# Abstract Archives of the RSNA, 2024

M4-PL02

## Plenary Session: AI’s Transformation of Medicine

Monday, Dec. 2 11:00AM - 12:00PM Room: ARIE CROWN THEATER

**COURSE DESCRIPTION**

The progress from unimodal supervised learning of medical images to multimodal, self- or unsupervised learning foundation models, has enabled marked changes in the practice of medicine. They include promoting accuracy of diagnoses, freeing up time for clinicians to provide better care for patients, and partitioning patient risk for various medical conditions that integrate many layers of patient data, including electronic health record, images, genomics, biosensors, and environmental. Not only can the objective of individualizing medicine be more likely fulfilled, but rebooting how we do cancer screening, hospital-at-home, and enhanced coaching of patients to prevent conditions they are at-risk for manifesting. Patients with large language model support will be more autonomous. However, all of this potential is contingent on dealing with the many challenges of conducting prospective clinical research, real world validation and provision of compelling evidence, transparency, regulatory oversight, minimizing bias and maximizing fairness, promoting utmost privacy and security, preventing inequities, and implementation with careful ongoing surveillance.

**Sub-Events**

**PL02A** **AI's Transformation of Medicine**

Eric Topol, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M8-PL03

## Image Interpretation Session

Monday, Dec. 2 4:30PM - 5:30PM Room: ARIE CROWN THEATER

Bruce B. Forster, MD, FRCPC (*Moderator*) Stockholder, Canada Diagnostic Centres

### LEARNING OBJECTIVES

1) Identify key abnormal findings on radiologic studies that are critical to making a specific diagnosis. 2) Construct a logical list of differential diagnoses based on the radiologic findings, focusing on the most probable differential diagnoses. 3) Determine which, if any, additional radiologic studies or procedures are needed in order to make a specific final diagnosis. 4) Choose the most likely diagnosis based on the clinical and the radiologic information. 5) Have fun achieving 1-4!

### COURSE DESCRIPTION

This session will employ an expert panel to discuss unknown cases in the fields of neuroradiology, musculoskeletal radiology, breast imaging, body imaging and chest radiology. The material will include plain radiography, CT, Ultrasound, MRI, and PET imaging with an overall theme of cases with unusual appearances that can be solved by carefully analyzing the images and recognized ancillary findings in order establish the correct diagnosis. The five expert readers will provide insights into how they approach challenging clinical cases, the pearls and pitfalls during the creation of a differential diagnosis, and the keys to a final diagnosis, in a light-hearted entertaining format.

**Sub-Events**

### PL03B Chest Imaging

David M. Naeger, MD (*Presenter*) Nothing to Disclose

### PL03C Breast Imaging

Amy K. Patel, MD (*Presenter*) Medical Advisor, Kheiron Medical Technologies Ltd;Consultant, Hologic, Inc

### PL03D Neuroradiology

Francis Deng, MD (*Presenter*) Nothing to Disclose

### PL03E Abdominal Imaging

Silvia D. Chang, MD, FRCPC (*Presenter*) Nothing to Disclose

### PL03F Musculoskeletal Imaging

Aline Serfaty Sr, MD, PhD (*Presenter*) Nothing to Disclose

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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R4-PL07

## RSNA/AAPM Symposium: Together We Can Make A Difference

Thursday, Dec. 5 11:00AM - 12:00PM Room: E450A

Lifeng Yu, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Explain how a multidisciplinary team can work together to realize the promise of AI in cancer care.

**COURSE DESCRIPTION**

The hype on artificial intelligence is highlighting our need to transform the current approach to manage the pace of technological innovation in healthcare. While these technologies are expected to have substantial impact, the reality is that healthcare is ill-prepared to assure they are safe, efficient, and impactful. Maturation of institutional data stewardship and algorithm oversight capabilities should be a priority for healthcare organizations. Growing and operationalizing this capability requires redefining the multidisciplinary and interdisciplinary team needed to successfully manage these technologies in healthcare. A broad collaborative effort to develop and deploy this transformative approach in a large cancer center will be illustrated in this presentation in the context of quantitative analysis of imaging data for cancer care and research.

**Sub-Events**

### PL07B A Framework for Realizing the Promise of AI in Cancer Care

David A. Jaffray, PhD (*Presenter*) Research Grant, Koninklijke Philips Electronics NVResearch Grant, Elekta ABResearch Grant, Raysearch Laboratories ABResearch Grant, IMRIS IncResearch Grant, Varian Medical Systems, IncResearch Grant, Modus Medical Devices IncRoyalties, Raysearch Laboratories ABRoyalties, Modus Medical Devices IncRoyalties, Elekta ABRoyalties, IMRIS Inc

### PL07C A Framework for Realizing the Promise of AI in Cancer Care

Caroline Chung, MD, FRCPC (*Presenter*) Research support, RaySearch Laboratories AB;Research support, Siemens AG;Clinical Advisory Board, CRnR

# Abstract Archives of the RSNA, 2024

S6-PL01

**President's Address and Opening Session**

Sunday, Dec. 1 4:00PM - 5:30PM Room: ARIE CROWN THEATER

**Sub-Events**

## PL01A President's Address: Building Intelligent Connections

Curtis P. Langlotz, MD, PhD (*Presenter*) Stockholder, whiterabbit.ai;Advisor, whiterabbit.ai;Stockholder, Galileo CDS, Inc;Advisor, Galileo CDS, Inc;Stockholder, Bunker Hill, Inc;Board of Directors, Bunker Hill, Inc;Stockholder, Sirona Medical, Inc;Advisor, Sirona Medical, Inc

### LEARNING OBJECTIVES

Radiology has revolutionized medicine, embracing change and fostering progress by pursuing innovation that improves our ability to diagnose and treat patients more effectively and efficiently. Now, as the pace of change rapidly accelerates in the modern medical landscape, radiology's leadership in driving health care innovation becomes increasingly important. We are experiencing transformations in all facets of patientcare, from our clinical knowledge base and technological capacities to modes of health care delivery and practice management. These transformations are happening at every level, in every country in the world, in academia and in private practice. Change is not only inevitable, but also necessary as we commit to continuous improvement for our practices and our patients. That is why leading teams through change in an uncertain healthcare environment is an essential skill for today's radiologist. To lead through change, we must first be able to identify when change is necessary. After identifying a need for change, we can form a clear strategic vision for moving forward. By effectively communicating that vision, we inspire others to join us in removing barriers to change and empowering our teams to work as one to achieve our goal. RSNA President Matthew A. Mauro, MD, will explore how radiologists, regardless of setting, can embrace and influence change among their teams and throughout the radiology community; and—in so doing—spark a renewed commitment to ingenuity and innovation among practitioners across multiple disciplines of patient care. By strengthening our foundation as leaders to address the transformative challenges of our specialty, radiologists will be well positioned to secure our future and advance health care for the good of our patients.

## PL01B Opening Session: The Only Way to Predict the Future Is to Create It

Nina E. Kottler, MD, MS (*Presenter*) Partner, Radiology Partners Stockholder, Radiology Partners (Radiology Partners owns a minority interest in Aidoc medical and an indirect minority interest in Rad AI) Employee, Radiology Partners Consultant, ES3 Consultant, W.L. Gore & Associates, Inc Consultant, Synapsica Healthcare Pvt Ltd

### LEARNING OBJECTIVES

"History never repeats itself, but if does often rhyme", is often mistakenly credited to Mark Twain. Regardless of the origin, the notion that events, discoveries and circumstances are "unprecedented", when evaluated more thoughtfully, turnout to have precedent. While the nature of disruptive events and change can be uncomfortable, it must be embraced by leaders. Is today's world more complex than the past, perhaps? But do we leaders need to thoughtfully embrace advancements such as Artificial Intelligence, I think so. And as radiologist, while many may suggest AI might lead us to irrelevancy, I would argue, like past challenges, we should be excited to continue to do what we do best, which is be agile and innovative.

# Abstract Archives of the RSNA, 2024

T4-PL04

**Plenary Session: Removing the Mask v. 2.0**

Tuesday, Dec. 3 11:00AM - 12:00PM Room: ARIE CROWN THEATER

**LEARNING OBJECTIVES**

1) Summarize the current state of mental health in our community. 2) Discuss the impact of cultural norms and stigma on seeking treatment. 3) Outline personal, institutional, and societal strategies to enact change.

**COURSE DESCRIPTION**

Dr. Cunningham will discuss the current mental health crisis among health care professionals. Through her own lived experience, she will discuss the current state, barriers to care, and a multifaceted approach to enacting change in mental health awareness, reducing stigma and increasing resources for those who are struggling in our community.

**Sub-Events**

**PL04A** **Removing the Mask v. 2.0**

Carrie Cunningham, MD, MPH (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T6-PL05

**Plenary Session: Social Artificial Intelligence**

Tuesday, Dec. 3 1:30PM - 2:30PM Room: ARIE CROWN THEATER

**COURSE DESCRIPTION**

Humans are naturally embedded in face-to-face social networks that obey particular mathematical and social principles. Increasingly, we are also embedding artificial agents, in the form of AI agents and physical robots, among us – giving rise to "hybrid systems" of humans and machines. These forms of AI act in humanlike ways and open up a new world of social artificial intelligence. Our lab has focused on human-human interactions in the presence of such AI. And specifically, we have focused not on super-smart AI to replace human cognition, but rather on "dumb AI" to supplement human interaction. In one experiment involving 4,000 people in 230 groups, we evaluated how adding bots to human groups improved their ability to coordinate to solve a problem. Another experiment involving 1,024 humans in 64 groups showed that cooperation within a group could be promoted when the AI intervened to rewire social connections. In still another experiment with 1,875 subjects in 125 groups, we showed how bots might enhance creativity by helping groups to avoid groupthink and optimize the diffusion of innovation. We have also done experiments with physical systems, adding humanoid and non-humanoid robots endowed with simple AI to face-to-face groups, showing how they can make it easier for groups to work together by reducing friction in their interactions. Humans have developed ethical and practical norms to address collective challenges, but such tacit understandings can break down in situations where machine intelligence is involved. Our work shows that AI can work to help humans to help themselves; but, of course, the reverse is possible, and AI can be used to harm groups. The ties between people make the whole of society greater than the sum of its parts. This is changing as AI is added.

**Sub-Events**

**PL05A** **Social Artificial Intelligence**

Nicholas A. Christakis, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W4-PL06

## Plenary Session Game Show: Microbial Mayhem: The Pathogenic Party You Won't Forget!

Wednesday, Dec. 4 11:00AM - 12:00PM Room: ARIE CROWN THEATER

Linda Probyn, MD (*Moderator*) Nothing to Disclose
Lindsey M. Negrete, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review radiologic images and diagnoses of common and uncommon infectious diseases. 2) Encourage teamwork and collaboration of a diverse group of expert subspecialty radiologists from around the world. 3) Demonstrate learning through gamification with engaging radiology content. 4) Understand the impact of emerging infectious diseases and novel imaging techniques in patient care and diagnostics.

**COURSE DESCRIPTION**

COURSE DESCRIPTION

Clue: This quiz show, created by Merv Griffin, features answers and questions, where contestants must respond in the form of a question.

Answer: What is “Jeopardy!”?

At RSNA 2024, get ready for two teams of elite subspecialty radiologists to face off using this popular and timeless quiz show format. Our notable teams will compete to answer clues across various infectious imaging categories in the body, brain, bones, and beyond! The interactive course will test and expand your knowledge of clinical cases of viral, bacterial, fungal, and parasitic infections. Rounds will include infections related to contagious diseases, pandemics, and tropical medicine, to name a few. Designed for students, residents, and experts in the field, this course provides a dynamic way to reinforce learning, encourage teamwork, and make mastering radiology both fun and memorable. This battle of the bugs will surely be an exciting 60 minutes of imaging modalities from head to toe, pathology identification, and a sprinkle of radiologic physics and trivia. Are you ready to play? Come join us and see if you become a Radiology Jeopardy champion.

**Sub-Events**

**PL06C** **Plenary Game Show Judge**

Christine B. Chung, MD (*Presenter*) Nothing to Disclose

**PL06D** **Plenary Game Show Judge**

Mark E. Mullins, MD, PhD (*Presenter*) Nothing to Disclose

**PL06E** **Plenary Game Show Judge**

Iain D. Kirkpatrick, MD, FRCPC (*Presenter*) Nothing to Disclose

**PL06F** **Plenary Game Show Team A**

Karen Rodriguez, MD (*Presenter*) Nothing to Disclose

**PL06G** **Plenary Game Show Team A**

Lane F. Donnelly, MD (*Presenter*) Nothing to Disclose

**PL06H** **Plenary Game Show Team A**

Andrew L. Wentland, MD, PhD (*Presenter*) Consultant, Our Next Energy;Consultant, Faeth Therapeutics Inc

**PL06I** **Plenary Game Show Team A**

Katharine Lampen-Sachar, MD (*Presenter*) Nothing to Disclose

**PL06J** **Plenary Game Show Team B**

Judith A. Gadde, DO, MBA (*Presenter*) Nothing to Disclose

**PL06K** **Plenary Game Show Team B**

Claire K. Sandstrom, MD (*Presenter*) Nothing to Disclose

**PL06L** **Plenary Game Show Team B**

Reto Sutter, MD (*Presenter*) Nothing to Disclose

**PL06M** **Plenary Game Show Team B**

Jeffrey D. Jaskolka, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

DLL01

## RSNA Deep Learning Lab: DIY Deep Learning: Programming Setup for Beginners (Beginner Friendly) (Registration Fee Required)

Sunday, Dec. 1 12:00PM - 1:00PM Room: DEEP LEARNING LAB

Kirti Magudia, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Establishing a Programming Environment: Participants will be able to set up a robust programming environment tailored for data science and deep learning, including proficiency with command line tools, Python, and package managers. 2) Managing Dependencies with Virtual Environments: Participants will learn to create and utilize virtual environments to manage project-specific dependencies, ensuring streamlined and conflict-free workflows for various data science projects. 3) Preparing Datasets for Deep Learning: By the end of the workshop, participants will be able to download, prepare, and preprocess datasets for deep learning experiments on their own computers, providing the necessary skills for flexible and independent AI development. You will need your own laptop computer to participate in this session. For the best experience, you should have administrator privileges on your laptop computer. You will also need a Google account.

**COURSE DESCRIPTION**

In this interactive session, you'll learn how to establish a robust programming environment tailored for data science and deep learning. We'll dive into command line tools, Python, and package managers to streamline your workflow, and demonstrate the power of virtual environments for managing project-specific dependencies. By the end of the workshop, you'll be equipped to download and prepare a dataset for a deep learning experiment on your own computer, giving you the flexibility and control needed for cutting-edge AI development.

You will need your own laptop computer to participate in this session. For the best experience, you should have administrator privileges on your laptop computer. You will also need a Google account.

**Sub-Events**

**DLL01B** **RSNA Deep Learning Lab: DIY Deep Learning: Programming Setup for Beginners (Beginner Friendly) (Registration Fee Required)**

Walter F. Wiggins, MD,PhD (*Presenter*) Advisor, Qure.ai;

**DLL01C** **RSNA Deep Learning Lab: DIY Deep Learning: Programming Setup for Beginners (Beginner Friendly) (Registration Fee Required)**

Kirti Magudia, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

DLL03

## RSNA Deep Learning Lab: Basics of NLP in Radiology (Beginner Friendly) (Registration Fee Required)

Monday, Dec. 2 9:00AM - 10:00AM Room: DEEP LEARNING LAB

Jae Ho Sohn, MD, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn to build basic NLP models in radiology, discussing preprocessing and model architectures, forming the foundation for more advanced NLP courses involving transformers. 2) Learn evaluation metrics and strategies for radiological NLP models. 3) Learn various potential applications of NLP in clinical radiology with hands-on coding.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

This session will feature a lecture introducing the basic technical concepts and clinical applications of natural language processing (NLP), highlight potential uses for it in radiology. The goal is to introduce standard text preprocessing techniques, NLP model training approaches, and model evaluation strategies that would be widely applicable and would form the basis for studying more advanced courses that use neural network and/or transformer based methods. We will follow up the didactic portion with a hands-on Google Colab demo implementing discussed concepts for a text classification task. For best experience, we highly recommend attendees bring a laptop with a keyboard as well as have a Gmail account to access Google Colab.

**Sub-Events**

### DLL03B Discussion of NLP Applications in Radiology

Timothy L. Chen, MD (*Presenter*) Nothing to Disclose

### DLL03C Data Set Up and Text Preprocessing Considerations

Gunvant R. Chaudhari, MD (*Presenter*) Nothing to Disclose

### DLL03D Model Training and Evaluation

Cody Savage, MD (*Presenter*) Nothing to Disclose

### DLL03E General Conceptual Introduction to NLP in Radiology

Jae Ho Sohn, MD, MS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

DLL04

## RSNA Deep Learning Lab: MIDRC - Cohort Building, Downloading, and Using Data for DL (Beginner Friendly) (Registration Fee Required)

Monday, Dec. 2 11:00AM - 12:00PM Room: DEEP LEARNING LAB

Maryellen L. Giger, PhD (*Moderator*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

### LEARNING OBJECTIVES

1) Understand the genesis and development of the Medical Imaging and Data Resource Center (MIDRC). 2) Experience how to build your own data cohort for AI research using the MIDRC publication platform - Gen3. 3) Explore additional MIDRC resources.

### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

The Medical Imaging Data and Resource Center (MIDRC) provides a model for collecting and publishing data to support research that can be applied across all areas of medical imaging. This session will give an overview of the structure of the MIDRC data commons, provide a tour of the open access data portal published on the Gen3 platform and discuss interoperability with other data commons including indexing with other imaging data commons. During this session, attendees will have the opportunity to experience how to build a selected data cohort direct from the MIDRC data commons for AI research.

**Sub-Events**

### DLL04B Introduction

Maryellen L. Giger, PhD (*Presenter*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

### DLL04C Using the MIDRC User Portal for Cohort Building and Downloading Data

Christopher Meyer, PhD (*Presenter*) Nothing to Disclose

### DLL04D MIDRC Resources (Metric Tree, Bias Tool, Stratified Sampling and GitHub)

Karen Drukker, PHD (*Presenter*) Royalties, Hologic, Inc

### DLL04E MIDRC Resources (Metric Tree, Bias Tool, Stratified Sampling and GitHub)

Jordan Fuhrman, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

DLL05

## RSNA Deep Learning Lab: Data Extraction from Radiology Reports with LLMs (Beginner Friendly) (Registration Fee Required)

Monday, Dec. 2 1:00PM - 2:00PM Room: DEEP LEARNING LAB

Walter F. Wiggins, MD,PhD (*Moderator*) Advisor, Qure.ai;

**LEARNING OBJECTIVES**

1) Understand the basics of prompt engineering and its application in extracting data from radiology reports using large language models (LLMs). 2) Gain hands-on experience with LLMs using an open-source computing platform to ensure data privacy. 3) Develop the ability to create and refine prompts that can accurately classify chest radiograph reports as normal or abnormal, enhancing skills in medical data analysis with LLMs.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

In this engaging, interactive tutorial, participants will learn the fundamentals of prompt engineering using an open-source library to deploy large language models (LLMs) on any computer, preserving data privacy. Using a dataset of chest radiograph reports, we will guide you step-by-step in developing a prompt that can reliably classify reports as normal or abnormal. Attendees must bring their own laptop computer (tablets will NOT provide an optimal experience) and have an active Google account. This session offers a valuable opportunity to gain hands-on experience and practical skills in applying LLMs to medical data extraction. No prior coding or machine learning experience is necessary.

**Sub-Events**

**DLL05B** **RSNA Deep Learning Lab: Data Extraction from Radiology Reports with LLMs (Beginner Friendly) (Registration Fee Required)**

Kirti Magudia, MD, PhD (*Presenter*) Nothing to Disclose

**DLL05C** **RSNA Deep Learning Lab: Data Extraction from Radiology Reports with LLMs (Beginner Friendly) (Registration Fee Required)**

Walter F. Wiggins, MD,PhD (*Presenter*) Advisor, Qure.ai;

# Abstract Archives of the RSNA, 2024

DLL06

## RSNA Deep Learning Lab: NCI Imaging Data Commons - Curated Data and Reproducible AI Workflows (Advanced) (Registration Fee Required)

Monday, Dec. 2 3:00PM - 4:00PM Room: DEEP LEARNING LAB

Andriy Fedorov, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn about the functionality of NCI Imaging Data Commons (IDC) related to selection and preparation of data cohorts for developing AI workflows. 2) Introduce the basic capabilities of IDC in support of development of reproducible AI workflows. 3) Experiment with the application of open source AI tools to public imaging datasets.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

NCI Imaging Data Commons (IDC), https://imaging.datacommons.cancer.gov , is a cloud-based environment of publicly available cancer imaging data co-located with the analysis and exploration tools and resources. IDC contains over 60TB of publicly available images and image annotations spanning a variety of cancer types and modalities. Attendees of this course will learn how to search, visualize and download IDC data, and how to build reproducible and shareable analysis workflows using Google Colab. The educational format will combine a lecture followed by a hands-on component and interactive discussions to gain familiarity with this resource.

**Sub-Events**

**DLL06B** **RSNA Deep Learning Lab: NCI Imaging Data Commons - Curated Data and Reproducible AI Workflows**

Andriy Fedorov, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

DLL07

## RSNA Deep Learning Lab: Accessing Freely Available Public Datasets from The Cancer Imaging Archive (TCIA) (Beginner Friendly) (Registration Fee Required)

Tuesday, Dec. 3 9:00AM - 10:00AM Room: DEEP LEARNING LAB

Justin Kirby (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn how TCIA makes data sharing easier for researchers and hear a summary of existing datasets that are freely available for download. 2) Practice utilizing TCIA for data exploration, cohort definition, and downloading data. 3) Learn how to access public and restricted access datasets using TCIA's REST APIs and other command line tools via Jupyter Notebooks.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

Access to large, high quality data is essential for researchers to understand disease and precision medicine pathways, especially in cancer. However HIPAA constraints make sharing medical images outside an individual institution a complex process. The Cancer Imaging Archive (TCIA) is a public service funded by the National Cancer Institute which addresses this challenge by providing de-identification and data publication services to take major burdens of data sharing off researchers. TCIA has published over 200 unique data collections containing more than 70 million images. Recognizing that images alone are not enough to conduct meaningful research, most collections are linked to rich supporting data including patient outcomes, treatment information, genomic / proteomic analyses, and expert image analyses (segmentations, annotations, and radiomic / radiogenomic features). In this course we will address basic use cases for identifying TCIA datasets of interest and downloading them via command-line tools and Jupyter Notebooks.

**Sub-Events**

**DLL07B** **RSNA Deep Learning Lab: Accessing Freely Available Public Datasets from The Cancer Imaging Archive (TCIA)**

Justin Kirby (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

DLL08

## RSNA Deep Learning Lab: ChatGPT - DICOM De-Identification Using ChatGPT (Beginner Friendly) (Registration Fee Required)

Tuesday, Dec. 3 11:00AM - 12:00PM Room: DEEP LEARNING LAB

George L. Shih, MD, MS (*Moderator*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

**LEARNING OBJECTIVES**

1) Introduction to DICOM tags and PHI stored in these tags. 2) Explain the issues around DICOM de-identification (DeID) and provide examples of DeID tools. 3) Leverage Large Language Model (eg, ChatGPT / GPT-4) to create a script to assist with DICOM DeID. 4) Hands-On DICOM DeID using GPT-4 generated scripts. 5) Other ways to leverage GPT-4 for DICOM DeID. 6) DICOM Pixel DeID.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

Hands-On learning lab that leverages conventional and AI tools (LLMs like ChatGPT / GPT-4) to help with DICOM de-identification (DeID). Will practice DeID using scripts generated by LLMs and leverage GPT-4 in other ways for the de-identification process.

**Sub-Events**

### DLL08B New Anonymizer Demo

Adam E. Flanders, MD (*Presenter*) Nothing to Disclose

### DLL08C MIDRC De-Identification Process

George L. Shih, MD, MS (*Presenter*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

### DLL08D Review of DICOM and De-Identification

Errol Colak, MD (*Presenter*) Nothing to Disclose

### DLL08E Hands-On GPT-4 Script for De-ID

Chinmay Singhal, MS (*Presenter*) Nothing to Disclose

### DLL08F DICOM Tag Exploration with Chat GPT and other LLMs

Hui Ming Lin, BSc (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

DLL09

## RSNA Deep Learning Lab: MIDRC - Contributing Data: Diversity, Annotations, and Harmonization (Beginner Friendly) (Registration Fee Required)

Tuesday, Dec. 3 1:00PM - 2:00PM Room: DEEP LEARNING LAB

Maryellen L. Giger, PhD (*Moderator*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

**LEARNING OBJECTIVES**

1) Understand the genesis and development of the Medical Imaging and Data Resource Center (MIDRC). 2) Understand the tools and processes to contribute data. 3) Appreciate how an imaging based data commons that links to clinical metadata can accelerate machine learning research.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

The Medical Imaging Data and Resource Center (MIDRC) provides a model for collecting and publishing data to support research that can be applied across all areas of medical imaging. This session will give an overview of the structure of the MIDRC data commons and the data contribution process.

**Sub-Events**

**DLL09B** **Intro to Contributing Data and Annotations**

Adam E. Flanders, MD (*Presenter*) Nothing to Disclose

**DLL09C** **Contributing Data and Annotations**

George L. Shih, MD, MS (*Presenter*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

**DLL09D** **Diversity Calculator**

Heather Whitney, PhD (*Presenter*) Nothing to Disclose

**DLL09E** **Diversity Calculator**

Robert Tomek, MSc (*Presenter*) Employee, Quantitative Insights, Inc

**DLL09F** **Harmonization of Data with LOINC Mapping**

Paul E. Kinahan, PhD (*Presenter*) Co-founder, PET/X LLC

# Abstract Archives of the RSNA, 2024

DLL10

## RSNA Deep Learning Lab: Deploy Your Own Model in Huggingface (Advanced) (Registration Fee Required)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: DEEP LEARNING LAB

Felipe C. Kitamura, MD, PhD (*Moderator*) Consultant, MD.ai, Inc Speaker, General Electric Company Speaker, SPCC (Sharing Progress in Cancer Care)

**LEARNING OBJECTIVES**

1) Learn the fundamentals of deep learning by training a model in PyTorch. 2) Build and deploy a custom bone age model in Hugging Face.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

Dive into applied deep learning in this focused, hands-on course. You'll directly engage with the process of constructing a bone age model in PyTorch and deploying it using the Hugging Face platform. This session emphasizes learning though action. You won't be lost in theory but rather immersed in the practical application of deep learning technologies.

**Sub-Events**

**DLL10B** **RSNA Deep Learning Lab: Deploy Your Own Model in Huggingface (Advanced) (Registration Fee Required)**

Ian Pan, MD (*Presenter*) Consultant, MD.ai, Inc;Consultant, Centaur Labs Inc;Consultant, Diagnosticos da America SA;Consultant, CoRead AI

**DLL10C** **RSNA Deep Learning Lab: Deploy Your Own Model in Huggingface (Advanced) (Registration Fee Required)**

Felipe C. Kitamura, MD, PhD (*Presenter*) Consultant, MD.ai, Inc Speaker, General Electric Company Speaker, SPCC (Sharing Progress in Cancer Care)

# Abstract Archives of the RSNA, 2024

DLL11

## RSNA Deep Learning Lab: Building a Simple Chest X-Ray Classification Model with TensorFlow (Beginner Friendly) (Registration Fee Required)

Wednesday, Dec. 4 9:00AM - 10:00AM Room: DEEP LEARNING LAB

Jason Adleberg, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn the basics of building a simple TensorFlow classification model for chest x-rays.

2) Evaluate a classification model, with metrics like sensitivity, specificity, and the ROC curve.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

In this one-hour tutorial, participants will learn the basics of building a simple TensorFlow classification model for chest x-rays. Topics include defining a problem, preparing the data, training the model, and statistical evaluation.

**Sub-Events**

**DLL11B** **RSNA Deep Learning Lab: Building a Simple Chest X-Ray Classification Model with TensorFlow (Beginner Friendly) (Registration Fee Required)**

Nicholas J. Primiano, MD, MS (*Presenter*) Nothing to Disclose

**DLL11C** **RSNA Deep Learning Lab: Building a Simple Chest X-Ray Classification Model with TensorFlow (Beginner Friendly) (Registration Fee Required)**

Jason Adleberg, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

DLL12

## RSNA Deep Learning Lab: Developing and Implementing a 3D Segmentation Model - From DICOM to Deployment (Advanced) (Registration Fee Required)

Wednesday, Dec. 4 11:00AM - 12:00PM Room: DEEP LEARNING LAB

Evan D. Calabrese, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Have a basic understanding of how to curate and preprocess DICOM data. 2) Develop segmentation models from scratch using human-in-the-loop learning. 3) Deploy pre-trained segmentation models for their task of interest.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

This session will be focused on developing and deploying an image segmentation model starting from raw DICOM data. We will use DICOM data from the publicly available CURE.ai head CT dataset. We will briefly review key data curation and preprocessing steps including series conversion and normalization. Most of the session will focus on developing segmentation models using open-source tools with minimal user coding. We will highlight a human-in-the-loop learning approach using MONAI label. Participants will get hands on experience with image annotation in 3D slicer and real-time model training using cloud resources from AWS. Finally, we will discuss model deployment using the MONAI deploy. At the end of the session, participants will understand how to curate and preprocess DICOM data, develop segmentation models using human-in-the-loop learning, and deploy trained models for their task of interest.

**Sub-Events**

**DLL12C** **RSNA Deep Learning Lab: Developing and Implementing a 3D Segmentation Model - From DICOM to Deployment (Advanced) (Registration Fee Required)**

Evan D. Calabrese, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

DLL13

## RSNA Deep Learning Lab: Quantifying Uncertainty in Deep Learning (Advanced) (Registration Fee Required)

Wednesday, Dec. 4 1:00PM - 2:00PM Room: DEEP LEARNING LAB

Bradley J. Erickson, MD, PhD (*Moderator*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc

**LEARNING OBJECTIVES**

1) Recognize the role of uncertainty in AI applications. 2) Recognize the difference between raw AI model output, calibrated model output, and model uncertainty value. 3) Recognize the different forms of uncertainty quantification and see examples of how to implement UQ.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

This course will focus on understanding different types and sources of uncertainty in medical imaging, learning about model calibration and exploring various uncertainity quantification techniques. PyTorch and MONAI to be used for hands-on experience and will include implementing model ensembling, applying Monte Carlo Dropout and integrating conformal prediction methods into practical applications.

**Sub-Events**

**DLL13B** **RSNA Deep Learning Lab: Quantifying Uncertainty in Deep Learning (Advanced) (Registration Fee Required)**

Shahriar Faghani, MD (*Presenter*) Nothing to Disclose

**DLL13C** **RSNA Deep Learning Lab: Quantifying Uncertainty in Deep Learning (Advanced) (Registration Fee Required)**

Mana Moassefi, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

DLL14

## RSNA Deep Learning Lab: Best Practices for Model Training: Architectures, Hyperparameters and Optimization (Advanced) (Registration Fee Required)

Wednesday, Dec. 4 3:00PM - 4:00PM Room: DEEP LEARNING LAB

Peter Chang, MD (*Moderator*) Co-founder, Avicenna.ai;Stockholder, Avicenna.ai;Research Grant, Canon Medical Systems Corporation;Speakers Bureau, Canon Medical Systems Corporation;Research Grant, General Electric Company

### LEARNING OBJECTIVES

1) Review top-performing convolutional neural network design choices and architecture motifs. 2) Develop heuristics for customizing model design based on specific medical imaging task. 3) Identify strategies for efficient hyperparameter search. Note: This session is completely new from the topic previously presented as part of the 2022-2023 RSNA Deep Learning Labs.

### COURSE DESCRIPTION

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

Deep learning models are characterized by a constant influx of new, innovative design choices. However, for any specific medical imaging task, it remains unclear how to best choose between different training strategies, from network topology to layer implementations (activation and normalization functions) to loss objectives and other permutations. In this session, we review top-performing design choices with a particular emphasis on developing heuristics for how to best customize model architectures and hyperparameters based on task-specific characteristics (e.g., image modality, anatomy, resolution and dimensionality, size and distribution of target pathology, class imbalance, etc). To help guide experimentation, a code repository is provided including a generic framework for rapid prototyping and model comparison to enable robust hyperparameter search. Though the presented key ideas generalize to many settings, this specific session will utilize demonstrations based on optimizing semantic segmentation using convolutional neural network (CNN) based architectures.

**Sub-Events**

**DLL14B** **RSNA Deep Learning Lab: Best Practices for Model Training: Architectures, Hyperparameters & Optimization**

Peter Chang, MD (*Presenter*) Co-founder, Avicenna.ai;Stockholder, Avicenna.ai;Research Grant, Canon Medical Systems Corporation;Speakers Bureau, Canon Medical Systems Corporation;Research Grant, General Electric Company

# Abstract Archives of the RSNA, 2024

M1-CAS03

## Insights on AI Governance, a Health System Approach (Sponsored by the RSNA Associated Sciences Consortium)

Monday, Dec. 2 8:00AM - 9:00AM Room: N226

Brian Fox, MBA (*Moderator*) Nothing to Disclose
Keith Chew, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Outline various methodologies for deploying AI in clinical environments. 2) Evaluate the considerations, relative costs, benefits, and risks associated with each deployment method. 3) Understand the advantages of an AI platform for scaling AI deployment within a health system.

**COURSE DESCRIPTION**

Ensuring robust cybersecurity is crucial when deploying AI. This presentation will examine the three primary deployment models—cloud, private cloud, and on-site hardware—analyzing the cybersecurity advantages and disadvantages of each approach.

**Sub-Events**

### M1-CAS03C Choosing an AI Platform

Jon Darnell, MBA, ARRT (*Presenter*) Nothing to Disclose

### M1-CAS03D Securing the Future: Navigating Cybersecurity Considerations in AI Deployment

Stephen Willis (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M1-CCA11

## Cardiac CT Mentored Case Review: Imaging the Heart: Imaging Techniques, Anatomy, and Function

Monday, Dec. 2 8:00AM - 9:00AM Room: E353C

Jacobo Kirsch, MD, MBA (*Moderator*) Medical Advisory Board, Zebra Medical Vision Ltd

**LEARNING OBJECTIVES**

1) To review the expected appearance of normal cardiac anatomy on CTA and the appearance of coronary artery pathologies beyond coronary artery disease. To learn technical strategies for a successful coronary CT scan.

**COURSE DESCRIPTION**

This course will provide the basis for recognizing normal appearance of cardiac structures on CTA. The concept on non-atherosclerotic coronary artery pathology will be introduced with several case examples of disease on CTA. Finally, the attendees will learn techncial tips and tricks on how to obtain ideal image quality on a coronary CTA study.

**Sub-Events**

### M1-CCA11B Normal Anatomy and Congenital Coronary Arteries Variants

Gilad Borisovsky, MD (*Presenter*) Nothing to Disclose

### M1-CCA11C Coronary CTA: Major Technical Aspects to Achieve a Successful Scan

Diana Litmanovich, MD (*Presenter*) Nothing to Disclose

### M1-CCA11D Non-CAD Coronary Artery Pathology

Elsie Nguyen, MD, FRCPC (*Presenter*) Nothing to Disclose

### M1-CCA11E CT of Cardiac Valves and CT Cardiac Function, Including Normal Cardiac Chamber Sizes

Suhny Abbara, MD (*Presenter*) Royalties, RELX

# Abstract Archives of the RSNA, 2024

M1-CCH02

## HRCT Topics

Monday, Dec. 2 8:00AM - 9:00AM Room: E451A

Brett M. Elicker, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe recent advances in our understanding of the role of antifibrotic agents in progressive fibrotic lung diseases. 2) Recognize the broad spectrum of imaging manifestations of hypersensitivity pneumonitis. 3) Distinguish recurrent malignancy from malignancy-directed pulmonary radiation and drug toxicity on imaging.

**COURSE DESCRIPTION**

This session will focus on several advanced topics in the diffuse lung disease space. First, the role of imaging in progressive pulmonary fibrosis will be presented. This topic is particularly pertinent with the expansion of the use of anti-fibrotic agents to other diseases other than idiopathic pulmonary fibrosis. Additional topics presented will include the spectrum of imaging findings in hypersensitivity pneumonitis and the typical imaging manifestations of radiation and drug-induced lung disease in the setting of treated cancer.

**Sub-Events**

### M1-CCH02B Progressive Pulmonary Fibrosis

Brett M. Elicker, MD (*Presenter*) Nothing to Disclose

### M1-CCH02C Antifibrotic Therapy in Fibrotic Lung Disease

Seth J. Kligerman, MD, MS (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH;Consultant, Riverain Technologies, LLC;Consultant, Bayer AG

### M1-CCH02D Hypersensitivity Pneumonitis

Justus E. Roos, MD (*Presenter*) Nothing to Disclose

### M1-CCH02E Oncologic Therapy Induced Lung Disease

Kimberly G. Kallianos, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M1-CER11

## Multi-Energy CT in the ER: Where Are We in 2024?

Monday, Dec. 2 8:00AM - 9:00AM Room: N228

Savvas Nicolaou, MD, FRCPC (*Moderator*) Institutional research agreement, Siemens AG;Stockholder, Canada Diagnostic Centres

**LEARNING OBJECTIVES**

1) Understand the fundamental principles and technological advancements of multi-energy CT (MECT) imaging. 2) Identify the clinical indications and benefits of utilizing MECT in the emergency room setting. 3) Explore the role of MECT in expediting patient triage and treatment decisions in emergency radiology practice. 4) Discuss strategies for optimizing MECT protocols to enhance image quality and diagnostic confidence in acute musculoskeletal presentations. 5) Assess the potential challenges and limitations associated with implementing MECT technology in the emergency room environment.

**COURSE DESCRIPTION**

In this session, leading experts in Multi-Energy CT(MECT) imaging will discuss the evolving landscape of MECT imaging and its crucial role in diagnosing acute conditions affecting the head, neck, abdomen, and musculoskeletal system. Participants will gain valuable insights into the clinical applications of MECT, uncovering their potential to revolutionize emergency radiology practice. This comprehensive discussion aims to enhance understanding of the benefits, challenges, and future directions of MECT in the ER, empowering attendees to optimize patient care and decision-making in acute settings.

**Sub-Events**

### M1-CER11B Value Add of DECT in Acute Head Neck Conditions

Savvas Nicolaou, MD, FRCPC (*Presenter*) Institutional research agreement, Siemens AG;Stockholder, Canada Diagnostic Centres

### M1-CER11C Novel Applications of Spectral CT in the Acute Abdomen Present and Future

Jennifer W. Uyeda, MD (*Presenter*) Nothing to Disclose

### M1-CER11D Color the Pathology World of Colors in Acute MSK Applications One Stop Shop

Adnan M. Sheikh, MD (*Presenter*) Nothing to Disclose

### M1-CER11E Creating and Realizing the Value of DECT in the Acute Setting

Lakshmi Ananthakrishnan, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M1-CGI02

## Colorectal Imaging

Monday, Dec. 2 8:00AM - 9:00AM Room: E451B

Kevin J. Chang, MD (*Moderator*) Speaker, RELX;Speaker, Koninklijke Philips NV

**LEARNING OBJECTIVES**

1) Get updated on the latest techniques to detect pathology in CT Colonography, stage rectal cancer by MRI, and evaluate treatment response on rectal MRI. 2) Learn about what has changed in the latest version of C-RADS.

**COURSE DESCRIPTION**

Colorectal cancer is the 2nd leading cancer killer in the US with incidence skyrocketing amongst younger patients, now also the leading cancer killer of men and 2nd leading cancer killer of women under the age of 50.

This 4 lecture session will teach the basics of staging and restaging rectal cancer by rectal MRI, illustrate how CT colonography (CTC) can diagnose challenging cases, as well as update the practicing radiologist on how to classify and manage CTC findings using the 2023 update of the C-RADS classification system.

**Sub-Events**

### M1-CGI02B C-RADS 2024 Update

Kevin J. Chang, MD (*Presenter*) Speaker, RELX;Speaker, Koninklijke Philips NV

### M1-CGI02C Rectal Cancer MRI Technique, Anatomy & Primary Staging

Mukesh G. Harisinghani, MD (*Presenter*) Nothing to Disclose

### M1-CGI02D Rectal Cancer MRI: Post Treatment Follow-up

Kartik S. Jhaveri, MD, FRCPC (*Presenter*) Research Grant, General Electric Company;Research Grant, Bayer AG;Research Consultant, Perspectum Diagnostics Ltd;

### M1-CGI02E CT Colonography: Challenging Cases

Judy Yee, MD (*Presenter*) Research Grant, General Electric Company

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# Abstract Archives of the RSNA, 2024

M1-CIN16

## Writing Grant Proposal for AI Model: Tips and Tricks

Monday, Dec. 2 8:00AM - 9:00AM Room: E450B

Imon Banerjee, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

**M1-CIN16B** **Know your Readers: Balance between Details and Understanding**

Imon Banerjee, PhD (*Presenter*) Nothing to Disclose

**M1-CIN16C** **Simple Strategies to Employ When Writing**

Bhavik N. Patel, MD, MBA (*Presenter*) Nothing to Disclose

**M1-CIN16D** **Aspirations vs. Realities -Dream Big with Small Steps**

Jayashree Kalpathy-Cramer, PhD (*Presenter*) Institutional Research Grant, General Electric Company;Institutional Research Grant, F. Hoffmann-La Roche Ltd;Institutional Research Grant, Bayer AG

**M1-CIN16E** **Planning your Grant, From Team, Preliminary Results and Statistical Analysis and Beyond**

Mirabela Rusu, DPhil (*Presenter*) Research Grant, General Electric Company

# Abstract Archives of the RSNA, 2024

M1-CMK04

## Hip Imaging: The Fundamentals

Monday, Dec. 2 8:00AM - 9:00AM Room: E450A

Megan K. Mills, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn the imaging findings and appropriate reporting of tendon injuries about the hip.

2) Identify expected and unexpected postoperative imaging findings of frequently encountered surgical procedures of the hip.

3) Discuss the various diagnostic imaging markers of hip dysplasia and impingement morphology in the adult patient population.

**COURSE DESCRIPTION**

Hip Imaging: The Fundamentals session is an up-to-date lecture-based review of imaging of the hip with specific emphasis on femoroacetabular impingement, hip dysplasia, gluteal tendon pathology, hamstring tendon pathology, and hip arthroplasty imaging. Attendees will have the opportunity to learn about the latest multimodality radiologic findings of hip related disease process as well as practical reporting, relevant clinical and treatment details from content experts in the field.

**Sub-Events**

### M1-CMK04B Femoracetabular Impingement: Update

Megan K. Mills, MD (*Presenter*) Nothing to Disclose

### M1-CMK04C Hip Dysplasia: Multimodality Imaging Evaluation

Luis S. Beltran, MD (*Presenter*) Nothing to Disclose

### M1-CMK04D Gluteal Tendon Pathology: What to Include in your Reports

Christian W. Pfirrmann, MD, MBA (*Presenter*) Nothing to Disclose

### M1-CMK04E Proximal Hamstring Tendon Pathology: Imaging Evaluation of Acute Injuries

Ara Kassarjian, MD, FRCPC (*Presenter*) Research Consultant, Arthrosurface, Inc

### M1-CMK04F Hip Arthroplasty Imaging: Pearls and Pitfalls

Alissa J. Burge, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M1-CMS06

## IgG4-related Disease from Head to Toe

Monday, Dec. 2 8:00AM - 9:00AM Room: S502

Ichiro Ikuta, MD, MMedSc (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Participants will learn to recognize the multi-system characteristic features and pitfalls of IgG4-related disease in neuroradiology, head and neck, cardiac, thoracic, gastrointestinal (GI), and genitourinary (GU) radiology. 2) Participants will learn the complimentary nature of multimodality imaging in IgG4-related disease across multiple body systems. 3) Participants will learn an appropriate differential diagnosis when the imaging characteristics overlap with other diseases along with clinically appropriate next steps.

**COURSE DESCRIPTION**

IgG4-related disease can affect multiple body systems. This course provides insights into characteristic imaging manifestations of IgG4-related disease "from head-to-toe" including neuroradiology, head and neck, cardiac, thoracic, gastrointestinal (GI), and genitourinary (GU) radiology. Multimodality imaging provides complimentary information for this multisystem disease, and can help guide clinical testing, surveillance, and impact patient care.

**Sub-Events**

**M1-CMS06B** **Head and Neck**

Ajay Malhotra, MD, MMM (*Presenter*) Nothing to Disclose

**M1-CMS06C** **Chest**

Cristina Fuss, MD, PhD (*Presenter*) Nothing to Disclose

**M1-CMS06D** **Abdomen and Pelvis**

Yashant Aswani, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M1-CNPM12

## Radiologist Reimbursements: Cuts, Solutions, and Beyond

Monday, Dec. 2 8:00AM - 9:00AM Room: S402

Andrew B. Rosenkrantz, MD (*Moderator*) Money paid to institution from ARRS (AJR Editorship)

**LEARNING OBJECTIVES**

1) Explore current issues and trends in radiology reimbursements, focusing on strategies and solutions being pursued at the specialty level to address recent payment cuts. 2) Describe challenges in receiving reimbursements for a spectrum of noninterpretive radiologist activities as well as for artificial intelligence and emerging technologies. 3) Present opportunities and novel ways in which radiologists could receive payments for their services in the future, as well as ongoing specialty-level efforts seeking their implementation.

**COURSE DESCRIPTION**

This course will the latest issues in radiologist reimburesements, focusing on ongoing cuts, potential solutions, and future opporunities. The course will comprise a series of lectures addressing such matters as specialty-level strategies, noninterpretive activities, as well as artificial intelligence and other emerging technologies.

**Sub-Events**

### M1-CNPM12B Nontraditional Sources of Radiologist Payments (Tumor Boards, Consultations, and Beyond)

Melissa M. Chen, MD (*Presenter*) Nothing to Disclose

### M1-CNPM12C Getting Paid for Artificial Intelligence and New Technologies

Andrew K. Moriarity, MD (*Presenter*) Nothing to Disclose

### M1-CNPM12D Ongoing Medicare Physician Payment Cuts: Solutions at the Specialty Level

Gregory N. Nicola, MD (*Presenter*) Conultant, Xstrahl Ltd;Consultant, NeuTigers

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# Abstract Archives of the RSNA, 2024

M1-CNR03

## I Don’t Want to Read This Spine! - Complicated Spine Topics Made Easy

Monday, Dec. 2 8:00AM - 9:00AM Room: S406B

Peter G. Kranz, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify easy-to-remember strategies for addressing common but difficult clinical scenarios in spine imaging.

**COURSE DESCRIPTION**

Ever feel like you want to run and hide from that one particular spine imaging study on the worklist? This session will feature experts in spine imaging presenting accessible and easily understandable approaches to complicated topics in spine imaging. Speakers will focus on providing the audience with simple and easy-to-remember take home points that will change how you feel about tackling those challenging spine cases.

**Sub-Events**

### M1-CNR03B Is This Spinal Finding Actionable?

Troy Hutchins, MD (*Presenter*) Nothing to Disclose

### M1-CNR03C Is This Spinal Infection?

Jennifer L. McCarty, MD (*Presenter*) Nothing to Disclose

### M1-CNR03D What am I Looking for on This CSF Leak Spine Imaging?

Anoma Lalani Carlton Jones, MBBS, FRCR (*Presenter*) Nothing to Disclose

### M1-CNR03E What am I Looking for on This Post-Op Spine Imaging?

Peter G. Kranz, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M1-COB07

## Dysfunctional Uterine Bleeding

Monday, Dec. 2 8:00AM - 9:00AM Room: E351

Catherine R. Phillips, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1)Understand the role of imaging in the setting of premenopausal bleeding. 2)Understand the role of imaging in the setting of bleeding during pregnancy. 3) Understand the role of imaging in the setting of postmenopausal bleeding.

**Sub-Events**

### M1-COB07B Abnormal Premenopausal Bleeding

Catherine R. Phillips, MD (*Presenter*) Nothing to Disclose

### M1-COB07C Bleeding During Pregnancy

Liina Poder, MD (*Presenter*) Nothing to Disclose

### M1-COB07D Postmenopausal Bleeding

Mark D. Sugi, MD (*Presenter*) Consultant, Nextrast, Inc;Author with royalties, RELX

# Abstract Archives of the RSNA, 2024

M1-CPH05

## Radiation and Medical Imaging: Best Practices for Communicating Risk

Monday, Dec. 2 8:00AM - 9:00AM Room: N227B

Cynthia H. McCollough, PhD (*Moderator*) Research Grant, Siemens AG

**LEARNING OBJECTIVES**

1) To understand the difficulties in discussing radiation and identify strategies to help the audience hear the right message. 2) To describe message maps and review several examples related to the use of radiation in medical imaging. 3) To recognize best practices for communicating with the media. 4) To experience examples of effective risk communication.

**COURSE DESCRIPTION**

While medical imaging can provide lifesaving medical care, the transfer of energy into human tissue can be associated with some level of risk to the patient. Not only are healthcare providers responsible for balancing the benefits of medical imaging with the potential risks, but they must also be able to effectively exchange information about the benefits and risks of medical imaging with patients, their families, the public, and other health professionals. The American Association of Physicists in Medicine created a Radiation and Medical Imaging Communication Guide to assist healthcare providers with this essential task. The educational content and sample questions and answers provided in the guide are intended to provide health professionals with the tools necessary for effective risk communication about the use of ionizing radiation in medicine. This course will review the difficulties in discussing radiation and identify communication strategies that can help the audience hear the right message. Speakers will describe the use of message maps when communicating about risk and summarize best practices when communicating with the media. The session will conclude with a series of role plays to demonstrate effective communication about radiation and medical imaging.

**Sub-Events**

### M1-CPH05B Effective Risk Communication

Cynthia H. McCollough, PhD (*Presenter*) Research Grant, Siemens AG

### M1-CPH05C Message Maps

James M. Kofler JR, PhD (*Presenter*) Nothing to Disclose

### M1-CPH05D Best Practices for Communicating with Media

Rebecca Milman, PhD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

M1-CRO01

## Head and Neck Multidisciplinary Review

Monday, Dec. 2 8:00AM - 9:00AM Room: S401

Suresh K. Mukherji, MD, MBA (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review common head and tumors. 2) Introduce the audience to a multidisciplinary head and neck tumor board. 3) Emphasize imaging findings that directly affect treatment and management of patients with different types of head and neck cancer.

**COURSE DESCRIPTION**

This session will introduce the audience to a multidiciplinary head and neck tumor board. We will review common head and neck tumors that the radiologist will encounter in their daily practice. We will emphasize imaging findings that directly afftect treatment and mamagement of patients with different types of head and neck cancer.

**Sub-Events**

### M1-CRO01B Head and Neck Multidisciplinary Review

Sung Kim, MD (*Presenter*) Consultant, Nanobiotix

### M1-CRO01C Head and Neck Multidisciplinary Review

Alice Tang, MD (*Presenter*) Nothing to Disclose

### M1-CRO01D Head and Neck Multidisciplinary Review

Francis P. Worden, MD (*Presenter*) Speaker, Merck & Co, Inc;Advisory Board, Merck & Co, Inc;Institutional research support, Merck & Co, Inc;Travel support, Merck & Co, Inc;Speaker, Eisai Co, Ltd;Advisory Board, Eisai Co, Ltd;Institutional research support, Eisai Co, Ltd;Speaker, Bristol-Myers Squibb Company;Advisory Board, Bristol-Myers Squibb Company;Research funded, Bristol-Myers Squibb Company;Speaker, Eli Lilly and Company;Advisory Board, Eli Lilly and Company;Research funded, Eli Lilly and Company;Speaker, Bayer AG;Advisory Board, Bayer AG;Travel support, Bayer AG;Speaker, Cue Biopharma, Inc;Advisory Board, Cue Biopharma, Inc;Advisory Board, Rakuten Group, Inc;Research funded, Oragenics, Inc;Institutional research support, Pfizer Inc

# Abstract Archives of the RSNA, 2024

M1-CVA01

## Multimodality Thoracic Aortic Imaging: What the Radiologist and Surgeon Need to Know

Monday, Dec. 2 8:00AM - 9:00AM Room: N229

Kate Hanneman, MD, MPH (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Minhaj S. Khaja, MD, MBA (*Moderator*) Institutional Research Grant, Boston Scientific Corporation;Speaker, Boston Scientific Corporation;Speaker, Medtronic plc;Advisory Board, Medtronic plc;Institutional Grant, Penumbra, Inc

### LEARNING OBJECTIVES

1) Identify imaging findings for aortic imaging. 2) Describe key findings in pre- and post-operative aortic imaging from the perspective of interventional radiology and surgery. 3) Discuss aortic imaging measurements and practical imaging recommendations.

### COURSE DESCRIPTION

Multi-modality aortic imaging and practical recommendations - what the diagnostic radiologist, interventional radiologist, and surgeon needs to know.

**Sub-Events**

### M1-CVA01C Thoracic Aortic Imaging: What the Surgeon Needs to Know

Jennifer Chung, MD (*Presenter*) Nothing to Disclose

### M1-CVA01D Thoracic Aortic Imaging for the Diagnostic Radiologist: Measurements and Practical Considerations

Nicholas S. Burris, MD (*Presenter*) Royalties, ImBio, LLC

### M1-CVA01E Thoracic Aortic Imaging: What the Interventional Radiologist Needs to Know

Minhaj S. Khaja, MD, MBA (*Presenter*) Institutional Research Grant, Boston Scientific Corporation;Speaker, Boston Scientific Corporation;Speaker, Medtronic plc;Advisory Board, Medtronic plc;Institutional Grant, Penumbra, Inc

# Abstract Archives of the RSNA, 2024

M2-CMS09

## RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature (Registration Fee Required)

Monday, Dec. 2 9:00AM - 10:30AM Room: S504CD

Mark E. Lockhart, MD, MPH (*Moderator*) Author, Jaypee Brothers Medical Publishers Ltd;Author, Reed Elsevier;Employee, Journal of Ultrasound in Medicine;

**LEARNING OBJECTIVES**

1) To describe imaging techniques and diagnostic criteria regarding diagnosis of vascular abnormalities using Doppler ultrasound. 2) To provide real-time guidance and suggestions in the performance of Doppler studies of the abdominal and carotid vessels as the learners scan live models.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. The course will begin with didactic lectures followed by real-time scanning of live models.

**Sub-Events**

**M2-CMS09B** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature (Registration Fee Required)**

Corinne Deurdulian, MD (*Presenter*) Nothing to Disclose

**M2-CMS09C** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature (Registration Fee Required)**

Nirvikar Dahiya, MD (*Presenter*) Nothing to Disclose

**M2-CMS09D** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Mark E. Lockhart, MD, MPH (*Presenter*) Author, Jaypee Brothers Medical Publishers Ltd;Author, Reed Elsevier;Employee, Journal of Ultrasound in Medicine;

**M2-CMS09E** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Margarita V. Revzin, MD, MS (*Presenter*) Nothing to Disclose

**M2-CMS09F** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Michelle L. Robbin, MD, MS (*Presenter*) Research Grant, Koninklijke Philips NV

**M2-CMS09G** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Gayatri Joshi, MD (*Presenter*) Royalties from Elsevier.

**M2-CMS09H** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Leslie M. Scoutt, MD (*Presenter*) Speaker, Koninklijke Philips NV

**M2-CMS09I** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

John S. Pellerito, MD (*Presenter*) Nothing to Disclose

**M2-CMS09J** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Carol B. Benson, MD (*Presenter*) Nothing to Disclose

**M2-CMS09K** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Mary C. Frates, MD (*Presenter*) Nothing to Disclose

**M2-CMS09L** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Wui K. Chong, MBBS (*Presenter*) Research Consultant, Koios Medical, Inc

**M2-CMS09M** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Sheila Sheth, MD (*Presenter*) Speakers Bureau , Koninklijke Philips NV

**M2-CMS09N** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Eugenio Zalaquett, MD, MS (*Presenter*) Nothing to Disclose

**M2-CMS09O** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Nira Beck-Razi, MD (*Presenter*) Nothing to Disclose

**M2-CMS09P** **RSNA Hands-On Lab: Ultrasound Doppler Hands-On Course of the Carotid System and Abdominal Vasculature**

Vikram S. Dogra, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M3-CAS01

## A Profession Fit for the Future: Educating the Future Imaging Technologist/Radiographer Workforce (Sponsored by the RSNA Associated Sciences Consortium)

Monday, Dec. 2 9:30AM - 10:30AM Room: N226

Charlotte Beardmore, MBA (*Moderator*) Nothing to Disclose
Nancy McDonald, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the challenges in supporting the future growth of the imaging technologists/ radiographer workforce to meet imaging services demands. 2)Discuss solutions being developed in US and UK in relation to evolving education pathways at entry and advancing levels. 3) Consider and understand how regulators, professional bodies, accrediting bodies, education and clinical providers are supporting new models of education and training.

**COURSE DESCRIPTION**

This course is for radiological technologists / radiographers and managers wishing to learn about the development of the profession. As technologies evolve, radiological technologists /radiographers will be required to develop their skills set, continuing to efficiently provide high quality compassionate patient care and safe delivery of imaging services to patients. The course will discuss the changing skills sets within imaging services and look at these skills sets from entry to advancing levels of practice. The speakers in this session from the UK and US, will deliver interactive lectures providing attendees with learning from both countries, and consider how both education and regulatory requirements are changing in order to support the rapidly changing clinical

**Sub-Events**

### M3-CAS01C A UK Perspective - Evolving Workforce Skills

Beverly Snaith (*Presenter*) Nothing to Disclose

### M3-CAS01D How Educators Can Respond to the Evolving Workforce Demands

Taylor Ward, PhD (*Presenter*) Nothing to Disclose

### M3-CAS01E A US Accreditors Perspective New Workforce Models

Traci B. Lang, RT (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M3-CBR13

## Landscape of AI in Current Clinical Breast Imaging Practice and Ethical Considerations

Monday, Dec. 2 9:30AM - 10:30AM Room: S406A

Emily F. Conant, MD (*Moderator*) Research Grant, Hologic, Inc;Advisory Panel, Hologic, Inc;Research Grant, OM1, Inc;Research Grant, iCad, Inc;Advisory Panel, iCad, Inc;Speaker, WebMD LLC

**LEARNING OBJECTIVES**

1) Describe artificial intelligence (AI) applications that may be used to optimize workflow by reducing interpretation and reporting time while maintaining or improving clinical outcomes. 2) Examine ethical challenges of artificial intelligence (AI) applications including conflicts of interest among radiologists, artificial intelligence (AI) algorithm developers, and patients. 3) Critically evaluate existing regulator frameworks for artificial intelligence (AI). 4) Identify potential barriers to the clinical implementation of artificial intelligence (AI).

**COURSE DESCRIPTION**

This educational session provides an in-depth exploration of artificial intelligence (AI) in contemporary breast imaging clinical practices. AI applications that can be used to optimize clinical workflow will be described. In addition, ethical considerations and challenges that arise when implementing AI into clinical practice and strategies to overcome these challenges will be discussed. Through lectures and a Q&A session, participants will gain a comprehensive understanding of the practical and ethical dimensions of implementing AI into breast imaging practices.

**Sub-Events**

### M3-CBR13B Workflow Improvements

Manisha Bahl, MD, MPH (*Presenter*) Consultant, Lunit Inc;Expert Advisory Committee, 2nd.MD

### M3-CBR13C Hurdles and Pitfalls of Clinical Implementation

Emily F. Conant, MD (*Presenter*) Research Grant, Hologic, Inc;Advisory Panel, Hologic, Inc;Research Grant, OM1, Inc;Research Grant, iCad, Inc;Advisory Panel, iCad, Inc;Speaker, WebMD LLC

### M3-CBR13D Artificial Intelligence in Radiology: Some Ethical Considerations for Radiologists and Algorithm Developers

Sarah Eskreis-Winkler, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M3-CCA12

## Cardiac CT Mentored Case Review: Coronary Atherosclerotic Disease: From Straightforward to Most Complicated

Monday, Dec. 2 9:30AM - 10:30AM Room: E353C

Michelle C. Williams, MBChB, PhD (*Moderator*) Speakers Bureau, Canon Medical Systems Corporation;Speakers Bureau, Siemens AG

**LEARNING OBJECTIVES**

1) To understand the significance and how to report cardiac calcifications on CT. 2) To develop skills to apply the CAD-RADS system to coronary CT. 3) To understand the range of information available from coronary CT and its clinical significance.

**COURSE DESCRIPTION**

To understand the significance and how to report cardiac calcifications on CT.

To develop skills to apply the CAD-RADS system to coronary CT.

To understand the range of information available from coronary CT and its clinical significance.

**Sub-Events**

### M3-CCA12B All You Need to Know About Cardiac Calcifications

Rozemarijn Vliegenthart, MD, PhD (*Presenter*) Institutional Research Grant, Siemens Healthineers Speaker's Bureau, Siemens Healthineers Speaker's Bureau, Bayer

### M3-CCA12C Coronary Atherosclerosis I: Approach to Atherosclerotic Plaque Analysis and Severity of Stenosis Assessment

Brian B. Ghoshhajra, MD, MBA (*Presenter*) Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Consultant, Siemens AG

### M3-CCA12D Coronary Atherosclerosis II: CAD-RAD System

Prachi P. Agarwal, MD (*Presenter*) Nothing to Disclose

### M3-CCA12E Coronary Atherosclerosis III: How do I Use CT FFR and CT Myocardial Perfusion to Assess CAD

U. Joseph Schoepf, MD (*Presenter*) Research Grant, Bayer AG;Research Grant, Bracco Group;Research Grant, Elucid BioImaging Inc;Consultant, Elucid BioImaging Inc;Research Grant: General Electric Company;Research Grant, Guerbet SA;Research Grant, Heartflow, Inc;Speakers Bureau, Heartflow Inc

# Abstract Archives of the RSNA, 2024

M3-CER13

## Role of Imaging in Disasters

Monday, Dec. 2 9:30AM - 10:30AM Room: N228

Mehmet Ruhi Onur, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Raise awareness about preparedness strategies and requirements for radiology departments in case of a disaster. 2) Provide attendees with the knowledge to contribute to disaster management plans of their hospitals. 3) Present imaging findings in natural, accidental, and violence-related disasters.

**COURSE DESCRIPTION**

Natural, accidental, and violence-related disasters are catastrophic incidents

that require accurate infrastructure capability, preparedness, and staff performance in emergency radiology units.

This course aims to present the essential requirements for a well-set-out response of emergency radiology units in various types of disasters such as earthquakes, bombings, hurricanes, and transportation accidents. Lecturers of the course will focus on the disaster preparedness planning of radiology departments including policy-making, managing imaging workup, organizing equipment and staff, and implementing interim processes to overcome challenges.

Attendees of the course will learn about the injury types and imaging findings related to disaster-related injuries, which are crucial for emergency radiologists in diagnosing and managing disaster victims.

**Sub-Events**

**M3-CER13B** **Imaging in Earthquakes: Lessons from February 2023 Turkey Earthquakes**

Mehmet Ruhi Onur, MD (*Presenter*) Nothing to Disclose

**M3-CER13C** **Violence-Related Mass Casualty Incidents: Role of Emergency Radiology**

Jacob Sosna, MD (*Presenter*) Stockholder, HighRAD Ltd

**M3-CER13D** **Natural Disasters: A Struggling Arena for Emergency Radiologists**

Courtney P. Orsbon, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M3-CGU07

## Mastering Imaging of Urothelial Cell Carcinoma

Monday, Dec. 2 9:30AM - 10:30AM Room: E353B

Antonio C. Westphalen, MD, PhD (*Moderator*) Shareholder, ScanMed, LLC;Research funded, BotImage, Inc
Danielle E. Kruse, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify and describe the imaging features of atypical and aggressive histology in urothelial cell carcinoma, enhancing their diagnostic capabilities. 2) Evaluate gaps in current imaging guidelines for urothelial cell carcinoma and apply expanded imaging utilization practices to improve patient outcomes. 3) Understand the diagnostic accuracy and potential pitfalls of VI-RADS and will explore new applications of imaging techniques in the management of urothelial cell carcinoma.

**COURSE DESCRIPTION**

This educational session provides a comprehensive overview of the latest advancements and challenges in imaging urothelial cell carcinoma. The session will cover imaging features of atypical and aggressive histologies, the expanding role of imaging in clinical practice, and the diagnostic accuracy and pitfalls of VI-RADS. Additionally, new applications of imaging techniques will be discussed. Through a combination of lectures and discussions led by experts in the field, attendees will gain valuable insights and practical knowledge to improve diagnostic accuracy and patient outcomes. This session is essential for radiologists and clinicians seeking to stay updated on cutting-edge imaging practices in urothelial cell carcinoma.

**Sub-Events**

### M3-CGU07C Gaps in Current Guidelines. Why is Imaging Utilization Expanding?

Hebert Alberto Vargas, MD (*Presenter*) Nothing to Disclose

### M3-CGU07D Imaging Features of Atypical and Aggressive Histology

Antonio C. Westphalen, MD, PhD (*Presenter*) Shareholder, ScanMed, LLC;Research funded, BotImage, Inc

### M3-CGU07E Diagnostic Accuracy and Pitfalls of VI-RADS

Valdair F. Muglia, MD, PhD (*Presenter*) Nothing to Disclose

### M3-CGU07F New Applications of Imaging

Valeria Panebianco, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

M3-CHN05

## Cranial Nerve Deficits - A Symptom Based Session

Monday, Dec. 2 9:30AM - 10:30AM Room: E352

Nikdokht Farid, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Select the appropriate imaging algorithm for patients presenting with diplopia, trigeminal neuralgia, and facial weakness. 2) Identify the common causes of diplopia, trigeminal neuralgia, and facial weakness.

**COURSE DESCRIPTION**

In this clinical correlation didactic head and neck imaging session, speakers will review the imaging evaluation and common causes of diplopia, trigeminal neuralgia, and facial weakness. Speakers will emphasize search patterns, pitfalls of interpretation to avoid, and relevant clinical management considerations with which radiologists should be familiar. This session offers attendees the opportunity to refine their interpretation of complex head and neck imaging studies by incorporating tips from world experts.

**Sub-Events**

### M3-CHN05B Diplopia

Yun Jung Bae, MD, PhD (*Presenter*) Nothing to Disclose

### M3-CHN05C Trigeminal Neuralgia

Xin Wu, MD (*Presenter*) Nothing to Disclose

### M3-CHN05D Facial Weakness

Hillary R. Kelly, MD (*Presenter*) Investigator, Bayer AG;Institutional research agreement, Bayer AG

# Abstract Archives of the RSNA, 2024

M3-CIR03

## Musculoskeletal Interventions – Fixation and Augmentation Procedures

Monday, Dec. 2 9:30AM - 10:30AM Room: S405

Ernesto G. Santos Martin, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understanding of pathologic fractures of the pelvis and patient selection for percutaneous approach. 2) Importance of combined therapies in patients with pathologic fractures of the pelvis: ablation, RT, augmentation and screw fixation. 3) Learn about complications and their management after MSK interventions.

**COURSE DESCRIPTION**

In this educational session, participants will dive into the world of the percutaneous treatment in patients with pathologic fractures of the pelvis. These fractures pose a unique challenge for orthopedic surgery and traditional open approaches may not be possible in patients with bone metastases. IR should be a key component of multidisciplinary bone metastases team. Percutaneous treatments can offer a minimally invasive alternative with promising outcomes. Learners will be familiar with the current minimally invasive percutaneous options and how to combine different techniques, including ablation, embolization, cement augmentation and screw fixation.

This session will combined lectures and interactive discussions to provide a comprehensive understanding of augmentation and screw fixation and their combination with radiation therapy. Participants will also have the opportunity of discussing indications, contraindications and potential complications and review the current research and future directions in the field.

By the end of the course, participants will:

- Gain proficiency in the field of minimally invasive image-guided interventions in patients with pathologic fractures of the pelvis

- Advantages and disadvantages of this approach

- Review evidence-based conceptual and technological paradigm shifts in percutaneous treatment strategies for this patient population

- Integration of augmentation and percutaneous fixation into clinical practice.

Join us for an engaging and informative course on advance percutaneous interventions in patients with pathologic fractures of the pelvis

**Sub-Events**

**M3-CIR03B** **Cement Augmentation and Osteosynthesis of the Pelvic Rim: Pre-procedural Considerations and Technical Tips**

Brandon M. Key, MD (*Presenter*) Consultant, Siemens

**M3-CIR03C** **Point/Counterpoint: Ablation, Cementation +/- Fixation Should Occur Prior to Radiation**

Ernesto G. Santos Martin, MD (*Presenter*) Nothing to Disclose

**M3-CIR03D** **Point/Counterpoint: Ablation, Cementation +/- Fixation Should Occur After Radiation**

Frederic Deschamps (*Presenter*) Consultant, Medtronic plc;Consultant, General Electric Company;Consultant, Ablatech;Consultant, Boston Scientific Corporation;Consultant, Surgnova Healthcare Technologies;Consultant, InnoProd, Inc

**M3-CIR03E** **Percutaneous Sacroiliac Fixation: How and When?**

Alexios Kelekis, MD, PhD (*Presenter*) Research Grant, Medtronic plc;Speaker, Medtronic plc;Speaker, Mindray Medical International Ltd

**M3-CIR03F** **Complications of MSK Interventions**

Alda L. Tam, MD (*Presenter*) Consultant, Johnson & Johnson;Research Grant, Boston Scientific Corporation;Research Grant, Johnson & Johnson;Consultant, AstraZeneca PLC;Consultant, Endocare, Inc;

# Abstract Archives of the RSNA, 2024

M3-CMK08

## Musculoskeletal Tumor Imaging: Current Trends and Recent Advances

Monday, Dec. 2 9:30AM - 10:30AM Room: E450A

Shivani Ahlawat, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss key diagnostic features of imaging of musculoskeletal malignancies to differentiate benign vs malignant etiologies and to distinguish tumor mimics. 2) Explain current trends and recent advances in musculoskeletal tumor imaging evaluation to assist in accurate diagnosis and management.

**COURSE DESCRIPTION**

This session discusses benign and malignant features of musculoskeletal malignancies including differentiating tumors from tumor mimics. Important features to distinguish lipoma vs ALT/WDL, encondroma vs chondrosarcoma and benign vs malignant PNST will be described during and key features of SoftTissue-RADS will be reviewed during the lectures. The expected outcome is for participants to gain a better understanding of the current trends and advances in musculoskeletal tumor imaging.

**Sub-Events**

### M3-CMK08B Top 4 Tips for Distinguishing MSK Neoplasms From Their Mimics

Julia R. Crim, MD (*Presenter*) Nothing to Disclose

### M3-CMK08C Lipoma vs ALT/WDL

Ty K. Subhawong, MD (*Presenter*) Research Consultant, Arog Pharmaceuticals, Inc;Stockholder, AbbVie Inc;Stockholder, AstraZeneca PLC;Stockholder, Johnson & Johnson;Stockholder, Pfizer Inc ;Stockholder, F. Hoffmann-La Roche Ltd;Stockholder, Teva Pharmaceutical Industries Ltd

### M3-CMK08D Enchondroma vs Chondrosarcoma: What to Evaluate and Recommend

Mark D. Murphey, MD (*Presenter*) Nothing to Disclose

### M3-CMK08E Benign vs Malignant PNST

Shivani Ahlawat, MD (*Presenter*) Nothing to Disclose

### M3-CMK08F Top 3 Takeaways from SoftTissue-RADS

Avneesh Chhabra, MD, MBA (*Presenter*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab

# Abstract Archives of the RSNA, 2024

M3-CNMMI04

## Therapy Response Assessment: Read with the Experts

Monday, Dec. 2 9:30AM - 10:30AM Room: S403A

Don C. Yoo, MD (*Moderator*) Consultant, Konica Minolta, Inc

**LEARNING OBJECTIVES**

1) Review current response assessment criteria applicable to PET/CT. 2) Illustrate the applications of these response assessment criteria in clinical practice. 3) Discuss advances in the field of PET/CT and response assessment.

**Sub-Events**

### M3-CNMMI04B Update on PET CT Application of Response Assessment to Therapy in Gynecological Malignancies

Esma A. Akin, MD (*Presenter*) Nothing to Disclose

### M3-CNMMI04C Update on Prostate Therapy Response Assessment

Don C. Yoo, MD (*Presenter*) Consultant, Konica Minolta, Inc

### M3-CNMMI04D Updates and Controversies in PET/CT Response Assessment

Eric M. Rohren, PhD, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

M3-CNPM19

## Planetary Health and Radiology: Actionable Steps to Decrease Our Environmental Impact (Sponsored by the RSNA Professionalism Committee)

Monday, Dec. 2 9:30AM - 10:30AM Room: S501

Kate Hanneman, MD, MPH (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Reed A. Omary, MD, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the intersection of planetary health and radiology including energy and non-energy related environmental impacts. 2) Discuss key actionable strategies to reduce electricity and energy use in radiology and potential impact. 3) Discuss of key actionable strategies to reduce our environmental impact beyond energy in radiology including reducing waste and environmental waterbody contrast contamination. 4) Explore the impact of climate change on patient outcomes and the delivery of radiology services and describe the need to prepare for these effects including infrastructure upgrades, disaster management protocols, and education on changing disease patterns.

**COURSE DESCRIPTION**

The overarching purpose of this course is to discuss the intersection of planetary health and radiology and describe actionable steps we can take to decrease the environmental impact of radiology.

**Sub-Events**

### M3-CNPM19C Planetary Health and Radiology

Andrea G. Rockall, FRCR, MRCP (*Presenter*) Nothing to Disclose

### M3-CNPM19D Energy Related Strategies to Reduce Greenhouse Gas Emissions in Radiology

Jan Vosshenrich, MD (*Presenter*) Nothing to Disclose

### M3-CNPM19E Beyond Energy: Strategies to Reduce Waste and Contrast Contamination in Radiology

Sean A. Woolen, MD, MS (*Presenter*) Research Grant, Siemens AG;Investigator, Siemens AG

### M3-CNPM19F Adaptation in Radiology: Preparing for the Effects of Climate Change

Rachel F. Gerson, MD, MA (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M3-CPD01

## Pediatric Neuroimaging: You Don't Want To Miss This!

Monday, Dec. 2 9:30AM - 10:30AM Room: E350

Thierry Huisman, MD, PhD (*Moderator*) Nothing to Disclose
Birgit B. Ertl-Wagner, MD, PhD (*Moderator*) Spouse, Employee, Siemens AG

### LEARNING OBJECTIVES

1) Know the pearls and pitfalls of interpreting imaging of children with suspected spine trauma and identify critical injuries outside the CNS associated with spinal trauma. 2) Differentiate focal cerebral arteriopathy of childhood and understand the use of vessel wall imaging in these conditions. 3) Explain the typical neuroimaging features of important metabolic disorders in children.

### COURSE DESCRIPTION

This session will provide an overview of some of the most important and challenging topics in pediatric neuroimaging, with an emphasis on practical and clinical implications. The speakers will share their expertise and experience in the following areas: Spine trauma in children: how to avoid missing critical injuries and complications; pediatric stroke and focal cerebral arteriopathy of childhood; metabolic disorders affecting the brain: how to recognize and differentiate them on neuroimaging. The session will include case-based presentations and key take-home messages for the attendees. Attendees will gain confidence in making diagnoses in pediatric neuroimaging that they really don't want to miss.

**Sub-Events**

### M3-CPD01C Stroke

Shelly I. Shiran, MD (*Presenter*) Nothing to Disclose

### M3-CPD01D Spine Trauma

Laura L. Hayes, MD (*Presenter*) Nothing to Disclose

### M3-CPD01E Metabolic Diseases

Cesar Augusto P. Alves SR, MD, PhD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M3-RCP20

## Navigating the Job Market (Sponsored by the RSNA Resident and Fellow Committee)

Monday, Dec. 2 9:30AM - 10:30AM Room: N229

Brandon K.K. Fields, MD (*Moderator*) Nothing to Disclose
Julia Niemierko, MD (*Moderator*) Nothing to Disclose
Divya M. Surabhi, MD, MPH (*Moderator*) Nothing to Disclose
Heba Albasha, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Learn about the current job market, as well as current hiring patterns. 2) Assess your individual preferences to find the right job for you. 3) Explore strategies for networking and succeeding in the interview. 4) Discuss the diversity of radiology jobs, and gain insight from the personal experiences of the panelists.

### COURSE DESCRIPTION

This course provides trainees and early career radiologists with information and the tools necessary to enter and successfully navigate the job market. The course will feature an update on the current job market, tips on how to find a job that aligns with your interests, and a Q&A panel with radiologists from various practice settings

**Sub-Events**

**M3-RCP20E** **The Radiology Job Market and Future Projections**

Eric M. Rubin, MD (*Presenter*) Nothing to Disclose

**M3-RCP20F** **Careers in Radiology: Finding the Right Fit**

Benjamin D. White, MD (*Presenter*) Nothing to Disclose

**M3-RCP20G** **Career Panel Q&A**

Aaron Schein, MD (*Presenter*) Nothing to Disclose

**M3-RCP20H** **Career Panel Q&A**

Olga Pasternak Wise, MD, MS (*Presenter*) Nothing to Disclose

**M3-RCP20I** **Career Panel Q&A**

Eric M. Rubin, MD (*Presenter*) Nothing to Disclose

**M3-RCP20J** **Career Panel Q&A**

Benjamin D. White, MD (*Presenter*) Nothing to Disclose

**M3-RCP20K** **Career Panel Q&A**

Suhny Abbara, MD (*Presenter*) Royalties, RELX

# Abstract Archives of the RSNA, 2024

M4-CAS02

## Empowering Health: Bridging the Gap with Population Health, Patient Advocacy and Quality Access in Medical Imaging (Sponsored by the RSNA Associated Sciences Consortium)

Monday, Dec. 2 11:00AM - 12:00PM Room: N226

Napapong Pongnapang, BSc, PhD (*Moderator*) Nothing to Disclose
Susie M. Moseley, MS, RT (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Examine key strategies and challenges integral to ensuring equitable access to healthcare, with a specific emphasis on the dynamics of population health. 2) Discuss the crucial role of patient advocacy and describe actionable strategies for community empowerment. 3) Identify opportunities to enhance professional capabilities for quality access in the specific context of low-resourced regions.

### COURSE DESCRIPTION

This session will explore the vital realm of patient advocacy, unravelling its significance in shaping the landscape of medical imaging practices. The speakers will examine contributing factors to health disparities both within the United States and on a global scale and highlight the transformative role of strategic patient advocacy in fostering community engagement and empowerment. The speakers will also consider professional capabilities, quality access, and the specific context of low-resourced regions. Through a discussion of real-world initiatives that have successfully addressed and mitigated health disparities, this session will help participants identify concrete solutions aimed at enhancing access to care for diverse communities, fostering a more inclusive and responsive healthcare landscape.

**Sub-Events**

### M4-CAS02C Addressing Critical U.S. Population Health Needs Through Patient Advocacy

Fredrick Lee II, PhD, MBA (*Presenter*) Nothing to Disclose

### M4-CAS02D ISRRT Perspectives on Enhancing Professional Capabilities for Quality Access to Imaging and Radiation Therapy in Low-Resourced Countries

Napapong Pongnapang, BSc, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M4-CIN13

## Vision-Language Generative Models for Radiology: A Quick Introduction and Current State-of-the-Art

Monday, Dec. 2 11:00AM - 12:00PM Room: E450B

Amara Tariq, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Introduce fundamental concepts of vision-language modeling. 2) Explain current applications of vision-language modeling in the domain of radiology. 3) Discuss future directions for vision-language modeling for radiology data.

**COURSE DESCRIPTION**

In this session, the audience will be introduced to state-of-the-art vision-language models (VLM) and their application in the field of radiology through a series of lectures from four experts. VLMs are designed to jointly process visual and textual data and have shown astounding performance for challenging tasks like information retrieval and generation such as caption or image generation. Such models tend to outperform image-only models for zero-shot detection and diagnosis using radiology images. Expert speakers will introduce the fundamentals and describe their latest work in VLM.

**Sub-Events**

**M4-CIN13B** **Detecting Clinical Findings on CXR Images Using Multimodal LLMs**

Yifan Peng, MD (*Presenter*) Nothing to Disclose

**M4-CIN13C** **Current State of LLMs in Radiology**

George L. Shih, MD, MS (*Presenter*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

**M4-CIN13D** **Vision Language Model Development and Application in Radiology**

William Hsu, PhD (*Presenter*) Nothing to Disclose

**M4-CIN13E** **Vision-Language Generative Models for Radiology: A Quick Introduction and Current State-of-the-Art**

Akshay Chaudhari, PhD (*Presenter*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research Consultant, Subtle Medical, Inc

# Abstract Archives of the RSNA, 2024

M6-CAS07

## What Happened to the Radiology Department: Exploring the Relationship of People, Place and Performance (Sponsored by the RSNA Associated Sciences Consortium)

Monday, Dec. 2 1:30PM - 2:30PM Room: N226

Meena Amlani, PhD, MBA (*Moderator*) Nothing to Disclose
Morris A. Stein, BArch (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss the impact and opportunity for radiology design from physical, social and digital perspectives. 2) Understand the advantages and disadvantages of centralizing vs. decentralizing imaging while embracing new technologies. (Digital Health, AI, Model Guided Medicine) to futureproof imaging designs. 3) Participants will be able to understand how a Central Command Suite for a "Hospital of the future" can improve multidisciplinary coordination and personalized care.

**COURSE DESCRIPTION**

As healthcare delivery trends continue to evolve rapidly, so must our approach for imaging planning and functional expectations. Historical patterns and relationships may no longer be most effective or efficient. New models provide a timely opportunity to rethink the how and where we connect patient experience and radiologist/staff performance.

**Sub-Events**

### M6-CAS07C Programatic Design Implications

Morris A. Stein, BArch (*Presenter*) Nothing to Disclose

### M6-CAS07D Decentralized Imaging for Patients, Physicians and Staff

Carlos L. Amato, MArch (*Presenter*) Nothing to Disclose

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

M6-CBR10

## Breast Screening Status and Updates for Underrepresented Populations

Monday, Dec. 2 1:30PM - 2:30PM Room: S406A

Thomas H. Helbich, MD, MBA (*Moderator*) Grant, Siemens AG;Grant, Bracco Group;Grant, Guerbet SA;Grant, Hologic, Inc;Grant, Novomed GmbH

**LEARNING OBJECTIVES**

1) To provide a comprehensive overview on breast screening programs in three continents. 2) To become familiar with pros and cons on breast screening programs in three continents. 3) To learn how future directions (AI, personalized screening etc.) will be implemented.

**COURSE DESCRIPTION**

Four lectures will allow a deep insight into breast screening programs in US, Canada, Australia and Europe

**Sub-Events**

### M6-CBR10B USA Perspective and Update

Laurie R. Margolies, MD (*Presenter*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical

### M6-CBR10C European Perspective and Update

Thomas H. Helbich, MD, MBA (*Presenter*) Grant, Siemens AG;Grant, Bracco Group;Grant, Guerbet SA;Grant, Hologic, Inc;Grant, Novomed GmbH

### M6-CBR10D Canadian Perspective and Update

Supriya R. Kulkarni, DMRD, FRCPC (*Presenter*) Nothing to Disclose

### M6-CBR10E Australian Perspective and Update

Helen Frazer, FRANZCR, MBBS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M6-CCA13

## Cardiac CT Mentored Case Review: Imaging of Post Coronary and Valvular Surgical and Trans Vascular Interventions

Monday, Dec. 2 1:30PM - 2:30PM Room: E353C

Kate Hanneman, MD, MPH (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

**LEARNING OBJECTIVES**

1) Discuss Imaging of Post Coronary and Valvular Surgical and Trans Vascular Interventions. 2) Describe Pre- and Post-TAVR Imaging. 3) Identify key imaging findings Pre- and Post-TMVR and TTVR. 4) Discuss an Approach to Assessment of Coronary Stents/CABG Patency.

**COURSE DESCRIPTION**

Mentored Case Review of Cardiac CT Imaging of Post Coronary and Valvular Surgical and Trans Vascular Interventions

**Sub-Events**

### M6-CCA13B Pre-TAVR Imaging

Amar B. Shah, MD, MA (*Presenter*) Nothing to Disclose

### M6-CCA13C Post-TAVR Imaging

Cristina Fuss, MD, PhD (*Presenter*) Nothing to Disclose

### M6-CCA13D Pre- and Post-TMVR, TTVR Imaging

Eric E. Williamson, MD (*Presenter*) Nothing to Disclose

### M6-CCA13E Approach to Assessment of Coronary Stents/CABG Patency

Rodrigo A. Salgado, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M6-CCH04

## Thoracic Multidisciplinary Tumor Board Meeting

Monday, Dec. 2 1:30PM - 2:30PM Room: E451A

Jane P. Ko, MD (*Moderator*) Research collaboration, Siemens AG

### LEARNING OBJECTIVES

1) Review current therapies for thoracic malignancy treatment related to surgery, radiation, and thoracic oncology.

2) Emphasize challenges in diagnosis and treatment of thoracic malignancy and important imaging features that aid in clinical management decisions.

3) Discuss expected imaging manifestations after therapy and identify complications.

### COURSE DESCRIPTION

This session will cover management decisions that are encountered in the multidisciplinary care of patients with thoracic malignancy, including lung cancer. Evaluation of thoracic malignancy patients span multiple modalities and organ systems and is a crucial contributing determinant for diagnostic and therapeutic decisions. Awareness of the radiology consultant of current techniques and potential complications associated with treatment of thoracic malignancy pertaining to surgery, radiation, and thoracic oncology is important. Emphasis will also be placed on important information on chest imaging that aids referring clinicians in the diagnosis, planning for therapy, and surveillance. The attendee will gain knowledge that they would be able to apply through participation in tumor boards and in daily clinical practice.

**Sub-Events**

### M6-CCH04B Radiologist Panelist

Michelle S. Ginsberg, MD (*Presenter*) Speaker, Ultimate Opinions In Medicine LLC

### M6-CCH04C Surgeon Panelist

Ravi Rajaram, MD, MSc (*Presenter*) Nothing to Disclose

### M6-CCH04D Oncologist Panelist

Gregory J. Riely, MD, PhD (*Presenter*) Consultant, Boehringer Ingelheim GmbHConsultant, Merck & Co, IncConsultant, F. Hoffmann-La Roche Ltd

### M6-CCH04E Radiation Therapist Panelist

Andreas Rimner, MD (*Presenter*) Research Consultant, General Electric CompanyResearch Consultant, Varian Medical Systems, IncResearch Grant, Varian Medical Systems, Inc

# Abstract Archives of the RSNA, 2024

M6-CER04

## Non-Traumatic Thoracic Emergencies

Monday, Dec. 2 1:30PM - 2:30PM Room: N228

Nupur Verma, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the role of CCTA in evaluation of patients with acute chest pain, parameters for use of CCTA, and limitations. 2) Review acute aotic syndrome diagnosis as they may present in patients with chest pain symptoms and describe imaging classification for radiology reporting. 3) Describe findings in chest infections of fungal pathology, considering endemic and special populations as well as associated risk factors.

**COURSE DESCRIPTION**

The lectures in the session will focus on crucial diagnoses in non-traumatic acute aortic syndromes, fungal infections, and CCTA in the emergency department. Concepts of critical imaging features, accurate and clinically relevant reporting, and strategies to overcome diagnostic challenges in the emergency setting will be emphasized.

**Sub-Events**

### M6-CER04B CT in Non-Traumatic Acute Aortic Syndromes

Dhiraj Baruah, MBBS, MD (*Presenter*) Grant, Blue Eye Soft Corp;Consultant, ImBio, LLC

### M6-CER04C Fungal Infections: What Every Radiologist Should Know

Bruno Hochhegger, MD,PhD (*Presenter*) Nothing to Disclose

### M6-CER04D CCTA in the Emergency Department

Rawan Abu Mughli, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M6-CGI09

## Case-Based Imaging Review

Monday, Dec. 2 1:30PM - 2:30PM Room: E451B

Douglas S. Katz, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review several emergency diagnoses which can be identified on abdominal and pelvic ultrasound, with differential diagnoses if appropriate. 2) To discuss the differential diagnosis of peritoneal disease on cross sectional imaging. 3) To review current imaging findings of pancreatic tumors including with dual energy CT. 4) To understand the incidence of common and less common liver tumors and their imaging findings.

**COURSE DESCRIPTION**

Case-based abdominal imaging session with 4 topics covering acute diagnoses of miscellaneous etiologies in the abdomen and pelvis, liver tumors which are uncommon and more common, peritoneal disease, and pancreatic tumors. The experienced faculty will make relevant teaching points sharing cases from their institutions, with briefs reviews of the relevant literature.

**Sub-Events**

**M6-CGI09B** **Acute Ultrasound Abdomen & Pelvis**

Douglas S. Katz, MD (*Presenter*) Nothing to Disclose

**M6-CGI09C** **Liver Tumors (Usual and Unusual)**

Victoria Chernyak, MD, MS (*Presenter*) Consultant, Bayer AG

**M6-CGI09D** **Peritoneal Lesions**

Se Hyung Kim, MD, PhD (*Presenter*) Nothing to Disclose

**M6-CGI09E** **Pancreatic Lesions**

Desiree E. Morgan, MD (*Presenter*) Equipment support, AW Server

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M6-CIN14

## Best Practices for AI Model Creation (Multi-modal (image+text) AI Model Development and Interpretation)

Monday, Dec. 2 1:30PM - 2:30PM Room: E450B

Hari Trivedi, MD (*Moderator*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;

### LEARNING OBJECTIVES

1) Develop robust AI models that integrate multi-modal data (image and text) for enhanced clinical decision-making. 2) Understand the role of public-private partnerships in the validation and deployment of AI models within healthcare settings. 3) Implement advanced evaluation techniques to assess the performance, trustworthiness, and clinical applicability of AI models beyond traditional metrics.

### COURSE DESCRIPTION

This course is designed to attendees with insights into the development and interpretation of multi-modal AI models. Topics include practical approaches to building robust AI models, the latest advancements in vision-language generative models for radiology, advanced evaluation metrics for AI performance and trustworthiness, and the validation of commercial AI models through public-private partnerships. Participants will gain a deeper understanding of the best practices for creating and implementing ethical, reliable, and clinically useful AI models in healthcare.

**Sub-Events**

**M6-CIN14B** **Public-Private Partnerships in AI Validation: A Comprehensive Review of Evidence from Commercial Models**

Judy W. Gichoya, MBChB, MS (*Presenter*) Consultant, Softbrew Digital LTD

**M6-CIN14C** **Beyond AUROC: Evaluating Performance, Trustworthiness, and Clinical Usefulness of AI in Radiology**

Paul H. Yi, MD (*Presenter*) Consultant, FH Orthopedics SAS;Consultant, BunkerHill Health

**M6-CIN14D** **Practical Ways to Develop Robust Artificial Intelligence Models**

Aimilia Gastounioti, PhD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

M6-CIR09

## Management of Portal Hypertension

Monday, Dec. 2 1:30PM - 2:30PM Room: E352

David C. Madoff, MD (*Moderator*) Advisory Board, Zimmer Biomet Holdings, Inc;Consultant, General Electric Company;Consultant, Guerbet SA;Consultant, Merck & Co, Inc;Consultant, Sirtex Medical Ltd;Consultant, Boston Scientific Corporation;Consultant, Johnson & Johnson;Consultant, Siemens AG

### LEARNING OBJECTIVES

1) Understand the Etiology and Pathogenesis of Portal Hypertension: Grasp the underlying causes and mechanisms of portal hypertension. Review current medical management strategies for portal hypertension. 2) Explore the Role of Interventional Radiology (IR): Identify the options and indications for IR in the management of portal hypertension. Discuss the benefits and limitations of various IR techniques. 3) Learn Advances in TIPS/DIPS Procedures: Understand the latest techniques for access and guidance in TIPS/DIPS. Manage postprocedural care and complications associated with TIPS/DIPS. 4) Management of Non-TIPS Portosystemic Shunts: Review the techniques and indications for mesocaval shunts and variceal embolization. Compare and contrast these methods with TIPS/DIPS procedures. 5) Handle Complications in Portal Hypertension Interventions: Identify potential complications during portal hypertension interventions. Develop strategies for managing complications, including prevention and treatment approaches.

### COURSE DESCRIPTION

This course offers an in-depth exploration of portal hypertension, a common and serious condition in patients with liver cirrhosis and other liver diseases. It provides a comprehensive understanding of the disease's etiology, pathogenesis, and medical management, followed by a detailed examination of the role of Interventional Radiology (IR) in treating this condition. Attendees will gain insights into various IR techniques, including Transjugular Intrahepatic Portosystemic Shunt (TIPS) and Direct Intrahepatic Portocaval Shunt (DIPS), as well as the management of other portosystemic shunts and variceal embolization. The course will also cover the complications that can arise during these interventions, providing strategies for managing both successful outcomes and potential disasters.

**Sub-Events**

### M6-CIR09B Disease Etiology, Pathogenesis and Medical Management

Abhishek Kumar, MD (*Presenter*) Speaker, Boston Scientific Corporation

### M6-CIR09C Role of IR in the Management of Portal Hypertension - Options and Indications

Claire Kaufman, MD (*Presenter*) Research Grant, Boston Scientific Corporation

### M6-CIR09D Advances in TIPS/DIPS: Access, Guidance, and Postprocedural Management

Vijay Ramalingam, MD (*Presenter*) Nothing to Disclose

### M6-CIR09E Management of Portosystemic Shunts (Everything but TIPS) - Mesocaval Shunts and Variceal Embolization

Rahul S. Patel, MD, MD (*Presenter*) Consultant, Sirtex Medical LtdResearch Consultant, Medtronic plcConsultant, Penumbra, IncConsultant, Terumo Corporation

### M6-CIR09F Complications During Portal Hypertension Interventions

Joshua D. Kuban, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M6-CMK16

## RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot (Registration Fee Required)

Monday, Dec. 2 2:00PM - 3:30PM Room: S504CD

Linda Probyn, MD (*Moderator*) Nothing to Disclose
Viviane Khoury, BSc, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review anatomy and ultrasound imaging techniques for evaluation of the ankle and foot. 2) Describe useful dynamic imaging techniques to enhance assessment of the ankle and foot. 3) Discuss ultrasound imaging of common pathologic musculoskeletal conditions at the ankle and foot.

**COURSE DESCRIPTION**

This session will review an approach to ultrasound of the ankle and foot.

Part 1: There will be a hands-on demonstration by an instructor showing an approach to ultrasound examination of the ankle and foot. This will include assessment of the tibiotalar joint, extensor, flexor, peroneal tendons, Achilles tendon, ligaments (ATFL, PTFL, calcaneofibular ligament, deltoid ligament, spring ligament), subtalar joint, plantar fascia, neurovascular structures with dynamic maneuvers.

This will be followed by a brief presentation highlighting common pathologic musculoskeletal conditions about the ankle and foot that are seen on ultrasound.

Part 2: Participants will be divided into small groups and will practice an approach to ultrasound of the ankle and foot on a model with an instructor teaching the participants.

Proper patient positioning will be shown. Tips on how to optimize ultrasound imaging to best evaluate the area of concern will be reviewed and discussed. Participants will have an opportunity to practice these skills and techniques.

Time is allocated for questions and answers.

**Sub-Events**

**M6-CMK16C** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Theodore T. Miller, MD (*Presenter*) Nothing to Disclose

**M6-CMK16D** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Robert S. Campbell, MBChB, FRCR (*Presenter*) Nothing to Disclose

**M6-CMK16E** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Jon A. Jacobson, MD (*Presenter*) Research Consultant, BioClinica, Inc;Advisory Board, Koninklijke Philips NV;Royalties, RELX;Contactor, POCUS PRO

**M6-CMK16F** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Benjamin D. Levine, MD (*Presenter*) Nothing to Disclose

**M6-CMK16G** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Kambiz Motamedi, MD (*Presenter*) Royalties, RELX

**M6-CMK16H** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Luca Maria Sconfienza, MD, PhD (*Presenter*) Travel support, Bracco Group;Travel support, Esaote SpA;Speakers Bureau, Esaote SpA;Travel support, ABIOGEN PHARMA SpA;Speakers Bureau, P&R Holding;Speakers Bureau, Pfizer Inc ;Speaker, Novartis AG;Speaker, Merck KGaA;Speaker, MSDF

**M6-CMK16I** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Marcos L. Sampaio, MD (*Presenter*) Nothing to Disclose

**M6-CMK16J** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Humberto G. Rosas, MD (*Presenter*) Co-founder, AyrFlo;Stockholder, AyrFlo

**M6-CMK16K** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Girish Gandikota, MD (*Presenter*) Nothing to Disclose

**M6-CMK16L** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Adnan M. Sheikh, MD (*Presenter*) Nothing to Disclose

**M6-CMK16M** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Joseph G. Craig, MBChB (*Presenter*) Nothing to Disclose

**M6-CMK16N** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Andrew B. Ross, MD, MPH (*Presenter*) Nothing to Disclose

**M6-CMK16O** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Dyan V. Flores, MD (*Presenter*) Nothing to Disclose

**M6-CMK16P** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Emma L. Rowbotham, FRCR (*Presenter*) Nothing to Disclose

**M6-CMK16Q** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Christopher F. Beaulieu, MD, PhD (*Presenter*) Nothing to Disclose

**M6-CMK16R** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Mark Cresswell, MBBCh, BSc (*Presenter*) Consultant, Koninklijke Philips NV

**M6-CMK16S** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Kenneth S. Lee, MD, MBA (*Presenter*) Grant, NFL;Research support, Hologic, Inc;Royalties, RELX

**M6-CMK16T** **RSNA Hands-On Lab: Musculoskeletal Ultrasound Workshop: Ankle and Foot**

Angela Atinga, MBBChir, FRCPC (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

M6-CNR11

## Masterclass in the Multidisciplinary Management of Gliomas

Monday, Dec. 2 1:30PM - 2:30PM Room: S406B

Suyash Mohan, MD (*Moderator*) Research Grant, NovoCure Ltd;Research Grant, Galileo CDS, Inc;Consultant, Northwest Biotherapeutics, Inc;Consultant, AIRS Medical Inc;Consultant, Qynapse SAS

**LEARNING OBJECTIVES**

1) Review the progress in the war on cancer with impact of tumor treating fields, new/targeted therapies including IDH inhibitors, in the age of genomics and immuno-oncology. 2) Discuss role of extent of resection, clinically relevant molecular markers, and value of providing percentage of viable tumor in the resected specimen. 3) Illustrate role of advanced neuroimaging techniques and AI-methods to differentiate tumor progression from treatment related changes.

**COURSE DESCRIPTION**

Join us to stay at the forefront of brain tumor diagnosis and treatment - to improve patient outcomes through integrated, multidisciplinary care. Led by renowned experts in the field, this masterclass offers an interactive 'case-based' session discussing how to approach brain tumors as a team. This advanced course will showcase how radiologists can tailor their reports and imaging assessment to what is relevant for clinical decision making. Participants will also have the opportunity to network with peers and leaders, fostering collaboration and knowledge sharing.

**Sub-Events**

### M6-CNR11B TMZ to TTFields and Beyond: Progress in "The War on Cancer"

Roger Stupp, MD (*Presenter*) Research Consultant, Carthera;Research Grant, Carthera;Scientific Advisory Board, Alpheus Medical Inc;Scientific Advisory Board, Hemispherian AS;Consultant, GT Medical Technologies, Inc;Consultant, Triact Therapeutics Inc;Research Consultant, AstraZeneca PLC;Research Consultant, Boston Scientific Corporation

### M6-CNR11C Neurosurgical Management of Gliomas: State-of-the-Art

Shawn Hervey-Jumper, MD (*Presenter*) Nothing to Disclose

### M6-CNR11D Tumor Progression or Treatment-Related Changes: Putting the Pieces Together

Suyash Mohan, MD (*Presenter*) Research Grant, NovoCure Ltd;Research Grant, Galileo CDS, Inc;Consultant, Northwest Biotherapeutics, Inc;Consultant, AIRS Medical Inc;Consultant, Qynapse SAS

### M6-CNR11E 2021 WHO Classification of CNS Tumors: Impact of Innovation

Maria Martinez-Lage Alvarez, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M6-COB01

## Endometriosis 2024 Updates

Monday, Dec. 2 1:30PM - 2:30PM Room: E353B

Myra K. Feldman, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe US scanning maneuvers recommended by the SRU consensus to improve sensitivity of routine pelvic US for detection of endometriosis. 2) Analyze augmented ultrasound images for direct and indirect imaging findings of endometriosis. 3) Evaluate pelvic MR studies and report high-yield findings that impact surgical decision-making. 4) Identify common pitfalls and mimics of endometriosis on pelvic imaging studies.

**COURSE DESCRIPTION**

This course will review important concepts in endometriosis imaging including a summary of the recently published Society of Radiologists in Ultrasound (SRU) consensus paper on routine pelvic ultrasound for endometriosis detection, important findings to report on pelvic MR studies for endometriosis that will impact treatment planning, and common pitfalls and endometriosis mimics on both ultrasound and MR.

**Sub-Events**

### M6-COB01B Ultrasound Detection for Endometriosis: SRU Consensus Panel Recommendations

Priyanka Jha, MBBS (*Presenter*) Nothing to Disclose

### M6-COB01C MRI for Endometriosis with Surgical Correlation

Wendaline M. VanBuren, MD (*Presenter*) Nothing to Disclose

### M6-COB01D Pitfalls and Mimics of Endometriosis

Luciana P. Chamie, MD, PhD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M6-CPH11

## Emerging Technologies Integrating Imaging into Radiotherapy

Monday, Dec. 2 1:30PM - 2:30PM Room: S404

Tokihiro Yamamoto, PhD (*Moderator*) Nothing to Disclose
Gregory C. Sharp, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize the rationale, opportunities, and challenges of the current and emerging technologies integrating imaging into radiotherapy. 2) Identify the current and emerging applications of these technologies to treatment planning, delivery, adaptation, and response assessment. 3) Promote collaboration among radiologists, radiation oncologists, and medical physicists in research and clinical applications of these technologies.

**COURSE DESCRIPTION**

Imaging plays a crucial role in radiotherapy (RT) and various imaging technologies, methods, and biomarkers have been increasingly integrated into RT for investigational and clinical use in treatment planning, delivery, adaptation, and response assessment. Photon RT delivery systems combined with x-ray imaging systems have become widespread and critical for i mage-guided RT. The recent advent of MR-guided RT (MRgRT) systems, combining an MRI system with an RT delivery system, has provided new capabilities, including real-time image guidance and treatment adaptation. Biology-guided RT (BgRT) system, combining a PET system with an RT delivery system, has enabled synchronizing PET signals from tumors with RT delivery to direct treatment with sub-second latency. Imaging is also a topic of growing importance in particle RT for accurate prediction of stopping-power ratios and for in-vivo verification of treatment delivery. Moreover, functional/biological imaging has been increasingly utilized to guide RT (for example, to selectively increase dose to subvolumes within the target exhibiting a specific phenotype or to selectively avoid irradiating radiosensitive subvolumes or substructures within the organ at risk) and to assess therapy response in cancer patients. This educational course seeks to bring together a diverse group of experts in radiology, radiation oncology, and medical physics to review and discuss the current and emerging technologies integrating imaging into RT, with a view to promote and accelerate collaboration in this rapidly evolving field.

**Sub-Events**

### M6-CPH11C Photon RT Delivery Systems Integrating Imaging Systems

Jennie S. Crosby, PhD (*Presenter*) Nothing to Disclose

### M6-CPH11D Imaging in Particle RT

Ming Yang, PhD (*Presenter*) Nothing to Disclose

### M6-CPH11E Functional/Biological Image-guided Radiotherapy

Tokihiro Yamamoto, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M6-CPH15

## AAPM/RSNA Basic Physics Lecture for the RT: MRI Safety

Monday, Dec. 2 1:30PM - 2:30PM Room: N227B

Samuel A. Einstein, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify strategies to investigate and characterize foreign bodies in a patient who is scheduled to have an MRI exam. 2) Understand the risks associated with exposing patients with foreign bodies to static magnetic fields, time-varying gradient fields, and time-varying radiofrequency fields in MRI.

**COURSE DESCRIPTION**

Ferromagnetic implants and foreign bodies are known to pose a potential risk for MRI system-related accidents and injuries to patients. However, the magnitude of the risk of performing an MRI exam is not always clear when a poorly characterized foreign body is discovered during patient screening or, in some cases, once the exam has begun. This lecture will discuss how to assess risks of imaging patients with foreign bodies. Following this session, participants will be familiar with strategies to characterize foreign bodies and assess the risks they pose in an MRI environment. This knowledge will aid participants in communicating risk to help determine whether a patient with a foreign body should proceed with their MRI exam and if additional precautions are necessary.

**Sub-Events**

**M6-CPH15B** **Assessing Risks for Patients with Foreign Bodies in MRI**

Emanuel Kanal, MD (*Presenter*) Consultant, Medtronic plc;Consultant, General Electric Company

# Abstract Archives of the RSNA, 2024

M6-RCP04

## Introduction to Cardiac Imaging for the Radiologist (CIR Session in Spanish)/Introduccion a las Imįgenes cardķacas para el radiólogo(a) (Sesión del CIR en Español)

Monday, Dec. 2 1:30PM - 2:30PM Room: E350

Fernando R. Gutierrez, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Evaluate the increasing cardiac imaging applications in our daily practice which has resulted in a growing need for general radiologist to have a more protagonic, central role in the performance of these studies. 2) Outline innovative strategies (including AI) and their application to CT and MR in the diagnosis of congenital and acquired heart conditions. 3) Review and update general concepts of hypertrophic cardiomyopathy, imaging options in diagnosis and quantification. 4) Outline basic techniques of coronary CTA and its applications in different clinical settings.

**COURSE DESCRIPTION**

Provide audience with a general outline of basic knowledge of several topics of cardiac imaging and their impact on their daily practice.

Note: This course will be in Spanish.

**Sub-Events**

**M6-RCP04B** **Introduction by the President of the Interamerican College of Radiology / Introducción del presidente del Colegio Interamericano de Radiologķa**

Claudio Bonini, MD (*Presenter*) Nothing to Disclose

**M6-RCP04C** **One Stop Shop in Coronary CT / Enfoque integral de la angiotomografķa computarizada coronaria**

Cesar H. Nomura, MD, PhD (*Presenter*) Nothing to Disclose

**M6-RCP04D** **Update on Hypertrophic Cardiomyopathy / Actualización en miocardiopatķa hipertrófica**

Julia Alegria, MD (*Presenter*) Nothing to Disclose

**M6-RCP04E** **The Future of Cardiac Imaging / El futuro de la imagen cardķaca**

Eliseo Vano Galvan, MD (*Presenter*) Nothing to Disclose

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

M6-RCP22

## Independent Clinical Practice and Quality of Care in Interventional Oncology

Monday, Dec. 2 1:30PM - 2:30PM Room: S401

Andreas Adam, FRCR, DSc (*Moderator*) Institutional research support, Boston Scientific Corporation;Institutional research support, Siemens AG;Institutional research support, Medtronic plc

### LEARNING OBJECTIVES

1) To learn how quality assurance improves patient care in interventional oncology. 2) To understand how radiation oncology raised its standards of care by applying quality assurance principles and the lessons applicable to interventional oncology. 3) To understand how the application of quality assurance principles can help to make interventional oncology a mainstream oncological discipline.

### COURSE DESCRIPTION

This session will demonstrate how the application of quality assurance principles can raise standards of patient care and help interventional oncology to become a mainstream discipline in cancer care.

**Sub-Events**

### M6-RCP22B How Quality of Care Is Assured in Radiation Oncology and Why This Is Also Applicable to IO

Lizbeth Kenny, MD, FRANZCR (*Presenter*) Consultant, GenesisCare

### M6-RCP22C An Accreditation System for IO and What It Aims to Achieve

Andreas Adam, FRCR, DSc (*Presenter*) Institutional research support, Boston Scientific Corporation;Institutional research support, Siemens AG;Institutional research support, Medtronic plc

### M6-RCP22D IASIOS Accreditation: Why and How We Got It, and What It Has Done for Our IO Service

Jack W. Jennings, MD, PhD (*Presenter*) Consultant, Stryker Corporation;Consultant, Boston Scientific Corporation;Consultant, Becton, Dickinson and Company;Consultant, Teleflex Incorporated;Consultant, Varian Medical Systems, Inc

# Abstract Archives of the RSNA, 2024

M7-CAS08

## The ROI of AI (Sponsored by the RSNA Associated Sciences Consortium)

Monday, Dec. 2 3:00PM - 4:00PM Room: N226

Catherine Gunn, MBA, RT (*Moderator*) Nothing to Disclose
Brian Fox, MBA (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the infrastructure and workflow for a successful AI deployment. 2) Recognize the value of ROI from a patient, provider, and enterprise perspective. 3) Identify selection, evaluation, and testing criteria for AI solution deployment.

**COURSE DESCRIPTION**

The discussion will provide a strategy in the identification and selection of AI within Radiology, a system level approach. Session will share the BJC Healthcare selection, implementation and governance of AI. Understanding and importance of both financial and non-financial ROI during evaluation of AI within Radiology.

**Sub-Events**

### M7-CAS08C AI Returns More Than Just Dollars: Adoption Makes Sense

Jason B. Wiesner, MD, MBA (*Presenter*) Nothing to Disclose

### M7-CAS08D AI in Imaging: ROI and Beyond. An Organizational Perspective

Vamsi R. Narra, MD, FRCR (*Presenter*) Advisory Board, Canon Medical Systems Corporation

# Abstract Archives of the RSNA, 2024

M7-CBR05

## Contrast Enhanced Mammography Development and Implementation (Supported in part by an Unrestricted Medical Education Grant from GE Healthcare, Inc.)

Monday, Dec. 2 3:00PM - 4:00PM Room: S406A

Janice S. Sung, MD (*Moderator*) Research Grant, General Electric Company

**LEARNING OBJECTIVES**

1) Review how to perform contrast enhanced mammography (CEM) and considerations when starting a CEM program. 2) Discuss the emerging roles of contrast enhanced mammography in both the screening and diagnostic settings.

**COURSE DESCRIPTION**

Contrast enhanced mammography (CEM) is an FDA approved technique that is emerging as an alternative vascular based technique to conventional breast imaging and MRI in both the screening and diagnostic settings. This session will review considerations in beginning a CEM program and review data supporting the use of CEM in both the screening and diagnostic settings.

**Sub-Events**

### M7-CBR05B Technique, Indications, Reporting and Implementation

Janice S. Sung, MD (*Presenter*) Research Grant, General Electric Company

### M7-CBR05C Which is Better CEM or MRI

Rodrigo Alcantara, MD, MSc (*Presenter*) Nothing to Disclose

### M7-CBR05D Is CEM Ready for Screening?

Bhavika K. Patel, MD (*Presenter*) Research support, GRAIL, Inc;Research Grant, Hologic, Inc

# Abstract Archives of the RSNA, 2024

M7-CCA14

## Cardiac CT Mentored Case Review: Imaging of Pulmonary Veins, Pericardium, and Adult Congenital Heart Disease

Monday, Dec. 2 3:00PM - 4:00PM Room: E353C

Daniel Ocazionez-Trujillo, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To learn CTA imaging appearance of cardiac diseases beyond coronary artery disease. 2) To learn best approach for cardiac CTA iamging for planning of left atrial ablation.

**Sub-Events**

### M7-CCA14B Cardiac and Pericardial Neoplasms

Jacobo Kirsch, MD, MBA (*Presenter*) Medical Advisory Board, Zebra Medical Vision Ltd

### M7-CCA14C Left Atrial Pre- and Post-Ablation Imaging

Phillip M. Young, MD (*Presenter*) Nothing to Disclose

### M7-CCA14D Mixed Case-Review - Summary

Gautham P. Reddy, MD, MPH (*Presenter*) Nothing to Disclose

### M7-CCA14E Adult Congenital Heart Disease

Linda B. Haramati, MD, MS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M7-CER15

## Emergency Radiology Practice Management 2024: Managing Productivity and Wellness: Dialectical Dilemma or Zero Sum Game?

Monday, Dec. 2 3:00PM - 4:00PM Room: N228

Suzanne T. Chong, MD, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss the physiology of nocturnal and diurnal work. 2) Describe features and staffing benefits of a successful overnight radiology service. 3) Understand the importance of real time objective operational data in structuring and monitoring an emergency radiology service. 4) Review key performance indicators which can be useful for the management of an emergency radiology practice and help inform staffing decisions. 5) Understand wellness and impact on individual and organizational success. 6) Discuss evidence-based burnout mitigation strategies.

**COURSE DESCRIPTION**

Optimizing the value chain of emergency radiology while also attending to radiologists' wellbeing can result in maximal performance and productivity. In this practice management session, we explore physiological reasons behind why some radiologists find enhanced job satisfaction working overnight and discuss practice features that attract night radiologists. We familiarize you to inward and outward facing data, dashboards, and key performance indicators to assist in the creation and maintenance of a successful emergency radiology practice. We discuss evidence-based burnout mitigation strategies that can be implemented in your practices to re-energize your emergency radiologists who may be struggling with job satisfaction in the face of relentless shift intensity and imaging volumes. At the conclusion of this session, you will feel a sense of renewed optimism and vigor for managing your emergency radiologists and have discrete tools to help you manage your emergency radiology practice for both productivity and enhanced wellness.

**Sub-Events**

**M7-CER15B** **Data and Dashboards in Emergency Radiology Practice Management**

Tarek N. Hanna, MD (*Presenter*) Nothing to Disclose

**M7-CER15C** **Middle of the Night Matters: How to Support a Nocturnist Service**

Summer L. Kaplan, MD, MS (*Presenter*) Nothing to Disclose

**M7-CER15D** **Wellness: Quelling the Burnout Fire With Evidence-Based Strategies**

Suzanne T. Chong, MD, MS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M7-CGI07

## Artificial Intelligence in Abdominal Imaging

Monday, Dec. 2 3:00PM - 4:00PM Room: E451B

Kirti Magudia, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn about implementing AI in your practice. 2) Learn about AI for GI imaging including opportunistic screening, CT-based body composition analysis and coronary artery calcium scoring. 3) Learn about different aspects of AI in medical imaging including bias, fairness, and safety.

**COURSE DESCRIPTION**

This session will focus on various aspects of Abdominal AI including how to implement AI in your practice and specific applications in GI Imaging including CT-based body composition analysis and coronary artery calcium scoring in addition to opportunistic screening. AI issues like bias, fairness, and safety will also be discussed.

**Sub-Events**

### M7-CGI07B Implementing AI in Your Practice

Paul H. Yi, MD (*Presenter*) Consultant, FH Orthopedics SAS;Consultant, BunkerHill Health

### M7-CGI07C AI Bias

Tessa S. Cook, MD, PhD (*Presenter*) Grant, Independence Blue Cross;Speaker, Sectra AB;

### M7-CGI07D AI for Opportunistic Screening

Matthew H. Lee, MD (*Presenter*) Nothing to Disclose

### M7-CGI07E AI for GI Imaging

Kirti Magudia, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M7-CGU02

## GU Case-Based Audience Participation Session: Fundamentals

Monday, Dec. 2 3:00PM - 4:00PM Room: E353B

Tharakeswara K. Bathala, MD, MS (*Moderator*) Nothing to Disclose
Sina Houshmand, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Collaboratively participate in the interpretation of high-yield multimodality images of the genitourinary system, specifically focusing on fundamentals of the imaging of the kidney, ureter, bladder, and reproductive organs to enhance their diagnostic reasoning. 2) Be familiarized with the latest advances in GU imaging and updates in the guidelines and staging systems.

**COURSE DESCRIPTION**

Elevate your GU imaging skills with our "GU Case-Based Audience Participation Session: Fundamentals" course. This essential program is designed to help you master the interpretation of images related to the kidney, ureter, bladder, and reproductive organs. Through expert-led lectures and interactive participation by the audience, you will gain a solid foundation in diagnostic reasoning and decision-making skills. Join us to build a strong foundation in GU imaging and advance your career.

**Sub-Events**

### M7-CGU02C Kidney

Lyndon Luk, MD (*Presenter*) Nothing to Disclose

### M7-CGU02D Bladder/Ureter

Tristan Barrett, MBBS, MD (*Presenter*) Nothing to Disclose

### M7-CGU02E Prostate

Tharakeswara K. Bathala, MD, MS (*Presenter*) Nothing to Disclose

### M7-CGU02F GynOnc

Bahar Mansoori, MD (*Presenter*) Nothing to Disclose

### M7-CGU02G Benign Gyn

Ekta Maheshwari, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M7-CHN06

## Sinus Pressure: All About Those Painful Paranasal Sinuses

Monday, Dec. 2 3:00PM - 4:00PM Room: E352

Kristen L. Baugnon, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review sinonasal anatomy as relevant to imaging. 2) Understand the imaging algorithm and search patterns for patients presenting with sinus disease and how to differentiate benign from malignant entities. 3) Understand the clinical and surgical implications of imaging findings in the paranasal sinuses.

**COURSE DESCRIPTION**

In this Head and Neck session devoted to the paranasal sinuses, attendees will review the imaging approach and will be presented with clinical case examples of patients with benign and malignant sinus disease. Attendees will also review the imaging anatomy as well as how to identify and convey key imaging information to the sinus surgeons. Speakers will emphasize pearls for imaging evaluation and differentiating each entity from common mimics, pitfalls of interpretation to avoid, and relevant clinical management considerations with which radiologists should be familiar. This session offers attendees the opportunity to refine their interpretation of complex head and neck imaging studies by incorporating tips from world experts.

**Sub-Events**

### M7-CHN06B Anatomy

Marin A. McDonald, MD, PhD (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation

### M7-CHN06C Benign Sinus Disease

Greg D. Avey, MD (*Presenter*) Research Consultant, General Electric Company

### M7-CHN06D Sinonasal Malignancy

Kristen L. Baugnon, MD (*Presenter*) Nothing to Disclose

### M7-CHN06E What the Surgeon REALLY Wants to Know

Mari Hagiwara, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M7-CIN09

## Best Practices for AI Model Regulation and Human-AI interaction (Supported in part by an Unrestricted Medical Education Grant from Siemens Healthineers of Siemens Medical Solutions, USA, Inc)

Monday, Dec. 2 3:00PM - 4:00PM Room: N227B

Susanne Gaube, PhD, MSc (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn how the FDA views clear communication regarding the design and limitations of a product as an essential component of its safe and effective use. 2) Understand different paradigms to study human-AI interaction and identify appropriate evaluation methods. 3) Know about the different options of how AI results may be returned in the workflow and understand the implications of the choice of integration.

**COURSE DESCRIPTION**

This session provides an overview of regulatory considerations for AI/ML-enabled radiological devices and showcases the importance of understanding how users interact with these types of products. First, we will provide a brief overview of the FDA authorization process for AI/ML-enabled products and discuss the role human factors play in the premarket review and regulation of these types of devices, as well as their importance across the product lifecycle. We will then examine key radiologist-specific considerations, such as automation bias, deskilling, and education, and how these factors influence both user experience and performance & safety in AI/ML-enabled medical devices. Next, examples of different paradigms and methodologies that can be used to investigate various aspects of human-AI interaction and how AI/ML-generated advice affects clinical decision-making will be explored. Then, we will see how AI algorithms are brought to clinical routine use and how they impact clinical operations, what challenges were observed, and what lessons have been learned from projects in recent years. This session equips participants with practical knowledge for navigating AI model regulation from a human factors perspective, the role of and best practices for evidence-based user testing, and provides examples of AI-enabled products to help participants better understand how users interact with these technologies in clinical settings.

**Sub-Events**

**M7-CIN09B** **Artificial Intelligence in Radiology: Transparency in Design and Use of Medical Devices**

Samuel Fielden, PhD (*Presenter*) Nothing to Disclose

**M7-CIN09C** **Radiologist-Machine Interaction in AI: Automation Bias, Neglect, Deskilling, Education, and Interface Design**

Merel Huisman, MD, PhD (*Presenter*) Nothing to Disclose

**M7-CIN09D** **Understanding Human-AI Interaction Processes when Developing and Deploying AI-enabled Decision Support**

Susanne Gaube, PhD, MSc (*Presenter*) Nothing to Disclose

**M7-CIN09E** **Bringing AI Tools to Routine Clinical Use - Roadblocks - Learnings - Impact**

Clemens Janus (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M7-CMK01

## Shoulder Imaging in the Athlete

Monday, Dec. 2 3:00PM - 4:00PM Room: E450A

Reto Sutter, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe how to best evaluate sports injuries of the rotator cuff, the labrum and the articular cartilage of the shoulder. 2) Identify the key imaging findings seen in shoulder instability. 3) Know how to evaluate imaging of the shoulder after rotator cuff surgery and instability surgery.

**COURSE DESCRIPTION**

State-of-the-art imaging is crucial for assessing shoulder injuries in athletes, and in recent years there have been many new insights and technological developments on how to image the shoulder. This course covers both the basics and new knowledge about imaging the rotator cuff, the labrum and articular cartilage, as well as imaging of shoulder instability. In addition, post-operative imaging will be discussed with lectures on the post-operative rotator cuff and shoulder instability surgery.

**Sub-Events**

### M7-CMK01B Shoulder Instability in the Athlete

P. Diana Afonso, MD (*Presenter*) Nothing to Disclose

### M7-CMK01C Assessing Labrum and Cartilage

Jung-Ah Choi, MD, PhD (*Presenter*) Nothing to Disclose

### M7-CMK01D Rotator Cuff Pathology & Muscles

Benjamin Fritz, MD (*Presenter*) Nothing to Disclose

### M7-CMK01E Post-operative Rotator Cuff

Reto Sutter, MD (*Presenter*) Nothing to Disclose

### M7-CMK01F Post-operative Shoulder Instability

Mohammad M. Samim, MD, MRCS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M7-CNPM06

## The Future of DEI: A Leadership Perspective to Challenges and Opportunities (Sponsored by the RSNA Health Equity Committee and the RSNA Committee on Diversity, Equity and Inclusion)

Monday, Dec. 2 3:00PM - 4:00PM Room: S402

Efren J. Flores, MD (*Moderator*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Lucy B. Spalluto, MD, MPH (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Prioritize DEI values and goals are infused across the organization and identify areas of needs. 2) Using evidence-based practices address diversity gaps and the impact of unconscious bias across our radiology profession. 3) Collaborate with historically and currently marginalized groups to bolster pipeline efforts and deliver equitable care. 4) Establish a leadership vision and foster collaborations with national organizations to promote sustainability in DEI efforts. This session will include a 15-minute Q&A session with the audience.

### COURSE DESCRIPTION

Diversity, Equity & Inclusion (DEI) are key priorities to the future of our radiology practices aimed to deliver the best care to all patients, while fostering a sense of belonging among all patients and radiology professionals at all levels. Although new opportunities have risen over the past few years to advance the DEI goals and mission, the current environment has resulted in unexpected challenges that may impact the commitment to advance these goals. In alignment with RSNA's commitment to advancing Diversity, Equity, Inclusion & Belonging (DEIB), it is paramount that radiologists are equipped with the necessary knowledge toolkit to navigate emerging challenges and foster opportunities that advance the DEIB goals. The goal of this session is to provide radiologists with a leadership perspective on how to successfully advance DEI goals in the current environment and to overcome emerging barriers in the future.

**Sub-Events**

### M7-CNPM06C Supporting the DEI Mission at the National and Organizational Level

Maureen P. Kohi, MD (*Presenter*) Nothing to Disclose

### M7-CNPM06D Developing a DEI Vision for Sustained Commitment at an Integrated Health System

Matthew D. Bucknor, MD (*Presenter*) Nothing to Disclose

### M7-CNPM06E Perspectives From EIC to Develop the Evidence Based Case for DEI

Ruth C. Carlos, MD, MS (*Presenter*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company

# Abstract Archives of the RSNA, 2024

M7-CPD09

## Emergencies in Pediatric Radiology

Monday, Dec. 2 3:00PM - 4:00PM Room: E350

Ali Pourvaziri, MD, MPH (*Moderator*) Nothing to Disclose
Francisco A. Perez, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn appropriate imaging indications for pediatric emergencies. 2) Identify important imaging findings in the pediatric emergency setting.

**COURSE DESCRIPTION**

This course will provide an overview of pediatric emergencies, including neck, gonadal and abdominal emergencies through four lectures. The presentations will include key diagnoses to know in the emergency setting, as well as appropriate imaging modalities based on clinical scenarios. The outcome of the session will be improved understanding of pediatric emergency imaging.

**Sub-Events**

**M7-CPD09C** **Don't Stick your Neck Out: Pediatric Neck Emergencies**

David M. Mirsky, MD (*Presenter*) Nothing to Disclose

**M7-CPD09D** **Learning How to Identify the Twist: Gonadal Torsion Imaging**

Tatiana M. Fazecas, MD (*Presenter*) Nothing to Disclose

**M7-CPD09E** **Pearls of Abdominal Trauma: When to Use Ultrasound vs CT**

Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

**M7-CPD09F** **Pediatric Abdominal Emergencies: Emblematic and Challenging Cases**

Marcelo S. Takahashi, MD, PhD (*Presenter*) Speaker, Vertex Pharmaceuticals Incorporated

# Abstract Archives of the RSNA, 2024

M7-CPH16

## Best of AAPM Summer School: Chicago Fireside Chat - Radiopharmaceutical Therapy

Monday, Dec. 2 3:00PM - 4:00PM Room: S404

Vrinda Narayana, PhD (*Moderator*) Nothing to Disclose
Robert Hobbs, PhD (*Presenter*) Nothing to Disclose
Roger W. Howell, PhD (*Presenter*) Nothing to Disclose
Joseph O'Donoghue, PhD (*Presenter*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Develop and implement a comprehensive radiopharmaceutical therapy program. 2) Understand the principles and applications of radiopharmaceutical dosimetry in patient care. 3) Recognize and utilize QA tools to maintain high standards in radiopharmaceutical therapy programs.

### COURSE DESCRIPTION

Radiopharmaceutical therapy is an increasingly significant field in medical treatment, offering targeted solutions for various conditions. This interactive course, modeled on the AAPM Summer School curriculum, is designed to educate both new and experienced practitioners on the essential components of establishing and maintaining an effective radiopharmaceutical therapy program.

Participants will engage in dynamic Q&A sessions, allowing for a deeper understanding and practical application of key concepts. The course will cover:

• Program Setup: Step-by-step guidance on developing and implementing a comprehensive radiopharmaceutical therapy program, including infrastructure, regulatory compliance, and safety protocols.

• Dosimetry: An exploration of radiopharmaceutical dosimetry principles, enabling participants to analyze dosimetric data, optimize treatment plans, and enhance therapeutic outcomes.

• Quality Assurance (QA): Identification and utilization of QA tools, adherence to standardized protocols, and alignment with International Commission on Radiation Units and Measurements (ICRU) guidelines to ensure high standards in therapy delivery.

Enhance your knowledge and skills in radiopharmaceutical therapy, and stay at the forefront of this rapidly evolving field. This course promises an engaging and informative experience for all participants, fostering both professional growth and improved patient care.

# Abstract Archives of the RSNA, 2024

M7-CRO06

## Breast MDC Review

Monday, Dec. 2 3:00PM - 4:00PM Room: S401

Bethany L. Niell, MD, PhD (*Moderator*) Equipment support, Hologic, Inc

**LEARNING OBJECTIVES**

1) Describe the latest advances in breast cancer imaging before, during, and after treatment. 2) Facilitate a multidisciplinary approach to the diagnosis, management, and treatment of breast cancer.

**COURSE DESCRIPTION**

This course utilizes a case-based multi-disciplinary approach to discuss appropriate breast imaging examinations, available radiotherapy options, breast pathophysiology, as well as medical and surgical oncologic treatment planning in the setting of breast cancer.

**Sub-Events**

**M7-CRO06B** **Breast MDC Review**

Anna Shapiro, MD (*Presenter*) Nothing to Disclose

**M7-CRO06C** **Breast MDC Review**

Avan Armaghani, MD (*Presenter*) Nothing to Disclose

**M7-CRO06D** **Breast MDC Review**

Lorena Gonzalez, MD (*Presenter*) Nothing to Disclose

**M7-CRO06E** **Breast MDC Review**

Rohin Mehta, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M7-CVA02

## Vascular Access Imaging for Structural Heart Practices

Monday, Dec. 2 3:00PM - 4:00PM Room: N229

Dominika Sucha, MD, PhD (*Moderator*) Nothing to Disclose
Nicholas S. Burris, MD (*Moderator*) Royalties, ImBio, LLC

**LEARNING OBJECTIVES**

1) Understand unique image acquisition protocols to optimize evaluation of the vasculature in the setting of surgical repairs and ECMO. 2) Define important imaging findings that differentiate normal and expected post-operative changes from unexpected and concerning features among patients that have undergone aortic surgery. 3) Review a variety of key findings and descriptors that are important to include in diagnostic imaging reports for best patient management from the perspective of surgeons and interventionalists.

**COURSE DESCRIPTION**

Vascular imaging in the setting of extracorporeal circulatory support and in the post-operative setting after aortic surgery can be challenging for diagnostic radiologists for a variety of reasons related to determining optimal imaging acquisition protocols and differentiating normal/expected versus potentially problematic findings. Such determinations can rely on detailed knowledge of the surgical procedure and/or devices used in the operation, which may not be familiar to the imager or readily available in the patient's history. This course will focuse= on practical aspects of imaging the central vasculature (primarily the aorta) in the setting of a patient who has recently undergone or planned to undergo major cardiovascular surgery. Additionally, there will be a review of endovascular and open aortic repair techniques and relevant imaging findings that are important to surgeons and interventionalists who are managing the patient.

**Sub-Events**

### M7-CVA02C Imaging in Extracorporeal Membrane Oxygenation

Felipe A. Sanchez, MD (*Presenter*) Nothing to Disclose

### M7-CVA02D Imaging of Vascular Access Needs for Transcather Valve Procedures

Dominika Sucha, MD, PhD (*Presenter*) Nothing to Disclose

### M7-CVA02E Imaging After Endovascular Stent Grafts

William Sherk, MD (*Presenter*) Nothing to Disclose

### M7-CVA02F Imaging After Graft Repairs (Ascending, Descending, and Thoracoabdominal): Expected Post-Surgical Findings and Complications

Barbara Hamilton, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M7-RCP01

## Fast 5

Monday, Dec. 2 4:00PM - 4:30PM Room: ARIE CROWN THEATER

Angel A. Gomez-Cintron, MD, MPH (*Moderator*) Nothing to Disclose

**COURSE DESCRIPTION**

This fast-paced session features five speakers delivering five-minute presentations on non-clinical topics in the Arie Crown Theater.

**Sub-Events**

**M7-RCP01B** **Mentors, Sponsors, and Coaches: The People We Need in Our Professional Lives**

Tessa S. Cook, MD, PhD (*Presenter*) Grant, Independence Blue Cross;Speaker, Sectra AB;

**M7-RCP01C** **An Opportunity for Opportunistic Screening**

Abhinav Suri, BA, MPH (*Presenter*) Nothing to Disclose

**M7-RCP01D** **Fixing Responsibility When AI Fails!**

Niraj N. Pandey, MBBS, MD (*Presenter*) Nothing to Disclose

**M7-RCP01E** **Leveraging Community-Engaged Research Principles to Bridge Gaps between Communities, Healthcare, and Technology and Advance Health Equity**

Lauren R. Kriger Groner, DO, MS (*Presenter*) Nothing to Disclose

**M7-RCP01F** **Stepping Out of the Darkroom & Into the Spotlight: How to Use Social Media to Educate & Advocate**

Robyn G. Roth, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M7-RCP10

## The Academy's Annual Imaging Shark Bait Session

Monday, Dec. 2 1:30PM - 3:00PM Room: E351

Scott A. Penner, JD (*Moderator*) Spouse, Research Grant, General Electric Company;Spouse, Consultant, Human Longevity, Inc;Spouse, Stockholder, CureMetrix, Inc;Spouse, Stock options, Cortechs.ai

**LEARNING OBJECTIVES**

1) Identifying strategies for bringing research to the competitive marketplace. 2) Presenting a proposal in a way that elicits interest from potential investors. 3) Taking steps to secure investor funding while developing and protecting their intellectual property. 4) Identifying ways to generate business value through licensing and collaborations.

**COURSE DESCRIPTION**

The Academy for Radiology & Biomedical Imaging Research's Shark Tank/Shark Bait program will welcome an expert panel composed of a venture capitalist, intellectual property attorney, leaders of industry & academia, and a pitcher/entrepreneur who has successfully obtained funding. In this session, attendees will learn what experts look for and expect when deciding to invest in an innovative idea, providing tips, shared experiences, and an opportunity to ask questions. If you have ever wondered how to pitch your idea or if you wish to consider alternative funding resources, do not miss this fun, educational, and interactive session!

**Sub-Events**

### M7-RCP10B Expert Shark: Industry Perspective

Susan Harris, MS (*Presenter*) Employee, General Electric Company

### M7-RCP10C Expert Shark: Venture Capitol

Collin Larkin, MSc (*Presenter*) Nothing to Disclose

### M7-RCP10D Expert Shark: Academia & Entrepreneurship

Andrew D. Smith, MD, PhD (*Presenter*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms

### M7-RCP10E Shark Tank Presenter

Tinsu Pan, PhD (*Presenter*) Consultant, Bracco Group

# Abstract Archives of the RSNA, 2024

M8-CAS05

## Dose and Rad Safety, Dose Monitoring: PET/MR vs PET/CT (Sponsored by the RSNA Associated Sciences Consortium)

Monday, Dec. 2 4:30PM - 5:30PM Room: N226

Brandy J. Reed, MBA, RT (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Comparing PETMR and PETCT in regards to radiation dose. A radiologist and a physicist's perspective. 2) Utilizing PET's hybrid partners for mapping and attenuation correction. Is one better than the other?

**COURSE DESCRIPTION**

Embracing three perspectives on PETMR vs. PETCT in relation to radiation dose safety and clinical practice.

**Sub-Events**

### M8-CAS05B Radiation Dose Comparison: PET/CT vs PET/MR

Osama R. Mawlawi, PhD (*Presenter*) Nothing to Disclose

### M8-CAS05C PET & Hybrid Partners for Mapping, Diagnostic & Attenuation Correction

Dmitry Beyder, MBA (*Presenter*) Nothing to Disclose

### M8-CAS05D PET/MR vs. PET/CT Radiation Dose Comparison

Devaki Shilpa S. Surasi, MD (*Presenter*) Research support, Blue Earth Diagnostics Ltd

# Abstract Archives of the RSNA, 2024

M8-CIN05

## Best Practices for AI Model Selection

Monday, Dec. 2 4:30PM - 5:30PM Room: E450B

Melissa A. Davis, MD, MBA (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand best practices for the selection of artificial intelligence (AI) tools from the perspectives of the clinical evaluation, business evaluation, and technical evaluation.

**COURSE DESCRIPTION**

In this course we break down the main components needed to fully evaluate artificial intelligence (AI) tools for clinical practice. Learners will delve in to the clinical, business, and technical evaluations of these types of tools.

**Sub-Events**

### M8-CIN05B Best Practices for AI Model Selection: The Clinical Evaluation

Jason A. Poff, MD (*Presenter*) Nothing to Disclose

### M8-CIN05C Best Practices for AI Model Selection: The Business Evaluation

Sriyesh Krishnan, MD (*Presenter*) Nothing to Disclose

### M8-CIN05D Best Practices for AI Model Selection: The Technical Evaluation

Melissa A. Davis, MD, MBA (*Presenter*) Nothing to Disclose

Printed on: 05/28/25


# Abstract Archives of the RSNA, 2024

M8-CNMMI02

## Revolution in Alzheimer's Disease Therapy is Finally Here: What does the Radiologist Need to Know

Monday, Dec. 2 4:30PM - 5:30PM Room: S405

Jeffrey S. Kempf, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the special roles of amyloid PET and MRI in the treatment protocol for anti-amyloid therapy. 2) Review appropriate use criteria of amyloid PET in the era of anti-amyloid therapy. 3) Discuss the neurologist's perspective on what the radiologist needs to know.

**COURSE DESCRIPTION**

The first anti-amyloid therapy to show clnical benefit will revolutionize the treatment of Alzhimer's disease. The neurologist and nuclear radiologist will describe the great impact of this new therapy on the practice of nuclear medicine and radiology.

**Sub-Events**

### M8-CNMMI02B Overview of PET Biomarkers for Alzheimer's Disease

Katherine A. Zukotynski, MD, PhD (*Presenter*) Research Consultant, Konica Minolta, Inc;Research Consultant, General Electric Company;Speakers Bureau, Jubilant DraxImage Inc

### M8-CNMMI02C Molecular Imaging for Selection and Management of Patients for Anti-Amyloid Therapy

Phillip H. Kuo, MD, PhD (*Presenter*) Consultant, Konica Minolta, Inc;Consultant, Amgen Inc;Consultant, Blue Earth Diagnostics Ltd;Research Grant, Blue Earth Diagnostics Ltd;Consultant, Novartis AG;Speaker, Novartis AG;Consultant, Chimerix, Inc;Consultant, Fusion Pharmaceuticals Inc;Consultant, Bayer AG;Consultant, General Electric Company;Speaker, General Electric Company;Research Grant, General Electric Company;Speaker, Digital Science Press, Inc;Consultant, Radionetics;Former Employee, Konica Minolta, Inc

### M8-CNMMI02D Update on Alzheimer's Disease Diagnosis and Treatment

Gil Rabinovici, MD (*Presenter*) Scientific Advisory Board, Eisai Co, Ltd;Committee member, Johnson & Johnson;Research Grant, Eli Lilly and Company;Research Grant, General Electric Company;Research Grant, Life Molecular Imaging

# Abstract Archives of the RSNA, 2024

M8-CNPM09

## Curing Burnout: Optimizing Radiologist Well-Being Through Local and National Approaches

Monday, Dec. 2 4:30PM - 5:30PM Room: S402

Jay R. Parikh, MD, FRCPC (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe practical workflow solutions to improve radiologist burnout. 2) Understand how leadership can help cause or cure radiologist burnout. 3) Become aware of a national approach in the United Kingdom to improve radiologist well-being.

**COURSE DESCRIPTION**

Previous studies have demonstrated a high prevalence of burnout amongst radiologists. The conversation needs to now shift from demonstrating prevalence to actually addressing it. Specifically, since physician resilience is amongst the highest in the population, operational and cultural solutions are required. In this session, three predominant levels at which burnout can be Improved will be described: improved informatics workflow, leadership, and system approaches.

**Sub-Events**

### M8-CNPM09B Burnout - Setting the Stage

Jay R. Parikh, MD, FRCPC (*Presenter*) Nothing to Disclose

### M8-CNPM09C Informatics Solutions to Improve Workflow and Help Radiologist Burnout

Dorothy A. Sippo, MD, MPH (*Presenter*) Nothing to Disclose

### M8-CNPM09D Leadership Approaches to Improve Radiologist Burnout

Frank J. Lexa, MD, MBA (*Presenter*) Nothing to Disclose

### M8-CNPM09E A National Approach to Improve Radiologist Well-Being

Teik Choon See, MBBS, FRCR (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M8-CPH02

## Photon Counting CT

Monday, Dec. 2 4:30PM - 5:30PM Room: S404

Shuai Leng, PhD (*Moderator*) License agreement, Siemens AG

**LEARNING OBJECTIVES**

1) Understand the basic principles of photon counting detector (PCD). 2) Explore the benefits of PCD-CT in comparison with energy-integrating detector CT. 3) Identify potential applications of PCD-CT in various clinical areas.

**COURSE DESCRIPTION**

Photon counting detector (PCD) has been an active research area in recent years. Commercial PCD-CT has been available for routine clinical use since the FDA cleared the first PCD-CT in late 2021, representing a major imaging device advancement for CT. In this lecture, we will discuss the fundamental principles of PCD and explain major benefits of this technology relative to energy integrating detectors which are used on most commercial CT scanners. The history and current status of PCD-CT will also be discussed, including both FDA-cleared scanners and prototype/research systems. Potential applications in various clinical areas will be demonstrated using sample phantom and patient images. Challenges and opportunities will also be discussed.

**Sub-Events**

**M8-CPH02B** **Clinical Translation Focus**

Shuai Leng, PhD (*Presenter*) License agreement, Siemens AG

**M8-CPH02C** **Basic Principles of EID and PCD**

Ke Li, PhD (*Presenter*) Research Consultant, Pulmera Inc.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M8-RCP24

## Reducing Diagnosis Error in Radiology - Is It Possible? (Sponsored by the RSNA Quality Improvement Committee)

Monday, Dec. 2 4:30PM - 5:30PM Room: E350

Nadja Kadom, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe methods for reducing diagnosis error. 2) Define Cognitive Errors. 3) Employ AI to address diagnostic error.

**COURSE DESCRIPTION**

This session will introduce the SEIPS (Systems Engineering Initiative for Patient Safety) model, which expands on our understanding of the interaction between structure, process and environment based on the previous Donabedian model. The SEIPS expanded model helps identify factors that introduce risks for error.

An existing library of cognitive error in radiology will be described and paired with a number of improvement interventions.

Introduction to AI methods that can improve image interpretation through image segmentation and classification, reduction of false positives, prognostics and predictive analytics.

**Sub-Events**

### M8-RCP24B Diagnosis Error: A Framework for Identifying Interventions

Nadja Kadom, MD (*Presenter*) Nothing to Disclose

### M8-RCP24C Cognitive Error: Interventions That Can Lead to Better Diagnostic Accuracy

Cindy S. Lee, MD (*Presenter*) Nothing to Disclose

### M8-RCP24D Reporting Levels of Uncertainty

Atul B. Shinagare, MD (*Presenter*) Consultant, VirtualScopics, Inc;Consultant, Imaging Endpoints

### M8-RCP24E Fewer Diagnosis Errors With AI?

Safwan Halabi, MD (*Presenter*) Advisor, Change Healthcare

# Abstract Archives of the RSNA, 2024

R1-CER14

## Hot Topics in 2024 Emergency Radiology

Thursday, Dec. 5 8:00AM - 9:00AM Room: N228

Scott D. Steenburg, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn to recognize the imaging features associated with intimate partner violence (IPV). 2) Define burnout and the scope of the problem, and discuss ways to mitigate burnout. 3) Discuss the supply-demand mismatch in the subspecialty of emergency radiology, and list strategies for successful recruitment and retention of emergency radiologists.

**COURSE DESCRIPTION**

This year, the "Hot Topics in Emergency Radiology" session at the RSNA will focus on 3 very important and timely topics that are relevant to the emergency radiologist: an update on imaging of intimate partner violence (IPV), strategies for managing burnout for the emergency radiologist, and an overview of the current recruiting challenges specific to emergency radiology practices. Our 3 expert panelists will break down these important topics into easy-to-understand points that can be directly and immediately applied to their practice and personal situation.

**Sub-Events**

### R1-CER14B Intimate Partner Violence: Update

Bharti Khurana, MD, MBA (*Presenter*) Consultant, General Electric Company;Editor, Wolters Kluwer nv;Author, Cambridge University Press;Consultant, ROKIT Healthcare, Inc

### R1-CER14C Current State of Emergency Radiologist Recruiting

Tarek N. Hanna, MD (*Presenter*) Nothing to Disclose

### R1-CER14D Managing Burnout for the Emergency Radiologist

Carrie N. Hoff, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R1-CGI12

## Liver Diffuse Disease

Thursday, Dec. 5 8:00AM - 9:00AM Room: E451B

Sudhakar K. Venkatesh, MD, FRCR (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the principles and clinical applications of MR elastography and US elastography in evaluating liver fibrosis and chronic liver diseases. 2) Understand basic principles, strengths, and limitations of advanced US- and MR-based methods to assess hepatic steatosis. 3) Utilize iron quantification methods in liver imaging to evaluate and monitor iron overload disorders. 4) Integrate these advanced imaging techniques into clinical practice to improve the diagnosis and management of patients with chronic liver diseases.

**COURSE DESCRIPTION**

This educational session aims to provide participants with a comprehensive understanding of advanced imaging techniques for evaluating chronic liver diseases, with a focus on MR elastography, US elastography, fat quantification, and iron quantification. The session will delve into the principles, clinical applications, advantages, and limitations of each technique, enabling radiologists (participants) to make informed decisions about their use in clinical practice.

**Sub-Events**

### R1-CGI12B MR Elastography

Sudhakar K. Venkatesh, MD, FRCR (*Presenter*) Nothing to Disclose

### R1-CGI12C US Elastography

Jeong Min Lee, MD, PhD (*Presenter*) Grant, Bayer AG Grant, Canon Medical Systems Corporation Grant, Koninklijke Philips NV Grant, General Electric Healthcare Grant, Guerbet SA Grant, Samsung Electronics Co, Ltd Grant, Bracco Group Grant, Dongkuk Pharma Grant, Starmed Ltd Grant, RF medical Grant, Siemens AG Speakers, Bayer AG Speakers, Philips Healthcare Speakers, Samsung Medison Speakers, GE Healthcare

### R1-CGI12D Fat Quantification

Claude B. Sirlin, MD (*Presenter*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC

### R1-CGI12E Iron Quantification

Takeshi Yokoo, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R1-CIN11

## Multi-institutional Collaboration for Artificial Intelligence - Best Practices

Thursday, Dec. 5 8:00AM - 9:00AM Room: E450B

Nishith Khandwala, MS (*Moderator*) Founder, Bunkerhill Health

**LEARNING OBJECTIVES**

1) Understand how to implement and manage prospective multi-site randomized controlled trials (RCTs) for validating AI algorithms across various institutions. 2) Apply effective data sharing strategies and understand international patient perspectives on AI in radiology. 3) Learn how expertly-annotated datasets are built and understand the importance of global AI challenges like the RSNA AI Challenges.

**COURSE DESCRIPTION**

Join us for an essential educational session focused on best practices for multi-institutional collaboration in AI. As AI continues to revolutionize radiology, the need for effective collaboration across institutions is paramount. This session will address critical issues such as running prospective multi-site RCTs, data sharing strategies, and building expertly-annotated datasets. Additionally, we will explore international patient perspectives on AI in radiology. Participants will leave with practical knowledge and skills to drive forward multi-institutional AI collaborations successfully.

**Sub-Events**

### R1-CIN11B Running a Prospective Multi-Site RCT for an AI Algorithm

Nishith Khandwala, MS (*Presenter*) Founder, Bunkerhill Health

### R1-CIN11C Data Sharing for Multi-Institutional AI Collaborations

John Mongan, MD, PhD (*Presenter*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Amazon Web Services, Inc;Royalties, General Electric Company;Spouse, Employee, Annexon, Inc;Spouse, Employee, AbbVie Inc

### R1-CIN11D Building Expertly-Annotated Multi-Institution Datasets and Hosting the RSNA AI Challenges

Luciano M. Prevedello, MD, MPH (*Presenter*) Nothing to Disclose

### R1-CIN11E International Attitudes Towards AI in Radiology: Understanding Patient Perspectives

Helen Frazer, FRANZCR, MBBS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R1-CMK15

## MSK Intervention: How I Do It

Thursday, Dec. 5 8:00AM - 9:00AM Room: E450A

MK Lowry, MD (*Moderator*) Faculty, Medtronic plc

**LEARNING OBJECTIVES**

1) To understand the place of image guided intervention in the patient pathway for various common MSK conditions. 2) Learn about new and emerging techniques from experts in image guided intervention. 3) Review cases where image guided intervention has been used successfully for treatment.

**COURSE DESCRIPTION**

This session is an overview of image guided musculoskeletal intervention. This will start with an overview of the injectable substances available and the evidence behind their use in common musculoskeletal conditions. New techniques in neuromodulation will then be reviewed and discussed followed by lectures on several anatomical areas where MSK image guided intervention is common.

**Sub-Events**

**R1-CMK15B** **Neuromodulation for Pain Management of OA**

Paul I. Mallinson, MBChB (*Presenter*) Nothing to Disclose

**R1-CMK15C** **Spinal Intervention: Tips and Tricks**

MK Lowry, MD (*Presenter*) Faculty, Medtronic plc

**R1-CMK15D** **Indications for Image Guided Intervention Around the Hip**

Kenneth S. Lee, MD, MBA (*Presenter*) Grant, NFL;Research support, Hologic, Inc;Royalties, RELX

**R1-CMK15E** **Image Guided Intervention Around the Shoulder**

Jeffrey J. Peterson, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R1-CMS05

## Arthridities and Systemic Diseases with Dermatologic Manifestations

Thursday, Dec. 5 8:00AM - 9:00AM Room: E353A

Stacy E. Smith, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review dermatologic manifestations of the systemic diseases. 2) Review the role of imaging in the assessment of soft tissue necrosis. 3) Identify key imaging characteristics of phacomatoses and systemic diseases with dermatologic manifestations.

**COURSE DESCRIPTION**

Developments and improvements in knowledge are rapid and ongoing in both the radiologic and rheumatologic /neurologic/dermatologic fields. During the past decade, the roles of imaging and the radiologist in the assessment and management of many inflammatory arthritidies and phakomatoses and soft tissue necrosis have undergone several changes. To remain effective in-patient care, the radiologist needs to be aware of these changes when recommending and interpreting imaging examinations for the referring physician. The session will provide an update on various systemic presentations and dermatological manifestations of main inflammatory arthritidies and phakomatoses as well as discuss imaging of soft tissue necrosis

**Sub-Events**

### R1-CMS05B Dermatologic Manifestations of Systemic Diseases

Clarissa C. Moraes Do Carmo, MD (*Presenter*) Nothing to Disclose

### R1-CMS05C Phacomatoses/Systemic Diseases with Dermatologic Manifestations

Majid Chalian, MD (*Presenter*) Grant, The Boeing Company

### R1-CMS05D Imaging of Soft Tissue Necrosis

Jack A. Porrino JR, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R1-CNPM04

## Errors in Radiology: The Human Factor is the X-Factor (Sponsored by the RSNA Professionalism Committee and RSNA Quality Improvement Committee)

Thursday, Dec. 5 8:00AM - 9:00AM Room: S402

Kate Hanneman, MD, MPH (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Michael K. Atalay, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the role of human factors in radiology, including increasing safety, error avoidance and learning from errors and how communication can be crucial in safety critical environments. 2) Discuss error in radiology and the application of Human Factors - including personal factors (workload, stress, RVUs) as well as organizational issues (interruptions, workload) and communication. 3) Describe classification of errors, describe their prevalence, and review why and how they occur. 4) Review strategies to reduce error in radiology, including de-biasing, noise audits, quality assurance, standardization, self-improvement, improved workplace environments and others.

**COURSE DESCRIPTION**

This session will review the role of human factors (HFs) in radiology. Broadly, job-related HFs describe workplace interactions of humans with our environments and with other individuals. They include such concerns as: organizational culture; the nature, scope and intensity of the job; system processes and procedures; communication between team members (including interruptions); decision-making strategies and execution; ergonomics; and psychological and physiological factors (rested-state, fed-state, etc). Primary goals of human factors research in medicine are 1) to identify and reduce or eliminate causes of human error, 2) to enhance productivity and system efficiency, and 3) to improve safety, health, and well-being of both patients and care providers.

The goals of this course will be to understand the salient features of human factors, why they occur, how they lead to errors in radiology, and strategies for managing them and reducing their adverse effects.

**Sub-Events**

### R1-CNPM04C Human Factors: How Radiology Can Learn From Aviation

Niall Downey, MD (*Presenter*) Nothing to Disclose

### R1-CNPM04D Human Factors in Radiology

Bettina Siewert, MD (*Presenter*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv

### R1-CNPM04E Types and Causes of Errors in Radiology

Grayson L. Baird, PhD, MS (*Presenter*) Nothing to Disclose

### R1-CNPM04F Solutions and Strategies for Error Reduction in Radiology

Elizabeth A. Krupinski, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R1-CNR01

## CSF Imaging in Clinical Practice - What You Need to Know

Thursday, Dec. 5 8:00AM - 9:00AM Room: S406B

Lubdha M. Shah, MD, MSc (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review CSF circulation throughout the CNS in normal and abnormal states. 2) Evaluate effect of CSF alterations on brain and spine parenchyma. 3) Discuss the advances in imaging of CSF flow.

**COURSE DESCRIPTION**

Cerebrospinal fluid (CSF) is a plasma ultrafiltrate in the extra axial compartment of the cranium and spine, providing hydromechanical protection, nourishment, and waste removal. Another role of the CSF is to maintain a stable environment. CSF is propelled along the neuroaxis from the site of secretion to the site of absorption, mainly by the rhythmic systolic pulse wave within the choroidal arteries and to a lesser degree by respiration, venous pressure, physical effort, and time of day. This didactic session will be a comprehensive review of CSF circulation throughout the CNS in normal physiologic conditions and the alterations that are observed in pathologic disorders. The participant will gain an in-depth understanding the role of CSF flow in maintaining homeostasis and of the imaging advances to identify abnormalities.

**Sub-Events**

### R1-CNR01B Role of Glymphatics in Normal and Abnormal CSF Flow

Christopher G. Filippi, MD (*Presenter*) Research Consultant, Syntactx, LLC Minority stockholder, Avicenna.ai Research consultant, Sana Biotech, Inc.

### R1-CNR01C Increased Water in the Head - From NPH to Obstruction

Petrice M. Cogswell, MD, PhD (*Presenter*) Nothing to Disclose

### R1-CNR01D Low-Lying Cerebellar Tonsils: It's Not All Chiari

Jessica L. Houk, MD (*Presenter*) Nothing to Disclose

### R1-CNR01E Spinal CSF Flow Dynamics

Lubdha M. Shah, MD, MSc (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R1-CPD12

## 360 Assessment of Contrast in Children: Looking at the Bowel, at the Liver, at Bubbles, and at the Environment (Partially supported by an Unrestricted Educational Grant from Guerbet LLC.)

Thursday, Dec. 5 8:00AM - 9:00AM Room: N226

Maria Navallas, MD (*Moderator*) Nothing to Disclose
Alex El-Ali, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Gain a comprehensive understanding of pediatric liver and biliary tree diseases, and improve diagnostic skills using various imaging modalities and specific contrast media. 2) Demonstrate the utility and encourage the use of contrast-enhanced ultrasound in children. 3) Describe enteric and gadolinium-based intravenous contrast agents used in MR Enterography (MRE). 4) Discuss iodine contrast shortage and the need to implement strategies to reduce the administration and waste of contrast materials such as the use of photon counting CT.

**COURSE DESCRIPTION**

This course deals with the use of contrast in pediatric imaging through four different lectures:

1) Presentation on the use of ultrasound and MRI in pediatric liver and biliary diagnostics. Tips on optimizing imaging techniques for pediatric patients.

2) Utility, indications and add-on values of contrast-enhanced ultrasound in diagnostic imaging in children, as well as its usefullness in pediatric interventional radiology.

3) Enteric and gadolinium-based intravenous contrast agent used in MR Enterography (MRE), including options and alternatives; standard MRE protocol, and patterns of bowel inflammation and damage in pediatric inflammatory bowel disease.

4) Principles of improved contrast resolution on a photon counting detector platform with illustrative case examples of reduced contrast usage on a photon counting CT, and opportunities in the radiology department and manufacturing process to reduce contrast use.

**Sub-Events**

**R1-CPD12C** **Looking at the Liver and Biliary Tree**

Lisa Suzuki, MD, PhD (*Presenter*) Nothing to Disclose

**R1-CPD12D** **Looking Through Bubbles: Contrast-Enhanced Ultrasound**

Kassa Darge, MD, PhD (*Presenter*) Nothing to Disclose

**R1-CPD12E** **Looking at the Bowel: MRE**

Mary-Louise C. Greer, MBBS (*Presenter*) Research Grant, AbbVie Inc

**R1-CPD12F** **Looking at Sustainability: Iodine Contrast Shortage and How Photon Counting CT Can Close the Gap**

Joseph Y. Cao, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R1-CPH10

## Cone Beam Breast CT: CBCT Principles: Technology, Image Quality, and Dose (Supported in part by an Unrestricted Medical Education Grant from GE Healthcare, Inc.)

Thursday, Dec. 5 8:00AM - 9:00AM Room: S404

Mahadevappa Mahesh, PhD, MS (*Moderator*) Nothing to Disclose
Ioannis Sechopoulos, PhD (*Moderator*) Research Grant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research Grant, Sectra AB;Research Grant, ScreenPoint Medical BV;Research Grant, Volpara Health Technologies Limited

### LEARNING OBJECTIVES

1) To learn the principles of CBCT and cone beam breast CT systems. 2) To understand image acquisition and dose measurement in cone beam breast CT. 3) To become familiar with clinical application of cone beam breast CT.

### COURSE DESCRIPTION

Cone-beam CT (CBCT) is increasingly used in diagnostic imaging and image-guided procedures, ranging from interventional radiology to breast imaging, radiation therapy and surgery. The proliferation of CBCT systems that are used as standalone or as part of the fluoroscopy systems are used not only in radiology but in surgery, pain clinic, dental clinics, etc. Even though the fundamentals of cone beam breast CT are similar to CBCT, there are distinct differences between the two technologies, in terms of acquisition, image processing and radiation dose estimation. This course is aimed to cover the general principles of CBCT and Cone Beam Breast CT systems, along with the challenges of quality control evaluation, radiation dose measurements and clinical applications. The course has three presentations with first two aimed at describing the physics principles of CBCT and cone beam breast CT, while the final presentation will focus on clinical applications of breast CT.

**Sub-Events**

### R1-CPH10C Overview of Cone Beam CT and The Challenges in Quality Control

Mahadevappa Mahesh, PhD, MS (*Presenter*) Nothing to Disclose

### R1-CPH10D Breast Cone Beam CT Imaging System - Technology, Image Quality & Dose

Ioannis Sechopoulos, PhD (*Presenter*) Research Grant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research Grant, Sectra AB;Research Grant, ScreenPoint Medical BV;Research Grant, Volpara Health Technologies Limited

### R1-CPH10E Dedicated Breast CT: Clinical Applications

Shadi Aminololama-Shakeri, MD (*Presenter*) Consultant, Becton, Dickinson and Company;Consultant, Izotropic Corporation;Stock options, Izotropic Corporation

# Abstract Archives of the RSNA, 2024

R1-RCP28

## Where are all the Women Physicists? (Sponsored by the RSNA Committee on Diversity, Equity and Inclusion)

Thursday, Dec. 5 8:00AM - 9:00AM Room: E350

Gayle E. Woloschak, BS, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To discuss reasons why women are avoiding careers in Radiation Physics. 2) To develop approaches to help remedy the problem. 3) To facilitate communication among those women in the radiation physics community.

**COURSE DESCRIPTION**

This session will provide a panel discussion on why women are not pursuing careers in radiation physics. Discussants will talk about their own experiences as well as those that they have observed among colleagues and friends in the community. Each panelist will present their own views, and then questions from the audience will be entertained related to the topics. The goal is to provide discussion on this difficult topic in hopes of developing solutions.

**Sub-Events**

**R1-RCP28B** **Radiating Change: Empowering Women as Leaders in Medical Physics**

Diana E. Carver, PHD (*Presenter*) Nothing to Disclose

**R1-RCP28C** **From Diverse Minds to Precise Imaging: The Value of Inclusivity in Physics**

Cornelia Laule, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R3-CBR06

## Essentials of Breast Imaging

Thursday, Dec. 5 9:30AM - 10:30AM Room: S406A

Paola Clauser, MD, PhD (*Moderator*) Speaker, Siemens AG

**LEARNING OBJECTIVES**

1) To understand applications, advantages and limitations of x-ray-based breast imaging, particularly digital breast tomosynthesis. 2) To understand the role of ultrasound in the screening and diagnostic setting. 3) To have a basic understanding of breast magnetic resonance imaging techniques, indications, reporting and consequent management recommendations.

**COURSE DESCRIPTION**

This educational course will review the basis of image acquisition and evaluation with digital breast tomosynthesis (DBT), ultrasound (US) and magnetic resonance imaging (MRI). The current indications of the methods will be reviewed and discussed. Upon completion of this course participants will understand the current clinical applications and limitations of the methods.

**Sub-Events**

### R3-CBR06B Evaluation With DBT Techniques Include Synthetic Digital Mammography, and DBT Biopsy

Paola Clauser, MD, PhD (*Presenter*) Speaker, Siemens AG

### R3-CBR06C Evaluation with US Include US Biopsy

Haydee Ojeda-Fournier, MD (*Presenter*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc

### R3-CBR06D Evaluation with MRI

Christopher E. Comstock, MD (*Presenter*) Speakers Bureau, Bracco Group;Advisory Board, Guerbet SA;Consultant, Bayer AG;Speaker, Northwest Imaging Forums, Inc

# Abstract Archives of the RSNA, 2024

R3-CCH12

## Lung Cancer Screening (2) - Practical Implementation (Supported by an Independent Medical Education Grant from Merck Sharp and Dohme LLC)

Thursday, Dec. 5 9:30AM - 10:30AM Room: E451A

Terrance T. Healey, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Develop an approach to handle cystic nodules/masses which were not included in earlier versions of LungRADS. 2) Develop a strategy to educate your practice and trainees about the changes made in LungRADS 2022. 3) Understand how large language models can be used to enhance lung cancer screening.

**COURSE DESCRIPTION**

This course will address some of the most common problems encountered by radiologists who routinely read lung cancer screening CT scan. We will incorporate our real life solutions to everyday conundrums and address how AI can be incorporated into your workflow.

**Sub-Events**

### R3-CCH12B Cystic Lung Lesions: A Practical Approach

Saurabh Agarwal, MD (*Presenter*) Nothing to Disclose

### R3-CCH12C Implementing LungRADS 2022 in Clinical Practice

Ashley E. Prosper, MD (*Presenter*) Nothing to Disclose

### R3-CCH12D Utility of Large Language Models in Lung Cancer Screening

Jonathan H. Chung, MD (*Presenter*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd

### R3-CCH12E How to Build a Decentralized Lung Cancer Screening Program in the Community Setting

Terrance T. Healey, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R3-CGU05

## An Introduction to GU Specific Diagnostic Classification Systems

Thursday, Dec. 5 9:30AM - 10:30AM Room: E350

Silvia D. Chang, MD, FRCPC (*Moderator*) Nothing to Disclose
Bahar Mansoori, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) To become familiar with the classification systems used in GU imaging for the kidneys, bladder and prostate, specifically Bosniak, Clear Cell RCC Likelihood Score, VI-RADS and PI-RADS.

2)To be able to apply these GU classification systems in clinical practice.

### COURSE DESCRIPTION

This lecture-based educational course will introduce the audience to specific diagnostic classification systems used in GU imaging of the kidneys, bladder and prostate. Diagnostic classification systems guide the assessment and interpretation of disease processes on imaging exams. This promotes standardization in terminology and interpretation enabling uniform data for monitoring of outcomes and refining quality assurance. The following systems will be presented: 1. PI-RADS in assessing for clinically significant prostate cancer on MRI, 2. VI-RADS in local assessment of bladder cancer on MRI, 3. Bosniak classification in assessing renal cysts and 4. the clear cell RCC likelihood score in assessing renal masses.

**Sub-Events**

**R3-CGU05C** **PI-RADS**

Silvia D. Chang, MD, FRCPC (*Presenter*) Nothing to Disclose

**R3-CGU05D** **Bosniak Classification**

Nicola Schieda, MD (*Presenter*) Nothing to Disclose

**R3-CGU05E** **Clear Cell RCC Likelihood Score**

Melissa J. McGettigan, MD (*Presenter*) Nothing to Disclose

**R3-CGU05F** **VI-RADS**

Refky Nicola, MSc, DO (*Presenter*) Royalties, RELX

# Abstract Archives of the RSNA, 2024

R3-CNMMI01

## Update in Nuclear Medicine for Breast Cancer Imaging

Thursday, Dec. 5 9:30AM - 10:30AM Room: N226

Elizabeth H. Dibble, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn the utility of PET/CT for imaging breast cancer with FDG and emerging tracers. 2) Become familiar with the role of FES PET/CT for breast cancer. 3) Identify ways that molecular imaging can improve detection of invasive lobular carcinoma.

**COURSE DESCRIPTION**

This session will examine current best practices and emerging techniques for using nuclear medicine to image breast cancer through three lectures. Attendees will learn the utility of PET/CT for imaging breast cancer with FDG and emerging tracers, become familiar with the role of FES PET/CT for breast cancer, and identify ways that molecular imaging can improve detection of invasive lobular carcinoma.

**Sub-Events**

### R3-CNMMI01B PET/CT for Breast Cancer: FDG and Emerging Tracers

Elizabeth H. Dibble, MD (*Presenter*) Nothing to Disclose

### R3-CNMMI01C FES PET/CT: Introduction to the Tracer, SNMMI Appropriate Use Criteria, and Emerging Uses

Sophia R. O'Brien, MD, MEd (*Presenter*) Nothing to Disclose

### R3-CNMMI01D Improving Detection of Invasive Lobular Carcinoma Through Molecular Imaging

Matthew Covington, MD (*Presenter*) Consultant, inviCRO, LLC

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# Abstract Archives of the RSNA, 2024

R3-CNPM03

## Preparing Your Radiology Residents for Academic Research Careers (Sponsored by the RSNA Research Development Committee)

Thursday, Dec. 5 9:30AM - 10:30AM Room: S402

Janie M. Lee, MD, MSc (*Moderator*) Research Grant, General Electric Company;Investigator, General Electric Company
Jeffrey G. Jarvik, MD, MPH (*Moderator*) Royalties, Mannheim Media;Co-editor, Mannheim Media;Travel support, General Electric Company;Author with royalties, Wolters Kluwer nv

### LEARNING OBJECTIVES

1) To describe the impact of RSNA's Fellow Research Grant on academic career paths. 2) To describe how T32 Research Training grants can develop high potential residents. 3) To explain how departments can leverage resources for successful research mentorship.

### COURSE DESCRIPTION

Current radiology residents are the future physician-scientists who will conduct studies that generate evidence to improve clinical care and patient outcomes. This course will provide insight as to how current training programs can identify and train radiology residents in preparation for careers in academic research. Speakers will focus on how RSNA Fellow grants, Federal T32 training grants, and internal departmental resources can all be used to train the next generation of radiology physician scientists.

**Sub-Events**

### R3-CNPM03C RSNA's Fellow Research Grants: Impact on an Academic Career Path

Michael O'Reilly, MBBCh, MPH (*Presenter*) Nothing to Disclose

### R3-CNPM03D T32 Research Training Grants to Develop High Potential Residents

Pamela K. Woodard, MD (*Presenter*) Researcher, Siemens AG;Consulting, Medtronic plc;Researcher, Bayer AG;Patent, Washington University

### R3-CNPM03E Leveraging Departmental Resources for Successful Research Mentorship

Summer J. Decker, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R3-COB04

## First Trimester and Post Pregnancy Updates: Pearls and Pitfalls

Thursday, Dec. 5 9:30AM - 10:30AM Room: E351

Alyssa K. Kirsch, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the new first trimester lexicon. 2) Able to implement new first trimester lexicon. 3) Understand normal and abnormal post pregnancy imaging findings.

**Sub-Events**

### R3-COB04B The SRU Consensus on First Trimester US Lexicon: Getting the Words Right

Loretta M. Strachowski, MD (*Presenter*) Royalties, RELX;Speaker, World Class CME

### R3-COB04C Implementing the Updated Lexicon in Clinical Practice

Shuchi K. Rodgers, MD (*Presenter*) Royalties, RELX

### R3-COB04D First Trimester Post Pregnancy: The Expected and The Unexpected

Hailey Choi, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

R3-CRO10

## CNS Tumors: Case-Based Multidisciplinary Tumor Board Review

Thursday, Dec. 5 9:30AM - 10:30AM Room: S401

Christina I. Tsien, MD (*Moderator*) Advisory Board, Blue Earth Diagnostics Ltd;Speakers Bureau, Agilent Technologies, Inc;Consultant, Carl Zeiss AG
Soonmee Cha, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Discuss key imaging modalities to differentiate recurrent tumor and treatment effect. 2) Discuss the role of each modality including surgery, radiotherapy, and chemotherapy in managing the major malignant adult primary CNS tumors
3) Describe the new updates of the 5th edition of the WHO Classification of Tumors of the CNS 2021. Discuss the prognostic and predictive variables that allow for the selection of the appropriate therapy.

### COURSE DESCRIPTION

Recent updates of the 5th edition WHO Classification of CNS tumors will be summarized. Significant progress has been made in the treatment of diffuse gliomas with an emphasis on prognostic and predictive biomarkers that allow for appropriate treatment selection. The role of neuroimaging to help clinicians improve the diagnosis, treatment and response assessment for CNS tumors will be emphasized. This session highlights the need for a multi-disciplinary treatment approach for primary CNS tumors in a rapid-fire tumor board format.

**Sub-Events**

### R3-CRO10C Rapid Fire Tumor Board Case Review

Soonmee Cha, MD (*Presenter*) Nothing to Disclose

### R3-CRO10D Neuro-Oncology Current Updates

Roger Stupp, MD (*Presenter*) Research Consultant, Carthera;Research Grant, Carthera;Scientific Advisory Board, Alpheus Medical Inc;Scientific Advisory Board, Hemispherian AS;Consultant, GT Medical Technologies, Inc;Consultant, Triact Therapeutics Inc;Research Consultant, AstraZeneca PLC;Research Consultant, Boston Scientific Corporation

### R3-CRO10E Neuro-Surgical Current Updates

Clark C. Chen, PhD (*Presenter*) Consultant, Medtronic plc;Consultant, MRI Interventions, Inc;Consultant, GT Medical Technologies, Inc

### R3-CRO10F Radiation Oncology Current Updates

Christina I. Tsien, MD (*Presenter*) Advisory Board, Blue Earth Diagnostics Ltd;Speakers Bureau, Agilent Technologies, Inc;Consultant, Carl Zeiss AG

# Abstract Archives of the RSNA, 2024

R3-CVA05

## Visceral Vascular Imaging

Thursday, Dec. 5 9:30AM - 10:30AM Room: N229

Daniel Vargas, MD (*Moderator*) Nothing to Disclose
Iain D. Kirkpatrick, MD, FRCPC (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify key imaging findings and diagnostic criteria for mesenteric ischemia, pelvic congestion syndrome, renal artery stenosis and causes of gastrointestinal bleeding. 2) Understand where radiology fits within the diagnostic pathway of these four conditions and how it can guide management. 3) Describe how to optimize imaging protocols for these conditions.

**COURSE DESCRIPTION**

Abdominal visceral vascular diseases can be challenging for many radiologists as they involve multiple organ systems and cross the boundaries between subspecialty vascular and abdominal expertise. Abdominal radiologists may have less experience creating and interpreting 3D angiographic reconstructions, and vascular radiologists may be less comfortable with parenchymal solid or hollow organ changes in these diseases. As CT and MR technology evolves, our ability to diagnose these diseases early with angiographic techniques improves steadily and radiologists must be aware of a spectrum of imaging findings that have only been described in the era of multidetector CT and accelerated MRI/MRA.

This session will review the vascular and visceral findings that can be seen in a number of diseases, including mesenteric ischemia, renal artery stenosis, pelvic congestion syndrome and gastrointestinal bleeding. Techniques, diagnostic criteria, and imaging findings will all be discussed as well as the role of radiology in guiding the management of these conditions.

**Sub-Events**

### R3-CVA05C Pelvic Venous Disorders

Rebecca Rakow-Penner, MD, PhD (*Presenter*) Research Grant, General Electric Company;Consultant, Human Longevity Inc;Stockholder, CureMetrix, Inc;Stock options, CorTechs Labs, Inc

### R3-CVA05D Mesenteric Ischemia

Iain D. Kirkpatrick, MD, FRCPC (*Presenter*) Nothing to Disclose

### R3-CVA05E Renal Artery Imaging

Kevin R. Kalisz, MD (*Presenter*) Reviewer, Oakstone Publishing, LLC;Consultant, VoxelMetrix, LLC

### R3-CVA05F Gastrointestinal Bleeding

Avneesh Gupta, MD (*Presenter*) Speaker, Koninklijke Philips NV;;

# Abstract Archives of the RSNA, 2024

R3-RCP18

## Jeopardy! Tournament of Editors: Tips to Get Your AI Paper Published

Thursday, Dec. 5 9:30AM - 10:30AM Room: S406B

Ali S. Tejani, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the key elements of a manuscript on imaging AI. 2) Apply components of the Checklist for Artificial Intelligence in Medical Imaging (CLAIM) 2024 Update for imaging AI manuscript submissions. 3) Identify and correct errors in example imaging AI manuscripts and abstracts. 4) Understand appropriate use of AI performance metrics.

**COURSE DESCRIPTION**

It can be daunting to draft a concise, yet detailed manuscript about radiology artificial intelligence (AI) projects. Manuscripts about radiology AI should incorporate key information that enables reviewers to determine the quality and reproducibility of the submitted work, as well as how the submitted work adds to a rapidly evolving field. This session will help attendees improve the quality of their AI manuscripts for submission to the RSNA Journal Suite and guide them as effective peer-reviewers for AI-related submissions. The session will follow a "game show" format based on "Jeopardy!" featuring a panel composed of editorial board members from Radiology and Radiology: Artificial Intelligence. Categories and questions will facilitate discussion on experiences from the editorial board members, including thoughts on best practices for AI-related submissions and frequently seen errors. Topics will include highlights from the CLAIM 2024 Update and general recommendations for effective medical writing. Questions will include examples inspired by manuscript submissions encountered by the editorial review board.

**Sub-Events**

**R3-RCP18B** **Jeopardy! Tournament of Editors: Tips to Get Your AI Paper Published**

Ali S. Tejani, MD (*Presenter*) Nothing to Disclose

**R3-RCP18C** **Jeopardy! Tournament of Editors: Tips to Get Your AI Paper Published**

Linda Moy, MD (*Presenter*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

**R3-RCP18D** **Jeopardy! Tournament of Editors: Tips to Get Your AI Paper Published**

Charles E. Kahn JR, MD, MS (*Presenter*) Nothing to Disclose

**R3-RCP18E** **Jeopardy! Tournament of Editors: Tips to Get Your AI Paper Published**

Merel Huisman, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R4-CBR08

**Case Based Review of Challenging Cases (CEM and Multimodality Biopsy) (Supported in part by an Unrestricted Medical Education Grant from GE Healthcare, Inc.)**

Thursday, Dec. 5 11:00AM - 12:00PM Room: S406A

Maxine S. Jochelson, MD (*Moderator*) Speaker, General Electric Company

**LEARNING OBJECTIVES**

1) Understand the principals and limitations of ultrasound correlation with other modalities. 2) Identify lesion criteria that benefit most from MRI directed ultrasound correlation. 3) Familiarize learners with options for using Contrast Enhanced Mammography both in diagnostic scenarios and biopsy situations to reduce the use of MRI when possible.

**COURSE DESCRIPTION**

During this course we will discuss challenging cases involving the most commonly used modalities in breast imaging including Digital Breast Tomosynthesis (DBT), Ultrasound (US), Magnetic Resonance Imaging (MRI), and Contrast Enhanced Mammography (CEM). We will address how we correlate the images among these modalities to better characterize breast lesions and to be able to chose the best possible modalities to perform percutaneous biopsies when necessary- taking into consideration that MRI guided and Contrast Enhanced Mammography biopsy availability may be limited in many practices. We will stress the importance of accurate lesion correlation in this setting. This session aims to provide participants with valuable knowledge and skills to deal with these scenarios effectively in various breast imaging practices.

**Sub-Events**

**R4-CBR08B** **DBT & US**

Almir Bitencourt, MD, PhD (*Presenter*) Nothing to Disclose

**R4-CBR08C** **MRI & US**

Steven P. Poplack, MD (*Presenter*) Faculty, Ultimate Opinions in Medicine LLC;Speaker, Efficiency Learning Systems Inc

**R4-CBR08D** **CEM & Biopsy**

Maxine S. Jochelson, MD (*Presenter*) Speaker, General Electric Company

# Abstract Archives of the RSNA, 2024

R4-CCA02

## Imaging Guidance for Transcatheter Structural Heart Interventions

Thursday, Dec. 5 11:00AM - 12:00PM Room: E353C

Phillip M. Young, MD (*Moderator*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1. Explain the utility of imaging in transcatheter mitral valve procedures.

2. Review the role of imaging in planning of transcatheter tricuspid valve replacement.

3. Illustrate the role of the CT in pre- and post-procedural evaluation of transcatheter left atrial appendage closure.

### COURSE DESCRIPTION

This session reviews the vital role of imaging in guidance of transcatheter structural heart interventions. The three speakers will review the utility of imaging in transcatheter mitral valve procedures, transcatheter tricuspid valve replacement and transcatheter left atrial appendage closure.

**Sub-Events**

**R4-CCA02C** **TMVR: MAC, Rings and Other Things**

Melany B. Atkins, MD (*Presenter*) Consultant, General Electric Company;Speaker, General Electric Company

**R4-CCA02D** **The Not-So-Forgotten Valve: Transcatheter Tricuspid Valve Interventions**

Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

**R4-CCA02E** **Plugs & Baskets: Imaging for LAA Closure**

Monika Radike, MD, PhD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

R4-CER05

## Abdominopelvic Trauma: Core Concepts and Advances

Thursday, Dec. 5 11:00AM - 12:00PM Room: N228

Scott D. Steenburg, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the indications and diagnostic features for CT imaging in non-traumatic acute aortic syndromes, CCTA in the emergency department for acute chest pain, and the imaging features of fungal infections across different body systems. 2) Identify key imaging characteristics and provide a focused, clinically relevant review of non-traumatic acute aortic syndromes, CCTA in acute chest pain, and fungal infections, including protocols and patient criteria. 3) Analyze the limitations, potential pitfalls, and diagnostic challenges associated with CT and CCTA in acute aortic syndromes and emergency chest pain evaluation, as well as the epidemiology, risk factors, and differential diagnosis of fungal infections.

**COURSE DESCRIPTION**

The series of lectures will deliver key diagnostic pointers in liver trauma, bowel and mesenteric injuries on trauma CT, and renal trauma. Strategies will be focused on overcoming diagnostic challenges and ensuring effective patient management in trauma settings.

**Sub-Events**

### R4-CER05B Liver Trauma - Injuries & Complications

Scott D. Steenburg, MD (*Presenter*) Nothing to Disclose

### R4-CER05C Bowel and Mesenteric Injury on Trauma CT

Dinesh D. Chinchure, FRCR, MBBS (*Presenter*) Nothing to Disclose

### R4-CER05D Renal Trauma

Alexis Boscak, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R4-CGI04

## Post-Operative Imaging

Thursday, Dec. 5 11:00AM - 12:00PM Room: E451B

Lauren M. Burke, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the common GI surgical interventions. 2) Be able to identify typical post-surgical imaging findings and complications.

**COURSE DESCRIPTION**

This course is designed to be an "all you need to know" course that covers the typical post-surgical findings following common hepatic, pancreatic, bariatric and gastrointestinal surgeries. Topics will be discussed through a multimodality approach with CT, MR, US, and fluoroscopy findings highlighted throughout the session.

With continued advances in surgical interventions and institutional variations in surgical technique, radiologists are expected to have a broad understanding of the post-surgical abdomen. Throughout the four didactic lectures, participants should be familiar with common gastrointestinal surgical interventions and the typical post-surgical findings and complications.

**Sub-Events**

### R4-CGI04B Liver

Dow-Mu Koh, FRCR (*Presenter*) Nothing to Disclose

### R4-CGI04C Whipple

Atif Zaheer, MD (*Presenter*) Nothing to Disclose

### R4-CGI04D GI Track

Kristina T. Flicek, MD (*Presenter*) Nothing to Disclose

### R4-CGI04E Bariatric Surgery

Lauren M. Burke, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25


# Abstract Archives of the RSNA, 2024

R4-CIN15

## How Anomaly Detection Can Help with AI Model Generalization?

Thursday, Dec. 5 11:00AM - 12:00PM Room: E450B

Imon Banerjee, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

**R4-CIN15B** **Unsupervised Learning for Anomaly Detection in Medical Images**

Peter Chang, MD (*Presenter*) Co-founder, Avicenna.ai;Stockholder, Avicenna.ai;Research Grant, Canon Medical Systems Corporation;Speakers Bureau, Canon Medical Systems Corporation;Research Grant, General Electric Company

**R4-CIN15C** **How Anomaly Detection Can Help with AI Model Generalization?**

Kayhan Batmanghelich, PhD (*Presenter*) Spouse, Employee, AstraZeneca PLC

**R4-CIN15D** **Derive Individualized Abnormality Maps and Parse Disease Heterogeneity**

Aristeidis Sotiras, PhD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

R4-CIR10

## Management of Compressive Venous Syndromes

Thursday, Dec. 5 11:00AM - 12:00PM Room: E353A

Timo A. Auer, MD (*Moderator*) Nothing to Disclose
Kush R. Desai, MD (*Moderator*) Speakers Bureau, Cook Group Incorporated Consultant, Cook Group Incorporated Consultant, Koninklijke Philips NV Speakers Bureau, Becton, Dickinson and Company Consultant, Becton, Dickinson and Company Speakers Bureau, Boston Scientific Corporation

**LEARNING OBJECTIVES**

1) Identify significant venous compression and optimal methodology for assessment.

**COURSE DESCRIPTION**

The goal is to understand central venous anatomy and diameter change to optimally assess for causes of venous disease. Venous disease can include thrombosis and/or pelvic pain.

**Sub-Events**

### R4-CIR10C Spectrum of Compressive Venous Disease in the IVUS Era

Kush R. Desai, MD (*Presenter*) Speakers Bureau, Cook Group Incorporated Consultant, Cook Group Incorporated Consultant, Koninklijke Philips NV Speakers Bureau, Becton, Dickinson and Company Consultant, Becton, Dickinson and Company Speakers Bureau, Boston Scientific Corporation

### R4-CIR10D Managing Intra and Postprocedural Anticoagulation

Ketan Y. Shah, MD (*Presenter*) Nothing to Disclose

### R4-CIR10E Optimal Venous Stent Selection and Placement to Avoid Complications

Mona B. Ranade, MD (*Presenter*) Nothing to Disclose

### R4-CIR10F Non-Thrombotic Iliac Vein Lesions

Kush R. Desai, MD (*Presenter*) Speakers Bureau, Cook Group Incorporated Consultant, Cook Group Incorporated Consultant, Koninklijke Philips NV Speakers Bureau, Becton, Dickinson and Company Consultant, Becton, Dickinson and Company Speakers Bureau, Boston Scientific Corporation

### R4-CIR10G Complications of Stents: Migration, Thrombosis and Disasters

Timo A. Auer, MD (*Presenter*) Nothing to Disclose

### R4-CIR10H Lysis vs. Mechanical Thrombectomy: When to Choose What for Which Patient?

Peiman Habibollahi, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R4-CMK02

## Reading MSK Radiographs: An Art that Should Not be Lost (Supported by an Unrestricted Medical Education Grant from Carestream Health, Inc.)

Thursday, Dec. 5 11:00AM - 12:00PM Room: N227B

Andrew J. Grainger, MD (*Moderator*) Speakers Bureau, General Electric Company

**LEARNING OBJECTIVES**

1) To review and recognize radiographic features, patterns and variants, that can help and hinder our interpretation of peripheral skeletal radiographs in clinical practice.

**COURSE DESCRIPTION**

Conventional radiographs remain a fundamental part of the radiologist's workload but beyond initial training, teaching and learning radiographic interpretation is often neglected. This course brings together renowned experts in the field of musculoskeletal radiology who share a passion for the importance and teaching of conventional radiograph reading skills. Whether you have been reading radiographs for many years, or are just setting out on your radiology career, this course will offer tips and tricks that will refresh and help develop your interpretative skills.

**Sub-Events**

**R4-CMK02B** **Reading the Shoulder Radiograph: Tips and Tricks**

Christine B. Chung, MD (*Presenter*) Nothing to Disclose

**R4-CMK02C** **Targeting Arthritis of the Hand and Wrist with Conventional Radiography: Bullseye!**

Donald L. Resnick, MD (*Presenter*) Nothing to Disclose

**R4-CMK02D** **The Hip and Pelvis Radiographs: Findings Hidden in Plain View**

David A. Rubin, MD (*Presenter*) Scientific Advisory Board, ImageBiopsy Lab

**R4-CMK02E** **Knee Radiographs: The Knee-cessities you Need to Know**

Andrew J. Grainger, MD (*Presenter*) Speakers Bureau, General Electric Company

**R4-CMK02F** **A Deep Dive into Radiographs of the Foot and Ankle**

Miriam A. Bredella, MD, MBA (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R4-CNPM16

## Is Whole Body MRI a Net Positive or Negative for Society? A Debate

Thursday, Dec. 5 11:00AM - 12:00PM Room: S402

Ruth C. Carlos, MD, MS (*Moderator*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company

**LEARNING OBJECTIVES**

1) Understand the advantages of screening whole body MRI. 2) Appreciate how the state of the art in screening MRI. 3) Identify the drawbacks of screening.

**COURSE DESCRIPTION**

Screening Whole Body MRI has been adopted in certain health-conscious constituencies. The gains touted include catching potentially fatal diseases early in their presentation and better preventive health. Skeptics question the potential for false positives and overdiagnosis. This debate will expose the pros and cons of whole body MRI at an individual and societal level.

**Sub-Events**

### R4-CNPM16B Against Whole Body MRI

Saurabh Jha, MBBS, MRCS (*Presenter*) Nothing to Disclose

### R4-CNPM16C In Favor of Whole Body MRI

Daniel Sodickson, MD, PhD (*Presenter*) Royalties, General Electric CompanyLicense agreement, General Electric CompanyRoyalties, Bruker Corporation License agreement, Bruker CorporationResearch collaboration, Siemens AG

# Abstract Archives of the RSNA, 2024

R4-CNR08

## Controversial Topics in Neuroradiology

Thursday, Dec. 5 11:00AM - 12:00PM Room: S406B

Brent D. Weinberg, MD, PhD (*Moderator*) Research Consultant, Canon Medical Systems Corporation

**LEARNING OBJECTIVES**

1) Understand specific challenges facing neuroradiology in the next five to ten years. 2) Reflect on controversial topics in neuroradiology and how they may affect current and future radiology practice. 3) Discuss pros and cons of paradigm shifts in imaging techniques and reporting in neuroradiology.

**COURSE DESCRIPTION**

Presenters will discuss several controversial topics in neuroradiology, including how changes in imaging techniques and reporting patterns may affect current and future practice. Specific topics addressed will include ongoing and upcoming developments in nuclear medicine brain imaging, quantitative brain imaging, cerebrovascular imaging, and structured reporting. Likely future advantages will be discussed alongside potential pitfalls and challenges.

**Sub-Events**

**R4-CNR08B** **Nuclear Medicine for Brain Tumors: Ready for Primetime?**

Jana Ivanidze, MD, PhD (*Presenter*) Research Grant, Novartis AG;

**R4-CNR08C** **Quantitative Brain Imaging: Next Year or Next Decade?**

John-Paul J. Yu, MD, PhD (*Presenter*) Nothing to Disclose

**R4-CNR08D** **Next Generation Cerebrovascular Imaging: Game Changer?**

Laura B. Eisenmenger, MD (*Presenter*) Nothing to Disclose

**R4-CNR08E** **Disease Specific Structured Reporting: Shortcut or Short Circuit?**

Brent D. Weinberg, MD, PhD (*Presenter*) Research Consultant, Canon Medical Systems Corporation

# Abstract Archives of the RSNA, 2024

R4-CPD04

## From Fetal to Neonatal Brain & Spine

Thursday, Dec. 5 11:00AM - 12:00PM Room: E351

Dorothy I. Bulas, MD (*Moderator*) Nothing to Disclose
Roya Sohaey, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Identify imaging characteristics of fetal and neonatal brain and spine anomalies in order to make concise diagnoses. 2) Strategize imaging techniques, particularly MRI, for imaging of this unique population of fetuses and neonates with often severe anomalies.

### COURSE DESCRIPTION

Congenital brain and spine anomalies are common and have vast differential diagnoses. In this session, faculty will present standard and advanced imaging techniques and strategies to guide the learner towards accurate diagnoses.

**Sub-Events**

### R4-CPD04C Fetal Brain

Carolina V. Guimaraes, MD (*Presenter*) Nothing to Disclose

### R4-CPD04D Fetal Spine

Paula J. Woodward, MD (*Presenter*) Royalties, RELX

### R4-CPD04E Neonatal Brain

Ricardo Faingold, MD (*Presenter*) Nothing to Disclose

### R4-CPD04F Neonatal Spine

Gregor Kasprian, MD, MBA (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

R4-RCP11

## Career Pivots in Radiology: Thriving in New Roles (Sponsored by the RSNA Professionalism Committee)

Thursday, Dec. 5 11:00AM - 12:00PM Room: E352

Carl C. Flink, MD (*Moderator*) Nothing to Disclose
Richard E. Heller III, MD (*Moderator*) Consultant, Gerson Lehrman Group, Inc;

**LEARNING OBJECTIVES**

1) Identify different types of career pivots. 2) Understand the challenges that can be faced when making a career transition. 3) Discuss strategies for achieving a successful career pivot.

**COURSE DESCRIPTION**

Career transitions have increased in frequency motivated myriad factors including values, purpose, aspirations, job security, job satisfaction, long term goals and wellness. Whether the pivot is carefully charted, or an unplanned career change strategic planning, a growth mindset and strong relationships are critical to success. This session will discuss common career change pathways as well as the opportunities, challenges and keys to success of each.

**Sub-Events**

### R4-RCP11C The Administrative Transition

Jamlik-Omari Johnson, MD (*Presenter*) Nothing to Disclose

### R4-RCP11D Moving Between Academia and Private Practice: Challenges and Opportunities

Marta E. Heilbrun, MD, MS (*Presenter*) Nothing to Disclose

### R4-RCP11E Moving From the IR Suite to the Reading Room

Christopher M. Straus, MD (*Presenter*) Nothing to Disclose

### R4-RCP11F Afterhours and Teleradiology: Embracing and Thriving With New Schedules and Settings

Suzanne T. Chong, MD, MS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R6-CCH11

## PET-CT in Thoracic Malignancy

Thursday, Dec. 5 1:30PM - 2:30PM Room: E451A

David M. Naeger, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the imaging findings used to stage lung cancer. 2) Evaluate imaging findings that are seen in the response to cancer treatment.

**COURSE DESCRIPTION**

This course will review the use of PET/CT in evaluating malignancies of the chest. We will review how the modality is used to stage lung cancer, how it can provide insights into the response of tumors to treatment, and how it is used to evaluate masses in the mediastinum.

**Sub-Events**

### R6-CCH11B Technical Update: Recent Innovations in Thoracic PET-C

Osama R. Mawlawi, PhD (*Presenter*) Nothing to Disclose

### R6-CCH11C PET-CT: Staging in NSCLC

H. Henry Guo, MD, PhD (*Presenter*) Nothing to Disclose

### R6-CCH11D PET-CT: Response Assessment in Lung Cancer

Ritu R. Gill, MBBS, MPH (*Presenter*) Research support, Canon Medical Systems Corporation

### R6-CCH11E PET-CT: Assessment of Mediastinal Masses

David M. Naeger, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R6-CHN04

## T-Bone Central: High Yield Topics in Temporal Bone Imaging

Thursday, Dec. 5 1:30PM - 2:30PM Room: E351

Mohit Agarwal, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn salient features of temporal bone anatomy. The session will also review the anatomy using images from photon counting CT. 2) Learn about strategies to approach cases of hearing loss on imaging. 3) Learn to develop an imaging approach in cases of tinnitus.

**COURSE DESCRIPTION**

Temporal bone anatomy and pathology is challenging for radiologists at all levels - from first year residents to practicing physicians. This session has been designed to tackle this difficult topic where Dr Bruno Policeni will teach about the complex anatomy of the temporal bone with review of photon counting CT images, Dr Paul Bunch will take us through an imaging approach to patients presenting with hearing loss and Dr Katherine Reinshagen will teach about strategies to approach cases of tinnitus.

**Sub-Events**

### R6-CHN04B Temporal Bone Anatomy Review with Help from Photon Counting CT

Bruno A. Policeni, MD, MBA (*Presenter*) Nothing to Disclose

### R6-CHN04C Imaging Approach to Hearing Loss

Paul M. Bunch, MD (*Presenter*) Research Grant, General Electric Company

### R6-CHN04D Imaging Approach to Tinnitus

Katherine L. Reinshagen, MD, FRCPC (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

R6-CIN21

## Enterprise Imaging at 10 Years: Biggest Accomplishments and Biggest Challenges for Radiologists to Solve

Thursday, Dec. 5 1:30PM - 2:30PM Room: N226

Christopher J. Roth, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe 3 challenges that still need to be solved to advance enterprise imaging. 2) List 5 IHE and white paper resources that the HIMSS SIIM Enterprise Imaging Community has created for radiologists to guide the growth of local enterprise imaging programs in the last 10 years. 3) Recognize the roles radiologists play as imaging experts to guide best practices in partner image and video creating specialties.

**Sub-Events**

### R6-CIN21B Biggest Accomplishments in 10 Years of Enterprise Imaging

Christopher J. Roth, MD (*Presenter*) Nothing to Disclose

### R6-CIN21C Setting the Clinical Vision for Enterprise Imaging

Alex Towbin, MD (*Presenter*) Author, RELX;Consultant, Anderson Publishing, Ltd;Advisory Board, KLAS Enterprises LLC;Travel support, Merative LP

# Abstract Archives of the RSNA, 2024

R6-CRO07

## Gynecologic MDC Review

Thursday, Dec. 5 1:30PM - 2:30PM Room: S401

Madeleine Sertic, MBBCh (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the multi-modality imaging appearances of various gynecologic malignancies, and the important features that contribute to staging. 2) Understand the role of radiation oncology, and how diagnostic reports can help guide treatment. 3) Learn the common surgical approaches and explore up-and-coming treatment strategies.

**COURSE DESCRIPTION**

A multidisciplinary panel of diagnostic radiologists, radiation oncologists, and gynecologic oncologists will perform a case-base overview of gynecologic malignancies.

**Sub-Events**

### R6-CRO07B Gynecologic MDC Review

Jessika A. Contreras, MD (*Presenter*) Nothing to Disclose

### R6-CRO07C Gynecologic MDC Review

Lilie Lin, MD (*Presenter*) Investigator, AstraZeneca PLC;Research Grant, Pfizer Inc

### R6-CRO07D Gynecologic MDC Review

Alexander Melamed, MD, MPH (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R6-CVA07

## Non-Atherosclerotic Arterial Vascular Disease

Thursday, Dec. 5 1:30PM - 2:30PM Room: N229

Kate Hanneman, MD, MPH (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Nicholas S. Burris, MD (*Moderator*) Royalties, ImBio, LLC

**LEARNING OBJECTIVES**

1) Describe the role of imaging in non-atherosclerotic aortic disease. 2) Identify key imaging findings in vasculitis, heritable thoracic aortic disease, and fibromuscular dysplasia. 3) Discuss congenital aortic arch anomalies and associated imaging findings.

**COURSE DESCRIPTION**

Practical approach to imaging of non-atherosclerotic aortic disease including vasculitis, fibromuscular dysplasia, hereditary aortic disease, and aortic arch anomalies

**Sub-Events**

### R6-CVA07C Vasculitis and Inflammatory Aortic Disease

Jordi Broncano, MD (*Presenter*) Nothing to Disclose

### R6-CVA07D Fibromuscular Dysplasia and Related Non-Inflammatory Disorders

Brian B. Ghoshhajra, MD, MBA (*Presenter*) Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Consultant, Siemens AG

### R6-CVA07E Congenital Vascular Anomalies and Malformations

Kate Hanneman, MD, MPH (*Presenter*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

### R6-CVA07F Imaging in Heritable Thoracic Aortic Disease

Caroline Robb, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R7-CBR07

## Novel Breast MRI Techniques

Thursday, Dec. 5 3:00PM - 4:00PM Room: N227B

Ritse M. Mann, MD, PhD (*Moderator*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV

### LEARNING OBJECTIVES

1) To understand the goal of the use of various sequences in breast MRI, and define indications where it is appropriate to use a full protocol. 2) Identifying solutions to shorten breast MRI protocols in order to increase capacity and reduce costs. 3) To gain as much information as possible from abbreviated breast MRI protocols using ultrafast imaging.

### COURSE DESCRIPTION

This course aims at all interested in breast MRI from a technical and clinical perspective. The course aims to review the components of breast MRI protocols and discuss their use in clinical practice. It provides insight in various options to reduce the length of standard breast MRI protocols without decreasing their diagnostic capacity. The course will also highlight when the value of true multi parametric protocols is still strong. After following this session you should be able to adapt your MRI protocols to scan indications and build a highly efficient practice, while simultaneously providing high quality assessments.

**Sub-Events**

### R7-CBR07B Abbreviated

Christiane K. Kuhl, MD, PhD (*Presenter*) Advisory Board, Guerbet SA;Speaker, Bracco Group;Speaker, Bayer AG

### R7-CBR07C Ultrafast

Ritse M. Mann, MD, PhD (*Presenter*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV

### R7-CBR07D Parametric

Habib Rahbar, MD (*Presenter*) Research Grant, General Electric Company;Research Consultant, Guerbet SA

# Abstract Archives of the RSNA, 2024

R7-CCA04

## What Cardiac Device is That? Interactive Session on Imaging Heart Failure Patients

Thursday, Dec. 5 3:00PM - 4:00PM Room: N226

Byoung Wook Choi, MD, PhD (*Moderator*) Nothing to Disclose
Carole J. Dennie, MD, FRCPC (*Moderator*) Research Consultant, AstraZeneca PLC

**LEARNING OBJECTIVES**

1) Identify and describe the X-ray and CT appearances of different cardiac devices used in heart failure patients. 2) Recognize and overcome technical challenges in CT imaging of severe heart failure to optimize image quality and diagnostic accuracy. 3) Understand the imaging considerations, protocols, and potential complications associated with left ventricular assist devices (LVAD) and right ventricular assist devices (RVAD).

**COURSE DESCRIPTION**

This educational session is a comprehensive exploration of cardiac devices and their imaging appearances in heart failure patients. The session consists of three lectures that cover essential aspects of cardiac device imaging, including X-ray and CT appearances, technical challenges in CT imaging of severe heart failure, and imaging of left ventricular assist devices (LVAD) and right ventricular assist devices (RVAD). The session aims to enhance participants' knowledge and proficiency in imaging heart failure patients with various cardiac devices, ultimately improving patient care and diagnostic accuracy

**Sub-Events**

### R7-CCA04C Toolbelt of Cardiac Devices: X-Ray and CT Appearance

Byoung Wook Choi, MD, PhD (*Presenter*) Nothing to Disclose

### R7-CCA04D Technical Challenges in CT: Imaging Severe Heart Failure

Carole J. Dennie, MD, FRCPC (*Presenter*) Research Consultant, AstraZeneca PLC

### R7-CCA04E Who Needs Assistance? Imaging of LVAD & RVAD

Daniel Vargas, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

R7-CCH13

## Understanding Thoracic AI/Radiomics: Where Are We and Where We Are Going?

Thursday, Dec. 5 3:00PM - 4:00PM Room: E451A

Carol C. Wu, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the fundamentals of AI and radiomics in thoracic imaging. 2) Assess AI and radiomics tools for clinical implementation in thoracic imaging. 3) Identify challenges and potential pitfalls of implementing AI tools in thoracic imaging.

**COURSE DESCRIPTION**

The course is designed to provide a basic overview of the current status and future directions in the fast evolving field of thoracic imaging artificial intelligence (AI) and radiomics. Through the lectures and discussion, participants will learn about principles and pitfalls of AI and radiomics and considerations required for successful clinical implementation and utilization of these advance tools in thoracic radiology.

**Sub-Events**

**R7-CCH13B** **AI, Machine Learning and the Rest: A Guide for All of Us**

Chi Wan Koo, MD (*Presenter*) Nothing to Disclose

**R7-CCH13C** **Understanding Radiomics and Trial Outcomes**

Anastasia Oikonomou, MD, PhD (*Presenter*) Nothing to Disclose

**R7-CCH13D** **Pragmatic Thoracic AI/Data Science Implementations and the Near Future**

Carol C. Wu, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R7-CER09

## Emergent Traumatic Musculoskeletal Imaging

Thursday, Dec. 5 3:00PM - 4:00PM Room: N228

Susanna C. Spence, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify and rapidly describe key features of musculoskeletal injuries involving the upper and lower extremities. 2) Provide a focused and clinically relevant report including the features the surgeons want to know.

**COURSE DESCRIPTION**

A high-yield series of lectures focused on key diagnoses in the upper extremity, pelvis and lower extremity, with emphasis on diagnosis and key features that impact patient management. Create a highly relevant and concise radiology report focused on the critical components of these injuries, with emphasis on what the surgeons need to know.

**Sub-Events**

**R7-CER09B** **Pelvis/Acetabular Injuries**

Susanna C. Spence, MD (*Presenter*) Nothing to Disclose

**R7-CER09C** **Ankle/Foot Trauma**

Claire K. Sandstrom, MD (*Presenter*) Nothing to Disclose

**R7-CER09D** **Wrist/Hand Trauma**

Ashwin V. Asrani, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R7-CGI14

## LI-RADS

Thursday, Dec. 5 3:00PM - 4:00PM Room: E451B

Jeong Min Lee, MD, PhD (*Moderator*) Grant, Bayer AG Grant, Canon Medical Systems Corporation Grant, Koninklijke Philips NV Grant, General Electric Healthcare Grant, Guerbet SA Grant, Samsung Electronics Co, Ltd Grant, Bracco Group Grant, Dongkuk Pharma Grant, Starmed Ltd Grant, RF medical Grant, Siemens AG Speakers, Bayer AG Speakers, Philips Healthcare Speakers, Samsung Medison Speakers, GE Healthcare

### LEARNING OBJECTIVES

1) Understand the Latest Updates in LI-RADS treatment response algorithms (TRA) and CEUS LI-RADS TRA, and learn their practical applications for HCC management. 2) Identify Prognostic Imaging Features and Pathomolecular Subtypes of HCC, aiding in better diagnosis and treatment planning. 3) Learn how to effectively evaluate the treatment response to systemic therapy in HCC, with a focus on practical case-based learning to manage challenging clinical scenarios.

### COURSE DESCRIPTION

This session will offer a comprehensive overview of the latest updates and clinical applications of the Liver Imaging Reporting and Data System (LI-RADS). Topics will include the newest updates on the LI-RADS Treatment Response Algorithm (TRA) and the pathomolecular subtypes and prognostic imaging features of hepatocellular carcinoma (HCC). The session will also cover clinical applications of LI-RADS TRA and Contrast-Enhanced Ultrasound (CEUS) LI-RADS-TRA for HCC management. Additionally, a case-based approach to systemic therapy of HCC will be featured, focusing on challenging cases to provide practical insights and enhance participants' understanding of complex clinical scenarios. This session aims to enhance participants' understanding of LI-RADS and its pivotal role in liver cancer management.

**Sub-Events**

### R7-CGI14B New Updates: LI-RADS TRA

Mishal Mendiratta-Lala, MD (*Presenter*) Nothing to Disclose

### R7-CGI14C Pathomolecular Subtypes and Prognostic Imaging Features of HCC

Victoria Chernyak, MD, MS (*Presenter*) Consultant, Bayer AG

### R7-CGI14D Case-Based: Systemic Therapy of HCC With Challenging Cases

Maxime Ronot, MD, PhD (*Presenter*) Speaker, General Electric Company;Speaker, Ipsen SA;Speaker, Canon Medical Systems Corporation;Speaker, Alexion Pharmaceuticals, Inc;Speaker, Guerbet SA;Speaker, Sirtex Medical Ltd

### R7-CGI14E Case-Based: LIRADS CEUS Diagnosis and TRA

Andrej Lyshchik, MD, PhD (*Presenter*) Royalties, RELX;Speaker, General Electric Company;Consultant, General Electric Company;Research support, General Electric Company;Consultant, BioClinica, Inc;Consultant, WCC, Inc;Consultant, Bracco Group;Advisory Board, Bracco Group

# Abstract Archives of the RSNA, 2024

R7-CIN12

## Automatic Report Generation by Image-based AI

Thursday, Dec. 5 3:00PM - 4:00PM Room: E450B

Eduardo M. Farina, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand Current Technologies: Participants will be able to describe the latest approaches in automatic report generation and their applications in radiology. 2) Evaluate Performance Metrics: Learners will be able to identify and apply key metrics for assessing the quality and accuracy of automatically generated reports. 3) Analyze Ethical Implications: Attendees will gain insights into the ethical considerations and potential challenges associated with the implementation of automatic report generation in clinical practice.

**COURSE DESCRIPTION**

The rapid evolution of automatic report generation in radiology is reshaping the landscape of medical imaging. This educational session, titled "Automatic Report Generation by Image-based AI" will provide a comprehensive overview of the latest advancements and future directions in this dynamic field. Attendees will gain insights into the practical implementation of these technologies, the metrics used to evaluate their effectiveness, and the ethical implications surrounding their use. The session will feature expert presentations, followed by a panel discussion, enabling participants to engage with thought leaders and explore critical issues from multiple perspectives. This course is essential for radiologists, data scientists, and healthcare professionals interested in harnessing the power of AI to enhance diagnostic accuracy and efficiency. Expected outcomes include an improved understanding of current technologies, the ability to assess their performance critically, and a deeper awareness of ethical considerations.

**Sub-Events**

### R7-CIN12B Current and Future Approaches in Report Generation

Woojin Kim, MD (*Presenter*) Co-founder, Equium Intelligence, Inc;Shareholder, Equium Intelligence, Inc;Stockholder, Nuance Communications, Inc;Consultant, Nuance Communications, Inc;Stockholder, Hyperfine Research, Inc;Consultant, Hyperfine Research, Inc;Stockholder, Nanox Imaging LTD;Advisory Board, Braid Health, Inc;Advisory Board, ImageBiopsy Lab;Advisory Board, Inference Analytics;Advisory Board, Infiniti Medical, LLC;Advisory Board, Luxsonic Technologies Inc;Advisory Board, Rad AI;Advisory Board, Xcel Capital Pty Ltd

### R7-CIN12C Metrics for Automatic Report Generation

Pranav Rajpurkar, PhD (*Presenter*) Nothing to Disclose

### R7-CIN12D Ethical Considerations Regarding Automatic Report Generation

Mana Moassefi, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

R7-CIR08

## Management of Complications from Percutaneous Interventions

Thursday, Dec. 5 3:00PM - 4:00PM Room: E353A

Anne M. Covey, MD (*Moderator*) Stockholder, Amgen Inc

**Sub-Events**

**R7-CIR08B** **Managing Complications from TIPS and BRTO**

Ryan Hickey, MD (*Presenter*) Advisor, BTG International Ltd

**R7-CIR08C** **Complications of Biopsy and Drainage Procedures**

Amy R. Deipolyi, MD, PhD (*Presenter*) Nothing to Disclose

**R7-CIR08D** **Risk Factors and Management of Complications from Liver Ablation**

Haruyuki Takaki, MD (*Presenter*) Nothing to Disclose

**R7-CIR08F** **Managing Complications of Liver Directed Therapy**

William S. Rilling, MD (*Presenter*) Consultant, Boston Scientific Corporation;Consultant, Agilent Technologies, Inc;Consultant, Terumo Corporation;Consultant, Becton, Dickinson and Company;Consultant, Sirtex Medical Ltd;Consultant, AstraZeneca PLC

# Abstract Archives of the RSNA, 2024

R7-CMK13

## Small Joints: Big Problems

Thursday, Dec. 5 3:00PM - 4:00PM Room: E450A

Bruce B. Forster, MD, FRCPC (*Moderator*) Stockholder, Canada Diagnostic Centres

**LEARNING OBJECTIVES**

1) Determine the most effective imaging modality to evaluate common small joints. 2) Describe key normal anatomic features of these joints. 3) Categorize the imaging findings and treatment options in traumatic and non-traumatic pathologies.

**COURSE DESCRIPTION**

This one hour lecture series, using concise 10 minute presentations by MSK experts, will provide the attendee with a synopsis of the key multimodality imaging features of pathology of the acromioclavicular joint, the sternoclavicular joint, the tibio-fibular joint, the symphysis pubis and the sub-talar joint. These small joints are often under-represented in educational curricula, but can be a significant source of pain and dysfunction for patients, which attendees will be better able to diagnose and treat by the end of the session.

**Sub-Events**

### R7-CMK13B AC Joints in All Their Glory

Bruce B. Forster, MD, FRCPC (*Presenter*) Stockholder, Canada Diagnostic Centres

### R7-CMK13C Sternoclavicular Joint: Small but Mighty

Stacy E. Smith, MD (*Presenter*) Nothing to Disclose

### R7-CMK13D Tibiofibular Joint: The Forgotten Joint of the Knee

Yulia Melenevsky, MD (*Presenter*) Nothing to Disclose

### R7-CMK13E Pubic Symphysis: The Joint at the Core

Adam C. Zoga, MD, MBA (*Presenter*) Nothing to Disclose

### R7-CMK13F Subtalar Joint: Underneath it All

Iman Khodarahmi, MD, PhD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

R7-CMS04

## Therapeutic and Sociocultural Cosmetical Modifications and Related Complications

Thursday, Dec. 5 3:00PM - 4:00PM Room: N229

Nariman Nezami, MD (*Moderator*) Consultant, CAPS Medical Ltd

**LEARNING OBJECTIVES**

1) Describe a wide variety of common and rare therapeutic cosmetical procedures. 2)Introduce radiologists to the sociocultural phenomenon of "Image is everything " including historical context and evolution of the plastic surgery practice. 3) Familiarize the radiologist with the diversity of plastic surgeries performed for enhancement of physical appearance, with particular focus on implants, including typical and atypical locations and their appearances on medical imaging examinations. 4) Describe potential complications of cosmetic surgeries and implant procedures and the imaging findings associated with "botched" procedures. Discuss management of "botched" and otherwise complicated procedures.

**COURSE DESCRIPTION**

Therapeutic and Sociocultural Cosmetical Modifications and Related Complications" is an advanced course that explores the intersection of therapeutic interventions, sociocultural practices, and their cosmetic modifications. This course provides a comprehensive understanding of various cosmetic procedures, the sociocultural factors influencing them, and the potential complications that may arise. Participants will learn about the latest advancements in cosmetic treatments and imaging findings of complications. The course integrates theoretical knowledge with practical applications, preparing radiologists for real-world scenarios in clinical and sociocultural contexts.

**Sub-Events**

### R7-CMS04B Image is Everything: Plastic and Cosmetic Surgery as a Sociocultural Phenomenon

Nadia Solomon, MD, MSc (*Presenter*) Nothing to Disclose

### R7-CMS04C The Aftermath of Cosmetic Injectables: Imaging for Surgical Planning and Post-surgical Follow Up

Jonathan S. Luchs, MD (*Presenter*) Nothing to Disclose

### R7-CMS04D A Primer on Imaging Findings in Cosmetic Procedures and Associated Complications in the Abdomen/Pelvis

Meghan G. Lubner, MD (*Presenter*) Spouse, Consultant, Elephas Bio

# Abstract Archives of the RSNA, 2024

R7-CNMMI05

## Chest Imaging: When Molecular Imaging Helps

Thursday, Dec. 5 3:00PM - 4:00PM Room: S405

Ryan J. Avery, MD (*Moderator*) Research Consultant, Konica Minolta, Inc

**LEARNING OBJECTIVES**

1) A case-based review discussing the emerging of Molecular Imaging techniques, which can improve detection of ischemic heart disease, infiltrative cardiomyopathies, and inflammatory cardiomyopathies, with a focus on sarcoidosis. 2) Provide a discussion of new Molecular Imaging techniques that are available for routine clinical diagnosis of pathologies related to coronary artery disease and infiltrative/inflammatory cardiomyopathies. Further, the rationale of the examinations will be provided by explaining the medical and imaging sciences that necessitate when and how to perform these examinations. 3) The case-based approach will discuss the key imaging findings that can be used to improve diagnosis of cardiothoracic diseases. Given the novelty of these exams, a review of important incidental findings and imaging pitfalls will also be provided to improve examination implementation and interpretation.

**Sub-Events**

### R7-CNMMI05B Multimodality Perspective of Cardiac Sarcoidosis - Hybridizing FDG-PET and Cardiac MR Imaging

Ryan J. Avery, MD (*Presenter*) Research Consultant, Konica Minolta, Inc

### R7-CNMMI05C Complementary Roles of PET, MRI, and CT in Cardiac Ischemia, Small Vessel Disease, and COVID

Pamela K. Woodard, MD (*Presenter*) Researcher, Siemens AG;Consulting, Medtronic plc;Researcher, Bayer AG;Patent, Washington University

### R7-CNMMI05D Multimodality Imaging of Infiltrative and Inflammatory Cardiomyopathy

Robert K. Zeman, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R7-CNPM07

## Advancing Justice Oriented Innovation in Radiology (Sponsored by the RSNA Health Equity Committee)

Thursday, Dec. 5 3:00PM - 4:00PM Room: S402

Efren J. Flores, MD (*Moderator*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Lucy B. Spalluto, MD, MPH (*Moderator*) Nothing to Disclose
Jacob A. Blythe, MA, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Discussing the implementation of a practical framework to justice oriented innovation. 2) Identifying and accelerating the justice-oriented pipelines. 3) Articulating the business case for commercialization of justice-oriented innovation. This session will include a 15-minute Q&A session with the audience.

### COURSE DESCRIPTION

Radiology is a continuously evolving field driven by technological healthcare innovations. Innovation and new technologies in our clinical radiology practices lead us to deliver better care. The shape that these technologies take, while in part unpredictable, can be guided by our shared values. In recent years, radiology has increasingly recognized its role in health disparities, many of which may be rooted in the innovative spirit without an equity lens that has motivated radiologic practice since its inception. This creates a fresh opportunity to reconsider innovative activities in radiology through a justice-oriented lens. In an effort at incorporating responsible innovation into radiology, justice-oriented innovation in radiology is concerned principally with reducing imaging disparities and leverages novel technologies as an opportunity to achieve this goal. The rapid implementation and growth of AI and theranostics in radiology provide an opportune window to set a foundation for justice-oriented innovation in radiology.

**Sub-Events**

### R7-CNPM07D Defining Key Performance Indicators for Accelerating Justice-Oriented Innovation

Marc D. Succi, MD (*Presenter*) Inventor, Frequency Therapeutics

### R7-CNPM07E The Role of Reciprocal Innovation to Achieving Equity in Global Health

Farouk Dako, MD, MPH (*Presenter*) Nothing to Disclose

### R7-CNPM07F Potential Pitfalls and Opportunities for Health Equity in AI

Florence X. Doo, MD, MA (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R7-CNR05

## Crash Course! Imaging of Neurodegenerative Diseases and ARIA

Thursday, Dec. 5 3:00PM - 4:00PM Room: S406B

Timothy M. Shepherd, MD, PhD (*Moderator*) Co-founder, MICroStructure Imaging

**LEARNING OBJECTIVES**

1) Describe the key features of Alzheimer's disease and related diseases on clinical exam, MRI and PET imaging. 2) Explain the potential complications of anti-amyloid immunotherapy, their appearance on MRI and the role for imaging in treatment monitoring. 3) Identify near-future developments that may change how MRI and PET are used to diagnose or monitor treatment in patients with Alzheimer's disease.

**COURSE DESCRIPTION**

Alzheimer’s disease is an important clinical problem with high societal costs as US and global populations both age and live longer. MRI and PET imaging have become a more important part of clinical diagnosis and management over the past 5 years – this emerging new radiology role should grow with recently FDA-approved anti-amyloid immunotherapy. This educational session will provide the audience with a background understanding of Alzheimer’s disease pathology, prevalence and clinical presentation. We will review the specific roles for MRI and PET in shaping the diagnosis for Alzheimer’s disease and related diseases. We will review the potential benefit and complications of anti-amyloid immunotherapies, with a specific focus on how imaging contributes to clinical management. These changes are placing new demands on radiology and the situation is currently dynamic – the last presentation will preview how the radiology role may change over the next 5 years as more therapies, novel imaging methods and potential robust serum biomarkers for Alzheimer’s disease emerge. The session will conclude with a panel discussion by speakers that addresses both current controversies in this field and questions from the audience.

**Sub-Events**

### R7-CNR05B Introduction to Alzheimer's Disease and Imaging of Dementia

Gloria C. Chiang, MD (*Presenter*) Advisory Board, Biogen Idec Inc;Consultant, Life Molecular Imaging;Speaker, Horizon CME

### R7-CNR05C Role of PET for Alzheimer's Dementia

Ana M. Franceschi, MD, PhD (*Presenter*) Consultant, Biogen Idec Inc

### R7-CNR05D Imaging for Ant-Amyloid Therapy and ARIA

Timothy M. Shepherd, MD, PhD (*Presenter*) Co-founder, MICroStructure Imaging

### R7-CNR05E Imaging of Dementia in 2030

Sven Haller, MD, MSc (*Presenter*) Consultant, Spineart SA;Scientific Advisory Board, EPAD

# Abstract Archives of the RSNA, 2024

R7-COB05

## Acute Pelvic Pain in a Reproductive Age Female

Thursday, Dec. 5 3:00PM - 4:00PM Room: E351

Alyssa K. Kirsch, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize the findings of adnexal torsion. 2) Understand the commonest cause of pelvic pain in pregnancy. 3) Perform tailored evaluation of pelvic pain in reproductive age females using US, CT, and MRI.

**COURSE DESCRIPTION**

Acute pelvic pain in a reproductive age female patient is a common imaging indication that radiologists often encounter. It is imperative that radiologists be familiar with imaging findings associated with pathologies of acute pelvic pain which may require more urgent attention and management. This session will be a lecture case-based review of US, CT, and MR imaging findings associated with acute pelvic pain in the reproductive age patient including pregnant and non-pregnant patients. This will include a review of common entities such as ovarian torsion, and less common and challenging pathology such as ectopic pregnancy, complications following pregnancy, and placenta accreta spectrum.

**Sub-Events**

**R7-COB05B** **Acute Pelvic Pain: + Pregnancy Test**

Tara A. Morgan, MD (*Presenter*) Nothing to Disclose

**R7-COB05C** **Acute Pelvic Pain: - Pregnancy Test**

Dorothy J. Shum, MD (*Presenter*) Nothing to Disclose

**R7-COB05D** **Testing your knowledge: Just Another Day in the Reading Room**

Anne M. Kennedy, MBBCh (*Presenter*) Author with royalties, RELX

# Abstract Archives of the RSNA, 2024

R7-CPD08

## Skeletal Reflections of Systemic Diseases in Children

Thursday, Dec. 5 3:00PM - 4:00PM Room: E352

Andrea S. Doria, MD, PhD (*Moderator*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)
Brent H. Adler, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1)Provide an overview of pediatric metabolic abnormalities that present with musculoskeletal manifestations. 2)Discuss common and uncommon appearances of chronic nonbacterial osteomyelitis at the light of different imaging modalities. 3)Discuss musculoskeletal and extra-musculoskeletal manifestations of vasculitis in children. 4)Differentiate normal and abnormal imaging characteristics of bone marrow of children of different ages.

**Sub-Events**

### R7-CPD08C Metabolic Skeletal Diseases

Jennifer Stimec, MD (*Presenter*) Nothing to Disclose

### R7-CPD08D Chronic Nonbacterial Osteomyelitis

Sarah D. Bixby, MD, MBA (*Presenter*) Nothing to Disclose

### R7-CPD08E Vasculitis of Musculoskeletal Disorders and Its Myriad Appearances in Children

Pritish Bawa, MD (*Presenter*) Nothing to Disclose

### R7-CPD08F Bone Marrow in Children: When It Is Pathologic

Kirsten Ecklund, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R7-CPH09

## Optimizing the Use of Radiation in Fluoroscopy: Technological and Behavioral Approaches

Thursday, Dec. 5 3:00PM - 4:00PM Room: S404

David Borrego, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss the impact of emerging angiography technologies on patient dose and safety. 2) Illustrate the usefulness of contributing to dose index registries and identify opportunities for incorporating their results into your clinical practice. 3) Describe radiation safety principles and opportunities for clinicians with fluoroscopy-privileges to engage in active learning. 4) Understand strategies for integrating novel technologies, leveraging powerful databases, and advanced learning methods with the goal of improving radiation safety and patient care.

**COURSE DESCRIPTION**

During this session we explore topics that are helping drive the practice of radiation protection in both occupational and medical exposures. This session, with a special emphasis on fluoroscopic imaging, will provide an overview of emerging dose saving technologies, national registries of dose indices, and perspectives from a physicist on how to integrate effective radiation safety training. These topics are presented with the goal of improving radiation protection and patient care in the clinic. Attendees will leave the course with an understanding of technological and behavioral changes contributing towards dose optimization and, more importantly, how they can play a key role in contributing towards improvements in radiation protection.

**Sub-Events**

**R7-CPH09B** **Welcoming a New Generation of Angiography Systems: Dose Reduction Without Compromising Image Quality?**

Annalisa Trianni (*Presenter*) Nothing to Disclose

**R7-CPH09C** **ACR Dose Index Registry: Strength in Numbers and Your Role in Radiation Protection**

Steve D. Mann, PhD (*Presenter*) Nothing to Disclose

**R7-CPH09D** **Perspective on Teaching Radiation Protection to Health Care Professionals and Learning From Them**

David Borrego, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S1-CBR09

## Management of High-Risk Breast Lesions

Sunday, Dec. 1 9:00AM - 10:00AM Room: S406A

Sarah J. Vinnicombe, FRCR, MRCP (*Moderator*) Consultant, Bayer AG

**LEARNING OBJECTIVES**

1) Gain a greater understanding of the nature of high risk lesions. 2) Appreciate how the level of risk varies according to pathologic subtype 3) Recognize how strategies to manage these lesions are evolving, and how they vary internationally.

**COURSE DESCRIPTION**

This educational session will consist of three talks and discussion on elevated or high risk breast lesions, diagnosed on core needle biopsy. The session will highlight the challenges in pathologic diagnosis of these lesions and explore the differing management strategies of these lesions.

**Sub-Events**

### S1-CBR09B USA Perspective

Vilert A. Loving, MD, MMM (*Presenter*) Nothing to Disclose

### S1-CBR09C European Perspective

Sarah J. Vinnicombe, FRCR, MRCP (*Presenter*) Consultant, Bayer AG

### S1-CBR09D Pathologist Perspective With Focus on Lobular Neoplasia

Husain Sattar, MD, BA (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S1-CCA07

## Efficient and Focused Cardiac MRI

Sunday, Dec. 1 9:00AM - 10:00AM Room: E353C

Karen G. Ordovas, MD, MS (*Moderator*) Nothing to Disclose
Jens Bremerich, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To review accelerated techniques for cardiac MRI. 2) To identify essential diagnostic information required in specific clinical scenarios and to focus imaging protocols.

**COURSE DESCRIPTION**

Cardiac MRI is a powerful tool for imaging myocardial structure, function, perfusion, and flow. The role of the radiologist is to taylor concise acquisition protocols focused on specific clinical situations. Lectures and discussions in this course aim to enhance knowledge on accelerated MRI techniques, patient physiology and contribution of imaging to management of specific cardiac diseases.

**Sub-Events**

### S1-CCA07C Fast & Focused: Cardiac MRI in 20 Minutes

Chiara Bucciarelli Ducci, MD, PhD (*Presenter*) Consultant, Circle Cardiovascular Imaging Inc

### S1-CCA07D Stress, Don't Sweat: Quick Ischemia Imaging With Cardiac MRI

Ming-Yen Ng, BMBS, FRCR (*Presenter*) Education Grant, General Electric Company;Education Grant, Bayer AG;Education Grant, Circle Cardiovascular Imaging Inc;Education Grant, TeraRecon, Inc;Education Grant, Arterys Inc;Speakers Bureau, Boehringer Ingelheim GmbH

### S1-CCA07E Go With the Flow: All-In-One 4D Flow MRI

James C. Carr, MD (*Presenter*) Institutional Research Grant, Siemens AG;Advisory Board, Siemens AG;Travel support, Siemens AG;Institutional Research Grant, Bayer AG;Advisory Board, Bayer AG;Travel support, Bayer AG;Speaker, Bayer AG;Institutional Research Grant, Guerbet SA;Advisory Board, Bracco Group

# Abstract Archives of the RSNA, 2024

S1-CER01

## Non-Traumatic Musculoskeletal Emergencies

Sunday, Dec. 1 9:00AM - 10:00AM Room: N228

Adnan M. Sheikh, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify common non-traumatic musculoskeletal conditions affecting the shoulder, hip, and pediatric populations. 2) Describe the essential imaging features associated with different patterns of non-traumatic musculoskeletal conditions. 3) Develop proficiency in interpreting imaging results to aid in timely and accurate diagnosis of musculoskeletal emergencies.

**COURSE DESCRIPTION**

This session focuses on non-traumatic musculoskeletal emergencies, emphasizing the pivotal role of imaging in diagnosis. Participants will explore common conditions affecting the shoulder, hip, and pediatric infections, gaining insights into the essential imaging features. By the end of the session, attendees will be equipped to recognize and articulate key imaging characteristics associated with various non-traumatic musculoskeletal conditions.

**Sub-Events**

**S1-CER01B** **Non Traumatic Hip Pain**

Adnan M. Sheikh, MD (*Presenter*) Nothing to Disclose

**S1-CER01C** **Non Traumatic Shoulder Pain**

Kawanpreet S. Rakhra, MD, FRCPC (*Presenter*) Nothing to Disclose

**S1-CER01D** **Paediatric MSK Infections**

Summer L. Kaplan, MD, MS (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

S1-CGI06

## Pancreaticobiliary Imaging

Sunday, Dec. 1 9:00AM - 10:00AM Room: E451B

Kumaresan Sandrasegaran, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Be able to recognize causes of secondary sclerosing cholangitis. 2) Recognize the clinical implications of the level of biliary obstruction in MBDO. 3) Learn the importance of template reporting of severe acute pancreatitis.

**COURSE DESCRIPTION**

1. Cover common and uncommon causes of secondary sclerosing cholangitis.

2. Focus on the importance of accurate and detailed review of imaging prior to percutaneous biliary intervention for malignant bile duct obstruction (MBDO).

3. Understand the revised Atlanta criteria for acute pancreatitis.

**Sub-Events**

**S1-CGI06B** **Biliary Pathology**

Maria Antonietta Bali, MD, PhD (*Presenter*) Nothing to Disclose

**S1-CGI06C** **Cholangiocarcinoma**

Meghan G. Lubner, MD (*Presenter*) Spouse, Consultant, Elephas Bio

**S1-CGI06D** **Pancreatitis**

Kumaresan Sandrasegaran, MD (*Presenter*) Nothing to Disclose

**S1-CGI06E** **Biliary Interventions**

Anne M. Covey, MD (*Presenter*) Stockholder, Amgen Inc

# Abstract Archives of the RSNA, 2024

S1-CIN03

## Communication Errors in Radiology and How to Avoid Them: From Actionable Reports to AI (Sponsored by the RSNA Quality Improvement Committee)

Sunday, Dec. 1 9:00AM - 10:00AM Room: E450B

Bettina Siewert, MD (*Moderator*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv

**LEARNING OBJECTIVES**

1) Describe the etiology of communication errors in radiology and their impact on patient outcomes. 2) Explain measures to ensure closed loop communication in actionable reports and in verbal communication in the radiology department supported by human factors engineering and AI tools. 3) Discuss the value of a radiology consult service for communication with referring physician.

**COURSE DESCRIPTION**

Communication errors contribute to serious adverse events in 65% of cases. In malpractice cases, this increases to 80%. Communication errors in radiology adversely affect the patient in 38%. Potential impact has been noted in an additional 52% of reported near miss events. Awareness among radiologists regarding the nature of communication errors in radiology and how to avoid them is therefore critical.

This course will discuss root causes of communication errors in radiology, where in the diagnostic process communication errors most frequently occur, and which staff pairings are most vulnerable to communication errors. Countermeasures on how to avoid errors in direct communications with other staff and in radiology reports will be described. The benefit of human factors engineering and artificial intelligence tools will be discussed.

**Sub-Events**

**S1-CIN03B** **Communication Errors in Radiology: Where, When, Why, What**

Bettina Siewert, MD (*Presenter*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv

**S1-CIN03C** **Avoiding Communication Errors in Report: Creating Actionable Reports Despite Uncertainty**

Atul B. Shinagare, MD (*Presenter*) Consultant, VirtualScopics, Inc;Consultant, Imaging Endpoints

**S1-CIN03D** **Improving Communication with Referring Physicians: The Radiology Consult**

Hanna M. Zafar, MD (*Presenter*) Nothing to Disclose

**S1-CIN03E** **Effective Communication in the Radiology Department**

Matthew S. Davenport, MD (*Presenter*) Royalties, Wolters Kluwer nv

**S1-CIN03F** **AI Tools to Improve Communication in Radiology**

Alex Towbin, MD (*Presenter*) Author, RELX;Consultant, Anderson Publishing, Ltd;Advisory Board, KLAS Enterprises LLC;Travel support, Merative LP

# Abstract Archives of the RSNA, 2024

S1-CMK06

## Ankle and Foot Imaging: The Fundamentals

Sunday, Dec. 1 9:00AM - 10:00AM Room: E450A

Donna G. Blankenbaker, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review normal anatomy of the hindfoot, midfoot, and forefoot. 2) Recognize MR imaging features of ligament and tendon tears. 3) Identify causes for metatarsalgia. 4) Describe pitfalls and normal variants that may mimic ankle and foot injuries.

**Sub-Events**

### S1-CMK06B Midfoot Injuries

Donna G. Blankenbaker, MD (*Presenter*) Nothing to Disclose

### S1-CMK06C Imaging and Injury of the Ankle Ligaments

James M. Linklater, FRANZCR, BMedSc (*Presenter*) Nothing to Disclose

### S1-CMK06D Metatarsalgia - Usual and Unusual Causes

Hilary R. Umans, MD (*Presenter*) Nothing to Disclose

### S1-CMK06E Hindfoot Injuries

Thomas M. Link, MD, PhD (*Presenter*) Research Consultant, General Electric Company

### S1-CMK06F Tendon and Retinaculum Injuries

Jenny T. Bencardino, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S1-CNPM02

## Accelerating Patient Care Through the Electronic Medical Record: Case Studies in Learning Health Systems (Sponsored by the RSNA Research Development Committee)

Sunday, Dec. 1 9:00AM - 10:00AM Room: S402

Janie M. Lee, MD, MSc (*Moderator*) Research Grant, General Electric Company;Investigator, General Electric Company
Stella Kang, MD, MSc (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Review processes for integrating and evaluating artificial intelligence applications into routine clinical practice workflows. 2) Discuss electronic medical record tools to support peer learning in the clinical setting. 3) Identify actions that clinical practices can use to leverage the electronic medical record to increase cancer screening rates.

### COURSE DESCRIPTION

Clinical data is available in electronic medical record (EMR) systems and is underutilized, or can be used in ways that introduce bias. Preparing raw data from the EMR for clinical analytics, quality improvement projects, or clinical research involves curation and transformation of raw data and variables into a dataset which can be used to analyze data, inform meaningful interventions, and assess outcomes. This session will highlight how radiology learning health systems can leverage electronic medical record (EMR) data for operational, peer learning, and clinical research goals. Using case studies, we will review strengths and important pitfalls of EMR data analysis.

**Sub-Events**

### S1-CNPM02C Case 1: Evaluating AI Applications in Clinical Practice

Nathan M. Cross, MD, MS (*Presenter*) Nothing to Disclose

### S1-CNPM02D Case 2: EMR Tools for Peer Learning

Shlomit Goldberg-Stein, MD (*Presenter*) Nothing to Disclose

### S1-CNPM02E Increasing Lung Cancer Screening Rates in the ACR Learning Network

Ben C. Wandtke, MD, MS (*Presenter*) Clinical Advisory Board, CAK Tech, Inc

# Abstract Archives of the RSNA, 2024

S1-CNR14

## A Bug's Life: Journey Through Infection of the Brain, Orbit, Neck and Spine (In Collaboration With Head and Neck)

Sunday, Dec. 1 9:00AM - 10:00AM Room: S406B

Nancy Pham, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the relevant anatomy for the brain, orbit, neck, and spine and patterns of infectious spread. 2) Review the potential complications related to infection in each of these anatomic regions.

**COURSE DESCRIPTION**

This session is comprised of 4 high-yield lectures focused on the spectrum of infectious imaging findings related to the brain, orbits, neck and spine. Discussion will address the relevant anatomy, interesting cases, potential complications, and current imaging strategies for evaluating infection.

**Sub-Events**

### S1-CNR14B Battling Bad Brain Bugs

Kambiz Nael, MD (*Presenter*) Consultant, Canon Medical Systems Corporation;Consultant, Brainomix Limited

### S1-CNR14C Eye See What's Bugging You

Tabassum A. Kennedy, MD (*Presenter*) Nothing to Disclose

### S1-CNR14D Spotting Critters in the Neck

Alok A. Bhatt, MD (*Presenter*) Nothing to Disclose

### S1-CNR14E Creepy Crawlers in the Canal

Nancy Pham, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S1-COB03

## Integrating US and MR O-RADS in Your Practice

Sunday, Dec. 1 9:00AM - 10:00AM Room: E351

Elizabeth A. Sadowski, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn how to avoid common pitfalls when incorporating the O-RADS US and MRI risk stratification system into your clinical practice. 2) Understand which lesions may be adequately characterized with US. 3) Identify lesions that would benefit from further assessment on MRI before definitive management.

**COURSE DESCRIPTION**

This series of lectures will review the O-RADS US and MRI risk stratification system, with a focus on common pitfalls, when US is enough and when MRI adds value.

**Sub-Events**

### S1-COB03B O-RADS: Pearls and Pitfalls

Elizabeth A. Sadowski, MD (*Presenter*) Nothing to Disclose

### S1-COB03C O-RADS US Cases: When US is Enough

Yang Guo, MD (*Presenter*) Nothing to Disclose

### S1-COB03D O-RADS MRI Cases: When MRI Adds Value

Isabelle Thomassin-Naggara, MD (*Presenter*) Researcher, General Electric Company;Research funded, General Electric Company;Researcher, Canon Medical Systems Corporation;Research funded, Canon Medical Systems Corporation;Research funded, Hologic, Inc;Research funded, Siemens AG;Research funded, Guerbet SA

# Abstract Archives of the RSNA, 2024

S1-CPD13

## RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound (Registration Fee Required)

Sunday, Dec. 1 9:30AM - 11:30AM Room: S504CD

Andrea S. Doria, MD, PhD (*Moderator*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)

**LEARNING OBJECTIVES**

1) Review the anatomy and common pediatric pathologic musculoskeletal conditions in three pediatric joints: the shoulder, elbow and nerves of the lower extremity. 2) Use dynamic scanning of the joints to better demonstrate the anatomy of soft tissue and osteochondral components of three pediatric joints and will point out the distinction of soft tissue structures by a compression technique. 3)Discuss pathologies in the aforementioned joints as an overview of common pediatric pathologic musculoskeletal conditions.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. This 120-min pediatric musculoskeletal hands-on session is targeted to general radiologists who aim to get an overview of technical and clinical application perspectives on ultrasound scanning and interpreting pathology of elbows, hands and ankles of children and adolescents.

The information provided in this session adds value to the diagnostic tools that can be used for assessment of musculoskeletal disorders that affect growing joints, particularly in young children who may require general anesthesia for MRI assessment of their joints.

The session has two parts, a 60-min hands-on part where pre-assigned radiologists scan teenager models' joints in real time and a second 60-min knowledge application part where the audience has the opportunity to scan models' joints by themselves.

**Sub-Events**

**S1-CPD13B** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Lauren A. May, MD (*Presenter*) Nothing to Disclose

**S1-CPD13C** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Mahesh M. Thapa, MD, MEd (*Presenter*) Nothing to Disclose

**S1-CPD13D** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Jon A. Jacobson, MD (*Presenter*) Research Consultant, BioClinica, Inc;Advisory Board, Koninklijke Philips NV;Royalties, RELX;Contactor, POCUS PRO

**S1-CPD13E** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Patricia Nally (*Presenter*) Nothing to Disclose

**S1-CPD13F** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Jonathan D. Samet, MD (*Presenter*) Nothing to Disclose

**S1-CPD13G** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Kathryn S. Milks, MD (*Presenter*) Nothing to Disclose

**S1-CPD13H** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Falguni Patel, RDMS, RVT (*Presenter*) Nothing to Disclose

**S1-CPD13I** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Swati Patel, BS, RDMS (*Presenter*) Nothing to Disclose

**S1-CPD13J** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Laura Jurgens (*Presenter*) Nothing to Disclose

**S1-CPD13K** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Ayla Kljako,

RDMS (*Presenter*) Nothing to Disclose

**S1-CPD13L** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Andrea S. Doria, MD, PhD (*Presenter*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)

**S1-CPD13M** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Anna Alexiev, RDMS (*Presenter*) Nothing to Disclose

**S1-CPD13N** **RSNA Hands-On Lab: Pediatric Musculoskeletal Ultrasound**

Emily L. Bromagen, BS (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

S1-CRO04

## Pediatric MDC Review

Sunday, Dec. 1 9:00AM - 10:00AM Room: S401

Hesham Elhalawani, MD, MSc (*Moderator*) Nothing to Disclose
Camilo Jaimes Cobos, MD, MPH (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Engage in a multidisciplinary discussion concerning three complex pediatric oncology cases, focusing on their clinical and imaging characteristics. 2) Present recommendations from the COG/SPR consensus papers pertaining to image acquisition and interpretation. 3) Examine the role of radiation therapy in these cases, emphasizing strategic planning and delivery considerations.

**COURSE DESCRIPTION**

This interactive panel discussion will delve into three complex pediatric oncology cases. The panel, composed of two pediatric radiologists, a radiation oncologist, and a medical oncologist, will guide the conversation. Each case will be introduced through its clinical presentation and initial imaging. The medical oncologist will provide insights into the biology of the tumor, its staging, and the standard medical management. Following this, the radiation oncologist will discuss treatment alternatives, intricacies of radiation planning, and crucial aspects of delivery. The discussion will emphasize key aspects of medical imaging for each case, drawing on the recent recommendations from the Children's Oncology Group (COG)/Society for Pediatric Radiology (SPR) guidelines.

**Sub-Events**

### S1-CRO04C Pediatric MDC Review

Jessica Clymer, MD (*Presenter*) Nothing to Disclose

### S1-CRO04D Pediatric MDC Review

Michael S. Gee, MD, PhD (*Presenter*) Researcher, General Electric Company Researcher, Siemens AG Researcher, Motilent LLC

# Abstract Archives of the RSNA, 2024

S1-CVA04

## Peripheral Vascular Imaging

Sunday, Dec. 1 9:00AM - 10:00AM Room: N226

Jeffrey D. Jaskolka, MD (*Moderator*) Nothing to Disclose
Kacie Kuykendall, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review CT and MR techniques for evaluating the peripheral vasculature. 2) Discuss findings on imaging examinations of the peripheral vasculature that radiologists must be able to identify. 3) Learn to use imaging findings to make diagnoses and help direct patient management.

**COURSE DESCRIPTION**

This RSNA course is geared towards providing the listener with an overview of current imaging of the peripheral vascular system. CT and MR angiogrpaphic techniques will be reviewed. Attention will be directed towards using these exams to identify findings that affect medical decision making and patient management. One particularly important disease, thoracic outlet syndrome, will be presented in detail. In addition, there will be a specific presentation addressing the role of noninvasive imaging on interventional radiology techniques and management.

**Sub-Events**

### S1-CVA04C Thoracic Outlet Syndrome

Albert A. Nemcek JR, MD, MS (*Presenter*) Nothing to Disclose

### S1-CVA04D Upper and Lower Extremity CTA

Katherine A. Cheng, MD (*Presenter*) Nothing to Disclose

### S1-CVA04E Upper and Lower Extremity MRA

Ayaz Aghayev, MD (*Presenter*) Nothing to Disclose

### S1-CVA04F How Imaging Enables Endovascular Treatment in Peripheral Artery Disease

Sasan Partovi, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S1-RCP16

## Imaging Innovations in Obesity and Weight Loss: Shaping Patient Care from Weight Loss to Ethical Screening (Sponsored by the RSNA Public Information Committee)

Sunday, Dec. 1 9:00AM - 10:00AM Room: N227B

Vijay M. Rao, MD (*Moderator*) Nothing to Disclose
Jennifer L. Kemp, MD (*Moderator*) Stockholder, Scanslated, Inc

### LEARNING OBJECTIVES

1) Have a greater understanding of incidental imaging findings and appropriate screening in obese and overweight patients. 2) Know more about changes in body composition after weight loss and how those changes are reflected in imaging studies. 3) Grasp how medical images enhanced with cinematic rendering can aid in informing diagnoses and treatment decisions in the context of obesity, as well as improve communication with patients.

### COURSE DESCRIPTION

According to the World Health Organization, worldwide 43% of adults over 18 years old are overweight, and 16% are obese. Worldwide adult obesity has more than doubled since 1990, and adolescent obesity has quadrupled. It is critical that radiologists understand the challenges and findings associated with imaging this patient population. This course consists of three integrated lectures focused on imaging of obese or overweight patients, including those who have had weight loss from either surgery or medication. The first lecture examines appropriate screening for obese patients and touches on common incidental findings that may occur when imaging these patients. The second talk delves into changes in body composition after weight loss and impact on imaging results. Lastly, cinematic rendering has emerged as an innovative tool in diagnosis, treatment planning and communication. This talk will focus on how cinematic rendering of medical images can be utilized to help patients visualize their health and make informed decisions with their care team.

**Sub-Events**

**S1-RCP16C** **From Pixels to Patients: The Power of Medical Imaging in Obesity**

Louise Thomas, PhD (*Presenter*) Nothing to Disclose

**S1-RCP16D** **Weight Loss, Imaging of Patients, and Body Composition After Weight Loss**

Lee M. Kaplan, MD, PhD (*Presenter*) Nothing to Disclose

**S1-RCP16E** **Incidental Findings and Appropriate Screening in the Context of Obesity**

Mukesh G. Harisinghani, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S1-RCP30

## Strategic Career Moves Beyond Clinical Practice (Sponsored by the American Association for Women in Radiology)

Sunday, Dec. 1 9:00AM - 10:00AM Room: E350

Meridith J. Englander, MD (*Moderator*) Medical Director, Capital District Physicians' Health Plan, Inc
Catherine J. Everett, MD, MBA (*Moderator*) Shareholder, Radiology Partners;Officer, Radiology Partners;President, Eidetico Radiology Solutions;Medical Director, MSN Healthcare Solutions

### LEARNING OBJECTIVES

1) Understand Non-Clinical Career Paths: Identify and describe various non-clinical career opportunities available to radiologists and radiation oncologists, including roles in practice and hospital leadership, professional societies, and industry. 2) Analyze Career Success Stories: Consider the career paths of the featured speakers to gain insights into how they transitioned from clinical roles to significant non-clinical achievements. 3) Explore Personal Insight: Evaluate the role of professional coaching in achieving career goals. Learn strategies to identify professional interests and how to navigate the challenges of family and self-care. Explore how non-clinical roles can help mitigate burnout. 4) Assess the Impact of Mentorship: Discuss the importance of mentorship in professional development and career progression and identify strategies for seeking and benefiting from mentorship relationships. 5) Develop Strategic Career Planning Skills: Learn how to create and implement a strategic career plan, including setting realistic goals, identifying opportunities, and navigating potential challenges in pursuing non-clinical roles.

### COURSE DESCRIPTION

As radiologists and radiation oncologists progress through their careers, non-clinical roles offer opportunities to learn and use new skills. Whether it is leadership within your practice or hospital system, professional society or industry, there are many paths to career fulfillment. This session will feature speakers who have achieved significant professional successes outside of their clinical roles. Moderators will guide the panelists through a discussion of their career journeys with an emphasis on understanding the roles of personal insight, mentorship, coaching and strategic planning in reaching professional goals.

**Sub-Events**

### S1-RCP30C Inclusive Leadership as a Recipe for Success

Geraldine B. McGinty, MD, MBA (*Presenter*) Board Member, NextGen Healthcare ;Stockholder, NextGen Healthcare

### S1-RCP30D Linking Board Service, Entrepreneurship and Advocacy

Sheila D. Rege, MD (*Presenter*) Nothing to Disclose

### S1-RCP30E The Path to Private Practice CEO

Lauren P. Nicola, MD (*Presenter*) Nothing to Disclose

### S1-RCP30F Research + Quality = Health System Leadership

Yoshimi Anzai, MD, MPH (*Presenter*) Nothing to Disclose

### S1-RCP30G Coaching is a Tool

Julia R. Fielding, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S2-CCH01

## Lung Cancer Screening (1) - US/International Perspectives and Directions (Supported by an Independent Medical Education Grant from Merck Sharp and Dohme LLC)

Sunday, Dec. 1 10:30AM - 11:30AM Room: E451A

Mark M. Hammer, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss current state of lung cancer screening in the United States, Europe, and East Asia. 2) Compare and contrast eligibility for lung cancer screening across different countries. 3) Discuss challenges with increasing uptake of lung cancer screening around the world.

**COURSE DESCRIPTION**

This course will be a panel-based session with 3 speakers discussing United States and International perspectives on CT lung cancer screening. Each speaker will offer a perspective, after which we will have a lively discussion of the similarities, differences, and challenges moving forward.

**Sub-Events**

### S2-CCH01B US Perspective: Current Status and Directions

Jared D. Christensen, MD, MBA (*Presenter*) Advisory Board, Riverain Technologies, LLC;Consultant, Coreline Soft, Co Ltd

### S2-CCH01C European Perspective: Current Status and Directions

Mathias Prokop, MD, PhD (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation;Research Grant, Siemens AG;Speakers Bureau, Siemens AG

### S2-CCH01D Asia Perspective: Current Status and Directions

Jin Mo Goo, MD, PhD (*Presenter*) Research Grant, LG Electronics Inc Research Grant, Coreline Soft, Co, Ltd

### S2-CCH01E Discussion

Mark M. Hammer, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S2-CER02

## Spine Trauma - Core Concepts and Advances

Sunday, Dec. 1 10:30AM - 11:30AM Room: N228

Nicholas M. Beckmann, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize common injury patterns in pediatric spine trauma. 2) Identify and properly classify common injury patterns of the thoracolumbar spine. 3) Describe current concepts in classifying sacral fracture patterns.

**COURSE DESCRIPTION**

In this didactic-based session on spine trauma, key basic concepts and current recommendations in pediatric, thoracolumbar, and sacral spine trauma imaging will be reviewed along with current classifications of spine trauma.

**Sub-Events**

**S2-CER02B** **Core Concepts in Sacral Trauma**

Nicholas M. Beckmann, MD (*Presenter*) Nothing to Disclose

**S2-CER02C** **Core Concepts in Pediatric Spine Trauma**

Laura L. Hayes, MD (*Presenter*) Nothing to Disclose

**S2-CER02D** **Core Concepts in Thoracolumbar Spine Trauma**

Ellen X. Sun, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S2-CGU01

## Prostate MRI and Molecular Imaging: Core and Advanced Applications

Sunday, Dec. 1 10:30AM - 11:30AM Room: E353B

Spencer C. Behr, MD (*Moderator*) Grant, Cancer Targeted Technology;Scientific Advisory Board, Novartis AG;Research Consultant, GenVivo
Aytekin Oto, MD (*Moderator*) Research Grant, Koninklijke Philips NV;Medical Advisory Board, Profound Medical Inc;Consultant, IBM Corporation;Co-founder, Qmis LLC;Co-owner, Qmis LLC

### LEARNING OBJECTIVES

1) Explore the latest advancements in prostate imaging, with a particular focus on MRI and PET imaging techniques. 2) Analyze the clinical performance expectations and limitations of AI in Prostate MRI, aiming to set realistic benchmarks for clinical application. 3) Prepare for the integration of MRI in routine prostate cancer screening protocols, including considerations for technology, workflow, and patient selection.

### COURSE DESCRIPTION

This educational session aims to provide a comprehensive update on the latest developments on prostate imaging with a special focus on MR and PET imaging. The presentations cover a well-balanced, broad scope from practical, updated tips for optimized prostate MR acquisition and interpretation to new techniques such as PET MRI and PSMA PET imaging. There will be a critical examination of the use of artificial intelligence in Prostate MRI, discussing both its potential and its limitations to establish realistic clinical expectations. The session will guide attendees on how to effectively incorporate MRI into routine prostate cancer screening protocols, considering technological needs, workflow integration, and patient selection criteria. Finally, the course will address healthcare disparities in prostate imaging by identifying existing inequities and proposing strategies to mitigate them.

**Sub-Events**

### S2-CGU01C Prostate MR Update: What is in the Horizon?

Aytekin Oto, MD (*Presenter*) Research Grant, Koninklijke Philips NV;Medical Advisory Board, Profound Medical Inc;Consultant, IBM Corporation;Co-founder, Qmis LLC;Co-owner, Qmis LLC

### S2-CGU01D Molecular Imaging of Prostate Cancer for Biochemical Recurrence and Metastatic Disease

Spencer C. Behr, MD (*Presenter*) Grant, Cancer Targeted Technology;Scientific Advisory Board, Novartis AG;Research Consultant, GenVivo

### S2-CGU01E AI in Prostate MRI: Clinical Performance Expectations and Limitations

Baris Turkbey, MD (*Presenter*) Nothing to Disclose

### S2-CGU01F MRI for Prostate Cancer Screening - Getting Ready

Andrei S. Purysko, MD (*Presenter*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;

### S2-CGU01G Healthcare Disparities in Prostate Cancer Imaging

Judy W. Gichoya, MBChB, MS (*Presenter*) Consultant, Softbrew Digital LTD

# Abstract Archives of the RSNA, 2024

S2-CIN01

## Telemammography: Success Stories, Tools for Troubleshooting, and Embracing Innovation

Sunday, Dec. 1 10:30AM - 11:30AM Room: E351

Mindy L. Yang, MD (*Moderator*) Clinical Advisory Board, Solutionreach, Inc

**LEARNING OBJECTIVES**

1) Identify benefits and challenges of telemammography. 2) Understand the current status of telemammography in various practice settings. 3) Identify specific troubleshooting tips and solutions for optimizing telemammography in the real world.

**COURSE DESCRIPTION**

Telemammography, including remote screening and diagnostic mammography, while sparsely utilized in the past, has gained significant traction in recent years, offering several potential advantages including improved patient access to high level fellowship-trained breast radiologists as well as efficient turnaround from screening to diagnosis and subsequent downstream treatment of breast cancer. Given the unique challenges of evaluating a breast patient remotely, a hybrid didactic and interactive discussion of the pearls and pitfalls by experts in the field will help breast imagers gain confidence and improve problem-solving in the telemammography setting.

**Sub-Events**

**S2-CIN01B** **Discussion of Innovative Strategies Including Possible Incorporation/Impact of AI Tools in this Practice**

Mindy L. Yang, MD (*Presenter*) Clinical Advisory Board, Solutionreach, Inc

**S2-CIN01C** **Optimal Set-up for Successful Telemammography Program**

Arlene O. Sussman, MD (*Presenter*) Nothing to Disclose

**S2-CIN01D** **Covering Telemammography in the Academic Setting**

Margarita L. Zuley, MD (*Presenter*) Investigator, Hologic, Inc

**S2-CIN01E** **Impact on Access Across the US**

Sean D. Raj, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S2-CIN19

## Emerging Topics in AI: Trustworthiness, Safety, Ethics and Bias

Sunday, Dec. 1 10:30AM - 11:30AM Room: E450B

Shandong Wu, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the importance of the trustworthiness, bias, and ethics in advancing AI for clinical translation and practice. 2) Learn about the key factors that are associated with gaining trust to, mitigating biases of, and incorporating ethical considerations in medical AI. 3) Identify challenges and opportunities to improve clinical implementation and adoption of AI in clinical settings.

**COURSE DESCRIPTION**

Artificial intelligence (AI) is gaining rapid evolvement and showing early success in radiology for clinical translation and applications, with great potential to increase diagnosis accuracy, optimize workflow efficiency, reduce unnecessary procedures, and save costs. To achieve scaled impact of radiology AI in operational clinical settings, it is critical for medical AI to be trustworthy for clinicians, informaticists, providers, and patients. This indicates challenges and opportunities in ethical design, rigorous evaluation, bias mitigation, secure/safe deployment, practical acceptance, human-AI synergy, and equitable access. The speakers of this course will discuss important pillars of trustworthy AI and important considerations on bias and ethics, which will help the attendees understand the importance of trust for AI's utilities, learn insights on advancing AI translation, and identify opportunities for research, practice, and collaboration.

**Sub-Events**

### S2-CIN19B AI in Radiology: Potential, Progress, and Problems

Raym R. Geis, MD (*Presenter*) Nothing to Disclose

### S2-CIN19C Bias and Ethics of AI in Medical Imaging

Patricia Balthazar, MD, MPH (*Presenter*) Dr. Balthazar received research support from the Association of University Radiologists GE Radiology Research Academic Fellowship.

### S2-CIN19D Delivering Trustworthy Medical Imaging AI to Clinical Practice

Shandong Wu, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S2-CIR02

## State-of-the-Art Management of Hepatocellular Carcinoma

Sunday, Dec. 1 10:30AM - 11:30AM Room: S402

Julius Chapiro, MD, PhD (*Moderator*) Research Grant, Guerbet SA;Consultant, Guerbet SA;Research Grant, Boston Scientific Corporation;Consultant, AstraZeneca PLC;Consultant, Bayer AG

### LEARNING OBJECTIVES

1) To understand the current landscape of HCC imaging and image-guided interventions including staging, treatment algorithms and therapy combinations. 2) To learn about novel developments and evolution of combination therapies in intermediate-advanced stage HCC and the role of image-guided therapies. 3) To learn about novel technologies, including AI, virtual reality, robotics and personalized staging systems. 4) To refresh on available percutaneous and transarterial therapy options and their advanced utilization in the multi-modal therapy of HCC.

### COURSE DESCRIPTION

The course will feature an update on advanced imaging and image-guided interventions in primary liver cancer, highlighting recent updates on imaging guidelines, therapy recommendations as well as an update on novel technologies and therapeutics. The course will highlight recent developments involving prospective clinical trials that combine locoregional therapy and immunotherapy of HCC and touch on new developments in AI facilitating image-guidance, imaging standardization and patient workflows.

**Sub-Events**

**S2-CIR02B** **Making Sense of Different HCC Subtypes and Relevance for Local Therapies**

Terence P. Gade, MD, PhD (*Presenter*) Scientific Advisory Board, TriSalus Life Sciences;Research Consultant, Instylla, Inc;Research Grant, Instylla, Inc

**S2-CIR02C** **Pushing TACE to the Limit**

Toshihiro Tanaka (*Presenter*) Nothing to Disclose

**S2-CIR02D** **Choosing the Optimal Y90 Dose for Your Patient**

Edward Kim, MD (*Presenter*) Consultant, Koninklijke Philips NVAdvisory Board, Onyx Pharmaceuticals, IncAdvisory Board, Sterigenics International LLC

**S2-CIR02E** **State of the Art Systemic Therapy for HCC in 2024**

Amit Singal, MD (*Presenter*) Consultant, Bayer AG;Consultant, Glycotest, Inc;Consultant, FUJIFILM Holdings Corporation;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Exact Sciences Corporation;Consultant, Illumina;

**S2-CIR02F** **Present and Future of Combination Therapies**

Riad Salem, MBA (*Presenter*) Consultant, Boston Scientific Corporation;Consultant, Eisai Co, Ltd;Consultant, Sirtex Medical Ltd;Consultant, Cook Group Incorporated;Consultant, Siemens AG

# Abstract Archives of the RSNA, 2024

S2-CMK12

## Optimization of MSK Imaging: Pitfalls and Workarounds (Supported by an Unrestricted Medical Education Grant from Carestream Health, Inc.)

Sunday, Dec. 1 10:30AM - 11:30AM Room: E450A

Robert D. Boutin, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize particularly important pitfalls encountered in MSK imaging that can adversely affect accuracy and efficiency. 2) Identify practical strategies to address pitfalls, with actionable tips for optimizing MSK imaging.

**COURSE DESCRIPTION**

This course provides essential insights and expert advice for optimizing effectiveness in musculoskeletal radiology. Participants will gain practical knowledge by effectively recognizing common pitfalls and identifying how to implement effective workarounds with valuable tips and tricks. By attending this course, radiologists can enhance their diagnostic accuracy, improve patient care, and stay up-to-date with the latest advancements in musculoskeletal imaging.

**Sub-Events**

### S2-CMK12B Optimization of Opportunistic Imaging: Pitfalls & Workarounds

Robert D. Boutin, MD (*Presenter*) Nothing to Disclose

### S2-CMK12C Optimization of MSK Radiography: Tips & Tricks

Tetyana A. Gorbachova, MD (*Presenter*) Nothing to Disclose

### S2-CMK12D Optimization of MSK CT: From Hardware to Photon Counting

Kenneth A. Buckwalter, MD, MBA (*Presenter*) Nothing to Disclose

### S2-CMK12E Optimization of MSK MRI: View from the Chief

Hollis G. Potter, MD (*Presenter*) Research support, General Electric Company;Institutional research agreement, General Electric Company;Stockholder, Imagen Technologies Inc;Consultant, Atria Academy of Science and Medicine

### S2-CMK12F Optimization of MSK Imaging: ACR Appropriateness Criteria

Daniel E. Wessell, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S2-CMS01

## MRI and Ultrasound Elastography: Where Do We Stand?

Sunday, Dec. 1 10:30AM - 11:30AM Room: N226

Margarita V. Revzin, MD, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss pros and cons of Ultrasound versus MRI elastography in evaluation of liver fibrosis. 2) Discuss pros and cons of Ultrasound versus MRI elastography in evaluation of musculoskeletal pathologies. 3) Discuss pros and cons of Ultrasound versus MRI elastography in the evaluation of various other vascular and abdominal/pelvic pathological processes, including but not limited to kidneys, spleen, transplants, scrotum, ovaries and more.

**COURSE DESCRIPTION**

Elastography is gaining popularity in the assessment of various solid and hollow organs and structures, and pathological processes, including but not limited to liver disease, thyroid nodules, breast lesions, vascular clot pathology, scrotal masses and more.

The session provides a detailed review of various applications of elastography using MRI and Ultrasound, with emphasis on benefits and limitations of each modality in the assessment of different pathological conditions. Specifically, elastography applications in the Abdomen/Pelvis, Musculoskeletal, and Vascular Systems will be discussed. The session's format is panel discussion.

**Sub-Events**

### S2-CMS01B MR Elastography in GI, GU, MSK

Richard L. Ehman, MD (*Presenter*) CEO, Resoundant, Inc;Stockholder, Resoundant, Inc;

### S2-CMS01C MRI Elastography: Cancer in Breast, Prostate, Brain, Lungs

Arunark Kolipaka, PhD (*Presenter*) Benzer Pharmacy;Tenet Healthcare Corporation;Lonwin Healthcare

### S2-CMS01D US Elastography MSK

Mihra S. Taljanovic, MD, PhD (*Presenter*) Nothing to Disclose

### S2-CMS01E US Elastography

Ronald S. Adler, MD, PhD (*Presenter*) Nothing to Disclose

### S2-CMS01F Ultrasound Elastography Applications in the Abdomen and Pelvis

Vito Cantisani, MD, PhD (*Presenter*) Speaker, Canon Medical Systems Corporation;Speaker, Bracco Group;Speaker, Samsung Electronics Co, Ltd;

# Abstract Archives of the RSNA, 2024

S2-CNMMI08

## Novel Radiopharmaceuticals on the Horizon

Sunday, Dec. 1 10:30AM - 11:30AM Room: S405

Aileen O'Shea, MBBCh (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Provide an introduction and overview to the emerging radiotracers and theranostic agents. 2) Recognize the utility of PET imaging in the context of novel immunotherapeutic agents. 3) Understand the breadth of applications of fibroblast activated protein inhibitor (FAPI) PET imaging in oncology and the basic principles of interpretation.

**Sub-Events**

### S2-CNMMI08B FAPI Imaging

Shadi Abdar Esfahani, MD, MPH (*Presenter*) Scientific Advisory Board, RefleXion Medical Inc;Scientific Advisory Board, ImaginAb, Inc;Scientific Advisory Board, General Electric Company;Scientific Advisory Board, Trevarx Biomedical, Inc;Consultant, General Electric Company;Spouse, CEO, Trevarx Biomedical, Inc;Spouse, Owner, Trevarx Biomedical, Inc

### S2-CNMMI08C PET Imaging in the Era of Immunotherapy

Pedram Heidari, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

S2-CNPM15

## MRI Safety Update for Healthcare Professionals

Sunday, Dec. 1 10:30AM - 11:30AM Room: N227B

Frank G. Shellock, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the three factors responsible for most MRI-related adverse events. 2) Review the procedures that are necessary to prevent each factor responsible for most MRI-related adverse events. 3) Explain the MRI-related issues that impact implants and devices. 4) Define the labeling terms applied to MRI labeling of implants and devices. 5) Understand how to make risk versus benefit decisions for patients with untested and unlabeled implants. 6) List and describe the new elements of the ACR's MR Safety Manual.

**Sub-Events**

### S2-CNPM15B MRI-Related Issues, Labeling Terminology, and Information for Implants and Devices

Frank G. Shellock, PhD (*Presenter*) Nothing to Disclose

### S2-CNPM15C ACR's 2024 Manual on MR Safety: Overview and New Elements

Robert E. Watson JR, MD, PhD (*Presenter*) Nothing to Disclose

### S2-CNPM15D The Three Factors Responsible for Most MRI-Related Adverse Events

Laura P. Vasquez, PhD, MS (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

S2-CNR04

## Epilepsy Imaging - Pearls, Pitfalls and the Misses

Sunday, Dec. 1 10:30AM - 11:30AM Room: S406B

Dhairya Lakhani, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the range of hippocampal abnormalties in temporal lobe epilepsy. 2) Understand potential pitfalls in interpretation of FDG-PET in epilepsy. 3) Learn the role and potential challenges of epilepsy imaging at 7T.

**COURSE DESCRIPTION**

Epilepsy is a common and debilitating neurological condition, with imaging playing a crucial role in patient evaluation and outcome prediction. This multi-part lecture series will delve into the complexities of epilepsy imaging, covering four key modalities: MRI, PET, fMRI, and ultra-high field MRI. Speakers will share essential insights for evaluating epilepsy patients and highlight common pitfalls in interpreting cases across each modality. By the end of the session, attendees will be better equipped to navigate the challenges of epilepsy imaging and identify common mistakes made in imaging interpretation.

**Sub-Events**

**S2-CNR04B** **Subfields of Dreams: Pearls and Pitfalls in Hippocampal Imaging for Epilepsy**

Dhairya Lakhani, MD (*Presenter*) Nothing to Disclose

**S2-CNR04C** **Sweet Successes and Sticky Situations in FDG-PET Imaging for Epilepsy**

Noriko Salamon, MD, PhD (*Presenter*) Nothing to Disclose

**S2-CNR04D** **Speaking the Same Language: Pearls and Pitfalls of fMRI in Epilepsy**

Licia P. Luna, MD, PhD (*Presenter*) Nothing to Disclose

**S2-CNR04E** **Epilepsy in High-Def: Navigating the Highs and Lows of 7T MRI in Epilepsy**

Stephen E. Jones, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S2-CPH03

## Virtual Clinical Trial

Sunday, Dec. 1 10:30AM - 11:30AM Room: S404

Ehsan Samei, PHD (*Moderator*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc

### LEARNING OBJECTIVES

1) Understand the role of virtual trials in medicine and in radiology. 2) Understand the components of virtual imaging trials. 3) Understand the research, clinical, and regulatory potentials of virtual trials.

### COURSE DESCRIPTION

The complexity and diversity of medical imaging technologies have continued to accelerate, outpacing our ability to optimize their use. This has become a significant challenge across the spectra of scientific inquires, product designs, and clinical applications. New imaging technology has been traditionally evaluated through clinical trials. However, such trials are often not feasible or even definitive due to ethical limitations, expense, time requirements, difficulty in accruing enough subjects - especially with low prevalence conditions, or the fundamental lack of ground truth. Virtual Clinical Trials (VCT) provide a new paradigm to assess the impact of medical imaging innovations on patient care. VCTs offer a new disease-known approach to conduct medical trials that can be clinically relevant, timely, and accurate while reflecting the variabilities of human subjects and disease, as well as the complexities of technologies, providing answers that would otherwise be impractical to obtain or simply unattainable. A VCT consists of 1) realistic populations of computational patients spanning ages and a range of phenotypical characteristics including sex and race with realistic models of disease, 2) detailed models of clinical imaging systems, and 3) computational models of the image interpretation processes. This session offers a summary of VCT methods and processes in the field of radiology and highlights applications in clinical practice and in the regulatory assessment of imaging products.

**Sub-Events**

### S2-CPH03B VCT in Service of Clinical Practice

Hilde Bosmans, PhD (*Presenter*) Stockholder, Qaelum NV;Research Grant, Siemens AG;Research Grant, General Electric Company

### S2-CPH03C VCT in Service of Technology Assessment

Aldo Badano, PhD (*Presenter*) Research Grant, Barco nv

### S2-CPH03D VCT and Its Role in Radiology

Ehsan Samei, PHD (*Presenter*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc

# Abstract Archives of the RSNA, 2024

S3-RCP21

## NIH Grantsmanship Workshop (Sponsored by the RSNA Research Development Committee)

Sunday, Dec. 1 12:00PM - 3:30PM Room: S101

Gayle E. Woloschak, BS, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To learn about different grant mechanisms that are available. 2) To understand what is required for a grant application. 3) To learn some criteria that will be used in evaluating grants.

**COURSE DESCRIPTION**

The goal of this course is to introduce participants to the process of submitting a grant. This includes selecting the grant application that is proper for your work and stage of career development; preparing all parts of the grant application and getting help where needed; and understanding the type of criteria that will be used in grant evaluation by a study section.

**Sub-Events**

### S3-RCP21B Preparing an R01 Research Application

Maryellen L. Giger, PhD (*Presenter*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

### S3-RCP21C Preparing K Awards

Ruth C. Carlos, MD, MS (*Presenter*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company

### S3-RCP21D Clinical Trials in Applications

Michael W. Vannier, MD (*Presenter*) Nothing to Disclose

### S3-RCP21E Program Perspectives

Rui Carlos Sa, PhD (*Presenter*) Nothing to Disclose

### S3-RCP21F Mock Study Section

Ruth C. Carlos, MD, MS (*Presenter*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company

### S3-RCP21G Mock Study Section

Elizabeth A. Krupinski, PhD (*Presenter*) Nothing to Disclose

### S3-RCP21H Mock Study Section

David A. Mankoff, MD, PhD (*Presenter*) Speaker, Siemens AG Advisory Board, ImaginAb, Inc Advisory Board, RefleXion Medical Inc Consultant, Blue Earth Diagnostics Ltd Consultant, General Electric Company Research funded, Siemens AG Spouse, Owner, Trevarx Biomedical, Inc

### S3-RCP21I Mock Study Section

Michael W. Vannier, MD (*Presenter*) Nothing to Disclose

### S3-RCP21J Questions to the Faculty

Gayle E. Woloschak, BS, PhD (*Presenter*) Nothing to Disclose

### S3-RCP21K Summary

Gayle E. Woloschak, BS, PhD (*Presenter*) Nothing to Disclose

RSNA 2024
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# Abstract Archives of the RSNA, 2024

S4-CBR02

## DCIS Non-Traditional Treatment and Management

Sunday, Dec. 1 1:00PM - 2:00PM Room: S406A

Nisha Sharma, MBChB, FRCR (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Have a clear understanding of the current challenges with DCIS from an imaging and oncological perspective. 2) Recognize the need for change. 3) Understand the barriers to change.

**COURSE DESCRIPTION**

DCIS Non-Traditional Treatment and Management

This is an important and challenging topic for all of us. The three speakers will discuss this topic from the perspective of population data, imaging perspective and advances in imaging techniques and from an oncological perspective - the shifts in traditional treatment to evidence based need for treatment. The speakers will highlight the challenges we face and how do we move forward in a collaborative way

**Sub-Events**

### S4-CBR02B Radiology Perspective on DCIS

Lars J. Grimm, MD (*Presenter*) Advisor, Hologic, Inc;Consultant, Hologic, Inc;Editorial Advisory Board, WebMD Health Corp (WebMD, Inc)

### S4-CBR02C Oncology Perspective

William J. Gradishar, MD (*Presenter*) Nothing to Disclose

### S4-CBR02D Population Data Insights

Nisha Sharma, MBChB, FRCR (*Presenter*) Nothing to Disclose

RSNA 2024
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# Abstract Archives of the RSNA, 2024

S4-CCA05

## Essentials of Mapping Targets for Ablation: Imaging Guidance for Electrophysiology Procedure Planning

Sunday, Dec. 1 1:00PM - 2:00PM Room: E353C

Jamie L. Schroeder, MD, DPhil (*Moderator*) Nothing to Disclose
Jiayin Zhang, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Realize the significance of interactive 3D modeling in guiding EP procedure. 2) Explain the value of advanced CT imaging in EP planning. 3) Identify the role of CMR biomarkers in EP Planning.

**COURSE DESCRIPTION**

The course aims to provide insights into the role of multi-modality imaging for electrophysiology procedure planning. CT is helpful for 3D mapping of left atrium and excluding thrombus. In addition to the anatomical evaluation, the imaging of AF substrate is also essential. This course will provide a general view of the essentials of mapping targets for ablation.

**Sub-Events**

**S4-CCA05C** **Interactive 3D Modeling: Creating the Cardiac Avatar**

Mushabbar A. Syed, MD (*Presenter*) Nothing to Disclose

**S4-CCA05D** **Beyond the Scar: Advanced CT Imaging**

Jamie L. Schroeder, MD, DPhil (*Presenter*) Nothing to Disclose

**S4-CCA05E** **Cardiac MRI Biomarkers in EP Planning**

Harold I. Litt, MD, PhD (*Presenter*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV

# Abstract Archives of the RSNA, 2024

S4-CER08

## A Case-Based Review of Pediatric Trauma

Sunday, Dec. 1 1:00PM - 2:00PM Room: N228

Summer L. Kaplan, MD, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe common mechanisms of trauma in children. 2) Discuss how developmental changes in the body predispose children to unique injuries. 3) Explore common and easily missed features of pediatric trauma. 4) Explain features of non-accidental trauma apparent on imaging. 5) Understand "Do Not Miss" imaging findings in pediatric trauma.

**COURSE DESCRIPTION**

An intensive series of lectures focused on essential diagnoses in pediatric abdominal trauma, musculoskeletal trauma, neurological trauma, and chest trauma. The focus will be identifying critical imaging features, producing accurate and clinically relevant reports, developing strategies to address diagnostic challenges, and ensuring effective patient management in pediatric trauma settings.

**Sub-Events**

**S4-CER08B** **Pediatric Abdominal Trauma**

Summer L. Kaplan, MD, MS (*Presenter*) Nothing to Disclose

**S4-CER08C** **Pediatric Musculoskeletal Trauma**

Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

**S4-CER08D** **Pediatric Neuro Trauma**

Anna K. Thomas, MD (*Presenter*) Nothing to Disclose

**S4-CER08E** **Pediatric Chest Trauma**

James Christopher Davis, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

S4-CGI01

## GI/GU Jeopardy

Sunday, Dec. 1 1:00PM - 2:00PM Room: S406B

David J. DiSantis, MD (*Moderator*) Nothing to Disclose
Christine O. Menias, MD (*Moderator*) Royalties, RELX
Olga R. Brook, MD, MBA (*Moderator*) Nothing to Disclose
Katja N. De Paepe, MD (*Presenter*) Nothing to Disclose
Giulia A. Zamboni, MD (*Presenter*) Nothing to Disclose
Anuradha S. Shenoy-Bhangle, MD (*Presenter*) Nothing to Disclose
Samuel J. Galgano, MD (*Presenter*) Research support, Blue Earth Diagnostics Ltd;Research support, Novartis AG;Research Support, Curium SAS
Joseph H. Yacoub, MD, MD (*Presenter*) Stockholder, NVIDIA Corporation
Sathi A. Sukumar, MBBS, FRCR (*Presenter*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Identify imaging findings that facilitate diagnosis of common and unusual gastrointestinal tract and abdominal solid organ pathologies. 2) Identify imaging features of common and unusual genitourinary tract abnormalities.

### COURSE DESCRIPTION

A fast-paced game show session highlighting the imaging findings in an eclectic array of abdominal pathologies.

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# Abstract Archives of the RSNA, 2024

S4-CGI15

## RSNA Hands-On Lab: Liver Elastography (Registration Fee Required)

Sunday, Dec. 1 1:30PM - 3:30PM Room: S504CD

Richard G. Barr, MD, PhD (*Moderator*) Consultant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Consultant, Canon Medical Systems Corporation;Advisor, Hologic, Inc;Research Grant, Hologic, Inc

**LEARNING OBJECTIVES**

1) To review the protocol required for accurate liver stiffness measurements. 2) To discuss the confounding factors needed to be considered when interpreting results. 3) Identify the various quantitative ultrasound methods for liver fat quantification.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

Chronic Liver disease is a world-wide health problem. The use of multiparametric ultrasound can assess the presence of disease, severity of the disease, and monitor treatment. This course will review how to perform and interpret liver elastography. For accurate measurements a strict protocol is required. The protocol will be reviewed, and potential acquisition errors will be discussed. Confounding factors will be discussed as they can significantly affect the interpretation of the results. The course will also review the state-of-the-art for quantitative ultrasound assessment of liver fat content which is critical in making the diagnosis of non-alcoholic fatty liver disease. The combination of these techniques will be discussed on how to evaluate chronic liver disease.

**Sub-Events**

**S4-CGI15B** **RSNA Hands-On Lab: Liver Elastography**

Giovanna Ferraioli, MD (*Presenter*) Speakers Bureau, Koninklijke Philips NV;Speakers Bureau, FUJIFILM Holdings Corporation;Speakers Bureau, Canon Medical Systems Corporation;Speakers Bureau, Shenzhen Mindray Bio-Medical Electronics Co, Ltd;Speakers Bureau, Siemens AG

**S4-CGI15C** **RSNA Hands-On Lab: Liver Elastography**

Vito Cantisani, MD, PhD (*Presenter*) Speaker, Canon Medical Systems Corporation;Speaker, Bracco Group;Speaker, Samsung Electronics Co, Ltd;

**S4-CGI15D** **RSNA Hands-On Lab: Liver Elastography**

Maija Radzina, MD, PhD (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation;peakers Bureau, Bayer AG;Speakers Bureau, Medtronic plc;Speakers Bureau, Bracco Group

**S4-CGI15E** **RSNA Hands-On Lab: Liver Elastography**

Nitin G. Chaubal, MD (*Presenter*) Nothing to Disclose

**S4-CGI15F** **RSNA Hands-On Lab: Liver Elastography**

Rajas N. Chaubal, MBBS, MD (*Presenter*) Nothing to Disclose

**S4-CGI15G** **RSNA Hands-On Lab: Liver Elastography**

Jonathan R. Dillman, MD, MSc (*Presenter*) Research Grant, Perspectum Ltd;Research Grant, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research support, Koninklijke Philips NV;Research support, General Electric Company;Research support, Motilent Ltd

**S4-CGI15H** **RSNA Hands-On Lab: Liver Elastography**

David T. Fetzer, MD (*Presenter*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research support, Siemens AG;Consultant, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Consultant, General Electric Company;Advisory Board, General Electric Company

**S4-CGI15I** **RSNA Hands-On Lab: Liver Elastography**

Adrian K. Lim, MD, FRCR (*Presenter*) Nothing to Disclose

**S4-CGI15J** **RSNA Hands-On Lab: Liver Elastography**

Michelle L.

Robbin, MD, MS (*Presenter*) Research Grant, Koninklijke Philips NV

**S4-CGI15K** **RSNA Hands-On Lab: Liver Elastography**

Mirko D'Onofrio, MD (*Presenter*) Speaker, Bracco Group;Speaker, Siemens AG;Consultant, Siemens AG;Speaker, Hitachi, Ltd

**S4-CGI15L** **RSNA Hands-On Lab: Liver Elastography**

Riccardo De Robertis, PhD, MD (*Presenter*) Nothing to Disclose

**S4-CGI15M** **RSNA Hands-On Lab: Liver Elastography**

Arinc Ozturk, MD (*Presenter*) Nothing to Disclose

**S4-CGI15N** **RSNA Hands-On Lab: Liver Elastography**

Chander Lulla, MD, MBBS (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

S4-CHN01

## Is it a TUMOR? Case Based Review of Common Mimics in the Brain, Spine, Head and Neck (Joint Session with Neuroradiology)

Sunday, Dec. 1 1:00PM - 2:00PM Room: E352

Ian T. Mark, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify cross-sectional imaging findings of malignancies in the brain, spine, and head and neck. 2) Distinguish the imaging appearances of malignancy from their non-malignant mimics. 3) Learn common imaging pitfalls related to the diagnose of malignancy.

**COURSE DESCRIPTION**

This case-based imaging review will show a series of examples to highlight how to distinguish malignancies in the head, neck, brain and spine from their mimics, with a focus on don't miss diagnoses and imaging pitfalls. This is a DO NOT MISS session for radiologists who read cross-sectional imaging of the brain, spine, or head & neck!

**Sub-Events**

### S4-CHN01B Is it a Brain Tumor?

Virginia B. Hill, MD (*Presenter*) Medical Science Liaison, Alphabet Inc;;

### S4-CHN01C Is it a Spine Tumor?

Nancy J. Fischbein, MD (*Presenter*) Nothing to Disclose

### S4-CHN01D Is it a Pediatric Head or Neck Tumor?

William T. O'Brien Sr, DO (*Presenter*) Nothing to Disclose

### S4-CHN01E Is it a Skull Base Tumor?

Ilona M. Schmalfuss, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S4-CIR06

## Trauma Interventions

Sunday, Dec. 1 1:00PM - 2:00PM Room: N227B

Theresa M. Caridi, MD (*Moderator*) Consultant, Boston Scientific Corporation;Speaker, Boston Scientific Corporation;Consultant, Cook Group Incorporated;Speaker, Cook Group Incorporated;Consultant, Terumo Corporation;Speaker, Terumo Corporation;Consultant, Siemens AG;Speaker, Siemens AG;Speaker, Penumbra, Inc;Research Grant, Siemens AG

**LEARNING OBJECTIVES**

1) Indications for Splenic artery embolization(SAE). 2) Role of Proximal and Distal Embolization in trauma. 3) Latest data on use of embolic agents in SAE.

**Sub-Events**

**S4-CIR06B** **Teamwork makes the Trauma Dream Work!- Showcase!**

Robert A. Morgan, MBChB, FRCR (*Presenter*) Proctor, Medtronic plc

**S4-CIR06C** **Vascular Management of Pelvic Trauma**

Anna Maria Ierardi, MD (*Presenter*) Nothing to Disclose

**S4-CIR06D** **IR Management of Hepatic Injuries**

Mireia Teixidor Vinas, PhD (*Presenter*) Nothing to Disclose

**S4-CIR06E** **IR Management of Splenic Injuries**

Dania Daye, MD, PhD (*Presenter*) Research Consultant, Sigilon Therapeutics, Inc;Research Consultant, Medtronic plc

**S4-CIR06F** **Management of Thoracic Trauma**

David Y. Johnson, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S4-CNPM11

## Contract Review and Negotiation (Sponsored by the RSNA Resident and Fellow Committee)

Sunday, Dec. 1 1:00PM - 2:00PM Room: S402

Heba Albasha, MD (*Moderator*) Nothing to Disclose
Jocelyn Cheng, MD (*Moderator*) Nothing to Disclose
Megan K. Mercer, MD (*Moderator*) Nothing to Disclose
Aishwariya S. Vegunta, MD (*Moderator*) Nothing to Disclose
Brandon K.K. Fields, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Identifying the key elements of a contract. 2) Defining and explaining common contract terms. 3) Comparing and contrasting different compensation models. 4) Assessing the fairness of benefits and compensation packages. 5) Identifying and understanding the business and legal consequences of contracts. 6) Highlight contract negotiation strategies.

### COURSE DESCRIPTION

The ability to negotiate and understand contracts is one of the most challenging aspects of the job search. This session will provide participants at all career levels with tips and strategies for understanding and negotiating contracts. During this session, the various elements of a contract will be broken down and reviewed. In this process, the speakers will also explain common contract language. Key differences between contracts in private practice versus academics will be discussed. Sample academic and private practice contracts will be dissected in detail. Additionally, the speakers will describe the elements of a contract that may be negotiated and strategies for negotiation. Furthermore, options to add value to a contract with non-compensation-related benefits will be suggested.

**Sub-Events**

### S4-CNPM11F Contract Essentials

Carrie A. Orlikowski, MD, JD (*Presenter*) Nothing to Disclose

### S4-CNPM11G Academic Contracts

Seetharam C. Chadalavada, MD, MS (*Presenter*) Consultant, Cook Group Incorporated;Grant, Cook Group Incorporated;Speaker, Cook Group Incorporated;Consultant, Koninklijke Philips NV;Speaker, Koninklijke Philips NV

### S4-CNPM11H Private Practice Contracts

Kimberly Beavers, MD (*Presenter*) Nothing to Disclose

### S4-CNPM11I Strategies for Negotiation

Kiran Sheikh, MD (*Presenter*) Nothing to Disclose

### S4-CNPM11J Panel Q&A

Carrie A. Orlikowski, MD, JD (*Presenter*) Nothing to Disclose

### S4-CNPM11K Panel Q&A

Seetharam C. Chadalavada, MD, MS (*Presenter*) Consultant, Cook Group Incorporated;Grant, Cook Group Incorporated;Speaker, Cook Group Incorporated;Consultant, Koninklijke Philips NV;Speaker, Koninklijke Philips NV

### S4-CNPM11L Panel Q&A

Kimberly Beavers, MD (*Presenter*) Nothing to Disclose

### S4-CNPM11M Panel Q&A

Kiran Sheikh, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S4-CPD10

## Hot Topics in Pediatric Imaging: Molecular Biomarkers and AI

Sunday, Dec. 1 1:00PM - 2:00PM Room: E350

Safwan Halabi, MD (*Moderator*) Advisor, Change Healthcare
Teresa Chapman, MD, MA (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Summarize the current status of imaging biomarkers in pediatric abdominal imaging, their value and current clinical applications. 2) Explore various clinical examples of radiomics applied to enhance diagnosis of intracranial tumors in children. 3) Discuss value-added and clinical indications of PET-CT and PET-MRI in the children. 4) Discuss available AI algorithms currently approved for the pediatric population and the appropriateness of using algorithms originally designed for the adult population in children.

**COURSE DESCRIPTION**

In this hour-long pediatric imaging-focused session, four lectures will summarize past, present and upcoming topics surrounding molecular biomarkers and artificial intelligence. The audience members will gain improved understanding of advancements in pediatric care as they relate to neuro-oncology, abdominal imaging, positron-emission tomography advances, and AI.

**Sub-Events**

### S4-CPD10C Biomarkers: PET-CT/PET-MRI Indications

Helen R. Nadel, MD, FRCPC (*Presenter*) Consultant, ICON plc;;

### S4-CPD10D Imaging Biomarkers in the Pediatric Body: What They Are and Where We Are in the Field Now

Andrew T. Trout, MD (*Presenter*) Author, RELX Author, Wolters Kluwer nv Research Grant, Canon Medical Systems Corporation Research Grant, Siemens AG Research support, Perspectum Diagnostics Ltd Consultant, Lantheus Holdings

### S4-CPD10E Radiogenomics in Pediatric Neurotumors: What is Possible Now and in the Future

Kristen W. Yeom, MD (*Presenter*) Nothing to Disclose

### S4-CPD10F AI: The Utilization of AI Algorithms of Adults in Children - Present and Future of AI in Pediatric Radiology

Steven L. Blumer, MD, MBA (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

S4-CPH13

## AAPM/RSNA Physics Tutorial 1: Tutorial on Basics of Flat Panel C-Arm CT and Its Use in Interventional Radiology

Sunday, Dec. 1 1:00PM - 2:00PM Room: N226

Thaddeus A. Wilson, PhD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Flat panel technologies: this section explains the fundamental structure and different designs of the flat panel detector, covering both the direct and indirect conversion approaches. Characteristics of different flat panels often lead to different CT designs.

2) Flat panel CT: this section describes how CT data are acquired and how images are generated. The goal is not to dive deep into the mathematics, but to provide an intuitive explanation of the image reconstruction process. Similarities and differences between flat panel CT and the x-ray computed tomography are discussed.

3) Applications and future development: this section provides a brief survey of major clinical applications of the flat panel CT. The session concludes with a brief discussion on the future technology development and applications.

### COURSE DESCRIPTION

Flat panel-based CT has been used extensively in many clinical applications. The goal of this course is to provide an introductory overview of the technology, a brief survey of major clinical applications, and a quick exploration of the future.

**Sub-Events**

**S4-CPH13B** **Basics of Flat Panel C-Arm CT and Its Use in Clinical Applications**

Jiang Hsieh, PhD (*Presenter*) Former Employee, General Electric Company

# Abstract Archives of the RSNA, 2024

S4-RCP14

## From the Editors of RADIOLOGY: New Research That Should Impact Your Practice

Sunday, Dec. 1 1:00PM - 2:00PM Room: E351

Linda Moy, MD (*Moderator*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

**LEARNING OBJECTIVES**

1) Highlight the most influential articles that we have published. 2) Discuss the most impactful novel medical imaging techniques. 3) Feature the underlying issues that AI researchers are trying to solve and the proposed solutions as we move closer to clinical AI implementation.

**COURSE DESCRIPTION**

Provides a digestible synopsis of articles in cutting-edge technologies that we published in 2024.

Help sharpen the attendees' interpretive and diagnostic acumen Underscore the hot topics in medical imaging and how these examinations and/or techniques can improve patient care

**Sub-Events**

### S4-RCP14B Gastrointestinal Imaging: Research That Should Impact Your Practice

Kathryn J. Fowler, MD (*Presenter*) Consultant, Bayer AG;Research support, General Electric Company;Research Grant, Pfizer Inc;Institutional Grant, MEDIAN Technologies;Consultant, General Electric Company

### S4-RCP14C New Research That Should Impact Your Practice Thoracic Imaging

Mizuki Nishino, MD, MPH (*Presenter*) Institutional Research Grant, Daiichi Sankyo Co, Ltd;Institutional Research Grant, AstraZeneca PLC;Institutional Research Grant, Canon Medical Systems Corporation;Consultant, AstraZeneca PLC

### S4-RCP14D Genitourinary Imaging: Research That Should Impact Your Practice

Vicky J. Goh, MBBChir, FRCR (*Presenter*) Research Grant, Siemens AG

### S4-RCP14E Top Neuroimaging Papers That Should Impact Your Practice

Yoshimi Anzai, MD, MPH (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S5-CCH03

## Early Interstitial Lung Abnormality - Categorization and Management

Sunday, Dec. 1 2:30PM - 3:30PM Room: E451A

David A. Lynch, MBBCh (*Moderator*) Research Consultant, CALYX Inc;Research Consultant, Boehringer Ingelheim GmbH;Research Consultant, Veracyte, Inc;Research Consultant, DAIICHI SANKYO Group;Research Consultant, AstraZeneca PLC;Consultant, Polarean, Inc;Consultant, Bristol Myers Squibb Company

### LEARNING OBJECTIVES

1) Define interstitial lung abnormalities (ILAs) and identify important subtypes. 2) Differentiate between ILAs and early/subclinical interstitial lung disease (ILD). 3) Understand the clinical significance and management of ILAs.

### COURSE DESCRIPTION

This session will provide the most recent imaging and clinical information on interstitial lung abnormalities (ILAs). Topics for this rapidly evolving area will include defining ILAs and their specific CT patterns, understanding smoking related interstitial abnormalities, the clinical significance of ILAs from a pulmonologist's perspective, and the significance of early ILA in higher risk individuals such as those with connective tissue disease.

**Sub-Events**

### S5-CCH03B Interstitial Lung Abnormality and Early Fibrosis - Definition and Patterns

Andrea Oh, MD (*Presenter*) Nothing to Disclose

### S5-CCH03C Clinical Significance of Interstitial Lung Abnormality

Rachel K. Putman, MD, MPH (*Presenter*) Nothing to Disclose

### S5-CCH03D Smoking Related Interstitial Abnormalities

David A. Lynch, MBBCh (*Presenter*) Research Consultant, CALYX Inc;Research Consultant, Boehringer Ingelheim GmbH;Research Consultant, Veracyte, Inc;Research Consultant, DAIICHI SANKYO Group;Research Consultant, AstraZeneca PLC;Consultant, Polarean, Inc;Consultant, Bristol Myers Squibb Company

### S5-CCH03E Interstitial Lung Abnormalities in Higher Risk Individuals

Jonathan H. Chung, MD (*Presenter*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd

# Abstract Archives of the RSNA, 2024

S5-CER10

## AI in Emergency Radiology - Insights in 2024

Sunday, Dec. 1 2:30PM - 3:30PM Room: N228

Melissa A. Davis, MD, MBA (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand trends of emerging artificial intelligence (AI) tools in radiology. 2) To understand the international perspective on AI tools in the teleradiology setting. 3) To understand the governance of AI tools after implementation.

**COURSE DESCRIPTION**

This course will review artificial intelligence (AI) tools from a practical sense, understanding emergent tools, practice experience, and the governance of tools after implementation.

**Sub-Events**

**S5-CER10B** **Research and Development of AI for the Emergent Setting. Trends Over the Next 5-10 Years**

David Dreizin, MD (*Presenter*) Nothing to Disclose

**S5-CER10C** **AI in the Teleradiology Setting and an International Perspective**

Anjali Agrawal, MD (*Presenter*) Nothing to Disclose

**S5-CER10D** **The Governance of AI Solutions After Implementation**

Joseph J. Cavallo, MD, MBA (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S5-CIN04

**AI and Opportunistic Screening in 2024: The Future is Now (Supported in part by an Unrestricted Medical Education Grant from Siemens Healthineers of Siemens Medical Solutions, USA, Inc)**

Sunday, Dec. 1 2:30PM - 3:30PM Room: E450B

Ross W. Filice, MD (*Moderator*) Advisor, BunkerHill Health, Inc;Shareholder, BunkerHill Health, Inc;Speaker, General Electric Company;Speaker, Koios Medical;Researcher, Koios Medical

**LEARNING OBJECTIVES**

1) Understand the role of opportunistic screening tools. 2) Learn about real-world examples and their clinical impact. 3) Consider exploratory biomarkers that may be used for disease and treatment monitoring.

**COURSE DESCRIPTION**

Learn what opportunistic screening tools are and how they can be used for substantial patient and public health impact. We will discuss a range of tools - some in clinical use today - and consider future roles for biomarkers resulting from these screening methodologies.

**Sub-Events**

**S5-CIN04B** **Intro to Opportunistic Screening; Bone Mineral Density Use Case**

Ross W. Filice, MD (*Presenter*) Advisor, BunkerHill Health, Inc;Shareholder, BunkerHill Health, Inc;Speaker, General Electric Company;Speaker, Koios Medical;Researcher, Koios Medical

**S5-CIN04C** **CT-based Body Composition: The Sky is the Limit**

Kirti Magudia, MD, PhD (*Presenter*) Nothing to Disclose

**S5-CIN04D** **Coronary Artery Calcium**

Bhavik N. Patel, MD, MBA (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

S5-CIR07

## Management of Oligometastatic Disease

Sunday, Dec. 1 2:30PM - 3:30PM Room: E353A

Bruno C. Odisio, MD, PhD (*Moderator*) Research Grant, Siemens AG;Consultant, Siemens AG;Speaker, Siemens AG;Research Grant, Johnson & Johnson; Kirema I. Garcia-Reyes, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

### S5-CIR07C Portal Vein Embolization and Liver-venous Deprivation

Diana Dinh, MD, MPH (*Presenter*) Nothing to Disclose

### S5-CIR07D Criteria for Resectability for Metastatic Disease of the Liver

Hop Tran Cao, MD (*Presenter*) Nothing to Disclose

### S5-CIR07E Long-term Outcomes for Unresectable mNET Patients Undergoing Liver-directed Therapy

Daniel M. Depietro, MD (*Presenter*) Nothing to Disclose

### S5-CIR07F Multimodality Treatment of Colorectal Cancer Metastases

Nadine Abi-Jaoudeh, MD (*Presenter*) Institutional research collaboration, Koninklijke Philips NV;Institutional research collaboration, Teclison Limited;Intellectual property, Bruin Biosciences Inc;Owner, Bruin Biosciences Inc;Institutional research collaboration, Sirtex Medical Ltd

### S5-CIR07G Advanced Imaging to Improve Percutaneous Ablation Outcomes

Bruno C. Odisio, MD, PhD (*Presenter*) Research Grant, Siemens AG;Consultant, Siemens AG;Speaker, Siemens AG;Research Grant, Johnson & Johnson;

# Abstract Archives of the RSNA, 2024

S5-CMK03

## Imaging of the Elbow, Wrist and Hand: Focus on Trauma

Sunday, Dec. 1 2:30PM - 3:30PM Room: E450A

Hillary W. Garner, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify imaging findings associated with traumatic injury patterns of the elbow, forearm, wrist, and hand. 2) Explain when advanced imaging is indicated for further evaluation of traumatic injuries in the upper extremity.

**COURSE DESCRIPTION**

This course will offer five high-yield 10-minute lectures on imaging in the setting of upper extremity trauma with a focus on must-know traumatic injury patterns in the elbow, wrist, and hand.

**Sub-Events**

### S5-CMK03B Phalangeal Avulsion Injuries

Hillary W. Garner, MD (*Presenter*) Nothing to Disclose

### S5-CMK03C Trauma to the Thumb Base

Barry G. Hansford, MD (*Presenter*) Nothing to Disclose

### S5-CMK03D Wrist Dislocation Patterns

Naveen Subhas, MD, MPH (*Presenter*) Research support, Siemens AG

### S5-CMK03E Forearm Fractures

Sarah D. Bixby, MD, MBA (*Presenter*) Nothing to Disclose

### S5-CMK03F Elbow Dislocation Patterns

Tony T. Wong, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

S5-CMS03

## Multisystem Diseases Jeopardy

Sunday, Dec. 1 2:30PM - 3:30PM Room: N229

Margarita V. Revzin, MD, MS (*Moderator*) Nothing to Disclose
Stacy E. Smith, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Learn with the contestants various signs and pathognomonic imaging findings of diseases involving multiorgan multisystem. 2) Challenge yourself with answering the questions for the audience. 3) Support Contestants and Have Fun!

### COURSE DESCRIPTION

This session will help attendees to improve the quality of their interpretations of the findings specific to a particular multisystemic disease.

The session will follow a “gameshow” format based on “Jeopardy”, featuring a panel composed of experts specializing in various fields of Radiology. Categories and questions will facilitate discussion on experiences from the panelists, including main differentiating features of certain diseases that aid in differentiation of various diagnostic multisystemic entities. The cases will be divided into 5 categories with topics including congenital, immune, oncology, infection, vascular, and metabolic multisystemic diseases. Questions will include examples inspired by the panelists’ suggested diagnoses.

The “gameshow” format will help deliver the content through targeted discussion, while offering an opportunity for the audience to interact with panelists throughout the session. Participants will be familiarized with presentations of various multisystemic diseases and learn decision algorithms which will help in making an accurate diagnosis.

# Abstract Archives of the RSNA, 2024

S5-CNMMI03

## Prostate Theranostics

Sunday, Dec. 1 2:30PM - 3:30PM Room: S405

Terence Z. Wong, MD, PhD (*Moderator*) Consultant, General Electric Company

**LEARNING OBJECTIVES**

1) To review clinical interpretation of PET/CT with PSMA-targeting agents. 2) To discuss patient selection and implementation of PSMA targeted-therapy.

**COURSE DESCRIPTION**

This course will describe a radiotheranostic approach for imaging and treating prostate cancer, and will provide updates on current clinical applications and practice.

**Sub-Events**

### S5-CNMMI03B PSMA PET/CT Imaging

Terence Z. Wong, MD, PhD (*Presenter*) Consultant, General Electric Company

### S5-CNMMI03C PSMA Therapy

Andrei Iagaru, MD (*Presenter*) Research Grant, General Electric Company;Research Grant, Lantheus Holdings;Research Grant, Novartis AG

# Abstract Archives of the RSNA, 2024

S5-CNPM18

## The Radiologist and the Patient

Sunday, Dec. 1 2:30PM - 3:30PM Room: S402

Colbey W. Freeman, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the payment policies and regulations that impact radiologists' ability to bill for patient consults. 2) Describe how frequently patients utilize available tools and systems to speak directly to radiologists. 3) Legal implication of communicating radiology results directly to the patient: Should we do it? If so, when? 4) Understand the impact of the 21st Century Cures Act outside of Radiology.

**COURSE DESCRIPTION**

This session will focus on a number of important aspects of patient-radiologist interactions, including consultations with patients and the economic considerations, the legal ramifications of communicating directly with patients, and the impact of the 21st Century Cures Act.

**Sub-Events**

### S5-CNPM18B Do Patients Want to Speak to Radiologists? What Does the Evidence Say?

Colbey W. Freeman, MD (*Presenter*) Nothing to Disclose

### S5-CNPM18C 21st Century Cures Act. The Opinion of Referring Clinicians on Early Disclosure of Results to Patients

Tessa S. Cook, MD, PhD (*Presenter*) Grant, Independence Blue Cross;Speaker, Sectra AB;

### S5-CNPM18D The Legal Aspects of Radiologists Speaking to Patients

Shambo Guha Roy, MBBS, MD (*Presenter*) Nothing to Disclose

### S5-CNPM18E How to Get Paid for Consulting Patients

Lauren P. Nicola, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S5-CNR07

## Practical Use of AI in Daily Neuroradiology Practice: Challenges and Opportunities

Sunday, Dec. 1 2:30PM - 3:30PM Room: S406B

Amish H. Doshi, MD (*Moderator*) Speaker, Becton, Dickinson and Company;Consultant, Siemens AG

**LEARNING OBJECTIVES**

1) Gain a comprehensive understanding of the current utilization of artificial intelligence (AI) in clinical neuroradiology practice. 2) Explore and articulate practical applications of AI within neuroradiology, highlighting how these technologies are integrated into diagnostic and treatment workflows. 3) Describe the challenges and opportunities presented by existing AI applications in neuroradiology, assessing their impact on clinical decision-making, patient outcomes, and operational efficiency.

**COURSE DESCRIPTION**

This course will feature lectures that explore the contemporary applications of artificial intelligence (AI) in Neuroradiology, focusing on practical implementations. Lecturers will use real-life examples to underscore the challenges facing AI adoption in clinical settings. Additionally, they will discuss opportunities to enhance patient care, safety, and radiology diagnostic interpretation and efficiency.

**Sub-Events**

### S5-CNR07B AI Powered MRI Acceleration of the Brain and Spine - Speed vs. Quality

Lawrence N. Tanenbaum, MD (*Presenter*) Speaker, General Electric Company;Speaker, Siemens AG;Speaker, Guerbet SA;Speaker, Koninklijke Philips NV;Consultant, icoMetrix NV;Consultant, Subtle Medical, Inc;Consultant, Columbo;Consultant, iMedis;Consultant, Agamon;Consultant, FUJIFILM Holdings Corporation

### S5-CNR07C Clinical Implementation of AI in Brain Tumor Imaging

Mariam S. Aboian, MD, PhD (*Presenter*) Researcher, Blue Earth Diagnostics Ltd;Researcher, Fusion Pharmaceuticals;Research collaboration, Pro Medicus Limited

### S5-CNR07D Report Automation in Neuroimaging

Jason F. Talbott, MD, PhD (*Presenter*) Nothing to Disclose

### S5-CNR07E AI Triage of the Brain and Spine - Help or Hindrance?

Amish H. Doshi, MD (*Presenter*) Speaker, Becton, Dickinson and Company;Consultant, Siemens AG

# Abstract Archives of the RSNA, 2024

S5-CPD05

## Zooming In - FAST MRI Imaging: Imaging with the Wiggles (Partially supported by an Unrestricted Educational Grant from Guerbet LLC.)

Sunday, Dec. 1 2:30PM - 3:30PM Room: N227B

Teresa Chapman, MD, MA (*Moderator*) Nothing to Disclose
Ting Y. Tao, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize the strengths and limitations of motion reduction methods to enable selection of the appropriate techniques for pediatric abdominal MRI. 2) Apply a structured program to minimize the potential risks of intravenous contrast in pediatric MRI. 3) Highlight barriers/challenges in implementation of a rapid MRI appendicitis program with guidance on potential solutions. 4) Learn methods for reduced imaging time and improved image quality of diffusion weighted imaging (DWI) in the abdomen and pelvis.

**COURSE DESCRIPTION**

In this session of four separate lectures, learners will have the opportunity to pick up new skills and ideas for protocol optimization allowing for fast MR imaging of the abdomen and pelvis in our pediatric patients. Our expert faculty presenters will cover aspects of pediatric abdominal imaging including synthetic MRI- and AI deep learning-based reconstruction methods, clinical indications for intravenous contrast agents in pediatric abdominal MRI, the medical evidence supporting a need for fast pediatric MRI to diagnosis appendicitis, and a review of the current and potential future applications of diffusion weighted imaging in the pediatric abdomen.

**Sub-Events**

### S5-CPD05C MRI Sequences for Pediatric Imaging: The Old and The New

Suraj D. Serai, PhD (*Presenter*) Nothing to Disclose

### S5-CPD05D Indications for Intravenous Contrast in Pediatric MRI and Strategies to Minimize Its Use

Michael S. Gee, MD, PhD (*Presenter*) Researcher, General Electric Company Researcher, Siemens AG Researcher, Motilent LLC

### S5-CPD05E Updates on Fast Appendicitis MRI Protocols

Rama S. Ayyala, MD (*Presenter*) Nothing to Disclose

### S5-CPD05F When Being Bright is What Matters: Diffusion Weighted MRI Applications

Jesse L. Courtier, MD (*Presenter*) Founder, Sira Medical, Inc;Consultant, Sira Medical, Inc

# Abstract Archives of the RSNA, 2024

S5-CPH12

## Total Body PET/CT Imaging: Current and Future Status of this Technology Innovation

Sunday, Dec. 1 2:30PM - 3:30PM Room: S404

Osama R. Mawlawi, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn about the various commercial TB system offerings and their performance characteristics. 2) Learn about the potential clinical and research applications of TB PET/CT systems. 3) Develop an in-depth understanding of the advantages and challenges of TB PET/CT systems.

**COURSE DESCRIPTION**

Total body (TB) PET/CT is one of the major recent innovations in the field of PET imaging. This is evidenced by the introduction of several TB systems from various manufacturers such as General Electric, SIEMENS, and United imaging. With total body PET there are potential advantages of reduced scan duration, decreased patient radiation dose, new clinical/research applications and quantitative outcome measures. This session will discuss the design and performance characteristics of these various systems as well as their potential clinical and research applications in oncology. A moderated debate centered around the need for TB systems in nuclear medicine is also included in this session and will cover the advantages/need for these systems versus their challenges.

**Sub-Events**

### S5-CPH12B Commercial TB PET/CT Systems and their Performance Characteristics

Ramsey Badawi, PhD (*Presenter*) Research Grant, Shanghai United Imaging Healthcare Co, Ltd;Institutional research agreement, Shanghai United Imaging Healthcare Co, Ltd

### S5-CPH12C Clinical and Research Applications of TB PET/CT Systems

Brian J. Burkett, MD, MPH (*Presenter*) Nothing to Disclose

### S5-CPH12D Moderated Debate/Discussion: Should or Shouldn't We Buy a TB PET/CT System

Osama R. Mawlawi, PhD (*Presenter*) Nothing to Disclose

### S5-CPH12E Moderated Debate/Discussion: Should or Shouldn't We Buy a TB PET/CT System

Ramsey Badawi, PhD (*Presenter*) Research Grant, Shanghai United Imaging Healthcare Co, Ltd;Institutional research agreement, Shanghai United Imaging Healthcare Co, Ltd

# Abstract Archives of the RSNA, 2024

S5-CPH14

## AAPM/RSNA Physics Tutorial 2: Tutorial on Yttrium-90 Microspheres in Interventional Radiology Practices

Sunday, Dec. 1 2:30PM - 3:30PM Room: N226

Thaddeus A. Wilson, PhD (*Moderator*) Nothing to Disclose

**COURSE DESCRIPTION**

As Y-90 has increased significantly and falls presently under the purview of interventional radiologist and radiological physicists this course is intended to give a broad overview of the implementations and use of the new device. It is also going to cover the safety and dosimetry of these high energy beta particle based therapies.

**Sub-Events**

### S5-CPH14B The Nuts and Bolts of Yttrium-90 Radioembolization

Osmanuddin S. Ahmed, MD (*Presenter*) Speaker, Canon Medical Systems Corporation;Research Grant, Canon Medical Systems Corporation;Speaker, Becton, Dickinson and Company;Speaker, Cook Group Incorporated;Advisory Board, Boston Scientific Corporation;Advisory Board, Argon Medical Devices, Inc;Speaker, Koninklijke Philips NV;Speaker, Argon Medical Devices, Inc;Advisory Board, Argon Medical Devices, Inc;Consultant, Asahi Kasei Medical Co, Ltd;Consultant, Medtronic plc;Speaker, Penumbra, Inc;Speaker, Inari Medical, Inc

### S5-CPH14C Dosimetry and Safety Considerations for Yttrium-90

Robert Hobbs, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S5-CRO03

## GI Multidisciplinary Review

Sunday, Dec. 1 2:30PM - 3:30PM Room: S401

Ann Raldow, MD, MPH (*Moderator*) Consultant, ViewRay, Inc

**LEARNING OBJECTIVES**

1) Review the anatomy and physiology of the liver, biliary tract, and surrounding structures relevant to the diagnosis and management of hepatobiliary malignancies. 2) Discuss the various treatment modalities available for hepatobiliary malignancies, including surgical resection, liver transplantation, locoregional therapies, systemic chemotherapy, targeted therapy, and immunotherapy. 3) Discuss the challenges and controversies in the management of hepatobiliary malignancies, including surveillance strategies, treatment sequencing, and the integration of emerging therapies into clinical practice.

**COURSE DESCRIPTION**

This course offers a comprehensive review of hepatobiliary malignancies, focusing on the anatomy, diagnosis, and management of these complex and challenging diseases. Participants will explore the latest advancements in treatment modalities, including surgical techniques, systemic therapies, and emerging immunotherapies. Through interactive discussions and case-based learning, attendees will gain insights into the multidisciplinary approach necessary for optimal patient care and address the challenges and controversies in the management of hepatobiliary malignancies.

**Sub-Events**

**S5-CRO03B** **GI Multidisciplinary Review**

Spencer C. Behr, MD (*Presenter*) Grant, Cancer Targeted Technology;Scientific Advisory Board, Novartis AG;Research Consultant, GenVivo

**S5-CRO03C** **GI Multidisciplinary Review**

Nina Sanford (*Presenter*) Nothing to Disclose

**S5-CRO03D** **GI Multidisciplinary Review**

Ryan P. Lokken, MD, MPH (*Presenter*) Consultant, Neptune Medical Inc

**S5-CRO03E** **GI Multidisciplinary Review**

Kristin Kelly, MD, MPH (*Presenter*) Nothing to Disclose

**S5-CRO03F** **GI Multidisciplinary Review**

Joseph Franses, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S5-RCP15

## Growing Green Radiology: Building Teams, Engaging Stakeholders, and Defining Measurements (Sponsored by the RSNA Professionalism Committee)

Sunday, Dec. 1 2:30PM - 3:30PM Room: E352

Kate Hanneman, MD, MPH (*Moderator*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Maura J. Brown, MD (*Moderator*) Synthesis Health Inc - research collaboration, no financial relationship at this time ( Nov 2022).

**LEARNING OBJECTIVES**

1) Discuss a practical approach to creating a green radiology team in radiology departments, including key stakeholders to engage, and an action plan to implement changes. 2) Describe key measurements and metrics, define short- and long-term goals, highlight the role of dashboards, key performance indicators, and AI to improve environmental sustainability in radiology. 3) Explore the need for collaboration and engagement with industry partners to support environmental sustainability in radiology and align technical development with the goal of reducing emissions and reliance on finite resources. 4) Discuss the need for advocacy and the role of regulators and other professional organizations in improving environmental sustainability in radiology.

**COURSE DESCRIPTION**

The overarching purpose of this course is to discuss the intersection of environmental sustainability and radiology and provide a practical roadmap to establishing local green teams, engaging key stakeholders, collaborating with industry and vendor partners, and defining key measurements and metrics.

**Sub-Events**

### S5-RCP15C Building Environmental Sustainability Green Teams in Radiology

Benjamin E. Northrup, MD (*Presenter*) Nothing to Disclose

### S5-RCP15D Green Radiology Teams: Outcomes, Metrics, and Measurements

Katherine E. Maturen, MD, MS (*Presenter*) Nothing to Disclose

### S5-RCP15E Vendor and Industry Engagement to Improve Environmental Sustainability in Radiology

Christopher P. Hess, MD, PhD (*Presenter*) Consultant, General Electric Company; Consultant, Siemens AG; DSMB, Focused Ultrasound Foundation; DSMB, uniQure Biopharma; DSMB, Asklepios BioPharmaceutical; Medical Advisory Board, Kheiron Medical Technologies

### S5-RCP15F Role of Advocacy and Professional Organizations in Sustainable Radiology

Beth Zigmund, MD (*Presenter*) Consultant, BioVentrix, Inc

# Abstract Archives of the RSNA, 2024

T1-CAS04

## Economics of Imaging (Sponsored by the RSNA Associated Sciences Consortium)

Tuesday, Dec. 3 8:00AM - 9:00AM Room: N226

Catherine Gunn, MBA, RT (*Moderator*) Nothing to Disclose
Keith Chew, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Important forecast updates, along with how top trends and new developments will impact the growth outlook. 2) How factors such as technology advances, industry landscape, and other market trends are intersecting to impact Diagnostic Imaging. 3) Considerations for strategic planning.

**COURSE DESCRIPTION**

The increased demand for imaging services is being met with continued workforce challenges and reimbursement pressures. Delayed capital investments, which have left many providers with aged equipment, now require proactive asset management and strategic planning to meet future demand with the appropriate technology. Challenging system-wide management strategies, imaging volumes are expected to continue to shift to lower-cost outpatient facilities as the industry landscape evolves. To improve cost, quality, access to care, and patient/clinician experience, radiology providers should consider the forecasting and trends impacting the industry.

**Sub-Events**

### T1-CAS04C Imaging Snapshot

Gurmeet Bawa, MSc, BS (*Presenter*) Nothing to Disclose

### T1-CAS04D Imaging Snapshot

Adam Fairbourn (*Presenter*) Nothing to Disclose

### T1-CAS04E Harnessing AI in Government-Funded Healthcare Systems

Remy C. Lim, MBChB (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T1-CBR01

## Breast AI in Clinical Practice...Are We There Yet?

Tuesday, Dec. 3 8:00AM - 9:00AM Room: S406A

Linda Moy, MD (*Moderator*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

**LEARNING OBJECTIVES**

1) Update the roles of artificial intelligence (AI) for breast imaging into clinical practice. 2) Explain the current clinical applications of AI such as standalone AI, triage and risk prediction.

**COURSE DESCRIPTION**

AI for breast imaging is evolving quickly. This course will the hurdles to clinical implementation to AI. Issues such as the pearl and pitfalls of AI in breast imaging will be reviewed. The important issue of what we have learned from clinical trials of AI and breast imaging will be highlighted. Regulatory concerns for AI and procurement framework that will incentivize the adoption of AI in clinical care while keeping our patients safe will be addressed.

**Sub-Events**

### T1-CBR01B Pearls and Pitfalls of AI in Clinical Practice Implementation

Linda Moy, MD (*Presenter*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc

### T1-CBR01C What Do We Know So Far From Clinical Trials?

Fredrik Strand, MD, PhD (*Presenter*) Speaker, Lunit Inc

### T1-CBR01D Development, Testing and Regulatory Concerns With AI

Etta D. Pisano, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

T1-CBR15

## RSNA Hands-On Lab: Breast US Biopsy (Registration Fee Required)

Tuesday, Dec. 3 8:30AM - 10:30AM Room: S504CD

Stamatia V. Destounis, MD (*Moderator*) Medical Advisory Board, iCad, Inc

**LEARNING OBJECTIVES**

1) Identify the different types of biopsy devices and understand the ultrasound biopsy process as to obtain tissue for diagnosis. 2) Explain the current clinical applications of needle biopsy devices in daily breast practice.

**COURSE DESCRIPTION**

Identify and review the multiple biopsy devices whether spring loaded or vacuum and how to utilize for breast biopsy with guidance and support from expert breast faculty.

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

**Sub-Events**

**T1-CBR15B** **RSNA Hands-On Lab: Breast US Biopsy**

Michael N. Linver, MD (*Presenter*) Medical Advisory Board, Three Palm Software LLC;Scientific Advisory Board, Seno Medical Instruments, Inc

**T1-CBR15C** **RSNA Hands-On Lab: Breast US Biopsy**

Cecilia L. Mercado, MD (*Presenter*) Nothing to Disclose

**T1-CBR15D** **RSNA Hands-On Lab: Breast US Biopsy**

Gary J. Whitman, MD (*Presenter*) Consultant, Siemens AG;Editor, Wolters Kluwer nv

**T1-CBR15E** **RSNA Hands-On Lab: Breast US Biopsy**

Sarah M. Pittman, MD, FRCPC (*Presenter*) Nothing to Disclose

**T1-CBR15F** **RSNA Hands-On Lab: Breast US Biopsy**

Georgia G. Spear, MD (*Presenter*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company;Scientific Advisory Board, Hologic, Inc

**T1-CBR15G** **RSNA Hands-On Lab: Breast US Biopsy**

Athina Vourtsi, MD (*Presenter*) Research Consultant, General Electric Company;Research Grant, General Electric Company;Educator, Arbutus Biopharma Corporation;Research collaboration, ScreenPoint Medical BV;Medical Advisory Board, Volpara Health Technologies Limited

**T1-CBR15H** **RSNA Hands-On Lab: Breast US Biopsy**

Linda J. Warren, MD (*Presenter*) Shareholder, Hologic, Inc

**T1-CBR15I** **RSNA Hands-On Lab: Breast US Biopsy**

Paula B. Gordon, MD, FRCPC (*Presenter*) Stockholder, OncoGenex Pharmaceuticals, Inc;Stockholder, Volpara Health Technologies Limited;Scientific Advisor, Besins Healthcare SA

**T1-CBR15J** **RSNA Hands-On Lab: Breast US Biopsy**

Jean M. Seely, MD, FRCPC (*Presenter*) Nothing to Disclose

**T1-CBR15K** **RSNA Hands-On Lab: Breast US Biopsy**

Marcio M. Saito, MD (*Presenter*) Speaker, General Electric Company

**T1-CBR15L** **RSNA Hands-On Lab: Breast US Biopsy**

Maria Helena S. Mendonca, MD, PhD (*Presenter*) Expert Advisory Committee, Guerbet SA

**T1-CBR15M** **RSNA Hands-On Lab: Breast US Biopsy**

Asha Bhatt, MD (*Presenter*) Nothing to Disclose

**T1-CBR15N** **RSNA Hands-On Lab: Breast US Biopsy**

Erin I. Neuschler, MD (*Presenter*) Nothing to Disclose

**T1-CBR15O** **RSNA Hands-On Lab: Breast US Biopsy**

Tanya W. Moseley, MD, PhD (*Presenter*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC

**T1-CBR15P** **RSNA Hands-On Lab: Breast US Biopsy**

Beatriz E. Adrada, MD (*Presenter*) Nothing to Disclose

**T1-CBR15Q** **RSNA Hands-On Lab: Breast US Biopsy**

Phan T. Huynh, MD (*Presenter*) Nothing to Disclose

**T1-CBR15R** **RSNA Hands-On Lab: Breast US Biopsy**

Norran H. Said, MD, FRCR (*Presenter*) Nothing to Disclose

**T1-CBR15S** **RSNA Hands-On Lab: Breast US Biopsy**

David V. Schacht, MD (*Presenter*) Nothing to Disclose

**T1-CBR15T** **RSNA Hands-On Lab: Breast US Biopsy**

Liane E. Philpotts, MD (*Presenter*) Nothing to Disclose

**T1-CBR15U** **RSNA Hands-On Lab: Breast US Biopsy**

Shadi Aminololama-Shakeri, MD (*Presenter*) Consultant, Becton, Dickinson and Company;Consultant, Izotropic Corporation;Stock options, Izotropic Corporation

**T1-CBR15V** **RSNA Hands-On Lab: Breast US Biopsy**

Jessica W. Leung, MD (*Presenter*) Scientific Advisory Board, Subtle Medical, Inc;Speaker, General Electric Company;Speaker, Hologic, Inc;Scientific Advisory Board, Seno Medical Instruments, Inc

**T1-CBR15W** **RSNA Hands-On Lab: Breast US Biopsy**

Regina J. Hooley, MD (*Presenter*) Consultant, Hologic, Inc

**T1-CBR15X** **RSNA Hands-On Lab: Breast US Biopsy**

Lizbel A. Arredondo, MD, MBA (*Presenter*) Nothing to Disclose

**T1-CBR15Y** **RSNA Hands-On Lab: Breast US Biopsy**

Gloria Palazuelos, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

T1-CCA08

## Cardiac Imaging in Private Practice: Maximizing Efficiency With Quality

Tuesday, Dec. 3 8:00AM - 9:00AM Room: E353C

Whitney B. Edmister, MD, PhD (*Moderator*) Consultant, McKesson Corporation
Michael F. Morris, MD (*Moderator*) Educator, Medtronic plc

**LEARNING OBJECTIVES**

1) Identify strategies for improving workflow and patient throughput in cardiac MRI and CT. 2) Understand how AI can assist with cardiac MRI and CT, and which AI tools can be used in current practice. 3) Learn how a 3D post processing lab can help improve efficiency, standardization, and quality.

**COURSE DESCRIPTION**

This course covers methods for improving efficiency in cardiac MRI/CT, which is applicable to imagers in private practice and academic/employed settings. Topics include techniques for improving efficiency via high throughput workflows, how to use AI/which AI programs to use, and the utility of a virtual or in-person 3D lab.

**Sub-Events**

**T1-CCA08C** **Maximizing Efficiency: High Throughput CT/MR Workflows**

Diana M. Palacio, MD (*Presenter*) Nothing to Disclose

**T1-CCA08D** **The Future is Now: How AI Helps Your Cardiac Imaging Practice Today**

Amar B. Shah, MD, MA (*Presenter*) Nothing to Disclose

**T1-CCA08E** **Virtual or Live 3D Lab: The Solution to All Your Problems**

Richard L. Hallett II, MD (*Presenter*) Consultant, Bracco Group

# Abstract Archives of the RSNA, 2024

T1-CER07

## A Case Based Review of GU Emergencies

Tuesday, Dec. 3 8:00AM - 9:00AM Room: N228

Refky Nicola, MSc, DO (*Moderator*) Royalties, RELX

**LEARNING OBJECTIVES**

1) To explore the various imaging modalities used to diagnose traumatic injuries to the kidneys, ureters, and bladder. 2) To recognize imaging features of traumatic injuries to the kidneys including contusions, hematomas, lacerations, and vascular and collecting system injuries using the AAST grading system. 3) To review diagnostic evaluation and imaging findings of ureteral and bladder trauma including blunt, penetrating, and iatrogenic injuries. 4) Discuss the findings associated with non-traumatic GU emergencies. 5) Present the imaging findings associated with non-traumatic and traumatic scrotal and penile emergencies.

**COURSE DESCRIPTION**

Present the findings associated with GU non-acute and acute emergencies within the kidney, ureters, and bladder

Discuss the findings with scrotal and penile emergencies.

**Sub-Events**

**T1-CER07B** **Non-Traumatic GU Emergencies: A Case-Based Approach**

Hanna Falinska, MD (*Presenter*) Nothing to Disclose

**T1-CER07C** **GU Trauma: Kidneys, Ureters, and Bladder**

Jennifer W. Uyeda, MD (*Presenter*) Nothing to Disclose

**T1-CER07D** **Non-Traumatic and Traumatic Scrotal and Penile Emergencies: A Multimodality Approach**

Refky Nicola, MSc, DO (*Presenter*) Royalties, RELX

# Abstract Archives of the RSNA, 2024

T1-CGU08

## Multimodal Imaging in Urogenital Cancers: Integrating PET, MRI, and CT

Tuesday, Dec. 3 8:00AM - 9:00AM Room: E353B

Devaki Shilpa S. Surasi, MD (*Moderator*) Research support, Blue Earth Diagnostics Ltd
Garvit D. Khatri, MBBS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the principles, protocols and imaging techniques in the evaluation of urogenital cancers. 2) Identify key imaging features and patterns across imaging modalities to improve detection, characterization, and staging of urogenital cancers. 3) Develop strategies for interdisciplinary collaboration among radiologists, oncologists, and urologists to optimize the use of PET, MRI, and CT imaging in urogenital cancer management. 4) Recognize common pitfalls and limitations associated with PET, MRI, and CT imaging in urogenital cancer assessment and develop strategies to overcome them.

**COURSE DESCRIPTION**

Course description:

This case based interactive session will delve into the imaging, comprehensive evaluation and management of urogenital cancers. Through a series of engaging cases, participants will explore the synergistic advantages of multimodality imaging in enhancing diagnostic accuracy, treatment planning, and patient outcomes in urogenital cancer care. Session will be divided into four case based sessions including the adrenals, kidneys, bladder and prostate.

Advantages :

Cutting-Edge Insights: Discover the latest advancements and techniques in multimodality imaging for urogenital cancers, providing attendees with cutting-edge insights into latest developments.

Interactive Case Studies: Engage in interactive case discussions led by experts, offering attendees a unique opportunity to apply theoretical knowledge to real-world scenarios and refine their diagnostic skills.

Practical Strategies: Acquire practical strategies and solutions for overcoming challenging cases to enhance clinical decision-making in their practice.

CME Credits: Earn valuable continuing medical education (CME) credits by participating in this educational session, enhancing your professional development while staying up-to-date with the latest advancements in urogenital cancer imaging.

**Sub-Events**

**T1-CGU08C** **Adrenal**

Elaine M. Caoili, MD, MS (*Presenter*) Steering Committee, ProKidney, LLC

**T1-CGU08D** **Kidney**

Elizabeth A. Edney, MD (*Presenter*) Nothing to Disclose

**T1-CGU08E** **Bladder**

Ersan Altun, MD (*Presenter*) Nothing to Disclose

**T1-CGU08F** **Prostate**

Devaki Shilpa S. Surasi, MD (*Presenter*) Research support, Blue Earth Diagnostics Ltd

# Abstract Archives of the RSNA, 2024

T1-CHN03

## Don't Reinvent the Wheel! High Yield Tips for Perfecting your Head and Neck Imaging Protocols

Tuesday, Dec. 3 8:00AM - 9:00AM Room: N227B

Gopi Nayak, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Optimize protocols for CT and MR head and neck imaging studies with special attention to CT contrast timing, dual-energy CT, and MRI for Meniere's disease.

**COURSE DESCRIPTION**

This session will include short, practical talks with high-yield content on how to optimize protocols in head and neck imaging, including recent advances in CT and MR imaging such as DECT protocols and inner ear imaging for Meniere's disease.

**Sub-Events**

### T1-CHN03B Build your Head and Neck MRI Protocols

David Zander, MD (*Presenter*) Nothing to Disclose

### T1-CHN03C CT Contrast Timing in Head and Neck Protocols including 4D CT

Nicholas A. Koontz, MD (*Presenter*) Nothing to Disclose

### T1-CHN03D Dual Energy/Spectral Applications in Head and Neck Imaging

Linda Postma, MD, PhD (*Presenter*) Nothing to Disclose

### T1-CHN03E Build your Meniere's MRI Protocol

Amy F. Juliano, MD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

T1-CIN06

## Best Practices for AI Model Deployment

Tuesday, Dec. 3 8:00AM - 9:00AM Room: E450B

Catherine M. Jones, MBBS (*Moderator*) Researcher, Annalise-AI Pty Ltd

**Sub-Events**

**T1-CIN06B** **Deploying AI Algorithms: Platforms vs Direct Deployment**

Catherine M. Jones, MBBS (*Presenter*) Researcher, Annalise-AI Pty Ltd

**T1-CIN06C** **How to Set Up a Cross Functional AI Deployment Team within your Organisation**

Amrita Kumar, MD, FRCR (*Presenter*) Nothing to Disclose

**T1-CIN06D** **Deploying AI - Metrics of Success**

Benjamin Fine, MD, MS (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

T1-CMK07

## Nerve Imaging: Entrapment Neuropathies and Approach to Lumbosacral Plexus Imaging

Tuesday, Dec. 3 8:00AM - 9:00AM Room: E450A

Theodore T. Miller, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Be able to describe the techniques for MR Neurography. 2) Be able to describe the anatomy of the lumbosacral plexus and sites of entrapment. 3) Be able to describe the MR and US appearances of upper and lower extremity nerve entrapments. 4) Be able to discuss various injection therapies for nerve entrapment.

**COURSE DESCRIPTION**

This course will highlight techniques for MR neurography and will apply them to evaluation of the lumbosacral plexus. Nerve entrapments of the upper and lower extremity will be discussed using US and MRI. Lastly, US-guided injections for nerve entrapment will be reviewed.

**Sub-Events**

### T1-CMK07B Approach to Neurography

Laura M. Fayad, MD (*Presenter*) Nothing to Disclose

### T1-CMK07C Lumbosacral Plexus

Jan Fritz, MD (*Presenter*) Institutional research support, Siemens AG;Scientific Advisor, Siemens AG;Patent agreement, Siemens AG;Institutional research support, Johnson & Johnson;Institutional research support, Zimmer Biomet Holdings, Inc;Institutional research support, BTG International Ltd

### T1-CMK07D Lower Extremity Entrapments

Dyan V. Flores, MD (*Presenter*) Nothing to Disclose

### T1-CMK07E Upper Extremity Entrapments

Theodore T. Miller, MD (*Presenter*) Nothing to Disclose

### T1-CMK07F Perineural Injection Therapy

Kambiz Motamedi, MD (*Presenter*) Royalties, RELX

# Abstract Archives of the RSNA, 2024

T1-CMS08

## Paraneoplastic Syndromes: Head to Toe

Tuesday, Dec. 3 8:00AM - 9:00AM Room: S402

Margarita V. Revzin, MD, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review pathophysiology and clinical presentations of paraneoplastic syndromes. 2) Discuss neurologic imaging findings in paraneoplastic syndromes associated with malignancies. 3) Discuss paraneoplastic manifestations of chest, abdominal and pelvic malignancies. 4) Discuss musculoskeletal and dermatologic manifestations of paraneoplastic syndromes and associated malignancies.

**COURSE DESCRIPTION**

Recent advances in medicine have improved the understanding of the pathogenesis of paraneoplastic syndromes (PNSs) and enhanced their diagnosis and treatment. Knowledge of various PNSs is necessary, as these syndromes may precede tumor development, complicate the patient's clinical presentation, indicate tumor prognosis, or be mistaken for metastatic spread.

The session provides a review of paraneoplastic manifestations involving neurologic, musculoskeletal, dermatologic, endocrinologic, gastrointestinal, and cardiovascular systems. The attendees will learn characteristic imaging findings associated with paraneoplastic syndromes and various tumors responsible for their development. Clinical manifestations of PNSs will also be discussed. Emphasis will be made on the role of surveillance for reoccurrence of PNSs as a measure to evaluate tumor treatment response.

**Sub-Events**

**T1-CMS08B** **Paraneoplastic Neurological Syndromes: Imaging Findings and Associations**

Ajay A. Madhavan, MD (*Presenter*) Nothing to Disclose

**T1-CMS08C** **Paraneoplastic Syndromes: Musculoskeletal Manifestation**

Stacy E. Smith, MD (*Presenter*) Nothing to Disclose

**T1-CMS08D** **Paraneoplastic Syndromes in the Chest and Abdomen/Pelvis: Imaging Findings and Associations**

Margarita V. Revzin, MD, MS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T1-CNMMI09

## Case-based Review of PET/CT: Brain, Dementia and Tumors

Tuesday, Dec. 3 8:00AM - 9:00AM Room: S405

Cristina S. Matushita, MD, MSc (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Understand best clinical practices for the use and interpretation of PET imaging in the diagnosis of dementia. 2) Understand best clinical practices for the use and interpretation of PET imaging for central nervous system tumors. 3) Identify common pitfalls and effective strategies for interpreting PET/CT scans in complex CNS cases.

### COURSE DESCRIPTION

This course will delve into the complexities of PET/CT imaging for the brain, focusing on dementia and tumors. Attendees will gain valuable insights from clinical cases presented by experts in the field, highlighting the best clinical practices for the use and interpretation of PET imaging. The session will cover the essential fundamentals, as well as the common pitfalls and pearls that can improve diagnostic accuracy. This lecture-based session aims to equip attendees with practical knowledge that can be directly applied in clinical practice, ultimately enhancing patient outcomes in diagnosing and managing CNS conditions.

**Sub-Events**

### T1-CNMMI09B Amyloid and Tau PET for Dementia

Phillip H. Kuo, MD, PhD (*Presenter*) Consultant, Konica Minolta, Inc;Consultant, Amgen Inc;Consultant, Blue Earth Diagnostics Ltd;Research Grant, Blue Earth Diagnostics Ltd;Consultant, Novartis AG;Speaker, Novartis AG;Consultant, Chimerix, Inc;Consultant, Fusion Pharmaceuticals Inc;Consultant, Bayer AG;Consultant, General Electric Company;Speaker, General Electric Company;Research Grant, General Electric Company;Speaker, Digital Science Press, Inc;Consultant, Radionetics;Former Employee, Konica Minolta, Inc

### T1-CNMMI09C PET for CNS Tumors

Jana Ivanidze, MD, PhD (*Presenter*) Research Grant, Novartis AG;

# Abstract Archives of the RSNA, 2024

T1-CNR02

## The Spinal Cord in Hot Water - Compression, Demyelination, and Inflammation

Tuesday, Dec. 3 8:00AM - 9:00AM Room: S406B

Wende N. Gibbs, MD, MA (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the intrinsic spinal cord pathologies that produce myelopathy. 2) Recognize the primary processes that disfigure the cord and post treatment appearances. 3) Identify key features of cord infarction and hemorrhage. 4) Understand the acute and chronic causes of extrinsic cord compression and their treatments.

**COURSE DESCRIPTION**

Patients with pathology involving the spinal cord may present acutely in the emergency setting, or may present with subacute to chronic symptoms. An approach to imaging spinal cord pathology is therefore an essential skill to master for radiologists of a wide variety of backgrounds and practice types. This session will review acute and non-acute presentations of spinal cord compression, the most common cause of spinal cord pathology, and will also discuss the most common pathologies intrinsic to the spinal cord itself, including demyelinating and inflammatory lesions.

**Sub-Events**

**T1-CNR02B** **Acute Cord: Infarct and Hemorrhage**

Mahmud Mossa-Basha, MD (*Presenter*) Nothing to Disclose

**T1-CNR02C** **Chronic Cord: Intrinsic Pathologies Causing Myelopathy**

Miriam Peckham, MD (*Presenter*) Nothing to Disclose

**T1-CNR02D** **Disfigured Cord: Chiari and Syrinx, Tethering, Arachnoiditis**

Timothy J. Amrhein, MD (*Presenter*) Nothing to Disclose

**T1-CNR02E** **Crushed Cord: Acute and Chronic**

Wende N. Gibbs, MD, MA (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T1-COB02

## All You Need to Know About Fibroids

Tuesday, Dec. 3 8:00AM - 9:00AM Room: E351

Nicole M. Hindman, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review FIGO staging of fibroids and the different surgical methods of approach by the gynecologists. 2) Review adenomyomas versus fibroid differentiation and importance. 3) Cover updates in MR imaging for prediction of leiomyosarcoma and other tumors when imaging the symptomatic patient with fibroids.

**COURSE DESCRIPTION**

Fibroids are a common cause of symptoms in female patients, including bleeding, bulk symptoms, infertility or recurrent pregnancy loss and pain. These patients often present to gynecologists for these symptoms and typically are then imaged by ultrasound and sometimes MRI. Radiologists have a central role in the description of these fibroids (or fibroid mimickers) to best guide appropriate treatment and inform the gynecologist about any atypical features that may affect management.

**Sub-Events**

### T1-COB02B Fibroids: What the Referring Gynecologist Needs to Know

Nancy Kim, MD (*Presenter*) Nothing to Disclose

### T1-COB02C MR Screening for LMS: Updates for 2024

Nicole M. Hindman, MD (*Presenter*) Nothing to Disclose

### T1-COB02D Case Based Review

Angela Tong, MD (*Presenter*) Equipment support, Siemens AG

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# Abstract Archives of the RSNA, 2024

T1-CRO02

## GU Multidisciplinary Review

Tuesday, Dec. 3 8:00AM - 9:00AM Room: S401

Tristan Barrett, MBBS, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand the typical imaging findings of prostate cancer on mpMRI. 2) To assess the impact of MRI on staging prostate cancer in a multidisciplinary setting. 3) To assess the role of imaging in the diagnosis of prostate cancer through case examples. 4) Recognize the imaging findings of post-treatment prostate cancer recurrence.

**COURSE DESCRIPTION**

This course uses a case-based approach to diagnostic and management decision making in the work-up of patients presenting with locally advanced and recurrent prostate cancer. The panel includes radiologists, urologists and radiation oncologists.

**Sub-Events**

**T1-CRO02B** **GU Multidisciplinary Review**

Andrei S. Purysko, MD (*Presenter*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;

**T1-CRO02C** **GU Multidisciplinary Review**

Tyler Seibert, MD, PhD (*Presenter*) Research Consultant, Cortechs.ai;Scientific Advisory Board, Cortechs.ai;Stock options, Cortechs.ai;Travel support, Siemens AG;Speaker, Siemens AG;Institutional research agreement, General Electric Company

**T1-CRO02D** **GU Multidisciplinary Review**

Sophia C. Kamran, MD (*Presenter*) Nothing to Disclose

**T1-CRO02E** **GU Multidisciplinary Review**

Michael Leapman, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T3-CAS06

**Global – Solving Staffing Problems, Education in Different Fields: Remote Scanning (Sponsored by the RSNA Associated Sciences Consortium)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: N226

Brandy J. Reed, MBA, RT (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Implementing and setting the expectations of remote scanning. 2) Lessons learned when setting up a remote practice for success. 3) Dealing with state limitations.

**COURSE DESCRIPTION**

Remote scanning is coming to a facility near you, ready or not. We will explore the current trends, CT and MR limitations and what it takes to set up a successful practice.

**Sub-Events**

**T3-CAS06B** **2024 Remote Scanning Trends: Are You Ready?**

Angelic Chapman, MS, ARRT (*Presenter*) Nothing to Disclose

**T3-CAS06C** **Remote CT: State Limitations**

Terrell Evans, MBA, ARRT (*Presenter*) Nothing to Disclose

**T3-CAS06D** **Remote Scanning: Design and How to Implement**

William Lee, ARRT (*Presenter*) Nothing to Disclose

**T3-CAS06E** **Remote Scanning: Design and How to Implement**

Elizabeth Evans, MBA (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

T3-CCH05

## MRI in Chest Imaging

Tuesday, Dec. 3 9:30AM - 10:30AM Room: E451A

Rachna Madan, MBBS, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the problem-solving value of MRI for more definitive characterization of indeterminate intrathoracic (mediastinal, pleural, pulmonary) masses on CT and appreciate how various MR pulse sequences help achieve the above objectives. 2) Understand the rationale, physical basis and clinical applications of advanced functional MR techniques used to characterize focal and diffuse lung abnormalities. 3) Understand the rationale and clinical applications of vascular MR/MRA.

**COURSE DESCRIPTION**

MRI in Chest Imaging session includes lectures by 4 experienced speakers and clinical practitioners in this subspecialty. This session will provide learners with a quick recap of nuts and bolts of non-vascular and vascular thoracic MRI as well as recent significant updates to protocols and sequences to enhance the problem-solving capability of MRI. Using multiple case studies and examples speakers will illustrate how the soft tissue contrast, tissue characterization, multiparametric and dynamic functional imaging capabilities of MRI adds to diagnostic specificity, preventing unnecessary and sometimes hazardous diagnostic intervention.

Attendees will also learn about sequences used and clinical applications of functional MRI as well as vascular thoracic MR/MRA.

**Sub-Events**

### T3-CCH05B Chest MRI: Update your Protocols/Sequences

Albert Hsiao, MD, PhD (*Presenter*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging

### T3-CCH05C Pulmonary Vascular MRI

Mark L. Schiebler, MD (*Presenter*) Stockholder, Stemina Biomarker Discovery, Inc Stockholder, Elucida Oncology, Inc Stockholder, X-Vax Technology Inc Stockholder, Elucent Medical

### T3-CCH05D Mediastinal MRI: The Problem Solver

Jeanne B. Ackman, MD (*Presenter*) Royalties, Reed Elsevier;Spouse, Consultant, Bristol-Myers Squibb Company;Spouse, Stockholder, LungLife AI;Spouse, Scientific Advisory Board, LungLife AI;Spouse, Consultant, Calyx;Spouse, Advisory Board, Canon Medical Systems Corporation

### T3-CCH05E Lung MRI

Jordi Broncano, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T3-CGI03

## Transplant Imaging

Tuesday, Dec. 3 9:30AM - 10:30AM Room: E451B

Reena C. Jha, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the findings which should be reported in patients undergoing evaluation for potential living donor liver transplant. 2) Describe the findings that may be contraindications for living donor liver transplant. 3) Review the normal appearance of the post- transplant liver and early and late complications. 4) Discuss indications for bowel transplant. Illustrate the typical bowel and vascular anatomy of small bowel transplants and describe imaging techniques and postoperative complications. 5) Discuss the role of imaging in pancreatic transplantation focusing on post-surgical evaluation including review of normal and abnormal appearances.

**COURSE DESCRIPTION**

This lecture series will review the indications, imaging anatomy, surgical techniques and critical findings in patients undergoing evaluation for potential small bowel, pancreas and living liver transplant and review imaging post liver transplant.

**Sub-Events**

### T3-CGI03B Liver Transplant - Pre-Op

Jeff L. Fidler, MD (*Presenter*) Nothing to Disclose

### T3-CGI03C Liver Transplant - Post-Op

Reena C. Jha, MD (*Presenter*) Nothing to Disclose

### T3-CGI03D Pancreas Transplant

Avinash R. Kambadakone, MD, FRCR (*Presenter*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

### T3-CGI03E Bowel Transplant

Erick M. Remer, MD (*Presenter*) Advisory Panel, Concept Pharmaceuticals Ltd

# Abstract Archives of the RSNA, 2024

T3-CIN07

## Best Practices for AI Education

Tuesday, Dec. 3 9:30AM - 10:30AM Room: E450B

Katherine P. Andriole, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Know why Radiologists whether in training or beyond should have an understanding of Artificial Intelligence/Machine Learning (AI/ML) technologies at least at a high level. 2) Learn example curricula and ways in which Radiologists and residents can be trained in AI/ML. 3) Become familiar with ways to educate care team members and patients about AI.

**COURSE DESCRIPTION**

Clinical Radiology will be practiced using Artificial Intelligence/Machine Learning (AI/ML) tools. Multiple steps are involved in developing and deploying machine learning models and artificial intelligence applications and clinical radiological expertise and input is required throughout the development and translation pipeline. In order to contribute to the process, Radiologists should have at a minimum, knowledge of AI/ML technology at a high level, understanding of technology limitations and recognition of error, the ability to converse and collaborate with a multidisciplinary team, capability to critically read the literature, and the ability to evaluate and properly use an AI/ML product or application. Example educational activities for residents are discussed. Other health care team members as end-users and patients as consumers must be educated as well. This session will present best practices for educating each of these constituents.

**Sub-Events**

### T3-CIN07B An Example AI Educational Program: What Radiology Trainees and Staff Need to Know

Katherine P. Andriole, PhD (*Presenter*) Nothing to Disclose

### T3-CIN07C An Inter-National Imaging Informatics Curriculum: The NIIC Course

Nabile M. Safdar, MD, MPH (*Presenter*) Nothing to Disclose

### T3-CIN07D Educating the Care Team and Our Patients About AI

Tessa S. Cook, MD, PhD (*Presenter*) Grant, Independence Blue Cross;Speaker, Sectra AB;

# Abstract Archives of the RSNA, 2024

T3-CNMMI10

## Case-based Review of PET/CT: Genitourinary Malignancies

Tuesday, Dec. 3 9:30AM - 10:30AM Room: S405

Ming Yang, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand best clinical practices for use and interpretation of PSMA-PET/CT in patient with prostate cancer. 2) Understand best clinical practices for use and interpretation of PET in patients with other genitourinary malignancies.

**COURSE DESCRIPTION**

PSMA-PET has revolutionized the imaging and therapy of patients with prostate cancer. FDG-PET of the genitourinary system remains one of the most challenging areas of the field. In this session, experts on prostate and other genitourinary malignancies will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation.

**Sub-Events**

### T3-CNMMI10B Prostate Cancer

Aileen O'Shea, MBBCh (*Presenter*) Nothing to Disclose

### T3-CNMMI10C Genitourinary Malignancies (Non-prostate)

Terence Z. Wong, MD, PhD (*Presenter*) Consultant, General Electric Company

# Abstract Archives of the RSNA, 2024

T3-CNPM20

## Medicolegal Issues and Hot Topics in Radiology

Tuesday, Dec. 3 9:30AM - 10:30AM Room: S402

Jonathan Mezrich, MD, JD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand how the legal system may address liability for errors which occur when using artificial intelligence in radiology. 2) Learn about recent litigation results which could impact future malpractice exposure. 3) Learn about recent medicolegal developments involving radiology litigation.

**COURSE DESCRIPTION**

Malpractice and other medico-legal issues are commonplace in radiology, and risks of liability are often underappreciated. Many radiologists would benefit from a greater understanding of legal issues they may face in the current landscape. This course will feature four lectures on medico-legal topics, along with an opportunity for audience questions, and will provide an overview of several “hot topics” in radiology. In this thought provoking session we will address potential medico-legal implications and liability risks relating to artificial intelligence liability in radiology generally, and generative AI more specifically. Lectures will also include a case based analysis of a recent malpractice lawsuit involving stroke diagnosis, as well as a discussion of use of functional neuroimaging in the courtroom. It is expected that attendees will have a greater understanding of a number of medico-legal issues affecting radiologists in current practice, and some insight on evolving topics to keep tabs on in the future.

**Sub-Events**

### T3-CNPM20B Robot Justice - Who is Accountable When Your AI Errs?

Jonathan Mezrich, MD, JD (*Presenter*) Nothing to Disclose

### T3-CNPM20C Malpractice Litigation in Stroke Diagnosis: A Case Study

Francis Deng, MD (*Presenter*) Nothing to Disclose

### T3-CNPM20D Functional Neuroimaging in the Courtroom

Jeffrey Ware, MD (*Presenter*) Nothing to Disclose

### T3-CNPM20E LLMs in LLMs: Legal Land Mines in Large Language Models; Generative AI in Radiology - Legal and Ethical Considerations

Sophie Chheang, MD (*Presenter*) Medical Director, Agamon Technologies Limited

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# Abstract Archives of the RSNA, 2024

T3-CPD07

## Peds Cardiac Imaging: Fundamentals to Advanced

Tuesday, Dec. 3 9:30AM - 10:30AM Room: E350

Cynthia K. Rigsby, MD (*Moderator*) Nothing to Disclose
Prakash M. Masand, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss basic and advanced pediatric cardiovascular imaging techniques and interpretation. 2) Describe how CT and MRI can be used to diagnose pulmonary embolism in children. 3) Illustrate fetal vascular imaging procedures.

**COURSE DESCRIPTION**

This lecture-based course will improve pediatric cardiovascular imaging knowledge through highlighting points relevant to both the general pediatric radiologist and the advanced cardiac imager for performing and interpreting pediatric cardiovascular CT and MR and fetal vascular imaging studies.

**Sub-Events**

**T3-CPD07C** **Pediatric Cardiovascular Imaging for the Generalist: Common Diagnoses**

Erin K. Romberg, MD (*Presenter*) Nothing to Disclose

**T3-CPD07D** **Pediatric Cardiovascular Imaging: Advanced Know-How**

Mariana Ribeiro Rodero Cardoso, MD, MSc (*Presenter*) Nothing to Disclose

**T3-CPD07E** **Fetal Vascular Imaging: Helpful Hints for Daily Work**

Luis F. Goncalves, MD, MSc (*Presenter*) Speaker, Koninklijke Philips NV;;

# Abstract Archives of the RSNA, 2024

T3-CPH01

## AI in Ultrasound Imaging

Tuesday, Dec. 3 9:30AM - 10:30AM Room: S404

Karen Drukker, PHD (*Moderator*) Royalties, Hologic, Inc

**LEARNING OBJECTIVES**

1) To learn about incorporating imaging physics into AI models for ultrasound image reconstruction and beamforming, and to examine a practical example of AI in ultrasound image reconstruction that integrates imaging physics. 2) To understand the current challenges in ultrasound-guided interventions and discover how AI and robotics can enhance these procedures. 3) To understand how AI in medical ultrasound image analysis can assist radiologists and clinicians in the detection, diagnosis, and prognosis of disease.

**COURSE DESCRIPTION**

This course features 3 expert speakers and is essential for professionals seeking to understand the cutting-edge advancements in artificial intelligence (AI) medical ultrasound imaging and their practical applications. Attendees will gain valuable knowledge on three key topics: the use of AI in detecting and imaging targeted microbubbles, the role of AI and robotics in ultrasound-guided interventions, and the application of AI in medical image analysis for disease detection, diagnosis, and prognosis. Each lecture will provide in-depth exploration of these areas, equipping participants with the skills to leverage AI technologies in enhancing ultrasound imaging practices.

**Sub-Events**

### T3-CPH01B Incorporating Ultrasound Imaging Physics into Artificial Intelligence: Example in the Detection and Imaging of Targeted Microbubbles

Jeremy J. Dahl, PhD (*Presenter*) Technical Advisory Board, MAUI Imaging, Inc;Technical Advisory Board, Cephasonics Ultrasound;Technical Advisor, Vortex Imaging

### T3-CPH01C AI and Robotics for Ultrasound Guided Interventions

Laura Brattain, PhD (*Presenter*) Nothing to Disclose

### T3-CPH01D AI in Medical Image Analysis; Ultrasound Imaging for Detection, Diagnosis, and Prognosis of Disease

Karen Drukker, PHD (*Presenter*) Royalties, Hologic, Inc

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# Abstract Archives of the RSNA, 2024

T3-CVA08

## Aortic Dissection

Tuesday, Dec. 3 9:30AM - 10:30AM Room: S502

Kacie Kuykendall, MD (*Moderator*) Nothing to Disclose
Dominik Fleischmann, MD (*Moderator*) Research Grant, Siemens AG;Stockholder, iSchemaView, Inc;Stockholder, Segmed, Inc

**LEARNING OBJECTIVES**

1) Review the role of imaging in patients presenting with an acute aortic syndrome. 2) Explain the spectrum less common lesions such as PAU and limited tears. 3) Identify the imaging features which are most important for surgical or endovascular treatment planning. 4) Review the rationale and techniques for surveillance imaging in survivors of aortic dissection.

**COURSE DESCRIPTION**

This course provides a selection of high-yield topic related to imaging of aortic dissection. After a thorough overview of pathologies that can present clinically as an 'acute aortic syndrome', several less common entities of this spectrum will be reviewed, such as penetrating atherosclerotic ulcers, and limited tears of the aorta.

The course will highlight imaging features and new classifications to support surgical and endovascular treatment planning. Finally, the rationale and measurement techniques required for surveillance imaging in patients with chronic dissection will be presented.

**Sub-Events**

### T3-CVA08C Imaging Acute Aortic Syndrome

Thekla H. Oechtering, MD (*Presenter*) Nothing to Disclose

### T3-CVA08D Limited Tears and Ulcer-Like Aortic Lesions

Kacie Kuykendall, MD (*Presenter*) Nothing to Disclose

### T3-CVA08E Imaging for Surgical and Intervention Planning in Aortic Dissection

Kaitlin Marquis, MD (*Presenter*) Nothing to Disclose

### T3-CVA08F Imaging Chronic Aortic Dissection

Dominik Fleischmann, MD (*Presenter*) Research Grant, Siemens AG;Stockholder, iSchemaView, Inc;Stockholder, Segmed, Inc

# Abstract Archives of the RSNA, 2024

T3-RCP02

## Peru Presents: A Mosaic of Technology and Tradition

Tuesday, Dec. 3 9:30AM - 10:30AM Room: E352

Theo R. Aliaga SR, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To learn about the Lady of Cao: A mummy found in the Moche culture in Northern Peru. 2) Understand and analyze the unique findings of the mummy with technological insights. 3) To present the reality of the pneumoconiosis diagnosis in Peru. 4) To present different cases of pneumoconiosis in different settings an clinical correlation. 5) Identify Key MRI Findings: Understand and recognize the MRI manifestations associated with pediatric brain parasitic infections, based on specific cases from Peru. 6) Clinical Integration: Integrate MRI findings into clinical practice to improve the diagnosis and management of pediatric brain parasitic infections.

**Sub-Events**

**T3-RCP02B** **MRI Manifestation of Pediatric Brain Parasitic Infection: A Peruvian Experience**

Carlos F. Ugas-Charcape, MD (*Presenter*) Nothing to Disclose

**T3-RCP02C** **The Lady of Cao: Women's Role in Moche Society and Technological Insights**

Pedro Tapia, MD (*Presenter*) Nothing to Disclose

**T3-RCP02D** **Radiological Cases of Pneumoconiosis in Peru: A Closer Look**

Luis A. Campos Calderon, MD, MBA (*Presenter*) Nothing to Disclose

**T3-RCP02E** **Unusual MRI Findings in CNS Tuberculosis: A Peruvian Experience**

Raul L. Marquina, MD (*Presenter*) Nothing to Disclose

**T3-RCP02F** **RSNA Closing Remarks**

Curtis P. Langlotz, MD, PhD (*Presenter*) Stockholder, whiterabbit.ai;Advisor, whiterabbit.ai;Stockholder, Galileo CDS, Inc;Advisor, Galileo CDS, Inc;Stockholder, Bunker Hill, Inc;Board of Directors, Bunker Hill, Inc;Stockholder, Sirona Medical, Inc;Advisor, Sirona Medical, Inc

# Abstract Archives of the RSNA, 2024

T3-RCP13

## Fostering Culturally Aware Mentoring in Radiology (Sponsored by the RSNA Health Equity Committee and the RSNA Committee on Diversity, Equity and Inclusion)

Tuesday, Dec. 3 9:30AM - 10:30AM Room: S501

Efren J. Flores, MD (*Moderator*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Ashley E. Prosper, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Define culturally aware mentorship (CAM) and best ways to identify belief and perceptions that influence mentoring relationships. 2) Navigate barriers and facilitators to incorporating CAM into your mentorship practices in radiology. 3) Use relational meetings to navigate cultural differences and promote career advancement for mentees. This session will include a 15-minute Q&A session with the audience.

### COURSE DESCRIPTION

Radiology efforts to address health equity require the investment of meaningful resources to diversify the radiology workforce. However, diversity efforts often may fall short without mentorship that considers the mentees sociocultural background to ensure a sense of belonging. Culturally Aware Mentoring (CAM) seeks to address this gap in the mentor-mentee relationship, by forming a bidirectional relationship that takes into consideration their sociocultural background and uses this approach to create new pathways for career advancement. To effectively mentor radiology faculty and trainees across radiology among all practice settings, it is paramount that culturally aware mentoring (CAM) is included in efforts to improve successful mentoring in radiology.

**Sub-Events**

### T3-RCP13C Navigating Relational Vulnerability in Mentoring

Priyanka Reddy, MD, MPH (*Presenter*) Nothing to Disclose

### T3-RCP13D Asset-Based Approaches Toward Radiology Education

Anand K. Narayan, MD, PhD (*Presenter*) Nothing to Disclose

### T3-RCP13E Practical Approach to Culturally Aware Mentorship in Radiology

Maria D. Martin, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T4-CIN08

## Best Practices for AI Model Continuous Monitoring

Tuesday, Dec. 3 11:00AM - 12:00PM Room: E450B

Walter F. Wiggins, MD,PhD (*Moderator*) Advisor, Qure.ai;

**LEARNING OBJECTIVES**

1) Understand Regulatory Compliance and Best Practices: Gain a comprehensive understanding of the regulatory landscape and requirements/best practices for AI model performance monitoring post-product approval. 2) Evaluate Real-World AI Deployment: Analyze practical experiences and lessons learned from deploying AI in large academic medical centers, focusing on continuous monitoring and performance validation. 3) Address Post-Deployment Challenges: Develop strategies for effective post-market validation, comparative performance analysis of commercial AI tools, and ongoing surveillance to identify and mitigate biases in AI applications.

**COURSE DESCRIPTION**

This course will delve into the continuous monitoring of AI models in Radiology, covering regulatory compliance, real-world deployment insights, and post-market validation. Participants will learn from deployments in large practices and academic medical centers, explore the comparative performance of commercial AI tools, and gain strategies for effective post-deployment surveillance. The session will also address the critical issue of evaluating and mitigating bias, ensuring the ethical and effective use of AI in clinical practice.

**Sub-Events**

### T4-CIN08B Regulating AI Performance after Product Approval, Current Status

Walter F. Wiggins, MD,PhD (*Presenter*) Advisor, Qure.ai;

### T4-CIN08C What we Learned after Deploying AI in a Large Academic Medical Center

Peter A. Harri, MD (*Presenter*) Radiology Advisory Board, Sectra AB

### T4-CIN08D Post-market Validation and Comparative Performance of Commercial AI Tools

Merel Huisman, MD, PhD (*Presenter*) Nothing to Disclose

### T4-CIN08E Post-Deployment Surveillance and Evaluation of Bias

A. Gregory Sorensen, MD (*Presenter*) Employee, RadNet, Inc;Board member, IMRIS Inc;Board member, Siemens AG;Board member, DFB Healthcare Acquisitions Corp;Board member, inviCRO, LLC;;;;

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# Abstract Archives of the RSNA, 2024

T4-CNPM14

## Role of Nonphysician Providers (NPP) in Radiology: Existential Threat or Unforeseen Opportunity? (Sponsored by the RSNA Professionalism Committee)

Tuesday, Dec. 3 11:00AM - 12:00PM Room: N227B

Monica M. Sheth, MD (*Moderator*) Nothing to Disclose
R. Paul Guillerman, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Identify and differentiate the types of radiology NPPs. 2) Discuss current utilization trends of NPPs in academic and private practice. 3) Understand how state and federal regulations impact the role of NPPs in radiology practice.

### COURSE DESCRIPTION

The use of nonphysician providers (NPPs) is a potential strategy to mitigate the shortfall of radiologists to cover increasing work volume in the setting of declining reimbursement. The lectures and discussions in this session will inform attendees of the rules and regulations regarding the scope of practice of NPPS in radiology, the operational and budgetary impact of NPPs, and the potential quality and safety issues related to the practice of NPPs.

**Sub-Events**

### T4-CNPM14C The Role of NPP in Radiology: A Historical Perspective, Current Trends, and Impact on Global Outreach

Farouk Dako, MD, MPH (*Presenter*) Nothing to Disclose

### T4-CNPM14D Rules and Regulations Relating to Roles of NPP in Radiology Practice

C. Matthew Hawkins, MD, MBA (*Presenter*) Nothing to Disclose

### T4-CNPM14E The Impact of NPP on DR and IR Practices: Operational and Educational Implications

Richard Duszak JR, MD (*Presenter*) Advisor, Ethos Medical, Inc;Shareholder, Ethos Medical, Inc

### T4-CNPM14F Safety and Legal Consequences - Is it Worth the Risk?

Geraldine B. McGinty, MD, MBA (*Presenter*) Board Member, NextGen Healthcare ;Stockholder, NextGen Healthcare

# Abstract Archives of the RSNA, 2024

T4-CRT01

## ASRT@RSNA: Artificial Intelligence in Radiology: Exploring the Radiologic Technologist's Role

Tuesday, Dec. 3 11:00AM - 12:00PM Room: N226

Susie M. Moseley, MS, RT (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Define and differentiate between clinical informatics, imaging informatics, artificial intelligence and machine learning in radiology. 2) Clearly interpret informatics' impact on radiology and develop a deeper understanding of the use of AI in radiology. 3) Discuss current and future applications of informatics and AI in medical imaging.

**COURSE DESCRIPTION**

The integration of informatics and imaging significantly impacts how radiologic technologists care for patients. This session provides an overview of artificial intelligence and how it is impacting radiology and radiologic technologists. Attendees will learn why it is imperative to understand informatics applications and AI's role and function in health care's daily operations. The speaker will discuss current innovations and forthcoming applications of informatics and AI, including a look into the future of informatics and its impact on patient-centered care.

**Sub-Events**

**T4-CRT01B** **Artificial Intelligence in Radiology: Exploring the Radiologic Technologist's Role**

Kori Stewart, PhD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

T4-RCP17

## Immersive Imaging - The Intersection of Evolving Technologies (Sponsored by the RSNA 3D Printing Special Interest Group)

Tuesday, Dec. 3 11:00AM - 12:00PM Room: E451B

Lumarie Santiago, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the fundamental role of imaging in immersive imaging. 2) Outline the shared workflow between 3D printing, AR and VR. 3) Develop a strategy to determine the clinical scenarios that benefit most from immersive imaging and most appropriated immersive modality. 4) Recognize the influence of AI in the workflow of immersive imaging.

**Sub-Events**

**T4-RCP17B** **Workflows - Common Processes in 3D Printing, AR & VR**

Karthik K. Tappa, PhD (*Presenter*) Nothing to Disclose

**T4-RCP17C** **Case Study: DIEA Flap Reconstruction 3D Printing, AR & VR**

David H. Ballard, MD (*Presenter*) Nothing to Disclose

**T4-RCP17D** **Case Study: Structural Heart 3D Printing, AR & VR**

Shafkat Anwar, MD (*Presenter*) Consultant, PrinterPrezz Inc;Stockholder, PrinterPrezz Inc

# Abstract Archives of the RSNA, 2024

T6-CBR11

## Localization and Biopsy Techniques

Tuesday, Dec. 3 1:30PM - 2:30PM Room: S406A

Sarah M. Friedewald, MD (*Moderator*) Consultant, Hologic, Inc;Research Grant, Alphabet Inc

**LEARNING OBJECTIVES**

1) Identify different ways to optimize imaged guided biopsies

2) Understand the advantages and disadvantages of upright versus prone biopsies

3) Appreciate different methods of image guided localizations, and understand their strengths and limitations

**COURSE DESCRIPTION**

In this course, the attendee will learn the basics of tomosynthesis guided biopsies, ultrasound guided biopsies, MRI guided biopsies and image guided localizations. The most recent literature supporting these techniques will be reviewed. Additionally, through imaging examples, different scenarios will be presented that the radiologist may encounter during these procedures. A practical guide on how to troubleshoot various issues that might arise will be presented.

**Sub-Events**

### T6-CBR11B Pearls and Pitfalls of Challenging Mammo and DBT Biopsies and Localizations

Sarah M. Friedewald, MD (*Presenter*) Consultant, Hologic, Inc;Research Grant, Alphabet Inc

### T6-CBR11C Challenging Biopsies With Breast MRI and Targeted US

Alexandra Athanasiou, MD, MSc (*Presenter*) Nothing to Disclose

### T6-CBR11D Challenging Cases With US Findings and Procedures

Regina J. Hooley, MD (*Presenter*) Consultant, Hologic, Inc

# Abstract Archives of the RSNA, 2024

T6-CBR16

## RSNA Hands-On Lab: MRI-Guided Breast Biopsy (Registration Fee Required)

Tuesday, Dec. 3 2:00PM - 4:00PM Room: S504CD

Roberta M. Strigel, MD, MS (*Moderator*) Research support, General Electric Company

**LEARNING OBJECTIVES**

1) Define indications for MRI-guided breast biopsy and appropriate patient selection including relative and absolute contraindications to MRI-guided breast biopsy. 2) Describe and understand the steps of a MRI-guided breast biopsy procedure, including protocol and requirements for appropriate coil, needle, and approach selection. 3) Identify the benefits and limitations of MRI-guided breast biopsy and understand tips for handling challenging biopsy locations and patient anatomy.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited.

This course is intended to provide both didactic and hands-on experience performing MRI-guided breast biopsy. Those with experience and those who do not have experience with this procedure are welcome and will find this course beneficial. The course begins with a 45-minute lecture covering patient selection criteria, contraindications, appropriate biopsy positioning and troubleshooting, steps of the procedure, lesion targeting using both manual and computer aided techniques, post-biopsy care, radiologic/pathologic concordance, and potential challenges and strategies. The final 75-minutes is a hands-on workshop with 11 stations, each with a breast coil, targeting options (computer and manual), biopsy device and two expert faculty members to teach the performance of an MRI-guided biopsy with live coaching, tips, techniques, and advice, with opportunities for questions.

**Sub-Events**

**T6-CBR16B** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Tabassum Ahmad, MD (*Presenter*) Nothing to Disclose

**T6-CBR16C** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Rend Al-Khalili, MD (*Presenter*) Nothing to Disclose

**T6-CBR16D** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Dana Ataya, MD (*Presenter*) Nothing to Disclose

**T6-CBR16E** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Thomas Loduca, MD (*Presenter*) Nothing to Disclose

**T6-CBR16F** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Jessica H. Porembka, MD (*Presenter*) Nothing to Disclose

**T6-CBR16G** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Beatriu Reig, MD, MPH (*Presenter*) Nothing to Disclose

**T6-CBR16H** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Raman Verma, MD (*Presenter*) Nothing to Disclose

**T6-CBR16I** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Uzma Waheed, MD (*Presenter*) Consultant, Becton, Dickinson and Company

**T6-CBR16J** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Georgia G. Spear, MD (*Presenter*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company;Scientific Advisory Board, Hologic, Inc

**T6-CBR16K** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Kathryn P. Lowry, MD (*Presenter*) Research Grant, General Electric Company

**T6-CBR16L** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Gaiane M. Rauch, MD, PhD (*Presenter*) Nothing to Disclose

**T6-CBR16M** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Alyssa Cubbison, DO (*Presenter*) Nothing to Disclose

**T6-CBR16N** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Kirti M. Kulkarni, MD (*Presenter*) Nothing to Disclose

**T6-CBR16O** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Vilert A. Loving, MD, MMM (*Presenter*) Nothing to Disclose

**T6-CBR16P** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Wendi A. Owen, MD (*Presenter*) Nothing to Disclose

**T6-CBR16Q** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Jeffrey S. Reiner, MD (*Presenter*) Nothing to Disclose

**T6-CBR16R** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Rifat A. Wahab, DO (*Presenter*) Nothing to Disclose

**T6-CBR16S** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Jennifer R. Kohr, MD (*Presenter*) Nothing to Disclose

**T6-CBR16T** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Mitra Noroozian, MD (*Presenter*) Nothing to Disclose

**T6-CBR16U** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Supriya R. Kulkarni, DMRD, FRCPC (*Presenter*) Nothing to Disclose

**T6-CBR16V** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Karla A. Sepulveda, MD (*Presenter*) Nothing to Disclose

**T6-CBR16W** **RSNA Hands-On Lab: MRI-Guided Breast Biopsy**

Amy L. Kerger, DO (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

T6-CCA01

## Cardiac Rapid Fire: 60 Cases in 60 minutes

Tuesday, Dec. 3 1:30PM - 2:30PM Room: E353C

Liisa L. Bergmann, MD, MBA (*Moderator*) Nothing to Disclose
Jean Jeudy JR, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Imaging findings of cardiac and pericardial masses. 2) Imaging findings of valvular disease. 3) Imaging findings of congenital heart disease in pediatric and adult patients, including both pre- and post-repair.

**COURSE DESCRIPTION**

Case-based lecture reviewing imaging findings of cardiac and pericardial masses, valvular disease and congenital heart disease both pre- and post-repair in both pediatric and adult patients.

**Sub-Events**

**T6-CCA01C** **Cases 1-20 - Cardiac & Pericardial Masses**

Jean Jeudy JR, MD (*Presenter*) Nothing to Disclose

**T6-CCA01D** **Cases 21-40 - Valvular Disease**

Jordi Broncano, MD (*Presenter*) Nothing to Disclose

**T6-CCA01E** **Cases 41-60 - Congenital Heart Disease**

Liisa L. Bergmann, MD, MBA (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

T6-CER12

## Emergency Radiology Challenge: Jeopardy

Tuesday, Dec. 3 1:30PM - 2:30PM Room: N228

Christina A. LeBedis, MD, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand and differentiate the imaging features of traumatic and non-traumatic conditions commonly encountered in the emergency room. 2) Provide accurate and clinically relevant radiologic reports highlighting critical findings for effective ER management. 3) Exposure to a panel discussion to analyze and discuss common diagnostic challenges, limitations, and potential pitfalls in emergency radiology imaging for traumatic and non-traumatic conditions and develop strategies to improve diagnostic accuracy and patient outcomes.

**COURSE DESCRIPTION**

Join us for an engaging Jeopardy-style session where multiple non-traumatic and traumatic cases presented to emergency radiology will be discussed. This interactive format will encourage audience participation, challenging attendees to solve cases and learn about critical findings. Participants will gain valuable insights into making accurate and timely emergency radiology diagnoses, ultimately improving patient outcomes. This session promises to be both educational and entertaining, significantly impacting your emergency radiology practice.

**Sub-Events**

**T6-CER12B** **Emergency Radiology Challenge: Jeopardy**

Vincent M. Mellnick, MD (*Presenter*) Nothing to Disclose

**T6-CER12C** **Emergency Radiology Challenge: Jeopardy**

Jason A. Pietryga, MD (*Presenter*) Consultant, Radiostics LLC

**T6-CER12D** **Emergency Radiology Challenge: Jeopardy**

Mohamed Z. Rajput, MD (*Presenter*) Nothing to Disclose

**T6-CER12E** **Emergency Radiology Challenge: Jeopardy**

Carrie N. Hoff, MD (*Presenter*) Nothing to Disclose

**T6-CER12F** **Emergency Radiology Challenge: Jeopardy**

Matthew W. Roberts, MD (*Presenter*) Nothing to Disclose

**T6-CER12G** **Emergency Radiology Challenge: Jeopardy**

Ashish Patel, MD, MBA (*Presenter*) Nothing to Disclose

**T6-CER12H** **Emergency Radiology Challenge: Jeopardy**

Carlota Andreu Arasa, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T6-CGI11

## Pancreatic Tumor Imaging

Tuesday, Dec. 3 1:30PM - 2:30PM Room: E451B

Avinash R. Kambadakone, MD, FRCR (*Moderator*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

### LEARNING OBJECTIVES

1) To describe the key updates in the imaging diagnosis of pancreatic cancer. 2) To explain the current role of imaging in assessment of therapeutic response in pancreatic cancer. 3) To discuss the importance of structured reporting in pancreatic cancer and implications for patient management. 4) To review the current and emerging applications of artificial intelligence in pancreatic cancer. 5) To explain recent advances in pancreatic neuroendocrine tumor imaging.

### COURSE DESCRIPTION

This course will review the current state-of-the-art and recent advances in imaging of pancreatic cancer and pancreatic neuroendocrine tumors. The attendees will also learn the role of structured reporting and emerging applications of artificial intelligence in pancreatic cancer.

**Sub-Events**

### T6-CGI11B Diagnosis and Staging of Pancreatic Cancer: State of the Art

Avinash R. Kambadakone, MD, FRCR (*Presenter*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

### T6-CGI11C Pearls and Pitfalls in Pancreatic Cancer Response Assessment

Zhen J. Wang, MD (*Presenter*) Stockholder, Nextrast, Inc

### T6-CGI11D Pancreatic Cancer: Structured Reporting

Olga R. Brook, MD, MBA (*Presenter*) Nothing to Disclose

### T6-CGI11E Artificial Intelligence in the Fight Against Pancreatic Cancer

Michael H. Rosenthal, MD, PhD (*Presenter*) Nothing to Disclose

### T6-CGI11F Pancreatic Neuroendocrine Neoplasms

Motoyo Yano, MD, PhD (*Presenter*) Nothing to Disclose

## Abstract Archives of the RSNA, 2024

T6-CIN17

# Improving Patient-Centered Care in Radiology Using LLMs: Opportunities and Challenges

Tuesday, Dec. 3 1:30PM - 2:30PM Room: E351

Arun Krishnaraj, MD, MPH (*Moderator*) Nothing to Disclose

**Sub-Events**

**T6-CIN17B** **Patient-Centered Care in Radiology in the Era of LLMs**

Arun Krishnaraj, MD, MPH (*Presenter*) Nothing to Disclose

**T6-CIN17C** **Clinical Implementation of LLMs: Opportunities and Challenges**

Tessa S. Cook, MD, PhD (*Presenter*) Grant, Independence Blue Cross;Speaker, Sectra AB;

**T6-CIN17D** **Applications of LLMs: Where Are We Today?**

Dania Daye, MD, PhD (*Presenter*) Research Consultant, Sigilon Therapeutics, Inc;Research Consultant, Medtronic plc

**T6-CIN17E** **LLMs in Radiology: What's Next?**

Paul H. Yi, MD (*Presenter*) Consultant, FH Orthopedics SAS;Consultant, BunkerHill Health

# Abstract Archives of the RSNA, 2024

T6-CIN22

## RSNA Radiology Reimagined Demo and IHE: Facilitating the Future of AI-Enabled Radiology

Tuesday, Dec. 3 1:30PM - 2:30PM Room: E450B

Mohannad Hussain (*Presenter*) Consultant, Techie Maestro Inc
Namita S. Gandhi, MD, MSc (*Presenter*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize the future of AI applications throughout the entire radiology workflow. 2) Understand how semantic and interoperability standards enable clinical implementation of AI. 3) Consider how standards were specifically applied to an example RSNA Imaging AI in Practice demo.

**COURSE DESCRIPTION**

The Imaging AI in Practice (IAIP) demonstration project was started in 2020 to demonstrate the utility of AI applications throughout the radiology workflow. Partnering radiologists, technical experts and vendors developed clinically relevant scenarios highlighting the use of integration and semantic standards. Integrating the Healthcare Enterprise (IHE) is an initiative by health care professionals and industry to improve the way computer systems in healthcare share information. Relevant integration and semantic standards will be reviewed. We will take a detailed look at one of the demonstration cases presented at IAIP this year. This will be followed by a panel discussion responding to questions from the audience with particular emphasis on lessons learned and what the future may hold.

If you're interested in this session, we recommend you visit the Radiology Reimagined demo booth (5104 South Hall Level 3) to observe the live demos that run Sunday-Wednesday 10am - 5pm.

**Sub-Events**

### T6-CIN22A Moderator and Session Introduction

Katherine P. Andriole, PhD (*Moderator*) Nothing to Disclose

### T6-CIN22B RSNA Radiology Reimagined Demo: Motivation and Execution

Kirti Magudia, MD, PhD (*Presenter*) Nothing to Disclose

### T6-CIN22C How IHE and Standards Work Together

R. Kent Hutson JR, MD (*Presenter*) Nothing to Disclose

### T6-CIN22D Technical Deep Dive into the Radiology Reimagined Demo

Ali S. Tejani, MD (*Presenter*) Nothing to Disclose

### T6-CIN22E What's Next for the Radiology Reimagined Demo?

Madhavi V. Duvvuri, MD, MS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T6-CIR01

## Management of Early-Stage Lung Cancer

Tuesday, Dec. 3 1:30PM - 2:30PM Room: E352

Florian J. Fintelmann, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Explain the current non-surgical options for the diagnosis and treatment of stage I and II NSCLC. 2) Identify selection criteria for CT-guided percutaneous biopsy and ablation. 3) Identify selection criteria for navigational biopsy and transbronchial ablation.

**COURSE DESCRIPTION**

Lectures will cover state-of-the-art thoracic interventions for the diagnosis and treatment of stage I and II non-small cell lung cancer, including percutaneous and transbronchial approaches. Awareness of non-surgical management options enhances care for patients with lung cancer.

**Sub-Events**

**T6-CIR01B** **Percutaneous Lung Needle Biopsy and Fiducial Placement**

Elsie Nguyen, MD, FRCPC (*Presenter*) Nothing to Disclose

**T6-CIR01C** **Radiation Therapy Options for Early-stage NSCLC: SBRT and Beyond**

Florence K. Keane, MD (*Presenter*) Nothing to Disclose

**T6-CIR01D** **Percutaneous Ablation of Early-stage NSCLC**

Robert D. Suh, MD (*Presenter*) Nothing to Disclose

**T6-CIR01E** **Navigational Biopsy and Transbronchial Ablation: Role in Early-stage NSCLC Management**

Michael A. Pritchett, DO, MPH (*Presenter*) Nothing to Disclose

**T6-CIR01F** **Multimodality (Hybrid) Management of Multifocal Primary NSCLC**

Florian J. Fintelmann, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T6-CMK10

## Musculoskeletal Ultrasound: Normal Appearances, Pathologic Conditions and Hands-On Demo (Shoulder, Wrist, Knee)

Tuesday, Dec. 3 1:30PM - 3:00PM Room: E450A

Robert S. Campbell, MBChB, FRCR (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Learn the US scan techniques to be able to perform studies of US of the Shoulder, Wrist & Knee. 2) Understand the normal US appearances of the relevant anatomical structures related to US of the Shoulder, Wrist & Knee. 3) Apply that knowledge to be able to interpret pathologic conditions around the Shoulder, Wrist & Knee.

**COURSE DESCRIPTION**

This Course is focused in 3 parts on US of the Shoulder, Wrist & Knee. Each section will include a live demonstration of scanning technique and the normal US anatomical appearances, followed by a powerpoint oration discussing the important pathologic conditions that may be diagnosed by US, and discuss any diagnostic limitations and in what circumstances other imaging techniques such as MRI may be required.

Please use the following links to follow along with the presenters in the session:

Shoulder

Knee

Wrist and Hand

**Sub-Events**

**T6-CMK10B** **Live Demonstration/Didactic Cases (Shoulder, Wrist, Knee)**

Jon A. Jacobson, MD (*Presenter*) Research Consultant, BioClinica, Inc;Advisory Board, Koninklijke Philips NV;Royalties, RELX;Contactor, POCUS PRO

**T6-CMK10C** **Live Demonstration/Didactic Cases (Shoulder, Wrist, Knee)**

Viviane Khoury, BSc, MD (*Presenter*) Nothing to Disclose

**T6-CMK10D** **Live Demonstration/Didactic Cases (Shoulder, Wrist, Knee)**

Girish Gandikota, MD (*Presenter*) Nothing to Disclose

**T6-CMK10E** **Live Demonstration/Didactic Cases (Shoulder, Wrist, Knee)**

Marnix T. Van Holsbeeck, MD (*Presenter*) Stockholder, Koninklijke Philips NV;Stockholder, General Electric Company;Stockholder, MedEd3D

**T6-CMK10F** **Live Demonstration/Didactic Cases (Shoulder, Wrist, Knee)**

Mark Cresswell, MBBCh, BSc (*Presenter*) Consultant, Koninklijke Philips NV

**T6-CMK10G** **Live Demonstration/Didactic Cases (Shoulder, Wrist, Knee)**

Gina A. Di Primio, MD, FRCPC (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T6-CNMMI11

## Case-based Review of PET/CT: Infection/Inflammation and Gastrointestinal Malignancies

Tuesday, Dec. 3 1:30PM - 2:30PM Room: S405

Emily S. Nia, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand best clinical practices for use and interpretation of PET for infection and inflammation. 2) Understand best clinical practices for use and interpretation of PET for gastrointestinal malignancies.

**COURSE DESCRIPTION**

FDG-PET is a uniquely suited modality for the imaging of infection and inflammation, both as the primary indication or as an important secondary finding. PET for gastrointestinal malignancies is as complex and varied in presentation as the pathologies are. In this session, PET experts will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation.

**Sub-Events**

### T6-CNMMI11B Infection and Inflammation

Philipose G. Mulugeta, MD (*Presenter*) Nothing to Disclose

### T6-CNMMI11C Gastrointestinal Malignancies

Gabriel C. Fine, MD (*Presenter*) Founder, Site Therapeutics, LLC

# Abstract Archives of the RSNA, 2024

T6-CNPM08

## Radiologists' Role in LGBTQIA+ Health Equity (Sponsored by the RSNA Health Equity Committee)

Tuesday, Dec. 3 1:30PM - 2:30PM Room: S402

Vaz A. Zavaletta, MD, PhD (*Moderator*) Nothing to Disclose
Huber David Jaramillo Gil, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify Barriers and Challenges in Radiology for LGBTQIA+ Individuals 2) Evaluate how increased awareness and education on LGBTQIA+ healthcare can positively influence various facets of radiological practice, including advancements in imaging techniques for cancer diagnosis. 3) Learn to effectively engage with LGBTQIA+ patients, tailor treatment approaches, and make well-informed medical decisions to improve overall patient care in radiological settings.

**COURSE DESCRIPTION**

There is a need for education about the specific barriers and challenges faced by LGBTQIA+ individuals in radiology settings. This includes awareness of the social determinants of health that disproportionately affect this community and how these determinants can impact radiological care and outcomes. By delving into the intricacies of LGBTQIA+ health, societal attitudes, policy landscapes, familial dynamics, educational contexts, and economic factors, radiologists can develop a nuanced understanding aimed at mitigating provider misinformation, instances of medical mistreatment, barriers to gender-affirming care, and misconceptions regarding transgender individuals' bodies. A deeper understanding will allow radiologists to effectively engage with patients, tailor treatment approaches, and make well-informed medical decisions. Moreover, the panelist will uncover ways that increased awareness and education surrounding LGBTQIA+ healthcare can positively influence various facets of radiological practice. For instance, advancements in imaging techniques for cancer diagnosis, especially concerning breast and cervical cancer screenings, stand to benefit significantly and immediately from in-depth education in LGBTQIA+ health. All in all, the exploration of LGBTQIA+ health, and the advancement of the field of transgender radiology in particular, offers a pathway to broader improvements in interventional radiology and medical imaging.

**Sub-Events**

### T6-CNPM08C Disparities in LGBTQ HealthCare: Origins of Our Inequities

Hirschel D. McGinnis, MD (*Presenter*) Nothing to Disclose

### T6-CNPM08D Understanding LGBTQIA+ Specific Health Equity Challenges in Radiology

Anne Darrow, MD (*Presenter*) Nothing to Disclose

### T6-CNPM08E Trauma-Informed Care in Medical Imaging

Evelyn Carroll, MD (*Presenter*) Nothing to Disclose

### T6-CNPM08F Trauma-Informed Care in Medical Imaging

Nicolas Freeman, MD, BA (*Presenter*) Nothing to Disclose

### T6-CNPM08G Improvement of Data Collection on Sexual Orientation and Gender Identity

Huber David Jaramillo Gil, PhD (*Presenter*) Nothing to Disclose

### T6-CNPM08H Improvement of Data Collection on Sexual Orientation and Gender Identity

Vaz A. Zavaletta, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T6-CNR12

## Pediatric Neuroimaging: White Matter Disease Simplified

Tuesday, Dec. 3 1:30PM - 2:30PM Room: N227B

Rupa Radhakrishnan, MD, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review typical imaging findings and diagnostic challenges in common white matter diseases in the pediatric age group. 2) Understand the role of imaging in early diagnosis, disease monitoring and prognosis of these conditions.

**COURSE DESCRIPTION**

This session will be a didactic lecture series from expert pediatric neuroradiologists. Topics will cover a wide variety of pediatric white matter diseases including autoimmune and demyelinating diseases, leukodystrophies, and hypomyelinating disorders. The talks will highlight the characteristic radiological features and diagnostic challenges in these conditions, as well as brief clinical-radiological. Advanced imaging techniques, including the use of MR spectroscopy will be discussed. At the end of the session, participants will understand the characteristic imaging findings of common pediatric white matter diseases and imaging tips to arrive at a diagnosis.

**Sub-Events**

**T6-CNR12B** **Imaging Approach to Pediatric Demyelinating Diseases**

Rupa Radhakrishnan, MD, MS (*Presenter*) Nothing to Disclose

**T6-CNR12C** **Putting it All Together: Imaging Diagnosis in a Child With Leukodystrophy Part 1 - Disorders With Early Subcortical Involvement**

Bindu Setty, MD (*Presenter*) Nothing to Disclose

**T6-CNR12D** **Putting it All Together: Imaging Diagnosis in a Child With Leukodystrophy Part 2- Disorders With Early Periventricular Involvement**

Stephen F. Kralik, MD (*Presenter*) Nothing to Disclose

**T6-CNR12E** **Distinguishing Hypomyelinating Disorders on Imaging**

Arastoo Vossough, PhD, MD (*Presenter*) Research Consultant, Syneos Health;Stockholder, DeepSight Technology, Inc

# Abstract Archives of the RSNA, 2024

T6-CPD06

## Head to Toe Pitfalls in Pediatric Imaging: Don't fall for These Errors in Interpretation!

Tuesday, Dec. 3 1:30PM - 2:30PM Room: E350

Amy R. Mehollin-Ray, MD (*Moderator*) Nothing to Disclose
Yumin Zhong, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the normal imaging anatomy of the growing pediatric patient to recognize variants that may be confused with pathology. 2) Present both common pathologies and mimics that might be mistaken for pathology, with focus on the pediatric abdomen, head and spine, and skeleton.

**COURSE DESCRIPTION**

This course is designed for both early career and experienced radiologists who may encounter pediatric patients in their clinical practice, with a focus on differentiating pathology from the normal, varying appearance of the developing pediatric patient. Information will be presented in a case-based format and include a variety of imaging modalities.

**Sub-Events**

**T6-CPD06C** **Interesting Cases at the Intersection of Emergency Pediatric Body and Neuroradiology**

Ailish Coblentz, MD (*Presenter*) Nothing to Disclose

**T6-CPD06D** **Imaging of the Growing Skeleton: When Normal Meets Pathology**

Christabell C. Ndibe, MD (*Presenter*) Nothing to Disclose

**T6-CPD06E** **Skull, Brain and Spine: Head Scratchers in Imaging**

Christopher T. Watterson, MD (*Presenter*) Nothing to Disclose

**T6-CPD06F** **Mimics and Differential Diagnoses in the Abdomen**

Eoghan E. Laffan, FFR(RCSI), BSc (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T6-CRT02

**ASRT@RSNA: The Radiographer's Role in Patient Pathways: Facilitator or Passenger?**

Tuesday, Dec. 3 1:30PM - 2:30PM Room: N226

Susie M. Moseley, MS, RT (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Consider how imaging fits into patient pathways. 2) Discuss how radiographers can be influential in pathway improvement. 3) Learn from examples in practice to optimize the radiographer’s contribution.

**COURSE DESCRIPTION**

Imaging is a critical component in elective, acute and emergency pathways. Although radiographers are often bystanders in pathway redesign, they can take a proactive role to ensure patients receive the optimal diagnosis in a timely manner. This session explores examples from practice to examine how radiographers can lead in improving patient care and services.

**Sub-Events**

**T6-CRT02B** **The Radiographer's Role in Patient Pathways: Facilitator or Passenger?**

Beverly Snaith (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T6-RCP25

## Resident Competition (Hosted by the RadioGraphics Team)

Tuesday, Dec. 3 1:30PM - 2:30PM Room: S406B

Heba Albasha, MD (*Moderator*) Nothing to Disclose
Maria Lucia Brun, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Invite residents from across the world to compete against each other in a riveting case competition. 2) Foster team-building and friendly competition.

**COURSE DESCRIPTION**

Please join us for a friendly case competition between programs across the world! Form a team with your co-residents and prepare for multiple rounds of fun and challenging cases! Teams can have up to 6 residents each. In-person attendance is required to participate, and the competition will be hosted through Kahoot! using a mobile device. Only twenty teams can participate, but everyone is welcome to attend the show! Please use the following form to register your team: https://forms.gle/Pdngo2yDtDqMCbNd6. Limited spots will be reserved for on-site team registration - please head to the Residents Lounge on Sunday or Monday of the meeting to register.

**Sub-Events**

**T6-RCP25C** **Resident Competition**

Jacqueline Kunzelman, BS (*Presenter*) Nothing to Disclose

**T6-RCP25D** **Resident Competition**

Bardia Nadim, MD (*Presenter*) Nothing to Disclose

**T6-RCP25E** **Resident Competition**

Surbhi Raichandani, MD (*Presenter*) Nothing to Disclose

**T6-RCP25F** **Resident Competition**

Kevin K. Fung, MBBS, FRCR (*Presenter*) Nothing to Disclose

**T6-RCP25G** **Resident Competition**

Rui Dai, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T7-CCH06

## Staging Updates in Thoracic Malignancy (TNM 9)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E451A

Mylene T. Truong, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the 9th edition of the staging system for lung cancer, thymic epithelial tumors and mesothelioma. 2) Review the rationale for changes proposed in N and M staging for lung cancer. 3) Review the rationale for changes proposed in T staging for thymic epithelial tumors and mesothelioma.

**COURSE DESCRIPTION**

Staging classification provides universal, well-defined nomenclature to describe the anatomic extent of tumor: T for the primary tumor, N for nodal involvement and M for distant metastases. Updates in staging are needed to optimize tailored patient treatment. The proposed changes in TNM 9th edition are based on data collected by the International Association for the Study of Lung Cancer database.

**Sub-Events**

### T7-CCH06B Lung Cancer

Ioannis Vlahos, MBBS, FRCR (*Presenter*) Director, Grayscale Ltd;Co-owner, Grayscale Ltd;

### T7-CCH06C Thymoma

Edith M. Marom, MD (*Presenter*) Speaker, Boehringer Ingelheim GmbH;Speaker, Merck & Co, Inc;Speaker, AstraZeneca PLC

### T7-CCH06D Mesothelioma

Chad D. Strange, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T7-CGU03

## GU Case-Based Audience Participation Session: Advanced

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E353B

Shaun A. Wahab, MD (*Moderator*) Consultant, GlaxoSmithKline plc;Consultant, BioClinica, Inc;Consultant, Mersana Therapeutics, Inc
Joanie M. Garratt, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Engage in a fast-paced audience participation session with a variety of genitourinary cases to challenge yourself and have fun while doing so.

2) Interpret common and uncommon GU cases from the adrenal glands, kidneys, ureters/bladder, prostate, and gynecologic oncology.

3) Identify pearls and pitfalls of challenging GU cases that will aid in making the correct diagnoses.

**COURSE DESCRIPTION**

Join us for an exciting interactive hour of challenging genitourinary cases moderated and presented by experts! Audience members will have the opportunity to join the fun and test their diagnostic skills on topics including the adrenal glands, kidneys, ureters/bladder, prostate, and gynecologic oncology.

**Sub-Events**

### T7-CGU03C Adrenal

Anugayathri Jawahar, MD (*Presenter*) Nothing to Disclose

### T7-CGU03D Kidney

Sung Yoon Park, MD (*Presenter*) Nothing to Disclose

### T7-CGU03E Bladder/Ureter

Kristen Olinger, MD (*Presenter*) Nothing to Disclose

### T7-CGU03F Prostate

Angela Tong, MD (*Presenter*) Equipment support, Siemens AG

### T7-CGU03G GynOnc

Shaun A. Wahab, MD (*Presenter*) Consultant, GlaxoSmithKline plc;Consultant, BioClinica, Inc;Consultant, Mersana Therapeutics, Inc

# Abstract Archives of the RSNA, 2024

T7-CNMMI12

## Case-based Review of PET/CT: Lung Cancer and Lymphoma

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S405

Giuseppe Esposito, MD (*Moderator*) Medical Advisory Board

**LEARNING OBJECTIVES**

1) Understand best clinical practices for use and interpretation of PET in patients with lung cancer. 2) Understand best clinical practices for use and interpretation of PET for lymphoma.

**COURSE DESCRIPTION**

PET has revolutionized the staging and monitoring of response for lung cancer and lymphoma and thus accurate reads are of the utmost importance for patient management. In this session, experts in PET will use clinical cases to demonstrate fundamentals of interpretation, as well as pearls and pitfalls to help improve interpretation of PET studies involving lung cancer and lymphoma.

**Sub-Events**

### T7-CNMMI12B Lung Cancer

Munir Ghesani, MD (*Presenter*) Author, Siemens AG;Speaker, Siemens AG

### T7-CNMMI12C Lymphoma

Kathryn A. Morton, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T7-COB08

## Imaging Ovarian Cancer: Radiologists as Partners in Cancer Care

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S502

Atul B. Shinagare, MD (*Moderator*) Consultant, VirtualScopics, Inc;Consultant, Imaging Endpoints

**LEARNING OBJECTIVES**

1) Understand role of CT in assessment of incidental adnexal masses. 2) Discuss role of imaging in the initial staging of advanced ovarian cancer.

**COURSE DESCRIPTION**

Incidental adnexal lesions are commonly detected on CT but there is confusion about the role of CT in guiding further management of these lesions. Ovarian cancer is one of the leading causes of cancer deaths in women. Radiologists play an important role in the initial staging and guiding the management of advanced ovarian cancer. While CT is the most common modality used for staging, role of MRI for this purpose is evolving. This didactic refresher course will address various imaging considerations around detection and staging of ovarian cancer.

**Sub-Events**

### T7-COB08B Incidental Ovarian Lesions on CT: When is it Cancer

Atul B. Shinagare, MD (*Presenter*) Consultant, VirtualScopics, Inc;Consultant, Imaging Endpoints

### T7-COB08C Ovarian Cancer Staging: Pretreatment Imaging Evaluation (CT, MRI, PET)

Yuliya Lakhman, MD (*Presenter*) Stockholder, Y-mAbs Therapeutics Inc;Consultant, Perceptive Informatics, LLC

### T7-COB08D Predicting Extent of Disease: MRI versus CT

Andrea G. Rockall, FRCR, MRCP (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T7-CRT03

## ASRT@RSNA: Patient Partnerships – Journey to Implementation in Academic Programs

Tuesday, Dec. 3 3:00PM - 4:00PM Room: N226

Susie M. Moseley, MS, RT (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Summarize the importance of patient partnerships in health care education. 2) Share insights on implementing patient partnerships into academic programs. 3) Discuss current patient partnership activities in imaging programs.

**COURSE DESCRIPTION**

In diagnostic imaging, the patient is at the center of what we do and why we do it. Technology continues to advance and improve care; however, the human element will always be the most critical part of our role. In the past 20 years, there has been a greater focus on patient and family-centered care in our health care systems and that is filtering into education programs as well. Traditionally, postsecondary education programs focus on students and their needs. However, the re-emphasizing of the patient voice has shifted the culture in our programs. This session looks at the journey a postsecondary education program in Canada is taking to implement the patient voice and perspective into its curriculum. The speaker will discuss the importance of the patient voice in education and how to balance that with students' needs. Attendees will learn about the framework, tools and committees created to provide structure and guidance for the faculty during implementation. The speaker will describe patient partnership models in health care and how those models were used as a foundation to develop patient partnerships in education. Attendees will discover ways to work with patients through co-learning, co-creating, co-developing and sharing.

**Sub-Events**

**T7-CRT03B** **Patient Partnerships - Journey to Implementation in Academic Programs**

Jennifer Brown (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T7-CVA03

## Practical Applications of Advanced Vascular Imaging

Tuesday, Dec. 3 3:00PM - 4:00PM Room: N229

Michael Markl, PhD (*Moderator*) Research support, Siemens AG Research Grant, Circle Cardiovascular Imaging Inc
Jeremy D. Collins, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the applications of advanced imaging technologies including photon counting CT, 4D flow MRI and PET imaging in non-coronary vascular disease. 2) Consider opportunities for AI to improve imaging evaluation of non-coronary vascular disease.

**COURSE DESCRIPTION**

Cross-sectional imaging methods have advanced our capabilities in the in-vivo assessment of vascular disease. This course will review the current clinical applications of advance vascular imaging techniques including photon counting CT, 4D flow MRI, and PET imaging. Additionally clinical applications of Artificial Intelligence methods will be discussed in the context of advanced vascular imaging applications.

**Sub-Events**

### T7-CVA03C Photon Counting CT in Non-Coronary Vascular Imaging

Anushri Parakh, MBBS, MD (*Presenter*) Nothing to Disclose

### T7-CVA03D 4D Flow MRI: Clinical Implementation and Analysis

Bradley D. Allen, MD, MS (*Presenter*) Consultant, Circle Cardiovascular Imaging Inc;Speaker, WebMD LLC

### T7-CVA03E PET Imaging in Vascular Disease

Molly Roseland, MD (*Presenter*) Nothing to Disclose

### T7-CVA03F Clinical Applications of AI in Vascular Disease

Domenico Mastrodicasa, MD (*Presenter*) Stockholder, Segmed, Inc;Consultant, Segmed, Inc

# Abstract Archives of the RSNA, 2024

T7-RCP03

## Japan Presents: Unique Evolution and Global Influence of Japanese Radiology

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E352

Noriko Aida, MD, PhD (*Moderator*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the unique evolution and current state of radiology in Japan, even in challenging circumstances, which may serve as a reference for other countries. 2) Share insights into the diverse global landscape of radiology.

**COURSE DESCRIPTION**

Japan is in a unique situation, having the highest number of CT and MRI units per capita in the world despite having far fewer radiologists compared to North America. Despite this challenging situation, radiology in Japan has achieved remarkable development. In this session, we will introduce our struggles, efforts, achievements, current status, and future prospects in various fields.

**Sub-Events**

### T7-RCP03C Overview of the Japanese Healthcare System and JRS

Kei Yamada, MD, PhD (*Presenter*) Research funded, Fukushima SiC Applied Engineering, Inc;Research funded, Nihon Medi-Physics Co, Ltd;Research funded, PDR Network, LLC;Research funded, Doctor-NET. Inc

### T7-RCP03D Development of the Japan-Medical Image Database for Data Science by Japan Radiological Society

Toshiaki Akashi, MD (*Presenter*) Nothing to Disclose

### T7-RCP03E Accreditation Organization for Management of Radiologic Imaging - To Promote Medical Safety and Quality Control

Osamu Abe, MD, PhD (*Presenter*) Nothing to Disclose

### T7-RCP03F The State of Diversity and Inclusion Within the Japanese Radiological Society: Today's Efforts and Tomorrow's Vision

Noriko Oyama-Manabe, MD, PhD (*Presenter*) Grant, DAIICHI SANKYO Group;Grant, Bayer AG;Grant, Eisai Co, Ltd;Grant, Canon Medical Systems Corporation

### T7-RCP03G RSNA Closing Remarks

Curtis P. Langlotz, MD, PhD (*Presenter*) Stockholder, whiterabbit.ai;Advisor, whiterabbit.ai;Stockholder, Galileo CDS, Inc;Advisor, Galileo CDS, Inc;Stockholder, Bunker Hill, Inc;Board of Directors, Bunker Hill, Inc;Stockholder, Sirona Medical, Inc;Advisor, Sirona Medical, Inc

# Abstract Archives of the RSNA, 2024

T7-RCP27

## The New Era of Performance Evaluation (Sponsored by the RSNA Quality Improvement Committee)

Tuesday, Dec. 3 3:00PM - 4:00PM Room: N227B

Nadja Kadom, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Use KPI for specific goals. 2) Describe examples of patient care KPI. 3) Implement a new approach to performance evaluation. 4) Implement personalized feedback for radiologists.

**COURSE DESCRIPTION**

This course differentiates between various uses for key performance indicators (KPI), and focuses on KPI that can lead to better patient care. The session describes a new approach to KPI for technologists. Rad-Path correlation is described as an example of personalized and private performance feedback.

**Sub-Events**

### T7-RCP27B Performance Indicators: Compliance, Improvement, or Business?

Nadja Kadom, MD (*Presenter*) Nothing to Disclose

### T7-RCP27C KPI for Patient Care Improvement

Alex Towbin, MD (*Presenter*) Author, RELX;Consultant, Anderson Publishing, Ltd;Advisory Board, KLAS Enterprises LLC;Travel support, Merative LP

### T7-RCP27D New Approach to Technologist Performance Evaluation

Laura A Benson (*Presenter*) Nothing to Disclose

### T7-RCP27E My Personalized Feedback Example: Rad-Path Correlation

Ankur Doshi, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T8-CBR04

## BI-RADS 6th Edition Updates and Challenging Cases

Tuesday, Dec. 3 4:30PM - 5:30PM Room: S406A

Stamatia V. Destounis, MD (*Moderator*) Medical Advisory Board, iCad, Inc

### LEARNING OBJECTIVES

1) Identify the updates and additions in the mammography, ultrasound, MRI and Audit and outcomes sections of the 6th Edition BI-RADS Atlas. 2) Explain the clinical applications and utilization of the updated descriptors and audit processes.

### COURSE DESCRIPTION

This course will provide standardized breast imaging terminology, report organization, assessment structure and a classification system for mammography, ultrasound and MRI of the breast.

Through a medical audit and outcome monitoring, the system provides important mechanisms for peer review and quality assurance data to improve the quality of patient care.

**Sub-Events**

### T8-CBR04B Mammo

Stamatia V. Destounis, MD (*Presenter*) Medical Advisory Board, iCad, Inc

### T8-CBR04C Ultrasound

Jessica W. Leung, MD (*Presenter*) Scientific Advisory Board, Subtle Medical, Inc;Speaker, General Electric Company;Speaker, Hologic, Inc;Scientific Advisory Board, Seno Medical Instruments, Inc

### T8-CBR04D MRI

Roberta M. Strigel, MD, MS (*Presenter*) Research support, General Electric Company

### T8-CBR04E Auditing and Outcomes Monitoring

Peter R. Eby, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CCA03

## Fundamentals of Cardiac MRI for Nonischemic Cardiomyopathies - A Case-Based Review

Tuesday, Dec. 3 4:30PM - 5:30PM Room: E353C

Bradley D. Allen, MD, MS (*Moderator*) Consultant, Circle Cardiovascular Imaging Inc;Speaker, WebMD LLC
Jadranka Stojanovska, MD, MS (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Review current best-practices for CMR evaluation of non-ischemic cardiomyopathy. 2) Discuss CMR interpretation and reporting in non-ischemic cardiomyopathy to provide accurate diagnosis and risk-stratification. 3) Highlight areas of uncertainty in the current diagnostic approach and when other tools and modalities can be helpful.

### COURSE DESCRIPTION

Cardiac MRI (CMR) is an important tool for providing accurate diagnosis and risk-stratification for non-ischemic cardiomyopathies. In this course, learners will be presented with a broad overview of the current state-of-the-art for CMR evaluation of multiple non-ischemic cardiomyopathies. Topics will be presented in a case-based lecture format highlighting relevant CMR acquisitions and interpretation approaches, with a data-driven focus on current best-practices for providing optimal patient care.

**Sub-Events**

### T8-CCA03C Differentiating Hypertrophic Heart Diseases

Bradley D. Allen, MD, MS (*Presenter*) Consultant, Circle Cardiovascular Imaging Inc;Speaker, WebMD LLC

### T8-CCA03D Restrictive Cardiomyopathy: Causes and Imaging Appearance

Jadranka Stojanovska, MD, MS (*Presenter*) Nothing to Disclose

### T8-CCA03E Systemic Diseases Affecting the Heart

Karen G. Ordovas, MD, MS (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T8-CCH07

## Fundamentals of HRCT

Tuesday, Dec. 3 4:30PM - 5:30PM Room: E451A

Smita Patel, MBBS, FRCR (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Evaluate HRCT images for the presence of key imaging features, including lung cysts, pulmonary fibrosis and micronodules. 2) Define key imaging features used to characterize pulmonary fibrosis. 3) Formulate a differential diagnosis based on the presence of cysts and micronodules in the lungs.

**COURSE DESCRIPTION**

This course will review three important topics needed to evaluate HRCT of the lungs and is intended for radiologists re-reviewing the fundamentals of this important aspect of chest radiology. We will use didactic and case-based material to review how to evaluate cystic and micronodular lung disease and how to categorize pulmonary fibrosis.

**Sub-Events**

**T8-CCH07B** **Cystic Lung Disease**

Brent P. Little, MD (*Presenter*) Nothing to Disclose

**T8-CCH07C** **Categorizing Lung Fibrosis**

James F. Gruden, MD (*Presenter*) Nothing to Disclose

**T8-CCH07D** **Micronodular Lung Disease**

Smita Patel, MBBS, FRCR (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CER17

## It’s a Full Moon: A Nightmare on Night Float, Trauma Cases

Tuesday, Dec. 3 4:30PM - 5:30PM Room: N228

Laura L. Avery, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Improve your speed for diagnosing various traumatic injuries in hopes of achieving a state of Zen during the trauma STAT. 2) Develop mastery and confidence in communicating imaging findings quickly and gracefully; establish dominance over trauma surgeons.

**COURSE DESCRIPTION**

As your grandmother said, “Nothing good happens after midnight; the only thing open is the 7-11 and trouble”. Unfortunately, you are spending Saturday night in a dark room overwhelmed by trauma CT scans- just another night of saving people from their own bad ideas. Spend an hour reviewing rapid-fire trauma cases with an emphasis on tricky traumatic injuries.

**Sub-Events**

**T8-CER17B** **Losing the Game of Chutes and Ladders: Cervical Spine Trauma**

Laura L. Avery, MD (*Presenter*) Nothing to Disclose

**T8-CER17C** **Your Uber Had Florida License Plates: Chest and Aortic Trauma**

Ashwin V. Asrani, MD (*Presenter*) Nothing to Disclose

**T8-CER17D** **Drag Racing in a Prius: Abdominal Trauma**

Polina Kanj, MD (*Presenter*) Nothing to Disclose

**T8-CER17E** **Band-Aids Don't Fix Bullet Holes: Ballistic Injuries**

Noah G. Ditkofsky, MD, FRCPC (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CGI08

## Essentials of GI Imaging

Tuesday, Dec. 3 4:30PM - 5:30PM Room: E451B

Khaled M. Elsayes, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify common and uncommon imaging findings in patients with biliary disease and gallbladder pathology. 2) Review the imaging appearance of small bowel neuroendocrine neoplasms and splenic lesions.

**COURSE DESCRIPTION**

This session will include lectures describing imaging findings in patients with biliary disease, gallbladder pathology, small bowel neuroendocrine neoplasms, and splenic lesions.

**Sub-Events**

### T8-CGI08B Gallbladder Pathology

Vincent M. Mellnick, MD (*Presenter*) Nothing to Disclose

### T8-CGI08C Small Bowel Neuroendocrine Neoplasms

Shannon P. Sheedy, MD (*Presenter*) Nothing to Disclose

### T8-CGI08D Biliary Imaging

Jeong Hee Yoon, MD (*Presenter*) Speaker, Bayer AG;Grant, Koninklijke Philips NV

### T8-CGI08E Splenic Lesions

Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T8-CHN08

## Horse or Zebra? Case-Based Review of High Yield Head and Neck Topics

Tuesday, Dec. 3 4:30PM - 5:30PM Room: E351

Elizabeth George, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Recognize typical and atypical imaging features of thyroid, parathyroid, odontogenic, salivary and vascular lesions.

2) Differentiate thyroid, parathyroid, odontogenic, salivary and vascular lesions from relevant mimics.

**COURSE DESCRIPTION**

In this case-based Head and Neck session, attendees will be presented with frequently and rarely seen thyroid, parathyroid, odontogenic, salivary and vascular lesions. Speakers will emphasize imaging pearls that distinguish the common diagnoses from the unusual and infrequent, as well as how not to get fooled by mimics and pitfalls. This session offers attendees the opportunity to refine their interpretation of complex head and neck imaging studies by incorporating tips from world experts.

**Sub-Events**

### T8-CHN08B Thyroid and Parathyroid Lesions

C. Douglas Phillips, MD (*Presenter*) Nothing to Disclose

### T8-CHN08C Odontogenic Lesions

Osamu Sakai, MD, PhD (*Presenter*) Consultant, Boston Imaging Core Lab LLC

### T8-CHN08D Salivary Lesions

Christine M. Glastonbury, MBBS (*Presenter*) Author with royalties, RELX;

### T8-CHN08E Vascular Lesions

Deborah R. Shatzkes, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CIN02

## Artificial Intelligence Empowered Radiology: Unleashing the Power of Language Models for an Intelligent Future

Tuesday, Dec. 3 4:30PM - 5:30PM Room: E450B

Zi Zhang, MD, MSc (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Address the educational need for integrating advanced artificial intelligence (AI) Language Models into the radiology field. 2) Equip radiologists, radiology residents, medical educators, and healthcare IT professionals with the knowledge to harness AI in enhancing the quality and efficiency of radiological services. 3) Explore the impact of AI on medical imaging, research, and education, learning to translate complex data into insightful narratives. 4) Offer a unique journey into the future of radiological practice, where advanced AI tools and human expertise converge to create new standards in medical imaging, research, education, and presentation effectiveness.

**COURSE DESCRIPTION**

This course includes four lectures as listed below:

1. Transforming Current Practices with AI Language Models in Radiology:

In this session, attendees will discover how AI language models like Google's Gemini and custom ChatGPTs can improve radiology practices. We will demonstrate the practical applications of these tools in enhancing report generation and communication. Participants will learn how Google's Gemini can simplify complex imaging results for patients, and how ChatGPT can be utilized to create clear and concise radiology reports. This session will highlight the role of AI in improving workflow efficiency, report accuracy, and communication between radiologists, referring physicians, and patients, thereby advancing patient care and collaboration within the healthcare system.

2. Tailored AI Language Models for Personalized Radiology Education:

Participants in this session will be introduced to the concrete applications of AI language models in radiology education. We will dissect how AI language models analyze learner performance data to create a customized educational experience that identifies individual learning gaps and tailors' content accordingly. The session will provide a walk-through of an AI-powered module that adjusts the complexity of cases and questions based on the learner's progress, thereby supporting radiologists in mastering nuanced diagnostic skills.

3. AI Language Models in Radiological Research Innovation:

In this session, participants will explore the use of AI language models, including Google's NotebookLM, in radiological research. We will demonstrate how NotebookLM acts as a virtual research assistant, summarizing literature, clarifying complex concepts, and stimulating creative thought based on the user's uploaded documents. Custom ChatGPTs, designed for specific medical domains, will also be covered, highlighting their utility in synthesizing data and enhancing research output.

4. Creating Radiology Presentations and Patient Education Materials with AI language models:

In this workshop, attendees will be guided on leveraging AI language models to craft dynamic radiology presentations and engaging patient education content. Radiologists will acquire skills for the efficient production of lecture slides and educational materials. Through practical demonstrations, the session will showcase the potential of AI language models in enhancing presentation effectiveness and enriching patient education.

**Sub-Events**

### T8-CIN02B Transforming Current Practices with AI Language Models in Radiology

Marc D. Kohli, MD (*Presenter*) Founder, Alara Imaging;Stockholder, Alara Imaging

### T8-CIN02C Tailored AI Language Models for Personalized Radiology Education

Abhi Jain, DO, MEd (*Presenter*) Nothing to Disclose

### T8-CIN02D AI Language Models in Radiological Research Innovation

Zi Zhang, MD, MSc (*Presenter*) Nothing to Disclose

### T8-CIN02E Creating Radiology Presentations and Patient Education Materials with AI language Models

Tessa S. Cook, MD, PhD (*Presenter*) Grant, Independence Blue Cross;Speaker, Sectra AB;

# Abstract Archives of the RSNA, 2024

T8-CIR04

## Management of Complications from Endovascular Interventions

Tuesday, Dec. 3 4:30PM - 5:30PM Room: E352

Gloria M. Salazar, MD (*Moderator*) Consultant, Speakers Bureau, Medtronic plc;Consultant, Boston Scientific Corporation;Speakers Bureau, Boston Scientific Corporation;Speakers Bureau, Cook Group Incorporated;Consultant, Avail Medsystems, Inc;Consultant, Mentice AB

**Sub-Events**

### T8-CIR04B General Strategies to Deal with Complications?

Gloria M. Salazar, MD (*Presenter*) Consultant, Speakers Bureau, Medtronic plc;Consultant, Boston Scientific Corporation;Speakers Bureau, Boston Scientific Corporation;Speakers Bureau, Cook Group Incorporated;Consultant, Avail Medsystems, Inc;Consultant, Mentice AB

### T8-CIR04C Arterial Dissection, Perforation and Rupture: What To Do?

Sharjeel Sabir, MD (*Presenter*) Travel support, Johnson & Johnson;

### T8-CIR04D Approach to Complications from Venous Thrombectomy

Timo A. Auer, MD (*Presenter*) Nothing to Disclose

### T8-CIR04E Management of Complications from Pulmonary AVM Embolization

Clifford R. Weiss, MD (*Presenter*) Research Grant, Siemens AG;Consultant, Siemens AG;Research Grant, Boston Scientific Corporation;Consultant, Boston Scientific Corporation;Research Grant, Medtronic plc;Consultant, Medtronic plc;Research Grant, Guerbet SA;Consultant, Guerbet SA

### T8-CIR04F Extreme IR Case: Step by Step

Sarah B. White, MD, MS (*Presenter*) Consultant, Cook Group Incorporated;Consultant, Guerbet SA;Research support, Guerbet SA;Consultant, DB Medical Supplies, Inc;Consultant, Sirtex Medical Ltd;Research support, InSightec Ltd;Speakers Bureau, Penumbra, Inc

# Abstract Archives of the RSNA, 2024

T8-CMK09

## Imaging of Infection: Patterns, Complications and Things not to Miss

Tuesday, Dec. 3 4:30PM - 5:30PM Room: E353B

William B. Morrison, MD (*Moderator*) Co-founder, Trace Orthopedics;Patent agreement, Trace Orthopedics;Consultant, AprioMed AB;Patent agreement, AprioMed AB;Consultant, Centinel Spine, LLC;Consultant, Medical Metrics, Inc

**LEARNING OBJECTIVES**

1) Discuss key diagnostic features of multimodal imaging of infection including osteomyelitis, joint, soft tissue and spine infection. 2) Explain complications and important features to be included in the imaging report to assist with patient management.

**COURSE DESCRIPTION**

This session focuses on imaging of infection and includes important information on imaging of acute and chronic osteomyelitis, joint, soft tissue and spine infection. The lectures will provide essential pearls and pitfalls relating to the diagnostic assessment and multimodal imaging evaluation of infection. The expected outcome is for participants to review and understand patterns of infection, complications and essential features not to miss.

**Sub-Events**

### T8-CMK09B Chronic Osteomyelitis: Pearls and Pitfalls

William B. Morrison, MD (*Presenter*) Co-founder, Trace Orthopedics;Patent agreement, Trace Orthopedics;Consultant, AprioMed AB;Patent agreement, AprioMed AB;Consultant, Centinel Spine, LLC;Consultant, Medical Metrics, Inc

### T8-CMK09C Acute Osteomyelitis: What to Include in your Imaging Report

Claus S. Simpfendorfer, MD (*Presenter*) Nothing to Disclose

### T8-CMK09D Joint Infection Imaging: Multimodal Imaging Evaluation

Pamela J. Walsh, MD (*Presenter*) Nothing to Disclose

### T8-CMK09E Soft Tissue Infection: Everything but the Bones and Joints

Alessandra J. Sax, MD (*Presenter*) Nothing to Disclose

### T8-CMK09F Spine Infection: Diagnosis and Mimics

Douglas N. Mintz, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CMS02

## What Test is the Best: Point Counterpoint Debate on CEUS vs MRI

Tuesday, Dec. 3 4:30PM - 5:30PM Room: E353A

John S. Pellerito, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Discuss pros and cons of CEUS versus MRI in evaluation of liver neoplasms. 2) Discuss pros and cons of CEUS versus MRI in evaluation of pediatric pathologies. 3) Discuss pros and cons of CEUS versus MRI in the evaluation of vascular and abdominal/pelvic pathological processes, including but not limited to aorta and post EVAR, kidney neoplasms, solid organ transplants, organs of reproduction and more.

**COURSE DESCRIPTION**

The session provides a review of various applications of CEUS vs MRI in a point counterpoint format, where the speakers have a chance to debate about the benefits and limitations of each of these modalities when applied to a specific organ assessment. Discussion will involve comparison of CEUS vs MRI in evaluation of liver and renal lesions, solid organ transplants, gastrointestinal tract, gyn, pediatrics, and vascular systems with emphasis on ease to perform these studies, skill set needed for interpretation of the findings, associated reimbursement issues, as well as sensitivity and accuracy of these modalities in making a correct diagnosis.

**Sub-Events**

### T8-CMS02B Role of CEUS in Kidneys, Liver, Vascular, and Gynecology

John S. Pellerito, MD (*Presenter*) Nothing to Disclose

### T8-CMS02C CEUS or MRI: When is CEUS Preferred in Pediatric Imaging?

Harriet J. Paltiel, MD (*Presenter*) Nothing to Disclose

### T8-CMS02D MRI vs CEUS in Abdomen

Corinne Deurdulian, MD (*Presenter*) Nothing to Disclose

### T8-CMS02E MRI vs CEUS in Gynecology

Mark E. Lockhart, MD, MPH (*Presenter*) Author, Jaypee Brothers Medical Publishers Ltd;Author, Reed Elsevier;Employee, Journal of Ultrasound in Medicine;

### T8-CMS02F Role of CEUS in Evaluation of Liver Lesions

Maria Cristina Chammas, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CNPM05

## Peer Learning Among the Nations (Sponsored by the ACR Peer Learning Committee and RSNA Quality Improvement Committee)

Tuesday, Dec. 3 4:30PM - 5:30PM Room: S402

Jennifer C. Broder, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the objectives of Peer Learning programs. 2) Understand various models of peer learning implementation across several countries. 3) Identify opportunities for advancement of peer learning initiatives internationally.

**COURSE DESCRIPTION**

Peer learning has become a pillar of radiology quality improvement programs internationally. This session will explore trends and examples of peer learning implementation in the U.S, Canada, Switzerland and England. Presentations will share uptake, best practices, and ideas for future directions. Presentations will be followed by a panel discussion on the opportunities for growth of peer learning between nations.

**Sub-Events**

**T8-CNPM05B** **USA: Spreading Peer Learning to Improve Culture, Systems, and Patient Care**

Richard E. Sharpe JR, MD, MBA (*Presenter*) Nothing to Disclose

**T8-CNPM05C** **North of the Border: Peer Learning Updates from Canada**

Ania Z. Kielar, MD, FRCPC (*Presenter*) Nothing to Disclose

**T8-CNPM05D** **Ignition, Implementation & Sustainability of Peer Learning in a Swiss Private Practice Setting**

Benoit Rizk, MD (*Presenter*) Shareholder, GLEAMER

**T8-CNPM05E** **It's Not About the Errors, It's About the Learning: The UK Royal College of Radiologists National Radiology Events and Learning Meetings (REALM) Initiative**

Jonathan T. Smith, MBChB, FRCR (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CNR09

## Essential Updates in Ischemic Stroke Imaging and Treatment

Tuesday, Dec. 3 4:30PM - 5:30PM Room: N227B

Arindam R. Chatterjee, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the latest clinical trial developments in large core and distal vessel ischemic stroke therapy. 2) Explain standard-of-care neuroimaging in ischemic stroke and the latest changes in 2024. 3) Understand the expanding frontier of ongoing ischemic stroke trials and neuroimaging implications that are likely to report results in 2025.

**COURSE DESCRIPTION**

Ischemic stroke therapy has undergone a paradigm shift in the last decade with a flurry of groundbreaking randomized clinical trials expanding eligibility criteria. Developments in neuroimaging acquisition, processing, and interpretation have been critical in the design and implications of the latest clinical trials. Learn from neuroradiology and neurointerventional experts working at the frontier as we discuss the latest and ongoing ischemic stroke clinical trials focusing on large core infarctions and distal vessel occlusions and their implications for neuroimaging expectations. The standard-of-care in ischemic stroke is changing – catch up with the latest in 2024. The educational formal will be lectures.

**Sub-Events**

**T8-CNR09B** **Large Core Ischemic Stroke Trials - The Evidence and What You Need to Know**

Achala S. Vagal, MD (*Presenter*) Departmental Research Grant, Johnson & Johnson

**T8-CNR09C** **Limits of Endovascular Therapy for Large Core Patients- Are We There Yet? Implications for Imaging and Future Directions**

Arindam R. Chatterjee, MD (*Presenter*) Nothing to Disclose

**T8-CNR09D** **Improving Acute Stroke Medium and Distal Vessel Occlusion Detection and Update on Current Trials**

Dylan Wolman, MD (*Presenter*) Nothing to Disclose

**T8-CNR09E** **Future of Acute Stroke Endovascular Therapy Trials and the Role of Neuroimaging**

Benjamin Pulli, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CPD03

## Pediatric Lymphoma vs Sarcoma vs Mimickers

Tuesday, Dec. 3 4:30PM - 5:30PM Room: E350

Adina L. Alazraki, MD (*Moderator*) Nothing to Disclose
Larry A. Binkovitz, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the use of imaging techniques to evaluate the most common pediatric soft tissue sarcomas, identifying key imaging features by advanced MRI (DC-MRI and DWI) for diagnosis and re-assessment. 2) Describe the role of imaging, the diversity of imaging findings and unique features in pediatric lymphoma and its mimickers which may help guide imaging protocols. 3) Review anatomic (CT and MRI) and functional (PET) imaging techniques, including AI and deep learning; identify updated COG recommendations for imaging and surveillance as well as those that apply to patients with cancer predisposition syndromes.

**COURSE DESCRIPTION**

This pediatric imaging course aims to provide the learner with methods to diagnose and evaluate soft tissue sarcomas using advanced MRI techniques as well as novel functional PET and deep learning approaches. In addition to reviewing the most common pediatric sarcomas and their look alikes, this session will cover pediatric lymphoma, diagnosis, staging and restaging using advanced imaging techniques. This will be a high yield course for all radiologists with interest in pediatric sarcoma, lymphoma and cancer predisposition syndromes.

**Sub-Events**

**T8-CPD03C** **Soft Tissue Sarcomas in Children: The Better, The Bad and The Ugly**

Emilio Inarejos Clemente, MD (*Presenter*) Nothing to Disclose

**T8-CPD03D** **Lymphoma in Children and its Various Looks**

Eman E. Marie, MD, MSc (*Presenter*) Nothing to Disclose

**T8-CPD03E** **Mimickers of Pediatric Lymphoma and Sarcoma**

Victor M. Ho-Fung, MD (*Presenter*) Nothing to Disclose

**T8-CPD03F** **Novel Techniques and Approaches for Diagnosis and Prognosis of Pediatric Cancer**

Stephan D. Voss, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CPH04

## Tales from the Bedside: Clinical Experiences with AI in Medical Imaging (Supported in part by an Unrestricted Medical Education Grant from Siemens Healthineers of Siemens Medical Solutions, USA, Inc)

Tuesday, Dec. 3 4:30PM - 5:30PM Room: S404

Lubomir M. Hadjiiski, PhD (*Moderator*) Nothing to Disclose
Samuel G. Armato III, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the FDA requirements for the approval of CAD-AI tools prior to clinical adoption. 2) Describe the role of clinical acceptance testing from the perspectives of generalizability, efficiency in a clinical workflow, output explainability, and performance stability over time. 3) Identify practical considerations for the translation of CAD-AI tools to the clinic, including the human-machine interface, user training, and prospective surveillance. 4) Discuss challenges and opportunities of large-scale implementation of radiology AI systems, including the quantitative evaluation of their real-world usefulness in clinical practice.

**COURSE DESCRIPTION**

Artificial intelligence (AI) and machine learning techniques are finding their way into a wide variety of applications across the healthcare enterprise. These techniques have advanced the computer-aided diagnosis (CAD) paradigm by incorporating newer deep-learning-based approaches to achieve an expanded clinical decision support environment referred to as "CAD-AI." It is of paramount importance to ensure that a clinical decision support tool undergoes proper training and rigorous validation of its generalizability and robustness before adoption for patient care. Ongoing QA after clinical installation is also essential. An AAPM task group developed recommendations on practices and standards for the development and performance assessment of CAD-AI decision support systems. With CAD applications expanding to new stages of the patient care process, this educational session will explore the broader issues common to the translation of CAD-AI applications from the bench to the clinic. The goal of this lecture-based session (followed by discussion) is to bring attention to the advantages and challenges associated with the adoption of CAD-AI systems for clinical decision support. The presentations will focus on (1) the FDA approval process of CAD-AI tools, (2) clinical acceptance (generalizability, efficiency of use in a clinical workflow, explainability of the output, and performance consistency over time), (3) translation of CAD-AI tools to the clinic (the human-machine interface, user training, acceptance testing, and prospective surveillance), and (4) challenges and opportunities of large-scale implementation of radiology AI systems, including the quantitative evaluation of their real-world usefulness in clinical practice.

**Sub-Events**

### T8-CPH04C FDA Approval of CAD-AI Tools: Necessary but Not Sufficient for Clinical Adoption

Ravi K. Samala, PhD (*Presenter*) Nothing to Disclose

### T8-CPH04D Clinical Acceptance Testing of CAD-AI Tools: Generalizability, Explainability, and Performance Stability

Ronald M. Summers, MD, PhD (*Presenter*) Royalties,iCAD, Inc;Royalties, Koninklijke Philips NV;Royalties, ScanMed, LLC;Royalties, Ping An Insurance (Group) Company of China, Ltd;Royalties, Translation Holdings;Research support, Ping An Insurance (Group) Company of China, Ltd

### T8-CPH04E Clinical Implementation of CAD-AI Tools: The Human-machine Interface, User Training, and Prospective Surveillance

Axel Wismueller, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-CRO05

## Musculoskeletal MDC Review

Tuesday, Dec. 3 4:30PM - 5:30PM Room: S401

Edward Y. Kim, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Expose the attendees to multidisciplinary discussion when treating sarcomas and other musculoskeletal malignancies. 2) Demonstrate specific imaging findings that directly affect staging and treatment decisions. 3) Provide the audience with specific information they should include in their reports that directly after prognosis and management.

**COURSE DESCRIPTION**

This multidisciplinary panel will discuss a series of challenging soft tissue and bone sarcoma cases. The session will highlight the importance of imaging in the diagnosis and treatment of these rare tumors. Panelists will represent radiology, orthopedic oncology, medical oncology, and radiation oncology.

**Sub-Events**

**T8-CRO05B** **Musculoskeletal MDC Review**

Meng X. Welliver, MD, PhD (*Presenter*) Advisory Board, NovoCure Ltd;Advisory Board, Eli Lilly and Company

**T8-CRO05C** **Musculoskeletal MDC Review**

Seth Pollack, MD (*Presenter*) Consultant, Bayer AG;Consultant, Deciphera Pharmaceuticals, LLC;Consultant, Apexigen Inc;Consultant, T-Knife, GmbH;Consultant, Aadi Bioscience, Inc;Consultant, Epizyme, Inc;Consultant, Obsidian;Consultant, Sensei;Consultant, SpringWorks Therapeutics, Inc

**T8-CRO05D** **Musculoskeletal MDC Review**

F. Joseph Simeone, MD (*Presenter*) Nothing to Disclose

**T8-CRO05E** **Musculoskeletal MDC Review**

Kevin Raskin, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-RCP19

## MIDRC: Engaging the Cancer Imaging Research Community (Sponsored by the RSNA Radiology Informatics Committee)

Tuesday, Dec. 3 4:30PM - 5:30PM Room: N226

Adam E. Flanders, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand the purpose of the Medical Imaging and Data Repository (MIDRC). 2) Review metrics describing the progress in data dissemination and AI research so far. 3) Examine possible futures for MIDRC as it expands to other disease areas, including cancer.

**COURSE DESCRIPTION**

The Medical Imaging and Data Resource Center (MIDRC), initially funded through the National Institute of Biomedical Imaging and Bioengineering (NIBIB) under the National Institutes of Health (NIH) special emergency COVID-19 process, is an open-access platform for medical images and associated data. After collecting more than 300,000 imaging studies on COVID-19 patients, the initiative is expanding to engage the cancer imaging research community. This session will describe the purpose of MIDRC, its progress so far, and how it is expanding its scope.

**Sub-Events**

### T8-RCP19B Role of MIDRC Within the ARPA-H Structure

Maryellen L. Giger, PhD (*Presenter*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC

### T8-RCP19C MIDRC's Diversity Calculator

Heather Whitney, PhD (*Presenter*) Nothing to Disclose

### T8-RCP19D MIDRC's Diversity Calculator

Robert Tomek, MSc (*Presenter*) Employee, Quantitative Insights, Inc

### T8-RCP19E Harnessing the Power of Radiologists for the Advancement of AI Through MIDRC

Adam E. Flanders, MD (*Presenter*) Nothing to Disclose

### T8-RCP19F Harnessing the Power of Radiologists for the Advancement of AI Through MIDRC

George L. Shih, MD, MS (*Presenter*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

### T8-RCP19G Role of MIDRC in the Cancer Imaging Research Community

Adam E. Flanders, MD (*Presenter*) Nothing to Disclose

### T8-RCP19H Role of MIDRC Within the ARPA-H Structure

Christopher Meyer, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T8-RCP29

## Deep Tech Innovation in Medical Imaging: The Roles of EIC and ARPA-H

Tuesday, Dec. 3 4:30PM - 5:30PM Room: S406B

Alex Towbin, MD (*Moderator*) Author, RELX;Consultant, Anderson Publishing, Ltd;Advisory Board, KLAS Enterprises LLC;Travel support, Merative LP

**LEARNING OBJECTIVES**

Explore the latest advancements in deep tech innovation within the field of radiology; understand the role of the European Innovation Council (EIC) and U.S. Advanced Research Projects Agency for Health (ARPA-H) in managing and fostering these innovations; discuss the impact of these innovations on clinical practices, patient outcomes, and future research directions.

**Sub-Events**

### T8-RCP29B Deep Tech Innovations in Radiology and their Clinical Applications

Mathias Prokop, MD, PhD (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation;Research Grant, Siemens AG;Speakers Bureau, Siemens AG

### T8-RCP29C Role of the European Innovation Council (EIC)

Federica Zanca, PhD (*Presenter*) Nothing to Disclose

### T8-RCP29D Role of the Advanced Research Projects Agency for Health (ARPA-H)

Ileana Hancu, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-CBR12

## Breast Cancer Screening and Risk for Intermediate Risk Patient

Wednesday, Dec. 4 8:00AM - 9:00AM Room: S406A

Elizabeth A. Morris, MD (*Moderator*) Scientific Advisory Board, Bracco Group;Speaker, Bayer AG;Scientific Advisory Board, Bayer AG;Speaker, Guerbet SA;Researcher, Guerbet SA;Stockholder, Revel Transit Inc;Stockholder, Kheiron Medical Technologies Ltd

**LEARNING OBJECTIVES**

1) Understand how to identify the intermediate risk patient. 2) Describe the current imaging modalities that may benefit the intermediate risk patient. 3) Review current risk assessment algorithms.

**COURSE DESCRIPTION**

Guidelines on how to screen are clear for high-risk and average-risk patients however there are limited guidelines for the intermediate-risk patient. Identifying the intermediate-risk patient is challenging and not uniformly agreed upon. This course will address the current thinking on risk assessment and how to screen these important patients.

**Sub-Events**

**W1-CBR12B** **Screening With US? Should We Do It for All Women With Dense Breasts?**

Jocelyn A. Rapelyea, MD (*Presenter*) Speakers Bureau, General Electric Company

**W1-CBR12C** **Screening for Everyone With Breast MRI If Average or Intermediate Risk?**

Pascal A. Baltzer, MD (*Presenter*) Nothing to Disclose

**W1-CBR12D** **Image Based Risk Assessment and Risk Adjusted Screening**

Elizabeth A. Morris, MD (*Presenter*) Scientific Advisory Board, Bracco Group;Speaker, Bayer AG;Scientific Advisory Board, Bayer AG;Speaker, Guerbet SA;Researcher, Guerbet SA;Stockholder, Revel Transit Inc;Stockholder, Kheiron Medical Technologies Ltd

# Abstract Archives of the RSNA, 2024

W1-CCA09

## Cardiac CT Updates 2024

Wednesday, Dec. 4 8:00AM - 9:00AM Room: N227B

Jill E. Jacobs, MD (*Moderator*) Nothing to Disclose
Pamela K. Woodard, MD (*Moderator*) Researcher, Siemens AG;Consulting, Medtronic plc;Researcher, Bayer AG;Patent, Washington University

**LEARNING OBJECTIVES**

1) Understand the current benefits and limitations of cardiac CT perfusion and CT FFR based on decades of experience. 2) Identify the importance of quantitative atherosclerotic plaque imaging and reporting. 3) Recognize the utility of cardiac CT for planning minimally invasive cardiac surgery.

**COURSE DESCRIPTION**

This Cardiac Updates 2024 session will provide attendees with the state-of-the-art information on cardiac CT perfusion, CT FFR, quantitative atherosclerotic plaque imaging and reporting, and utilization of cardiac CT for planning minimally invasive cardiac surgery.

**Sub-Events**

### W1-CCA09C Truth and Myths About Cardiac CT Perfusion - Two Decades of Experience

Michelle C. Williams, MBChB, PhD (*Presenter*) Speakers Bureau, Canon Medical Systems Corporation;Speakers Bureau, Siemens AG

### W1-CCA09D Truth and Myths about CT FFR - A Decade of Experience

Lynne M. Hurwitz Koweek, MD (*Presenter*) Departmental Research Grant, Siemens AG;Departmental Research Grant, HeartFlow, Inc;Departmental Research Grant, Verily Lifesciences LLC

### W1-CCA09E Quantitative Atherosclerotic Plaque Imaging: Pushing the Limits With CAD RAD 2.0

Jonathon A. Leipsic, MD (*Presenter*) Consultant, Heartflow, Inc;Consultant, Circle Cardiovascular Imaging Inc;Speakers Bureau, General Electric Company;Research Grant, Edwards Lifesciences Corporation;Research Grant, Medtronic plc;Research Grant, Abbott Laboratories;Research Grant, Boston Scientific Corporation;Research Grant, PI-Cardia Ltd

### W1-CCA09F Cardiac CT in Minimally Invasive Cardiac Surgery Planning

Carole A. Ridge, FFR(RCSI) (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-CCH08

## Imaging Pulmonary Infection - An International Perspective

Wednesday, Dec. 4 8:00AM - 9:00AM Room: E451A

Jeffrey P. Kanne, MD (*Moderator*) Research Consultant, PAREXEL International Corporation;

**LEARNING OBJECTIVES**

1) State the difference in endemic infections in the Americas, India, and Oceania. 2) Describe how travel history affects the differential diagnosis of infections. 3) Describe thoracic imaging findings of North American fungal infections, infections prevalent in South America, Mycobacterial infections in India, and infections prevalent in Oceania.

**COURSE DESCRIPTION**

This course will cover the thoracic imaging findings of North American endemic fungal infections, infections prevalent in South America, Mycobacterial infections in India, and infections in Australia and New Zealand. Learners will become familiar with infections that they may not normally encounter in their routine daily practice.

**Sub-Events**

### W1-CCH08B North American Fungal Infections

Jeffrey P. Kanne, MD (*Presenter*) Research Consultant, PAREXEL International Corporation;

### W1-CCH08C South American Prevalent Infections

Bruno Hochhegger, MD,PhD (*Presenter*) Nothing to Disclose

### W1-CCH08D Mycobacterial Infections in India

Harsh Mahajan, MD, MBBS (*Presenter*) Director, Mahajan Imaging Pvt Ltd;Research collaboration, General Electric Company;Research collaboration, Koninklijke Philips NV;Research collaboration, Qure.ai;Research collaboration, Nference, Inc

### W1-CCH08E Infections in Australia/New Zealand

Sharyn L. MacDonald, MBChB, FRANZCR (*Presenter*) Employee, Pacific Radiology;Shareholder, Pacific Radiology

# Abstract Archives of the RSNA, 2024

W1-CER16

## What Do You Worry About and Know Less of in the ER?

Wednesday, Dec. 4 8:00AM - 9:00AM Room: N228

Sameer B. Raniga, MD, FRCR (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify key diagnostic challenges and strategies in emergency radiology cases that overlap with other subspecialties such as neuro, head-neck, and nuclear medicine. 2) Explain the complexities and nuances involved in acute care settings through case studies, expert insights, and interactive discussions. 3) Enhance diagnostic acumen in emergency radiology by uncovering hidden complexities and improving understanding of lesser-exposed areas.

**COURSE DESCRIPTION**

Emergency radiology often intersects with other radiology subspecialties, presenting unique diagnostic challenges to emergency radiologists. This session, "What Do You Worry About and Know Less of in the ER?" is crucial for radiologists seeking to enhance their expertise in emergency radiology by delving into lesser-known areas that overlap with neuro, head-neck, and nuclear medicine.

Participants will engage in an interactive educational format featuring a mix of case studies, expert insights, and discussions that will guide attendees through real-world scenarios, highlighting the nuances and intricacies of emergency radiology.

The expected outcome is for learners to gain a deeper understanding of the diagnostic challenges in emergency radiology, develop enhanced diagnostic acumen, and be better prepared to manage complex cases that span multiple subspecialties. This session promises to be an invaluable resource for those looking to elevate their skills and confidence in the ER.

**Sub-Events**

**W1-CER16B** **Paranasal Sinus Imaging On-Call: Non-Traumatic Emergencies**

Sameer B. Raniga, MD, FRCR (*Presenter*) Nothing to Disclose

**W1-CER16C** **Nuclear Medicine On-Call: What Emergency Radiologists Don't Know**

Don C. Yoo, MD (*Presenter*) Consultant, Konica Minolta, Inc

**W1-CER16D** **Non-Traumatic Spine Emergencies On-Call: Cross-Roads of ER and Neuroradiology**

Wende N. Gibbs, MD, MA (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-CGI13

## Multi-Energy & Photon Counting CT

Wednesday, Dec. 4 8:00AM - 9:00AM Room: E451B

Benjamin M. Yeh, MD (*Moderator*) Grant, Koninklijke Philips NV;Grant, General Electric Company;Consultant, Canon Medical Systems Corporation;Speaker, Canon Medical Systems Corporation;Royalties, Oxford University Press;Shareholder, Nextrast, Inc;Board Member, Nextrast, Inc

**LEARNING OBJECTIVES**

1) Describe the clinical benefits of multi-energy CT of the abdomen and pelvis. 2) Identify methods to introduce multi-energy CT to clinical practice. 3) Describe photon counting CT technology and the advantages of this technology for clinical diagnosis. 4) Review ways in which photon counting CT can be used to improve evaluation of the abdomen and pelvis. 5) Explain how multi-energy CT may influence the way we use contrast agents now and in the future.

**COURSE DESCRIPTION**

Multi-energy CT has opened new diagnostic possibilities for abdominopelvic imaging. Benefits of multi-energy CT include increased reader confidence for a range of clinical diagnoses, increased sensitivity for subtle lesions, improved detection of iodine enhancement, and reduction of common CT artifacts. The recent introduction of photon counting CT further augments our ability to obtain crisp high resolution imaging of the abdomen and pelvis with improved iodine detection and reduced radiation dose. Multi-energy CT allows unprecedented accuracy in the delineation of otherwise subtle or ambiguous contrast agent enhancement. Conversely novel non-iodine contrast agents promise to unlock information-rich capabilities of our modern multi-energy CT scanners.

**Sub-Events**

### W1-CGI13B Interpretation of Abdominal Pelvic Dual Energy CT in Daily Practice

Bari Dane, MD (*Presenter*) Nothing to Disclose

### W1-CGI13C Practical Clinical Adoption of Dual Energy CT

Alvin C. Silva, MD (*Presenter*) Scientific Advisory Committee, HealthMyne, Inc;Consultant, Exact Sciences Corporation;Research Grant, Ascelia Pharma AB

### W1-CGI13D Principles of Photon Detector Counting CT

Cynthia H. McCollough, PhD (*Presenter*) Research Grant, Siemens AG

### W1-CGI13E Photon Counting CT in Clinical Practice

Joel G. Fletcher, MD (*Presenter*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc

### W1-CGI13F Contrast Agents at Multi-Energy CT

Benjamin M. Yeh, MD (*Presenter*) Grant, Koninklijke Philips NV;Grant, General Electric Company;Consultant, Canon Medical Systems Corporation;Speaker, Canon Medical Systems Corporation;Royalties, Oxford University Press;Shareholder, Nextrast, Inc;Board Member, Nextrast, Inc

# Abstract Archives of the RSNA, 2024

W1-CGU06

## Gender-Affirming Surgery and Health in the Trans Community

Wednesday, Dec. 4 8:00AM - 9:00AM Room: E350

Angela Tong, MD (*Moderator*) Equipment support, Siemens AG
Elainea N. Smith, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand correct and inclusive terminology to use in the setting of gender-affirming care. 2) Understand the common surgeries in gender affirming care. 3) Identify the common complications in gender-affirming imaging.

**COURSE DESCRIPTION**

This course will discuss the best practices of imaging in gender-affirming care with emphasis on proper communication, common surgeries, and common surgical complications.

**Sub-Events**

### W1-CGU06C Understanding the Epidemiology, Gender-Affirming Steps, and Cancer Care in Transgender Individuals

Justin Stowell, MD (*Presenter*) Nothing to Disclose

### W1-CGU06D Navigating the Post-Operative Landscape: Anatomy, Complications, and Imaging Strategies

Maurice M. Garcia, MD, MS (*Presenter*) Nothing to Disclose

### W1-CGU06E Empowering Gender-Affirming Radiology: Basic Terminology, Reporting Pitfalls, and Enhancement of Patient Experience

Evelyn Carroll, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-CIN18

## Regulatory Landscape of AI in the US and Beyond

Wednesday, Dec. 4 8:00AM - 9:00AM Room: E450B

Bernardo C. Bizzo, MD, PhD (*Moderator*) Consultant, Diagnosticos da America (Dasa)

**LEARNING OBJECTIVES**

1) Understand the US regulatory review process for AI/ML-based devices, evolving AI landscape and enhancing transparency. 2) Appreciate how the US regulatory framework translates into clinical research to support the FDA clearance/approval process and clinical use of AI/ML-based devices. 3) Explain the regulatory clearance/approval process for AI/ML-based devices in Europe and upcoming European legislation related to AI.

**COURSE DESCRIPTION**

This session will include lectures about the regulatory framework and processes for AI/ML-based software medical devices in the US and Europe from the perspective of the regulators (FDA, CE Mark), industry, and healthcare consumers.

**Sub-Events**

### W1-CIN18B FDA-Regulatory Considerations for AI/ML-based SaMD

Robert Ochs, PhD (*Presenter*) Nothing to Disclose

### W1-CIN18C Regulating AI Devices in the US: User Perspective

James M. Hillis, MBBS, DPhil (*Presenter*) Research funded, General Electric Company;Research funded, Annalise-AI Pty Ltd;Investor, Elly Health Inc

### W1-CIN18D Use of AI in European Clinical Practice

Jacob J. Visser, MD, PhD (*Presenter*) Medical Advisor, Contextflow GmbH;Medical Advisor, Quibim SL;Medical Advisor, NLC Ventures Netherlands BV;Medical Advisor, Noaber Foundation

### W1-CIN18E AI Regulatory Landscape: Industry Perspective

Camille Vidal (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-CIR05

## Management of Thrombotic Venous Interventions (Including PE)

Wednesday, Dec. 4 8:00AM - 9:00AM Room: E352

Kush R. Desai, MD (*Moderator*) Speakers Bureau, Cook Group Incorporated Consultant, Cook Group Incorporated Consultant, Koninklijke Philips NV Speakers Bureau, Becton, Dickinson and Company Consultant, Becton, Dickinson and Company Speakers Bureau, Boston Scientific Corporation
Mona B. Ranade, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Describe the workup and selection of patients for interventional treatment of venous thromboembolism. 2) Understand the attributes of various thrombus management technologies. 3) Learn how to manage difficult interventions and procedure-related complications.

### COURSE DESCRIPTION

In this session, we will examine the role of modern technology in the workup, selection, and treatment of patients with venous thromboembolism. Further, we will discuss optimal procedural technique and best practice management of adverse events.

**Sub-Events**

### W1-CIR05C Artificial Intelligence and the Diagnosis and Management of Pulmonary Embolism

Scott T. Williams, MD (*Presenter*) Nothing to Disclose

### W1-CIR05D Current State of Clinical Trials in the Management of Pulmonary Embolism

Victor F. Tapson, MD (*Presenter*) Research, sanofi-aventis Group;Research, Actelion Ltd;Research, Gilead Sciences, Inc;Research, United Therapeutics Corporation;Research, Bayer AG;Research, Novartis AG;Research, Pfizer Inc;Consultant, sanofi-aventis Group;Consultant, Actelion Ltd;Consultant, Gilead Sciences, Inc;Consultant, United Therapeutics Corporation;Consultant, Bayer AG;Consultant, Novartis AG;Consultant, Bristol-Myers Squibb Company;Speaker, sanofi-aventis Group;Speaker, Actelion Ltd;Speaker, Gilead Sciences, Inc;Speaker, United Therapeutics Corporation

### W1-CIR05E Point/Counterpoint: Lysis Should be the Standard of Care for Sub-massive Pulmonary Embolism

Kush R. Desai, MD (*Presenter*) Speakers Bureau, Cook Group Incorporated Consultant, Cook Group Incorporated Consultant, Koninklijke Philips NV Speakers Bureau, Becton, Dickinson and Company Consultant, Becton, Dickinson and Company Speakers Bureau, Boston Scientific Corporation

### W1-CIR05F Point/Counterpoint: Aspiration Thrombectomy Should be the Standard of Care for Sub-massive Pulmonary Embolism

Bernhard Gebauer, MD (*Presenter*) Speaker, PAREXEL International Corporation;Speaker, Becton, Dickinson and Company;Speaker, Sirtex Medical Ltd;Speaker, Abbott Laboratories;Speaker, Cook Group Incorporated;Speaker, AngioDynamics, Inc;Speaker, PharmCept;Speaker, ewimed GmbH;Speaker, Novartis AG;Speaker, F. Hoffmann-La Roche Ltd;Speaker, Merck & Co, Inc;Speaker, ICON plc;Speaker, Ipsen SA;Speaker, Bayer AG;Speaker, Pfizer Inc;Speaker, Guerbet SA;Speaker, Terumo Corporation

### W1-CIR05G Complications in the Endovascular Management of Pulmonary Embolism

Venkat Tummala, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-CMK05

## Knee Imaging: Pre and Post Operative Evaluation

Wednesday, Dec. 4 8:00AM - 9:00AM Room: E450A

Soterios Gyftopoulos, MD, MBA (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To provide a comprehensive update on knee imaging, including the latest imaging techniques and understanding of important clinical pathologies such as post-operative ACL, meniscal tears, and knee arthroplasty complications.

**COURSE DESCRIPTION**

This course consists of five lectures that will review the imaging options and important imaging findings in the following categories: post-operative ACL imaging, Meniscal tears, Patellar instability, extensor mechanism injuries, and knee arthroplasty complications.

**Sub-Events**

### W1-CMK05B Post-operative ACL Imaging: Complications to Look For

Soterios Gyftopoulos, MD, MBA (*Presenter*) Nothing to Disclose

### W1-CMK05C Imaging of Meniscal Tears: The Basics

Jie C. Nguyen, MD, MS (*Presenter*) Nothing to Disclose

### W1-CMK05D Imaging of Patellar Instability

Erin F. Alaia, MD (*Presenter*) Biorez Inc, Consultant

### W1-CMK05E Extensor Mechanism

Leon Lenchik, MD (*Presenter*) Nothing to Disclose

### W1-CMK05F Knee Arthroplasty Imaging: Pearls and Pitfalls

Kara D. Gaetke-Udager, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-CMS10

## RSNA Hands-On Lab: Contrast Reaction Management (Registration Fee Required)

Wednesday, Dec. 4 8:30AM - 10:30AM Room: E265

Carolyn L. Wang, MD (*Moderator*) Research Grant, General Electric Company

**LEARNING OBJECTIVES**

1) Recognize various types of contrast reactions and the proper management of various types of contrast reactions through hands-on simulation-based training. 2) Learn with hands-on practice the proper administration of various routes of epinephrine as well as other medications to treat the more common hypersensitivity contrast reactions. 3) Recognize and manage a contrast reaction in a sedated patient and pediatric patient.

**COURSE DESCRIPTION**

In Person Session Only. Tickets must be purchased in advance for this course. This course can be added through the registration portal or by stopping by the Registration Desk. Space is limited. Through hands-on high-fidelity simulation scenario training, learners will practice recognizing and managing various types of contrast reactions. Following a brief lecture, learners will rotate through multiple stations during the course to gain individual hands-on experience. To enhance the learner's experience and allow for more time in the hands-on stations, we ask all learners for the course to watch this short 15 min. video on contrast reaction management prior to the course: https://www.youtube.com/watch?v=9r-_E8dmJ0A

**Sub-Events**

**W1-CMS10B** **RSNA Hands-On Lab: Contrast Reaction Management**

Carina W. Yang, MD (*Presenter*) Nothing to Disclose

**W1-CMS10C** **RSNA Hands-On Lab: Contrast Reaction Management**

Alisa Sumkin, DO (*Presenter*) Speaker, Siemens AG;Speaker, Devicor Medical Products, Inc

**W1-CMS10D** **RSNA Hands-On Lab: Contrast Reaction Management**

Benjamin Mervak, MD (*Presenter*) Nothing to Disclose

**W1-CMS10E** **RSNA Hands-On Lab: Contrast Reaction Management**

Erik Soloff, MD (*Presenter*) Nothing to Disclose

**W1-CMS10F** **RSNA Hands-On Lab: Contrast Reaction Management**

Kirk G. Banerian, MD, BS (*Presenter*) Nothing to Disclose

**W1-CMS10G** **RSNA Hands-On Lab: Contrast Reaction Management**

Anup J. Alexander, MD (*Presenter*) Nothing to Disclose

**W1-CMS10H** **RSNA Hands-On Lab: Contrast Reaction Management**

Stephen C. O'Connor, MD (*Presenter*) Nothing to Disclose

**W1-CMS10I** **RSNA Hands-On Lab: Contrast Reaction Management**

Matthew A. Silbergleit, MD (*Presenter*) Nothing to Disclose

**W1-CMS10J** **RSNA Hands-On Lab: Contrast Reaction Management**

Senta M. Berggruen, MD (*Presenter*) Nothing to Disclose

**W1-CMS10K** **RSNA Hands-On Lab: Contrast Reaction Management**

Linda C. Kelahan, MD (*Presenter*) Nothing to Disclose

**W1-CMS10L** **RSNA Hands-On Lab: Contrast Reaction Management**

Melissa M. Picard, MD (*Presenter*) Nothing to Disclose

**W1-CMS10M** **RSNA Hands-On Lab: Contrast Reaction Management**

Ahmed Gabr, MD, MBBCh (*Presenter*) Nothing to Disclose

**W1-CMS10N** **RSNA Hands-On Lab: Contrast Reaction Management**

Shilpa Reddy, MD (*Presenter*) Nothing to Disclose

**W1-CMS10O** **RSNA Hands-On Lab: Contrast Reaction Management**

Derek G. Hesse, MD (*Presenter*) Nothing to Disclose

**W1-CMS10P** **RSNA Hands-On Lab: Contrast Reaction Management**

Hongmin Xu, MD (*Presenter*) Nothing to Disclose

**W1-CMS10Q** **RSNA Hands-On Lab: Contrast Reaction Management**

Emily Lowery, DO (*Presenter*) Nothing to Disclose

**W1-CMS10R** **RSNA Hands-On Lab: Contrast Reaction Management**

William Chen, MD (*Presenter*) Nothing to Disclose

**W1-CMS10S** **RSNA Hands-On Lab: Contrast Reaction Management**

Adlai R. Grayson, MD (*Presenter*) Nothing to Disclose

**W1-CMS10T** **RSNA Hands-On Lab: Contrast Reaction Management**

Rami El-Baba, DO (*Presenter*) Nothing to Disclose

**W1-CMS10U** **RSNA Hands-On Lab: Contrast Reaction Management**

Stanley Chu, MD (*Presenter*) Nothing to Disclose

**W1-CMS10V** **RSNA Hands-On Lab: Contrast Reaction Management**

Nayla Mroueh, MD (*Presenter*) Nothing to Disclose

**W1-CMS10W** **RSNA Hands-On Lab: Contrast Reaction Management**

Esther Kim, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W1-CNR10

## Looking Beyond the Occlusion: Imaging Markers of Heightened Stroke Risk

Wednesday, Dec. 4 8:00AM - 9:00AM Room: S406B

Hediyeh Baradaran, MD, MS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify appropriate imaging in patients with embolic stroke of undetermined source. 2) Develop an approach for interpreting intracranial vessel wall imaging and evaluating risk of extracranial carotid plaque. 3) Identify markers of heightened stroke risk on standard neuroimaging.

**COURSE DESCRIPTION**

This lecture-based session will review imaging markers of heightened stroke risk frequently encountered in neuroimaging in both emergent and non-emergent settings. The session will be comprised of individual talks from both a vascular neurologist and neuroradiologists discussing critical imaging findings which may aid in stroke risk classification and future stroke mitigation. Talks will focus on imaging of embolic stroke of undetermined source from a neurologist's perspective, utilizing intracranial vessel wall imaging for ischemic stroke, extracranial carotid plaque classification and stroke risk, and other imaging findings of heightened stroke risk.

**Sub-Events**

### W1-CNR10B Changing Landscape of ESUS: When and Why We Image: A Neurologist's Perspective

Hooman Kamel, MD (*Presenter*) Investigator, Pfizer Inc;In-kind support, F. Hoffmann-La Roche Ltd;Committee member, Medtronic plc;Committee member, Boehringer Ingelheim GmbH

### W1-CNR10C Using Intracranial Vessel Wall Imaging in Stroke Workup

Jae W. Song, MD, MS (*Presenter*) Nothing to Disclose

### W1-CNR10D Extracranial Carotid Plaque: Standardizing Risk Reporting

Tobias Saam, MD (*Presenter*) Nothing to Disclose

### W1-CNR10E Brain Imaging Markers of Stroke Risk

Hediyeh Baradaran, MD, MS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-COB06

## Endometrial and Cervical Cancer: Imaging Before and After Treatment

Wednesday, Dec. 4 8:00AM - 9:00AM Room: E351

Jeanne M. Horowitz, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Explain what radiologists need to know about the new 2023 Endometrial Cancer FIGO Guidelines to add value in their reports for their ordering physicians, featuring interactive cases. 2) Review how to optimize and interpret cervical cancer MRI exams for staging, with interesting case examples. 3) Learn pearls and pitfalls of imaging endometrial and cervical cancer after treatment with practical take home points.

**COURSE DESCRIPTION**

"Endometrial and Cervical Cancer: Imaging Before and After Treatment" will feature three lecturers using interactive imaging case examples and giving practical take home points focusing on the new 2023 Endometrial Cancer FIGO Guidelines, Cervical Cancer staging with MRI, and Imaging of Endometrial and Cervical Cancer after treatment.

**Sub-Events**

### W1-COB06B Endometrial Cancer: New 2023 FIGO Guidelines

Jeanne M. Horowitz, MD (*Presenter*) Nothing to Disclose

### W1-COB06C Cervical Cancer: Staging using MRI

Lauren A. Roller, MD (*Presenter*) Nothing to Disclose

### W1-COB06D Imaging after Cancer Treatment: Pearls and Pitfalls

Aradhana Venkatesan, MD (*Presenter*) Research Grant, Siemens;Honorarium, Elsevier

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

W1-CPH08

## Clinical Implementation and Standardization of Proton Magnetic Resonance Spectroscopy

Wednesday, Dec. 4 8:00AM - 9:00AM Room: S404

Yuxiang Zhou, PHD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the physical principles of magnetic resonance spectroscopy (MRS) and MRS pulse sequences. 2) Describe strategies to effectively acquire, analyze, and quantify the quality of MRS data. 3) Discuss emerging applications of MRS in clinical practice. 4) Provide MRS reporting standards and discuss future perspectives in clinical reality.

**COURSE DESCRIPTION**

Magnetic resonance spectroscopy (MRS) permits the quantification of metabolites within a diverse range of tissues and pathologies. This metabolic information has been shown to enable better diagnoses, personalized treatments, and rapid assessment of treatment response. However, implementation of MRS remains challenging and consistent acquisition of high-quality data remains difficult due to the lack of technical standardization. This session will provide experts' advice, consensus recommendations, standardization of MRS acquisition, analysis and reporting to improve MRS quality in routine clinical practice. First, this educational course will introduce the physical principles of MRS and describe the latest clinically available MRS pulse sequences. Next, this course will present strategies to effectively and consistently acquire high-quality MRS data, robustly analyze this data, and perform MRS quality management in routine clinical practice. Finally, this session will discuss established and emerging applications of MRS, reporting standards and future perspectives in clinical reality.

**Sub-Events**

**W1-CPH08B** **Magnetic Resonance Spectroscopy: Fundamental Physics and Emerging Technologies**

Samuel A. Einstein, PhD (*Presenter*) Nothing to Disclose

**W1-CPH08C** **Standardization of Data Acquisition and Analysis of Clinical Magnetic Resonance Spectroscopy**

Yuxiang Zhou, PHD (*Presenter*) Nothing to Disclose

**W1-CPH08D** **MRS Applications, Reporting Standards and Future Perspectives in Clinical Reality**

Ichiro Ikuta, MD, MMedSc (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-CRT04

## ASRT@RSNA: Thriving in an Environment of Accelerating Change: A Survival Guide for Breast Imaging Teams

Wednesday, Dec. 4 8:00AM - 9:00AM Room: N226

Susie M. Moseley, MS, RT (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand how breast imaging technologies and tools have changed over the last several years, bringing challenges, opportunities and growth to breast imaging teams. 2) Discover methods for minimizing burnout and stress caused by a physically and emotionally demanding environment. 3) Identify steps in the Guide to Thrive toolkit to overcome challenges and embrace opportunities in an environment of accelerating change.

**COURSE DESCRIPTION**

This session provides an overview of how breast imaging technologies have changed over the

last several years, bringing challenges, opportunities and growth to breast imaging teams across

the globe. The speaker will share methods for minimizing burnout and stress in a physically

and emotionally demanding environment, using new technologies, focusing on proper

ergonomics and enhancing communication skills.

**Sub-Events**

**W1-CRT04B** **Thriving in an Environment of Accelerating Change: A Survival Guide for Breast Imaging Teams**

Sarah Jacobs, BS, RT (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W1-RCP05

## RSNA/ESR Symposium: Advances in Prostate Cancer Imaging and Therapy - Early Detection and Organized Testing in US and Europe

Wednesday, Dec. 4 8:00AM - 9:00AM Room: E353B

Katarzyna J. Macura, MD, PhD (*Moderator*) Author with royalties, RELX;Research Grant, Profound Medical Inc
Ivo Schoots, MD,PhD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Discuss the evolution of diagnostic pathway and role of MRI in improving the detection and localization of life-threatening prostate cancer. 2) Describe the MRI-pathway for early detection of prostate cancer based on the North American and European guidelines and discuss how practice patterns of MR-informed prostate biopsy may differ between the US and Europe. 3) Learn about the basis for the European screening recommendations from the Europe Union's Beating Cancer Plan and discuss the challenges and controversies of prostate cancer screening vs. early detection, based on guidelines (EAU/AUA/NCCN).

### COURSE DESCRIPTION

This course highlights advancements in imaging for prostate cancer diagnosis and treatment. In this educational session, presenters will focus on early detection of prostate cancer and discuss the role of MR imaging and MR-informed prostate biopsy. Other topics will include practice patterns and guidelines in US and Europe, and controversies surrounding prostate cancer screening.

**Sub-Events**

### W1-RCP05C MR Imaging and MRI-Directed Biopsy in Early Detection in US

Katarzyna J. Macura, MD, PhD (*Presenter*) Author with royalties, RELX;Research Grant, Profound Medical Inc

### W1-RCP05D MR Imaging and Biopsy Indications in Early Detection in Europe

Patrick Asbach, MD (*Presenter*) Institutional research support, Siemens AG;Institutional research support, Canon Medical Systems Corporation;Speaker, b.e.imaging GmbH;Travel support, b.e.imaging GmbH

### W1-RCP05E MR Imaging in Screening/Organized Testing in Europe

Ivo Schoots, MD,PhD (*Presenter*) Nothing to Disclose

### W1-RCP05F Interactive Case-Vignettes US/Europe

Katarzyna J. Macura, MD, PhD (*Presenter*) Author with royalties, RELX;Research Grant, Profound Medical Inc

### W1-RCP05G Interactive Case-Vignettes US/Europe

Ivo Schoots, MD,PhD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W1-RCP26

## Root-Cause-Analysis Simulation (Sponsored by the RSNA Quality Improvement Committee)

Wednesday, Dec. 4 8:00AM - 9:00AM Room: E353A

Nadja Kadom, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Experience a simulated abbreviated Root Cause Analysis (RCA).

**COURSE DESCRIPTION**

In Person Session Only. Attendance will be limited in this room.

Participants will be presented with a error event scenario and participate in a simulated abbreviated root case analysis (RCA)

**Sub-Events**

### W1-RCP26B Root-Cause-Analysis Simulation (Sponsored by the RSNA Quality Improvement Committee)

Nadja Kadom, MD (*Presenter*) Nothing to Disclose

### W1-RCP26C Facilitator

Jay K. Pahade, MD (*Presenter*) Consultant, General Electric Company;Consultant, Clario Medical Imaging, Inc;

### W1-RCP26D Facilitator

Andrew Bowman, MD, PhD (*Presenter*) Nothing to Disclose

### W1-RCP26E Facilitator

Bettina Siewert, MD (*Presenter*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv

### W1-RCP26F Facilitator

Susan Reich (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W3-CCH09

## Update on Acute Thoracic Vascular Emergencies

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E451A

Lea Azour, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Highlight pearls and pitfalls in the imaging and diagnosis of acute pulmonary embolism. 2) Review the spectrum of acute aortic syndromes. 3) Delineate cardiac and acute coronary syndromes encountered in thoracic radiology practice.

**COURSE DESCRIPTION**

This course will provide an update on acute thoracic vascular emergencies, including imaging and interpretation of acute pulmonary embolism, acute aortic syndrome, and acute cardiac/coronary pathology.

**Sub-Events**

### W3-CCH09B Acute Pulmonary Embolism

Martine J. Remy-Jardin, MD, PhD (*Presenter*) Research Grant, Siemens AG;Speaker, Siemens AG

### W3-CCH09C Acute Aortic Syndromes

Sanjeev Bhalla, MD (*Presenter*) Advisory Board, Precisa Gravimetrics AG

### W3-CCH09D Cardiac/Coronary Acute Syndromes for the Thoracic Radiologist

Kristopher W. Cummings, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W3-CHN07

## Why Anatomy REALLY Matters in the Head and Neck

Wednesday, Dec. 4 9:30AM - 10:30AM Room: S502

Salman Qureshi, MBChB (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Develop an understanding of the underlying foundation of anatomy in head and neck imaging. 2) Ascertain the anatomical compartments related to different head and neck pathologies.

**COURSE DESCRIPTION**

This session will review essential head and neck anatomy topics that are fundamental to interpreting head and neck imaging and crafting clinically-relevant differential diagnoses

**Sub-Events**

### W3-CHN07B Nasopharynx, Oropharynx, Oral Cavity, OH MY!

Kristine M. Mosier, DMD, PhD (*Presenter*) Nothing to Disclose

### W3-CHN07C Larynx and Hypopharynx

Minerva Becker, MD, PhD (*Presenter*) Nothing to Disclose

### W3-CHN07D The Parapharyngeal Space

Katie S. Traylor, DO (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W3-CNMMI06

## NET Imaging

Wednesday, Dec. 4 9:30AM - 10:30AM Room: S405

Terence Z. Wong, MD, PhD (*Moderator*) Consultant, General Electric Company

**LEARNING OBJECTIVES**

1) Learn applications, pitfalls, and recommendations for imaging neuroendocrine neoplasms with DOTATATE and MIBG radiotracers. 2) Understand clinical applications, patient selection, and the different practical aspects of treating patients with 177Lu-DOTATATE and 131I-MIBG radiopharmaceuticals.

**Sub-Events**

**W3-CNMMI06B** **Molecular Imaging for Neuroendocrine Neoplasms**

Terence Z. Wong, MD, PhD (*Presenter*) Consultant, General Electric Company

**W3-CNMMI06C** **Advances for NET Theranostics**

Amir Iravani, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W3-CNPM17

## Re-Imagining Academia

Wednesday, Dec. 4 9:30AM - 10:30AM Room: S402

Saurabh Jha, MBBS, MRCS (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Appreciate the non-traditional methods of academic trajectory. 2) Understand how to become domain experts in global health and education. 3) Identify how success in non-traditional endeavors can be measured.

**COURSE DESCRIPTION**

Traditionally academic success has been rooted in the "publish or perish" sentiment. Much deference has been given to hypothesis-driven research work. As academia has evolved, what it means to be an academic scholar, a domain expert, and create impact has changed. This panel discussion will explore non-traditional routes to academic success, such as by advancing education, advancing imaging in resource-poor settings, and science communication, to give aspiring academic radiologists options for a fulfilling career.

**Sub-Events**

### W3-CNPM17B Fox and the Hedgehog: New and Old Academic Scholarships

Saurabh Jha, MBBS, MRCS (*Presenter*) Nothing to Disclose

### W3-CNPM17C Being Rewarded in Academia for Global Work in Radiology

Toma Omofoye, MD (*Presenter*) Nothing to Disclose

### W3-CNPM17D How to Make an Academic Career in Education

Scott A. Simpson, DO, MEd (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W3-CPD02

## Liver Disease Imaging in Children

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E350

Gary R. Schooler, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review ultrasound techniques, particularly liver shear wave elastography, and how they can be adapted to and optimized for pediatric patients in the evaluation of liver disease. 2) Summarize AI and non-AI-based MRI methods for detecting and characterizing chronic liver diseases in children. 3) Apply ultrasound and MRI techniques in the evaluation of chronic liver disease in children through case-based review.

**COURSE DESCRIPTION**

Imaging is an important component in the diagnosis and longitudinal care of many pediatric patients with liver disease. This lecture-based course will provide a review of imaging-based techniques used in the evaluation of pediatric liver diseases. Techniques ranging from quantitative ultrasound to artificial intelligence aided MRI will be reviewed and discussed by pediatric radiology content experts.

**Sub-Events**

### W3-CPD02C US Techniques for Evaluation of Diffuse Hepatic Disease: From Contrast-enhanced Sonography to Elastography

Giovanna Ferraioli, MD (*Presenter*) Speakers Bureau, Koninklijke Philips NV;Speakers Bureau, FUJIFILM Holdings Corporation;Speakers Bureau, Canon Medical Systems Corporation;Speakers Bureau, Shenzhen Mindray Bio-Medical Electronics Co, Ltd;Speakers Bureau, Siemens AG

### W3-CPD02D MRI Techniques for Evaluation of Diffuse Hepatic Disease: From Elastography to AI Techniques

Jonathan R. Dillman, MD, MSc (*Presenter*) Research Grant, Perspectum Ltd;Research Grant, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research support, Koninklijke Philips NV;Research support, General Electric Company;Research support, Motilent Ltd

### W3-CPD02E Challenging and Emblematic Cases

Erica Riedesel, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W3-CPH06

## Updates to MRI Safety Guidance for Varied MR Environments and Devices

Wednesday, Dec. 4 9:30AM - 10:30AM Room: N227B

Michael N. Hoff, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe unique MRI safety considerations and corresponding guidance in radiation oncology environments. 2) Describe unique MRI safety considerations and corresponding guidance in low field, high field, and alternate layout MR environments. 3) Understand unique concerns of implants and devices within the context of new MR environments.

**COURSE DESCRIPTION**

MRI safety guidance is continually evolving to keep pace with the changing MRI landscape. Recent years have seen the introduction of novel clinical MR environments, including those with the MR/LINAC and ultra-high and low field systems, challenging the abilities of institutions, governing bodies, and regulators to stay abreast of the wave of change. It is not only essential that new safety standards for these diverse environments are established, but it is also necessary to clearly communicate new guidance to radiological personnel in a timely fashion. These lectures will outline key MRI safety considerations involving radiation oncology, variable magnetic fields, and patients with implants and devices, with special attention paid to the unique challenges in each environment, how radiologists, physicists, and technologists can address them.

**Sub-Events**

### W3-CPH06B MRI Safety Guidance in Alternate Fields; The Highs and Lows

Michael N. Hoff, PhD (*Presenter*) Nothing to Disclose

### W3-CPH06C Current MR Safety Guidance in Radiation Oncology Environments

Lisa Singer, MD, PhD (*Presenter*) Nothing to Disclose

### W3-CPH06D Updates on MR Safety Guidance for Imaging Patients with Implanted Medical Devices

R. Jason Stafford, PhD (*Presenter*) Nothing to Disclose

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# Abstract Archives of the RSNA, 2024

W3-CRO09

## Lung/Mediastinum MDC Review

Wednesday, Dec. 4 9:30AM - 10:30AM Room: S401

Simon S. Lo, MBChB (*Moderator*) Committee member, Elekta AB

**LEARNING OBJECTIVES**

1) Discuss the imaging evaluation of thoracic malignancies. 2) Discuss the work-up of thoracic malignancies. 3) Discuss the multidisciplinary management of intrathoracic malignancies.

**COURSE DESCRIPTION**

In this course, 4 cases of thoracic malignancies will be included for multidisciplinary discussion. The panel will consist of a diagnostic radiologist, a thoracic surgeon, a thoracic medical oncologist, and a radiation oncologist.

**Sub-Events**

**W3-CRO09B** **Lung/Mediastinum MDC Review**

Michelle S. Ginsberg, MD (*Presenter*) Speaker, Ultimate Opinions In Medicine LLC

**W3-CRO09C** **Lung/Mediastinum MDC Review**

Rafael Santana-Davila, MD (*Presenter*) Nothing to Disclose

**W3-CRO09D** **Lung/Mediastinum MDC Review**

Percy Lee, MD (*Presenter*) Consultant, ViewRay, Inc

**W3-CRO09E** **Lung/Mediastinum MDC Review**

David W. Johnstone, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W3-CRT05

## ASRT@RSNA: Managing the Pediatric Patient

Wednesday, Dec. 4 9:30AM - 10:30AM Room: N226

Susie M. Moseley, MS, RT (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Recognize the pediatric patient's feelings through facial expressions. 2) Understand the role of the child life specialist. 3) Recognize tips and tricks to avoid procedure sedation. 4) Identify how to increase pediatric patient satisfaction.

### COURSE DESCRIPTION

Although health care encompasses all ages, the pediatric population often feels afraid and anxious in the health care environment. White coat syndrome is when the patient experiences anxiety around physicians and the patient's blood pressure subsequently rises. Pediatric patients can feel anxious and scared because they don't know what is going to happen or the procedure that's going to take place, and they may fear pain from the needle placement. This session provides education on how to interpret the patients' feelings through their facial expressions and understand their age specific needs. Attendees will learn about the child life specialist role, patient education and distraction techniques, and how teamwork can support the best experience possible for pediatric patients.

**Sub-Events**

### W3-CRT05B Managing the Pediatric Patient

Jason K. Lee, MSc (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W3-RCP06

## RSNA/ESR Symposium: Advances in Prostate Cancer Imaging and Therapy - Management Strategies for Monitoring Prostate Cancer

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E353B

Tristan Barrett, MBBS, MD (*Moderator*) Nothing to Disclose
Andrei S. Purysko, MD (*Moderator*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;

### LEARNING OBJECTIVES

1) Discuss the implications of overdiagnosis and overtreatment in prostate cancer management, with a focus on how biopsy regimens contribute to these challenges. 2) Review the indications, adoption, and risk assessment in active surveillance in North America and Europe, and discuss differences. 3) Describe the scenarios for abbreviated prostate MRI and discuss the pros and cons of contrast-enhanced imaging and how the omission of MR sequences may impact the diagnostic accuracy.

### COURSE DESCRIPTION

This session will cover the impact of various biopsy strategies on early detection and active surveillance in the US, and compare active surveillance approaches between Europe and the US, highlighting key differences in indications and definitions. Additionally, participants will assess the pros and cons of contrast-enhanced imaging and the indications for abbreviated prostate MRI. This session will provide critical insights and practical strategies to enhance prostate cancer management through a combination of informative lectures and interactive discussions.

**Sub-Events**

### W3-RCP06C Impact of Biopsy Strategies in Early Detection and Active Surveillance in US

Andrei S. Purysko, MD (*Presenter*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;

### W3-RCP06D Active Surveillance in Europe and How Indications/Definitions May Differ between US and Europe

Tristan Barrett, MBBS, MD (*Presenter*) Nothing to Disclose

### W3-RCP06E Contrast-enhanced Imaging and Indications for Abbreviated Prostate MRI: Pros and Cons

Patrick Asbach, MD (*Presenter*) Institutional research support, Siemens AG;Institutional research support, Canon Medical Systems Corporation;Speaker, b.e.imaging GmbH;Travel support, b.e.imaging GmbH

# Abstract Archives of the RSNA, 2024

W3-RCP23

## RadioGraphics: Editor's Picks/Choice Over the Years

Wednesday, Dec. 4 9:30AM - 10:30AM Room: S501

Christine O. Menias, MD (*Moderator*) Royalties, RELX
Mark M. Hammer, MD (*Moderator*) Nothing to Disclose
Antonio Luna, MD, PhD (*Moderator*) Speaker, General Electric Company

**LEARNING OBJECTIVES**

1) Identify and comprehend the key characteristics of different disease entities discussed in top RadioGraphics papers from the past year. 2) Correlate anatomic, pathologic, and imaging findings for a variety of pathologic conditions relevant to clinical radiology practice. 3) Understand the clinical significance and management implications of diseases from select RadioGraphics papers from the past year.

**COURSE DESCRIPTION**

RadioGraphics: Editor’s Choice course will highlight 4 published papers from the last year , where authors will summarize key points from their manuscripts highlighting the significance of imaging findings, clinical significance and management implications to the wider radiology community

**Sub-Events**

### W3-RCP23D Low Rectal Cancers at Initial Staging MRI

Matthew H. Lee, MD (*Presenter*) Nothing to Disclose

### W3-RCP23E CT Approach to Lung Injury

Kaitlin Marquis, MD (*Presenter*) Nothing to Disclose

### W3-RCP23F Amyloid Related Imaging Abnormalities in Patients with Alzheimer's Disease Treated with Anti-Amyloid Beta Therapy

Pavan Brahmbhatt, MBBS (*Presenter*) Nothing to Disclose

### W3-RCP23G Advanced Applications Of Gadoxetic Acid-enhanced Magnetic Resonance Imaging: What To Expect?

Sandra Baleato Gonzalez, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W4-CIN10

## AI that Knows When it Doesn’t Know – Uncertainty Quantification and Safe Clinical Integration of AI Algorithms

Wednesday, Dec. 4 11:00AM - 12:00PM Room: E450B

Natalia Alves, MSc (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand and explain the importance of uncertainty quantification (UQ) in AI predictions and its impact on clinical decision-making. 2) Describe the latest UQ methods and their applications in medical imaging to enhance the reliability of AI-generated outcomes. 3) Apply practical UQ strategies in daily work as radiologists, AI vendors, or AI scientists to improve the trustworthiness of AI predictions in clinical settings.

**COURSE DESCRIPTION**

Artificial Intelligence (AI) has shown remarkable promise in medical imaging applications, yet a significant gap remains between technological advancements and clinical integration. For AI algorithms to be truly beneficial in real-world settings, it is crucial that their confidence, or uncertainty, in individual predictions is effectively communicated to clinicians. Uncertainty quantification (UQ) enhances AI outputs by adding a layer of trustworthiness to predictions, such as cancer likelihood or survival rates. This layer informs end-users about the reliability of AI outcomes, making predictions without UQ methods generally less reliable.

In this course, we delve into the fundamentals and latest developments in UQ from technical, clinical, and application perspectives. The course features three presentations by leading experts, each focusing on different aspects of UQ: technical details, clinical implications, and practical implementation. Interactive components will be included in all talks, culminating in a round-table discussion where speakers will address audience questions. By the end of the course, participants will have a robust understanding of UQ fundamentals and recent advancements, equipped with practical insights to apply in their daily work as radiologists, AI vendors, or AI scientists.

**Sub-Events**

### W4-CIN10B Fundamentals of Uncertainty Quantification

Florian Buettner (*Presenter*) Nothing to Disclose

### W4-CIN10C Uncertainty Quantification for Safe Clinical AI in Radiology

Shahriar Faghani, MD (*Presenter*) Nothing to Disclose

### W4-CIN10D Recent Developments in AI Uncertainty Quantification - Conformal Predictions, Triaging, and Rad-Ontology

Synho Do, PhD, MS (*Presenter*) Nothing to Disclose

### W4-CIN10E AI that Knows When it Doesn't Know - Uncertainty Quantification and Safe Clinical Integration of AI Algorithms

Natalia Alves, MSc (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W4-CNPM13

## Success for Mid-Career Radiologists Across the Board: Research, Education, Leadership (Sponsored by the RSNA Research Development Committee)

Wednesday, Dec. 4 11:00AM - 12:00PM Room: S402

Jadranka Stojanovska, MD, MS (*Moderator*) Nothing to Disclose
Ahuva Grubstein, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify strategies for balancing clinical, research, and educational responsibilities: Participants will learn to create a sustainable plan for integrating these three critical aspects into their professional lives, ensuring continuous growth and impact in each area. 2) Develop a plan for securing research funding and managing successful research projects: Attendees will gain insights into the grant application process, project management, and how to produce high-quality, publishable research that advances the field of radiology. 3) Enhance leadership skills to effectively lead teams and drive innovation within radiological departments: This objective focuses on building leadership capabilities, including communication, decision-making, and team-building skills, to foster a collaborative and innovative work environment.

**COURSE DESCRIPTION**

As radiologists progress to the mid-career stage, they often encounter a unique set of challenges and opportunities that require a balance of clinical expertise, research innovation, educational commitment, and leadership skills. This session at the Radiological Society of North America (RSNA) conference is designed to empower mid-career radiologists with the knowledge and tools needed to excel in these multifaceted roles. In this comprehensive course, participants will explore strategies to enhance their professional development across three critical areas: research, education, and leadership. Expert speakers will address issues such as securing research funding, developing impactful educational initiatives, and cultivating effective leadership skills. The session will also cover practical approaches to managing time and resources efficiently while maintaining a high standard of clinical care. Through a blend of lectures, interactive discussions, and case study analyses, attendees will gain actionable insights and practical skills to navigate the complexities of mid-career advancement. This course is essential for radiologists looking to make significant contributions to their field and achieve a balanced, fulfilling career.

**Sub-Events**

### W4-CNPM13C Succeeding in the Transition From Early to Mid-Career

Charlotte J. Yong-Hing, MD, FRCPC (*Presenter*) Nothing to Disclose

### W4-CNPM13D Academic Promotion and Advancement

Jean M. Seely, MD, FRCPC (*Presenter*) Nothing to Disclose

### W4-CNPM13E Mentorship for Mid-Career Radiologists

David A. Mankoff, MD, PhD (*Presenter*) Speaker, Siemens AG Advisory Board, ImaginAb, Inc Advisory Board, RefleXion Medical Inc Consultant, Blue Earth Diagnostics Ltd Consultant, General Electric Company Research funded, Siemens AG Spouse, Owner, Trevarx Biomedical, Inc

# Abstract Archives of the RSNA, 2024

W4-CRT06

## ASRT@RSNA: Understanding Imaging for Patient Selection in Mechanical Thrombectomy

Wednesday, Dec. 4 11:00AM - 11:45AM Room: N226

Susie M. Moseley, MS, RT (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Understand the clinical and imaging criteria for selecting patients for mechanical thrombectomy. 2) Analyze clinical data to identify suitable candidates for the different imaging modalities. 3) Understand recent advancements in imaging that aid in patient selection. 4) Apply this knowledge to clinical scenarios.

### COURSE DESCRIPTION

The criteria for selecting patients for mechanical thrombectomy has changed significantly in recent years due to the evolving landscape of evidence and imaging techniques. This session provides radiographers with information regarding the latest imaging techniques and standards for mechanical thrombectomy patient selection. The speaker will use selected clinical cases to illustrate the different imaging modalities and established protocols. The session aims to bridge the gap between theoretical knowledge and practical application, providing radiographers with the tools to improve patient care in acute ischemic stroke.

**Sub-Events**

### W4-CRT06B Understanding Imaging for Patient Selection in Mechanical Thrombectomy

Olivia Sanders, BSc (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-CBR14

## DWI Clinical Applications and Future Directions

Wednesday, Dec. 4 1:30PM - 2:30PM Room: S406A

Katja Pinker-Domenig, MD, PhD (*Moderator*) Speakers Bureau, European Society of Breast Imaging;Speakers Bureau, Siemens AG;Speakers Bureau, IDKD;Speakers Bureau, Canon Medical Systems Corporation;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Merantix Healthcare;Consultant, AURA Health

### LEARNING OBJECTIVES

1) Explain the clinical application of DWI in breast imaging. 2) Identify the current technical advances. 3) Understand the future directions and recommendations.

### COURSE DESCRIPTION

DWI is a non-contrast MRI technique that measures the diffusion of water molecules within biologic tissue and is increasingly incorporated into routine breast MRI examinations. Main applications of DWI are breast cancer detection and characterization, prognostication, and prediction of treatment response to neoadjuvant chemotherapy and might be a non-contrast alternative for breast cancer screening. Problems with suboptimal resolution and image quality have restricted the mainstream use of DWI for breast imaging, but these shortcomings are being addressed through several technologic advancements. In this review, we present a summary of the implementation of breast DWI in clinical practice, discuss technical advances and present future directions including standardization.

**Sub-Events**

### W6-CBR14B Implementation of DWI in Clinical Practice

Katja Pinker-Domenig, MD, PhD (*Presenter*) Speakers Bureau, European Society of Breast Imaging;Speakers Bureau, Siemens AG;Speakers Bureau, IDKD;Speakers Bureau, Canon Medical Systems Corporation;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Merantix Healthcare;Consultant, AURA Health

### W6-CBR14C Technical Advances

Savannah C. Partridge, PhD (*Presenter*) Research Grant, General Electric Company;Research support, Koninklijke Philips NV;Consultant, Guerbet SA

### W6-CBR14D Future Direction Including Standardization

Mami Iima, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-CCA10

## Fundamentals of Cardiac MRI

Wednesday, Dec. 4 1:30PM - 2:30PM Room: E353C

Elsie Nguyen, MD, FRCPC (*Moderator*) Nothing to Disclose
Jeremy D. Collins, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Review the naming conventions and how to setup standard cardiac MR imaging planes. 2) Learn the cardiac MR imaging pulse sequences used across imaging protocols including flow imaging. 3) Review techniques for myocardial tissue characterization including late gadolinium enhancement. 4) Review pulse sequences and techniques for magnetic resonance angiography. 5) Learn common cardiac MR imaging applications in clinical practice.

### COURSE DESCRIPTION

Cardiac MRI is an established technique to evaluate myocardial structure and function. When combined with MR angiography and flow imaging Cardiac MRI offers a comprehensive assessment of both cardiac and vascular pathology in a single exam. In this educational course we will review the basics of performing cardiac MRI and MR angiography including imaging planes and pulse sequences. Techniques and applications of flow imaging will be reviewed. Finally, common clinical applications of cardiac MR will be reviewed.

**Sub-Events**

### W6-CCA10C ABC of Cardiac Planes and Sequences

Scott J. Adams, MD, PhD (*Presenter*) Nothing to Disclose

### W6-CCA10D Tissue Characterization: Late Gadolinium Enhancement and Beyond

Kathleen Eddy, MD (*Presenter*) Nothing to Disclose

### W6-CCA10E Basic of MRA and Flow Imaging

Vineeta Ojha, MD (*Presenter*) Nothing to Disclose

### W6-CCA10F Top 3 Cardiac MR Applications

Elsie Nguyen, MD, FRCPC (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-CCH10

## Pearls and Pitfalls in Chest Radiography

Wednesday, Dec. 4 1:30PM - 2:30PM Room: E451A

Mark S. Parker, MD (*Moderator*) Co-author, Thieme Medical Publishers, Inc

**LEARNING OBJECTIVES**

1) List definitions, types, and etiologies of atelectasis. 2) Recognize classic radiographic signs of atelectasis and volume loss. 3) Identify cases of atelectasis requiring additional imaging assessment for exclusion of a central obstructing lesion. 4) Understand the mechanism of pneumomediastinum formation. 5) How to detect pneumothorax in a supine patient. 6) Distinguish benign mediastinal gas from those conditions associated with pneumomediastinum requiring urgent evaluation and management. 7) Acknowledge some of the diagnostic challenges associated with accurate interpretation of single view and 2-view chest radiographic exams. 8) Provide case-based examples highlighting various potential and or unrecognized radiographic findings, iatrogenic injuries, and or disease processes. 9) Emphasis radiographic tips to avoid potential interpretative errors that can adversely impact patient care.

**COURSE DESCRIPTION**

I. "The Many Faces of Atelectasis": Course will review protean radiographic manifestations of atelectasis and volume loss. Various types of atelectasis will be defined and described including obstructive, non-obstructive, and postoperative atelectasis. Direct and indirect radiographic signs of atelectasis will be illustrated classic radiographic signs of atelectasis and volume loss highlighted. Morphologic and radiographic features of lobar atelectasis will be presented. Special situations leading to atelectasis and volume loss will be presented including rounded atelectasis and middle lobe syndrome.

II. "Anormal Intrathoracic Gas Collections": This course will review the radiographic detection of abnormal intrathoracic gas collections, with a focus on the detection of pneumothorax on portable radiography. We will review the radiographic findings in pneumothorax, pneumomediastinum, pneumopericardium and extrapleural gas collections and their radiographic mimics. While most abnormal intrathoracic gas collections are innocuous, there are specific situations, such as pneumomediastinum in a patient with esophageal perforation or tracheobronchial injury, that require urgent management.

III. "Radiographic Misses and Mysteries": Despite widespread clinical use, accurate chest radiographic interpretation is challenging. Even good quality single view portable and standard 2-view chest radiographic exams are simply 2-dimensional imaging modalities used to assess a complex 3-dimensional organ system with multiple superimposed anatomic structures and often complex disease processes. As a result, abnormal iatrogenic and pathologic disease processes are often subtle, obscured by overlapping anatomic structures, and nonspecific, contributing to potential diagnostic errors. This course will highlight some of these diagnostic challenges and potential ways to improve diagnostic interpretations and avoid potential diagnostic errors.

**Sub-Events**

### W6-CCH10B Radiographic Misses and Mysteries

Mark S. Parker, MD (*Presenter*) Co-author, Thieme Medical Publishers, Inc

### W6-CCH10C Abnormal Intrathoracic Gas Collections

Jeffrey S. Klein, MD (*Presenter*) Editor with royalties, Wolters Kluwer nv

### W6-CCH10D The Many Faces of Atelectasis

Melissa L. Rosado de Christenson, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-CER06

## GI Emergencies: Core Concepts and Advances

Wednesday, Dec. 4 1:30PM - 2:30PM Room: N228

Douglas S. Katz, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To demonstrate a series of recent challenging cases of the acute abdomen and pelvis on CT. 2) To show a set of important diagnoses of acute conditions of the abdomen and pelvis with ultrasound. 3) To review the role of cross-sectional imaging for demonstrating expected and unexpected findings in the findings related to interventional abdominal procedures, with an emphasis on emergency conditions and subsequent appropriate patient management.

**COURSE DESCRIPTION**

Three very experienced emergency and abdominal radiologists will conduct case-based practice reviews of three topics of relevance to emergency and general abdominal radiology. The first presentation will be on recent challenging CT cases of the abdomen and pelvis in the emergency setting. The second presentation will be on emergency imaging using ultrasound of the abdomen and pelvis. The third presentation will be using cross-sectional imaging to demonstrate findings related to expected and unexpected findings related to procedures before and after interventional abdominal procedures. Brief relevant reviews of the literature will be performed, differential diagnoses - if any - will be discussed, and patient management will be emphasized.

**Sub-Events**

### W6-CER06B Challenging Recent CT Cases of the Acute Abdomen and Pelvis

Douglas S. Katz, MD (*Presenter*) Nothing to Disclose

### W6-CER06C Use of Abdominal Ultrasound in the Emergency Setting

Douglas S. Katz, MD (*Presenter*) Nothing to Disclose

### W6-CER06D Abdominal Interventional Non-Vascular Emergencies - Pre- and Post-Multi-Modality Imaging

Meghan G. Lubner, MD (*Presenter*) Spouse, Consultant, Elephas Bio

# Abstract Archives of the RSNA, 2024

W6-CGI10

## Abbreviated and Accelerated MRI

Wednesday, Dec. 4 1:30PM - 2:30PM Room: N227B

Hersh Chandarana, MD, MBA (*Moderator*) Institutional research agreement, Siemens AG;Equipment support, Siemens AG;Software support, Siemens AG
Ivan Pedrosa, MD, PhD (*Moderator*) Scientific Advisor, Health Tech International;Scientific Advisor, Merck & Co, Inc

**LEARNING OBJECTIVES**

1) Describe and compare strengths and weaknesses of different methods for performing abbreviated MRI for Hepatocellular Carcinoma (HCC) screening. 2) Describe the current evidence for abbreviated protocol for pancreatic cyst surveillance. 3) Examine the latest technological advancements and innovations in Prostate MRI (such as AI-assisted image reconstruction /acquisition and intelligent scanning) that support the use of abbreviated protocols.

**COURSE DESCRIPTION**

With increasing healthcare costs and challenges with staffing and access to MR imaging, it is important to consider focused indication-based abbreviated scanning and reporting of MRI to maximize efficiency and address above mentioned challenges. In this course, we will review current evidence for abbreviated MRI protocol for liver cancer, pancreatic cysts, and prostate cancer as well as opportunities and challenges in implementing abbreviated protocols in busy clinical practice. Furthermore, we will have a lively panel discussion to dive deeper into the opportunities and challenges and share experiences of how one can get started and measure the utility, efficacy, and cost savings with implementation of abbreviated protocols.

**Sub-Events**

### W6-CGI10C Evidence Based Opportunities and Challenges for Abbreviated MRI Protocol in Hepatocellular Carcinoma (HCC)

Mustafa R. Bashir, MD (*Presenter*) Research Grant, Siemens AG;Research Grant, NGM Biopharmaceuticals, Inc ;Research Grant, Madrigal Pharmaceuticals, Inc ;Research Grant, Metacrine, Inc ;Research Grant, ProSciento, Inc ;Research Grant, MedPace, LLC ;Research Grant, Carmot Therapeutics Inc

### W6-CGI10D Evidence Based Opportunities and Challenges for Abbreviated MRI Protocol in Pancreatic Cysts

Zhen J. Wang, MD (*Presenter*) Stockholder, Nextrast, Inc

### W6-CGI10E Evidence Based Opportunities and Challenges for Abbreviated MRI Protocol in Prostate Cancer

Sadhna Verma, MD, MBA (*Presenter*) Nothing to Disclose

### W6-CGI10F Panel Discussion on Implementation and Impact of Abbreviated Protocols on Disease Management

Ivan Pedrosa, MD, PhD (*Presenter*) Scientific Advisor, Health Tech International;Scientific Advisor, Merck & Co, Inc

### W6-CGI10G Panel Discussion on Implementation and Impact of Abbreviated Protocols on Disease Management

Hersh Chandarana, MD, MBA (*Presenter*) Institutional research agreement, Siemens AG;Equipment support, Siemens AG;Software support, Siemens AG

### W6-CGI10H Panel Discussion on Implementation and Impact of Abbreviated Protocols on Disease Management

Mustafa R. Bashir, MD (*Presenter*) Research Grant, Siemens AG;Research Grant, NGM Biopharmaceuticals, Inc ;Research Grant, Madrigal Pharmaceuticals, Inc ;Research Grant, Metacrine, Inc ;Research Grant, ProSciento, Inc ;Research Grant, MedPace, LLC ;Research Grant, Carmot Therapeutics Inc

### W6-CGI10I Panel Discussion on Implementation and Impact of Abbreviated Protocols on Disease Management

Zhen J. Wang, MD (*Presenter*) Stockholder, Nextrast, Inc

### W6-CGI10J Panel Discussion on Implementation and Impact of Abbreviated Protocols on Disease Management

Sadhna Verma, MD, MBA (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-CIN23

## A Debate on the Future of Radiology Reporting: Semantic vs Large Language Models

Wednesday, Dec. 4 1:30PM - 2:30PM Room: E450B

Namita S. Gandhi, MD, MSc (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Introduction of structured report, semantic standardization and large language models in context of radiology report Discuss opportunities and challenges with semantic standardization in radiology reports. 2) Discuss opportunities and challenges with large language models in radiology reports.

**COURSE DESCRIPTION**

Data from radiology reports not only contributes to clinical care, but can be used for facilitating downstream workflows like clinical decision support, clinical registries and AI development.

Structured reports provide the benefit of structured data and semantic standardization which facilitates these downstream workflows. With the recent advancements, large language models can be applied to radiology reports and can potentially facilitate similar downstream workflows. This session will focus on this evolving landscape of radiology reporting, juxtaposing the structured, semantically standardized reports against the burgeoning capabilities of large language models, discussing the opportunities and challenges with both these models and envisioning the future of radiology reports.

**Sub-Events**

**W6-CIN23B** **Introduction of CDEs/Semantic Reporting and LLMs for the Practicing Radiologist**

Namita S. Gandhi, MD, MSc (*Presenter*) Nothing to Disclose

**W6-CIN23C** **Large Language Models (LLMs) and the Future of Radiology Reporting**

George L. Shih, MD, MS (*Presenter*) Consultant, MD.ai, Inc;Shareholder, MD.ai, Inc

**W6-CIN23D** **Semantic Reporting and CDEs in the Future of Radiology Reporting**

Marc D. Kohli, MD (*Presenter*) Founder, Alara Imaging;Stockholder, Alara Imaging

# Abstract Archives of the RSNA, 2024

W6-CIN24

## The Rules of Engagement: Regulatory Perspectives on Healthcare AI on Reducing Bias and Discrimination

Wednesday, Dec. 4 1:30PM - 2:30PM Room: E352

Alex Towbin, MD (*Moderator*) Author, RELX;Consultant, Anderson Publishing, Ltd;Advisory Board, KLAS Enterprises LLC;Travel support, Merative LP

**LEARNING OBJECTIVES**

1) Describe key U.S. federal regulations, including Section 1557 of the ACA, addressing AI bias and healthcare discrimination. 2) Participants will gain an understanding of the ONC HTI-2 Final Rule and its implications for AI bias reduction. 3) Participants will learn about Canada's AIDA and how it influences AI development and deployment in medical imaging.

**COURSE DESCRIPTION**

Artificial intelligence (AI) is rapidly advancing in radiology, offering significant potential to improve diagnostic accuracy and efficiency. However, the risk of perpetuating bias within data and algorithms poses a severe challenge, potentially leading to discriminatory outcomes in healthcare. This session provides a comprehensive review of the regulatory frameworks of the United States and Canada that aim to mitigate these risks. The session will cover overviews and specific discussions of federal and state-level regulations in the U.S. that have significant implications for healthcare AI and algorithm-based bias. Additionally, it will explore Canada’s approach through the Artificial Intelligence and Data Act (AIDA). The discussions will highlight the complexities of implementing these regulations in clinical practice and their impact on AI development and deployment in radiology.

**Sub-Events**

### W6-CIN24B Overview of the U.S. AI Regulatory Landscape: Section 1557 of the ACA and Beyond

Nina E. Kottler, MD, MS (*Presenter*) Partner, Radiology Partners Stockholder, Radiology Partners (Radiology Partners owns a minority interest in Aidoc medical and an indirect minority interest in Rad AI) Employee, Radiology Partners Consultant, ES3 Consultant, W.L. Gore & Associates, Inc Consultant, Synapsica Healthcare Pvt Ltd

### W6-CIN24C Key Takeaways for ONC HTI-2 Final Rule on Advancing Interoperability and Information Sharing

Po-Hao Chen, MD, MBA (*Presenter*) Nothing to Disclose

### W6-CIN24D How Artificial Intelligence and Data Act (AIDA) Affects Healthcare Providers

Jaron Chong, MD (*Presenter*) Nothing to Disclose

### W6-CIN24E An Overview of State Regulations About the Use of AI in Healthcare

William Auffermann, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-CMK11

## Imaging of Muscle Injury: Diagnosis and Reporting

Wednesday, Dec. 4 1:30PM - 2:30PM Room: E450A

Christopher F. Beaulieu, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Improve understanding and reporting on myotendinous injuries across the age spectrum and in various anatomic locations. 2) Learn to recognize abnormal muscle signal intensity patterns as they pertain to myopathy and its mimics. 3) Appreciate differential diagnostic tips that help distinguish muscle injury from malignancies.

**COURSE DESCRIPTION**

This five part session focuses on common and clinically important disorders of muscle. Attendees will hear from experts on key issues in assessment of myotendinous injury including tips on radiological reporting, imaging of pediatric and adolescent patients, and how to distinguish injury from neoplasia. Special focus will be given to uncommon but important injuries along the chest wall, including pectoralis and latissimus doors injuries. Diffuse patterns of muscle abnormality will also be addressed during the presentation on myopathy and its mimics.

**Sub-Events**

### W6-CMK11B Myotendinous Injuries in Pediatric and Adolescent Patients

Vivek Kalia, MD, MPH (*Presenter*) Research Consultant, Hyalex Orthopaedics, Inc

### W6-CMK11C Muscular Injuries of the Chest Wall

Jennifer A. Padwal, MD, MS (*Presenter*) Nothing to Disclose

### W6-CMK11D Myositis and its Mimics

Eddy Zandee van Rilland, MD (*Presenter*) Nothing to Disclose

### W6-CMK11E Muscle Injury versus Malignancy

William E. Palmer, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-CNPM10

## Conquering 2024 Radiologist Workforce Challenges

Wednesday, Dec. 4 1:30PM - 2:30PM Room: S402

Jay R. Parikh, MD, FRCPC (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To understand the current radiologist job market within the United States. 2) To describe how understanding diversity can be leveraged to improve retention of radiologists. 3) To describe strategies to help recruit and retain radiologists in the current job market.

**COURSE DESCRIPTION**

The last five years have demonstrated an unprecedented radiologist job market within the United States. Radiology practices across the country are having challenges both retaining and recruiting radiologists. The purpose of this session is to update the attendees with respect to the current job market, understand the implications regarding diversity in the job market, and describe strategies to help retain slash recruit radiologists in this current job market.

**Sub-Events**

### W6-CNPM10B Cultural Solutions to Increase Radiologist Retention

Eric M. Rubin, MD (*Presenter*) Nothing to Disclose

### W6-CNPM10C Operational Solutions to Increase Radiologist Retention

Elizabeth H. Dibble, MD (*Presenter*) Nothing to Disclose

### W6-CNPM10D Practical Solutions to Improve Diversity and Increase Radiologist Retention

Sherry S. Wang, MBBS, FRANZCR (*Presenter*) Royalties, RELX

# Abstract Archives of the RSNA, 2024

W6-CNR13

## Can I Call a Consult Please? This is a Weird Case!

Wednesday, Dec. 4 1:30PM - 2:30PM Room: S406B

Carlos H. Torres, MD, FRCPC (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify key imaging findings, including pertinent positive and negative findings, that can help narrow the differential diagnosis in the provided clinical context. 2) Develop an approach and organized thought process when faced with difficult unknown cases.

**COURSE DESCRIPTION**

This will be a case-based session focused on complex and challenging neuroradiology cases. The goal is not necessarily nailing the diagnosis, but rather to develop an approach and organized thought process when encountering complex cases. It will include brain, spine, head & neck and pediatric neuroradiology cases.

**Sub-Events**

**W6-CNR13B** **Can I Call a Consult Please? This is a Weird Spine Case!**

Anousheh Sayah, MD (*Presenter*) Nothing to Disclose

**W6-CNR13C** **Can I Call a Consult Please? This is a Weird H&N Case!**

Philip R. Chapman, MD (*Presenter*) Nothing to Disclose

**W6-CNR13D** **Can I Call a Consult Please? This is a Weird Peds Case!**

Susan Palasis, MD (*Presenter*) Nothing to Disclose

**W6-CNR13E** **Can I Call a Consult Please? This is a Weird Brain Case!**

Carlos H. Torres, MD, FRCPC (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W6-CPD11

## Avoiding Complications in Pediatric Procedures

Wednesday, Dec. 4 1:30PM - 2:30PM Room: E350

Anne Marie Cahill, MBBCh (*Moderator*) Advisory Committee, Siemens AG;Speakers Bureau, Avanos Medical, Inc
Lisa H. Kang, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Increase awareness of complications to avoid in common pediatric procedures and how to deal with them. 2) Gain more knowledge around useful tips for intussusception. 3) Increased knowledge of thyroid disease and intervention.

**COURSE DESCRIPTION**

These audience inspired lectures go over complications radiologists may encounter in common pediatric procedures. Learn how to recognize and effectively manage complications, gaining insight into pitfalls and pearls from our experts.

**Sub-Events**

### W6-CPD11C Potential Complications in Percutaneous Body Procedures

Eric J. Monroe, MD (*Presenter*) Advisory Board, Biogen Idec Inc

### W6-CPD11D Potential Complications in Percutaneous Extremity Procedures - MSK Non-vascular Interventions

Dimitri A. Parra, MD, MMEd (*Presenter*) Nothing to Disclose

### W6-CPD11E Tricks and Complications in Ileocolic Intussusception

Alan Daneman, MD (*Presenter*) Nothing to Disclose

### W6-CPD11F Pediatric Thyroid Nodules: Learning from Procedures

Hedieh Khalatbari, MD, MBA (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-CRO08

## Case- based Imaging Review for Diagnosis and Response Assessment in Lymphoma

Wednesday, Dec. 4 1:30PM - 2:30PM Room: S401

Sarah A. Johnson, MD, FRCPC (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) To recognize important differential diagnostic considerations in lymphoma imaging. 2) To recognize and apply key features of the Deauville criteria.

**COURSE DESCRIPTION**

Case based review of lymphoma cases of the head and neck and body with a focus on diagnostic pearls and response assessment. Lymphoma is a common diagnosis encountered by all radiologists and further information on imaging for patients with lymphoma will be applicable to many practicing radiologists, who may expect to gain practical points for imaging of lymphoma from this session.

**Sub-Events**

**W6-CRO08B** **Case- based Imaging Review for Diagnosis and Response Assessment in Lymphoma**

Eugene Yu, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W6-CRT07

## ASRT@RSNA: Breaking down the Barriers of Quality Control

Wednesday, Dec. 4 1:30PM - 2:30PM Room: N226

Susie M. Moseley, MS, RT (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Explain changes in required imaging equipment quality control before ACR accreditation and Joint Commission-required testing. 2) Learn how to interpret quality control data and demonstrate how to apply working knowledge in quality control across multiple imaging modalities. 3) Present rationale for changes in radiology departments. 4) Discuss future directions in quality control and continuous quality improvement.

**COURSE DESCRIPTION**

Quality control requirements for radiologic imaging equipment have changed significantly over the past 20 years. The advent of new imaging systems and hybridized imaging equipment now requires competency in multiple imaging modalities. This session discusses how quality control has evolved over the past 20 years, including quality control before American College of Radiology accreditation and Joint Commission-required testing, machine- and modality-specific quality control, the benefits of quality control standards, regulatory and accrediting body requirements, and continuous quality improvement strategies for radiologic imaging equipment.

Attendees will learn how to incorporate what they know about their modality's principles in accuracy, constancy, geometry, linearity and reproducibility and apply that knowledge to hybridized systems and new technology. The speaker will provide data on how to improve quality control, offer continuous quality improvement resources and rationale for future process improvement, and give strategies for ACR and Joint Commission compliance.

**Sub-Events**

**W6-CRT07B** **Breaking down the Barriers of Quality Control**

Ryan Misseldine, MBA, BS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-CVA06

## Case Based Review of Vascular Imaging

Wednesday, Dec. 4 1:30PM - 2:30PM Room: N229

Christopher J. Francois, MD (*Moderator*) Nothing to Disclose
Prachi P. Agarwal, MD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Explain the radiographic and cross-sectional imaging findings essential for diagnosis of congenital thoracic vascular diseases, pulmonary arterial and venous vascular diseases, and challenging thoracic aortic diseases. 2) Identify advanced imaging techniques for use in patients with congenital thoracic vascular diseases, pulmonary arterial and venous vascular diseases, and challenging thoracic aortic diseases.

### COURSE DESCRIPTION

After this course, attendees will be more comfortable in the diagnosis of congenital thoracic vascular diseases, pulmonary arterial and venous vascular diseases, and challenging thoracic aortic diseases. In addition, attendees will be able to explain the rationale for recommending and using advanced imaging techniques in patients with thoracic vascular diseases. The format of this course will be case-based presentations.

**Sub-Events**

### W6-CVA06C Case-Based Review: Congenital Vascular Diseases

Prachi P. Agarwal, MD (*Presenter*) Nothing to Disclose

### W6-CVA06D Challenging Cases in Aortic Imaging

Tugce Agirlar Trabzonlu, MD (*Presenter*) Nothing to Disclose

### W6-CVA06E Pulmonary Arterial and Venous Vascular Diseases

Arzu Canan, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-RCP07

## RSNA/ESR Symposium: Advances in Prostate Cancer Imaging and Therapy - Developments on Accreditation, Certification, Quality Control and AI

Wednesday, Dec. 4 1:30PM - 2:30PM Room: E353B

Katarzyna J. Macura, MD, PhD (*Moderator*) Author with royalties, RELX;Research Grant, Profound Medical Inc
Ivo Schoots, MD,PhD (*Moderator*) Nothing to Disclose

### LEARNING OBJECTIVES

1) Discuss the importance of quality control and assurance measures in maintaining the accuracy and reliability of prostate MRI within diagnostic centers, including the role of radiologists and frontline staff in ensuring adherence to best practices. 2) Review the criteria, standards, and procedures required for prostate cancer MRI center designation in US, and outline the framework with key learnings from ACR Prostate MRI Quality Improvement Collaborative. 3) Discuss radiologists' certification and MR imaging quality control initiatives in Europe. 4) Learn about developments in artificial intelligence (AI) for prostate cancer imaging and detection, as well as applications of AI methods to increase efficiency and improve accuracy.

### COURSE DESCRIPTION

This course highlights advancements in imaging for prostate cancer diagnosis and treatment. In this educational session, presenters will discuss the accreditation of imaging centers, certification of radiologists, quality control in MR imaging, and emerging applications of artificial intelligence for the improvement of diagnostic accuracy and workflow efficiency.

**Sub-Events**

### W6-RCP07C Mastering Excellence: Elevating Prostate MRI Standards in US

Andrei S. Purysko, MD (*Presenter*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;

### W6-RCP07D Certification of Radiologists and Quality Control in Europe

Tristan Barrett, MBBS, MD (*Presenter*) Nothing to Disclose

### W6-RCP07E AI Challenges - Opportunities and Barriers

Ivo Schoots, MD,PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W7-CHN02

## Head and Neck Cancer: Read Like the Experts and Tumor Board Discussion

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E352

Ashley H. Aiken, MD (*Moderator*) Nothing to Disclose
Luke N. Ledbetter, MD (*Moderator*) Royalties, RELX

**LEARNING OBJECTIVES**

1) Review the key imaging findings in evaluation of head and neck cancer patients, including at staging, treatment response and surveillance time points.
2) Recognize the important imaging findings that impact clinical management of patients with head and neck cancer.

**COURSE DESCRIPTION**

In this "Best of" head and neck imaging session, attendees will hear short talks from experts focusing on the key information the multidisciplinary tumor board (surgeons, radiation oncologists and oncologists) needs to know from the imaging at diagnosis and follow-up of tumors in the head and neck. Speakers will emphasize imaging pearls and important clinical management considerations with which radiologists should be familiar. These talks will be followed by a case-based discussion by a panel of experts in a simulated tumor board session. Sample cases will be presented and discussed by radiologists, a head and neck cancer surgeon and a radiation oncologist. This session offers attendees a real world glimpse into how imaging interpretation impacts decision-making in the clinical management of head and neck cancer patients.

**Sub-Events**

### W7-CHN02C Radiology Perspective

Ashley H. Aiken, MD (*Presenter*) Nothing to Disclose

### W7-CHN02D Radiology Perspective

Luke N. Ledbetter, MD (*Presenter*) Royalties, RELX

### W7-CHN02E Radiation Oncology Perspective

Sue S. Yom, MD, PhD (*Presenter*) Research Grant, F. Hoffmann-La Roche Ltd;Research Grant, Merck & Co, Inc;Research Grant, Bristol-Myers Squibb Company

### W7-CHN02F Surgical Perspective

Maie St John, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W7-CIN20

## Cybersecurity in Healthcare: Implications of Generative AI and Large Language Models (LLMs)

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E450B

Benoit Desjardins, MD, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand which aspects of generative AI and LLMs relate to cybersecurity. 2) Understand how these can be used for good or nefarious purposes. 3) Describe how generative AI and LLMs can help offensive cybersecurity. 4) Describe how generative AI and LLMs can help defensive cybersecurity.

**COURSE DESCRIPTION**

Cybercrime against healthcare institutions has exploded in recent years. Five years ago, the Hollywood Presbyterian Medical Center paid a $17,000 ransom to regain access to its medical records blocked by ransomware. In 2021, more than 1 in 3 healthcare organizations reported being hit by ransomware. The Russia-tied Ryuk group hit over 235 healthcare facilities, raking in more than $100 million in ransoms. Although paying ever-increasing ransoms can be costly for medical centers, refusing to pay them often leads to even bigger losses. The University of Vermont Health system lost $50 million and Universal Health System lost $67 million for refusing to pay ransoms in 2020. The situation has been considerably worsened by the pandemic, which produced a triple threat for healthcare systems: (1) a rapid expansion of internet-connected technologies and services causing an expanded attack surface, (2) an increase in many types of cyberattacks, and (3) fewer available resources to defend against cyberattacks. Recently, the zero-day vulnerability Log4j in Apache software has been leading to hundreds of cyber-attacks around the world since December 2021. Cybersecurity has become an important part of healthcare, and we must address this topic at RSNA since every radiology practice can become a victim of a cyber-attack. This explosion in cyber-attacks against medical centers is the result of (1) the US Justice System penalizing cyber-attack victims, rather than going after the perpetrators, (2) the commoditization of cyber-attack tools, and (3) the increased use of artificial intelligence (AI) to fine-tune cyber-attacks. The latest developments in generative AI and LLMs is truly changing the game, both from an offensive and a defensive point of view. AI is now extensively used by both attackers (“Offensive AI”) and defenders (“Defensive AI”). In this refresher course, we will explore the latest developments in generative AI and LLMs from a cybersecurity point of view. 1- Overview of generative AI and LLMs for cybersecurity: After providing a quick overview of the latest developments in generative AI and LLMs, Dr Benoit Desjardins, a leader in cybersecurity and artificial intelligence, will discuss not only how these techniques are helpful in general, but also how they can be used for good or nefarious purposes in the context of cybersecurity. 2- Cybercriminals are weaponizing generative AI and LLMs against healthcare: how cybercriminals are weaponizing artificial intelligence to improve their attacks against medical institutions. This will be discussed by Brett Strassner (Archangel), a leader in cybersecurity. He will provide a cutting-edge picture of how cyber-criminals are currently using generative AI and LLMs to improve success of different types of attacks, such as phishing, scanning, and intrusions of medical centers. 3- Generative AI and LLMs are transforming healthcare cybersecurity: how cyber-defense teams at medical centers are using artificial intelligence to supplement the limited capabilities of humans to detect and defend against cyberattacks, especially now that many of those cyberattacks are controlled by artificial intelligence. This will be discussed by Ty Greenhalgh, a top leader in the cybersecurity industry, who will provide many current examples of how generative AI and LLMs are used to defend against attacks against medical centers and healthcare personnel. This refresher course will bring the radiology community up to date on the latest interaction between artificial intelligence and cybersecurity involving generative AI and LLMs, affecting healthcare, including recent attacks, and techniques of defense. The course will be presented by radiologists and top cybersecurity and artificial intelligence experts. The information technology issues will be addressed at a technical level appropriate for the radiology community at large, to make the community aware of this growing era of digital warfare and its implicatio

**Sub-Events**

### W7-CIN20B Overview of Generative AI and LLMs for Cybersecurity

Benoit Desjardins, MD, PhD (*Presenter*) Nothing to Disclose

### W7-CIN20C Cybercriminals are Weaponizing Generative AI and LLMs Against Healthcare

Brett Strassner, MA (*Presenter*) Nothing to Disclose

### W7-CIN20D Generative AI and LLMs are Transforming Healthcare Cybersecurity

Ty Greenhalgh (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W7-CIR11

## State-of-the-Art Management of Biliary Disease

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E353A

Nariman Nezami, MD (*Moderator*) Consultant, CAPS Medical Ltd

**LEARNING OBJECTIVES**

1) Understand the Principles of Percutaneous Biliary Stenting

**COURSE DESCRIPTION**

"State-of-the-Art Management of Biliary Disease" is a specialized course designed to provide an in-depth understanding of the latest advancements in the diagnosis, treatment, and management of biliary diseases. This course covers the comprehensive spectrum of biliary pathology, including benign and malignant conditions, and highlights the role of radiology and interventional radiology in patient care. Through a combination of lectures, case studies, and hands-on training, students will gain expertise in state-of-the-art imaging techniques, minimally invasive procedures, and multidisciplinary approaches to biliary disease management.

**Sub-Events**

### W7-CIR11B Principles of Percutaneous Biliary Stenting

Meaghan Dendy, MD (*Presenter*) Nothing to Disclose

### W7-CIR11C Optimizing Gallstone Management - Percutaneous Stone Removal Techniques

Todd Schlachter, MD (*Presenter*) Research Grant, Guerbet SA

### W7-CIR11D Percutaneous Radiofrequency Ablation for the Biliary System

Nariman Nezami, MD (*Presenter*) Consultant, CAPS Medical Ltd

### W7-CIR11E Gallbladder Interventions for Acute and Chronic Cholecystitis

Peiman Habibollahi, MD (*Presenter*) Nothing to Disclose

### W7-CIR11F Extreme Biliary Cases and How to Avoid Complications

Anne M. Covey, MD (*Presenter*) Stockholder, Amgen Inc

# Abstract Archives of the RSNA, 2024

W7-CMS07

## Dos and Don'ts of Whole Body MR: Evaluation of Oncologic and Congenital Diseases versus Celebrity Screening

Wednesday, Dec. 4 3:00PM - 4:00PM Room: N227B

Yuliya Lakhman, MD (*Moderator*) Stockholder, Y-mAbs Therapeutics Inc;Consultant, Perceptive Informatics, LLC

**LEARNING OBJECTIVES**

1) Describe how to perform the state-of-the-art whole-body MRI and how to tailor the protocol to different clinical settings. 2) Illustrate the important of proper patient selection for various applications of whole-body MRI. 3) Highlight the value of whole-body MRI in different clinical settings. 4) Emphasize the importance of quality-control measures.

**COURSE DESCRIPTION**

This course provides an overview of the whole-body MRI potential. The lectures will highlight how whole-body MRI is performed, how its properly implemented, and how it can add value compared to other available tools.

**Sub-Events**

### W7-CMS07B WB MRI Screening: Celebrity Screening

Rachita Khot, MD (*Presenter*) Nothing to Disclose

### W7-CMS07C Whole-body MRI for Cancer - Do/Don't in Population Screening for Cancer

Anwar R. Padhani, MBBS, FRCR (*Presenter*) Advisory Board, Siemens AG;Speakers Bureau, Siemens AG;Advisory Board, Lucida Medical Ltd;Stockholder, Lucida Medical Ltd

### W7-CMS07D Whole-body MRI for Cancer - Do/Don't in Familial Cancer Syndromes

Christina Messiou, MD, BMBS (*Presenter*) I am a co-founder of Diafora (alongside the Institute of Cancer Research and The Royal Marsden) that has formed a joint venture, Celescan, with Sopra Steria

# Abstract Archives of the RSNA, 2024

W7-CNMMI07

## Update on Pediatric Nuclear Medicine

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S501

Helen R. Nadel, MD, FRCPC (*Moderator*) Consultant, ICON plc;;

**LEARNING OBJECTIVES**

1) To discuss advances in pediatric general nuclear medicine and PET. 2) To review patient preparation and clinical indications for nuclear medicine and PET studies in pediatrics. 3) To illustrate pearls and pitfalls of imaging in the pediatric population.

**Sub-Events**

**W7-CNMMI07B** **Pediatric PET - Update on Tracers and Indications**

Helen R. Nadel, MD, FRCPC (*Presenter*) Consultant, ICON plc;;

**W7-CNMMI07C** **Pediatric Total Body SPECT/CT"-Benign and Malignant Indications**

Zvi Bar-Sever, MD (*Presenter*) Nothing to Disclose

**W7-CNMMI07D** **Radioiodine Therapy for Differentiated Thyroid Cancer in Children and Young Adults**

Frederick D. Grant, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W7-CNPM01

## Financial Planning: From Investment to Retirement

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S502

Sherwin S. Chan, MD, PhD (*Moderator*) Consultant, Jazz Pharmaceuticals plc;Research Grant, Jazz Pharmaceuticals plc;Research Grant, Hyperfine, Inc;Research Grant, General Electric Company

**LEARNING OBJECTIVES**

1) Understand how to construct an appropriate investment portfolio for retirement. 2) Understand the importance of savings and learn strategies to make it a priority. 3) Gain insight into asset protection strategies for radiologists.

**COURSE DESCRIPTION**

Many radiologists are unable to translate their high income into a high net worth. This is due to high student debt, poor financial literacy and lifestyle creep. High debt drives choices in career path for trainees and practicing radiologists and contributes to physician burnout and mental health issues. Despite the importance of personal financial health, education on finances is absent from most radiology training programs. Some highly successful and intelligent radiologists who contribute enormously to research, radiology education, and clinical care have not spent the necessary time learning about finances and preparing for retirement. This course will feature lectures on more advanced financial literacy topics. The expected outcome of the session will be that attendees will learn about some financial literacy topics and then will be inspired to learn even more and improve their personal financial health.

**Sub-Events**

### W7-CNPM01B Constructing a Portfolio for Retirement

Christopher Walker, MD (*Presenter*) Author, RELX;Speakers Bureau, Boehringer Ingelheim GmbH

### W7-CNPM01C Beyond Simple Stocks and Bonds

Sherwin S. Chan, MD, PhD (*Presenter*) Consultant, Jazz Pharmaceuticals plc;Research Grant, Jazz Pharmaceuticals plc;Research Grant, Hyperfine, Inc;Research Grant, General Electric Company

### W7-CNPM01D Prioritizing the Bucket List: How to Maximize Savings For Multiple Financial Goals

Cindy S. Lee, MD (*Presenter*) Nothing to Disclose

### W7-CNPM01E Asset Protection Considerations for Radiologists

Jeffrey S. Klein, MD (*Presenter*) Editor with royalties, Wolters Kluwer nv

# Abstract Archives of the RSNA, 2024

W7-CRT08

## ASRT@RSNA: Milestones in CT: Past, Present, and Future

Wednesday, Dec. 4 3:00PM - 4:00PM Room: N226

Susie M. Moseley, MS, RT (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Summarize major technical developments in CT over the past five decades. 2) Describe specific changes that have occurred to decrease the radiation dose associated with CT. 3) Review key developments that enabled cardiac CT. 4) Explain what is unique about photon-counting CT.

**COURSE DESCRIPTION**

Since its invention in the 1970s, computed tomography has undergone numerous technical developments and innovations that have established it as an indispensable tool in the practice of medicine. Multiple CT scanner geometries, or generations, have existed, and with each new generation of technology, the speed and spatial resolution of CT increases, enabling new clinical applications and decreasing the required doses of radiation and iodinated contrast media. Technical developments such as shorter gantry rotation times, multiple detector rows, multisector reconstructions, and dual-source technologies have increased the quality and robustness of cardiac CT. Meanwhile, radiation doses in CT have been reduced using tube current modulation, lower tube potential, beam-shaping filters, beam collimation and iterative reconstruction algorithms. Recently, photon-counting detectors have been introduced into commercial CT systems to provide increased spatial resolution and multi-energy CT imaging from a single acquisition. This session reviews these and other major milestones in CT imaging.

**Sub-Events**

### W7-CRT08B Milestones in CT: Past, Present, and Future

Shuai Leng, PhD (*Presenter*) License agreement, Siemens AG

# Abstract Archives of the RSNA, 2024

W7-RCP08

## RSNA/ESR Symposium: Advances in Prostate Cancer Imaging and Therapy - Advancements in Precision Oncology and Therapy

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E353B

Fiona M. Fennessy, MBBCh, PhD (*Moderator*) Consultant, Imaging Endpoints II LLC
Patrick Asbach, MD (*Moderator*) Institutional research support, Siemens AG;Institutional research support, Canon Medical Systems Corporation;Speaker, b.e.imaging GmbH;Travel support, b.e.imaging GmbH

### LEARNING OBJECTIVES

1) Review the role of imaging biomarkers in detection and characterization of prostate cancer, guidance of personalized treatment planning, prediction and assessment of response to therapy, and detection of disease recurrence. 2) Review the emerging image-guided focal therapies as methods for personalized treatment of prostate cancer based on risk criteria and optimization of oncologic and life quality outcomes. 3) Discuss the role of theranostic agents in the treatment of prostate cancer.

### COURSE DESCRIPTION

This course will provide a comprehensive lecture-format overview of latest developments in precision oncology, addressing both prostate cancer detection and treatment. It will delve into the significance of novel imaging biomarkers in detection and characterization of prostate cancer, and in tailoring personalized therapy. Furthermore, the course will review both image-guided focal therapy and theranostics in prostate cancer care, emphasizing the importance of selecting suitable candidates and strategies for optimizing treatment outcomes for these forms of precision therapy.

**Sub-Events**

### W7-RCP08C Novel Multimodality Imaging Biomarkers

Fiona M. Fennessy, MBBCh, PhD (*Presenter*) Consultant, Imaging Endpoints II LLC

### W7-RCP08D Advancements in Focal Therapies

Katarzyna J. Macura, MD, PhD (*Presenter*) Author with royalties, RELX;Research Grant, Profound Medical Inc

### W7-RCP08E Theranostics

Steven P. Rowe, MD, PhD (*Presenter*) Consultant, Lantheus Holdings;Research support, Lantheus Holdings;Stockholder, D&D Pharmatech;Consultant, D&D Pharmatech;Research support, D&D Pharmatech;Stockholder, PlenaryAI, Inc;Research support, PlenaryAI, Inc

# Abstract Archives of the RSNA, 2024

W7-RCP09

**AOSR-RSNA 2024 Joint Session: Acute Abdomen**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S402

Dinesh K. Varma, FRANZCR (*Moderator*) Nothing to Disclose
Judy Yee, MD (*Moderator*) Research Grant, General Electric Company

**LEARNING OBJECTIVES**

Acute abdominal pain – Right Lower Quadrant

Understand Acute Appendicitis: Gain a understanding of acute appendicitis, its commonality, and its appearances in radiology.

Master Pain Mechanism and Pathways: Learn about the mechanism and pathways of right lower quadrant (RLQ) pain, with a focus on appendicitis as the most common pathology.

Explore Imaging Techniques: Understand various imaging techniques and protocols for acute appendicitis, including MRI protocols and performance criteria.

Identify Differential Diagnoses: Learn to identify and understand the most common differential diagnoses for RLQ pain from gastrointestinal, gynecological, and genitourinary systems through imaging case examples.

Traumatic acute abdomen: hepatobiliary, pancreas and spleen

1.Importance of initial patient hemodynamic status and CT protocol with multidisciplinary management

2.Image finding with AAST injury scale according to organs

3.Organ specific traumatic conditions for diagnosis and treatment options.

**COURSE DESCRIPTION**

The talk emphasizes the importance of diagnosing acute appendicitis, a common condition encountered by radiologists.

It discusses the mechanism and pathways of right lower quadrant (RLQ) pain, with appendicitis being the most common pathology in this area.

Imaging Techniques: Various imaging techniques and protocols for acute appendicitis are outlined, including MRI protocols and performance criteria.

Differential Diagnosis: The talk provides case examples and discusses differential diagnoses for RLQ pain from gastrointestinal, gynecological, and genitourinary systems.

This talk will focus on hepatobiliary, pancreas and splenic trauma in traumatic acute abdomen.

It discusses from diagnostic methods to organ specific traumatic image findings and evaluation of traumatic injury scale. This talk also includes recent

treatment options according to injury scales and organs.

**Sub-Events**

### W7-RCP09C Acute Gastrointestinal Bleeding

Judy Yee, MD (*Presenter*) Research Grant, General Electric Company

### W7-RCP09D Acute Abdominal Pain: Right Lower Quadrant

Jan F. Gerstenmaier, FFR(RCSI), FRANZCR (*Presenter*) Nothing to Disclose

### W7-RCP09E Traumatic Acute Abdomen

Song-Ee Baek, MD (*Presenter*) Nothing to Disclose

### W7-RCP09F MRI in Abdominal Emergencies

Kevin J. Chang, MD (*Presenter*) Speaker, RELX;Speaker, Koninklijke Philips NV

# Abstract Archives of the RSNA, 2024

W8-CBR03

## Pearls and Pitfalls of Challenging Cases (MMG, US, MRI, CEM) (Supported in part by an Unrestricted Medical Education Grant from GE Healthcare, Inc.)

Wednesday, Dec. 4 4:30PM - 5:30PM Room: S406A

Silvia Perez, MD (*Moderator*) Support, Becton, Dickinson and Company;Support, Bayer AG

### LEARNING OBJECTIVES

1) Identify and understand common pitfalls in the diagnosis of breast cancer using mammography (MMG), ultrasound (US), magnetic resonance imaging (MRI), and contrast-enhanced mammography (CEM). 2) Apply key diagnostic pearls to enhance the interpretation of challenging breast cancer cases across different imaging modalities. 3) Integrate multimodal imaging findings to improve diagnostic accuracy and decision-making in complex breast cancer scenarios.

### COURSE DESCRIPTION

Join us for an in-depth exploration of the complexities and nuances of breast cancer imaging in the session "Pearls and Pitfalls of Challenging Cases (MMG, US, MRI, CEM)." This course is designed to enhance the diagnostic skills of radiologists by addressing the common challenges and pitfalls encountered in mammography, ultrasound, magnetic resonance imaging, and contrast-enhanced mammography. Through a combination of lectures and interactive case discussions, participants will gain valuable insights into identifying and overcoming diagnostic obstacles, improving accuracy, and integrating multimodal imaging approaches in clinical practice. Attendees will leave with practical strategies and a deeper understanding of advanced imaging techniques, ultimately improving patient outcomes.

**Sub-Events**

### W8-CBR03B Work Ups Initiated From Challenging Screening Cases

Silvia Perez, MD (*Presenter*) Support, Becton, Dickinson and Company;Support, Bayer AG

### W8-CBR03C Diagnostic Pts and Challenging Evaluations

Beatriz E. Adrada, MD (*Presenter*) Nothing to Disclose

### W8-CBR03D Rad Path Correlation

Cherie M. Kuzmiak, DO (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W8-CCA06

## Master Your AI Skills for Cardiovascular Imaging

Wednesday, Dec. 4 4:30PM - 5:30PM Room: E353C

Marly Van Assen, MSc, PhD (*Moderator*) Nothing to Disclose
Albert Hsiao, MD, PhD (*Moderator*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging

### LEARNING OBJECTIVES

1) Understand the Role of AI in Cardiac Imaging: Gain insights into how artificial intelligence is revolutionizing cardiac MRI and CT imaging, highlighting both current applications and future advancements. 2) Identify Challenges and Opportunities of AI in Cardiac Imaging to improve diagnosis, prognosis and workflow efficiency. 3) Identify Strategies and Challenges for AI Implementation in Clinical Practice: Gain knowledge on effective strategies, tips, and potential challenges for meaningful clinical use of AI.

### COURSE DESCRIPTION

This course offers an in-depth exploration of the role of artificial intelligence in cardiac imaging. Participants will gain insights into how AI is revolutionizing cardiac MRI and CT imaging, with a focus on both current applications and future advancements. The challenges and opportunities presented by AI in cardiac imaging will be discussed. Additionally, this session will be addressing potential implementation strategies and challenges to ensure successful adoption and optimization of these technologies in a clinical setting.

**Sub-Events**

### W8-CCA06C AI in Cardiac MRI Pipeline: The Future is Here

Albert Hsiao, MD, PhD (*Presenter*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging

### W8-CCA06D AI in Cardiac CT: How to Use it Today

Damini Dey, PhD (*Presenter*) Nothing to Disclose

### W8-CCA06E Implementing AI in Daily Practice- Tips, Tricks and Challenges

Tim Leiner, MD, PhD (*Presenter*) Research support, Pie Medical Imaging BV;Advisory Board, Cart-Tech BV;Advisory Board, AI4MedImaging;Advisor, Quantib BV;Consultant, Guerbet SA

# Abstract Archives of the RSNA, 2024

W8-CCH14

## Thoracic Imaging of Medical Devices

Wednesday, Dec. 4 4:30PM - 5:30PM Room: N227B

Girish S. Shroff, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Review the indications for and expected imaging appearances of central venous access catheters, cardiac devices including ventricular assist devices, and airway devices. 2) Review imaging appearances of complications associated with these devices.

**COURSE DESCRIPTION**

This series of educational lectures will review thoracic and cardiac devices including indications for their use, expected imaging appearances, and complications associated with their placement.

**Sub-Events**

### W8-CCH14B Venous Access Catheters - Expected and Unexpected

Girish S. Shroff, MD (*Presenter*) Nothing to Disclose

### W8-CCH14C Imaging Patients with Cardiac Devices

Daniel Vargas, MD (*Presenter*) Nothing to Disclose

### W8-CCH14D Ventricular Assist Devices

Demetrios A. Raptis, MD (*Presenter*) Nothing to Disclose

### W8-CCH14E Airway Devices

Maria D. Martin, MD (*Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W8-CER03

## Fundamentals of Thoracic Trauma

Wednesday, Dec. 4 4:30PM - 5:30PM Room: N228

Felipe Munera, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand and differentiate the imaging features of traumatic conditions commonly encountered in the emergency room, including thoracic vascular injuries, cardiac trauma, and non-vascular thoracic trauma. 2) Refine radiologic reports and improve accuracy by highlighting critical findings for effective ER management, ensuring clear communication regarding traumatic presentations, including thoracic vascular injuries, cardiac trauma, and non-vascular thoracic trauma. 3) Recognize and develop strategies for diagnostic challenges, limitations, and potential pitfalls in emergency radiology imaging of thoracic vascular injuries, cardiac trauma, and non-vascular thoracic trauma.

**COURSE DESCRIPTION**

A focused series of lectures on thoracic vascular injuries, cardiac trauma, and non-vascular thoracic trauma. Learn to identify critical imaging features, produce accurate reports, and overcome diagnostic challenges to enhance patient management in emergency settings.

**Sub-Events**

### W8-CER03B Thoracic, Vascular Injuries

Felipe Munera, MD (*Presenter*) Nothing to Disclose

### W8-CER03C Cardiac Trauma

Sanjeev Bhalla, MD (*Presenter*) Advisory Board, Precisa Gravimetrics AG

### W8-CER03D Non-Vascular Thoracic Trauma

Margarita V. Revzin, MD, MS (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W8-CGI05

## Crohn's Disease Imaging

Wednesday, Dec. 4 4:30PM - 5:30PM Room: E451B

Bari Dane, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand appropriate interpretation of Crohn's disease phenotypes including stricturing and penetrating disease as well as perianal fistuals. 2) Learn imaging technique best practices for CT enterography, MR enterography, and bowel ultrasound. 3) Understand the role of imaging in the assessment of disease activity and treatment response.

**COURSE DESCRIPTION**

This Crohn's disease imaging educational course will review CT and MR enterography imaging technique, assessment of stricturing and penetrating disease, treatment response, perianal fistulas and bowel ultrasound for Crohn's disease.

**Sub-Events**

### W8-CGI05B Assessment of Stricturing and Penetrating Crohn Disease

Danielle E. Kruse, MD (*Presenter*) Nothing to Disclose

### W8-CGI05C CT and MR Enterography: Assessment of Disease Activity and Response Treatment

Jonathan R. Dillman, MD, MSc (*Presenter*) Research Grant, Perspectum Ltd;Research Grant, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research support, Koninklijke Philips NV;Research support, General Electric Company;Research support, Motilent Ltd

### W8-CGI05D CT and MR Enterography in Crohn's Disease: Patient Preparation and Techniques

Bari Dane, MD (*Presenter*) Nothing to Disclose

### W8-CGI05E MRI of Perianal Fistula

Mahmoud M. Al-Hawary, MD (*Presenter*) Nothing to Disclose

### W8-CGI05F Bowel Ultrasound for Crohn's Disease: How to Get Started?

Sudha A. Anupindi, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W8-CGU04

## GU Tumor Boards: How to Bring Value and Become Indispensable

Wednesday, Dec. 4 4:30PM - 5:30PM Room: E353B

Krupa K. Patel-Lippmann, MD (*Moderator*) Nothing to Disclose
Carla B. Harmath, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Utilize case-based format, identifying key images and findings that impact patient management. 2) Understand the common pitfalls in imaging management of GU tumors. 3) Improve clear communication with referring providers, promoting positive shift in outcomes.

**COURSE DESCRIPTION**

The continued advancement in oncologic imaging diagnosis and treatment options makes radiologists key participants in GU cancer diagnosis and management. The radiologists' input has become even more important given the aim for individualized precision care in cancer. This course will guide attendees through the various challenges and pitfalls faced by the radiologist at the GU tumor boards in diagnosis, staging and clinical decision making, in order to successfully guide patient management.

**Sub-Events**

**W8-CGU04C** **Radiologist at the GU Tumor Boards: Speaking the Common Language**

Atul B. Shinagare, MD (*Presenter*) Consultant, VirtualScopics, Inc;Consultant, Imaging Endpoints

**W8-CGU04D** **Renal Masses: What the Urologists Need to Know**

Matthew S. Davenport, MD (*Presenter*) Royalties, Wolters Kluwer nv

**W8-CGU04E** **Common Pitfalls in Imaging Assessment of Prostate Cancer**

Antonio C. Westphalen, MD, PhD (*Presenter*) Shareholder, ScanMed, LLC;Research funded, BotImage, Inc

**W8-CGU04F** **Gynecologic Malignancies: Radiologist Guiding the Way**

Krupa K. Patel-Lippmann, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W8-CMK14

## Arthritis: Back to Basics

Wednesday, Dec. 4 4:30PM - 5:30PM Room: E450A

Anne Cotten, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Identify the main diagnostic imaging features of axial and peripheral spondyloarthritis. 2) Depict imaging features that may be misleading. 3) Recognize the main differential diagnoses of Spondyloarthritis.

**COURSE DESCRIPTION**

After the educational lectures of this course, the participant will have learned to recognize the key imaging features of spondyloarthritis and how to recognize the main differential diagnoses.

**Sub-Events**

### W8-CMK14B MRI in Axial Spondyloarthritis

Filip M. Vanhoenacker, MD, PhD (*Presenter*) Nothing to Disclose

### W8-CMK14C Low Dose CT in Axial Spondyloarthritis

James F. Griffith, MD (*Presenter*) Nothing to Disclose

### W8-CMK14D This Is Not Axial Spondyloarthritis

Anne Cotten, MD (*Presenter*) Nothing to Disclose

### W8-CMK14E Arthritis on MRI: 5 Signs not to Miss

Navid Faraji, MD (*Presenter*) Nothing to Disclose

### W8-CMK14F Arthritis on Radiographs: 5 Common Mistakes

Behrang Amini, MD, PhD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W8-CNR06

## Advanced Neuroimaging Techniques- Ready for Prime Time?

Wednesday, Dec. 4 4:30PM - 5:30PM Room: S406B

Luca Saba, MD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Describe the principles and clinical applications of MR fingerprinting, and discuss its transition from theory to practice. 2) Evaluate the current and potential uses of functional MRI (fMRI) in clinical settings. 3) Understand the glymphatic system's role in neuroimaging and its implications for clinical practice. 4) Assess the advancements and current status of photon counting CT technology and its application in neuroimaging.

**COURSE DESCRIPTION**

This session will move into the cutting-edge advancements in neuroimaging techniques and their readiness for clinical application. Attendees will explore a range of topics from the practical implementation of MR fingerprinting to the clinical utility of fMRI, the role of the glymphatic system, and the current status of photon counting CT. The session aims to provide a comprehensive understanding of these advanced imaging techniques and their potential impact on clinical practice.

**Sub-Events**

### W8-CNR06B MR Fingerprinting: From Theory to Practice

Chaitra A. Badve, MD (*Presenter*) Nothing to Disclose

### W8-CNR06C Resting-State fMRI: Can it be Used in Clinical Practice?"

Vinodh A. Kumar, MD (*Presenter*) Nothing to Disclose

### W8-CNR06D Application of Photon Counting CT: Where We Are?

Luca Saba, MD (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W8-CPH07

## Advance Radiology Practice: Generative AI and Imaging Physics

Wednesday, Dec. 4 4:30PM - 5:30PM Room: S404

Shandong Wu, PhD (*Moderator*) Nothing to Disclose

**LEARNING OBJECTIVES**

1) Understand basic generative AI techniques on how to generate synthetic imaging data and the some latest technical advances. 2) Learn representative use cases of training AI models using synthetic data and reducing uses of contrast agents by generative AI. 3) Explain how imaging physics and radiology can be augmented by generative AI and how physics knowledge can be adapted to enhance synthetic data generation.

**COURSE DESCRIPTION**

Artificial intelligence (AI) is gaining rapid evolvement in radiology for clinical translation and applications. The emergence of generative AI techniques shows impressive power in generating massive amount of synthetic data, including medical images, which not only have a large influence to AI models but also some strong indications to the physics of imaging formation. Generative AI can be an important supplement to medical physics, and meanwhile, imaging physics may play a fundamental role in ascertaining fidelity of synthetic imaging data. Currently, there is a gap in introducing the latest generative AI techniques and its clinical indications to the community of medical physics. Some of the related knowledge, such as how to generate synthetic imaging data, how to incorporate physics into data synthetization, and how synthetic data may reduce uses of contrast agents, remains to be delivered to medical physicists and radiology practitioners. In this educational course proposal, we aim to bring in the latest generative AI techniques and applications that are relevant to radiology and imaging physics to the RSNA audiences.

**Sub-Events**

### W8-CPH07B Overview of AI and Generative AI for Clinical Applications

Shandong Wu, PhD (*Presenter*) Nothing to Disclose

### W8-CPH07C Technical Basics of Generative AI and Potential Roles of Physics

Xiaofeng Yang, PhD (*Presenter*) Nothing to Disclose

### W8-CPH07D Knowledge-based Methods for Generating Synthetic Medical Images

Aldo Badano, PhD (*Presenter*) Research Grant, Barco nv

# Abstract Archives of the RSNA, 2024

W8-RCP12

## Publishing Your Radiology Research: Tips From the Junior Editors of the RSNA Journals

Wednesday, Dec. 4 4:30PM - 5:30PM Room: E351

Susanna I. Lee, MD, PhD (*Moderator*) Royalties, Wolters Kluwer nv
Gary D. Luker, MD (*Moderator*) Institutional Research Grant, Polyphor, Ltd

**LEARNING OBJECTIVES**

1) Understand the manuscript submission and editorial process for trainees and early career physicians and scientists intending to publish in the RSNA journals. 2) Identify available resources and platforms useful in performing and publishing imaging research. 3) Find opportunities to contribute to the RSNA journals in non-author roles (e.g. peer reviewer, editor, etc.).

**COURSE DESCRIPTION**

Gary Luker, Editor of Radiology Imaging Cancer and Susanna Lee, Editor of Radiology Advances, will lead a panel discussion of early career editors of the RSNA journals. Each participant will present a brief talk on a focused topic related to scientific publishing. Following this, 25-30 minutes will be devoted to a question and answer session open to the audience. Sample discussion points include: "Selecting the right journal for your manuscript: how do you decide?" "Journal author information: what's in them and why?", "How to write a good title, abstract, summary statement and key results/teaching points", "Tips on creating graphics, tables and figures", "Responding to peer review comments".

**Sub-Events**

**W8-RCP12C** **Getting Your Research Published**

Luke A. Ginocchio, MD (*Presenter*) Nothing to Disclose

**W8-RCP12D** **Getting Your Research Published**

Merel Huisman, MD, PhD (*Presenter*) Nothing to Disclose

**W8-RCP12E** **Getting Your Research Published**

Ningcheng Li, MD, MS (*Presenter*) Nothing to Disclose

**W8-RCP12F** **Getting Your Research Published**

Xiaoyang Liu, MD, PhD (*Presenter*) Nothing to Disclose

**W8-RCP12G** **Getting Your Research Published**

Aileen O'Shea, MBBCh (*Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M1-SSBR03

**Breast Imaging (Supplemental Screening of Patients with Dense Breasts)**

Monday, Dec. 2 8:00AM - 9:00AM Room: S404

Athina Vourtsi, MD (*Moderator*) Research Consultant, General Electric Company;Research Grant, General Electric Company;Educator, Arbutus Biopharma Corporation;Research collaboration, ScreenPoint Medical BV;Medical Advisory Board, Volpara Health Technologies Limited
Ellen B. Mendelson, MD, MA (*Moderator*) Medical Advisory Board, Seno Medical Instruments, Inc;Medical Advisory Board, Delphinus Medical Technologies, Inc

**Sub-Events**

## M1-SSBR03-1 BRAID TRIAL - COMPARISON OF THREE SUPPLEMENTAL IMAGING TECHNIQUES FOR SCREENING DENSE BREASTS

Stephen W. Duffy (*Abstract Co-Author*) Nothing to Disclose
Yit Y. Lim, MRCS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Archana Seth (*Abstract Co-Author*) Nothing to Disclose
William Wei Lian Teh, MBChB (*Abstract Co-Author*) Speaker, Hologic, Inc;Speaker, Devicor Medical Products, Inc
Miaad Al-Attar, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Iris Allajbeu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nisha Sharma, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Tamara Suaris, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Sarah Savaridas, FRCR,MBChB (*Abstract Co-Author*) Nothing to Disclose
Sarah J. Vinnicombe, FRCR, MRCP (*Abstract Co-Author*) Consultant, Bayer AG
Jonathan James, BMBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Nicholas R. Payne, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Fiona J. Gilbert, MBChB, FRCR (*Presenter*) Research Grant, Hologic, Inc Research Grant, General Electric Company Research Consultant, Alphabet Inc Research Consultant, Kheiron Medical Technologies Ltd Research support, Bayer AG Research collaboration, Volpara Health Technologies Limited Research collaboration Lunit Research collaboration Merantix Research collaboration Screenpoint Research collaboration Therapixel Research support GSK Research collaboration RhinoHealth Research collaboration Curemetrix

### PURPOSE

To compare supplemental imaging techniques following a negative screening mammogram in women with dense breasts in a UK breast screening programme.

### METHODS AND MATERIALS

Women with BI-RADS (5th Ed.) c/d and negative 2D mammograms were randomized to either abbreviated MRI (Abb-MRI), automated whole breast ultrasound (ABUS), contrast enhanced mammography (CEM) or standard of care (SoC) at 10 UK centres. Double reading with arbitration was undertaken. Cancer detection rate (CDR) and recall rate (RR) was compared in each intervention arm together with cancer type and size.

### RESULTS

Over 9,000 women aged 50-70 years were randomized to Abb-MRI (2318), ABUS (2253), CEM (2242) or SoC (2553). Numbers undergoing supplemental imaging were 1970, 2119, and 1959, respectively. Intention to treat CDR was 10.8/1000, 4.0/1000, 13.8/1000 and RR was 9.5%, 4.1%, 9.4% in each arm respectively. There were 57 invasive cancers (with and without DCIS) and 14 DCIS alone. Median invasive cancer size was 10 mm (IQR: 8-11 mm), 9 mm (15 - 29 mm) and 12 mm (9 - 14 mm) for Abb-MRI, ABUS, and CEM respectively. All cancers detected by ABUS were invasive, while the proportions of invasive cancers in CEM and ABB-MRI were 79% and 74%, respectively. Cancers detected by all arms were predominantly grade 2.

### CONCLUSION

Supplemental imaging finds additional cancers not detected by 2D mammography. Contrast techniques (Abb-MRI and CEM) are more sensitive at the expense of higher recall rates than ABUS.

### CLINICAL RELEVANCE/APPLICATION

Earlier detection of cancers by offering supplemental screening will result in fewer late-stage cancers and improve mortality.

## M1-SSBR03-2 IMPROVING CANCER DETECTION IN DENSE BREASTS IN BREAST SCREENING PROGRAMS: THE COMPLEMENTARY STRENGTH OF AI AND HUMAN INTELLIGENCE

William Wei Lian Teh, MBChB (*Abstract Co-Author*) Speaker, Hologic, Inc;Speaker, Devicor Medical Products, Inc
Galvin Khara, PhD (*Abstract Co-Author*) Employee, Kheiron Medical Technologies Ltd
Catharina Oberije, PhD (*Abstract Co-Author*) Nothing to Disclose
Georgia Fox (*Abstract Co-Author*) Nothing to Disclose
Nisha Sharma, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose

Rachael Currie (*Abstract Co-Author*) Nothing to Disclose
Jonathan Nash, MBBS (*Abstract Co-Author*) Nothing to Disclose
ALAN REDMAN (*Abstract Co-Author*) Nothing to Disclose
Ben Glocker, PhD (*Abstract Co-Author*) Employee, Kheiron Medical Technologies Ltd;Employee, HeartFlow, Inc;Researcher, Microsoft Corporation
Peter D. Kecskemethy, PhD (*Abstract Co-Author*) CEO, Kheiron Medical Technologies
Annie Ng, PhD (*Presenter*) Researcher, Kheiron Medical Technologies Ltd

**PURPOSE**

While women with dense breasts have a higher probability of developing breast cancer, detecting cancers in dense breast tissue is found to be more challenging in standard screening. This study investigated the use of an AI system regarding cancer detection across different density categories compared to standard human double reading.

**METHODS AND MATERIALS**

In the largest retrospective clinical study in breast screening to date (306,839 cases from 236,739 participants between 2017-2021), Sensitivity (SEN) of a commercially available AI system was compared to the first human reader (HR) in double reading, using the McNemar test at a significance level of 0.05 and reported with 95% CIs. Cancer cases were pathology proven, including screen-detected (SD) and interval cancers (IC). Breast density was determined by an AI tool according to the 4 BIRADS categories (A-D), with A or B defined as "fatty" and C or D defined as "dense".

**RESULTS**

The breast density distribution of the cohort was 12.7% A, 45.5% B, 37.5% C and 4.3% D, resulting in subgroup proportions of 58.2% fatty and 41.8% dense. The dataset included 2588 SDs and 379 ICs.AI and HR SEN was 82.7% (81.3%-84.0%) vs 80.9% (79.4%-82.2%) (p=0.027) for the whole study population, 84.8% (83.0%-86.5%) vs 86.2% (84.4%-87.8%) (p=0.198) for participants with fatty breasts, and 80.3% (78.2%-82.3%) vs 75.1% (72.8%-77.3%) (p<0.001) for participants with dense breasts, respectively. Subgroup analysis for age 49-55 yr resulted in SEN of 81.2% (76.6%-86.1%) vs 85.8% (80.9%-89.5%) (p=0.133) in fatty breasts and 77.9% (73.9%-81.5%) vs 72.3% (68.0%-76.2%) (p=0.014) for dense breasts, for AI and HR respectively. Screening participants with age 56-71 yr showed similar results with SEN 84.1% (82.6%-86.8%) vs 85.9% (83.7%-87.8%) (p=0.420) for fatty breasts and 81.4% (78.6%-83.8%) vs 75.8% (72.9%-78.5%) (p<0.001) for dense breasts, for AI and HR respectively.

**CONCLUSION**

In this large-scale study, human readers had non-significant higher sensitivity than the AI system for cancer detection in fatty breasts but the effect was opposite in dense breasts, showing a significantly higher sensitivity of the AI system compared to HR. These results suggest that the combination of human reading and AI may achieve best overall screening performance, as they seem to complement each other in cancer detection performance across breast densities.

**CLINICAL RELEVANCE/APPLICATION**

While cancer incidence is higher in dense breasts, cancer can be masked by dense tissue. This study showed that AI performs significantly better than human readers in dense breasts, demonstrating the potential to reduce cancer misses in this group and to support equitable breast screening with the integration of AI into screening workflows.

## M1-SSBR03-3 CANCER DETECTION RATE OF BREAST-MR IN SUPPLEMENTAL SCREENING AFTER NEGATIVE MAMMOGRAPHY IN WOMEN WITH DENSE BREASTS. PRELIMINARY RESULTS OF THE MA-DETECT STUDY AFTER 200 PARTICIPANTS

Clemens G. Kaiser, MD, BA (*Abstract Co-Author*) Nothing to Disclose
Pascal A. Baltzer, MD (*Abstract Co-Author*) Nothing to Disclose
Sabrina Walter (*Presenter*) Nothing to Disclose

**PURPOSE**

Due to increased cancer detection rates (CDR), breast MR (breast MRI) can reduce underdiagnosis of breast cancer compared to conventional imaging techniques, particularly in women with dense breasts. The purpose of this study is to report the additional breast cancer yield by breast MRI in women with dense breasts after receiving a negative screening mammogram.

**METHODS AND MATERIALS**

For this study we invited consecutive participants of the national German breast cancer Screening program with breast density categories ACR C D and a negative mammogram to undergo additional screening by breast MRI. Endpoints were CDR and recall rates. This study reports interim results in the first 200 patients. At a power of 80% and considering an alpha error of 5%, this preliminary population size is sufficient to demonstrate a 4/1000 improvement in CDR.

**RESULTS**

In 200 screening participants, 8 women (40/1000, 17.4-77.3/1000) were recalled due to positive breast MRI findings. Image-guided biopsy revealed four cancers, 3 of them invasive in women presenting with ACR C breast density and one non-calcifying DCIS in a woman with ACR D breast density, resulting in a CDR of 20/1000 (95%-CI 5.5-50.4/1000) and a PPV of 50% (95%-CI 15.7-84.3%).

**CONCLUSION**

Our initial results demonstrate that supplemental screening using breast MRI in women with heterogeneously dense and very dense breasts yields an additional cancer detection rate in line with a prior randomized trial on breast MRI screening of women with extremely dense breasts. These findings are highly important as the population investigated constitutes a much higher proportion of women and yielded cancers particularly in women with heterogeneously dense breasts.

**CLINICAL RELEVANCE/APPLICATION**

Due to its significant additional cancer detection in women with dense breasts, high quality breast MRI should be considered for selected screening purposes.

## M1-SSBR03-4 COMPARATIVE ANALYSIS OF DIGITAL BREAST TOMOSYNTHESIS AND BREAST ULTRASOUND AS SUPPLEMENTAL SCREENING TOOL FOR WOMEN WITH DENSE BREAST AND NEGATIVE MAMMOGRAM: A PROSPECTIVE STUDY FROM A LOW-INCOME COUNTRY

Rashmi Sudhir, MBBS, FRCR (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the effectiveness of supplementary digital breast tomosynthesis (DBT) and breast ultrasound (US) screening among Asian women with dense breasts (ACR category C and D) and negative mammograms.

**METHODS AND MATERIALS**

A prospective study was conducted at a tertiary-level hospital in South India between November 2022 and October 2023, with approval from the Institutional Review Board. Asymptomatic women with negative and dense mammograms were offered supplemental screening for breast cancer through DBT and ultrasound. The assessments were categorized according to the 5th edition of ACR BI-RADS. Follow-up after 6 months was recommended for BI-RADS 3 cases, while biopsy was recommended for BI-RADS 4 and 5 cases. Cancer detection rates and diagnostic efficiency tests of supplemental DBT and breast US were calculated and compared.

**RESULTS**

.A total of 4,430 women were screened for breast cancer. Out of these, 2,120 women (47.8%) with a mean age of 48 ± 10.08 years (age range; 38-84 years) were found to have dense breasts (ACR category C and D). Among these women, 97 (4.6%) had positive findings on screening mammograms. The remaining 2,023 women (95.4%) with dense breasts and negative mammograms underwent additional screening with digital breast tomosynthesis (DBT) and breast ultrasound (US). Supplemental screening detected 14 additional cancers, with a cancer detection rate (CDR) of 6.9/1000 women. For women with dense breasts and negative findings at screening mammograms, the CDR was 5.9/1000 for supplemental US screening and 2.9/1000 for supplemental DBT screening.The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of supplemental DBT screening were 33.3% (95% CI: 13.3 - 59.01%), 51.3% (95% CI: 35 - 67.6%), 24.0% (95% CI: 13.2 - 39.6%), 62.5% (95% CI: 51.6 - 71.3%), and 45.6% (95% CI: 32.4 - 59.3%), respectively. For supplemental US screening, the sensitivity was 85.7% (95% CI: 57.9 - 98.2%), specificity was 9.3% (95% CI: 2.6 - 22.1%), PPV was 23.5% (95% CI: 19.6 - 28.0%), NPV was 66.7% (95% CI: 29.0 - 70.7%), and accuracy was 28.0% (95% CI: 17.7 - 41.5%).

**CONCLUSION**

Supplemental DBT and breast ultrasound screening can detect additional cancers in dense breasts which are not visible on mammograms. Breast ultrasound is more effective but has lower specificity than DBT. Larger multicentre studies are needed to validate findings.

**CLINICAL RELEVANCE/APPLICATION**

Breast cancer is a major issue in public health, especially in low and middle-income countries where access to digital breast tomosynthesis (DBT) facilities is limited. In these settings, breast ultrasound can be an effective supplementary screening tool for women with dense breasts and without exposure to additional radiation.

## M1-SSBR03-5 A DEEP NEURAL NETWORK TO REDUCE THE NUMBER OF UNNECESSARY SUPPLEMENTAL SCREENING BREAST ULTRASOUND EXAMS IN SELECT PATIENTS

Krzysztof J. Geras (*Abstract Co-Author*) Nothing to Disclose
Yiqiu Shen (*Abstract Co-Author*) Nothing to Disclose
Guan-De Wu (*Abstract Co-Author*) Nothing to Disclose
Alana A. Lewin, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study is to assess the performance of a deep neural network (DNN), the Ultrasound Benefit Predictor (UBP), in estimating the added value of supplemental screening ultrasound (US) following a negative screening mammogram.

**METHODS AND MATERIALS**

In this IRB approved study, we developed a DNN system that analyzes full-field digital mammogram (FFDM) to produce a score estimating the added value of same-day supplemental screening ultrasound. The model was trained utilizing 141,791 same-day screening FFDM and US paired exams from 2012-2020 in 82,271 patients with patient-based training/validation/test split of 84.4%/4.6%/11%. The ultrasound benefit predictor (UBP) assessed the added value of US as follows: Positive Added Value - FFDM negative, US BI-RADS 0, cancer diagnosis; Negative Added Value - FFDM negative, US BI-RADS 0, no cancer at one year; No Added Value - both FFDM and US negative. Sensitivity, specificity and PPV were calculated at varying thresholds to test optimal US reduction rate.

**RESULTS**

In a test set of 9,468 patients (15,535 same-day FFDM-US exam pairs; mean age 58.8 years, standard deviation 10.6 years), 1.81% (171/9,468) had pathology-proven cancer. Breast density was 1.3% (201/15,535) almost entirely fatty, 25.0% (3,884/15,535) scattered fibroglandular, 62.2% (9,657/15,535) heterogeneously dense, 10.1% (1,563/15,535) extremely dense, 1.5% (230/15,535) unknown. The UBP determined that when 4% (621/15535) of screening US exams are skipped, 16/2131 false positive recall exams are avoided with no missed cancers (0/171, false negative rate 0%). Breast density in skipped patients: 1.6% (10/621) almost entirely fatty, 23.8% (148/621) scattered fibroglandular, 62.0% (385/621) heterogeneously dense, 11.4% (71/621) extremely dense, 1.1% (7/621) unknown. When 9% (1398/15535) of screening US exams are avoided, 45/2131 false positive recall exams are avoided, and 1/171 cancer was missed (false negative rate 0.058%; path: invasive ductal carcinoma). Breast density: 1.7% (24/1398) almost entirely fatty, 24.8% (347/1398) scattered fibroglandular, 61.4% (858/1398) heterogeneously dense, 11.1% (155/1398) extremely dense, 1.0% (15/1398) unknown.

**CONCLUSION**

Utilizing the UBP on same-day screening mammograms potentially decreases unnecessary supplemental screening ultrasounds performed, reducing downstream diagnostic exams and biopsies.

**CLINICAL RELEVANCE/APPLICATION**

Individualized recommendations for supplemental screening that consider relative risk within breast density categories are needed. The UBP can tailor supplemental screening recommendations and limit unnecessary exams in select patients, including those with dense breasts.

## M1-SSBR03-6 IMAGE-ONLY DEEP LEARNING RISK MODEL PERFORMANCE VS BREAST DENSITY TO PREDICT FUTURE BREAST CANCER

Andrew R. Carney, MS (*Abstract Co-Author*) Nothing to Disclose
Constance D. Lehman, MD, PhD (*Abstract Co-Author*) Institutional Grant, General Electric Company;Institutional Grant, Hologic, Inc;Co-founder, Clairity, Inc.

Sarah Mercaldo, PhD (*Abstract Co-Author*) Nothing to Disclose
Leslie Lamb, MD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Mammograms contain highly predictive biomarkers of future breast cancer risk, which can be identified by deep learning (DL) risk stratification models. Traditional risk assessment models have demonstrated improved performance with the inclusion of breast density, a known risk factor for breast cancer and cancer masking agent. The purpose of this study is to assess the performance of an image-only DL risk model with and without the addition of breast density.

**METHODS AND MATERIALS**

This retrospective, multisite study included consecutive patients >30 years undergoing routine bilateral screening mammography from 01/10/2009 to 01/10/2018 at five facilities with at least five years of follow-up. A DL 5-year model was used to assess risk. No mammograms included were used for model development. Demographic data and risk factors, including qualitative visual assessment of breast density using ACR BI-RADS 5th edition guidelines, were obtained from electronic medical records. Cancer outcomes were obtained through linkage to a regional tumor registry. DL model performance with and without breast density was compared using areas under the receiver operating characteristic curve (AUCs) with DeLong test ($P<0.05$).

**RESULTS**

123,418 bilateral screening mammograms in 67,106 patients met inclusion criteria. Median patient age was 58.0y (IQR: 50.0-67.0). 101,437/123,418 (82.2%) of patients were White, 6331/123,418 (5.1%) Asian, 5975/123,418 (4.8%) Black, 5933/123,418 (4.8%) other races, and 3742/123,418 (3.0%) had an unknown race. 23,622/123,418 (19.1%) had a family history of breast cancer, 94,068/123,418 (76.2%) were post-menopausal, and 29,350/123,418 (23.8%) pre-menopausal. 11,023/123,091 (9.0%) had fatty breasts, 61,094/123,091 (49.6%) scattered fibroglandular, 45,771/123,091 (37.2%) heterogeneously dense, and 5203/123,091 (4.2%) had extremely dense breasts. The AUCs of: DL model without vs with density were 0.71 (95% confidence interval [CI]: 0.70, 0.72) vs 0.70 (95% CI: 0.69, 0.71); $P=0.084$. Density alone was signficiantly worse (0.53 [95% CI: 0.52, 0.54]) compared to DL model, $P<0.001$.

**CONCLUSION**

Breast density is a poor predictor of breast cancer. A screening mammography DL breast cancer risk assessment model has higher risk discriminatory accuracy compared to breast density and does not improve with the addition of breast density.

**CLINICAL RELEVANCE/APPLICATION**

Breast density legislation mandates that women are informed of breast density, a historic marker of breast cancer risk. A DL image-only risk model derived automatically at the time of screening mammography, provides an opportunity to improve risk discrimation beyond breast density.

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# Abstract Archives of the RSNA, 2024

M1-SSBR04

**Breast Imaging (Screening Modalities Analyses and Mode of Detection)**

Monday, Dec. 2 8:00AM - 9:00AM Room: S406A

Sujata V. Ghate, MD (*Moderator*) Research Grant, Bracco Group;Reader, QT Ultrasound, LLC;Travel support, QT Ultrasound, LLC
Cecilia L. Mercado, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M1-SSBR04-1 IMPACT OF BREAST CANCER MODE OF DETECTION ON PATIENT OUTCOME AND MORTALITY

Cindy S. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Steven Chen (*Presenter*) Nothing to Disclose

### PURPOSE

Screening mammography significantly reduces breast cancer deaths. Little research exists on how the mode of breast cancer detection impacts patient outcome. We aim to compare the patient outcome and factors associated with breast cancers diagnosed by screening versus clinical symptoms in TriNetX, a global research network containing real-world aggregate EMR data from 35 health institutions and 51 million patients worldwide.

### METHODS AND MATERIALS

This HIPAA-compliant, IRB-exempt retrospective cohort study queried data from 898,049 women over age 40 diagnosed with breast cancers 1/1/2000-1/1/2023 at 89 institutions. Screening-detected cohort had abnormal screening mammography within 1 year prior to breast cancer diagnosis followed by abnormal diagnostic findings and breast biopsy within 3 months of diagnosis. Clinically-detected cohort had a diagnostic mammogram within 1 year prior to diagnosis, followed by breast biopsy within 3 months of diagnosis, but didn't have screening mammography for 2 years prior to diagnosis. Age, all-cause mortality, race, ethnicity, medical history, family history, and use of preventative services were compared.

### RESULTS

Among 3,927 women with breast cancers and reported mode of detection, 3,186 (81.1%) were in screening cohort and 741 (18.9%) in clinical cohort. Age range 49-70 years, mean 59.6 ± 10. Clinically detected breast cancers were associated with higher risks of mortality (16.87% vs. 8.38%; OR 2.22, 95% CI 1.76 - 2.79, $p < 0.0001$). Screening-detected breast cancers were associated with non-Hispanic/Latino ethnicity (OR 0.57, 95% CI 0.45 - 0.72; $p < 0.0001$), family history of breast cancer (OR 0.47, 95% CI 0.38 - 0.57; $p < 0.0001$), hyperlipidemia (OR 0.67, 95% CI 0.56 - 0.81; $p < 0.0001$), postmenopausal status (OR 0.39, 95% CI 0.30 - 0.51; $p < 0.0001$), uses of cervical cancer screening (OR 0.41, 95% CI 0.33 - 0.52; $p < 0.0001$), colon cancer screening (OR 0.52, 95% CI 0.41 - 0.65; $p < 0.0001$), and immunization (OR 0.51, 95% CI 0.42 - 0.62; $p < 0.0001$). History of stroke was associated with a higher risk of clinically detected breast cancer (OR 1.68, 95% CI 1.09 - 2.58; $p < 0.0001$) (Table 1).

### CONCLUSION

Screening versus clinical mode of detection impacts the overall mortality of breast cancer patients, with higher risks of mortality associated with clinically detected breast cancers. Women of non-Hispanic ethnicity, with family history of breast cancer who participated in cervical and colon cancer screening were more likely to have breast cancers detected during routine mammographic screening.

### CLINICAL RELEVANCE/APPLICATION

Mammographic screening significantly reduces mortality by detecting cancers earlier, before clinical symptoms develop.

## M1-SSBR04-2 2D DIGITAL MAMMOGRAPHY OCCULT, DIGITAL BREAST TOMOSYNTHESIS DETECTED ARCHITECTURAL DISTORTION: PATHOLOGIC RESULTS AND FEATURES OF MALIGNANCY

Zeeshan A. Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Sean D. Raj, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Architectural distortion detected on 2D digital mammography (DM) can indicate underlying malignancy and often warrants additional imaging or biopsy. 3D digital breast tomosynthesis (DBT), a more sensitive imaging modality, detects architectural distortion at higher rates than DM. There is a paucity of data on the radiologic-pathologic correlation of DM-occult, DBT-detected architectural distortion. The purpose of this study is to evaluate the rate and features of malignancy in DM occult, DBT detected architectural distortion, and provide radiologic-pathologic correlation for benign, high-risk, and malignant lesions associated with architectural distortion that proceeded to stereotactic core biopsy with tomosynthesis guidance.

### METHODS AND MATERIALS

A retrospective review of all stereotactic core biopsies with tomosynthesis guidance from June 1st, 2017, to August 31st, 2020. All 2D-occult, 3D-detected architectural distortions biopsied with tomosynthesis guidance were identified and reviewed by two fellowship-trained breast imagers and two trained medical students. Radiologic features, clinicopathologic features, and final pathologic diagnoses were documented for analysis.

**RESULTS**

Of 624 total stereotactic core biopsies with tomosynthesis guidance during the study period, 168 2D-occult, 3D-detected architectural distortions in 166 patients (average age 60.4 years) were identified. The positive predictive value (PPV) of 2D-occult, 3D-detected architectural distortion for malignancy was 22.0% (37/168 cases; 95% CI = 16.2-29.2%). DBT-guided biopsy revealed a malignant diagnosis in 37/168 (22.0%), a high-risk diagnosis in 22 /168 (13.1%), and a benign diagnosis in 109/168 (64.9%). Among the malignant biopsy results, low-grade malignancy was most common (94.6%; 35/37 cases). Radial scar was the most common high-risk finding (21/22, 95.5%), and fibrosis and fibrocystic change were the most common benign findings (73/109, 67.0%). The negative predictive value of non-malignancy for a single-view distortion (seen only on DBT mediolateral oblique or craniocaudal view) was 92.9% (26/28).

**CONCLUSION**

The final malignancy rate of 22.0% (37/168) in 2D-occult, 3D-detected architectural distortions warrants stereotactic core biopsy with tomosynthesis guidance.

**CLINICAL RELEVANCE/APPLICATION**

Architectural distortion that is 2D digital mammography occult, 3D digital breast tomosynthesis detected is worrisome for low-grade malignancy without any clear predictive factors, and stereotactic core biopsy is justified.

## M1-SSBR04-3 MAXIMIZING BREAST CANCER DETECTION: A COMPARATIVE ANALYSIS OF SCREENING STRATEGIES

Matthew Covington, MD (*Presenter*) Consultant, inviCRO, LLC

**PURPOSE**

While mammography is crucial and lifesaving, it doesn't identify all breast cancers, especially in dense breasts. The proportions of all theoretical cancers in the screening population detected through mammography and supplemental techniques like US, MBI, CEM, or MRI are unclear. This study estimates the total detectable breast cancers via mammography and the potential detection rates of supplemental techniques like ultrasound (US), molecular breast imaging (MBI), contrast-enhanced mammography (CEM), and breast MRI.

**METHODS AND MATERIALS**

This study, with IRB approval waived, uses published data to determine the cancer detection rate (CDR) of 2D mammography and dense breast prevalence from Breast Cancer Surveillance Consortium (BCSC) data (PMID: 32227180, 25217577). ICDRs from supplemental screening methods were estimated from a 2021 multi-institution expert panel literature review (PMID: 32903054). The maximum number of 2023 U.S. mammograms was estimated from Mammography Quality Standards Act MQSA data. The calculation to estimate the maximum number of detectable cancers in the 2023 screening population is: (2D Mammography CDR x Total 2023 Screening Mammograms)/1000 + (ICDR of Most Sensitive Supplemental Screening Method x (Percentage of Dense Breast Tissue x Total 2023 Screening Mammograms))/1000 To estimate the proportion of cancers detected by various screening strategies, the number of cancers detectable by each method is divided by the total number of detectable cancers.

**RESULTS**

The number of screening mammograms estimated from MQSA was 40,538,610 in 2023. BCSC data suggest a 43% prevalence of dense breast tissue and a 2D mammography CDR of 4.7 cancers/1000 exams. The ICDRs of supplemental screening per 1,000 exams are estimated at 1.7 for DBT, 2.7 for US, 8.1 for MBI, 10.7 for CEM and 16 for MRI. The maximal number of supplemental screening exams was 17,431,602. Total detectable cancers in the 2023 screening population is 469,437. Of these, 2D mammography would detect 190,531 cancers (41%). Additional supplemental screening would detect 220,165 cancers (47%) for DBT, 237,596 (47%) for US, 331,727 (71%) for MBI, 377,049 (80%) for CEM and 469,437 (100%) for MRI.

**CONCLUSION**

It is likely that 2D mammography identifies less than half of all detectable cancers within the screening population. Detection can markedly improve with supplemental screening, but effectiveness varies. Maximal breast cancer detection involves mammography with MRI for dense breast supplemental screening.

**CLINICAL RELEVANCE/APPLICATION**

Evaluating the efficacy of different breast cancer screening methods, inclusive and exclusive of supplemental dense breast screening, could offer significant insights for devising effective screening strategies.

## M1-SSBR04-4 ENHANCING MAMMOGRAPHY SCREENING: A COMPARATIVE ANALYSIS OF AI ENSEMBLE STRATEGIES

Tatiana C. Tucunduva, MD (*Abstract Co-Author*) Nothing to Disclose
Vasanth Venugopal (*Abstract Co-Author*) Nothing to Disclose
Giselle G. Mello, PhD (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno A. Rocha, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The objective of this study is to delineate the diagnostic performance spectrum of AI algorithms in mammographic analysis by comparing the efficacy of individual algorithms with ensemble approaches, which involve the simultaneous use of multiple AI algorithms in the same case. The focus is on a critical examination of the trade-offs between optimizing sensitivity and specificity.

**METHODS AND MATERIALS**

A cohort of 1,381 mammography screenings was retrospectively analyzed, including 494 positive cases confirmed via biopsy and 887 negative cases ascertained through a one-year follow-up. The study evaluated three AI solutions—Therapixel, Lunit, and Medcog—by employing tailored thresholds to generate binary classifications. For the Any-Positive Ensemble (APE) method, a study was classified as positive if any AI model yielded a score surpassing its designated threshold. The Balanced Score Ensemble (BASE) method involved normalizing each AI score by its respective threshold and computing an average; a positive classification was determined if this average exceeded the aggregate midpoint of normalized thresholds. Metrics, including accuracy, precision, recall, specificity, F1 score, MCC, and AUC, were computed alongside false positives and negatives to objectively assess each model and ensemble strategy.

**RESULTS**

The algorithms displayed distinct AUCs: Medcog (0.91), Lunit (0.92), and Therapixel (0.93). APE All, designed to prioritize sensitivity, registered an AUC of 0.72 and a sensitivity rate of 99.39%, revealing a deliberate design choice for sensitivity prioritization. BASE All reported an AUC of 0.85, reflecting a

balanced sensitivity-specificity profile. The standard Max and Average Probability Ensembles yielded AUCs of 0.75 and 0.88, respectively, each signifying a different balance in performance trade-offs.

**CONCLUSION**

The comparative analysis elucidates the heterogeneous performance landscape of AI models and ensembles in mammography, with each method exhibiting distinct trade-offs between diagnostic accuracy and false-negative reduction. The study provides an empirical foundation for the judicious selection of AI tools in mammography, guided by clinical screening objectives.

**CLINICAL RELEVANCE/APPLICATION**

This study highlights the clinical relevance of AI integration in mammography screening, offering insights into how different AI models and ensemble strategies can be tailored to improve diagnostic accuracy. Such integration could lead to more personalized, efficient, and sensitive breast cancer screening processes, potentially improving patient outcomes through earlier and more accurate detection.

## M1-SSBR04-5 PERFORMANCE OF A COMMERCIAL DIGITAL BREAST TOMOSYNTHESIS CANCER DETECTION MODEL IN A LARGE, RACIALLY DIVERSE US SCREENING POPULATION

Theodorus Dapamede, MD, PhD (*Abstract Co-Author*) Intern, MARS BioImaging Ltd
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Samia Belhadj (*Abstract Co-Author*) Nothing to Disclose
Thijs Kooi, MSc,PhD (*Abstract Co-Author*) Stockholder, Lunit Inc
Aawez Mansuri (*Abstract Co-Author*) Nothing to Disclose
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Ambika Seth, MBBS, MD (*Abstract Co-Author*) Medical Director, Lunit Inc
Han Eol Jeong (*Abstract Co-Author*) Nothing to Disclose
Beatrice Brown-Mulry (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Presenter*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;

**PURPOSE**

To investigate the standalone performance of a commercially available artificial intelligence (AI) algorithm for breast cancer detection on digital breast tomosynthesis (DBT) images in a large, racially heterogeneous US screening population, both overall and by various patient subgroups.

**METHODS AND MATERIALS**

A total of 137,460 retrospective cases with DBT images were collected from multiple screening centers associated with Emory University from 2013-2020. A commercial AI algorithm (INSIGHT DBT, Lunit, South Korea) was used to analyze each DBT exam and return an abnormality score ranging from 1-100. Scores gt; 10 were defined as positive per previously validated relevant operating point thresholds for the model. The area under the receiver operating characteristic curve (AUC), sensitivity, and specificity, were calculated in the overall cohort and further stratified by race (White, Black, Asian, Other), ethnicity (Hispanic, non-Hispanic, Unknown), age, breast density, cancer subtype (invasive, non-invasive), and imaging features (mass, calcification, architectural distortion, asymmetry, or multiple).

**RESULTS**

Of 121,995 screening DBT examinations, there were 656 biopsy-proven breast cancers. The model achieved an overall AUC of 0.920 (95% CI 0.91-0.93), with a sensitivity and specificity of 84.5% and 83.8%, respectively. The Al algorithm demonstrated robust performance with no significant differences between race, ethnicity, age groups, or breast density. There was no statistically significant difference in performance between lesion types with AUCs (95% CI) ranging between 0.88 (0.86-0.91) for calcifications and 0.97 (0.96-0.98) for architectural distortions.

**CONCLUSION**

A commercial breast cancer detection model for digital breast tomosynthesis demonstrated equitable performance across multiple patient subgroups when tested on a diverse screening population. Notably, there were no significant differences in performance for various lesion types, indicating the model performs well across various imaging findings which may be difficult for radiologists to detect.

**CLINICAL RELEVANCE/APPLICATION**

A commercially available AI algorithm for breast cancer detection based on DBT images performs equitably across multiple patient subgroups in a diverse screening population, suggesting that the model could perform well in various patient populations.

## M1-SSBR04-6 FALSE NEGATIVE BREAST CANCER DIAGNOSES AFTER DIGITAL BREAST TOMOSYNTHESIS SCREENING: RESULTS OVER 10 YEARS

Katie Jolin, MD (*Abstract Co-Author*) Nothing to Disclose
Lawrence H. Staib, PhD (*Abstract Co-Author*) Nothing to Disclose
Maryam Etesami, MD (*Abstract Co-Author*) Nothing to Disclose
Liane E. Philpotts, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Digital breast tomosynthesis (DBT) has been shown to increase cancer detection at screening compared with 2D mammography. The interval cancer rate of DBT is an important area where more data is needed. The purpose of this study was to assess the rate and types of cancers not detected at screening DBT, but detected by either interval (symptomatic) presentation or supplemental screening.

**METHODS AND MATERIALS**

An IRB-approved (consent waived) review of our breast imaging electronic database (PenRad, Inc) was performed to identify all true positive (TP) and false negative (FN) cancers over 10 years (8/1/2011-7/31/2021). FN cancers were defined as being diagnosed within 12 months of a normal DBT screening mammogram. In our practice women with dense breasts primarily undergo supplemental hand-held ultrasound (US) and many at increased risk opt for supplemental magnetic resonance imaging (MRI). The electronic medical records were reviewed to determine patient age, risk status, method of detection (symptomatic versus supplemental screening), lesion imaging features, breast density, and cancer type, size, and molecular receptor profile. Advanced cancers were defined as: Invasive cancers 2cm or larger, HER2+ or triple-negative tumors >10mm, one or more positive axillary nodes, or distant organ spread. The cancer types, molecular profiles and rate of advanced cancers were compared.

## RESULTS

Over 10 years there were 237,394 DBT screenings, 1265 TP and 132 FN cancers for a TP rate of 5.3 and a FN rate of 0.6 per 1000. The sensitivity of DBT was 90.6% (1265/1397). Of 132 FN, 57 (43%) were symptomatic interval cancers (IC), 59 (45%) supplemental US and 16 (12%) MRI. The symptomatic interval cancer rate was 0.2 per 1000. The breast density categories were: A 1%, B 14%, C 73%, D 12%. The mean size was largest for IC and smallest for US: IC 2.6 cm, US 1.1 cm, MRI 1.4 cm. The majority of cancers were invasive: IC (57/57, 100%), US (56/59, 95%), MRI (12/16, 75%). The molecular profiles differed by group with higher rates of HER2+ and TN in the IC and MRI groups (IC:ER+ 60%, HER2+TN 40%; US:ER+ 82%, HER2+TN 18%, MRI: ER+ 50%, HER2+TN 50%). The advanced cancer rate varied significantly by method of detection with highest in the IC group: IC 43/57 (75%), US 9/56 (16%), MRI 1/12 (8%) (p=0.00001).

## CONCLUSION

The sensitivity rate of DBT is high and the FN rate low, with the interval cancer rate very low. The majority of FN cancers were detected by supplemental screening. HER2+ and TN cancers account for a large percent of IC as well as those detected by MRI. US detected cancers had smallest size and most favorable molecular profile.

## CLINICAL RELEVANCE/APPLICATION

The use of DBT for screening, in conjunction with supplemental screening for women with dense breasts or high risk, optimizes interval cancer rate.

# Abstract Archives of the RSNA, 2024

M1-SSCA03

**Cardiac Imaging (Workflow Enhancement)**

Monday, Dec. 2 8:00AM - 9:00AM Room: E352

Bradley D. Allen, MD, MS (*Moderator*) Consultant, Circle Cardiovascular Imaging Inc;Speaker, WebMD LLC
Michael F. Morris, MD (*Moderator*) Educator, Medtronic plc

**Sub-Events**

## M1-SSCA03-1 EVALUATION OF HIGHLY ACCELERATED CINE WITH DEEP LEARNING IMAGE RECONSTRUCTION TO DECREASE SCAN TIME WHILE MAINTAINING IMAGE QUALITY AND ACCURATE VOLUMETRIC ANALYSIS

Junjie Ma (*Abstract Co-Author*) Nothing to Disclose
Martin A. Janich, PhD (*Abstract Co-Author*) Employee, General Electric CompanyStockholder, General Electric Company
Xucheng Zhu (*Abstract Co-Author*) Employee, General Electric Company
Alessandro Scotti, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael Vinsky (*Abstract Co-Author*) Nothing to Disclose
Melany B. Atkins, MD (*Presenter*) Consultant, General Electric Company;Speaker, General Electric Company

### PURPOSE

Cardiac MR (CMR) is a labor-intensive examination with long acquisition times and long breath hold requirements1. Use of CMR to characterize cardiomyopathies, infarct, scar, valvular, and congenital heart diseases is increasing2. These patients are often dyspneic and orthopneic and symptoms can worsen during the examination. We aim to show how deep learning reconstruction (DLR) of highly undersampled cine images (Sonic DL) can substantially decrease scan time while maintaining image quality and quantitative accuracy.

### METHODS AND MATERIALS

Seventy patients (ages 10-88 years) were scanned on a 1.5T with three short axis (SA) cine techniques: standard steady state free procession (SSFP), Sonic DL 3 RR (three heartbeats per slice), and Sonic DL 1 RR (one heartbeat)3. Scan times were recorded for all sequences and defined as the total scan time from the start of one sequence until the start of the following sequence, including breaks between slices and breath holds. Volumetric measurements were processed independently with Arterys software. Bland-Altman plots were performed to compare measurements between techniques. Image quality was scored on a 5-point Likert scale and scores were compared via a Wilcoxon signed rank-sum tests.

### RESULTS

Average total scan time for standard SSFP was 7.9 minutes, significantly longer (p-value <0.001) than 3 RR (2.7 minutes), and 1 RR (1.6 minutes). Scan time savings was 66% for 3R-R and 80% for 1 R-R. Conventional SSFP Cine image quality is comparable to Sonic DL 1RR and 3RR. The volumetric and function measurements demonstrated negligible differences between the three acquisition types.

### CONCLUSION

Standard SSFP cine acquisitions are the mainstay of the CMR examination and are limited by long acquisition times, data segmentation over multiple heart beats, and breath hold requirements. We demonstrated in this study the use of the novel Sonic DL method can significantly decrease scan time while maintaining image quality. While other studies have previously evaluated sequence acquisition time and volumetric assessments3,4, this study specifically evaluates the three techniques in a routine clinical setting to assess total SSFP scan time including breath holds and dead times. Future studies will evaluate the clinical impact of Sonic DL in reducing the entire exam time.

### CLINICAL RELEVANCE/APPLICATION

Use of DLR can be a powerful tool in reducing long CMR scan times, while maintaining or improving image quality and functional assessments. Such time reduction is critical, especially in patients with cardiac conditions affecting CMR quantitative accuracy. Scan time reduction will also allow for additional patient throughput, successful exam completion, and access to cardiac MR in locations with long patient back logs.

## M1-SSCA03-2 FRACTAL ANALYSIS IMPROVES INTERPRETABILITY OF CT PERFUSION ESPECIALLY IN PATIENTS WITH REDUCED REMOTE MYOCARDIAL BLOOD FLOW

Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Kakuya Kitagawa, MD, PhD (*Abstract Co-Author*) Chair, Siemens AG
Kaoru Dohi (*Abstract Co-Author*) Nothing to Disclose
Tairou Kurita, MD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Florian Michallek, MD (*Presenter*) Nothing to Disclose

### PURPOSE

When interpreting myocardial blood flow (MBF) obtained from dynamic stress CT perfusion (CTP), presence of microvascular ischemia can be a confounder by reducing overall MBF. Fractal analysis has potential in differentiating etiology of ischemia in terms of obstructive coronary artery disease (CAD) and microvascular disease. This study evaluates fractal analysis for diagnosing obstructive CAD and improving interpretation of CTP depending on absolute MBF of remote myocardium, using relative MBF measurements as comparison.

### METHODS AND MATERIALS

We investigated data from a prospective, multicenter trial (7 centers), which enrolled patients with clinical indication for invasive coronary angiography (ICA). All patients underwent ICA with fractional flow reserve (FFR) measurements in vessels with stenosis = 25% and < 90%. Obstructive CAD was defined as either stenosis = 90% on ICA, or FFR < 0.8. Vessels were excluded if hypoplastic, or if FFR was missing. Comprehensive CT evaluation was performed by calcium scan, stress CTP, CT angiography and CT delayed enhancement. We conducted fractal analysis as well as MBF calculations as previously established. We compared diagnostic accuracy of fractal analysis and MBF standardized to remote myocardium ("relative MBF") for diagnosing obstructive CAD, and we stratified patients into high, intermediate and low absolute remote MBF to reflect potential impact of microvascular ischemia. We compared areas under receiver-operating curves (AUC) by DeLong test, and sensitivity and specificity by McNemar chi2 test.

### RESULTS

We included 156 patients (high, intermediate and low remote MBF groups; n=52 patients each) with 439 vessels. On vessel level, fractal analysis outperformed relative MBF for diagnosing obstructive CAD (AUC: 0.89 vs 0.77 for fractal analysis vs relative MBF, $p < 0.01$). In patients with high remote MBF, fractal analysis performed equally well as relative MBF (AUC: 0.91 vs 0.81, $p=0.18$), however, in intermediate and low absolute remote MBF, fractal analysis outperformed relative MBF (AUC: 0.89 vs 0.78, $p=0.04$ and 0.87 vs 0.7, $p<0.01$). On patient level, sensitivity and specificity for diagnosing obstructive CAD was 87% and 92% for fractal analysis, and 76% and 78% for relative MBF ($p<0.01$).

### CONCLUSION

Diagnostic accuracy of relative MBF for diagnosing obstructive CAD is limited in patients with reduced absolute remote MBF, which can occur due to microvascular ischemia. Fractal analysis operates independently from remote MBF and maintains high diagnostic accuracy for obstructive CAD even in patients with reduced remote MBF.

### CLINICAL RELEVANCE/APPLICATION

Fractal analysis reliably identifies obstructive CAD even in patients with reduced remote MBF in whom interpretability of relative MBF is limited.

## M1-SSCA03-3 AI-ENABLED AUTOMATIC CARDIAC CHAMBER VOLUMETRY: A COMPARATIVE ANALYSIS USING CCTA, CACT, AND NCCT

Joon-Won Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Dong Hyun Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Hyun Jung Koo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jong Eun Lee, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the feasibility of AI-enabled automatic cardiac chamber volumetry inelectrocardiography (ECG)-gated calcium scoring CT (CaCT) and non-ECG-gated chest CT (NCCT) scans. This study also investigates the prognostic implications of volumetric measurements in the context of atrial fibrillation and major adverse cardiac events (MACE).

### METHODS AND MATERIALS

Participants who underwent ECG-gated coronary CT angiography (CCTA), CaCT, and NCCT either on the same day or within one month from 2008 to 2013 were retrospectively collected from a national health screening center. AI-enabled volumetry was used to compare chamber volume congruence across modalities and to assess the prognostic association of chamber volumes with atrial fibrillation diagnosis and MACE, including unstable angina requiring hospitalization or revascularization, myocardial infarction, ischemic stroke, and cardiovascular death, using Cox hazard regression models.

### RESULTS

The study included 964 participants with a mean age of 66.8 years; 67.4% were male (650 of 964). The average left ventricular (LV) and left atrial (LA) volume indices measured from CCTA, CaCT, and NCCT were 57.4 ± 10.8 mL, 63.1 ± 10.6 mL, and 68.1 ± 16.0 mL for the LV, and 52.1 ± 11.7 mL, 45.6 ± 10.8 mL, and 44.8 ± 11.0 mL for the LA, respectively, showing excellent agreement (intraclass correlation coefficient of 0.825 and 0.903, respectively). In the multivariable Cox hazard regression models, the LA volume indices measured from CaCT and NCCT were associated with an increased risk of atrial fibrillation (HR, 1.06; 95% CI: 1.03-1.10; $P < .001$ and HR, 1.09; 95% CI: 1.04-1.15; $P < .001$, respectively), and the LV volume indices measured from CaCT and NCCT were associated with an increased risk of MACE (HR: 1.03; 95% CI: 1.01-1.04; $P < .001$ and HR, 1.02; 95% CI: 1.01-1.03; $P = .028$, respectively).

### CONCLUSION

AI-enabled automatic cardiac chamber volumetry demonstrates high reliability and congruence across different CT modalities. This technology not only aids in precise volume measurement but also provides significant prognostic value in predicting atrial fibrillation diagnosis and MACE.

### CLINICAL RELEVANCE/APPLICATION

AI-enabled automatic cardiac chamber volumetry demonstrates that AI technology can accurately measure cardiac chamber volumes across different CT scans, providing crucial prognostic information for conditions such as atrial fibrillation and MACE. This advancement supports non-invasive risk stratification, offering significant potential to enhance patient care and treatment outcomes in cardiovascular health.

## M1-SSCA03-4 QUANTIFICATION OF LEFT VENTRICULAR LGE IN CARDIAC MRI USING LARGE LANGUAGE MODELS (LLMS)

Florian Schiffers (*Abstract Co-Author*) Nothing to Disclose
Santiago Lopez-Tapia (*Abstract Co-Author*) Nothing to Disclose
Aggelos K. Katsaggelos (*Abstract Co-Author*) Nothing to Disclose
Daniel Lee (*Abstract Co-Author*) Research Grant, Abbott Laboratories;Spouse, Employee, Takeda Pharmaceutical Company Limited
Brandon Benefield (*Abstract Co-Author*) Nothing to Disclose
Daniel Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Neda Tavakoli, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

While left ventricular (LV) scar volume derived from late gadolinium enhancement (LGE) is a proven predictor of major adverse cardiac events (MACE) and correlates with poor outcomes, it is seldom used in clinical practice due to its time-consuming, labor-intensive nature, and susceptibility to inter-observer variability. Initial deep learning (DL) methods using a U-Net to automate this image processing have been largely unsuccessful (DICE scores < 0.70). In direct response, we propose a new method using DL to automatically segment and quantify LV scars on LGE images.

### METHODS AND MATERIALS

This study utilized labeled LGE data with myocardial wall and scar contours from the DETERMINE Trial dataset. We implemented an LLM-based DL model, based on the fine-tuned MedSAM model, on a GPU workstation (NVIDIA A100-PCIE-40GB) equipped with PyTorch, to automatically segment the LV into 4 classes: background, healthy myocardium, scar, and LV blood pool. Labeled data were randomly selected from 150 patients (totaling 1415 2-D images) for network fine-tuning. The remaining labeled data from 101 patients (totaling 829 2-D images) with ischemic cardiomyopathy and LV ejection fraction (LVEF) < 50 % were reserved for testing. We utilized PyTorch's built-in cross-entropy loss combined with the DICE loss of the entire LV (i.e., myocardium outer boundary). We compared our approach to previously described methods using the 4-class U-Net, where both our and previous approaches used the same manual contour files. To evaluate the network's performance, we calculated the DICE score and scar volume for each testing subject with manual contours as the reference. Mean DICE score between LLM and 4-class U-Net was compared using Bland-Altman (BA) analysis and paired t-test.

### RESULTS

Using manual contouring as the reference standard and conducting BA analysis, LLM showed superior agreement with less variability than the 4-class U-Net (Figure 1). Mean scar DICE score for LLM was significantly better than 4-class U-Net (0.914±0.08 vs. 0.57±0.09, respectively, P<0.001). Additionally, mean myocardium DICE score differed statistically between LLM and 4-class U-Net (0.91±0.05 vs. 0.81±0.02, respectively, P<0.001).

### CONCLUSION

Statistically closer agreement of LLM segmentation with reference standard in comparison with 4-class U-Net demonstrates a promising automatic segmentation tool to accurately quantify LV scar. Using pre-trained models and fine-tuning with domain-specific datasets in the LLM model significantly enhances the performance of the DL network compared to training from scratch used in 4-class U-Net.

### CLINICAL RELEVANCE/APPLICATION

LV scar quantification from cardiac MRI can enhance prognosis and clinical outcome understanding.

## M1-SSCA03-5 FAST AND ROBUST SINGLE-SHOT CINE CARDIAC MRI USING DEEP LEARNING SUPER-RESOLUTION RECONSTRUCTION

Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Alexander Isaak, MD (*Abstract Co-Author*) Nothing to Disclose
Christoph Katemann (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Dmitrij Kravchenko, MD (*Abstract Co-Author*) Nothing to Disclose
Leonie Weinhold (*Abstract Co-Author*) Nothing to Disclose
Daniel Kuetting, MD (*Abstract Co-Author*) Nothing to Disclose
Johannes M. Peeters, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Leon Bischoff, MD (*Abstract Co-Author*) Nothing to Disclose
Ulrike I. Attenberger, MD (*Abstract Co-Author*) Consultant, Bayer AG
Narine Mesropyan, MD (*Abstract Co-Author*) Nothing to Disclose
Oliver M. Weber (*Abstract Co-Author*) Nothing to Disclose
Taraneh Aziz-Safaie, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To apply a deep-learning (DL) method to reconstruct balanced steady-state free precession (bSSFP) single-shot (SSH) cine images and to compare them to standard bSSFP cine imaging.

### METHODS AND MATERIALS

Retrospective electrocardiogram-gated breath-hold images in short-axis view were acquired using both bSSFP compressed sensing SSH cine and standard bSSFP cine techniques (1.5T MRI). SSH cine images were reconstructed using a DL super-resolution algorithm provided by Philips Healthcare that combines and integrates compressed sensing with two distinct convolutional neural networks: Adaptive-CS-Net and Precise-Image-Net. Two readers evaluated the diagnostic quality (endocardial edge definition and blood-pool to myocardium contrast) and artifact burden using a Likert scale (from 1 = non-diagnostic to 5 = excellent). For quantitative image sharpness assessment, edge rise distance was calculated. Apparent signal-to-noise ratio (aSNR) and contrast-to-noise ratio (aCNR) were calculated. Wilcoxon signed-rank test, Bland-Altman analysis, linear regression and Pearson correlation were used

### RESULTS

45 patients (mean age, 50 years ± 18; 30 men) were included. The acquisition duration of SSH cine was about 50% lower compared to standard cine (mean duration, 32 sec ± 8 vs. 67 sec ± 20; p<.0001). Image sharpness and contrast were superior in DL-SSH cine compared to standard cine (edge rise distance: 2.0 mm ± 0.3 vs. 2.6 mm ± 0.7; p<.0001; contrast: 5.0 ± 0.1 vs. 4.8 ± 0.4, p=.01). No significant difference in ratings of artifacts (4.4 ± 0.6 vs. 4.6 ± 0.8, p=.26) and the assessment of aSNR (44.3 ± 25.8 vs. 46.5 ± 16.4; p=.37) and aCNR (33.7 ± 20.9 vs. 35.5 ± 13.1; p=.41) was found. High agreement between both cine techniques was found for functional LV parameters (e.g. ejection fraction: 0.99 [0.89, 1.09], r=0.95; end-diastolic volume index: 0.98 [0.91, 1.05], r=0.97). Subgroup analysis of patients with arrhythmia or unreliable breath holding (n=14/45, 31%) showed more distinct differences between DL-SSH and standard cine (e.g., artifacts: 4.3 ± 0.6 vs. 3.9 ± 1.0, p=.06).

### CONCLUSION

DL reconstruction of single-shot bSSFP cine sequences enabled accelerated acquisition times and non-inferior diagnostic quality with excellent agreement in the quantification of functional LV parameters compared to standard cine acquisitions.

### CLINICAL RELEVANCE/APPLICATION

Clinical application of DL reconstruction can improve the limited spatial resolution of the SSH cine technique and thus provide the basis for a fast and robust ultrafast cardiac MRI protocol, improving patient comfort and compliance and diagnostic quality in challenging patients with arrhythmia or unreliable breath holding, and meeting the increasing demand for cardiac MRI examinations.

## M1-SSCA03-6 DEEP LEARNING AUTOMATED MEASUREMENT OF SHUNT SEVERITY IN 4D FLOW MRI

(*Abstract Co-Author*) Nothing to Disclose
Arielle Tycko (*Abstract Co-Author*) Nothing to Disclose
Albert Hsiao, MD, PhD (*Abstract Co-Author*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging
Evan Masutani, PhD (*Abstract Co-Author*) Nothing to Disclose
Kent M. Hall, MD (*Abstract Co-Author*) Nothing to Disclose
Roshun Sankaran, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Akhilesh Yeluru, MS, BS (*Presenter*) Nothing to Disclose

## PURPOSE

4D Flow MRI is increasingly used for the clinical evaluation and non-invasive quantification of hemodynamics, such as shunt severity, in patients with congenital heart disease. Unfortunately, 3D post-processing expertise is still needed to accurately measure blood flow with 4D Flow MRI. The purpose of this study was to assess the feasibility of using deep learning to fully-automate measurement of blood flow and shunt severity with 4D Flow MRI and evaluate this against an expert cardiac radiologist who served as the reference standard.

## METHODS AND MATERIALS

With HIPAA compliance, IRB approval, and waiver of informed consent, we retrospectively collected clinical cardiac 4D Flow MRI exams from 400 patients between February 2015 and January 2021 for algorithm development. Images were manually labeled with multiple landmarks and vessel contours along the aorta and pulmonary artery. MRI from 35 patients referred for simple congenital heart disease between April 2021 and December 2022 were separately collected for algorithm evaluation. Neural networks were trained to serially perform two tasks: a multichannel 3D U-Net for vessel localization and a 2D U-Net for vessel segmentation. To evaluate performance, Euclidean distance error and Dice score were used. To evaluate the end-to-end system, automatic measurements of aortic (Ao) flow, pulmonary artery (PA) flow, and shunt severity (Qp/Qs) were compared against measurements made by an expert cardiac radiologist. Statistical analysis included Pearson correlation and Bland-Altman Analysis.

## RESULTS

Across all 35 test patients, the median distance between automatically and manually localized landmarks was 7.87 mm (IQR: 5.74-10.20 mm). Across all test patients, at ten landmarks and twenty time-points, the median dice score when comparing automatic vessel segmentations with manual vessel segmentations was 0.878 (IQR: 0.826-0.913). Automatic end-to-end measurements correlated strongly with manual measurements of aortic flow (0.884, $p<0.001$), pulmonary flow (0.863, $p<0.001$), and Qp/Qs (0.928, $p<0.001$). Mean difference [95% limits of agreement] for Ao, PA, and Qp/Qs respectively were as follows: 0.26 [1.9,-1.4] L/min, 0.51 [3.9, -2.9] L/min, and 0.0 [0.61,-0.61] L/min.

## CONCLUSION

A cascaded system of U-Nets can be used to automate measurement of blood flow for quantification of shunt severity in patients with simple congenital heart disease with accuracy comparable to an expert cardiac radiologist.

## CLINICAL RELEVANCE/APPLICATION

Deep learning algorithms, based on convolutional neural networks, have the potential to improve efficiency of interpretation of 4D Flow MRI for congenital heart disease by automating routine measurements of blood flow and shunt severity.

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# Abstract Archives of the RSNA, 2024

M1-SSGU03

**Genitourinary Imaging (Benign Kidney Diseases)**

Monday, Dec. 2 8:00AM - 9:00AM Room: E353B

Carolyn L. Wang, MD (*Moderator*) Research Grant, General Electric Company
Jay K. Pahade, MD (*Moderator*) Consultant, General Electric Company;Consultant, Clario Medical Imaging, Inc;

**Sub-Events**

## M1-SSGU03-1 DEEP LEARNING-ACCELERATED T1-W DIXON SEQUENCE TO IMPROVE KIDNEY EVALUATION IN 3T MRI

Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Alexander Rau, MD (*Abstract Co-Author*) Nothing to Disclose
Johannes Beat Kessler, MD (*Abstract Co-Author*) Nothing to Disclose
Marcel D. Nickel (*Abstract Co-Author*) Employee, Siemens AG
Ralph Strecker (*Abstract Co-Author*) Employee, Siemens AG
Niklas Verloh, MD (*Abstract Co-Author*) Speaker, Bayer AG;Research Funded, Bayer AG
Caroline Wilpert, MD (*Abstract Co-Author*) Nothing to Disclose
Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Lorenz Kolbe (*Abstract Co-Author*) Nothing to Disclose
Tobias Scheef, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Examining the renal parenchyma and common incidental lesions can be challenging in abdominal imaging. This study investigated a novel, deep learning (DL)-accelerated super-resolution MRI sequence compared to the standard sequence for assessing the kidneys.

### METHODS AND MATERIALS

This study prospectively enrolled patients undergoing abdominal 3T MRI for various clinical indications. Examination protocol encompassed both a standard T1-weighted sequence (T1STD: T1-volumetric interpolated breath-hold examination (VIBE) 3D with DIXON) and a prototype DL-accelerated super-resolution T1-weighted sequence (T1DL: deep learning-accelerated T1-volume VIBE 3D with DIXON) after application of contrast agent. Image data was anonymized and evaluated independently by two radiologists in the third and fourth year of residency. The qualitative assessment included overall image quality, edge sharpness, noise, and movement artifacts rated on Likert scales (5=excellent). Additionally, with regard to renal cysts, the presence and conspicuity of cysts, detection of septa or wall irregularity, and diagnostic confidence were evaluated. For quantitative analysis, the coefficient of variation was employed. Mann-Whitney-U-Test and Kruskal-Wallis-Test were used for statistical analysis.

### RESULTS

50 patients (21 women; mean=62.6y±15.2) were included. A T2w sequence confirmed cystic renal lesions in 68% (34/50). The acquisition time of T1DL (13sec) was 24% faster than T1STD (17sec). With regard to qualitative parameters, T1DL was superior in overall image quality (T1STD: Median(Mdn)=3[interquartile range=1]; T1DL: Mdn=4[1]; p=0.05), edge sharpness (T1STD: Mdn=3[1], T1DL: Mdn=4[1]; p=0.001), noise (T1STD: Mdn=4[0], T1DL: Mdn=5[1]; p=0.001) and movement artifact reduction (T1STD: Mdn=4[0], T1DL: Mdn=4[1]; p=0.001). Moreover, T1DL was significantly better in evaluation of the presence of renal cysts (p=0.02), conspicuity (T1STD: Mdn=4[0], T1DL: Mdn=5[1]; p=0.001), detection of microstructures (T1STD: Mdn=2[1], T1DL: Mdn=4[1]; p=0.001) and diagnostic confidence (T1STD: Mdn=3[1], T1DL: Mdn=4[2]; p=0.001) of renal cystic lesions. No difference between T1STD and T1DL was noted for the coefficient of variation (T1STD: 0,044 vs. T1DL: 0,044; p=n.s.).

### CONCLUSION

Our findings suggest that the DL-accelerated T1-weighted MRI sequence might improve evaluation and diagnostic confidence in imaging the kidneys and cystic lesions.

### CLINICAL RELEVANCE/APPLICATION

Accurate assessment of renal structures is crucial for patient care. Obtaining super-resolution images may improve decision-making in patients with kidney diseases.

## M1-SSGU03-2 1. POST-CONTRAST ACUTE KIDNEY INJURY ASSOCIATES WITH RENAL FUNCTION BUT NOT DOSE OF IODINE

Per Liss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Robert Frithiof (*Abstract Co-Author*) Nothing to Disclose
Felix Berglund (*Presenter*) Nothing to Disclose

**PURPOSE**

The aim of this study is to investigate if any of the two components of the injected amount of iodine contrast media (ICM) to renal function ratio is independently associated with the development of contrast-associated acute kidney injury (CA-AKI).

**METHODS AND MATERIALS**

All patients admitted to the intensive care units (ICUs) of a tertiary hospital from January 2013 to February 2020 were retrospectively identified. Those who underwent ICM-enhanced CT scans were included in this nested case-control study. CA-AKI was defined and staged based on the creatinine and urine output criteria set forth by the Kidney Disease Improving Global Outcomes guidelines. The two components of the ratio, the dose of ICM (measured in grams of iodine) and renal function estimated by plasma creatinine, were analyzed separately in relation to the odds of developing CA-AKI.

**RESULTS**

Among the 214 patients included in the analysis CA-AKI occurred in 42 of the patients (19.6%). Median age was 61.5 years (IQR 40-73) and 59.3% were of male sex. Renal function at the day of the CT-scan differed between those developing CA-AKI (eGFR 56.9, IQR 35-87) and those that did not (eGFR 81.6, IQR 58-96). However, the dose of ICM was not associated with CA-AKI development (OR 1.31 (IQR 0.49-3.47), p=0.827).

**CONCLUSION**

In this case-control study, renal function at the day of the examination but not the administered dose of iodine contrast media was associated with CA-AKI. This suggest that including injected amount of iodine contrast media as a variable to clinically predict risk of CA-AKI is futile.

**CLINICAL RELEVANCE/APPLICATION**

This study indicates that the potential nephrotoxicity of ICM is clinically negligible and that the ratio of injected amount of iodine contrast media to renal function adds no more predictive value for CA-AKI development than renal function by itself.

## M1-SSGU03-3 BODY COMPOSITION AS A POTENTIAL IMAGING BIOMARKER FOR PREDICTING THE PROGRESSION RISK OF CHRONIC KIDNEY DISEASE

Ping Liang (*Abstract Co-Author*) Nothing to Disclose
Zhen Li, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mengmeng Gao (*Abstract Co-Author*) Nothing to Disclose
Anqin Li (*Abstract Co-Author*) Nothing to Disclose
Guanjie Yuan (*Abstract Co-Author*) Nothing to Disclose
Shichao Li (*Abstract Co-Author*) Nothing to Disclose
Kangwen He (*Abstract Co-Author*) Nothing to Disclose
Zhouyan Liao (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate whether the body composition parameters can employ as potential biomarkers for predicting the progression risk of chronic kidney disease (CKD).

**METHODS AND MATERIALS**

2980 patients diagnosed as CKD were included in this retrospective study. Body composition area, the index (visceral fat index (VFI), subcutaneous fat index (SFI), skeletal muscle index (SMI), renal sinus fat index (RFI)) and the radiodensities (VATd, SATd, SMAd, RSFd) were measured on abdominal CT images. The visceral to subcutaneous fat ratio (VSR) and the abdominal fat to SMA ratio (FM) were then calculated. The demographics and comorbid conditions such as hypertension and diabetes were also assessed. Univariate and multivariate survival regression analyses were performed according to sex, diabetes and hypertension to explore the associations between body composition parameters and the prognosis of CKD.

**RESULTS**

Univariate and multivariate survival analyses showed that high risk of CKD progression had diabetes, abnormal urea and Scr, higher 24h-Upro, MAP, VATd and RSFd. The area under curve (AUC) of 1, 3 and 5 years for differentiating high progression risk from low progression risk were 0.805, 0.836, 0.781, respectively. Urea, HCO3- , NLR, MAP, diabetes and RSFd were independent predictors of males with CKD, while urea, MAP, SMI, VSR and VATd were independent risk factors for females. Time dependent receiver operating characteristics curves shown that the AUC of at 1, 3 and 5 years of nomogram for males/females were 0.831/0.816, 0.892/0.833, 0.893/0.741, respectively. The multivariate model identified urea, HCO3-, 24h-Upro, MAP, RFI, FM and RSFd as significant predictors of no-diabetic patients, while age, urea, ALB, MAP as significant predictors of diabetic patients. Urea, diabetes, VFI, VATd and SATd were independent predictors of non-hypertensive patients, while urea, uric acid, HDL, 24h-Upro, MAP, RSFd were independent risk factors for hypertensive patients.

**CONCLUSION**

Urea, Scr, diabetes, 24h-Upro, MAP, VATd and RSFd were valuable indicators for predicting CKD progression risk. VATd and RSFd were the most valuable of all body composition parameters for predicting high-risk populations with CKD.

**CLINICAL RELEVANCE/APPLICATION**

Radiodensity rather than area of adipose tissue can be used as a new biomarker of prognosis for CKD patients, providing new insights into risk assessment, stratified management and treatment for CKD patients.

## M1-SSGU03-4 UTILIZING CHEST RADIOGRAPHS (CXRS) FOR KIDNEY FAILURE PROGNOSTICATION AND EARLY RISK STRATIFICATION WITH PROSPECTIVE AND EXTERNAL VALIDATION

Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Stephen M. Borstelmann, MD (*Abstract Co-Author*) Nothing to Disclose
Ayis T. Pyrros, MD (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, MSc, PhD (*Abstract Co-Author*) Ther-AI LLC
Theodorus Dapamede, MD, PhD (*Presenter*) Intern, MARS BioImaging Ltd

**PURPOSE**

The Kidney Failure Risk Equation (KFRE), a standard for predicting CKD progression to kidney failure, is limited in clinical use due to its reliance on specialized tests like urine Albumin Creatinine Ratio (ACR). We aim to develop a machine learning prognostic model using chest radiographs (CXR), a more routinely accessible test, to improve early risk assessment and prognostication for kidney failure.

**METHODS AND MATERIALS**

In this IRB-approved study, we analyzed 224,323 adult patients' initial frontal non-portable CXRs (51.5% Black, 48.5% White) from 2008 to 2021. Time-to-event was defined as the interval from the first CXR to the first ICD-10 based KF diagnosis. The dataset was divided into a development set (2008-2018) and a prospective set (2019-2021), with an 80/20 split in the development set for Train and Test sets, stratified by time-to-event. A pre-trained ICD-10 comorbidity CNN model analyzed images to predict 10 KF risk factors, which were used in an XGBoost survival model to compute risk scores. We evaluated the model on test and prospective sets, assessing prognostic performance with C-index and diagnostic performance using time-dependent AUC, PPV, and NPV. External validation was conducted on a distinct geographic dataset (AUC). Prediction scores for normal/low (stage 1 2) and high (stage 3, 4, 5) CKD stages were compared and classified by KFRE risk category. Additionally, a multivariable Cox model served as a comparative baseline, and explainability analysis was conducted (Occlusion maps, SHAP values).

**RESULTS**

Our model outperformed the baseline clinical model, achieving a higher C-Index of 0.76 (95% CI: 0.71-0.80) compared to 0.57 (95%CI: 0.57-0.57). At the 2-year mark, it showed an AUC of 0.74, a PPV of 0.23, and an NPV of 0.94. External validation confirmed an AUC of 0.78 (95%CI: 0.77-0.79). SHAP values identified diabetes and CHF as significant influencers on model decisions, aligning with known risk factors for KF. Subgroup analysis indicated that normal/low CKD patients developing KF had similar risk scores to high CKD patients not developing KF, suggesting a potential for early risk stratification.

**CONCLUSION**

This study demonstrates the potential of using deep learning and machine learning models to predict KF from CXR, enabling early risk stratification for patients otherwise ineligible for KFRE assessment. Further categorization reveals these patients can be classified as KFRE low risk, underscoring the possibility for early intervention

**CLINICAL RELEVANCE/APPLICATION**

The model's ability to perform early risk assessment for patients not screened for CKD or KF through KFRE could significantly impact strategies to prevent or slow KF progression, potentially reducing the disease burden and enhancing patient outcomes.

## M1-SSGU03-6 R2' MAPPING FOR EVALUATING THE DIRECT EFFECT OF REMOTE ISCHEMIC PRECONDITIONING: AN EXPERIMENTAL STUDY

Jinggang Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Zhangyan Bi (*Abstract Co-Author*) Nothing to Disclose
Zha Tingting, MD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the value of R2' mapping in evaluating the direct effects of RIPC by comparing the difference of R2' values in renal dermal medulla after distal ischemic preconditioning (RIPC) between early and late phases.

**METHODS AND MATERIALS**

Eighteen rabbits were randomly divided into 3 groups: RICP-1H group, RICP-24H group and control group (with n= 6 each group). RICP model: Two tourniquets were applied around two hind-limbs just below the level of the inguinal ligament for 3×10 minutes with 10-minute intermittent reperfusion periods. In RICP-1H group and RICP-24H group, they were performed with the GE 3.0 Telsa MRI at 1H and 24H after reperfusion respectively. The R2' values of cortex(CO), outer medulla(OM)and inner medulla(IM)in the left kidney were measured. Blood samples were taken for testing blood gas, acid-base, metabolic and hemorheological parameters. One-way ANOVA and Kruskal-Wallis test were used for statistical analysis.

**RESULTS**

Compared to the control group, the R2' values of CO, OM and IM in RICP-1H group and RICP-24H group decreased significantly (each $P < 0.05$). The R2' values of OM and IM in RICP-1H group were lower than those in RICP-24 group ($P<0.05$). Arterial blood pCO2 in RICP-1H group increased compared to the control group ($P>0.05$), and pCO2 in RICP-24H group decreased($P>0.05$), and there was statistical significance in pCO2 between RICP-1H group and RICP-24H group ($P < 0.01$). Compared to the control group, arterial blood pO2 in RICP-1H group and RICP-24H group both increased, and the difference between RICP-1H group and control group was statistically significant ($P=0.02$). Arterial blood K+ concentration in RICP-1H group and RICP-24H group was lower than that in control group, and the difference between RICP-1H group and control group was statistically significant ($P=0.027$). The serum creatinine concentration of RICP-1H group and RICP-24H group was higher than that of control group, and the difference between RICP-24H group and control group was statistically significant ($P=0.011$), the difference between RICP-1H group and RICP-24 group was statistically significant ($P=0.033$). Arterial blood cSO2 in RICP-1H and RICP-24H groups was higher than that in control group ($P < 0.05$).

**CONCLUSION**

R2' mapping MRI can directly evaluate the effect of remote ischemic preconditioning.

**CLINICAL RELEVANCE/APPLICATION**

In this paper, R2' value indirectly reflects the changes in the oxygen environment of renal medullary cortex in the early and late phases after RIPC, to explain its effect on the improvement of renal functional reserve capacity and its histopathological basis, and to establish a set of RIPC evaluation system based on R2' value in vivo.

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M1-SSIR01

**Science Session with Keynote: Interventional Radiology (AI Solutions and Innovations in Periinterventional Imaging)**

Monday, Dec. 2 8:00AM - 9:00AM Room: E353A

Susie Y. Huang, MD, PhD (*Moderator*) Research Grant, Siemens AG
Benedikt M. Schaarschmidt, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M1-SSIR01-1 MACHINE LEARNING-BASED MODELING TO PREDICT HCC LOCATION IN PATIENTS WITH LIVER CIRRHOSIS UNDERGOING SCREENING MRI - A PROOF-OF-CONCEPT STUDY

Moritz Gross (*Abstract Co-Author*) Nothing to Disclose
David C. Madoff, MD (*Abstract Co-Author*) Advisory Board, Zimmer Biomet Holdings, Inc;Consultant, General Electric Company;Consultant, Guerbet SA;Consultant, Merck & Co, Inc;Consultant, Sirtex Medical Ltd;Consultant, Boston Scientific Corporation;Consultant, Johnson & Johnson;Consultant, Siemens AG
Lynn J. Savic, MD (*Abstract Co-Author*) Research Grant, Guerbet SA
James S. Duncan, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Tefera, MD (*Abstract Co-Author*) Nothing to Disclose
Rabea Sobirey (*Abstract Co-Author*) Nothing to Disclose
Sara Abosabie, MD (*Abstract Co-Author*) Nothing to Disclose
Mingde Lin, PhD (*Abstract Co-Author*) Employee, PRO Medicus Ltd;Stockholder, PRO Medicus Ltd
Tal Zeevi (*Abstract Co-Author*) Nothing to Disclose
Salma A. Abosabie (*Abstract Co-Author*) Nothing to Disclose
Bernhard Gebauer, MD (*Abstract Co-Author*) Speaker, PAREXEL International Corporation;Speaker, Becton, Dickinson and Company;Speaker, Sirtex Medical Ltd;Speaker, Abbott Laboratories;Speaker, Cook Group Incorporated;Speaker, AngioDynamics, Inc;Speaker, PharmCept;Speaker, ewimed GmbH;Speaker, Novartis AG;Speaker, F. Hoffmann-La Roche Ltd;Speaker, Merck & Co, Inc;Speaker, ICON plc;Speaker, Ipsen SA;Speaker, Bayer AG;Speaker, Pfizer Inc;Speaker, Guerbet SA;Speaker, Terumo Corporation
Julius Chapiro, MD, PhD (*Abstract Co-Author*) Research Grant, Guerbet SA;Consultant, Guerbet SA;Research Grant, Boston Scientific Corporation;Consultant, AstraZeneca PLC;Consultant, Bayer AG
Nickolai Matuschewski (*Abstract Co-Author*) Nothing to Disclose
Weicheng Dai, MS, BSc (*Abstract Co-Author*) Nothing to Disclose
Shawn Thomas, MD (*Abstract Co-Author*) Nothing to Disclose
Olivia Gaddum (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the feasibility of accurately predicting and localizing hepatic regions at high-risk for HCC development in screening MRIs.

### METHODS AND MATERIALS

This study considered 968 patients with liver cirrhosis and HCC seen at a tertiary care center between 2012 and 2023. The final cohort comprised 124 patients with negative screening MRI preceding their diagnostic MRI by up to 18 months. Additionally, 18 patients with non-progressing LR-3 lesions were included. Liver volumes were segmented on arterial-phase screening MRI. Areas which became an HCC (<=LR-3 and non-visible) and exemplary benign liver parenchyma were manually annotated with bounding boxes (bboxes) in each axial slice to create a 3D volume of interest (VOI) in MD.ai. Bboxes of different dimensions at random locations from malignant (HCC VOI) and benign (liver segmentation) regions were extracted from the screening MRI. Texture imaging biomarkers were derived from manually and randomly annotated VOIs using Pyradiomics. Machine learning models (Logistic Regression (LR), Random Forest (RF), XGBoost (XGB)) were optimized to differentiate bboxes as malignant or benign, and their performance was validated using 5-fold cross validation and four distinct "training - validation" approaches based on the annotation methods: 1. "manual - manual" (MM), 2. "manual - random" (MR), 3. "random - random" (RR), 4. "random - manual" (RM). XGB was optimized using grid search. Voxel-level heatmaps were generated to visually represent high-risk areas for HCC across the liver using the "RR" approach.

### RESULTS

The study included 186 benign and 130 malignant manual and 1240 benign and 1300 malignant random bboxes. AUC-ROCs for the "MM" approach were: LR: 0.79, RF: 0.74, XGB: 0.78. After optimization, XGB represented an AUC of 0.81. It performed better when only assessing LR-3 lesions evident in screening MRIs (AUC: 0.88) and worse (AUC: 0.65) when only predicting non-visible precursors. Training and validation on manually annotated data ("MM", AUC: 0.81) yielded the best results, followed by random bboxes for training and validating on manual ("RM", AUC: 0.74), or random data ("RR", AUC: 0.73). "MR" caused the biggest decrease in AUC (0.60).

### CONCLUSION

Four methods for HCC prediction on screening MRIs were evaluated, achieving an AUC of up to 0.88. The approaches introduce potential future applications while heatmaps add interpretable results. These promising results call for further research aiming to reproduce and improve the presented results.

### CLINICAL RELEVANCE/APPLICATION

A basis for clinicians to focus attention and strategize treatments, e.g. considering preventive ablation of LR-3 lesions, and making informed decisions on resection, ablation, transplantation (uni- vs multifocal HCC), and biopsy.

## M1-SSIR01-2 OPTIMIZING IMAGING QUALITY AND REDUCING RADIATION EXPOSURE IN PROSTATIC ARTERY EMBOLIZATION: A COMPARATIVE ANALYSIS OF DIGITAL VARIANCE ANGIOGRAPHY AND DIGITAL SUBTRACTION ANGIOGRAPHY

Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Christian Booz, MD (*Abstract Co-Author*) Speaker, Siemens AG
Leon D. Gruenewald, MD (*Abstract Co-Author*) Nothing to Disclose
Mirela Dimitrova (*Abstract Co-Author*) Nothing to Disclose
Ibrahim Yel, MD (*Abstract Co-Author*) Nothing to Disclose
Leona Alizadeh, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Digital Variance Angiography (DVA) has demonstrated superior image quality in retrospective trials. This prospective study aimed to evaluate DVA's performance in radiation dose-optimized protocols compared to standard Digital Subtraction Angiography (DSA) in Prostatic Artery Embolization (PAE) for benign prostatic hyperplasia.

### METHODS AND MATERIALS

Angiographic acquisitions from 53 patients (mean age 72.35, SD 10.02, range 49-87) undergoing PAE were assessed. Contrast-to-noise ratio (CNR) between DSA and DVA pairs was compared using regions of interest across standard and optimized low-dose protocols. Clinical image quality was evaluated by three experienced interventional radiologists in a randomized blinded trial using a 5-point Likert scale based on clinically relevant criteria. Fleiss' kappa test determined interrater agreement and adequate statistic means applied.

### RESULTS

Using optimized low-dose protocols a radiation-dose reduction of -27% was achieved. DVA images still provided a 1.54 times higher CNR than DSA (median value, Q1 Q3 interval was 1.32 2 13). The visual evaluation indicated that DVA-videos provided similar to higher image quality than the full dose DSA images, since in 72.9% of comparisons evaluators preferred DVA over DSA. The interrater agreement was 88.2% and Fleiss's kappa was 0.61 ($p<0.001$).

### CONCLUSION

In PAE procedures, DVA demonstrates a significant image quality advantage, enabling radiation dose reduction, addressing a significant concern in PAE interventions. DVA's improved visualization of vascular structures, coupled with its substantial CNR increase even in low-dose acquisitions, suggests potential for reducing contrast agent use in the future.

### CLINICAL RELEVANCE/APPLICATION

DVA enhances safety and procedural confidence in PAE interventions by minimizing image noise and improving the visualization of intricate vascular structures. This facilitates the reduction of radiation dose and contrast agent, addressing critical safety considerations in PAE procedures.

## M1-SSIR01-3 EVALUATION OF MAGNETIC RESONANCE NAVIGATION (MRN) AND ANALYSIS OF THE IMPACT OF MAGNETIC DRUG ELUTING BEADS (MDEBS) DISTRIBUTION ON TARGETING SUCCESS IN HEPATIC ARTERIES

Mara Vagai, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Vignon-Clementel (*Abstract Co-Author*) Nothing to Disclose
Gilles P. Soulez, MD, MSc (*Abstract Co-Author*) Speaker, Siemens AG;Research Grant, Siemens AG;Research Grant, Cook Group Incorporated;Advisory Board, Cook Group Incorporated;Patent agreement, Cook Group Incorporated;Research Grant, ViTAA Medical Solutions Inc;Advisory Board, ViTAA Medical Solutions Inc
Dominique Trudel (*Abstract Co-Author*) Nothing to Disclose
Urs O. Hafeli, PhD (*Abstract Co-Author*) Nothing to Disclose
Simon Lessard, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahdi Rezaei Adariani (*Abstract Co-Author*) Nothing to Disclose
Ning Li (*Abstract Co-Author*) Nothing to Disclose
Cyril Tous, PhD (*Abstract Co-Author*) Support, Siemens AG
Amina Hadjadj, MD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Evaluate the performance of Magnetic Resonance Navigation (MRN) of magnetic drug eluting beads (MDEBs) for selective liver embolization in a clinical MRI using imaging gradients and the gravitational force and assess the impact of the advancement of embolization on targeting performance.

### METHODS AND MATERIALS

The efficacy of MRN was compared on 12 pigs: 4 control (no MRN), 5 left liver-targeted, and 3 right liver-targeted MRNs. A dedicated particle injector was used to inject 100 aggregates of 20-25 aggregates in the proper hepatic artery, while a blood flow control system was used to maintain a velocity under 10 cm/s. The imaging gradient was oriented to divert MDEBS aggregates toward the target lobe and the pig positioned to take advantage of gravitational forces during the procedure. 3D slicer and Meshmixer software were used for liver, segments, lobes, particles and arterial trees segmentation and fusion. MDEBs particle number was determined after 25, 50, 75 and 100 aggregate injections by manually counting aggregates on the images and applying a mathematical relationship as established before.

### RESULTS

MRN improved significantly: targeting success from 50.7 ± 12.7% for control pigs to 80.5 ± 4.0% for the right lobe ($p=0.0211$) and from 49.1 ± 11.1% to 82.8 ± 13.7% for the left lobe ($p=0.0121$). Targeting success decreased when more aggregates were injected (80.9% ± 10.1% (injection 25), 77.7% ± 14.3% (injection 50), 76.1% ± 15.6% (injection 75), 74.5 ±12.4 (injection 100) ($p=0.037$). MDEB aggregate blockages were observed in proximal arteries at the latter stage of injections. After 100 injections, the pigs were removed from the MRI and Bo field to allow aggregate to separate in individual MDEBS and reach peripheral segmental branches. After pig reinsertion in the Bo field, targeting success rebounded from 74.5 ±12.4% (injection 100 in) to 81.9 ± 11.2% (injection 100 Out) ($p=0.0119$).

### CONCLUSION

Liver and MDEBs segmentation after MRN enables straightforward assessment of targeting success. Early detection of proximal blockages will allow prompt removal of patients from MRI magnetic field, improving targeting success. Currently, an AI software is under development for automated MDEB segmentation. It will be combined with a computational flow dynamics software to prevent proximal occlusion, optimize pig positioning, gradient orientation, and monitor flow velocities to further increase MRN performance.

### CLINICAL RELEVANCE/APPLICATION

Transarterial chemoembolization (TACE) using DEB or radioembolization are more and more used in management of intermediate and advanced HCCs. MRN could offer a more selective and less invasive approach using an implantable arterial port compared to fluoroscopy guided TACE with excellent visualization of tumor coverage.

## M1-SSIR01-4 AUTOMATIC EXTRACTION OF CRITICAL DIAGNOSTIC IMAGING FINDINGS FOLLOWING INTERVENTIONAL ONCOLOGY TREATMENTS USING TWO-STAGED LARGE LANGUAGE MODEL GENERATION

Kristy K. Brock, PhD (*Abstract Co-Author*) Grant, RaySearch Laboratories AB;License agreement, RaySearch Laboratories AB;Research support, Mirada Medical Ltd
Bruno C. Odisio, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Siemens AG;Speaker, Siemens AG;Research Grant, Johnson & Johnson;
Iwan Paolucci, PhD (*Abstract Co-Author*) Stockholder, Intuitive Surgical, Inc ;Stockholder, SOPHiA GENETICS
Jessica A. Albuquerque (*Abstract Co-Author*) Nothing to Disclose
Alexander Shieh, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Collecting oncological outcomes is crucial for new treatment development and quality control in the field of interventional oncology. Reviewing follow-up imaging for specific research purposes can be time consuming. Using large language models (LLMs) to automatically extract cancer progression findings from these imaging reports may increase the efficiency of this process by prioritizing images to review and facilitate the construction of interventional oncology registries.

### METHODS AND MATERIALS

This study included 47 consecutive patients undergoing PTA for HCC during 2022-2023. Post-PTA CT, MRI and PET/CT reports were collected. Progression findings, defined as new or enlarging lesions compared to pre-PTA scan reports, were manually annotated as ground truth. The open-source Llama 2 LLM was used on internal servers to ensure information safety. We designed a two-stage prompt for Llama 2 to extract critical cancer progression findings. The first stage proposes possible findings, and the second stage determines whether the proposed findings were true progressions. The precision and recall of lesions retrieved at each stage were evaluated with sub-analysis on different types of cancer progression: local disease progression (LDP, including residual tumor), intrahepatic progression (IHP, progression within liver excluding LDPs) and extrahepatic progression (EHP). For reports using LI-RADS, we defined LR TR viable lesions as LDP, and LR4/LR5 lesions as IHP.

### RESULTS

A total of 137 reports were analyzed (96 CT, 36 MRI, 5 PET/CT). LI-RADS was utilized in 38 reports. Manual annotation found 157 cancer progression findings. Overall precision improved from 0.24 to 0.53 ($p<0.001$) and recall was minimally decreased from 0.89 to 0.85 ($p=0.50$) after the second stage. In sub-analysis, LDP, IHP and EHP all achieved better precision with recall numerically decreased (recall: LDP 0.94 vs 0.94 [NS], IHP 0.83 vs 0.85 [NS], EHP 0.78 vs 0.86 [NS]; precision: LDP 0.35 vs 0.15 [$p=0.008$], IHP 0.70 vs 0.39 [$p<0.001$], EHP 0.37 vs 0.13 [$p<0.001$]). For reports using LI-RADS, the precision and recall for LDP and IHP were numerically better when compared to non-LI-RADS results except IHP precision, which were significantly better (recall: LDP 1.0 vs 0.90 [NS], IHP 0.90 vs 0.81 [NS]; precision: LDP 0.46 vs 0.30 [NS], IHP 0.87 vs 0.65 [$p=0.02$]).

### CONCLUSION

An open-source LLM can extract cancer progression findings to flag sentinel scans. We also found extraction results can be controlled as a tradeoff between precision and recall using a two-stage strategy.

### CLINICAL RELEVANCE/APPLICATION

This system can be used to flag sentinel scans for thorough review. Utilizing LI-RADS in reports showed a trend of better extraction by LLMs, highlighting the importance of standardized reporting.

## M1-SSIR01-5 FULLY-AUTOMATED TRANSCATHETER AORTIC VALVE REPLACEMENT PLANNING ON CONTRAST-FREE CMR USING A COMPUTATIONAL AORTA UNWRAPPING METHOD

Markus Haltmeier (*Abstract Co-Author*) Nothing to Disclose
Agnes Mayr, MD (*Abstract Co-Author*) Nothing to Disclose
Christian Kremser, PhD (*Abstract Co-Author*) Nothing to Disclose
Enrique Almar-Munoz (*Presenter*) Nothing to Disclose

### PURPOSE

This study presents a fully automated pipeline for Transcatheter Aortic Valve Replacement (TAVR) surgery planning using contrast-free CMR. It addresses the challenge of accurately identifying, without contrast, the Aortic Annulus (AA) and the coronary ostia height, crucial for graft selection and positioning. The proposed automatic approach employs an innovative aorta unwrapping technique, built on the top of a deep-learning segmentation.

### METHODS AND MATERIALS

Utilizing a in-house dataset of 78 navigator-gated non-contrast 3D whole-heart CMR scans from TAVR candidates, a nnUNet architecture was employed for multiclass segmentation, aorta and coronaries arteries. It was trained on 59 scans. To detected the AA virtual plane, an angular projection method followed by contrast enhancement, creates 2D maps of the unwrapped valve leaflets' commisures. Using them as input, a 2D-UNet was trained to detect the hinge points. Those points define the virtual plane. To detect the coronary ostia heights, we measured the distance from the aorta-coronary intersection to the AA plane.

### RESULTS

The nnUNet achieved a Dice Score of 0.962 in aorta segmentation and 0.786 in coronaries segmentation, enhanced to 0.971 and 0.798 after post-processing. The inference is computationally efficient with 3.116s per CMR scan. Data Augmentation improved leaftle commisures' segmentation, with a Dice Score of 0.848 and reduced Error Mean Line (EML) to 1.0152mm. Regarding the AA plane segmentation, technical metrics showed Mean Absolute

Error (MAE) in diameter of 2.279±0.922mm, Root Mean Squared Error (RMSE) of 2.671±1.111mm, and Wasserstein Distance of 1.933±0.920mm. Blind testing confirmed comparable results between manual and automated segmentation.Regarding the ostia detection, among the 19 scans in the test set, both coronaries were correctly detected.

**CONCLUSION**

We present a fully automated TAVR planning approach using contrast-free CMR, achieving computational efficiency. Neural network architectures demonstrate reliability even in low-quality images, supported by high correlation between measurements. Further validation in diverse patient populations is suggested. This approach streamlines procedures and improves outcomes, pending broader clinical integration and refinements.

**CLINICAL RELEVANCE/APPLICATION**

TAVR planning is critical for optimal outcomes in valvular heart disease. The pipeline enhances patient safety and procedural efficiency, especially for patients with contraindications to iodinated contrast. It represents a significant advancement in interventional cardiology, contributing to personalized, patient-centered care. This paper presents the first automatic approach for TAVR planning on CMR.

**M1-SSIR01-6** **Keynote Speaker**

Benedikt M. Schaarschmidt, MD (*Science Invited Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M1-SSNMMI02

**Nuclear Medicine and Molecular Imaging (Prostate Cancer Imaging)**

Monday, Dec. 2 8:00AM - 9:00AM Room: S405

Phillip H. Kuo, MD, PhD (*Moderator*) Consultant, Konica Minolta, Inc;Consultant, Amgen Inc;Consultant, Blue Earth Diagnostics Ltd;Research Grant, Blue Earth Diagnostics Ltd;Consultant, Novartis AG;Speaker, Novartis AG;Consultant, Chimerix, Inc;Consultant, Fusion Pharmaceuticals Inc;Consultant, Bayer AG;Consultant, General Electric Company;Speaker, General Electric Company;Research Grant, General Electric Company;Speaker, Digital Science Press, Inc;Consultant, Radionetics;Former Employee, Konica Minolta, Inc
Ryan J. Avery, MD (*Moderator*) Research Consultant, Konica Minolta, Inc

**Sub-Events**

## M1-SSNMMI02-1 EXPLORING RADIOGRAPHIC DISEASE PROGRESSION ON PSMA PET/CT IN PROSTATE CANCER PATIENTS WITH UNDETECTABLE PSA: A RETROSPECTIVE ANALYSIS

Geoffrey Johnson, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ayse T. Karagulle Kendi, MD (*Abstract Co-Author*) Investigator, Novartis AG
Wael Zeina (*Abstract Co-Author*) Nothing to Disclose
Rimki Haloi (*Abstract Co-Author*) Nothing to Disclose
Eugene D. Kwon, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Childs (*Abstract Co-Author*) Nothing to Disclose
Ahmed Mahmoud (*Abstract Co-Author*) Nothing to Disclose
Carter Day (*Abstract Co-Author*) Nothing to Disclose
Yalda Nikanpour, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Our study aimed to evaluate the clinical features and oncological outcomes for prostate cancer patients with undetectable prostate-specific antigen (PSA) and radiographic disease progression (rDP) on PSMA PET/CT imaging referred as PSA zero rDP.

### METHODS AND MATERIALS

In our retrospective study, we examined the Mayo Clinic's PSMA PET Prostate Cancer Registry to identify patients who exhibited rDP on PSMA PET/CT despite undetectable PSA level and classified them into two groups according to the castrate status (Hormone-Sensitive Prostate Cancer [HSPC] and castrate-resistant prostate cancer [CRPC]). Disease progression was confirmed either by histological analysis from tissue biopsy or by assessing the response to subsequent therapy. We calculated overall survival for the different sites of rDP using the Kaplan-Meier method and assessed intergroup differences using the log-rank test. Furthermore, a univariate Cox regression model was used to investigate factors linked to poor survival following rDP.

### RESULTS

Out of 2141 patients with rDP, we identified 257 (12%) patients with PSA zero rDP. More than 60% of those patients presented initially with localized PCa disease while the rest (39%) had de-novo metastatic disease with a median (IQR) Gleason score of 8 (7-9). The majority (95%) of these men had received at least one systemic therapy prior to PSA zero rDP. Over a median (IQR) time of 119 (30.8-368.5) months elapsed between the initial PCa diagnosis and the PSA zero rDP occurrence, 184 (72%) patients progressed to CRPC. Significant differences were observed in Gleason score, tumor staging, initial treatment, and sites of rDP between HSPC and CRPC groups (p-value $<0.05$). Over a median follow-up period of 6.7 months in HSPC and 8.9 months in CRPC from the diagnosis of PSA zero rDP, one patient in the HSPC group and 12 patients in the CRPC group died. The median biochemical progression-free survival was 9 months and the location of rDP in visceral organs was the only statistically significant indicator of poor overall survival ($p<0.001$).

### CONCLUSION

Despite undetectable PSA levels, periodic PET imaging especially in CRPC patients is critical in early detection and management of disease progression.

### CLINICAL RELEVANCE/APPLICATION

In prostate cancer management, the undetectable PSA level does not guarantee the absence of disease progression, emphasizing the ongoing need for frequent monitoring of the disease with the PSMA PET/CT technique.

## M1-SSNMMI02-2 CLINICAL UTILITY OF WHOLE-BODY SPECT/CT AFTER THE 1$^{ST}$ CYCLE OF $^{177}$LU-PSMA-617 THERAPY COMPARED TO PRE-THERAPY PSMA PET/CT

Hiram A. Gay, MD (*Abstract Co-Author*) Nothing to Disclose
Joel Picus, MD (*Abstract Co-Author*) Nothing to Disclose
Melissa Reimers (*Abstract Co-Author*) Nothing to Disclose
Richard L. Wahl, MD (*Abstract Co-Author*) Investigator, Siemens AG;Researcher, Siemens AG;Consultant, Clarity Pharmaceuticals;Scientific Advisory

Board, Clarity Pharmaceuticals;Stock Options, Clarity Pharmaceuticals;Scientific Advisory Board, Seno Medical Instruments, Inc;Speaker, ITM Instruments Inc;Researcher, ITM Instruments Inc;Investigator, ITM Instruments Inc;Investigator, Bayer AG;Researcher, Bayer AG;Scientific Advisory Board, Voximetry Incorporated;Stock Options, Voximetry Incorporated
Niharika Pant (*Abstract Co-Author*) Nothing to Disclose
Farrokh Dehdashti, MD (*Abstract Co-Author*) Nothing to Disclose
Jeff M. Michalski, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher A. Swingle, DO,MBA (*Abstract Co-Author*) Nothing to Disclose
Vikas Prasad, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hyun Kim, MD (*Abstract Co-Author*) Research Grant and Speakers Bureau, Varian Medical Systems, Inc;Research Grant and Speakers Bureau, ViewRay, Inc
Amin Haghighat Jahromi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Russell Pachynski (*Abstract Co-Author*) Nothing to Disclose
Ashwin Singh S. Parihar, MBBS, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Post-177Lu-PSMA therapy SPECT/CT in men with advanced prostate cancer (PCa) accurately verifies targeted treatment. Along with its value in dosimetry, post-therapy SPECT/CT can also suggest discrepancies from the baseline PSMA PET, especially with increasing time from PET to therapy. We assessed the clinical utility of 1st post-therapy SPECT/CT compared to the pre-therapy PSMA PET/CT in men with PCa treated with 177Lu-PSMA with the primary objective of estimating the rate of SPECT-PET discordance.

**METHODS AND MATERIALS**

We retrospectively reviewed the records of men with PCa who were treated with 177Lu-PSMA-617 at our facility and received a whole-body SPECT/CT after the 1st therapy. We recorded the time between the PSMA PET and start of treatment, and other relevant demographic/imaging data. We compared the PSMA PET/CT with the 1st post-therapy SPECT/CT to determine discordance. Discordant findings included either unequivocal appearance of new lesions on the SPECT/CT (n <5, 6-10, >10), increase in size of the previous lesions, or appearance of additional findings that would necessitate additional management (such as new hydronephrosis). A Shapiro-Wilk test test of normality was used to guide additional testing.

**RESULTS**

51 men (median age: 72 years; range: 44-89) had the pre-therapy PSMA PET/CT and post-1st cycle SPECT/CT available for review. The median duration between the PET and 1st therapy was 49 days (range: 3-294). SPECT/CT was performed at 2-6 hours after therapy in 6 men and at 24 hours in the rest. 21 (41.2%) men had a SPECT-PET discordance: 9 had enlarging lesions, 6 had new lesions, 5 had both new and enlarging lesions, while 1 had a new-onset hydronephrosis requiring ureteral stenting. The number of new lesions was <5 in 7/11 men and >10 in the rest. Kruskal-Wallis test showed significant differences in the duration from PET to therapy in men who had concordant versus discordant SPECT-PET findings (P=0.001). The median duration between PET and therapy was 77 days (IQR: 60.5) in men who had SPECT-PET discordance versus 35.5 days (IQR: 20) in those with concordance. 19/21 men with discordant disease had the 1st therapy performed at >30 days of the baseline PET.

**CONCLUSION**

The 1st post-therapy SPECT/CT showed discordance with the PSMA PET in 41% patients, the majority (90.5%) of which had over 30 days between PET and therapy.

**CLINICAL RELEVANCE/APPLICATION**

Post 1st cycle whole-body SPECT/CT highlights important differences from the pre-therapy PET, especially when the latter is more than 30 days before therapy, thus acting as a new baseline for future comparisons and can also provide adjunct information requiring additional clinical management. These results strongly support performing post-therapy SPECT/CT in patients being treated with 177Lu-PSMA.

## M1-SSNMMI02-3 DO PATIENT OR TREATMENT RELATED FACTORS ENHANCE PSMA EXPRESSION IN PATIENTS WITH PROSTATE CANCER?

Yong C. Bradley, MD (*Abstract Co-Author*) Nothing to Disclose
Turgut Bora Cengiz, MD (*Abstract Co-Author*) Nothing to Disclose
Marc D. Benayoun, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Karol L. Cardenas Montalvo, MD (*Abstract Co-Author*) Nothing to Disclose
Madison N. Crank, MD, BS (*Abstract Co-Author*) Nothing to Disclose
Jackson Sullivan, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Prostate-specific membrane antigen (PSMA) PET/CT has emerged as an instrumental imaging modality for the detection and staging of prostate cancer. PSMA expression in prostate cancer cells vary greatly and there is a scarcity of research on factors that lead to higher PSMA expression in prostate cancer. Some studies indicated androgen signal inhibiting agents may increase PSMA expression in animal models; however, such factors need to be thoroughly analyzed prior to application into daily practice. The purpose of this study is to analyze factors impacting minimum standardized uptake value (SUVmin), maximum SUV (SUVmax), and mean SUV (SUVmean) in a group of patients receiving PSMA PET/CT for therapeutic purposes.

**METHODS AND MATERIALS**

All patients with prostate cancer undergoing treatment with Lutetium vipivotide tetraxetan (Lu-177 PSMA-617) at a single institution who underwent PSMA PET/CT were included. Patient demographic factors, prior treatments (hormonal treatment, chemotherapy, surgical interventions), Gleason score, and initial lab values were recorded. A semi-manual software workflow was implemented to segment each lesion to analyze SUVmin, SUVmax, SUVmean, total tumor volume, total bone volume, and total soft tissue volumes. Spearman correlation and Wilcoxon rank-sum test were then used to analyze the correlations.

**RESULTS**

A total of 34 patients were identified. Patients with Gleason scores of 6, 7, or 8 had significantly higher SUVmin compared to those with Gleason scores of 9 or 10 (SUVmin Gleason: median 4.6 vs. 4, P = 0.0275). Patients who were previously treated with enzalutamide had significantly higher SUVmin values than those who were not (SUVmin enzalutamide: median 5 vs. 4.3, P = 0.0484). Patients with visceral lesions compared to those with no visceral lesions had significantly higher SUVmin (SUVmin Visceral Lesions: median 5 vs. 4.3, P = 0.0429). Patients who were previously treated with olaparib had significantly higher SUVmax than those who were not (SUVmax : median 151.5 vs. 34, P = 0.0191). Bone tumor volume had a significant correlation with SUVmax (Spearman Cor: 0.6314, P = 0.0001) and SUVmean (Spearman Cor: 0.3448, P = 0.0458). Total tumor volume had a significant correlation with SUVmax (Spearman Cor: 0.6867, P = 0.0001) and SUVmean (Spearman Cor: 0.4915, P = 0.0032).

### CONCLUSION

This study demonstrates that some prostate cancer treatments prior to PSMA PET/CT can enhance the PSMA expression and SUV. This information can be utilized for careful selection of the patients undergoing Lu-177 PSMA-617 therapy.

### CLINICAL RELEVANCE/APPLICATION

Informs physicians of prostate cancer features that may be useful in selecting candidates who will be more likely to have positive response to PSMA-mediated radioligand therapy.

## M1-SSNMMI02-4 $^{68}$GA-PSMA-11 VERSUS $^{18}$F-DCFPYL PSMA POSITRON EMISSION TOMOGRAPHY/COMPUTED TOMOGRAPHY OF PATIENTS WITH PROSTATE CANCER FOR ELIGIBILITY TO TREAT WITH $^{177}$LU-PSMA-617 RADIOPHARMACEUTICAL THERAPY

Oliver Sartor (*Abstract Co-Author*) Nothing to Disclose
Matthew P. Thorpe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Takahashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eugene D. Kwon, MD (*Abstract Co-Author*) Nothing to Disclose
Geoffrey Johnson, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eric C. Ehman, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Childs (*Abstract Co-Author*) Nothing to Disclose
Yalda Nikanpour, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare equivalence of the molecular imaging PSMA expression (miPSMA) score between 18F-PSMA-DCFPyL and 68Ga-PSMA-11 Positron Emission Tomography/Computed Tomography (PET/CT) scans for determining eligibility for 177LuPSMA-617 therapy for patients with metastatic castrate resistant prostate cancer (PCa) who have been treated with taxane-based chemotherapy.

### METHODS AND MATERIALS

We retrospectively identified patients referred to a quaternary care center for therapy with 177Lu-PSMA-617, had undergone a 18F-PSMA-DCFPyL and a 68Ga-PSMA-11 PET/CT. Most were enrolled in a prospective trial (NCT05547386). We excluded patients with an interval greater than 90 days between their two scans. The miPSMA scores were derived from clinical reports, determined in our practice by comparison to normal tissues including the mediastinal blood pool, liver, spleen, and parotid glands, following the classification suggested by PROMISE for PSMA ligand PET/CT interpretation. Equivalence of paired ordinal miPSMA scores was assessed via two one-sided test (TOST) approach, simultaneously testing null hypotheses of 1) an effect size lower than -0.1, and 2) an effect size greater than 0.1, using one-sided Wilcoxon signed rank tests. A significant result would reject the null hypothesis of an absolute effect size (rank biserial correlation) more extreme than 0.1, supporting equivalence. Analysis used the TOSTER package 0.8.2 library in R version 4.3.3 with a = 0.05.

### RESULTS

In total, 68 patients were included for scan analyses. On 68Ga-PSMA-11, 56 scans showed miPSMA scores of 3 and 12 showed scores of 2; on 18F-PSMA-DCFPyL, 54 patients had scores of 3 and 14 scans had scores of 2. No patients within this cohort had an miPSMA score of 0 to 1. Discordant miPSMA scores between the two tracers were observed in 6 cases (8.82%). In 4 patients, the scores were higher on 68Ga-PSMA-11, while in 2 patients, they were higher on 18F-PSMA-DCFPyL. Selection of radiotracer did not impact patient eligibility for 177Lu-PSMA-617. The observed mean difference was 0.029, standard deviation of the difference was 0.30 (95% CI: [- 0.271,0.329]). TOST analysis demonstrated $p<0.001$, rejecting a rank biserial correlation more extreme than our conservative equivalence bound of 0.1.

### CONCLUSION

Our data support the equivalence of the miPSMA score between 18F-PSMA-DCFPyL and 68Ga-PSMA-11 PET/CT for eligibility for 177Lu-PSMA-617 radiopharmaceutical therapy. Further analysis, including patients with miPSMA score of 0 or 1, would be helpful.

### CLINICAL RELEVANCE/APPLICATION

Two variants of PSMA PET/CT scans are deemed equivalent for determining patient eligibility for treatment with 177Lu-PSMA-617 radiopharmaceutical therapy.

## M1-SSNMMI02-5 THE PROGNOSTIC VALUE OF WHOLE-BODY COMPOSITION ANALYSIS IN PROSTATE CANCER PATIENTS UNDERGOING [$^{177}$LU]PSMA RADIOLIGAND THERAPY: A PROOF OF CONCEPT STUDY USING PRETHERAPEUTIC [$^{18}$F]PSMA-PET-CT

Kambiz Rahbar (*Abstract Co-Author*) Nothing to Disclose
David Ventura (*Abstract Co-Author*) Nothing to Disclose
Lucas Plagwitz (*Abstract Co-Author*) Nothing to Disclose
Philipp Schindler, MD (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Roll (*Presenter*) Nothing to Disclose

### PURPOSE

This retrospective study aims to develop a deep learning-based approach to whole-body CT segmentation out of standard [18F]PSMA-PET-CT to assess body composition in metastatic castration resistant prostate cancer (mCRPC) patients prior to [177Lu]PSMA radioligand therapy (RLT). Our goal is to go beyond standard [18F]PSMA-PET-based pretherapeutic assessment and identify additional body composition metrics out of the CT-component, with predictive and prognostic value.

### METHODS AND MATERIALS

We used a deep learning segmentation model to perform fully automated segmentation of subcutaneous fat, visceral fat, skeletal muscle, and L3 vertebrae from whole-body [18F]PSMA-PET-CT scans of n=92 prostate cancer patients before RLT. The proportions of subcutaneous fat to skeletal muscle and visceral fat to skeletal muscle are compared in detail, both on a 2D slice-by-slice basis (centered at L3) and across the entire 3D CT scan. Statistical analyses were conducted to correlate the parameter ratios of the segmented fat-to-skeletal-muscle composition with patient outcomes. For this purpose, the subjects were divided into two groups based on the median value of the tissue composition.

### RESULTS

The automated segmentation model was useful for delineating subcutaneous fat, visceral fat, and skeletal muscle across diverse patient anatomies. Analyses revealed significant correlations between lower subcutaneous fat ratios and poorer therapeutic outcomes (subcutaneous fat volume / skeletal muscle volume; high: median OS: 17 months; low: median OS: 12 months; p=0.037) in the 3D model, suggesting these parameters as potential prognostic indicators. In both 2D and 3D formats, the ratio of visceral fat to skeletal muscle, as well as the ratio of subcutaneous fat to skeletal muscle in 2D, showed no significant differences.

### CONCLUSION

In this proof-of-principle study the implementation of a deep learning-based whole-body analysis provides a robust and detailed CT-based assessment of body composition in mCRPC patients undergoing RLT. Potential prognostic parameters have to be corroborated in larger prospective datasets and compared to [18F]PSMA-PET parameters.

### CLINICAL RELEVANCE/APPLICATION

Following the approval of 177Lu-PSMA therapy for mCRPC patients in the US and many other countries around the world, the number of patients taking up this new treatment option is increasing. Patient selection and response prediction are critical to providing patients with appropriate and effective treatment and reducing side effects.

## M1-SSNMMI02-6 PROGNOSTIC VALUE OF RESPONSE EVALUATION USING PSMA PET/CT IN PATIENTS WITH METASTATIC CASTRATION-RESISTANT PROSTATE CANCER (RECIP 1.0): A SYSTEMATIC REVIEW AND META-ANALYSIS

Ur Metser, MD, FRCPC (*Abstract Co-Author*) Consultant, POINT Biopharma Inc
Giovanni B. Torri, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Veit-Haibach, MD (*Abstract Co-Author*) Grant, Siemens AG;Speaker, Siemens AG;Travel support, Siemens AG
Felipe Mourato (*Abstract Co-Author*) Nothing to Disclose
Adriano Basso Dias, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Stephan Altmayer, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Miriana E. Mariussi, MD (*Abstract Co-Author*) Nothing to Disclose
Seyed Ali Mirshahvalad, MD,MPH (*Abstract Co-Author*) Nothing to Disclose
Simone Brandao (*Abstract Co-Author*) Nothing to Disclose
Luiza G. Schmitt, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to evaluate the prognostic performance of Response Evaluation Using PSMA PET/CT in Patients with Metastatic Castration-Resistant Prostate Cancer (RECIP 1.0) in assessing treatment outcomes in metastatic prostate cancer patients. Additionally, it seeks to compare its prognostic capability with PSMA PET Progression Criteria (PPP).

### METHODS AND MATERIALS

Searches were conducted across PubMed/MEDLINE, EMBASE, and Web of Science databases through March 2024. Only studies involving patients with metastatic prostate cancer who underwent PSMA PET/CT to assess therapeutic response and who were evaluated using the RECIP 1.0 criteria were included. Pooled hazard ratios for mortality and concordance indices (c-index) of RECIP were assessed. A secondary analysis compared RECIP 1.0 with PSMA PET Progression Criteria (PPP) in head-to-head studies.

### RESULTS

From an initial 74 articles, 10 met the eligibility criteria after full-text review. Data from seven studies involving 544 patients showed that RECIP 1.0 significantly differentiated between disease progression and non-progression in terms of mortality risk (HR: 3.43; 95% CI: 2.63 - 4.48). A sub-analysis of four studies with 202 patients demonstrated a pooled c-index of 0.68 (95% CI: 0.65-0.71). Comparison involving 252 patients from four studies indicated a non-significant trend favoring RECIP 1.0 over PPP with an HR difference of 0.27 (95% CI: -0.18 - 0.72, p = 0.11). Some studies demonstrated improved performance when PSA analysis was included in RECIP criteria, although a pooled analysis was unfeasible.

### CONCLUSION

RECIP 1.0 is a robust tool for assessing prognostic outcomes in patients with metastatic prostate cancer. While it shows a trend towards superiority over PPP, this difference was not statistically significant. The addition of PSA measurements to RECIP 1.0 criteria can enhance its prognostic accuracy.

### CLINICAL RELEVANCE/APPLICATION

These findings support the integration of RECIP 1.0 into clinical practice for evaluating treatment responses in metastatic prostate cancer.

# Abstract Archives of the RSNA, 2024

M1-SSPD02

**Science Session with Keynote: Pediatric Imaging (Neuroradiology and Head/Neck)**

Monday, Dec. 2 8:00AM - 9:00AM Room: E350

Pilar Dies-Suarez, MD (*Moderator*) Nothing to Disclose
Usha D. Nagaraj, MD (*Moderator*) Author with royalties, Reed Elsevier;

**Sub-Events**

## M1-SSPD02-1 PEDIATRIC NEURO CT: RADIATION DOSE AND IMAGE QUALITY COMPARISONS BETWEEN PCCT AND EID-CT

Andres Abadia, PhD (*Abstract Co-Author*) Nothing to Disclose
Allan Thomas, PhD (*Abstract Co-Author*) Nothing to Disclose
Robert C. McKinstry III, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhongwei Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kevin Naceanceno, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Despite its potential benefits, the clinical use of photon-counting CT (PCCT) for pediatrics remains limited and poorly understood. In this work, radiation dose and image quality were compared between traditional energy-integrating detector CT (EID-CT) and PCCT in a matched group of pediatric patients across a range of ages, neuro CT protocols, and clinical indications.

### METHODS AND MATERIALS

Head CT exams were collected from EID-CT and PCCT and separated into two protocol groups used for distinct clinical indications: 1) Full Dose (head trauma, seizure, stroke) and 2) Low Dose (hydrocephalus, shunt). A total of 186 Full Dose and 51 Low Dose matched pairs between EID-CT and PCCT were created using restrictions to water equivalent diameter (?WED =2.5 mm), age (?age <1 yr), and time between exams (<2 yrs). Subgroups with five matched pairs each from age groups of <1, 1 to <5, 5 to <10, 10 to <15, and 15 to <18 yrs old were selected for detailed image quality analysis. Mean attenuation, image noise, and SNR were measured using automated methods similar to the global noise (GN) algorithm in two target regions: 1) a soft tissue mask from thresholding (0-100 HU) and 2) segmented brain. Differences in CTDIvol and GN were compared among the matched pairs. A noise-dose-metric was calculated as GN2*CTDIvol and image quality metrics were also compared after normalization of dose and slice thickness differences between EID-CT and PCCT.

### RESULTS

All patient characteristics (age, BMI, WED) showed no statistically significant differences among the 186 and 51 matched pairs in each respective protocol group (p=0.11). CTDIvol changes depended on the protocol, with PCCT maintaining median changes of -2% (p=0.018) and -14% (p<0.001) for Full Dose and Low Dose groups, respectively. In the subgroup analysis for image quality, mean HU in the brain was lower in PCCT vs EID-CT for both protocols (p=0.002). The PCCT Full Dose protocol achieved 14% lower GN (p<0.001) and 9% higher SNR (p<0.001) in the brain despite thinner slices relative to EID-CT (3 mm vs 4 mm). In the Low Dose protocol, image noise was 17% lower (p<0.001) and SNR comparable (p=0.12) at equal slice thickness despite lower doses with PCCT. After normalization for both dose and slice thickness, PCCT showed significantly improved image quality metrics over EID-CT: 46% lower noise-dose-metric, 26% lower GN, and 24% higher SNR.

### CONCLUSION

Compared to EID-CT, PCCT shows potential for improved image quality at comparable or lower dose, as well as decreased slice thickness, in pediatric head CT.

### CLINICAL RELEVANCE/APPLICATION

Relative to EID-CT, PCCT can be tailored by the end user to: 1) maintain or slightly improve image quality while reducing radiation dose, or 2) significantly improve image quality at comparable dose in pediatric neuro CT.

## M1-SSPD02-2 GLYMPHATIC CLEARANCE ANALYSIS FROM DIFFUSION TENSOR IMAGE ALONG THE PERIVASCULAR SPACE IN CHILDREN DURING THEIR FIRST FIVE YEARS OF LIFE

Camilo Calixto, MD (*Abstract Co-Author*) Nothing to Disclose
Jeremy N. Ford, MD,MBA (*Abstract Co-Author*) Nothing to Disclose
Camilo Jaimes Cobos, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Lilla Zollei (*Abstract Co-Author*) Nothing to Disclose
Maria Camila Cortes Albornoz, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Evaluate age-related changes in glymphatic clearance using the ALPS (Along Perivascular Space) index from diffusion tensor imaging (DTI) in children during the first five years of life

### METHODS AND MATERIALS

This retrospective cross-sectional analysis of a publicly available data set was IRB-approved and HIPAA-compliant. The data utilized were acquired as part of the Lifespan Developing Human Connectome Project from the NIMH. Data were prospectively acquired on a 3T MRI Siemens scanner with a 32channel head coil. Diffusion-weighted MR images (dMRI) were acquired with 4 shells (b0 = 0 s/mm2, b1 = 400, 1000, 2600 s/mm2), in-plane resolution 1.5 × 1.5 mm, 3 mm slice thickness, TE = 90 ms, TR = 3800 ms. DTI maps were calculated using DSI Studio (https://dsi-studio.labsolver.org/). We placed four regions of interest along the association and projection fibers of both hemispheres (superior longitudinal fasciculus and superior corona radiata of the periventricular area) (Fig1A). The ALPS index was then calculated as described by Taoka T et al. (2017). To investigate the effect of age on the ALPS index, we used linear regression with age as the predictor, sex and laterality as co-variates. We also estimated the amount of subject motion (translation and rotation) during the diffusion acquisition using FSL and incorporated these two measurements as co-variates in the regression. All statistical analyses were done using R statistical software

### RESULTS

We examined 79 DTI images from children (44 females) aged 2 to 65 months (median 23 months). The mean ALPS index was 1.306 (range, 1.084 - 1.571). Age showed a significant positive association with the ALPS index, (ß-estimate: 0.0035; 95% CI: 0.0019 to 0.0051, P<001) Fig1B. We found no differences in laterality. Sex, image rotation, and translation had no statistically significant relation with the model.

### CONCLUSION

We found significant increase in ALPS index with age, which may suggest increasing glymphatic activity in the first five years of life. These findings provide a preliminary benchmark for future studies analyzing glymphatic clearance in children and suggest that it could be utilized as a biomarker in neurodevelopmental disorders.

### CLINICAL RELEVANCE/APPLICATION

Malfunction of the glymphatic system responsible for brain waste removal, is closely related to the pathophysiology of neurological disorders, such as neurodegenerative disorders, epilepsy, brain trauma, and autism, among others. This work probes normal glymphatic clearance in children for the first time. This pioneering approach holds immense promise in revolutionizing pediatric neurological care, offering invaluable insights into pathophysiology, therapeutic efficacy, and prognosis using glymphatic clearance as a surrogate of brain health.

## M1-SSPD02-4 SEGMENTATION-FREE PRETHERAPEUTIC BRAF-STATUS IDENTIFICATION OF PEDIATRIC LOW-GRADE GLIOMAS

Matthias W. Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Uri Tabori (*Abstract Co-Author*) Nothing to Disclose
Birgit B. Ertl-Wagner, MD, PhD (*Abstract Co-Author*) Spouse, Employee, Siemens AG
Farzad Khalvati, PhD, MSc (*Abstract Co-Author*) Board of Directors, MESH Scheduling Inc
Khashayar Namdar, MSc, MEng (*Abstract Co-Author*) Nothing to Disclose
Kareem Kudus (*Presenter*) Nothing to Disclose

### PURPOSE

BRAF status is currently obtained by analyzing tumor tissue and is crucial for treating pediatric low-grade gliomas (pLGG). It has been shown that BRAF status can be identified non-invasively from the tumor regions of MRIs using machine learning (ML) models. However, manual tumor segmentations are irreproducible and tedious to generate, while automatic segmentation models are unreliable. Here we introduce an ML classification pipeline that identifies BRAF status from whole MRIs, only relying on tumor segmentations for pretraining, resulting in a more reliable and thus clinically useful model.

### METHODS AND MATERIALS

In this REB-approved retrospective study, genetic status and FLAIR MRIs were collected from 455 patients with pLGG treated between 1999 and 2020 at a single hospital. Previous works suggest that automated segmentation models fail in certain cases. We tested whether this was true on our dataset by training and evaluating three popular medical segmentation models, TransBTS, MedNeXt, and MedicalNet. Next, we tested the feasibility of identifying BRAF status from whole MRIs, without segmentations, using a classification model derived from the architecture that performed best on the segmentation task. We hypothesized that if the tumor region was highlighted, classification performance would improve. Thus, we conducted another set of experiments where pretraining was employed to embed segmentation knowledge into the model before training it to classify pLGGs based on whole MRIs.

### RESULTS

The MedNeXt segmentation model (mean Dice score: 0.555) outperformed both the convolutional neural network (CNN) based MedicalNet (0.516) and the CNN-transformer hybrid TransBTS (0.449). None of these models produced reliable segmentations; each missed the tumor completely for numerous patients. The MedNeXt style classification model achieved a one-vs-rest area under the ROC curve of 0.741 using the whole MRI as an input, without any segmentation knowledge. This was improved to 0.772 through pretraining on the segmentation task. No segmentation was used in test. All differences in model performance were statistically significant (p-value <0.05).

### CONCLUSION

BRAF status can be identified non-invasively by ML models relying on whole MRIs. Dependence on inconsistent manual or automatic segmentations can be eliminated by integrating tumor region information into the model through pretraining.

### CLINICAL RELEVANCE/APPLICATION

It has previously been shown that BRAF status can be identified non-invasively from tumor regions of MRIs using ML models. Here we introduce a classification model that only relies on segmentations for pretraining, not once deployed, resulting in a more robust pipeline suitable for clinical deployment.

## M1-SSPD02-5 EXPLORING THE ASSOCIATION BETWEEN ANNULAR FISSURES AND PEDIATRIC CERVICAL SPINAL CORD INFARCTION

Richard Jones, PhD (*Abstract Co-Author*) Nothing to Disclose
Bryan Philbrook (*Abstract Co-Author*) Researcher, Eisai Co, Ltd
J. Damien Grattan-Smith, MBBS (*Abstract Co-Author*) Nothing to Disclose
Stephen B. Little, MD (*Abstract Co-Author*) Nothing to Disclose

Ashishkumar K. Parikh, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Reisner (*Abstract Co-Author*) Nothing to Disclose
Farid Hajibonabi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Spinal cord infarction is an acute, potentially lethal injury with significant morbidity among survivors. The pathologic finding of multiple microscopic emboli of nucleus pulposus material within the intrinsic spinal vasculature has been well documented following non-traumatic spinal cord infarction. Although previously thought to be rare, there is an increasing body of literature suggesting fibrocartilage embolism may be a more common cause of non-traumatic spinal cord infarction than generally accepted. We hypothesize that annular fissures may be of particular importance in the pathophysiology of non-traumatic cervical spinal cord infarction in children. In this study, we assessed the relative incidence of annular fissures in children with and without cervical spinal cord infarction.

**METHODS AND MATERIALS**

In this IRB approved retrospective study, annular fissure frequency was determined in all children with non-traumatic cervical cord infarction (2004 to 2023) alongside two control groups: children with other non-compressive cervical myelopathies (Group 1, 2004 to 2014) and children without myelopathy (Group 2, Mar to Jul 2014). The diagnosis of cervical cord infarction was confirmed by two pediatric neuroradiologists, supported by the patients' cerebrospinal fluid analysis and clinical findings. SPSS (IBM v29.0) was used for data analysis, with significance set at $p<0.05$.

**RESULTS**

A total of 156 children including 18 with cervical spinal cord infarction and 138 without (Group 1: 39 with other myelopathies; Group 2: 99 with no myelopathies) were studied. The mean (SD) age was 10.04 (5.81) years, with 48.1% (75/156) of the patients being female. Annular fissures were present in 28.8% (45/156) of patients across = 1 disc levels. 88.9% (16/18) of cervical spinal cord infarct patients had = 1 annular fissure. Age and gender showed no significant correlation with spinal cord infarct occurrence. The odds ratio of having an annular fissure was 30.06 (CI [6.53 - 138.30]) in spinal cord infarct patients compared to the total control group (Group 1+ Group 2). Furthermore, the odds ratio of having an annular fissure in the spinal cord infarct group compared to Group 1 was 26.66 (CI [5.13-138.56]) and compared to Group 2 was 31.60 (CI [6.70-148.83]).

**CONCLUSION**

Our study highlights a strong association between annular fissures and cervical spinal cord infarction in children. Further investigation is needed as to whether this could support the postulated theory of embolization of nucleus pulposus material through annular fissures into the cervical spinal cord microcirculation.

**CLINICAL RELEVANCE/APPLICATION**

Annular fissures are strongly associated with non-traumatic pediatric cervical spinal cord infarction, warranting attention from radiologists.

## M1-SSPD02-6 Keynote Speaker

Bruno P. Soares, MD (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

M2-STCE1

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## M2-STCE1-1 REDUCING ENERGY CONSUMPTION IN MRI USING SHORTER SCAN PROTOCOLS, OPTIMIZED MAGNET COOLING PATTERNS AND DEEP LEARNING SEQUENCES: HOW LOW CAN WE GO?

Sebastian Gassenmaier, MD (*Abstract Co-Author*) Nothing to Disclose
Haidara Al Mansour, MD, MEng (*Abstract Co-Author*) Nothing to Disclose
Sebastian Werner, MD (*Abstract Co-Author*) Nothing to Disclose
Andreas Brendlin, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas Kuestner, DIPLENG (*Abstract Co-Author*) Nothing to Disclose
Judith Herrmann, MD (*Abstract Co-Author*) Nothing to Disclose
Saif Afat, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The significant rise in energy costs across Europe, combined with the high energy demands of MRI scanners in radiology departments, underscores the need for strategies to optimise energy usage without compromising efficiency or image quality. This study examines MRI energy consumption and identifies methods to enhance energy efficiency, with a particular focus on musculoskeletal MRI. Three approaches to potential savings are evaluated: 1) optimising protocols, 2) integrating deep learning (DL) accelerated acquisitions, and 3) enhancing the cooling system (see Figure 1).

### METHODS AND MATERIALS

Energy consumption measurements were conducted on two MRI scanners (1.5T Aera, 1.5T Sola) at medical practices in Munich, Germany, from December 2022 to March 2023. Three levels of energy reduction measures were implemented and compared to the baseline. The Wilcoxon signed-rank test with Bonferroni correction was employed to evaluate the impact of these measures on sequence scan times and energy consumption.

### RESULTS

The results demonstrated that significant energy savings could be achieved by optimising protocol settings and implementing DL technologies. The average energy consumption across all body regions was reduced by 72% with DL and 31% with economic protocols. Furthermore, scan times were reduced by 71% with DL and 18% with economic protocols compared to the baseline (Figure 2 and 3). Optimising the cooling system during non-scanning periods resulted in a 30% reduction in energy consumption.

### CONCLUSION

The implementation of energy-saving strategies, including economic protocols, DL accelerated sequences and optimised magnet cooling, has the potential to significantly reduce the energy consumption of MRI scanners. It is recommended that radiology departments and practices adopt these measures in order to enhance energy efficiency and reduce costs.

### CLINICAL RELEVANCE/APPLICATION

The implementation of energy-saving strategies in radiology departments has the potential to reduce operating costs and minimise environmental impact, thereby contributing to greater sustainability without compromising diagnostic quality. Furthermore, the number of patients that can be examined is increased, thereby expanding the department's capacity.

## M2-STCE1-2 BREAST CANCER ARTIFICIAL INTELLIGENCE ALGORITHM IMPROVES CANCER DETECTION RATE EQUITABLY ACROSS RACE AND ETHNICITY

Edgar Wakelin (*Abstract Co-Author*) Nothing to Disclose
Bryan Haslam, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Jiye G. Kim, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Matthew McCabe, PhD (*Abstract Co-Author*) Nothing to Disclose
Leeann Louis, BS, PhD (*Presenter*) Researcher, RadNet, Inc

### PURPOSE

Large prospective studies in breast cancer screening have shown that AI can improve cancer detection rate (CDR). However, no studies have investigated whether these benefits are equitable across populations. Here, we perform a retrospective analysis of a prospective deployment of an AI augmented digital breast tomosynthesis (DBT) reading program across a large and diverse US population. We test the hypothesis that changes in radiologist performance when reading with vs. without the AI are equal across racial and ethnic subgroups.

### METHODS AND MATERIALS

An AI CADe/x device was run on all eligible screening mammograms at 5 practices (200 sites, 107 radiologists) from June 3, 2022 - Nov 2, 2022. Data from Aug 3 - Nov 2, 2022 was used to characterize radiologist performance with the AI (Post-AI, N=167 809). To characterize performance without the AI, data on eligible exams from Sep 1, 2021 - May 19, 2022 was collected (Pre-AI, N=419 551). The period from June 3 - Aug 3, 2022 was used as a 2 month washout period to allow radiologists to learn the new workflow. Data collected included BI-RADS interpretation, patient self-identified race and ethnicity, and biopsy outcomes up to 12 months after the screening exam. ?2 tests were used to evaluate significance of changes in CDR and recall rate (RR) for the whole population, White non-Hispanic (W), Black non-Hispanic (B), and Hispanic women (H). To test for differences between groups, a general linear model was fit with terms for the treatment (Pre-AI vs. Post-AI), demographics, and the interaction between the terms. For all tests, the significance threshold was ?<0.05.

### RESULTS

After the breast cancer AI was deployed, CDR increased across the whole population (?0.83 or 18%, 95% CI 0.44 - 1.21, p<0.01), and for all of the populations of interest (W: ?0.81 or 14%, p=0.03, B: ?0.95 or 21%, p=0.02, H: ?0.83 or 24%, p=0.02). The interaction between the AI and demographic group was not significant (B vs. W: p=0.53, H vs. W: p=0.44, B vs. H: p=0.85), indicating that the improvement in CDR with the AI did not differ between populations. RR also increased after deployment, but to a lesser extent (Pre-AI 10.9%, Post-AI 11.5%, increase of 6%, p<0.01). Recall rate Post-AI did not differ between populations (B vs. W: p=0.66, H vs. W: p=0.12, B vs. H: p=0.29).

### CONCLUSION

Radiologist cancer detection performance improved with the use of an AI augmented DBT reading program similarly across all demographics investigated. AI algorithms with robust and diverse training data can avoid the pitfalls of bias and improve radiologist clinical performance for all demographics.

### CLINICAL RELEVANCE/APPLICATION

Prospective deployment of a breast cancer AI platform on a large diverse population suggests radiologist improvement is not dependent on patient race and ethnicity.

## M2-STCE1-3 INITIAL DATA FROM A SCREENING MAMMOGRAPHY PROGRAM INSIDE SUPERWALMART

A. Gregory Sorensen, MD (*Abstract Co-Author*) Employee, RadNet, Inc;Board member, IMRIS Inc;Board member, Siemens AG;Board member, DFB Healthcare Acquisitions Corp;Board member, inviCRO, LLC;;;;
Edgar Wakelin (*Abstract Co-Author*) Nothing to Disclose
Leeann Louis, BS, PhD (*Abstract Co-Author*) Researcher, RadNet, Inc
Bryan Haslam, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Jiye G. Kim, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Matthew McCabe, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Many women eligible for breast cancer screening do not comply with the most recent guidelines in part because access to screening is not convenient. Reduced rates of participation are amplified in at-risk populations, leading to delayed diagnoses and ultimately poorer prognosis. We launched a pilot program to bring screening mammography (MG) to a more convenient setting: inside SuperWalmart. Here we report early observations on whether this approach improves access by comparing population demographics and recent MG history in a retail setting vs. a traditional radiology clinic.

### METHODS AND MATERIALS

A screening MG center was opened in a SuperWalmart store in a rural town in Delaware. This center was affiliated with an outpatient imaging network with 7 other "traditional" facilities in Delaware. The SuperWalmart location was selected in part to be within 20 miles of another imaging center so that women could get diagnostic follow-up at a convenient distance, but still be far enough away to enable screening access to a different group of women. We report on the self-reported demographics and our past screening records for the first 500 women screened in comparison to the 28,208 women screened at the traditional facilities during the same timeframe. Continuous variables were compared using a T-Test, and categorical variables with a Chi Squared test. A generalized linear model was used to evaluate cancer detection rate (CDR), recall rate (RR) and positive predictive value (PPV) controlling for demographics.

### RESULTS

We found that the SuperWalmart cohort had fewer patients with a prior mammogram at an affiliated location since 2021 (24.4% vs 76.3%, $p < 0.001$) compared to the traditional radiology practice. The SuperWalmart cohort was also significantly younger (57.36 SD = ±11.15 vs 60.1±11.51 years, $p < 0.001$) and had a lower proportion of White and Asian women (White: 63% vs 67%, $p = 0.04$, Asian: 2% vs 5%, $p = 0.001$), and higher proportion of Hispanic ethnicity (10% vs 5%, $p < 0.001$). RR (p=0.78), CDR (p=0.48), and PPV (p=0.60) were similar across the cohorts with the data available and up to 8 months of follow-up.

### CONCLUSION

The observed 3-fold increase in the proportion of exams in women who did not have prior mammograms at affiliated practices since 2021, younger population, and greater proportion of women who identify as Hispanic indicates the retail setting provides patient care to a new population. Retail placement of screening MG may be a valuable approach to increase equitable access to breast cancer screening.

### CLINICAL RELEVANCE/APPLICATION

Initial results suggest retail locations for breast cancer screening could extend services to populations that experience barriers to traditional healthcare.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

M2-STCE2

**Science Session (Theranostics)**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## M2-STCE2-1 QUANTIFICATION OF LEFT VENTRICULAR LATE GADOLINIUM ENHANCEMENT FOR THE PRIMARY PREVENTION OF VENTRICULAR ARRHYTHMIAS IN ARRHYTHMOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY

Shihua Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Yanyan Song (*Abstract Co-Author*) Nothing to Disclose
Zhixiang Dong (*Presenter*) Nothing to Disclose

### PURPOSE

A novel risk-prediction model based on clinical data and right ventricular imaging tests was developed to provide an individualized estimate of sustained ventricular arrhythmias (VA) in patients with arrhythmogenic right ventricular cardiomyopathy (ARVC), but it was recently shown to potentially underestimate the risk when left ventricle (LV) was involved. It remains unclear whether the quantification of LV cardiovascular magnetic resonance (CMR) late gadolinium enhancement (LGE) provides additional value in predicting arrhythmic events in ARVC. This study sought to explore whether LV LGE could serve as an independent predictor of the first episode of sustained VA, thus further improving the risk stratification of ARVC.

### METHODS AND MATERIALS

A total of 283 consecutive patients (median age, 38 [IQR, 27-49] years; 179 male) with a definite ARVC diagnosis, no history of sustained VA at diagnosis, and CMR performed at baseline were retrospectively enrolled for analysis. The novel 5-year ARVC risk score was retrospectively calculated based on the patients' baseline characteristics. The primary outcome was defined as the first episode of sustained VAs (sustained ventricular tachycardia, ventricular fibrillation/flutter, sudden cardiac death, aborted cardiac arrest, and appropriate implantable cardioverter-defibrillator intervention). Univariable and multivariable Cox regression analysis was performed to evaluate the independent predictive value of LV LGE. Restricted cubic spline was used to flexibly model the association between LV LGE volume and hazard of sustained VAs. Additional prognostic value of LV LGE beyond 5-year ARVC risk score was evaluated using Kaplan-Meier curves, calibration plot, and likelihood ratio test.

### RESULTS

Of the 283 definite ARVC patients, LV LGE was observed in 183 (64.7%) subjects. Over a median follow-up of 42.8 months, 88 (31.1%) patients experienced sustained VAs. LV LGE volume remained an independent predictor after adjusting for important clinical and CMR variables in the multivariable analysis (HR, 1.08 [1.05-1.10]; P<0.001). The restricted cubic spline analysis indicated that the risk of sustained VAs was relatively flat until LV LGE volume reached approximately 10%, after which it started to increase rapidly. At Kaplan-Meier analysis, patients with both a 5-year ARVC risk score=25% and LV LGE=10% had the highest risk of sustained VAs. Notably, even among those with a 5-yeaer ARVC risk score<25%, patients with LV LGE=10% had a worse prognosis than those with LV LGE<10% (Log-rank P=0.02). Risk estimates for sustained VAs using the 5-year risk score showed a tendency to underestimate risk in patients with LV LGE=10% and to overestimate it in those with LV LGE<10%. When both LV LGE and 5-year risk score were considered together, receiver operating characteristic analysis showed an increase in predictive accuracy at 5 years (area under the curve from 0.69 to 0.80). The likelihood ratio test also demonstrated a significantly incremental prognostic value of LV LGE when added to the existing 5-year ARVC risk model (P<0.001).

### CONCLUSION

LV LGE was an independent predictor of the first episode of sustained ventricular arrhythmias in ARVC patients and may enhance the 5-year prediction of arrhythmic outcomes when incorporated into the novel ARVC risk calculator.

### CLINICAL RELEVANCE/APPLICATION

With the increased awareness of a broader phenotypic spectrum of arrhythmogenic right ventricular cardiomyopathy, the prognostic value of left ventricular involvement has attracted intense interest. Our study demonstrated that left ventricular late gadolinium enhancement was independently associated with the first occurrence of sustained ventricular arrhythmias in definite arrhythmogenic right ventricular cardiomyopathy patients and could improve risk prediction on the basis of the proposed 5-year risk calculator, which might further refine the primary prevention strategies of the disease.

## M2-STCE2-2 CAN WE IDENTIFY PATIENTS WHO WILL NOT BENEFIT FROM [$^{177}$LU]LU-DOTATATE TREATMENT EARLY IN THEIR TREATMENT COURSE? YES, WE CAN

Joseph Steiner, PHD (*Abstract Co-Author*) Nothing to Disclose
Madeleine Hinojos, MD (*Abstract Co-Author*) Nothing to Disclose
Farhad Jafari, PHD (*Abstract Co-Author*) Nothing to Disclose
Zuzan Cayci, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Steinberger, MD (*Abstract Co-Author*) Nothing to Disclose

Stephanie Rhee (*Abstract Co-Author*) Nothing to Disclose
Onur Tuncer, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Current FDA-recommended standard therapy of [177Lu]Lu-DOTATATE for gastroenteropancreatic neuroendocrine tumor (GEP-NET) patients consists of administering the drug every two months for a total of four cycles, the same for every patient. However, due to highly heterogeneous nature of GEP-NETs, patient responses vary. Our aim is to identify patients unlikely to benefit from this treatment early, enabling a timely switch to alternative therapies and thereby reducing unnecessary toxicities and financial burdens.

**METHODS AND MATERIALS**

GEP-NET patients who completed the FDA-recommended [177Lu]Lu-DOTATATE treatment schedule were retrospectively selected. All patients underwent SPECT/CT imaging at the end of each treatment session according to our institutional protocol. Initial SPECT/CT scans served as the baseline. Maximum axial tumor diameter and the number of tumoral foci were used to calculate the previously defined Tumor Burden Score. Peak counts were automatically measured in predetermined target lesions on SPECT images with commercially available Syngo.Via software and normalized using spleen peak counts. Patient overall treatment responses were evaluated using third-month follow-up CT images according to revised RECIST criteria and binarized as progressive disease (PD) or non-PD. Changes in Tumor Burden Score and normalized peak counts after each treatment session relative to baseline (?TBS2nd-1st, ?TBS3rd-1st, ?TBS4th-1st; ?nPC2nd-1st, ?nPC3rd-1st, ?nPC4th-1st) were calculated and compared between PD and non-PD groups. ROC curves were plotted to predict PD cases, Area Under the Curves (AUCs) were calculated.

**RESULTS**

27 patients were included (7 PD, 20 non-PD). Significant differences were observed in ?nPC2nd-1st, ?TBS2nd-1st, ?TBS3rd-1st, and ?TBS4th-1st between PD and non-PD ($P = 0.033$, 0.023, 0.002, and $< 0.001$, respectively). At the optimal threshold, ?TBS4th-1st exhibited AUC of 0.957, achieving 100% sensitivity and 80% specificity. ?TBS2nd-1st and ?TBS3rd-1st reached AUCs of 0.793 and 0.893, sensitivities of 71.4%, and specificities of 85% and 95%, respectively. ?nPC2nd-1st showed AUC of 0.764 sensitivity of 71.4% and specificity of 75%.

**CONCLUSION**

Patients whose Tumor Burden Scores and normalized peak counts increase or remain relatively stable throughout the treatment are less likely to benefit from [177Lu]Lu-DOTATATE therapy and may consider switching to alternative treatment strategies.

**CLINICAL RELEVANCE/APPLICATION**

[177Lu]Lu-DOTATATE therapy is promising but comes with toxic side effects and high costs. Early transition to alternative treatment strategies for patients unlikely to benefit prevents treatment delays, which can be up to eight months, avoids resource waste, and minimizes toxicities.

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# Abstract Archives of the RSNA, 2024

M3-SSCH03

**Chest Imaging (ILD)**

Monday, Dec. 2 9:30AM - 10:30AM Room: N227B

Shaunagh McDermott, MBBCh (*Moderator*) Nothing to Disclose
Micheal McInnis, MD (*Moderator*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Bayer AG

**Sub-Events**

## M3-SSCH03-1 RESURGENCE OF AN EPIDEMIC: CRIPPLING SILICOSIS IN ENGINEERED COUNTERTOP WORKERS - A PILOT SINGLE INSTITUTIONAL CROSS-SECTIONAL STUDY

Nader Kamangar (*Abstract Co-Author*) Nothing to Disclose
Andrea Oh, MD (*Abstract Co-Author*) Nothing to Disclose
Sheiphali Gandhi (*Abstract Co-Author*) Nothing to Disclose
Robert J. Tallaksen, MD, MA (*Abstract Co-Author*) Nothing to Disclose
Jonathan H. Chung, MD (*Abstract Co-Author*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd
Karoly Viragh, MD (*Abstract Co-Author*) Nothing to Disclose
Jane Fazio (*Abstract Co-Author*) Nothing to Disclose
Sundus Lateef, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Our goals are to (1) describe the silicosis imaging phenotype in a unique patient population - engineered stone countertop workers who are exposed to higher concentrations and different mixtures of silica dust than historically described silicosis cases, (2) correlate chest computed tomography (CT) findings with clinical severity as measured by pulmonary function tests (PFTs), and (3) assess primary provider and radiologist awareness of silicosis at presentation.

### METHODS AND MATERIALS

We performed a cross-sectional pilot study at a large urban safety-net hospital with few historic cases of silicosis. The pilot analysis included 21 patients diagnosed with silicosis with available CT and PFTs. The CT images were classified as typical or atypical for chronic silicosis defined as mediastinal lymphadenopathy and upper-lobe predominant small nodularity and/or progressive massive fibrosis. Standard descriptive statistics and preliminary inferential statistics were performed. Initial clinician/radiologist impression was graded in a binary fashion for recognition of silicosis. Given pilot nature, no a priori power calculations or evaluation for interrater reliability were performed. The full cohort of 55 patients diagnosed with silicosis will be analyzed for the current presentation.

### RESULTS

Fifty-five engineered stone workers with silicosis were identified, of which 21 underwent preliminary analysis. Of these, 100% were male and Hispanic with median age of 43 years (IQR 36-49) and median exposure of 18 years (IQR 10-22). All patients were symptomatic, with dyspnea (91%, 19/21) and cough (81%, 17/21) the most common symptoms. Recognition of silicosis at the initial encounter was 19% (4/21) by the primary clinicians and 33% (7/21) by the radiologists, with alternative diagnoses (especially, mycobacterial/atypical infection) initially suggested in most cases. Upon secondary retrospective review, 52% (11/21) of cases were typical for classic silicosis. The other 48% (10/21) had atypical imaging features (e.g. diffuse nodularity, multiple cavitary lesions, ground-glass/mosaic attenuation and/or crazy paving). PFTs revealed a restrictive pattern in 85% (18/21). In addition, patients with consolidations (including large opacities >1 cm) had lower DLCO than patients without large opacities (18.1 ± 2.7 vs. 24.5 ±1.7, p=0.02). These correlative/inferential statistics should be interpreted with caution prior to the analysis of all 55 patients.

### CONCLUSION

Engineered stone countertop workers commonly present with atypical and advanced features of silicosis.

### CLINICAL RELEVANCE/APPLICATION

The unexpected resurgence of a new silicosis epidemic with atypical features may catch providers off-guard and lead to delays in diagnosis.

## M3-SSCH03-2 IMPROVING INTERREADER AGREEMENT IN CT PATTERN CLASSIFICATION FOR DIAGNOSIS OF IDIOPATHIC PULMONARY FIBROSIS USING CONTENT-BASED IMAGE RETRIEVAL

Eun Jin Chae, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joon Beom Seo, MD, PhD (*Abstract Co-Author*) Stockholder, Promedius Inc;Stockholder, Coreline Soft, Co Ltd;Stockholder, Anymedi Inc
Heejun Park, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Han Na Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Sang Min Lee, MD, PhD (*Abstract Co-Author*) Research Consultant, Coreline Soft, Co Ltd;Stockholder, Coreline Soft, Co Ltd;Research Grant, Coreline Soft, Co Ltd

Hye Jeon Hwang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jooae Choe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Donghoon Yu, MSc (*Abstract Co-Author*) Employee, Coreline Soft, Co Ltd
Hana Jeong, MD (*Abstract Co-Author*) Nothing to Disclose
Sohee Park, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the effect of a proposed content-based image retrieval (CBIR) of similar chest CT images on readers' classification of CT patterns for the diagnosis of idiopathic pulmonary fibrosis (IPF).

**METHODS AND MATERIALS**

This retrospective study included patients who underwent high-resolution chest CT (HRCT) between 2013 and 2015 for the initial work-up for fibrosing interstitial lung disease. HRCT scans were independently classified into four categories according to the 2011 guideline for the diagnosis of IPF by two thoracic radiologists and discordant cases were resolved by consensus meeting with a tertiary thoracic radiologist. One-hundred patients were selected as queries from the database. The proposed CBIR retrieved the top three similar CT images with providing predetermined usual interstitial pneumonia (UIP) classifications from the database by comparing the extent and distribution of six regional disease patterns quantified by a deep-learning algorithm. Two radiology residents and two thoracic radiologists classified CT patterns of the query CT images in two reading sessions 3 weeks apart, without and with CBIR results. Inter-reader agreement was analyzed by using Fleiss k and diagnostic accuracies of two reading sessions were compared by using McNemar test.

**RESULTS**

Of 587 patients included (mean age, 63 years; 356 men), 148 were classified into UIP pattern, 155 with probable UIP pattern, 31 with indeterminate for UIP, and 253 with alternative diagnosis. Overall survival was stratified based on the CT patterns (Log-rank $P < 0.001$). Interreader agreement improved after applying CBIR (Fleiss k, 0.382 to 0.514). Diagnostic accuracies improved in all readers (reader 1: 61.0% to 64.0%, reader 2: 60.0% to 64.0%, reader 3: 62.0% to 69.0%, and reader 4: 80.0% to 84.0%), but there was no statistical significance ($P = 0.12$ to 0.73) after applying CBIR. Readers tended to classify cases into indeterminate for UIP or alternative diagnosis more frequently after applying CBIR, compared to stand-alone reading (152 before CBIR and 184 after CBIR). With CBIR results, more cases moved from UIP or probable UIP pattern to indeterminate for UIP or alternative diagnosis, compared to vice versa (sum of readers' results, 51 vs. 18).

**CONCLUSION**

The proposed CBIR system improved interreader agreement of CT pattern classification for the diagnosis of IPF in readers with varying levels of experience.

**CLINICAL RELEVANCE/APPLICATION**

This CBIR system may guide consistent work-up and treatment strategies by enhancing interreader agreement of CT pattern classifications.

## M3-SSCH03-3 UTILITY OF CT-BASED DELTA-RADIOMICS FOR PREDICTION OF PATHOLOGICAL COMPLETE RESPONSETO NEOADJUVANT IMMUNOTHERAPYIN NSCLC PATIENTS

Ying Liu (*Abstract Co-Author*) Nothing to Disclose
Qiliang Wang (*Abstract Co-Author*) Nothing to Disclose
Jingyi Yang (*Abstract Co-Author*) Nothing to Disclose
Zhao Xiang Ye, PhD (*Abstract Co-Author*) Nothing to Disclose
Fan Liu (*Abstract Co-Author*) Nothing to Disclose
Fangyuan Qu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a unified CT-based delta radiomics model to integrate serial imaging data at different time points and assess its predictive capacity of differentiate pathologic complete response (pCR) or non-pCR status in patients with resectable stage II/IIIA non-small-cell lung cancer (NSCLC) after neoadjuvant immunotherapy.

**METHODS AND MATERIALS**

209 eligible patients with histologically confirmed NSCLC between November 2018 and January 2024 were retrospectively enrolled and they were randomly divided into training and testing sets at a ratio of 7: 3 (training: 146 patients; testing: 63 patients). Absence of residual tumor cells in both tumor bed and lymph nodes was defined as pCR. CT examinations were performed at baseline (TP0) and following 3-4 cycles of neoadjuvant immunotherapy (TP1). Tumor boundary was delineated manually on nonenhanced CT images using 3D-slicer software. A total of 1688 radiomics features were extracted from the TP0 and TP1, and then Delta-radiomics feature was calculated as the relative net change in radiomics feature between TP0 and TP1. We applied PCC, Relief and analysis of variance (ANOVA) to eliminate redundant features. LASSO regression analysis was used to determine optimal radiomics features. Two machine learning models, one based on TP0 radiomics features and the other based on Delta-radiomics features, were developed for the prediction of pCR and model performance was evaluated using ROC analysis, calibration curve and decision curve analysis (DCA).

**RESULTS**

Among the enrolled patients, 93 achieved pCR (44.4%). According to RECIST 1.1, 11 patients (5.3%) had a complete response (CR), 124 (59.3%) showed a partial response (PR), and 74 (35.4%) had stable disease (SD). Radiomics signatures with a selection of the 6 and 5 optimal features were developed for baseline radiomics model and Delta-radiomics model respectively. Delta-radiomics model demonstrated satisfactory performance in distinguishing pCR from non-pCR with AUCs of 0.74 (95% CI: 0.66-0.82) and 0.71 (95% CI: 0.58-0.84) in the training and testing sets respectively, which had an obvious advantage over baseline radiomics model (AUC in training: 0.60, AUC in testing: 0.54). With the optimal cutoff value for Delta-radiomics model above 0.4064, pCR may be detected with a sensitivity of 85.7% and a specificity of 57.1%. DCA demonstrated a net benefit of using Delta-radiomics model for adjuvant treatment decision support compared to default strategies ("treat all" or "treat none") and the baseline radiomics model.

**CONCLUSION**

Delta-radiomics model showed good performance for predicting pCR to neoadjuvant immunotherapy in patients with resectable stage II/IIIA NSCLC.

**CLINICAL RELEVANCE/APPLICATION**

Delta-radiomics model allows screening for benefit.

## M3-SSCH03-4 THE ROLE OF IMAGING BIOMARKERS IN PREDICTING OUTCOMES FOR PATIENTS WITH NON-IPF FIBROTIC ILD

Anand Devaraj, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Michael Kreuter (*Abstract Co-Author*) Nothing to Disclose
Hans-Ulrich Kauczor, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Speakers Bureau, AstraZeneca PLC;Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Merck & Co, Inc
Oyunbileg von Stackelberg, MD (*Abstract Co-Author*) Nothing to Disclose
Yao Kou (*Abstract Co-Author*) Nothing to Disclose
Peter George (*Abstract Co-Author*) Nothing to Disclose
Claus P. Heussel, MD (*Abstract Co-Author*) Nothing to Disclose
Katharina Abbasi Dezfouli, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Although fibrotic interstitial lung diseases (fILD) are associated with impaired prognosis, the ability to prognosticate and predict disease trajectory remains very limited. The aim of this study was to analyse baseline clinical data and computed tomography (CT) based imaging parameters of patients with non-IPF fILD as predictors for progressive pulmonary fibrosis (PPF).

**METHODS AND MATERIALS**

Records in a prospectively collected database of 399 patients with non-IPF fILD managed between January 2012 to December 2022 at the tertiary referral center for ILD at the University Hospital Heidelberg were retrospectively screened for clinical (e.g. demographics, lung function, clinical features of progression) and radiological parameters. Patients =18 years, who underwent supine, baseline, and follow-up high resolution CT (HRCT) scans (thin slice (=2mm), volumetric, axial, non-contrast enhanced) covering the complete lung at full inspiration were identified. AI-based quantification of fibrotic lung tissue was performed with e-Lung (Brainomix (Oxford, UK)), using the Weighted Reticulovascular Score (WRVS) as an imaging biomarker for pulmonary fibrosis. Based on clinical and imaging parameters, multivariate Cox models were applied to calculate predictors of death and significant decline in lung function (relative decrease in forced vital capacity (FVC) =10%).

**RESULTS**

A total of 347 patients were included in the analysis. The WRVS increased over time as an image-based sign for progressive fibrosis. Independent baseline clinical risk factors for death were advanced age (HR 1.1 CI 1.0-1.1, p<0.001) and the presence of chronic renal failure (HR 2.1 CI 1.1-4.0, p=0.02). WRVS (% of total lung volume) was a strong imaging-based predictor for death (HR 1.1 CI 1.1-1.2, p<0.001). No lung function parameters could independently predict mortality in multivariate analyses. Clinical risk factors for =10% FVC decline were the occurrence of acute exacerbations (HR 2.3 CI 1.6-3.5, p<0.001) and baseline FVC (HR 1.0 CI 1.0-1.0, p=0.002). Again, WRVS was an independent risk factor for 10% FVC decline (HR 1.1 CI 1.0-1.1, p=0.017).

**CONCLUSION**

In this studied cohort of patients with non-IPF fILD, e-Lung based imaging biomarkers applied to baseline HRCTs were a valuable predictor of progressive disease.

**CLINICAL RELEVANCE/APPLICATION**

This AI-based approach to quantify alterations in lung texture due to fibrosis might be a valuable tool to prognosticate patient outcome at an early stage of the disease. This can help to identify those patients at risk, to intensify therapy as soon as possible, and therefore improving their prognosis.

## M3-SSCH03-5 DEEP LEARNING FOR SEPARATE QUANTIFICATION OF PULMONARY ARTERIES AND VEINS ON NON-ENHANCED CHEST CT: PROGNOSTIC VALUE IN PATIENTS WITH CONNECTIVE TISSUE DISEASE

Joon Beom Seo, MD, PhD (*Abstract Co-Author*) Stockholder, Promedius Inc;Stockholder, Coreline Soft, Co Ltd;Stockholder, Anymedi Inc
Sang Min Lee, MD, PhD (*Abstract Co-Author*) Research Consultant, Coreline Soft, Co Ltd;Stockholder, Coreline Soft, Co Ltd;Research Grant, Coreline Soft, Co Ltd
Jihye Yun, PhD (*Abstract Co-Author*) Nothing to Disclose
Sola Seo (*Abstract Co-Author*) Employee, Coreline Soft, Co Ltd
Seungbin Bae (*Abstract Co-Author*) Nothing to Disclose
Hye Jeon Hwang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jihwan Kim, BSc, MSc (*Abstract Co-Author*) Nothing to Disclose
Jooae Choe, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Currently, accurately quantifying pulmonary arteries (PA) and veins (PV) separately on nonenhanced CT (NECT) scans in patients with fibrosing interstitial lung disease remains challenging. This study aimed to develop deep learning algorithms for separate quantification of PA and PV on NECT and to evaluate their prognostic value in patients with connective tissue disease (CTD).

**METHODS AND MATERIALS**

We conducted a retrospective study involving CTD patients who underwent NECT for interstitial lung disease (ILD) screening or follow-up from August 2012 to October 2019. A deep learning algorithm (nnU-Net) was developed to accurately quantify PA separately from PV on NECT, using a training set derived from a different cohort with enhanced CT and gold standard PA segmentation masks, which were finally converted to simulate NECT images for training. PV was quantified by subtracting PA from total pulmonary vessel masks. Quantitative analysis of PA and PV was performed, and the prognostic value of these parameters was assessed using Cox analysis.

**RESULTS**

The study included 120 CTD patients (median age 52 years; 43 males) and 55 healthy controls (median age 42 years; 24 males). 10% of CTD patients developed pulmonary hypertension, and 27% died during follow-up. Significant differences in vascular QCT metrics such as peripheral mean PA diameters, volumes of PA and PV, and PV to PA ratios for small vessels were observed between CTD patients and controls (all, P<.05). These metrics correlated significantly with pulmonary function measures, FVC and DLCO (r, 0.23-0.49; all, P<.001). For mortality, PV5/PA5 (the ratio of PV to PA with a cross-sectional area of <5mm², adjusted HR: 1.12; P<.001) was an independent predictor along with age, but BV5/TBV% (the percentage of blood vessels, aggregating both PA and PV with a cross-sectional area of <5mm²) was not. For PV5/PA5, mortality was significantly stratified based on a threshold value of 7.0 (P<.001).

**CONCLUSION**

Our study developed and validated a deep learning algorithm capable of separately quantifying PA and PV on NECT in patients with CTD. The distinct quantification of PA and PV, as opposed to a combined assessment, revealed significant predictive value for mortality outcomes.

## CLINICAL RELEVANCE/APPLICATION

Our study highlights the benefits of detailed vascular analysis for PA and PV over aggregated measures on NECT, which could enhance patient stratification in patients with CTD and ILD.

## M3-SSCH03-6 DEVELOPMENT AND MULTI-INSTITUTIONAL VALIDATION OF ESTIMATING FORCED VITAL CAPACITY IN PULMONARY FIBROSIS USING QUANTITATIVE CHEST CT DATA

Joonmin Park (*Abstract Co-Author*) Nothing to Disclose
Jiwan Kwak (*Abstract Co-Author*) Nothing to Disclose
Andrew D. Smith, MD, PhD (*Abstract Co-Author*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms
Ryoungwoo Jang (*Abstract Co-Author*) Nothing to Disclose
Chad Blackshear (*Abstract Co-Author*) Nothing to Disclose
John Eddins (*Abstract Co-Author*) Nothing to Disclose
Seth Lirette, PhD (*Abstract Co-Author*) Nothing to Disclose
Tejaswini Kulkarni, MD (*Abstract Co-Author*) Nothing to Disclose
Steven A. Rothenberg, MD (*Presenter*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC

### PURPOSE

To develop and validate a method for estimating forced vital capacity (FVC) from quantitative CT lung texture in participants with interstitial lung disease (ILD).

### METHODS AND MATERIALS

Linear regression was used to predict FVC from chest CT data. Training data included patients with a diagnosis of ILD comprised of both IPF (idiopathic pulmonary fibrosis) and non-IPF ILD from the Open Source Imaging Consortium with matched same day pulmonary function tests (PFTs) and high resolution CT (HRCT). Models were generated using ILD (N=498) and a subset of this data with non-IPF ILD (N= 307). This was subsequently validated in an external multi-institutional dataset from 39 centers enrolled in the Pulmonary Fibrosis Foundation Patient Registry. Prior to linear regression, 31 features were extracted from chest CT corresponding to lung texture using a commercially available, fully automated AI algorithm with a U-net architecture. Bland-Altman plots, correlation coefficients, and mean absolute error compared the estimated FVC to the actual FVC.

### RESULTS

The validation cohort (N=715) included 61% males and was 89% white. The mean actual FVC in the overall (N=715), IPF (N=411), and non-IPF ILD (N=304) cohorts were 2.63, 2.73, and 2.49 liters. The ILD estimated FVC model had an R2 of 46% with correlation coefficient of 0.68 with mean absolute error of -0.117 in the overall cohort. The non-IPF ILD estimated FVC model had an R2 of 59% with correlation coefficient of 0.77 with mean absolute error of -0.113 across both cohorts. The non-IPF ILD estimated FVC model had an R2 of 59% with correlation coefficient of 0.77 with mean absolute error of -0.166 within the non-IPF ILD cohort.

### CONCLUSION

A fully automated AI algorithm to quantify lung texture features can estimate forced vital capacity using linear regression in patients with ILD.

### CLINICAL RELEVANCE/APPLICATION

Initiation of anti-fibrotic therapy in patients with non-IPF ILD is based on a combination of symptomatic, radiographic, and functional progression. Estimating pulmonary function with CT can potentially be used to evaluate for both functional and radiographic progression. Further investigation is needed to explore the accuracy of estimated FVC for determining pulmonary function decline, progression, and mortality.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

M3-SSGI05

**Gastrointestinal Imaging (Oncology I)**

Monday, Dec. 2 9:30AM - 10:30AM Room: E351

Gaurav Khatri, MD (*Moderator*) Nothing to Disclose
Aya Kamaya, MD (*Moderator*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation

**Sub-Events**

## M3-SSGI05-1 IMPACT OF PRE-OPERATIVE ABDOMINAL MRI ON SURVIVAL FOR PATIENTS WITH RESECTED PANCREATIC CARCINOMA: A POPULATION-BASED STUDY

Christian B. van der Pol, MD (*Abstract Co-Author*) Nothing to Disclose
Brandon Meyers, MSc,MD (*Abstract Co-Author*) Nothing to Disclose
Michael N. Patlas, MD, FRCPC (*Abstract Co-Author*) Royalties, Holtzbrinck Publishing Group
Amer Alaref, MD (*Abstract Co-Author*) Nothing to Disclose
Abdullah Alabousi, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Serrano (*Abstract Co-Author*) Nothing to Disclose
Dylan Siltamaki, MD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Patients with pancreatic ductal adenocarcinoma (PDAC) who undergo pancreatectomy have among the worst outcomes of cancer patients undergoing curative-intent treatment. This study determined the impact of pre-operative abdominal MRI on all-cause mortality for patients with resected PDAC.

### METHODS AND MATERIALS

All adult (=18 years) PDAC patients who underwent pancreatectomy between January 2011 and December 2022 in Ontario, Canada, were identified for this population-based cohort study (ICD-O-3 codes: C250, C251, C252, C253, C257, C258). Patient demographics, comorbidities, PDAC stage, medical and surgical management, and survival data were sourced from multiple linked provincial administrative databases at ICES. All-cause mortality was compared between patients with and without a pre-operative abdominal MRI after controlling for multiple covariates.

### RESULTS

A cohort of 4,579 patients consisted of 2,432 men (53.1%) and 2,147 women (46.9%) with mean age 65.2 years (standard deviation: 11.2 years); 2,998 (65.5%) died while 1,581 (34.5%) survived. Median follow-up duration post-resection was 22.4 months (interquartile range: 10.8-48.8 months), and median survival post-pancreatectomy was 25.9 months (95% confidence interval [95%CI]: 24.8,27.5). Patients who underwent a pre-operative abdominal MRI had a median survival of 33.1 months (95%CI: 30.7,37.2) compared to 21.1 months (95%CI: 19.8,22.6) for all others. A total of 2,354/4,579 (51.4%) patients underwent a pre-operative abdominal MRI, which was associated with a 17.2% (95%CI: 11.0,23.1) decrease in the rate of all-cause mortality, with an adjusted hazard ratio (aHR) of 0.828 (95%CI: 0.769,0.890). Other covariates independently associated with improved survival included higher neighborhood income quintile, residence =50 km from the surgical center, fewer comorbidities, no neoadjuvant chemotherapy, earlier stage cancer, no adjuvant chemotherapy, younger age and non-Whipple pancreatectomy.

### CONCLUSION

Pre-operative abdominal MRI was associated with improved overall survival for PDAC patients who underwent pancreatectomy, possibly due to better detection of liver metastases than CT.

### CLINICAL RELEVANCE/APPLICATION

Clinical practice guidelines and clinical trials may benefit from considering abdominal MRI as a mandatory step for the workup of patients who appear to have resectable or borderline resectable disease on CT.

## M3-SSGI05-3 18F-FDG PET/CT IN THE INITIAL STAGING OF SQUAMOUS CELL CANCER OF THE ANAL CANAL: RESULTS OF A PROSPECTIVE MULTICENTER REGISTRY

Aruz Mesci (*Abstract Co-Author*) Nothing to Disclose
Andres Kohan, MD (*Abstract Co-Author*) Nothing to Disclose
Jelena Lukovic, BS (*Abstract Co-Author*) Nothing to Disclose
Deanna L. Langer, PhD (*Abstract Co-Author*) Nothing to Disclose
Pamela MacCrostie, BSC (*Abstract Co-Author*) Nothing to Disclose
Victor Mak, MSc (*Abstract Co-Author*) Nothing to Disclose
Lisa Avery, PhD (*Abstract Co-Author*) Nothing to Disclose
Ur Metser, MD, FRCPC (*Presenter*) Consultant, POINT Biopharma Inc

**PURPOSE**

To determine the impact of 18F-FDG PET/CT (PET) on the initial staging of patients with clinical stage II-IV squamous cell carcinoma of the anal canal and to assess association of clinical and PET-determined stage to patient outcomes.

**METHODS AND MATERIALS**

This single arm, prospective multicenter registry enrolled patients between September 2017 to March 2023 with clinical stage II-IV squamous cell carcinoma of the anal canal or with equivocal findings on conventional imaging (CI). Pre-PET clinical stage (based on clinical exam, CT ± MRI), PET stage and overall survival (OS) were recorded. For a subset of patients from one institution, progression free survival (PFS) was documented.

**RESULTS**

The registry cohort was comprised of 813 patients including 556/813 women (68.4%) and 257/813 men (31.6%), with a median age of 64 years (range:25-97). There were 232 patients referred for equivocal findings on CI and 577 patients with a clinical stage of II (326/577; 56.5%), III (229/577; 39.7%) or IV (22/577; 3.8%); clinical stage was missing for 4 patients. A specific stage was assigned to 200/232 patients (86.2%) with equivocal findings on CI after PET. There were 78/813 patients (9.6%) with equivocal findings for a specific stage following PET. Matched clinical and PET stage data was available for 531 patients. Following PET, 150/531 (28.2%) patients were upstaged and 84/531 (15.8%) were downstaged. PFS as shorter for patients with stage IV on PET compared to others (log rank; $p<0.001$), but there was no difference in PFS was observed for patients with pre-PET clinical stage IV vs stage I-III (log rank; $p= 0.556$). There was poorer overall survival for patients with PET stage IV vs stage I-III (log rank; $p=0.0013$), but no significant difference in survival between pre-PET clinical stage IV vs stage II-III (log rank; $p=0.06$).

**CONCLUSION**

PET upstages more than 28% of patients with squamous cell carcinoma of anal canal, compared to clinical stage and offers better prognostication of clinical outcomes. Following PET, a specific stage can be assigned for most patients with equivocal findings on CI.

**CLINICAL RELEVANCE/APPLICATION**

FDG PET/CT frequently impacts stage of patients with squamous cell carcinoma of the anal canal and allows for better prognostication at initial presentation.

## M3-SSGI05-5 PREDICTION OF LYMPH NODE METASTASIS IN RESECTABLE PANCREATIC DUCTAL ADENOCARCINOMA USING DUAL-LAYER SPECTRAL CT

Zheng-rong Zhou (*Abstract Co-Author*) Nothing to Disclose
Yu Wang (*Abstract Co-Author*) Nothing to Disclose
Yi Chen, BMedSc, MMedSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the predictive value of parameters from dual-layer spectral CT (DLCT) derived from the primary tumor for predicting lymph node metastasis (LNM) in patients with resectable pancreatic ductal adenocarcinoma (PDAC).

**METHODS AND MATERIALS**

In this retrospective study, patients with resectable PDAC who underwent three phase enhanced DLCT within two-week before surgery were enrolled. Patients were randomly divided into a training set (74 patients) and a validation set (33 patients). Clinical data, tumor morphological features, and DLCT parameters including tumor location, shape, presence of necrosis, long-axis diameter, iodine concentration (IC) at each enhancement phase and CT-derived extracellular volume (ECV) were collected. ECV was calculated as follows: ECV (%) = IC_tumor / IC_aorta × (100 - Hct%). These parameters were examined using univariate and multivariate logistic regression to identify predictors of LNM. A predictive model was constructed and its diagnostic efficacy was assessed using receiver operating characteristic (ROC) curves.

**RESULTS**

A total of 107 patients were enrolled (44 with LNM, and 63 without LNM). In the training set, there were no significant differences in clinical data between the LNM and non-LNM groups. Among all DLCT parameters and morphological features, ECV, IC in venous phase (VP), and long-axis diameter of tumor were identified as independent predictors of LNM. The AUCs of IC in VP, ECV and tumor long-axis diameter on the training and validation sets were 0.640, 0.665, 0.678 and 0.626, 0.673, 0.774. The combined model using these parameters achieved an AUC of 0.877 (95% CI: 0.803-0.952) and 0.842 (95% CI: 0.707-0.977) for predicting LNM in the training and validation set, respectively. The Hosmer-Lemeshow test suggested a good model calibration. Decision curves confirmed greater clinical applicability of the combined model.

**CONCLUSION**

The model integrating DLCT-derived ECV, IC in VP, and tumor long-axis diameter displays high diagnostic performance in predicting LNM in patients with resectable PDAC.

**CLINICAL RELEVANCE/APPLICATION**

Preoperative diagnosis of lymph node status suggests prognosis and facilitates therapeutic decision-making. However, morphological features of lymph nodes have limited value in diagnosing LNM. Considering the difficulty of image-pathology one-to-one correspondence of lymph nodes, our objective was to develop and validate a model using quantitative DLCT parameters derived from the primary tumor to accurately identify LNM in PDAC before initiating treatment.

## M3-SSGI05-6 EVALUATION OF THE EXPRESSION AND DISTRIBUTION OF VEGFA AND PD-L1 IN HEPATOCELLULAR CARCINOMA PATIENTS WITH MULTIPARAMETRIC MAGNETIC RESONANCE IMAGING

Shi-Ting Feng (*Abstract Co-Author*) Nothing to Disclose
Chenyu Song, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The combination of atezolizumab and bevacizumab therapy (CABT) showed a significant survival benefit compared with sorafenib in hepatocellular carcinoma. We aimed to explore the feasibility of multiparametric magnetic resonance imaging (MRI) in evaluating the expression and distribution of VEGFA and PD-L1 related to CABT.

## METHODS AND MATERIALS

MRI scan with liver-specific contrast was conducted on C57/BL6 mouse model. The corresponding planes of MRI with pathology (ntumor=15, nplane=115) were spatially matched with 3D printing technology. MRI parameters and the targeted indicators stained by immunohistochemistry were evaluated and analyzed in different spatial regions (margin, center, plane, whole tumor). We constructed the targeted indicators evaluation model with MRI parameters in different spatial regions, respectively. The combined targeted indicators related to CABT were grouped into VhighIhigh (high VEGFA, high PD-L1), VhighIlow, VlowIhigh, VlowIlow groups and the combined targeted indicators evaluation model was established.

## RESULTS

The expressions of VEGFA and PD-L1 were significantly different between the marginal and central regions. MRI parameters were significantly correlated to the targeted indicators in different spatial regions. MRI parameters, Ktrans, Kep, Ve, and a showed significant differences between VEGFA high- and low- groups in different spatial regions. The area under the curves (AUCs) of VEGFA evaluation model at the regions of margin combining center (ROCM+T) and margin (ROCM) were 0.732(95%CI 0.663-0.793), and 0.715(95%CI 0.621-0.797), respectively. MRI parameters, Kep, Ve, iAUC60, and T1pre, T1pos showed significant differences between PD-L1 high- and low- groups in different spatial regions. The AUCs of PD-L1 evaluation models of ROCM+T, ROCM, ROCplane were 0.707(95%CI 0.637-0.770), 0.647(95%CI 0.552-0.735), 0.648(95%CI 0.552-0.736), respectively. MRI parameters, Ktrans, Kep, Ve, and T1pre showed significant differences among VhighIhigh, VhighIlow, VlowIhigh, and VlowIlow groups. The combined targeted indicators evaluation model was statistically significant (P=0.001) with the goodness-of-fit test P> 0.8.

## CONCLUSION

Multiparametric MRI has the potential to evaluate the expression and distribution of VEGFA and PD-L1, and to group the combined targeted indicators related to CABT.

## CLINICAL RELEVANCE/APPLICATION

Multiparametric MRI can noninvasively evaluate and group the targeted indicators related to CABT with the consideration of spatial heterogeneity, providing valuable information for clinical treatment decisions in HCC.

# Abstract Archives of the RSNA, 2024

M3-SSGI06

**Gastrointestinal Imaging (Bilary Diseases)**

Monday, Dec. 2 9:30AM - 10:30AM Room: E451B

Seong Hyun Kim, MD (*Moderator*) Nothing to Disclose
Andrea S. Kierans, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M3-SSGI06-1 RADIOMICS FEATURES FOR RISK STRATIFICATION IN PRIMARY SCLEROSING CHOLANGITIS: A PROOF-OF-CONCEPT STUDY

Chiara Spasiano (*Abstract Co-Author*) Nothing to Disclose
Cesare Maino, MD (*Abstract Co-Author*) Nothing to Disclose
Davide G. Gandola, MD (*Abstract Co-Author*) Nothing to Disclose
Cammillo R. Talei Franzesi (*Abstract Co-Author*) Nothing to Disclose
Paolo N. Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Davide Ippolito, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To identify the radiomics features, semi-automatically extracted from MRI-MRCP images, useful to identify patients at higher risk of clinical outcome development.

### METHODS AND MATERIALS

Fifty-eight PSC patients with an MRI-MRCP study acquired with a standardized protocol were prospectively enrolled from Jan-2020 to Dec-2021. Blood tests and liver stiffness measurement were collected close to the MRI-MRCP. Patients were classified into high-risk or low-risk for disease progression using the Mayo risk score (MRS) and liver stiffness measurement (LSM). Radiomics features have been extracted using PyRadiomics in each of the five MRI-MRCP sequences analyzed.

### RESULTS

Among the 58 patients, 15(25.0%) and 17(30.0%) were considered at high-risk using MRS and LSM, respectively. 107 radiomics features have been extracted from each MRI-MRCP sequence analyzed. The selection process individuated two features associated with high MRS: NGTDM-Busyness in the ADC and GLRLM-Run Entropy in T2spir showing both a mean cross-validated AUC of 80%. The multivariable model, including both features, showed an AUC of 87%(SD 11%). When considering LSM (>9.6Kpa) as a stratifier of disease severity, GLCM-Cluster Shade in T1W HBP phase, GLCM-Maximal Correlation Coefficient in T1W arterial phase, GLDM-Large Dependence Low Gray Level Emphasis in ADC, and GLRLM-Run Entropy in T2spir showed an AUC of 85%, 83%, 85%, and 92%, respectively. The most accurate multivariable model included three variables: GLDM-Large Dependence Low Gray Level Emphasis in ADC, GLRLM-Run Entropy in T2spir and GLCM-Cluster Shade in T1W HBP phase with a median AUC of 96%.

### CONCLUSION

This proof-of-concept study demonstrates the predictive value of the radiomics features in PSC and their potential role in risk stratification assessment

### CLINICAL RELEVANCE/APPLICATION

Radiomics can offer a quantitative approach in the risk stratification of PSC patients.

## M3-SSGI06-3 REDUCTION OF GHOST ARTIFACTS ON 3-D MRCP OF GASTRO-BILIARY TRACT WITH SIGNAL SUPPRESSING ORAL CONTRAST AGENTS: INSIGHTS FROM A PHANTOM STUDY

Zhen J. Wang, MD (*Abstract Co-Author*) Stockholder, Nextrast, Inc
Kasen Wong, BA, MS (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD (*Abstract Co-Author*) Grant, Koninklijke Philips NV;Grant, General Electric Company;Consultant, Canon Medical Systems Corporation;Speaker, Canon Medical Systems Corporation;Royalties, Oxford University Press;Shareholder, Nextrast, Inc;Board Member, Nextrast, Inc
Joy Liau, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuxin Sun, BS, MSc (*Abstract Co-Author*) Stockholder, Nextrast, Inc
Theresia Aschauer, MD (*Presenter*) Nothing to Disclose

### PURPOSE

T2-weighted (T2w) signal suppressing oral contrast agents, such as high manganese (Mn) content fruit juices, improves magnetic resonance cholangiopancreatography (MRCP) image quality. Oral dark borosilicate contrast materials (DBCM) also minimize natural bright T2 signals in the bowel. Our study aimed to evaluate the impact of these agents on MRCP ghost artifacts in a gastro-biliary phantom.

### METHODS AND MATERIALS

A saline-filled biliary phantom was constructed to simulate the gallbladder, biliary tract including, 1st and 2nd order bile duct branches, and pancreatic duct. An adjacent 7cm diameter gastric chamber was serially filled with saline, high and low [Mn] pineapple juice (PJ) with differing concentrations novel DBCM at different strengths. Imaging was performed using a 3-D T2W MRCP sequence (TE=894ms, TR=2152ms, Slice thickness=1mm, Matrix=320x200, Field of view=380mm, Number of averages=2, Echo train Length=160) on a 3T MR scanner (Premier Signa, GE HealthCare). On 12 contiguous 1mm coronal images per scan, regions of interest (ROI) were placed on the following to record signal intensities: stomach, gallbladder ghost, stomach ghost, and background free from ghost artifacts. Values were normalized to that of the gallbladder for each scan and averaged for each stomach lumen material.

### RESULTS

The mean stomach lumen signal significantly decreased when filled with the high or low [Mn] PJ (10.5, 18.2) or full or half-strength DBCM (8.7, 10.3) compared to saline (1862.8, p=0.004, 0.005, 0.004, 0.004). Saline stomach ghosts showed significantly higher mean signal (18.8) than for high and low [Mn] PJ (11.2, 11.1) and full and half-strength DBCM (12.3, 10.7) (p=0.031, 0.007, 0.045, 0.032). Gallbladder ghost signal with low [Mn] PJ (100.4) was significantly higher compared to saline (67.7, p=0.009), but not significantly higher for high [Mn] PJ, full and half-strength DBCM (64.4, 86.4, 77.1) compared to saline (p=0.723, 0.189, 0.411). Conversely, the artifact-free region signal intensity was not significantly different for saline (2.79) than low and high [Mn] PJ (3.65, 4.22) or full-and-half strength DBCM (3.82, 3.11) (p=0.255, 0.110, 0.210, 0.678, respectively).

### CONCLUSION

Signal-suppressing oral contrast materials effectively reduce stomach ghost and gallbladder ghost artifact signals in 3-D MRCP compared to bright T2w signal fluids such as saline, indicating their potential to reduce distracting overlapping signal at MRCP.

### CLINICAL RELEVANCE/APPLICATION

Reduction of bowel lumen T2 signal with oral signal suppressing agents minimize ghost artifacts in MRCP imaging, potentially improving image quality and clinical interpretation.

## M3-SSGI06-4 COMPUTED TOMOGRAPHY VERSUS ULTRASOUND FOR THE DIAGNOSIS OF ACUTE CHOLECYSTITIS: A SYSTEMATIC REVIEW AND META-ANALYSIS

Stephan Altmayer, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Giovanni B. Torri, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Basso Dias, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Fernanda Engel Gandolfi (*Abstract Co-Author*) Nothing to Disclose
Guilherme De Oliveira (*Presenter*) Nothing to Disclose

### PURPOSE

Ultrasound (US) is considered the first-line diagnostic test for the diagnosis of acute cholecystitis (AC). Many patients with abdominal pain in the emergency department have both computed tomography (CT) and US as part of the same evaluation, which may lead to a prolonged length of stay, potentially discrepant interpretations, and increased costs. Our purpose was to perform a systematic review and meta-analysis comparing the diagnostic performance of US and CT in the diagnosis of AC.

### METHODS AND MATERIALS

Relevant databases were search through November 2023 for studies evaluating the diagnostic accuracy of US and CT for AC. The primary objective was to evaluate studies comparing the head-to-head performance of US and CT. For the secondary analysis, all individual US and CT studies were analyzed. The pooled sensitivities, specificities, and areas under the receiver operating characteristic curve (AUCs) for US and CT were determined along with 95% confidence intervals (CIs). The prevalence of specific imaging findings of US and CT in patients with and without AC was also evaluated.

### RESULTS

Sixty-four studies met the inclusion criteria. In the primary analysis of head-to-head studies (n = 5), CT had a pooled sensitivity of 83.9% (95% CI, 78.4-88.2%) versus 79.0% (95% CI, 68.8-86.6%) of US (P = .44). The pooled specificity of CT was 94% (95% CI, 82.0-98.0%) versus 93.6% (95% CI, 79.4-98.2%) of US (P = .85). The AUC of CT and US were 90.3% (95% CI, 82.0-95.7%) and 90.0% (95% CI, 81.1-95.2%) respectively (P = .92). The concordance of positive or negative test between both modalities was 82.3% (95% CI, 72.1-89.4%). US and CT led to a positive change in management in only 4 to 8% of cases, respectively, when ordered sequentially after the other test.

### CONCLUSION

The diagnostic performance of CT is comparable to US for the diagnosis of acute cholecystitis with a high rate of concordance between the two modalities.

### CLINICAL RELEVANCE/APPLICATION

A subsequent US after a positive or negative CT for suspected acute cholecystitis may be unnecessary in most cases.

## M3-SSGI06-5 COMPARATIVE EVALUATION OF THE PROGNOSTIC SIGNIFICANCE BETWEEN 68 GA - FAPI VERSUS F-18 FDG PET SCANS IN PATIENTS WITH CHOLANGIOCARCINOMA

Nadezhda N. Gloria JR, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare and evaluate the diagnostic efficiency of 68 Ga - FAPI versus F-18 FDG PET scans in patients with Cholangiocarcinoma on contrast-enhanced CT scans.

### METHODS AND MATERIALS

The study was conducted on 30 patients with Cholangiocarcinoma who had Ga 68 FAPI and 18 F FDG PET study and further underwent a histopathological analysis to determine the subtype. The SUV max,TLG and MTV was obtained on FAPI and FDG PET. Further, tumour size, lymph nodal and distant metastasis for each histological subtype and location of primary tumour was noted.

### RESULTS

Tumour SUVmax, MTV and TLG was more for FAPI PET scan in comparison to FDG PET scan ($p<0.005$). It was also shown higher SUV values on both scans denoted poorer prognosis of the tumour. Higher the SUV values, higher was the T stage of the primary tumour, lymph nodal and solid organ metastasis. Peritoneal metastatic disease associated with cholangiocarcinoma was better delineated on FAPI PET scan.

## CONCLUSION

From the present study, it could be concluded that the prognosis of patients with high SUVmax at baseline is significantly worse than that of patients with low SUVmax. Cholangiocarcinomas showed significant differences in SUVmax,MTV and TLG parameters on FAPI PET CT's than FDG PET CT's.

## CLINICAL RELEVANCE/APPLICATION

68Ga-FAPI scan demonstrates more efficient radiotracer uptake, especially in grade 3 tumours of cholangiocarcinoma and improved lesion detection especially peritoneal disease when compared with 18F-FDG PET/CT. Higher SUV max parameters gives accurate prognosis of the tumour along with superior tumour detection by 68Ga-FAPI PET led to tumour diagnosis in patients. Thus, FAPI proves to be a valuable option for imaging of cholangiocarcinoma.

# Abstract Archives of the RSNA, 2024

M3-SSGI07

**Gastrointestinal Imaging (Focal Liver Disease: HCC)**

Monday, Dec. 2 9:30AM - 10:30AM Room: E451A

Ijin Joo, MD (*Moderator*) Nothing to Disclose
Alessandro Furlan, MD, MMM (*Moderator*) Royalties, RELX;Research support, Endra, Inc;Consultant, Bracco Group

**Sub-Events**

## M3-SSGI07-1 EVALUATION OF RADIOLOGICAL RESPONSE TO TACE IN PATIENTS WHO UNDERWENT LIVER TRANSPLANTATION FOR HEPATOCELLULAR CARCINOMA: A MULTICENTER COHORT STUDY

Karim Boudjema (*Abstract Co-Author*) Nothing to Disclose
Giorgia Porrello, MD (*Abstract Co-Author*) Nothing to Disclose
Valerie Paradis, MD (*Abstract Co-Author*) Nothing to Disclose
Olivier Scatton (*Abstract Co-Author*) Nothing to Disclose
Valerie Vilgrain, MD (*Abstract Co-Author*) Expert Witness, Bayer AG;Speaker, Canon Medical Systems Corporation;Speaker, General Electric Company;Advisory Board, Guerbet SA;Expert Witness, Guerbet SA;Expert Witness, Zimmer Biomet Holdings, Inc;Speaker, Sirtex Medical Ltd;Expert Witness, Sirtex Medical Ltd;Investigator, AIdream Group LLC;Expert Witness, Terumo Corporation;;
Alexis Laurent (*Abstract Co-Author*) Nothing to Disclose
Francois Cauchy (*Abstract Co-Author*) Nothing to Disclose
Daniel Pietrasz (*Abstract Co-Author*) Nothing to Disclose
Sophie Chopinet (*Abstract Co-Author*) Nothing to Disclose
Kayvan Mohkam (*Abstract Co-Author*) Nothing to Disclose
Louise Barbier (*Abstract Co-Author*) Nothing to Disclose
Claire Francoz (*Abstract Co-Author*) Nothing to Disclose
Mohamed Bouattour (*Abstract Co-Author*) Nothing to Disclose
Christian HOBEIKA (*Abstract Co-Author*) Nothing to Disclose
Marco Dioguardi Burgio, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the efficacity of transarterial chemoembolization (TACE) for hepatocellular carcinoma (HCC) as a bridging therapy in liver transplantation (LT) recipients.

### METHODS AND MATERIALS

We analyzed 386 patients who underwent LT patients for HCC from 8 French transplant centers and =1 pre-LT session of TACE between 2012 and 2017. The radiological response was assessed on pre-LT imaging using mRECIST criteria. Survival regressions were Cox models with center-specific cluster robust variance. A nodule-by-nodule analysis (NBN), including patients with =2 HCCs was performed using a multilevel (center- and patient-specific random effects) linear regression with downsizing (%) as the continuous response variable.

### RESULTS

There were 328 (85%) males; median age 59 (interquartile range, IQR: 54, 63) years, the cause of cirrhosis was alcohol in 195 (50%). Median MELD score was 10 [IQR: 8, 15]. At baseline, the median number of HCCs was 2 [IQR: 1, 3] and the median sum of the target lesions size was 41mm [IQR: 30, 51]. Two hundred six patients (53%) were beyond Milan criteria. Patients received a median of 2 TACE sessions (IQR: 1-3). The response after TACE was complete, partial, stable, or progressive in 142 (36.8%), 127 (32.9%), 39 (10.1%), and 78 (20.2%) patients. Five years after LT 87% of patients was free of recurrence and estimated disease-free survival (DFS) was 76%.Using complete response as a reference, each type of response to TACE was independently associated with DFS [hazard ratio (HR) partial vs. complete: 2.04 (95% confidence interval, CI: 1.17, 3.55); stable vs. complete: 3.98 (95% CI: 2.39, 6.64); progressive vs. complete: 7.65 (95%CI: 4.27, 13.7); all p<0.01]. Similar results were obtained for the overall survival. NBN analysis included 281 HCCs nested in 239 patients; median tumor downsizing was -100% (IQR: -100, -36) and was correlated with pathological necrosis [correlation coefficient (r): -0.51 (95%CI: -0.59, -0.42)], p<0.001). A 10% downsizing was associated with DFS (conditional HR 0.94; 95%CI: 0.92, -0.95 p<0.001). Downsizing was independently associated with embolization (p=0.047), super-selective approach (tumoral feeding pedicle, p=0.036) as well as differentiation grade (p<0.001), microvascular invasion (p=0.036) and satellites nodules (p=0.006) on explants.

### CONCLUSION

The prognosis of patients with LT for HCC is associated with TACE response. A selective approach and embolization optimize the downsizing of targeted HCC, which histologically translates into increased necrosis and favorable pathological features.

### CLINICAL RELEVANCE/APPLICATION

The radiological response to TACE should be considered as an additional parameter in patient selection before liver transplantation.

## M3-SSGI07-2 Junhan Pan (*Presenter*) Nothing to Disclose

## PREOPERATIVE SCORING MODEL FOR IDENTIFYING PROLIFERATIVE HEPATOCELLULAR CARCINOMA ON MULTIPHASE LIVER MRI AND ITS IMPLICATION FOR SURGICAL RESECTION


### PURPOSE

To develop and validate a scoring model for preoperative identification of proliferative hepatocellular carcinoma (HCC) using multiphase liver MRI, and to compare the postoperative early recurrence rates between patients with model-predicted proliferative and nonproliferative HCCs.

### METHODS AND MATERIALS

Between September 2019 and August 2021, consecutive patients with surgically-proven HCC who underwent preoperative multiphase liver MRI were retrospectively included. The classification of HCCs into proliferative and nonproliferative classes was determined through histological analysis. Logistic regression analyses were conducted to identify predictors associated with the proliferative HCC. The significant predictors from the training cohort were used to establish a scoring model, which was then verified in a time-independent validation cohort using the area under the AUC. To assess the model's applicability in molecular classification, it was applied to a RNA sequencing dataset for discriminating proliferative HCCs (G1, G2, G3) from nonproliferative HCCs (G4, G5, G6). Early recurrence rates were evaluated by the Kaplan-Meier method with log-rank test.

### RESULTS

A total of 498 patients (391 men; median age, 59.1years; IQR, 18-83 years) were divided into the training cohort (n=332), time-independent validation cohort (n=144), and RNA sequencing dataset (n=22). Independent predictors for proliferative HCCs included irregular tumor margin (OR, 4.9; P < 0.001), rim arterial phase hyperenhancement (OR, 3.6; P = 0.002), marked diffusion restriction (OR, 3.3; P < 0.001), tumor-to-liver arterial phase ratio = 1.4 (OR, 3.1; P < 0.001), and serum alpha-fetoprotein > 100 ng/mL (OR, 3.1; P < 0.001). The scoring model was constructed using these predictors with cutoff values of >18 points. The AUC of the model was 0.83, 0.80, and 0.77 in the training cohort, validation cohort, and RNA sequencing dataset, respectively. Patients with model-predicted proliferative HCCs exhibited significantly higher postoperative early recurrence rates than those with model-predicted nonproliferative HCCs (P < 0.05). However, patients with BCLC stage B-C and predicted nonproliferative HCCs exhibited similar early recurrence rates to those with BCLC stage 0-A and predicted proliferative HCCs (P = 0.05).

### CONCLUSION

The developed scoring model, incorporating four MRI features and serum alpha-fetoprotein, showed promising potential for predicting proliferative HCCs and identifying suitable surgical candidates for patients with HCC.

### CLINICAL RELEVANCE/APPLICATION

The identification of potential imaging and clinical markers for proliferative hepatocellular carcinoma holds implications for tailoring therapies and predicting clinical outcomes.


## M3-SSGI07-3 SURGICAL RESECTION VERSUS MICROWAVE ABLATION FOLLOWING TACE FOR UNRESECTABLE HEPATOCELLULAR CARCINOMA: A NATIONWIDE MULTICENTER COHORT STUDY


Peihong Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Chao An (*Abstract Co-Author*) Nothing to Disclose
Hanyu Jiang (*Presenter*) Nothing to Disclose



### PURPOSE

The optimal curative-intent therapeutic option following successful conversion therapy for unresectable hepatocellular carcinoma (uHCC) is controversial. Therefore, we aimed to compare the efficacy and safety of surgical resection (SR) versus microwave ablation (MWA) after transarterial chemoembolization (TACE) for initially uHCC.

### METHODS AND MATERIALS

From June 2008 to October 2022, consecutive adult patients with treatment naive Barcelona Clinic Liver Cancer A/B stage uHCC who received upfront TACE and subsequent curative-intent SR or MWA were retrospectively identified from 15 tertiary-care hospitals. SR or MWA was recommended by multidisciplinary tumor boards if tumor burden reduced within BCLC A stage for =eight weeks and that R0 resection or complete ablation was anticipated achievable. Propensity score matching (PSM) was performed to balance baseline variables between the SR and MWA groups. Disease-free survival (DFS, time from TACE to recurrence or all-cause death after SR or MWA) and overall survival (OS) were estimated using the Kaplan-Meier method and compared with the log-rank test.

### RESULTS

1348 patients (age, 54.0 ± 7.5 years; 1,148 men) were included, 619 (45.9%) received SR and the remaining 729 (54.1%) received MWA. After 1:1 PSM, 542 patients were included in each group for analyses. Based on the matched cohort, SR demonstrated superior OS (median OS, 10.6 vs 5.8 years; hazard ratio [HR], 1.83; 95%CI, 1.48-2.25; p<0.001) and DFS (median DFS, 3.2 vs 2.5 years; HR, 1.27; 95%CI, 1.09-1.49; p=0.003) outcomes than MWA. However, for patients with tumors downstaged within the Milan criteria (n=578, 42.9%), the OS (HR, 1.13; 95% CI, 0.77-1.66; p = 0.543) and DFS (HR, 1.07; 95% CI, 0.83-1.37; p = 0.614) outcomes were comparable between the SR and MWA groups. After PSM, the major complication rates were similar between the two groups (p = 0.705), but the SR group had significantly longer operation time and hospitalization duration as well as higher cost than the MWA group (all p < 0.001).

### CONCLUSION

For initially uHCC patients eligible for curative-intent SR or MWA after TACE, SR was associated with superior OS and DFS than MWA. However, the survival outcomes of SR and MWA were comparable for patients with tumors downstaged within the Milan criteria.

### CLINICAL RELEVANCE/APPLICATION

MWA might be a safe and effective alternative to SR for initially uHCC patients eligible for curative-intent treatment after TACE in selected patients, especially for patients with tumors downstaged within the Milan criteria.


## M3-SSGI07-4 VISION TRANSFORMER-BASED BIOMARKER CAN OPTIMIZE CURATIVE TREATMENT FOR PATIENTS WITH RECURRENT HEPATOCELLULAR CARCINOMA


Ke Zhang (*Presenter*) Nothing to Disclose



### PURPOSE

No definitive classification systems or clinical practice guidelines exist to advocate individual preferences for optimizing the treatment of recurrent hepatocellular carcinoma (rHCC). Our aim was to develop a Vision Transformer-based (ViT) strategy to optimize the treatment selection between thermal

ablation (TA) and repeat hepatic resection (RHR) for rHCC using multimodal imaging.

**METHODS AND MATERIALS**

This real-world, multicenter and retrospective cohort study included patients with HCC who underwent preoperative contrast-enhanced ultrasound and magnetic resonance imaging, and curative-intent TA or surgical resection (SR) from January 2012 to August 2023. Development of HEROVision-TA and -SR models, based on the 1stTA and 1stSR datasets using a ViT-based Cox proportional hazard regression algorithm to achieve individualized progression-free survival prediction. Concordance index (C-index) and time-independent area under the curve (AUC) were computed in the external testing cohort to compare the model with current staging systems. Both models were applied to each enrolled patient to investigate potential options for treatment optimization and to determine the potential to decrease risk after propensity score matching.

**RESULTS**

The study included 1434 patients with HCC: 885 from the TA dataset (median age, 59 years; interquartile range [IQR], 51-65 years) and 594 from the SR dataset (median age, 58 years; IQR, 51-66 years). The HEROVision model showed better prediction for early-stage recurrence than six staging systems in the external testing cohort (2-year C-index: 0.72 vs. 0.51-0.57 for the 2ndTA dataset and 0.74 vs 0.54-0.58 for the 2ndSR dataset, all P-values < 0.001; 2-year AUC: 0.78 vs. 0.51-0.59 and 0.82 vs. 0.51-0.61, respectively, all P-values < 0.001). The most substantial improvement was observed when HEROVision was incorporated into the analysis of the aforementioned systems for both the 2ndTA and 2ndSR datasets. We identified 26.0% 2ndTA and 5.6% 2ndSR patients in the high-risk group we would recommend switch treatment. The average risk of 2ndTA significantly decreased; switching to SR could be beneficial; however, 2ndSR patients switching to TA may not benefit.

**CONCLUSION**

The multimodal-based HEROVision model can optimize personalized curative treatment and holds promise as a tool to complement existing clinical guidelines for early-stage rHCC.

**CLINICAL RELEVANCE/APPLICATION**

The HEROVision model is an innovative AI model capable of simulating redecision-making between two treatment approaches and enhance patient care in the management of rHCC.

## M3-SSGI07-6 REAL-WORLD PERFORMANCE OF CLINICALLY IMPLEMENTED GADOXETATE-ENHANCED HEPATOBILIARY-PHASE ABBREVIATED MRI FOR SURVEILLANCE OF PRIMARY LIVER CANCER IN HIGH-RISK PATIENTS

Bachir Taouli, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Bayer AG;Consultant, Guerbet SA;Research Grant, Regeneron Pharmaceuticals, Inc
Mustafa R. Bashir, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, NGM Biopharmaceuticals, Inc ;Research Grant, Madrigal Pharmaceuticals, Inc ;Research Grant, Metacrine, Inc ;Research Grant, ProSciento, Inc ;Research Grant, MedPace, LLC ;Research Grant, Carmot Therapeutics Inc
Michael T. Booker, MD,MBA (*Abstract Co-Author*) Nothing to Disclose
Adrija Mamidipalli, MD (*Abstract Co-Author*) Nothing to Disclose
Cody Keller, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan L. Brunsing, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paulette Mariette Dautt Medina, MD (*Abstract Co-Author*) Nothing to Disclose
Cairine McNamee, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia J. Burns, MD (*Abstract Co-Author*) Nothing to Disclose
Scott B. Reeder, MD, PhD (*Abstract Co-Author*) Owner, Calimetrix;Owner, Reveal Pharmaceuticals;Owner, Cellectar Biosciences, Inc;Owner, Elucent Medical;Owner, HeartVista, Inc;;
Kathryn J. Fowler, MD (*Abstract Co-Author*) Consultant, Bayer AG;Research support, General Electric Company;Research Grant, Pfizer Inc;Institutional Grant, MEDIAN Technologies;Consultant, General Electric Company
Julie Y. An, MD (*Abstract Co-Author*) Nothing to Disclose
Nadera Layyous (*Abstract Co-Author*) Nothing to Disclose
Sara Hosseinzadeh Kassani (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC
Anna Pecorelli, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sedighe Hosseini Shabanan, MD, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

Assess diagnostic performance of clinically implemented gadoxetate-enhanced hepatobiliary-phase (HBP) abbreviated MRI (HBP-AMRI) for surveillance of primary liver cancer (PLC: hepatocellular carcinoma [HCC], intrahepatic cholangiocarcinoma [iCCA], combined HCC and iCCA [cHCC-CCA]) in at-risk patients (cirrhosis or chronic hepatitis B viral infection).

**METHODS AND MATERIALS**

Our institution implemented HBP-AMRI for clinical care in 2014 as a surveillance method for detecting primary liver cancer in high-risk patients who had suboptimal ultrasound (US) surveillance due to poor liver visualization. HBP-AMRI exams were interpreted prospectively by abdominal radiologists using templated reports with a category code (positive, subthreshold, negative) analogous to LI-RADS US surveillance algorithm. For each patient and blinded to other data, one author reviewed all HBP-AMRI reports from June 2014-May 2019 until the first positive exam (if any) and recorded the highest category code (negative, subthreshold, positive). A second author reviewed each patient's electronic medical record through October 2023 to extract follow-up data. Blinded to HBP-AMRI results, the senior author applied a composite reference standard (imaging, pathology, or =4 years of clinical follow up) to classify each patient as PLC-positive, HCC-positive, PLC-negative, or lost to follow-up. Per-patient diagnostic performance parameters and their exact binomial 95% confidence intervals (CIs) were calculated. Subthreshold AMRI was considered negative in the analysis.

**RESULTS**

538 at-risk patients underwent 1160 AMRI exams. 119 were lost to follow-up (114 negative HBP-AMRI surveillance, 5 subthreshold) and excluded from final analysis. The remaining 419 patients (351 HBP-AMRI surveillance negative, 22 subthreshold, 46 positive) were classified by the reference standard as PLC-negative (n=385) or PLC-positive (n=34: 32 HCC, 2 iCCA). For detecting PLC, HBP-AMRI surveillance had 0.94 accuracy (393/419; 95% CIs: 0.91-0.96), 0.79 sensitivity (27/34, 0.62-0.91) and 0.95 specificity (366/385, 0.92-0.97). For detecting HCC in particular, HBP-AMRI had 0.93 accuracy (391/419, 0.91-0.96), 0.78 sensitivity (25/32, 0.60-0.91), specificity of 0.95 (366/387, 0.92-0.97).

**CONCLUSION**

Clinically implemented HBP-AMRI surveillance had good sensitivity and excellent specificity for detecting PLC in patients with suboptimal US surveillance. Future research is needed to compare HBP-AMRI surveillance directly with other surveillance methods.

## CLINICAL RELEVANCE/APPLICATION

HBP-AMRI can be implemented clinically for primary liver cancer surveillance with high diagnostic performance in at-risk patients with suboptimal US surveillance.
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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

M3-SSIN02

**Imaging Informatics (Harnessing LLMs - From Data Extraction to the ACR In-Service)**

Monday, Dec. 2 9:30AM - 10:30AM Room: E450B

Ali S. Tejani, MD (*Moderator*) Nothing to Disclose
Joseph H. Yacoub, MD, MD (*Moderator*) Stockholder, NVIDIA Corporation

**Sub-Events**

## M3-SSIN02-1 ADVANCED RETRIEVAL AUGMENTED GENERATION FOR AUTOMATED CLINICAL DATA EXTRACTION FROM UNSTRUCTURED RADIOLOGY REPORTS: ASSESSMENT OF APPROACHES AND PARAMETERS

Evan D. Calabrese, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kartikeye Gupta (*Abstract Co-Author*) Nothing to Disclose
Ayush Jain (*Abstract Co-Author*) Nothing to Disclose
Mohamed Sobhi Jabal, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The study purpose was to develop and evaluate a comprehensive automated system for extracting precise clinical information from unstructured radiology reports in returned structured formats using large language models (LLMs) and retrieval augmented generation (RAG). We aimed to build the end-to-end pipeline interface and assess its performance across different LLM architectures, embedding methods, parameters, and retrieval strategies.

### METHODS AND MATERIALS

A labeled dataset of 8315 radiology reports of patients with brain tumor was processed to extract brain follow-up score. Experiments included locally deployed open-source LLMs (Llama3, Biollama3, Llama2, Medllama2) at two quantization levels to reflect low and high resource settings. Open source local vector database was used for storing extracted embeddings. Different embedding models and retrieval strategies were compared, and the effect of LLM hyperparameter variance was examined. With the targeted output format being javascript object notation (JSON), extracted scores were analyzed against ground truth labels through binary and multiclass evaluation metrics.

### RESULTS

Preliminary results indicated the best-performing model was Llama3, achieving 80% accuracy, with 81% precision, 82% recall, 78% F1-score, and an AUROC of 82. Recent models notably outperformed their prior generation, while fine tuned medical LLMs and medical embedding did not yield significantly improved performance. LLM and RAG hyperparameters had varied influence over the extraction effectiveness. Comprehensive benchmarking of the overall combinations of experiments is underway.

### CONCLUSION

The proposed automated system showcases the potential of recent open-source LLMs and RAG methods in extracting clinical information from unstructured radiology reports and return structured formats. The choice of LLM architecture, embedding model, and retrieval strategy significantly impacts the method effectiveness. Such approaches could assist radiologists, clinicians, and researchers in efficiently mining valuable information from reports, enabling data-driven decision-making, real-time interactivity with diagnostic reports, as well as conducting efficient and labor-free clinical research.

### CLINICAL RELEVANCE/APPLICATION

The ability to extract specific clinical information automatically and accurately from unstructured radiological reports rendered in structured formats using locally deployed open-source RAG and LLMs can enhance and streamline medical workflows and drastically reduce research burden in data collection, both in low and high resource environments.

## M3-SSIN02-2 BUILDING AN AUTOMATED PROTOCOL COMPLIANCE MONITORING AND AUDITING SYSTEM USING A NOVEL FOUNDATION MODEL FOR MEDICAL IMAGING EXAMS

Deborah A. Langman, PhD (*Abstract Co-Author*) Employee, LANDAUER, Inc
Martin P. Smith, MD (*Abstract Co-Author*) Research Grant, Bracco GroupResearch Grant, Bayer AGConsultant, Bayer AGResearch Consultant, General Electric Company
Robert Macdougall (*Abstract Co-Author*) Nothing to Disclose
Christopher J. MacLellan, PhD (*Abstract Co-Author*) Stockholder, NNOX
Benoit Scherrer (*Abstract Co-Author*) Nothing to Disclose
Dimitri Falco (*Presenter*) Nothing to Disclose

**PURPOSE**

We introduce a system to automate the process of evaluating compliance of radiological exams subject to ACR MR Accreditation Program (MRAP) requirements. Our approach utilizes the embedding properties of a new foundational model of examinations to classify acquisition and exam-level features and evaluate compliance, with the goal of enabling continuous real-time monitoring and periodic auditing.

**METHODS AND MATERIALS**

MR Cholangiopancreatography (MRCP) exams were pre-selected to evaluate our system for automated compliance evaluation. For each exam, acquisitions were manually labeled (166 exams, 1965 labels) by sequence type {Localizer, Diffusion, Calibration, 2D MRCP, 3D MRCP, T1 Dynamic, T1 IPOP, T1 IPOP LOW FA, T1 Pre, T2, Timing Run, Other}, serving as the ground truth. A new foundational model of exams from acquisition metadata, based on graph representation learning, was used to generate embeddings and visualize MRCP exams with respect to other exam types. A neural network classifier was trained and tested to automatically classify the acquisition types solely based on their technical parameters (training test split: 79%/21%). We then assessed exam and acquisition-level compliance for both manual and NN-classified data sets using a deterministic, rule-based function embodying the ACR compliance criteria.

**RESULTS**

A qualitative analysis identified three distinct clusters where MRCP exams are situated, effectively highlighting the foundation model's ability to identify MRCP exams solely from their technical parameters. Our acquisition type classifier had an overall F1 score of 97%, demonstrating our ability to accurately detect acquisition type from technical parameters. Using the predicted series type and their associated technical parameters the compliance binary classification matched the ground truth for all 35 exams.

**CONCLUSION**

We built upon a new foundational model for imaging exams and showed the ability to isolate MRCP exams based solely on acquisition parameters. When combined with our sequence type classifier, we were able to accurately identify which acquisitions should be assessed against their respective MRAP criteria allowing us to optimize the QA workflow.

**CLINICAL RELEVANCE/APPLICATION**

Today, identifying studies for ACR MRAP submission is a manual process. Moreover, while imaging protocols are reviewed periodically, the instantiations of protocols (completed imaging studies) are not continuously evaluated for compliance and deviations in real-time. The current approach presents a path for streamlined study identification, compliance monitoring, and site self-monitoring against ACR accreditation, regulatory requirements, and local policies and procedures.

## M3-SSIN02-3 NOVEL LARGE LANGUAGE MODEL SYSTEM FOR CUSTOM-TAILORED RADIOLOGY RESEARCH USING RETRIEVAL-AUGMENTED GENERATION (RAG)

Dana Alkhulaifat, MD (*Abstract Co-Author*) Nothing to Disclose
Xinmeng Wang (*Abstract Co-Author*) Nothing to Disclose
Vahid Khalkhali, MSc (*Abstract Co-Author*) Nothing to Disclose
Julian Lopez Rippe, MD (*Abstract Co-Author*) Nothing to Disclose
Susan Sotardi, MD, MEng (*Abstract Co-Author*) Nothing to Disclose
Michael Welsh, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Large language models (LLMs) exhibit great potential in improving medical research, particularly in radiology, through assisted question-answering. Top publicly available LLMs such as OpenAI's GPT-4-Consensus use relevant articles as context to avoid hallucination/citing non-existent sources. Only privately deployed LLMs within an institution guarantee data privacy. Thus, our purpose was to build a secure LLM system at our institution, using web-scraped PubMed radiology-related abstracts and retrieval-augmented generation (RAG) techniques, and evaluate its performance relative to GPT-4-Consensus.

**METHODS AND MATERIALS**

In this retrospective IRB-approved study, 167,028 publicly available abstracts with keyword "radiology" published from 2000 to 2024 were programmatically web scraped off PubMed. Two pretrained 7-billion parameter open-source LLMs were used, one for embedding and one for response generation. Each abstract was converted to its embedded space representation and stored in a vector database to enable semantic search. Given a prompt, semantically similar abstracts were retrieved, the prompt was contextualized with the abstracts, then a response was generated with references appended at the end. A cross-comparison between our LLM system and GPT-4-Consensus was then performed on 20 different prompts by a cohort of radiologists and radiology researchers at our institution, using a consensual web-based survey. Participants were asked to submit radiology-related questions as prompts. Blinded to output origin, outputs from our LLM system and GPT-4-Consensus were then shown and evaluated using three 5-point Likert scale questions (1=very low, 5=very high) assessing the factual accuracy (FA), citation relevance (CR), and perceived performance (PP). Participants were then asked to choose their preferred output. The Likert scale ratings between outputs were compared using a Wilcoxon signed-rank test. A p-value less than 0.05 was considered statistically significant.

**RESULTS**

For our LLM system, the mean ± SD of FA, CR, and PP ratings were 4.15 ± 0.99, 3.70 ± 1.17, and 3.55 ± 1.39, respectively. For GPT-4-Consensus, they were 4.25 ± 0.72, 3.85 ± 1.23, and 3.90 ± 1.12, respectively. No statistically significant differences were found between these ratings (p-values of 0.97, 0.65, and 0.42, respectively). 50% of participants preferred our LLM system's output.

**CONCLUSION**

Using RAG, our LLM system achieved similar FA, CR, and PP, compared to GPT-4-Consensus, while ensuring data privacy by being securely deployed within our institution.

**CLINICAL RELEVANCE/APPLICATION**

Our LLM system demonstrates high potential in improving medical research in radiology while ensuring data privacy and can be adapted to other medical domains.

## M3-SSIN02-4 RECIST ASSESSMENT OF HEPATOCELLULAR CARCINOMA AFTER LOCOREGIONAL THERAPY WITH LARGE LANGUAGE MODELS: BARD, BING, CHATGPT-3.5, AND CHATGPT-4

Fatma Celiker, MD (*Abstract Co-Author*) Nothing to Disclose
Merve Solak (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
esat kaba, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to evaluate response evaluation criteria in solid tumors (RECIST) using tumor longest diameter measurements from computed tomography (CT) reports of hepatocellular carcinoma (HCC) patients before (baseline) and after (follow-up) transcatheter arterial chemoembolization (TACE) with four different large language models (LLM).

### METHODS AND MATERIALS

Ninety-three HCC patients were included in this study after exclusion criteria. RECIST assessment was performed using Bard, Bing, ChatGPT-3.5, and ChatGPT-4 LLMs based on baseline and follow-up measurements of the longest diameter of lesions obtained from contrast-enhanced CT of HCC patients. A zero-shot learning technique was used for the initial prompts entered into the LLMs. For each patient, the RECIST classification results provided by the LLMs were compared with the radiologist evaluations.

### RESULTS

Bard, Bing, ChatGPT-3.5, and ChatGPT-4 accuracy in a RECIST assessment were 0.581, 0.839, 0.871, and 1.000, respectively. The precisions were 0.429, 0.920, 0.919, and 1.000, respectively. Recalls were 0.544, 0.738, 0.773, and 1.000, respectively. ChatGPT-4 outperformed other LLMs and all ninety-three patients were correctly evaluated for RECIST. However, Bard showed the lowest performance in this study with an accuracy of 0.581.

### CONCLUSION

LLMs are highly successful in text analysis and studies on their potential applications of LLMs in medicine and radiology have been increasing rapidly in recent years. The results of this study demonstrate that LLMs, especially ChatGPT-4, can perform rapid and effective RECIST assessments using baseline and follow-up lesion diameters in CT reports.

### CLINICAL RELEVANCE/APPLICATION

Some LLMs can potentially help radiologists in the RECIST evaluation, which is very important in the field of interventional oncology. ChatGPT-4 in particular, with its remarkable performance, shows promise for future use for this purpose.

## M3-SSIN02-5 ASSESSING COMPLETENESS OF CLINICAL HISTORIES ACCOMPANYING IMAGING ORDERS USING OPEN- AND CLOSED-SOURCE LARGE LANGUAGE MODELS

Hye Sun Na (*Abstract Co-Author*) Nothing to Disclose
Akshay Chaudhari, PhD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research Consultant, Subtle Medical, Inc
Lina Cheuy (*Abstract Co-Author*) Nothing to Disclose
Magdalini Paschali (*Abstract Co-Author*) Nothing to Disclose
David B. Larson, MD, MBA (*Abstract Co-Author*) Research Grant, Siemens AG ;Advisor, Bunkerhill Health;Shareholder, Bunkerhill Health
Matthew Petterson, MD (*Abstract Co-Author*) Nothing to Disclose
Zhongnan Fang, PhD (*Abstract Co-Author*) Nothing to Disclose
Dave Van Veen (*Abstract Co-Author*) Nothing to Disclose
Arogya Koirala, BS, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Clinical histories accompanying imaging orders are often incomplete. Using completeness of the clinical history to measure quality, this study adapted open-source and proprietary large language models (LLMs) to extract five elements from provided clinical histories: past medical history, what, when, where, and clinical concern. Then, the completeness of 49,026 clinical histories from a large academic medical center was assessed to obtain a quality benchmark.

### METHODS AND MATERIALS

Prompt engineering with in-context learning (2-16 examples) was performed for open-source (LLaMA-2-7B, Mistral-7B) and proprietary (GPT-4-Turbo; GPT-4) LLMs. GPT-4, which cannot be fine-tuned, was included to assess maximum out-of-the-box performance. The best-performing open-source LLM was further fine-tuned using a training set and validation set (n=796 and 150, respectively). Following this, both GPT-4 and the fine-tuned open-source LLM were evaluated against a test set independently annotated by two radiologists (n=300). Model performance was compared using detection (accuracy, F1 score) and textual semantic similarity (BERTScore) metrics. Model-radiologist agreement was assessed using Cohen's kappa and BERTScore. Finally, the best-performing open-source LLM was used to extract the five elements and analyze the quality of 49,026 clinical histories from an academic center.

### RESULTS

Mistral-7B outperformed LLaMA-2-7B after prompt engineering. After further fine-tuning, Mistral-7B with 16 in-context examples rivaled GPT-4 (accuracy: 0.91, F1 score: 0.87, mean BERTScore: 0.97). Both Mistral-7B and GPT-4 achieved substantial agreement with the two radiologists, with model-radiologist agreement levels similar to that achieved between the two radiologists (Cohen's kappa: 0.73-0.77 vs. 0.76; mean BERTScore: 0.96-0.97 vs. 0.96). Using Mistral-7B on the 49,026 clinical histories, the weighted mean inclusion rate of all relevant elements was 73.8%.

### CONCLUSION

A fine-tuned open-source LLM, rivaling GPT-4 in performance, extracted clinical history elements with substantial agreement to radiologists and yielded a benchmark for clinical history quality. The model and code will be open-sourced to help enable similar quality assessments.

### CLINICAL RELEVANCE/APPLICATION

Quality improvement efforts for clinical histories have relied on manual analysis, which is tedious and costly. Smaller open-source LLMs can help automate such efforts, while maintaining data security. Providing clinical histories with the most relevant information can improve patient care by helping radiologists better understand the clinical context and may improve the accuracy of tasks like automated protocolling that rely on the history.

## M3-SSIN02-6

Prateek Prasanna, PhD (*Abstract Co-Author*) Nothing to Disclose
Katherine Chung, MD (*Abstract Co-Author*) Nothing to Disclose

# COMPARATIVE PERFORMANCE OF STATE-OF-THE-ART LARGE LANGUAGE MODELS ON THE ACR IN-TRAINING EXAMINATION

Kush Purohit, MD, MS (*Abstract Co-Author*)

Nothing to Disclose
Mutshipay C. Mpoy, MD (*Abstract Co-Author*) Nothing to Disclose
Virginia B. Hill, MD (*Abstract Co-Author*) Medical Science Liaison, Alphabet Inc;;
David Payne, MD, MS (*Presenter*) Nothing to Disclose

## PURPOSE

Previous work has demonstrated the impressive performance of GPT-4 (Open AI) on the image-rich American College of Radiology (ACR) Diagnostic Radiology In-Training Examination (DXIT). In our study, we compare the performance of GPT-4 to two other popular publicly available large multimodal models, Claude 3 Opus (Anthropic) and Gemini 1.5 Pro (Google) on the 2022 DXIT.

## METHODS AND MATERIALS

Multiple choice questions from the 2022 DXIT were sequentially input into GPT-4, Claude 3 Opus, and Gemini 1.5 Pro with a standardized prompt. Responses from each model for each question were recorded and accuracy was calculated, as was logic-adjusted accuracy, which counted a response as incorrect if there were significant flaws in reasoning or image interpretation, regardless of answer choice. Sub-analyses assessed accuracy on image-based versus text-only questions as well as accuracy by question subject. The confidence level for each answer was also noted. Confidence levels were compared between models and for correct versus incorrect answers. Means were compared using paired and 2-sample t-tests. Model accuracy was compared to nationwide resident performance.

## RESULTS

GPT-4 achieved an overall accuracy of 56.1%, lower than PGY-3 average (61.9%) but higher than PGY-2 average (52.8%). Gemini 1.5 Pro attained a non-statistically lower accuracy of 51.5%. Claude 3 Opus's accuracy was 25.7%, significantly worse than the other models and comparable to random guessing on this multiple choice question set. Adjusted accuracy, which accounts for flaws in logic and image analysis, was lower than overall accuracy for each model, at 51.5%, 45.5%, and 21.2% for GPT, Gemini, and Claude respectively. Performance on image-rich questions was also significantly poorer for each model, at 43.9%, 39.0%, and 19.5% for GPT, Gemini, and Claude respectively, than for text-based questions. GPT, which had the highest overall accuracy, had the lowest confidence at 84.3%. Claude, which had the lowest overall accuracy, had the highest confidence at 88.3%.

## CONCLUSION

GPT-4 outperformed Gemini and Claude with overall accuracy between PGY-2 and PGY-3 levels. Each model performed significantly poorer on image-based questions and at times struggled with logical decision making and interpretation.

## CLINICAL RELEVANCE/APPLICATION

This study highlights the numerous risks of using the current generation of general AI models in interpreting radiologic images as a diagnostic tool. Clinical implementers of general multimodal AI systems in radiology should exercise caution given the possibility of spurious yet confident responses, particularly given the risk of automation bias. Future work will assess whether domain specific models exhibit similar traits to the models evaluated in this study.

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# Abstract Archives of the RSNA, 2024

M3-SSNR03

**Neuroradiology (Stroke: Risk Factors and Prevention)**

Monday, Dec. 2 9:30AM - 10:30AM Room: S402

Mahmud Mossa-Basha, MD (*Moderator*) Nothing to Disclose
Saurabh Rohatgi, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M3-SSNR03-1 MACHINE LEARNING-DERIVED RISK SCORE FROM CAROTID ULTRASOUND IMAGES IS ASSOCIATED WITH STROKE AND BRAIN ATROPHY IN UK BIOBANK PARTICIPANTS

Vineet K. Raghu, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael T. Lu, MD, MPH (*Abstract Co-Author*) Stockholder, NVIDIA Corporation;Institutional Research Grant, Kowa Company, Ltd;Institutional Research Grant, AstraZeneca PLC;Stockholder, Advanced Micro Devices, Inc;Stockholder, Intel Corporation
Saurabh Rohatgi, MD (*Abstract Co-Author*) Nothing to Disclose
Pradeep Natarajan (*Abstract Co-Author*) Nothing to Disclose
Javier M. Romero, MD (*Abstract Co-Author*) Stockholder, TMA Precision Medicine
Seyedeh Zekavat (*Abstract Co-Author*) Nothing to Disclose
Saman Doroodgar Jorshery, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to test whether a deep learning-derived biomarker of aging from carotid ultrasound images is associated with incident stroke and cortical volume from brain MRI.

### METHODS AND MATERIALS

We developed a convolutional neural network model (called Carotid-Risk) using carotid ultrasound images of 59,137 participants in UK Biobank, a population study of volunteers in the UK. The model was trained on 80% of the dataset, to predict biological age, defined as an individual's chronologic age at the time of the ultrasound, adjusted for the presence of cardiovascular risk factors, comorbidities, and observed all-cause mortality and major cardiovascular events during follow-up. For testing (remaining 20% of the dataset), we assessed the association of the Carotid-Risk score with observed incident stroke over median 3.8 years of follow-up (based on International Classification of Disease codes) and brain volume of cortical grey matter (derived from T1-weighted brain MRI via FreeSurfer software; normalized for head size). Analyses were performed using regression models adjusted for age, sex, body mass index (BMI), history of smoking, type 2 diabetes, hypertension, and genetic ancestry principal components. Results are provided for the testing dataset only.

### RESULTS

59,137 participants in UK Biobank had carotid imaging. The full dataset had mean age of 65.5 (SD: 7.7), 48.2% male, 62.4% never smokers, mean BMI of 26.6 (SD: 4.5). In the testing dataset (N=11,832), after adjusting for the aforementioned covariates, each standard deviation increase in Carotid-Risk was significantly associated with incident stroke (aHR: 1.37, 95% CI [1.03 to 1.82], P=0.03). 38,135 of these participants also had brain MRI, with mean brain volume of 1,492.6 (SD: 73.8) cubic centimeters. In the subset of testing dataset participants with Brain MRI (N=7,559), after adjusting for all covariates, each standard deviation increase in Carotid-Risk was significantly associated with 0.05 SD decrease in cortical grey matter volume (Beta: -0.05, 95% CI [-0.02 to -0.07], P< 0.001). There was no significant association between Carotid-Risk and white matter volume (P=0.27).

### CONCLUSION

A deep learning-based measure of biological age from a carotid ultrasound image (Carotid-Risk) is associated with incident stroke and reduced brain grey matter, beyond chronological age and prevalent cardiovascular risk factors.

### CLINICAL RELEVANCE/APPLICATION

Deep learning derived Carotid-Risk may help direct preventive interventions to those at high-risk for neurovascular disease and improve understanding of the role of the carotid artery in neuronal degeneration.

## M3-SSNR03-3 EVALUATING THE CLINICAL RELEVANCE OF INTRAPLAQUE HEMORRHAGE VOLUME IN ISCHEMIC STROKE RISK ASSESSMENT

Ian T. Mark, MD (*Abstract Co-Author*) Nothing to Disclose
Mana Moassefi, MD (*Abstract Co-Author*) Nothing to Disclose
Ajay A. Madhavan, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Carrie M. Carr, MD (*Abstract Co-Author*) Nothing to Disclose

John C. Benson, MD (*Abstract Co-Author*) Nothing to Disclose
Shahriar Faghani, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The relationship between carotid intraplaque hemorrhage (IPH) volume and severity of the ischemic event is not well-established. We sought to determine whether IPH volume is related to the severity of ischemic events and what volume of IPH most likely contributes to ischemic symptoms.

**METHODS AND MATERIALS**

A retrospective review was conducted on consecutive patients who underwent magnetic resonance imaging of carotid plaque using specific sequences to detect IPH. The presence or absence of plaque and IPH was determined by a neuroradiologist, who also assessed the IPH volume. Patients were categorized into four groups: none, amaurosis fugax (AF), other transient ischemic attacks (TIA), and stroke. The categorization also considered the side of the event when possible. To focus on carotid plaque as the etiology of ischemic events, cases with bilateral ischemic events or without carotid plaque were excluded. The normality of the IPH volume in each ischemic category was checked and the mean IPH volume in each ischemic group was compared using either the Mann-Whitney or T-test, with p-values reported. The analyses were conducted separately for events on the left and right sides.

**RESULTS**

We included 358 patients in our study. Of these, 105 had right-sided symptoms, with 75 patients having plaque (23 IPH positive, 52 IPH negative). There were 121 patients with left-sided symptoms, with 101 patients having plaque (46 IPH positive, 55 IPH negative). Additionally, 32 patients had bilateral symptoms, and 100 presented with symptoms of unknown-sidedness. We observed 19 strokes, 1 AF, and 3 other TIAs for the right side. 28 strokes, 6 AF, and 12 other TIAs for the left side. Analyses revealed no significant differences in IPH volumes across different ischemic events. For left-sided comparisons, the p-values were 0.802 for stroke vs. other TIAs, 0.173 for AF vs. strokes, and 0.222 for AF vs. other TIAs, indicating no significant differences. For the right side, the p-values were 1.0 for stroke vs. other TIAs and 0.2 for stroke vs. AF. Comparisons between AF and other TIAs were inconclusive due to limited data. However, there is a certain threshold that corresponds to stroke (200 and 650 mm3 for the right and left side).

**CONCLUSION**

The study indicates that while carotid IPH is detectable in patients with various ischemic events, there is no linear correlation between IPH volume and symptomatic severity, there may be a threshold IPH volume that makes stroke more likely than other neurologic deficits.

**CLINICAL RELEVANCE/APPLICATION**

This study challenges the potential predictive value of IPH volume in clinical practice, emphasizing the need for further research to explore other factors that might influence the impact of carotid atherosclerosis on ischemic stroke risk.

## M3-SSNR03-4 INTEGRATING CLINICAL AND MRI DATA FOR STROKE PREDICTION IN AT-RISK SUBJECTS: A MULTIMODAL APPROACH ON UK BIOBANK DATA

Marwa Ismail (*Abstract Co-Author*) Nothing to Disclose
Juhi Desai (*Abstract Co-Author*) Nothing to Disclose
Pallavi Tiwari, PhD (*Abstract Co-Author*) Nothing to Disclose
Vivek Prabhakaran, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nagesh Adluru, PhD (*Abstract Co-Author*) Nothing to Disclose
Veena A. Nair, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Ischemic stroke, a global health burden accounting for significant mortality and morbidity, necessitates robust risk stratification strategies. Current risk prediction models have limitations in accurately identifying at-risk individuals who will develop a stroke. Leveraging a large dataset from the UK Biobank, this study integrates clinical information and MRI-derived metrics for robust prediction of ischemic stroke. We hypothesize that machine learning models that combine clinical, demographic, and imaging features can provide reliable prognostication of stroke for at-risk population.

**METHODS AND MATERIALS**

This study comprises n=1226 subjects from the UK biobank data (640 males, mean age = 55.5 years) who are at risk of ischemic stroke, all with at least one known vascular risk factor associated with stroke. Within this cohort, n=317 participants reported ischemic stroke during subsequent follow-up assessments within a span 10-years. Clinical features included demographics, traditional risk factors (e.g., age, hypertension), and cardiopulmonary features (e.g., Chronic Obstructive Pulmonary Disorder, Asthma). MRI-derived metrics included Fractional Anisotropy, Mean Diffusivity, and White Matter Hyperintensities volume, extracted from diffusion-weighted, susceptibility, T1w, and FLAIR sequences, totaling 114 features. Multivariate logistic regression was utilized to select relevant MRI features associated with stroke risk (p lt 0.05), which were then concatenated with the 18 clinical features. Individual as well as concatenated features sets were fed into the XGBoost (XGB) algorithm in a 5-fold cross-validation scheme for classifying individuals who develop stroke from those who remain at risk.

**RESULTS**

The regression models yielded a reduced MRI set of 32 features. When concatenated with the 18 clinical features, the combined clinical and MRI XGB model achieved an accuracy of 82.0%, precision of 0.93 and recall of 0.70, and AUC of 0.86 for stroke cases. The top 5 features were: history of high blood pressure, asthma, father's history of stroke, mean MD in the cerebral peduncle on the left FA skeleton, and mean MD in the superior corona radiata on the right FA skeleton. The clinical XGB model achieved an accuracy of 82.7% with precision and recall of 0.89 and 0.75, and an AUCROC of 0.85. The MRI XGB model achieved an accuracy of 56.0% with precision and recall of 0.60 and 0.35, and AUC of 0.57.

**CONCLUSION**

Our results demonstrate the potential of integrating clinical and MRI data, towards reliable prognostication of likelihood of developing ischemic stroke.

**CLINICAL RELEVANCE/APPLICATION**

Timely identification of at-risk individuals who develop ischemic stroke is essential for efficient treatment planning and improved outcomes.

## M3-SSNR03-5 HIGH BLOOD PRESSURE IN HOSPITALIZED PATIENTS WITH ACUTE SYMPTOMATIC INTRACRANIAL ATHEROSCLEROTIC DISEASE IS ASSOCIATED WITH POST-CONTRAST PLAQUE ENHANCEMENT: A WHOLE-BRAIN MR VESSEL WALL IMAGING STUDY

Steven Cen, PhD (*Abstract Co-Author*) Nothing to Disclose
Patrick D. Lyden, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Lerner, MD (*Abstract Co-Author*) Nothing to Disclose

Tao Jiang, MD (*Abstract Co-Author*) Nothing to Disclose
Zhaoyang Fan, PhD (*Abstract Co-Author*) Nothing to Disclose
Jae W. Song, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Xiao Liu (*Abstract Co-Author*) Nothing to Disclose
Qi Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Fang Wu (*Abstract Co-Author*) Nothing to Disclose
Xiaomeng Lei (*Abstract Co-Author*) Nothing to Disclose
Jiayu Xiao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the associations among a known history of hypertension, blood pressure (BP) during hospitalization, intraplaque hemorrhage (IPH), and plaque enhancement in patients who had acute symptomatic intracranial atherosclerotic disease (ICAD) using whole-brain MR vessel wall imaging (VWI).

**METHODS AND MATERIALS**

We retrospectively screened VWI data from consecutive hospitalized patients with acute symptomatic ICAD for atherosclerotic plaques. Intracranial internal carotid arteries, V4 segments of the vertebral arteries, and the basilar artery were considered proximal segments; A1, M1, and P1 segments of the anterior, middle, and posterior cerebral arteries were considered intermediate segments; A2, M2-3, and P2 segments were considered distal segments. Each plaque was reviewed for the presence of IPH (defined as a hyperintense region on pre-contrast VWI) and strong enhancement (defined as a greater enhancement degree than the pituitary on post-contrast VWI). During the hospitalization after stroke, the mean of 3 BP measurements from the first 3 days was used in the analyses.

**RESULTS**

Among 108 patients, 63 had a history of hypertension. Pre-stroke hypertension was associated with a higher plaque count ($p = 0.01$), specifically in the proximal segments (4.37 vs. 2.91, $p = 0.02$). No strong evidence was found in the association between a history of hypertension and the likelihood of having plaques with IPH or strong enhancement. Higher BP during hospitalization was associated with a higher count of plaques with strong enhancement, regardless of a history of hypertension. Specifically, for each 10 mmHg increase in diastolic BP (DBP), the count of plaques with strong enhancement would be as high as 1.23 times, 95% CI (1.11, 1.37), $p<0.01$. For systolic BP (SBP), the trend was similar but not as strong as that for DBP (1.07 times, 95% CI [1, 1.4], $p=0.05$). When examining the association between BP and the patient-level probability of having strong plaque enhancement, a consistent positive log-linear association was found in the proximal segments for both DBP and SBP with a slope of 1.19, 95% CI (1.04, 1.35), $p<0.01$ and 1.12, 95% CI (1.03, 1.21), $p<0.01$, respectively, but not in the intermediate or distal segments. Neither DBP nor SBP was significantly associated with the count of plaques with IPH.

**CONCLUSION**

Higher BP during hospitalization, especially DBP, was associated with a higher count of plaques with strong enhancement in patients with symptomatic ICAD.

**CLINICAL RELEVANCE/APPLICATION**

Elevated BP is common after acute stroke and is associated with poor prognosis. The unstable intracranial plaques in patients with post-stroke hypertension require close attention.

## M3-SSNR03-6 THE IMPACT OF WHITE MATTER HYPERINTENSITIES BURDEN AND CEREBRAL VESSELS MORPHOLOGICAL ALTERNATION ON THE ONE-YEAR RISK OF ISCHEMIC STROKE RECURRENCE

Hao Wang, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to evaluate the association of white matter hyperintensities (WMHs) burden and cerebral vessel morphological features with the one-year risk of ischemic stroke recurrence.

**METHODS AND MATERIALS**

We conducted a retrospective study on 677 patients diagnosed with ischemic stroke from January 2018 to April 2021. Automated segmentation was utilized to delineate WMH lesions and quantify their spatial distribution. In addition, cerebral vessel morphological features including volume, length, radius, density, tortuosity, branch, and degree of stenosis were extracted and calculated. Utilizing these measurements alongside clinical characteristics, a total of six predictive models were developed using Cox proportional hazards analysis to estimate one-year risk of stroke recurrence. The performance of these models was compared via concordance index (C-index).

**RESULTS**

The study found significant associations between the lack of antiplatelet therapy at discharge, increased burden of whole brain and periventricular WMHs, and reduced length and branching of cerebral vessels, with a higher one-year risk of recurrent ischemic stroke (all $P < 0.05$). The integrated model, incorporating WMHs, cerebral vessel morphology, and clinical characteristics, demonstrated superior prognostic capability (C-index: 0.750; 95% CI: 0.684-0.817), outperforming models based solely on clinical characteristics (C-index: 0.636; 95% CI: 0.555-0.717), cerebral vessel morphology (C-index: 0.601; 95% CI: 0.526-0.676), and WMH volume (C-index: 0.680; 95%CI: 0.603-0.757).

**CONCLUSION**

The quantitative assessment of WMHs and cerebral vessel morphological features provides a promising neuroimaging tool for estimating the likelihood of recurrence in patients who have experienced an ischemic stroke.

**CLINICAL RELEVANCE/APPLICATION**

The quantitative analysis of WMHs and cerebral vascular features may provide a new neuroimaging approach for predicting stroke recurrence.

# Abstract Archives of the RSNA, 2024

M3-SSNR04

**Neuroradiology (Stroke: Diagnosis and Treatment)**

Monday, Dec. 2 9:30AM - 10:30AM Room: S406B

Nicholas Telischak, MD, MS (*Moderator*) Research Consultant, Terumo Corporation;Research Consultant, Stryker Corporation;Research Consultant, Medtronic plc
Laura B. Eisenmenger, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M3-SSNR04-2 ACUTE STROKE DETECTION USING PORTABLE ULTRA LOW-FIELD MRI: A MULTICENTER OUTLOOK

Adnan Siddiqui, MD,PhD (*Abstract Co-Author*) Investor, Shifamed LLC;Consultant, Alexion Pharmaceuticals, Inc;Advisory Board, Alexion Pharmaceuticals, Inc;Consultant, Amnis Therapeutics;Advisory Board, Amnis Therapeutics;Investor, Amnis Therapeutics;Investor, Bendit Technologies, Ltd;Investor, Blinktbi Inc ;Consultant, Boston Scientific Corporation;Advisory Board, Boston Scientific Corporation;Investor, Boston Scientific Corporation;Investor, Buffalo Technology Partners, Inc;Consultant, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation;Consultant, Cardinal Health, Inc;Advisory Board, Cardinal Health, Inc;Investor, Cardinal Health, Inc;Consultant, Cerebrotech Medical Systems, Inc;Advisory Board, Cerebrotech Medical Systems, Inc;Investor, Cerebrotech Medical Systems, Inc;Investor, Cognition Medical;Consultant, Endostream Medical, Ltd;Advisory Board, Endostream Medical, Ltd;Investor, Endostream Medical, Ltd;Consultant, Imperative Care, Inc;Advisory Board, Imperative Care, Inc;Investor, Imperative Care, Inc;Investor, Instylla, Inc;Consultant, IRRAS AB;Advisory Board, IRRAS AB;Investor, IRRAS AB;Consultant, Johnson & Johnson;Advisory Board, Johnson & Johnson;Committee member, Johnson & Johnson;Investor, NeuroRadial Technologies, Inc;Investor, Neurovascular Diagnostics, Inc;Consultant, Perflow Medical Ltd;Advisory Board, Perflow Medical Ltd;Investor, Perflow Medical Ltd;Consultant, Q'Apel Medical Inc;Advisory Board, Q'Apel Medical Inc;Investor, Q'Apel Medical Inc;Investor, Radical Catheter Technologies, Inc;Consultant, Integra LifeSciences Holdings Corporation;Advisory Board, Integra LifeSciences Holdings Corporation;Investor, Integra LifeSciences Holdings Corporation;Investor, RIST Neurovascular, Inc;Investor, Sense Diagnostics LLC ;Consultant, Serenity Medical Inc;Advisory Board, Serenity Medical Inc;Investor, Serenity Medical Inc;Consultant, Siemens AG;Advisory Board, Siemens AG;Consultant, Silk Road Medical;Advisory Board, Silk Road Medical;Investor, Silk Road Medical;Investor, Spinnaker Medical Consultants ;Consultant, StimMed;Advisory Board, StimMed;Investor, StimMed;Investor, Synchron AB;Investor, Truvic Medical, Inc;Investor, Vastrax , LLC;Investor, VICIS;Investor, Viseon Inc;Consultant, Viz.ai Inc;Advisory Board, Viz.ai Inc;Investor, Viz.ai Inc;Consultant, Medtronic plc;Advisory Board, Medtronic plc;Committee member, Medtronic plc;Consultant, Terumo Corporation;Advisory Board, Terumo Corporation;Committee member, Terumo Corporation;Consultant, Minnetronix Medical, Inc;Advisory Board, Minnetronix Medical, Inc;Consultant, Penumbra, Inc;Advisory Board, Penumbra, Inc;Committee member, Penumbra, Inc;Consultant, Rapid Medical;Advisory Board, Rapid Medical;Consultant, Stryker Corporation;Advisory Board, Stryker Corporation;Consultant, VasSol, Inc;Advisory Board, VasSol, Inc;Consultant, W. L. Gore & Associates, Inc;Advisory Board, W. L. Gore & Associates, Inc
Olivia Nelson (*Abstract Co-Author*) Nothing to Disclose
Edmond A. Knopp, MD (*Abstract Co-Author*) Nothing to Disclose
William T. Kimberly, MD,PhD (*Abstract Co-Author*) Research Grant, Remedy Pharmaceuticals, Inc
Shahid Nimjee (*Abstract Co-Author*) Nothing to Disclose
Joshua Goldstein, MD (*Abstract Co-Author*) Consultant, CSL Limited
John Pitts (*Abstract Co-Author*) Nothing to Disclose
VINAY JAIKUMAR (*Abstract Co-Author*) Nothing to Disclose
Stewart Rodney (*Abstract Co-Author*) Nothing to Disclose
Keith Muir, MD (*Abstract Co-Author*) Grant, Medtronic plc
Annabel Sorby-Adams (*Abstract Co-Author*) Nothing to Disclose
Nandor K. Pinter, MD (*Presenter*) Consultant, Koninklijke Philips NV

### PURPOSE

Portable, ultra-low-field (LF) MRI has the potential to improve access to MRI and facilitate diagnosis of acute ischemic stroke (AIS). To evaluate the accuracy of LF-MRI for AIS detection, we scanned patients presenting to the emergency department across three US stroke centers within 24 hours of last known well (LKW) and determined the agreement and predictive values of accurately detecting stroke.

### METHODS AND MATERIALS

Sixty-six patients (50% female, 66±13 years) were enrolled at the Massachusetts General Brigham, Buffalo General Medical Center and Ohio State Hospitals and underwent diffusion weighted imaging (DWI; single direction b=900 s/mm2) on a 0.064T scanner (Hyperfine Inc.). Three independent assessors (each with >10 years of experience reading acute stroke MRI) underwent training on LF-MRI images. Assessors then evaluated LF-MRI scans from acute stroke patients and evaluated for the presence of a DWI lesion and its location. The agreement between assessors, positive (PPV; based on confirmed diagnosis of AIS on conventional neuroimaging obtained as part of clinical care) and negative (NPV; based on no acute intracranial findings on conventional imaging) predictive values, sensitivity and specificity were calculated [95% CI].

### RESULTS

There was strong agreement between assessors regarding lesion detection (?=0.80, [0.68-0.92]) and lesion location (?=0.95, [0.81-1.0]). Predictive values for detecting AIS on LF-MRI revealed a 96.4% PPV [81.7-99.9] and 65.8% NPV [48.6-80.4] which was associated with a 67.5% sensitivity [50.9-81.4] and 96.2% specificity [80.4-99.9].

### CONCLUSION

We observed agreement between assessors and favorable positive predictive values. Sources of disagreement were observed when lesions were smaller and less conspicuous. Our findings also reveal the importance of experience in both reading acute stroke exams and undergoing prior training to familiarize assessors with the nuances of LF-MRI images. NPV was higher than PPV, which may be a consequence of the single direction DWI. Multi-directional DWI could improve lesion detection and confidence between assessors, which is an avenue for future development.

### CLINICAL RELEVANCE/APPLICATION

LF-MRI has the potential to detect hyperacute stroke, which may increase access to MRI given its unique portable capabilities.

## M3-SSNR04-3 ASPECTS MISMATCH BETWEEN HEAD CT - HEAD CTA AND BRAIN COLLATERALS STATUS AS PROGNOSTIC FACTORS IN ACUTE ISCHEMIC STROKE

Manuel F. Granja, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia Bermudez, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia P. Marquez Zuchini, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Andrea Campana Perilla, MD (*Abstract Co-Author*) Nothing to Disclose
Angela P. Guarnizo, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the association between the ASPECT score mismatch in head CT - head CTA and brain collaterals with the clinical outcome of patients with acute ischemic stroke.

### METHODS AND MATERIALS

We conducted a Retrospective cross-sectional observational study from patients who presented to the emergency department with acute ischemic stroke and underwent to head CT and head CTA between 2016 and 2022. Head CT and head CTA ASPECTS was calculated by two neuroradiologists as well as brain collaterals by using the Mass system. A univariate and bivariate analysis was performed as well as logistic regression model to assess the discrepancy between the two modalities and clinical outcomes

### RESULTS

A total of 121 patients were analyzed. A difference was found in the ASPECTS in head CT vs head CTA. Patients who presented a negative mismatch between head CT and head CTA (lower ASPECTS on head CTA than on head CT) had a higher proportion of atrial fibrillation as comorbidity (p 0.027), less collateral circulation in the infarcted cerebral hemispheres (p < 0.0001), higher blood pressure values ??(p 0.028) and blood glucose levels upon admission (p 0.05). Patients with negative mismatch also had a longer hospital stay (p 0.02), higher NIHSS score (p 0.002) and RANKIN score (p 0.05) at discharged. Most of the patients showed a mismatch ASPECTS between 0 to -2 points. Regarding the interobserver agreement it was moderate for head CTA ASPECTS and brain collaterals (k= 0.403 and 0.457 respectively). The interobserver agreement for head CT ASPECTS was low (k=0.374).

### CONCLUSION

The negative ASPECTS discrepancy between head CT and head CTA is associated with lower cerebral blood flow through collaterals and a higher probability of negative clinical outcomes. Thus, ASPECTS discrepancy constitutes a feasible marker when selecting optimal candidates for endovascular treatment.

### CLINICAL RELEVANCE/APPLICATION

ASPECTS head CT and head CTA mismatch constitutes a feasible marker when selecting optimal candidates for endovascular treatment.

## M3-SSNR04-4 DEEP LEARNING BASED AUTOMATIC DETECTION ALGORITHM FOR ACUTE ISCHEMIC STROKE ON BRAIN CT: A PIVOTAL RANDOMIZED CLINICAL TRIAL

Roh-Eul Yoo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Inpyeong Hwang, MD (*Abstract Co-Author*) Research Consultant, AIRS Medical Inc.
Woo Sang Jung (*Abstract Co-Author*) Nothing to Disclose
Jin Wook Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Miran Han, MD (*Abstract Co-Author*) Nothing to Disclose
Ji Ye Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Tae Jin Yun, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Acute ischemic stroke (AIS) is a potentially life-threatening emergency that requires prompt and accurate assessment and management. This study aimed to develop and validate an artificial intelligence (AI) algorithm for the diagnosis of AIS using brain CT images.

### METHODS AND MATERIALS

A retrospective, multi-reader, pivotal, crossover, randomized study was performed to validate the performance of an AI algorithm using a novel approach that combines convolutional neural network and recurrent neural network using CT scans from 1,972 patients. Brain CT images from 917 patients were evaluated by nine reviewers belonging to one of three subgroups (non-radiologist physicians, n=3; board-certified radiologists, n=3; and neuroradiologists, n=3) with and without the aid of our AI algorithm. Sensitivity, specificity, and accuracy were compared between the AI-unassisted and AI-assisted interpretations using Chi-square tests.

### RESULTS

Brain CT interpretation with AI assistance resulted in significantly higher diagnostic accuracy compared to that without AI assistance (0.7563 vs. 0.7203 with a difference of 3.60%, p<0.0001). Among the three subgroups of reviewers, non-radiologist physicians demonstrated the greatest improvement in diagnostic accuracy for brain CT interpretation with AI assistance compared to that without AI assistance (0.7535 vs. 0.6997, with a difference of 5.38%, p<0.0001). For both board-certified radiologists and neuroradiologists, diagnostic accuracy for brain CT interpretation were also significantly higher with the use of AI assistance than without AI assistance (for board-certified radiologists, 0.7488 vs. 0.7230, with a difference of 2.58%, p=0.0299, for neuroradiologists, 0.7666 vs. 0.7383, with a difference of 2.84%, p=0.0148).

### CONCLUSION

We validated the improvement in diagnostic performance with the assistance of our AI algorithm for the detection of AIS on brain CT images in pivotal randomized clinical trial.

**CLINICAL RELEVANCE/APPLICATION**

1. Improvement in diagnostic performance with the assistance of our AI algorithm for the detection of AIS on brain CT images was validated in pivotal randomized clinical trial. 2. The AI algorithm described in this study may serve as a reliable assistant for the detection of acute ischemic stroke (for small acute ischemic stroke as well as acute ischemic stroke associated with large vessel occlusion) on brain CT scans in which prompt and accurate assessment are required.

## M3-SSNR04-5 COMPUTED TOMOGRAPHY PERFUSION ISCHEMIC CORE PREDICTS FAVORABLE OUTCOMES AFTER BASILAR ARTERY THROMBECTOMY

Xia Li (*Abstract Co-Author*) Nothing to Disclose
Pengjun Chen (*Presenter*) Nothing to Disclose

**PURPOSE**

Recent trials confirmed the predictive value of computed tomography perfusion (CTP) ischemic core in anterior circulation stroke patients caused by large vessel occlusion, however, the value of CTP for functional outcomes of successful endovascular thrombectomy (ET) remains to be investigated in patients with acute basilar artery occlusion (BAO). We tried to address this question by comparing the performance of Posterior Circulation Alberta Stroke Program Early CT Score (pc-ASPECTS) and Critical Area Perfusion Score (CAPS), based on the presumed ischemic core generated by syngo.via.

**METHODS AND MATERIALS**

A retrospective analysis was performed with a cohort of acute BAO uderwent successful ET in a comprehensive stroke center. The primary outcome was a good functional outcome 90-days (modified Rankin Scale 0-3). Pc-ASPECTS and CAPS were quantified by a 6-years experienced radiologist (observer-Li) and a 13-years experienced neuro-radiologist (observer-Chen) based on NCCT, CTP maps, severe hypoperfusion (Tmax > 10s generated by RAPID and syngo.via) and presumed ischemic core (CBF < 10 mL * min-1 * 100 g-1, 15 mL * min-1 * 100 g-1, and CBV < 1.2 mL * 100mL-1) generated by syngo.via. The intraclass correlation coefficient was used to assess the inter-observer reliability. Multivariate regression analyses and receiver operating characteristics (ROC) analyses were performed for the ability of predicting the primary outcome.

**RESULTS**

A total of 57 patients were matched the inclusion criteria. In binary logistic regression analyses, pc-ASPECTS and CAPS assessed by observer-Li and observer-Chen based on CBF < 10 ml * min-1 * 100 g-1 presented as independent predictors of 90-day favorable outcomes, and yielded the best performance in the ROC analyses with the areas under the curve (AUC) values were 0.790 ([95% CI, 0.669-0.911]), 0.824 ([95% CI, 0.714-0.934]), 0.818 ([95% CI, 0.707-0.928]), and 0.854 ([95% CI, 0.755-0.954]), respectively, with the intraclass correlation coefficients of 0.888 and 0.841. RAPID-Tmax > 10 s had moderate discriminatory power (AUC, 0.717, 0.718, 0.718, and 0.718, respectively), with the intraclass correlation coefficients of 0.970, 0.970.

**CONCLUSION**

CTP presumed ischemic core (CBF < 10 ml * min-1 * 100 g-1) generated by syngo.via contains prognostic information for functional outcome of successful ET in patients with basilar artery occlusion at an early stage of hospitalization.

**CLINICAL RELEVANCE/APPLICATION**

We tried to investigate the predictive value of computed tomography perfusion ischemic core in patients with acute basilar artery occlusion underwent successful endovascular thrombectomy, and to give more attention and active treatment to patients with potentially poor prognosis.

# Abstract Archives of the RSNA, 2024

M3-SSPH03

**Physics (CT Image Quality I)**

Monday, Dec. 2 9:30AM - 10:30AM Room: S401

Grace J. Gang, PhD (*Moderator*) Nothing to Disclose
Adam S. Wang, PhD (*Moderator*) Research support, General Electric Company;Research support, Siemens AG;Research collaboration, Varex Imaging Corporation;

**Sub-Events**

## M3-SSPH03-1 COMMUNICATING VARIABILITY IN DEEP LEARNING CT RECONSTRUCTIONS WITH POSTERIOR SAMPLING

Grace J. Gang, PhD (*Abstract Co-Author*) Nothing to Disclose
Patrick Li (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Stayman, PhD (*Abstract Co-Author*) Research Grant, Fischer Medical;Research Grant, General Electric Company;Research Grant, Canon Medical Systems Corporation;Research collaboration, Koninklijke Philips NV;Research collaboration, Siemens AG;Researcher, Varex Imaging Corporation
Xiao Jiang (*Abstract Co-Author*) Nothing to Disclose
Shudong Li (*Abstract Co-Author*) Nothing to Disclose
Cheng Ting Lin, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Deep learning reconstructions hold potential for dose reduction and image quality improvements, but interpretability and propensity for hallucinations limit translation. A new class of interpretable algorithms, diffusion posterior sampling (DPS), permits generation of multiple representative reconstructions from measurement data. Proper interpretation of these posterior samples is the key to combating hallucinations and understanding image outputs. In this work, we explore the effect of different communication strategies in an observer study.

### METHODS AND MATERIALS

Lung Image Database Consortium CT scans containing spiculated and non-spiculated lesions were assembled and treated as ground truth. Low dose projections were simulated and reconstructed using filtered-backprojection (FBP) and DPS. The dose level was intentionally set to a very low level where significant hallucinations were present. For DPS, 32 posterior samples were obtained. We performed a receiver operating characteristic study to evaluate the effect of communication strategies for specific imaging tasks. In preliminary investigations, an expert observer was asked to discriminate spiculated from non-spiculated lesions in 100 patients. Three strategies were evaluated: 1) low dose FBP, 2) a single DPS sample, and 3) an ensemble of 32 DPS samples presented as scrollable slices. High dose FBP was used to establish ground truth annotations. Additionally, we recorded the time taken to complete each task and confidence levels from 1-5.

### RESULTS

The percentage correct for low dose FBP, single sample DPS, and ensemble DPS is 66%, 68%, and 73%, respectively. The ensemble display has the highest true positives among all strategies, but slightly lower true negatives compared to low dose FBP, indicating that non-spiculated lesions tend to be misclassified as spiculated lesions due to spurious generation of lung parenchyma. The ensemble display outperforms the single sample display overall. For confidence, the single sample diffusion is highest due to the appearance of low image dose; the ensemble diffusion shows variability in outputs and therefore reduces confidence. The confidence for ensemble diffusion is overall higher than FBP.

### CONCLUSION

Diffusion model outputs improve performance relative to low dose FBP. Task performance improves by showing the variability in posterior samples, albeit at the cost of reduced confidence. This work provides initial evidence that novel communication strategies are important for this new class of deep learning algorithms.

### CLINICAL RELEVANCE/APPLICATION

Novel communication methods for a new class of interpretable deep learning reconstruction algorithms could mitigate the risk of hallucinations and facilitate clinical translation.

## M3-SSPH03-2 AI-BASED COMPUTER-AIDED VOLUMETRY FOR INVASIVENESS EVALUATION IN LUNG ADENOCARCINOMA: COMPARISON OF CAPABILITY FOR NODULE COMPONENT MEASUREMENT AND DIAGNOSTIC PERFORMANCE ON DIFFERENT DOSE LEVELS AND RECONSTRUCTION METHODS ON ULTRA-HIGH-RESOLUTION CT

Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Kota Aoyagi (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Satomu Hanamatsu (*Abstract Co-Author*) Nothing to Disclose
Takahiro Ueda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yota Noda (*Abstract Co-Author*) Nothing to Disclose
Hirona Kimata (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation

Yuya Ito (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yoshiharu Ohno, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology
Masahiko Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuka Oshima (*Abstract Co-Author*) Nothing to Disclose
Daisuke Takenaka, MD (*Abstract Co-Author*) Canon Medical Systems Corporation
Kenji Fujii (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hiroyuki Nagata (*Abstract Co-Author*) Canon Medical Systems Corporation
Yoshiyuki Ozawa, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare capabilities of artificial intelligence (AI)-based computer-aided volumetry (CADv) for nodule component measurement and diagnostic performance to evaluate invasiveness in lung adenocarcinoma among standard-, reduced- and ultra-low-dose ultra-high-resolution CT (UHR-CT) reconstructed with hybrid-type iterative reconstruction (IR) and deep learning reconstruction (DLR) methods.

**METHODS AND MATERIALS**

112 consecutive patients with 181 lung adenocarcinomas underwent thin-section UHR-CTs at standard- (SDCT: 9.0±1.8 mGy), reduced- (RDCT: 1.7±0.2 mGy) and ultra-low-dose (ULDCT: 0.8±0.1 mGy) levels. All CT data were reconstructed with hybrid-type IR and DLR. Then, standard references for solid and GGO components and consolidation-to-tumor ratio (CTR) were computationally determined with the simultaneous truth and performance level estimation (STAPLE) method from annotated CT data by three board-certified chest radiologists. Then, each component volume and CTR on all UHR-CT data were measured by AI-based CADv software. Each component volume and consolidation-to-tumor ratio (CTR) were correlated between CADv measurement on each CT data and standard reference. Then, Measurement differences of each index between standard reference and each CADv measurement were compared among all CT data by Tukey's HSD test. Finally, diagnostic performance of invasiveness was compared among all CTR measurements by ROC analysis.

**RESULTS**

There were significant correlations for each component and volume and CTR on all UHR-CTs (hybrid-type IR: 0.71=r=0.88, p<0.0001DLR: 0.71=r=0.88, p<0.0001). Mean difference of each index between each CADv measurement and standard reference had no significant differences among all UHR-CT data (p>0.05). Area under the curve (AUC) of each CT protocol with DLR (SDCT: AUC=0.98, RDCT: AUC=0.98, ULD-CT: AUC=0.97) was significantly larger than that with hybrid-type IR (SDCT, RDCT and ULDCT: AUC=0.95, p<0.05).

**CONCLUSION**

DLR has better potential than hybrid-type IR for improving diagnostic performance of AI-based CADv for invasiveness evaluation in lung adenocarcinoma on UHR-CT with standard-reduced- and ultra-low-dose levels.

**CLINICAL RELEVANCE/APPLICATION**

DLR has better potential than hybrid-type IR for improving diagnostic performance of AI-based CADv for invasiveness evaluation in lung adenocarcinoma on UHR-CT with standard-reduced- and ultra-low-dose levels.

## M3-SSPH03-3 DEEP LEARNING-BASED METRIC FOR CT IMAGE QUALITY ASSESSMENT: CAPABILITIES AND POTENTIAL CLINICAL APPLICATIONS

Jie Zhang, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Evaluating CT image quality has become more challenging with the widespread use of iterative reconstruction (IR). Traditional metrics often fail to meet clinical requirements for assessing contrast resolution, noise levels, artifact presence, and visibility of critical details. This study examines the potential of a deep learning (DL)-based metric developed during the Low-dose CT Perceptual Image Quality Assessment Grand Challenge 2023 for clinical applications.

**METHODS AND MATERIALS**

Our DL model, which ranked in the top three of the Grand Challenge, is based on Efficient-Net V2-L and was enhanced by an ensemble of the best four outcomes from a 5-fold cross-validation. To evaluate its potential, we first conducted an animal study by scanning a 72 kg, four-year-old sheep using a Siemens CT scanner at exposure levels ranging from 360 mAs to 30 mAs. Images were reconstructed using both Advanced Modeled Iterative Reconstruction (ADMIRE) at strengths 1-5 and FBP. We then retrospectively analyzed abdominal CT images from 50 pediatric patients (ages 2-12) and 50 obese patients (BMI>35), investigating the impact of patient size and IR reconstruction parameters on image quality.

**RESULTS**

The animal study identified a radiation dose point at 210 mAs, beyond which increases in dose did not improve image quality for either FBP or IR. Above this point, FBP produced better images, while the use of IR degraded image quality. Below the point, the use of IR improved image quality, with the optimal IR strength varying based on the dose reduction. In pediatric patients, the average image quality score was 3.40 ± 0.15 for routine clinical images, demonstrating the effective use of AEC (CarekV CareDose4D) across various patient sizes. For obese patients, image quality scores decreased with increasing BMI, i.e., ranging from 2.64 (FBP) to 3.71 (IR strength 5) at a BMI of 34.46, and from 1.84 to 3.02 at a BMI of 66.22.

**CONCLUSION**

The DL-based metric shows promise in evaluating CT image quality, which can aid in optimizing CT imaging parameters and ensuring diagnostic adequacy while maintaining low radiation exposure to patient.

**CLINICAL RELEVANCE/APPLICATION**

A DL-based metric for assessing CT image quality can contribute to the improvement of imaging practices, patient care, and clinical outcomes by providing a reliable, efficient, and automated means of ensuring high-quality diagnostic images.

## M3-SSPH03-4 THE SEPARATION OF SIMULTANEOUSLY ADMINISTERED IODINE AND GADOLINIUM CONTRAST: PHOTON-COUNTING CT VERSUS DUAL-ENERGY CT

Paul Deak, PhD (*Abstract Co-Author*) Employee, General Electric Company
Gert van Gompel, PhD (*Abstract Co-Author*) Nothing to Disclose
Hugo Linder (*Abstract Co-Author*) Nothing to Disclose

Nico Buls, PhD (*Abstract Co-Author*) Nothing to Disclose
Dominic Crotty, PhD (*Abstract Co-Author*) Employee, General Electric Company
Johan De Mey, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Emma Verelst, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare a prototype silicon-based photon-counting CT (Si-PCCT) with dual-energy CT (DECT) for the differentiation of simultaneously administered Iodine (I) and Gadolinium (Gd).

**METHODS AND MATERIALS**

I-and Gd-based contrast agents, diluted with saline to achieve a similar 300 HU target in a conventional 120 kVp CT scan (13 mg/mL I, 31 mg/mL Gd), were mixed into five tubes containing different I/Gd fractions: 10/0, 7.5/2.5, 5/5, 2.5/7.5, 0/10 mL, and inserted into a 20 cm diameter water phantom along with a saline control tube. Helical scans were acquired using a prototype Si-PCCT system using 8 energy bins at 120 kVp and a conventional DECT system (80-140 Fast kVp switching). Three types of images were reconstructed: image data from 4 energy bins (44 - 52.2, 52.2 - 60, 60 - 80, 80+ keV), conventional mono-energetic kV reconstructions at 8 energies in a 40 - 120 keV interval (approximating the equivalent energies of the 4 Si-PCCT energy bins) and Iodine(water) maps. To evaluate the ability of the Si-PCCT system to separate I from Gd, their attenuation as function of energy, their differences in CT values, and the quantification accuracy of I throughout the different I/Gd fractions were compared between systems and evaluated using a paired sample t-test.

**RESULTS**

DECT-based attenuation curves for I and Gd allowed differentiation through distinct attenuation behavior across a 40 - 120 keV energy range. Binned Si-PCCT data and mono-energetic keV attenuation curves also revealed distinct attenuation patterns. Additionally, Gd K-edge absorption (50.2 keV) was observed on binned Si-PCCT data. The extent to which I attenuation differed from Gd attenuation, or the mean difference in CT-values between I and Gd across a 70 - 120 keV energy range was significantly increased for Si-PCCT (167 ± 60.5 HU), when compared to DECT (61.7 ± 30.4 HU), $p < 0.001$. I quantification throughout the different I/Gd fractions showed a significant reduced error towards the target concentration for Si-PCCT (1.2 ± 1.8 mg/mL), when compared to DECT (5.1 ± 3.3 mg/mL), $p < 0.001$.

**CONCLUSION**

Both DECT and Si-PCCT can differentiate I and Gd. However, only Si-PCCT energy binned images allowed to identify the K-edge of Gd. Furthermore, energy binning-based imaging enabled improved material separability, and made it possible to quantify iodine more correctly when diluted with Gd, when compared to DECT

**CLINICAL RELEVANCE/APPLICATION**

Using contrast agents with K-edges within the diagnostic CT energy range is challenging as basic assumptions of material decomposition are violated. While experimental K-edge imaging through energy binning with Si-PCCT may differentiate contrast materials regardless of their K-edge, potentially facilitating research on novel contrast agents and multi-contrast agent imaging.

## M3-SSPH03-5 COMPARISON OF WATER-CALCIUM AND WATER-HYDROXYAPATITE MATERIAL DECOMPOSITION IN BONE MARROW EDEMA ASSESSMENT USING DUAL-ENERGY CT: A MULTICENTER SMALL-COHORT STUDY

Xiaofeng Mao (*Abstract Co-Author*) Nothing to Disclose
Jie Wang (*Abstract Co-Author*) Nothing to Disclose
Guozhi Zhang (*Abstract Co-Author*) Nothing to Disclose
Zhiyan Chang (*Abstract Co-Author*) Nothing to Disclose
Kaibo He (*Abstract Co-Author*) Nothing to Disclose
Jintao Han (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the diagnostic performance of water-calcium and water-hydroxyapatite (HAP) material decomposition in dual-energy CT (DECT) for quantitatively assessing bone marrow edema (BME) in patients with fracture or arthritis.

**METHODS AND MATERIALS**

This retrospective study included 18 patients from three hospitals on whom DECT and magnetic resonance imaging (MRI) data were acquired at a similar time for the spine, knee, or ankle. The DECT images were post-processed with the water-calcium and the water-HAP material decomposition. Two readers independently measured the water mass density of the edema zone and of the normal bone marrow on the decomposed images from each of the two methods. The interreader agreement was evaluated using the interclass correlation coefficient (ICC). The MRI was used as the reference standard for the presence of BME. Diagnostic performance of DECT was assessed using the receiver operating characteristic (ROC) curve and the optimal cutoff value in detecting BME was determined.

**RESULTS**

A total of 49 vertebrae and 18 joint regions were included in the analysis, in which 23 vertebrae and 9 joint regions were found with BME on MRI. The interreader agreement of measurements on water-calcium and water-HAP images was good for the edema zone (ICC = 0.81 and 0.86, respectively) and excellent for the normal bone marrow (ICC = 0.92 and 0.94, respectively). The averaged water mass density of the BME area on water-calcium and water-HAP images was 1067.1 ± 16.8 and 1008.5 ± 19.0 mg/cm3, respectively, which was higher than that of the normal bone marrow (1014.0 ± 20.2 and 980.9 ± 18.2 mg/cm3, respectively, both $p < 0.001$). The area under the ROC curve of water-calcium and water-HAP images for identifying the BME was 0.98 and 0.86, respectively ($p = 0.006$). With a cutoff value of 1039.1 mg/cm3, the sensitivity, specificity, and accuracy of water-calcium images were 96.9%, 91.4%, and 94.0%. Similarly, with a cutoff value of 991.4 mg/cm3, the results of water-HAP images were 81.3%, 74.3%, and 77.6%.

**CONCLUSION**

Compared to water-HAP decomposition, water-calcium decomposition showed superior diagnostic performance in dual-energy CT for quantitatively assessing BME in patients with fracture or arthritis.

**CLINICAL RELEVANCE/APPLICATION**

Dual-energy CT with water-calcium material decomposition has the potential to be a reliable imaging tool in routine practice for detecting bone marrow edema.

## M3-SSPH03-6 DUAL-EXTRUDER PIXELPRINT PHANTOM FOR EVALUATION OF METAL ARTIFACT REDUCTION ALGORITHMS

Kai Mei, PhD (*Abstract Co-Author*) Nothing to Disclose
Leening Liu (*Abstract Co-Author*) Nothing to Disclose
Olivia Sandvold, BS (*Abstract Co-Author*) Nothing to Disclose
Jessica Im, BEng (*Abstract Co-Author*) Nothing to Disclose
Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Pouyan Pasyar (*Presenter*) Nothing to Disclose

## PURPOSE

Algorithms for Metal Artifact Reduction (MAR) enhance diagnostic image quality compromised by artifacts from implants. However, MAR algorithms are challenging to evaluate without ground truth information about the geometry of implants and adjacent structures. We adapted PixelPrint technology for dual-extrusion 3D printing to create lifelike metal-containing phantoms for the assessment of MAR algorithms.

## METHODS AND MATERIALS

To demonstrate the feasibility of fabricating multi-material lifelike CT phantoms, a dual-filament 3D printer (Epsilon W27, BCN3D Technologies) was modified to enable a novel dual-filament PixelPrint methodology to print metal components into a realistic background. Calcium-doped (StoneFil, Formfutura) and metal-doped PLA (Ultrafuse 17-4, BASF) was used to simulate bone and soft tissue and emulate orthopedic implants to generate realistic metal artifacts, respectively. These two materials were interleaved to seamlessly integrate orthopedic screw model and patient image data. Two types of phantoms were printed: homogeneous background featuring a screw and patient-specific knee with a superimposed orthopedic implant screw at low and high infills. Phantoms were scanned using a photon-counting CT (NAEOTOM Alpha, Siemens Healthineers). Conventional and virtual monoenergetic images (VMI) at 190 keV were reconstructed with and without MAR to qualitatively evaluate the phantoms' capabilities to generate realistic metal artifacts and replicate geometry and textures in both patient image data and metallic screws.

## RESULTS

Dual-filament phantoms produced realistic metal artifacts in conventional images, particularly the patient-specific knee phantom with a high infill orthopedic implant screw. The metal screw phantom produced significant metal artifacts, closely resembling those of an actual screw. VMI 190 keV images with MAR illuminated the geometry of the screw obscured by metal artifact on conventional images and matched that of the screw model. Similarly, the patient-specific knee phantom accurately reproduced lifelike geometry and textures of bone and soft tissue in addition to the screw.

## CONCLUSION

PixelPrint combined with dual-extruder 3D printing facilitated the fabrication of multi-material phantoms that closely mimic patient data and metal artifacts on images while also replicating the geometry of orthopedic screws. This innovative approach ensures a ground truth geometry of the metal artifact producing object critical for evaluating MAR algorithms.

## CLINICAL RELEVANCE/APPLICATION

Lifelike metal-containing phantoms offer a platform for designing and evaluating MAR algorithms that may improve diagnostic evaluation adjacent to metal implants and enable more precise assessment of implants.

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# Abstract Archives of the RSNA, 2024

M3-SSPH04

**Physics (Image-guided Intervention and Therapy)**

Monday, Dec. 2 9:30AM - 10:30AM Room: S404

Michael Speidel, PhD (*Moderator*) Institutional research agreement, Siemens AG
Andrea Ferrero, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M3-SSPH04-1 DUAL-ENERGY X-RAY IMAGING FOR VISUALIZATION OF RADIOPAQUE MICROSPHERES IN HEPATIC TRANSARTERIAL EMBOLIZATION

Michael Speidel, PhD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Ayca Z. Kutlu, MD (*Abstract Co-Author*) Nothing to Disclose
James Scheuermann, PhD (*Abstract Co-Author*) Nothing to Disclose
Paul F. Laeseke, MD, PhD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, NeuWave Medical, Inc;Shareholder, HistoSonics, Inc;Consultant, HistoSonics, Inc;Research Grant, HistoSonics, Inc;Shareholder, Elucent Medical;Consultant, Elucent Medical;Shareholder, McGinley Orthopaedic Innovations, LLC
Ethan Nikolau, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Radiopaque microspheres provide a means for visualizing both on- and off-target deposition throughout hepatic transarterial embolization (TAE) procedures. In this study, we develop an interventional x-ray imaging sequence that can provide 2D dual-energy material-specific images both during and after each microsphere injection.

### METHODS AND MATERIALS

In the developed x-ray imaging sequence, initial images of the subject are acquired at high kV with a wedge filter (125 kV, 3.29 mGy/s). Several seconds prior to and throughout injection of radiopaque microspheres, the acquisition mode is switched to low kV imaging without a filter (64 kV, 7.70 mGy/s). Microsphere-specific dual-energy (DE) images are formed by a log subtraction approach with automatic weighting factor selection. For comparison, conventional DSA images can be formed from the low-kV portion of the acquisition. The sequence was tested in a 50 kg porcine model of hepatic TAE. With suspended ventilation, approximately 2-3mL of barium-loaded microspheres (70.3 mg iodine/mL equivalent) were injected into the left hepatic artery. Microspheres of progressively larger sizes (40um followed by 100um, then 250um) were injected. Microsphere visibility and vessel contrast were compared on DE and DSA images during and after each injection. Cone-beam CT (CBCT) scans were performed to establish ground truth microsphere positions.

### RESULTS

Microspheres were visible during injection on both 2D DE and DSA images. However, post-injection, the microspheres were only consistently visible in DE images. In post-injection DSA, pre-existing microspheres were subtracted and only visible in the form of misregistration artifacts. In a distal region containing previously embolized vessels, 2 vessel segments were identified using DSA, while 6 and 10 segments were identified on DE and CBCT, respectively. The measured contrast of the two vessels (full-width-at-half-maximum of 2.4 mm and 1.2 mm) on DSA were 5.2% and 1.6%, respectively; for DE images, contrast measurements were 12.9% and 4.1%. The DE imaging method automatically accounted for the presence of the wedge filter.

### CONCLUSION

A 2D imaging sequence was designed to form DE images throughout a progressive TAE procedure. Compared with DSA imaging, both imaging techniques could visualize barium-loaded microspheres during injection within an in-vivo porcine model. However, DE imaging was also able to provide direct visualization of previously injected microspheres.

### CLINICAL RELEVANCE/APPLICATION

Barium-loaded radiopaque microspheres visible on interventional imaging may provide direct intra- and post-procedural monitoring of both on- and off-target microsphere distribution and embolization.

## M3-SSPH04-3 IMPACT OF $^{18}$F-DOPA PET IMAGING FOR RADIATION TARGET VOLUMES IN PRIMARY GLIOMA PATIENTS

Maasa Seaberg, PHD (*Abstract Co-Author*) Nothing to Disclose
Nadia N. Laack, MD (*Abstract Co-Author*) Nothing to Disclose
Brad Kemp, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Yan Zhang, PHD (*Abstract Co-Author*) Nothing to Disclose
Deanna H. Pafundi, PhD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. Yan, MD (*Abstract Co-Author*) Nothing to Disclose
Adam Kessel, MD (*Abstract Co-Author*) Nothing to Disclose
Val J. Lowe, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Eli Lilly and

Company;Research Consultant, Eli Lilly and Company
Jann N. Sarkaria, MD (*Abstract Co-Author*) Nothing to Disclose
Paul D. Brown, MD (*Abstract Co-Author*) Speaker, Wolters Kluwer nv;Board Member, IQVIA
Timothy J. Kaufmann, MD, MS (*Abstract Co-Author*) Consultant, SpineThera
Jonathan M. Morris, MD (*Abstract Co-Author*) Consultant, Medtronic plc;Speaker, Medtronic plc;Consultant, Merit Medical Systems, Inc;Speaker, Merit Medical Systems, Inc;Consultant, Landauer Inc;Speaker, Johnson & Johnson
Derek R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Debra Brinkmann, PhD (*Abstract Co-Author*) Nothing to Disclose
Christopher H. Hunt, MD (*Abstract Co-Author*) Nothing to Disclose
Hok Seum Wan Chan Tseung (*Abstract Co-Author*) Nothing to Disclose
William G. Breen, MD (*Abstract Co-Author*) Nothing to Disclose
Nina M. Givens (*Presenter*) Nothing to Disclose

**PURPOSE**

Radiation target volumes for gliomas are defined using MRI T1 post-gadolinium (T1-CE) and T2-FLAIR (T2) sequences. T1-CE is found where the blood-brain barrier (BBB) is broken. For low-grade astrocytomas (astros) and most oligodendrogliomas (oligos) of any grade, the BBB is mostly intact and radiation target volumes defined with T2 imaging. Due to lack of specificity of T2 hyperintensity, this practice may result in target volumes and radiation doses larger or smaller than optimal for a patient. Amino acid (AA) radiotracers are independent of BBB breakdown and have a low uptake in normal brain tissue. We hypothesize that the AA radiotracer, 3,4-dihydroxy-6-[18F]-fluoro-L-phenylalanine (18F-DOPA), will demonstrate volumetric uptake for non-enhancing tumors (T1-NCE) and extend beyond tumors with T1-CE.

**METHODS AND MATERIALS**

30 biopsy-proven newly diagnosed or recurrent glioma patients on two prospective clinical trials underwent an 18F-DOPA PET/CT with T1 post-gad and T2-FLAIR MR imaging between 2010-2015. The PET/CT was rigidly registered to the MRIs. Neuroradiologists created T1-CE, T2, and 18F-DOPA PET uptake volumes. Based on our previous studies, a tumor-to-background ratio (T/N) > 2.0 was used to define the aggressive tumor volume (HGG FDOPA) within the total PET uptake volume (FDOPA) for astro patients only. Concordant and discordant volumes between MRI and PET were evaluated.

**RESULTS**

Based on the 2016 WHO classifications, patient demographics: 20 male and 10 female patients; Age: 20-69 yrs; 22 new and 8 recur; 22 astros (n=5 grade II, 8 grade III, 9 grade IV) and 8 oligos (n=6 grade II and 2 grade III). For grade II, III, and IV astros, 40%, 52%, and 41% HGG FDOPA was outside the T1-CE, respectively. FDOPA uptake, but not T1-CE, was found in all grade III oligos. No significant vol of FDOPA was found outside T2.

**CONCLUSION**

Our initial hypothesis that 18F-DOPA imaging shows glioma outside of conventional T1-CE was confirmed. This was the case regardless of grade or tumor type. In addition, all astro patients, regardless of grade, contained both HGG FDOPA and total FDOPA uptake volume outside of the T1-CE volume. In patients with T1-NCE, 18F-DOPA uptake, including HGG FDOPA for some patients, was observed in all but 2 patients.

**CLINICAL RELEVANCE/APPLICATION**

Glioma patients have poor progression-free (PFS) and overall survival (OS). Tumor recurrences are predominantly central and in-field to the radiotherapy treatment plan. Given that additional FDOPA vol outside of T1-CE, more importantly HGG FDOPA, can be seen, we hypothesize that using both conventional MRI and 18F-DOPA imaging could improve PFS, recurrence patterns, and OS. The results justify an importance for clinical trials including both MRI and 18F-DOPA PET, dose escalation, and reduced margins.

## M3-SSPH04-5 A NOVEL ON-BOARD PHOTON COUNTING CONE-BEAM CT SYSTEM FOR PROTON THERAPY

Hao Gao (*Abstract Co-Author*) Nothing to Disclose
Yuting Lin, PhD (*Abstract Co-Author*) Nothing to Disclose
Christian De Caro (*Abstract Co-Author*) Nothing to Disclose
Ke Li, PhD (*Presenter*) Research Consultant, Pulmera Inc.

**PURPOSE**

While the steep dose gradient of protons enables highly conformal dose distributions, it also tightens the tolerance margins for positioning errors and anatomical changes. For optimal proton radiotherapy (RT) outcomes, it's imperative to adapt the dose delivery plan promptly upon detecting anatomy changes, ideally with the patient on the table, i.e., online adaptive proton therapy (APT). Implementing APT demands daily 3D imaging of the patient in the treatment position. Presently, proton RT machines typically feature a scintillator-based flat-panel detector (FPD) to generate cone-beam CT (CBCT) images for patient alignment. However, the existing CBCT system suffers from subpar image quality and fails to meet the clinical requirement for APT. This study aims to experimentally showcase the feasibility of producing high-quality CBCT images using photon counting detector (PCD) technology integrated into the existing proton RT gantry.

**METHODS AND MATERIALS**

A CdTe-based PCD, featuring a 50 cm field-of-view and 100 pixel pitch, was affixed onto the surface of the existing FPD in an IBA Proteus ONE proton RT system. The PCD's readout trigger was synchronized with the kV source using a high-sensitivity radiation sensor. The PCD-CBCT scan adopted the same acquisition protocol as the clinical FPD-CBCT scan for head imaging (100 kV, 204 mAs, total angular span = 204°, dose=9.0 mGy). Geometric distortion was estimated and rectified during image reconstruction. Low-contrast detectability and spatial resolution of both PCD-CBCT and FPD-CBCT were assessed using a Catphan and a water QA phantom. Additionally, the physics characteristics of the PCD and FPD were compared through measurements of MTF and DQE.

**RESULTS**

The PCD exhibits an MTF50 of 3.4 lp/mm, while the FPD's MTF50 is 1.1 lp/mm. For MTF10, the PCD achieves 6.7 lp/mm, compared to the FPD's 2.1 lp/mm. The DQE0 values are 0.81 for the PCD and 0.50 for the FPD. PCD-CBCT images demonstrate superior uniformity and reduced artifacts. The smallest resolvable low-contrast target in PCD-CBCT measures 6 mm in diameter with a 0.5% contrast disc, whereas FPD-CBCT images do not resolve any contrast discs in the Catphan. In terms of resolving line pair patterns, PCD-CBCT reaches 21 lp/cm, while FPD-CBCT achieves 3 lp/cm.

**CONCLUSION**

The feasibility of high-quality, on-board PCD-CBCT imaging has been demonstrated using the existing proton RT gantry. The PCD-CBCT prototype exhibits superior low-contrast detectability and spatial resolution compared to the existing FPD-CBCT.

## CLINICAL RELEVANCE/APPLICATION

High-quality on-board imaging via PCD-CBCT can potentially improve patient setup accuracy and enable daily APT with patients in the treatment position, to enhance delivery accuracy and treatment outcomes for proton RT.

## M3-SSPH04-6 ADVANCEMENTS IN DIGITAL IRRADIATION X-RAY SYSTEMS WITH CNT FOR RADIATION THERAPY

Jehwang Ryu, PhD (*Abstract Co-Author*) Nothing to Disclose
Jinho Choi (*Abstract Co-Author*) Nothing to Disclose
Hanna Lee (*Presenter*) Nothing to Disclose

## PURPOSE

The biological effects of high-dose radiation (HDR) have been studied for a long time and their effects are relatively well known. However, in the case of low-dose radiation (LDR), it is still unclear as previous studies have shown compatible in vivo effects depending on the dose range. Under these circumstances, we developed a pulsed cell irradiation system that can control the position of an electron gun (E-gun) based on carbon nanotube (CNT) field emission for the purpose of studying the effects of LDR on cells. In this study, the functions of the X-ray system were verified, and the amount of emitted dose was controlled. And the results of LDR irradiation on cells were described.

## METHODS AND MATERIALS

The component of the system is as follows; 1) a CNT-based E-gun that generates electrons by field emission 2) a vacuum chamber that delivers the emitted electrons, 3) an anode where radiation is generated, 4) a radiation emission part from which generated radiation is emitted, 5) a distance control part capable of adjusting the distance between the E-gun and the radiation emission part. The radiation generating part is a triode structure consists of an electron gun and an anode. The dose emitted in continuous and pulsed mode of the system was checked. And the cells were irradiated with a dose and their responses were analyzed.

## RESULTS

CNTs were randomly grown throughout the surface of the emitter, a component of the E-gun. The characteristics of the CNT-based E-gun were confirmed through the current emitted from the emitter according to the voltage applied to the emitter. In continuous mode, doses of about 1.2 cGy were obtained at 3 mA when the distance between the emitter and the window was 20 mm. Also in the pulse mode, it was confirmed that the emitted dose linearly increased according to the on-time ratio of the cathode, and that the dose was stably emitted with the time. Fibroblast cells irradiated with two modes in the LDR region showed that neither mode affected cell viability in the LDR region.

## CONCLUSION

In this study, we developed a cell irradiation digital X-ray system using CNT for field emission. We also demonstrated that high-speed digital drive-in pulse units with instantaneous on-off is possible, which is difficult to implement with conventional hot cathode X-ray system. The results of LDR irradiation on cells using the developed system are interpreted as statistically not affecting the viability of cells. However, the effect of LDR irradiated with the system on cells seems to require further study.

## CLINICAL RELEVANCE/APPLICATION

We exposed the cells to radiation using a cell irradiation digital X-ray system based on CNTs and examined their response. We anticipate that the developed system can be further utilized for application in orthovoltage radiation therapy.

# Abstract Archives of the RSNA, 2024

M3-SSRO02

**Radiation Oncology (Head and Neck/CNS)**

Monday, Dec. 2 9:30AM - 10:30AM Room: S502

Sung Kim, MD (*Moderator*) Consultant, Nanobiotix
Anupama Chundury, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M3-SSRO02-1 SOFT TISSUE RESTORATION AFTER FEEDING TUBE INSERTION IN HEAD AND NECK CANCER PATIENTS UNDERGOING RADIOTHERAPY

X. Sharon Qi, PHD (*Abstract Co-Author*) Nothing to Disclose
Eulanca Y. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Ricky R. Savjani, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Erika Jank, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Patients receiving radiation therapy to the head and neck undergo several adverse effects from treatment, most concerning of which are dysphagia and anorexia. Without adequate nutritional intake, several complications emerge including treatment interruption, dehydration, and hospitalization. Weight loss can be significant enough to require gastric tube (G-tube) insertion, which requires patients to learn how to use tube feeds and can lead to serious complications including infection. The current standard is to weigh patients weekly throughout treatment; however, weights can fluctuate drastically based on hydration, clothing, and bowel habits. Here, we repurpose routine daily cone beam computed tomography (CBCT) imaging to more frequently and accurately assess soft tissue decomposition in patients undergoing radiotherapy for head and neck cancers.

### METHODS AND MATERIALS

In this retrospective study, daily CBCT scans of 61 patients undergoing radiotherapy for head and neck cancers were used to obtain contours of the body, skeletal muscle, and subcutaneous fat automatically with TotalSegmentator. This patient cohort all received G-tubes during the treatment process. The percent change in skeletal muscle and subcutaneous fat relative to G-tube insertion was tracked daily during treatment. Additionally, weekly weights were obtained clinically and recorded for patients.

### RESULTS

Overall, feeding tube insertion slowed the progression of weight loss. Prior to G-tube insertion, patients were losing weight roughly linearly at 0.29% per day, which slowed to 0.05% per day after G-tube insertion. For soft tissue decomposition, prior to G-tube insertion, there was a 1.07% per day loss of subcutaneous fat and a 0.65% per day loss of skeletal muscle, both of which slowed to 0.02% per day (subcutaneous fat) and 0.19% per day (skeletal muscle). Of note, after G-tube insertion, subcutaneous fat loss followed a U-shaped trajectory with an initial continued loss followed by restoration at day 20 and later.

### CONCLUSION

By repurposing routine clinical CBCT images, we characterized soft tissue changes before and after G-tube insertion. Deep-learning autosegmentation provides a way to automate the detection of these changes. On average, patients tend to have significantly decreased rates of weight and soft tissue decomposition after G-tube insertion. Segmentation of CBCT images provides a more frequent and accurate assessment of nutritional compromise.

### CLINICAL RELEVANCE/APPLICATION

Our approach may help clinicians determine optimal and potentially earlier times for nutritional intervention including G-tube placement.

## M3-SSRO02-3 ACCURATE CLASSIFICATION OF HYPOPHARYNGEAL CANCER T4 STAGING BASED ON MRI RADIOMICS FEATURES

Cheyu Hsu, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Chun Hao Chang (*Abstract Co-Author*) Nothing to Disclose
HE LIN KU, MA (*Abstract Co-Author*) Nothing to Disclose
Weichung Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Shihmin Lin, MD (*Abstract Co-Author*) Nothing to Disclose
Hsin-Han Tsai (*Abstract Co-Author*) Nothing to Disclose
Rou-Yi Chen, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study was to use the radiomics features to predict TNM T4 stage versus others on hypopharyngeal cancer.

**METHODS AND MATERIALS**

In this retrospective study, clinical and MRI data for 560 patients, including 285 with clinical T4 stage according to AJCC 8th version and others with different stages, were collected. The dataset was divided into training (n = 444) and internal (n = 116) test sets. We extracted 1,781 radiomics features from original and derived images in total and performed skewness, reproducibility and high Pearson correlation screening to distinguish the most informative features. Employing XGBoost models within a nested5-fold cross-validation framework, we developed a classification system to distinguish T4 stage from other stages in hypopharyngeal cancer.

**RESULTS**

A total of 211 extracted features were selected to build the classification model for predicting T4 stage, and the ensembling model achieved an accuracy of 0.8671 and 0.8276, sensitivity of 0.8135 and 0.8902, and F1-score of 0.8418 and 0.8795 on the training cohort and internal testing cohort, respectively.

**CONCLUSION**

Radiomics features derived from MRI demonstrate a promising potential in identifying T4 stage, which leads the worst prognosis and survival rates, in hypopharyngeal cancer.

**CLINICAL RELEVANCE/APPLICATION**

The precise staging of T4 hypopharyngeal cancer lays the foundation for prognostic estimation and provides a rapid auxiliary method for clinicians to determine treatment decisions.The precise staging of T4 hypopharyngeal cancer lays the foundation for prognostic estimation and provides a rapid auxiliary method for clinicians to determine treatment decisions.

## M3-SSRO02-4 MODELING OF OUT-OF-POCKET COSTS ACROSS MEDICAID AND MEDICARE PLANS OF STANDARD-OF-CARE EXTERNAL BEAM RADIATION THERAPY VERSUS RADIOSURGERY FOR SYMPTOMATIC METASTATIC SPINE CANCER

Shearwood McClelland, MD (*Abstract Co-Author*) Consultant, Gilmartin Capital
Martha Khlopin (*Abstract Co-Author*) Nothing to Disclose
Victoria Wu (*Presenter*) Nothing to Disclose

**PURPOSE**

The choice between SBRT and EBRT for spine metastases depends on various factors: size, location, patient's health, prognosis, other treatments, and treatment goals. There remains limited evidence regarding the influence of insurance coverage on out-of-pocket (OOP) expenses for patients receiving different modalities of radiation and fractionation. This study seeks to assess costs across various insurance plans, thereby improving clarity and understanding of treatment expenses.

**METHODS AND MATERIALS**

NCCN guidelines and expert input determined standard treatment for symptomatic metastatic spine cancer. OOP costs were calculated based on deductibles, treatment costs, and copays from three public insurance plans: Original Medicare, Medigap Plan G, and Medicaid. All costs were calculated over a two-year time horizon (not adjusted for inflation), and all treatment and work-ups were assumed to have taken place at an Ohio hospital. EBRT was defined as 1 fraction (8 Gy x 1), 5 fractions (4 Gy x 5), or 10 fractions (3 Gy x 10).

**RESULTS**

RT-specific charges include on-treatment visits, planning, simulation, verification, delivery, and follow-ups. Medicare beneficiaries face OOP costs: $807.01, $871.51, $959.69 for EBRT 1 fraction, 5 fractions, and 10 fractions, respectively, after 2 years. Medicare beneficiaries face charges: $1,127.03, $1,444.92, $1,762.82, and $2,398.60 for SBRT 1, 2, 3, and 5 fractions, respectively. Under Medigap Part G, patients are only responsible for the annual deductible, facing a total charge of $480 after 2 years, regardless of radiation modality and fractionation. Medicaid beneficiaries face no OOP expenses as all expenses are covered with no cap, regardless of treatment option.

**CONCLUSION**

SBRT remains a more costly treatment modality compared to EBRT, regardless of the number of fractions. Under Medicare, single-fraction EBRT has OOP financial toxicity 19% less than 10-fraction EBRT, 40% than single-fraction SBRT, 79% less than two-fraction SBRT, and 197% less than five-fraction SBRT at two-years post-treatment.

**CLINICAL RELEVANCE/APPLICATION**

For spinal metastases patients unlikely to benefit from SBRT's durability, reduced OOP financial toxicity of EBRT may optimize quality of life. By understanding these cost differences, patients and their healthcare providers can work together to determine the best treatment option for each patient from a clinical and financial perspective.

## M3-SSRO02-5 DEEP LEARNING BASED PREDICTION MODEL FOR PATIENTS WITH PRIMARY CENTRAL NERVOUS SYSTEM LYMPHOMA

Sanjay Aneja, MD (*Abstract Co-Author*) Nothing to Disclose
Klara Osenberg (*Abstract Co-Author*) Nothing to Disclose
David Weiss (*Abstract Co-Author*) Nothing to Disclose
Sajid Hossain (*Abstract Co-Author*) Nothing to Disclose
Nicholas S. Moore, MD (*Abstract Co-Author*) Nothing to Disclose
Durga Sritharan (*Abstract Co-Author*) Nothing to Disclose
Saahil Chadha (*Abstract Co-Author*) Nothing to Disclose
Thomas Hager (*Abstract Co-Author*) Nothing to Disclose
Joshua Zhu, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Primary central nervous system lymphoma (PCNSL) is typically treated with chemotherapy, steroids, and/or whole brain radiotherapy (WBRT). Identifying which patients benefit from WBRT following chemotherapy, and which patients can be adequately treated with chemotherapy alone remains a persistent clinical challenge. Although WBRT is associated with improved outcomes, it also carries a risk of neuro-cognitive side effects. This study aims to refine patient phenotyping for PCNSL by leveraging deep learning (DL) extracted imaging biomarkers to enable personalized therapy.

**METHODS AND MATERIALS**

Our study included 71 patients treated at our institution between 2009-2021. The primary outcome of interest was overall survival (OS) assessed at one- and two-year cutoffs. The DL model leveraged an 8-layer 2D convolutional neural network which analyzed individual slices of post-contrast T1-weighted pre-treatment MRI scans. Survival predictions were made using a weighted voting system related to tumor size. Model performance was assessed with accuracy, sensitivity, specificity, and F1 scores. Time-dependent AUCs were calculated and C-statistics were computed to summarize the results. Kaplan-Meier (KM) survival analysis assessed differences between low and high-risk groups and statistically evaluated using the log-rank test.

**RESULTS**

The cohort's average age was 65.6 years with an average OS of 2.80 years. For one-year OS, the model achieved an AUC of 0.73 (0.60-0.85), accuracy of 0.73 (0.61-0.82), sensitivity of 0.72 (0.54-0.85), and specificity of 0.73 (0.58-0.84). For two-year OS, the model achieved an AUC of 0.70 (0.58-0.82), accuracy of 0.70 (0.58-0.79), sensitivity of 0.68 (0.55-0.81), and specificity of 0.71 (0.55-0.84). Model performance is presented with their respective 95% confidence intervals (CI).KM survival curves showed that the one and two-year models effectively discriminated between low- and high-risk groups across the entire cohort, reporting a c-statistic of 0.73 ($p<.001$) and 0.71 ($p<.001$) respectively. A sub-analysis confirmed consistent model performance across different tumor volumes and focality.

**CONCLUSION**

DL classifiers of PCNSL MRIs can stratify patient phenotypes beyond traditional risk paradigms. Given dissensus surrounding PCNSL treatment, DL can augment risk stratification and treatment personalization, especially with regards to WBRT decision making.

**CLINICAL RELEVANCE/APPLICATION**

PCNSL poses complex treatment decision-making challenges. To this end, we developed a novel DL model to aid in risk stratification of patients based on OS. Our approach shows that MRI-derived biomarkers are prognostic indicators for PCNSL, and can guide the personalization of chemoradiation treatment.

## M3-SSRO02-6 FET-PET- VERSUS MRI-BASED RE-IRRADIATION OF RECURRENT GLIOBLASTOMA: GLIAA TRIAL (NOA 10/ARO 2013-1, DKTK-A)

Carsten Nieder (*Abstract Co-Author*) Nothing to Disclose
Franziska Eckert (*Abstract Co-Author*) Nothing to Disclose
Michael Mix (*Abstract Co-Author*) Nothing to Disclose
Tanja Schimek-Jasch, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Eble (*Abstract Co-Author*) Nothing to Disclose
Irina Spehl (*Abstract Co-Author*) Nothing to Disclose
Bernd Krause (*Abstract Co-Author*) Nothing to Disclose
Anca L. Grosu, MD (*Abstract Co-Author*) Nothing to Disclose
Rita Engenhart-Cabillic, MD, PHD (*Abstract Co-Author*) Nothing to Disclose
Rainer Fietkau, MD (*Abstract Co-Author*) Nothing to Disclose
Frank Giordano (*Abstract Co-Author*) Nothing to Disclose
Horst Urbach (*Abstract Co-Author*) Shareholder, VEObrain GmbH
Juergen Beck (*Abstract Co-Author*) Nothing to Disclose
Martin Stuschke (*Abstract Co-Author*) Nothing to Disclose
Ilja Ciernik (*Abstract Co-Author*) Nothing to Disclose
Felix Momm (*Abstract Co-Author*) Nothing to Disclose
Claus Belka (*Abstract Co-Author*) Nothing to Disclose
Denise Bernhardt (*Abstract Co-Author*) Nothing to Disclose
Liane Konig (*Abstract Co-Author*) Nothing to Disclose
Rolf Wiehle (*Abstract Co-Author*) Nothing to Disclose
Markus Schymalla (*Abstract Co-Author*) Nothing to Disclose
Christoph Pottgen (*Abstract Co-Author*) Nothing to Disclose
Erika Graf (*Abstract Co-Author*) Nothing to Disclose
Guido Hildebrandt (*Abstract Co-Author*) Nothing to Disclose
Arnab Chakravarti (*Abstract Co-Author*) Nothing to Disclose
Stephanie E. Combs, MD (*Abstract Co-Author*) Advisory Board, AstraZeneca PLC;Advisory Board, F. Hoffmann-La Roche Ltd;Advisory Board, Bristol-Myers Squibb Company;Advisory Board, DAIICHI SANKYO Group;Advisory Board, Swiss icotec AG;Speaker, Accuray Incorporated;Speaker, Elekta AB;Speaker, Varian, Inc;Speaker, Bristol-Myers Squibb Company;Speaker, F. Hoffmann-La Roche Ltd;Speaker, AstraZeneca PLC;Speaker, BrainLAB AG
Philipp Meyer (*Abstract Co-Author*) Nothing to Disclose
Sabine Semrau, MD (*Abstract Co-Author*) Nothing to Disclose
Stephan Nadji (*Abstract Co-Author*) Nothing to Disclose
Frank Paulsen (*Abstract Co-Author*) Nothing to Disclose
Brigitta Baumert (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Weber (*Abstract Co-Author*) Nothing to Disclose
Beatrix Hueltenschmidt (*Abstract Co-Author*) Nothing to Disclose
Elena Sperk (*Abstract Co-Author*) Nothing to Disclose
Susan Short (*Abstract Co-Author*) Nothing to Disclose
Thomas Brunner, PhD (*Abstract Co-Author*) Nothing to Disclose
Ursula Nestle, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Maximilian Niyazi (*Abstract Co-Author*) Nothing to Disclose
Ilinca Popp, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The GLIAA trial was designed to evaluate the role of O-(2-[18F]fluoroethyl)-L-tyrosine (FET) positron emission tomography (PET) as compared to contrast-enhanced T1-weighted magnetic resonance imaging (GdT1-MRI) for the radiation treatment planning of recurrent glioblastoma.

**METHODS AND MATERIALS**

GLIAA was a prospective, multicenter, randomized clinical trial (NOA 10/ARO 2013-1, DKTK-a., NCT01252459), that included patients with rGBM of 1-6 cm. Patients were randomized 1:1 at 14 centers in Germany between FET-PET-based and T1Gd-MRI-based target volume delineation. High-precision stereotactic re-irradiation was performed with 39 Gy in 13 fractions. Primary endpoint was progression-free survival (PFS) from randomization. Secondary endpoints included overall survival (OS), locally controlled survival (LCS), volumetric analyses and safety.

## RESULTS

Between 26.11.2013 and 02.09.2021, 200 patients were randomized between FET-PET-based (n=100) and GdT1-MRI-based (n=100) target volume delineation. N=98 and n=97 patients, respectively, were treated per protocol. Median PFS was 4.0 months (95% confidence interval [CI] 3.7-5.2) in the FET-PET arm and 4.9 months (95% CI 3.7-6.0) in the GdT1-MRI arm (one-sided stratified log-rank test p=0.98; adjusted HR for the experimental versus the control arm 1.14 [95% CI 0.85-1.52], p=0.39;). Median OS was 9.4 months (95% CI 7.8-11.1) in the FET-PET arm and 9.0 months (95% CI 7.6-10.5) in the GdT1-MRI arm (HR 1.01 [95% CI 0.75-1.37], p=0.92). Median LCS was 6.3 months (95% CI 5.1-7.2) in the FET-PET arm and 6.8 months (95% CI 6.2-7.3) in the GdT1-MRI arm (HR 1.20 [95% CI 0.88-1.62], p=0.25). Tumor volumes on PET and MRI were of similar size (mean ± SD): 10.7 ± 9.9 ml and 10.0 ± 10.6 ml. The overlapping volume was 5.1 ± 5.9 in PET arm and 5.7 ± 6.3 in MRI arm. In 82% of patients in PET arm and 84% of patients in MRI arm there was a relevant difference of at least 2 ml between the MRI and PET volumes. For patients in PET arm, 93.2% ± 13.6% of the MRI volume received at least 30 Gy and 87.7% ± 17.7% received at least 37 Gy. For patients in MRI arm, 93.6% ± 14.5% of the PET volume received at least 30 Gy and 89.7% ± 15.9% received at least 37 Gy. There were no FET-PET-associated adverse events.

## CONCLUSION

The results of this trial could not demonstrate a significant difference in outcome following FET-PET- versus GdT1-MRI-based re-irradiation of rGBM. Both FET-PET and re-irradiation proved safe.

## CLINICAL RELEVANCE/APPLICATION

Both imaging methods - FET-PET and GdT1-MRI - led to similar outcomes and can therefore be used for the re-irradiation treatment planning of rGBM.

# Abstract Archives of the RSNA, 2024

M3-STCE1

**Science Session (Multiomic and Multicenter Radiology AI)**

Monday, Dec. 2 10:00AM - 10:30AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## M3-STCE1-1 EXPLORING ANATOMICAL RACE DIFFERENCES IN MAMMOGRAPHIC IMAGES USING AI: PRELIMINARY RESULTS

Robert M. Nishikawa, PhD (*Abstract Co-Author*) Research Grant, Hologic, Inc;Royalties, Hologic, Inc;Research Consultant, iCAD, Inc;Research Grant, Koios Medical, Inc;Research Consultant, maiData Corporation;Researcher, General Electric Company
Juhun Lee, PhD (*Abstract Co-Author*) Nothing to Disclose
Belayat Hossain, PhD (*Abstract Co-Author*) Nothing to Disclose
Tamerlan Mustafaev, MD (*Presenter*) Nothing to Disclose

### PURPOSE

AI models can predict patient race from medical images. Exploring race-wise differences is crucial for overcoming model bias and recognizing anatomical differences linked to disease risks. Identifying features used by AI for race prediction reveals important traits and distinctions among races.The purpose of this study was to conduct multiple ablation experiments to identify anatomical breast features that differentiate Black and Asian races. This approach differs from previous studies that focused on imaging features.

### METHODS AND MATERIALS

For our study, we used mammograms from Asian and Black women taken from the Emory EMBED dataset. We matched the Asian and Black cohorts by age and BI-RADS breast density for a total of 1039 Asian and 1016 Black women. These were divided 1485/263/307 into training/validation/ testing datasets. In addition, we had an independent test set consisting of 157/643 Asian/Black women from our institution. We stitched RCC, LCC, RMLO, and LMLO views and resized the composite to 224x224 as input to a ViT (transformer-based) model. To determine factors that allow AI to differentiate between Black and Asian, we used a segmentation model to segment breast area and fibro-glandular tissue. We produced three different ViT models trained and tested on the original images, binary breast area images (breast shape and size), and binary fibro-glandular tissue images (amount and distribution of fibroglandular tissue).

### RESULTS

Our ViT model trained on original images achieved an AUC of 0.90/0.82 (EMBED/Independent test set). With binary fibro-glandular tissue images, the AUC was 0.76/0.73 (EMBED/Independent test sets), highlighting density distribution differences between Asian and Black races. For the breast area, the AUC was 0.81/0.80 (EMBED/Independent test sets). Using the breast size (total number of pixels in the breast area) as a feature for ROC analysis, the resulting AUC was 0.72/0.73, indicating its importance for distinguishing races, but breast shape also had some discriminatory power. For Black women, the AI model focused on the pectoral muscle/axillary lymph node area, and for Asian women, it focused on the breast borders, suggesting shape and area differences. Breast area had higher discriminatory power than breast shape. There was also some discriminatory power in the amount and distribution of fibroglandular tissue.

### CONCLUSION

Our AI algorithm accurately predicted race from mammographic images. Attention map analysis revealed how the model views race images differently.

### CLINICAL RELEVANCE/APPLICATION

Identifying race-specific anatomical differences and variations in breast density distribution may help develop less racially biased AI algorithms and establish a link between different races and disease risk.

## M3-STCE1-3 MULTICENTER, MULTIVENDOR GENERALIZABILITY STUDY OF AI ALGORITHM IN THE DETECTION OF PULMONARY EMBOLISM

Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Bernardo C. Bizzo, MD, PhD (*Abstract Co-Author*) Consultant, Diagnosticos da America (Dasa)
Parisa Kaviani, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedehelaheh Hosseini, MD (*Abstract Co-Author*) Nothing to Disclose
Lina Karout, MD (*Abstract Co-Author*) Nothing to Disclose
Muhiddin Dervis, PhD (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Anushree M. Burade, MBBS (*Abstract Co-Author*) Nothing to Disclose
Tejash Sikka (*Abstract Co-Author*) Nothing to Disclose

Ryan Krishna (*Abstract Co-Author*) Nothing to Disclose
Javier Contreras Yametti, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The accurate detection of pulmonary embolism (PE) with CT pulmonary angiography (CTPA) and contrast-enhanced routine chest CT (CTCC) plays a pivotal role in prompt treatment. CTPA is the gold standard for the diagnosis of PE. We assessed the performance of an AI tool to triage and localize PE on CTPA and CTCC with a large, consecutive, and multicenter imaging data.

**METHODS AND MATERIALS**

Our IRB-approved study contained 2026 consecutive CTPA an CTCC exams in 913 adult males (45.1%) and 1113 adult females (54.9%) with mean age of 63±16 years. The data belonged to 7 imaging centers in urban (n=2), community (n=2), and rural settings (n=3). The presence/absence and the location of PE were recorded from radiology reports. The deidentified images were processed locally with the offline version of the AI model (UII, United Imaging Intelligence, 23-26F, No. 701, Yunjin Road, Xuhui District, Shanghai), and the AI output contained the presence/absence and the location of the PE. We calculated the NPV, PPV, F1-score, ROC Area Under the Curve (95% CI), sensitivity, and specificity to assess the performance of the AI model. Separately, we calculated the Chi-Square test to assess if there were significant differences in AI performance across different age groups, genders and hospitals.

**RESULTS**

Off the 2026 exams, there were 1894 without (93.5%) and 132 (6.5%) with PE. The AI algorithm was able to detect the lesion with NPV, PPV, F1-score, AUC (95% CI), sensitivity, and specificity of 0.987, 0.253, 0.390, 0.837 (0.801-0.874), 84.8%, and 82.6%, respectively. There were no significant differences in AI performance gender-wise (P=0.447) and age group-wise (< 66 years versus =/> 66 years; P=0.550), but there were significant differences in AI performance across different hospitals (P<0.001) with slightly lower performance (lowest AUC = 0.701) in complex, multi-comorbidities CT exams from urban settings.

**CONCLUSION**

Our consecutive, multicenter large cohort demonstrates the high performance of AI tools across different gender groups, age groups, CT scanners, CT protocols, and imaging practice types.

**CLINICAL RELEVANCE/APPLICATION**

Evaluation of the generalizability of AI models across different practices, protocols, and patient characteristics is crucial for trustworthy, equitable AI applications.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M3-STCE2

**Science Session (Low-Field and Mobile MRI)**

Monday, Dec. 2 10:00AM - 10:30AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## M3-STCE2-1 UTILITY OF LOW-FIELD PORTABLE BRAIN MRI FOR RULING OUT SPACE-OCCUPYING LESIONS AND HYDROCEPHALUS IN PATIENTS WITH PAPILLEDEMA AND OTHER OPHTHALMOLOGIC SIGNS OF POSSIBLE INCREASED INTRACRANIAL PRESSURE: PRELIMINARY EXPERIENCE

Aditya Bharatha, MD (*Abstract Co-Author*) Nothing to Disclose
Suradech Suthiphosuwan, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Micieli (*Abstract Co-Author*) Nothing to Disclose
Anish Kirpalani, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Yingming Amy Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Amy W. Lin, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Shobhit Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Jiwon Oh, MD,PhD (*Abstract Co-Author*) •I have received research funding from Biogen-Idec, Roche, and EMD-Serono.;•I have received personal compensation for consulting or speaking from EMD-Serono, Sanofi-Genzyme, Biogen-Idec, Novartis, BMS, and Roche.;
Julian Spears (*Abstract Co-Author*) Nothing to Disclose
Timothy Reynold U. Lim, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Papilledema, a sign of elevated intracranial pressure (eICP), often prompts ED referrals to rule out conditions requiring immediate neurosurgical attention. This study evaluates the effectiveness of low-field portable brain MRI (pMRI) in identifying space-occupying lesions (SOLs) and hydrocephalus in patients with papilledema / optic disc edema (ODE) and other ophthalmologic manifestations.

### METHODS AND MATERIALS

This retrospective study included patients with ODE and other ophthalmologic signs of possible eICP referred for same-day pMRI (Hyperfine Swoop) from our ophthalmology clinic and inpatients from March 2022 to July 2024. All underwent 64mT pMRI (Hyperfine Swoop) and conventional neuroimaging (CN), either MDCT, 1.5T or 3T MRI. Two raters, blinded to clinical and CN findings, evaluated pMRI images for mass lesions, mass effect (sulcal effacement, midline shift or herniation), hydrocephalus and empty sella. CN performed soonest after the pMRI scans was used as the reference. Interrater and intermodality agreement between pMRI and CN were evaluated using Cohen's ?.

### RESULTS

28 patients (median age 39.5 [IQR 27-50]; 64% females) were included: 15 (54%) had ODE, 7 (25%) less responsive, dilated or fixed pupils, 4 (14%) 6th cranial nerve palsy, and 2 (7%) visual field defects. pMRIs were done in 17 outpatients (61%) and 11 inpatients (39%). pMRI was 100% sensitive for findings requiring urgent neurosurgical evaluation compared to CN. On pMRI, 8 (29%) had mass lesions, 12 (43%) mass effect, and 8 (29%) hydrocephalus. Interrater agreement was very good for mass lesions (93%, ?=0.81), mass effect (93%, ?=0.85), and hydrocephalus (100%, ?=1.00). Comparison CN was CT in 10 (36%) and fixed MRI in 18 (64%) patients; median time interval between scans was 5.5 (IQR 0.5-22) days. Intracranial masses were seen in 9 (32%), while 8 (29%) had hydrocephalus on CN. Intermodality agreement was very good for intracranial masses (96%, ?=0.92), mass effect (100%, ?=1.00), and hydrocephalus (100%, ?=1.00). pMRI detected all except one intracranial mass (8/9, 89%); a posterior fossa mass was not included in the field of view due to positioning difficulties, but hydrocephalus was detected. Isolated empty sella was seen on pMRI in 8/16 (50%) patients without mass or hydrocephalus (interrater and intermodality agreement of 85%, ?=0.78 and 96%, ?=0.91, respectively), 7/8 (88.5%) of which had imaging features of idiopathic intracranial hypertension on CN.

### CONCLUSION

pMRI was an effective screening tool for identifying findings requiring urgent neurosurgical evaluation in patients presenting with ophthalmologic findings of possible eICP. Specifically, pMRI was highly sensitive for SOLs and hydrocephalus and had high concordance rates with CN.

### CLINICAL RELEVANCE/APPLICATION

Low-field pMRI is feasible for ruling out conditions requiring urgent neurosurgical assessment in patients presenting with ophthalmologic signs of possible eICP and may play a role in point of care assessment in clinics.

## M3-STCE2-2 DETERMINATION OF R1 RELAXIVITIES OF GADOBUTROL AND GADOQUATRANE AT LOW AND ULTRA-LOW MAGNETIC FIELD STRENGTHS

Felix Kreis (*Abstract Co-Author*) Nothing to Disclose
Stephan Gruendemann (*Abstract Co-Author*) Nothing to Disclose
Jessica Lohrke, PhD (*Abstract Co-Author*) Employee, Bayer AG

Gregor Jost, PhD (*Abstract Co-Author*) Employee, Bayer AG
Hubertus Pietsch, VMD, PhD (*Presenter*) Employee, Bayer AG

**PURPOSE**

The efficacy and clinical utility of gadolinium-based contrast agents (GBCAs) in contrast-enhanced magnetic resonance imaging (CE-MRI) are well established at field strengths of 1.5 and 3.0 Tesla. Recently, significant advancements by OEMs, academic institutions, startups, and NGOs have aimed at increasing access to MR Imaging by substantially reducing the costs and infrastructural requirements of scanner hardware. Most cost reductions have been achieved by utilizing low-field and very low-field magnets. Consequently, it is essential to evaluate the potential of both new and established GBCAs at these lower field strengths.

**METHODS AND MATERIALS**

Human plasma was collected from six donors. Solutions of gadoquatrane and gadobutrol were prepared in aliquots of individual donor plasmas and in aliquots of water at concentrations of 1000 µmol/L, along with one blank plasma sample per donor. T1-relaxation rates were measured at 0.55, 1.5, and 3 Tesla using a Stelar High Field Relaxometer and at 0.06 Tesla using a Stelar Fast Field Cycling Relaxometer. Concentrations were corrected using ICP-OES measurements. Relaxivity was calculated as the change in relaxation rate per unit concentration.

**RESULTS**

R1 relaxivities (L/mmol/s) were as follows:
- Gadobutrol in plasma: 9.38 @0.06T, 5.84 @0.55T, 5.00 @1.5T, and 4.61 @3.0T
- Gadobutrol in water: 7.94 @0.06T, 3.83 @0.55T, 3.45 @1.5T, and 3.41 @3.0T
- Gadoquatrane in plasma: 13.17 @0.06T, 12.39 @0.55T, 11.36 @1.5T, and 10.03 @3.0T
- Gadoquatrane in water: 11.64 @0.06T, 10.09 @0.55T, 10.01 @1.5T, and 9.17 @3.0T These results are summarized and shown alongside measured relaxation rates of plasma and water, as well as literature values for gray and white matter (Fig. 1).

**CONCLUSION**

Since tissue and plasma relaxation rates increase at lower field strengths, an efficient low-field contrast agent must exhibit higher relaxivities at these lower field strengths. We demonstrate this increase in relaxivity at low field strengths for both gadoquatrane and gadobutrol. The next steps to establish CE-MRI at low magnetic field strengths should include phantom and in-vivo imaging studies.

**CLINICAL RELEVANCE/APPLICATION**

Using GBCAs in CE-MRI at low field strengths could significantly expand patient access to CE-MRI, enhancing diagnostic capabilities in a broader range of clinical settings.

## M3-STCE2-3 ACCELERATED MRI AT LOW MAGNETIC FIELDS. CAN FAST IMAGING APPROACHES FROM CLINICAL FIELD STRENGTHS BE TRANSLATED TO THE LOW-FIELD REGIME?

Thomas Boele (*Abstract Co-Author*) Nothing to Disclose
Neha Koonjoo (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Rosen, PhD (*Abstract Co-Author*) Founder, Hyperfine Research, Inc;Stockholder, Hyperfine Research, Inc;Consultant, Hyperfine Research, Inc;Founder, Vizma Life Sciences;Stockholder, Vizma Life Sciences;Consultant, Vizma Life Sciences;Founder, Intact Data Services;Stockholder, Intact Data Services;Consultant, Intact Data Services
Annabel Sorby-Adams (*Abstract Co-Author*) Nothing to Disclose
James Grover (*Abstract Co-Author*) Nothing to Disclose
Shanshan Shan (*Abstract Co-Author*) Nothing to Disclose
John Kirsch, PhD (*Abstract Co-Author*) Nothing to Disclose
Sheng Shen (*Abstract Co-Author*) Nothing to Disclose
David Waddington, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The intrinsic low signal-to-noise ratio (SNR) of low-field MRI scanners often requires many signal averages, which can lead to impractically long acquisition times.Conventionally, MRI scans are accelerated via k-space undersampling and subsequent data restoration via compressed sensing (CS) and/or artificial intelligence (AI) reconstruction. However, complete k-space restoration requires high-fidelity data. Here, we test the performance of MRI acceleration methods across high and low field regimes, highlighting challenges unique to low-field MRI.

**METHODS AND MATERIALS**

Data sampling: Undersampling approaches (e.g. 2x, 4x acceleration) were tested experimentally and in silico. Low-field and high-field brain data from healthy subjects were acquired on a custom 6.5 mT MRI scanner and a 3 T Siemens Skyra, respectively, using a 3D balanced-steady state free precession (bSSFP) sequence. For in silico tests, data from the fastMRI 3 T database was synthetically degraded to simulate the transition from a high-field to low-field.Image Reconstruction: Undersampled data were reconstructed with an inverse fast Fourier transform (IFFT) after zero-filling as a baseline. Missing k-space data were restored with l1-wavelet regularized CS and two AI-based reconstruction methods (data-driven AUTOMAP and model-driven Unrolled Optimization).

**RESULTS**

Our in silico tests on fastMRI data showed that the highest quality sampling and reconstruction method depends on the SNR of the underlying image. At low-field, the best quality images were reconstructed from data undersampled by 2x with a Poisson Disc mask.Our undersampled 3 T data was reconstructed effectively with CS, AUTOMAP and Unrolled methods. However, at 6.5 mT, only the Unrolled AI method removed undersampling artifacts. The Unrolled AI network performs more robust denoising at low field.For the same bSSFP imaging sequence, significant differences in image contrast were observed between 3 T and 6.5 mT. E.g. ventricles appear much brighter than surrounding tissue at 3 T, as compared to low-field images.

**CONCLUSION**

MRI sampling and reconstruction approaches proven at clinical field strengths should not be assumed to translate directly to low-field MRI. The Unrolled reconstruction approach is likely superior to AUTOMAP at 6.5 mT due to its model-driven nature. Unrolled AI models have previously shown robustness to domain shifts between training and testing.Changes in contrast at low-field are consistent with the convergence of T1 and T2 times at 6.5 mT. New approaches to contrast in portable MRI will be needed.

**CLINICAL RELEVANCE/APPLICATION**

Our findings will enable the acquisition and reconstruction of higher quality images with portable MRI scanners, expanding their clinical diagnostic use.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

M5-STCE1

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## M5-STCE1-1 3D MR IMAGE SUPER RESOLUTION USING AUXILIARY 3D MR IMAGE WITH DISTINCT CONTRAST WEIGHTING

Yuehua Li (*Abstract Co-Author*) Nothing to Disclose
Zheng Zhang (*Abstract Co-Author*) Nothing to Disclose
Xin-Yu Song (*Abstract Co-Author*) Nothing to Disclose
Lei Xiang (*Abstract Co-Author*) Nothing to Disclose
Xiaoer Wei (*Abstract Co-Author*) Nothing to Disclose
Zechen Zhou (*Presenter*) Nothing to Disclose

### PURPOSE

3D Magnetic Resonance (MR) imaging can provide higher resolution and quality for diagnosis compared to multi-slice 2D MR scans. However, 3D MR scans require much longer acquisition time that hampers its clinical usage for all contrast weightings. To accelerate multi-contrast MR scans and allow 3D high resolution (HR) reconstruction, a novel deep learning approach is developed to enhance the resolution of 2D FLAIR and T2-weighted (T2) MR images by leveraging the distinct contrast weighting of auxiliary 3D HR T1-weighted (T1) image.

### METHODS AND MATERIALS

80 subjects with 2D thick-slice FLAIR/T2 MRI, 3D HR FLAIR/T2, and T1 MRI are acquired from a 3T MR scanner. The 3D T1 image serves as the reference image for cross-contrast registration, and then the 2D images are linearly interpolated to match the number of slices in 3D T1 volume. These 2D images are used as low resolution (LR) images, while 3D images are served as HR images. The dataset consisted of 65 pairs of LR and HR FLAIR/T2-T1 image volumes for training and 15 patient pairs for testing. Our approach proposes a 3D-based model, which utilizes a U-shaped network architecture enriched with residual convolutional neural network blocks. Overall image quality (IQ) was evaluated using Structural Similarity Index Measure (SSIM), Peak Signal Noise Ratio (PSNR), and Signal Noise Ratio (SNR). Paired t-test was used to compare across interpolated 2D, synthesized 3D and acquired 3D images.

### RESULTS

The proposed method can produce high quality multi-contrast volumetric images from corresponding 2D acquisitions with much less scan time (2D FLAIR/T2: 28/70s, 3D FLAIR/T2: 342/349s), particularly the through-plane resolution can be recovered to the same level as 3D scans enabling the depiction of lesions and small structures in sagittal or coronal view as shown in Fig. A and B. Quantitative IQ analysis in Fig. C also demonstrated that the synthesized 3D images are more close to the acquired 3D images.

### CONCLUSION

The novel approach significantly improves the quality of 2D MRI scans to a similar level as acquired 3D HR MRI, which enables a highly accelerated multi-contrast 3D MR acquisition strategy. This fast imaging strategy can reduce the brain protocol scan time by 5~12 times while providing similar IQ as 3D scans for diagnosis, which also allows MR scanners to service more patients.

### CLINICAL RELEVANCE/APPLICATION

A novel multi-contrast 3D MR imaging acceleration approach is developed and evaluated in a neurovascular application, allowing reduced scan time while providing high resolution 3D multiplanar reformation for clinical diagnosis.

# Abstract Archives of the RSNA, 2024

M6-SSCA04

**Science Session with Keynote: Cardiac Imaging (Surrogate Marker in Drug Trials)**

Monday, Dec. 2 1:30PM - 2:30PM Room: N229

Prachi P. Agarwal, MD (*Moderator*) Nothing to Disclose
David A. Bluemke, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M6-SSCA04-1 PAEONIFLORIN'S CARDIOPROTECTIVE ROLE IN HIGH ALTITUDE MI: A CMR STUDY

Xin Fang (*Abstract Co-Author*) Nothing to Disclose
Lei Wang (*Abstract Co-Author*) Nothing to Disclose
Hongke Yin, MD (*Abstract Co-Author*) Nothing to Disclose
Fabao Gao (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to evaluate the potential protective role of paeoniflorin in a rat model of MI-induced ventricular remodeling under high-altitude hypobaric hypoxia using 7.0T cardiovascular magnetic resonance (CMR) strain analysis.

### METHODS AND MATERIALS

Sixty rats were randomly allocated to six groups (10 rats per group): plain sham operation control (PSO), high-altitude sham operation control (HSO), high-altitude myocardial infarction operation group (Model control), and low-dose, middle-dose, and high-dose paeoniflorin treatment groups. Rats in the high-altitude groups were transported to institution 1 (altitude: 4,250 m), while the plain group rats were transported to institution 2 (altitude: 500 m). The rats acclimatized to their respective environments under standard animal laboratory conditions for three months before undergoing experimental procedures. After four weeks of modeling, CMR was employed to assess cardiac function and left ventricular (LV) structural changes post-interventions. Strain analysis was performed to determine the protective effects of paeoniflorin on MI-induced ventricular remodeling in the high-altitude hypobaric hypoxia rat model.

### RESULTS

Paeoniflorin treatment groups (low-dose, middle-dose, and high-dose) demonstrated a dose-dependent enhancement in LV function compared to the Model control group. Regional strains, encompassing circumferential, longitudinal, and radial strains, showed significant differences between the paeoniflorin treatment groups and the Model control group. Additionally, histological analyses revealed reduced myocardial injury and fibrosis in the paeoniflorin treatment groups relative to the HMO group.

### CONCLUSION

This study's findings indicate that paeoniflorin exerts a protective effect on MI-induced ventricular remodeling in a high-altitude hypobaric hypoxia rat model. These results contribute to understanding the potential therapeutic advantages of paeoniflorin for patients at risk of MI in high-altitude environments, promoting further research into the underlying mechanisms and possible clinical applications.

### CLINICAL RELEVANCE/APPLICATION

The study's outcomes have implications for managing patients at risk of MI, especially those in high-altitude environments or exposed to hypobaric hypoxia. Recognizing the cardioprotective effects of paeoniflorin could lead to innovative therapeutic approaches, such as preconditioning interventions or pharmacological agents targeting hypoxia-related pathways. Utilizing advanced CMR techniques, including strain analysis, may offer valuable insights into myocardial function and injury, potentially enhancing diagnostic and prognostic precision in clinical settings.

## M6-SSCA04-3 CARDIOVASCULAR EFFECTS OF ANDROGEN DEPRIVATION THERAPY IN MEN WITH PROSTATE CANCER

Luca Saba, MD (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Covanos, Inc
Marly Van Assen, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Bill Zheng (*Abstract Co-Author*) Nothing to Disclose
Ashesh B. Jani, MD, MS (*Abstract Co-Author*) Speakers Bureau, Blue Earth Diagnostics Ltd;Advisory Board, Blue Earth Diagnostics Ltd;Consultant, Blue Earth Diagnostics Ltd;
Pretesh Patel (*Abstract Co-Author*) Nothing to Disclose
Sagar Patel (*Abstract Co-Author*) Nothing to Disclose
Stephanie Cantu (*Abstract Co-Author*) Nothing to Disclose
Vishal Dhere (*Abstract Co-Author*) Nothing to Disclose
Nikhil Sebastian, MD (*Abstract Co-Author*) Nothing to Disclose
Bruce Hershatter, MD (*Abstract Co-Author*) Nothing to Disclose

Anant Mandawat (*Abstract Co-Author*) Nothing to Disclose
Carlotta Onnis, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Prostate cancer (PC) men receiving androgen-deprivation therapy (ADT) targeting the gonadotropin releasing hormone (GNRH) axis are at increased risk of major adverse cardiovascular events. However, the pathophysiologic basis of ADT and CVD is unclear. We hypothesize that ADT is associated with accelerated atherosclerosis due to GNRH-mediated inflammatory cascade. Herein, we prospectively examine coronary plaque progression using coronary computed tomography angiography (CCTA) in a cohort of PC men treated with versus without ADT.

**METHODS AND MATERIALS**

Sixty-three men with localized PC receiving radiation (XRT) alone (n=18) or XRT+ADT (n=45) were prospectively enrolled. Patients underwent CCTA, according to clinical protocols, at baseline and 12-month after completion of radiation. Plaque quantification was performed, blinded to therapy and time-point, using semi-automated software (Coronary analysis research prototype, Siemens Healthineers, Forchheim, Germany) and total plaque volume (TPV) and plaque volume by subtype were evaluated (calcified, CPV, non-calcified, NPV) on a per-patient basis. CAD-RADS was also evaluated.

**RESULTS**

At baseline, median (IQR) TPV, CPV, NPV (mm3) and CAD-RADS among patients who received XRT alone versus XRT+ADT were 358.2 (128.1-1034.1) vs 814.9 (204.6-1214.3), 22.6 (6.6-233.8) vs 74.3 (20.4-221.8), 343.1 (110.3-846.3) vs 626.3 (183.6-960.8), 2 (1-2) vs 2 (2-3), respectively. At 12-month follow-up, TPV, CPV, NPV, and CAD-RADS between XRT alone versus XRT+ADT were 422.7 (191.6-1207.6) vs 904.6 (312.9-1557.1), 23.8 (13.0-339.7) vs 111.9 (30.4-264.1), 393.7 (177.5-1030.9) vs 730.4 (271.3-1167.1), 2 (1-2) vs 3 (2-3), respectively. A statistically significant difference between baseline and follow-up was noted among patients treated with XRT+ADT for TPV ($p<0.001$), CPV ($p<0.001$), and NPV ($p=0.004$). A significant difference in CAD-RADS grade was noted in both cohorts ($p=0.025$ for XRT and $p<0.001$ for the XRT +ADT). There was no significant difference in any plaque volume between baseline and follow-up in the XRT alone cohort.

**CONCLUSION**

Addition of ADT to XRT in treatment of localized PC was associated with a significant increase in TPV, CPV, NPV and CAD-RADS grade over a 12-month period.

**CLINICAL RELEVANCE/APPLICATION**

Insights on treatment-associated cardiotoxicity may lead to enhanced cardioprotective strategies tailored to patients with PC treated with ADT, potentially improving overall outcomes.

## M6-SSCA04-4 IMPROVEMENT OF GLOBAL AND REGIONAL MYOCARDIAL FUNCTION MONITORED BY CARDIAC MAGNETIC RESONANCE IN STEMI PATIENTS WITH THROMBOLYTIC THERAPY BEFORE PRIMARY PCI

Yi Xu (*Abstract Co-Author*) Nothing to Disclose
Hao Gong, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine whether in patients presenting with ST-segment-elevation myocardial infarction (STEMI) a single bolus recombinant staphylokinase (r-SAK) within 120 minutes before their first medical contact with percutaneous coronary intervention (PCI) leads to improved global and regional myocardial function derived from cardiac magnetic resonance imaging (CMR).

**METHODS AND MATERIALS**

Sixty-seven STEMI patients [thrombolysis group(n=33), non-thrombolysis group (n=34)] from an open-label, prospective, multicenter randomized study(optimal-5) who underwent CMR one year later after PCI were included. According to the degree of late gadolinium enhancement (LGE) transmurality and circumferential involvement, myocardial segments were divided into the following four types: non-infarcted segments (LGE=0), locally infarcted segments (LGE circumferential involvement= 50%), non-transmural infarcted segments (LGE circumferential involvement>50% and transmurality = 50%), and transmural infarcted segments. Clinical features and CMR derived global and regional myocardial function were recorded and analyzed. The global function included conventional function parameters, global radial strain (GRS), global circumference strain (GCS), and global longitudinal strain (GLS). The regional function included segmental radial strain (SRS), segmental circumference strain (SCS), segmental longitudinal strain (SLS), segmental wall thickening and segmental wall motion.

**RESULTS**

At the patient level, the cardiac index, left ventricular (LV) wall thickening and LV wall motion in r-SAK thrombolysis group were higher than those in non-thrombolysis group (all $P<0.05$). There were no statistical differences in GRS, GCS and GLS between the two groups. At the segment level, SRS of non-transmural infarcted segments in thrombolysis group was superior than that in non-thrombolysis group (30.17% vs19.40%, $P=0.034$). The segmental wall motion of the locally infarcted segments in thrombolysis group was larger than that in the non-thrombolysis group (5.76mm vs 4.66mm, $P=0.025$). Compared with non-thrombolysis group, patients received r-SAK before primary PCI had better SCS, segmental wall thickening and segmental wall motion in the non-infarcted segments (all $P<0.05$).

**CONCLUSION**

The global and regional myocardial function of STEMI patients treated with r-SAK thrombolysis before primary PCI was better than that of non-thrombolysis group one year later.

**CLINICAL RELEVANCE/APPLICATION**

For STEMI patients without clear taboos, the optimal thrombolytic therapy before primary PCI maybe a beneficial choice to achieve a favorable restoration of myocardial function.

## M6-SSCA04-6 Keynote Speaker

David A. Bluemke, MD, PhD (*Science Invited Presenter*) Nothing to Disclose

## M6-SSCA04-7 Keynote Speaker: Quantification of Coronary Plaque with CTA - Potential Role to Inform Drug Trials

Hamid Chalian, MD (*Science Invited Presenter*) Nothing to Disclose

## M6-SSCA04-8 Keynote Speaker: Quantitative Myocardial Perfusion as a Biomarker for Drug Trials

Ming-Yen Ng, BMBS, FRCR (*Science Invited Presenter*) Education Grant, General Electric Company;Education Grant, Bayer AG;Education Grant, Circle Cardiovascular Imaging Inc;Education Grant, TeraRecon, Inc;Education Grant, Arterys Inc;Speakers Bureau, Boehringer Ingelheim GmbH
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M6-SSMK03

**Musculoskeletal Imaging (Clinical Applied Artificial Intelligence)**

Monday, Dec. 2 1:30PM - 2:30PM Room: E450A

Daniel M. Walz, MD (*Moderator*) Nothing to Disclose
Hugue A. Ouellette, MD, FRCPC (*Moderator*) Nothing to Disclose

**Sub-Events**

## M6-SSMK03-1 THE BENEFICIAL IMPACT OF IMPLEMENTING AN AI APPLICATION FOR FRACTURE DETECTION IN CLINICAL ROUTINE AT A NORWEGIAN HOSPITAL TRUST

Ramprabananth Sivanandan, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Line Tveiten, BMedSc (*Presenter*) Nothing to Disclose

### PURPOSE

Vestre Viken Hospital Trust (VV) in Norway is pioneered in implementing a CE-approved artificial intelligence (AI) application in a real-world clinical setting in four hospitals. This study evaluates the impact and benefits of adopting a fracture detection algorithm on clinical workflow, patient waiting times, and doctor consultations across four hospitals within the trust.

### METHODS AND MATERIALS

This AI application analyzed the x-ray images of patients presenting with trauma. An external validation was performed before being integrated into the daily workflow of radiology departments across four hospitals. Pre-implementation, each hospital had various workflows (fig.1) for handling these patients until treatment. Steps were taken to simplify and streamline the process on implementation. Radiographers used this AI application's result as preliminary reports to navigate patients accordingly. Triaging was incorporated within the Radiology Information System (RIS) with flagging system for the AI results. The study analyzed 20,083 patient examinations by this AI algorithm, collecting data on workflow types, patient waiting times, the necessity for doctor consultations, and the triaging process.

### RESULTS

Post-implementation the various (six) workflow pathways were consolidated to a single standardized pattern which significantly improved the function in radiology department (fig.2). The application enabled radiographers to directly discharge 4,697 patients with negative findings unless there is request by the clinician, thereby reducing total patient waiting time by 201.3 days in total (fig. 3). Since then, there was a decrease in the need for 2,348.5 doctor consultations at emergency departments (ED, ER) and utilizing the doctor’s time for sick patients, and potentially increasing the patient safety. The AI-enhanced triaging capability in RIS allowed radiologists to prioritize reporting of urgent cases facilitating the flow (fig. 4).

### CONCLUSION

Workflow changes brought standardization across the four hospitals. Examinations with AI negative results drastically reduced the waiting time for those patients and are sent home (fig.5). Patients with positive AI results are prioritized for treatment. Flagging in RIS enhanced efficiency of radiologists.

### CLINICAL RELEVANCE/APPLICATION

The integration of an AI-based fracture detection application in the radiology departments significantly optimized clinical workflows, reduced patient waiting times, decreased crowding in waiting rooms, and saved time by reducing unnecessary doctor consultations. This enhanced hospital efficiency and effectiveness, especially in high-volume clinical settings.

## M6-SSMK03-2 LEVERAGING DEEP LEARNING FOR QUANTITATIVE ASSESSMENT OF LOWER LIMB MUSCLES THROUGH WHOLE LIMB AND 3D SECTIONAL ANALYSIS ON A COHORT OF 21,464 HEALTHY PATIENTS

Ahmed Gouda, MSc (*Abstract Co-Author*) Nothing to Disclose
Saqib Basar (*Abstract Co-Author*) Nothing to Disclose
Siavash Khallaghi (*Abstract Co-Author*) Nothing to Disclose
Yosef G. Chodakiewitz, MD (*Abstract Co-Author*) Nothing to Disclose
Javad Khaghani, MSc (*Abstract Co-Author*) Nothing to Disclose
Sam Hashemi, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Establishing normative aging curves is imperative to understand the aging process and allows for interventions when deviations occur, to that end the purpose of this study is to establish the normative curves for the musculoskeletal system of the lower limbs.

### METHODS AND MATERIALS

T1-weighted whole-body MRI sequences were utilized in two datasets: 72 scans for training segmentation model and another 21,464 patients for establishing the normative. The deep learning (DL) pipeline quantifies the thigh and calf muscles volumes relative to femur and tibial bones using 3D nnU-Net segmentation model. To ensure consistency in 3D sectional measurements, the leg bones and their corresponding muscles were rotated to align with the axial axis. This enabled the division of the lower limb into nine overlapped sections (P1 to P9), with subsequent computation and normalization of muscle volumes based on bone length, as illustrated in Figure A. Regression analysis was performed on the normalized muscle volumes to generate normative curves, which were further stratified by gender and plotted against ages ranging from 18 to 85 years old.

### RESULTS

As depicted in Figure B, normative analysis shows a decline in thigh muscle volume for both genders from their 30s, with females experiencing earlier reduction in calf muscle volume by their late 40s, and males in their mid-50s. Detailed 3D section analysis reveals more age-related variations than total muscle volumes. Thigh and calf muscle sections farther from the belly continue to decline with age, while the muscle belly increases during the 30s before declining faster afterwards. Similarly, 3D sections covering the gastrocnemius muscle belly increase until age 60 for males and 50 for females, followed by a faster decline.

### CONCLUSION

DL-based analysis of lower limb muscles provides a powerful means to quantify volume differences across genders and ages. By scrutinizing 3D muscle sections, we gain insights into how muscle volumes change at different parts of the muscle.

### CLINICAL RELEVANCE/APPLICATION

3D segmental and whole lower limb musculoskeletal analysis aids radiologists in quantifying volume variations in muscle belly, origin and insertion, facilitating muscle degeneration risk assessment. This capability enables longitudinal tracking of volume changes, aiding in the diagnosis of conditions like Muscular Dystrophy and Amyotrophic Lateral Sclerosis (ALS).

## M6-SSMK03-3 ESTABLISHMENT OF A NOVEL CASCADE RADIOMICS PIPELINE FOR PREDICTING THE ONSET AND PROGRESSION OF OSTEOARTHRITIS: DATA FROM THE OSTEOARTHRITIS INITIATIVE

Lin Mu, MD,MS (*Abstract Co-Author*) Nothing to Disclose
Jiahui Fu (*Abstract Co-Author*) Nothing to Disclose
Huimao Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Chunjie Guo, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop novel cascading radiomics model based on cartilage and subchondral bone to predict the onset and progression of knee osteoarthritis (KOA) within 4 years.

### METHODS AND MATERIALS

The prospective nested case-control study conducted on 456 participants with Kellgren-Lawrence (KL) grade 0 or 1 at baseline from the Osteoarthritis Initiative (OAI). Utilizing 3.0T Magnetic Resonance Imaging (MRI) of the right knee, participants were stratified into KOA and non-KOA groups based on 4-year radiographic follow-up and 1:2 propensity score matching (PSM). Early and late progressors were further classified based on the timing of KOA progression. All patients were randomly divided into train set and test set according to 7:3 ratio. Clinical information at baseline and all 3D DESS MRI images of the right knee during 4-year follow-up were collected. ITK-SNAP was used to segment the cartilage and subchondral bone of femur, tibia and patella in 3D DESS MRI. Radiomic features were extracted from cartilage and subchondral bone to establish logistic regression (LR) models for predicting KOA onset and progression, respectively. These models were then cascaded to achieve a one-stop multi-classification system. Model performance was primarily evaluated using the receiver operating characteristic (ROC) curve. Other model evaluation indicators include sensitivity, specificity, F1 score.

### RESULTS

After PSM, there was no statistical difference between KOA group and non-KOA group($P<0.05$). The combined cartilage and subchondral bone radiomics models demonstrated superior performance in predicting KOA onset and progression. The area under the ROC curve (AUC) for predicting KOA occurrence was 0.985 (95%CI,0.969-1.000), and for progression, it was 0.738 (95%CI,0.565-0.911). In the model predicting onset of KOA, cartilage-based performance was slightly better than that based on subchondral bone, with AUC of 0.974 (95%CI,0.944-1.000) and 0.941 (95%CI,0.941-0.979), respectively. However, the model predicting progression of KOA based on subchondral bone (AUC,0.721) was slightly higher than that of cartilage (AUC,0.676). After cascading the LR models above, the AUC values of each category are predicted to be above 0.800 with accuracy of 0.791.

### CONCLUSION

The MRI-based radiomics model of combined cartilage and subchondral bone information, effectively predicts the onset and progression of KOA within 4-year, facilitating earlier identification of high-risk individuals in clinical.

### CLINICAL RELEVANCE/APPLICATION

The novel cascade radiomic pipeline we constructed to predict the occurrence and progression of KOA can provide one-stop technical support for early diagnosis of KOA, screening of high-risk populations, and prediction of disease progression.

## M6-SSMK03-4 IMPLEMENTATION OF FULLY AUTOMATIC DEEP LEARNING SYSTEM FOR BODY COMPOSITION ASSESSMENT ON CT FOR OPPORTUNISTIC SARCOPENIA SCREENING

Yousun Ko, PhD (*Abstract Co-Author*) Nothing to Disclose
Seongwon Na (*Abstract Co-Author*) Nothing to Disclose
KyoYeong Koo (*Abstract Co-Author*) Nothing to Disclose
Sejin Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bushra Urooj (*Abstract Co-Author*) Nothing to Disclose
Heeryeol Jeong (*Abstract Co-Author*) Nothing to Disclose
Jimi Huh, MD (*Abstract Co-Author*) Nothing to Disclose
Kyung Won Kim, MD (*Presenter*) CEO, Trial Informatics Company

### PURPOSE

Opportunistic screening for the evaluation of sarcopenia and obesity has been gaining emphasis. A fully automatic deep learning system for body composition assessment on abdominal CT scans is a prerequisite for opportunistic screening. We aimed to evaluate the efficiency and effectiveness of the

implemented fully automatic deep learning system for body composition assessment for routine health check-ups.

**METHODS AND MATERIALS**

Our fully automatic deep learning system is composed of selecting L3 slices and segmenting muscle and fat areas in an end-to-end manner, which has been used in 30 published scientific sarcopenia research. Our AI system was integrated into the Picture Archiving and Communication System (PACS) of three health check-up institutions. Our AI system's performance was assessed for technical success rate, overall processing time, and segmentation accuracy across three different institutions to confirm its robustness and scalability. The AI system was applied to 532 CT scans consecutively.

**RESULTS**

The AI system was implemented on on-premise servers which were successfully integrated into the PACS in three institutions. The technical success rate of the AI system was 100% without any failed cases requiring manual adjustment. The mean processing time from the completion of CT acquisition to the generation of AI results was 4.12 seconds. The segmentation accuracy comparing AI results and human expert results was 97.4%. In addition, our AI system also provided a diagnosis of sarcopenia and myosteatosis.

**CONCLUSION**

Implementing the AI-based system for sarcopenia screening from opportunistic CT scans significantly enhances diagnostic processes, drastically reducing the time and effort required compared to conventional methods. This improvement in diagnostic capability allows for quicker and more accurate assessments, facilitating earlier and potentially more effective interventions.

**CLINICAL RELEVANCE/APPLICATION**

The integration of AI in detecting sarcopenia offers significant clinical benefits, enabling earlier and more accurate diagnoses that can lead to improved patient management and outcomes. This technological advancement is poised to transform clinical practices, ensuring that patients receive timely and appropriate care informed by precise and reliable diagnostic data.

## M6-SSMK03-5 CHARACTERIZING PREOPERATIVE MRI VIA MACHINELEARNING FOR PREDICTING PROGRESSION-FREE SURVIVALOF OSTEOSARCOMA: A MULTICENTER STUDY

Qiuping Ren (*Abstract Co-Author*) Nothing to Disclose
Xiao Zhang (*Abstract Co-Author*) Nothing to Disclose
Shui Xing Zhang Sr, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaoyun Liang (*Abstract Co-Author*) Nothing to Disclose
Bin Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Yuchi Tian (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the value of preoperative MRI combined with machine learning in predicting progression-free survival (PFS) of osteosarcoma.

**METHODS AND MATERIALS**

A total of 270 patients with histologically confirmed osteosarcoma from 14 hospitals were retrospectively enrolled, which were strictly divided into the training (n=166), test cohort 1 (n=56), and test cohort 2 (n=48). Univariate and multivariate logistic regressions were used to analyze the correlation between PFS and clinical features. Contrast-enhanced fat-suppressed T1-weighted images (CE-FS-T1WI)-based radiomics analysis was based on 1130 radiomics features, which were filtered by Pearson correlation coefficient analysis and Relief algorithm successively, and finally modeled by comparing multiple classifiers. In addition, the effectiveness of features from three advanced deep learning framework (ResNet-50, DenseNet-121, and EfficientNet-B7) for PFS prediction was investigated. Unsupervised segmentation was adopted to extract the nucleus from the pathological images, based on which 150 features were further extracted and finally aggregated into individual-level pathological features. The correlations between score of the optimal predictive model and pathological features were evaluated by Spearman correlation analysis.

**RESULTS**

The performance of the radiomics model constructed by 12 features exceeded that of clinical features and deep learning features ($P < 0.001$), with AUCs of 0.916 (0.900-0.932), 0.802 (0.777-0.828), and 0.895 (0.879-0.911) in the training cohort, validation cohort 1, and validation cohort 2, respectively (FIGURE 1). The high- and low-risk groups showed significant differences in PFS (FIGURE 2, $P < 0.05$). As independent prognostic factors of PFS, six pathological features showed strong correlations with the radiomics scores (FIGURE 3, $P < 0.05$).

**CONCLUSION**

Our study verified the effectiveness of the CE-FS-T1WI-based radiomics model for predicting PFS in osteosarcoma, which can be used as a non-invasive prognostic tool before treatment.

**CLINICAL RELEVANCE/APPLICATION**

The proposed radiomics model can help clinicians identify patients with poor prognosis and adjust treatment accordingly, thus leading to a better prognosis for osteosarcoma patients.

## M6-SSMK03-6 AN ARTIFICIAL INTELLIGENCE ASSESSMENT SYSTEM FOR RISK GRADING OF SARCOPENIA BASED ON ULTRASONOGRAPHIC MULTIDIMENSIONAL DATA: A CROSS-REGIONAL, MULTI-ETHNIC, CROSS-SECTIONAL STUDY

Li Qiu (*Abstract Co-Author*) Nothing to Disclose
Xinyi Tang (*Presenter*) Nothing to Disclose

**PURPOSE**

To establish an ultrasound-centered intelligent risk grading system for sarcopenia in the older adults.

**METHODS AND MATERIALS**

Participants in were recruited from one medical centre, one urban community, and three plateau communities. According to AWGS2019, the diagnosis of sarcopenia was made through the sarcopenia-related symptoms (low muscle mass, low gait speed, low handgrip strength). Three trained sonographers scanned the upper arms, forearms, thighs, and legs of each subject and obtained corresponding ultrasound images. We concatenated four ultrasound images of each sample and input them into the RESNET50 network and concatenated the corresponding muscle thickness measurements, BMI, and age values and input them into the MLP. After re-concatenating the two sections and adding a linear layer, we initially established the model.

**RESULTS**

A total of 990 volunteers were recruited, and after amplification, 1145 samples were included in this study. In the first step, the determination of whether there is muscle mass loss or muscle function decline, our model achieved AUC of 0.879 and 0.813 in men and women, respectively. For men, there is a sensitivity of 87.1% and a specificity of 75.8% in detecting the presence of sarcopenia related symptoms, while for women, there is a sensitivity of 85.8% and a specificity of 65.5%. In further assessment of the presence of two or more symptoms, AUC of 0.770 and 0.662 were achieved in men and women, respectively.Based on the classification results of these two steps, we classified all image samples into different risk groups. Overall, out of 380 samples identified as low-risk, only 1.3% were ultimately diagnosed with sarcopenia. Among the 466 samples classified as middle-risk, 80.7% had at least one sarcopenia related symptom and 17.6% were ultimately diagnosed with sarcopenia. Among the 299 samples classified as high-risk, more than half were ultimately diagnosed with sarcopenia, and about one-third were diagnosed with severe sarcopenia.

**CONCLUSION**

We established an ultrasound-centered intelligent risk grading system for sarcopenia in the older adults, which can classify the risk of sarcopenia in a cross-regional, multi-ethnic population.

**CLINICAL RELEVANCE/APPLICATION**

In middle- to low-income areas, the identification of sarcopenia in older adults is very low, due in part to the lack of good accessibility of equipment, including DXA and high-end BIA equipment, as well as a cumbersome assessment process. A four-image ultrasound-centered risk grading system for sarcopenia is not only cost-effective, but also helps community primary care providers to quickly assess the risk of sarcopenia in older adults and provide further medical advice.
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M6-SSMS01

**Multisystem (Role of AI and Advanced Imaging in Screening and Prognostication of Multisystem Multiorgan Diseases: DM, Obesity, Dementia, Hematologic Malignancies and Erdeim Chester Disease**

Monday, Dec. 2 1:30PM - 2:30PM Room: S405

Nariman Nezami, MD (*Moderator*) Consultant, CAPS Medical Ltd
Peiman Habibollahi, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M6-SSMS01-1 A MULTILEVEL ANATOMICAL EVALUATION OF THE EFFECT OF GLUCAGON-LIKE PEPTIDE-1 (GLP-1) RECEPTOR AGONISTS ON ABDOMINAL BODY COMPOSITION: A LONGITUDINAL STUDY

Roshan Fahimi, MD (*Abstract Co-Author*) Nothing to Disclose
Anushree M. Burade, MBBS (*Abstract Co-Author*) Nothing to Disclose
Keith J. Dreyer, DO, PhD (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Bernardo C. Bizzo, MD, PhD (*Abstract Co-Author*) Consultant, Diagnosticos da America (Dasa)
Parisa Kaviani, MD (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Lina Karout, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedehelaheh Hosseini, MD (*Abstract Co-Author*) Nothing to Disclose
Ashley McKnight (*Abstract Co-Author*) Nothing to Disclose
Emiliano Garza Frias, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the longitudinal effects of glucagon-like peptide-1 (GLP-1) receptor agonists on the AI-derived abdominal body composition biomarkers on abdomen-pelvis CT examinations.

### METHODS AND MATERIALS

The study included 102 adult patients (mean age: 60±14 years; F:M 64:38) from seven quaternary and community hospitals. Using a radiology report search database (mPower, Nuance) and electronic medical records (Epic), we identified consecutive patients who underwent abdominal CT examinations before (CT1) and after (CT2) their first GLP-1 prescription. We also included a third CT examination (CT3) of 79/102 patients performed after 14 months (mean) of their second CT. The time between the radiological examination and the medication prescriptions was recorded. We de-identified, exported, and processed thin-section CT images of each examination with an AI tool (ClariMETABO, ClariPI) to segment and quantify the area of abdominal wall muscles, psoas muscles, visceral adipose tissues, and subcutaneous adipose tissues at T12, L1, L2, L3, and L4 vertebral levels. We performed paired two-tailed t-tests to compare AI output at each vertebral level and time point.

### RESULTS

There were significant statistical differences between the visceral and subcutaneous adipose tissues on follow-up CT2 and CT3 exams when compared to the baseline CT1 (p 0.44-<0.001). However, between the two follow-ups, CT2 and CT3, only subcutaneous adipose tissue decreased significantly at all vertebral levels (p<0.001). There was a larger decrease in adipose tissues and waist circumference at lower lumbar levels than at T12/L1 levels. Interestingly, there was also a decrease in the overall abdominal wall and psoas muscles between baseline CT1 and follow-up CT2, but not between the two follow-up CT1 and CT2 exams.

### CONCLUSION

We demonstrate that AI-inferred abdominal body composition biomarkers from abdomen-pelvis CT examinations can help in the longitudinal assessment of visceral and subcutaneous adiposity changes in patients on glucagon-like peptide-1 (GLP-1) receptor agonists.

### CLINICAL RELEVANCE/APPLICATION

The metabolic biomarker evaluation AI tool can provide useful information for monitoring intra- and post-treatment changes in adipose tissues and waist circumference in patients on GLP-1 treatment.

## M6-SSMS01-2 ASSOCIATION BETWEEN BRAF$^{V600E}$ MUTATION, DISEASE SEVERITY, AND GERM LINE LAYER INVOLVEMENT IN ERDHEIM-CHESTER DISEASE BY USING RADIOLOGICAL FINDINGS FROM A UNIQUE ECD POPULATION

Ritu Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Mark A. Ahlman, MD (*Abstract Co-Author*) Nothing to Disclose
Moozhan Nikpanah, MD (*Abstract Co-Author*) Nothing to Disclose
Fahimul Huda, MD (*Abstract Co-Author*) Nothing to Disclose
Jhanavi R. Rao, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Rahul Dave (*Abstract Co-Author*) Nothing to Disclose
Lauren M. Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Babak Saboury, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Faraz Farhadi, BS (*Abstract Co-Author*) Nothing to Disclose
Fatemeh Dehghani Firouzabadi, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth C. Jones, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
William A. Gahl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fatemeh Homayounieh, MD (*Abstract Co-Author*) Nothing to Disclose
Mahshid Golagha, MD (*Abstract Co-Author*) Nothing to Disclose
Aryan Zahergivar, MD (*Abstract Co-Author*) Nothing to Disclose
Nadia M. Biassou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ashkan A. Malayeri, MD (*Abstract Co-Author*) Nothing to Disclose
Evrim B. Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Mojdeh Mirmomen, MD (*Abstract Co-Author*) Nothing to Disclose
Safa Samimi (*Abstract Co-Author*) Nothing to Disclose
Ali Sheikhy, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study evaluates the relationship between BRAFV600E mutation, disease severity, and germ line layer involvement in Erdheim-Chester Disease (ECD) using radiological findings.

**METHODS AND MATERIALS**

A prospective analysis of radiological findings from a cohort of 40 biopsy-confirmed ECD patients were conducted. These patients had available imaging data along with BRAFV600E mutation status. Our evaluation of radiological findings comprised 10 organ involvements (including bone, pulmonary, CNS, uropathy, nephropathy, cardiac, vascular, orbit, hepatobiliary, and spleen)(table 1) and germ line layer involvement (Mesoderm, Endoderm, Ectoderm), based on radiological findings. A team of expert radiologists, comprising 5 body, 2 neuro, 1 thoracic, 2 clinical fellows, and 2 nuclear medicine specialists, reviewed MRI/CT/PET-CT/Bone Scan studies. Discrepancies were resolved either by a third reader or by achieving consensus between two radiologists.

**RESULTS**

A significant association was found between BRAFV600E mutation and disease severity based on organ involvement. Bone and pulmonary regions exhibited the highest frequency of involvement, regardless of the presence of BRAFV600E mutation (95% and 92% respectively). Positive associations were found between BRAFV600E mutation and cardiac (OR=4.55, p=0.027) and vascular (OR=5.60, p=0.013) involvement. ECD patients showed full involvement in Mesoderm (100%), 93% in Endoderm, and 75% in Ectoderm using radiological findings. However, no significant correlation existed between germ line layer involvement and BRAFV600E mutation.

**CONCLUSION**

BRAF mutation is associated with disease severity in ECD, particularly in cases with more organ involvement. Bone and pulmonary regions are consistently affected, while cardiac and vascular involvement are associated with BRAFV600E mutation. ECD patients showed full involvement in Mesoderm while no direct correlation was found with BRAFV600E mutation with any specific germ line layer.

**CLINICAL RELEVANCE/APPLICATION**

This study represents the largest single-center investigation of ECD patients, encompassing a comprehensive assessment of radiological findings to elucidate the impact of the BRAFV600E mutation on disease severity, thereby facilitating risk stratification and treatment decision-making in ECD. Furthermore, the identification of BRAFV600E mutation status as a potential prognostic indicator highlights the multifaceted nature of ECD, underscoring the imperative for targeted therapeutic approaches and additional molecular research.

## M6-SSMS01-3 CAN OPPORTUNISTIC AI-BASED AUTOMATED MEASURES OF ABDOMINAL FAT, MUSCLES, AND WAIST CIRCUMFERENCE ON EMERGENCY ABDOMEN CT IN 30-39-YEAR-OLD PREDICT FUTURE DIABETES AND HYPERTENSION? A MULTICENTER MULTI-YEAR FOLLOW-UP STUDY

Keith J. Dreyer, DO, PhD (*Abstract Co-Author*) Nothing to Disclose
Roshan Fahimi, MD (*Abstract Co-Author*) Nothing to Disclose
Ashley McKnight (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Parisa Kaviani, MD (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Lina Karout, MD (*Abstract Co-Author*) Nothing to Disclose
Anushree M. Burade, MBBS (*Abstract Co-Author*) Nothing to Disclose
Seyedehelaheh Hosseini, MD (*Abstract Co-Author*) Nothing to Disclose
Emiliano Garza Frias, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

We assessed if AI-enabled measures of abdominal fat, muscles, and waist circumference on abdomen CT in 30-39-year-old predict future diabetes (DM) and hypertension (HT) over a multi-year follow-up.

**METHODS AND MATERIALS**

Our IRB-approved, retrospective study included 1277 patients (between 30-39 years; 776 females, 501 men) with an abdomen-pelvis CT performed as part of their emergency department workup for clinical reasons unrelated to diabetes and hypertension. We excluded patients with known diagnosis of DM and HT either at or before their CT examinations. From the review of their electronic medical records, we assessed if patients developed DM or HT over an eight-year follow-up since their CT. We processed all CT exams with an AI algorithm (ClariMetabo, Claripi.ai) and obtained following measures: HU and volume of subcutaneous fat (SAT) and visceral fat (VAT), waist circumference (WC), psoas muscle, and abdominal wall muscles, at five levels including

T12-L4 vertebrae. We used each level measurements and divided the patients according to their respective quartiles. Cox Regression tests were performed across different categories using the lowest quartile of measures as the references for comparing the hazard ratios (HR) for predicting DM and HT. The highest quartile was used as a reference for mean skeletal and psoas muscle density analysis.

**RESULTS**

Our study demonstrates that VAT (HR:1.4-2.5; p<0.001), SAT volumes (HR:1.9 to 2.2; p<0.001), and WC (HR:1.9 to 2.6; p<0.001) in the highest quartiles were the best and most significant to assess the risk of developing DM. The HR for DM in VAT and WC increased progressively from T12 to L4 (HR @ T12 1.4 and 2.1, respectively, vs HR @ L4 2.5 and 2.6). Patients in the lowest quartile of mean skeletal muscle density had higher HT and DM risks (HT HR: 1 to 1.4; DM HR 1.1 to 1.7) at multiple levels than the psoas muscle (HT HR: 0.6 to 1.3; DM HR: 0.8 to 1.2). We also found that the DM HR in the lowest quartile group for mean skeletal muscle density was higher as the spine level increased (T12 HR:1.7 vs L4 HR:1.1).

**CONCLUSION**

Our study demonstrates that the use of opportunistic AI-based body composition analysis of emergency abdominal CT examinations in tricenarians can be used for predicting hypertension and diabetes mellitus.

**CLINICAL RELEVANCE/APPLICATION**

Larger, prospective studies can help assess if opportunistic screening in young patients with an autonomous, efficient, single-click AI tool can increase the lead time for preventive steps to detect patients at risk of diabetes mellitus and hypertension.

## M6-SSMS01-5 EXPLORING ASSOCIATIONS BETWEEN OBESITY AND SARCOPENIA WITH DEMENTIA USING BODY AND BRAIN MRI QUANTITATIVE MEASUREMENTS

Fan Huang, PhD (*Abstract Co-Author*) Nothing to Disclose
Varut V. Vardhanabhuti, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Man Kwun Andrew Li, BSc, MBBS (*Presenter*) Nothing to Disclose

**PURPOSE**

Previous studies have shown a strong association between obesity and sarcopenia with risk of dementia. However, only physical/biometric measurements, such as body mass index, grip strength and gait speed, and DEXA scan quantitative measurements, such as appendicular lean mass index, have been used to demonstrate this association. Recent advances in MRI segmentation have led to the development of more specific quantitative measures of fat content and muscle quantity, allowing for a more standardized means of characterizing obesity and sarcopenia in patients. Furthermore, the relationship between these MRI quantitative measurements with MRI brain volumetric measurements of dementia has not been explored. This study aims to identify associations between body MRI quantitative measurements of central obesity and quantitative muscle assessment with MRI brain volumetric measurements of dementia.

**METHODS AND MATERIALS**

We randomly identified 9,938 patients from the UK Biobank cohort who underwent both body MRI and MRI brain studies. For body MRI, we derived quantitative measurements of central obesity and quantitative muscle assessment. More specifically, fat percentages and normalized fat free indices of large muscle groups, including abdominal wall and thigh muscles, were derived using in-house deep learning segmentation algorithm. For MRI brain, we utilized volumetric measurements known to be associated with dementia. Linear regression was performed, with incorporation of important confounders, such as age, gender, body mass index, smoking and alcohol status, to determine the significance of associations between the two groups of MRI quantitative parameters.

**RESULTS**

In our analysis, bilateral anterior thigh fat percentage was demonstrated to be the most consistent quantitative parameter that was predictive of MRI volumetric measurements related to dementia, with significant associations with total brain volume, total grey matter volume, and bilateral hippocampal volume. In addition, fat free index whole abdominal wall muscle from T1 to L5 levels was found to be a significant predictor of multiple MRI volumetric measurements related to dementia, including total grey matter volume, mean peripheral cortical grey matter volume, and bilateral hippocampal volume.

**CONCLUSION**

This study demonstrated the predictive ability of MRI-derived quantitative measurements of central obesity and quantitative muscle assessment with MRI brain volumetric parameters of dementia, consistent with previous studies showing the strong association between these conditions.

**CLINICAL RELEVANCE/APPLICATION**

This study lends support for the use of body MRI to characterize the degree of sarcopenia and obesity in patients to predict the risk of dementia.

## M6-SSMS01-6 SCREENING OF PATIENTS DIAGNOSED WITH HHT (HEREDITARY HEMORRHAGIC TELANGIECTASIA) OR THEIR FIRST-DEGREE RELATIVES FOR DISEASE EXPRESSION IN BRAIN, LIVER AND LUNG BY MAGNETIC RESONANCE IMAGING

Peter Fries, MD (*Abstract Co-Author*) Research Grant, Guerbet SA
Arno Buecker, MD (*Abstract Co-Author*) Consultant, Bracco Group;Speaker, Bracco Group;Consultant, Medtronic plc;Speaker, Medtronic plc;Research Grant, Novartis AG;Research Grant, GlaxoSmithKline plc;Research Grant, Biotest AG;Research Grant, OncoGenex Pharmaceuticals, Inc;Research Grant, Bristol-Myers Squibb Company;Research Grant, Eli Lilly & Company ;Research Grant, Pfizer Inc;Research Grant, F. Hoffmann-La Roche Ltd;Research Grant, sanofi-aventis Group;Research Grant, Merrimack Pharmaceuticals, Inc;Research Grant, Sirtex Medical Ltd;Research Grant, Concordia Healthcare Corp;Research Grant, AbbVie Inc;Research Grant, Takeda Pharmaceutical Company Limited ;Research Grant, Merck & Co, Inc;Research Grant, Affimed NV;Research Grant, Bayer AG;Research Grant, Johnson & Johnson;Research Grant, Seattle Genetics, Inc;Research Grant, Onyx Pharmaceuticals, Inc;Research Grant, Synta Pharmaceuticals Corp;Research Grant, Siemens AG;Research Grant, iSYMED GmbH;Research Grant, Abbott Laboratories;Co-founder, Aachen Resonance GmbH
Diane Wagner-Jochem (*Abstract Co-Author*) Nothing to Disclose
Guenther K. Schneider, MD, PhD (*Presenter*) Research Grant, Siemens AG;Speakers Bureau, Siemens AG;Speakers Bureau, Bracco Group;Research Grant, Bracco Group

**PURPOSE**

To evaluate MRI for screening of pediatric and adult patients with clinical and/or genetic proven diagnosis of HHT or first-degree relatives of HHT patients for AVMs (arterio-venous malformations) in the brain, liver or lung.

## METHODS AND MATERIALS

419 patients (3-86 years; mean 42 +/-19 years; male/female 157/262) underwent MRI of the brain, liver and pulmonary vasculature for the detection of AVMs in a single examination. The imaging protocol included unenhanced MRI of the brain (T2w, FLAIR, SWI, DWI and T1w imaging) followed by T1w and T2w liver imaging and flow-sensitive GRE-sequences of the liver to detect increased vessel density. This was followed by a time-resolved and a high-resolution contrast-enhanced MR-angiography of the thorax. Finally a contrast-enhanced T1w scan of the liver and of the brain was performed, so with one CM dose a complete work-up could be performed. The total magnet time was 40-45 minutes.

## RESULTS

In 278 of 419 Pts. (66%) at least one disease expression in either brain, liver or lung was found with a mean age at diagnosis of 44 +/-18 years. The total number of Pts. with cerebral AVMs was 34 (8 %), pulmonary AVMs 236 (56%) and liver AVMs 64 (15%). Of these 5 Pts. only showed AVMs in the brain, 188 only in the lung and 34 only in the liver respectively. 21 Pts. had simultaneous AVMs in both brain and lung, 3 in both brain and liver and 22 in both lung and liver. Only 5 Pts. demonstrated AVMs in all evaluated organs. With regard to male female ratio 179 out of 262 female Pts. (68%) and 98 out of 157 male Pts. (62%) at least showed one disease expression in either brain, liver or lung. All AVMs detected in the screening MRI were confirmed either by catheter angiography during treatment, dedicated MRI or CT studies or in follow-up imaging. No clinically relevant AVMs were missed in screening, only some small additional PAVMs (feeding vessel </= 1mm) were detected on CT imaging of the lung.

## CONCLUSION

MRI is a feasible, radiation-free one stop screening method for evaluation of disease expression in brain, liver and lung in Pts. diagnosed with HHT. The average age at first imaging of 44 +/-18 years shows that in many Pts. clinically relevant AVMs are diagnosed relatively late and in fact several Pts. were already suffering from brain abscess or stroke, cerebral hemorrhage, heart failure (due to left-to-right shunt in liver AVMs), impaired liver function or respiratory failure at the time of diagnosis.

## CLINICAL RELEVANCE/APPLICATION

Early diagnosis of disease expression in the brain, liver and lungs in patients with HHT is essential to avoid irreversible complications of the disease. Therefore, a single MRI study that provides an overview of disease expression is an important tool for the treatment of patients with HHT with the goal of normal quality of life and life expectancy.

# Abstract Archives of the RSNA, 2024

M6-SSNPM01

**Noninterpretive Skills (Beyond Imaging) (Sustainability and Access to Care)**

Monday, Dec. 2 1:30PM - 2:30PM Room: S402

Sean A. Woolen, MD, MS (*Moderator*) Research Grant, Siemens AG;Investigator, Siemens AG
Nadja Kadom, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M6-SSNPM01-1 ENERGY-EFFICIENT USAGE OF CT SCANNERS THROUGH OPTIMIZED EXAMINATION SCHEDULING - EVALUATION OF TWO MATHEMATICAL MODELS

Armin Nurkanovic (*Abstract Co-Author*) Nothing to Disclose
Tobias Heye, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Vosshenrich, MD (*Abstract Co-Author*) Nothing to Disclose
Martin Segeroth, MD, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

Medical imaging devices are large consumers of electricity. This study aimed to estimate potential energy savings through optimized CT examination scheduling using an ideal (hypothetical) and a realistic mathematical model.

### METHODS AND MATERIALS

Examination timestamps and power consumption data of all CT examinations performed on three CT scanners in our tertiary care radiology department in 2015 were retrospectively included. Both scheduling models were formulated mathematically using linear constraints, a linear objective function and only binary decision variables as a binary linear programming (BLP) model. This formulation allows for rigorous modelling of a non-convex and non-differentiable objective function and offers the possibility to compute the optimal solution in a significantly reduced solution time. The BLPs were formulated and solved using the commercial integer programming solver Gurobi. The lower bound model (LB-model) allowed to power down all CT scanners, except the one in the emergency department. For the realistic model (R-model), the emergency department CT scanner and one CT scanner in the radiology department remained online to allow for continuous scanning of non-emergent exams as well.

### RESULTS

Measurements included 261 workdays with 15,072 CT examinations. The median duration to solve the BLP for each workday was 9.9 s (9.2-10.6 s) for the LB-model and 6.0s (5.5-6.6 s; p<.001) for the R-model. The LB-model yielded a 34.8% (34.2-35.5%) reduction in combined daily energy consumption through optimal examination scheduling, the R-model yielded an 11.0% (10.7-11.3%) reduction. In absolute numbers, daily energy consumption could hypothetically be decreased by 41.9 kWh from (121.0 kWh to 79.1 kWh; p<.001) for the LB-model and by 13.3 kWh (121.0 kWh to 107.9 kWh; p<.001) for the R-model.Hypothetical energy savings for the LB-model were primarily realized through examination shifting to the emergency CT scanner, thus increased system off times for the other CT scanners. The R-model compensated for this mechanism, rendering the estimated savings realistically achievable.Estimated annual savings were 10,933 kWh in energy consumption, $2,865 in costs, and 1,399 kgCO2eq in carbon emissions for the LB-model, and 3,460 kWh, $907 and 443 kgCO2eq for the R-model.

### CONCLUSION

Optimized CT examination scheduling through mathematic modelling could have substantial sustainability and cost benefits for radiology departments. Feasibility of model implementation in clinical routine however needs further investigation.

### CLINICAL RELEVANCE/APPLICATION

Mathematic modelling could allow for automated CT examination scheduling to realize an optimized and more energy efficient usage of CT scanners within radiology departments.

## M6-SSNPM01-2 MRI SUSTAINABILITY: UNLOCKING THE POWER OF HEAT RECOVERY IN RADIOLOGY

Daniel Audette (*Abstract Co-Author*) Nothing to Disclose
Filipp Alaverdyan (*Abstract Co-Author*) Nothing to Disclose
Daniel J. Margolis, MD (*Abstract Co-Author*) In-kind support, Siemens AG;Consultant, Promaxo, Inc
Akhil Soman (*Abstract Co-Author*) Nothing to Disclose
Lara Pes (*Abstract Co-Author*) Nothing to Disclose
Akua Amoah, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

Magnetic Resonance Imaging (MRI) scanners are indispensable tools in modern healthcare, providing detailed diagnostic images for various medical conditions. However, the operation of MRI scanners consumes significantly energy and generates an enormous amount of waste heat, presenting an

opportunity for sustainable energy utilization. By harnessing heat pumps, heat generated by MRI machines can be repurposed for warming buildings rather than wasted. We hypothesized that a heat pump system can be designed for incorporation into a heat recovery system to exploit heat generated by MRI.

**METHODS AND MATERIALS**

An Office of Energy Sustainability and Department of Radiology at one institution in the United States coordinated with a commercial entity to design a proposed schematics for heat capture. The existing heat capture and waste exhaust for the MRI and the heating system for the hospital system were evaluated. These were used to design a heat pump schematic and cost analysis.

**RESULTS**

A potential schematic for integration of a heat pump into MRI siting with a breakdown of implementation and costs was generated. Incorporating a heat recovery system using heat pump will cost $813,433. Preliminary calculations estimate a total savings of 6,209 million British thermal units (mmBTU) annually, resulting in a substantial reduction (30%) in fossil fuel usage for the building's entire heating system.

**CONCLUSION**

By embracing innovative energy conservation and emission reduction approaches, radiology departments can serve as catalysts for transformative change within healthcare facilities. Energy currently being rejected by the MRI chiller cooling towers will be recovered and reused. While this may be straightforward to apply for future MRI site designs, integration into existing MRI installation may be challenging and require additional investigation and costs, and potentially taking the MRI offline for implementation.

**CLINICAL RELEVANCE/APPLICATION**

This provides a comprehensive framework for leveraging radiology's energy-intensive operations to drive decarbonization within healthcare facilities. Specifically, we highlight the potential of repurposing MRI heat as a sustainable heating source and offer a leading edge for medical facilities to reduce their reliance on fossil fuels and mitigate their environmental impact.

## M6-SSNPM01-3 REDUCING THE AMOUNT OF EXCRETED CONTRAST MEDIA IN SEWAGE WATER: A PILOT STUDY USING A SPECIALIZED TOILET FILTER SYSTEM

Mathias Prokop, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Canon Medical Systems Corporation;Research Grant, Siemens AG;Speakers Bureau, Siemens AG
Alex Hol (*Abstract Co-Author*) Nothing to Disclose
Anne Talsma, MS (*Abstract Co-Author*) Nothing to Disclose
Helena M. Dekker, MD, MBA (*Presenter*) Nothing to Disclose

**PURPOSE**

Contrast media has been shown to be increasingly present in surface water and entering drinking water supply. We tested and optimized a toilet filtration system (TFS) to reduce the amount of contrast media entering sewage water.

**METHODS AND MATERIALS**

The TFS (manufactured by Zereau, Nijmegen, The Netherlands) consists of a specialized toilet system with two cartridges, the first of which retains faecal matter and toilet paper, the second contains adsorbents that bind contrast media. Cartridge configurations were adapted in a stepwise fashion to optimize the amount of retained contrast material. These configurations were tested in two settings in which patients were asked to use the TFS (a) during their stay in a cardiology holding unit after interventional cardiac procedures (ICP) with Iomeron 300 (Bracco, Italy) and (b) after an outpatient contrast-enhanced MRI (ceMRI) with Dotaram (Guerbet, France). Contrast media concentrations were measured in both influent and effluent streams and contrast removal efficiency was determined from the ratios between excreted and injected contrast.

**RESULTS**

The TFS was optimized in 170 ICP patients and 140 ceMRI patients to find the optimal cartridge configurations. The contrast removal efficiency with the optimized cartridge configurations was tested on 34 ICP patients and 37 ceMRI patients who had, on average, received 115 ml Iomeron and 20 ml Dotarem, respectively. Patients after ICP stayed on average 200 minutes in the cardiology holding unit and used the TFS there. Patients after ceMRI could leave the hospital immediately after having used the TFS. While contrast removal efficiency was 99% for Iomeron and 99% for Dotarem, 42% of the injected iodine and 14% of the injected Gd could be retrieved with the TFS.

**CONCLUSION**

The toilet filtration system was highly effective in removing iodinated and Gd-based contrast agents from the excreted urine. However, the total amount of contrast that was excreted when the patients used the toilet, needs to be further optimized and this retrieval is higher for longer hospital stays.

**CLINICAL RELEVANCE/APPLICATION**

This is the first study to show that nearly all contrast media can be removed from excreted urine when using a toilet filtration system, reducing the amount of contrast media in waste water. However, further measures need to be taken to optimize the amount of excreted contrast in the urine during a hospital stay.

## M6-SSNPM01-4 WHERE DO WE GO FROM HERE? STRUCTURED SCOPING REVIEW AND ROADMAP FOR SUSTAINABILITY RESEARCH IN RADIOLOGY

Marisa Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine E. Maturen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Mark P. MacEachern (*Abstract Co-Author*) Nothing to Disclose
Sean A. Woolen, MD, MS (*Abstract Co-Author*) Research Grant, Siemens AG;Investigator, Siemens AG
Colby Foster, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This scoping review of environmental sustainability in radiology summarizes current literature and identifies research gaps with the ultimate intention to reduce the carbon footprint of medical imaging.

**METHODS AND MATERIALS**

A scoping review using PRISMA-ScR guidelines searched multiple databases from inception to 2/12/2024. Citations were screened in a multi-reader structured process, including all original research on diagnostic imaging and/or image-guided procedures with environmental impact as an outcome.

Conference abstracts, narrative reviews, commentaries and editorials were excluded. Data extraction was performed by two investigators. The outcomes and research gaps were summarized using descriptive statistics and narrative reviews. Outcomes were converted to CO2e for purposes of comparison.

**RESULTS**

2280 citations were reviewed and 75 studies containing original data from 28 countries were included, spanning 1975 to 2024, most using an observational cross-sectional design. Five thematic domains emerged: nuclear medicine waste (27 publications), energy and waste from image acquisition (26), energy from radiology operations (11), energy in radiation oncology (7), and sustainability perceptions (4). Annual CO2 emissions from radiology equipment varied by modality, with MRI emitting 34.3-72.1 MT, CT 6.0-17.1 MT, IR suites 8.6-10.6 MT, fluoroscopy 4.8 MT, X-Ray 4.0 MT, workstations 0.2-1.0 MT, and US 0.3 MT. An IR suite on a single weekday generated 1.6 MT CO2, with the highest contributors being HVAC and single use devices (solid waste weight was converted to CO2e). A few studies analyzed contrast media and radiotracers in water systems. Research gaps include: validating existing estimates of modality specific emissions; initial emissions estimates for nuclear medicine and breast imaging; solid waste from single-use devices; hospital vs. ambulatory center imaging; MR imaging at lower field strengths; cooling systems; and data center impacts; and efficacy of proposed mitigation strategies.

**CONCLUSION**

Among thousands of publications addressing environmental sustainability and medical imaging, only a small percentage provide primary data. This structured scoping review consolidates the literature on radiology's environmental impact and summarizes existing estimates and potential interventions, highlighting areas for future research to improve sustainability in radiology.

**CLINICAL RELEVANCE/APPLICATION**

A scoping review of a large but diffuse body of literature establishes a roadmap for future original research on environmental sustainability in radiology practice, ultimately contributing to climate change mitigation and public health improvement.

## M6-SSNPM01-5 COMMUNITY SUPPORT FOR LUNG CANCER SCREENING

Farouk Dako, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Farouk Dako, MD, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

Lung cancer screening (LCS) using low-dose CT (LDCT) for high-risk individuals is a critical public health tool for reducing lung cancer mortality. Despite the recent expansion of the inclusion criteria to be more equitable, uptake and adherence remains low and is lowest among low-income and racial/ethnic minority populations and in individuals with a negative baseline screening study. Community-based programs promoting cancer screening uptake have demonstrated increased screening engagement compared to clinic-based programs in reaching disadvantaged individuals but suffer from lack of robust funding and limited data demonstrating impact on a population level.

**METHODS AND MATERIALS**

We performed a pragmatic clinical trial to measure the effect of our community support program (free rideshare, education and navigation) on adherence to annual LCS in patients with a scheduled exam following a previous negative study. We designed an educational program for LCS a grade 6 readability to train a community health worker who was tasked with reaching out to patients with upcoming appointments and offering free ride, education and health system navigation. We defined our intervention group (West Philadelphia) and control group (SW Philadelphia) using geospatial analysis of census track data. After a 6-month period, we compared adherence rates between participants in the intervention group and participants in the control group, who received routine care. We also compared outcomes between individuals in the intervention group who opted into our program vs those who did not. We utilized parts of the RE-AIM framework for planning and evaluation. Descriptive statistics was performed, and chi-square test was performed.

**RESULTS**

Within the intervention group (191 individuals),14% of individuals opted to participate in our program. 88% of the participants in our program attended their LCS appointment versus 68% of the individuals who chose not to. In the control group (52 individuals), 62% of individuals attended their appointment. The was a statistically significant difference in the rate of adherence to appointments between individuals in our program and those who received routine care, $p < 0.05$. 69% of individuals in the program opted to take a rideshare. Average age and smoking history were similar among all groups. Individuals in our program were more likely to be African American and Female.

**CONCLUSION**

Our study demonstrates that providing social support could improve adherence to LCS appointment. However more work needs to be done to improve the reach of such programs

**CLINICAL RELEVANCE/APPLICATION**

Provides data supporting community based approaches for health promotion

## M6-SSNPM01-6 PREDICTIVE MODELING FOR GUIDELINE-CONCORDANT FOLLOW UP OF INCIDENTAL LUNG NODULES: A TOOL FOR CARE DELIVERY

Saul Blecker, MD,MS (*Abstract Co-Author*) Nothing to Disclose
Mutita Siriruchatanon (*Abstract Co-Author*) Nothing to Disclose
Samrachana Adhikari (*Abstract Co-Author*) Nothing to Disclose
Stella Kang, MD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Evidence-based follow up for incidental lung nodules (ILN) represents an important opportunity to improve early detection of lung cancer and racial-ethnic disparities in outcomes. We assessed the feasibility of developing an accurate and fair predictive model for guideline-concordant follow up of ILN.

**METHODS AND MATERIALS**

We compared various machine learning approaches for prediction of inappropriate follow-up care for ILN. The data consisted of 8,910 patients with ILN with structured follow-up recommendations and 12 predictors for patients (sex, age, race, ethnicity, smoking history, type/size of nodules), care setting (inpatient, Emergency Department, ambulatory), and census-tract level social determinants of health (Index of Concentration of Extremes and Social Vulnerability Index). Five-fold cross validation was performed for hyperparameter tuning and assessing out of sample prediction performance. Algorithm fairness using an "equal opportunity" approach was assessed using true positive rates (TPR) and positive predictive value (PPV) in Black patients as compared with Non-Hispanic white patients, given that this minority group experiences the worst disparity in lung cancer outcomes nationally.

## RESULTS

Lack of appropriate follow up occurred similarly in Black and other minority groups compared with Non-Hispanic White patients (45-48%). Higher risk ILN with recommended follow up within 3 or 3-6 months underwent inappropriate care more often in minorities than in non-Hispanic white patients (68% vs. 61%, respectively, p=0.01). Several machine learning methods performed well; a decision tree algorithm achieved high accuracy (85%) and AUC (0.89) for predicting inappropriate care, with TPR 99% and FPR 28%. The predictive model also had high positive predictive value (76%). In terms of algorithm fairness, TPR and PPV were similar for Black patients vs. non-Hispanic white patients with TPR 99% and PPV 78% in Black patients vs 99% and 75% in Non-Hispanic white patients, respectively, suggesting feasibility to develop a fair prediction model with high accuracy.

## CONCLUSION

The developed predictive model can aid identification of patients at greatest risk of receiving inadequate follow-up care for ILN and facilitate care delivery strategies for follow up. The model performed with adequate fairness with high TPR and PPV for a minority group experiencing the worst early-stage detection and survival rates in lung cancer.

## CLINICAL RELEVANCE/APPLICATION

This predictive model for inadequate ILN follow up is a tool that may ultimately facilitate health systems leaders in multilevel interventions when implementing ILN follow-up guidelines. Algorithm fairness better establishes the model's validity for addressing health disparities.
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# Abstract Archives of the RSNA, 2024

M6-SSVA02

**Vascular Imaging (Aorta)**

Monday, Dec. 2 1:30PM - 2:30PM Room: S501

Kacie Kuykendall, MD (*Moderator*) Nothing to Disclose
Brian B. Ghoshhajra, MD, MBA (*Moderator*) Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Consultant, Siemens AG

**Sub-Events**

## M6-SSVA02-1 IMAGING-INFORMED MORPHOELASTIC GROWTH MODEL OF AORTIC SHAPE EVOLUTION

Nhung Nguyen (*Abstract Co-Author*) Nothing to Disclose
Junsung Kim (*Abstract Co-Author*) Nothing to Disclose
Luka Pocivavsek (*Abstract Co-Author*) Nothing to Disclose
Kameel Khabaz, BA (*Presenter*) Nothing to Disclose

### PURPOSE

Minimally invasive approaches for type B aortic dissection (TBAD) have raised the specter of long-term risks, including device failure. Proper identification of patients for endovascular repair and accurate timing of surgical intervention are critical in preventing disease-related complications. We develop an imaging-informed finite element (FE) morphoelastic model of aortic shape evolution. Based on the hypothesis that pathologic growth drives morphologic heterogeneity, we incorporate past geometric information into FE simulations to predict future aortic shape change.

### METHODS AND MATERIALS

Four TBAD patients, each with two 3D segmentations at different time points, are modeled. Per-element growth rates are defined by mapping localized area changes between the two geometries. Specifically, each patient's two scans are anatomically mapped with rigid and non-rigid registration algorithms. The meshes are subdivided into corresponding partitions, and the growth rate of each region in the initial scan is calculated as the time-normalized area change from the corresponding region in the second scan. Per-element growth rates are smoothed into a globally contiguous growth field, which serves as input to FE simulation. Resulting geometries are quantitatively analyzed for size, measured as surface area (A), and shape, defined using a previously published shape signal of aortic pathology (dS).

### RESULTS

The spatially mapped growth fields model the heterogenous aneurysmal evolution of aortic dissections, such that the geometries modeled in the FE simulations demonstrate a high degree of similarity to real aortic geometric trajectories, both in visual 3D space and the shape-size feature space (dS vs. A). A standard FE simulation modeling uniform growth failed to reproduce the trend of increasing shape deformity coupled to increased surface area.

### CONCLUSION

Imaging-informed FE growth simulations show promising trends in modeling aortic shape evolution in TBAD patients. We show that the source of the morphologic shape signal (dS), which has been shown to be the hallmark of aortic pathology, is embedded in the spatial gradients of local aortic growth.

### CLINICAL RELEVANCE/APPLICATION

Individualized prediction of a patient's future aortic geometry carries the potential to improve TBAD management by better informing timing of surveillance imaging and surgical interventions.

## M6-SSVA02-2 UTILIZING SIZE-SHAPE METRICS TO ADJUDICATE DISEASE SEVERITY IN ASCENDING THORACIC AORTIC ANEURYSM DISEASE

Nicholas S. Burris, MD (*Abstract Co-Author*) Royalties, ImBio, LLC
Timothy Baker, PhD (*Abstract Co-Author*) Nothing to Disclose
Prabhvir S. Marway, BA, MBBChir (*Abstract Co-Author*) Nothing to Disclose
Nic Tjahjadi (*Abstract Co-Author*) Nothing to Disclose
Gregory Spahlinger (*Abstract Co-Author*) Nothing to Disclose
Carlos Alberto Campello Jorge, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Borderline ascending aortic dilation diagnosis is increasing due to incidental detection on CT/MRI, with potential increase in patient and healthcare burden due to often-indolent disease and low complication rate. Diagnosis is based on maximal diameter measurements, which vary with age and body size and neglect 3D morphologic features. New methods are needed to adjudicate normal vs. pathologic anatomy in marginal degrees of dilation. We aimed to harness ascending aortic shape, taken from clinical CT angiography (CTA), and statistical shape modeling (SSM), a method to quantify deviation of 3D shapes, to investigate new combined size-shape metrics to adjudicate disease severity.

### METHODS AND MATERIALS

We retrospectively analyzed CTA scans of 334 adults without prior aortic repair, categorized into 3 groups: ascending thoracic aortic aneurysm (aTAA; mid-ascending "MA" diameter >45 mm), Normal aorta controls (MA diameter: males <34 mm; females <33 mm), and a "Borderline" group meeting neither criterion. We excluded patients with bicuspid or significant aortic valve dysfunction, genetic aortopathy or first degree relative with aTAA. We computed aortic size index (ASI) to account for body size differences (ASI=max diameter/body surface area). We generated a new metric (M/S ratio) to reflect relative size of the MA aorta relative to sinuses (M/S=MA/sinus diameters). An SSM score for each patient was calculated to quantify 3D similarity between an individual patient's aortic shape and mean Normal ascending aortic shape.

### RESULTS

Included were 334 patients (54% male; average age 55 ± 15 years). Within the aTAA group (n=42), 91% had hypertension, average age of 65 ± 10 years, mid-ascending diameter of 47 ± 2 mm, and predominant mid-ascending dilation (M/S ratio = 1.13 ± 0.13). The normal aorta group (n=165) demonstrated a lower hypertension rate (14%; p<0.001), smaller mid-ascending diameter (29 ± 3 mm), lower M/S ratio (0.87 ± 0.08; p<0.001), and younger age (48 ± 14 years; p<0.001). The remaining 127 patients were in the Borderline group. Combined SSM scores and ASI showed that 54% of borderline cases were closer to aTAA, while 34% were closer to normal aortas. Adding M/S ratio to a 3D plot revealed a discernible upward and rightward trend with increasing SSM score, ASI, and M/S ratio across disease severity strata.

### CONCLUSION

Differences in 3D shapes and size ratios between normal ascending aortas and aTAA from CTAs can be exploited to quantify anatomic abnormalities in patients with borderline degrees of dilation.

### CLINICAL RELEVANCE/APPLICATION

Combined shape-size assessment shows promise in adjudicating ascending aortic disease severity, especially in borderline cases, which could alleviate overdiagnosis and tailor patient-specific management strategies.

## M6-SSVA02-3 TRACKING AORTIC GROWTH WITH MANUAL DIAMETER MEASUREMENTS OVER TIME IS UNABLE TO RELIABLY DIFFERENTIATE STABLE VERSUS GROWING CASES, IMPAIRING DISEASE DETECTION

Gregory Spahlinger (*Abstract Co-Author*) Nothing to Disclose
Juliana Robayo (*Abstract Co-Author*) Nothing to Disclose
Nicholas S. Burris, MD (*Abstract Co-Author*) Royalties, ImBio, LLC
Nic Tjahjadi (*Abstract Co-Author*) Nothing to Disclose
Timothy Baker, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlos Alberto Campello Jorge, MD (*Abstract Co-Author*) Nothing to Disclose
Prabhvir S. Marway, BA, MBBChir (*Presenter*) Nothing to Disclose

### PURPOSE

Determining the trajectory of growth in ascending thoracic aortic aneurysm (aTAA) is central to management. Recent work implicates increased growth rates (>1mm/year) with a 2-3X risk of aortic dissection, with guidelines incorporating rapid growth (>3-5mm) as an indication for prophylactic surgical repair, regardless of size. However, a reliable assessment of aortic growth is limited in clinical practice by significant variability in manual diameter measurements (±3-5 mm). Our group has developed vascular deformation mapping (VDM), a validated registration-based image analysis technique that allow for 3D growth measurement with sub-millimeter accuracy using clinical CT angiograms (CTAs). The purpose of this study was to compare the consistency of aTAA growth trajectories measured by manual diameters measurements versus by VDM.

### METHODS AND MATERIALS

We included patients with a chart diagnosis of aTAA without repair, selecting a random sample of 50 patients. Manual diameters were collected by trained 3D lab technicians in all available CTAs including the maximal diameter of the ascending aorta. VDM analysis was conducted between the baseline and every subsequent CTA. Each patient's growth trajectory by both methods was assessed for inconsistency, defined as growth less than -1mm between serial CTAs (biologically implausible). Agreement was assessed by intraclass correlation coefficients (ICC).

### RESULTS

We included 196 non-overlapping intervals from 240 CTAs across 44 aTAA patients (6 excluded for <3 CTAs). Median (IQR) growth across all intervals was 0.0 mm (-0.8, 0.9) for manual measurements vs. 0.2mm (0.0, 0.5) for VDM (p = 0.041), with a median time between CTAs of 1.5 years (1.0, 2.2). 41% (18) of patients had at least one negative growth interval (i.e., <-1mm) by manual measurements, whereas 0 patients showed negative growth by VDM (p <0.01). By manual measurements, 11 patients had >2mm growth intervals, however, these were preceded or followed by negative growth in 8 (73%) cases. By contrast, VDM had 3 patients with >2mm growth intervals, with no preceding or following negative growth. Median growth over the whole follow-up period (median 6.3 years) was 0.3mm (-1.0, 1.4) for manual measurements vs. 0.7mm (0.4, 1.4) for VDM (p =0.03), with an ICC of 0.49 (95% CI: 0.30, 0.63).

### CONCLUSION

Tracking aTAA growth by manual measurements exhibits high variability compared to VDM, with most negative and positive growth intervals (73%) likely due measurement error with manual approaches.

### CLINICAL RELEVANCE/APPLICATION

The current clinical practice of manual diameter measurements in monitoring ascending aortic aneurysm is unable to reliably differentiate stability from growth, a significant limitation to characterizing disease progression over time.

## M6-SSVA02-4 AORTIC TORTUOSITY AS A GENOTYPE-ASSOCIATED MARKER OF MORTALITY IN LOEYS-DIETZ SYNDROME

Joao A. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Harry Dietz (*Abstract Co-Author*) Nothing to Disclose
Bharath Ambale-Venkatesh, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Co-founder, Third Eye Health Inc;Research Grant, Myocardial Solutions, Inc
Stefan L. Zimmerman, MD (*Abstract Co-Author*) Consultant, Siemens AGSupport, Siemens AG
Shadi Afyouni, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Patients with Loeys-Dietz (LDS) syndromes are susceptible to dilation of the proximal aorta and other vascular segments leading to a higher prevalence of aneurysms and dissections. LDS is secondary to mutations in genes involved in the transforming growth factor beta pathway, with aggressive genotypes associated with severe morbidity and mortality. Our goal was to assess the utility of different markers of aortic shape in predicting mortality as compared to aortic diameter.

### METHODS AND MATERIALS

This retrospective study used the PMCOE database (Precision Medicine Center of Excellence - Aortopathies) at Johns Hopkins. All patients with LDS since 2005 with a CT angiography were included in this study. Clinical and follow-up data was obtained from electronic medical records, and all patients included had genotypic classification. Images were loaded into Slicer 3D, and TotalSegmentator was used to segment the aorta and adjacent vessels. Users corrected the segmentation as needed. The vascular modeling toolkit (VMTK) was used for generating centerlines and geometric parameters such as aortic volume, tortuosity, mean curvature, maximum cross-sectional diameter (CSd), and the diameter of the maximum inscribed sphere (MISd). Patients were followed up every 1-2 years to assess their status. Hazard ratios (HR) from Cox regression adjusted for age and gender assessed the association of imaging markers with mortality. Ideal cut-offs were chosen using a classification and regression tree. $P<0.05$ was considered significant.

### RESULTS

In all, 102 patients were included in the study - and were distributed across the 6 LDS subtypes 1 to 6 - 23, 43, 10, 14, 10, and 2 respectively. Patients with LDS type 2 had the highest tortuosity and CSd, followed by those with LDS type 1. LDS types 3 and 6 had the smallest diameters and lowest aortic tortuosity. Over the follow-up period, there were 22 deaths. LDS types 1, 2, and 4 had 5, 16 and 1 deaths respectively with no deaths recorded in the other groups. Tortuosity was the only parameter that was independently associated with mortality both univariately (HR: 1.93, $p=0.024$) and after adjustments for age and gender (HR:1.98, $p=0.032$). There was an observed interaction between gender and tortuosity. Females with high tortuosity (more than 1.55) were at a higher risk of mortality as compared to males ($p<0.05$).

### CONCLUSION

Aortic tortuosity was associated with aggressive genotypes and mortality in LDS patients. Females with high tortuosity were at a particularly high risk of mortality as compared to males, and females with low tortuosity.

### CLINICAL RELEVANCE/APPLICATION

Imaging markers play a critical role in the surveillance of LDS patients and tortuosity may potentially be a more useful marker than currently used measures of aortic dimension.

## M6-SSVA02-6 ASSESSMENT OF THE THORACIC AORTA AFTER ASCENDING AORTIC SURGERY USING 3D MODIFIED RELAXATION-ENHANCED ANGIOGRAPHY WITHOUT CONTRAST AND TRIGGERING

Kenan Kaya, MD (*Abstract Co-Author*) Nothing to Disclose
Carsten H. Gietzen, MD (*Abstract Co-Author*) Nothing to Disclose
David C. Maintz, MD (*Abstract Co-Author*) Nothing to Disclose
Thorsten Persigehl, MD (*Abstract Co-Author*) Nothing to Disclose
Robert Terzis, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Kottlors (*Abstract Co-Author*) Nothing to Disclose
Roman J. Gertz, MD (*Abstract Co-Author*) Institutional research contract, Koninklijke Philips NV
Robert Hahnfeldt (*Abstract Co-Author*) Nothing to Disclose
Jan Paul Janssen, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander C. Bunck (*Abstract Co-Author*) Nothing to Disclose
Lenhard Pennig, MD (*Presenter*) Speakers Bureau, Koninklijke Philips NV;Institutional Grant, Koninklijke Philips NV

### PURPOSE

Relaxation-Enhanced Angiography without Contrast and Triggering (REACT) is a novel 3D isotropic flow-independent non-contrast-enhanced MRA (non-CE-MRA) sequence and has already shown promising results in imaging of the thoracic aorta, primarily in patients without prior aortic surgery. Hence, its performance after ascending aortic surgery is unknown. The purpose of this study was to evaluate the performance of REACT in patients after surgery of the ascending aorta by performing an intraindividual comparison to CE-MRA.

### METHODS AND MATERIALS

This retrospective single center study included 38 consecutive MRI studies of 17 patients (mean age at first examination 50.20±13.80 years, 11 (64.71%) female) after ascending aortic surgery. MRI was performed at 1.5T using a standardized protocol comprising modified REACT (ECG- and respiratory-triggering, Compressed SENSE factor 9, nominal scan time: 2:11 min, reconstructed resolution 0.8 × 0.8 × 0.9 mm3) and 3D CE-MRA. Independently, two radiologists measured vessel diameters and evaluated image quality (5-point scale, 5=excellent) for the following levels (inner-edge): mid-graft, distal landing zone, ascending aorta, aortic arch, and descending aorta. Additionally, readers evaluated MRAs for the presence of aortic dissection (AD) and graded the quality of depiction as well as their diagnostic confidence using 5-point scales (5=excellent).

### RESULTS

David procedure was performed in 6 (35.29%), Bentall procedure in 7 (41.18%), and supracoronary ascending aorta replacement in 4 (23.53%) patients. Overall, vessel diameters were larger in CE-MRA compared to REACT (total acquisition time: 05:42±00:38 minutes), albeit without statistical significance (CE-MRA: 28.79±4.02 vs. REACT: 28.65±4.05, $p=.36$). Image quality for all levels combined was higher in REACT (median [IQR] 3 [3-4] vs. 4 [3-4], $p=.052$), with statistically significant difference at mid-graft (3 [3-4] vs. 4 [4-4], $p<.001$) and ascending aorta (3 [3-4] vs. 4 [3-4], $p=.02$). Using CE-MRA as the standard of reference, readers detected all cases of AD (Stanford A: 15 (82.35%); Stanford B: 3 (17.65%)) in REACT with equal quality of depiction (4 [3-5] vs. 4 [3-4], $p=.45$) and diagnostic confidence (4 [4-4] vs. 4 [3-4]), $p=.15$) in both sequences.

### CONCLUSION

REACT enables fast and reliable imaging of the thoracic aorta after ascending aortic surgery with superior image quality compared to CE-MRA at the aortic graft without diagnostic compromise regarding the detection of AD.

### CLINICAL RELEVANCE/APPLICATION

This study indicates the feasibility of REACT for assessment of the thoracic aorta after ascending aortic surgery and expands its clinical use for gadolinium-free MRA to these patients.

# Abstract Archives of the RSNA, 2024

M6-STCE1

**Science Session (Theranostics)**

Monday, Dec. 2 1:30PM - 2:00PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## M6-STCE1-2 DEVELOPMENT OF A THERAGNOSTIC RADIOPHARMACEUTICAL FOR PANCREATIC CANCER

Anuja Konda (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this research is to develop a radiotheragnostic strategy targeting claudin-4 (CLDN4), a tight junction protein highly upregulated in pancreatic cancer, with a radiolabeled peptide for the diagnostic imaging and treatment of pancreatic cancer. We identified a CLDN4 binding peptide (C4BP) fragment with high affinity and conjugated a chelator at the N-terminus of the peptide to incorporate 64Cu (half-life: 12.7h) for diagnostic imaging and 177Lu (half-life: 6.7 days) for therapy. In vivo studies have been conducted to evaluate the 64Cu-labeled CLDN4 peptides in mouse models of pancreatic cancer. We aimed to assess the accumulation, clearance and intratumoral distribution of 64Cu-labeled C4BP (64Cu-C4BP), along with co-injected non-labeled C4BP (blocking), in xenograft mouse model of pancreatic cancer from PET/CT images.

### METHODS AND MATERIALS

PET/CT scans of mice bearing pancreatic cancers were analyzed using Siemens Inveon Research Workplace. The tumor region of interest (ROI) was drawn based on anatomical information from CT and functional information from PET. The following ROIs were assessed for accumulation and clearance of radiolabeled peptides: left tumor, right tumor, muscle (identified in quadriceps), blood (identified in ventricles), left and right kidney. ROI data is exported as percent injected does per gram (%ID/g) or standardized uptake value (SUV).

### RESULTS

Using the ROIs that were drawn on blood, tumors, muscle, kidneys, and bladder, time activity curve (TAC) was generated as a plot of %ID/g over multiple time frames. While the 64Cu-C4BP clearance from blood pool was similar between two groups, PET image thresholding at 5%ID/g of maximum radioactivity showed significantly greater tumor uptake in mice injected with 64Cu-C4BP ($p<0.01$) compared to 64Cu-C4BP in blocking group co-injected with excess C4BP. 64Cu-C4BP was cleared through the kidneys and bladder as shown by the steady increase and accumulation over time (min), but there was no significant difference in accumulation between the blocking and non-blocking studies. Blood demonstrated the fastest clearance of the peptide at all the timepoints.

### CONCLUSION

64Cu-C4BP was retained well in tumor expressing CLDN-4 receptors representing pancreatic cancer tumors. Co-injection of excess non-labeled C4BP blocked tumor accumulation demonstrates that 64Cu-C4BP binding is specific to CLDN4. Therefore, in pancreatic cancer xenograft model, we were able to confirm the specificity of C4BP to CLDN4.

### CLINICAL RELEVANCE/APPLICATION

We can translate these findings to develop the therapeutic approach. Future research endeavors will explore developing this C4BP for therapeutic use by switching the isotope to 177Lu as treatment for pancreatic cancer.

## M6-STCE1-3 EQUIPPING BACTERIA WITH A VISUALLY THERAPEUTIC NANOCOATING FOR THE INTEGRATION OF DIAGNOSIS AND TREATMENT

Shi-Xiong Chen (*Presenter*) Nothing to Disclose

### PURPOSE

Oral probiotic therapy has been considered as an effective strategy for treating intestinal dysbiosis-associated diseases. Monitoring the treatment process to understand the relationships between microbiome regulation and disease progression is valuable but remains a formidable challenge. Current bacterial modification strategies fail to address issues of low bioavailability, limited therapeutic responses, and difficulty in visualization simultaneously.

### METHODS AND MATERIALS

Here, the use of a visually therapeutic nanocoating is reported to enable the integrated diagnosis and treatment of oral probiotics. Specifically, inspired by the biomineralization in nature, the probiotics were wrapped in a calcium carbonate/manganese dioxide/ferric oxide hybrid nanocoating by sequential triple biointerface mineralization.

### RESULTS

Following administration, the outermost calcium carbonate layer of the coating can rapidly neutralize gastric acid via a spontaneous double-decomposition reaction, facilitating the adaptive release of manganese dioxide/ferric oxide dual-mineralized bacteria. This process enhances the stability of the newly

exposed layer and protects the encapsulated probiotics from harsh gastric conditions. Upon reaching the lesion site, the manganese dioxide/ferric oxide layer can act as nanozymes with superoxide dismutase and catalase activities, achieving increased synergistic therapeutic effects with probiotics. Meanwhile, the layer can also serve as a contrast agent of T1 and T2 dual-mode magnetic resonance imaging, allowing visualization of the probiotics and disease treatment progression in vivo. The integrated diagnostic and therapeutic potential of the triple mineralized probiotics has been demonstrated in both a Salmonella-induced mouse model of colitis and an apolipoprotein E-deficient mouse model of atherosclerosis.

## CONCLUSION

In summary, we have reported the utilization of a visually therapeutic nanocoating to integrate diagnosis and treatment for oral probiotics. The probiotics wrapped in a hybrid nanocoating of $CaCO_3$, $MnO_2$, and $Fe_2O_3$ are fabricated through sequential triple biointerface mineralization. Upon oral ingestion, the triple mineral coating acts as a physical barrier, with the outermost $CaCO_3$ layer reacting spontaneously with gastric acid to neutralize it rapidly and adaptively release the $MnO_2/Fe_2O_3$ dual-mineralized bacteria. This process enhances the stability of the newly exposed coating and protects the encapsulated probiotics from harsh gastric conditions. At the lesion site, $MnO_2/Fe_2O_3$ dual-mineralized coating functions as a nanozyme with SOD and CAT activities, reducing inflammation, eliminating ROS, and synergizing with probiotics for enhanced therapeutic effects. Additionally, $MnO_2/Fe_2O_3$ coating acts as an MRI contrast agent, enabling T1 and T2 dual-mode imaging, thereby allowing visualization of the in vivo distribution of probiotics and monitoring the progression of related disease treatments. Both a Salmonella-induced mouse model of colitis and an ApoE-/- mouse model of AS have demonstrated the concurrent diagnostic and therapeutic potential of triple mineralized probiotics.

## CLINICAL RELEVANCE/APPLICATION

This work will provide new insights and potential solutions for developing innovative microbial theranostic agents for treating flora disturbance-associated intestinal and extraintestinal diseases.

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# Abstract Archives of the RSNA, 2024

M6-STCE2

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Monday, Dec. 2 1:30PM - 2:00PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## M6-STCE2-1 ADDED VALUE OF THE MDIXON-QUANT MRI SEQUENCE AS ONE-STEP EXAM IN RESEARCH WITH RESPECT TO TIME, ENERGY CONSUMPTION AND CLINICAL BENEFITS

Thuy Mai Luu (*Abstract Co-Author*) Nothing to Disclose
Lena Ahmarani (*Abstract Co-Author*) Nothing to Disclose
Anne Monique Nuyt (*Abstract Co-Author*) Nothing to Disclose
Anik Cloutier (*Abstract Co-Author*) Nothing to Disclose
Ramy El-Jalbout (*Abstract Co-Author*) Nothing to Disclose
Alexander Mavromatis (*Presenter*) Nothing to Disclose

### PURPOSE

The mDIXON-Quant MRI sequence is valued for delivering several different quantitative measurements efficiently. Its rapid acquisition and low energy footprint make it more valuable in research settings. In this perspective, in preterm birth, the mDIXON-Quant as a one time sequence measures transverse relaxation rate (R2*), reflecting deoxyhemoglobin levels and fat fraction (FF) in both the liver and kidneys. Typical abdominal MRIs sequences give less clinical information and consume significant energy contributing notably to greenhouse gas emissions. This study aims to 1) highlight the energy benefits of the mDIXON-Quant sequence, and to 2) demonstrate its benefits and efficiency for both liver and kidney evaluation in young adults born preterm as a one-step exam in research settings.

### METHODS AND MATERIALS

A prospective observational study was conducted on a subgroup of the Health of Adults born Preterm Investigation (HAPI) cohort. Energy consumption during the acquisition of the mDIXON-Quant sequence was recorded using energy consumption meter (kWh) and compared to that of a VIBE T1 sequence using Philips Ingenia 1.5T MRI system. R2* and FF measurements were made in the renal cortex and medulla of all kidney poles. FF was also measured in the liver.

### RESULTS

An analysis demonstrated that a single mDIXON-Quant sequence takes 82 seconds, with a total energy expenditure of 0.670 kWh, compared to a VIBE T1 sequence, consuming 1.204 kWh in 153 seconds. Seventy-four adults born preterm (mean age 29.91 years) and 69 born at term (mean age 29.08 years) were recruited. mDIXON-Quant feasibility was 97.2% with excellent intra- and inter-operator reproducibility for all the quantitative measures. Mean R2* values of the right kidney cortex and medulla were lower in preterm adults compared to term adults (18.7 ± 2.67 /s vs 19.9 ± 2.88 /s, p=0.01 and 20.5 ± 2.68 /s vs 21.4 ± 2.53 /s, p=0.045 respectively). Preterm adults had higher though not significant liver FF than term controls.

### CONCLUSION

mDIXON-Quant sequence is a rapid and energy efficient method for assessing liver and renal structural changes using 2 reproducible parameters R2* and FF in a one-step MRI exam in young adults born preterm in the research setting. The decreased renal R2* values in preterm group indicate glomerular hyperfiltration, an early sign of renal damage.

### CLINICAL RELEVANCE/APPLICATION

Rapid and efficient, this technique delivers more information in a single sequence with improved time and less energy consumption. It supports sustainable healthcare at all levels including early diagnosis of kidney and liver disease contributing to research advancements with reproducible measurements.

## M6-STCE2-2 PUTTING CARBON EMISSION RISK IN PERSPECTIVE OF RADIATION AND CLINICAL RISK IN COMPUTED TOMOGRAPHY

Ehsan Samei, PHD (*Abstract Co-Author*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc
Liesbeth Vancoillie, PhD (*Abstract Co-Author*) Nothing to Disclose
Mina Mohammadi (*Abstract Co-Author*) Nothing to Disclose
Francesco Ria, DMP (*Presenter*) Metis Health Analytics

**PURPOSE**

Energy production impacts climate change, causing a significant number of excess deaths, and Computed Tomography (CT) represents one of the largest energy intensive consumer procedure in medicine. However, next to the risk induced by energy consumption and production, there are other risks related to CT practice, namely the radiation risk and the risk associated with a misdiagnosis. To guide policymakers and healthcare professionals in the effort of reducing the patient detriment, it is essential to gauge all the risks associated with a radiological procedure. In this study we calculated and compared the risks induced to the patient by energy consumption, radiation exposure, and misdiagnosis in clinical CT.

**METHODS AND MATERIALS**

Using a previously reported method and informed by census data, we simulated a dataset of 1 million CT studies for the investigation of localized stage liver cancer. Per each patient, we calculated organ-specific radiation doses and the Risk Index according to BEIR-VII report. Then, the related radiation exposure-induced mortality was calculated, giving the so-called radiation risk. The clinical risk was calculated as the expected life-expectancy loss for an incorrect diagnosis for different age, sex, and race, with a typical false positive rate of 5%, and average radiologist interpretative performance of 0.75 AUC. Lastly, the carbon emission risk was calculated by combining known energy consumption data per CT scan and the related mortality cost. The average radiation, clinical, and carbon emission risks were compared in terms of mortality per 100 studies.

**RESULTS**

The average radiation risk for the simulated population was 9.3×10-3 deaths per 100 patients and the average clinical risk was 5.4×10-2 deaths per 100 patients. The average energy consumption for abdominal CT studies was reported in 10.3 kWh, including 1.2 kWh for CT active usage, 0.8 kWh for the cooling system, and 8.2 kWh for idle time. The associated carbon emission (CO2) was 4.3 kg, corresponding to 9.1×10-5 excess induced deaths per 100 patients.

**CONCLUSION**

The risk induced by carbon emission associated with CT energy consumption is small when compared with radiation and clinical risks. Energy sustainable practice should be implemented in radiology without compromising the CT procedure performance in terms of radiation dose and effective diagnosis.

**CLINICAL RELEVANCE/APPLICATION**

Putting carbon emission risk in perspective of radiation and clinical risk in radiology can inform the implementation of sustainable practices without compromising patient safety.

## M6-STCE2-3 SPARKLE: A MULTICENTER, OPEN-LABEL STUDY TO EVALUATE THE SAFETY AND DIAGNOSTIC EFFICACY OF ACE-MBCA IN PATIENTS WITH KNOWN OR SUSPECTED FOCAL LIVER LESIONS AND SEVERE RENAL IMPAIRMENT

Alvin C. Silva, MD (*Presenter*) Scientific Advisory Committee, HealthMyne, Inc;Consultant, Exact Sciences Corporation;Research Grant, Ascelia Pharma AB

**PURPOSE**

ACE-MBCA (Ascelia Pharma Manganese Based Contrast Agent, proposed trade name Orviglance), is an oral contrast agent developed for liver MRI. Given the known risks of Gd-based contrast agents, including Gd retention and NSF, developing non-Gd agents is a new frontier in MR imaging. More than 35 million Americans live with renal disease, and those with severe renal disease are particularly exposed to risks associated with Gd. This phase 3 study evaluates the safety and efficacy of ACE-MBCA in patients with known or suspected focal liver lesions and severe renal impairment, potentially enhancing health equity in an underserved population that will benefit from a targeted imaging solution.

**METHODS AND MATERIALS**

This global study was approved by relevant institutions and conformed to current GCP guidelines. Informed patient consent was obtained. Patients (N=85) with known or suspected focal liver lesions and severe renal impairment received a liver MRI before and 4±1 h after the administration of ACE-MBCA (800 mg). The primary analysis, improvement in visualization of focal lesions was evaluated by 3 independent readers by qualitative scoring of the change in two co-primary variables, lesion contrast (LC) and border delineation (BD) (scores from 1= poor to 4= excellent). Safety was assessed at 24 (± 4) h, 48 (± 4) h, and 5 (± 2) days post-dose.

**RESULTS**

The primary analysis showed highly significant ($p<0.001$) improvement of the mean LC and BD scores in combined MRI (CMRI: combined contrast-enhanced + unenhanced MRI) compared to unenhanced MRI: Across the 3 readers, the mean (SD) LC increased by 0.65 (0.622) to 0.95 (0.824) score points and mean (SD) BD was increased by 0.81 (0.678) to 1.02 (0.909) score points.No patients were withdrawn from the study. The most reported post dose AEs were mild to moderate nausea (16.1%), diarrhea (13.8%), vomiting (9.2%), and blood urea increased (3.4%). No drug-related serious AE or deaths were reported.

**CONCLUSION**

ACE-MBCA 800 mg provides significant improvement in focal lesion visualization over unenhanced MR and was safe for patients with suspected or known liver lesion and severe kidney impairment.

**CLINICAL RELEVANCE/APPLICATION**

Using manganese as an MR contrast agent may benefit patients lacking alternatives to Gd-based agents or unenhanced MR. This targeted approach supports equitable healthcare for underserved populations, ensuring all patients receive necessary care. Following further development, ACE-MBCA has the potential to be used in a broader population and thereby reduce Gd release into the environment and water supply.

# Abstract Archives of the RSNA, 2024

M7-SSCH04

**Chest Imaging (MR and Dose Reduction)**

Monday, Dec. 2 3:00PM - 4:00PM Room: E451A

Patricia J. Mergo, MD (*Moderator*) Nothing to Disclose
Jonathan A. Liu, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M7-SSCH04-5 ADVANCED LUNG IMAGING WITH PHOTON-COUNTING DETECTORS: INSIGHTS FROM THERMOLUMINESCENCE DOSIMETRY

Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Carsten Hackenbroch, MD (*Abstract Co-Author*) Nothing to Disclose
Simone Schuele, MD (*Abstract Co-Author*) Nothing to Disclose
Tobias Wech (*Abstract Co-Author*) Nothing to Disclose
Meinrad J. Beer, MD (*Abstract Co-Author*) Nothing to Disclose
Henner Huflage, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Thermoluminescence dosimetry allows for precise assessment of effective radiation dose. The objective of this study was to investigate the absolute dose burden of photon-counting detector (PCD) lung CT with ultra-high-resolution (UHR) and standard mode with and without organ-based tube current modulation (OBTCM).

### METHODS AND MATERIALS

An anthropomorphic Alderson-Rando phantom was scanned in UHR and standard mode with and without OBTCM on three dose levels each (IQ 5 [Sn 100 kVp], IQ 20 and IQ 50 [both Sn 140 kVp]). The effective radiation dose was determined by thermoluminescent dosimetry in 13 measurement sites and compared with the calculated effective dose derived from the dose-length product. Criteria of image quality (image noise and sharpness) were evaluated independently by six radiologists using an equidistant 7-point scale. Additionally, the modulation transfer function was compared among protocols using a dedicated line-pair phantom.

### RESULTS

Measured effective radiation exposure as the sum of weighted organ doses did not differ substantially between UHR and standard mode with and without OBTCM (IQ 5: 0.31-0.33 mSv, IQ 20: 1.42-1.54 mSv, IQ 50: 3.41-3.62 mSv). Compared with the “effective dose” calculated from the dose-length product, the measured effective doses were 108-144% higher. Image noise in lung tissue of UHR images was rated lower compared to standard (all P=0.42) and OBTCM protocols (all P=0.28) on all dose levels. Similarly, image sharpness was also considered higher in UHR than in standard-resolution images with and without OBTCM (all P=0.42). In standard mode, the use of OBTCM had no significant effect on either dimension of subjective image quality (all P=0.99). Modulation transfer function analysis confirmed the highest spatial frequency in UHR datasets on each dose level.

### CONCLUSION

In PCD-CT, UHR image acquisition entails no effective dose disadvantage over standard mode despite resulting in superior image quality. Meanwhile, the dose saving potential of OBTCM over standard protocols is minimal.

### CLINICAL RELEVANCE/APPLICATION

Thermoluminescence dosimetry revealed substantially higher effective doses than calculation from the dose-length products included in the automatically scanner-generated report.

## M7-SSCH04-6 CT TAKES THE LEAD WITH LOWER DOSES THAN CONVENTIONAL X-RAY: CHEST CT AT 0.098 MSV

Sonja Kandel, MD (*Abstract Co-Author*) Nothing to Disclose
Jonatas Favero Prietto Dos Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Eric Salomon, RT (*Abstract Co-Author*) Nothing to Disclose
Sam Santiago (*Abstract Co-Author*) Nothing to Disclose
Sean Carey (*Abstract Co-Author*) Nothing to Disclose
Patrik Rogalla, MD, MBA (*Presenter*) Institutional Research Grant, Canon Medical Systems Corporation;Institutional Research Grant, KA Imaging

### PURPOSE

To explore the combination of a primary silver beam filter (Ag+) with deep-learning reconstruction to achieve an effective radiation dose below 0.1 mSv for non-contrast chest CT in adults.

## METHODS AND MATERIALS

81 patients who underwent a CT-guided chest biopsy (Canon Aquilion Prism) were included in this study with research ethics board approval. Prior to the patients' departure from the CT table, an ultra-low dose (ULD) chest CT was obtained to rule out complications using the following parameters based on body weight (BW) groups: 120 kV, 20 mAs for BW < 90 kg (group I), 30 mAs for BW 90-120 kg (group II), and 40 mAs for BW >120 kg (group III). An additional 0.5 mm silver filter was employed to harden the X-ray energy spectrum. Images were reconstructed using deep-learning reconstruction (AiCE, Canon Medical Systems). All patients received a chest X-ray 1h after the procedure end (standard-of-care). Reporting radiologists evaluated the clinical suitability of the CT images using a dedicated reporting template, considering both post-biopsy diagnostic criteria and subjective adequacy for clinical interpretation, as well as the potential need for higher dose CT. The dose-length products (DLP, scout and helical) and the dose-area product (DAP, chest X-ray) were recorded.

## RESULTS

The mean/standard deviation (SD) of the DLP in mGy*cm for the scout views and helical in all patients, in group I (n=49), II (n=28), and III (n=4) were 1.2/0.02 and 8.6/2.39, 1.2/0.01 and 7.0/0.68, 1.2/0.04 and 10.4/1.34, and 1.2/0.0 and 14.9/1.65, respectively. Utilizing conversion factors of 0.014 mSv/(mGycm) for DLP and 0.16 mSv/(Gy*cm2) for DAP, the effective radiation doses in CT/X-ray (p-value) for all patients, group I, II, and III were 0.12/0.15 ($p<0.001$), 0.098/0.13 ($p<0.001$), 0.15/0.19 ($p<0.001$), and 0.21/0.21 ($p=0.93$) mSv, respectively. On average, the scout view in CT increased the dose in all patients, group I, II, and III by 13.9%, 17.1%, 11.5%, and 8.0%, respectively. All CT scans were deemed suitable for clinical interpretation, with reporting radiologists not recommending a higher dose for any patient.

## CONCLUSION

By combining an additional silver beam filter with DLR, the effective radiation dose in non-contrast chest CT can be reduced to dose parity with a single chest X-ray while providing subjectively sufficient image quality for assessing the lung parenchyma post biopsy. Further research is needed to validate these findings across diverse clinical indications and patient populations.

## CLINICAL RELEVANCE/APPLICATION

For a typical adult weighing up to 90kg body weight, the CT radiation dose can be reduced to less than 0.1 mSv while maintaining diagnostic image quality for excluding post chest biopsy complications, equivalent to a single chest X-ray.

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# Abstract Archives of the RSNA, 2024

M7-SSNMMI03

**Nuclear Medicine and Molecular Imaging (Neuroendocrine Tumors)**

Monday, Dec. 2 3:00PM - 4:00PM Room: S405

Katherine A. Zukotynski, MD, PhD (*Moderator*) Research Consultant, Konica Minolta, Inc;Research Consultant, General Electric Company;Speakers Bureau, Jubilant DraxImage Inc
Cristina S. Matushita, MD, MSc (*Moderator*) Nothing to Disclose

**Sub-Events**

## M7-SSNMMI03-1 STRUCTURED REPORTING FOR THE DIAGNOSIS OF NEUROENDOCRINE TUMOR (NET) IN $^{18}$F-SIFALIN-TATE PET/CT - IMPACT ON QUALITY AND INTERDISCIPLINARY COMMUNICATION

Freba Grawe, MD (*Abstract Co-Author*) Nothing to Disclose
Johannes Ruebenthaler, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Hinterberger (*Presenter*) Nothing to Disclose

### PURPOSE

Our retrospective single-center study aims to evaluate the impact of structured reporting (SR) using a self-developed template on report quality compared to conventional free-text reporting (FR) in 18F-SiFAlin-TATE Positron Emission Tomography/Computer Tomography (PET/CT) for the primary staging and therapy monitoring of patients diagnosed with neuroendocrine tumors (NET).

### METHODS AND MATERIALS

We included 50 patients who underwent 18F-SiFAlin-TATE-PET/CTs for NET staging. FR reports were generated post-examination and compared to SR reports, which were composed retrospectively using a self-developed template within an established software tool (Smart Reporting). All findings were evaluated by a radiologist and a surgeon through a questionnaire to determine their contribution to facilitating clinical decision-making and to assess their completeness, linguistic quality, and overall quality.

### RESULTS

In SR the rate of missing at least one key feature was significantly lower than in FR with missing information in 51% of FR vs. 11% of SR ($p < 0.001$). SR significantly increased the capacity of facilitating therapy decision-making from 32% in FR to 55% in SR ($p<0.001$). Trust in the report was significantly higher in SR with a mean of 5.0 (SD= 0.5) vs. 4.7 (SD= 0.5) for FR ($p < 0.001$). SR received significantly higher mean ratings regarding linguistic quality with 4.7 for SR vs. 4.4 for FR ($p =0.004$) and overall report quality with a mean of 4.9 for SR vs. 4.6 for FR ($p < 0.001$).

### CONCLUSION

Using SR over traditional FR enhances the overall quality of reports in 18F-SiFAlin-TATE-PET/CTs for NET staging, serving as a tool to streamline clinical decision-making and enhance interdisciplinary communication in the future.

### CLINICAL RELEVANCE/APPLICATION

The enhancement in report quality not only reduces the likelihood of missing key information but also facilitates more informed and confident clinical decision-making, thereby fostering greater trust in the reported findings and improving interdisciplinary communication to simplify the process of making treatment decisions.

## M7-SSNMMI03-2 AN AUTOMATED PHEOCHROMOCYTOMA AND PARAGANGLIOMA LESION SEGMENTATION AI-MODEL FOR WHOLE-BODY $^{68}$GA-DOTATATE PET/CT IMAGE

Peter L. Choyke, MD (*Abstract Co-Author*) Nothing to Disclose
Philip Eclarinal (*Abstract Co-Author*) Nothing to Disclose
Liza Lindenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Carrasquillo, MD (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Harmon, PhD (*Abstract Co-Author*) Nothing to Disclose
Frank I. Lin, MD (*Abstract Co-Author*) Nothing to Disclose
Esther Mena, MD (*Abstract Co-Author*) Nothing to Disclose
Fahmida Haque, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Pheochromocytoma and paraganglioma (PHEOs/PGLs) are rare neuroendocrine tumors (NET), which can lead to extensive metastases in the whole body and can be surgically inoperable. Positron emission tomography (PET) with computed tomography (CT) imaging-targeting somatostatin receptor 68Ga-DOTATATE is frequently used to assess patients with PHEOs/PGLs. Currently, imaging physicians rely on qualitative assessments of tumor burden

parameters after manual segmentation of tumor lesions, which is a tedious and time-consuming process. The goal of this study is to develop a deep learning-based automated lesion segmentation artificial intelligence (AI) model for whole-body 3D DOTATATE-PET/CT and automate the tumor burden calculation.

**METHODS AND MATERIALS**

In this study, 129 68Ga-DOTATATE PET/CT scans from 38 patients with inoperable PHEOs/PGLs were split into 55, 14, and 60 scans, from 15, 5, and 18 patients for training, validation, and test sets, respectively. 3D full resolution nnUNet configuration (3D_FullRes) was trained with 5-fold cross-validation. The model's performance was evaluated on the test set for lesion segmentation using dice similarity coefficient (DSC). Both lesion-level and patient-level statistical analysis including total lesion glycolysis (TLG), and metabolic tumor volume (MTV), was conducted to validate the diagnostic performance of the model.

**RESULTS**

The developed 3D_FullRes model achieved an average 5-fold validation DSC of 0.84. The model achieved a DSC of 0.87, a sensitivity of 0.87, and a positive predictive value of 0.88, with 4 median false positive lesions per scan on the test set. The average mean difference with 95% confidence interval and Spearman correlation coefficient between AI-predicted and ground truth (GT) lesions' MTV and TLG were -32.27 (-281.06, 216.53), -395.44 (6072.86, -6863.73), and 0.95 and 0.96 respectively, which was slightly less than GT annotations, because of false negative (FN). Anatomical position-based failure analysis showed that most of the FN lesions (70 out of 504 lesions) were observed in the liver. Due to the high hepatic background and image noise in 68Ga- DOTATATE scans, detection of metastatic lesions in the liver, was difficult for the model.

**CONCLUSION**

The developed deep learning-based lesion segmentation AI model showed promising and reliable performance for the whole-body DOTATATE-PET/CT images, which has the potential to be used by imaging physicians to make the annotation process more efficient.

**CLINICAL RELEVANCE/APPLICATION**

The proposed lesion-segmentation model for DOTATATE PET/CT scan can help imaging physicians in lesion segmentation, tracking progression, and determining better treatment decisions for patients with PHEOs/PGLs.

## M7-SSNMMI03-3 THERAPY GUIDANCE OF177LU DOTA-TATEPRRT IN GEP-NET PATIENTS BY MULTIMODALITY IMAGING

Lena Unterrainer (*Abstract Co-Author*) Nothing to Disclose
Christian Dascalescu (*Abstract Co-Author*) Nothing to Disclose
Matthias P. Fabritius, MD (*Abstract Co-Author*) Nothing to Disclose
Jens Ricke, MD, PhD (*Abstract Co-Author*) Research Grant, Sirtex Medical Ltd;Research Grant, Bayer AG;Research Grant, Terumo Corporation;Research Grant, Boston Scientific Corporation
Clemens C. Cyran, MD (*Abstract Co-Author*) Nothing to Disclose
Felix Herr, MD (*Abstract Co-Author*) Nothing to Disclose
Maurice Heimer, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the incremental diagnostic value Gd-EOB-DTPA MRI of the liver to somtatostatin-receptor (SSR)-PET/CT for response assessment and management of gastroenteropancreatic neuroendocrine tumors (GEP-NET) in patients undergoing 177Lu DOTA-TATE Peptide Receptor Radionuclide Therapy (PRRT).

**METHODS AND MATERIALS**

In this single center retrospective study, we reviewed patients undergoing PRRT for GEP-NET between 2012-2023. 178 patients (78 female, mean 63.4 years) who were treated with at least two consecutive cycles of PRRT were included. Therapy response was assessed by SSR-PET/CT after 2 (~6 months) and 4 PRRT-cycles (~12 months) using RECIST 1.1 criteria as well as multidisciplinary team (MDT) review. All metastases were grouped by region, size and SSR-conversion ("flip-flop" phenomenon). Also, findings were compared to available Gd-EOB-DTPA liver MRI after 2 (n=52) and after 4 PRRT cycles (n = 118).

**RESULTS**

At baseline, whole body SSR PET/CT revealed NET metastases in the liver in 80.1% of cases, in the head and neck area in 28.1%, the thoracic region in 55.1%, the lower extremities in 7.3% and in the upper extremities in 7.9% of cases. SSR-PET/CT detected progressive disease (PD) in 9 and 10 patients, compared to 10 and 14 patients at MDT after 2 cycles and 4 cycles of PRRT, respectively. Isolated extra-abdominal PD was detected in 1 patient (0.5%) after two cycles of PRRT and 1 patient (0.7%) after 4 cycles of PRRT. PD was associated with hepatic PD in 90.0% / 92.6% cases after 2 cycles and 4 cycles of PRRT respectively. Gd-EOB-DTPA liver MRI detected all patients with progressive hepatic disease, revealing SSR-PET/CT occult hepatic PD in n=4 patients after 4 cycles of PRRT. Among patients with PD, SSR-PET/CT demonstrated a "flip-flop" phenomenon in 2 patients (0.9%) after 2 cycles and 1 patient (0.7%) after 4 cycles of PRRT.

**CONCLUSION**

Our results demonstrate that PD is observed in less than 10% of patients with GEP-NET undergoing PRRT after both 2 and 4 cycles of PRRT and is associated with hepatic PD in more than 90% of cases. Gd-EOB-DTPA liver MRI had improved sensitivity for liver evaluation, resulting in MDT upstaging of four patients after 4 cycles of PRRT compared to SSR-PET/CT alone. Tumor dedifferentiation and isolated extrahepatic disease progression detected in SSR-PET/CT were rare.

**CLINICAL RELEVANCE/APPLICATION**

Gd-EOB-DTPA MRI of the liver presents as overall promising response assessment strategy in patients with GEP-NET undergoing PRRT. Considering cumulative life-time radiation dose and associated costs SSR-PET/CT may be reserved to selected cases and troubleshooting. Further studies to evaluate the imaging strategy are warranted.

## M7-SSNMMI03-6 PREDICTORS OF OVERALL SURVIVAL AFTER $^{177}$LU DOTATATE THERAPY

Ann Packard, MD (*Abstract Co-Author*) Nothing to Disclose
Blake Kassmeyer (*Abstract Co-Author*) Nothing to Disclose
Geoffrey Johnson, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Patrick Navin, MBBCh, FFR(RCSI) (*Abstract Co-Author*) Nothing to Disclose
Derek R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Brendan W. Lunn, MD (*Abstract Co-Author*) Nothing to Disclose
Ayse T. Karagulle Kendi, MD (*Abstract Co-Author*) Investigator, Novartis AG

David J. Bartlett, MD (*Abstract Co-Author*) Nothing to Disclose
Gokce Belge Bilgin, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy J. Hobday (*Abstract Co-Author*) Nothing to Disclose
Matthew P. Thorpe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Corrie Bach, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick McGarrah (*Abstract Co-Author*) Nothing to Disclose
Matthew Johnson (*Abstract Co-Author*) Nothing to Disclose
Thorvardur Halfdanarson (*Abstract Co-Author*) Research Consultant, Curium SAS;Research Consultant, Lexicon Pharmaceuticals, Inc;Research Consultant, Advanced Accelerator Applications SA;Research Grant, Ipsen SA;Research Grant, Thermo Fisher Scientific Inc
Brian J. Burkett, MD, MPH (*Presenter*) Nothing to Disclose

## PURPOSE

177Lu DOTATATE is a radionuclide therapy for metastatic enteropancreatic neuroendocrine tumors, administered in a course of four cycles eight weeks apart. Many patients treated with 177Lu DOTATATE have a complex medical history including cytopenia, renal function impairment, and multiple previous treatment modalities. We aim to characterize prognostic features associated with overall survival following 177Lu DOTATATE treatment.

## METHODS AND MATERIALS

Consecutive patients (n=98) treated with 177Lu DOTATATE for metastatic enteropancreatic neuroendocrine tumors were retrospectively reviewed. Clinical and imaging data prior to treatment, number of cycles administered, and overall survival from the start of radionuclide therapy were recorded. Cox proportional hazards regression estimated a hazard ratio (HR) for baseline predictors of survival, adjusted for therapy completion status. Groups of participants who underwent complete (=4 cycles) and incomplete therapy (< 4 cycles) were compared. Linear model ANOVA or Pearson's Chi-squared test were used to compare categorical and continuous variables, respectively (alpha = 0.05).

## RESULTS

Prior to the start of 177Lu DOTATATE, statistically significant predictors of overall survival include lymph node metastasis, baseline hemoglobin, previous external beam radiation, largest lesion diameter, body mass index, and functional status (Figure). Expected prognostic variables of age and time from initial diagnosis to the start of therapy were also statistically significant predictors of overall survival. Kaplan Meier survival curves demonstrate significantly different overall survival comparing those who do (n=78) and do not (n=20) complete all four cycles of therapy (HR 4.6, 95% CI 2.7-8.1) (Figure). Statistically significant factors associated with early discontinuation of 177Lu DOTATATE included age, baseline hemoglobin, functional status, body mass index, and estimated glomerular filtration rate.

## CONCLUSION

Patients with nodal metastasis, previous radiation treatment, lower hemoglobin, lower body mass index, poor functional status, or inability to complete the four cycles of therapy had worse survival outcomes following 177Lu DOTATATE. The group of patients who did not complete therapy had worse survival outcomes than those who did. Although it may still be appropriate to treat patients with risk factors for poor survival prognosis, this may inform patient counseling discussions.

## CLINICAL RELEVANCE/APPLICATION

Patient characteristics at the start of treatment may predict overall survival following 177Lu DOTATATE therapy. Those who did not complete therapy had significantly worse survival outcomes and may represent a distinct population with poor prognosis.

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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

M7-SSNR05

**Neuroradiology (Cognition and Memory)**

Monday, Dec. 2 3:00PM - 4:00PM Room: S406B

Chad W. Farris, MD, PhD (*Moderator*) Nothing to Disclose
Daniel A. Murphy, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M7-SSNR05-1 HIGHER BRAIN IRON LEVELS IN THE OLDER ADULT ARE ASSOCIATED WITH ELEVATED TRANSVERSE RELAXATION RATE ($R_2$) IN GRAY MATTER AND MORE WHITE MATTER HYPERINTENSITIES: AN EX-VIVO MRI, NEUROPATHOLOGY AND MASS SPECTROMETRY STUDY

Julie A. Schneider, MD (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Arfanakis, PhD (*Abstract Co-Author*) Nothing to Disclose
David A. Bennett, MD (*Abstract Co-Author*) Nothing to Disclose
Md Tahmid Yasar, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

Higher iron in brain is a source of free radicals that causes oxidative stress which has been linked to cognitive impairment, dementia and age-related pathologies including Alzheimer's disease among older adults. The aim of this study was to investigate the association of iron levels with relaxation rate, R2, and white matter hyperintensities (WMH), independent of the effects of other trace metals and neuropathologies.

### METHODS AND MATERIALS

Cerebral hemispheres from 437 older adults participating in the Rush Memory and Aging Project were imaged ex vivo using 3T MRI scanners. R2 maps were generated from multi-echo spin-echo data and then registered to an ex vivo brain template. WMH were segmented based on T2-weighted images. WMH volume was normalized by the total hemisphere volume and then log-transformed. Following ex vivo MRI, all hemispheres underwent pathologic assessment including Aß plaques, neurofibrillary tangles, hippocampal sclerosis, Lewy bodies, cerebral amyloid angiopathy, gross infarcts, microinfarcts, atherosclerosis, arteriolosclerosis and TDP-43 pathology.Inductively coupled plasma mass spectrometry (ICP-MS) was used to measure brain trace metal levels. The assessed metals included iron, boron, titanium, manganese, copper, zinc, selenium, rubidium, molybdenum and mercury.Linear regression was used to test the association of R2 and WMH burden with iron levels. All models were controlled for all other trace metals and pathologies listed above, demographics (age at death, sex, years of education), the presence of the APOE-e4 allele, postmortem interval to fixation and imaging and scanners. Statistical analysis was performed using PALM, with tail-accelerated 5000 permutations. Statistical significance was set at $p<0.05$ after family wise error rate correction.

### RESULTS

The voxel-wise analysis revealed a spatial pattern of higher R2 for higher brain iron levels, particularly in gray matter. The pattern included basal ganglia structures such as the globus pallidus, caudate and putamen, and cortical regions including the precentral, postcentral and occipital cortex. Higher lobar and total WMH burden also showed statistically significant positive association with brain iron levels. No negative associations were observed.

### CONCLUSION

This investigation combined ex vivo MRI, neuropathology and ICP-MS in a community-based older adults and showed that higher brain iron levels were independently associated with elevated R2 in gray matter and higher WMH burden.

### CLINICAL RELEVANCE/APPLICATION

Our work demonstrates the association of brain iron level with gray matter R2 and white matter hyperintensities in older adults. The findings will help to understand the mechanism of brain iron accumulation and its impact in older adults.

## M7-SSNR05-2 THE TRAJECTORY OF OLFACTORY CORTEX DEGENERATION FROM COGNITIVE NORMAL CONTROLS TO ALZHEIMER'S DISEASE

Chunjie Guo, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Olfactory dysfunction serves as a potential biomarker for early detection and progression of Alzheimer's Disease (AD). We aim to validate olfactory impairments and further explore the trajectory of olfactory cortex degeneration, from cognitive normal controls (NCs) to mild cognitive impairment (MCI) and AD.

### METHODS AND MATERIALS

In this study, 42 individuals with AD, 35 with MCI, and 28 with NC were recruited. Based on the clinical and multimodal MRI dataset, including individual structural MRI (grey matter volume, GMV and white matter volume, WMV), resting-stated functional MRI (amplitude of low-frequency fluctuation, ALFF and regional homogeneity, ReHo), and olfactory-task functional MRI (olfactory activation values), as well as neuropsychological assessment and University of Pennsylvania Smell Identification Test (UPSIT), comparisons measured in olfactory-related regions were made among the three groups . Logistic regression was employed to differentiate between the AD, MCI, and NC groups and to further delineate the trajectory of olfactory cortex degeneration from NCs to AD.

### RESULTS

From the NC to individuals with MCI and then to those with AD groups, a consistent pattern emerged, showing declining GMV, WMV, and olfactory activation values, coupled with increased ALFF and ReHo in olfactory subregions. Additionally, corresponding decreases in olfactory and cognitive function assessment scores were evident. Logistic regression analyses revealed an early and pronounced decline in olfactory function, particularly in terms of olfactory activation, as individuals progressed from NC to MCI. Moreover, our finding discovered a quadratic accelerated atrophic trajectory in the olfactory cortex from MCI to AD.

### CONCLUSION

Olfactory deficits are evident throughout the AD trajectory. Functional MRI (fMRI), especially olfactory fMRI, stands out as a pivotal tool for early detection, particularly during the MCI stage, which could help a comprehensive understanding of AD development and offer a potential biomarker for the progressive trajectory of AD.

### CLINICAL RELEVANCE/APPLICATION

Olfactory deficits play a significant role in the progression of AD and are evident even in its early stages. This study indicates that functional MRI, especially olfactory-task fMRI, is crucial for early AD detection, particularly during the transition from normal cognition to MCI. These findings point to the potential of olfactory measures as biomarkers for tracking AD, underscoring the importance of early and precise detection methods for the disease.

## M7-SSNR05-3 BRAIN ARTERIOLOSCLEROSIS IS ASSOCIATED WITH LOWER GRAY MATTER VOLUME

Konstantinos Arfanakis, PhD (*Abstract Co-Author*) Nothing to Disclose
Julie A. Schneider, MD (*Abstract Co-Author*) Nothing to Disclose
David A. Bennett, MD (*Abstract Co-Author*) Nothing to Disclose
Mahir Tazwar, BS (*Abstract Co-Author*) Nothing to Disclose
Md Tahmid Yasar, BSc (*Abstract Co-Author*) Nothing to Disclose
Ana Tomash (*Presenter*) Nothing to Disclose

### PURPOSE

Brain arteriolosclerosis, characterized by vessel wall thickening and arteriolar stenosis, is a common pathology of cerebral small vessel disease. It shows a higher prevalence among older adults and increased severity in women and black individuals. It is linked to decreased cognitive and motor function and increased dementia risk. This study investigates the relationship between brain arteriolosclerosis and regional gray matter volumes in a large cohort of community-based older adults.

### METHODS AND MATERIALS

The ex-vivo MRI and neuropathological data from 882 older adults were collected from four aging studies: the Rush Memory and Aging Project, Religious Orders Study, Minority Aging Research Study, and Clinical Core of the Rush Alzheimer's Disease Research Center. Cerebral hemispheres obtained at autopsy were imaged ex-vivo with a multi-echo spin-echo sequence (ME-SE) (0.6 × 0.6 × 1.5mm3) on 3T clinical MRI scanners about one month postmortem. Gray and white matter were segmented, and gray matter was divided into 42 regions using multi-atlas segmentation. Each volume was normalized by cerebral hemisphere volume. Following ex-vivo MRI, a detailed neuropathologic assessment was performed on pathologies including arteriolosclerosis, atherosclerosis, cerebral amyloid angiopathy, gross and microscopic infarcts, Alzheimer's pathology, Lewy bodies, limbic-predominant age-related TDP-43 encephalopathy neuropathological change (LATE-NC), and hippocampal sclerosis.The association between brain arteriolosclerosis and regional gray matter volumes (normalized by cerebral hemisphere volume), while controlling for all other neuropathologies, demographic variables (age at death, sex, years of education), postmortem intervals, and the scanner was investigated by utilizing linear regression. Statistical analysis was performed using FSL's PALM tool with 10,000 permutations. The significance level was established at $p<0.05$ after correcting for multiple tests using the false discovery rate (FDR).

### RESULTS

More severe brain arteriolosclerosis was associated with lower volume in several gray matter regions, including medial orbitofrontal, superior frontal, pericalcarine, cuneus, and lateral occipital areas, independently of the effects of other neuropathologies.

### CONCLUSION

The given study illustrated that brain arteriolosclerosis is associated with lower volume in multiple gray matter regions independently of the effects of other vascular or neurodegenerative pathologies.

### CLINICAL RELEVANCE/APPLICATION

The finding enriches our comprehension of the brain anomalies associated with this common small vessel disease pathology and may improve prediction performance of ARTS, a novel in-vivo marker of arteriolosclerosis.

## M7-SSNR05-4 THE ASSOCIATION BETWEEN BODY FAT LOCALIZATION, INSULIN RESISTANCE, AND AMYLOID BURDEN IN MIDLIFE

Nancy Hantler (*Abstract Co-Author*) Nothing to Disclose
Caitlyn Nguyen (*Abstract Co-Author*) Nothing to Disclose
Bettina Mittendorfer (*Abstract Co-Author*) Nothing to Disclose
Sara Hosseinzadeh Kassani (*Abstract Co-Author*) Nothing to Disclose
Abigayl McBee-Kemper (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC
John Morris (*Abstract Co-Author*) Research support, Eli Lilly and CompanyConsultant, Eli Lilly and Company
Paul Commean (*Abstract Co-Author*) Nothing to Disclose

Mahshid Naghashzadeh (*Abstract Co-Author*) Nothing to Disclose
Tammie S. Benzinger, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company;Investigator, Eli Lilly and Company;Investigator, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Research Grant, Siemens AG;Consultant, ADM Diagnostics, LLC;Speakers Bureau, Biogen Idec Inc;Advisory Board, Biogen Idec Inc
Shaney Flores, BS (*Abstract Co-Author*) Nothing to Disclose
Jake Weeks, BS (*Abstract Co-Author*) Nothing to Disclose
Cyrus Raji, MD, PhD (*Abstract Co-Author*) Consultant, Brainreader ApS;Consultant, Neuroevolution, LLC;Consultant, Apollo Health
Joseph E. Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yifei Xu (*Abstract Co-Author*) Nothing to Disclose
Lakisha Lloyd (*Abstract Co-Author*) Nothing to Disclose
Esther Lu (*Abstract Co-Author*) Nothing to Disclose
Mahsa Dolatshahi, MD, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

Obesity in midlife is a risk factor for developing Alzheimer disease later in life. However, the metabolic and inflammatory effects of body fat vary based on its anatomical localization. In this study, we aimed to investigate the association of MRI-derived abdominal visceral and subcutaneous adipose tissue (VAT and SAT), liver proton-density fat fraction (PDFF), thigh fat-to-muscle ratio (FMR), and insulin resistance with whole-brain amyloid burden in cognitively normal midlife individuals.

**METHODS AND MATERIALS**

A total of 62 cognitively normal midlife individuals (Age: 50.35 years, 61.3% female, BMI: 32.30 kg/m2, 53.2% obese) underwent brain PET scan, body MRI, and metabolic assessment. Homeostatic Model Assessment for Insulin Resistance (HOMAIR) was used for measuring insulin resistance. Dynamic amyloid imaging was performed with a bolus injection of ~15mCi [11C]PiB, and a 60-min scan. Data from the 30-60 minute post-injection window was used for calculating whole-brain amyloid Centiloid. VAT and SAT were semi-automatically segmented using an in-house MATLAB-based software. The PDFF maps were generated from liver chemical shift encoded MR images and segmented using a 3D CNN model and manual correction. After preprocessing and N4ITK bias correction on mid-thigh slices between the ischial ramus and the medial knee condyle, an in-house MATLAB program was used for segmenting thigh total fat (subcutaneous, inter-, and intra-muscular fat) and muscle volumes. Total thigh fat-to-muscle ratio (FMR) was calculated. Using linear regression, the association between Centiloid and BMI, HOMAIR, VAT, SAT, PDFF, and FMR was assessed, with age and sex as covariates.

**RESULTS**

Obese individuals had higher Centiloids compared to the non-obese ($p=0.008$). Centiloids were significantly associated with VAT (Adj-$R^2=0.25$, $p<0.0001$), HOMAIR (Adj-$R^2=0.08$, $p=0.02$), SAT (Adj-$R^2=0.08$, $p=0.02$), and BMI (Adj-$R^2=0.09$, $p=0.01$), but not other fat metrics. A mediation analysis showed that the effects of BMI on Centiloid is fully mediated by VAT (ACME= 0.282, $p <2e-16$, and ADE= 0.061, $p=0.56$) and there is a significant direct effect of VAT (ADE=0.0104, $p<2e-16$) on amyloid burden, not explained by HOMAIR (ACME=-0.003, $p=0.86$).

**CONCLUSION**

Obesity, higher visceral fat, and to a lesser extent insulin resistance, BMI, subcutaneous fat, but not liver or thigh fat, are associated with higher whole-brain amyloid in midlife. This highlights the importance of anatomical characterization of body fat for Alzheimer risk, where obesity-related amyloid pathology is fully explained by visceral fat.

**CLINICAL RELEVANCE/APPLICATION**

Modifying visceral adipose tissue can be considered to reduce obesity-related risk of Alzheimer pathology in midlife years before its development.

## M7-SSNR05-5 NORMAL AGEING-RELATED BRAIN MORPHOLOGICAL SUBNETWORKS WERE DIFFERENTLY INTERACT WITH MULTIPLE NEUROLOGICAL DISEASES

Li Yuna, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Zhizheng Zhuo (*Presenter*) Nothing to Disclose

**PURPOSE**

How ageing interacts with various neurological diseases at the brain network level remains unclear.

**METHODS AND MATERIALS**

We collected 2770 healthy controls aged 20-90 years and 1121 patients with neurological diseases, including MCI, AD, PD, SVD and MS. First, to define the ageing-related subnetworks, we constructed individual MCN in the HC group and decomposed the MCN into distinct subnetworks using ICA. Ageing-related subnetworks were defined as subnetworks that had significant associations with age. Second, to characterize the relationships between the ageing-related subnetworks and multiple neurological diseases, we spatially correlated ageing-related subnetworks with disease-related MCN disruption via age- and sex-matched case-control analyses. Third, to determine the clinical significance of the ageing-related subnetworks, we calculated the regression coefficients of the ageing-related subnetworks for each individual MCN of patient group using linear regression. The regression coefficients of the ageing-related subnetworks were further correlated with specific clinical variables. Finally, annotated biological maps were utilized to advance the biological interpretation of ageing-related subnetworks .

**RESULTS**

(1) Three ageing-related subnetworks, including default mode network-predominant (DMNpre), dorsal attention network-predominant (DANpre) and somatomotor network-predominant (SMNpre), exhibited heterogeneous trajectories, in which the loading of the DMNpre subnetwork increased with ageing, while the loading of the DANpre and SMNpre subnetworks decreased with ageing. (2) Distinct relationships between the ageing-related subnetworks and MCN disruption in various neurological diseases were observed;(3) Ageing-related subnetworks were associated with cognitive scores of MCI and AD , MRI disease burden of SVD , and physical disability and language ability of MS. (4) Glucose metabolism and several neurotransmitters were possibly biological factors driving the identified age-related subnetworks.

**CONCLUSION**

Ageing-related subnetworks were identified, correlated with brain network disruptions and clinical variables of multiple neurological diseases, and used to identify potential therapeutic targets for diseases.

**CLINICAL RELEVANCE/APPLICATION**

(1)The present study offers a new dimension to understand the complex ageing process. (2)The ageing-related subnetworks may serve as network markers capable of discriminating normal ageing effects from disease-specific mechanisms, and for disease monitoring and evaluation. (3)Biological explanation for the ageing-related subnetworks provide a clue for alleviating the adverse effects of ageing on neurological diseases

## M7-SSNR05-6 CLEAR ASSOCIATION BETWEEN BOTH AMYLOID AND VASCULAR PATHOLOGIES WITH ENHANCED PERIVASCULAR SPACES

Yejin Hwang (*Abstract Co-Author*) Nothing to Disclose
Wha-Jin Lee (*Abstract Co-Author*) Nothing to Disclose
Woo Sik Kim (*Abstract Co-Author*) Nothing to Disclose
Roh-Eul Yoo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joon-Kyung Seong (*Abstract Co-Author*) Nothing to Disclose
Sun Won Park, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seung Hong Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yelim Yang (*Abstract Co-Author*) Nothing to Disclose
Jun-Hee Kim, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The malfunction of the glymphatic system, marked by increased MRI-visible Perivascular Spaces (PVS), is suggested to contribute to the accelerating of amyloid accumulation in Alzheimer's Disease (AD). However, while PVS is also commonly observed in Vascular Dementia (VD), the specific pathological variances in regional PVS between AD and VD remain largely unexplored. In this study, we examined these pathology-driven localization patterns using automated PVS segmentations from T2-weighted MRI within a mixed dementia cohort.

### METHODS AND MATERIALS

Total 99 cognitively unimpaired (CU) and 190 cognitively impaired (CI) patients were included from the Seoul National University Dementia cohort. Expert radiologists visually assessed 18F-Florbetaben PET, FLAIR, and SWI images to categorize CI patients into four groups based on both amyloid and vascular-damage burden (26 A-VB-, 63 A-VB+, 26 A+VB-, and 75 A+VB+). PVS segmentation entailed masking and thresholding hyperintense vessel structures using slice-wise Frangi filters on T2-weighted MRIs, targeting the basal ganglia (BG) and cerebral white matter (WM), segmented into four major lobes (frontal, parietal, temporal, and occipital). PVS volume fractions (PVS-VF) were computed as voxel counts normalized by intracranial volumes. Groupwise disparities were assessed using two-sample t-tests, with adjustments made for multiple comparisons.

### RESULTS

The accuracy of automated segmentations was verified against manually segmented PVS volumes at BG and WM (rank correlation coefficients: 0.634, 0.539). In the A+ groups, significant increases in PVS-VF were observed within the temporal and occipital lobes compared to CU, consistent with previous visual rating studies. Conversely, the VB+ showed significant PVS-VF increases across all lobes compared to CU. Specifically, the BG demonstrated the most distinct PVS expansion associated with VD, with notably higher PVS-VF in the VB+ compared to their VB- counterparts. Intriguingly, there were no significant increases in PVS volume ratios for lobar regions and BG in the A-VB+, while all A+ groups demonstrated significant increases in the temporal and occipital regions compared to CU.

### CONCLUSION

To leverage PVS as a biomarker for distinguishing glymphatic dysfunctions in AD, a comprehensive understanding of their characteristics within these contexts is essential. The cross-sectional differentiation of regional PVS localization in AD could serve as a foundational step toward elucidating these associations within the AD continuum.

### CLINICAL RELEVANCE/APPLICATION

This study reveals distinct regional PVS patterns in AD and VD, enhancing our understanding of the correlation between glymphatic dysfunctions marked as PVS patterns and the AD continuum.

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# Abstract Archives of the RSNA, 2024

M7-SSNR06

**Neuroradiology (Techniques and Methods: Other Techniques)**

Monday, Dec. 2 3:00PM - 4:00PM Room: E450B

Kambiz Nael, MD (*Moderator*) Consultant, Canon Medical Systems Corporation;Consultant, Brainomix Limited
Jessica L. Houk, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## M7-SSNR06-1 GADOQUATRANE: PHARMACOKINETICS IN HEALTHY VOLUNTEERS AND PATIENTS WITH CNS LESIONS IN COMBINATION WITH MR IMAGING IN COMPARISON TO GADOBUTROL SUPPORT DOSE SELECTION FOR THE NOVEL TETRAMERIC GBCA (Kuo York Chynn Neuroradiology Research Award)

Gabriele Sutter, PhD (*Abstract Co-Author*) Employee, Bayer AG
Birte M. Hofmann, DVM, PhD (*Abstract Co-Author*) Employee, Bayer AG
Mark Klemens, MD (*Abstract Co-Author*) Employee, Bayer AG
Petra Palkowitsch (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of the Phase 1 and 2 studies was to select the gadoquatrane dose for further development by using signal enhancement data in relation to dose in healthy volunteers (HV) together with clinical efficacy in patients with CNS lesions, supported by gadolinium (Gd) plasma concentration-time data (PK) from both studies.

### METHODS AND MATERIALS

Two single-blind, cross-over studies were conducted, one Phase (Ph) 1 in healthy volunteers receiving 3 different doses of gadoquatrane (0.01, 0.03, 0.06 mmol Gd/kg) and one Ph 2 in patients with known or highly suspected CNS lesions receiving gadoquatrane at a dose of 0.04 mmol Gd/kg. Gadobutrol was used as comparator at a dose of 0.1 mmol Gd/kg and Gd plasma concentrations were determined by Inductively Coupled Plasma Mass Spectrometry after each GBCA injection at 3 time points post injection (p.i.; 20-60 min, 2-4 h and 6-8 h). In the Ph 2 study an additional sample was collected at 24h p.i.. The dose-response relationship of gadoquatrane in HVs was assessed as relative signal enhancement (RSE) and compared with the RSE after gadobutrol injection. RSEs were determined in 5 regions of the head and neck area (carotid artery, parotid gland, sagittal sinus, sigmoidal sinus, submandibular gland) representing different degrees of vascularization. Dose-response curves were established individually per region by linear regression at 5-, 10- and 15-minutes p.i. using a Bayesian method of inverse regression. In the Phase 2 study, overall diagnostic preference and non-inferiority of lesion visualization parameters at 5 min p.i. were used to confirm the dose.

### RESULTS

For all 5 regions gadoquatrane demonstrated a linear increase in RSE with dose. For each region the equivalent dose was less than half the Gd dose of gadobutrol, in line with the more than 2-fold higher relaxivity (r1) of gadoquatrane. Dose-normalized plasma Gd concentrations for both GBCAs were almost equivalent demonstrating very similar PK. Based on this, the starting dose of 0.04 mmol Gd/kg was selected for Ph2, which was confirmed by the overall image preference and non-inferiority of the lesion visualization parameters. Dose-normalized plasma concentration-time curves were essentially the same in HVs and patients with CNS lesion vs gadobutrol.

### CONCLUSION

The aggregated results of both studies confirmed that the common mode of action, relaxivity and pharmacokinetic behavior allow to select a Gd dose that will yield adequate clinical efficacy as confirmed by the Ph 2 study to lead the way into Ph 3 of clinical development and beyond.

### CLINICAL RELEVANCE/APPLICATION

The novel, tetrameric macrocyclic gadoquatrane is a promising GBCA in development for MRI and MRA at a substantially reduced Gd (by 60%) and molecule dose (by 90%) compared to established macrocyclic GBCAs.

## M7-SSNR06-2 DEVELOPMENT AND VALIDATION OF A HISTOLOGICALLY INFORMED SEGMENTATION PROTOCOL FOR ANTERIOR MEDIAL TEMPORAL LOBE CORTICES ON MRI

Murray Grossman, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Corey McMillan (*Abstract Co-Author*) Nothing to Disclose
Winifred Trotman (*Abstract Co-Author*) Nothing to Disclose
Sandra Cebada-Sanchez (*Abstract Co-Author*) Nothing to Disclose
Jose Carlos Delgado Gonzalez (*Abstract Co-Author*) Nothing to Disclose
John A. Detre, MD (*Abstract Co-Author*) Research Consultant, CuraSen Therapeutics, Inc;Research Consultant, Cerecin Inc;Medical Advisor, Hura Imaging, LLC
David A. Wolk, MD (*Abstract Co-Author*) Research Consultant, General Electric Company;Instructor, Haymarket Media, Inc;Speaker, Quintiles Medical Education, Inc;Instructor, Quintiles Medical Education, Inc

Amanda Denning (*Abstract Co-Author*) Nothing to Disclose
Ranjit Ittyerah (*Abstract Co-Author*) Nothing to Disclose
Karthik Prabhakaran (*Abstract Co-Author*) Nothing to Disclose
Dylan Tisdall, PhD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Insausti Serrano (*Abstract Co-Author*) Nothing to Disclose
Daniel Ohm (*Abstract Co-Author*) Nothing to Disclose
Eunice Chung (*Abstract Co-Author*) Nothing to Disclose
Maria Del Mar Arroyo Jimenez (*Abstract Co-Author*) Nothing to Disclose
Sydney Anne Lim (*Abstract Co-Author*) Nothing to Disclose
Monica Munoz Lopez (*Abstract Co-Author*) Nothing to Disclose
David Irwin (*Abstract Co-Author*) Nothing to Disclose
Madigan Bedard (*Abstract Co-Author*) Nothing to Disclose
Paul Yushkevich, PhD (*Abstract Co-Author*) Investigator, KinetiCor, Inc
John Trojanowski (*Abstract Co-Author*) Nothing to Disclose
Shokufeh Sadaghiani (*Abstract Co-Author*) Nothing to Disclose
Edward Lee (*Abstract Co-Author*) Nothing to Disclose
Laura Wisse (*Abstract Co-Author*) Nothing to Disclose
Niyousha Sadeghpour, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The anterior portion of the medial temporal lobe (MTL) is one of the first regions targeted by pathology in sporadic Alzheimer's disease (AD)indicating a potential for this region to be used as a valuable imaging biomarker. However, most existing automated approaches for MTL segmentation do not incorporate anterior MTL subregions, and the few that do fail to account for complex anatomical variability of this region. Leveraging a unique postmortem dataset consisting of histology and MRI scans we aimed to develop an anatomically valid segmentation protocol for anterior entorhinal cortex (ERC), Brodmann Area (BA) 35, and BA36 and apply it for automated MTL segmentation of in vivo 3 tesla (T) MRI.

**METHODS AND MATERIALS**

We enrolled 20 cases between 61 to 97 years of age (50% females) including individuals both with and without neurodegenerative diseases (11 vs. 9 cases) to ensure broad generalizability of the developed protocol. Serial coronal Nissl-stained histology sections of the MTL from these cases were digitized, registered to same-subject 0.2x0.2x0.2-mm3 9.4T postmortem MRI and annotated by an expert neuroanatomist. To develop the segmentation protocol, we determined the location of cytoarchitectonic borders of interest in relation to anatomical landmarks observable on in vivo MRI. The protocol was first applied manually to 29 3T in vivo MRI scans and then used to train an automatic segmentation method, Automatic Segmentation of Hippocampal Subfields (ASHS)-T1. Intra-rater reliability of a manual rater and five-fold cross-validation accuracy of ASHS-T1 were assessed with the Dice Similarity Index (DSI).

**RESULTS**

We developed segmentation rules for the borders of ERC, BA35 and BA36 based on systematic analysis of inter-landmark distances on histological sections. The intra-rater reliability for the manual rater applying these rules to 15 in vivo 3T MRI scans was high, with the DSI ranging from 0.85 to 0.88. However, cross-validation of automated segmentations with ASHS-T1 against the manual segmentation showed moderate reliability (DSI ranging from 0.67 to 0.78), reflecting the challenging anatomy of this region. Notably, segmentation accuracy for the entire MTL, including the newly added region, remained comparable to the previously reported accuracy for the MTL (DSI: 0.79).

**CONCLUSION**

We developed a reliable, and anatomically valid segmentation protocol for the anterior MTL cortices and incorporated it in an automated approach.

**CLINICAL RELEVANCE/APPLICATION**

Our protocol makes automated segmentation of anterior MTL regions on 3T MRI feasible. Given the vulnerability of these regions to tau deposition in AD, we expect this updated automated pipeline will help generate improved imaging biomarkersfor early AD.

## M7-SSNR06-3 REGIONAL MAPPING OF HUMAN BRAIN SODIUM USING ANATOMICALLY-GUIDED RECONSTRUCTION OF DUAL ECHO SODIUM-23 MR IMAGES

Ying-Chia Lin (*Abstract Co-Author*) Nothing to Disclose
Georg Schramm (*Abstract Co-Author*) Nothing to Disclose
Fernando E. Boada, PhD (*Abstract Co-Author*) Nothing to Disclose
Yvonne W. Lui, MD (*Abstract Co-Author*) Nothing to Disclose
Johan Nuyts, PhD (*Abstract Co-Author*) Nothing to Disclose
Yongxian Qian (*Abstract Co-Author*) Founder, General Labs Cloud, LLC
Alaleh Alivar, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

23Na-MRI provides unique in-vivo ionic information relevant to a host of neurological diseases. However, challenges with low signal-to-noise have made it difficult to provide accurate quantitative measures of tissue sodium. Here, we attempt to map regional total sodium concentration in the human brain using our novel anatomically-guided reconstruction (AGR) method that employs a proton (1H) T1w image as anatomical information to address both spatial resolution and partial volume effect (PVE). The mapping was compared against standard reconstruction (SR).

**METHODS AND MATERIALS**

20 healthy subjects were scanned on a 3T MRI scanner (Prisma, Siemens) using a dual-tuned (1H-23Na) birdcage coil, TPI sequence (TR=100ms, TE1/TE2=0.5/5ms), and 1H T1w MPRAGE. AGR was performed with previously optimized regularization parameter =2.0. SR was performed on k-space data from the TPI trajectory using re-gridding algorithm with compensation for non-uniform sampling. Coregistration was done with rigid simpleITK. Sodium images were calibrated using vitreous humor (145 mmol/L) and air (0 mmol/L) as internal references. Total Sodium Concentration (TSC) was calculated in lobar cortical gray matter (GM), subcortical GM, callosal and whole brain white matter (WM). Paired Sampled T-test was used to compare regional TSC between AGR and SR.

**RESULTS**

We observed a significant increase in SNR with visible WM and GM boundaries on AGR images ($p<0.001$). Differences between GM and WM TSC were more evident using AGR compared to SR with significantly higher values in GM (48.1±2.8 mmol/L) compared to WM (30.6±2.5 mmol/L) ($p<0.001$) in line with previous studies, possibly due to improved ability of AGR to resolve PVE. TSC in subcortical GM regions was more variable and fell between measures for cortical GM and WM depending on the region, likely relating to variable mix of GM and WM in subcortical nuclei. Cortical measures were more

consistent across brain lobes. Unlike for WM and subcortical GM regions, there were no significant differences in cortical GM TSC between two methods; possibly relating to opposing PVE from CSF and WM occurring in the SR for measures of cortical sodium.

**CONCLUSION**

In this study, we are able to address PVE in low resolution 23Na-MRI followed by improved TSC quantifications in different brain regions including WM, cortical and subcortical GM using the novel AGR method. This work provides a foundation for future investigation of ionic changes in the setting of neurological disease.

**CLINICAL RELEVANCE/APPLICATION**

Brain sodium content is vital for neuronal function and understanding of neurological disease; This novel approach improves in vivo 23Na-MRI quantification, previously unattainable.

## M7-SSNR06-5 MQSM: MULTITASK LEARNING-BASED QUANTITATIVE SUSCEPTIBILITY MAPPING FOR IRON ANALYSIS IN BRAIN

Junjie He (*Abstract Co-Author*) Nothing to Disclose
Rongpin Wang, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Quantitative analysis of brain iron is widely utilized in neurodegenerative diseases, typically accomplished through the utilization of quantitative susceptibility mapping (QSM) and medical image registration. However, this approach heavily relies on registration accuracy, and image registration can alter QSM values, leading to distorted quantitative analysis results. This study employs a deep learning-based multimodal whole-brain segmentation instead of registration, thereby achieving accurate analysis of whole-brain iron quantification without altering QSM values.

**METHODS AND MATERIALS**

The article employs 65 MRI subjects matched between T1 and QSM for deep learning modeling. This paper proposes a multi-modal multitask QSM reconstruction algorithm (mQSM) and introduces a mutual Transformer mechanism (mTrans) to efficiently fuse multi-modal information for QSM reconstruction and brain region segmentation tasks. The proposed mTrans leverages Transformer computations on Query and Value feature matrices for mutual attention calculation, eliminating the need for additional computational modules and ensuring high efficiency in multi-modal data fusion.

**RESULTS**

Experimental results demonstrate an average dice coefficient of 0.92 for segmentation, and QSM reconstruction achieves an SSIM evaluation of 0.9854 compared to the gold standard. Moreover, segmentation-based (mQSM) brain iron quantitative analysis shows no significant difference from the ground truth in all 115 brain regions, whereas the registration-based approach exhibits notable differences in brain cortical regions compared to the ground truth.

**CONCLUSION**

Results from segmentation-based brain iron quantification are more effective than the registration-based. This research provides an all-in-one method for QSM reconstruction and brain iron quantification analysis.

**CLINICAL RELEVANCE/APPLICATION**

The proposed mQSM enables precise quantification of iron deposition in 115 brain regions, providing an opportunity for assisting the diagnosis of neurodegenerative diseases.

## M7-SSNR06-6 ALTERATIONS IN BRAIN CONNECTIVITY PATTERNS AMONG PREMENSTRUAL SYNDROME PATIENTS FOLLOWING IMMEDIATE TRANSCUTANEOUS VAGUS NERVE STIMULATION AT VARIED FREQUENCIES

Yinqi Lai, BS, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Premenstrual Syndrome (PMS) periodically causes significant distress in women and may lead to depression. Characterized by physical pain and emotional disturbances. Transcutaneous vagus nerve stimulation (tVNS) is a non-invasive neuromodulation technique that has shown promising results in pilot studies for treating pain and depression. However, its precise neurophysiological mechanisms remain unclear. This study evaluates the intrinsic connectivity networks in PMS patients, examining changes in brain connectivity patterns and their clinical correlations following immediate frequency-varied tVNS applications.

**METHODS AND MATERIALS**

A total of 71 PMS patients and 81 healthy controls were recruited. Baseline evaluations measured sex hormone and inflammatory cytokine levels. Participants received immediate 2Hz, 25Hz, and sham tVNS treatments during the late luteal phase, accompanied by pre- and post-treatment resting-state functional MRI scans. Brain connectivity changes were analyzed using degree centrality (DC) and seed-based functional connectivity (FC).

**RESULTS**

At baseline, PMS patients exhibited higher scores in somatic symptoms, emotional disturbances, and sleep issues. Although no significant hormonal differences were noted compared to controls. PMS patients showed higher inflammatory markers and altered connectivity in pain and emotion-related brain areas, such as increased right putamen DC and altered FC in the right orbital inferior frontal gyrus, right orbital middle frontal gyrus, and right superior temporal gyrus. Post-treatment, 25Hz tVNS notably enhanced connectivity in the Striato-Cortical Circuit, particularly between the right caudate and right anterior cingulate, demonstrating more effective modulation compared to 2Hz. No significant changes were observed with sham tVNS.

**CONCLUSION**

PMS is associated with enhanced nodal properties in the right putamen and altered functional connectivity in emotion and pain-related brain areas. This study highlights the potential of tVNS, especially at 25Hz, to effectively modulate brain circuits involved in PMS, providing insights into its mechanisms and clinical benefits.

**CLINICAL RELEVANCE/APPLICATION**

tVNS represents a promising neuromodulation strategy for treating PMS, with 25Hz applications showing greater efficacy in alleviating symptoms.

# Abstract Archives of the RSNA, 2024

M7-SSPH05

**Physics (Spectral CT)**

Monday, Dec. 2 3:00PM - 4:00PM Room: E353A

Lifeng Yu, PhD (*Moderator*) Nothing to Disclose
Peter B. Noel, PhD (*Moderator*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation

**Sub-Events**

## M7-SSPH05-1 ADVANCING IODINE QUANTIFICATION: THE SYNERGY OF RAPID KVP-SWITCHING X-RAY TUBES AND DUAL-LAYER SPECTRAL CT DETECTORS

Thomas Koehler, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Grace J. Gang, PhD (*Abstract Co-Author*) Nothing to Disclose
Heiner Daerr (*Abstract Co-Author*) Nothing to Disclose
Amy Perkins (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Joseph W. Stayman, PhD (*Abstract Co-Author*) Research Grant, Fischer Medical;Research Grant, General Electric Company;Research Grant, Canon Medical Systems Corporation;Research collaboration, Koninklijke Philips NV;Research collaboration, Siemens AG;Researcher, Varex Imaging Corporation
Ravindra Manjeshwar, PhD (*Abstract Co-Author*) Nothing to Disclose
Roland Proksa (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Kevin M. Brown, MS (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Olivia Sandvold, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Accurate quantitative measurement of low concentration iodine in spectral computed tomography (CT) remains challenging using current technologies. This accuracy is required for the development of clinical biomarkers and to leverage spectrally derived imaging capabilities. This study highlights the performance of a hybrid spectral CT system equipped with a clinical-grade rapid kVp-switching x-ray tube and a dual-layer detector.

### METHODS AND MATERIALS

A spectral CT bench system built with clinical-grade rapid kVp-switching x-ray tube and dual-layer detector (Philips Healthcare) was operated at tube voltages 140/80 kVp, tube current of 570 mA, and three duty cycle ratios from 15/85 to 75/25. This produced three dose levels. A 270 mm diameter polyamide phantom containing eight tissue mimicking inserts (iodine 0.5-20 mg/mL, solid water) was rotated at 1 Hz. Four unique spectral projection channels were available per kVp pair. Three weighting schemes were created to reduce the four spectral channels into two projection inputs for 2D material decomposition. These schemes represented a kVp-switching scheme that included all four channels, an "All 80/HighE 140" weighting scheme which included three channels, and a "maximum separation" scheme which used only two channels: 80 kVp low photon energy and 140 kVp high photon energy spectral information. Photoelectric effect, scatter, iodine density, and virtual non-contrast images were generated. Regions of interest placed on each insert measured the mean and standard deviation value of estimated iodine concentration for each slice. Bias was calculated by taking the difference between measured iodine concentration and expected insert concentration.

### RESULTS

The 15/85 duty cycle scans produced iodine density images with lower average bias across inserts compared to 33/67 and 75/25 duty cycles. Comparing weighting schemes, using the 15/85 duty cycle ratio, maximum separation contained the lowest average bias across all inserts of 0.12 ± 0.11 mg/mL whereas All 80/HighE 140 and kVp-switching schemes contained biases of 0.34 ± 0.22 and 0.30 ± 0.25 mg/mL respectively. The 75/25 duty cycle ratio produced the worst average biases with -1.26 ± 0.97 mg/mL and -1.06 ± 0.84 mg/mL for kVp-switching and maximum separation respectively.

### CONCLUSION

We demonstrate enhanced quantification accuracy, achieving a bias below 0.25 mg/mL, through maximum spectral separation with combined dual-layer and rapid kVp-switching technologies.

### CLINICAL RELEVANCE/APPLICATION

The combination of rapid kVp-switching x-ray tube and dual-layer CT increases spectral separation and enables high sensitivity quantitative iodine imaging strengthening the diagnostic benefit of spectral CT.

## M7-SSPH05-2 HIGH-FIDELITY PREFILTRATION USING A DOUBLE BOWTIE DESIGN FOR QUANTITATIVE LOW-DOSE PEDIATRIC SPECTRAL CT IMAGING

Olivia Sandvold, BS (*Abstract Co-Author*) Nothing to Disclose
Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips

NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Roland Proksa (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Yinglin Ge, BEng (*Presenter*) Nothing to Disclose

**PURPOSE**

Spectral computed tomography (CT) yields more information, benefiting pediatric diagnostic imaging. But existing spectral CT systems are optimized primarily for adults. We hypothesize that an innovative prefiltration concept, termed "double bowtie", combining traditional Teflon with K-edge filtration, will enhance the quantification accuracy of iodinated contrast and reduce radiation dose in pediatric CT imaging.

**METHODS AND MATERIALS**

A spectral CT system with rapid kVp-switching X-ray source in fan-beam geometry was simulated. The incident x-ray was generated at tube voltages of 120/70 kVp, tube current of 100 mA, and duty cycle ratio of 10/90. A circular pediatric-sized phantom of 150 mm diameter was comprised of water [1 g/mL] and 1 mm of iodine [4.93 g/mL]. The reference dose was established using a conventional Teflon bowtie filter. The Cramer Rao lower bound of variance (CRLB) was used to estimate the signal to noise ratio (SNR) in monoenergetic maps after decomposition. The area under mono-energy curve (AUMC) represented the integral of the SNR estimated for each photon energy. Filter thicknesses (0.0-0.4 mm) for three K-edge materials, holmium (Ho), erbium (Er), ytterbium (Yb) were optimized at 0ŗ fan angle without Teflon filtration. The ideal thickness for each K-edge material was determined by maximizing the AUMC. To achieve the reference dose, imaging parameters were adjusted within the system's limitations. After determining ideal system parameters and K-edge filter thickness at the center of the fan angle, our optimization procedure determined a new thickness for the Teflon filter along the fan-beam geometry. This adjustment ensured an equivalent dose compared to the reference system, while maximizing AUMC for the double bowtie design.

**RESULTS**

The optimized combination of characterized K-edge material filters and Teflon bowtie filter with corresponding system settings of the kVp-switching CT system improves AUMC relative to unoptimized system at the same dose. The maximum improvement is 39.8% for 0.242 mm of Ho compared to 34.3% and 10.9% maximum improvement using optimal thickness Er and Yb. To match patient dose compared to reference system, tube currents for the optimal systems were adjusted to 665 mA (Ho), 662 mA (Er), 584 mA (Yb).

**CONCLUSION**

In this study, we demonstrate initial simulation results of a novel double bowtie design enhancing spectral imaging in pediatric diagnostics. Our results illustrate that noise can be significantly reduced using our concept. This improvement in SNR can be leveraged to reduce dose while maintaining current image quality.

**CLINICAL RELEVANCE/APPLICATION**

Given the rise in CT imaging and the vulnerability of pediatric populations, it is crucial to provide high-quality, low-dose spectral CT imaging.

## M7-SSPH05-3 SPECTRAL DEPENDENCE OF LIVER FAT VOLUME FRACTION RELATIONSHIP TO CT NUMBER IN UNENHANCED FAT LESIONS

Yifang Zhou, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Correct assessment of fat volume fraction (FVF) is vitally important for non-alcoholic fatty liver disease. Compared with MRI, CT may be more desirable for FVF quantification due to its lower cost, faster speed, and wider use. Although it is expected that the FVF linearly depends on the CT number (Hounsfield Units- HU) for true monochromatic beams, the linearity can be compromised in reality due to the polychromatic x-ray property. Our objectives were to find the relationship from various single and dual energy settings and to suggest the optimal selections for least FVF errors.

**METHODS AND MATERIALS**

: Six un-enhanced focal fat lesions (0.79- 6.28 cc) with known and clinically relevant FVF (5- 40%) were built in a medium size anthropomorphic liver phantom. Siemens Force and GE Revolution scanners were used for single energy (120 kV) and dual energy acquisitions at CT volume dose index 14 mGy (80 kV/140 kV for GE, 80 kV/150 kV(Sn) and 100 kV/150 kV(Sn) for Siemens). Virtual monochromatic images (40- 140 keV) were obtained from all dual-energy scans. The HU of each lesion was measured using a volume of interest for each monochromatic image set. The final HU values were obtained from the average of the three repeated scans. Similar analysis was performed on single-energy images.

**RESULTS**

The measured HU was found to increase as FVF decreases, but the relationship is not always well characterized with linearity, depending on the choices of dual energy technology and keV values. The deviation from linearity was the worst at 40- 50 keV for both scanners. With the 80 kV/150 kV(Sn) dual energy option, the linear fit showed FVF estimate errors of 3.1% or less at 110 - 140 keV. However, the 100 kV/150 kV(Sn) selection resulted in 10.3% FVF errors at the best at 80 keV. With 80 kV/140 kV fast switch dual energy option, the best linear fits showed 4.8% and 5.1% FVF errors at 90 and 100 keV, respectively. With single energy 120 kV, both scanners showed comparable FVF errors (9.1- 9.5%).

**CONCLUSION**

Optimal virtual monochromatic energy settings were identified to estimate FVF from the CT number using linear relations with RMS errors < 5.1%. The results were more accurate than from the single energy (120 kVp) where the errors were about 9%.

**CLINICAL RELEVANCE/APPLICATION**

Liver fat content quantification for non-alcoholic fatty liver disease

## M7-SSPH05-4 K-EDGE IMAGING IN A FIRST-GENERATION CLINICAL PHOTON-COUNTING CT SYSTEM

Harold I. Litt, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV
David P. Cormode, DPhil, MS (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Stockholder, PolyAurum;Stockholder, Daimroc Imaging
Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Manoj C. Mathew, MD (*Abstract Co-Author*) Nothing to Disclose
Tristan Nowak (*Abstract Co-Author*) Employee, Siemens AG
Michael Grasruck, PhD (*Abstract Co-Author*) Employee, Siemens AG
Jonas Neumann (*Abstract Co-Author*) Nothing to Disclose

Pooyan Sahbaee, PhD (*Abstract Co-Author*) Employee, Siemens AG
Leening Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

Photon-counting computed tomography (PCCT) can uniquely detect and quantify K-edge materials, thereby facilitating clinical applications of dual-contrast imaging to evaluate multiple perfusion states simultaneously. We assess the accuracy of multi-material decomposition with k-edge materials, tungsten (W) and bismuth (Bi) in a first-generation clinical PCCT.

**METHODS AND MATERIALS**

Solutions with different concentrations of iodine (I), W, and Bi were inserted into an anthropomorphic phantom (QRM Abdomen, QRM). These included each material at 10 mg/mL and I and W mixes at 2, 5, and 10 mg/mL. The phantom was then scanned on a PCCT (Naeotom Alpha, Siemens Healthineers) without (20 x 30 cm, small) and with its extension ring (25 x 35 cm, large) at a tube voltage of 140 kVp with energy thresholds of 20, 55, 72, and 90 keV. Three exposure levels (50, 200, 501 mAs) were utilized. From the reconstructed threshold images, three and four material decomposition were implemented to generate material maps of water/I/W and water/I/W/Bi, respectively. Regions of interest were then placed on 10 central slices for each material map to measure mean and standard deviation for each material solution. Additionally, relative error was calculated to examine the accuracy of three and four material decomposition at different phantom sizes and radiation doses.

**RESULTS**

Material maps derived from three and four material decomposition showed accurate results, minimally affected by phantom size and radiation dose. With three material decomposition, water, I, and W maps illustrated comparable average errors between large and small phantoms with errors of -21 ± 26, 0.06 ± 0.24, and 0.9 ± 1.1 and -20 ± 23, -0.2 ± 0.3, and -1.0 ± 0.9 mg/mL, respectively. The addition of Bi improved the accuracy of I and W maps, resulting in errors of -0.06 ± 0.26 mg/mL and 0.09 ± 0.22 mg/mL, respectively. Meanwhile, the relative errors for water and Bi were 26 ± 48 and -1 ± 2 mg/mL, respectively. However, it traded off with significant errors in Bi maps of -5 and -2 mg/mL for W 10 mg/mL and W+I 10 mg/mL, respectively, suggesting challenges in separating W and Bi. Radiation dose exhibited a small effect on quantification with average errors ranging from 0.9 to 1.0 and 0.09 to 0.57 mg/mL for W in three and four material decomposition, respectively.

**CONCLUSION**

PCCT effectively differentiated and quantified water, iodine, tungsten, and bismuth in both three and four material decompositions, with minimal influence from phantom size and radiation dose.

**CLINICAL RELEVANCE/APPLICATION**

Recent PCCT adoption enables diverse applications; precise K-edge material discrimination marks innovative progress, paving the way for advanced simultaneous arterial and portal phase imaging to assess multiple perfusion stages in one scan.

## M7-SSPH05-5 METAL ARTIFACT REDUCTION IN PHOTON COUNTING DETECTOR CT USING FOUR-ENERGY THRESHOLDS

Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Kishore Rajendran, PhD (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Shanblatt, PhD (*Abstract Co-Author*) Employee, Siemens AG
Michael R. Bruesewitz, RT (*Abstract Co-Author*) Nothing to Disclose
Joseph R. Swicklik, RT, BS (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Shaojie Chang, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to investigate the reduction of metal artifacts through the use of high-energy threshold images from a photon-counting detector (PCD) computed tomography (CT), utilizing a four-energy threshold mode.

**METHODS AND MATERIALS**

A 3D-printed spine model with pedicle screws, placed within a 30-cm-wide water phantom, was scanned using a clinical PCD-CT system (NAEOTOM Alpha, Siemens Healthineers), utilizing a four-energy threshold mode (140 kV) with thresholds set at 20, 55, 72, and 90 keV. This setup categorized x-ray photons into four datasets, each representing photons above a specified energy threshold, resulting in four threshold images: T1 (20-140 keV), T2 (55-140 keV), T3 (72-140 keV), and T4 (90-140 keV). T1 images, equivalent to single-energy equivalent (T3D) images on the scanner, utilized all x-ray photons above 20 keV incident on the detectors. Images were reconstructed using the Filtered Back-Projection (FBP) algorithm with a 3 mm slice thickness and a quantitative (Qr40) kernel. The severity of artifacts and image noise were assessed across the four images. An Artifact Index (AI) was employed to measure the severity of metal artifacts, defined as v(SD_m-SD_b ), where SD_m and SD_b is the standard deviation within regions affected by metal artifacts and background (reference) regions without artifacts, respectively. Noise was quantified by measuring the standard deviation of CT numbers in uniform water regions unaffected by artifacts.

**RESULTS**

Metal artifacts progressively decreased from T1 to T4 images, with the T4 images (90-140 keV) demonstrating the most significant reduction. The AI value confirmed a clear trend of decreasing values with higher thresholds, dropping by 60% (from 4.4 to 1.8) from T1 to T4. This indicates substantial artifact reduction at higher energy levels. Conversely, noise levels rose with increased thresholds due to the reduced number of photons utilized. Specifically, noise levels escalated from 16.4 HU in T1 to 37.6 HU in T4.

**CONCLUSION**

The highest energy threshold images (90-140 keV), acquired with a four-energy threshold mode on PCD-CT, significantly reduced metal artifacts but also exhibited increased noise levels compared to lower energy threshold images. With effective noise control, this could provide improved diagnostic performance adjacent to metal implants.

**CLINICAL RELEVANCE/APPLICATION**

Using PCD-CT with a four-energy threshold mode to reconstruct high-energy photons offers a substantial improvement for patients with metal implants. This technique significantly reduces metal artifacts, thereby improving image quality and aiding more accurate clinical diagnoses.

## M7-SSPH05-6 IMPROVING THE SPECTRAL SEPARABILITY OF K-EDGE CONTRAST AGENTS WITH DEEP-SI PHOTON-COUNTING CT

Yuxin Sun, BS, MSc (*Abstract Co-Author*) Stockholder, Nextrast, Inc
Changlyong Kim (*Abstract Co-Author*) Employee, General Electric Company
Benjamin M. Yeh, MD (*Abstract Co-Author*) Grant, Koninklijke Philips NV;Grant, General Electric Company;Consultant, Canon Medical Systems

Corporation;Speaker, Canon Medical Systems Corporation;Royalties, Oxford University Press;Shareholder, Nextrast, Inc;Board Member, Nextrast, Inc
Nariman Nezami, MD (*Abstract Co-Author*) Consultant, CAPS Medical Ltd
Zhye Yin (*Abstract Co-Author*) Employee, General Electric Company
Arnaud Choux (*Abstract Co-Author*) Nothing to Disclose
Amir Pourmorteza, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Photon-counting detector (PCD) CT offers multi-material separation beyond what is available with dual-energy CT which is commonly used to separate iodine and soft tissue. this is achieved by tuning the energy thresholds of the detector to the characteristic K-edge energy of specific contrast agents such as those based on Gd, Bi, and Ta. While narrower energy bins will lead to better detection of the K-edge, it will lead to fewer detected photons per energy bins and therefore more noise. The tradeoff between noise and energy bin width remains an open area of research. Here we investigate different threshold settings to maximize spectral separability (SS) of K-edge contrast agents with iodine.

**METHODS AND MATERIALS**

A series of inserts with calibrated contrast agents (iodine, Gd, Ta, Bi) and tissue mimicking materials (hydroxyapatite (HA): calcifications, ferrous sulfate: blood), were placed inside a 20-cm diameter circular phantom filled with ballistic gel. The phantom was scanned on a prototype clinical deep-Si PCD-CT scanner at two different settings of tube voltage with top 5 energy thresholds: 1- 120kVp, thresholds [33, 44, 52, 60, 80] keV, optimized for equal noise in all energy bins, 2- 120kVp optimized for Gd(50keV), Ta(67 keV), and Bi (90 keV) K-edge imaging [33, 50, 67,78, 90] keV. The top 5 energy bins were used for material decomposition and spectral analyses. We measured the angles between basis materials in the 5D spectral space as a measure of spectral separability. Signal difference to noise ratio (SDNR) of iodine and gadolinium were calculated.

**RESULTS**

The revised K-edge energies of gadolinium and Tantalum improved their SS. Iodine-Gd separation improved from 15.3° to 19.5°, iodine-Ta from 14.2° to 29.3°, and iodine-Bi from 6.5° to 14.2°. In addition, Iodine-blood separation improved from 7.9° to 19.5°. Maximum SNDR for Gd and iodine improved from 5.1 to 7.6 and 10.3 to 16.9, respectively.

**CONCLUSION**

Bracketing K-edge energies of contrast agents improved their spectral separability from iodine-based contrast agents and increased their maximum SDNR. The bins above the K-edge of materials which do not improve SS may be combined to improve SDNR. These results translate to improved performance of multi-contrast material decomposition algorithms.

**CLINICAL RELEVANCE/APPLICATION**

The ability to distinguish multiple contrast agents will lead to visualization of multiple perfusion phases of an organ and will significantly reduce the radiation dose required by combining multiple CT scans into one.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

M7-STCE1

**Science Session (Low-Field and Mobile MRI)**

Monday, Dec. 2 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## M7-STCE1-1 DETECTING MYELIN LOSS AT 0.064T USING A NOVEL MYELIN WATER IMAGING TECHNIQUE: A MULTIPLE SCLEROSIS CASE STUDY

Megan Poorman (*Abstract Co-Author*) Nothing to Disclose
Anthony Traboulsee, MD (*Abstract Co-Author*) Research Grant, F. Hoffmann-La Roche Ltd;Grant, F. Hoffmann-La Roche Ltd;Research Grant, sanofi-aventis Group;Grant, sanofi-aventis Group;Grant, Biogen Idec Inc;Grant, Novartis AG;Grant, Teva Pharmaceutical Industries Ltd
Sean C. Deoni, PhD (*Abstract Co-Author*) Nothing to Disclose
Rui Pedro Azeredo Gomes Teixeira (*Abstract Co-Author*) Nothing to Disclose
Hanwen Liu (*Abstract Co-Author*) Nothing to Disclose
Sharada Balaji (*Abstract Co-Author*) Nothing to Disclose
Francesco Padormo (*Abstract Co-Author*) Nothing to Disclose
Neale Wiley (*Abstract Co-Author*) Nothing to Disclose
Adam Dvorak (*Abstract Co-Author*) Nothing to Disclose
Steven Williams (*Abstract Co-Author*) Nothing to Disclose
Shannon H. Kolind, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The use of portable ultra-low field MRI systems offers greater accessibility to neuroimaging, though it poses challenges in the quantitative measurement of brain microstructure due to the limited hardware capabilities of portable scanners and the relatively unexplored physics at such low fields. Myelin, vital in the brain's function and impacted in various neurodegenerative diseases like multiple sclerosis (MS), can be assessed using myelin water imaging (MWI), although typically at higher magnetic fields. MWI acquires multi-echo T2 decay data to derive the myelin water fraction (MWF), a histologically validated biomarker for evaluating myelin integrity. This work aims to integrate novel MWI data acquisition and analysis techniques tailored for ultra-low field MRI, effectively assessing myelin damage in MS, as demonstrated by a case study.

### METHODS AND MATERIALS

A 0.064T portable MRI scanner (Swoop, Hyperfine Inc., Guilford, CT) was employed to scan a participant diagnosed with MS. The imaging protocol included: (1) FLAIR for MS lesion identification: 1.7x1.7x5 mm3 resolution, 8 minutes; (2) MWI for myelin quantification: multi-echo spin echo sequence with CALIPR acceleration, 80 echoes, ?TE/TR = 4.31/800 ms, 3x3x5 mm3 resolution, 7.5 minutes. MWI Data were postprocessed using a recently proposed machine learning method SLED to derive the MWF map.

### RESULTS

The FLAIR images successfully identified MS lesions. The novel MWI technique revealed substantial MWF reduction in these regions, indicating myelin loss. The spatial alignment of decreased MWF with the FLAIR-detected lesions supports the capability of our method for myelin assessment at ultra-low field.

### CONCLUSION

The correspondence between MWF maps and FLAIR images in detecting myelin loss demonstrates the feasibility of applying MWI at ultra-low field strengths, showcasing the potential for quantitative measurements for brain microstructures using a portable MRI platform.

### CLINICAL RELEVANCE/APPLICATION

Implementing MWI on portable ultra-low field MRI systems provides a promising avenue for frequent and cost-effective monitoring of myelin-related diseases. This approach is especially beneficial in regions lacking high-field MRI facilities, enabling improved management and understanding of disease progression associated with myelin.

## M7-STCE1-2 LOW FIELD STRENGTH PELVIC MRI: IMAGE QUALITY CONSIDERATIONS AND COMPARISON WITH HIGH FIELD STRENGTH MRI

Avinash R. Kambadakone, MD, FRCR (*Abstract Co-Author*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer
Anuradha S. Shenoy-Bhangle, MD (*Abstract Co-Author*) Nothing to Disclose
Jinjin Cao, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD (*Abstract Co-Author*) Nothing to Disclose
Nathaniel D. Mercaldo (*Abstract Co-Author*) Nothing to Disclose
Nayla Mroueh, MD (*Abstract Co-Author*) Nothing to Disclose
Madeleine Sertic, MBBCh (*Abstract Co-Author*) Nothing to Disclose

Madeline H. Carney, MD (*Abstract Co-Author*) Nothing to Disclose
Shane Vahjen (*Abstract Co-Author*) Nothing to Disclose
Soumyadeep Ghosh, MBBS, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study was to perform a quantitative and qualitative evaluation of image quality of low-field strength open magnetic resonance (MR) scanners compared to traditional high-field strength closed MR scanners in imaging of the female pelvis.

**METHODS AND MATERIALS**

This retrospective study included patients undergoing pelvic MRI exam on a low field strength open MRI scanner (between Jan 2017 to June 2022). Prior MRI on high-field strength closed MR scanners were used for comparison. Three subspecialty board-certified radiologists, blinded to examination details performed qualitative evaluation of the pelvic MR scans on pre- and post-contrast T1-weighted, T2-weighted and Diffusion-weighted (DWI) images using a 5-point Likert scale (1 = unacceptable, and 5 = excellent). Qualitative evaluation included assessment of edge/contour sharpness (UO1), ability to resolve adjacent structures (UO2), visual analysis of signal homogeneity (UO3), and visual analysis of image contrast with respect to organs such as the uterus and ovaries (UO4), other organs, and any pathologies identified. Uterus was evaluated for clarity of myometrium, endometrial stripe, and cervix, and ovaries were assessed for clarity of small and large ovarian follicles. Separate proportional odds logistical models were constructed, producing odds ratios for objectively comparing closed and open MR images. Gwet's AC2 statistic was performed to compute inter-reader agreement. Wilcoxon signed rank test was performed to compare image quality considerations on low and high field strength MRI.

**RESULTS**

Out of 152 patients scanned on low field strength MRI, 15.8% (n=24/152) had comparison MRI on high field strength MRI. Image quality scores were higher for high field strength MRI for pre and post contrast T1 and T2-weighted images but were not statistically significant. Image quality of DWI was scored higher compared to low field strength MRI with an odds ratio of 5.66 (1.68-19.0; $p<0.05$) in favor of closed MRI. The odds ratio for non-gynecological organ assessment on DWI was 5.77 in favor of high field strength MRI. Good inter-reader agreement (AC2 statistic of 0.70 or higher) was observed for all pre-contrast T1 image quality parameters except visual analysis of signal homogeneity of uterus and ovaries, T2 evaluation of other organs and artifacts, all post-contrast T1 image quality parameters and all DWI image quality parameters for closed MRI.

**CONCLUSION**

Pelvic MRI scans performed on low field strength MRI have adequate image quality but scored lower compared to pelvic MRI scans performed on high field strength MRI.

**CLINICAL RELEVANCE/APPLICATION**

Low field strength open MRI scanners provide adequate image quality in patients unable to undergo clinically indicated scans due to claustrophobia despite their lower score compared to high field strength MRI.

## M7-STCE1-3 CARDIAC IMAGING AT 0.55T - A COMPARISON TO 1.5T

Stefan Zicha (*Abstract Co-Author*) Nothing to Disclose
Matthias S. May, MD (*Abstract Co-Author*) Speakers Bureau, Siemens AG
Simon Mayr (*Presenter*) Nothing to Disclose

**PURPOSE**

Low-field magnetic resonance imaging (MRI) might improve accessibility of MRI. Leveraging compressed sensing-based image acquisition techniques, cardiovascular magnetic resonance (CMR) at low-field MRI has become more feasible than ever. This study aimed to compare functional and structural measurements of the left ventricle from 0.55T to 1.5T in patients with a clinical indication for cardiac MRI under routine clinical conditions.

**METHODS AND MATERIALS**

We recruited 13 consecutive patients who were scheduled for cardiac MRI on conventional 1.5T scanners for preceding examinations on the same day using a clinical 0.55T system. An external ECG device was used for triggering. The average delay between the examinations was one hour. Research bSSFP sequences with segmented cine, T1 and T2 mapping sequences were used. All data were automatically segmented and manually corrected by a radiologist using a dedicated software. Ten healthy volunteers were additionally examined with the mapping protocol at 0.55T to calculate a reference for this study. Two-sided t-tests or Wilcoxon-tests were used for comparison of the two field strengths, Pearson's coefficient for correlation.

**RESULTS**

The ejection fraction from 0.55T measurements was comparable to 1.5T ($p=0.12$, $r=0.98$). The measurements of end-diastolic, and systolic volumes, stroke volume, and end-diastolic mass were slightly smaller than the reference (all $p<0.05$) but correlated all very well ($r=0.95$; 0.98; 0.94; 0.99). Comparison of T1 mapping resulted in significantly lower mean relaxation times at 0.55T (690.38 ± 31.1 ms, $p<0.01$) compared to 1.5T (1026.6 ± 42.4 ms). T2 mapping relaxation times (0.55T: 68.5 ± 3.9; 1.5T: 49 ± 2.2 ms) were increased at 0.55T ($p<0.01$). Both exhibited a strong correlation to the reference ($r=0.79$; $p<0.01$ and $r=0.63$; $p=0.02$). Reference values at 0.55T were at 678.6 ms ± 13.5 ms for T1, and at 66.5 ms ± 4.1 ms for T2 mapping. 0.55T measurements had a 97% accuracy in differentiating patients between physiological and pathological.

**CONCLUSION**

Cardiac functional analysis and mapping of the left ventricle at low-field MRI has a good correlation with conventional 1.5T measurements. T1 mapping values at low field strength are decreased, while T2 times are increased. Clinical stratification in normal and abnormal functional and structural characteristics is reliable.

**CLINICAL RELEVANCE/APPLICATION**

Low-field MRI at 0.55T has the potential to increase the world wide availability to standardized functional and structural assessment of the left ventricle, once it becomes clinically available.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

M7-STCE2

**Science Session (Multiomic and Multicenter Radiology AI)**

Monday, Dec. 2 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## M7-STCE2-2 CT RADIOMICS MODEL TO PREDICT PLATINUM SENSITIVITY IN EPITHELIAL OVARIAN CARCINOMA—A MULTI-CENTER STUDY

Elaine Lee, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Grace Ho, MBChB (*Abstract Co-Author*) Nothing to Disclose
Keith Wan Hang Chiu (*Abstract Co-Author*) Nothing to Disclose
Lujun Han (*Abstract Co-Author*) Nothing to Disclose
Rahul Singh (*Abstract Co-Author*) Nothing to Disclose
Man Fung Esther Wong, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mandi Wang (*Abstract Co-Author*) Nothing to Disclose
Cheuk Nam Hwang (*Abstract Co-Author*) Nothing to Disclose
Mengge He, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the value of radiomics model based on contrast-enhanced CT (ceCT) in predicting platinum-based chemotherapy response of epithelial ovarian carcinoma (EOC).

### METHODS AND MATERIALS

Consecutive patients with histologically confirmed EOC with pre-treatment ceCT were retrospectively recruited from 5 centers. All patients underwent standard platinum-based chemotherapy before or after optimal cytoreduction. Platinum sensitivity was based on treatment response assessment with refractory disease or resistant disease defined as disease progression while on platinum-based chemotherapy or disease recurrence within 6 months after completion of platinum-based chemotherapy, respectively; otherwise, they were considered as platinum sensitive. The whole volume of primary tumor was manually delineated on each slice of the baseline ceCT images. Radiomics features were extracted using the open-source package PyRadiomics (version 3.0.1). Patients from the center A-C were randomly divided into training set and internal validation set with a ratio of 4:1. Patients from the center D and E were assigned as independent external testing sets. First, Spearsman rank correlation was used to exclude those highly correlated features (r>0.9), followed by 5-fold stratified cross validation (SCV) elastic net repeated for 100 times for feature selection, only features that were there for > 400 times were selected. Next, Mann-Whitney U test was performed for feature reduction. Then, adaptive synthetic sampling (ADASYN) was applied to minimize class biases. Finally, extra trees (ET) classifier across 10-fold grid-search SCV was used for model building.

### RESULTS

Seven hundred and three EOC patients (51.6 ± 9.3 years) were recruited. The training data from center A-C (n=608) yielded classification metrics: area under the curve (AUC) (0.917), sensitivity (83.9%), specificity (94.4%), and accuracy (91.7%) in the internal validation set; AUC (0.877), sensitivity (76.5%), specificity (92.6%), and accuracy (86.4%) in the external testing set using center D (n=44); AUC (0.845), sensitivity (73.3%), specificity (86.1%), and accuracy (82.4%) in external testing set using center E (n=51) in predicting platinum sensitivity.

### CONCLUSION

CT radiomics model proposed could be useful in predicting platinum sensitivity in EOC with potential in guiding personalized treatment in EOC.

### CLINICAL RELEVANCE/APPLICATION

As a non-invasive imaging biomarker, the proposed CT-based radiomics model may allow predicting the treatment response to platinum-based chemotherapy and guiding personalized treatment in EOC patients. It may enable treatment stratification and selection for clinical trials to improve disease prognostication. It also helps platinum-resistant patients avoid chemotherapy toxicity and save time and financial costs.

## M7-STCE2-3 INVESTIGATING THE IMPACT OF METABOLIC DYSFUNCTION ON FOLLICLE COUNT AND ENDOMETRIAL THICKNESS IN WOMEN OF REPRODUCTIVE AGE USING DEEP LEARNING ON MR PELVIS SCANS

Saqib Basar (*Abstract Co-Author*) Nothing to Disclose
Yosef G. Chodakiewitz, MD (*Abstract Co-Author*) Nothing to Disclose
Sam Hashemi, MSc (*Abstract Co-Author*) Nothing to Disclose
Siavash Khallaghi (*Abstract Co-Author*) Nothing to Disclose
Javad Khaghani, MSc (*Abstract Co-Author*) Nothing to Disclose
Soojin Lee (*Presenter*) Nothing to Disclose

## PURPOSE

This study aims to leverage deep learning insights applied to MR pelvis scans to investigate the impact of metabolic dysfunction on the number of follicles and endometrial thickness in women of reproductive age.

## METHODS AND MATERIALS

A semantic segmentation network extracted the endometrium and ovaries from sagittal T2 pelvis scans obtained as part of a 1.5T whole body MRI protocol across various sites in US and Canada. Endometrial thickness was measured by applying a distance transform on the sagittal slice with the largest endometrial area. An instance detection solution identified the bounding boxes of individual follicles within each ovary to count the total number of follicles per patient. Metabolic dysfunction was assessed from the patient's medical history through a medical intake form. One-way Analysis of Variance (ANOVA) and Kruskal-Wallis (KW) tests analyzed the effects of each metabolic dysfunction on follicle count and endometrial thickness in reproductive age women (n=1536). Patients with missing information for any metabolic dysfunction were excluded.

## RESULTS

Significant differences in total follicle count were observed across different blood pressure grades (ANOVA: $F=4.95$, $p=0.01$; KW: $H=8.31$, $p=0.02$), blood sugar grades (ANOVA: $F=3.35$, $p=0.04$; KW: $H=7.87$, $p=0.02$), and diabetes status (ANOVA: $F=3.21$, $p=0.04$; KW: $H=8.62$, $p=0.01$). Specifically, the mean follicle counts were 29.09 (normotensive), 24.49 (elevated), and 25.2 (Stage 1 hypertension) for blood pressure grades, and 29.26 (Normal), 24.25 (Prediabetes), and 28.43 (Diabetic) for blood sugar grades. Further, mean follicle counts were 29.48 (No Diabetes), 39.3 (Type 1 Diabetes), and 22.27 (Type 2 Diabetes) for diabetes classification. No significant differences in total follicle count were found for thyroid hormone grades (ANOVA: $F=0.05$, $p=0.82$; KW: $H=0.25$, $p=0.62$) or thyroid conditions (ANOVA: $F=0.59$, $p=0.62$; KW: $H=1.33$, $p=0.72$). The mean follicle counts were 29.1 (Normal) and 29.44 (Abnormal) for thyroid hormone grades, and 29.61 (No thyroid condition), 28.0 (Hyperthyroidism), 29.1 (Hypothyroidism), and 23.0 (Parathyroidism) for thyroid condition groups. No significant differences in endometrial thickness were observed across any metabolic dysfunction groups.

## CONCLUSION

While metabolic factors and conditions such as blood pressure, blood sugar, and diabetes influence follicle count, they do not significantly impact endometrial measurements.

## CLINICAL RELEVANCE/APPLICATION

Metabolics dysfunction is a complex entity that affects multiple organs and systems across the body. The effect of metabolic dysfunction on women's reproductive health provides valuable insights in fertility assessment and improving patient outcomes.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

R1-SSBR10

**Breast Imaging (AI and Treatment Applications)**

Thursday, Dec. 5 8:00AM - 9:00AM Room: S406A

Alana A. Lewin, MD (*Moderator*) Nothing to Disclose
Yiming Gao, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R1-SSBR10-1 USING ARTIFICIAL INTELLIGENCE (AI) SCORES FOR MAMMOGRAPHY INTERPRETATION IN PREDICTING RECURRENCE AFTER DCIS TREATMENT

Hye Jung Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Jung Min Chang, MD (*Abstract Co-Author*) Research Consultant, Genoray Co, Ltd
Jin Chung, MD (*Abstract Co-Author*) Nothing to Disclose
Na Lae Eun, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jung Hyun Yoon, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate whether artificial intelligence (AI) scores on preoperative mammography along with clinical and radiologic factors is associated to recurrence after DCIS treatment.

### METHODS AND MATERIALS

This multicenter, retrospective study has been approved by the institutional review board (IRB) of five institutions, all academic referral centers. From January 2012 to December 2017, 1,741 women (mean age, 51.5±10.3 years, range, 20-83 years) with final diagnosis of pure DCIS were included. Preoperative routine 4-view mammograms were analyzed by a commercially-available AI algorithm (Lunit INSIGHT for Mammography, Lunit Inc.) for assisting mammography interpretation which provides marks and corresponding abnormality scores (range, 0-100%) per view. Recurrence-free survival rates were estimated using the Kaplan-Meier method and the log-rank test. Uni- and multivariable Cox regression analysis was used to evaluate the factors associated to recurrence after DCIS treatment. Subgroup analysis was performed in women with mastectomy vs. breast-conserving surgery (BCS).

### RESULTS

Of the 1,740 women treated for DCIS, 35 (2.0%) had ipsilateral recurrences and 25 (1.5%) contralateral breast cancer, and 1,680 (96.5%) were recurrence-free. Mean AI scores (66.9±39.3 vs. 46.4±40.4, P=0.003) were significantly higher in ipsilateral recurrences, but not for contralateral second cancers (P=0.197). Recurrence-free survival rate was significantly lower in ipsilateral recurrences for DCIS with AI scores =75% (P<0.001), but not for contralateral breast cancers (P=0.399). Multivariable analysis showed that younger age (OR: 0.920, 95% CI: 0.866, 0.959, P<0.001), DCIS on surgical margins (OR: 4.640, 95% CI: 1.645, 13.091, P=0.004), hormone receptor negativity (OR: 0.284, 95% CI: 0.138, 0.584, P<0.001), and AI score=75% (OR: 3.493, 95% CI: 1.695, 7.196, P=0.007) were significant factors associated to ipsilateral recurrence. Among the subgroup of women with BCS (n=1118), similar trend was seen. AI scores did not show significant association to contralateral second cancers, regardless of surgery type.

### CONCLUSION

AI scores in the upper quartile (=75%) can be used in predicting ipsilateral recurrences after DCIS treatment, especially for women who had breast-conserving surgery, but not for contralateral second breast cancers.

### CLINICAL RELEVANCE/APPLICATION

Quantitative AI scores for assisting mammography interpretation can be used as a imaging biomarker for predicting ipsilateral recurrences in women treated for DCIS. Based on our results, more aggressive treatment may be considered in women diagnosed with DCIS showing AI scores in the upper quartile (=75%) on preoperative mammography.

## R1-SSBR10-2 PERSONALIZED NEOADJUVANT THERAPY RECOMMENDATIONS IN BREAST CANCER FROM A MULTI-OMICS CAUSAL ARTIFICIAL INTELLIGENCE RESPONSE MODEL

Yuan Gao, MS (*Abstract Co-Author*) Nothing to Disclose
Luyi Han (*Abstract Co-Author*) Nothing to Disclose
Xin Wang, MS (*Abstract Co-Author*) Nothing to Disclose
Tao Tan (*Abstract Co-Author*) Nothing to Disclose
Xinglong Liang (*Abstract Co-Author*) Nothing to Disclose
Chunyao Lu (*Abstract Co-Author*) Nothing to Disclose
Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher,

ScreenPoint Medical BV
Tianyu Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the use of multi-omics causal artificial intelligence (AI) response models in providing breast cancer patients with personalized neoadjuvant therapy (NAT) recommendations based on individual clinical information and pre-treatment DCE-MRI.

**METHODS AND MATERIALS**

The model learned the causal relationship between individual patient data, factual regimen, and corresponding treatment outcomes. This enables selection of the optimal regimen by estimating the effects of all potential regimens. 1310 breast cancer patients treated with one of the NAT regimens (anthracycline backbone, anthracycline plus taxane backbone, single HER2 antibody, multiple HER2 antibodies, and hormone therapy) between 2000 and 2020 at a Cancer Institute from Europe were retrospectively collected. 655 cases were randomly selected for 5-fold cross-validation, and the remaining 655 cases were used for independent validation. Each factual regimen population was divided into two risk groups using the optimal regimen recommended by the model, or participation in a clinical trial when predicted survival with standard regimens was poor. Survival outcomes between the created groups were compared.

**RESULTS**

The model input with DCE-MRI accurately predicted survival for potential regimens with overall survival C indexes of 0.583 (95% CI 0.407-0.743) for HER2-enriched, 0.662 (95% CI 0.557-0.765) for triple-negative, and 0.629 (95% CI 0.536-0.716) for HR-positive populations, which brings increase of C indexes of 0.061, 0.025, and 0.068 for each population compared with using clinical information only. For patients treated with an anthracycline backbone regimen, the group for whom supplemental taxane was recommended by the model had a worse prognosis than for cases where taxane was not recommended by the model, as reflected by a hazard ratio (HR) of 1.62 (95% CI 0.81-3.26). Likewise, for patients treated with anthracycline plus taxane backbone regimen, the risk group for whom a clinical trial was recommended by the model, because current therapy was judged to be likely insufficient, had a worse prognosis than other recommended regimens, as reflected by an HR of 2.31 (95% CI 1.07-4.98).

**CONCLUSION**

The regimen recommended by the model can select high-risk groups with poorer treatment effects among a factual regimen population, which may enable personal NAT regimen recommendations for breast cancer patients.

**CLINICAL RELEVANCE/APPLICATION**

This research helps to provide personalized NAT regimen recommendations for breast cancer patients, which can avoid inefficiency or overtreatment caused by regimens generally determined according to cancer stage and molecular subtypes without fully considering the individual variants of patients.

## R1-SSBR10-3 PREOPERATIVE PREDICTION OF DUCTAL CARCINOMA IN SITU UPGRADE RISK USING MAMMOGRAPHIC IMAGING, DEEP LEARNING, AND RADIOMICS

Manisha Bahl, MD, MPH (*Abstract Co-Author*) Consultant, Lunit Inc;Expert Advisory Committee, 2nd.MD
Synho Do, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Adham Alkhadrawi (*Abstract Co-Author*) Nothing to Disclose
Kyungsu Kim, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Active surveillance has emerged as a strategy to manage ductal carcinoma in situ (DCIS). The Comparison of Operative versus Monitoring and Endocrine Therapy (COMET) active surveillance trial is a United States-based randomized controlled clinical trial in which women with DCIS undergo standard-of-care treatment with surgery and radiation or active surveillance with imaging and clinical monitoring. Critical to the implementation of active surveillance programs is precise selection of eligible patients. The purpose of this study is to pre-operatively predict the upgrade risk of DCIS at biopsy to invasive carcinoma at surgery, using mammographic imaging, deep learning, and radiomics techniques, in order to inform eligibility for the COMET active surveillance trial.

**METHODS AND MATERIALS**

This Institutional Review Board-approved and Health Insurance Portability and Accountability Act-compliant study includes 2D mammograms from 484 women with DCIS who presented with calcifications and subsequently underwent surgery from 2007 to 2016. Utilizing the Rank-Driven Learning Data Exclusion (RLDE) technique, nonupgraded cases for which the artificial intelligence algorithm had low classification confidence were excluded from the training dataset, thereby reducing the impact of low-confidence cases on algorithm performance. Deep learning and radiomics models were developed, with and without RLDE, to predict DCIS upgrade risk, and their performance was compared to current COMET active surveillance trial eligibility criteria using standard statistical techniques.

**RESULTS**

The imaging-based models attained areas under the receiver operating characteristic curves (AUCs) of 0.66 to 0.67. All models significantly improved with use of RLDE (all $p<0.001$). If the hybrid model incorporating both deep learning and radiomics features was used to determine active surveillance eligibility rather than current COMET trial eligibility criteria, then the number of eligible women would be reduced by approximately one-half (44.9% to 21.4%, $p<0.001$), but the number of missed invasive cancers would be reduced by a greater degree, approximately one-third (30.5% to 9.5%, $p<0.001$).

**CONCLUSION**

Compared to current COMET active surveillance trial eligibility criteria, use of a mammographic imaging-based model to determine eligibility would lead to one-third fewer misses of upgraded DCIS cases.

**CLINICAL RELEVANCE/APPLICATION**

Mammographic imaging-based deep learning and radiomics models show promise for the preoperative prediction of DCIS upgrade risk and could thus help determine which patients are appropriate candidates for active surveillance.

## R1-SSBR10-4 STABLE AND INTERPRETABLE RADIOMIC FEATURES REVEAL TUMOR HETEROGENEITY ASSOCIATED WITH THE RESPONSE TO NEOADJUVANT CHEMOTHERAPY IN LUMINAL BREAST CANCER: A MULTICENTER STUDY

Jinhui Li (*Abstract Co-Author*) Nothing to Disclose
Chao You, MD (*Abstract Co-Author*) Nothing to Disclose

Yajia Gu (*Abstract Co-Author*) Nothing to Disclose
Shiyun Sun (*Presenter*) Nothing to Disclose

**PURPOSE**

To identify stable and interpretable MRI radiomic features to develop a predictive model for NAC response in luminal breast cancer, ultimately promoting personalized precision medicine.

**METHODS AND MATERIALS**

This study retrospectively included luminal breast cancer patients from four cohorts: a development cohort (n=253), an external validation cohort (n=176), the I-SPY 1 cohort with both imaging and genetic information (n=49), and a GEO gene validation cohort (n=227). Patients were divided into NAC response (M-P 4-5) and non-response (M-P 1-3) group. Multiregional MRI radiomic features analyzed included intratumoral subregional, peritumoral, whole tumor, and kinetic features. We introduced a novel two-step feature selection approach using four common methods (LR, SVM, Lasso, XGBoost), performing 50 random rounds of feature selection within each and retaining features chosen over 25 times. We then identified features consistently selected by at least two methods to create a set of 'stable features'. These were cross-combined with four classifiers (LR, Lasso, SVM, XGBoost) to develop and validate the predictive model. In the I-SPY1 cohort, we correlated mRNA data to explore the biological significance of the optimal MRI prediction model.

**RESULTS**

Stable features showed significantly better predictive performance than other features (AUC=0.70-0.90 vs 0.59-0.87), while XGBoost outperformed other classifiers (AUC=0.83-0.90 vs 0.59-0.78). Among 20 cross-combined models, the stable features and XGBoost model had the best performance (AUC=0.78-0.90) and prognostic value (log-rank, P<0.001). Adding clinical and pathological features improved performance further (AUC=0.87-0.92). We identified seven key genes through mRNA correlation with the MRI model, and the predictive model based on these genes performed well in the genetic validation cohort (AUC=0.70). Patients resistant to NAC were primarily associated with activation of the PI3K-Akt, RTK/Ras, Raf/MAPK, and cell cycle signaling pathways, potentially benefiting from CDK4/6i and PARPi inhibitors. Patients sensitive to NAC showed minimal T cell infiltration, possibly indicating some degree of immune activity.

**CONCLUSION**

Our study proposes a method for identifying stable and interpretable MRI features, offering alternative treatment options for luminal breast cancer patients unresponsive to NAC, and recommending additional beneficial treatments for responders.

**CLINICAL RELEVANCE/APPLICATION**

This study targets the largest breast cancer patients by developing an interpretable model for predicting NAC responses, using innovative feature selection and radiogenomic analysis. This allows for tailored management of luminal breast cancer.

## R1-SSBR10-5 A FULLY AUTOMATED DEEP LEARNING SYSTEM BASED ON DYNAMIC CONTRAST-ENHANCED MRI FOR PREDICTION OF PATHOLOGICAL COMPLETE RESPONSE TO NEOADJUVANT CHEMOTHERAPY IN BREAST CANCER: A MULTICENTER STUDY

Ning Mao (*Abstract Co-Author*) Nothing to Disclose
Jing Gao (*Abstract Co-Author*) Nothing to Disclose
Haizhu Xie (*Abstract Co-Author*) Nothing to Disclose
Qi Wang (*Abstract Co-Author*) Nothing to Disclose
Yi Dai, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to develop and validate a fully automated deep learning system (FADLS) utilizing the pre-enhanced and peak enhanced phases images of dynamic contrast-enhanced MRI (DCE-MRI) for the prediction of pathological complete response (pCR) to neoadjuvant chemotherapy (NAC) in breast cancer, and further explored the biological basis underlying FADLS prediction.

**METHODS AND MATERIALS**

The study included 4041 patients underwent DCE-MRI before NAC from ten medical centers and TCGA dataset. They were divided into training, internal testing, external testing, and prospective testing sets. A FADLS were developed with an U-shaped segmentation network and a Siamese-Vision Transformer to perform tumor segmentation and pCR prediction sequentially. The performance of FADLS was compared to Desnet121 and Swin Transformer network. The area under the receiver operating characteristic curve (AUC), accuracy, sensitivity, specificity and heatmap were used to assess the predictive performance of FADLS. RNA sequencing and genetic analysis were conducted on 100 patients to explore the biological basis of FADLS.

**RESULTS**

The results demonstrated that FADLS achieved optimum predictive performance in the training set (AUC=0.853), the internal testing set (AUC=0.850), the external testing set (AUC range from 0.807 to 0.834), and the prospective testing set (AUC=0.833). Furthermore, genetic analysis revealed that high FADLS scores were associated with the up-regulation of immune-mediated genes and pathways.

**CONCLUSION**

The FADLS has the potential to provide an automatic, non-invasive and reliable tool for the early prediction of pCR to NAC in breast cancer patients, which can guide the formulation and adjustment of clinical treatment strategies. patients. Moreover, the underlying biological basis of deep learning for pCR prediction to NAC might be related to the up-regulation f immune-mediated genes and pathways.

**CLINICAL RELEVANCE/APPLICATION**

The FADLS may provide an automatic, non-invasive and reliable tool for the early prediction of pCR to NAC in breast cancer patients, which can guide the formulation and adjustment of clinical treatment strategies.

## R1-SSBR10-6 END-TO-END PROGNOSTICATION AND SURVIVAL ANALYSIS OF BREAST CANCER BY COMBINED VISUAL-LANGUAGE DEEP LEARNING

Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Luyi Han (*Abstract Co-Author*) Nothing to Disclose
Nika Rasoolzadeh (*Abstract Co-Author*) Nothing to Disclose

Carla Sitges, MD (*Abstract Co-Author*) Nothing to Disclose
Yuan Gao, MS (*Abstract Co-Author*) Nothing to Disclose
Xinglong Liang (*Abstract Co-Author*) Nothing to Disclose
Xin Wang, MS (*Abstract Co-Author*) Nothing to Disclose
Tao Tan (*Abstract Co-Author*) Nothing to Disclose
Chunyao Lu (*Abstract Co-Author*) Nothing to Disclose
Tianyu Zhang (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the stand-alone and combined performance of AI prognostication and survival analysis models in women with breast cancer using dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) and electronic health record (EHR) data.

## METHODS AND MATERIALS

We retrospectively collected 10,336 of women with breast cancer presenting at our Cancer Institute between January 2010 and November 2020. Cases with poor MRI imaging quality, and cases with missing or incomplete electronic health records and/or follow-up data were excluded. Finally, 2079 patients were included, and divided into training (n=1455), validation (n=416) and test (n=208) sets. A visual-language (V-L) -based Cox proportional hazards model was developed to predict breast cancer survival. Patients were grouped in low and high-risk cohorts using the median predicted risk. Kaplan-Meier analysis and log-rank test were used to compare survival differences between groups. C-index and hazard ratio (HR) were calculated based on the model-predicted risk scores to compare survival outcomes between these groups. The area under the receiver operating characteristic curve (AUC) was used as an indicator to evaluate the performance of the model in predicting 5-year survival. 95% confidence intervals (CI) were generated using bootstrapping with 1000 replications.

## RESULTS

Breast cancer patients can be divided into high-risk and low-risk using a deep learning-based risk score. In the independent test set, the V-L survival analysis model we developed performed the best, with a C-index of 0.710 (95% CI 0.631, 0.780), significantly better than the model based on only DCE-MRI (C-index=0.601; 95% CI 0.503, 0.706; $p<0.001$), and only EHRs (C-index=0.683; 95% CI 0.601, 0.759; $p<0.001$). The HR for death in the high-risk group using the V-L model was 5.62 (95% CI 1.91, 16.52) (log-rank $p=0.002$), higher than that obtained with the model based on images only (HR=1.79; 95% CI 1.42, 4.14; log-rank $p=0.172$), and on EHRs only (HR=3.67; 95% CI 1.36, 9.89; log-rank $p=0.010$). 5-year survival prediction using the visual-language model showed an AUC of 0.81 (95% CI 0.73, 0.88).

## CONCLUSION

The developed V-L survival analysis model shows potential in risk grouping and survival prediction of breast cancer. V-L deep learning outperforms models in a single mode - only images or only text - setting.

## CLINICAL RELEVANCE/APPLICATION

This study contributes to risk grouping and survival analysis of breast cancer patients and shows that incorporating images in risk models may improve their predictive power. The visual-language survival analysis model we developed can efficiently utilize medical imaging data and EHRs, and may be valuable to select breast cancer patients for more or less intensive adjuvant treatment.

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# Abstract Archives of the RSNA, 2024

R1-SSCA09

**Science Session with Keynote: Cardiac Imaging (Advanced Myocardial Imaging)**

Thursday, Dec. 5 8:00AM - 9:00AM Room: E353C

Yoo Jin Lee, MD (*Moderator*) Nothing to Disclose
Ming-Yen Ng, BMBS, FRCR (*Moderator*) Education Grant, General Electric Company;Education Grant, Bayer AG;Education Grant, Circle Cardiovascular Imaging Inc;Education Grant, TeraRecon, Inc;Education Grant, Arterys Inc;Speakers Bureau, Boehringer Ingelheim GmbH

**Sub-Events**

## R1-SSCA09-1 MITRAL ANNULAR DISJUNCTION IN MARFAN SYNDROME: A RETROSPECTIVE MULTICENTER CARDIOVASCULAR MAGNETIC RESONANCE STUDY

David C. Maintz, MD (*Abstract Co-Author*) Nothing to Disclose
Kilian Weiss, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jan M. Brendel (*Abstract Co-Author*) Nothing to Disclose
Leon Bischoff, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Krumm, MD (*Abstract Co-Author*) Speakers Bureau, Siemens AG
Jan Paul Janssen, MD (*Abstract Co-Author*) Nothing to Disclose
Tilman S. Emrich, MD (*Abstract Co-Author*) Speaker, Siemens AG;Travel support, Siemens AG;Advisory Board, Siemens AG
Moritz Halfmann, MD (*Abstract Co-Author*) Nothing to Disclose
Carsten H. Gietzen, MD (*Abstract Co-Author*) Nothing to Disclose
Roman J. Gertz, MD (*Abstract Co-Author*) Institutional research contract, Koninklijke Philips NV
Jonathan M. Kottlors, MD (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Lenhard Pennig, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Institutional Grant, Koninklijke Philips NV
Kenan Kaya, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Mitral annular disjunction (MAD) refers to the separation of the mitral valve annulus from the left ventricular (LV) myocardium. MAD has recently gained interest in research and clinical practice; however, its prevalence in Marfan syndrome (MFS) based on cardiovascular magnetic resonance (CMR) imaging data is unknown. The purpose of this study was to evaluate the prevalence of MAD in MFS patients using CMR and to examine its association with other CMR findings.

### METHODS AND MATERIALS

This retrospective multicenter study included baseline CMR studies of patients treated for MFS at four tertiary care medical centers with diagnosis based on the revised Ghent criteria and a confirmed (likely) pathogenic FBN1 gene variant. The authors evaluated the datasets for MAD (at the attachment of the mitral valve to the anterior, anterolateral, inferolateral, and inferior segments; =1 mm), mitral valve prolapse (MVP; =2 mm), aortic root z-score, LV ejection fraction (LVEF), LV end-diastolic diameter (LVEDD), and left atrial (LA) size.

### RESULTS

Among 91 patients (28.9±14.0 years, 43 (47.3%) female, body surface area (BSA) 1.9±0.4), 74 (81.3%) had MAD (6.1±2.6 mm), most commonly at the inferior ventricular wall (66 (72.5%), 6.9±3.2 mm). The remaining sites showed a similar prevalence (anterior: 56 (61.5%), 6.0±2.5 mm; anterolateral: 55 (60.4%), 6.1±3.1 mm; inferolateral: 54 (59.3%), 7.0±3.6 mm). There were no significant differences (all p>0.05) between MAD and no MAD groups in aortic root z-score (5.3±3.1 vs. 5.5±3.1), LVEF (62.3±8.0 vs. 57.7±14.7 %), LVEDD/BSA (29.7±7.7 vs. 30.0±8.6 mm/m2), and LA size (11.2±3.1 vs. 11.4±2.7 cm/m2). Decreased LVEF was associated with anterolateral (r=-0.46) and inferolateral (r=-0.39) MAD, whereas increased LVEDD/BSA was mainly observed in anterior (r=0.63) and anterolateral (r=0.46) MAD. Thirty-five patients (38.5%) had MVP, predominantly in patients with MAD (33 (36.3%) vs. 2 (2.2%), p=0.017), especially in anterior MAD (r=0.69).

### CONCLUSION

MAD is highly prevalent in MFS and mostly located at the inferior site. While aortic dimensions, LV parameters, and LA size in patients with MAD were not different in patients without MAD, certain locations showed an association with decreased LV function and increased diameter. MVP was almost exclusively found in MAD and was mostly associated with anterior MAD.

### CLINICAL RELEVANCE/APPLICATION

This study provides insight into the prevalence of MAD in MFS and underscores the need to analyze the different insertion sites of the atrioventricular junction using CMR.

## R1-SSCA09-2 ASSESSMENT OF MYOCARDIAL INJURY IN PATIENTS WITH CHRONIC HIGH ALTITUDE DISEASE BY USING CARDIAC MAGNETIC RESONANCE NATIVE T1 AND T2 MAPPING

Zhenlin Li, MD (*Abstract Co-Author*) Nothing to Disclose
Chunchao Xia (*Abstract Co-Author*) Nothing to Disclose
Ke Shi (*Abstract Co-Author*) Nothing to Disclose
Wanlin Peng, MS (*Abstract Co-Author*) Nothing to Disclose
Xinyang Lv (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate left ventricular myocardial injury in patients with chronic high altitude disease (CHAD) using native T1 and T2 mapping, and further explore the relationship between left ventricular myocardial impairment and ventricular function and strain.

**METHODS AND MATERIALS**

This study prospectively recruited patients with CHAD in our hospital from November 2019 to January 2024. Meanwhile, age- and gender-matched high altitude (HA) healthy controls and sea level (SL) healthy controls were prospectively recruited. All participants underwent cardiac magnetic resonance (CMR) examinations. Native T1 values, T2 values and myocardial strain parameters (the longitudinal peak strain (LPS), circumferential peak strain (CPS) and radial peak strain (RPS) of left and right ventricles) from CMR were measured and compared. Bivariate correlation was used to analyze the relationship between the native T1 and T2 values and ventricular function and myocardial strain.

**RESULTS**

A total of 30 CHAD patients, 14 HA and 12 SL healthy controls were recruited. 47% (14/30) of patients with CHAD were identified as having right heart dysfunction according to the right ventricular ejection fractions (RVEF) < 40% as the threshold. The global native T1 value of patients with CHAD was increased and was the highest among the three groups ($P<0.05$). There was no significant difference in native T1 of the apical segment among the three groups ($P=0.055$). The T2 value of the myocardial basal segment in patients with CHAD was higher than that in the two control groups ($P<0.05$), but there were no significant differences between HA and SL groups. In addition, there was a slightly negative correlation between left ventricular ejection fractions and the myocardial native T1 value of the third segment ($r = -.498$, $P=0.019$). Moreover, there was a negative correlation between RVEF and the native T1 value of the basal segment ($r =-0.431$, $P=0.045$).

**CONCLUSION**

The multiple CMR sequences demonstrated diffuse myocardial fibrosis existed in patients with CHAD, accompanied by segmental myocardial edema. Hypoxia and hypoxia induced right ventricular injury together contributed to myocardial fibrosis, which is related to the left ventricular strain and function impairment.

**CLINICAL RELEVANCE/APPLICATION**

Myocardial edema and myocardial fibrosis are the common pathological manifestation of different cardiovascular disease, and further lead to cardiac remodeling. The T1 and T2 mapping has emerged as potential technology to quantitate the degree of myocardial injury in the early stage, and it is important to make an accurate diagnosis on account of difference in progression and treatment.

## R1-SSCA09-3 INCREMENTAL VALUE OF MULTIPARAMETRIC CARDIAC MRI FOR THE IDENTIFICATION OF SIGNIFICANT ACUTE CARDIAC ALLOGRAFT REJECTION: A PROSPECTIVE AND BIOPSY-PROVEN STUDY

Shihua Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Zhixiang Dong (*Abstract Co-Author*) Nothing to Disclose
Pengyu Zhou, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Using endomyocardial biopsy (EMB) as the reference standard, this study aimed to evaluate the association between multiparametric cardiac magnetic resonance (CMR) parameters and acute cardiac allograft rejection (SR), and assess the incremental value of CMR parameters over conventional cardiac examinations for identifying SR.

**METHODS AND MATERIALS**

Heart transplantation (HTx) recipients with EMBs and healthy controls were prospectively recruited for CMR assessment including cine, late gadolinium enhancement, T1 mapping, and T2 mapping. CMR feature tracking (CMR-FT) was performed to evaluate the left ventricular (LV) global strain in all three directions. The serum examinations including N-terminal pro brain natriuretic peptide (NT-proBNP) before anti-immunotherapy were recorded. Participants were divided into 3 groups based on EMB grade: control, SR (acute cellular rejection grade=2R and/or antibody-mediated rejection [AMR] grade=pAMR1), and NSR (non-SR).

**RESULTS**

Thirty controls (43.3±13.6 years, 26 male) and 51 HTx recipients comprising 23 SRs (48.6±12.6 years, 24 male) and 28 NSRs (42.7±14.9 years, 16 male) were enrolled for analysis. Compared with NSRs, SRs showed elevated NT-proBNP (7797.0±7527.6pg/ml vs 3334.6±5935.3pg/ml, $p<.001$), worse LV global longitudinal strain (GLS) (-9.7±3.1% vs -13.1±2.9%, $p<.001$), and increased native T1 (1384±80.1ms vs 1321±69.9ms, $p<.001$) and T2 values (50.9±2.7ms vs 45.7±4.3ms, $p<.001$). In multivariable analysis, LV GLS (OR=0.76, 95%CI, 0.59 to 0.98, $p=.03$) and T2 value (OR=1.35, 95%CI, 1.10 to 1.65, $p=.01$) were independently associated with SR after NT-proBNP adjustment. The likelihood ratio test showed LV GLS (-2 log likelihood=55.8, X2=14.4, $p=.002$) and T2 value (-2 log likelihood=50.3, X2= 20.0, $p<.001$) had incremental value over NT-proBNP for identifying SR. Furthermore, when added the combination of LV GLS and T2, there was a further improvement for the identification of SR (-2 log likelihood=44.9, X2=25.3, P= .02).

**CONCLUSION**

LV GLS and T2 value were independently associated with SR, providing incremental value for the non-invasive rejection surveillance in HTx recipients.

**CLINICAL RELEVANCE/APPLICATION**

Given the increasing need for non-invasive rejection surveillance in HTx recipients, our research found that LV GLS and T2 value were independently associated with SR in HTx recipients, providing incremental value for the non-invasive rejection surveillance after heart transplantation, which may help define the clinical benefit and appropriate application of multiparametric CMR in HTx recipients for clinical use and future randomized trials.

## R1-SSCA09-6 REALTIME CINE CARDIAC MRI BASED ON DISENTANGLED REPRESENTATION LEARNING ENABLES FEATURE TRACKING STRAIN ANALYSIS IN PATIENTS WITH ARRHYTHMIA

Thorsten A. Bley, MD (*Abstract Co-Author*) Speakers Bureau, F. Hoffmann-La Roche Ltd;Research Consultant, F. Hoffmann-La Roche Ltd;Speakers Bureau, Novartis AG;Research Consultant, Novartis AG;Research Consultant, Baltimore RH Typing Laboratory

Tobias Wech (*Abstract Co-Author*) Nothing to Disclose
Nils Petri (*Abstract Co-Author*) Nothing to Disclose
Oliver Schad (*Abstract Co-Author*) Nothing to Disclose
Julius F. Heidenreich, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Myocardial strain is proposed as more sensitive imaging biomarker of myocardial disease compared to ejection fraction. If conventional segmented cine MRI is used, the analysis is based on a synthetic (temporally averaged) cardiac cycle. We demonstrate realtime cardiac MRI based on undersampled spiral acquisitions and a reconstruction using disentangled representation learning, and evaluate preliminary data of feature tracking (FT) strain analysis in a small cohort of arrhythmic patients with atrial fibrillation.

**METHODS AND MATERIALS**

A neural network with extended spatial decomposition architecture (xSDNet) was trained for joint reconstruction and semantic segmentation of undersampled realtime cardiac data acquired with a spiral bSSFP pulse sequence. Two healthy participants and four patients with atrial fibrillation were examined on a 1.5 T MRI in breath-hold. Realtime MRI was acquired across four sequential R-R cycles; ECG-gated segmented cine MRI covering one synthetic heartbeat served as reference. Strain analysis was performed on a single mid-ventricular short axis slice for each individual. Global radial (GRS) and circumferential strain (GCS; each in %) were calculated using cvi42®. Peak strain from segmented cine MRT was compared with maximum, minimum and calculated mean peak strain across the four acquired heartbeats from realtime MRI.

**RESULTS**

Overall, mean peak GRS and GCS were well comparable in realtime and segmented CMR (GRS: realtime = 31.9 ± 7.6 % vs. segmented = 31.4 ± 6.9 %, mean difference = 0.53 %; GCS: realtime = -18.5 ± 3.0 % vs segmented = -18.4 ± 2.7 %, mean difference = 0.53 %). One patient exhibited relevant arrhythmia during examination with a variance of 11.9 % for GRS (max: 26.6 %, min: 17.5 %) and 2.4 % (max: -12.4 %, max: -16.4%) for GCS across the four examined heartbeats. For the same patient, mean values from realtime were largely comparable to GRS (23.2 % vs. 20.9 %) and GCS (-15.2 % vs. -14.3 %) from segmented CMR. Both healthy participants had stable heartbeats and a low variance of GRS (0.88 %) and GCS (0.3 %).

**CONCLUSION**

Realtime imaging has the potential to accelerate the cine building block of CMR and may omit the need of ECG gating. In healthy participants peak radial and circumferential strain were highly comparable between both imaging techniques, accompanied by a very low variance across the measured R-R cycles in real-time imaging. In patients with arrhythmia, traditional ECG-gated segmented cine imaging can be severely affected by image artifacts which may lead to incorrect strain analysis.

**CLINICAL RELEVANCE/APPLICATION**

Strain analysis is proposed as a sensitive biomarker for myocardial disease, but analysis may be incorrect in patients with arrhythmia. Strain analysis from realtime cine MRI may overcome this drawback.

## R1-SSCA09-7 Keynote Speaker: Applications of Parametric Mapping in Clinical CMR

Vineeta Ojha, MD (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R1-SSCH09

**Chest Imaging (New Techniques)**

Thursday, Dec. 5 8:00AM - 9:00AM Room: E451A

Axel Wismueller, MD, PhD (*Moderator*) Nothing to Disclose
Parisa Kaviani, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R1-SSCH09-1 A PHANTOM VALIDATION STUDY OF ARTIFICIAL INTELLIGENCE GENERATED 1024-AND 2048-MATRIX CT IMAGES

Qingyao LI, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the image quality of AI-generated 2048-matrix CT images versus standard 512-matrix CT images, standard 1024-matrix and AI-generated 1024-matrix CT images at different dose levels.

### METHODS AND MATERIALS

Standard 512-matrix and 1024-matrix CT images were acquired by scanning the Catphan® phantom 600 using a chest protocol under four different radiation doses. These images were subsequently processed with super-resolution techniques to generate AI-generated 2048-matrix and AI-generated 1024-matrix CT images. An observer utilized the commercial software ImQuest (Reference) to measure the Noise Power Spectrum (NPS), Task Transfer Function (TTF), noise, and signal-to-noise ratio (SNR) for the CT images; this software has been validated in multiple peer-reviewed studies. Statistical analyses for NPS, TTF, noise levels, and SNR were conducted using the non-parametric rank sum test. Additionally, the uniformity of CT values across peripheral and intermediate regions of interest was examined using the Bland-Altman method at a consistent image level of the Catphan® phantom.

### RESULTS

Overall, Super-resolution processing of original CT images improved the TTF50%Teflon, Noise, NPSpeak, and NPSave, while maintaining CT value uniformity and accuracy. In visual analysis, AI-2048 matrix CT images had the largest identifiable line pairs,which also confirms this. Additionally, there is a trend of decreasing NPS_peak and increasing NPS_ave with increasing dose, suggesting an improvement in noise texture.However, using super-resolution swin2SR technology in lung kernel may reduce the image's signal-to-noise ratio (SNR).

### CONCLUSION

The utilization of the Swin2SR model for generating super-resolution CT images has demonstrated promising results, contributing to advancements in spatial resolution and a decrease in image noise without compromising the accuracy and uniformity of CT values.

### CLINICAL RELEVANCE/APPLICATION

The Swin2SR model can be applied to medical CT image processing to improve the resolution of medical images and help doctors make more accurate diagnoses.

## R1-SSCH09-2 DYNAMIC CONTRAST-ENHANCED AREA-DETECTOR CT FOR DETECTION OF TISSUE BLOOD SUPPLY CHANGES IN STAGE I NSCLC PATIENTS WITH PF-ILD

Yoshiyuki Ozawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Yasuko Fujisawa, MS (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hiroyuki Nagata (*Abstract Co-Author*) Canon Medical Systems Corporation
Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Daisuke Takenaka, MD (*Abstract Co-Author*) Canon Medical Systems Corporation
Kenji Fujii (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Masahiko Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hirona Kimata (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takahiro Ueda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD (*Presenter*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology

### PURPOSE

Although thin-section CT is widely used for management of progressive fibrosing ILD (PF-ILD), PF-ILD warrants additional quantitative radiological imaging for evaluation of lung structure change and pharmacologic treatment or prediction of therapeutic effect. The purpose of this study was to determine the capability of dynamic first-pass contrast-enhanced (CE-) perfusion area-detector CT (ADCT) for detecting pathological structure changes in stage I non-small cell lung cancer (NSCLC) patients with PF-ILD.

### METHODS AND MATERIALS

63 consecutive stage I NSCLC patients with PF-ILD underwent dynamic CE-perfusion ADCT, surgical treatment and pathological examination, followed by computational generation of total perfusion (TPDMS), pulmonary arterial perfusion (PAPDMS) and systemic arterial perfusion (SAPDMS) maps by dual-input maximum slope model. ROIs were then placed over sites pathologically diagnosed as normal lung, pulmonary emphysema, usual interstitial pneumonia (UIP) pattern, probable UIP pattern and indeterminate for UIP pattern the resected lung. Next, Tukey's honesty significant difference (HSD) test was performed for a comparison of each of the perfusion parameters for normal lung, pulmonary emphysema, UIP pattern, probable UIP pattern, and indeterminate for UIP pattern. Finally, discrimination accuracy for evaluation of lung structure change was compared for all indexes as well as combined methods.

### RESULTS

PAPDMSs of abnormal lungs other than emphysematous were significantly lower than those of normal lungs ($p<0.0001$). SAPDMSs of normal or emphysematous lungs were significantly lower than those of others ($p<0.0001$). SAPDMS of indeterminate for UIP was significantly lower than that for probable UIP and UIP ($p<0.0001$). Discrimination accuracies of PAPDMS (52.6%) and SAPDMS (54.9%) were significantly higher than that of TPDMs (TPDMS: 41.8%, $p<0.0001$). Discrimination accuracy of the combined method (71.6%) was significantly higher than that of each of the perfusion indexes (TPDMS: $p<0.0001$, PAPDMS: $p<0.0001$, SAPDMS: $p<0.0001$).

### CONCLUSION

Dynamic first-pass CE-perfusion ADCT is useful for detecting pathological structural changes in stage I NSCLC patients with PF-ILD.

### CLINICAL RELEVANCE/APPLICATION

Dynamic first-pass CE-perfusion ADCT is useful for detecting pathological structure changes in stage I NSCLC patients with PF-ILD.

## R1-SSCH09-3 THE IMPACT OF DEEP LEARNING RECONSTRUCTION COMBINED WITH CONTRAST-ENHANCED BOOST TECHNOLOGY ON CT PULMONARY ARTERY IMAGING WITH LOW CONTRAST VOLUME AND LOW FLOW RATE

Rulin Xu (*Abstract Co-Author*) Nothing to Disclose
Zhiman Lai (*Abstract Co-Author*) Nothing to Disclose
Hui Ma (*Abstract Co-Author*) Nothing to Disclose
Jingyi Lin (*Abstract Co-Author*) Nothing to Disclose
Mulan Huang (*Abstract Co-Author*) Nothing to Disclose
Dingxiang Xie (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to assess the impact of deep learning reconstruction (DLR) algorithm combined with contrast enhanced boost (CE-boost) technology on CT pulmonary artery (CTPA) imaging under conditions of low contrast volume and low flow rate.

### METHODS AND MATERIALS

This study enrolled 106 prospective suspected pulmonary embolism patients, who were randomly assigned to two groups (each n=53) for CTPA examination. For Group A, 30 ml contrast agent was administered at a flow rate of 3 ml/s; while volume 50 ml and flow rate 4ml/s were used with Group B. And images in Group A were reconstructed and underwent post-processing with four different methods, namely 4 subgroups: using only hybrid iterative reconstruction (HIR, Group A1) or DLR (Group A2), and using CE-boost combined with HIR (Group A3) or DLR (Group A4). Images in Group B were reconstructed using HIR exclusively. We quantified CT values and image noise of the main pulmonary artery, left and right pulmonary arteries, and upper and lower pulmonary arteries in all groups, and calculated the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). Subjective evaluations of vascular enhancement degree, sub-segmental pulmonary artery visualization, noise, and overall image quality in five groups of images were conducted.

### RESULTS

In Groups A1-A4 and Group B, 46, 46, 53, 53, and 48 cases met the objective diagnostic criteria, namely pulmonary artery CT values >250 HU, respectively. Following CE-boost, the diagnostic rates increased by 13.21% in Groups A1 and A2. Group A4 exhibited the lowest noise values, and the highest SNRs and CNRs, in all measurement areas among all groups; additionally, Group A4 had the highest CT values in all measurement areas, significantly higher than those of Groups A1, A2, and B (all $P < 0.01$), but the difference with Group A3 did not reach statistical significance ($P > 0.05$). Group A4 scored higher in subjective assessments of sub-segmental pulmonary artery visualization and noise compared to the other four groups (all $P < 0.05$). The overall subjective image score of Group A4 was higher than that of Groups A1 and B, respectively (all $P < 0.05$).

### CONCLUSION

The application of DLR combined with CE-boost technology for CTPA can enhance pulmonary artery visualization and achieve better image quality, in condition of substantially reduced contrast flow rate and total volume.

### CLINICAL RELEVANCE/APPLICATION

This technological approach holds particular promise for patients susceptible to contrast-induced nephropathy or elderly individuals with compromised vascular conditions, potentially aiding in the detection of sub-segmental pulmonary artery embolism. Considering the current research findings, there remains potential for further reduction in radiation dose and contrast volume.

## R1-SSCH09-4 OPPORTUNISTIC SCREENING FOR OSTEOPOROSIS USING ARTIFICIAL INTELLIGENCE IN CHEST CT SCANS: VALIDATION AGAINST DEXA SCANS

Orhan K. Oz, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Christopher Fan (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Peshock, MD (*Abstract Co-Author*) Stockholder, General Electric Company;Researcher, Siemens AG;Researcher, Aidoc Medical
Fernando U. Kay, MD, PhD (*Abstract Co-Author*) Research Grant, Edwards Lifesciences Corporation
Michael Long, MS (*Abstract Co-Author*) Nothing to Disclose
Roderick McColl, PhD (*Abstract Co-Author*) Nothing to Disclose
Angelo Scanio (*Presenter*) Nothing to Disclose

### PURPOSE

Osteoporosis, characterized by low bone mineral density (BMD), is a prevalent yet often undiagnosed condition, leading to significant morbidity and mortality. Dual-energy X-ray absorptiometry (DXA) is the current gold standard for measurement of BMD. Leveraging existing chest CT scans, this study

proposes an opportunistic approach using an Artificial Intelligence tool, (AI Rad Companion, Siemens), along with a machine learning algorithm to predict low BMD as defined by DXA scans.

**METHODS AND MATERIALS**

A total of 781 patients underwent a non-contrast chest CT and a DXA scan within a one-year period between Sept. 9, 2022, and Dec. 29, 2023. Utilizing Hounsfield units of the trabecular bone from chest CT scans and vertebral body height collected from AI-Rad companion, we trained a Light Gradient Boosting Machine Learning model (LightGBM) to predict low BMD from multiple covariates. A Logistic Regression (LR) model was derived using only Hounsfield units at the most caudal thoracic spine vertebra for comparison, which is the standard approach for opportunistic screening of low BMD on chest CT.

**RESULTS**

In the unseen test cohort (30% of the sample), the LightGBM model achieved an area under the receiver operating characteristics curve of 0.84, in comparison to the LR model of 0.76 ($p<0.001$). The LightGBM model demonstrated higher accuracy and sensitivity in predicting low BMD, 79% and 87% respectively, compared to the chest CT radiological reports, 36% and 12%, respectively. However, the AI model reported a lower specificity of 59% compared to 94%.

**CONCLUSION**

Quantitative metrics extracted from chest CT scans using AI can be integrated with machine learning algorithms to predict low BMD. The LightGBM machine learning model demonstrated robust performance in detecting low BMD, outperforming the sensitivity of radiological reports.

**CLINICAL RELEVANCE/APPLICATION**

These findings advocate for a broader adoption of AI models in opportunistic screening for low BMD among patients undergoing chest CTs. Integration of these models in screening for low BMD can possibly reduce the morbidity and mortality of patients with osteoporosis or osteopenia.

## R1-SSCH09-5 WHOLE-BODY STATIC CT SYSTEM WITH DUAL-RING STRUCTURE AND TWENTY-FOUR SOURCES: INITIAL EXPERIENCE IN LUNG

Weisen Yang (*Abstract Co-Author*) Nothing to Disclose
Mu Lin, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Recently, the clinical trial of a prototype stationary CT with dual-ring structure has started. The stationary architecture doesn't have gantry rotation related blurring and provides ultra-high spatial resolution. This study aims to evaluate the clinical image quality and potential clinical benefits of the stationary CT system in chest imaging by comparing it with a traditional helical CT system using visual grading analysis (VGA) scores.

**METHODS AND MATERIALS**

The prototype static CT system (CompoundEye™ 24, Nanovision Medical Technology Co., Ltd., Shanghai, China) has an 83-cm bore size and 50-cm FOV. It has a unique dual-ring structure comprising an X-ray source ring and a detector ring. The X-ray source ring incorporates 24 X-ray tubes and the detector ring consists of 10240 channels across 288 rows with each element having a size of 0.265mm × 0.265mm. Cone beam projections are collected by electronically triggering all X-ray sources sequentially. An FDK-based iterative scheme with total variation was adapted for reconstruction. The study included fifty patients who underwent scans with the stationary CT system (3072-matrix, 0.33-mm slice thickness, 120 kVp, 100 mAs) and had previously received a helical CT scan (512-matrix, 0.625-mm slice thickness, 100 mAs) within the last 12 months. Two radiologists evaluated the visibility of various lung structures using a 5-point scale (-2 = worse visibility on stationary CT impacting diagnosis, -1 = worse visibility without impact, 0 = equivalent visibility, 1 = better visibility without impact, 2 = better visibility on stationary CT impacting diagnosis). The median VGA scores were compared and statistically analyzed using one-sample Wilcoxon signed-rank tests with hypothesized median values of 0 and 2, considering p-values < 0.05 as statistically significant.

**RESULTS**

All lung structures had significantly better visibility on stationary CT compared to helical CT (mean VGA > 0), with notable improvements noted in peripheral airways, micronodules, inter- and intralobular lines, emphysema, and calcifications (mean VGA > 1). Although better visibility, a perceived difference in diagnostic interpretation could not be demonstrated, since the median VGA was significantly different from 2.

**CONCLUSION**

The stationary CT system provides markedly superior visibility of multiple lung structures compared to traditional helical CT. Despite these imaging improvements, the impact on clinical diagnostic interpretation remains inconclusive, suggesting a need for further studies to assess how these visibility enhancements influence clinical outcomes.

**CLINICAL RELEVANCE/APPLICATION**

The ultra-high-resolution images of the stationary CT has potential to improved diagnostic performance in chest imaging.

## R1-SSCH09-6 PATIENT-CENTRIC SUMMARIZATION OF RADIOLOGY REPORT FINDINGS USING LARGE LANGUAGE MODELS

Bhavik N. Patel, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Matthew T. Stib, MD (*Abstract Co-Author*) Nothing to Disclose
Imon Banerjee, PhD (*Abstract Co-Author*) Nothing to Disclose
Sam Fathizadeh (*Abstract Co-Author*) Nothing to Disclose
Nelly Tan, MD (*Abstract Co-Author*) Nothing to Disclose
Shubham Trivedi (*Abstract Co-Author*) Nothing to Disclose
Aisha Urooj (*Abstract Co-Author*) Nothing to Disclose
Gokul Ramasamy (*Abstract Co-Author*) Nothing to Disclose
Amara Tariq, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Radiology reports contain medical jargon limiting patients' understanding of their health and negatively impacting treatment compliance. We developed an automated patient-sensitive radiology report summarization model, i.e., model generates different summaries of the same report for patients with different levels of education/knowledge.

## METHODS AND MATERIALS

We finetuned 3 LLMs; T5 (0.77B), GPT2 (1.5B) and BioGPT (1.5B) for generating layman and expert-level summaries of findings in chest CT exam reports, conditioned on prompt describing patient's knowledge level (expert vs. layman). 6970 reports (2013-2022) were collected for development; impression sections were used as technical/expert summary surrogates while layman summaries were curated using LLaMA-13B as zero-shot framework and manual filtering of inaccurate summaries (~15% data filtered). Three board-certified radiologists (experts) and three readers with non-clinical backgrounds (laymen) evaluated summaries generated by our model. Comparative analysis with ChatGPT (zero-shot) was performed on 50 randomly sampled reports.

## RESULTS

Quantitative analysis established superiority of T5 (encoder-decoder model) over GPT2 and BioGPT (decoder-only). Among decoder-only models, BioGPT (pretrained on PubMed abstracts) outperformed GPT2. In manual evaluation of 23 reports, i) experts indicated one case of missed information in expert-level and one in laymen summaries; ii) 5 cases of hallucination were found in laymen summaries which mostly concerned with fracture locations. This may be due to insufficient training data for a finding like fracture (<10% of training reports mentioned fractures). Layman users reported 63% improvement in their understanding of information by reading model-generated layman summaries. ChatGPT (zero-shot) i) hallucinated twice as often and ii) missed information five-times more frequently than our model, and always generated unnecessarily long summaries which can negatively impact comprehension.

## CONCLUSION

Task-specific training of smaller LLM on limited training data achieved reliable performance for radiology report summarization, compared to zero-shot performance of ChatGPT. Integration of our summarizer framework in clinical workflow can improve patients’ understanding of their radiology reports.

## CLINICAL RELEVANCE/APPLICATION

Patients' lack of understanding of their clinical status, often reported in radiology reports, may lead to missed follow-up and potentially poor clinical outcomes. We present a solution to this challenge, i.e., development of automated report summarizers that can customize their response to each patients, thus improving their comprehension of clinical information.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

R1-SSGU06

**Genitourinary Imaging (MRI for Prostate Cancer Detection)**

Thursday, Dec. 5 8:00AM - 9:00AM Room: E353B

Silvia D. Chang, MD, FRCPC (*Moderator*) Nothing to Disclose
Manish Dhyani, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R1-SSGU06-1 COMPARING BIPARAMETRIC AND MULTIPARAMETRIC MAGNETIC RESONANCE IMAGING FOR THE DETECTION OF PROSTATE CANCER: AN INTERNATIONAL, MULTICENTRE, NON-INFERIORITY CLINICAL TRIAL (NCT04571840)

PRIME Trial Group (*Abstract Co-Author*) Nothing to Disclose
Aqua Asif, MBChB, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Multiparametric MRI (mpMRI) with or without prostate biopsy has become the new standard of care for diagnosing clinically significant prostate cancer. However, resource limitations limit widespread adoption. The PRIME (Prostate Imaging using MRI ± Contrast Enhancement) trial aimed to evaluate whether biparametric MRI (bpMRI), a shorter, more streamlined MRI, without contrast enhancement, was non-inferior to mpMRI in detecting clinically significant PCa (csPCa).

### METHODS AND MATERIALS

Multiparametric MRI (mpMRI) with or without prostate biopsy has become the new standard of care for diagnosing clinically significant prostate cancer. However, resource limitations limit widespread adoption. The PRIME (Prostate Imaging using MRI ± Contrast Enhancement) trial aimed to evaluate whether biparametric MRI (bpMRI), a shorter, more streamlined MRI, without contrast enhancement, was non-inferior to mpMRI in detecting clinically significant PCa (csPCa).

### RESULTS

A total of 555 men were recruited in 22 centres across 12 countries, of which 490 men were included in the primary outcome analysis. In the bpMRI group (T2W and DWI), clinically significant cancer was detected in 141 of 490 men (28.8%), as compared to 143 of 490 men (29.2%) with the addition of the DCE sequences in the mpMRI group (adjusted difference, 0.4 percentage points; 95 confidence intervals [CI], -0.4 to 1.2; P=0.5). bpMRI, with or without targeted biopsy, was non-inferior to mpMRI, with or without targeted biopsy. bpMRI detected clinically insignificant cancer in 47 of 490 men (9.6%), as compared to 49 of 490 men (10.0%) on mpMRI (adjusted difference, 0.4 percentage points; 95% CI, -0.4, 1.2; P=0.5). Central quality control demonstrated that 95% of scans were of adequate diagnostic quality.

### CONCLUSION

In men with suspected prostate cancer, bpMRI with or without targeted biopsy should become the new standard of care for prostate cancer diagnosis in scans of adequate diagnostic quality.

### CLINICAL RELEVANCE/APPLICATION

This study demonstrates that biparametric MRI (bpMRI) can reliably diagnose prostate cancer without the use of dynamic contrast-enhanced sequences, potentially reducing healthcare costs and increasing the accessibility of prostate MRI.By establishing bpMRI as a sufficient diagnostic approach in cases where MRI quality meets diagnostic standards, it supports the adaptation of prostate cancer screening protocols to be more efficient while maintaining high diagnostic accuracy. This change could lead to wider implementation in various healthcare settings, improving patient outcomes by providing timely and effective prostate cancer diagnosis.

## R1-SSGU06-2 MRI WITHOUT CONTRAST MEDIA INJECTION FOR PROSTATE CANCER SCREENING: RESULTS FROM PROSTATE CANCER SECONDARY SCREENING IN SAPIENZA (PROSA)

Martina Pecoraro, MD (*Abstract Co-Author*) Nothing to Disclose
Ludovica Laschena, MD (*Abstract Co-Author*) Nothing to Disclose
Antonella Borrelli, MD (*Abstract Co-Author*) Nothing to Disclose
Valeria Panebianco, MD (*Abstract Co-Author*) Nothing to Disclose
Ailin Dehghanpour, MD (*Abstract Co-Author*) Nothing to Disclose
Emanuele Messina, MD (*Presenter*) Nothing to Disclose

### PURPOSE

PROSA (Prostate Cancer Secondary Screening in Sapienza) is a randomized MRI-based screening protocol, investigating the role of MRI without the injection of contrast media (bi-parametric MRI, bpMRI) as a secondary prevention test for prostate cancer (PCa) early diagnosis, comparing MRI with the

prostate specific antigen (PSA) test. PROSA has the aim to investigate the efficiency of this screening protocol, both in terms of diagnostic accuracy, and cost-effectiveness.

**METHODS AND MATERIALS**

590 men aged 49 to 69 years have been enrolled and blindly randomized into two different arms: (A) Men underwent bpMRI regardless of their PSA values;(B) Men with increased PSA were referred to bpMRI, while those with normal PSA were not.Men who screened positive on MRI were directed to MR-directed targeted biopsy.To evaluate the efficiency of the protocol we calculated the experimental event rate (EER), control event rate (CER), absolute risk reduction (ARR), number needed to treat (NNT).Health Technology Assessment analysis was implemented to evaluate the cost-effectiveness.

**RESULTS**

285 men were randomized on Arm A and among them 12 clinically significant PCa (csPCa) were detected; 305 men were randomized on Arm B, with 5 csPCa detected (p = 0.070). The two arms did not show any statistically significant difference in terms of demographic and clinical variables, resulting comparable. Considering the efficiency of the screening protocol, EER was 4.21%, CER 1.64%, ARR 2.57%, NNT 39.0%. Considering long term costs, and more specifically the management of csPCa, the present screening programs shows promising results in terms of economic impact, and could be associated with cost-savings over no screening, when treatment costs for the screened diseases are considered.

**CONCLUSION**

Prostate MRI without contrast medium injection showed promising results compared to the use of PSA analysis alone as a screening tool, both in terms of accuracy and cost-effectiveness.

**CLINICAL RELEVANCE/APPLICATION**

This new approach to PCa screening could facilitate the early diagnosis of csPCa, allowing cost-savings of csPCa management and it could reduce the number of unnecessary prostate biopsies and the detection of ciPCa.

## R1-SSGU06-3 INTEGRATING PREOPERATIVE MRI AND CLINICOPATHOLOGICAL FEATURES TO PREDICT POSITIVE SURGICAL MARGINS IN PROSTATE CANCER PATIENTS UNDERGOING RADICAL PROSTATECTOMY

Haiyi Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Mengqiu Cui (*Abstract Co-Author*) Nothing to Disclose
Bai Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Xueyi Ning (*Abstract Co-Author*) Nothing to Disclose
Baichuan Liu (*Abstract Co-Author*) Nothing to Disclose
Yuanhao Ma (*Abstract Co-Author*) Nothing to Disclose
Honghao Xu (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a lesion-based grading system for predicting the risk of positive surgical margin (PSM) following robotic-assisted laparoscopic prostatectomy (RALP) among prostate cancer (PCa) patients, utilizing the MRI features and clinicopathological examination.

**METHODS AND MATERIALS**

Consecutive MRI exams of patients undergoing RALP for PCa were retrospectively collected from two institutions (center 1: 297 patients; center 2: 119 patients). Patients who underwent RALP between January 2020 and December 2021 were included in the derivation cohort (n = 227) and those who underwent RALP between January 2022 and December 2022 were assigned to the internal validation cohort (n = 70). Patients from center 2 were assigned to the external test cohort. MRI-based predictors associated with PSM were assessed: tumor size, curvilinear contact length of lesions (CCL), capsular irregularity and bulge, the Prostate Imaging Reporting and Data System category (PI-RADS), tumor location (apex abutting or lateral portion near the neurovascular bundle), apical depth (APD), asymmetry of neurovascular bundles, obliteration of rectoprostatic angle and frank extraprostatic extension (EPE) at MRI. Clinicopathological parameters include prostate-specific antigen (PSA), clinical T stage and Gleason score, which transformed into a three-tiered risk stratification system (RISK) according to the European Society for Medical Oncology (ESMO) guidelines. A prediction model was developed by using fixed effect logistic regression and classification and regression tree (CART) analysis, and then it was transformed into a scoring system. The prediction performance of lesion-based scoring system was evaluated using the area under the curve (AUC).

**RESULTS**

A total of 396 patients (derivation cohort: 227, validation cohort: 69 and test cohort: 107) were included and 489 lesions (derivation cohort: 282, validation cohort: 90 and test cohort: 117) were identified. Of these, 82 (29.1%), 32(35.6%) and 42 (35.9%) of lesions in the derivation, validation and test cohorts, respectively, had PSMs after RALP. The scoring system consisted of the following variables: CCL, RISK, tumor location (apex abutting), APD and frank EPE at MRI. This scoring system provided good prediction performance for PSM in the derivation (AUC 0.82 [95% CI: 0.77, 0.87]), validation (AUC 0.78 [95% CI: 0.68, 0.87]) and test (AUC 0.79 [95% CI: 0.70, 0.87]) cohorts.

**CONCLUSION**

A lesion-based scoring system integrating MRI and clinicopathological features can help efficiently estimate the risk of PSM after RALP.

**CLINICAL RELEVANCE/APPLICATION**

This scoring system evaluating per-lesion risk of PSM based on MRI and clinicopathological features can assist surgeons in making surgical strategies.

## R1-SSGU06-4 PROSPECTIVE VALIDATION OF AN AUTOMATED HYBRID MULTI-DIMENSIONAL MR IMAGING TOOL FOR PROSTATE CANCER DETECTION USING TARGETED BIOPSY: COMPARISON WITH PIRADS- BASED ASSESSMENT

Grace H. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Aytekin Oto, MD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Medical Advisory Board, Profound Medical Inc;Consultant, IBM Corporation;Co-founder, Qmis LLC;Co-owner, Qmis LLC
Milica Medved, PhD (*Abstract Co-Author*) Nothing to Disclose
Carla B. Harmath, MD (*Abstract Co-Author*) Nothing to Disclose
Scott Eggener (*Abstract Co-Author*) Nothing to Disclose
Batuhan Gundogdu, PhD (*Abstract Co-Author*) Nothing to Disclose
Mihai Giurcanu (*Abstract Co-Author*) Nothing to Disclose
Abel Lorente Campos, PhD (*Abstract Co-Author*) Nothing to Disclose
Ambereen Yousuf, MBBS (*Abstract Co-Author*) Nothing to Disclose
Parth Modi (*Abstract Co-Author*) Nothing to Disclose
Gregory S. Karczmar, PhD (*Abstract Co-Author*) Stockholder, QMIS TBS Capital Group Corp

Tatjana Antic (*Abstract Co-Author*) Nothing to Disclose
Roger Engelmann, MS (*Abstract Co-Author*) License agreement, Hologic, Inc;License agreement, General Electric Company;License agreement, Toshiba Corporation;License agreement, Deus Technologies, LLC;License agreement, Riverain Technologies, LLC;Research Grant, Riverain Technologies, LLC;License agreement, MEDIAN Technologies;License agreement, Mitsubishi Corporation;License agreement, Quantitative Insights, Inc;
Ernest Jamison (*Abstract Co-Author*) Nothing to Disclose
Luke Reynolds (*Abstract Co-Author*) Nothing to Disclose
Aritrick Chatterjee, PhD (*Presenter*) Stockholder, QMIS LLC

**PURPOSE**

The purpose of this study was to evaluate the use of an automated Hybrid Multidimensional MRI (HM-MRI) based tool to prospectively identify targets before MR-US fusion biopsy in comparison with PIRADS based evaluation by expert radiologists for prostate cancer (PCa) diagnosis.

**METHODS AND MATERIALS**

In this prospective clinical trial, 91 patients with known or suspected PCa underwent 3T MRI with a conventional mpMRI protocol and HM-MRI and subsequent biopsy. Using the HM-MRI tool, tissue composition was calculated using a three-compartment model and suspected PCa regions with elevated epithelium (>40%) and reduced lumen (<20%) meeting the minimum size requirement of 25 mm2 were identified. Up to two additional biopsy targets per patient were automatically selected by the HM-MRI tool, in addition to the biopsy targets selected based on an expert radiologist's mpMRI interpretation (=PI-RADS 3) using Uronav MR-US fusion biopsy device. Additional 12-core TRUS-guided sextant random biopsy cores were also obtained.

**RESULTS**

The diagnostic performance of HM-MRI for diagnosing clinically significant cancers (=Gleason 3+4), was either higher than, or on par with that of mpMRI. On a per-patient basis, HM-MRI had significantly higher accuracy (55% vs 44%, p=0.022) and specificity (36% vs 14%, p=0.002) than mpMRI. On a per-lesion basis, HM-MRI has significantly higher accuracy compared to mpMRI (58% vs 39%, p<0.001) and PPV (31% vs 22%, p=0.003). On a per-sextant basis, HM-MRI showed significantly better performance than mpMRI for all metrics, including primary endpoints, AUC (0.760 vs 0.647, p<0.001) and accuracy (83.9% vs 79.0%, p<0.001).

**CONCLUSION**

This study demonstrates that HM-MRI has the potential to improve MR-US fusion biopsy results by providing more accurate results compared to PIRADS based evaluation by expert radiologists.

**CLINICAL RELEVANCE/APPLICATION**

HM-MRI has the potential to improve MR-US fusion biopsy and prostate cancer (PCa) diagnosis.

## R1-SSGU06-5 MAGNETIC RESONANCE ELASTOGRAPHY COMBINED WITH PI-RADS V2.1 IMPROVES THE IDENTIFICATION OF CLINICALLY SIGNIFICANT PROSTATE CANCER

Jun Chen, PhD (*Abstract Co-Author*) Nothing to Disclose
Meng Yin, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuntian Chen (*Abstract Co-Author*) Nothing to Disclose
Bin Song, MD (*Abstract Co-Author*) Nothing to Disclose
Jin Yao (*Abstract Co-Author*) Nothing to Disclose
JIE CHEN (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the diagnostic value of tissue stiffness for clinically significant prostate cancer (CSPCa) and to determine the added value of incorporating stiffness into the PI-RADS v2.1 for CSPCa detection.

**METHODS AND MATERIALS**

Patients screened for CSPCa were prospectively included for magnetic resonance elastography and contrast-enhanced MR examination (Clinical trial registration: ChiCTR2300076464). PI-RADS V2.1 score was assessed. Shear stiffness at 60Hz (SS@60Hz) and 90Hz (SS@90Hz) were measured and compared between groups. Area under the receiver operating characteristic curve (AUC) analysis was used to assess diagnostic performance of each variable in detecting CSPCa. AUCs were compared by using the DeLong test.

**RESULTS**

Final cohort included 147 participants (mean age, 67 years±9), including 71 with CSPCa (68 years±9) and 76 without CSPCa (65 years±10). In the peripheral zone, CSPCa had higher stiffness than indolent PCa and chronic prostatitis. No significant difference in stiffness was found between CSPCa and prostate hyperplasia in the transitional zone. For detecting CSPCa in the peripheral zone, sensitivity, specificity, and AUC were 100% (35/35), 58% (30/52), and 0.79 with PI-RADS v2.1, 97% (34/35), 52% (27/52), and 0.80 with SS@60Hz, and 63% (22/35), 87% (45/52), and 0.78 with SS@90Hz. While maintaining high sensitivity, the modified PI-RADS score by incorporating SS@60Hz into PI-RADS v2.1 produced an increased ACU of 0.86, surpassing PI-RADS v2.1 (p=0.02), with a sensitivity of 97% (34/35) and specificity of 75% (39/52).

**CONCLUSION**

The MRE-derived stiffness showed diagnostic performance comparable to the Prostate Imaging Reporting and Data System version 2.1 (PI-RADS v2.1) for clinically significant prostate cancer (CSPCa) in the peripheral zone. Integrating stiffness into the PI-RADS v2.1 improved the diagnostic accuracy and specificity for CSPCa in the peripheral zone.

**CLINICAL RELEVANCE/APPLICATION**

Including lesion stiffness in the Prostate Imaging Reporting and Data System version 2.1 improved the diagnostic accuracy and specificity for clinically significant prostate cancer in the peripheral zone, thus reducing the use of unnecessary biopsy.

## R1-SSGU06-6 THE EFFICACY OF SYNTHETIC DWI IN MULTIPARAMETRIC MRI FOR PROSTATE CANCER DETECTION

Mitsuru Takeuchi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akira Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuichi Kojima (*Abstract Co-Author*) Nothing to Disclose
Yoshihiko Fukukura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yu Ueda, PhD (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Tamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Takuma Maruhisa (*Abstract Co-Author*) Nothing to Disclose
Atsushi Higaki, MD, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

For prostate evaluation in multiparametric MRI (mpMRI), image contrast between benign and malignant tissues using conventional high-b-value single-shot echo-planar diffusion-weighted imaging (DWI) is often insufficient. Inadequate diagnostic accuracy in mpMRI leads to unnecessary biopsies. This study evaluated whether synthetic DWI (syDWI), designed to improve diffusion contrast by adjusting TR and TE in response to the shorter T1 and T2 values of prostate cancer compared to benign prostatic tissue, can enhance the diagnostic performance for clinically significant prostate cancer (csPC) over native acquired conventional DWI (nDWI).

## METHODS AND MATERIALS

This study analyzed 52 patients with csPC who underwent mpMRI using a 3.0T scanner followed by radical prostatectomy. nDWI with a b-value of 2000 s/mm2 (b2000) was obtained with a TR of 6000 ms and TE of 70 ms, followed by the b2000 syDWI was created using dedicated software with a TR of 1000 ms to enhance T1 shine-through and a TE of 0 ms to eliminate T2 shine-through (Figures 1 and 2). syDWI acquisition includes b0 images acquired with two different TR and TE to calculate T1 and T2 values, and b2000 acquired with single TR and TE (Figures 2 and 3). Three radiologists independently assessed each prostate in 12 regions, six peripheral zone (PZ) and six transition zone (TZ) using PI-RADS v2.1 assessment category, where a category =3 indicated positive csPC detection. After evaluating nDWI, syDWI was evaluated 3 weeks later. The index lesion in each patient was also evaluated quantitatively for the tumor contrast ratio.

## RESULTS

In a PI-RADS v2.1-based assessment using radical prostatectomy specimens as a pathological reference standard, syDWI showed a significantly higher diagnostic performance than nDWI for csPC across various prostate zones (Figure 4, 5). For combined the PZ and the TZ evaluations, AUC in syDWI was significantly higher than that in nDWI for all three readers ($P<0.001$ to $P=0.019$). In the PZ assessments, syDWI also provided significantly higher AUC for two readers ($P=0.001$ and $P=0.002$). TZ evaluation confirmed significantly higher AUC on syDWI for all three readers ($P<0.001$ to $P=0.015$). In addition, syDWI tended to have higher sensitivity and specificity in PZ and higher sensitivity in TZ compared to nDWI. The tumor contrast ratio for syDWI was significantly higher than that for nDWI ($0.67\pm0.12$ vs $0.37\pm0.12$, $P < 0.001$).

## CONCLUSION

Compared with nDWI, syDWI demonstrated a higher diagnostic performance for csPC. Utilizing syDWI could be advantageous in avoiding unnecessary biopsies because of its higher diagnostic accuracy for csPC.

## CLINICAL RELEVANCE/APPLICATION

This study highlights the potential of syDWI to improve the accuracy of prostate cancer diagnosis and reduce unnecessary biopsies.

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# Abstract Archives of the RSNA, 2024

R1-SSNMMI07

**Nuclear Medicine and Molecular Imaging (Innovations in Nuclear Medicine)**

Thursday, Dec. 5 8:00AM - 9:00AM Room: S405

Don C. Yoo, MD (*Moderator*) Consultant, Konica Minolta, Inc
Paulo Henrique Rosado de Castro, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R1-SSNMMI07-1 FIRST CLINICAL RESULTS WITH Z-SCANNER, A NOVEL ROBOTIC, HIGH-RESOLUTION SPECT SCANNER

Roxanna Juarez, MD, BA (*Abstract Co-Author*) Nothing to Disclose
Leena Awni (*Abstract Co-Author*) Nothing to Disclose
Andrei Claudiu Cosma (*Abstract Co-Author*) Nothing to Disclose
Kyle Champley (*Abstract Co-Author*) Nothing to Disclose
Paul Barton, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucian Mihailescu (*Abstract Co-Author*) Nothing to Disclose
Youngho Seo, PhD (*Presenter*) Consultant, Biolaurus, Inc;Consultant, BioClinica, Inc;Stockholder, Fortis Therapeutics

### PURPOSE

Leveraging CZT detectors and coded aperture imaging, Z-Scanner is a novel, portable, and robotic SPECT system designed to provide both higher resolution and higher sensitivity per detector area compared to existing gantry-based SPECT systems. A SPECT system able to provide higher imaging performance can have a significant clinical impact for multiple indications. Our main purpose for the study was to demonstrate the clinical feasibility and the technical capability of Z-Scanner in several clinical indications.

### METHODS AND MATERIALS

Twelve patients scheduled to receive a standard-of-care SPECT scan as part of their clinical workups have been recruited in this observational study. Following their regular clinical SPECT scan, the patients were scanned using the Z-Scanner SPECT system in a similar amount of scanning time. Image qualities of images from the clinical standard system and the Z-Scanner system were compared. The scans were focused on constrained anatomical areas because the sensor panel of the current Z-Scanner prototype has a relatively small field-of-view, approximately 22 cm x 12 cm.

### RESULTS

Whereas earlier patient scans were performed to mainly support Z-Scanner development efforts, imaging results were obtained from several different scan types, including lymphoscintigraphy with 99mTc-tilmanocept, thyroid/parathyroid scans with 99mTc-sestamibi, DaTScan with 123I-ioflupane, and regional bone scan with 99mTc-MDP. Compared to the standard of care SPECT, Z-Scanner images indicated superior definition of radiotracer uptake distribution, with increased contrast, higher resolution, and lower noise. Laboratory measurements also indicate that Z-Scanner provides 1-2 mm FWHM resolution, depending on the optics used, and approximately 10 times better contrast to noise ratio for lesions as small as 7.9 mm in diameter in a phantom with spherical lesions with warm background (8:1 lesion-to-background ratio) when compared to standard-of-care SPECT.

### CONCLUSION

Clinical feasibility was demonstrated for the portable, robotic Z-Scanner SPECT system. Clinical images indicate superior representation of radiotracer uptake distribution for regional scans of patients of several indications.

### CLINICAL RELEVANCE/APPLICATION

Whereas the current Z-Scanner prototype has a small single panel with a relatively small field-of-view, the next version of Z-Scanner will have four times the field-of-view and six times the sensitivity. That version is expected to provide fast, high image quality scans of expanded scan coverage. Combined with its portable and open configuration, Z-Scanner may bring a significant change in how molecular imaging will be used throughout the clinical practice.

## R1-SSNMMI07-3 CLINICAL UTILITY OF AI DENOISING FOR COUNT-POOR AMYLOID BRAIN PET/CT STUDIES

Karin Knesaurek, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of our study is to enhance the clinical utility of count-poor amyloid brain PET/CT studies using AI denoising.

### METHODS AND MATERIALS

A time-of-flight (TOF) PET/CT system, specifically the Biograph128_Vision 600 Edge (Siemens Medical Systems, Erlangen, Germany), was utilized for the acquisition of amyloid brain PET/CT studies in list mode. This mode permitted the creation of shorter reconstructed studies in addition to the standard 10-minute study. Images were reconstructed using the iterative 3D Poisson-OSEM algorithm with 8 iterations, 5 subsets (8i5s), an all-pass filter, and corrections for point spread function and TOF. Low-dose CT at 80 kV and exposure 120 mAs was utilized for PET attenuation correction. The

reconstruction matrix size was 440 x 440 mm, resulting in a pixel size of 1.65 x 1.65 mm and a slice thickness of 3.0 mm. The gold standard 10-minute study was visually and quantitatively compared with a 2-minute study processed with FDA-cleared AI denoising software, SubtlePET (Subtle Medical, Menlo Park, CA). Cortical-to-cerebellum SUVr was calculated using six target cortical regions (anterior cingulate gyrus, inferior medial frontal gyrus, lateral temporal lobe, posterior cingulate gyrus, precuneus areas, and superior parietal lobule) along with the cerebellum, employing the MIM Neuro application (MIM Software Inc., Cleveland, OH, Version 7.1).

**RESULTS**

In Figure 1, the visual similarity between the 10-minute and 2-minute corrected scans is notable. The figure displays 2-minute, 10-minute, and 2-minute corrected amyloid PET scans. SUVr values for the anterior cingulate gyrus, inferior medial frontal gyrus, lateral temporal lobe, posterior cingulate gyrus, precuneus areas, and superior parietal lobule were 1.17, 1.20, 1.37, 0.93, 1.26, and 0.95, respectively, for both the 10-minute scan and the 2-minute corrected scan. The average SUVr from all six cortical ROIs in both cases was 1.15, indicating a pathological, amyloid-positive case. Figure 2 presents the Z-score analysis for the 2-minute corrected and 10-minute scans, showing almost identical results.

**CONCLUSION**

The results suggest that 2-minute corrected PET amyloid scans are virtually indistinguishable, both visually and quantitatively, from standard 10-minute PET amyloid scans.

**CLINICAL RELEVANCE/APPLICATION**

Our findings demonstrate that count-poor and noisy amyloid brain PET/CT studies can be rendered clinically useful through AI denoising.

## R1-SSNMMI07-4 COLLAGEN-TARGETED PET/CT IMAGING OF TUBERCULOSIS PATIENTS

Alvaro Ordonez, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

After completing treatment for tuberculosis (TB), millions of TB survivors each year suffer from chronic lung damage. Post-TB lung disease (PTLD) is a multifactorial process that leads to tissue remodeling of the extracellular matrix components, which include fibrillar collagen. 68Ga-CBP8 is a peptide-based type I collagen-targeted probe developed for imaging of tissue fibrosis (Desogere et al. 2017). We hypothesized that PET imaging of pulmonary fibrosis in TB patients would provide valuable data on pathogenesis and serve as an early-disease biomarker for PTLD. Newly identified patients with pulmonary TB were enrolled for the first evaluation of collagen-specific PET imaging in TB patients.

**METHODS AND MATERIALS**

We prospectively enrolled patients with recently confirmed active pulmonary TB with a moderate to severe lung burden as determined by X-ray. Patients were injected IV with 68Ga-CBP8 followed by a PET/CT. Images were analyzed using MIM, and volumes of interest (VOIs) were drawn using the CT as reference. The % affected lung volume was determined by histogram analysis of segmented PET VOIs and included values with an SUVmean >1. Pulmonary function tests and evaluation of blood and sputum inflammatory markers were also performed.

**RESULTS**

Nineteen patients (age 19-58, 6 females) were imaged. The mean administered activity of 68Ga-CBP8 was 120.5 ± 33.2 MBq. There were no adverse effects in any of the subjects. 68Ga-CBP8 demonstrated predominantly renal clearance. CT demonstrated heterogeneity of pulmonary TB, including multiple different lesions (e.g., nodular opacities and cavities). Whole lung and lesion VOIs [122 pulmonary lesions (28 cavitary) and 19 control regions] were analyzed. 68Ga-CBP8 localized in the areas of tissue remodeling (based on tissue density and CT characteristics). The mean % affected lung (based on PET values with SUVmean > 1) was 4.9 ± 3.4 % (range, 0.3 - 13.8 %). The % affected lung volume based on 68Ga-CBP8 PET correlated with decreased lung capacity measured by spirometry (P=0.02). Increased tracer signal was also observed in regions where fibrosis was not apparent by CT, suggesting that 68Ga-CBP8 PET may detect active collagen deposition that is not yet visible by anatomical imaging.

**CONCLUSION**

We present data from a prospective study evaluating collagen-specific PET to characterize fibrotic changes in TB patients. 68Ga-CBP8 PET signal localized to areas of cavitation and consolidation observed in CT. Quantification of 68Ga-CBP8 PET correlated with decreased lung capacity as measured by spirometry.

**CLINICAL RELEVANCE/APPLICATION**

PET imaging of fibrosis represents a clinically translatable tool to noninvasively evaluate early fibrotic changes that could lead to optimization of the diagnosis and management of PTLD.

## R1-SSNMMI07-5 CYTOTOXICITY OF TARGETED ALPHA THERAPY BASED ON SUBCELLULAR LOCALIZATION

Robert Mach (*Abstract Co-Author*) Nothing to Disclose
Jonathan Pham (*Abstract Co-Author*) Nothing to Disclose
Mark A. Sellmyer, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Peter Sang Uk Park (*Abstract Co-Author*) Nothing to Disclose
Daniel Pryma, MD (*Abstract Co-Author*) Research Consultant, Siemens AG;Speaker, Siemens AG;Grant, Siemens AG;Scientific Advisory Board, Trevarx Biomedical, Inc;Stock options, Trevarx Biomedical, Inc;Scientific Advisory Board, MTTI;Stock options, MTTI;Speaker, MTTI;Consultant, Curium SAS;Speaker, Curium SAS;Researcher, Lantheus Holdings;Grant, Lantheus Holdings;Data Safety Monitoring Board, ITM;Speaker, ITM;Consultant, Fusion Pharmaceuticals;Grant, Fusion Pharmaceuticals;Speaker, Fusion Pharmaceuticals;Consultant, Actinium Pharmaceuticals, Inc;Speaker, Actinium Pharmaceuticals, Inc
Hwan Lee, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Uncertainty exists as to whether the subcellular location of targeted alpha therapy (TAT) affects its cytotoxicity. Using a model system that provides a subcellular “zip code” for TAT, we examined the hypothesis that alpha emitters localized closer to the DNA cause higher cytotoxicity.

**METHODS AND MATERIALS**

Human pleural mesothelioma (I45) and ovarian adenocarcinoma (SKOV3) cell lines were engineered to express a fusion Escherichia coli dihydrofolate reductase-yellow fluorescent protein (eDHFR-YFP) localized to the DNA, nucleus, cytoplasm, and plasma membrane. Subcellular TAT was achieved by targeting eDHFR with [211At]At-TMP, the small molecule trimethoprim (TMP) radiolabeled with alpha-emitting astatine-211. This model system was characterized using confocal microscopy, flow cytometry, and radioligand binding assays. In vitro cytotoxicity of subcellular [211At]At-TMP therapy was measured, followed by Monte Carlo microdosimetry. In vivo biodistribution of [211At]At-TMP was measured.

## RESULTS

Live-cell confocal microscopy confirmed the proper subcellular localization of eDHFR-YFP in the nucleus (+/- DNA binding), cytoplasm, and plasma membrane. eDHFR and DNA fluorescence showed co-localization for DNA-bound eDHFR ($p<0.001$) and inverse localization for nuclear eDHFR ($p=0.005$). eDHFR-YFP fluorescence was strongly correlated with the binding assay Bmax ($R2=0.97$). The Kd of [211At]At-TMP was 4.8 ± 0.1 nM. eDHFR-expressing cells showed significantly higher cytotoxicity from [211At]At-TMP compared to the wild-type cells ($p<0.0001$), but not from free 211At treatment. The highest cytotoxicity was seen when [211At]At-TMP was targeted to the DNA, followed by the nucleus. Targeting the plasma membrane caused similar to higher cytotoxicity compared to cytoplasmic targeting. Based on microdosimetry, the relative biological effectiveness (RBE) of 3 was obtained for the recoil nuclei compared to alpha particles and the RBE of 0.1 was obtained for dose deposition in the plasma membrane vs. nucleus. The cytotoxic advantage of DNA-bound and nuclear [211At]At-TMP was maximized in individual tumor cells and tumor cell clusters below 100 µm. Biodistribution showed 84% higher radiation dose in eDHFR-positive vs. wild-type tumors ($p<0.001$). The effect of subcellular TAT is being examined in vivo. *Only I45 results are reported here; SKOV3 yielded similar results.

## CONCLUSION

An alpha emitter's subcellular localization to the DNA or nucleus leads to higher cytotoxicity, and the plasma membrane may also represent a sensitive radiobiological target.

## CLINICAL RELEVANCE/APPLICATION

Our results help understand TAT radiobiology to guide future drug development, and our model system has potential for application in broader TAT research.

## R1-SSNMMI07-6 EXPLORING 3D SPECT FOR LUNG SHUNT FRACTION ESTIMATION IN Y-90 RADIOEMBOLIZATION COMPARED TO 2D PLANAR IMAGING

James R. Halama, PhD (*Abstract Co-Author*) Nothing to Disclose
Jian-Feng Chen, PhD (*Abstract Co-Author*) Nothing to Disclose
Robert H. Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Judy R. James, PHD (*Abstract Co-Author*) Nothing to Disclose
Christopher A. Molvar, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Patricia Gamero Kubota, MD (*Presenter*) Nothing to Disclose

## PURPOSE

Transarterial radioembolization with Yttrium-90 (Y-90) microspheres is an effective treatment for HCC. It is essential to calculate the lung shunt fraction (LSF) to ensure its safety and efficacy. Current LSF calculations employ 2D planar imaging, which may lead to overestimations. Literature suggests that 3D SPECT offers a more accurate LSF. The aim is to compare the LSF calculated using 2D and 3D SPECT images to determine whether using 3D images would yield a more accurate LSF.

## METHODS AND MATERIALS

A retrospective analysis was conducted on LSF and cumulative doses for 56 patients and 86 tumors with HCC, who underwent 99mTc-MAA mapping before the Y-90 treatment. 2D planar and 3D SPECT images of these patients were reviewed. Tomo-SPECT with CT pre-Y90 images was reconstructed using the OESM technique within Q-Volumetrix software to obtain 3D images, allowing visualization of 99mTc-MAA activity in the organs. The software was utilized for the segmentation of the liver and the lungs, providing an automated LSF calculation from 3D SPECT. Calculated Y-90 liver dose and lung dose to be delivered using 2D Planar LSF were compared using the newly obtained 3D SPECT LSF values. The mean LSF between the different calculation methods was compared with paired t-tests and Pearson's correlations. Y-90 doses using 2D Planar LSF and the newly obtained 3D SPECT LSF values were also compared using the same statistical tools.

## RESULTS

The mean LSF in the 2D images was 5.13%, contrasting with 2.12% in 3D SPECT ($p < 0.05$). In 43 out of 56 patients, there was more than 40% increase in the LSF obtained on 2D vs. 3D. Of those, $n=36$, the increase was more than 50%. This could be due to planar imaging may overestimate LSF by providing a global assessment, whereas SPECT offers 3D visualization and calculation of the tracer distribution. The average Y-90 liver dose was found to be 201.42Gy with 2D, while 3D SPECT was 207.70Gy, with a strong Pearson correlation of 0.99. The lung dose showed lower mean values with the 3D, 1.47Gy, compared to the 2D, 3.7Gy ($p < 0.05$), with a Pearson correlation that showed a strong correlation of 0.87. The LSF results with the 3D approach show that a higher liver dose could be administered while delivering lower doses to the lungs.

## CONCLUSION

The abstract highlights the discrepancy in LSF calculation between using a 2D planar or 3D SPECT assessment, and the resulting variance in the dosage delivered. Acknowledging these differences and their significance for patients is essential.

## CLINICAL RELEVANCE/APPLICATION

The significant differences in LSF results between planar and SPECT imaging have potential implications for Y-90 therapy. 3D SPECT could help avoid unnecessary dose reductions, leading to more precise dosage determination and potentially improved treatment outcomes.

# Abstract Archives of the RSNA, 2024

R1-SSRO04

**Radiation Oncology (Genitourinary and Gynecology)**

Thursday, Dec. 5 8:00AM - 9:00AM Room: S401

Brittany Simone, DO (*Moderator*) Nothing to Disclose
Sophia C. Kamran, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R1-SSRO04-1 SINGLE-STEP AUTOMATED SEGMENTATION AND SYNTHETIC CT GENERATION FOR ADAPTIVE PROTON THERAPY

Susu Yan, PHD (*Abstract Co-Author*) Nothing to Disclose
Derek Tang, BS, BA (*Presenter*) Nothing to Disclose

### PURPOSE

To develop and evaluate a single-step deep learning method for simultaneous segmentation and synthetic CT (sCT) generation for adaptive proton radiotherapy using cone-beam CT (CBCT) acquisitions.

### METHODS AND MATERIALS

In this study, a cycle-consistent generative adversarial network (CycleGAN) is used for simultaneous segmentation and sCT generation. CT and CBCT acquisitions from 150 patients with prostate cancer were used to train and validate the model. Transverse CT slices are paired with physician contours of the prostate, bladder, and rectum to form the input images for the CT-to-CBCT generator. Hounsfield unit data and segmentations are stored in individual image channels. A modified cycle-consistent loss is introduced to account for the cross-entropy loss between a physician contour and the segmentation result from a full generative cycle of the model. The mean absolute error (MAE), root-mean-squared error (RMSE), and Dice scores are used to determine sCT and segmentation quality of the model output relative to a deformably registered ground truth. Results of this single-step method are compared to a sequential approach using a traditional CycleGAN model for sCT generation and TotalSegmentor for segmentation of resulting sCT images.

### RESULTS

The proposed single-shot CycleGAN method demonstrated the best performance for automated segmentation and sCT generation. The MAE, RMSE, and Dice scores of generated outputs from this model, relative to the ground truth, are 50.67± 6.82 HU, 92.20 ± 0.45 HU, and 0.85 ± 0.03 respectively. The MAE, RMSE, and Dice of the sequential CycleGAN and TotalSegmentor method are 52.26 ± 7.42 HU, 100.78 ± 0.48 HU, and 0.62 ± 0.11.

### CONCLUSION

The CycleGAN network successfully implemented simultaneous segmentation and unsupervised image translation, outperforming a sequential workflow. This single-shot method drops the runtime of sCT generation and segmentation, providing improved patient care by reducing the duration a patient is on the treatment table. Furthermore, slight decreases in the MAE minimize uncertainties in range during adaptive proton treatments. The DIRs used to establish the ground truth are limited in accurately conforming a CT scan and contours to its corresponding CBCT geometry, especially with the bladder and rectum. This suggests that the Dice scores reported are deflated and highlights the benefits of an adaptive workflow for improved organ-at-risk monitoring. Ongoing work focuses on improving proton treatment planning outcomes using this model.

### CLINICAL RELEVANCE/APPLICATION

This work accelerates the adaptive proton therapy workflow to improve the patient treatment experience while minimizing setup errors and range uncertainties due to changes in patient position and internal anatomies.

## R1-SSRO04-3 EFFECTS OF AGE, RACE, ETHNICITY, AND MEDICATION USE ON RSIRS, A QUANTITATIVE PROSTATE MRI BIOMARKER

Daniel J. Margolis, MD (*Abstract Co-Author*) In-kind support, Siemens AG;Consultant, Promaxo, Inc
Ahmed Shabaik, MD (*Abstract Co-Author*) Nothing to Disclose
Sophia C. Kamran, MD (*Abstract Co-Author*) Nothing to Disclose
Mariluz Rojo Domingo (*Abstract Co-Author*) Nothing to Disclose
Madison Baxter (*Abstract Co-Author*) Nothing to Disclose
Anders M. Dale, PhD (*Abstract Co-Author*) Founder, CorTechs Labs, Inc;Stockholder, CorTechs Labs, Inc;Research Grant, General Electric Company;Scientific Advisory Board, Human Longevity, Inc;Consultant, Eli Lilly and Company
Kang-Lung Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Allison Zhong (*Abstract Co-Author*) Nothing to Disclose
Dimitri A. Kessler, PhD (*Abstract Co-Author*) GlaxoSmithKline, Funding of PhD Studentship
Karoline Kallis (*Abstract Co-Author*) Nothing to Disclose
Ian Mathews (*Abstract Co-Author*) Nothing to Disclose
Isabella Pompa (*Abstract Co-Author*) Nothing to Disclose
Rebecca Rakow-Penner, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Consultant, Human Longevity Inc;Stockholder,

CureMetrix, Inc;Stock options, CorTechs Labs, Inc
Michael A. Ohliger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael E. Hahn, MD,PhD (*Abstract Co-Author*) Consultant, CorTechs Labs, Inc;Research Grant, General Electric Company;Spouse, Employee, Illumina, Inc;;
Michael Liss, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Kane, MD (*Abstract Co-Author*) Nothing to Disclose
Tyler Seibert, MD, PhD (*Abstract Co-Author*) Research Consultant, Cortechs.ai;Scientific Advisory Board, Cortechs.ai;Stock options, Cortechs.ai;Travel support, Siemens AG;Speaker, Siemens AG;Institutional research agreement, General Electric Company
Christopher Conlin (*Abstract Co-Author*) Nothing to Disclose
Anthony Pamatmat (*Abstract Co-Author*) Nothing to Disclose
Aditya Bagrodia (*Abstract Co-Author*) Nothing to Disclose
Jacob Roberts (*Abstract Co-Author*) Nothing to Disclose
Clare M. Tempany-Afdhal, MBBCh, MA (*Abstract Co-Author*) Advisory Board, Profound Medical Inc;Advisory Board, Promaxo, Inc;Advisory Board, Medscape, LLC;Research support, InSightec Ltd;Research support, Gilead Sciences, Inc;;
Eric P. Weinberg, MD (*Abstract Co-Author*) Nothing to Disclose
Gary M. Hollenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD (*Abstract Co-Author*) Nothing to Disclose
Tristan Barrett, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Natasha E. Wehrli, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew Cooperberg (*Abstract Co-Author*) Consultant, Sanpower Group Co., Ltd;Consultant, Astellas Group;Consultant, AstraZeneca PLC;Consultant, Veracyte, Inc;Consultant, Bayer AG;Consultant, Exelixis, Inc;Consultant, F. Hoffmann-La Roche Ltd
Paul M. Murphy II, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sean A. Woolen, MD, MS (*Abstract Co-Author*) Research Grant, Siemens AG;Investigator, Siemens AG
Nour Nakrour, MD (*Abstract Co-Author*) Nothing to Disclose
Felix Feng, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Exact Sciences Corporation;Consultant, Sumitovant Biopharma Ltd;Consultant, Roivant Sciences Holdings Limited;Consultant, Astellas Group;Consultant, SerImmune Inc;Scientific Advisory Board, Serimmune Inc;Stock options, Serimmune Inc;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Consultant, Bristol-Myers Squibb Company;Consultant, BlueStar Genomics, Inc;Consultant, Artera Services, LLC;Medical Advisor, Artera Services, LLC;Stock options, Artera Services, LLC;Consultant, Novartis AG;Consultant, Tempus Labs
Jonathan Levine, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas L. Osinski, MD (*Abstract Co-Author*) Nothing to Disclose
Courtney Ollison (*Abstract Co-Author*) Nothing to Disclose
Yuze Song (*Abstract Co-Author*) Nothing to Disclose
George Xu (*Abstract Co-Author*) Nothing to Disclose
David Song (*Abstract Co-Author*) Nothing to Disclose
Karan Santhosh (*Abstract Co-Author*) Nothing to Disclose
Deondre Do, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Multiparametric MRI (mpMRI) has significantly improved detection of clinically significant Prostate cancer (csPCa), but a lack of expert sub-specialist radiologists leads to widespread variation in the performance of Prostate Imaging Reporting Data System [PI-RADS] v2.1. A reliable, reproducible quantitative imaging biomarker with objective interpretation could mitigate variation in subjective mpMRI interpretation, leading to more equitable patient care. Restriction Spectrum Imaging restriction score (RSIrs) is an MRI biomarker previously shown to improve quantitative interpretation of prostate MRI. Patient-level factors (age, race, ethnicity, and 5-alpha-reductase inhibitors [5-ARIs]) might affect interpretation of MRI. Their impact on quantitative RSIrs is unknown.

**METHODS AND MATERIALS**

RSI data was gathered at 4 institutions. Inclusion criteria for this retrospective analysis were: prostate MRI performed for suspicion of csPCa, no hip implant, and no csPCa detected (i.e., PI-RADS v2.1 score of 1 or 2 with prostate specific antigen density < 0.15 or any PI-RADS score followed by biopsy negative for csPCa within 6 months of mpMRI). RSI data was corrected to account for noise, B0-inhomogeneities, gradient nonlinearities, and eddy currents. Maximum RSIrs (RSIrsmax) was calculated using the maximum restricted signal intensity divided by the median b=0 diffusion signal within the prostate. Linear mixed effects modeling was used to estimate effects of patient-level factors on RSIrsmax.

**RESULTS**

427 patients met the inclusion criteria. Median (IQR) age was 69 (63,74). Self-reported race was 313 White, 36 Asian, 13 Black, 65 Other; 50 also self-reported Hispanic ethnicity. 66 patients were on 5-ARIs at the time of mpMRI. Median (IQR) RSIrsmax was 169 (136, 205), consistent with a low probability of csPCa. None of the patient-level factors was associated with a significant difference in RSIrsmax.

**CONCLUSION**

RSIrs is a promising biomarker and is not noticeably affected by age or 5-ARIs in patients without csPCa, suggesting reliability across a broad population. There was no indication of effects by race or ethnicity, either, but more data are needed to confirm.

**CLINICAL RELEVANCE/APPLICATION**

An imaging score, RSIrsmax, that has been previously shown to make prostate cancer more consistently detectable on prostate MRI, appears unaffected by patient age, race, ethnicity, or use of common medications for urinary symptoms (5-ARIs) and therefore may be useful for a wide range of patients.

## R1-SSRO04-4 MULTIMODAL ARTIFICIAL INTELLIGENCE FOR PROSTATE CANCER TREATMENT OUTCOME PREDICTION: A PILOT STUDY

Peter L. Choyke, MD (*Abstract Co-Author*) Nothing to Disclose
Luca F. Valle, MD (*Abstract Co-Author*) Nothing to Disclose
Krishnan Patel (*Abstract Co-Author*) Nothing to Disclose
Lindsay Rowe (*Abstract Co-Author*) Nothing to Disclose
J. Daniel Pennington (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Harmon, PhD (*Abstract Co-Author*) Nothing to Disclose
Avani Rao (*Abstract Co-Author*) Nothing to Disclose
David Clifton (*Abstract Co-Author*) Nothing to Disclose
Deborah Citrin, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Pinto (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;License agreement, Koninklijke Philips NV;

Lei Clifton (*Abstract Co-Author*) Nothing to Disclose
Benjamin Simon, BS, BA (*Presenter*) Nothing to Disclose

**PURPOSE**

Prostate cancer (PCa) is the second most common cause of mortality among biological males in the US. Risk stratification techniques such as the D'Amico risk categories and NCCN risk groups have suboptimal performance. Presently, there are no high-quality, artificial intelligence (AI)-based computer vision (CV) models to risk stratify patients with PCa based on T2W MRI. Here, we report the development of a multimodal, deep-learning pipeline using CV enhanced with clinical covariates to predict the probability of biochemical recurrence (BCR) for patients with PCa undergoing definitive radiotherapy (RT) ± androgen deprivation therapy (ADT).

**METHODS AND MATERIALS**

A single-center cohort (n=176 [RT:17% / RT+ADT:83%]) was used to develop a pilot model prior to an ongoing multicenter study (n□1000). Three models were developed: a unimodal CV model (M1), a unimodal random forest (RF) model (M2), and a multimodal RF model (M3). Using an open-source, pre-trained segmentation algorithm, we used transfer learning to create a T2W MRI-based risk prediction score by augmenting a pre-trained, 34-layer ResNet with additional layers. For M1, a train (n=100)/validation (n=28)/test (n=48) split was used. Subsequently, RF models (M2-3) were developed using equivalent data partitioning, utilizing 128 cases for training/cross-validation and the same test set (n=48) as in M1 development. Clinical variables included pre-RT PSA, Gleason score, primary Gleason pattern, and seminal vesicle invasion (SVI) confirmed with biopsy. Evaluated performance metrics included accuracy, sensitivity, specificity, and area under the receiver operating curve (AUROC), reported with corresponding bootstrapped intervals (n=5000); M2 and M3 were compared via a paired z-test on each bootstrapped sample for each metric.

**RESULTS**

At a median follow-up of 6.3 years, 22 BCR events were observed. M3 had the highest test set performance (90% accuracy, 86% sensitivity, 90% specificity, and AUROC of .92) with no significant difference over M2 (all p>0.05).

**CONCLUSION**

We present the first multimodal computer vision-based model for predicting BCR after RT±ADT and demonstrate its potential for superior performance over unimodal models. Planned expansion in a future multi-center study will augment the training set and provide external validation. With this novel approach, we demonstrate that this model combining computer vision and clinical co-variates may improve model performance over purely clinical or radiologic models alone.

**CLINICAL RELEVANCE/APPLICATION**

Leveraging AI to predict BCR from MRI has the potential to improve PCa risk stratification over clinical variables alone. After further external validation, future models based on this pilot work may inform treatment selection.

## R1-SSRO04-5 RELATIONSHIP BETWEEN RADIATION-RELATED BONE SIDE EFFECTS IN FEMALES TREATED FOR GYNECOLOGICAL CANCERS AND THEIR PRETREATMENT BONE DENSITIES OF L1 VERTEBRAL BODY AND THE TOTAL RECEIVED RADIATION DOSE

Hana Malikova, PhD, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of our study was to evaluate the rate of radiation-related bone side effects in females treated for gynecological cancer as cervical and endometrial cancer and to study the relationship between radiation-related bone side effects and patient´s age, pretreatment bone densities of the L1 vertebral body and the total received radiation dose.

**METHODS AND MATERIALS**

We retrospectively studied all imaging scans (CT and MRI) in patients that were treated by radical radiotherapy (RT) for cervical cancer and patients with endometrial carcer who were treated by radical surgery followed by RT. On available imaging scans we searched for radiation-related bone side effects as insufficiency fractures or osteonecrosis. Bone density was measured on pretreatment CT in the center of the L1 vertebral body with a region of interest of 4 cm2. The total received radiation dose was calculated as the sum of external beam RT, brachy-RT and lymph nodes RT doses. Data were compared by pair t-test.

**RESULTS**

We included 127 females, 63 treated for cervical and 64 treated for endometrial cancer. The rate of radiation-related bone side effects mostly fractures was similar in both groups; 28.6 % versus 26.6% of subjects. Both groups significantly differed in age, in the values of pretreatment densities at L1 and in the total received RT dose. Females with cervical cancer were significantly younger than females with endometrial cancer; 52.8 ± 13.1 versus 66.0 ± 9.9 years ($p < 0.001$); their mean bone densities were higher 150.5 ± 54.5 versus 125.8 ± 41.2 HU $p = 0.005$); they received higher total RT dose 80.1 ± 14.1 versus 62.1 ± 13.9 Gy ($p < 0.001$). When we compared only subjects with radiation-related fractures, we found that subjects treated for cervical cancer with fractures were still significantly younger than subjects treated for endometrial cancer that suffered from bone side effects, mean 62.4 ± 10.1 versus 70.0 ± 7.3 years ($p = 0.018$), and they received higher total RT dose, 77.9 ± 5.8 versus 62.2 ± 11.4 Gy ($p < 0.001$). However, bone densities were comparably low in both subgroups, 106.3 ± 40.0 versus 103.8 ± 29.0 HU ($p = 0.829$).

**CONCLUSION**

Despite of age and total received RT dose differences between groups of females treated for cervical and endometrial cancers, we found similarly high rate of radiation-related fractures in both groups, 28.6 % versus 26.6%, respectively. Radiation-related bone side effects were strongly associated with low pretreatment bone densities at L1 that reflected osteoporosis.

**CLINICAL RELEVANCE/APPLICATION**

L1 bone densities measurement is easy without additional cost and could help to search for patients in risk; in those patients preventive treatment could be considered.

## R1-SSRO04-6 DOES SEQUENCING MATTER? GENITOURINARY (GU) TOXICITY RISK FOR COMBINATION HIGH DOSE-RATE (HDR) BRACHYTHERAPY PLUS INTENSITY MODULATED RADIOTHERAPY (IMRT) FOR PROSTATE CANCER (PC)

Thandiwe Gray, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Watkins (*Abstract Co-Author*) Nothing to Disclose
Keaton A. Rummel, BS (*Abstract Co-Author*) Nothing to Disclose
John M. Watkins, MD (*Abstract Co-Author*) Nothing to Disclose

Jackson S. Wilson, BS (*Abstract Co-Author*) Nothing to Disclose
Annika O. Price, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Determine whether clinically significant acute and late GU toxicity risks differ for IMRT followed by HDR (IMRT->HDR) versus HDR followed by IMRT (HDR->IMRT) for PC.

**METHODS AND MATERIALS**

Intradepartmental quality assurance database was utilized to identify patients with non-metastatic PC treated with combination single-fraction HDR brachytherapy (15 Gy) plus IMRT (37.5-45 Gy in 15-25 fractions) with minimum 90 day post-HDR follow-up, and charts were reviewed for GU toxicities. Acute toxicities occurred within 90 days of treatment completion, while late were those persisting/developing >90 days. Clinically significant toxicities (G3+) were defined as refractory to initial medication therapy or emergency/inpatient management or procedure. Regression analyses were performed on clinical (e.g., age, GU symptom score, pre-/post-HDR medication) and treatment (HDR/IMRT sequence/interval, dosimetry) factors for association with G3+ GU toxicities.

**RESULTS**

From 2019 to 2023, 76 HDR/IMRT patients were identified for inclusion. Nineteen (25%) underwent IMRT->HDR and 57 (75%) HDR->IMRT. Median age was 69 years (range, 50-84), median PSA 8.0 ng/mL (4.3-144.1), and 62 (82%) received hormone therapy (HT; median 6 months). Median prostate volume was 35cc (17-82). Median intervals between HDR and IMRT was 13 days (1-50). Treatment groups were balanced by clinical and treatment factors. Sixteen patients experienced G3+ acute GU toxicity (n=3 (16%) IMRT->HDR, 13 (23%) HDR->IMRT), including 7 requiring catheter. At a median follow-up of 32mo (4-58), 13 patients experienced G3+ late GU toxicity; 4 patients (21%) IMRT->HDR and 9 (16%) HDR->IMRT. Toxicities were medication-refractory dysuria or urgency/frequency (8), catheter (2), stricture (1), or other (2). No statistically significant difference was detected for treatment sequence and either G3+ acute (p=0.516) or late (p=0.587) GU toxicity risks. Only pre-HDR NSAID (p=0.034) and post-HDR urinary modifier medication (p=0.027) were significantly correlated with reduced risk of acute GU toxicity, while higher volume receiving 200% of prescribed HDR dose (V200) was associated with increased risk of late toxicity (p=0.028).

**CONCLUSION**

HDR/IMRT sequence does not appear to impact G3+ acute or late GU toxicity risks. Further investigation of medication intervention and dosimetric factor associations with GU toxicity risks are warranted.

**CLINICAL RELEVANCE/APPLICATION**

HDR brachytherapy and IMRT is a safe and effective option for localized PC. The present study demonstrates that clinicians can select either sequence of HDR or IMRT first without detectable differences in G3+ GU toxicity risk.

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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R1-SSVA04

**Vascular Imaging (Neurovascular)**

Thursday, Dec. 5 8:00AM - 9:00AM Room: N229

Shruti Mishra, MD (*Moderator*) Nothing to Disclose
Laura B. Eisenmenger, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R1-SSVA04-1 HIGH-RESOLUTION SPINAL CORD MR ANGIOGRAPHY (HRSPC-MRA)FOR DETECTING ARTERIAL SUPPLY AND FISTULAE IN SPINAL DURAL ARTERIOVENOUS FISTULAE(SDAVF)

Kai Ai (*Abstract Co-Author*) Nothing to Disclose
Jing Zhang (*Abstract Co-Author*) Nothing to Disclose
Wanjun Hu (*Presenter*) Nothing to Disclose

### PURPOSE

Non-invasive arterial supply and fistula location detection in SDAVF is a tremendous clinical challenge. This study aimed to improve the diagnostic efficacy of SDAVF disease by detecting the arterial supply location and fistula in SDAVF with HRSPC-MRA and comparing it with digital silhouette angiography (DSA).

### METHODS AND MATERIALS

A total of 21 patients with clinically suspected and confirmed dural arteriovenous fistulae were enrolled in this prospective study. All patients underwent HRSPC-MRA preoperatively, with the following imaging parameters: FOV: 380×380, matrix: 480×480, and voxel: 0.8 mm×0.8 mm×0.8 mm, and then double-dose Magnevist and saline were injected using a high-pressure syringe at a flow rate of 4 ml/s. Finally, maximum-density projection images were used to identify and confirm the dural arteriovenous fistulae. A double dose of Magnevist and saline was injected using a high-pressure syringe at a flow rate of 4 ml/s while spinal cord dynamic angiography and HRSPC-MRA were acquired. Finally, maximum density projection images were used to identify and confirm the arteries supplying blood to the dural arteriovenous fistula and the fistula location and number, and the results were compared with the intraoperative DSA imaging results. The agreement between the two imaging techniques was also assessed using Bland-Altman analysis with t-test and Mann-Whitney test for measurement data and Chi2 for dichotomous/categorical variables.

### RESULTS

Demographic data (age, gender, tumor location) of all patients were not statistically significant, the number of fistulas was obtained based on HRSPC-MRA detection (n=25) and DSA imaging (n=28), the two imaging methods were not statistically significant in detecting the number of fistulas (p=0.256), whereas the location of the supplying arteries was obtained by HRSPC-MRA detection and the number of fistulas were comparable to DSA imaging, with high agreement in Bland-Altman analysis.

### CONCLUSION

HRSPC-MRA is comparable to DSA in detecting the location of blood-supplying arteries and the number of fistulas in SDAVF and can detect and confirm the location of blood-supplying arteries and fistulas in SDAVF noninvasively before surgery, which provides an essential value for the clinical treatment of SDAVF.

### CLINICAL RELEVANCE/APPLICATION

HRSPC-MRA can not only detect SDAVF blood-supplying arteries and the number and location of fistulas non-invasively before surgery, but also improve the ability to treat SDAVF, reduce the cost of patients, shorten the treatment time of clinical patients, and reduce the radiation dose to patients and clinicians.

## R1-SSVA04-2 DOES CT ANGIOGRAPHY FOR THE ARTERY OF ADAMKIEWICZ TRULY PROVIDE VALUE-ADDED INFORMATION OVER STANDARD CT ANGIOGRAPHY?

Tatsuya Saito, RT (*Abstract Co-Author*) Nothing to Disclose
Hiroki Horinouchi (*Abstract Co-Author*) Nothing to Disclose
Rina Sakai (*Abstract Co-Author*) Nothing to Disclose
Yuna Okura (*Abstract Co-Author*) Nothing to Disclose
Yasutoshi Ohta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akiyuki Kotoku, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masaki Sakurai (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Tomoro Morikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroki Nakajima, RT (*Abstract Co-Author*) Nothing to Disclose

Tatsuya Nishii, MD, PhD (*Presenter*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation

**PURPOSE**

Finding the critical segmental artery supplying the artery of Adamkiewicz (AKA) is crucial to assess the risk of spinal cord ischemia (SCI) before treating the descending aorta. AKA-CTA has high success rates in AKA identification, but its effectiveness in TEVAR scenarios needs to be confirmed. This study aims to determine whether additional information from AKA-CTA, beyond standard CTA, influences TEVAR strategy and which cases would benefit from this additional procedure.

**METHODS AND MATERIALS**

A retrospective analysis was conducted on 176 consecutive cases from January 2021 to February 2024, where both standard CTA and specialized AKA-CTA were performed to evaluate the AKA before treatment. Cases with more than 90 days interval between two CTAs or those using reduced contrast protocols due to renal impairment were excluded. A single specialist assessed the level and laterality of the AKA. The consistency of the results between CTA and AKA-CTA was measured by the accuracy and positive predictive value (PPV) and negative predictive value (NPV) using AKA-CTA as the reference standard. Planning for TEVAR was also evaluated based on CTA, with changes in TEVAR strategy and SCI risk score upon incorporating additional information from AKA-CTA. Predictors of these value-added AKA-CTA cases were assessed in a multivariate analysis.

**RESULTS**

Out of 160 cases (median age 70 [IQR 58-77], 50 females, 101 dissections, 47 aneurysms, and 12 others), CTA identified the AKA in 94 cases (58.8%). In comparison, AKA-CTA did so in 155 cases (96.9%). AKA-CTA resulted in significantly higher radiation exposure (CTDIvol 16.3 [13.9-23.0] vs. 7.3 [5.8-8.9] mGy) and contrast agent dosage (498±61.6 vs. 385±54.0 mgI/kg). CTA had an accuracy of 50% (80/160), PPV of 83% (77/94), and NPV of 5% (3/66) compared to AKA-CTA. AKA at the thoracic level was more consistent than at the lumbar level (P = 0.04). TEVAR planning was conducted in 55 cases out of 80 with inconsistent results for CTA and AKA-CTA. Using CTA, a proximal landing zone =3 was observed in 39 cases (71%), a distal landing zone =5 in 23 cases (47%), and a cover length of 150mm [IQR 131-150]. An SCI risk score of =1 was observed in 35 cases (64%). Based on additional AKA-CTA information, 17 cases (31%) had TEVAR planning or SCI risk score changes. Multivariate analysis showed that only the distal landing zone =5 (OR=18.4, 95%CI 4.3-130) were a significant independent predictor of these changes.

**CONCLUSION**

AKA-CTA provided value-added insights over CTA in TEVAR cases with the distal landing zones=5, influencing treatment decisions.

**CLINICAL RELEVANCE/APPLICATION**

In the current TEVAR era, AKA CTA is only sometimes part of the routine before treating the descending aorta. However, it is a worthwhile addition in cases with the distal landing zone =5.

## R1-SSVA04-3 DEEP LEARNING ENHANCED MR TIME-OF-FLIGHT REDUCES ACQUISITION TIME AND IMPROVES DELINEATION OF SMALL ARTERIES

Suzie C. Bash, MD (*Abstract Co-Author*) Consultant, CorTechs Labs, Inc;Consultant, icoMetrix NV;Consultant, Subtle Medical, Inc;Consultant, Darmiyan, Inc
Ajit Shankaranarayanan (*Abstract Co-Author*) Employee, Subtle Medical, Inc
Lanhong Yao (*Abstract Co-Author*) Nothing to Disclose
Zechen Zhou (*Abstract Co-Author*) Nothing to Disclose
Lei Xiang (*Abstract Co-Author*) Nothing to Disclose
Long Wang (*Abstract Co-Author*) Nothing to Disclose
Lawrence N. Tanenbaum, MD (*Presenter*) Speaker, General Electric Company;Speaker, Siemens AG;Speaker, Guerbet SA;Speaker, Koninklijke Philips NV;Consultant, icoMetrix NV;Consultant, Subtle Medical, Inc;Consultant, Columbo;Consultant, iMedis;Consultant, Agamon;Consultant, FUJIFILM Holdings Corporation

**PURPOSE**

3D Time-of-Flight (TOF) Magnetic Resonance (MR) angiography has demonstrated its diagnostic value in detecting cerebrovascular diseases. Compressed Sensing (CS) and Parallel Imaging (PI) have been used to accelerate 3D TOF scans, but the amplified noise may hinder image quality and limit scan acceleration. In this work, we propose a Deep Learning (DL) enhancement method to improve the quality of accelerated TOF and evaluate its performance for artery delineation in comparison to the standard-of-care (SOC) TOF.

**METHODS AND MATERIALS**

A novel DL network was developed based on ConvNext with local and global skip connections, and trained on a larger training dataset with 2051 low and high quality MR image pairs, covering a wide range of different MR field strengths, contrast weightings and anatomies. For this study, 30 3D TOF brain image sets were acquired for qualitative and quantitative evaluation: 25 TOF sets (Hitachi/Fuji 1.16T) with PI accelerated protocols (scan time from 3:55 to 9:14, acceleration factor from 1.9 to 2.4, TR from 20ms to 34ms), 1 TOF set (Siemens 1.5T) acquired with SOC (with PI x2, 8:26), and 2-fold/5-fold CS accelerated SOC (8:45/4:22), and 4 TOF sets (United Imaging 3T) acquired with paired SOC (with PI, 1:43) and further CS accelerated SOC (1:08). We applied the trained DL model on the accelerated TOF and qualitatively compared quality against the input. On the 5 test sets with a SOC series, we measured the Signal-to-Noise Ratio (SNR) on the TOF slices (within a local uniform white matter region) and Contrast-to-Noise Ratio (CNR) on the axial Maximum Intensity Projection (MIP) images (left and right posterior cerebral arteries in the P4 segment). A paired t-test was performed to test the statistical significance.

**RESULTS**

The qualitative review showed consistent and superior quality of enhanced TOF over the acquired TOF across all 30 test cases. DL processing largely suppressed the noise/artifacts on CS x2 and CS x5 acquired images, while preserving the signal intensities within the lumen. Superior artery contrast and more small peripheral arterial branches can be observed on the MIP reconstruction in enhanced images. Significant improvement in SNR on TOF slices ($a<0.0001$, 167% over SOC on average) and CNR at peripheral arterial branches on MIP images ($a<0.01$, 188% over SOC on average) were demonstrated.

**CONCLUSION**

The proposed DL enhancement method can significantly improve the quality of accelerated 3D TOF enabling faster acquisition and more small arteries becoming visible with improved contrast on the MIP image.

### CLINICAL RELEVANCE/APPLICATION

DL enhancement methods can significantly improve the quality of TOF images allowing shortened clinical scan time and improved delineation of arteries for cerebrovascular disease assessment.

## R1-SSVA04-4 SUB-1-MINUTE RELAXATION-ENHANCED ANGIOGRAPHY WITHOUT CONTRAST AND TRIGGERING OF THE EXTRACRANIAL ARTERIES BY COMBINING COMPRESSED SENSE WITH DEEP LEARNING BASED RECONSTRUCTION: EVALUATION IN HEALTHY VOLUNTEERS

Thorsten Persigehl, MD (*Abstract Co-Author*) Nothing to Disclose
Christoph Kabbasch (*Abstract Co-Author*) Consultant, Acandis GmbH & Co KG;Proctor, Terumo Corporation
Robert Terzis, MD (*Abstract Co-Author*) Nothing to Disclose
Kilian Weiss, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Carsten H. Gietzen, MD (*Abstract Co-Author*) Nothing to Disclose
Kenan Kaya, MD (*Abstract Co-Author*) Nothing to Disclose
Lenhard Pennig, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Institutional Grant, Koninklijke Philips NV
Lukas Goertz (*Abstract Co-Author*) Nothing to Disclose
Robert Hahnfeldt (*Abstract Co-Author*) Nothing to Disclose
Roman J. Gertz, MD (*Abstract Co-Author*) Institutional research contract, Koninklijke Philips NV
Jan Paul Janssen, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the acceleration of Relaxation-Enhanced Angiography without Contrast and Triggering (REACT) using Compressed SENSE (CS) and a newly developed deep learning-based algorithm (CS-AI) for rapid non-contrast MRA of the cervical arteries.

### METHODS AND MATERIALS

This prospective single-center study included 34 healthy volunteers (median age 59 [IQR53-62] years; 14 men), who received carotid imaging using a 3D isotropic flow-independent REACT (reconstructed voxel size: 0.625×0.625×0.75 mm3) sequence at 3T. REACT was acquired threefold: (1) CS factor 7 (CS 7; fixed scan time: 1:20 min), (2) CS factor 10 (CS 10, fixed scan time: 0:55 min), and CS factor 10 with deep learning-based image reconstruction (CS 10-AI, fixed scan time: 0:55 min). Two radiologists rated the image quality of eight different cervical artery segments on a 7-point scale (7=excellent) and assessed overall image noise on a 5-point scale (5=none). Pairwise forced-choice comparison was performed to determine the acquisition technique considered more suitable for vessel evaluation. Apparent signal- and contrast-to-noise ratios (aSNR/aCNR) were measured for the common carotid artery (CCA) and internal carotid artery (ICA, C1 segment).

### RESULTS

Compared to CS 7 and for all arteries combined (5.07 [4.52-5.43]), CS 10 showed lower image quality scores (4.71 [4.38-5.11]; p<.001) while CS 10-AI obtained higher results (5.29 [4.88-5.43]; p=.01). In this context, CS 10-AI achieved significantly higher scores at the aortic arch (p=.004), while CS 10 achieved significantly lower scores at the V1 segment (p=.002) and for all segments of the extracranial carotid arteries combined (p<.001). Forced choice revealed a preference for CS 7 over CS 10 (p<.001), a preference for CS 10-AI over CS 10 (p<.001), but no preference between CS 7 and CS 10-AI (p=1). Image noise was rated similar between CS 7 and CS 10 (p=.14) while CS 10-AI yielded a lower noise than CS 7 (p=.008). Compared to CS 7 and for CCA and ICA combined (aSNR: mean 30.12±5.14, aCNR: 27.49±5.34), values of objective image quality were lower in CS 10 (aSNR: 27.17±5.28, aCNR: 24.67±5.44; all p<.001) whereas CS 10-AI yielded higher results (aSNR: 32.86±5.47, p<.001; aCNR: 29.81±5.79, p=.001).

### CONCLUSION

CS-AI enables rapid acquisition of REACT of the cervical arteries in less than a minute without compromising image quality. Future studies are required to confirm these findings in patients and evaluate its diagnostic performance for vascular findings, e.g. ICA stenosis or dissection.

### CLINICAL RELEVANCE/APPLICATION

CS-AI enables the acquisition of REACT of the neck in less than one minute, indicating its use for rapid imaging of the extracranial arteries without gadolinium contrast.

## R1-SSVA04-5 DEEP LEARNING MODEL FOR AUTOMATED DIAGNOSIS OF MOYAMOYA DISEASE BASED ON MAGNETIC RESONANCE ANGIOGRAPHY: DIFFERENTIAL DIAGNOSIS WITH ATHEROSCLEROTIC DISEASE AND NORMAL CONTROLS

Chune Ma (*Abstract Co-Author*) Nothing to Disclose
Lv Jiahui (*Abstract Co-Author*) Nothing to Disclose
Yuan Liu (*Abstract Co-Author*) Nothing to Disclose
Baobao Li (*Abstract Co-Author*) Nothing to Disclose
Chao Zheng (*Abstract Co-Author*) Nothing to Disclose
Mingming Lu (*Abstract Co-Author*) Nothing to Disclose
Shitong Liu (*Abstract Co-Author*) Nothing to Disclose
Yijia Zheng (*Abstract Co-Author*) Nothing to Disclose
Jianming Cai (*Abstract Co-Author*) Nothing to Disclose
Hongtao Zhang (*Abstract Co-Author*) Nothing to Disclose
Xiaolan Zhang (*Abstract Co-Author*) Nothing to Disclose
Dennis Jiang (*Presenter*) Nothing to Disclose

### PURPOSE

Moyamoya disease (MMD) is a rapidly progressing cerebrovascular disease with a high risk of cerebral hemorrhage, making early diagnosis and intervention crucial. Magnetic resonance angiography (MRA) is preferred over DSA and CTA for MMD screening due to its non-invasive and lack of contrast agents. However, the scarcity of MMD coupled with the large number of cerebrovascular examination images present challenges, including time-consuming and risk of misdiagnosis and missed diagnosis. This study explores the potential of the deep learning-based convolutional neural network (CNN) to automatically recognize MMD using MRA images.

### METHODS AND MATERIALS

The dataset comprised MRA images from 600 patients including 200 MMDs, 200 ASDs and 200 NCs, collected from our institution (Ethic ID: 20160411). The images were divided into training (75%), validation (15%), and testing (10%) sets. The performances of 3D CNN models were evaluated using a comprehensive set of metrics such as area under the curve (AUC), accuracy (ACC) and others. The input to the CNN models comprised preprocessed MRA

images, while the output was a tripartite classification label that identified the patient's diagnostic group (Figure 1). Finally, Grad-CAM was used to visualize the CNN's decision-making process in MMD diagnosis by highlighting key areas.

## RESULTS

Table 1 presents the performance metrics for all models in the tripartite classification of MMD, ASD and NC. Notably, DenseNet-121 exhibited superior discrimination capabilities, achieving a macro AUC of 0.980 and an ACC of 0.9444 in the test sets. The per-class area under the receiver operating characteristic curve (ROC) and AUC values are depicted in Figure 2. In the binary classification where ASD and NC were group together, with MMD as the separate group for targeted detection, DenseNet-121 achieved an ACC of 0.983 (Table 2). Additionally, Figure 3 illustrates the Grad-CAM results for the MMD, with areas of intense redness indicating critical areas identified by the model, reflecting decision-making similar to human experts.

## CONCLUSION

This study highlights the efficacy of CNN model in the automated diagnosis of MMD on MRA images.

## CLINICAL RELEVANCE/APPLICATION

The CNN-based deep learning models enhances the accuracy and efficiency of MMD detection, easing the workload on radiologists and promising integration into clinical workflows.

# Abstract Archives of the RSNA, 2024

R2-STCE1

**Science Session (Low-Field and Mobile MRI)**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## R2-STCE1-1 IMPLEMENTATION AND REPRODUCIBILITY ASSESSMENT OF MYELIN-SENSITIVE SCANS WITH MOBILE ULTRA-LOW FIELD MRI

Sean C. Deoni, PhD (*Abstract Co-Author*) Nothing to Disclose
Rui Pedro Azeredo Gomes Teixeira (*Abstract Co-Author*) Nothing to Disclose
Alex L. MacKay, PhD (*Abstract Co-Author*) Nothing to Disclose
Hanwen Liu (*Abstract Co-Author*) Nothing to Disclose
Emil Ljungberg (*Abstract Co-Author*) Nothing to Disclose
Steven Williams (*Abstract Co-Author*) Nothing to Disclose
Francesco Padormo (*Abstract Co-Author*) Nothing to Disclose
Shannon H. Kolind, PhD (*Abstract Co-Author*) Nothing to Disclose
Neale Wiley (*Abstract Co-Author*) Nothing to Disclose
Megan Poorman (*Abstract Co-Author*) Nothing to Disclose
Adam Dvorak (*Abstract Co-Author*) Nothing to Disclose
Sharada Balaji (*Presenter*) Nothing to Disclose

### PURPOSE

Mobile, ultra-low field magnetic resonance imaging (MRI) scanners can vastly improve access to neuroimaging. Implementing MRI techniques to quantify microstructure, particularly myelin, allows monitoring of neurodegenerative diseases as well as myelination trajectories during development. In this study, we developed MRI sequences to measure magnetization transfer ratio (MTR) and T2 relaxation time as surrogate markers for myelin, and assessed their reproducibility at ultra-low field.

### METHODS AND MATERIALS

Five healthy adults underwent MRI using a 0.064T portable MRI scanner (Swoop, Hyperfine Inc., Guilford, CT) using the following scans:• T2-weighted for white matter (WM) segmentation, 1.6x1.6x5 mm3, 3 minutes• MTR imaging: 2 PSIF sequences, ?MToff/?MTon = 60°/300°, TR/tRF = 12 ms/220 µs, 2x2x5 mm3, 4 minutes total• T2 mapping: multi-echo spin echo, 80 echoes, ?TE/TR = 3.93/800 ms, 3x3x5 mm3, 7.5 minutesSubjects were then removed from the scanner, repositioned, and rescanned with the same protocol.MTR maps were calculated as MTR=(MToff-MTon)/(MToff), and T2 was estimated using a mono-exponential fit. Data was assessed for reproducibility by visually comparing maps, using histograms of MTR and T2 values in whole brain and WM voxels, and comparing scan-rescan values for all subjects.

### RESULTS

Mean ± standard deviation for MTR in WM was 0.231±0.010 across all subjects, and T2 in WM was 82.9±2.6 ms. No visible difference between repeated scans were noted, and histograms showed strong overlap between scans. Both measures showed strong correlation between scans (MTR: $r=0.99$, $p<0.001$, T2: $r=0.97$, $p=0.004$). Average scan-rescan coefficient of variation was 1.03% for MTR and 0.33% for T2 mapping.

### CONCLUSION

The ultra-low field myelin-sensitive scans measuring MTR and T2 were successfully implemented and provided values in agreement with expectations. The variability of metrics between, and reproducibility within, subjects was deemed sufficient to track neurodevelopment or neurodegeneration. Metric reproducibility was comparable to higher field strengths.

### CLINICAL RELEVANCE/APPLICATION

Coupled with the increased accessibility of modern mobile ultra-low field MRI scanners, MTR and T2 relaxation time could be used as biomarkers for frequent, non-invasive assessment of myelin-related damage. Applications include detecting and monitoring progression in multiple sclerosis, Alzheimer's disease, leukodystrophies, and traumatic injury. This approach has the potential to extend the reach of clinical trials of new therapies, particularly those aimed at remyelination. It can also be used to track healthy aging during childhood development and through the lifespan into elderliness.

## R2-STCE1-2 APPLICATION OF CLINICAL LOW FIELD MOBILE MRI IN A LARGE ACADEMIC MEDICAL CENTER

Gloria J. Guzman Perez-Carrillo, MD,MPH,MSc,MBA (*Abstract Co-Author*) Consultant, Medtronic plc
Jordan Gutovich, MD (*Abstract Co-Author*) Nothing to Disclose
Saurabh Jindal, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Sara Hosseinzadeh Kassani (*Abstract Co-Author*) Nothing to Disclose
Cyrus Raji, MD, PhD (*Abstract Co-Author*) Consultant, Brainreader ApS;Consultant, Neuroevolution, LLC;Consultant, Apollo Health
Tammie S. Benzinger, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company;Investigator, Eli Lilly and Company;Investigator, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Research Grant, Siemens AG;Consultant, ADM Diagnostics, LLC;Speakers Bureau, Biogen Idec Inc;Advisory Board,

Biogen Idec Inc
Mitchell McMillen (*Abstract Co-Author*) Nothing to Disclose
Jordan Fleming (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

We sought to determine common indications for use of a portable low-field brain MRI (Hyperfine Swoop® 0.064T) and concordance with conventional non-contrast brain MRI (1.5 or 3T).

**METHODS AND MATERIALS**

Patients undergoing low-field brain MRI exams from two sites: 1) Missouri Baptist Medical Center (MBMC, n=293) and 2) Barnes-Jewish Hospital Neuro-ICU (BJH-ICU, n=61), were included. A follow-up non-contrast conventional brain MRI exam (1.5T or 3T) was defined by the following criteria: 1) it was conducted within three days of the low-field exam and 2) there were no new indications or relevant events between the two exams. Concordance between the follow-up and low-field exams was defined as the presence or absence of the same pathology in the same region, whether stable or evolved. The two exams were considered discordant if a positive finding on the follow-up exam was not identified by the low-field exam, or if a positive finding on the low-field exam was contradicted by the follow-up exam.

**RESULTS**

Overall, 354 Hyperfine Swoop MRIs from 351 patients (197/154 female/male, age=69±15 years) were acquired between Sep-2022 and Aug-2024. The most common indication for exam was stroke or stroke-like symptoms [n(%)=269(91.4) in MBMC, 41(67.2%) in BJH-ICU], followed by anoxic brain injury [n(%)=10(2.8) in MBMC and 4(6%) in BJH-ICU. All scans were interpreted by trained neuroradiologists.A total of 36 follow-up conventional MRIs were performed within 3 days of the portable scan. The time elapsed between the low-field and conventional exams varied widely, ranging from 31 minutes to 70 hours and 21 minutes (mean: 24±23 hours). In 20 out of 36 exams (55.5%) findings from the subsequent conventional MR were discordant with low-field, with equal numbers demonstrating unidentified pathology (n=10) or refuting a new/reported positive finding on the low-field study (n=10). From a quality perspective, a total of 24(6.7%) initial low-field scans were noted to be limited or non-diagnostic by the interpreting neuroradiologist, of which only 6 were followed by conventional MRI. This suggests that most of the repeat conventional exams (72.3%) were likely performed for clinical reasons rather than due to a lack of diagnostic quality in the portable MRI scans.

**CONCLUSION**

Point-of-care low-field portable MR with low field strength carries promise for rapid delivery of actionable diagnostic imaging to persons with acute neurological injury.

**CLINICAL RELEVANCE/APPLICATION**

Portable low field MRI should be considered for patients with acute stroke who cannot readily undergo conventional MRI. When clinically indicated, patients may benefit from follow-up conventional 1.5T or 3T MRI exam.

## R2-STCE1-3 A DEEP LEARNING FRAMEWORK FOR GENERATING SYNTHETIC LOW-FIELD IMAGES WITH PAIRED HIGH AND LOW-FIELD DATA

Daniel S. Reich, MD, PhD (*Abstract Co-Author*) Research support, Vertex Pharmaceuticals Incorporated;Research support, sanofi-aventis Group
Serhat Okar (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Arnold, PhD (*Abstract Co-Author*) Nothing to Disclose
Joel M. Stein, MD, PhD (*Abstract Co-Author*) Research Grant, Hyperfine Research, Inc;Consultant, Centaur Diagnostics, Inc
Chetan Vadali (*Abstract Co-Author*) Nothing to Disclose
Alfredo Lucas, PhD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Limited availability of low-field MRI imaging data hampers the development of algorithms and tools tailored for low-field MRI applications. This study introduces a deep learning framework designed to generate synthetic low-field (64mT) MRI images from high-field (3T) data, aiming to create larger datasets necessary for advancing diagnostic applications and understanding the potential uses of low-field MRI in clinical practice.

**METHODS AND MATERIALS**

A total of 50 multiple sclerosis patients were scanned on portable 64mT (Hyperfine) and standard 3T scanners (Siemens) at Penn or NIH with T1-weighted, T2-weighted and FLAIR acquisitions. We previously developed LowGAN, a multi-contrast low-to-high field super resolution generative adversarial network, trained using this paired dataset. In this study we reversed the training process of LowGAN (rLowGAN) such that the input would be the 3T sequences (T1w, T2w, and FLAIR) and the outputs would be synthetic 64mT data. We trained rLowGAN using leave-5-out cross-validation, such that each subject's synthetic 64mT data was created from a rLowGAN model trained without that participant's data. We tested our model in 13 additional MS participants not included during training, as well as on a subset of 20 brain tumor patients from the brain tumor segmentation challenge (BRaTs).

**RESULTS**

We found that rLowGAN produced images that were visually similar to low-field images. rLowGAN synthetic 64mT outputs had a higher structural similarity to actual 64mT images, relative to input 3T images across T1w, T2w and FLAIR contrasts ($p<0.001$). This was the case for both cross-validation and test sets, except for the T2 contrast in the test set where there was no difference in SSIM between rLowGAN vs. 64mT and 3T vs. 64mT ($p=0.304$). We found that rLowGAN made white matter lesions similar to those seen in native 64mT images, and it also introduced venous vascular hyperintense signal on FLAIR images present in 64mT acquisitions. In the external BRaTS dataset, rLowGAN succesfully produced images with the noise and artifact profile of native 64mT images, and simulated brain tumor appearance at low-field.

**CONCLUSION**

Our deep learning framework successfully generates high-fidelity synthetic low-field MRI images from high-field inputs, providing a robust method to create low-field imaging datasets from existing 3T datasets.

**CLINICAL RELEVANCE/APPLICATION**

The ability to produce synthetic low-field MRI images from high-field data using deep learning techniques offers a cost-effective solution to the scarcity of low-field imaging data. Large datasets are necessary for developing algorithms and tools specific to low-field MRI, ultimately enabling the exploration of its diagnostic applications and expanding its clinical utility.

# Abstract Archives of the RSNA, 2024

R2-STCE2

**Science Session (Multiomic and Multicenter Radiology AI)**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## R2-STCE2-1 LONG-TERM PROGNOSTIC IMPLICATIONS OF AI-BASED THORACIC AORTA CALCIFICATION QUANTIFICATION IN A SCREENING POPULATION: A MULTICENTER STUDY

Nayoung Kim (*Abstract Co-Author*) Nothing to Disclose
Young Joo Suh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yonghan Kwon, MS (*Abstract Co-Author*) Nothing to Disclose
Kyunghwa Han, PhD (*Abstract Co-Author*) Nothing to Disclose
Jong Eun Lee, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the long-term prognostic implication of incidental TAC on non-gated chest computed tomography (CT) in an asymptomatic screening population.

### METHODS AND MATERIALS

This retrospective study included asymptomatic individuals aged 40 years or older who underwent chest CT scans at two health screening centers between 2007 and 2014. CT scans were assessed for thoracic aorta calcification (TAC) status and coronary artery calcification (CAC) status, stratified using both artificial intelligence (AI)-based Agatston score measurement and visual analysis. Multivariable Cox proportional hazards models were used to evaluate the hazard of TAC stratification models for major adverse cardiovascular events (MACE) and all-cause mortality, adjusting for CAC and clinical risk factors. Discriminative ability of TAC stratification models, both quantitative and visual, for the prediction of MACE and all-cause mortality, was measured using C-statistics.

### RESULTS

Of the 7404 participants, 383 experienced MACEs over a median observation period of 7.4 years, and 330 all-cause deaths occurred over a median observation period of 10.9 years. All groups with TAC greater than 0 had a higher hazard of all-cause mortality compared to those without TAC, with the highest in the TAC score > 3000 group (adjusted HR: 2.73; 95% CI: 1.57-4.75; P < .001). The combined TAC and CAC AI-based quantitative stratification with clinical variables model showed the best discriminative ability (C-index: 0.787 and 0.800 for MACE and all-cause mortality, respectively) compared to other models.

### CONCLUSION

TAC has significant long-term potential to predict all-cause mortality. TAC AI-based quantitative stratification, along with CAC and clinical variables, is helpful for the long-term prediction of MACE and all-cause mortality.

### CLINICAL RELEVANCE/APPLICATION

Identifying and quantifying TAC on routine non-gated chest CT scans in asymptomatic individuals significantly enhances long-term risk stratification for all-cause mortality.

## R2-STCE2-2 DEEP LEARNING ANALYSIS OF VOLUMETRIC BODY COMPOSITION IN A MULTI-CENTER TAVR STUDY

Julia Rodighiero (*Abstract Co-Author*) Nothing to Disclose
Jonathan Afilalo (*Abstract Co-Author*) Nothing to Disclose
Ding Yi Zhang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Radiographic assessment of body composition is useful for preoperative risk stratification, notably in frail older adults referred for transcatheter aortic valve replacement (TAVR). Prior studies focused on L3 or L4 single-slice manual measurements of psoas muscle area. Technological advancements in artificial intelligence and deep learning segmentation now enable multi-slice automated measurements of muscle and fat volumes, which are more rapid and reliable for large multi-center implementations.

### METHODS AND MATERIALS

The FRAILTY-TAVR cohort was assembled across 14 centers in the United States, Canada, France, and Ireland. Pre-TAVR CT scans were retrieved in DICOM format and analyzed using our 3-dimensional convolutional neural network (coreslicer.com) to measure the volume and density of the skeletal muscle, subcutaneous fat, and visceral fat. Volumetric measurements were restricted to axial slices between the L1-S vertebral levels using a built-in vertebral classifier. The outcome was all-cause mortality post-TAVR.

### RESULTS

The cohort consisted of 635 patients that underwent TAVR with 39% females, a median age of 83 years (IQR 78-87), and a median follow-up of 466 days (IQR 371-1010). The Cox proportional hazards survival model containing the volumetric body composition measurements outperformed the basic model containing the L3 single-slice psoas muscle area (Harell's C statistic +0.04). Interestingly, the volumetric measurements revealed that low muscle density, indicative of low muscle quality due to intramuscular adiposity, was a superior predictor of mortality compared to low muscle volume (P=0.003).

### CONCLUSION

Opportunistic assessment of body composition using an automated deep learning method identifies patients with higher mortality post-TAVR. Low skeletal muscle density, which is associated with intramuscular adiposity, is particularly predictive.

### CLINICAL RELEVANCE/APPLICATION

Deep learning methods to analyze body composition on preoperative CT scans are more predictive and generalizable than single-slice manual methods, and should be preferred for wide-scale deployment to inform clinical decision making.

## R2-STCE2-3 MULTIOMIC AI-ASSISTED PREDICTION OF LOCAL RECURRENCE AND SURVIVAL AFTER RF ABLATION OF HCC FROM A MULTICENTER TRIAL

Bradford J. Wood, MD (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;Researcher, Koninklijke Philips NV;Intellectual property, Koninklijke Philips NV;Equipment Support, Koninklijke Philips NV;Researcher, Celsion Corporation;Research Grant, Celsion Corporation;Researcher, BTG International Ltd;Intellectual property, BTG International Ltd;Researcher, Boston Scientific Corporation;Research Grant, Boston Scientific Corporation;Intellectual property, Boston Scientific Corporation;Researcher, Siemens AG;Equipment Support, Siemens AG;Researcher, Sarasota Interventional Radiology;Researcher, NVIDIA Corporation;Research Grant, NVIDIA Corporation;Equipment support, AngioDynamics, Inc;Equipment support, Profound Medical Inc;Researcher, Canon Medical Systems Corporation;License agreement, Canon Medical Systems Corporation;Researcher, AstraZeneca PLC;Researcher, Exact Imaging Inc
Ming Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Lindsey A. Hazen, RN,BSN (*Abstract Co-Author*) Nothing to Disclose
Riccardo Lencioni, MD (*Abstract Co-Author*) Research Consultant, BTG International Ltd;Research Consultant, Guerbet SA;Research Consultant, Eisai Co, Ltd
Anna Christou (*Abstract Co-Author*) Nothing to Disclose
Laetitia Saccenti, MD (*Abstract Co-Author*) Nothing to Disclose
Katerina H. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Sheng Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicole Varble, PhD (*Abstract Co-Author*) Nothing to Disclose
Tabea Borde, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate performance of clinical and 3D radiographic ablation margin and tumor features to predict local recurrence and survival in hepatocellular carcinoma (HCC) patients treated with radiofrequency ablation (RFA).

### METHODS AND MATERIALS

550 patients included in the multicenter (39 study sites), multinational (11 countries) OPTIMA trial were considered in this study. Patients with solidary HCC lesions between 3-7cm and with well-defined pre-RFA tumor and 1-month post-RFA devascularized (ablation) zones on enhanced CT were analyzed. AI-assisted 3D tumor and ablation zone segmentation was performed with subsequent elastic registration. Radiomic tumor features were extracted from the segmented tumor and ablation zones in contrast-enhanced CTs, and included: tumor volume, treated and undertreated tumor volume, and tumor morphometrics. Patient clinical features analyzed included sex, age, underlying liver disease, body-mass index, elevated alpha-fetoprotein and number of treatments. Predictive models were built to determine the association of features to local recurrence (incomplete response, local recurrence or local residual disease) and 5-year survival. Three multivariate logistic regression models were built and compared, which included clinical features alone, radiologic features alone, and clinical and radiologic features combined.

### RESULTS

185 patients with corresponding pre-ablation and 28-days post-ablation images were included in the study. When predicting local recurrence in HCC patients, models that included both clinical and radiomic features performed better than clinical features alone (AUC 0.64, [CI95% 0.51, 0.71] vs 0.54 [CI95% 0.36, 0.77], P=0.006). When predicting survival, radiomic features did not improve the predictive performance of clinical features alone (AUC clinical features alone 0.62 [CI95% 0.52, 0.73] vs AUC combined 0.64 [CI95% 0.54-0.74] P=0.4). Amongst all models, 3D tumor metrics showed the highest odds ratios for the prediction of both survival and local recurrence (e.g., tumor flatness OR 8.8 [CI95% 0.36, 305], tumor elongation 4.5 [0.25, 173]).

### CONCLUSION

A machine learning model including both clinical and radiomic tumor and ablation zone features can predict local recurrence after RFA in HCC patients. These analyses suggest the need for the use of both clinical features and 3D evaluation metrics of the tumor to better predict local recurrence, while clinical features alone may best predict survival in HCC patients.

### CLINICAL RELEVANCE/APPLICATION

Together, clinical and image assessment and registration with ablation may support standardization, quality control, and outcome prediction. Understanding the factors contributing to outcome could help tailor treatment approaches.

# Abstract Archives of the RSNA, 2024

R3-SSCA10

**Cardiac Imaging (Advanced CT)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: E353C

Prabhakar Rajiah, MD, FRCR (*Moderator*) Nothing to Disclose
Avanti Gulhane, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R3-SSCA10-1 FRACTAL ANALYSIS OF DYNAMIC CT PERFUSION IMAGING PREDICTS MYOCARDIAL ISCHEMIA IMPROVEMENT AFTER PERCUTANEOUS CORONARY INTERVENTION

Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Kakuya Kitagawa, MD, PhD (*Abstract Co-Author*) Chair, Siemens AG
Florian Michallek, MD (*Abstract Co-Author*) Nothing to Disclose
Suguru Araki (*Abstract Co-Author*) Nothing to Disclose
Satoshi Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Takanori Kokawa, MD (*Abstract Co-Author*) Nothing to Disclose
Miyuko Fujita (*Abstract Co-Author*) Nothing to Disclose
Shintaro Yamaguchi (*Abstract Co-Author*) Nothing to Disclose
Masafumi Takafuji, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Myocardial ischemia arises from different etiologies, including epicardial coronary stenosis and microvascular disease, posing challenges for the efficacy of percutaneous coronary intervention (PCI). Dynamic four-dimensional stress CT perfusion (dCTP) allows to quantify myocardial blood flow (MBF) and is useful for diagnosing myocardial ischemia. Fractal analysis applied to dCTP data shows potential for differentiating ischemia according to etiology, i.e., epicardial stenosis or microvascular disease. This study investigates pre-PCI fractal analysis of dCTP for predicting improvement of myocardial ischemia post-PCI by identifying microvascular ischemia components.

### METHODS AND MATERIALS

Patients with stable coronary artery disease (CAD) who underwent dual-source dCTP within 120 days before PCI and within 400 days after clinically indicated PCI (median interval 308 days) were retrospectively included. Fractal analysis and MBF quantification were performed on dCTP images pre- and post-PCI adhering to the AHA myocardial 17-segment model. To define improvement of perfusion defects after PCI, two experienced observers, blinded to patient clinical information, visually compared pre- and post-PCI short-axis MBF maps for extent of perfusion defects. In a previous study, fractal dimension (FD) classified perfusion defects as either epicardial (FD=4.31) or microvascular (FD>4.31) with the latter being hypothesized to remain unchanged post-PCI. Additionally, we analyzed clinical characteristics and FD by multivariate logistic regression.

### RESULTS

We included 29 patients (24 male, mean age 73.1±9.7 years) and PCI was performed in 36 vessels. Ischemia improvement after PCI in terms of extent of the perfusion defect was observed in 19 of 36 vessels and 84 of 214 myocardial segments. The proportion of vessels and segments with ischemia improvement with low FD (FD=4.31) was significantly higher than those with high FD (FD>4.31) [vessel level; 16/17 (94.1%) vs. 3/19 (15.8%), p<0.001, segment level; 53/58(91.4%) vs. 31/156 (19.9%), p<0.001]. Area under the curve (AUC) of FD for predicting improvement was 0.866. In multivariate analysis, low pre-PCI FD [odds ratio (OR) 77.93; 95% confidence interval (95% CI) 23.17-262.16; p<0.0001], non-smoker status (OR 6.29; 95% CI 2.71-14.62; p<0.0001), and presence of chest pain (OR 4.62; 95% CI 1.63-13.10; p=0.004) were independently associated with ischemia improvement after PCI.

### CONCLUSION

Fractal analysis of dCTP predicts post-PCI improvement of myocardial ischemia in stable CAD by identifying microvascular ischemia components.

### CLINICAL RELEVANCE/APPLICATION

Fractal analysis aids in discerning microvascular disease, potentially guiding PCI decision-making in patients with stable CAD.

## R3-SSCA10-2 A PRELIMINARY STUDY OF CORONARY ARTERY VASCULITIS EVALUATION ON PHOTON-COUNTING CT: STENOSIS AND INFLAMMATION DETECTING

Yining Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Yue Sun (*Presenter*) Nothing to Disclose

**PURPOSE**

To validate the performance of spectral photon-counting detector coronary CT angiography (PCD-CCTA) in stenosis detection and inflammation evaluation in patients with coronary artery vasculitis (CAV).

**METHODS AND MATERIALS**

In this prospective study, patients diagnosed with CAV and referral for hospitalization were enrolled between September 2023 and March 2024. All patients underwent spectral PCD-CCTA examination with virtual monoenergetic images (VMI). Subjective image quality was graded on a scale of 1-5 (1—unacceptable, and 5—excellent). For objective image quality, the contrast-to-noise ratio (CNR) and the signal-to-noise ratio (SNR) per vessel were calculated by CNR = (average luminal HU - average perivascular epicardial HU)/ (aortic root HU standard deviation) and SNR = average luminal HU / (aortic root HU standard deviation). Stenosis evaluation was performed on 55keV VMI and fat attenuation index (FAI) measurement was performed on 70keV VMI. Clinical data during hospitalization were recorded, including percutaneous coronary intervention (PCI), erythrocyte sedimentation rate (ESR) and high sensitivity C-reactive protein (hsCRP). The diagnostic accuracy in detecting obstructive coronary stenosis on PCD-CCTA was determined, with invasive coronary angiography (ICA) serving as the standard of reference. FAI values between obstructive and non-obstructive lesions were compared. The associations of FAI with PCI, ESR and hsCRP were assessed using generalized linear mixed-effects model.

**RESULTS**

41 CAV patients (mean age, 54 ± 12; 35 females) were ultimately included. With a dose of contrast medium 25 mL (interquartile range (IQR), 23.25-30 mL) and effective radiation 3.05 mSv (IQR, 1.73-4.21mSv), the overall image quality was rated as excellent 5 (IQR range, 4-5). The mean overall CNR and SNR were 10.73 ± 2.99 and 8.28 ± 2.44, respectively. PCD-CCTA demonstrated a high diagnostic accuracy in detecting obstructive coronary stenosis at both lesion 0.98 (95% CI: 0.92, 1.00) and vessel level 0.98 (95% CI: 0.91, 1.00). FAI at lesion level displayed significant difference between stents with and without restenosis (-74.82 ± 8.39 vs -83.78 ± 8.88; P = 0.023), as well as between obstructive and non-obstructive stenosis (-78.01 ± 10.75 vs -85.69 ± 7.28; P = 0.003). There was a positive association of FAI with ESR (estimate 0.06 ± standard error 0.01 HU, P < 0.001) and hsCRP (estimate 0.11 ± standard error 0.02 HU, P < 0.001).

**CONCLUSION**

PCD-CCTA appears promising in the stenosis and inflammation status evaluation in patients with CAV, all while utilizing a low dose of contrast medium and radiation.

**CLINICAL RELEVANCE/APPLICATION**

PCD-CCTA allows a comprehensive evaluation of coronary stenosis and inflammatory profile in patients with CAV.

## R3-SSCA10-4 THE DIFFERENCES BETWEEN NON-ST-SEGMENT ELEVATION ACUTE CORONARY SYNDROME AND CHRONIC CORONARY SYNDROME IN CCTA PLAQUE MEASUREMENT

Zhong-Fei Lu, MD (*Abstract Co-Author*) Nothing to Disclose
Bin Lu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

A high proportion of patients with acute chest pain could not be diagnosed as non-ST-segment elevation acute coronary syndrome (NSTE-ACS) confidently because of inconclusive electrocardiogram and troponin. The study aims to distinguish NSTE-ACS from chronic coronary syndrome (CCS) through comparing the plaque differences in coronary CT angiography (CCTA) images between the culprit plaque in NSTE-ACS patients and the most severe stenosis plaque in CCS patients

**METHODS AND MATERIALS**

This study was a case-control study. The case group were included from a prospective NSTE-ACS cohort. All patients in this cohort underwent CCTA immediately after being diagnosed with NSTE-ACS. The control pair included CCS patients who underwent CCTA examination. Patients with NSTE-ACS and patients with CCS were propensity matched 1:1 for age and gender. The culprit lesion in NSTE-ACS patients and the most severe stenosis plaque in CCS patients were used for comparison. The plaque volume and burden of lipid, fibrous, and calcified constituents were measured. Using stenosis as the baseline model for adjudication of NSTE-ACS (Model 1). CCTA coronary artery plaque variables with statistic significance from multivariate logistic regression analysis were added to the baseline model (Model 2).

**RESULTS**

A total of 258 NSTE-ACS patients (age 58.8 ± 11.1 years, 71.7% male) were included in the study. The NSTE-ACS group and CCS group were completely matched. The degree of stenosis of culprit lesions in NSTE-ACS group is higher than that of the most severe stenosis plaques in CCS group (71.9% vs. 37.4%). The lipid volume (9.8 mm3 vs. 0.4 mm3) and burden (5.0% vs. 0.3%), fibrous volume (50.2 mm3 vs. 19.9 mm3) and burden (36.0% vs. 15.0%) were higher in the NSTE-ACS group. The calcification volume (0.5 mm3 vs. 3.5 mm3) and burden (0.3% vs. 2.8%) was lower in the NSTE-ACS group. In multivariate logistic regression analysis, fibrous burden, calcified burden, and stenosis were independent predictive factors for NSTE-ACS. The AUC (area under curve) of Model 2 composed of stenosis, fibrous burden, and calcified burden was higher than model 1 (0.782 vs 0.699, P<0.001).

**CONCLUSION**

The quantitative information of plaque constituents in CCTA images could provide additional information for the diagnosis of NSTE-ACS.

**CLINICAL RELEVANCE/APPLICATION**

Plaque quantification in CCTA images could be used to diagnose NSTE-ACS.

## R3-SSCA10-5 ROLE OF DUAL ENERGY CT IN QUANTIFYING MYOCARDIAL AND LIVER IRON DEPOSITION IN PATIENTS WITH THALASSEMIA MAJOR: A COMPARISON WITH T2* MRI

Ambuj Roy (*Abstract Co-Author*) Nothing to Disclose
Kartik P. Ganga, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Priya Jagia, MD (*Abstract Co-Author*) Nothing to Disclose
Vineeta Ojha, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Currently, T2 * MRI is considered the gold standard in myocardial and liver iron estimation. Material decomposition techniques using dual energy has been shown to accurately characterize renal and ureteric stones with minimal radiation exposure. The purpose of the proposed study is to elucidate if similar techniques using dual energy CT can be used to identify and quantify iron deposition in myocardium and liver with T2* being the gold standard.

### METHODS AND MATERIALS

Consecutive thalassemia patients were prospectively enrolled. Patients with cardiovascular risk factors were excluded. Control group consisted of 15 patients who were referred for CT scan of the thorax for other unrelated causes. Patients and controls underwent non contrast CT and cardiac MRI using fixed protocol. CT datasets were then be loaded into the Rho/Z application (syngo.via DE Rho/Z Maps, Siemens Healthcare,). Rho/Z and attenuation at 90 kV and 150 kV of the septum, liver, spleen and pancreas were determined with a free-hand region of interest (ROI). Three separate measurements were taken for all the locations and averages of measurements were used for statistical analysis.

### RESULTS

126 patients (mean age-38 years, 65.87% male) were included. The median Serum Ferritin, myocardial and liver T2* were significantly higher in the study group (p<0.001). Myocardial Rho (3.48 vs 3.50; p=0.017), myocardial Z (7.56 vs 7.47; p=0.005) and Myocardial attenuation at 150 kVp (45.4 HU vs 49.08 HU; p=0.02) were significantly different between thalassemia patients and controls. Myocardial Rho with a cut off of 3.497, had a sensitivity and specificity of 46.6 % and of 46.15 %, respectively and myocardial Z with a cut off of 7.51, had a sensitivity and specificity of 69.23 % and 73.33 % respectively for differentiating between thalassemia patients with any myocardial iron (n = 26) and controls. Liver Rho with a cut off of 3.56, had a sensitivity and specificity of 70.97 % and 68.75 % respectively and liver Z with a cut off of 7.66, had a sensitivity and specificity of 92.47 % and 93.75 % respectively for differentiating between thalassemia patients with moderate + severe liver iron (n = 92) and thalassemia patients with mild + no liver iron (n = 34). The average radiation dose per scan was 3.6 +/- 0.84 mSv.

### CONCLUSION

While the sensitivity and specificity of dual energy CT parameters, specifically Liver Z, in identifying liver iron deposition is high, the accuracy of dual energy CT parameters for identifying iron deposition in myocardium is poor.

### CLINICAL RELEVANCE/APPLICATION

DECT can be used to identify liver iron deposition with high accuracy. This may be used as a tool in facilities without availability of T2* MRI or expertise and can also be used as opportunistic screening tool in CTs done for unrelated purposes.

## R3-SSCA10-6 NEW RECONSTRUCTION ALGORITHM ENHANCES IMAGE QUALITY AND DIAGNOSTIC USABILITY OF PHOTON-COUNTING CONTRAST-ENHANCED CORONARY CT ANGIOGRAPHY

Nina Pauline Haag, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The recent ZeeFree (ZF) reconstruction algorithm introduced for the photon counting CT was evaluated to determine its potential to enhance image quality and diagnostic precision compared to Standard (SD) and TrueStack (TS) reconstruction algorithms.

### METHODS AND MATERIALS

79 patients (mean age 63 years ± 13 SD, 55 males) undergoing photon-counting Coronary CT angiography (CCTA) with ZeeFree reconstruction (NAEOTOM Alpha, Syngo.CT VB10, Siemens Healthineers) between July and December 2023 were retrospectively identified. Curved planar reformations were reconstructed for coronary arteries using ZF, SD, and TS. Three blinded readers individually evaluated image quality on a 5-point Likert scale. Results are given as median (IQR). Differences were evaluated using Friedman’s test with pair-wise post-hoc testing. Readers stated whether image quality was diagnostic, presented as percentages, with significance evaluated by the Pearson Chi-Square test. Interrater reliability for image quality used Gwet’s AC2 coefficient with ordinal weights, and Gwet's AC1 coefficient for diagnostic usability.

### RESULTS

Image quality differed among reconstruction algorithms (P<.001). ZF showed superior quality (4 (2)) surpassing SD (4 (2), P=.03), and TS (4 (1), P<.001). Inter-rater agreement was collectively substantial (0.70 - 0.74). ZF had the highest diagnostic usability 438/531 (82.5 %), SD 409/531 (77.0%, P<.001), and TS 401/531 (75.5%, P<.001), with almost perfect inter-rater agreement (0.84).

### CONCLUSION

The exploration of ZF image reconstruction algorithm in photon-counting CCTA reveals improvements in diagnostic quality and usability compared to SD and TS, suggesting its primary use for assessment, supplemented by SD images, while TS may be reserved for cases with severe motion artifacts.

### CLINICAL RELEVANCE/APPLICATION

The ZeeFree reconstruction algorithm for photon-counting CT increases the diagnostic usability of coronary CT angiography images, significantly outperforming Standard and TrueStack reconstructions. Consequently, it can improve diagnostic precision and enhance patient compliance, along with potentially improving clinical outcomes, especially in cases where diagnostic clarity is borderline. This advancement brings us closer to the goal of achieving non-invasive, artifact-free diagnostic coronary CT angiography imaging.

# Abstract Archives of the RSNA, 2024

R3-SSGI17

**Gastrointestinal Imaging (Ultrasound)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: E451B

Theodore T. Pierce, MD, MPH (*Moderator*) Research Grant, General Electric Company;Research Grant, Massachusetts Institute of Technology Lincoln Laboratory;Research Grant, Massachusetts General Hospital
Yi Dong, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R3-SSGI17-1 WHAT IS THE IMPACT OF CHANGING GALLBLADDER POLYP RECOMMENDATIONS? SRU VS EUROPEAN GUIDELINES VS CAR VS ACR

Martin Matuszczak, MD (*Abstract Co-Author*) Nothing to Disclose
Aya Kamaya, MD (*Abstract Co-Author*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation
Luyao Shen, MD (*Abstract Co-Author*) Nothing to Disclose
Thodsawit Tiyarattanachai (*Abstract Co-Author*) Nothing to Disclose
Jenny Vo-Phamhi, MS (*Presenter*) Nothing to Disclose

### PURPOSE

To compare follow-up imaging and surgical cost implications of the Society of Radiologists in Ultrasound (SRU) guidelines, 2017 and 2022 European (EUR) guidelines, 2020 Canadian Association of Radiologists (CAR) recommendations, and 2013 American College of Radiology (ACR) White Paper for managing incidentally detected gallbladder polyps.

### METHODS AND MATERIALS

253 consecutive patients with gallbladder polyps identified on ultrasound were independently reviewed by three radiologists for polyp size and morphology. Electronic medical records were reviewed for patient demographics, cholecystectomy (if performed) pathological findings, or any subsequent diagnosis of gallbladder cancer. For each patient, the following were calculated for each of the 5 guidelines studied: 1) number of recommended follow-up ultrasounds based on initial presentation, 2) number of surgical consultations recommended based on initial presentation, 3) number of surgical consultations recommended based on growth, and 4) associated imaging and surgical costs. Interrater agreement was calculated.

### RESULTS

The SRU 2022 guidelines suggested significantly fewer follow-up ultrasounds and surgical consultations, leading to a cost reduction of 96.5% and 96.7% compared to European 2022 and 2017, respectively; 86.5% compared to CAR; and 86.2% compared to ACR guidelines, without compromising sensitivity for gallbladder cancer detection. With SRU Recommendations, the majority of gallbladder polyps would be classified as extremely low risk (68.4%), 30.8% low risk, and 0.8% indeterminate risk. In our cohort, a single case of gallbladder cancer was identified (26 mm) which would be recommended for surgical consult by all guidelines.

### CONCLUSION

The SRU 2022 guidelines offer a cost-effective approach for managing incidentally detected gallbladder polyps without compromising cancer detection.

### CLINICAL RELEVANCE/APPLICATION

The SRU Consensus Conference guidelines can lead to significant savings for patients, health systems, and society, while reducing unnecessary medical interventions.

## R3-SSGI17-2 ARRIVAL TIME ON CONTRAST-ENHANCED ULTRASOUND FOR DIAGNOSIS OF HEPATIC VENOUS CONGESTION AFTER LIVING DONOR LIVER TRANSPLANTATION USING A RIGHT LOBE

Kyowon Gu, MD (*Abstract Co-Author*) Nothing to Disclose
Ji Hye Min, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Woo Kyoung Jeong, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate whether the arrival time of microbubbles was associated with hepatic venous congestion at middle hepatic vein (MHV) tributaries after living-donor liver transplantation (LDLT) with a right lobe

### METHODS AND MATERIALS

A total of 69 patients (55 men, 14 women; mean age, 55.6 years) who underwent LDLT with the right lobe were included. All patients underwent Doppler US and contrast-enhanced ultrasonography (CEUS) on postoperative day 1 (immediate post-op period) and contrast-enhanced CT within 14 days (early

post-op period). Arrival times of HA (HAAT), PV (PVAT), and HA-PV arrival time intervals were compared according to normal, mild, and severe congestion groups. Diagnostic performance was compared before and after adding HA-PV arrival time interval to Doppler US for diagnosis of obstruction at MHV tributaries.

**RESULTS**

In the normal group, HAAT, PVAT, and HA-PV arrival time intervals were 10.6 s ± 3.3, 12.7 s ± 3.3, and 2.1 s ± 0.6, respectively. HA-PV time interval was significantly increased as the severity of congestion increased, 2.1 s, 2.4 s, and 2.8 s, respectively, p = 0.016). After adding the HA-PV arrival time interval (= 3 s), the sensitivity was significantly improved during both immediate and early post-op periods (60.5% to 79.1% and 58.3% to 70.8%, respectively; p = 0.008 and 0.031).

**CONCLUSION**

HA-PV arrival time interval on CEUS was increased according to the severity of hepatic venous congestion. Adding CEUS with increased HA-PV arrival time interval to Doppler US was significantly more sensitive than Doppler US only for the diagnosis of obstruction at MHV tributaries after LDLT.

**CLINICAL RELEVANCE/APPLICATION**

Contrast-enhanced ultrasonography, focusing on the hepatic artery (HA) to the portal vein (PV) arrival time interval, can effectively assess hepatic venous congestion after living-donor liver transplantation (LDLT) using the right lobe. In particular, incorporating the interval between HA and PV arrival times enhances diagnostic accuracy in detecting MHV tributary obstruction, aiding in the management of patients undergoing LDLT.

## R3-SSGI17-3 EFFECT OF MANEUVERS, IV FLUID ADMINISTRATION, AND DIURESIS ON ULTRASOUND LIVER STIFFNESS MEASUREMENTS IN HEALTHY CONTROLS AND PATIENTS WITH FONTAN PHYSIOLOGY

Jonathan R. Dillman, MD, MSc (*Abstract Co-Author*) Research Grant, Perspectum Ltd;Research Grant, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research support, Koninklijke Philips NV;Research support, General Electric Company;Research support, Motilent Ltd
samjhana Thapaliya, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew T. Trout, MD (*Abstract Co-Author*) Author, RELX Author, Wolters Kluwer nv Research Grant, Canon Medical Systems Corporation Research Grant, Siemens AG Research support, Perspectum Diagnostics Ltd Consultant, Lantheus Holdings
Cara E. Morin, PhD (*Abstract Co-Author*) Nothing to Disclose
Julie Bonn (*Abstract Co-Author*) Nothing to Disclose
Clayton Smith (*Abstract Co-Author*) Nothing to Disclose
Adam Lubert (*Abstract Co-Author*) Nothing to Disclose
Pradipta Debnath, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine the effect of stress maneuvers, IV fluid administration, and diuresis on ultrasound liver stiffness measurements (LSM) in Fontan patients and healthy controls.

**METHODS AND MATERIALS**

Ultrasound shear-wave elastography was prospectively performed in ten patients post-Fontan surgery and ten healthy volunteers. LSMs were taken while supine with suspended respiration (baseline) and after/during multiple maneuvers: maximum inspiration, maximum expiration, standing, handgrip exercise, Trendelenburg positioning, exercise (five minutes of walking), normal saline IV infusion (10 mL/kg, maximum of 500 mL), and 15/30/60 minutes after furosemide administration. Clinically indicated abdominal MRI exams from Fontan patients were independently reviewed by three pediatric radiologists and Fontan liver MRI scores were assigned.The absolute and percent change in LSM were compared between baseline and each maneuver and between post-fluid infusion and post-diuretic administration. Patients were also divided into groups based on liver MRI score and LSMs were compared between groups. The Mann-Whitney U test or Wilcoxon signed-rank tests were used to compare groups. Pearson correlation (r) was used to test for an association between baseline LSM and liver MRI score.

**RESULTS**

LSMs in the Fontan group were higher at baseline (median: 2.6kPa vs. 1.3kPa) and for all maneuvers (all $p<0.001$) and had increased variation compared to healthy controls. There was no significant difference in LSM between Fontan patients with high and low liver MRI scores. There was no significant correlation between liver baseline LSM and liver MRI score ($r=-0.53$, $p=0.11$). Fontan LSM did not significantly change versus baseline for any maneuver ($p>0.06$ for all, Figure). Healthy control LSM increased versus baseline only for inspiration (0.02 kPa, 1.6%, $p=0.03$), standing (0.07 kPa, 5.5%, $p=0.03$), and fluid administration (0.10 kPa, 7.8%, $p=0.002$). LSMs post-diuretic were significantly decreased compared to post-fluid infusion for the Fontan group at 30 min (-0.79 kPa, -26.5%, $p=0.004$) and 60 min (-0.78 kPa, -26.2%, $p=0.02$) and for healthy controls at 15 min (-0.12 kPa, -8.70%, $p=0.002$), 30 min (-0.15 kPa, -10.9%, $p=0.003$) and 60 min (-0.15 kPa, -10.9%, $p=0.005$).

**CONCLUSION**

LSM in Fontan patients are higher and have increased variation compared to healthy controls. Diuresis is associated with significantly decreased liver stiffness in both Fontan patients and healthy controls, with suggestion of a greater effect in Fontan patients.

**CLINICAL RELEVANCE/APPLICATION**

Relative euvolemia/hypovolemia impacts ultrasound LSM in Fontan patients and should be further investigated as a potential means to reduce the confounding effect of congestion on LSM.

## R3-SSGI17-4 THE RELEVANCE OF GALLBLADDER POLYPS TO GALLBLADDER CANCER IN A COHORT OF 218,418 PATIENTS

Chelsea Kim (*Abstract Co-Author*) Nothing to Disclose
David R. Urbach (*Abstract Co-Author*) Nothing to Disclose
Brian M. Moloney, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Sapisochin (*Abstract Co-Author*) Nothing to Disclose
Korosh Khalili, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine imaging and clinical variables associated with development of gallbladder cancer (GBCA) and specifically assess the risk of gallbladder polyps (GBP).

### METHODS AND MATERIALS

All patients who underwent a liver ultrasound over 21 years at 3 academic institutions with an intact gallbladder were included and linked at the individual-level to health administrative provincial data in Ontario, Canada. Imaging data (polyp size multiplicity, adenomyomatosis, stones, primary sclerosing cholangitis (PSC), porcelain gallbladder, choledochal cysts) were extracted from reports using natural language processing with I2E (Linguamatics®). Patients with GBP without reported size were excluded. Country of birth/ethnicity (COB/E) was extracted through linkage with the national immigration authority (1985 onwards) and a validated surname-based protocol; patients were divided into low risk and high risk based on global incidence data. GBCA diagnosis was derived from the provincial cancer registry. The primary outcome was time to GBCA after documentation of GB on ultrasound. Multivariate modeling was performed using Cox proportional hazard regression.

### RESULTS

218,418 patients (mean age 50.7, 55.3% female) were included. The prevalence of variables were: High-Risk COB/E 11.4%, GBP 9.2%, stone 10.8%, adenomyomatosis 2.2%, PSC 0.27% choledochal cysts 0.039%, porcelain GB 0.045%. GBP (n=20,033, 34.3% multiple) sizes when quantitively reported were: =6mm 89.4%; 7-9mm 8.2%, = 10 mm 2.3%. 15-year cumulative probability of growth to =10 mm were 2.6% for = 6mm and 18.6% for 7-9mm polyps (HR 10.96, p=0.001). 21,513 (9.8%) patients underwent cholecystectomy in the follow-up period, 15-year cumulative probability of cholecystectomy in patients with GBP and without stones were = 6mm 13.6%; 7-9mm 30.5%; = 10 mm 67.4%. 114 patients were diagnosed with GBCA, 50 of which were>12 months after US scan documenting intact GB. A maximum of 25/114 GBCA patients had a polyp (=21.9%). On multivariate analysis, Age (HR 1.06/year, p<0.001), High-Risk COB/E (HR 2.01,p=0.003), adenomyomatosis (HR 3.36,p<0.001), GBP=10 mm (HR 4.78,p=0.045), stones (HR 4.81,p=<0.001), choledochal cyst (HR 8.55,p=0.03) were directly, and GBP<10mm (HR 0.14,p=0.045) was inversely associated with subsequent GBCA diagnosis.

### CONCLUSION

Development of GBCA from polyps initially measured at <10mm is quite rare and in our cohort, GBP<10mm did not increase the risk of subsequent GBCA.

### CLINICAL RELEVANCE/APPLICATION

New North American and European practice guidelines suggest surveillance of some GBP<1cm. Our study questions the need for surveillance of GBP<10mm in patients without other risk factors.

## R3-SSGI17-5 ASSOCIATION BETWEEN US IMAGING MARKERS AND NECROINFLAMMATION, STEATOSIS, AND FIBROSIS IN PATIENTS WITH SUSPECTED METABOLIC DYSFUNCTION-ASSOCIATED STEATOTIC LIVER DISEASE

Richard G. Barr, MD, PhD (*Abstract Co-Author*) Consultant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Consultant, Canon Medical Systems Corporation;Advisor, Hologic, Inc;Research Grant, Hologic, Inc
Valerie Vilgrain, MD (*Abstract Co-Author*) Expert Witness, Bayer AG;Speaker, Canon Medical Systems Corporation;Speaker, General Electric Company;Advisory Board, Guerbet SA;Expert Witness, Guerbet SA;Expert Witness, Zimmer Biomet Holdings, Inc;Speaker, Sirtex Medical Ltd;Expert Witness, Sirtex Medical Ltd;Investigator, AIdream Group LLC;Expert Witness, Terumo Corporation;;
Adrian K. Lim, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Dong Ho Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Pintong Huang, MD (*Abstract Co-Author*) Nothing to Disclose
Fuminori Moriyasu (*Abstract Co-Author*) Nothing to Disclose
Hiroko Iijima (*Abstract Co-Author*) Nothing to Disclose
Byung Ihn Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thomas Karlas, MD (*Abstract Co-Author*) Nothing to Disclose
Jing Gao, MD (*Abstract Co-Author*) Nothing to Disclose
Takashi Nishimura (*Abstract Co-Author*) Nothing to Disclose
Yanan Zhao (*Abstract Co-Author*) Nothing to Disclose
Edward G. Grant, MD (*Abstract Co-Author*) Nothing to Disclose
Theodore J. Dubinsky, MD (*Abstract Co-Author*) Nothing to Disclose
Helena Gabriel, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Young Lee, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Linda C. Kelahan, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanna Ferraioli, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Speakers Bureau, FUJIFILM Holdings Corporation;Speakers Bureau, Canon Medical Systems Corporation;Speakers Bureau, Shenzhen Mindray Bio-Medical Electronics Co, Ltd;Speakers Bureau, Siemens AG
Marco Dioguardi Burgio, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kentaro Sakamaki (*Abstract Co-Author*) Nothing to Disclose
Daniel Jesper (*Abstract Co-Author*) Nothing to Disclose
Jie Zeng (*Abstract Co-Author*) Nothing to Disclose
Deike H. Strobel (*Abstract Co-Author*) Nothing to Disclose
Vito Cantisani, MD, PhD (*Abstract Co-Author*) Speaker, Canon Medical Systems Corporation;Speaker, Bracco Group;Speaker, Samsung Electronics Co, Ltd;
Hirohisa Yano (*Abstract Co-Author*) Nothing to Disclose
Xiaoyan Xie (*Abstract Co-Author*) Nothing to Disclose
Takao Itoi (*Abstract Co-Author*) Nothing to Disclose
Valentin Blank (*Abstract Co-Author*) Nothing to Disclose
Katsutoshi Sugimoto, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the relationship between the multiparametric US imaging markers shear-wave dispersion slope (DS), attenuation coefficient (AC), and shear-wave speed (SWS) and liver histopathological necroinflammation in patients with metabolic dysfunction-associated steatotic liver disease (MASLD).

### METHODS AND MATERIALS

This international, multicenter prospective study enrolled consecutive biopsy-proven MASLD patients between June 2019 and March 2023. Before biopsy, all participants underwent multiparametric US to obtain DS, AC, and SWS. Multivariable linear regression analyses were performed to assess the association between clinical variables or imaging markers with pathological findings. The diagnostic performance of imaging markers for determining inflammation, steatosis, and fibrosis grades was assessed using the area under the receiver operating characteristic curve (AUC).

### RESULTS

A total of 124 participants (mean age, 53 years ± 15 [standard deviation]; 62 men) were evaluated. Lobular inflammation was associated with DS (P = .02), alanine aminotransferase level (P = .002), and Hispanic ethnicity (P = .047), while AC was associated with steatosis (P <.001), and SWS was

associated with fibrosis (P <.001) and body mass index (P = .02). DS achieved an AUC of 0.72 (95% confidence interval (CI): 0.63, 0.82) for identifying participants with inflammation grade = A2 (moderate). AC showed excellent performance for identifying participants with steatosis grade = S1 (mild) (AUC, 0.92 [95% CI: 0.87, 0.97]) while SWS showed excellent performance for identifying participants with fibrosis stage = F2 (periportal fibrosis) (AUC, 0.91 [95% CI: 0.86, 0.96]). The combination of DS, AC, and SWS showed an AUC of 0.81 (95% CI:0.73, 0.89) for MASH diagnosis.

**CONCLUSION**

Among the three US imaging markers, DS, AC, and SWS, only DS was associated with lobular inflammation grade on histology and demonstrated fair diagnostic performance in distinguishing moderate lobular inflammation grade.

**CLINICAL RELEVANCE/APPLICATION**

Multiparametric US is useful for the management of patients with MASLD.

## R3-SSGI17-6 ULTRASOUND-DERIVED FAT FRACTION FOR HEPATIC STEATOSIS ASSESSMENT: A PROSPECTIVE STUDY WITH MRI PROTON DENSITY FAT FRACTION AS REFERENCE STANDARD

Xiaohui Qiao (*Abstract Co-Author*) Nothing to Disclose
Hong Ding, MD (*Abstract Co-Author*) Nothing to Disclose
Guangwen Cheng (*Abstract Co-Author*) Nothing to Disclose
Liyun Xue, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Metabolic dysfunction-associated fatty liver disease (MAFLD), formerly known as non-alcoholic fatty liver disease (NAFLD), affect approximately 25% of the global population. The noninvasive and accurate assessment of MAFLD is a clinical challenge. We aim to explore the methodology of ultrasound-derived fat fraction (UDFF) and its value for assessing hepatic steatosis, using MRI Proton Density Fat Fraction (MRI-PDFF) as reference standard.

**METHODS AND MATERIALS**

338 MAFLD patients were included in the research between April 2023 and March 2024, and they received the examination of UDFF, MRI-PDFF and laboratory tests. UDFF and MRI-PDFF examinations were performed in the right hepatic lobe. Five measurements of UDFF was collected and the median was recorded, which was compared with the median of the first three measurements as well as the first measurement. 35 patients underwent UDFF examination by two radiologists and the intra- and inter-observe consistency test was performed. The MRI-PDFF results were used to determine the stage of hepatic steatosis: S0, MRI-PDFF< 5%; S1, 5%=PDFF< 16.3%; S2: 16.3%=PDFF<21.7%; S3: PDFF=21.7%. The diagnostic performance of UDFF was evaluated and compared with other non-invasive methods. UDFF performance for hepatic steatosis was showed by the area under the receiver operating characteristic curve (AUC).

**RESULTS**

Intra-observer consistency test showed that the interclass correlation coefficient (ICC) was 0.988, and the inter-observe ICC was 0.965. Paired t-tests showed no statistically significant differences between the median of the first five measurements, the median of the first three measurements, and the first measurement (p all > 0.05). UDFF showed a significant positive correlation with MRI, with a Spearman correlation coefficient of 0.812 (p=0.000). The mean of UDFF in liver steatosis S0-S3 was 5.24±3.06, 13.23±6.42, 20.80±7.90, and 24.02±7.71, respectively. As the degree of steatosis increased, the udff values gradually rise. The difference between any two grades was statistically significant (p all <0.05), with the exception between S2 and S3 (p=0.322). The AUCs of UDFF for diagnosing =S1, =S2, and S3 were 0.927, 0.893, and 0.878, respectively.

**CONCLUSION**

UDFF reliably quantifies liver fat content and provides a accurate, noninvasive and convenient method for hepatic steatosis assessment.

**CLINICAL RELEVANCE/APPLICATION**

As a novel method, UDFF could provide reliable and accurate quantification of liver fat content, offering guidance for the degree evaluation and efficacy assessment of metabolic dysfunction-associated fatty liver disease

# Abstract Archives of the RSNA, 2024

R3-SSGI18

**Gastrointestinal Imaging (Bowel)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: E353B

Courtney C. Moreno, MD (*Moderator*) Nothing to Disclose
Paul Nikolaidis, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R3-SSGI18-1 DECIPHERING GUT MICROBIOTA AND METABOLITES INTERACTIONS WITH MAGNETIC RESONANCE ENTEROGRAPHY PHENOTYPES OF BOWEL DAMAGE IN CROHN'S DISEASE: TOWARD DEVELOPING A MULTIDIMENSIONAL DIAGNOSTIC MODEL

Jixin Meng (*Abstract Co-Author*) Nothing to Disclose
Qingzhu Zheng (*Abstract Co-Author*) Nothing to Disclose
Shiting Feng, MD (*Abstract Co-Author*) Nothing to Disclose
Zhoulei Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Xiao Di Shen (*Abstract Co-Author*) Nothing to Disclose
Ruonan Zhang (*Abstract Co-Author*) Nothing to Disclose
Xuehua Li II (*Abstract Co-Author*) Nothing to Disclose
Yang Di Wang (*Abstract Co-Author*) Nothing to Disclose
Xinyue Wang (*Abstract Co-Author*) Nothing to Disclose
Lili Huang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Bowel damage (BD) critically influences Crohn's disease (CD) prognosis. Gut microbiota and their metabolites play a crucial role in the pathogenesis of BD, while magnetic resonance enterography (MRE) serves as a valuable tool for assessing BD severity. This study aimed to unravel the connections between gut microbiota, metabolites, and MRE phenotypes of BD, with the ultimate goal of developing an optimal diagnostic model for BD by leveraging these biomarkers.

### METHODS AND MATERIALS

A prospective cohort of 230 CD patients were enrolled, who underwent MRE, fecal/blood metabolomic analysis using UPLC-MS/MS, and fecal 16S rRNA gene sequencing. Based on Lémann index (LI) evaluation, patients were categorized into BD (n=103) and non-BD (n=127) groups. We analyzed ten MRE features associated with BD and explored their associations with microbiota and metabolites through correlation and mediation analyses. Significant biomarkers were identified and further confirmed by a random forest algorithm with 10-fold cross-validation. Diagnostic models were constructed using selected gut microbiota, fecal/blood metabolites, and MRE features either independently or in combination, and their efficacy was evaluated using ROC analysis.

### RESULTS

Distinct microbiota, metabolites and MRE phenotypes were observed between CD patients with and without BD. Network graphing detailed the complex interplay among bacterial taxa, metabolites, and MRE phenotypes. Among various pathways, Prevotella_9 potentially contributed to perianal disease through serum PE(38:1). Significant multi-omic features related to BD were further identified, including three bacterial genera (e.g., [Ruminococcus] gnavus group), nine fecal metabolites (e.g., Citrulline), and eight serum metabolites (e.g., N-Acetylneuraminic acid), alongside seven MRE features (e.g., Penetration). The area under the curve (AUC) for the models was 0.620 (95% CI: 0.527-0.712) for microbiota, 0.678 (95% CI: 0.538-0.787) for fecal metabolites, and 0.663 (95% CI: 0.533-0.737) for serum metabolites; while MRE registered an AUC of 0.700 (95% CI: 0.617-0.782). Integrating all parameters in a comprehensive model yielded an improved AUC of 0.761 (95% CI: 0.685 - 0.833) ($P<0.05$).

### CONCLUSION

MRE phenotypes of BD are at least partially attributable to microbial and metabolite factors. The comprehensive model, which integrates macroscopic and microscopic information through simultaneous blood, fecal, and MRE examinations, offers a promising alternative tool for efficient diagnosis of BD in CD patients.

### CLINICAL RELEVANCE/APPLICATION

This study provides a multidimensional diagnostic tool for BD in CD by combining MRE, gut microbiota, and metabolites, minimizing the need for extensive clinical data.

## R3-SSGI18-2 A PROSPECTIVE MULTI-MODEL STUDY FOR COMPARISON OF THE DIAGNOSTIC PERFORMANCE OF MULTI-MODEL MOLECULAR IMAGING TO DETECT INTESTINAL FIBROSIS IN CROHN’S DISEASE

Shi-Ting Feng (*Abstract Co-Author*) Nothing to Disclose
Yang Di Wang (*Abstract Co-Author*) Nothing to Disclose

Zhoulei Li, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Accurate and timely detection of intestinal fibrosis induced by Crohn's disease (CD) is imperative for effective clinical management, yet it remains an unmet need. Magnetization transfer MR Imaging (MTI) has been reported to offer high accuracy in detecting intestinal fibrosis. Recently, the utilization of fibroblast activating protein inhibitor (FAPI) PET/CT has emerged as a promising tool for assessing fibrosis. The diagnostic efficacy of different imaging technique (18F-FAPI and 18F-FDG PET/CT as well as MTI) in detecting intestinal fibrosis was compared with each other.

**METHODS AND MATERIALS**

22 rats were subjected to TNBS treatment for 2-4 weeks, simulating the development of fibrosis, then underwent multi-model quantitative imaging during one week. The standardized uptake values (SUVmean and SUVmeax) were calculated on both 18F-FAPI and 18F-FDG PET/CT scans, while the normalized magnetization transfer ratio (normalized MTR) was determined using MTI. Intestinal histological fibrosis was assessed. Ten patients with a total of 34 intestinal strictures were prospectively recruited and underwent the same imaging protocol.

**RESULTS**

In patients, the accuracy of FAPI uptake (AUCs=0.80-0.87, P=0.01) was comparable to that of MTI (AUCs=0.90-0.91, P=0.05), but superior to FDG uptake (AUCs=0.53-0.82, P=0.01-0.36) in distinguishing non-to-mild from moderate-to-severe fibrosis. In the early phase of the disease (rats treated until week 2), a stronger correlation was detected between fibrotic scores and FAPI uptake (SUVmean: R=0.69) compared to FDG uptake (SUVmean: R=0.17) and normalized MTR (R=0.52). In the late phase (rats treated until week 3 or 4), normalized MTR (R=0.93) exhibited stronger correlations with fibrotic scores than FAPI uptake (SUVmean: R=0.55) or FDG uptake (SUVmean: R=0.19). A strong influence of serve inflammation was detected on both FAPI and FDG uptake, which disturbed their efficiency in diagnosing fibrosis during late phase in patients with CD.

**CONCLUSION**

The 18F-FAPI PET/CT is comparable to MTI and superior to 18F-FDG in terms of characterizing intestinal fibrosis in CD. Notably, 18F-FAPI PET/CT enables accurately identifying early-stage intestinal fibrosis, surpassing the other two imaging modalities, warranting further investigation.

**CLINICAL RELEVANCE/APPLICATION**

18F-FAPI PET/CT is a highly sensitive imaging tool to accurately detect early intestinal fibrosis. Recommendations have been made for selecting non-invasive imaging techniques based on different situations of CD-induced intestinal fibrosis, aiming to improve CD patient management.

## R3-SSGI18-3 PREDICTION OF DISEASE PROGRESSION IN PATIENT WITH CROHN'S DISEASE BASED ON TIME-DEPENDENT DIFFUSION MRI COMBINED WITH MAGNETIZATION TRANSFER IMAGING

Luyao Wu (*Abstract Co-Author*) Nothing to Disclose
Xuehua Li II (*Abstract Co-Author*) Nothing to Disclose
Li Huang (*Abstract Co-Author*) Nothing to Disclose
Qingzhu Zheng (*Abstract Co-Author*) Nothing to Disclose
Shiting Feng, MD (*Abstract Co-Author*) Nothing to Disclose
Xiao Di Shen (*Abstract Co-Author*) Nothing to Disclose
Xinyue Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

Noninvasive evaluation of intestinal fibrosis in Crohn's disease (CD) is crucial for guiding management. Time-dependent diffusion MRI (TD-dMRI) has potential to map cellular characteristics; while magnetization transfer imaging (MTI) has been proven to quantify extracellular collagen. We aimed to evaluate the feasibility of TD-dMRI in detecting intestinal fibrosis and combined it with MTI to predict the risk of disease progression.

**METHODS AND MATERIALS**

This study prospectively enrolled 106 CD patients, with 13 of them later receiving surgery. TD-dMRI indices, including cell diameter, extracellular diffusivity, intracellular volume fraction, cellularity, and diffusivities with different effective diffusion times, were estimated with a two-compartment model. For patients who received surgery, the area ratio of myofibroblasts to fibroblasts was used to depict fibrotic cellular information and then correlated with TD-dMRI indices. Bowel normalized MT ratio (MTR)>0.71 was considered as high collagen deposition. All non-surgical patients were followed up for at least 6 months, unless the disease progressed. Disease progression referred to the development of penetration, strictures, or CD-related surgery.

**RESULTS**

In 45 bowel specimens from 13 surgical patients (lesions, n=22; surgical margins, n=23), TD-dMRI-derived cell diameter was highly correlated with the area ratio of myofibroblasts to fibroblasts (r=0.58; P<0.001). A cutoff value of 11 μm for cell diameter between diseased and normal specimens was obtained using ROC curve analysis. Cell diameter=11 μm indicated the dominance of pro-fibrotic phenotype cells. Based on cell diameter and normalized MTR, 93 non-surgical patients were divided into 4 groups (group1: low cell diameter, low normalized MTR; group2: high cell diameter, low normalized MTR; group3: high cell diameter, high normalized MTR; group4: low cell diameter, high normalized MTR). Group 3 had the highest disease progression rate (33.3%), followed by group 2 (20.0%), group 4 (10.8%), and group 1 (0%). In addition, multivariable Cox regression analysis indicated high cell diameter was the only significant risk factor for disease progression in this study (HR: 4.353; P=0.01).

**CONCLUSION**

TD-dMRI-derived cell diameter effectively characterizes fibrosis-associated cell features. Combing TD-dMRI with normalized MTR enables a comprehensive assessment of fibrosis, allowing prediction of disease progression.

**CLINICAL RELEVANCE/APPLICATION**

TD-dMRI-based microstructural mapping could noninvasively characterize the fibrosis-associated cell features in CD, and the combination with MTI showed promise for comprehensively evaluating the severity of fibrosis, thus accurately predicting disease progression.

## R3-SSGI18-4 ENHANCING RADIOLOGIST'S DETECTION: AN IMAGING-BASED GRADING SYSTEM FOR IDENTIFYING CROHN'S DISEASE IN CLINICALLY SUSPECTED INFLAMMATORY BOWEL DISEASE

Zhen Li, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yaqi Shen, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Ziman Xiong (*Presenter*) Nothing to Disclose

**PURPOSE**

To establish an imaging report and data system of inflammatory bowel disease (IBD-RADS) for the preliminary classification of Crohn's disease (CD) and ulcerative colitis (UC).

**METHODS AND MATERIALS**

This multicenter retrospective study included adult patients diagnosed with IBD and underwent CT enterography scans at three tertiary referral centers between January 2012 and May 2022. Patients were divided into derivation and validation cohorts. The intestinal and perianal inflammatory features were evaluated. Visceral fat information from CT images was extracted, including the ratio of visceral to subcutaneous fat volume (VSR), fat distribution, and attenuation values. The valuable indicators were screened out in the derivation cohort by binary logistic regression and receiver working curve (ROC) analysis to construct the IBD-RADS, which was tested in the validation cohort.

**RESULTS**

The derivation cohort included 606 patients (365 CD, 241 UC), and the validation cohort included 155 patients (97 CD, 58 UC). Asymmetric enhancement (AE) (OR = 88.87 [37.65, 209.78]; P < 0.001), perianal fistula (OR = 5.024 [2.154, 11.71]; P < 0.001) and VSR (OR = 1.579 [1.090, 2.287]; P = 0.02) were independent predictors of CD. VSR improved the efficiency of imaging signs (AUC: 0.929 vs. 0.901; P < 0.001), with a threshold greater than 0.97 defined as visceral fat predominance (VFP). In IBD-RADS, AE was the major criterion, VFP and perianal fistula were auxiliary criteria, and inter-intestinal fistula and limited small bowel disease were special favoring items as their 100% specificity. Grade 3 to 5 correctly classified approximately 80% of CD patients (derivation: 78.6% (287/365), validation: 86.6% (84/97)), and more than 97% of those were eventually diagnosed with CD (derivation: 97.3% (287/295), validation: 97.7% (84/86)).

**CONCLUSION**

IBD-RADS can help radiologists distinguish between CD and UC in patients with suspected IBD.

**CLINICAL RELEVANCE/APPLICATION**

The IBD-RADS proposed in the present study is helpful for radiologists to make a preliminary classification, to shorten the diagnosis time of Crohn's disease.

## R3-SSGI18-5 MRI NEUROPHENOTYPE REFLECTING BRAIN-GUT INTERACTIONS TO PREDICT INTESTINAL DISEASE PROGRESSION IN PATIENTS WITH CROHN'S DISEASE

Xuehua Li II (*Abstract Co-Author*) Nothing to Disclose
Yang Di Wang (*Abstract Co-Author*) Nothing to Disclose
Lili Huang, MD (*Abstract Co-Author*) Nothing to Disclose
Shiting Feng, MD (*Abstract Co-Author*) Nothing to Disclose
Ruonan Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

There is considerable recent interest in the role of brain-gut axis in the pathogenesis and manifestations of Crohn's disease (CD). We developed a multimodal neuroimaging-based model to characterize the neurophenotype of CD patients and predict intestinal disease progression, using multi-omics data to demonstrate its validity.

**METHODS AND MATERIALS**

This prospective study enrolled 109 CD patients who underwent baseline tests (including multimodal neuroimaging, psychological scales, MR enterography, ileocolonoscopy) and fecal/blood samples collection within one week. The neurophenotype of patients with different intestinal inflammation levels was characterized using a radiomics model, developed from 13 out of 13,870 neuroimaging features. This neurophenotype in predicting disease progression during follow-up was evaluated using Kaplan-Meier curves and Cox regression analysis. Multi-omics data (including fecal microbiome, fecal/blood metabolomics, intestinal/blood-brain-barrier permeability, and blood neurotransmitter) were used to elucidate how this neurophenotype reflecting brain-gut interactions.

**RESULTS**

The model enabled accurate characterization of neurophenotypes in patients with different intestinal inflammation levels in training and test cohorts (AUC=0.824-0.842, both P<0.05). Neurophenotype was the most important predictor of disease progression (HR=29.05, P=0.033), surpassing psychological traits (HR=0.95-1.09, all P>0.05). Multi-omics analysis revealed that elevated intestinal inflammation was correlated with increased intestinal permeability and specific gut microbiota (e.g., Enterococcus) and metabolites (e.g., caproic acid), which collectively contributed to high-risk neurophenotype (all P<0.05). High-risk neurophenotype subsequently associated with intestinal disease progression by establishing correlations with six blood neurotransmitters (e.g., tryptophan) (all P<0.05).

**CONCLUSION**

The neurophenotype varies among CD patients with different intestinal inflammation levels and can predict intestinal disease progression. Multi-omics data offer biological evidence to support its validity.

**CLINICAL RELEVANCE/APPLICATION**

Our neurophenotype characterization model effectively illuminates these brain changes and accurately stratifies their neurophenotypic risk, paving the way for the implementation of new strategies to initiate transformative advancements.

# Abstract Archives of the RSNA, 2024

R3-SSHN03

**Science Session with Keynote: Head and Neck Imaging (Advanced Techniques in Head and Neck Imaging)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: E352

Ashok Srinivasan, MD (*Moderator*) Nothing to Disclose
Jacqueline Junn, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R3-SSHN03-1 Keynote Speaker

Ashok Srinivasan, MD (*Science Invited Presenter*) Nothing to Disclose

## R3-SSHN03-2 COMPREHENSIVE SINGLE-SCAN 3D FACE MR IMAGING INCLUDING QUALITATIVE AND QUANTITATIVE BONE AND SOFT-TISSUE ASSESSMENT

Ana Beatriz Solana (*Abstract Co-Author*) Nothing to Disclose
Jeffrey P. Guenette, MD (*Abstract Co-Author*) Nothing to Disclose
Florian Wiesinger (*Abstract Co-Author*) Employee, General Electric Company
Eugene Milshteyn, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose De Arcos (*Abstract Co-Author*) Nothing to Disclose
Simon Kidanemariam (*Presenter*) Nothing to Disclose

### PURPOSE

Establish the feasibility of a single-acquisition 3D quantitative and qualitative multi-contrast, zero echo time (ZTE) based sequence for rapid clinical face MR imaging.

### METHODS AND MATERIALS

This prospective study included two aims: 1) phantom validation of T1 and T2 quantitative relaxometry map accuracy; 2) IRB-approved and HIPAA-compliant application of the sequence in human patients undergoing clinical face MRI. The sequence combines T2 and T1 magnetization preparation with 3D ZTE segmented readout. The obtained raw data are Deep Learning (DL) reconstructed into five echo images of variable contrast weighting which are then fitted into quantitative T1 and T2 parameter maps. For enhanced visualization of bone anatomy, the PD-weighted ZTE was inverted (using an inverse gray scale). Quantitative T1 and T2 accuracy and reproducibility was assessed using the NIST/ISMRM phantom. In clinical MRI examinations, the sequence was scanned in coronal orientation with 1mm isotropic resolution, 5mins01sec scan time, and prior to intravenous contrast injection. All clinical examinations were performed on a 3T GE Premier system with a 21-channel head and neck coil.

### RESULTS

Quantitative T1 and T2 ROI measurements had excellent accuracy and precision on par with other parameter mapping methods. SNR was similar or favorable to SNR of the clinical T1- and T2-weighted images (study sequence echo 3 SNR: 81.6 for muscle and 122.6 for fat; clinical 3D T1 TSE SNR: 25.7 for muscle and 123.4 for fat). Images were of visually adequate clinical quality and nicely showed pathology, including a left submandibular sialocele.

### CONCLUSION

The study sequence provides similar SNR and similar spatial resolution compared with current standard-of-care face MRI with the benefits of a substantially shortened examination, addition of quantitative parameters that could serve as biomarkers, and the addition of bone images that could potentially suffice for bone evaluation in place of CT.

### CLINICAL RELEVANCE/APPLICATION

A single-acquisition 5-minute, 1 mm isotropic, comprehensive clinical sinus MRI examination including bone images appears feasible pending further validation.

## R3-SSHN03-3 QUANTITATIVE HIGH-DEFINITION MICROVASCULATURE IMAGING FOR DIFFERENTIATION OF SMALL CHOROIDAL MELANOMAS FROM BENIGN NEVI

Mostafa Fatemi, PhD, PhD (*Abstract Co-Author*) Nothing to Disclose
Azra Alizad, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas B. Larson, PhD (*Abstract Co-Author*) Nothing to Disclose
Shaheeda Adusei (*Abstract Co-Author*) Nothing to Disclose
Lauren Dalvin (*Abstract Co-Author*) Nothing to Disclose
Soroosh Sabeti, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Accurate differentiation of early-stage (thickness=2mm) melanoma cases from choroidal nevi is of high clinical importance. The purpose of this study is to determine the effectiveness of a contrast-free ultrasound-based technique called high-definition microvasculature imaging (qHDMI) in discriminating malignant from benign small intraocular tumors.

**METHODS AND MATERIALS**

An in-vivo study approved by our institutional review board (IRB) and compliant with Health Insurance Portability and Accountability Act, consisting of 36 participants with suspicious intraocular masses was conducted. Diagnoses made based by ocular oncologist through clinical evaluation of the results of multimodal imaging were used as the gold standard reference. Microvasculature images were generated through post-processing of the data, in a series of clutter filtering, denoising, and vessel enhancement steps. The qHDMI biomarkers extracted included number of vessel segments (NV), number of branch points (NB), vessel density (VD), Murray's deviation (MD), fractal dimension (FD), diameter (D), bifurcation angle (BA) and tortuosity (t). Distributional differences across the malignant and benign cases were tested using a non-parametric Wilcoxon rank-sum test and statistical significance was assumed for biomarkers with p-values $< 0.05$.

**RESULTS**

Out of the 36 lesions (from 36 participants, 21 male and 15 female) included in the study, 21 were clinically diagnosed as choroidal melanoma (malignant) and 15 were determined to be choroidal nevus (benign). Participants with malignant lesions had their age ranging from 30 to 86 years with mean age ± standard deviation of 60.48±15.75 years. Ages of participants with benign masses ranged from 34 to 89 years with a mean ± standard deviation of 67.47±14.31 years. The mean thickness of benign and malignant masses was 1.70±0.40 mm and 3.81±2.63 mm, respectively. Five qHDMI biomarkers exhibited significant distributional differences between the two groups. These biomarkers and their corresponding p-values are vessel density (p-value = 0.011), number of vessel segments (p-value = 0.003), number of branch points (p-value = 0.003), maximum tortuosity (p-value = 0.002), and fractal dimension (p-value = 0.001).

**CONCLUSION**

The proposed qHDMI technique can be utilized as a complementary tool for characterization of small ocular tumors and early detection of choroidal melanoma.

**CLINICAL RELEVANCE/APPLICATION**

In an extremely sensitive organ such as eye, where biopsies are accompanied by high-morbidity, the proposed method can noninvasively and objectively diagnose small ocular melanomas that could lead to better patient outcome.

## R3-SSHN03-6 PROGNOSTIC VALUE OF DIFFUSION RELAXATION CORRELATED SPECTROSCOPIC IMAGING IN IDENTIFYING CERVICAL LYMPH NODE METASTASIS IN ORAL TONGUE SQUAMOUS CELL CARCINOMA

Yongming Dai (*Abstract Co-Author*) Nothing to Disclose
Yingwei Wu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Siyu Li (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine the feasibility of DR-CSI to predict the pathological T (pT) stage and cervical lymph node metastasis (CLNM) in oral tongue squamous cell carcinoma (OTSCC).

**METHODS AND MATERIALS**

Patients with a new diagnosis of OTSCC were enrolled from January 2023 to December 2023. Preoperative head and neck MR scan including DWI and DCE-MRI were performed. DR-CSI scan conducted by multi b-values and multi-TE based diffusion imaging were acquired for all patients. Tumor dimension features and MRI-based depth of invasion (DOI) were measured. For each patient, a D-T2 spectrum was fitted and segmented into 5 compartments, and the volume fractions VA, VB, VC, VD, VE were obtained. The tumor-stroma ratio (TSR) was determined based on HE specimens. All MRI and histopathologic metrices were compared between CLNM and non-CLNM OTSCCs. The relationship between Vi fraction or TSR to CLNM was calculated by Spearman's correlation test.

**RESULTS**

58 patients (age: 54.3±13.9 years; 38 male) with OTSCC were evaluated; 28 in CLNM group while other 30 in non-CLNM group. Max tumor diameter(MTD) and MRI-based DOI was larger in CLNM group than that in non-CLNM group (MTD 3.4±1.2cm vs. 2.6±1.0cm, p=0.006, DOI:11.6±1.2mm vs. 7.3±1.0mm, p<0.01). CLNM group exhibited increased VB(CLNM vs non-CLNM, 29.9±12.2% vs 19.0±12.6%, p<0.01), decreased VA(CLNM vs non-CLNM, 30.3±16.7% vs 41.5±22.8%, p<0.05) and decreased VD(LNM vs non-LNM, 24.0±10.1 vs 17.1±13.2, p<0.01). VB, VD, MTD and high TSR were independent preoperative factors for CLNM.VB+VD+MTD model yielded an excellent performance in predicting CLNM (area under AUC:81.5%). VB was positively correlated with TSR (p<0.01, with correlation coefficients of 0.71(95% CI:0.62-0.83).

**CONCLUSION**

DR-CSI can detect microstructural changes between CLNM and non-CLNM groups. VB was correlated with Higher TSR, offering potential for subtype identification in OTSCC. DR-CSI may serve as a useful imaging biomarker for tailoring individual treatment regimens in OTSCC.

**CLINICAL RELEVANCE/APPLICATION**

Subclinical lymph node (LN) metastasis is associated with poor survival outcome in oral tongue squamous cell carcinoma (OTSCC), and a subset of patients with aggressive disease experiences treatment failure. DR-CSI has emerged to discern sub-voxel level environments by resolving the entangled MR signal of diffusion and relaxation time weights, offering useful information for distinguishing intra-tumor components such as TSR. DR-CSI would serve as a useful imaging modality to identify subtypes of OTSCC and tailor individual treatment regimens in OTSCC.

# Abstract Archives of the RSNA, 2024

R3-SSIN07

**Imaging Informatics (3D Printing Meets Segmentation)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: E450B

Lumarie Santiago, MD (*Moderator*) Nothing to Disclose
Prashanth Ravi, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R3-SSIN07-1 INITIAL SPEED AND ACCURACY MEASUREMENTS OF 3D PRINTED MEDICAL PARTS USING A NEW-TECHNOLOGY DESKTOP INVERTED VAT POLYMERIZATION PRINTER

Summer J. Decker, PhD (*Abstract Co-Author*) Nothing to Disclose
Prashanth Ravi, PhD (*Abstract Co-Author*) Nothing to Disclose
Aisling McEleney, MPH (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Ford, PhD (*Abstract Co-Author*) Nothing to Disclose
Rayna Debellevue (*Abstract Co-Author*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD (*Presenter*) Medical Director, Imagia Cybernetics Inc

### PURPOSE

Patient-specific 3D printing from medical images is time consuming, and faster 3D printing will save resources. This project tests the hypothesis that 3D printing with a new-technology desktop inverted vat polymerization printer is faster and more accurate than a commonly used legacy printer.

### METHODS AND MATERIALS

This initial evaluation tests a new-technology (Form 4B, Formlabs, Sommerville, MA) that incorporates masked liquid crystal display based optics versus a legacy printer (Form 3B) that incorporates laser-based optics. Using three new-technology printers, five previously validated clinical anatomic models were 3D printed with a 15mm cube; the same surface mesh files were also printed once with the legacy printer. All print, wash, and cure settings were harmonized for the new-technology and legacy printers. For each patient, there was one 3D printed part. Four of the 5 parts were printed in Clear (V5, Form 4B and V4, Form 3B) resin with 0.05mm layers; the fifth (cardiac - flexible) model was printed in Elastic (50A V2, Form 4B and 50A V1, Form 3B) with 0.1mm layers. Print time, material consumption, and post-processing (wash, support removal, post-cure) times were recorded; accuracy was meticulously measured using calipers.

### RESULTS

The mean print time (hr:min) for the new-technology printer was 4:44 versus 12:19 for the legacy technology. For the new-technology compared to the legacy technology, for the models, the maximum deviation among the parts was 0.387mm (new) versus 1.06mm (legacy) on the same part (a mandible 3D printed to pre-bend plates); for all 5 parts, the mean absolute error was 0.77% (new) versus 2.3% (legacy), p=0.0087, unpaired t-test. For the 15mm cube, there was no significant difference in the mean absolute error along any of the three dimensions. Material consumption for the new-technology printer (mean 133ml) was not significantly different than the legacy technology (126ml). Similarly, the mean post-processing time for the new technology printer (30 min) was not significantly different from that of the legacy technology (38 min).

### CONCLUSION

This initial study of a new-technology desktop inverted vat polymerization printer shows an acceleration of 2.5x (250% faster) when comparted to its precursor 3D printer commonly used to fabricate medical devices. The accuracy of the parts is improved roughly 3x. The rationale for these improvements is a liquid crystal display with integrated heating and temperature sensors. Further research is warranted to validate these initial measurements across a larger cohort of 3D printed parts used for patient care.

### CLINICAL RELEVANCE/APPLICATION

Improved print speed with more accurate parts is expected to improve clinical 3D printing throughput and efficiency.

## R3-SSIN07-2 ROBUST SEGMENTATION OF 40 DIFFERENT ORGANS IN MAGNETIC RESONANCE IMAGING

Lina Xu (*Abstract Co-Author*) Nothing to Disclose
Lisa C. Adams, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcus R. Makowski (*Abstract Co-Author*) Nothing to Disclose
Alessa Hering, PhD (*Abstract Co-Author*) Nothing to Disclose
Hartmut Hantze (*Abstract Co-Author*) Nothing to Disclose
Mathias Prokop, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Canon Medical Systems Corporation;Research Grant, Siemens AG;Speakers Bureau, Siemens AG
Keno K. Bressem, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To introduce a deep learning model capable of multi-organ segmentation in MRI scans, offering a solution to the current limitations in MRI analysis due to challenges in resolution, standardized intensity values, and variability in sequences.

**METHODS AND MATERIALS**

The model was trained on 1,200 manually annotated MRI scans from the UK Biobank and 221 in-house MRI scans, leveraging cross-modality transfer learning from CT segmentation models. A human-in-the-loop annotation workflow was employed to efficiently create high-quality segmentations. The model's performance was evaluated on the AMOS22 dataset containing 60 MRI scans. Dice Similarity Coefficient (DSC) was used to assess segmentation accuracy. The model will be open sourced.

**RESULTS**

The model showcased high accuracy in segmenting well-defined organs, achieving Dice Similarity Coefficient (DSC) scores of 0.932 and 0.934 for the right and left lungs, respectively, and 0.919 for the heart. It also demonstrated robustness in organs like the liver (DSC: 0.875) and kidneys (DSC: 0.882 left, 0.909 right), which present more variability. However, segmentation of smaller and complex structures such as the portal and splenic veins (DSC: 0.548) and adrenal glands (DSC: 0.596 left, 0.648 right) revealed the need for further model optimization.

**CONCLUSION**

The proposed model is a robust, tool for accurate segmentation of 40 anatomical structures in MRI and CT images. By leveraging cross-modality learning and interactive annotation, the model achieves strong performance and generalizability across diverse datasets, making it a valuable resource for researchers and clinicians.

**CLINICAL RELEVANCE/APPLICATION**

The model can facilitate the extraction of quantitative imaging biomarkers, improve diagnostic algorithms, and support treatment planning by providing detailed anatomical context in MRI. Its open-source availability will accelerate research on MRI-based biomarkers and AI diagnostic systems.

## R3-SSIN07-3 SEGMENTING TUMORS ON 3D AUTOMATED BREAST ULTRASOUND (ABUS) WITH SELF-CONFIGURING HYBRID TRANSFORMER

Chulhong Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Chiho Yoon (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD (*Abstract Co-Author*) Stockholder, Anymedi, Inc
Jongjun Won, BS (*Abstract Co-Author*) Nothing to Disclose
Hyunseok Lim, MS (*Abstract Co-Author*) Nothing to Disclose
Hyunsu Jeong, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

To propose a self-configuring hybrid transformer to segment tumors on 3D automated breast ultrasound (ABUS) by automatically creating the network for a large model in small graphic processing unit (GPU) memory.

**METHODS AND MATERIALS**

A total of 200 GE Invenia ABUS scans with breast tumors in TDSC-ABUS 2023 public dataset in MICCAI 2023 challenge with anonymized patient information were used. A tumor boundary was labeled by a breast clinic doctor with 5-year experiences. Our network mainly consists of hybrid transformer blocks with an efficient self-attention module by reducing the dimension of features and a channel-cross gate that considers long-range dependency among channels. In addition, multi-task learning was performed by classifying whether the patch includes tumors or not. All configurations (the size of model, the degree of dimensional reduction, etc) on the hybrid transformer were automatically created and evaluated. Quantitative evaluation was performed on dice similarity coefficient (DSC) and precision. Comparing our network with the conventional models, paired T-test was used. Segmentation results were analyzed according to whether the tumor size was T1 (=2cm ) or more advanced (>2cm ) stages. All experiments are conducted on five-fold cross validations with training and validation (160 scans) and test sets (40 scans).

**RESULTS**

Mean tumor size for the dataset was 2.5cm± 1.3cm. 80 and 120 cases were included in the T1 and more advanced T stages, respectively. In the five-fold cross validations, DSCs of Unet, SwinUNet, nnUNet, and our network were 33.90% (95% confidence interval, CI: 29.65 - 38.15), 32.54% (95% CI: 29.11 - 35.96), 54.70% (95% CI: 50.77 - 58.62), 58.26% (95% CI: 54.03 - 62.5), respectively. Our model significantly outperformed UNet and SwinUNet ($P<0.001$), except nnUNet ($P=0.185$). Our network significantly outperformed the other networks with precision of 62.71% (95% CI: 58.12 - 67.30). Our model showed better DSC (mean: 42.26%, 95% CI: 34.75 - 49.77), precision (mean: 42.16%, 95% CI: 34.19 - 50.12) at T1 stage, and DSC (mean: 68.93%, 95% CI: 64.96 - 72.90), precision (mean: 76.41%, 95% CI: 72.48 - 80.34)) at more advanced T stage than other models.

**CONCLUSION**

Our model maximizes the capability of self-attention for the characteristics of 3D ABUS data. Our network with self-attention for the characteristics of 3D ABUS data is relatively robust to the size variance of tumors by quantitatively better results than the other models in both T1 and more advanced stages.

**CLINICAL RELEVANCE/APPLICATION**

Our model could be expected to improve the performance of quantification of tumor volumetry and computer-aided diagnosis for reducing radiologists' fatigue by reducing false positive rates and automated segmentation.

## R3-SSIN07-4 ASSESSING THE EFFECTIVENESS OF AN INTEGRATED QUALITY ASSURANCE PROTOCOL ON LUNG CT SEGMENTATION ACCURACY ACROSS A LARGE MULTICENTER STUDY

Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ricarda Elisabeth Fischbach (*Abstract Co-Author*) Nothing to Disclose
Andreas Bucher, MD (*Abstract Co-Author*) Travel support, Bayer AG Travel support, Guebert SA Travel support, Pharmacept
Eric Frodl, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the impact of a structured quality assurance protocol (QAP) on the accuracy and consistency of lung CT scan segmentations in a multicenter setting. Our objective was to monitor segmentation consistency and accuracy using an integrated QAP developed for large multicenter datasets in the extraction of image-based biomarkers from chest CT studies.

**METHODS AND MATERIALS**

In this retrospective multicenter study, part of the nationwide RACOON project, we enrolled 75 readers from 36 sites, including all university hospitals in the country. Each reader performed voxel-wise segmentation (labels: ground-glass opacity [GGO], consolidation [CONS]) on chest CT image series. Participation in the QAP took place in three rounds, corresponding to progress milestones in each reader's worklist (R1: 0%, R2: 50%, R3: 100%). Segmentations were evaluated using an integrated analysis workflow within our annotation software, focusing on accuracy and inter-reader consistency. Quantitative evaluation was performed using Sụrensen's Dice Coefficients (SDC) and Root-Mean-Square Distance (RMSD). A structured survey assessed the readers' experience in each round. A robust linear mixed effects model was used for statistical analysis.

**RESULTS**

From July 2021 to June 2022, 2961 image series were labeled across the entire training dataset, of which 519 were specifically analyzed within our QAP (R1: 205, R2: 171, R3: 143). Most readers (57%) had minimal experience with segmentation (intermediate: 25%, expert: 17%). We observed significant improvements in segmentation accuracy for both labels, with mean SDC increasing from 0.376±0.214 to 0.584±0.340 for GGO ($p < 0.0001$) and from 0.313±0.301 to 0.556±0.311 for CONS ($p < 0.0001$). RMSD improvements were also significant for GGO (from 8.18±3.28 to 6.04±6.47, $p < 0.0001$) and CONS (from 4.83±2.25 to 3.96±4.25, $p = 0.0009$). Mean reading time decreased by 25% (from 96.6±77.5 min to 78.01±65.9 min, $p = 0.02558$). There was no significant correlation between readers' prior segmentation experience and their quality improvements for GGO ($p = 0.9622$) and CONS ($p = 0.9685$).

**CONCLUSION**

Implementing a comprehensive quality assurance process can provide critical metrics on the reliability of training datasets, reducing reliance on full expert review. Our QAP, integrated into the annotation software, supports systematic monitoring of training success across different levels of reader experience.

**CLINICAL RELEVANCE/APPLICATION**

In multicenter studies, a dedicated QAP efficiently ensures dataset quality and provides critical metrics that reflect reader accuracy.

## R3-SSIN07-5 IMPROVING FOUNDATION MODELS WITH DEEP LAYER ADAPTERS FOR MEDICAL IMAGE SEGMENTATION

Matthew S. Brown, PhD (*Abstract Co-Author*) Nothing to Disclose
Dan Ruan, PhD (*Abstract Co-Author*) Nothing to Disclose
Jin Kim, BEng, MEng (*Presenter*) Nothing to Disclose

**PURPOSE**

Foundation models, such as the Segment Anything Model (SAM), have shown strong general performance in image segmentation tasks. However, the optimal approach to adapting these models for domain-specific applications, such as medical image segmentation, remains an open question. In this work, we investigate the effectiveness of introducing adapters to deep layers of foundation models for medical image segmentation.

**METHODS AND MATERIALS**

Experiments were conducted using the VinDr-RibCXR dataset, consisting of 245 Chest X-ray images focusing on rib segmentation. The dataset was split into a training set of 196 images and a validation set of 49 images. ViT-B and ViT-H architectures were employed as backbones for the SAM-Adapter model, which adds fully-connected adapters as inputs to the transformer blocks. Models were trained for 50 epochs using a batch size of 2, the AdamW optimizer, and IoU as the loss function. The number of adapters, starting from the deepest blocks, was systematically varied to investigate their impact.

**RESULTS**

For the ViT-B architecture (12 transformer blocks), performance plateaued with adapters at the 7 deepest blocks, with an F1 score of 0.824. This surpassed the no-adapter baseline of 0.777 and the full-adapter configuration of 0.821. For the ViT-H architecture (32 transformer blocks), performance plateaued with adapters at the 20 deepest blocks, with an F1 score of 0.847. This surpassed the no-adapter baseline of 0.770 and the full-adapter configuration of 0.837.

**CONCLUSION**

Adding adapters to the deepest 60% of layers in both ViT-B and ViT-H architectures led to the most improved performance compared to the baseline and the full-adapter configuration. This finding highlights the importance of infusing domain-specific information into the SAM foundation model for specific medical image segmentation tasks and shows that adapters can be focused on the deeper layers to reduce the training burden and model size.

**CLINICAL RELEVANCE/APPLICATION**

Foundation models such as Segment Anything Model (SAM) require refinement for medical image segmentation if they are to provide automation and improve clinical workflows and patient care. This study investigates an adapter approach and provides insights into the benefits of adding adapters to the deeper layers only, thus reducing the training burden and model size. Further research is needed to validate these findings across a broader range of medical imaging tasks, datasets, and foundation models.

## R3-SSIN07-6 ENHANCED CHOROID PLEXUS SEGMENTATION WITH 3D UX-NET AND ITS ASSOCIATION WITH DISEASE PROGRESSION IN MULTIPLE SCLEROSIS

Xiaohua Wang (*Abstract Co-Author*) Nothing to Disclose
Li Yongmei, PhD (*Abstract Co-Author*) Nothing to Disclose
Qi Hao (*Presenter*) Nothing to Disclose

**PURPOSE**

The choroid plexus (CP) is suggested to be closely associated with the neuroinflammation of multiple sclerosis (MS). We aim to develop a reliable deep learning (DL) model for the automatic segmentation of CP and further validate its clinical significance in MS.

**METHODS AND MATERIALS**

The 3D UX-Net model (3D U-Net used for comparison) was trained and validated on a cohort of 216 relapsing-remitting MS (RRMS) patients and 75 healthy subjects. Among these, 53 RRMS with baseline and 2-year follow-up scans formed an independent internal test set (dataset1b). Another 58 RRMS from multi-center data served as an external test set (dataset2). Dice coefficient was computed to assess segmentation performance. Compare the correlation of CP volume segmented using 3D UX-Net and manual methods with clinical outcomes. Disability and cognitive function in MS were assessed using the expanded disability status scale (EDSS) and symbol digit modalities test (SDMT).

## RESULTS

The 3D UX-Net model achieved Dice coefficients of 0.875 and 0.870 for CP segmentation on dataset1b and dataset2, respectively, outperforming 3D U-Net's scores of 0.809 and 0.601. Furthermore, CP volumes segmented by the 3D UX-Net model aligned consistently with clinical outcomes compared to manual segmentation. In dataset1b, both manual and automatic segmentation revealed a significant positive correlation between normalized CP volume (nCPV) and EDSS score at baseline($r = 0.285/0.287$, $p = 0.045/0.044$) and a negative correlation with SDMT score ( $r = -0.331/-0.329$, $p = 0.020/0.021$). Similar correlation with EDSS score was found in dataset2 ($r = 0.337/0.346$, $p = 0.021/0.017$). Meanwhile, in dataset1b, both manual and automatic segmentation revealed a significant increase in nCPV from baseline to follow-up ($p < 0.05$). The increase of nCPV was more pronounced in patients with disability worsened compared to stable patients for both manual ($0.50 \pm 0.43$ vs $0.14 \pm 0.30$, $p = 0.023$) and automatic segmentation ($0.44 \pm 0.31$ vs $0.15 \pm 0.26$, $p = 0.018$). Disease-modifying therapy (DMT) patients exhibited a significantly lower nCPV increase compared to untreated patients for both manual segmentation ($0.13 \pm 0.36$ vs $0.38 \pm 0.31$, $p = 0.004$) and automatic segmentation ($0.13 \pm 0.25$ vs $0.34 \pm 0.33$, $p = 0.004$).

## CONCLUSION

The 3D UX-Net model demonstrated outstanding segmentation performance for the CP, yielding consistent results in clinical investigations compared to manual segmentation in MS.

## CLINICAL RELEVANCE/APPLICATION

The 3D UX-Net model exhibited excellent performance for choroid plexus (CP) segmentation on T1-weighted images of multiple sclerosis (MS), and the CP volume obtained can serve as an imaging marker for disease progression and post-treatment monitoring in patients with MS.

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# Abstract Archives of the RSNA, 2024

R3-SSIR04

**Interventional Radiology (Global Experts Debate: High-Impact Abstracts in Interventional Radiology 2024)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: E353A

Lynn J. Savic, MD (*Moderator*) Research Grant, Guerbet SA
Rony Avritscher, MD (*Moderator*) Speakers Bureau, Boston Scientific Corporation;Research Consultant, Siemens AG

**Sub-Events**

**R3-SSIR04-1** **Emerald-1: Phase 3 Randomized Study of TACE Combined with Durvalumab with or without Bevacizumab in Participants with Unresectable HCC Eligible for Embolization**

Irene Bargellini, MD (*Presenter*) Consulting fees from: AstraZeneca, EISAI, Ge Healthcare, Guerbet, Merck, Sirtex, Terumo Lecture fees from: AstraZeneca, Bayer, Boston Scientific, Eisai, Guerbet, Merck, Sirtex, Sobi, Terumo Institutional research grant from: Boston Scientific Serves on Independent Data Safety Monitoring Board for: AstraZeneca
Rony Avritscher, MD (*Science Invited Presenter*) Speakers Bureau, Boston Scientific Corporation;Research Consultant, Siemens AG

**R3-SSIR04-2** **Computational Models to Predict Local Tumor Progression After Microwave Ablation**

Punit Prakash, PhD (*Science Invited Presenter*) Nothing to Disclose

**R3-SSIR04-4** **Embolization of the Superior Rectal Artery Versus Closed Hemorroidectomy in Treatment of Hemorrhoidal Disease: A Randomized Clinical Trial**

Felipe Nasser, MD (*Science Invited Presenter*) Nothing to Disclose

**R3-SSIR04-5** **Genicular Artery Embolization in Patients with Osteoarthritis of the Knee (Genesis)**

Marcus Katoh, MD (*Science Invited Presenter*) Consultant, Straub Medical AGConsultant, Medtronic, Inc

RSNA 2024
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# Abstract Archives of the RSNA, 2024

R3-SSMK11

**Science Session with a Keynote: Musculoskeletal Imaging (Spine)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: E450A

Usa Cain, MD (*Moderator*) Nothing to Disclose
Gunnar K. Astrom, PhD (*Moderator*) Royalties, AprioMed AB

**Sub-Events**

## R3-SSMK11-1 RETROSPECTIVE ANALYSIS OF THE PERFORMANCE OF AN INTELLIGENCE TOOL IN THE DETECTION OF UNSUSPECTED VERTEBRAL FRACTURES IN A TERTIARY CARE CENTER FOR ONCOLOGY PATIENTS

Nathalie B. Lassau, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Corinne Balleyguier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Baptiste Bonnet (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sarah Quenet, MD (*Abstract Co-Author*) Employee, Avicenna.ai
Julie Kiewsky (*Abstract Co-Author*) Nothing to Disclose
Astrid Orfali Camez, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Zemmouri (*Abstract Co-Author*) Nothing to Disclose
Lambros C. Tselikas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tarek Assi (*Abstract Co-Author*) Nothing to Disclose
Angela Ayobi, MENG,MSc (*Abstract Co-Author*) Employee, Avicenna.ai
El Mehdi Mniai, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Cancer and cancer treatments induce profound depletion of serum estrogen levels and can lead to an increased risk of vertebral fractures (VF). This study aimed to evaluate the performance of artificial intelligence (AI) in detecting vertebral fractures in cancer patients compared with radiological assessment. The secondary objective was to determine to what extent the detection of these VF, particularly for severe fractures, could have modified treatment management by offering an interventional radiology procedure.

### METHODS AND MATERIALS

Chest, abdominal and pelvis CT follow-up exams acquired from September to December 2023 for adult patients treated for stage IV cancer were retrospectively reviewed to evaluate the performance of an AI tool, CINA-VCF, to detect incidental VF. The AI tool quantifies intra-vertebral height loss and height loss relative to neighboring vertebrae. VF were categorized into three stages according to the degree of height loss: grade 1 with a loss of 20-25%; 26-40% for grade 2 and > 40% for grade 3. Grade 3 were considered as severe fractures. AI also calculated the mean value of L1 trabecular attenuation using a fully automated tool on healthy L1 vertebrae - to estimate bone mineral density and identify patients at risk of osteoporosis. We also collected relevant demographic and clinical information such as age, sex, type of cancer, type of treatment, bone metastatic status, and spinal treatment history. Two expert interventional radiologists in cancer treatment (IR1 and IR2), with over 10 and 2 year's experience respectively, assessed whether or not they would have treated severe fractures with vertebroplasty.

### RESULTS

We included 1501 patients over a three-month period. Among these patients, AI detected VF in 501, with 436 true positives (TP) and 65 false positives (FP). The Predictive Positive Value was 87%. 51 % of patients were at risk of osteoporosis and 32 % had vertebral metastasis. 81 % of fractures detected by the AI tool had not been described on the initial radiological report, including 10 severe fractures, with 9 requiring an interventional treatment. Overall, based on expert opinion, 89.6 % of severe fractures had an indication for cementoplasty.

### CONCLUSION

AI detects more incidental VF than radiologists in cancer patients, including severe VF that, according to expert opinion, could have benefited from specific management.

### CLINICAL RELEVANCE/APPLICATION

AI could assist radiologists to detect more incidental vertebral fractures in adult cancer patients, optimizing timely treatment and reducing associated morbidity and economic burden. Automated assessment of L1 trabecular attenuation offers potential for osteoporosis screening, facilitating early identification of at-risk individuals.

## R3-SSMK11-2 ARTIFICIAL INTELLIGENCE MEASURES COBB ANGLES WITH HIGH ACCURACY

Ali Guermazi, MD, PhD (*Abstract Co-Author*) Consultant, Novartis AG;Consultant, Pfizer Inc;Consultant, AstraZeneca PLC;Consultant, Merck KGaA;Consultant, TissueGene, Inc;Consultant, Regeneron Pharmaceuticals, Inc;Shareholder, Boston Imaging Core Lab, LLC
Andrew J. Kompel, MD (*Abstract Co-Author*) Nothing to Disclose

Vincent Marty (*Abstract Co-Author*) Employee, Gleamer
Boston Center (*Abstract Co-Author*) Nothing to Disclose
Daichi Hayashi, MD, PhD (*Abstract Co-Author*) Author with royalties, Wolters Kluwer nv
Jeanne Ventre, PhD (*Abstract Co-Author*) Researcher, GLEAMER
Nor-Eddine Regnard, MMed (*Presenter*) Founder, GLEAMER;Officer, GLEAMER;Stockholder, GLEAMER

**PURPOSE**

Radiographic Cobb angles are routinely measured by radiologists, orthopedic surgeons, and pediatricians treating patients with spinal scoliosis. Although it is a relatively simple task, repetitive Cobb angle measurement on a large number of radiographs can be tedious for human readers. Accordingly, artificial intelligence (AI) with its ability to automate angles' measurements, can be valuable. Consequently, our study aims to evaluate the accuracy and reliability of an AI-based software (BoneMetrics, Gleamer) in automatic Cobb angle measurements using full spine radiographs.

**METHODS AND MATERIALS**

The radiology reports of 400 full spine radiographs of patients =4 years of age were screened using a Natural Language Processing algorithm to identify the studies performed for Cobb angle measurements. Two US board-certified experienced musculoskeletal radiologists and one US board-certified experienced orthopedic surgeon independently annotated Cobb angles exceeding 7°, and indicated the curves' location as either proximal thoracic (apices between T3 and T5), main thoracic (apices between T6 and T11), or thoraco-lumbar (apices between T12 and L4). If at least two annotators agreed on the number of coronal curves, their respective locations, and the difference between the corresponding curves was less than 8°, then the ground truth was defined as the mean of their measurement. Otherwise, the radiograph was reviewed by the three annotators in consensus.The AI used was BoneMetrics (Gleamer), an automated image-processing software for conventional and EOS radiographs. The software includes a deep learning algorithm that detects key points used for the computation of the Cobb angles. The AI was evaluated against the manual annotation with the mean absolute error (MAE) for the major Cobb angle and the minor ones.

**RESULTS**

A total of 345 patients were included in the study (age: 33±24 years, range: 4-85 years, 221 women): 179 pediatric (< 22 years old), and 166 adult patients. 53 cases were reviewed in consensus. The MAE of the AI for the main Cobb angle was 2.6° (95% CI: [2.0; 3.3]). For the subgroup of pediatric patients, the MAE was 1.9° (95% CI: [1.6; 2.2]) versus 3.3° (95% CI: [2.2; 4.8]) for adults with no significant statistical difference (p=.09). The MAE for the minor angles was 2.8° (95% CI: [2.3; 3.3]).

**CONCLUSION**

The AI predicted the Cobb angle of scoliotic patients with high accuracy regardless of patients' age. The main limitation was that one radiograph was not processed by the AI due to low confidence in key point placement.

**CLINICAL RELEVANCE/APPLICATION**

AI demonstrates accuracy in measuring Cobb angles for scoliosis assessment across various age groups, offering a prospective support to physicians in busy clinical setting.

## R3-SSMK11-3 AI GENERATED SYNTHETIC STIR IMAGING IN THE LUMBAR SPINE

Zenas Igbinoba, MD (*Abstract Co-Author*) Nothing to Disclose
Ek Tsoon Tan, PhD (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Medtronic Inc Research Grant, AMAG Pharmaceuticals
Mark Fontana (*Abstract Co-Author*) Nothing to Disclose
Darryl B. Sneag, MD (*Abstract Co-Author*) Researcher, General Electric Company;Researcher, Siemens AG;Research support, AMAG Pharmaceuticals, Inc
J. Levi Chazen, MD (*Abstract Co-Author*) Nothing to Disclose
Erwin Xia, MD (*Abstract Co-Author*) Nothing to Disclose
Alice Santilli, MSc, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Generative adversarial networks (GANs) can be used to generate MRI series to allow for faster acquisitions with less opportunity for motion artifacts while lowering costs. This study uses a continuous dataset to synthetically create STIR series from T1 and T2 sequences and evaluates the models both mathematically and using radiology experts.

**METHODS AND MATERIALS**

Sagittal T1, T2, and STIR images were extracted from lumbar MRIs from patients over a three-month period and randomly divided into a training, validation, and testing sets. No patients were excluded, including patients with and without spine surgery, spinal instrumentation, and scoliosis. A Pix2Pix GAN backbone was optimized using the training and validation sets to select appropriate loss function and model hyperparameters. The optimal model was then used to generate a synthetic STIR volume for 100 test patients. These volumes, real and synthetic, were assessed by three radiologists with expertise in musculoskeletal imaging and neuroradiology. Each radiologist was blinded to the imaging technique and reviewed all volumes, divided into two sessions, with a two week wash out period between them. Radiologists evaluated image quality, degree of motion artifacts, confidence in whether the evaluated image was real or synthetic, and whether a short list of pathologies existed in the inspected volume.

**RESULTS**

The dataset was comprised of 1817 examinations acquired sequentially. Of the 100 test set patients, radiologists were able to tell a synthetic volume from a real volume in most cases. However, the synthetic volumes were graded with equal or better quality than the real volumes in 77% of test patients; moreover, the synthetic volumes had equal or reduced motion artifacts in 78% of test patients. Assuming that a diagnosis was present if the majority (2/3) of reviewers noted it in a given real or synthetic volume, we found that the synthetic volumes had high positive predictive value (>75% across diagnoses) but relatively lower sensitivity (23-77%, depending on the diagnosis).

**CONCLUSION**

GAN-generated STIR imaging from T1 and T2 volumes using sequentially collected data are of high-quality and reproduce many of the important features and pathologies seen in the real images from our institution. Our research creates a key link between objective computer vision performance metrics and subject clinical performance metrics. The conservative nature of our model requires further refinement to achieve diagnostic equivalency, however this project provides a promising first step in expediting imaging protocols.

**CLINICAL RELEVANCE/APPLICATION**

AI synthetic MRI sequence generation holds promise in reducing image acquisition times and increasing patient throughput while retaining diagnostic accuracy.

## R3-SSMK11-5 DIFFERENTIATION OF MULTIPLE MYELOMA AND VERTEBRAL METASTASES ON T1-WEIGHTED MR IMAGING OF THE SPINE

Abdulla Alansari (*Abstract Co-Author*) Nothing to Disclose
Antonio Santimano (*Abstract Co-Author*) Nothing to Disclose
Mahmoud Al Raheem Heidous, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Alhassan (*Abstract Co-Author*) Nothing to Disclose
Omar Aboumarzouk (*Abstract Co-Author*) Nothing to Disclose
Hanan Sherif, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the accuracy of the lesion-to-cord signal-intensity ratio in differentiation of multiple myeloma and metastases on T1-weighted magnetic resonance (MR) imaging of the spine.

### METHODS AND MATERIALS

Forty-one patients with pathologically proven focal multiple myeloma of the spine and 59 patients with pathologically proven vertebral metastases were included in the study. Patients with vertebral metastases included 26 patients with breast carcinoma, 11 patients with bronchogenic carcinoma, 7 patients with prostatic carcinoma, 5 patients with hepatocellular carcinoma, 3 patients with renal cell carcinoma, 2 patients with gastric carcinoma, 1 patient with thyroid carcinoma, 1 patient with neuroendocrine carcinoma, 1 patient with nasopharyngeal carcinoma, 1 patient with colon carcinoma, and 1 patient with tongue carcinoma. The signal intensity of focal lesions and that of the spinal cord were measured by operator-determined region of interest (ROI). The signal intensity of the vertebral focal lesions to that of the spinal cord was calculated for each patient. Statistical analysis was done by the Student's t-test and by the Receiver-Operating-Characteristic (ROC) curve analysis.

### RESULTS

The lesion-to-cord signal-intensity ratio was significantly higher in multiple myeloma (1.39±0.24) than that of metastases (0.85±0.31) ($p<0.0001$). It had a diagnostic accuracy of 76% at the threshold of =1 for multiple myeloma and an area under the ROC curve of 0.78. One type of metastases, those of hepatocellular carcinoma, showed a statistically significant higher lesion-to-cord signal-intensity ratio (1.33±0.4) than that of the rest of metastases (0.80±0.27) ($p<0.0002$). There was no statistically significant difference between lesion-to-cord signal-intensity ratio of multiple myeloma and hepatocellular carcinoma metastases ($p<0.6268$). On re-analysis of the ROC curve after exclusion of hepatocellular carcinoma metastases, diagnostic accuracy for multiple myeloma at the threshold of =1 increased to 80% and the area under the curve increased to 0.82.

### CONCLUSION

On sagittal T1-weighted MR images, focal multiple myeloma lesions appear hyperintense to the spinal cord while vertebral metastases appear hypointense to the spinal cord in most cases. Hepatocellular carcinoma metastases represent a unique category of metastases which, like multiple myeloma, appear hyperintense to the spinal cord.

### CLINICAL RELEVANCE/APPLICATION

In patients with vertebral focal lesions without a recognized primary neoplasm, T1-weighted MR imaging can differentiate between multiple myeloma and metastases after exclusion of hepatocellular carcinoma by imaging of the liver. Machine learning of the results may further improve the diagnostic accuracy.

## R3-SSMK11-6 AI-ASSISTED RADIOLOGIC INTERPRETATION: EVALUATING DIAGNOSTIC AGREEMENT AND CLINICAL EFFICACY IN MULTI-VENDOR LUMBAR-SPINE MRI

Young Han Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Youngho Won (*Abstract Co-Author*) Nothing to Disclose
Jiwoo Park, MD (*Abstract Co-Author*) Nothing to Disclose
SOOHO AHN, MS (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate diagnostic agreement and clinical efficacy of commercially available artificial intelligence (AI) solution for L-spine MRI in clinical real-world by analyzing AI-generated radiologic interpretation and by comparing radiologists' reading time with and without AI support.

### METHODS AND MATERIALS

First session, 101 cases of L-spine MRI (GE Healthcare, Philips Healthcare, Siemens Healthineer) were evaluated by board-certified radiologists and by Columbo software (Smart Soft Healthcare, Varna, Bulgaria). Qualitative analysis used the board-certified radiologist's readings as a gold standard and recorded agreements in scale of 0, 25, 50, 75 and 100%. For quantitative analysis, the number of words deleted from AI reading and the number of words for missed findings were counted, and errors from each reading were categorized. These errors were then categorized again to see which findings were missed. Second session, in clinical settings, reading times of 11 cases of L-spine MRI with and without Colombo software were recorded by two radiologists (board-certified radiologist and radiologist in training).

### RESULTS

AI radiologic interpretations were successful in most cases (n=92/101) with three different MRI images. Agreements of major findings showed 0% (n=8/92), 25% (n=11), 50% (n=28), 75% (n=41), and 100% agreement (n=4). The numbers of deleted words from AI interpretations were average 44.3 (SD=26.45), and words for missed findings were average 6.3(SD=4.64). Most common types of errors were incorrect severity (n=37), followed by false prediction (n=35) and missed findings (n=29). Lesion location and positions were correct in all cases. False predictions were found in disc bulging (n=13), fracture (n=11), central stenosis (n=6), and antero/retrolisthesis (n=4). Omission of finding was seen in central stenosis (n=12), disc bulging (n=7), instrumentation (n=7), and post operative status (n=2). The average radiologic reading time was decreased from 178.9 to 109.0sec in certified radiologist ($p=0.0169$) and decreased from 296.6 sec to 75.8 sec in radiologist-in-training ($p=0.0015$).

### CONCLUSION

Use of AI software shows acceptable agreements with major findings in lumbar spine MRI, but revealed some weaknesses in measuring severity, false findings, and missed findings of findings. Combining the strengths of AI and radiologists could lead to better diagnostic performance and efficient radiologic reading workflow.

**CLINICAL RELEVANCE/APPLICATION**

This study highlights the benefits of AI radiologic reading software into radiologic workflows. The radiologists assisted with AI software would reduce the burden of radiologists and would lead to better patient outcomes and more efficient use of healthcare resources.

## R3-SSMK11-7 Keynote Speaker: 7T Musculoskeletal MRI

Reto Sutter, MD (*Science Invited Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

R3-SSNR14

**Neuroradiology (Techniques and Methods: Artificial Intelligence)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: N228

Jeffrey Rudie, MD, PhD (*Moderator*) Medical Advisory Board, Cortechs.ai;Consultant, Cortechs.ai;Stockholder, Cortechs.ai;Medical Advisory Board, Subtle Medical, Inc;Consultant, Subtle Medical, Inc;Stockholder, Subtle Medical, Inc
Arsany H. Hakim, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R3-SSNR14-1 AUTOMATED SEGMENTATION OF MULTIPLE SCLEROSIS LESIONS, PARAMAGNETIC RIMS, AND CENTRAL VEIN SIGN ON MRI PROVIDES RELIABLE DIAGNOSTIC BIOMARKERS

Andrew Solomon (*Abstract Co-Author*) Nothing to Disclose
Russell Shinohara (*Abstract Co-Author*) Nothing to Disclose
Daniel Ontaneda (*Abstract Co-Author*) Nothing to Disclose
Nancy Sicotte (*Abstract Co-Author*) Nothing to Disclose
Pascal Sati (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Reich, MD, PhD (*Abstract Co-Author*) Research support, Vertex Pharmaceuticals Incorporated;Research support, sanofi-aventis Group
Fengling Hu, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Multiple sclerosis (MS) is characterized by central nervous system lesions visible on MRI. The diagnostic criteria include typical MS lesions, but specificity can be improved using MS-specific, pathologically-validated imaging biomarkers, including paramagnetic rim lesions (PRLs) and central vein sign (CVS). However, manual segmentation of MS lesions, PRLs, and CVS is time-consuming and subjective. We propose a fully automated method for segmenting MS lesions, PRLs, and CVS, called Automated Lesion, PRL, and CVS Analysis (ALPaCA).

### METHODS AND MATERIALS

ALPaCA uses an intensity-based, voxel-wise lesion segmentation method to identify a large set of lesion candidates. Lesion candidates are input into a multi-contrast 3D CNN as 24x24x24 voxel patches from four MRI contrasts: T1-weighted, FLAIR, echo planar imaging (EPI) magnitude, and EPI phase. ALPaCA then jointly makes multi-label predictions of lesion, PRL, and CVS status of the candidate inside each patch. Since PRL and CVS status depend on lesion status, ALPaCA first predicts lesion status and then uses this prediction for PRL and CVS status. When multiple lesions exist within a patch, an attention mechanism allows ALPaCA to identify which lesion candidate to classify.

### RESULTS

We trained ALPaCA with subject-level cross validation in a multi-site dataset of 47 adults with MS and 50 with radiological MS mimics. Medians and interquartile ranges (IQRs) of lesions, PRLs, and CVS for individuals with MS were 36 [20, 71], 1 [0.5, 4], and 9 [3, 15], respectively. For individuals with radiological MS mimics, median and IQRs were 40 [20, 106], 0 [0, 0], and 2 [0, 3]. At the lesion candidate level, ALPaCA achieves areas under the receiver-operator curve (AUROCs) of 0.95, 0.91, and 0.87 for lesion, PRL, and CVS classification when run on validation data. These AUROCs are higher than those of automated competitors run on the same dataset - 0.72, 0.78, and 0.67 (all $p < 0.001$). In logistic regression models where MS diagnosis was the outcome and age and sex were controlled for, when ALPaCA subject-level PRL and CVS percentages increased by 10, the odds for MS were 28.5 (95% CI: [6.8, 120.2], $p < 0.001$) and 4.9 (95% CI: [2.2, 11.2], $p < 0.001$) times as high. These odds increases were comparable to those from manual labels. Meanwhile, neither ALPaCA nor manual lesion count was associated with MS diagnosis ($p = 0.08$ and $p = 0.44$), reflecting the specificity of PRL and CVS biomarkers over lesion count.

### CONCLUSION

ALPaCA provides a fully-automated pipeline for voxel-wise segmentation of standard MS lesions, PRLs, and CVS using clinically-feasible scans.

### CLINICAL RELEVANCE/APPLICATION

Automated segmentations may allow for translation of PRL and CVS biomarkers to clinical practice and advancement of quantitative lesion-based research.

## R3-SSNR14-2 THE 2024 BRAIN TUMOR SEGMENTATION (BRATS) CHALLENGE: GLIOMA SEGMENTATION ON POST-TREATMENT MRI

Raymond Y. Huang, MD, PhD (*Abstract Co-Author*) Advisory Board, Vysioneer Inc;Consultant, Nuvation Bio, Inc ;Institutional research support, Bristol-Myers Squibb Company
Andreas M. Rauschecker, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Rudie, MD, PhD (*Abstract Co-Author*) Medical Advisory Board, Cortechs.ai;Consultant, Cortechs.ai;Stockholder, Cortechs.ai;Medical Advisory Board, Subtle Medical, Inc;Consultant, Subtle Medical, Inc;Stockholder, Subtle Medical, Inc
Gian Marco Conte, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Louis Gagnon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Ayman Nada (*Abstract Co-Author*) Nothing to Disclose
Mariam S. Aboian, MD, PhD (*Abstract Co-Author*) Researcher, Blue Earth Diagnostics Ltd;Researcher, Fusion Pharmaceuticals;Research collaboration, Pro Medicus Limited
Evan D. Calabrese, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nourel Hoda M. Tahon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Ujjwal R. Baid, PhD (*Abstract Co-Author*) Nothing to Disclose
Aly H. Abayazeed, MBChB (*Abstract Co-Author*) Nothing to Disclose
Nikdokht Farid, MD (*Abstract Co-Author*) Nothing to Disclose
Dominic LaBella, MD (*Abstract Co-Author*) Nothing to Disclose
Rachit Saluja, MS,BEng (*Abstract Co-Author*) Nothing to Disclose
Maria Correia de Verdier, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The 2024 Brain Tumor Segmentation (BraTS) challenge on post-treatment glioma aims to create a large public database of annotated post-treatment diffuse glioma MRIs and a benchmarking environment for the development and evaluation of deep learning segmentation algorithms towards addressing challenges in disease monitoring and treatment planning.

**METHODS AND MATERIALS**

The challenge, launched in April 2024, brings together a new multi-institutional dataset of patients diagnosed with diffuse gliomas that have undergone treatment (i.e., surgery, radiation, and/or systemic therapy). All MRI scans include pre-contrast T1 weighted, contrast enhanced T1 weighted, T2 weighted, and T2 weighted Fluid Attenuated Inversion Recovery (FLAIR) sequences. Data preprocessing and annotation protocols follow established BraTS standards, ensuring consistency across multi-site contributions. Ground truth reference annotations are approved by expert neuroradiologists with test data annotated by two independent expert neuroradiologists to assess interrater reliability. Annotations comprise four labels: enhancing tissue, surrounding non-enhancing FLAIR hyperintensity, non-enhancing tumor core, and resection cavity. These data will be used by participants to develop, containerize, and evaluate their automated segmentation models, predicting the four distinct sub-regions on validation data through July 2024. In August, participants that submit a formal methods paper will be invited to submit containerized solutions to one hidden testing data.

**RESULTS**

The dataset comprises approximately 2400 MRIs from six different contributing sites. The winner of the challenge will be announced at the Medical Image Computing and Computer Assisted Intervention (MICCAI) Conference in October 2024. Algorithm performance will be evaluated using common segmentation metrics, including lesion-wise Dice Similarity Coefficient, 95% Hausdorff distance for different tumor subregions and will be compared to neuroradiologist interrater reliability.

**CONCLUSION**

The 2024 BraTS challenge on post-treatment glioma establishes a benchmark for automated segmentation on post-treatment MRI, leveraging the largest expert-annotated glioma dataset available to date. The developed state-of-the-art models will provide a crucial tool for objectively assessing residual tumor volume for follow-up and treatment planning.

**CLINICAL RELEVANCE/APPLICATION**

Automated segmentation algorithms developed through BraTS 2024 challenges have significant clinical relevance in neuro-oncology practice. By providing accurate and efficient tools for tumor volume assessment on MRI, these algorithms have the potential to improve patient management and outcome.

## R3-SSNR14-3 DEVELOPMENT AND VALIDATION OF A RADIOMICS-BASED TREATMENT RESPONSE PREDICTIVE MODEL FOR BRAIN METASTASES RECEIVING STEREOTACTIC RADIOSURGERY THERAPY

Peng Du, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The selection of the initial treatment strategy for brain metastases (BM) plays a crucial role in the prognosis of patients, and stereotactic radiosurgery (SRS) is considered one of the promising therapies. Therefore, we developed and validated a radiomics-based predictive model to prospectively identify BM patients that are insensitive to SRS, especially those with potential risk of local failure (LF) after treatment.

**METHODS AND MATERIALS**

A total of 337 BM patients (247, 60, and 30 in the training set, internal validation set, and external validation set, respectively) were enrolled in this study. 12918 radiomics features [2 masks × 3 MRI sequences (T2-FLAIR, DWI and CE-T1WI) × 2153 features] extracted from 9 ROIs were filtered through LASSO and Max-Relevance and Min-Redundancy (mRMR) algorithms. The selected radiomics features were combined with four clinical features to establish a model for the prediction of BM patients' response to SRS using SVM classifier. The performance of the model was evaluated by its accuracy, specificity, sensitivity, and AUC curve.

**RESULTS**

In the training set, the SVM classifier that uses a combination of clinicaland radiomics features shows excellent discriminative performance (AUC=0.95, 95% CI: 0.93-0.97). Moreover, this model also achieves satisfactory results in the validation sets (AUC=0.95 in the internal validation set and AUC=0.93 in the external validation set), demonstrating outstanding generalizability.

**CONCLUSION**

The predictive model established in this study can non-invasively predict the response of BM patients to SRS, thus helping neuro-oncologists to develop a more refined and individualized first treatment plan for patients.

**CLINICAL RELEVANCE/APPLICATION**

We present a novel non-invasive SRS treatment response prediction model of BM patients based on an machine learning approach. The model combines the pre-treatment multimodal MRI radiomics features and relevant clinical risk factors, and is capable of accurately identifying BM patients at risk of LF after treatment, thus helping neuro-oncologists to develop a more refined and individualized first treatment plan for patients.

## R3-SSNR14-4 USING THE BLACK BOX OF AI TO FIND RADIOLOGIST BLINDSPOTS IN DETECTING CERVICAL SPINE FRACTURES ON CT

Errol Colak, MD (*Abstract Co-Author*) Nothing to Disclose
Shobhit Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin D. Shek, MD (*Abstract Co-Author*) Nothing to Disclose
Jefferson Wilson (*Abstract Co-Author*) Nothing to Disclose
Hui Ming Lin, BSc (*Abstract Co-Author*) Nothing to Disclose
Christopher Witiw (*Abstract Co-Author*) Nothing to Disclose
Markand Patel, MBBS (*Abstract Co-Author*) Nothing to Disclose
Robyn L. Ball, PhD (*Abstract Co-Author*) Nothing to Disclose
Zixuan Hu (*Abstract Co-Author*) Nothing to Disclose
Ervin Sejdic (*Abstract Co-Author*) Nothing to Disclose
Yingming Amy Chen, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To use machine learning (ML) models to retrospectively identify cervical spine fractures that were missed by radiologists; describe and categorize fracture types, and assess their clinical significance.

**METHODS AND MATERIALS**

Emergency department adult cervical spine CTs between 2018 and 2022 were included. CT scans reported as negative based on radiology reports were identified and processed by seven of the award-winning ML models from the RSNA 2022 Cervical Spine Fracture Detection Challenge. CT scans that were classified as positive by a majority of the ML models but reported as negative by a radiologist underwent independent review by two neuroradiologists, who identified the true missed fractures and documented their cervical spine segment, specific anatomical locations, and fracture patterns. Two spine surgeons blinded to clinical data evaluated the clinical significance of missed fractures based on CT images only and determined whether the misses warranted any of the following interventions: surgery, MRI, CTA, or cervical collar immobilization. Inter-observer agreement was measured with a weighted kappa statistic. Disagreements in clinical significance were resolved with discussion.

**RESULTS**

A total of 6,979 cervical spine CT studies of 6,671 patients were included in the study. Out of these, 6,378 studies were reported negative for cervical spine fractures by the initial reporting radiologist. 350 studies of these negative scans were classified as positive by a majority of the ML models. 30/350 (8.6%) ML model-identified studies were positive for fracture on secondary review by neuroradiologists. 24/30 patients had one missed fracture location, 5 patients had two missed fracture locations, and 1 patient had three missed fracture locations. The most common vertebral level for missed fractures was C7 while the most common fracture types were of spinous processes and transverse processes. 11/30 missed fractures were considered clinically significant by spine surgeons (kappa 0.93): 1 for potential surgery, 8 for immobilization, 9 for MRI evaluation, and 5 for CTA evaluation.

**CONCLUSION**

We demonstrate that missed cervical spine fractures can be reliably identified using ML models. Understanding these misses and their clinical significance is of educational value. This information can be used to help improve radiologist search patterns, reducing future diagnostic errors and mitigating the potentially negative consequences associated with them.

**CLINICAL RELEVANCE/APPLICATION**

We are pioneering the use of ML models to retrospectively identify and qualify radiology misses on cervical spine CT. Our results can help radiologists refine their search patterns and highlight the clinical importance of prone-to-miss fractures.

## R3-SSNR14-5 EXPLORING THE UTILITY OF ARTIFICIAL INTELLIGENCE AUGMENTED FUNCTIONAL CONNECTOMICS APPROACH IN BRAIN TUMOURS TO EVALUATE THE INVOLVEMENT OF NON-ELOQUENT AREAS - A PROSPECTIVE COHORT STUDY

Sunitha P Kumaran, MD (*Abstract Co-Author*) Nothing to Disclose
Akshay Kumaar M (*Abstract Co-Author*) Nothing to Disclose
Sachin Patalasingh (*Abstract Co-Author*) Nothing to Disclose
Rimjhim Agrawal, PhD (*Abstract Co-Author*) Nothing to Disclose
Radha Kumari (*Abstract Co-Author*) Nothing to Disclose
Shreyas Reddy K, MBBS, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The primary goal of brain tumour surgery is to maximize tumour removal for better survival, but this can cause new neurological problems and lower quality of life. While surgeons use fMRI to map basic brain functions like language and movement, and might not have information on the location of personalized higher-order functions. These higher-order complex functions such as the default mode network (DMN), central executive network (CEN), salience network (SN), dorsal attention network (DAN), and ventral attention network (VAN), are often compromised to achieve adequate resection, leading to deficits in attention, memory, and emotions. Computational algorithms with the augmentation of machine learning offer a promising individualized reconstruction of these complex brain networks, potentially improving surgical outcomes.

**METHODS AND MATERIALS**

This is part of the ongoing study (CTRI/2022/11/046964) to retrospectively assess the utility of rs-fMRI in presurgical planning for glioblastomas. Several assessments were performed, including the Adenbroke cognitive examination (ACE), the Edinburgh handedness inventory (EHI), and muscle strength using the Oxford muscle scale. Of the 35 patients, 5 patients demonstrated low ACE scores and were evaluated for non-eloquent area involvement (DMN, CEN, VAN, SN, and DAN).

**RESULTS**

In all 5 patients (45-55, 4 M, and 1 F), low ACE scores were associated with the involvement of at least 3 of the non-eloquent areas, most commonly involving DAN, SN, and VAN. ACE scores ranged from 21 to 54. Involvement in all 5 networks corresponded to the highest discrepancy in scores ranging from 21 to 45. When 3 areas were involved, scores ranged from 51 to 54.

**CONCLUSION**

Our study reveals that non-eloquent areas are often involved in brain tumours, as evidenced by low ACE scores. The involvement of these areas could potentially result in decreased overall quality of life during the post-operative period. Using ML algorithms, the integration of these non-traditional eloquent network maps may help in the preservation of higher mental functions.

### CLINICAL RELEVANCE/APPLICATION

In neuro-oncology, preserving complex higher cognitive functions during brain tumour surgery is crucial for maintaining a patient's overall quality of life. However, traditional surgical approaches may compromise cognitive networks like default mode, salience, executive, and attention networks. Our ongoing study highlights the prevalence of low cognitive assessment scores in patients with involvement in these non-eloquent areas. Integration of machine learning algorithms for individualized mapping of these complex brain networks may aid in preserving higher mental functions, thereby enhancing patients' quality of life following surgery.

## R3-SSNR14-6 THE BRAIN TUMOR SEGMENTATION - METASTASES (BRATS-METS) CHALLENGE 2023: BRAIN METASTASES SEGMENTATION ON PRE-TREATMENT MRI

Mariam S. Aboian, MD, PhD (*Abstract Co-Author*) Researcher, Blue Earth Diagnostics Ltd;Researcher, Fusion Pharmaceuticals;Research collaboration, Pro Medicus Limited
Jeffrey Rudie, MD, PhD (*Abstract Co-Author*) Medical Advisory Board, Cortechs.ai;Consultant, Cortechs.ai;Stockholder, Cortechs.ai;Medical Advisory Board, Subtle Medical, Inc;Consultant, Subtle Medical, Inc;Stockholder, Subtle Medical, Inc
Ujjwal R. Baid, PhD (*Abstract Co-Author*) Nothing to Disclose
Ahmed W. Moawad, MD (*Abstract Co-Author*) Nothing to Disclose
Evan D. Calabrese, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Khaled Bousabarah, MSc (*Abstract Co-Author*) Software Engineer, Pro Medicus Limited
Leon Jekel (*Abstract Co-Author*) Nothing to Disclose
Brats Consortium (*Abstract Co-Author*) Nothing to Disclose
Bjoern Menze (*Abstract Co-Author*) Nothing to Disclose
Gian Marco Conte, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Dominic LaBella, MD (*Abstract Co-Author*) Nothing to Disclose
Rachit Saluja, MS,BEng (*Abstract Co-Author*) Nothing to Disclose
Anastasia Yevgeniyivna Janas (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Devon J. Godfrey, PhD (*Abstract Co-Author*) Nothing to Disclose
Marius G. Linguraru, DPhil, MSc (*Abstract Co-Author*) Co-founder, PediaMetrix Inc
Fatima Memon, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Udunna Anazodo, PhD (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Holler (*Abstract Co-Author*) Nothing to Disclose
Maruf Adewole, MD (*Abstract Co-Author*) Nothing to Disclose
Divya Ramakrishnan (*Abstract Co-Author*) Nothing to Disclose
Kiril Krantchev (*Abstract Co-Author*) Nothing to Disclose
Scott R. Floyd, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yuri Velichko, PhD (*Abstract Co-Author*) Nothing to Disclose
Mingde Lin, PhD (*Abstract Co-Author*) Employee, PRO Medicus Ltd;Stockholder, PRO Medicus Ltd
Nourel Hoda M. Tahon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Nader Ashraf, MBBS (*Abstract Co-Author*) Nothing to Disclose
Anahita Fathi Kazerooni (*Abstract Co-Author*) Nothing to Disclose
Nazanin Maleki, MD (*Abstract Co-Author*) Nothing to Disclose
Raisa Amiruddin, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

Translation of AI generated brain metastases (BM) segmentation into clinical practice is dependent on the availability and quality of diverse annotated medical imaging datasets. BraTS-METS 2023 challenge has gained momentum for testing and benchmarking algorithms using rigorously annotated internationally compiled real-world datasets. We present the segmentation challenge results and characterize the challenging cases that affected winning algorithm performance.

### METHODS AND MATERIALS

Untreated brain metastases on standard anatomic MRI sequences (T1, T2, FLAIR, T1PG) from 8 contributed international datasets were annotated in stepwise method: published UNET algorithms, student, neuroradiologist, final approver neuroradiologist. Segmentations were ranked based on lesion-wise Dice and Hausdorff distance (HD95) scores. False positives (FP) and false negatives (FN) were rigorously penalized, receiving a score of 0 for Dice and a fixed penalty of 374 for HD95. The mean scores for the teams were calculated.

### RESULTS

Datasets from 8 international institutions containing 1303 studies were reviewed and 966 were annotated after meeting the inclusion criteria. Of these, 402 studies (3076 lesions) were released on Synapse as publicly available datasets to challenge participating teams. Additionally, 31 studies (139 lesions) were held out for validation and 59 studies (218 lesions) were used for testing. The Dice for the winning team was 0.65 ± 0.25 with an average rank across subjects being 7.9. Common errors by leading teams included false negative for small lesions and misregistration of masks in space. The Dice scores and lesion detection rates of all algorithms were found to diminish with decreasing tumor size, especially for those noticeably less than 100 mm3.

### CONCLUSION

Algorithms for BM segmentation need to be refined to effectively balance a high sensitivity of lesion detection and the need to minimize false positive and false negatives.

### CLINICAL RELEVANCE/APPLICATION

BraTS-METS 2023 challenge curated well annotated diverse datasets and identified common errors in developing generalizable algorithms. This approach will allow translation of BM segmentation across varied clinical environments and provide personalized volumetrics reports to patients undergoing BM treatment.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R3-SSNR15

**Neuroradiology (Techniques and Methods: Perfusion, Diffusion and Other Techniques)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: S405

Masis Isikbay, MD (*Moderator*) Nothing to Disclose
Audrey R. Verde, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R3-SSNR15-1 EVALUATION OF CEREBROVASCULAR REACTIVITY BY MULTIPHASE ASL PERFUSION IN CHRONIC CEREBROVASCULAR STENO-OCCLUSIVE DISEASE: COMPARISON WITH TC-99M HMPAO SPECT

Tae Jin Yun, MD (*Abstract Co-Author*) Nothing to Disclose
Chul-Ho Sohn, MD (*Abstract Co-Author*) Nothing to Disclose
Inpyeong Hwang, MD (*Presenter*) Research Consultant, AIRS Medical Inc.

### PURPOSE

In chronic steno-occlusive disease, impaired cerebrovascular reactivity (CVR) is related to not only increased future stroke risk but also risk factors of hyperperfusion syndrome after carotid endarterectomy or stenting. We evaluated cerebrovascular reactivity by multiphase ASL perfusion with acetazolamide challenge and compared the diagnostic performance to detect CVR impairment with 99mTc-HMPAO SPECT.

### METHODS AND MATERIALS

This IRB-approved, single center study prospectively enrolled participants with unilateral moderate or severe stenosis at proximal internal carotid artery or proximal middle cerebral artery, between July 2021 to April 2022. The participants underwent acetazolamide-challenged multiphase ASL perfusion-weighted imaging and 99mTc-HMPAO SPECT within 1 week interval to evaluate CVR. patient-specific gray matter segmentation masks were obtained from 3D T1-weighted images using freesurfer software, then further divided according to major vascular territory. The basal and acetazolamide-challenged transit time-corrected cerebral flow (CBF), arterial transit time (ATT) and SPECT CBF were measured, then normalized by cerebellum (nCBF). CVR index (CVRI) were calculated as follows: CVRI = (nCBFacetazolamide - nCBFbasal)/ nCBFbasal×100%. Correlation analysis and the ROC curve analysis were performed to evaluate diagnostic performance of CVRIASL and non-normalized CVRASL to detect CVR impairment, defined as CVRISPECT < -10%.

### RESULTS

We enrolled 11 participants (2 women, 69 ± 6 years, 3 proximal MCA stenosis and 8 proximal ICA stenosis). The CVRIASL showed lower value than CVRISPECT (mean difference, -10.1%). The mean difference of CVRIASL, CVRISPECT, CVRASL in MCA territory cortical gray matter between stenosis and contralateral side were -9.6%, -5.0%, and -17.0%, respectively. The correlation coefficient between CVRISPECT and CVRIASL was 0.604, while that between CVRISPECT and CVRASL was slightly lower (0.411). For detection of CVR impairment region of interest, the AUC of CVRIASL and CVRASL were 0.970 and 0.959, respectively (optimal threshold, -27.7% and 4.3%, respectively).

### CONCLUSION

The acetazolamide-challenged multiphase ASL perfusion can be used to assessment of CVR impairment region in cerebrovascular chronic steno-occlusive disease in replacement of 99mTc-HMPAO SPECT. ASL CVR without normalization also could be used to detect CVR impairment region.

### CLINICAL RELEVANCE/APPLICATION

Evaluation of CVR impairment can be performed precisely by acetazolamide-challenged multiphase ASL without radiation hazard for decision of treatment plan in chronic steno-occlusive disease. The impaired CVR might be directly perceivable on the ASL CBF images in routine clinical practice.

## R3-SSNR15-2 PREDICTION OF MALIGNANT CEREBRAL EDEMA FOLLOWING THROMBECTOMY IN ACUTE ISCHEMIC STROKE DUE TO LARGE VESSEL OCCLUSION USING A DEEP LEARNING MODEL BASED ON CT PERFUSION

Zhifang Pan (*Abstract Co-Author*) Nothing to Disclose
Heng Lin (*Abstract Co-Author*) Nothing to Disclose
Yunjun Yang (*Abstract Co-Author*) Nothing to Disclose
Haoli Xu, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Malignant cerebral edema (MCE) is a severe complication following endovascular thrombectomy (EVT) in patients with acute ischemic stroke due to large vessel occlusion (AIS-LVO). This study aimed to develop and test deep-learning (DL) models based on computed tomography perfusion (CTP) imaging to predict MCE automatically in AIS-LVO patients undergoing EVT.

**METHODS AND MATERIALS**

CTP and clinical data from AIS-LVO patients undergoing EVT between August 2018 to June 2023 from two stroke centers were utilized. Cohort 1 (n = 160) was used for model training and validation (10-fold cross-validation), cohort 2 (n = 50) served for external testing. The DL models incorporated whole maps of each CT perfusion parameter without distinguishing between the infarct core and ischemic penumbra. Among ShuffleNet, ViT, MobileNet, ResNet34, and ResNet50, the network with the best prediction performance was selected for DL modeling. Models based on single CTP maps and multi-maps were trained and validated to predict MCE post-EVT. Data augmentations for CTP images of the MCE group were performed using random affine transformation via Monai libraries to deal with data imbalance and prevent the prediction model from over-fitting. A clinical model comprising baseline NIHSS, age, net water uptake, collateral circulation status and other parameters was established, and fusion models were established by integrating DL features and clinical parameters. Model performance was evaluated by the area under the receiver-operating characteristic curve, accuracy, sensitivity, specificity, negative predictive value, and positive predictive value.

**RESULTS**

During the follow-up, 38 patients developed MCE in cohort 1 within 48 hours after EVT, and 15 patients developed MCE in cohort 2. In the validating cohort, the performance of single map models based on CBF (AUC = 0.782, ACC = 0.806) and Tmax (AUC = 0.773, ACC = 0.819) were better than the other single map models. The fusion model based on CBF, Tmax, MTT, CBV, TTP, and Clinical data (FaxMVPC) showed the best performance for predicting MCE (AUC = 0.857, ACC = 0.844). The performance of FaxMVPC model in predicting MCE was better than that of clinical model (AUC = 0.768, ACC = 0.806, $p < 0.05$). The FaxMVPC model in the external testing cohort achieved comparable performance (AUC = 0.812, ACC = 0.761).

**CONCLUSION**

Our study indicates that incorporating DL features derived from CTP can enhance the predictive ability of clinical model for MCE following EVT in AIS-LVO. Moreover, this DL-clinical fusion model demonstrates a certain degree of generalizability.

**CLINICAL RELEVANCE/APPLICATION**

The proposed model has potential for identifying patients at risk of developing MCE post-EVT, facilitating timely intervention and improving patient outcomes.

## R3-SSNR15-5 MR FINGERPRINTING DYNAMIC CONTRAST ENHANCED: TEMPORAL VARIATION CHARACTERISTICS OF BRAIN TUMOR

Jingliang Cheng (*Abstract Co-Author*) Nothing to Disclose
Yanglei Wu (*Abstract Co-Author*) Nothing to Disclose
Gaoyang Zhao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Heterogeneity in brain tumors influences clinical decisions and prognosis. However, the temporal variations in T1 during contrast agent perfusion are understudied. Here, we employed MR Fingerprinting (MRF) to obtain time-T1 curves following the injection of contrast agent with the aim of exploring its temporal characteristics and its potential value in assessing the properties and diagnosis of brain tumors.

**METHODS AND MATERIALS**

We enrolled 12 patients with intracranial lesions with a mean age of 51.6 years (range 31-73 years), who underwent preoperative MRI scans follow by surgical resection. The MRF sequence was acquired following routine scans, with a focus on the axial level of the lesion as determined by T2 FLAIR images. The time resolution of MRF is 27 seconds and scanning were repeated 12 times during contrast agent injection. Commencing with the third scan, Single dose (0.1 ml/kg of body weight) of Gadobutrol (Bayer Schering Pharma, Berlin, Germany) was administered via antecubital intravenous access at the rate of 2.0 mL/s. This was followed by a 20 mL saline flush at the same rate. The moment at which the signal curve reached its minimum was determined as the time to peak (TTP). The corresponding T1 relaxation times at this point were recorded as T1peak. The initial T1 relaxation times were recorded as T10, and the T1 relaxation times of last stage were recorded as T1end.

**RESULTS**

Among the 12 patients, 8 had been confirmed pathological types, including four meningiomas, one low-grade glioma, one diffuse large B-cell lymphoma (DLBCL), one hemangioblastoma (HB), and one is grey matter (GM) heterotopia. Meningiomas exhibited the fastest TTP with the lowest T1peak, while the T1peak of low-grade glioma was higher than that of GM. DLBCL displayed slightly slower signal changes with T1peak values closer to normal white matter (WM) signals. Nodules formed by GM heterotopia were showed similarities to normal GM signals. HB exhibited two distinct signal components.

**CONCLUSION**

In this study, we adapted the MRF sequence to dynamically quantify the changes in T1 relaxation time during contrast enhancement. Temporal curves of different brain tumors revealed substantial heterogeneity, both among various tumor types and within the same tumor type.

**CLINICAL RELEVANCE/APPLICATION**

For the first time, our work reveals the temporal patterns of T1 during contrast enhancement in various brain tumors, providing a wealth of dynamic information. These findings present a promising approach for exploring the "Bio-MRI features" associated with tumor heterogeneity, and they hold the potential to advance the clinical adoption of T1 quantitative imaging techniques.

## R3-SSNR15-6 CEREBRAL PERFUSION IN PATIENTS WITH SICKLE CELL ANEMIA ASSESSED THROUGH TRANSCRANIAL CONTRAST ENHANCED ULTRASOUND COMPARED TO MAGNETIC RESONANCE IMAGING

Alessandra R. Chiovatto (*Abstract Co-Author*) Nothing to Disclose
Emanoel R. Melo, MD (*Abstract Co-Author*) Nothing to Disclose
Claudio C. Castro (*Abstract Co-Author*) Nothing to Disclose
Mateus Esmeraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Chiovatto, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate whether transcranial contrast-enhanced ultrasound (CEUS) can detect cerebral perfusion alterations in adult sickle cell anemia (SCA) patients, comparing its effectiveness with brain magnetic resonance imaging (MRI).

## METHODS AND MATERIALS

A comparative study was designed with two participant groups: a case group consisting of adults diagnosed with SCA (HbSS genotype) and a control group without SCA. Each participant underwent a series of diagnostic tests including transcranial CEUS, transcranial color-coded Doppler (TCCD), and brain MRI utilizing both dynamic susceptibility contrast (DSC) and arterial spin labeling (ASL) protocols. Transcranial CEUS was performed using both bolus and flash-replenishment technique. Multiple perfusion parameters from these imaging techniques were collected and analyzed.

## RESULTS

The bolus technique of the transcranial CEUS, the TAMAX parameter of the TCCD, and the DSC and ASL techniques of the brain MRI were able to differentiate the SCA patients from the control individuals, with $p < 0,05$. SCA patients had a larger area under the bolus curve on transcranial CEUS, higher TAMAX on TCCD, higher cerebral blood flow (CBF) and shorter mean transit time (MTT) than controls on brain MRI.

## CONCLUSION

Transcranial CEUS has demonstrated potential as an effective screening tool to detect cerebral perfusion anomalies in adults with SCA. While brain MRI continues to be the definitive method for evaluating cerebral perfusion, its high cost and limited availability highlight the need for alternative approaches. Transcranial CEUS, with its lower resource demands, offers a promising complement to MRI, potentially increasing the accessibility of diagnostic evaluations and providing information about cerebral hemodynamics.

## CLINICAL RELEVANCE/APPLICATION

Identifying cerebral perfusion deficits early in patients with SCA is crucial for preventing severe complications such as stroke and cognitive deficits. The ability of transcranial CEUS to provide rapid and reliable perfusion assessments could transform the standard of care, given its cost-effectiveness and simpler learning curve. Additionally, the contrast agent used in CEUS (microbubbles) is not limited by renal function, offering a significant advantage for SCA patients who may face restrictions with MRI contrast agents. This positions transcranial CEUS as a promising initial screening tool and a follow-up imaging modality for SCA patients.

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# Abstract Archives of the RSNA, 2024

R3-SSPH13

**Physics (Novel Imaging Technology)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: N227B

Ioannis Sechopoulos, PhD (*Moderator*) Research Grant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research Grant, Sectra AB;Research Grant, ScreenPoint Medical BV;Research Grant, Volpara Health Technologies Limited
James M. Kofler JR, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R3-SSPH13-2 A NOVEL ENERGY-MODULATED SCATTER CORRECTION METHOD FOR DUAL-LAYER FLAT-PANEL DETECTOR BASED CBCT IMAGING

Dong Liang (*Abstract Co-Author*) Nothing to Disclose
Ting Su, PhD,PhD (*Abstract Co-Author*) Nothing to Disclose
Xin Zhang (*Abstract Co-Author*) Nothing to Disclose
Yongshuai Ge, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a rapid and precise scatter correction method for cone-beam CT (CBCT) imaging using a dual-layer flat-panel detector (DL-FPD).

### METHODS AND MATERIALS

In this work, a new scatter estimation model is established for DF-FPD based CBCT imaging, in which the primary and scattered X-ray photons having lower energy are captured by the top detector layer, while the primary and scattered X-ray photons having higher energy are captured by the bottom detector layer. With these two independent measurements, the scattered X-ray signals on both detector layers can be analytically extracted. To validate this energy-modulated scatter correction method, phantom experiments are conducted on our DL-FPD CBCT imaging benchtop.

### RESULTS

Experimental results show that the newly proposed energy-modulated scatter correction method is able to grealy reduce the shading artifacts in both low-energy and high-energy CBCT images acquired from a DL-FPD. On average, image non-uniformity is reduced by over 77% in low-energy CBCT images and by over 66% in high-energy CBCT images.

### CONCLUSION

The newly proposed scatter correction method based on the dual-layer flat-panel detector is able to effectively and rapidly reduce shading artifacts, resulting in significantly improved CBCT image quality.

### CLINICAL RELEVANCE/APPLICATION

In the future, the performance of CBCT imaging in interventional C-arm modalities can be greatly enhanced, resulting in improved CBCT images for more precise intra-operative navigation.

## R3-SSPH13-3 IMPACT OF BOWTIE SCATTER ON IODINE QUANTIFICATION IN PHOTON-COUNTING CT

Wojciech Zbijewski, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Medtronic plc
Donghyeon Lee (*Abstract Co-Author*) Nothing to Disclose
Katsuyuki Taguchi, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Canon Medical Systems Corporation;Consultant, Suzhou Bowing Medical Technologies
Xiaohui Zhan, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yang Tai (*Presenter*) Research Grant, Canon Medical Systems Corporation

### PURPOSE

We investigate the impact of scatter from the bowtie (BT) on the quantitative accuracy of energy channel reconstructions in photon-counting CT (PCCT) to establish whether BT scatter needs to be included in subtraction-based correction.

### METHODS AND MATERIALS

A high-fidelity Monte Carlo (MC) simulator was used to obtain PCCT projections of a digital abdomen phantom with spherical iodine inserts (2, 5, 10mg/mL) of 10 and 20mm diameters placed in the liver. The PCCT configurations involved 4cm and 16cm collimations (isocenter), 1mm detector pixels, 6 energy channels per pixel with thresholds of 20/30/45/55/65/80keV, a 1-dimensional 20:1 anti-scatter grid (ASG), and a realistic aluminum BT for body imaging. HU accuracy of the iodine inserts was compared in energy channel reconstructions between (i) a reference PCCT simulation without scatter, (ii) a simulation contaminated by BT and object scatter, and (iii) a simulation contaminated by BT scatter only, including absorption and secondary scattering of BT scatter in the object. A beam-hardening (BH) correction incorporating BT attenuation was applied.

**RESULTS**

Overall, scatter leads to appreciable biases in reconstructions of low-energy channels. In the presence of object and BT scatter, the relative iodine HU errors wrt. the scatter-free reference in the 30-44keV channel were up to 35% for 2mg/mL, 25% for 5mg/mL, and 20% for 10mg/mL inserts (20mm dia.) at 4 cm collimation and increased to 80%, 66% and 54% at 16 cm collimation. BT scatter is a substantial contributor to these biases, especially at large collimations: the relative errors in simulations with BT scatter alone were 2%, 12%, and 5% for the 2, 5, 10mg/mL inserts, respectively, in the 30-44keV channel at 4 cm collimation, and 17%, 29%, and 16% at 16 cm collimation. The biases are reduced in higher energy channels but remain substantial, especially at 16 cm collimation (relative iodine HU errors of 20% - 60% in the presence of object+BT scatter and 2%-10% due to BT scatter alone). These results are consistent with projection-domain data that show that BT scatter contributes ~80% of the scatter signal in the periphery of the abdomen for the 30-44keV channel and ~50% for the 65-79keV channel.

**CONCLUSION**

For abdominal PCCT imaging, BT scatter is an appreciable contributor to the total low-energy scatter, especially at wide collimations. It needs to be accounted for in scatter correction to ensure accurate material quantification, in particular in future PCCT generations with wide axial coverage.

**CLINICAL RELEVANCE/APPLICATION**

We show that scatter from the bowtie is a non-negligible contributor to iodine quantification bias caused by x-ray scatter in PCCT imaging. The results are relevant for the development of correction algorithms.

## R3-SSPH13-4 SCATTER CORRECTION USING A HALF GRID IN CBCT IMAGING

Dong Liang (*Abstract Co-Author*) Nothing to Disclose
Han CUI (*Abstract Co-Author*) Nothing to Disclose
Ting Su, PhD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yongshuai Ge, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This work aims at developing a cost effective and fast Compton scatter correction method for cone-beam CT (CBCT) imaging using a new grid design.

**METHODS AND MATERIALS**

In this study, we propose the use of a half anti-scatter grid (h-ASG) that covers only half of the full detector surface. This setup allows for the estimation of Compton scatter distribution through two distinct measurements: one captures the full primary and scatter signals not shielded by the ASG, and the other captures a portion of the primary and scatter signals that are shielded by the ASG. To validate the feasibility of this novel scatter correction method using h-ASG, physical phantom experiments are conducted on our benchtop system.

**RESULTS**

Experimental results demonstrate that the distribution of Compton scatters can be accurately and quickly estimated from the h-ASG, resulting in a significant reduction of shading artifacts. Notably, it is found that the newly proposed h-ASG method outperforms the conventional ASG method, enhancing the uniformity of CBCT images by more than 75%.

**CONCLUSION**

Compton scatter correction in a CBCT imaging system can be simply and quickly performed using a half anti-scatter grid.

**CLINICAL RELEVANCE/APPLICATION**

The use of a novel half anti-scatter grid is able to remove the Compton scatter artifacts, significantly improving the image quality of CBCT imaging systems such as C-arm, O-arm and dental CBCT modalities.

## R3-SSPH13-5 THERMAL ANALYSIS OF AN ARCHITECTURE TO IMPROVE X-RAY SOURCE POWER IN HIGH RESOLUTION PHOTON COUNTING DETECTOR CT

Scott S. Hsieh, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The spatial resolution of photon counting detector (PCD) CT is limited by the power of the small focal spot of the X-ray source. In a conventional X-ray source, increasing power would melt or damage the tungsten anode. We propose a new CT system architecture in which the focal spot is multiplexed across multiple tracks to increase effective power without increasing maximum anode temperature.

**METHODS AND MATERIALS**

In focal spot multiplexing, the PCD circuitry is modified so that recorded photons are assigned according to the active focal spot track in addition to the photon energy, effectively creating "spatial bins" that coexist alongside conventional energy bins. The X-ray source toggles between tracks much more quickly than in conventional focal spot wobble to allow tracks to cool momentarily before continued bombardment. This requires fast electromagnetic or electrostatic control, or field emission cathodes. The thermal implications of this architecture were simulated using the heat equation to determine the maximum possible power, assuming (1) an ideal, 0.4 mm square focal spot, (2) a maximum allowed surface track temperature increase of 1500 K [i.e., a strictly track-limited source], (3) an 8 degree anode angle with anode track velocity of 100 m/s, (4) instantaneous track switching, and (5) that the heat equation could be linearized at 2000 K.

**RESULTS**

Without focal spot multiplexing, the maximum power was estimated to be 28 kW. Focal spot multiplexing provides no benefit whatsoever at switching frequencies below 250 kHz, which includes conventional focal spot wobble (<10 kHz). When using two tracks and switching at 500, 2000, or 8000 kHz, power could be increased to 39, 46, or 53 kW, respectively. When using four tracks, the power could be increased to 40, 69, or 92 kW, respectively. Note that at high power, the anode bulk must be considered and the source will no longer be strictly track-limited. The maximum power with infinitely fast switching is proportional to the number of tracks used (e.g., 56 and 112 kW for 2 and 4 tracks, respectively), but the electron steering apparatus response time and PCD charge drift time set upper limits.

**CONCLUSION**

Focal spot multiplexing is a potential architecture for PCD CT to overcome the tube power limitations that are currently intrinsic to small focal spots. Increases in power could also be translated to further decreases in focal spot size. Fast track switching times and modifications to the PCD circuitry would

be necessary to achieve these gains.

**CLINICAL RELEVANCE/APPLICATION**

High resolution PCD CT is currently limited to low power protocols. This architecture could increase power or further shrink the size of the focal spot.

## R3-SSPH13-6 TO BIN OR NOT TO BIN: EFFECT OF DETECTOR PIXEL BINNING IN DEEP-SI PHOTON-COUNTING CT

Lusik Cherkezyan (*Abstract Co-Author*) Employee, General Electric Company
Arnaud Choux (*Abstract Co-Author*) Nothing to Disclose
Jiahua Fan, PhD (*Abstract Co-Author*) Employee, General Electric Company
Zhye Yin (*Abstract Co-Author*) Employee, General Electric Company
Amir Pourmorteza, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Photon-counting detector (PCD) CT have improved the quality of CT images by providing ultra-high-resolution (UHR) images and spectral information.While PCD-CT can resolve high spatial frequencies, many routine clinical applications do not require such detailed features.UHR imaging in these cases poses a challenge in data transfer, processing, and storage especially when spectral data is also present. Some PCD-CT scanners avoid this by binning detector pixel data in standard-resolution (SR) acquisition modes. Although this binning reduces the size of CT projection data, it has been shown to decrease the sampling frequency of the imaging system, consequently increasing image noise in high-z PCDs and flat panel detectors. In this paper, we explore the effect of binning on the image quality of spectral deep-Si PCD-CT images.

**METHODS AND MATERIALS**

A cylindrical water phantom (d=20cm) was scanned on a prototype deep-Si PCD-CT scanner at 120 kVp and 250 mAs with 8-energy thresholds at UHR. The two adjacent pixels in the projection data were averaged together to create 1-D (2-pixel) binned data. Virtual monoenergetic images (VMIs) were calculated from filtered-backprojection (FBP) reconstruction of basis material images after projection-based material decomposition. Three linear convolution kernels with matched modulation transfer functions (MTF) with increasing sharpness (MTF10% = 7.3, 9.8, 12.3 lp/cm) were used. We compared CT number accuracy and image noise in large circular regions of interest (area>120 mm2) placed in water in 5-mm thick VMIs.

**RESULTS**

Binning did not significantly affect the CT numbers and the average deviation between original and binned images were 0.2, 0.5, and 1.5 HU for the three kernels for all VMI energies. Image noise was significantly higher in binned images and the difference increased with the sharpness of reconstruction kernels: 5.0%, 9.9%, 19.5%. For example, the standard deviation of noise was 14.5 HU vs 17.4 HU for original vs binned VMI at 65 keV.

**CONCLUSION**

While binning of UHR PCD projection data may help alleviate the cost of large data storage, transferring, and processing of SR images in soft kernels, the noise tradeoff at sharper kernels may need to be considered. The noise increase may adequately be compensated with advanced denoising techniques so that sharper kernels are not significantly impacted by effective pixel size.

**CLINICAL RELEVANCE/APPLICATION**

Processing UHR data without binning may reduce image noise in applications where sharp kernels are required at the cost of increased workflow burden. This may be alleviated by advanced denoising. Soft kernel applications may benefit from the speedup offered by binning without noise penalty.

# Abstract Archives of the RSNA, 2024

R3-SSPH14

**Physics (Radiomics and Quantitative Imaging)**

Thursday, Dec. 5 9:30AM - 10:30AM Room: S404

Heang-Ping Chan, PhD (*Moderator*) Nothing to Disclose
Zhihua Qi, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R3-SSPH14-1 MULTI-INSTITUTIONAL STUDY OF RADIOMICS MODEL FOR ASSESSMENT OF TREATMENT RESPONSE TO NEOADJUVANT CHEMOTHERAPY OF BLADDER CANCER

Elaine M. Caoili, MD, MS (*Abstract Co-Author*) Steering Committee, ProKidney, LLC
Vikas Gulani, MD, PhD (*Abstract Co-Author*) Research support, Siemens AG;Consulting, Cook Group Incorporated
Yousef Zakharia (*Abstract Co-Author*) Nothing to Disclose
Chuan Zhou, PhD (*Abstract Co-Author*) Scientific Advisory Board, Perception Vision Medical Technology Co., Ltd
Ajjai S. Alva, MD (*Abstract Co-Author*) Advisory Board, Merck & Co, Inc;Institutional Research Grant, Merck & Co, Inc;Advisory Board, Bristol-Myers Squibb Company;Institutional Research Grant, Bristol-Myers Squibb Company;Advisory Board, AstraZeneca PLC;Institutional Research Grant, AstraZeneca PLC;Institutional Research Grant, Prometheus Pharmaceuticals;Institutional Research Grant, Lantheus Holdings;Institutional Research Grant, Bolt Biotherapeutics, Inc;
Dean Elhag (*Abstract Co-Author*) Nothing to Disclose
Richard H. Cohan, MD (*Abstract Co-Author*) Co-author, Wolters Kluwer nv
Lubomir M. Hadjiiski, PhD (*Abstract Co-Author*) Nothing to Disclose
Heang-Ping Chan, PhD (*Abstract Co-Author*) Nothing to Disclose
Monika Joshi (*Abstract Co-Author*) Institutional Research Grant, Pfizer Inc;Institutional Research Grant, AstraZeneca PLC;Advisory Board, sanofi-aventis Group;
Di Sun, MEng, BEng (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a radiomics model to assess the treatment response to neoadjuvant chemotherapy in bladder cancer patients from CT Urogram (CTU) images, and perform a pilot validation study of model generalizability on multi-institutional sequestered test sets.

### METHODS AND MATERIALS

With Institutional Review Board (IRB) approval, 835 patients with bladder cancer treated with neoadjuvant chemotherapy between 2003 and 2020 at three U.S. institutions were identified. Patient selection criteria included having CTU scans before and after neoadjuvant chemotherapy treatment and a pathological cancer stage determined by post-radical cystectomy. The criteria outlined above were met by 295 patients. The ground truth of treatment response was established based on pathological cancer stages: a stage of pT0 indicated a complete responder (CR), while any stage above pT0 was classified as a non-complete responder (NCR). The model development data set was sourced from Institution A and was split into three sets: training (56%: 35 CRs, 113 NCRs); validation (4%: 5 CRs, 5 NCRs); and a held-out internal test set (40%: 19 CRs, 87 NCRs). Institution B data (3 CRs, 16 NCRs) and Institution C data (4 CRs, 8 NCRs) were used as external test sets, which were sequestered from the developer until the model development was completed and frozen. Radiomics features, including morphology, texture, and intensity-based features were extracted from the pre- and post-treatment CTU scans. A random forest algorithm was utilized to perform classification and the area under the receiver operating characteristic curve (AUC) was used to evaluate the classification performance on the test sets.

### RESULTS

The selected features included morphology features (lesion area and surface) and intensity-based features. The developed model achieved an AUC of 0.77±0.05, 0.85±0.13, and 0.84±0.12 on the test set of Institution A, B, and C, respectively.

### CONCLUSION

While larger data sets are needed for further validation, this study demonstrates the potential generalizability of a developed radiomic model based on CTU images to assess the treatment response to neoadjuvant chemotherapy for bladder cancer patients across different institutions. Efforts to expand the external test sets are underway.

### CLINICAL RELEVANCE/APPLICATION

Accurate treatment response assessment to neoadjuvant chemotherapy can help identify NCR who may benefit from alternative treatments, potentially avoiding side effects and toxicities from ineffective chemotherapy.

## R3-SSPH14-2 HARMONIZATION OF LUNG DENSITY QUANTIFICATION FOR RELIABLE CLINICAL INSIGHTS

Ehsan Abadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Ehsan Samei, PHD (*Abstract Co-Author*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens

AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc
Saman Sotoudeh Paima, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

To improve the reproducibility of lung density quantification in Computed Tomography (CT) and its correlation with clinical endpoints via a harmonization framework (i.e., CT-HARMONICA).

**METHODS AND MATERIALS**

Reproducibility of lung density CT quantification is vital for reliable assessment of patient lung health. However, variations in acquisition protocols (e.g., radiation dose levels, reconstruction algorithms) and patient attributes (e.g., patient size, breath-hold volumes) limit this reproducibility. To alleviate this, we recently developed a harmonization framework, composed of image resampling, spatial resolution, and noise matching, followed by lung volume adjustment. This study aims to demonstrate the clinical benefit of this harmonization framework on a cohort of clinical subjects. A total of 448 subjects were selected from the COPDGene study, scanned using both the full-dose (FD) and reduced-dose (RD) protocols. The image acquisitions are reconstructed across one or more reconstruction kernels (e.g., smooth, and sharp). The 15th percentile of lung density histogram (Perc15) was used as the metric to evaluate measurement reproducibility. The quantification results are correlated with the diffusing capacity of the lungs for carbon monoxide (DLCO % predicted) adjusted for both hemoglobin and altitude.

**RESULTS**

CT-HARMONICA improved the reproducibility across different reconstruction kernels and radiation dose levels, from 44.0 ± 1.5 HU to 12.5 ± 0.4 HU. Similarly, the Bland-Altman plot demonstrates the improved bias (before: -13.9 HU, after: 3.0 HU) and limits of agreement (before: [-48.6, 20.9] HU, after: [-8.2, 14.1] HU) of the measurements. Harmonization also improved the linear relationship between the Perc15 imaging biomarker and DLCO % predicted as shown by the improved Pearson correlation coefficient (before: 0.06-0.13, after: 0.27-0.31, across three variations of reconstruction kernel and radiation dose).

**CONCLUSION**

CT-HARMONICA offered a robust solution for harmonizing CT images, enhancing the reliability of lung density quantification. This approach facilitates better comparison of images under different conditions, enabling robust longitudinal and multi-center studies.

**CLINICAL RELEVANCE/APPLICATION**

Confounding factors like imaging and patient variabilities have hindered the practical use of lung density in monitoring lung health. Our harmonization approach improves reproducibility, translating into better clinical insight.

## R3-SSPH14-3 CORONARY ARTERY CALCIUM SCORE - LUNG CANCER SCREENING VERSUS CORONARY ARTERY CALCIUM SCAN: A QUANTITATIVE STUDY OF DIFFERENT CHEST SIZES WITH DYNAMIC CARDIAC PHANTOM

Yifang Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexander W. Scott II, PhD (*Abstract Co-Author*) Nothing to Disclose
Christina M. Lee, BS,ARRT (*Abstract Co-Author*) Nothing to Disclose
Chao Guo, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Lung cancer CT screening (LCS) is gaining wider clinical use. It will significantly benefit the diagnostic process if it can also contribute to the evaluation of the patient's coronary artery calcification. Currently, there have been no well controlled studies about the quantitative correlation of the coronary artery calcium score between LCS scans and gated coronary artery calcium scans (CACs). The purpose of this study was to examine the quantitative relationship between the calcium score from LCS and CACs with different chest sizes considered.

**METHODS AND MATERIALS**

A CIRS dynamic cardiac phantom was used with 12 calcification (hydroxyapatite) inserts of various densities and diameters. A fat ring was added to the phantom to simulate a large chest. The phantoms were set in motion according to the ECG with heart rates ranging from 50 to 100 beats per minute. For the phantom of the medium chest size, gated scans (CTDIvol = 1.74 mGy) were performed with the above ECG to obtain the ground truth calcium score. Non-gated LCS scans were then performed with CTDIvol = 2 mGy for the medium size and with CTDIvol = 6.69 mGy for the large size with similar SNR. The LCS results were later compared with ground truth CACs results. A FOV of 200 mm was used throughout this study. Siemens SyngoVia was used to score the calcifications by three individual readers.

**RESULTS**

The LCS calcium scores were affected by blurring and distortion induced by cardiac motion. With regular patient size phantom, the Agatston score was found to have a linear relationship to the score from LCS. The averaged slope on regular chest size was 1.44, with an intercept of 21.47. The results varied for different heart rates, with the slope from 1.48 to 1.58 and the intercept from 6.80 to 19.19. With the large phantom, the averaged slope for large size was 1.12, with an intercept of 18.66. The results varied for different heart rates, with the slope from 1.11 to 1.21, and the intercept from 3.32 to 14.68. Compared with the large size's result, the calcium score of regular size chest from LCS was lower than the Agatston score with a larger variance.

**CONCLUSION**

When compared with the ground truth, the results from non-gated LCS were underestimated; however, this can be compensated by a factor especially for regular size chest. Calcifications of higher density will be scored more accurately in the LCS, irrespective of heart rate. Despite the potential impact of heart rate on calcium scoring, it is still feasible to reliably assess major calcifications by substantially reducing the patient's dose.

**CLINICAL RELEVANCE/APPLICATION**

The study verifies the feasibility of incorporating coronary artery calcium scoring into LCS scans. The incorporation allows for simultaneous diagnosis with lower dose, and potentially earlier diagnosis of CAC.

## R3-SSPH14-4 AUTOMATED EMPHYSEMA SEGMENTATION BY ACTIVE LEARNING: CLOSER CONCORDANCE WITH CLINICAL VISUAL SCORES COMPARED TO THE CONVENTIONAL LAA-950 IMAGING BIOMARKER

Ehsan Samei, PHD (*Abstract Co-Author*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging

Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc
Dhrubajyoti Ghosh (*Abstract Co-Author*) Nothing to Disclose
Saman Sotoudeh Paima, MS (*Abstract Co-Author*) Nothing to Disclose
Bryan O'Sullivan-Murphy, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ehsan Abadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Mobina Ghojogh Nejad, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to evaluate the concordance of two automated techniques (1- AI-based emphysema segmentation, 2- conventional method of low attenuations below -950 HU (LAA-950)) with clinical visual scoring.

**METHODS AND MATERIALS**

A cohort of COPD patients underwent chest CT scans, which were scored by two clinical experts using the Fleischer Society classification system. Same CT cases were used to measure LAA-950 and to automatically segment emphysema using our developed automated emphysema detection algorithm leveraging active learning. The performance of the AI-based and LAA-950 emphysema measurements were evaluated by comparing them against the visual scores. Since the visual scores were ordinal variables, an ordinal logistic regression was used. The goodness of regression fits was quantified in terms of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).

**RESULTS**

We investigated 99 patients (54 males, 45 females, 72% white, 28% black) with various severities according to the Global Initiative for Obstructive Lung Disease (GOLD) stages (32, 12, 26, 20, and 6 cases for GOLD 0,1,2,3, and 4, respectively, and 3 subjects with persevered ratio). The AIC and BIC were 261 and 276 for the AI-based segmentation algorithm, and 277 and 292 for the LAA-950 technique. These values showed a significant superior performance for the AI-based emphysema segmentation algorithm compared to the conventional LAA-950 measurements in terms of concordance with the manual visual scoring of emphysema.

**CONCLUSION**

Our findings showed that the AI-based emphysema detection better reflects clinical visual scoring of emphysema compared to the LAA-950 measurements which are susceptible to image acquisition variabilities such as noise and resolution. Such robust automated methods can boost the precision of emphysema assessment in a timely manner, leading to better patient care and outcomes in COPD management.

**CLINICAL RELEVANCE/APPLICATION**

The AI-based detection provided accurate assessment of emphysema severity. By integrating this automated technique into routine practice, clinicians can assess the emphysema severity in a rapid and standardized manner.

## R3-SSPH14-5 IMPACT OF RADIOLOGIST ANNOTATION VARIABILITY ON RADIOMICS-PREDICTED BREAST CANCER PROGRESSION RISK

Qian Cao (*Abstract Co-Author*) Nothing to Disclose
Berkman Sahiner, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Petrick, PhD (*Abstract Co-Author*) Nothing to Disclose
Thibaud Coroller, PhD (*Abstract Co-Author*) Employee, Novartis AG;Spouse, Employee, Bristol-Myers Squibb Company;Spouse, Stockholder, Bristol-Myers Squibb Company
Subrata Mukherjee (*Abstract Co-Author*) Nothing to Disclose
Ravi K. Samala, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Reproducible prediction of drug response to cancer therapy is important for improving clinical care. We developed a radiomics-based model of metastatic breast cancer (MBC) progression risk based on a retrospective analysis of the MONALEESA clinical trials, in which radiomic features were derived from radiologist annotations of target lesions across sequential CT exams. In this work, we focus on quantifying the uncertainty in risk score output associated with radiologist annotations.

**METHODS AND MATERIALS**

Consecutive CT imaging studies from 191 patients in the MONALEESA-3 and MONALEESA-7 trials were partitioned by patient into 106 and 85 patients for training and testing, respectively. Most of the target lesions in the dataset were annotated by multiple radiologists. Each annotation includes the target lesion segmentation at the RECIST slice. Radiomic features at the baseline (screening and week 8 follow-up) were extracted from each annotation. This includes 98 radiomic features and 98 delta radiomic features (ratio of features from screening and week 8). For patients with multiple target lesions at a single timepoint, the radiomic features were summed to produce an aggregate feature vector for the timepoint. Random survival forest models were then trained to predict a patient's risk of breast cancer progression, with high risk interpreted as shorter progression free survival (PFS) time. To evaluate the impact of radiologist annotation variability on risk score output, we randomized the selection of annotation for the same target lesion across multiple radiologists during model training, testing, and in both phases. We carried out 50 repeats of the analysis for each randomization scheme and characterized the distribution of the concordance indices from all repeats.

**RESULTS**

The coefficient of variation for all radiomic feature values was 0.126±0.009 with respect to the selection of radiologist annotation. Randomization of annotation during model training, testing, and both phases resulted in concordance indices of 0.66±0.00, 0.67±0.01, and 0.66±0.01, respectively, over all repeats of the analysis.

**CONCLUSION**

Variability in multiple radiologists' annotation impacts radiomic feature values. However, this variability does not significantly affect model training but can have a much larger impact on testing performance.

**CLINICAL RELEVANCE/APPLICATION**

Radiomic models of MBC progression risk trained from multiple annotators and reference standards are consistent. However, the variability in annotation still contributes to uncertainty in real-world performance.

## R3-SSPH14-6 EARLY ASSESSMENT OF PROGRESSION-FREE SURVIVAL IN METASTATIC BREAST CANCER: RADIOMIC ANALYSIS FROM INITIAL POST-TREATMENT CT DATA

Kenny H. Cha,
PhD (*Abstract Co-Author*) Nothing to Disclose
Julie A. Schneider, MD (*Abstract Co-Author*) Nothing to Disclose
Thibaud Coroller, PhD (*Abstract Co-Author*) Employee, Novartis AG;Spouse, Employee, Bristol-Myers Squibb Company;Spouse, Stockholder, Bristol-Myers Squibb Company
Berkman Sahiner, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Petrick, PhD (*Abstract Co-Author*) Nothing to Disclose
Qian Cao (*Abstract Co-Author*) Nothing to Disclose
Alexej Gossmann (*Abstract Co-Author*) Nothing to Disclose
Tingting Hu (*Abstract Co-Author*) Nothing to Disclose
Subrata Mukherjee (*Abstract Co-Author*) Nothing to Disclose
Ravi K. Samala, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop an interpretable model for early assessment of metastatic breast cancer progression-free survival based on clinical features and early serial chest computed tomography (CT) scans obtained from the MONALEESA clinical trial.

**METHODS AND MATERIALS**

We considered CT data, with target lesions annotated by radiologists, from 213 breast cancer patients participating in the MONALEESA-3 and 7 clinical trials. The data is divided into 112 and 101 patients for training and testing, respectively. For each target lesion, 98 radiomics features were computed at baseline and at the first post-treatment tumor assessment at week 8. Delta radiomics features were computed as the ratio of week 8 and baseline radiomic features. Appending baseline radiomics features with delta radiomics and 9 baseline clinical variables resulted in 205 total features to predict progression-free survival (PFS) for the patients in trials, 55% of which were either censored due to lost-to-follow-up or no event. We reduced the dimensionality of the baseline and delta radiomics features through principal components and fitted a Cox proportional hazard model using the reduced 15-dimensional covariate vector. Interactions between the delta-radiomics features and the clinical features were also included in the Cox model to understand how interaction terms might improve early prediction of progression. We used concordance index (C-index) to evaluate the performance of the fitted Cox models on the test data.

**RESULTS**

The mean C-index increased from 0.52 using only the baseline radiomics features to 0.61 when delta radiomic features were added. The C-index when treatment arm and other clinical variables were added to the above model increased to 0.625. On adding interactions among significant effects, the C-index of the resulting Cox model further increased to 0.63 (0.55-0.71). We next considered Pearson and Spearman’s rank correlation coefficient among the uncensored and predicted survival times for patients in the test data with events. We found that the interaction model provides 24.92% and 20.28% improvement in these metrics over the Cox model without interaction.

**CONCLUSION**

A principal component-based Cox proportional hazard model with clinical and delta radiomic features from baseline and week 8 follow-up achieved high predictive performance of cancer progression. Modeling interactions between the delta radiomic features and treatment arm information further increased predictive performance. The features driving the model's performance warrants further investigations.

**CLINICAL RELEVANCE/APPLICATION**

This study shows that a radiomics PFS model can be an early indicator of treatment response in metastatic breast cancer.
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

R3-STCE1

**Science Session (Theranostics)**

Thursday, Dec. 5 10:00AM - 10:30AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## R3-STCE1-2 ARTERIAL MUCOSAL LINEAR ENHANCEMENT AT CONTRAST-ENHANCED MRI TO EXCLUDE RESIDUAL TUMOR AFTER NEOADJUVANT CHEMO AND RADIATION THERAPY FOR RECTAL CANCER

Gengyun Miao (*Presenter*) Nothing to Disclose

### PURPOSE

A watch-and-wait regimen for locally advanced rectal cancer after neoadjuvant chemo and radiation therapy (NCRT) relies on identifying complete tumor response. However, the concordance between a complete response at T2-weighted and diffusion-weighted MRI (DWI) and pathologic complete response (pCR; ie, ypT0N0) in the tumor is unsatisfactory. To assess whether identification of mucosal linear enhancement (MLE) at arterial-phase contrast-enhanced (CE) T1-weighted MRI is associated with ypT0 status in patients with locally advanced rectal cancer after NCRT and to evaluate whether combining MLE at CE T1-weighted MRI and negative lymph node metastasis (LNM) at T2-weighted DWI can improve identification of pCR.

### METHODS AND MATERIALS

This retrospective study included patients with locally advanced rectal cancer who underwent total mesorectal excision after NCRT between July 2020 and July 2023 at a tertiary referral academic center. Restaging MRI included T2-weighted DWI and arterial-phase CE T1-weighted MRI for primary tumor assessment, and T2-weighted DWI for evaluation of LNM status. Imaging features associated with ypT0 status were identified at multivariable regression analysis.

### RESULTS

In total, 239 patients (mean age, 58 years ± 12 [SD]; 180 male patients) were assessed. MLE was more common in ypT0 group than in ypT1-4 group after NCRT (73% vs 4%, respectively; $P < .001$). MLE was associated with higher odds of ypT0 status in an adjusted analysis (odds ratio, 137; 95% CI: 25, 767; $P < .001$). The combination of MLE and negative LNM status achieved an area under the receiver operating characteristic curve of 0.84 (95% CI: 0.79, 0.88) for pCR.

### CONCLUSION

MLE at CE MRI was associated with higher odds of complete tumor response. Combining MLE and negative LNM status showed good performance for identifying complete tumor response and may exclude residual tumors after NCRT in patients with locally advanced rectal cancer.

### CLINICAL RELEVANCE/APPLICATION

The study highlights the potential of mucosal linear enhancement (MLE) at arterial-phase contrast-enhanced T1-weighted MRI as a key indicator of complete tumor response (ypT0) in patients with locally advanced rectal cancer after neoadjuvant chemoradiotherapy (NCRT). The combination of MLE and negative lymph node metastasis (LNM) on T2-weighted diffusion-weighted imaging (DWI) significantly improves the accuracy of predicting pathologic complete response (pCR), achieving an area under the receiver operating characteristic curve (AUC) of 0.84. This non-invasive imaging approach can guide clinical decisions for a watch-and-wait regimen, potentially reducing the need for invasive surgeries and improving patient outcomes by precisely assessing residual tumor presence.

## R3-STCE1-3 MULTIDIMENSIONAL DIFFUSION MRI FOR THE PREDICTION OF HER2 STATUS IN BREAST CANCER

Yaqin Zhang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yuxi Tao (*Presenter*) Nothing to Disclose

### PURPOSE

Breast cancer patients with different HER2 expression status are suitable for different treatment options. This study aims to explore the performance of multidimensional diffusion imaging (MDD) in predicting HER2 expression in breast cancer and assist in the precise classification and treatment of breast cancer

### METHODS AND MATERIALS

The study included women with breast cancer who underwent MRI between December 2023 and July 2024. Three sets of b-values (100, 1000, and 2000 s/mm2) were acquired using gradient waveforms targeting 29 isotropic linear encoding directions and 26 spherically encoded signals. The quantitative parameters reflecting tissue microscopic heterogeneity were calculated by diffusion tensor distribution (DTD) model and encoding scheme for diffusional variance decomposition (DIVIDE), including microscopic normalized shape variance (Cμ), normalized size variance (CMD), microscopic fractional anisotropy (μFA), total mean kurtosis (MKT), microscopic anisotropy (MKA) and isotropic heterogeneity (MKI), axial diffusivity (AD), radial diffusivity (RD), and mean diffusivity (MD). Mann-Whitney U test and t-tests were used to determine the difference of mdd-MRI parameters between benign and

malignant breast lesions. The differences in these parameters were compared between different pathological grading of breast cancer by Kruskal-Wallis H test. Receiver operating characteristic (ROC) analysis was used to evaluate the performance of various parameters.

**RESULTS**

Forty-nine patients with breast lesions who received preoperative 3.0T MRI were enrolled. There are 9, 11, and 29 samples in the HER2-negative, HER2-low, and HER2-positive groups, respectively. CMD (P<.034) and MKI (P<.027) were significantly different in HER2 expressions. The area under the ROC curve (AUC) for distinguishing HER2-low status versus HER2-negative and HER2-positive group was 0.701 and 0.703 of CMD and MKI, respectively. MKI reflects variable cell density (such as necrotic areas) and CMD indicates the change in the size of the average diffusion tensor in the microenvironment.

**CONCLUSION**

Several parameters, such as normalized size variance and isotropic heterogeneity, reflect tissue heterogeneity and change significantly in different HER2 expression levels in breast cancer.

**CLINICAL RELEVANCE/APPLICATION**

By measuring these parameters in multidimensional diffusion MR sequences, HER2 status could be distinguish noninvasively and quantitatively, which is helpful for screening patients for HER2 targeted therapy.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R3-STCE2

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Thursday, Dec. 5 10:00AM - 10:30AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## R3-STCE2-1 UTILIZING RELAXATION-ENHANCED ANGIOGRAPHY WITHOUT CONTRAST AND TRIGGERING (REACT) AS SUSTAINABLE AND EFFECTIVE ALTERNATIVE TO CONTRAST-ENHANCED MR ANGIOGRAPHY OF EXTRACRANIAL ARTERIES IN ACUTE ISCHEMIC STROKE AT 1.5 TESLA

Lukas Goertz (*Abstract Co-Author*) Nothing to Disclose
Robert Hahnfeldt (*Abstract Co-Author*) Nothing to Disclose
Thorsten Persigehl, MD (*Abstract Co-Author*) Nothing to Disclose
Christoph Kabbasch (*Abstract Co-Author*) Consultant, Acandis GmbH & Co KG;Proctor, Terumo Corporation
Kilian Weiss, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Carsten H. Gietzen, MD (*Abstract Co-Author*) Nothing to Disclose
Kenan Kaya, MD (*Abstract Co-Author*) Nothing to Disclose
Roman J. Gertz, MD (*Abstract Co-Author*) Institutional research contract, Koninklijke Philips NV
Lenhard Pennig, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Institutional Grant, Koninklijke Philips NV
Jan Paul Janssen, MD (*Abstract Co-Author*) Nothing to Disclose
Robert Terzis, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Drawbacks of invasive contrast-enhanced MRA (CE-MRA) such as potential allergic reactions, nephrogenic systemic fibrosis, and long-time deposition of gadolinium, a metal element, have led to the introduction of non-contrast-enhanced MRA (non-CE-MRA) techniques. This study aimed to evaluate a novel flow-independent sequence (Relaxation-Enhanced Angiography without Contrast and Triggering (REACT)) for imaging of the extracranial arteries in acute ischemic stroke (AIS) at 1.5 T.

### METHODS AND MATERIALS

This retrospective single-center study included 47 AIS patients (median age 67 [53-80] years; 34 men), who received a standardized protocol in clinical routine including REACT (fixed scan time: 3:01 min) and CE-MRA of the extracranial arteries at 1.5 T. Two radiologists assessed scans for the presence of proximal internal carotid artery (ICA) stenosis and stated their diagnostic confidence using a 3-point scale (3=good). Image quality of cervical arteries as well as the impact of artifacts and image noise were scored on 5-point scales (5=excellent/none). Apparent signal- and contrast-to-noise ratios (aSNR/aCNR) were measured for the common carotid artery and ICA.

### RESULTS

REACT achieved a sensitivity of 95.0% and a specificity of 97.3% for ICA stenoses in high agreement with CE-MRA (?=0.83) with equal diagnostic confidence (both: 3[3-3]; p=.22). Subjective image quality was comparable between both techniques (CE-MRA: 4 [3.57-4.43] vs. REACT: 3.79 [3.43-4.14]; p=.03), with higher scores for CE-MRA at the aortic arch (4 [4-4.5] vs. 4 [3-4]; p=.002) and vertebral arteries (e.g., V1 segment: 3 [3-4] vs. 3 [2.5-3]; p<.001), whereas REACT provided superior results for the C1 segment of the ICA (4 [4-5] vs. 5 [4.5-5]; p=.008). Both sequences were only slightly affected by artifacts (both: 5 [4-5]; p=.60), while image noise was more pronounced in CE-MRA (4 [3-4] vs. 4.5 [4-5]; p<.001) in line with higher aSNR (18.3±6.7 vs. 34.1±15.1; p<.001) and aCNR (12.8±5.4 vs. 27.6±12.7; p<.001) values in REACT for both vessels combined.

### CONCLUSION

Given its short acquisition time and good diagnostic performance while yielding to CE-MRA comparable image quality, REACT is suitable for the imaging of the extracranial arteries in acute ischemic stroke at 1.5 T. Avoiding gadolinium as a contrast agent is sustainable for both human health and the environment.

### CLINICAL RELEVANCE/APPLICATION

Based on the study results, REACT proves to be a suitable, more cost-effective, and sustainable alternative to contrast-enhanced MRA of the neck at 1.5 T, e.g. to rule out vascular pathologies in acute ischemic stroke.

# Abstract Archives of the RSNA, 2024

R4-SSCH10

**Chest Imaging (Miscellaneous)**

Thursday, Dec. 5 11:00AM - 12:00PM Room: E451A

Hamid Chalian, MD (*Moderator*) Nothing to Disclose
Michael R. Harowicz, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R4-SSCH10-1 CLINICAL IMPLEMENTATION OF INSPIRATORY-EXPIRATORY CHEST CT: DEFINING CRITERIA FOR DIAGNOSTIC QUALITY AND DETECTION OF CONCURRENT FEV1 DECLINE FOLLOWING LUNG TRANSPLANTATION

Albert Hsiao, MD, PhD (*Abstract Co-Author*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging
Kyle Hasenstab, PhD (*Abstract Co-Author*) Nothing to Disclose
Kamyar Afshar (*Abstract Co-Author*) Nothing to Disclose
Eugene Golts (*Abstract Co-Author*) Nothing to Disclose
Jonathan H. Chung, MD (*Abstract Co-Author*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd
Alexander Cypro, MD (*Abstract Co-Author*) Nothing to Disclose
Roshun Sankaran, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

Bronchiolitis obliterans syndrome (BOS) is the most common form of chronic lung allograft dysfunction (CLAD) after lung transplantation, affecting 50% of recipients within 5 years. Quantitative inspiratory-expiratory chest CT has emerged as a potential technique to facilitate diagnosis, and novel artificial intelligence algorithms can be used to automate analysis of air trapping. However, in clinical practice, these exams may be uninterpretable if the expiratory phase is not performed at full expiration. We sought to define criteria for diagnostic adequacy of expiratory phase CT and, after applying these criteria, determine what quantitative CT thresholds correlate with FEV1 decline and spirometric evidence of BOS progression.

### METHODS AND MATERIALS

We conducted a retrospective chart review of all lung transplant patients with at least two inspiratory-expiratory chest CT acquired at our institution between March 2020 and November 2023. Diagnostic adequacy of expiratory phase CT was defined as the presence of concave tracheal morphology or flat tracheal morphology with volume change with between inspiration and expiration (VCCT) =1.5L. We applied a previously developed deep learning lung segmentation and deformable co-registration algorithm to automate measurements of lung volumes and voxelwise air trapping. Linear regression analysis was used to compare CT lung volumes with spirometry. ROC analysis was used to determine the optimal threshold to detect concurrent FEV1 decline, defined as a =10% decrease, and confirmed with a Chi-squared test.

### RESULTS

We identified 192 patients with 527 inspiratory-expiratory CTs. Of these, 311 (59%) CTs were diagnostically adequate based on tracheal morphology and VCCT criteria. Diagnostic quality scans showed improved correlation between spirometry and CT volumes, including between forced vital capacity and VCCT ($r=0.75$, $p<0.001$) and between residual volume and expiratory volume ($r=0.76$, $p<0.001$). Area under ROC for increase in air trapping between CT exams to predict FEV1 decline was 0.66, and at a threshold of =20% increase in air trapping, specificity was 95% and sensitivity was 26.1% ($X2=11.85$, $p=0.0006$).

### CONCLUSION

Diagnostically adequate CTs exhibited good correlation with spirometry for lung volumes. Increased air trapping by =20% is highly specific for concurrent FEV1 decline. However, air trapping measurements may not be reliable with suboptimal expiratory phase imaging.

### CLINICAL RELEVANCE/APPLICATION

Quantitative inspiratory-expiratory chest CT can be a useful adjunct for monitoring CLAD and can complement spirometry for diagnosis of BOS. Dedicated efforts to enhance technologist training are necessary to ensure diagnostic value of these exams.

## R4-SSCH10-3 THE STUDY OF QUANTITATIVE PARAMETERS OF ENHANCED CT TO DISTINGUISH THE ANTERIOR MEDIASTINAL CYSTS FROM TYPE B1 AND B2 THYMOMAS

Lulu Liu I, RT, RT (*Abstract Co-Author*) Nothing to Disclose
Xiaoyun Liang (*Abstract Co-Author*) Nothing to Disclose
Yuchi Tian (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the value of quantitative parameters based on CT in differentiating anterior mediastinal cyst from type B1 and type B2 thymoma.

### METHODS AND MATERIALS

From January 2019 to May 2023, a total of 102 cases (76 cases of anterior mediastinal cyst and 26 cases of B1 and B2 type thymostoma confirmed by routine surgery and pathology below 3cm) were retrospectively collected from Zhejiang Cancer Hospital. Quantitative parameter data were collected on CT images of mediastinal window in unenhanced phase and enhanced phase before surgery, respectively. The target nodules and the area of interest of subscapular muscle at the same level were delineated, the unenhanced and enhanced CT values and their standard deviations in the area of interest were measured, and the relative enhancement rate of nodules, nodular non-uniformity and relative non-uniformity rate were calculated, and the quantitative parameters between the two groups were analyzed by univariate analysis and multivariate logistic regression analysis. Receiver operating characteristic (ROC) curve was drawn to evaluate the diagnostic efficiency of each parameter.

### RESULTS

There were statistically significant differences in unenhanced and enhanced CT values, relative enhancement rate, enhanced nodular inhomogeneity and relative heterogeneity between the two groups (all $P < 0.05$), while no statistically significant differences in unenhanced inhomogeneity and relative heterogeneity between the two groups (all $P > 0.05$). The ROC curve showed that the area under ROC curve of enhanced CT values was the largest among the quantitative parameters, and the AUC values were 0.849 (95% CI: 0.754-0.943). respectively. The sensitivity was 80.8%(21/26) and the specificity was 88.2%(68/76). Multivariate logistic regression analysis showed showed enhanced CT value and enhanced inhomogeneity of nodule were independent predictors, and the combined AUC value of both was 0.929 (95% CI: 0.880, 0.977).

### CONCLUSION

It is valuable to distinguish anterior mediastinal cysts below 3cm and thymoma type B1 and B2 based on preoperative quantitative CT parameters, in which combined enhanced CT value and inhomogeneity is the highest.

### CLINICAL RELEVANCE/APPLICATION

This study reveals that quantitative CT parameters such as unenhanced and enhanced CT values and standard deviation of CT value means heterogeneous degree of nodule in conventional CT images can quickly and accurately distinguish anterior mediastinal cysts and thymomas below 3cm, and avoid preoperative misdiagnosis of anterior mediastinal cysts as thymomas and unnecessary surgical treatment, which has great clinical value.

## R4-SSCH10-4 EVALUATING TUMOR SIZE AND VOLUME AS A PROGNOSTIC FACTOR IN LIMITED STAGE THYMIC EPITHELIAL TUMORS: IS THERE A NEED FOR VOLUMETRIC MEASUREMENT OR DIFFERENT THRESHOLDS ACCORDING TO HISTOLOGIC SUBTYPES?

Joon Beom Seo, MD, PhD (*Abstract Co-Author*) Stockholder, Promedius Inc;Stockholder, Coreline Soft, Co Ltd;Stockholder, Anymedi Inc
Jooae Choe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eun Jin Chae, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shinhyeong Nam (*Presenter*) Nothing to Disclose

### PURPOSE

The recent proposal for 9th edition of the TNM staging system for thymic epithelial tumors (TETs) incorporates tumor size, specifically the longest tumor diameter (LTD), to differentiate between T1a and T1b. However, the prognostic value of tumor size in TETs remains controversial, potentially due to non-standardized measurement methods and variability across histologic subtypes. This study aimed to evaluate and compare the prognostic significance of tumor size and tumor volume (TV) in TETs and assess the need for different threshold values based on histologic risk groups.

### METHODS AND MATERIALS

This retrospective study included patients with surgically resected limited-stage TETs from January 2006 to December 2019. Tumor size was measured on axial, coronal, and/or sagittal images for LTD, and volumetric analysis was performed using software. Optimal cutoff values were selected using a maximally selected log-rank statistic which were also evaluated based on each histologic subtype. Prognostic value was evaluated for recurrence-free survival (RFS) using univariable and multivariable Cox proportional hazard models. Interreader agreement for LTD and TV between two readers was evaluated using the intraclass correlation coefficient (ICC).

### RESULTS

Of 253 patients (median age 52 years, 140 male [55%]), 80 (32%) were classified as low-risk (A and AB), 123 (49%) intermediate-risk (B1 and B2), and 50 (20%) high-risk (B3 and thymic carcinoma [TC]) based on histologic subtypes. LTD (HR, 1.02; P = .006) and TV (HR, 1.00; P = .007) were significant independent predictors for RFS on both univariable and multivariable analysis, but LTD > 5.0 cm was not. TV performance was comparable to LTD for RFS (C-index 0.60 vs. 0.62; P = .18). The optimal cutoffs for RFS were >7.0 cm for tumor size and >140 cm2 for TV. According to risk groups, the cutoff value differed for TV (32 cm2 for B3 and TC vs. 130-140 cm2 for A, AB, B2, and B2) but less for LTD (6.5 cm for high-risk, 4.3 cm for intermediate-risk, and 7.4 cm for low-risk). Interreader agreement was excellent, although slightly higher for TV than LTD (ICC, 0.997 vs. 0.942).

### CONCLUSION

Tumor size and volume are independent prognostic factors in limited-stage TETs, with comparable performance and high interreader agreement. The identified optimal cutpoints for RFS—over 7.0 cm for tumor size and over 130 cm2 for tumor volume—were slightly higher than 5.0 cm suggested by the recent update for TET staging.

### CLINICAL RELEVANCE/APPLICATION

The recent update for staging TET incorporating tumor size based on longest diameter is a reasonable and robust approach that can improve patient risk stratification for recurrence, but the cutoff value suggested should be further validated.

## R4-SSCH10-5 NEW IMAGING PROTOCOL TO ASSESS ET TUBE PLACEMENT

Daniela M. Tridente, MD (*Abstract Co-Author*) Nothing to Disclose
Ronald L. Eisenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Diana Litmanovich, MD (*Abstract Co-Author*) Nothing to Disclose
Rokas Liubauskas, MD (*Abstract Co-Author*) Nothing to Disclose
Nihara Chakrala, MBBS (*Abstract Co-Author*) Nothing to Disclose
Yuval Liberman, MD, MMedSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Following intubation, a frontal chest radiograph is obtained to assess endotracheal tube (ETT) position by measuring the ETT tip to carina distance. ETT tip location changes with neck position and can be determined by assessing the position of the mandible. Since the mandible is typically not visualized on standard chest radiographs, we developed a new protocol where the mandible is seen on the chest radiograph, hypothesizing that it will improve the accuracy of the ETT position assessment

**METHODS AND MATERIALS**

Two groups of intubated patients studied (2/9/2021-5/4/2021): chest radiograph taken in either standard or new protocol (visible mandible required). Two observers independently assessed the images for neck position (neutral, flexed, extended) based on mandible position relative to the vertebral bodies. With the mandible absent (i.e., neck position unknown), we established terms: "gray-zone" (difficult to assess the ETT position adequately) and "clear-zone" (confident recommendation to retract, advance, or maintain ETT position). We compared the rate of confident assessment of the ETT in the standard vs the new protocol.

**RESULTS**

Of 308 patients, 155 had standard chest radiographs and 153 the new protocol. Inter-rater agreements for the distance between the ETT and the carina and mandible height based on vertebral bodies were 0.986 ($p<0.001$) and 0.955 ($p<0.001$), respectively. The mandible was visualized significantly more often ($p<0.001$) with the new protocol (92%; 141/153) than with standard protocol (21%; 32/155). By visualizing the mandible or the presence of the ETT within the clear zone, a reader could confidently assess the ETT position more often using the new protocol (96.7% vs 51.6%, $p<0.001$).

**CONCLUSION**

Mandible visibility on post-intubation chest radiograph is helpful for assessing ETT position.

**CLINICAL RELEVANCE/APPLICATION**

The new protocol resulted in a significant increase in both visualizing the mandible and accurately determining ETT position on post-intubation chest radiograph.

## R4-SSCH10-6 AUTOMATED CHEST CT THREE-DIMENSIONAL QUANTIFICATION OF BODY COMPOSITION IN PATIENTS WITH ESOPHAGEAL CANCER: ASSOCIATION WITH MORTALITY

Hiroto Hatabu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Yanagawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuriko Yoshida (*Abstract Co-Author*) Nothing to Disclose
Yukiko Tokuda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Keisuke Ninomiya (*Abstract Co-Author*) Nothing to Disclose
Daiki Nishigaki, PhD (*Abstract Co-Author*) Nothing to Disclose
Yohei Muraguchi (*Abstract Co-Author*) Nothing to Disclose
Ryo Ogawa, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Akihiro Koga, PhD (*Abstract Co-Author*) Nothing to Disclose
Shuhei Doi, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuki Yamagata, MD (*Abstract Co-Author*) Nothing to Disclose
Minoru Nakatsugawa, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation;
Takuo Negishi (*Abstract Co-Author*) Nothing to Disclose
Yu Hiraoka (*Abstract Co-Author*) Nothing to Disclose
Akinori Hata, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

We previously developed an AI for automated chest CT three-dimensional quantification of body composition. The objectives were to validate the performance of the AI and investigate the significance of the quantification for mortality in patients with esophageal cancer.

**METHODS AND MATERIALS**

Patients with esophageal cancer from January 2011 to December 2015 were investigated in this retrospective study. The AI segmented adipose tissue and paravertebral muscle in the whole slices on unenhanced chest CT. Subcutaneous and visceral (mediastinal) adipose tissue was segmented separately (SAT and VAT, respectively) and the volume of SAT and VAT was quantified. Muscle area, mean CT value, and the percentage of intermuscular adipose tissue (IMAT%) were calculated in the muscle quantification. Three radiologists independently and manually segmented adipose tissue and paravertebral muscle in 15 patients. The Dice score and Pearson correlation coefficient were used as the metric for assessing the similarity between the manual and AI segmentations. The association between the quantifications in AI segmentation and overall survival in five years was evaluated by multivariable Cox proportional hazards models.

**RESULTS**

Overall, 464 patients were included. The Dice score for SAT between AI and each radiologist (reader#1, #2, and#3) was 0.91, 0.91, and 0.92, those for VAT were 0.84, 0.79, and 0.82, those for muscle other than IMAT were 0.90, 0.89, and 0.89, and those for IMAT were 0.85, 0.82, and 0.83, respectively. In the Cox proportional hazard model, higher VAT volume (HR=1.26 [95%CI: 1.06, 1.51], P=0.010) and lower CT value in the muscle (HR=0.86 [95%CI: 0.74, 0.997], P=0.046) were significant factors for worse OS adjusting for age, sex, body mass index, NYHA status, smoking history, and clinical cancer stage. In the Cox proportional hazard model using quantification variables with stepwise selection, VAT volume, VAT/SAT ratio, and IMAT% were selected and VAT volume was a significant factor for worse OS (HR=1.29 [95%CI: 1.07, 1.57], P=0.009) adjusting for age, body mass index, NYHA status, smoking history, and clinical cancer stage.

**CONCLUSION**

Automated three-dimensional quantification of body composition by AI was successfully performed. VAT volume was significantly associated with shorter survival in patients with esophageal cancer.

**CLINICAL RELEVANCE/APPLICATION**

VAT volume may be a useful prognostic factor in patients with esophageal cancer.

# Abstract Archives of the RSNA, 2024

R6-SSBR11

**Breast Imaging (Lesion Analysis, Tumor Subtypes and Treatment Response)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: S406A

Hiroyuki Abe, MD, PhD (*Moderator*) Nothing to Disclose
Elissa Price (*Moderator*) Nothing to Disclose

**Sub-Events**

## R6-SSBR11-1 CRYOABLATION AS A PRIMARY TREATMENT FOR LOW-RISK BREAST CANCERS LESS THAN 1.5CM WITHOUT SURGICAL EXCISION: FINAL RESULTS OF THE ICE3 TRIAL

Kenneth R. Tomkovich, MD (*Presenter*) Consultant, IceCure Medical, Inc;Speakers Bureau, IceCure Medical, Inc

### PURPOSE

The ICE3 trial was the first large scale multi-center trial in the world with the primary endpoint to assess ipsilateral breast tumor recurrence (IBTR) rates following image guided breast cancer cryoablation for low-grade breast cancers less than 1.5cm without surgical excision. Secondary endpoints included evaluation of adverse events and cosmetic satisfaction rates. We report final results and important imaging findings.

### METHODS AND MATERIALS

This HIPPA compliant IRB approved single arm prospective trial sought enrollment of 150-200 females ages 50 and over with unifocal invasive ductal carcinoma 1.5cm or less and ER+/PR+ or ER+/PR- and HER2-. Patients underwent ultrasound-guided cryoablation using the ProSense system (IceCure Medical). A freeze, thaw, freeze cycle was performed with the goal of a visible cryosphere with at least a 10mm margin of ice. Patients did not undergo surgical lumpectomy. Patients were followed with mammography at 6 and 12 months and then annually for 5 years. Additional imaging with MRI or ultrasound was optional. Adjuvant therapy was offered. Adverse events were recorded and classified. Patient and physician satisfaction with cosmetic results was evaluated.

### RESULTS

Enrollment began in October 2014 at 19 sites across the United States. 5-year follow up was completed in March 2024. 194 patients met inclusion criteria. The ages were 55-94 years (mean 74.9). The tumor sizes were 2.5mm-14.9mm (mean 8.1mm). There were no serious procedure related adverse events. A total of 7 recurrences were reported. The mean time to recurrence was 46.4 months. 162 patients were included in the final 5 year follow up analysis for an IBTR rate of 4.3%. There were 4 recurrences out of 108 patients who received adjuvant hormone therapy following cryoablation for an IBTR rate of 3.7%. Physician's and patient's satisfaction with cosmetic results were 100%. The most common imaging findings included fat necrosis, dystrophic calcifications, and fibrosis.

### CONCLUSION

Cryoablation of low-risk breast cancers is safe and well tolerated and yielded an overall 5-year recurrence rate of 4.3%. These results are similar to reported results for surgical lumpectomy. Performed in an outpatient setting using local anesthesia with only minor adverse events reported and 100% satisfaction with cosmetic outcomes, breast cancer cryoablation provides significant benefits when compared to breast cancer surgery.

### CLINICAL RELEVANCE/APPLICATION

Results of the ICE3 trial suggest that cryoablation for women with small low-risk breast cancers is a safe and effective primary treatment option offering this group of patients a new alternative to surgical lumpectomy. Additional trials are encouraged to validate these findings.

## R6-SSBR11-2 AN MRI-BASED INTERPRETABLE MODEL DECODING BREAST TUMOR HETEROGENEITY THROUGH MULTI-DIMENSIONAL INFORMATION FOR PREDICTING TREATMENT RESPONSE TO NEOADJUVANT CHEMOTHERAPY

Yanting Liang (*Abstract Co-Author*) Nothing to Disclose
Yanfen Cui (*Abstract Co-Author*) Nothing to Disclose
Zaiyi Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Chu Han (*Abstract Co-Author*) Nothing to Disclose
Chinting Wong (*Abstract Co-Author*) Nothing to Disclose
Zhenwei Shi, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a predictive model using pretreatment MRI scans for predicting pathologic complete response (pCR) after neoadjuvant chemotherapy (NAC) in patients with breast cancer.

**METHODS AND MATERIALS**

Retrospective data from 3156 patients with breast cancer, collected between January 2000 and September 2022 from 8 international cohorts, were used. Pretreatment MRI scans were analyzed using three different imaging biomarkers: deep learning (DL) based on a pretrained foundation model, radiomics (Rad), and imaging tumor microenvironment (ITM) assessment on intratumor and peritumor regions. A multivariable logistic regression model, incorporating the three imaging biomarkers, was used to generate a Breast cancer Treatment Response to NAC (BTRnac) score. The performance of the model was evaluated using the area under the receiver operating characteristic curve (AUC) and other metrics.

**RESULTS**

The training dataset comprised 1481 patients (median age: 45.4 years [IQR: 38.6-62.7 years]) from centers A-D, while the four external test datasets included 1675 patients (median age: 43.2 years [IQR: 39.4-60.5 years]) from centers E-H. All three imaging biomarkers showed a significant association with the odds ratio of achieving pCR. The final model demonstrated good performance in predicting pCR to NAC in both the training dataset (AUC: 0.92) and the external test datasets (AUC range: 0.81-0.86). The BTRnac score, quantifying tumor ecological diversity and heterogeneity, successfully stratified patients into high and low-risk groups with significant differences ($P<0.001$).

**CONCLUSION**

This study developed a predictive model that effectively utilized multi-information from DCE-MRI scans. The model exhibited strong performance in predicting pCR to NAC in patients with breast cancer. Genetic analysis provided further insights into the underlying interpretation of the model. These findings highlight the potential of the model as a valuable tool for predicting treatment response in clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

The developed predictive model has significant potential in accurately stratifying patients, aiding in optimal treatment decision-making before NAC. This has important implications for guiding treatment strategy modifications and selections in clinical practice.

## R6-SSBR11-3 BACKGROUND BREAST TISSUE CHARACTERISTICS IN MAMMOGRAPHY, US, AND MRI AND RELATIONSHIP WITH BREAST CANCER RECURRENCE: INSIGHTS FROM LONG-TERM FOLLOW-UP RESULTS

Arim Yeom (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the association between background breast tissue characteristics (BTC) in mammography, ultrasound, and magnetic resonance imaging and in-breast tumor recurrence (IBTR).

**METHODS AND MATERIALS**

We retrospectively reviewed preoperative images and clinicopathologic data of the patients who underwent breast cancer surgery in 2008 to 2009 at our institution, and follow-up data for up to 14 years following breast cancer surgery. BTC (mammographic (MG) breast density, background echotexture, glandular tissue component (GTC), and background parenchymal enhancement (BPE)) was assessed in the contralateral breast of proven cancer, and bilateral breast cancer patients were excluded. Relationship between MG density, background echotexture, GTC, and BPE was assessed using Spearman's correlation. Kaplan-Meier survival analysis and Cox proportional hazards model were used to assess association of the BTC and IBTR, and tumor staging was adjusted. Subgroup analysis was conducted according to the tumor subtype and menopausal status. We also evaluated the relationship between each BTC and clinicopathologic parameters. Statistical analysis was performed using SAS version 9.4.

**RESULTS**

A total of 2,268 female patients were included in the study (mean age, 48.5±9.6 years), and median follow-up was 10.8 years (interquartile range, 6.9-12.9 years). Among them, 128 patients (5.6%) developed IBTR. There was no significant association among MG density, background echotexture, GTC, and BPE. High BPE was associated with IBTR ($p<0.001$), while other BTCs were not. In subgroup analysis, in patients with triple-negative breast cancer, there was statistically significant association between GTC and IBTR ($p=0.03$) and BPE and IBTR ($p=0.001$). Also, high MG density, high GTC, and high BPE were associated with extensive intraductal component ($p=0.03$). High MG density and high BPE were correlated with hormone receptor positivity, but GTC was not.

**CONCLUSION**

High BPE is associated with IBTR. High BPE and GTC are associated with increased risk of developing IBTR in triple-negative breast cancer patients.

**CLINICAL RELEVANCE/APPLICATION**

By assessing background breast tissue characteristics in preoperative images, personalized postoperative surveillance considering the possibility of in-breast recurrence can be performed.

## R6-SSBR11-4 A ROBUST DEEP LEARNING FRAMEWORK FOR AUTOMATIC MOLECULAR SUBTYPES ASSESSMENT IN BREAST CANCER BASED ON MRI

Jiuquan Zhang (*Abstract Co-Author*) Nothing to Disclose
Yao Huang (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

To build a novel deep learning framework using pretreatment dynamic-contrast enhanced (DCE) MRI for lesion segmentation and automatic molecular subtypes assessment in breast cancer without any human interaction and validate the robustness by multicenter data.

**METHODS AND MATERIALS**

In this multicenter study, eligible patients who had biopsy-proven breast cancer were recruited. And their pretreatment breast DCE-MRIs were collected for analysis. We designed an automatic segmentation model for lesions from DCE-MRI, using the 3D-ResU-Net as the backbone. We used dice to evaluate the lesion segmentation performance. Moreover, we further proposed an ensembled molecular subtypes classification model (Ensembled ResNet) merging both 2D and 3D features from lesion from a training cohort. The accuracy of Ensembled ResNet for the prediction of molecular subtypes in breast cancer was verified in one internal and two external validation cohorts. Model performances were evaluated using area under the curve (AUC).

**RESULTS**

A total of 632 patients were retrospectively recruited. Our proposed segmentation method had high accuracy among the three validation cohorts (dice scores: 0.8606, 0.8530, 0.8451) and four molecular subtypes (dice scores: 0.8525, 0.8432, 0.8290, 0.8559). Ensembled ResNet had favourable accuracy for the prediction of Luminal A subtypes (AUC of 0.7485), Luminal B subtypes (AUC of 0.6854), HER2-enriched subtypes (AUC of 0.7792) and triple negative breast cancer (AUC of 0.7999), superior than 2D-ResNet, 3D-ResNet and radiomics models in all validation datasets (with all $p < 0{\cdot}05$, except for the comparison between Ensembled ResNet and the 2D-ResNet model in Luminal B and TNBC subtypes).

**CONCLUSION**

Our proposed novel deep learning framework can fully automatically assess molecular subtypes with high accuracy and robustness in patients with breast cancer. And this proposed framework may be a noninvasive decision-making tool with great potential in clinical application.

**CLINICAL RELEVANCE/APPLICATION**

In this study, we built a novel deep learning framework using pretreatment dynamic-contrast enhanced MRI for lesion segmentation and automatic molecular subtypes assessment in breast cancer without any human interaction. The framework can fully automatically assess molecular subtypes with high accuracy superior to 2D-ResNet, 3D-ResNet and Radiomics models. The prediction performance of the proposed framework was validated in a multicenter cohort, and the robustness and generalization are highlighted. In clinical practice, such a deep learning framework could non-invasively and accurately assess breast cancer molecular subtypes to guide clinical individualized drug treatment, thereby reducing complications caused by biopsy.

## R6-SSBR11-5 ACCURACY OF MAGNETIC RESONANCE IMAGING IN PREDICTING PATHOLOGICAL RESPONSE IN PATIENTS WITH TRIPLE-NEGATIVE BREAST CARCINOMAS UNDERGOING NEOADJUVANT CHEMOTHERAPY AND IMMUNOTHERAPY

Mariah C. Wanderley (*Abstract Co-Author*) Nothing to Disclose
Solange Sanches (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Felipe SR, PhD (*Abstract Co-Author*) Nothing to Disclose
Fabiana B. Makdissi (*Abstract Co-Author*) Nothing to Disclose
Bianca M. Lago, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia Damiao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Compare the diagnostic performance of magnetic resonance imaging (MRI) in predicting the pathological response in patients with invasive triple-negative invasive breast carcinomas undergoing neoadjuvant chemotherapy (NAC) with and without immunotherapy.

**METHODS AND MATERIALS**

A retrospective, single-center study, which included female patients diagnosed with triple-negative invasive breast carcinoma who underwent neoadjuvant chemotherapy (NAC group) or neoadjuvant chemotherapy combined with immunotherapy (NACI group), followed by surgery, from 2021 to 2024. Patients underwent two MRI scans: one before and one after neoadjuvant treatment (preoperative). The diagnostic performance of MRI to predict treatment response was calculated, considering the pathological response as the gold standard. Radiological complete response (CR) was defined as the absence of residual abnormal enhancement in the tumor bed at preoperative MRI. The pathological response was assessed using the Residual Cancer Burden (RCB), and pathological complete response (pCR) was defined as the absence of invasive carcinoma in the tumor bed and axillary lymph nodes at histology after surgery (RCB-0).

**RESULTS**

The study included 106 patients, 61 in the NAC group (mean age: 44 years; mean tumor size: 33mm) and 45 in the NACI group (mean age: 46 years; mean tumor size: 39 mm). There was no statistically significant difference between the two groups in terms of age, clinical staging, tumor size, and lesion type at MRI (mass vs. non-mass enhancement). Regarding treatment response, the NACI group showed higher rates of rCR (75.6% x 44.3%; p=0.003) and pCR (68.9% x 45.6%; p=0.025). In the NAC and NACI groups, MRI showed a sensitivity of 74% and 85%, specificity of 73% and 81%, positive predictive value of 69% and 93%, negative predictive value of 78% and 64%, and accuracy of 73% and 84% to predict pCR, respectively. The positive predictive value to detect a complete response was higher in the NACI group (p=0.016).

**CONCLUSION**

Our preliminary results show that MRI has an excellent diagnostic performance in predicting pCR in patients with triple-negative breast cancer treated with NAC associated with immunotherapy. These patients showed a higher rate of pCR, and preoperative MRI showed better diagnostic performance in predicting pCR in this population compared with patients treated without immunotherapy.

**CLINICAL RELEVANCE/APPLICATION**

By highlighting the diagnostic performance of MRI in this specific context, the study supports the use of MRI as a non-invasive method to tailor therapeutic planning, optimize treatment efficacy, and potentially improve patient outcomes in this challenging subset of breast cancer patients.

# Abstract Archives of the RSNA, 2024

R6-SSCA11

**Cardiac Imaging (Non-ischemic Heart Disease)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: E353C

James C. Carr, MD (*Moderator*) Institutional Research Grant, Siemens AG;Advisory Board, Siemens AG;Travel support, Siemens AG;Institutional Research Grant, Bayer AG;Advisory Board, Bayer AG;Travel support, Bayer AG;Speaker, Bayer AG;Institutional Research Grant, Guerbet SA;Advisory Board, Bracco Group
Carole J. Dennie, MD, FRCPC (*Moderator*) Research Consultant, AstraZeneca PLC

**Sub-Events**

## R6-SSCA11-1 CARDIAC MRI GENOTYPE-PHENOTYPE ASSOCIATIONS IN GENE-POSITIVE ARRHYTHMOGENIC CARDIOMYOPATHY

Sarin Lekchuensakul (*Abstract Co-Author*) Nothing to Disclose
Danna Spears (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Melanie Care (*Abstract Co-Author*) Nothing to Disclose
Farah Cadour, MD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Several genes have been identified as pathogenic in arrhythmogenic cardiomyopathy (ACM) including desmosomal and non-desmosomal genes. However, there is currently limited data on the association between imaging findings and genotypes in ACM. The purpose of this study was to evaluate genotype-phenotype associations between desmosomal and non-desmosomal variants using cardiac MRI.

### METHODS AND MATERIALS

In this retrospective cohort study, consecutive adult patients with a pathogenic or likely pathogenic variant in a gene associated with ACM and at least one cardiac MRI between 2004-2023 were included. Cardiac MRI evaluation included quantification of left ventricular (LV) and right ventricular (RV) volumes and function, evaluation of regional wall motion abnormalities, late gadolinium enhancement (LGE) and native T1/T2 mapping.

### RESULTS

Of the 224 included ACM patients (105 women, mean age 39±15 years), pathogenic or likely pathogenic variants in desmosomal genes were identified in 104 (46%, most frequently plakophilin-2 PKP2 in 23% and desmoplakin DSP in 17%) and non-desmosomal genes in 120 (54%, most frequently titin TTN in 28% and lamin A/C LMNA in 11%). The proportion of women was higher in the desmosomal group compared to the non-desmosomal group (59% vs 37%, p=0.002), however there was no difference in age (38±15 years vs 40±16 years, p=0.38). Patients with non-desmosomal variants had higher prevalence of RV abnormalities (RV dilation, low RVEF, RV regional wall motion abnormality, or RV LGE), LV abnormalities (LV dilation, low LVEF, LV regional wall motion abnormality, or LV LGE) and bi-ventricular abnormalities (62% vs 44%, p=0.01; 73% vs 35%, p<0.001; and 65% vs 27%, p<0.001, respectively) and significantly lower RVEF and LVEF (44±13% vs 52±8%, p<0.001 and 42±16% vs 56±8%, p<0.001, respectively) compared to those with desmosomal variants. The prevalence of LV LGE and native T1 and T2 Z-scores did not differ between non-desmosomal and desmosomal variants (48% vs 55%, p=0.52; 0.24 [IQR -0.55-0.90] vs. 0.70 [IQR -0.13, 1.67], p=0.15; 0.13 [IQR -0.34-0.80] vs. 0.48 [IQR -0.19, 0.94], p=0.55, respectively). However, desmosomal variants were associated with more extensive LGE (median 3 segments [IQR 0-10] vs. 0 [IQR 0-4], p=0.001) and more frequent ring-like pattern of LGE (41% vs 12%, p<0.001).

### CONCLUSION

Non-desmosomal ACM variants are associated with worse biventricular function; however, desmosomal variants are associated with higher extent of LGE and more frequent ring-like LGE.

### CLINICAL RELEVANCE/APPLICATION

Cardiac MRI identifies clinically relevant phenotypic differences in gene-positive ACM. Futher study is needed to evaluate genotype relationships with respect to disease progression trajectory and risk of future adverse events.

## R6-SSCA11-2 PROGNOSIS AND RISK STRATIFICATION IN DILATED CARDIOMYOPATHY WITH LVEF ≤ 35%: CARDIAC MRI INSIGHTS FOR BETTER OUTCOMES

Minjie Lu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Di Zhou (*Presenter*) Nothing to Disclose

### PURPOSE

Current guidelines categorize implantable cardioverter-defibrillators as a Class I recommendation for primary prevention of sudden cardiac death (SCD) in dilated cardiomyopathy (DCM) patients with left ventricular ejection fraction (LVEF) = 35%. However, its effectiveness is hindered by the inability to

reliably discriminate between the risk of SCD and competing death of heart failure (HF) deterioration, thereby limiting its clinical utility. We aimed to refine a risk stratification model based on cardiac magnetic resonance imaging (MRI) for DCM patients with LVEF = 35%.

**METHODS AND MATERIALS**

A total of 1272 DCM patients with LVEF = 35% who underwent cardiac MRI were consecutively enrolled in this study. The primary endpoint is SCD-related endpoint, which is a composite of SCD or aborted SCD and the second endpoint is HF-related endpoint, which is a composite of HF death or heart transplantation. The risk models were validated in a prospective temporal validation cohort (n = 301).

**RESULTS**

Over a median follow-up of 87.4 months, 104 patients reached the SCD-related endpoints, and 131 patients reached the HF-related endpoints. Late gadolinium enhancement (LGE) = 7.5% was associated with a greater rate of the SCD-related endpoints (adjusted hazard ratio [HR]: 3.6; $p < 0.001$), while left atrial volume index (LAVi) = 75.6 ml/m2 was associated with a greater rate of the HF-related endpoints (adjusted HR: 2.1; $p < 0.001$). High-risk SCD patients with LVEF < 20% and LGE = 7.5% had a 9.29-fold higher risk of SCD events, compared with low-risk SCD patients with LVEF of 20-35% and without LGE. Patients with LVEF < 20% and LAVi = 75.6ml/m2 had the highest risk of HF-related endpoints.

**CONCLUSION**

DCM patients with LGE = 7.5% were at heightened risk of SCD events, which may potentially benefit from prompt implantable cardioverter-defibrillator therapy. Physicians should prioritize addressing worsening heart failure in patients with LGE < 7.5% and LAVi = 75.6 ml/m2, as the escalation in the risk of HF death/HTx surpasses that of SCD or aborted SCD.

**CLINICAL RELEVANCE/APPLICATION**

In this cohort study, patients with late gadolinium enhancement (LGE) = 7.5% showed a 3.6-fold greater risk of sudden cardiac death composite events.The risk categories and stratification models, integrated by LVEF, LGE, and LAVi, hold promise for guiding interventions like implantable cardioverter-defibrillators, heart transplantation, LV assist device therapy, and referral for heart failure specialty care, ultimately improving outcomes. This endeavor can enhance targeted therapeutic decision-making and potentially alleviate the economic burden on patients with DCM and severely reduced LVEF.

## R6-SSCA11-3 STRAIN CMR CAN PREDICT REGIONS OF INFLAMMATION ON PET/CT IN PATIENTS WITH CARDIAC SARCOIDOSIS

Hubert J. Vesselle, MD, PhD (*Abstract Co-Author*) Consultant, MIM Software Inc
Wei Wu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mohamed M. Abdelmotleb, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Avanti Gulhane, MD (*Abstract Co-Author*) Nothing to Disclose
Mehrzad Shafiei, MD (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Murat Sadic, MD (*Abstract Co-Author*) Nothing to Disclose
Karen G. Ordovas, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Ganesh Raghu, MD (*Abstract Co-Author*) Nothing to Disclose
Negar Firoozeh, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine if cardiac magnetic resonance (CMR) strain parameters can identify regional myocardial inflammation in cardiac sarcoidosis (CS).

**METHODS AND MATERIALS**

This single-institution, HIPAA-compliant, IRB-approved, retrospective study included consecutive patients with confirmed or probable cardiac sarcoidosis per the updated Japanese Circulation Society Guideline, with both CMR and F18-FDG PET/CT within 90 days of each other in the past 5 years. Comparison of strain CMR parameters between left ventricular (LV) myocardial segments with and without inflammation on PET/CT was performed using t-test and nonparametric test of hypothesis depending on variable distribution. To assess if strain association with inflammation was independent from the presence of late gadolinium enhancement (LGE), multivariable logistic regression models were employed, adjusting for key demographic and clinical characteristics as covariates.

**RESULTS**

Among 125 patients with cardiac sarcoidosis (mean age 59.45 years, 58% male), segmental analysis identified inflammation in 385 out of 2125 myocardial segments (18.11%) on PET/CT. LGE was present in 89 (4.2%) of all segments and in 23.11% of inflamed segments. Segments with inflammation had significantly decreased Peak Circumferential Strain (PCS) mean -14.1, SD 5.7) and Peak Longitudinal Strain (mean -10.3, SD 5.4) compared to non-inflamed segments (mean -18.4, SD 3.5 and mean -13, SD 3.6, respectively; both $p < 0.001$). Multivariable logistic regression showed that PCS (OR: 1.406; p=0.011) and PLS (OR: 1.020; p=0.011), where independent from LGE to predict inflammation, while adjusting for potential confounders including age, sex, LV ejection fraction, and LV end-diastolic volume index. Additional strain parameters investigated did not differ between segments with and without inflammation.

**CONCLUSION**

The presence of abnormal peak circumferential and longitudinal strains remained significantly associated with myocardial inflammation as detected by PET/CT, irrespective of the concurrent presence of LGE, underscoring the independent diagnostic value of strain measures in this context.

**CLINICAL RELEVANCE/APPLICATION**

CMR strain parameters were independently associated with inflammation, suggesting their potential utility for non-invasive assessment in detecting active sarcoidosis.

## R6-SSCA11-4 TOWARDS PHENOTYPING CHARACTERISTICS AND MECHANISM OF QRS DURATION AND MORPHOLOGY IN PATIENTS WITH NON-ISCHEMIC HFREF: INSIGHTS FROM CMR IMAGING

Minjie Lu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Di Zhou (*Presenter*) Nothing to Disclose

**PURPOSE**

As the cornerstone of decision-making and prognosis, there is currently a lack of data focusing on the association between phenotype and underlying mechanisms among various conduction delay patients. We aimed to elucidate the phenotyping characteristics among different QRS duration and

morphology in patients with non-ischemic heart failure and reduced ejection fraction(HFrEF) and explore predictive metrics for survival outcomes following cardiac resynchronization therapy (CRT).

**METHODS AND MATERIALS**

A retrospective analysis was conducted on 887 consecutive patients with non-ischemic HFrEF and prolonged QRS duration who underwent cardiac magnetic resonance (CMR) imaging, as well as 200 subjects with HFrEF and normal QRS duration as the control group. Survival estimates for patients who underwent CRT were determined using Kaplan-Meier curves with the log-rank test.

**RESULTS**

Patients with left bundle branch block (LBBB) had a higher right ventricular ejection fraction (RVEF) and worse LV torsion and strains compared to controls and patients with right bundle branch block (RBBB). Late gadolinium enhancement (LGE) percentage was significantly larger in patients with RBBB and non-specific intra-ventricular conduction delay (IVCD) than in controls and LBBB patients (LBBB vs. RBBB vs. IVCD vs. controls: 4.5% ± 6.7 vs. 8.9% ± 9.1 vs. 8.3% ± 8.0 vs. 4.9% ± 7.0). Multivariable logistic regression revealed that LGE presence and torsion were independent determinants of IVCD. Over a median follow-up of 4.7 years, RVEF = 48.1% (HR [95% CI]: 6.247 [1.923-20.294]), torsion = 0.1°/cm (HR [95% CI]: 2.692 [1.310-5.532]), and LGE = 2.3% (HR [95% CI]: 7.948 [3.108-20.328]) were associated with reduced survival after CRT.

**CONCLUSION**

RBBB is associated with reduced RVEF and larger LGE burden, indicating a worse prognosis after undergoing CRT. LV torsion was notably impaired in patients with LBBB and IVCD, suggesting decreased LV synchrony, which may benefit from CRT.

**CLINICAL RELEVANCE/APPLICATION**

As the cornerstone of decision-making and prognosis, we found that left ventricular dyssynchronous was evident in patients with left bundle branch block or non-specific intra-ventricular conduction delay, which may indicate an improved clinical outcome after CRT. Right bundle branch block patients may not benefit from CRT due to right ventricular dysfunction and relatively preserved left ventricular synchronous contraction. Based on cardiac magnetic resonance, reduced right ventricular ejection fraction, preserved left ventricular torsion, and larger late gadolinium enhancement are associated with worse outcomes following CRT. CMR imaging may assist clinicians in assessing patients who could benefit from CRT and those who might have less favorable outcomes.

## R6-SSCA11-5 CARDIAC MAGNETIC RESONANCE-DERIVED LEFT ATRIOVENTRICULAR COUPLING INDEX AS A NOVEL PROGNOSTIC MARKER FOR LIGHT-CHAIN AMYLOIDOSIS

Yinqiu Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the prognostic value of left atrioventricular coupling index (LACI) in patients with light-chain (AL) amyloidosis.

**METHODS AND MATERIALS**

We prospectively enrolled 170 patients with biopsy-proven AL amyloidosis who underwent cardiac magnetic resonance (CMR) imaging between December 2011 and January 2020. LACI was defined as the ratio between the left atrial volume and the left ventricular volume in end-diastole. The primary endpoint was all-cause death. Youden's Index was used to identify the optimal cut-off for LACI in predicting all-cause mortality. Association between LACI and all-cause mortality was analyzed with univariable and multivariable Cox proportional hazards models. The Kaplan-Meier curve was depicted and compared using the log-rank test.

**RESULTS**

LACI was significantly higher in patients with primary endpoint compared to those without primary endpoint (55.9%, interquartile range: 29.9%-72.0% vs. 39.4%, interquartile range: 23.8%-51.8%, p=0.002). Among 170 patients with AL amyloidosis, 113 (66.5%) experienced primary endpoint during a median follow-up of 30 months. The optimal cut-off for LACI to predict mortality was 51.9%. Multivariate Cox analysis demonstrated LACI=51.9% (HR 1.807, 95% CI 1.171-2.788, p=0.008) was an independent predictor of all-cause mortality after adjusting for baseline confounders, left ventricular and left atrial functional parameters. On Kaplan-Meier analysis, LACI assessment enabled further risk stratification in patients at advanced Mayo stage (IIIa and IIIb) (log-rank p=0.002, p=0.038, respectively).

**CONCLUSION**

CMR-derived LACI is a powerful independent predictor of all-cause mortality in patients with AL amyloidosis and it offers incremental prognostic information for all-cause mortality in patients at advanced Mayo stage.

**CLINICAL RELEVANCE/APPLICATION**

LACI is independently associated with all-cause mortality in AL amyloidosis and it can further improve risk stratification in patients with AL amyloidosis.

## R6-SSCA11-6 PARAMETRIC MAPPING USING CARDIOVASCULAR MAGNETIC RESONANCE FOR THE DIFFERENTIATION OF LIGHT CHAIN AMYLOIDOSIS AND TRANSTHYRETIN-RELATED AMYLOIDOSIS

Daniel Kuetting, MD (*Abstract Co-Author*) Nothing to Disclose
Leon Bischoff, MD (*Abstract Co-Author*) Nothing to Disclose
Narine Mesropyan, MD (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Alexander Isaak, MD (*Abstract Co-Author*) Nothing to Disclose
Dmitrij Kravchenko, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate different cardiovascular magnetic resonance (CMR) parameters for the differentiation of light chain amyloidosis (AL) and transthyretin-related amyloidosis (ATTR).

**METHODS AND MATERIALS**

In total, 75 patients, 53 with cardiac amyloidosis (20 patients with AL (66±12 years, 14 males [70%]) and 33 patients with ATTR (78±5 years, 28 males [88%])) were retrospectively analyzed regarding CMR parameters such as T1 and T2 mapping, extracellular volume (ECV), and late gadolinium enhancement (LGE) distribution patterns, and myocardial strain, and compared to a control cohort with other causes of left ventricular hypertrophy (LVH; 22 patients (53±16 years, 17 males [85%])). One way-ANOVA and receiver operating characteristic analysis were used for statistical analysis.

## RESULTS

ECV was the single best parameter to differentiate between cardiac amyloidosis and controls (area under the curve [AUC]: .97, 95% confidence intervals [CI]: .89-.99, p<.0001, cutoff: >30%). T2 mapping was the best single parameter to differentiate between AL and ATTR amyloidosis (AL: 63±4 ms, ATTR: 58±2 ms, p<.001, AUC: .86, 95% CI: .74-.94, cutoff: >61 ms). Subendocardial LGE was predominantly observed in AL patients (10/20 [50%] vs. 5/33 [15%]; p=.002). Transmural LGE was predominantly observed in ATTR patients (23/33 [70%] vs. 2/20 [10%]; p<.001). The diagnostic performance of T2 mapping to differentiate between AL and ATTR amyloidosis was further increased with the inclusion of LGE patterns (AUC: .96, 95% CI: .86-.99]; p=.05).

## CONCLUSION

ECV differentiates cardiac amyloidosis from other causes of LVH. T2 mapping combined with LGE differentiates AL from ATTR amyloidosis with high accuracy on a patient level.

## CLINICAL RELEVANCE/APPLICATION

CMR findings such as ECV, T1 and T2 mapping can speed up diagnosis of cardiac amyloidosis in a clinical setting while also differentiating between ATTR and AL amyloidosis, the two most common causes of cardiac involvement.

# Abstract Archives of the RSNA, 2024

R6-SSGI19

**Gastrointestinal Imaging (Oncology II)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: E450B

Surbhi Raichandani, MD (*Moderator*) Nothing to Disclose
Lauren M. Burke, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R6-SSGI19-1 ASSESSING THE DIAGNOSTIC UTILITY OF CT IN PREOPERATIVE LOCAL STAGING OF COLON CANCER: INSIGHTS FROM A SYSTEMATIC REVIEW AND META-ANALYSIS

Miriana E. Mariussi, MD (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gustavo d. Monjardim, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanni B. Torri, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza G. Schmitt, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Helena Kaca Do Carmo (*Abstract Co-Author*) Nothing to Disclose
Adriano Basso Dias, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Stephan Altmayer, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Meiri Silva (*Abstract Co-Author*) Nothing to Disclose
Camila Wiethan (*Abstract Co-Author*) Nothing to Disclose
Joao Manoel M. Santos, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This meta-analysis aims to evaluate the diagnostic accuracy of computed tomography (CT) for local staging of colon cancer and identifying associated poor prognostic factors.

### METHODS AND MATERIALS

Conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA-DTA) guidelines and the Cochrane Handbook for Diagnostic Test Accuracy, this review searched relevant databases from January 2010 to assess the efficacy of CT in diagnosing locally advanced colon cancer (stage pT3 or higher). Additionally, lymph node involvement (N+) and extramural vascular invasion (EMVI+) were evaluated.

### RESULTS

Out of 117 studies reviewed in full, 31 met the inclusion criteria, encompassing a total of 222,838 patients. CT demonstrated a sensitivity and specificity of 0.78 (95% CI: 0.72 - 0.83 and 0.67 - 0.86, respectively) for identifying pT = 3 stages, with an Area Under the Curve (AUC) of 0.85 (95% CI: 0.79 - 0.88). For detecting lymph node involvement, the sensitivity and specificity were both 0.62 (95% CI: 0.55 - 0.68 and 0.53 - 0.70, respectively), and the AUC was 0.65 (95% CI: 0.59 - 0.69). For EMVI+, the sensitivity was 0.36 (95% CI: 0.18 - 0.59), the specificity was 0.78 (95% CI: 0.64 - 0.88), and the AUC was 0.64 (95% CI: 0.49 - 0.75).

### CONCLUSION

CT is effective for staging locally advanced colon cancer, confirming its utility in clinical decision-making. This study underscores the need for further research to refine diagnostic criteria and explore new diagnostic approaches.

### CLINICAL RELEVANCE/APPLICATION

Given the FOxTROT trial results, which indicate potential benefits of neoadjuvant chemotherapy for locally advanced colon cancer, accurate preoperative staging becomes crucial. CT has proven effective for patient stratification and demonstrating diagnostic accuracy, essential for selecting appropriate treatment plans.

## R6-SSGI19-2 DIAGNOSTIC ACCURACY AND INTERREADER AGREEMENT OF NODE REPORTING AND DATA SYSTEM (NODE-RADS) IN CT-BASED STAGING OF REGIONAL LYMPH NODES IN GASTRIC CANCER

Fabian Elsholtz, MD (*Abstract Co-Author*) Nothing to Disclose
Bernd K. Hamm III, MD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation;Research Grant, Canon Medical Systems Corporation;Stockholder, Siemens AG;Research Grant, Siemens AG;Stockholder, General Electric Company;Research Grant, General Electric Company;Research Grant, Koninklijke Philips NV;Research Grant, Elbit Imaging Ltd;Equipment support, Elbit Imaging Ltd;Research Grant, Bayer AG;Research Grant, Guerbet SA;Research Grant, Bracco Group;Research Grant, B. Braun Melsungen AG;Research Grant, Krauth Medical KG GmbH & Co;Research Grant, Boston Scientific Corporation;Investigator, CMC Contrast AB
Moritz Tronser (*Abstract Co-Author*) Nothing to Disclose
Carsten Kamphues (*Abstract Co-Author*) Nothing to Disclose

Florian Loch (*Abstract Co-Author*) Nothing to Disclose
Rolf O. Reiter, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The current assessment of regional lymph nodes in gastric cancer lacks precision, prompting a growing need for standardized oncologic imaging through "reporting and data systems" (RADS). Our goal was to evaluate the diagnostic accuracy of Node-RADS in comparison to specific criteria for regional lymph nodes in gastric cancer, employing CT scans and histopathology as reference.

**METHODS AND MATERIALS**

This retrospective study examined 91 consecutive patients (median age 66, range 33-91, including 37 women) diagnosed with histologically confirmed gastric adenocarcinoma who underwent surgery. CT scans were used to assess the Node-RADS score, ranging from 1 to 5, indicating the probability of regional lymph node metastases based on combined size and configuration criteria as follows: 1 (very low), 2 (low), 3 (equivocal), 4 (high) and 5 (very high). Additionally, individual evaluations of Node-RADS criteria were conducted, along with assessments of long-axis diameter and specific subcategories of altered border contour (such as lobulated, spiculated, and indistinct).

**RESULTS**

Representative examples of Node-RADS scores are shown in figure 1. The highest diagnostic accuracy was observed in Node-RADS scores of =3 and =4, exhibiting a sensitivity/specificity/Youden index of 56.8%/90.7%/0.47 and 48.6%/98.1%/0.47, both with good interreader agreement (? = 0.73 and 0.67, $p < 0.01$). Among the individual criteria, optimal performance was associated with a short-axis diameter of 10 mm, demonstrating a sensitivity/specificity/Youden index of 56.8%/87.0%/0.44 (? = 0.65, $p < 0.01$).

**CONCLUSION**

Our findings indicate that employing a structured blend of size and configuration criteria for regional nodal staging in gastric cancer marginally improves the overall diagnostic accuracy compared to several individual criteria, including short axis diameter. This improvement reflects an increase in specificity, while sensitivity remain consistent. The Node-RADS assessment showed good interreader agreement.

**CLINICAL RELEVANCE/APPLICATION**

Evaluation of lymph nodes in gastric cancer remains limited, with a lack of agreement on radiological assessment. In gastric cancer, Node-RADS slightly increases diagnostic accuracy when compared to individual criteria, such as short-axis diameter. For structured reporting of regional lymph nodes in gastric cancer, Node-RADS holds promise as a potential tool.

## R6-SSGI19-4 PRELIMINARY RESULTS ON INTER-RATER AGREEMENT BETWEEN FULLY AUTOMATED TUMOR SEGMENTATION MODEL AND RADIOLOGIST RECIST RESPONSE ASSESSMENT IN PATIENTS WITH COLORECTAL LIVER METASTASES

Lawrence H. Schwartz, MD (*Abstract Co-Author*) Nothing to Disclose
Lin Lu (*Abstract Co-Author*) Nothing to Disclose
Natalie Gangai (*Abstract Co-Author*) Nothing to Disclose
Pengfei Geng, MD (*Abstract Co-Author*) Nothing to Disclose
Binsheng Zhao, DSc (*Abstract Co-Author*) Royalties, Varian Medical Systems, Inc;License agreement, Keosys SAS;License agreement, Hinacom Software and Technology, Ltd;
Hao Yang (*Abstract Co-Author*) Nothing to Disclose
Gregory V. Goldmacher, MD, PhD (*Abstract Co-Author*) Employee, Merck & Co, Inc;Stockholder, Merck & Co, Inc
Richard Kinh Gian Do, MD, PhD (*Presenter*) Author, RELX;Consultant, General Electric Company;Consultant, Bayer AG;Spouse, Author, Wolters Kluwer nv;Spouse, Committee Member, ALK-Abello A/S;Spouse, Consultant, JDP Therapeutics Inc;Spouse, Consultant, F. Hoffmann-La Roche Ltd

**PURPOSE**

Automated tumor segmentation (TS) models have potential in the development of quantitative imaging biomarkers for treatment response in cancer patients. This study aims to compare the agreement between an automated novel TS model and two radiologists applying RECIST to patients with colorectal liver metastases (CRLM) undergoing systemic chemotherapy.

**METHODS AND MATERIALS**

In this IRB approved retrospective study, treatment naḭve patients with CRLM who underwent chemotherapy were included if they had baseline and one follow-up CECT available for response assessment by RECIST 1.1. A ScaleNAS TS model trained on liver metastases across a range of primary cancers was applied to an independent data set to obtain total tumor volumes (TTV) in the liver. Response categories were then automatically generated based on changes in TTV. A threshold of +/- 65% was used to define Progressive Disease (PD), Stable Disease (SD), and Partial Response (PR). Complete Response (CR) and PR categories were combined. Inter-rater agreement was measured by weighted kappa statistics for 1) RECIST 1.1 response categories generated by two expert radiologists (R1 and R2), and 2) the response categories generated from TTV by the TS model compared to R1.

**RESULTS**

189 patients (mean age 59.3 y, 54.0% male) from a single cancer center were included. For 52 patients evaluated by both radiologists, 37/52 (71.2%) RECIST categories were in agreement (19 PR, 15 SD, and 3 PD) with weighted kappa = 0.58. For 189 patients evaluated by R1 and processed by the automated TS model, there was agreement in 133/189 (70.4%) RECIST categories (55 PR, 66 SD, 12 PD), with weighted kappa = 0.54.

**CONCLUSION**

In this preliminary study of patients with colorectal liver metastases on chemotherapy, automated calculation of treatment response by a novel ScaleNAS TS model showed a moderate level of inter-rater agreement with an expert radiologist, similar to the moderate agreement between two expert radiologists applying RECIST 1.1.

**CLINICAL RELEVANCE/APPLICATION**

Preliminary results suggest the potential of using automated TS model to achieve expert radiologist level performance in identifying responders to chemotherapy. Further multi-center multi-reader validation is required.

## R6-SSGI19-6 A HUMAN IN THE LOOP DEEP LEARNING APPROACH FOR SEMI-AUTOMATED RECTAL TUMOR SEGMENTATION ON MULTI-PLANE MRI

Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Stephen Tang (*Abstract Co-Author*) Nothing to Disclose
Satish Viswanath (*Abstract Co-Author*) Nothing to Disclose

Kristina Young, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company;Institutional support, Bristol-Myers Squibb Company;
Gregory M. O'Connor, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas Desilvio, BS, BA (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Purysko, MD (*Abstract Co-Author*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;
Brennan Flannery (*Abstract Co-Author*) Nothing to Disclose
Leo Bao (*Abstract Co-Author*) Nothing to Disclose
Michael Kong (*Abstract Co-Author*) Nothing to Disclose
Benjamin Parker, MD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Precise segmentation of rectal tumors on pre-treatment MRI can enable accurate clinical staging toward personalized treatment selection. However, the accuracy of clinical staging can vary based on reader experience, and developing deep learning models to assist in this regard requires laborious manual annotation of tumor extent. We present initial results of an integrated human-in-the-loop (HITL) refinement learning model for semi-automated segmentation of rectal tumors on axial and coronal pre-treatment MRI scans.

**METHODS AND MATERIALS**

Baseline staging MRI scans from locally advanced rectal cancer patients were accrued from 4 institutions, for all of which consensus radiologist annotations of tumor extent had been obtained as surrogate "ground truth". A deep learning (DL) nnUNet tumor segmentation model was trained on axial and coronal T2w MRIs from two institutions, with segregated training and internal validation cohorts. Two rounds of HITL refinement learning were conducted, where model-generated segmentations were refined by two novice radiology readers. Refined annotations were used to re-optimize the nnUnet model. Model-generated segmentations were evaluated before HITL and after each HITL round against "ground truth" in two external validation cohorts, with performance quantified via dice similarity coefficient (DSC) and time taken for human annotation.

**RESULTS**

A total of 381 MRI scans from 231 rectal cancer patients were considered. The optimized HITL informed DL model yielded the best overall tumor segmentation performance on the external validation cohort (N=20, two institutions) for both axial (DSC = 0.76) and coronal scans (DSC=0.68), with no further improvement in model performance after a second round of HITL refinement. By comparison, the pre-HITL DL tumor segmentation model yielded significantly worse performance on both axial (DSC=0.60, p=0.0362) and coronal (DSC=0.62, p=0.0186) MRI scans. This HITL-informed DL model also yielded robust performance on a second validation cohort across both axial (DSC=0.65) and coronal views (DSC = 0.65). HITL refinement for rectal tumor annotation was also found to significantly improve reader efficiency by requiring only 18 minutes/scan compared to manual de novo annotations which took up to 38 minutes/scan ($p<0.001$).

**CONCLUSION**

Human-in-the-loop deep learning models can enable accurate and efficient semi-automated rectal tumor segmentations on pre-treatment MRI scans across axial and coronal acquisition planes

**CLINICAL RELEVANCE/APPLICATION**

Semi-automated tumor segmentation approaches could enable more accurate and reproducible staging of rectal cancers as well as improved treatment selection, regardless of reader experience.

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# Abstract Archives of the RSNA, 2024

R6-SSGI20

**Gastrointestinal Imaging (Esophagus and Stomach)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: E451B

Eun Sun Lee, MD, PhD (*Moderator*) Nothing to Disclose
Matthew A. Morgan, MD (*Moderator*) Advisory Board, sanofi-aventis Group

**Sub-Events**

## R6-SSGI20-1 EXTRAMURAL VENOUS INVASION MEDIATED BY HSA_CIRC_0097977 IN ORTHOTOPIC MOUSE MODEL OF GASTRIC CANCER—A MR IMAGING-HISTOPATHOLOGICAL CORRELATION STUDY

Jin Cheng, MD (*Abstract Co-Author*) Nothing to Disclose
Yiqun Liu (*Abstract Co-Author*) Nothing to Disclose
Yi Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Caizhen Feng, MBChB (*Abstract Co-Author*) Nothing to Disclose
Xinyi Gou (*Presenter*) Nothing to Disclose

### PURPOSE

To perform a magnetic resonance imaging (MRI)-histopathological correlation study of extramural venous invasion (EMVI) and to investigate the relationship between EMVI and the expression of hsa_circ_0097977 on orthotopic gastric cancer (GC) mouse model.

### METHODS AND MATERIALS

We first retrospectively collected samples from patients with locally advanced GC for circRNA sequencing and found that hsa_circ_0097977 was significantly related with EMVI status. On animal level, orthotopic GC mouse model was constructed by implanting GC cells (BGC-823 and NCI-N87) with/without knock-down (KD) of hsa_circ_0097977, and followed by 9.4 Tesla (T) MRI scan. MRI-histopathological correlation study on EMVI, analysis of the association between EMVI and metastasis were performed respectively. Subsequently, cell function experiments were conducted to confirmed the effect of hsa_circ_0097977 on cell level.

### RESULTS

EMVI could be accurately detected by 9.4T MRI on orthotopic mouse model with pathological confirmation as the reference standard, with the area under the curve (AUC) of 0.843 (sensitivity 78.57%, specificity 90.0%). MRI detected EMVI was the only imaging factor associated with distant metastasis (p=0.04). Furthermore, KD of hsa_circ_0097977 was the only factor associated with EMVI (p=0.043, 0.038). Cell function test identified that KD of hsa_circ_0097977 could decrease the invasion and migration of GC cells.

### CONCLUSION

EMVI of GC, the risk factor of distant metastasis, could be detected by 9.4T MRI and confirmed by histopathological analysis. At the same time, the expression of EMVI can be regulated by KD of hsa_circ_0097977.

### CLINICAL RELEVANCE/APPLICATION

Extramural venous invasion of gastric cancer could be detected by 9.4T MRI, confirmed by histopathological analysis, and modulated by knock-down of hsa_circ_0097977 on the orthotopic mouse model, which could be a foundation of further research on extramural venous invasion.

## R6-SSGI20-2 DEEP LEARNING PREDICTION FOR EARLY RECURRENCE AND SURVIVAL IN PATIENTS WITH LOCALLY ADVANCED GASTRIC CANCER USING CT IMAGES

Jiansong Ji, MD (*Abstract Co-Author*) Nothing to Disclose
Mingzhen Chen (*Abstract Co-Author*) Nothing to Disclose
Xinyu Guo (*Presenter*) Nothing to Disclose

### PURPOSE

Early recurrence (ER) in patients with locally advanced gastric cancer (LAGC) portends aggressive biological characteristics and a dismal prognosis. To develop and validate a deep learning-based ER prediction model in patients with LAGC (DLER) using multiphase CT images along with other clinical factors, and further explore the underlying biological basis under its prediction.

### METHODS AND MATERIALS

In this retrospective multicentre study, we enrolled 594 patients with LAGC underwent curative surgery from three institutions between January 1, 2015 to March 31, 2023. Patients were divided into the training set (n = 284), internal validation set (n = 71), external test set 1 (n =155), and external test set 2 (n = 84). DenseNet169-based features of 2.5dimensional (2.5D) CT image from the primary tumour were employed to develop the DLER, and then

clinical factors were integrated within the model (DLERinteg). The discrimination performance of different models was measured by the area under the curve (AUC), accuracy, sensitivity, and specificity. The log-rank test was used to analyze early recurrence-free survival (ERFS), disease-free survival (DFS) and overall survival (OS) based on low versus high model-derived score. The genetic analysis was performed based on 41 patients with RNA-sequencing data from The Cancer Image Archive (TCIA).

**RESULTS**

Early recurrence (ER) rates were 9.9% (35/355), 16.1% (25/155) and 10.7% (9/84) in the three centers, respectively. DLER had a consistently high performance in the training set (AUC = 0.950), internal validation set (AUC = 0.852), external validation set 1 (AUC = 0.766), and external validation set 2 (AUC = 0·816). DLERinteg further improved the prediction performance with AUCs of in the four sets, respectively. In multivariable analysis, the deep learning score remained an independent predictor for early recurrence-free survival, DFS and OS ($P < 0.001$ for all). In the biological basis exploration, a high deep learning score was related with the upregulation of pathways facilitating tumour proliferation and the suppression of immune cell infiltration in the tumor microenvironment.

**CONCLUSION**

The deep learning model could allow accurate prediction of early recurrence and survival in patients with LAGC.

**CLINICAL RELEVANCE/APPLICATION**

Our approach enables noninvasive assessment of the ER, which opens the door for longitudinal monitoring response to cancer therapy and predicting cancer outcomes. Given the routine use of radiologic imaging in oncology, our approach can be extended to many other solid tumor types.

## R6-SSGI20-3 BASELINE VIRTUAL MR ELASTOGRAPHY AND EXTRACELLULAR VOLUME FRACTION IN THE PREDICTION OF RESPONSE TO NEOADJUVANT IMMUNOCHEMOTHERAPY IN GASTRIC CANCER

Ying Li (*Abstract Co-Author*) Nothing to Disclose
Liming Jiang, MD (*Abstract Co-Author*) Nothing to Disclose
Yongjian Zhu, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Although neoadjuvant immunochemotherapy (NAIC) showed great potential for improving the prognosis of gastric cancer (GC), only about 40% patients could achieve pathological response. Accurate prediction of the NAIC response is crucial for patients' benefits. To evaluate the predictive performance of virtual MR elastography (vMRE) and extracellular volume (ECV) for predicting the response to of NAIC in GC patients.

**METHODS AND MATERIALS**

Consecutive patients with pathologically confirmed gastric adenocarcinoma and received NAIC plus radical gastrectomy were prospective collected. The patients underwent three cycles of the NAIC and received radical surgery within 4 weeks of completion of NAIC. Pathologic tumor regression was assessed using the Mandard tumor regression grade (TRG) standard. All patients underwent MR examination including DWI with four b-value. T1 mapping was performed before and 5 min after contrast agent injection, using variable flip angle VIBE sequence. The shifted ADC (sADC), DWI-based virtual shear modulus (μDiff), and ECV maps were calculated via an in-house developed software written in MATLAB .Diffusion parameters were compared by Mann-Whitney U test. Logistic regression analyses were performed to construct the combined model for MTM prediction. The receiver operating characteristic (ROC) curve was performed to evaluate the prediction performance.

**RESULTS**

A total of 68 LAGC patients were finally enrolled. After gastrectomy, 44.12% were pathologic responders (Table 1). Non-responders showed a higher tumor stage ($p = 0.027$) than responders. Statistical differences were observed for histopathological type, histological grade, and Lauren type between responders and non-responders ($p < 0.05$). The differences in the vMRE and ECV parameters between the two groups are listed in Table 2 and Figure 1A-E. Table 3 and Figure 1F-K summarize and displayed the predictive performance of the parameters for discriminating responders from non-responders. sADC and μDiff exhibited the highest predictive performance with an AUC of 0.833. The combination of μDiff and ECV could further improve predictive performance to an AUC to 0.968. Figure 2 illustrative examples of vMRE and ECV imaging for a responder and non-responder, respectively.

**CONCLUSION**

Tumor stiffness determined by vMRE and ECV exhibited good performances in predicting response to NAIC and may be used to guide clinical treatment in LAGC patients.

**CLINICAL RELEVANCE/APPLICATION**

Our result revealed that DWI-based virtual shear modulus (μDiff) and ECV exhibited promising predictive ability for predicting response to NAIC. This would aid in identifying responders before treatment, reducing unnecessary toxicity and side effects, and guiding individualized treatment.

## R6-SSGI20-4 PREDICTING COMBINED POSITIVE SCORE IN ESOPHAGEAL CANCER PATIENTS USING MULTIPARAMETRIC CEST-MRI

Xin Li, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yuan Liu (*Abstract Co-Author*) Nothing to Disclose
Chuansheng Zheng, MD (*Abstract Co-Author*) Nothing to Disclose
Peng Sun, MD,MD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Ziwei Jin (*Abstract Co-Author*) Nothing to Disclose
Si Xu (*Abstract Co-Author*) Nothing to Disclose
Quan Chen (*Presenter*) Nothing to Disclose

**PURPOSE**

Combined Positive Score (CPS), based on the expression of PD-L1, has emerged as a potential predictor of immunotherapy response in various cancers, including esophageal cancer. The objective of this study is to assess the potential of multiparametric chemical exchange saturation transfer magnetic resonance imaging (CEST-MRI) in predicting CPS in patients with esophageal cancer.

**METHODS AND MATERIALS**

A prospective study was conducted on esophageal cancer patients who underwent CEST-MRI imaging between August 2023 and April 2024. Demographic and clinical data, including age, BMI, gender, tumor location, TNM staging, and pathology, were collected. CPS was calculated based on PD-L1 expression in tumor tissues. Multiparametric CEST-MRI technology yields a total of 12 quantitative parameters, including Amide, NOE, Amine, MT, DS, AmideVsAmine, MTR35, MTRrex-amide, AREX-admide, DNS-AREX, pH-weighted and AACID maps. The data are fitted using in-house MATLAB scripts. A

statistical analysis, including correlation analysis and multivariate regression, was conducted to assess the relationship between CEST-MRI parameters and CPS.

**RESULTS**

A total of 28 patients of esophageal cancer divided into 2 group (CPS <10 and CPS = 10). Significant correlations were observed between specific CEST-MRI parameters (AACID, MT, AREX-amide, DNS_AREX and MTR3.5) and CPS = 10 ($p < 0.05$). Furthermore, multivariate regression analysis demonstrated the independent predictive value of CEST-MRI parameters for CPS.

**CONCLUSION**

Multiparametric CEST-MRI has the potential to serve as a non-invasive imaging modality for predicting CPS in patients with esophageal cancer.

**CLINICAL RELEVANCE/APPLICATION**

The correlation between CEST-MRI parameters and CPS indicated that CEST-MRI may be a useful tool in guiding immunotherapy strategies and patient management. Further prospective studies are required to validate these findings and elucidate the clinical utility of CEST-MRI in a personalized treatment approach for esophageal cancer.

## R6-SSGI20-5 RADIOGRAPHIC CHARACTERIZATION TO NONINVASIVELY DIFFERENTIATE TRUE DISEASE PROGRESSION FROM PSEUDOPROGRESSION IN LYMPH NODES

Qingling Zhang (*Abstract Co-Author*) Nothing to Disclose
Ziyu Ning (*Abstract Co-Author*) Nothing to Disclose
Yihuai Hu, MD (*Abstract Co-Author*) Nothing to Disclose
Zaiyi Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Chenyi Xie, BMBS, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The therapeutic landscape for locally advanced esophageal squamous cell carcinomas (ESCC) is remarkably evolving. This study aims to differentiate lymph nodal disease progression from immune-activated responses by systematically analyzing sematic imaging features based on routine workup and re-assessment CT images

**METHODS AND MATERIALS**

We retrospectively enrolled 232 ESCC patients receiving neoadjuvant immunochemotherapy (nICT) plus surgery from three medical centers. CT images were evaluated by experienced radiologists and enlarged LNs after immunotherapy were further analyzed for size measurement and morphological appearances. Subsequently, we correlated radiological features with well-established clinicopathological characteristics and overall survival for clinical significance. Last, we profiled lymph nodal T cell abundance and spatial distribution by using the multiplexed immunofluorescence (mIHC) profile to explore the potential mechanisms in radiologically LN enlargement.

**RESULTS**

The nICT yielded radiologically enlarged LN in 60/232 (25.9%) of patients. We observed that changes in long-axis diameters, the imaging-identified extranodal extensions, and shapes are predictive for LN involvement status. A cutoff value of <32% change in the long axis was a significant predictor of malignancy (AUC = 0.709). The presence of enlarged metastatic LNs is independently associated with poor overall survival for ESCC receiving nICT (hazard ratio: 2.25 [95% CI: 1.16,4.35], $P < 0.001$). The benign enlargements are more likely to occur in patients with favorable prognostic biomarkers receiving nICT. The mIHC staining reveals differences in the composition of T helper and T cytotoxic cells between the metastatic and nonmetastatic groups. The enlarged uiLNs presented more prominent elevated PD-1 expression in the germinal follicles and highly proliferative CD4+ T cells.

**CONCLUSION**

The systematic assessment of LNs in ESCC responses to ICIs remains inadequately defined. This study represents the initial preliminary report documenting radiologically enlarged regional and distant LN in locally advanced ESCC subjected to nICT. We emphasize the critical importance of a precise evaluation approach for suspected progression LNs following nICT before finalizing treatment decisions. We expected that the multidimensional evaluation of tumor-draining LNs in this study might facilitate the improved decision-making in clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

Radiologist-evaluated semantic features continue to have diagnostic values in differentiating metastatic status of tumor-draining lymph nodes, revealing the potential mechanism and clinical significance of immune-related responses in ESCC.

## R6-SSGI20-6 BASELINE HIGH-RESOLUTION MRI FOR PREDICTING PROGNOSIS IN PATIENTS WITHLOCALLY ADVANCED ESOPHAGEAL SQUAMOUS CARCINOMA UNDERGOINGDEFINITIVE CHEMORADIATION THERAPY

Linlin Wang, MEd, MEd (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to assess the performance of baseline high-resolution MRI in predicting progression-free survival (PFS) among patients with locally advanced esophageal squamous cell carcinoma (ESCC) treated with definitive chemoradiation therapy (CRT).

**METHODS AND MATERIALS**

We retrospectively analyzed 30 patients with locally advanced ESCC between June 2019 and May 2021. Pretreatment high-resolution MRI data were comprehensively evaluated. Multivariate Cox proportional hazards models were employed to identify independent prognostic factors. Time-dependent receiver operating characteristic (ROC) curve analysis was performed to assess the prognostic accuracy of the MRI model. Survival analysis was calculated using the Kaplan-Meier method and log-rank tests.

**RESULTS**

In multivariate Cox regression analysis, tumor thickness (HR 1.20, 95% CI 1.01-1.43, $P = 0.036$), the evaluation of aorta invasion [clear boundary, suspicious involvement (HR 4.20, 95% CI 1.01-17.40, $P = 0.048$), definite involvement (HR 11.00, 95% CI 1.20-101.00, $P = 0.034$)], and the change ratios of signal intensity of lymph nodes in the delayed enhancement phase (HR 0.04, 95% CI 0.01-0.31, $P = 0.002$) were significant prognostic factors for PFS. The MRI model exhibited excellent prognostic accuracy, with AUC values of 0.924 and 0.920 for 1-year and 3-year PFS, respectively. Kaplan-Meier analysis demonstrated that patients in the high-risk group exhibited significantly poorer PFS than those in the low-risk group (log-rank test, $P < 0.001$).

## CONCLUSION

Baseline high-resolution MRI could predict the prognosis of locally advanced ESCC patients receiving CRT.

## CLINICAL RELEVANCE/APPLICATION

This MRI model had the potential to guide clinical decision-making and achieve individualized treatment for patients with locally advanced esophageal cancer.

# Abstract Archives of the RSNA, 2024

R6-SSGU07

**Genitourinary Imaging (Miscellaneous)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: E353B

Katherine M. Krajewski, MD (*Moderator*) Research Grant, General Electric Company;Spouse, Employee, Ironwood Pharmaceuticals, Inc
Tharakeswara K. Bathala, MD, MS (*Moderator*) Nothing to Disclose

**Sub-Events**

## R6-SSGU07-2 DEVELOPING A ROBUST DEEPLEARNING MODEL FOR ADRENAL GLAND SEGMENTATION IN LARGE-SCALE NON-CONTRAST CT IMAGES

Tuo Zhang (*Abstract Co-Author*) Nothing to Disclose
Feng Shi (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Yinghui Ge (*Abstract Co-Author*) Nothing to Disclose
Yuwei Xia (*Abstract Co-Author*) Nothing to Disclose
Fanxing Meng (*Presenter*) Nothing to Disclose

### PURPOSE

Quantifying the adrenal glands is crucial for research into related diseases, as they are vital endocrine organs in the human body. The challenge of accurately segmenting adrenal glands due to their changing positions, size and low contrast in non-contrast CT examinations. The purpose of our study is to overcome these challenges by developing a non-contrast CT-based deep learning algorithm for precise adrenal gland segmentation.

### METHODS AND MATERIALS

This retrospective study included 1,220 CT examinations. The data were further divided to training set (n= 960), test set (n=240) and inter-reader set (n=20). Furthermore, an independent test set (n=81) were also collected. Two radiologists manually segmented the adrenal parenchyma of each side in axial images, and then these results were checked and modified by a senior radiologist. For the inter-reader set, five board-certified radiologists provided annotations on a subset of 20 random cases, performed in a multi-blind manner. A 3D nnU-net based model was utilized to build an automatic segmentation model of the adrenal glands from the CT scans, enabling automatic positioning, volume, and diameter quantitative analysis of the left and right adrenal glands. Model performance was assessed through Dice Similarity Coefficient (DSC), Hausdorff Distance (HD), and Average Symmetric Surface Distance (ASSD). In light of the need for robust validation, we further evaluated the performance of our segmentation model by gauging its consistency against the expertise of human radiologists.

### RESULTS

The developed segmentation models yielded median DSC scores of 0.899 and 0.904 for the left and right adrenal glands respectively in the test set, and similar scores of 0.900 for the left and 0.896 for the right gland in the independent test set. Furthermore, no significant difference was found between inter-reader DSC for manual segmentation by radiologists and the automatic segmentation by our machine (P=0.541). It has showcased a superior degree of adaptability and precision compared to enhanced CT-based models.

### CONCLUSION

This robust deep learning model provides a quick and precise method to measure adrenal quantitative parameters.

### CLINICAL RELEVANCE/APPLICATION

This automatic process has the capacity to screen patients with abnormal adrenal manifestations (such as adrenal enlargement) during regular CT examinations. The automaticity and precision of this model could enhance clinical diagnosis and decision-making. Given the potential impact on renal healthcare, further validations of the proposed model in multi-center studies with a larger sample volume will increase its robustness and applicability in the real-world setting.

## R6-SSGU07-3 UNLOCKING THE MYSTERY: BODY COMPOSITION TWEAKS REVEALED IN CT IMAGING - MACS AND NFAI IN ADRENAL INCIDENTALOMAS. WHAT TO DO?

Emilio Quaia, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Alessia Pepe, MD (*Abstract Co-Author*) Nothing to Disclose
Filippo Crimi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Chiara Zerbato (*Abstract Co-Author*) Nothing to Disclose
Giovanni Sussan, MD (*Abstract Co-Author*) Nothing to Disclose
Filippo Ceccato (*Abstract Co-Author*) Nothing to Disclose
Irene Tizianel (*Abstract Co-Author*) Nothing to Disclose
Carlo D'Alessandro, MD (*Abstract Co-Author*) Nothing to Disclose
Emilia Giugliano, MD (*Abstract Co-Author*) Nothing to Disclose

Francesco Bigolin, MD (*Abstract Co-Author*) Nothing to Disclose
Matteo Scordari, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Adrenal incidentalomas (AI) are adrenal masses found during unrelated imaging procedures. Roughly 50% are classified as non-functioning adrenal incidentalomas (NFAI), while 30 to 50% as exhibit mild autonomous cortisol secretion (MACS). According to the clinical guidelines from the European Society of Endocrinology, surgery might be considered as an option for patients with significant co-morbidities who have MACS, with careful consideration of individual factors. Our aim was to investigate whether a more prompt and specific approach to surgery could be applied to differentiate between MACS and NFAI.

**METHODS AND MATERIALS**

We examined 117 patients with AI. 54 patients with MACS were compared with 63 patients with NFAI. CT scans were conducted on patients with MACS at baseline and following a median duration of 5 years, while patients with NFAI underwent CT scans at baseline and after a median duration of 4.1 years. Measurements were performed at the 3rd lumbar spine level. We analyzed total body surface and body circumference, total fat area (TFA), visceral and parietal areas (VFA, PFA), visceral-total and visceral- parietal ratios, muscle surface and perimeter. Additionally, liver, spleen, muscle, and bone attenuation were registered. For our analysis, we utilized ImageJ, a Java-based software derived from NIH Image. Statistical comparisons were conducted using Student's t-test or Mann-Whitney test.

**RESULTS**

In the MACS group, our analysis revealed a statistically significant increase in total body area (Median pre 710cm2, IQR 584-829; Median post 765cm2, IQR 615-867; p=0.03) and in visceral fat (Median pre 174cm2, IQR 113-278; Median post 183cm2, IQR 133-276; p=0.05), a reduction in mean densitometry of the spleen (Median pre 47.1HU, IQR 42-51; Median post 45.3HU; IQR 40-48; p=0.02), and a decrease in densitometry at the L1 level (Median pre 106HU, IQR 84-142; Median post 100HU, IQR 76-134; p=0.02). Conversely, in the NFAI group, our analysis did not reveal any statistically significant difference between the baseline and follow-up CT scans concerning the total body area, the visceral fat, and the HU of the spleen, while, we identified a statistically significant reduction of the mean densitometry at the L1 level (Median pre 125HU, IQR 100-159; Median post 114HU, IQR 86-159; p=0.04).

**CONCLUSION**

Surgery should be considered as the primary treatment option for MACS in order to reduce cardiovascular, stroke, and osteoporotic risks.

**CLINICAL RELEVANCE/APPLICATION**

Analyzing body composition alterations via CT scans aids in better patient management, guiding surgical decisions and reducing cardiovascular and stroke risks.

## R6-SSGU07-5 APPLICATION VALUE OF CT LYMPHANGIOGRAPHY IN THE GRADING OF PRIMARY CHYLURIA

Qi Hao (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the value of CT lymphangiography (CTL) in the grading of primary chyluria.

**METHODS AND MATERIALS**

The clinical and CTL imaging data of 77 patients diagnosed with primary chyluria were collected retrospectively.Referring to the clinical grading criteria,seventy-seven patients were divided into mild and severe groups, and CTL indexes were recorded separately for each group.CTL indexes include: Abnormal deposition of lipiodol in the urinary system, chest, abdomen and pelvis, image manifestations of the two groups were statistically analyzed. ?2 test was used for counting data, and independent sample t test was used for measurement data. $P < 0.05$ was considered statistically significant.

**RESULTS**

Among 77 cases of primary chyluria, 27 cases were in mild group and 50 cases were in severe group. Among the 27 patients with mild primary chyluria, CTL showed abnormal deposition of iodide in renal parenchyma in 10 cases (37.0%), perivascular in 23 cases (85.2%), subcapsular in 2 cases (7.4%), extracapsular in 7 cases (25.9%), adiposicular in 8 cases (29.6%), adrenal in 5 cases (18.5%), and extracapsular in 6 cases (22.2%). There were 6 cases in bladder (22.2%) and 1 case in peribladder (14.8%). Among the 50 patients with severe primary chyluria, CTL showed abnormal deposition of iodide in renal parenchyma in 25 cases (50.0%), perivascular in 47 cases (94.0%), subcapsular in 2 cases (4.0%), extracapsular in 14 cases (28.0%), adiposicular in 6 cases (12.0%), adrenal in 7 cases (14.0%), and extracapsular in 4 cases (8.0%). There were 23 cases (46.0%) within the bladder and 8 cases (16.0%) around the bladder.The difference of whole kidney type was statistically significant (P=0.009), and the incidence of severe group (68.0%) was higher than that of mild group (37.0%).There were statistically significant differences in abnormal lipiodol deposition in renal parenchyma and bladder between 2 groups ($P < 0.05$), and the incidence of abnormal lipiodol deposition in severe group was higher than that in mild group.

**CONCLUSION**

CTL can show the distribution, extent and severity of abnormal dilated lymphatic vessels in primary chyluria, and the abnormal distribution of iodide in kidney and bladder has clinical significance for the classification of primary chyluria.In addition, it can also show systemic lymphatic abnormalities.

**CLINICAL RELEVANCE/APPLICATION**

CTL can provide an important image basis for the diagnosis,classification and treatment of primary chyluria.

## R6-SSGU07-6 RETROSPECTIVE ANALYSIS OF ANNUAL TRENDS IN PROSTATE CANCER GRADING: A COMPREHENSIVE RESEARCH STUDY

Robert E. Reiter, MD (*Abstract Co-Author*) Nothing to Disclose
Holden H. Wu, PhD (*Abstract Co-Author*) Institutional research support, Siemens AG
Steven S. Raman, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Merck & Co, Inc;Consultant, Amgen Inc;Consultant, Profound Medical Inc
William Hsu, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyunghyun Sung, PhD (*Abstract Co-Author*) Nothing to Disclose
Sohaib Naim, MSc (*Presenter*) Nothing to Disclose

## PURPOSE

This study aims to examine the impact of evolving prostate cancer (PCa) screening guidelines for a patient population with both multiparametric MRI (mpMRI) and histopathological (HP) data by analyzing annual PCa grade distribution, detection rate (DR), and positive predictive value (PPV) trends.

## METHODS AND MATERIALS

For this retrospective study, our study group consisted of 902 male subjects whose data was collected at our single institution between 2010 and 2021. Eligibility criteria for this study included available clinicodemographic data, mpMRI scans acquired via standardized protocol, and prostate whole-mount HP (WMHP), all retrieved with HIPPA and IRB approval. Genitourinary (GU) pathologists and GU radiologists performed monthly matching workflows to determine concordance for detected and graded PCa true positive (TP), false negative (FN), and false positive (FP) lesions. Information from TP, FN, and FP lesions were used to calculate DRs and PPVs for every patient. All TP, FN, and FP lesions were then grouped by acquisition year to estimate annual trends. Reviewed clinical features included mean and standard deviation for subject age, PSA level, prostate volume, PSA density, and MRI lesion size. All PCa grading guidelines were issued by PI-RADS for mpMRI lesions and ISUP for WMHP lesions. A weighted chi-square test correlated statistical differences for DR and PPV at each annual cutoff point.

## RESULTS

Annual trends are presented for MRI, WMHP, clinical, and statistical findings. Total MRI scans acquired per year gradually increases from 2010-2013 before stabilizing from 2014 onwards and peaking in 2015. The same trend is reflected for PI-RADS grades, where from 2010-2013 there is a gradual increase in grades 3-5 lesions per year. Although grades 4 and 5 lesions stabilize from 2014 onwards, grade 3 lesions gradually decrease. ISUP annual trends reflect PI-RADS trends, showing steady growth in total findings from 2010-2013 at every grade. Like PI-RADS grade 3 lesions, ISUP lesions grade 1 gradually decrease 2014 onwards whereas grade 2-5 lesions per year stabilize. Included clinical features were largest in 2018 and 2020, and our statistical findings showed DR and PPV before and after 2018 and 2014, respectively, were the most significantly different.

## CONCLUSION

Our study has confirmed significant DR and PPV differences for several annual groupings while also confirming the impact of evolving PCa screening guidelines through annual PI-RADS and ISUP grading trends for TP, FN, and FP lesions, all of which should be closely monitored for prospective studies.

## CLINICAL RELEVANCE/APPLICATION

Understanding annual PCa grading and clinical trends can lead to key findings that can contribute to improving PCa diagnosis rates and screening guidelines.

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# Abstract Archives of the RSNA, 2024

R6-SSMK12

**Musculoskeletal Imaging (Tumors of Bone, Tumors of Soft Tissue)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: E450A

Rosemary J. Klecker, MD (*Moderator*) Nothing to Disclose
Benjamin Fritz, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R6-SSMK12-1 FUTILITY OF PREOPERATIVE US-GUIDED SENTINEL LYMPH NODE BIOPSY IN ACRAL MELANOMA: A 5-YEAR RETROSPECTIVE STUDY

Jung Han Kim (*Abstract Co-Author*) Nothing to Disclose
Kee-Taek Jang, MD (*Abstract Co-Author*) Nothing to Disclose
Harim Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Sang-Hee Choi, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Preoperative evaluation of nodal status is crucial for treatment and prognosis in acral melanoma patients. While clinical guidelines for surgical sentinel lymph node biopsy (SLNB) are well established, clinical indications for preoperative sentinel lymph node ultrasound (US) and US-guided SLNB are relatively obscure. This study explores clinical usefulness of preoperative sentinel lymph node US and US-guided SLNB.

### METHODS AND MATERIALS

In this single-center retrospective study, 90 acral melanoma patients who underwent both preoperative sonographic lymph node evaluation and surgical lymph node dissection were identified from 2015 to 2018. Patients were categorized into four groups based on the preoperative US findings and the performance of US-guided SLNB. Preoperative US score was measured by presence of loss of hilar fat, cortical irregularity, increased cortical echogenicity, increased cortical Doppler, and mass-forming morphology. The medical records including body mass index (BMI), pathologic report and images were reviewed. The survival of groups was analyzed with the preoperative US findings and the performance of preoperative US-guided SLNB. Subgroup analysis was performed for surgical SLNB negative patients to find out risk factors for 5-year recurrence. Uni- and multivariable analysis including Cox regression were performed to identify risk factors for 1- and 5-year recurrence and death within 5 years.

### RESULTS

Regardless of preoperative US abnormality, US-guided SLNB did not yield difference in patient survival ($p = 0.346$ and 0.556 respectively). Higher US score correlated with both 1- and 5-year recurrence ($p = 0.002$ and 0.013 respectively), and hematogenous metastasis within 5 years after surgery ($p = 0.008$). The thickness of tumor and lymphatic metastasis at initial surgery was related to local tumor recurrence within 5 years after surgery ($p = 0.001$ and 0.002 respectively). Tumor size and the presence of hematogenous metastasis ($p = 0.002$, and 0.003 respectively) were closely correlated with 5-year survival. In subgroup analysis, the thickness of tumor was statistically significant factor for 5-year recurrence after surgery among surgical SLNB negative patients ($p = 0.0013$). Preoperative BMI did not show any significant correlation with recurrence nor metastasis.

### CONCLUSION

Preoperative US-guided SLNB did not affect the postoperative patient prognosis. However, applying preoperative US scoring criteria can help predict 1- and 5-year recurrence.

### CLINICAL RELEVANCE/APPLICATION

Preoperative US-guided SLNB is not necessary for identification of micro-metastasis as it does not affect patient prognosis. However, preoperative sentinel lymph node US has clinical value in that it helps predict 1- and 5-year recurrence.

## R6-SSMK12-2 MRI OF ATYPICAL LIPOMATOUS TUMOR: DOES GADOLINIUM HELP? A MULTICENTER STUDY

Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sonia Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Cyrus Bateni, MD (*Abstract Co-Author*) Nothing to Disclose
Fatma Sen, MD (*Abstract Co-Author*) Nothing to Disclose
Michelle Zhang, MD,FRCPC (*Abstract Co-Author*) Nothing to Disclose
MICHELE GUINDANI (*Abstract Co-Author*) Nothing to Disclose
Lorenzo Nardo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD (*Abstract Co-Author*) Research Consultant, General Electric Company
Ahmed W. Moawad, MD (*Abstract Co-Author*) Nothing to Disclose
Yasser Abdelhafez, MD (*Abstract Co-Author*) Nothing to Disclose
Nimu Yuan, PhD (*Abstract Co-Author*) Nothing to Disclose

Felipe Godinez (*Abstract Co-Author*) Nothing to Disclose
Hande Nalbant, MD, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic performance of Magnetic Resonance Imaging (MRI) with and without gadolinium-based contrast agents (GBCA) for differentiating atypical lipomatous tumor (ALT) from benign lipoma (BL) in a large dataset.

**METHODS AND MATERIALS**

This multicenter (5 different institutions) retrospective study included subjects with a histopathologic diagnosis of BL or ALT and a preoperative MRI study with contrast.A musculoskeletal radiologist of 10 years of experience reviewed all the images in two sessions (at least 4 weeks apart), the first session with non-contrast only, and the second session, including postcontrast sequences.At each session the radiologist scored the probability of being ALT or BL using as a binary decision and as a 5-point grading scale to mimic the clinical reporting language (Fig. 1). Pathology reports were used as the gold standard.McNemar's test was used to evaluate the statistical significance of the differences in sensitivity and specificity. Intraclass correlation coefficient (ICC) was used to compare the ordinal diagnostic scores.

**RESULTS**

466 cases (228 ALT, 238 SL) were eligible for analysis.In the first session (no contrast- WOC), 239 lesions were assessed as BLs (77.4% were true negative) and 227 lesions were assessed as ALTs (76.7% were true positive).In the second session (with contrast images -WC), 234 lesions were assessed as BLs (77.8% were true negative) and 232 lesions were assessed as ALTs (75.9% were true positives).The agreement on assigning the exact score between the two sessions, as measured by ICC, was 0.883 (95%CI: 0.863 - 0.901).There were no significant differences between the two readings in sensitivity or specificity on analysis.

**CONCLUSION**

Our study demonstrated no significant difference in radiologic readings between with contrast and without contrast MRIs in the assessment of BL and ALT.

**CLINICAL RELEVANCE/APPLICATION**

Most MRI examinations include post contrast sequences to improve image quality. On the other hand, GBCAs may cause some adverse reactions such as allergic reaction, nephrogenic systemic fibrosis or long-term accumulation in the organs including bones and brain. Therefore, the use of contrast administration should be carefully prescribed, especially when the clinical indication is differentiation between BL vs ALT.

## R6-SSMK12-3 REVISED BONE REPORTING AND DATA SYSTEM (BONE-RADS): PERFORMANCE AND RELIABILITY COMPARED WITH THE ORIGINAL BONE-RADS

Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The Bone Reporting and Data System (Bone-RADS) has some limitations due to biased clinical factors. We aimed to propose a revised Bone-RADS and to compare its diagnostic performance and inter-reader reliability with the original algorithm for solitary bone lesions on CT.

**METHODS AND MATERIALS**

This retrospective analysis included 159 patients (mean age, 56 ± 19 years; 88 men) who underwent bone biopsies between March 2005 and September 2021. Patients with solitary bone lesions on CT and sufficient histopathology results were included. In the revised Bone-RADS, the criteria of pain attributable to the lesion and a history of malignancy were omitted. Two radiologists categorized the bone lesions in the original and revised Bone-RADS (1, likely benign; 4, suspicious for malignancy or need for treatment). The diagnostic performance of the Bone-RADS was calculated using histopathology results as a standard reference and compared with each other. Inter-reader reliability was assessed.

**RESULTS**

Bone lesions were categorized into two groups: 96 lucent and 63 sclerotic/mixed lesions. For the original and revised Bone-RADS in reader 1, algorithms in lucent lesions demonstrated sensitivities of 93% and 93%, specificities of 11% and 50%, positive predictive values of 72% and 82%, negative predictive values of 38% and 74%, and accuracies of 69% and 80%, respectively. In sclerotic/mixed lesions, they exhibited sensitivities of 73% and 65%, specificities of 32% and 92%, positive predictive values of 43% and 85%, negative predictive values of 63% and 79%, and accuracies of 49% and 81%, respectively. For the original and revised Bone-RADS in reader 2, algorithms in lucent lesions showed sensitivities of 82% and 94%, specificities of 11% and 46%, positive predictive values of 69% and 81%, negative predictive values of 20% and 76%, and accuracies of 61% and 80%, respectively. In sclerotic/mixed lesions, they had sensitivities of 69% and 73%, specificities of 32% and 86%, positive predictive values of 42% and 79%, negative predictive values of 60% and 82%, and accuracies of 48% and 81%, respectively. Inter-reader reliability in the revised algorithm was higher than in the original algorithm (? = 0.744 vs. 0.854).

**CONCLUSION**

In comparison with the original Bone-RADS, the revised Bone-RADS demonstrated increased specificity and accuracy while maintaining sensitivity.

**CLINICAL RELEVANCE/APPLICATION**

The original Bone-RADS has some limitations, where there are many ambiguous cases distinguishing whether the pain is caused by the tumor itself or by general condition such as internal degeneration or trauma. Revised Bone-RADS, excluding clinical factors from original Bone-RADS, performed better in evaluating solitary bone tumor on CT.

## R6-SSMK12-4 DETECTIVE ABILITY OF PH IN OSTEOSARCOMA MICROENVIRONMENT USING CHEMICAL EXCHANGE SATURATION TRANSFER(CEST) IMAGING

Songtao Ai (*Abstract Co-Author*) Nothing to Disclose
Zhengjia Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

The aim of this study is to investigate the ability of ioversol chemical exchange saturation transfer (CEST) imaging in detecting pH in the microenvironment of rat osteosarcoma.

**METHODS AND MATERIALS**

In vitro, we used 15 phantom tubes filled with PBS solution with different pH and different concentration of ioversol to verified the relation between pH and CEST ratiometric values. And in vivo, ten rats were used to test whether ioversol could be used as contrast agent for pH imaging on osteosarcoma. Rat osteosarcoma cells were injected subcutaneously into the hind limbs of SD rats. 2 weeks after cell implantation, the rats were scanned by a 3T MR system with a 32-channel head coil. For 9 out of 10 rats, ioversol (4g I/kg body weight) was injected through tail vein. CEST images were acquired using a 2d turbo spin echo sequence with the saturation duration of 1.5s and saturation powers of 1μT and 3μT. All CEST images were postprocessed via MATLAB. The pH weighted ratiometric values were calculated by the ratio of MTRasym (3.5 ppm) in 1 μT to MTRasym (3.5 ppm) in 3 μT using a custom Matlab code.

**RESULTS**

To test whether CEST imaging could distinguish the ioversol solutions at different pH level, 10 tubes of 30mM ioversol at pH 5.0 to 8.2 were used. The result showed that the pH value and CEST effect were linearly correlated in the pH range of 5.8-7.0 ($R2=0.86$, $p<0.0001$). To test the relationship between ioversol concentration and ratiometric value, 5 tubes of pH 7.2 with different ioversol concentrations (30, 50, 70, 90, 110 mM) were prepared, the result showed that the ratiometric values of ioversol solution were not concentration-dependent on in the concentration range tested. In addition, the results of rat osteosarcoma models showed that the calculated ratiometric value of the majority of the tumor region was relatively low, suggesting the acidic and solid part of the tumor, while there was also small region with high value, suggesting the necrotic and cystic portion of the tumor. This finding was confirmed by histopathology.

**CONCLUSION**

Our findings provide the first evidence that ioversol-enhanced CEST imaging can actually measure pH-related ratiometric value in osteosarcoma in a concentration-independent manner, with excellent spatial resolution. Furthermore, the CEST effect is heterogeneous in the tumor ROI, it can be expected to become one of the methods for early evaluation of the effect of preoperative neoadjuvant chemotherapy in cancer patients.

**CLINICAL RELEVANCE/APPLICATION**

By using CEST imaging, the status of osteosarcoma can be correlated with the actual pH value. CEST imaging potentially can be a novel method for assessing the early effect of preoperative neoadjuvant chemotherapy in the future.

## R6-SSMK12-5 NESTED HABITAT ANALYSIS BASED ON MRI FOR THE PREDICTION OF PROGRESSION-FREE SURVIVAL IN AGGRESSIVE SPINAL TUMOR

Tongyu Wang (*Abstract Co-Author*) Nothing to Disclose
Dapeng Hao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yang Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Ning Lang, MD (*Abstract Co-Author*) Nothing to Disclose
Qizheng Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the feasibility of MRI-based Nested Habitat Radiomics for predicting the progression-free survival (PFS) of aggressive spinal tumors to aid early personalized treatment decisions.

**METHODS AND MATERIALS**

Clinical, pathological and imaging data of 211 patients underwent spinal tumor resection from March 2010 and January 2021 were retrospectively analyzed. The primary outcome was 3-year PFS. Fuzzy C-means algorithm was used to perform clustering on T1-weighted images (T1WI) and T2-weighted images (T2WI) to segment ROIs of the lesions. Then a Nested Habitat Analysis Method was employed to evaluate the heterogeneity of the lesions. For the first round of habitat analysis, a Support Vector Machine (SVM) is then developed to classify the lesions based on global features extracted from ROIs. Following the global analysis, the local radiomics features were extracted from smaller patches inside ROIs of patients with poor prognosis. We applied this SVM model to these local features to generate probability maps that indicate areas of potential aggressiveness, followed by k-means clustering to segment the ROIs into 2 sub-ROIs. Then an updated SVM model were trained to identify these sub-ROIs of poor prognosis. For each poor prognosis patients, another round of habitat analysis was applied and each of sub-ROI was divided into 2 micro-ROIs using k-means clustering. The final radiomics model were established based on the each patient's mico-ROI with highest probability. A nomogram was developed by radiomics signatures and the clinical independent parameter for personalized PFS prediction. The performance was primarily evaluated using the area under the receiver operating characteristics curve (AUC) via the DeLong test. Meanwhile, survival analysis was conducted to explore the hierarchical guidance significance.

**RESULTS**

Compared with texture features extracted from the whole tumor, the features generated by the Nested Habitat method can better predict the recurrence ($p < 0.05$). At the same time, the Habitat model combined with clinical characteristics showed best performance in postoperative PFS evaluation, with AUC of 0.93 and 0.88 in the training and external test cohort, respectively. Kaplan-Meier survival analysis showed the Nested Habitat Rad-score were independent risk factors for 3-year PFS.

**CONCLUSION**

The Nested Habitat Rad-score is a noninvasive imaging predictor that could guide the stratification of prognosis in aggressive spinal tumor.

**CLINICAL RELEVANCE/APPLICATION**

The Nested Habitat model to predict PFS could be useful in clinical decision-making associated with personalized selection of surgical interventions and therapeutic options for patients with aggressive spinal tumor as a noninvasive and less costly approach.

## R6-SSMK12-6 DIAGNOSTIC PERFORMANCE AND INTER-READER RELIABILITY OF BONE REPORTING AND DATA SYSTEM (BONE-RADS) ON COMPUTED TOMOGRAPHY

Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose

Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic performance and inter-reader reliability of the Bone Reporting and Data System (Bone-RADS) for solitary bone lesions on CT.

**METHODS AND MATERIALS**

This retrospective analysis included 179 patients (mean age, 56 ± 18 years; 94 men) who underwent bone biopsies between March 2005 and September 2021. Patients with solitary bone lesions on CT and sufficient histopathology results were included. Two radiologists categorized the bone lesions using the Bone-RADS (1, benign; 4, malignant). The diagnostic performance of the Bone-RADS was calculated using histopathology results as a standard reference. Inter-reader reliability was calculated.

**RESULTS**

Bone lesions were categorized into two groups: 103 lucent (pathology: 34 benign, 12 intermediate, 54 malignant, and 3 osteomyelitis) and 76 sclerotic/mixed (pathology: 46 benign, 2 intermediate, 26 malignant, and 2 osteomyelitis) lesions. The Bone-RADS for lucent lesions had sensitivities of 95% and 82%, specificities of 11% and 11%, and accuracies of 57% and 50% for readers 1 and 2, respectively. The Bone-RADS for sclerotic/mixed lesions had sensitivities of 75% and 68%, specificities of 27% and 27%, and accuracies of 45% and 42% for readers 1 and 2, respectively. Inter-reader reliability was moderate to very good (? = 0.744, overall; 0.565, lucent lesions; and 0.851, sclerotic/mixed lesions).

**CONCLUSION**

Bone-RADS has a high sensitivity for evaluating malignancy in lucent bone lesions and good inter-reader reliability. However, it has poor specificity and accuracy for both lucent and sclerotic/mixed lesions. A possible explanation is that proposed algorithms heavily depend on clinical features such as pain and history of malignancy.

**CLINICAL RELEVANCE/APPLICATION**

Bone-RADS has the merits of high sensitivity and inter-reader reliability, but it showed poor specificity and accuracy. We speculate that Bone-RADS heavily depend on clinical factors such as pain. Further studies comparing the performance of the original with the revised algorithm, excluding clinical factors, are needed.
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# Abstract Archives of the RSNA, 2024

R6-SSNMMI08

**Nuclear Medicine and Molecular Imaging (Miscellanous)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: S405

Sophia R. O'Brien, MD, MEd (*Moderator*) Nothing to Disclose
Elizabeth H. Dibble, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R6-SSNMMI08-1 HYBRID CMR/FDG-PET IMAGING FOR DETECTION AND DIFFERENTIATION OF MYOCARDIAL INJURY IN PATIENTS WITH LONG COVID

Konstantin Nikolaou, MD, MBA (*Abstract Co-Author*) Advisory Panel, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Advisory Panel, Bayer AG;Speakers Bureau, Bayer AG;Research Grant, Bayer AG
Helmut Dittmann (*Abstract Co-Author*) Nothing to Disclose
Christian La Fougiere (*Abstract Co-Author*) Nothing to Disclose
Meinrad Gawaz, MD (*Abstract Co-Author*) Nothing to Disclose
Jan M. Brendel (*Abstract Co-Author*) Nothing to Disclose
Simon Greulich (*Abstract Co-Author*) Nothing to Disclose
Patrick Krumm, MD (*Presenter*) Speakers Bureau, Siemens AG

### PURPOSE

To assess the diagnostic value of combined hybrid cardiac magnetic resonance (CMR) and 18F-fluorodeoxyglucose positron emission tomography (FDG-PET) for the detection and differentiation of chronic active versus healed myocardial injury in patients with a history of confirmed SARS-CoV-2 infection and persistent symptoms.

### METHODS AND MATERIALS

Twenty-six patients presenting with persistent symptoms since the onset of COVID-19 infection, with a median symptom duration of 7.5 months and a mean age of 39 ± 12 years (50% female), were prospectively enrolled in this study. Following dietary preparation for the suppression of myocardial glucose metabolism, patients underwent evaluation using a 3 Tesla hybrid PET/MR scanner. The CMR protocol comprised T1 and T2 mapping, assessment of myocardial function, and LGE imaging. Myocardial FDG uptake was categorized as negative (successful suppression), positive (focal or focal-on-diffuse uptake), or excluded if diffuse and homogenous myocardial FDG uptake exceeded liver uptake and affected the entire left ventricle, suggesting unsuccessful suppression. FDG uptake was quantified as the ratio of normal myocardium to blood pool (TBRmax) and the ratio of target to normal myocardium (TNMRmax).Chronic active myocardial injury was assumed if both PET and CMR findings were positive, healed myocardial injury if PET was negative but CMR findings were positive, and no myocardial injury if patients were CMR-negative regardless of PET findings.

### RESULTS

Myocardial FDG uptake was successfully suppressed in all patients with TBRmax 1 ± 0.2. Chronic active myocardial injury with focal FDG uptake was diagnosed in 9 (35%) patients, healed myocardial injury in 8 (30%) patients, and no myocardial injury in 9 (35%) patients. TNMRmax was significantly higher in patients with chronic active myocardial injury 2.6 ± 0.9 vs. healed or no myocardial injury 1.1 ± 0.2 ($p<0.0001$). Left ventricular ejection fraction was preserved overall (66 ± 5%). Non-ischemic LGE was present in 8 (31%) patients, while T1 mapping abnormalities were observed in 16 (62%) patients and T2 mapping abnormalities in 15 (58%) patients.

### CONCLUSION

The combined CMR/FDG-PET imaging approach appears to be valuable not only for the detection of myocardial injury but also for the differentiation between chronic active and healed myocardial injury in patients with long COVID.

### CLINICAL RELEVANCE/APPLICATION

Combined CMR/FDG-PET holds promise in evaluating myocardial injury in long COVID, potentially guiding management decisions and long-term monitoring strategies.

## R6-SSNMMI08-2 ASSESSING PRECISION IN HEPATOCELLULAR CARCINOMA (HCC) TREATMENT RESPONSE ASSESSMENT: INTER-READER AND INTRA-READER RELIABILITY USING $^{68}$GA PSMA PET/CT VERSUS CROSS-SECTIONAL IMAGING

Aashna M. Karbhari, MD (*Abstract Co-Author*) Nothing to Disclose
Ajit H. Goenka, MD (*Abstract Co-Author*) Nothing to Disclose
Scott M. Thompson, MD, PhD (*Abstract Co-Author*) Research Consultant, Boston Scientific Corporation
Kamaxi H. Trivedi, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Nguyen H. Tran, MD (*Abstract Co-Author*) Research Consultant, BridgeBio Pharma
Sovanlal Mukherjee, PhD (*Abstract Co-Author*) Nothing to Disclose

Nandakumar Patnam, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Ajith Antony, MBBS, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Precise HCC treatment response evaluation is vital for optimizing therapies and trial designs. 68Ga-PSMA, a theranostic radiotracer, is hyper-expressed in HCC neovasculature. We tested its measurement reliability against CT/MRI across and within readers.

**METHODS AND MATERIALS**

We prospectively enrolled treatment-naļve HCC patients qualified for loco-regional therapy (LRT) or immunotherapy (IT) who underwent 68Ga-PSMA PET before and after treatment, alongside a multiphasic CT/MR. Lesions with PSMA uptake less than (grade 1) or equal to liver (grade 2) were excluded, while those with uptake higher than liver (grade 3) or spleen (grade 4) were included. Three radiologists independently evaluated the imaging response, applying mRECIST and LR-TR to the LRT cohort, and mRECIST with RECIST 1.1 to the IT group, with a minimum 2-week gap between CT/MR and PET assessments. Post-treatment uptakes of PSMA at grades 1 and 2 indicated response; grades 3 and 4 were categorized as non-response. For intra-reader assessment, a minimum 3-week gap was observed with randomized scans for each review session. Reader agreement was evaluated using Gwet's AC1 and 2.

**RESULTS**

Of 88 patients screened with PSMA PET, 69 (78%) had PSMA-avid HCC. Thirteen patients (mean age:75.1, range:30-84; 11 males) with 29 lesions (mean size:3.6 cm, range:1-20 cm) qualified for the study, split into seven (54%) for LRT with 10 lesions and six (46%) for IT with 19 lesions. Average interval between pre-treatment PET and CT/MRI was 19-days (range:0-46), and post-treatment was 10-days (range:0-56). Pre-treatment mean SUVmax was 11.4 (range: 4.7-17.7), with a tumor-to-liver SUVmax ratio of 3.1 (range:1.5-5.3). Inter-reader agreement was moderate (?=0.54) using mRECIST, but intra-reader was higher (?=0.72-0.86). With treatment stratification, both inter- and intra-reader agreements in the LRT group were nearly perfect (?>0.8) using mRECIST and LR-TR. For the IT group, inter-reader agreement was fair (?=0.37) with mRECIST and substantial (?=0.66) with RECIST 1.1; intra-reader varied from moderate to almost perfect (?=0.47-0.82) with mRECIST and was substantial to almost perfect (?=0.69-0.93) with RECIST 1.1. PSMA-based assessments showed almost perfect inter- and intra-reader agreement (?>0.8) across all cohorts.

**CONCLUSION**

HCC treatment response assessment using 68Ga-PSMA PET demonstrates high repeatability and reproducibility, particularly higher than CT/MR for the immunotherapy group.

**CLINICAL RELEVANCE/APPLICATION**

68Ga-PSMA PET offers precise HCC response evaluation across treatments, meriting larger studies to correlate with oncologic outcomes.

## R6-SSNMMI08-3 COMBINED LONG-AXIAL FIELD-OF-VIEW PET AND SPECTRAL CT TO ENABLE INNOVATIVE SCAN PROTOCOLS FOR IMPROVED QUANTIFICATION IN ONCOLOGY

Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Elizabeth Li (*Abstract Co-Author*) Nothing to Disclose
Florence Marie Muller (*Abstract Co-Author*) Nothing to Disclose
Joel Karp, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV
Austin Pantel, MD (*Presenter*) Institutional research support, Lantheus Holdings;Consultant, Blue Earth Diagnostics Ltd;Consultant, General Electric Company;Consultant, Lantheus Holdings

**PURPOSE**

Independent advances in PET and CT technology have led to improvements in image quality and expanded clinical applications. Truly integrated systems utilizing both state-of-the-art PET and CT, though, have not been realized. Recently, we have combined a long axial field-of-view (LAFOV) PET with a detector-based spectral CT (IQon Spectral CT, Philips Healthcare). We aim to leverage the strengths of these two high performance instruments (PET: functional information/quantification, and Spectral CT: reduced metal artifacts, iodine concentration mapping, detection of bone metastases etc.) to improve malignancy characterization. More specifically, we aim to develop clinically accessible protocols for improved quantification in oncology, by utilizing spectral CT to measure tumoral perfusion and to provide a surrogate for the input function peak for PET kinetic modelling. Initial protocol developments for this new integrated instrument are included here.

**METHODS AND MATERIALS**

A multi-modal flow phantom was developed for protocol refinement to limit radiation dose in vivo. An insert was added into a NEMA Image Quality phantom to create plasma and tissue compartments, with a peristaltic pump used to induce flow. Fluorine-18 and CT iodine concentration in the plasma compartment were compared. Preliminary in vivo perfusion studies in a porcine model were then performed, using iodinated contrast for CT and two PET tracers (82Rb and an experimental 18F-labeled tracer).

**RESULTS**

Dynamic flow phantom studies capture the bolus shape with 5-second frames, supporting harmonization between modalities for in vivo studies. Preliminary studies in a ventilated pig demonstrated similar blood input between three different iodine injections and two PET tracer injections. Consistent hepatic perfusion measurements were realized across the three CT acquisitions with different injection rates. These perfusion measurements were greater than that estimated from 82Rb, as expected given differences in extraction fraction.

**CONCLUSION**

Early results from this combined LAFOV PET/spectral CT demonstrate the ability to measure a blood input function and tissue perfusion from both modalities. We expect to have human studies in the coming months. Additional benefits of this combined system (e.g., reduced metal artifacts, detection of bone metastases) for clinical imaging will also be assessed.

**CLINICAL RELEVANCE/APPLICATION**

By leveraging a LAFOV PET/spectral CT, clinically translatable protocols can be developed to measure tumoral perfusion and PET radiotracer uptake/kinetics, with potential for translation to standard AFOV PET. Such data will better characterize malignancy, and in turn guide personalized treatment approaches, advancing precision medicine.

## R6-SSNMMI08-4 UPDATE ON DEAUVILLE SCORING WITH THE USE OF DIGITAL PET-CT SCANNERS

Stephen Graves (*Abstract Co-Author*) Research Consultant, RayzeBio
Michael M. Graham, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sinan Akay, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Since introduction of the Deauville five-point scale in 2009, digital PET-CT scanners have been widely adopted. The improved sensitivity, time-of-flight performance, and smaller detector element size have enabled clinical image reconstruction with improved spatial resolution which could impact the Deauville scoring of small lesions. The goal of this study was to investigate the clinical significance of Deauville scores on digital PET-CT scanners in patients with diffuse large B-cell lymphoma (DLBCL).

### METHODS AND MATERIALS

Digital FDG PET-CT of patients with newly diagnosed DLBCL, who underwent standard first-line treatment between April 2019 and Jan 2024, were retrospectively reviewed. The reported Deauville scores (1-5) on interim (after 2nd or 3rd cycle) and end-of-therapy (after 6 cycles) PET-CTs were recorded. Subsequently, therapy response on post first-line treatment and disease status based on 6-month clinical follow-up were evaluated based on review of patient charts. The predictive value of Deauville scores for treatment outcome at 6-month follow-up were analyzed.

### RESULTS

The study group comprised 80 patients. Forty-six patients had Deauville scores 1, 2 or 3 on end-of-therapy PET/CT scan; amongst these patients 42 (91%) patients had no evidence of disease (NED) at 6 months post-therapy. Thirty-four patients had end-of-therapy Deauville 4 or 5 scans; 10 (29%) of them patients had NED on 6-month follow-up. Further analysis of Deauville 4 revealed that 7/10 (70%) of end-of-therapy and 10/17 (60%) of interim PET-CT scans revealed NED at 6-month follow-up. The probability of having recurrent/persistent disease at the 6th month follow-up was found to be 16.4 times lower in patients categorized as Deauville 4 on end-of-therapy scan compared to those categorized as Deauville 5.

### CONCLUSION

A majority of patients with Deauville 4 scores on digital PET-CT interim or end-of-therapy scans did not have persistent disease at follow-up. Therefore, it is crucial to obtain a tissue sample or follow-up PET-CT scans for patients with DLBCL with Deauville 4 score before a possible change in therapy.

### CLINICAL RELEVANCE/APPLICATION

There is a score migration of Deauville five-point scale with the use of digital PET-CT scanners. In contrast to initial scoring, our data shows that the majority of patients with Deauville score 4 PET-CT scans did not have persistent disease and showed good outcomes.

## R6-SSNMMI08-5 $^{18}$F-FDG PET/CT: CORRELATION OF IMAGING MARKERS AND CAR-T CELL THERAPY ASSOCIATED ADVERSE EVENTS

Julian Kirchner (*Abstract Co-Author*) Nothing to Disclose
Daniel Weiss (*Abstract Co-Author*) Nothing to Disclose
Kai Jannusch (*Abstract Co-Author*) Nothing to Disclose
Frederik L. Giesel, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Peter Minko, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias Boschheidgen (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD (*Abstract Co-Author*) Nothing to Disclose
Christina Antke (*Abstract Co-Author*) Nothing to Disclose
Vivien Lorena Ivan, MD (*Abstract Co-Author*) Nothing to Disclose
Helena A. Peters, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study is to evaluate the predictive potential of pre -CAR-T [18F]FDG PET/CT in patients with diffuse large B-cell lymphoma (DLBCL) concerning Cytokine Release Syndrome (CRS) and Immune Effector Cell-associated Neurotoxicity Syndrome (ICANS) and their correlation with treatment response in post-CAR-T [18F]FDG PET/CT.

### METHODS AND MATERIALS

Eighteen DLBCL-patients (mean age: 60 ± 12 years) were retrospectively included who underwent CAR-T therapy and [18F]FDG-PET/CT at predefined time points (t0 -t2). Median follow-up time was ten months (IQR 6 - 16) after CAR-T cell infusion. Following clinical parameters were obtained: age, sex, serum lactate dehydrogenase (LDH) and Interleukin-6 (IL-6). The occurrence of CRS / ICANS has been recorded. SUVmax, Deauville score and Lugano response criteria (LC) were evaluated. Pearson correlations, group comparisons (Mann-Whitney-U-test) and chi-quadrat test were calculated. P values below 0.05 were defined as statistically significant. 95%-confidence intervals (CI) were defined.

### RESULTS

SUVmax at t0 correlates positive with LDH ($r = 0.5$, $p = 0.02$) and grade of CRS ($r = 0.5$, $p = 0.04$) and ICANS ($r = 0.6$; $p < 0.01$). Appearance of ICANS was significantly associated with SUVmax at t0 ($p = 0.03$, $U = 7.0$, $Z = -2.2$). Using ROC analysis and Youden's index a SUVmax threshold of 17 at t0 (AUC: 0.865, $p < 0.01$) could be defined. Patients exceeding SUVmax of 17 had a significant higher risk of CRS > 1 (OR = 22, CI 2 - 314, $p = 0.03$) and ICANS > 1 (OR = 18, CI 1 - 271, $p = 0.04$). There was a significant difference between patients with progressive disease (PD) and patients with a best response of complete remission (CR), partial remission (PR), or stable disease (SD) with respect to the presence of an ICANS > 1 ($p < 0.01$).

### CONCLUSION

SUVmax at t0 could be a useful marker for identifying DLBCL-patients with an increased risk of CRS > 1 and ICANS > 1. Patients with ICANS > 1 were significantly associated with a PD at t1.

### CLINICAL RELEVANCE/APPLICATION

• Pre-therapeutic SUVmax could be a useful imaging marker for risk stratification of CAR-T therapy-associated adverse events.• An ICANS > 1 could be a relevant indicator for a progressive disease at t1.

## R6-SSNMMI08-6 EVALUATION OF THE QUALITY OF IMAGES AND THE SENSITIVITY OF DETECTION OF SUB-CENTIMETER LESIONS OF A NEW GENERATION OF PET-CT

Marie Terroir (*Abstract Co-Author*) Nothing to Disclose
Chloe Lamesa (*Abstract Co-Author*) Nothing to Disclose
Frederic Courbon, MD,PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Speakers Bureau, Novartis AG;Speakers Bureau, Ipsen SA;Speakers Bureau, Bayer AG
Delphine Vallot (*Abstract Co-Author*) Nothing to Disclose
Lawrence Dierickx (*Abstract Co-Author*) Nothing to Disclose
Quentin Maronnier (*Abstract Co-Author*) Nothing to Disclose
Kuan-Hao Su, PhD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Erwan Gabiache, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Jean-Sebastien Texier (*Abstract Co-Author*) Nothing to Disclose
Severine Brillouet (*Abstract Co-Author*) Nothing to Disclose
Thibaut Cassou-Mounat (*Abstract Co-Author*) Nothing to Disclose
Lavinia VIJA (*Abstract Co-Author*) Nothing to Disclose
Olivier Caselles, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

The Omni Legend 32cm (Omni6R) represents a cutting-edge PET/CT scanner showing high sensitivity, small crystal size, and a deep learning (DL) based PET reconstruction algorithm, Precision DL. Precision DL was designed to emulate Time of Flight (TOF) enhancement on a "non TOF" PET scanner. The Omni6R is expected to enhance image quality while reducing acquisition duration without impairing detection and quantitation in comparison to standard of care (SOC) systems. We conducted a single-blinded, prospective, non-randomized clinical study (NCT05154877), comprising of 2 phases, to evaluate the Omni6R.

## METHODS AND MATERIALS

Subjects underwent a BMI based FDG PET scan (~2 MBq/kg), performed on Discovery-MI 25cm (DMI5R) or Discovery-IQ 25cm (DIQ5R) using 10-minute scanning protocol. Subjects were then scanned on the Omni6R, and data were reconstructed into 8- and 6-minute images, Standard (Omni6R-S) and Reduced Time (Omni6R-RT). Phase 1 focused on a qualitative assessment of images from the Omni6R compared to SOC for 30 patients. PET images were evaluated by 3 physicians using 4 clinical indexes (image quality, diagnostic confidence, sharpness, and noise), each scored on a 5-point Likert and summed for a total score out of 20. We chose the optimal SOC and the acquisition duration for the Omni6R for phase 2 based on the Likert score obtained. In Phase 2, 15 patients were recruited, following the same consecutive scan pattern. A software provided by the scanner-vendor is used to synthesize 150 spherical lesions with diameters from 6-10 mm and contrast from 3-15. The synthetic lesions were inserted into sinograms at clinically relevant locations and reconstructed into PET images. 3 physicians assessed lesion detectability and reported PET metrics for each lesion during the review. We calculated the true positive ratio (TPR) of synthetic lesions by dividing the number of detected lesions by their total number and compared it across scanners.

## RESULTS

During phase 1, the DMI5R obtained the highest Likert scores among the SOCs, which were still lower than the scores obtained by the Omni6R-RT (DIQ5R: 13.2 ± 1.5 / DMI5R: 14.8 ± 1.5 / Omni6R-S: 17.1 ± 1.4 / OmniI6R-RT: 16.4 ± 1.3). Therefore, we used the DMI5R and Omni6R-RT, i.e. acquisition with a 40% duration reduction when compared with the SOC protocol, for the lesion detectability study. The averaged TPR across the 3 readers were 84.4% and 84.6% for the Omni6R-RT and the DMI5R, respectively.

## CONCLUSION

Omni6R showed better qualitative results over all SOC studied. Lesion detectability analysis demonstrated equivalency between the Omni6R-RT and the DMI5R. Omni6R provides performance equivalent to high-performance TOF systems while enabling optimization for acquisition durations.
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

R6-SSNR16

**Neuroradiology (Artificial Intelligence: Image Interpretation)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: S406B

Brandon K.K. Fields, MD (*Moderator*) Nothing to Disclose
Mariam S. Aboian, MD, PhD (*Moderator*) Researcher, Blue Earth Diagnostics Ltd;Researcher, Fusion Pharmaceuticals;Research collaboration, Pro Medicus Limited

**Sub-Events**

## R6-SSNR16-1 REVEALING HEMODYNAMIC HETEROGENEITY IN GLIOBLASTOMA AND MEDULLOBLASTOMA BY DEEP-ANALYSIS OF DYNAMIC SUSCEPTIBILITY CONTRAST-ENHANCED MRI DATA

Hui Mao, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Kartik M. Reddy, MD (*Abstract Co-Author*) Nothing to Disclose
Farid Hajibonabi, MD (*Abstract Co-Author*) Nothing to Disclose
Quanquan Gu (*Abstract Co-Author*) Nothing to Disclose
Leonardo Tang, MS, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Intratumoral heterogeneity is a hallmark of malignant tumors, such as glioblastoma (GBM) and medulloblastoma (MB). It is presentation of cellular, genetic and epigenetic variations within the tumor microenvironment (TME) and is directly linked to the poor prognosis and treatment failure. While intratumoral heterogeneity can be described based on morphological features of tumor tissue derived from structural MRI, physiological and hemodynamic heterogeneity is largely overlooked. Dynamic susceptibility contrast-enhanced magnetic resonance imaging (DSC MRI) is a clinically available non-invasive tool for analyzing blood supply and vascular permeability of tumors. Wholistically analyzing time course profiles from DSC MRI can improve the segmentation of the tumors while revealing the intertumoral hemodynamic heterogeneity of tumors and TME in GBM and MB.

### METHODS AND MATERIALS

Data for 31 MB patients, consisting of 3D T1-MPRAGE, T1 contrast-enhanced, and 4D DSC MRI, were acquired from Children's Healthcare of Atlanta. Data for 103 GBM patients, consisting of 3D T2-FLAIR and 4D DSC MRI images, was acquired from the University of Pennsylvania glioblastoma cohort (UPENN-GBM) in the Cancer Imaging Archive (TCIA). Tumor region of interest (ROI) on 3D structural MRI was obtained by U-Net tumor segmentation convolutional neural network in GBM patients and by expert radiologist review in MB patients. A hybrid method of HDBScan was then performed on 4D DSC MRI to perform density-based clustering based on hemodynamic responses derived from the patterns of time course profiles within ROIs.

### RESULTS

Across 103 GBM patients, our approach revealed an average of 5.32 distinct subtypes of tumor tissue with 67.93% hemodynamically active tissue within the tumor ROI. Conversely, analysis of 31 MB patients identified an average of 4.67 hemodynamically distinctive tumor tissue subtypes with 62.53% active tissue. Representative features for the average signal profile of each cluster were extracted for additional quantitative analysis.

### CONCLUSION

We demonstrated that proposed neural network is capable of delineating tumor tissue subtypes within the TME and extracts relevant time course signal features. MB exhibits fewer hemodynamically distinctive tumor tissue subtypes, suggesting a lower degree of intratumoral heterogeneity compared to GBM.

### CLINICAL RELEVANCE/APPLICATION

This study leverages machine learning and routinely obtained 4D DSC MRI data to improve the tumor segmentation and analyze intratumoral heterogeneity within and between MB and GBM, complementing traditional morphological assessments of tumor heterogeneity. Furthermore, features extracted from DSC time course profiles offer data-driven quantification of hemodynamic parameters.

## R6-SSNR16-2 AI IN ROUTINE USE - RESULTS OF A LARGE-SCALE TEST ACROSS GERMANY AND AUSTRIA

Torsten B. Moeller, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The study was conducted to answer the question of whether the use of artificial intelligence is already having a quality-improving effect in routine teleradiological reporting throughout Germany and Austria.

### METHODS AND MATERIALS

We performed a study of over 3000 native cranial CT scans (CCT) from CT departments of 140 hospitals in Germany and Austria between MArch and April 2022. Of these scans, 2707 CCT were analyzed using AI with hemorrhage analysis. The results were compared with the findings of more than 70

teleradiologists who did not have the AI results at that time. Possible discrepant findings were evaluated by two full radiologists with specific neuroradiological CCT experience including controls or previous findings.

**RESULTS**

Of the 2707 CCT examined by both radiologists and AI, 189 cases (approximately seven percent) were found to have ICB (intracranial hemorrhage) described by both radiologists and AI. In 30 patients (approximately one percent) there was a discrepancy: the AI had seen a hemorrhage that the radiologist had not described. These cases were subsequently reevaluated by two experienced radiologists. 12 of the 30 unclear examinations were classified as false positives by the AI, eight cases as questionablepositives, and 10 cases as true positives. Thus, there were 199 cases with ICB in the studied patient group, of which more than 5 percent were primarily missed by radiologists without AI support.

**CONCLUSION**

The positive effect of AI on the quality of radiological reporting postulated in several studies can also be confirmed in practice and especially in the teleradiological context.

**CLINICAL RELEVANCE/APPLICATION**

Our study provides evidence that, at least in the field of teleradiology, AI is already a valuable tool, particularly with regard to improving quality and speed.

## R6-SSNR16-3 COMPARISON OF 2D & 3D DEEP LEARNING MODELS FOR HEAD CT TISSUE SEGMENTATION

Alger Remirata (*Abstract Co-Author*) Nothing to Disclose
Ling Ling Chan, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Pik Hsien Chai (*Abstract Co-Author*) Nothing to Disclose
Thomas Welton, PhD (*Abstract Co-Author*) Nothing to Disclose
Yar Ting Lim (*Abstract Co-Author*) Nothing to Disclose
Beng Chin Ooi (*Abstract Co-Author*) Nothing to Disclose
Qicong Sun (*Abstract Co-Author*) Nothing to Disclose
Weiling Lee (*Abstract Co-Author*) Nothing to Disclose
CHANGSHUO LIU (*Abstract Co-Author*) Nothing to Disclose
Septian Hartono, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Automated brain volumetry is vital for detecting brain atrophy. CT has lower soft tissue contrast than MRI but is more affordable, accessible and time-saving. Limited works exist on CT segmentation for brain volumetry. In this study, we developed 3D deep learning (DL) models for semantic segmentation of gray matter (GM), white matter (WM) and cerebrospinal fluid (CSF) tissue classes on head CT in a multi-ethnic Southeast Asian population, leveraging on paired MRI labels as a benchmark to enhance accuracy.

**METHODS AND MATERIALS**

The study was approved by the institutional ethics committee. Participants underwent CT scan on a Siemens Somatom Force CT system with tube voltage = 120 kVp, acquisition matrix = 512 × 512, number of slices = 225, voxel size 0.4 × 0.4 × 1.0 mm3. MR scan was performed on the same day as the CT scan, on a Siemens Vida 3T using sagittal T1-MPRAGE sequence with following parameters: TR/TE/TI = 2300/3.0/900 ms, matrix = 256 x 256, number of slices = 176, voxel size = 1 × 1 × 1.1 mm3.CT and MRI images were skull-stripped using Synthstrip and FSL BET respectively. GM, WM, and CSF labels were derived from the MR images using FSL FAST. CT and MR images were co-registered with FSL FLIRT. The resulting transformations were then applied to the MR labels. The alignment of the MR labels with the CT image was visually assessed for each data set.The final pre-processed datasets consisting of CT images and their paired, co-registered MR labels were split with a train-test ratio of 4:1. There were 234 subjects (mean age 64.6 ± 6.1 years) in total with 187 CT-MRI pairs for training and 47 pairs for testing.We trained and tested various 2D and 3D models and compared their accuracy with Dice score and complexity in terms of number of parameters and floating point operations (FLOPs).

**RESULTS**

Spatially-Aware Swin-Unet outperformed other 2D models with Dice scores of 0.865, 0.776 and 0.787 in WM, GM and CSF, respectively, and overall Dice score of 0.809 (Figure 1). UNETR++ was the best performing 3D model with Dice scores of 0.849, 0.824, and 0.818 for WM, GM, and CSF, respectively, and an average dice score of 0.830.

**CONCLUSION**

We showed the feasibility of 2D and 3D DL models for direct and accurate head CT tissue segmentation. 2D Spatially-Aware Swin-Unet with its added inter-slice contextualization and 3D UNETR++ with its efficient paired attention block offers both accuracy as well as efficiency within their respective classes.

**CLINICAL RELEVANCE/APPLICATION**

While brain MRI offers highly precise segmentation, CT is more readily available. Deep learning facilitates CT-based brain tissue segmentation, bridging the gap between MRI and CT. This enables rapid brain tissue assessment, aiding in early neurodegenerative disease detection and precision medicine in Southeast Asia.

## R6-SSNR16-4 OPTIMIZING 3D T1 MPRAGE PROCESSING FOR ROBUST DIFFERENTIATION OF ALZHEIMER'S DISEASE FROM COGNITIVELY NORMAL IN OLDER ADULTS: THE IMPACT OF ADVANCED DEEP LEARNING-BASED RECONSTRUCTION AND SEGMENTATION

Seoyeon Park (*Abstract Co-Author*) Nothing to Disclose
Koung Mi Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Woojin Jung, PhD (*Abstract Co-Author*) Employee, AIRS Medical Inc
Seoyoung Lim, MS, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Structural MRI with brain segmentation is crucial in detecting early anatomical changes indicative of Alzheimer's diseases (AD), but challenges like low resolution, noise, and inaccurate segmentation limit its efficacy. This study aimed to enhance differentiation of AD from cognitively normal (CN) in older adults by using two deep learning (DL)-based algorithms for image reconstruction and segmentation.

**METHODS AND MATERIALS**

This study leveraged the OASIS-2 open dataset, consisting of 3D T1w MRI scans of 150 subjects aged 60-96. The dataset includes 373 MRI sessions from AD/CN subjects, with each subject undergoing multiple sessions at least a year apart. In each session, 3~4 T1w scans were acquired. Excluding scans from subjects with a change in diagnosis, 585 AD scans and 724 CN scans were analyzed. In each scan, 22 region of interest (ROI) volumes were measured by applying DL-based image reconstruction (DLR) that functions denoising and super resolution (SwiftMR, AIRS Medical), and DL-based volumetry (DLV) for segmentation, developed using a U-net-based architecture trained on 1336 T1w scans with manually corrected labels from FastSurfer. Comparative analysis was performed across four frameworks combining two image reconstructions (before and after DLR) and two segmentations (FastSurfer and DLV). The volume measures were applied to a machine learning classifier comprising an ensemble of XGBoost, Random Forest, and TabNet. The classifier was evaluated with 5-fold nested cross-validation, calculating AUC-ROC for each session to assess inter-session variability, and for each scan during the first session to assess inter-scan variability. Additionally, feature importance was estimated to select the top 2 significant ROIs.

**RESULTS**

In inter-session analysis, the average AUC-ROC of after DLR was higher than before DLR regardless of segmentation algorithm (before/after DLR = 96.8%/97.5% in FastSurfer; before/after DLR = 98.1%/99.0% in DLV). On the other hand, DLV showed higher average AUC-ROC than FastSurfer in both before and after DLR. The improvement of after DLR and DLV were also demonstrated in inter-scan analysis (before/after DLR = 60.2%/62.2% in FastSurfer; before/after DLR = 67.7%/71.5% in DLV). Overall, DLR + DLV marked a significant advancement over the whole frameworks. In addition, only DLR+DLV consistently identified the top 2 significant ROIs as hippocampus and amygdala except session 4 which had a small number of samples, revealing high reproducibility.

**CONCLUSION**

Our framework combining DLR and DLV enhances AD differentiation from CN in older adults using 3D MRI.

**CLINICAL RELEVANCE/APPLICATION**

A deep learning-based framework for MRI reconstruction and segmentation improves AD classification with high reproducibility.

## R6-SSNR16-5 ENHANCING GLIOMA SEGMENTATION AND KI-67 BIOMARKER CORRELATION WITH SHAP ANALYSIS

Sakib Abrar Hossain (*Abstract Co-Author*) Nothing to Disclose
Md. Shaheenur Sumon (*Abstract Co-Author*) Nothing to Disclose
Akib Muntakim Mahmud Khan (*Abstract Co-Author*) Nothing to Disclose
Xiaohong J. Zhou, PhD (*Abstract Co-Author*) Owner, Horizon Medical Physics Services;Consultant, Horizon Medical Physics Services;Consultant, General Electric Company;Royalties, Reed Elsevier
Muge Karaman, PhD (*Abstract Co-Author*) Nothing to Disclose
Muhammad E. H. Chowdhury (*Abstract Co-Author*) Nothing to Disclose
Enamul Bhuiyan, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To enhance glioma tumor segmentation accuracy in MRI scans through deep learning techniques. We also aim to correlate bottleneck features extracted from glioma brain tumor MR images with Ki-67 biomarkers using SHapley Additive exPlanation (SHAP) analysis.

**METHODS AND MATERIALS**

The study involved 103 patients with glioma from an internal dataset and 110 patients from the Cancer Genome Atlas (TCGA) lower-grade glioma collection. Ground truth data were provided through manual segmentation by radiologists. Models were trained and validated using MATLAB for preprocessing and PyTorch on Google ColabPro for 2D segmentation, with consistent hyperparameters across all networks (learning rate: 0.00001, Dice loss function, Adam optimizer). Performance was assessed using Dice Score (DSC) and Intersection over Union (IoU). Additionally, 256 explainable AI (XAI) features were extracted from glioma brain tumor MR images, with the top 10 features selected via Principal Component Analysis (PCA). SHAP analysis explored the association among Ki-67 biomarkers, patient demographics, and XAI features.

**RESULTS**

We explored the effectiveness of convolutional neural networks (CNNs), including UNet, UNet++, and FPN, combined with various backbones such as ResNet152, DenseNet201, and a novel Self-ONN architecture. Our results indicated that UNet with ResNet152 backbone achieved the highest performance, with a DSC of 89.13% and IoU of 86.46%. UNet with ResNet152_Self-ONN backbone followed closely with a DSC of 88.91% and IoU of 86.24%. Other configurations also showed competitive results, such as ResNet152_Self-ONN_UNet++ with a score of 88.89%. Our preliminary results reveal that the top 10 XAI extracted features have strong correlations with Ki-67 biomarkers having p-value range 0.04-0.001 with 95% confidence interval.

**CONCLUSION**

Our study highlighted the effectiveness of ResNet152_UNet in tumor segmentation and the slight improvement achieved with the inclusion of Self-ONN characteristics. These findings suggest the potential benefits of investigating different backbone networks and segmentation topologies. Future research could focus on optimizing image enhancement parameters to further improve segmentation accuracy. Additionally, combining demographics (age, sex), histological tumor grade, and XAI features' SHAP analysis indicates a strong association between XAI features and Ki-67 biomarkers. However, a rigorous study of a large cohort is mandatory to validate the preliminary results.

**CLINICAL RELEVANCE/APPLICATION**

The correlation among the Ki-67 biomarker, patient demographics, and explainable AI features in glioma tumors can enhance existing diagnosis, prognosis, and treatment planning with meticulous precision.

## R6-SSNR16-6 AI Based Brain Tumour Subtype Prediction from Preoperative MRI - Glioma, CNS Lymphoma and Metastasis

Stephen L. Gock, MBCHB (*Presenter*) Nothing to Disclose
John Scotter, MBChB,MRCS (*Presenter*) Nothing to Disclose
Tubo Shi, BMBCh (*Presenter*) Nothing to Disclose
Willem Ikink, MBChB (*Presenter*) Nothing to Disclose
Luis Slyfield (*Presenter*) Nothing to Disclose
Hugh McHugh, MBChB (*Science Invited Presenter*) Clinical AI Registrar, Harrison AI Research Grant, RANZCR

# Abstract Archives of the RSNA, 2024

R6-SSPD05

**Science Session with Keynote: Pediatric Imaging (Gastrointestinal and Genitourinary)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: E352

Pedro Augusto B. Albuquerque, MD (*Moderator*) Nothing to Disclose
Roberto Avritchir, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R6-SSPD05-1 ABDOMINAL IMAGING IN PEDIATRIC NON-ACCIDENTAL TRAUMA: INCIDENCE OF POSITIVE FINDINGS ON ABDOMINAL CT

Edward J. Richer, MD (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Chilukuri, MD (*Abstract Co-Author*) Nothing to Disclose
Susan D. Taylor, DO (*Abstract Co-Author*) Nothing to Disclose
Geetika Khanna, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Erica Riedesel, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Retrospective observational study to evaluate incidence of positive findings on Computed Tomography (CT) of the abdomen/pelvis performed as part of evaluation for suspected pediatric non-accidental trauma (NAT).

### METHODS AND MATERIALS

This was an IRB approved, single institution, retrospective review of patients under age 6 years old who had both a skeletal survey and CT abdomen/pelvis with IV contrast in the same admission for the workup of suspected NAT between 2013-2023. The EMR was reviewed for each patient, and note was made of findings on imaging, physical exam, and laboratory analysis.

### RESULTS

Between 2013 and 2023, a total of 2429 patients under age 6 yrs underwent skeletal survey due to clinical concern for NAT. Of those, 133 patients (5.4%, 133/2429) had additional CT imaging of the abdomen/pelvis to evaluate for possible intra-abdominal injury. The largest total number of CT abdomen/pelvis studies were performed in patients under age 4mos (n=50). 30% (40/133) of CT studies had positive imaging findings. The most common imaging finding was presence of free fluid (n = 23, 57.5% [23/40]). Liver injury was the second most common imaging finding (n=14, 40% of studies [16/40]). Bowel injury was seen in 27.5% (11/40). Multiple positive findings were seen in 45% (18/40) of patients. Positive findings on CT were seen least in patients <4mos of age (14%, 7/50) and most in patients age >2 yrs (52%, 12/23).

### CONCLUSION

In this 10-year, single institution retrospective review, approximately 5% of patients under age 6 yrs with concern for NAT underwent additional imaging with CT abdomen/pelvis for possible intrabdominal injury. However, positive findings concerning for traumatic intrabdominal injury were seen in only 1% of all patients. Types of intrabdominal injury seen were relatively similar at all ages. While CT imaging was performed most in the youngest members of this population (<4mos), these patients also had the lowest percentage of positive imaging findings on CT.

### CLINICAL RELEVANCE/APPLICATION

A high number of abdominopelvic CT scans are performed in pediatric patients with suspected NAT despite low prevalence of intrabdominal injury. While reduction of unnecessary CT scans in pediatric blunt trauma patients has been a topic of high interest in pediatric trauma, emergency medicine, and radiology literature there has been little evaluation of how to "image gently" for intra-abdominal injury in suspected NAT. Further investigation into the role of clinical and laboratory markers in guiding appropriate imaging is needed. In addition, there is potential for alternative imaging such as ultrasound or contrast-enhanced ultrasound to be used as a screening evaluation prior to CT which may be beneficial in this vulnerable patient population.

## R6-SSPD05-3 STANDARD USE OF 3D CLOACAGRAMS WITH PRINTED MODELS FOR COMPLEX CLOACA REPAIR

Rex M. Pillai, MD (*Abstract Co-Author*) Nothing to Disclose
Osama A. Raslan, MD, MBBCh (*Abstract Co-Author*) Research Grant, Bracco Group;Contract, Shanghai United Imaging Healthcare Co, Ltd
Steven Lucero (*Abstract Co-Author*) Nothing to Disclose
Neha Antil, MD (*Abstract Co-Author*) Nothing to Disclose
Eric Kurzrock (*Abstract Co-Author*) Nothing to Disclose
Zoe Saenz (*Presenter*) Nothing to Disclose

### PURPOSE

Cloacas are complex congenital malformations that involve the urinary, reproductive, and colorectal tracts. Due to their multisystem involvement, they present significant technical challenges to surgical repair. Routine 3D cloacagrams have been advocated for surgical planning as they allow improved

characterization of spatial relationships. However, while 3D printed models from these cloacagrams are feasible, they have yet to become standard in the repair of cloacas. Our objective is to evaluate our institution's experience in the routine use of 3D cloacagrams with printed 3D models in operative planning and education.

**METHODS AND MATERIALS**

We performed a retrospective review of cloacal patients who underwent 3D printed modeling for their malformation based upon a 3D cloacagram from 2020 to 2024. Demographics, imaging, measurements, pre-operative planning, repair time and findings, and follow-up were assessed.

**RESULTS**

Five patients with a 3D cloacagram were identified. The median age was 30.52 months (SD 12.61). All underwent cloacal repair. Common co-morbidities were cardiac (80%), renal (80%), and vertebral anomalies (60%). The median age at 3D cloacagram was 5.98 months (SD 2.14) with an average procedure time of 1 hour, 8 mins. Two patients were managed preoperatively with clean intermittent catheterization (CIC) and one required vaginostomy and suprapubic vesicostomy tube placement. Median age at repair was 9.13 months (SD 2.89) with an average repair time of 7 hrs, 42 mins. The common channel length measurements correlated best between the 3D cloacagram and intraoperative findings. All five patients had 3D printed models used for surgical planning and education which were utilized in preoperative counseling with families and trainees. Median follow-up time was 12 months (SD 8.43). One patient underwent appendicostomy requiring flushes, one patient requires CIC, and one requires suprapubic tube with persistent bilateral severe hydronephrosis and reflux. 25% are on medications for bowel management.

**CONCLUSION**

3D cloacagrams are provide accurate measurements with minimal intraoperative discrepancy.

**CLINICAL RELEVANCE/APPLICATION**

3D printed models can supplement imaging findings while reinforcing operative management and education.

## R6-SSPD05-4 DUODENUM INVERSUM: IS IT A VARIANT OF NORMAL ANATOMY?

Ellen Park, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Anthony Deross (*Abstract Co-Author*) Nothing to Disclose
Jennifer Bullen, MSc (*Abstract Co-Author*) Nothing to Disclose
Brooke S. Lampl, DO (*Abstract Co-Author*) Nothing to Disclose
Deborah D. Brahee, MD, DC (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the clinical outcomes of patients diagnosed with duodenum inversum and to determine if this diagnosis requires further investigation or if it can confidently be considered a variant of normal anatomy.

**METHODS AND MATERIALS**

There were 1662 upper GI exams between January 2016 and December 2020. Repeat exams on the same patient were excluded, so that only the patient's earliest exam remained in the sample. Additionally, post-operative exams, non-diagnostic exams, and other exams meeting various exclusion criteria were excluded, ie. heterotaxy). A total of 1490 exams (from 1490 unique patients) remained. All upper GI's were reviewed and categorized by 3 fellowship trained pediatric radiologists (EP, BL, and DB) with 18, 15, and 5 years experience as DI, WD, malrotation, and normal. Duodenum inversum was defined as the distal duodenum ascending to the right of midline to the level of the bulb and then crossing to the left with the duodenal jejunal junction in normal location, fixed by the ligament of Treitz. Any cases that were of unclear diagnosis, WD, and DI were reviewed by 3 pediatric radiologists for consensus. Patients diagnosed with DI on upper GI exam, had a retrospective chart review performed by pediatric radiology (BL) and pediatric surgery (AD) (15 and 18 years experience) to evaluate clinical and/or surgical outcomes.

**RESULTS**

Of the 1490 patients identified, 11 (0.7%) were marked DI, 23 (1.5%) were marked malrotation, and 1456 (97.7%) were marked normal (n=1433) or WD (n=23) (i.e. without DI or malrotation). Mean patient age at exam was 5.6 years (median: 2.5 years, IQR: 4.4 months to 10.6 years, full range: 0 to 18.9 years). Of the 11 patients with DI on upper GI exam, seven went to the operating room. Of the seven patients, five had abnormalities including abnormal peritoneal attachments, cocooning of the peritoneum, and Ladd's bands with all 5 patients undergoing Ladd's procedures. One of the 7 had a genitourinary finding of endometriosis and paratubal cyst. A second patient had a pylorotomy and no other intraoperative findings.

**CONCLUSION**

Duodenum inversum is an uncommon diagnosis seen in 0.7% (11/1490) patients in this study. Traditionally, DI has been considered a variant of normal anatomy in the radiology literature. Of the 11 patients, 5 went on to Ladd's procedure and had other findings concerning for malrotation. In a symptomatic patient, we propose that the diagnosis of duodenum inversum on upper GI may warrant further investigation and not be considered a variant of normal anatomy.

**CLINICAL RELEVANCE/APPLICATION**

Duodenum inversum has classically been taught to be a variant of normal anatomy. We suggest that further investigation is warranted in the symptomatic patient.

## R6-SSPD05-5 MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY (MRCP) FOR SUSPECTED CHOLANGIOPATHY IN CHILDREN: A MULTI-READER AGREEMENT STUDY

Jonathan R. Dillman, MD, MSc (*Abstract Co-Author*) Research Grant, Perspectum Ltd;Research Grant, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research support, Koninklijke Philips NV;Research support, General Electric Company;Research support, Motilent Ltd
Gary R. Schooler, MD (*Abstract Co-Author*) Nothing to Disclose
Bin Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Shailee V. Lala, MD (*Abstract Co-Author*) Editor, RELX
Andrew T. Trout, MD (*Abstract Co-Author*) Author, RELX Author, Wolters Kluwer nv Research Grant, Canon Medical Systems Corporation Research Grant, Siemens AG Research support, Perspectum Diagnostics Ltd Consultant, Lantheus Holdings
Luana Stanescu, MD (*Abstract Co-Author*) Nothing to Disclose
Leslie H. Spence, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph Y. Cao, MD (*Abstract Co-Author*) Nothing to Disclose
Archana Malik, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Miethke, MD (*Abstract Co-Author*) Nothing to Disclose
Erica Riedesel, MD (*Abstract Co-Author*) Nothing to Disclose

Narendra S. Shet, MD (*Abstract Co-Author*) Nothing to Disclose
Nadeen Abu Ata, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Khendek (*Abstract Co-Author*) Nothing to Disclose
Pradipta Debnath, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess inter-radiologist agreement when interpreting Magnetic Resonance Cholangiopancreatography (MRCP) examinations in pediatric patients with known or suspected cholangiopathy.

**METHODS AND MATERIALS**

This was a retrospective, multi-reader study of clinically obtained MRCP examinations performed in patients less than 21 years-old due to known or suspected cholangiopathy between January 2018 and September 2023. Based on review of clinical records, patients were classified as having Primary Sclerosing Cholangitis (PSC), Autoimmune Sclerosing Cholangitis (ASC), or other diagnosis. Images were reviewed in a HIPAA-compliant, cloud-based image viewing platform by nine blinded fellowship-trained pediatric radiologists who independently documented biliary and liver findings. Kappa (?) statistics and intra-class correlation coefficients (ICC) with 95% confidence intervals (CIs) were used to quantify inter-reader agreement.

**RESULTS**

Seventy-five unique patients were included [median age=16.8 years (IQR: 13.8 to 18.7 years); 48 boys]. Within our study cohort, 22.7% (17/75) had PSC, 22.7% (17/75) had ASC, and 41/75 (54.7%) had other diagnoses. Among observers, agreement was slight for presence of cholangiopathy (?=0.15 [95% CI: 0.073 to 0.23]) and presence of PSC/ASC (?=0.13 [0.062 to 0.21]). For all patients, there was no agreement for intrahepatic stricture number (?=-0.002 [(-0.158 to 0.153]) and stricture extent (?=-0.056 [-0.093 to -0.019]). Agreement was slight for presence of intrahepatic stricturing disease (?=0.08 [0.04 to 0.12]). Most other findings had fair agreement between readers [including intrahepatic biliary dilation without stricture, intrahepatic focal/segmental dilations, intrahepatic and extrahepatic diverticula, “floating” bile ducts, diffuse extrahepatic dilation without stricture, extrahepatic stricture, bile duct mural thickening, intrahepatic peribiliaryT2-weighted signal, and biliary obstruction (?=0.22 to 0.34). There was moderate agreement on measured extrahepatic stricture length (? =0.46 [-0.113 to 1.00]) and presence of extrahepatic biliary dilation (?=0.53 [0.40 to 0.65]). There was good agreement for measured extrahepatic bile duct diameter (ICC=0.89 [0.85 to 0.92]).

**CONCLUSION**

Inter-radiologist agreement while interpreting MRCP in children is poor to fair for most findings of cholangiopathy, including the diagnosis of PSC/ASC.

**CLINICAL RELEVANCE/APPLICATION**

Suboptimal inter-radiologist agreement related to findings of pediatric cholangiopathy, including the diagnosis of PSC/ASC suggests, the need for education and more objective diagnostic tools.

**R6-SSPD05-6 Keynote Speaker**

Jeanne S. Chow, MD (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

R6-SSPH15

**Physics (AI in Medical Imaging)**

Thursday, Dec. 5 1:30PM - 2:30PM Room: S404

Yongshuai Ge, PhD (*Moderator*) Nothing to Disclose
Emil Y. Sidky, BS, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## R6-SSPH15-1 VALIDATING AN AI-POWERED AUTOMATED TOOL FOR DELINEATING METASTATIC BONE DISEASE AND EXTRACTING QUANTITATIVE RESPONSE BIOMARKERS FROM WHOLE-BODY DIFFUSION WEIGHTED IMAGING (WBMRI)

Christina Messiou, MD, BMBS (*Abstract Co-Author*) I am a co-founder of Diafora (alongside the Institute of Cancer Research and The Royal Marsden) that has formed a joint venture, Celescan, with Sopra Steria
Nina Tunariu, MD (*Abstract Co-Author*) Nothing to Disclose
Dow-Mu Koh, FRCR (*Abstract Co-Author*) Nothing to Disclose
Matthew Blackledge, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Donners, MD (*Abstract Co-Author*) Nothing to Disclose
Richard P. Holbrey, PhD (*Abstract Co-Author*) Software developer, Mint Medical GmbH
Antonio Candito, PhD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

WBMRI is an established technique used to assess bone metastases in patients with Advanced Prostate Cancer (APC), allowing quantification of two response biomarkers: (i) Total Diffusion Volume (TDV, in millilitres), and (ii) the Apparent Diffusion Coefficient (ADC), which is inversely correlated to tumour cellularity. However, manual delineations to measure ADC and TDV typically takes 1-2 hours, depending on disease volume. To overcome this challenge, we propose an AI-powered automated tool that can generate a detailed report on WBMRI biomarkers and their changes post-treatment within two minutes for APC patients.

### METHODS AND MATERIALS

The core technologies of the automated tool include: (i) a previously developed semi-supervised deep learning model with 2-channel inputs (calculated ADC map and b=0 s/mm2 image), which generates a skeleton probability map and a normalised b900 signal image; (ii) a convolutional neural network, which processes the output from (i), in order to generate a mask for suspected bone metastases, characterised by high b900 signal intensity and low ADC values (>500 mm2/s). This mask is applied to the ADC map to extract ADC statistics and TDV. Thresholds for changes in median ADC and TDV were established to assess response to treatment. The tool's segmentation and diagnostic accuracy were validated through an IRB approved multi-centre retrospective cohort study of 94 patients and single-centre prospective trial with 16 patients. Manual disease delineations (66 scans from the retrospective cohort) and clinical standard for response were defined by experienced radiologists for both cohorts.

### RESULTS

Our tool showed an average relative error below 5% for median ADC and 8.5% for TDV (after log-transform), compared to expert delineations. The diagnostic accuracy in classifying response/stable/progression disease across the retrospective and prospective cohorts yielded 81%, with sensitivity of 84% and specificity of 74%.

### CONCLUSION

WBMRI allows assessments of early treatment changes in metastatic bone disease. Our automated tool provides fast and reproducible delineations and measurements of ADC and TDV from restricted diffusion bone lesions on WBMRI scans. This solution could assist clinicians in shifting towards a quantitative paradigm for assessing treatment response, potentially improving clinical decision-making for APC patients.

### CLINICAL RELEVANCE/APPLICATION

Our automated tool enables fast delineations of suspected bone disease and measurement of WBMRI response biomarkers, potentially assisting clinicians in tailoring treatment plans for APC patients.

## R6-SSPH15-2 DECOUPLING ITERATIVE ALGORITHM FOR RAPID CALCULATION OF STANDARD TOFTS MODEL PARAMETERS

Wei Qian (*Abstract Co-Author*) Nothing to Disclose
Shouliang Qi (*Abstract Co-Author*) Nothing to Disclose
Shu Chang (*Abstract Co-Author*) Nothing to Disclose
Xiaobing Fan, PhD (*Abstract Co-Author*) Nothing to Disclose
Ying Ma (*Abstract Co-Author*) Nothing to Disclose
Dianning He, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The standard Tofts model (STM) is an important pharmacokinetic (PK) model for analyzing dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) data. However, it is time-consuming to perform pixel-by-pixel analysis of three-dimensional DCE-MRI data using the STM. Here, we introduced a decoupling iterative algorithm, prediction-correction method (PCM), for rapid calculation of the STM parameters.

**METHODS AND MATERIALS**

We utilized the QIBA_v6_Tofts dataset from the Quantitative Imaging Biomarkers Alliance and public prostate DCE-MRI dataset (n = 11) (QIN-PROSTATE). Our PCM eliminates the need for fitting the entire contrast agent concentration as function of time (C(t)) curve to calculating the volume transfer constant (Ktrans) and volume fraction (ve). The PCM is beginning with predicted ve=C(tN)/Cp(tN), where tN is the last time point and Cp(t) is artieral input function (AIF). Then utilizing earler part of C(t) (0 = t = tp) and predicted ve to predict Ktrans, where tp is the time when the AIF reached peak value. Subsequently, ve is fitted with the later part of C(t) (tL = t = tN, tL is 15 or 30 second before tN) with above prediced Ktrans. This process were repeated until the changes of Ktrans and ve were less than given error. This method relies on fitting one parameter by leveraging a small amount of data to reduce the computation time.

**RESULTS**

The PCM is verified with QIBA data and calculated Ktrans and ve values are close to values obtained from the STM. Validation using clinical data confirmed that the prediction-correction method significantly enhances the speed of parameter fitting. The results demonstrate that the speed of parameter fitting by PCM is enhanced by an average of 690% in comparison to the traditional method.

**CONCLUSION**

The PCM is significantly accelerates the calculations of Ktrans and ve with the accuracy close to the STM. By using the PCM, physiological parameters Ktrans and ve can be calculated rapidly for 3D DCE-MRI data.

**CLINICAL RELEVANCE/APPLICATION**

The novel PCM was significantly reduced the computation time required to fit entire C(t) used in the STM. There is a significant advance to use PCM for physicians accessing PK parameters maps in diagnosing cancers.

## R6-SSPH15-3 3D FAT BODY MASS QUANTIFIED FROM CT SCANS USING AI PREDICTS SURVIVAL IN EARLY PHASE CLINICAL TRIALS IN PATIENTS TREATED WITH ANTIBODY-DRUG-CONJUGATES

Christophe Massard (*Abstract Co-Author*) Nothing to Disclose
Matthieu DELAYE (*Abstract Co-Author*) Nothing to Disclose
Nathalie B. Lassau, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pierre Decazes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Bone (*Abstract Co-Author*) Employee, Guerbet SA
Felix Wirth, MEng, MSc (*Abstract Co-Author*) Nothing to Disclose
Younes Belkouchi, MSc (*Abstract Co-Author*) Nothing to Disclose
Vincent GOLDSCHMIDT (*Abstract Co-Author*) Nothing to Disclose
Santiago PONCE-AIX (*Abstract Co-Author*) Nothing to Disclose
Capucine Baldini (*Abstract Co-Author*) Nothing to Disclose
Littisha Lawrance (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore if the body mass quantified in 3D from CT scans are able to predict the survival for patients in early phase clinical trials for patients treated with Antibody Drug Conjugates(ADCs).

**METHODS AND MATERIALS**

In this retrospective cohort 136 patients treated with ADCs in early phase clinical trials were included. A deep learning software (Anthropometer3DNet) automatically quantified the multi-slice measurements of muscle body mass (MBM), fat body mass (FBM), subcutaneous fat mass (SFM) and visceral fat mass (VFM), which was normalized according to the height of the patient. Clinical and biological parameters such as the RMH (Royal Marsden Hospital) score, Charlson Comorbidity and ECOG PS were also retrieved. Primary endpoints were progression free survival (PFS) and overall survival (OS).The anthropometric parameters were also used to predict duration spent in the clinical trial. Survival analysis was performed using Cox regression models and Kaplan-Meier (KM) estimator. Cut-offs were determined using the maximally ranked selected statistics method. The effect of the anthropometric parameters with respect to the toxicity observed was also evaluated using ROC analysis. Correlation between these anthropometric parameters and the clinical and biological parameters was also examined to see if they provided the same kind of information.

**RESULTS**

The most frequent primary cancers were non-small cell lung cancer (41%) and colorectal cancer (23%). The median PFS and OS were 2.6 and 7.9 months respectively. A higher SFM (>3.34 kg/m2) (p=0.03) and higher FBM (>3.63 kg/m2) (p=0.01) were significantly associated with longer PFS .Similarly, A higher SFM (p=0.04) and a higher FBM (p=0.04) was significantly associated with longer OS. A higher FBM also predicted a longer duration spent in clinical trial significantly (p=0.01). About 90 (66%) patients had experienced toxicity, of which 46 were high grade (3-4). All anthropometric parameters were significantly associated with toxicity in the univariate but not in the multivariate analysis, none were associated significantly with high grade toxicity.The correlation of anthropometric and clinical parameters, was also examined. None of them showed a significant linear correlation with the anthropometric parameters.

**CONCLUSION**

In this mono-center cohort, anthropometric parameters measured in 3D from CT scan (high SFM and high FBM) were significantly associated with survival and duration in the clinical trial.

**CLINICAL RELEVANCE/APPLICATION**

The measuring of anthropometric parameters with a CT scan in 3D at baseline can be advantageous for patients when recruiting them to a clinical trial.

## R6-SSPH15-4 KNOWLEDGE DISTILLATION FOR LYMPH NODE METASTASIS CLASSIFICATION IN ESOPHAGEAL CANCER WITH PATHOLOGY-GUIDED LABEL SHARPENING AND TWO-STREAMED MULTI-SCALE FEATURE FUSION

Ke Yan (*Abstract Co-Author*) Nothing to Disclose
Dazhou Guo (*Abstract Co-Author*) Nothing to Disclose
Li Zhang (*Abstract Co-Author*) Nothing to Disclose
Xianghua Ye (*Abstract Co-Author*) Nothing to Disclose
Qifeng Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Le Lu (*Abstract Co-Author*) Nothing to Disclose
Yirui Wang, MS (*Abstract Co-Author*) Nothing to Disclose
Jie Zhu (*Abstract Co-Author*) Nothing to Disclose
Haoshen Li (*Abstract Co-Author*) Nothing to Disclose
Qinji Yu (*Abstract Co-Author*) Nothing to Disclose
Dakai Jin, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Diagnosis of lymph node (LN) metastasis in CT scans is crucial for esophageal cancer staging and treatment planning. Deep learning can potentially address it by learning from large-scale, accurately labeled data. However, due to the surgery procedure in LN dissection, it is difficult to pair the metastasis of individual LN reported in the pathology report to the LN instance found in CT. In addition, even for experienced physicians, only partial LN metastases can be accurately determined in CT. In this study, we propose a two-streamed multi-scale feature fusion network and leverage the teacher-student paradigm with pathology prior to explore the potential of large-scale unlabeled LNs in performance improvement.

### METHODS AND MATERIALS

We collected 1052 esophageal cancer patients who underwent treatment. Each patient has a preoperative contrast-enhanced CT and pathology report indicating the metastasis status of resected LN-stations. Among them, 310 patients had their LNs manually delineated and confirmed the metastasis status (benign or metastasis) by one radiologist (5 years experiences) and reviewed by another radiologist (15 years experiences), while the rest patients only had automatically segmented LN instance masks without the metastasis status. We first developed a supervised two-stream (local and global stream) classification network with 2.5D multi-scale feature fusion, which better characterized LN's global (size, shape) and localized features (intensity, textures). Then, for unlabeled data, we adopted the teacher-student mechanism with pathology prior, where hard pseudo labels were assigned to unlabeled LNs if the model generated high confident predictions that were consistent with the corresponding LN-station metastasis derived from pathology report. Four-fold cross-validation was conducted to evaluate the model’s performance, reporting sensitivity, specificity, and AUC as classification metrics.

### RESULTS

LN classification results are shown in the Table and Figure. Our supervised model exhibited the AUC of 0.9068, outperforming the 2nd-best compared supervised method (DualNet_3D) by 4.20% (0.9068 vs. 0.8648). For our semi-supervised method, the AUC can be further increased to 0.9318, with an improvement of 2.50% compared to our supervised model and outperforming other semi-supervised method by at least 2.95% in AUC.

### CONCLUSION

This study established a supervised and a semi-supervised model for predicting LN metastasis of esophageal cancer patients on CT scan, and showed high predictive performance on a large patient cohort.

### CLINICAL RELEVANCE/APPLICATION

Our developed LN classification model may be applied in the clinical workflow to assist the diagnosis and treatment for esophageal cancer patients.

## R6-SSPH15-5 3D QUANTITATIVE ANGIOGRAPHY USING SPARSE PROJECTION DATA WITH VIRTUAL ANGIOGRAPHY-INFORMED CONVOLUTIONAL NEURAL NETWORK RECONSTRUCTION

Allison Shields, PHD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Adnan Siddiqui, MD,PhD (*Abstract Co-Author*) Investor, Shifamed LLC;Consultant, Alexion Pharmaceuticals, Inc;Advisory Board, Alexion Pharmaceuticals, Inc;Consultant, Amnis Therapeutics;Advisory Board, Amnis Therapeutics;Investor, Amnis Therapeutics;Investor, Bendit Technologies, Ltd;Investor, Blinktbi Inc ;Consultant, Boston Scientific Corporation;Advisory Board, Boston Scientific Corporation;Investor, Boston Scientific Corporation;Investor, Buffalo Technology Partners, Inc;Consultant, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation;Consultant, Cardinal Health, Inc;Advisory Board, Cardinal Health, Inc;Investor, Cardinal Health, Inc;Consultant, Cerebrotech Medical Systems, Inc;Advisory Board, Cerebrotech Medical Systems, Inc;Investor, Cerebrotech Medical Systems, Inc;Investor, Cognition Medical;Consultant, Endostream Medical, Ltd;Advisory Board, Endostream Medical, Ltd;Investor, Endostream Medical, Ltd;Consultant, Imperative Care, Inc;Advisory Board, Imperative Care, Inc;Investor, Imperative Care, Inc;Investor, Instylla, Inc;Consultant, IRRAS AB;Advisory Board, IRRAS AB;Investor, IRRAS AB;Consultant, Johnson & Johnson;Advisory Board, Johnson & Johnson;Committee member, Johnson & Johnson;Investor, NeuroRadial Technologies, Inc;Investor, Neurovascular Diagnostics, Inc;Consultant, Perflow Medical Ltd;Advisory Board, Perflow Medical Ltd;Investor, Perflow Medical Ltd;Consultant, Q’Apel Medical Inc;Advisory Board, Q’Apel Medical Inc;Investor, Q’Apel Medical Inc;Investor, Radical Catheter Technologies, Inc;Consultant, Integra LifeSciences Holdings Corporation;Advisory Board, Integra LifeSciences Holdings Corporation;Investor, Integra LifeSciences Holdings Corporation;Investor, RIST Neurovascular, Inc;Investor, Sense Diagnostics LLC ;Consultant, Serenity Medical Inc;Advisory Board, Serenity Medical Inc;Investor, Serenity Medical Inc;Consultant, Siemens AG;Advisory Board, Siemens AG;Consultant, Silk Road Medical;Advisory Board, Silk Road Medical;Investor, Silk Road Medical;Investor, Spinnaker Medical Consultants ;Consultant, StimMed;Advisory Board, StimMed;Investor, StimMed;Investor, Synchron AB;Investor, Truvic Medical, Inc;Investor, Vastrax , LLC;Investor, VICIS;Investor, Viseon Inc;Consultant, Viz.ai Inc;Advisory Board, Viz.ai Inc;Investor, Viz.ai Inc;Consultant, Medtronic plc;Advisory Board, Medtronic plc;Committee member, Medtronic plc;Consultant, Terumo Corporation;Advisory Board, Terumo Corporation;Committee member, Terumo Corporation;Consultant, Minnetronix Medical, Inc;Advisory Board, Minnetronix Medical, Inc;Consultant, Penumbra, Inc;Advisory Board, Penumbra, Inc;Committee member, Penumbra, Inc;Consultant, Rapid Medical;Advisory Board, Rapid Medical;Consultant, Stryker Corporation;Advisory Board, Stryker Corporation;Consultant, VasSol, Inc;Advisory Board, VasSol, Inc;Consultant, W. L. Gore & Associates, Inc;Advisory Board, W. L. Gore & Associates, Inc
Mohammad Mahdi Shiraz Bhurwani, PhD (*Abstract Co-Author*) Stockholder, qas.ai
Ciprian N. Ionita, PhD (*Abstract Co-Author*) CEO, QAS.AI;Grant, Canon Medical Systems Corporation
Swetadri Vasan Setlur Nagesh, MS, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyle Williams, BS (*Abstract Co-Author*) Nothing to Disclose
Parmita Mondal, PhD (*Abstract Co-Author*) Nothing to Disclose
Parisa Naghdi, PhD (*Abstract Co-Author*) Nothing to Disclose
Ahmad Rahmatpour, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Traditional quantitative angiography (QA) during neurovascular interventions relies on 2D digital subtraction angiography, which is limited by its lack of comprehensive spatial information, leading to inaccuracies in disease assessment and treatment guidance. In theory, 3D-QA would address the 2D limitation, however, capturing reliable 3D-QA is challenging due to the rapid contrast bolus transit. These factors emphasize the need for improved 3D-QA. This study explores the feasibility of using sparse projection cone beam computed tomography (CBCT) for 3D angiographic reconstruction using computed fluid dynamics (CFD) data.

**METHODS AND MATERIALS**

This study utilizes CFD with patient-specific 3D vascular geometries to generate a set of 3D virtual angiograms. Sparse reconstructions were derived from 15 projections using the Feldkamp-Davis-Kress algorithm and created a corresponding ground truth for each slice from the 3D virtual angiogram. A modified U-Net convolutional neural network (CNN) architecture was trained to reconstruct full angiographic data from these sparse projections. Training involved 4,100 axial slices with an 80:20 training-testing split (by geometry). Augmentation techniques, including rotation and mirroring of the vessel image, were utilized to enhance model robustness. C-arm based CBCT acquisitions operating at 25 frames per second with a 200-degree rotation, capturing 108 projections with 10 ms integration time and a 30 ms inter-projection gap, employing a cone beam projection geometry were acquired from 3 patients. Finally, the trained U-Net was applied to actual patient CBCT data to evaluate the model’s ability to recover full reconstructions from sparse data. We employed metrics like the Dice coefficient, precision, recall, and F1-score to gauge our performance.

**RESULTS**

Evaluation of our U-Net model across the dataset yielded a Dice coefficient of 0.71, indicating good model-to-ground truth alignment, with an F1-score of 71%. Despite a modest precision of 56%, the model's recall was high at 97%, demonstrating its capability in capturing relevant features critical for clinical diagnosis and intervention planning.

**CONCLUSION**

Our findings demonstrate the feasibility of using CNNs for accurate 3D quantitative angiography reconstruction. Trained on virtual CFD data, the model effectively applied these insights to real patient CBCT data, demonstrating promising clinical applicability.

**CLINICAL RELEVANCE/APPLICATION**

This study underscores the potential of machine learning algorithms, trained on virtually generated data, to address the challenges of acquiring accurate 3D quantitative angiography from CBCT scans, improving clinical assessments and vascular intervention planning.

## R6-SSPH15-6 A NOVEL DEEP LEARNING IMAGE RECONSTRUCTION ALGORITHM FOR LOW-DOSE CDTE PHOTON-COUNTING BREAST CT

Sabee Y. Molloi, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Huanjun Ding (*Abstract Co-Author*) Nothing to Disclose
Hamidreza Khodajou-Chokami, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

We present a novel deep learning (DL)-based framework designed to rapidly generate high-quality CT images for low-dose breast CT applications.

**METHODS AND MATERIALS**

Our deep learning model, RecGAN-Net, combines generator and discriminator networks to optimize CT image reconstruction. The generator employs a multi-receptive field densely connected convolutional neural network with an encoder-decoder structure and dense skip connections to expand the receptive field and enhance performance. The discriminator utilizes a traditional architecture with binary cross-entropy loss, enhanced by leaky ReLUs with a slope of 0.2, culminating in a sigmoid-activated output layer to determine the final probability assessment. Our data were experimentally collected using a cone-beam breast CT system, equipped with a Cadmium Telluride (CdTe) photon-counting detector, operating at a maximum tube voltage of 70 kVp and set at a source-to-detector distance of 62.5 cm. To harness the advantages of transfer learning, RecGAN-Net was initially trained on the AAPM challenge dataset, and subsequently fine-tuned on our in-house dataset, containing high-dose breast CT images (12 mGy, 1480 projections) and the corresponding low-dose CT images (1.5 mGy, 180 projections), featuring embedded microcalcifications ranging from 140 μm to 500 μm.

**RESULTS**

Transitioning from the high-dose reference image to an approximately eightfold reduction in projection data, RecGAN-Net achieved a Structural Similarity Index (SSIM) of 0.989 and a Root Mean Square Error (RMSE) of 0.007 HU as compared with Feldkamp-Davis-Kress (FDK) reconstruction with SSIM of 0.533 and an RMSE of 0.04 HU. This demonstrates that the low-dose CT image maintains a high level of similarity to the high-dose reference image, significantly outperforming the FDK reconstruction. Preliminary postmortem breast results have demonstrated RecGAN-Net's capability to detect 140 μm microcalcifications with a low radiation dose of 1.5 mGy.

**CONCLUSION**

Integrating our deep learning algorithm into a photon-counting breast CT system not only yields high-quality images but also significantly reduces the radiation dose. Microcalcifications can be detected at a mean glandular dose level comparable to that of clinical mammography.

**CLINICAL RELEVANCE/APPLICATION**

RecGAN-Net advances breast CT imaging by maintaining high image quality while reducing radiation to levels comparable with mammography (1.5 mGy). This enables the detailed detection of critical microcalcifications (140 μm), essential for early breast cancer diagnostics. By minimizing radiation without compromising diagnostic quality, RecGAN-Net can transform breast cancer screening, enhancing patient safety and facilitating earlier interventions.

# Abstract Archives of the RSNA, 2024

R6-STCE1

**Science Session (Theranostics)**

Thursday, Dec. 5 1:30PM - 2:00PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## R6-STCE1-2 MICROFLUIDIC-MEDIATED LABELING OF HUMAN T-CELLS WITH SUPERPARAMAGNETIC IRON OXIDE NANOPARTICLES FOR NON-INVASIVE CELLULAR TRACKING VIA MR IMAGING

Todd Sulchek (*Abstract Co-Author*) Nothing to Disclose
Avi Gupta (*Abstract Co-Author*) Nothing to Disclose
Hossein Nejadnik, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
S. Ali Nabavizadeh, MD (*Abstract Co-Author*) Research grant , Blue Earth Diagnostics;Research grant Navidea
Nastaran Khalili, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Hannah Anderson (*Abstract Co-Author*) Nothing to Disclose
Sina Bagheri, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Magnetic resonance imaging (MRI) has become a powerful, non-invasive method for visualizing and tracking labeled cells. Superparamagnetic iron oxide nanoparticles (SPIONs), valued for their biocompatibility and magnetic properties, hold potential for cellular labeling. This study employed microfluidic devices to precisely label human T-cells with SPIONs through mechanoporation, enhancing the accuracy and efficiency of the labeling process.

### METHODS AND MATERIALS

Experiments were conducted using a novel, custom-engineered microfluidic device designed to enhance the delivery of SPIONs through volume exchange and convective transfer. Within the device, human T-cells traverse multiple ridged channels, undergoing a series of rapid and high-intensity deformations that transiently open cellular pores, facilitating the convective transport of SPIONs into the cells. The uptake of nanoparticles by the cells was assessed using Prussian blue staining and a colorimetric iron assay. Both labeled and unlabeled T-cells were imaged in vitro using MRI. T2 relaxation times were compared between labeled and unlabeled T-cells using a Student's t-test, with significance set at $p<0.05$.

### RESULTS

The uptake of SPIONs was significantly greater in labeled T-cells compared to unlabeled ones (0.250 ± 0.048 pg/cell versus 0.009 ± 0.003 pg/cell, $p<0.001$). This cellular nanoparticle uptake was further verified using Prussian blue staining. Additionally, T-cells labeled with nanoparticles exhibited significantly shorter T2 relaxation times (50.49 ± 7.19 ms) compared to unlabeled cells (89.35 ± 11.03 ms) as determined by MRI ($p=0.007$).

### CONCLUSION

This study successfully demonstrated the labeling of human T-cells with SPIONs, establishing a foundation for the labeling of therapeutic T-cells, including CAR T-cells.

### CLINICAL RELEVANCE/APPLICATION

The methodology developed enables non-invasive in vivo tracking of therapeutic T-cells using MRI, thereby offering significant potential for monitoring the distribution and migration of therapeutic T-cells in clinical applications. This advancement could greatly enhance the precision and efficacy of T-cell-based therapies.

## R6-STCE1-3 UTILIZING 19F NANOEMULSIONS IN MRI TO MONITOR CANCER PROGRESSION POST-IMMUNOTHERAPY AND RADIATION THERAPY IN BREAST AND COLON CANCER MODELS

Emily Qi, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Colon and breast cancer are 2 of the most prominent and aggressive forms of cancer. While magnetic resonance imaging (MRI) is commonly used alongside biopsies to diagnose and monitor cancer progression, biopsies are invasive and time intensive. A novel method of tracking tumor growth after immunotherapy or radiation therapy is the use of fluorine (19F) nano-emulsions as contrast agents for MRI, which label systemic macrophages. Macrophages flock to the tumor site to initiate tumor resistance, and there is an increase in immune response, and thus, macrophages, when treatment is used.

### METHODS AND MATERIALS

Anti-PD-L1 immunotherapy was used to block the PD-L1 protein found on the surface of various types of cancer cells, which work to inhibit immune response. Female mice were injected with murine breast (4T1) or colon cancer (MC38) cell lines in the mammary fat pad, followed by intravenous injections of the 19F contrast agent, and finally, a baseline 19F MRI. The study then diverged into 2 primary directions: radiation therapy (RT) and

immunotherapy. In the first study, half of the mice underwent 8 Gy of localized RT while the other half remained untreated; they were monitored for 14 days to elucidate tumor growth and 19F signal. In the second study, 12 mice received anti-PD-L1 immunotherapy and 3 remained untreated. MRI was performed on days 3, 7, 10, 14, and 17 of the study to evaluate response rate.

**RESULTS**

The RT study yielded a significantly higher fluorine signal and tumor growth reduction in treated mice versus untreated. The immunotherapy study showed a response rate of 75%, allowing us to quantify responders versus non-responders using MRI as the primary diagnostic modality.

**CONCLUSION**

19F MRI is a promising method for diagnosing and tracking cancer through noninvasive precise tracking of macrophage activity during radiation therapy and immunotherapy.

**CLINICAL RELEVANCE/APPLICATION**

This novel approach shows great potential for improving clinical outcomes through more consistent and accurate monitoring.

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# Abstract Archives of the RSNA, 2024

R6-STCE2

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Thursday, Dec. 5 1:30PM - 2:00PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## R6-STCE2-2 DEEP LEARNING-ACCELERATED MR IMAGING IN MUSCLE INJURIES OF PROFESSIONAL SOCCER ATHLETES: ENHANCING EFFICIENCY AND REDUCING COSTS IN RADIOLOGY

Ibrahim Yel, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Simon S. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Jan-Erik Scholtz, MD (*Abstract Co-Author*) Nothing to Disclose
Vitali Koch, MD (*Abstract Co-Author*) Nothing to Disclose
Leon D. Gruenewald, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer Gotta (*Abstract Co-Author*) Nothing to Disclose
Scherwin Mahmoudi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

MRI has become a relevant diagnostic imaging method for evaluating muscle injuries in professional athletes, aiding in treatment planning and rehabilitation management. The purpose of this study was to investigate the impact of deep learning-accelerated PD-weighted sequences on acquisition time, image quality, and operational costs in muscle injuries of professional soccer athletes.

### METHODS AND MATERIALS

22 professional male soccer athletes (mean age 25.4±3.4) who underwent 3-Tesla MRI of the lower limb due to suspicion of structural muscle injuries were included in this study. Standard sequences were acquired according to a dedicated protocol comprimising PD-weighted imaging in axial, paracoronal and parasagittal plane, as well as T1-weighted imaging in axial plane. Additionally, PD-weighted imaging sequences were acquired using the deep learning algorithm (PDDL). Subjective evaluation was independently performed by three blinded radiologists. 5-point Likert scales were utilized to subjectively assess diagnostic confidence, image quality, and lesion sharpness. Objective analysis encompassed time efficiency and quantitative imaging parameters, including signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR), as well as operational costs including electricity and personnel.

### RESULTS

MRI analysis revealed structural injuries in 18 patients (81.1%). Subjective evaluations of PDDL sequences revealed excellent diagnostic confidence (median 5, interquartile range (IQR): 5-5), image quality (median 5, IQR: 5-5), and lesion sharpness (median 5, interquartile range: 4-5). PDDL was preferred over conventional PD sequences in 90.9% of cases. Objective image analysis of PDDL revealed significant higher SNR (115.0±9.1) and CNR values (80.5±12.8) when compared to conventional PD sequences (81.3±5.9 and 54.3±5.4, respectively; $p < 0.05$). Acquisition times could be reduced by an average of 39.7% using PDDL sequences, leading to relevant cost savings in terms of electricity and personnel.

### CONCLUSION

Our findings suggest that deep learning-accelerated PD sequences in MRI imaging of muscle injuries among professional athletes allow a reduction in acquisition time while additionally improving both subjective and objective image quality. The integration of these sequences may enhance operational efficiency and reduce ongoing costs, promoting a more sustainable and value-based approach in radiology.

### CLINICAL RELEVANCE/APPLICATION

The integration of deep learning sequences into MRI protocols for muscle injury evaluation not only facilitates prompt treatment and rehabilitation in professional sports medicine but also underscores the potential for substantial cost savings and increased efficiency, contributing to a more equitable and sustainable healthcare system.

# Abstract Archives of the RSNA, 2024

R7-STCE1

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Thursday, Dec. 5 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## R7-STCE1-1 TRANSCRIBING MULTILINGUAL RADIOLOGIST-PATIENT DIALOGUE INTO MAMMOGRAPHY REPORTS USING AI: A STEP TOWARDS PATIENT-CENTRIC RADIOLOGY

Mohak Narang, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Neha Rani (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the efficiency of generating mammography reports using artificial intelligence (AI)-based transcription and information extraction from simulated radiologist-patient conversations in vernacular language.

### METHODS AND MATERIALS

A curated dataset of 50 mammograms (10 normal, 20 benign, 20 malignant) was used in this retrospective study. A radiologist (10 years' experience) discussed mammogram findings with paramedical staff in vernacular language to simulate patient conversations. Conversation for each mammogram was transcribed using OpenAI's large-v2 whisper model at different temperature (temp) settings (0, 0.3, 0.5 and 0.7). The generated transcript versions were processed by Generative Pre-trained Transformer-4o (GPT-4o) to generate reports in a predetermined JSON format, displayed as editable files in HTML. Time taken for conversation, transcription, GPT-4o response and radiologist editing was measured. Accuracy metrics, including word error rate (WER) and character error rate (CER) for AI-generated transcriptions were compared to manual transcriptions. Concordance rates for JSON fields in AI-generated versus radiologist-edited reports were calculated.

### RESULTS

The mean WER and CER for AI-generated transcripts respectively, were: 0.577 and 0.379 at temp 0; 0.641 and 0.428 at temp 0.3; 0.604 and 0.380 at temp 0.5; and 0.622 and 0.395 at temp 0.7. The concordance rates for various fields in the json format report varied from 0.96 (for 'recommendation') to 0.54 (for 'left breast. parenchyma'); with a mean concordance of 0.81 for all the fields. The mean time for report generation was 206.7s, with conversation 113.8s, transcription 45.6s, GPT-4o response 4.3s, and editing 43.1s.

### CONCLUSION

AI-driven transcription for vernacular languages using automated speech recognition along with feature extraction by language model for radiology report generation provides an efficient method to establish a radiologist-patient dialogue and advance a patient-centric and equitable radiology practice.

### CLINICAL RELEVANCE/APPLICATION

Traditional radiology reports, designed for physicians, are seldom understandable to the patients especially in non-English-speaking populations. While radiologist-generated summaries offer some assistance, they contribute to an already heavy workload and are not widely practiced. AI-enhanced report generation from vernacular-language dialogues between radiologists and patients, promises not only a more engaging and empathetic experience for patients but also the potential for comparable efficiency with current radiology workflows. This approach could transform how information is conveyed, making radiology more accessible and patient-centered.

## R7-STCE1-2 CARBON FOOTPRINT OF CT COLONOGRAPHY VERSUS OPTIC COLONOSCOPY

Christina A. LeBedis, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Clara Kerwin, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin J. Chang, MD (*Abstract Co-Author*) Speaker, RELX;Speaker, Koninklijke Philips NV
Monica Kassavin, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The growing awareness of climate change and the need for sustainable practices have led to increased scrutiny of the carbon footprint associated with medical procedures . This study focuses on comparing the carbon footprint of CT colonography versus optic colonoscopy, two procedures used for colorectal cancer screening and diagnosis with similar sensitivities in detecting colorectal lesions.

### METHODS AND MATERIALS

A comprehensive review of peer-reviewed articles was undertaken to evaluate the carbon footprint associated with CT colonography and optical colonoscopy. Studies were chosen based on data on carbon emissions and procedural methodologies. In the absence of studies specifically addressing the carbon footprint of CT colonography, general emissions data for CT procedures were used as a proxy. The carbon footprint was measured in carbon emissions equivalent (CO2eq).

## RESULTS

Existing literature suggests that CT colonography has a lower carbon footprint compared to optical colonoscopy. The average carbon footprint for colonoscopy ranges from 15.0 to 28.4 kg CO2eq , while CT ranges from 2.6 to 9.2 kg CO2eq. This difference is largely due to the lower resources required, including fewer staff, no need for anesthesia, shorter procedure times, less disposable waste and minimal equipment and laundry requirements. Additionally, technological advancements in imaging have enhanced the efficiency of CT, reducing scanning time and, consequently, energy consumption, which is the largest contributor to greenhouse gas emissions in diagnostic imaging.

## CONCLUSION

Incorporating environmental impact assessments into medical decision-making is crucial for sustainable healthcare practices. Although CT colonography and optical colonoscopy offer comparable diagnostic accuracy, the lower carbon footprint of CT colonography presents an opportunity for reducing the environmental impact of colorectal cancer screening. Limitations to existing literature include no specific quantification of CT colonography footprint and most studies from countries outside the United States which may have a different energy grid. Future research should focus on national and institutional-level carbon footprint analysis to validate these findings and guide healthcare policies. By prioritizing sustainability, healthcare providers and policymakers can align medical practices with global climate goals?.

## CLINICAL RELEVANCE/APPLICATION

Given that gastrointestinal endoscopies are the third-largest source of medical waste in healthcare facilities, it is important to consider the comparative carbon footprint of CT colonography to drive sustainable medical practices.

# R7-STCE1-3 REDUCING MRI ENVIRONMENTAL IMPACT THROUGH AI: COMPARATIVE ANALYSIS OF DL AND NON-DL MPRAGE IMAGE QUALITY AND IMPACT ON MRI PRACTICE SUSTAINABILITY

Salil Soman, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Christopher J. MacLellan, PhD (*Abstract Co-Author*) Stockholder, NNOX
Blake Foster, MD (*Abstract Co-Author*) Nothing to Disclose
Ibraheem Shaikh, MD (*Abstract Co-Author*) Nothing to Disclose
Eugene Milshteyn, PhD (*Abstract Co-Author*) Nothing to Disclose
Semyon Chulsky, MD (*Presenter*) Nothing to Disclose

## PURPOSE

To compare pathology visibility, morphometry, and the need for repeat sequences between DL and non-DL MPRAGE at 1.5T, and to determine how AI in MRI enhances diagnostic accuracy and sustainability, supporting equitable healthcare delivery.

## METHODS AND MATERIALS

35 patients were scanned on a 1.5T Voyager MR system (GE HealthCare, WI, USA) from May to August 2023, under an IRB-approved protocol. 13 had abnormalities. Images were reconstructed using a commercial DL method (AIR™ Recon DL, GE HealthCare), which reduced noise by 75%, and conventional non-DL methods. Qualitative analysis involved a neuroradiologist, a neuroradiology fellow, and 2 radiology residents with 19, 8, 2, and 1 years of experience, respectively. Preference for DL or non-DL images was scored on a scale of 0 (non-DL), 1 (DL), and 2 (no difference), with inter-rater agreement measured by Fleiss' Kappa. Morphometric analysis used FreeSurfer (v7.4.0). Volumes and cortical thickness were compared using a paired t-test ($p<0.05$). Two neuroradiologists assessed the need to repeat scans on a 5-point scale from -2 (not repeating) to 2 (repeating) and patient callbacks. Inter-rater agreement was measured, and differences were calculated using a two-tailed t-test ($p<0.05$).

## RESULTS

Preference for DL images was 78%, non-DL images 13%, and no preference 9.5%, with a Fleiss Kappa of 0.9, indicating strong agreement. Morphometric comparisons remained within a 5% mean value difference. A significant difference in rescan recommendations between DL and non-DL images was found ($p<0.001$). Non-DL images scored -0.03 with an inter-rater reliability of 1, while DL images scored -1.62 and -1.48 with an inter-rater reliability of 0.895. Callback rates differed significantly ($p=0.04$); 17% for non-DL with inter-rater reliability of 1, compared to 3.4-6.9% for DL with inter-rater reliability of 0.651.

## CONCLUSION

This study shows that DL MPRAGE images provide equal or better diagnostic quality than non-DL images while decreasing repeat scans. This reduction lowers greenhouse gas emissions from energy use, patient travel, and MRI waste, highlighting environmental benefits. Improved imaging efficiency enhances health equity by reducing patient burden. However, the environmental impact of training advanced AI models should be considered.

## CLINICAL RELEVANCE/APPLICATION

Concerns about climate change highlight the significant energy consumption of MRI scans and their environmental impact. This necessitates strategies for environmental sustainability while maintaining imaging quality. AI applications show promise but require further investigation into their effects on imaging quality and sustainability through reduced scan times and fewer repeat exams.

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# Abstract Archives of the RSNA, 2024

R7-STCE2

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Thursday, Dec. 5 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## R7-STCE2-2 PEDIATRIC RADIOLOGY DEPARTMENT ENVIRONMENTAL FOOTPRINT: AWARNESS AMONG EMPLOYEES AND COMPREHENSIVE QUANTITATIVE ENERGY EXPENDITURE

Francoise Rypens, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana Arnoldo (*Abstract Co-Author*) Nothing to Disclose
Ramy El-Jalbout (*Abstract Co-Author*) Nothing to Disclose
Joanna J. Abi Ghosn, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Health care facilities have a major impact on climate change since they contribute to important greenhouse gas emissions. Medical imaging contributes greatly to this pollution through its energy consumption from imaging equipment, workstations, monitors and the production of medical waste including contrast agents. Although the climate change's issue was highlighted since decades, a well-organized action plan was not adopted quickly by the health care systems. The purpose of the study is to promote the need to reduce the environmental footprint of a pediatric radiology department, by first determining the level of knowledge and the personal attitude of the medical imaging staff and employees with respect to radiology environmental footprint, and second by measuring the energy consumption of the different imaging equipment and electronic devices.

### METHODS AND MATERIALS

Prospective study in which a survey of 18 questions with multiple choices and open-ended questions was distributed to the radiology staff, residents, technologists and administrative agents. The mean kilowatt-hour energy expenditure per equipment was collected with an energy consumption meter in every sector and exam room of the radiology department to measure energy expenditure.

### RESULTS

A total of 31 employees responded to the survey of whom 51.6% were technologists, 32.2% aged 31 to 40 years old and 83.8% women. While the majority believe that Radiology Department consumes up to 50 % of total energy expenditure of the hospital and all the respondents do green actions to decrease environmental impact in their daily lives, only 42 % turn off their computer stations and radiology equipment daily. On the other hand, 67.7% believe that working from home decreases environmental impact and 48.4% do not know whether Artificial Intelligence (AI) has an impact on radiology department environmental impact. As expected, the majority of energy expenditure in the radiology department was from radiology equipment. Among the latter, energy consumption of MRI (25 kWh) dropped significantly after working hours (5kWh).

### CONCLUSION

Most of radiology staff and employees are aware of the environmental impact of the radiology department. However, actions that could have decreased energy expenditure are overlooked because of lack of awareness. We intend to launch an awareness campaign via a memory aid based on our survey results and objective energy expenditure in the department and then do a follow up survey at institution's level in 3 months to assess the behavioral changes.

### CLINICAL RELEVANCE/APPLICATION

Radiology is a major source of greenhouse gas emissions mostly from imaging equipment. However informed staff and employees can drive change by simple daily actions at bedside and in exam rooms.

# Abstract Archives of the RSNA, 2024

S1-SSCH01

**Chest Imaging (Diffuse Lung Disease/Infection)**

Sunday, Dec. 1 9:00AM - 10:00AM Room: E451A

Jose de Arimateia B. Araujo Filho, MD, PhD (*Moderator*) Nothing to Disclose
Janardhana Ponnatapura, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S1-SSCH01-1 VOLUMETRIC AIRWAY-TO-LUNG DYSANAPSIS: ASSOCIATIONS WITH RESPIRATORY MORBIDITY AND MORTALITY IN COPD

Sandeep Bodduluri, MS, PhD (*Abstract Co-Author*) Nothing to Disclose
Surya Bhatt (*Abstract Co-Author*) Nothing to Disclose
Venkata Sthanam (*Abstract Co-Author*) Nothing to Disclose
Arie Nakhmani (*Abstract Co-Author*) Nothing to Disclose
Stephanie Marie Aguilera, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

Airway-to-lung dysanapsis is associated with increased risk of developing chronic obstructive pulmonary disease (COPD) and premature mortality. It has been quantified by the ratio of the geometric mean of segmental airway lumen diameters to the cube root of the lung volume. We derived a more anatomically accurate 3D volumetric measure of dysanapsis using airway to-lung volume ratio. We hypothesize that greater volumetric dysanapsis, indicated by lower airway-to-lung volume ratios, is associated with respiratory morbidity and mortality in COPD.

### METHODS AND MATERIALS

Inspiratory CT scans from 8102 subjects enrolled in the multicenter COPDGene study were included. Airways and lungs were segmented using a UNet-based segmentation model. Volumetric dysanapsis is defined by the airway to lung volume ratio scaled to 1000. Multivariable regression analyses were used to test associations between volumetric dysanapsis and lung function measures (FEV1, FEV1/FVC) adjusted for age, race, sex, BMI, smoking status, pack-years of smoking, Pi10 and %CT emphysema. We also tested associations between volumetric dysanapsis with 6-minute walk distance, SGRQ score for quality of life, mMRC dyspnea score, and annualized change in FEV1 over 5 years with additional adjustments for baseline FEV1. We categorized volumetric dysanapsis into quartiles and performed multivariable Cox proportional hazards analysis to test its association with mortality.

### RESULTS

Airway-to-lung volume ratio was lower with disease progression ($p<0.001$): 6.21(1.80), 5.25(1.49), 4.70(1.52), 4.23(1.32), 3.65(0.98) through GOLD severity stages 0-4 respectively. In adjusted multivariable analyses, volumetric dysanapsis was independently associated with FEV1 (ß = -0.03 L, 95%CI -0.01 to -0.04, $P<0.001$), FEV1/FVC (ß = -0.025 , 95%CI -0.022 to -0.027; $P<0.001$), 6-min-walk distance (ß = -2.68 m; 95%CI -3.55 to -1.81; $P<0.001$), SGRQ score (ß = 0.74 , 95%CI 0.23 to 1.25, $P=0.004$), mMRC dyspnea score (ß = 0.03, 95% CI 0.01 to 0.06, $P =0.003$), and lung function decline (ß = -3.48 ml/year; 95%CI -5.28 to -1.69; $P <0.001$). When divided by quartiles, there were 831(10%) subjects with moderate dysanapsis and 304 (4%) subjects with severe dysanapsis in GOLD 0. Moderate (adjusted HR= 1.37, 95%CI 1.21 to 1.56, $P<0.001$) and severe volumetric dysanapsis (adjusted HR= 2.25, 95%CI 2.00 to 2.54, $P<0.001$) were significantly associated with increased mortality.

### CONCLUSION

Volumetric airway-to-lung dysanapsis increases with COPD severity, and is independently associated with lung function, respiratory morbidity, and mortality.

### CLINICAL RELEVANCE/APPLICATION

Volumetric dysanapsis significantly enhances early COPD screening before major symptoms arise.

## S1-SSCH01-2 CHEST CT-BASED CHARACTERIZATION OF OSTEOPOROSIS AND SARCOPENIA IN COPD

Eric A. Hoffman, PhD (*Abstract Co-Author*) Founder, VIDA Diagnostics, Inc;Shareholder, VIDA Diagnostics, Inc;Advisory Board, Siemens AG
Kung-Sik Chan (*Abstract Co-Author*) Nothing to Disclose
Xiaoliu Zhang (*Abstract Co-Author*) Nothing to Disclose
Syed Ahmed Nadeem, PhD (*Abstract Co-Author*) Nothing to Disclose
Xinyu ZHANG (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Regan, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Comellas, MD (*Abstract Co-Author*) Nothing to Disclose
Punam K. Saha, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Osteoporosis and sarcopenia are major comorbidities in chronic obstructive pulmonary disease (COPD). We compute thoracic bone and muscle metrics from chest CT data and retrospectively characterize osteoporosis and sarcopenia in COPD.

**METHODS AND MATERIALS**

Deep learning-based automated algorithms were applied to inspiratory chest CT images of participants from the Genetic Epidemiology of COPD (COPDGene) Iowa cohort at baseline visits to compute their pectoral muscle area (PMA) and spinal volumetric bone mineral density (BMD). A generalized additive model (GAM) was built by accounting for possible nonlinear effects of demographics and risk variables, specifically, the model formula being: log(Y) ~ Sex + Smoking + Race + s(Age) + s(Height) + s(Weight) + s(PackYears), where s(·) are variable-specific smooth natural cubic spline functions determined by the data based on generalized cross validation, and Y could be the PMA or BMD metric. The GAMs were built using data from participants with preserved lung function. For each model, the corresponding residual standard deviation s measures the typical variation around the predicted value. For each participant, BMD (PMA) was predicted with the model and the computed prediction residual was standardized by s.

**RESULTS**

Study participants (n=1,127; age (mean±standard deviation): 60.2±9.1 years; 572 (50.7%) females) were grouped according to COPD severity: 1) preserved lung function (n=520); 2) mild COPD (n=214); 3) moderate COPD (n=212); and 4) severe COPD (n=181). A gradual decline in PMA with COPD severity was observed in Figure 1(a), while a relatively sharper fall in BMD between mild and moderate COPD group was noted. Participants with increasing COPD severity had greater negative shifts in BMD and PMA falling in the osteoporosis, sarcopenia, and osteosarcopenia quadrants, which indicates adverse relations of bone and muscle features with COPD (Figure 1(b)). Also, the distribution suggests that a large proportion of patients with COPD in Quadosteoporosis and Quadsarcopenia have divergent negative findings in bone and muscle outcome metrics. Welch's t-test shows that prediction residuals for BMD and PMA in moderate and severe COPD groups are significantly lower compared to the preserved lung function group (Figure 1(c)).

**CONCLUSION**

Bone density and muscle mass are reduced with increasing COPD severity, and spherical distributions of shifts in bone and muscle metrics are suggestive of different pathways of bone and muscle loss in COPD.

**CLINICAL RELEVANCE/APPLICATION**

CT-based automated characterization of osteoporosis and sarcopenia in COPD will facilitate the understanding of multi-pathway bone and muscle loss in COPD and their associations and impacts on disease progression and clinical outcomes.

## S1-SSCH01-3 INCREASING FREQUENCY OF CHEST CT ACQUISITION IN ELDERLY PATIENTS WITH PNEUMONIA: ASSOCIATION WITH INCIDENCE RATE AND PROGNOSIS IN POPULATION-BASED COHORT

Eui Jin Hwang, MD, PhD (*Presenter*) Research Grant, Lunit Inc;Research Grant, Coreline Soft, Co Ltd;Research Grant, Monitor Corporation Inc

**PURPOSE**

The accessibility to diagnostic imaging such as chest CT, which is essential for diagnosing pneumonia, has continuously improved. This study investigated the temporal trend of chest CT acquisition in elderly patients with pneumonia and associated incidence rate and prognosis of pneumonia.

**METHODS AND MATERIALS**

A population-based cohort comprising a randomly sampled Korean population aged 60 to 80 in January 2008 was investigated. The age- and sex-adjusted incidence rate of pneumonia was evaluated in each year from 2009 to 2018. Incidence rates of hospitalized and non-hospitalized pneumonia, as well as pneumonia with and without chest CT acquisition, were separately evaluated. Among patients with pneumonia, the frequency of chest CT acquisition was evaluated each year after adjustment of potential confounding variables (age, sex, severity of pneumonia, and comorbidities). The 30-day mortality rate of pneumonia patients was also evaluated each year after adjustment of confounding variables.

**RESULTS**

The entire cohort comprised 511,931 individuals (mean age 69 years in 2009; 56% female), representing 8% of the Korean population with the same age. The age- and sex-adjusted incidence rate of pneumonia showed mild growth (53 to 58 per 1000 person-year from 2009 to 2018). The incidence rates of non-hospitalized pneumonia (32 to 44 per 1000 person-year) and pneumonia with chest CT (9 to 15 per 1000 person-year) showed a clear tendency to increase, while the incidence rates of hospitalized pneumonia (19 to 18 per 1000 person-year) and pneumonia without chest CT (44 to 45 per 1000 person-year) remained stable. The frequency of chest CT acquisition in pneumonia patients showed a trend of continuous increase (12% to 29%, from 2009 to 2018), both in hospitalized (38% to 68%) and non-hospitalized pneumonia (5% to 12%). The 30-day mortality rate of pneumonia patients remained stable between 2009 and 2018 (1.2% to 1.1%), regardless of hospitalization (8.9% to 9.4% for hospitalized pneumonia; 0.18% to 0.07% for non-hospitalized pneumonia) and chest CT acquisition (3.7% to 3.6% for pneumonia with chest CT; 0.93% to 0.85% for pneumonia without chest CT).

**CONCLUSION**

Between 2009 and 2018, the incidence rates of non-hospitalized pneumonia and pneumonia with chest CT acquisition increased in elderly individuals. Despite the increased frequency of chest CT acquisition in pneumonia patients, the 30-day mortality rate of pneumonia patients remained similar.

**CLINICAL RELEVANCE/APPLICATION**

The increased accessibility to chest CT may have contributed to the increased diagnosis of mild pneumonia, which did not require hospitalization. However, the increased frequency of obtaining chest CT in pneumonia patients may not have improved the prognosis.

## S1-SSCH01-4 AUTOMATIC CLASSIFICATION OF PARENCHYMAL CLUSTERS AS INDICATORS OF PULMONARY EMPHYSEMA IN LUNG CANCER SCREENING

Mario Silva, MD (*Abstract Co-Author*) Consultant, F. Hoffmann-La Roche Ltd;Speakers Bureau, F. Hoffmann-La Roche Ltd;Speakers Bureau, Boerhinger Ingelheim GmbH
Yifei Mao, MD (*Abstract Co-Author*) Nothing to Disclose
Daiwei Han (*Abstract Co-Author*) Nothing to Disclose
Matthijs Oudkerk, MD, PhD (*Abstract Co-Author*) Officer, i-DNA
Jan-Willem C. Gratama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marjolein A. Heuvelmans, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jaeyoun Yi, PhD (*Abstract Co-Author*) Officer, Coreline Soft, Co Ltd;Stockholder, Coreline Soft, Co Ltd
Harry De Koning (*Abstract Co-Author*) Research Grant, F. Hoffmann-La Roche LtdEquipment support, Siemens AGMedical Advisory Board, F. Hoffmann-La

Roche Ltd
Hailan Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

Quantifying emphysema holds potential for asymptomatic smokers in lung cancer screening(LCS) population. This study aims to optimize Hounsfield Unit(HU) threshold for emphysema quantification and severity classification through the analysis of low-attenuation(LA) clusters of lung parenchyma in LCS.

**METHODS AND MATERIALS**

In this study, 352 individuals (170 females) had low-dose chest CT scans(120 kVp and 35 mAs) for lung cancer screening[3]. Images were reconstructed with a B30f kernel at 2.0mm slice thickness. A commercial AI software was used to perform lung segmentation for excluding pulmonary vessels and bronchi. LA cluster were calculated and classified by size, under HU thresholds(-950HU, -960HU, -970HU, -975HU). The severity of emphysema was divided into four groups based on the diameter of the largest cluster: trace(3-6mm), mild(6-12mm), moderate(12-16mm), and confluent(>16mm). Clusters measuring less than 3mm in diameter were identified as typical lung parenchyma. Two experienced radiologists and two trainees visually assessed CT images for emphysema according to Fleischner criteria. Inter-reader agreement and correlation with quantified emphysema were evaluated using Spearman analysis.

**RESULTS**

Using a 6mm LA cluster size cutoff, agreement between automatic classification and visually scored emphysema scores exceeded 79%. Peak agreement occurred at -975 HU, reaching 89.7%, 89.5%, 79.2%, and 88.3% for readers A, B, C, and D, respectively. For the 12mm cutoff, agreements between automatic classification and readers' emphysema scores were above 89%. Peak agreement occurs at -960HU, 95.2%, 93.5%, 89.2%, and 92.0% for readers A, B, C, and D, respectively.

**CONCLUSION**

Utilizing cluster analysis during lung cancer screening, the threshold from -960HU to -975HU was found to be the optimal choice for a dichotomous emphysema severity classification of the lung parenchyma in lung cancer screening. Strong agreement between visual severity scores and LA cluster classification suggests visual scoring based on the largest emphysema regions may be more objective in estimating severity.

**CLINICAL RELEVANCE/APPLICATION**

LA cluster analysis seems effective for objective emphysema quantification and severity classification. In LCS, the application of LA-cluster analysis has the potential to automate emphysema scoring.

## S1-SSCH01-5 ASSESSING THE FEASIBILITY OF AN AI REPORT GENERATION MODEL IN DETECTING TUBERCULOSIS ON CHEST RADIOGRAPHS

Byungseok Roh (*Abstract Co-Author*) Nothing to Disclose
Ok Kyu Song (*Abstract Co-Author*) Nothing to Disclose
Eun Kyoung Hong, MD,PhD (*Abstract Co-Author*) Research Consultant, VUNO Inc
Kyu-Chong Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Hae Won Kim (*Abstract Co-Author*) Nothing to Disclose
Dong Kyu Kim (*Abstract Co-Author*) Nothing to Disclose
Woong Bae, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Advances in multimodal generative Artificial Intelligence (AI) have the potential to improve radiologic workflow by automating radiological reporting processes. Utilization of AI report generation model can enhance the efficiency of tuberculosis (TB) detection on Chest Radiographs (CR), especially in areas of high prevalence of TB and shortage of radiologists. The current study aims to assess the feasibility of a multimodal AI report generation model for CR in detecting TB.

**METHODS AND MATERIALS**

Two public datasets (Shenzhen, Mongomery) from US National Library of Medicine, and an AI report generation model, available online for research purposes (karacxr.ai), were utilized for the analysis. From the AI-generated reports, text descriptions of all lung and pleural abnormalities were extracted by one radiologist, except findings related to lung inflation status. The stand-alone performance of the AI model in detecting TB-related abnormalities was compared to independent readings of 3 radiologists, in terms of sensitivity, specificity, positive and negative predictive values and accuracy. Additionally, the autonomous reporting rate of the AI model was analyzed by 2 radiologists, by assessing the acceptability of the AI-generated reports.

**RESULTS**

The AI model demonstrated sensitivity, specificity, and accuracy of 0.944, 0.892, and 0.918, respectively, where that of 3 radiologists' ranged between 0.919-0.947, 0.894-0.968 and 0.920-0.945, respectively in detecting abnormalities in TB patients (Table 1). The most commonly mentioned abnormalities in the CRs are, in the following order: nodular lesion, 138; patchy, hazy, focal opacity/density, 135; consolidation, 120; and scarring, 106 cases. (Figure 1). The AI-generated reports achieved autonomous reporting rates of 73.13% (585/800) and 61.38% (491/800), as assessed by two radiologists.

**CONCLUSION**

The result of this study demonstrated the AI report generation model's comparable performance in detecting TB-related abnormalities on CRs to radiologists and the majority of AI-generated reports were accepted by radiologists, suggesting a potential for autonomous reporting on CRs in the specific clinical setting.

**CLINICAL RELEVANCE/APPLICATION**

The multimodal AI report generation model showed promising performance in detecting TB-related abnormalities, with a potential for autonomous reporting of CRs. However, further validation is necessary to fully establish its clinical efficacy and ensure its reliability in broader clinical practice.

## S1-SSCH01-6 PLEURAL EFFUSION AS A PROGNOSTIC MARKER IN COVID-19: INSIGHTS FROM A NATIONWIDE MULTICENTER STUDY

Christiane K. Kuhl, MD, PhD (*Abstract Co-Author*) Advisory Board, Guerbet SA;Speaker, Bracco Group;Speaker, Bayer AG
Felix G. Meinel, MD (*Abstract Co-Author*) Nothing to Disclose
Malte M. Sieren, MD (*Abstract Co-Author*) Nothing to Disclose

Alexey Surov (*Abstract Co-Author*) Nothing to Disclose
Jan Borggrefe, MD (*Abstract Co-Author*) Nothing to Disclose
Tobias Penzkofer, MD (*Abstract Co-Author*) Researcher, Aprea Therapeutics AB;Researcher, Astellas Group;Researcher, AstraZeneca PLC;Researcher, Bristol-Myers Squibb Company;Researcher, Genmab A/S;Researcher, Incyte Corporation;Researcher, Lion Biotechnologies, Inc;Researcher, Takeda Pharmaceutical Company Limited
Matthias A. Fink, MD, BSc (*Abstract Co-Author*) Nothing to Disclose
Dorottya More (*Abstract Co-Author*) Nothing to Disclose
Andreas Bucher, MD (*Presenter*) Travel support, Bayer AG Travel support, Guebert SA Travel support, Pharmacept

**PURPOSE**

This study evaluates the prognostic value of pleural effusion (PE) in predicting clinical outcomes in COVID-19 patients at thirteen centers in Germany. This nationwide multicentric analysis aims to fill this gap by evaluating the prognostic significance of PE in COVID-19 patients.

**METHODS AND MATERIALS**

In this retrospective analysis within the RACOON (Radiological Cooperative Network of the COVID-19 pandemic) project, 1,183 patients (29.3% women, 70.7% men) underwent chest CT to evaluate for PE. We examined the association of PE with 30-day mortality, ICU admission, and the need for mechanical ventilation. All CT scans were evaluated by a team of experienced radiologists who applied standardized criteria to identify and measure pleural effusion, ensuring consistency across all evaluations. Data regarding patient outcomes were meticulously recorded, including mortality rates, ICU admissions, and the necessity for mechanical ventilation, to assess the impact of pleural effusion on patient prognosis effectively.

**RESULTS**

The patient sample consisted of 1183 patients, 347 (29.3%) women and 836 (70.7%) men. Mean age was 62.5 ± 15.2 years; median age, 63 years. PE was detected in 31.5% of patients and was significantly correlated with higher 30-day mortality (47.5% in non-survivors vs. 27.3% in survivors, $p<0.001$), yielding a hazard ratio of 2.22 (95% CI 1.65-2.99, $p<0.001$). Moreover, the volume of the PE was larger in cases with fatal outcome compared to non-fatal cases (5417 ± 34514 mm$\acute{N}$ versus 1461 ± 8359 mm$\acute{N}$, $p<0.001$). There was no significant association between PE volume or density and mortality outcomes. ICU admission was reported in 46.8% of patients and 26.7% required mechanical ventilation. The prevalence of PE was lower in male patients compared to female (n=236, 28.2% versus n=137, 39.4%, $p=0.008$).

**CONCLUSION**

Pleural effusion is a significant independent predictor of increased 30-day mortality in COVID-19 patients, highlighting its importance as a prognostic marker. The presence of PE, regardless of its volume or density, should be highlighted in radiological reports to aid clinical decision making.

**CLINICAL RELEVANCE/APPLICATION**

This study confirms pleural effusion as an independent prognostic factor for increased 30-day mortality in COVID-19 patients. Recognition of PE, regardless of volume or density, is critical to improve patient management and target treatment strategies more effectively.
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# Abstract Archives of the RSNA, 2024

S1-SSGU01

**Genitourinary Imaging (Kidney and Prostate)**

Sunday, Dec. 1 9:00AM - 10:00AM Room: E353B

Agatha Stanek, MD (*Moderator*) Nothing to Disclose
Kerry L. Thomas, MD (*Moderator*) Stockholder, Medtronic plc;Stockholder, UnitedHealth Group;Stockholder, Amgen Inc;Stockholder, AbbVie Inc

**Sub-Events**

## S1-SSGU01-1 A MULTI-TASK DEEP LEARNING MODEL INCORPORATING CT RADIOLOGICAL FEATURES FOR IDENTIFYING CLEAR CELL RENAL CELL CARCINOMA IN SOLID RENAL MASSES: MULTICENTER DEVELOPMENT AND EXTERNAL VALIDATION

Yanlin HE (*Abstract Co-Author*) Nothing to Disclose
Yaqin Zhang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jiayue Han (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a multi-task deep learning model incorporating CT radiological features (hereafter, MMulti) for diagnosing clear cell renal cell carcinoma (ccRCC) in solid renal masses and identifying radiological features of the masses and to compare the performance of MMulti, radiologists, a radiomic model (hereafter, MRadomic), and a model trained without incorporating radiological features (hereafter, MDiag).

### METHODS AND MATERIALS

This retrospective study included 597 surgically proven renal masses from four centers. Multivariate logistic regression analyses were employed to identify radiological features associated with ccRCC. These features were then introduced into a multi-task deep learning model based on residual networks as the radiologist's domain knowledge. MMulti, MDiag and MRadiomic were trained on contrast-enhanced CT images of 402 masses (Data from Centers I, II, and III). The performance of MMulti was compared with that of MDiag, MRadiomic and radiologists with different experience levels on the external test dataset (195 masses, data from Centers IV) with the DeLong method and McNemar test.

### RESULTS

The area under the receiver operating characteristic curve (AUC) , accuracy and sensitivity of MMulti in the external test set were 0.93, 83% and 83%, respectively, which were not significantly different from those of experienced radiologists (0.93 [P = 0.88], 85% [P = 0.35] and 86% [P = 0.22] ) and exceeded those of junior radiologists (0.80 [P < 0.001], 65% [P < 0.001] and 54% [P < 0.001]), MRadiomic (0.85 [P=0.005], 77% [P = 0.002] and 73% [P < 0.001]) and MDiag (0.88 [P = 0.048], 75% [P = 0.012] and 70% [P = 0.001]). In the test set, the consistency rates between MMulti and the experienced radiologist group were higher than those between MMulti and the junior radiologist group for enhancement pattern (70% vs 51%, P < 0.001), early dark cortical band (84% vs 70%, P < 0.001), and intra-tumoural vessel (78% vs 71%, P = 0.035).

### CONCLUSION

The multi-task deep learning model incorporating CT radiological features can noninvasively identify ccRCC in solid renal masses with good performance comparable with experienced radiologists and superior to that of junior radiologists, radiomic model and deep learning model without radiological features.

### CLINICAL RELEVANCE/APPLICATION

We developed an artificial intelligence model that is generalizable and can reliably identify ccRCC in solid renal masses. The model may be used as a tool for risk stratification to reduce unnecessary surgery and biopsy of patients and assist clinical decision-making.

## S1-SSGU01-2 CONTRAST-ENHANCED CT RADIOMIC ANALYSIS FOR THE PREOPERATIVE PREDICTION OF PATHOLOGICAL T3A UPSTAGING IN RENAL CELL CARCINOMA: MODEL DEVELOPMENT AND MULTI-SOURCE VALIDATIONS

Bin Song (*Abstract Co-Author*) Nothing to Disclose
Chunlei He, MMEd (*Abstract Co-Author*) Nothing to Disclose
Jin Yao (*Abstract Co-Author*) Nothing to Disclose
Yuntian Chen (*Abstract Co-Author*) Nothing to Disclose
Enyu Yuan, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop and validate the contrast-enhanced CT-based radiomic models for predicting pathological T3a upstaging in patients with renal cell carcinoma.

**METHODS AND MATERIALS**

This study included a total of 1542 patients from 3 medical centers and 4 TCIA cohorts. Radiomic features of the lesion and the 5mm peritumoral area were extracted from the manually labeled portal venous phase CT images. The features were split into tumor-shape, tumor-texture, and peritumor-texture features. Six logistic regression models based on different classes of features were developed and internally nested-cross-validated using data from center 1 (n = 999). Then these models were externally validated using data from center 2 (n = 236), center 3 (n = 120), and TCIA cohorts (n = 187). The best model was selected based on the performance on center 1 dataset. Subgroup analyses were performed by stratifying the T3a invasion into four subtypes. The prognostic value of the best model was also evaluated.

**RESULTS**

In the development set, the tumor-shape based model showed significantly the highest discrimination performance (AUC = 0.868 [0.866-0.870]). The discrimination of the other models ranged from 0.823 to 0.865. The performance of the best model had the lowest coefficient of variation (CoV = 2.9%) among different validations (AUC = 0.868, 0.872, 0.822, and 0.837). The other models also showed low variation of performance in internal and external validations. The subgroup analyses showed the tumor-shape model had the highest sensitivity in tumors with renal vein invasion (sensitivity = 0.943) and the lowest sensitivity in tumors with perinephric fat invasion (sensitivity = 0.740). A total of 550 patients in center 1 were followed up. The survival analysis showed significant worse progression-free survival in model-predicted T3a high risk group than in model-predicted T3a low risk group ($p < 0.0001$).

**CONCLUSION**

The tumor-shape-based radiomic model area showed favorable performance in predicting pathological T3a upstaging preoperatively in renal cell carcinoma patients, which could benefit risk stratification and clinical decision-making.

**CLINICAL RELEVANCE/APPLICATION**

The contrast-enhanced CT-based radiomic model showed good performance and generalizability for preoperative prediction of pathological T3a upstaging in renal cell carcinoma.

## S1-SSGU01-3 IMAGING-BASED RISK STRATIFICATION IN ONCOCYTIC RENAL NEOPLAMS (UPDATED CLASSIFICATION)

Nicola Schieda, MD (*Abstract Co-Author*) Nothing to Disclose
Rajesh Bhayana, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Ankush Jajodia, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Murray Di Loreto, MBBS (*Abstract Co-Author*) Nothing to Disclose
Susan Prendeville (*Abstract Co-Author*) Nothing to Disclose
Satheesh Krishna, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Oncocytomas account for the largest cause of benign nephrectomy in renal masses. Renal mass biopsy in this setting is often reported as 'oncocytic neoplasm' and is unreliable in differentiating benign from malignant oncocytic renal masses. In addition, the pathological classification oncocytic neoplasms have been updated with new and emerging entities. The role of imaging in risk stratifying oncocytic neoplasms, in the updated classification scheme is not known.

**METHODS AND MATERIALS**

In this IRB approved retrospective study, 222 consecutive renal oncocytic neoplasms (ON) which underwent nephrectomy from May 2002 to November 2022 were included. A genitourinary pathologist with 10 years of experience, blinded to the original report, reviewed all slides to re-classify the masses by the 2016 WHO classification with the addition of newer and emerging entities in 2021 by the Genitourinary Pathology Society (GUPS) update. Two blinded radiologists reviewed available imaging (n=185) prior to nephrectomy to extract qualitative and quantitative previously described imaging features for renal masses (including size, attenuation, heterogeneity [5-point Likert], margin, calcification, margin/interface, segmental enhancement inversion SEI, central scar, cystic/necrotic features and growth rate mm/y). Outcomes (recurrence/metastasis) were recorded, if any.

**RESULTS**

185 oncocytic neoplasms (ON) were identified of which 28% (51/185) were benign, and 72% (134/185) were malignant. While there was no difference in sex, benign ONs were more common in older patients compared to malignant ONs (64 vs 55y, P<.001). There was no difference in multiplicity (20% vs. 8%, P=.07) or size (4.5 vs 4.6cm, P=.69). Benign ONs had a higher mass-cortex ratio in corticomedullary phase (0.8 vs 0.5, P=.002) and higher attenuation in nephrographic phase (105 vs 74, P<.001) compared to malignant ONs. Calcification was less frequent in benign ONs (8% vs 19%). Homogeneity was less frequent in benign ONs (6% vs 39%, P<.001). There was no difference in margins, SEI, central scar. There was no difference in growth rate (5 vs 4mm/y, P=.28). Of the 134 malignant ONs, 2% (3/134) had metastasis and 2% (2/134) had recurrence. AUC of multivariable model in classifying benign vs malignant ONs was 0.77.

**CONCLUSION**

Benign ONs are more frequently found in older patients, and more heterogeneous, enhance more (higher NG attenuation, higher CMratio), have less calcification compared to malignant ONs. Imaging helps classification of ONs to benign and malignant categories.

**CLINICAL RELEVANCE/APPLICATION**

Imaging stratification of ONs into benign and malignant ONs may help overcome inability of biopsy in differentiation of benign and malignant ONs, enabling increased adoption of active surveillance.

## S1-SSGU01-4 PREDICTION OF CHRONIC KIDNEY DISEASE DEVELOPMENT WITH PRE-OPERATIVE NON-CONTRAST FUNCTIONAL MRI IN PATIENTS UNDERGOING SURGICAL MANAGEMENT FOR RENAL MASSES

Sara Lewis, MD (*Abstract Co-Author*) Research Grant, Bayer AG
Octavia Bane, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Arthi M. Reddy, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Horowitz, PhD (*Abstract Co-Author*) Nothing to Disclose
Haitham Al-Mubarak, PhD (*Abstract Co-Author*) Nothing to Disclose
Paul Kennedy, MSc,PhD (*Abstract Co-Author*) Nothing to Disclose
Jordan Cuevas, BS (*Abstract Co-Author*) Nothing to Disclose
Kirolos Meilika, MD (*Abstract Co-Author*) Nothing to Disclose
Bachir Taouli, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Bayer AG;Consultant, Guerbet SA;Research Grant, Regeneron Pharmaceuticals, Inc

Ketan Badani (*Abstract Co-Author*) Nothing to Disclose
Philip M. Robson, PhD (*Abstract Co-Author*) Nothing to Disclose
Bernd Kuhn (*Abstract Co-Author*) Nothing to Disclose
Mira M. Liu, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess performance of pre-operative functional MRI to diagnose and predict CKD at baseline and at 12 months in patients undergoing surgical management of SRM.

**METHODS AND MATERIALS**

In a prospective, IRB-approved, single-center study, 43 patients (13F/30M, 59.0±11.7y) with SRMs underwent pre-operative 1.5T MRI (Aera, Siemens Healthcare). Protocol included advanced DWI (9 b-values:10-800s/mm2), pCASL, BOLD/R2*, and T1. Advanced DWI was post-processed with ADC, IVIM, tri-exponential, and spectral diffusion models. Baseline CKD was determined as CKD-EPI<60ml/min/1.73m2 at the pre-operative scan. CKD development was determined as CKD-EPI<60ml/min/1.73m2 within 12 months of a healthy baseline eGFR. Ipsilateral and contralateral cortical and medullar ROIs were delineated. Diagnostic performance of logistic regression models, with significant (Mann-Whitney U-test p<0.05) clinical and MR-parameter histogram features, was evaluated through ROC analysis.

**RESULTS**

At baseline, 12 patients had CKD (mean CKD-EPI =49.3ml/min/1.73m2) and 30 patients had healthy function (mean CKD-EPI =80.0ml/min/1.73m2) Follow-up CKD-EPI was available for 19 patients with baseline healthy eGFR; 7 developed CKD and 12 retained normal function.For diagnosis of baseline CKD: R2* and ADC showed increased variance and IVIM showed increased ipsilateral D*. Tri-exponential DWI showed an increased fast diffusion, and spectral diffusion showed a decreased tubular diffusion; median T1 increased. All logistic regression models for baseline CKD were statistically significant (AUC=0.70-0.76, 95%CI>0.5, p=0.01-0.045), and spectral diffusion returned highest AUC=0.76[0.60, 0.91], p =0.036-0.045, SN = 0.83, SP = 0.59.For prediction of CKD development: Tri-exponential, spectral, and T1 values were significant (AUC=0.81-0.95, 95%CI>0.5, p =0.005-0.049). Spectral diffusion showed increased contralateral vasculature and the highest AUC=0.95[0.86, 1.0], SN=0.93, SP=0.91. ADC, IVIM, pCASL, weight, BMI, tumor volume, malignancy, and grade were not predictors of CKD development.

**CONCLUSION**

Spectral and tri-exponential DWI, T1, and BOLD/R2* were associated with CKD diagnosis at baseline and prediction of development of CKD. Classification and prediction of kidney function using MRI could improve diagnosis and prognosis of CKD and treatment planning in patients with SRM undergoing surgery.

**CLINICAL RELEVANCE/APPLICATION**

Patients with solid renal masses (SRM) who have undergone partial or radical nephrectomy are at specific risk of developing renal dysfunction in the post-operative period. Pre-operative glomerular filtration rate (eGFR) is limited in prediction of chronic kidney disease development.

## S1-SSGU01-5 PROSTATE CANCER STAGING RADIO-PATHOLOGIC CORRELATION

Arnas Rakauskas (*Abstract Co-Author*) Nothing to Disclose
Massimo Valerio (*Abstract Co-Author*) Nothing to Disclose
Clarisse Dromain, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julien Dagher (*Abstract Co-Author*) Nothing to Disclose
Mario Jreige, MD (*Abstract Co-Author*) Nothing to Disclose
Naik Vietti Violi, MD (*Abstract Co-Author*) Nothing to Disclose
Sandy Schaer (*Abstract Co-Author*) Nothing to Disclose
Adrien Richemond (*Abstract Co-Author*) Nothing to Disclose
Jade Matthey-des-Bornels (*Presenter*) Nothing to Disclose

**PURPOSE**

To perform a radio-pathologic correlation of prostate cancer in terms of lesion detection and cancer volume correlation.

**METHODS AND MATERIALS**

This retrospective study included 64 consecutive patients (mean age: 64 ± 9y.o) with radical prostatectomy for biopsy-proven prostate adenocarcinoma between 2018 and 2020. All patients underwent prostate MRI within 6 months before surgery. One radiologist performed 3D prostate cancer lesion segmentation using Mint LesionTM software, for all detected lesions (up to 3 lesions), allowing volume measurements. Segmentations were performed on T2 weighted imaging (WI), diffusion weighted imaging (DWI), apparent coefficient diffusion (ADC) and perfusion. Two pathologists viewed the prostate specimens and measured the volume of each lesion. Radio-pathologic correlation of each lesion considering = grade group 2 and volume = 0.5 ml was tested for detectability and for volume correlation using Pearson's correlation, Bland-Altman limit-of-agreement and Lin's concordance correlation.

**RESULTS**

In total 63 clinically significant prostate cancer lesions (grade group 2 or higher and volume = 0.5 ml) were identified on pathology. 41 patients had one lesion on pathology, 9 had 2 lesions and 1 had 3 lesions. When considering lesion detection detectability diagnostic performance, the sensitivity and specificity were 91.8% and 97.8% for T2WI, 85.2% and 98.5% for DWI, 90.2% and 98.5% for ADC, and 86.9% and 97.1% for perfusion, respectively. The mean lesion volume was 5.8±7.9 ml on pathology and 5±7.6 ml on perfusion MR (p=0.569). Perfusion showed the best correlation with lesion volume derived from pathology compared to T2WI, DWI, and ADC (?c= 0.934, ?c= 0.571, ?c= 0.418, and ?c= 0.485, respectively).

**CONCLUSION**

Prostate MRI allows the detection of clinically significant prostate cancer with high sensitivity and specificity. Perfusion is the most accurate sequence for cancer volume measurement, highlighting the added value of multi-parametric MRI for prostate cancer staging and treatment planning.

**CLINICAL RELEVANCE/APPLICATION**

Perfusion is the most accurate sequence for cancer volume measurement, highlighting the added value of multi-parametric MRI for prostate cancer staging and treatment planning.

## S1-SSGU01-6 MRI-GUIDED IN-BORE BIOPSY POST MRI/US FUSION-GUIDED BIOPSY IN PATIENTS WITH CONTINUING SUSPICIONS OF CLINICALLY SIGNIFICANT PROSTATE CANCER

Michael Quentin, MD (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD (*Abstract Co-Author*) Nothing to Disclose
Kai Jannusch (*Abstract Co-Author*) Nothing to Disclose
Peter Albers, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lars Schimmoeller, MD (*Abstract Co-Author*) Nothing to Disclose
Birte Valentin, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias Boschheidgen (*Presenter*) Nothing to Disclose

### PURPOSE

Patients presenting with suspected clinically significant prostate cancer (csPC) based on multiparametric prostate MRI (mpMRI) findings, yet negative or inconclusive results from MRI/US fusion-guided biopsy (FB), pose a clinical challenge. This study aimed to evaluate the efficacy of MRI in-bore biopsy (IB) in patients with discordant imaging and histopathological findings post-FB.

### METHODS AND MATERIALS

We retrospectively analyzed consecutive patients with Prostate Imaging Reporting and Data System (PI-RADS) category 4 or 5 lesions on 3T mpMRI following FB, who lacked histologically confirmed csPC and subsequently underwent IB between January 2014 and May 2022. The primary goal was to determine the csPC detection rate, while secondary objectives included analyzing clinical and MRI parameters, as well as lesion localization.

### RESULTS

In our final cohort comprising 51 patients, IB yielded an overall detection rate of 71% for prostate cancer (PC) and 47% for csPC. Notably, 55% of cases initially diagnosed with low-grade PC experienced a Gleason score upgrade post-IB. CsPC was frequently localized apically and/or anteriorly. The PC detection rates were 58% and 94% for PI-RADS category 4 and 5, respectively (csPC rates: 39% and 61%, respectively). Patients diagnosed with csPC exhibited statistically significant smaller prostate volumes, higher PI-RADS categories, elevated prostate-specific antigen density (PSAD), and were older.

### CONCLUSION

In a considerable proportion of patients presenting with PI-RADS category 4 or 5 lesions and negative or inconclusive results following FB, but with persistent suspicion of csPC, subsequent IB confirmed the presence of csPC. Thus, IB serves as a valuable adjunct in cases of diagnostic uncertainty.

### CLINICAL RELEVANCE/APPLICATION

Our results indicate the viability of a sequential approach, employing MRI in-bore biopsy as a secondary measure for individuals exhibiting a strong suspicion of clinically significant prostate cancer on mpMRI, yet lacking confirmation from MRI/US fusion-guided biopsy. Particularly, this biopsy method proved advantageous for patients categorized as PI-RADS category 5 or ISUP GG 1 prostate cancer, as well as for those with discernible apical and/or anterior MRI lesions (which may vary depending on the initial biopsy method), and smaller prostate volumes coupled with higher PSA density (PSAD).

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# Abstract Archives of the RSNA, 2024

S1-SSHN01

**Science Session with Keynote: Head and Neck Imaging (Head and Neck Cancer)**

Sunday, Dec. 1 9:00AM - 10:00AM Room: E352

Jacqueline D. Angel, MD (*Moderator*) Nothing to Disclose
Gabriel C. Garcia, MD, MSc (*Moderator*) Employee, Compagnie Generale de Teleradiologie

**Sub-Events**

## S1-SSHN01-1 CAN SYNTHETIC MRI DISCRIMINATE THE ORIGIN OF METASTATIC LYMPH NODES IN THE NECK: NASOPHARYNX VS. NON-NASOPHARYNX AND TONSILS VS. NON-TONSILS?

Xiaoduo Yu (*Abstract Co-Author*) Nothing to Disclose
Hongmei Zhang (*Abstract Co-Author*) Nothing to Disclose
Haoran Wei (*Abstract Co-Author*) Nothing to Disclose
Meng Lin (*Abstract Co-Author*) Nothing to Disclose
Fan Yang (*Presenter*) Nothing to Disclose

### PURPOSE

Approximately 2%~9% of patients with head and neck squamous cell carcinoma (HNSCC) have an unknown primary site, and diagnostic and therapeutic dilemmas exist in these patients. Unilateral or bilateral tonsillectomy is the diagnostic or therapeutic option of choice. How to identify that metastatic lymph nodes (LNs) from the tonsils can prevent needless injury. Patients with nasopharyngeal carcinoma (NPC) has completely different treatment method compared with others with HNSCC (chemoradiotherapy only vs. surgery). In order not to delay treatment, the first step of this study is to compare the metastatic LNs from NPC and non-NPC. Moreover, the second step is to identify if the remaining metastatic LNs are from tonsil carcinoma to avoid unnecessary treatments and to choose the right treatment options.

### METHODS AND MATERIALS

This study prospectively included patients with biopsy-defined NPC (n = 35) and HNSCC (n = 29). All patients underwent SyMRI (Discovery MR 750, GE Healthcare, USA) scan before contrast agent injection. The detailed information is as follows: repetition time, 6200; echo time, 18.9/94.7; FOV, 26; acquisition matrix, 256 × 320; slice thickness/gap, 4.0/0.4; number of excitations, 1; acquisition time, 7.02. Each patient selected one metastatic LN in level II as a representative. The criteria of representative LN are as follows: 1) surgery-confirmed metastatic LNs (n = 6); 2) LN with maximum axial short diameter = 15mm or with obvious necrosis and extracapsular spread (n = 58). Two senior radiologists delineated the representative LNs manually on SyT2WI, avoiding any obvious necrosis or cystic area. Histogram parameters from T1 map, T2 map, and PD map were obtained through Pyradiomics. SPSS software and R studio were used in statistical analysis. Independent sample t-test or Mann-Whitney U test was used. The areas under the curve (AUCs) for all significant variables were calculated.

### RESULTS

5/29 (17.4%) patients were diagnosed with tonsil carcinoma. All parameters had excellent or good inter-observer agreement. Metastatic LNs from NPC had higher T1_Kurtosis and T1_Skewness and lower T2_75th and 90th than those from non-NPC (all P=0.033, Figure). The AUCs were 0.652~0.678. Moreover, compared with LNs from non-tonsil (n=24), LNs from tonsil (n = 5) had higher T2_Mean and T2_Median (all P=0.019, Figure), with the AUCs were 0.883 (95% CI: 0.761, 1.000) and 0.838 (95% CI: 0.687, 0.988), respectively (Figure).

### CONCLUSION

The parameters from SyMRI could differentiate the origin of metastatic LNs, which could help in timely selection of radiotherapy and avoidance of non-effective treatments.

### CLINICAL RELEVANCE/APPLICATION

Identification of the origin of the lymph nodes prior to treatment facilitates the selection of appropriate treatment

## S1-SSHN01-2 PREDICTION OF BRAF$^{V600E}$MUTATION IN PAPILLARY THYROID CARCINOMABY A CLINICAL-SPECTRAL CTMODEL

Dan Zhang, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The BRAFV600E is the most common mutant oncogene in thyroid cancer and is associated with the aggressiveness of papillary thyroid carcinoma (PTC). The aim of this study was to investigate the effectiveness of a dual-layer detector spectral computed tomography (DLCT)-based model for predicting BRAFV600E mutation in PTC.

**METHODS AND MATERIALS**

Two hundred and fifty-three patients with PTCs who underwent DLCT and BRAFV600E mutation detection (mutant group: n=203; wild group: n=50) were retrospectively reviewed. Quantitative parameters of DLCT in arterial phase, typical image features and clinical information were compared between the mutant and wild-type BRAFV600E groups. The nomogram of the prediction model with the highest area under the receiver operating characteristic curve (AUC) was constructed based on the significantly different variables using logistic regression analysis. The AUC, calibration curve and decision curve analysis (DCA) were used to evaluate the model performance.

**RESULTS**

The normalized iodine concentration (NIC), calcification and Hashimoto's thyroiditis (HT) were identified as independent risk factors of BRAFV600E mutation in PTC. The prediction model based on the three parameters had the highest AUC (0.750; 95% CI: 0.667-0.832). The calibration curve revealed good agreement between the prediction results and the actual observations. The DCA demonstrated that the model can provide net benefit than the all or none intervention strategy within a large range of threshold probabilities.

**CONCLUSION**

As an easily and visually noninvasive prediction tool, the DLCT-based nomogram with NIC, calcification and HT presented moderate effectiveness, which may be a supplementary tool for preoperatively predicting BRAFV600E mutation in PTC.

**CLINICAL RELEVANCE/APPLICATION**

It is an easily and visually noninvasive prediction tool for the preoperative prediction of BRAFV600E mutation in PTC.

## S1-SSHN01-3 MRI BASED MODEL FOR PREDICTING LOCOREGIONALLY ADVANCED NASOPHARYNGEAL CARCINOMA SURVIVAL AT DIFFERENT CENTERS AND DIFFERENT FIELD STRENGTHS: THE COMBAT CORRECTION STUDY

Wei Pei (*Abstract Co-Author*) Nothing to Disclose
Hai Liao (*Abstract Co-Author*) Nothing to Disclose
Dan Ke Su (*Abstract Co-Author*) Nothing to Disclose
Yunyun Wei, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the anti-batch effect of ComBat correction on MRI data from different centers and at different field strengths, and to provide technical support to improve the generalizability of MRI radiomics prognostic prediction model in locally advanced nasopharyngeal carcinoma (LANPC).

**METHODS AND MATERIALS**

MRI data were collected from 572 LANPC patients in two hospitals, all of whom had underwent 1.5T or 3.0T MRI before Induction Chemotherapy (IC) + Concurrent Chemoradiotherapy (CCRT). And the data were all processed according to field strength in ComBat "batch correction". The 3.0T MRI data were taken as the training set, the 1.5T MRI data before ComBat correction were taken as the validation set 1, and the 1.5T MRI data after ComBat correction were taken as the validation set 2. Tumor radiomics features were extracted from MRI images, and principal component analysis (PCA) was used to reduce dimensionality and visualize the results of ComBat correction. Clinical and radiomics features that associated with prognosis were identified by Univariate Cox and LASSO-Cox analyses. And a prediction model was constructed, its ability was assessed by concordance index (C-index).

**RESULTS**

Clinical features were not suitable as the indicator for the prognosis of LANPC patients ($P > 0.05$). Seven radiomics features were associated with the prognosis of LANPC patients ($P < 0.05$) and used to construct a radiomics prediction model. The C-index of the training set, validation set 1, and validation set 2 were 0.713, 0.625 and 0.673, respectively. The prognosis of patients in the high- and low-risk groups divided based on the radiomics features, differed significantly($P < 0.001$). Compared with the validation set 1, the validation set 2 showed improved predictive performance (C-index: 0.625 vs 0.673), and its ability to identify high- and low-risk groups, trend of prognostic curves, and hazard ratios (HR) were all closer to those of the training set.

**CONCLUSION**

The method based on the ComBat can reduce the potential batch effect caused by different centers or different MRI field strengths. The stability and generalization ability of the prediction model constructed from the corrected data are good. And it is helpful for the optimization and clinical generalization of the radiomics model for prognosis prediction in LANPC.

**CLINICAL RELEVANCE/APPLICATION**

The model can provide decision support for clinical treatment and technical reference for model generalization and multicenter radiomics studies.

## S1-SSHN01-4 AN IMPROVED DIAGNOSTIC CRITERION BASED ON NODE-RADS MRI SCORE FOR LYMPH NODE METASTASIS IN PAPILLARY THYROID CARCINOMA

Qiying Tang (*Presenter*) Nothing to Disclose

**PURPOSE**

Accurate preoperative diagnosis of lymph node (LN) metastasis in papillary thyroid carcinoma (PTC) remains challenging. This study aimed to evaluate the diagnostic performance of standard Node Reporting and Data System (Node-RADS) MRI score for detecting LN metastasis in PTC, and to investigate whether a novel diagnostic criterion incorporating modifications to Node-RADS with supplementary MRI features could improve diagnostic accuracy.

**METHODS AND MATERIALS**

In this prospective study, 82 consecutive PTC patients with 156 histopathologically confirmed LNs were enrolled. Standard Node-RADS and supplementary MRI features were evaluated by three radiologists independently. Modifications to Node-RADS were implemented, including a reduction in the "normal" size criterion from <10 mm to <5 mm short-axis diameter. A new diagnostic criterion was further developed by combining modified Node-RADS and significant supplementary MRI features. Sensitivity, specificity, accuracy, positive predictive value, negative predictive value, and area under the curve in receiver operating characteristic curve analysis were calculated to evaluate diagnostic performances. Univariate and multivariate logistic regression identified potential predictors of metastasis. Interobserver agreement was assessed using Kendall W coefficient. A p value < 0.05 was considered statistically significant.

**RESULTS**

Standard Node-RADS demonstrated modest performance (sensitivity 51.4%; specificity 89.5%; AUC = 0.704) in diagnosing LN metastasis in PTC when applying a Node-RADS score = 4 criterion. Modified Node-RADS and T1 hyperintensity were independent predictors of metastasis on multivariate analysis. Then a new criterion combining modified Node-RADS and T1 hyperintensity was developed and showed a better diagnostic performance (sensitivity 89.0%; specificity 91.5%; AUC = 0.953) than the standard Node-RADS.

**CONCLUSION**

The new MRI-based diagnostic criterion incorporating modified Node-RADS and T1 hyperintensity demonstrates improved accuracy for diagnosing LN metastasis in PTC compared to standard Node-RADS.

**CLINICAL RELEVANCE/APPLICATION**

The new criterion based on Node-RADS MRI score enables accurate diagnosis of LN metastasis in PTC patients, contributing to standardized and convenient interpretation of LN conditions.

## S1-SSHN01-6 Keynote Speaker

Gabriel C. Garcia, MD, MSc (*Science Invited Presenter*) Employee, Compagnie Generale de Teleradiologie

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

S1-SSNMMI01

**Nuclear Medicine and Molecular Imaging (Novel Radiopharmaceuticals)**

Sunday, Dec. 1 9:00AM - 10:00AM Room: S405

Eric M. Rohren, PhD, MD (*Moderator*) Nothing to Disclose
Terence Z. Wong, MD, PhD (*Moderator*) Consultant, General Electric Company

**Sub-Events**

## S1-SSNMMI01-3 68GA.DATA.SA.FAPI-PET/MRI AND 18F-FDG-PET/CT FOR LOCOREGIONAL STAGING IN BLADDER CANCER: PRELIMINARY RESULTS OF A PROSPECTIVE COMPARATIVE STUDY

Dina Muin (*Presenter*) Nothing to Disclose

### PURPOSE

Fibroblast activation protein (FAP) targeting cancer-associated fibroblasts is frequently overexpressed in various tumor types. This study aimed to compare the diagnostic accuracy of [68Ga]DATA.SA.FAPi PET/MR and [18F]-FDG PET/CT imaging in predicting locoregional tumor stages in patients with muscle-invasive bladder cancer (MIBC).

### METHODS AND MATERIALS

In this prospective, comparative study, MIBC patients planned for radical cystectomy (RC) with or without prior neoadjuvant chemotherapy (NAC) were enrolled. Prior to RC, patients underwent [68Ga]DATA.SA.FAPi-PET/MRI and [18F]-FDG-PET/CT. Patients receiving NAC underwent [68Ga]DATA.SA.FAPi-PET/MRI and [18F]-FDG-PET/CT before and after treatment with chemotherapy, mainly with Gemcitabin und Cisplatin. The primary outcome of interest was the diagnostic accuracy of [68Ga]DATA.SA.FAPi-PET/MRI (mean time PET-RC (days) - 28.7 (± 25.3)) and [18F]-FDG-PET/CT (mean time PET-RC (days) - 20.61 (± 20.20)) for local and nodal staging in MIBC patients with pathology results serving as the reference test.

### RESULTS

Nineteen MIBC patients (67.26 (± 11.91) years, 74% male) were included, with 42% (8/19) receiving NAC. Sensitivity and specificity for [18F]-FDG PET/CT and [68Ga]DATA.SA.FAPi-PET/MRI in histologically positive primary tumors were identical with 58.3% and 71.4%, respectively. For the prediction of histologically positive lymph nodes, [18F]-FDG PET/CT exhibited superior performance with a sensitivity, specificity, PPV and NPV of 75.0%, 100%, 100% and 90.9% versus 50.0%, 90.0%, 66.7% and 81.8%, respectively, for [68Ga]DATA.SA.FAPi-PET/MRI.

### CONCLUSION

Preliminary findings suggest inferiority of diagnostic accuracy of [68Ga]DATA.SA.FAPi-PET/MRI compared to [18F]-FDG PET/CT. While the detection of cancer lesions in the bladder wall was similar for both modalities, [18F]-FDG-PET/CT showed better results for lymph node staging compared to [68Ga]DATA.SA.FAPi-PET/MRI.

### CLINICAL RELEVANCE/APPLICATION

FAPI-PET/MRI is not as stong as FDG-PET/CT in detecting positive lymph nodes. However FDG-PET can be a useful tool for staging of lymphnodes, as it is more accurate than CT alone.

## S1-SSNMMI01-4 SUPERIOR DETECTION OF PRIMARY AND METASTATIC BREAST CANCER LESIONS: A COMPARATIVE ANALYSIS OF $^{68}$GA-FAPI AND $^{18}$F-FDG PET/CT

Umut Elboga (*Abstract Co-Author*) Nothing to Disclose
Akmaral Ainakulova, MD (*Abstract Co-Author*) Nothing to Disclose
Zhamilya Zholdybay (*Abstract Co-Author*) Nothing to Disclose
Zhandos M. Amankulov, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Madina Gabdullina, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The objective of this study was to compare the diagnostic efficacy of 68Ga-FAPI PET/CT versus 18F-FDG PET/CT in identifying primary breast cancer lesions, lymph node metastases, and distant metastases, emphasizing enhancing accuracy in clinical staging.

### METHODS AND MATERIALS

This prospective study enrolled 17 women diagnosed with breast cancer from January 2024 to April 2024. The mean age of participants was 52.5 years. Each participant underwent both 68Ga-FAPI PET/CT and 18F-FDG PET/CT. The lesions identified were subsequently confirmed histologically.

## RESULTS

We identified 20 primary lesions and 43 metastatic lymph nodes in 17 breast cancer patients, in addition to 10 bone metastases and 6 liver metastases. 68Ga-FAPI PET/CT showed a sensitivity and specificity of 100% (95% CI: 81.47%-100%) and 85.71% (95% CI: 42.13%-99.64%), respectively, for primary lesions. Comparatively, 18F-FDG PET/CT demonstrated sensitivity and specificity of 83.3% (95% CI: 58.58%-96.42%) and 71.43% (95% CI: 29.04%-96.33%) for primary lesions detection. Notably, 68Ga-FAPI PET/CT identified 3 primary lesions smaller than 7 mm in size. Furthermore, the diagnostic accuracy for lymph node metastasis detection was 100% (95% CI: 91.7%-100%) with 68Ga-FAPI PET/CT, significantly surpassing 76.74% (95% CI: 61.37%-88.24%) with 18F-FDG PET/CT. In the context of distant metastases, 68Ga-FAPI achieved a diagnostic accuracy of 100% (95% CI: 79.41%-100%) compared to 87.5% (95% CI: 61.65%-98.45%) for 18F-FDG. The ROC analysis of PET/CT imaging demonstrated a significantly higher area under the curve (AUC) for 68Ga-FAPI PET/CT at 0.945 compared to 0.783 for 18F-FDG PET/CT, indicating superior diagnostic performance ($p < 0.001$).

## CONCLUSION

68Ga FAPI PET/CT markedly enhances the detection rate and staging of primary and metastatic breast cancer, demonstrating superior sensitivity and specificity compared to 18F-FDG PET/CT. Crucially, it also resulted in upstaging in 23.7% of cases (p=0.001).

## CLINICAL RELEVANCE/APPLICATION

The study demonstrates that 68Ga FAPI PET/CT significantly enhances the accuracy of detecting and staging breast cancer compared to 18F-FDG PET/CT. This superior diagnostic capability facilitates more precise treatment decisions, potentially reducing unnecessary interventions and aligning with personalized cancer care.

# S1-SSNMMI01-5 CORRELATION OF FAPI PET SIGNALS WITH HIGH-RESOLUTION HRCT IN PATIENTS WITH INTERSTITIAL LUNG DISEASES TREATED BY LUNG TRANSPLANT: A PRELIMINARY RESULT OF THE PROSPECTIVE EXPLORATORY STUDY

Jonathan G. Goldin, MD, PhD (*Abstract Co-Author*) Founder, MedQIA Imaging Core Laboratory
Johannes Czernin, MD (*Abstract Co-Author*) Stockholder, Trethera CorporationBoard Member, Trethera Corporation
Masatoshi Hotta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Stephen Weigt, MD (*Abstract Co-Author*) Nothing to Disclose
Jeremie Calais, MD (*Abstract Co-Author*) Consultant, RadioMedix, Inc;Consultant, Blue Earth Diagnostics Ltd;Consultant, Lantheus Holdings;Consultant, Johnson & Johnson;Consultant, Curium SAS;Consultant, General Electric Company
Gregory A. Fishbein, BS (*Abstract Co-Author*) Nothing to Disclose
Pang Yu Teng, PhD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Volkmann (*Abstract Co-Author*) Nothing to Disclose
Hyung J. Kim, PhD, MS (*Presenter*) Research Consultant, MedQIA Imaging Core Laboratory;Research Grant, Boehringer Ingelheim GmbH

## PURPOSE

Recent studies suggest potential value of fibroblast activation protein (FAP) expression assessed by FAPI PET, and quantitative interstitial lung disease (ILD) patterns by high-resolution CT (HRCT) for predicting the development of a progressive fibrosing ILD phenotype at the time of diagnosis. The primary aim was to compare the FAPI PET signal with ILD patterns on HRCT in patients with ILD treated by lung transplant.

## METHODS AND MATERIALS

This is a preliminary post-hoc analysis of a single-center, open-label, single-arm, prospective exploratory biodistribution study of 68Ga-FAPI-46 PET imaging in ILD. Patients with ILD, confirmed by HRCT and scheduled for transplantation of the affected lung, were included. Volumetric HRCT taken most recently before the FAPI PET scans were used. Quantitative ILD (QILD) scores were obtained from HRCT using high throughput machine learning based on radiomic features. QILD score includes fibrotic reticular patterns of quantitative lung fibrosis (QLF), and inflammatory patterns of ground glass (QGG). Additionally, single time point prediction (STP), extent of progressive ILD, were obtained. The SUVs from FAPI PET/CT were obtained. The findings were summarized in whole lung, most severe lobe among five lobes, and voxels. Mixed effect models were used to test the association in lobar scores. Furthermore, the pair of chest images were registered from HRCT to FAPI PET/CT and the corresponding registered voxels were characterized by SUV from FAPI PET/CT and ILD patterns from HRCT.

## RESULTS

Between November 2021 and April 2022, four patients with ILD underwent FAPI PET/CT before lung transplant. The types of ILD were idiopathic pulmonary fibrosis (n = 2), rheumatoid arthritis ILD (n = 1), and non-specific interstitial pneumonia (n = 1). Mean (±SD) SUVmax was 4.2 (±0.7) in whole lung, and 4.0 (±1.0) at the most severe lobe. Mean (± SD) fibrotic patterns of QLF was 25.1% (± 8.9) in whole lung, and 51.7% (±8.2) at the most severe lobe. Mean (± SD) inflammatory patterns of QGG was 23.1% (±7.4) in whole lung, and 25.5% (±4.3) at the most severe lobe. Mean (±SD) predictive area of STP was 45.1% (±10.9) in whole lung, and 60.3% (±5.5) at the most severe lobe. In five lobes, FAPI PET SUV mean and quantitative ILD scores from HRCT were positively associated (all p-values <0.001) and SUV mean increased by 0.024 for 1% increment of QLF. In the registered voxels, SUVs were correlated with the ILD patterns.

## CONCLUSION

FAPI PET signals positively correlated with ILD patterns of HRCT. These findings may serve to support further exploration of FAPI PET as an imaging marker and as a stratification tool for progressive ILD.

## CLINICAL RELEVANCE/APPLICATION

A phenotype of progressive fibrosing ILD may improve the stratification, leading to better patient’s management.

# Abstract Archives of the RSNA, 2024

S1-SSPH01

**Physics (Photon Counting Detector CT I)**

Sunday, Dec. 1 9:00AM - 10:00AM Room: S404

Cynthia H. McCollough, PhD (*Moderator*) Research Grant, Siemens AG
Marc Kachelriess, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S1-SSPH01-1 PERFORMANCE EVALUATION IN PHOTON COUNTING CT (PCD-CT): MEASURING DQE AND DETECTOR DEAD TIME USING AN IMAGE-BASED FRAMEWORK

Ke Li, PhD (*Abstract Co-Author*) Research Consultant, Pulmera Inc.
Guang-Hong Chen, PhD (*Abstract Co-Author*) Nothing to Disclose
Ran Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Linying Zhan, MS (*Presenter*) Nothing to Disclose

### PURPOSE

In photon counting computed tomography (PCD-CT), the performance of photon counting detectors (PCDs) significantly impacts image quality and diagnostic performance. This study addresses the need to evaluate detector deadtime and detective quantum efficiency (DQE)—key factors affecting PCD-CT performance. Traditionally, evaluating PCD properties requires the collection of detector counts at different exposures or energy bins. However, for clinical end-users of PCCT, monitoring PCD quality over time posed a challenge, as direct access to detector counts was typically restricted by the PCCT manufacturer. In this work, we introduced an innovative image-based approach for direct characterization of detector DQE and deadtime from reconstructed PCD-CT images.

### METHODS AND MATERIALS

At the core of the proposed method is a collection of closed-form relationships between the variance of flood-field PCCT images, PCD deadtime, and PCD counts for individual energy bins. For example, the average output counts of an energy bin can be estimated through parametric fitting of the measured PCCT noise power spectrum (NPS) of the same energy bin. Furthermore, by leveraging a novel quantitative relationship between PCCT image variance, PCD deadtime, and tube current (mA), the deadtime can be deduced through parametric fitting of the measured PCCT variance vs. mA curve. These derived theoretical relationships and the proposed PCD characterization method underwent validation using both simulated data and experimental data collected from a clinical whole-body PCCT scanner.

### RESULTS

At an incident photon rate of 5×105 counts per second (cps), the absorbed photon rate estimated from the NPS was (4.21±0.01)×105 cps, resulting in a detector DQE of 84.1±0.1% . Compared to the raw counts-based DQE (85%), the relative error was 1.1%. From PCD-CT images obtained without undergoing any pulse pileup correct and acquired at different incident photon rates ranging from 5×106 to 3.5×107 cps, the PCD deadtime was estimated to be 20.2±5.3 ns. This estimate exhibited a relative error of 1.1% when compared to the raw counts-based deadtime value of 20 ns. For PCD-CT images subject to pulse pileup correction, the proposed method yielded a deadtime of 20.0±7.1 ns, which corresponds to a mean relative error of 0.3%.

### CONCLUSION

Our image-based method successfully estimates PCD-CT detector DQE and deadtime using air scan PCD-CT images, circumventing the need for raw count data.

### CLINICAL RELEVANCE/APPLICATION

This novel framework allows clinical PCD-CT users to effectively assess and monitor their scanners' performance, enhancing operational insights and diagnostic accuracy.

## S1-SSPH01-2 SPECTRAL DEEP SCATTER ESTIMATION FOR PHOTON-COUNTING CT

Joscha Maier, PhD (*Abstract Co-Author*) Nothing to Disclose
Andreas Heinkele (*Abstract Co-Author*) Nothing to Disclose
Karl Stierstorfer, PhD (*Abstract Co-Author*) Employee, Siemens AG
Marc Kachelriess, PhD (*Abstract Co-Author*) Nothing to Disclose
Martin Petersilka, PhD (*Abstract Co-Author*) Employee, Siemens AG
Julien Erath, MSc (*Abstract Co-Author*) Employee, Siemens AG
Eric Fournie (*Abstract Co-Author*) Employee, Siemens AG
Lukas Hennemann, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To provide a scatter estimation and correction algorithm that is specific to the energy threshold information inherent in clinical photon-counting CT (PCCT) scans.

**METHODS AND MATERIALS**

In contrast to conventional energy-integrating (EI) detectors photon-counting (PC) detectors are energy-selective, i.e. they provide spectral information about the energies of the x-ray photons interacting with the detector. Each energy bin receives a different amount of scatter. Moreover, this spectral signature also contains information about the scatter content of a projection and thus can be used for scatter correction. To estimate scatter, we generalized the Deep Scatter Estimation (DSE), a U-Net-like CNN capable of predicting Monte Carlo (MC) scatter distributions as a function of input projections, to be bin-specific. Spectral DSE (sDSE) processes four energy thresholds simultaneously. We compare this to four separate DSE networks, each tuned to a single energy threshold for input and output values. In the training of our networks, we employed simulated data generated by our in-house MC simulation software, utilizing the geometry of the photon-counting CT scanner NAEOTOM Alpha (Siemens Healthineers, Forchheim, Germany). We simulated simple water phantoms as well as semi-anthropomorphic thorax and head phantoms of varying body sizes. The energy thresholds were 20, 55, 70, and 90 keV, respectively, with simulations conducted at a tube voltage of 140 kV. We tested our approach for phantoms of a semi-anthropomorphic thorax phantoms. The spectral DSE was evaluated, and the improvement in image quality was quantified.

**RESULTS**

Threshold images corrected with sDSE show better image quality for three of the four energy thresholds tested in this work, in contrast to the method with four individually trained conventional DSE networks. For the highest energy threshold (90 keV) both sDSE and DSE perform equally well. For spectral applications such as virtual monoenergetic images and iodine maps, sDSE can reduce the mean absolute error (MAE) by up to 80% compared to the uncorrected MC-simulated images. DSE performs slightly worse with around 75% reduction of the MAE. sDSE is also able to reduce the MAE for virtual non-contrast images by up to 75%, while DSE leads to a reduction of 65%.

**CONCLUSION**

Making use of the spectral information inherent in PCCT improves scatter estimation, compared to conventional DSE-based scatter estimation. The ability to utilize the context of different energy thresholds leads to improved performance in scatter estimation, especially for spectral applications.

**CLINICAL RELEVANCE/APPLICATION**

Spectral DSE can improve diagnostic image quality due to the consideration of the different energy thresholds occurring in PCCT scans.

## S1-SSPH01-3 TEMPORAL CONSISTENCY OF SPECTRAL DATA FROM A FIRST-GENERATION DUAL-SOURCE PHOTON-COUNTING CT: A TWO YEAR STUDY

Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Pooyan Sahbaee, PhD (*Abstract Co-Author*) Employee, Siemens AG
Pouyan Pasyar (*Abstract Co-Author*) Nothing to Disclose
Harold I. Litt, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV
Olivia Sandvold, BS (*Abstract Co-Author*) Nothing to Disclose
Leening Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

Photon-counting CT (PCCT) is a novel and paradigm-shifting technology that promises enhanced quantitative imaging capabilities. However, like any new technology, it presents many unknowns, including long-term stability. We evaluated the temporal stability of quantitative spectral results in a first-generation dual-source PCCT over two years.

**METHODS AND MATERIALS**

To assess the quantitative stability of spectral results over time in a first-generation dual-source PCCT (Naeotom Alpha, Siemens Healthineers), a phantom containing tissue-mimicking and material-specific inserts was scanned nearly every week for two years. Scans were performed in both single and dual-source modes at a tube voltage of 120 kVp and a volumetric CT dose index (CTDIvol) of 10 mGy. Notable software and hardware updates occurred at weeks 8, 18, 35, 69, and 80. Virtual monoenergetic images (VMI) between 40 and 190 were measured to determine error relative to the expected value and noise over time. To identify timepoints where spectral quantification changes, a pruned exact linear time algorithm was implemented.

**RESULTS**

Quantification of spectral results was stable across two years with some distinct improvements in accuracy from software and hardware updates, particularly in dual-source mode. For VMI 70 keV, the relative error in single-source mode was 9 ± 7 HU and did not experience significant change points during the two years. VMI 70 keV in dual-source mode, however, demonstrated a significant decrease from 16 ± 10 to 1 ± 7 HU during week 8, which corresponded to hardware and software changes for cross-scatter correction. Similar trends were observed in VMIs at other energies as well as iodine density, where error reduced to -0.3 ± 0.1 mg/mL. Additional change points were also identified at weeks 35 and 69 for different VMIs and iodine density maps but represented small nominal changes ranging from 5 to 15 HU and 0.2 to 0.3 mg/mL, respectively. VMI noise remained stable throughout the two years at 42 ± 1 and 36 ± 1 HU across inserts in single and dual-source modes, respectively.

**CONCLUSION**

PCCT demonstrated high temporal stability in VMIs and iodine density, with significant improvements in quantification with dual-source mode as a result of software and hardware changes. At this point, PCCT delivers high quantitative performance comparable between both single and dual-source modes, offering quantitative imaging across a wide range of clinical applications for the first time.

**CLINICAL RELEVANCE/APPLICATION**

Stable quantification over time in PCCT not only enables the use of quantitative imaging in diagnostic radiology but also establishes confidence that quantitative changes in longitudinal studies, such as cancer staging, are associated with disease progression and treatment.

## S1-SSPH01-4 MULTI-MATERIAL DECOMPOSITION USING FOUR ENERGY THRESHOLDS ON A COMMERCIAL DUAL-SOURCE PHOTON-COUNTING-DETECTOR (PCD) CT

Bernhard Schmidt, PhD (*Abstract Co-Author*) Employee, Siemens AG
Jeffrey Marsh JR, BS (*Abstract Co-Author*) Nothing to Disclose
Tristan Nowak (*Abstract Co-Author*) Employee, Siemens AG

Chelsea Dunning, PHD (*Abstract Co-Author*) Nothing to Disclose
George S.K. Fung, PhD (*Abstract Co-Author*) Employee, Siemens AG
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Kevin J. Treb, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To use a dual-source PCD-CT system with 4 energy thresholds to perform multi-material decomposition of iodine, gadolinium, and water.

**METHODS AND MATERIALS**

Experiments were performed on a PCD-CT scanner (NAEOTOM Alpha, Siemens Healthineers) using a special research mode with 4-energy thresholds. Material calibration was performed by scanning multiple diameters (d) of a cylindrical water-equivalent plastic phantom containing samples of contrast material with varying tube current (mA) and distance from the isocenter (r). From these data, per-voxel contrast models were derived for each material by multiple linear regression, where the predictor variables were combinations of mA, r and d up to second order. Subsequent material decompositions can then then be performed on individual voxels of the acquired threshold images using the derived models. After calibration, a 20 cm diameter multi-energy CT phantom (Sun Nuclear) with a uniform solid water background and several quantitative inserts of iodine (2-20 mg/mL), gadolinium (1.25-10 mg/mL), and a mixture of both (5 mg/mL each) was scanned using 140 kV and the 4-energy bin mode with energy thresholds set at 20, 52, 75, and 82 keV. The CTDIvol of the exam was 5.28 mGy (32 cm phantom). Images were reconstructed with a quantitative kernel (Qr44) for each energy threshold, which together with the derived models from calibration were used to generate water, iodine, and gadolinium basis images. Quantitative accuracy of material concentrations was assessed, and image noise was measured.

**RESULTS**

Both iodine and gadolinium were decomposed into their respective material basis maps with no observable cross-talk between material bases. Pixel values in material basis images were linearly related to their nominal concentrations ($R2 > 0.99$). Iodine and gadolinium concentrations from the material basis maps were within 0.55 mg/mL of the nominal values for all material inserts, with average deviations of 0.21 mg/mL I and 0.38 mg/mL Gd. The measured noise in uniform solid water at the phantom center for the water, I, and Gd basis images was 13, 22 (0.77 mg/mL I), and 26 HU (0.79 mg/mL Gd), respectively. Noise in the PCD threshold images (20, 52, 75, 82 keV) was 8, 9, 13, and 16 HU.

**CONCLUSION**

PCD-CT with four energy thresholds enables simultaneous multiple material decomposition of iodine, gadolinium, and water into respective material basis images from the same scan, with quantitative accuracy within 0.38 mg/mL and reasonable image noise (13-26 HU).

**CLINICAL RELEVANCE/APPLICATION**

The availability of multiple (4) energy thresholds in PCD-CT opens the possibility for unique clinical applications such as k-edge imaging, simultaneous multi-contrast imaging, and potential functional and molecular imaging with nanoparticles.

## S1-SSPH01-5 OPTIMIZING IMAGE QUALITY OF ENERGY-INTEGRATING AND PHOTON-COUNTING CT SYSTEMS AT LOW DOSE FOR LOW CONTRAST LUNG NODULES

Mishal Ursan (*Presenter*) Nothing to Disclose

**PURPOSE**

To optimize lung cancer screening (LCS) protocols in ultra-low dose CT for lung nodule contrast of 150 HU and above (ground glass nodules and others) for three different phantom sizes and for three generations of CT systems.

**METHODS AND MATERIALS**

Recommendations for the German LCS program require the detection of nodules with 150 HU contrast at dose levels of at most Dref = 1.3 mGy (for patients of 26 kg/m2 BMI) with a spatial resolution of better than 1 mm. To determine adequate scan protocols, we acquired phantom data on three different CT systems, namely the Somatom Definition Flash, Somaton Force and the Naeotom Alpha (Siemens Healthineers, Germany). The first two are the traditional energy integrating technologies, while the Alpha uses photon counting detectors and has two resolution modes: standard (STD) and ultra-high resolution (UHR). A semi-anthropomorphic thorax phantom used for the experiments consists of two additional modular extension rings to simulate patient sizes of small (20×30 cm), medium (25×35 cm) and large (30×40 cm), resulting in BMIs of about 22, 26, and 30 kg/m2, respectively. Since the phantom did not have a built-in contrast of 150 HU, we created such a lesion manually and placed it into a 10 cm water-equivalent phantom which was then placed on the top of the thorax phantom. The images were generated with iterative reconstruction using kernels ensuring a spatial resolution with a full width at half maximum = 1 mm in both axial and longitudinal direction. The contrast-to-noise ratio (CNR) was used to assess the visibility of lung nodules in all images.

**RESULTS**

With noised-matched acquisitions, a CNR = 1.0 was achieved for both energy integrating (Flash and Force) and photon counting systems (Alpha) at a viewing thickness of 3.0 mm at tube voltages of 120 kV (Flash), 120 kV Sn (Force) and 100 kV Sn (Alpha). The dose / tube currents were determined for each patient size on each CT system as follows: for small, 0.5 mGy / 8 mAs (Flash), 0.3 mGy / 28 mAs (Force), 0.2 mGy / 24 mAs (Alpha STD), 0.1 mGy / 12 mAs (Alpha UHR), for medium, 1.0 mGy / 16 mAs (Flash), 0.7 mGy / 64 mAs (Force), 0.3 mGy / 35 mAs (Alpha STD), 0.3 mGy / 35 mAs (Alpha UHR), for large, 2.3 mGy / 34 mAs (Flash), 1.3 mGy/ 120 mAs (Force), 0.6 mGy / 70 mAs (Alpha STD), 0.7 mGy / 81 mAs (Alpha UHR).

**CONCLUSION**

The considered CT systems are easily capable of providing an image quality sufficient for lung cancer screening according to the German regulations. The dose limit of 1.3 mGy (for the 26 kg/m2 BMI) did not even have to be exhausted by far. When viewed with a slab thickness of 3.0 mm, the ground glass nodules were clearly visible to the reader.

**CLINICAL RELEVANCE/APPLICATION**

A wide variety of clinically deployed CT systems allows for the dose efficient visualization of challenging lung nodules in a low contrast scenario.

## S1-SSPH01-6 VOLUMETRIC LESION DETECTION ON THE PHOTON COUNTING CT SYSTEM: OPTIMIZATION OF IMAGE TYPE AND SLICE THICKNESS

Jason P. Weinman, MD (*Abstract Co-Author*) Reviewer, Parexel International Corporation;Reviewer, Perceptive Informatics, LLC;Adisory Board, Boehringer Ingelheim GmbH;Support, Boehringer Ingelheim GmbH
Donglai Huo, PhD (*Abstract Co-Author*) Nothing to Disclose

Lorna Browne, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Nolan Dang (*Abstract Co-Author*) Nothing to Disclose
Wei Zhou, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the optimal image type and slice thickness options on the photon counting CT (PCCT) for the volumetric lesion detection task in a controlled phantom study.

## METHODS AND MATERIALS

A 10 cm cylinder containing 3D low contrast (-20 HU) spherical lesion targets was inserted into an anthropomorphic 30 x 20 cm abdomen phantom (QRM, Germany). The spherical lesion diameters are 8, 6, 4, 3 mm for investigations. The phantom setting was scanned on a clinical PCCT unit (NAEOTOM Alpha, Siemens) using 120 kV, pitch 0.8, collimation 0.4 x 144 mm, and CTDI of 15 mGy. The acquisition was repeated 25 times to achieve 100 independent target sets (4 each scan) for each lesion size. T3D (full spectrum) and 70 keV virtual monoenergetic image (VMI) were reconstructed using clinical Br40 kernel, QIR level of 3 and 10 cm FOV. The slice thickness options were selected as 3 mm (clinical thick), 1 mm (clinical thin), and 0.4 mm (thinnest). For each condition, lesion detectability index (D') was calculated using a validated multi-slice channelized Hotelling observer (MS-CHO) method. D' was compared across image types and slice thickness.

## RESULTS

As expected, the D' decreases with reduced lesion size, median of 10.64 for 8 mm lesion, 3.19 for 3 mm lesion at T3D and 1 mm slice thickness. When comparing performance between image types, D' of T3D and 70keV VMI are comparable with differences of median values < ±7% at variable conditions. For 4 mm lesion size and 3 mm slice, median D' of T3D and 70keV VMI are 3.58 and 3.62, respectively. The D' increases with reduced slice thickness. At 8 mm lesion and 70keV VMI, 0.4 mm slice (median 12.32) shows a 9.8% improvement of D', compared to 1 mm slice (median 11.22). Such improvement is more prominent in smaller lesions sizes. For instance, at 3 mm lesion size and 70keV VMI, D' of 0.4 mm slice (median 4.08) is 23.2% higher than that of 1 mm slice (median 3.31). The optimal D' of each lesion size stays at the thinnest slice 0.4 mm, with either T3D or 70keV VMI.

## CONCLUSION

The detectability of volumetric lesion detection was dependent on the lesion size, slice thickness and the image type on PCCT. No obvious preference of image type (T3D or 70keV VMI) was found while it is recommended to use the thinnest slice thickness (0.4 mm) to achieve the optimal 3D lesion detection.

## CLINICAL RELEVANCE/APPLICATION

With increased dose efficiency and spectral capacity, the optimal image type and slice thickness is not yet to be determined on PCCT. We investigated the detection task of the clinical lesion mimicking targets (spheres) and provided valuable guidance for PCCT's general utilizations in body imaging.

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# Abstract Archives of the RSNA, 2024

S1-STCE1

**Science Session (Low-Field and Mobile MRI)**

Sunday, Dec. 1 9:30AM - 10:00AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## S1-STCE1-1 POWER GRID INDEPENDENT LOW FIELD MRI

Hans-Martin Klein, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To provide power grid independant, sustainable MR imaging using a permanent magnet, solar energy, and a generator supported battery system.

### METHODS AND MATERIALS

We installed a 0,4 T MRI system with an open design permanent magnet (Fujifilm Aperto Lucent Plus). Regenerative energy was produced using a 29,8 kWp solar array, combined with a 22 kWh LiFePO4 battery. For periods of power outage and insufficient solar energy, a specially designed, direct current (DC), high voltage diesel generator is used. This generator simulates the power profile of a solar array, and is connected to the solar power converter, feeding the battery.

### RESULTS

Annual energy uptake of the MRI was 7.022 kWh in 2023. RIS and PACS components consumed 4.959 kWh. Heating and air conditioning consumed 12.500 kWh. Total energy consumption of the practice was 26.801 kWh. Total energy production was 30.930 kWh. Energy balance was positive with 4.129 kWh. Battery and DC generator can provide power grid independent operation. Without grid and solar energy, the practice has an energy consumption rate of max. 1,9 l gasoil/hour.

### CONCLUSION

Grid independent MR imaging is possible using permanent magnet technology, solar energy production, battery storage and a specially designed power generator.

### CLINICAL RELEVANCE/APPLICATION

Power outages can represent a problem in medical imaging, particularly in regions with insufficient infrastructure. Use of regenerative energy, reduction of energy consumption, battery storage, and an emergency power generator enable power grid independent MRI and can improve access to care.

## S1-STCE1-2 0.55 T MRI IN CYSTIC FIBROSIS LUNG MANIFESTATION - A CLINICAL APPLICATION STUDY

Michael Uder, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Schnell (*Abstract Co-Author*) Nothing to Disclose
Oliver Rompel, MD (*Abstract Co-Author*) Nothing to Disclose
Armin Nagel (*Abstract Co-Author*) Research Grant, Siemens AG
Rafael Heiss (*Abstract Co-Author*) Speakers Bureau, Siemens AG
Stephan Ellmann, MD (*Abstract Co-Author*) Nothing to Disclose
Maximilian Hinsen (*Abstract Co-Author*) Nothing to Disclose
Tobias Baeuerle, MD (*Abstract Co-Author*) Nothing to Disclose
Nadine Bayerl, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study was to compare 0.55 T MRI with chest X-ray (CXR) for the assessment of pulmonary manifestations in patients with cystic fibrosis (CF) attending routine annual check-ups.

### METHODS AND MATERIALS

The prospective study was approved by the local ethics committee and involved 28 CF patients (median age 12 years; age range 6-27 years; 11 females) without contraindications for MRI. CXR (posterior-anterior view) and low-field MRI at 0.55 T were performed on the same day. The MRI protocol included proton density-weighted transverse sequences and T2-weighted fat-suppressed coronal sequences with a slice thickness of 6 mm. The pulmonary findings (including mucus plugging, ground glass opacity, air trapping, bronchiectasis, consolidations and sacculations) were assessed on CXR and MRI by three raters using a semi-quantitative scoring system (modified Eichinger score). The scores were analyzed using Wilcoxon signed-rank tests. Interobserver reliability was evaluated using the intraclass correlation coefficient (ICC).

## RESULTS

Significantly more pulmonary findings were reported with low-field MRI (median score=8.2, interquartile range [IQR]=4-25) compared to CXR (median score=7.5, IQR=5-22; p=0.03), especially in patients with advanced stages of disease. Significant differences were found in the interpretation of mucus plugging (p=0.02), ground glass opacities (p=0.004) and air trapping (p=0.02). No significant differences were observed between MRI and CXR in assessing bronchiectases, consolidations and sacculations. Interobserver agreement was consistently higher for MRI ratings than for CXR (MRI, mean ICC=0.93, CXR, mean ICC=0.72). Limitations of our study were the small sample size and the single-center study design.

## CONCLUSION

The clinical use of low-field MRI for the annual check-up is a superior method of monitoring CF compared to CXR in terms of diagnostic value and radiation exposure.

## CLINICAL RELEVANCE/APPLICATION

Monitoring of pulmonary manifestations in cystic fibrosis using low-field MRI is superior to CXR.

# S1-STCE1-3 QUANTIFYING BRAIN VOLUMES AND LESION BURDEN IN RELATION TO DISEASE DURATION AND SEVERITY IN MULTIPLE SCLEROSIS WITH LOW-FIELD MRI

Serhat Okar (*Abstract Co-Author*) Nothing to Disclose
Joel M. Stein, MD, PhD (*Abstract Co-Author*) Research Grant, Hyperfine Research, Inc;Consultant, Centaur Diagnostics, Inc
Thomas C. Arnold, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel S. Reich, MD, PhD (*Abstract Co-Author*) Research support, Vertex Pharmaceuticals Incorporated;Research support, sanofi-aventis Group
Alfredo Lucas, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Chetan Vadali (*Presenter*) Nothing to Disclose

## PURPOSE

Multiple sclerosis (MS) causes characteristic central nervous sytem white matter lesions (WML) as well as atrophy. Brain atrophy begins early in MS, may proceed independently of WML disease activity, predicts disease progression and functional impairment, and may also be a target for therapy. We investigated whether lower-cost and more accessible but lower resolution portable 64mT low-field MRI accurately estimates brain volumes and total WML burden, and their relationship with clinical characteristics, relative to 3T MRI in patients with MS.

## METHODS AND MATERIALS

We scanned 50 MS patients on portable 64mT (Hyperfine) and standard 3T scanners (Siemens) at Penn or NIH with T1-weighted, T2-weighted and FLAIR acquisitions. Two super-resolution deep-learning algorithms, SynthSR and LowGAN, were used to generate 3T-like outputs from 64mT inputs. We measured thalamic, lateral ventricle, and cortical gray matter volumes using SynthSeg and manually segmented WMLs at each field strength. We then analyzed correlations between brain volumes, total WML lesion burden, disease duration, and a clinical assessment of functional impairment (Expanded Disability Status Scale [EDSS]).

## RESULTS

Brain volume measures were all strongly correlated, with LowGAN providing the most accurate estimates overall (thalamic: Cohen's d = 0.32, pFDR=0.008; lateral ventricle: Cohen's d = 0.04, pFDR>0.05; cerebral cortex: Cohen's d = 0.031, pFDR>0.05). Low-field-derived volumes accurately depicted a negative correlation between thalamic/cerebral cortex volume and disease duration, with no difference relative to 3T for 64mT+SynthSR in the thalamus and 64mT+LowGAN in the cortex (Steiger's test, p>0.05). Low-field-derived lateral ventricle volumes showed a positive correlation with disease duration, not significantly different from 3T (Steiger's test, p>0.05). Lesion burden estimates at 3T correlated highly with 64mT (r=0.89, p<0.01) and 64mT+LowGAN (r=0.83, p<0.01). We found the same positive correlation between WML lesion burden, disease duration, and EDSS at both field strengths (Steiger's test, p>0.05).

## CONCLUSION

Our findings show strong concordance between 64mT and 3T MRI measurements, suggesting that lower resolution low-field MRI can estimate regional brain volumes and WML burden, and preserve relationships between these measures and clinical characteristics in MS.

## CLINICAL RELEVANCE/APPLICATION

Portable low-field MRI could enable earlier or more frequent imaging in MS, particularly on presentation at the point-of-care or for patients with access limitations, and identifying brain atrophy may improve disease management.

# Abstract Archives of the RSNA, 2024

S1-STCE2

**Science Session (Multiomic and Multicenter Radiology AI)**

Sunday, Dec. 1 9:30AM - 10:00AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## S1-STCE2-1 FACILITATING THE DEVELOPMENT AND VALIDATION OF CUTTING-EDGE FAST CARDIAC MRI TECHNIQUES - SUMMARY OF THE CMRXRECON2023 CHALLENGE

Yan Li (*Abstract Co-Author*) Nothing to Disclose
Zi Wang (*Abstract Co-Author*) Nothing to Disclose
Mengting Sun (*Abstract Co-Author*) Nothing to Disclose
Shuo Wang (*Abstract Co-Author*) Nothing to Disclose
Fanwen Wang (*Abstract Co-Author*) Nothing to Disclose
Yajing Zhang (*Abstract Co-Author*) Nothing to Disclose
Longyu Sun (*Abstract Co-Author*) Nothing to Disclose
Qing Li (*Abstract Co-Author*) Nothing to Disclose
Chen Qin (*Abstract Co-Author*) Nothing to Disclose
Jun Lyu (*Abstract Co-Author*) Nothing to Disclose
Chengyan Wang, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To summarize effective strategies in developing and validating cutting-edge fast cardiac MRI (CMR) techniques and contribute to the translation of the latest deep learning techniques into clinical practice.

### METHODS AND MATERIALS

We organized the CMRxRecon Challenge (https://cmrxrecon.github.io) in 2023, in collaboration with the 26th International Conference on MICCAI. CMRxRecon is currently the largest cardiac MRI challenge that provides an open dataset consisting of multi-contrast, multi-view, and multi-coil raw k-space data from 300 healthy subjects, which holds crucial value for the development of deep learning algorithms. A total of 10 institutions jointly involved and organized this challenge. Data were collected from two types of 3T scanners (MAGNETOM Vida, Siemens; Ingenia CX, Philips). The released dataset included both cine and mapping raw k-space data with detailed annotations of anatomical structures, such as four chambers and left ventricular myocardium. Long and short-axis, two-chamber, three-chamber, and four-chamber views were collected for cine. T1 and T2 mapping were acquired using MOLLI and T2prep-FLASH sequences. The challenge included two independent tasks: 1) Fast cine imaging, and 2) Fast T1 T2 mapping.

### RESULTS

The challenge attracted more than 285 teams and over 600 participants. All teams used deep learning-based approaches, indicating that deep learning has become a promising solution to the problem. The winning solution achieved PSNR, SSIM, and NMSE scores of 46.873, 0.990, 0.003 for cine, and 45.481, 0.987, 0.004 for mapping reconstruction, respectively. Figure 1 summarizes the characteristics of the models from all participating teams. The top 3 performance teams in both tasks all include the SSIM in their loss functions, which aligns with the evaluation metrics of the challenge. The first-place winner of both tasks utilizes the E2E-VarNet architecture as backbones. In contrast, U-Net was still the most popular backbone for both multi-coil and single-coil reconstructions. Regarding pre-processing, the majority of participating teams opted for normalization of dividing by the maximum value, while a few utilized the z-score normalization method.

### CONCLUSION

This study provides an overview of the CMRxRecon2023 dataset and a summary of the submitted results, including backbone architecture, loss function, pre-processing techniques, physical modeling, and model complexity. Through the training and validation of this dataset using cutting-edge models, our goal is to advance the current research in the field of CMR imaging.

### CLINICAL RELEVANCE/APPLICATION

The advancements from the CMRxRecon2023 challenge will be expected to contribute to more accurate diagnoses and improved patient outcomes in cardiac imaging.

## S1-STCE2-2 INTEGRATING IMAGING DERIVED PHENOTYPES AND GENOMICS DATA TO PREDICT THE RISK OF EIGHT COMMON DISEASES

Longyu Sun (*Abstract Co-Author*) Nothing to Disclose
Qing Li (*Abstract Co-Author*) Nothing to Disclose
Xumei Hu (*Abstract Co-Author*) Nothing to Disclose
Yan Li (*Abstract Co-Author*) Nothing to Disclose
Chengyan Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Mengting Sun (*Abstract Co-Author*) Nothing to Disclose

Yajing Zhang (*Abstract Co-Author*) Nothing to Disclose
Mengyao Yu (*Abstract Co-Author*) Nothing to Disclose
Meng Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the efficacy of combining multi-organ imaging-derived phenotypes (IDPs) with genomic data to predict the risk of eight common diseases using the UK Biobank (UKBB) dataset.

**METHODS AND MATERIALS**

The UKBB, a prospective cohort study initiated between 2006 and 2010, has amassed data from nearly 500,000 participants across the UK. The cohort includes extensive phenotyping, imaging, and multiple genomic data types. Our research focused on 312 imaging phenotypes from different organs such as heart, brain, kidney, liver, lung, pancreas, and spleen in 8,000 individuals. For the genetic analysis, we calculated Polygenic Risk Scores (PRS) utilizing established genetic markers linked to the diseases under investigation. The diseases studied include atrial fibrillation (AF), heart failure (HF), myocardial infarction (MI), asthma, type 2 diabetes (T2D), chronic kidney disease (CKD), coronary artery disease (CAD), and chronic obstructive pulmonary disease (COPD). We constructed three predictive models per disease: one based solely on imaging features, one on genomic data, and a hybrid model combining both. The predictive model employed was a logistic regression with L1 norm regularization.

**RESULTS**

The fusion of IDPs and PRS in our predictive models led to a significant improvement in the predictive power for seven out of the eight diseases studied. Notably, the combined model for CAD achieved an AUC of 0.81±0.06, outperforming the models relying on imaging features alone (AUC 0.76±0.05) and genomic data alone (AUC 0.66±0.06). Similarly, the PRS+IDPs model for HF also demonstrated enhanced predictive accuracy with an AUC of 0.79±0.12, surpassing the individual contributions of PRS (AUC 0.63±0.16) and IDPs (AUC 0.68±0.15). For AF, imaging features related to the left atrium were identified as pivotal. In the case of T2D, liver-related features were found to be particularly influential. For CAD and COPD prediction, PRS made a more substantial contribution than other IDPs. A decrease in kidney parenchyma volume emerged as a potential indicator for CKD. The lung function parameter was identified as a key factor in the predictive models for both COPD and asthma, underscoring its established significance. For HF, the ejection fraction of the ventricle was the most critical feature among all the features considered. Interestingly, for MI prediction, the fat fraction of the pancreas andthe liver iron corrected T1 value were more predictive than cardiac IDPs.

**CONCLUSION**

The integration of multi-organ imaging features with genetic dataenhances the prediction predictive capabilities forcommon diseases, underscoring the value of a multi-modal diagnostic approach in medical diagnostics and personalized medicine.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrates the potential of combining imaging and genomic data to enhance disease prediction, which can be crucial for early diagnosis and personalized treatment strategies in clinical settings.

## S1-STCE2-3 UNCERTAINTY-AWARE COLLABORATIVE LEARNING BETWEEN AI AND RADIOLOGISTS FOR PREDICTING NEOADJUVANT THERAPY RESPONSE IN BREAST CANCER

Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Regina G. Beets-Tan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tao Tan (*Abstract Co-Author*) Nothing to Disclose
Hong-Yu Zhou (*Abstract Co-Author*) Nothing to Disclose
Xin Wang, MS (*Abstract Co-Author*) Nothing to Disclose
Xinglong Liang (*Abstract Co-Author*) Nothing to Disclose
Chunyao Lu (*Abstract Co-Author*) Nothing to Disclose
Jonas Teuwen, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Sofia Ventura-Diaz, MD (*Abstract Co-Author*) Nothing to Disclose
Tianyu Zhang (*Abstract Co-Author*) Nothing to Disclose
Luyi Han (*Abstract Co-Author*) Nothing to Disclose
Yuan Gao, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Integrating artificial intelligence (AI) in radiology as a concurrent or second diagnostic reader holds promise. However, the optimal way to combine AI and human assessments is less clear, particularly when diagnostic outcomes are not immediately evident, as is the case in response prediction to neoadjuvant therapy (NAT). We aimed to develop a deep learning system to enhance the collaboration between AI and radiologists in the radiology decision-making workflow.

**METHODS AND MATERIALS**

This multi-modal study included 3,384 breast cancer patients who underwent NAT followed by surgery, comprising 3,719 longitudinal DCE-MRI exams, 4,802 pre-NAT mammogram (MG) exams, and clinicopathological (CP) data. We developed multi-modal models (MG-CP, MRI-CP, MG-MRI-CP) to predict pathological complete response (pCR). Ten board certified radiologists assessed pCR for test set (n=120) by analyzing scans taken throughout NAT. We introduced the Uncertainty-aware Clinical Decision System (UCDS) to enhance interactions among various combinations of humans and AI participants. UCDS assesses uncertainty scores by evaluating the performance of AI models and radiologists within specified standalone and collaborative patterns to determine the final decision.

**RESULTS**

UCDS significantly surpassed standalone baseline and traditional collaborative methods in all settings (?AUROC = 3.4-6.1%; ?sensitivity = 5.4-13.5%; ?specificity = 2-8.6%). In radiologist collaboration settings (i.e., human-human interactions using optimized threshold searching and weighted fusion), UCDS reached a statistically significant AUROC of 74.7% for predicting pCR (p = 5.2e-03). Compared to the AI-AI collaboration baseline, UCDS achieved an AUROC of 74.5% (p = 1.7e-03). Particularly, in real word collaborative scenarios between human and AI, UCDS achieved an AUROC of 84.9% (p = 6.9e-04), with a 4.9% increase in true positives and a 6.8% increase in true negatives, without increasing false predictions.

**CONCLUSION**

The UCDS model demonstrates effective in managing the integration of AI and human expertise in predicting BC treatment response, enhancing decision-making accuracy by quantifying uncertainty in collaborative settings.

## CLINICAL RELEVANCE/APPLICATION

Consensus decision-making between radiologists and AI systems is valuable but can be resource-intensive in clinical environments facing workforce shortages, potentially leading to errors when outcomes are not immediately evident. The UCDS model efficiently considers the uncertainty of opinions between predictive AI models and radiologists, offering a potential tool in streamlining decision-making processes and improving accuracy in collaborative clinical practices.

# Abstract Archives of the RSNA, 2024

S2-SSBR01

**Breast Imaging (Perceptions and Clinical Utilization of AI in Screening)**

Sunday, Dec. 1 10:30AM - 11:30AM Room: S406A

Fredrik Strand, MD, PhD (*Moderator*) Speaker, Lunit Inc
Janie M. Lee, MD, MSc (*Moderator*) Research Grant, General Electric Company;Investigator, General Electric Company

**Sub-Events**

## S2-SSBR01-1 ASSESSING FAIRNESS OF AI: GENERALISABILITY EVALUATION IN WHITE, BLACK, ASIAN, AND MIXED ETHNICITY WOMEN IN A LARGE-SCALE RETROSPECTIVE CLINICAL STUDY IN BREAST CANCER SCREENING

Rachael Currie (*Abstract Co-Author*) Nothing to Disclose
Jonathan Nash, MBBS (*Abstract Co-Author*) Nothing to Disclose
Catharina Oberije, PhD (*Abstract Co-Author*) Nothing to Disclose
Georgia Fox (*Abstract Co-Author*) Nothing to Disclose
Nisha Sharma, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Annie Ng, PhD (*Abstract Co-Author*) Researcher, Kheiron Medical Technologies Ltd
ALAN REDMAN (*Abstract Co-Author*) Nothing to Disclose
William Wei Lian Teh, MBChB (*Abstract Co-Author*) Speaker, Hologic, Inc;Speaker, Devicor Medical Products, Inc
Ben Glocker, PhD (*Abstract Co-Author*) Employee, Kheiron Medical Technologies Ltd;Employee, HeartFlow, Inc;Researcher, Microsoft Corporation
Peter D. Kecskemethy, PhD (*Presenter*) CEO, Kheiron Medical Technologies

### PURPOSE

Performance in (human) double reading breast screening varies with client ethnicity; the variance relates to characteristics like inherent cancer prevalence and breast density. To guarantee fairness, AI systems should not introduce systematic deviations from this human screening pattern.

### METHODS AND MATERIALS

A commercially available breast screening AI system was evaluated in a large retrospective clinical study covering a genetically diverse population, screened between 2017 and 2021. Ethnicity information was available at one of the participating sites where 189,257 cases were included. . Standard double reading (DR) with and without AI was assessed for relevant screening metrics per ethnic subgroup: White, Black, Asian, Mixed/other, Unknown. The spectrum of cancers detected by DR with and without AI were compared using the chi-square test at a significance level of 0.05. DR with AI involved modelling the use of AI to serve as the second reader when AI and the first reader opinions agree 'recall' or 'no recall', otherwise, the historical second reader opinion was used.

### RESULTS

The ethnicity data consisted of 49.0% White, 10.2% Black, 17.7% Asian, 6.5% mixed/other, 13.9% unknown and 2.8% missing ethnicity. DR showed a recall rate (RR) of 5.0%, 4.3%, 4.4%, 5.5% and 4.5% for White, Black, Asian, mixed/other and unknown ethnicities, respectively. DR with AI closely followed the same pattern with recall rates of 4.6%, 3.9%, 4.1%, 4.9% and 4.1%, yielding absolute differences compared to DR of -0.4%, -0.4%, -0.3%, -0.6%, and -0.4%. The PPV of DR was 19.6%, 17.5%, 18.2%, 15.9%, 13.9% for White, Black, Asian, mixed and unknown ethnicity, respectively. DR with AI showed a similar trend for PPV, but yielded improvements with absolute increases of 1.5%, 1.7%, 1.4%, 1.4%, and 1.1%, respectively. The chi-square tests to compare invasiveness and tumour size, grade and lymph node status for invasive cancers detected by DR with or without AI were statistically not significant, for all ethnicities with p-values >0.05 (ranging from 0.72-1).

### CONCLUSION

The AI system demonstrated generalisability across different ethnic groups, with the potential to to support improvements in RR and PPV. Screening metrics for DR with AI showed statistically similar trends between ethnicities to DR, with no systematic decreases in performance for any ethnic subgroup, indicating the safety of using AI across ethnicities.

### CLINICAL RELEVANCE/APPLICATION

Biases in the development of AI can lead to risks around generalisability and ethnic inequalities. The study results demonstrate that double reading with an AI system closely followed human reading patterns for different ethnicities. supporting ethnic fairness and safety in breast screening.

## S2-SSBR01-2 EFFECT OF FULL-FIELD DIGITAL MAMMOGRAPHY SOFTWARE VERSION AND VENDOR ON THE PERFORMANCE OF COMMERCIAL DEEP-LEARNING ALGORITHMS FOR BREAST CANCER DETECTION

Fiona J. Gilbert, MBChB, FRCR (*Abstract Co-Author*) Research Grant, Hologic, Inc Research Grant, General Electric Company Research Consultant, Alphabet Inc Research Consultant, Kheiron Medical Technologies Ltd Research support, Bayer AG Research collaboration, Volpara Health Technologies Limited Research collaboration Lunit Research collaboration Merantix Research collaboration Screenpoint Research collaboration Therapixel Research support GSK Research collaboration RhinoHealth Research collaboration Curemetrix
Richard Black, MS (*Abstract Co-Author*) Nothing to Disclose

Joshua Rothwell (*Abstract Co-Author*) Nothing to Disclose
Sarah Hickman, MBBS (*Abstract Co-Author*) Research collaboration, Vara;Research collaboration, ScreenPoint Medical BV;Research collaboration, Lunit Inc;Research collaboration, Kheiron Medical Technologies Ltd;Research collaboration, Alphabet Inc;Research collaboration, Volpara Health Technologies Limited
Nicholas R. Payne, PhD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Investigating how the performance of deep-learning (DL) algorithms for detection of breast cancer on Full-Field Digital Mammography (FFDM) is affected by software version of the FFDM machine.

**METHODS AND MATERIALS**

210,515 screening FFDM examinations were retrospectively collected from two sites with cancers confirmed by histopathology. Examinations were scored by two commercial DL algorithms (DL-1, DL-2). DICOM headers were used to find 11 FFDM software versions from 3 vendors. Examinations were excluded if they were not scored by both algorithms (50,115) and, subsequently, if a software version subset had lt20 cancers (880). 159,521 exams were analysed, covering 3 versions of GE (GE-A, GE-B, and GE-C) software and 2 from Philips (Ph-A and Ph-B). Each subset was used to define a threshold for DL-1 and DL-2 at 89.8% specificity. Performance at each threshold was then tested across all 5 subsets.

**RESULTS**

Area under the curve (AUC) for DL-1 were 0.90 (GE-A), 0.89 (GE-B), 0.88 (GE-C), 0.86 (Ph-A), and 0.88 (Ph-B). DL-2 AUC were 0.87 (GE-A), 0.87 (GE-B), 0.87 (GE-C), 0.82 (Ph-A), and 0.81 (Ph-B). The intra-vendor recall rate (RR), with thresholds and test subsets from the same vendor, varied between 10.5-11.4% for DL-1 on GE, 10.7-11.2% for DL-1 on Philips, 10.4-11.5% for DL-2 on GE, and 10.7-11.1% for DL-2 on Philips. Variations were statistically significant (plt0.05) for RRs of DL-1 and DL-2 between GE-A and GE-B software versions. The inter-vendor RR varied between 7.9-15.5% and 4.6-23.7% for DL-1 and DL-2 respectively, with significant differences in every combination of threshold and test set. Intra-vendor sensitivity didn't differ significantly for DL-1 or DL-2 on either vendor. Inter-vendor sensitivity varied between 67.9-78.7% for DL-1, which was significant for thresholds set on GE-A and GE-B when applied to Ph-A, and for the threshold set by Ph-A when applied to GE-B. For DL-2, inter-vendor sensitivity varied between 48.9-80.6%, which was statistically significant for all combinations bar a threshold set on GE-C used on Ph-A.

**CONCLUSION**

Performance variations were seen for intra-vendor software versions, however only significantly for the RR between two GE versions. Inter-vendor performance varied more, affecting all RRs as well as 3/12 sensitivity measures of DL-1 and 11/12 from DL-2. Awareness is needed when algorithms thresholds set on one vendor are applied to FFDM acquired on another. This is less the case for software versions from the same vendor, however variations due to major updates or iterative changes should be anticipated.

**CLINICAL RELEVANCE/APPLICATION**

DL algorithm performance depends upon the vendor and software version of the FFDM used to select a threshold. When FFDM software is updated the DL thresholds may need to be reset.

## S2-SSBR01-3 COMBINING TWO OR THREE AI CAD SYSTEMS TO REPLACE RADIOLOGIST DOUBLE-READ AND CONSENSUS DISCUSSION IN BREAST CANCER SCREENING - A RETROSPECTIVE EVALUATION

Hakan Gustafsson, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando Cossio Ramirez, BSc (*Abstract Co-Author*) Nothing to Disclose
Haiko Schurz, BSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Davida Astrom (*Abstract Co-Author*) Nothing to Disclose
Taeyang Choi (*Abstract Co-Author*) Nothing to Disclose
Sophia Zackrisson, MD, PhD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG;Speaker,Pfizer Inc;Patent holder, PCT/EP2014/057372;
Fredrik Strand, MD, PhD (*Presenter*) Speaker, Lunit Inc

**PURPOSE**

Prospective trials have shown that Artificial Intelligence Computer-Aided Detection systems (AI CAD) may improve the accuracy of breast cancer screening. Trials were implemented with AI CAD replacing one (or none) of the two initial reads followed by a radiologist consensus discussion to decide on recalls. In this study, we examined the results of having one, two or three AI CADs directly recalling.

**METHODS AND MATERIALS**

From the Swedish VAI-B cohort, we extracted screening mammograms from Philips equipment January 2015 to April 2019. A three-year follow-up time defined the ground truth of cancer diagnosis or healthy. If any individual had more than one screening exam, we randomly included one. Healthy observations were up-sampled to attain a realistic 1.1% proportion of cancer. For each AI CAD, we created a ranking list based on exam scores. The AI CAD strategies made the same number of recalls as the original radiologists. For strategies involving an initial flagging step, the AI CADs were set to flag twice the number of recalled individuals. We evaluated three different commercial AI-CAD systems.

**RESULTS**

There were 1214 exams linked to breast cancer diagnosis and 175020 exams (up-sampled from 5834 individuals) linked to healthy status. The original radiologists had recalled 4130 women resulting in screen-detecting 545 cancers. Single-AI CAD strategies recalling women directly based on the score from a single AI CAD resulted in detection ratios (relative to the historic) from 0.97 to 1.08 across the three AI CAD systems. Double-AI CAD strategies resulted in detection ratio of 1.09 to 1.14. Triple-AI CAD strategies resulted in detection ratios of 1.08 to 1.15. For the best AI CADs, the detection ratio only marginally increased when combined with the worst AI CAD in a double-AI CAD strategy. When combining the two best in a double-AI CAD strategy, it was better to use the sum of their assessments to recall rather than using one AI to flag and the other to recall.

**CONCLUSION**

Combining two or three AI CADs ensured that cancer detection was improved compared to the historic records based on double-read and consensus discussion. The largest improvement was the result of combining two similarly performing AI CAD systems. Even though cancer detection overall is likely to increase, around 20% of currently screen-detected cancers would be missed, for which the cause must be further analyzed.

**CLINICAL RELEVANCE/APPLICATION**

Based on a retrospective evaluation it appears that there is a potential for AI CAD to completely replace the read and recall performed by radiologists. The safest implementation would be at least two AI CADs together.

**S2-SSBR01-4** Silvia Penco (*Abstract Co-Author*) Nothing to Disclose
Enrico Cassano (*Abstract Co-Author*) Nothing to Disclose

## AI IN BREAST CANCER SCREENING: A SURVEY ON WOMEN'S PERCEPTIONS AND ATTITUDES ABOUT ITS USE IN A CANCER REFERRAL CENTRE

Chiara Trentin (*Abstract Co-Author*) Nothing to Disclose
Anna Rotili, MD (*Abstract Co-Author*) Nothing to Disclose
Filippo Pesapane, MD (*Abstract Co-Author*) Nothing to Disclose
Luca Nicosia (*Abstract Co-Author*) Nothing to Disclose
Ottavia Battaglia, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Mammography is recognized as the only screening tool that has enabled early diagnosis and subsequent reduction of breast-cancer related mortality.Main limitations include the large amount of mammography yearly produced, shortage of trained radiologist to interpret them and consequent high proportion of false-negative and false-positive results. A tangible solution to these limits may be represented by artificial intelligence (AI).Nevertheless, it is still not known if and in what terms, the use of AI is going to be accepted by the non- scientific community. The aim of our survey was to assess what is the knowledge and perception about AI of the population eligible for breast cancer screening.

### METHODS AND MATERIALS

We conducted a prospective survey consisting of a 11-multiple-choice questionnaire evaluating statistical associations with Chi-Square-test or Fisher-exact-test. Multinomial-logistic-regression was performed on items with more than two response categories. Odds ratio (OR) with 95% CI were computed to estimate the probability of a specific response according to patient's characteristics.

### RESULTS

Of the 800 questionaries that have been analyzed, half of the respondents (51%) declared to have knowledge about AI and of these, 88% expressed a positive opinion about its involvement in medicine.In the non-Italian population, there was a deep awareness about AI more often than Italian respondents (OR = 1.91;95% CI[1.10-3.33]).A better opinion on the use of AI in medicine has been shown by the population with an higher level of education (OR = 4.69;95% CI[1.36-16.12]).Most of the respondents (94%) assessed that the radiologists should always produce their own report on mammograms, whilst 77% agreed that AI should be used as a second reader.52% of the respondents, believed that both the software developer and the radiologist should be held accountable for AI errors.

### CONCLUSION

Our survey has shown that most of the females undergoing screening in our Institute approve the introduction of AI, however only as a support to radiologist’s work and not in place of them. Remains unsolved the accountability in case of AI errors.

### CLINICAL RELEVANCE/APPLICATION

Understanding patient’s demands and concerns about AI, might be a starting point to edit a strategy aimed at improving their knowledge and acceptance of AI application in the breast cancer screening field.

## S2-SSBR01-5 PUTTING IT IN PERSPECTIVE: AI TRIAGE STREAMLINING SCREENING MAMMOGRAM TURNAROUND TIME (TAT) AMID STAFF SHORTAGES

Hakki Celik, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammed Salman Shazeeb, PhD (*Abstract Co-Author*) Nothing to Disclose
Srinivasan Vedantham, PhD (*Abstract Co-Author*) Research collaboration, Koning Corporation Research collaboration, General Electric Company
Gopal R. Vijayaraghavan, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the potential of AI software for prioritizing interpretation to reduce turnaround time (TAT) in breast cancer detection and diagnosis.

### METHODS AND MATERIALS

During a 1-year period (March 2023-Feb 2024), AI scores (Transpara AI, ScreenPoint Medical, The Netherlands) from 47,490 breast cancer screening exams (80% breast tomosynthesis; 20% digital mammography) were prospectively obtained. Blinded to AI results, the exams were interpreted by eight fellowship-trained, board-certified breast imaging radiologists with 2-30 years of experience. Exact Clopper-Pearson 95% confidence intervals (CI) for binomial proportions were obtained.

### RESULTS

AI exam scores ranged from 1-10, with 10 indicating the highest probability of malignancy (elevated risk), scores of 8-9 (intermediate risk) and scores below 7 (low risk). Of the 195 cancers diagnosed, the majority of cancers had a score of 10 (164/195; 84%; CI: 78.6-89.3%) and there were no cancers diagnosed for AI scores of 5 or below. Of 47,490 screens, 27,116 (57%; CI: 56.5%-57.5%) were assigned 7 or higher, indicating that these screens can be prioritized for interpretation to reduce TAT. 1004/7303 (13.8%; CI: 13%-14.6%) cases assigned an AI score of 10 were assigned a BIRADS-0 and called back by radiologist, which indicates the propensity of the AI software to provide higher scores than needed.

### CONCLUSION

Utilizing an AI score of 7 or higher can be beneficial in prioritizing the reading list in at least 57% of screening exams, with the concomitant decrease in TAT from screening to diagnostic workup. However, caution is expressed in using the AI score during interpretation due to its propensity for higher scores than warranted.

### CLINICAL RELEVANCE/APPLICATION

With ongoing shortage of breast imaging radiologists and continually increasing screening volume, AI score, notwithstanding some limitations, can be used for prioritized interpretation list to reduce TAT. For clinical interpretation, using AI provided annotation in addition to the AI score is preferable, to help in clinical decision support.

## S2-SSBR01-6 REAL WORLD EFFECT OF ARTIFICIAL INTELLIGENCE ON HISTOPATHOLOGY AND STAGE IN BREAST CANCER SCREENING WITH DIGITAL BREAST TOMOSYNTHESIS

Jeffrey W. Hoffmeister, MD, MS (*Abstract Co-Author*) Employee, iCAD, Inc
Julie Shisler (*Abstract Co-Author*) Consultant, iCAD, Inc

Shakira Sarquis-Kolber (*Abstract Co-Author*) Nothing to Disclose
Kathy J. Schilling Colletta, MD (*Presenter*) Consultant, General Electric Company;Investigator, General Electric Company

## PURPOSE

To assess impact of an Artificial Intelligence (AI) on radiologists' detection of cancer on digital breast tomosynthesis exams (DBT) based on size, stage, density and histopathology.

## METHODS AND MATERIALS

A retrospective analysis of mammography audit data and screening cancers detected was conducted at four sites during two time periods with nine dedicated breast radiologists. Data was collected from March 1, 2018 to February 29, 2020 prior to install of AI ("pre-AI") and March 1, 2020 to February 28, 2022 with concurrent use of deep learning AI detection (ProFound Detection, iCAD, Nashua, NH) ("post-AI"). Age, breast density, tumor size, staging and histopathology were collected for all screen detected cancers. Endpoints were cancer detection rate (CDR), tumor size, stage and histopathology. Estimates of performance and differences obtained using Chi square test and two-sample independent t-test.

## RESULTS

The pre-AI period had 54,440 exams (339 true positives) and post-AI had 48,742 exams (369 true positives). CDR per 1000 improved from 6.23 (95% CI: 5.60, 6.92) to 7.57 (95% CI: 6.84, 8.38), increase of 1.34 (95% CI: 0.33, 2.36, P < .01). Of the women diagnosed with breast cancer, there were no statistical differences in mean age 67.6 pre-AI and 68.7 post-AI, P = .22, while radiologists detected more cancers in dense breasts post-AI (45.0%, 95% CI: 40.0%, 50.1%) than pre-AI (37.2%, 95% CI: 32.2%, 42.4%), increase of 7.8% (95% CI: 0.6%,15.0%, P = .04). Mean size of invasive cancers in mm, pre-AI was 12.16 (1.0 to 85.0) and decreased to 10.74 (1.5 to 60.0) post-AI, 1.42 mm smaller (95% CI: 0.11, 2.83, P <.05). More invasive cancers were T1 post-AI (92.2%, 95% CI: 88.5%, 94.9%) than pre-AI (85.3%, 95% CI: 80.3%, 89.1%), increase of 7.0% (95% CI: 1.6%, 12.4%, P = .01), without any change in detection of DCIS post-AI (23.0%, 95% CI: 19.0%, 27.6%) vs pre-AI (25.7%, 95% CI: 21.3%, 30.6%), P = .42. Invasive cancer detection per 1000 screened increased from 4.63 (95% CI: 4.09, 5.24) pre-AI to 5.83 (95% CI: 5.19, 6.54) post-AI, difference of 1.20 (95% CI: 0.31, 2.08, P < .01). In the subset of lobular cancers, the detection per 1000 screened increased post-AI from 0.44 (95% CI: 0.29, 0.66) to 0.98 (95% CI: 0.74, 1.31), a difference of 0.54 (95% CI: 0.21, 0.87, P < .001).

## CONCLUSION

Interpretation of screening DBT exams by dedicated breast radiologists with concurrent use of AI resulted in an increase in CDR, invasive and lobular detection rates, an increase in cancers detected in dense breasts and a decrease in mean invasive size and stage. AI was able to detect more invasive cancers without an increase in non-invasive cancers.

## CLINICAL RELEVANCE/APPLICATION

Detection with an AI tool in screening may be useful in identifying difficult to detect lesions without overdiagnosis by overestimating DCIS.

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# Abstract Archives of the RSNA, 2024

S2-SSCA01

**Cardiac Imaging (Artificial Intelligence for Interpretation)**

Sunday, Dec. 1 10:30AM - 11:30AM Room: E353C

Tim Leiner, MD, PhD (*Moderator*) Research support, Pie Medical Imaging BV;Advisory Board, Cart-Tech BV;Advisory Board, AI4MedImaging;Advisor, Quantib BV;Consultant, Guerbet SA
Marly Van Assen, MSc, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S2-SSCA01-1 FEASIBILITY OF DEEP LEARNING MYOCARDIAL STRAIN ASSESSMENT FOR CARDIAC CTA

Arash Bedayat, MD (*Abstract Co-Author*) Nothing to Disclose
Elliot R. McVeigh, PhD (*Abstract Co-Author*) Shareholder, Clearpoint Neuro, Inc;Research funded, General Electric Company;Research funded, Tendyne Holdings, Inc;Research funded, Abbott Laboratories
Hana Hadiprodjo (*Abstract Co-Author*) Nothing to Disclose
Seth J. Kligerman, MD, MS (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Consultant, Riverain Technologies, LLC;Consultant, Bayer AG
Albert Hsiao, MD, PhD (*Abstract Co-Author*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging
Lewis D. Hahn, MD (*Abstract Co-Author*) Nothing to Disclose
Evan Masutani, PhD (*Abstract Co-Author*) Nothing to Disclose
Sophie Y. Wong, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Coronary CTA (CCTA) is a first-line modality for the evaluation of coronary artery disease. Wide-detector scanners allow for a full-cardiac cycle acquisition in a single heartbeat, enabling assessment of wall motion abnormalities during CCTA. Regional wall motion abnormalities can be an indication of hemodynamically significant disease, but reliable visual evaluation can be challenging. We therefore investigated the feasibility of using a novel deep learning algorithm to measure myocardial strain on CCTA, providing quantitative metrics to support clinical interpretation.

### METHODS AND MATERIALS

We retrospectively collected 167 CCTA exams performed between Jan 2017 and Jan 2024 in patients who also had invasive coronary catheterization within 30 days. A single mid-ventricular short axis slice was generated from each exam and processed using a deep learning strain algorithm developed in-house. Four subspecialty-trained, board-certified cardiothoracic radiologists rated wall motion in each of six cardiac segments in two phases: first without algorithm results, and subsequently using quantitative maps produced by the algorithm. A subset of 12 exams were read by all four readers. Analyses included Spearman's rho (?), Cohen's kappa (?), and intraclass correlation using a single-rater, 2-way random effects model (ICC).

### RESULTS

Of the 668 coronary arteries, there were 27 with occlusion, 156 with severe stenosis, and 80 with moderate stenosis by invasive catheterization. Peak radial strain showed moderate correlation with independent expert reader assessment of regional wall motion (?=-0.40; ICC 0.44; p<0.001). Intraclass correlation for segments graded by all readers was 0.57 (p<0.001). When provided algorithm results, readers with greater subspecialty experience were more likely to change their interpretation: ?=0.69 (16 years), ?=0.72 (10 years), ?=0.82 (6 years), and ?=0.93 (4 years). Readers upgraded wall motion scores on 46/1002 (4.59%) segments and downgraded scores on 32/1002 (3.19%) segments, increasing overall alignment with the algorithm in their second review (?=-0.52; ICC=0.51; p<0.001).

### CONCLUSION

The deep learning algorithm demonstrated moderate agreement with independent expert visual assessment of segmental wall motion. Readers also demonstrated moderate agreement with each other. When provided algorithm results, readers with more subspecialty experience were more likely to change their interpretation to align with the algorithm.

### CLINICAL RELEVANCE/APPLICATION

We demonstrated the feasibility of applying a deep learning algorithm to quantify regional myocardial function using full cardiac cycle CCTA. Novel algorithms such as these have the potential to assess the functional significance of coronary lesions.

## S2-SSCA01-2 MULTISITE STUDY DEMONSTRATING PERFORMANCE OF A NOVEL, AUTOMATIC, DEEP LEARNING-BASED MODEL FOR DETECTION OF FOUR HIGH RISK PLAQUE PROGNOSTIC FEATURES ON CORONARY CTA

Dijia Wu, PhD (*Abstract Co-Author*) Nothing to Disclose
Yining Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Yiqiang Zhan, PhD (*Abstract Co-Author*) Nothing to Disclose
Yanli Song (*Abstract Co-Author*) Nothing to Disclose

Xiang S. Zhou (*Abstract Co-Author*) Nothing to Disclose
Dinggang Shen (*Abstract Co-Author*) Nothing to Disclose
Pei DONG (*Abstract Co-Author*) Nothing to Disclose
Fan Yang (*Abstract Co-Author*) Nothing to Disclose
Jacob M. Agris, MD, PhD (*Presenter*) Officer, ConvaTec Group

**PURPOSE**

CCTA has revolutionized the ability to visualize biomarkers indicative of high risk plaque but radiologist and cardiologists often fail to identify these biomarkers due to the complexity in interpretation, artifacts and variable imaging techniques. A deep-learning based coronary plaque analysis algorithm to automatically identify the four image features of high risk plaque including positive remodeling (PR), low attenuation plaque (LAP), spotty calcification (SC), and napkin ring sign (NRS) was developed.

**METHODS AND MATERIALS**

Our training dataset comprised 10,208 plaques from 1,919 patients, including 2,048 with positive remodeling, 3,137 with low attenuation plaque, 729 with napkin ring sign, and 325 with spotty calcification. A classification model was developed utilizing a convolutional neural network (CNN) based on plaque regions manually annotated along the coronary centerlines, to automatically recognize the four image features associated with high risk plaques. This model consists of two stages. The first stage extracts image features through a series of operations, namely a convolutional layer, followed by a rectified linear unit (ReLU) activation function, and a down-sampling process that is iteratively repeated four times. The resulting feature maps are passed through the second stage, which consists of fully connected layers culminating in a sigmoid function to predict the probability of each high-risk plaque feature. Performance was evaluated with CCTAs from 15 sites that were not used for training which included 2,442 plaques from 482 patients (mean 62 years old), including 521 plaques with positive remodeling, 743 with low attenuation plaques, 164 with napkin ring sign, and 78 with spotty calcification.

**RESULTS**

Truthing for the multisite trial was performed by 4 radiologists, over-read by 2 radiologists, and disagreements adjudicated by a radiologists with 20+ years experience. The DL model achieved an area under the curve (AUC) of 0.89 for PR, 0.85 for LAP, 0.87 for SC and 0.92 for NRS. The sensitivity of the model to predict PR, LAP, SC, and NRS was 81%, 83%, 70%, and 71%, respectively. The specificity for these four vulnerable plaque characteristics was 81%, 72%, 87%, and 94%, respectively.

**CONCLUSION**

AI can automatically identify the four features of high risk plaques on CCTA images with high accuracy and repeatability. Readers have a kappa of 0.2 to 0.4 for these features. Our model aids readers in consistently identifying these high risk plaque features which are highly correlated with a coronary or MACE event within 1 year.

**CLINICAL RELEVANCE/APPLICATION**

AI coronary plaque analysis can aid readers in the detection of high-risk plaques on CCTA images, thereby facilitating treatment to reduce the risk of coronary and MACE events.

## S2-SSCA01-3 FAST AND ROBUST CARDIAC MRI OF MYOCARDIAL EDEMA USING A DEEP LEARNING SUPER-RESOLUTION RECONSTRUCTION OF SINGLE-SHOT T2 STIR BLACK-BLOOD TECHNIQUE

Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Johannes M. Peeters, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Oliver M. Weber (*Abstract Co-Author*) Nothing to Disclose
Ulrike I. Attenberger, MD (*Abstract Co-Author*) Consultant, Bayer AG
Christoph Katemann (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Dmitrij Kravchenko, MD (*Abstract Co-Author*) Nothing to Disclose
Leonie Weinhold (*Abstract Co-Author*) Nothing to Disclose
Daniel Kuetting, MD (*Abstract Co-Author*) Nothing to Disclose
Narine Mesropyan, MD (*Abstract Co-Author*) Nothing to Disclose
Leon Bischoff, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Isaak, MD (*Abstract Co-Author*) Nothing to Disclose
Taraneh Aziz-Safaie, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To clinically evaluate a deep-learning (DL) reconstructed single-shot T2-weighted short tau inversion recovery (STIR) sequence to assess myocardial edema.

**METHODS AND MATERIALS**

Besides standard T2-STIR black-blood turbo spin echo breath-hold (standard T2-STIR) images, a retrospective electrocardiogram-gated single-shot (SSH) black-blood T2-STIR sequence was developed and acquired with breath-hold (BH) and free-breathing (FB) in short-axis view on a 1.5T MRI system. Single-shot images were reconstructed using a DL super-resolution algorithm provided by Philips Healthcare that combines and integrates compressed sensing with two distinct convolutional neural networks: Adaptive-CS-Net and Precise-Image-Net. Diagnostic quality (endocardial edge definition and blood-pool to myocardium contrast) and artifact burden were evaluated using a Likert scale (from 1= non-diagnostic to 5 = excellent). Apparent signal-to-noise ratio (aSNR) and contrast-to-noise ratio (aCNR) were calculated. T2 signal intensity ratio (T2 SI ratio) of myocardial and skeletal muscle was assessed. Student’s t-test and Wilcoxon signed-rank test were used.

**RESULTS**

In total, 42 patients (mean age, 52 years ± 19; 27 men) were included. The acquisition duration of BH SSH-T2-STIR was 60,4% lower while that of FB SSH-T2-STIR was 52,5% lower compared to standard T2-STIR (mean duration 30 sec ± 7 vs. vs. 75 sec ± 17, p<.0001; 35 sec ± 4 vs. 75 sec ± 17, p<.0001). Edge definition was superior in FB-SSH-T2-STIR and BH-SSH-T2-STIR compared to standard T2-STIR (4.9± 0.4 vs. 4.8 ± 0.5 vs. 4.5 ± 0.7, p<.0001). BH-SSH-T2-STIR had significantly lower artifact burden compared to FB-SSH-T2-STIR and standard T2-STIR (4.6 ± 0.7 vs. 4.3 ± 0.8 vs. 4.1 ± 0.9, p<.0001). No significant difference were found for aSNR (10.6 ± 4.1 vs. 10.4 ± 2.5; p=.78, 9.3 ± 4.5 vs. 10.4 ± 2.5; p=.10), aCNR (5.0 ± 2.3 vs. 4.5 ± 1.95; p=0.44, 4.1 ± 2.5 vs. 4.5 ± 1.9; p=.34), and T2 SI ratio (1.9 ± 0.4 vs. 1.9 ± 0.4; p=.15; 1.9 ± 0.5 vs. 1.9 ± 0.4; p=.51) between BH-SSH-T2-STIR, FB-SSH-T2-STIR and standard T2-STIR. Visual assessment of presence of focal myocardial or pericardial edema (n = 6/42, 14%) by two readers showed complete agreement between all three sequences.

**CONCLUSION**

DL reconstructed single-shot T2-STIR sequence enabled accelerated acquisition times and non-inferior diagnostic quality.

### CLINICAL RELEVANCE/APPLICATION

DL reconstruction of single-shot T2 STIR sequences might enable fast and robust assessment of myocardial edema, especially in challenging investigation of patients with arrhythmia and shortage of breath. Faster imaging techniques using DL may improve patient comfort and compliance and could be a possible concept for overcoming increasing cardiac MRI investigations in the future.

## S2-SSCA01-4 DEEP LEARNING IN CORONARY ARTERY ORIGIN ANOMALIES: CLASSIFICATION AND CLINICAL IMPLICATIONS

Yonggao Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Jun Li (*Abstract Co-Author*) Nothing to Disclose
Lichen Ren, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Few studies have been conducted to automatically detect coronary origin anomalies through coronary CT angiography scans, because accurately determining the origin and identifying the alignment of an anomalous coronary artery is time-consuming and labor-intensive. The aim of this study is to develop and validate a deep learning model for the automatic identification of coronary artery anomalous origins in CT angiography, as well as to achieve accurate tracking of the vessels' paths.

### METHODS AND MATERIALS

In this study, we employed deep learning techniques, combining convolutional neural networks (CNNs) and recurrent neural networks (RNNs), to achieve automatic identification and vessel tracking of ectopic origins of coronary arteries. Coronary CT angiography images, collected from our hospital between January 2011 and June 2023, were used. These images were divided into a training set and a test set at a ratio of 7:3, and the data were preprocessed and labeled. Subsequently, the model was trained. The image quality of the deep learning (DL) reconstruction was evaluated by two experienced radiologists to determine if it met the needs of clinical diagnosis.

### RESULTS

A total of 656 patients (mean age ± SD, 57.1 ± 14.0 years; 391 men) were included in this study. On a per-vessel basis, the accuracy of the DL-assisted algorithm for identifying ectopic origins of coronary arteries was 96.0% (630 of 656 cases). This reduced the time required by the radiologist to reconstruct the images from 15.2 minutes ± 3.70 to 3.1 minutes ± 0.21 ($P<0.001$). There was good agreement between the two experienced radiologists in their assessment of the images (k coefficient = 0.96), and the quality of the DL-reconstructed images met the diagnostic requirements.

### CONCLUSION

Using deep learning techniques, we have implemented a CT angiography tracking method that can automatically identify and track ectopic origins of coronary arteries. This method can provide better diagnostic and therapeutic decision support for physicians.

### CLINICAL RELEVANCE/APPLICATION

Deep learning-based neural networks can significantly improve the efficiency of reconstructing images of coronary origin anomalies, saving time and cost and improving the efficiency of clinical work.

## S2-SSCA01-5 HIGH RESOLUTION CORONARY CT ANGIOGRAPHY USING ENERGY-INTEGRATING DETECTOR (EID) AND ARTIFICIAL INTELLIGENCE, INFORMED BY ULTRA-HIGH-RESOLUTION PHOTON COUNTING DETECTOR (PCD) CT

Prabhakar Rajiah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Andrew Missert, PhD (*Abstract Co-Author*) Nothing to Disclose
Jamison Thorne, BSc (*Abstract Co-Author*) Nothing to Disclose
Shaojie Chang, PhD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Hao Gong, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Safa Hoodeshenas, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Koons (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the performance of a convolutional neural network with Improved LUMEN visualization through Artificial super-resoluTion imagEs (ILUMENATE), informed by PCD-CT to improve EID-CT image resolution and its impact on coronary CT angiography (cCTA).

### METHODS AND MATERIALS

After IRB approval and written informed consent, 30 patients undergoing clinically indicated cCTA were scanned with EID-CT (SOMATOM Force, Siemens) and subsequently with ultra-high-resolution (UHR, 120x0.2 mm) PCD-CT (NAEOTOM Alpha, Siemens) on the same day. EID-CT images were reconstructed with medium sharp (Qr40) kernel and 0.6 mm thickness. PCD-CT images were reconstructed with 0.2 mm thickness, Qr40 kernel and a sharp Qr72 kernel. ILUMENATE uses a modified U-Net architecture, with 2 max pooling and 2 up-convolutional layers, rectified linear unit (ReLU) activation function, and mean-squared-error as the loss function. The low-resolution (Qr40) and high-resolution (Qr72) PCD-CT images of 8 patients were used as training input and label, respectively. To combat the noise texture difference between EID- and PCD-CT, noise patches from a uniform water phantom scanned on EID-CT were inserted into the input PCD-CT images, enabling the network to account for noise texture differences during the training. The trained ILUMENATE was applied to 22 unseen EID-CT cases. Spatial resolution was evaluated using line profiles. Percent diameter stenosis was measured using commercial software (syngo.via). Two cardiovascular radiologists, blinded to image type, scored images for overall quality, sharpness (1=worst, 5=best), and noise (1=worst, 4=best). All assessments were compared between the original EID-CT and ILUMENATE output.

### RESULTS

Visual assessment and line profiles showed substantial resolution improvement with ILUMENATE. Of the 22 test patients, 37 stenotic lesions were identified. Percent diameter stenosis was significantly reduced by an average of 5.32% with ILUMENATE ($p<0.001$). Readers preferred ILUMENATE output image in 22/22 cases. The average score for reader 1 was image quality 3.54/3.95, sharpness 2.91/3.95, and noise 3.05/3.91, and for reader 2 image quality 3.86/4.73, sharpness 3.14/4.91, and noise 3.36/4 for EID input/ILUMENATE output, respectively.

### CONCLUSION

ILUMENATE enhanced image resolution (sharpness) and reduced image noise, resulting in improved overall image quality and reduced calcium blooming artifacts in cCTA exams performed using EID-CT.

### CLINICAL RELEVANCE/APPLICATION

The reduced blooming artifact and improved lumen visibility with ILUMENATE could allow UHR cardiac CT to be performed using conventional EID-CT scanners and allow for more accurate assessment of stenotic lesions in patients with coronary artery disease.

## S2-SSCA01-6 ARTIFICIAL INTELLIGENCE-ENABLED INTRALUMINAL ATTENUATION GRADIENT MEASUREMENTSIN CORONARY CT ANGIOGRAPHY FOR DIAGNOSINGIN-STENT RESTENOSIS: A RETROSPECTIVE STUDY

Yanhui Hao (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the use of intraluminal attenuation gradient (TAG) measurements in coronary CT angiology (CCTA) obtained with an AI post-processing technique in the diagnosis of In-Stent Restenosis (ISR).

### METHODS AND MATERIALS

This retrospective study included a total of 23 coronary vessels with stents in 20 patients who underwent CCTA. There were 9 vessels with ISR, while 14 vessels without based on the digital subtraction angiography results. TAG in CCTA was defined by the linear regression coefficient between intraluminal radiological attenuations and vessel length from the ostium to the proximal end of the coronary stent (TAGproximal) or the distal end of the coronary stent to the end of the vessel (TAGdistal). TAGproximal and TAGdistal values of each vessel were obtained using a commercially available AI-post-processing auxiliary diagnosis system. TAGdifference is the difference between TAGproximal and TAGdistal.

### RESULTS

Coronary arteries with ISR showed lower TAGproximal (-11.17±5.43 vs. -4.59±2.57, P=0.006), lower TAGdistal (-4.56±2.89 vs. -2.88±1.58, P=0.138) and higher TAGdifference (6.61±6.17 vs. 1.71±3.16, P=0.020) compared with arteries without. Receiver operating characteristic curve analysis showed that TAGproximal achieved AUC of 0.897 (95% confidence interval: 0.698 to 0.984) with sensitivity of 88.89% and specificity of 85.71% ($p<0.05$), TAGdifference achieved AUC of 0.770 (95% confidence interval: 0.549 to 0.918) with sensitivity of 77.78% and specificity of 78.57% ($p<0.05$) in distinguishing ISR. However, the use of TAGdistal yielded a low AUC value of 0.698 (95% confidence interval: 0.474 to 0.870) with $p>0.05$, indicating no statistically significant difference from the null hypothesis of 0.5.

### CONCLUSION

TAG measurements in CCTA obtained using an AI post-processing technology could be used to noninvasively distinguish ISR with certain accuracy.

### CLINICAL RELEVANCE/APPLICATION

AI-enabled TAG measurements may be used to assist radiologists to differentiate ISR with moderate diagnostic accuracy, improving diagnostic workflow.

# Abstract Archives of the RSNA, 2024

S2-SSGI01

## Gastrointestinal Imaging (Artificial Intelligence: Clinical Implementation (1))

Sunday, Dec. 1 10:30AM - 11:30AM Room: E451B

Linda C. Chu, MD (*Moderator*) Nothing to Disclose
Satheesh Krishna, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

### S2-SSGI01-1 AI-BASED ASSESSMENT OF T STAGE OF RECTAL CANCER USING MRI

Ke Zhao (*Abstract Co-Author*) Nothing to Disclose
Tong Tong, PHD (*Abstract Co-Author*) Nothing to Disclose
Huifen Ye, MMEd (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study was to automatically evaluate the extent of tumor infiltration by artificial intelligence (AI) based on T2-weighted imaging (T2WI) and compare the agreement among AI-mrT, manual T stage (mrT), and pathological T stage (pT).

**METHODS AND MATERIALS**

A total of 938 patients were enrolled in this retrospective study, divided into a training cohort (792 patients from five centers) and a validation cohort (84 patients from one center). In addition, 62 patients from three other centers were used as a independent validation cohort to evaluate the performance of the model. Initially, an automatic segmentation model based on T2WI was constructed using a ResNet-based nnUNet model to segment the areas of tumor, rectum, and mesorectum in the training cohort. The performance of the model was evaluated using the dice similarity coefficient (DSC) in the independent validation cohort. If the tumor area breaks through the rectum area, AI-mrT score was 1, and otherwise it was scored as 0. Inter-reader weighted agreement among AI-mrT, mrT and pT were assessed by the weighted ? statistic. Survival analysis was performed using the Cox proportional hazard model, and the endpoint of the event was the overall survival.

**RESULTS**

In the independent validation cohort, the DSC for rectal tumor, rectum and mesorectum reached an astonishing 0.865, 0.922 and 0.954, respectively. There was moderate agreement between AI-mrT and pT (weighted ? = 0.548). 11 patients were understaged for the T component of the tumor-node-metastasis classification and 8 patients were overstaged. The ? was 0.571 between AI-mrT and mrT. 66 patients were identified correctly, and 8 patients were understaged and 10 patients were overstaged. Kaplan-Meier curves show that score 1 had the more unfavorable overall survival in the validation cohort (Log-rank test, P = 0.047).

**CONCLUSION**

This study highlighted the powerful utility of AI-based automatic segmentation model for evaluating the extent of tumor infiltration of rectal cancer on T2WI. The tumor invasion calculated by AI was moderately consistent with pathological stage and correlated with unfavorable survival.

**CLINICAL RELEVANCE/APPLICATION**

The prognosis and optimal treatment of rectal cancer are directly related to accurate pretreatment stage. With the assistance of AI, inter-observer differences between radiologists with different experience and between different institutions could be bridged.

### S2-SSGI01-2 THE PANORAMA STUDY: PANCREATIC CANCER DIAGNOSIS - RADIOLOGISTS MEET AI

Henkjan Huisman, PhD (*Abstract Co-Author*) Shareholder, QView Medical, Inc;Grant Support, Siemens AG;Grant Support, Canon Medical Systems Corporation
Geert Litjens, PhD (*Abstract Co-Author*) Nothing to Disclose
Pierpaolo Vendittelli (*Abstract Co-Author*) Nothing to Disclose
Derya Yakar, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
John J. Hermans, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Megan Schuurmans (*Abstract Co-Author*) Nothing to Disclose
Natalia Alves, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

The PANORAMA study transparentlly evaluates artificial intelligence (AI) and radiologists in detecting pancreatic ductal adenocarcinoma (PDAC) using contrast-enhanced computed tomography (CECT). The study hypothesizes that state-of-the-art AI algorithms are non-inferior to radiologists, showing promise for opportunistic screening.

**METHODS AND MATERIALS**

This retrospective study includes 3338 CECT abdominal scans of patients without prior history of treatment or positive histopathology findings of PDAC acquired between 2006 and 2021 from 5 centres (Netherlands, Norway, and Sweden) including subsequent workup and follow-up. Of these, 2238 cases (676 PDAC) are publicly available to develop and train AI algorithms, and100 and 1000 cases were sequestered for AI tuning and testing, respectively. The test set comprises data from two external centres not present in the other cohorts. A subset of 400 testing cases is used for a reader study. Both AI and radiologists indicate PDAC likelihood and localization of lesions. AI is developed in a Grand Challenge set-up. A baseline algorithm is provided and teams from multiple institutions and countries are invited to submit AI solutions to the tuning set live leaderboard hosted at panorama.grand-challenge.org. After this development phase, teams can make one final submission to the hidden testing cohort. Patient-level performance is assessed using the area under the receiver operating characteristic curve (AUROC). Multi-reader multi-case analysis is used to compare the diagnostic performance of readers and AI. The study protocol was developed and published open access in conjunction with an international scientific advisory board of 13 experts in AI, radiology, and histopathology to ensure transparent development and validation of pancreas-AI as a benchmark for clinical translation.

**RESULTS**

The PANORAMA study results will be presented for the first time at RSNA 2024. Currently, 45 radiologists (26 centers,13 countries, 2-30 years of experience, median: 9 years) participate in the study. The baseline AI (nnU-Net with cross-entropy loss) achieves 97.95% AUROC in the tuning set. There are currently 165 registered challenge participants. A significant improvement over the baseline is expected in the testing set, in line with previous challenges' results.

**CONCLUSION**

Transparently benchmarked, expert AI can enable opportunistic screening to start catching PDAC at earlier stages and improve patient survival.

**CLINICAL RELEVANCE/APPLICATION**

Early-detected PDAC patients have improved survival but 40% of lesions are missed in pre-diagnostic imaging. AI and expert radiologists' comparison proving non-inferiority can enable AI-based opportunistic screening.

## S2-SSGI01-3 UTILIZING A DOMAIN-SPECIFIC LARGE LANGUAGE MODEL FOR LI-RADS V2018 CATEGORISATION OF FREE-TEXT MRI REPORTS: A FEASIBILITY STUDY

Mario Matute Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Darnell, MD (*Abstract Co-Author*) Speaker, Bayer AG;Grant, Bayer AG
Alexandre Soler, MD (*Abstract Co-Author*) Nothing to Disclose
Maria B. Saborido (*Abstract Co-Author*) Nothing to Disclose
Jordi Rimola, MD, PhD (*Presenter*) Consultant, Alimentiv Health Trust;Speaker, Takeda Pharmaceutical Company Limited;Consultant, Johnson & Johnson;Consultant, Boehringer Ingelheim GmbH;Research Grant, AbbVie Inc

**PURPOSE**

Large language models (LLM) can be utilized on a large scale to extract structured information from free-text radiology reports but its optimal integration for data curation is not well characterized. The aim of the study us to develop a domain-specific LLM for Liver Imaging Reporting and Data System (LI-RADS) v2018 categorisation of hepatic observations based on free-text descriptions extracted from MRI reports.

**METHODS AND MATERIALS**

This retrospective study included 175 MRI reports from a single institution. A total of 171 observation descriptions were extracted and divided into training (n=51) and test (n=120) datasets. The LLM evaluated in this study was LiverAI, a domain-specific chatbot developed on generative pre-trained transformes (GPT) architecture using the OpenAI’s. The performance of the algorithm was assessed in comparison to two independent radiologists in a human replacement scenario and considering two combined strategies (double reading with arbitration and triage). Agreement on LI-RADS category and dichotomic malignancy (LR-4, LR-5, and LR-M) were estimated using linear-weighted ? statistics and Cohen’s ?, respectively. Sensitivity and specificity for LR-5 were calculated. The consensus agreement of three other readers served as the ground truth.

**RESULTS**

The model showed moderate agreement against the ground truth for both LI-RADS categorisation (k=0.54 [95%CI, 0.42-0.65]) and the dichotomized approach (k=0.58 [95%CI, 0.42-0.73]). Sensitivity and specificity for LR-5 were 0.76 (95%CI, 0.69-0.86) and 0.96 (95%CI, 0.91-1.00), respectively. When the chatbot was used as a triage tool, performance improved for LI-RADS categorisation (k=0.86 and k=0.87 for the two independent readers), dichotomized malignancy (k=0.91 and k=0.94) and LR-5 identification (1.00 and 0.98 sensitivity, 0.96 and 0.92 specificity), with no statistical significance compared to the human readers' individual performance. Through this strategy, radiologists' workload decreased by 45%.

**CONCLUSION**

LI-RADS v2018 categorisation from unlabelled MRI reports is feasible using our LLM, and it enhances the efficiency of the data curation process.

**CLINICAL RELEVANCE/APPLICATION**

Our proof-of-concept study provides novel insights into the potential applications of LLMs, offering a real-world example of how these tools could be integrated into a local workflow for research purposes.

## S2-SSGI01-4 AI-DERIVED BODY COMPOSITION PARAMETERS AS PROGNOSTIC FACTORS IN PATIENTS WITH HCC UNDERGOING TACE:RESULTS FROM A MULTICENTER STUDYRESULTS FROM A MULTICENTER STUDY

Roman Kloeckner, MD (*Abstract Co-Author*) Advisory Board, Guerbet SA;Speaker, Guerbet SA;Advisory Board, Bristol-Myers Squibb Company;Advisory Board, Sirtex Medical Ltd;Speaker, Sirtex Medical Ltd;Advisory Board, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd;Advisory Board, Boston Scientific Corporation;Speaker, Boston Scientific Corporation;Speaker, BTG International Ltd;Speaker, Siemens AG;Speaker, Eisai Co, Ltd
Lukas Mueller, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Body composition assessment (BCA) parameters have recently been identified as relevant prognostic factors for patients with hepatocellular carcinoma (HCC). Here we aimed to investigate the role of BCA parameters for prognosis prediction in patients with HCC undergoing transarterial chemoembolization (TACE).

### METHODS AND MATERIALS

This retrospective multicenter study included a total of 754 treatment-naļve patients with HCC who underwent TACE at six tertiary care centers between 2010-2020. Fully automated artificial intelligence-based quantitative 3D volumetry of abdominal cavity tissue composition was performed to assess skeletal muscle volume (SM), total adipose tissue (TAT), intra- and intermuscular adipose tissue (IMAT), visceral adipose tissue (VAT), and subcutaneous adipose tissue (SAT) on pre-intervention computed tomography scans. BCA parameters were normalized to the slice number of the abdominal cavity. We assessed the influence of BCA parameters on median overall survival (OS) and performed multivariate analysis including established estimates of survival.

### RESULTS

Univariate survival analysis revealed that impaired median OS was predicted by low SM volume ($p < 0.001$), high TAT volume ($p = 0.013$), and high SAT volume ($p = 0.006$). In multivariate survival analysis, SM remained an independent prognostic factor ($p = 0.039$), while TAT and SAT volumes no longer showed predictive ability.

### CONCLUSION

Skeletal muscle volume is an independent prognostic factor for survival prediction. Thus, the integration of SM into novel scoring systems could potentially improve survival prediction and clinical decision-making. Fully automated approaches are needed to foster the implementation of this imaging biomarker into daily routine.

### CLINICAL RELEVANCE/APPLICATION

BCA parameters, especially skeletal muscle mass, have been identified as relevant prognostic factors for many diseases and treatments. In this study skeletal muscle volume has been identified as an independent prognostic factor for patients with HCC undergoing TACE. Therefore, skeletal muscle mass as a metaparameter could play a role as an opportunistic biomarker in holistic patient assessment and be integrated into decision support systems. Workflow integration with AI evaluation is essential for automated BCA quantification output enabling broad availability in multidisciplinary case discussions.

## S2-SSGI01-5 DETECTING PANCREATIC CANCER ON NON-CONTRAST CT IMAGES WITH DEEP LEARNING

Kao-Lang Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Holger R. Roth, PhD (*Abstract Co-Author*) Employee, NVIDIA Corporation;Researcher, NVIDIA Corporation
Weichung Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Pochuan Wang (*Abstract Co-Author*) Nothing to Disclose
Dawei Chang (*Abstract Co-Author*) Nothing to Disclose
Wei-Chih Liao, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Po-Ting Chen, MD (*Presenter*) Nothing to Disclose

### PURPOSE

CT is the major imaging modality for detecting/diagnosing pancreatic cancer (PC), and injection of intravenous contrast to augment tissue contrast is generally required for this purpose. However, contrast medium cannot be administered in patients with hypersensitivity or risk of renal failure from contrast-induced nephropathy, rendering the detection/diagnosis of PC in those patients a challenging task. This study aimed to detect/diagnose PCs on non-contrast CT images with deep learning.

### METHODS AND MATERIALS

Non-contrast CT images from a tertiary referral center were collected to develop and validate an end-to-end CAD tool. A total of 3,080 patients [713 with PC, 1,661 with normal pancreas (Normals), and 706 with other pancreatic diseases (OPDs)] were randomly split into training, validation, and hold-out testing sets (3:1:1) with stratification by the three disease status. A convolutional neural network (CNN)-transformer hybrid deep learning model was trained using training and validation sets to distinguish PC from Normals and OPDs. Image slices harboring crucial diagnostic information were provided as key image slices by the CAD tool.

### RESULTS

In the hold-out test set, the developed CAD tool distinguished non-contrast images of PCs from those of Normals and OPDs with 90.8% (95% CI 84.9-95.0) sensitivity [87.2% (72.6-95.7) for tumors < 2 cm, 92.2% (85.3-96.6) for tumors > 2 cm], 93.0% (90.4-95.2) specificity [97.3% (94.9-98.8) for Normals, 83.0% (75.7-88.8) for OPDs], and 92.5% (90.2-94.5) accuracy [AUC 0.975 (0.957-0.993)]. Among the 129 correctly diagnosed PCs, the CAD-designated key non-contrast slices included the tumor in 95 (73.6%) patients and secondary signs of PC (dilation of pancreatic duct, extrahepatic bile duct or intrahepatic bile duct) in 21 (16.3%) patients according to review of the corresponding contrast-enhanced images by an experienced radiologist.

### CONCLUSION

The CAD tool could detect/diagnose PC on non-contrast CT images and indicate the key images to facilitate radiologist interpretation.

### CLINICAL RELEVANCE/APPLICATION

Deep learning-based analysis of non-contrast CT images may enable detection/diagnosis of PC in patients for whom contrast enhancement was contraindicated or not administered when performing CT.

## S2-SSGI01-6 END-TO-END PROGNOSTICATION IN PANCREATIC CANCER BY MULTIMODAL DEEP LEARNING: A RETROSPECTIVE, MULTI-CENTRE STUDY

Anindo Saha, MSc (*Abstract Co-Author*) Nothing to Disclose
Derya Yakar, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
John J. Hermans, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Natalia Alves, MSc (*Abstract Co-Author*) Nothing to Disclose
Henkjan Huisman, PhD (*Abstract Co-Author*) Shareholder, QView Medical, Inc;Grant Support, Siemens AG;Grant Support, Canon Medical Systems Corporation
Geert Litjens, PhD (*Abstract Co-Author*) Nothing to Disclose
Pierpaolo Vendittelli (*Abstract Co-Author*) Nothing to Disclose
Megan Schuurmans, BSc, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Pancreatic ductal adenocarcinoma (PDAC) remains one of the deadliest cancers, with a five-year survival rate of 5%. Current PDAC staging methods lack prognostic accuracy to correlate significantly with overall survival and prove unreliable in guiding treatment decisions. This study evaluates the

performance of unimodal and multimodal AI models, combining imaging and clinical markers at the time of diagnosis, to predict short—and long-term survival in PDAC patients.

**METHODS AND MATERIALS**

This retrospective study includes 862 PDAC patients from three centres (Netherlands, Spain). Contrast-enhanced computed tomography (CECT) scans and clinical data from 501 patients were split into a development cohort (n=401) and an independent testing cohort (n=100). Three separate AI algorithms were developed to predict short- vs long-term PDAC survival: 1) using only clinical variables, 2) using only imaging data, and 3) a multimodal algorithm combining clinical and imaging data. The AI algorithms were validated in two separate external cohorts of 252 and 109 PDAC patients, respectively.

**RESULTS**

Short-term survival (<230 days) was observed in 89 (22·2%), 23 (23·0%), 64 (25·4%), and 46 (42·2%) patients in the development, internal-, external test set 1 and 2, respectively. In the internal test set and external test sets 1 and 2, the multimodal AI achieved an area under the receiving operating characteristic curve (AUROC) of 0.67, 0·57, and 0·68, respectively. Kaplan-Meier analysis showed statistically significant differences between short- and long-term survivors defined by the AI algorithms (P<0·05).

**CONCLUSION**

Our study showed that integrating patients' information with imaging at the time of diagnosis in a multimodal AI model is favored over unimodal AI models and outperforms current PDAC TNM staging systems at stratifying short-term and long-term survivors at baseline.

**CLINICAL RELEVANCE/APPLICATION**

Exploring the predictive power of AI models, emulating input conditions that clinicians currently use to address complex clinical questions, can help clinicians make more informed decisions.
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

S2-SSGI02

**Gastrointestinal Imaging (Diffuse Liver Disease)**

Sunday, Dec. 1 10:30AM - 11:30AM Room: E352

Amirkasra Mojtahed, MD (*Moderator*) Nothing to Disclose
Lyndon Luk, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S2-SSGI02-1 COMPARING A FULLY AUTOMATED HYBRID APPROACH ON MRI AND FIBROSCAN FOR TRIAGING CLINICALLY SIGNIFICANT LIVER FIBROSIS:COMPARING A FULLY AUTOMATED HYBRID APPROACH ON MRI AND FIBROSCAN FOR TRIAGING CLINICALLY SIGNIFICANT LIVER FIBROSIS:A MULTI-CENTER COHORT STUDY

Junhao Zha, MD (*Presenter*) Nothing to Disclose

### PURPOSE

We aimed to 1) develop and validate the combined radiomics-clinic (CoRC) model on MRI for triaging clinically significant liver fibrosis (= F2), 2) compare or combine with transient elastography-based liver stiffness measurement (TE-LSM) in large-scale samples.

### METHODS AND MATERIALS

This retrospective multi-center study recruited 595 patients with biopsy proven liver fibrosis from Jan 2015 to Dec 2021. Training (n = 276) and internal test (n = 118) sets were randomly allocated. A temporal test set (n = 96) and an external test set (n = 105) were used for validation. Radiomics features were extracted from the ResUNet-based automated MRI entire liver segmentation on fat-suppressed T2-weighted and delayed enhanced T1-weighted images, respectively. CoRC model integrated Radiomics scores and optimal clinical variables in the training set with multivariate logistic regression. Diagnostic performance was mainly evaluated by the area under the receiver operating characteristic curve (AUC) in the test sets.

### RESULTS

n the internal, temporal, and external test sets, the CoRC model yielded AUCs of 0.79 (0.70, 0.86), 0.82 (0.73, 0.89), and 0.81 (0.72-0.91), and outperformed TE-LSM in the temporal test set (integrated discrimination improvement, 12.9% [2.4-23.4%]; P = .02). Additive value of CoRC model to TE-LSM was explored, with combined AUC of 0.86 (0.79-0.94), and 0.81 (0.72-0.90) in the internal, and temporal sets (P = .01). Considering necroinflammation, CoRC model maintained the discriminatory power in the test sets (AUCs range, 0.74-0.86).

### CONCLUSION

CoRC models exhibited promising diagnostic performances for clinically significant liver fibrosis, complementary to TE-LSM.

### CLINICAL RELEVANCE/APPLICATION

Our study used an interactive deep learning approach to automatedly segment the entire volumetric liver contours more effectively. The combined radiomics-clinic model demonstrated good discrimination capability for clinically significant liver fibrosis in all sets, superior to FIB-4 and APRI as routine clinical approaches. Especially, the combined radiomics-clinic model could be a promising alternative and supplement to FibroScan based liver stiffness measurement as the standard imaging modality.

## S2-SSGI02-2 RELIABLE LIVER FAT QUANTIFICATION USING DUAL-SOURCE PHOTON-COUNTING CT: COMPARED WITH MRI

Rong Deng (*Abstract Co-Author*) Nothing to Disclose
Fuhua Yan, MS (*Abstract Co-Author*) Nothing to Disclose
Zhihan Xu, MD (*Abstract Co-Author*) Nothing to Disclose
Huimin Lin (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to assess the value of dual-source photon counting detector (PCD)-CT in liver fat quantification, compared with MRI proton density fat fraction (PDFF).

### METHODS AND MATERIALS

Between September and December 2023, asymptomatic participants were prospectively recruited to undergo a non-contrast abdominal CT scan on a PCD-CT. Participants were randomly assigned to four groups with different PCD-CT protocols of tube voltage (120-, 140-kVp) and dose level (standard- and low-dose). The CT-derived fat fraction (CTFF) was estimated using a material-decomposition method. The agreement evaluation was conducted between CTFF and PDFF. Participants were categorized into normal liver fat content (< 6%), mild (6%-17%), and moderate-to-severe steatosis (>17%), using PDFF as the reference. The Precision-Recall curve was plotted to measure the performance of the binary classifier in distinguishing between different levels of liver fat content.

**RESULTS**

The final cohort comprised 320 participants with a median age of 45. According to their PDFF results, normal liver fat content, mild steatosis, and moderate-to-severe steatosis were noted in 206, 79, and 35 participants, respectively (example case in Figure 1). The intraclass correlation coefficient and mean bias between CTFF and PDFF were 0.9155 (95% CI: 0.907-0.923) and -1.70% ± 2.76%. For detecting fat content = mild steatosis, the F1 score and the area under the precision-recall curve (AUC-PR) were 0.870 and 0.950 (95% CI: 0.929-0.965), with a sensitivity of 0.88 and a specificity of 0.93. Similarly, for detecting fat content = moderate-to-severe steatosis, the F1 score and AUC-PR were 0.904 and 0.948 (95%CI: 0.903-0.973), with a sensitivity of 0.93 and a specificity of 0.91 (Figure 2). The average effective dose for standard-dose and low-dose protocols was 3.09 mSv, and 2.04 mSv, respectively.

**CONCLUSION**

Using a material-decomposition method, PCD-CT showed a robust agreement with MRI-PDFF across various protocols and may serve as a precise alternative for liver fat quantification.

**CLINICAL RELEVANCE/APPLICATION**

PCD-CT holds significant potential for liver fat quantification in routine clinical use, even under low-dose conditions.

## S2-SSGI02-3 ACOUSTIC OUTPUT EXCEEDING REGULATORY LIMITS IS SAFE AND DECREASES SHEAR WAVE ELASTOGRAPHY MEASUREMENT VARIABILITY

Anthony E. Samir, MD, MPH (*Abstract Co-Author*) Consultant, AstraZeneca PLC;Research funded, AstraZeneca PLC;Consultant, Bracco Group;Consultant, Bristol-Myers Squibb Company;Consultant, General Electric Company;Scientific Advisory Board, General Electric Company;Research support, General Electric Company
Theodore T. Pierce, MD, MPH (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Massachusetts Institute of Technology Lincoln Laboratory;Research Grant, Massachusetts General Hospital
Nathaniel D. Mercaldo (*Abstract Co-Author*) Nothing to Disclose
Scott J. Schoen JR, PhD,MS (*Abstract Co-Author*) Nothing to Disclose
Mary Peters (*Abstract Co-Author*) Nothing to Disclose
Sunethra Dayavansha (*Abstract Co-Author*) Nothing to Disclose
Rimon Tadross (*Abstract Co-Author*) Nothing to Disclose
Viksit Kumar, PhD (*Abstract Co-Author*) Nothing to Disclose
David Hunt (*Abstract Co-Author*) Nothing to Disclose
Lauren Ling (*Abstract Co-Author*) Nothing to Disclose
Michael Washburn, MS (*Abstract Co-Author*) Nothing to Disclose
Kathleen Pope (*Abstract Co-Author*) Nothing to Disclose
Ann IAFRATE (*Abstract Co-Author*) Nothing to Disclose
Kurt Sandstrom (*Abstract Co-Author*) Nothing to Disclose
Michael Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Kim Naja, MD, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Metabolic dysfunction-associated steatotic liver disease (MASLD) affects 1 in 3 people worldwide. Ultrasound shear wave elastography (SWE) is widely available to quantify liver fibrosis, but may fail due to ultrasound beam attenuation and distortion from larger body habitus common in MASLD. Current FDA mechanical index (MI) limitations preclude compensatory increases in acoustic energy. We assess the safety and efficacy of conditionally increased acoustic output (CIO) above FDA limits to improve SWE imaging.

**METHODS AND MATERIALS**

This single-center prospective HIPAA-compliant IRB-approved clinical trial (July 2023 - April 2024) enrolled healthy adults stratified by body mass index (BMI). Participants underwent conventional (MI 1.4) and increased energy (MI 2.5) SWE using a GE HealthCare LOGIQ E10 with a GE C1-6 curved abdominal ultrasound probe. 10 conventional and 10 CIO diagnostic measurements were obtained with up to 20 attempts each if initially non-diagnostic. Interquartile range to median ratio (IQRM) was calculated. Participants underwent blood liver function testing <48 hours prior and 1 day after imaging. The primary endpoint assessed increase in aspartate aminotransferase (AST), alanine transaminase (ALT), or alkaline phosphatase (ALP) indicating liver injury with a noninferiority margin defined as the lab value upper limit of normal (AST 40 U/L, ALT 55 U/L, ALP 115 U/L). The secondary endpoints were a reduction in SWE measurement variability by paired t-test and imaging attempts by Wilcoxon Sign Rank Test.

**RESULTS**

24 participants were enrolled; 2 withdrew prior to imaging and were excluded from analysis. 22 participants (39.64 ± 16.3 years; 15 women) had normal BMI (6), overweight (6), class 1 obesity (7), and class 2 obesity (3). The mean [95% CI] increase in LFTs was 1) AST: -0.86 [-2.34, 0.61], p = 0.24, 2) ALT: 0.32 [-1.04, 1.68], p = 0.63, 3) ALP: 1.73 [-1.02, 4.47], p = 0.21. The upper 95% CI for all biomarkers met the criterion for non-inferiority. Mean IQRM was 0.0659 for standard SWE and 0.0466 for CIO. IQRM decreased by 0.019 across exams (p=0.01). The mean number of attempts decreased by 0.68 [IQR: 0,0.75], p=0.058.

**CONCLUSION**

CIO SWE caused no increase in liver function tests to suggest liver injury. It led to reduced measurement variability, suggesting improved exam quality, and a trend toward fewer required measurements. This suggests that CIO SWE is safe to use and may improve exam quality and acquisition efficiency in challenging to image patients.

**CLINICAL RELEVANCE/APPLICATION**

Increased energy shear wave elastography is safe, reduces measurement variability, and may increase image acquisition efficiency. This may improve diagnostic evaluation in challenging to image high body mass index patients at risk for MASLD.

## S2-SSGI02-4 CT-BASED CLINICALLY SIGNIFICANT PORTAL HYPERTENSION: PREDICTING COMPLICATIONS IN HCC HEPATECTOMY

Seung Soo Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Subin Heo, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The role of CT-based clinically significant portal hypertension (CSPH) in predicting short-term and long-term liver-related complications following hepatic resection has not been evaluated.

**METHODS AND MATERIALS**

This retrospective study included patients with advanced chronic liver disease (ACLD) who underwent partial hepatectomy for hepatocellular carcinoma (HCC) with BCLC stage 0 or A between 2017 and 2018. The presence of CT-based CSPH was evaluated in preoperative contrast-enhanced CT, defined as the presence of both splenomegaly and at least one of esophagogastric varix, spontaneous portosystemic shunt, or ascites. We performed multivariable logistic regression and competing risk analysis to evaluate the association of CT-based CSPH with liver-related outcomes. The primary endpoint was severe post-hepatectomy liver failure (PHLF), as defined by International Study Group of Liver Surgery. Secondary endpoints were the occurrence of hepatic decompensation and liver-related death or liver transplantation. Additionally, CT-based CSPH was applied to two well-known PHLF prediction models (Citterio's algorithm and Wang's model), and their performance was compared with that when applying the conventional surrogate CSPH assessment (presence of esophageogastric varix at endoscopy or coexistence of splenomegaly and a platelet count < 100 ×103/μL).

**RESULTS**

A total of 593 patients (mean age, 57.9 years ± 9.3; 460 male) were included in the study. Severe PHLF occurred in 41 patients (6.9 %). The presence of CT-based CSPH was a significant independent predictor for the occurrence of severe PHLF (odds ratio 7.672, 95% confidence interval [CI] 3.209-18.346). The performance of both Citterio's algorithm and Wang's model significantly improved when using the CT-based CSPH criteria compared to the conventional method (AUC 0.724 vs. 0.694, p=0.036, and AUC 0.854 vs 0.830, p=0.011, respectively). CT-based CSPH was also a significant predictor for long-term hepatic decompensation (hazard ratio [HR] 4.518, 95% CI 1.868-10.929) and liver-related death or transplantation (HR 2.756, 95% CI 1.315-5.773).

**CONCLUSION**

The presence of CT-based CSPH predicts short-term and long-term liver related outcomes following partial hepatectomy for HCC in ACLD.

**CLINICAL RELEVANCE/APPLICATION**

The current gold standard for CSPH evaluation is an invasive method involving hepatic venous pressure gradient measurement, which limits its clinical utilization. CT is a routine exam prior to hepatectomy, so CT-based CSPH evaluation is a highly practical method, also with good performance as shown in this study, for predicting postoperative liver-related outcomes. Patients with a high risk of post-operative complications may consider upfront transplantation.

## S2-SSGI02-5 TRAJECTORIES OF LIVER VOLUME AND STEATOTIC LIVER DISEASE ACROSS AGING AND THEIR ASSOCIATION WITH INCIDENT DIABETES IN THE GENERAL POPULATION

Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Reisert (*Abstract Co-Author*) Nothing to Disclose
Michael T. Lu, MD, MPH (*Abstract Co-Author*) Stockholder, NVIDIA Corporation;Institutional Research Grant, Kowa Company, Ltd;Institutional Research Grant, AstraZeneca PLC;Stockholder, Advanced Micro Devices, Inc;Stockholder, Intel Corporation
Vineet K. Raghu, PhD (*Abstract Co-Author*) Nothing to Disclose
Susanne Rospleszcz (*Abstract Co-Author*) Nothing to Disclose
Matthias Jung, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Steatotic liver disease (SLD) is a public health concern with a global prevalence of 32.4%. SLD is an independent risk factor for cardiometabolic disease. With advances in AI, automated and accurate assessment of hepatic volume and SLD from MRI has become feasible. We used a fully automated deep learning framework to quantify liver volume and SLD from MRI, described their trajectories across aging in the general population, and investigated their prognostic value to predict incident diabetes.

**METHODS AND MATERIALS**

We used data from the UK Biobank (UKBB; n=36,317) and the German National Cohort (NAKO; n=30,349) to quantify liver volume and SLD. The framework takes a T1w dual-echo Dixon MRI as input, and outputs (i) liver volume (mL) and (ii) Dixon-derived liver fat fraction (FF in %). Sex-stratified changes in liver volume and FF across age decades were calculated. Mild, moderate, and severe SLD were defined using established FF thresholds (5%, 15%, and 25%). Trajectories of liver volume and FF were assessed by computing age, sex, and height adjusted normative reference curves. The prognostic value of normative liver volume (volume z-score) and FF was assessed for incident diabetes in the UKBB only. Cumulative incidence curves and log-rank tests investigated time to diabetes for volume z-score (<1; 1-2; >2) and SLD categories. Cox regression assessed the association between volume z-score/FF and diabetes after adjustment for age, sex, BMI, race, serum glucose, Hb1Ac, lipid panel, hypertension, history of cancer, alcohol consumption, and smoking status.

**RESULTS**

Among 66,666 individuals from the general population (57.7±12.9y; BMI: 26.2±4.5 kg/m2, 48.3% female), 3D liver analysis showed that liver volume and variance increased in both sexes until age 60 and decreased after. Hepatic FF increased throughout the lifespan with a higher variability in males compared to females. 70.3% of the cohort had SLD. Normative reference curves showed a similar pattern for both sexes across the lifespan with higher variance in liver volume and FF in males. Cumulative incidence curves showed a higher incidence of diabetes in higher volume and SLD categories (p<0.001). Cox regression revealed an association between volume z-score (aHR:1.17, 95% CI [1.07-1.29], p<0.001) and FF (aHR:1.02, 95% CI [1.01-1.03], p<0.001) and incident diabetes after full adjustment.

**CONCLUSION**

Our results confirm a high prevalence of SLD in the general population. Hepatic fat fraction and normative liver volume predicted incident diabetes beyond traditional risk factors.

**CLINICAL RELEVANCE/APPLICATION**

Applying fully automated deep learning-based liver assessment to routine MRI may help to identify high-risk individuals to improve personalized prevention and lifestyle interventions.

## S2-SSGI02-6

Xin-Liang Xu (*Abstract Co-Author*) Nothing to Disclose
Ying Wang (*Abstract Co-Author*) Nothing to Disclose

# DIAGNOSTIC PERFORMANCE OF ULTRASOUND-DERIVED FAT FRACTION (UDFF) TO QUANTIFY HEPATIC STEATOSIS IN A BIOPSY-PROVEN COHORT

Li Wei (*Abstract Co-Author*) Nothing to Disclose
Juan Cheng (*Abstract Co-Author*) Nothing to Disclose
Rui Cheng (*Abstract Co-Author*) Nothing to Disclose
Yun-Lin Huang, MD (*Abstract Co-Author*) Nothing to Disclose
Xiu-Yun Lu (*Abstract Co-Author*) Nothing to Disclose
Shi-Wen Wang (*Abstract Co-Author*) Nothing to Disclose
Yi Dong (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the performance of ultrasound-derived fat fraction (UDFF) for diagnosing hepatic steatosis using liver biopsy as the gold standard.

## METHODS AND MATERIALS

Patients who had steatosis liver disease and were referred to undergo liver biopsy were enrolled in this prospective study. All patients underwent UDFF and controlled attenuation parameter (CAP) measurements. The histologic hepatic steatosis was graded (S0, < 5 %; S1, 5 % - 33 %; S2, 33 % - 66 %; S3, > 66 %). The Kruskal-Wallis tests were performed to compare UDFF values between different degrees of hepatic steatosis. The area under the receiver operating characteristic curve (AUC) was performed to evaluate the diagnostic performance of UDFF and CAP. The cut-off values were determined to maximize the Youden index. The correlation between UDFF and CAP was evaluated using the Spearman correlation coefficient.

## RESULTS

From February 2023 to March 2024, a total of 41 patients (44.0 % [18/41] men and 56.0 % [23/41] women) were included. The median age and body mass index were 46 years (interquartile range [IQR]: 34 - 58) and 24 kg/m2 (IQR: 22 - 27), respectively. Among the 41 patients, 46.3 % (19/41), 31.7 % (13/41), 9.7 % (4/41), and 12.1 % (5/41) of them were steatosis graded S0, S1, S2, and S3, respectively. The success rate of the UDFF and CAP measurements were 100 % and 97.6 %, respectively. The median UDFF value of all patients was 6.0 % (IQR: 3.3 - 12.0). The median UDFF values of patients with S0, S1, S2, and S3 were 4.0 % (IQR: 3.0 - 6.5), 10.0 % (IQR: 4.0 - 11.5), 10.3 % (IQR: 5.0 - 20.4), and 18.5 % (IQR: 16.5 - 31.8), respectively.There were significant differences in UDFF values between S0 and S2, S0 and S3, S1 and S3, and S2 and S3 ($P < 0.05$). The cut-off value of UDFF for detecting hepatic steatosis was 9.5 %. Both UDFF and CAP had good diagnostic performance in detecting hepatic steatosis, with AUCs of 0.81 (95 % confidence intervals [CI]: 0.68 - 0.94) and 0.87 (95 % CI: 0.76 - 0.98), sensitivity of 63.6 % (95 % CI: 43.0 - 80.3) and 81.8 % (95 % CI: 61.5 - 92.7), and specificity of 94.7 % (95 % CI: 75.4 - 99.7) and 78.9 % (95 % CI: 56.7 - 91.5), respectively. However, The diagnostic performance showed no significant difference between UDFF and CAP ($P > 0.05$). UDFF values had a significant positive correlation with CAP values ($R = 0.77$, $P < 0.001$).

## CONCLUSION

UDFF showed good diagnostic performance in the evaluation of hepatic steatosis. Especially when patients fail to obtain valid CAP values, UDFF measurement could be a potential alternative tool in clinical practice.

## CLINICAL RELEVANCE/APPLICATION

UDFF showed good diagnostic performance in diagnosing hepatic steatosis in patients with steatosis liver disease. UDFF measurement had an excellent success rate and is a potential alternative tool in clinical practice with promising results.

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# Abstract Archives of the RSNA, 2024

S2-SSPD01

**Science Session with Keynote: Pediatric Imaging and OB/Gynecology (Chest, Cardiac and Fetal)**

Sunday, Dec. 1 10:30AM - 11:30AM Room: E350

Teresa Victoria, MD, PhD (*Moderator*) Nothing to Disclose
Evan J. Zucker, MD (*Moderator*) Research Consultant, F. Hoffmann-La Roche Ltd

**Sub-Events**

## S2-SSPD01-1 OPTIMIZING CORONARY ARTERY ANEURYSM WITH THROMBOSIS DETECTION IN KAWASAKI DISEASE: A PROSPECTIVE STUDY OF 3T CORONARY MRA WITH COMBINED DIASTOLIC AND SYSTOLIC PHASES IMAGING

Hu Xihong (*Abstract Co-Author*) Nothing to Disclose
Haitang Jiang (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the diagnostic performance with a new strategy combining diastolic and systolic imaging on coronary MRA for coronary artery aneurysm (CAA) with thrombosis detection in Kawasaki children.

### METHODS AND MATERIALS

From August 2023 to April 2024,29 participants with Kawasaki disease (KD) who had undergone X-ray coronary angiography (CAG) or coronary CT angiography (CCTA) were prospectively enrolled. Each participant underwent 3T water-fat coronary MRAs twice separately in the diastolic and systolic phases. The combined coronary MRA in diastole and systole was considered as the third approach. Using CAG/CCTA as the reference, scan-relevant parameters, subjective image quality score objective image quality measurement (signal-to-noise ratio [SNR], and contrast-to-noise ratio [CNR]) were evaluated in both diastole and systole phases. CAA was defined as the Z score of the vessel diameter being = 2.5. The diagnostic performance for detection CAA and CAA with thrombosis by the three approaches was compared on per-patient, per-vessel, and per-segment basis.

### RESULTS

A total of 29 participants (age 6.6±3, 10.9%female) were evaluated. The mean MR acquisition time was 208.8±43.8s in systole phase, 247.1±127.5 in diastole phase. Compared with the image in diastole phase, the overall image quality($p=0.018$), per-vessel image quality in LCX ($p<0.001$), and per-segmental image quality on p-LAD($p=0.034$), p-LCX ($p<0.001$) and d-LCX ($p < 0.001$) were higher in systole phase. The per-patient sensitivity, specificity, and accuracy of combined coronary MRA were 92.86%, 100% and 93.1%, respectively. Compared with diastolic phase, systolic phase showed higher sensitivity (93.3% vs 84%, $p=0.039$), but lower specificity in a per-vessel basis. Compared with single systolic mode, combined coronary MRA showed lower sensitivity on a per-segment (80.49 %vs 100%, $p=0.008$) and per-vessel (93.33% vs 82.67%, $p=0.021$), but improved specificity on a per-vessel basis (100% vs. 80.49%, $p=0.008$). Compared with single diastolic mode, combined coronary MRA showed equally high sensitivity and specificity of CAA with thrombosis.

### CONCLUSION

Compared with single-phase coronary MRA, dual-phase combined scanning has the advantage of increasing specificity without decreasing sensitivity for detection of CAA with thrombosis.

### CLINICAL RELEVANCE/APPLICATION

Combined coronary MRA is non-invasive and without radiation, may be a superior option for the risk assessment and treatment and also follow-up of children with Kawasaki disease, providing comparable image quality and diagnostic efficacy.

## S2-SSPD01-2 AUTOMATIC AIRWAY SEGMENTATION OF ULTRA-SHORT ECHO TIME (UTE) MRI EXAMS OF NEONATAL PATIENTS WITH PATHOLOGIES

Hailong Li, DPhil (*Abstract Co-Author*) Nothing to Disclose
Chamindu Gunatilaka (*Abstract Co-Author*) Nothing to Disclose
Neeraja Mahalingam, MSc,BSC (*Abstract Co-Author*) Nothing to Disclose
Alexandra Hendricks (*Abstract Co-Author*) Nothing to Disclose
Jason C. Woods, PhD (*Abstract Co-Author*) Research Consultant, Vertex Pharmaceuticals Incorporated;Advisory Panel, Polarean, Inc
Alister Bates, PhD (*Abstract Co-Author*) Nothing to Disclose
Elanchezhian Somasundaram, PhD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

To study the performance of benchmark AI models in segmenting neonatal airway passages from ultrashort echo time (UTE) MRI exams - a complex and time-consuming task to perform manually.

### METHODS AND MATERIALS

331 UTE (200 microsections) 1.5T MRI images with a voxel dimension of .703 cubic mm were used in this study. The exams fell under 4 broad categories based on the patient's pathology; 18 were control, 175 were BPD (Bronchopulmonary Dysplasia), 73 were CDH (Congenital Diaphragmatic Hernia), and 65 were from several other pathological conditions. Training and testing sets were formed with stratified sampling across pathologies with an 85-15 percentage split. An expert pulmonary researcher manually segmented the airway passage in 3DSlicer. Based on initial experiments using models in the Medical Open Network for AI (MONAI) framework, the DynUNet architecture was selected and further optimized with various preprocessing and data augmentation schemes. nnUnet is a self-configuring pipeline that has won several medical image segmentation challenges and was chosen to establish a performance benchmark. nnUnet employs a 20-model ensemble that uses 5-fold cross validation and 4 different U-net configurations, resulting in long training and inference times. The custom tuned single DynUNet model was compared to the nnUnet ensemble using Dice Similarity Score (DSC).

### RESULTS

The best DynUNet model achieved a DSC of 0.79 ± 0.09 on a test set of 50 exams. The DSC for each pathology category was BPD: 0.82, CDH: 0.77, control: 0.78, and miscellaneous pathologies: 0.71. Training the nnUnet pipeline resulted in an overall DSC of 0.79 ± 0.09, which matched the performance achieved using a single custom tuned DynUNet. The nnUnet took on average 150 seconds for segmenting the airway in a single scan, while the DynUNet took only 15 seconds on a Nvidia A100 GPU.

### CONCLUSION

A thorough evaluation of automatic airway passage segmentation models for chest UTE MRI exams was performed for the first time in neonatal patients.

### CLINICAL RELEVANCE/APPLICATION

Automatic airway segmentation for neonatal patients can enable quantitative assessment of anatomy for respiratory disease diagnosis, treatment planning and monitoring disease progression for various pulmonary disorders.

## S2-SSPD01-3 NON-ECG-TRIGGERED DUAL-SOURCE DEPENDENT CTA IN CHILDREN WITH CONGENITAL HEART DISEASE

Shipeng Zhang (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the value of non-electrocardiogram-triggered (non-ECG-triggered) on third-generation dual-source computed tomography application in children with congenital heart disease (CHD) and a fast heart rate.

### METHODS AND MATERIALS

Data on children with CHD received cardiac CT angiography (CTA) were collected between November 2019 and March 2022. CT images were obtained using two different protocols: non-ECG-triggered and retrospectively-ECG-triggered (retro-ECG-triggered). All children received transthoracic echocardiography (TTE) before surgery . Sex, age, weight, heart rate, volume CT dose index (CTDI vol), and dose length product (DLP) were recorded, and the effective dose (ED) was calculated. Image quality was rated using five-point Likert scales and the diagnostic values of CTA and TTE were compared.

### RESULTS

Children's age ranged from 1 day to 34 months, with minimum and maximum heart rates of 90 bpm and 160 bpm, respectively. There were significant differences between the retro-ECG-triggered and non-ECG-triggered groups in the average tube current (54.95±23.52 vs. 45.47±24.65 mAs, p=0.003), CTDI vol (2.41±1.6 vs. 0.58±0.27 mGy, p<0.001), DLP (44.43±34.65 vs. 9.92±5.48 mGy.cm, p<0.001), and ED (1.48±0.90 vs. 0.35±0.17 mSv, p<0.001). There was no difference between the two CT examination protocols in the demonstration of extracardiac and intracardiac malformations(all p=0.05).The diagnostic accuracy of both retro and non ECG triggering in intracardiac and extracardiac malformations were high, and there were no significant differences (p=1.00, 0.80,respectively). The diagnostic advantage of TTE is mainly in intracardiac malformations (p=0.03, 0.01,respectively)

### CONCLUSION

High-pitch non-ECG-triggered CTA can significantly reduce radiation dose, whereas there was no significant difference in image quality and diagnostic accuracy between non-ECG-triggered and retro-ECG-triggered CTA.

### CLINICAL RELEVANCE/APPLICATION

High-pitch non-ECG-triggered cardiac CTA can overcome the influence of high rate and respiratory motion on image quality and significantly reduce the radiation dose compared with retro-ECG-triggered cardiac CTA ,and obtain the same high-quality image as retro-ECG-triggered cardiac CTA.

## S2-SSPD01-4 EXPLORING HEMODYNAMIC ALTERATIONS IN FETUSES WITH GASTROSCHISIS AND PLACENTA-RELATED FGR: A FETAL MRI STUDY

Hui Shi (*Presenter*) Nothing to Disclose

### PURPOSE

Fetuses with gastroschisis (GS) exhibit a high incidence of Fetal growth restriction (FGR) and placental fetal vascular malperfusion (FVM) while the underlying cause remains elusive. We aim to identify umbilical vein (UV) compression at the hernial orifice in GS, and the resulting backflow of blood into the placenta and FGR.

### METHODS AND MATERIALS

This retrospective study included 86 GS cases, 30/86 were classified as complex GS according to postnatal outcome (intestinal obstruction, atresia/stenosis, volvulus, perforation). Co-occurrence analysis was conducted based on prenatal MRI and postnatal follow-up data of fetal gastroschisis. Morphological measurements including abdominal wall defect size, abdominal circumference, colon length and diameter, maximum small intestine diameter, UV diameter, and placenta characteristics, were subjected to PCA (Principal Component Analysis) for multivariate data classification between GS cases with FGR and without FGR. Furthermore, twenty-six 1:1 age-matched omphalocele cases and 26 normal cases were incorporated to compare the UV diameter, T2* signal intensity (SI) differences between the left and right lobe of the liver, and placental characteristics.

### RESULTS

The incidence of FGR in simple and complex GS was 66% and 85%, respectively. Co-occurrence analysis displays robust connections between FGR and placenta hemorrhage/infarction, umbilical vein stenosis at the defect, and post-stenotic dilatation, particularly correlated with preterm birth, small for gestational age, PROM. Placentas in the GS with FGR group were significantly thickened (P=0.048), with more frequent lobules (P=0.046), and

hemorrhages (P=0.002), accompanied by UV stenosis at the defect, and significant T2* SI difference between the left and right lobe of the liver. PCA showed different clustering patterns between GS-FGR, GS +FGR, and omphalocele controls.

**CONCLUSION**

GS with placenta-related FGR is possibly due to UV stenosis at the abdominal defect and reduced blood supply to the fetus and is associated with FVM and resulting backflow alterations into the placenta.

**CLINICAL RELEVANCE/APPLICATION**

Complex GS with severe UV stenosis and post-stenotic dilatation might be at risk of hemodynamic compromise and need to be considered as potential candidates for prenatal repair surgery.

## S2-SSPD01-5 FETAL BRAIN T2* MAPPING AND INFANT NEURODEVELOPMENTAL OUTCOMES IN CONGENITAL HEART DISEASE

Shabnam Peyvandi (*Abstract Co-Author*) Nothing to Disclose
Patrick McQuillen (*Abstract Co-Author*) Nothing to Disclose
Lauren Christopher (*Abstract Co-Author*) Nothing to Disclose
Duan Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Jing Liu, PhD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth George, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Fetal T2* mapping has demonstrated altered brain oxygenation in fetuses with congenital heart disease (CHD) compared to normal controls. We sought to assess the association of fetal T2* relaxation time with neurodevelopmental (ND) outcomes among infants with CHD requiring a neonatal intervention.

**METHODS AND MATERIALS**

48 fetuses with transposition of great arteries (TGA) or single ventricle physiology (SVP) underwent fetal brain MRI in the 3rd trimester including T2*mapping. T2* relaxation time was adjusted for gestational age (GA) at time of MRI and sex and a residual T2* was calculated which reflects the difference between the subject's T2* and the expected value based on normal controls. ND outcome was assessed at 18- and 30-months using Bayley Scales of Infant and Toddler Development (BSID, version III or IV). Due to the differences in BSID versions, the primary outcomes at 18 months were abnormal motor, cognition, or language defined as a score < 85 in the corresponding domain (BSID III or IV). The primary outcomes at 30 months were the motor, cognitive, language scores on BSID version IV. Race/ethnicity, GA at birth, cardiac lesion type, length of neonatal hospital stay, maternal education (college graduate or higher vs. partial college or specialized training or lower), and fetal total brain volume (TBV) were included in univariate analysis. Multivariate (MV) analysis included residual T2* and those variables with $p<0.1$ on univariate analysis (after excluding highly correlated variables).

**RESULTS**

The study population was 73% (24/33) male with a median gestational age at birth of 39.1 (IQR: 38.3-39.3) weeks. The median GA at fetal brain MRI was 34.1 (IQR: 33.5-34.6) weeks and median residual T2* was -13.2 (IQR: -26.3- -7.9) msec. On MV analysis, abnormal language at 18 months was associated with low maternal education (OR: 6.51 (0.97-43.54, p=0.5), and there was a trend for abnormal motor and cognition outcome to be associated with cardiac lesion type (SVP relative to TGA, OR: 8.46 (0.82-86.97), p=0.07) and low maternal education (OR: 8.57 (0.72-102.02), p=0.09), respectively. On MV analysis, 30-month motor, language, and cognition scores were associated with cardiac lesion type (ß =-19.97- -23.16, p=0.03-0.04) and maternal education (ß=-19.59- -30.61, p=0.01-0.04).

**CONCLUSION**

Fetal brain T2* is not associated with 18- or 30-month ND outcomes. Maternal education is associated with 18-month language outcome, while both cardiac lesion type and maternal education are associated with 30-month motor, language, and cognition scores.

**CLINICAL RELEVANCE/APPLICATION**

Fetal brain T2* is not associated with early ND outcomes, while cardiac lesion type and the home environment have a greater impact on outcome.

## S2-SSPD01-6 Keynote Speaker: Emerging Clinical Role of Fetal Cardiac MRI

Mike Seed, MBBS, FRCR (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S2-SSRO01

**Radiation Oncology (Lung and Sarcoma)**

Sunday, Dec. 1 10:30AM - 11:30AM Room: S401

Meng X. Welliver, MD, PhD (*Moderator*) Advisory Board, NovoCure Ltd;Advisory Board, Eli Lilly and Company
Simon S. Lo, MBChB (*Moderator*) Committee member, Elekta AB

**Sub-Events**

## S2-SSRO01-1 EXTERNAL EXPERT REVIEW OF FDG-PET-BASED RADIOTHERAPY PLANS - RESULTS OF THE PROSPECTIVE RANDOMIZED PET-PLAN STUDY

Martina Eschmann (*Abstract Co-Author*) Nothing to Disclose
Markus Hecht (*Abstract Co-Author*) Merck Serono (advisory role, speakers' bureau, honoraria, travel expenses, research funding); MSD (advisory role, speakers' bureau, honoraria, travel expenses, research funding); AstraZeneca (research funding); BMS (advisory role, honoraria, speakers' bureau, research funding).
Christian Rischke, MD (*Abstract Co-Author*) Nothing to Disclose
Eleni Gkika (*Abstract Co-Author*) Nothing to Disclose
Jochem Koenig (*Abstract Co-Author*) Nothing to Disclose
Anca L. Grosu, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias Miederer (*Abstract Co-Author*) Nothing to Disclose
Marco Tosch, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Brose (*Abstract Co-Author*) Nothing to Disclose
Tanja Schimek-Jasch, MD (*Abstract Co-Author*) Nothing to Disclose
Ursula Nestle, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Andreas Rimner, MD (*Presenter*) Research Consultant, General Electric CompanyResearch Consultant, Varian Medical Systems, IncResearch Grant, Varian Medical Systems, Inc

### PURPOSE

The PET-Plan trial was a multicenter, prospective randomized phase II study on patients with inoperable stage III non-small cell lung cancer who were treated with 18F-FDG-PET/CT -based vs conventionally planned definitive concurrent chemoradiotherapy (cCRT). The primary endpoint was previously published (Nestle et al., Lancet Oncol 2020). Here we analyzed, whether pre-treatment radiological external expert (REE) imaging review and discrepancies between the local study center (LSC) and REE read were associated with local tumor control or toxicity.

### METHODS AND MATERIALS

All 205 patients were treated to 60-74 Gy with concurrent platinum-based chemotherapy and randomized to have their target volumes defined by either 18F-FDG-PET/CT alone (experimental arm) or 18F-FDG-PET/CT plus elective nodal irradiation (control arm). We assessed availability of the REE, frequency and characteristics of discrepancies (DIS) between reports of LSC and REE in terms of FDG-avidity of mediastinal lymph node stations (LNS). The relation of DIS to toxicities, nodal in- and out-field recurrences, progression-free and overall survival was analyzed.

### RESULTS

In 172 patients with 2528 LNS who were treated per protocol the interobserver agreement between LSC and REE was excellent (Cohens kappa 0.83;). However, 182 DIS (1.1/case; range 0-6) were documented, mostly in the subcarinal, hilar and paratracheal LNS (n=23). Frequency of DIS was not associated with the number of positive LNS per patient. In LNS with DIS, the SUVmax and nodal size showed no significant differences to patients without DIS. In 26 cases, REE was available for RT prior to treatment planning. PFS and OS were neither affected by availability of REE nor by DIS. With regards to locoregional tumor recurrence, the REE and LSC largely agreed in terms of LNS involved in nodal progression (60/68 = 88%; vs. 8/68 = 12% with DIS). In one case, not treated per protocol (RTQA failure), an isolated out-of-field recurrence was documented with significant DIS between REE and LSS. Target volumes that included more LNS than necessary per REE did not result in higher individual patient toxicity compared to other patients.

### CONCLUSION

We did not observe an impact of pre-treatment REE and not many DIS between REE and LSC after 18F-FDG-PET-based cCRT. This suggests that diagnostic quality and oncological safety based on LSC are sufficient for radiotherapy planning. However, in selected cases, an REE opinion may help to avoid a geographic miss.

### CLINICAL RELEVANCE/APPLICATION

18F-FDG-PET-based radiation treatment planning is the standard of care for patients with LA-NSCLC. Availability of REE does not appear to have a significant impact on oncologic endpoints or toxicity.

## S2-SSRO01-2 DOES CONSECUTIVE DAILY (QD) VERSUS NONDAILY (QOD) SCHEDULING IMPACT LOCAL CONTROL (LC) FOR STEREOTACTIC BODY RADIOTHERAPY (SBRT) IN EARLY-STAGE NON-SMALL-CELL LUNG CANCER (ES-NSCLC)?

Annika O. Price, BS (*Abstract Co-Author*) Nothing to Disclose
Lauren Johnson, BS (*Abstract Co-Author*) Nothing to Disclose
John M. Watkins, MD (*Abstract Co-Author*) Nothing to Disclose
Keaton A. Rummel, BS (*Abstract Co-Author*) Nothing to Disclose
Thandiwe Gray, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Watkins (*Abstract Co-Author*) Nothing to Disclose
Jackson S. Wilson, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Determine whether QD versus QoD impacts LC for patients with ES-NSCLC treated with 5-fraction SBRT.

**METHODS AND MATERIALS**

Patients with biopsy-proven ES-NSCLC treated with 5-fraction SBRT to >49 Gy from 2011 through 2022 were identified from a single-institution SBRT quality assurance database for study inclusion. The primary outcome measure was freedom from local failure (FFLF), measured from SBRT completion to demonstration of local failure (LF) or last clinical follow-up. Patients scheduled for treatment on consecutive days (excluding holidays/weekends) were considered QD, while all others QoD (every other day or twice per week), constituting the primary analysis (from which patients with treatment break >5 days were excluded to reduce risk of interaction). A secondary analysis of SBRT duration (first to last SBRT treatment, independent of QD/QoD group) was additionally performed, inclusive of all eligible patients. Logistic regression analyses (Cox for continuous variables, chi-square for nominal) were performed on clinicopathologic and treatment variables to determine correlations with FFLF.

**RESULTS**

From 2011 to 2022, 100 patients with 105 SBRT target lesions were identified for inclusion. At a median follow-up and survival of 23mo (range, 1-150), 7 LFs had occurred (4 biopsy-proven), and 77 patients had died (including 33 of/with disease). Median age at SBRT was 75 years (38-93), with 55 (52%) female, 20 (19%) prior lung cancer diagnoses, and 14 prior thoracic RT (13%). Median maximal tumor dimension was 2.3cm (0.6-5.4); 57 (54%) adenocarcinoma and 97 (92%) PET-staged. Median dose was 50 Gy (range 49-55), over median 9 days (range, 4-45), with 21 QD patients (20%) and 81 (77%) QoD (excluding 3 patients with treatment break >5 days, 6-21). Treatment groups were balanced with respect to clinicopathologic and treatment factors, without difference in follow-up. FFLF at 2/5y was 95%/85% for the entire population, without statistically significant difference between QD versus QoD groups (p=0.6; Table). When analyzed as a continuous variable, SBRT duration was not significantly associated with FFLF (p=0.363).

**CONCLUSION**

No significant FFLF differences were identified for 5-fraction SBRT for QD versus QoD schedule or treatment duration.

**CLINICAL RELEVANCE/APPLICATION**

Clinicians may reasonably consider QD versus QoD treatment schedules for 5 fraction SBRT without appreciable impact on FFLF.

## S2-SSRO01-3 ARTIFICIAL INTELLIGENCE IN THE DETECTION OF UNSUSPECTED PULMONARY EMBOLISM IN ONCOLOGY PATIENTS

Tarek Assi (*Abstract Co-Author*) Nothing to Disclose
Corinne Balleyguier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sarah Quenet, MD (*Abstract Co-Author*) Employee, Avicenna.ai
Amir Zemmouri (*Abstract Co-Author*) Nothing to Disclose
Nathalie B. Lassau, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Angela Ayobi, MENG,MSc (*Abstract Co-Author*) Employee, Avicenna.ai
El Mehdi Mniai, MD (*Abstract Co-Author*) Nothing to Disclose
Astrid Orfali Camez, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The incidence of venous thromboembolism is estimated at around 3% of cancer patients. However, a majority of incidental pulmonary embolism (iPE) can be overlooked by radiologists in asymptomatic patients, performing CT scans for surveillance, which may significantly impact the patient's health and management. Routine imaging in oncology is usually reviewed with delayed hours after the acquisition of images. The advent of AI in radiology could reduce the risk of diagnostic delay of iPE by an optimal triage immediately after the CT exam. This study aimed to determine the accuracy of an AI algorithm (CINA-iPE) in detecting iPE and the time to management for these cancer patients in our center in addition to describing the characteristics of patients with a confirmed PE.

**METHODS AND MATERIALS**

This is a retrospective analysis of the role of Avicenna's CE-certified and FDA cleared CINA-iPE algorithm in oncology patients treated at Gustave Roussy Cancer Campus. The results obtained from the AI algorithm were compared with the attending radiologist's report and analyzed by both a radiology resident and a senior radiologist. In case of any discordant results, the reason was further investigated. The duration between the exact time of the CT scan and images analysis was assessed as well as the duration from the result’s reporting to the start of active management.

**RESULTS**

Out of 3047 patients, 104 alerts were detected for iPE (prevalence of 1.3%) while 2942 had negative findings. 36 of the 104 patients had confirmed PE while 68 alerts were false positives. Only 1 patient reported as negative by the AI tool was deemed to have a PE by the radiologist. The sensitivity and specificity of the AI model were 97.3% and 97.74% while the PPV and NPV were 34.62% and 99.97% respectively. Most causes of FP were artifacts (22 cases, 32.3%) and lymph nodes (11 cases, 16.2%). Seven patients experienced delayed diagnosis, requiring them to return to the ER for treatment after being sent home following their CT scan. The remaining patients received prompt care immediately after their testing with a mean delay time of 8.13 hours.

**CONCLUSION**

The addition of an AI system for the detection of unsuspected PEs on chest CT scans in routine oncology care demonstrated a promising efficacy in comparison to human performance. This study describes the potential synergy between AI and radiologists for optimal diagnosis of iPE in routine clinical cancer care.

**CLINICAL RELEVANCE/APPLICATION**

In the oncology field, iPEs are common with an increased risk of morbidity when missed with a delayed diagnosis. With the assistance of a reliable AI tool, the radiologist can focus on the challenging analysis of oncology results while dealing with urgent diagnosis such as PE by sending the patient straight to

the ER for prompt treatment.

## S2-SSRO01-4 EVALUATION OF ONCOGENIC RISK AND CUMULATIVE DOSE FROM RADIOLOGICAL INVESTIGATIONS IN INTENSIVE CARE UNIT PATIENTS. VARIABILITY BETWEEN BEIR VII VS RADRAT VS ICRP 103 VS US EPA MODEL RISKS

Marta Paiusco, MPH (*Abstract Co-Author*) Nothing to Disclose
Chiara Zanon, MD,MS (*Abstract Co-Author*) Nothing to Disclose
Francesca De Monte (*Abstract Co-Author*) Nothing to Disclose
Emilio Quaia, MD (*Presenter*) Speakers Bureau, Bracco Group

### PURPOSE

To compare additional oncogenic risk (AOR) related to radiation exposure according to different risk model including biological effects of ionizing radiation seventh report (BEIR VII), Radiation Risk Assessment Tool (RadRAT), International Commission on Radiological Protection (ICRP) 103, and U.S. Environmental Protection Agency (EPA) risk models in intensive care unit (ICU) patients.

### METHODS AND MATERIALS

This was an IRB-approved observational retrospective study. 150 patients (45 F; 105 M, mean age 63.2 ± 27 years) admitted to intensive care multivisceral transplant unit (MTU, 44 patients) or cardiac surgery unit (CSU,106 patients), who underwent x-ray radiological examinations between april and june 2023, were included. For each patient, the cumulative effective dose during one single hospital admission was calculated and AOR for all cancer and leukemia were estimated according to the risk models.

### RESULTS

All cancer risks was lower according to ICRP 103 vs BEIR VII vs U.S. EPA vs RadRAT (20 ± 105 vs 40 ± 226 vs 41.88± 254 vs 47.5 ± 346 $p < 0.001$), while it was higher in male patients according to BEIR VII (male vs female median ± IQR, 58.6 ± 279 vs 18.6 ± 112), RadRAT (77.2 ± 456 vs 24.2± 130), ICRP 103 (20 ± 121 vs15.94 ± 64) and U.S. EPA (69.40 ± 329 vs 20.59 ±125).Leukemia risk was higher in the U.S. EPA vs BEIR VII vs RadRAT vs ICRP 103 vs (7.75 ± 41 vs 7.6 ± 37 vs 7.27 ± 42 vs 1.8 ± 13, $p < 0.001$), while it was higher in male patients both according to all the models: BEIR VII (male vs female median ± IQR, 9.5 ± 52 vs 2.12 ± 11 ), RadRAT (9.94 ± 50 vs 2.03 ± 12), ICRP 103 ( 2.17± 18 vs ± 0.92 ± 4 ) and U.S. EPA (9.83 ± 51 vs 2.34 ± 12).

### CONCLUSION

The ICRP 103 risk model estimated a lower radiation-induced cancer risk for all cancer risks. The U.S. EPA estimated an increased radiation-induced leukemia risk compared to BEIR VII, U.S. EPA and RadRAT.

### CLINICAL RELEVANCE/APPLICATION

Our study shows the wide variability between the most used model risks which should deserve further research to establish a more consistent risk assessment.

## S2-SSRO01-5 PRE-TREATMENT 18F-FDG PET BASED RADIOMICS IN PREDICTING OUTCOMES IN OLIGOMETASTATIC NON-SMALL CELL LUNG CANCER PATIENTS RECEIVING DEFINITIVE STEREOTACTIC BODY RADIATION THERAPY

Victor Lee, BSC (*Abstract Co-Author*) Nothing to Disclose
Sajid Hossain (*Abstract Co-Author*) Nothing to Disclose
Joshua Zhu, MS (*Abstract Co-Author*) Nothing to Disclose
Durga Sritharan (*Abstract Co-Author*) Nothing to Disclose
James Laird (*Abstract Co-Author*) Nothing to Disclose
Thomas Hager (*Abstract Co-Author*) Nothing to Disclose
Nicholas S. Moore, MD (*Abstract Co-Author*) Nothing to Disclose
Sanjay Aneja, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Stereotactic body radiation therapy (SBRT) is increasingly used to treat oligometastatic non-small cell lung cancer (NSCLC) and has been associated with improved outcomes compared to chemotherapy alone. Current clinical challenges are focused upon identifying the patients who would benefit the most from SBRT while balancing toxicity associated with additional local therapy. PET Radiomics have been shown to be an effective method to personalize treatment in locally advanced NSCLC but have been unexplored in patients with oligometastatic disease. In this study we hypothesize that the PET radiomic features would improve prognostic ability for patients with oligometastatic NSCLC.

### METHODS AND MATERIALS

A total of 152 oligometastatic NSCLC lesions treated with definitive radiation therapy at our institution were used for this study. The main outcome of interest was 1 year progression free survival (PFS). PET radiomic features were collected from pre-treatment PET/CT images features including SUV and intensity histogram (n = 37), shape (n = 4), gray level co-occurrence matrix (GLCM, n = 7), gray-level run-length matrix (GLRLM, n = 11), neighborhood gray-tone difference matrix (NGTDM, n = 5), gray-level size zone matrix (GLSZM, n = 11), normalized GLCM (n = 6), neighboring gray level dependence (NGLD, n = 5), texture feature coding (TFC, n = 4), TFC GLCM (n = 8) and texture spectrum (TS, n = 2). Random forest models were used to construct classification models for 1-year PFS. Discriminatory performance was measured by C-statistics. PET Radiomic models were compared to models using SUV statistics and total tumor volume.

### RESULTS

Of 152 oligometastatic NSCLC lesions, 105 were used for training and 47 as a blinded validation cohort. The random forest models using PET radiomic features showed strong prognostic ability for 1-year PFS (c-statistic 0.81, 95% CI 0.70-.92). PET radiomics showed stronger discriminatory ability compared to simple SUV statistics (c statistic 0.81 vs 0.62, $p = 0.043$) and total tumor volume (c statistic 0.81 vs 0.52, $p<.001$). PET Radiomic features of greatest importance included SUV Skewness, SUV bias-correct Skewness, and SUV mean sphericity.

### CONCLUSION

PET radiomic features appear to have prognostic ability in patients with oligometastatic NSCLC treated with SBRT. As PET directed therapy becomes increasingly used in treatment further studies are needed to leverage PET radiomic signatures to personalize treatments and optimize outcomes for patients with NSCLC.

## CLINICAL RELEVANCE/APPLICATION

This study provides evidence that PET imaging features have prognostic value. Moreover, our findings suggest PET imaging features can be used to tailor therapy for patients with oligometastatic non-small cell lung cancer.

## S2-SSRO01-6 LIMITED UTILITY OF RECIST 1.1 IN PREDICTING PATHOLOGIC RESPONSE TO NEOADJUVANT RADIOTHERAPY IN MYXOID LIPOSARCOMA

Linda C. Kelahan, MD (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, MSc, PhD (*Abstract Co-Author*) Ther-AI LLC
Seth Pollack, MD (*Abstract Co-Author*) Consultant, Bayer AG;Consultant, Deciphera Pharmaceuticals, LLC;Consultant, Apexigen Inc;Consultant, T-Knife, GmbH;Consultant, Aadi Bioscience, Inc;Consultant, Epizyme, Inc;Consultant, Obsidian;Consultant, Sensei;Consultant, SpringWorks Therapeutics, Inc
Laetitia Perronne, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Gorkem Durak, MD (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Meghana Karri (*Abstract Co-Author*) Nothing to Disclose
Ronen Sumagin (*Abstract Co-Author*) Nothing to Disclose
Hatice Savas, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Velichko, PhD (*Abstract Co-Author*) Nothing to Disclose
Jessica L. Davis, MD (*Abstract Co-Author*) Research Consultant, Bayer AG;Research Consultant, Eli Lilly and Company
Mariam Goreish (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Borhani, MD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Tugce Agirlar Trabzonlu, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Hermida De Viveiros (*Abstract Co-Author*) Nothing to Disclose
Ryan J. Avery, MD (*Abstract Co-Author*) Research Consultant, Konica Minolta, Inc
Sean Sachdev, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolo Gennaro, MD (*Presenter*) Nothing to Disclose

## PURPOSE

Myxoid liposarcoma (mLPS) treatment response is typically assessed by tumor shrinkage using RECIST 1.1 imaging criteria. This study investigates the potential of MRI scans to monitor mLPS size changes before and after neoadjuvant radiotherapy (nRT) as a measure of treatment effectiveness.

## METHODS AND MATERIALS

Thirty patients with pathologically confirmed mLPS that received nRT with or without chemotherapy were selected in this IRB-approved study. Tumor size measurements, including two perpendicular axial diameters and the longest vertical diameter, were obtained from pre- and post-nRT MRI scans by four independent readers (three trained radiologists and one researcher). In addition to measurements, cross-sectional areas and tumor volume were calculated. Inter-reader agreement for all size measurements was evaluated using Kendall's concordance coefficient. Patients with =10% viable cells on post-treatment pathology were classified as responders (R), while those not meeting this criterion were classified as non-responders (NR). Changes in tumor size between responders and non-responders were compared using one-way ANOVA and Tukey's honestly significant difference (HSD) test for multiple comparisons of means.

## RESULTS

The study included 14 responders and 16 non-responders. Inter-reader agreement for all size measurements was high (Kendall's $W>0.8$, $p>0.00001$). Both responder and non-responder groups showed a decrease in tumor size after nRT. However, the difference in size reduction between the groups was weak or not statistically significant across all size measures except the tumor volume. For example, the percentage change in the longest diameter (RECIST criteria) was -15.1% for responders and -13.3% for non-responders, with a non-significant difference of -1.8% (95% CI: -8.9 to 5.4, $p = 0.62$). Only the change in tumor volume demonstrated a statistically significant difference. Responders experienced a larger decrease (-42.9%) compared to non-responders (-27.3%), with a difference of -15.6% (95% CI: -30.2 to -0.99, $p = 0.036$).

## CONCLUSION

mLPS tumors demonstrated a decrease in size after nRT, suggesting RECIST 1.1 remains a viable response criterion. However, RECIST diameter changes did not significantly differentiate responders from non-responders based on pathology. Only changes in tumor volume showed significant results, suggesting that volumetry might be a more sensitive measure of treatment effectiveness in mLPS after nRT.

## CLINICAL RELEVANCE/APPLICATION

This study suggests that traditional RECIST criteria may not be sufficient for assessing treatment response in mLPS. However, larger decreases in tumor volume might offer an earlier indication of treatment effectiveness.

# Abstract Archives of the RSNA, 2024

S2-STCE1

**Science Session (Theranostics)**

Sunday, Dec. 1 10:30AM - 11:00AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## S2-STCE1-1 APPLYING FAS-4-1BB IMMUNOMODULATORY FUSION PROTEIN (IFP)-ENGINEERED T-CELLS FOR TARGETED THERANOSTIC NANOMEDICINE USING COMPUTED TOMOGRAPHY-IMAGEABLE PARTICLES THAT RELEASE THE BISPECIFIC ANTIBODY IMC-KRAS$^{G12D}$WITH THE KRAS$^{G12D}$NEOANTIGEN, DIRECTED BY TWO RADIATION SESSIONS

Satoshi G. Harada, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Fas-4-1BB IFP-engineered CD3+ T cells were applied to theranostic nanomedicine for CD3+ bispecific antibodies associated with the KRASG12D neoantigen by two radiation sessions in Rag2-/- C57BL/6 mice with KP9093FasL+ sarcoma in the left foot pad with lung metastases. Computed tomography (CT)-imageable hyaluronate-alginate nanocapsules (HA-NCs, ? 564 nm) and liposome-protamine-hyaluronate nanoparticles (LPH-NPs, ? 43 nm) that released their contents upon radiation exposure were evaluated.

### METHODS AND MATERIALS

T cells were engineered to express Fas-4-1-BB IFP via retroviral transduction and transferred into mice. Sessions 1 and 2 were conducted 28 days after the transfer. In session 1, KRASG12D and IFN-? LPH-NPs were prepared using the self-assembly method and encapsulated into ?4ß1-antibody-labeled HA-NCs with P-selectin, using electrospray and Fe. Nine hours after the intravenous injection of 1 × 1010 HA-NCs, 10 or 20 Gy 60Co ?-rays were administered to the primary tumor and metastatic lesion. In session 2, the JD1a96b35 × anti-CD3 ScFv-bispecific antibody (IMC-KRASG12D), which has a high affinity for KRASG12D and CD3+T-cell) was encapsulated into P-selectin-antibody-labeled HA-NCs. HA-NCs were intravenously injected 24 h after the first irradiation. Subsequently, session 2 was performed 24 h after the injection in the same manner as session 1.

### RESULTS

Proliferation of transferred Fas-4-1BB IFP engineered CD3+ T cells in mice. In session 1, anti-?4ß1-Ab-HA-NCs were accumulated in the primary tumor and metastasis, which were imaged by CT. Upon the 1st radiation, the HA-NCs discharged IFN? and KRASG12D LPN-NPs continuously released IFN? and KRASG12D, respectively. The released IFN? induced HLA-A*11 and the released KRASG12D were captured by HLA-A*11, which formed an HLA-A* 11-KRASG12D complex. HA-NCs released P-selectins into the tumor vessels. In session 2, P-selectin Ab-labeled HA-NCs accumulated to P-selectin, and a second dose of radiation was administered. HA-NCs continuously released IMC-KRASG12D and formed an immunological synapse consisting of HLA-A* 11-KRASG12D, IMC-KRASG12D, and Fas-4-1BB IFP-engineered CD3+ T-cells, which converted FasL-mediated inhibitory/death signals into activating/survival signals in T cells and enhanced the release of perforin/granzymes to attack the primary tumor and metastasis. These phenomena in sessions 1 and 2 resulted in an EF of 1.7 and an 83 % reduction in metastasis, respectively.

### CONCLUSION

The combination of Fas-4-1BB IFP-engineered CD3+T-cells with thoranostic nanomedicine will lead to better diagnosis and new radiotherapies.

### CLINICAL RELEVANCE/APPLICATION

Our theranostic nanomedicine combined with Fas-4-1BB IFP-engineered CD3+ T cells led to improved diagnostic and therapeutic effects.

## S2-STCE1-3 REAL-TIME MONITORING OF INTRATHERAPEUTIC BODY FAT LOSS DURING RADIOLIGAND THERAPY WITH [177LU]LU-PSMA PREDICTS SURVIVAL IN PROSTATE CANCER PATIENTS

Nick Lasse Beetz, MD (*Abstract Co-Author*) Nothing to Disclose
Johannes Kolck, MD (*Abstract Co-Author*) Nothing to Disclose
Seyd Shnayien, MD (*Abstract Co-Author*) Nothing to Disclose
Holger Amthauer, MD (*Abstract Co-Author*) Speaker, General Electric Company;Speaker, Sirtex Medical Ltd;Speaker, Pfizer Inc;Speaker, Norgine BV;Travel support, Terumo Corporation
Christian Furth (*Abstract Co-Author*) Nothing to Disclose
Julian Rogasch (*Abstract Co-Author*) Nothing to Disclose
Dominik Geisel, MD (*Abstract Co-Author*) Nothing to Disclose
Markus Galler (*Abstract Co-Author*) Nothing to Disclose
Tristan Ruhwedel, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Patients with metastatic castration-resistant prostate cancer (mCRPC) respond differently to radioligand therapy (RLT). Therefore, prognostic factors to estimate overall survival (OS) are required. Body composition (BC) analysis is done to quantify the relative amounts of different body tissues as a

measure of physical fitness and tumor cachexia. We used BC to investigate whether relative changes in BC parameters between baseline imaging before the start of RLT and interim staging after two cycles of RLT can predict OS.

## METHODS AND MATERIALS

This is a single-center, retrospective analysis of 92 patients treated with a median of 3 cycles (range 2 - 8 cycles) of RLT with [177Lu]Lu-PSMA. Patients underwent baseline staging within 6 weeks before RLT and interim staging 6-8 weeks after the second RLT cycle. BC parameters were obtained from computed tomography (CT) at the L3 vertebral level using an AI-based, PACS-integrated software tool. Relative BC changes were determined as the percentage difference at interim staging from baseline. Cox regression was used to determine the prognostic impact on OS. All variables with a p-value below 0.1 in univariable Cox regression were included in multivariable regression in a stepwise fashion (likelihood ratio).

## RESULTS

During follow-up, 78 patients (85%) died. Median OS was 16.3 months; median follow-up in survivors was 25.6 months. In univariable Cox regression, 3 parameters representing relative changes in BC, previous treatment with Xofigo, previous chemotherapy of any type, lymph node metastases, liver metastases, baseline prostate-specific antigen (PSA) level, hemoglobin level, and De Ritis ratio were significant predictors of OS (each $p<0.05$). The relative change in body mass index (BMI) achieved a $p<0.1$. In multivariable regression, a higher relative decrease in the visceral adipose tissue (VAT) (HR: 0.26; $p = 0.006$), previous chemotherapy of any type (HR: 2.4; $p = 0.003$), the presence of hepatic metastasis (HR: 2.4; $p = 0.018$) and a higher baseline De Ritis ratio (HR: 1.4; $p < 0.001$) remained independent predictors of shorter OS. Patients with a higher decrease in VAT (?VAT < -20%) had a median OS of 10.2 months versus 18.5 months in patients with a lower VAT decrease or increase (?VAT = -20%) (logrank test: $p = 0.008$). In a separate Cox model, the change in VAT predicted OS ($p = 0.005$) independent of the best PSA response after 1-2 RLT cycles ($p = 0.09$), and there was no interaction between the two ($p=0.09$).

## CONCLUSION

Real-time, PACS-integrated, AI-based BC monitoring during therapy detects relative changes in the VAT, which emerged as an independent predictor of shorter OS in our population of patients undergoing RLT. Beyond traditional clinical markers like PSA response, understanding how body composition changes influence outcomes provides a more holistic approach to patient care. Interventions aimed at preserving muscle mass and managing nutritional status could potentially improve treatment tolerance and overall outcomes in these patients undergoing RLT.

## CLINICAL RELEVANCE/APPLICATION

In summary, the study's findings on body fat loss, particularly VAT reduction, during RLT highlight its clinical relevance by offering a novel prognostic indicator and potential target for optimizing patient management strategies in metastatic castration-resistant prostate cancer. The study opens avenues for further research into the mechanisms underlying VAT loss and its impact on treatment outcomes in prostate cancer and potentially other cancers treated with RLT.

# Abstract Archives of the RSNA, 2024

S2-STCE2

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Sunday, Dec. 1 10:30AM - 11:00AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## S2-STCE2-1 CLIMATE RESILIENCE AND ENVIRONMENTAL SUSTAINABILITY IN RADIOLOGY: ASSOCIATION BETWEEN LONG-TERM AMBIENT AIR POLLUTION AND MYOCARDIAL FIBROSIS ASSESSED BY CARDIAC MRI

Dinesh Thavendiranathan, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel Hong (*Abstract Co-Author*) Nothing to Disclose
Scott Delaney (*Abstract Co-Author*) Nothing to Disclose
Chloe DesRoche, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Rachel Nethery (*Abstract Co-Author*) Nothing to Disclose
Heather Ross (*Abstract Co-Author*) Nothing to Disclose
Jacques Du Plessis, MBChB, FFRad(D)SA (*Presenter*) Nothing to Disclose

### PURPOSE

Strengthening environmental sustainability of radiology requires adaptation strategies to build resiliency and address adverse health effects of climate change. Climate change contributes to poor air quality and is associated with cardiovascular morbidity, but the underlying pathophysiological mechanisms are unclear. The purpose of this study was to evaluate the relationship between long-term exposure to ambient fine particulate matter (PM2.5) air pollution and myocardial fibrosis.

### METHODS AND MATERIALS

All adult patients with dilated cardiomyopathy undergoing cardiac MRI at 1.5T or 3T between 2018-2022 were included in this single-center retrospective cohort study. Left ventricular end-diastolic volume (LVEDV), ejection fraction (LVEF), native T1 z-score (marker of interstitial fibrosis), and T2 z-score (marker of edema) were evaluated. Long-term air pollution exposure was assessed as the mean of daily ambient PM2.5 levels over the one-year period prior to cardiac MRI based on direct measurements from the closest monitoring station to each patient's home postal code. Multivariable linear regression models were used to investigate the relationship between one-year mean PM2.5 exposure and individual cardiac MRI parameters, adjusting for age, sex, body surface area, field strength, ambient temperature, and cardiac risk factors (hypertension, hyperlipidemia, smoking status, and diabetes mellitus).

### RESULTS

493 patients were included (71% male, mean age 48±16 years) with mean LVEF 39±17%, indexed LVEDV 129±41 mL/m2, median native T1 z-score 1.4 [IQR 0.4, 2.5], median T2 z-score 0.2 [IQR -0.6, 0.9], and LGE in 65%. Median one-year mean daily PM2.5 concentration was 7.8 (IQR 7.4, 8.1) μg/m3. In a fully adjusted multivariable model, one-year mean ambient PM2.5 exposure was associated with 0.22 higher native T1 z-score per 1 μg/m3 increase PM2.5 (ß-coefficient 0.22, 95%CI, 0.07, 0.38, P=.004), corresponding to a native T1 increase of 7 ms at 1.5T and 8 ms at 3T. Long-term PM2.5 exposure explained 2.2% of the variance in native T1, but was not associated with LVEF (ß-coefficient -1.3, 95%CI, -2.8, 0.12, P=.07), indexed LVEDV (ß-coefficient 1.3, 95%CI, -2.4, 4.9, P=.49) or T2 z-score (ß-coefficient 0.04, 95%CI, -0.06, 0.14, P=.44) in multivariable models.

### CONCLUSION

Higher past exposure to fine particulate air pollution was associated with increased myocardial native T1, a marker of interstitial fibrosis, even at relatively low exposure levels meeting current air quality standards.

### CLINICAL RELEVANCE/APPLICATION

Chronic exposure to air pollution is a modifiable risk factor and public health measures are needed to reduce ambient levels. Medical imaging has an important role in identifying the deleterious effects and mechanisms of disease.

## S2-STCE2-2 DISPARITIES OF ACCESS TO MEDICAL IMAGING TECHNOLOGY ACROSS THE U.S. AS A FUNCTION OF SOCIAL VULNERABILITY

Ehsan Samei, PHD (*Abstract Co-Author*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc
David Crowley (*Abstract Co-Author*) Nothing to Disclose
Ehsan Abadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Isabel Montero, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Equity of technological access and its impact on patient-centered care is an often-overlooked aspect of the clinical imaging landscape. This study investigates the relationship between the age of CT scanners across the United States and the Social Vulnerability Index (SVI). The aim is to identify metrics that may indicate disparities in access to medical imaging technologies.

**METHODS AND MATERIALS**

Data were extracted regarding the location and year of assembly of CT scanners across the U.S. from the Food and Drug Administration (FDA). SVI scores were sourced for each applicable U.S. County from the CDC-ATSDR (Center for Disease Control - Agency for Toxic Substances and Disease Registry) database. Statistical analysis methods such as linear regression explored associations between the SVI scores and CT scanner ages. Additionally, CT phantom image data were analyzed for image quality metrics such as noise magnitude and compared as a function of scanner technology age.

**RESULTS**

Approximately 40,000 CT scanners, aged 3-28 years, and corresponding SVI scores were analyzed. Significant associations found between the CT scanner age and SVI scores ($p < 0.05$), suggesting that a county's social conditions may impact CT technology access. Data shows positive correlation between the counties with higher percentiles of persons with disabilities (slope = 0.45 yr/SVI unit, 95% CI [0.3,0.6]), those 65 or older (slope = 0.35 yr/SVI unit, 95% CI [0.2,0.5]), or in extreme poverty (slope = 0.16 yr/SVI unit, 95% CI [0.1,0.3]), and the age of CT scanners. Conversely, negative correlation was found between the counties with higher percentiles of minority populations (slope = -0.41 yr/SVI unit, 95% CI [-0.5,-0.3]), crowding (slope = -0.26 yr/SVI unit, 95% CI [-0.4,-0.1]), or cost-burdened housing (slope = -0.30 yr/SVI unit, 95% CI [-0.4,-0.2]), and the age of CT scanners. Further, analysis of comparable phantom images from scanners developed 11 and 23 years ago demonstrated an 8.7 HU increase in noise magnitude in older models.

**CONCLUSION**

The study highlights disparities in medical imaging technology across the U.S. as it relates to social vulnerability, potentially exacerbating healthcare inequities for socially vulnerable populations. The findings provide a quantitative benchmark to target future improvements and depict, for the first time, the "cost" of such disparities in terms of patient safety and image quality.

**CLINICAL RELEVANCE/APPLICATION**

Identification of disparities in access to medical imaging technologies based on social vulnerability underscores the need for mitigating healthcare inequities to ensure equitable, patient-centered care across diverse populations. Addressing these disparities can enhance diagnostic accuracy and safety, particularly for vulnerable groups.

## S2-STCE2-3 IMPACT OF PATIENT VOLUME ON IODINATED CONTRAST MATERIAL WASTE WITH MULTIDOSE CONTRAST INJECTORS

Seyedeh Niloufar Rafiei Alavi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Multidose iodinated contrast media (ICM) injectors have shown promise in reducing waste. However, the effect of varying patient volumes on ICM waste in multidose injectors compared to common single-dose injectors has not yet been explored. This study aims to evaluate the impact of patient volume on ICM waste in multidose injectors.

**METHODS AND MATERIALS**

We included 12,290 contrast-enhanced CT studies with a multidose injector at our emergency CT unit. We recorded the ICM volume for each injection and calculated total annual ICM waste, accounting for the 500 mL containers' 8-hour usage limit in multidose injectors. We then calculated the ICM waste in the same patient cohort assuming single-dose vials were used instead. To assess the impact of patient volume, we categorized days into four subgroups based on daily patient counts: Group 1 (20-29 patients/day), Group 2 (30-39 patients/day), Group 3 (40-49 patients/day), and Group 4 (>50 patients/day), and compared the annual ICM waste for both injector types. Additionally, we simulated low patient volumes by randomly removing half of the dataset, creating two new subgroups: Group 5 (<10 patients/day) and Group 6 (10-19 patients/day). ICM waste per patient was calculated for both injector types in these two new groups and compared with the previous four subgroups.

**RESULTS**

In total, using multidose injectors reduced annual ICM waste by 86.1% compared to single-use injectors. Waste was zero for days with over 50 patients and minimal (253 mL) for days with 40-49 patients, indicating negligible waste for patient volumes above 40 per day. In contrast, waste was substantially higher in groups with 20-39 patients per day, with Group 1 generating 9,087 mL of waste. A significant negative correlation between patient volume and ICM waste was observed ($r = -0.365$, $p < 0.0001$). Mean ICM waste per patient was 2.5 times higher in Group 5 (<10 patients/day) and 71.4% higher in Group 6 (10-19 patients/day) with multidose injectors compared to single-dose injectors. Conversely, in groups with at least 20 patients per day, mean ICM waste per patient was lower with multidose injectors, with waste reduced by 100% in Groups 3 and 4, 88.9% in Group 2, and 53.9% in Group 1.

**CONCLUSION**

High patient throughput centers with over 40 patients per day can nearly eliminate ICM waste with multidose injectors. However, using multidose injectors in centers with lower patient volumes (<20 patients per day) may lead to increased ICM waste compared to single-dose injectors.

**CLINICAL RELEVANCE/APPLICATION**

Multidose iodinated contrast media (ICM) injectors significantly reduce contrast waste in high-volume centers. However, in facilities with lower patient volumes, ICM waste is less in single-dose injectors, underscoring the importance of aligning injector choice with patient volume to optimize resource utilization and minimize waste.

# Abstract Archives of the RSNA, 2024

S4-SSCH02

**Chest Imaging (CT Techniques)**

Sunday, Dec. 1 1:00PM - 2:00PM Room: E451A

Joon Beom Seo, MD, PhD (*Moderator*) Stockholder, Promedius Inc;Stockholder, Coreline Soft, Co Ltd;Stockholder, Anymedi Inc
Joel G. Fletcher, MD (*Moderator*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc

**Sub-Events**

## S4-SSCH02-1 TOWARDS LUNG FUNCTIONAL COLOR K-EDGE IMAGING IN COMBINATION WITH DEDICATED CONTRAST AGENTS AND SPECTRAL PHOTON-COUNTING CT: A PHANTOM STUDY

David P. Cormode, DPhil, MS (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Stockholder, PolyAurum;Stockholder, Daimroc Imaging
Derick N Rosario Berrios (*Abstract Co-Author*) Nothing to Disclose
Agnieszka Gutwinska (*Abstract Co-Author*) Nothing to Disclose
Angele Houmeau (*Abstract Co-Author*) Nothing to Disclose
Amanda Pang (*Abstract Co-Author*) Nothing to Disclose
Simon Rit (*Abstract Co-Author*) Nothing to Disclose
Salim Si-Mohamed, MD, PhD (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH

### PURPOSE

Spectral photon-counting CT (SPCCT) is an emerging technology that not only capitalizes on all the advantages of lung morphological CT imaging, but also offers a cutting-edge imaging method known as color K-edge imaging. This method allows a specific and quantitative identification of one or more atoms concomitantly within a tissue, enabling the simultaneous functional imaging of independent or interactive processes. However, it is still limited by its low sensitivity. Hence, we aim to compare sensitivity for various atoms-based contrast agents of Color K-edge imaging.

### METHODS AND MATERIALS

Eight agents based on gadolinium (Gd), holmium (Ho), ytterbium (Yb), hafnium (Hf), tantalum (Ta), tungsten (W), gold (Au) and bismuth (Bi) were prepared in 1.5 mL tubes of 12 increased concentrations (from 0 to 2 mg/mL). Tubes were inserted in an anthropomorphic thorax phantom (QRM GmbH), and scanned with a clinical prototype SPCCT (Philips, Israel). Parameters matched with a standard chest CT protocol using a radiation dose of 4 mGy (voltage fixed at 120 kVp), a voxel size of 0.7 mm3 and 5 axial scans. Energy thresholds were set at 51-72-30-62-81 for Gd,Yb and Au, at 51-68-30-62-81 for Hf and Ta, at 30-50-60-69-80 for W, at 30-56-60-69-80 for Ho and at 30-51-63-78-92 for Bi. Regions of interest were drawn to measure contrast-to-noise ratios (CNR) and quantification accuracy.

### RESULTS

Mean CNR in K-edge images were high for all elements and increased respectively with increased concentrations. CNR were significantly higher in K-edge images than in conventional CT images, with a slope of 26.3, 14.9, 14.0, 12.1, 9.4, 8.4, 7.6 and 7.2, respectively for Gd, Yb, Au, Ho, W, Bi, Ta and Hf. Mean relative error between prepared and measured concentrations across all elements was on average of 25%, with the best accuracy for Yb (± 10%) and lowest accuracy for Tantalum (± 75%) and Bismuth (± 50%). Altogether, these performances are highlighting a dependence of the contrast and the accuracy on the atomic number of the elements and the photon statistics of X-ray tube. This is explained by the ratio between photons and the K-edge energies of each atom.

### CONCLUSION

Color K-edge imaging is feasible with dedicated contrast agents while outperforming sensitivity in comparison to conventional CT images, opening to the development of lung functional imaging. However, there is room to adapt the X-ray tube voltage in order to provide greater performances for high-Z atoms.

### CLINICAL RELEVANCE/APPLICATION

Proving the feasibility of Color K-edge imaging with dedicated contrast agents paves the way for lung functional imaging.

## S4-SSCH02-2 COMBINATION OF SPECTRAL CT AND IMMUNE CELL PARAMETERS FOR PREDICTING EARLY RECURRENCE/PROGRESSION OF POSTOPERATIVE ADJUVANT CHEMOTHERAPY IN NON-SMALL CELL LUNG CANCER

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Liangna Deng, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the predictive value of spectral CT quantitative parameters for early recurrence/progression (ERP, =24 months) of postoperative adjuvant chemotherapy in non-small cell lung cancer (NSCLC), a diagnostic model was constructed and visualized as a nomogram to assist clinical preoperative treatment decisions.

**METHODS AND MATERIALS**

70 patients with NSCLC underwent spectral CT before surgery and were divided into two groups: ERP and non-ERP (NERP). Paraffin-embedded resected specimens were stained by immunofluorescence, and the density percentiles of CD8+ T cells, PD-L1 and PD-L1 CD8+ TIL co-expression were quantified. Clinical baseline characteristics, imaging features and spectral CT parameters were collected. ?2 test, t-test, U test and Kruskal-Wallis test were used for calculated differences between groups. Then, multivariate logistic regression was used to select the most discriminating features, build a predictive model and visualize the model as a nomogram. ROC curves, calibration curves and decision curves analysis (DCA) were used to evaluate prediction performance and clinical utility.

**RESULTS**

The CD8+ TIL and PD-L1 CD8+ TIL co-expression was statistically different between ERP and non-ERP groups ($P < 0.05$). CD8 and PD-L1 CD8+ TIL co-expression were negatively correlated with iodine concentration (IC) and normalized iodine concentration (NIC) in dual phase, PD-L1 was negatively correlated with IC in dual phase and NIC in venous phase, and PD-L1 and PD-L1 CD8+ TIL co-expression were positively correlated with NIC (A/V) (all $P < 0.05$). 31 patients with ERP and 39 patients with NERP in NSCLC receiving postoperative adjuvant chemotherapy. IC and NIC in venous phase, and IC (A/V) differed between the ERP and NERP groups ($P < 0.05$). Multivariable analysis revealed that PD-L1 CD8+ TIL co-expression and IC (A/V) were independently associated with ERP, and were used to construct a nomogram. The AUC of combined model were 0.82 (95%CI: 0.72~0.91). The sensitivity and specificity were 0.97 and 0.64, respectively.

**CONCLUSION**

Spectral CT parameters provided a promising way to predict the immune cell of NSCLC and to infer clinical outcomes for patients who had been treated with postoperative adjuvant chemotherapy. The nomogram is helpful to predict ERP for patients who are candidates for postoperative adjuvant chemotherapy.

**CLINICAL RELEVANCE/APPLICATION**

The nomogram is helpful to predict ERP for patients who are candidates for postoperative adjuvant chemotherapy, which can assist in clinical preoperative decision-making and patient risk stratification.

## S4-SSCH02-4 EXPLORING THE DIAGNOSTIC VALUE OF VIRTUAL CALCIUM IMAGING FROM LOW-DOSE CHEST CT USING PHOTON-COUNTING DETECTOR CT FOR UPPER LUMBAR VERTEBRAL OSTEOPOROSIS

QING ZHANG (*Abstract Co-Author*) Nothing to Disclose
Dong Sheng Jin (*Abstract Co-Author*) Nothing to Disclose
Ji Liang Chen (*Abstract Co-Author*) Nothing to Disclose
Bei Chen (*Abstract Co-Author*) Nothing to Disclose
Song Luo (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the feasibility and accuracy of virtual calcium imaging (VCI) from low-dose chest CT(LDCT)with photon-counting detector CT (PCD-CT) for diagnosing upper lumbar vertebral osteoporosis (OP).

**METHODS AND MATERIALS**

A prospective collection of patients who underwent both low-dose chest CT with photon-counting CT and dual-energy X-ray absorptiometry (DXA) examinations from January to April 2024 was conducted. LDCT scan range covered the thoracic inlet to L2. VCI was generated by adjusting the dual-energy liverVNC parameters to the ratio of calcium (1.55@120kV). Two readers independently measured virtual calcium CT values (CM), calcium density values (CaD), virtual monoenergetic 70keV CT values (ME70), virtual non-contrast (VNC) and fat percentage (Fat), and at three levels in the mid-coronal plane of the lumbar vertebrae. Intra-class correlation coefficient (ICC) assessed inter-reader agreement. Spearman correlation coefficients evaluated the correlation between PCD-CT measurements and DXA-derived BMD and T-scores. Receiver operating characteristic (ROC) curves analyzed the diagnostic performance of VCI parameters for OP.

**RESULTS**

Exclusions were based on specific criteria, 63 patients participated, with 26 males (average age: 73±9 years). The mean CTDIvol was 1.01 mGy, and the mean DLP was 38.15 mGy·cm, the mean of effective dose (ED) was 0.53mSv. High inter-reader agreement was observed (ICC:0.91-0.95). The medians and percentiles of CM, CaD, and ME70 were 143.20 (121.78, 176.79), 5.00 (4.35, 6.29), and 124.83 (92.46, 150.46), respectively. CM, CaD, and ME70 values significantly correlated with BMD ($r=0.704$, 0.719, 0.667, respectively; all $p<0.01$) and T-scores ($r=0.751$, 0.836, 0.719, respectively; all $p<0.01$). For CM=133.13HU, CaD=4.93mg/cm³, and ME70=109.4HU, the areas under the curve were 0.872, 0.844, and 0.841, with sensitivities of 83.87%, 100%, 83.87%, and specificities of 79.49%, 67.86%, 76.92%, respectively.

**CONCLUSION**

VCI from low-dose chest PCD-CT accurately assesses upper lumbar vertebral bone density, offering a potential additional screening tool for osteoporosis during routine lung disease screening.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrates the feasibility and promising diagnostic accuracy of VCI using low-dose chest PCD-CT for osteoporosis assessment, potentially offering a valuable tool for early osteoporosis detection and intervention.

## S4-SSCH02-5 SPECTRAL CT FOR PRECISE NEEDLE BIOPSY PLANNING IN LUNG CANCER WITH OBSTRUCTIVE LESION

Yaqiong Ma (*Abstract Co-Author*) Nothing to Disclose
Xiaoyue Zhang (*Abstract Co-Author*) Nothing to Disclose
Yongkun Zheng (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to utilize spectral parameters derived from dual-layer spectral detector computed tomography (SDCT) to precisely identify regions for lung cancer biopsy in cases with obstructive lesions. It ensured that the most effective tissue samples can be obtained for biomarker testing.

**METHODS AND MATERIALS**

This prospective study enrolled 40 patients with suspected lung cancer with obstructive lesions who decided to undergo lung biopsy and then another 15 patients were recruited to verify the accuracy of main body tumor. Initially, each patient underwent contrast-enhanced spectral chest CT. Subsequently, the suspected lung cancer tissue and suspected obstructive lesion area were delineated before biopsy according to spectral CT multi-parameter images. Then two biopsies were performed respectively. The samples of different areas were fixed in different bottles for hematoxylin-eosin staining and immune histochemical detection. Pathologists, blinded to the study, evaluated and recorded the percentages of tumor cells in the biopsy samples. Samples were categorized into main body tumor (= 20% tumor cells) and obstructive lesion (< 20% tumor cells) groups. The performance of spectral parameters in distinguishing between tumors and surrounding obstructive lesion areas were analyzed. The cutoff value of optimal spectral parameter was used to prospectively guide the biopsy of the tumors in 15 cases for further validation, and then the accuracy was calculated.

**RESULTS**

Spectral parameters demonstrated superior performance over conventional CT in identifying tumors (all $p < 0.05$). Specifically, iodine density in the arterial phase, with a cutoff value of 1.44 mg/mL, exhibited good performance (specificity: 93.70%) in identifying tumors. It was applied to 15 cases for validation, and the accuracy rate was 100 %.

**CONCLUSION**

Spectral parameters are effective in distinguishing between lung cancer tumors and surrounding obstructive lesions, so as to ensure the acquisition of optimal tissue specimens for biomarker detection.

**CLINICAL RELEVANCE/APPLICATION**

The findings suggest that spectral parameters are helpful to identify between lung cancer and its surrounding obstructive lesions, and have potential clinical application value in the preoperative planning of lung cancer needle biopsy complicated with obstructive lesions.

## S4-SSCH02-6 EXPLORATION OF THE DIAGNOSTIC VALUE OF ENERGY SPECTRAL CT TECHNOLOGY BASED ON IRON EXTRACTION IN THE IMAGING DIAGNOSIS OF ARC-WELDERS' PNEUMOCONIOSIS

Li Xin Lu (*Abstract Co-Author*) Nothing to Disclose
Yuan Ou (*Abstract Co-Author*) Nothing to Disclose
Min Xue Wang (*Abstract Co-Author*) Nothing to Disclose
Weiling Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the value of iron extraction by spectral CT in the imaging diagnosis of arc-welders' pneumoconiosis (AWP).

**METHODS AND MATERIALS**

This study prospectively recruited 57 subjects and divided into three groups: Group A (n=24, healthy people with no history of dust-related occupational history), Group B (n=21, welder's occupational history of more than 5 years), Group C (n=12, no welder's occupational history, chest CT showed similar imaging findings of AWP: diffuse centrilobular ground-glass nodules in both lungs).Chest energy spectrum CT scans in all three groups and the whole lung extraction was performed by thresholdeffect, and lung_volume and 70kev_CT values were measured at the same time.The mean values of Fe2O3 (Water), Water (Fe2O3) and Z Effective were obtained by substrate material separation technology. The receiver operating characteristic (ROC) curve of the subjects determined the optimal cut-off value of the corresponding AWP index, and judged its sensitivity and specificity.

**RESULTS**

The mean value of Fe2O3 in Group B was significantly higher than that in the other two groups, and there was a statistical difference ($P<0.05$). There were no statistically significant differences($P>0.05$) in the mean of Water, Z Effective, 70kev_CT values and lung_volume among the groups. The results of pairwise comparison between groups showed that there were statistically significant differences in the mean values of Fe2O3 between Group A and Group B, Group B and Group C ($P<0.05$), and there was no significant difference in the mean values of Fe2O3 between Group A and Group C ($P=1.000$). The area under the curve (AUC) of the mean Fe2O3 between Group B and Group C was 0.815, the associated criterion was 0.777, the sensitivity was 57.14%, and the specificity was 91.67%. The AUC value of Fe2O3 between Group A and Group B was 0.893, the associated criterion was 0.664, the sensitivity was 76.19%, and the specificity was 100.00%.

**CONCLUSION**

The mean value of Fe2O3 in the whole lung of the welder's occupational population was significantly higher than the non-occupational population, and it was highly specific, which had certain diagnostic value for AWP.

**CLINICAL RELEVANCE/APPLICATION**

The diagnosis of AWP must rely on the comprehensive diagnosis of clinical-imaging-pathology, among which the imaging diagnosis mainly depends on the CT features, and it is difficult to distinguish under similar imaging findings . The high specificity of the mean Fe2O3 in the whole lung of energy spectrum CT can play a certain role in the differential diagnosis of diseases.

# Abstract Archives of the RSNA, 2024

S4-SSIN01

**Imaging Informatics (Cutting Edge Radiomics Research)**

Sunday, Dec. 1 1:00PM - 2:00PM Room: E450B

Okan Ince, MD (*Moderator*) Nothing to Disclose
Steven A. Rothenberg, MD (*Moderator*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC

**Sub-Events**

## S4-SSIN01-1 THE POTENTIAL OF GPT-4 ADVANCED DATA ANALYSIS (ADA) FOR RADIOMICS-BASED MACHINE LEARNING MODELS

Gianluca Brugnara, MD (*Abstract Co-Author*) Nothing to Disclose
Aditya Rastogi (*Abstract Co-Author*) Nothing to Disclose
Philipp Vollmuth, MD,MBA (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Wick (*Abstract Co-Author*) Nothing to Disclose
Marianne Schell, MD (*Abstract Co-Author*) Nothing to Disclose
Mustafa Ahmed Mahmutoglu (*Abstract Co-Author*) Nothing to Disclose
Martin Bendszus (*Abstract Co-Author*) Nothing to Disclose
Felix Sahm (*Abstract Co-Author*) Nothing to Disclose
Jaeyoung Cho (*Abstract Co-Author*) Nothing to Disclose
Martha Foltyn-Dumitru, MD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

This study explores the potential of GPT-4 a large language model (LLM), with its Advanced Data Analytics (ADA) capability, to autonomously develop machine learning (ML) models for classifying glioma types based on radiomic features extracted from preoperative MRI scans.

### METHODS AND MATERIALS

MRI data from n=615 newly diagnosed glioma patients were classified by IDH and 1p/19q status for multiclass classification and split into an 80/20 training/testing ratio. Radiomic features were extracted from these scans. External validation used glioma datasets from UCSF (n=410) and TCGA (n=160). We utilized ADA within GPT-4 to develop modeling strategies autonomously, construct an ML model, and benchmark performance against an established hand-crafted model. The effectiveness of these models was evaluated using various normalization methods (N4, Z-score, WhiteStripe) to compare the accuracy and consistency of GPT-4's outcomes with established benchmarks.

### RESULTS

The highest accuracy of 0.820 (95% CI=0.819-0.821) was achieved by a GPT-4 model in the UCSF dataset with N4/WS normalization, significantly outperforming the benchmark model's accuracy of 0.678 (95% CI=0.677-0.680) ($p<0.001$). A class-wise analysis revealed performance variations between different glioma types. In the IDH-wt group, the GPT-4 model achieved a high recall of 0.997 (95% CI=0.997-0.997), substantially surpassing the benchmark model's recall of 0.742 (95% CI=0.740-0.743). For the IDH-mut 1p/19q-non-codel group, the GPT-4 model had a recall of 0.275 (95% CI=0.272-0.279), which was lower than the benchmark's recall of 0.426 (95% CI=0.423-0.430). In the IDH-mut 1p/19q-codel group, the GPT-4's recall was 0.199 (95% CI=0.191-0.206), below the benchmark's recall of 0.730 (95% CI=0.721-0.738). In contrast to the UCSF dataset, the accuracy of GPT-4 on the TCGA dataset was significantly lower ($p<0.001$) than the benchmark model's accuracy, e.g. with N4/WS normalization GPT-4 achieved an accuracy of 0. 0.668 (95% CI=0.666-0.671) as compared to 0.719 (95% CI=0.717-0.722) for the benchmark model ($p<0.001$) with class-wise analysis revealing the same pattern as observed in UCSF.

### CONCLUSION

GPT-4 can develop radiomics-based ML models comparable to handcrafted ones without an expert data scientist, but its poorer class-wise performance due to unbalanced datasets shows limitations in handling complete end-to-end ML pipelines.

### CLINICAL RELEVANCE/APPLICATION

This study shows that LLM like GPT-4 can develop radiomics-based ML models with performance comparable to handcrafted benchmarks, thus bridging the gap between ML developers and clinicians. However, GPT-4 models still require human fine-tuning to optimize their effectiveness in real-world settings.

## S4-SSIN01-2 PROSTATE CANCER AND RADIOMICS FOR AGGRESSIVENESS CLASSIFICATION - INFLUENCE OF SEGMENTATION MASK, MRI SEQUENCE, AND MRI VENDOR

Carlos Bilreiro, MD (*Abstract Co-Author*) Nothing to Disclose
Ines Domingues (*Abstract Co-Author*) Nothing to Disclose
Manolis Tsiknakis (*Abstract Co-Author*) Nothing to Disclose
Raquel A. Moreno, MD (*Abstract Co-Author*) Nothing to Disclose

Ana Mascarenhas Gaivao (*Abstract Co-Author*) Nothing to Disclose
Daniele Regge, MD (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Ines A. Santiago, MD (*Abstract Co-Author*) Nothing to Disclose
Sara M. Beliao, MD (*Abstract Co-Author*) Nothing to Disclose
Kostas Marias, PhD (*Abstract Co-Author*) Nothing to Disclose
Nuno Rodrigues (*Abstract Co-Author*) Nothing to Disclose
Jose Almeida (*Abstract Co-Author*) Nothing to Disclose
Joana Ip, MD (*Abstract Co-Author*) Nothing to Disclose
Nickolas Papanikolaou, PhD (*Abstract Co-Author*) Stockholder, MRIcons Ltd;Stockholder, Advantis Medical Imaging
Ana Carolina Rodrigues, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

In recent years, interest has grown in employing artificial intelligence and radiomics for stratifying the aggressiveness of prostate cancer using magnetic resonance imaging. However, methodological guidelines are unclear: whether AI models should be trained on multi- or single-vendor data, individual or all bpMRI sequences, or if radiomic features should be calculated on the index lesion or entire gland. The latter approach is less common in the literature, despite the multifocal nature of prostate cancer.

**METHODS AND MATERIALS**

The ProstateNet dataset (5649 patients from 13 institutions, 9 countries and 3 MRI vendors), was employed to develop bpMRI radiomics models to assess Prostate Cancer aggressiveness (N=4983 for training, N=200 for testing, N=466 for prospective validation). Three definitions of aggressiveness were considered: (A) ISUP=1 vs ISUPgt;1, (B) ISUP=2 vs ISUPgt;2, and (C) ISUP=3 vs ISUPgt;3. Radiomic features were extracted from automatically segmented lesions and whole glands. Machine learning models were trained on various combinations: all or specific vendors (Siemens, Philips, GE), all or individual bpMRI sequences (T2, DWI, ADC), and with/without clinical variables (PSA, age, PI-RADS, index lesion location). The chosen models were validated prospectively and assessed for explainability and fairness in different subgroups (age, MRI vendor, endorectal coil).

**RESULTS**

In all target definitions, whole gland radiomics outperformed lesion radiomics, which were less prone to generalize prospectively. Models utilizing all bpMRI sequences yielded better results than those trained on individual sequences for definitions (A) and (C). However, DWI-based models exhibited the best performance for definition (B), albeit with reduced prospective generalization. In general, models developed using heterogeneous data (encompassing all vendors) surpassed vendor-specific models. Models relying solely on radiomic features produced the best results for definitions (A) and (C), whereas the incorporation of clinical variables led to the best outcomes for definition (B). Fairness assessments revealed comparable sensitivities among vendors, but consistently higher specificities for Philips. Specificity declined with age, and performance deteriorated for studies employing endorectal coils.

**CONCLUSION**

Large heterogeneous datasets are essential for prospective generalization. Whole-gland radiomics has higher predictive power and results in less overfitting than lesion-radiomics.

**CLINICAL RELEVANCE/APPLICATION**

It is uncommon to find studies with large datasets, prospective validation, and assessing the model performance on data subgroups. These are essential to a positive clinical translation of AI models.

## S4-SSIN01-3 A NOMOGRAM COMBINING CLINICAL INFORMATION, IMAGING FEATURES AND DECT IODINE MAP-BASED RADIOMICS FROM MULTI-REGIONS FOR PREOPERATIVE PREDICTION OF AXILLARY LYMPH NODE METASTASIS

Lin Lin, MBBS (*Abstract Co-Author*) Nothing to Disclose
Suping Chen (*Abstract Co-Author*) Nothing to Disclose
Fang Zeng, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the value of an integrated nomogram using clinical parameters, CT and ultrasonography (US) features of axillary lymph node (ALN), dual-energy CT based iodine map radiomics extracted from multi-regions to preoperatively predict ALN metastasis (ALNM) in clinical T1/2 stage breast cancers.

**METHODS AND MATERIALS**

This study enrolled 197 patients with breast cancer who underwent preoperative contrast-enhanced DECT from March 2021 to May 2022. The patients were randomly divided into training (n=139) and testing cohorts (n=58). Radiomics features were extracted from iodine map in the venous phase from three regions of interest (ROIs): ALN, tumoral region and peritumoral region (2.5 mm around the tumor). Clinical information, CT and US parameters were recorded and evaluated. Eight models were built: 1) A clinical model; 2) CT ALN features-based model; 3) US ALN features-based model; 4) tumor-based iodine-mapping radiomic model; 5) peritumor-based iodine-mapping radiomic model; 6) ALN-based iodine-mapping radiomic model; 7) combined radiomics model integrating 4) and 6); 8) integrative nomogram combing 1), 2), 3) and 7). Their ALNM prediction performances and clinical usefulness were assessed and compared.

**RESULTS**

The radiomic signatures using the features of ALN, tumor, peritumoral and muti-ROIs showed good or moderate abilities in predicting ALNM with AUC of 0.860, 0.709, 0.747 and 0.890 in the training cohort, and 0.860, 0.676, 0.663, and 0.890 in the test cohort, respectively. An integrated nomogram with clinical parameters, ALN features from CT and US, and radiomic features increased the discriminatory ability with AUC of 0.923 in the training cohort and 0.914 in the test cohort. The nomogram also showed good calibration and clinical usefulness.

**CONCLUSION**

A nomogram combining clinical information, DECT- and US- reported ALN features, and iodine map-derived radiomic features from both primary breast tumor and ALNs can be used to improve the preoperative prediction of ALN status non-invasively.

**CLINICAL RELEVANCE/APPLICATION**

The nomogram model can be used to preoperatively predict ALN status non-invasively, and could be a powerful and individualized tool to assist clinicians in personalized therapeutic regimen selections for patients with early-stage breast cancers.

**S4-SSIN01-4** Kun Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Jinling Wang, MMEd (*Presenter*) Nothing to Disclose

## UTILIZING AI TO PREDICT OSTEOPOROSIS AND OSTEOPENIA: A FUSION OF DEEP TRANSFER LEARNING AND CLASSICAL RADIOMICS FROM SINGLE-SOURCE DUAL-ENERGY CT IMAGING

### PURPOSE

To develop and validate a predictive model for osteoporosis and osteopenia prediction by fusing deep transfer learning (DTL) features and classical radiomics features based on single-source dual-energy computed tomography (CT) virtual monochromatic imaging.

### METHODS AND MATERIALS

A total of 606 lumbar vertebrae with dual-energy CT imaging and quantitative computed tomography (QCT) evaluation were included in the retrospective study and randomly divided into the training (n=424) and validation (n=182) cohorts. Radiomics features and DTL features were extracted from 70-keV monochromatic CT images, followed by feature selection and model construction, radiomics and DTL features models were established. Then, we integrated the selected two types of features into a features fusion model. We developed a two-level classifier for the hierarchical pairwise classification of each vertebra. All the vertebrae were first classified into osteoporosis and non-osteoporosis groups, then non-osteoporosis group was classified into osteopenia and normal groups. QCT was used as reference. The predictive performance and clinical usefulness of three models were evaluated and compared.

### RESULTS

The area under the curve (AUC) of the features fusion, radiomics and DTL models for the classification between osteoporosis and non-osteoporosis were 0.981, 0.999, 0.997 in the training cohort and 0.979, 0.943, 0.848 in the validation cohort. Furthermore, the AUCs of the abovementioned models for the differentiation between osteopenia and normal were 0.994, 0.971, 0.996 in the training cohort and 0.990, 0.968, 0.908 in the validation cohort. The overall accuracy of the abovementioned models for two-level classifications was 0.979, 0.955, 0.908 in the training cohort and 0.918, 0.885, 0.841 in the validation cohort. Decision curve analysis (DCA) showed that all models had high clinical value.

### CONCLUSION

The feature fusion model can be used for osteoporosis and osteopenia prediction with improved predictive ability over a radiomics model or a DTL model alone.

### CLINICAL RELEVANCE/APPLICATION

With the aging population of society, osteoporosis and osteoporosis-related fractures are leading causes of morbidity and mortality in the elderly. Our approach combines radiomics features with deep transfer learning features based on virtual monochromatic spectral images generated from single-source dual-energy CT, and uses QCT as a reference standard to perform two-level osteoporosis and osteopenia prediction, shedding lights onto a class of bone mineral density (BMD)-related diagnosis methods without the need for QCT or a dedicated phantom.

## S4-SSIN01-5 PREOPERATIVE PREDICTION OF ADHERENT PERINEPHRIC FAT USING CT RADIOMICS COMBINED WITH DEEP LEARNING:A PROSPECTIVE, MULTICENTER STUDY

Xu Li (*Abstract Co-Author*) Nothing to Disclose
Hongcheng Liu (*Abstract Co-Author*) Nothing to Disclose
Mingshuang Lu (*Abstract Co-Author*) Nothing to Disclose
Da Yong Jin (*Abstract Co-Author*) Nothing to Disclose
Mingyang Li (*Abstract Co-Author*) Nothing to Disclose
Xiaobo Ding, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Developing and validating CT radiomics features to preoperatively identify APF, indirectly estimating the surgical complexity of renal tumor patients, and validating the performance of the model in an independent cohort.

### METHODS AND MATERIALS

Renal tumor patients who underwent surgical treatment in a domestic medical institution from December 2020 to May 2023 were retrospectively collected, and randomly divided into cross-validation set and internal test set in a ratio of 7:3. Kidney tumor patients who underwent surgical treatment in three other domestic medical institutions from June to September 2023 were prospectively collected as an external test set. Perirenal 5mm fat was covered by deep learning-based automated kidney segmentation and manual delineation of the 3D-Unet on each part of noncontrast-enhanced CT images. Features are reduced and selected using ANOVA and minimum absolute value convergence and selection operator algorithm. Subsequently, radiomics, clinical and fusion models were established using Logistic regression. Finally, the intra-and inter-observer reproducibility of renal segmentation was measured by the Dice similarity coefficient. The diagnostic efficiency of the model was assessed by the receiver operating characteristic curve and the area under the curve.

### RESULTS

A total of 460 patients with renal tumors (mean [SD] age, 60.1 [8.7] years) were included and analyzed. Both the intra-and interobserver dice similarity coefficient were greater than 0.80. Twenty-eight imaging omic features and three clinical features were selected for modeling. In the training, validation, cross-validation, internal test, and external test sets, radiomics models showed high efficacy in distinguishing adherent and non-adherent renal fat, with area under the curve (AUC) of 0.95 (95% CI,0.94-0.97), 0.91 (95% CI,0.87-0.94), 0.951 (95% CI,0.925-0.977), 0.867 (95% CI,0.798-0.935), and 0.802 (95% CI,0.672-0.933), respectively.

### CONCLUSION

The radiomics model constructed based on perinephric fat radiomics features derived from CT showed high diagnostic efficacy for discrimination of adherent perinephric fat from non-adherent perinephric fat.

### CLINICAL RELEVANCE/APPLICATION

The status of perinephric fat significantly impacts the complexity of renal tumor surgery. Currently, clinical practice heavily relies on subjective high-image scoring for estimation, which has limited accuracy and repeatability in assessment. There is a lack of objective methods to assess the presence of adherent perinephric fat (APF) preoperatively.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

S4-SSMK01

**Musculoskeletal Imaging (Ankle and Foot, Orthopedic Implants, Outcomes and Comparative Effectiveness)**

Sunday, Dec. 1 1:00PM - 2:00PM Room: E450A

Lauren M. Ladd, MD (*Moderator*) Nothing to Disclose
Karen C. Chen, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S4-SSMK01-2 MRI EVALUATION OF PACINIAN CORPUSCLE NUMBER AND DISTRIBUTION IN THE FOREFOOT IN DIABETIC SENSORIMOTOR POLYNEUROPATHY

Michele Hubli (*Abstract Co-Author*) Nothing to Disclose
Reto Sutter, MD (*Abstract Co-Author*) Nothing to Disclose
Adrian Marth, MD (*Abstract Co-Author*) Nothing to Disclose
Georg Feuerriegel, MD (*Abstract Co-Author*) Nothing to Disclose
Felix Waibel (*Abstract Co-Author*) Nothing to Disclose
Sophia Goller, MD, MBA (*Presenter*) Nothing to Disclose

### PURPOSE

Pacinian corpuscles (PC) can be visualized with MRI. However, pathologic changes of these cutaneous mechanoreceptors in diabetic sensorimotor polyneuropathy (DSP) remain to be explored. The purpose of this study was to evaluate PC number, size, and distribution in the feet of type 2 diabetes mellitus (DM)-derived DSP compared to healthy volunteers with MRI.

### METHODS AND MATERIALS

This was a combined retro- and prospective single-center study on 16 DSP patients (mean age 67.4 ± 9.9 years, 11 males) who underwent clinical routine forefoot MRI and on 16 gender- and age-matched healthy subjects who underwent a 3T MRI forefoot examination. Two radiologists rated MR examinations concerning PC number and distribution. Correlations between PC number and duration of DM, as well as HbA1c values, were assessed.

### RESULTS

Quantitative analysis revealed the highest number of PC at the plantar side of the metatarsophalangeal (MTP) joints and proximal phalanges in both DSP patients and healthy subjects. In DSP patients, the total number of PC on the forefoot was significantly reduced compared to healthy subjects (85.8 ± 42.5 vs. 267.4 ± 48.7, P<.001), which was also true for each individual digit ray. In DSP patients, the maximum diameter of PC was 3 mm (1-3 mm), while that of healthy subjects was 5 mm (1-5 mm). In contrast to the typically “chain-like” configured PC in healthy subjects, their arrangement in DSP patients was heterogeneous and showed a more isolated PC pattern. In the DSP cohort, the mean duration of DM was 234.8 ± 130.4 months, while the mean HbA1c was 7.6 ± 1.1 %. There was no significant correlation between the number of PC and DM duration and HbA1c values, respectively.

### CONCLUSION

Compared to healthy subjects, DSP patients had significantly reduced numbers of PC in the forefoot, which were smaller in maximum size and showed a disturbed arrangement with a lack of the "chain-like" configuration typically seen in healthy subjects.

### CLINICAL RELEVANCE/APPLICATION

These results might open up the possibility of using MRI as a non-invasive diagnostic tool for assessing patients with DSP.

## S4-SSMK01-3 OPPORTUNISTIC CT-DERIVED ASSESSMENT OF FATTY MUSCLE FRACTION PREDICTS OUTCOME IN PATIENTS UNDERGOING MITRACLIP

Ulrike I. Attenberger, MD (*Abstract Co-Author*) Consultant, Bayer AG
Daniel Kuetting, MD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Nowak, PhD (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Alexander Isaak, MD (*Abstract Co-Author*) Nothing to Disclose
Alois M. Sprinkart, PhD (*Abstract Co-Author*) Nothing to Disclose
Maike Theis, MSc (*Abstract Co-Author*) Nothing to Disclose
Leon Bischoff, MD (*Abstract Co-Author*) Nothing to Disclose
Babak Salam, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Sarcopenia is strongly interrelated with frailty, which is considered a major risk factor for poor outcomes in patients undergoing MitraClip. This study aimed to investigate the prognostic value of fatty muscle fraction (FMF), measured from routine preinterventional CT, as an objective surrogate for frailty

in patients undergoing MitraClip for treatment of recurrent mitral regurgitation.

**METHODS AND MATERIALS**

Consecutive patients undergoing MitraClip between February 2011 and November 2022 at the Heart Center Bonn were retrospectively evaluated. Based on pre-interventional CT scans, skeletal muscle area at the L3/L4 level was determined using densitometric threshold values. Subsequently, skeletal muscle area was subdivided into regions of fatty and lean muscle, and FMF was calculated.

**RESULTS**

A total of 196 patients (mean age: 78.3±8.0 years, mean EuroSCORE II: 5.1±3.8%) were investigated. 1-year survivors had a significantly lower FMF compared to non-survivors (49.5±13.5% vs. 58.9±14.2%, P<0.001). According to their FMF values, patients were divided into tertiles and were defined to have low (<44.42 %), medium (44.42-56.69 %), and high FMF (>56.69%), respectively. Following MitraClip, high FMF was related to increased 30-day (1.5% vs. 6.1% vs. 15.4%, P=0.010), 1-year (6.7% vs. 19.7% vs. 29.2%, P=0.007), 2-year (12.3% vs. 22.7% vs. 35.4%; P=0.008), and 3-year mortality (13.8% vs. 22.7% vs. 36.9%; P=0.008). On multivariate Cox regression analysis, FMF (Hazard Ratio 1.05 [95% Confidence Interval: 1.02-1.08]; P<0.001), as well as age (HR 0.93 [95% CI: 0.89-0.98]; P=0.004) and male sex (HR 3.10 [95% CI: 1.28-7.51]; P=0.012) were identified as independent predictors of 1-year mortality.

**CONCLUSION**

Our results indicate CT-derived FMF as a potentially new frailty marker, which provides additional information for risk stratification in MitraClip patients. Future studies should explore the clinical value of FMF compared with other frailty markers and the prognostic role of FMF for other cardiovascular and oncologic diseases.

**CLINICAL RELEVANCE/APPLICATION**

FMF from preinterventional CT emerges as a novel frailty marker, aiding risk assessment in MitraClip patients, thus enhancing prognostic insights for better clinical management of recurrent mitral regurgitation.

## S4-SSMK01-4 TRAJECTORIES OF ABDOMINAL CT MEASUREMENTS OF BODY COMPOSITION AND ASSOCIATION WITH POST-KIDNEY TRANSPLANTATION OUTCOMES

Clifford R. Weiss, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Siemens AG;Research Grant, Boston Scientific Corporation;Consultant, Boston Scientific Corporation;Research Grant, Medtronic plc;Consultant, Medtronic plc;Research Grant, Guerbet SA;Consultant, Guerbet SA
Dorry Segev, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Omid Shafaat, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Early post-kidney transplantation (KT) changes likely impact body composition and susceptibility to aging. With CT as a more comprehensive measurement for body composition compared with BMI, the goal of this study was to estimate the post-KT trajectories of CT-based body composition and quantify associated risks of mortality and death-censored graft loss (DCGL).

**METHODS AND MATERIALS**

We leveraged a prospective cohort of adult KT recipients (n=301) from 12/2008 to 2/2020 who underwent abdominal CT scans during 1-year pre-KT to KT admission. Body composition measurements were obtained including skeletal muscle index (SMI) for muscle quantity and skeletal muscle radiation attenuation (SM-RA) for muscle quality using OsiriX software by manual segmentation; lower values of SMI and SM-RA indicate worse muscle quantity and quality. We used mixed linear regression models to estimate the post-KT trajectories of SMI and SM-RA, as well as Cox proportional hazards models to quantify the association between time-varying CT-based body composition measures and post-KT mortality and DCGL, respectively.

**RESULTS**

The mean SMI at KT was 47.9 cm2/m2 (SD=10.4) and mean SM-RA at KT was 31.8 Hounsfield units (HU) (SD=8.1). After KT, muscle quantity (SMI:-1.5 cm2/m2/year) and quality (SM-RA:-1.1 HU/year) decreased over time. Overall, lower muscle quantity (SMI) was not associated with the risks of post-KT outcomes. However, the association was modified by frailty (p-interaction=0.044) and age (p-interaction=0.016). Among frail KT recipients, lower muscle quantity (SMI) was associated with increased risk of mortality (aHR: 1.07, 95%CI=1.01-1.14, per 1 unit), while there was no association among non-frail recipients. In KT recipients =65 years, lower muscle quantity (SMI) was associated with elevated risk of DCGL (aHR: 1.10, 95%CI=1.00-1.22, per 1 unit), while there was no association among those <65 years. After adjustment, lower muscle quality (SM-RA) was associated with elevated risks of mortality (aHR: 1.08, 95%CI=1.05-1.1,2 per 1 unit) and DCGL (aHR: 1.07, 95%CI=1.02-1.12, per 1 unit). The association of muscle quality (SM-RA) did not differ by other factors.

**CONCLUSION**

Muscle quality is stronger as a risk factor for KT outcomes than muscle quantity. With the development of artificial intelligence, pre-existing CT measurements may be a convenient and valuable tool for risk stratification among KT recipients, particularly in older and frail recipients.

**CLINICAL RELEVANCE/APPLICATION**

Tracking muscle quality and quantity post-kidney transplant is crucial for predicting patient outcomes. CT-based metrics can identify high-risk individuals, allowing for targeted interventions that improve long-term survival and graft success in transplant recipients.

## S4-SSMK01-5 CORRELATION BETWEEN SKELETAL MUSCLE AND FATTY DEGREE OF L3 VERTEBRAL BODY AND BONE MINERAL DENSITYIN PATIENTS WITH CHRONIC KIDNEY DISEASE BASED ON ENERGY SPECTRUM CT

Hua He, MMedSc (*Presenter*) Nothing to Disclose

**PURPOSE**

The risk of osteoporosis in patients with chronic kidney disease (CKD) with sarcopenia is significantly higher than that in normal people. Therefore, this study is based on energy spectrum CT to explore the correlation between skeletal muscle and fatty degree of L3 vertebral body and bone mineral density (BMD) in patients with chronic kidney disease.

**METHODS AND MATERIALS**

GSI scanning mode combined with 40% ASiR-V, automatic modulated tube current (Smart mAs) were used in 42 patients with CKD. ?Using GSI Viewer software, the images of HAP (FAT)-based material pairs were reconstructed from 0.625mm thick images, and the Region of interest (ROI) was placed in the middle layer of L3 vertebral body. The HAP concentration in L3 vertebral body was recorded, and divided into osteoporosis group and non-

osteoporosis group with the boundary value of 116.16 mg/cm3. ?Using "X Section" software, the edges of skeletal muscle and adipose tissue were manually delineated on the cross-sectional images of the transverse process of L3 vertebral body. The CT values of skeletal muscle and adipose tissue were set in the ranges of-29 ~ 150HU and-190 ~-30HU. The software automatically calculated the area and average CT values of the corresponding tissues in the delineated ranges. Record the skeletal muscle area of L3 Vertebral Plane (L3 SMA), fat area of skeletal muscle space, and calculated the skeletal muscle index (L3SMI=L3 SMA/[height (m)] 2. Independent sample T test was used to compare L3SMI and intermuscular fat between the two groups. Pearson correlation analysis was used to compare the correlation between L3SMI, intermuscular fat and HAP concentration in L3 vertebral body.

**RESULTS**

The intermuscular fat(18.52±1.88)cm2 in osteoporosis group was significantly different from that in non-osteoporosis group(13.82±1.15)cm2($P<0.05$). The intermuscular fat was negatively correlated with HAP concentration in L3 vertebral body ($r=-0.263$, $P<0.05$), while L3SMI was positively correlated with HAP concentration in L3 vertebral body ($r=0.34$, $P<0.05$).

**CONCLUSION**

L3SMI and skeletal muscle space fat in patients with CKD are related to HAP concentration in L3 vertebral body, and skeletal muscle space fat in osteoporosis group is higher than that in non-osteoporosis group.

**CLINICAL RELEVANCE/APPLICATION**

Interventions aimed at reducing fracture risk in CKD patients should focus on reducing fat content and improving muscle quality to improve patients' quality of life.

## S4-SSMK01-6 METAL ARTIFACT REDUCTION MRI OF OSTEOSARCOMA LIMB SALVAGE SURGERY METALLIC ENDOPROSTHESES

Mingfei Xie, MMed (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess high-bandwidth (BW), slice encoding for metal artifact correction (SEMAC) and compressed sensing (CS)-SEMAC turbo spin echo techniques for metal artifact reduction MRI of osteosarcoma limb salvage surgery (LSS) metallic endoprostheses.

**METHODS AND MATERIALS**

Following institutional approval and consent, 39 subjects (29 men, 10 women; mean age, 22 years; age range, 8-68 years) with osteosarcoma LSS metallic endoprostheses underwent 1.5-T MRI prospectively. We compared high-BW, SEMAC and CS-SEMAC sequences with acquisition times of 3-4, 7-8 and 3-4 min, respectively. Outcome variables included bone-implant interfaces, image quality, periprosthetic structures, artifact size, and signal- and contrast-to-noise ratios (SNR and CNR) and abnormal findings. Statistical analysis included Friedman, repeated measures analysis of variances, and Cohen weighted k tests. Bonferroni-corrected p-values of 0.005 and less were considered statistically significant.

**RESULTS**

Metal artifact reduction and visibility of bone-implant interfaces, periprosthetic structures were very good and significantly better on both types of SEMAC than on high-BW images ($P < 0.005$). The implant artifact size was 5% to 11% larger on high-BW images when compared with SEMAC and CS-SEMAC images ($P < 0.005$). The SNRs of fat tissue, muscle tissue, tendon tissue, fluid and the CNRs of fluid and muscle, fluid and tendon as well as fat and muscle were significantly higher on SEMAC and CS-SEMAC images ($P < 0.005$, respectively). There was no statistical difference of outcome variables of SEMAC and CS-SEMAC images. CS-SEMAC was superior to high-BW in showing the periosteal reaction (50 % difference, $p=0.480$), fluid collection (56 % difference, $p=0.001$), soft tissues edema (19 % difference, $p=0.248$).

**CONCLUSION**

Compressed sensing acceleration of SEMAC is feasible for high-quality metal artifact reduction MRI of osteosarcoma LSS metallic endoprostheses and yields better quality and improves the diagnosis of abnormal findings than high-BW.

**CLINICAL RELEVANCE/APPLICATION**

Osteosarcoma is the most common primary malignancy of the bone. Limb salvage surgery (LSS) has become one of the standard treatment methods for patients with limb osteosarcoma, with 90% of patients undergoing LSS and a success rate of 60%-80%. However, complications and failures of metallic endoprostheses remain high compared to other arthroplasty procedures. CS-SEMAC provides superior metal artifact reduction capabilities and enables better visualization of peri-prosthetic bone and soft tissues, and thus improves the detection of complications. Early and accurate detection of complications is crucial to guide patient management and improve outcome.

# Abstract Archives of the RSNA, 2024

S4-SSMK02

**Musculoskeletal Imaging (Arthritis and Cartilage)**

Sunday, Dec. 1 1:00PM - 2:00PM Room: E353B

Mihra S. Taljanovic, MD, PhD (*Moderator*) Nothing to Disclose
Jorge A. Vidal, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S4-SSMK02-2 THE INFLUENCE OF EXTRAOSSEOUS VASCULAR LUMINAL DIAMETER ON THE DEVELOPMENT OF OSTEOCHONDRAL LESIONS OF THE TALAR DOME

Lercan Aslan (*Abstract Co-Author*) Nothing to Disclose
Gregory Waryasz (*Abstract Co-Author*) Nothing to Disclose
Cemil Gedik (*Abstract Co-Author*) Nothing to Disclose
Soheil Ashkani Esfahani, MD (*Abstract Co-Author*) Nothing to Disclose
Samir Ghandour, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the relationship between the luminal diameters of the posterior tibial artery (dPTA) and sinus tarsi artery (dSTA), and the incidence and characteristics of osteochondral lesions of the talar dome (OLT).

### METHODS AND MATERIALS

This retrospective study included 77 patients with OLT and 77 subjects with peroneal tendinitis as a matched control group (age range: 30-40 years). Using MRI, the dPTA was measured at 1 cm above the tibial plafond, the plafond, and at the level of the medial malleolar tip. Likewise, dSTA was measured at the level of the talar neck. The area, volume, depth, localization, and surgical intervention for OLT were recorded as well. Two observers performed the measurements separately, and interobserver reliability was evaluated using ICC.

### RESULTS

The OLT group had significantly smaller dPTA at all three levels (1.05±0.22mm, 0.99±0.18 mm, 0.98±0.31 mm, proximal to distal, respectively) compared to the control group (1.25±0.23mm, 1.20±0.22mm, 1.14±0.18 mm, respectively) (P<.001). The dSTA was also significantly lower in the OLT group as compared to the control group (0.5±0.11mm vs. 0.57±0.08 mm, respectively; P=.001). The mean dPTA (of all three levels) cutoff value for predicting the occurrence of OLT was 1.1 mm with 74% sensitivity and 75% specificity. A significant negative correlation was observed between OLT area and arterial diameters (P<.02). ICC between the two observers was excellent (0.95; P<.001).

### CONCLUSION

Smaller luminal dPTA and dSTA appear to be associated with a higher incidence of OLT, with defect size inversely correlated to arterial diameter. The determined cutoff values for dPTA may help clinicians identify high-risk patients who may develop OLT after an acute ankle injury. Further elucidation of these vascular abnormalities, particularly dPTA, might represent a prognostic factor and be used to predict disease progression and the likelihood of surgical success in OLT treatment.

### CLINICAL RELEVANCE/APPLICATION

Understanding the vascular contributions to OLT can enhance diagnostic accuracy and improve patient outcomes by identifying individuals at higher risk following ankle injuries, potentially guiding earlier and more tailored interventions that may prevent lesion incidence and progression.

## S4-SSMK02-4 THE DIFFERENCE BETWEEN POWER DOPPLER AND SUPERB MICROVASCULAR IMAGING IN THE ASSESSMENT OF RHEUMATOID ARTHRITIS AND OTHER ARTHROPATHIES

Alberto Paternain, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Del Nido Recio (*Abstract Co-Author*) Nothing to Disclose
Jesus D. Aquerreta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carmen Mbongo, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Rafael Lopez De La Torre Carretero (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Superb Microvascular imaging (SMI) has been proven to be a reliable Doppler technique and to have more sensitivity when detecting active synovitis, compared to Power (conventional) Doppler (PD). SMI upgrades Doppler activity in comparison to PD. This study aims to analyze whether the upgrade Doppler activity, when comparing SMI and PD, is significantly different in Rheumatoid Arthritis (RA), compared to other arthropathies.

## METHODS AND MATERIALS

Between May 2023 and April 2024, we prospectively analyzed a cohort of 57 joints of 21 different patients who underwent ultrasound exams at our center. Most of them were previously diagnosed with RA and other arthropathies, such as Osteoarthritis, Psoriatic Arthritis, Gout, etc. PD and SMI imaging were obtained in all joints and the individual grades for Doppler Activity were registered for each joint with active synovitis, raging from 0 to 3, according to the EULAR - OMERACT US Score (European League Against Rheumatism - Outcome Measure in Rheumatology):; Grade 0: no Doppler activity.; Grade 1: up to three single Doppler spots.; Grade 2: greater than Grade 1 but <50% of Doppler Signals in the total affected hypoechoic region.; Grade 3: >50% of Doppler signals in the affected region.Means of each grading for PD, SMI and the difference between PD and SMI were registered. Mann-Whitney U test was applied to calculate means in independent samples. Two-tailed p-values of $<0.05$ were considered statistically significant.

## RESULTS

21 joints of 8 patients with RA and 36 joints of 13 patients with other arthropathies were studied. Metacarpophalangical joints were the most frequently analyzed in the RA group (11), and interphalangeal joints were the most frequently analyzed in the other group (18). No statistically significant differences were found between the group with RA and the group with other arthropathies in terms of age (60.38 vs. 54.17 years, $p = 0.41$) or gender (5 women vs. 7 women, $p = 1$). When comparing Doppler activity, the mean PD was significantly higher in the RA group compared to the other group (1.14 vs. 0.75, $p = 0.043$). When upgrading the Doppler activity with SMI, we did not find statistically significant differences (2.52 vs 2.69, $p = 1.04$). Nevertheless, when comparing the mean of the difference between SMI and PD, it was significantly lower in the RA group (1.38 vs. 1.94, $p = 0.016$).

## CONCLUSION

Our results indicate that a higher upgrade between PD and SMI exams is more likely seen in arthropathies such as oligoarthritis, Psoriatic Arthritis or Gout, rather than in RA.

## CLINICAL RELEVANCE/APPLICATION

A higher difference between the PD and SMI grading could be used as a feasible technique to assess the diagnosis of an unknown arthropathy, considering the location of the affected joint and other clinical and systemic features.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

S4-SSNR01

**Science Session with Keynote: Neuroradiology (Brain: Anatomy, Developmental and Pediatrics)**

Sunday, Dec. 1 1:00PM - 2:00PM Room: S401

Elton B. Greene, MD (*Moderator*) Nothing to Disclose
Elizabeth Ryals, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S4-SSNR01-1 NEUROIMAGING CORRELATES OF THE MAIN COGNITIVE METRICS DERIVED FROM THE NIH TOOLBOX IN CHILDREN

Tal Zeevi (*Abstract Co-Author*) Nothing to Disclose
Pratheek Bobba, BS (*Abstract Co-Author*) Nothing to Disclose
Alicia Stephan (*Abstract Co-Author*) Nothing to Disclose
Ajay Malhotra, MD, MMM (*Abstract Co-Author*) Nothing to Disclose
Seyedmehdi Payabvash, MD (*Abstract Co-Author*) Nothing to Disclose
Hector Acosta Rodriguez, BS (*Presenter*) Nothing to Disclose

### PURPOSE

The NIH Toolbox is a comprehensive set of measures designed to assess cognitive, emotional, motor, and sensory functions across a wide age range. In this study, we investigated the microstructural, morphological, and functional connectivity correlates of NIH Toolbox cognitive scores using brain MRI in adolescents.

### METHODS AND MATERIALS

We obtained imaging, clinical, and cognitive information from the ABCD (Adolescent Brain Cognitive Development) database, which originally contained 11,868 subjects. Subjects with incomplete clinical information, a history of traumatic brain injury, a mental disorder, or those who failed MRI quality control were excluded. Mixed linear models, controlling for age and education and applying the False Discovery Rate to correct for multiple comparisons, were used to establish the association of the NIH Toolbox Fluid Cognition Composite Score with various neuroimaging metrics. These metrics included fractional anisotropy (FA), neurite density (ND), mean (MD), radial (RD), and axial (AD) diffusivity of white matter (WM) tracts, as well as cortical region thickness, surface areas, and functional network connectivity correlations from resting-state fMRI.

### RESULTS

We analyzed the information of 4,934 children with mean (± standard deviation) age of 9.9 (±0.6) years. Subjects with higher toolbox scores demonstrated significantly higher average FA and ND, most prominently in the left and right corticostriatal and corticostriatal parietal cortex WM tracts. Conversely, higher scores were associated with significantly lower average MD, RD, and AD, particularly in the inferior frontal superior frontal cortex WM tracts. Higher scores also correlated with reduced cortical thickness, especially in the left superior parietal region, and increased cortical surface area, predominantly in the right lateral orbitofrontal region. Lastly, higher cognitive scores were associated with greater positive connectivity between the Cingulo-parietal Network and Retrosplenial Temporal Network, and between the Sensorimotor Hand Network and Sensorimotor Mouth Network.

### CONCLUSION

The NIH Toolbox was developed as part of the NIH Blueprint for Neuroscience Research, to create a standardized set of brief, comprehensive assessments of neurological and behavioral functions. We showed the microstructural, morphological, and functional connectivity correlates of Fluid Cognition Composite Score derived from NIH-toolbox among children.

### CLINICAL RELEVANCE/APPLICATION

This study underscores the clinical relevance of using neuroimaging to identify cognitive performance in children based on widely used NIH-toolbox metrics. These insights can guide early therapeutic interventions and personalized educational strategies.

## S4-SSNR01-2 TRAJECTORIES OF BRAIN STRUCTURE AND FUNCTIONS IN NORMAL AGING

Yaqin Zhang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Di Wu (*Presenter*) Nothing to Disclose

### PURPOSE

The collaboration among components of the neurovascular unit plays a vital role in sustaining normal brain function. The evolution of the vascular function and oxygen metabolism indicating neural activity during normal aging remain underestimated. We examined the trajectories of brain structure, vascular and oxygen metabolic functions and evaluated the sex differences in order to understand normal aging and explore potential targets for study of pathological conditions.

### METHODS AND MATERIALS

Population 137 healthy subjects between 20~70 years old were enrolled with conventional MRI, structural 3D-T1WI, 3D-mGRE, and 3D-pCASL acquired by 3.0T MR scanner (Discovery MR750, GE Healthcare). Reconstruction The oxygen extraction fraction (OEF) maps were reconstructed based on QSM plus qBOLD model from 3D-mGRE data. The cerebral blood flow (CBF) maps were reconstructed through AW4.6 workstation from 3D-pCASL images. The cerebral metabolic rate of oxygen (CMRO2) maps were calculated as follows: CMRO2 = CBF· OEF · [H]a, [H]a = 7.377 μmol/mL. Segmentation 3D-T1WI images were segmented into global gray matter (GM), global white matter (WM), and cerebrospinal fluid. Statistical analysis The GM/WM volume was divided by total intracranial volume to generate relative GM/WM volume (rel_GM/rel_WM) for each subject. Sex differences in OEF, CBF, CMRO2, relative volume of GM/WM and age group were analyzed. Generalized additive models (GAMs) were used to evaluate the aging trajectories of brain structure and functions. We also evaluated the feasibility of age prediction by brain structure and functions. $P < 0.05$ was considered statistically significant.

### RESULTS

Females had larger rel_GM and higher CMRO2 and CBF of GM/WM than males ($P < 0.05$, Table 1). GAMs showed that CBF, CMRO2, and relative volume of GM all declined with aging ($R2 = 0.278$, $P < 0.001$; $R2 = 0.16$, $P < 0.001$; $R2 = 0.522$, $P < 0.001$) while controlling for sex. Specifically, CBF significantly declined between 20 and 31 years (Figure 1A). CMRO2 declined subsequently from 33 to 41 years (Figure 1B). Rel_GM decreased significantly at all ages (20~69 years) (Figure 1C). The combination of CBF, CMRO2, relative volume of GM, and sex were feasible to explain the age deviance at the level of 62.6% with an R2 of 0.565.

### CONCLUSION

There are sex disparities of functions of neurovascular unit. Furthermore, the evolution of cerebrovascular and oxygen metabolic functions follows sequential manner during aging, coinciding with a continuous decline in brain volume.

### CLINICAL RELEVANCE/APPLICATION

The age trajectories of brain structure and functions in healthy individuals provide insights into normal aging, which can be utilized for age prediction as well as delineating deviations in pathological conditions.

## S4-SSNR01-6 ASSOCIATION OF CHILDHOOD NEIGHBORHOOD DEPRAVATION INDEX WITH METRICS OF BRAIN WHITE MATTER MICROSTRUCTURE INTEGRITY DURING ADOLESCENCE

Alicia Stephan (*Abstract Co-Author*) Nothing to Disclose
Ajay Malhotra, MD, MMM (*Abstract Co-Author*) Nothing to Disclose
Seyedmehdi Payabvash, MD (*Abstract Co-Author*) Nothing to Disclose
Pratheek Bobba, BS (*Abstract Co-Author*) Nothing to Disclose
Tal Zeevi (*Abstract Co-Author*) Nothing to Disclose
Hector Acosta Rodriguez, BS (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the association of children's home address "Area Deprivation Index" (ADI) with brain white matter microstructural integrity at baseline and during adolescence.

### METHODS AND MATERIALS

We obtained baseline imaging, clinical, and demographic information for baseline, 2- and 4-year follow-up from the Adolescent Brain Cognitive Development (ABCD) Study database, which originally included 11,868 American Children. Subjects with incomplete clinical information, any traumatic brain injury, a mental disorder, or those who failed MRI quality control were excluded. Mixed linear models (MLM), controlling for age and education and applying the False Discovery Rate to correct for multiple comparisons, were used to establish the association of ADI with various neuroimaging metrics, including fractional anisotropy (FA), neurite density (ND), mean (MD), radial (RD), and axial (AD) diffusivity of white matter (WM) tracts. MLM was also applied to perform an interaction analysis on the effect of baseline neuroimaging metrics on the follow-up metrics.

### RESULTS

We analyzed the information of 5,341 children with mean (± standard deviation) age of 9.9 (±0.6) years at baseline; 2,629 with mean age of 12.0 (±0.6 years) at 2-year follow-up; and 910 with mean age of 14.1 (±0.7 years) at 4-year follow-up. Children living in neighborhoods with higher ADI showed significantly higher average FA, AD, and ND but lower RD and MD at baseline, most notably in the corpus callosum, cingulum, forceps minor and major, and anterior thalamic radiation. Similar pattern was observed in year-2 follow-up but with diminished number of tracts showing significant ADI association. No significant association was found for year-4 follow-up. Among children with follow-up scans, FA and ND tend to increase, whereas MD, AD, and RD decreased on 2- and 4-year follow-ups. However, ADI had opposite-direction interaction with the relationship of baseline diffusion metrics to follow-up values.

### CONCLUSION

Children from neighborhood with higher socioeconomic disadvantage depicted evidence of higher brain white matter microstructural integrity at age 9-to-10 year, even after correcting for parental education and family income. However, the association of neighborhood ADI and microstructural integrity abated over time on follow-up scans and became undetectable by age 13-to-14 years.

### CLINICAL RELEVANCE/APPLICATION

Understanding the neural impacts of socioeconomic status can guide subject selection in future study design interventions. It also informs policies to reduce disparities in underprivileged adolescents.

## S4-SSNR01-7 Keynote Speaker

Mohit Agarwal, MD (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

S4-SSNR02

**Neuroradiology (Trauma)**

Sunday, Dec. 1 1:00PM - 2:00PM Room: E451B

Dhairya Lakhani, MD (*Moderator*) Nothing to Disclose
Rajiv Mangla, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S4-SSNR02-1 IN VIVO DETECTION OF PATHOLOGY AT THE DEPTHS OF CORTICAL SULCI IN SPORTS REPETITIVE HEAD IMPACTS

Richard Lipton (*Abstract Co-Author*) Nothing to Disclose
Walter F. Stewart, MPH, PhD (*Abstract Co-Author*) Nothing to Disclose
Mimi Kim (*Abstract Co-Author*) Nothing to Disclose
Thomas Kaminski (*Abstract Co-Author*) Nothing to Disclose
Roman Fleysher (*Abstract Co-Author*) Nothing to Disclose
Michael L. Lipton, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kenny Ye, MD (*Abstract Co-Author*) Nothing to Disclose
Molly E Zimmerman (*Abstract Co-Author*) Nothing to Disclose
Bluye Demessie (*Presenter*) Nothing to Disclose

### PURPOSE

Post-mortem evidence suggests the depths of sulci (DoS) are vulnerable to repetitive head impacts (RHI). Diffusion MRI (dMRI) has identified microstructural features of brain injury but has largely overlooked the juxtacortical white matter (jWM). We assessed the relationship of RHI due to heading in soccer players with dMRI in DoS jWM. RHI has been associated with worse verbal learning; we assessed the mediating role of dMRI in this relationship.

### METHODS AND MATERIALS

Healthy amateur adult soccer players (n=380; 18-53 years old; 30% female) and healthy non-collision athlete controls (82; 18-50; 61%) were included. We assessed the cross-sectional relations among estimated 12-month RHI (HeadCount) represented in quartiles (medians: 43, 300, 782, 2,607) and verbal learning (International Shopping List).3T dMRI (2mm3, 109 directions, b=300, 800, 2000) was processed to extract DTI (fractional anisotropy, FA; axial diffusivity, AD; radial diffusivity, RD; mean diffusivity, MD) and NODDI (orientation dispersion index, ODI; neurite density index, NDI; isotropic water fraction, ISO) metrics from jWM subjacent to the DoS, jWM subjacent to the crests of gyri (CoG), and deep WM (dWM: corticospinal tract, corpus collosum, fornix, and uncinate fasciculus). dMRI metrics at each region for each RHI quartile were compared to non-collision athletes, using linear models adjusted for age, sex, and concussion history. Significant associations underwent causal mediation analysis using bootstrapping to test the significance the mediating effect of a dMRI metric on the relationship of RHI with verbal learning. Bonferroni correction was applied.

### RESULTS

dMRI metrics in DoS jWM differed from controls in an RHI dependent fashion. The highest RHI quartile exhibited (corrected $P<0.001$) lower FA in the frontal lobe (FL), orbitofrontal cortex (OFC), parietal lobe (PL), temporal lobe (TL), and occipital lobe (OL); lower AD in OFC, PL, TL, and OL; higher RD in FL, OFC, PL, TL, and OL; higher ODI in FL, OFC, PL, TL, and OL; and lower NDI in OFC. DoS effect sizes were larger than CoG or dWM. jWM ODI in OFC partially mediated the association of greater RHI with worse verbal learning ($P=0.008$); other white matter regions had no mediation effect.

### CONCLUSION

Microstructural injury related to RHI in young healthy individuals is most prominent in DoS jWM. The adverse association of RHI with verbal learning is partially mediated by OFC DoS jWM, consistent with measurable functional effects of subclinical axonal injury, demyelination, and/or inflammation.

### CLINICAL RELEVANCE/APPLICATION

Our findings suggest DoS jWM holds potential for identifying clinically significant injury pathology in RHI, which can be applied to expand and improve the use of imaging in assessment of traumatic brain injury.

## S4-SSNR02-2 CHANGES IN BRAIN STIFFNESS AFTER TRAUMATIC BRAIN INJURY: INSIGHTS FROM VIRTUAL MR ELASTOGRAPHY BASED ON DWI

Jin Wook Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Su Jeong Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Miran Han, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to assess changes in brain stiffness after traumatic brain injury (TBI) using virtual MR elastography (vMRE), a non-invasive and novel technique based on DWI. TBI often leads to significant morbidity and mortality. While early standard neuroimaging like CT is critical for evaluating serious intracranial injuries, it has ineffectiveness in detecting minor brain tissue alterations after injury, and cannot assess mechanical characteristics. MR elastography offers a solution but is limited by its invasiveness and long scan duration.

**METHODS AND MATERIALS**

We retrospectively analyzed MR imaging performed within 2 months of TBI from March 2021 to March 2024. Patients was groups into a no hemorrhage group, consisting of individuals with a history of traumatic brain injury but no parenchymal hemorrhage evident on MR, and a traumatic axonal injury (TAI) group. The TAI group was further categorized into three grades: Grade 1, where the bleeding is confined to the lobar white matter; Grade 2, which includes cases of bleeding in the corpus callosum; and Grade 3 where the bleeding extends to the brain stem. Shifted apparent diffusion coefficient was calculated from DWI (b=200 and 1500sec/mm2) and converted to DWI-based virtual shear modulus (μ). Brain stiffness was measured across the whole brain and specific anatomical regions. Independent t-tests and multiple comparison tests were performed to evaluate changes in brain stiffness following traumatic injury, according to the degree of brain hemorrhage.

**RESULTS**

Finally, 71 patients without hemorrhage and 81 patients with TAI were included in this study. The mean interval from trauma to MR acquisition was 15.2 ± 13.5 days. The TAI group showed significantly lower value of virtual shear modulus (μ) in brain, particularly in cerebral white matter ($p = 0.012$), frontal ($p = 0.011$) and temporal lobe ($p = 0.006$). The brain stiffness also decreased according to the grade of TAI in the whole brain ($p = 0.010$), cerebral WM ($p = 0.004$), temporal lobe ($p = 0.008$), parietal lobe ($p = 0.007$), hippocampus ($p = 0.047$) and corpus callosum ($p = 0.047$).

**CONCLUSION**

Higher TAI grades were associated with lower brain stiffness. It is suggested that edema and tissue necrosis following traumatic injury may contribute to the decrease in viscoelastic property of brain tissue. However, future research is required to investigate the correlation between these quantitative brain stiffness data and the clinical outcomes of patients.

**CLINICAL RELEVANCE/APPLICATION**

This research highlights how vMRE, a novel DWI-based technique, can provide insights into the biomechanical impacts of TBI, aiding in the evaluation and management of this condition.

## S4-SSNR02-3 REVISITING OCCIPITAL CONDYLE FRACTURES: NEW INSIGHTS FROM TRAUMA DATA

David M. Yousem, MD, MBA (*Abstract Co-Author*) Royalties, RELX;Speaker, MRI Online;Board Member, MRI Online;
Mahla Radmard, MD (*Abstract Co-Author*) Nothing to Disclose
Armin Tafazolimoghadam (*Abstract Co-Author*) Nothing to Disclose
Dhairya Lakhani, MD (*Abstract Co-Author*) Nothing to Disclose
Akua Amoah, MD, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

Occipital condyle fractures may be a marker for severe head and craniocervical trauma. If not specifically searched for they may be easily overlooked. We sought to assess the incidence of occipital condyle fractures in a large cohort of patients with head trauma and to characterize their presentations.

**METHODS AND MATERIALS**

The study was IRB-approved and HIPAA-compliant. We retrospectively reviewed the brain and cervical spine reports of CT scans performed in our two Emergency Departments performed from 2018 to 2023. Variables studied included age, gender reported, coincident brain and cervical spine injuries, and Anderson and Montesano classification

**RESULTS**

Of 21986 patients studies reviewed there were 55 patients with occipital condyle fractures (0.25%). The mean age was 51.0 years (median 51, SD 20.1). There were 17 females and 38 males. The incidence of occipital condyle fractures in patients less than 65 years old was 42/12531 (0.34%) was significantly higher than those 65 and older (13/9455 = 0.14%) which may be associated with the higher rate of motor vehicle collisions as the cause of trauma in the younger group. 26/55 (47.3%) had concomitant brain injuries and 16/55 (29.1%) had a cervical spine injury as well. The Type III Anderson was the most common being Type III (29/55) with the remainder split between Types I and II.

**CONCLUSION**

Occipital condyle fractures in patients suffering trauma are uncommon (0.25%) and often are the potentially unstable Anderson and Montesano Type III variety. However, they may be associated with brain (47.3%) or cervical spine (29.1%) injuries. Recognizing their presence may be helpful in planning treatment for head and neck trauma patients.

**CLINICAL RELEVANCE/APPLICATION**

Being aware of occipital condyle fractures and types is important in the emergency radiology evaluation of trauma patients, particularly in the young and those involved in MVCs.

## S4-SSNR02-4 CHANGES OF THE GLYMPHATIC SYSTEM IN INDIVIDUALS EXPOSED TO HIGH VERSUS LOW BLAST IMPACT

Rafael Glikstein, MD (*Abstract Co-Author*) Nothing to Disclose
Gerd Melkus, PhD (*Abstract Co-Author*) Nothing to Disclose
Nerses Nersesyan, MD (*Abstract Co-Author*) Nothing to Disclose
Chris Skinner (*Abstract Co-Author*) Nothing to Disclose
Betty Anne Schwarz, PhD (*Abstract Co-Author*) Nothing to Disclose
Azza Reda, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore changes in DTI and glymphatic system activity among individuals Exposed to High versus Low Blast Impact with mild traumatic brain injury (mTBI) suggesting axonal damage.

### METHODS AND MATERIALS

Total of 68 military personnel with low and high exposure to explosive operations have undergone longitudinal MRIs (including volumetric T1 and DTI sequences). FSL software was used for registration of the diffusion datasets into MNI standard space and spherical ROIs were placed into projection and association area to calculate the DTI-ALPS index. DTI-ALPS was compared between the initial and follow-up scan of the high- and low exposure group using a paired t-test. The automated longitudinal Freesurfer pipeline was used to calculate brain volumes and volume changes. Volumetric changes were compared to changes in the ALPS-Index using Spearman correlation (?).

### RESULTS

significant increased ALPS-Index from the initial scan to the follow-up scan for the whole group ($p<0.05$). The dichotomization into low and high exposure group retained this significance increase of the ALPS-index for both groups, and the p-value was lower in the high exposure group Significant decrease of the corpus callosum volume with an increase of the ALPS-index (? = -0.34). Further the cortical volume (? = -0.28) and the gray matter (? = -0.27) decreased significantly with an increasing ALPS index.

### CONCLUSION

The difference in the glymphatic system in mTBI individuals exposed to low and high impact blast, plays a crucial role. The increase in the ALPS-index suggests an enhanced compensating mechanism to reduce secondary damage by facilitating the clearance of endotoxic products.

### CLINICAL RELEVANCE/APPLICATION

These findings of altered glymphatic system may help in understanding the effect on the brain after mTBI and determine prognostic evaluation for individuals exposed to traumatic injuries.

## S4-SSNR02-5 DEVELOPMENT OF A QUANTITATIVE IMAGING TOOL TO IDENTIFY CANDIDATES FOR TRANEXAMIC ACID TREATMENT IN ACUTE TRAUMATIC BRAIN INJURY

Holly Hinson, MD (*Abstract Co-Author*) Research Consultant, Biogen Idec Inc;Former Research Consultant, iSchemaView, Inc
Samir Dagher, MD (*Abstract Co-Author*) Nothing to Disclose
Max Wintermark, MD (*Abstract Co-Author*) Consultant, Magnetic Insight, Inc;Consultant, icoMetrix NV;Consultant, Subtle Medical, Inc;Consultant, EMTensor Imaging
Prashant Raghavan, MD (*Abstract Co-Author*) Speaker, Siemens AG
Susan Rowell (*Abstract Co-Author*) Nothing to Disclose
Peter Kamel, MD (*Abstract Co-Author*) Nothing to Disclose
Maguy Farhat, MD, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Tranexamic acid (TXA) has been shown to mediate the blood-brain barrier and limit vasogenic edema after Traumatic Brain Injury (TBI) in preclinical models. Our purpose was to develop a novel CT-based quantitative imaging tool to identify patients with TBI that will show survival benefit from TXA initiated in the prehospital setting.

### METHODS AND MATERIALS

This study is a post hoc analysis of the Phase II prehospital TXA in TBI trial. We included patients in both placebo and TXA arms with moderate or severe TBI and available head CT scan at baseline. Patients with >25 ml intracranial hematoma, gunshot wounds, and those who died unrelated to TBI were excluded. Using a MATLAB code, we performed densitometric analysis quantifying the percentage (%) of voxels within the density scale. We determined that % voxel in 10-20 HU correlated the best with mean ADC values for 101 patients that had available MRIs. To determine whether % voxel in 10-20 HU predicts response to TXA, multivariate logistic regression with interaction term voxel %: TXA was performed. Wald test was then used to identify the minimum % voxel cutoff value in 10-20 HU beyond which significant survival benefit of TXA is observed. The reduction in relative risk (RR) in mortality was calculated in % of voxel group above the selected cutoff value at hospital discharge, 28 days, and at 6 months.

### RESULTS

Logistic regression showed significant effect of % voxel in 10-20 HU ($p = 0.0387$) on survival benefit, implying that the impact of TXA varies across different voxel %s. Threshold analysis revealed a significant difference in survival benefit to TXA when at least 3% of voxels were in the 10-20 HU density range (~40 ml vasogenic edema) ($p = 0.04$). Within the subgroup with a minimum of 3% of voxels of 10-20 HU, the administration of TXA exhibited a significant reduction in RR of mortality of 62.5% at hospital discharge (n=550), 62.7% at 28 days (n=549), and 61.5% at 6 months (n=499).

### CONCLUSION

A CT imaging biomarker quantifying more than 40 ml of vasogenic edema may serve as a promising imaging biomarker for identifying TXA treatment candidates in patients presenting with moderate/severe acute TBI. This biomarker needs further validation in prospective studies.

### CLINICAL RELEVANCE/APPLICATION

Secondary edema is a major cause of death in patients with acute TBI. TXA may be effective in decelerating cerebral edema progression, and baseline CT can help identify TBI patients who may benefit from TXA.

## S4-SSNR02-6 ASSOCIATIONS OF COMORBID RISK FACTORS WITH WHITE MATTER HYPERINTENSITIES IN PATIENTS WITH MILD TRAUMATIC BRAIN INJURY

Travis H. Snyder, DO (*Abstract Co-Author*) Nothing to Disclose
Leo Germin, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas Knoblauch, MS (*Abstract Co-Author*) Nothing to Disclose
Cheryl E. Vanier, PhD (*Abstract Co-Author*) Nothing to Disclose
Enrico Fazzini, DO,PhD (*Abstract Co-Author*) Nothing to Disclose
Alan Rodriguez, MD (*Presenter*) Nothing to Disclose

### PURPOSE

White matter hyperintensities (WMH) may appear in neuroimaging after a mild traumatic brain injury (mTBI). Not all; however, will be a result of trauma. This study explores the incidence of WMH with reported comorbidities in mTBI patients.

## METHODS AND MATERIALS

A medical chart review of 531 mTBI patients (57.8% female, 48.6% under 40) ages 18-82 (mean=42) was performed to extract demographic and comorbid data, including sex, age, diabetes (D), lipidemia (L), obesity (O), smoking (S), and hypertension (H). From a 3T MRI scanner, axial and sagittal T2 weighted and T2 FLAIR sequences with 4.0mm slice thickness were selected to measure the presence of WMH and their distance to cortex (DTC) taken from the center of the hyperintensity to the nearest gray-white matter junction. A modified Fazekas scale was implemented to report any identified confluence as either present, moderate or severe. Comorbidities and age were analyzed relative to presence of WMH lesions or confluence using logistic regression, and the (log-transformed) DTC was analyzed using linear regression.

## RESULTS

At least one comorbidity (D (3.4%), L (2.3%), O (7.2%), S (5.1%), and H (9.4%)) was reported in 15.6% of patients. All comorbidities except obesity and smoking were more common in patients 40 and over. WMH were 4.7 times more likely in patients 40 and over compared to those under 40 ($p<0.001$) and 2.4 times more likely in patients with hypertension ($p=0.025$). No confluence was observed in patients <40. Confluence was less common in males than females (OR=0.5, $p=0.045$) while the odds of any degree of confluence was 7.1-fold higher in those with lipidemia ($p=0.005$) and 6.7-fold higher in those with hypertension ($p<0.001$). Participants classified as obese had WMH more distant from the cortex (mean distance=3.33mm) compared to those who were not obese (mean distance=2.20mm; $p=0.013$). WMH in patients <40 were more distant from the gray-white matter junction (mean distance=3.8mm) relative to those 40 and over (mean distance 1.8mm; $p<0.001$).

## CONCLUSION

Risk factors, specifically those affecting the health of blood vessels, predict the presentation of WMH after mTBI. The distance a WMH was from the cortex was generally not influenced by comorbid risk factors. It is known that head injury is associated with WMH, yet further research is needed to help determine how mTBI and pre-existing risk factors may interact to influence the morphology and development of hyperintensities.

## CLINICAL RELEVANCE/APPLICATION

Although Wallerian degeneration and diffuse axonal injury may play a pivotal role in the formation of WMH after injury, it is important to consider comorbid factors.

# Abstract Archives of the RSNA, 2024

S4-SSPH02

**Physics (Radiography and Breast Imaging)**

Sunday, Dec. 1 1:00PM - 2:00PM Room: S404

Wei Zhao, PhD (*Moderator*) Research support, Siemens AG
Ingrid Reiser, PhD (*Moderator*) Family member, Employee, Clarix Imaging

**Sub-Events**

## S4-SSPH02-1 IMPACT OF FLYING FOCAL SPOT TECHNIQUE ON THE IMAGING PERFORMANCE AND MICROCALCIFICATION DETECTION OF DIGITAL BREAST TOMOSYNTHESIS

Wei Zhao, PhD (*Abstract Co-Author*) Research support, Siemens AG
Xiaoyu Duan (*Abstract Co-Author*) Nothing to Disclose
Hailiang Huang, PHD (*Abstract Co-Author*) Nothing to Disclose
Jann Stavro, PhD (*Abstract Co-Author*) Nothing to Disclose
Xiangyi Wu, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Continuous-motion (CM) and step-and-shoot (SS) are two gantry motion techniques used in clinically available digital breast tomosynthesis (DBT) systems. CM introduces image blur due to focal spot (FS) motion during x-ray exposures, which could degrade the conspicuity of microcalcifications. SS reduces FS motion with a stationary source during exposures, however, the tube may wobble when stopped and introduce additional blur. The flying focal spot (FFS) technique has recently been adopted for DBT, where the FS is virtually stationary during image acquisition, thus minimizing FS blur. This work aims to investigate the impact of FFS on imaging performance and compare DBT systems with FFS (Siemens B. Brilliant*), CM (Siemens Revelation), and SS modes (GE Pristina).

### METHODS AND MATERIALS

Effective FS size in the tube travel direction was measured for DBT using a slit camera. System pre-sampling modulation transfer functions (MTF) were measured in DBT projection images as a function of projection angle and height above the detector with a slanted edge. The impact of FS blur on spatial resolution was evaluated by comparing the MTF among tube motion modes after eliminating the effect of pixel pitch. The conspicuity of microcalcifications in the reconstructed DBT volume for FFS and CM acquisition modes were evaluated using the ACR Model 156 phantom and CIRS Model 011 phantom. The assessed microcalcifications range in size from 165 μm to 320 μm and are located at different positions in the images.

### RESULTS

Effective FS sizes in the tube travel direction are 2.370 ± 0.302 mm, 0.636 ± 0.017 mm, and 0.297 ± 0.146 mm for CM, SS, and FFS techniques, respectively. At 4 cm above the detector cover, the spatial frequencies for 50% MTF values (MTF50%) in central projections are 2.5 lp/mm, 4.0 lp/mm, and 7.5 lp/mm for CM, SS, and FFS, respectively. In 12-degree projection images, MTF50% decrease to 2.4 lp/mm, 3.7 lp/mm, and 6.9 lp/mm, respectively. In reconstructed DBT slices of phantoms, FFS shows improved conspicuity of microcalcifications compared to CM.

### CONCLUSION

FFS provides the smallest effective FS size and the highest MTF at high frequencies among the three tube motion modes investigated. The reconstructed in-plane slices of phantoms show that FFS improves the conspicuity of microcalcifications compared to CM.

### CLINICAL RELEVANCE/APPLICATION

DBT systems featuring FFS may offer superior microcalcification detection by minimizing FS blur. *The product/feature and/or service offerings mentioned herein for B. Brilliant are not commercially available in all countries and/or for all modalities. Their future availability cannot be guaranteed.

## S4-SSPH02-2 A TWO-DIMENSIONAL MULTIPLE X-RAY-SOURCE ARRAY FOR DIGITAL BREAST TOMOSYNTHESIS

Jeffrey H. Siewerdsen, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Advisory Board, Siemens AG;Research Grant, Medtronic plc;Advisory Board, Carestream Health, Inc;License agreement, Carestream Health, Inc;License agreement, Precision X-Ray, Inc;License agreement, Elekta AB;;;
Paul R. Schwoebel, PhD (*Abstract Co-Author*) Nothing to Disclose
John M. Boone, PhD (*Abstract Co-Author*) Board of Directors, Izotropic Corporation;Shareholder, Izotropic Corporation;Co-author with royalties, Wolters Kluwer nv;Patent agreement, The Phantom Laboratory;In-kind support, Canon Medical Systems Corporation
Alejandro Sisniega, PhD (*Presenter*) Research Grant, Siemens AG;Research Grant, Micro-X Ltd;Research Grant, Izotropic Corporation

### PURPOSE

To develop a two-dimensional (2D) Multiple X-ray-source Array (MXA), that will improve image quality in digital breast tomosynthesis (DBT) by: 1) Reducing the under-sampling inherent with one-dimensional (1D) scan geometries used in commercial DBT systems; and 2) Eliminating mechanical motion of the X-ray source to reduce scan time to < 1s and minimize blur and artifacts from source and patient motion.

### METHODS AND MATERIALS

The stationary source used in this feasibility study was a linear (1D) MXA of 11 X-ray sources with a common rotating anode shaft and 11 individual thermionic cathodes. A 2D MXA can be achieved using a second array of thermionic cathodes on the other side of the anodes. In the current work, the 2D MXA geometry with cathode separation of 23 mm was simulated using 1D 11-source MXA and translating the detector and object. Image quality comparisons between the 1D and 2D MXA geometries were quantified in quantitative and anatomical phantom studies measuring out-of-plane background clutter, noise-power spectrum, and slice sensitivity profile (SSP).

### RESULTS

The 2D MXA source configuration reduced background clutter by 10.2% (median) and 16.9% (90th percentile). The background clutter power spectrum of the 1D MXA showed a distinct null cone in the Fourier domain in the anterior field of view (far from the chest wall). The null cone was eliminated with the 2D MXA, consistent with improved sampling. In addition, the 2D MXA improved the median FWHM of the SSP by 15% (6.1 mm for 1D MXA vs 5.3 mm for 2D MXA) and increased conspicuity of both microcalcifications and tumor features compared to 1D MXA and mammography.

### CONCLUSION

The 2D MXA geometry significantly improved image quality compared to 1D MXA and mammography by improved tomosynthesis sampling and narrowing the SSP. These studies have guided the design and fabrication of a prototype 2D MXA DBT system.

### CLINICAL RELEVANCE/APPLICATION

The 2D MXA has the potential to provide next-generation tomosynthesis with a scan time < 1 s and improved image quality compared to current DBT systems.

## S4-SSPH02-3 EVALUATING THE EFFICACY OF NEW AUTO-EXPOSURE CONTROL (S-AEC) IN PORTABLE ANTEROPOSTERIOR CHEST RADIOGRAPHY: A RETROSPECTIVE EXAMINATION OF RADIATION DOSE OPTIMIZATION AND IMAGE QUALITY

Myung Jin Chung, MD (*Abstract Co-Author*) Research Consultant, Samsung Electronics Co, Ltd;Research Consultant, Pharmex Advanced Laboratories, SL;Research Grant, Lunit Inc;Research Grant, VUNO Inc
Jung Han Woo (*Presenter*) Nothing to Disclose

### PURPOSE

The latest advancement in the field of chest radiography had led to incorporation of an Auto-Exposure Control (AEC) system within the detector, which holds the promise of significantly enhancing image quality and managing radiation dose effectively. This innovation has yet to gain widespread acceptance in portable radiographic systems. Our study retrospectively examines the efficacy of new AEC system (S-AEC) embedded in portable X-ray devices, employing artificial intelligence to fine-tune image quality alongside radiation dosage.

### METHODS AND MATERIALS

In this retrospective analysis, we evaluated the performance of an approved portable X-ray apparatus outfitted with a Detector Auto-Exposure Control system (DAEC). Anteroposterior chest radiographs were obtained between November 17, 2023, and December 10, 2023, at a single tertiary referral center. A comparative quantitative evaluation comparing manual controls with DAEC was conducted, focusing on exposure indices (EI) and dose-area products (DAP). Furthermore, observer-based analysis of image quality was performed by two board-certified thoracic radiologists for lowest exposure (EI < 200 μGy; 3% threshold outliers) and average exposure images within both the manual and DAEC groups, by utilizing a 5-point visual grading scale. Paired comparisons (manual and DAEC conducted within a one-week interval) were also executed.

### RESULTS

A total of 2093 examinations (1235 manual, 858 DAEC) were conducted on 467 patients. The DAEC group demonstrated a significant reduction in DAP (1.99 dGycm2, manual; 1.64 dGycm2, DAEC) and EI (393 uGy, manual; 266 uGy, DAEC) compared to the manual group ($p<0.001$). When evaluating the average and lowest exposure images, the DAP and EI were consistently lower in the DAEC group ($p<0.01$). In the observer-based analysis of lowest exposure images, the DAEC group yielded a significantly higher score compared to the manual group (12.5, manual; 13.4, DAEC; $p<0.001$). The DAEC group outperformed the manual group in the paired comparison in terms of higher observer analysis score (manual, 14.1; DAEC, 14.3; $p=0.029$) and 18% lower DAP (manual, 1.98; DAEC, 1.63; $p<0.001$).

### CONCLUSION

The implementation of the Detector Auto-Exposure Control system (DAEC) within portable X-ray devices significantly improves image quality while reducing radiation exposure, as substantiated by both quantitative and qualitative metrics.

### CLINICAL RELEVANCE/APPLICATION

The clinical application of the DAEC system represents a substantive advancement in patient safety and image precision in portable chest radiography, suggesting a pivotal change in radiological practices and a move towards more AI-integrated diagnostic tools.

## S4-SSPH02-4 LUNG FUNCTION MEASUREMENT FROM DYNAMIC CHEST RADIOGRAPHY USING RESPIRATORY MOTION ESTIMATION BY IMPLICIT NEURAL REPRESENTATION

Alejandro Sisniega, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Micro-X Ltd;Research Grant, Izotropic Corporation
Jeffrey Zhu (*Abstract Co-Author*) Nothing to Disclose
Alejandro Lopez Montes (*Abstract Co-Author*) Nothing to Disclose
David F. Yankelevitz, MD (*Abstract Co-Author*) Consultant, Accumetra LLC;Stockholder, Accumetra LLC;Medical Advisory Board, Carestream Health, Inc;Royalties, General Electric Company;Consultant, AstraZeneca PLC;Consultant, Pfizer Inc;Consultant, F. Hoffmann-La Roche Ltd
Wojciech Zbijewski, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Medtronic plc
Alexander Lu (*Abstract Co-Author*) Nothing to Disclose
Xiaohui Wang, PhD (*Abstract Co-Author*) Employee, Carestream Health, Inc
Deborah Cooper-Schifitto (*Abstract Co-Author*) Nothing to Disclose
Huanyi Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To estimate respiratory motion and develop quantitative measurements of lung function from dynamic chest radiography (D-CXR) and to correlate these new radiographic metrics to the first-second Forced Expiratory Volume (FEV1) by conventional spirometry.

### METHODS AND MATERIALS

The D-CXR protocol involves a serial radiographic sequence collected at 8 frames/second. Eight subjects performed forced expiration during a D-CXR acquisition, followed by a separate spirometry test to obtain FEV1. Lung parenchyma projections were segmented from the D-CXR series by a Deep Learning (DL) model trained on digitally reconstructed radiographs computed from CT volumes. Each segmented frame during a one-second-long inspiration-expiration (INSP-EXP) interval was deformably registered to the reference INSP projection using an Implicit Neural Representation (INR) with a multi-layer perceptron model of respiratory motion and temporal regularization to promote consistent deformations across the sequence. The INR was computed by one-shot learning minimizing a joint Normalized Cross-Correlation of all segmented frames. The registration aligned the shape of lung parenchyma in each D-CXR view to the reference INSP shape but preserved local radiographic density change during expiration. Ventilation maps at each time point were then obtained by pixel-by-pixel subtraction of the aligned segmentations from INSP density. An estimate of the exhaled volume of air was calculated as a spatial average of the ventilation map at EXP multiplied by the total lung parenchyma area at INSP.

### RESULTS

The INR deformable registration of D-CXR frames provided an estimate of the projected respiratory deformation field (DF). After applying the DF to align the segmented lung parenchyma projections, the shape mismatch across the 1 sec expiration sequence was reduced from ~18% (area difference averaged across the study sample) to ~0.5%. Averaged estimated INSP-EXP displacements of lung parenchyma ranged ~4.4 mm - 32 mm, depending on the subject; relative change in average radiographic density ranged 5% - 46%. Preliminary results indicate a Pearson correlation between the exhaled air volume estimated from D-CXR and FEV1 of 0.81 after removing outliers (2 cases)

### CONCLUSION

A D-CXR sequence combined with DL segmentation of lung parenchyma and INR deformable registration enables quantitative evaluation of respiratory DFs and radiographic density changes during breathing. The volume of exhaled air estimated from D-CXR appears to agree with conventional spirometry in a pilot human subject study.

### CLINICAL RELEVANCE/APPLICATION

Dynamic chest radiography combined with advanced image analysis techniques might provide new quantitative markers of lung function.

## S4-SSPH02-5 DEVELOPMENT OF A QUALITY CONTROL PROGRAM FOR CONTRAST-ENHANCED MAMMOGRAPHY: PHANTOM EVALUATION

William R. Geiser, MS (*Abstract Co-Author*) Nothing to Disclose
Cayla Wood, PhD (*Abstract Co-Author*) Nothing to Disclose
Megan C. Jacobsen, PhD (*Abstract Co-Author*) Honorarium and Travel, Kyoto Kagaku
Emily Thompson, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Dual-energy contrast-enhanced mammography (CEM) has emerged as a promising modality for improving the detection and characterization of breast lesions. However, quality control (QC) procedures have not been well-defined. A CEM QC program plays a crucial role in standardizing imaging protocols, assessing image quality, verifying contrast agent uptake, monitoring system performance, and ensuring quality assurance in clinical practice. This study seeks to evaluate the suitability of commercially available CEM phantoms and their role in a clinical QC program.

### METHODS AND MATERIALS

Two commercially available CEM phantoms were assessed for quality control: Contrast Enhanced Spectral Mammography Phantom Model 022 (CIRS, VA, USA) [Phantom A] and the Mammo CESM?? Phantom PN 805929 (Sun Nuclear, WI, USA) [Phantom B]. Phantoms were evaluated for feasibility in terms of ease of use and comparing SNR, CNR, and reproducibility across Hologic, GE, and Siemens mammography systems. Additionally, breast texture cancellation and the ability to evaluate image signal as a function of iodine concentration measured in the breast tissue of differing thickness and composition (glandular vs. adipose) were also evaluated.

### RESULTS

Both phantoms demonstrated potential for use in a routine quality control program and can be used to evaluate SNR, CNR, reproducibility, breast texture cancellation, and iodine concentration at different breast thicknesses and tissue combinations. Phantom A offers several iodine concentrations, tissue thickness, and composition combinations and provides a reproducible phantom setup. Given the simple design, Phantom A is well-suited for routine clinical QC performed by multiple people (physicists, technologists). Phantom B enables a deeper analysis of smaller changes in tissue composition and iodine concentration by providing more combinations in smaller increments. However, this functionality increases the complexity of phantom setup, rendering Phantom B a well-designed phantom for troubleshooting or research applications.

### CONCLUSION

This study emphasizes the importance of selecting CEM phantoms suited for specific quality control or research objectives. By considering SNR, CNR, reproducibility, breast texture cancellation, and image signal evaluation as part of quality control programs, this research guides informed decision-making in phantom selection for a robust CEM quality control program that advances breast cancer diagnosis and management.

### CLINICAL RELEVANCE/APPLICATION

Appropriate phantom selection is essential for a successful CEM quality control program and facilitates the optimization and maintenance of CEM systems to deliver consistent and high-quality diagnostic results.

## S4-SSPH02-6 ADVANCES IN BREAST TOMOSYNTHESIS ACQUISITION TECHNOLOGIES

Nikolaos A. Gkanatsios, PHD (*Abstract Co-Author*) Nothing to Disclose
Andrew P. Smith, PhD (*Abstract Co-Author*) Employee, Hologic, Inc
Tushita Patel (*Abstract Co-Author*) Nothing to Disclose
Andrew D. Maidment, PhD (*Presenter*) Research support, Hologic, Inc;Research support, Barco nv;Research support, Analogic Corporation;Founder, Daimroc Imaging LLC;Scientific Advisory Board, Real Time Tomography, LLC;Spouse, Employee, Real Time Tomography, LLC;Spouse, Stockholder, Real Time Tomography, LLC;;

### PURPOSE

Minimizing Digital Breast Tomosynthesis (DBT) scan time can reduce the likelihood of image-degrading patient motion and lessen patient discomfort by shortening compression time. DBT systems can be classified into two main scan motions - step-and-shoot or continuous. Of commercially available systems, those with the shortest scan times utilize continuous tube motion. Systems with conventional x-ray tube technology may have reached the limits

of scan speeds, as faster scans can lead to image-degrading focal spot motion blur. One solution is to use steered-beam x-ray tube technology, recently introduced by some mammography vendors. With these x-ray tubes, the focal spot is steered at the same speed but in the opposite direction of tube motion. The emitted x-rays appear stationary with respect to the detector and breast and virtually eliminate focal spot motion blur. This allows faster scans without image degradation and can improve image quality compared to systems without this innovation. The purpose of this study is to characterize the timing and imaging resolution of a DBT system that employs steered-beam technology.

**METHODS AND MATERIALS**

The imaging performance of a DBT system using steered-beam technology was evaluated for spatial resolution as a function of height in the breast. The spatial resolution was characterized by quantifying the imaging spread of an object in the in-focus slice of the reconstructed image for objects placed 2 to 8 cm above the breast platform. Line pair resolution phantoms were imaged to quantify system resolution in the scanning and perpendicular direction. Finally, the time for the DBT scan was measured from the start of the first exposure to the end of the last exposure. The same methods were repeated on a system not employing this technology for a baseline comparison.

**RESULTS**

For a fixed object, the average object width (full-width half-max) using conventional x-ray tube technology was 1.52, 1.69, 2.17, and 3.23 mm at heights of 2, 4, 6, and 8 cm above the breast platform, while when using steered-beam x-ray tube technology the values were 1.45, 1.47, 1.76, and 1.88 mm. The system with steered-beam x-rays had a spatial resolution improvement of 5% for objects 2 cm above the breast platform, 13% at 4 cm, 19% at 6 cm, and 42% at 8 cm. The scan time was shortened by about 1/3 from 3.7 sec to 2.5 sec.

**CONCLUSION**

This new technology demonstrated a reduction in scan time of about 33% while simultaneously improving spatial resolution.

**CLINICAL RELEVANCE/APPLICATION**

DBT systems employing steered beam x-ray tubes can provide benefits such as shorter scan times and improved spatial resolution compared to systems not employing this technology. The spatial resolution improvement is greatest at the largest compressed breast thicknesses.

# Abstract Archives of the RSNA, 2024

S4-SSVA01

## Vascular Imaging (Abdominal Applications)

Sunday, Dec. 1 1:00PM - 2:00PM Room: N229

Scott B. Reeder, MD, PhD (*Moderator*) Owner, Calimetrix;Owner, Reveal Pharmaceuticals;Owner, Cellectar Biosciences, Inc;Owner, Elucent Medical;Owner, HeartVista, Inc;;
Anushri Parakh, MBBS, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

### S4-SSVA01-1 PRE-SURGICAL LYMPHATIC AND VENOUS MAPPING WITH NON-CONTRAST ULTRA HIGH FREQUENCY ULTRASOUND

Leo L. Tsai, MD, PhD (*Abstract Co-Author*) Stockholder, Agile Devices Inc;Consultant, Agile Devices Inc
Dhruv Singhal, MD (*Abstract Co-Author*) Nothing to Disclose
Clarissa Lee (*Abstract Co-Author*) Nothing to Disclose
James Fanning (*Abstract Co-Author*) Nothing to Disclose
Ivan Diogo Queiros, MD,MMed (*Abstract Co-Author*) Nothing to Disclose
Charissa Kim, MD, PhD (*Presenter*) Nothing to Disclose

#### PURPOSE

Lymphaticovenous mapping is a necessary component of lymphaticovenous anastomosis (LVA) surgery but is limited by the costly nature of existing preoperative planning techniques, including indocyanine green fluorescent lymphography and contrast-enhanced ultrasound, which both require contrast administration. There is a clinical need for noninvasive imaging modalities to assess lymphatic channels for LVA. The purpose of the study was to determine whether ultra-high frequency ultrasound (UHFUS) performed on patients with upper or lower extremity lymphedema can accurately estimate the target lymphatic channel and vein diameters before LVA surgery.

#### METHODS AND MATERIALS

In this single-institution retrospective study, UHFUS (48-70 MHz) was performed between 09/2021-08/2023 on patients with upper or lower extremity lymphedema to identify lymphatic channels and veins for LVA. The results of UHFUS mapping were compared to the number and size of lymphatic channels and veins identified during LVA, with surgical data serving as the reference standard. Bland-Altman analyses were performed to quantify bias and agreement intervals between UHFUS and LVA diameter estimates. Linear mixed-effects models were constructed to estimate all analysis parameters since participants may contribute multiple measurements.

#### RESULTS

Twenty-four patients were included in the study (20 women, mean age, 54 years ± 13 [SD]). A total of 32 LVAs were performed: One LVA was performed in 16 patients (67%), and two were performed in 8 (33%). UHFUS was performed, on average, 184 days (range, 1-432) prior to LVA. The estimated bias associated with the lymphatic channel diameter was 0.02 (95%CI: -0.07, 0.12), and the corresponding agreement interval was -0.50 (-0.66, -0.34) to 0.54 (0.38,0.70). Similarly, the bias and agreement interval for the vein diameter was -0.02 (-0.10, 0.08) and -0.50 (-0.65,-0.35) to 0.46 (0.32, 0.62).

#### CONCLUSION

UHFUS is a noninvasive imaging modality that can accurately and without systematic bias map lymphatic channels and veins in patients with lymphedema for LVA without intravenous contrast.

#### CLINICAL RELEVANCE/APPLICATION

UHFUS is a noninvasive imaging modality that can accurately map suitable lymphatic and venous targets for LVA.

### S4-SSVA01-2 FULLY AUTOMATEDASSESSMENTOFTHE FLR IN A BLOOD-FREE SETTINGVIACT BEFORE MAJOR HEPATECTOMY VIA DEEP LEARNING

Xiaoying Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Guanxun Cheng, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Tingting Xie JR, MD (*Presenter*) Nothing to Disclose

#### PURPOSE

Automated segmentation of hepatic veins and portal veins for preoperative planning has been reported recently. However, these studies have focused mainly on developing new models to improve segmentation performance or volumetry of the right lobe for living donor liver transplantation. Adequate validation in diverse liver conditions and application in preoperative future liver remnant (FLR) assessment are lacking. We aimed to develop a deep learning (DL) model for automated segmentation of hepatic veins and portal veins, validate the segmentation performance of the model, and apply the model in blood-free FLR assessments via CT before major hepatectomy.

### METHODS AND MATERIALS

3D U-Net models were developed for the automatic segmentation of hepatic veins and portal veins on contrast-enhanced CT images. A total of 170 patients treated from January 2018 to March 2019 were included. The hepatic veins and portal veins were annotated by radiologists. 3D U-Net models were trained and tested under various liver conditions (146 patients with different pathological livers and 32 patients who were candidates for major hepatectomy). The Dice similarity coefficient (DSC) and volumetric similarity (VS) were used to evaluate the segmentation accuracy. The use of quantitative volumetry for evaluating resection was compared between blood-filled and blood-free settings and between manual and automated segmentation.

### RESULTS

The DSC and VS in the test dataset for hepatic veins and portal veins were 0.66 ± 0.08 and 0.80 ± 0.10 and 0.67 ± 0.07 and 0.74 ± 0.08, respectively. No significant differences in FLR, FLR% assessments, or the percentage of major hepatectomy patients were noted between the blood-filled and blood-free settings (P=0.67, 0.59 and 0.99 for manual methods, P=0.66, 0.99 and 0.99 for automated methods, respectively) according to the use of manual and automated segmentation methods.

### CONCLUSION

Fully automated segmentation of hepatic veins and portal veins and FLR assessment via blood-free CT before major hepatectomy are accurate and applicable in clinical cases involving the use of DL.

### CLINICAL RELEVANCE/APPLICATION

Preoperative CT volumetry of FLR has been criticized for under- and overestimating real FLR mainly because volumetry on CT images is blood-filed while intraoperative volumetry is blood-free. Blood vessels account for 9% of total liver volume, which has potential to change the prediction of resection because the minimum FLR% which required to preserved ranged from 20% to 40%. So, a precise FLR Blood-free calculation, and a comparison between FLR Blood-filled and FLR Blood-free are essential. Our fully automatic models could provide FLR Blood-free assessment before major heptatectomy with reliable outcomes.

## S4-SSVA01-3 CONJUGATE GRADIENT ITERATION WITH DEEP LEARNING RECONSTRUCTION IMPROVES WORKFLOW EFFICIENCY IN THREE-DIMENSIONAL ULTRASHORT ECHO TIME ABDOMINAL MR ANGIORAPHY

Hideki Ota, PhD (*Presenter*) Grant, Canon Medical Systems Corporation

### PURPOSE

While 3-dimensional (3D) ultrashort TE (UTE)-based non-contrast MR angiography enables the visualization of visceral arteries treated by endovascular interventions, prolonged scan time remains a challenge to achieve satisfactory image quality. This study aimed to assess whether the application of conjugate-gradient iteration combined with denoising deep learning reconstruction can reduce scan time without compromising image quality in 3D UTE abdominal MR angiography.

### METHODS AND MATERIALS

In this IRB-approved prospective study, 10 healthy subjects (7 men, mean age 30 ± 7.5 years) underwent 3D UTE time-spatial Labeling Inversion Pulse (time-SLIP) MR angiography on a 3T MR scanner. Scan parameters included a 3.7ms TR, 0.096ms TE, 5 degrees flip angle, 9960 trajectories (k-space filling ratio 4.84%), 120 segments, 1500ms blood-traveling TI, and spatial resolution of 1.29mm × 1.29mm × 2mm. Two sets of raw data were generated: 1) full data with 9960 trajectories and 2) 67% data with 6640 trajectories. Image reconstruction comprised two steps: conjugate-gradient reconstruction (CG-recon) and denoising deep learning reconstruction (dDLR). Each raw data set yielded four image data sets per subject: two with CG-Recon and two without; dDLR was applied to all data sets. Image quality was assessed using a five-point scale (1, poor; 5, excellent), and the number of visualized renal arterial branches was noted. Statistical analyses included Friedman test with post-hoc Bonferroni correction, Wilcoxon signed-rank tests, and paired t-tests ($p < 0.05$ considered significant).

### RESULTS

Mean scan time was 10.0 ± 1.8 minutes. Images reconstructed with CG-Recon demonstrated significantly higher quality than those without CG-Recon in all raw data sets. 6640-trajectory images with CG-Recon showed comparable quality to 9960-trajectory images without CG-Recon (4.0 vs. 4.1, $p = 0.66$). CG-recon significantly improved branch visualization in 6640-trajectory images compared to those without (2.9 vs. 2.2, $p < 0.01$), whereas no significant difference was observed in 9960-trajectory images.

### CONCLUSION

The combination of CG-recon with dDLR enabled trajectory reduction without sacrificing image quality in 3D UTE time-SLIP MR angiography. This approach has the potential to facilitate broader adoption of UTE-based non-contrast MRA in patients with visceral arterial diseases.

### CLINICAL RELEVANCE/APPLICATION

Conjugate gradient iteration combined with denoising deep learning reconstruction compensates for image quality in 3D UTE abdominal MR angiography with 33%-reduced trajectories, potentially enhancing workflow and patient experience in MR practice by reducing scan time.

## S4-SSVA01-4 4D FLOW MRI FOR THE ASSESSMENT OF RENAL TRANSPLANT DYSFUNCTION: A COMPARISON WITH ULTRASONOGRAPHY

Yaqi Shen, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Gen Chen (*Abstract Co-Author*) Nothing to Disclose
Zhen Li, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hao Tang (*Presenter*) Nothing to Disclose

### PURPOSE

4D flow MRI is an emerging technique enabling visualization and quantification of 3D blood flow in renal vascular transplants. However, studies assessing its accuracy are scarce. Thus, we compared blood flow quantification using 4D flow MRI with ultrasonography (US).

### METHODS AND MATERIALS

Sixty-seven prospectively enrolled renal transplant patients underwent both ultrasonography and 4D flow MRI. 4D flow coronal oblique acquisitions were conducted in the transplant renal artery (RA) at 3.0T. Test-retest repeatability and inter-observer reproducibility were evaluated using Cohen’s kappa and Bland-Altman statistics.

### RESULTS

A total of 65 transplant renal arteries were compared. 4D flow MRI underestimated peak systolic velocity (PSV) by 18% (62.6±21 cm/s vs 76.4±25 cm/s) compared to US (P<0.05). Resistance index (RI) values were comparable between MRI and US (0.72±0.11 vs 0.73±0.09; not significant). Reproducibility and inter-observer agreement of 4D flow MRI were excellent (K=0.89).

### CONCLUSION

4D flow parameters exhibited superior repeatability in the transplant renal artery. Despite a moderate underestimation of PSV compared to US, 4D flow MRI provided accurate measurements of PSV and RI in renal transplant patients.

### CLINICAL RELEVANCE/APPLICATION

4D flow MRI shows promise for future integration with MRA to comprehensively evaluate transplant renal artery stenosis and associated changes in renal transplant function.

## S4-SSVA01-5 DIAGNOSTIC PERFORMANCE, INTER-OBSERVER RELIABILITY, AND SAFETY OF INTRANODAL CT LYMPHANGIOGRAPHY WITH WATER-SOLUBLE IODINATED CONTRAST MEDIUM FOR DETECTING LYMPHATIC LEAKAGE

Hiroshi Kondo, MD (*Abstract Co-Author*) Nothing to Disclose
Masayoshi Yamamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Wada, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the diagnostic performance, inter-observer reliability, and safety of intranodal CT lymphangiography with water-soluble iodinated contrast medium (ICTL-WSI) for detecting leakage of lymphorrhea patients.

### METHODS AND MATERIALS

This retrospective study examined patients who underwent ICTL-WSI as an index test to detect lymphatic leakage. During January 2020 - March 2023, consecutive patients with suspected lymphorrhea were enrolled. Patients underwent ICTL-WSI followed by intranodal lymphangiography (IL) with an oil-based iodinated contrast medium. The presence of leakage and location of disrupted lymphatic vessels were found by consensus between two board-certificated radiologists as the reference standard. Two other board-certificated radiologists independently examined the presence and location of leakage in ICTL-WSI without patient clinical information. The sensitivity, specificity, and area under the receiver operator characteristic curve (AUC) were calculated to assess diagnostic performance. Kappa coefficients for inter-observer reliability, complications associated with ICTL-WSI, and radiation exposure were analyzed.

### RESULTS

In all, 28 patients (ages 15-83 years; 11 female and 17 male; 17 nontraumatic and 11 traumatic lymphorrhea) and 30 examinations were included. The sensitivity, specificity, and AUC for the presence of leakage were, respectively, 1.00, 0.895, 0.971 by Reader 1 and Reader 2. The ICTL-WSI scores for depicting disrupted lymphatic vessel by Reader 1 and Reader 2 were, respectively, 13/13 (100%) and 11/13 (84.6%). The inter-observer reliability for detecting leakage was excellent (kappa coefficients, 1.00). No complication associated with ICTL-WSI was observed. The median volume-weighted CT dose index and the median dose-length product of ICTL-WSI were, respectively, 11.2 mGy (range, 4.7-24.8) and 725.6 mGy cm (range, 321.0-1551.9).

### CONCLUSION

For detecting leakage in lymphorrhea patients, ICTL-WSI can be a reliable, safe, and diagnostically important examination.

### CLINICAL RELEVANCE/APPLICATION

ICTL-WSI can be an effective alternative to IL with oil-based iodine contrast medium, especially for patients with difficulty using oil-based iodine contrast medium.

## S4-SSVA01-6 PREDICTION OF ARTERIAL INVASION BY PREOPERATIVE ENHANCED CT COMBINED WITH RADIOMICS-BASEDCLASSIFICATION MODEL OF PANCREATIC DUCTAL ADENOCARCINOMA

Haoran Zhang (*Abstract Co-Author*) Nothing to Disclose
Manju Liu, PhD (*Abstract Co-Author*) Nothing to Disclose
Yanzhao Yang (*Abstract Co-Author*) Nothing to Disclose
Fuhua Yan, MS (*Abstract Co-Author*) Nothing to Disclose
Ning Wen, PHD (*Abstract Co-Author*) Nothing to Disclose
Yajiao Zhang, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Prediction of arterial invasion by preoperative enhanced CT combined with radiomics-based classification model of pancreatic ductal adenocarcinoma (PDAC) on arteries and classify the invasion angle, to provide guidance for judging the resectability of PDAC.

### METHODS AND MATERIALS

Patients who were pathologically proven with PDAC were recruited retrospectively between January 2018 and December 2022. Firstly, the CNN-based Attention Unet segmentation models were developed four Individual Unet Models that segments pancreas, tumor, and arteries (celiac artery, hepatic artery, and superior mesenteric artery) separately. The segmentation efficacy was assessed using Accuracy and Dice similarity coefficient. Secondly, 1835 radiomics features were extracted from tumors and arteries and to build a classification model with support vector machine. Vascular invasion was divided into three grades. Grade 0 was no contact between tumor and blood vessels. The degree of vascular involvement was characterized as less than 180° in grade 1, and in grade 2, the degree was greater than 180°. The performance of this model was assessed in the training and validation cohorts using the area under the receiver operating curve (AUC).

### RESULTS

A total of 290 patients [mean (SD) age, 70.0 (9.4) years; 167 (57.6%) male and 123 (42.4%) female] were divided into the training cohort (n=195) and validation cohort (n=95). Firstly, the segmentation model achieve notable performance: pancreas (Accuracy: 0.819, Dice: 0.756), tumor (Accuracy: 0.695, Dice: 0.687), and artery (Accuracy: 0.920, Dice: 0.927). Secondly, a total of 1835 CT radiomic features were extracted. Nineteen, seventeen and five optimal features were selected to predict the invasion grade of lesions with celiac artery, hepatic artery and superior mesenteric artery, respectively. The radiomics-based model yielded an AUC of 0.938 (95%CI: 0.904-0.971), 0.903 (95% CI: 0.852-0.953) , and 0.870 (95% CI: 0.814-0.927) in the

training cohort, and an AUC of 0.765 (95%CI: 0.656-0.874), 0.811 (95% CI: 0.696-0.926), and 0.856 (95%CI: 0.780-0.932) in the validation cohort, respectively.

**CONCLUSION**

The model based on radiomics features that can reflect spatial information improves the accuracy of preoperative assessment of vascular invasion status, and help to predict the likelihood of achieving complete resection.

**CLINICAL RELEVANCE/APPLICATION**

The proposed segmentation model and radiomics classification model can be used for an array of preoperative assessments, involving accurate segmentation of preoperative lesions and blood vessels and grading of vascular invasion status in PDAC, thereby improving the decision-making process regarding the feasibility of surgery for PDAC patients.

# Abstract Archives of the RSNA, 2024

S4-STCE1

**Science Session (Multiomic and Multicenter Radiology AI)**

Sunday, Dec. 1 1:00PM - 1:30PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## S4-STCE1-1 SEGMENT2REPORT: ENHANCING AI-ASSISTED RADIOLOGY REPORT GENERATION WITH PER-VOXEL ORGAN AND TUMOR SEGMENTATION

Kang Wang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Pedro Ricardo Ariel Salvador Bassi (*Abstract Co-Author*) Nothing to Disclose
Andrea Cavalli (*Abstract Co-Author*) Nothing to Disclose
Yang Yang, PhD (*Abstract Co-Author*) Nothing to Disclose
Xiaoxi Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Sergio Decherchi (*Abstract Co-Author*) Nothing to Disclose
Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To automatically generate clinically relevant reports that include both biomarkers easily obtained by radiologists, such as tumor presence, long/short diameters, and tumor types, and those not easily obtained, such as organ/tumor volumes, HU intensity distribution, and Radiomics features.

### METHODS AND MATERIALS

We developed AI algorithms to identify the margins of the liver, pancreas, and kidneys from CT scans and segment tumors, cysts, and blood vessels within these organs. We proposed an automatic tool, termed Segment2Report, to translate these body segments into comprehensive radiology reports. Segment2Report leverages multiomic data to enhance clinical decision-making by incorporating quantitative imaging biomarkers alongside traditional Radiological features. First, we utilized hepatic vessels to divide the liver into multiple sub-segments, precisely localizing tumors. Each tumor was measured using its long and short diameters on the largest CT slice, following WHO standards (illustrated in Figure), and its volume was calculated by multiplying the number of voxels by the spacing information provided in the DICOM header. We calculated the average Hounsfield Unit (HU) values for tumors and organs, integrating radiomic features that offer additional insights into tissue characterization. Segment2Report analyzed the interaction between tumors and adjacent blood vessels, providing critical information for tumor staging and risk stratification. Segment2Report, trained on large-scale, multicenter datasets, was externally evaluated on 165 CT volumes from UCSF, which included scans of normal patients and those with kidney, pancreas, and liver tumors.

### RESULTS

Without training on UCSF scans, our AI algorithms achieved a high DSC of 96.2%, 83.1%, and 92.3% for liver, pancreas, and kidney segmentation, and our AI-generated reports presented a Sensitivity of 85.6%, 92.6%, 99.2% and a Specificity of 64%, 86.7%, 93.8% for detecting tumors in the liver, pancreas, and kidney, respectively. A comprehensive list of tumors was generated for patients with multiple lesions.

### CONCLUSION

Leveraging precise per-voxel segmentations and a reproducible measuring system, our AI-generated reports can surpass human-written reports in the objective measurement of organs and tumors. Moreover, our framework performs in-depth analyses commonly omitted by humans.

### CLINICAL RELEVANCE/APPLICATION

Segment2Report can assist radiologists by automating lengthy tasks, enabling them to write more complete and detailed reports under tight time constraints. Providing comprehensive, precise and reproducible tumor evaluation, our AI-generated reports can improve cancer staging, progress monitoring, and treatment planning.

## S4-STCE1-2 NEXT-GEN RADIOLOGIC ASSISTANT INTEGRATING MULTI-MODAL DATA AND DOMAIN EXPERT PREDICTIONS WITH D-RAX

Ramon Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Marius G. Linguraru, DPhil, MSc (*Abstract Co-Author*) Co-founder, PediaMetrix Inc
Vishwesh Nath, PhD (*Abstract Co-Author*) Nothing to Disclose
Holger R. Roth, PhD (*Abstract Co-Author*) Employee, NVIDIA Corporation;Researcher, NVIDIA Corporation
Syed M. Anwar, PhD (*Abstract Co-Author*) Nothing to Disclose
Abhijeet Parida (*Abstract Co-Author*) Nothing to Disclose
Hareem Nisar (*Abstract Co-Author*) Nothing to Disclose
Zhifan Jiang, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

With the increasing workload in radiology departments, generative artificial intelligence (AI) can reduce the work burden and potentially enhance healthcare delivery. Recent large vision language models (VLMs) can assist clinicians in interpreting complex medical images and provide feedback in natural language. Despite their advanced capabilities, these models are very general and prone to hallucinations, which limits their precision in answering radiology-specific questions. To address this, we propose D-Rax, an enhanced domain-specific, conversational radiologic assistance tool to provide interpretation of chest X-ray images (CXR).

**METHODS AND MATERIALS**

D-Rax was developed by fine-tuning a base VLM architecture (LLaVA) using a carefully curated and enhanced dataset. This dataset comprised of 129,232 CXR from the public MIMIC-CXR dataset, instructions derived from 429,000 CXR-related visual question-answer pairs (VQA) from the Medical-Diff-VQA dataset, and disease diagnosis (n=18 types) and demographic predictions (asian, black, white) obtained from multiple state-of-the-art (SOTA) pre-trained expert AI models for radiology available through TorchXRayVision. We conducted extensive experiments for end-to-end instruction tuning of the base LLaVA, LLaVA pretrained on RAD and SLAKE datasets, comparing their performance with and without expert model predictions. Performance was assessed using accuracy (%) for close-ended (C) questions and the ratio (%) of correctly generated words for open-ended (O) questions.

**RESULTS**

The expert model-enhanced instruction tuning of D-Rax showed improvements in model performance for both C and O questions. The averaged accuracy (%) with and without expert model predictions resulted in 78.6 vs. 77.3, 79.0 vs. 77.0, and 78.8 vs. 76.3, with p-value < 0.001 for the three LLaVA models respectively. The averaged ratio (%) resulted in 61.6 vs. 61.3 (p-value > 0.05), 61.6 vs. 60.4 (p-value < 0.001), and 61.7 vs. 60.4 (p-value < 0.001), respectively.

**CONCLUSION**

We established a novel training paradigm that incorporates predictions from expert models to improve the precision of VLMs in CXR analysis. Our results validated the hypothesis that domain-specific knowledge extracted from clinical radiology reports reduces hallucination. Secondly, the addition of expert information from SOTA AI models enhanced the accuracy of answering questions in a clinically-relevant conversation.

**CLINICAL RELEVANCE/APPLICATION**

Leveraging the power of SOTA AI diagnostic models combined with VLMs, D-Rax empowers clinicians to interact with medical images using natural language, which could potentially streamline their decision-making process, enhance diagnostic accuracy, and conserve their time.

## S4-STCE1-3 ENHANCING FEDERATED LEARNING IN MULTICENTER RADIOLOGY AI SYNTHETIC DATA GENERATION FOR IMPROVED MAMMOGRAPHY CLASSIFICATION

Daniel Sigrist (*Abstract Co-Author*) Nothing to Disclose
Marc Molina (*Abstract Co-Author*) Nothing to Disclose
Antje-Christin Knopf (*Abstract Co-Author*) Nothing to Disclose
Stephanie Nadine Benz (*Abstract Co-Author*) Nothing to Disclose
Cyril Fischer (*Abstract Co-Author*) Nothing to Disclose
Daniela Sarahi Ramirez Figueroa, MD (*Abstract Co-Author*) Nothing to Disclose
Felice A. Burn, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Federated learning (FL) has emerged as a very promising approach for Multicenter Radiology AI, enhancing collaborative model training while strongly preserving data privacy. However, class imbalance and limited data availability can critically impact model performance. This study investigates the potential of synthetic data generation to enhance FL-based mammography classification across multiple centers.

**METHODS AND MATERIALS**

We used an open-source mammography dataset containing 10,000 X-ray images labeled on a scale of 1-8, indicating cancer masking evaluated by 5 radiologists. The dataset was split into 9,500 training and 500 validation images. A baseline FL model was trained simulating 5 distinct centers. We developed a synthetic data generation pipeline using a class-conditioned Diffusion Transformer. This model doubled the size of each class while maintaining the original distribution of cancer masking. A privacy filter based on a self-supervised network trained with contrastive loss ensured that synthetic images were not direct training data copies. We trained a second FL model, providing each center access to its original data plus the complete synthetic data. Both FL models employed an EfficientNet-B4 architecture pre-trained on ImageNet. Training occurred over 30 rounds, with each client processing its entire dataset once per round using an AdamW optimizer and a learning rate of 0.0005. Client-side evaluation was used with the resulting metrics sent back to the server for aggregation and model updates. The model performance was assessed with adjusted mean absolute error (AMAE) and Kendall's tb.

**RESULTS**

Our analysis revealed that the synthetic-augmented FL model achieved a Kendall's tb of 0.74, indicating a stronger correlation between predicted and true classes compared to the baseline FL model, which scored 0.70. The AMAE showed a notable reduction from 1.08 in the baseline FL model to 0.88 in the synthetic augmented model.

**CONCLUSION**

Our study demonstrates another huge potential of multicenter AI radiology by combining the use of Federated Learning with synthetic data. By addressing class imbalances and augmenting limited datasets, this approach enhances model accuracy significantly while maintaining data privacy across multiple centers. These findings suggest a promising avenue for advancing collaborative AI development in clinical radiology.

**CLINICAL RELEVANCE/APPLICATION**

These findings suggest a promising avenue for advancing the collaborative development of radiology clinical studies and computer-aided diagnosis tools, particularly in scenarios where data is scarce within rare disease, and sharing is restricted. This method can remarkably enhance the scalability and effectiveness of AI in medical imaging, paving the way for improved diagnostic accuracy and patient outcomes across multiple centers.

# Abstract Archives of the RSNA, 2024

S4-STCE2

**Science Session (Low-Field and Mobile MRI)**

Sunday, Dec. 1 1:00PM - 1:30PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## S4-STCE2-1 INLINE SNR-DRIVEN AUTOMATIC QUALITY CONTROL FOR PATIENT-SPECIFIC SCAN TIME MINIMIZATION AT 0.55T

Kelvin Chow, PhD (*Abstract Co-Author*) Employee, Siemens AG
Ahsan Javed (*Abstract Co-Author*) Nothing to Disclose
Adrienne Campbell (*Abstract Co-Author*) Nothing to Disclose
Rajiv Ramasawmy (*Abstract Co-Author*) Nothing to Disclose
Pierre Daude, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Conventional fixed duration acquisitions can result in patient-dependent image quality. We recently demonstrated a periodic inline automatic quality control based on signal-to-noise ratio (SNR) to achieve consistent diagnostic image quality for 2D phase-contrast flow cardiac MRI on a commercial 0.55T MR system. In this work, we aim to extend the SNR-driven quality control to a 3D ultra-short echo time (UTE) pulmonary MRI.

### METHODS AND MATERIALS

We implemented a closed-loop feedback framework between image reconstruction and data acquisition to automatically stop the acquisition when a target SNR is achieved. The quality control was optimized for minimal computational latency. A snapshot reconstruction was triggered 2min 30s after the start of imaging, and an SNR map was estimated using pseudo replica methods. The SNR of the lung parenchyma was automatically extracted. Based on this snapshot SNR, the total optimal subject specific time needed to achieve the target SNR was calculated. The predicted number of spiral shots corresponding to this duration is sent to the sequence controller and the acquisition is automatically stopped as soon as this number is reached.Ten healthy volunteers (HVs) were imaged on a 0.55T MRI scanner (MAGNETOM Free.Max, Siemens Healthineers AG, Erlangen, Germany) using a prototype free-breathing golden angle stack-of-spirals 3D ultrashort echo time sequence (TE/TR=0.8/7.5ms, FA=5°, (1.75mm)3 resolution, FOV=480x480x190 mm3, maximum scan time=12min). A target SNR of 4 was used to demonstrate the stopping criterion in real-time (1 HV) or retrospectively (10 HVs).

### RESULTS

By applying the quality control retrospectively, pulmonary acquisitions would have automatically stopped at 6min 49s ± 1min48s. The distribution of automated stopping times across the population (standard deviation > 1 minute) revealed the value of a subject-specific scan time. The computation time for the SNR-driven quality control was 40s which were compatible with the online deployment.

### CONCLUSION

Our proposed inline SNR-driven automatic quality control mimics the “ALARP” principle applied to MRI. This approach enables time-efficient subject-specific acquisitions while ensuring consistent diagnostic image quality. Additional metrics for stop criteria will be considered in future work. The ability to achieve a consistent image quality as efficiently as possible on a 0.55T MRI platform may help to avoid repeated scans, optimize scans workflow, and improve the accessibility of cardiac and pulmonary MRI.

### CLINICAL RELEVANCE/APPLICATION

We propose an inline automatic quality control to stop acquisitions when image quality is sufficient to answer the clinical question on a low field MRI system. This achieves the minimum possible scan time for each patient.

## S4-STCE2-2 DETERMINANTS OF IMAGE QUALITY IN RESPIRATORY TRIGGERED FREE BREATHING LUNG MRI AT 0.55T

Yoo Jin Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Peder E. Larson, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Bristol-Myers Squibb Company;Research Consultant, Human Longevity Inc;Advisory Board, Imaginostics, Inc;Shareholder, Imaginostics, Inc
Pan Su (*Abstract Co-Author*) Nothing to Disclose
Michael A. Ohliger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan A. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Sohn, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Felicia Tang, BA, BS (*Abstract Co-Author*) Nothing to Disclose
Kiara Bowers (*Abstract Co-Author*) Nothing to Disclose
Richard Schonour, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Newly emerging respiratory-triggered low-field (0.55T) MR systems have shown promise in pulmonary imaging due to reduced susceptibility artifacts at the air-tissue interface, but variability in image quality remains a lingering challenge to overcome in clinical workflow. Our objective is to evaluate sets of anatomic imaging from 0.55T MR of the lungs and identify predictors of degraded image quality. We hypothesize that body mass index (BMI), respiratory pattern, and certain disease processes could have significant influence on image quality or its variability.

### METHODS AND MATERIALS

Participants with significant pulmonary disease who were scheduled to undergo CT or PET/CT were recruited to undergo same-day 0.55T MRI (MAGNETOM Free.Max, Siemens Healthcare, Erlangen, Germany) between January 2023 and August 2023. Examples of conditions that prompted participant enrollment included lung nodules, masses, cancer, infection, bronchiectasis, and pulmonary fibrosis. A total of 28 participants were enrolled. After acquisition of respiratory triggered T2-weighted (axial BLADE) and T1-weighted (ultra short-echo time) sequences, six radiologists assigned quantitative grades based on overall image quality. Analysis of clinical covariates in and between grade tertiles was performed. Tidal depth (TD), respiratory rate (RR), and respiration length were quantified to determine patient breathing patterns. Respiration length was the average duration of a single breath in the triggered sequence. Body surface area and BMI were calculated to determine if participant height and weight impacted image quality. One-way ANOVA was conducted to examine the effect of the potential predictor groups on image quality. Statistical significance was defined by P values of less than .05.

### RESULTS

28 participants (mean age, 59 years +/- 19; 17 women) were evaluated. The most common clinical condition associated with degraded image quality was fibrotic interstitial lung disease. Deeper tidal depth (P = .04), longer respiration length (P = .002), and higher BMI (P = .02) were found to be statistically significant predictors of degradation. Neither respiratory rate nor body surface area were found to have a significant association (P > .05) with poor image quality.

### CONCLUSION

High body mass index, fibrotic interstitial lung disease, deep tidal depth breathing, and longer respiratory length were associated with image degradation in pulmonary imaging with 0.55T MR.

### CLINICAL RELEVANCE/APPLICATION

Knowing what predicts image degradation in 0.55T Lung MR allows radiologists to prepare at-risk patients accordingly (e.g. free-breathing MR sequences or alternative imaging modality) to obtain the best possible images while guiding future research to improve image quality.

## S4-STCE2-3 MRI NEAR TITANIUM TOTAL HIP ARTHROPLASTY AT 0.55T COMPARED WITH 3T

Jay Acharya, MD (*Abstract Co-Author*) Nothing to Disclose
Jay R. Lieberman (*Abstract Co-Author*) Nothing to Disclose
Krishna S. Nayak, PhD (*Abstract Co-Author*) Nothing to Disclose
Brian A. Hargreaves, PhD (*Abstract Co-Author*) Research support, General Electric Company;Royalties, General Electric Company;Royalties, Koninklijke Philips NV;Royalties, Siemens AG
Jordan S. Gross, MD (*Abstract Co-Author*) Nothing to Disclose
Bochao Li (*Abstract Co-Author*) Nothing to Disclose
Kubra Keskin, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

MRI provides a non-invasive imaging tool that offers soft tissue contrast for evaluating tissues near metallic implants. Artifacts can occur due to magnetic susceptibility differences between tissues and implants, and these are proportional to the field strength. As a result, MRI performance, including metal artifact levels, can vary with field strength. This study aims to compare the imaging of patients with titanium total hip arthroplasty (THA) using 0.55T and 3T MRI.

### METHODS AND MATERIALS

Six patients with titanium THA were scanned with comparable protocols at 0.55T and 3T on the same day back-to-back. Protocols include Turbo Spin Echo (TSE), TSE with View-Angle Tilting (TSE-VAT), Slice Encoding for Metal Artifact Correction (SEMAC), and Short Tau Inversion Recovery with SEMAC (STIR-SEMAC). The 0.55T scans were performed using a whole-body prototype MAGNETOM Aera (Siemens Healthineers), while the 3T scans were performed on a whole-body MAGNETOM Prisma Fit (Siemens Healthineers). Images from both scanners were evaluated by two radiologists, who scored them on diagnostic confidence, perceived metal artifact, perceived sharpness, and perceived SNR with a 5-point Likert scale. Statistical differences between all the scores for 0.55T and 3T images for each sequence were determined via Wilcoxon signed-rank tests with a significance level of 0.05.

### RESULTS

We observed a significant reduction in the severity of metal artifacts at 0.55T compared to 3T. At 0.55T, TSE and TSE with VAT provided results comparable to SEMAC in terms of metal artifacts. However, imaging at 3T still required multi-spectral imaging (MSI) to reduce through-plane artifacts. There were remaining ripple artifacts near the stem and the femoral head at 3T, which were not observed at 0.55T. Reader study yielded statistically higher scores for 0.55T compared to 3T in terms of diagnostic confidence for all sequences.

### CONCLUSION

0.55T MRI offers substantially reduced metal artifacts and higher diagnostic confidence when imaging patients with titanium THA compared to 3T. Evaluation of these patients may not require advanced multi-spectral imaging at 0.55T. The use of 0.55T has the potential to improve radiological evaluation in these patients.

### CLINICAL RELEVANCE/APPLICATION

The ability to obtain diagnostic-quality MRI images at 0.55T in the presence of titanium implants, with significantly reduced artifact severity without advanced imaging techniques, offers a promising alternative to higher field strengths. This could facilitate broader access to MRI diagnostics for patients with metal implants and improve workflow efficiency.

# Abstract Archives of the RSNA, 2024

S5-SSBR02

**Breast Imaging (AI and Screening)**

Sunday, Dec. 1 2:30PM - 3:30PM Room: S406A

Nisha Sharma, MBChB, FRCR (*Moderator*) Nothing to Disclose
Debra L. Monticciolo, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S5-SSBR02-1 ARTIFICIAL INTELLIGENCE SHOULD ONLY READ A MAMMOGRAM WHEN IT IS CONFIDENT: A HYBRID BREAST CANCER SCREENING READING STRATEGY

Mireille Broeders, PhD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Hologic, Inc
Ioannis Sechopoulos, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research Grant, Sectra AB;Research Grant, ScreenPoint Medical BV;Research Grant, Volpara Health Technologies Limited
Sarah D. Verboom, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

To incorporate and evaluate uncertainty quantification metrics in an artificial intelligence (AI) mammography interpretation model and test their ability to guide a novel hybrid reading strategy in breast cancer screening in which recall decisions are only made by AI when it exhibits high certainty.

### METHODS AND MATERIALS

A method to quantify uncertainty, based on structured Monte Carlo dropout, was added to an AI mammography interpretation model. The model consists of three steps: 1) a sensitive region detection algorithm that proposes regions of interest, 2) a region classification network, and 3) the generation of an exam level conclusion. Four metrics, based on the variance and entropy of one or all suspicious regions, were used to estimate the confidence of the AI malignancy-present decision. A hybrid reading approach was tested where recall decisions were only made by AI when predictions were deemed confident; otherwise, standard radiologist-double reading was applied. This new reading strategy was retrospectively tested with a previously-unseen set of mammographic screening examinations (n=41,469) acquired between 2003-2018 from a unit of the Dutch National Breast Cancer Screening Program with minimal 2-year follow-up.

### RESULTS

The AI mammography interpretation model achieved an area under the receiver operating characteristics curve (AUC) of 0.957 (95% CI 0.943-0.970). The best-performing uncertainty metric, entropy of the mean output of a single region, can result in a 50% reduced workload with a reading performance within the interquartile range of standard double reading with a recall rate of 27.1 per 1,000 (95% CI 25.6-28.7) and a cancer detection rate of 8.0 per 1,000 (95% CI 7.4-8.7). At this split the AI achieved an AUC of 0.983 (95% CI 0.969 - 0.994) for the cases with confident predictions, compared to 0.880 (95% CI 0.850 - 0.907) for the exams with the uncertain predictions.

### CONCLUSION

Uncertainty metrics can be used to classify exam predictions as certain or uncertain. Leveraging uncertainty to guide the reading strategy may halve the workload without changing cancer detection and recall rates, even with a model that has lower performance than that of a single radiologist.

### CLINICAL RELEVANCE/APPLICATION

Leveraging model uncertainty of an AI mammography interpretation model can reduce workload in screen reading without decreasing performance by only considering the model's interpretations when it is confident.

## S5-SSBR02-2 USE OF ARTIFICIAL INTELLIGENCE TO REDUCE THE INTERVAL CANCER RATE OF SCREENING DIGITAL BREAST TOMOSYNTHESIS

Saul Langarica (*Abstract Co-Author*) Nothing to Disclose
Synho Do, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Ariel Kniss, MD, PhD (*Abstract Co-Author*) Intern, General Electric Company
Manisha Bahl, MD, MPH (*Presenter*) Consultant, Lunit Inc;Expert Advisory Committee, 2nd.MD

### PURPOSE

The interval cancer rate, or symptomatic false-negative (FN) cancer rate, of screening digital breast tomosynthesis (DBT) is considered to be a surrogate marker for long-term patient outcomes. To our knowledge, there is no published literature that focuses on the use of artificial intelligence (AI) to detect FN cancers on screening DBT. The purpose of this study is to assess whether an AI algorithm can correctly localize FN cancers, both interval cancers (symptomatic FN cancers) and asymptomatic FN cancers, on screening DBT examinations and to compare features of interval cancers detected versus not detected by AI.

**METHODS AND MATERIALS**

In this Institutional Review Board-approved and Health Insurance Portability and Accountability Act-compliant study, FN screening DBT examinations from 2013 to 2022 at an academic institution were analyzed by an AI algorithm (INSIGHT DBT v1.0.0.2; Lunit, Inc.). Lesions were marked on the DBT slices and assigned a score from 0-100, with the examination-level score reflecting the highest lesion score. Examinations considered positive by AI (i.e., those with an examination score of 10 or higher) were reviewed by a breast imaging radiologist to determine if the mark corresponded to the correct site of the subsequently diagnosed breast cancer. Clinical, imaging, and pathological features were compared between cancers detected and not detected by AI using standard statistical tests.

**RESULTS**

There were 339 FN screening DBT examinations in 336 women (mean age, 59 years +/- 12 [standard deviation]). Two-thirds of the FN cases had dense breast tissue on mammography (66.1%, 224/339). The mean interval from the FN screening DBT examination to the tissue diagnosis of breast cancer was 213 days +/- 92 (standard deviation). AI correctly identified 27.4% (93/339) of all FN cancers and 35.7% (74/207) of interval cancers. AI detected a higher proportion of interval cancers than asymptomatic FN cancers (35.7% [74/207] versus 14.4% [19/132], $p<0.001$). Features associated with interval cancers detected by AI (versus not detected) included dense breast tissue (75.7% [56/74] versus 57.9% [77/133], $p=0.01$), the presence of a mammographic finding identified by the radiologist at the time of breast cancer diagnosis (94.2% [65/69] versus 73.6% [92/125], $p<0.001$), and large size on surgical pathology (37 mm versus 25 mm, $p=0.001$).

**CONCLUSION**

AI correctly identifies more than one-third of interval cancers on retrospective evaluation of screening DBT examinations.

**CLINICAL RELEVANCE/APPLICATION**

This study shows the potential of AI to reduce the interval cancer rate of screening DBT, which could ultimately lead to improved screening outcomes.

## S5-SSBR02-3 REAL-WORLD IMPACT OF AI CAD IN POPULATION-BASED BREAST CANCER SCREENING - COMPARING SCREENING METRICS BEFORE AND AFTER THE SCREENTRUSTCAD TRIAL

Fredrik Strand, MD, PhD (*Abstract Co-Author*) Speaker, Lunit Inc
Frida Pilblad (*Abstract Co-Author*) Nothing to Disclose
Karin Dembrower, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

ScreenTrustCAD (NCT04778670) was the first prospective interventional study of AI in population-based breast cancer screening conducted April 2021 to April 2022 with a total of 55,581 women included. In June 2023, the study hospital decided to fully replace one radiologist with AI. We have now analyzed how flagging, recall and cancer detection has changed compared to the time before the trial.

**METHODS AND MATERIALS**

At the same hospital where the ScreenTrustCAD trial was conducted, we analyzed all screening examinations from two six-month time periods - before and after the trial. The first period was January to June 2020, when regular radiologist double-reading and consensus discussions were performed, before the ScreenTrustCAD study. The second period was July to December 2023, when AI had replaced one of the two radiologists in double-reading, more than a year after the ScreenTrustCAD ended inclusions. The AI system Lunit INSIGHT MMG was used for our full-field mammograms from Philips mammography equipment. We calculated number of screened women, flaggings, recalls, cancers as well as cancer detection rates and positive predictive values for each period.

**RESULTS**

For the six-month period without any AI, 16,217 women were screened, 1,201 were flagged (7.4%), 608 (3.7%) were recalled and 93 cancers were screen-detected. The cancer detection rate was 5.7 per 1000 screened, and the positive predictive values were 7.7% of flagged and 15.3% of recalled. For the six-month period after clinical implementation of AI, 26,629 women were screened, 2,307 were flagged (8.7%), 683 (2.6%) were recalled and 154 cancers were screen-detected. The cancer detection rate was 5.8 per 1000 screened, and the positive predictive values were 6.7% of flagged and 22.5% of recalled. The second period, when AI was used, showed a reduction of 26,629 (50%) initial reads and an increase of 344 (17%) consensus discussions.

**CONCLUSION**

After implementing an AI system as one of two readers in double-reading of screening mammograms, the workload of initial reads decreased by 50% whilst consensus discussions increased by 17%. Cancer detection rates were similar with a smaller proportion of women recalled.

**CLINICAL RELEVANCE/APPLICATION**

The real-world results, comparing periods before and after AI implementation, reinforces the finding from the previous ScreenTrustCAD trial that AI may be favorably used as one of two readers in double-reading of screening mammograms.

## S5-SSBR02-4 IMPLEMENTATION OF A CONVOLUTIONAL NEURAL NETWORK-BASED DETECTION SOFTWARE AS AN INDEPENDENT THIRD READER IN THE GERMAN MAMMOGRAPHY SCREENING: A PROSPECTIVE STUDY

Thomas Lehnen, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the impact of using a software for computer-aided detection in digital mammography as an independent third reader in the German breast cancer screening program on detection rates and on the screening process.

**METHODS AND MATERIALS**

In this prospective study, over a period of 6 months from August 23 to February 24, the screening mammograms of 15,377 participants aged 50 to 69 years were analyzed using a software for computer-aided detection (Transpara, Screenpoint Medical), additionally to independent double reading which was conducted without knowledge of the software results. The software assigns a score from 1 - 10, with 10 representing the highest probability for malignancy. Each lesion detected by the software is either categorized as density or calcification. All cases with a Score of 10 were brought into the consensus conference, consisting of the two readers and a program director radiologist, together with the cases selected by one or both of the readers. All screening cases deemed in need of further investigation during the consensus conference underwent further diagnostic evaluation.

**RESULTS**

Among the 15,377 cases, 114 breast cancers were diagnosed. 10 ( 8.8%) were solely identified by the software. This resulted in an increase in the detection rate of 8.7% ( from 0.68% to 0.74%). The PPV of the recalled cases was 13.6%, whereas without the use of the software, it would have been 15.0%. The additionally diagnosed cancers were all invasive and characterized by the software as densities, except for one case, which was a DCIS and identified as calcification. The invasive cancers were exclusively HR-positive, Her2-negative, with Ki-67 values up to 16%. 12 malignancies were software negative, 8 of them received a score of 9. 8 software negative cancers were invasive, of which 3 were triple negative, with Ki-67 values of 25% and above and rated with low scores of 7, 6 and 2 respectively.

**CONCLUSION**

Using the software as an independent third reader improved the cancer detection rate with reasonable additional burden on the screening attendees and workload in terms of decrease in PPV of the recalled cases. Including score 9 densities for presentation in the consensus conference may result in a further improvement of screening sensitivity without inadequately increasing the workload. Considerations about replacing readers with the software should take into account the weaknesses of the software in detecting triple negative breast cancers.

**CLINICAL RELEVANCE/APPLICATION**

Using an analyzing software as an independent third reader may be a suitable means to improve screening results. Including cases with a score of 9 classified as densities by the software may further improve the sensitivity of the screening and should be evaluated in future studies.

## S5-SSBR02-5 EARLY ALERTS - AN ANALYSIS OF TEMPORAL CHANGES IN THREE MAMMOGRAPHY-BASED ARTIFICIAL INTELLIGENCE ALGORITHM SCORES OVER THE COURSE OF A PATIENT'S SCREENING TIMELINE

Pantelis Gialias, MD (*Abstract Co-Author*) Nothing to Disclose
Fredrik Strand, MD, PhD (*Abstract Co-Author*) Speaker, Lunit Inc
Fernando Cossio Ramirez, BSc (*Abstract Co-Author*) Nothing to Disclose
Haiko Schurz, BSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Sophia Zackrisson, MD, PhD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG;Speaker,Pfizer Inc;Patent holder, PCT/EP2014/057372;
Taeyang Choi (*Abstract Co-Author*) Nothing to Disclose
Sarah Hickman, MBBS (*Presenter*) Research collaboration, Vara;Research collaboration, ScreenPoint Medical BV;Research collaboration, Lunit Inc;Research collaboration, Kheiron Medical Technologies Ltd;Research collaboration, Alphabet Inc;Research collaboration, Volpara Health Technologies Limited

**PURPOSE**

Artificial intelligence computer-aided detection (AI CAD) scores have been validated for detection of breast cancer using a 1-to-2-year follow-up time in several studies. However, women attend screening over many years and analysing AI CAD scores over longer time periods could provide insight into the earlier detectable change.

**METHODS AND MATERIALS**

The retrospective VAI-B dataset from 4 different screening regions in Sweden was used for this study. All women with breast cancer were included and randomly selected healthy controls. Two-view full-field digital mammograms screening rounds in 2007 to 2021 were included. Exams with images from GE and Philips equipment were included. Cancer ground truth was based on histopathology and healthy status on at least three-year follow-up. The abnormality scores from three commercial AI CADs were determined at each screening episodes based on the images from that episode only. Population percentile cut-off points for AI CAD scores were calculated separately for each AI CAD and each age of the participating women in the full population.

**RESULTS**

In total 29,136 individuals and 83,723 exams were included, of which 10,350 individuals were diagnosed with breast cancer (35.5%). The median age of the cohort was 58.4 [IQR 49.2 - 65.9] with an average number of 3 screening episodes per cancer case included over a median of 4.1 years [IQR 2.1 - 6.2]. After up-sampling of healthy cases, the final study population included 1,024,794 individuals, to attain a proportion of diagnosed and healthy reflective of the source population (cancer proportion of 1%).The proportion of cancer cases with an age-adjusted AI CAD score above the 90th centile of the entire population, for AI-1, AI-2, and AI-3 respectively, at 5 years before diagnosis, were 19.5%, 18.5% and 19.6% . The proportions had increased at 3 years before diagnosis to 32.6%, 29.9% and 32.4%. And at 1 year before diagnosis were 80.5%, 71.2% and 77.5%.When set at the 75th centile, at 5 years before diagnosis, 39.4%, 36.5% and 42.7% of the cancer cases exceeded the threshold; which increased at 3 years before to 53.1%, 50.5%, 52.7%; and at 1 year before diagnosis to 88.8%, 82.4% and 87.9%.See Figure for AI CAD score dynamics up to 10 years out.

**CONCLUSION**

The AI CAD scores from sequential mammograms show that many years before diagnosis, the scores are disproportionately higher for women who will later be diagnosed with breast cancer compared to the overall population

**CLINICAL RELEVANCE/APPLICATION**

Based on AI CAD scores from three commercial AI systems, there is a potential to detect up to a third of current cancers around 3 years earlier by an intervention targeting 10% of the population, or, if preferred, to detect up to half of current cancers by targeting 25% of the population

## S5-SSBR02-6 OPTIMISING BREAST SCREENING PATHWAY INTEGRATION: A COMPARATIVE ANALYSIS OF AI WORKFLOWS IN A PROSPECTIVE EVALUATION

Catharina Oberije, PhD (*Abstract Co-Author*) Nothing to Disclose
Georgia Fox (*Abstract Co-Author*) Nothing to Disclose
Clarisse De Vries (*Abstract Co-Author*) Nothing to Disclose
Benjamin Yi Hong Tse (*Abstract Co-Author*) Nothing to Disclose
Lesley A. Anderson, PhD,MPH (*Abstract Co-Author*) Nothing to Disclose
Roger T. Staff, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Nash, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ben Glocker, PhD (*Abstract Co-Author*) Employee, Kheiron Medical Technologies Ltd;Employee, HeartFlow, Inc;Researcher, Microsoft Corporation
Joseph Yearsley (*Abstract Co-Author*) Support, Kheiron Medical Technologies Ltd
Annie Ng, PhD (*Abstract Co-Author*) Researcher, Kheiron Medical Technologies Ltd
Peter D. Kecskemethy, PhD (*Abstract Co-Author*) CEO, Kheiron Medical Technologies
Gerald Lip, MBBCh, FRCR (*Presenter*) Nothing to Disclose

## PURPOSE

The integration of artificial intelligence (AI) into breast screening holds significant promise for improving cancer detection accuracy and service efficiency, with the optimal workflow for implementing AI dependent on clinical site requirements. This evaluation aimed to compare and evaluate different workflows for integrating AI into breast screening, assessing their impact on screening outcomes and workload.

## METHODS AND MATERIALS

In a prospective evaluation, a commercially available AI system was implemented within a breast screening unit to examine AI integration workflow strategies, Fig 1. Women could choose to opt out of AI assessment. Each case received standard double reading (DR) with arbitration of discordant cases. If the DR process did not prompt recall but the AI flagged potential abnormalities (as a safety net), additional arbitration was employed. Women identified as needing further evaluation were recalled. Workflow variations using AI were assessed including a combination of AI as 1) a 'second reader' in a portion of cases (which was modelled), and 2) a safety net 'extra reader' (implemented live). Non-inferiority (alpha of 0.05) was tested for recall rate (RR), cancer detection rate (CDR), sensitivity (SEN), specificity (SPEC) and positive predictive value (PPV). Superiority was tested when non-inferiority passed alpha of 0.1.

## RESULTS

The evaluation included 10,889 women. The primary workflow resulted in additional arbitration for 1,345 (12.4%) women after being flagged by the AI, yielding an increased CDR of 1 per 1000 (11 extra cancers found), a modelled workload savings of 31% and relative RR reduction of 0.8%. Other workflow variations showed different trade-offs in terms of CDR, RR, PPV, SEN, SPEC and workload savings. Statistical testing showed a combination of non-inferior or superior outcomes for some workflows, while others yielded superior outcomes, across all measured metrics.

## CONCLUSION

This evaluation presents the advantages and challenges of different workflow options for integrating AI into breast screening. The primary workflow and multiple other variations emerge as particularly promising strategies, offering superior clinical outcomes and operational gains. These findings underscore the importance of tailoring AI integration to specific clinical contexts to optimise its impact on breast screening.

## CLINICAL RELEVANCE/APPLICATION

This evaluation shows that different AI implementation strategies provide improved CDR and workload savings with varied trade-offs. Some may provide superior performance across all metrics assessed. The optimal method of implementing AI into breast screening pathways will need to be considered prior to its use in clinical practice according to local requirements.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

S5-SSCA02

**Science Session with Keynote: Cardiac Imaging (Artificial Intelligence for Acquisition)**

Sunday, Dec. 1 2:30PM - 3:30PM Room: E353C

Hamid Chalian, MD (*Moderator*) Nothing to Disclose
Rozemarijn Vliegenthart, MD, PhD (*Moderator*) Institutional Research Grant, Siemens Healthineers Speaker's Bureau, Siemens Healthineers Speaker's Bureau, Bayer

**Sub-Events**

## S5-SSCA02-2 INFLUENCE OF THE DENOISING ALGORITHM ON PERICORONARY ADIPOSE CT ATTENUATION: COMPARISON BETWEEN ADAPTIVE STATISTICAL ITERATIVE RECONSTRUCTION AND DEEP LEARNING IMAGE RECONSTRUCTION

Ning Pan (*Abstract Co-Author*) Nothing to Disclose
Jianxin Guo (*Abstract Co-Author*) Nothing to Disclose
Jianying Li, PhD (*Abstract Co-Author*) Employee, General Electric Company
Lihong Chen (*Abstract Co-Author*) Nothing to Disclose
Tingting Qu (*Presenter*) Nothing to Disclose

### PURPOSE

Pericoronary adipose tissue CT mean attenuation (PCATMA) is a marker of coronary artery inflammation. The influence of deep learning image reconstruction algorithm (DLIR) on PCATMA is still unknown, which was investigated in this study in comparison with adaptive statistical iterative reconstruction veo (ASIR-V) algorithm.

### METHODS AND MATERIALS

Twenty-one patients with confirmed or suspected coronary artery disease who underwent CT coronary angiography were included. All scans were reconstructions with both low and high strength of ASIR-V and DLIR. PCATMA of the left anterior descending artery (LAD), left circumflex artery (LCX), and right coronary artery (RCA) were calculated using a dedicated software. The differences of PCATMA between the low and high strength of ASIR-V and DLIR algorithms were compared by Wilcoxon rank sum test and Bland-Altman plot.

### RESULTS

The PCATMA significantly increased when higher strength of ASIR-V or DLIR was used (Fig.1). However, Bland-Altman plot showed that the mean difference between the low and high strength of DLIR for LAD, LCX, and RCA (-1.2±0.9 HU, -1.7±0.9 HU and -1.1±0.8 HU, respectively) was significantly smaller than the difference (-4.1±5.9, -4.5±6.0 and -3.9±5.5, respectively) of ASIR-V (all $P<0.05$) (Fig.2 and Fig.3).

### CONCLUSION

The PCATMA increased significantly with higher strength of ASIR-V or DLIR. However, comparing with ASIR-V, the magnitude of change in PCATMA was significantly smaller for DLIR compared with ASIR-V.

### CLINICAL RELEVANCE/APPLICATION

Because PCATMA changes only slightly with the progression of coronary atherosclerosis, and because PCATMA is more robust to different strengths of DLIR, it is better to use DLIR for denoising when applying PCATMA in clinical practice to reduce bias.

## S5-SSCA02-3 PHOTON-COUNTING CT: HOW THE GENERATION OF CT CHANGE THE RESULT OF COMPUTED ASSISTANCE DIAGNOSTIC (CAD)?

Yiran Wang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To explore whether the artificial intelligence-aided diagnosis results of the new generation photon counting CT will be affected by the image quality.

### METHODS AND MATERIALS

A total of 50 patients who underwent CCTA imaging in photon counting CT were included. The acquisition scheme selected high-resolution imaging mode, only 0.2mm and 0.6mm images were selected for reconstruction, and Bv72 and Bv48 were used for convolution kernals. The two groups of images were deliverd to the coronary post-processing module of the artificial intelligence assistant diagnosis software, and the subjective score of the image judged by the software and the degree of stenosis of the three main coronary arteries were recorded. The results of invasive coronary angiography were also recorded at the same time.Qualitative image analysis was performed by four radiologists. The statistical significance of the difference between groups was evaluated by Friedman test, and the Kappa consistency score was used to compare the results of AI-assisted diagnosis between the two groups. If there is a significant difference, the pairwise post-test corrected by Bonferroni is used.

### RESULTS

Compared with standard reconstruction, the image of High-Difination reconstruction algorithm was more consistent with invasive coronary angiography in AI software-assisted diagnosis (Kappa=0.874;p < 0.001). Of the 12 moderate stenosis segments initially scored in the standard reconstruction, 4 segments (30%) were reclassified as mild stenosis, while only 1 of the 7 severe stenosis segments was reclassified as moderate stenosis, while no change in AI determination of stenosis was found in mild stenosis and normal segments. However, using this algorithm will reduce the subjective score of the image judged by the software (3.64 vs.4.23 p < 0.001).

### CONCLUSION

Photon counting CT coronary artery HD imaging can improve the accuracy of AI-assisted diagnosis.

### CLINICAL RELEVANCE/APPLICATION

Photon counting CT coronary artery HD imaging can improve the accuracy of AI-assisted diagnosis.

## S5-SSCA02-4 DIAGNOSTIC PERFORMANCE OF AI-DRIVEN ANALYSIS OF CORONARY ARTERY STENOSIS IN CARDIAC CTA

Kristina Hallam (*Abstract Co-Author*) Employee, Siemens AG
Ronald M. Peshock, MD (*Abstract Co-Author*) Stockholder, General Electric Company;Researcher, Siemens AG;Researcher, Aidoc Medical
Keith Hulsey (*Abstract Co-Author*) Nothing to Disclose
Vishal Kukkar, MD (*Abstract Co-Author*) Nothing to Disclose
Suhny Abbara, MD (*Abstract Co-Author*) Royalties, RELX
Arzu Canan, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo Scanio (*Abstract Co-Author*) Nothing to Disclose
Christopher Fan (*Abstract Co-Author*) Nothing to Disclose
Fernando U. Kay, MD, PhD (*Presenter*) Research Grant, Edwards Lifesciences Corporation

### PURPOSE

This study aims to evaluate the diagnostic performance of an Artificial Intelligence (AI) algorithm prototype in automatically analyzing coronary artery stenosis using the CAD-RADS 2.0 system on cardiac computed tomography angiography (CTA).

### METHODS AND MATERIALS

We included all cardiac CTA studies performed between 2017 and 2021 at a single academic center. Studies were included under a waiver for informed consent. Exclusions were non-diagnostic studies (CAD-RADS category N), coronary anomalies, and patients post coronary artery bypass graft (CABG) or stenting. CAD-RADS categories extracted from structured clinical radiology reports served as the reference standard. All available CTA series were processed independently by the AI algorithm (ACA Prototype, Siemens Healthineers). None of these CTA scans were used in the development of the algorithm. Discrepancies exceeding one CAD-RADS category between the radiological report and the ACA CAD-RADS prompted adjudication by two independent expert readers, who were blinded to both the clinical and AI-based scores.

### RESULTS

Out of 1,128 studies initially screened, 87 were excluded (3 CABG, 7 stents, 23 coronary anomalies, 54 CAD-RADS N), leaving a total of 1,041 studies from 1,033 patients (56% female, median age 62 years; interquartile range: 54 - 69). The studies originated from five models across three manufacturers (Siemens, Philips, and Canon). The weighted kappa coefficient for agreement between the ACA prototype and the reference CAD-RADS scores was 0.73 (95% CI: 0.69 - 0.76). The area under the receiver operating characteristic curve for detecting maximum stenosis of = 50% and = 70% was 0.90 (95% CI: 0.88 - 0.92) and 0.90 (95% CI: 0.87 - 0.92), respectively.

### CONCLUSION

The AI algorithm prototype demonstrates high diagnostic accuracy in assessing coronary artery stenosis using the CAD-RADS 2.0 system on cardiac CTA across a large, diverse sample of scans from multiple vendors in an academic center.

### CLINICAL RELEVANCE/APPLICATION

Its substantial agreement with the clinical reference standard and ability to detect significant stenosis highlight its potential for improving clinical workflows. Future research studies are required to investigate how AI-preliminary read strategies impact patient management by assessing their safety, as well as their influence on turnaround time.

## S5-SSCA02-5 DEEP LEARNING-BASED CT MYOCARDIAL BLOOD FLOW QUANTIFICATION AND RISK STRATIFICATION OF CORONARY ARTERY DISEASE

Yarong Yu (*Presenter*) Nothing to Disclose

### PURPOSE

To train and validate an AI-model that carry out fully automatic quantification of MBF and ischemic myocardial volume, enable accurate diagnosis of hemodynamically significant stenosis with reference to invasive FFR, and particularly to investigate the prognostic value of AI-MBF.

### METHODS AND MATERIALS

This multi-center study involved 3 cohorts from 3 hospitals. We gathered 268 patients underwent CT-MPI + CCTA retrospectively to develop the AI model. These patients were randomly divided into 8:2 ratio: training dataset (211 patients) and tuning dataset (57 patients). Subsequently, we collected 90 patients for external validation. 90 symptomatic patients with stable angina were prospectively enrolled. These patients underwent dynamic CT-MPI initially and then took ICA or invasive FFR measurement within a 1-month interval for the purpose of diagnostic performance assessment, with invasive FFR serving as the reference standard. Finally, we evaluated the prognostic value of AI-MBF for major adverse cardiovascular events (MACEs) in 660 patients from 3 distinct hospitals, using multivariable Cox regression analysis.

### RESULTS

In the test set, there was excellent agreement, between AI model and manual measurements of both segment and patient-based MBF. Ninety participants with 116 target vessels were included for final analysis. AI-based MBF had lager AUC (using 93 mL/100 mL/min as a cutoff) than diameter stenosis (DS) (AUC = 0.970 vs 0.789, P<0.001, in per-vessel level; AUC = 0.963 vs 0.797, P<0.001, in per-patient level). Over a median follow-up of 35 months, MACEs occurred in 126 (19%) of 660 patients in this study. Multivariate Cox regression analysis revealed that AI-based ischemic myocardial volume (HR 1.13, p=0.019), presence of obstructive CAD (HR 2.04, p<0.001) and low attenuation plaque (HR=2.03, p=0.020) were the independent predictors for MACEs. Furthermore, the model with ischemic myocardial volume had higher global chi-square test result and improved reclassification than the model

without ischemic myocardial volume. For per-patient, the mean CT-MPI postprocessing time of AI-model was 8s (SD=1s) versus 403s (45s) taken manual reconstruction.

**CONCLUSION**

AI-model enabled fast, fully automatic CT-MBF quantification and accurate diagnosis of ischemic coronary stenosis. The ischemic myocardial volume percentage derived from AI-model improved risk stratification of CAD.

**CLINICAL RELEVANCE/APPLICATION**

AI-model enable accurate diagnosis of hemodynamically significant stenosis, precisely guiding treatment strategy for purpose. The model with ischemic myocardial volume derived from AI-model had better risk stratification for CAD patients. AI-model significantly improved clinical workflow.

**S5-SSCA02-6** **Keynote Speaker**

Benoit Desjardins, MD, PhD (*Science Invited Presenter*) Nothing to Disclose

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

S5-SSGI03

**Gastrointestinal Imaging (Pancreas Diffuse Disease)**

Sunday, Dec. 1 2:30PM - 3:30PM Room: E350

Abraham Fourie Bezuidenhout, MD (*Moderator*) Nothing to Disclose
Marc Zins, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S5-SSGI03-1 DETECTION OF PERI-PANCREATIC EDEMA USING DEEP LEARNING AND RADIOMICS

Temel Tirkes, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Velichko, PhD (*Abstract Co-Author*) Nothing to Disclose
Elif Keles, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Zheyuan Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Borhani, MD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Ulas Bagci, MSc, PhD (*Abstract Co-Author*) Ther-AI LLC
Debesh Jha, PhD (*Abstract Co-Author*) Nothing to Disclose
Cemal Yazici (*Abstract Co-Author*) Nothing to Disclose
Gorkem Durak, MD (*Abstract Co-Author*) Nothing to Disclose
Alpay Medetalibeyoglu (*Abstract Co-Author*) Nothing to Disclose
Ziliang Hong (*Presenter*) Nothing to Disclose

### PURPOSE

To establish a strong baseline for peri-pancreatic edema detection with deep learning and conventional machine learning approaches and to provide a unique dataset for the public.

### METHODS AND MATERIALS

We develop a new deep learning algorithm for automatic detection of peri-pancreatic edema from CT scans. Our method is based on a combination of segmentation algorithms for ROI determination of the pancreas, radiomics (XGBoost), and transformer-based (Swin-tiny) combined classifier for detection/diagnosis. We also introduce a novel CT dataset sourced from 255 patients with acute pancreatitis, featuring annotated pancreas segmentation masks and corresponding diagnostic labels for peri-pancreatic edema condition, publicly available for reproducible research and transparency. With this novel dataset, we both evaluate the efficacy of the segmentation model (LinTransUNet), a linear Transformer-based segmentation algorithm, as well as a classification model for predicting peri-edema existence. The Dice score was used for segmentation evaluation, and accuracy and precision were used for classification (diagnostic) experiments.

### RESULTS

LinTransUNet for the segmentation mask generation of CT pancreas images, yielding a commendable dice coefficient of 80.85%. We also evaluated different deep learning backbones in this study for classification (diagnosis). The best deep learning model (Swin-tiny) demonstrates robust accuracy rates averaging 97.95%. While the radiomics-based model exhibited a lower score in every indicator, it achieved an accuracy of 79.61% and a precision of 81.91%.

### CONCLUSION

In this study, we established a unique dataset comprising CT images from 255 patients with acute pancreatitis, categorized into classes indicative of the presence or absence of peri-pancreatic edema. LinTransUNet was employed for segmentation, showing promising results. By evaluating various deep learning and radiomics-based models, we established a new baseline for peri-pancreatic edema detection.

### CLINICAL RELEVANCE/APPLICATION

Early and accurate detection of peri-pancreatic edema is crucial for diagnosis and predicting the prognosis of pancreatitis. Our algorithm could potentially improve diagnostic accuracy by automatically detecting subtle signs of edema that might be missed by radiologists on visual inspection alone.

## S5-SSGI03-2 IDENTIFYING RADIOLOGICAL PREDICTORS FOR THE EVOLUTION OF ACUTE PANCREATITIS INTO RECURRENT AND CHRONIC FORMS: A SYSTEMATIC REVIEW AND META-ANALYSIS

Endre Botond Gagyi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The progression of acute pancreatitis (AP) to its recurrent (RAP) and chronic (CP) forms involves significant clinical and radiological challenges, necessitating detailed imaging studies to understand the morphological changes that predict disease progression. This systematic review and meta-

analysis aimed to identify radiological risk factors and imaging biomarkers associated with the progression of AP to RAP and CP.

**METHODS AND MATERIALS**

Following the protocol registration on PROSPERO (CRD42022368931), we searched Medline, Embase, and Cochrane databases up to December 19th, 2023, for studies examining risk factors for the evolution of AP into RAP or CP. Pooled odds ratios (OR) with 95% confidence intervals (CI) were calculated using the random effects model. Heterogeneity was evaluated using the $I^2$ statistic. The risk of bias assessment was performed using the Quality in Prognostic Studies (QUIPS) tool.

**RESULTS**

A total of 124 articles were included in the meta-analysis, and several risk factors were identified for the progression of AP into RAP and CP. We found the following radiological risk factors of AP recurrence: pseudocyst, acute peripancreatic fluid collections (APFC), anatomic abnormality etc. The pooled OR for pseudocyst was 2.19 (95% CI: 1.53-3.14, $I^2$ = 0%), for APFC was 2.15 (95% CI: 1.00 - 4.62, $I^2$ = 6%), for anatomic abnormality was 9.77 (95% CI: 1.16 - 82.29, $I^2$ = 78% . The risk of bias was moderate in the majority of the included studies.

**CONCLUSION**

Radiological features such as pseudocysts, acute peripancreatic fluid collections, and anatomic abnormalities are crucial predictors of the transition from AP to its recurrent and chronic forms. Recognizing these features early through imaging can guide clinical interventions to prevent disease progression, highlighting the essential role of radiology in managing pancreatitis.

**CLINICAL RELEVANCE/APPLICATION**

This study underscores the importance of imaging in the management of acute pancreatitis. Identifying radiological features like pseudocysts, acute peripancreatic fluid collections, and anatomic abnormalities early can critically inform treatment strategies, potentially preventing the progression of AP into RAP and CP and improving patient outcomes.

## S5-SSGI03-3 ASSOCIATION OF RADIOMIC FEATURES WITH GEOLOCATION-BASED ALLOSTATIC LOAD AND OUTCOMES IN ACUTE PANCREATITIS

Abraham Fourie Bezuidenhout, MD (*Abstract Co-Author*) Nothing to Disclose
Manisha Bohara, MBBS, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Investigate the association of radiomics with geolocation-based allostatic load measured by food access and social vulnerability index (SVI) (based on 16 attributes in 4 domains: socioeconomic status, household composition and disability, minority status and language, and housing type and transportation), and also with outcomes in patients with acute pancreatitis (AP).

**METHODS AND MATERIALS**

This study included all AP-related hospitalizations from 2008-2018. We recorded clinicoradiologic information and geocoded physical addresses to determine food access (normal vs low), and SVI (divided into quartiles; IV being the most vulnerable). Radiomic indices included visceral (VA) subcutaneous adiposity (SA), visceral/total adiposity ratio (VA/TA), and sarcopenic imaging marker, psoas muscle Hounsfield Unit Average Calculation (HUAC).

**RESULTS**

Among 486 patients with 592 AP-related hospitalizations, we noted median (IQR) VA of 159.5(159), SA of 203(168), VA/TA of 42.85(23) HUAC of 52.4(14). Higher severity of AP was associated with higher VA (mild AP: 137.5(148), moderate: 159(150), severe: 223.5(163); P=0.001) and lower HUAC (mild: 53.74(14), moderate:51.3(13), severe: 47.17(13); P=0.001). AP recurrence was associated with higher VA [single AP: 149(156) vs. recurrent AP: 177(148); p=0.04] and sarcopenia [single AP: 54.5(12) vs. recurrent AP: 53.6(13); p=0.04]. Also, higher VA/TA ratios were associated with active smoking [36.3(21) vs. 45.8(23); p=0.001] and alcohol consumption [38.0(23) vs. 45.8(22); p=0.001]. Geospatial analysis showed lower VA among patients with higher SVI: (I: 176(149), II: 145.5(168), III: 174(149), IV: 38.4(25); P=0.038). By regression analysis, VA had significant association with SVI [-47.24(-77- -18); P =0.002] and SVI subindices: socioeconomic status [-49.5(95%CI: -81 - -18); P=0.002], Minority status and Language [-59.3(95%CI: -92- -27); P<0.001], Housing type and transportation [-42(95%CI: -75- -9); P=0.002].

**CONCLUSION**

Severity of AP and recurrent AP, were associated with higher VA and sarcopenia, while SA was associated with smoking and alcohol. Geospatial analysis of radiomics in AP showed significant association of residence in socially vulnerable areas with lower VA which may protect against recurrent and severe AP.

**CLINICAL RELEVANCE/APPLICATION**

This is the first study investigating epidemiology of radiomics among patients with variable geospatial allostatic load. We noted higher VA and lower sarcopenia in regions with relatively preserved social determinants of health, which have significant association with AP severity and recurrence. Health interventions in visceral obesity are imperative to improve outcomes of patients with AP, regardless of social vulnerability.

## S5-SSGI03-5 CHRONIC PANCREATITIS MRI SCORE (CP-MRI): A NEW PROPOSAL FOR DIAGNOSIS AND DISEASE SEVERITY USING PARENCHYMA AND DUCTAL FEATURES

Evan L. Fogel (*Abstract Co-Author*) Nothing to Disclose
Dhiraj Yadav, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Temel Tirkes, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Generate a new diagnostic scoring system for chronic pancreatitis (CP) using MRI parameters in the well-phenotyped PROCEED study population. We aimed to generate a semi-quantitative composite score that would fulfill the need for a more accurate and early diagnosis of CP.

**METHODS AND MATERIALS**

The MINIMAP study prospectively imaged and analyzed 46 control, 45 suspected, and 46 definite CP patients enrolled at seven clinical centers in the USA from February 2019 to May 2021. Suspected and definite CP diagnoses were established based on imaging findings, symptomatology, and clinical presentation. MRI was performed using a standard imaging protocol on 1.5T Siemens and GE scanners. Logistic regression analysis generated multiparametric CP-MRI score, which included fat fraction (FF), arterial-to-venous enhancement ratio (AVR), and pancreatic tail diameter (PTD). If secretin-enhanced MRCP was performed, pancreatic ductal elasticity (PDE) was added to generate the CP-SMRI score. Lin's concordance correlation coefficient was used for interobserver agreement.

### RESULTS

All MRI and MRCP parameters were significantly different between the control and definite CP cohorts: FF ($p<0.001$), AVR ($p<0.01$), PTD ($p<0.001$) and loss of PDE ($p<0.001$). Using a multiparametric score yielded better diagnostic performance than the individual parameters. CP-MRI and CP-SMRI had cross-validated AUCs of 0.84 and 0.86, respectively. The score of 2.6 was 87% sensitive, 68% specific using CP-SMRI and 89% sensitive, 67% specific using CP-MRI for the diagnosis of CP. Interobserver agreement for both scores was 0.74.

### CONCLUSION

The multiparametric approach to diagnose CP yields higher diagnostic performance than individual parameters. Larger population studies with multiple observers and longitudinal analyses are warranted.

### CLINICAL RELEVANCE/APPLICATION

We propose new diagnostic criteria that combine three parenchymal MRI features and an optional dynamic secretin-enhanced MRCP feature.

## S5-SSGI03-6 CORRELATION BETWEEN FAT AND IRON CONTENT, PARENCHYMAL STIFFNESS, GLAND VOLUME, AND PANCREATIC FUNCTION

Mirko D'Onofrio, MD (*Abstract Co-Author*) Speaker, Bracco Group;Speaker, Siemens AG;Consultant, Siemens AG;Speaker, Hitachi, Ltd
Carlo Giuseppe Licata (*Abstract Co-Author*) Nothing to Disclose
Rachele Zibbra (*Abstract Co-Author*) Nothing to Disclose
Anna Garofano (*Abstract Co-Author*) Nothing to Disclose
Flavio Spoto, MD (*Abstract Co-Author*) Nothing to Disclose
Riccardo De Robertis, PhD, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate correlations between pancreatic fat and iron content assessed by 3D multi-echo Dixon MRI, gland volume, parenchymal stiffness assessed by US point shear wave elastography (pSWE), and pancreatic function.

### METHODS AND MATERIALS

117 subjects prospectively underwent 3D multi-echo Dixon MRI and transabdominal US pSWE evaluation on the same day. Volumes of interest encompassing the whole pancreas were segmented on MRI images to calculate median proton density fat fraction (PDFF), median R2* values, and gland volume. The median value of nine pSWE measurements was calculated for each subject. Measurements were compared between subjects with normal pancreatic function and those with pancreatic insufficiency using the Mann-Whitney U test. P values =0.05 were considered statistically significant.

### RESULTS

93 subjects were included (50 men and 43 women; mean age 61 years, range 18- 85); 28 subjects (30.1%) had pancreatic insufficiency. MRI-PDFF was the only parameter with a significant difference between groups, being significantly higher in subjects with pancreatic insufficiency than in those with a normal pancreatic function (median 7% vs. 3.1%, $p=0.008$).

### CONCLUSION

Pancreatic fat content assessed by MRI-PDFF may be correlated with pancreatic insufficiency.

### CLINICAL RELEVANCE/APPLICATION

The pancreatic fat content, as determined by MRI-PDFF, demonstrates reliability and holds clinical significance in enhancing diagnostic precision for the detection of pancreatic insufficiency and it could potentially be incorporated into the screening process for patients presenting with risk factors.

# Abstract Archives of the RSNA, 2024

S5-SSGI04

**Gastrointestinal Imaging (Artificial Intelligence: Clinical Implementation (2))**

Sunday, Dec. 1 2:30PM - 3:30PM Room: E451B

Elias Kikano, MD (*Moderator*) Nothing to Disclose
Marc D. Kohli, MD (*Moderator*) Founder, Alara Imaging;Stockholder, Alara Imaging

**Sub-Events**

## S5-SSGI04-1 RETROSPECTIVE EXTERNAL VALIDATION OF A DEEP LEARNING BASED SPLENIC INJURY DETECTION MODEL

Errol Colak, MD (*Abstract Co-Author*) Nothing to Disclose
Robert K. Moreland, MD (*Abstract Co-Author*) Nothing to Disclose
Hui Ming Lin (*Abstract Co-Author*) Nothing to Disclose
Zixuan Hu (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Wu, MD,FRCPC (*Abstract Co-Author*) Nothing to Disclose
Paraskevi Vlachou, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Monica Tafur, MD (*Abstract Co-Author*) Nothing to Disclose
Robyn L. Ball, PhD (*Abstract Co-Author*) Nothing to Disclose
Theo Viel (*Abstract Co-Author*) Nothing to Disclose
David Gomez (*Abstract Co-Author*) Nothing to Disclose
Aaditeya Jhaveri, BS (*Presenter*) Nothing to Disclose

### PURPOSE

The spleen is the most commonly injured organ in blunt abdominal trauma with high grade injuries having a high mortality rate due to hemorrhagic shock. Multi-detector contrast enhanced CT is the gold-standard diagnostic imaging tool for the detection of such injuries, and the rapid identification of splenic injuries is crucial. However, turnaround time from presentation to image interpretation can be delayed, especially at non-trauma centres. Machine learning (ML) models have potential to accelerate this through automatic detection and grading of splenic injuries. We externally validated an open source ML model using the largest validation dataset in the literature for such a purpose.

### METHODS AND MATERIALS

The second place ML model from the RSNA 2023 Abdominal Trauma Detection AI Challenge was modified and retrained to focus on splenic injuries. External validation of the model was performed using a dataset of 1,216 split bolus protocol trauma CT scans performed between January 1, 2005 and July 31, 2021 on adult patients (= 18 years) at a level 1 trauma centre. Ground truth labels were established by 5 abdominal radiologists using the AAST splenic injury scoring scale. The dataset consisted of 608 positive (172 female, 438 male; age range 18-97 years; mean age 44.4 ± 19.9 years) and 608 negative cases (154 female, 456 male; age range 18-103 years; mean age 46.6 ± 19.5 years). There were 455 low (AAST I-III) and 153 high (AAST IV and V) grade splenic injuries.

### RESULTS

The model demonstrated an overall AUC of 0.930 (95% CI: 0.917, 0.944), sensitivity of 0.766 (95% CI: 0.730, 0.797), specificity of 0.957 (95% CI: 0.940, 0.969), positive predictive value (PPV) of 0.936 (95% CI: 0.911, 0.954), and negative predictive value (NPV) of 0.832 (95% CI: 0.806, 0.856) for the detection of splenic injuries. For the detection of high-grade injuries, the model demonstrated an AUC, sensitivity, specificity, PPV, and NPV of 0.959 (95% CI: 0.945, 0.974), 0.942 (95% CI: 0.893, 0.969), 0.857 (95% CI: 0.836, 0.876), 0.459 (95% CI: 0.405, 0.514), and 0.991 (95% CI: 0.984, 0.995) respectively.

### CONCLUSION

The ML model demonstrated robust performance in both the 3-class splenic injury classification and detection of high-grade injuries. Overall, performance metrics either met or surpassed those reported in existing literature. These findings demonstrate the potential for ML in automatic splenic injury detection. This will ultimately enhance patient care by prioritizing radiologist worklists and facilitate early trauma intervention.

### CLINICAL RELEVANCE/APPLICATION

Rapid detection and accurate grading of splenic trauma is critical due to the high mortality risk. We externally validated an ML model that demonstrated robust performance and high potential for clinical deployment.

## S5-SSGI04-2 PREDICTING LIVER SHEAR STIFFNESS WITH A MULTI-CHANNEL DEEP LEARNING MODEL USING MULTIPARAMETRIC ABDOMINAL MRI AND CLINICAL DATA IN CHILDREN AND ADULTS

Scott B. Reeder, MD, PhD (*Abstract Co-Author*) Owner, Calimetrix;Owner, Reveal Pharmaceuticals;Owner, Cellectar Biosciences, Inc;Owner, Elucent Medical;Owner, HeartVista, Inc;;
Anum Aslam, MD (*Abstract Co-Author*) Nothing to Disclose
Lili He, MD (*Abstract Co-Author*) Nothing to Disclose

Nehal Parikh (*Abstract Co-Author*) Nothing to Disclose
Redha Ali, PhD (*Abstract Co-Author*) Nothing to Disclose
William Masch, MD (*Abstract Co-Author*) Nothing to Disclose
Krishna Prasad Shanbhogue, MD (*Abstract Co-Author*) Nothing to Disclose
Hailong Li, DPhil (*Abstract Co-Author*) Nothing to Disclose
David T. Harris, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan R. Dillman, MD, MSc (*Presenter*) Research Grant, Perspectum Ltd;Research Grant, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research support, Koninklijke Philips NV;Research support, General Electric Company;Research support, Motilent Ltd

**PURPOSE**

To develop multi-channel transformer-based deep learning (DL) models for predicting liver shear stiffness in children and adults diagnosed or suspected of chronic liver disease, using multiparametric abdominal MRI images and clinical data.

**METHODS AND MATERIALS**

In this IRB-approved retrospective multi-site study, we identified all children and adults who underwent abdominal MRI with MR elastography (MRE) for liver stiffness assessment between 2011 and 2022 from four sites. From each site, we collected axial T1-weighted (T1w), T2-weighted (T2w), and diffusion-weighted (DWI) MR images as well as relevant clinical data (e.g., age, sex, laboratory values). Mean liver shear stiffnesses (kPa) measured by MR elastography (MRE) were extracted from the electronic health record as ground truth. Our proposed multi-channel model utilized a pre-trained Swin Transformer model to capture latent features for regression (Figure 1). Model performance was evaluated using Pearson's correlation coefficient (PCC) and Mean Absolute Error (MAE) with 95% confidence intervals, assessed through internal multi-site 10-fold cross-validation (CV) and external validation experiments.

**RESULTS**

3,691 MRI examinations were acquired from 3,296 patients (mean [SD] age=50.3 [16.5] years; mean BMI=29.1 [6.6] kg/m2; 1,735 [52.2%] females). The initial cohort, consisting of 2,467 exams acquired between 2011 and 2020, was utilized for internal CV, while a second cohort, consisting of 1,224 exams obtained between 2021 and 2022, served as an external validation dataset. Our integrated multiparametric MRI and clinical model achieved a mean (95% CI) PCC of 0.75 (0.71, 0.77) and MAE at 0.83 kPa (0.79, 0.86) during internal validation. External validation yielded a mean PCC of 0.73 (0.69, 0.76) and MAE at 0.86 kPa (0.82, 0.89). The model's performance excluding cases of fatty liver disease reached 0.76 (0.72, 0.79).

**CONCLUSION**

The proposed multi-channel transformer-based DL model demonstrated strong prediction capability on predicting liver stiffness using multiparametric MR images on a large, multi-site, multi-vendor dataset.

**CLINICAL RELEVANCE/APPLICATION**

Our AI model can predict liver shear stiffness using multiparametric abdominal MRI data in children and adults, showing strong correlation with MR elastography measurements. Model refinements may further increase performance.

## S5-SSGI04-3 NON-INVASIVE IMAGING ASSESSMENT OF TERTIARY LYMPHOID STRUCTURES AND IMMUNOTHERAPY RESPONSE IN GASTRIC CANCER: A MULTI-CENTER RETROSPECTIVE AND PROSPECTIVE STUDY

Yuming Jiang, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Tertiary lymphatic structures (TLSs) are associated with improved survival and enhanced response to anti-cancer immunotherapy. However, assessing TLSs relies on substantial tissue samples, which is limited by access to tissue, spatial heterogeneity, and temporal evolution. This study aimed to develop a computed tomography (CT) imaging-based approach for non-invasive assessment of TLSs and immunotherapy response.

**METHODS AND MATERIALS**

This study involved 3,155 patients with gastric cancer (GC) from twelve cohorts spanning six hospitals. TLSs were classified into four stages (absence, Agg, FL-I, FL-II) according to their maturation based on immunohistochemistry staining. A CT imaging-based TLSs scoring model (ctTLSs) was developed to assess TLSs status, subsequently classified into four classes (ctTLSs-0/1/2/3). We next evaluated the model's associations with prognosis and immunotherapy response. To enhance the model's interpretability, we analyzed multi-omics data and employed the Shapley value strategy to provide its biological insights and order of importance.

**RESULTS**

The ctTLSs model achieved high accuracies in predicting TLSs status in the internal validation (AUC range: 0.809-0.872) and external validation (0.801-0.856) cohorts. In retrospective and prospective validation cohorts, ctTLSs exhibited significant associations with both disease-free and overall survival (HR range: 0.206-0.634, all $P < 0.01$). Shapley value analysis highlighted ctTLSs as the strongest predictor of TLSs status. Upon analyzing multi-omics data, we found that higher ctTLSs levels positively correlated with tumor immune activation and apoptosis signaling, while displaying a negative correlation with tumor proliferation and metabolism signaling. Intriguingly, patients with high ctTLSs (but not low ctTLSs) exhibited substantial benefits from immunotherapy ($P < 0.0001$). The objective response rate of four ctTLSs classes was 16.7% in ctTLSs-0, 35.5% in ctTLSs-1, 45.8% in ctTLSs-2, and 53.8% in ctTLSs-3.

**CONCLUSION**

The ctTLSs model could noninvasively assess TLSs status, enabling improved prognosis evaluation and informed decisions regarding immunotherapy.

**CLINICAL RELEVANCE/APPLICATION**

The imaging model has the potential for non-invasive prediction of prognosis and immunotherapy response, which will allow the optimization of individual decision-making.

## S5-SSGI04-4 COMPUTATIONAL ALGORITHM FOR AUTOMATED PATTERN RECOGNITION DIFFERENTIATING BILIARY AND PORTAL VENOUS GAS IN COMPUTED TOMOGRAPHY

Shri Krishna Jayanthi, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Esmeraldo, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The primary aim of this study is to develop and evaluate the efficacy of a novel computer program designed to automatically distinguish between biliary and portal venous gas observed on Computed Tomography (CT) scans. By using imaging analysis techniques with a theoretically based approach based on different branching pattern and gas distribution between biliary and portal venous gas, our program seeks to provide an accurate, fast and automated solution that enhances diagnostic accuracy and optimizes clinical outcomes, thereby reducing the potential for misdiagnosis and improving patient care in acute settings.

**METHODS AND MATERIALS**

A retrospective analysis of 40 abdominal CT scans was performed, comprising 20 cases of portal venous gas and 20 cases of biliary gas. For each case, the slice showing the maximum gas presence in the liver parenchyma was selected post multiplanar reconstruction with a minimum intensity projection of 20 mm. This slice underwent pixel binarization, converting to a binary image using a window setting of Width: 1 and Level: -20 HU on a standard DICOM (Digital Imaging and Communications in Medicine) viewer. The binary image was then processed by our program to produce 1-pixel wide representations, and the ratio of these representations to the amount of gas (represented by black pixels) was calculated.

**RESULTS**

The program demonstrated a sensitivity and specificity of 100% in differentiating between biliary and portal venous gas in the tested sample. Compared with the radiologist reports, in four cases the report was either incorrect (misidentifying pneumobilia as portal venous gas) or inaccurate (failing to distinguish between the two conditions), resulting in a sensitivity of 100% and a specificity of 84% for correct portal venous gas identification by radiologists.

**CONCLUSION**

The developed algorithm achieved 100% accuracy in differentiating between biliary and portal venous gas in the tested sample, demonstrating its potential as a valuable diagnostic tool for radiologists and in settings where a radiologist is not available.

**CLINICAL RELEVANCE/APPLICATION**

Distinguishing between portal and biliary gas is crucial due to their associated clinical implications. Portal venous gas often indicates severe conditions that may require urgent intervention, such as bowel ischemia, whereas biliary gas more frequently arises from benign causes like surgical manipulation of the biliary tract. Current diagnostic practices heavily rely on subjective assessments by generalist physicians, surgeons and radiologists, who frequently make errors in this differentiation. Our tool aims to improve patient outcomes by significantly reducing the rate of misdiagnosis.

## S5-SSGI04-5 DEEP LEARNING-BASED AUTOMATIC DETECTION OF PANCREATIC DUCTAL ADENOCARCINOMA SMALLER THAN 2 CM USING HIGH-RESOLUTION COMPUTED TOMOGRAPHY AND INDIRECT INDICATORS

Miyuki Sone, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Speakers Bureau, Canon Medical Systems Corporation;Research Grant, Dream Medical Partners Co., Ltd;Speakers Bureau, Bayer AG;Consultant, Astellas Group;Consultant, Guerbet SA
Yusuke Wakatsuki (*Abstract Co-Author*) Nothing to Disclose
Chihiro Hattori (*Abstract Co-Author*) Nothing to Disclose
Masahiko Kusumoto, MD (*Abstract Co-Author*) Speaker, AstraZeneca PLC;Speaker, DAIICHI SANKYO Group;Research Grant, Canon Medical Systems Corporation;
Susumu Hijioka (*Abstract Co-Author*) Nothing to Disclose
Ryo Hirano (*Abstract Co-Author*) Nothing to Disclose
Ishihara Toshihiro (*Abstract Co-Author*) Nothing to Disclose
Shintaro Ambo (*Abstract Co-Author*) Nothing to Disclose
Mizuki Ozawa, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Pancreatic ductal adenocarcinoma (PDAC) has very poor prognosis, with a 5-year survival rate of 6%, but small PDACs (=2 cm, T1 stage, UICC 8th edition) have relatively higher survival rates (20-40%). Detecting small PDACs is challenging, with 40% of PDACs missed by computed tomography (CT). Although deep learning-based automated detection of PDACs has been developed, sensitivity on detecting small PDACs is modest at 75%. Small PDACs are difficult to detect as tumor mass, and indirect findings such as dilatation of main pancreatic duct (MPD), parenchymal atrophy may be the key to their diagnosis. High-resolution CT (HR-CT) has good low-contrast detectability, and may improve PDAC diagnosis. This study assessed diagnostic performance of an automatic small PDAC detection system using a three-dimensional convolutional neural network with HR-CT with indirect indicators.

**METHODS AND MATERIALS**

Contrast-enhanced pancreas protocol HR-CT scans of 181 patients diagnosed with PDAC between January 2018 and December 2023 were identified. The inclusion criteria were PDAC diameter = 2cm and age = 18 years. The exclusion criteria were history of surgery or chemotherapy for PDAC and lack of appropriate thickness of CT images. Among those patients, 101 were included; 104 patients with no pancreatic abnormalities were chosen as controls. We identified the ratio of the cross-sectional area of MPD and pancreatic parenchyma (D/P ratio) as a value of indirect indicator of PDAC. Our proprietary software for automatic tumor mass and D/P ratio detection blindly analyzed clinical data from the 205 patients. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were evaluated to detect tumor mass, D/P ratio and combination of tumor mass and D/P ratio detection. A receiver operating characteristic (ROC) curve analysis was performed.

**RESULTS**

The overall sensitivity, specificity, PPV and NPV of tumor mass detection were 0.75, 0.76, 0.75 and 0.76, respectively; those for D/P ratio detection were 0.85, 0.94, 0.93 and 0.87, respectively and those for both tumor mass and D/P ratio detection were 0.94, 0.70, 0.75 and 0.92, respectively. The area under the ROC curve for tumor mass and D/P ratio detection were 0.85 and 0.95, respectively.

**CONCLUSION**

Adding indirect indicator evaluation to automatic tumor mass detection can improve the accuracy of small PDAC detection using HR-CT.

**CLINICAL RELEVANCE/APPLICATION**

Our high-sensitivity detection software can help physicians and radiologists avoid non-detection of small PDACs.

# Abstract Archives of the RSNA, 2024

S5-SSGU02

**Genitourinary Imaging (Imaging of Urothelium)**

Sunday, Dec. 1 2:30PM - 3:30PM Room: E353B

Helen C. Addley, FRCR, BMBCh (*Moderator*) Nothing to Disclose
Lyndon Luk, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S5-SSGU02-1 REEVALUATING DIAGNOSTIC CONFIDENCE: THE IMPACT OF DELAYED EXCRETORY PHASE IMAGING IN CT-IVP ON DETECTING RENAL AND URINARY TRACT ABNORMALITIES

Sung Yoon Park, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Mahdavi, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio C. Westphalen, MD, PhD (*Abstract Co-Author*) Shareholder, ScanMed, LLC;Research funded, BotImage, Inc
Deepashri Basavalingu, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Rajat Bhargava, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Rozita Jalilianhasanpour, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher A. Mejias, MD (*Abstract Co-Author*) Nothing to Disclose
Negar Firoozeh, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the value of delayed excretory phase imaging when combined with non-contrast and nephrographic phase images in enhancing diagnostic consistency and radiologist confidence.

### METHODS AND MATERIALS

This HIPAA compliant, IRB approved retrospective, single institution cross sectional study, granted a waiver for informed consent, included 100 randomly selected CT-IVP done to investigate hematuria between 01/01/2012 and 03/11/2023. Using MIM Software, six readers (2 radiologists with over 10 years of experience, 3 fellows, 1 resident) reviewed 2 sets of images, with a 3-week washout period between sessions. The first set included non-contrast and nephrographic images, while the second also had delayed excretory images. At least 3 readers reviewed each pair of sets. Data were collected using Redcap, addressing the presence or absence of renal parenchymal, collecting system and ureteral, and vesical abnormalities, along with assessments of diagnostic confidence levels. Statistical analyses were done using Stata 18. The McNemar test was selected because it is used for paired dichotomous data and is suitable for 'before-and-after' studies. A mixed-effects model analyzed the influence of the interpretation session and reader specific variations on lesion detection. The Wilcoxon signed-rank test assessed changes in radiologists' confidence levels between interpretation sessions.

### RESULTS

There were no statistically significant differences in the rate of detected abnormalities involving the renal parenchyma, collecting system and ureters, and bladder between the two sessions. For brevity, only the mixed-effects model for the detection of ureteral lesions is provided, but the results were similar for all abnormalities. The analysis reveals that different imaging sessions, one of which included delayed phase images, do not significantly influence the detection of ureteral lesions ($p = 0.61$). Statistical analysis showed significant changes in diagnostic confidence for readers 4 and 5 ($p = 0.04$ and $p < 0.001$, respectively), but not for other readers (all $P > 0.05$). However, the direction of the ranks shows that both readers were more confident on session 1, rather than session 2. (R4, positive ranks sum = 501, negative ranks sum = 974; R5, positive ranks sum: 272.5, negative ranks sum: 966.5).

### CONCLUSION

Our results suggest that the delayed excretory phase images do not significantly enhance the diagnostic detection of lesions nor affect the confidence of radiologists in detecting abnormalities, underscoring a need to evaluate its clinical utility further.

### CLINICAL RELEVANCE/APPLICATION

The exclusion of delayed excretory phase may improve scanning and interpretation efficiency and decrease exposure to radiation.

## S5-SSGU02-2 OPTIMIZING BLADDER MRI: ACCELERATING SCAN TIME AND IMPROVING IMAGE QUALITY THROUGH DEEP LEARNING

Gu Mu Yang Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Lili Xu (*Abstract Co-Author*) Nothing to Disclose
Qianyu Peng (*Abstract Co-Author*) Nothing to Disclose
Li Chen (*Abstract Co-Author*) Nothing to Disclose
Hao Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Erjia Guo, MS, BA (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the value of deep learning on T2-weighted imaging (T2DL) of the bladder regarding acquisition time (TA), image quality and diagnostic confidence as compared to standard T2-weighted TSE imaging (T2S).

**METHODS AND MATERIALS**

In total, 28 consecutive patients for the evaluation of bladder cancer were prospectively enrolled in this institutional review board approved study. T2S and T2DL sequences in three planes were performed for each participant. Acquisition time was compared between the two acquisition protocols. The image evaluation was performed by two radiologists independently using a 5-point Likert scale for artifacts, noise, bladder wall clarity, bladder trigone clarity, lesion edge sharpness, tumor-to-bladder muscle layer contrast, overall image quality, and diagnostic confidence, with 5 indicating the best quality. Additionally, T2 scoring based on VI-RADS were performed by two readers. The intergroup comparisons were performed using the Wilcoxon signed rank test.

**RESULTS**

The mean patient age was 66 ± 13 years (range, 33-85 years). Compared to T2S, acquisition time of T2w TSE imaging in T2DL could be reduced by 49.4% in axial orientation and 43.8% in coronal and sagittal orientations. Inter-reader agreement for image quality parameters was substantial. The severity and impact of artifacts was evaluated to be superior in T2DL versus T2S in axial imaging by Reader 2 ($p<0.05$). Noise levels were rated significantly superior in T2DL compared to T2S ($p < 0.05$) in axial imaging for both readers. For both readers, the lesion edge sharpness in all planes was rated to be signi& 7;cantly higher in T2DL compared to T2S ($p < 0.05$). The tumor-to-bladder muscle layer contrast was also signi& 7;cantly higher in T2DL with a median of 5 (4-5) as compared to T2S with a median of 4 (4-5) for both readers in axial and sagittal imaging. Overall image quality in T2DL was evaluated to be higher compared to T2s in axial (4 (IQR 4-5) vs. 4 (IQR 3-4)) and sagittal imaging (4 (IQR 4-4.75) vs. 4 (IQR 3-4)) (both $p < 0.05$). Additionally, there was no signi& 7;cant difference regarding the diagnostic confidence and T2 scoring of both sequences in all planes ($p > 0.05$).

**CONCLUSION**

Our findings demonstrated the feasibility of using T2DL of the bladder in reducing acquisition time, enhancing image quality, and improving the detectability of lesions compared to T2s. Meanwhile, there is no significant difference in diagnostic confidence and T2 score between the two sequences.

**CLINICAL RELEVANCE/APPLICATION**

Our results indicated that T2DL might be able to replace conventional T2S with a significant reduction of acquisition time, superior lesion detectability and overall image quality while maintaining diagnostic confidence.

## S5-SSGU02-3 DIAGNOSTIC SIGNIFICANCE OF PERITUMORAL ENHANCEMENT IN DISTINGUISHING BETWEEN MUSCLE-INVASIVE AND NON-MUSCLE-INVASIVE BLADDER CANCER

Atsushi Higaki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mitsuru Takeuchi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akira Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuichi Kojima (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Tamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takuma Maruhisa (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Watanabe (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the prevalence of peritumoral enhancement (PTE) in muscle-invasive bladder cancer (MIBC) and non-MIBC (NMIBC) and propose a Modified Vesical Imaging-Reporting And Data System (VI-RADS) diagnostic criterion incorporating PTE.

**METHODS AND MATERIALS**

This retrospective study included 95 patients (pathologically confirmed 36 MIBCs and 59 NMIBCs; age, 71+/-11; 77 men) who underwent MRI between 2011 and 2023. The images were interpreted by four radiologists. T2-weighted imaging, diffusion-weighted imaging and dynamic contrast-enhanced imaging (DCEI) were performed. DCEI was acquired using a 3D T1-weighted gradient echo sequence with fat suppression. After acquisition of pre-contrast imaging, contrast medium (Magnescope, Guerbet) was injected using a power injector system at a dose of 0.1 mmol/kg body weight at a rate of 3.0 ml/s, followed by a saline flush. DCEI was acquired 7-8 times every 15 seconds after contrast administration. The readers categorized the images into three patterns, based on the presence or absence of PTE: Absent, Possibly present, or Definitely present. In this study, PTE was defined as a linear structure convex outward from the normal bladder wall (more curved than bladder wall) and contrasts more than the normal muscle layer and tumor. The frequency of PTE was calculated for each of the MIBC and NMIBC. A Modified VI-RADS was proposed, with Definitely present PTE assigned to VI-RADS category 5 and Possibly present PTE to VI-RADS category 4, regardless of DWI category. Sensitivity and specificity were compared with the Original VI-RADS using McNemar test. Pathologic diagnosis was used as the reference standard.

**RESULTS**

PTE was Possibly present in 6%-31% (2/36-11/36) and Definitely present in 50%-64% (18/36-23/36) of MIBC. PTE was absent in 92%-98% (54/59-58/59) of NMIBC. The sensitivity and specificity of Original VI-RADS was 41.7% to 55.6% (15/36-20/36) and 98.3% to 100% (58/59-59/59) for MIBC (cutoff = category 4), respectively. The sensitivity and specificity of the Modified VI-RADS was 72.2% to 86.1% (26/36-31/36) and 91.5% to 98.3% (55/59-58/59), respectively. The sensitivity of Modified VI-RADS was higher than that of Original VI-RADS ($p < 0.01$) in all readers but specificity was not significantly different.

**CONCLUSION**

Modified VI-RADS incorporating PTE, which is highly specific for MIBC, can correctly diagnose MIBC underdiagnosed by the Original VI-RADS.

**CLINICAL RELEVANCE/APPLICATION**

Modified VI-RADS can correctly classify MIBC that are underestimated as Category 2 or 3 by Original VI-RADS as Category 4 or higher, and can contribute to treatment decisions of bladder cancer.

## S5-SSGU02-4 EFFECT OF HISTOLOGICAL VARIANT PROPORTION ON THE DIAGNOSTIC EFFICACY OF THE VESICLE IMAGING-REPORTING AND DATA SYSTEM IN BLADDER UROTHELIAL CARCINOMA WITH VARIANT HISTOLOGY: A MULTI-INSTITUTIONAL, MULTI-READER RADICAL CYSTECTOMY COHORT STUDY

Hiromi Edo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Kwee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Oguz Akin, MD (*Abstract Co-Author*) Research Consultant, Ezra AI
Christian Roest, MSc (*Abstract Co-Author*) Grant, Siemens AG
Yuma Waseda (*Abstract Co-Author*) Nothing to Disclose
Akitoshi Inoue, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryota Ishii, MSc (*Abstract Co-Author*) Nothing to Disclose
Yuki Arita, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Recent studies showed the VI-RADS's high accuracy in diagnosing muscle-invasive bladder cancer (MIBC). Nonetheless, the diagnostic efficacy of VI-RADS in bladder urothelial carcinoma (UC) with variant histology remains contentious. This research aimed to examine the diagnostic value of VI-RADS in assessing muscle invasion in variant UC according to the proportion of histological variants using a radical cystectomy (RC) cohort.

**METHODS AND MATERIALS**

Multi-institutional retrospective analysis of 81 treatment-naļve patients with pathologically confirmed variant UC who underwent bladder multiparametric MRI (mpMRI) before RC without receiving neoadjuvant chemotherapy between 2011 and 2021. Two sets of images, biparametric MRI (bpMRI) and mpMRI including DCE-MRI, were independently reviewed by three board-certified radiologists based on VI-RADS. The RC-based histological results served as the reference standard for all included patients. Receiver operating characteristic curve analysis, Z-test, and Wald test were used to assess diagnostic accuracy.

**RESULTS**

Among the 81 patients, 55 (67.9%) and 26 (32.1%) were diagnosed with MIBC and non-MIBC, respectively. The area under the curves (AUCs) of mpMRI in the entire cohort was significantly higher than that of bpMRI for readers 1 and 2 (0.919/0.900/0.882 vs 0.881/0.850/0.850, p=0.006/0.041/0.099 for Reader 1/2/3). In the subgroup analysis for predominant variant histology (histological variant>50%), the sensitivity of mpMRI was significantly higher than that of bpMRI for all readers (82.8/82.8/79.3% vs. 65.5/62.1/62.1%, p=0.025/0.014/0.025 for Reader 1/2/3), using the VI-RADS cut-off score of 4. No significant differences were observed between mpMRI and bpMRI in terms of specificity for all readers (91.7/91.7/91.7% vs 91.7/83.3/83.3%, p=0.99/0.317/0.317 for Reader 1/2/3). For non-predominant variant histology (histological variant<50%), no significant differences were detected between mpMRI and bpMRI in terms of sensitivity and specificity for all readers (sensitivity: 84.6/76.9/73.1% vs 69.2/69.2/69.2%, p=0.056/0.157/0.317; specificity: 92.9/92.9/85.7% vs 92.9/85.7/85.7%, p=0.99/0.317/0.99, for Reader 1/2/3).

**CONCLUSION**

In this treatment-naļve patient cohort with RC, mpMRI's diagnostic accuracy was superior to bpMRI's in evaluating muscle invasion in variant UC. The presence of predominant variant histology may decrease bpMRI's diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

mpMRI including DCE-MRI is recommended for the assessment of muscle invasion in variant UC patients, particularly those with predominant variant histology (who are known to potentially exhibit resistance to chemotherapy, warranting immediate surgical interventions).

## S5-SSGU02-5 MULTIPARAMETRIC MRI TO PREDICT COMPLETE RESPONSE AFTER NEOADJUVANT RADIOIMMUNOTHERAPY OF LOCALLY ADVANCED BLADDER CANCER - RADIOLOGIC ASPECTS OF THE PROSPECTIVE, MULTICENTER, PHASE II TRIAL RACE IT

Marcus R. Makowski (*Abstract Co-Author*) Nothing to Disclose
Andreas Sauter, MD (*Abstract Co-Author*) Nothing to Disclose
Stefan Reischl, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Neoadjuvant therapy, including radioimmunotherapy (RIT), is being evaluated within trials for locally advanced bladder cancer (BC) patients who may not be candidates for surgery. Predicting complete tumor response (CR) after neoadjuvant therapy is crucial for determining the feasibility of bladder-sparing strategies. This study aims to evaluate the utility of multiparametric magnetic resonance imaging (mpMRI) using the Vesical Imaging-Reporting And Data System (VI-RADS) criteria in predicting CR in BC patients after neoadjuvant RIT.

**METHODS AND MATERIALS**

This tertiary-center, retrospective study analyzed mpMRI data of patients treated by neoadjuvant RIT for locally advanced BC within the prospective RACE IT trial. The imaging protocol and tumor-staging followed the VI-RADS guidelines and was performed by two radiologists of different experience levels (expert / resident). Histopathological examination of tumor stage served as ground truth for the evaluation of the diagnostic accuracy of mpMRI.

**RESULTS**

Twenty-one patients with muscle-invasive BC were included, of which 15 underwent post neoadjuvant-RIT mpMRI and subsequent cystectomy. Intrareader agreement was moderate to substantial, with the expert reader demonstrating better agreement 0.74 ($p < 0.001$). Interreader agreement was moderate. Post-RIT mpMRI sensitivity/specificity for detection of residual tumor (>ypT0) was 100%/33% for the expert and 89%/33% for the resident at a cut-off VI-RADS > 0, the corresponding AUROC values were 0.86 (expert) and 0.78 (resident). For residual muscle-invasive tumor AUROC values were 0.78 (expert) and 0.88 (resident), resulting at a sensitivity/specificity of 100%/30% (expert) and 100%/50% (resident) for a cut-off VI-RADS = 2.

**CONCLUSION**

This study suggests that VI-RADS criteria can be valuable tools for evaluating tumor response in mpMRI of BC patients after neoadjuvant RIT. Sensitivity for residual tumor was high, even though at the cost of a low specificity, compared to what was reported in the literature for cases without neoadjuvant treatment and potentially caused by postradiogenic tissue alterations.

**CLINICAL RELEVANCE/APPLICATION**

This is the first report on the use of mpMRI to evaluate the outcome after neoadjuvant RIT in bladder cancer. Our findings could open the door to expanding bladder-sparing strategies for a broader patient population, pending validation in larger studies.

## S5-SSGU02-6 EVALUATING VI-RADS SCORE PERFORMANCE IN THE POST-TURBT SETTING: EXPLORING THE NEED FOR MODIFICATION

Martina Pecoraro, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Bicchetti (*Abstract Co-Author*) Nothing to Disclose

Giuseppe Martina (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD (*Abstract Co-Author*) Nothing to Disclose
Valeria Panebianco, MD (*Abstract Co-Author*) Nothing to Disclose
Antonella Borrelli, MD (*Abstract Co-Author*) Nothing to Disclose
Ailin Dehghanpour, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The vesical imaging reporting and data system (VI-RADS) was introduced to standardise bladder MRI protocol. VI-RADS is not recommended post-TURBT due to potential inflammatory changes. Moreover, certain tumor characteristics, such as the presence of a stalk and inner layer enhancement, may be lost after TURBT. However, in routine clinical practice, bladder MRI is often performed post-diagnostic or therapeutic TURBT to achieve more accurate local staging.The aim of this study was to assess the diagnostic accuracy of the VI-RADS score and its individual MRI categories, structural (T2W), diffusion (DWI), and contrast-enhanced (DCE) after diagnostic TURBT. The primary objective was to determine the optimal dominant sequence. Additionally, we aimed to evaluate inter-reader agreement in scoring VI-RADS.

**METHODS AND MATERIALS**

This retrospective study utilized a prospectively maintained cohort. Two experienced uroradiologists, with 4 and 6 years of expertise in bladder imaging, independently and blinded to clinico-pathological information evaluated 150 mpMRI bladder scans. For each scan, besides assigning the final VI-RADS score and individual VI-RADS scores for each sequence, a separate VI-RADS score was assigned, once considering DWI and once considering DCE as the dominant sequence. This approach aimed to compare the diagnostic predominance and accuracy between these functional sequences in a post-TURBT setting. Exclusion criteria included intravesical local treatment and a temporal distance of less than 2 weeks between TURBT and mpMRI.

**RESULTS**

The performance of VI-RADS assessment in detecting muscle-invasive bladder cancer after TURBT showed an AUCs of 0.94 (95% CI 0.91-0.99) for the most experienced reader. On a per-sequence analysis, overall DWI showed the highest AUC compared to the single sequences (T2WI: 0.90 [95% CI 0.86, 0.94]; DWI: 0.96 [95% CI 0.90, 0.98]; DCE: 0.92 [95% CI 0.88, 0.96]).Inter-reader agreement between the more and less experienced radiologists using k statistics was 0,83 for overall VI-RADS assessment.

**CONCLUSION**

MRI, particularly VI-RADS, demonstrates high diagnostic accuracy in local staging of bladder cancer when performed at least two weeks after TURBT. The inflammatory changes resulting from the procedure make DWI the more accurate sequence compared to DCE. Therefore, DWI should be considered as the dominant sequence when scoring VI-RADS post-TURBT.

**CLINICAL RELEVANCE/APPLICATION**

Accurate local staging of bladder cancer patients undergoing TURBT is crucial for effective patient management. By preventing under- or over-staging due to inflammatory changes, it significantly impacts therapeutic decisions.
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

S5-SSOB01

**OB/Gynecology and Pediatric Imaging (Cutting Edge Advancements in Obstetric and Gynecologic Imaging)**

Sunday, Dec. 1 2:30PM - 3:30PM Room: E351

Mark D. Sugi, MD (*Moderator*) Consultant, Nextrast, Inc;Author with royalties, RELX
Ryne Didier, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## S5-SSOB01-1 A RADIOGENOMICS APPLICATION FOR EVALUATING ENDOMETRIAL CANCER FEATURES: A MULTICENTER RETROSPECTIVE STUDY

Haijie Wang (*Abstract Co-Author*) Nothing to Disclose
Qi Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Hua Li (*Abstract Co-Author*) Nothing to Disclose
Ruxue Han (*Abstract Co-Author*) Nothing to Disclose
Xiaoyun Liang (*Abstract Co-Author*) Nothing to Disclose
He Zhang (*Abstract Co-Author*) Nothing to Disclose
Wenyi Yue (*Presenter*) Nothing to Disclose

### PURPOSE

The transition from FIGO 2008 to FIGO 2023 introduces molecular classification, which included POLEmut, MMR-D, NSMP and P53abn, for endometrial cancer (EC) staging, aiding in prognostic risk assessment and treatment decisions. Our objective was to explore a pioneering radiogenomics method leveraging MRI, clinicopathological and genetic data to create a gene expression signature for EC patients across three institutions.

### METHODS AND MATERIALS

Between January 2020 and March 2024, we included 526 patients with histopathologically confirmed EC. These patients were recruited from three medical centers: 292 individuals from the Institution 1, 154 from Institution 2 and 80 from Institution 3. We collected clinicopathological data, preoperative MRI and genomic DNA from these patients. The MRI examinations were conducted utilizing either 1.5T MR scanners or 3.0T MR scanners. The ROIs were delineated and reviewed by two radiologists on T2WI images, and matched to corresponding areas on T1WI, T1CE, and DWI. The data were used as training and test sets respectively. Radiomics features were extracted using the IBSI-compliant Pyradiomics 3.0. Features that were robust to image preprocessing parameters, contour variations (ICC > 0.8) and equipment differences (P > 0.05) were retained for subsequent analysis. Recursive feature elimination was used for feature selection. The final discrimination model was an ensemble of four multivariate logistic regression models based on the one-vs-all strategy. The minority class was upsampled during the training. ComBat and z-score were used to normalize the feature matrix. The most effective hyperparameter were determine based on a 5-fold cross-validation.

### RESULTS

The clinical and pathological characteristics of the three institutions are summarized. The clinical-radiomics combined model achieved a macro-average AUC of 0.771. The class-wise AUCs were 0.79, 0.70 and 0.76 for POLEmut; 0.70, 0.67 and 0.68 for MMR-D; 0.79, 0.69 and 0.73 for NSMP; 0.80, 0.76 and 0.76 for P53abn in the internal test, external test set 1 and 2, respectively. Histograms of the distribution of the most important features of each sub-model were plotted to reflect the heterogeneity within the ROIs.

### CONCLUSION

Our results demonstrate that the predictive model derived from MRI imaging features holds significant promise in identifying molecular subtypes in EC.

### CLINICAL RELEVANCE/APPLICATION

This model has the potential to guide clinicians in tailoring individualized treatments for EC patients.

## S5-SSOB01-2 PRENATAL LINK BETWEEN CEREBRAL BLOOD FLOW AND CARDIAC FUNCTION IN CHD ASSESSED BY FETAL MRI

Sophia Stoecklein, MD (*Abstract Co-Author*) Nothing to Disclose
Gloria Biechele, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Congenital heart defects (CHD) are common severe birth defects. This condition also impacts on brain development with biometric and neurocognitive consequences from the neonatal period onwards. Recent technologies allow in-utero evaluation of cerebral perfusion using MRI-based arterial spin labelling (ASL) as well as the dynamic assessment of cardiac function using DUS (Doppler Ultrasound) gating. We therefore investigated brain perfusion in CHD as well as healthy control (HC) fetuses in relation to cardiac anatomy and function.

### METHODS AND MATERIALS

52 singleton pregnancies (n=38 HC, n=14 CHD) underwent fetal MRI (1.5T) after US examination at 29 weeks onwards. Cerebral blood flow (CBF) was quantified by flowsensitive alternating inversion recovery ASL (FAIR-ASL) sequences of the fetal brain in all patients and cardiac anatomy and function were assessed by DUS-gated cine-sequences of the fetal heart and thoracic vessels in a subgroup (n=8 HC, n=14 CHD) of the patients. Readouts' courses over gestation and associations were evaluated and compared between the groups.

### RESULTS

Mean gestational age (GA) was similar between the groups (HC: 33.4 [range 29-36] weeks vs. CHD: 32.7 [range 30 - 36] weeks, p=0.31). In 52 pregnancies, mean total CBF was 89.4 ± 29.9 ml/min/100g and mean regional CBF in basal ganglia was 93.0 ± 25.4 ml/min/100g, both increasing over gestation. There was no difference in mean total CBF between HC and CHD (87.9 ± 3.8 ml/min/100g vs. 93.7 ± 11.0 ml/min/100g, p=0.52), whereas mean regional CBF in basal ganglia was significantly increased in CHD (88.8 ± 3.8 vs. 105.4 ± 7.7, p=0.04). In addition, basal ganglia CBF revealed an inverse correlation with right ventricular shortening fraction in HC (p=0.003), but not in CHD.

### CONCLUSION

Although limited in sample size and very preliminary, our results suggest differences in cerebral perfusion between HC fetuses and those affected by CHD, as assessed by our novel ASL-based approach. More precisely, modified cardiac function related to CHD may particularly affect perfusion of the basal ganglia. Further studies should confirm these findings reflecting on potential roots of altered fetal gyration patterns and neonatal brain biometrics, that have been reported in individuals affected by CHD.

### CLINICAL RELEVANCE/APPLICATION

Given the substantial number of CHD cases, the heart-brain interplay is of importance for parental counceling.

## S5-SSOB01-3 DETECTING FETAL GERMINAL MATRIX AND INTRAVENTRICULAR HEMORRHAGE IN BRAIN MRI USING LABEL-FREE DEEP LEARNING

Haoxiang Li (*Abstract Co-Author*) Nothing to Disclose
Zhu Juncheng (*Abstract Co-Author*) Nothing to Disclose
Hongjia Yang (*Abstract Co-Author*) Nothing to Disclose
Zihan Li (*Abstract Co-Author*) Nothing to Disclose
Mingxuan Liu (*Abstract Co-Author*) Nothing to Disclose
Qiyuan Tian (*Abstract Co-Author*) Nothing to Disclose
Jialan Zheng (*Abstract Co-Author*) Nothing to Disclose
Ziyu Li (*Abstract Co-Author*) Nothing to Disclose
Zechen Zhou (*Presenter*) Nothing to Disclose

### PURPOSE

Germinal matrix and intraventricular hemorrhage (GMH-IVH) is the most common fetal intracranial hemorrhage. MRI is pivotal for the early detection of subtle prenatal GMH-IVH lesions, which manifest as hypointense signals in T2-weighted MRI. Deep learning emerges as a powerful tool for detecting such lesions from MRI. However, supervised learning methods are limited by the amount of training data due to the disease rarity (0.5-0.9 per 1000 pregnancies). To address the challenge, a fetal GMH-IVH detection method based on synthetic training data with anomalies is proposed to achieve accurate hemorrhage detection without the need for GMH-IVH labels.

### METHODS AND MATERIALS

The study used MRI data from 84 pregnant women, with 74 normal fetal brains and 10 brains with GMH-IVH lesions. 2D T2-weighted TSE image data were acquired in axial, coronal, and sagittal directions. The NiftyMIC method was used for slice-to-volume motion correction and reconstruction of a single super-resolved fetal brain volume at 0.8 mm isotropic resolution. Experienced radiologists manually annotated the hemorrhage regions. Generating pseudo MRI data with GMH-IVH from normal fetal brain images involved four steps: 1) extracted brain regions of interest (ROIs, e.g., ventricles and thalamus) using a pre-trained deep learning model for brain segmentation; 2) created random-shaped masks by generating uniform noise, applying Gaussian blur, stretch and thresholding; 3) created hemorrhage regions by dilating ROIs (30%), removing ventricles and thalamus from ROIs (30%), and directly selecting brain white matter regions (10%); 4) computed the intersection of masks from step 2 3, randomly decreased signal values, and applied Gaussian blur. The Swin-Unet was trained using 370 pseudo hemorrhage images synthesized from 74 normal fetal brains, or using 10 images from 2 GMH-IVH brains. The remaining 40 slices from 8 GMH-IVH brains were used to evaluate hemorrhage detection results.

### RESULTS

Swin-Unet trained with limited empirical data yielded segmentation dice similarity coefficient (DSC) of 0.169 ± 0.189 and mean intersection over union (MIOU) of 0.107 ± 0.134. In contrast, Swin-Unet trained with synthetic pseudo hemorrhage data achieves substantially higher segmentation accuracy with DSC of 0.635 ± 0.138 and MIOU of 0.479 ± 0.144.

### CONCLUSION

The proposed fetal brain GMH-IVH detection method based on pseudo anomaly synthesis can accurately segment hemorrhage regions without the need for annotated hemorrhage images.

### CLINICAL RELEVANCE/APPLICATION

The proposed label-free deep learning method achieves accurate and efficient detection and localization of fetal brain hemorrhages potentially for early diagnosis and improved treatment for GMH-IVH.

## S5-SSOB01-5 USING DIFFUSION WEIGHTED IMAGING AND BLOOD INFLAMMATORY MARKERS TO PREOPERATIVELY DIFFERENTIATE BETWEEN LEIOMYOSARCOMA AND ATYPICAL LEIOMYOMAS

Nishat Bharwani, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Miriam Salib, MBBS (*Abstract Co-Author*) Nothing to Disclose
Andrea L. da Silva, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Andrea G. Rockall, FRCR, MRCP (*Abstract Co-Author*) Nothing to Disclose
Kavita Shapriya, MBBS, FRCR (*Presenter*) Nothing to Disclose

**PURPOSE**

The preoperative differentiation of leiomyosarcoma (LMS) from atypical benign leiomyoma (LM) poses a diagnostic challenge. Diffusion-weighted imaging and low ADC values have been found in LMS, but there is overlap with LM. There is increasing evidence that inflammation and malignancy are inherently linked. This study's purpose was twofold: to review ADC values of histologically proven LMS compared to LM, with a focus on comparative assessment of the most restricted portion of the lesion, and to compare preoperative haematological markers in both groups.

**METHODS AND MATERIALS**

Patients with atypical myometrial lesions on MRI who underwent surgery were identified from surgical, imaging, and pathological databases over a 10-year period (2013-2023). From these, patients with histologically proven LMS and LM were included. For all patients, the pre-operative full blood count was analysed, focusing on white cell counts and the neutrophil: lymphocyte ratio (NLR). A subset of patients with DWI MRI sequences were identified for imaging analysis where readers manually segmented the whole lesion on the ADC map to give a volume of interest (VOI) and a mean ADC value for the whole lesion. VOIs were visually analysed to pick out the most restricted parts, with up to 3 regions of interest (ROI) identified, and a mean calculated over the 3 ROIs. Segmentations and ROIs were checked by 2 readers independently. Haematological markers and ADC values between the two groups were compared using Mann Whitney U tests and ROC curves.

**RESULTS**

A total of 235 patients with atypical myometrial lesions were identified, with 195 with histologically proven LM and 24 with LMS. Blood parameters of 191 LM and 20 LMS patients were available. A total of 64 patients had imaging with both DWI and ADC maps (52 LM and 12 LMS).Blood analysis found higher NLR correlated with LMS, with a median of 3.32 versus 1.72 for LM ($p<0.001$). A Youden index cut off of =2.10 was suggested for LMS. The VOI mean ADC value for LMS 1.18 x10-3 mm2/sec (+/-0.24 SD) was found to be significantly lower than for LM 1.49 x10-3 mm2/sec (+/-0.36 SD) ($p=0.006$). The mean ADC value generated on the ROIs was significantly lower for LMS than for LM at 0.82 versus 1.10 x10-3 mm2/sec ($p=<0.001$). The specificity of ROI ADC values was 65.4% with a sensitivity of 83.3% and a NPV of 94.4%.

**CONCLUSION**

ADC, particularly with the use of a focal ROI, is a useful diagnostic tool for improving preoperative diagnostic prediction of LMS in atypical LM. The NLR is higher in the LMS cohort, suggesting an inflammation-malignancy relationship.

**CLINICAL RELEVANCE/APPLICATION**

Future considerations involve modelling a predictive scoring system that combines imaging characteristics with biomarkers to improve diagnostic certainty and differentiate between LM and LMS.

## S5-SSOB01-6 ASSESSING JOINT HUMAN-AI SYSTEMS BASED ON UNCERTAINTY ESTIMATION

Elisabeth Epstein (*Abstract Co-Author*) Nothing to Disclose
Filip Christiansen, MSc, BSc (*Abstract Co-Author*) Nothing to Disclose
Robert Welch (*Abstract Co-Author*) Nothing to Disclose
Kevin Smith, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Emir Konuk (*Presenter*) Nothing to Disclose

**PURPOSE**

Collaborative human-AI systems that leverage notions of confidence and uncertainty have the potential to surpass the effectiveness of both doctors or AI working in isolation. However, we currently lack meaningful metrics to evaluate the performance of such joint systems. In this study, we proposed a novel and meaningful performance measure for joint human-AI systems and aimed to identify the best uncertainty or confidence estimation methods for such joint decision making systems.

**METHODS AND MATERIALS**

We utilized a retrospective dataset comprising 17,119 ultrasound images from 3,652 patients with an ovarian tumor, gathered from 20 centers in 8 countries using 21 different devices. The ground truth for model training and evaluation was histological diagnosis. The exams were assessed by 66 doctors. We developed neural network classifiers using 7 different methods, including temperature scaling and deep ensembles. These methods either calibrate the confidence of the classifier or impart a notion of uncertainty to the AI. We estimated confidence by maximum classifier response and utilized the entropy of the estimated probabilities for measuring uncertainty, further decomposed into aleatoric and epistemic components. We evaluated human-AI systems' joint risk and F1 score both with in domain (InD) data which is an internal dataset where the AI is trained and evaluated, and out of domain data where the AI is evaluated on external hospitals it did not see before (OoD-H), or unseen devices (OoD-D).

**RESULTS**

We found that all joint human-AI confidence-based decision-making systems surpassed both standalone doctors or AI. For OoD-D, joint systems achieved a boost in F1 score of 0.04 over both AI and doctors, while demanding 25% less of doctors' time. For OoD-H, a joint human-deep ensemble achieved an F1 of 0.79 vs. 0.73 of the doctors' while demanding 40% less time. For unseen (OoD) data, most joint systems required more doctor oversight to perform optimally, indicating the ability of the decision-making system to defer to human judgment when encountering unfamiliar data patterns.

**CONCLUSION**

Our findings reveal a 'sweet spot' of human involvement in the joint human-AI system, beyond which additional human oversight harms performance. In joint decision-making systems, the expertise of the doctors has a higher impact on overall clinical performance than the choice of AI method, especially in OoD data.

**CLINICAL RELEVANCE/APPLICATION**

Existing metrics do not consider the efficiency impact of AI on healthcare resource utilization. Our framework allows hospitals to tailor AI usage to align with available resources, optimizing both performance and resource allocation. Our framework can be extended to various reading strategies, including unblinded double reading.

# Abstract Archives of the RSNA, 2024

S5-STCE1

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Sunday, Dec. 1 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## S5-STCE1-1 DIAGNOSTIC EFFICACY AND JUSTIFICATION OF ADJACENT AND CONCURRENT X-RAY IMAGING

Dania Abu Awwad, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Injuries to extremities are common presentations to emergency departments and there is no limit to the number of X-rays that can be requested. While multiple fractures or concurrent injuries are possible, justification for each requested region is needed as this impacts workflow efficiency and radiation dose to patients. There have been limited studies on the efficacy of concurrent imaging, most of which have focused on paediatric populations alone or on forearm injuries. Hence, this study aims to assess the diagnostic efficacy of X-ray requests for all patients presenting for multiple adjacent body regions.

### METHODS AND MATERIALS

Data was extracted from two hospitals over a six-month period. All patients who presented for X-ray examinations and had multiple adjacent regions X-rayed within 24 hours were included in the study. X-ray examinations were restricted to upper and lower extremities. The main region of interest or the first X-ray taken was referred to as the initial X-ray, while any other X-ray taken after was considered adjacent imaging. The clinical history of each imaging request was collected and compared to the radiology reports.

### RESULTS

There were 3589 X-rays taken for 1514 patients, ranging from two to six imaging requests. In total, 60% of X-rays showed no new findings, 24% had other findings such as osteoarthritis or swelling, 2% had suspicious findings, and only 15% had new findings such as fractures. 92% of all new findings were found in the initial X-ray, meaning that 32% of initial X-rays had a new finding but only 2% of adjacent X-rays had new findings. Of all the included X-rays, only 59% had symptoms for the requested body regions, which drops to 51% for X-ray examinations that led to no findings but increases to 76% for X-rays that reported new findings.

### CONCLUSION

Adjacent imaging had low diagnostic efficacy for both upper and lower limb regions. While many request forms had limited clinical history provided, it was much higher for imaging requests that reported no findings. While the clinical history in imaging requests does not encompass the full patient story or presenting issue, there has been a correlation between clinical history and imaging results. The vast difference between the percentage of fractures detected in initial versus adjacent imaging highlights a need to re-evaluate how and when X-ray imaging is used, particularly when multiple regions are requested.

### CLINICAL RELEVANCE/APPLICATION

The findings underscore the importance of adopting a value-based approach to radiology. By ensuring that imaging requests are clinically justified and based on individual patient needs, healthcare providers can optimize resource use and reduce unnecessary procedures, which in turn helps minimize patient exposure to radiation.

## S5-STCE1-2 THREE INTERVENTIONS, THREE VILLAGES, ONE GOAL - HEALTH EQUITY

Komal Verma Saluja, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

Breast cancer is the most prevalent cancer and second-leading cause of cancer death among women across all ages, ethnicities, and socioeconomic backgrounds. The potential benefits of mammography screening in early detection of breast cancer continue to be underutilized. Major factors contributing to breast imaging disparities include lack of awareness, cultural and linguistic barriers, social inhibitions, poor access to imaging services, financial constraints and lack of insurance support. This study was aimed to comparatively assess the impact of various health equity interventions in improving breast cancer diagnostics.

### METHODS AND MATERIALS

Study population comprised of women aged 40-75 years, from three neighboring villages A (n=331), B (n=297), C (n=316), with similar socio-cultural, demographic, geographical and economic characteristics. The adopted health equity interventions were those recommended and proven effective by previous researchers. These included (1) periodic community education sessions consisting of contact sessions and special events for village A, (2) breast health volunteers selected from local communities and trained for village B and (3) mobile mammography van for village C. The impact of the interventions was measured in terms of percentage of women who underwent screening mammography over a two-year period, with a secondary objective to identify shifts in awareness, attitude and perception about breast cancer screening mammography, which was explored through a structured, validated questionnaire administered to the women within target population.

**RESULTS**

Percentage of women in target population undergoing mammography screening in villages A, B and C was 57.4%, 65.5% and 68.8% respectively ($p < 0.009$). Mobile van by addressing financial, transport and time barriers established itself as the most effective intervention. Health volunteer approach statistically proved superior in improving awareness and reducing stigma. Based on input output analysis, education emerged as the most efficient tool. The biggest barrier faced by women was stigma followed by finance, transport, and time. The graph displays the impact of different interventions on the barriers perceived by the study population.

**CONCLUSION**

Mobile mammography van is the most effective tool to address breast imaging inequities however in a resource poor setting, community education remains a more efficient tool.

**CLINICAL RELEVANCE/APPLICATION**

Gauging the efficacy of various health equity interventions allows efficient implementation of tailor-made programs according to population characteristics.

## S5-STCE1-3 FUTURE OF RADIOLOGY: CLINICAL AND ENVIRONMENTAL ADVANTAGES OF DIGITAL CARBON NANOTUBE X-RAY SOURCES - 75% SMALLER SIZE, 17% LESS ENERGY CONSUMPTION, 40% LESS RADIATION DOSAGE FOR PATIENT SAFETY, WITH FLUOROSCOPY AND EXTREMITIES IMAGING INSIGHTS COMPARED TO CONVENTIONAL X-RAY SOURCES

Taewon Kim (*Abstract Co-Author*) Nothing to Disclose
Amar P. Gupta, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

With the advent of nanotechnology, it has transformed and digitalized many fields of medical imaging. One such example is digital X-ray detectors which have many advantages over X-ray films. Similar paradigm shift is seen in X-ray sources, where Carbon Nanotubes (CNTs) based digital X-ray sources are outperforming the conventional analogue filament-based X-ray sources. In this paper, we have shown that CNT X-ray tubes are 75 % smaller in size, 17% less energy consumed and produces 40% less radiation dose in fluoroscopic setting rated for similar use and specifications. Not only this, shifting to Digital-CNT X-ray tube has substantial impact on environment considering the manufacturing process compared to conventional X-ray sources which signifies that CNT X-ray sources are future of radiology.

**METHODS AND MATERIALS**

We compared the CNT and Filament X-ray tubes bought from different vendors. Both tubes were rated for 70 kV, 3 mA and 0.4 Focal spot. The Tubes' physical dimensions were measured and compared. Tubes were operated in pulsed mode at 50 kV, 1 mA by digitally switching with MOSFET circuit for a pulse of 40 ms with 50% duty cycle for fluoroscopic patient dosage measurement. The cadaver hand was imaged using Varex Flat panel at different kVps but constant 2mAs using both tubes and the image qualities were compared in 2× and no magnification mode. Lastly, we interviewed the vendors about manufacturing process of these tubes and compared the environmental impact during the production.

**RESULTS**

Digital CNT X-ray source was ~75 % less small in volume size, ~ 50% less in weight and consumes 17% less energy for producing the X-ray of same energy and current. Moreover, in the fluoroscopic setting, where the X-rays are continuous the CNT X-ray tube performed ~44% less radiation dosage due to perfect digital switching. The cadaver hand imaging at different magnification and kVps shows similar quality for both X-ray tubes. When compared to their manufacturing process, we found that CNT X-ray tubes can have less carbon emissions because they are produced in simple vacuum ovens in huge quantities whereas filament X-ray tubes are manufactured one by one individually using flammable gases which can have bad environmental impact.

**CONCLUSION**

Digital CNT X-ray tubes are the future of radiological imaging and sustainable in production. For the same rating and usage, the digital X-ray source outperforms the conventional one in every aspect which shows that it is better for patient, medical practitioners and X-ray manufactures to shift to this technology.

**CLINICAL RELEVANCE/APPLICATION**

Digital CNT X-ray source produces 40% less radiation than conventional sources in fluoroscopic setting and can perform better in cardiac and respiratory-gated imaging due to faster switching and better synchronization with detector.

# Abstract Archives of the RSNA, 2024

S5-STCE2

**Science Session (Theranostics)**

Sunday, Dec. 1 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## S5-STCE2-1 UTILIZING PET RADIOMICS FOR PREDICTING CANCER-ASSOCIATED CACHEXIA RISK: A PROMISING APPROACH

Xin-Gui Peng, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yang Jiang, PhD, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to assess if a model constructed from radiomics features extracted from PET images can predict cachexia risk in cancer patients undergoing [18F]fluoro-2-deoxy-D-glucose (18F-FDG) PET/CT scans.

### METHODS AND MATERIALS

Cancer patients who underwent 18F-FDG PET/CT scans from April 2017 to October 2021 were included. Radiomics feature extraction and model construction utilized the FeAture Explorer Professional Edition (FAE, Version 0.5.3) on PET images of the liver, pancreas, visceral fat, subcutaneous fat, psoas muscle, and sacrospinal muscle. Feature selection employed Pearson correlation, recursive feature elimination, and support vector machine methods. Logistic regression identified clinical features associated with cancer-associated cachexia and constructed a clinical-radiomics model.

### RESULTS

A total of 626 patients were analyzed, divided into training (n=438) and testing (n=188) datasets. In the training dataset, the AUC for the clinical-radiomics model (0.802) surpassed clinical (0.741) and radiomics (0.772) models. The clinical-radiomics model also outperformed the clinical model ($P < 0.001$) and the radiomics model ($P = 0.012$). In the validation dataset, AUCs were 0.759, 0.772, and 0.796 for clinical, radiomics, and clinical-radiomics models, respectively, with no significant differences observed.

### CONCLUSION

PET radiomic features extracted from the liver, pancreas, visceral fat, subcutaneous fat, and erector spinae muscles are beneficial for identifying cancer patients at higher risk of developing cachexia.

### CLINICAL RELEVANCE/APPLICATION

The integration of radiomics features from specific organs and tissues into a predictive model offers clinicians a powerful tool for early identification of cachexia risk in cancer patients, facilitating personalized management strategies and potentially improving treatment outcomes.

## S5-STCE2-2 THE RATIO OF VISCERAL TO SUBCUTANEOUS FAT IS A PREDICTIVE FACTOR FOR CYTOKINE RELEASE SYNDROME GRADE IN GASTRIC CANCER PATIENTS RECEIVING CLAUDIN18.2-TARGETED CHIMERIC ANTIGEN RECEPTOR T-CELL THERAPY

Changsong Qi (*Abstract Co-Author*) Nothing to Disclose
Lei Tang, MD (*Abstract Co-Author*) Nothing to Disclose
Meng He, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Cytokine release syndrome (CRS) has a significant impact on survival and functional recovery in patients after chimeric antigen receptor (CAR)-T cell therapy, and the identification of its determinants is still challenging. We analysed the impact of body composition parameters from CT images and serum inflammatory markers on the severity of CRS in patients with advanced gastric cancer (GC) treated with CLDN18.2-targeted CAR-T cells.

### METHODS AND MATERIALS

Forty-five advanced GC patients treated with CLDN18.2-targeted CAR-T cells were enrolled in the study. The skeletal muscle index, skeletal muscle density, subcutaneous fat area (SFA), visceral fat area (VFA) and VFA-to-SFA ratio (VSR) on baseline CT were automatically segmented and calculated by using a deep learning-based tool that we have previously proposed. The relationship between body composition and CRS severity was investigated by using univariate and multivariate binary logistic regression analyses.

### RESULTS

Patients with CRS grade 2 had a significantly higher VSR than did patients with CRS grade 1 (1.07 vs. 0.23, respectively; P=0.003). Furthermore, the SFA was slightly higher in patients with CRS grade 1 than in those with CRS grade 2 (80.95 vs. 52.71 cm2, respectively; P=0.051). However, skeletal muscle-related parameters and body mass index (BMI) were not significantly different between the two groups. The area under the ROC curve (AUC) showed that patients with SFA < 77.19 and VSR = 0.21 had a greater probability of developing CRS grade 2, with AUCs of 0.660 (0.491-0.829) and 0.762

(0.620-0.905), respectively. Binary logistic regression analysis demonstrated that SFA < 77.19 and VSR = 0.21 were significantly associated with an increased likelihood of CRS severity (P=0.005 and 0.002, respectively).

**CONCLUSION**

The baseline ratio of visceral to subcutaneous fat area correlated with the severity of CRS in advanced GC patients treated with CLDN18.2-targeted CAR-T cells.

**CLINICAL RELEVANCE/APPLICATION**

The fat parameters from CT images are associated with the severity of cytokine release syndrome (CRS) in patients treated with CLDN18.2-targeted CAR-T cell therapy. The CT-based VSR exhibits potential for clinical application in early prediction of CRS grade and perhaps directing interventions.

## S5-STCE2-3 SAFETY OF LU-PSMA WITH PRIOR RADIUM-223 TREATMENT FOR METASTATIC PROSTATE CANCER

John Wang (*Abstract Co-Author*) Nothing to Disclose
Matthew Labriola (*Abstract Co-Author*) Nothing to Disclose
Hannah McManus (*Abstract Co-Author*) Nothing to Disclose
Valeria Maldonado Grijalva (*Abstract Co-Author*) Nothing to Disclose
Terence Z. Wong, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company
Colm Kelleher, MD (*Abstract Co-Author*) Nothing to Disclose
Marybeth A. Nedrud, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Lu177-PSMA-617 (LuPSMA) is approved for the treatment of metastatic castration resistant prostate cancer (mCRPC). There is limited real-world safety data for this radioligand therapy in the setting prior treatment with radium-223.

**METHODS AND MATERIALS**

Retrospective chart review was completed for the first 100 mCRPC patients who received =1 dose of LuPSMA at a single institution from June 2022 to July 2024. Demographics, clinical history, including prior lines of therapy before LuPSMA, and baseline laboratory studies were collected. Clinical outcomes pertaining to LuPSMA, including the total doses received, the presence of dose reductions/treatment holds, and post-treatment blood counts/renal function were reviewed. Student's t and chi-squared tests analyzed differences between outcomes for those who completed prior treatment with radium-223 and those who did not.

**RESULTS**

Ninety-eight participants were included, with 2 excluded due to prior receipt of LuPSMA on clinical trial. Of those included, 17% (17/98) received radium-223 prior to LuPSMA administration. The mean age and baseline PSA, Hgb, WBC, and Cr, did not differ between those who received prior radium-223 (n=17) and those who had not (n=81, p>0.05). The mean number of prior lines of therapy was greater for those who received radium-223 (n=5.2) than those who had not (n=3.7, p=0.0006). The mean number of LuPSMA doses received per participant did not differ between the two groups (3.7 doses with radium-223 vs. 4.1 doses without radium-223, p>0.05). In addition, there were no differences in number of treatment holds or dose reductions (p>0.05). Early termination of LuPSMA therapy for both groups was most often due to clinical disease progression (4/10, 40%, with radium-223 vs. 28/47, 59%, without radium-223, p>0.05). There were numerically higher rates of LuPSMA discontinuation secondary to cytopenias in the radium-223 group (3/10, 30%) when compared to those without radium-223 (8/47, 17%), but no statistical differences between the two (p>0.05). There was no difference in mean Hgb, WBC, or Cr between the two groups at the end of LuPSMA treatment (p>0.05).

**CONCLUSION**

For a small group with prior radium-223 treatment, there was no difference in mean number of LuPSMA doses received, post-treatment blood counts, or rates of early termination secondary to cytopenias when compared to those who had not received prior radium-223. Although limited by small sample size, this data suggests that prior radium-223 treatment does not interfere with the ability to safely administer LuPSMA.

**CLINICAL RELEVANCE/APPLICATION**

Our results build upon the current literature and provide further support for the real-world safety of LuPSMA therapy in the setting of prior radium-223.

# Abstract Archives of the RSNA, 2024

T1-SSCH05

**Chest Imaging (Lung Nodules)**

Tuesday, Dec. 3 8:00AM - 9:00AM Room: E451A

Yoshiharu Ohno, MD, PhD (*Moderator*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology
Scott J. Adams, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T1-SSCH05-1 IMPACT OF IMMEDIATE AI ENABLED PATIENT TRIAGE TO CHEST CT ON THE LUNG CANCER PATHWAY: LUNGIMPACT

Madava G. Djearaman, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
David Baldwin (*Abstract Co-Author*) Nothing to Disclose
Arjun Nair, MD, FRCR (*Abstract Co-Author*) Advisory Board, Aidence BV
Indrajeet Das, FRCR (*Abstract Co-Author*) Nothing to Disclose
Neal Navani (*Abstract Co-Author*) Nothing to Disclose
Nick Woznitza, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Lung cancer is the leading cause of cancer deaths worldwide. Early detection and rapid diagnosis of lung cancer is essential to improve outcomes for patients. Despite introduction of lung cancer screening, the majority of patients present through the symptomatic route when a chest X-ray (CXR) is the most common first investigation. Rapid diagnosis is facilitated by correct identification of patients who would benefit most from an urgent CXR report and progression to urgent CT where indicated. Artificial intelligence (AI) may play a role in improving the process of identifying abnormalities suspicious of lung cancer and thus accelerating entry onto the diagnostic pathway. This has to be achieved in the context of services that are often at maximum capacity and there needs to robust scientific evidence for important clinical benefits that outweigh any extra activity.

### METHODS AND MATERIALS

The study was approved by the East of England Research Ethics Committee. It is a prospective, block randomised controlled trial of AI prioritisation of abnormal CXRs for clinician review vs. standard reporting (with AI available). It is underway across 5 geographically diverse distinct hospital sites in England, UK. All patients who are referred for a chest X-ray from primary/family care at each site are included. The study commenced 17 July 2023 and will conclude 31 July 2024. Co-primary outcomes are time from CXR to diagnosis of lung cancer and time from CXR to CT chest. Secondary outcomes include concordance between clinician report and AI, and stage of lung cancer diagnosis. A health economic evaluation will estimate the cost-effectiveness of CXR AI in lung cancer diagnosis including the difference in costs per patient screened, cost per patient diagnosed, and costs per percentage increase in early diagnosis.

### RESULTS

To date (April 2024) we have randomised 46,360 CXRs and are projected by trial close to have randomised 78,220 CXRs. The full results will be published in late 2024 or early 2025 and will be available at the RSNA meeting.

### CONCLUSION

LungIMPACT is measuring the impact of immediate AI-based prioritisation of CXRs for reporting and is measuring an important clinical impact (the speed of diagnosis of lung cancer). A positive result may change practice (inclusion of AI) whilst a negative result will prompt better evaluation of AI products before introduction into routine practice. The study was identified as one of the "11 clinical trials to shape medicine in 2024" by Nature Medicine.

### CLINICAL RELEVANCE/APPLICATION

Adoption of AI in clinical practice requires robust evidence of clinical and cost-effectiveness. The LungIMPACT trial is the largest multisite randomised trial of CXR AI for lung cancer and will provide answers to both.

## T1-SSCH05-2 AI-RAD COMPANION MEETS LUNG-RADS: DIAGNOSTIC VALUE OF A DEEP-LEARNING BASED PROTOTYPE FOR AUTOMATED PULMONARY NODULE CLASSIFICATION ON CHEST CT

Jonathan I. Sperl (*Abstract Co-Author*) Employee, Siemens AG
Jordan H. Chamberlin, MD (*Abstract Co-Author*) Nothing to Disclose
William Auffermann, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mathis Zimmermann, MS,MBA (*Abstract Co-Author*) Employee, Siemens AG
Anna Newman (*Abstract Co-Author*) Nothing to Disclose
Lacey Woods (*Abstract Co-Author*) Nothing to Disclose
Jeremy R. Burt, MD (*Abstract Co-Author*) Research Grant, Siemens AG Consultant, Canatu OY
Naim Qaqish, MD (*Abstract Co-Author*) Nothing to Disclose

Malorie Carter (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Bracco Group;Research Grant, Elucid BioImaging Inc;Consultant, Elucid BioImaging Inc;Research Grant: General Electric Company;Research Grant, Guerbet SA;Research Grant, Heartflow, Inc;Speakers Bureau, Heartflow Inc
Ismail M. Kabakus, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Parker Anderson, MD (*Abstract Co-Author*) Nothing to Disclose
Adrienn Toth, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study was to investigate the performance of a prototype, fully automated AI decision support tool (AI-Rad Companion, "AIRC") in classifying benign and malignant pulmonary nodules on chest CT scans with histopathologic confirmation or 2-year radiographic stability as the reference standard.

**METHODS AND MATERIALS**

282 patients were enrolled in this multicenter retrospective study, who previously underwent clinically indicated chest CT. 167 had biopsy proven lung cancer, while 115 had at least one benign pulmonary nodule. Diagnostic, baseline, and follow-up CT exams were evaluated using a prototype software (AIRC Research, Chest CT Explore V1.3.4, Siemens Healthineers), which provided automated image analysis, quantification, and visualization of lung nodules. By combining the information about lesion size, its temporal change, and lesion characteristics, a Lung-RADS score (1, 2, 3, 4A, 4B, 4X) was computed according to the guidelines by the American College of Radiology. Lung nodule validation was performed with the histopathologic result or stability for 2 years confirmation as the ground truth. A true positive nodule was defined as a nodule confirmed to be malignant by biopsy and reported as Lung-RADS 4B/X by the AIRC. The diagnostic performance was tested on the diagnostic CT exams, while follow-up exams were used to assess the intra-rater reliability. Baseline scans were analyzed to evaluate the clinical usefulness of AIRC in the early detection of high-risk pulmonary nodules.

**RESULTS**

Overall diagnostic accuracy for lung nodule classification (benign or malignant) was 0.762 (95% CI 0.783 - 0.811). Sensitivity and specificity of nodule classification were 0.749 (95% CI 0.676 - 0.812) and 0.783 (95% CI 0.696 - 0.854), respectively, with positive and negative predictive values of 0.833 (95% CI 0.778 - 0.877) and 0.682 (95% CI 0.619 - 0.739). 21 lung cancer patients had the lung cancer present as a much smaller nodule, an average of 17 months prior to the diagnostic scan. 80% of these 'baseline' nodules were detected and rated as Lung-RADS 4A or higher by AIRC. Furthermore, AIRC accurately characterized and classified the same nodules on subsequent scans within 7 days of the diagnostic CT with high (> 95 %) intra-rater reliability.

**CONCLUSION**

AIRC showed promising performance in malignancy risk categorization of benign and malignant lung nodules, showcasing its potential for early detection, and indicating its reliability for longitudinal monitoring.

**CLINICAL RELEVANCE/APPLICATION**

These findings suggest that AIRC holds promise as a valuable tool for clinicians in the accurate classification and early detection of high-risk pulmonary nodules, potentially improving patient outcomes through timely intervention and management.

## T1-SSCH05-3 STREAMLINING PRE-DEPLOYMENT VALIDATION AND BENCHMARKING OF MULTIPLE AI SYSTEMS FOR PULMONARY NODULE DETECTION: A CONCORDANCE-DISCORDANCE BASED APPROACH?

Catherine M. Jones, MBBS (*Abstract Co-Author*) Researcher, Annalise-AI Pty Ltd
Shraddha Mittal (*Abstract Co-Author*) Nothing to Disclose
Vasantha Kumar Venugopal, MD (*Presenter*) Officer, CARPL.AI Inc

**PURPOSE**

To streamline pre-deployment validation of AI tools for lung nodule detection and characterization on CT, using inter-AI concordance as a surrogate for traditional ground truth. We evaluated the efficacy and efficiency of this novel validation method against standard practices.

**METHODS AND MATERIALS**

The study employed a structured multi-phase approach to benchmarking AI solutions for lung nodule detection. 142 CT studies were processed via two distinct AI algorithms to identify lung nodules and assess malignancy risks. Studies were classified based on AI agreement: Concordant, where all AIs agree on nodule location, bypassing radiological evaluation; Discordant, prompting detailed radiologist analysis due to varied nodule locations flagged by AIs; and Partially concordant, involving a combination of agreement and discrepancy in AI findings within the same case. Kappa statistics quantified inter-AI concordance, and radiologist-AI agreement metrics were calculated for discordant and partially concordant cases to validate the efficiency and reliability of using AI concordance as a surrogate ground truth. A Thoracic Radiologist reviewed the discordant and partially concordant cases to evaluate the AI outputs of the nodule locations.

**RESULTS**

The study achieved an inter-AI concordance rate of 44.46%. AI1 detected 290 nodules, while AI2 detected 342, with only 68 nodules unmatched, indicating substantial agreement on detected nodules. Among the studies, 103 (72.54%) were fully concordant, requiring no further radiologist review. The total reading time for the dataset was 3,778 seconds, with an average of approximately 63 seconds per study. Discordant cases, which exclude fully concordant cases, accounted for 19.30% of the total reading time, suggesting a potential significant reduction in time spent on reviews if concordance rates improve. The AI solutions demonstrated a Kappa of 0.261 for nodule detection concordance, indicating fair agreement.

**CONCLUSION**

Employing inter-AI concordance as a surrogate for ground truth validation demonstrates a promising approach to optimize the pre-deployment validation process for lung nodule detection AI, enhancing efficiency and potentially accelerating the integration of reliable AI tools into clinical workflows.

**CLINICAL RELEVANCE/APPLICATION**

This study's innovative approach of employing inter-AI concordance as a surrogate for ground truth in pre-deployment validation holds promise for quicker integration of reliable AI solutions into clinical practice without compromising on safety and trust.

## T1-SSCH05-4 WORKFLOW EFFICIENCY BENEFITS OF A LUNG NODULE DETECTION AI PROGRAM

Paras Lakhani, MD (*Abstract Co-Author*) Nothing to Disclose
Matt Deng, PhD (*Abstract Co-Author*) Employee, Infervision Inc
Vijay M. Rao, MD (*Abstract Co-Author*) Nothing to Disclose

Ryan K. Lee, MD, MBA (*Abstract Co-Author*) Bayer, Speaker's BureauPhilips, Speaker's BureauBracco, Advisor
Adam E. Flanders, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher G. Roth, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Richard M. Beck, MD (*Abstract Co-Author*) Nothing to Disclose
Avishkar Sharma, MD (*Abstract Co-Author*) Nothing to Disclose
Baskaran Sundaram, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

One of the earliest clinical applications of deep learning in radiology was automated detection of lung nodules from CT of the chest. The adoption of AI for this purpose has been slow, partly due to the insufficient evidence of the inherent value when integrated into the clinical workflow. This study directly addresses whether adoption of the technology augments radiologist efficiency.

**METHODS AND MATERIALS**

We performed an IRB approved pilot research study evaluating the interpretation times of nine community-based radiologists before and after deployment of a PACS integrated, FDA cleared lung nodule detection algorithm (InferRead Lung CT.AI) . This software automatically detects lung nodules from chest CT, and reports nodule characteristics such as diameter and volume. We recorded the reading time (report launch to report final time) for all chest CT interpreted over a ninety-day time period before and after implementing the detection tool. Aggregate mean reading time intervals for the nine radiologists were generated before and after deployment. Reading times greater than 60 min were excluded from this study. Participating radiologists also completed a survey.

**RESULTS**

During the trial period, a total of 1,192 chest CT were interpreted without the detection tool, and 738 scans were read with it. The reading time distributions are shown in the attached bar plots. Overall, the utilization of AI software resulted in a statistically significant reduction in reading times (Mann-Whitney U-test, p value = 0.032). The average reading time was 16.5±11.4 minutes without AI, with the peak time between 8-10 minutes, while the reading time was 14.8±10.0 minutes with AI and a peak time between 6-8 minutes. A reduction of reading time with AI was observed in eight out of the nine participants. In addition, eight anonymous responses were collected from the survey. Radiologists felt more confident reporting lung nodules using the AI system with an average score of 4.5/5. Subjective average reading experience score with the tool was 4.75/5. The AI software alleviates anxiety with an average score of 4.5/5.

**CONCLUSION**

Deployment of the lung nodule detection AI system was shown to significantly reduce the radiologist reading time interval for the nine community based radiologists in this pilot project. The deployment of the tool not only significantly reduced reading times but also bolstered radiologists' confidence in reporting lung nodules, diminished anxiety, and enhanced the overall reading experience.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrates a soft benefit of adopting a lung nodule detection system into clinical workflow. It is perhaps one rationale that can be used to justify clinical adoption of a specific AI system.

## T1-SSCH05-5 DIFFERENTIATION BETWEEN INVASIVE ADENOCARCINOMA AND FOCAL INTERSTITIAL FIBROSIS AMONG PERSISTENT PULMONARY PART-SOLID NODULES: WITH EMPHASIS ON THE CT MORPHOLOGIC ANALYSIS

Jung Han Woo (*Abstract Co-Author*) Nothing to Disclose
Yoon Ki Cha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Min Hyuk Yu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Focal interstitial fibrosis (FIF) manifesting as persistent part-solid nodule (PSN) has been mistakenly treated surgically due to similar imaging features to invasive adenocarcinoma (ADC). The purpose of this study was to observe predictive imaging features correlated with FIF through CT morphologic analysis.

**METHODS AND MATERIALS**

From January 2009 to December 2020, 44 patients with surgically proven FIF in a single institution were enrolled and compared with 88 ADC patients through propensity score matching. Patient characteristics and CT morphologic analysis of persistent PSNs were used to identify predictive imaging features of FIF. Receiver operating characteristic (ROC) curve analysis was used to quantify performance of imaging features.

**RESULTS**

Total of 132 patients with 132 PSNs (44 FIF, 88 ADC; mean age, 67.7 ± 7.58; 75 females) were involved in our analysis. Multivariable analysis demonstrated that preserved peritumoral vascular margin (preserved vascular margin), preserved secondary pulmonary lobule margin (preserved lobular margin), lower coronal to axial ratio (C/A ratio; cut-off: 1.005) were significant independent predictors of FIF ($p < 0.05$). ROC curve analysis to evaluate the predictive value of the logistic model based on the imaging features of FIF, and the AUC value was 0.881.

**CONCLUSION**

CT imaging features of preserved vascular margin, preserved lobular margin, and lower C/A ratio (cut-off, < 1.005) might be helpful imaging features in discriminating FIF over ADC, among persistent PSN in clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

The clinical relevance of our study lies in its contribution to improving the diagnostic accuracy for patients with persistent part-solid nodules (PSNs). By identifying specific CT imaging features—such as preserved vascular and lobular margins, and a lower coronal to axial ratio—that are indicative of focal interstitial fibrosis (FIF) rather than invasive adenocarcinoma (ADC), clinicians can reduce the likelihood of unnecessary surgical interventions.

# Abstract Archives of the RSNA, 2024

T1-SSGI08

**Gastrointestinal Imaging (Dual Energy CT - Techniques)**

Tuesday, Dec. 3 8:00AM - 9:00AM Room: E451B

Noor Fatima Majeed, MD (*Moderator*) Nothing to Disclose
Anugayathri Jawahar, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T1-SSGI08-1 INFLUENCE OF CT CONTRAST MATERIAL ATTENUATION ON LINE PAIR DELINEATION AT PHOTON-COUNTING VERSUS DUAL-SOURCE CT WITH DIFFERENT MATRIX AND KERNEL RECONSTRUCTIONS

Maurice Heimer, MD (*Abstract Co-Author*) Nothing to Disclose
Theresia Aschauer (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD (*Abstract Co-Author*) Grant, Koninklijke Philips NV;Grant, General Electric Company;Consultant, Canon Medical Systems Corporation;Speaker, Canon Medical Systems Corporation;Royalties, Oxford University Press;Shareholder, Nextrast, Inc;Board Member, Nextrast, Inc
Te Yu Lin, MS (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Kevin J. Treb, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuxin Sun, BS, MSc (*Presenter*) Stockholder, Nextrast, Inc

### PURPOSE

To assess influence of contrast attenuation (air, dark borosilicate contrast material [DBCM], water, and iodine solutions) on visualization of thin structures at photon-counting CT (PCCT) and dual-source CT (DSCT).

### METHODS AND MATERIALS

A line pair phantom with 6 groups of alternating acrylic bars (120 HU at 120 kVp) and slits of equal width at increasing line pair frequencies (3.0 to 9.0 LP/cm) was serially filled with 8 different contrast materials (air; DBCM -400, -160, and -60 HU; water; iodine 140, 240, and 540 HU). Phantom was placed in a body-shaped phantom (40x30 cm, Gammex) and scanned on Siemens PCCT (NAEOTOM Alpha) and DSCT (SOMATOM Force) with similar acquisition and reconstruction parameters (512 or 1024 matrix, 400 or 200 mm FOV, soft [BR44] or sharp [BR68/69] kernel, at 1 mm slice thickness). Two radiologists readers (MH and TA) assessed on a 5-point Likert scale for each group of bars at standard abdominal window levels (W=400, L=40): 1) Number of acrylic bars visible (0 to 4); 2) Accuracy of bar width (0=not visible, 4=bars and slits equal width); and for each acrylic bar 3) Clarity of bar (0=cannot distinguish from noise, 4=entire bar clearly seen). For analysis, the three DBCMs were pooled, and iodine 140 HU was omitted for poor bar delineation.

### RESULTS

When grouping all agents, number of bars visible was significantly higher with sharp kernel compared to soft (2.1 vs 1.3, p=0.002) but not between 1024 vs 512 matrix size (1.7 vs 1.8, p=0.76). Accuracy and clarity scores were also higher between sharp and soft kernels (1.3 vs 0.7, p=0.01; and 1.1 vs 0.6, p=0.02) but not for matrix size. Number of bars, accuracy, or clarity scores were not different between PCCT vs DSCT (1.5 vs 1.9, p=0.12; 0.9 vs 1.1, p=0.29; 0.7 vs 1.0, p=0.16). Between agents, at PCCT with soft kernel and both matrix sizes, pooled DBCMs had highest scores for number of bars (1.7, p=0.02), accuracy (1.0, p=0.001), and clarity (0.9, p<0.001) than air (0.8, 0.6, 0.5), water (1.5, 1.0, 0.6), iodine 240 (1.5, 0.5, 0.4) and iodine 540 HU (0.7, 0.2, 0.2). Comparing all reconstructed datasets (n=6), there was a significant difference between contrast agents for accuracy (p=0.007) and clarity (p=0.009) but not number of bars (p=0.17), with DBCMs performing better than iodine 240 and 540 HU for both accuracy (1.5 vs 0.5 and 0.6, p=0.001 and p=0.009), and clarity (1.2 vs 0.3 and 0.6, p<0.001 and p=0.04).

### CONCLUSION

Use of sharp kernel improves visualization of thin structures at PCCT and DSCT irrespective of matrix size. At standard soft kernel, DBCM performs best for delineating thin bars compared to air, neutral, or positive contrast agents.

### CLINICAL RELEVANCE/APPLICATION

Oral DBCM could improve delineation of fine bowel folds and potentially pathology at both conventional and PCCT. Clinical testing is warranted.

## T1-SSGI08-2 SPECTRAL CT IODINE CONCENTRATION FOR NORMAL LIVER AND HEPATIC STEATOSIS

Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Tobias Klinder, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Amy Perkins (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jonathan D. Dorff, MD (*Abstract Co-Author*) Nothing to Disclose
Ali H. Dhanaliwala, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Matthew N. Nazarian, MD (*Abstract Co-Author*) Nothing to Disclose

Tom Brosch (*Abstract Co-Author*) Researcher, Koninklijke Philips NV
Mahati Mokkarala, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Spectral CT offers a wide range of potential applications, utilizing various quantitative parameters for analysis by radiologists and scientists. Currently, consensus normal values for liver iodine concentration do not exist. This study aims to assess whether spectral CT can provide reliable quantitative data for normal livers and those with steatosis.

**METHODS AND MATERIALS**

A retrospective PACS search identified 174 portal venous phase examinations on 174 patients performed on a spectral CT (Spectral CT 7500, Philips Healthcare) at an urban academic center. These examinations were analyzed using spectral data, including virtual monoenergetic images, iodine maps, and virtual non-contrast images. Abdominal organs and the abdominal aorta were segmented. Radiology reports were reviewed. Out of the 174 examinations, 134 total examinations had normal livers by radiology report and 24 had hepatic steatosis as the only remarkable liver finding. Excluded from the study were 7 examinations with other diffuse liver diseases such as cirrhosis and 11 examinations with liver lesions > 1.0 cm. Mean liver iodine concentrations were obtained via liver segmentation. Iodine concentration obtained from adequate segmentation of the abdominal aorta was used to normalize liver iodine concentration for each examination. Mean absolute and normalized iodine concentration in normal livers (n=130) and those with hepatic steatosis alone (n=24) were calculated. Statistical analyses were performed using Excel (Office 365, Microsoft) and R (R Core Team).

**RESULTS**

Normal livers had a mean liver iodine concentration of 2.57 mg/mL (SD=0.39), and a normalized liver iodine concentration of 0.54 (SD=0.13). Livers with hepatic steatosis alone had a mean liver iodine concentration of 2.33 mg/mL (SD=0.54) and a normalized liver iodine concentration of 0.40 (SD= 0.14). There was a statistically significant difference between the normalized iodine concentrations in the normal livers when compared to the group of hepatic steatosis alone ($p<0.0001$).

**CONCLUSION**

Livers with hepatic steatosis alone showed decreased iodine concentration compared to normal livers. Additional quantitative spectral CT data can help define abnormal and normal liver parameters.

**CLINICAL RELEVANCE/APPLICATION**

The initial clinical integration of spectral CT enables the utilization of additional information, such as quantitative iodine maps. However, for successful clinical integration, it will be necessary to determine a consensus regarding iodine concentrations in hepatic steatosis and other diffuse liver diseases.

## T1-SSGI08-3 OPTIMIZING PHOTON-COUNTING CT VIRTUAL MONOENERGETIC IMAGING WINDOW SETTINGS IN THE ABDOMEN

Richard W. Ahn, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Anish Goel (*Abstract Co-Author*) Nothing to Disclose
Vasantha Vasan, MD (*Abstract Co-Author*) Nothing to Disclose
Lakshmi Ananthakrishnan, MD (*Abstract Co-Author*) Nothing to Disclose
Xinhui Duan, PhD (*Abstract Co-Author*) Nothing to Disclose
Yue Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Yin Xi, PhD (*Abstract Co-Author*) Nothing to Disclose
Darren M. Imphean (*Abstract Co-Author*) Nothing to Disclose
Xunbo Xu, ARRT (*Abstract Co-Author*) Nothing to Disclose
Liqiang Ren, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To optimize window settings and display contrast to noise ratio (dCNR) on photon-counting CT virtual monoenergetic images (VMIs) for improved soft tissue and liver visualization.

**METHODS AND MATERIALS**

Institutional IRB approval was obtained. CT data was retrospectively collected from 39 patients scanned on a clinical photon-counting CT (NAEOTOM Alpha, Siemens) with an abdomen-pelvis dual-phase (arterial and portal venous) protocol. For each phase, axial VMIs (Br44 kernel and 5mm thickness) were reconstructed at 60 and 70 keV, resulting in four image series in total for each patient. First, 3 radiologists defined optimal window center/width (C/W) soft tissue and liver settings by manually adjusting windows for optimal soft tissue and liver visualization. The median C/W across all readers and 39 patients were used. Next, for each phase, dCNR was quantified for 5 window settings: default soft tissue (40/400 HU), default liver (50/250 HU), optimal soft tissue, optimal liver, and a vendor-recommended soft tissue setting for 60 keV (FAST-WINDOW: 65/470 HU), and in 3 structures: portal vein, aorta, and muscle. The soft tissue window setting was evaluated by calculating the dCNR of aorta against muscle whereas that for liver window evaluation was done by calculating the dCNR of portal vein against muscle. Percent change in dCNR from the reference C/W settings (default) were reported. Paired t-tests were used to test the percent change against 0.

**RESULTS**

The optimal soft tissue window C/W settings were determined as 100/600 and 60/480 HU for 60 and 70 keV at arterial phase, and 75/500 and 45/400 HU for 60 and 70 keV at portal venous phase. The optimal liver settings were 120/350 and 100/280 HU for 60 and 70 keV at arterial phase, and 130/300 and 105/250 HU for 60 and 70 keV at portal venous phase. For soft tissue windows, display CNR increased by up to 51% when viewing images using the reader-determined optimal C/W settings compared to default C/W settings. Compared to 70 keV images at default liver window, the 60 keV with default window decreased the display CNR by 10% (arterial) and 14% (venous) but increased by 57%/92% (arterial) and 43%/75% (venous) for 70/60 keV images with optimal liver windows. All comparisons were statistically significant with a $p < 0.01$.

**CONCLUSION**

Optimal window settings for both soft tissue and liver can significantly improve the display CNR on PCCT virtual monoenergetic images with more improvements on 60 keV compared to 70 keV images.

**CLINICAL RELEVANCE/APPLICATION**

Low keV images have the potential benefit of increased CNR but inappropriate window settings result in lower display CNR. Viewing images at the determined optimal window settings can achieve higher display CNR and improve image interpretation.

## T1-SSGI08-4 DEEP LEARNING IMAGE RECONSTRUCTION REDUCES NOISE, IMPROVES CONTRAST AND SHARPNESS, AND MAINTAINS TEXTURE FOR ROUTINE LOW-KILOELECTRON VOLT VIRTUAL MONOENERGETIC IMAGE

## RECONSTRUCTION TO MELIORATE DIAGNOSTIC ACCEPTANCE AND LESION CONSPICUITY: A PROSPECTIVE STUDY WITH FIVE READERS

Huan Zhang (*Abstract Co-Author*) Nothing to Disclose
Lingyun Wang (*Abstract Co-Author*) Nothing to Disclose
Weiwu Yao (*Abstract Co-Author*) Nothing to Disclose
Jingyu Zhong, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare image quality and diagnostic acceptance of low-kiloelectron volt virtual monoenergetic image (VMI) to adaptive statistical iterative reconstruction (Asir-V).

### METHODS AND MATERIALS

We prospectively include portal-venous phase scans in contrast-enhanced abdomen dual-energy CT from 109 participants (66 men, mean age ± standard deviation, 57.3 ± 13.1 years) with 152 lesions (median, 12, range, 3 to 107 mm). The raw data of each participant was reconstructed into four image series: VMI at 50-keV using Asir-V at 50% blending (AV-50), and VMI at 40-keV using AV-50 and DLIR at medium (DLIR-M) and high strength (DLIR-H). The CT number values of nine anatomical sites (liver, spleen, pancreas, kidney, abdominal aorta, main portal vein inferior vena cava, paraspinal muscle, and fat tissue) and their standard deviations were measured, and the corresponding (SNR), and (CNR) were calculated. Noise power spectrum (NPS) using homogenous region of liver, and edge rise slope (ERS) at five edges (liver-fat, spleen-fat, kidney-fat, liver-portal vein, and pancreas-splenic vein) were measured. Five radiologists rated image quality in terms of image noise, image contrast, image sharpness, image texture, small structure visibility, and diagnostic acceptability, and evaluated the lesion conspicuity.

### RESULTS

The CT number values in 50-keV images were significantly different from those in 40-keV images, in all anatomical sites (all $p<0.001$). The SD, SNR and CNR values, and noise and noise peak in NPS measurements, were significantly lower in DLIR images than AV-50 images in all anatomical sites (all $p<0.001$). The ERS values were significantly higher in 40-keV images than 50-keV images at all edges (all $p<0.001$). The difference of the peak and average spatial frequency among the four algorithms were significant (both $p<0.001$) but relatively small. The 40-keV images were rated higher in image contrast and sharpness than 50-keV images (both $p<0.001$). The 40-keV AV-50 images showed most severe image noise, but were reduced by DLIR (both $p<0.001$). The 40-keV DLIR-M images were rated higher than 40-keV and 50-keV AV-50 images for diagnostic acceptability and lesion conspicuity (both $p<0.001$).

### CONCLUSION

Our study evaluated the low-keV VMIs, and proved that DLIR can provide lower noise, higher contrast and sharpness, and nature texture to allow 40-keV as a new standard for routine VMI reconstruction. The DLIR-M may gain higher diagnostic acceptance than DLIR-H in abdomen.

### CLINICAL RELEVANCE/APPLICATION

DLIR can improve images quality to allow 40-keV as a new standard for routine VMI reconstruction in abdomen, and the DLIR-M may provide a better trade-off among noise, contrast, sharpness, and texture, for higher diagnostic acceptability and lesion conspicuity.

## T1-SSGI08-5 HEPATIC FAT QUANTIFICATION USING DUAL-ENERGY COMPUTED TOMOGRAPHY:A REGION-OF-INTEREST EVALUATION ON PATIENTS SUSPECTED OF MILD HEPATIC STEATOSIS

Guozhi Zhang (*Abstract Co-Author*) Nothing to Disclose
Baozhi Liu (*Abstract Co-Author*) Nothing to Disclose
Shidan Dou (*Abstract Co-Author*) Nothing to Disclose
Xiaojian Li (*Abstract Co-Author*) Nothing to Disclose
Tianhui Wu (*Abstract Co-Author*) Nothing to Disclose
Dongbo Li (*Abstract Co-Author*) Nothing to Disclose
Liying Peng, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the potential of dual-energy computed tomography (DECT) for fat quantification on patients suspected of mild hepatic steatosis, by using a fine-grained region-of-interest (ROI) evaluation, with magnetic resonance imaging (MRI) serving as the reference.

### METHODS AND MATERIALS

Ten patients who were suspected of mild hepatic steatosis in ultrasonography and had also undergone a recent MRI exam were enrolled in this prospective study, where non-contrast DECT was performed <30 days after the MRI. A total of one hundred ROIs were defined by one fellowship-trained abdominal radiologist on the MRI proton density fat fraction (MRI-PDFF) map, where for each patient three ROIs were positioned on the left liver lobe and seven were positioned on the right liver lobe. Another radiologist was asked to delineate one hundred ROIs at corresponding locations on the DECT fat fraction (DECT-FF) map, expressed in fat percentage ranging from 0 to 100%, which was acquired through dual-material decomposition using fat and normal liver parenchyma as basis materials, on a routinely available post-processing workstation (uOmnispace.CT). The agreement between DECT-FF and MRI-PDFF (reference) was analyzed with the intraclass correlation coefficient (ICC) and the Bland-Altman plot.

### RESULTS

The mean hepatic fat fraction for the left lobe, the right lobe, and the whole liver was 7.5%, 7.7%, and 7.6%, respectively, with DECT-FF, and 7.2%, 8.1%, and 7.8%, respectively, with MRI-PDFF. Good agreement was found between DECT-FF and MRI-PDFF for the left lobe (ICC, 0.81; 95% CI 0.64-0.90). The agreement was slightly lower for the right lobe (ICC, 0.71; 95% CI 0.57-0.81) and the whole liver (ICC, 0.73; 95% CI 0.63-0.81). The Bland-Altman analysis showed a mean difference of 0.3% (95% LoA, -4.5%-5.2%), -0.4% (95% LoA, -7.1%-6.2%), and -0.2% (95% LoA,-6.4%-6.0%), for the left lobe, the right lobe, and the whole liver, respectively, between DECT-FF and MRI-PDFF.

### CONCLUSION

Overall, DECT-FF exhibited fairly acceptable agreement with MRI-PDFF, in hepatic fat quantification for mild steatosis.

### CLINICAL RELEVANCE/APPLICATION

DECT shows potential in hepatic fat quantification for the patients suspected of mild hepatic steatosis, which might be useful for early diagnosis of hepatic steatosis.

## T1-SSGI08-6 SPECTRAL HU CURVE EVALUATION OF LIVER LESIONS IN PANCREATIC CANCER

Corey T. Jensen, MD (*Abstract Co-Author*) Research Grant, General Electric Company
Gauruv S. Likhari, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the accuracy of CT spectral HU curve assessment of hypodense liver lesions.

### METHODS AND MATERIALS

In this retrospective Health Insurance Portability and Accountability Act-compliant study (January 2016 through May 2023), patients with biopsy-proven pancreatic adenocarcinoma and a biopsy-proven indeterminate liver lesion underwent a DECT abdominal CT scan in the late arterial phase. Spectral HU curves were provided for each hypodense liver lesion 0.5 cm and larger and the curve slopes were calculated. Lesion Hounsfield units were recorded on virtual non-contrast, 40 keV, and 70 keV imaging. Lesion iodine concentrations and enhancement were also recorded. A diagnosis of benign versus malignant was determined based on a spectral curve slope cutoff of 1.4, iodine concentration of 7.1 mg/mL, and virtual enhancement of 10.

### RESULTS

The final study group included 36 patients consisting of 19 men and 17 women with a mean age of 63 years ± 9 (standard deviation), a mean height of 170.9 cm ± 9.5, a mean weight of 69.8 kg ± 14.5, and body mass index of 23.9 kg/m2 ± 3.5. Reference standard assessment identified 92 liver lesions (50 metastases, 24 cysts, 2 hemangiomas, 3 regions of inflammation) with a mean size of 1.1 cm ± 0.5. The mean number of days between CT scan and liver lesion biopsy was 24. There were a total of 145 follow-up imaging exams performed for the study group related to indeterminate liver lesions (119 CTs, 12 MRIs, 8 PET-CTs, 6 U/S). Diagnosis by use of spectral curve slope, iodine concentration, and virtual enhancement resulted in accuracies of 0.92, 0.92, and 0.89, respectively.

### CONCLUSION

Spectral HU curves provide highly accurate differentiation of benign from metastatic hypodense liver lesions, most useful in the determination of cyst versus necrotic metastasis.

### CLINICAL RELEVANCE/APPLICATION

Hypodense liver lesions are a challenging issue at staging, often requiring further imaging, follow-up, and/or biopsy. The additional information from multienergy CT can provide useful additional information in this setting and may reduce the need for costly additional evaluation.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T1-SSGI09

**Gastrointestinal Imaging (Pancreas Focal Lesions)**

Tuesday, Dec. 3 8:00AM - 9:00AM Room: E352

Khoschy Schawkat, MD, PhD (*Moderator*) Nothing to Disclose
Amir Borhani, MD (*Moderator*) Institutional research agreement, Siemens AG

**Sub-Events**

## T1-SSGI09-1 DETECTION OF CYSTIC LESIONS OF THE PANCREAS: IMAGE QUALITY AND DIAGNOSTIC ACCURACY OF PHOTON-COUNTING DETECTOR CT VS. CONVENTIONAL ENERGY-INTEGRATING DETECTOR CT

Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Wilpert, MD (*Abstract Co-Author*) Nothing to Disclose
Fabian Bernhard Pallasch, MD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Faby, DIPLPHYS (*Abstract Co-Author*) Employee, Siemens AG
Thomas Stein (*Abstract Co-Author*) Nothing to Disclose
Balazs Bogner, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Rau, MD (*Abstract Co-Author*) Nothing to Disclose
Stephan Rau, MD (*Presenter*) Nothing to Disclose

### PURPOSE

MR imaging is the modality of choice for the diagnosis and characterization of cystic pancreatic lesions as diagnostic accuracy of CT is limited, especially if lesions are small. Photon-counting detector (PCD) CT with its higher resolution and lower image noise compared to conventional energy-integrating detector (EID) CT may have the potential to improve diagnosis. Here, we investigated image quality and diagnostic accuracy of PCD-CT for the detection of cystic pancreatic lesions compared to EID-CT in clinical routine datasets.

### METHODS AND MATERIALS

In this prospective IRB-approved study, we included consecutive patients who underwent clinically indicated contrast-enhanced PCD-CT of the abdomen. For all patients an additional EID-CT with a comparable imaging protocol was available for comparison. Multiparametric MRI served as reference standard. CT images were assessed in a blinded reading by three independent radiologists for the presence of pancreatic cystic lesions. In addition, image quality, lesion conspicuity, and diagnostic confidence were rated on 5-point Likert scales (5=excellent). As quantitative measures, the coefficient-of-variation (CV) and the contrast of cystic pancreatic lesions to the parenchyma were calculated. Radiation doses were compared via CTDIvol [mlGy].

### RESULTS

Among 106 included patients (age 62.7±12.6 years; 45 [42.5 %] male), 46 MRI-confirmed cystic lesions (mean size 8.7±7.4 mm; range: 2-45 mm) were present. Sensitivity for the detection of cystic lesions was significantly higher for PCD-CT vs. EID-CT across all readers (50.7% vs. 41.3%; p=0.05, respectively). Image quality, lesion conspicuity, and diagnostic confidence were rated superior for PCD-CT vs. EID-CT (5.0 [4.66-5.00] vs. 4.0 [3.67-4.33]; 4.0 [3.0-4.33] vs. 3.0 [2.33-3.67] and 5.0 [4.33-4.66] vs. 4.0 [3.67-4.33], respectively). Quantitative analyses revealed a significantly lower CV of 0.18 vs. 0.24 (p=0.002) at lower radiation doses of 7.13 vs. 8.68 mGy (p<0.001). Contrast of cystic lesions to pancreas parenchyma was significantly higher for PCD-CT vs. EID-CT (103.2 ± 29.9 HU vs. 77.6 ± 19.5 HU p<0.001).

### CONCLUSION

PCD-CT provides superior image quality and diagnostic accuracy for the detection of cystic pancreatic lesions compared to EID-CT at lower radiation dose.

### CLINICAL RELEVANCE/APPLICATION

Cystic pancreatic lesions are a frequent incidental finding in routine abdominal CT examinations. PCD-CT provides significantly higher diagnostic accuracy compared to EID-CT and can improve diagnosis of cystic pancreatic lesions that may otherwise go unnoticed. In addition, multispectral data of PCD-CT may further help in lesion characterization.

## T1-SSGI09-3 AN EXPLAINABLE PREDICTION MODEL OF LYMPHOVASCULAR INVASION& ITS PROGNOSTIC VALUE IN RESECTABLE PDAC:A MULTICENTER STUDY

Linxia Wu (*Abstract Co-Author*) Nothing to Disclose
Ziwei Jin (*Presenter*) Nothing to Disclose

**PURPOSE**

Lymphovascular invasion (LVI) is an independent factor for early recurrence, metastases and poor prognosis in pancreatic ductal adenocarcinoma (PDAC). Early identification and prediction of LVI are crucial. This study aimed to establish and validate an explainable prediction model based on the machine learning (ML) approach for LVI and assess its prognostic value in patients with PDAC.

**METHODS AND MATERIALS**

Patients who underwent radical surgical resection and were pathologically proven with PDAC were recruited retrospectively from two centers. The derivation cohort, consisting of 202 PDAC patients admitted to Center 1 from January 2014 to November 2021, was separated for training and internal validation, and an external dataset of 60 patients with PDAC admitted to another center was employed for external validation. LVI was defined based on pathological reports. With 16 medical characteristics easily obtained or evaluated before surgery, 10 ML algorithms were used to construct prediction models. Several evaluation indexes, including the area under the receiver operating characteristic curve (AUC), were used to compare the predictive performance. The Shapley Additive explanation method was used to rank the feature importance and explain the final model. A probability threshold for the final model was identified for LVI prediction. Subsequently, the association of the model's risk stratification with disease-free survival (DFS) and overall survival (OS) was then statistically examined using Cox regression analysis and the log-rank test.

**RESULTS**

The LightGBM model performed best in discriminative ability among the 10 ML models. After reducing features according to feature importance rank, an explainable final LightGBM model was established with 10 features. The final model could accurately predict LVI in both internal (AUC=0.814) and external (AUC=0.790) validations. The model's risk stratification was an independent predictor of DFS (all $P < 0.001$) and OS (all $P < 0.001$). Furthermore, patients in the high-risk group stratified by the model consistently had a significantly shorter DFS and OS in all patients (all $P < 0.001$).

**CONCLUSION**

Our explainable ML model was not only successfully developed to accurately predict LVI but was also highly relevant to shorter DFS and OS in early resectable PDAC patients, and it mitigated the concern of the “black-box” issue with an undirect interpretation of the ML technique.

**CLINICAL RELEVANCE/APPLICATION**

The final LightGBM model aims to assist clinicians in identifying patients at high risk of recurrence and with poor prognoses at the molecular biological level. It provides clinicians with a novel perspective for making effective diagnoses and treatment strategies for patients with PDAC.

## T1-SSGI09-5 IMPACT OF REPORTED MEASUREMENT VARIABILITY ON PANCREATIC CYST SURVEILLANCE: 40% INCREASE IN DIAGNOSTIC AND INVASIVE PROCEDURES OVER 15 YEARS

Yameng Deng (*Abstract Co-Author*) Nothing to Disclose
Fiona Kolbinger (*Abstract Co-Author*) Nothing to Disclose
Thoa Tran (*Abstract Co-Author*) Nothing to Disclose
Edward Jackson (*Abstract Co-Author*) Nothing to Disclose
C. Max Schmidt, MD, PhD (*Abstract Co-Author*) Consultant, RedPath Integrated Pathology, Inc;Consultant, RedPath Integrated Pathology, Inc;Scientific Advisory Board, Asuragen, Inc;Speaker, Asuragen, Inc;Founder, B9, Inc
George Ralli, DPhil (*Abstract Co-Author*) Employee, Perspectum Diagnostics Ltd
Fatih Akisik, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Surveillance of pancreatic cysts imposes a significant burden on healthcare systems. While several healthcare-economic studies have explored this aspect of pancreatic cyst surveillance, none account for variability in radiological measurement. To assess the additional costs this imposes, we extend a published surveillance model to include measurement variability.

**METHODS AND MATERIALS**

We used a previously established approach to simulate pancreatic cyst progression and resultant clinical pathways for a cohort of 10,000 patients (starting age 55, 50% female) managed under the international consensus guidelines of the International Association of Pancreatology (IAP) for 15 years. To examine the effect of varying rates of interobserver measurement variability, at each time-point where a patient received an MRI scan, random Gaussian noise was added to the diameters of the cyst and main pancreatic duct, for a range of noise levels. At each level of noise, the simulation was conducted 30 times.

**RESULTS**

After incorporating reported rates of interobserver variability for cyst measurement (6.4 mm) and a conservative estimate of pancreatic duct variability (1 mm) the mean number of surgeries for benign cysts rose from 530 [95% CI 488, 571] to 964 [915,1013]. The entirety of these additional surgeries was caused by error in cyst diameter, as benign cases were unlikely to have sufficiently dilated pancreatic ducts to trigger surgery. MRI studies/patient rose from 9 [8.9, 9.1] to 11.9 [11.8, 12], EUS studies/patient from 4.6 [4.5, 4.8] to 7.3 [7.2, 7.4], total deaths/ 10,000 patients from 44.5 [35.7, 57.2] to 55.6 [42.6, 68.7]. Total surveillance costs/patient from $ 19,853 to $ 28,845, compared to an error-free case. The rate of correct cancer diagnoses remained stable (123.4 [101.6, 145.1] vs 123.9 [102.2, 145.7]).

**CONCLUSION**

Incorporating previously reported levels of interobserver variability into models of patients undergoing pancreatic cyst surveillance significantly increases unnecessary procedures.

**CLINICAL RELEVANCE/APPLICATION**

Pancreatic cyst guidelines heavily depend on threshold-based decision-making, yet measurement variability in examinations can significantly alter clinical decisions and care trajectories.

## T1-SSGI09-6 EXTRACELLULAR VOLUME FRACTIONS DETERMINED BY EQUILIBRIUM CONTRAST-ENHANCED CT TO PREDICT POSTOPERATIVE PROGRESSION-FREE SURVIVAL IN PANCREATIC DUCTAL ADENOCARCINOMA

Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Motonori Nagata, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kensuke Domae, MD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose

Yutaka Toyomasu, MD (*Abstract Co-Author*) Nothing to Disclose
Yasutaka Ichikawa, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Extracellular volume (ECV) fractions determined by equilibrium contrast-enhanced CT have recently emerged as an imaging biomarker for predicting survival in patients with pancreatic ductal adenocarcinoma (PDAC). The aim of this study was to evaluate the utility of the ECV fractions for predicting postoperative recurrence in patients with resectable or borderline resectable PDAC.

**METHODS AND MATERIALS**

The study cohort included 53 patients (mean age, 72±9 years) who underwent radical resection for resectable or borderline resectable PDAC and who underwent dynamic contrast-enhanced CT preoperatively. On non-contrast and equilibrium phase CT, changes in mean CT values in the tumor and aorta were measured by placing regions of interests, and corrected for hematocrit to calculate the ECV fraction of the tumor as follows: ECV (%) = (1 - hematocrit) × (?HUtumor / ?HUaorta) × 100. Using the cutoff value of ECV determined by the Contal-O'Quigley method, the Kaplan-Meier method with log-rank test was used to evaluate ECV in relation to progression-free survival (PFS). The incremental prognostic value of ECV over tumor size (long diameter) was evaluated using the global chi-square test.

**RESULTS**

Mean observation period was 507 days (interquartile range, 177-1521 days). Recurrence of PDAC occurred in 32 (60%) of 53 patients. The optimal cutoff values of tumor ECV fraction was 55.6% for PFS. In the Kaplan-Meier method with log-rank test, patients with lower tumor ECV fraction showed poorer PFS than that with higher tumor ECV (p=0.037) when stratified by the cutoff value (Figure 1). The 5-year survival rate for the lower and higher ECV group was 24% and 75%, respectively. The number of patients in the favorable prognosis group with ECV above the cutoff value was 9 (17%) of the patients included in this study. There was no significant linear correlation between ECV and tumor size (p=0.7). Global chi-square test showed that ECV was of significant incremental prognostic predictive value to tumor size (p=0.046).

**CONCLUSION**

The ECV fraction (the cut-off value, approximately 56%) obtained from equilibrium contrast-enhanced CT is a promising quantitative indicator for predicting postoperative recurrence in patients with resectable or borderline resectable PDAC and has incremental prognostic value relative to tumor size.

**CLINICAL RELEVANCE/APPLICATION**

The ECV fraction derived from equilibrium contrast-enhanced CT has the potential as an imaging biomarker for predicting postoperative recurrence in patients with PDAC.

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# Abstract Archives of the RSNA, 2024

T1-SSPD03

**Science Session with Keynote: Pediatric Imaging (Musculoskeletal and Quality Improvement)**

Tuesday, Dec. 3 8:00AM - 9:00AM Room: E350

Jie C. Nguyen, MD, MS (*Moderator*) Nothing to Disclose
Randheer Shailam, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T1-SSPD03-1 DEEP LEARNING-ENHANCED CLINICAL 4-MINUTE MRI OF THE KNEE IN CHILDREN AND ADOLESCENTS - ARTHROSCOPY-VALIDATED DIAGNOSTIC PERFORMANCE FOR INTERNAL DERANGEMENT

Jan Fritz, MD (*Abstract Co-Author*) Institutional research support, Siemens AG;Scientific Advisor, Siemens AG;Patent agreement, Siemens AG;Institutional research support, Johnson & Johnson;Institutional research support, Zimmer Biomet Holdings, Inc;Institutional research support, BTG International Ltd
Shivani Ahlawat, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Donners, MD (*Abstract Co-Author*) Nothing to Disclose
Sven S. Walter, MD (*Abstract Co-Author*) Nothing to Disclose
Aline Serfaty Sr, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatiane C. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Markus M. Obmann, MD (*Abstract Co-Author*) Nothing to Disclose
Hanns-Christian Breit, MD (*Abstract Co-Author*) Nothing to Disclose
Dorothee Harder, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Vosshenrich, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the diagnostic performance of 4-minute DL-reconstructed 6-fold parallel imaging (PI) and simultaneous multislice (SMS) accelerated knee MRI in children and adolescents.

### METHODS AND MATERIALS

Pediatric patients with painful knee conditions who underwent DL-reconstructed 6-fold PI-SMS-accelerated knee MRI and arthroscopic knee surgery between October 2022 and December 2023 were retrospectively identified. Nine fellowship-trained musculoskeletal radiologists independently scored the MRI studies for image quality and the presence of ligamentous, meniscal, tendinous, and osteocartilaginous abnormalities. Cartilage defects were divided into partial and full-thickness defects and assessed for each joint compartment individually. Intraarticular fractures were assessed separately for all osseous structures (femur, tibia, patella). Kappa-based interreader agreements and diagnostic performance parameters with arthroscopic surgery as the reference standard were computed (significance level p <.05).

### RESULTS

Forty-four children and adolescents (mean age: 15±2 years; range: 9-17 years; 24 boys) who underwent 3T knee MRI and arthroscopic surgery within a median of 22 days (range: 2-133 days) were analyzed. Overall image quality was rated very good (median: 5 [95% CI: 4;5]) without degradation by motion artifacts (median: 5 [5;5]). Arthroscopy-verified structural abnormalities were detected with good to very good agreement (? = 0.66 [0.61-0.71]). Consensus sensitivities/specificities/accuracies were 100%/84-100%/93-100% for the diagnosis of anterior (n=25) and posterior (n=1) cruciate ligament tears, 65-71%/97-100%/86-93% for the diagnosis of medial (n=7) and lateral (n=17) meniscus tears, 100%/100%/100% for the diagnosis of discoid lateral menisci (n=5), 100%/95%/96% for the diagnosis of medial patellofemoral ligament tears (n=3), and 55-60%/100%/98-99% for the diagnosis of cartilage defects (n=11) and fractures (n=3).

### CONCLUSION

DL-enhanced clinical 4-minute knee MRI has excellent image quality and high diagnostic performance for diagnosing internal derangement in children and adolescents with a good-to-very-good interreader agreement.

### CLINICAL RELEVANCE/APPLICATION

Deep learning augmented ultra-fast musculoskeletal MRI adds value to pediatric radiology by maximizing scan efficiency, potentially decreasing the need for sedation or general anesthesia without negatively affecting diagnostic accuracy.

## T1-SSPD03-2 GADOLINIUM DEPOSITION IN MULTIPLE ORGANS/TISSUES IN MOTHER AND PUP MOUSE: EXPOSURE DURING PREGNANCY, LACTATION

Kai Xu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shi Qiu (*Abstract Co-Author*) Nothing to Disclose
YING KONG (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the effects of pregnancy, lactation, and repeated administration of GBCAs on gadolinium deposition in multi-organ/tissue of mother and pup mice.

**METHODS AND MATERIALS**

Two hundred and seventy ICR mice were divided into three groups (non-pregnant, pregnant, and lactating; n=90/group) and received Gadodiamide, Gadoterate meglumine, or saline intravenously (2.5 mmol Gd/kg once every two days for a total of 10 doses) throughout the entire gestation or lactation period. Gadolinium concentration detection, histological analyses, and transmission electron microscopy were performed on mothers and pup mice at corresponding time points (the completion of the injection, one month later, and three months later).

**RESULTS**

(i)Gadolinium deposition exhibits analogous patterns in non-pregnant, pregnant, and lactating mice: gadodiamide exhibited more gadolinium retention in multi-organ/tissue and showed faster accumulation and regression speed in examined tissues versus gadoterate meglumine; gadolinium deposition decreased more rapidly in the first month in all tissues examined, exception of skin where it decreased at a near-uniform rate over 3 months; gadolinium deposition was found to be lower in the kidneys of both pregnant and lactating mice than in non-pregnant mice, and was more pronounced in gadodiamide.(ii)Exposure to GBCAs during pregnancy resulted in gadolinium deposition in the organs of the fetus, with the greatest deposition observed in the kidneys. Gadolinium deposition was observed to be higher in fetuses due to gadodiamide, and the administration of gadodiamide also resulted in a reduction in litter rates in pregnant mice. A noteworthy observation is the substantial proportion of gadolinium deposits in the fetal body that were metabolized after 1 month.(iii)Exposure to GBCAs during lactation did not result in detectable gadolinium deposition in the organs/tissues of their unweaned pups.

**CONCLUSION**

Exposure to GBCAs during pregnancy resulted in gadolinium deposition in multiple organs/tissues in their fetuses, with significant gadodiamide, and the deposited gadolinium was almost completely metabolized within 1 month, with no significant organ toxicity found in the fetus.

**CLINICAL RELEVANCE/APPLICATION**

The utilization of GBCAs in pregnant women is discouraged, and if clinically necessary, only the more stable, less-deposited macrocyclic GBCAs are recommended.Continued breastfeeding after exposure to GBCAs during lactation does not pose a risk of gadolinium deposition to the pups.

## T1-SSPD03-3 VIRTUAL 3D MODEL FOR MEASURING SUPRA- AND INFRATROCHANTERIC FEMORAL TORSION IN CEREBRAL PALSY: COMPARISON TO A MATCHED CONTROL GROUP

Michael B. Millis, MD (*Abstract Co-Author*) Nothing to Disclose
Ata Kiapour, PhD (*Abstract Co-Author*) Nothing to Disclose
Sarah D. Bixby, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Jade Iwasaka-Neder, MD, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

Cerebral palsy (CP) leads to complex torsional abnormalities in the femur due to muscle spasticity, which is often corrected by derotational osteotomy. The level of torsion, either supra- or infratrochanteric, is still not known and could guide pre-surgical planning of osteotomy site. Axial measurements on 2D imaging do not capture the complex anatomy of the proximal femur on this population. This study evaluated a novel measurement technique for assessing the supra- and infratrochanteric components of femoral torsion in virtual 3D models, comparing these measurements in patients with cerebral palsy and in a matched control group.

**METHODS AND MATERIALS**

This IRB-approved prospective study included patients < 18 years old with a diagnosis of CP referred for hip/femur CTs and a matched control group of patients with healthy femurs referred for hip/femur MRI. CT scans were performed according to standard protocols on state-of-the art multidetector scanners with submillimeter resolution. Subjects in the control group were scanned on a 3 Tesla MRI scanner according to standard department protocol, including a fast 3D gradient echo sequence (T1 VIBE). CT scans and T1 VIBEs were reconstructed in virtual 3D femur models and reviewed by three pediatric musculoskeletal radiologists who measured the supra- and infra-trochanteric femoral torsions. Statistical analysis included the independent t test, Mann-Whitney U test, and intraclass correlation coefficient (ICC).

**RESULTS**

The study cohort consisted of 52 femurs from patients with CP (10.2 ± 4.5 years, range 4-17; female=30) and 52 control femurs (11.9 ± 2.5 years, range 8-17; female=20). Intra- and inter-reader correlations on both groups were good to excellent (ICC=0.80). The supra- and infratrochanteric torsion values of the control femurs were 28.5° ± 9.6° (mean ± SD) and -5° ± 7.3°, respectively. On the CP group, supratrochanteric torsion was 35.1° ± 13.3° and infratrochanteric torsion was -1.6° ± 15.9°. On both groups, the supratrochanteric torsion is the main contributor to the overall femoral torsion. In comparison with the controls, patients with CP had significantly higher supratrochanteric torsion values ($p = 0.05$). There is no statistical difference in infratrochanteric torsion between the two groups, but infratrochanteric torsion had a wider range and right skew of values in the CP group.

**CONCLUSION**

The 3D femur model technique is a reliable technique to measure supra- and infratrochanteric femoral torsions. Patients with CP have predominantly increased supratrochanteric torsion.

**CLINICAL RELEVANCE/APPLICATION**

Quantification of supra- and infratrochanteric femoral torsion angles allows a more detailed analysis of cerebral palsy and may influence treatment planning.

## T1-SSPD03-4 SOLID BREAST MASSES DETECTED BY ULTRASOUND IN ADOLESCENT PEDIATRIC POPULATION: FREQUENCY AND DIAGNOSTIC OUTCOMES

Teresa Victoria, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Christian A. Barrera, MD (*Abstract Co-Author*) Nothing to Disclose
Michael S. Gee, MD, PhD (*Abstract Co-Author*) Researcher, General Electric Company Researcher, Siemens AG Researcher, Motilent LLC
Valeria Pena-Trujillo, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the prevalence and outcome of breast masses with ultrasound evaluation and biopsy in the adolescent pediatric population

**METHODS AND MATERIALS**

In this retrospective study, all female patients aged 13 - 18 years with a breast ultrasound between 2018 and 2024 were identified. Thirteen years of age was used as a lower limit as this is the average menarche age in the United States. Eighteen years of age was used as an upper limit as patients older than 18 years are seen by the Adult Breast Imaging Center instead of Pediatric Radiology. Demographic information was registered. Patients who had an ultrasound-guided biopsy and subsequent surgical excision were collected. The pathology results for both procedures were recorded.

**RESULTS**

773 breast ultrasounds were performed. 78 (10%) ultrasound-guide breast mass biopsies were performed. Fibroadenoma (49/78, 63%) was the most common diagnosis, followed by fibroepithelial lesion (15/78, 19%). 29 out of 78 (37%) patients underwent surgical excision. 9 patients were upgraded from fibroepithelial lesion to fibroadenoma and 2 patients to Phylloides tumor. 3 patients were diagnosed with a hamartoma, 3 patients with intraductal papilloma, and 1 with nodular fasciitis. No malignant pathology results were identified.

**CONCLUSION**

The number of breast masses detected by ultrasound in adolescent girls is low. Fibroadenoma is the most common breast mass in girls and the prevalence of malignancy is extremely rare.

**CLINICAL RELEVANCE/APPLICATION**

Pediatric breast masses in adolescent patients aged 13-18 years are benign. Small pediatric departments embedded in larger adult hospitals may opt for their dedicated breast center overseeing the adolescent population. We argue that given that the likelihood of benignity is high, that these patients are seen and diagnosed in a pediatric center, cared for by pediatric specialists, rather than in an adult center, which may be overwhelming for the young patient.

## T1-SSPD03-5 RADIOLOGIC GROWTH CHART OF FEMORAL HEAD OSSIFICATION CENTER AND ACETABULAR INDEX IN NORMAL KOREAN CHILDREN USING DEEP LEARNING-BASED AUTOMATIC MASUREMENT

MOON KI RYUM (*Abstract Co-Author*) Nothing to Disclose
Byoung-Dai Lee, PhD (*Abstract Co-Author*) Nothing to Disclose
Musook Lee (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a deep learning (DL)-based algorithm using a vast amount of hip anteroposterior (AP) radiographs of Korean children, and to utilize it for establishing a growth chart of the femoral head ossification center (FHOS) and the acetabular index (AI) in normal Korean children."

**METHODS AND MATERIALS**

A total of 4,560 hip AP radiographs were used to develop the DL-based algorithm for automatic measurement of FHOS sizes and AI. Additionally, 1,200 hip AP radiographs of normal Korean children were collected to evaluate the variation in the size of FHOS and the AI as they relate to growth. The agreement between the reference standard and the outputs of the DL-based algorithm was determined using Pearson correlation coefficient (r), intraclass correlation coefficient (ICC), mean absolute error (MAE), and root mean squared error (RMSE). Linear regression analysis was employed to assess the correlations between FHOS size and age.

**RESULTS**

The FHOS sizes measured by the DL-based algorithm demonstrated excellent agreement with the reference standard for all evaluation data (left, r = 0.95; ICC = 0.95; MAE = 2.73 mm; RMSE = 3.53 mm; right, r = 0.95; ICC = 0.95; MAE = 2.70 mm; RMSE = 3.45 mm). Similarly, the AI measurements obtained through the DL-based algorithm also exhibited outstanding agreement with the reference standard (left, r = 0.90; ICC = 0.90; MAE = 2.11°; RMSE = 2.99°; right, r = 0.90; ICC = 0.90; MAE = 2.03°; RMSE = 2.80°). The correlation between age and FHOS size was significant, with high R2 correlation coefficient of 0.91 for the left and right femoral heads, respectively.

**CONCLUSION**

The DL-based algorithm developed in this study successfully achieved accurate detection and measurement of the FHOS size and the AI in hip radiographs. Consequently, it enabled the establishment of reference values for the development of hip joints of normal Korean children.

**CLINICAL RELEVANCE/APPLICATION**

This growth chart may provide foundational data on the various developmental stage of femoral head size and acetabular index in normal Korean children by age. Consequently, it could be instrumental in the diagnosing and managing a range of developmental disorders.

## T1-SSPD03-6 Keynote Speaker

Eva I. Rubio, MD, MBA (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T1-SSPH06

**Physics (Innovations in MRI)**

Tuesday, Dec. 3 8:00AM - 9:00AM Room: S404

Yunhong Shu, PhD (*Moderator*) Patent agreement, General Electric Company
Timothy J. Carroll, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T1-SSPH06-1 APPLICATION OF AI-BASED SEQUENCES FOR SIGNIFICANT REDUCTION OF ENERGY CONSUMPTION OF MRI

Meinrad J. Beer, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie Lorenz (*Presenter*) Nothing to Disclose

### PURPOSE

Strategies to reduce energy consumption by imaging modalities in healthcare are an essential topic in the era of climate and energy crises. Here, MRI scanners have the highest energetic impact. The advent of AI-based sequences allows a significant reduction in measurement times, which might have also a positive impact on energy consumption. Real-world energy measurements of MRI systems are largely lacking, especially regarding reduction by the application of AI-sequences.

### METHODS AND MATERIALS

During a two-weeks period power consumption, log files were collected of one 1.5T and one 3T MRI system (Magnetom SOLA and Magnetom VIDA fit, Siemens Healthineers, Germany) in a tertiary hospital. Times for procedure, standby and turn-off were tracked, as well as the number and type of procedures, sequence type, application of AI-based sequences, and energy used. In all measurements, the apparent power was determined according to the units VA or VAh. Values were calculated for energy consumption of three main clinical szenarios (MRI of Head, Knee, Abdomen) without and with AI-application, extrapolating these for one year.

### RESULTS

Comparing the mean electrical power of both devices during measurements and in standby/idle mode, the 1.5T system consumed less energy during measurements (27.32 kVA vs. 29.99 kVA, $p<0.001$), while the 3T system consumed less energy in standby/idle mode (9.01 kVA vs. 9.89 kVA, $p<0.001$). Energetic cost for most frequent clinical scenarios were on average 15.04 kVAh for Head MRI, 10.24 kVAh for Knee MRI and 15.80 kVAh for Abdominal MRI. Highest mean energetic costs were measured for CISS -sequences (3.34 kVAh), lowest for FLASH 3D sequences (0.17 kVAh). AI-based sequences were applied for Head MRI (33.0 %) and Pelvis MRI (52.4 %). This yielded in a reduction of the respective measurement times of 2.3 min ($p=0.371$) and 2.5 min ($p=0.376$), accompanied by a reduction of energy consumption by 2.32 kVAh ($p=0.125$) and 3.07 kVAh ($p=0.065$), extrapolated to one year of 5860.55 kVAh and 1674.94 kVAh.

### CONCLUSION

Application of AI-based sequences does not only reduce measurement times but also significantly reduces energy consumption in MRI scanners, regardless of field strength (1.5T and 3T). Sequences technologies with the highest energy consumption such as CISS and EPI would profit most from AI-technologies. A broad application of AI-sequences could reduce energy consumption by 15-20 %.

### CLINICAL RELEVANCE/APPLICATION

MRI scanners consume significant amounts of energy. Optimization is mandatory in times of climate and energy crises. Application of AI-based sequences will have a major impact to be a carbon-reduced healthcare provider.

## T1-SSPH06-2 WHICH DIELECTRIC PAD TO USE AT 7T CLINICAL NEUROIMAGING. BARIUM TITANATE OR CALCIUM TITANATE?

Wendy Elvendahl (*Abstract Co-Author*) Nothing to Disclose
Zuzan Cayci, MD (*Abstract Co-Author*) Nothing to Disclose
James Joers (*Abstract Co-Author*) Nothing to Disclose
Bhargavi Goduguchinta (*Abstract Co-Author*) Nothing to Disclose
Young Woo Park, PhD (*Abstract Co-Author*) Nothing to Disclose
Gulin Oz (*Abstract Co-Author*) Nothing to Disclose
Matthew White (*Abstract Co-Author*) Nothing to Disclose
Jeffrey B. Rykken, MD (*Abstract Co-Author*) Nothing to Disclose
Can Ozutemiz, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Transmit B1 inhomogeneities and susceptibility artifacts limit the usefulness of 7T MRI for assessing structures near the skull base. Dielectric pads composed of high-permittivity materials such as barium titanate ($BaTiO_3$) or calcium titanate ($CaTiO_3$) can reduce these effects. Our purpose was to

compare these pads regarding imaging quality in clinical neuroimaging.

**METHODS AND MATERIALS**

BaTiO3 and CaTiO3 dielectric pads with matching size (2x6.5x10cm2, 1x18×10cm2, 1x36x10cm2) and thickness (5.5mm) were produced with deuterated water in our center following literature guidance. Pads were double heat sealed and double bagged for safety. Five healthy volunteers underwent 7T MRI with an FDA-approved clinical MRI system (Siemens Terra, 1TX/32RX Nova head coil) with BaTiO3 and CaTiO3 pads. Pads were placed in the suboccipital, frontal and bitemporal regions. Clinically used standard sequences, 3D-T2-SPACE, 3D-FLAIR, oblique coronal T2-TSE, oblique coronal 2D-FLAIR, and coronal T1-TSE were applied in each volunteer in addition to B1 mapping. Two board-certified neuroradiologists assessed each image blindly and scored image quality (1: excellent, 2: reasonably good, 3: adequate, 4: suboptimal, 5: poor) and artifacts (1: none, 2: mild, 3: moderate, 4: moderate/severe, 5: severe) using a 5-point Likert scale and were asked which exam they preferred. The scores for 5 subjects, across 2 observers, were pooled, and paired comparison was made with Wilcoxon signed rank test between BaTiO3 and CaTiO3 pads.

**RESULTS**

Significantly more artifacts were noted with BaTiO3 compared with CaTiO3 in posterior fossa (3D-T2-SPACE, 3D-FLAIR), orbitofrontal gyri (3D-T2-SPACE, 3D-FLAIR) and temporal lobes (3D-FLAIR) ($P < 0.05$). The BaTiO3 pads also showed increased right/left side differences in posterior fossa and orbitofrontal gyri over CaTiO3. Image quality was higher in the skull base structures with CaTiO3 pads in 3D-T2-SPACE and 3D-FLAIR ($P < 0.05$).

**CONCLUSION**

For the pad compositions and geometries used in this study, CaTiO3 pads provided better imaging quality and fewer artifacts in the skull base compared with BaTiO3 pads when placed in suboccipital, bitemporal and frontal regions.

**CLINICAL RELEVANCE/APPLICATION**

BaTiO3 pads create a stronger B1 shift, leading to more magnetic inhomogeneity than CaTiO3 pads. When placed in suboccipital, bitemporal, and frontal regions, CaTiO3 pads provide more homogeneous imaging with relatively fewer artifacts and higher imaging quality. Use of CaTiO3 pads is recommended for optimal homogeneity in clinical neuroimaging at 7T.

## T1-SSPH06-3 INTERROGATION OF GLIOBLASTOMA FATTY ACID SYNTHESIS AND METABOLISM WITH DEUTERIUM METABOLIC IMAGING

Xia Ge (*Abstract Co-Author*) Nothing to Disclose
Joseph E. Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kevin Cho (*Abstract Co-Author*) Nothing to Disclose
Elena Nunez (*Abstract Co-Author*) Nothing to Disclose
Andrew L. Chang, MD,PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Glioblastoma, an invariably lethal brain tumor, undergoes marked metabolic alterations during tumorigenesis and is extraordinarily difficult to treat. Detecting recurrence after treatment and understanding metabolic alterations within the tumor microenvironment is extremely challenging. An exciting and emerging imaging method called deuterium metabolic imaging (DMI) detects metabolic adaptations via non-radioactively labeled deuterated substrates. This study developed approaches to image lipid synthesis with deuterium oxide (D2O) and metabolism with d31-palmitic acid (d31-PA) in glioblastoma.

**METHODS AND MATERIALS**

A fatty acid phantom was generated for characterization of lipid DMI signal performed at 12 T. DMI was performed in mice orthotopically implanted with GL261 glioblastoma utilizing either orally administered d31-PA or D2O and was correlated with pharmacokinetic metabolic measurements from mouse serum. Mice were either orally gavaged with an emulsion of d31-PA prior to imaging or provided dilute D2O for ad libitum consumption following tumor implantation. Following imaging, tumor, brain, and other organs were harvested for ex vivo DMI or conventional and imaging mass spectrometry to characterize spatial metabolism of deuterated tracers.

**RESULTS**

Although D2O administration resulted in robust enrichment of lipid signal in GBM, d31-PA uptake and metabolism was not significantly detected within intracranial tumors. Interestingly, d31-PA uptake and metabolism was detected in normal tissues, indicating preferential utilization of fatty acids in non-neoplastic tissues. These findings suggest de novo lipogenesis within GBM is a preferential pathway for cellular lipids rather than uptake of administered long chain fatty acids.

**CONCLUSION**

DMI can assist in interrogating GBM fatty acid synthesis and metabolism, as well as further our understanding of lipid distribution within the body by providing a non-invasive scaffold for dynamic interrogation of fatty acid distribution in an oncologic model.

**CLINICAL RELEVANCE/APPLICATION**

Developing a non-invasive method for characterization of tumor fatty acid synthesis and metabolism may improve our understanding of tumor metabolism and could dynamically guide selection of patient-tailored metabolic therapies in the future.

## T1-SSPH06-4 NEWLY DEVELOPED CONJUGATE GRADIENT AND DEEP LEARNING RECONSTRUCTIONS: UTILITY FOR LUNG MRI WITH ULTRA-SHORT TE TO REDUCE ACQUISITION TIME WITH KEEPING IMAGE QUALITY AND NODULE DETECTION CAPABILITY

Yoshiharu Ohno, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology
Daisuke Takenaka, MD (*Abstract Co-Author*) Canon Medical Systems Corporation
Masahiko Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masato Ikedo (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hiroyuki Nagata (*Abstract Co-Author*) Canon Medical Systems Corporation
Yuichiro Sano, RT (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Maiko Shinohara (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takeshi Yoshikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Masao Yui (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takahiro Ueda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Kaori Yamamoto (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yoshiyuki Ozawa, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Conjugate gradient reconstruction (CG-recon) and deep learning reconstruction (DLR) for lung MRI with ultra-short TE (UTE-MRI) are newly developed to reduce acquisition time without decreasing image quality and nodule detection capability. The purpose of this study was to determine utilities of CG-recon and DLR for reducing acquisition time with keeping image quality and nodule detection capability on UTE-MRI.

**METHODS AND MATERIALS**

35 patients with lung nodule underwent UTE-MRI obtained with CG-recon and grid-reconstruction (Grid-recon) by original (UTEoriginal), 1/2 (UTE1/2) and 1/4 (UTE1/4) sampling spoke numbers at 1.5T and 3T systems. Then, each UTE-MRI was reconstructed with and without DLR. Standard protocol in this study was UTEoriginal obtained by Grid-recon and reconstructed without DLR. In each patient, standard reference for nodule was determined by thin-section CT. To determine the influence of sampling spoke number reduction and reconstruction method differences, signal-to-noise ratios (SNRs) of lung and nodule, overall image quality and nodule presence probability were assessed by ROI measurements or 5-point scales. SNRs and overall image quality were compared between each UTE-MRI and standard protocol by Student's t-test or Wilcoxon's signed rank test. Then, ROC analysis was performed to compare nodule detection capability between each UTE-MRI and standard protocol.

**RESULTS**

DLR was significantly improved SNRs of all UTE-MRIs as compared with standard protocol ($p<0.05$). Overall image qualities of each UTE1/4 and all UTE1/2s except UTE1/2 obtained by CG-recon and reconstructed with DLR were significantly lower than that of standard protocol ($p<0.05$). Area under the curve (Az) of standard protocol (Az=0.966) was significant larger than that of UTE1/4 obtained by Grid-recon (with DLR: Az=0.913, $p<0.0001$; without DLR: Az=0.824, $p<0.0001$) and CG-recon (with and without DLR: Az=0.913, $p<0.0001$) and UTE1/2 obtained by Grid-recon and reconstructed without DLR (Az=0.944, $p=0.03$), and significantly smaller than that of UTEoriginal obtained by CG-recon (with DLR: Az=0.98, $p=0.008$; without DLR: Az=0.977, $p=0.03$).

**CONCLUSION**

CG-recon and DLR were useful for reducing acquisition time without degradation of image quality and nodule detection on UTE-MRI.

**CLINICAL RELEVANCE/APPLICATION**

CG-recon and DLR are useful for reducing acquisition time without degradation of image quality and nodule detection on UTE-MRI.

## T1-SSPH06-5 UNIFORM: A UNIFIED DEEP LEARNING FRAMEWORK FOR MULTI-ORGAN AND MULTI-CONTRAST MRI RECONSTRUCTION

Jan-Jakob Sonke, PhD (*Abstract Co-Author*) Royalties, Elekta AB;Royalties, Precision X-Ray, Inc;Research Grant, Elekta AB
Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Jonas Teuwen, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Nikita Moriakov (*Abstract Co-Author*) Nothing to Disclose
Jonatan Ferm (*Abstract Co-Author*) Nothing to Disclose
George Yiasemis, MSc, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and validate UNIFORM, a unified deep learning framework designed for reconstructing MRI images from undersampled data across different organs and contrasts. This approach aims to speed up MRI procedures and reduce the need for multiple specialized reconstruction algorithms.

**METHODS AND MATERIALS**

We optimized the state-of-the-art vSHARP algorithm —a top contender from the CMRxRecon challenge at MICCAI 2023—this physics-based deep learning model employs variable half-quadratic splitting with ADMM unrolled optimization to reconstruct images from undersampled multi-coil k-space data. The model was trained on a broad dataset that included multi-coil k-space data from various organs sites and contrasts, such as fastMRI knee (proton density, with and without fat suppression), fastMRI brain (T1-weighted, both pre and post-contrast, T2-weighted, FLAIR), fastMRI prostate (T2-weighted), and CMRxRecon cardiac (cine - short and long-axes, T1 and T2-weighted) MRI. Training was executed over 420,000 iterations on two A100 80GB Nvidia GPUs, using data retrospectively undersampled at different acceleration factors (2x, 4x, 6x, 8x) with diverse undersampling strategies. Additionally, zero-shot training was performed on prospectively undersampled data for an unseen organ (breast, T1-weighted) at higher accelerations (10x, 17x) using a self-supervised learning (SSL) method.

**RESULTS**

Evaluation of the model's performance on test data undersampled at various accelerations (2x, 4x, 6x, 8x) used fidelity metrics such as the structural similarity index measure (SSIM) and peak signal-to-noise ratio (pSNR). The results displayed robust performance across various organs and contrasts with high image quality maintained even at higher acceleration factors SSIM/pSNR: 2x: 0.9774 ± 0.0306/46.10 ± 3.49, 4x: 0.9678 ± 0.0347/42.82 ± 2.78, 6x: 0.9583 ± 0.0359/40.44 ± 2.57, 8x: 0.9469 ± 0.0376/38.41 ± 2.76. Zero-shot experiments on the unseen breast data lead to reconstructions with significantly fewer artifacts (sharper anatomical details, reduced background noise) compared to the zero-filling reconstruction.

**CONCLUSION**

The UNIFORM framework shows substantial promise in multi-organ and multi-contrast MRI reconstruction, potentially providing a robust solution for clinical MRI regardless of the data type, provided sufficient training data is available. Challenges remain in the availability of fully-sampled data for certain organs, which are vital for supervised training but can be partially mitigated by self-supervised learning methods.

**CLINICAL RELEVANCE/APPLICATION**

UNIFORM offers a promising approach for significantly reducing MRI scan times while ensuring high fidelity in image reconstruction across a range of organs and contrasts.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

T1-SSPH07

**Physics (Photon Counting Detector CT II)**

Tuesday, Dec. 3 8:00AM - 9:00AM Room: N229

Ke Li, PhD (*Moderator*) Research Consultant, Pulmera Inc.
Shuai Leng, PhD (*Moderator*) License agreement, Siemens AG

**Sub-Events**

## T1-SSPH07-1 A NOVEL VIRTUAL NON-CONTRAST ALGORITHM ON PHOTON-COUNTING-DETECTOR CT: IMPROVED CT NUMBER ACCURACY AND VISUALIZATION OF ADIPOSE AND SOFT TISSUES

Rainer Raupach, PhD (*Abstract Co-Author*) Employee, Siemens AG
Bernhard Schmidt, PhD (*Abstract Co-Author*) Employee, Siemens AG
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Kevin J. Treb, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Virtual non-contrast (VNC) images generated from spectral CT data might obviate the need to acquire a separate true non-contrast image. However, due to assumptions behind VNC algorithms, CT numbers of materials besides water and iodine might be inaccurate. The purpose of this work was to demonstrate the improvement in CT number accuracy and visual distinguishability of adipose and other soft tissues using a new VNC algorithm on a photon-counting-detector CT (PCD-CT) system.

### METHODS AND MATERIALS

Phantoms were scanned on two clinical PCD-CT scanners with identical hardware (NAEOTOM Alpha, Siemens Healthineers): One scanner was equipped with a classic VNC algorithm and the other with the new VNC algorithm. For each scanner, both low-energy threshold ("T3D") and VNC images were reconstructed from the same set of acquisition parameters using a clinical abdomen protocol with a quantitative reconstruction kernel (Qr44). Two phantoms were scanned: An adult abdomen phantom (Multi-Energy CT Phantom, Sun Nuclear) with a uniform solid water background and several quantitative material inserts (adipose, liver, blood, 2-5 mg/mL iodine), and an ex vivo porcine tissue phantom injected with approximately 15 mg/mL iodine contrast.

### RESULTS

CT numbers of the adipose insert in the multi-energy phantom were -71 HU in the T3D images, and were -57 HU and -75 HU in the classic and new VNC images, respectively. CT numbers of the liver insert were 53 HU and 59 HU for the classic and new VNCs, compared to 64 HU in T3D images. CT numbers of 2 and 4 mg/mL iodine + blood inserts and a 5 mg/mL iodine + water insert agreed within +/- 5 HU between the classic and new VNC images. The image noise magnitudes of the two VNC algorithms were within 1 HU of each other in all material inserts, and the contrast-to-noise ratio (CNR) between adipose and liver inserts improved by 22% with the new VNC. In the porcine tissue phantom, boundaries between the muscle, adipose, and virtually-removed contrast bolus were readily distinguishable along a muscle-adipose interface in the new VNC images, but were more ambiguous with the classic VNC.

### CONCLUSION

The new VNC algorithm improves the CT number accuracy and CNR of adipose and other soft tissues while retaining the ability to remove iodine signal and preserve accurate CT numbers of water.

### CLINICAL RELEVANCE/APPLICATION

VNC images with accurate CT numbers for tissues of interest might be utilized in place of true non-contrast CT images to reduce radiation dose and streamline clinical workflow. Improving the accuracy of CT numbers and the CNR of adipose and other soft tissues can extend the practical range of clinical applications where VNC imaging is viable.

## T1-SSPH07-2 RELIABLE IODINE MEASUREMENT IN SMALL LUMEN DIAMETERS FOR CORONARY ARTERY DISEASE ASSESSMENT VIA PHOTON-COUNTING CT

Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Harold I. Litt, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV
Pooyan Sahbaee, PhD (*Abstract Co-Author*) Employee, Siemens AG
Leening Liu (*Abstract Co-Author*) Nothing to Disclose
Martin Rybertt, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

The recent deployment of the first-generation clinical dual-source photon-counting CT (PCCT) addresses existing challenges in both visualization and quantification of iodine within the coronary arteries, a critical factor disease assessment. This study evaluates the capability of PCCT to quantify iodine accurately in small lumen diameters, across different phantom sizes and iodine concentrations.

**METHODS AND MATERIALS**

To characterize the effect of lumen diameter on iodine quantification, phantom inserts for a body phantom (Multi-energy CT phantom, Gammex) containing a U-shaped constant diameter tube that can be filled with iodinated contrast agents were 3-D printed with a calcium-based filament (StoneFil, Formfutura). Phantoms with different lumen diameters (4, 6, 8, 10, 12 mm) were filled with solutions of different iodine concentrations (2, 5, 10 mg/mL). They were then scanned with PCCT (Naeotom Alpha, Siemens Healthineers) at four different patient sizes (20x20 (S), 25x25 (M), 30x40 (L), and 40x50 cm (XL)) and four radiation dose levels (CTDIvol 5, 10, 15, 20 mGy). Regions of interest (ROIs) were placed on virtual monoenergetic images (VMI) at 70 keV and iodine density maps (ID). Mean and standard deviation were calculated along the length of the tube. Measurements of a 12 mm lumen diameter at a CTDIvol of 20 mGy on the small body phantom served as the reference value for calculating absolute differences between lumen diameters.

**RESULTS**

At lumen diameters greater than 6 mm, ID maps showed good performance at smaller patient sizes (S, M) with maximum absolute differences of 0.8 mg/mL at 20 mGy. With the L phantom, ID demonstrated average differences of 0.5±0.5, 0.5±0.6, and 0.1±0.3 mg/mL for iodine 2, 5, and 10 mg/mL, respectively. Radiation dose had a minimal effect on lumen diameters of 4 mm at S, M, and L phantoms with maximum variance of 0.5, 0.2, and 0.1 mg/mL for 2, 5, and 10 mg/mL of iodine, respectively. Similarly, VMI 70 keV performance was consistent across all patient sizes for lumen diameters greater than 6 mm, exhibiting absolute differences of VMI 70 that averaged 3.8, 5.6, and 6.8 HU for iodine concentrations of 2, 5, and 10 mg/mL respectively.

**CONCLUSION**

Spectral quantification with PCCT demonstrated consistency between lumen diameters greater than 6 mm across patient sizes for different iodine concentrations. By exploiting the combination of high resolution and spectral quantification, small structures can be characterized to improve diagnostic evaluation of diseases, such as coronary artery disease.

**CLINICAL RELEVANCE/APPLICATION**

Consistent quantification at different lumen diameters and phantom sizes with PCCT may facilitate accurate quantitative evaluation of coronary arteries and other clinically relevant small structures.

## T1-SSPH07-3 TECHNICAL EVALUATION OF A DUAL-SOURCE DUAL-ENERGY MODE ON PHOTON-COUNTING DETECTOR CT FOR MUSCULOSKELETAL IMAGING

Francis I. Baffour, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Shanblatt, PhD (*Abstract Co-Author*) Employee, Siemens AG
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Kishore Rajendran, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the performance of an investigational dual-source dual-energy mode on photon-counting detector (DS-PCD) CT for bone imaging.

**METHODS AND MATERIALS**

Hydroxyapatite inserts (HA 100, 200 and 300 mg/cc) were placed in water phantoms (30 cm [S], 40 cm [M], and 50 cm [L] diameter) and scanned on clinical PCD-CT (Siemens NAEOTOM Alpha) using DS-PCD mode (Quantum Peak). Two kV-pairs were used (70/Sn150 kV and 90/Sn150 kV) for S and M phantoms with CTDIvol range 11-24 mGy, and 90/Sn150 kV for L phantom at 41 mGy CTDIvol. The phantoms were also scanned on single-source PCD-CT with two energy thresholds (SS-PCD) at 120 kV and 140 kV, and on a dual-source energy-integrating detector (DS-EID) CT (SOMATOM Force). Dual-energy images (low/high for DS-PCD and DS-EID, threshold-low / threshold-high for SS-PCD) were reconstructed using Qr40 kernel at 2 mm section thickness. Spectral separation was quantified using HA dual-energy ratio (DER), difference in effective energies between low and high images, and mean absolute percent error (MAPE) of HA mass density obtained from HA/water basis decomposition. To demonstrate clinical feasibility, two patients (a 46-year-old male and 24-year-old male) were scanned using DS-PCD under IRB approval. Bone edema maps were reconstructed and compared with clinical imaging reference standards (MRI or DS-EID).

**RESULTS**

For S and M phantoms, DS-PCD at 70/Sn150 kV showed the highest mean DER (S: 2.43 and M: 2.47), followed by DS-EID at 70/Sn150 kV (S: 2.38 and M: 2.34), and SS-PCD at 120 kV showed the lowest mean DER (S: 1.66 and M: 1.67). For L phantom, DS-PCD at 90/Sn150 kV showed highest mean DER (1.89) compared to SS-PCD (1.68 to 1.71) and DS-EID at 90/Sn150 kV (1.80). Across phantom sizes and kV pairs, the difference in effective energies for DS-PCD were slightly lower than the DS-EID at matching kV pair (average percent difference 5.2%). Despite this, the DER was higher on DS-PCD compared to DS-EID for all sizes at matching kV pair which can be attributed to the uniform photon-weighting benefit from PCDs. The MAPE values for DS-PCD were consistently lower across all phantom sizes (MAPE max. of 1.44%) compared to SS-PCD (MAPE max. 3.97%) and DS-EID (MAPE max. 3.68%). Qualitatively, patient wrist and knee images showed bone edema on DS-PCD comparable to clinical MR images, and more precise edema depiction compared to DS-EID images at the site of fractures with fewer artifacts.

**CONCLUSION**

The investigational dual-source dual-energy configuration on clinical PCD-CT showed superior spectral performance for bone imaging task compared to single-source multi-energy PCD-CT and dual-source EID-CT.

**CLINICAL RELEVANCE/APPLICATION**

Accurate material decomposition reduces artifacts and improves bone edema visualization associated with bone pathology.

## T1-SSPH07-4 ULTRA HIGH-RESOLUTION SPECTRAL IMAGING USING CZT-BASED PHOTON-COUNTING CT: A PHANTOM STUDY FOR EVALUATION OF SPATIAL RESOLUTION AND IODINE QUANTIFICATION ACCURACY

Xiaohui Zhan, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Thomas Labno, BS (*Abstract Co-Author*) Employee, Toshiba Corporation
Richard Thompson, PhD (*Abstract Co-Author*) Employee, Canon Medical Research, USA

Steven Ross, PhD (*Abstract Co-Author*) Nothing to Disclose
Amir Pourmorteza, PhD (*Abstract Co-Author*) Nothing to Disclose
Ruoqiao Zhang, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Zhou Yu, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Shobhit Sharma, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the ultra high-resolution spectral (spectral-UHR) imaging capabilities of CZT-based photon-counting CT (PCCT) using a custom phantom enabling simultaneous evaluation of spatial resolution and iodine quantification accuracy.

**METHODS AND MATERIALS**

A custom phantom containing known iodine concentrations (0.1-20 mgI/ml) and 3D-printed microfluidic channels simulating line pairs (10, 20, and 30 lp/cm) filled with high concentration of iodine (170 mgI/ml) was placed inside a ballistic gel frame to simulate realistic patient sizes. The phantom was scanned in axial mode on a prototype CZT-based PCCT at 120 kVp using a small focal spot (0.4x0.5 mm) and exposures of 50, 100, and 200 mAs (CTDIvol = 3.2, 6.4, and 12.8 mGy, respectively). Spectral-UHR mode was used to perform projection-domain two-material decomposition and UHR virtual monoenergetic images (VMIs) at 60 and 90 keV (pixel size/slice thickness: 0.2/0.2 mm) were reconstructed using the filtered-backprojection (FBP) with a sharp bone kernel (FC30) and iterative denoising. Iodine maps were generated using the 60 and 90 keV VMIs in the image domain. For line pairs, iodine maps with pixel size/slice thickness of 0.015/0.2 mm were also generated. To assess spectral-UHR performance, the following evaluations were done: (1) visual comparison of line pairs in iodine maps between spectral-NR (spectral normal-resolution) and spectral-UHR images at 200 mAs (slice thickness = 1.2 mm), and (2) Bland-Altman analysis for iodine measurements across all exposures (slice thickness = 3.0 mm).

**RESULTS**

Spectral-UHR mode showed improved visualization of iodine-filled line pairs, with the ability to resolve frequencies between 20-30 lp/cm for the chosen kernel. Iodine concentration measurements in spectral-UHR mode showed strong agreement with true concentrations across all exposures, with the 95% confidence intervals (mgI/ml) of [-0.40, 0.82]/[-0.44, 0.86]/[-1.24, 0.58] (<2 mgI/ml) and [-0.47, 1.07]/[-0.74, 0.88]/[-2.50, 0.46] (>2 mgI/ml) and minimal bias (mgI/ml) of 0.21/0.21/-0.33 (<2 mgI/ml) and 0.30/0.07/-1.02 (>2 mgI/ml) at 200/100/50 mAs. A slight increase in bias and reduction in precision for iodine measurements was found with decreasing exposure levels.

**CONCLUSION**

Spectral-UHR imaging with CZT-based PCCT enables visualization of high-resolution features while preserving spectral information as indicated by good iodine quantification accuracy across all exposures.

**CLINICAL RELEVANCE/APPLICATION**

Iodine quantification accuracy is important for all contrast-enhanced CT exams, especially in cardiovascular and oncological domains. The ability to visualize finer structures while preserving iodine accuracy would remarkably improve the diagnostic performance of CT images.

## T1-SSPH07-5 ACCURATE SIMULATION OF LOWER-DOSE DATA AND SPECTRAL CORRELATION IN PHOTON-COUNTING-DETECTOR CT

Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Timothy Winfree, BS, MS (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a projection domain lower-dose simulation algorithm for PCD-CT that accurately emulates spatial and spectral correlations in measured data.

**METHODS AND MATERIALS**

Performing noise insertion of PCD-CT data to simulate lower-dose exams requires careful considerations of spectral and spatial correlations in the projection data that could arise due to effects unique to photon counters such as charge sharing and pulse pileup. First, to determine the extent to which charge sharing and pulse pileup affect the data, repeated scans of a 10cm water phantom were acquired over the available mA range and subtracted to obtain noise only projections - from which the correlation between energy channels and adjacent pixels were measured. To accurately simulate the spectral correlation, we assume that the energy bins (B1 and B2), obtained by subtracting the measured threshold data, are independent and insert Poisson noise in each of the bin data. Subsequently, the noisy bins are summed together to form the noisy threshold data (T1 and T2).Quarter dose data at 22, 90, and 214 mA were simulated for comparison with measured data at each corresponding mA condition. The correlation between T1 and T2, B1 and B2, as well as the image-domain spatial 3D NPS were compared for validation.

**RESULTS**

Excellent agreement in NPS between simulated and measured lower-dose data was achieved, differing by a maximum of 5.0%, 6.3%, 4.1%, and 6.1% for half-dose (HD) T1, HD T2, quarter-dose (QD) T1, and QD T2 images, respectively. Spatial correlation between adjacent detector pixels was very small (0.002-0.1) for both energy thresholds regardless of mA, indicating that charge sharing can be neglected for the purpose of noise insertion. Simulated lower dose data underestimates the spectral correlation (T1 and T2) at the target dose when the mA in the reference scan increases. As the mA of the reference scan decreases (less pileup), the correlation in the simulated data converges to that of the measured data (0.586 vs. 0.588 at 22 mA).

**CONCLUSION**

The proposed noise insertion algorithm can synthesize lower dose images with realistic spatial and spectral correlations in PCD-CT when the reference scan is not significantly affected by pileup.

**CLINICAL RELEVANCE/APPLICATION**

This tool enables accurate simulation of lower-dose data from existing PCD-CT exams, which can be used to optimize radiation dose and train AI-based denoising algorithms.

## T1-SSPH07-6 EVALUATION OF CORONARY STENOSIS, PLAQUES, AND STENTS IN A PHANTOM USING THE SUPER HIGH RESOLUTION SPECTRAL MODE FROM A PROTOTYPE CZT-BASED PHOTON COUNTING CT SYSTEM

Zhou Yu, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Shobhit Sharma, PhD (*Abstract Co-Author*) Nothing to Disclose
Xiaofeng Niu (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
John Schuzer, ARRT, BS (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation

Marcus Y. Chen, MD (*Abstract Co-Author*) Institutional research agreement, Canon Medical Systems Corporation
Steven Ross, PhD (*Abstract Co-Author*) Nothing to Disclose
Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Xiaohui Zhan, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Ilmar Hein, PhD (*Abstract Co-Author*) Nothing to Disclose
Ruoqiao Zhang, PhD (*Presenter*) Employee, Canon Medical Systems Corporation

## PURPOSE

Compared with conventional scintillator-based energy-integrating detectors (EIDs), photon counting detectors can be made with smaller pixel sizes with reduced pixel crosstalk and measure the spectral information with multiple energy bin output simultaneously. In this work, we compared the image quality between normal-resolution (NR) and super-high-resolution (SHR) spectral modes provided by a full-size PCCT clinical prototype system in phantom studies.

## METHODS AND MATERIALS

The prototype PCCT is built based on a Aquilion Precision system. The CZT-based PCCT system covers the full 50cm FOV in the fan angle and 39.6mm in the cone angle. Summation of 3x3 detector pixels is used for NR image reconstruction, while 1x1 detector pixel is used for SHR reconstruction. The counting mode generates images based on events with energy greater than 30keV, and the spectral mode generates images using 5 energy bin counts with data-domain decomposition. In this study, scans were acquired in axial mode at 120 kVp, 200 mA, 1 sec rotation, with a focal spot size of 0.4mm*0.5mm. Both NR and SHR Spectral images were reconstructed with FBP and AIDR3D methods using a standard body kernel. The modulation transfer function (MTF) was measured at the Teflon rod in Catphan CTP682 module for resolution evaluation. Different tubes mimicking various degrees of coronary stenosis and plaques were placed inside a water-filled phantom to compare the performance of PCCT NR Spectral and SHR Spectral with respect to coronary stenosis, plaques, and stents.

## RESULTS

MTF result shows that SHR Spectral provides similar spatial resolution as SHR Counting and is much sharper than NR Spectral. Coronary stenosis phantom results show that SHR Spectral can resolve different types of stenosis and plaques by evaluating the trend of CT number across different keVs, providing better material differentiation than SHR Counting. SHR Spectral delineates small in-stent stenosis and plaques much more clearly and improves the visualization of the stent significantly than NR Spectral thanks to the reduction of blooming artifacts.

## CONCLUSION

We compared image quality between NR and SHR Spectral modes on a full-size PCCT prototype system. Result demonstrated that SHR Spectral improved the spatial resolution significantly than NR Spectral while retaining spectral information for material discrimination.

## CLINICAL RELEVANCE/APPLICATION

The SHR Spectral mode in our PCCT system can potentially provide more accurate evaluation of different types and degrees of in-stent stenosis and plaques than conventional scanners in cardiac imaging.

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# Abstract Archives of the RSNA, 2024

T2-STCE1

**Science Session (Low-Field and Mobile MRI)**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## T2-STCE1-1 LOW-FIELD (64MT) PORTABLE BRAIN MRI IN HOSPITALIZED AND EMERGENCY DEPARTMENT PATIENTS: REAL-WORLD EXPERIENCE FROM OUR FIRST TWO YEARS

Yingming Amy Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Shobhit Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Julian Spears (*Abstract Co-Author*) Nothing to Disclose
Aditya Bharatha, MD (*Abstract Co-Author*) Nothing to Disclose
Amy W. Lin, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Vinu Mathew, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Point-of-care portable MRI (pMRI) is a novel technology that allows bedside brain imaging, potentially eliminating the risks and resource demands associated with transporting patients to conventional stationary CT and MRI units. We reviewed our institutional experience with pMRI in hospitalized and emergency department (ED) patients in the first two years after acquiring this technology.

### METHODS AND MATERIALS

We retrospectively reviewed all portable MRI brain scans performed on hospitalized and ED patients at our institution between March 30, 2022 and March 29, 2024. Radiology reports were reviewed and categorized as having new findings not previously documented on imaging, incremental interval changes, or stable/normal findings. The subset of cases with new findings were compared with subsequent conventional stationary CT or MRI brain scans for accuracy.

### RESULTS

194 pMRI scans were performed in hospitalized and ED patients, 192 of which were considered diagnostic quality. Nearly half of the scans had either new findings (30/192 or 16%) or incremental interval changes (58/192 or 30%) that could potentially lead to changes in patient management. The most common new findings not previously documented on imaging were infarcts, hemorrhages, and contusions. The most common incremental interval changes were changes in ventricular size, changes in extra-axial collection size, and changes in mass effect (changes in midline shift, brain herniation, or ventricular compression). Within the subset of patients with new findings that had subsequent conventional stationary CT/MRI brain (0-6 days later), the vast majority (24/26, 92%) were true positives, one was a false positive, and one was indeterminate.

### CONCLUSION

In this largest patient series to date in a real-world setting, pMRI shows promise as a valuable new tool for neuroimaging in hospitalized and ED patients at the bedside that provided actionable information for guiding patient care.

### CLINICAL RELEVANCE/APPLICATION

In this largest patient series to date in a real-world setting, pMRI shows promise as a valuable new tool for neuroimaging in hospitalized and ED patients at the bedside that provided actionable information for guiding patient care.

## T2-STCE1-2 EVALUATING BRONCHODILATOR RESPONSE USING FREE-BREATHING OXYGEN AND COMPLIANCE MAPPING WITH 0.55T MRI

Adrienne Campbell (*Abstract Co-Author*) Nothing to Disclose
Rajiv Ramasawmy (*Abstract Co-Author*) Nothing to Disclose
Pierre Daude, PhD (*Abstract Co-Author*) Nothing to Disclose
Ahsan Javed (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Plummer, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Mid-field MRI is particularly well suited to lung imaging techniques including oxygen mapping. Here, we utilize a self-calibrating, motion-compensating, reconstruction technique to generate lung images at several points throughout the breathing-cycle. Not only does this provide a novel insight to oxygen-uptake throughout the breathing-cycle, but it also provides a bonus view of lung compliance.

### METHODS AND MATERIALS

Five healthy-volunteers (HV) and ten patients with asthma were imaged on a 0.55T MRI scanner (MAGNETOM Free.Max, Siemens Healthineers AG, Erlangen, Germany) using a T1-weighted free-breathing stack-of-spirals ultrashort echo time sequence (TE/TR=0.55/7.6ms; FA=12°, resolution=(3.0mm)3, FOV=480x480x240 mm3, scan-duration=6min). Free-breathing data were acquired while under 100% oxygen, followed by a 6-minute break, then under room air. Asthma patients were imaged before and after receiving albuterol bronchodilator treatment (within 1 hour). Data were retrospectively divided into six bins, corresponding to their position within the breathing-cycle, and reconstructed into six respiratory-resolved 3D images using a custom motion-compensated low-rank reconstruction pipeline. Percent signal enhancement (PSE) maps were calculated from the fractional-difference between the oxygen and room air images following registration and volume correction. Specific ventilation (SV) maps were estimated by fractional-difference between the oxygen images at each respiratory phase, registered to end expiration. Mean PSE and SV were measured at end-inspiration for each subject.

### RESULTS

The figure demonstrates the free-breathing PSE and SV maps for a HV and a patient with asthma before/after bronchodilator treatment. For the HV, the PSE distributed evenly throughout the lungs and across the breathing-cycle; while the SV distributed evenly across space but increased towards end-inspiration, as would be expected with the alveolar expansion. Across five HVs, mean PSE=(11.84±2.10)% and SV=(9.49±2.03)%. The asthma patient example (pre-bronchodilator) showed extensive regions of low PSE throughout the breathing-cycle, with less-uniform SV. Across ten asthma patients, mean PSE=(5.46±3.21)% and SV=(7.34±3.66)%. However, the PSE increased post-bronchodilator throughout the lungs (10.10±4.81)%, indicating improved oxygen uptake. Furthermore, the SV increased (9.01±3.85)% post-bronchodilator, indicating improved gas intake following treatment.

### CONCLUSION

Our proposed method enables a dynamic assessment of oxygen uptake and lung compliance during tidal breathing. In principle, PSE maps are sensitive to dissolved oxygen in the tissue and blood, while SV maps correspond to the local lung compliance throughout the breathing-cycle, and therefore provide complementary insights into lung function. Notably, the gained-temporal resolution is obtained without extra data acquisition and provides clinicians a novel insight into bronchodilator response.

### CLINICAL RELEVANCE/APPLICATION

We propose a free-breathing low-field MRI method that generates both oxygen-enhancement and compliance maps dynamically throughout the respiratory cycle. This method enables novel insights of the spatio-temporal response to bronchodilator treatment in asthma without acquiring additional data.

## T2-STCE1-3 QUALITY OF MOBILE MRI IN EMERGENCY AND TRAUMA RADIOLOGY

Waqas Ahmad I, MBBS (*Abstract Co-Author*) Nothing to Disclose
Quratulain Sahi, MBBS, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

Mobile MRI units are increasingly being adopted due to their portability and cost-effectiveness. This study aims to assess the diagnostic performance, comparative effectiveness, and overall impact of mobile MRI in the context of emergency and trauma radiology.

### METHODS AND MATERIALS

This prospective study was conducted in the emergency departments (EDs) of 3 major trauma centers over one year. 200 patients with acute trauma or other emergency conditions were included, and randomly assigned to imaging with traditional high-field MRI or mobile low-field MRI unit. The mobile MRI units used were equipped with low-field magnets (0.2-0.5 Tesla). Diagnostic performance was evaluated by comparing the image quality, diagnostic accuracy, and time to diagnosis. Primary outcomes measured were: 1. Image quality, rated on a standardized scale by a panel of radiologists. 2. Diagnostic accuracy, by comparing findings with final clinical diagnoses. 3. Time to diagnosis and treatment. 4. Patient and clinician satisfaction. Secondary outcomes included technical feasibility of deployment, logistical challenges and cost-effectiveness.

### RESULTS

The study found that mobile low-field MRI units provided diagnostic images of sufficient quality for most cases, which was deemed acceptable for clinical decision-making in 92% of cases. The diagnostic accuracy of mobile MRI was comparable to high-field MRI, with a concordance rate of 95%. On average, the mobile MRI group had a 30% shorter time to imaging and a 25% faster time to definitive Patient outcomes showed no significant differences in recovery times, complication rates or overall treatment efficacy. Patients and clinicians reported high satisfaction levels with the process. Mobile MRI units were successfully deployed and operated in all three EDs with minimal logistical issues. Cost-effectiveness analysis revealed that mobile MRI units, reduced overall imaging costs by decreasing the need for patient transportation and improving efficiency of the diagnostic process.

### CONCLUSION

Mobile low-field MRI offers acceptable image quality and high diagnostic accuracy, comparable to traditional high-field MRI, while significantly reducing time to diagnosis and treatment. The convenience and rapid deployment of mobile MRI units make them particularly valuable in acute care settings.

### CLINICAL RELEVANCE/APPLICATION

Mobile MRI units provide a flexible and efficient solution that can be used in a variety of clinical scenarios, from busy urban trauma centers to remote or resource-limited locations. Future research should focus on further optimizing mobile MRI technology, exploring its use in other clinical settings, and developing guidelines for its integration into standard emergency and trauma care protocols.

# Abstract Archives of the RSNA, 2024

T2-STCE2

**Science Session (Multiomic and Multicenter Radiology AI)**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## T2-STCE2-1 DEVELOPMENT AND VALIDATION OF MRI-BASED ON DEEP LEARNING RADIOMIC SIGNATURES TO PREDICT EIGHT CORE MOLECULAR BIOMARKERS IN ADULT DIFFUSE GLIOMA: A MULTICOHORT STUDY

Junjie Li (*Abstract Co-Author*) Nothing to Disclose
Zhizheng Zhuo (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to develop a Deep Learning and Radiomics signature (DLR) model and a combined DLRC (Deep Learning and Radiomics with Clinical signature) model using MRI to predict eight core molecular pathological biomarkers for adult diffuse glioma.

### METHODS AND MATERIALS

A retrospective study was conducted on 1151 adult diffuse glioma patients in our hospital. Multi-parameter MRI images (T2 and T1C) and pathological information, including IDH mutation, 1p/19q co-deletion, MGMT methylation, TERT mutation, EGFR amplification, +7/-10, and KI67 expression were collected. Patients were randomly divided into a training set (n=805) and an internal test set (n=346). Subsequently, 3562 radiomics features and 4096 DL features were extracted. After feature reduction and selection, the MLP was used to build radiomics and DL model. The DLR model base on radiomics and DL results from MLP. Finally, logistic regression was used to integrate the DLR and clinical prediction model to build the DLRC prediction model. The DLR model and DLRC models were tested in external test sets from JL Hospital (n=118), TCGA (n=237), and UCSF (n=477).

### RESULTS

The DLR model showed AUCs of 0.829 to 0.927 for predicting IDH mutation in internal, JL, TCGA, and UCSF test sets, AUCs of 0.805 to 0.880 for predicting 1p/19q co-deletion, AUCs of 0.531 to 0.714 for predicting MGMT methylation, and AUCs of 0.725 to 0.761 for predicting TERT mutation. In the internal test set, the DLR model showed an AUC of 0.753 for predicting EGFR amplification, an AUC of 0.832 for predicting +7/-10, an AUC of 0.792 for predicting CDKN2A/B co-deletion, and an AUC of 0.883 for predicting KI67 expression. In the internal, JL, TCGA, and UCSF test sets, the DLRC model showed AUCs of 0.899 to 0.966 for predicting IDH mutation, AUCs of 0.825 to 0.896 for predicting 1p/19q co-deletion, AUCs of 0.530 to 0.716 for predicting MGMT methylation, and AUCs of 0.620 to 0.844 for predicting TERT mutation. In the internal test set, the DLRC model showed an AUC of 0.775 for predicting EGFR amplification, an AUC of 0.849 for predicting +7/-10, an AUC of 0.815 for predicting CDKN2A/B co-deletion, and an AUC of 0.890 for predicting KI67 expression.

### CONCLUSION

This study developed and validated a DLR model to preoperatively predict eight core molecular pathological biomarkers in ADG patients, combining with additional clinical-available variable could facilitate their clinical application.

### CLINICAL RELEVANCE/APPLICATION

The study verified the DLR and DLRC demonstrated high diagnostic performance in identifying eight molecular biomarkers with adult diffuse glioma patients at MRI. Our approach has the potential to facilitate timely diagnoses and management of adult diffuse glioma patients encountered in routine clinical practice.

## T2-STCE2-2 DATASET PROFILE: STUDY TRACEBACK, ERROR DETECTION, AND LABEL REFINEMENT FOR MULTICENTER RADIOLOGY DATASETS

Wenxuan Li, BS (*Abstract Co-Author*) Nothing to Disclose
Pedro Ricardo Ariel Salvador Bassi (*Abstract Co-Author*) Nothing to Disclose
Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Yucheng Tang, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrea Cavalli (*Abstract Co-Author*) Nothing to Disclose
Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Maximilian Rokuss (*Abstract Co-Author*) Nothing to Disclose
Yannick Kirchhoff (*Abstract Co-Author*) Nothing to Disclose
Sergio Decherchi (*Abstract Co-Author*) Nothing to Disclose
Fabian Isensee, MSc (*Abstract Co-Author*) Nothing to Disclose
Constantin Ulrich (*Abstract Co-Author*) Nothing to Disclose
Saikat Roy (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

To assess and improve the quality of anatomical annotations in public multicenter radiological image datasets.

## METHODS AND MATERIALS

Massive multicenter datasets are essential for elevating medical AI quality and inter-hospital generalization. By combining multiple public datasets, enormous databases are being created, but ensuring their quality is not easy. We propose an automatic tool to generate comprehensive profiles of radiology datasets, identifying same patient data, duplicates, data leakage, and label noise. By assessing image similarity, it avoids images from the same patients from being shared between training and validation scripts, removes duplicate data and ensures rigorous external validation, by checking for data leakage in test datasets. Additionally, the tool finds potential low-quality per-voxel annotations, by analyzing labels from two perspectives: (I) annotation deviation from anatomical priors, and (II) samples that are exceedingly difficult for AI algorithms to overfit during training. Label error detection is especially important considering the rise of AI-annotated datasets. The profiler flags problematic cases for manual revision and automatically corrects some errors, leveraging anatomical priors and AI-generated pseudo-labels. We used the profiler to analyze AbdomenAtlas 1.0, a multicenter public dataset with 5,195 CT scans fully annotated for 9 anatomical structures, collected from 16 public databases.

## RESULTS

The profiler identified overlaps in the public datasets, i.e., AbdomenAtlas, and removed 436 duplicated CT volumes. It grouped same-patient samples, tracing 221 CT volumes to a group of 90 patients. Label error detection identified 32.4% of the aorta and 2.6% of the kidney annotations as noisy, due to diverging annotation standards in public data. Moreover, 30% of the errors identified derived from inadequate CT scan quality. With the profiler's help, radiologists assisted by AI revised problematic annotations.

## CONCLUSION

The profiler effectively prevents duplicates when merging public databases, avoids data leakage and improves per-voxel annotations, facilitating the creation of high-quality large-scale multicenter databases.

## CLINICAL RELEVANCE/APPLICATION

Massive datasets revolutionized computer vision, and the same is expected for medical AI. By improving these datasets’ quality, our profiler can help the multiple models that learn from them, including AI models that accelerate the radiologist workflow by segmenting organs and tumors.

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# Abstract Archives of the RSNA, 2024

T3-SSBR05

**Breast Imaging (Contrast Enhanced Imaging)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: S406A

Maxine S. Jochelson, MD (*Moderator*) Speaker, General Electric Company
Rodrigo Alcantara, MD, MSc (*Moderator*) Nothing to Disclose

**Sub-Events**

## T3-SSBR05-1 CONTRAST-ENHANCED MAMMOGRAPHY IN WOMEN WITH PREVIOUS BREAST-CONSERVING SURGERY FOR BREAST CANCER: INTERIM ANALYSIS FROM THE COMBO TRIAL, A PROSPECTIVE STUDY

Giulia Pruneddu (*Abstract Co-Author*) Nothing to Disclose
Isabella Bolengo, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela Bernardi, MD (*Abstract Co-Author*) Nothing to Disclose
Giulia Pinna (*Abstract Co-Author*) Nothing to Disclose
Francesco Patrone (*Abstract Co-Author*) Nothing to Disclose
Nicolo Turri (*Abstract Co-Author*) Nothing to Disclose
Rubina Manuela Trimboli (*Abstract Co-Author*) Nothing to Disclose
Daria Volpe (*Abstract Co-Author*) Nothing to Disclose
Alessandra Sapori (*Abstract Co-Author*) Nothing to Disclose
Giulia Vatteroni, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To present interim findings from the 'COMBO TRIAL,' a prospective intraindividual study evaluating the performance of Contrast-Enhanced Mammography (CEM) compared to Digital Mammography (DM) for the surveillance of women with a personal history of breast cancer (BC).

### METHODS AND MATERIALS

Between January 2023 and April 2024, 1150 asymptomatic women who underwent breast-conserving surgery for BC within the last 10 years were invited to undergo CEM instead of DM for routine surveillance. Exclusion criteria included: suspicious symptoms of BC, allergy to iodinated contrast agents, renal failure and breast implants. For each patient, one reader reported CEM (Low energy [LE] + Recombined), while a second reader, independent and blinded, evaluated only LE images equivalent to DM. Both readers assigned independent BI-RADS scores for DM and CEM. The reference standard was 1-year follow-up for negative cases and biopsy/surgery for BI-RADS 4 and 5. The primary endpoints included the Cancer Detection (CD) rate for both DM and CEM, along with the incremental CD rate for CEM. Secondary endpoints included sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy for each test. We evaluated differences in diagnostic performance between DM and CEM using the McNemar test for paired data ($p<0.05$ significant) and assessed the statistical significance examining the overlap of the confidence intervals.

### RESULTS

Overall, 607 patients met the inclusion criteria and 600 were included in the analysis. Of these, 59 women were recalled for assessment, resulting in a recall rate of 9.8%. Among them, 14 cases of BC were detected: 8 (5 Ductal Carcinoma In Situ [DCIS]+3 invasive) were identified by both DM and CEM, while CEM detected 6 additional cases (1 DCIS+5 invasive). Three cases were missed by both DM and CEM but subsequently detected by US, resulting in a global recurrence rate of 2.8%. The CD rate for CEM was 23 per 1000, compared to 13 per 1000 for DM, indicating an incremental CD for CEM of 10 per 1000 compared to DM ($p=0.014$). Compared to DM, CEM demonstrated significantly higher sensitivity (82.4% vs. 47.1%), slightly lower specificity (96.4% vs. 97.6%), slightly higher PPV (40.0% vs. 36.4%), slightly higher NPV (99.5% vs. 98.4%), and similar accuracy (96.0% vs. 96.2%).

### CONCLUSION

Implementation of CEM in BC surveillance was associated with a significant increased detection of invasive cancers. Final results and the collection of interval cancers are awaited for comprehensive evaluation.

### CLINICAL RELEVANCE/APPLICATION

Women with history of breast cancer face higher risks of recurrence or new cancers. CEM in surveillance protocols enables earlier detection compared to DM, potentially improving overall survival.

## T3-SSBR05-2 GENERATING IODINE-ENHANCED MAMMOGRAPHY FROM LOW-ENERGY IMAGES USING DEEP LEARNING

Paolo Belli, MD (*Abstract Co-Author*) Nothing to Disclose
Ludovica Iaccarino, MD (*Abstract Co-Author*) Nothing to Disclose
Anna D'Angelo, MD (*Abstract Co-Author*) Nothing to Disclose
Matteo Mancino, MD (*Abstract Co-Author*) Nothing to Disclose
Evis Sala, MD, PhD (*Abstract Co-Author*) Co-founder, Lucida Medical Ltd

Valentina Longo (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Zormpas-Petridis, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Contrast-enhanced mammography (CEM) is an invaluable tool for the diagnosis, monitoring and screening of breast cancer (BC) patients, including those with high-breast density, offering great sensitivity and high spatial resolution. We show that deep learning can be used to generate clinically-equivalent iodine-enhanced images from low-energy images. Due to the similar appearance of low-energy to non-contrast digital mammography (DM), this could alleviate the need for contrast media, thus sparing patients from potential side effects and making CEM more accessible.

**METHODS AND MATERIALS**

We retrospectively selected 140 CEM examinations in patients with suspicious imaging findings, who underwent histologic verification or follow-up of at least 12 months. We trained a 2D CycleGAN on 100 patients in a supervised manner by using paired low-energy and iodine-enhanced images as input and output (ground-truth) respectively. We utilized a ResNet architecture for the generator, patch-based (128x128 pixels) training and a perceptual cycle-loss function to generate the iodine-enhanced images. We quantitatively validated our approach in 40 test patients (63 breasts - 37 positive and 36 negative for malignancy) by calculating the contrast-to-noise ratio (CNR), the mean-absolute-error (MAE) and the SSIM between the low-energy and clinical/synthetic iodine-enhanced images. Additionally, two trained radiologists (> 6 and > 2 years' experience) blindly scored the 40 test patients for background parenchymal enhancement (BPE; score 1-4) and potential malignancy detection (yes/no).

**RESULTS**

Our method showed high correlation to the clinical images regarding the changes from low-energy (CNR: Mean=-0.015/-0.16, standard deviation=0.23/0.05 for clinical/synthetic respectively, MAE: r=0.99, SSIM: r=0.8). Upon visual inspection a "halo" artifact present in above 50% of the clinical images was corrected in the synthetic. The two radiologists on average estimated the BPE from the synthetic images by grouping scores as mild (1-2) and marked (3-4) with 90% accuracy and identified potential malignancies with 89.6/78.6 % accuracy, 87.8/70.2 % sensitivity and 94.4/93.1 % specificity for clinical/synthetic respectively.

**CONCLUSION**

Deep learning can generate clinically usable iodine-enhanced mammography images. We demonstrated proof-of-concept that radiologists can perform the same clinical tasks, such as malignancy detection and BPE calculation, paving the way for the evaluation of our approach directly on DM images.

**CLINICAL RELEVANCE/APPLICATION**

The possibility of avoiding the use of contrast media in large scale examinations and the reduction of image artifacts would improve BC diagnosis and make CEM more available to intermediate risk patients.

## T3-SSBR05-3 COMPARISON OF THE CLINICAL, IMAGING, AND HISTOPATHOLOGIC FEATURES OF BREAST CANCERS DETECTED ON LOW ENERGY VS RECOMBINED IMAGES ON SCREENING CONTRAST ENHANCED MAMMOGRAPHY

Sarah Eskreis-Winkler, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Juliana Atallah, MD (*Abstract Co-Author*) Nothing to Disclose
Noam Nissan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carol H. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher E. Comstock, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group;Advisory Board, Guerbet SA;Consultant, Bayer AG;Speaker, Northwest Imaging Forums, Inc
Janice S. Sung, MD (*Abstract Co-Author*) Research Grant, General Electric Company
Maxine S. Jochelson, MD (*Abstract Co-Author*) Speaker, General Electric Company
Marina J. Corines, MD (*Abstract Co-Author*) Nothing to Disclose
Varadan Sevilimedu (*Abstract Co-Author*) Nothing to Disclose
Kailyn Li, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the clinical, imaging, and histopathologic features of breast cancers detected on low energy vs recombined images on screening contrast enhanced mammography (CEM) in women at increased risk for breast cancer.

**METHODS AND MATERIALS**

This is a retrospective, HIPAA-compliant, and IRB-approved review of our CEM database from 01/2015-12/2021. Medical records were reviewed for age at diagnosis, breast density, background parenchymal enhancement (BPE), and tumor histopathology. The clinical, imaging, and histopathological features were compared for cancers detected on the low energy images (LE) with or without associated enhancement vs those detected due to enhancement only on recombined images (RI). LE images were considered equivalent to 2D full field digital mammography (FFDM).

**RESULTS**

7661 screening CEM were performed in 2820 women during the study period. Eighty-two cancers were diagnosed, including 51 (62%) invasive cancers, 5 (6%) microinvasive cancers, and 26 (32%) cases of ductal carcinoma in situ (DCIS). Median age at diagnosis was 52 years for women whose cancers were seen on LE +/- enhancement, and 54 years for those with cancers detected due to enhancement only on RI. There was no statistically significant difference in breast density (p=0.74) or BPE (p=0.44) between the two groups. Thirty-one (38%) were detected on LE +/- enhancement, and 51 (62%) on RI only. 6/10 (60%) cancers detected as calcifications on LE only were DCIS. 39/51 (76%) of cancers detected due to enhancement only on the RI were either invasive cancers or DCIS with microinvasion.

**CONCLUSION**

In women undergoing screening CEM, 62% of cancers detected are due to enhancement alone on RI. The cancers detected due to enhancement alone are more likely to be invasive cancers compared to those detected on the LE images.

**CLINICAL RELEVANCE/APPLICATION**

CEM increases the number of cancers detected by 165% compared to a 2D FFDM. The additional cancers detected due to enhancement alone are predominantly invasive cancers, highlighting the benefit of vascular based screening in women without access to breast MRI.

## T3-SSBR05-4 EFFECTIVENESS OF CONTRAST ENHANCED MAMMOGRAPHY FOR EVALUATION OF ARCHITECTURAL DISTORTION DETECTED ON SCREENING MAMMOGRAPHY

Vandana M. Dialani, MD (*Abstract Co-Author*) Research Consultant, Hologic, Inc;Research Consultant, Intrinsic Imaging LLC
Alexander Brook, PhD (*Abstract Co-Author*) Nothing to Disclose
Shutao Wang, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Contrast enhanced mammography (CEM) is an emerging technology utilizing iodinated intravenous contrast media to evaluate breast lesions. Architectural distortion (AD) is a common concerning finding on screening mammography, resulting in recalls and biopsies. Here, we hypothesize that CEM can be used as an effective diagnostic imaging tool for further evaluation and management of patients with AD.

### METHODS AND MATERIALS

This retrospective study was conducted under an IRB approved protocol. Clinical data from adult patients who were recalled for AD and underwent diagnostic CEM were collected. Patients without a biopsy or a 2-year follow-up were excluded from the study. Patients with no cancer on biopsy or subsequent follow up imaging for at least 2 years were considered negative.

### RESULTS

Among the 148 patients with age ranging from 40 to 87 years old, 89 patients had no positive findings on CEM (60%) while 59 patients (40%) had either enhancing mass/focus or non-mass enhancement. All CEM positive cases were biopsied, among which 45/59 (76%) were cancers. All the 89 cases with negative CEM findings were negative based on either tissue sampling (10/89;11%) or 2-year imaging follow-up (79/89;89%). Correlating to the biopsy/surgical pathology results, CEM demonstrates a sensitivity of 1.00 (95% CI 0.92-1.00) and specificity of 0.86 (95% CI 0.78-0.92). The negative predictive value of CEM was 1.00 (95% CI 0.96-1.00). The positive predictive value of CEM was 0.76 (95% CI 0.63-0.86). Majority (8/14;71%) of the false positive CEM cases with benign biopsies had radial scars on pathological examination.

### CONCLUSION

In this study, contrast enhanced mammography demonstrated excellent sensitivity and negative predictive value when used as a diagnostic tool for patients who had a recall for architectural distortion on routine screening mammograms.

### CLINICAL RELEVANCE/APPLICATION

High negative predictive value of CEM may allow this technique to be the new confirmatory diagnostic study, thus potentially avoiding unnecessary biopsies in patients with architectural distortion.

## T3-SSBR05-5 THE CLINICAL SIGNIFICANCE OF LESION CONSPICUITY ON CONTRAST ENHANCED MAMMOGRAPHY

Janice S. Sung, MD (*Abstract Co-Author*) Research Grant, General Electric Company
Christopher E. Comstock, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group;Advisory Board, Guerbet SA;Consultant, Bayer AG;Speaker, Northwest Imaging Forums, Inc
Sarah Eskreis-Winkler, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Varadan Sevilimedu (*Abstract Co-Author*) Nothing to Disclose
Maxine S. Jochelson, MD (*Abstract Co-Author*) Speaker, General Electric Company
Carol H. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Tali Amir, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To determine if lesion conspicuity on contrast enhanced mammography (CEM) is associated with likelihood of malignancy

### METHODS AND MATERIALS

This was a retrospective, IRB approved study. From January 1, 2020 through December 31, 2021 a total of 3,427 CEM examinations were performed. Cases of known cancer, those done for short interval follow-up, and those without adequate follow-up were excluded. There were a total of 473 enhancing lesions among 436 women. Conspicuity was assigned by one of two radiologists who were blinded to the outcome of the case. Conspicuity was assigned as low, moderate, or high as defined by the Breast Imaging and Data System (BI-RADS) lexicon. All cases had tissue confirmation and/or at least two years of imaging follow-up.

### RESULTS

Among the 473 lesions, 248 (52.4%) were low conspicuity, 181 (38.3%) showed moderate conspicuity, and 44 (9.3%) were high conspicuity. There were 31 cancers among the 473 cases (6.5/1000)of which 13 (42% of cancers) were low conspicuity, 16 (52% of cancers) were moderate conspicuity, and 2 (6% of cancers) were high conspicuity. The positive predictive value (PPV) of low conspicuity for cancer was 5.3% (95% confidence interval [CI] 2.8% to 8.9%). PPV of moderate conspicuity was 8.8% (95% CI 5.1% to 13.9%). For high conspicuity, PPV was 4.5% (95% CI 0.5% to 15.5%)There was no statistically significant difference of PPV of low versus high conspicuity (p= 0.99) or moderate versus high conspicuity (p = 0.52).

### CONCLUSION

Lesions conspicuity on CEM is not reliably associated with malignancy and is not helpful for discriminating benign from malignant findings. Lesions should not be discounted based on low conspicuity alone.

### CLINICAL RELEVANCE/APPLICATION

Lesion conspicuity is not a useful criterion for differentiating benign from malignant enhancing lesions on CEM.

## T3-SSBR05-6 BREAST MAGNETIC RESONANCE IMAGING AND CONTRAST-ENHANCED MAMMOGRAPHY INTER-READER AGREEMENT FOR BREAST CANCER DIAGNOSIS: A MULTI-READER RETROSPECTIVE STUDY

Serena Carriero (*Abstract Co-Author*) Nothing to Disclose
Gianpaolo Carrafiello, PhD (*Abstract Co-Author*) Nothing to Disclose
Filippo Pesapane, MD (*Abstract Co-Author*) Nothing to Disclose
Enrico Cassano (*Abstract Co-Author*) Nothing to Disclose
Lorenza Meneghetti (*Abstract Co-Author*) Nothing to Disclose

Sonia Santicchia (*Abstract Co-Author*) Nothing to Disclose
Ottavia Battaglia, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Early Breast cancer (BC) detection and exact tumoral extent evaluation are of pivotal importance for successful treatment and to improve survival rate.Breast magnetic resonance imaging (MRI) and contrast-enhanced mammography (CEM), represent the most effective techniques for BC local staging, depicting tumoral neovascularization and providing functional information.We aimed to assess intra-patient concordance between readers of varying experience in CEM and breast MRI for breast cancer diagnosis.

**METHODS AND MATERIALS**

Breast MRI and CEM exams performed in a single center (09/2020-09/2021) for an IRB-approved study were retrospectively and independently evaluated by four radiologists of two different centers with different levels of experience who were blinded to the clinical and other imaging data. The reference standard was the histological diagnosis or at least 1-year negative imaging follow-up. Inter-reader agreement was examined using Cohen's and Fleiss' kappa (?) statistics and compared with the Wald test.

**RESULTS**

Of the 750 patients, 395 met inclusion criteria (44.5 ± 14 years old), with 752 breasts available for CEM and MRI. Overall agreement was moderate (? = 0.60) for MRI and substantial (? = 0.74) for CEM. For expert readers, the agreement was substantial (? = 0.77) for MRI and almost perfect (? = 0.82) for CEM; for non-expert readers was fair (? = 0.39) for MRI and moderate (? = 0.57) for CEM. Pairwise agreement between expert readers and non-expert readers was moderate (? = 0.50) for breast MRI and substantial (? = 0.74) for CEM and it showed a statistically superior agreement of the expert over the non-expert readers only for MRI (p = 0.011) and not for CEM (p = 0.062).

**CONCLUSION**

The agreement of CEM was superior to that of MRI (p=0.012), including for both expert (p=0.031) and non-expert readers (p = 0.005).

**CLINICAL RELEVANCE/APPLICATION**

Despite both breast MRI and CEM have been showed to improve diagnostic accuracy in the diagnosis and staging of primary breast cancer, the lack of standardization in the interpretation of imaging findings with a wide range of inter-reader agreement rate remains a key issue.Identifying a diagnostic approach that is both accurate and associated to a high agreement is of pivotal importance to ensure optimal and equal patient's management. Furthermore, consistency enhances confidence in the diagnostic findings and reduces the potential for diagnostic errors or discrepancies that could occur with individual interpretations. Finally, the inter-reader agreement is crucial to assess the reproducibility and generalizability of findings across multiple readers and institutions.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T3-SSCA05

**Science Session with Keynote: Cardiac Imaging (Systemic Diseases Affecting the Heart)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: E353C

Karen G. Ordovas, MD, MS (*Moderator*) Nothing to Disclose
Jadranka Stojanovska, MD, MS (*Moderator*) Nothing to Disclose

**Sub-Events**

## T3-SSCA05-1 T2 MAPPING RATIO OF THE RIGHT-LEFT VENTRICULAR BLOOD POOL AS A MARKER TO EVALUATE THE SEVERITY OF DISEASE IN PATIENTS WITH PRIMARY PULMONARY HYPERTENSION AND LEFT HEART FAILURE

Carlo Catalano, MD (*Abstract Co-Author*) Nothing to Disclose
Nicola Galea, MD (*Abstract Co-Author*) Nothing to Disclose
Giulia Cundari, MD (*Abstract Co-Author*) Nothing to Disclose
Martina Giannetti, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The ratio between blood T2 mapping measured in the right (RV) and left (LV) ventricular cavity by Cardiac Magnetic Resonance (CMR) was proven to be correlated to the level of blood oxygenation. The aim of the study was to demonstrate the modifications of RV/LV-ratio in patients with heart failure (HF) and primary pulmonary hypertension (PAH), as conditions characterized by a reduction in pulmonary oxygen exchange.

### METHODS AND MATERIALS

44 patients with HF, 32 with PAH on therapy and 30 controls who underwent CMR were retrospectively enrolled. The protocol included GRE T2 mapping, native MOLLI T1 mapping and cine-SSFP sequences. The volumes of both ventricles and the blood T1 and T2 mapping values, delineating two circular regions of interest (ROI) in the cavity of the RV and LV blood pool, were evaluated. Then, the ratio (RV/LV-T2 ratio) was assessed.

### RESULTS

The difference between RV/LV-T2 ratio was statistically significant among patients with HF (ratio:0.59 ± 0.12) and PAH (ratio: 0.75 ± 0.16) and between HF and controls (ratio: 0.79 ± 0.12, $p< 0.0001$), but not between PAH and controls. A significant linear correlation was found between the RV/LV-T2 ratio and the RV ejection fraction (EF) (Pearson:0.259, $p<0.05$), the LV EF (Pearson:0.508, $p<0.0001$), all volumetric parameters of the LV (Pearson: -0.473/-0.408, $p<0.0001$) and the blood T1 mapping in the RV (Pearson: -0.439, $p<0.0001$).

### CONCLUSION

In patients with HF, the RV/LV-T2 ratio decreased in relation to the reduced oxygenation capacity of the blood.

### CLINICAL RELEVANCE/APPLICATION

The RV/LV-T2 ratio correlates with biventricular systolic function and may represent a marker to evaluate the severity of the disease in patients with HF or PAH.

## T3-SSCA05-2 GENDER-SPECIFIC IMPACTS OF ASYMPTOMATIC HYPERURICEMIA ON CARDIAC STRUCTURE AND FUNCTION IN HYPERTENSIVE PATIENTS: INSIGHTS FROM CARDIAC MAGNETIC RESONANCE IMAGING

Xinyuan Zhang (*Abstract Co-Author*) Nothing to Disclose
Si-shi Tang (*Abstract Co-Author*) Nothing to Disclose
Xue-Ming Li (*Abstract Co-Author*) Nothing to Disclose
Zhongqin Zhou (*Abstract Co-Author*) Nothing to Disclose
Yue Gao, MD (*Abstract Co-Author*) Nothing to Disclose
Wei-Feng Yan, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study uses cardiac magnetic resonance (CMR) to explore how asymptomatic hyperuricemia (HU) affects left ventricular (LV) function and structure in patients with essential hypertension and examines gender differences in these effects.

### METHODS AND MATERIALS

We included 225 patients with essential hypertension (125 males and 100 females), divided into 93 with asymptomatic hyperuricaemia (HU+ group) and 132 without (HU- group), along with 65 normotensive controls. Conventional LV function parameters and global myocardial strain measures—radial (GRPS), circumferential (GCPS), and longitudinal peak strain (GLPS)—were assessed using CMR. Pearson correlation and regression analyses evaluated the links between serum uric acid levels and CMR parameters across different genders.

### RESULTS

Ejection fraction remained stable across groups, but left ventricular global longitudinal peak strain (LV GLPS) decreased progressively from normotensive controls to the hypertensive without hyperuricemia (HU-) group, and further in the hypertensive with hyperuricemia (HU+) group. Additionally, both left ventricular global circumferential peak strain (LV GCPS) and global radial peak strain (LV GRPS) were lower in the HU+ group compared to controls. Left ventricular mass index (LVMI) and remodeling index (LVRI) increased progressively from controls, through the HU- group, to the HU+ group. Serum uric acid levels were significantly correlated with GRPS, GCPS, and GLPS. Furthermore, after adjusting for clinical factors, serum uric acid was independently associated with LV GLPS. In male patients, multiple regression analyses revealed independent associations of serum uric acid with LVMI and LVRI, whereas such associations were not observed in female patients.

### CONCLUSION

Asymptomatic hyperuriceamia is linked to a further decline in LV function in hypertensive patients, with significant associations between increased serum uric acid levels and decreased myocardial strain. Moreover, the impact of elevated uric acid on LV remodeling appears to be gender-specific.

### CLINICAL RELEVANCE/APPLICATION

Patients with essential hypertension and coexisting asymptomatic hyperuricaemia demonstrate more pronounced decreases in left ventricular motor function and structural changes compared to those without hyperuricaemia. These findings underline the significant correlation between elevated serum uric acid levels and myocardial strain impairments. It has been observed that elevated uric acid levels may have gender-specific pathophysiological effects on cardiac structure, suggesting the need for gender-tailored approaches in managing hypertensive patients with hyperuricaemia.

## T3-SSCA05-4 COMPARISON OF ECG GATING VERSUS PERIPHERAL PULSE GATING IN QUANTIFYING MYOCARDIAL IRON USING T2* MRI IN PATIENTS WITH THALASSEMIA MAJOR

Geetanjali Nanda, MD (*Abstract Co-Author*) Nothing to Disclose
Abhishek Suman, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Madhuri Barnwal (*Abstract Co-Author*) Nothing to Disclose
Kabir Mahajan, MBA (*Abstract Co-Author*) Nothing to Disclose
Vineeta Ojha, MD (*Presenter*) Nothing to Disclose

### PURPOSE

T2* MRI is the current non-invasive gold standard for myocardial iron quantification. As recommended in major societal guidelines (including SCMR), ECG gated T2* acquisition is standard of practice. The ECG gating entails additional time in attaching ECG electrodes on the chest before the scan. Sometimes, this is cumbersome in smaller children who are non-cooperative. The aim of this study was to compare the accuracy of ECG-gating versus peripheral pulse (PP) gating in estimating the T2* mapping values for myocardial iron quantification in Thalassemia Major patients.

### METHODS AND MATERIALS

109 thalassemia major patients referred for T2* MRI were prospectively recruited to undergo T2* MRI of heart and liver using both ECG -gating and peripheral pulse gating for heart. Images were analyzed using a dedicated cardiac MRI software by two independent observers and myocardial T2* was calculated by drawing a single septal ROI as previously described.

### RESULTS

The mean age of the study population was 22.72 y (range - 3-49 years) with male predominance (67 males). The median T2* of heart using ECG and PP gating was 34.35 ms; IQR: 16.43 and 32.91 ms; IQR:11.93, respectively. There was excellent intra-class correlation between the T2* of the heart using ECG gating and PP gating (ICC 0.97, $p<0.001$). There was excellent agreement (weighted kappa=0.988, 95% CI-0.902 to 1) between the ECG gating and PP gating methods for accepted T2* classification (>20 ms as normal, 10-20 ms as mild to moderate, and <10 ms as severe iron overload), with only one patient with normal T2* on ECG gating being classified as mild-moderate category on PP gated T2* MRI. Bland- Altman analysis revealed that the difference between the values obtained by two methods was more in those with higher T2* values (>30 ms) where it did not reclassify the patients (all normal myocardial iron).

### CONCLUSION

There is high degree of accuracy and agreement between ECG and PP-gated T2* MRI in quantifying myocardial iron in Thalassemia Major patients and in classifying them into normal, mild to moderate and severe groups using T2* MRI, which defines the recommended chelation therapy.

### CLINICAL RELEVANCE/APPLICATION

1. The findings suggest that PP gating can serve as a reliable alternative to ECG gating for myocardial iron quantification in Thalassemia Major patients, especially in situations where ECG gating is impractical or challenging.2. If incorporated into protocol, PG T2* MRI, may have the potential to expedite the imaging process. 3. This might also mean a step in the direction of sustainable MRI by not only decreasing overall scanner time per scan but also reduce wastage of raw materials like metallic electrodes, especially pertinent in LMIC countries like ours with huge Thalassemia burden.

## T3-SSCA05-5 METABOLIC SYNDROME AND 10-YEAR INCIDENCE OF SUBCLINICAL CORONARY HEART DISEASE IN MIDDLE ADULT LIFE

Ivana Isgum, PhD (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV;Research Grant, 3mensio Medical Imaging BV;Research Grant, Koninklijke Philips NV;Research Grant, Esaote SpA;Co-founder, Quantib BV;Shareholder, Quantib BV;Researcher, Quantib BV;;;
George R. Washko, MD (*Abstract Co-Author*) Spouse, Employee, Merck & Co, Inc
Bennett A. Landman, PhD (*Abstract Co-Author*) Nothing to Disclose
David R. Jacobs JR, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuankai Huo, PhD (*Abstract Co-Author*) Nothing to Disclose
Sangeeta Nair, DVM (*Abstract Co-Author*) Nothing to Disclose
Cora E. Lewis, MD (*Abstract Co-Author*) Institutional Research Grant, Novo Nordisk AS
James G. Terry, MS (*Abstract Co-Author*) Nothing to Disclose
Aravind Krishnan (*Abstract Co-Author*) Nothing to Disclose
Raul San Jose Estepar, PhD (*Abstract Co-Author*) Nothing to Disclose
Ravi Kalhan (*Abstract Co-Author*) Nothing to Disclose
John J. Carr, MD, MS (*Presenter*) Institutional Research Grant, Francisco Partners Management, LP;Investigator, Francisco Partners Management, LP;Institutional Research Grant, General Electric Company;Investogator, General Electric Company;Institutional Research Grant, Siemens AG;Researcher, Siemens AG;Institutional Research Grant, Medtronic plc;Investigator, Medtronic plc

**PURPOSE**

Metabolic Syndrome (MetS) encompasses a set of cardiometabolic risk factors that elevate the risk of cardiovascular diseases. This study investigates whether MetS in middle-aged individuals, who are initially free of coronary artery calcium (CAC), is predictive of incident CAC a biomarker of subclinical coronary artery disease (CAD).

**METHODS AND MATERIALS**

The study participants were part of The Coronary Artery Risk Development in Young Adults (CARDIA) Study, a community-based study with initial recruitment in 1985. Based on ATP-III criteria, we coded MetS positive when 3 or more of the following were present: waist circumference >102 cm in men or >88 cm in women; fasting triglyceride =150 mg/dl; HDL-cholesterol <40 mg/dl in men or <50 mg/dl in women; blood pressure =130/85 or treatment; fasting glucose =100 mg/dl or treatment at the year 25 exam(baseline, 2010-11). This report is a subset of 513 participants (347 females, 202 Black) all with CAC scores of zero at the 2010-11 exam who participated in the chest CT exams in 2020-22. The chest CT exams were analyzed using a deep-learning algorithm with additional expert review for the presence and amount of CAC. We evaluated the association between baseline MetS status and incident CAC using logistic regression models adjusted for study field center, age, race, sex, smoking status, alcohol intake, physical activity, and education.

**RESULTS**

At baseline (mean age 49.8 ± 3.6 years), 18.9% of participants had MetS. A decade later, 32.7% had incident non-zero CAC scores. Presence of MetS at baseline was associated with incident CAC, with unadjusted and adjusted odds ratios of 2.2 (95% CI, 1.4-3.4, $p<0.001$) and 2.3 (95% CI, 1.5-3.8, $p<0.001$), respectively.

**CONCLUSION**

Ten-year Incidence of CAC was almost 33% during middle-age and those with MetS had more than twofold increased risk of subclinical CAD. This finding underscores the importance of early cardiometabolic risk management in the prevention of subclinical atherosclerosis.

**CLINICAL RELEVANCE/APPLICATION**

Our findings indicate that community dwelling middle-aged adults with MetS are over twice as likely to develop incident subclinical CAD within ten years, highlighting the necessity of addressing cardiometabolic abnormalities early and across the lifespan.

## T3-SSCA05-7 Keynote Speaker: CMR for Assessment of Muscular Dystrophies

Felipe A. Sanchez, MD (*Science Invited Presenter*) Nothing to Disclose

## T3-SSCA05-8 Keynote Speaker: CMR Assessment of Inflammatory Diseases Affecting the Heart

Jadranka Stojanovska, MD, MS (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

T3-SSER01

**Emergency Radiology (Scientific Session 1)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: N228

Lee A. Myers, MD (*Moderator*) Nothing to Disclose
Bharti Khurana, MD, MBA (*Moderator*) Consultant, General Electric Company;Editor, Wolters Kluwer nv;Author, Cambridge University Press;Consultant, ROKIT Healthcare, Inc

**Sub-Events**

## T3-SSER01-1 IMAGING UTILIZATION OF SELF-NEGLECT MANDATE PATIENTS IN THE EMERGENCY DEPARTMENT

Bharti Khurana, MD, MBA (*Abstract Co-Author*) Consultant, General Electric Company;Editor, Wolters Kluwer nv;Author, Cambridge University Press;Consultant, ROKIT Healthcare, Inc
Zhou Lan (*Abstract Co-Author*) Nothing to Disclose
Sharmila Duraisamy, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Elder self-neglect, defined as the inability to perform essential self-care, is an emerging global public health problem. We hypothesize that older adults experiencing self-neglect have higher medical and imaging needs. We aimed to evaluate imaging patterns, and outcomes over four years in these patients compared to matched controls at Emergency Department (ED) visits, particularly comparing adherence to the self-neglect mandate.

### METHODS AND MATERIALS

This IRB-approved retrospective study, conducted at two major academic medical centers, utilized the enterprise data warehouse to identify patients of >60 years receiving a self-neglect mandate in the ED during 2019. Our study cohort consisted of 111 cases and 108 matched controls by age, gender, race, and time of ED presentation. An emergency radiology fellow systematically reviewed chart notes and imaging reports at the time of mandate (index visit) and for subsequent follow-up periods.

### RESULTS

The imaging utilization was higher among cases for radiographs ($p<0.001$), CT studies ($p<0.0002$) and overall imaging studies ($p<0.0001$). Additionally, cases who did not follow discharge recommendations had higher use of imaging during the initial visit ($p=0.018$) and on subsequent visits or readmissions ($p=0.02$). There was also a higher prevalence of substance use ($p=0.02$) and mental health disorder ($p=0.001$) among cases. Mortality rates were higher in the self-neglect patients (44%) compared to controls (6.5%; $p=0.0001$), and among self-neglect patients who did not follow discharge recommendations (52.1% vs. 30.2%; $p=0.02$). Nearly half of the patients in both groups showed no acute imaging findings on index visit. Pneumonia was more common in self-neglect patients (7.2% vs 1%; $p=0.05$) (Table 3)

### CONCLUSION

Imaging utilization, pneumonia, and mortality were significantly high in the self-neglect patients; particularly for those who did not follow recommendations.

### CLINICAL RELEVANCE/APPLICATION

Identifying at-risk patients and employing early intervention strategies can support this vulnerable population and decrease the strain on the already overwhelmed healthcare system.

## T3-SSER01-2 RADIOLOGIC ASSESSMENT ENABLES EARLY DETECTION OF INTIMATE PARTNER VIOLENCE

Alejandra Duran-Mendicuti, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana C. Rocha, MD (*Abstract Co-Author*) Nothing to Disclose
Bharti Khurana, MD, MBA (*Abstract Co-Author*) Consultant, General Electric Company;Editor, Wolters Kluwer nv;Author, Cambridge University Press;Consultant, ROKIT Healthcare, Inc
Patrick Lenehan, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Intimate partner violence (IPV) is a serious public health concern but can be difficult to detect in the clinical setting. Previous work has demonstrated that radiologists can raise suspicion for IPV before it is self-reported. We aimed to validate this observation on an expanded cohort and to assess the prevalence of radiologically suspected IPV among a group of patients who have never self-reported.

### METHODS AND MATERIALS

The study population consisted of females reporting physical IPV to our institution's violence prevention support program between 2013 and 2018 ("cases"; N = 1437 patients with 48792 imaging studies) and age- and race-matched females who did not report IPV ("controls"; N = 6693 patients with

102752 imaging studies). Reports were retrospectively reviewed in chronological order for each patient by two Emergency Radiologists who were blinded to case-control status. For each study, the radiologist indicated whether IPV was suspected based on observed injuries and overall findings. Rates of suspected IPV between cases and controls were compared using a crude odds ratio and Fisher-exact test. Potential for early detection was assessed by summarizing the distribution of time between the date of initial self-reporting and the date on which a radiologist first raised suspicion for IPV.

**RESULTS**

Suspicion of IPV was raised on a total of 433 out of 151,544 (0.29%) radiology reports reviewed, including 250 reports from cases and 183 reports from controls. At the patient-level, IPV was suspected by radiologists at any time for 159 of 1437 cases versus 129 of 6693 controls (11.1% vs. 1.9%; OR=6.3; p<0.0001). Upper and lower extremity fractures were among the most common injury patterns that raised suspicion for both groups, while facial fractures contributed disproportionately for cases (17 of 250 reports, 6.8%) compared to controls (2 of 183 reports, 1.1%) (OR=6.6; p=0.004). Among the 159 cases for whom IPV was suspected by a radiologist, the first radiologic evidence occurred a median of 1 day before initial self-reporting (IQR: 1865 days), and 64 of these cases (40.3%) were suspected by radiologists at least six months prior to self-reporting.

**CONCLUSION**

In a blinded retrospective review of radiology reports, suspicion for IPV was raised for a significantly higher fraction of cases than controls. Radiologic evidence of IPV was often present several months or years before it was first self-reported.

**CLINICAL RELEVANCE/APPLICATION**

Awareness of characteristic imaging patterns can help radiologists detect IPV before disclosure and facilitate earlier interventions to reduce the resultant cycles of physical and psychological harm.

## T3-SSER01-3 EVALUATING THE UTILITY OF PELVIC ULTRASOUND FOLLOWING A NEGATIVE CT PELVIS IN WOMEN PRESENTING TO THE EMERGENCY ROOM WITH ABDOMINAL PAIN

Tamanna Hossin (*Abstract Co-Author*) Nothing to Disclose
Joseph J. Cavallo, MD, MBA (*Presenter*) Nothing to Disclose

**PURPOSE**

Evaluate the utility of pelvic ultrasound (US) performed within 24 hours after a CT of the abdomen and pelvis (CTAP) in the emergency department (ED) for finding emergent pelvic gynecological pathology in instances where CT Pelvis did not report significant findings.

**METHODS AND MATERIALS**

We extracted imaging reports of patients seen across 9 EDs of a large northeast health system between 2017 and 2020 who received a pelvic US within 24 hours of having a CTAP. We established criteria for determining pelvic pathology in CTAP via expert author consensus between emergency medicine and radiology physicians, and used the criteria to screen out cases with abnormal CT pelvis findings. We reviewed US reports for the remaining cases to determine if pelvic US revealed any new information. Notable pelvic US findings were categorized into the following three groups: (1) incidental finding with no follow up needed, (2) significant finding that may need non-emergent outpatient follow up, and (3) emergent finding that may affect acute management.

**RESULTS**

Out of 1569 cases evaluated, 651 (41.5%) patients had negative pelvic findings on CTAP. Of these 651 cases, 433 (66.5%), 205 (31.5%), and 13 (2%) had US had findings that met criteria for group 1, 2, and 3, respectively. Group 3 US findings consisted of 1 case with gonadal vein thrombosis for which aspirin was started, 5 cases with pelvic inflammatory disease which required antibiotics, 5 cases with tubal abnormalities (i.e. hematosalpinx, hydrosalpinx) which did not affect ED management, and 2 cases with suspected retained products of conception (RPOC), one of which was ruled out clinically, and the other underwent dilation and curettage with subsequent pathology revealing no RPOC. Negative predictive value of a negative CT Pelvis for emergent pathology (group 3) was 98%. Looking at the broader dataset of 1569 cases, no cases of tubo-ovarian abscess (TOA) or torsion suggested on US were missed when using the criteria we established to identify abnormal CT Pelvis studies.

**CONCLUSION**

Pelvic ultrasound within 24 hours following a negative CT of the pelvis is unlikely to alter immediate management in the acute setting.

**CLINICAL RELEVANCE/APPLICATION**

In women presenting to the ED with abdominal pain, a pelvic ultrasound following a CTAP that shows no significant findings is unlikely to reveal emergent conditions such as tubo-ovarian abscess or ovarian torsion. The findings of this study suggest that over 98% of subsequent ultrasound examinations do not influence immediate clinical decisions. Therefore, limiting follow-up ultrasounds in these scenarios in the ED could decrease healthcare costs and reduce ED lengths of stay, thereby enhancing care efficiency and generating cost savings.

## T3-SSER01-4 THE FREQUENCY OF IMAGING MARKERS ADJUSTED FOR TIME SINCE SYMPTOM ONSET IN INTRACEREBRAL HEMORRHAGE: A NOVEL PREDICTOR FOR HEMATOMA EXPANSION

Xiaoming Qiu (*Abstract Co-Author*) Nothing to Disclose
Lei Song (*Presenter*) Nothing to Disclose

**PURPOSE**

Hematoma expansion (HE) is common in patients with intracerebral hemorrhage (ICH) and associated with a worse outcome. Imaging makers and shorter time from symptom onset are both associated with HE, but prognostic scores based on these parameters individually have not been satisfactory. We hypothesized that a score including both imaging markers of expansion, and time of onset, would improve prediction.

**METHODS AND MATERIALS**

Patients with supratentorial ICH within 6 h after onset were consecutively recruited from six centers between January 2018 and August 2022. Three markers were used: hypodensities, the blend sign, and the island sign. We first defined frequency of imaging markers (FIM) as the relationship between the number of imaging markers and onset-to-CT time (OCT). The time-adjusted FIM was defined as the ratio of the number of imaging markers to the onset-to-initial imaging time. Multivariate analysis was performed to determine the relationship between FIM and HE. Receiver operating curve analysis was used to identify potential threshold values of FIM that optimally predict HE. In addition, the sensitivity, specificity, positive and negative predictive values (PPVs and NPVs), and the area under the curve (AUC) of the optimal cut-off in predicting HE were calculated.

**RESULTS**

In total, 1488 patients were eligible for inclusion, of whom 418 had incident HE. Multivariate analysis showed that age, male sex, baseline Glasgow Coma Scale score, presence of intraventricular hemorrhage, and FIM were independent predictors of HE (odds ratio (OR) = 0.98, 95% confidence interval (CI) = 0.97-0.99; OR = 1.73, 95% CI = 1.28-2.35; OR = 0.87, 95% CI = 0.83-0.92; OR = 0.42, 95% CI = 0.28-0.62; OR = 7.82, 95% CI = 5.86-10.42, respectively). The optimal cut-off point for FIM in predicting HE was 0.63, with sensitivity, specificity, PPV, NPV, and AUC values of 0.69, 0.89, 0.71, 0.88, and 0.83, respectively.

**CONCLUSION**

The FIM adjusted for time since symptom onset is a significant predictor of HE. Its use may allow improved prediction of those patients with ICH who develop HE, and the score may be clinically applicable in the management of patients with ICH.

**CLINICAL RELEVANCE/APPLICATION**

FIM may be useful to further identify ICH groups with high-risk HE and optimize clinical decision-making.

## T3-SSER01-5 REDUCING PHYSIOLOGICAL ACUTE ADVERSE REACTIONS BY DE-EMPHASIZING RISK NOTIFICATION BEFORE IODINATED CONTRAST INJECTION IN CONTRAST-ENHANCED COMPUTED TOMOGRAPHY: A RANDOMIZED STUDY

Jia Xiaoqian, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To demonstrate the reduced physiological acute adverse reactions (PAAR) by de-emphasizing the potential risks of iodinated contrast media (ICM) to patients before ICM injection in contrast-enhanced computed tomography (CT).

**METHODS AND MATERIALS**

This was a prospective, randomized study and was approved by the Institutional Ethics Committee of our hospital. Prospectively enrolled 51884 patients undergoing contrast-enhanced CT from August 16, 2018 to December 16, 2019. Patients were divided into two groups based on their reservation methods. Patients who had in-person reservation were enrolled into the traditional group (Group A) where detailed risk factors of ICM were explained by a dedicated nurse before contrast injection; and patients with online reservation were enrolled in the de-emphasizing group (Group B) where patients obtained and signed an informed consent form including risk notification online without having detailed risk notification by a dedicated nurse before CT examination. After CT examination, patients were asked to stay for 30 minutes before leaving. The differences of PAAR and other clinical impact between the two groups were statistically analyzed.

**RESULTS**

There is no statistically significant difference in the incidence of ICM related hypersensitivity reactions (HSRs) between the two groups (0.17% vs. 0.16%, P = 0.766). Group B had reduced incidence rate of PAAR (0.22% vs. 0.40%, P<0.001), lower rate of patients experiencing anxiety (0.87% vs. 2.67%, P<0.001), and lower rate of refusing CT due to concerns about the risks of using ICM (0.23% vs. 1.33%, P<0.001); Additionally, Group B required no prep time for risk notification just before CT examinations (0 vs. 14 min) and saved 2 nurses per shift.

**CONCLUSION**

De-emphasizing the potential risks of using ICM to patients can minimize patient anxiety and ICM-related PAAR, reduce examination time and hospital staffing requirement.

**CLINICAL RELEVANCE/APPLICATION**

De-emphasizing the potential risks of using ICM to patients can minimize patient anxiety and ICM-related PAAR. In addition, this risk notification method can reduce examination time and demand for nursing requirement.

## T3-SSER01-6 SHATTERED BUT NOT OVERLOOKED: RADIOLOGICAL INSIGHTS INTO ABDOMINOPELVIC INJURIES FROM BOMB BLASTS IN A WAR-HIT COUNTRY

Zohaib Mallick, MBBS (*Abstract Co-Author*) Nothing to Disclose
Zahra Rahmatullah (*Presenter*) Nothing to Disclose

**PURPOSE**

Abdominopelvic injuries resulting from bomb blasts represent a critical area of concern, requiring detailed radiological assessment for effective management. This study analyzes the radiological and clinical findings from such incidents to provide insights into the most common injuries and subsequent diagnostic strategies.Objective: To delineate the patterns and implications of abdominopelvic injuries in bomb blast victims through comprehensive radiological and clinical profiling.

**METHODS AND MATERIALS**

We reviewed 160 patients with abdominopelvic injuries for first and second radiology investigations, including computed tomography (CT), ultrasound (US), X-ray (XR), and additional specialized procedures. Clinical parameters such as systolic and diastolic blood pressure and pulse rates were also examined to correlate physiological responses with injury severity. The demographic data of the patients involved in the study were analyzed to understand the distribution across different age groups and genders.

**RESULTS**

Among 160 bomb blast victims, initial radiological findings identified hemoperitoneum in 15 cases and abdominal wall injuries in 7, highlighting severe internal trauma. Vascular injuries were less common, reported in only 2 patients. Notably, visceral injuries were rare with only one case detected. The cohort was predominantly male (91.8%), aged 30-40 years, with systolic blood pressure peaks at 120 and 140 mmHg, and pulse rates around 110 bpm. Primary investigations predominantly utilized CT and US, essential for diagnosing and monitoring these injuries.

**CONCLUSION**

This study provides comprehensive insights into the radiological and clinical profiles of bomb blast victims with abdominopelvic injuries, highlighting the importance of immediate and sequential radiological evaluations. This research underscores the critical role of tailored diagnostic pathways in improving clinical outcomes for bomb blast victims.

## CLINICAL RELEVANCE/APPLICATION

The clinical relevance of this project lies in enhancing trauma care for bomb blast victims by improving diagnostic accuracy and treatment protocols.Key applications include:Refined Diagnostic Protocols: Data from this study supports the prioritization of CT and ultrasound in detecting critical conditions.Enhanced Trauma Management: Insights on common injury patterns can inform standardized emergency responses and training, optimizing care in mass casualty events.Policy and Preparedness: The findings can guide public health policies and preparedness strategies, particularly in conflict-prone areas.Overall, this project contributes to better patient outcomes through informed medical practices and emergency preparedness.
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# Abstract Archives of the RSNA, 2024

T3-SSHN02

**Science Session with Keynote: Head and Neck Imaging (Temporal Bone Imaging and Photon Counting CT)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: S403A

Bert De Foer, MD, PhD (*Moderator*) Nothing to Disclose
Alok A. Bhatt, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T3-SSHN02-1 Keynote Speaker: MRI of Cholesteatoma

Bert De Foer, MD, PhD (*Science Invited Presenter*) Nothing to Disclose

## T3-SSHN02-2 IMPACT OF SPATIAL RESOLUTION ON CT IMAGING OF MIDDLE EAR PROSTHESES: A COMPARATIVE STUDY OF MULTI-VENDOR SCANNERS WITH PHOTON COUNTING DETECTOR AND ENERGY INTEGRATING DETECTOR

John I. Lane, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Norbert G. Campeau, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Kevin J. Treb, PhD (*Abstract Co-Author*) Nothing to Disclose
Joseph R. Swicklik, RT, BS (*Abstract Co-Author*) Nothing to Disclose
Matthew Carlson, MD (*Abstract Co-Author*) Nothing to Disclose
John C. Benson, MD (*Abstract Co-Author*) Nothing to Disclose
Michael R. Bruesewitz, RT (*Abstract Co-Author*) Nothing to Disclose
Maryam Sadeghian Sharafi (*Presenter*) Nothing to Disclose

### PURPOSE

High spatial resolution is required for CT imaging of the small (sub-millimeter) middle ear prostheses, which is vital for determining complications after stapedectomy and ossiculoplasty and informing potential revision surgery. This study aims to evaluate the impact of spatial resolution for the visualization of stapes and ossicular replacement prostheses using photon counting detector (PCD) CT, energy integrating detector (EID) CT, and comb filters.

### METHODS AND MATERIALS

A collection of 21 common middle ear prostheses of various shapes and materials were placed within a head phantom and scanned on a PCD-CT (NAEOTOM Alpha, Siemens) and 3 EID-CT: 2 dual source CTs with comb filters (Flash and Force, Siemens), and a dual-layer CT without comb filter (7500, Philips). Scanning and reconstruction were performed following the clinical temporal bone protocols for each scanner, with a matched 120 kV and 80 mm field of view; sharp kernels/algorithms of Qr89, Ur77, Ur77, and YD; and minimal allowable slice thickness of 0.2, 0.4, 0.5, and 0.67 mm, respectively. Qualitative and quantitative assessments were performed for image quality, including visual inspection, volume rendering, line profiles, and full-width half measurement (FWHM) of the prostheses.

### RESULTS

PCD-CT provided images with the highest spatial resolution and detail, allowing clinically relevant assessment of prosthesis position relative to the coupled ossicular chain - rivaling that of direct visualization. The EID-CT scanner with comb filter provided good results, but had noticeable loss of detail compared to PCD-CT. For the EID-CT without a comb filter, a substantial loss of spatial resolution was observed, and characterization of prosthesis details became unfeasible. This was also quantitatively validated by the line profiles and FWHM measurements, which were 0.55 mm for PCD-CT, 0.78 mm and 0.94 mm for EID-CT with comb filters, and 1.09 mm for the EID-CT without comb filter. PCD-CT result showed a 49.54% improvement in FWHM compared to the EID-CT without comb filter. Among the 3 scanners with ultra-high-resolution (UHR) capabilities, PCD-CT had lower radiation dose (CTDIvol: 31.5 vs 46.7 and 51.4 mGy) and lower image noise (81.3 vs 93.0 and 274.8 HU) compared to the two EID-CTs with comb filters.

### CONCLUSION

PCD-CT provides dose-efficient UHR imaging for visualization and characterization of sub-millimeter structures of middle ear prostheses, which were degraded for the EID-CT with comb filters and undifferentiable for EID-CT without comb filters. Compared to EID-CT with comb filters, PCD-CT images show higher resolution and lower noise at lower radiation dose due to its high dose efficiency.

### CLINICAL RELEVANCE/APPLICATION

UHR PCD-CT provides accurate evaluations of stapes prostheses.

## T3-SSHN02-3 VALUE OF DUAL-LAYER SPECTRAL DETECTOR CT IN DIFFERENTIATING MIDDLE EAR CHOLESTEATOMA AND CHRONIC SUPPURATIVE OTITIS MEDIA

Wenguang Liu (*Abstract Co-Author*) Nothing to Disclose
Yiwen Sun (*Abstract Co-Author*) Nothing to Disclose
Xiaomin Liu (*Abstract Co-Author*) Nothing to Disclose
Shuangyuan Zhou, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the potential value of dual-layer spectral detector CT (DLCT) in differentiating middle ear cholesteatoma and chronic suppurative otitis media.

### METHODS AND MATERIALS

This prospective, institutional review board-approved study included sixty-six patients who were preliminary diagnosed as cholesteatoma or otitis media, and received DLCT scanning before surgery. Thirty-four patients were finally diagnosed cholesteatoma based on intraoperative or pathological findings. The conventional CT value, virtual mono-energetic images (VMIs) at 40keV and 70keV, slope of the spectral attenuation curve in Hounsfield units (?HU), electron density (ED), and effective atomic number (Zeff) were measured to quantitatively differentiate cholesteatoma and otitis media. Mann-Whitney test was used for comparison and the receiver operator curves (ROCs) was used to find out the best parameters.

### RESULTS

The VMI 40keV, and Zeff of cholesteatoma were significantly lower than that of the otitis media while ED was significantly higher ($p<0.001$), but conventional CT value and VMI 70keV were not significant difference. The spectral attenuation curve of cholesteatoma was arched upward, which was consistent with the curve of subcutaneous fat, while the curve of middle ear mastoiditis was down or relatively flat. The optimal cutoff values for VMI 40keV, ED, Zeff, ?HU were 45.9HU, 99.6, 7.0, and 0.67, with AUCs of 0.989 (sensitivity=100%; specificity=90.6%), 0.812 (sensitivity=97.1%; specificity=59.4%), 1.00 (sensitivity=97.1%; specificity=100%), and 1.00 (sensitivity=97.1%; specificity=100%), respectively.

### CONCLUSION

Spectral CT improved both quantitative and qualitative determination of cholesteatoma versus otitis media.

### CLINICAL RELEVANCE/APPLICATION

The preferred treatment and surgical methods of cholesteatoma and otitis media are different. Conventional CT is limited in differentiating these two diseases. Our result demonstrates spectral CT can distinguish the two diseases excellently and help clinicians make reasonable treatment plans effectively.

## T3-SSHN02-4 UNLOCKING THE FULL POTENTIAL OF ULTRA-HIGH-RESOLUTION PHOTON-COUNTING-DETECTOR CT WITH A DEDICATED DENOISING CONVOLUTIONAL NEURAL NETWORK FOR ENHANCED TEMPORAL BONE IMAGING

Matthew Carlson, MD (*Abstract Co-Author*) Nothing to Disclose
John I. Lane, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joseph R. Swicklik, RT, BS (*Abstract Co-Author*) Nothing to Disclose
Jamison Thorne, BSc (*Abstract Co-Author*) Nothing to Disclose
Michael R. Bruesewitz, RT (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
John C. Benson, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Koons (*Abstract Co-Author*) Nothing to Disclose
Shaojie Chang, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Ultra-high-resolution (UHR) photon-counting-detector (PCD) CT improves image resolution but also increases image noise. This requires use of smoother kernels, which yield resolution below the system's capability (0.125 mm in-plane). This work developed a denoising convolutional neural network (CNN) to reduce noise while preserving high spatial resolution for enhanced temporal bone visualization.

### METHODS AND MATERIALS

With IRB approval, a CNN was developed and trained on clinical temporal bone images (n=1885) to reduce noise and tested on 20 independent patient cases. All exams were conducted using the UHR mode on a dual-source PCD-CT (NAEOTOM Alpha, Siemens Healthcare). Images were reconstructed using iterative reconstruction at strength 3 (QIR3), slice thickness of 0.2 mm, clinical routine (Hr84) and the sharpest available kernel (Hr96). The trained CNN was applied to the 0.2 mm images reconstructed with the Hr96 kernel and QIR1. For each of the 20 test cases, three image series (Hr84-QIR3, Hr96-QIR3, and Hr96-CNN) were displayed side-by-side in a randomized order for blinded review by two experienced neuroradiologists to assess overall image quality and the delineation of three key anatomical structures: the modiolus, stapes footplate, and incudomallear joint. Images were ranked from 1 to 3, with 1 being the most preferred and 3 the least preferred; equal ranking was permitted.

### RESULTS

The trained CNN significantly reduced image noise—by approximately 80% compared to the highest resolution commercial images (Hr96-QIR3), and 50% relative to clinical routine images (Hr84-QIR3), while maintaining the ultra-high resolution. For overall image quality, Hr96-CNN images were ranked significantly higher than both Hr84-QIR3 ($p<0.001$) and Hr96-QIR3 ($p<0.001$). Both readers preferred the CNN denoising images for visualization of all three anatomical structures: the modiolus (Hr96-CNN/Hr84-QIR3/HR96-QIR3: 1/1.8/2.8, $p<0.001$), the stapes footplates (Hr96-CNN/Hr84-QIR3/HR96-QIR3: 1/1.94/2.88, $p<0.001$), and the incudomallear joint (Hr96-CNN/Hr84-QIR3/HR96-QIR3: 1/1.64/2.53, $p<0.001$).

### CONCLUSION

The proposed CNN significantly reduced image noise in UHR PCD-CT, enabling the use of the sharpest kernel with acceptable noise levels. UHR PCD-CT combined with CNN denoising significantly enhanced diagnostic image quality and improved visualization of key anatomy.

### CLINICAL RELEVANCE/APPLICATION

The resulting high-resolution images feature acceptable noise levels that not only improve anatomical delineation but also more precisely define the interfaces between metal prostheses and surrounding structures, enhancing temporal bone visualization.

## T3-SSHN02-5 PHOTON-COUNTING CT TEMPORAL BONE IMAGING CAN ACHIEVE BOTH HIGH SPATIAL RESOLUTION AND LOW RADIATION DOSE

Feng Feng, MD (*Abstract Co-Author*) Nothing to Disclose
Zhuhua Zhang (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Tong Su, MD (*Abstract Co-Author*) Nothing to Disclose
Yang Yu, MENG (*Abstract Co-Author*) Employee, Siemens AG
Yu Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Jiajing Tong (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the value of photon-counting CT combined with tin-filter technology for high spatial resolution imaging in temporal bone imaging, especially in detail display and radiation dose reduction advantage.

### METHODS AND MATERIALS

This study included 30 healthy volunteers who underwent both photon-counting CT and conventional EID CT for high spatial resolution imaging of the inner ear in the recent past. Photon-counting CT imaging was performed with sn100kV, collimation of 120*0.2mm, IQ set at 110, and the thinnest reconstructed slice thickness was 0.2mm with 0.1mm increment. EID-CT was performed with conventional parameters: 120kV, 200mAs, collimation of 96*0.6mm, and reconstructed image slice thickness of 0.6mm. Two experienced radiologists conducted a double-blind assessment on the delineation, details, and overall image quality of structures including stapes, incudomalleolar joint, cochlear foramen, and vestibular aqueduct using a 5-point scale. In addition, radiation doses between the two groups were also comparably analyzed.

### RESULTS

Twenty-seven patients were finally included in the study (35.19±16.38 years, 17 females). Photon-counting CT was superior to EID-CT for all observed structures (stapes 4.63±0.56 vs. 3.37±0.56 , incudomalleolar joint 4.53±0.51 vs. 3.87±0.57, cochlear foramen 4.97±0.18 vs. 4.40±0.50, and vestibular aqueduct 4.37±0.72 vs. 3.93±0.74, $P<0.05$ for all). At the same time, the radiation dose was significantly reduced by 64% (0.33±0.05 VS 0.92±0.28, $P<0.001$).

### CONCLUSION

Photon-counting CT ultra-high-resolution imaging combined with tin-filter technology can achieve higher image quality under less radiation dose conditions.

### CLINICAL RELEVANCE/APPLICATION

Photon-counting CT provides high spatial resolution inner ear imaging at ultra-low radiation doses, which is expected to expand the application of this examination and even be applied to routine physical examinations for the elderly population.

## T3-SSHN02-6 PHOTON-COUNTING-DETECTOR CT OUTPERFORMS STATE-OF-THE-ART CONE-BEAM CT IN ASSESSMENT OF DENTAL ROOT CHANNEL IMAGING

Markus Altenburger (*Abstract Co-Author*) Nothing to Disclose
Maximilian Russe, MD (*Abstract Co-Author*) Nothing to Disclose
Martin Peter Pichotka (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Wiebke Semper Hogg (*Abstract Co-Author*) Nothing to Disclose
Alexander Rau, MD (*Abstract Co-Author*) Nothing to Disclose
Stephan Rau, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Accurate treatment of dental root canals profits from sufficient imaging of the root canals. Especially untreated accessory root canals can lead to a persistence of symptoms. Therefore, high-resolution imaging of dental structures improves the outcome and is frequently warranted. This study systematically compared cone beam computed tomography (CBCT), energy-integrating CT (EID), and photon counting detector (PCD) CT scanners regarding their potential in dental high resolution imaging. For this, we employed a dental phantom with small artificial bore holes to simulate dental root channels.

### METHODS AND MATERIALS

In this experimental phantom study, bore holes of different sizes (diameters: 1000µm, 600 µm, 400 µm, 300 µm and 200 µm) were drilled into three bovine teeth mounted on a bovine rib as a jaw substitute. Subsequently, the phantom was scanned in a dental CBCT, a third generation EID-CT scanner and a first-generation PCD-CT scanner using established ultra-high-resolution protocols from clinical routine. Scans from a micro CT served as reference standard. Spatial resolution of the scans was evaluated via line profiles through the bore holes, whereby visibility compared to surrounding noise (signal = 2*SD) as well as width compared to the ground truth were assessed.

### RESULTS

PCD-CT was able to reliably delineate all bore holes in each of the three teeth down to 200 µm diameter. In contrast, in CBCT and EID-CT the bore holes could only be detected until 300 µm, whereby in EID-CT only two of three teeth, bore holes at 300 µm and 400 µm could be delineated. In addition, the PCD-CT shows a considerably smaller divergence of the bore hole width compared to the ground trough with 3.7% at 1000 µm and 10.6% at 300 µm compared to CBCT (12.6% and 22.3%) and EID-CT (11.0% and 38.2%).

### CONCLUSION

PCD-CT provided superior resolution, more accurate size measurement, and enhanced detection of dental root channels, thereby offering improvements in diagnostic capabilities compared to CBCT and EID-CT systems.

### CLINICAL RELEVANCE/APPLICATION

Clinical PCD-CT allows for detailed dental anatomy visualization superior to CBCT, potentially improving patient outcomes via more precise treatment planning and the possibility of opportunistic assessment of dental structures in routine examinations of the head.

# Abstract Archives of the RSNA, 2024

T3-SSIR02

**Science Session with Keynote: Interventional Radiology (Cutting-Edge Techniques in Image-guided Ablation and Biopsies)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: N227B

S. Nahum Goldberg, MD (*Moderator*) Consultant, Cosman Medical, Inc;Consultant, Sarasota Interventional Radiology
Bradford J. Wood, MD (*Moderator*) Royalties, Koninklijke Philips NV;Researcher, Koninklijke Philips NV;Intellectual property, Koninklijke Philips NV;Equipment Support, Koninklijke Philips NV;Researcher, Celsion Corporation;Research Grant, Celsion Corporation;Researcher, BTG International Ltd;Intellectual property, BTG International Ltd;Researcher, Boston Scientific Corporation;Research Grant, Boston Scientific Corporation;Intellectual property, Boston Scientific Corporation;Researcher, Siemens AG;Equipment Support, Siemens AG;Researcher, Sarasota Interventional Radiology;Researcher, NVIDIA Corporation;Research Grant, NVIDIA Corporation;Equipment support, AngioDynamics, Inc;Equipment support, Profound Medical Inc;Researcher, Canon Medical Systems Corporation;License agreement, Canon Medical Systems Corporation;Researcher, AstraZeneca PLC;Researcher, Exact Imaging Inc

**Sub-Events**

## T3-SSIR02-1 HEPATIC RADIOFREQUENCY (RF) ABLATION CAN INDUCE GLOBAL ACTIVATION OF MULTIPLE CELLULAR PROCESSES AND PATHWAYS

Justin Amadi (*Abstract Co-Author*) Nothing to Disclose
S. Nahum Goldberg, MD (*Abstract Co-Author*) Consultant, Cosman Medical, Inc;Consultant, Sarasota Interventional Radiology
Jens Ricke, MD, PhD (*Abstract Co-Author*) Research Grant, Sirtex Medical Ltd;Research Grant, Bayer AG;Research Grant, Terumo Corporation;Research Grant, Boston Scientific Corporation
Moritz Nikolaus Groper (*Abstract Co-Author*) Nothing to Disclose
Eithan Galun, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lukas Salvermoser (*Abstract Co-Author*) Nothing to Disclose
Matthias M. Stechele, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To comprehensively elucidate the transcriptional activation of hepatic cell populations following RF ablation.

### METHODS AND MATERIALS

Single cell RNA sequencing (scRNAseq) was performed on 8-10w old male C57/Bl6 mice 7d following standardized RF ablation (70Cx5min) of normal liver and appropriate controls. >6,000 cells/sample were analyzed using Seurat5.0.1 on R4.3.0. Normalized datasets were subject to unbiased analysis of >4000 highly variable genes to identify those elevated in ten major cell populations including hepatocytes, macrophages, stellate cells, lymphocytes, and endothelial cells. These genes were further evaluated by string-db pathway analysis (https://string-db.org/) including clustering by Markov Cluster Algorithm (MCL) methodology to define key active pathways and interactions.

### RESULTS

311 genes had 4-fold transcriptional elevation 7d post-ablation, with 171 genes showing 4-fold expression in >4 cell types. Hepatocytes, Kupffer cells, and macrophages had 311, 158, 127 genes activated, respectively. Activated genes clustered into 14 major pathways; the largest, most-central pathways included cytokines (n=47, including Ccl2 and Ccl7), immunomodulators (n=33, including Il-6, Il-10, Ctla-4, and Pdcd-1), and growth factors (n=40, including Egf, Pdgf, and Fgf). All 10 cell types showed activation of these three pathways. Additionally, genes of angiogenesis pathways were seen in endothelial cells and hepatocytes, and increased genes for collagen production were noted for hepatic stellate cells and cholangiocytes. T-cells had notable increases in Ccl2 and Ccl7, whereas NK-cells in Il-10 and Cd86.

### CONCLUSION

RF ablation can induce persistent activation of hepatic cellular processes throughout the entire liver. Factors that can promote tumorigenesis and immunologic pathways, potentially amenable to immunomodulation, are simultaneously activated.

### CLINICAL RELEVANCE/APPLICATION

Systemic effects of hepatic RF ablation can include immune-stimulation, as well as the generation of unwanted pro-tumorigenic growth factors that can negatively impact ablation outcomes, both when used as a standalone treatment or in combination with immunotherapy. Transcriptional scRNAseq analysis following RF ablation of normal liver permits a better understanding of the microenvironment of most metastases. This technology enables the development of targeted therapies and predictive biomarkers together, which will enable tailoring personalized interventional oncology for maximum efficacy

## T3-SSIR02-2 RECALCITRANT PELVIC PAIN- EFFECTIVENESS OF PULSED RADIOFREQUENCY ABLATION FOR PUDENDAL NEUROPATHY MANAGEMENT

Yin Xi, PhD (*Abstract Co-Author*) Nothing to Disclose
Sarah Attia, BS (*Abstract Co-Author*) Nothing to Disclose

Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Zuhair Zaidi, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Pudendal neuropathy, a disabling chronic pelvic pain condition, poses challenges for patients in obtaining lasting relief and functional improvements. Surgical intervention carries risks of iatrogenic nerve injury and perineural scarring while physical therapy has shown varying efficacy and requires many sessions to achieve benefits. Alternative therapeutic options include perineural injection or pulsed radiofrequency ablation (pRFA), currently described only in case reports. This study systematically evaluated pRFA's effectiveness against perineural steroid injections alone, aiming to provide clearer insights into lasting pain management for such patients.

**METHODS AND MATERIALS**

A retrospective review was conducted on 78 pudendal neuropathy patients who were diagnosed using clinical findings, responses to perineural injections, and MR neurography (MRN). These patients underwent a total of 149 standardized CT-guided pudendal nerve pRFAs at 42 degrees Celsius for 120 seconds, between October 2020 and April 2024. This study analyzed demographic data, pain levels, quality of life, analgesic usage, duration of pain relief, and responses to personal pain relief questionnaires to evaluate functional improvements following the pRFA treatment.

**RESULTS**

There were 78 patients with pudendal neuropathy, consisting of 37 males and 41 females with an average age of 58 years and an average BMI of 27.37. The pudendal pRFA provided pain relief for 17.2 ± 26.7 weeks, significantly longer than the 6.7 ± 8.9 weeks from anesthetic injections ($p<0.05$), with a similar post-pRFA average pain score of 1.4 ± 1.9 as with injections (1.7 ± 1.5; 1.8 ± 1.8) ($p=0.9$). No complications were observed except transient urinary incontinence, lasting for 2 hours in one patient. No correlations were observed between symptom onset and treatment efficacy; however, subjective quality of life improvements ($p<0.0001$) and less analgesic use were reported post-pRFA by 6-weeks ($p<0.05$).

**CONCLUSION**

pRFA provides more sustained pain relief for patients suffering from pudendal neuropathy than perineural steroid injections alone suggesting a potential advancement in treatment options that could significantly improve the functional ability and quality of life for those affected by this condition.

**CLINICAL RELEVANCE/APPLICATION**

Clinicians are encouraged to consider pRFA for pudendal neuropathy in treatment plans, particularly for those who have not found relief with traditional methods or perineural injections alone.

## T3-SSIR02-3 EFFICACY OF GELATIN SPONGE EMBOLIZATION IN REDUCING POST-RENAL BIOPSY HEMORRHAGE AND PREDICTORS FOR BLEEDING COMPLICATIONS FOLLOWING PERCUTANEOUS RENAL BIOPSY

Bedros Taslakian, MD (*Abstract Co-Author*) Nothing to Disclose
Tarub Mabud, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Mikhail Silk, MD (*Abstract Co-Author*) Nothing to Disclose
Frederic Bertino, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Ma, BA (*Abstract Co-Author*) Nothing to Disclose
Tommy Pan, MD, BA (*Presenter*) Nothing to Disclose

**PURPOSE**

Percutaneous renal biopsy (PRB) is the gold-standard for diagnosing kidney pathology. However, PRB carries a risk of clinically significant bleeding. This study aims to investigate the effectiveness of gelatin sponge embolization in reducing post-biopsy bleeding and highlight risk factors for bleeding complications following PRB.

**METHODS AND MATERIALS**

We performed an Institutional Review Board-approved retrospective review of the electronic medical record from 2013 to 2023 and identified patients who underwent native PRB. All PRB were performed by board-certified Interventional Radiologists or supervised IR residents/fellows. Demographic data included: age, gender, body mass index (BMI), baseline antiplatelet and/or anticoagulant use and medical comorbidities. Pre-procedural labs included: effective glomerular filtration rate (eGFR), urine protein, protein-creatinine ratio, hemoglobin/hematocrit and platelet count. Procedural data included: coaxial needle size, the use or non-use of gelatin sponge, biopsy device, number of passes, and imaging modality. Statistical analysis was performed using a logistic regression model that compared bleeding complications with gelatin sponge usage and covariates (antiplatelet/anticoagulant usage, pass number, and renal pathology).

**RESULTS**

Four hundred ninety-eight patients were studied (256 male, 242 female). The mean age was 50.1 years (SD ± 18.0 years). Gelatin sponge was used in 144 (28.9%) of patients. The average number of passes was 3.0 (SD ± 1.2). There were 94 (18.9%) incidences of bleeding complications within 30 days of the procedure, of which 29 (5.8%) required intervention with CT angiogram and transcatheter arterial embolization. Our regression model suggests that gelatin sponge usage during biopsy tract closure is not significantly associated with reduced odds of bleeding complications ($p = 0.213$). The number of passes was significantly associated with increased odds of bleeding complications ($p = 0.022$).

**CONCLUSION**

While gelatin sponge is a rapid and inexpensive embolic material, our results suggest it does not significantly reduce the incidence of clinically significant hemorrhage after PRB. The number of biopsy passes was a significant predictor of increased bleeding risk.

**CLINICAL RELEVANCE/APPLICATION**

Life-threatening renal hemorrhage following PRB has been reported up to 16%. While gelatin sponge has been reported to decrease the risk of bleeding after other IR procedures, it did not significantly decreasing the risk of bleeding after PRB.

## T3-SSIR02-4 ASSESSING THE DIAGNOSTIC ACCURACY OF TRANSPERINEAL PROSTATE BIOPSY: A RETROSPECTIVE STUDY

Soraia Damiao, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Cavalcante (*Abstract Co-Author*) Nothing to Disclose
Mariana Galupo (*Abstract Co-Author*) Nothing to Disclose

Laura S. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz H. Schiavon, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the accuracy of detecting prostate cancer (PCa) through the transperineal biopsy approach, assisted by multiparametric magnetic resonance imaging (mpMRI).

**METHODS AND MATERIALS**

Retrospective, single-center study through the analysis of medical records and images from transperineal prostate biopsy examinations of male patients between 2023 and 2024. All biopsies were performed after evaluating previous MRI exams; however, some were unavailable for analysis.

**RESULTS**

The study included 58 patients with an average age of 65 years and a mean PSA value of 15.3 ng/ml. Transrectal ultrasound examination identified lesions in 62.1% of patients (36), where 50% had a circumscribed lesion. In the peripheral zone, lesions were most commonly visualized (86.1%). Among those with lesions, 66.7% (24) were diagnosed with adenocarcinoma. Of those without lesions, 54.5% (12) were diagnosed as positive. Regarding the results of the anatomopathological analysis, 58 biopsies were analyzed, and it was found that 36 patients (37.9%) did not present affected fragments, while 22 patients (62.1%) were diagnosed with adenocarcinoma. Within this group diagnosed with adenocarcinoma, there were 13 patients (36.1%) with a Gleason score of 6 (3+3), 13 patients (36.1%) with a Gleason score of 7 (3+4), 4 (11.1%) with Gleason 9 (4+5), 3 patients (8.3%) with a Gleason score of 7 (4+3), 2 (5.6%) with a Gleason score of 8 (4+4), and 1 with a Gleason score of 10 (5+5). Among the 34 patients who had available information about the results of the prostate mpMRI, it was observed that the average prostatic weight was calculated at 49.5 grams, ranging from 5 to 111 grams. The distribution of findings in the PI-RADS score revealed that 41.2% of the sample (14) had a PI-RADS score of 4, while 23.5% (8) reached a PI-RADS score of 5, 17.6% (6) had a PI-RADS score of 2, and 11.8% (4) had a PI-RADS score of 3. 32 patients showed a correlation between the findings of the mpMRI study and the biopsy findings. Comparing the results of the mpMRI with the anatomopathological findings, it was found that, among the patients classified with a PI-RADS score of 2, 3 patients (40%) were diagnosed with adenocarcinoma, 3 patients with PIRADS 3, 9 patients with PIRADS 4, and 5 patients with PIRADS 5.

**CONCLUSION**

Tranperineal has proven to be a valuable approach for detecting prostate cancer. The importance of this strategy to improve diagnostic accuracy and treatment planning is emphasized.

**CLINICAL RELEVANCE/APPLICATION**

The study's results suggest that this method effectively identifies and characterizes prostate lesions, thus improving diagnostic accuracy and becoming an alternative in cases where transrectal biopsy has contraindications.

## T3-SSIR02-5 SOFTWARE-AIDED VERSUS VISUAL INSPECTION OF INTRAPROCEDURAL MINIMAL ABLATIVE MARGINS OF PATIENTS WITH LIVER TUMORS UNDERGOING PERCUTANEOUS THERMAL ABLATION (COVER-ALL): A RANDOMIZED, INTENT-TO-TREAT, PHASE 2, SUPERIORITY TRIAL

Kristy K. Brock, PhD (*Abstract Co-Author*) Grant, RaySearch Laboratories AB;License agreement, RaySearch Laboratories AB;Research support, Mirada Medical Ltd
Iwan Paolucci, PhD (*Abstract Co-Author*) Stockholder, Intuitive Surgical, Inc ;Stockholder, SOPHiA GENETICS
Yuan-Mao Lin, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan H. Fellman (*Abstract Co-Author*) Nothing to Disclose
Jessica A. Albuquerque (*Abstract Co-Author*) Nothing to Disclose
Caleb Oconnor (*Abstract Co-Author*) Nothing to Disclose
Bruno C. Odisio, MD, PhD (*Presenter*) Research Grant, Siemens AG;Consultant, Siemens AG;Speaker, Siemens AG;Research Grant, Johnson & Johnson;

**PURPOSE**

This study evaluates the use of a novel ablation confirmation (AC) method consisting of biomechanical deformable image registration (DIR) with AI-based autosegmentation and its impact on minimal ablative margins (MAM).

**METHODS AND MATERIALS**

Patients aged 18 or older with = 3 histology-agnostic liver tumors (1-5 cm) referred to percutaneous thermal ablation (PTA) at a quaternary cancer center were enrolled in this intent-to-treat, phase 2 clinical trial. All PTAs were performed with CECT imaging guidance, aiming to achieve MAM =5mm. Intraprocedural randomization (1:1) between experimental (AC method) and control (visual inspection) arms employed Pocock-Simon dynamic allocation to balance baseline covariates. Primary endpoint was MAM quantified by the AC method using intraprocedural pre- and post-ablation CECT images. The MAM quantified by AC method on the control arm was not disclosed to the operating physician. An interim analysis for superiority at 50% patient enrollment was performed to stop control arm enrollment. The MAMs were compared using a 2-sample t-test. Secondary endpoints included assessing 2-years oncological outcomes. Adverse events (AEs) were recorded with CTCAE v5.0. The study is registered with Clinicaltrials.gov: NCT04083378.

**RESULTS**

Between June 15, 2020, and October 05, 2023, 100 patients were enrolled (57.8 years [SD ± 13.2]; 61% male; 51% colorectal liver metastasis). At interim analysis with 50 patients, mean MAM (95% CI) was 5.87 mm (4.71-7.03) on the experimental arm (n = 24) vs 2.21 mm (1.08-3.34) on the control arm (n = 26), (P < 0.001). Control arm enrollment was then halted, with subsequent 50 patients enrolled in the non-randomized experimental arm, showing a mean MAM = 7.2 mm (95% CI 6.41-8.0). Categorical MAM evaluation for the entire experimental (n = 74) vs control (n = 26) arms demonstrated: MAM = 0 mm in 4% (3/74) vs. 46.2% (12/26); MAM > 0 - < 5 mm in 14.9% (11/74) vs. 38.5% (10/26); MAM = 5 mm in 81% (60/74) vs. 15.4% (4/26), respectively. After a median 24.7-month follow-up, local disease progression was noted in 15.4% (4/26) ablated tumors in the control arm vs 4% (1/24) in the experimental randomized arm (P = 0.34). Non-randomized group's 2-year follow-up is ongoing. Grade 1-3 AEs occurred in 5 patients (2 experimental, 3 control), with no Grade 4-5 AEs.

**CONCLUSION**

Intraprocedural use of our AC method significantly improved MAM and resulted in lower local disease progression rates, warranting its adoption as a standard-of-care for patients undergoing liver PTA.

**CLINICAL RELEVANCE/APPLICATION**

Intra-procedural AC methods' direct impact on ablation efficacy is underexplored, hindering widespread acceptance. This clinical trial findings endorse integrating our AC method into liver PTA practices.

## T3-SSIR02-6 Keynote Speaker: Elucidating the Cellular and Molecular Response to Tumor Ablation

S. Nahum Goldberg, MD (*Science Invited Presenter*) Consultant, Cosman Medical, Inc;Consultant, Sarasota Interventional Radiology

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T3-SSMK04

**Musculoskeletal Imaging (Elbow, Forearm, Wrist and Hand, Trauma and Fractures )**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: E450A

Kevin McGill, MD, MPH (*Moderator*) Consultant, Teleflex Incorporated
Russell W. Chapin, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T3-SSMK04-1 HIGH-RESOLUTION 3D CT SYNTHESIS FROM ULTRA-SPARSE VIEW X-RAY IMAGES USING 3D DIFFUSION MODELS

Xiang Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Matthew T. Tivnan (*Abstract Co-Author*) Nothing to Disclose
Wen-Chih Liu (*Abstract Co-Author*) Nothing to Disclose
Jayanth Pratap (*Abstract Co-Author*) Nothing to Disclose
Quanzheng Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Siyeop Yoon (*Abstract Co-Author*) Nothing to Disclose
Dufan Wu, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Despite radiation exposure and cost concerns, 3D Computed Tomography (CT) scans are the benchmark for selecting patient-specific implants and surgical planning. On the other hand, bidirectional X-rays are already a primary diagnostic tool in everyday medical practice. Recent advancements have seen generative AI models, such as diffusion models, become powerful in creating high-quality images, although generating 3D images demands significant memory, restricting resolution. In our research, we present a new method to create 3D CT images from X-ray images using an efficient 3D diffusion model. This approach aims to lessen the reliance on CT scans, provide quick access to 3D data, and reduce healthcare expenses.

### METHODS AND MATERIALS

This study included 290 patients and utilized body-part segmentation to exclude any casts. The 3D CT scans had dimensions of 256 × 256 × 160, corresponding to a resolution of 0.5 $mm^3$. We used a diffusion model, a type of generative AI that applies a diffusion process. In this process, a slight amount of noise is iteratively added to an image during the forward diffusion phase, and the model is trained to estimate noise components. To enable training of the 3D diffusion model on a single GPU, sub-regions were extracted from the X-ray images along the superior and inferior directions, using regional coordinates as conditional inputs. This training method allows the neural network to refine 3D Gaussian noise while maintaining the data's characteristics, ultimately synthesizing an image with the desired visual properties.

### RESULTS

The synthesized 3D CT images, synthesized from two X-ray images, accurately displayed the fracture at the same location as observed in the original CT scans. The synthesized 3D CT had a resolution of 0.5 mm. The time required to reconstruct was approximately 5 minutes per patient. This demonstrates the potential of the proposed generative AI model to provide accurate 3D geometric relationships between bones and fragments

### CONCLUSION

Initial results indicate that our diffusion model is capable of effectively synthesizing 3D CT volumes from bidirectional X-rays, accurately capturing the complex 3D geometric relationships. This method is designed to be computationally efficient, allowing it to be trained on a single GPU and facilitating rapid 3D CT synthetization.

### CLINICAL RELEVANCE/APPLICATION

There are multiple benefits to patients, hand surgeons, health care systems, and health care economics: (1) Patients can avoid additional radiation from CT scans; (2) simulated CT for all fractures could improve our understanding of distal radius fractures in general; (3) workflows for complex distal radius fractures would be streamlined, avoiding the delay of an additional scan.

## T3-SSMK04-2 IS RADIOGRAPHY STILL SUITABLE FOR STAGING KIENBOECK'S DISEASE? - RETROSPECTIVE ASSESSMENT OF 281 CASES WITH CONVENTIONAL RADIOGRAPHY AND COMPUTED TOMOGRAPHY

Paul Reidler, MD (*Abstract Co-Author*) Nothing to Disclose
Rainer Schmitt, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Hesse (*Abstract Co-Author*) Nothing to Disclose
Hannah Elena Gildein (*Presenter*) Nothing to Disclose

### PURPOSE

Comparison of diagnostic accuracy of conventional radiography (CR) and computed tomography (CT) for classifying Kienboeck's disease according to Lichtman.

### METHODS AND MATERIALS

Retrospective analysis of 278 patients (mean age 36.57 ± 12.61, 168 male) in a consensus reading by two musculoskeletal radiologists with 10 and 35 years of experience, respectively. A total of 281 lunate necroses were classified in CR and CT imaging based on the Lichtman classification (stages I, II, IIIa, IIIb, IIIc and IV corresponded to scores 1 to 6). Statistical analyses, including Wilcoxon signed-rank test, multinominal regression model, and weighted Cohen's kappa coefficient, were performed to evaluate scores for CR and CT.

### RESULTS

The most common rated stage in CR and CT imaging was stage IIIc with 122 (43.42%) and 171 (60.85%) cases, respectively, followed by stage IIIa (24.56%) for CR and stage IV (14.59%) for the CT assessment. In 188 out of 281 cases (66.90%), Kienboeck's disease was classified the same in both CR and CT imaging. Lichtman stage had to be upgraded in CT in 96 (34.16%) cases. Kienboeck's disease stage IIIa and IIIb were upgraded to stage IIIc after CT assessment in 24 (34.78%) and 23 (60.53%) cases, respectively. Overall, Kienboeck's disease was scored significantly higher in CT than in CR imaging (CT vs. CR: 4.66 (stage IIIc) ± 1.06 vs. 4.12 (stage IIIb) ± 1.23, $p < 0.001$). After adjusting for age, gender, affected hand side and time difference between CT and X-ray, there is a significant 2.05-fold increased likelihood for classifying Lichtman stage 3c with CT compared to CR.

### CONCLUSION

CT imaging is significantly more accurate than CR in determining the exact osseous stage of Kienboeck's disease.

### CLINICAL RELEVANCE/APPLICATION

In more than one third of the cases, the disease stage was upgraded in CT imaging, most commonly to stage IIIc, indicating a potential shift in therapy towards more destructive salvage procedures.

## T3-SSMK04-3 GANTRY-FREE CONE-BEAM CT ARTHROGRAPHY OF THE WRIST FOR FAST ONE-STOP-SHOP IMAGING OF SCAPHOLUNATE LIGAMENT TEARS

Henner Huflage, MD (*Abstract Co-Author*) Nothing to Disclose
Andreas Kunz, MD (*Abstract Co-Author*) Nothing to Disclose
Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Theresa Sophie Patzer, MD (*Abstract Co-Author*) Nothing to Disclose
Karsten Luetkens, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Modern x-ray systems are capable of high-resolution cone-beam CT (CBCT) imaging in addition to radiography and fluoroscopy. Combining different modalities in a multi-purpose setup holds potential for musculoskeletal interventions like CBCT arthrography. This study investigates the diagnostic performance of CBCT arthrography in patients with suspected scapholunate ligament (SLL) tears.

### METHODS AND MATERIALS

In this retrospective investigation, consecutive patients with acute wrist trauma and suspected SLL injuries who underwent CBCT arthrography with a multi-use x-ray system were enrolled between June 2021 and March 2024. Three radiologists independently assessed all examinations for tears of the palmar and dorsal SLL segments. Surgical reports served as the reference standard for calculating indicators of diagnostic performance and interreader reliability was analyzed by computing Krippendorff a. Radiation dose and examination time were recorded.

### RESULTS

A total of 47 patients (mean age, 44.94 ± 15.77 [SD] years, 25 men) were included. Injuries of the palmar and dorsal SLL segment found recorded in 19 individuals (40%) and 5 patients (11%), respectively. CBCT arthrography facilitated good sensitivity (range for all readers, 79-89%) and excellent specificity (93-96%) in the diagnostic assessment of the palmar SLL. For the dorsal SLL, sensitivity (80-100%) and specificity (95-98%) were even higher. Substantial interreader agreement was determined for both the palmar (a = 0.78, 95% CI: 0.68, 0.89) and dorsal SLL segments (a = 0.81, 95% CI: 0.65, 0.94). The dose-area product for CBCT arthrography was established at 106.6 ± 48.0 mGy*cm2 and the volume CT dose index was 3.4 ± 1.4 mGy. Without patient repositioning in between required, the median time between the final contrast injection and CBCT was 3:07 min (2:32-3:50 min).

### CONCLUSION

CBCT arthrography allows for excellent diagnostic performance in the detection and exclusion of SLL tears with low radiation dose and short examination times.

### CLINICAL RELEVANCE/APPLICATION

The ability to alternate between fluoroscopy and 3D imaging without patient repositioning facilitates a "one-stop-shop" approach for CBCT arthrography of the wrist with minimal examination time.

## T3-SSMK04-4 SUPPRESSION OF IMMOBILIZATION DEVICE ON WRIST RADIOGRAPHY TO IMPROVE FRACTURE VISUALIZATION

Hyemin Park (*Abstract Co-Author*) Nothing to Disclose
Seung Eun Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Keum San Chun, PhD (*Abstract Co-Author*) Nothing to Disclose
Joon-Yong Jung, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sungwon Lee, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study validates CycleGAN-generated splint-suppressed wrist radiographs, specifically focusing on fracture visualization.

### METHODS AND MATERIALS

We retrospectively collected 1748 patients who had wrist radiographs before and after immobilization device (splint) application. The dataset was divided into training (1696 patients with 5353 images) and testing sets (52 patients with 965 images). A CycleGAN-based model was trained to generate wrist radiographs with digitally removed splint densities (splint-suppressed wrist radiographs) from splint-applied radiographs. Two radiologists scored the generated splint-suppressed test set images for remaining splint density, hardware distortion, anatomical distortion, fracture clarity, and new artifacts using pre-defined semi-quantitative criteria. Subtraction images were created to quantify overall image alteration. A pre-trained YOLO8s fracture detection model was employed to assess fracture detection performance on three image groups of the test set: radiographs before splint application (original splint-less radiographs), splint-applied radiographs (original splint radiographs), and CycleGAN-generated splint-suppressed radiographs.

**RESULTS**

CycleGAN effectively generated splint-suppressed radiographs with minimal remaining splint density (97.99% had <10% remaining), hardware distortion (<10% in 100%), anatomy distortion (<10% in 99.63%), and fracture lesion changes (<10% in 100%). New artifacts were rarely introduced (absent in 97.54% of images). Importantly, the fracture detection model achieved improved precision (0.94 vs 0.92), recall (0.63 vs 0.5), and F1 score (0.75 vs 0.65) on the generated splint-suppressed images compared to the original splint radiographs, approaching the performance of the original splint-less radiographs (F1 0.71). Additionally, larger image alterations by CycleGAN corresponded to greater improvements in fracture detection.

**CONCLUSION**

CycleGAN successfully suppressed the density of splints from splint-applied wrist radiographs. Furthermore, the generated splint-suppressed radiographs enhanced the performance of wrist fracture detection in a pre-trained fracture detection model.

**CLINICAL RELEVANCE/APPLICATION**

This approach has the potential to improve fracture assessment in splint-applied patients.

## T3-SSMK04-5 ABSENCE OF T2 SIGNAL VOID IN VERTEBRAL ARTERY ON CERVICAL SPINE MRI IN TRAUMA PATIENTS: ASSOCIATED INJURIES AND OUTCOMES

Taeran Ahn, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the characteristics of cervical spine trauma patients with absence of T2 signal void in the vertebral artery (VA) on cervical spine MRI and evaluate the association between this finding and actual VA injury and subsequent brain infarction in the corresponding VA territory.

**METHODS AND MATERIALS**

This retrospective study analyzed 683 cervical spine MRI scans of acute trauma patients in a tertiary hospital with a regional trauma center from 2019 to 2023. Cases with absence of T2 signal void in the VA were identified, and injury characteristics were assessed. Angiography (CT angiography or conventional angiography) and brain MRI validated the absence of T2 signal void as an indicator of VA injury and brain infarction. Logistic regression analysis evaluated the relationship between injury characteristics and brain infarction, while descriptive statistics were used for bilateral VA involvement due to the small number of cases.

**RESULTS**

Forty-one patients (median age 60.0; 36 males) were included. Primary injury mechanisms were traffic accidents (48.8%), falls (36.5%), and being struck by an object (9.8%). T2 signal void absence was predominantly unilateral (95.1%). Most injuries were in the lower cervical spine (73.2%), with distraction being the most common morphology (26.8%). Coexisting disco-ligamentous complex (DLC) disruptions and cervical cord injuries occurred in 41.5% and 61%, respectively. VA occlusions and brain infarctions were confirmed in 43.9% and 29.3% of cases. Increased brain infarction risk was associated with distraction (OR=7.50, p=0.035), rotation/translation (OR=10.00, p=0.014), DLC disruption (OR=7.50, p=0.032), and spinal cord injury (OR=10.00, p=0.020). Bilateral VA involvement was observed in two patients, both developing brain infarction.

**CONCLUSION**

The absence of T2 signal void in the VA on cervical spine MRI is a notable indicator of vascular injury in trauma patients and is frequently associated with brain infarction. When accompanied by high-risk injury characteristics, such as severe injury morphology, DLC disruption, spinal cord injury, and bilateral VA involvement, focused consideration for brain MRI screening is warranted to assess for ischemic complications.

**CLINICAL RELEVANCE/APPLICATION**

Identifying the absence of T2 signal void in the VA on cervical spine MRI and recognizing high-risk injury patterns may help guide prompt treatment and prevent ischemic complications in trauma patients.

# Abstract Archives of the RSNA, 2024

T3-SSMK05

**Musculoskeletal Imaging (Image Guided Interventions and Infection)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: E353B

Richard J. Hughes, FRCR (*Moderator*) Nothing to Disclose
Hilary R. Umans, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T3-SSMK05-1 DIAGNOSTIC UTILITY OF PUBIC SYMPHYSEAL BIOPSY IN MALE PATIENTS WITH SUSPECTED OSTEOMYELITIS/SEPTIC ARTHRITIS

Jeremiah R. Long, MD (*Abstract Co-Author*) Nothing to Disclose
Motoyo Yano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicholas G. Rhodes, MD (*Abstract Co-Author*) Nothing to Disclose
Logan Haug, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the diagnostic utility of pubic symphyseal bone biopsy in the setting of suspected (PS) infection in male patients.

### METHODS AND MATERIALS

A multi-site retrospective study of male patients with pelvic CT or MR over a ten-year period within a single institution was performed. The radiology report database was searched for 13 key phrases such as “pubic symphyseal osteomyelitis” to identify suspected PS infections and puboprostatic fistulas (PPF). Findings were confirmed on imaging review by two musculoskeletal radiologists. All PS CT-guided and surgical biopsy culture results were recorded and considered positive based on growth of one or more organisms. Changes in clinical management were based on two criteria: 1) identification of an organism not seen in blood or urine within 1 month of biopsy and 2) change in the antibiotic regimen after sampling. Descriptive statistics, Fisher’s exact test and odds ratios were calculated using GraphPad Prism 10.

### RESULTS

69 of 112 patients underwent PS sampling: 37 CT-guided, 32 surgical, and 15 both. 22 patients had CT guided biopsy only, 9/22 (41%) with positive culture, 6 (27%) of which were management altering. 32 patients had surgical sampling only, 27/32 (84%) with positive culture, 22/32 (69%) of which were management altering. There is a nearly 8 times greater odds of obtaining a positive culture from surgical compared to CT guided sampling (OR 7.8, 95% CI 2.08-26.75, $p<0.01$). Surgical sampling results in nearly 6 times greater odds of management alteration (OR 5.9, 95% CI 1.8-17.6, $p<0.01$). Of the 15 patients undergoing both methods of sampling, 8 had negative culture with CT; 7/8 had subsequent positive culture with surgical sampling. 7/15 with positive culture on CT also had positive culture with surgical sampling. 6 of 37 patients had aspiration in addition to bone biopsy at the time of CT-guided sampling, 5 of which (83%) had positive cultures and 3 of which demonstrated pathogens not identified in bone. There was no significant association between PPF and culture positivity, however only 2/16 positive CT biopsies occurred in the absence of PPF.

### CONCLUSION

Surgical biopsies were significantly more likely to result in positive culture and lead to management change compared to CT guided biopsy. Aspiration at the time of CT guided procedure may increase yield of positive culture.

### CLINICAL RELEVANCE/APPLICATION

CT guided biopsy of PS infection has lower yield of organism identification than surgical sampling and may not be necessary if surgical intervention is planned.

## T3-SSMK05-2 UTILITY OF CALF MRI IN SUSPECTED LOWER EXTREMITY CELLULITIS

Andrew B. Ross, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Monica M. Cooley, MD (*Abstract Co-Author*) Nothing to Disclose
John S. Symanski, MD (*Abstract Co-Author*) Nothing to Disclose
Ian Kuckelman, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the yield of MRI of the calf for detecting complications of soft tissue infection and to identify risk factors predictive of MRI positivity.

### METHODS AND MATERIALS

We identified MRIs of the calf in adult Emergency Department and inpatients with suspected cellulitis between 01/01/2020 and 02/03/2024. The primary endpoint was identification of abscess or deep infection (fasciitis, myositis, or osteomyelitis). Data on clinical history, physical examination findings,

laboratory and culture results, imaging findings, and treatment were collected. Descriptive and secondary statistical analyses were performed to determine clinical and serologic factors associated with a positive MRI.

**RESULTS**

Our search identified 48 MRIs in 45 patients. The mean age was 60 (range 19-89) and 32 (71%) were male. Of the 48 studies, presenting complaints included pain (39/48, 81%), redness (36/48, 75%), fever (17/48, 35%), wounds or ulcerations (39/48, 81%), and/or evidence of sepsis (8/48, 17%). MRIs showed subcutaneous edema in 44 cases (92%) and were read as concerning for cellulitis in 32/48 cases (67%). 9/48 MRIs were positive (defined as showing suspected complications of infection, either a fluid collection or osteomyelitis); of those, fluid collections were found in 6 (13%) and suspected osteomyelitis in 3 (6%). 4/6 potential abscesses were sampled; of those, 3 were culture negative and one grew Citrobacter Koseri. Surgical biopsy was performed in 1/3 suspected osteomyelitis cases and was culture negative; the other two cases were unsampled and treated empirically. Only a history of ipsilateral surgery showed a significant association with a positive MRI (p=0.002). Specifically, a complicated infection was shown in 7/14 (50%) cases with ipsilateral surgery (3 cases of osteomyelitis and 4 cases of abscess) but in only 2/34 (6%) of cases without surgery (2 cases of abscess). Positive blood cultures and elevated serologies including WBC, ESR, and CRP were not significantly associated with a positive MRI. Almost all patients were treated with antibiotics(46/48, 95%) while surgical treatment of infection was rare (5/48, 10%) and occurred only in patients with a prior surgical history at the site.

**CONCLUSION**

In the absence of prior surgery, MRI of the calf is of low yield to detect abscess or deep infection in a patient with cellulitis.

**CLINICAL RELEVANCE/APPLICATION**

In patients with cellulitis and no history of prior surgery in the ipsilateral lower extremity, MRI of the calf is of low yield for identifying abscess or osteomyelitis.

## T3-SSMK05-3 ULTRASOUND-GUIDED HISTOTRIPSY FOR NON-INVASIVE TREATMENT OF SOFT TISSUE SARCOMA: FEASIBILITY STUDY

Steven B. Soliman, DO (*Abstract Co-Author*) Consultant, General Electric Company;Speaker, General Electric Company
Gunjan B. Malhotra, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose/objective is to assess the feasibility of using ultrasound (US)-guided histotripsy to treat various histotypes of excised human musculoskeletal benign masses and malignant soft tissue sarcomas (STS). Treatment was tracked with B-mode and shear wave elastography (SWE) imaging, then evaluated with hematoxylin and eosin (HE) histology. Analysis proved treatment of all samples.

**METHODS AND MATERIALS**

Histotripsy was delivered to 43 surgically excised human samples with a custom 1 MHz 8-element histotripsy US transducer using 1-cycle pulses at 100 Hz pulse-repetition frequency for 50 pulses per focal location and 0.5 mm spacings with peak negative pressure greater than 30 MPa. Histotripsy treatments were guided by B-mode US. SWE and B-mode were both collected pretreatment and posttreatment to evaluate the lesions. Following treatment, samples were processed for histologic analysis to evaluate damage generated by histotripsy.

**RESULTS**

Histotripsy created identifiable treatment across all histotypes, including liposarcomas, fibrous aggressive sarcomas, and various dedifferentiated sarcomas. B-mode imaging showed hypoechoic regions where treatment occurred and SWE measurement showed a 30-90% decrease in shear modulus of non-lipomatous tumors posttreatment, however, the shear modulus did not significantly change for lipomatous tumors. B-mode and SWE were shown to effectively identify the treatment by comparing pre and post treatment imaging.

**CONCLUSION**

US-guided histotripsy treatment resulted in effective STS necrosis in the treatment zone across multiple different sarcoma histotypes. There was an associated decrease in shear modulus measured by US SWE in histotripsy-treated non-lipomatous tumors, compared to no significant change in lipomatous tumors. Findings reflect differences in pre-treatment and post-treatment tissue stiffness based on the original tissue subtype.

**CLINICAL RELEVANCE/APPLICATION**

Currently, many STS histotypes are resistant to various forms of treatment including radiation, chemotherapy, and immunotherapy. Complete surgical excision is sometimes impossible. High Intensity Focused Ultrasound (HIFU) has limitations due to the off-target damage and slow treatment speed. Histotripsy utilizes microsecond-length, high-pressure ultrasound pulses to generate cavitation capable of mechanically liquefying tissue to acellular homogenate which the body then clears. Furthermore, histotripsy's precise targeting and tissue-selective ablation prevents off-target damage rendering it an ideal treatment method.

## T3-SSMK05-4 TRANSPEDICULAR-TRANSDISCAL CEMENT AUGMENTATION TECHNIQUE IN THE TREATMENT OF PROXIMAL JUNCTIONAL SPINAL FUSION HARDWARE FAILURE - A 5-YEAR FOLLOW UP

Mary E. Buchanan, MD (*Abstract Co-Author*) Nothing to Disclose
Corey K. Ho, MD (*Abstract Co-Author*) Nothing to Disclose
MK Lowry, MD (*Abstract Co-Author*) Faculty, Medtronic plc
David C. Gimarc, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Spinal deformity and degenerative disc disease can be surgically treated with fusion constructs, which can be extensive. Due to forced rigidity throughout the fused levels, the proximal junctional level is most prone to accelerated disc and endplate breakdown including hardware failure, and can cause pain, functional limitations, and the need for further revision. We report a novel technique describing a transpedicular-transdiscal approach of vertebral cement augmentation (VCA) at the proximal junctional level, and present a larger cohort over half a decade including longer-term follow-up and technical experience.

**METHODS AND MATERIALS**

We identified 45 patients undergoing 46 unique procedures of fluoroscopic-guided transpedicular-transdiscal VCA at the proximal junctional levels of their hardware fusion at our institution between 2016-2023. Cases were retrospectively reviewed in our EMR and PACS databases to identify their clinical presentation including timing of fusion and subsequent failure, procedure specifics, and follow-up course including the need for further spinal hardware revision.

### RESULTS

Cases were performed most commonly at the mid thoracic (n=34, 73.9%), and upper thoracic and lumbar regions (each n=6, 13.0%). Hardware failure was identified by imaging a median of 43.5 days after the surgical fusion (range 4-1250 days). Patients experienced an average VAS pain reduction of 2.2 between pre- and post-procedural assessments. Patients had an average of nearly 2 years of follow-up data (565 days; range 9-2480 days). 10 patients (21.7%) required further surgical revision 49-1178 days (mean 393, median 202 days) after the primary VCA procedure due to continued pain, kyphosis, and progressive junctional breakdown.

### CONCLUSION

Transpedicular, transdiscal VCA is a safe and effective procedure that can treat proximal junctional level failure in spinal fusion patients. This can delay and possibly avoid the need for subsequent revision surgery.

### CLINICAL RELEVANCE/APPLICATION

The early recognition of proximal junctional failure/kyphosis with spinal fusion constructs is an important diagnostic indicator of failing hardware, and can progress to further complications and revision. Our novel VCA technique has been shown to effectively treat symptoms and reduce further breakdown in many patients, avoiding or delaying the need for subsequent surgical revision.

## T3-SSMK05-5 CT-GUIDED PERINEURAL STEROID INJECTIONS AND CONTINUOUS FREQUENCY ABLATIONS FOR GENITOFEMORAL NEURALGIA WITH A HISTORY OF INGUINAL HERNIA: WHICH ONE IS BETTER?

Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Alex Iancau, BS (*Abstract Co-Author*) Nothing to Disclose
Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Sarah Attia, BS (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study was to evaluate the utility and efficacy of CT-guided perineural injections and continuous radiofrequency ablations (cRFA) for the treatment work-up for clinically suspected genitofemoral neuralgia confirmed on MR neurography (MRN) for patients with a history of inguinal hernia diagnosis and repair. Our hypothesis was that cRFA is therapeutically more effective than the perineural injection alone.

### METHODS AND MATERIALS

In this retrospective cross-sectional study, electronic medical records were searched for patients with a history of an inguinal hernia who had underwent MRN between the years of 2014 to 2024 for clinically suspected genitofemoral neuralgia. A consecutive series of 31 patients were included. Patient demographics, pain location/level/duration, previous work-up for the same indication, MRN imaging results, and work-up after MRN were noted. Patients who have a history of inguinal hernia diagnosis and repair as well as CT-guided perineural steroid injection or CT-guided cRFA treatment plus perineural steroid injection were included. Final diagnosis of genitofemoral neuropathy was made by multiple diagnostic criteria, including clinical symptoms and response to therapy. Treatment choice and their success rates were evaluated. Descriptive statistics were derived.

### RESULTS

Among 31 patients included, 7 (21.9%) were women and 24 were men (75%) of ages 55+/-16.31. All had good quality imaging studies without motion degradation. All 31 patients had inguinal hernia and all 31 had subsequent MRN work-up, yet only 27 (87.1%) of the patients had a history of inguinal hernia repair. All 31 (100%) patients were treated with CT guided perineural steroid injections and among them- 6 (19.4%) were followed up with cRFA. On average, it took 85.8+/- 112.6 days for the pain to return post perineural steroid injection. The pain improved significantly by -6.1+/-3.9 pain levels on a visual analogue scale of 1-10 (p-value = 6.72E-10). On an average, it took 117.8+/- 109.4 days for the pain to return post RFA. The pain improved significantly by -7.2 +/- 6.8 pain levels (p-value = 0.020) after RFA. There was not a statistically significant difference between the pain improvement (p-value = 0.59) or the time for the pain to return (p-value = 0.87) between CT guided perineural steroid injection and RFA.

### CONCLUSION

Both CT-guided perineural injection and RF ablation are similarly therapeutically effective for genitofemoral neuralgia related to inguinal hernia and its post-hernia repair complications.

### CLINICAL RELEVANCE/APPLICATION

Depending upon patient preferences, either CT-guided perineural injection or RFA can be used for targeted treatments for genitofemoral neuralgia related to inguinal hernia.

## T3-SSMK05-6 MSKI-RADS: AN MRI-BASED MUSCULOSKELETAL INFECTION REPORTING AND DATA SYSTEM FOR THE DIAGNOSIS OF EXTREMITY INFECTIONS

William B. Morrison, MD (*Abstract Co-Author*) Co-founder, Trace Orthopedics;Patent agreement, Trace Orthopedics;Consultant, AprioMed AB;Patent agreement, AprioMed AB;Consultant, Centinel Spine, LLC;Consultant, Medical Metrics, Inc
Yin Xi, PhD (*Abstract Co-Author*) Nothing to Disclose
Mina Guirguis (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Karim Salhadar (*Abstract Co-Author*) Nothing to Disclose
Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Angela He, BS, BA (*Presenter*) Nothing to Disclose

### PURPOSE

Current terms used to describe MRI findings for musculoskeletal (MSK) infections are nonspecific and inconsistent. Thus, it is critical to create a RADS system for reporting them. The purpose of the study is to develop and validate a musculoskeletal infection classification and MRI-based scoring system.

### METHODS AND MATERIALS

In this retrospective cross-sectional internal validation study, Musculoskeletal Infection Reporting and Data System (MSKI-RADS) was designed. Adult patients of all genders with radiographs and MRI studies for suspected extremity infections between June 2015 and May 2019 were randomly included

with a known reference standard. The scoring categories included: 0 - incomplete imaging, I - negative for infection, II - superficial soft tissue infection, III - deeper soft tissue infection, IV - possible osteomyelitis (OM), V - highly suggestive of OM and/or septic arthritis, VI - known OM, NOS - nonspecific bony lesions. Twenty MSK readers from 13 institutions performed validation. Interreader agreement (intraclass correlation coefficient (ICC)), sensitivity of MSKI-RADS were calculated and accuracies of final diagnoses rendered by readers were compared using generalized estimating equations for clustered data.

**RESULTS**

Among 208 total radiographic and MRI image sets from 208 unique patients, male:female ratio was 63.9:36.1 with average age± SD of 55.1 ± 12.6 years and 55.1 ± 14.4 years, respectively. There was 20 Class I, 34 Class II, 35 Class III, 30 Class IV, 35 Class V, 18 Class VI, and 36 NOS. Moderate interreader agreement was observed among 20 readers (ICC: 0.7; 95% CI: 0.66, 0.75). There was no evidence of correlation between reader experience and overall accuracy (P = 0.94). Highest sensitivity was for MSKI-RADS I and NOS at 88.7% (95% CI: 84.6%, 91.7%). Sensitivity was 72.6% (95% CI: 63.4%, 80.1%) for MSKI-RADS V. Overall reader accuracy using MSKI-RADS across all patients was 64.9%±4.7%, higher than final reader diagnoses at 54.8%±6.8% (P<.001).

**CONCLUSION**

MSKI-RADS is a valid, reliable system for standardized terminology and recommended management of imaging findings of peripheral extremity infections across various MSK-fellowship-trained reader experience levels.

**CLINICAL RELEVANCE/APPLICATION**

By reducing confusion and minimizing usage of misleading terms, MSKI-RADS offers the potential to improve inter-disciplinary communication when treating patients with peripheral extremity infections. Its use can aid in efficient management decisions, improved patients outcomes, and better longitudinal collection of data for future research.

# Abstract Archives of the RSNA, 2024

T3-SSMS02

**Multisystem (New Horizons in the Diagnosis and Management of Patients with Liver Disease and Beyond)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: S401

Refky Nicola, MSc, DO (*Moderator*) Royalties, RELX
Mindy X. Wang, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T3-SSMS02-1 RADIOLOGY-PATHOLOGY CORRELATION: A SAFEGUARD AGAINST MISSED CANCER DIAGNOSIS IN CT-GUIDED OMENTAL AND MESENTERIC BIOPSIES

Francesca Rigiroli, MD (*Abstract Co-Author*) Nothing to Disclose
Olga R. Brook, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Alexander Brook, PhD (*Abstract Co-Author*) Nothing to Disclose
Lutfullah Sari, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To analyze rate of malignancy on follow-up of concordant, discordant, and indeterminate non-malignant results of CT-guided mesenteric and omental biopsies.

### METHODS AND MATERIALS

In this retrospective, IRB-approved study, consecutive patients undergoing CT-guided omental biopsy between March 2005 and August 2021 were included. Concordance between pathology results and imaging findings was assessed by procedural radiologists. Definitions: concordant, for malignant biopsy results or benign pathology where imaging findings agree; discordant, if pathology results were not congruent with imaging; and indeterminate, if imaging could be explained by pathology, but could also reflect malignancy. Rate of malignancy and time to diagnosis were determined for each category. The tissue density was determined by drawing an ROI at the level of the targeted biopsy area encompassing the maximum possible area within the lesion.

### RESULTS

204 omental and mesenteric biopsies were included. Pathology showed non-malignant result in 41/204 (20%), further classified by radiology-pathology concordance evaluation as discordant in 24/41 (59%), indeterminate in 7/41 (17%), and concordant in 10/41 (24%). The prevalence of malignancy on follow-up was higher in discordant (13/24, 54%) and indeterminate (2/6, 33%) groups vs. concordant cases (0%), p<.001. There were 15/41 (37%) patients with final diagnosis of malignancy that would have been missed if radiology-pathology concordance evaluation had not been performed. The discordant and indeterminate groups demonstrated lower median lesion density (-63 HU, IQR -76- -41 and -53 HU, IQR -62- -46, respectively) and infiltration percentage (10%, IQR 10-10 and 10%, IQR 10-30, respectively) compared to the concordant group (-37 HU, IQR -48- -12 and 30%, IQR 10-35) (p= 0.02 and p= 0.01, respectively). Median time to diagnosis was shorter with repeat biopsy (18 days, IQR 9-34) and surgery (38 days, IQR 17-63) vs. imaging (185 days, IQR 107-239) and clinical follow-up (330 days, IQR 240-373), p<.001.

### CONCLUSION

The prevalence of malignancy was high in discordant (54%) and indeterminate (33%) cases of radiology-pathology concordance. Routine radiology-pathology concordance evaluation prevented missed cancer diagnosis in 37% of patients with non-malignant pathology result of the index CT-guided omental and mesenteric biopsies.

### CLINICAL RELEVANCE/APPLICATION

Implementing a standardized radiology-pathology concordance assessment can identify patients who are at risk for missed malignancy.

## T3-SSMS02-2 INDICATORS OF NEAR-INFRARED SPECTROSCOPY (NIRS) AND CT PERFUSION OF THE LIVER AFTER LIVING DONOR LIVER TRANSPLANTATION

Adham Ikramov (*Abstract Co-Author*) Nothing to Disclose
Ravshan Ibadov (*Abstract Co-Author*) Nothing to Disclose
Azimjon Usmonov (*Abstract Co-Author*) Nothing to Disclose
Khanum V. Abdukhalimova, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nigora Djuraeva, MD, PhD, DSc (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the relation between oxygenation parameters and CT perfusion of liver tissue in the early postoperative period in patients undergoing liver transplantation from living related donors.

**METHODS AND MATERIALS**

A single-center study was conducted from 2022 to 2024 on recipients of 96 liver transplantation from living related donors. All patients underwent continuous monitoring of regional liver tissue oxygen saturation (LSrO2) using NIRS (Equanox™ device with 3 and 4 wavelengths (Nonin Medical, Plymouth, Minnesota)) within the first 24 hours after surgery, with the NIRS sensor attached to the level of the liver allograft. One week after surgery, CT perfusion parameters of the liver (AF-arterial flow (ml/100ml³/min), PF-portal flow (ml/100ml³/min)) were determined using a 640-slice wide-detector computed tomography. To assess the correlation between the indicators, a Pearson correlation analysis was conducted.

**RESULTS**

The average LSrO2 value in all patients in the first hours of observation was 73±4.5, then by 24 hours of observation it reached 75±4.3. For the group of patients without postoperative complications, conditional normal levels of CT perfusion parameters were determined: AF - 34.47±9.27 ml/100ml³/min, PF - 153.55±4 ml/100ml³/min, which correlated with LSrO2 values at 24 hours (r=0.376 and r=0.437). After surgery, vascular complications were observed in 15 patients (15.6%), including arterial complications in 11 patients (11.4%) and venous complications in 3 patients (3.1%). The mean LSrO2 value in these patients was 48±3.2. CT perfusion parameters, expressed as AF and PF indexes, did not have significant correlation with LSrO2 at 24 hours (r=0.095 and r=0.059). However, within 1 week of the postoperative period, recipients with thrombotic complications experienced changes in perfusion parameters: the mean AF values were 21.8±0.6 ml/100ml³/min, PF - 185.6±4.7 ml/100ml³/min.

**CONCLUSION**

Reduction LSrSO2 levels in liver tissue may serve as a predictor of vascular complications in liver transplant recipients, confirmed by a decrease in AF perfusion and an increase in PF compared with without postoperative interventions.

**CLINICAL RELEVANCE/APPLICATION**

NIRS combined with CT liver perfusion is a new monitoring tool that provides valuable information on hepatic blood flow and oxygenation immediately after liver transplantation. It can be easily practiced and interpreted, but more research is still recommended for its use.

## T3-SSMS02-3 IMPLICATIONS OF VIRTUAL REALITY IN RADIOLOGY: PRESENT AND FUTURE APPLICATIONS - A SYSTEMATIC REVIEW

Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Bedayat, MD (*Abstract Co-Author*) Nothing to Disclose
Soheil Kooraki, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Zaki, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Virtual reality (VR) is ushering in a new era across various medical domains, offering promising applications ranging from education to treatment. As VR technology rapidly evolves, it's crucial to stay abreast of its implications, particularly in the field of imaging. This study systematically reviews the literature to assess the latest developments and potential impacts of VR in radiology.

**METHODS AND MATERIALS**

We conducted a systematic search of PubMed and Google Scholar using a predefined search string encompassing keywords related to "radiology" and "virtual reality." This search aimed to comprehensively gather relevant literature pertinent to our study objectives. Following predefined inclusion criteria, we conducted data extraction using structured sheets.

**RESULTS**

Our review revealed that VR is revolutionizing multiple aspects of radiology. It notably enhances education and training by simulation-based learning, thereby augmenting the skills of medical professionals. In procedural accuracy, particularly in interventional radiology, VR offers real-time guidance, ensuring precise navigation during complex procedures and ultimately improving patient outcomes.Moreover, VR facilitates connectivity and collaboration in healthcare by enabling telemedicine and remote consultations. This breaks down geographical barriers, promotes interdisciplinary teamwork, and facilitates knowledge exchange among professionals. Additionally, VR streamlines workstation tasks for radiologists, optimizing workflow efficiency and enhancing image interpretation and analysis speed and accuracy.

**CONCLUSION**

Our systematic review underscores the potential transformative impact of VR on various aspects of radiology. As VR technology continues to advance, it presents promising opportunities for further innovation and enhancement within the field, promises a future of improved patient care and outcomes.

**CLINICAL RELEVANCE/APPLICATION**

With the increasing demand for imaging and the need for radiologists, VR-dependent technology not only improves workstation efficacy but also potentially enhances accuracy and facilitates remote working.

## T3-SSMS02-4 COMPARING QIBA CTVOL CLASSIFICATIONS WITH RECIST RESPONSE CATEGORIES

Daniel C. Sullivan, MD (*Abstract Co-Author*) Nothing to Disclose
Lawrence H. Schwartz, MD (*Abstract Co-Author*) Nothing to Disclose
Nancy A. Obuchowski, PhD, MS (*Abstract Co-Author*) Research Consultant, Siemens AG;Research Consultant, IBM Corporation;Research Consultant, Elucid Bioimaging Inc;Research Consultant, Takeda Pharmaceutical Company Limited
Ying Tang, PhD (*Abstract Co-Author*) Nothing to Disclose
Hao Yang (*Abstract Co-Author*) Nothing to Disclose
Binsheng Zhao, DSc (*Presenter*) Royalties, Varian Medical Systems, Inc;License agreement, Keosys SAS;License agreement, Hinacom Software and Technology, Ltd;

**PURPOSE**

CT volumetry provides more reproducible measurements of tumor size compared to unidimensional RECIST, enabling better estimation of changes in tumors over time. However, the lack of data validating tumor volumetry as a response assessment biomarker has hindered widespread adoption. The purpose of this study was to assess agreement between CT volumetry change classifications derived from QIBA Profile cut points (i.e., QIBA CTvol classifications) and the RECIST categories.

## METHODS AND MATERIALS

Target lesions in lung, liver, and lymph nodes were randomly chosen from patients in 10 historical phase III clinical trials for various cancer types, ensuring a balanced representation of lesion types, diameter ranges described in the QIBA Profile, and variations in diameter change magnitudes. Three radiologists independently segmented these lesions at baseline and follow-up scans using two different software tools. Two types of disagreements were assessed: (i) substantive disagreement, where the disagreement between QIBA CTvol classifications and RECIST categories could not be attributable to improved sensitivity with volumetry, and (ii) disagreement potentially due to improved sensitivity with volumetry. The proportion of lesions with disagreements between QIBA CTvol and RECIST, as well as type of disagreements, was reported along with 95% CIs, both overall and within subgroups representing various factors.

## RESULTS

2,390 measurements from 478 lesions (158 lung, 170 liver, 150 lymph node) in 281 patients were included. QIBA CTvol agreed with RECIST in 66.6% of interpretations, while 33.4% showed discrepancies, categorized as substantive disagreement (i) in 1.5% (95% CI: [0.8%, 2.1%]) and disagreement type (ii) in 31.9%. Scanner vendor (p=0.584), segmentation tool (p=0.331), and lesion type (p=0.492) were not significant predictors of disagreement. However, significantly more disagreements were observed for larger lesions (>=50mm, as per the large size category defined in the QIBA Profile).

## CONCLUSION

We conclude that QIBA CTvol classifications agree with RECIST categories.

## CLINICAL RELEVANCE/APPLICATION

Validation of QIBA CTvol classifications facilitates the use of precise CT volumetry, which is crucial for tracking tumor changes, improving treatment assessment, and guiding clinical decision-making.

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RSNA 2024
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# Abstract Archives of the RSNA, 2024

T3-SSNR07

**Science Session with Keynote: Neuroradiology (Movement Disorders)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: N229

Alexander M. Khalaf, MD (*Moderator*) Nothing to Disclose
Timothy J. Kaufmann, MD, MS (*Moderator*) Consultant, SpineThera

**Sub-Events**

## T3-SSNR07-3 WHITE MATTER ABNORMALITIES IN CHILDREN WITH TYPE 2 AND 3 SPINAL MUSCULAR ATROPHY: A DTI-BASED WHITE MATTER MICROSTRUCTURE AND NETWORK ANALYSIS

Yujian Liang (*Abstract Co-Author*) Nothing to Disclose
Pei Xiang (*Abstract Co-Author*) Nothing to Disclose
Yingqian Chen (*Abstract Co-Author*) Nothing to Disclose
Huirong Nie (*Presenter*) Nothing to Disclose

### PURPOSE

Spinal muscular atrophy (SMA) is an autosomal recessive disorder caused by a mutation in the survival motor neuron 1 (SMN1) gene on chromosome 5 that results in reduced expression of survival motor neuron (SMN) protein. Although this disease is characterized by progressive muscle weakness and atrophy, previous studies indicated SMA is a multisystem disease. Moreover, evidence from SMA patients and animal models suggests that it causes not only lower motor neuron degeneration but also extensive brain involvement. In this study, we aimed to investigate the changes in brain white matter microstructure and network by using diffusion tensor imaging (DTI) in children with type 2 and 3 SMA.

### METHODS AND MATERIALS

Forty-two type 2 and 3 pediatric patients and 42 age- and gender-matched healthy controls were enrolled in this study. The tract-based spatial statistics(TBSS) was used to assess white matter integrity and the structural network properties were calculated based on DTI white matter fiber tracking.

### RESULTS

TBSS analysis revealed widespread white-matter changes among a lot of brain white fiber groups, including projecting fibers, commissural fibers, association fibers, and limbic system fibers. Fractional anisotropy (FA) and axial diffusivity(AD) values were reduced and radial diffusivity(RD) value was increased in the SMA group and the difference was statistically significant ($P < 0.05$, TFCE and FWE correction). In the white matter network, compared to the HC group, SMA showed increased characteristic path length (Lp), normalized clustering coefficient (?), and small-world characteristic (s), and decreased global efficiency (Eglob)(all $P < 0.05$). In the node properties, after performing BenjaminiHochberg's procedure, only right supramarginal gyrus(SMG.R), right superior frontal gyrus, orbital part (ORBsup.R), right supplementary motor area(SMA.R), and left median cingulate and paracingulate gyri (DCG.L) were statistically significant ($P < 0.05$, FDR correction).

### CONCLUSION

This study discovered extensive brain white matter and DTI-based brain network alterations in types 2 and 3 pediatric SMA patients, which indicated that SMN protein deficit may cause abnormal development of white matter in the brain of SMA.

### CLINICAL RELEVANCE/APPLICATION

As the lifespan of SMA children is increasing as therapy becomes more effective, patients' changes in cognition and intellect are receiving more attention. Therefore, we should focus more on the changes of the disease on the brain and cognitive function of SMA children to improve their subsequent quality of life. An in-depth study of brain changes will help draw up a more comprehensive treatment plan to help patients reintegrate into society.

## T3-SSNR07-5 REGIONAL GLYMPHATIC DYSFUNCTION IN PATIENTS WITH SPINOCEREBELLAR ATAXIA TYPE 3

Manxi Xu (*Presenter*) Nothing to Disclose

### PURPOSE

Spinocerebellar ataxia type 3 (SCA3) involves neuroinflammation and imbalance between production and clearance of proteins which affects the glymphatic system, the lymphatic-like, fluid-transport system in the brain. However, it is unclear whether SCA3 is related to impairments in glymphatic function.

### METHODS AND MATERIALS

Using multimodal imaging data, 34 SCA3 patients and 36 age-, sex- and educational matched healthy controls (HCs) were compared using multiple glymphatic measurements, including choroid plexus (CP) and cerebrospinal fluid (CSF) volume, diffusion tensor imaging along the perivascular (DTI-ALPS) index, and coupling relationship between blood-oxygen-level-dependent signals and CSF flow (BOLD-CSF coupling). Then, we evaluated regional

glymphatic function by dividing DTI-ALPS and BOLD-CSF coupling into anterior, middle, posterior, and cerebellum regions, thereby identifying the spatial variation of glymphatic function in the two groups.

**RESULTS**

We demonstrated that compared with HCs, larger CP and CSF volumes were found in SCA3 patients. More importantly, for DTI-ALPS index and BOLD-CSF coupling, these surrogate markers for glymphatic clearance were weaker in SCA3 patients. Furthermore, altered regional glymphatic functions were most prominent in midbrain, cerebellum and middle regions. Crucially, the altered midbrain, cerebellum, middle and global glymphatic functions were accompanied by the severity of ataxia and other SCA3 symptoms. Similar to other neurodegenerative disorders, the association between multiple glymphatic indexes and SCA3 symptoms suggested that waste clearance is disrupted in SCA3 patients, which shed light on the pathogenesis of this disease from a glymphatic lens.

**CONCLUSION**

Our findings highlighted the dysregulated glymphatic function as a novel diagnostic marker for SCA3.

**CLINICAL RELEVANCE/APPLICATION**

These glymphatic dysfunctions correlate strongly with the severity of ataxia and other SCA3 symptoms, suggesting their potential as novel diagnostic markers for SCA3. This insight into glymphatic involvement provides a foundation for potential therapeutic strategies targeting enhanced glymphatic clearance in SCA3 treatment.

## T3-SSNR07-7 Keynote Speaker: What's All the Fuss About FUS? Focused Ultrasound for Movement Disorders

Timothy J. Kaufmann, MD, MS (*Science Invited Presenter*) Consultant, SpineThera

# Abstract Archives of the RSNA, 2024

T3-SSNR08

**Neuroradiology (Epilepsy)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: S406B

Noriko Salamon, MD, PhD (*Moderator*) Nothing to Disclose
Salil Soman, MD, MS (*Moderator*) Nothing to Disclose

**Sub-Events**

## T3-SSNR08-1 NORMATIVE AND INDIVIDUAL, NON-NORMATIVE INTRINSIC NETWORKS AND THE TRANSITION TO IMPAIRED COGNITION IN TEMPORAL LOBE EPILEPSY

Joseph Tracy (*Abstract Co-Author*) Nothing to Disclose
Sam Sharifzadeh Javidi (*Abstract Co-Author*) Nothing to Disclose
Qirui Zhang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Despite their temporal lobe pathology, a significant subgroup of temporal lobe epilepsy (TLE) patients are able to maintain normative cognitive functioning. Here, we identify TLE patients with intact versus impaired neurocognitive profiles, and interrogate for the presence of both normative and highly individual intrinsic connectivity networks (ICN) - all towards understanding the transition from impaired to intact neurocognitive status.

### METHODS AND MATERIALS

We retrospectively investigated data from 88 TLE patients and matched 91 healthy controls with resting-state functional MRI. Functional MRI data were decomposed using independent component analysis to obtain individualized ICNs. Here, we calculated the degree of match between individualized ICNs and canonical ICNs (e.g., Yeo et.al 17 resting-state network) and divided each participant's ICNs into normative or non-normative status based on the degree of match.

### RESULTS

We found that the individualized networks matched the canonical networks less well in the cognitively impaired compared to the cognitively intact TLE patients by two-way mixed measures ANOVA (Group effect: $F= 6.445$, $p = 0.002$, impaired vs. intact $p = 0.028$, intact vs. HC $p = 0.429$ and impaired vs. HC $p = 0.001$, Tukey's corrected). The cognitively impaired patients showed significant abnormalities in the profiles of both normative (Group effect: $F = 8.434$, $p < 0.001$, impaired vs. intact $p = 0.017$, intact vs. HC $p = 0.220$ and impaired vs. HC $p < 0.001$, Tukey's corrected) and non-normative networks (Group effect: $F = 12.01$ $p < 0.001$, Impaired vs. Intact $p = 0.033$, intact vs. HC $p = 0.014$ and impaired vs. HC $p < 0.001$, Tukey's corrected), whereas the intact patients showed abnormalities only in non-normative networks. At the same time, we found normative networks held a strong, positive association with the neuropsychological measures, with this association negative in non-normative networks.

### CONCLUSION

We provide the first data demonstrating that significant cognitive deficits are associated with the status of both canonical and highly-individual ICNs, making clear that the transition from intact to impaired cognitive status is not simply the result of disruption to normative brain networks.

### CLINICAL RELEVANCE/APPLICATION

Based on this, we conclude that non-normative brain networks may serve as early biological markers of forthcoming cognitive impairment.

## T3-SSNR08-3 FREQUENCY OF TEMPORAL THUMB SIGN IN ADULT PATIENTS WITH IDIOPATHIC SEIZURES WITH AND WITHOUT ELEVATED OPENING CEREBROSPINAL FLUID PRESSURE

Arash Kamali, MD (*Abstract Co-Author*) Nothing to Disclose
Kamand Khalaj, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

Temporal lobe epilepsy has been associated with structural anomalies such as temporal lobe encephaloceles. Research suggests that these structural skull base alterations may be linked with intracranial hypertension. Following to our most recent published study in pediatric patients, which unveiled a significant association between the Temporal Thumb sign (TTS), seizures, and elevated opening cerebrospinal fluid (CSF) pressure, we aimed to determine the frequency of TTS in adult patients with elevated and normal opening CSF pressure without and with diagnosis of idiopathic unprovoked seizures.

### METHODS AND MATERIALS

This IRB approved retrospective study analyzed adults aged 18-40 who underwent lumbar puncture and MRI or CT scan at our institution, resulting in four distinct groups. Group 1 (n=52) comprised patients with confirmed diagnosis of idiopathic intracranial hypertension (IIH) presenting with headaches

or visual changes without seizures. Groups 2 (n=27) and 3 (n=30 ) consisted of patients with idiopathic seizures, distinguished by elevated and normal CSF opening pressure (OP), respectively. Group 4 (n=38) comprised age- and sex-matched healthy controls with normal CSF exam and normal opening pressure who presented to emergency room with syncope or headaches. MRI and CT scans were re-evaluated, focusing on the TTS identified on coronal views, indicated by unilateral or bilateral protrusion of the inferior temporal gyrus into the skull base. The presence of TTS was independently assessed by two observers. In-house statistical analysis conducted.

**RESULTS**

The TTS was detected most frequently in patients with elevated OP and seizures at 92.6% compared to patients with IIH with no seizures and patients with normal OP and seizures (63.5% and 53.3%, respectively). The TTS had a frequency of 13.2% in the control group. The TTS had the highest combination of specificity and sensitivity (86.8% and 63.4%) for diagnosis of elevated OP between patients with elevated OP and without seizures (IIH) compared to healthy controls (P value < 0.001) (Table 2).

**CONCLUSION**

Our results suggest the "temporal thumb sign" could be used as a screening tool with high sensitivity (92.6%) and high negative predictive value of 90% to suggest possibility of elevated intracranial pressure in adult patients presenting with seizures to the emergency department.

**CLINICAL RELEVANCE/APPLICATION**

-- The TTS maybe used as an imaging screening tool on CT or MRI scans of adult patients in emergency department-- The presence of TTS may indicate intracranial hypertension in adult patients with idiopathic seizures by negative predictive value of 90%-- The presence of TTS may indicate possibility of seizures in adult patients diagnosed with elevated opening pressure by 92.6% sensitivity

## T3-SSNR08-4 INTELLIGENT OPTIMIZATION METHOD FOR SEEG-GUIDED RADIOFREQUENCY THERMOCOAGULATION TREATMENT PLANS BASED ON PET-MRI

Wei Qian (*Abstract Co-Author*) Nothing to Disclose
Shu Chang (*Abstract Co-Author*) Nothing to Disclose
Shouliang Qi (*Abstract Co-Author*) Nothing to Disclose
Haoming Zhuang (*Abstract Co-Author*) Nothing to Disclose
Bixuan Xia (*Abstract Co-Author*) Nothing to Disclose
Dianning He, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study is to localize stereotactic electroencephalography (SEEG) epileptogenic electrode sites based on magnetic resonance imaging (MRI) and positron emission tomography (PET) images of the brain in patients with refractory epilepsy (RE) and to combine them with the SEEG electrode point signal classification model to assist neurologists in the treatment of SEEG radiofrequency thermocoagulation (RF-TC).

**METHODS AND MATERIALS**

In this study, we initially obtained the 3D coordinates of the SEEG electrode locations in the patient's brain based on computed tomography (CT) images and clinical information. Subsequently, we registered the MRI and PET images with the CT images to obtain the electrode sites. Finally, the PET data for the specified locations was extracted. The SEEG signal was processed using EEGLAB, which enabled the extraction and selection of features from 1D time series and EEG signals. The information extracted from the image data regarding the coordinate positions of the electrode sites and the information extracted from the SEEG signals were utilized as the features of the electrode sites. The features extracted from the SEEG signals were subjected to feature selection by a t-test, and the 34 features with significant differences were retained. Subsequently, the eXtreme Gradient Boosting (XGBoost) machine learning model was employed to classify the electrode site and determine its categorization.

**RESULTS**

In this study, the prediction accuracy and performance of the ensemble model based on the fusion of SEEG signal features with PET image data features were found to be significantly improved compared to the unimodal model using only PET image data features. The area under the curve (AUC) of the ensemble model was 0.69, the sensitivity was 0.69, and the specificity was 0.52, while the AUC of the unimodal model was 0.56, the sensitivity was 0.55, and the specificity was 0.47.

**CONCLUSION**

The ensemble model based on the fusion of SEEG signal features with PET imaging data features demonstrates considerable potential and is anticipated to facilitate more effective assistance to physicians in the classification of SEEG electrode sites. This finding provides valuable insights for the precision surgical treatment of RE using the combination of imaging and signaling.

**CLINICAL RELEVANCE/APPLICATION**

The findings of our study are clinically significant in that they assist physicians in developing SEEG RF-TC treatment protocols that allow for faster and more precise localization of the electrode sites in the epileptogenic zone. This will prevent the failure to precisely localize and remove the epileptogenic zone during surgery, which may result in significant trauma and side effects to the patient.

# Abstract Archives of the RSNA, 2024

T3-SSOB02

**OB/Gynecology (Ovarian Imaging Updates)**

Tuesday, Dec. 3 9:30AM - 10:30AM Room: E351

Yang Guo, MD (*Moderator*) Nothing to Disclose
Yuliya Lakhman, MD (*Moderator*) Stockholder, Y-mAbs Therapeutics Inc;Consultant, Perceptive Informatics, LLC

**Sub-Events**

## T3-SSOB02-1 IMPACT OF MULTIPARAMETRIC MRI ON INITIAL TREATMENT PLANNING IN SUSPECTED OR CONFIRMED OVARIAN CANCER

Isabelle Thomassin-Naggara, MD (*Abstract Co-Author*) Researcher, General Electric Company;Research funded, General Electric Company;Researcher, Canon Medical Systems Corporation;Research funded, Canon Medical Systems Corporation;Research funded, Hologic, Inc;Research funded, Siemens AG;Research funded, Guerbet SA
Rebecca Wiles, MBBCh,FRCR (*Abstract Co-Author*) Nothing to Disclose
Syed A. Sohaib, MBBS (*Abstract Co-Author*) Nothing to Disclose
Helen C. Addley, FRCR, BMBCh (*Abstract Co-Author*) Nothing to Disclose
Sue Mallett, DIPLPHYS,MS (*Abstract Co-Author*) Nothing to Disclose
Andrea G. Rockall, FRCR, MRCP (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the ability of imaging tests mpMRI and CT to correctly inform patient management in women being considered for up-front or interval debulking surgery (IDS) for ovarian cancer (OC) against a reference standard based on multidisciplinary tumor board review of all patient tests and treatment.

### METHODS AND MATERIALS

This prospective ethically approved observational study recruited women being considered for their initial surgery for suspected or confirmed OC in 18 gyneoncology cancer centres. Standard of care CT was reported on study proforma and treatment decision was recorded (benign surgery or follow-up, cancer surgery or chemotherapy). Patients underwent study mpMRI, for ORADS MRI score and peritoneal evaluation, reported by blinded radiologist, mpMRI alone followed by mpMRI/CT combined. Any significant mpMRI finding was conveyed to tumor board after CT plan was electronically submitted to ensure ethical patient management. Hypothetical treatment plans based on mpMRI alone and mpMRI/CT were completed months later, blind to the patient and their final management. All clinical events were recorded for 9 months. The joint primary outcomes were the difference between mpMRI and CT for agreement with the final reference standard for patient management, and classification of women as advanced or non-advanced ovarian cancer.

### RESULTS

647evaluable patients were included (mean age 61, SD 12). Patients entered the study for IDS (n=159, 24.6%) or pre treatment (n=488, 75.4%). Of these 488, borderline (n=55) and OC (n=296) were stage 1/2 in 36% (n=176), stage 3/4 in 35.9% (n=175), benign in 23.4% (n=114) and malignant non-OC in 4.7% (n=23). Actual treatment received was surgical in 86.4% (n=559), chemotherapy in 11% (n=71), follow-up in 0.6% (n=4) or other 2% (n=13). There was no significant difference in disease stage between the imaging paradigms. Based on 647 women, 6% more women were assigned correct treatment based on mpMRI compared to CT (95% CI 3 to 10). This significant difference benefit was due to women referred for primary surgery, where mpMRI had a 9.4% (n=46) higher accuracy than CT (95% CI 5 to 13); based on 18.2% (n=89) and 27.7% (n=135) incorrect decisions for mpMRI and CT respectively. For women imaged immediately prior to delayed surgery, decision making was not significantly different based on mpMRI or CT.

### CONCLUSION

Treatment planning based on mpMRI in suspected OC significantly reduced the number of incorrect treatment plans based on CT, with increased agreement with reference standard.

### CLINICAL RELEVANCE/APPLICATION

Pre-operative mpMRI may increase optimal initial treatment in suspected OC, with avoidance of inappropriate surgery, including over-extensive surgery for benign lesions or open-close/incomplete surgery in advanced OC.

## T3-SSOB02-2 THE ACCURACY OF COMPUTED TOMOGRAPHY IN PREDICTION OF THE PERITONEAL CANCER INDEX BEFORE CYTOREDUCTIVE SURGERY WITH HYPERTHERMIC INTRAPERITONEAL CHEMOTHERAPY IN ADVANCED OVARIAN CANCER

Liu Jhe Hong, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Among patients with advanced ovarian cancer, the addition of hyperthermic intraperitoneal chemotherapy (HIPEC) to interval cytoreductive surgery resulted in longer recurrence-free survival and overall survival. Computed tomography (CT) is routinely performed for optimal patient selection and surgical planning based on peritoneal cancer index (PCI). We aimed to investigate the accuracy of CT in prediction of the PCI in this setting.

**METHODS AND MATERIALS**

This retrospective study included 69 ovarian cancer patients underwent CT before cytoreductive surgery and HIPEC. Lesion size (LS) score was assigned from zero to three points: zero: no tumor; one: < 0.5 cm; two: up to 5 cm; and three: > 5 cm or confluent disease or matting to pelvic structures. LS score summation in the 13 abdominopelvic regions was the PCI. We calculated the accuracy of CT in the calculation of the PCI by the reference standard PCI at surgery. We also correlated the surgical PCI with the CT-PCI.

**RESULTS**

382 (42.6%) of the 897 regions had peritoneal deposits at surgery. The sensitivity were 60.7%, 52.1%, specificity 91.3%, 87.4%, PPV 68.1 %, 75.4%, NPV 88.3%, 71.1%, and accuracy 84.1 %, 72.4%, in comparison score 0,1 versus score 2,3, and in comparison score 0 versus score 1,2,3, respectively. The CT-PCI diagnostic performance is less accurate in pelvic and small intestinal regions. The CT-PCI (7.3 ± 6.1, mean ± standard deviation) and surgical PCI (9.8 ± 6.9) showed excellent correlation ($r = 0.83$, $p < 0.05$). Optimal cytoreduction was achieved in 65 (94%) patients.

**CONCLUSION**

CT seems to be effective in prediction of peritoneal carcinomatosis using the PCI score. Optimal cytoreduction with HIPEC could be achieved guided by CT even if implants < 0.5 cm.

**CLINICAL RELEVANCE/APPLICATION**

Dedicated MDCT protocol with routine use of a standardized PCI form may provide better comprehensive multiregional analysis that may help surgeons referring patients to the best treatment option.

## T3-SSOB02-3 PREDICTION OF PLATINUM RESISTANCE IN EPITHELIAL OVARIAN CANCER USING HABITAT RADIOMICS BASED ON MRI IMAGING

Jiejun Cheng (*Abstract Co-Author*) Nothing to Disclose
Lingling Lin, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the potential of using habitat radiomics as a novel tumour biomarker in predicting epithelial ovarian cancer (EOC) patients response to platinum-based chemotherapy.

**METHODS AND MATERIALS**

In this multicenter retrospective study, 258 EOC with preoperative MRI were included. Multivariable analysis was performed to identify independent risk factors for developing the clinical model. The entire primary tumor was partitioned into five spatial habitats through K-means clustering. The classical radiomics model and habitat radiomics model were developed using the features extracted from T2WI data. The area under the receiver operating characteristics curve (AUC) through the DeLong test, calibration curves, and decision curve analysis were used to compare the performance and clinical utility of models. The Spearman correlation test was used to assess the relationship between serum lipid and habitat radiomics features.

**RESULTS**

167 patients from A hospital were divided into train set (n = 116) and validation set (n = 51), 91 patients from B hospital were split into test set (n = 91). The multivariate regression analysis showed that P53 mutation is an independent risk factor for platinum resistance in EOC. The habitat radiomics model achieved a higher AUC than the classical radiomics model and clinical model in the test set (0.852 vs. 0.475 and 0.706). The habitat-based nomogram combined 9 habitat radiomics features with clinical features had an AUC of 0.867 in the test set, displaying improved calibration and clinical utility. Furthermore, the serum lipid (LDL, HDL, CHOL, and TG) had significant correlation with 9 habitat radiomics features in the test set.

**CONCLUSION**

The habitat-based nomogram could potentially help to predict platinum resistance in EOC patients treatment. The habitat radiomics features could reflect serum lipid situation.

**CLINICAL RELEVANCE/APPLICATION**

The habitat-based nomogram can offer precise predictions and valuable assistance to physicians in developing personalized treatment strategies. The correlation between habitat radiomics features and serum lipid explained the potential biological significance of habitat, and provided ideas for combining habitat with biological indicators to improve the prognosis of EOC.

## T3-SSOB02-4 OVARIAN-ADNEXAL IMAGING REPORTING AND DATA SYSTEM (O-RADS) ULTRASOUND (US) RISK ASSESSMENT SYSTEM: MORPHOLOGIC ANALYSIS OF BENIGN CASES IN O-RADS US 4 AND 5 CATEGORIES

Elizabeth A. Sadowski, MD (*Abstract Co-Author*) Nothing to Disclose
Priyanka Jha, MBBS (*Abstract Co-Author*) Nothing to Disclose
Krupa K. Patel-Lippmann, MD (*Abstract Co-Author*) Nothing to Disclose
Yang Guo, MD (*Abstract Co-Author*) Nothing to Disclose
Akshya Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Aya Kamaya, MD (*Abstract Co-Author*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation
Katherine E. Maturen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hanna M. Zafar, MD (*Abstract Co-Author*) Nothing to Disclose
Lisa Barroilhet, MD (*Abstract Co-Author*) Nothing to Disclose
Neha Antil, MD (*Abstract Co-Author*) Nothing to Disclose
Luyao Shen, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine which imaging features result in benign lesions to be upscored to O-RADS US 4 and 5.

**METHODS AND MATERIALS**

This IRB-approved, multicenter, retrospective study included consecutive patients who underwent pelvic US in 2011-2014. Investigators blinded to the outcome recorded imaging features per the O-RADS US lexicon. Patients with O-RADS US 4 and 5 lesions were analyzed with a reference standard of benign pathology, benign on CT/MRI, or complete resolution on follow-up imaging. Morphologic features of benign lesions were analyzed comparing pathology with the O-RADS US score. Statistical significance was determined between O-RADS US 4 and 5 with $p<0.05$.

**RESULTS**

Of 1036 lesions in 935 subjects, 298 lesions were included: 200 O-RADS US 4 and 98 O-RADS US 5. 135 lesions were benign (112 O-RADS US 4 and 23 O-RADS US 5) and 84 were malignant. 79 other lesions met 2-year clinical or imaging stability criteria for benignity, however, were excluded due to a lack of pathology or definitive diagnosis on CT/MRI. Of 135 benign lesions, physiologic cysts, endometriomas, dermoid, or other benign non-neoplastic lesions comprised 51% (69/135) of total lesions: 53% (59/112) of O-RADS US 4 lesions, and 43% (10/23) of O-RADS US 5 lesions. The rest were benign tumors. Per lesion analysis demonstrated presence of solid-appearing components was the most common lexicon feature in benign lesions, overall (71%, 96/135) and in each pathologic category: physiologic cysts (57%, 20/35), endometriomas (80%, 12/15), dermoids (100%, 10/10), other benign tumors (70%, 46/66), and other benign non-neoplastic lesions (89%, 8/9). Multilocularity was the second most frequent feature overall (45%, 61/135) and in dermoids (50%, 5/10) and other benign tumors (53%, 35/66). Per O-RADS score analysis, presence of solid-appearing components was the most common lexicon feature for O-RADS US 4 (69%, 77/112) and O-RADS US 5 (83%, 19/23) ($p=0.216$). Multilocularity was the second most common feature and was more frequently seen in O-RADS US 5 (40%, 45/112, for O-RADS US 4 and 70%, 16/23, for O-RADS US 5, $p=0.012$).

**CONCLUSION**

Approximately half of benign lesions scored as O-RADS US 4 or 5 were physiologic cysts, endometriomas, dermoids, or other benign non-neoplastic lesions. Per lesion and O-RADS US Score analysis showed solid-appearing components and multilocularity to be frequently associated with benign lesions scored as O-RADS US 4 and 5.

**CLINICAL RELEVANCE/APPLICATION**

Presence of solid-appearing components and multilocularity can lead to upscoring of benign lesions into O-RADS US 4 and 5 risk scores. Critical assessment for solid-appearing components is key for O-RADS US risk assessment.

## T3-SSOB02-5 PREDICTIVE VALUE OF WHOLE-BODY DIFFUSION-WEIGHTED MRI IN THE PREOPERATIVE ASSESSMENT OF ADVANCED OVARIAN CANCER AFTER NEO-ADJUVANT CHEMOTHERAPY

Vincent Vandecaveye, MD,PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Predicting surgical outcome after neoadjuvant chemotherapy (NACT) for advanced ovarian cancer remains challenging. We aimed to evaluate the diagnostic utility of whole body diffusion-weighted magnetic resonance imaging (WB-DWI/MRI) after NACT to predict resectability at interval debulking surgery (IDS) and patient survival.

**METHODS AND MATERIALS**

In the framework of a prospective single-center clinical trial (NCT01657747), 105 patients undergoing NACT for non-primary resectable Fédération Internationale de Gynécologie et d'Obstétrique (FIGO) stage IIIC/IV ovarian cancer underwent WB-DWI/MRI prior to IDS from May 2011 to May 2015. WB-DWI/MRI was analyzed for predicting involvement of irresectable disease sites, complete IDS, progression-free (PFS) and overall survival (OS). Surgical exploration, biopsies of metastases beyond surgical reach and imaging follow-up served as reference standard. We recorded patient outcome with standardized imaging follow-up of at least 6.5 years and participants alive as censors.

**RESULTS**

IDS achieved complete resection in 78 of 105 patients (74%). Median PFS was 15 months; median OS was 33 months. WB-DWI/MRI showed 99.1% accuracy for detecting distant irresectable metastases, 94.3% accuracy for detecting irresectable deep upper abdominal disease and suprarenal lymphadenopathy and 96.1% accuracy for detecting irresectable multifocal intestinal metastases and/or SMA/mesenteric root involvement.WB-DWI/MRI predicted complete resection at IDS with 97.4% sensitivity, 81.5% specificity and 93.3% accuracy. Prediction of complete resection by WB-DWI/MRI correlated with improved PFS (median 18 versus 7 months) and OS (median 45 months versus 20 months); similar as complete resection at IDS (PFS: median 18 versus 7 months; OS: median 41 versus 21 months). MRI prediction of (in)complete resection, preoperative absolute CA-125 value and (in)complete resection status at IDS showed significant effects on PFS (MRI: Hazard ratio (HR) = 5.43, $p<0.01$; CA-125: HR = 1.00, $p<0.001$; IDS: HR = 4.19, $p<0.001$) and OS (MRI: HR = 4.24, $p<0.01$; CA-125: HR = 1.00, $p<0.001$; IDS: HR = 2.87, $p<0.001$). After multivariable analysis, only MRI prediction of complete resection and preoperative CA-125 remained significant (both $p<0.001$).

**CONCLUSION**

WB-DWI/MRI accurately predicts complete resection at IDS for FIGO stage IIIC/IV ovarian cancer. MRI prediction of complete resection was an independent predictor of PFS and OS and a stronger predictive factor than complete resection at IDS.

**CLINICAL RELEVANCE/APPLICATION**

WB-DWI/MRI is an effective tool for operability assessment of ovarian cancer patients treated with NACT and can aid to optimize patient selection for and outcome of IDS.

# Abstract Archives of the RSNA, 2024

T3-STCE1

**Science Session (Theranostics)**

Tuesday, Dec. 3 10:00AM - 10:30AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## T3-STCE1-1 MYOCARDIAL FIBROSIS QUANTIFIED BY T1 MAPPING PREDICTS OUTCOMES IN DIABETES MELLITUS PATIENTS WITH PRESERVED EJECTION FRACTION: A CARDIAC MRI STUDY

Lu Minjie, PhD (*Abstract Co-Author*) Nothing to Disclose
Wenjing Yang (*Presenter*) Nothing to Disclose

### PURPOSE

Cardiac magnetic resonance(CMR) could serve as a robust tool for the assessment of myocardial fibrosis in diabetes mellitus(DM). We aimed to evaluate the prognostic significance of CMR T1 mapping as a new noninvasive way to risk stratify patients with DM, with particular attention to its role in different clinical scenarios.

### METHODS AND MATERIALS

DM participants with preserved ejection fraction who completed CMR T1 mapping examinations between October 2016 and December 2022 were enrolled in this study. Extracellular volume fraction(ECV) was calculated from pre- and post-T1 mapping for the assessment of interstitial fibrosis. The primary composite outcome was cardiovascular death or heart failure hospitalization.

### RESULTS

A total of 377 DM participants (mean age, 56 years±13; 274 men) completed follow-up and were enrolled in the final analysis. During a median follow-up of 30.1 months, 58 DM patients experienced the primary outcome. In univariate Cox analysis, age, prevalent coronary heart disease, estimated glomerular filtration rate, NT-proBNP, cardiac index, LV end-diastolic volume index, global longitudinal strain, the presence of LGE, and ECV were all associated with the primary outcome(all $P<0.05$). In multivariate analysis, ECV remained significantly associated with outcome in two separate models incorporating clinical variables and CMR parameters. In a final model consisting of the strongest predictors overall, ECV(HR: 1.080, 95% CI: 1.007 to 1.159; $p=0.030$) remained an independent predictor along with age, LVEDVi and GLS. The final multivariate model predicted outcome with a C-statistic of 0.74. In addition, the prognostic value of ECV remained consistent in all subgroups of clinical interest, such as men and women, patients with or without other comorbidities(hypertension and obesity), and those with or without heart failure. In sensitivity analysis after excluding patients with LGE, ECV remained significantly associated the primary outcome in multivariate Cox analysis and subgroup analyses. Kaplan-Meier survival curves showed that patients without LGE but with ECV higher than or equal to 30.48% had no significant difference in survival probability compared to patients with LGE.

### CONCLUSION

ECV derived from CMR T1 mapping was significantly associated with the primary outcome in DM patients in different clinical scenarios. Notably, the myocardial fibrosis assessed by T1 mapping could provide prognostic value in patients without LGE.

### CLINICAL RELEVANCE/APPLICATION

Myocardial fibrosis is one of the key pathophysiologic findings in DM, which can be noninvasively evaluated by CMR. Our study showed ECV was significantly associated with the primary outcome in DM patients, particularly in various clinical scenarios. The prognostic value of ECV remained consistent in DM patients without LGE, supporting the clinical relevance of CMR T1 mapping for the assessment of interstitial fibrosis.

## T3-STCE1-3 DEEP LEARNING-BASED SUPERRESOLUTION RECONSTRUCTION FOR MR-GUIDED THERMOABLATION

Marcel D. Nickel (*Abstract Co-Author*) Employee, Siemens AG
Saif Afat, MD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Gassenmaier, MD (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, MBA (*Abstract Co-Author*) Advisory Panel, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Advisory Panel, Bayer AG;Speakers Bureau, Bayer AG;Research Grant, Bayer AG
Rudiger Hoffmann (*Abstract Co-Author*) Nothing to Disclose
Jens Kubler, MD (*Abstract Co-Author*) Nothing to Disclose
Moritz T. Winkelmann, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study investigates the effects of a deep learning-based super-resolution reconstruction approach for T1-weighted volume-interpolated breath-hold examinations (DL-VIBE) on image quality and intraprocedural parameters during MR-guided thermoablation of liver malignancies, compared to standard VIBE images (SD-VIBE).

## METHODS AND MATERIALS

Between September 2021 and February 2023, 34 patients (mean age: 65.4 ± 11.5 years, women: n=13) with liver malignancies were treated using MR-guided microwave ablation on a 1.5 T MR-scanner. Intraprocedural VIBE sequences (SD-VIBE) were acquired to monitor needle position and assess the ablation zone. The raw T1-weighted VIBE data were processed using a prototype deep learning algorithm to reduce noise and blurring while improving sharpness (DL-VIBE). Two experienced interventional radiologists independently evaluated the image data sets in a randomized, blinded manner, comparing DL-VIBE to unprocessed SD-VIBE images. Measurements included assessment of overall image quality, noise, artifacts, sharpness of liver and portal vein branches, detectability of needle artifacts, delineation of costodiaphragmatic recess, contrast of ribs, detectability of target lesion and antenna tip, confidence in needle position, and adequacy of ablation zone. Ratings were on a 5-point Likert scale, and interrater agreement was analyzed. Noise maps were created to demonstrate signal-to-noise ratio improvements.

## RESULTS

DL-VIBE images showed significantly higher overall image quality, lower artifacts and noise, and better sharpness of liver contours and portal vein branches compared to SD-VIBE ($P<0.001$). Interventional parameters, including real-time imaging of the interventional path, target lesion and needle tip detectability, confidence in needle positioning, and diagnostic confidence in the adequacy of the ablation zone, were significantly better with DL-VIBE ($P<0.001$). Interrater agreement was high (Cohen ? = 0.86). Quantitative noise maps indicated an improved signal-to-noise ratio with higher resolution using DL-VIBE. DL-VIBE reduced reconstruction time from 3.5 seconds to 1 second and decreased acquisition time per sequence by 14.4%, with an average of 24.7 sequences per patient (range: 9-69).

## CONCLUSION

DL-VIBE significantly improves the image quality and diagnostic reliability of MR-guided thermal ablation procedures while saving time compared to standard methods.

## CLINICAL RELEVANCE/APPLICATION

This integration of deep learning technology into theranostics promises improved patient outcomes through better image quality and procedural accuracy.

# Abstract Archives of the RSNA, 2024

T3-STCE2

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Tuesday, Dec. 3 10:00AM - 10:30AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## T3-STCE2-1 ENVIRONMENTAL SUSTAINABILITY IN RADIOLOGY: AGE AND SEX SPECIFIC EXCESS UTILIZATION OF MEDICAL IMAGING ASSOCIATED WITH SHORT TERM EXPOSURES TO AMBIENT HEAT AND FINE AIR POLLUTION

Birgit B. Ertl-Wagner, MD, PhD (*Abstract Co-Author*) Spouse, Employee, Siemens AG
Anish Kirpalani, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Julien Aguet, MD (*Abstract Co-Author*) Nothing to Disclose
Ania Kielar (*Abstract Co-Author*) Nothing to Disclose
Scott Delaney (*Abstract Co-Author*) Nothing to Disclose
Heidi C. Schmidt, MD (*Abstract Co-Author*) Nothing to Disclose
Michael N. Patlas, MD, FRCPC (*Abstract Co-Author*) Royalties, Holtzbrinck Publishing Group
Hayley Panet (*Abstract Co-Author*) Nothing to Disclose
Omar Taboun (*Abstract Co-Author*) Nothing to Disclose
Maura J. Brown, MD (*Abstract Co-Author*) Synthesis Health Inc - research collaboration, no financial relationship at this time ( Nov 2022).
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Rachel Nethery (*Abstract Co-Author*) Nothing to Disclose
Joseph Choi (*Abstract Co-Author*) Nothing to Disclose
Shane O'Driscoll, MBBCh, FFR(RCSI) (*Presenter*) Nothing to Disclose

### PURPOSE

Strengthening environmental sustainability in radiology requires adaptation planning to prepare for climate-related adverse health effects. The purpose of this study was to determine short-term associations of climate-related environmental exposures with utilization of emergency medical imaging by stratified by patient age and sex.

### METHODS AND MATERIALS

In this retrospective, time-stratified, case-crossover study, daily imaging utilization counts from four local emergency departments from 2018-2023 were linked to local daily environmental data, including ambient heat and fine particulate matter (PM2.5) air pollution. Moving averages of ambient PM2.5 and temperature were calculated to account for lagged exposure effects. Conditional Poisson regression models were used to evaluate short-term associations of daily variations in ambient environmental exposures with daily utilization of emergency medical imaging stratified by sex and age group controlling for day-of-week, month, and year.

### RESULTS

A total of 738,084 emergency department imaging studies were included. A rise of 10°C in the 2-day moving average of mean daily temperature (representing average exposure to heat over the current and previous 1 day) was associated with overall imaging utilization increases of 4.5% (IRR 1.045; 95%CI 1.033, 1.057) in females, 6.7% (IRR 1.067; 95%CI 1.054, 1.080) in males, 5.8% (IRR 1.058; 95%CI 1.035, 1.080) in patients <18 years, 4.9% (IRR 1.049; 95%CI 1.037, 1.061) in patients =18 to <65 years, and 6.5% (IRR 1.065; 95%CI 1.050, 1.081) in those =65 years. A rise of 10 µg/m3 in the 3-day moving average of mean daily PM2.5 (representing average exposure of fine particulate air pollution over the current and previous 2 days) was associated with overall imaging utilization increases of 2.0% (IRR 1.020; 95%CI 1.010, 1.031) in females, 3.8% (IRR 1.038; 95%CI 1.027, 1.048) in males, 2.6% (IRR 1.026; 95%CI 1.007, 1.045) in patients <18 years, 2.4% (IRR 1.024; 95%CI 1.014, 1.034) in patients =18 to <65 years, and 3.9% (IRR 1.039; 95%CI 1.026, 1.052) in those =65 years.

### CONCLUSION

Ambient heat and particulate air pollution are associated with increased utilization of emergency department medical imaging across all age and sex groups. Effect sizes were larger in males compared to females with a bimodal effect by age, with largest effect sizes in older adults =65 years of age followed by pediatric patients <18 years of age.

### CLINICAL RELEVANCE/APPLICATION

These results advance our understanding of who is most at risk of climate related exposures and can be used to inform preparations in radiology departments to build resilience into existing systems. Readily available environmental data could provide early warnings about impending surges in imaging volumes.

## T3-STCE2-2 QUANTIFYING THE ENVIRONMENTAL SUSTAINABILITY OF LARGE LANGUAGE MODELS IN RADIOLOGY REPORTS ANALYSIS

Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of

Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Florence X. Doo, MD, MA (*Abstract Co-Author*) Nothing to Disclose
Sanaz Vahdati, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Natural language processing (NLP) in radiology has become increasingly important for efficient data extraction and analysis of medical reports. However, the growing use of large language models (LLMs) raises concerns about their environmental impact. This study aims to assess the performance and environmental footprint in the context of radiology report analysis, using two powerful state-of-the-art LLMs, LLaMA3-70B, and LLaMA3.1-70B to extract the presence of liver metastases from radiology reports.

**METHODS AND MATERIALS**

We collected radiology reports from 105 abdominopelvic CT scans, with 55 of 105 reports indicating liver metastases from our institution. We used two versions of powerful open-source large language models, LLaMA3 70B and LlaMA3.1 70B, to extract information from radiology reports and indicate the presence or absence of liver metastases. We employed few-shot pre-defined prompting to direct the model's generation of target outputs in accordance with specified parameters. The models' performance was measured by comparing model outputs with expert-annotated reference standards. To assess the environmental impact of LLM's operations, we used the "Carbon tracker" package. Our computations were performed on one local NVIDIA A100 GPU, allowing us to measure the energy consumption associated with processing each report as a distinct computational cycle.

**RESULTS**

The LlaMA3-70B and LLaMA3.1-70B models demonstrated high accuracy in extracting liver metastases, achieving 91% and 90%, respectively. For LLaMA3-70B, the positive predictive value (PPV) was 0.98 and the negative predictive value (NPV) was 0.86. LLaMA3.1-70B showed a PPV of 0.94 and an NPV of 0.87. Carbon footprint assessment of LLaMA3-70B inference determined an energy consumption of approximately 0.52 kWh, resulting in 187.33 g of CO2 equivalent emissions. LLaMA3.1-70B used approximately 0.62 kWh energy, producing 219.71g of CO2 equivalent (Table 1).

**CONCLUSION**

Our findings reveal that the LLaMA 3-70B model, though one iteration older, achieves comparable accuracy in extracting radiology report data while demonstrating a reduced environmental footprint compared to LLaMA 3.1-70B. This highlights the importance of conducting a comprehensive assessment of LLM models for radiology, balancing model performance with ecological considerations.

**CLINICAL RELEVANCE/APPLICATION**

Our work emphasizes considering both the performance and environmental aspects when selecting LLM models. This could lead to more eco-friendly radiology practices without compromising the quality of data extraction from reports. Integrating AI model evaluation with other departmental sustainability metrics is crucial to develop comprehensive eco-friendly innovations in radiology.

## T3-STCE2-3 MEASURING GEOGRAPHIC ACCESS TO IMAGING CENTERS IN URBAN AREAS

Claire Brookmeyer, MD (*Abstract Co-Author*) Nothing to Disclose
Preetham Bachina, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Current studies show that areas of extreme socioeconomic disadvantage have less access to accredited imaging facilities, mainly focusing on lung and breast cancer screening. Little has been done to evaluate geographic access to general outpatient radiological services, especially in urban settings. Imaging access via public transportation is particularly relevant as underserved populations are more likely to use public transport.

**METHODS AND MATERIALS**

Three cities of interest were chosen for our initial study: Baltimore, Chicago, and Houston. American College of Radiology (ACR) accredited facilities within each city's metropolitan area were identified from the ACR website. Each city was divided into census tracts. Isochrone maps from each census tract's centroid were generated using the TravelTime API to determine areas reachable within 20, 30, or 40 minutes by driving or public transportation. Tracts without an ACR imaging facility within the specified time were considered imaging access deserts. 2019 American Community Survey data was used to classify tracts by majority racial groups (>50%) and by income (poor vs. nonpoor at 200% of the federal poverty level). Odds ratios for access based on racial and income composition were calculated.

**RESULTS**

In all three cities, >99% census tracts are within a 20-minute drive of at least one imaging center. At the 30-minute public transit threshold, 23% of tracts in Baltimore, 32% in Chicago, and 74% in Houston are classified as imaging access deserts. In Baltimore, racial minority and poor census tracts generally have similar odds of being access deserts compared to White and non-poor tracts. In Chicago and Houston, at the 20-minute public transit threshold, Black, Hispanic, and poor tracts generally have significantly higher odds of being access deserts compared to White and non-poor tracts. However, at the 30-minute threshold, these differences become nonsignificant, and at the 40-minute threshold, Black and poor tracts have significantly lower odds of being access deserts than White and non-poor tracts.

**CONCLUSION**

While driving access to radiologic services is universally adequate in the studied cities, access via public transportation is notably limited. In Houston and Chicago, a shorter public transport threshold showed minority and poor census tracts generally having worse access which was reduced and eventually reversed with a longer transport time threshold.

**CLINICAL RELEVANCE/APPLICATION**

Inequities in imaging access lead to suboptimal outcomes for underserved communities. Radiology's current limitations in meeting these needs may be addressed by establishing imaging services in more accessible locations for underserved populations and individuals facing transportation barriers.

# Abstract Archives of the RSNA, 2024

T6-SSCH06

**Chest Imaging (Radiography)**

Tuesday, Dec. 3 1:30PM - 2:30PM Room: E451A

Bruno Hochhegger, MD,PhD (*Moderator*) Nothing to Disclose
William Auffermann, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T6-SSCH06-1 REAL-WORLD, POST-MARKET SURVEILLANCE STUDY OF A CHEST X-RAY AI MODEL IN A MULTICENTER STUDY

Hyo Hyun Shin (*Abstract Co-Author*) Nothing to Disclose
Emiliano Garza Frias, MD (*Abstract Co-Author*) Nothing to Disclose
Roshan Fahimi, MD (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Ruhani Doda Khera, MD (*Abstract Co-Author*) Nothing to Disclose
Giridhar Dasegowda, MD (*Abstract Co-Author*) Nothing to Disclose
Lina Karout, MD (*Abstract Co-Author*) Nothing to Disclose
Anushree M. Burade, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ashley McKnight (*Abstract Co-Author*) Nothing to Disclose
Yu Kuo, MD (*Abstract Co-Author*) Nothing to Disclose
Tin Nadarevic, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seyedehelaheh Hosseini, MD (*Abstract Co-Author*) Nothing to Disclose
Parisa Kaviani, MD (*Presenter*) Nothing to Disclose

### PURPOSE

As the number of FDA-approved chest X-ray AI algorithms increases, there's still a lack of data on how they perform in real-world clinical settings. To address this gap, we conducted an international post-market surveillance study to evaluate a chest X-ray AI algorithm's performance in real-world clinical practice.

### METHODS AND MATERIALS

In our IRB-approved study, we included 2096 CXRs from 4 sites in India, 2 sites from Korea, and 1 site from Thailand. The inclusion criteria were the availability of CXR AI algorithm (Lunit.ai) outputs at the time of interpretation of CXRs as part of the standard of care workflow. All CXRs were deidentified and uploaded to an offline, secure annotation platform (Carpl.AI) for evaluation. Two thoracic radiologists, blinded to the AI outputs and radiology reports, independently reviewed the following AI-assessable CXR findings: pulmonary nodule, atelectasis, cardiomegaly, consolidation, fibrosis, mediastinal widening, nodule, pleural effusion, pneumothorax, and active tuberculosis. In addition, they also recorded the presence of any suboptimality for each CXR (incomplete anatomic coverage of thorax, under-/over-exposure, marked patient rotation, overlying external object, low lung volume, and artifacts impairing CXR evaluation). In cases of a disagreement between the two radiologists, a third radiologist independently reviewed the CXR to help establish a majority consensus ground truth. The sensitivity, specificity, and AUC with a 95% confidence interval were calculated to evaluate the performance of the reporting radiologist and standalone AI model. Chi-Square test was calculated to determine significant differences between reports and standalone model performance.

### RESULTS

The overall performance of AI-aided radiology reports was higher than the standalone AI algorithm. Table 1 summarizes the sensitivity, specificity, area under the curve, and the 95% confidence interval for the AI-aided radiology reporting as compared to the ground truth. There were small but significant differences in AI-aided radiology reports and standalone AI performance (p value<0.001) in suboptimal CXRs: incomplete anatomic coverage: 0.75, 0.667, low lung volume: 0.927, 0.899, over/under exposure: 0.895, 0.94, marked patient rotation: 0.939, 0.932, and more than one suboptimality, 0.879, 0.917, respectively.

### CONCLUSION

Compared to the multi-reader ground truth, our multicenter study demonstrates that real-world AI-aided radiology reporting results in extremely high sensitivity, specificity, and AUCs.

### CLINICAL RELEVANCE/APPLICATION

Our post-market surveillance of a chest x-ray AI algorithm supports the positive impact of AI on reporting of CXRs.

## T6-SSCH06-2 LOCAL VALIDATION OF A COMMERCIAL AI SYSTEM FOR AUTONOMOUS REPORTING OF CHEST RADIOGRAPHS: A LARGE-CENTRE UK RETROSPECTIVE ANALYSIS

Deborah J. Tattersall, MBChB (*Abstract Co-Author*) Nothing to Disclose
Benjamin J. Holloway, MBChB (*Abstract Co-Author*) Nothing to Disclose

Akif Malik, MD (*Abstract Co-Author*) Nothing to Disclose
Gareth D. Lewis, MBChB (*Abstract Co-Author*) Nothing to Disclose
Robert McEwan (*Abstract Co-Author*) Nothing to Disclose
Aditya Kale (*Abstract Co-Author*) Nothing to Disclose
Qasim Malik (*Abstract Co-Author*) Nothing to Disclose
Sonam Vadera, MBBS, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

The increasing burden of chest X-ray reporting calls for novel methods to streamline radiological assessment, whilst maintaining accuracy. This study aimed to evaluate the performance of ChestLink, a CE-marked Class IIb AI as a Medical Device tool developed by Oxipit (Vilnius, Lithuania), designed to autonomously report high-confidence normal chest X-ray studies.

**METHODS AND MATERIALS**

A retrospective analysis was undertaken at University Hospitals Birmingham NHS Foundation Trust, examining 82,761 chest X-rays across GP, AE, outpatient, and inpatient referral sources. A separately validated natural language processing (NLP) tool is provided by Oxipit to classify the clinician reports. The concordance between ChestLink's classifications and the clinician reports was calculated to evaluate accuracy and reliability.

**RESULTS**

Among the X-rays reviewed, 37,048 were normal scans based on clinician opinion. ChestLink was able to confidently report 9,821 (26.5%) of these as normal, effectively removing them from further assessment and expediting the workflow. The highest autonomous reporting rate was observed in the GP setting, with ChestLink correctly classifying 32% of studies as normal. Conversely, autonomous reporting rate was lowest among inpatients, where it identified 16.8% of normal chest X-rays. Overall, discordance was observed in 426 (4.3%) cases, whereby ChestLink classified the X-ray as normal while clinicians reported abnormalities. Among these discordant cases, 15 (0.15%) were deemed clinically significant.

**CONCLUSION**

ChestLink demonstrates promising accuracy in identifying normal chest X-rays, potentially reducing reporting workload. Nonetheless, the observed discordance warrants further investigation. A further 60,000 CXRs are currently being processed, and a case-by-case review by four consultant cardiothoracic radiologists is underway. Furthermore, a medical algorithmic audit and root-cause analysis are being conducted to identify potential failure modes and inform the decision to proceed to the prospective trial stage and subsequent deployment.

**CLINICAL RELEVANCE/APPLICATION**

The findings highlight the potential of AI tools like ChestLink in enhancing the efficiency of chest X-ray reporting. Integrating such AI tools into clinical workflows can aid radiologists in prioritising abnormal cases, thereby facilitating timely patient care, and enabling re-allocation of clinician time.

## T6-SSCH06-3 TOWARDS PHYSICIAN-LEVEL RADIOLOGIC REPORT GENERATION: COMPREHENSIVE EXPLORATION OF CLINICAL SIGNIFICANCE OF A NOVEL MULTIMODAL GENERATIVE ARTIFICIAL INTELLIGENCE MODEL

Eun Kyoung Hong, MD,PhD (*Abstract Co-Author*) Research Consultant, VUNO Inc
Byungseok Roh (*Abstract Co-Author*) Nothing to Disclose
Hae Won Kim (*Abstract Co-Author*) Nothing to Disclose
Woong Bae, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Generative AI is anticipated to significantly alter the landscape of medicine, especially in medical diagnostics. The aim of the study is to develop and comprehensively evaluate a novel, domain-specific multimodal generative AI model for Chest X-ray (CXR) report generation.

**METHODS AND MATERIALS**

Over 14 million CXR-report pair datasets were utilized in the study. After the model development, validation included: 1) Assessing the detection accuracy of the 13 most important CXR findings (RRDA), 2) Evaluating the acceptability rate, agreement, and quality scores of the generated reports, along with a comparative ranking analysis against radiologists' reports and outputs from a general-purpose Large-Language Model (GPT-4v), conducted independently by four radiologists (RRQE), 3) A multireader, multicase study was conducted, where CXRs were interpreted with and without the aid of AI-generated reports.

**RESULTS**

AI-generated reports demonstrated high sensitivities in detecting critical CXR findings, 95.26% for pneumothorax and 92.62% for subcutaneous emphysema. The acceptance rates by four evaluating radiologists were 70.48%, 73.29% and 29.56% for AI-generated, radiologists' and GPT-4v reports, respectively. The agreement and quality score analysis showed that AI-generated reports had higher agreement (Mean ± SD: 3.80 ± 1.32) and quality (3.87 ± 1.34) scores over radiologists' (3.45 ± 0.84 for agreement; 3.44 ± 1.17 for quality) and GPT-4v reports (2.12 ± 1.14 for agreement; 1.14 ± 0.27 for quality) ($p < .001$). From ranking analysis, AI-generated reports were most frequently ranked the highest (59.98%), GPT-4v reports lowest (73.58%), and radiologists' reports in the middle (54.73%). Results from the reader study demonstrated that when reporting with AI-generated reports, there was a significant reduction in reading time from 34.2 to 19.8 seconds ($p < .001$), and both report agreement and quality scores improved (4.47 ± 0.61 to 4.69 ± 0.46) and (4.31 ± 0.52 to 4.57 ± 0.44, respectively) (ps < .001).

**CONCLUSION**

The multimodal generative AI model can offer clinical value by assisting radiologists in generating radiologic reports with high precision, suggesting the potential to bring a positive impact on patient care.

**CLINICAL RELEVANCE/APPLICATION**

Our study demonstrates the potential of a novel multimodal generative AI model to achieve physician-level accuracy in radiologic report generation, by not only enhancing the clinical workflow by reducing reading times, but also improving the accuracy and quality of radiological reports. These results highlight the AI model's potential for clinical utility in medical imaging interpretation, suggesting future validation across various clinical settings is needed to fully demonstrate its benefits.

## T6-SSCH06-4 OPTIMIZING CHEST RADIOGRAPH WORKFLOW: EFFICIENCY GAINS OF AI-ASSISTED REPORTING IN A MULTI-ETHNIC COHORT

Akanksha Ojha (*Abstract Co-Author*) Nothing to Disclose
Charlene Liew, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose

Ashutosh Pathak (*Abstract Co-Author*) Nothing to Disclose
Richa Pant (*Abstract Co-Author*) Nothing to Disclose
Siddhant Pardeshi (*Abstract Co-Author*) Nothing to Disclose
Yogesh Mantri (*Abstract Co-Author*) Nothing to Disclose
Amit T. Kharat, PhD,DMRD (*Presenter*) Co-founder, DeepTek.ai, Inc

**PURPOSE**

To evaluate the impact of an AI-powered PACS platform on report generation time (RGT) and turnaround time (TAT) for chest radiographs in a multi-ethnic patient cohort.

**METHODS AND MATERIALS**

The study included 1054 patients who visited Changi General Hospital, Singapore between November 2023 and January 2024. 8 board-certified radiologists, specializing in various fields, reported chest radiographs in two sessions. In Session 1, they used conventional PACS (Carestream Phillips VuePACS v12.2), while in Session 2, they used an AI-powered PACS (Augmento v1.4.6, DeepTek, India) integrated with Lunit INSIGHT CXR v3.1.5.0. There was a wash out period of 4 weeks between the two sessions to mitigate memory bias. The AI platform assigned a priority order (Normal, non-urgent, urgent, critical) to the chest radiographs as opposed to the conventional PACS which follows First In First Out worklist order. Mean and median were compared between sessions for RGT and TAT.

**RESULTS**

The median RGT was reduced from 2 minutes in Session 1 to 0.53 minutes in Session 2, resulting in a reduction of 1.47 minutes (73.33%). A statistically significant reduction in median RGT was observed across all notification levels in Session 2: normal (90% reduction), non-urgent (72.5% reduction), urgent (54.2% reduction) and critical (35.6% reduction). Even CXR's with 3 or more findings experienced a significant reduction in RGT (42.9%). Similarly, the median TAT was reduced from 675.87 minutes in Session 1 to 55.87 minutes in Session 2, resulting in the reduction of 620 minutes (91.73%). The effect of AI assistance on TAT reduction extended to all notification levels, prominently for critical CXRs where the median TAT decreased from 711.08 minutes to 41.56 minutes, resulting in 96.7% reduction. The improvement in the TAT was greater for chest radiographs with 3 or more findings (94.95%) compared to those with fewer findings.

**CONCLUSION**

Integration of an AI-powered PACS platform led to significant reductions in RGT and TAT for chest radiographs. These improvements were consistent across different notification levels of findings. The improvement in the TAT was greatest for chest radiographs with 3 or more findings, indicating the importance of AI powered workflow in reporting the critical scans first for making faster diagnostic decisions.

**CLINICAL RELEVANCE/APPLICATION**

The study demonstrates that AI assistance in radiology reporting significantly enhances efficiency, enabling faster diagnosis and treatment decisions. These findings are particularly relevant in clinical settings where timely diagnosis is crucial, highlighting the potential of AI technology to improve patient care in radiology departments.

## T6-SSCH06-6 ACCURACY OF ARTIFICIAL INTELLIGENCE-BASED PREDICTION OF OSTEOPOROSIS FROM CHEST RADIOGRAPHS AND ASSOCIATION WITH RISK OF LONG-TERM MORTALITY

Eui Jin Hwang, MD, PhD (*Abstract Co-Author*) Research Grant, Lunit Inc;Research Grant, Coreline Soft, Co Ltd;Research Grant, Monitor Corporation Inc
Ji Young Lee, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Osteoporotic fracture has become a big concern in elderly individuals. Identifying asymptomatic individuals with osteoporosis may help reduce this burden. We aimed to evaluate the accuracy of an artificial intelligence (AI) model to predict osteoporosis from chest radiographs (CXRs) and its association with long-term mortality.

**METHODS AND MATERIALS**

We retrospectively included consecutive adult (age =19 years) individuals who underwent CXRs and dual-energy x-ray absorptiometry (DEXA) scans on the same day for health checkups between 2014 and 2017 in a single institution. A commercialized AI tool (PROS® CXR: OSTEO, PROMEDIUS INC, Seoul, Korea) for predicting osteoporosis in the form of probability scores (0-100%) was retrospectively applied to CXRs. The accuracy of AI was evaluated based on osteoporosis diagnosis using DEXA as reference standards. We evaluated the area under receiver operating characteristic curves (AUCs) for the score provided by AI. We also evaluated the sensitivity and specificity of AI at two different thresholds: Predicted scores of 10% and 50%. We also investigated the association between the prediction of osteoporosis by AI and long-term all-cause mortality after adjustment of age, sex, and body mass index using Cox proportional hazard analysis.

**RESULTS**

A total of 10,412 CXRs from 8,618 asymptomatic individuals (mean age, 58 years; 2882 men) were included. The prevalence of osteoporosis by DEXA scan was 4.2% (440/10,412). The AI's prediction exhibited an AUC of 0.91 (95% confidence interval [CI], 0.90-0.92) for osteoporosis by DEXA scan. At a threshold predicted score of 10%, the sensitivity and specificity were 72.5% (319/440; 95% CI, 68.1-76.6%) and 89.4% (8,911/9,972; 95% CI, 88.7-90.0%), respectively. Meanwhile, at a score of 50%, the sensitivity and specificity were 61.1% (269/440; 95% CI, 56.4-65.7%) and 93.7% (9344/10,412; 93.2-94.2%), respectively. In multivariate Cox proportional hazard analyses of 8,167 individuals with available mortality information, a higher predicted score for osteoporosis by the AI was associated with a higher risk of long-term all-cause mortality (hazard ratio [HR], 1.01 per 1% point increase of score; 95% CI, 1.00-1.01; P=.016). Binary prediction results by both thresholds of 10% (HR, 1.40; 95% CI, 1.08-2.06; P=.014) and 50% (HR, 1.49; 95% CI, 1.05-2.12; P=.027) were also independently associated with long-term all-cause mortality.

**CONCLUSION**

Osteoporosis prediction from CXR using AI was accurate compared to DEXA scan, and was associated with risk of long-term mortality.

**CLINICAL RELEVANCE/APPLICATION**

An AI analysis of CXR can help opportunistic screening of asymptomatic osteoporosis, which can potentially provide a chance to reduce the risk of long-term mortality and morbidity.

# Abstract Archives of the RSNA, 2024

T6-SSGU04

**Genitourinary Imaging (Prostate MRI and PSMA PET)**

Tuesday, Dec. 3 1:30PM - 2:30PM Room: E353B

Angela Tong, MD (*Moderator*) Equipment support, Siemens AG
Eric C. Ehman, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T6-SSGU04-1 DISCORDANCE BETWEEN PROSTATE MRI AND PSMA PET/CT: THE NEXT BIG CHALLENGE FOR PRIMARY PROSTATE TUMOR ASSESSMENT?

Doris Leithner, MD (*Abstract Co-Author*) Nothing to Disclose
Michael J. Zelefsky, MD (*Abstract Co-Author*) Nothing to Disclose
Hebert Alberto Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Marius E. Mayerhoefer, MD, PhD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bristol-Myers Squibb Company;Speaker, General Electric Company
Angela Tong, MD (*Abstract Co-Author*) Equipment support, Siemens AG
Samir S. Taneja, MD (*Abstract Co-Author*) Royalties, Reed Elsevier;Consultant, TROD Medical;Consultant, InSightec Ltd;Consultant, Francis Medical;Consultant, Exact Imaging Inc;Consultant, Johnson & Johnson;Investigator, MDxHealth SA
Anton S. Becker, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sungmin Woo, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Increasing number of patients with prostate cancer undergo assessment with multiparametric magnetic resonance imaging (mpMRI) and prostate-specific membrane antigen positron emission tomography/computed tomography (PSMA PET/CT). This approach offers comprehensive multimodality staging but can lead to discrepant findings. The objective of this study was to assess the frequency and types of discordances between mpMRI and PSMA PET/CT for primary prostate cancer assessment and explore their impact on treatment planning.

### METHODS AND MATERIALS

Consecutive men with diagnosed or suspected prostate cancer who underwent mpMRI and PSMA PET/CT in 2021-2023 were retrospectively included. mpMRI and PSMA PET/CT were interpreted using PI-RADS v2.1 and PRIMARY scores. Discordances between the two imaging modalities were categorized as “minor discordance” (e.g., larger or additional lesion seen on one modality) or “major discordance” (e.g., positive on only one modality or different index lesions between mpMRI and PSMA PET/CT).

### RESULTS

320 men (median age 69 years, interquartile range [IQR] 64-75) were included. Most had Gleason Grade Group =3 prostate cancer (68.1% [218/320]). Median PSA was 8.7 ng/mL (IQR 5.5-13.6). mpMRI and PSMA PET/CT were concordant in 164/320 (51.2%) and discordant in 156/320 (48.8%) patients among which 42/156 (26.9%) were "major discordances" and 114/156 (73.1%) were "minor discordances". Of 27 patients with lesions only seen on mpMRI, 85.2% (23/27) were clinically significant prostate cancer (csPCa). Of 23 patients with lesions only seen on PSMA PET/CT, 78.3% (18/23) were csPCa. Altogether, lesions seen on only one modality were csPCa in 80.0% (36/45).

### CONCLUSION

mpMRI and PSMA PET/CT were discordant in half of patients for primary prostate cancer evaluation, with major discrepancies seen in roughly one out of 8 patients.

### CLINICAL RELEVANCE/APPLICATION

For evaluating tumours in the prostate, mpMRI and PSMA PET/CT were discordant in about half of the patients. Furthermore, a non-negligible proportion of them showed major discordances such as lesions only seen on one imaging modality. Synergistic usage of mpMRI and PSMA PET/CT has the potential to result in better biopsy and treatment planning (e.g., focal boosting in radiation therapy, candidacy for focal therapy, etc.).

## T6-SSGU04-2 CLINICAL, PATHOLOGICAL AND IMAGING VARIABLES ASSOCIATED WITH PROSTATE CANCER DETECTION BY PSMA PET/CT AND MPMRI

Hye Ok Kim (*Abstract Co-Author*) Nothing to Disclose
Ida Sonni, MD (*Abstract Co-Author*) Nothing to Disclose
Jeremie Calais, MD (*Abstract Co-Author*) Consultant, RadioMedix, Inc;Consultant, Blue Earth Diagnostics Ltd;Consultant, Lantheus Holdings;Consultant, Johnson & Johnson;Consultant, Curium SAS;Consultant, General Electric Company
Anthony Sisk, DO (*Abstract Co-Author*) Nothing to Disclose
William Hsu, PhD (*Abstract Co-Author*) Nothing to Disclose
Robert E. Reiter, MD (*Abstract Co-Author*) Nothing to Disclose
Tristan H. Grogan, MS (*Abstract Co-Author*) Nothing to Disclose

Sahith Doddipalli (*Abstract Co-Author*) Nothing to Disclose
Adam Weiner (*Abstract Co-Author*) Nothing to Disclose
Johannes Czernin, MD (*Abstract Co-Author*) Stockholder, Trethera CorporationBoard Member, Trethera Corporation
Preeti Ahuja, PhD (*Abstract Co-Author*) Nothing to Disclose
Madhvi Deol, BS, MD (*Abstract Co-Author*) Nothing to Disclose
Nashla Barroso (*Abstract Co-Author*) Nothing to Disclose
Steven S. Raman, MD (*Presenter*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Merck & Co, Inc;Consultant, Amgen Inc;Consultant, Profound Medical Inc

**PURPOSE**

To assess differences in sensitivity and positive predictive value between pre-surgical PSMA-PET and mpMRI and characterize tumors detected and not detected by each imaging modality focusing on identifying the clinical, pathological and imaging variables associated with tumors detected by PSMA-PET and mpMRI invisible.

**METHODS AND MATERIALS**

This single-center, retrospective analysis included patients who underwent both PSMA-PET and mpMRI prior to radical prostatectomy with centralized imaging and pathology review. Two nuclear medicine physicians and 2 radiologists blindly and independently contoured PCa lesions on PSMA-PET and mpMRI, respectively. We used a majority rule (2:1) with a third reader for each modality in case of disagreement.We fused the PET/CT and MRI and assessed for agreement/disagreement visually, based on the overlapping lesion contours, and matched each lesion with the tumors delineated by a genito-urinary pathologist on WMHP. Logistic regression models explored associations between clinico-pathological variables and tumor detection on imaging

**RESULTS**

A total of 132 csPCa tumors from 100 patients were identified on surgical pathology. PSMA-PET and mpMRI identified 143 and 122 lesions, respectively. PSMA-PET showed higher sensitivity (87% vs 80%), but lower positive predictive value compared to mpMRI (87% vs 93%). Tumors correctly identified on each imaging modality had significantly higher ISUP GG, larger size, and were more likely to show large cribriform pattern (LCP) and intraductal carcinoma (IDC). Tumors detected by both imaging modalities were significantly larger and had higher ISUP grade groups than those invisible on one or both imaging modalities. On multivariable analysis, smaller tumor size on pathology and older age were associated with PSMA PET/CT not detecting csPCa. Whereas for mpMRI, smaller tumor size on pathology was associated with invisible PCa, while ISUP GG4/5 vs GG2 was associated with lower odds of non-detection. csPCa tumors invisible on mpMRI but detected by PSMA-PET were smaller in size compared to those detected by both modalities. Limitations include selection bias in a surgical cohort.

**CONCLUSION**

PSMA-PET tends to detect smaller csPCa not detected by mpMRI. Larger tumors on pathology with higher grade groups are more likely to be correctly detected by both imaging modalities. These findings provide insights for refining pre-surgical evaluation strategies in PCa.

**CLINICAL RELEVANCE/APPLICATION**

These findings provide insights for refining pre-surgical evaluation strategies in PCa.

## T6-SSGU04-3 IMPACT OF $^{18}$F-DCFPYL PSMA PET AND MP-MRI ON ACCURACY OF LESION DETECTION IN MEN ON ACTIVE SURVEILLANCE WITH LOW/INTERMEDIATE RISK PROSTATE CANCER

Shane A. Wells, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson
David Jarrard (*Abstract Co-Author*) Nothing to Disclose
Steve Cho, MD (*Abstract Co-Author*) Research Grant, Voximetry, Inc;Research Grant, AIQ Australia Pty Ltd;Consultant, Focus-X Therapeutics, Inc;Research Consultant, General Electric Healthcare;Research Consultant, Bristol-Myers Squibb Company;Speaker, Haymarket Media Group Ltd;Central Reviewer, Radmetrix International
Edward M. Lawrence, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Evaluate the value of prostate specific antigen (PSMA) PET imaging and multi-parametric MRI (mpMRI) in detection of clinically significant prostate cancer (csPC) in patients with low/intermediate risk prostate cancer on active surveillance.

**METHODS AND MATERIALS**

Prospective IRB-approved Phase II trial with 18F-DCFPyL PSMA PET and mpMRI obtained on a dedicated PET/MRI scanner (3.0T Signa, GE Healthcare). Planned accrual of 100 men on AS with biopsy-proven low or intermediate-risk PC and primary outcome of csPC (grade group(GG)/ISUP=2) detection. Pelvic PET and mpMRI of the prostate were performed 1 hour after injection of ~9mCi of 18F-DCFPyL PSMA. Prostate mpMRI and pelvic PET was interpreted independently by experienced GU radiologist and nuclear medicine physician, respectively, both blinded to results of the other modality followed by convened integrated review for biopsy lesion identification. Lesions were classified according to PI-RADS v2.1 (mpMRI), and 5-point visual Likert scale (PSMA PET). PET quantitative maximum standardized uptake value (SUVmax) was obtained for all PI-RADS and Likert lesions =3. Systematic (12 cores) as well as targeted MRI-US fusion biopsies (DynaCAD; UroNav) were performed by an experienced urologist for all MRI PI-RADS=3 (standard of care) with addition of a research PET+ Likert=3 lesion. Per lesion and per patient analysis were performed with prostate biopsy histopathology results.

**RESULTS**

Eighty patients recruited with imaging and biopsy completed on 57 [median age 68; mean PSA 8.1 ng/mL; time on active surveillance 25 months (IQR, 13-58 mo); 67% very low/low risk versus 28% intermediate risk]. One hundred sixty three lesions were targeted for biopsy (Gleason grade group 1, 28/163, 17%; Gleason grade group 2 or higher, 36/163, 22%). The addition of PSMA PET to mpMRI resulted in improved detection of csPC at a lesion level with AUC of 0.72 (95% CI 0.63-0.81), 0.70 (0.60-0.79), and 0.79 (0.71-0.88) for mpMRI, PSMA PET, and combined MRI/PET respectively. In the initial cohort of 18 lesions with csPC, 15/18 (83%) were positive on both modalities with 1/18 (6%) positive on mpMRI only, and 2/18 (11%) positive on PET only.

**CONCLUSION**

Combining PSMA PET and mpMRI improves diagnostic accuracy for csPC detection and offers complementary information.

**CLINICAL RELEVANCE/APPLICATION**

PSMA PET can add value to mpMRI in patients with low/intermediate risk prostate cancer on active surveillance, including detection of csPC that is missed by mpMRI and highlighting areas of disease that may be progressing to higher grade. Ongoing subset analysis will investigate which patients may benefit the most from this combined approach.

## T6-SSGU04-4 COMPARISON OF MULTIPARAMETRIC MRI-TARGETED AND SYSTEMATIC BIOPSIES FORDETECTION OF CRIBRIFORM AND INTRADUCTAL CARCINOMA MORPHOLOGY PROSTATE CANCER

Gregory Pond (*Abstract Co-Author*) Nothing to Disclose
Theodorus van der Kwast (*Abstract Co-Author*) Nothing to Disclose
Eric Belanger (*Abstract Co-Author*) Nothing to Disclose
Michelle Downes (*Abstract Co-Author*) Nothing to Disclose
Madeleine Moussa (*Abstract Co-Author*) Nothing to Disclose
Laurence Klotz (*Abstract Co-Author*) Nothing to Disclose
Sangeet Ghai, MD (*Presenter*) Research Grant, INSIGHTEC Ltd

### PURPOSE

To compare the detection of Cr/IDC morphology PCa on multiparametric (mpMRI) targeted biopsy versus systematic biopsy in biopsy naive men at risk for PCa .

### METHODS AND MATERIALS

This study was a secondary analysis of a prospective randomized controlled trial which recruited participants with a clinical suspicion of PCa between April 2017 and November 2019 at 5 centers. Participants were randomized 1:1 either to MRI arm or systematic biopsy arm. Targeted biopsy was performed in participants with a Prostate Imaging-Reporting and Data System (PI-RADS) score =3.MRI features were recorded and biopsy slides and prostatectomy specimens were reviewed for the presence or absence of Cr/IDC histological patterns. Comparison of Cr/IDC patterns was performed using generalized linear mixed modeling.

### RESULTS

A total of 453 participants were enrolled, with 226 in the systematic biopsy arm (median age, 65 years [IQR: 59, 70]; 196 biopsies available for assessment) and 227 in the mpMRI targeted biopsy arm (median age, 67 years [IQR: 60, 72]; 132 biopsies available for assessment). Identification of Cr/IDC PCa was lower in the systematic biopsy arm compared to the mpMRI arm (31 of 196 [16%] vs 33 of 132 [25%]; P = .01). No evidence of a difference in mean cancer core length (CCL) (11.3 mm ± 4.4 [SD] versus 9.7 mm ± 4.5 [SD]; P=.09), apparent diffusion coefficient value (685 μm2/s ± 178 [SD] versus 746 μm2/s 245 [SD]; P=.52; P = .52) or dynamic contrast enhanced positivity (27 [82%] versus 37 [90%]; P = .33) for clinically significant PCa (csPCa) were observed between participants with or without Cr/IDC disease in the MRI arm. Cr/IDC positive histology overall had a higher mean CCL compared to negative Cr/IDC csPCa (11.1 mm ± 4.4 [SD] versus 9.2 mm ± 4.1 [SD]; P=.009).

### CONCLUSION

MRI targeted biopsy showed increased detection of Cr/IDC histological patterns compared to systematic biopsy. Clinical trial registration no. NCT02936258

### CLINICAL RELEVANCE/APPLICATION

Multiparametric MRI (mpMRI) and targeted biopsy only are increasingly replacing systematic biopsy for diagnosis, risk stratification and monitoring. However, the evidence regarding MRI detection of Cr/IDC pattern PCa is contradictory. Our Phase 3 RCT trial demonstrated that Cr/IDC pattern PCa is more likely to be detected on mpMRI targeted biopsy compared with systematic biopsy

## T6-SSGU04-5 PROSTATE MRI USING THE PROSTATE IMAGING FOR RECURRENCE REPORTING (PI-RR) SCORING SYSTEM TO DETECT RECURRENT PROSTATE CANCER: A SYSTEMATIC REVIEW AND META-ANALYSIS

Nathan Perlis (*Abstract Co-Author*) Nothing to Disclose
Giovanni B. Torri, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Andres Abreu Gomez (*Abstract Co-Author*) Nothing to Disclose
Luiza G. Schmitt, MD (*Abstract Co-Author*) Nothing to Disclose
Sangeet Ghai, MD (*Abstract Co-Author*) Research Grant, INSIGHTEC Ltd
Francesco Giganti, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Stephan Altmayer, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masoom A. Haider, MD (*Abstract Co-Author*) Nothing to Disclose
Miriana E. Mariussi, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Mourato (*Abstract Co-Author*) Nothing to Disclose
Alejandro Berlin (*Abstract Co-Author*) Nothing to Disclose
Adriano Basso Dias, MD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this systematic review and meta-analysis was to assess the diagnostic performance of the PI-RR system in predicting the likelihood of local recurrence after whole-gland treatment.

### METHODS AND MATERIALS

The Preferred Reporting Items for Systematic Reviews (PRISMA) - Diagnostic Test Accuracy guidelines were followed. Relevant databases were searched through December 2023. Primary studies met eligibility criteria if they reported MRI diagnostic performance in prostate cancer recurrence using PI-RR. Diagnostic performance for MRI was performed using two different cut-off points (= 3 or = 4 as positive cases according to the PI-RR system). A meta-analysis with a random-effects model was used to estimate pooled sensitivity and specificity.

### RESULTS

Sixteen articles were reviewed with full-text reading, and six were considered eligible totaling 467 patients. Using a cutoff of PI-RR = 3 (4 studies) for recurrent disease, the sensitivity and specificity were 77.8% (95% CI: 69.9-84.1%) and 80.2% (95% CI: 58.2-92.2%), respectively. Considering a cutoff of PI-RR = 4 (4 studies), the sensitivity and specificity were 61.9% (95% CI: 35.6-82.7%) and 86.6% (CI: 75.1-93.3%), respectively. Overall, the inter-rater agreement varied from fair to excellent.

### CONCLUSION

PI-RR is accurate in detecting local recurrence after whole-gland treatment for prostate cancer and shows fair-to-good to excellent inter-reader agreement. Overall, the PI-RR cutoff = 3 showed high sensitivity and specificity.

### CLINICAL RELEVANCE/APPLICATION

In this systematic review we looked at MRI diagnostic performance in prostate cancer recurrence when following the PI-RR system. We found that it has good sensibility and specificity, with fair to excellent agreement between different radiologists.

## T6-SSGU04-6 MULTIPARAMETRIC MRI CHARACTERISTICS IN YOUNG MEN WITH NORMAL PSA

Kai Jannusch (*Abstract Co-Author*) Nothing to Disclose
Birte Valentin, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Albers, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lars Schimmoeller, MD (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias Boschheidgen (*Presenter*) Nothing to Disclose

### PURPOSE

To analyze multiparametric magnetic resonance imaging (mpMRI) appearance in young men (median age 50 years) with PSA below 3ng/ml.

### METHODS AND MATERIALS

In this prospective analysis within the PROBASE study consecutive men with PSA below 3 ng/ml and mpMRI were included. These men were screened with PSA-measurement at the age of 50 and underwent subsequent mpMRI. Occurrence of PI-RADS 4/5 would indicate MRI/TRUS-fusion and systematic biopsy. MRI findings in the peripheral zone (PZ) were characterized regarding changes in T2w, ADC value, and dynamic contrast enhancement (DCE).

### RESULTS

Between September 2021 and March 2022 fourty-seven men were analyzed. The median baseline characteristics were age 50 (50-51), PSA level 1.22 ng/ml (0.47 - 1.79), PI-RADS classification 2 (1-3), PI-QUAL 5 (3-5), prostate volume 27 ml (23-32), and PSA density 0.04 ng/ml2 (0.02-0.06). PI-RADS 3 occurred in 45% of men. No PI-RADS 4/5 was observed. Consecutively, no men underwent biopsy. But with more than two years f/u according to PROBASE no cancer case was reported. For PZ, diffuse T2w-hypointensities were present in 81% of men. Focal and accentuated T2w-lesions were detected in 11% and 40%, respectively. DCE enhancement of the PZ was partially and severely observed in 53% and 17%, respectively. The lowest and highest ADC values were 1230 ± 197 [×10-3 mm2/s] and 1819 ± 174 [×10-3 mm2/s], respectively. 30% of men had significant hyperplasia of TZ.

### CONCLUSION

In younger men with normal PSA levels, no instances of MRI suspicion for clinically significant prostate cancer were observed. However, diffuse T2w-hypointensities and DCE enhancement of the PZ were very common and resulted in PI-RADS 3 in 45%. That seems more likely to be age specific or inflammatory matching with the higher ACD values compared to PC.

### CLINICAL RELEVANCE/APPLICATION

Our study characterizes the “normal” imaging appearance of MRI in younger men with PSA values below 3 ng/ml in a screening setting. Nearly half of all men had PI-RADS classification of 3 which emphasizes the difficulties of the PI-RADS system for young subjects in a screening setting. However, no instances of MRI suspicion for clinically significant prostate cancer were observed and after more than 2 years f/u no cancer case was reported.

# Abstract Archives of the RSNA, 2024

T6-SSPH08

**Physics (Innovations in Ultrasound)**

Tuesday, Dec. 3 1:30PM - 2:30PM Room: S404

Zheng Feng Lu, PhD (*Moderator*) Nothing to Disclose
Ivan Rosado-Mendez, PHD (*Moderator*) Equipment support, Siemens AG;Equipment support, General Electric Company;Consultant, Siemens AG

**Sub-Events**

## T6-SSPH08-1 AUTOMATED ULTRASOUND IMAGING PERFORMANCE EVALUATION USING A RANDOMLY-DISTRIBUTED SPHERE VOID PHANTOM

Zheng Feng Lu, PhD (*Abstract Co-Author*) Nothing to Disclose
Cristel X. Baiu, MENG (*Abstract Co-Author*) Nothing to Disclose
Dufan Wu, PhD (*Abstract Co-Author*) Nothing to Disclose
Baihui Yu, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

IEC TS 62791:2022 specified a method to quantify the human-observer-related lesion detectability by measuring the lesion signal-to-noise ratio (LSNR) using randomly distributed sphere phantoms with mechanical scanning devices. We developed an automated analysis method for this task using freehand scanning. This study aims to apply it to various acquisition settings for computerized performance evaluation and preset optimization.

### METHODS AND MATERIALS

An ultrasound tissue-mimicking phantom that includes randomly distributed high-contrast spheres of 2 mm diameter and 20% volume fraction was scanned by moving the transducer freehand from one side to the other using a cine-loop acquisition. The volumetric image data were generated by stacking the elevational frames. After non-local mean denoising and N4 bias correction, the spheres were segmented with adaptive thresholds and watershed algorithm. Lesion detectability was quantified by LSNR for each sphere on the original image with the derived segmentation. LSNR was only calculated within the scanning plane where the maximum sphere cross-section was detected out of the elevational frames acquired by freehand scanning. The depth-dependent mean LSNR curve was then generated.The phantom was scanned by a GE Logiq E10 system with an ML6-15 linear array transducer. LSNR and the sphere count as functions of the depth were evaluated by changing the following factors one at a time: nominal frequency, imaging modes and compound techniques, dynamic range, transmit power, and gain. The focus was uniformly applied across the entire depth range.

### RESULTS

The best LSNR was observed around the 4cm depth for all settings except for B-mode, demonstrating the robustness of the method. The following acquisition settings led to better LSNR: higher nominal frequency, harmonic imaging with compound, decreased dynamic range, higher power, and higher gain. All factors contributed to more detected spheres except the dynamic range. The results agreed with the visual assessments. The reproducibility was verified by repeating the freehand scans under the same setting 11 times. The standard deviation of LSNR averaged along the depth was only 8.2%, while that of the sphere counts was up to 33.8% due to different hand motion speeds.

### CONCLUSION

The automated analysis method for sphere phantom by freehand scanning provides accurate and stable quantitative assessment of the lesion detectability for ultrasound performance evaluation.

### CLINICAL RELEVANCE/APPLICATION

The automated analysis tool using a low-cost sphere void phantom, along with the ease of freehand scanning, has simplified ultrasound performance evaluation and preset optimization, and can play a critical role in routine ultrasound QA/QC in a clinical environment.

## T6-SSPH08-2 RISK ASSESSMENT OF CAROTID PLAQUES USING 2D AND 3D CONTRAST-ENHANCED US

Corinne Wessner (*Abstract Co-Author*) Consultant, Bracco Group
Patrick L. O'Kane, MD (*Abstract Co-Author*) Research Consultant, Shire plc
Flemming Forsberg, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research support, Canon Medical Systems Corporation;Research support, General Electric Company;Speaker, General Electric Company;Research support, Siemens AG;Research Grant, Butterfly Network, Inc;Research support, Lantheus Medical Imaging, Inc;Research support, Bracco Group
Paul Dimuzio (*Abstract Co-Author*) Nothing to Disclose
Andrej Lyshchik, MD, PhD (*Abstract Co-Author*) Royalties, RELX;Speaker, General Electric Company;Consultant, General Electric Company;Research support, General Electric Company;Consultant, BioClinica, Inc;Consultant, WCC, Inc;Consultant, Bracco Group;Advisory Board, Bracco Group
Priscilla Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Kibo Nam, PhD (*Presenter*) Equipment support, Canon Medical Systems Corporation;Equipment support, General Electric Company ;Support, Lantheus Medical Imaging;Research funded, Canon Medical Systems Corporation

## PURPOSE

To evaluate the feasibility of risk assessment of carotid plaques using 2D and 3D contrast-enhanced ultrasound (CEUS) with subharmonic-aided pressure estimation (SHAPE)

## METHODS AND MATERIALS

This prospective study enrolled 20 patients scheduled for carotid endarterectomy. Prior to their endarterectomy, subjects underwent 2D and 3D CEUS. The calcified plaque area, contrast-enhanced plaque area, and mean intensity of the contrast-enhanced plaque area were obtained from 2D CEUS. 3D SHAPE was used to estimate the pressure gradient between the carotid artery and plaque as well as the intraplaque pressure, utilizing the strong inverse linear relationship between subharmonic signal intensity from US contrast agents and ambient pressure. The subharmonic signal gradient i.e., the pressure gradient between the carotid artery and plaque as well as the mean subharmonic signal in the plaque were calculated from 3D SHAPE data. Four surrogate predictors of cardiovascular events were obtained from histological analysis of the plaque specimens collected after the endarterectomy: percentage lipid core, vascularity, intraplaque hemorrhage, and plaque cap thickness. The histology grades and US results were correlated using Spearman's correlation. The risk score combined from the histology predictors were compared to the US results independently or in combination.

## RESULTS

The contrast-enhanced plaque area and mean intensity of contrast-enhanced plaque area correlated moderately with the histological vascularity (? = 0.48-0.55). The pressure gradient between carotid artery and plaque had negative correlations with plaque vascularity (? = -0.31), cap thickness (? = -0.21), and intraplaque hemorrhage (? = -0.18). The plaque calcification showed negative correlation with cap thickness (? = -0.32). The intraplaque pressure by 3D SHAPE showed weak correlations with plaque vascularity (? = 0.28) and lipid core (? = 0.15). The mean intensity of contrast-enhanced plaque area showed the highest correlation with histology risk score combined from all 4 surrogate predictors (? = 0.35). When all US results were combined, correlation coefficients with the risk score based on all 4 surrogate predictors, based on plaque cap thickness, vascularity, and intraplaque hemorrhage, and based on vascularity and intraplaque hemorrhage were 0.56, 0.63, and 0.63, respectively.

## CONCLUSION

The plaque vascularity quantified by CEUS correlated well with the vascularity assessed by histology. Combined with the plaque calcification and vascularity from CEUS, the pressure estimates by 3D SHAPE showed the feasibility of risk assessment of carotid plaques.

## CLINICAL RELEVANCE/APPLICATION

CEUS with SHAPE showed potential to assess the risk of carotid plaques.

# T6-SSPH08-3 ULTRASOUND B MODE PERITUMORAL HETEROGENEITY OF LIVER METASTASES PREDICTS EARLIER OVERALL SURVIVAL FOR PATIENTS TREATED WITH IMMUNOTHERAPY

Jules Dupont (*Abstract Co-Author*) Nothing to Disclose
Corinne Balleyguier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicolas BILLET (*Abstract Co-Author*) Nothing to Disclose
Nathalie B. Lassau, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Younes Belkouchi, MSc (*Abstract Co-Author*) Nothing to Disclose
Felix Wirth, MEng, MSc (*Abstract Co-Author*) Nothing to Disclose
Baya Benatsou (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Bone (*Abstract Co-Author*) Employee, Guerbet SA
Littisha Lawrance (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the heterogeneity in the liver tumor and peritumoral area on B mode images to predict overall survival (OS) in metastatic patients who were treated with immunotherapy and had undergone an ultrasound (US) for the follow-up of their liver metastases irrespective of the cancer of origin.

## METHODS AND MATERIALS

This retrospective cohort included 49 patients who started their treatment from 2016. Patients who were followed up with a US of their liver tumor, after the onset of treatment at baseline, day 8 (D8) or day 14 (D14) and day 21(D21) were included.They eligible if they presented metastatic solid liver tumors, and were treated with immunotherapy, irrespective of their cancer of origin. The B Mode images of these patients were collected for each time point, totaling to 217 images. The liver and the lesion, regions of interest (ROI) visible on the images were outlined by a junior and a senior radiologist. The peritumoral mask was obtained by dilating the lesion ROI 1 cm. The images were normalized according to the gray levels of the fat mass. The heterogeneity index (H-index) for each lesion was calculated by clustering the ROI based on their gray level intensity and by quantifying the cluster's spatial heterogeneity(SH). The SH was based on the connectivity of the patches created by the clusters in the ROI and the cluster volume occupied with respect to the ROI volume. The end-point of the analysis was OS. Analyses were performed using the univariate Cox proportional hazard models, and the Kaplan Meir curves were used to visualize the separation between the populations with respect to the cut-offs found using maximally ranked selected statistics.

## RESULTS

Among the 49 patients, 42 patients, with availability of good quality images, were selected. The type of primary cancers included skin, colon, liver, rectal and breast cancers. The median OS was 12.33 months. Univariate cox analyses show that the H-index (p=0.009) of the peri tumoural region is an independent predictor of OS at D21. When normalized with respect to the area of the tumor, the H-index (p=0.01) still significantly predicts the OS at D21. Patients with a higher H-index (>0.109) have longer median OS (46.06 months) compared to those with a smaller H-index (=0.109) and a shorter OS (7.32 months). The analyses with the images at baseline, D8 and D14, did not yield a significant prediction of the OS.

## CONCLUSION

Tumor heterogeneity in the liver peritumoral region can be considered as a biomarker for liver metastases, irrespective of the origin of cancer.

## CLINICAL RELEVANCE/APPLICATION

B mode image brightness is related to the amplitude of the echo received from the boundaries of the tissues, using this method to measure heterogeneity can bring insights for better patient follow up and better survival prediction.

## T6-SSPH08-4 MULTI-INSTITUTIONAL SURVEY OF ULTRASOUND QUALITY CONTROL FINDINGS OVER FOUR YEARS

Jennifer Stickel, PHD (*Abstract Co-Author*) Nothing to Disclose
Wei Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Megan K. Russ, PHD (*Abstract Co-Author*) Nothing to Disclose
Cameron Kofler, PhD (*Abstract Co-Author*) Nothing to Disclose
Sandra Larson, PhD (*Abstract Co-Author*) Nothing to Disclose
Zheng Feng Lu, PhD (*Abstract Co-Author*) Nothing to Disclose
Andreea C. Dohatcu, PhD (*Abstract Co-Author*) Nothing to Disclose
Jian-Feng Chen, PhD (*Abstract Co-Author*) Nothing to Disclose
James A. Zagzebski, PhD (*Abstract Co-Author*) Consultant, Gammex Sunnuclear;;;;
Mark Holland, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhimin Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Zaiyang Long, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Periodic quality control (QC) testing of ultrasound (US) scanner systems is essential to ensure and maintain image quality. This study analyzes QC findings from medical physics annual surveys of modern clinical US systems.

### METHODS AND MATERIALS

QC results from annual surveys between 2018 and 2021 were retrospectively collected from 12 medical physicists from 10 institutions and one consulting company (hereafter referred to as sites). QC tests were classified as scanner- and transducer-related, evaluation of diagnostic workstation (DWS) display monitors, and review of routine QC programs. Test methodology and pass/fail criteria were established by each site. QC findings were defined as results requiring follow-up action by service engineers or other personnel. Items earmarked for future QC monitoring were not considered findings. When possible, the causes of physical and mechanical integrity (PMI) findings and transducer nonuniformity and artifact (NUA) findings were recorded. QC findings as the percentage of the equipment count per year were calculated and averaged for sites with multiple years of data.

### RESULTS

Among 11 sites, the maximum number of scanners and transducers tested per year totaled 349 and 1690, respectively. For scanners, all sites performed PMI inspections and visual assessments of scanner display monitors (SDM). The average percentage of scanner findings per year ranged from 0 to 40.8% (median 18.0%) across all sites. The most common QC findings were from PMI, followed by quantitative measurements of SDM. The top cause for PMI findings was faulty scanner brakes. Additional scanner findings, in decreasing order, stemmed from transducer port testing, visual testing of SDM, and overall system sensitivity (exhibited as reduced sensitivity of all transducers). For transducers, all sites tested PMI, NUA, and sensitivity. The average percentage of transducer findings per year ranged from 0.5% to 19.9% (median 7.2%) across all sites. The most common QC findings were due to NUA, followed by PMI issues. The top causes were weak/bad elements for NUA and transducer face issues for PMI. Other findings, in decreasing order, resulted from sensitivity in fundamental mode, lateral spatial resolution, sensitivity in harmonic mode (all identified in sensitivity in fundamental mode), and horizontal distance accuracy. 18.2% of sites conducted DWS monitor testing with one monitor showing findings and 18.2% of sites evaluated the QC program with no finding.

### CONCLUSION

Medical physics annual surveys revealed considerable actionable findings of modern US systems across 11 sites.

### CLINICAL RELEVANCE/APPLICATION

The survey results highlight valuable QC tests which yield actionable findings and can guide clinical QC activities to ensure image quality.

## T6-SSPH08-5 CONFOUNDERS OF ULTRASOUND ATTENUATION IMAGING IN A LINEAR PROBE USING THE CANON APLIO I800 SYSTEM: A PHANTOM STUDY

Alexander Martin, DPhil, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

There have been studies showing attenuation imaging (ATI) with ultrasound as an approach to diagnose liver diseases such as steatosis or cirrhosis. So far, this technique has only been used on a convex probe. The goal of the study was to investigate the feasibility of ATI measurements using the linear array on a canon Aplio i800 scanner on certified phantoms.

### METHODS AND MATERIALS

Three certified liver tissue attenuation phantoms were measured in five different positions using a linear probe. The effects of positioning and depth were explored and compared. The values were compared to the certified expected value for each phantom as well as the different measurement values for each measurement position.

### RESULTS

The ATI measurements on phantoms significantly affected the different probe positions and region of interest (ROI) depths. Values in the center with the probe perpendicular to the phantom were closest to certified values. Median values at 2.5-4.5 cm depth for phantoms 1 and 2 and 0.5-2.5 cm for phantom 3 were comparable with certified values. Measurements taken at a depth greater than 6 cm in any position were the least representative of the certified values ($p$-value $< 0.01$) and had the widest range throughout the sessions.

### CONCLUSION

ATI measurements can be performed with the linear probe in phantoms; however, careful consideration should be given to depth dependency, as it can significantly affect measurement values. Remaining measurements at various depths within the 0.5-6.0 cm range showed deviation from the certified values of approximately 25%.

### CLINICAL RELEVANCE/APPLICATION

Developing a protocol for using a linear probe for attenuation imaging with potential uses for superficial structures such as MSK, breast or thyroid, as well as possible uses in paediatric medicine.

## T6-SSPH08-6 PROTOACOUSTIC RADIOGRAPHY

Liangzhong Xiang, PhD (*Abstract Co-Author*) Nothing to Disclose
Yong Chen, PHD (*Abstract Co-Author*) Nothing to Disclose
Kristina Bjegovic, BS (*Abstract Co-Author*) Nothing to Disclose
Kaitlyn Kim, BS (*Abstract Co-Author*) Nothing to Disclose
Gilberto Gonzalez, PHD (*Abstract Co-Author*) Nothing to Disclose
Prabodh K. Pandey, PhD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Introducing "Protoacoustic Radiography" as a novel imaging method which leverages proton-induced acoustic (PrA) waves near the Bragg peak (BP) to enable 3D visualization from a single projection, addressing the limitations of traditional proton radiography, which requires multiple projections and precise proton tracking for 3D imaging. Protoacoustic Radiography streamlines the process, reducing procedure times and minimizing organ exposure to radiation. Additionally, Protoacoustic Radiography fully utilizes the superior contrast available near the Bragg peak. Experimental studies we performed. indicate its effectiveness in sensing materials contrast as well.

### METHODS AND MATERIALS

Experiment #1 involved the setup of three Cerrobend bars, spaced approximately 1 cm apart both axially and laterally within a water tank. Positioned around 6 cm from the central target, a 256-element ultrasonic transducer (UT) collected PrA signals generated by pulsed proton absorption. The choice of a proton energy level of 176MeV was made to align with the Bragg peak (BP) between the first two rods. PrA signals were captured for two additional energy levels, each shifting the BP by 1 cm. Image reconstructions were performed using a universal backprojection algorithm. In Experiment #2, a copper and a Cerrobend bar, separated by about 1 cm laterally, underwent irradiation. The energy deposition (ED) was reconstructed and subsequently refined for proton fluence correction using a regularized division method.

### RESULTS

Experiment #1: Using 176MeV proton excitation, only the first bar was imaged. At the second energy level (181 MeV), the first two bars could be seen while the third energy level (186 MeV) extended the imaging to include all the three bars within the proton range. Experiment #2: The reconstructed energy deposition map exhibited comparable values for both copper and Cerrobend rods. The fluence correction underscored the contrast variation between the two materials.

### CONCLUSION

A novel imaging method emerges from the synergy between protons and ultrasound, providing three-dimensional imaging from a single projection, depth selectivity based on proton range, and material contrast detection. This technique not only minimizes radiation exposure to organs along the proton path but also strategically shields deeper vital organs from radiation.

### CLINICAL RELEVANCE/APPLICATION

The proposed technique, Protoacoustic Radiography (PAR), has the capability to provide comprehensive 3D imaging of a targeted region from a single projection. By minimizing radiation exposure to organs in its path and effectively shielding deeper vital organs from harmful radiation by tuning proton energy, PAR has the potential to revolutionize medical imaging practices.

Printed on: 05/28/25

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

T6-STCE1

**Science Session (Multiomic and Multicenter Radiology AI)**

Tuesday, Dec. 3 1:30PM - 2:00PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## T6-STCE1-3 AI TRIAGE OF CXR FOR EXPEDITING LUNG CANCER DIAGNOSIS IN THE NATIONAL HEALTH SERVICE

Mohamed Ziyad Abubacker, FRCR (*Abstract Co-Author*) Nothing to Disclose
Anne-Marie Bartsch (*Abstract Co-Author*) Nothing to Disclose
Anthony Chung, BSC,MBBS (*Abstract Co-Author*) Nothing to Disclose
Jack Packer (*Abstract Co-Author*) Nothing to Disclose
Daniel Togher (*Abstract Co-Author*) Nothing to Disclose
Souradip Mookerjee, MD (*Abstract Co-Author*) Nothing to Disclose
Susan C. Shelmerdine, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Geraldine Dean, MD (*Abstract Co-Author*) Nothing to Disclose
Simon Rickaby (*Abstract Co-Author*) Nothing to Disclose
Mathew Storey, MBChB (*Presenter*) Nothing to Disclose

### PURPOSE

Lung cancer is the leading cause of cancer mortality in the UK where five-year survival lags behind comparably developed nations. Improving early diagnosis is a national priority but is limited by the radiology workforce crisis and comparably low access to CT. We pilot the 'Artificial Intelligence triage to same day CT' (AI-CT) pathway using a 14 finding version of the Annalise CXR v2.3 model to improve access to CT for patients with suspected cancer and assess the diagnostic performance of the algorithm in this real-world project.

### METHODS AND MATERIALS

All chest radiographs between between January 2022 and October 2023 from 5 NHS centres in London, England. Time from chest radiograph acquisition to CT report (Time to CT), model findings, suspected cancer on CXR and CT were recorded before and after introduction of the AI-CT pathway . Survival analysis was performed using Time to CT and diagnostic performance metrics (including AUC-ROC and F1 scores) of the model were calculated using suspected cancer on CT as the ground truth.

### RESULTS

Data from 26,660 chest radiograph and 573 CT thorax examinations performed within 7 days were analysed. There was a significant improvement in the proportion of patients undergoing CT within 1 and 3 days of a suspicious chest radiograph (HR1.93 and 1.34 respectively, $p < 0.001$) following introduction of the AI-CT pathway. Same day CT was much more likely at sites with co-located CXR and CT facilities (HR 7.6, $p < 0.001$). The highest performing AI features were ‘single pulmonary nodule', 'multiple pulmonary masses' and 'single pulmonary mass' returning F1 scores of 0.47, 0.42 and 0.38 respectively. The combined 14-feature model sensitivity was 91% but specificity was 22% (F1 score 0.56).

### CONCLUSION

The custom model has high sensitivity but low specificity for cancer on chest radiographs and the AI-CT pathway improves the same day access to CT, but only at sites with co-located CXR and CT facilities.

### CLINICAL RELEVANCE/APPLICATION

The model can perform supervised triage to improve CT access for cancer while unsupervised deployment is limited by low specificity.

# Abstract Archives of the RSNA, 2024

T6-STCE2

**Science Session (Low-Field and Mobile MRI)**

Tuesday, Dec. 3 1:30PM - 2:00PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## T6-STCE2-1 FIRST EXPERIENCES COMPARING COMMERCIAL LOW-FIELD MRI WITH CT IN PULMONARY SARCOIDOSIS

Michael Bach (*Abstract Co-Author*) Nothing to Disclose
Constantinos Anastasopoulos, MD (*Abstract Co-Author*) Nothing to Disclose
Jens Bremerich, MD (*Abstract Co-Author*) Nothing to Disclose
Oliver Bieri, PhD (*Abstract Co-Author*) Nothing to Disclose
Shan Yang, MSc (*Abstract Co-Author*) Nothing to Disclose
Grzegorz Bauman (*Abstract Co-Author*) Nothing to Disclose
Hanns-Christian Breit, MD (*Abstract Co-Author*) Nothing to Disclose
Katrin Hostettler Haack (*Abstract Co-Author*) Nothing to Disclose
Martin Segeroth, MD, BSc (*Abstract Co-Author*) Nothing to Disclose
Maurice Pradella, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Accurate assessment of lung involvement is important for diagnosis and treatment planning in patients with sarcoidosis. Chest CT is the gold standard; however, low-field MRI promises to be a radiation-free alternative. This study aims to evaluate the inter-rater agreement between pulmonary MRI on a commercial low-field system with CT scans assessing lung parenchymal changes in sarcoidosis patients.

### METHODS AND MATERIALS

Patients with known pulmonary sarcoidosis were prospectively enrolled in this study. They underwent both CT (lung kernel reconstruction 1 mm3 resolution) and low-field MRI (commercial 0.55 T system; Free.Max, Siemens Healthineers). For MRI, a 3D radial balanced steady-state free precession (bSTAR) sequence with 1.3 mm3 isotropic resolution acquired during free-breathing was used; acquisition time was 6 min. Three cardiothoracic radiologists (experience: 20 years, 6 years, 1 year) independently reviewed first the CT scans and, after a blinding period of minimum 7 days, the MRI scans of all patients. Raters evaluated the presence or absence of reticulations, ground glass opacities, traction bronchiectasis, consolidations, and nodules. Inter-rater agreement for both MRI and CT reading sessions was quantified using Fleiss kappa (?). Furthermore, accuracy, sensitivity, and specificity using the CT readings as ground truth for the MRI readings were calculated.

### RESULTS

Fifteen patients were enrolled in this study, mean age: 50 years, 8 females. Mean accuracy, sensitivity and specificity between CT and MRI readings amounted to: consolidations (73%, 86%, 66%), traction bronchiectasis (73%, 27%, 96%), nodules (71%, 67%, 67%), ground glass opacities (64%, 70%, 59%), and reticulations (69%, 29%, 86%). Comparing inter-rater agreement between MRI and CT reading sessions, we found that agreement on MRI was higher for consolidations (?MRI = 0.62 vs. ?CT = 0.46), traction bronchiectasis (?MRI = 0.55 vs. ?CT = 0.30) and nodules (?MRI = 0.35 vs. ?CT = 0.17). On opposite, ground glass opacities (?MRI = -0.17 vs. ?CT = 0.73) and presence or absence of reticulations (?MRI = -0.29 vs. ?CT = 0.17) showed worse agreement in MRI readings.

### CONCLUSION

Our study suggests that commercial low-field MRI may offer new possibilities for pulmonary imaging. However, variance among raters identifying common lung parenchymal patterns was high. Technical and educational efforts are required to further improve imaging sequences and strengthen radiologists' confidence to enhance diagnostic accuracy and consistency in pulmonary MRI.

### CLINICAL RELEVANCE/APPLICATION

Commercial low-field MRI might be a radiation-free alternative to CT for lung imaging. Whilst dedicated MRI sequences might be improved further, radiologists should familiarize with pulmonary MRI, expanding its diagnostic potential for detection and management of lung diseases.

## T6-STCE2-2 EFFICACY OF FOLLOW-UP PORTABLE MRI COMPARED TO STANDARD FOLLOW-UP HEAD CT FOR INTERVAL EVALUATION OF TRAUMATIC INTRACRANIAL HEMORRHAGE

Ahmed Sayed Ahmed (*Abstract Co-Author*) Nothing to Disclose
Madonna Stotsenburg (*Abstract Co-Author*) Nothing to Disclose
Mario Rueda (*Abstract Co-Author*) Nothing to Disclose
Kaveh Asadi (*Abstract Co-Author*) Nothing to Disclose
Robert Borrego (*Abstract Co-Author*) Nothing to Disclose
Lauren Thompson (*Abstract Co-Author*) Nothing to Disclose
Faris Azar (*Abstract Co-Author*) Nothing to Disclose
Athina Yoham (*Presenter*) Nothing to Disclose

**PURPOSE**

Accurate and timely follow-up imaging is crucial for the effective clinical management of traumatic intracranial hemorrhage (TICH). The conventional follow-up modality is head computed tomography (CT), recognized for its widespread availability and rapid acquisition time. Portable magnetic resonance imaging (pMRI) presents several potential advantages, including enhanced portability, absence of ionizing radiation, and superior soft tissue contrast. This study seeks to evaluate the efficacy of follow-up pMRI relative to standard head CT in the assessment of TICH.

**METHODS AND MATERIALS**

From 02/23/2024 to 08/01/2024, patients with TICH at our level 1 trauma center were screened for eligibility to participate in our prospective study. Informed consent was obtained from all participants. Enrolled patients with TICH identified on head CT underwent pMRI on admission and pMRI images were then compared to CT images. The primary outcome was to evaluate pMRI's ability to identify and describe changes in TICH size and quality, compared to head CT. The secondary outcome was pMRI's impact on clinical decisions compared to head CT.

**RESULTS**

Twenty patients with a mean age of 63 years (±21 years), (14 males, 6 females) were included in this study. The mean interval between follow-up CT and pMRI was 10 hours (±5.7 hours). The study encompassed cases of subdural hematomas (n=11), subarachnoid hemorrhages (n=6), and intraparenchymal hemorrhages (n=3). pMRI exhibited superior performance in delineating intraparenchymal hemorrhages, subarachnoid hemorrhages, and the extent of hemorrhagic contusions, owing to its superior soft tissue contrast. Furthermore, pMRI identified detailed features of subdural hematomas that were not detected by CT, although certain subdural hematomas, such as tentorial hemorrhages, remained inconspicuous on pMRI. Both imaging modalities effectively assessed midline shifts and mass effects; however, pMRI provided a more comprehensive visualization of soft tissue involvement.

**CONCLUSION**

Follow-up pMRI is a reliable and effective alternative to standard head CT for monitoring TICH. It provides comparable diagnostic information while offering additional benefits such as portability and the absence of ionizing radiation, making it an excellent choice for routine clinical follow-up. These findings suggest that pMRI may enhance TICH follow-up and provide additional insights. Further research is necessary to confirm these results and evaluate the cost-effectiveness of incorporating pMRI into standard clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

pMRI is safer as it lacks ionizing radiation, enhancing patient outcomes and clinical treatment of TICH. Its superior soft tissue contrast and mobility improve follow-up care.

## T6-STCE2-3 EARLY EXPERIENCE SCANNING PATIENTS WITH CLINICAL CARDIOVASCULAR INDICATIONS ON A 0.55T MRI SCANNER

Adrienne Campbell (*Abstract Co-Author*) Nothing to Disclose
Rajiv Ramasawmy (*Abstract Co-Author*) Nothing to Disclose
Christine Mancini (*Abstract Co-Author*) Nothing to Disclose
Hui Xue, PhD (*Abstract Co-Author*) Nothing to Disclose
Haiyan Wang (*Abstract Co-Author*) Nothing to Disclose
W. Patricia Bandettini, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

We present our early experience scanning patients with clinical cardiovascular (CV) diagnoses and indications on a 0.55T MRI scanner to demonstrate feasibility of using mid field strengths in cardiovascular magnetic resonance (CMR).

**METHODS AND MATERIALS**

Patients with known or suspected cardiovascular disease underwent an IRB-approved research CMR on a 0.55T MRI scanner (prototype MAGNETOM Free.Max, Siemens Healthineers, Erlangen, Germany). The commercial 0.55T MRI system is not FDA cleared for CMR, and our prototype system includes a custom gradient upgrade. All sequences were research sequences and triggered by an external monitor (Expression MR400 In Vivo, Philips, Amsterdam, the Netherlands). Sequences used were based upon the CV assessment needs with all patients undergoing localizers and cine assessment. Phase contrast, parametric mapping, perfusion imaging, contrast angiography, and late gadolinium enhancement were added as indicated. An AI-based denoising filter was applied to cine, perfusion, and late enhancement imaging. Standard doses of gadolinium contrast were used as indicated and as agreed upon by subjects. CV evaluations were categorized into the following categories: cardiomyopathy, valve/shunt, myocardial infarction (MI)/stress, myocarditis, complex congenital, mass, aorta.

**RESULTS**

Forty-five patients underwent CMR on the 0.55T system. 43 were resting studies; 21 studies used gadolinium contrast. 29 participants were male (16 female); mean age 53±15 yrs; 33 White, 9 Black or African American, 3 Asian; 4 Hispanic/Latino. Categories of scans were distributed as follows: 13 cardiomyopathy, 13 valve/shunt, 7 MI (included 2 stresses), 3 myocarditis, 6 complex congenital disease, 4 masses, one aorta. Some patients had more than one indication. 43 patients had a clinical CMR performed within two months of the 0.55T scan. All studies were evaluated qualitatively and were diagnostic for structural and cardiac chamber functional information. All contrast late gadolinium enhancement studies were diagnostic, but in some cases AI-based denoising caused blurring. Valvular and shunt information correlated well between field strengths.

**CONCLUSION**

In our early experience in a moderate size group of patients with suspected and known clinical CV disease, we have demonstrated that cardiovascular assessment of a broad selection of disease processes is feasible using our 0.55T MRI system. Validation in larger groups of patients with additional indications will strengthen the diagnostic confidence of imaging at lower field strengths.

**CLINICAL RELEVANCE/APPLICATION**

Imaging at low to mid-field field strengths may offer the potential to expand clinical CMR assessment globally in a sustainable fashion.

# Abstract Archives of the RSNA, 2024

T7-SSBR06

**Breast Imaging (MRI Advanced Applications)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S404

Ritse M. Mann, MD, PhD (*Moderator*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Elizabeth A. Morris, MD (*Moderator*) Scientific Advisory Board, Bracco Group;Speaker, Bayer AG;Scientific Advisory Board, Bayer AG;Speaker, Guerbet SA;Researcher, Guerbet SA;Stockholder, Revel Transit Inc;Stockholder, Kheiron Medical Technologies Ltd

**Sub-Events**

## T7-SSBR06-1 INTRATUMORAL HETEROGENEITY-BASED RADIOMICS FOR PREOPERATIVE DIFFERENTIATION OF HER2-POSTIVE, -LOW AND -ZERO BREAST CANCERS USING MULTIPARAMETRIC MRI:A MULTICENTER STUDY

Yulu Liu (*Abstract Co-Author*) Nothing to Disclose
Yi Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Haoquan Chen (*Presenter*) Nothing to Disclose

### PURPOSE

Targeted therapy employing anti-HER2 antibody-drug conjugates has demonstrated efficacy in treating patients with HER2-low breast cancers. However, intratumoral heterogeneity (ITH) presents a great challenge in the identification of HER2-low cancers via pathological evaluation. Hence, the purpose of this study is to develop an ITH-based radiomics model to differentiate HER2-postive, -low and -zero breast cancers using multiparametric MRI.

### METHODS AND MATERIALS

A total of 675 patients were enrolled in this retrospective study from two institutions between July 2017 and October 2021. To identify patients with HER2-low breast cancers, the study involved a two-step process. Initially, discrimination between HER2-positive and -negative status was conducted, followed by differentiation between HER2-low and -zero status in the second step. For each step, four models were developed, including the clinical model, radiomics model, ITH model, and combined model, respectively. Multivariable logistic regression analysis was used to identify significant clinicopathologic variables. ITH was reflected by radiomics features extracted from intratumoral subregions, with an ITH score derived from model output probabilities. Subregion radiomics features combing clinicopathologic variables were integrated into a combined model. The area under the receiver operating characteristic curve (AUC) was used to assess the predictive power of each model.

### RESULTS

The first step was comprised of 675 patients from two centers (training, n=371, validation, n=158, test, n=146). The second step was encompassed 503 patients (training, n=283, validation, n=123, test, n=97). Ki-67 emerged as the sole independent factor associated with the odds of HER2-low status (odds ratio = 0.92; 95%CI: 0.87, 0.97; $P < 0.05$). In both steps, the ITH model showed great performance in the test cohort, with AUCs of 0.80(95%CI: 0.73-0.87) in Step 1 and 0.80(95%CI: 0.73-0.87) in Step 2. Among HER2-positive, -low and -zero breast cancers, the combined models performed the optimal, achieving an AUC of 0.84 (95%CI: 0.77-0.90) in the test cohort for differentiating between Her2-positive and -negative cancers, and an AUC of 0.80(95%CI: 0.72-0.89) for differentiating between Her2-low and -zero cancers.

### CONCLUSION

A model combining subregion radiomics features, reflecting ITH, with clinicopathologic variables can differentiate patients with HER2-positive, -low and -zero breast cancers.

### CLINICAL RELEVANCE/APPLICATION

Our study revealed that an ITH-based radiomics model can effectively differentiate among HER2-postive, -low and -zero breast cancers. This might contribute to precise clinical selection of suitable populations that acquire benefit from anti-Her2 targeted therapies.

## T7-SSBR06-2 KINETIC ANALYSIS OF BACKGROUND PARENCHYMAL ENHANCEMENT FOR IMPROVED BREAST CANCER RISK STRATIFICATION IN BREAST MRI

Sven Nebelung, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Jutz (*Abstract Co-Author*) Nothing to Disclose
Christiane K. Kuhl, MD, PhD (*Abstract Co-Author*) Advisory Board, Guerbet SA;Speaker, Bracco Group;Speaker, Bayer AG
Daniel Truhn, MD (*Abstract Co-Author*) Research Consultant, Aristra Medical
Gustav Mueller-Franzes, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Previous studies have shown that the degree of Background Parenchymal Enhancement (BPE) is associated with risk of subsequent breast cancer. This study aimed to evaluate whether a more refined analysis of BPE, i.e. analysis of BPE kinetics (BPEK) on dynamic contrast enhanced breast MRI, allows an improved risk stratification.

**METHODS AND MATERIALS**

The cohort consisted of 4,034 breast MRI scans from 2,017 women, including 585 women with breast cancer (186 pre-, 399 postmenopausal) and 1,432 cancer-free women (518 pre-, 914 postmenopausal). Breast MRI studies were acquired according to a fully standardized protocol, consisting of one pre- and four consecutive post-contrast T1-weighted images. A neuronal network was trained to segment the fibroglandular tissue automatically and to quantify degree of BPE as relative signal intensity increase between pre- and post-contrast. BPEK was defined as early to late BPE: (S1-S0)/(S4-S0), where S0, S1, and S4 refer to the mean signal intensity in the precontrast, first- and fourth post-contrast images. BPE and BPEK were compared for women with breast cancer in the contralateral healthy breast and women without breast cancer in the left or right breast.

**RESULTS**

Degree and kinetics of BPE differed significantly for the 1,313 postmenopausal women with vs. without breast cancer (5.51±3.70 vs. 4.55±2.73, P<.001 and 0.35±0.11 vs. 0.32±0.10, P=<.001). For the 704 premenopausal women with vs. without breast cancer, BPE did not differ significantly (11.27±7.21 vs. 10.78±7.86, P=0.53), while BPE kinetics did differ significantly (0.39±0.09 vs. 0.37±0.09, P=.05).

**CONCLUSION**

BPEK is significantly associated with breast cancer, independent of menopausal status, while BPE was not. BPEK may thus allow improved breast cancer risk stratification.

**CLINICAL RELEVANCE/APPLICATION**

Automatically derived quantitative measures of BPEK may help to stratify patients according to their risk of developing breast cancer.

## T7-SSBR06-3 A DEEP LEARNING-BASED APPROACH IN DISTINGUISHING BETWEEN BENIGN AND MALIGNANT BREAST LESIONS USING DIFFUSION-WEIGHTED MRI: A MULTICENTER STUDY

Yi Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Haoquan Chen (*Abstract Co-Author*) Nothing to Disclose
Yulu Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

Breast MRI has been recommended as a supplemental screening tool for breast cancer, but its long examination time and use of contrast material remains concerning. This study aims to develop a diagnostic model using deep learning approaches with an abbreviated, non-contrast-enhanced diffusion weighted (DW) MRI protocol.

**METHODS AND MATERIALS**

A total of 1888 patients were enrolled from 4 institutions, all with breast pathology diagnostic results. For model construction, 1290 patients from our institution were randomly divided at a 6:2:2 ratio (training n=774, validation n=258, test n=258). Data from 3 other institutions served as external test cohorts (external 1 n=102, external 2 n=144, external 3 n=352). Three diagnostic models, DWI model (b=800s/mm2 and b=0s/mm$^2$), non-enhanced model (DWI T2WI), and abbreviated enhanced model (DWI T2WI first contrast-enhanced T1WI), were developed using DenseNet121 convolutional neural network. DWI model's diagnostic AUCs was compared with non-enhanced and abbreviated enhanced models. Two radiologists reviewed external MR images using four protocols: i. DWI, ii. DWI T2WI, iii. DWI T2WI first contrast-enhanced T1WI and iv. standard breast MR protocol. Subgroups analysis based on tumor morphology, volume, glandular density, BPE, age, and malignant tumor types to evaluate model performance. Area under the curve (AUC) of receiver operating characteristic assessed the model performance.

**RESULTS**

Three models constructed based on DenseNet121 achieved good AUCs (training 0.849-0.907, validation 0.864-0.875, test 0.883-0.916, as well as external 1 0.726-0.758, external 2 0.783-0.823, external 3 0.738-0.791). Among these, DWI model showed no statistical difference in AUCs compared to the non-enhanced model and abbreviated enhanced model in validation, test and all external cohorts. The AUCs of DWI model showed no statistical difference compared to Reader 1 but were significantly lower than those of protocols iii and iv by Reader 2. Subgroup analysis revealed that BPE was a factor influencing DWI model's diagnostic performance ($p<0.05$), which demonstrated a sensitivity of 0.827 for invasive ductal carcinoma, significantly higher than for other malignant tumors ($p<0.05$).

**CONCLUSION**

The deep learning model utilizing abbreviated, non-contrast-enhanced DWI protocol displayed excellent diagnostic accuracy, comparable to non-enhanced model, abbreviated enhanced model and radiologists. These findings indicate that our model could potentially aid in breast cancer screening in the future.

**CLINICAL RELEVANCE/APPLICATION**

Our study showed that a deep learning model using DWI is effective in distinguishing breast lesions, which suggests its potentially assisst in screening breast cancers.

## T7-SSBR06-4 CANCER SCREENING IN BREAST MRI USING DEEP EXPLAINABLE ANOMALY DETECTION

Elyse S. Blum, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Anum S. Kazerouni, PhD (*Abstract Co-Author*) Nothing to Disclose
Habib Rahbar, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Consultant, Guerbet SA
Savannah C. Partridge, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Research support, Koninklijke Philips NV;Consultant, Guerbet SA
Felipe Oviedo, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Deep learning has been proposed to improve efficiency and accuracy for breast cancer detection on breast MRI. However, these models have limitations. In screening of high risk patients, cancer cases are only a small fraction (< 5%) of patients, leading to reduced model performance. Furthermore, deep learning classification models have limited ability to highlight malignant regions in the MRI (explainability). Our purpose was to develop and evaluate an explainable AI model for cancer detection on breast MRI, effective in both high and low cancer prevalence populations.

**METHODS AND MATERIALS**

This IRB-approved study utilized 9,567 breast MRI examinations in 5,026 women, imaged at a single institution from 2005-2014. A Fully Convolutional Data Description (FCDD) deep anomaly detection model was developed to detect breast malignancies on contrast-enhanced MRI. FCDD estimates an overall anomaly score and provides a spatially resolved heatmap as model explanation. Performance was evaluated with grouped cross validation in both balanced (24.9% malignant) and imbalanced (1.85% malignant) detection tasks and compared to binary classification and non-explainable anomaly detection models. Explainability was assessed through comparison with ground-truth radiologist annotations for a subset of malignancies.

**RESULTS**

FCDD surpassed binary classification models with a mean AUROC=0.842 [95% CI: 0.838, 0.845] across folds in the balanced detection task, and AUROC=0.722 [0.711, 0.733], AUPR=0.111 [0.101, 0.123] in the imbalanced detection task. In the imbalanced task, FCDD positive predictive value (0.142 [0.102, 0.188]) was twice that of binary classification, reducing false positives by 24.9%. At an operating point with 97% sensitivity, FCDD had more than 50% higher specificity than binary classification models. Assessing model explainability, FCDD explanations had mean pixel-wise AUROC=0.920 [0.891, 0.946] compared with radiologists, surpassing the pixel-wise AUROC of saliency maps for binary classification 0.807 [0.773, 0.838].

**CONCLUSION**

The FCDD model performed well in breast MRI cancer detection with good spatial explainability of abnormal regions, which has the potential of accelerating breast MRI interpretation workflows.

**CLINICAL RELEVANCE/APPLICATION**

Our model has the potential to assist radiologists in breast MRI analysis, demonstrating both high detection performance and human explainability in low prevalence scenarios.

## T7-SSBR06-5 COULD BREAST MULTIPARAMETRIC MRI DISCRIMINATE BETWEEN PURE DUCTAL CARCINOMA IN SITU AND MICROINVASIVE CARCINOMA ?

Giuliana Moffa, MD (*Abstract Co-Author*) Nothing to Disclose
Francesca Galati, MD (*Abstract Co-Author*) Nothing to Disclose
Veronica Rizzo, MD (*Abstract Co-Author*) Nothing to Disclose
Federica Pediconi, MD (*Abstract Co-Author*) Nothing to Disclose
Federica Cicciarelli, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Ductal carcinoma in situ (DCIS) is often reclassified as invasive cancer in the final pathology report of the surgical specimen. It is of significant clinical relevance to acknowledge the possibility of underestimating invasive disease when utilizing preoperative biopsies for a DCIS diagnosis. In cases where such histologic upgrades occur, it is imperative to consider them in the preoperative planning process, including the potential inclusion of sentinel lymph node biopsy dueto the risk of axillary lymph node metastasis.To assess the capability of breast multiparametric magnetic resonance imaging (MP-MRI) in differentiating between pure DCIS and microinvasive carcinoma (MIC).

**METHODS AND MATERIALS**

Between January 2018 and November 2022, this retrospective study enrolled patients with biopsy-proven DCIS who had undergone preoperative breast MP-MRI. We assessed various MP-MRI features, including size, morphology, margins, internal enhancement pattern, extent of disease, presence of peritumoral edema, time-intensity curve value, diffusion restriction, and ADC value. Subsequently, a logistic regression analysis was conducted to explore the association of these features with the pathological outcome.

**RESULTS**

Of 129 patients with biopsy-proven DCIS, 36 had foci of micro-infiltration on surgical specimens and eight were diagnosed with invasive ductal carcinoma (IDC). The presence of micro-infiltration foci was significantly associated withseveral MP-MRI features, including tumor size (P <0.001), clustered ring enhancement (P <0.001), segmental distribution (P <0.001), diffusion restriction (P=0.005), and ADC values <1.3 × 10-3 mm2/s (P =0.004).

**CONCLUSION**

Breast MP-MRI has the potential to predict the presence of micro-infiltration foci in biopsy-proven DCIS and may serve as a valuable tool for guiding therapeutic planning.

**CLINICAL RELEVANCE/APPLICATION**

to predict the presence of micro-infiltration foci in biopsy-proven DCIS

## T7-SSBR06-6 PERFORMANCE OF BREAST MRI FOR HIGH-RISK SCREENING DURING LACTATION

Maxine S. Jochelson, MD (*Abstract Co-Author*) Speaker, General Electric Company
Jill Gluskin, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa E. Ochoa Albiztegui, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hila Fruchtman (*Abstract Co-Author*) Nothing to Disclose
Janice S. Sung, MD (*Abstract Co-Author*) Research Grant, General Electric Company
Noam Nissan, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To summarize our institutional experience with high-risk screening breast MRIs performed during lactation.

**METHODS AND MATERIALS**

Consecutive screening breast MRIs performed between 4/2008 and 3/2024 were retrospectively reviewed. Background parenchymal enhancement (BPE) grade was compared between actively lactating patients and patients who stopped lactating prior to the scan using the Mann-Whitney U test. BI-RADS scores prevalence rate was compared with controls encompassing screening MRIs of young non-lactating patients, using the Chi-square test. Diagnostic performance was calculated for patients with adequate biopsy reference or at least one year of follow-up.

## RESULTS

Overall, 142/85,710 (0.17%) screening MRIs (median age, 36.0 ± 6.0 years) were performed during lactation, for mostly BRCA mutation (60/142, 42.2%). BPE was characterized as predominantly marked (116/142, 82%), and was lower in the post-weaning group, including patients who stopped nursing one month prior to MRI (P<0.001). BI-RADS scores were distributed as follows: 0 (1/142, 1%), 1/2 (88/142, 62%), 3 (40/142, 28%) and 4 (13/142, 9%), marking a higher rate of BI-RADS 3 score (P<0.001) and lower rate of BI-RADS 1/2 scores (P=0.002) for the lactating group compared with the controls (7.7%, n=8922). One pregnancy-associated breast cancer (PABC) was detected and one interval cancer occurred. All MRI-guided biopsies were negative (n=13). The following performance was yielded: 50% sensitivity (1/2), 60% specificity (72/120), 2.0% PPV (1/49) and 98.6% NPV (71/82).

## CONCLUSION

The efficacy of breast MRI for high-risk screening during lactation is limited by prominent BPE, leading to an increased rate of BI-RADS 3 categorization and diminished overall specificity.

## CLINICAL RELEVANCE/APPLICATION

Despite its noted lower performance, and amidst the significant risk of PABC, this screening approach remains relevant for patients with exceptionally high-risk profiles, such as BRCA carriers.

# Abstract Archives of the RSNA, 2024

T7-SSBR07

**Breast Imaging (AI Radiologist Performance and Workflow)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S406A

Cindy S. Lee, MD (*Moderator*) Nothing to Disclose
Fiona J. Gilbert, MBChB, FRCR (*Moderator*) Research Grant, Hologic, Inc Research Grant, General Electric Company Research Consultant, Alphabet Inc Research Consultant, Kheiron Medical Technologies Ltd Research support, Bayer AG Research collaboration, Volpara Health Technologies Limited Research collaboration Lunit Research collaboration Merantix Research collaboration Screenpoint Research collaboration Therapixel Research support GSK Research collaboration RhinoHealth Research collaboration Curemetrix

**Sub-Events**

## T7-SSBR07-1 TWO DATA-DRIVEN METHODS TO SET RADIOLOGIST PERFORMANCE GUIDELINES IN THE CONTEXT OF AI ASSISTANCE

Jacqueline S. Holt, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan Haslam, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Benjamin Reece (*Abstract Co-Author*) Employee, RadNet, Inc
A. Gregory Sorensen, MD (*Abstract Co-Author*) Employee, RadNet, Inc;Board member, IMRIS Inc;Board member, Siemens AG;Board member, DFB Healthcare Acquisitions Corp;Board member, inviCRO, LLC;;;;
Mina Moussavi, BSc, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Leeann Louis, BS, PhD (*Presenter*) Researcher, RadNet, Inc

### PURPOSE

Radiologists interpreting screening mammography have performance benchmarks, as reported by the Breast Cancer Surveillance Consortium (BCSC) and others. There is growing evidence that AI devices can improve radiologist reading performance, but there are no benchmarks in the context of AI assistance. We sought to determine acceptable ranges for recall rates for different levels of AI suspicion scores using two different data-driven approaches.

### METHODS AND MATERIALS

Our study included 346,570 DBT screening mammograms from 03/2021 - 05/2022 performed at 1 large practice (73 radiologists) and exam-level data, including BI-RADS interpretations and biopsy outcomes with 12 months of follow-up. We retrospectively evaluated all mammograms with an FDA-cleared AI that sorts exams into 4 categories based on their suspicion for cancer (Minimal, Low, Intermediate, and High). The cancer detection rate (CDR) for the overall practice and for each suspicion level was calculated. We used two approaches to determine an acceptable range for recall rate (RR): a CDR-driven approach and an expert-driven approach. The CDR-driven approach set recommendations by calculating the ratio of the CDR for each suspicion level to the overall CDR, then multiplying by the range of BCSC accepted values for RR (5-12%). The expert-driven approach set recommendations based on the RR of 6 breast imaging specialists for each suspicion category. Selected experts had 1) a reading volume > 75% in breast imaging, 2) a RR below the BCSC 25th percentile, and 3) a CDR above the BCSC 25th percentile.

### RESULTS

CDR was 5.34 per 1,000 at the practice overall, 0.27 for Minimal (Min), 0.90 for Low, 6.22 for Intermediate (Int), and 83.42 for High suspicion exams. The CDR-driven approach indicates the recommended RR should be 0.3-0.6% for Min, 0.8-2.0% for Low, 5.8-14.0% for Int, and 78.0-100.0% for High suspicion exams. The expert-driven approach indicates that RR should be 2.5% for Min, 4.7% for Low, 10.3% for Int, and 26.9% for High suspicion exams. Radiologists on average had a RR of 7.8% for Min, 12.6% for Low, 22.6% for Int, and 37.0% for High suspicion exams.

### CONCLUSION

By combining AI performance with BCSC guidelines and the behavior of experts, we generated metrics for use in monitoring radiologist performance in the context of AI assistance. Most radiologists recall more exams than both CDR- and expert-driven recommendations for Minimal, Low, and Intermediate suspicion levels, indicating that further education on these AI outputs might improve overall performance.

### CLINICAL RELEVANCE/APPLICATION

Practice leaders could leverage this approach to monitor radiologist performance, identify radiologists who might need additional education, and provide targeted information on how they might improve.

## T7-SSBR07-2 AI SCORE ON SCREENING MAMMOGRAMS BY TIME

Christoph I. Lee, MD, MS (*Abstract Co-Author*) Royalites, The McGraw-Hill Companies;Royalties, Oxford University Press;Royalties, Wolters Kluwer nv;Research Consultant, GRAIL, LLC
Diana Miglioretti, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonas Gjesvik (*Abstract Co-Author*) Nothing to Disclose
Solveig S. Hofvind (*Presenter*) Nothing to Disclose

**PURPOSE**

To analyze risk score for cancer detection given by a regulatory-approved tool using artificial intelligence (AI), on screening mammograms at consecutive screening rounds.

**METHODS AND MATERIALS**

In this this retrospective study we used data from 116,496 women aged 50-69 with no history of breast cancer who had at least three consecutive biennial screening mammograms in the Norwegian national screening program, 2004-2018. Mean breast-level AI scores (0-100, with 100 representing highest likelihood of cancer) were used to compare score of the two breasts for women who were screened negative in two consecutive screening rounds and developed screen-detected or interval cancer on or within two years after the third screening round, and for those who were screened negative during three consecutive screening rounds. Area under the receiver operating curve (AUC) for the AI score and the absolute difference in scores between the two breast among women developing screen-detected breast cancer was estimated nonparametrically.

**RESULTS**

Among the 1265 women diagnosed with screen-detected cancer in the third screening round, mean difference in AI score between the breast developing and not developing breast cancer was 9.7 (SD: 33.9), 22.6 (SD: 38.6), and 77.7 (SD: 32.3) in the first, second and third screening round, respectively. Mean difference in AI score between the breast developing and not developing interval cancer was 7.3 (SD: 32.7), 10.0 (SD: 33.3), and 24.6 (SD: 41.0) in the first, second and third screening round, respectively. For women not developing breast cancer mean difference for the two breasts were 0.0 (SD: 20.1), -0.1 (SD: 19.9), and -0.0 (SD: 19.6) in the first, second and third screening round. AUC for screen-detected cancer was 0.63 in the first, 0.73 in the second and 0.97 in the third screening round, and 0.64, 0.65, and 0.77 for interval cancer in the first, second and third screening round, respectively.

**CONCLUSION**

Among women undergoing biennial mammography screening, AI scores were elevated in the breast diagnosed with breast cancer 4 and 2 years prior to diagnosis.

**CLINICAL RELEVANCE/APPLICATION**

Commercial AI algorithms developed to help detect cancer at the time of mammography interpretation may identify women at high risk of a future breast cancer, opening for offering a pathway for earlier cancer diagnosis.

## T7-SSBR07-3 ARTIFICIAL INTELLIGENCE MAMMOGRAPHY INTERPRETATION SYSTEMS ARE MORE AFFECTED BY MAMMOGRAPHIC IMAGE QUALITY ISSUES THAN RADIOLOGISTS

Ioannis Sechopoulos, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research Grant, Sectra AB;Research Grant, ScreenPoint Medical BV;Research Grant, Volpara Health Technologies Limited
Joana Boita (*Abstract Co-Author*) Nothing to Disclose
Mireille Broeders, PhD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Hologic, Inc
Sarah D. Verboom, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine how common image quality variations in mammograms affect the performance of artificial intelligence (AI)-based mammography interpretation systems compared to expert breast radiologists.

**METHODS AND MATERIALS**

Common image quality issues were simulated on a dataset of 80 digital screening mammograms, which involved 60 cases with lesions (40 cancers, 20 benign findings) and 20 normal cases. Five image quality issues were simulated on 16 mammograms each: two acquisition-related issues (lower spatial resolution and increased random quantum noise to simulate lower dose), and three post-processing-related issues (increased or decreased contrast and increased pixel noise correlation). Each issue was simulated at two different levels: the most degradation that is still deemed acceptable by radiologists, and a realistic degradation that is no longer acceptable for radiologists. Thirteen expert breast radiologists from five countries assessed all mammograms at each degradation level and scored the mammograms with a probability of malignancy (PoM) score between 1 and 10 and a recall decision. All images were also scored by a commercial AI system with a PoM score and a recall decision with the specificity set at the specificity of the radiologists. At each degradation level the area under the receiver operating characteristics curve (AUC) is calculated for the radiologists and for the AI system. Lastly, the recall decisions of radiologists and AI for the two degradation levels were compared to the recall decisions at the standard quality images.

**RESULTS**

Radiologists achieved a mean AUC of 0.760 (95% CI 0.678 - 0.843) on the standard quality mammograms which was comparable to the AUCs at the two degradation levels 0.765 (95% CI 0.687 - 0.844), p=0.76, and 0.746 (95% CI 0.666 - 0.826), p=0.38. Although not significantly different, the AUC of the AI system decreased from an AUC of 0.717 (95% CI 0.603 - 0.830) to 0.676 (95% CI 0.554 - 0.798), p=0.47 and 0.612 (95% CI 0.486 - 0.738), p=0.06 for the two degradation levels. Radiologists were also more stable in their recall decisions, with the same recall decision in 83% (95% CI 71%-90%) and 82% (95% CI 67%- 91%) of the cases. In contrast, AI gave the same recall decision in 75% and 68% of the cases.

**CONCLUSION**

Image quality can affect AI predictions and performance, even when image quality is still acceptable for radiologists and radiologists performance is not affected.

**CLINICAL RELEVANCE/APPLICATION**

Performance of AI systems can be influenced by different image quality issues. Therefore, there is a need for a safety guard to recognize images with poor quality before AI can be safely deployed as a stand-alone application.

## T7-SSBR07-4 A COMPARATIVE STUDY OF AI AND EXPERT RADIOLOGIST PERFORMANCE FOR TECHNICAL RECALL ASSESSMENT IN SCREENING MAMMOGRAPHY

Thomas P. Matthews, PhD (*Abstract Co-Author*) Employee, Whiterabbit.ai;Stockholder, Whiterabbit.ai
Jason Su (*Abstract Co-Author*) Employee, whiterabbit.ai;Stockholder, whiterabbit.ai;Board Member, whiterabbit.ai;Pending Patent
Hugo Vergnes, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Safeguards are needed to protect autonomous artificial intelligence (AI) rule-out systems for breast cancer screening from exams with image quality (IQ) deficiencies that could impair the sensitivity of the models. This work introduces an AI system that assesses IQ in full-field digital mammography (FFDM)

exams and evaluates it against expert radiologists.

**METHODS AND MATERIALS**

An AI system was trained to identify screening FFDM exams that require a technical recall due to inadequate IQ. The system evaluates positioning and blur, with features based on MQSA criteria as well as learned features. This model was evaluated on 1,100 screening exams from 2 independent held-out U.S. datasets (Dataset 1: 835 exams, from 2012-2019; Dataset 2: 265 exams, from 2002-2009) that were labeled as requiring recall or not by 5 breast fellowship trained radiologists with at least 15 years of experience (used for testing only). The performance of the model was first evaluated based on a reference standard of the median assessment of the 5 readers. To compare the AI and individual readers, we employ an evaluation methodology similar to leave-one-out cross-validation. In this method, we left out one reader at a time to establish a consensus based on the assessments of the other readers. Then, we compared the excluded reader and the AI model to this consensus. We repeated this for each reader to ensure an unbiased comparison between the AI and readers.

**RESULTS**

The percentage of exams recalled (inadequate IQ) by the 5 readers ranged from 0.7% to 13.7% (Mean: 6.4% Standard Deviation: 4.8%). Pairwise agreement between the readers was low (Cohen's kappa: 0.06-0.36). Based on a reference standard established by all 5 readers, the AI model achieved a sensitivity of 66.7% [48.2%, 82.0%], a specificity of 96.3% [94.9%, 97.3%], and an area under the receiver operating characteristic curve (AUC) of 0.92 [0.88, 0.96]. The sensitivity of the model increased when more readers labeled a sample as inadequate (3/5 readers: 56.5%, 13/23; 4/5 readers: 83.3%, 5/6; 5/5 readers: 100.0%, 4/4). Based on the cross-validation approach, the system exhibited comparable performance to the mean of the readers in sensitivity (AI: 48.9% [45.5%, 52.3%]; Mean Rad.: 45.7% [18.3%, 73.1%]) and specificity (AI: 96.1% [95.6%, 96.5%]; Mean Rad.: 95.0% [89.5%, 100.0%]). The system achieved an average AUC of 0.86 [0.85, 0.87].

**CONCLUSION**

This study demonstrates that an AI model can achieve comparable performance to expert radiologists in assessing IQ for mammography, overcoming the inherent challenges in the task's subjectivity.

**CLINICAL RELEVANCE/APPLICATION**

AI systems that provide an automatic check on IQ can assist with improving image acquisition and also help safeguard cancer-detecting AI models from exams with poor IQ.

## T7-SSBR07-5 COMPARING DIFFERENT SCENARIOS FOR THE COMBINED USE OF TWO COMMERCIAL AI ALGORITHMS TO IMPROVE MAMMOGRAPHY INTERPRETATION AND DECREASE RADIOLOGIST WORKLOAD

Eun Young Chae, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joo Hee Cha, MD (*Abstract Co-Author*) Nothing to Disclose
Hee Jung Shin, MD (*Abstract Co-Author*) Nothing to Disclose
Woo Jung Choi, MD (*Abstract Co-Author*) Nothing to Disclose
Hak Hee Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hee Jeong Kim, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare different scenarios for the combined use of two commercial AI algorithms in improving mammography interpretation and decreasing radiologist workload.

**METHODS AND MATERIALS**

In this retrospective analysis, 3012 mammograms, including 213 cancer cases, were assessed using two commercial AI algorithms (AI-1 and AI-2). Mammograms were categorized into "high-risk (highest 10%)," "minimal-risk (lowest 20%)," and "indeterminate" groups based on the likelihood of malignancy from each AI algorithm. In Scenario 1 (Sensitive mode), mammograms in the "high-risk" group in at least one AI algorithm were recalled without radiologist review, those in the "minimal-risk" group in both AI algorithms were deemed negative, and the rest were assessed by radiologists. In Scenario 2 (Intermediate mode), mammograms in the "high-risk" group in both algorithms were recalled, those in the "minimal-risk" group in both algorithms were deemed negative, and the rest were assessed by radiologists. In Scenario 3 (Specific mode), mammograms in the "high-risk" group in both algorithms were recalled, those in the "minimal-risk' group in at least one algorithm were deemed negative, and the rest were assessed by radiologists. Scenario 4 (Sequential mode A) used AI-1 to triage mammograms into recall or negative screening categories, followed by AI-2 for further triage. Scenario 5 (Sequential mode B) reversed the order of referencing AI-1 and AI-2. Changes in recall rate, sensitivity, specificity, and workload across Scenarios 1-5 were compared to using a single AI or no AI, using McNemar's test.

**RESULTS**

Scenario 1 showed an 18.3% reduction in workload, along with significantly higher sensitivity compared to using a single AI or no AI (84.0% vs. 81.7% [AI-1, $p = 0.025$]; 80.8% [AI-2, $p = 0.008$]; 81.2% [No AI, $p = 0.034$]). Scenario 2 resulted in a 9.8% reduction in workload and achieved higher specificity compared to single AI use (86.3% vs. 85.1% [AI-1, $p < 0.001$]; 83.9% [AI-2, $p < 0.001$]). Scenario 3 reduced workload by 45.7% without significant differences in sensitivity (78.4% vs. 81.2%, $p = 0.083$) or specificity (87.7% vs. 87.4%, $p = 0.371$) compared to no AI use. Both Scenario 4 and 5 reduced workload by 49.8% without significant changes in sensitivity compared to using a single AI or no AI (80.8% [Scenario 4] and 80.3% [Scenario 5] vs. 81.7% [AI-1], 80.8% [AI-2], and 81.2% [No AI], $p > 0.05$ for all).

**CONCLUSION**

The combined use of two AI algorithms can improve mammography interpretation while decreasing radiologist workload. Different scenarios can be considered based on specific clinical settings.

**CLINICAL RELEVANCE/APPLICATION**

Using two AI algorithms could enhance mammography interpretation over using a single AI or none. Tailoring the integration method may optimize screening efficacy.

## T7-SSBR07-6 PERFORMANCE OF AN ARTIFICIAL INTELLIGENCE SYSTEM ON SCREENING DIGITAL BREAST TOMOSYNTHESIS CASES IN DENSE AND NOT DENSE BREASTS

Murray D. Becker, MD, PhD (*Abstract Co-Author*) Stockholder, ScreenPoint Medical BV;Stockholder, Covera Health, Inc
Jennifer Levy, MD (*Abstract Co-Author*) Nothing to Disclose
Steve Higgins (*Abstract Co-Author*) Nothing to Disclose
Roger S. Yang, MD (*Presenter*) Nothing to Disclose

## PURPOSE

Studies have shown that cancer detection among radiologists is lower for dense breasts than for not dense breasts. This provides an opportunity for artificial intelligence (AI) to aid radiologists in improving cancer detection in women with dense breasts. For this study, we evaluate the performance of an AI system on screening tomosyntheseis mammograms in patients with dense and not dense breasts.

## METHODS AND MATERIALS

This retrospective study included 28,278 DBT screening exams collected from February to July 2022 from multiple outpatient imaging centers within a private practice. The screening exams (Hologic) were evaluated by MQSA radiologists who scored the exams according to the Breast Imaging Reporting and Data Classification System (BIRADS) and assigned a breast density category [almost entirely fatty (A), scattered fibroglandular densities (B), heterogeneously dense (C), and extremely dense (D)]. Patients in categories A and B were considered "not dense," and those in categories C and D were considered "dense."BIRADS 0 cases were recalled for additional evaluation and potential biopsy. All exams were analyzed by an AI system (Transpara 1.7.1, ScreenPoint Medical), which assigned an exam score between 1-10 indicating an increasing likelihood of malignancy. The performance of the AI system was evaluated, overall and for dense and not dense breasts.

## RESULTS

Out of 28,278 screening exams, 4,170 exams were labeled as BIRADS 0, resulting in a recall rate of 14.8%. Of the 4,170 patients recalled, 3,531 returned to one of our facilities for diagnostic imaging. There were 581 diagnostic exams assigned BIRADS 4-5 and recommended for biopsy. Biopsy results were available for 331 cases at the time of analysis, revealing 70 biopsy-proven cancers. Including all densities, AI identified 59/70 cancers (84%) with an exam score of 10 and 65/70 cancers (93%) with an exam score 8-10. In women with not dense breasts, AI identified 29/34 cancers (85%) with exam score of 10 and 31/34 (91%) with exam score 8-10. In women with dense breasts, AI identified 30/36 (83%) with an exam score of 10 and 34/36 (94%) with an exam score 8-10.

## CONCLUSION

AI score 8-10 has a strong predictive value for cancer. The system performs similarly well in dense and not dense breasts.

## CLINICAL RELEVANCE/APPLICATION

The results of our study suggest that AI could serve as a helpful tool to aid radiologists in identifying cancers in women with dense and not dense breasts.

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# Abstract Archives of the RSNA, 2024

T7-SSCA06

**Cardiac Imaging (Electrophysiology and Structural Heart Disease)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E353A

Brian B. Ghoshhajra, MD, MBA (*Moderator*) Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Consultant, Siemens AG
Cristina Fuss, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T7-SSCA06-1 THE PREDICTIVE VALUE OF LEFT ATRIAL EPICARDIAL AND PERICORONARY FAT COMBINED WITH TRIGLYCERIDE GLUCOSE INDEX ON RECURRENCE AFTER RADIOFREQUENCY CATHETER ABLATION FOR ATRIAL FIBRILLATION

Zishuo Wang (*Abstract Co-Author*) Nothing to Disclose
Hu Chunfeng Sr, MD (*Abstract Co-Author*) Nothing to Disclose
Li-xiang Xie (*Abstract Co-Author*) Nothing to Disclose
Xiaole Li (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the correlation between left atrial epicardial adipose tissue (LA-EAT), pericoronary adipose tissue (PCAT), and the recurrence of atrial fibrillation (AF) in patients after radiofrequency catheter ablation (RFCA) and construct a predictive model combining the triglyceride glucose (TyG) index.

### METHODS AND MATERIALS

A retrospective cohort of 325 patients who underwent their initial successful RFCA surgery was enrolled. Follow-ups were conducted every three months after the initial treatment. Patients were categorized into a recurrence group (79 patients) and a non-recurrence group (256 patients) based on their recurrence status within three months to one year post-surgery. Imaging parameters of LA-EAT (volume and density, noted as LA-EATV and LA-EATD) and PCAT (fat attenuation index) were measured and compared with general clinical data. Multivariate logistic regression was applied to identify independent influencing factors. The receiver operating characteristic curve (ROC) was used to determine the optimal thresholds for AF recurrence risk factors. Post-hoc subgroup analysis was conducted to evaluate the predictive value of the TyG index for AF recurrence among different patient subgroups postoperatively.

### RESULTS

LA-EATV, LA-EATD, LCX-FAI, and the TyG index were independent risk factors for AF recurrence after RFCA, and the optimal thresholds for predicting post-ablation AF recurrence for LA-EATV, LA-EATD, LCX-FAI, and the TyG index were 21.7 cm3, -79.5 HU, -82.5 HU, and 8.625, respectively. A comprehensive model built on these factors achieved an AUC of 0.792, with a sensitivity of 0.671 and a specificity of 0.817. Post hoc subgroup analysis showed that the TyG index was significantly associated with an increased risk of AF recurrence after RFCA, independent of the type of AF and type 2 diabetes mellitus (T2DM).

### CONCLUSION

LA-EATV, LA-EATD, LCX-FAI, and the TyG index can effectively predict the recurrence of atrial fibrillation after radiofrequency catheter ablation. The combined predictive value of these factors is higher, and the TyG index's prediction of recurrence is unaffected by the state of T2DM and the type of atrial fibrillation.

### CLINICAL RELEVANCE/APPLICATION

This study identifies postoperative recurrence factors by preoperative measurement of LA-EAT and PCAT parameters combined with the TyG index, providing more reliable non-invasive predictive markers for clinical use, thus enabling the formulation of precise, individualized treatment plans to improve patient outcomes.

## T7-SSCA06-2 LEFT ATRIAL MECHANICAL DYSFUNCTION AND THE RISK FOR ISCHEMIC STROKE IN HCM PATIENTS WITHOUT PRIOR ATRIAL FIBRILLATION OR STROKE

Jiaxin Wang (*Abstract Co-Author*) Nothing to Disclose
Wei Zhuxin (*Presenter*) Nothing to Disclose

### PURPOSE

Patients with hypertrophic cardiomyopathy (HCM) are at high risk of atrial fibrillation (AF) and ischemic stroke. Left atrial enlargement and dysfunction that characterize atrial myopathy may precede and promote AF and cardiac thromboembolism. In HCM patients without prior AF or stroke, whether left atrial mechanical dysfunction can improve ischemic stroke prediction is unknown.

### METHODS AND MATERIALS

Patients with prior AF or stroke were excluded and 653 consecutive patients with HCM (mean age 47.3 ± 12.3 years, 71% male) who underwent cardiac magnetic resonance (CMR) at Hospital between January 2012 and December 2013 were finally enrolled. LA ejection fraction, strain and strain rate indices on reservoir, conduit and booster-pump phases that represent LA mechanical function were analyzed. The primary endpoint was ischemic stroke. The secondary endpoint was new-onset AF.

### RESULTS

At 7.6 ± 2.4 years of follow-up, 24 (3.7%) had ischemic stroke and 73 (11.2%) had new-onset AF. Patients with stroke had an older age ($p = 0.014$), higher incidence of hypertension ($p < 0.001$), more LGE presence ($p = 0.006$) and LGE extent ($p = 0.007$). For LA size and function, patients with stroke showed significantly higher LA volume index and lower LA ejection fraction and LA strain (all $p < 0.01$). Age, hypertension, LGE presence, LGE extent and all LA mechanical indices were univariably associated with stroke. On multivariate model, LA reservoir strain was associated with stroke (Hazard Ratio = 0.91. 95%CI 0.85-0.97, $p = 0.005$) independent of Age ($p = 0.292$), hypertension ($p = 0.002$), LGE extent ($p = 0.003$) and LA volume ($p = 0.737$). In addition, LA reservoir strain was also associated with new-onset AF (Hazard Ratio = 0.93. 95%CI 0.89-0.96, $p < 0.001$) independent of Age ($p < 0.001$), hypertension ($p = 0.607$), LGE extent ($p = 0.882$) and LA volume ($p = 0.002$).

### CONCLUSION

In HCM patients without prior AF or stroke, LA mechanical dysfunction was a strong predictor for stroke and new-onset AF independent of LA enlargement, age, hypertension and LGE extent.

### CLINICAL RELEVANCE/APPLICATION

This study provides a predictor for stroke and new-onset AF in HCM patients without prior AF or stroke,

## T7-SSCA06-5 RECURRENCE AND NON-IMPROVEMENT OF EUROPEAN HEART RHYTHM ASSOCIATION SYMPTOM SCORES AFTER ATRIAL FIBRILLATION ABLATION: THE ROLE OF LEFT ATRIAL FRACTAL DIMENSION

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Zheng Xu, MD (*Abstract Co-Author*) Nothing to Disclose
Mengyuan Jing (*Presenter*) Nothing to Disclose

### PURPOSE

Left atrial (LA) morphology can characterize LA remodeling and is correlated with the outcomes of ablation for atrial fibrillation (AF) . We aimed to explore the relationship between LA morphologic heterogeneity quantified by fractal dimension (FD) and AF recurrence, and whether European Heart Rhythm Association (EHRA) symptom scores improved after recurrence following radiofrequency ablation.

### METHODS AND MATERIALS

This study retrospectively collected the data of patients with AF who underwent their first radiofrequency ablation procedure between October 2019 and September 2022 and underwent cardiac computed tomography angiography (CTA) within 3 days before the procedure. On the cardiac CTA images, we calculated the FD of each patient's LA using fractal analysis. Cox proportional risk models were used to calculate the risk ratios for the predictors of AF recurrence and no improvement in the EHRA symptom scores.

### RESULTS

A total of 512 patients with AF were included with a mean follow-up of 29 (18, 37) months, of which 146 had recurrence of AF and 366 did not have recurrence, and 48 had improvement of EHRA symptoms and 98 did not have improvement. COX regression analysis showed that LA-FD (HR=16.056 [7.493, 34.406], P<0.001; 10.500 [3.086, 35.728], P<0.001) was an independent predictor of recurrence and non-improvement in EHRA symptom score after AF ablation. Furthermore, patients with a larger LA-FD (>1.208) had a higher incidence of AF recurrence and EHRA symptom score non-improvement than those with a smaller LA-FD (<1.208).

### CONCLUSION

A larger LA-FD on cardiac CTA could be a predictor for adverse LA remodeling and was independently associated with recurrence and non-improvement of the EHRA symptom score after AF ablation.

### CLINICAL RELEVANCE/APPLICATION

The FD can be used as a quantitative marker to characterize LA morphology and has been used to assess several cardiovascular diseases. A larger LA-FD on cardiac CTA images is an indication of adverse LA remodeling and an independent predictor of recurrence and non-improvement in the EHRA symptom score after ablation for AF.

## T7-SSCA06-6 CORRELATION BETWEEN LEFT ATRIAL APPENDAGE MORPHOLOGY BASED ON FRACTAL DIMENSION QUANTIFICATION AND ITS HEMODYNAMIC PARAMETERS IN PATIENTS WITH ATRIAL FIBRILLATION

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Mengyuan Jing (*Presenter*) Nothing to Disclose

### PURPOSE

In patients with atrial fibrillation (AF), although left atrial appendage (LAA) morphology and hemodynamic parameters are closely associated with the development of LAA thrombosis, the relationship between LAA morphology and its hemodynamic parameters remains unclear. Therefore, this study aimed to investigate the relationship between LAA morphology, quantified based on fractal dimension (FD), and LAA hemodynamic parameters in patients with AF, in an effort to reveal the effect of LAA shape on blood flow.

### METHODS AND MATERIALS

A total of 225 patients with AF who underwent cardiac computed tomography angiography (CTA) and transesophageal echocardiography (TEE) on the same day between March 2020 and December 2022 at our institution were enrolled. LAA morphology was quantified based on FD on cardiac CTA images, and LAA hemodynamic parameters, including injection fraction (EF), filling peak flow velocity (FV), maximum speed of emptying (PEV), and wall motion velocity (WMV), were assessed using TEE.

## RESULTS

Among the enrolled participants, 134 (59.60%) were men and 91 (40.40%) were women. The average age of all participants was 61.71±0.72 years. We divided the patients with AF into two groups based on a mean LAA FD of 1.32: the low FD group (n = 124) and the high FD group (n = 101). Compared to the low FD group, there were more patients with LAA circulatory stasis/thrombus (P = 0.008) in the high FD group, as well as lower LAA FV (P = 0.004), LAA PEV (P = 0.007), and LAA WMV (P = 0.007). Correlation analysis showed that LAA FD was negatively associated with LAA EF (r = -0.211, P = 0.001), LAA FV (r = -0.209, P=0.002), LAA PEV (r = -0.189, P = 0.004), and LAA WMV (r = -0.244, P <0.001). Furthermore, LAA FD was an independent and significant determinant of LAA EF (ß = -11.755, P = 0.001), LAA FV (ß = -17.364, P = 0.004), LAA PEV (ß = -18.743, P <0.001), and LAA WMV (ß = -7.740, P = 0.001) in multiple linear regression analysis.

## CONCLUSION

LAA FD is an essential determinant of LAA hemodynamic parameters, suggesting that the relatively complex morphology of the LAA may influence its hemodynamics, which can correlate with embolic events.

## CLINICAL RELEVANCE/APPLICATION

Left atrial appendage fractal dimension is an essential determinant of its injection fraction, filling peak flow velocity, maximum speed of emptying, and wall motion velocity. These findings indicate relatively complex morphology of the left atrial appendage may influence its hemodynamics, which can correlate with embolic events.

# Abstract Archives of the RSNA, 2024

T7-SSGI10

**Gastrointestinal Imaging (Dual Energy CT - Diagnosis)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E351

Bari Dane, MD (*Moderator*) Nothing to Disclose
Avinash R. Kambadakone, MD, FRCR (*Moderator*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer

**Sub-Events**

## T7-SSGI10-2 PHOTON-COUNTING DETECTOR CT-BASED CALCIUM REMOVAL ALGORITHM FOR ASSESSING ABDOMINAL ATHEROSCLEROSIS: RELATIONSHIP WITH CORONARY ARTERY CALCIFICATION

Mitsuaki Tatsumi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Hori, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Hiromitsu Onishi, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company
Hideyuki Fukui, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Takashi Ota, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The severity of abdominal atherosclerosis (AA) remains uncertain despite clarified cardiac severity. Agatston score (AS) assesses calcified coronary artery plaques, predicting major adverse cardiovascular events (MACE). An increased risk of MACE was reported when AS exceeded 100. This study investigated the relationship between AS and abdominal aortic calcification (AAC) and determined the severity of AA using a virtual calcium removal algorithm (PureLumen) on photon-counting detector CT (PCD-CT), with the risk of MACE as the outcome.

### METHODS AND MATERIALS

This retrospective study included 132 patients with AAC who underwent abdominal CT angiography (CTA) and non-contrast-enhanced chest CT (nCE-CCT) with PCD-CT. We randomly divided the 132 patients into a training group (n = 106) and a validation group (n = 26) in an 80:20 ratio to build prediction models for the high-risk group for MACE. AAC maps were generated by subtracting the PureLumen from the corresponding CTA images. Abdominal calcification volume (ACV [mL]), CT value [HU], and histogram indices were calculated. Abdominal aortic 3D images without calcification were generated from the PureLumen. The aortic wall volume (AWV [mL]) was computed, and the percentage calcification volume (PCV [%]) was calculated by dividing ACV by AWV. AS was automatically calculated from the nCE-CCT images using dedicated software. To reduce bias from the imbalanced dataset, the AS>100 group was oversampled using the synthetic minority oversampling technique (SMOTE). Receiver operating characteristic curve analysis was used to calculate the area under the curve (AUC).

### RESULTS

In the training group, 29 patients had AS>100 and were oversampled to 58. Univariate analysis identified ACV, PCV, CT_mean, CT_SD, CT_Max, CT_min, CT_dif, skewness, kurtosis, and entropy as significant variables ($p < .05$). In the training group, PCV had the highest AUC (0.94). A PCV cutoff of 9.74% differentiated AS=100 from AS>100 with 74.4% sensitivity and 96.1% specificity. In a multivariate logistic regression (MLR) model incorporating five variables, PCV was the only significant variable, with an AUC of 0.94. In the support vector machine (SVM) model with 10 variables, the AUC was 0.97. In the validation group, the AUC of the PCV, MLR, and SVM models were 0.98, 0.98, and 0.98, respectively. PCV alone showed a discriminative ability comparable to that of the MLR and SVM models.

### CONCLUSION

PCV effectively discriminated between the high and low MACE risk groups. Measuring PCV is crucial for assessing the severity of AA, with =9.74% indicating a high severity.

### CLINICAL RELEVANCE/APPLICATION

As the demand for abdominal CT increases, prediction of cardiovascular risk from abdominal CT can guide additional surveillance recommendations.

## T7-SSGI10-3 EFFICIENCY EVALUATION OF DUAL-ENERGY CT TO PREDICT THE POSTOPERATIVE EARLY RECURRENCE OF PANCREATIC DUCTAL ADENOCARCINOMA

Qing Xu, MD (*Abstract Co-Author*) Nothing to Disclose
Siyao Yu, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the predictive value of dual-energy CT (DECT) quantitative parameters and basic CT features for the postoperative early recurrence (ER) of pancreatic ductal adenocarcinoma (PDAC).

**METHODS AND MATERIALS**

This study included patients with PDAC who underwent radical resection and DECT from January 2018 to December 2022. Patients were divided into ER and non-ER groups. The clinical data, basic CT features and DECT parameters of all patients were analysed. Univariate and multivariable logistic regression analyses were performed to identify independent predictors of ER. Three models (model A: basic CT features; model B: DECT parameters; model C: basic CT features + DECT parameters) were established. Receiver operating characteristic curve analysis was performed to evaluate prediction efficiency.

**RESULTS**

In total, 150 patients were enrolled (ER group: n = 63; non-ER group: n = 87). Rim enhancement (odds ratio [OR], 3.32; 95% confidence interval [CI], 1.221-9.026; p = 0.019), peripancreatic strands appearance (OR, 2.68; 95% CI, 1.021-7.079; p = 0.045), electron density in the pancreatic parenchymal phase (P-Rho; OR, 0.90; 95% CI, 0.820-0.992; p = 0.033), arterial enhancement fraction (AEF; OR, 0.05; 95% CI, 0.008-0.409; p = 0.004) and pancreatic parenchyma fat fraction in the delayed phase (OR, 1.25; 95% CI, 1.142-1.374; p < 0.001) were identified as independent predictors of ER. The areas under the curves (AUCs) of the three models were 0.739, 0,859, and 0.898, respectively. Model C showed the highest AUC.

**CONCLUSION**

Quantitative parameters derived from DECT can be used to noninvasively predict postoperative ER in patients with PDAC, and the combination of DECT parameters and basic CT features shows a high prediction efficiency.

**CLINICAL RELEVANCE/APPLICATION**

Preoperative DECT parameters and basic CT features were identified as independent predictors of postoperative ER in patients with PDAC and can guide clinicians in developing more effective treatments.

## T7-SSGI10-4 DEEP-DIABETES: FUSION DEEP LEARNING MODEL FEATURES PREDICT DIABETES OCCURRENCE, SEVERITY, AND MEDICATION RESPONSIVENESS ON CT IMAGING

Ronald M. Summers, MD, PhD (*Abstract Co-Author*) Royalties,iCAD, Inc;Royalties, Koninklijke Philips NV;Royalties, ScanMed, LLC;Royalties, Ping An Insurance (Group) Company of China, Ltd;Royalties, Translation Holdings;Research support, Ping An Insurance (Group) Company of China, Ltd
Perry J. Pickhardt, MD (*Abstract Co-Author*) Advisor, Bracco Group;Advisor, Zebra Medical Vision Ltd;Advisor, Nano X Imaging;
Pritam Mukherjee, PhD (*Abstract Co-Author*) Nothing to Disclose
Abhinav Suri, BA, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

Diabetes is one of the leading causes of morbidity and mortality in the United States. However, 17.8% of adults who have diabetes are undiagnosed. Prior work has examined the use of CT scans for opportunistic screening of diabetes on non-contrast CT scans. However, no observation of its efficacy has been undertaken in a multi-institutional cohort with contrast scans. Furthermore, no work has attempted to assess severity of diabetes and pharmacologic resistance on CT scans. Here we aim to create a deep learning network architecture that achieves all of these goals.

**METHODS AND MATERIALS**

This retrospective study included patients from two institutions (9747 patients) who had contrast or non-contrast abdominal CT scans performed from 2004-2023 (Fig1A). Each patient's first scan (repeat scans excluded) was labeled as either being "Diabetes" (patient had diabetes at time of scan, n=416), "Incident" (patient will develop diabetes w/in 4 years of scan, n=183), or "Non-Diabetic" (patient will not develop diabetes w/in 4 years of scan, n=9148). For diabetic patients at institution 1, we determined diabetes severity (HbA1c w/in 3 months of scan <9, n=171 vs HbA1c=9, n=45) and drug resistance (on =3 unique medications, n=34, or not, n=156) since HbA1c and medication information was available for these patients.A fusion deep learning model that combines convolutional neural network embeddings with 29 imaging biomarkers was trained (Fig1B). A 3D DenseNet was originally trained to predict diabetes status using pancreas and liver segmentations (predicted using TotalSegmentator v1.5.0). Its embeddings (added to the 29 biomarkers) were used to train separate models (via PyCaret v3.3.2) to predict all tasks (diabetes prediction, severity, drug resistance).

**RESULTS**

The model achieved an overall AUC of 0.83 (95%CI: 0.81,0.86) when tasked with predicting diabetes status (Fig1C). This performance exceeded that of a baseline logistic regression that used only 29 imaging biomarkers [AUC: 0.69 (0.65, 0.73)]. AUCs were similar for obese [macro-AUC: 0.80] vs non-obese [0.83] and older (=60yo [0.79]) vs younger patients [0.85]; however, performance degraded on contrast scans [0.63] in comparison to non-contrast scans ([0.78], Fig1c). For diabetes severity prediction and drug resistance, the classifier achieved an AUC of 0.76 (0.64-0.87) and 0.82 (0.73-0.90), respectively (Fig1D,E).

**CONCLUSION**

We created a fusion deep learning model that can generalize to multiple tasks: diabetes prediction, diabetes severity assessment, and diabetes drug resistance prediction.

**CLINICAL RELEVANCE/APPLICATION**

This network can be used for opportunistic screening of diabetes in a general population and additional prediction of uncontrolled diabetes and medication resistance.

## T7-SSGI10-5 COMPARISON OF LESION DETECTABILITY OF HYPOVASCULAR LIVER METASTASES BETWEEN 70- AND 40-KEV IMAGES RECONSTRUCTED FROM DUAL-ENERGY CT

Satoshi Goshima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Saya Igarashi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Okada (*Abstract Co-Author*) Nothing to Disclose
Taketo Suto (*Abstract Co-Author*) Nothing to Disclose
Tatsunori Kobayashi, MS,RT (*Abstract Co-Author*) Nothing to Disclose
Yoshifumi Noda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Funayama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazuto Kozaka, MD (*Abstract Co-Author*) Nothing to Disclose

Kumi Ozaki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomoko Hyodo, MD (*Abstract Co-Author*) Nothing to Disclose
Kojiro Suzuki, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Akio Ito, MD (*Abstract Co-Author*) Nothing to Disclose
Masayuki Matsuo, MD (*Abstract Co-Author*) Nothing to Disclose
Akiko Narita, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Kakuya (*Abstract Co-Author*) Nothing to Disclose
Shintaro Ichikawa, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study compares the lesion detectability of hypovascular liver metastases between 70 and 40-keV images from dual-energy computed tomography (DE-CT) reconstructed with deep-learning image reconstruction (DLIR).

**METHODS AND MATERIALS**

This multi-institutional, retrospective study was conducted between January 2019 and December 2022. This study included adult patients pre- and post-treatment for gastrointestinal adenocarcinoma. All patients underwent contrast-enhanced CT and reconstruction of virtual monoenergetic images at 40- and 70-keV. The presence or absence of liver metastases was confirmed using gadoxetic acid-enhanced magnetic resonance imaging performed within 1 month pre- or post-DE-CT. Four radiologists (two experts and two residents) independently scored the lesion conspicuity (per patient and lesion) of the 70- and 40-keV images using a 5-point scale. The five largest lesions were selected for evaluation among patients with multiple lesions. Interobserver agreement regarding lesion conspicuity was also evaluated. The image noise, tumor-to-liver contrast, and contrast-to-noise ratio (CNR) of the hepatic parenchyma and metastatic lesions were measured by a radiologic technologist.

**RESULTS**

The final cohort comprised 208 liver metastases in 138 patients (mean age, 68.9 ± 11.7 years; 80 men) from four institutions. Seventy-one patients had liver metastases while 67 did not. The breakdown of the primary sites was as follows: 68 pancreatic, 50 colorectal, 12 stomach, and eight gallbladder or bile duct sites. No statistical difference was observed in per-patient lesion detectability for liver metastases between 70-keV images (sensitivity, 71.8-90.1%; specificity, 61.2-85.1%; accuracy, 73.9-79.7%) compared with the 40-keV protocol (sensitivity, 76.1-90.1%; specificity, 53.7-82.1%; accuracy, 71.7-79.0%) by all four radiologists (P = 0.18-1.00). No statistical difference was observed by the four radiologists in per-lesion lesion detectability for liver metastases between the 70-keV images (sensitivity, 67.3-82.2%) compared to the 40-keV images (sensitivity, 68.8-81.7%) (P = 0.20-1.00). The interobserver agreement for each image was moderate (kappa = 0.58 on 70-keV and 0.53 on 40-keV for per-patient, kappa = 0.56 on 70-keV and 0.59 on 40-keV for per-lesion). The image noise, tumor-to-liver contrast, and CNR of the 40-keV images were significantly higher than those of the 70-keV images (P lt;0.01).

**CONCLUSION**

No significant difference was found in detecting hypovascular liver metastases between 70- and 40-keV images using the latest DLIR.

**CLINICAL RELEVANCE/APPLICATION**

With the latest DLIR, using 40-keV images to improve hypovascular liver metastasis, detection may be less significant.

## T7-SSGI10-6 ASSESSMENT OF CT IMAGING FEATURES AND ENERGY SPECTRUM CT QUANTITATIVE PARAMETERS FOR THE PREDICTION OF C-KIT EXON 11 MUTATION STATUS IN GASTROINTESTINAL STROMAL TUMORS

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Jiachen Sun, PhD, MA (*Presenter*) Nothing to Disclose

**PURPOSE**

Mutation type in patients with gastrointestinal stromal tumors (GISTs) is strongly associated with targeted drug selection and therapeutic efficacy. Therefore, this study aims to evaluate the value of CT imaging features and energy spectrum CT quantitative parameters in predicting the mutation status of c-KIT exon 11 in GISTs and to construct a predictive model to assist in clinical treatment decision-making.

**METHODS AND MATERIALS**

We retrospectively reviewed 69 pathologically confirmed patients with GISTs who underwent preoperative energy spectrum CT (Discovery CT 750 HD, General Electric) and c-KIT gene testing. chi-square test, Mann-Whitney U test and independent samples t test were used to compare and analyze the CT imaging features and energy spectrum CT quantitative parameters of patients. The statistically significant parameters in the above univariate analysis were entered into logistic regression to screen independent predictors for prediction of c-KIT exon 11 mutation status. Establishing a model for predicting c-KIT exon 11 mutation status and evaluating the clinical applicability of the model by receiver operating characteristic (ROC).

**RESULTS**

There were 34 men and 35 women in our study. The average age of all participants was 57.55±12.78 years. There was a significant statistical difference in the age of the c-KIT exon 11 mutation status (P=0.028). In terms of CT imaging features, there were significant statistical differences between the two groups for tumor size, shape, margin, necrosis/cystic change, enhancement pattern, and enhancement grade (all P<0.05). In the energy spectrum CT quantitative parameters, CT-AP40keV, energy spectrum curve slope (K), and iodine concentration (IC) in the arterial phase, CT-VP40keV, CT-VP70keV, CT-VP100keV, K, IC, and normalized iodine concentration (NIC) in the venous phase, and CT-DP40keV, CT-DP70keV, K, IC, and NIC in the delay phase of c-KIT exon 11 mutant type is lower than c-KIT exon 11 wild type (all, P<0.05). The AUC of the model was 0.851 (95% CI: 0.760-0.941), the sensitivity and specificity were 78.4% and 88.7%, respectively.

**CONCLUSION**

Age, CT imaging features and energy spectrum CT quantitative parameters can be used as preliminary evaluation indicators for the mutation status of GISTs c-KIT exon 11. The clinical indicators, CT imaging features combined energy spectrum CT quantitative parameter model has high efficiency in predicting the mutation status of GISTs c-KIT exon 11.

**CLINICAL RELEVANCE/APPLICATION**

The energy spectrum CT serves as a useful, non-invasive imaging tool that can be used to predict the mutation status of c-KIT exon 11 in GISTs before surgery and can assist in clinical risk stratification and determining the treatment plan for patients.

# Abstract Archives of the RSNA, 2024

T7-SSGI11

**Gastrointestinal Imaging (MRI Techniques)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E451B

Jeanne M. Horowitz, MD (*Moderator*) Nothing to Disclose
Leslie K. Lee, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T7-SSGI11-1 ACTIVE BREATHING GUIDANCE: A NOVEL IN-BORE SOLUTION FOR PREDICTABLE, TIME-EFFICIENT AND HIGH IMAGE QUALITY LIVER MRI

Leon Bischoff, MD (*Abstract Co-Author*) Nothing to Disclose
Christoph Katemann (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Dmitrij Kravchenko, MD (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Alexander Isaak, MD (*Abstract Co-Author*) Nothing to Disclose
Annerieke Heuvelink (*Abstract Co-Author*) Nothing to Disclose
Ulrike I. Attenberger, MD (*Abstract Co-Author*) Consultant, Bayer AG
Narine Mesropyan, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Breathing artifacts in liver MRI lead to impaired image quality, decreased diagnostic confidence, and, as a result, longer acquisition times. This study aimed to evaluate the image quality and scan efficiency of newly developed in-bore breathing guidance application for diffusion-weighted imaging (DWIBG) and T2-weighted sequences with propeller acquisition (MultiVaneXD) (T2BG).

### METHODS AND MATERIALS

Patients with clinical indications to liver MRI, who underwent examination at 3T MRI were consecutively included in this study. MRI protocol included DWIconv and T2 conv followed by DWIBG with T2BG. For the active breathing guidance, a pre-clinical software was installed on the scanner. Prior to the scan session, each patient received short video instruction about the MRI with breathing guidance. Suitable parameters for desired breathing pattern for DWIBG and T2BG were set individually for each patient based on the patient`s physical respiratory ability and adaptivity. Artifacts, sharpness, lesion conspicuity, and overall image quality were assessed using a Likert grading scale from 1 (non-diagnostic) to 5 (excellent). Additionally, scanning time, time of repetition (TR), contrast-to-noise (CNR: SIliver-SInoise/SDnoise), and signal-to-noise ratio (SNR: SIliver/SInoise) were analyzed. Measurements were performed in consensus by two experienced board-certified radiologists. Paired t-test and Wilcoxon test were used for statistical analysis.

### RESULTS

27 patients (46±16 years; 11 female) were included. T2BG showed significantly less artefacts (4.5±0.7 vs.4.0±0.9, P<0.001) and better sharpness (4.7±0.6, P=0.003) compared to T2conv. Overall image quality (4.5±0.8 vs. 4.3±0.9, P=0.062) and lesion conspicuity (4.7±0.6 vs. 4.6±0.6, P=0.5) were similar for both T2BG and T2conv. T2BG had significantly longer TR (3608±667ms vs. 2244±384ms; P<0001). DWIBG provided similar overall image quality compared to DWIconv (P>0.4). Sequence scan time was shorter with T2BG (4.8±0.2min vs. 5.4±1.4min; P=0.041), with a reduction of scan time by 11%. Scanning time of DWIBG was also shorter compared to DWIconv (4.3±1,2 min vs. 2,6±0.06 min, P<0.001). DWIBG and T2BG provided not only reduced, but more constant and predictable total scan times.

### CONCLUSION

Our study results indicate that active breathing guidance for T2w and DWI liver MRI sequences lead to the significant reduction of breathing artifacts by significantly shorter and predictable total scan times while maintaining high image quality.

### CLINICAL RELEVANCE/APPLICATION

The application of an active visualized breathing guidance for breathing sensitive MRI sequences could improve scan efficiency, image quality, diagnostic confidence, and possibly patient experience.

## T7-SSGI11-2 INTRAINDIVIDUAL COMPARISON OF HALF-DOSE GADOPICLENOL AND STANDARD DOSE OF GADOBENATE DIMEGLUMINE FOR ABDOMINAL MRI

Rajan T. Gupta, MD (*Abstract Co-Author*) Consultant, Bayer AG;Speakers Bureau, Bayer AG;Consultant, Invivo Corporation;Consultant, Becton, Dickinson and Company;Consultant, Quibim;Consultant, Bracco Group
Domenico De Santis, MD (*Abstract Co-Author*) Nothing to Disclose
Ludovica Lofino, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle E. Kruse, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin R. Kalisz, MD (*Abstract Co-Author*) Reviewer, Oakstone Publishing, LLC;Consultant, VoxelMetrix, LLC
Francesco Ria, DMP (*Abstract Co-Author*) Metis Health Analytics

Daniele Marin, MD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Siemens AG;Research support, Bracco Group;Research Consultant, Bracco Group;Research Consultant, Bayer AG
Antonella Del Gaudio, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To intraindividually compare image quality and lesion conspicuity of abdominal MRI using gadopiclenol at 0.05 mmol/kg and gadobenate dimeglumine (Gd-BOPTA) at 0.1 mmol/kg.

**METHODS AND MATERIALS**

From September 2023 to March 2024, consecutive patients who had undergone two clinically-indicated contrast-enhanced abdominal MRIs within 12 months using gadopiclenol and Gd-BOPTA on the same scanner were retrospectively enrolled. One independent radiologist manually measured the signal intensity of abdominal organs, arterial and venous vessels, and abdominal lesions (liver, pancreas, and kidneys) on unenhanced, late arterial, venous, and equilibrium phases. Signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and magnitude of contrast enhancement (?E) were calculated for all organs and vessels on each contrast-enhanced phase. Percentage enhancement (%E) was calculated for all lesions on contrast-enhanced each phase. Subjective image quality was assessed for each phase using a 5-point Likert scale, including: enhancement of abdominal organs and vessels, liver-to-vessels contrast, and overall image quality. Lesion characteristics were also evaluated, including borders delineation, internal enhancement pattern, and lesion-to-liver visual contrast. Statistical analysis employed paired t- and Wilcoxon tests.

**RESULTS**

One hundred subjects (mean age, 63.7 years ± 14.1 [SD]; 55 men) were selected and a total of 21 abdominal lesions were included. Compared to Gd-BOPTA, gadopiclenol yielded significantly higher ?E value for all abdominal organs and vessels in each contrast-enhanced phase (all p = .024) Figure 1. Gadopiclenol yielded significantly higher SNR and CNR for the pancreas, kidneys, and spleen in the late hepatic arterial phase (p = .04). No significant differences in CNR were observed between gadopiclenol and Gd-BOPTA for all organs in the portal venous and equilibrium phases. The %E of abdominal lesions was significantly higher with gadopiclenol compared to Gd-BOPTA for all contrast-enhanced phases (p <.001).No significant differences were observed between gadopiclenol and Gd-BOPTA in readers' perception of image quality and lesions' characteristics.

**CONCLUSION**

Gadopiclenol at 0.05 mmol/kg yields comparable image quality compared to Gd-BOPTA at 0.1 mmol/kg, along with improved measurements of enhancement for abdominal organs and lesions.

**CLINICAL RELEVANCE/APPLICATION**

By providing comparable image quality at half the dosage, gadopiclenol may improve patient's safety and reduce costs compared to Gd-BOPTA for abdominal MRI.

## T7-SSGI11-5 BIOMECHANICAL ASSESSMENT OF LIVER INTEGRITY: PROSPECTIVE EVALUATION OF MECHANICAL VERSUS ACOUSTIC MR ELASTOGRAPHY

Jennifer Gotta (*Abstract Co-Author*) Nothing to Disclose
Valerie Vilgrain, MD (*Abstract Co-Author*) Expert Witness, Bayer AG;Speaker, Canon Medical Systems Corporation;Speaker, General Electric Company;Advisory Board, Guerbet SA;Expert Witness, Guerbet SA;Expert Witness, Zimmer Biomet Holdings, Inc;Speaker, Sirtex Medical Ltd;Expert Witness, Sirtex Medical Ltd;Investigator, AIdream Group LLC;Expert Witness, Terumo Corporation;;
Victoria Chernyak, MD, MS (*Abstract Co-Author*) Consultant, Bayer AG
Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ralph Sinkus, PhD (*Abstract Co-Author*) Nothing to Disclose
Simon S. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Scherwin Mahmoudi, MD (*Abstract Co-Author*) Nothing to Disclose
Giacomo Annio, PhD (*Abstract Co-Author*) Nothing to Disclose
Katrin Eichler, MD (*Abstract Co-Author*) Nothing to Disclose
Christian Booz, MD (*Abstract Co-Author*) Speaker, Siemens AG
Renate M. Hammerstingl, MD (*Abstract Co-Author*) Nothing to Disclose
Ibrahim Yel, MD (*Abstract Co-Author*) Nothing to Disclose
Duygu Atasoy, MD (*Abstract Co-Author*) Nothing to Disclose
Leon D. Gruenewald, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Darwish (*Abstract Co-Author*) Nothing to Disclose
Vitali Koch, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Magnetic resonance elastography (MRE) is able to quantify tissue biomechanics noninvasively, including pathological hepatic states like metabolic dysfunction-associated steatohepatitis. This prospective single-center study aimed to compare the diagnostic performance of 2D/3D-MRE using the gravitational transducer concept (GT) with the current commercial acoustic (AC) solution utilizing a 2D-MRE approach. Additionally, quality index markers (QIs) were proposed based on quantitative measures to identify image pixels that yield sufficient quality for reliably estimating tissue biomechanics.

**METHODS AND MATERIALS**

193 participants were recruited with suspected or confirmed liver disease (median age 57 years [IQR, 47-65]; 78 females). Participants were scanned twice at 60Hz vibration frequency on a 1.5T scanner: firstly, using the commercial MRE system (AC, 2D-MRE, spin-echo EPI sequence, 11s breath-hold [BH]), and, secondly, using the GT transducer (2D- and 3D-MRE, gradient-echo sequence, 14s BH). Image analysis was performed blinded by two independent readers. Additionally, analytic plane shear waves were used to propose pertinent QIs.

**RESULTS**

Liver stiffness values quantified via GT-2D/3D correlated well with AC-2D (r=0.89 [95% CI: 0.85-0.92]; P<0.001) and histopathological grading (r=0.84 [95% CI: 0.72-0.91]; P<0.001), demonstrating excellent agreement in Bland-Altman plots and between readers (?=0.86 [95% CI: 0.81-0.91]). However, 2D-MRE showed a bias in overestimating stiffness compared to 3D-MRE. Proposed QIs enabled the identification of pixels deviating beyond 10% from true stiffness, based on a combination of total wave amplitude, temporal sinusoidal nonlinearity, and additionally wave signal-to-noise ratio in the case of 3D-MRE.

**CONCLUSION**

GT-MRE represents a precise alternative to AC-MRE for noninvasive liver tissue characterization. Both 2D and 3D approaches showed a strong correlation to the established commercial approach, providing a new biomechanical ground truth for advanced capabilities in abdominal imaging.

### CLINICAL RELEVANCE/APPLICATION

GT-MRE promises to become a precise alternative to the current commercial solution for liver fibrosis characterization based on a new biomechanical ground truth with advanced capabilities in abdominal imaging.

## T7-SSGI11-6 ACCELERATED MRI LIVER AT 3T USING FIVE SEQUENCES WITH DEEP LEARNING BASED IMAGE RECONSTRUCTION: IMPACT ON IMAGE QUALITY

Hersh Chandarana, MD, MBA (*Abstract Co-Author*) Institutional research agreement, Siemens AG;Equipment support, Siemens AG;Software support, Siemens AG
Krishna Prasad Shanbhogue, MD (*Abstract Co-Author*) Nothing to Disclose
Mary Bruno, RT (*Abstract Co-Author*) Nothing to Disclose
Hanisha Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Mahesh Bharath Keerthivasan, MS (*Abstract Co-Author*) Nothing to Disclose
Luke A. Ginocchio, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the image quality of five MRI prototype sequences with deep learning-based image reconstruction to the corresponding five conventional sequences for 3T liver MRI.

### METHODS AND MATERIALS

59 consecutive patients who prospectively underwent clinical liver MRI at 3T between 5/1/2023 and 12/26/2023, including the five prototype sequences, were included. Images were anonymized and subsequently reviewed by two fellowship trained radiologists using a 5-point Likert scale for image quality metrics. Acquisition time for each sequence was collected.

### RESULTS

Acquisition times for four of the five DL sequences were significantly shorter than for the corresponding conventional sequences: Coronal HASTE (DL 63.8±12.0 vs Conv 72.0±12.2 seconds, p<.001), Axial T2 FS (DL 62.8±13.5 vs Conv 150.5±25.6 seconds, p<.001), Axial T1 precontrast (DL 18.8±4.8 vs Conv 20.3±11.4 seconds, p=.296), Axial T1 postcontrast (DL 24.2±9.6 vs Conv 45.8±9.6 seconds, p<.001), and Axial DWI (DL 91.5±9.8 vs Conv 156.1±19.9 seconds, p<.001). On average, the combined savings in acquisition time from replacing the five conventional sequences with the respective DL sequences is 183.5 seconds. All five DL sequences received significantly higher scores than the corresponding conventional sequences for overall image quality (DL vs Conv: Coronal HASTE 4.5 vs 4.0, Axial T2 FS 4.0 vs 3.4, Axial T1 precontrast 4.2 vs 3.9, Axial T1 postcontrast 4.3 vs 4.0, and Axial DWI 4.2 vs 3.8, all p<.001), in addition to artifact and sharpness of liver margin scores. For studies with liver lesions, all five DL sequences received significantly (p<.001) higher scores for sharpness of lesion margin. All lesions detected on conventional sequences were detected on DL sequences.

### CONCLUSION

All five MRI prototype sequences with deep learning-based image reconstruction demonstrated decreased acquisition times compared with conventional liver sequences, while improving image quality for liver MRI. On average, replacing the five conventional liver MRI sequences with the respective DL sequences would save over 3 minutes in acquisition time, offering potential alternatives to the corresponding conventional sequences in routine clinical liver MRI.

### CLINICAL RELEVANCE/APPLICATION

Five MRI prototype sequences for liver MRI demonstrated decreased acquisition times while improving image quality, saving over 3 minutes of acquisition time in total, resulting in decreased cost and increased patient throughput and patient satisfaction.

# Abstract Archives of the RSNA, 2024

T7-SSIN03

**Imaging Informatics (Impact of AI on Workflow and Diagnosis)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E450B

Martha G. Menchaca, MD, PhD (*Moderator*) Nothing to Disclose
Seetharam C. Chadalavada, MD, MS (*Moderator*) Consultant, Cook Group Incorporated;Grant, Cook Group Incorporated;Speaker, Cook Group Incorporated;Consultant, Koninklijke Philips NV;Speaker, Koninklijke Philips NV

**Sub-Events**

## T7-SSIN03-1 AI-POWERED ASSISTANT FOR PROCEDURE REQUEST ROUTING IN A LARGE HOSPITAL SYSTEM

Nicholas T. Befera, MD (*Abstract Co-Author*) Founder and CEO, Scanslated, Inc
Christopher J. Roth, MD (*Abstract Co-Author*) Nothing to Disclose
Brendan C. Cline, MD (*Abstract Co-Author*) Nothing to Disclose
Walter F. Wiggins, MD,PhD (*Abstract Co-Author*) Advisor, Qure.ai;
Brian Triana, MD, MBA (*Presenter*) Nothing to Disclose

### PURPOSE

Within large hospital systems, difficulty with routing procedure requests to the appropriate team and covering provider can delay patient care and cause frustration for both radiologists and ordering clinicians. Furthermore, the heterogeneity of interventional radiology practices further increases complexity for procedure requests between non-vascular interventional teams or procedure teams from other specialties. Artificial intelligence (AI) large language models (LLMs) enable a wide range of capabilities across industries. This work demonstrates a proof-of-concept, LLM-based tool to route procedure requests to the appropriate teams.

### METHODS AND MATERIALS

At a large academic hospital, existing teams, pager/phone numbers, and schedules were used to create text-based rules for procedure requests. An LLM-based assistant was created to route procedure requests at specific days and times to the appropriate teams. The assistant was tested on 270 requests within the scope of the provided rules, and 23 requests out of sample requests using GPT-3.5-turbo and GPT-4 models from OpenAI and four open-weight models.

### RESULTS

The assistant correctly routed 96.3% of procedure requests using GPT-4 and 81.1% using GPT-3.5-turbo. Llama 3 70B outperformed GPT-3.5-turbo with an accuracy of 84.3%, although the remaining open-weight models demonstrated inferior performance. Open AI API costs were approximately $0.03 per request for GPT-4 and $0.0006 per request for GPT-3.5-turbo. The most common errors were in early morning requests, times at which multiple subspecialty division procedure services are covered by overnight resident phones. Secondary analysis on procedure requests outside the scope of provided rules, such as epidural blood patch, demonstrated decreased accuracy measuring up to 73.9% for GPT-4.

### CONCLUSION

This work demonstrates the feasibility of an accurate, low-cost AI-powered assistant to appropriately route procedure requests in a large academic hospital system. Given the free-text input, the rules and teams can easily be adapted to different coverages or hospital systems. A similar approach may be used to help clinicians navigate a radiology phone tree, or as a tool to help reading room coordinators route requests effectively with decreased training.

### CLINICAL RELEVANCE/APPLICATION

While many implementations of artificial intelligence in healthcare focus on aiding clinical decision making, this tool augments existing workflows and would coexist in parallel to the current call-routing or paging infrastructure. Compared to clinical decision-making tools, this type of implementation has a much lower risk profile and thus has fewer barriers to implementation within a hospital system.

## T7-SSIN03-2 EXTRACTING INFORMATION FROM UNSTRUCTURED DIAGNOSTIC REPORTS USING LARGE LANGUAGE MODELS FOR LOCAL VALIDATION OF INTERPRETIVE AI ALGORITHMS - INTRACRANIAL ANEURYSM USE CASE

Po-Hao Chen, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Scott Robertson (*Abstract Co-Author*) Nothing to Disclose
Samer Albahra (*Abstract Co-Author*) Nothing to Disclose
Todd M. Emch, MD (*Abstract Co-Author*) Nothing to Disclose
Chintan Shah, MD, MS (*Presenter*) Spouse, Employee, Merck & Co, Inc

**PURPOSE**

Pre-deployment local validation of artificial intelligence (AI) models is an important but commonly overlooked step, as it is labor-intensive. Large language models (LLMs) have been shown to be effective for medical text analysis. Local hosting reduces data privacy risks versus cloud hosted LLM solutions. We compared multiple LLMs to extract information from unstructured radiology reports, then applied the best model towards the local validation of a commercial AI product for intracranial aneurysm triage.

**METHODS AND MATERIALS**

LLMs were locally hosted using Ollama (ollama.com). Open-source LLMs tested included llama2 (7b, q4, Meta Platforms), wizardlm (70b, q8, Microsoft), mixtral (8x7b, fp16, Mistral AI). These were compared with GPT-4 (Open AI). LLMs were employed to extract the presence, location, and size of an aneurysm from the report for head/neck CTAs. Prompt engineering techniques utilized included role definition, explicit instructions, and multi-shot example prompting. The commercial Computer Aided Triage (CADt) device for local validation was for intracranial aneurysms = 4 mm on head CTA (Viz Aneurysm, Viz.ai). It was tested on 1470 head/neck CTAs from 4 sites over 105 days. LLMs were compared on reports of the first 37 CADt positive CTAs. The chosen LLM was then applied to all CTA reports to assess CADt device performance. All CADt positive and discordant CADt negative reports were manually reviewed for LLM accuracy. CADt positive cases with no aneurysm reported were adjudicated via image review. Summary performance statistics were calculated utilizing size thresholds of 4 mm or any size.

**RESULTS**

Aneurysm presence was correctly categorized in all 37 reports (15 present, 22 absent) by all LLMs except llama2. Size threshold = 4 mm was correctly categorized in all 37 reports only by mixtral. All CTAs were processed with wizardlm. Of 114 manually reviewed reports, 104 were correctly categorized for aneurysm presence; 6 false positives were due to extracranial aneurysms, and 4 false negatives were due to mention only in the body of the report. The sensitivity, specificity, PPV, and NPV of the aneurysm CADt device were: 88.9, 96.6, 32.9, and 99.8%, respectively (aneurysms = 4 mm); and 62.7, 97.8, 57.5, and 98.2%, respectively (any size).

**CONCLUSION**

Open source locally deployed LLMs can achieve similar performance to commercial LLMs for information extraction from radiology reports, but allow processing of protected data. This can enable local validation and performance monitoring, important aspects of commercial imaging AI deployments.

**CLINICAL RELEVANCE/APPLICATION**

Assessing local performance of commercial imaging AI products is imperative prior incorporating these into clinical workflows, and locally deployed LLMs can enable this process.

## T7-SSIN03-3 THE EFFECTS OF DIFFERENT AI SCENARIOS ON RADIOLOGISTS AND RESIDENTS PERFORMANCE

Ali Adibi (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Covanos, Inc
Elizabeth A. Krupinski, PhD (*Abstract Co-Author*) Nothing to Disclose
Mohammadreza Zandehshahvar (*Abstract Co-Author*) Nothing to Disclose
Marly Van Assen, MSc, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Understand decision-making process of human readers with and without assistance of different AI prompts.

**METHODS AND MATERIALS**

Five radiologists and 3 residents served as readers in 5 sessions, each with 2 parts. There were 80 COVID chest xray cases per scenario (40 per part). AI scenarios were image only, heatmaps, class prediction, probability+uncertainty, combined AI. A Bayesian neural network predicted pneumonia severity, trained on the RSNA pneumonia dataset (13k CXRs) and 348 COVID Emory patients - accuracy was 0.94. Monte Carlo Dropout and Grad-CAM created the AI scenarios. Readers rated severity (normal, mild, moderate, severe) and confidence (possible, probably, definite). Search was recorded with a Tobii eyetracker. Gold standard was consensus reading by 6 radiologists. Decisions are defined as AI does not impact original decision (no change), impacts positively (positive change), impacts negatively (negative change).

**RESULTS**

86.99% of severity ratings were unchanged between image only and AI read, with no significant differences by AI scenario ($X2 = 6.59$, $p = 0.6792$). Of those, 83.66% overall were correct (TP, TN) with no significant differences ($X2 = 6.27$, $p = 0.7126$) by AI scenario. There was no significant difference in the no change group by AI scenario ($X2 = 0.80$, $p = 0.8489$). There was a difference in the positive change group ($X2 = 21.78$, $p < 0.0001$) with combined AI having the most changes; and in the negative change group ($X2 = 25.06$, $p < 0.0001$) with heatmaps having the most changes. There were no significant differences between radiologists and residents for no change ($X2 = 0.27$, $p = 0.9655$) or positive ($X2 = 3.93$, $p = 0.2690$), but was for negative ($X2 = 12.52$, $p = 0.0058$) with radiologists having the most with heatmaps (10 vs 1.67%) but more similar with class prediction (3 vs 3.75%) compared to residents. For confidence, the was no significant difference between scenarios for no change ($X2 = 1.03$, $p = 0.7928$) or positive change ($X2 = 0.20$, $p = 0.9777$); although for positive there was for possible to definite ($X2 = 10.86$, $p = 0.0136$) with more changes with probability+uncertainty There was a significant difference ($X2 = 8.19$, $p = 0.0423$) for negative, with combined AI having the most. There were no differences between radiologists and residents for no change ($X2 = 2.33$, $p = 0.5073$) or negative change ($X2 = 0.83$, $p = 0.8413$) but was for positive ($X2 = 14.78$, $p = 0.0020$) with radiologists having more than residents with probability+uncertainty having the most (31.5 vs 9.58%)

**CONCLUSION**

Different AI scenarios can impact clinical performance and confidence, impacting radiologist and residents differently.

**CLINICAL RELEVANCE/APPLICATION**

Choosing an AI tool for clinical use should not only take accuracy into account but also how the output is shown to radiologist users.

## T7-SSIN03-4 A CUSTOM GPT CAN EFFECTIVELY ANSWER BOTH SIMPLE AND COMPLEX QUESTIONS ASKED OF RADIOLOGISTS

Sema Yildiz (*Abstract Co-Author*) Nothing to Disclose
Amanda Rushing (*Abstract Co-Author*) Nothing to Disclose
Bradley N. Delman, MD, MS (*Abstract Co-Author*) Consultant, Guerbet SA
Puneet Belani, MD (*Abstract Co-Author*) Nothing to Disclose
Xueyan Mei, PhD (*Abstract Co-Author*) Nothing to Disclose
Kushal Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Cassandra Soto (*Abstract Co-Author*) Nothing to Disclose

Amish H. Doshi, MD (*Abstract Co-Author*) Speaker, Becton, Dickinson and Company;Consultant, Siemens AG
Chloe G. Cross, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Phone calls and interruptions significantly compromise radiologists clinical efficiency. The purpose of this research was to assess whether a custom Chat-GPT4 can be successful in answering common questions asked of radiologists.

**METHODS AND MATERIALS**

A custom Chat-GPT 4 model, called Radiology GPT, was developed by the co-authors using informational material readily available to radiologists at the author's institution. 45 questions commonly asked of radiologists were developed by the co-authors. Each question was assigned a complexity grade of a simple technical question (level 1), a multistep technical question (level 2), or a multistep technical question with incomplete information (level 3). Each output was graded using a 6-point Likert scale for accuracy (1 = completely incorrect, 2 = more incorrect than correct, 3 = approximately equal parts correct and incorrect, 4 = more correct than incorrect, 5 = nearly all correct, 6 = correct), 3-point scale for completeness (1 = incomplete, 2 = adequate, 3 = comprehensive), and 5-point Likert scale for clarity (1 = strongly unclear, 2 = unclear, 3 = neutral, 4 = clear, 5 = strongly clear). All outputs were graded by 3 blinded MDs (2 resident radiologists, 1 attending radiologist), and clarity metric-only was graded by 2 blinded MD vascular surgery residents.

**RESULTS**

45 total questions were prompted to the Radiology GPT (level 1: n=26, level 2: n=11, level 3: n=7). Mean accuracy for all questions was 5.5 (SD±0.90), mean completeness was 2.3 (SD±0.50), and mean clarity was 4.7 (SD±0.67). Of the 135 scores for accuracy (45 questions, 3 radiology reviewers), only 7 received a score of 3 or less (approximately equal parts correct and incorrect). For completeness, 5/135 scores received a score of 1 (addresses some aspects of the question, but significant parts are missing or incomplete). Of the 225 scores for clarity (45 questions, 3 radiology reviewers, 2 clinician reviewers), 5 received a score of 2 or less.

**CONCLUSION**

A custom Chat GPT 4 can accurately and completely answer questions commonly posed to radiologists. Enabling this feature would enable radiologists to dedicate more time on clinical work and enhance wellness.

**CLINICAL RELEVANCE/APPLICATION**

A custom Chat GPT 4 targeted to radiology may be able to alleviate phone calls and interruptions for common questions posed to radiologists.

## T7-SSIN03-5 A NOVEL APPROACH TO ACCELERATE DEVELOPMENT OF IMAGING COMMON DATA ELEMENTS BY CAPTURING RADIOLOGISTS' OBSERVATIONS WITH A LARGE LANGUAGE MODEL

Tarik K. Alkasab, MD, PhD (*Abstract Co-Author*) Consultant, Nuance Communications, Inc;Medical Advisory Board, Nuance Communications, Inc
Roshan Fahimi, MD (*Abstract Co-Author*) Nothing to Disclose
Heather Chase, BS (*Abstract Co-Author*) Nothing to Disclose
Michael Hood, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Common Data Elements (CDEs) are data structures that comprehensively encode the information about a particular imaging finding from the unstructured text of a diagnostic radiology report. To date, CDE creation has been labor-intensive. We introduce a novel methodology that uses a large language model (LLM) to reliably generate preliminary CDEs for specified findings by automatically capturing the terms and associations used by radiologists to describe them.

**METHODS AND MATERIALS**

We assembled a corpus of anonymized chest CT reports from a single institution using a large language model (LLM). Each report was broken into overlapping chunks and semantic vectors were generated for each chunk using an embedding model (BAAI's bge-base-en-v1.5). The chunks were maintained in a vector-search-enabled database (Microsoft Azure). The created tool takes the name of a CT finding as input. Relevant report chunks were retrieved from the database using a cosine-similarity search to the semantic vector of the finding name, reranked using a reranking cross-encoder (BAAI's bge-reranker). These chunks were then included as context for a prompt to a GPT model (Microsoft Azure) to generate a structured data model describing the attributes radiologists used in the reports to describe the finding. The output data models included attributes such as Identification (presence and status changes), Characteristics (severity, distribution, location, etc.), and Associated Findings. Multiple iterations were generated, then integrated and reconciled to address redundancies. A fellowship-trained emergency radiologist reviewed each CDE definition to ensure its clinical accuracy.

**RESULTS**

An initial pilot of this methodology tested 20 selected findings that appear commonly in chest CT reports. Iteration of this process led to a refined definition of CDE sets and their standard element properties for 180 chest CT findings, which were then sent to a centralized repository (GitHub) for further review.

**CONCLUSION**

We show that an LLM can harness a corpus of diagnostic chest CT reports to rapidly and dependably produce a preliminary CDE for any specified imaging finding. This greatly broadens the basis for modeling chest CT reports. Future iterations of this methodology will aim to capture a broader range of observations by incorporating diagnostic reports from multiple institutions.

**CLINICAL RELEVANCE/APPLICATION**

CDEs are central to the Open Imaging Data Model initiative, which provides a standardized framework for representing the vast data within imaging exams to power downstream applications in the imaging informatics ecosystem. This method accelerates the development of the many CDEs needed to capture the detailed observations in a radiology report.

## T7-SSIN03-6 AI-AIDED DIAGNOSTIC SYSTEM PROVIDING EXPLANATIONS IN LI-RADS LANGUAGE IN LIVER CANCER DIAGNOSIS USING MRI

Kenji Suzuki, PhD (*Abstract Co-Author*) Nothing to Disclose
CHEN ZHANG (*Abstract Co-Author*) Nothing to Disclose
Takamichi Murakami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Hori, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Keitaro Sofue, MD (*Abstract Co-Author*) Nothing to Disclose
Ze Jin, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

AI for diagnosis has been developed to aid radiologists. Because of the "black-box" nature, AI does not provide reasons for its decisions, which prevents diagnostic AI from utilizing in clinical practice. This study aims to develop an innovative, interpretable AI model that mimics the decision-making process of radiologists by using the Liver Imaging Reporting and Data System (LI-RADS). The model is designed to provide transparent liver cancer diagnostic predictions with explanations in LI-RADS language.

## METHODS AND MATERIALS

Our study utilized an image database containing 221 dynamic contrast-enhanced (DCE) liver MRI studies from 94 patients with 89 malignant and 132 benign tumors, with radiologists-assessed LI-RADS reports. Our proposed interpretable AI scheme comprised three sections: AI model for LI-RADS feature prediction and selection based on segmented tumors, liver tumor classification with a support-vector AI with the predicted LI-RADS features, and AI for generating conversational explanations with LI-RADS and natural language expressions. The process started with identifying the most impactful LI-RADS features with our original maximal area-under-the-curve feature selection method. The support-vector AI model was then trained to differentiate between malignant and benign tumors to leverage the LI-RADS features to boost its classification performance. The predicted LI-RADS features from our model were transformed into clinically meaningful explanations with natural language expressions.

## RESULTS

In the feature prediction and selection section in our scheme, seven LI-RADS features were selected, including APHE (arterial phase hyperenhancement), marked T2 hyperintensity, mild-moderate T2 hyperintensity, restricted diffusion, capsule appearance, and washout. Our scheme predicted LI-RADS features very accurately: APHE (AUC of 0.88), marked T2 hyperintensity (0.86), mild-moderate T2 hyperintensity (0.89), restricted diffusion (0.88), capsule (0.92), washout (0.9), and the size feature achieved an MSE of 26.30 pixels2. With the predicted LI-RADS features, the liver tumor classification model achieved an AUC of 0.85, higher than the state-of-the-art deep leaning models such as VGGNet (0.39), DenseNet (0.36), and ResNet (0.54).

## CONCLUSION

We developed an interpretable AI model for liver cancer diagnosis that provided the reasons for the AI decisions in LI-RADS language.

## CLINICAL RELEVANCE/APPLICATION

Our scheme is not only theoretically sound for AI developers but also has great potentials for increasing the acceptance and trust of radiologists in its practical use.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T7-SSIN04

**Imaging Informatics (Reporting and Research with LLMs - The Future is Now)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E350

Paulo E. Kuriki, MD (*Moderator*) Nothing to Disclose
Hediyeh Baradaran, MD, MS (*Moderator*) Nothing to Disclose

**Sub-Events**

## T7-SSIN04-1 THE IMPACT OF LARGE LANGUAGE MODEL-GENERATED RADIOLOGY REPORT SUMMARIES ON PATIENT COMPREHENSION: A RANDOMIZED CONTROLLED TRIAL

Nicholas T. Befera, MD (*Abstract Co-Author*) Founder and CEO, Scanslated, Inc
Naiim S. Ali, MD,FRCPC (*Abstract Co-Author*) Nothing to Disclose
Kayla Berigan, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Assess the impact of Large Language Model (LLM)-generated radiology report summaries, alone and combined with lay language reports, on patient comprehension and need to search report content online.

### METHODS AND MATERIALS

In this prospective, randomized controlled study, adult patients with imaging ordered by a primary care provider were randomized to receive the standard radiology report only (Group 1) or the standard report and: LLM-generated report summary (Group 2), commercially available lay language report with explanations and diagrams of clickable terms (Group 3), LLM-generated summary + commercially available lay language report (Group 4). Participants were asked two survey questions: 1) How would you rank your understanding of your radiology report? 2) Do you plan to look anything up online that is in this report? Summaries were generated by a publicly available LLM using the prompt: “Explain this radiology report to a patient in layman's terms in second person: (manually deidentified report text).” Output was edited for accuracy and scope by a board-certified radiologist before delivery to patients.

### RESULTS

Patients who received LLM-generated summaries, alone or combined with lay language reports, were most likely to report high understanding and least likely to report needing to search content online. Of 51 LLM-generated summaries made available to patients, most (80.4%, 41/51) were edited before release, usually to remove suggestions of prognosis, treatment, or causality.

### CONCLUSION

LLM-generated radiology report summaries can improve patient understanding and decrease the need to search the internet but require human editing in most cases.

### CLINICAL RELEVANCE/APPLICATION

Reports of increased patient anxiety and clinician burden due to immediate patient access to radiology reports have sparked investigation into patient-friendly reports. Single arm studies have shown that patient-friendly reports increase comprehension and decrease anxiety, but these have not utilized LLMs or randomized controlled designs. LLM-generated lay language reports have been retrospectively evaluated for readability and accuracy according to established scales or review by radiologists, clinicians, or lay volunteers, but this study is the first in which patients were given access to LLM-generated lay language summaries of their own reports and impact was evaluated in a prospective randomized controlled trial. This novel study demonstrates that LLM-generated report summaries, alone and combined with commercially available lay language reports, can improve patient understanding and decrease their need to search report content online.

## T7-SSIN04-2 HARNESSING GPT-4 FOR CLINICAL DECISION SUPPORT: USING A LARGE LANGUAGE MODEL FOR TRIAGING PATIENTS AT RISK OF INTRAVENOUS CONTRAST REACTIONS

Evis Sala, MD, PhD (*Abstract Co-Author*) Co-founder, Lucida Medical Ltd
Matteo Bonatti, MD (*Abstract Co-Author*) Nothing to Disclose
Benedetta Gui, MD (*Abstract Co-Author*) Nothing to Disclose
Luca D'Erme, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta Chianura (*Abstract Co-Author*) Nothing to Disclose
Matteo Marin (*Abstract Co-Author*) Nothing to Disclose
Miriam Dolciami, MD (*Abstract Co-Author*) Nothing to Disclose
Giacomo Avesani, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine whether a Large Language Model (GPT 4) can provide accurate and valuable guidance on management for at risk for reaction during intravenous contrast administration.

**METHODS AND MATERIALS**

Six guidelines from various scientific societies were collected, both in English and the local language. These documents were embedded using OpenAI embeddings within the LangChain framework, creating a database to provide information to a GPT-4 turbo model. We formulated 200 clinical scenarios describing different situations, combining allergic and renal problems (e.g., moderate to severe allergic reaction and different renal functions) and different types of contrast media (iodine and gadolinium). We asked the model to give a textual answer for each clinical scenario indicating the correct patient management following the previously given guidelines. The responses generated by the model were evaluated by a human expert in the field, considering formal correctness and clinical usefulness. A Likert 5-point scale for each task (correctness and usefulness) was used to judge the answers (from 5=correct/safe or very useful to 1=completely wrong or completely useless for clinical purposes). We dichotomised the responses with a cut-off of =4 to consider the answers acceptable.

**RESULTS**

The model's answers were judged formally correct and safe for patients in 94% of scenarios and valuable in 82% of cases. Predominantly, answers deemed not valid were considered too vague to be used.

**CONCLUSION**

LLMs have the potential to aid in the clinical management of critical patients. Such models can be very useful for novice personnel or initial screenings. Better performance might be achieved with fine-tuning and the "tree of thought" techniques.

**CLINICAL RELEVANCE/APPLICATION**

Large Language Models can effectively assist in clinical decision-making, such as identifying patients at risk of reactions during intravenous contrast procedures, but require supervision.

## T7-SSIN04-3 FINE-TUNED LARGE LANGUAGE MODELS FOR ACCURATE BREAST PATHOLOGY INFORMATION EXTRACTION

Amie Y. Lee, MD (*Abstract Co-Author*) Institutional Research Grant, Kheiron Medical Technologies Ltd;Editor with royalties, RELX
Adam Yala, PhD (*Abstract Co-Author*) Nothing to Disclose
Yiyan Hao (*Abstract Co-Author*) Nothing to Disclose
Tony Lian (*Abstract Co-Author*) Nothing to Disclose
Maggie Chung, MD (*Abstract Co-Author*) Nothing to Disclose
William Pace (*Abstract Co-Author*) Nothing to Disclose
Bonnie N. Joe, MD, PhD (*Abstract Co-Author*) Institutional Research Grant, Kheiron Medical Technologies Ltd;Institutional research agreement, General Electric Company;Institutional research agreement, Siemens AG
Anobel Odisho, MD (*Abstract Co-Author*) Nothing to Disclose
Elaine Kim (*Presenter*) Nothing to Disclose

**PURPOSE**

The objective is to evaluate the performance of general and fine-tuned large language model (LLM)-based tools for automated extraction of pathology outcomes from breast pathology reports.

**METHODS AND MATERIALS**

We conducted a single-institution, retrospective review of breast pathology reports from FNAs, core biopsies, surgical excisions, and mastectomies from 1/2019-8/2023. We selected 978 pathology reports consisting of 609 reports containing =1 malignant diagnoses and 369 with only benign and/or high-risk pathologies for a cancer-enriched dataset. For each report, we annotated the source of the sample (left/right breast, left/right lymph node) and diagnosis category (benign, high-risk, or cancer). For cancers, the subtype (DCIS, invasive ductal carcinoma, invasive lobular carcinoma, adenocarcinoma not otherwise specified, or other malignant pathology) was collected. This dataset was split into 489/244/245 for training, validation, and testing. We selected 5 pre-trained LLMs (Mistral 7B Instruct, Mixtral-8x7b-instruct, GPT-4, Llama 2 7B Chat, and Llama3-8B-Instruct). We created prompts to extract the following information from the pathology reports: 1) Tissue source, including lateralities and tissue types; 2) Presence of cancer or high-risk lesion; 3) Cancer subtype and the laterality. We compared the performance of the general LLMs to a version of Mistral 7B Instruct that was fine-tuned on our training set. Question exact match accuracies (e.g., all cancer types across all sites extracted correctly) and category accuracies (e.g. left breast DCIS extracted correctly) were calculated as test metrics.

**RESULTS**

Our fine-tuned Mistral-7B obtained high accuracy across all tasks, obtaining exact match accuracies of 98.8%, 95.9%, and 96.3% for tissue source, cancer presence, and cancer subtype, respectively. Per category accuracies (e.g., correctly identified left breast DCIS) ranged from 97.1% to 100%. Exact match accuracy across 3 tasks was 91.4%. This vastly outperformed the best general LLM, GPT-4, which obtained an exact match accuracy of 76.7% across the tasks. GPT-4 obtained exact match accuracies of 98.4%, 98.0%, and 78.8% across the three questions, and per category accuracies ranged from 90.2% to 100%.

**CONCLUSION**

Mistral-7B fine-tuned on 489 breast reports achieved high accuracy in extracting tissue source, cancer presence, and cancer subtyping from pathology reports.

**CLINICAL RELEVANCE/APPLICATION**

Fine-tuned LLMs can accurately extract information from breast pathology reports, providing an efficient avenue for creating large-scale databases. Prompts and an open-source development platform from this study will be shared on a user-friendly platform to facilitate greater utilization of LLMs in cancer research.

## T7-SSIN04-4 LARGE LANGUAGE MODELS, THE FUTURE REPLACEMENT OF RADIOLOGY RETROSPECTIVE RESEARCH?

Tessa S. Cook, MD, PhD (*Abstract Co-Author*) Grant, Independence Blue Cross;Speaker, Sectra AB;
William W. Boonn, MD (*Abstract Co-Author*) CEO, Equium Intelligence Inc;Shareholder, Equium Intelligence, Inc
Michael Corbin, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

GPT-4 leverages large language models (LLMs) and natural language processing (NLP), opening the door to improve healthcare efficiency, quality, and research. After a manual internal institutional retrospective review, we found that, similar to Yousef et al., our radiologists use multiple descriptors when characterizing ascending thoracic aortic aneurysms (TAA). Our studies aim is to evaluate the accuracy, sensitivity (Sen), and specificity (Spe) of GPT-4 in data extraction and internal validation from radiology reports compared to manual data collection in the diagnosis of TAA.

**METHODS AND MATERIALS**

464 patients with TAA were initially reviewed in this IRB-approved study. Radiologic and clinical data were obtained retrospectively from the medical record. Patients with congenital malformations, bicuspid valves, ascending graft repairs, traumatic aortic injury, or Stanford type A and B dissections were excluded. TAA descriptors and sizes documented for the "ascending aorta" in the report were manually extracted. GPT-4 (in a HIPAA-compliant environment in Microsoft Azure) was used to parse the reports for the same data. GPT-4 was optimized to perform batched data extraction of descriptors and diameters of the aortic root, ascending, and descending aorta from radiology reports and perform internal validations. Manual and GPT-4 extracted data were compared. TAA descriptors were matched to "normal", "dilated", or "aneurysmal".

**RESULTS**

Reports from 363 patients were analyzed (75% male; average age 67 years). 39/363 patients had no aortic descriptor. Across 324 patients, radiologists (RAD) descriptors mapped to "normal" (16), "dilated" (38), and "aneurysmal" (270), while GPT-4's mapped to "normal" (15), "dilated" (31), and "aneurysmal" (327). RAD diagnosed 74% patients with TAA, while GPT-4 identified 90%. Average TAA size was 4.64 cm (RAD) vs. 4.62 cm (GPT-4). 261/270 patients were found to be "aneurysmal" by GPT-4 (Sen 97%). GPT-4 self-validation tracked number of diagnoses it extracted per report. GPT-4 found 6/48 cases with >1 diagnosis (Sen 13%, Spe 97%). GPT-4 correctly flagged 16/31 cases in its summary report for further review when identifying discrepancies. GPT-4 was congruent between the extracted data and its self-generated validation summary (87%).

**CONCLUSION**

GPT-4 efficiently extracts data from radiology reports and can be optimized to be sensitive and specific for medical diagnoses. Further work should be done to improve its accuracy and reliability. GPT-4, when optimized correctly, offers a promising platform for future radiology retrospective research and quality management.

**CLINICAL RELEVANCE/APPLICATION**

Leveraging LLMs and artificial intelligence for excellent patient care will shape the future of healthcare.

## T7-SSIN04-5 LEVERAGING FINE-TUNED LARGE LANGUAGE MODELS FOR AUTOMATED PROTOCOLING OF CT EXAMINATIONS

Joshy Cyriac (*Abstract Co-Author*) Nothing to Disclose
Shan Yang, MSc (*Abstract Co-Author*) Nothing to Disclose
Jakob Wasserthal (*Abstract Co-Author*) Nothing to Disclose
Maurice Pradella, MD (*Abstract Co-Author*) Nothing to Disclose
Tobias Heye, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Vosshenrich, MD (*Abstract Co-Author*) Nothing to Disclose
Martin Segeroth, MD, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To leverage large language models (LLMs) for automated protocoling of requested cardiothoracic and abdominal CT examinations and investigate their protocol assignment accuracies.

**METHODS AND MATERIALS**

Consecutive CT examinations from our cardiothoracic (n = 66,173) and abdominal imaging (n = 54,944) divisions performed between 01/2010-10/2021 were retrospectively included. Protocoling had been performed by radiology residents during clinical routine, assigning one of 25 institutional cardiothoracic or one of 33 abdominal standardized imaging protocols, respectively serving as ground-truth.Using LoRA and the transformer library for Python, we fine-tuned two LLMs (Mistral-7B-v0.1 and BioMistral-7B). The clinical question (e.g. "r/o pulmonary embolism") and the referrer (e.g. "emergency department") served as input for the classification task. The dedicated imaging protocols represented the output. Fine tuning was trained for 10 epochs.For comparison, we trained a simple deep neuronal network consisting of three dense layers with 64 neurons each and one dense layer with 25 respectively 33 neurons as output layer. The network was trained for 100 epochs on the most frequently used terms. Data was split 90%/10% for model training/validation.

**RESULTS**

The fine-tuned Mistral-7B model achieved overall accuracies of 77% for the cardiothoracic and 73% for the abdominal data set. In contrast, the overall accuracies for the simple deep neuronal network were 65% and 54%, respectively. Fine-tuning of already specialized models like BioMistral-7B increased the overall accuracy by only 1% to 78% for the cardiothoracic data set.On a protocol level, assignment accuracies of the Mistral-7B model for the most frequently performed cardiothoracic CT protocols in the validation dataset were 94% for CT pulmonary angiograms (n = 1,761), 91% for unenhanced chest CTs (n = 2,096), 80% for arterial phase chest CTs (n = 610) and 85% for ECG-gated aortic CT angiograms (n = 253).For abdominal imaging division protocols, Mistral-7B assignment accuracies in the validation dataset were 89% for portal venous phase CT abdomen (n = 993), 87% for portal venous phase CT chest/abdomen (n = 1,161), 96% for unenhanced kidney stone CT (n = 397), and 92% for multi-phase abdominal CT (n = 190).

**CONCLUSION**

Fine-tuned LLMs achieve good to excellent protocoling accuracies for the most frequently performed cardiothoracic and abdominal CT examinations and outperform a simple deep neuronal network trained solely on frequently used terms.

**CLINICAL RELEVANCE/APPLICATION**

LLMs may help streamlining the CT protocoling workflow, potentially reducing noninterpretative tasks for radiologists given accurate protocol assignment for the most frequently performed CT examinations.

# Abstract Archives of the RSNA, 2024

T7-SSMK06

**Musculoskeletal Imaging (Knee)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: E353C

Sarah I. Kamel, MD (*Moderator*) Nothing to Disclose
Yaron J. Berkowitz, MBBChir, MRCS (*Moderator*) Nothing to Disclose

**Sub-Events**

## T7-SSMK06-1 MRI DIAGNOSIS OF MENISCUS TEARS: SYSTEMATIC REVIEW AND META-ANALYSIS

Robert D. Boutin, MD (*Abstract Co-Author*) Nothing to Disclose
Tetyana A. Gorbachova, MD (*Abstract Co-Author*) Nothing to Disclose
Megan K. Mills, MD (*Abstract Co-Author*) Nothing to Disclose
Vandan Patel, BS (*Abstract Co-Author*) Nothing to Disclose
Wondwossen Lerebo (*Abstract Co-Author*) Nothing to Disclose
Kathryn J. Stevens, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Kimia K. Kani, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Jennifer S. Weaver, MD (*Abstract Co-Author*) Nothing to Disclose
Dyan V. Flores, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Yaya (*Abstract Co-Author*) Nothing to Disclose
Jie C. Nguyen, MD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

To fill the unmet need for an updated systematic review and meta-analysis on the diagnostic performance of MRI for meniscus tears compared to arthroscopy with subgroup analyses to identify factors that impact accuracy.

### METHODS AND MATERIALS

Literature search using PubMed®, Scopus®, and Embase® databases identified peer-reviewed publications on preoperative MRI of native menisci compared with subsequent arthroscopy using a combination of root words: "arthroscop*", "knee", "menisc*", and "MRI". Publications were excluded if true and false positives and negatives for each meniscus were not reported. Methodologic quality was determined using the QUADAS-2 tool. Publication bias was assessed with a funnel plot. Diagnostic performance with receiver operating characteristics (ROC) was calculated using random effects models with subgroup analyses for change over time, patient age, imaging parameters, and tear criteria. Student's t-test, ANOVA, and variate tests were used.

### RESULTS

75 studies (36 retrospective, 39 prospective) from 28 countries published from 1986 to 2023 yielded 10,694 patients (mean age: 35.8±8.5 years, range: 13.3-52.0) with 42.2±31.2 days (range: 2-180) between MRI and arthroscopy. QUADAS-2 assessment found overall low risk for methodologic bias and the funnel plot showed low risk of publication bias. Pooled weighted sensitivity was higher for medial than lateral meniscus tears (91.9%, 95%CI: 90.3-93.2 vs. 81.1%, 95%CI: 77.9-84.0), but specificity was higher laterally than medially (94.1%, 95%CI: 92.8-95.1 vs. 88.2%, 95%CI: 85.9-90.1, p<0.001). Except for increased specificity for lateral meniscus tears for each decade after 2000 (p range <0.001-0.040), diagnostic performance did not significantly change over time. Subgroup analyses found no significant differences in diagnostic performance based on patient age, study size, magnetic field strength, or use of 3D isotropic imaging. Bivariant ROC models found that for the lateral meniscus, the use of two tear criteria (linear signal extending to the articular surface and meniscus distortion) outperformed the use of only one of these criteria (p=0.020); this remained significant on multivariable analysis (p=0.005).

### CONCLUSION

MRI diagnostic performance for tears differs between menisci, with higher sensitivity for the medial meniscus and higher specificity for the lateral meniscus. For the lateral meniscus, specificity improved over time and with the combined use of two tear criteria.

### CLINICAL RELEVANCE/APPLICATION

This systematic review and meta-analysis on the diagnostic performance of MRI for meniscus tears provides updated benchmarking for clinical reporting (e.g., quality improvement) and helps direct health care resources (e.g., for clinical trials).

## T7-SSMK06-2 MRI REPORTING OF THE MENISCUS: ACHIEVING INTERDISCIPLINARY CONSENSUS

Kimia K. Kani, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Erin F. Alaia, MD (*Abstract Co-Author*) Biorez Inc, Consultant
Andrew Sheean (*Abstract Co-Author*) Nothing to Disclose
Russell C. Fritz, MD (*Abstract Co-Author*) Nothing to Disclose

Carl S. Winalski, MD (*Abstract Co-Author*) Research Consultant, Siemens AG;Stockholder, Pfizer Inc
Donald J. Flemming, MD (*Abstract Co-Author*) Nothing to Disclose
Robert D. Boutin, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas N. Mintz, MD (*Abstract Co-Author*) Nothing to Disclose
Adam C. Zoga, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Tetyana A. Gorbachova, MD (*Abstract Co-Author*) Nothing to Disclose
Paul Saluan, MD (*Abstract Co-Author*) Nothing to Disclose
Dyan V. Flores, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD (*Abstract Co-Author*) Research Consultant, General Electric Company
Ali Guermazi, MD, PhD (*Abstract Co-Author*) Consultant, Novartis AG;Consultant, Pfizer Inc;Consultant, AstraZeneca PLC;Consultant, Merck KGaA;Consultant, TissueGene, Inc;Consultant, Regeneron Pharmaceuticals, Inc;Shareholder, Boston Imaging Core Lab, LLC
Jennifer S. Weaver, MD (*Abstract Co-Author*) Nothing to Disclose
Bethany U. Casagranda, DO (*Abstract Co-Author*) Nothing to Disclose
Eric Y. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Megan K. Mills, MD (*Abstract Co-Author*) Nothing to Disclose
Theodore Ganley, MD (*Abstract Co-Author*) Vericel Corporation - Research support ;Arthrex - Research support ;AlloSource - Research support
Vandan Patel, BS (*Abstract Co-Author*) Nothing to Disclose
Kevin Shea (*Abstract Co-Author*) Nothing to Disclose
Aaron Krych (*Abstract Co-Author*) Nothing to Disclose
John Todd Lawrence, MD,PhD (*Abstract Co-Author*) Sawbones Inc - Royalties not related to research presented
Geoff Abrams (*Abstract Co-Author*) Nothing to Disclose
Brendon Mitchell (*Abstract Co-Author*) Nothing to Disclose
Allison Crepeau (*Abstract Co-Author*) Nothing to Disclose
David A. Rubin, MD (*Abstract Co-Author*) Scientific Advisory Board, ImageBiopsy Lab
William E. Palmer, MD (*Abstract Co-Author*) Nothing to Disclose
Kirkland W. Davis, MD (*Abstract Co-Author*) Nothing to Disclose
Kathryn J. Stevens, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Lutul D. Farrow, MD (*Abstract Co-Author*) Nothing to Disclose
Kirt Spindler (*Abstract Co-Author*) Nothing to Disclose
Jie C. Nguyen, MD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

To identify interdisciplinary consensus guidelines for reporting meniscus findings on MRI using a systematic, interactive approach.

**METHODS AND MATERIALS**

33 panelists (22 radiologists and 11 orthopaedists) with subspecialty expertise in menisci from 23 North American institutions were convened to assess for areas of agreement and disagreement related to MRI reporting of menisci. A 3-round Delphi method with anonymized feedback at each round was employed to encourage independent opinions while facilitating iterations toward agreement. In Round 1, each panelist responded to open-ended questions to identify potentially problematic terms and diagnostic criteria. With these data, 11 teams (each with 2 radiologists and 1 orthopaedist) created a total of 32 consensus statements on 11 topics with explanatory text supported by approximately 125 peer-reviewed references, prioritizing the highest levels of evidence by Oxford CEBM criteria. In Round 2, each statement was scored by panelists using a 9-point Likert scale, again with anonymized open-ended text feedback. Round 2 data were reviewed by each team to revise statements for a third, final round of voting. Consensus was defined as a score of =7 by =80% panelists and median of =7 (IQR: =3). Chi-square and Mann-Whitney U tests were used.

**RESULTS**

All panelists completed all Delphi rounds. In Round 1, the three most frequently identified problematic issues were MRI reporting of 1) the postoperative meniscus, 2) tear pattern terminology, and 3) criteria for diagnosing root tears. In Round 2, 24/32 (75%) statements achieved consensus, which included all statements covering 6 topics (MRI criteria for tear, meniscocapsular junction, extrusion, tear descriptors, recurrent tear descriptors, ancillary findings). The remaining 8/32 (25%) statements on 5 topics (MRI criteria for possible tears, postoperative menisci, meniscus roots, tear patterns, non-tear descriptors) did not reach consensus in Round 2. Between Rounds 2 and 3, agreement increased significantly ($p<.05$) among all panelists for MRI criteria for possible tears, among orthopaedists for the postoperative menisci, and among radiologists for meniscus roots, tear patterns, and non-tear descriptors. In Round 3, all statements achieved consensus.

**CONCLUSION**

Consensus among radiologists and orthopaedists was achieved for 32 evidence-based statements on MRI reporting of menisci, with iterative Delphi rounds improving agreement on reporting criteria for possible tears, postoperative menisci, meniscus roots, tear patterns, and non-tear descriptors.

**CLINICAL RELEVANCE/APPLICATION**

Interdisciplinary, multi-institutional consensus on MRI reporting of menisci facilitates consistent communication and minimizes misunderstanding.

## T7-SSMK06-3 MENISCAL RAMP LESION: OVER-REPORTED ON MRI? OR UNDER-REPORTED AT ARTHROSCOPY?

Richard E. Walker, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Peter Salat, MD (*Abstract Co-Author*) Nothing to Disclose
Callie Stirling (*Abstract Co-Author*) Nothing to Disclose
Steven K. Boyd, PhD (*Abstract Co-Author*) Nothing to Disclose
Sarah Manske (*Abstract Co-Author*) Nothing to Disclose
Nina Pavlovic (*Abstract Co-Author*) Nothing to Disclose
Victoria Peterson, MD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

We aim to correlate the incidence of meniscal ramp lesions (RLs) on MRI versus surgery and the distribution of ramp lesion type in a large cohort of ACL-injured subjects.

**METHODS AND MATERIALS**

MRI results and arthroscopy reports from a large, prospective multimodal imaging study evaluating bone injury associated with ACL tear were evaluated. Prospective MRI reports were compared to a blind consensus read by a single experienced MSK subspecialist radiologist and senior trainee, both with comparison to knee arthroscopy.

**RESULTS**

101 subjects completed baseline MRIs, 78 of which went on to surgery, including 55 females (71%), and an average age of 32.0 years (15-55 years). Average time between injury and MRI was 29.5 days (± 9.9) and 144.9 days between MRI and surgery (± 108.8). RLs were prospectively reported on MRI in 53% of participants (41/78). Consensus read identified 53 RLs (68.5%), with 4B the most common type (23/53 cases, 43%). 77% (41/53) were classified as unstable at consensus read. Surgical reports utilizing standard anteromedial and anterolateral portals identified 21 ramp lesions (27%). There was a statistically significant difference between the reporting of a RL on MRI (prospective read ($p<0.001$) and consensus read ($p<0.001$)) when compared to surgery. No surgical reports indicated the use of a posteromedial portal, which could result in under-reporting. The delay between MRI and surgery could result in interval RL healing.

**CONCLUSION**

There was a significant discrepancy in reporting of RLs on MRI compared to surgery. Potential explanations include MRI over-reporting, surgical under-reporting, or both.

**CLINICAL RELEVANCE/APPLICATION**

Accurate identification of ramp lesions on MRI and repair at the time of ACL reconstruction is important for restoration of knee stability.

## T7-SSMK06-4 DEEP LEARNING SUPER-RESOLUTION FOR SIMULTANEOUS MULTISLICE-PARALLEL IMAGING-ACCELERATED KNEE MRI: ARTHROSCOPY VALIDATION OF DIAGNOSTIC PERFORMANCE

Aline Serfaty Sr, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Danoob Dalili, MBBS (*Abstract Co-Author*) Nothing to Disclose
Jan Fritz, MD (*Abstract Co-Author*) Institutional research support, Siemens AG;Scientific Advisor, Siemens AG;Patent agreement, Siemens AG;Institutional research support, Johnson & Johnson;Institutional research support, Zimmer Biomet Holdings, Inc;Institutional research support, BTG International Ltd
Jan Vosshenrich, MD (*Abstract Co-Author*) Nothing to Disclose
Eun Hae Park, MD (*Abstract Co-Author*) Nothing to Disclose
Steven E. Stern (*Abstract Co-Author*) Nothing to Disclose
Richard Kijowski, MD (*Abstract Co-Author*) Research Consultant, Boston Imaging Core Lab, LLC
Benjamin Fritz, MD (*Abstract Co-Author*) Nothing to Disclose
Sven S. Walter, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Deep learning methods can improve accelerated MRI but require validation against an independent reference standard to ensure robustness and accuracy. Thus, the purpose was to validate the efficacy of fourfold simultaneous multislice-(SMSx2)-parallel imaging (PIx2)-accelerated deep learning super-resolution (DLSR) MRI against conventional SMSx2-PIx2-accelerated MRI and arthroscopic surgery.

**METHODS AND MATERIALS**

Adults with painful knee conditions were prospectively enrolled from December 2021 to October 2022. Participants underwent fourfold SMSx2-PIx2-accelerated standard-of-care and investigational DLSR MRI at 3.0T. Seven radiologists independently evaluated the MRI studies for overall image quality (Likert scale, 1=very bad, 5=very good), meniscus and ligament tears, and articular cartilage defects. Statistical analyses included ?-based interreader agreements and diagnostic performance testing. $P < .05$ was considered significantly different.

**RESULTS**

A total of 116 adults (mean age ± standard deviation: 45 years ± 15; 74 men) who underwent arthroscopic surgery within 38 ± 22 days were evaluated. Overall image quality was significantly better ($p <.001$) for DLSR MRI (5 [range, 3-5]) than conventional MRI (4 [3-5]) with good interreader agreements (? =0.81 [95%-CI: 0.79, 0.84]). Diagnostic performances of conventional versus DLSR MRI were similar for medial meniscus tears (AUC, 0.94 [95%-CI: 0.89, 0.97] vs. 0.94 [0.90, 0.98]; p >.99), lateral meniscus tears (0.85 [0.78, 0.91] vs. 0.87 [0.81, 0.94]; p >.96), and anterior cruciate ligament tears (0.98 [0.93, >0.99] vs. 0.98 [0.93, >0.99]; p >.99). Diagnoses of articular cartilage defects were significantly more accurate (p=.002) with DLSR MRI (0.78 [0.75, 0.81]) than conventional MRI (0.71 [0.67, 0.74]). Structural abnormalities were detected with good interreader agreements (? =0.64 [95%-CI: 0.57, 0.71]). DLSR MRI did not introduce hallucinations or erroneously omit abnormalities.

**CONCLUSION**

Fourfold SMSx2-PIx2 accelerated DLSR MRI of the knee is robust, provides better image quality, similar accuracy for meniscus and ligament tears, and improved accuracy for articular cartilage defects compared to conventional SMSx2-PIx2 accelerated MRI.

**CLINICAL RELEVANCE/APPLICATION**

Fourfold accelerated knee MRI augmented with deep learning super-resolution adds value to musculoskeletal radiology practice by optimizing scan efficiency while improving image quality and maintaining diagnostic accuracy.

## T7-SSMK06-5 PROGRESSION OF BONE MARROW LESION VOLUME AND RISK OF KNEE OSTEOARTHRITIS INCIDENCE: A LONGITUDINAL DEEP-LEARNING ANALYSIS OF MRI FROM OSTEOARTHRITIS INITIATIVE COHORT

Shadpour Demehri, MD (*Abstract Co-Author*) Consultant, Toshiba Corporation;Research support, General Electric Company;Research Grant, Carestream Health, Inc
Ali Guermazi, MD, PhD (*Abstract Co-Author*) Consultant, Novartis AG;Consultant, Pfizer Inc;Consultant, AstraZeneca PLC;Consultant, Merck KGaA;Consultant, TissueGene, Inc;Consultant, Regeneron Pharmaceuticals, Inc;Shareholder, Boston Imaging Core Lab, LLC
Frank W. Roemer, MD (*Abstract Co-Author*) Shareholder, Boston Imaging Core Lab, LLC;Consultant, Grunenthal
Hamza Ibad, MBBS (*Abstract Co-Author*) Nothing to Disclose
David J. Hunter, MD, PhD (*Abstract Co-Author*) Royalties, DJO GLobal, Inc
Quincy Hathaway, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Soheil Mohammadi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Sara Momtazmanesh (*Abstract Co-Author*) Nothing to Disclose
Kamyar Moradi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Bone marrow lesions (BMLs) are a risk factor for incident knee osteoarthritis (OA) and deep-learning (DL) methods can help in automated segmentation and risk prediction. We aimed to develop and validate a DL model for quantifying tibiofemoral BML volume from MRIs in knees without radiographic OA and assess the association between longitudinal changes in these volumes and knee OA incidence.

**METHODS AND MATERIALS**

The DL model segmented tibiofemoral joint into 10 subregions (akin to MRI Osteoarthritis Knee Score (MOAKS) system) and measured BML volume in each subregion. Baseline and 4th-year follow-up MRIs from 4700 participants (9400 knees) of the Osteoarthritis Initiative cohort were analyzed. Knees without OA at baseline were categorized into three groups based on 4-year BML volume changes: BML-free, regressing BML, and progressive BML. Over a 9-year period, the risk of radiographic and symptomatic knee OA incidence was compared among these groups.

**RESULTS**

We included 3869 non-OA knees from 2430 participants (age mean±SD: 59.5±9.0, female/male: 1.3). At the 4th-year follow-up, 2216 remained BML-free, 1106 showed an increase, and 547 showed a decrease in BML volume. Knees with progressive BML had a higher risk of radiographic knee OA incidence compared to BML-free (hazard ratio (HR), 95% confidence interval (CI): 3.01, 2.53 to 3.57, P<0.001) and regressing BML (HR, 95% CI: 2.00,1.56 to 2.56, P<0.001) knees. They also had a higher risk for symptomatic OA incidence compared to BML-free knees (HR, 95% CI: 1.25, 1.11 to 1.41, P:0.001). Larger volume changes in BML progression were associated with a higher risk of knee OA incidence (radiographic HR: 1.95, symptomatic HR: 1.70, P-values<0.001). In all subchondral plates, especially the medial femur and tibia, BML progression was associated with a higher risk of developing both radiographic and symptomatic knee OA compared to BML-free plates.

**CONCLUSION**

Progressive BMLs, according to the subregion and volume changes extent, are associated with an increased risk of OA incidence compared to BML-free or regressing BML knees, emphasizing the importance of monitoring BML volume changes in evaluating early interventions to prevent OA incidence.

**CLINICAL RELEVANCE/APPLICATION**

Changes in BML volume over time play a crucial role in predicting OA incidence. Monitoring BML changes may help assess the efficacy of early strategies aimed at preventing OA incidence in at-risk individuals.

## T7-SSMK06-6 EVALUATION OF THE ASSOCIATION BETWEEN CENTRAL OBESITY AND MRI-BASED BIOMARKERS OF KNEE OSTEOARTHRITIS INDEPENDENT OF BMI: A CROSS- SECTIONAL STUDY FROM OSTEOARTHRITIS INITIATIVE DATABASE

John A. Lynch, PhD (*Abstract Co-Author*) Nothing to Disclose
Ayush Arora (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD (*Abstract Co-Author*) Research Consultant, General Electric Company
Gabby B. Joseph (*Abstract Co-Author*) Nothing to Disclose
Zehra Akkaya (*Abstract Co-Author*) Nothing to Disclose
Fatemeh Dehghani Firouzabadi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the association between central obesity (using waist circumference (WC)) and MRI-based biomarkers of knee osteoarthritis (KOA), and to assess the association between WC with knee synovial inflammation using non-contrast-enhanced MRI, independent of BMI.

**METHODS AND MATERIALS**

3167 individuals with radiographic Kellgren-Lawrence grades 0-3 in the right knee at baseline from the Osteoarthritis Initiative (OAI) were included and WC was measured at baseline. Cartilage composition and joint structural abnormalities were assessed using MRI T2 cartilage and whole-organ magnetic resonance imaging score (WORMS), respectively. MRI-based synovial inflammation was semi-quantitatively assessed for effusion-synovitis. Linear regression analysis was used to investigate the associations between various measures of adiposity and MRI-based biomarkers of KOA (i.e. WORMS and T2-values), both with and without adjustment for BMI.

**RESULTS**

The participants in the study had a mean age of 60.82±9.12 years and average BMI of 29.27 ±4.47 kg/m². Central obesity showed positive associations with severity of knee structural abnormalities, particularly of meniscus(WC coeff.=0.042, 95%CI=[-0.002-0,085], p=0.05 and cartilage (WC coeff.=0.263, 95%CI=[-0.203-0.323], p<0.001), even after adjusting for BMI (WC coeff.=0.075[0.002-0.148], p=0.04, and WC coeff.=0.163, 95%CI= [0.062-0.264], p=0.002, respectively). Central obesity demonstrated positive associations with T2-values including average T2 values (WC coeff.=0.221, 95%CI= [0.157-0.285], p<0.001, lateral tibia(WC coeff.=0.145, 95%CI= (0.065-0.226), p<0.001), and lateral femur (WC coeff.=0.413, 95%CI= [0.322-0.504], p<0.001), even after adjusting for BMI(WC coeff.=0.110, 95%CI= [0.002-0.218], p=0.04, WC coeff.=0.188, 95%CI= [0.053-0.324], p=0.006, and WC coeff.=0.373, 95%CI= [0.219-0.527], p<0.001, respectively) Central obesity (via WC) and obesity (via BMI) were positively associated with effusion-synovitis. However, after adjusting for BMI, significant association between WC and effusion-synovitis score no longer persisted.

**CONCLUSION**

Central adiposity was significantly associated with T2-based cartilage composition and structural abnormalities of the meniscus and cartilage (WORMS), even after adjustment for BMI, indicating that central adiposity may provide information independent of BMI in knee OA.

**CLINICAL RELEVANCE/APPLICATION**

Waist circumference may be an independent risk factor for T2-based cartilage composition and structural abnormalities of the meniscus and cartilage (WORMS) outcomes, apart from general obesity as measured by BMI. This indicates that abdominal fat specifically, rather than overall body weight, may play a crucial role in KOA.

# Abstract Archives of the RSNA, 2024

T7-SSMK07

**Musculoskeletal Imaging (Metabolic, Quantitative and Functional)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: N228

Eric A. Brandser, MD (*Moderator*) Owner, Shift Procurement Services, LLC
Kimberly Lam, FRCR (*Moderator*) Nothing to Disclose

**Sub-Events**

## T7-SSMK07-1 DEEP LEARNING APPROACH FOR CLASSIFICATION OF OSTEOPOROSIS AND OSTEOPENIA ON CHEST X-RAY WITH A MULTINATIONAL STUDY

Namkug Kim, PhD (*Abstract Co-Author*) Stockholder, Anymedi, Inc
Junhyeok Park (*Abstract Co-Author*) Nothing to Disclose
Saerom Park (*Abstract Co-Author*) Nothing to Disclose
Jinhoon Jeong (*Abstract Co-Author*) Nothing to Disclose
Miso Jang (*Abstract Co-Author*) Nothing to Disclose
Minje Kim (*Presenter*) Nothing to Disclose

### PURPOSE

We aimed to determine the feasibility and performance of deep learning (DL) models based on CXR with screening osteoporosis and osteopenia with diverse external validation.

### METHODS AND MATERIALS

Our DL model assesses the bone status of patients on CXR to predict whether it is normal, osteopenia, or osteoporosis. We initially constructed the fundamental training set using the radiographs of 55,600 patients (54.3% men; mean age, 55.38 ± 7.28 years) from the tertiary university hospital A. Besides, to obtain bone information from other multi-ethnic, we collected 17,577 unlabeled radiographs (57.1% men; mean age, 62.08 ± 8.74 years) from several public datasets. The unlabeled radiographs were appended pseudo labels via semi-supervised learning to achieve global robustness and generalizability. Total radiographs of 73,177 patients were utilized to train the model, with 1,989 (83.9% men; mean age, 58.7 ± 6.76) radiographs employed for internal validation. For external validation, we collected radiographs from 3 institutions, which consist of multi-ethnic/regions. Hospital B (55.5% men; mean age, 59.38 ± 7.31) is a secondary healthcare facility, the dataset of Hospital C (56.2% men; mean age, 73.64 ± 6.74) represents diverse settings within the healthcare delivery system, and the dataset of D (2.4% men; mean age, 66.37 ± 7.27) denotes global medical platform.

### RESULTS

Our results of hospital A internal validation AUC scores of normal, osteopenia, and osteoporosis were 0.936, 0.891, and 0.965, respectively. In external validation, hospital B, hospital C, and platform D, AUC scores of normal were 0.911, 0.885, and 0.812, AUC scores of osteopenia were 0.845, 0.728, and 0.630, and AUC scores of osteoporosis were 0.921, 0.880, and 0.703, respectively.

### CONCLUSION

This study presents a DL model for CXR-based classification of Osteopenia and Osteoporosis via semi-supervised learning. Evaluating external multinational validation demonstrated that the proposed DL model is feasible for classification of Osteopenia and osteoporosis with CXR contrary to DXA with limited accessibility.

### CLINICAL RELEVANCE/APPLICATION

This study has the potential to demonstrate its value by facilitating opportunistic screening for osteoporosis and osteopenia patients using CXRs, which are among the most prevalent and cost-effective medical imaging techniques. Furthermore, compared to previous studies, the proposed DL model via semi-supervised learning improved global robustness and generalizability across multinational areas. In clinical practice, timely identification of osteoporosis patients is crucial for initiating appropriate medical treatment, while recognizing osteopenia allows for appropriate preventive interventions.

## T7-SSMK07-2 MUSCULAR FAT FRACTION QUANTIFIED WITH DUAL-LAYER DETECTOR SPECTRAL-CT AS A NEW IMAGING BIOMARKER OF FRAILTY

Jin Yamamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alina Busch (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD (*Abstract Co-Author*) Nothing to Disclose
Roland Fischer Sr, DiplPhys (*Abstract Co-Author*) Nothing to Disclose
Graeme M. Campbell, PhD (*Abstract Co-Author*) Scientist, Koninklijke Philips NV
Niklas Schubert (*Abstract Co-Author*) Nothing to Disclose
Isabel Molwitz, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the accuracy of dual-layer detector spectral-CT (dlCT) fat quantification in the skeletal muscle and assess the potential of dlCT to identify patients with clinically impaired muscle strength.

**METHODS AND MATERIALS**

In this prospective study, patients are included with a) gastrointestinal adenocarcinoma under palliative chemotherapy and b) a need for CT staging. All patients receive contrast-enhanced dlCT scans (CT7500) at 120 kV and MRI scans (both: Philips, the Netherlands), including mDIXONquant sequences for MRI fat quantification. In dlCT, fat was quantified using three-material decomposition for muscle tissue, iodine, and fat. Regions of interest for dlCT and MRI fat quantification were placed in the paraspinal muscle at the height of the third lumbar vertebra (L3). Clinically impaired muscle strength was defined by the chair-rise test (cut-off male/female: time to rise five times >15 s). Bland-Altman analysis, receiver operating characteristic (ROC) analysis, and univariate linear regression models were employed for statistics.

**RESULTS**

To date, 49 patients (20, 21.7% female) with a mean age of 63 ±12 years and a mean body mass index of 25±3 kg/m2 were included. The mean dlCT muscle fat content was 9.9 ±6.7%. The mean difference between dlCT and MRI was 2.7 % [95%-limits of agreement -3.4; 8.8%). The area under the ROC curve to identify patients below the chair-rise cut-off using the dlCT fat fraction was good (0.76 [95%-CI 0.603-0.910]). The number of times (one to a maximum of five times) a patient was able to rise from a chair was predicted well by the dlCT fat fraction (P=0.006).

**CONCLUSION**

The muscle fat fraction can be validly determined in dlCT scans. The dlCT muscle fat fraction appears to be suitable for identifying patients with clinically impaired muscle strength.

**CLINICAL RELEVANCE/APPLICATION**

Sarcopenia as indicated by low muscle strength has a negative impact on outcome in many diseases, e.g., in cancer patients. CT parameters that reliably predict the clinical muscle status in routine scans are important to enable risk stratification without the need for further clinical testing. In contrast to the CT muscle density or muscle mass, the dlCT fat fraction is not biased by contrast agent or water retention. The spectral muscle fat fraction therefore has the potential to replace these body composition parameters in research and clinical routine.

## T7-SSMK07-3 AGE-DEPENDENT CHANGE OF VERTEBRAL ATTENUATION VALUES IN OPPORTUNISTIC SCREENING OF OSTEOPOROSIS: A NATIONWIDE MULTI-CENTER STUDY

Hae Young Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joon Woo Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Youngjune Kim, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To examine how vertebral attenuation value changes with aging, and establish age-adjusted attenuation value cutoffs for diagnosing osteoporosis.

**METHODS AND MATERIALS**

This multi-center retrospective study included 11246 patients (mean age ± standard deviation, 50 ± 13 years; 4107 women) who underwent CT and DXA on same day in six health-screening centers in Korea from January 2022 to January 2023. A deep learning-based software was used to measure the L1 attenuation values. Segmented linear regression in women and simple linear regression in men was used to assess how attenuation value changes with aging. Multivariable linear regression analysis with DXA T-score as a covariate was also performed to determine whether age is associated with the attenuation value independently of BMD. Quantile regressions were used to derive age-adjusted cutoffs targeting either 90% sensitivity or 90% specificity, and were then compared to age-unadjusted cutoffs. Target sensitivity or specificity was deemed achieved, if their 95% confidence interval encompassed 90%.

**RESULTS**

The attenuation values showed a constant decline over all ages in men, but an abrupt decline in women after the age 42 years. Such decline was independent of DXA T-score ($P < 0.001$). The effect of age adjustment seemed to be critical for patients aged = 65 years, in whom the age-adjusted cutoffs achieved either the target sensitivity (91.5% [86.3-95.2%]) or specificity (90.0% [88.3-91.6%]), unlike the age-unadjusted cutoffs with compromised performance of either sensitivity of 95.5% (91.2-98.0%) or specificity of 73.8% (71.4-76.1%).

**CONCLUSION**

The vertebral attenuation values declined with aging, independently of DXA T-score. Our age-adjusted attenuation value cutoffs performed better than age-unadjusted cutoffs for diagnosing osteoporosis especially in the elderly.

**CLINICAL RELEVANCE/APPLICATION**

Owing to the decline in vertebral attenuation value with aging that occurs independently of DXA T-score, age adjustment in opportunistic screening of osteoporosis is needed especially in the elderly. Our age-adjusted cutoffs may contribute to reducing the treatment gap caused by under-utilization of DXA.

## T7-SSMK07-4 OPPORTUNISTIC BONE MINERAL DENSITY MEASUREMENT USING PHOTON-COUNTING DETECTOR CT LOCALIZER RADIOGRAPHS

Stephen M. Broski, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Kishore Rajendran, PhD (*Abstract Co-Author*) Nothing to Disclose
Francis I. Baffour, MD (*Abstract Co-Author*) Nothing to Disclose
Soeren Jasper (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Tristan Nowak (*Abstract Co-Author*) Employee, Siemens AG
Elisabeth Shanblatt, PhD (*Abstract Co-Author*) Employee, Siemens AG
Gina Mazza (*Abstract Co-Author*) Nothing to Disclose
Ahmed O. El Sadaney, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Localizer radiographs are used in CT scan to prescribe the scan volume. In photon-counting-detector (PCD) CT, localizer data sets having different x-ray spectra are automatically acquired and may be used opportunistically to determine areal bone mineral density (aBMD). Our purpose was to determine in a patient cohort the accuracy of spine aBMD values and T-scores derived from PCD-CT localizer radiographs.

### METHODS AND MATERIALS

Between October 2023 and March 2024, adult patients (>18 years) having a dual-energy x-ray absorptiometry (DEXA) scan (GE iLunar DEXA, USA) within 1 year were recruited to undergo a PCD-CT exam (NAEOTOM Alpha, Siemens Healthineers). Anteroposterior PCD localizers were acquired using 140 kV and 40 mA. Hydroxyapatite maps were derived using a prototype software from the vendor and used to calculate vertebral body aBMD and T-scores. For both DEXA and PCD-CT, a T-score =-1.0 was considered normal and a T-score <-1.0 was considered abnormal (i.e., osteopenia/osteoporosis). The relationship between PCD-CT and DEXA T-scores was examined with a Bland-Altman plot and agreement estimated with Pearson's correlation and Lin's concordance correlation.

### RESULTS

51 participants were included (20 male (39.2%); 31 female (60.8%); mean age = 62 years [SD = 12]; mean body mass index = 30.1 [SD = 6]). Mean duration between PCD-CT and DEXA was 63.6 days. 46/51 (90%) patients were classified as normal/abnormal by both DEXA and PCD CT (36 normal by both; 10 abnormal by both; accuracy: 0.90; 95% CI 0.79, 0.97). Only one patient was classified as abnormal by DEXA but not PCD-CT (T-scores: DEXA: -1.1; PCD-CT: -1.0). PCD-CT T-scores (mean=0.39, SD=1.64) were not significantly different than DEXA T-scores (mean=0.20, SD=1.73), p=0.09. Pearson's correlation (0.89 (95% CI [0.82, 0.94]) and Lin's concordance correlation (0.89 (95% CI [0.81, 0.93]) between PCD-CT and DEXA T-scores demonstrate a strong linear relationship between the two values. Differences between PCD-CT and DEXA T-scores were not correlated with age (r=-0.08, p=0.58), sex (r=0.09, p=0.54), or duration between PCD-CT scans and DEXA (r=0.07, p=0.61); however, differences were weakly positively correlated with BMI (r=0.28, p=0.05).

### CONCLUSION

BMD and T-scores can be derived opportunistically from PCD-CT localizer radiographs. PCD-CT derived T-scores identify patients with abnormal BMD but do not always yield identical values compared to DEXA, with differences potentially related to higher BMI. Furthermore, lack of population reference for PCD-CT data may be responsible for some of the discrepancies observed in the T-scores.

### CLINICAL RELEVANCE/APPLICATION

Accurate BMD values from PCD-CT localizer radiographs may expand the utility of PCD-CT for opportunistic osteoporosis screening.

## T7-SSMK07-5 ACCELERATED UTE MAGNETIZATION TRANSFER IMAGING OF BONE MATRIX BASED ON U-NET CNN

Kevin Du (*Abstract Co-Author*) Nothing to Disclose
Harry Tang (*Abstract Co-Author*) Nothing to Disclose
Eric Y. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Yajun Ma (*Abstract Co-Author*) Nothing to Disclose
Jiyo Athertya (*Abstract Co-Author*) Nothing to Disclose
Yidan Wang (*Abstract Co-Author*) Nothing to Disclose
Megan Hu (*Abstract Co-Author*) Nothing to Disclose
James Lo, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Collagen has a profound effect on bone fragility. However, current medical imaging modalities cannot assess unmineralized bone matrix. Ultrashort echo time (UTE) MRI can directly image bone. UTE with quantitative magnetization transfer (UTE-qMT) can model macromolecular fraction (MMF) in bone. The major drawback is the long scan time due to the requirement of repeated UTE acquisitions with different MT powers and frequency offsets required for modeling. Recently, deep learning (DL) has been used for image analysis in medicine. We propose a U-Net convolutional neural network (CNN) for accelerated UTE-qMT imaging of bone matrix.

### METHODS AND MATERIALS

83 female participants were recruited following local IRB approval, with 3T MRI centered in the tibial midshaft. The UTE-qMT sequence employed 14 cm field of view, 5 mm slice thickness, 7° flip angle, 160×160×24 acquisition matrix, three saturation power levels (500°, 1000°, 1500°), and five frequency offsets (2, 5, 10, 20, 50 kHz) for each power (a total of 15 datasets under 13 minutes scan time). MMF was defined as the ratio of collagen proton pool over the water pool and was estimated using a previously reported two-pool UTE-qMT model. Pixel maps of the MMF were generated for each subject. To accelerate data acquisition, we proposed to derive MMF maps from a reduced number of input image datasets (e.g., three MT powers and two frequency offsets). Therefore, 6 out of 15 UTE-qMT image datasets were used to predict bone MMF. The method is illustrated in Figure 1A,B, where all UTE-qMT data were used for training and testing with the application of 8-fold cross-validation. The predicted MMF of bone was compared with the ground truth derived from UTE-qMT modeling using all 15 input image datasets.

### RESULTS

With established U-Net models, accurate MMF mapping was obtained using only 6 out of the total 15 UTE-qMT datasets, corresponding to an acceleration factor of 2.5, as shown in Figure 1C-F. The overall error between the ground truth and predicted mean MMFs within the ROI of the bone is 2.36%. These results suggest that the proposed deep learning method allows accelerated UTE-qMT MMF mapping of collagen backbone protons, providing non-invasive assessment of bone matrix with approximately 5 minutes of scan time.

### CONCLUSION

The U-Net CNN can significantly accelerate UTE-MT modeling of MMF by exploiting data redundancy in the parameter direction with high accuracy. The clinical significance of this technique remains to be demonstrated in a future large scale study of patients with osteoporosis.

### CLINICAL RELEVANCE/APPLICATION

DL-based UTE-qMT allows accurate mapping of bone matrix in clinically compatible times, and may significantly increase the accuracy of fracture risk assessment and treatment monitoring.

## T7-SSMK07-6 HORMONE REPLACEMENT THERAPY AND MUSCLE LOSS IN POST-MENOPAUSAL WOMEN: LONGITUDINAL ANALYSIS FROM THE BALTIMORE LONGITUDINAL STUDY OF AGING USING REPEATED DUAL-ENERGY X-RAY ABSORPTIOMETRY

Elena Ghotbi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

In 2050, older adults are expected to comprise 22% of the global population. Older women commonly experience a decline physical function and an increase in age-related muscle loss. It has been theorized that post-menopausal hormonal changes could be a cause of muscle loss and body composition alterations. Current literature is controversial, with some studies reporting a favorable impact of estrogen with/without progesterone-based hormone replacement therapy (HRT) on body composition, while others fail to observe such effects. We aimed to determine the relationship between post-menopausal HRT and longitudinal body composition changes (i.e. muscle and fat-mass) in the Baltimore Longitudinal Study of Aging (BLSA), a large, community-based cohort of aging adults.

**METHODS AND MATERIALS**

We applied propensity score matching (ratio 1:3) to pair women who received HRT with those who did not, based on baseline characteristics : age, race, history of smoking, baseline height, and weight. Linear mixed-effects models (LMEM) accounting for between-participant variability were used to estimate cross-sectional and longitudinal relationships between HRT and repeated measurements of muscle (grams) and fat-mass (grams) using Dual-Energy-X-ray Absorptiometry.

**RESULTS**

We identified 192 menopausal women, comprising 48 HRT-treated and 144 non-treated participants, with a total of 873 eligible study visits from 2003 to 2020 (mean of 2 visits per HRT-treated and 5 visits per non-treated participant). The cohort was 70% White, with a median age of 68 and a median of BMI 25.7 at the index visit. In cross-sectional analysis, HRT displayed a positive association with total-body lean-mass (beta: 969.9;95% CI: 518.9;1420.05;p<0.001) and a negative association with total-body fat-mass (beta: -1397.7;95% CI:-2248.22, -547.61;p: 0.001). Upon introducing time-interaction into the models, the association between HRT and total-body lean-mass became non-significant (beta: 212.5; 95% CI: -268.78, 693.84,p:0.38), while the negative association with fat-mass remained significant (beta: -1722.67; 95% CI: -2682.69, -762.39; p< 0.001).

**CONCLUSION**

Among post-menopausal women in the BLSA, HRT was not associated with the longitudinal preservation of muscle-mass.

**CLINICAL RELEVANCE/APPLICATION**

Our longitudinal observational analysis does not support the hypothesis that HRT could have beneficial effect on sarcopenia progression among older adults.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T7-SSNPM02

**Noninterpretive Skills (Beyond Imaging) (Workforce Challenges and Cost Considerations)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S402

Jay R. Parikh, MD, FRCPC (*Moderator*) Nothing to Disclose
Matthew D. Bucknor, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T7-SSNPM02-1 THE WORKFORCE SHORTAGE AND STRATEGIES FOR MITIGATION: RESULTS FROM THE 2023 ACR/RBMA WORKFORCE SURVEY

Eric M. Rubin, MD (*Abstract Co-Author*) Nothing to Disclose
Jay R. Parikh, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Elizabeth H. Dibble, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the radiology workforce shortage in the United States and various strategies for mitigation

### METHODS AND MATERIALS

The ACR Commission on Human Resources fielded the 2023 ACR/RBMA Workforce Survey from 1/5/24-2/4/24. The sample drew from the ACR members (31,085) and non-members (11,565) and RBMA members (1,739). The survey used structured closed-end questions, consistent with earlier surveys. Responses were group practice deduplicated, weighted, and compared to 2022 and 2021. Statistical significance was defined as $p<0.05$.

### RESULTS

1642 respondents completed the survey. 69% indicate working in an understaffed practice in 2023, stable from 2022 (67%). There is steady growth in anticipated hiring by practices with 83% of practices reporting plans to hire in the upcoming year compared to 80% in 2022 and 79% in 2021. Subspecialty hiring importance has been largely consistent over the past three years with body, breast, and neuroradiology representing the largest proportion of planned and actual subspecialty hiring in 2023, 2022, and 2021. The likelihood of respondents to seek new employment is stable in 2023 vs 2022 (11% extremely or very likely to seek new employment). Among respondents who had greater rates were those who work overnight call (18%), feel their life is balances more toward work than life (17%), are in the first 5 years of their career (15%), or when they report that they intend to reduce their hours in the upcoming year. (15%). Respondents' likelihood to retire was stable in 2023 vs 2022 at 6%. 52% of respondents reported working remotely in some capacity in 2023, a significant increase compared to 2022 (48%), $p<0.01$. The proportion of practices that allow some telework increased significantly in 2023 compared to 2022, $p<0.01$ (Figure). A stable proportion of respondents report that they would like to work remotely in the future (46% in 2023 vs 48% in 2022). Practices report employing significantly more physician assistants ($p=0.03$) and nurse practitioners ($p=0.04$) in 2023 when compared to 2021, while the presence of radiologist assistants has been stable or dropped (Figure).

### CONCLUSION

Practices are experiencing a worsening radiologist workforce shortage. Based on survey responses, effective strategies to mitigate the shortage at the practice level appear to include increasing remote work opportunities, reducing overnight call, and hiring NPRPs.

### CLINICAL RELEVANCE/APPLICATION

Awareness of mitigation strategies for the ongoing radiologist workforce shortage can help practices recruit and retain adequate staff to optimize patient care and minimize radiologist burnout.

## T7-SSNPM02-2 PROJECTED RADIOLOGIST WORKFORCE SUPPLY, 2025-2055

Eric M. Rubin, MD (*Abstract Co-Author*) Nothing to Disclose
Jay R. Parikh, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Y. Rula, PhD (*Abstract Co-Author*) Nothing to Disclose
Eric Christensen, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To project the future radiologist workforce through 2055 based on historical numbers of radiologists completing residencies and historical rates of radiologist attrition.

### METHODS AND MATERIALS

We used the 2014-2023 CMS National Downloadable Files, which includes all clinicians enrolled to provide care to Medicare patients, to assess both the current supply of radiologists and model the attrition (i.e., retirement) based on years of practice. Using a non-linear regression model, differences in attrition patterns were assessed by sex as well as pre- and post-COVID. New entrants to the workforce were modeled via linear regression based on

2005-2024 National Residency Matching Program data on new radiologist residents. Finally, we integrated estimates of radiologists' attrition and new entrants to generate estimates of radiologist supply through 2055.

**RESULTS**

In 2023, 37,482 radiologists were enrolled to provide care to Medicare patients of whom 24.4% were female. Given attrition patterns, the projected number of years these radiologists will practice is 35.7 for males and 34.2 for females. Attrition increased post- compared to pre-COVID. For example, the projected mean years of practice for females is 35.0 and 32.3 years using pre- and post-COVID attrition patterns, respectively. We project that the radiologist workforce will be 46,152 in 2055 (23.1% above the 2023 level). This projection assumes no growth in radiology residencies after 2024. Assuming radiologist residency numbers will follow the historical trend (2005-2024) through 2055, the radiology workforce will be 51,498 in 2055 (37.4% above the 2023 level). These projections are based on an average of the pre- and post-COVID attrition patterns. If the projections (assuming no growth in residency positions after 2024) were based only on pre-COVID attrition patterns, the 2055 workforce would be 47,357 radiologists (26.3% above the 2023 level). Using the post-COVID attrition patterns, the 2055 workforce would be 44,448 radiologists (18.6% above the 2023 level).

**CONCLUSION**

The radiologist workforce is projected to grow at least 23.1% between 2023 and 2055. If residency positions continue to increase each year, we project the workforce will be 37.4% higher in 2055. Attrition is higher among female compared with male radiologists. Likewise, the post-COVID attrition patterns are significantly higher than pre-COVID levels.

**CLINICAL RELEVANCE/APPLICATION**

Modelling future radiologist supply in the U.S. will assist decision making regarding the funding for radiologist residencies. While a separate study should assess demand, we note for comparison that the U.S. Census population projections for 2055 show that the 65+ and 85+ populations will be 43% and 164% above the 2023 level, respectively.

## T7-SSNPM02-3 HOUR-BY-HOUR CHARACTERIZATION OF THE INCREASING PRESSURE ON RADIOLOGISTS - LOAD IS IN THE DETAILS

Eyal Bercovich, MD (*Abstract Co-Author*) Nothing to Disclose
Nitai Bar, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The escalating radiologic workloads in recent years have been well documented. Nevertheless, the effects on performance metrics such as reading speed and accuracy have not been quantified, limiting the ability to define safety and good-practice guidelines. We aim to characterize the distribution of workload pressures and delineate critical workload levels beyond which radiologist efficiency may be compromised.

**METHODS AND MATERIALS**

An analysis of CT scan data from 2016 to 2023 a tertiary trauma center was conducted. The dataset included timestamps of various stages of imaging workflow, patient demographics, and scan specifics. Statistical analyses were performed using R, focusing on workloads during off-hours, when staffing is minimal. We investigated performance metrics during peaks in workload based on an hour-by-hour analysis. We compared means of continuous variables with the independent t-test.

**RESULTS**

Data from 38,749 scans performed during 521 off-hour shifts (excluding weekends) were analyzed. The average daily workload increased by 36.4% from 62.9 in 2016 to 85.8 in 2023 (CI 25.5-20.2, $p<0.001$). Hour-by-hour analysis revealed that the average peak in workload occurred most commonly during 19:00-21:00 in 2016 and was shifted towards later hours in 2023, occurring between 21:00-00:00. The rise in workload was more pronounced during peak activity periods. The growing workload correlated with longer patient waiting times and increased pressure on radiologists.

**CONCLUSION**

The study identifies critical periods of workload surges, correlating these with potential declines in radiologist performance. It suggests that traditional metrics of average workload fail to capture the nuances of workload distribution and its effects on radiology departments.

**CLINICAL RELEVANCE/APPLICATION**

The findings underscore the need for revisiting radiology department protocols, particularly during off-hours. Adjustments in staffing and workflow during these peak times could mitigate the risks associated with high workload periods, ultimately enhancing patient care and radiologist well-being.

## T7-SSNPM02-4 WHICH DIAGNOSTIC IMAGING EXAMS ARE CONTRIBUTING THE MOST TO INCREASED RADIOLOGIST PRODUCTIVITY?

Richard E. Sharpe JR, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Alan Zhu, BS (*Abstract Co-Author*) Nothing to Disclose
Aditya Khurana, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine which imaging exams are contributing most to the productivity increases of radiologists.

**METHODS AND MATERIALS**

All fee-for-service outpatient imaging claims billed to Original Medicare Part B by radiologists for diagnostic imaging services from 2013 through 2021 were extracted from the CMS POSPUF database. Claims data was merged with year specific national work relative value unit (wRVU) files. For each diagnostic radiologist, the total wRVUs produced per year was calculated by multiplying the wRVU value of each CPT code by the total number of services by CPT code. Each code was also given a modality and body region classification. The absolute difference in wRVUs as well as the compound annual growth rate (CAGR) were calculated for each subanalysis.

**RESULTS**

After stratifying wRVU volumes by imaging modality and body region, the top five modality-body combinations with the highest number of wRVUs in 2013 were: CT-Abdomen/Pelvis (9189020.9), Radiography-Chest (5471996.1), Radiography-Breast [Mammography] (5091364.0), CT-Chest (4948370.4), and CT-Brain (4812475.2).The top five modality-body combinations with the highest number of wRVUs in 2021 were: CT-Abdomen/Pelvis (10928245.6), Radiography-Breast [Mammography] (8798231.4), CT-Chest (6745049.2), CT-Brain (5169016.3), and Radiography-Chest (3748685.0).The top five modality-body combinations with the largest increase in wRVUs from 2013-2021 were: Radiography-Breast [Mammography] (+3706867.3), CT-Chest (+1796678.8), CT-Abdomen/Pelvis (+1739224.7), MRI-Abdomen/Pelvis (+759537.4), and CT-Head/Neck (+680363.0).The top five modality-body

combinations with the largest decrease in wRVUs from 2013-2021 were: Radiography-Chest (-1723311.1), Radiography-Abdomen/Pelvis (-477542.6), US-Abdomen/Pelvis (-391467.2), Nuclear Medicine-Cardiac (-247762.5), and Radiography-Spine (-190695.5).The modality-body combinations with the highest number of unique radiologists that billed for that service were: Radiography-Chest (25442/32339 in 2021; 78.7%), CT-Abdomen/Pelvis (22746/32339 in 2021; 69.5%), Radiography-Abdomen/Pelvis (22180/32339 in 2021; 68.6%), CT-Chest (21711/32339 in 2021; 67.1%), and CT-Brain (20115/32339 in 2021; 62.2%).

**CONCLUSION**

Over the past decade, the imaging modality and body part combinations resulting in the largest growth in wRVUs were from radiography breast(mammography), CT chest, CT Abdomen/Pelvis, MR abdomen/pelvis, and CT head/neck.

**CLINICAL RELEVANCE/APPLICATION**

Practices may be well served to concentrate strategic growth efforts on complex imaging modality body part combinations that are growing faster than others.

## T7-SSNPM02-5 THE 52 MODIFIER: AN OFTEN-OVERLOOKED REASON FOR REDUCED PHYSICIAN PAYMENTS

Richard Duszak JR, MD (*Abstract Co-Author*) Advisor, Ethos Medical, Inc;Shareholder, Ethos Medical, Inc
Brandon Huddleston (*Abstract Co-Author*) Nothing to Disclose
Bryson Brister (*Abstract Co-Author*) Nothing to Disclose
Areejah Umar (*Abstract Co-Author*) Nothing to Disclose
Quinn Cottone (*Abstract Co-Author*) Nothing to Disclose
Stephen Atkins (*Abstract Co-Author*) Nothing to Disclose
Clinton Case (*Abstract Co-Author*) Nothing to Disclose
Robert W. Morris, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

CPT code modifier 52 is used to bill services performed at a level substantially reduced from a typical service, with an accompanying decrease in reimbursement. Its appropriate use in diagnostic radiology would be in the rare setting of an intentionally limited or incomplete examination (e.g., a few CT images to evaluate for questionable pneumothorax on a CXR), but not in situations in which a complete examination was performed but not ideally interpretable (e.g., motion degradation). At our institution, we identified numerous CT and MRI examinations billed with a 52 modifier resulting in reduced revenue. We aimed to identify factors in radiology reports leading coders to apply this modifier.

**METHODS AND MATERIALS**

Searching our billing database, we identified 389 MRIs and 134 CTs performed between 3/1/2022 and 2/28/2023 billed with the reduced services 52 modifier. Each radiology report was manually evaluated for words suggesting that the exam was limited, as well as the reasons for limitation, severity, and additional recommendations. Descriptive statistical analysis was performed.

**RESULTS**

Of MRIs and CTs billed with a 52 modifier, 65% and 57% respectively included the word “limited.” The next most used words were “degraded” and “incomplete” for MRI and “suboptimal” and “degraded” for CT. In 70% of MRIs and 40% of CTs, the degree of limitation was not specified, but for those with a characterized degree, “severely” and “significantly” were most common. For both MRI and CT, “motion” was the most common reason given for limitations. Recommendations for repeat or additional examinations were made in 19% of MRI and 30% of CT reports.

**CONCLUSION**

All identified exams billed with a 52 modifier had wording in the report to suggest that the exam was limited, and the largest number of limitations were study quality rather than for a true reduced service. Radiology coder education is warranted to ensure appropriate use of this modifier and to avoid inappropriate reduction in payments.

**CLINICAL RELEVANCE/APPLICATION**

In order to improve compliance and collections, radiology practices should ensure that the 52 reduced services modifier is being appropriately used by their coders.

## T7-SSNPM02-6 COST-EFFECTIVENESS OF ENDOVASCULAR THROMBECTOMY FOR BASILAR ARTERY OCCLUSION STROKE

Wolfgang G. Kunz, MD, MBA (*Presenter*) Nothing to Disclose

**PURPOSE**

Two recent studies showed clinical benefit for endovascular treatment (EVT) in basilar artery occlusion (BAO) stroke up to 12 h (ATTENTION) and between 6 and 24 h from onset (BAOCHE). Our aim was to investigate the cost-effectiveness of EVT from a U.S. healthcare perspective.

**METHODS AND MATERIALS**

Clinical input data were available for both trials, which were analyzed separately. A decision model was built consisting of a short-run model to analyze costs and functional outcomes within 90 days after the index stroke and a long-run Markov state transition model (cycle length of 12 months) to estimate expected lifetime costs and outcomes from a healthcare and a societal perspective (Figure 1). Incremental cost-effectiveness ratios (ICER) were calculated, deterministic (DSA) and probabilistic (PSA) sensitivity analyses were performed.

**RESULTS**

EVT in addition to best medical management (BMM) resulted in additional lifetime costs of $32,063 in the ATTENTION trial and lifetime cost savings of $7690 in the BAOCHE trial (societal perspective, Figure 2). From a healthcare perspective, EVT led to incremental costs and effectiveness of $37,389 and 2.0 QALYs (ATTENTION) as well as $3516 and 1.9 QALYs (BAOCHE), compared to BMM alone. The ICER values were $-4052/QALY (BAOCHE) and $15,867/QALY (ATTENTION) from a societal perspective. In each trial, PSA showed EVT to be cost-effective in most calculations (99.9%) for a willingness-to-pay threshold of $100,000/QALY. Cost of EVT and age at stroke represented the greatest impact on the ICER (Figure 3).

**CONCLUSION**

From an economic standpoint with a lifetime horizon, EVT in addition to BMM is estimated to be highly effective and cost-effective in BAO stroke.

## CLINICAL RELEVANCE/APPLICATION

The expanded EVT indication beyond the anterior circulation increases the need for EVT. Based on the projected health and cost benefits, healthcare investments are justified to cover this demand.
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T7-SSNR09

**Neuroradiology (Brain: Infectious, Inflammatory and Metabolic Disorders)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S406B

Kimberly Seifert, MD, MS (*Moderator*) Nothing to Disclose
Sara G. Tedla, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T7-SSNR09-1 ASSOCIATION OF LONG-TERM BLOOD PRESSURE EXPOSURE WITH GLYMPHATIC FUNCTION: A POPULATION-BASED COHORT STUDY

Zhenchang Wang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Han Lv, MD (*Abstract Co-Author*) Nothing to Disclose
Jing Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaoshuai Li (*Abstract Co-Author*) Nothing to Disclose
Yufan Zhang (*Abstract Co-Author*) Nothing to Disclose
Sihui Guo (*Presenter*) Nothing to Disclose

### PURPOSE

The relationship between long-term blood pressure exposure and glymphatic system function of the brain in the general population remains unknown. This study aimed to investigate the associations between cumulative exposure of blood pressure and neuroimaging metrics of glymphatic system function.

### METHODS AND MATERIALS

A multicenter, community-based cohort study involving 981 participants was conducted. The glymphatic system function was evaluated using diffusion tensor image analysis along the perivascular space (DTI-ALPS) based on brain MRI data acquired between 2020 and 2022. Cumulative systolic and diastolic blood pressure (cSBP, cDBP) during follow-up periods of 4, 8, and 12 years prior to neuroimaging data acquisition were calculated. Generalized linear models were employed to assess the association between cSBP and cDBP exposure across different time periods and the DTI-ALPS index.

### RESULTS

The mean age of participants was 55.9 years, with females accounting for 45.9 %. Participants with higher cDBP over 90 mmHg during a follow-up period of 12 years exhibited a lower average DTI-ALPS index compared to normotensive individuals (beta=-0.036, 95% confidence interval [CI] -0.065 to -0.006). This association remained significant among middle-aged individuals (beta=-0.052, 95% CI -0.098 to -0.006). No statistical difference was observed regarding high cSBP exposure or for groups with shorter follow-up periods.

### CONCLUSION

Prolonged exposure to high cDBP is associated with impaired glymphatic function, suggesting that controlling DBP may benefit brain health more than systolic blood pressure does, especially in midlife.

### CLINICAL RELEVANCE/APPLICATION

Our results provide new insights into understanding the impact of hypertension on negative brain health. Our results shed light on the potential detrimental impact of sustained high diastolic blood pressure over an extended period. It is worth noting that the association between a higher cDBP over a 12-year period and lower DTI-ALPS index, raises intriguing questions about the long-term effects of high DBP on brain health. A comprehensive understanding of the relationship between blood pressure exposure and glymphatic dysfunction will facilitate proactive preventive measures for public brain health.

## T7-SSNR09-2 QUANTITATIVE ASSESSMENT OF GADOLINIUM DEPOSITION IN DENTATE NUCLEI WITH MR FINGERPRINTING

Sachi Okuchi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshiki Arakawa (*Abstract Co-Author*) Nothing to Disclose
Sayo Otani, MD (*Abstract Co-Author*) Nothing to Disclose
Yuji Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Nakajima, MD (*Abstract Co-Author*) Nothing to Disclose
Shuichi Ito, MD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Ikeda (*Abstract Co-Author*) Nothing to Disclose
Yasutaka Fushimi, MD (*Abstract Co-Author*) Nothing to Disclose
Akihiko Sakata, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Tagawa, MD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Tanji (*Abstract Co-Author*) Nothing to Disclose

Yuta Urushibata (*Abstract Co-Author*) Employee, Siemens AG
Yang Wang, BA (*Presenter*) Nothing to Disclose

**PURPOSE**

Gadolinium deposition in dentate nuclei (DN) has been evaluated by T1WI, T1 (R1) mapping, but not MR fingerprinting (MRF). This study aimed to investigate associations between T1 and T2 values of DN and gadolinium-based contrast agents (GBCAs) using 2-dimensional MRF.

**METHODS AND MATERIALS**

This study included 101 patients. All patients underwent a 2D section-selective fast imaging with steady precession (FISP) MRF sequence for the axial slice of DN. ROI analysis was performed for T1 and T2 values of DN on MRF (T1-MRF, T2-MRF) and T1-weighted images (T1WI ratio). T1 and T2 ratios compared to normal cerebellar white matter (T1-MRF ratio, T2-MRF ratio) were calculated. Correlation analyses were performed for all 101 patients using Spearman rank correlation coefficient and Pearson correlation coefficient. The type of previous GBCA was confirmed in 79 patients, and linear regression (univariate and multivariate analyses respectively) were performed between T1, T2 values and the number of GBCAs.

**RESULTS**

Good correlation was observed between T1-MRF and T1WI ratio (?= -0.69, P < 0.001), and between T1-MRF ratio and T1WI ratio (? = -0.76, P < 0.001) in all patients (n = 101). Mild correlation was observed between T2-MRF and T1WI ratio (? = -0.32, P < 0.001) and between T2-MRF ratio and T1WI ratio (? = -0.44, P < 0.001). Associations of the number of GBCA administrations with MRF or T1WI were analyzed in subgroup (n = 79). The number of linear-type GBCAs was associated with T1-MRF (ß = -0.62, P < 0.001) and T1-MRF ratio (ß = -0.54, P < 0.001) in univariate linear regression analyses, and with T1-MRF (ß = -0.61, P < 0.001) and T1-MRF ratio (ß = -0.53, P < 0.001) in multivariate analysis. The number of linear-type GBCAs was associated with T2-MRF (ß = -0.30, P < 0.001) and T2-MRF ratio (ß = -0.29, P < 0.001) in univariate analyses, and with T2-MRF (ß=-0.31, P<0.001) and T2-MRF ratio (ß = -0.32, P < 0.001) in multivariate analyses. The number of linear-type GBCAs was associated with T1WI ratio (ß = 0.65, P < 0.001) in univariate analyses, and with T1WI ratio (ß = 0.65, P < 0.001) in multivariate analyses. No associations were observed between number of macrocyclic GBCAs and T1-MRF (ratio) or T2-MRF (ratio) or T1WI ratio.

**CONCLUSION**

T1 and T2 values obtained from MRF can be used to detect DN changes related to previous GBCA administrations. The number of linear-type GBCA administrations was associated with lower T1 and T2 values (ratios) in DN, but not with the number of macrocyclic GBCA administrations.

**CLINICAL RELEVANCE/APPLICATION**

MRF is easily used to follow up gadolinium deposition in DN over time by providing T1 and T2 values, which may help to understand the potential clinical implications of gadolinium deposition.

## T7-SSNR09-3 WHOLE-CEREBRUM GUANIDINO CHEMICAL EXCHANGE SATURATION TRANSFER (CEST)MRI MAPPINGS AT 3T - A FEASIBILITY STUDY WITH A 3D STACK-OF-SPIRALS GRADIENT ECHO ACQUISITION

Guanshu Liu, PhD (*Abstract Co-Author*) Nothing to Disclose
Jiadi Xu (*Abstract Co-Author*) Nothing to Disclose
Dan Zhu, PhD (*Abstract Co-Author*) Nothing to Disclose
Claire Liu (*Abstract Co-Author*) Nothing to Disclose
Georg Oeltzschner (*Abstract Co-Author*) Nothing to Disclose
Feng Xu (*Abstract Co-Author*) Nothing to Disclose
Lindsay Blair (*Abstract Co-Author*) Nothing to Disclose
Anna Li (*Abstract Co-Author*) Nothing to Disclose
Qin Qin, PhD (*Abstract Co-Author*) Nothing to Disclose
David Kamson (*Abstract Co-Author*) Nothing to Disclose
Licheng Ju (*Abstract Co-Author*) Nothing to Disclose
Kevin Xie (*Abstract Co-Author*) Nothing to Disclose
Richard A. Edden, PhD (*Abstract Co-Author*) Nothing to Disclose
Hye-Young Heo (*Abstract Co-Author*) Nothing to Disclose
Kexin Wang, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Creatine serves as a rapid energy source in the brain, linked with brain metabolism. Recent study on creatine exchange rate verifies the possibility of its indirect measurement via chemical exchange saturation transfer (CEST) MRI. This non-contrast, non-invasive method utilizes the guanidino group of creatine, a feature it shares with arginine from proteins. The resulting signal is known as guanidino CEST (GuanCEST), and we could achieve amideCEST from protein at the same time. However, GuanCEST observed in previous study only achieved less than 2% signal and partial coverage in 7 minutes or so. To better understand the creatine metabolism of the brain and differentiate small changes in the disease status, an optimized protocol should be established for an enhanced GuanCEST signal. Also, for clinical translation, a robust, whole-cerebrum, high-sensitivity 3D technique optimized for GuanCEST at 3T within a clinically acceptable timeframe is in great desire.

**METHODS AND MATERIALS**

In a pilot study, 22 healthy volunteers (age: 40.1±15.6 years; 10 females, 12 males) and a low-grade glioma patient (28 years, male) underwent scans at 3T (Philips Elition Achieva). We first optimized the saturation duration (1/2/3/4 s) and recovery delay (1.4/3 s) for the most time-efficient signal acquisition, then evaluated the 3D stack-of-spirals gradient echo readout (3DSOS) against 3D echo-planar imaging (3DEPI), and other spin echo techniques, comparing signal intensity in gray matter and white matter, test-retest reliability, and motion robustness. CEST contrasts were extracted by PLOF method. Then the optimized protocol was applied on the patient.

**RESULTS**

The optimal recovery delay/saturation were determined as 1.4/2 s. Only 3DSOS and 3DEPI achieved whole-cerebrum CEST imaging within a clinically acceptable timeframe (around 4 minutes). Both methods provided similar GuanCEST contrast, enhanced by more than 30% than previous studies, while 3DSOS outperforms with significantly larger amideCEST, higher test-retest reliability, and motion robustness. For the glioma (see the figure), GuanCEST from 3DSOS showed markedly enhanced contrast compared to 3DEPI, while M0 and amideCEST images exhibited no significant differences in both techniques. This suggests that GuanCEST mapping may be valuable for assessing tumor metabolism.

**CONCLUSION**

Whole-cerebrum GuanCEST mappings have been achieved by 3DSOS with consistent contrast and robustness to motion in around 4 minutes at 3T.

### CLINICAL RELEVANCE/APPLICATION

3DSOS enables rapid GuanCEST imaging that comprehensively covers the brain at 3T, featuring high motion robustness due to its spiral sampling scheme. It provides a promising mapping tool for creatine metabolism in the brain and studying tumor metabolism.

## T7-SSNR09-4 DIAGNOSTIC PERFORMANCE EVALUATION OF NATIVE 3D-FLAIR* IN THE ASSESSMENT OF CENTRAL VEIN SIGN IN MULTIPLE SCLEROSIS AT 1.5T VS. 3T; A PILOT STUDY

Ayse Altintas (*Abstract Co-Author*) Nothing to Disclose
Hande Ozen Atalay, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Yusuf Oner, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmet Peker (*Abstract Co-Author*) Nothing to Disclose
Yunus Emre Senturk, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Central vein sign (CVS) is a useful imaging biomarker in the identification of the demyelinating lesion, particularly in the context of radiological isolating syndrome (RIS). Recent literature has utilized segmented 3D-FLAIR* imaging at 3T settings to evaluate the CVS status of white matter lesions. Our objective is to evaluate the performance of unenhanced, segmented 3D-FLAIR* at 1.5T magnetic field strength by comparing it with 3T outcomes in participants with multiple sclerosis (MS).

### METHODS AND MATERIALS

Sixteen clinically established MS patients were recruited for this single-center prospective study. Patients were initially scanned with a 3D-FLAIR* protocol at an isotropic resolution of 0.8 mm at 3T (Skyra, Siemens, Germany). Subsequently, patients were transferred to a 1.5T scanner (Aera, Siemens, Germany) to perform the identical 3D-FLAIR* protocol with the same voxel size. Scans were accomplished without any contrast. The CVS status of each lesion was evaluated by two raters, using the NAIMS criteria for lesion eligibility. CVS assessment was performed using two different methods, Select-6* and the percentage-based method, on both scanners. Lesion distribution was also noted for both scans.

### RESULTS

Two hundred three (67%) of 304 lesions were eligible for CVS assessment in both magnetic strengths. Out of 203 eligible lesions, 149 (73.3%) in 3T, and 128 (60.6%) in 1.5T systems were CVS+ (p=0.031). The interrater reliability of CVS+ was almost perfect for both magnetic field strengths (Cohen's kappa coefficient: 0.87 in 3T and 0.83 in 1.5T system). Fifteen of 16 cases met the Select-6* prerequisites in both scanners. One case was Select-6* incompliant in both magnetic field strengths. For the percentage-based method of 3D-FLAIR*, the mean CVS+ ratio per participant was 75.2% ± 13.8 in the 3T scanner, and 64.6% ± 14.7 in the 1.5T scanner ($p<0.01$). Moreover, no differences were noted in the location-based distribution of CVS+ lesions in both scanners, (Table).

### CONCLUSION

Native segmented 3D-FLAIR* at 1.5T demonstrates remarkable and reproducible CVS assessment. Although outperformed by 3T based on a percentage-based method, the 1.5T scan demonstrated to be as effective as its counterpart when the widely established Select-6* is used. Therefore, when a 3T scanner is unavailable, CVS assessment in MS with native 3D-FLAIR* can also be done at a 1.5T magnetic field strength.

### CLINICAL RELEVANCE/APPLICATION

3D-FLAIR* at 1.5T proves to be effective in assessing CVS, especially using the Select-6* method, compared to its counterpart at 3T. This initial finding holds significance, considering the widespread use of 1.5T magnetic field systems globally.

## T7-SSNR09-5 STRUCTURAL AND FUNCTIONAL CHANGES IN THE SUBCORTICAL NUCLEUS AND ASSOCIATED NEGATIVE EMOTIONAL STATES IN PATIENTS WITH POST-COVID HEADACHE

Wenrui Bao (*Abstract Co-Author*) Nothing to Disclose
Xuan Niu (*Abstract Co-Author*) Nothing to Disclose
Qiange Zhu (*Abstract Co-Author*) Nothing to Disclose
Ming Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Xingpu Quan (*Presenter*) Nothing to Disclose

### PURPOSE

Mechanisms of chronic pain remain poorly understood and impose a significant health burden. Headache is a frequent symptom of coronavirus disease 2019 (COVID-19). Transitioning from acute to chronic pain and its associated negative emotional valence may be determined by the physiology of the limbic brain. The aim of this study was to investigate the structural and functional changes in subcortical nucleus in patients with post-COVID headache, and to further evaluate the relationship between the alterations and negative emotion.

### METHODS AND MATERIALS

This multi-center, prospective case-control study involved 195 COVID-infected participants, categorized into post-COVID headache (COVID H+) and non-headache (COVID H-) groups. Subcortical nucleus volumes were measured using Freesurfer, with ANCOVA and Bonferroni adjustments for inter-group comparisons. The Conn toolkit facilitated seed-to-voxel functional connectivity (FC) analysis, while structural equation modeling (SEM) explored the interplay among brain markers, negative emotions, and headache persistence.

### RESULTS

Patients with post-COVID headache had a longer temperature recovery time and a higher proportion of female ($P < 0.05$). The COVID H+ group had reduced volumes in the nucleus accumbens and amygdala, and lower psychosomatic scores ($P < 0.05$). FC analysis showed increased connectivity of the right amygdala with the putamen/pallidum and decreased with the middle temporal gyrus ($P < 0.05$, FDR corrected). The left nucleus accumbens had enhanced connectivity with the lingual gyrus/occipital fusiform gyrus, and the right with the cerebelum crus1/lingual gyrus ($P < 0.05$, FDR corrected). SEM indicated that lower amygdala volume and FC with the putamen/pallidum were linked to chronic pain through BAI and BDI scores ($P < 0.05$), while nucleus accumbens volume and FC directly influence post-COVID headache ($P < 0.05$).

### CONCLUSION

Limbic system alterations, notably in the nucleus accumbens and amygdala, predispose to post-COVID headache. The amygdala potentially drives chronic pain via negative emotions like anxiety and depression, whereas the nucleus accumbens has a direct role in pain chronicity, possibly linked to heightened negative visual memory recall and altered pain perception.

### CLINICAL RELEVANCE/APPLICATION

Our study affirms the limbic system's role in the negative emotion-pain model and uncovers distinct pathways through which the amygdala and nucleus ambiguus intensify chronic pain. Crucial for therapeutic research, neuroimaging-based structural biomarker analysis deepens our understanding of post-COVID-19 headache pathophysiology, enabling predictive modeling and personalized treatment development.

## T7-SSNR09-6 MULTIPLE SCLEROSIS LESION DETECTION WITH 3D DOUBLE INVERSION RECOVERY AS COMPARED TO 3D FLUID LOW ATTENUATION INVERSION RECOVERY (T2-FLAIR): A SYSTEMATIC REVIEW AND META-ANALYSIS

Bruno Murad (*Abstract Co-Author*) Nothing to Disclose
Fabricio S. Feltrin, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanni B. Torri, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza G. Schmitt, MD (*Abstract Co-Author*) Nothing to Disclose
Yin Xi, PhD (*Abstract Co-Author*) Nothing to Disclose
Fillipe T. Xavier de Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Thomaz R. Mostardeiro, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Several sequences have been developed to increase lesion detection in Multiple Sclerosis, including Double Inversion Recovery (DIR). The superiority of these pulse sequences is not well established compared to traditional T2-FLAIR images. This meta-analysis aims to describe if lesion detection rates are higher in DIR compared to conventional T2-FLAIR images in a 3D acquisition comparison.

### METHODS AND MATERIALS

Search was performed of the PubMed/MEDLINE, EMBASE and Cochrane databases between January 1995 and December 2023. Studies identified were assessed independently by two physicians following PRISMA guidelines. Articles were screened to exclude articles not reporting original data, not performing direct 3D DIR and 3D T2-FLAIR comparisons or abstracts excluded. Remaining articles were reviewed in a full-text review by two physicians independently, compelling a total of 5 articles.

### RESULTS

Cortical lesion count ranged from to 12.4 to 40.0 for DIR; 5.25 to 27.9 for T2-FLAIR, with juxtacortical lesions ranging from 4.9 to 19.7 and 4.72 to 22.0 on DIR and T2-FLAIR respectively. Intracortical lesions varied from 1.2 to 8.0 for DIR and 1.1 to 3.1 for T2-FLAIR. Infratentorial lesions mean lesions count varied from 2.0 to 12.0 for DIR, as compared to 1.45 to 8.4 for T2-FLAIR. In the periventricular WM, results varied from 11.84 to 73 and 11.31 to 69 for DIR and T2-FLAIR respectively.Pooled estimates showed relative significant differences in lesion detection for intracortical (175.41 [95% Confidence Interval (95%-CI): 48.68; 410.16]) and infratentorial (30.56 [95%-CI: 9.34; 55.91]) regions with the entire 95% confidence intervals >0. Confidence intervals were <0 when counting differences for total cortical lesions (37.35 [95%-CI: -12.47; 115.54]), including juxtacortical (25.44 [95%-CI: -32.12; 131.81]) and for supratentorial WM lesions (1.93 [95%-CI: -14.41; 21.39]), including the periventricular WM (11.22 [95%-CI: -4.02; 28.90]).

### CONCLUSION

3D-DIR acquisition allows higher detection in intracortical and infratentorial lesions compared to 3D T2-FLAIR.

### CLINICAL RELEVANCE/APPLICATION

DIR provides powerful information in Multiple Sclerosis detection lesion compared to the more traditional 2T-FLAIR acquisition. The sequence may further help diagnosing Multiple Sclerosis and during its imaging surveillance.

# Abstract Archives of the RSNA, 2024

T7-SSPH09

**Physics (AI in CT)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S501

Guang-Hong Chen, PhD (*Moderator*) Nothing to Disclose
Hao Gong, PhD, MSc (*Moderator*) Nothing to Disclose

**Sub-Events**

## T7-SSPH09-1 EVALUATING THE INFLUENCE OF SCAN AND PATIENT VARIABLES ON DEEP LEARNING-BASED ESTIMATION OF VIRTUAL MONOENERGETIC IMAGES FROM SINGLE-ENERGY CT

Brian F. Mullan, MD, MMed (*Abstract Co-Author*) Nothing to Disclose
Guang-Hong Chen, PhD (*Abstract Co-Author*) Nothing to Disclose
Prashant Nagpal, MD (*Abstract Co-Author*) Nothing to Disclose
Ran Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Grist, MD (*Abstract Co-Author*) Nothing to Disclose
Yijing Wu, PhD (*Abstract Co-Author*) Nothing to Disclose
John W. Garrett, PhD (*Abstract Co-Author*) Nothing to Disclose
Ke Li, PhD (*Presenter*) Research Consultant, Pulmera Inc.

### PURPOSE

Recent advancements in deep learning (DL) have opened avenues for estimating virtual monoenergetic (VME) images from single-energy CT (SECT) data. Despite multiple DL networks being validated using SECT data from dual-energy CT exams—which feature similar acquisition hardware conditions to the training data—it remains an open question whether such DL methods can be applied to real-world SECT data from various SECT scanners. In this study, we report the results of the first radiologist reader study to investigate the potential impacts of scanner model, SECT acquisition protocol, and patient demographics on the image quality and diagnostic accuracy of DL-based VME images.

### METHODS AND MATERIALS

A cohort of 52 patients who underwent SECT pulmonary angiography was retrospectively assembled. The images were acquired from a hospital independent of the institution where the DL training data was collected. The SECT dataset encompasses four scanner models, four tube potential levels ranging from 80 to 140 kV, and varying radiation dose levels from 1.8 to 20.2 mGy. A novel DL network was employed to generate 40 keV VME images from the SECT data. After randomizing the type of images and subject order, two experienced thoracic radiologists performed PE diagnosis and evaluated pulmonary vessel opacification and overall image quality using 5-point Likert scales. Additionally, the CNR of pulmonary vessels was measured. Statistical data analysis was performed for different sub-groups based on the scanner model, kV, dose, sex, and BMI.

### RESULTS

Among all cases, the mean vessel enhancement score for clinical SECT is 4.2 [95% CI: 4.0, 4.4], while for DL-VME, it is 4.7 [95% CI: 4.5, 4.8] (p=.001). The mean image quality score for SECT is 3.3 [95% CI: 3.1, 3.5], whereas for VME, it is 4.3 [95% CI: 4.0, 4.6] (p<.001). The CNR of pulmonary vessels is consistently improved by VME, with a mean improvement factor of 2.4 [95% CI: 2.1, 2.8]. The area under ROC is 0.874 for SECT and 0.875 for VME (p=.50). Results of the subgroup analysis indicate no significant variation (p=.67) in VME performance across patient sex, scanner, dose, and kV. However, both VME and SECT demonstrate dependence on patient BMI, with VME providing better image quality for both small and larger patient groups.

### CONCLUSION

DL-VME consistently outperforms SECT in pulmonary angiography in terms of vessel conspicuity and overall image quality. The advantage of DL-VME over SECT remains robust across variations in data acquisition and patient variables. Notably, the image quality of DL-VME shows a reduced dependence on X-ray tube potential and radiation dose levels.

### CLINICAL RELEVANCE/APPLICATION

This study offers the first expert analysis of the clinical advantages and robustness of DL-based dual-energy CT image estimation.

## T7-SSPH09-2 ENHANCING LESION DETECTABILITY FOR DEEP-LEARNING-BASED CT DENOISING AT LOWER RADIATION DOSE THROUGH INCORPORATING UNCERTAINTY AND PREDICTIVE MEAN

Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Scott S. Hsieh, PhD (*Abstract Co-Author*) Nothing to Disclose
Hao Gong, PhD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Deep-Learning-based Denoising (DLD) has the potential to improve image quality and reduce radiation dose in x-ray CT. However, the uncertainties of DLD outputs are detrimental to robust lesion detection in clinical deployment. We aim to enhance lesion detectability using the predictive mean and uncertainty of DLD outputs

**METHODS AND MATERIALS**

Data uncertainty (from noise in inputs) and model uncertainty (from randomness of network parameters) in DLD outputs were quantified in inference, using validated methods: the former via injecting augmented noise realizations to inputs; the latter through inserting Monte Carlo Dropout to approximate the posterior distribution of network parameters. The predictive mean was derived as the ensemble average after marginalizing over sampled noise and network parameters. Local mean to uncertainty ratio (MUR) served as a test statistic: if MUR < 1, local DLD outputs were deemed as over-dispersed and unreliable; otherwise, local predictive mean images were used for lesion searching. For validation, we used a pre-trained DLD and reader interpretations (3 radiologists) from a virtual lung nodule localization trial [10 experimental conditions with 4 dose levels (full and simulated 10%, 25%, 50% dose), 2 nodule types (ground glass (GGN) and partial solid (PSN)), and 3 nodule sizes (3.4, 5.4, and 7.4 mm)]. A recently validated deep-learning model observer (DLMO) method was used to quantify theoretical lesion detectability. To establish the baseline performance, DLMO was trained using independent data and well calibrated to mean radiologist performance on original DLD outputs. To assess performance gain, MUR calculation and the calibrated DLMO were integrated in lesion searching process in all experimental conditions. The area under localization receiver operating characteristic curve (AL) was the figure of merit

**RESULTS**

Predictive mean improved lesion visualization across different noise realizations and patients. MUR degraded as dose decreased (median MUR at lesions from 100% to 10% dose levels: GGN 5.53, 4.53, 3.54, 2.44, and PSN 5.5, 4.55, 3.55, 2.37). This indicated worse reliability of original DLD outputs at lower dose. Using MUR and predictive mean, lesion detectability was improved (Signed Rank test $p<0.01$) : median performance gain 5.5%, and range of performance gain 1% to 13%. More performance gain was achieved at the challenging conditions with lower dose and smaller lesions

**CONCLUSION**

Theoretical lesion detectability was enhanced using predictive mean and uncertainty of DLD outputs

**CLINICAL RELEVANCE/APPLICATION**

The proposed method can detect unreliable regions in DLD-denoised images and provide robust predictive mean images to systematically improve lesion detectability in clinical deployment

## T7-SSPH09-3 ULTRA-HIGH-RESOLUTION METAL ARTIFACT REDUCTION FOR PHOTON COUNTING DETECTOR CT IMAGES USING DEEP-LEARNING-BASED SUPER RESOLUTION

Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Nikkole Weber, ARRT, RT (*Abstract Co-Author*) Nothing to Disclose
Hao Gong, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Emily Koons (*Presenter*) Nothing to Disclose

**PURPOSE**

The maximum spatial resolution (i.e., kernel sharpness) available with some iterative metal artifact reduction (iMAR) software is limited although the intrinsic CT data contains higher spatial resolution. The purpose of this work was to develop and evaluate the performance of a Super-resolution convolutional neural network for ultra-high-resolution (UHR) imaging with Metal ARtifact reducTion (SMART).

**METHODS AND MATERIALS**

With IRB approval and written informed consent, 6 patients were scanned on a commercial photon-counting-detector (PCD) CT system (NAEOTOM Alpha, Siemens Healthineers) for clinically indicated imaging of the wrist. Scans were performed using a UHR (120 x 0.2 mm) protocol with 120kV/140kV tube potential in patients without/with metal, respectively. The four patients without metal served as the training dataset and were reconstructed with sharp (Qr56) and ultra-sharp (Qr89) kernels, 0.2/0.1-mm slice thickness/increment, 1024 matrix size, 100 mm FOV, and iterative reconstruction (QIR) strength 3. SMART is based on a U-Net architecture with 2 max pooling and 2 up convolutional layers, ReLU activation function, Adam optimizer, and mean squared error loss. The lower resolution Qr56 images and UHR Qr89 images served as training inputs and labels, respectively. A total of 55,820 patches of 128x128 pixels were extracted from corresponding locations on input and label images. For testing, data from the two patients with metal implants were reconstructed with the same parameters (Qr56 kernel, sharpest available with iMAR) in training but with iMAR software. Trained SMART was applied to the testing images. Resultant images were evaluated qualitatively and quantitatively by visual inspection of sharpness and metal artifacts and line profiles drawn through trabecular bone. Results were compared among Qr56 without iMAR, Qr56 with iMAR, and SMART output images.

**RESULTS**

iMAR substantially reduced metal artifacts in the testing cases but with low spatial resolution and poor trabecular bone visualization. SMART improved image quality in testing cases, with images showing spatial resolution similar to that of Qr89 kernel and reduced metal artifact similar to iMAR images at Qr56 kernel. Line profiles showed the improved resolution with SMART allowing for enhanced trabecular bone feature visualization and delineation, including bones neighboring metal devices.

**CONCLUSION**

SMART improved the resolution of iMAR images to take full advantage of the UHR capabilities of PCD-CT and allow for improved visualization of fine structures in the CT images.

**CLINICAL RELEVANCE/APPLICATION**

SMART allows iMAR images to be transformed to UHR iMAR images, enhancing the value of iMAR and PCD-CT in extremity imaging.

## T7-SSPH09-4 DIFFERENTIABLE SPECTRAL CT IMAGING: PHYSICS-INFORMED CROSS-DOMAIN LEARNING AND OPTIMIZATION

Adam S. Wang, PhD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Siemens AG;Research collaboration, Varex Imaging Corporation;
Yirong Yang, MEng (*Abstract Co-Author*) Research support, General Electric Company
Grant M. Stevens, PhD (*Abstract Co-Author*) Employee, General Electric Company
Sen Wang, PhD (*Presenter*) Research support, General Electric Company

**PURPOSE**

We aim to leverage the quantitative information offered by photon counting CT (PCCT) systems to perform physics-informed cross-domain learning and optimization by constructing an imaging chain that is fully differentiable. This approach enables optimization of the PCCT imaging chain automatically and adaptively by minimizing loss in the image domain and propagating updates upstream through reconstruction and material decomposition to the detector model and corrections.

**METHODS AND MATERIALS**

Quantitative PCCT generally consists of preprocessing, photon counting detector (PCD) modeling, material decomposition (MD), and image reconstruction. While some operations have explicit formulas and can readily be made differentiable, sinogram-domain MD is non-linear and often solved iteratively. In this work, we focus on enabling differentiable MD, i.e., finding its gradients. We show that its gradients can be given analytically by the implicit differentiation theorem. This enhances its robustness and GPU efficiency compared to the unrolled method, making it more suitable for detector pixel-specific modeling. We validated its performance with two tests: 1) a perturbation test of MD around a selected data point (10 cm water and 1 cm calcium) to visualize the gradients; 2) a cross-domain optimization task where we performed bin drift correction by minimizing loss in material images of a scanned phantom. A detector of 256 pixels with 4 energy bins was simulated, with three pixels having a bin drift of +/-1.5 keV in one of their bins. A water and calcium elliptical phantom was used for calibration, and a patient case was used for testing.

**RESULTS**

The perturbation test confirms the alignment between the tangent space from gradients and the MD results from the solver when a perturbation is applied on detector thresholds. In the detector bin drift correction test, the loss in material images is backpropagated through the differentiable reconstruction and the differentiable MD to correct the bin drift in the three pixels simultaneously. The bin error is reduced to less than 0.03 keV after the correction, effectively eliminating the ring artifacts.

**CONCLUSION**

We conducted theoretical analysis for the proposed differentiable PCCT imaging regarding its cross-domain capability and showed its application in PCD model correction. It holds additional potential applications for various learning and optimization tasks including correction for detector crosstalk, pulse pileup, energy response, and object scatter.

**CLINICAL RELEVANCE/APPLICATION**

The proposed differentiable PCCT imaging bridges the image domain and the upstream imaging chain, enabling distillation of knowledge from images to the entire imaging pipeline to improve clinical image quality.

## T7-SSPH09-5 AI-BASED METAL ARTIFACT REDUCTION ALGORITHM FOR SPECTRAL BASIS CT IMAGES IN INTERVENTIONAL ONCOLOGY (SPECTRAL MARIO): PHANTOM-BASED ASSESSMENT OF MODEL PERFORMANCE ACROSS QUANTITATIVE SPECTRAL RESULTS

Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Favazza, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrew Missert, PhD (*Abstract Co-Author*) Nothing to Disclose
Wenchao Cao, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the performance of a deep convolution neural network (CNN) framework, spectral MARIO, to reduce metal artifact from interventional oncology probes directly on the multi-energy CT basis images used for generating all spectral results, including quantitative image sets.

**METHODS AND MATERIALS**

An image domain data synthesis framework was implemented to virtually insert 20 different probe configurations into 21 different patients' pre-ablation planning images. Thus, a library was created consisting of co-registered Photelectric (PE) and Compton Scattering (CS) basis images (Spectral CT7500, Philips Healthcare) with and without metal artifact for training. A 2-channel U-Net style CNN was developed and trained using 100,000 128x128 pixel image patches. Performance was tested on images of a 30 cm (lateral dimension) water-filled anthropomorphic phantom containing either a single iodine (5 mgI/ml) or calcium (100 mg/cc) target rod. Each rod was scanned in 3 conditions: a) without cryoablation probes (reference), b) with 1 in-plane cryoablation probe above the rod (streak artifact) and c) with the rod sandwiched between 2 cryoablation probes (blooming artifact). Spectral MARIO was applied to the basis images from the scans with probes. Various spectral results were generated with and without spectral MARIO. Quantitative assessment compared mean attenuation values and iodine concentrations with and without spectral MARIO against reference values without probes.

**RESULTS**

Metal artifact severity was higher for spectral results more heavily weighted by the PE image relative to the CS image. Across all spectral results, spectral MARIO reduced both blooming and streaking metal artifacts in the phantom images, with improvements ranging from 66% to 96% compared to the original data. Specifically, iodine quantification within 1 and 6.9 mgI/ml could be obtained with and without spectral MARIO, respectively. Calcium suppression image values within 14 and 280 HU* could be obtained with and without spectral MARIO, respectively Finally, CT number accuracy within 41 and 345 HU could be obtained on low (50) keV data with and without spectral MARIO, respectively.

**CONCLUSION**

The study highlights the potential of spectral MARIO to improve image quality and quantitative accuracy in detector-based spectral CT by reducing metal artifacts in basis and thus obtaining more precise quantitative accuracy across all spectral results.

**CLINICAL RELEVANCE/APPLICATION**

The demonstrated performance of spectral MARIO opens the opportunity to leverage intraprocedural spectral CT data to extract quantitative biomarkers to increase radiologist confidence in probe placement, treatment monitoring and margin assessment during percutaneous, CT-guided ablations.

## T7-SSPH09-6 CONTINUAL SEGMENTATION OF WHOLE-BODY ORGANS IN 3D CT SCANS USING PYRAMID VISION TRANSFORMER AND LIGHT-WEIGHTED LOW-RANK ADAPTATION

Puyang Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Le Lu (*Abstract Co-Author*) Nothing to Disclose
Xianghua Ye (*Abstract Co-Author*) Nothing to Disclose
Yingda Xia (*Abstract Co-Author*) Nothing to Disclose
Dakai Jin, MS (*Abstract Co-Author*) Nothing to Disclose

Wei Zhu, PhD (*Abstract Co-Author*) Nothing to Disclose
Vince Zhu (*Abstract Co-Author*) Nothing to Disclose
Dazhou Guo (*Abstract Co-Author*) Nothing to Disclose
Zhanghexuan Ji, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

Deep segmentation networks achieve high performance when trained on specific datasets. However, in clinical practice, patient privacy and data storage constraints often require that pretrained models are capable of adapting dynamically, allowing for the segmentation of new organs without access to the previous training datasets. This clinically preferred process can be viewed as a continual semantic segmentation (CSS) problem, which is a non-trivial task and understudied in medical imaging. Previous CSS works would either experience catastrophic forgetting or lead to unaffordable memory costs as models expand. In this study, we introduce a novel continual whole-body organ segmentation model using a lightweight low-rank adaptation mechanism (LoRA), which effectively segments 121 organs without catastrophic forgetting and meanwhile maintaining a low parameter increasing rate (PIR).

## METHODS AND MATERIALS

For the model development and validation, we train a 3D Pyramid Vision Transformer (PVT) based segmentation model on the public TotalSegmentator dataset (1204 CTs with 103 labeled organs). Subsequently, for each new learning task, we freeze the already trained network parameters and introduce additional lightweight trainable LoRA parameters to continually segment new chest organs (9 organs, 153 CTs), new head-neck organs (9 organs, 244 CTs), and tumorous esophageal (567 CTs) over three in-house datasets. In each continual step, trainable LoRA parameters are incorporated into the patch-embedding, multi-head attention, and feed-forward layers. For validation, 20% of each dataset is reserved as test set. We report the Dice score (DSC) and 95% Hausdorff Distance (HD95) as evaluation metrics.

## RESULTS

Our proposed model exhibits segmentation performance comparable to the PVT model separately developed on each dataset (achieving an average DSC of 89.3% and HD95 of 4.2mm), while only requiring about 29% of the parameters. Other CSS models either experience catastrophic forgetting (yielding very low performance, e.g., (25% DSC for [PLOP, MiB] and 40% for [LISMO]) or have exploding PIR (32% for [SUN]). In comparison, our model avoids the knowledge forgetting (segmentation performance very similar to the upper bound) and meanwhile has the PIR of only 5.6%.

## CONCLUSION

We develop a lightweight LoRA-based continual whole-body organ segmentation model that accurately and efficiently segments 121 organs across different body parts. This method prevents catastrophic forgetting while maintaining high segmentation performance with minimal parameter growth.

## CLINICAL RELEVANCE/APPLICATION

Our model may reduce the time cost and inter-user variation in clinician's daily practice, where delineation or measurement of organs and lesions are required.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T7-SSRO03

**Radiation Oncology (Gastrointestinal)**

Tuesday, Dec. 3 3:00PM - 4:00PM Room: S401

Anna Shapiro, MD (*Moderator*) Nothing to Disclose
Thomas Kim, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T7-SSRO03-2 RECTAL-SAM:FULLY BIMODAL RECTAL TUMOR SEGMENTATION USING LARGE SEGMENTATION MODEL AND POTENTIAL ANALYSIS OF MAGNETIC RESONANCE RADIOMICS FEATURES ON PRE-NCRT AND POST-NCRT

Shaojun Xia (*Abstract Co-Author*) Nothing to Disclose
Ying-shi Sun, PhD (*Abstract Co-Author*) Nothing to Disclose
Xiao-Ting Li (*Abstract Co-Author*) Nothing to Disclose
Qingyang Li (*Abstract Co-Author*) Nothing to Disclose
Jiaqi Wu (*Abstract Co-Author*) Nothing to Disclose
Xiao-Yan Zhang (*Abstract Co-Author*) Nothing to Disclose
Yan-jie Shi (*Abstract Co-Author*) Nothing to Disclose
Wang Zhinan, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The optimal treatment for locally advanced rectal cancer (LARC) involves neoadjuvant chemoradiotherapy (nCRT) and total mesorectal excision (TME). Fully automated image segmentation models help to reduce the workload of radiologists, and the extraction of radiomics features helps to understand and quantify the image feature information. In this study, we first utilized a large segmentation model to segment pre- and post-nCRT bimodal images and validated the radiomics extraction efficacy of the model.

### METHODS AND MATERIALS

Totally 378 patients diagnosed with LARC who underwent pelvic MRI examinations consisting of pre- and post-nCRT T2-weighted imaging (T2WI) and the logarithmic form of diffusion-weighted signal at a b value of 1000 sec/mm2 [DWI (logb1000)]. Four types of MRI images were input into MedSAM for segmentation. Specifically, the network architecture primarily consisted of an image encoder, followed by an image embedding module, a prompt encoder, and a mask decoder. Radiomics features (First order and Shape) were extracted from the segmented resultant images.

### RESULTS

The mean Dice coefficient and correlation coefficient R for pre-nCRT T2WI were 0.74, 0.808 (First order) and 0.876 (Shape). For post-nCRT T2WI, these values were 0.66, 0.768 (First order), and 0.866 (Shape). For pre-nCRT DWI (logb1000), these values were 0.67, 0.525 (First order), and 0.864 (Shape). For post-nCRT DWI (logb1000), these values were 0.46, 0.606 (First order), and 0.545 (Shape).

### CONCLUSION

This approach shows that the large model has a stabilizing effect on segmenting the four types of images. The first-order and shape radiomics features extracted from the model-based tumor segmentation exhibit robustness and reproducibility.

### CLINICAL RELEVANCE/APPLICATION

The model shows promise as a tool for accurately assessing tumor downstaging and achieving pathological complete remission (pCR). Additionally, it can form the basis for reducing the need for manual delineation.

## T7-SSRO03-3 BASED ON SPECTRAL CT DERIVED EXTRACELLULAR VOLUME FOR THE PREDICTION OF POST-RESECTION HEPATIC METASTASIS IN PATIENTS WITH GASTRIC ADENOCARCINOMA

Yang Haiting, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to develop a model based on extracellular volume (ECV) derived from computed tomography (CT) for predicting post-resection hepatic metastasis in patients with gastric adenocarcinoma.

### METHODS AND MATERIALS

We retrospectively collected 78 patients with confirmed gastric cancer in our hospital, and divided them into hepatic metastasis group (HM group,22 case) and non-metastatic group (NM group, 46 case) according to follow-up results. We recorded the age, sex,differentiation grade, Borrmann type, Lauren type, Tumor sites, Neurovascular invasion, tumor market lever(AFP,CA199, CA125, CEA, CA724), Surgical procedures (distal gastrectomy, proximal

gastrectomy, total gastrectomy), Postoperative adjuvant chemotherapy, erythrocyte volume in blood routine; We recorded the patient's CT-based TN stage, the spectral curve (?HU), iodine concentration(IC), normalized IC (NIC), effective atomic number (Zeff) of the tumor.The ECV fraction was calculated using the following equation : ECV fraction (%) = (1 - hematocrit) × (IDtumor/IDartery) × 100. In addition, We used two-independent sample T-test, Chi-square analysis and binary logistic regression for analysis.The statistical significance levels were all set as 0.05 with two-sided tests.

**RESULTS**

CT-derived ECV had a strong correlation with post-resection hepatic metastasis ($p = 0.002$). The HM group showed significantly higher CT-based TN stage,nerovascular invasion,levels of Cancer antigen125 (CA125), Cancer antigen724 (CA724), and IC,nIC in the delayed phase (DP) than the NM group ($p < 0.05$). Binary logistic regression was then used for further analysis, and the results showed the significance regression coefficients of the CT-based N stage and ECV were all < 0.05. Finally, the prediction probability of the binary logistic regression was made as ROC curve, which was displayedThe mixed model that combined ECV with CT-based N stage achieved an AUC of 0.835 (95% confidence interval (CI) = 0.725 - 0.914).

**CONCLUSION**

The mixed model that combined ECV with CT-based N stage contributes to the preoperative prediction of post-resection hepatic metastasis in patients with gastric adenocarcinoma.

**CLINICAL RELEVANCE/APPLICATION**

This study may help to explore energy spectrum information, combine ECV fraction, collect the risk characteristics of liver metastasis of gastric cancer, and establish a more effective and convenient prediction method to accurately predict the risk of liver metastasis at an early stage, so as to guide the individualized treatment of patients with gastric cancer and improve the survival benefits of patients.

## T7-SSRO03-5 IODINE QUANTIFICATION AND LI-RADS CLASSIFICATION IN SPECTRAL COMPUTED TOMOGRAPHY OF HEPATOCELLULAR CARCINOMA

Alessandro Barbaro (*Abstract Co-Author*) Nothing to Disclose
Paolo Marra, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Celestino, MD (*Abstract Co-Author*) Nothing to Disclose
Sandro Sironi, MD (*Abstract Co-Author*) Nothing to Disclose
Pietro A. Bonaffini, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The LI-RADS classification is widely adopted as a valid tool for evaluating nodules of hepatocellular carcinoma (HCC), although it’s based on a qualitative evaluation. This study aims to investigate the potential role of a quantitative assessment for HCC characterization, by using material density (MD) parameters of spectral computed tomography (SCT).

**METHODS AND MATERIALS**

Dual-energy SCT scans of nodules in cirrhotic patients between March 2022 and September 2023 were retrospectively reviewed. All the nodules were classified as LI-RADS 3, LI-RADS 4 or LI-RADS 5. MD maps were generated in the hepatic arterial phase (HAP) and in the portal venous phase (PVP). In each of the SCT phases iodine concentration density (ICD) was measured within a ROI placed in a homogeneously enhancing portion of the nodules (ICDnodule) and within a ROI placed in the non-nodular liver parenchyma (ICDliver). Lesion-to-normal liver ICD ratio (LNR) was calculated in the two different phases and compared.

**RESULTS**

A total of 69 patients were included (age 67 years ± 10 years, mean ± SD). 197 nodules (size 24.67 ± 23.11 mm, mean ± SD) were examined in 79 DECT exams, categorized under different LI-RADS classes as follows: 44 nodules as LI-RADS 3 (22.34%), 14 as LI-RADS 4 (7.11%), and 139 as LI-RADS 5 (70.56%). MD parameters on HAP, PVP and DP and the nodule difference in ICD could discriminate LI-RADS 3 nodules from LI-RADS 4 and LI-RADS 5 nodules ($p<0.05$). In particular, the median value of LNR in HAP was respectively 1.61 for LI-RADS 3, 1.91 for LI-RADS 4 and 2.29 for LI-RADS 5, while the LNR between HAP and PVP was respectively 1.76 for LI-RADS 3, 2.41 for LI-RADS 4 and 2.55 for LI-RADS 5.

**CONCLUSION**

MD parameters of HCC nodules measured in SCT scans of cirrhotic patients may be viable diagnostic tools to increase the radiologists’ confidence in LI-RADS class allocation.

**CLINICAL RELEVANCE/APPLICATION**

Quantification of iodine concentration of HCC in cirrhotic livers may support the diagnosis of HCC with potential value in prognostication and treatment response assessment.

## T7-SSRO03-6 HEPATOCELLULAR CARCINOMA BURDEN AND CYBERKNIFE ROBOTIC RADIOSURGERY: INVALUABLE INSIGHT FROM LMIC

Shaista Shoukat, MBBS (*Abstract Co-Author*) Nothing to Disclose
Kamran Saeed V, BMBS,DMRD (*Abstract Co-Author*) Nothing to Disclose
Urooj Kanwal, DMRD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Afnan SHOUKAT (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine the clinical and radiological treatment response on follow up imaging in post stereotactic body radiation therapy (SBRT) treated hepatocellular carcinoma (HCC) patients with contrast enhanced cross-sectional imaging in low and middle income countries.

**METHODS AND MATERIALS**

This prospective observational study was conducted at the department of radiology and cyber-knife robotic radiosurgery, JPMC Karachi from January 2019 to January 2023 of histologically proven HCC patients who treated with SBRT patients of either gender who presented with histological confirmation of HCC, child-pugh score of A or low B, those who were not the ideal candidates for surgical resection and the disease confined to liver were consecutively enrolled. Imaging and clinical assessment for treatment response were recorded at every follow up at three months, six months and after a year post-treatment and compared with baseline investigations. Radiological assessment was done by observing pattern of arterial phase enhancement on CECT performed with tri-phasic protocol while clinically ECOG performance, child-pugh scoring and platelet counts were monitored.

## RESULTS

All patients remain healthy and alive at 3 months, at 1year interval 51.5% (28) showed CR (complete response) with tumor volume reduction and lack of thick lobulated enhancement, 30% (20) showed PR (partial response) and remain stable with intra-tumoral necrosis, 5% (3) showed PD (progressive disease) radiologically. Among PD, patients showed up with >20% enhancement of already treated lesion on follow-up. Clinically, 61% (32) patients remain stable with ECOG performance level < 2, child-pugh score maintained at A or low B and platelet count near the baseline values, 30% (16) showed improvement with ECOG performance level 0 and improved platelet count while 5% (3) deteriorated showed up with high child pugh score and ECOG level >2.

## CONCLUSION

SBRT is a promising modality with least treatment related toxicity and CECT remains a standard imaging technique for response evaluation.

## CLINICAL RELEVANCE/APPLICATION

SBRT is emerging treatment option for various carcinomas one of which is hepatocellular carcinoma as well. Its main benefit is delivery of maximum radiation dose to the target lesion without local spread of disease, hence minimizing dose to adjacent organs without significant adverse effects.Key words: SBRT ( stereotactic body radiation therapy), HCC (hepatocellular carcinoma), CECT (contrast enhanced computed tomography), LMIC (low and middle income countries).

# Abstract Archives of the RSNA, 2024

T7-STCE1

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Tuesday, Dec. 3 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## T7-STCE1-2 RAPID MRI FOR APPENDICITIS IN PEDIATRIC PATIENTS CAN STREAMLINE WORKFLOW AND DECREASE PROVIDER COST

Shireen Hayatghaibi, PhD, MPH (*Abstract Co-Author*) Nothing to Disclose
Andrew T. Trout, MD (*Abstract Co-Author*) Author, RELX Author, Wolters Kluwer nv Research Grant, Canon Medical Systems Corporation Research Grant, Siemens AG Research support, Perspectum Diagnostics Ltd Consultant, Lantheus Holdings
Pradipta Debnath, MD (*Abstract Co-Author*) Nothing to Disclose
Rama S. Ayyala, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Use of MRI for appendicitis is increasing in the pediatric ED and this rapid exam can streamline workflow. Studies have shown MRI can be cost-effective for appendicitis if the associated charge is decreased. Our purpose is to highlight a single institution experience implementing rapid MRI for appendicitis in the ED and to model the associated cost.

### METHODS AND MATERIALS

In April 2021, MRI was introduced at our institution for second-line imaging after equivocal US. A three sequence, free breathing, non-contrast MRI is now routinely utilized for patients > 6 years old. For the period Dec 2022-Jun 2023, scan times (1st image to last image acquired) and diagnostic accuracy was calculated. A time-based driven activity cost (TDABC) analysis was performed to characterize the cost of rapid MRI for appendicitis relative to MRI exams that correspond to billing codes that are typically billed for MRI appendicitis (MRI pelvis w/o IV contrast, MRI abdomen/pelvis w/o IV contrast, and MRI abdomen/pelvis w/ IV contrast). Process maps were created by direct shadowing of exams (10 MRI appendicitis, 2 MRI pelvis, 8 MRI abdomen/pelvis). Additional information for 327 MRI exams was collected from the medical record. Practical capacity costs rates for personnel, equipment and facilities were calculated and combined with the mean duration of each step to generate a total cost for each MRI exam.

### RESULTS

369 MRI appendicitis exams were performed. The median scan duration was 5 minutes (range: 3-26). The sensitivity and specificity of MRI for diagnosis of appendicitis is 95% and 99% with positive predictive value 91% and negative predictive value 99%. The mean duration and provider costs for the compared MRI exams were: MRI appendicitis: 11 min, $20.03; MRI pelvis w/o IV contrast: 55 min, $105.99; MRI abdomen/pelvis w/o IV contrast: 65 min, $144.83; MRI abdomen/pelvis w/ IV contrast: 128 min, $236.99.

### CONCLUSION

Rapid MRI allows for quick and accurate diagnosis of appendicitis in the ED. Rapid appendicitis MRI has lower associated provider costs than other MRI exams billed with the same codes suggesting need for unique billing codes to allow implementation targeted at streamlining workflow.

### CLINICAL RELEVANCE/APPLICATION

With increasing utilization of rapid MRI for appendicitis in the emergent setting, it is important to collectively assess the impact of cost to the institution and the patient, the diagnostic accuracy of the exam, and the potential workflow improvements. This study does this and shows that a smarter, effective strategy for billing needs to be considered.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

T7-STCE2

**Science Session (Theranostics)**

Tuesday, Dec. 3 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## T7-STCE2-2 THERANOSTICS IN THE COMMUNITY SETTING: ARE 177LU PSMA-617 TRIAL OUTCOMES APPLICABLE? YES, NO, AND MAYBE SO

James Cassuto (*Abstract Co-Author*) Nothing to Disclose
Emily R. Convery, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Compare early outcomes of a community hospital based Lu177-PSMA-617 program to those reported in landmark clinical trials.

### METHODS AND MATERIALS

Retrospective analysis of patients treated with Lu177-PSMA -617 (n=25) in a north-east USA community hospital between 10/2023 and 7/2024. Clinical and imaging therapy inclusion criteria and early outcomes were compared to those of select large and/or well know clinical trials in publication, including the VISION, TheraP, and LuPSMA trials.

### RESULTS

All patients met criteria for treatment according to the FDA Prescribing Information document. PSMA PET positive criteria was met by 100% of patients when compared to the VISION and LuPSMA trials, but only 28% compared to the TheraP trial. Twenty-eight percent of patients met PSMA PET negative exclusion criteria for the VISION trial. FDG PET was not used in patient evaluations, an inclusion requirement for TheraP and LuPSMA trials. Overall, 48% of patients met total body high PSMA SUV mean criteria, compared to 100% for trial populations. Except for death, treatment termination based on disease progression and persistent grade 3-5 adverse events were similar between study patients and those in the trials. Twenty-four percent of study patients died during treatment, or soon after terminating treatment, with 83% of these patients having received only 1 or 2 doses of therapy. These deaths only occurred during the first 5-months of the program. This is compared to study data where 7.7% of VISION trial patients died during therapy.

### CONCLUSION

Theranostic outcomes in the community hospital setting have the potential to be like trial data for patients fortunate enough to present for treatment while still meeting strict inclusion criteria. Despite many community patients presenting with more advanced and dedifferentiated disease when compared to trial populations, palliative and reduced side effect benefits of treating with Lu177-PSMA-617 persist (as reported in literature). Accordingly, it will be necessary to 1) Temper expectations for patients treated outside of trial selection criteria and 2) Educate referring physicians about the utility of incorporating nuclear medicine therapies earlier in their treatment plans to meet trial survival outcomes.

### CLINICAL RELEVANCE/APPLICATION

177Lu PSMA has been shown to significantly improve survival in patients with metastatic castration resistant prostate cancer when treatment is performed under ideal circumstances. However, ideal circumstances are not the norm in the community setting. Further research and targeted education is needed to help maximize theranostics outcomes in real world community settings and to support the delivery of this new and innovative care to these patients.

# Abstract Archives of the RSNA, 2024

T8-SSNMMI04

**Nuclear Medicine and Molecular Imaging (Breast Cancer)**

Tuesday, Dec. 3 4:30PM - 5:30PM Room: S405

Esma A. Akin, MD (*Moderator*) Nothing to Disclose
Elizabeth H. Dibble, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## T8-SSNMMI04-2 THE UTILITY OF HIGH-RESOLUTION SEMICONDUCTOR PET/CT IN THE ASSESSMENT OF BREAST CANCER EXTENT: COMPARISON WITH MR IMAGING

Rika Yoshida, MD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshizako, MD (*Abstract Co-Author*) Nothing to Disclose
Yasushi Kaji, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akina Miyamoto (*Presenter*) Nothing to Disclose

### PURPOSE

To retrospectively compare the usefulness of high-resolution semiconductor PET/CT (WB-SiPM-PET/CT) in prone position with MRI in diagnosing the extent of breast cancer.

### METHODS AND MATERIALS

76 patients with 82 breast cancers underwent WB-SiPM-PET/CT in prone position and dynamic MRI preoperatively without chemotherapy between September 2020 and November 2022. The lesions were histopathologically confirmed as breast cancer. Based on the PET accumulation values (SUVmean and standard deviation [SD]) of normal breast tissue, four tumor thresholds (SUVmean+2SD, SUVmean+3SD, 1.5SUVmean+2SD, 1.5SUVmean+3SD) were set and tumor sizes were measured semi-automatically for each threshold. The pathological size (invasive tumor and extensive intraductal components) was compared with MRI size and the four SUV thresholds sizes in relation to menopausal status and Ki-67.

### RESULTS

MRI successfully depicted all lesions, while WB-SiPM-PET/CT failed to visualize one lesion(a ductal carcinoma in situ of 6mm). There was a significant difference in the average SUVmean of normal breast tissue between premenopausal (0.865) and postmenopausal (0.767) patients ($p=0.029$). No significant differences were observed between MRI and the 1.5SUVmean+2SD or 1.5SUVmean+3SD thresholds in terms of imaging size / pathological size. All imaging size by MRI and the four SUV thresholds showed a strong correlation (the correlation coefficient > 0.6) with pathological size. The proportion of pathological size errors within 25% (pathological concordance rate) was highest for the 1.5SUVmean+2SD threshold among four thresholds, which was comparable to MRI. Especially, the percentage of pathological concordance rate of 1.5SUVmean+2SD was highest (68.2%, $p <0.05$) in premenopausal patients, while postmenopausal patients favored MRI (55.9%). In the low (=20%) Ki-67 group, the proportion of pathological concordance rate was low (3-50%) for all imaging. In the high (>21%) Ki-67 group, MRI (69.2%) and 1.5 SUVmean + 2SD (61.5%) showed high proportion of pathological concordance rate.

### CONCLUSION

The 1.5SUVmean+2SD threshold of WB-SiPM-PET/CT in breast cancer extent assessment exhibited diagnostic performance equivalent to MRI. The threshold was particularly useful in premenopausal patients, while MRI excelled in postmenopausal patients. The detection rates were low for all imaging in the low (=20%) Ki-67 group.

### CLINICAL RELEVANCE/APPLICATION

The 1.5SUVmean+2SD threshold of WB-SiPM-PET/CT in breast cancer extent assessment exhibited diagnostic performance equivalent to MRI. The threshold was particularly useful in premenopausal patients, while MRI excelled in postmenopausal patients. The detection rates were low for all imaging in the low (=20%) Ki-67 group.

## T8-SSNMMI04-4 PROSPECTIVE EVALUATION OF 18F-FLUOROESTRADIOL PET-CT FOR STAGING INVASIVE LOBULAR CARCINOMA

Samantha Salmon, MD (*Abstract Co-Author*) Nothing to Disclose
Sam Mitchell (*Abstract Co-Author*) Nothing to Disclose
Sophie Stolk (*Abstract Co-Author*) Nothing to Disclose
Jeffrey T. Yap, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrew Kozlov, MD (*Abstract Co-Author*) Nothing to Disclose
Brandon Buckway (*Abstract Co-Author*) Nothing to Disclose
Zane Archibald (*Abstract Co-Author*) Nothing to Disclose
Regan Butterfield (*Abstract Co-Author*) Nothing to Disclose
Matthew Covington, MD (*Presenter*) Consultant, inviCRO, LLC

**PURPOSE**

Invasive lobular carcinoma (ILC) often poses challenges in detection with standard imaging including staging with CT, bone scan, and FDG-PET/CT. Considering that approximately 95% of ILC cases are estrogen receptor (ER) positive, the use of 18F-Fluoroestradiol-PET/CT (FES-PET/CT) for ER imaging could potentially enhance ILC detection. This study aims to determine the frequency of change in clinical staging for ILC when using FES-PET/CT. The primary endpoint is that FES-PET/CT will change clinical staging in at least 20% of patients, compared to standard of care imaging.

**METHODS AND MATERIALS**

This study is both IND and IRB approved. The analysis presented is based on data collected mid-way through study enrollment. We enrolled patients with biopsy-proven primary or locoregional ILC. FES-PET/CT was performed on all patients. Additionally, an optional FDG-PET/CT scan was offered if not already been performed within 4 weeks of enrollment. We documented positive sites of uptake using FES-PET/CT and, if available, FDG-PET/CT. We compared the AJCC clinical stage between the standard of care imaging assessment and FES-PET/CT.

**RESULTS**

FES-PET/CT was performed on 21 patients. A positive shift in clinical staging, according to the AJCC 8th edition, was noted in 29% (6 out of 21) of cases. In three instances (14%, 3/21), FES-PET/CT revealed unexpected distant metastatic disease in two patients with clinical stage 2A disease and another patient with stage 3A disease, subsequently confirmed through additional imaging or biopsy. All three had concurrent FDG-PET/CT that did not indicate stage IV disease. In two separate cases, FES-PET/CT detected axillary metastatic disease in patients who showed no abnormalities in axillary lymph nodes based on standard imaging. In one case, FES-PET/CT showed more axillary disease than was seen on MRI and ultrasound, upstaging from Stage 3A to 3C. A false negative assessment of axillary lymph nodes in pathologic staging was observed in 24% (5 out of 21). All five involved small nodal metastases identified on sentinel lymph node biopsy with no abnormal axillary FES uptake.

**CONCLUSION**

The preliminary mid-study analysis suggests FES-PET/CT may detect unsuspected stage IV disease in patients compared to standard imaging. However, it was unable to identify multiple metastatic axillary lymph nodes in comparison to sentinel lymph node biopsy. The mid-study analysis indicates a positive shift in clinical staging in up to 29% of cases, suggesting the primary study endpoint will be met..

**CLINICAL RELEVANCE/APPLICATION**

FES-PET/CT could benefit ILC staging by accurately upstaging disease. However, it may fail to detect metastatic axillary lymph nodes identifiable on sentinel node biopsy.

## T8-SSNMMI04-5 IRISIN-LOADED NANOPARTICLES ENHANCE ANTIGEN PRESENTATION TO OVERCOME TRIPLE-NEGATIVE BREAST CANCER RESISTANCE TO APD-1 THERAPY

Yufei Zhao, PhD (*Abstract Co-Author*) Nothing to Disclose
Xin-Gui Peng, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Xingzhe Tang (*Presenter*) Nothing to Disclose

**PURPOSE**

The efficacy of aPD-1 in treating triple-negative breast cancer (TNBC) is hindered by multiple factors, including disruption of antigen presentation. The lipid-rich TNBC microenvironment contributes to immune evasion by inhibiting activation of cyclic GMP-AMP synthase-stimulator of interferon genes (cGAS-STING) pathway in tumor cells, resulting in downregulation of major histocompatibility complex class I (MHC I) expression and consequential impaired antigen presentation. Irisin is a hormone involved in lipid metabolism regulation. But systemic administration of irisin might induce cachexia. Therefore, we aim to develop an Irisin-loaded nanoparticle to modulate tumor lipid metabolism disorder, enhance antigen presentation, thereby overcome TNBC resistance to aPD-1.

**METHODS AND MATERIALS**

Manganese oxide hybridized mesoporous organosilica nanoparticles (MMONs) are synthesized, subsequently, Irisin and Cy5.5 are loaded to yield MMONs-Irisin (MMOI) and MMOI-Cy5.5. To validate inhibitory effect of high-lipid microenvironment on antigen presentation and the capacity of MMOI to enhance antigen presentation, co-culture experiments involving 4T1 cells (representative TNBC cells), white adipocytes, and bone marrow derived dendritic cells (BMDC) are performed(Figure S1), and intervened with MMOI. Activation of cGAS-STING pathway and biomarkers associated with antigen presentation are evaluated. To evaluate the therapeutic efficacy of MMOI to TNBC, TNBC mice are established and intravenously administered with MMOI combined with aPD-1. The near-infrared imaging properties of MMOI-Cy5.5 allow for the evaluation of MMOI accumulation in tumor using an in vivo imager. Tumor volume is monitored over time and flow cytometric analysis of tumor-infiltrating T cells is conducted.

**RESULTS**

MMOI exhibits quasi-spherical morphology (Figure S2) with particle size of 152 ± 2.4 nm (Figure S3). Notably, MMOI activates cGAS-STING pathway in 4T1 cells (Figure S4), leading to significant upregulation of MHC I expression (Figure S5). Furthermore, MMOI promotes the maturation of BMDC co-cultured with 4T1 cells (Figure S6). Overall, MMOI enhances antigen presentation. In vivo near-infrared imaging demonstrates MMOI accumulates in tumor 6h post-injection (Figure S7). Compared to aPD-1 monotherapy, combined MMOI with aPD-1 significantly suppresses tumor growth (Figure S8), facilitates massive expansion of tumor-infiltrating effector T cells, and enhances tumor-killing capacity of CD8+ T cells (Figure S9).

**CONCLUSION**

MMOI effectively overcomes TNBC resistance to aPD-1 therapy and substantially enhances therapeutic efficacy.

**CLINICAL RELEVANCE/APPLICATION**

This study is relevant to the field of Nuclear Medicine Molecular Imaging.

# Abstract Archives of the RSNA, 2024

W1-SSMS03

**Multisystem (Advanced Automatic Technology and Whole Body MRI in Oncologic Imaging)**

Wednesday, Dec. 4 8:00AM - 9:00AM Room: S401

Faezeh Sodagari, MD (*Moderator*) Nothing to Disclose
Ajay Malhotra, MD, MMM (*Moderator*) Nothing to Disclose

**Sub-Events**

## W1-SSMS03-1 DELINEATING PSMA HETEROGENEITY IN ADVANCED PROSTATE CANCER IMAGING: COMPARATIVE ANALYSIS OF WHOLE-BODY MRI AND PSMA PET/CT

Dow-Mu Koh, FRCR (*Abstract Co-Author*) Nothing to Disclose
Nina Tunariu, MD (*Abstract Co-Author*) Nothing to Disclose
Nabil Hujairi, MBBS (*Abstract Co-Author*) Nothing to Disclose
Giacomo Avesani, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Bottazzi, MD (*Abstract Co-Author*) Nothing to Disclose
Arrigo Cattabriga (*Abstract Co-Author*) Nothing to Disclose
Evis Sala, MD, PhD (*Abstract Co-Author*) Co-founder, Lucida Medical Ltd
Nuria Porta (*Abstract Co-Author*) Nothing to Disclose
Christina Messiou, MD, BMBS (*Abstract Co-Author*) I am a co-founder of Diafora (alongside the Institute of Cancer Research and The Royal Marsden) that has formed a joint venture, Celescan, with Sopra Steria
Brent E. Drake, MBBCh, MRCS (*Abstract Co-Author*) Nothing to Disclose
Samuel J. Withey, MBBS (*Abstract Co-Author*) Nothing to Disclose
Luca Russo, MD (*Presenter*) Grant, Elekta AB

### PURPOSE

To investigate the heterogeneity of prostate-specific membrane antigen (PSMA) expression in advanced prostate cancer using paired whole-body MRI (WB-MRI) and PSMA PET/CT.

### METHODS AND MATERIALS

Patients with advanced prostate cancer (APC) treated at one Institution between January 2017 and February 2024 who underwent both PSMA PET/CT and WB-MRI within a 30-day interval were included in this retrospective observational study. Image analyses were conducted by a consensus of paired experienced radiologist and nuclear medicine specialists. PSMA heterogeneity was defined as active lesions visible on MRI but show no PSMA uptake. Twenty-four potential sites were defined: 9 nodal stations, lung, liver, adrenal, prostate tumour, 10 bone sites and other. Each site of disease was categorised based on concordance between PSMA uptake and presence of active lesion on WB-MRI: complete agreement (same lesion count per site on both modalities), partial/no agreement (discrepancy in lesion count). Discrepancies arising from urinary uptake (PET), artefacts and subcentimetre nodes (affecting MRI diagnosis) were recorded.

### RESULTS

One hundred-seventeen patients were included, with a total of 170 metastatic sites. PSMA heterogeneity was observed in 16.2% of patients (19/117), encompassing 31.8% of metastatic sites (54/170). They were bone (63.0%; 34/54 sites), lymph nodes (16.7%; 9/54 sites), liver (13.0%; 7/54 sites), prostate tumour (5.5%; 3/54 sites) and intramuscular nodule in 1 case (1.8%). PSMA PET/CT failed to depict lesions in 3 cases (two local tumours and one bladder wall lesion), due to physiological uptake in the bladder masking these sites. Discrepancies leading to missed lesions on MRI were noted in 17.9% of patients (21/117), mostly due to subcentimetre nodes: mediastinal (8 cases), retroperitoneal (4 cases), pelvic and hilar nodes (3 cases).

### CONCLUSION

PSMA heterogeneity occurs throughout the body, especially in bone. Hence, using WBMRI -alone or together with PSMA PET/CT- can better define the presence of disease at all sites and provide deeper insight into tumour biology.

### CLINICAL RELEVANCE/APPLICATION

The PSMA heterogeneity in APC leads to suboptimal metastatic disease evaluation when relying solely on PSMA PET/CT, especially in bones. Awareness of these findings can contribute to a personalised diagnostic and therapeutic approach, tailored according to the prostate tumour imaging phenotype.

## W1-SSMS03-2 DIAGNOSTIC VALUE WHOLE-BODY MAGNETIC RESONANCE IMAGING (WBMRI) SHORT PROTOCOLS CAN BE USEFUL IN MULTIPLE MYELOMA PATIENTS

Teresa P. Giandola, MD (*Abstract Co-Author*) Nothing to Disclose
Davide Ippolito, MD (*Abstract Co-Author*) Nothing to Disclose
Paolo N. Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Cesare Maino, MD (*Abstract Co-Author*) Nothing to Disclose

Davide G. Gandola, MD (*Abstract Co-Author*) Nothing to Disclose
Cammillo R. Talei Franzesi (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the effectiveness and accuracy of whole-body magnetic resonance imaging (WBMRI) short protocols for the overall assessment of bone marrow involvement in patients with multiple myeloma (MM), in comparison with standard whole-body MRI protocol.

**METHODS AND MATERIALS**

Sixty-four patients with biopsy-proven MM, who underwent an WBMRI with full body coverage (from vertex to feet) were retrospectively enrolled. WBMRI images were independently evaluated, by two expert radiologists. After identifying the infiltration pattern (normal, focal, diffuse and combined), the whole skeleton was divided into six anatomic districts: skull, spine, sternum and ribs, upper limbs, pelvis and proximal two-third of femur, remaining parts of lower limbs, and patients were grouped according to number(< 5, 5-20, and > 20) and location of the lesions.

**RESULTS**

Most of patients showed a focal (59%) and combined (33%) infiltration patterns with lytic lesions predominantly distributed in the spine (82%) and pelvis (67%). Locations less frequently involved by focal bone lesions were skull and lower limbs (12%, respectively). Excluding both the anatomic regions mentioned before from the standard MRI protocol, a short MRI protocol with a shorter execution time (saving about 14 minutes) could be obtained, maintaining a good sensitivity (89.9%), specificity (66.7%) and diagnostic accuracy (AUROC=0.881; 95%CIs: 0.797-0.965).

**CONCLUSION**

MRI short protocols could be proposed as an effective and reliable approach to reduce the examination time preserving a high diagnostic accuracy.

**CLINICAL RELEVANCE/APPLICATION**

WBMRI for MM evaluation can be more focused on the main involved districts, especially to reduce acquisition time without reducing the diagnostic accuracy

## W1-SSMS03-3 EXTRAMEDULLARY DISEASE AND CONCURRENT CANCER ON WHOLE-BODY MRI OF NEWLY DIAGNOSED MULTIPLE MYELOMA

Vicky J. Goh, MBBChir, FRCR (*Abstract Co-Author*) Research Grant, Siemens AG
Sarah Natas, BSc, FRCR (*Abstract Co-Author*) Nothing to Disclose
Andrew Refalo, BSc, MBChB (*Abstract Co-Author*) Nothing to Disclose
Olwen A. Westerland, MBBS (*Abstract Co-Author*) Nothing to Disclose
Matthew Streetly, MRCP,PhD (*Abstract Co-Author*) Nothing to Disclose
Roberta Dunn (*Presenter*) Nothing to Disclose

**PURPOSE**

The presence of extramedullary disease (EMD) and concurrent cancer affect the management of newly diagnosed myeloma. With more sensitive imaging including whole-body MRI and 18F-FDG PET/CT, detection may be higher than reported historically. This retrospective study aimed to assess the incidence of EMD and concurrent cancer in newly diagnosed myeloma on whole-body MRI and to compare this with 18F-FDG PET/CT in a subset of patients who had both imaging tests.

**METHODS AND MATERIALS**

Patients with newly diagnosed myeloma who underwent whole-body MRI (diffusion-weighted, T2-weighted, pre- and post-gadolinium T1-weighted sequences) between January 2014 and 2024 were included. MRI was assessed by two readers in consensus and 18F-FDG PET/CT by a single reader as per institutional practice. EMD (from hematogenous spread to organs and/or extension through the bone cortex), concurrent cancer, and site(s) of involvement were recorded for each modality. Tumor board review served as the reference standard. Clinicopathological findings were collated from the institutional electronic health records. Kaplan-Meier survival analysis was undertaken.

**RESULTS**

172 newly diagnosed myeloma patients were included (93 male; mean age 69 ± 12 years). 19/172 (11%) were classified as having EMD: 7/172 patients (4%) had EMD from hematogenous spread. The most common sites of EMD were lymph nodes (4), muscle (2), liver (2), spleen (1) and thyroid cartilage (1). 13/172 (8%) had a concurrent malignancy. There was 1 hematological (plasmablastic lymphoma) and 12 solid malignancies: prostate (n=4), melanoma (n=2), laryngeal (n=2), breast (n=1), cecal signet ring cell (n=1), lung (n=1), renal cell (n=1). MRI detected all sites of EMD and concurrent malignancy. 18F-FDG PET/CT (performed in 155/172, 90%) were available for a subset of patients with EMD 18/19 (95%) and concurrent primary malignancy 11/13 (85%). 5/18 (28%) were not classified as having EMD on 18F-FDG PET/CT. Concurrent cancer was identified in 11/11 (100%) patients. Median survival was 54 vs 52 vs 24 months (P=.004) for patients without EMD, with concurrent cancer and EMD, respectively.

**CONCLUSION**

This study provides contemporary data from whole-body MRI ± 18F-FDG PET/CT showing a higher incidence of EMD than historically reported. MRI was more sensitive than 18F-FDG PET/CT for EMD.

**CLINICAL RELEVANCE/APPLICATION**

We have highlighted that MRI is a sensitive modality for EMD, which carries a poorer prognosis. There is a paucity of literature comparing performance of imaging modalities and future work should address this.

## W1-SSMS03-4 A COMPARATIVE PROGNOSTIC ANALYSIS BETWEEN TWO TUMOR BURDEN MEASUREMENTS: TUMOR FRACTION ON LIQUID BIOPSY AND TOTAL TUMOR VOLUME ON CT SCANS IN 1065 METASTATIC PATIENTS

Alexandre Bone (*Abstract Co-Author*) Employee, Guerbet SA
Samy Ammari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Littisha Lawrance (*Abstract Co-Author*) Nothing to Disclose
Nathalie B. Lassau, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lama DAWI, MD (*Abstract Co-Author*) Nothing to Disclose
Antoine Italiano (*Abstract Co-Author*) Nothing to Disclose
Paul-Henry Cournede (*Abstract Co-Author*) Nothing to Disclose
Ghina Jardali, MD (*Abstract Co-Author*) Nothing to Disclose
Jules Dupont (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the usefulness of tumor fraction (TF) of liquid biopsy and total tumor volume (TTV) for predicting overall survival (OS) at baseline in patients with advanced solid tumors, regardless of tumor origin and to compare the prognostic value of these two biomarkers.

**METHODS AND MATERIALS**

This retrospective cohort study enrolled 1065 patients between January 2021 and January 2023. Patients were eligible if they had metastatic solid tumors, regardless of their treatment type or disease stage at enrollment, with a liquid biopsy (LB) and with a chest-abdomen-pelvis CT scan at baseline, with a 90-day interval between CT scan/liquid biopsy and the start of treatment, and a 60-day interval between liquid biopsy and CT scan. TTV indicative of tumor burden in CT scans, was determined by adding the approximate 3D volumes of all lesions, and calculated using the following formula: Tumor volume = 2/3 x Surface x Minor Axis. The surface and minor axis were computed using pyradiomics. Two expert radiologists outlined each lesion on the largest surface on the axial view.Patients were divided into 3 groups for our analyses: first, based on LB: undetectable ctDNA with TF <10%, detectable ctDNA with TF <10% and detectable ctDNA with TF >10%. Each group was further divided based on their TTV. Second, based only on their TTV cutoff values. End-point of the analysis was OS. Analyses were performed using the univariate Cox proportional hazard models and the Kaplan Meier curves were used to visualize the separation between the populations with respect to the cut offs found using the ROC analysis and Youden's Index, and thresholds based on the best AUC for multiclass classification.

**RESULTS**

Among 1065 patients, 556 were selected for whom 31 763 lesions were annotated. Most common histological types were lung (16.2%) and colorectal adenocarcinomas (12.4%). Median OS was 11.24 months and median TTV was 96.87 cm3 (IQR: 240.63). Univariate analyses showed that TTV (p=2.905e-03) and TF (p=1.105e-10) were independent predictors of OS at baseline. TTV was significantly associated with the OS in the 3 patient groups divided according to TTV cut-offs: < 18.7 cm3, 18.7 cm3< TTV < 161.36 cm3, and > 161.36 cm3. High TTV (>161.36 cm3) and high TF (>10%) were independent predictive factor of worse OS (p=2.06e-07) and (p=9.42e-11) respectively. Patients with larger TTV (>161.36 cm3) and high TF (>10%) have shorter OS (6 months) versus those with smaller TTV (<18.7 cm3) and low TF (<10%) who have better OS (22 months).

**CONCLUSION**

Combining TTV and ctDNA stratifies patients well according to their survival at baseline.

**CLINICAL RELEVANCE/APPLICATION**

First study to compare the prognostic efficacy of tumor fraction (TF) with total tumor volume (TTV) in different types of metastatic solid tumors at baseline.

## W1-SSMS03-5 ADVANCED AUTOMATIC BONE MARROW SEGMENTATION AND RADIOMICS-BASED PREDICTION OF MONOCLONAL PROTEIN FOR MULTIPLE MYELOMA IN WHOLE-BODY MRI

Markus Wennmann, MD (*Abstract Co-Author*) Nothing to Disclose
Niels Weinhold, PhD (*Abstract Co-Author*) Nothing to Disclose
Stefan Delorme, MD (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter W. Schlemmer, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG
Peter Neher (*Abstract Co-Author*) Nothing to Disclose
Sandra Sauer, MD (*Abstract Co-Author*) travel grants or honoraria for presentations: Celgene, BMS, Janssen, Takeda and Amgen
Jessica Kaechele (*Abstract Co-Author*) Nothing to Disclose
Marina Hajiyianni (*Abstract Co-Author*) Nothing to Disclose
Tim F. Weber, MD (*Abstract Co-Author*) Research Consultant, Bayer AG
Martin Groezinger (*Abstract Co-Author*) Nothing to Disclose
Marc-Steffen Raab, MD (*Abstract Co-Author*) honoraria: Celgene, BMS, Novartis, Janssen, Takeda; consulting or advisory role: Celgene, BMS, Novartis, Janssen, Takeda; research funding: Celgene, Novartis, AMGEN; travel, accommodations, expenses: Janssen, BMS, Takeda.
Elias Mai (*Abstract Co-Author*) Consultant, Bristol-Myers Squibb Company;Speaker, Bristol-Myers Squibb Company;Research funded, Bristol-Myers Squibb Company;Travel Support, Bristol-Myers Squibb Company;Consultant, GSK plc;Speaker, GSK plc;Research funded, GSK plc;Travel Support, GSK plc;Consultant, Johnson & Johnson;Speaker, Johnson & Johnson;Research funded, Johnson & Johnson;Travel Support, Johnson & Johnson;Consultant, Groupe Sanofi;Speaker, Groupe Sanofi;Research funded, Groupe Sanofi;Travel Support, Groupe Sanofi;Consultant, Stemline Therapeutics, Inc;Speaker, Stemline Therapeutics, Inc;Research funded, Stemline Therapeutics, Inc;Travel Support, Stemline Therapeutics, Inc;Consultant, Takeda Pharmaceutical Company Limited;Speaker, Takeda Pharmaceutical Company Limited;Research funded, Takeda Pharmaceutical Company Limited;Travel Support, Takeda Pharmaceutical Company Limited
Juliane Bernhard (*Abstract Co-Author*) Nothing to Disclose
Hartmut Goldschmidt, MD (*Abstract Co-Author*) Grant, Amgen Inc;Research support, Amgen Inc;Advisory Board, Amgen Inc;Speaker, Amgen Inc;Grant, Bristol-Myers Squibb Company;Research support, Bristol-Myers Squibb Company;Advisory Board, Bristol-Myers Squibb Company;Speaker, Bristol-Myers Squibb Company
Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Fabian Bauer, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To establish an advanced automatic bone marrow (BM) segmentation algorithm with robust performance on multicentric data sets with severe myeloma-related pathologies, and a subsequent radiomics prediction of the monoclonal protein (m-protein) level from whole-body (wb) MRI in multiple myeloma (MM).

**METHODS AND MATERIALS**

The study group comprised 284 datasets of 282 (smoldering) MM patients with wb-MRI performed at 8 different centers. A nnU-Net algorithm was established segmenting 30 individual BM compartments of the vertebra, pelvis, humeri and femora. For this task, 186 T1w wb-MRIs from center 1 were used in the training set. Two test sets included 12 smoldering MM T1w wb-MRIs from center 2 (I) and 9 MM T1w wb-MRIs from center 3-8 (II). The validated segmentation algorithm was then deployed to segment the BM in wb-MRIs of 184 datasets with corresponding information on m-protein, overlapping partly with annotated segmentation datasets. 127 datasets from center 1 were used to train the radiomics model for prediction of m-protein levels, which was tested on an independent test set containing 57 datasets from center 2-7. Features were selected by Maximum Relevance Minimum Redundancy and used to train a Random Forest Regressor. Model optimization and validation was performed using 5-fold cross-validation. The performance of the radiomics model was measured using the Pearson correlation coefficient (r) between predicted values and actual values of serum m-protein. Mean Dice scores were calculated to assess the accuracy of the automatic segmentations on the test sets and compared to an interrater variability reference established within a previous study.

**RESULTS**

The mean Dice score of the individual BM segmentations was 0.89 (test set I) and 0.88 (test set II), compared to the interrater reference of 0.88. The radiomics model predicted the m-protein levels on a multicentric external test set with an r-value of 0.30 and a significant Pearson correlation between predicted and actual m-protein levels on the test set ($p<0.05$).

**CONCLUSION**

The established BM automatic segmentation in wb-MRI showed an accuracy equal to the interrater reference performed by radiologists, even on heterogeneously acquired multicenter data with extensive pathologies. This groundwork can be utilized for further automatic analysis of the individual BM compartments in the future. Additionally, segmented wb-BM contained relevant myeloma-associated information as indicated by the moderate correlation of the radiomics model predictions with the m-protein values.

**CLINICAL RELEVANCE/APPLICATION**

Automatic models capturing the spatial heterogeneity of MM in MRI necessitate precise automatic wb-segmentation models. Subsequent radiomics analysis are capable to inform on tumor load.

## W1-SSMS03-6 AUTOMATIC SEGMENTATION AND LOCALIZATION OF PELVIC AND RETROPERITONEAL LYMPH NODES BASED ON DEEP LEARNING ON CT IMAGES

Yaofeng Zhang (*Abstract Co-Author*) Nothing to Disclose
Kexin Wang (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaodong Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jinpeng Li (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the feasibility of automatic segmentation and localization of pelvic and retroperitoneal LNs by deep learning on CT images.

**METHODS AND MATERIALS**

956 pelvic and abdominal CT PVP scans develop 2 models (LN regions segmentation for model 1, LNs segmentation for model 2). 44 preoperative PVP CTs, 38 malignant tumor baseline PVP CTs evaluate models (hold-out test set 1 and 2). IOU, VS, PCK evaluate model 1. DSC evaluates segmentation efficiency of model 2. FROC, confusion matrix evaluate detection efficiency of model 2. BA analyze evaluate consistency of model 2's measurements with ground truth. Successful allocation partition, confusion matrix evaluate localization efficiency. SPE, SEN evaluate N-stage efficiency involving pelvic and retroperitoneal LNs.

**RESULTS**

Model 1 excelled in lymph node region segmentation, achieving the highest 0.95 of IoU in the inguinal region. VS and PCK-10.0mm medians surpassed 0.94 and 0.98. In hold-out tests, radiologists' satisfaction exceeded 90%, often reaching 100%. Model 2 also performed well in lymph node segmentation, with DSC values ranging from 0.75 to 0.86. At the lymph node level, DSC values improved as short diameter increased, peaking at 0.85 for LNs whose short diameters are greater than or equal to 1.0cm. In hold-out tests, DSC values approached 1.0 for larger LNs. Model 2 predicted LN volumes and diameters with high consistency with ground truth. For localization, the program successfully allocated 93.2-98.1% of detected LNs, with higher rates for larger LNs. The accuracy rates corresponding to the localization of these outputs were 98.0-100%. For detection, detection rates for all LNs or LNs whose short diameters are greater than or equal to 0.5cm, 0.8cm, 1.0cm in datasets were 78.8%-94.3%. FROC showed false positives well-controlled with high sensitivity. Localization-level detection was good except the sacral region. Patient-level detection was good in most datasets, but some patients with LNs whose short diameters are greater than or equal to 1.0cm in hold-out set 2 had false negatives. Unsuccessful detections/localizations were mainly in the sacral region. For N staging, binary classification sensitivity/specificity were 0.940/0.963 in the model construction set and 0.949/1.000 in hold-out set 1. Multi-classification sensitivity/specificity were 0.908/0.975 in the model construction set and 0.805/0.939 in hold-out set 1.

**CONCLUSION**

The automatic segmentation and localization of pelvic and retroperitoneal LNs model based on deep learning achieved good performance and can meet clinical needs in some scenarios.

**CLINICAL RELEVANCE/APPLICATION**

Automatic LNs segmentation and localization speeds up LNs evaluation, making tumor staging, prognosis, and treatment guidance more efficient.

# Abstract Archives of the RSNA, 2024

W1-SSNMMI05

**Nuclear Medicine and Molecular Imaging (Brain Imaging)**

Wednesday, Dec. 4 8:00AM - 9:00AM Room: S405

Helen R. Nadel, MD, FRCPC (*Moderator*) Consultant, ICON plc;;
Pedram Heidari, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W1-SSNMMI05-1 BRAIN F-18 FDG PET/CT: EFFECT OF UPTAKE TIME ON IMAGE QUALITY AND ADVANCED QUANTITATIVE ANALYSIS

Haseeb Ahmad (*Abstract Co-Author*) Nothing to Disclose
Katherine Manning (*Abstract Co-Author*) Nothing to Disclose
Hunter Colson (*Abstract Co-Author*) Nothing to Disclose
Jie Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Riham H. El Khouli, MD (*Abstract Co-Author*) Nothing to Disclose
Blaine T. Mischen, MD (*Abstract Co-Author*) Nothing to Disclose
Johnson Deshommes, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Tarek S. Ahmed, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Xingyu Nie, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To systematically compare the image quality of brain PET/CT images acquired with short versus long uptake time after administration of F-18 FDG in the same patient.

### METHODS AND MATERIALS

Brain F-18 FDG PET/CT studies performed in our institution between 1/31/2022 and 2/14/2024, using a Siemens Biograph mCT scanner, were reviewed, and only the ones who had two sets of brain PET images (short and long uptake) in the same patient were included in the study. Advanced neurology analysis using syngo.via (Siemens Healthcare, Erlangen, Germany) was performed for both sets of images, and regions of interest (ROIs) statistics were computed by comparing subject mean standardized uptake values (SUVs) to those of a normal database, generating z-scores. Paired t-tests were utilized to compare z-scores between the short- and long-uptake scans, as well as to compare their image qualities quantified by the Perception-based Image Quality Evaluator (PIQE) no-reference score, with statistical significance set at $p<0.05$.

### RESULTS

Eighty-five patients met our inclusion criteria. The average z-score of 196 ROIs across all patients decreased from -0.9±1.4 for short uptake to -1.2±1.4 for long uptake scans. In 76 ROIs (38.8%), the long-uptake scans exhibited significantly lower z-scores compared to the short-uptake scans. The most pronounced reductions were observed in the Amygdala (-0.8), Angular gyrus (-0.7), Anterior cingulate and paracingulate gyri (-0.7), Calcarine fissure and surrounding cortex (-0.7), Caudate nucleus (-0.6), Cerebellum (-0.5), and Cuneus (-0.5). For 47 subjects, the z-score of the long uptake scan was significantly lower, while for 15 patients, the z-score of the short uptake scan was significantly lower. Image quality testing using PIQE revealed slightly superior but significantly different image quality for the short uptake scan (63.5±8.6 vs 64.7±8.6, $p<0.0001$).

### CONCLUSION

Our data suggest an overall significant difference in the SUV and resultant z-score of brain F-18 FDG PET images acquired after a short versus longer uptake time. We also demonstrated a slight but significant difference in image quality between the 2 datasets. Limitations of the study include the potential disadvantage of the long-uptake scan being subject to motion artifacts as a result of the study design, the short- and long-uptake scans being acquired sequentially, which can lead to image degradation and distortion as well as misregistration during the database comparison workflow. Further studies are underway to improve the study design for better comparison and further investigate the clinical impact of these findings.

### CLINICAL RELEVANCE/APPLICATION

There was a significant difference in z-score between the short- and long-uptake datasets in brain F-18 FDG PET scans.

## W1-SSNMMI05-2 DYNAMIC AMYLOID PET: RELATIONSHIPS TO TAU PET AND COGNITION IN ALZHEIMER'S DISEASE

Tammie S. Benzinger, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company;Investigator, Eli Lilly and Company;Investigator, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Research Grant, Siemens AG;Consultant, ADM Diagnostics, LLC;Speakers Bureau, Biogen Idec Inc;Advisory Board, Biogen Idec Inc
Jonathan E. McConathy, MD, PhD (*Abstract Co-Author*) Research Consultant, Eli Lilly and Company;Research Grant, Eli Lilly and Company;Research Consultant, Blue Earth Diagnostics Ltd;Research Grant, Blue Earth Diagnostics Ltd;Research Consultant, General Electric Company;Research support, General Electric Company;Research support, CytoSite Biopharma;Research Consultant, ImaginAb, Inc;Research support, ImaginAb, Inc;Spouse, Research Consultant, Baird Capital;Spouse, Research Grant, Navidea Biopharmaceuticals, Inc

Erik D. Roberson, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company
Jordan Tzabari (*Abstract Co-Author*) Nothing to Disclose
Fabio Raman, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Neuroimaging biomarkers, such as positron emission tomography (PET) amyloid and tau and magnetic resonance (MR) hippocampal volume, have been associated with impaired cognition in individuals being evaluated for Alzheimer's disease. Information related to blood flow can be acquired during the early frames of amyloid PET (efAP) assessment: hippocampal efAP has recently been shown to be correlated with brain tau pathology measured with PET, and relative delivery (R1) is an established surrogate for blood flow derived from kinetic modeling to estimate brain perfusion. We hypothesized that both hippocampal efAP and R1 are similarly associated with [18F]flortaucipir (tau) PET deposition, and both can predict future cognitive trajectory more effectively than hippocampal volumes alone.

**METHODS AND MATERIALS**

257 participants with dynamic [18F]florbetapir amyloid PET/MR with at least 18 months of neuropsychological follow-up were selected from a retrospective cohort. Regression models were used to assess the longitudinal relationships between multidomain cognitive outcome measures and hippocampal efAP, R1, and volume.

**RESULTS**

Hippocampal R1 and efAP were both significantly associated with tau PET (rR1 = -0.59, refAP = -0.60, pR1/efAP < 0.0001) with strong predictive ability for tau PET positivity (AUCR1 = 0.926, AUCefAP = 0.913). Both R1 and efAP provided significant additive value above hippocampal volume in predicting attention and executive function aggregate Z-score (standardized effect size [ß]R1 = 4.079, ßefAP = 4.007) but not memory (ßR1 = 0.064, ßefAP = -0.891) or language (ßR1 = -0.679, ßefAP = -0.844). Additionally, R1 but not efAP, also better predicted the trajectory of semantic fluency (ßanimals / vegetables / MINT,R1 = 2.040 / 2.045 / 2.106, ßanimals / vegetables,efAP = 0.078 / -0.055 / 1.160), a component of language z-score, better than hippocampal volume alone. Hippocampal volume was the primary significant driver for memory z-score (ß = 2.238), but R1 provided an additional prediction of performance with the Selective Reminding Test (ß = -2.362).

**CONCLUSION**

Both hippocampal R1 and efAP, biomarkers acquired during the dynamic phase of amyloid PET, can be used to predict tau PET and provide additional information beyond hippocampal volume alone in predicting attention and executive function. Compared to efAP, R1 is less sensitive to bolus injection scheme, has significant association with semantic fluency and verbal learning and memory, but requires more sophisticated calculation methods.

**CLINICAL RELEVANCE/APPLICATION**

Successful development of this approach may increase utility of amyloid PET imaging and help predict who will respond best to therapy, especially with the recent FDA-approval of drugs targeting Aß plaques.

## W1-SSNMMI05-3 SUCCESSFUL RADIOLABELING OF THE NOVEL CURCUMIN ANALOG EF-24 WITH 68GA RESULTS IN INNOVATIVE PET-TRACER EXHIBITING SIGNIFICANT AFFINITY TO SYNTHETIC B-AMYLOID FIBRILS, SUGGESTING DIAGNOSTIC POTENTIAL FOR ALZHEIMER'S DISEASE

VASILIKI GIANNAKAKI (*Abstract Co-Author*) Nothing to Disclose
Kostas Marias, PhD (*Abstract Co-Author*) Nothing to Disclose
Eirini Saloustrou (*Abstract Co-Author*) Nothing to Disclose
Antonio Shegani (*Abstract Co-Author*) Nothing to Disclose
Georgios Z. Papadakis, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Curcuminoids have been reported to exhibit significant binding affinity for ß-amyloid plaques. EF-24 is an innovative synthetic curcumin analog with enhanced bioavailability and bioactivity presenting several biological activities, including neuroprotection. Aim of the current study was to successfully synthesize and characterize Gallium-68 EF-24 complex and explore its potential binding affinity to synthetic ß-amyloid fibrils.

**METHODS AND MATERIALS**

Firstly, DTC-EF-24 was synthesized and complexed with Gallium to form [Ga(DTC-EF-24)2 ]+. DTC-EF-24 was also radio-labeled with Gallium-68. The radio isotope was produced by reacting 68Ga3+ from a 68Ge/68Ga generator with 1mg/mL DTC-EF-24 solution. Reaction parameters (precursor amount, reaction temperature, and pH) were optimized to obtain high and reproducible radiochemical yield and purity. Quality controls and stability studies were performed by radio-TLC. Amyloid-beta (Aß) fibrils were prepared and incubated with the labeled complex. The binding affinity was estimated according to methods previously published (Asti Mattia et al,) . Displacement tests with an EF-24 solution were performed to evaluate specificity and interaction dynamics.

**RESULTS**

Synthesis and complexation of EF-24 with Gallium-68 were confirmed via comprehensive spectroscopic methods. Radiochemical purity (RCP) of 68Ga-complex was >95%, under best radio-labeling conditions. The identity of the [68Ga][Ga(DTC-EF-24)2 ]+ complex was confirmed by coelution with the equivalent natGa-complex in RP-HPLC analysis. The 68Ga-complex showed high and comparable stability to transchelation and transmetalation when challenged with DTPA solution or 0.9% NaCl solution or human serum. In all cases, the percentage of the intact complex remained >90% over 120 min of incubation. The [68Ga][Ga(DTC-EF-24)2 ]+ complex showed in vitro significant binding affinity to synthetic Aß fibrils, retaining 91.5 ± 2.0% radioactivity, markedly higher than the control. These results indicate the diagnostic potential of EF-24 complex in targeting amyloid-beta structures, a critical pathophysiologic feature in neurodegenerative diseases.

**CONCLUSION**

The current study reports the potential of 68Ga labeled EF-24 complexes as diagnostic tools in neurodegenerative diseases. The specificity towards amyloid-beta fibrils provides the groundwork for advanced in vivo studies.

**CLINICAL RELEVANCE/APPLICATION**

The development of a novel, highly specific 68Ga-radiolabeled PET-tracer with concomitant neuroprotective properties holds the potential of revolutionizing diagnostic/therapeutic approaches in the management of neurodegenerative disorders, such as the Alzheimer's disease.

## W1-SSNMMI05-5 DEVELOPMENT AND VALIDATION OF CLINICAL-RADIOMICS FOR PREDICTING IDH MUTATION AND WHO GRADE IN DIFFUSE GLIOMAS: A CONSECUTIVE L-[METHYL-11C] METHIONINE PET COHORT STUDY USING TWO SCANNERS

Wen Jianbo
(*Presenter*) Nothing to Disclose

**PURPOSE**

To build and validate radiomics models and clinical features incorporated nomogram for preoperative prediction of IDH mutation status and WHO grade of diffuse gliomas with l-[methyl-11C] methionine ([11C] MET) PET/CT imaging according to the 2016 WHO classification of tumors of CNS.

**METHODS AND MATERIALS**

Consecutive 178 preoperative [11C]MET PET/CT images were retrospectively studied for radiomics analysis. One hundred six patients from PET scanner 1 were used as training dataset, and 72 patients from PET scanner 2 were usedfor validation dataset. [11C]MET PET and integrated CT radiomics features were extracted, respectively; three independent predictive models were built based on PET features, CT features, and combined PET/CT features, respectively. The Select-KBest method, Spearman correlation analysis, Least Absolute Shrinkage and Selection Operator (LASSO) regression, and machine learning algorithms were applied for feature selection and model building, key clinical features were incorporated for the nomogram establishment.

**RESULTS**

The combined [11C]MET PET/CT radiomics model, which consisted of four PET features and eight integrated CT features, was significantly associated with IDH genotype ($p < 0.0001$ for both training and validation datasets). Nomogram based on the [11C]MET PET/CT radiomics score, patients' age, and dichotomous tumor location status showed satisfactory discrimination capacity, and the AUC was 0.880 (95% CI, 0.726-0.998) in the training dataset and 0.866 (95% CI,0.777-0.956) in the validation dataset. In IDH stratified WHO grade prediction, the final radiomics model consists of four PET features and two CT features had reasonable and stable differential efficacy of WHO grade II and III patients from grade IV patients in IDH-wildtype patients, and the AUC was 0.820 (95% CI, 0.541-1.000) in the training dataset and 0.766 (95% CI, 0.612-0.921) in the validation dataset.

**CONCLUSION**

Integrating [11C]MET PET and CT radiomics with clinical features into a nomogram enhances non-invasive IDH genotype prediction, offering insights into the efficacy and stability of radiomics in untreated diffuse gliomas

**CLINICAL RELEVANCE/APPLICATION**

Radiomics features from [11C]MET PET and integrated CT modalities could complement in non-invasive differentiation of IDH genotyping in diffuse glioma patients

## W1-SSNMMI05-6 UTILITY OF HIGH-RESOLUTION DEDICATED HEAD PET SYSTEM FOR CENTILOID SCALE CALCULATION IN AMYLOID PET

Kazunari Ishii, MD (*Abstract Co-Author*) Nothing to Disclose
Atsushi K. Kono, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company
Hayato Kaida (*Abstract Co-Author*) Nothing to Disclose
Takahiro Yamada, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Kojita (*Abstract Co-Author*) Nothing to Disclose
Kohei Hanaoka (*Abstract Co-Author*) Nothing to Disclose
Daisuke Morimoto, RT, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Centiloid scale (CL), standardized semi-quantitative measures of amyloid imaging, is scaled from 0 to 100. The purpose of this study was to verify the impact of high-resolution dedicated head PET System on CL values calculated from amyloid PET using 18F-flutemetamol (FFM).

**METHODS AND MATERIALS**

This retrospective single-institution study received approval from our institutional review board, with the requirement for informed consent being waived. We obtained FMM PET images from 45 consecutive patients, suspected early dementia or mild cognitive disorders (mean age, 72 years; age range, 47-85 years), who participated in BATON study from April 2023 to March 2024 using a dedicated head PET system (BresTome; Shimadzu Corporation). High-resolution FMM PET images and FMM PET images with resolution equivalent to conventional PET/CT system were generated from an identical raw data set. FMM PET images were visually interpreted as positive/negative based on amyloid deposition in the cortex by two experienced nuclear medicine specialists. CL values were calculated from each image and compared using paired t tests.

**RESULTS**

The subjects comprised 31 positive and 14 negative cases of amyloid deposition as per visual evaluation. In the positive group, CL values of the high-resolution FMM PET images were significantly higher than those of the conventional FMM PET images (68.1 ± 19.2 vs 65.9 ± 19.1; $P < 0.001$). While in the negative group, there was no significant difference between CL values in high-resolution FMM PET images and those in conventional FMM PET images (-3.8 ± 14.3 vs -3.0 ± 14.5; $P = 0.91$).

**CONCLUSION**

CL values derived from amyloid PET with FFM using a high-resolution dedicated head PET were higher in the amyloid positive group than those obtained from a conventional PET/CT system, while the CL values in the negative group remain constant.

**CLINICAL RELEVANCE/APPLICATION**

Centiloid values procured from a high-resolution dedicated head PET system could augment visual reading in the early diagnosis of dementia, thereby enhancing diagnostic accuracy.

# Abstract Archives of the RSNA, 2024

W1-SSNPM03

**Noninterpretive Skills (Beyond Imaging) (The Future of Imaging and Education)**

Wednesday, Dec. 4 8:00AM - 9:00AM Room: S402

Jessica G. Fried, MD (*Moderator*) Nothing to Disclose
Scott A. Simpson, DO, MEd (*Moderator*) Nothing to Disclose

**Sub-Events**

## W1-SSNPM03-1 OPTIMIZED FACILITY DESIGN IMPROVES BRAIN AND SPINE MAGNETIC RESONANCE IMAGING EXAM TURNAROUND TIMES AND WORKFLOW EFFICIENCY

Sean Hartmann (*Abstract Co-Author*) Nothing to Disclose
Arhaan Gupta-Rastogi (*Abstract Co-Author*) Nothing to Disclose
Michael Weber, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander J. Herold, MD (*Abstract Co-Author*) Nothing to Disclose
James A. Brink, MD (*Abstract Co-Author*) Board of Directors, Accumen Inc
Fiona M. Fennessy, MBBCh, PhD (*Abstract Co-Author*) Consultant, Imaging Endpoints II LLC
John Conklin, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Susie Y. Huang, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Wei-Ching Lo (*Abstract Co-Author*) Employee, Siemens AG
Bryan Clifford, PhD (*Abstract Co-Author*) Employee, Siemens AG
Andrew Sharp, MS (*Abstract Co-Author*) Nothing to Disclose
Onofrio A. Catalano, MD (*Abstract Co-Author*) Research Grant,Bayer AG;Consultant, IBM Corporation;
Oleg S. Pianykh, PhD (*Abstract Co-Author*) Nothing to Disclose
Min Lang, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Barbara D. Wichtmann, MD, MSc (*Presenter*) Speaker, Koninklijke Philips NV

### PURPOSE

To evaluate the impact of optimized magnetic resonance (MR) facility design on outpatient brain and spine MR turnaround times and workflow efficiency compared to traditional MR facilities.

### METHODS AND MATERIALS

This IRB approved, HIPAA compliant retrospective study included 5,881 patients (mean age 54.9 ± 17.5 y; 2,393 male) who received MR scans of the brain with contrast (34%), pituitary gland with contrast (15%), cervical spine without contrast (16%) or lumbar spine without contrast (35%) from April 2022 to January 2024. All exams were performed on 3T MRI scanners (MAGNETOM Vida, Siemens Healthineers, Forchheim, GER) located either at one of two traditional reference facilities (RF 38%) or an optimized facility (OF 62%) featuring 3 scanners and 4 dedicated preparation bays with dockable scanning tables. Efficiency metrics, including the time of table preparation, adjustment sequences, scanner pauses, measurements, table turnover, and exam turnaround as well as on-time performance were obtained from MRI scanner logs and the electronic health record. Statistical analyses were performed in MATLAB using three-way ANOVA and chi-square tests to evaluate the impact of facility, anatomical region, and time. Times are provided as mean ± std error.

### RESULTS

For all anatomical regions, table preparation (2.4 ± 0.1 vs. 2.9 ± 0.1 min; $p<0.001$) and table turnover times (6.0 ± 0.2 vs. 10.3 ± 0.3 min; $p<0.001$) were significantly shorter at the OF compared to the RF, reducing exam turnaround times significantly ($p<0.001$) by 5.4 min (17%) for brain MR exams, by 6.7 min (19%) for pituitary MR exams, by 2.8 min (9%) for cervical spine MR exams, and by 2.3 min (9%) for lumbar spine MR exams. Mean measurement times for all exams were <20 min following protocol optimization (Lang M et al Acad Radiol 2021). Patient throughput was higher in the OF compared to the RF, with the total number of exams increasing over the observation period by 59% for the RF (from 112 to 178 scans per quartile per scanner) and by 81% for the OF (from 112 to 203 scans per quartile per scanner). On-time performance was significantly higher for OF with 77% vs. 60% for RF of exams starting within 5 min of the scheduled appointment ($p<0.001$).

### CONCLUSION

The OF design markedly improved the efficiency of brain and spine MR exams, as evidenced by significant reductions in table turnover and exam turnaround times. The higher throughput and on-time performance demonstrate the strategic value of optimized facility design in managing rising MR exam volume.

### CLINICAL RELEVANCE/APPLICATION

Optimized facility design increases patient throughput and on-time performance. Improving capacity and reliability of MR services enables better patient care by reducing wait times and making high-volume neurological MR exams more accessible.

## W1-SSNPM03-2 OPPORTUNISTIC SCREENING OF LOW BONE DENSITY ON X-RAY: EXPERIENCE AT AN ACADEMIC HOSPITAL

Anastasia Oikonomou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrew Jayarajah, MBChB (*Presenter*) Nothing to Disclose

### PURPOSE

Osteoporosis is an often-overlooked but highly critical clinical disorder that leads to debilitating fractures, undesirable increase in healthcare usage and diminished quality of life. The current standard for diagnosis of osteoporosis and low bone mass is by clinical review of a patient's history and referral for dual-energy x-ray absorptiometry (DXA) if appropriate. We aimed to investigate the clinical adoption and perceived value of an artificial intelligence (AI) tool called Rho that opportunistically identifies patients at risk for low bone mineral density (BMD) when they undergo an x-ray for any clinical indication.

### METHODS AND MATERIALS

Patients aged 50 years and above (n=1142) were prospectively recruited and included if they underwent an x-ray for any clinical indication that included a body part eligible for Rho screening. Patients completed a pre-study questionnaire during the screening visit and a second study questionnaire at the end of the study. Family physicians of patients who had a Rho finding (likely low BMD) included in their x-ray report were asked to rate the effectiveness of Rho and provide feedback on an AI-screening tool for low BMD.

### RESULTS

Of 1142 patients screened, 589 were flagged as likely to have low BMD. Of these, 67% had not previously discussed osteoporosis or fracture risk with their doctor prior to the study. We expected that when these results were included in the x-ray report, a family physician might conduct a clinical risk assessment, and a portion would subsequently be referred for DXA. Within 6 months of the AI screen, 187 underwent DXA. Positive predictive value for low BMD was 77%, 19% had high fracture risk and 41% had moderate fracture risk. The family physician survey yielded 51 responses; 78% supported that Rho would be beneficial for patient care and 74% would use Rho screening information in their standard of care. Of patients who reported they had not discussed osteoporosis with their physician in the pre-study questionnaire, 29% had newly discussed osteoporosis with their physician by the post-study questionnaire, and 25% had newly prescribed osteoporosis medication.

### CONCLUSION

The Rho screening tool can identify patients at risk of low BMD in a real clinical setting. Radiologists incorporate the positive Rho results in their reports, and family physicians find these results useful for supporting the standard of care in osteoporosis management. Rho screening leads to additional DXA referrals for which there is a 77% PPV for low BMD.

### CLINICAL RELEVANCE/APPLICATION

Opportunistic screening for low BMD with Rho has the potential to help address low screening rates for fracture risk and osteoporosis.

## W1-SSNPM03-3 OPPORTUNISTIC, MULTILEVEL, BODY COMPOSITION ANALYSES OF EMERGENCY ABDOMINAL CT EXAMINATIONS IN TRICENARIANS: PREDICTION OF DISEASES AT AN 8-YEAR FOLLOW-UP

Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Anushree M. Burade, MBBS (*Abstract Co-Author*) Nothing to Disclose
Bernardo C. Bizzo, MD, PhD (*Abstract Co-Author*) Consultant, Diagnosticos da America (Dasa)
Keith J. Dreyer, DO, PhD (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Emiliano Garza Frias, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the role of opportunistic, multilevel, AI-based, single-click, body composition screening of emergency abdominal CT examinations in tricenarians for predicting major adverse cardiovascular events (MACE) and dyslipidemia with an 8-year follow-up.

### METHODS AND MATERIALS

Our study included 1277 patients (F:M 776:501; mean age 34 ± 3 years; age range 30-39 years) who underwent non-contrast or post-contrast abdomen-pelvis CT during their visit to the emergency department, regardless of the reason for examination. CT examinations were performed at one of the two quaternary and one community hospitals in the Greater Boston area between January 1, 2016, and December 31, 2016. The patients were identified from a Boolean search in the NLP-based radiology report search engine. We then queried Epic Datawarehouse using SQL queries to assess documentation of MACE and dyslipidemia over 8 years following CT examination (until April 2024). We used a single-click image-processing AI tool (ClariMetabo, Claripi.ai) for inferencing all de-identified CT examinations performed on multi-vendor CT equipment to obtain separate measures of CT attenuation values and volumes of subcutaneous and visceral fat, psoas, and all abdominal wall muscles, at T12-L4 vertebral levels. For the analysis, we used the anatomical measurements of each level and divided the patients according to their respective quartile at that level and anatomy location. These quartiles were used to do Cox Regression tests for different categories. We use the lowest quartile of anatomical measurement values as a reference to compare the hazard ratios (HR) for predicting MACE and dyslipidemia.

### RESULTS

Our study demonstrates that abdominal visceral (HR:1.7; $p< 0.02$) and waist circumference (HR:2; $p<0.03$) at multiple levels were the best and most significant predictors of MACE and dyslipidemia, respectively. Paradoxical protective HR (from -1.1 to - 1.6) for absolute CT attenuation values (high-fat attenuation offering protection against dyslipidemia) was likely related to a cofounder with smaller fat volumes in patients with higher fat attenuation ($p<0.001$ from ANOVA).

### CONCLUSION

Our study demonstrates the single-click, AI-based body composition analysis of emergency abdominal CT examinations in tricenarians for predicting major adverse cardiovascular events (MACE) and dyslipidemia.

### CLINICAL RELEVANCE/APPLICATION

Larger, prospective studies can help assess if opportunistic screening in young patients with an autonomous, efficient, single-click AI tool can increase the lead time for preventive steps to mitigate MACE and dyslipidemia.

## W1-SSNPM03-4 COUNTING COINS IN THE DARK - FUTURE DOCTORS VIEWS ON RADIOLOGY

Christoph J. Zech, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Donners, MD (*Abstract Co-Author*) Nothing to Disclose
Magdalena Seng, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To capture the overall attitude of medical students towards “radiology”, their perceptions of the university curriculum, the clinical relevance, the future prospects of the specialty as well as reasons for and against seeking out radiology as a career.

### METHODS AND MATERIALS

An 18-question survey was distributed among 21 universities in Germany, Switzerland and Austria. It was returned by 1150 medical students (730 females) within one month. The survey encompassed sociodemographic inquiries, question regarding the university curriculum, perceptions of clinical relevance, job attractiveness, expectations regarding salary and work-life balance, the role of AI in radiology, and students' outlook on the future of the specialty.

### RESULTS

Among the participants, 688 (60%) expressed a desire for increased exposure to radiology within the medical curriculum, and 926 (80%) acknowledged the importance of radiology in their future clinical practice. However, 740 (65%) students definitively ruled out pursuing a career as a radiologist, citing limited patient interaction as the primary deterrent (n=723). Notably, 98% of participants considered the potential salary and work-life balance in radiology as significantly more favorable compared to other medical disciplines. Moreover, 694 (60%) of medical students expect a positive impact of increasing utilization of artificial intelligence in radiology, while only 15 (1%) took a pessimistic outlook regarding radiologists’ future prospects.

### CONCLUSION

While medical students recognize the clinical importance of radiology, the majority are disinclined to pursue a career as radiologists.

### CLINICAL RELEVANCE/APPLICATION

The findings suggest a need for educational initiatives to address misconceptions and enhance the attractiveness of radiology as a viable career option for medical graduates.

## W1-SSNPM03-5 THE AI LITERACY COURSE THREE YEARS LATER: INCREASING ACCESS TO AI TRAINING, VALIDATION OF IMPACT ON A GLOBAL SCALE

Andrew D. Smith, MD, PhD (*Abstract Co-Author*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms
Srini Tridandapani, MD, PhD (*Abstract Co-Author*) Co-founder, Camerad Technologies, LLC;Spouse, Co-founder, Camerad Technologies, LLC;Officer, Camerad Technologies, LLC;Spouse, Officer, Camerad Technologies, LLC
Steven A. Rothenberg, MD (*Abstract Co-Author*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC
Houman Sotoudeh, MD (*Abstract Co-Author*) Nothing to Disclose
Adam Sturdivant (*Abstract Co-Author*) Nothing to Disclose
Asser Abou Elkassem, MD (*Abstract Co-Author*) Nothing to Disclose
Jordan D. Perchik, MD (*Presenter*) Nothing to Disclose

### PURPOSE

As artificial intelligence (AI) continues to change the practice of radiology, it has become all more important than ever to promote AI education in radiology training. To address the disparities in AI education in radiology, the AI Literacy Course has provided free, remote lecture series for radiology trainees in the US and internationally since 2021. In this project, we assess the trends in AI education, comfort with AI concepts and effect of the AI Literacy course on participant knowledge of fundamental AI terms and methods from 2021-2023.

### METHODS AND MATERIALS

The course is held remotely and broadcast to partner radiology programs in the US and internationally. An IRB approved pre- and post-course survey and evaluation is distributed to participants to collect demographic data, information on AI exposure, and the evaluation provides objective data on participant knowledge of AI terms and methods. Results of the evaluation data were compared using a student T-test.

### RESULTS

Since 2021 have been 728 participants in the AI Literacy Course from over 50 US radiology programs and over 30 countries. In the pre-course survey, the proportion of participants with prior AI experience has risen from 23% in 2021 to 64% in 2023. 22% of participants completed the AI literacy course previously, and only 15% of participants report that their home program has an AI education curriculum. Participants who took the course previously scored significantly higher on their pre-course evaluation (11 out of 15 vs. 9.0 out of 15, respectively (p=0.01)). Post-course evaluation scores increased significantly each year of the course, most recently increasing from 9.4 out of 15 to 10.4 out of 15 (p=0.02)

### CONCLUSION

The AI Literacy Course has contributed to the increasing accessibility of AI education. Participants in the course demonstrate an increased knowledge of AI terms and methods and an enduring understanding of core concepts of AI.

### CLINICAL RELEVANCE/APPLICATION

Free and accessible AI education is a critical step to ensuring an equitable integration of AI tools into radiology practice in the US and internationally.

## W1-SSNPM03-6 A HYBRID APPROACH TO SUBSPECIALTY TRAINING IN PEDIATRIC MUSCULOSKELETAL IMAGING: A NEW TOOL FOR OUTREACH, COLLABORATION AND FOSTERING COMMUNITY

Hansel J. Otero, MD (*Abstract Co-Author*) Nothing to Disclose
Maria A. Bedoya-Velez, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Galeano (*Abstract Co-Author*) Nothing to Disclose
Clara Anoni (*Abstract Co-Author*) Nothing to Disclose
Madelon Gonzalez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ramon Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Hermon M. Derbew, MD (*Abstract Co-Author*) Nothing to Disclose

Monica Miranda-Schaeubinger, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Mohammad Jalloul, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Dedicated pediatric musculoskeletal (MSK) radiology fellowship programs are rare. Dedicating a year to subspecialty training might be taxing for colleagues in the USA and worldwide. While most pediatric radiologists interpret MSK imaging studies of children, who gets to be called a pediatric MSK radiologist is often left to the individual, their level of interest, and their organization. Recognizing the growing interest in the subspecialty and the desire to create a global community around their clinical interest, the World Federation of Pediatric Imaging developed a virtual pediatric radiology MSK clinical fellowship tailored for radiologists in Low- and middle-income countries. We detail our experience in establishing this program.

**METHODS AND MATERIALS**

The organizing committee recruited fellows through Sociedad Latino Americana de Radiologia Pediatrica. Mentors were recruited from USA institutions with dedicated pediatric MSK services. A curriculum was organized to include weekly hour-long live case-review sessions, complemented by learning management system modules, and a 4-week long observership at USA institutions. During each case session, mentors and fellows presented and discussed cases displaying multiple modalities. Feedback was solicited after each session. Fellows were given access to pediatric MSK radiology modules including pre-recorded lectures, articles, teaching cases, and questions. The year-long fellowship concluded with a 4-week, in-person visit to 3 collaborating institutions, allowing for hands-on experience.

**RESULTS**

The inaugural class featured 3 fellows (2 Argentina and 1 Uruguay) paired with 10 mentors from 5 US children’s hospitals. Throughout the year, 150 MSK cases were shared in 38 live sessions covering hip and pelvis, shoulder, upper and lower limbs, and multisystemic pathologies. MRI was the focus in most cases. Feedback from fellows emphasized the ease of transferring education, the good quality of images, and the organization of cases. Fellows perceived the cases to be fair to hard in difficulty. Overall, the content of the program was praised as "very good." A limitation of the program was the challenge of scheduling times due to the busy schedules of both mentors and fellows.

**CONCLUSION**

We showed a hybrid subspecialty training suitable for outreach, affordable in time and resources for international participants and US-based clinical specialists. Future iterations should optimize trainee, mentor, and institution numbers to maximize benefits and maintain high-quality education.

**CLINICAL RELEVANCE/APPLICATION**

The pediatric MSK radiology fellowship aims to enhance expertise and foster global collaboration, addressing the scarcity of dedicated programs in low- and middle-income countries.

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# Abstract Archives of the RSNA, 2024

W1-SSVA03

**Vascular Imaging (AI and Emerging Techniques)**

Wednesday, Dec. 4 8:00AM - 9:00AM Room: N229

Dominika Sucha, MD, PhD (*Moderator*) Nothing to Disclose
Bradley D. Allen, MD, MS (*Moderator*) Consultant, Circle Cardiovascular Imaging Inc;Speaker, WebMD LLC

**Sub-Events**

## W1-SSVA03-2 PRECISE EVALUATION OF SUBSEGMENTAL PULMONARY THROMBOEMBOLISM IN CTEPH PATIENTS WITH CT PERFUSION IMAGING

Koray Hekimoglu (*Presenter*) Nothing to Disclose

### PURPOSE

Recovery of pulmonary artery thrombosis in chronic thromboembolic pulmonary hypertension (CTEPH) patients is the only curable form of pulmonary hypertension-CTEPH patients via surgery. Here we aim to demonstrate the impact of dual-energy computed tomography perfusion imaging (DE-CTPI) in SSPE diagnosis and investigate the quantitative differences between normal lung parenchyma and hypoperfused areas with and without corresponding dual-energy CT angiography (DE-CTA) findings in CTEPH patients.

### METHODS AND MATERIALS

Eighty-six consecutive CTEPH patients detected chronic SSPE with a DE-CTA examination and DE-CTPI were enrolled in this study. All DE-CTA and DE-CTPI examinations were acquired with a 3rd generation dual-source multidetector computed tomography scanner.Two radiologists reviewed DE-CTA and DE-CTPI images retrospectively and in consensus, blinded to radiology report, within two separate study groups. Iodine maps were evaluated for perfusion defects (which are represented as black areas of pulmonary parenchyma on the color-coded images) and locations of hypoperfused segments were noted. On each hypoperfused segment, three measurement regions of interest were placed for measuring mean lung parenchyma attenuation (HU), iodine density (mg/mL), and normalized uptake (HU) values.

### RESULTS

In 90 segments (55.6%) there was PE of the feeding segmental/subsegmental artery whereas for the remaining segments (n=72; 44.4%) there was a perfusion defect without any visible thrombus. Tamhane's T2 post-hoc analysis demonstrated mean lung attenuation values (HU) of hypoperfused areas with PE on CTA, were significantly different from normally perfused areas ($P<0.001$) (Figure 1).One-way ANOVA test and Tukey's post-hoc analysis demonstrated Iodine density and normalized uptake values of hypoperfused areas with PE were significantly lower than hypoperfused areas without PE on CTA. Iodine density of normal lung parenchyma, hypoperfused areas with PE on CTA were significantly different ($P<0.001$, $F=94.4$; $P<0.01$, $F=225$ respectively).

### CONCLUSION

Chronic SSPE could be not detected on routine CTA, and the regions of these vessels realized as hypoperfused segments on DE-CTPI due to different iodine densities. DE-CTPI iodine maps should be created in addition to CTA for precise diagnosis of SSPE in CTEPH patients.

### CLINICAL RELEVANCE/APPLICATION

DE-CTPI could reveal SSPE that is not visible on CTA and hypoperfused segments on DE-CTPI have significantly different iodine densities. DE-CTPI iodine maps should be created in addition to DE-CTA for precise evaluation and diagnosis of subsegmental small vessels.

## W1-SSVA03-3 VASCULAR IMAGING WITH PHOTON COUNTING DETECTOR CT IN THORAX: QUANTITATIVE AND QUALITATIVE ASSESSMENT FOR CT PULMONARY AND AORTA ANGIOGRAM

Nikahat Yasmine, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Nicole J. Martinez, MD (*Abstract Co-Author*) Nothing to Disclose
Ramandeep Singh, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mostafa M. Abdelraheem, MD (*Abstract Co-Author*) Nothing to Disclose
Sravani Mannuru, MD (*Abstract Co-Author*) Nothing to Disclose
Natally AlArab, MD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

To assess quantitatively and qualitatively monoenergetic (ME) and poly energetic (T3D) reconstructions images on post contrast CT pulmonary angiography (CTPA, non-ECG-gated) and CT aorta angiography (CTAA, ECG-gated) optimized thoracic vascular imaging with photon counting detector CT (PCD-CT).

### METHODS AND MATERIALS

Our retrospective study (IRB-approved) analyzed 124 CT series of 62 adults (37M:25F; age: 61±13 years; mean BMI: 102±7 kg/m2) who underwent CTPA or CTAA scans (mean contrast volume 102±14 and 92±20 ml) on PCD-CT. Quantitative assessment and image quality analysis were conducted using ROIs (mean ROI: 130±11.5 mm2) in pulmonary artery, thoracic aorta, and pectoralis major muscle, evaluating artifacts on ME 55 keV and T3D images. SNR and CNR were computed. Two radiologists (11 and 6 years of experience) independently assessed images for artifacts and subjective image quality on a three-point scale (1=mild artifact, diagnostically excellent; 2=moderate artifact, diagnostically acceptable; 3=severe artifact, diagnostically compromised). Descriptive statistics and inter-class correlation were performed.

### RESULTS

ME images showed higher SNR in the pulmonary artery (CTPA 14±1; CTAA 16±1) and aorta (CTPA 7±1; CTAA 27±10) than T3D images (CTPA 14±1 and13±1; CTAA 6±1 and 20±70; p value <0.001). CNR and SNR at the site of artifacts was higher for T3D images than ME images for CTPA (ME CNR:1.6±1.2; SNR:2.2±1.1, T3D CNR:1.0±1.5; SNR:2.7±1.6, p<0.003) and CTAA (ME CNR:1.3±2.7; SNR:0.3±2.4, T3D CNR:0.6±1.7; SNR: 1.0±1.7, p <0.001). The artifacts (n=288 in 62 patients) detected were streak artifacts due to contrast 88/288 (31%), cross scatter 58/288 (20%), photon starvation 40/288 (14%), cardiac pacemaker 11/288(4%), port catheter 11/288(4%), and sternal wires 20/288 (7%). Qualitatively, the cross scattered artifacts were most mitigated on T3D (4-12%) compared to ME (42-62%) images with ICC of 0.87-0.99. Overall subjective image quality was significantly better on T3D compared to ME images for both CTPA and CTAA (ICC:0.89-0.99, p<0.001).

### CONCLUSION

A combined approach of monoenergetic 55 keV and poly energetic T3D reconstructions yields best objective and subjective image quality for vascular thoracic imaging with CT pulmonary (non-ECG gated) and aorta (ECG gated) angiography.

### CLINICAL RELEVANCE/APPLICATION

Incorporating a dual reconstruction strategy in thoracic vascular imaging by utilizing monoenergetic and polyenergetic T3D techniques on photon counting CT presents a promising avenue for enhancing image quality.

## W1-SSVA03-4 HUMAN-IN-THE-LOOP SUPERVISION OF A NEURAL NETWORK APPROACH TO AORTIC DIAMETER AND GROWTH MEASUREMENTS IMPROVES PERFORMANCE VERSUS MANUAL MEASUREMENTS

Gregory Spahlinger (*Abstract Co-Author*) Nothing to Disclose
Timothy Baker, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlos Alberto Campello Jorge, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas S. Burris, MD (*Abstract Co-Author*) Royalties, ImBio, LLC
Nic Tjahjadi (*Abstract Co-Author*) Nothing to Disclose
Prabhvir S. Marway, BA, MBBChir (*Presenter*) Nothing to Disclose

### PURPOSE

Variability of manual diameter measurements (±3-5 mm) impedes accurate aortic diameter and growth assessments in ascending thoracic aortic aneurysm (aTAA). Our group has described a neural network (U-Net) approach for reliable and automated (~1 min) landmark localization and diameter measurements, but performance when integrated with human oversight has not yet been validated. We sought to compare performance of a U-Net with "human-in-the-loop" (HITL) validation for measuring static aortic diameters and diameter change (i.e., growth) during aTAA surveillance, versus manual clinical diameter measurements.

### METHODS AND MATERIALS

We included aTAA patients with >2 years between CT angiograms (CTA). Manual diameters were collected by 3D lab technicians at: sinus of Valsalva (SVS), sino-tubular junction (STJ), mid ascending aorta (AAo), and proximal, mid, and distal arch. An in-house U-Net - trained for multi-task segmentation and landmark localization on separate data - determined diameters at all locations and timepoints. A human rater verified U-Net derived landmarks and measurement planes. Highly discrepant (>5mm) static diameter measurements were adjudicated by a blinded 3rd expert rater. Growth was defined as the change in diameter at the same location over time. Ground-truth ascending aortic growth was derived from vascular deformation mapping (VDM), a validated method of 3D growth measurement with sub-millimeter accuracy. Accuracy of growth measurements was assessed by intraclass correlation coefficients (ICC).

### RESULTS

2028 unique diameters were collected by both manual and U-net measurements, from 338 CTAs in 169 patients (57% male, age 61 ± 6 years). 96% (1955) of U-net diameters passed HITL validation, ranging from 89% at the SVS to 100% at the AAo. After HITL validation, there was a 61% reduction (61 to 23) in >5 mm discrepancies between manual and U-Net diameters. Comparing remaining discrepancies to a 3rd expert rater showed a mean absolute error of 7.0 ± 2.9 mm for manual measurements vs. 2.2 ± 1.7 mm for U-net measurements (p <0.01). Considering aortic growth measurements, 43% of manual growth were negative compared to only 30% of U-net values (p <0.01). Compared to VDM-derived aortic growth, U-net yielded growth showed higher ICC agreement (0.74; 95% CI 0.62-0.80) versus manual growth (0.40; 95% CI 0.18-0.56).

### CONCLUSION

U-Net aortic diameters fail human validation at low rates (<4%) in a clinical aTAA population and show improved reliability and growth tracking accuracy compared to best-practice manual diameters.

### CLINICAL RELEVANCE/APPLICATION

Automated aortic measurements with HITL validation yielded superior reliability compared to manual measurements and may improve workflow efficiency and detection of disease progression.

## W1-SSVA03-5 MULTI-CENTER VALIDATION OF A DEEP LEARNING-BASED AORTIC DISSECTION AUXILIARY DIAGNOSIS SYSTEM

Chen Xia (*Abstract Co-Author*) Nothing to Disclose
Fule Wu (*Abstract Co-Author*) Employee, Infervision
Shaokang Wang (*Abstract Co-Author*) Nothing to Disclose
Dawei Wang, PhD (*Presenter*) Employee, Infervision

### PURPOSE

To validate the efficiency and validity of a deep learning (DL)-based auxiliary diagnosis system in aiding radiologists to diagnose aortic dissection.

### METHODS AND MATERIALS

A DL-based aortic dissection auxiliary diagnosis system (InferRead CT Aorta, Infervision) was employed and validated, including the fundamental segmentation performance of aorta and its branches as well as aortic dissection triage and Stanford subtype classification accuracy. 809 patients who underwent thoracoabdominal CTA examinations were enrolled from 8 hospitals. Two experienced radiologists annotated the aorta and the corresponding segments and their consensus serves as the reference standard. Diagnostics of aortic dissection and Stanford subtype were collected from electronic medical record system and further confirmed by the two participating radiologists. DICE and ICC were used to evaluate segmentation and subtype classification performance. The effect on triaging aortic dissection patients was evaluated by sensitivity and specificity.

### RESULTS

Segmentation of the aorta was performed on all 809 cases and the DICE index was 0.928. For the main aortic branches, the segmentation DICE reached 0.922, 0.922, and 0.923 for the brachiocephalic trunk, left common carotid artery, and left subclavian artery, respectively. Of note, there are 354 (43.76%) patients with aortic dissection in the collected dataset. The validated DL system displayed a sensitivity of 92.4% (95%CI: 89.6%-95.1%) and a specificity of 97.8% (95%CI: 96.5%-99.1%) when applied to triage patients with aortic dissection. No significant difference in triage performance was observed in age subgroups. Furthermore, the DL system performed well in classifying Stanford subtypes of aortic dissections as evidenced by an ICC of 0.82. In addition to the validated functions, the DL system could also automatically realize the curved plannar reconstruction, and even the three-dimensional aorta reconstruction, exerting application potential for surgery planning.

### CONCLUSION

The validated DL system is characterized by decent performance on aortic segmentation and aortic dissection triage and classification and is of great value in aiding the accurate and efficient diagnosis of aortic dissections.

### CLINICAL RELEVANCE/APPLICATION

As the commonly used diagnostic approach, thoracoabdominal CTA examination requires complex follow-up procedures to manually generate reference results for radiologists to give a report, which usually takes 30 minutes to an hour even for an experienced radiologist. The validated DL system has unique advantages in efficiency, accuracy, and reliability, and is of great clinical significance in assisting radiologists to provide the basis for clinical diagnosis and treatment.

## W1-SSVA03-6 AORTIC PERIVASCULAR FAT ATTENUATION INDEX CLASSIFIES DIAGNOSIS AND ACTIVITY OF TYPE I TAKAYASU ARTERITIS

Lele Cheng, DPhil, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Takayasu arteritis (TA), a rare granulomatous vasculitis affecting young people, is associated with considerable morbidity and premature mortality. Early diagnosis and evaluation of disease activity in TA helps inform therapy. Chronic inflammation is considered as main agent involved in TA pathogenesis. The peri-coronary fat attenuation index (FAI) is assessed using coronary computed tomography angiography (CTA), and it has emerged as a novel imaging biomarker of coronary inflammation. However, it is unclear whether the aorta-specific FAI provides incremental value to the diagnosis and activity classification of TA.

### METHODS AND MATERIALS

We consecutively enrolled 102 subjects with Type I TA, including 74 in the active phase and 27 in the inactive phase, and 77 matched controls underwent CTA examination. TA was diagnosed using clinical criteria for diagnosis of aortitis (ACR/EULAR Criteria 2022) and disease activity was assessed using the National Institutes of Health (NIH) criteria by experienced physicians. The aortic arch and 1cm above the arch were selected as the region of interest. Peri-aortic adipose tissue was defined as adipose tissue (-190HU to -30HU) within 1cm of the external vessel wall. The relationships between aorta-specific FAI and the presence and activity status of TA were evaluated.

### RESULTS

TA patients had higher FAI values than control individuals (-76.74±6.42HU vs. -80.34±6.43HU, $p<0.001$), and TA patients with activity had higher FAI values than those inactive (-75.64±5.08 HU vs. -79.74±5.60HU, $p<0.001$). Aortic wall thickness and erythrocyte sedimentation rate were higher in the active as group compared to the inactive group. FAI value was positively correlated with Kerr Clinical Activity Score ($r = 0.304$, $p = 0.002$), aortic wall thickness ($r = 0.305$, $p = 0.002$), and erythrocyte sedimentation rate ($r =0.278$, $p= 0.005$) and was higher in active vs. inactive TA (all $p< 0.05$). In the fully adjusted model, there was a 14.0% increase in the odds of TA activity status when the FAI increased by one unit (OR=1.14, 95% CI:1.02-1.27, $p=0.025$). Alone aorta-specific FAI above -78 HU had 67% sensitivity and 68% specificity for differentiating TA from controls and above -79 HU had 80% sensitivity and 60% specificity for differentiating active TA from all Type I TA patients.

### CONCLUSION

In this observational study, aorta-specific FAI demonstrated good diagnostic accuracy for Type I TA and was associated with clinical markers of inflammation and disease activity.

### CLINICAL RELEVANCE/APPLICATION

This finding suggests that quantitative assessment of aorta-specific perivascular FAI by CTA is of great significance for clinical practice in aiding the precise diagnosis and may be used to track activity assessment of Type I TA.

# Abstract Archives of the RSNA, 2024

W2-STCE1

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## W2-STCE1-1 LESSENING THE ENVIRONMENTAL IMPACT OF GADOLINIUM FROM BREAST MRI WITHOUT AFFECTING PATIENT OUTCOMES

Margarita L. Zuley, MD (*Abstract Co-Author*) Investigator, Hologic, Inc
Amy H. Lu, MD (*Abstract Co-Author*) Nothing to Disclose
Juhun Lee, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuying Cao, BSc (*Abstract Co-Author*) Nothing to Disclose
Federico Pineda, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Contamination by gadolinium-based contrast agents (GBCAs) has been found in waste, surface, and drinking water. Widespread adoption of MRI for breast cancer screening of women with dense breasts would mean a dramatic increase in the number of contrast-enhanced MRIs performed. The purpose of this work is to evaluate the effect of two strategies for reducing GBCA use in breast MRI: the use of a high relaxivity GBCA, and low-dose acquisitions followed by image enhancement via post-processing.

### METHODS AND MATERIALS

The first strategy was to compare screening MRIs acquired with a high relaxivity contrast agent (gadopiclenol) at 0.05mM/kg with priors in the same patient acquired with 0.1mM/kg gadoteridol. Signal enhancement was quantitatively compared between both imaging sessions in a sample of 7 patients. The second strategy for reduction of GBCA dosage was to administer 15% of a standard dose of gadobenate dimeglumine (0.015mM/kg) in 8 women with known enhancing lesions (suspected fibroadenomas). Several minutes later the remaining .085mM/kg was administered to obtain images at a "standard" dosage of 0.1 mM/kg. An image enhancement technique based on the Radon Cumulative Distribution Transform (RCDT) was applied to the low dose images. This technique highlights subtle changes in signal intensity. Lesion detection was evaluated using a detection algorithm trained on a publicly available dataset.

### RESULTS

Signal enhancement in the images acquired with 0.5mM/kg gadopiclenol was higher on average than in the priors acquired with 0.1mM/kg gadoteridol, though this difference was not significant. Relative signal enhancement was higher on average in the gadopiclenol images: 9.3% ± 10.2% in background parenchyma and 4.7% ± 20% in stable enhancing features. Using the RCDT, subtle signal enhancement in low dose images was highlighted better enabling detection of the enhancing lesions. Of the 11 lesions in the dataset, the detection algorithm detected 6 in both standard and low dose images, 3 in standard dose only, and 1 in low dose only.

### CONCLUSION

The preliminary results of imaging with gadopiclenol show that signal enhancement is not significantly affected by using half the dose of other GBCAs and may be in fact higher. Our results also suggest that the RCDT may be a useful tool in boosting lesion detection in images acquired with low doses of gadolinium. Improvements in the automatic lesion detection algorithm will allow us to better illustrate this technique's potential. Future work will evaluate the combination of both strategies for even greater reductions in the amount of Gd administered to patients and in-turn the amount of anthropogenic Gd present in the environment.

### CLINICAL RELEVANCE/APPLICATION

Increase in contrast-enhanced MRI use for breast cancer detection could have a significant environmental impact. Reducing the amount of GBCAs used in these examinations could help alleviate this impact. Our preliminary results suggest that strategies to reduce the dose of GBCAs administered by 50% to 85% could be an effective strategy for screening breast MRI.

## W2-STCE1-2 ALGORITHMIC FAIRNESS IN MEDICAL IMAGING: ASSESSING DEMOGRAPHIC BIAS IN A VISION-LANGUAGE MODEL

Dushyant Sahani, MD (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV;Advisory Board, Canon Medical Systems Corporation;Advisory Board, General Electric Company;
Avanti Gulhane, MD (*Abstract Co-Author*) Nothing to Disclose
Wei Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Yuzhe Yang (*Abstract Co-Author*) Nothing to Disclose
Domenico Mastrodicasa, MD (*Presenter*) Stockholder, Segmed, Inc;Consultant, Segmed, Inc

**PURPOSE**

To investigate the algorithmic fairness of a self-supervised vision-language foundation model, CheXzero, in chest X-rays across five radiology datasets (MIMIC, CheXpert, NIH, PadChest, and VinDr). Specifically, we tested the presence of demographic biases that could impact historically marginalized groups, potentially exacerbating health care disparities.

**METHODS AND MATERIALS**

The datasets included 858,804 chest X-rays with pathology labels and demographic data from 230,570 patients. CheXpert, PadChest, and VinDr datasets included radiologist labels, with CheXpert test set (n=666) and VinDr (n=5,323) including external annotations from radiologists (n=3). For fairness evaluation, we processed chest X-rays through CheXzero using specific text prompts for a wide range of pathologies (i.e., enlarged cardiomediastinum). Radiologist labels were used as benchmarks to evaluate diagnostic performance and fairness of CheXzero. Additionally, in a subset (n= 480) of the MIMIC dataset, the model's prediction of demographic attributes (sex, age, race) was compared to three additional board-certified radiologists. We compared false negative and false positive rates across demographic groups to quantify underdiagnosis disparities and identify potential biases in the model.

**RESULTS**

CheXzero achieved expert-level pathology detection accuracy but showed greater underdiagnosis disparities compared to radiologists. For instance, in detecting "enlarged cardiomediastinum" on the CheXpert dataset, CheXzero had an AUC of 0.92. However, underdiagnosis disparities were significant: sex 0.28 (p=1.280e-131), age 0.33 (p=2.510e-103), race 0.25 (p=8.790e-093), and sex-race intersection 0.36 (p=1.580e-206). CheXzero also achieved high AUCs for predicting sex (0.92), age (0.94), race (0.78), and intersectional subgroups (0.83), all substantially higher than random chance and outperforming the three radiologists, indicating robust demographic encoding.

**CONCLUSION**

CheXzero, tested across five independent radiology datasets, achieved high diagnostic accuracy but showed significant demographic biases, particularly underdiagnosing females, older adults, and racial minorities. The compounded biases in intersectional groups (i.e., Black females), highlight the need for targeted interventions before deploying vision-language models in clinical settings.

**CLINICAL RELEVANCE/APPLICATION**

Clinical deployment of vision-language foundation model with inherent demographic biases could exacerbate health care disparities, especially for marginalized groups. Our results highlight the importance of awareness of these biases and the need to intervene to mitigate them to achieve more equitable health care with AI models.

## W2-STCE1-3 METHODOLOGY TO EVALUATE THE ENVIRONMENTAL IMPACT OF CLINICAL TRIALS IN RADIOLOGY

Ehsan Samei, PHD (*Abstract Co-Author*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc
Francesco Ria, DMP (*Abstract Co-Author*) Metis Health Analytics
Liesbeth Vancoillie, PhD (*Abstract Co-Author*) Nothing to Disclose
Mina Mohammadi (*Presenter*) Nothing to Disclose

**PURPOSE**

In this study we assessed the environmental impact of a computed tomography (CT) clinical trial by focusing on five key dimensions: energy consumption, carbon footprint (CO2), methane (CH4), nitrogen (NOx) emissions, and water consumption. This evaluation identified areas for reducing the environmental impact of clinical research informing the implementation of sustainable practices.

**METHODS AND MATERIALS**

We developed a pipeline for estimating the environmental impact of clinical CT scan trial using the Greenhouse Gas (GHG) Protocol, defining three scopes for GHG accounting: Scope 1 covers direct emissions from the CT examination, cooling systems and idle scanner time; Scope 2 included indirect emissions from purchased energy; Scope 3 tracks the emissions from patient and staff transportation, hospital time, and waste.

**RESULTS**

Scope 1 showed a total energy consumption of 10.2± 5% kWh from CT usage, cooling systems, and idle time overhead, with no direct CO2, CH4, NOx emissions, or water usage. Scope 2 resulted in 4.3± 12% kg of CO2, 0.0004± 16% kg of CH4, and 0.00005± 19% kg of NOx, alongside a substantial water usage of 296± 58% kg. Scope 3 involved 28.1± 22% kWh of energy consumption, 0.008± 25% kg of CO2, 0.0003± 27% kg of CH4, 0.0002± 28% kg of NOx emissions, and 421± 62% kg of water usage. Overall, a single-patient clinical trial consumed 38.3± 16% kWh of energy, produced 4.3± 12% kg of CO2, 0.0007± 16% kg of CH4, 0.0002± 27% kg of NOx, and used 717.0± 44% kg of water. The total consumed energy, on average, is equivalent to powering an electric vehicle for 193 km, with a social cost of at least $240 per obtained image data. The environmental impact of clinical trials is further heightened by indirect water consumption and waste generated by disposable medical supplies.

**CONCLUSION**

The environmental impact of clinical trials in radiology is primarily driven by indirect activities (Scopes 2 and 3), including electricity sourcing, patient transportation and other material/energy usage. This results in a significant carbon footprint from fuel and hospital energy use, as well as GHG emissions from necessary travel. To reduce this impact, strategic actions are needed. One effective option is to replace some clinical trials with virtual trials, which can eliminate patient travel.

**CLINICAL RELEVANCE/APPLICATION**

Our project represents a pivotal step towards measuring the sustainability of clinical trials and promoting environmentally responsible practices within the radiology research community. We aim to create a more sustainable future for clinical research through interdisciplinary collaboration.

# Abstract Archives of the RSNA, 2024

W2-STCE2

**Science Session (Theranostics)**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## W2-STCE2-1 PREDICTION OF AMYLOID POSITIVITY IN PARKINSON'S DISEASE USING THE EARLY-PHASE $^{18}$F-FP-CIT PET IMAGES

Suhong Kim, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to explore whether early-phase 18F-N-(3-fluoropropyl)-2ß-carboxymethoxy-3ß-(4-iodophenyl) nortropane (18F-FP-CIT) positron emission tomography (PET) images can predict ß-amyloid positivity on 18F-florbetaben (18F-FBB) PET scans in patients with Parkinson's disease (PD). Early-phase 18F-FP-CIT PET images (i.e., images acquired within the first 10 min after 18F-FP-CIT injection in a single PET session when diagnosing PD) reflect cerebral perfusion that may have significant associations with brain ß-amyloid load.

### METHODS AND MATERIALS

We reviewed the medical records of 54 patients with PD who underwent dual-phase 18F-FP-CIT PET scans and 18F-FBB PET scans upon initial diagnosis. Patients were divided into two groups based on 18F-FBB PET images: amyloid-positive group (n = 20) and amyloid-negative group (n = 34). We compared regional uptake in the early-phase 18F-FP-CIT PET images between the two groups. We further performed a linear discriminant analysis (LDA) to predict ß-amyloid deposition based on the standard uptake value ratios (SUVRs) of each region of interest on the Desikan-Killiany atlas.

### RESULTS

The amyloid-positive group exhibited decreased uptake in the inferior parietal and isthmus cingulate cortices and increased uptake in the insula and rostral anterior cingulate cortices as well as the caudate nucleus compared to the amyloid-negative group. The LDA prediction model using a stepwise selection of these region of interests demonstrated that SUVRs of the isthmus cingulate cortex and rostral anterior cingulate cortex optimally distinguished the amyloid-positive group from amyloid-negative group Wilk's lambda, 0.786; AUC, 0.796 [95% confidence interval, 0.678-0.913]; misclassification rate 33.2%; cross-validated misclassification rate, 33.2%).

### CONCLUSION

The present study demonstrated that decreased regional uptake in the isthmus cingulate cortex and increased regional uptake in the rostral anterior cingulate cortex on the early-phase 18F-FP-CIT PET images were associated with ß-amyloid deposition in patients with PD.

### CLINICAL RELEVANCE/APPLICATION

The early-phase 18F-FP-CIT PET can be used for prediction of ß-amyloid deposition in patients with PD.

## W2-STCE2-2 DETECTION OF OSSEOUS SPINAL METASTASES WITH T1-WEIGHTED DYNAMIC CONTRAST-ENHANCED PERFUSION MRI AND PET: ACCESSING AGREEMENT WITH POSITIVE BIOPSY

Eric Lis, MD (*Abstract Co-Author*) Nothing to Disclose
Julio Arevalo Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Simone Krebs, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei I. Holodny, MD (*Abstract Co-Author*) Nothing to Disclose
Sasan Karimi, MD (*Abstract Co-Author*) Nothing to Disclose
Kyung K. Peck, PhD (*Abstract Co-Author*) Nothing to Disclose
Atin Saha, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Onur Yildirim (*Abstract Co-Author*) Nothing to Disclose
Deeptha Bejugam, BS (*Presenter*) Nothing to Disclose

### PURPOSE

For patients suspected of metastatic spinal lesions, 18F-fluorodeoxyglucose (FDG) positron emission tomography (PET) and magnetic resonance imaging (MRI) are first-line imaging modalities. While conventional MRI provides morphological information, dynamic contrast-enhanced MRI (DCE-MRI) measures vascular perfusion parameters, including vessel permeability (Ktrans) and plasma volume (Vp), which are markers of viable tumors.Although DCE-MRI and PET are individually recognized for detecting tumors, no prior comparisons between Vp and PET maximum standardized uptake value (SUVmax) have been performed. This study evaluates the concordance between PET and DCE-MRI in identifying pathologically confirmed, untreated osseous spinal metastases and assesses DCE-MRI's non-inferiority to PET.

### METHODS AND MATERIALS

Eighty-five biopsy-confirmed, untreated osseous spinal metastases with DCE-MRI and PET scans were included. Exclusion criteria included intervals exceeding one year between DCE-MRI and PET, recorded radiation therapy within two vertebrae of the lesion, and systemic therapy between DCE-MRI and PET. Cases had an average time of 1.39 days between scans. DCE-MRI was performed using gadopentetate dimeglumine injection sequences, and mean Ktrans and mean Vp were calculated from the lesion's region of interest (ROI) using an extended Tofts pharmacokinetic model with NordicICE software. SUVmax, adjusted for patient body weight and liver function, was obtained from the 18F-FDG PET scans in the lesion's ROI. For DCE-MRI, a Vp threshold of 2.10 was used, based on previous literature, to detect spinal metastases; lesions with a Vp of 2.10 or more were classified as true positives for viable tumors. For PET SUVmax, thresholds of 2.00, 2.50, and 4.00 reported in the literature were examined. Agreement between Vp and each SUVmax threshold was assessed, and McNemar tests were used to determine any statistically significant differences in the number of metastases detected.

### RESULTS

At an SUVmax threshold of 2.00, Vp demonstrated a high agreement of 81.18% with SUVmax in detecting spinal metastases. Agreement with other SUVmax thresholds was lower, as expected. Compared to SUVmax thresholds, Vp identified the highest number of metastases ($p < 0.001$).

### CONCLUSION

In general, Vp from DCE-MRI and SUVmax from PET exhibit good agreement in detecting osseous spinal metastases. However, when common thresholds for these metrics are applied, Vp outperforms SUVmax in identifying viable tumors. Our study indicates that DCE-MRI plays a crucial role in detecting viable spinal metastases and, in some instances, more accurately classifies tumors compared to PET.

### CLINICAL RELEVANCE/APPLICATION

This study provides strong evidence for incorporating DCE-MRI in diagnoses of spinal metastases. While current practices utilize conventional MRI, PET-CT, and biopsies, the perfusion parameters measured by DCE-MRI offer further qualitative and quantitative evidence to support diagnoses. DCE-MRI's ability to detect spinal metastases may reduce the need for radiotracer-based imaging, effectively decreasing costs and patient radiation exposure. Recently, gadolinium-based contrast agents, like the agent used in this DCE-MRI technique, have emerged as theragnostic agents to treat cancers through conjugation with targeted, cytotoxic ligands. Imaging insights from our study indicate that DCE-MRI can complement established diagnostic practices and emerging theragnostic techniques to improve spinal metastasis diagnosis and treatment.

## W2-STCE2-3 A PHARMACOKINETIC MODEL DETERMINATION OF TIME ACTIVITY CURVES IN RADIOPHARMACEUTICAL THERAPY

Joseph Steiner, PHD (*Abstract Co-Author*) Nothing to Disclose
Farhad Jafari, PHD (*Abstract Co-Author*) Nothing to Disclose
Brandon Nguyen, BS, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Radiopharmaceutical therapy (RPT) dosimetry often requires activity measurements at discrete time points post-therapy to create time activity curves (TAC) for a given tissue (compartment). Unlike the current methods of determining TACs for each compartment independently using curve fitting, a single patient-specific pharmacokinetic (PK) model is developed to estimate the TAC for multiple compartments simultaneously. Model feasibility and validity was assessed using clinical data.

### METHODS AND MATERIALS

A PK model to determine intercompartmental rate constants from serial activity measurements of patient compartments following RPT was rigorously developed. The model was numerically implemented to determine the rate constants for a 3 compartment (blood, tumor, kidney) and a 4 compartment (adding an aggregate whole body compartment) model for activity measurements at 5 time points from publicly available data for 5 patients. An optimization algorithm (gradient descent) was used over the rate constant parameter space to minimize the least-square error (LSE) between the PK model and the patient data. The rate constants were used to generate TACs for each compartment; these TACs were compared to TACs generated by curve fitting the same data using single exponential (2 parameter) and bi-exponential (3 and 4 parameter) models.

### RESULTS

The LSE was calculated and compared for the TACs generated with the PK models and the exponential models. The average LSEs across all patients were 0.0486 for the single exponential model and 0.0192 for both bi-exponential models. These LSEs were comparable to the average LSE generated by the 3 compartment PK model (0.0178) and the 4 compartment PK model (0.0165). Graphical analysis of the TAC for the exponential and PK models additionally demonstrated comparability.

### CONCLUSION

A PK model framework was developed to estimate rate constants and TACs from post-therapy activity measurements in patients after RPT. The resultant average LSE for the PK models ranged from an order of magnitude less than to comparable to the average LSE from typical curve fitting, which demonstrates feasibility of the PK model to generate TACs treating the patient as a single system with interconnected compartments. Graphical analysis of the TAC additionally demonstrated comparability between the exponential and PK models.

### CLINICAL RELEVANCE/APPLICATION

Physiologically, the patient's organs and tissues are a single system that can be modeled if the intercompartmental rate constants are known. The PK model developed in this work provides a theoretical estimate of rate constants for any patient organ systems of interest. Knowledge of these rate constants may provide a new prognostic tool to guide patient-specific dosing, which is the future of RPT.

# Abstract Archives of the RSNA, 2024

W3-SSBR08

**Breast Imaging (Breast Ultrasound Techniques)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: S406A

Richard G. Barr, MD, PhD (*Moderator*) Consultant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Consultant, Canon Medical Systems Corporation;Advisor, Hologic, Inc;Research Grant, Hologic, Inc
Wendie A. Berg, MD, PhD (*Moderator*) Institutional Research Grant, Koios Medical, Inc

**Sub-Events**

## W3-SSBR08-1 NON-MASS LESIONS BY CLINICAL INDICATION: PREDICTIVE VALUES OF US FEATURES AND COMPARISON BETWEEN REAL-WORLD BI-RADS CATEGORIES VS. A RISK STRATIFICATION SYSTEM

Kyunghwa Han, PhD (*Abstract Co-Author*) Nothing to Disclose
Seungchan Nahm (*Abstract Co-Author*) Nothing to Disclose
Ji Soo Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jiyoung Yoon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jung Hyun Yoon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vivian Y. Park, MD (*Abstract Co-Author*) Nothing to Disclose
Miribi Rho, MD (*Abstract Co-Author*) Nothing to Disclose
Min Jung Kim, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To analyze the performance measures of US features in non-mass lesions (NMLs) according to clinical indication and compare the performance of prospectively recorded BI-RADS categories vs. a recently proposed risk stratification system.

### METHODS AND MATERIALS

This retrospective study included 1152 women with 1183 pathologically confirmed NMLs from January 2014 to February 2021, which were prospectively categorized as NMLs prior to biopsy. Three breast radiologists independently reviewed US features and mammographic findings. Performance measures of US features were analyzed by clinical indication (screening, diagnostic, current breast cancer), and the performances of prospectively recorded BI-RADS categories vs. a risk stratification system were compared based on reader-averaged AUCs.

### RESULTS

Among 1183 NMLs, 766 (64.8%) were benign and 417 (35.2%) were malignant. Overall, the clinical indication, age, mammographic density, lesion size (=3cm), distribution, associated calcifications, posterior shadowing, abnormal ductal change, echogenicity, and positive mammographic findings were associated with malignancy (all p <.05). Multiple small cysts showed a negative association (p<.001). The PPVs of US features by indication subgroups (screening, diagnostic, current breast cancer) are as follows: distribution: 17.1%, 65.1%, 47.9%; calcifications: 50.0%, 70.8%, 77.0%; posterior shadowing: 12.0%, 58.6%, 59.4% and abnormal ductal change: 31.5%, 60.5%, 45.9%. The NPVs of multiple small cysts by indication were 89.6%, 54.5%, and 59.9%, respectively. BI-RADS categories from radiology reports showed an overall higher AUC than the risk stratification system (AUC 0.850 vs. 0.736) and for each indication subgroup (screening: 0.888 vs. 0.736, diagnostic: 0.880 vs. 0.766, current breast cancer: 0.717 vs. 0.614) (all p<.05).

### CONCLUSION

Previously reported US features were associated with malignancy in NMLs, but PPVs were lower in the screening subgroup. In all indication subgroups, radiologists' real-world BI-RADS classification demonstrated higher performance in the diagnosis of NMLs than the retrospective application of a risk stratification system.

### CLINICAL RELEVANCE/APPLICATION

US features were associated with malignancy in NMLs, but predictive values and diagnostic performance differed according to indication subgroup.

## W3-SSBR08-2 BREAST CANCER DETECTION USING CONTRAST-FREE ULTRASOUND QUANTITATIVE HIGH-DEFINITION MICROVASCULATURE IMAGING

Mostafa Fatemi, PhD, PhD (*Abstract Co-Author*) Nothing to Disclose
Azra Alizad, MD (*Abstract Co-Author*) Nothing to Disclose
Robert T. Fazzio, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Soroosh Sabeti, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To overcome the limitations of power Doppler in imaging angiogenesis, we investigated the utility of new quantitative biomarkers of a contrast-free ultrasound microvasculature imaging technique called quantitative high-definition microvasculature imaging (qHDMI) for differentiation of benign from malignant pathologies of breast lesions.

**METHODS AND MATERIALS**

In this prospective study, qHDMI was tested on 521 patients with 527 ultrasound-identified suspicious breast masses recommended for biopsy. The study was compliant with Health Insurance Portability and Accountability Act, and approved by our institutional review board (IRB). A signed informed IRB approved written consent was obtained from each patient. The histopathological results of breast core needle biopsy were used as the gold standard reference. Microvasculature images were generated through post-processing of the data, in a series of clutter filtering, denoising, and vessel enhancement steps. The extracted qHDMI biomarkers included number of vessel segments (NV), number of branch points (NB), vessel density (VD), vessel density ratio (VDR), spatial vascularity pattern (SVP), Murray's deviation (MD), fractal dimension (FD), diameter (D), bifurcation angle (BA), and tortuosity (t). Multivariable logistic regression analysis was used to study the performance of different prediction models trained with different sets of biomarkers in differentiating benign from malignant lesions.

**RESULTS**

The qHDMI biomarkers were statistically significantly different in malignant and benign lesions, regardless of tumor size. Models trained using all biomarkers showed an AUC, sensitivity, and specificity of 99.1% (95% CI: 98%-100%), 97.1%, 98.4%, respectively for lesions larger than 20mm. The classification was further improved by adding the BI-RADS score to the prediction model, showing an AUC, sensitivity, and specificity of 99.5% (95% CI: 99%-100%), 100%, 96.7%, respectively.

**CONCLUSION**

Without the help of contrast agents, through utilization of qHDMI on patients with breast masses, we were able to resolve tumor microvessels as small as 150 μm. We further showed that analysis of tumor vessel morphological parameters may improve the accuracy of ultrasound in differentiating malignant vs benign breast masses.

**CLINICAL RELEVANCE/APPLICATION**

qHDMI can offer a new means of detecting breast cancer when used as a complementary tool to standard ultrasound. The findings provide a translational rationale for the clinical implementation of qHDMI for breast cancer detection.

## W3-SSBR08-3 ASSESSING NONINFERIORITY OF QUANTITATIVE TRANSMISSION (QT) ULTRASOUND IMAGING COMPARED WITH DIGITAL BREAST TOMOSYNTHESIS (DBT): RESULTS FROM A MULTI-READER, MULTI-CASE (MRMC) OBSERVER STUDY

John C. Klock, MD (*Abstract Co-Author*) Officer, QT Imaging, Inc
Yulei Jiang, PhD (*Abstract Co-Author*) Research Grant, Delphinus Medical Technologies, Inc;Research Consultant, Delphinus Medical Technologies, Inc
Bilal Malik, PhD (*Presenter*) Consultant, QT Ultrasound, LLC

**PURPOSE**

Quantitative transmission (QT) imaging is a relatively new ultrasound breast imaging modality. Its inherent volumetric imaging allows for delineating overlapping breast tissue structures not differentiated well by mammography, specifically in women too young for screening mammography and in whom dense breasts are prevalent. Therefore, QT could potentially improve breast cancer detection and characterization in such a population. In this study, we present the results of a multi-reader multi-case (MRMC) study to compare radiologists' performance in interpreting QT vs digital breast tomosynthesis (DBT).

**METHODS AND MATERIALS**

The study utilized subject images obtained from HIPAA-compliant, institutional review board-approved prospective case collection studies conducted at four clinical sites. These images were interpreted by 24 board certified diagnostic radiologists. Adult females with either normal mammograms or mammographic abnormalities were enrolled and underwent QT scans after standard clinical DBT. DBT and QT images of both breasts were obtained for each subject, with bilateral images treated as separate cases for interpretation and analysis. The study image set comprised 177 cases, with 66 cases with cancer, atypia, or solid benign lesions and 111 normal cases or with non-solid benign lesions. Ground truth for abnormalities was established through biopsy or aspiration pathology results, while normal cases were determined by 1-year follow-up. The study tested the hypothesis that the area under the receiver operating characteristic curve (AUC) of QT imaging is non-inferior to that of DBT.

**RESULTS**

AUC of QT (0.746 ± 0.028, mean ± SD) was noninferior to DBT (0.700 ± 0.028) for AUC difference margin of -0.05 ($P < .05$). AUC difference was 0.046 ± 0.028 (95% CI: [-0.008, 0.101]). Sensitivity was 70.6 ± 7.2% for QT and 85.2 ± 6.4% for DBT, specificity was 60.1 ± 12.3% vs 37.2 ± 11.0%, with both differences statistically significant.

**CONCLUSION**

QT imaging holds promise as a possible substitute for mammography in screening for breast cancer among younger women who are not yet eligible for mammography.

**CLINICAL RELEVANCE/APPLICATION**

Although fewer than 5% of women with breast cancer are diagnosed before the age of 40, younger women often face the most aggressive forms with poorer survival rates. However, routine mammograms aren't advised for women under 40. QT imaging offers a promising alternative by more effectively imaging dense breast tissue and doing so without radiation exposure. The results of QT's non-inferiority to DBT demonstrate potential benefit of QT for younger women.

## W3-SSBR08-4 SUPPLEMENTARY ULTRASOUND AND MRI FOR DIAGNOSIS OF ABNORMAL CASES PRESENTING ARCHITECTURAL DISTORTION ON DBT

Meihao Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Jeon-Hor Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Jiejie Zhou, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Xiao Chen (*Abstract Co-Author*) Nothing to Disclose
Yang Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose

Yan-Lin Liu (*Abstract Co-Author*) Nothing to Disclose
Min-Ying Su, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The presentation of architectural distortion (AD) has not been extensively investigated and not interpreted well in the BI-RADS lexicon, and the interpretation of AD remains challenging. The diagnosis for lesions that only present as pure AD without accompanying mass or microcalcifications is the most difficult. In this study, the diagnostic role of supplementary ultrasound (US) and MRI was investigated by evaluating their correlations and comparing their diagnostic performance.

**METHODS AND MATERIALS**

Pathologically confirmed 471 cases were investigated, 265 (56%) malignant and 206 (44%) benign. The DBT images were reviewed to identify the suspicious AD areas and to determine whether the lesion was pure AD or was accompanied by mass or microcalcifications. The US reports were reviewed to determine whether there were suspicious findings corresponding to the detected AD. The malignancy rate in patients with or without US findings was compared. In patients presenting as pure AD, the BI-RADS score distribution between DBT and US was correlated. In 57 patients who had DBT, US, and MRI, the diagnostic performance was compared.

**RESULTS**

Malignancy rate in DBT BI-RADS 5, 4C, 4B, 4A, and 3 groups were 100%, 86%, 57%, 37%, and 19%, respectively. Of 471 cases, 315 showed the corresponding abnormality on US, and the malignancy rate was 72%. In 156 cases without corresponding US findings, the malignancy rate was lower at 24% ($P < 0.001$). In US examination, irregular shape, non-circumscribed margin, low echo, heterogeneous echo, and larger tumor size were associated with malignancy. In 256 pure AD cases, there were 114 malignant (46%) and 139 benign (54%). In malignant cases, scores are mainly distributed in 4C to 4A, and 15 cases do not have suspicious US. In benign cases, scores are mainly distributed in 4B to 3, and 32 cases (23%) have US BI-RADS 2-3, and 47 cases (34%) do not have corresponding suspicious US findings. In 57 cases with three imaging, the diagnostic accuracy was 67% for DBT, and 74% for both US and MRI. MRI had the highest sensitivity of 90%, and US had the best specificity of 67%.

**CONCLUSION**

AD lesions identified on DBT that had corresponding US abnormalities had a much higher malignancy rate than those without. In pure AD, no corresponding US finding can rule out many benign lesions and spare patients from unnecessary biopsies. Supplementary MRI has the highest sensitivity; however, some benign lesions demonstrating enhancements would result in a false positive diagnosis. In these cases, the lack of US abnormality may improve the specificity.

**CLINICAL RELEVANCE/APPLICATION**

Diagnosis of lesions presenting as architectural distortion on DBT can be improved with more understanding of associated features, and with the correlation of features imaged by ultrasound and MRI.

## W3-SSBR08-5 ENHANCED DIAGNOSTIC PERFORMANCE OF SHEAR-WAVE DISPERSION IMAGING IN BREAST MASSES: COMPARISON WITH SHEAR-WAVE ELASTOGRAPHY ACCORDING TO LESION SIZE, DEPTH, AND BREAST THICKNESS

Sung Eun Song, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eunkyung Woo (*Abstract Co-Author*) Nothing to Disclose
Kyu Ran Cho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ok Hee Woo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Min Sun Bae, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bo Kyoung Seo, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Human breast tissue exhibits viscoelastic properties, but ultrasound (US) assessments have primarily focused on elasticity measurement. Shear wave elastography (SWE) is a commonly used US technique for quantifying tissue elasticity, but its accuracy can be affected by lesion size, depth, and breast thickness. Recent technological advancements allow for the automatic quantification of viscosity through the shear-wave dispersion slope (SWD) in SWE. This study aims to evaluate the diagnostic performance of SWD in distinguishing between benign and malignant breast masses and to explore its supplementary role.

**METHODS AND MATERIALS**

From August 2020 to August 2021, we retrospectively evaluated 606 consecutive patients scheduled for ultrasound-guided biopsy. We performed SWD and SWE before the procedure. A total of 630 breast masses were included in the study. For each mass, we measured the average tumor elasticity (Etumor) and tumor-to-fat elasticity ratio (Eratio) using SWE, as well as the average tumor dispersion (Dtumor) and tumor-to-fat dispersion ratio (Dratio) using SWD. We compared the diagnostic performance of SWE and SWD using the area under the curve (AUC). Additionally, we conducted a Mann-Whitney U test to determine whether lesion size, depth, and breast thickness independently affected the overall diagnostic performance.

**RESULTS**

Of the 630 masses, 395 were benign and 235 were malignant. Mean values of Etumor, Eratio, Dtumor, and Dratio were 11.5 kPa, 2.6, 11.2 m/s/kHz, and 2.1 for benign lesions and 79.5 kPa, 16.4, 27.1 m/s/kHz, 5.0 for malignant lesions ($p < 0.05$). The overall AUC was significantly superior in SWD (Dtumor vs. Etumor, 0.96 vs. 0.93; Dratio vs. Eratio, 0.95 vs. 0.93) ($p < 0.05$). In small masses = 10 mm, the sensitivity and positive predictive value of Dtumor were higher than Etumor (70% and 85% vs. 38% and 68%) with the preservation of high specificity (98% vs. 96%) ($p < 0.05$). In lesions of any depth and breast thickness, Dtumor showed the highest sensitivity and specificity.

**CONCLUSION**

SWD can enhance the diagnostic performance for distinguishing between benign and malignant breast masses compared to SWE across various lesion sizes, depths, and breast thicknesses.

**CLINICAL RELEVANCE/APPLICATION**

SWD, obtained automatically during SWE examination, could compensate for the shortcomings of SWE regarding variance in diagnostic performance according to lesion size, depth, and breast thickness.

## W3-SSBR08-6 SINGLE INSTITUTION INTERIM RESULTS OF NO AXILLARY SURGICAL TREATMENT IN CLINICALLY LYMPH NODE-NEGATIVE PATIENTS AFTER ULTRASONOGRAPHY (NAUTILUS) TRIAL

Woo Kyung Moon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jung Min Chang, MD (*Abstract Co-Author*) Research Consultant, Genoray Co, Ltd
Jung Oh Lee, MD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the interim results of axillary lymph node (LN) metastasis rate and the factors related to axillary LN metastasis in patients who underwent sentinel LN biopsy (SLNB) within the single-institution cohort participating in the No Axillary Surgical Treatment in Clinically Lymph Node-Negative Patients after Ultrasonography (NAUTILUS) trial.

**METHODS AND MATERIALS**

Between September 2020 and October 2022, patients with clinically and sonographically node-negative T1-2 breast cancer and who are expected to undergo BCS and whole-breast radiation in South Korea were invited in the NAUTILUS trial and randomized (1:1) to the axillary surgery omission and SLNB groups (NCT04303715). In this trial, patients with normal LNs (oval shape, smooth margin, and uniformly thin cortex < 3 mm) or one LN with cortical thickness = 3 mm, but biopsy proven negative were only included. Among these patients, we analyzed axillary LN metastasis rates of SLNB group in a single institution using clinical follow-up or pathologic data. The numbers of metastatic LNs were evaluated, and the differences in the distribution clinicopathological, and US features between patients with vs. without LN metastasis were analyzed using the t-test or the chi-square.

**RESULTS**

Among 617 women (median [IQR] age, 56 [48-66] years), 308 were randomized in axillary surgery omission group, and 309 in SLNB group. In 309 patients in SLNB group, the median (IQR) tumor size was 1.5 (0.5-1.9) cm, 258 (83.5%) had invasive ductal carcinoma, and 28 (9.1%) had invasive lobular carcinoma. The median (IQR) follow-up was 24 (19-28) months. Among these patients, there was 29 cases (9.4%, 29/309) of LN metastasis (one [n=24], two [n=2], three or more [n=3]). The median (IQR) index tumor size (1.8 [1.3-2.0] cm vs. 1.4 [1.0-1.8] cm, p=0.007) and cortical thickness of LN on US (2.0 [1.6-2.4] mm vs. 1.7 [1.4-2.0] mm, p=0.006) was significantly larger in patients with LN metastasis compared to patients without LN metastasis. Lymphovascular invasion was more frequently noted in patients with LN metastasis than without LN metastasis (10.3% vs. 2.1%, p=0.013). Age, menopausal status, tumor histology, Ki-67 index, hormone receptor or human epidermal growth factor receptor type 2 status were not correlated with LN metastasis.

**CONCLUSION**

Interim results from a single institution showed a 9.4% axillary LN metastasis rate in the SLNB group. The tumor size, cortical thickness of LNs, and lymphovascular invasion were significantly correlated with LN metastasis.

**CLINICAL RELEVANCE/APPLICATION**

The tumor size, cortical thickness of LNs on US could be helpful for decision of axillary surgery, although pathologic LN status may not be clinically relevant to patient management.
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# Abstract Archives of the RSNA, 2024

W3-SSCA07

**Cardiac Imaging (Advanced CMR)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E353C

Michael Markl, PhD (*Moderator*) Research support, Siemens AG Research Grant, Circle Cardiovascular Imaging Inc
Melany B. Atkins, MD (*Moderator*) Consultant, General Electric Company;Speaker, General Electric Company

**Sub-Events**

## W3-SSCA07-1 IMPROVING CORRELATION BETWEEN RIGHT VENTRICULAR STROKE VOLUME ASSESSED BY CARDIAC MRI AND PULMONARY ARTERY FLOW ASSESSED BY 4D FLOW MRI IN PATIENTS WITH PULMONARY HYPERTENSION: TO EXCLUDE OR NOT TO EXCLUDE TRABECULATIONS?

Young-wouk Kim (*Abstract Co-Author*) Nothing to Disclose
Francois Haddad, MD (*Abstract Co-Author*) Nothing to Disclose
Kianosh Kasani (*Abstract Co-Author*) Nothing to Disclose
OLAF MERCIER (*Abstract Co-Author*) Nothing to Disclose
Laurette Kalifa (*Abstract Co-Author*) Nothing to Disclose
Marc Zins, MD (*Abstract Co-Author*) Nothing to Disclose
Virgile Chevance (*Abstract Co-Author*) Nothing to Disclose
Guillaume Reverdito, MD (*Abstract Co-Author*) Nothing to Disclose
Hichem Sakhi (*Abstract Co-Author*) Nothing to Disclose
Haifa Remili, DO (*Abstract Co-Author*) Nothing to Disclose
Arshid Azarine, MD, MSc (*Presenter*) Advisory Board, Arterys Inc

### PURPOSE

To optimize correlation between assessment of right ventricular (RV) stroke volume by cardiac MRI (CMR) and pulmonary artery forward flow (PAFF) using 4D flow MRI in patients with pulmonary hypertension (PH).

### METHODS AND MATERIALS

42 PH patients underwent right heart catheterization (RHC) and cardiovascular magnetic resonance (CMR) imaging, including 4D flow MRI, before and after surgery. Out of these, 31 patients with chronic thrombo-embolic PH (CTEPH) had pulmonary endarterectomy, while 11 patients with pulmonary arterial hypertension (PAH) had lung transplantation. CMR was performed using a 1.5T magnet. RV stroke volume was calculated conventionally (RVSV), and excluding hypertrophic RV trabeculations (RVSVt). Pulmonary artery forward flow (PAFF) was assessed conventionally at the mid-pulmonary artery trunk (MPAFF) and at the annular level (APAFF). Agreement between measurements was assessed using linear regression (Pearson), Blant-Altman analysis, Lin's concordance correlation coefficient, and intra-class correlation coefficients for interobserver reproducibility. The local ethics review board approved the study.

### RESULTS

Pre-operative mPAP significantly decreased from 44.5+/-12.7 to 22.5+/-5.2 mmHg after surgery ($p<0.001$). RV mass including trabeculations significantly decreased from 57.4+/-23.2 to 33.9+/-10.8g post-operatively ($p<0.001$). Pre-operatively, there was a significant difference between RVSV and RVSVt ($p=0.03$), and APAFF and MPAFF ($p=0.04$), with a strong correlation between RVSVt and APAFF ($r=0.90$, $p<0.001$), surpassing correlations with conventional RVSV and MPAFF measurements. Interobserver reproducibility was excellent for RVSV, RVSVt, APAFF and MPAFF, demonstrating high reliability of the assessment techniques. These differences were non significant post-operatively, indicating reliable RVSV assessment without need to exclude trabeculations after surgery.

### CONCLUSION

In PH patients, significant differences were demonstrated between RVSV and RVSVt, and MPAFF and APAFF, with a strong correlation between RVSVt and APAFF. After surgery, where RV reverse remodeling occured and decreased mPAP mitigated these differences. This study highlights the influence of excluding RV hypertrophic trabeculations and PA vortical flows that occur predominantly in mid-trunk PA, to assess RVSV and PAFF in PH patients.

### CLINICAL RELEVANCE/APPLICATION

The findings highlight the influence of the methodology to optimize the correlation between RVSV and PAFF assessment using CMR and 4D flow MRI in PH patients, underscoring the influence of excluding hypertrophic trabeculations to assess RVSV, and to avoid areas of vortical flows when assessing PA flows, for an optimal correlation between these measurements.

## W3-SSCA07-3 EVALUATION OF RIGHT VENTRICULAR DEFORMATION IN HYPERTROPHIC CARDIOMYOPATHY PATIENTS USING 1.5-T CARDIOVASCULAR MAGNETIC RESONANCE FEATURE TRACKING

Sanjeev Kumar, MBBS,MD (*Abstract Co-Author*) Nothing to Disclose
Priya Jagia, MD (*Abstract Co-Author*) Nothing to Disclose

Niraj N. Pandey, MBBS, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Right ventricular (RV) strain parameters have previously been used for prognostication in multiple cardiovascular diseases and are regarded as better markers of myocardium dysfunction compared to RV ejection fraction (RVEF). The present study sought to assess the global and regional RV deformation in hypertrophic cardiomyopathy (HCM) patients using 1.5-T cardiovascular magnetic resonance feature tracking (CMR-FT).

**METHODS AND MATERIALS**

Fifty-four HCM patients and 32 age- and sex- matched healthy controls were enrolled. HCM patients were divided into groups depending on the presence or absence of right ventricular hypertrophy (RVH), RV dysfunction, RV late gadolinium enhancement (RV-LGE), and left ventricular outflow tract obstruction (LVOTO), respectively. RV strain analysis by CMR-FT was performed using Circle Cvi42 software by automated and manual contouring of RV endocardial and epicardial surfaces.

**RESULTS**

The RV global longitudinal strain (LS), apical RS (radial strain), and mid and apical circumferential strain (CS) in HCM patients were significantly lower than those in controls ($p<0.05$). Compared to healthy controls, the RV global RS was significantly reduced in HCM patients even with absent RVH, the RV global CS and LS were significantly reduced in HCM patients even with normal RVEF, and the RV global RS and LS were significantly reduced in HCM patients even with absent RV-LGE ($p<0.05$). The RV global RS was significantly lower than that in HCM patients without RVH ($p<0.05$). The RV mid and apical CS and global, mid, and apical RS in HCM patients with RV-LGE were significantly lower than that in HCM patients without RV-LGE ($p<0.05$). No significant difference was found regarding RV strain parameters in HCM patients with LVOTO compared without LVOTO (all $p>0.05$) or among HCM patients with normal, reduced or hyperdynamic RVEF (all $p>0.05$).

**CONCLUSION**

CMR-FT can detect subclinical RV myocardial deformation, even in the absence of RVH, RVEF impairment, or RV-LGE; however, RV myocardial deformation in HCM patients is more severe in the presence of RVH and RV-LGE.

**CLINICAL RELEVANCE/APPLICATION**

CMR-FT may be used to detect subclinical RV myocardial deformation which in turn may aid in the prognostication of HCM patients.

## W3-SSCA07-4 THE FEASIBILITY OF HEMODYNAMIC FORCE ANALYSIS BY CARDIAC MAGNETIC RESONANCE FOR ASSESSMENT OF LEFT VENTRICULAR OUTFLOW TRACT OBSTRUCTION IN HYPERTROPHIC CARDIOMYOPATHY

Yang Peng (*Abstract Co-Author*) Nothing to Disclose
Lin Peng (*Abstract Co-Author*) Nothing to Disclose
Yu Feng (*Abstract Co-Author*) Nothing to Disclose
Yuying Chen (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the hemodynamic force (HDF) parameters by cardiac magnetic resonance (CMR) in patients with hypertrophic cardiomyopathy, and to assess their diagnostic value for left ventricular outflow tract (LVOT) obstruction.

**METHODS AND MATERIALS**

This study retrospectively included 81 HCM patients who underwent both CMR examinations with a 3.0 T scanner and color Doppler echocardiography within 2 weeks from January 2020 to November 2022. The patients were further diagnosed as non-obstructive HCM, occult obstructive HCM, or obstructive HCM according to color Doppler echocardiography. The HDF analysis were performed based on strain analysis of CMR cine images at long-axis views (2-chamber, 3-chamber, 4 chamber), including left ventricular longitudinal forces in the following phases: entire heartbeat, systole, diastole, systolic peak, systolic/diastolic transition, diastolic deceleration, as well as atrial thrust, and compared among the 3 groups. The multivariate analysis and receiver operating curve (ROC) analysis were performed to assess potential independent predictors of obstructive HCM.

**RESULTS**

Of the 81 HCM patients, there were 37 with non-obstructive HCM, 14 with occult obstructive HCM, and 30 with obstructive HCM. There was no significant difference in GLS among non-obstructive, occult obstructive and obstructive HCMs. HDF analysis revealed significantly higher forces in the entire heartbeat, systole, and diastole in obstructive HCM than those in non-obstructive HCM (all adjusted $P<0.05$). Peak systolic force was also higher in obstructive HCM than that in non-obstructive HCM (adjusted $P<0.05$). There was no HDF parameters revealing statistically significant difference between occult obstruction and the other two groups. At multivariate analysis, HDF in the entire heartbeat was confirmed as an independent predictor for obstructive HCM with an AUC of 0.738 (95% confidence interval:0.617-0.859, $P=0.001$). Its sensitivity and specificity were 53.3% and 81.1%, respectively.

**CONCLUSION**

HDF analysis indicated higher LV forces in obstructive HCM than that in non-obstructive HCM. HDF in the entire heartbeat showed the best predictive value for LVOT obstruction in HCM.

**CLINICAL RELEVANCE/APPLICATION**

LVOT obstruction in HCM was commonly assessed by LVOT gradient through color Doppler echocardiography or 4D flow CMR. This study revealed the potential value of HDF analysis by conventional CMR cine images in assessment of LVOT obstruction.

## W3-SSCA07-5 COMPARISON OF PULMONARY REGURGITATION FRACTION BETWEEN 2D PHASE CONTRAST AND 4D FLOW MRI IN ADULTS WITH REPAIRED TETRALOGY OF FALLOT

Michinobu Nagao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Hirozumi Mori, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

It is known that adult patients with repaired tetralogy of Fallot can exhibit severe pulmonary arterial regurgitation, which significantly influences treatment decisions. Measurement of regurgitation fraction(RF) on cardiac MRI is a valuable non-invasive examination, and 4D flow offers advantages over 2D phase contrast sequence by enabling measurement at multiple cross-sections and retrospective determination while visually assessing flow

features such as turbulence. In this study, we compared the RF of the main pulmonary artery (MPA) using 2D phase contrast sequence and 4D flow at the same cross-section and evaluated whether RF rate measured at multiple cross-sections with 4D flow are affected by turbulence.

## METHODS AND MATERIALS

30 patients post-repaired of tetralogy of Fallot (44.3 ± 15.7 years, 18 females) underwent imaging with 3.0-Tesla MRI (Ingenia 3T, Philips Healthcare) using 2D phase contrast sequence and 4D flow. RF of the main pulmonary artery(MPA) was calculated from forward and backward flow using Intellispace Portal (ISP) and compared between the two imaging techniques. In 4D flow, RF was measured at positions matching those in 2D phase contrast sequence and proximal and distal positions, with up to five slices measured at 1 cm intervals on the 3D model shape.

## RESULTS

Forward flow was significantly higher with 2D phase contrast sequence compared to 4D flow (103.5 ± 26.7ml vs. 85.8 ± 31.0ml; paired t-test, p=0.01), while backward flow tended to be higher with 2D phase contrast sequence but was not statistically significant (44.5 ± 29.5ml vs. 33.14± 24.5ml; paired t-test, p=0.055). The distribution of RF between 2D phase contrast sequence and 4D flow showed a high correlation (40.0 ± 18.1% vs. 37.5 ± 19.7%: Spearman rank correlation, rs= 0.757).In 10 of the 30 cases, there was a noticeable variation in the RF measured in multiple slices in 4D flow, with a difference of more than 20% compared to the RF measured at the same location in 2D phase contrast sequence. Both forward and backward turbulence were evident in areas where the shape of the pulmonary arteries was complex.

## CONCLUSION

RF measured with 2D phase contrast sequences and 4D flow showed high agreement when aligning slice positions. However, in cases with significant turbulence, variations in measurements from 4D flow were noticeable.

## CLINICAL RELEVANCE/APPLICATION

While measurements in the MPA with 2D phase contrast sequence are typically performed at a single location, accurate measurement with 2D phase contrast sequence at a single slice is difficult in cases with complex pulmonary artery shapes. Therefore, measurement with 4D flow, allowing multi-section evaluation, is crucial for comprehensive evaluation and treatment decision-making.

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# Abstract Archives of the RSNA, 2024

W3-SSER02

**Emergency Radiology (Scientific Session 2)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: N228

Melissa A. Davis, MD, MBA (*Moderator*) Nothing to Disclose
Carrie N. Hoff, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W3-SSER02-1 COMPARISON STUDY BETWEEN POSTMORTEM CT AND CONVENTIONAL AUTOPSY IN CORONER'S INVESTIGATIONS FORM THE PROVINCE OF QUEBEC, CANADA

Yann Daze (*Abstract Co-Author*) Nothing to Disclose
Gabriel Nadeau, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Martin Clavet (*Abstract Co-Author*) Nothing to Disclose
Luc Lacoursiere, MD, FRCPC (*Presenter*) Nothing to Disclose

### PURPOSE

To compare postmortem computed tomography (CT) and conventional autopsy in their capacity to determine the causes and manners of death and to detect anomalies, in coroner’s office investigations.

### METHODS AND MATERIALS

Postmortem CT was performed on 100 human corpses prior to conventional autopsy. The CT exams were read by a postmortem-trained and experienced radiologist and conventional autopsies (CA) performed by 4 forensic pathologists blinded to the CT results. All findings were recorded for each method and categorized by anatomic systems (soft tissue, bone, central nervous system (CNS), lungs, heart/vessels, abdomen). These findings were graded for their importance (essential, important, and fortuitous observations). The ability of each method to determine the cause of death and the primary anatomic system involved was also compared against coroner's final reports.

### RESULTS

Significant differences ($P < 0.05$) were observed in the detection of essential and important findings between CT and CA. Among all 378 findings, CT identified 271 (71.7%) compared to 309 (81.7%) for CA. Considering anatomic systems, there was a significant difference with CT performing better for CNS anomalies [90.2% (37/41) vs 65.9% (27/41)]. CA better detected heart/vessel anomalies [87.6 % (85/97) vs 57.7 % (56/97)] and abdominal findings [86.2 % (56/65) vs 47.7 % (31/65)]. Both CT and CA were of equal performance for detection of bone [93.9 % (62/66) vs 81.8 % (54/66)] and lung [78.6 % (44/56) vs 80.4 % (45/56)] anomalies. Kappa coefficient of agreement between CT and CA with coroner's final reports for the causes of death were: all causes of death (0.75), intoxication (0.59), natural causes of death (0.61), hypothermia (0.65), asphyxia (0.75), polytrauma (0.93), drowning (1), Fire (1), firearm and stabbing (1) and hanging (1). Kappa coefficient of agreement between CT and CA for the anatomic systems responsible for death were: all systems 0.73, heart 0.56, aorta and peripheral vessels 0.66, CNS 0.80, multisystem 0.86 and respiratory system 0.91.

### CONCLUSION

Postmortem CT and conventional autopsy are both effective in identifying most essential and important findings for determining the cause and manner of death. However, CT is better in detecting CNS anomalies, while conventional autopsy is better in detecting cardiovascular and abdominal anomalies. Agreement between both methods is considered near perfect or perfect for violent deaths and substantial for natural deaths.

### CLINICAL RELEVANCE/APPLICATION

This study demonstrated the great value of postmortem CT in the context of coroner's investigations in which finding a probable cause of death is the main purpose and led to changes in investigating protocols for Quebec’s coroners.

## W3-SSER02-2 DIAGNOSTIC ACCURACY: SENSITIVITY AND SPECIFICITY OF DEEP LEARNING TOOL FOR AUTOMATIC CERVICAL SPINE FRACTURE DETECTION

Marlene SCUDELER (*Abstract Co-Author*) Nothing to Disclose
Vladimir Laletin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasmina Chaibi, PhD (*Abstract Co-Author*) Employee, Avicenna.ai
Angela Ayobi, MENG,MSc (*Abstract Co-Author*) Employee, Avicenna.ai
Charlotte Castineira (*Abstract Co-Author*) Nothing to Disclose
Mar Roca-Sogorb (*Abstract Co-Author*) Nothing to Disclose
Sarah Quenet, MD (*Presenter*) Employee, Avicenna.ai

**PURPOSE**

This study assessed the diagnostic performance of an artificial intelligence (AI) application for triage and prioritization of cervical spine fractures on CT scans. The validation was performed on scans across multiple clinical centers and CT vendors.

**METHODS AND MATERIALS**

This retrospective, multi-center, multinational and blinded study evaluated non-enhanced cervical CT images provided by three teleradiology organizations. The dataset encompassed various clinical centers in Europe and America and included scans from five different CT vendors. The study evaluated the efficacy of an AI-based application CINA-CSpine (Avicenna.AI, La Ciotat, France) in detecting cervical fractures. The performance of the AI device was compared against the Ground Truth, established by the consensus of three board-certified radiologists. The relevance for clinical workflow was equally assessed. Finally, the stratification analysis for several CT scan and patient parameters was performed.

**RESULTS**

328 scans (mean age: 55.3 yo ± 5.1 [SD]; 59.5% male) were reviewed. Among the 155 exams identified as positive for acute cervical spinal fracture by the experts, the device correctly identified 140, resulting in a sensitivity of 90.3% [95% CI: 84.5% - 94.5%]. Likewise, 159 out of 173 were correctly identified as negatives (specificity of 91.9% [95% CI 86.8% - 95.5%]). The Positive Predictive Value (PPV) and Negative Predictive Value (NPV) were 90.9% and 91.4%, respectively. Missed cervical spine fractures were attributed to poor image quality, osteophyte fractures, and vertebral degenerative diseases. False positives were associated with confounding conditions such as degenerative disease, chronic spinal fractures, acquisition artefacts and complex osteophytes. The overall mean time-to-notification for the automated tool was estimated at 2.9 ± 1.1 [SD] minutes. Sensitivity and specificity across multiple image acquisition parameters and patient characteristics exceeded 85%.

**CONCLUSION**

The AI-based algorithm, evaluated on real-world data CT scans, exhibited high accuracy in detecting cervical spine fractures, coupled with a rapid time-to-notification. These findings imply that incorporating AI into routine clinical practice could streamline the workflow, facilitating faster and more accurate diagnosis.

**CLINICAL RELEVANCE/APPLICATION**

This study sheds light on the high performance of an AI-based algorithm in clinical data triage and prioritization for routine detection of cervical spine fractures. The algorithm was tested on diverse data sourced from multiple clinical sites, highlighting its robustness and versatility. Future prospective assessments are needed to clarify the direct impact of this AI-based tool on patient outcomes.

## W3-SSER02-3 SHOCK THYROID: DOES IT EXIST? INCIDENCE AND RELEVANCE OF CT SIGNS OF SHOCK THYROID IN HEMODYNAMICALLY UNSTABLE PATIENTS

Ferco H. Berger, MD (*Abstract Co-Author*) Nothing to Disclose
Rawan Abu Mughli, MD (*Abstract Co-Author*) Nothing to Disclose
Sadia R. Qamar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Jacques Du Plessis, MBChB, FFRad(D)SA (*Abstract Co-Author*) Nothing to Disclose
Matthew Mueller, MSc, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

CT signs of post-traumatic hypovolemic shock complex (HSC) in abdominal organs and vasculature correlate to existing/impending hypovolemic shock. Case reports described (non-) traumatic shock thyroid CT changes as peri-thyroid fluid, altered enhancement and swelling. This study aims to investigate the incidence of shock thyroid CT signs and correlate those with abdominal signs of HSC and patient outcome in trauma patients.

**METHODS AND MATERIALS**

This is a single-center, REB approved, retrospective study of CTs from 1051 hemodynamically unstable trauma patients at an academic Level-1 Trauma Center. CT scans of the neck, chest and abdomen/pelvis were retrospectively reviewed by a single reader blinded to outcome. Direct injury to the thyroid was excluded. Scoring included CT signs of acute thyroid changes (hypo-enhancement, heterogeneity, peri-thyroid fluid, and swelling), known abdominal visceral and vascular CT signs of HSC (IVC diameter; IVC halo; aortic diameter; and changes in enhancement to bowel wall, adrenals, renal cortex, and/or gallbladder wall), and clinical data.

**RESULTS**

This abstract reports on preliminary results of the first 135 patients or our cohort, the other 916 patient will be scored before presentation. 31/135 patients (23%) showed altered CT appearance of the thyroid. Patients were younger if thyroid abnormalities were present (41.8yrs vs 50.3yrs, $p = 0.035$). Striking peri-thyroid fluid correlated with a smaller IVC diameter (11.7 mm vs 14.9 mm; $p = 0.0154$). Of the 31 patients, only one showed visceral hypoperfusion signs on abdominal CT (altered enhancement of the gallbladder and renal cortex). Shock thyroid signs did not correlate with survival at discharge. Upon completion of scoring, further statistical analysis will be performed with subgroup stratification.

**CONCLUSION**

In hemodynamically unstable trauma patients, CT signs of shock thyroid could precede known abdominal CT signs. These preliminary results correlate striking peri-thyroid fluid with smaller IVC diameter, even without other CT HSC signs. Study completion will provide better insight of usefulness of shock thyroid CT signs for clinical management in post-traumatic hypovolemic shock.

**CLINICAL RELEVANCE/APPLICATION**

Signs of shock thyroid on CT may prove to be earlier imaging signs of existing/impeding hypovolemic shock in trauma patients, better guiding early trauma patient management and possibly improving survival.

## W3-SSER02-5 ANALYZING THE PREVALENCE OF INJURY AND VIOLENCE IN TRANSGENDER PATIENTS UTILIZING RADIOLOGY REPORTS

Bharti Khurana, MD, MBA (*Abstract Co-Author*) Consultant, General Electric Company;Editor, Wolters Kluwer nv;Author, Cambridge University Press;Consultant, ROKIT Healthcare, Inc
Rohan Chopra (*Presenter*) Nothing to Disclose

**PURPOSE**

Recent research indicates a concerning trend of increased violence against transgender individuals with significant underreporting. This study aims to investigate the prevalence and disparities in reported injuries and potential violence between transgender female and cisgender female patients by

analyzing radiology reports.

**METHODS AND MATERIALS**

Using our institution's Research Patient Data Registry, we identified 560 trans-female patients aged 18 and older, each confirmed by at least two specific transgender-related ICD codes. Among these individuals, 283 patients (cases) had at least one radiological study. We compared the imaging utilization, number, and types of injuries reported in the radiology reports of these transgender patients against those of 875 cisgender age-matched female control patients. Rates of injuries between cases and controls were compared using crude odds ratios and Fisher's Exact Tests.

**RESULTS**

In our study cohort, 20.5% (58/283) of cases sustained 85 distinct injuries, averaging 1.6 injuries per person (ranging from 1 to 4). In contrast, 11.4% (100/875) of controls experienced 119 injuries, averaging 1.2 injuries per person (ranging from 1 to 6). Fisher's Exact Test revealed a statistically significant difference in the likelihood of injury, with an odds ratio of 2.0 ($p = 0.0002$). Musculoskeletal (MSK) injuries dominated both groups (78.8% vs. 74.7%). Craniofacial injuries were more prevalent among cases, occurring in 18.8% (16/85) of injuries compared to 5% (6/119) among controls, with an odds ratio of 4.37 ($p = 0.002$). Of 2,294 radiological studies in cases, 55.2% (1267) were focused on MSK or neurological issues, significantly higher than the 30% (4039/13462) observed in the control group, yielding an odds ratio of 2.88 ($p < 0.0001$).

**CONCLUSION**

Our study demonstrates increased injury rates in trans-female patients despite lower imaging utilization compared to cisgender females, with a higher proportion of musculoskeletal and neurological imaging studies.

**CLINICAL RELEVANCE/APPLICATION**

The clinical significance of our study lies in its revelation of heightened injury rates among trans-female patients despite the underutilization of imaging services. The prevalence of musculoskeletal and neurological imaging among trans females indicates a propensity to seek medical attention primarily for injury-related concerns, potentially influenced by obstacles in healthcare access and hesitancy toward preventive healthcare measures. Addressing these disparities is pivotal for delivering equitable and comprehensive healthcare services to the transgender community, thereby fostering improved health outcomes and well-being.

## W3-SSER02-6 DOES AI ASSISTANCE IMPROVE CLINICIAN INTERPRETATION OF INPATIENT AND EMERGENCY DEPARTMENT CHEST X-RAYS?

Alex Novak, MBChB (*Abstract Co-Author*) Nothing to Disclose
Louise Wing, BMBCh, MA (*Abstract Co-Author*) Nothing to Disclose
Abdala Trinidad Espinosa Morgado (*Abstract Co-Author*) Nothing to Disclose
Edwin J. van Beek, MD, PhD (*Abstract Co-Author*) Research support, Siemens AG;Advisory Board, Aidence nv;Advisory Board, ImBio, LLC;Consultant, Holoxica Limited;Speaker, AstraZeneca PLC;Speaker, F. Hoffmann-La Roche Ltd;Founder, QCTIS UK, Ltd;Director, QCTIS UK, Ltd;Spouse, Director, QCTIS UK, Ltd;
John T. Murchison, PhD,FRCR (*Abstract Co-Author*) Nothing to Disclose
Marusa Kotnik, MD (*Abstract Co-Author*) Nothing to Disclose
Howell Fu, BMBCh (*Abstract Co-Author*) Nothing to Disclose
Indrajeet Das, FRCR (*Abstract Co-Author*) Nothing to Disclose
Sarim Ather, PhD, MBChB (*Abstract Co-Author*) Nothing to Disclose
Farhaan Khan, MBBCHIR (*Abstract Co-Author*) Nothing to Disclose
Fergus V. Gleeson, FRCR,MBBS (*Abstract Co-Author*) Stockholder, Optellum Ltd
Ruchir Shah, MD, MBBS (*Presenter*) Nothing to Disclose

**PURPOSE**

This study evaluates a commercial AI product from Lunit and the effect on reader performance with AI assistance for clinicians from a variety of different specialities and grades on inpatient and emergency chest x-ray (CXR) interpretation.

**METHODS AND MATERIALS**

A multi-reader multi-case study design was used to evaluate the performance of 30 clinicians. These clinicians came from a variety of backgrounds (radiologists, reporting radiographers, emergency, general internal and intensive care physicians) and grouped into 3 different grades (1-4 years postgraduate, 5-8 years postgraduate, 8 years postgraduate). They were tasked to provide their interpretation on 500 adult inpatient and emergency department CXRs which were identified from 2 large teaching hospitals. Readers were asked to identify the presence of 10 pathologies and give a confidence score for each interpretation. This was done without and then with AI assistance after a 4 week washout period.The case ground truth was determined by 2 thoracic radiology consultants. Arbitration by a further senior thoracic radiology consultant was done in cases of disagreement. AUC and ANOVA analysis was performed using the MRMCaov r package.

**RESULTS**

Standalone AI performance on the dataset ranged from 0.83-0.99. For 8 pathologies the AI achieved AUC above 0.9. The AI assistance showed a statistically significant improvement in performance for 8 out of the 10 pathologies for readers. There was no statistically significant difference for pneumoperitoneum and mediastinal widening. The greatest improvement was demonstrated for fibrosis (delta AUC 0.193).

**CONCLUSION**

AI assistance can improve a variety of clinicians ability to interpret emergency and inpatient chest x-ray findings.

**CLINICAL RELEVANCE/APPLICATION**

Many AI solutions exist which aim to classify common pathologies on CXRs. There have been studies which evaluate various AI solutions performance in interpretation against expert radiologist as well as studies that explore how AI aids interpretation by radiologists. However, previous work has failed to explore how AI can aide clinicians from patient facing specialities and those of differing grades, in their interpretation of CXRs. As the volume and complexity of radiological investigations performed on patients presenting to hospitals increases at a pace faster than the availability of timely expert reporting and interpretation, the urgent clinical decisions based on CXR findings are made by the patient facing clinicians own judgement and interpretation. Patient facing clinicians can make better decisions by using AI to improve their interpretation of chest xrays.

# Abstract Archives of the RSNA, 2024

W3-SSGI12

**Gastrointestinal Imaging (Focal Liver Disease: Non-HCC)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E352

Kristen Olinger, MD (*Moderator*) Nothing to Disclose
Sudhakar K. Venkatesh, MD, FRCR (*Moderator*) Nothing to Disclose

**Sub-Events**

## W3-SSGI12-1 DEEP-HCC: RADIOMIC FEATURES DIFFERENTIATE PATHOLOGICAL GRADE OF HEPATOCELLULAR CARCINOMA ON MULTIPHASE MRI

Xinyi (Mimi) Li (*Abstract Co-Author*) Nothing to Disclose
Pedram Keshavarz, MD (*Abstract Co-Author*) Nothing to Disclose
Kyunghyun Sung, PhD (*Abstract Co-Author*) Nothing to Disclose
Abhinav Suri, BA, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

Hepatocellular carcinoma (HCC) is one of the most common causes of cancer-related death worldwide. Pathological grading of these tumors on pre treatment biopsy can provide critical information about the likelihood of recurrence after local therapy. While the pre-treatment biopsy is rarely done, pre-treatment multiphase MR imaging prior is common. We aim to use radiomic features of tumors from four temporal phase T1-weighted MR images (pre-contrast, arterial, portal, delayed phase) to predict the pathological grade of HCC lesions.

### METHODS AND MATERIALS

In this retrospective study, we included 22 patients for analysis after exclusion criteria were applied (Figure 1a). Among these patients, 11 had well differentiated, 2 had moderately differentiated, and 9 had poorly differentiated lesions. 3D segmentations of the biopsy proven HCC lesions (verified by a radiologist with 30+ yrs experience) were performed on one MR series.For analysis, four temporal phase MRI images (pre-contrast, arterial, portal, delayed phase) were co-registered with each other based on imputed patient position. The HCC lesion segmentation on one image was propagated across all images and a bounding box was cropped around the segmentation (with a 5mm boundary). These values (Z score standardized relative to background) were input to PyRadiomics v3.1.0 to extract radiomic values for each MRI temporal phase. Additional values were generated by subtracting values for each pair of contrast phases and each radiomic feature (e.g., average[arterial] - average[delayed]) to generate a total of 644 features. These were used to select an optimal clustering algorithm (out of 9) that best-separated lesions by pathological grade (n clusters selected by elbow method using PyCaret v3.3.2, Figure 1b).

### RESULTS

K-Modes was found to be the best clustering algorithm (with n=2 clusters), achieving a complete separation between well-differentiated and poorly differentiated lesions (moderately differentiated lesions split between two clusters, Figure 1c). Out of the 110 features that were included (features with high collinearity and low variance were removed), 5 intensity-based features showed significant differences (t-test, $p<.001$) between the two clusters (Figure 1d).

### CONCLUSION

Radiomics features of HCC lesions on co-registered four phase MR images can successfully differentiate well from poorly differentiated HCC. Future directions of study include creating a prospective model for the prediction of lesion differentiation on imaging.

### CLINICAL RELEVANCE/APPLICATION

These radiomic values can be used to risk-stratify patients for therapeutics and monitoring based on initial imaging for HCC since pre-treatment biopsy has been shown to predict HCC recurrence rates.

## W3-SSGI12-2 LESION CO-REGISTRATION IN LIVER CT SCANS: A FULLY AUTOMATIC PIPELINE FOR RADIOLOGICAL FOLLOW-UP

Michael Uder, MD (*Abstract Co-Author*) Nothing to Disclose
Markus Kopp (*Abstract Co-Author*) Speakers Bureau, Siemens AG
Julia Rodriguez-Comas (*Abstract Co-Author*) Nothing to Disclose
Matthias S. May, MD (*Abstract Co-Author*) Speakers Bureau, Siemens AG
David Schinz (*Abstract Co-Author*) Nothing to Disclose
Christopher Lee Hessman (*Abstract Co-Author*) Nothing to Disclose
Saskia Egger-Hackenschmidt (*Abstract Co-Author*) Nothing to Disclose
Javier Garcia Lopez (*Abstract Co-Author*) Nothing to Disclose
Meritxell Riera I Marin (*Abstract Co-Author*) Nothing to Disclose
Daniel Canadas (*Abstract Co-Author*) Nothing to Disclose

Juan Moreno Vedia (*Abstract Co-Author*) Nothing to Disclose
Maximilian Schmidt (*Presenter*) Nothing to Disclose

**PURPOSE**

Radiological follow-up is a fundamental task for radiologists, requiring the analysis of multiple prior CT scans to assess lesion evolution and treatment efficacy. Within the complex abdominal anatomy, characterized by diverse structures and temporal changes, accurate co-registration of focal liver lesions across successive scans is crucial. In this study, we investigate the co-registration of liver lesions across different abdominal CT scans from individual patients, considering the lesions' temporal evolution. This method assigns a unique identification to each lesion detected at a single time-point and tracks its spatial position across consecutive imaging tests.

**METHODS AND MATERIALS**

This study presents a fully automatic end-to-end pipeline for analyzing changes in liver lesions across consecutive abdominal CT scans in oncology patients. The methodology integrates state-of-the-art registration methods for lesion co-registration. Lesions from subsequent studies are registered onto lesions in the first available study of the patient, and coincident lesions are assigned the same ID based on DICE score overlapping. To validate our method, we used a preliminary unique dataset from 68 clinical abdominal CT scans of 34 patients with a variety of focal liver lesions, expertly delineated by a radiologist.

**RESULTS**

The results demonstrate the efficacy of the proposed pipeline in accurately tracking lesions in the liver across successive CECT scans. In our preliminary results the pipeline exhibited excellent tracking accuracy, with a 100% mean accuracy rate in lesion co-registration. This level of precision facilitated the precise identification and tracking of individual lesions within the liver, enabling automated monitoring of lesion evolution, including changes in various parameters indicative of malignancy such as size, shape, or enhancement patterns.

**CONCLUSION**

The automated pipeline represents a promising approach to enhance the accuracy of clinical decision-making especially in radiological oncology. By streamlining liver lesion analysis and co-registration in abdominal CT scans, it offers valuable insights into disease progression and treatment effectiveness, ultimately leading to improved patient care.

**CLINICAL RELEVANCE/APPLICATION**

Comparing the development of liver lesions in CT scans over different time points represents a significant part of the daily work for many radiologists. An automated pipeline would greatly facilitate this task and at the same time enhance the quality of the comparison, by implying a wider range of metrics. These developments might be key in tackling future challenges such as rising number of studies or staff shortages.

## W3-SSGI12-3 HOW DOES ULTRASOUND COMPARE TO CROSS-SECTIONAL IMAGING IN THE WORKUP AND SURVEILLANCE OF FONTAN LIVER DISEASE

Ciara O'Brien, FRCPC, MBBCh (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic performance of ultrasound (US) for detecting liver cirrhosis and nodules in an adult population with Fontan circulation. To determine correlation between liver cirrhosis and mortality/transplantation. This is the 1st study to evaluate the diagnostic accuracy of US for the surveillance of Fontan liver disease in an adult population.

**METHODS AND MATERIALS**

This retrospective study, conducted at a single center. Patients with Fontan operation, older than 18 years old, followed at the our Adult Congenital Heart Disease Program between September 2015 and September 2022 who had a liver US and liver CT or MRI within 12 months apart, were included.The diagnostic accuracy of liver US for each liver finding was assessed against the cross-sectional imaging findings; sensitivity, specificity, positive predictive value , and negative predictive value were estimated for all variables. Agreement between the different methods was evaluated using the kappa index. A kappa value of 0-0.20 was considered slight agreement, 0.21-0.40 fair agreement, 0.41-0.60 moderate agreement, 0.61-0.80 substantial agreement, and 0.81-1.00 almost perfect agreement. All tests were considered significant in $p<0.05$.

**RESULTS**

131 patients met the inclusion criteria, mean age 34.4 ± 10.1 years, 57 (43.5%) females. The most common type of Fontan was an extracardiac conduit, 66 patients (50.3%). Liver US reported heterogeneous parenchyma, lobar redistribution, and surface nodularity in 85.4%, 72.5%, and 65.6%. Cross-sectional imaging reported the same features in 60.3%, 87.0% and 84.9%, respectively. US sensitivity was more than 0.75 for all variables, specificity was 0.21, 0.58 and 0.85 consequently. Liver US had sensitivity of 0.89 and specificity of 0.73 in defining hepatic nodules, with substantial agreement (kappa 0.64) between techniques. Liver cirrhosis was diagnosed in 78% and 90% of the population by US and cross-sectional respectively. Kappa agreement between techniques was 0.21. There was no correlation between presence of hepatic parenchymal changes or the presence of cirrhosis with mortality/transplantation.

**CONCLUSION**

US is appropriate for screening and surveillance of liver cirrhotic features in the adult Fontan population. Liver US accurately identifies small and large liver nodules. Liver cirrhosis does not correlate to mortality and transplantation.

**CLINICAL RELEVANCE/APPLICATION**

This study shows for the first time that US can be used accurately to detect features of liver cirrhosis and hepatic nodules in patients with Fontan circulation.

## W3-SSGI12-4 DIFFERENTIATING LIVER ADENOMA FROM FOCAL NODULAR HYPERPLASIA USING A NOVEL MECHANICAL TRANSDUCER FOR MRE: A PROSPECTIVE STUDY WITH GADOXETIC ACID-ENHANCED MRI AS THE REFERENCE STANDARD

Simon S. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Vitali Koch, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Darwish (*Abstract Co-Author*) Nothing to Disclose
Jennifer Gotta (*Abstract Co-Author*) Nothing to Disclose
Leon D. Gruenewald, MD (*Abstract Co-Author*) Nothing to Disclose
Victoria Chernyak, MD, MS (*Abstract Co-Author*) Consultant, Bayer AG

Scherwin Mahmoudi, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ralph Sinkus, PhD (*Abstract Co-Author*) Nothing to Disclose
Christian Booz, MD (*Abstract Co-Author*) Speaker, Siemens AG
Ibrahim Yel, MD (*Abstract Co-Author*) Nothing to Disclose
Philipp Reschke, MD (*Abstract Co-Author*) Nothing to Disclose
Jan-Erik Scholtz, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study evaluates a novel mechanical Magnetic Resonance Elastography (MRE) transducer for differentiating focal nodular hyperplasia (FNH) from liver adenoma based on mechanical tissue properties.

**METHODS AND MATERIALS**

Sixteen patients (13 women, 3 men; median age 41; interquartile range 35-46) who had undergone gadoxetic acid-enhanced MRI for differentiating FNH from liver adenoma were enrolled in this prospective study. Two experienced radiologists with 35 and 16 years of experience in liver imaging provided a reference standard based on the contrast-enhanced MRI images. MRE exams were performed using a novel mechanical transducer 15 to 45 days following the MRI. Localization and volumetric analysis of lesions were conducted using the gadoxetic acid-enhanced MRI data. Unenhanced MRI, including T2-weighted and DWI-weighted imaging, aided in lesion localization. Mechanical properties (kPa) of each lesion were measured during MRE; mean kPa values were computed and compared using Student's t-test. Diagnostic accuracy was assessed through confusion matrices.

**RESULTS**

The mean stiffness for FNHs was 3.7 kPa (range, 3.2 - 4.2 kPa), and the mean stiffness for adenomas was 2.3 kPa (range, 1.9 - 2.7 kPa). There was no significant association between lesion size and stiffness values in both FNHs and adenomas ($P = 0.4$). No overlap in stiffness between FNHs and adenomas was noted. Utilizing a stiffness threshold of 3.05 kPa resulted in a diagnostic accuracy of 100%. Stiffness maps showed homogeneous stiffness in adenomas and increased peripheral stiffness in FNHs with reduced stiffness in the central scar area, mimicking the appearance in contrast-enhanced scans.

**CONCLUSION**

A novel mechanical transducer for MRE can accurately differentiate focal nodular hyperplasia from liver adenoma via estimation and visualization of lesion stiffness.

**CLINICAL RELEVANCE/APPLICATION**

We demonstrate that magnetic resonance elastography using a novel mechanical transducer can distinguish focal nodular hyperplasia and liver adenoma without the requirement for intravenous contrast agents. The stiffness maps generated are closely aligned with contrast-enhanced MRI visualizations of FNH. This method is particularly useful when contrast agents are unavailable or contraindicated, offering an alternative for liver lesion characterization.

## W3-SSGI12-5 PER ORAL GADOXETIC ACID ENHANCED LIVER MRI IN A MOUSE HEPATIC METASTASIS TUMOR MODELPER ORAL GADOXETIC ACID ENHANCED LIVER MRI IN A MOUSE HEPATIC METASTASIS TUMOR MODEL

Honsoul Kim (*Presenter*) Nothing to Disclose

**PURPOSE**

To establish a liver MRI protocol based on per oral gadoxetic acid (liver selective contrast agent which 50% is taken up by the hepatocytes) administration using a mouse liver tumor model.

**METHODS AND MATERIALS**

Our institutional IACUC approved this study. 37 female BALB/c nude mice (8 weeks old) were used, of which liver tumor model was generated in only 27 mice (but 3 mice failed to generate a gross tumor) in order to achieve a mixed pool of tumor bearing and non-bearing mice. Liver tumor model was generated by surgically implanting Lewis lung carcinoma cells in the liver. A 7T scanner (Biospec 70/30 USR, Bruker., Ettlingen, Germany) was used for MRI. For contrast enhancement, gadoxetic acid (0.3mmol/Kg body weight, dose was determined by an equation calculating the equivalent inter-species dose adjusting body surface area) was delivered via an orogastric tube. Precontrast and post-contrast (15, 30, 45, 60, 75 minutes) T1WI and T2WI with fat suppression were obtained. The degree of liver enhancement was quantitatively measured by placing regions of interest on the liver and paravertebral muscle calculating their mean signal intensity (SI). The liver-to-muscle signal intensity ratio of each enhancement phase was calculated according to the following equation: Signal intensity ratio(liver/muscle) = (ROILiver1+ROILiver2)/(2×ROIm). After MRI was complete, autopsy was performed to confirm the liver tumor. Paired t-test was performed to compare the relative SI ratio of each sequence. A P-value $<0.05$ was considered as statistically significant.

**RESULTS**

None of the tumors could be confidently identified on precontrast T1WI. Post-enhancement (75 minutes) T1WI revealed either focal tumor lesions (n=14) or multiple tumor lesions (n=6), but failed to detect tumor in 4 mice. The liver-to-muscle signal intensity ratio has statistically significantly increased at all time points ($P<0.01$) when compared with that of the precontrast sequence (precontrast=1; post-30 minutes=1.42±0.24, $P<0.01$; post-75minutes=1.54±0.31, $P<0.01$).

**CONCLUSION**

MRI based on per oral gadoxetic acid administration induced significant liver enhancement which considerably improved tumor delineation.

**CLINICAL RELEVANCE/APPLICATION**

1. Liver MRI protocol can be established based on per oral gadoxetic acid administration at least in mice, and if reproducible in human may be applied to abbreviated liver MRI to further enhance study feasibility and reduce study cost. 2. The gadoxetic acid bowel reabsorption capacities suggest a concept of pharmacokinetic enterohepatic reentry circuit which may serve to prolong gadoxetic acid clearance especially in patients with impaired renal function (and raise the risk of Gd retention complications).

## W3-SSGI12-6 ESTIMATING EFFICACY OF CONVERSION THERAPY ON PATIENTS WITH INITIALLY UNRESECTABLE COLORECTAL CANCER LIVER METASTASES BY USING MRI: DEVELOPMENT OF A PREDICTIVE SCORE

Jingjing Liu (*Presenter*) Nothing to Disclose

## PURPOSE

The conversion success rate (CSR) has crucial implication for clinical outcomes of initially unresectable colorectal liver metastases (CRLM) following conversion therapy. This study aimed to develop a simple predictive scoring model for identifying CSR according to baseline magnetic resonance imaging (MRI) features, and confirm its performance and prognostic significance in a validation cohort.

## METHODS AND MATERIALS

A total of 155 consecutive patients with initially unresectable CRLM were retrospectively reviewed in the study. A simple MRI-based predictive scoring model for identifying CSR was developed in the development cohort (n=104) by using multivariable logistic regression analyses. The diagnostic performance was evaluated for the predictive score. Thereafter, patients in the validation cohort (n=51) were stratified into groups with predicted high CSR or low CSR according to the score. The progression-free survival (PFS) and overall survival (OS) were compared between two groups using the log-rank test.

## RESULTS

The predictive score of CSR, named mrNISE, incorporated the number of CRLM = 10, the largest size = 50 mm, poorly defined tumor-liver interface, and peritumoral enhancement. The AUC of the mrNISE score was 0.845 for the development cohort and 0.776 for the validation cohort. According to the score, patients with predicted high CSR had better PFS and OS than those with low CSR in both development and validation cohorts.

## CONCLUSION

The predictive score demonstrated great performance for identifying CSR of initially unresectable CRLM.

## CLINICAL RELEVANCE/APPLICATION

The predictive score demonstrated great performance for identifying CSR of initially unresectable CRLM.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

W3-SSGI13

**Gastrointestinal Imaging (MRI: Advanced Applications)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E451B

Leo L. Tsai, MD, PhD (*Moderator*) Stockholder, Agile Devices Inc;Consultant, Agile Devices Inc
Woo Kyoung Jeong, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W3-SSGI13-1 4D FLOW MRI OF SPLANCHNIC VASCULATURE FOR DIAGNOSIS OF SEVERE PORTAL HYPERTENSION

Bachir Taouli, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Bayer AG;Consultant, Guerbet SA;Research Grant, Regeneron Pharmaceuticals, Inc
Scott B. Reeder, MD, PhD (*Abstract Co-Author*) Owner, Calimetrix;Owner, Reveal Pharmaceuticals;Owner, Cellectar Biosciences, Inc;Owner, Elucent Medical;Owner, HeartVista, Inc;;
Ning Jin (*Abstract Co-Author*) Employee ,Siemens AG
Aaron M. Fischman, MD (*Abstract Co-Author*) Advisory Board, Terumo Corporation;Consultant, Terumo Corporation;Advisory Board, Embolx, Inc;Consultant, Embolx, Inc;Speakers Bureau, Boston Scientfic Corporation;Speakers Bureau, BTG International Ltd;Royalties, Merit Medical Systems, Inc;Investor, Adient Medical Inc
Thomas Schiano (*Abstract Co-Author*) Nothing to Disclose
Amine G. Geahchan, MD (*Abstract Co-Author*) Nothing to Disclose
Himanshu K. Sharma, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Markl, PhD (*Abstract Co-Author*) Research support, Siemens AG Research Grant, Circle Cardiovascular Imaging Inc
Emre Altinmakas, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Stocker, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie Hectors, PhD (*Abstract Co-Author*) Nothing to Disclose
Paul Kennedy, MSc,PhD (*Abstract Co-Author*) Nothing to Disclose
Swan Thung (*Abstract Co-Author*) Nothing to Disclose
Octavia Bane, PhD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the diagnostic performance of hemodynamic parameters measured with navigator-gated 4D flow MRI in the splanchnic vasculature for diagnosis of severe portal hypertension [hepatic venous pressure gradient (HVPG)=12 mmHg] and prediction of liver decompensation in patients with chronic liver disease.

### METHODS AND MATERIALS

56 patients (M/F 30/26, age 51±15y) with chronic liver disease and suspicion of portal hypertension (PH) were enrolled in our prospective study. Patients had transjugular liver biopsy with HVPG measurements (6±5 mmHg, 0-22 mmHg) within one month of multiparametric abdominal MRI at 1.5T. 4D flow MRI data was acquired 10 min. after injection of gadoxetic acid with a prototype respiratory navigator-gated pulse sequence, covering the abdominal vessels in coronal-oblique orientation (VENC=60 cm/sec, TR/TE/FA: 5.9 ms/3.4 ms/15°, 3 k-space segments/cardiac frame, 70.8 ms temporal resolution, 9-12 cardiac phases, 24 slices, resolution 2.5x2.5x2.5mm3). The portal (PV), superior mesenteric (SMV), splenic (SV) and middle hepatic veins (MHV), the supraceliac aorta and its celiac branches were segmented (Fig.1) by two independent observers. Time-averaged vessel cross-section area, through-plane time-averaged velocity and flow, and peak velocity were compared between patients with/without severe PH, and with/without future liver decompensation (varices, ascites or hepatic encephalopathy) by Mann-Whitney U test and ROC analysis.

### RESULTS

25 (45%) patients had PH, of which 8 (14%) had severe PH. Decompensation was diagnosed in 7/52 (13%) patients within 619±220 days from MRI. Celiac trunk peak velocity [AUC(95%CI)=0.90(0.81-0.99)] and superior mesenteric vein area [AUC= 0.89(0.79-0.99)] identified severe PH with the highest diagnostic performance. A logistic regression model combining peak velocity in the celiac trunk and superior mesenteric vein flow identified severe PH with AUC=0.950, sensitivity=1 and specificity=0.89. Superior mesenteric vein flow [AUC(95%CI)=0.79(0.66-0.94)] and area [AUC(95%CI)=0.78(0.63-0.94)], as well as hepatic artery area [AUC (95%CI)=0.74 (0.55-0.93)] predicted decompensation with good diagnostic performance.

### CONCLUSION

Splanchnic 4D flow MRI measurements have excellent performance for diagnosing severe PH and good performance for predicting liver decompensation. The elevated hemodynamic parameters in patients with severe PH are consistent with hyperdynamic circulation in portal hypertension.

### CLINICAL RELEVANCE/APPLICATION

Hemodynamic measurements in the splanchnic circulation with 4D flow MRI reflect compensatory mechanisms in PH, and have the potential to non-invasively diagnose severe PH and predict liver decompensation.

## W3-SSGI13-2 LIVER STIFFNESS VS. GADOXETATE HEPATOBILIARY UPTAKE SCORES FOR PREDICTION OF OUTCOME IN PATIENTS WITH ADVANCED CHRONIC LIVER DISEASE

Thomas Schiano (*Abstract Co-Author*) Nothing to Disclose
Kazuya Yasokawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Efe Ozkaya, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Francisco Restrepo, PhD (*Abstract Co-Author*) Nothing to Disclose
Ghadi S. Abboud, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Zhou, BA, MS (*Abstract Co-Author*) Nothing to Disclose
Bachir Taouli, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Bayer AG;Consultant, Guerbet SA;Research Grant, Regeneron Pharmaceuticals, Inc
Octavia Bane, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Amine G. Geahchan, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To correlate MRI-based markers including liver stiffness (LS), liver/spleen volumes, and gadoxetate uptake scores: FLIS (Functional Liver Imaging Score) and Liver to Spleen Index (LSI) both measured on hepatobiliary phase (HBP) with liver function in patients with advanced CLD (ACLD); as well as to compare the performance of MRI-based markers to blood tests for prediction of outcomes in the same patients.

### METHODS AND MATERIALS

This was a single-center retrospective study in which we assessed 87 patients (M/F 56/31, mean age 57±14y) with ACLD and histopathologic fibrosis stage of F3/F4 (advanced fibrosis/cirrhosis), who underwent gadoxetate-enhanced MRI with MRE and clinical follow up of at least 2y. Additionally, laboratory values were collected (within 3m from index MRI). LS was measured using 2D GRE/EPI MRE. FLIS (qualitative score determined by liver enhancement, portal vein intensity and biliary excretion at HBP, LSI=signal intensity (SI) liver at HBP/SI spleen at HBP, liver/spleen volume were also measured by 2 observers. Outcomes such as hepatic decompensation, HCC occurrence, transplant and death were collected.

### RESULTS

Patients were classified at baseline as compensated (cACLD, n=52) and decompensated (dACLD, n=35). 32 decompensation events were observed during follow-up in 24 patients (including 16 from baseline dACLD), additionally 36 outcomes (HCC occurrence, transplant, and death) were observed. FLIS (Fig. 1) outperformed all MRI markers in diagnosing decreased liver function based on MELD and Child-Pugh scores (CPS) with AUC up to 0.86 [CI, 0.77-.096], LS (Fig. 2) had lower performance with max AUC of 0.69 [0.53-0.84]. LS was a significant predictor of decompensation with AUC of 0.74 [CI, 0.63-0.85] equivalent to FIB-4 (0.73 [0.62-0.84]) and MELD-Na (0.71 [0.59-0.83]) whereas FLIS did not do as good with AUC of 0.68 [CI, 0.56-0.79]. CPS had the best performance for decompensation with AUC of 0.84 [0.75-0.92]. As for prediction of transplant or death the best MRI predictors were Liver/spleen volume ratio with AUC 0.76 [CI, 0.64-0.89] and FLIS with AUC of 0.71 [CI, 0.51-0.91] respectively. Multivariable logistic regression showed excellent performance when combining FIB-4, CPS and LS with AUC of 0.89 [0.82-0.96] for predicting decompensation.

### CONCLUSION

Our preliminary results suggest that FLIS is a better marker of decreased liver function than LS, while LS is superior to FLIS for prediction of decompensation in patients with ACLD. Future work will focus on assessing advanced markers such as spleen stiffness and 3D MRE markers.

### CLINICAL RELEVANCE/APPLICATION

Gadoxetate MRI and MRE can be used to assess liver function and predict outcome in patients with ACLD.

## W3-SSGI13-4 DEEP LEARNING RECONSTRUCTION OF PROSPECTIVELY ACCELERATED MR IMAGING OF THE PANCREAS: CLINICAL EVALUATION OF SHORTENED BREATH-HOLD EXAMINATIONS WITH DIXON FAT SUPPRESSION

Sebastian Werner, MD (*Abstract Co-Author*) Nothing to Disclose
Maryanna Chaika (*Abstract Co-Author*) Nothing to Disclose
Jan M. Brendel (*Abstract Co-Author*) Nothing to Disclose
Sebastian Gassenmaier, MD (*Abstract Co-Author*) Nothing to Disclose
Saif Afat, MD (*Abstract Co-Author*) Nothing to Disclose
Andreas Brendlin, MD (*Abstract Co-Author*) Nothing to Disclose
Judith Herrmann, MD (*Abstract Co-Author*) Nothing to Disclose
Haidara Al Mansour, MD, MEng (*Presenter*) Nothing to Disclose

### PURPOSE

Deep-learning (DL)-enabled MRI reconstructions can enable shortening of breath-hold examinations and improve image quality by reducing motion artifacts.Prospective studies with DL reconstructions of accelerated MRI of the upper abdomen in the context of pancreatic pathologies are lacking. In a clinical setting, the purpose of this study is to investigate the performance of a novel DL-based reconstruction algorithm in T1-weighted volumetric interpolated breath-hold examinations with partial Fourier sampling and Dixon fat suppression (hereafter, VIBE-DixonDL) and to analyze its impact on acquisition time, image quality, pancreatic lesion conspicuity and diagnostic confidence.

### METHODS AND MATERIALS

This prospective study included participants with various pancreatic pathologies who gave written consent from Jan 2023 to Sep 2023. During the same session, each participant underwent two MRI acquisitions using a 1.5 Tesla scanner: conventional pre-contrast and post-contrast T1-weighted VIBE acquisitions with Dixon fat suppression (VIBE-Dixon, reference standard) using fourfold parallel imaging acceleration and sixfold accelerated VIBE-Dixon acquisitions with partial Fourier sampling utilizing a novel DL reconstruction tailored to the acquisition. Image analysis was performed by four readers. Acquisition time, overall image quality, diagnostic image noise and artifacts, diagnostic confidence as well as pancreatic lesion conspicuity and size were compared.

### RESULTS

Thirty-two participants were evaluated (mean age, 62 years ± 19 [SD]; 20 men). The VIBE-DixonDL method enabled up to 52% reduction in average breath-hold time (7 seconds for VIBE-DixonDL vs 15 seconds for VIBE-Dixon, $P < .001$). A significant improvement of image sharpness, overall image quality, diagnostic confidence and pancreatic lesion conspicuity were observed in the images recorded using VIBE-DixonDL ($P < 0.001$). Furthermore, a significant reduction of image noise and motion artifacts were noted in the images recorded using the VIBE-DixonDL technique ($P < 0.001$). In addition, for all readers there was no evidence of a difference in lesion size measurement between VIBE-Dixon and VIBE-DixonDL. Interreader agreement between VIBE-Dixon and VIBE-DixonDL regarding lesion size was excellent (ICC > 90).

### CONCLUSION

The prospectively accelerated, deep learning (DL)-enhanced VIBE with Dixon fat suppression was clinically feasible. It enabled a 52% reduction in breath-hold time and provided superior image quality, diagnostic confidence, and pancreatic lesion conspicuity.

### CLINICAL RELEVANCE/APPLICATION

This technique might be especially useful for patients with limited breath-hold capacity and might improve MR throughput and patient experience.

## W3-SSGI13-5 PREDICTING POSTOPERATIVE PANCREATIC FISTULA AFTER MAJOR PANCREATIC SURGERIES USING CONTINUOUS-TIME RANDOM-WALK DWI MODEL AND VIRTUAL MR ELASTOGRAPHY

Xinming Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Yongjian Zhu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Wei Cai (*Presenter*) Nothing to Disclose

### PURPOSE

Clinically relevant postoperative pancreatic fistula (CR-POPF) is the most clinically problematic complication after major pancreatic surgeries. The aim of this study was to investigate the performance of continuous-time random-walk (CTRW) diffusion model and virtual MR elastography (vMRE) for predicting the risk of CR-POPF in patients undergoing major pancreatic surgeries.

### METHODS AND MATERIALS

One hundred twenty-four patients with pancreatic tumors were recruited in this study. All patients underwent pancreatic MRI including multi-b-value (Mb) DWI sequence. The Mb-DWI data were acquired using ss-EPI sequence with 14 b values from 0 to 3000 s/mm2. Diffusion-based shear modulus (μDiff) from vMRE was calculated as: μDiff (kPa) = -9.8 · ln(S200/S1500) + 14. CTRW model parameter maps of temporal diffusion heterogeneity (a), spatial diffusion heterogeneity (ß), and anomalous diffusion coefficient (Dm) can be described as equation: Sb/S0 = Ea·[-(b·Dm) ß]. Mean values of maps in pancreatic parenchyma were obtained. The conventional apparent diffusion coefficient (ADC) maps were also calculated. CR-POPF is defined as grade B or C POPF. The differences in clinical-pathological features and quantitative parameters between CR-POPF and non-CR-POPF groups were analyzed. Multivariate logistic regression was used to build the combined prediction model for CR-POPF. The predictive performance was evaluated using ROC analysis.

### RESULTS

Twenty-six out of 125 patients were CR-POPF. BMI, albumin (ALB), pancreatic texture, operative blood loss, fibrosis grading, pancreatic thickness, and main pancreatic duct (MPD) diameter showed significant difference between the two groups (all $p < 0.05$) (Table 1). The CR-POPF group had higher ADC, ß, Dm, and μDiff values than non-CR-POPF (all $p < 0.05$) (Table 2) (Figure 1 and Figure 2). Clinical model was constructed by BMI, ALB, and MPD diameter. MRI model was built using ß, Dm, and μDiff. Combined model was constructed by employing the above six significant predictors and visualized using a nomogram (Figure 3). μDiff exhibited the best predictive performance among individual parameters with an AUC of 0.779 (Table 3). The combined nomogram significantly improved the predictive performance with an AUC, sensitivity, specificity, in identifying CR-POPF were 0.925, 84.61%, 94.95%, respectively (Figure 4).

### CONCLUSION

The CTRW diffusion model, vMRE, together with clinical features, offers a new method for preoperative assessment the risk of CR-POPF noninvasively.

### CLINICAL RELEVANCE/APPLICATION

For patients receiving major pancreatic surgeries, CTRW diffusion model and vMRE can provide noninvasive assessment of CR-POPF with good accuracy and high specificity.

## W3-SSGI13-6 EVALUATING LIVER FIBROSIS: PROSPECTIVE ASSESSMENT OF A NOVEL MECHANICAL TRANSDUCER FOR MAGNETIC RESONANCE ELASTOGRAPHY IN COMPARISON WITH TRANSIENT ULTRASOUND ELASTOGRAPHY

Simon S. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Vitali Koch, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Darwish (*Abstract Co-Author*) Nothing to Disclose
Ralph Sinkus (*Abstract Co-Author*) Nothing to Disclose
Christian Booz, MD (*Abstract Co-Author*) Speaker, Siemens AG
Jennifer Gotta (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leon D. Gruenewald, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate a novel mechanical Magnetic Resonance Elastography (MRE) transducer in comparison to acoustic transducers and transient ultrasound elastography for the non-invasive quantification of tissue biomechanics in patients with histologically confirmed metabolic dysfunction-associated steatohepatitis (MASH) and liver fibrosis.

### METHODS AND MATERIALS

Seventy-six participants (45 men, 31 women; mean age 53, SD 12.8) with suspected or confirmed liver disease were enrolled in this prospective study. MRE was conducted using a novel mechanical transducer (MT), established acoustic transducers (AT), and transient ultrasound elastography (TE) within a 30-day interval. Patient records and histopathological samples were reviewed if sampled within three months of MRE or AT assessments. Generalized additive models (GAMs) analyzed relationships and predictive values for fibrosis classification using MT, AT, and TE. Multiclass ROC analysis with micro-averaging determined AUC values for precise fibrosis classification. ROC analysis was repeated after dichotomization of fibrosis into low-grade (0-2) and high-grade (3-4). Agreement between device-based classifications and histopathological grading was assessed using Cohens Kappa.

### RESULTS

Twenty-eight patients who underwent MT, AT, and TE had histopathological samples taken within 3 months (14 men, 14 women; mean age 57, SD 14). Agreement between histopathological fibrosis grading and MT, AT, and TE were 0.85, 0.77, and 0.71, respectively. GAMs showed an almost linear relationship between MT and TE up to 6 kPa; beyond this, TE values plateaued despite increased stiffness in MT. ROC analysis confirmed excellent discriminatory value in differentiating low-grade from high-grade fibrosis (MT: 0.99, AT: 0.97, TE: 0.96). In multiclass ROC, AUC values were 0.90, 0.87, and 0.85. Ordinal GAMs indicated a higher predictive value for MT (deviance explained 86.7%, AIC 31.4) and AT (deviance explained 80.4%, AIC 37.3) compared to TE (deviance explained 54.5%, AIC 60.0).

## CONCLUSION

The novel mechanical transducer for MRE shows better alignment with histopathological samples compared to acoustic transducers and transient elastography to further enhance the diagnostic accuracy and predictive value in the non-invasive assessment of liver fibrosis.

## CLINICAL RELEVANCE/APPLICATION

We demonstrate that magnetic resonance elastography using a novel mechanical transducer provides more precise fibrosis grading compared to established acoustic transducers and transient ultrasound elastography. Adopting this transducer can offer a reliable alternative for the early detection of liver fibrosis and the assessment of fibrosis progression in patients with MASH.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W3-SSGI14

**Gastrointestinal Imaging (Miscellaneous)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: N229

Hannah S. Recht, MD (*Moderator*) Nothing to Disclose
Nancy A. Hammond, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W3-SSGI14-1 COLORECTAL CANCER DETECTION ON ROUTINE ABDOMEN/PELVIS CT

Omar Hassan, MD (*Abstract Co-Author*) Nothing to Disclose
Spencer C. Behr, MD (*Abstract Co-Author*) Grant, Cancer Targeted Technology;Scientific Advisory Board, Novartis AG;Research Consultant, GenVivo
Stephen G. Wahlig, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the performance of routine abdomen/pelvis CT in detecting colorectal cancer.

### METHODS AND MATERIALS

A retrospective dataset consisting of 204 routine abdomen/pelvis CTs was compiled based on review of our institution's pathology/imaging archives. 64 cases had pathologically confirmed colorectal cancer, while 140 cases had no colonic neoplasms on colonoscopy. Two radiologists blinded to the patient history and imaging indication reviewed the cases independently. They scored each case for any colonic abnormality which could represent colorectal cancer. The imaging abnormality location, morphology, presence of regional lymphadenopathy, and degree of diagnostic confidence were recorded.

### RESULTS

Reviewers demonstrated a sensitivity of 64-77% and specificity of 83-86% for detection of colorectal cancer. Detected tumors were significantly larger than missed cancers, with mean maximum diameter of 5.2-5.7 cm for detected cancer (n=81) and 2.8-2.9 cm for missed cancer (n=25) (reviewer 1 $p<.001$; reviewer 2 $p=.02$). Positive predictive value (PPV) strongly correlated with diagnostic confidence, with 100% of pooled cases (39/39) reported as 5 (Almost Certainly Neoplastic) positive for cancer compared to 53% of cases (17/32) reported as 3 (Could be Benign or Neoplastic). The presence of regional lymphadenopathy was a strong predictive feature, with 94% of pooled cases with identified lymphadenopathy (48/51) positive for cancer compared to 51% (42/82) without lymphadenopathy ($p<.001$). Abnormalities characterized as polypoid intraluminal masses and exophytic masses demonstrated pooled PPV of 92% (11/12) and 100% (4/4) respectively, compared to 76% (25/33) for asymmetric wall thickening and 60% (50/84) for circumferential wall thickening. Cases classified as false negatives included low rectal tumors, tumor within a collapsed segment of colon, and cases with regional lymphadenopathy in the absence of discernable colonic wall abnormality on CT. False positives primarily consisted of colonic wall thickening secondary to an acute inflammatory pathology such as diverticulitis or perforated appendicitis.

### CONCLUSION

While colorectal cancers greater than 3 cm were detected with relatively high specificity, abdomen/pelvis CT performed poorly with lesions smaller than 3 cm. In our cohort, radiologist-reported diagnostic confidence was strongly associated with diagnostic accuracy. Regional lymphadenopathy, polypoid intraluminal masses, and exophytic masses are each highly specific findings, although insensitive.

### CLINICAL RELEVANCE/APPLICATION

Routine abdomen/pelvis CT may be helpful for identifying advanced cancer requiring further workup but is not sensitive enough to replace optical colonoscopy or CT colonography.

## W3-SSGI14-2 DEVELOPMENT OF MESENTERIC PANNICULITIS FOLLOWING BRAF/MEK INHIBITOR TREATMENT

Benedikt M. Schaarschmidt, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Forsting, MD (*Abstract Co-Author*) Nothing to Disclose
Marcel A. Drews, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In recent years, BRAF/MEK inhibitors (BRAFi/MEKi) together with PD-1 and CTLA-4 immune checkpoint inhibitors (ICI) have changed therapeutic strategy in advanced malignant melanoma and significantly improved patients' clinical outcome. However, these therapies can also be associated with immune-related side effects. While recent studies reported an increased rate of panniculitis of the skin following BRAFi/MEKi treatment, data on the development of mesenteric panniculitis (MP) are scarce. Because MP has been reported to mimic malignancy, we investigated the development of MP following BRAFi/MEKi treatment compared to ICI treatment in advanced melanoma.

### METHODS AND MATERIALS

In a monocentric retrospective study, abdominal CTs of patients [n = 486 patients] with malignant melanoma >= stage IIIa were evaluated for the development of MP. Patients were either treated with BRAFi/MEKi (Dabrafenib/Trametinib, Vemurafenib/Cobimetinib, Encorafenib/Binimetinib) or ICI (Nivolumab, Ipilimumab, Pembrolizumab, Nivolumab/Ipilimumab). Occurrence of MP was analyzed only during first-line treatment with either BRAFi/MEKi or ICI. MP was defined as the detection of at least three out of five imaging criteria (increased mesenteric density, increased number of lymph nodes, fat-ring sign, pseudocapsula, displacement of bowel segments). Explorative data analysis was performed and groups were compared using chi-square test. $p<0.05$ indicated statistical significance.

### RESULTS

100 BRAFi/MEKi first-line therapy periods (median follow-up 303 d, IQR: 379d) in 100 patients (41 women, median age at therapy start 58yrs, IQR: 18yrs) and 436 ICI first-line therapy periods (median follow-up 165 d, IQR: 256 d) in 386 patients (162 women, median age at therapy start 61yrs, IQR: 21yrs) were evaluated. Incidence of MP was significantly higher following BRAFi/MEKi therapy compared to ICI (6.4% vs. 2.5%, $p=0.044$). No significance was detected comparing time until MP development from therapy start (214d, IQR: 235d [BRAFi/MEKi] vs. 243d, IQR: 317d [ICI], $p>0.05$).

### CONCLUSION

Our study demonstrates a significant correlation between the development of mesenteric panniculitis and treatment with BRAF and MEK inhibitors compared to immune checkpoint inhibitors in patients with malignant melanoma. Since this benign condition can mimic malignancy, awareness of its appearance is important.

### CLINICAL RELEVANCE/APPLICATION

BRAF/MEK inhibitor treatment is associated with a significant higher rate of mesenteric panniculitis in malignant melanoma patients. Because it can mimic malignancy, awareness of this benign finding is important.

## W3-SSGI14-3 A STUDY ON DOSE CALIBRATION METHODS FOR CONSTANT RADIATION DOSE MANAGEMENT IN SINGLE PHASE ABDOMINAL-PELVIC CT SCAN

Chang Min Dae (*Abstract Co-Author*) Nothing to Disclose
Jinhee Lim (*Abstract Co-Author*) Nothing to Disclose
Yong Hwan Chung, RT (*Abstract Co-Author*) Nothing to Disclose
Joohyun Kim, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

CT Equipment varies between manufacturers and models with respect to components such as the X-ray tube, detector, and Automatic Exposure Control (AEC) modes. However, if the radiation dose required to achieve similar image quality is significantly higher compared to other equipment, it may indicate a potential error in the protocol. The purpose of this study is to conduct dose calibration for each equipment to minimize the differences in patient radiation dose between equipment, and to manage the radiation dose received by patients during Single phase Abdominal-Pelvic CT (SAPCT) scan.

### METHODS AND MATERIALS

The study included eight CT scanners from two manufacturers, featuring seven models, ranging from 64 to 512-slice MDCT (A~H). To compare the Dose Length Product (DLP) values of 8 scanners, the SAPCT protocol was performed 5 times using an anthropomorphic abdominal phantom (Kyoto Kagaku). Additionally, DLP values of 1679 patients who underwent SAPCT from October to November 2023 was extracted using the dose management system (DoseM, INFINITT). Median DLP values were analyzed using a Box Whisker Plot chart (MedCalc, version 10.0). The Target DLP was set based on Diagnostic Reference Levels (DRLs) provided by the Korea Disease Control and Prevention Agency (KDCA), and the target mAs was calculated according to the proportional equation. We identified the equipment that needed calibration and then applied the target mAs to perform phantom tests and patient SAPCT (100 patients per equipment, from February to March 2024). Median DLP values from which dose calibration was performed were compared with the DRLs value. Phantom image quality was evaluated using Signal-to-Noise Ratio (SNR), and patient image quality was evaluated by three radiologists using a Likert scale.

### RESULTS

Before calibration, the mean DLP from phantom tests ranged between 190.1 and 327.7 mGy*cm, and the median DLP from patient SAPCT was between 298.3 and 494.4 mGy*cm. The set target DLP was 400 mGy*cm, and the equipment identified as requiring calibration are models A and D, for which the Target mAs was calculated as 303 and 307, respectively. Post-calibration results showed that the mean DLP for phantom tests was 261.5 and 260.7 mGy*cm, respectively, while the median DLP for patients was 374.8 and 389.8 mGy*cm. Regarding image quality, SNR decreased from an average of 11.5 to 9.8, with a Likert scale rating of 4.7.

### CONCLUSION

If the methods described in this paper are applied to periodically verify and calibrate the dose for each equipment, it will be possible to minimize dose variations among different equipment and manage them in an integrated manner.

### CLINICAL RELEVANCE/APPLICATION

For patient safety, this approach can be utilized as one of the methods to optimize medical radiation dose.

## W3-SSGI14-4 ONE STEP CLOSER TO THE K-EDGE: PIONEERING CLINICAL FINDINGS OF 60 KVP LOW-DOSE CONTRAST-ENHANCED ABDOMINAL CT WITH ARTIFICIAL INTELLIGENCE ITERATIVE RECONSTRUCTION

Guozhi Zhang (*Abstract Co-Author*) Nothing to Disclose
Yixuan Zou, MS (*Abstract Co-Author*) Employee, Shanghai United Imaging Healthcare Co, Ltd
Peng Liu (*Abstract Co-Author*) Nothing to Disclose
Wenjie Sun (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the diagnostic image quality and radiation dose of 60 kVp low-dose abdominal contrast-enhanced CT with artificial intelligence iterative reconstruction (AIIR).

### METHODS AND MATERIALS

A total of 57 patients (No. of male: 25, age: 18-82 y, body mass index: 17.3-27.6 kg/m2) were prospectively enrolled to undergo both standard- (120 kVp, 100 mAs) and low-dose (60 kVp, 200 mAs) four-phase abdominal enhanced CT scans on a 320-row scanner within a week. Each scan contained

non-enhanced, arterial, venous, and delayed phase acquisitions. Standard-dose data were reconstructed with hybrid iterative reconstruction (HIR) served as the reference (Group Ref), while low-dose data were reconstructed using AIIR (Group A) and HIR (Group B). Image contrast and diagnostic confidence were evaluated using 5-point Likert scales (1-poor, 5-good) and compared between any paired groups via Wilcoxon signed-rank test. The diagnostic performance of Groups A and B in benign-malignant classification was analyzed using receiver operating characteristic (ROC) analysis on both per-patient and per-lesion basis. Consensus criteria from three radiologists based on Group Ref image were employed as diagnostic standard. Additionally, image noise on lesions was recorded and compared.

**RESULTS**

For the 57 patients, 60 kVp low-dose acquisition significantly reduced the mean effective radiation dose by 78.9% compared to the standard-dose acquisition (4.8 ± 1.1 mSv vs. 22.8 ± 3.3 mSv). No significant difference was found between Groups A and Ref in terms of image contrast (4.6 ± 0.5 vs. 4.7 ± 0.4, p = 0.083) and diagnostic confidence (4.8 ± 0.3 vs. 4.9 ± 0.2, p = 0.157). Based on Group Ref image, a total of 18 lesions were identified in 15 patients, with 8 lesions were classified as malignant. Group A demonstrated superior diagnostic performance in benign-malignant classification compared to Group B, with the area under the curve (AUC) being 0.93 (95% CI, 0.67-0.99) vs. 0.57 (95% CI, 0.30-0.82) on a per-patient basis and 0.94 (95% CI, 0.74-0.99) vs. 0.56 (95% CI, 0.32-0.77) on a per-lesion basis (p = 0.012 and p = 0.003, respectively). No statistical difference was observed between Groups A and Ref regarding image noise on lesions (26.8 ± 9.9 HU vs. 25.9 ± 5.0 HU, p = 0.776).

**CONCLUSION**

The 60 kVp low-dose acquisition combined with AIIR can significantly lower radiation exposure in abdominal contrast-enhanced CT without compromising image quality and diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

The 60 kVp low-dose acquisition with AIIR has the potential to revolutionize CT abdominal screening by significantly reducing radiation exposure while maintaining high diagnostic performance.

## W3-SSGI14-6 HEART-LIVER MRI FOR THE EVALUATION OF MYOCARDIAL INFLAMMATION AND FIBROSIS IN AN ANIMAL MODEL OF LIVER CIRRHOSIS

Narine Mesropyan, MD (*Abstract Co-Author*) Nothing to Disclose
Oliver M. Weber (*Abstract Co-Author*) Nothing to Disclose
Franziska Schneider (*Abstract Co-Author*) Nothing to Disclose
Christoph Katemann (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Dmitrij Kravchenko, MD (*Abstract Co-Author*) Nothing to Disclose
Johannes Chang (*Abstract Co-Author*) Nothing to Disclose
Alexander Isaak, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore and characterize cardiovascular abnormalities using multiparametric heart-liver MRI in an experimental animal model of liver cirrhosis.

**METHODS AND MATERIALS**

Cholestatic cirrhosis was induced in male Sprague-Dawley rats by bile-duct ligation (BDL). Sham-operated rats served as controls. Heart-liver MRI at 3T was performed in BDL rats after 3 weeks (3w-BDL group) and after 5 weeks (5w-BDL group) as well as in controls. Myocardial function was assessed using cine imaging in standard axes. Myocardial and hepatic T1, T2, and extracellular volume fraction (ECV) values were assessed. After the MRI scan, in-vivo portal pressure was measured. Serum biomarkers, gene expression studies, and histological examinations were performed to evaluate fibrotic and inflammatory abnormalities of the heart and liver.

**RESULTS**

BDL groups showed higher cardiac index (53±11 vs 67±23 vs 77±18 ml/min/m²; p=0.009), elevated left ventricular end-diastolic volume index (325±38 vs 375±57, 421±77 µl/m²; p<0.001) and elevated LV mass (321±34 vs 393±103, 395±69 mg/m²; p=0.021) compared to controls (sham vs BDL-3w vs BDL-5w). Myocardial T1, T2 and ECV values were elevated in BDL groups (T1: 946±29 vs 952±39 vs 987±39 msec; p=0.014; T2: 23±4 vs 32±3 vs 33±4 msec; p<0.001; ECV: 27±3 vs 32±3 vs 37±5; p<0.001; sham vs BDL-3w vs BDL-5w) and correlated with serum NT-proBNP levels (e.g., for T2: r=.560, p<0.001 or ECV: r=.537, p<0.001), myocardial CCL-3, MMP-9, and IL1b (e.g., for myocardial T2: r=.825, p<0.001). Interorgan correlations were found between quantitative myocardial parameters and parameters of hepatic fibrosis (e.g., hepatic CCL-3 and myocardial ECV: r.=552, p<0.001), inflammation (e.g., hepatic IL1b and myocardial T2: r=.678, p<0.001) and portal pressure (myocardial T2: r=.678, p<0.001). Quantitative cardiac MRI provides noninvasive, sensitive detection of hepatic cardiomyopathy, particularly diffuse myocardial edema/inflammation.

**CONCLUSION**

Functional cardiac remodeling and elevation of inflammatory and fibrotic biomarkers of the myocardium were found in preclinical models of cirrhosis. A marked increase in inflammatory gene expression suggests that hepatic cardiomyopathy is predominantly driven by systemic inflammation. Quantitative cardiac MRI provides noninvasive, sensitive detection of hepatic cardiomyopathy, particularly diffuse myocardial inflammation.

**CLINICAL RELEVANCE/APPLICATION**

This study may lay the groundwork for further clinical application of multiparametric MRI of the liver-heart axis and may reveal potential therapeutic approaches for cirrhotic cardiomyopathy.

# Abstract Archives of the RSNA, 2024

W3-SSGU05

**Genitourinary Imaging (Role of AI in Prostate Cancer)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E353A

Kirti Magudia, MD, PhD (*Moderator*) Nothing to Disclose
Antonio C. Westphalen, MD, PhD (*Moderator*) Shareholder, ScanMed, LLC;Research funded, BotImage, Inc
Angela Tong, MD (*Moderator*) Equipment support, Siemens AG

**Sub-Events**

## W3-SSGU05-1 DEEP LEARNING FOR QUALITY ASSESSMENT OF AXIAL T2-WEIGHTED PROSTATE MRI

Akira Kawashima, MD (*Abstract Co-Author*) Nothing to Disclose
Naoki Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Adam T. Froemming, MD (*Abstract Co-Author*) Nothing to Disclose
Hirotsugu Nakai, MD (*Abstract Co-Author*) Nothing to Disclose
Stephen J. Riederer, PhD (*Abstract Co-Author*) Nothing to Disclose
Eric A. Borisch (*Abstract Co-Author*) Nothing to Disclose
Jordan LeGout, MD (*Abstract Co-Author*) Nothing to Disclose
Jacob Gloe, PhD, MA (*Presenter*) Nothing to Disclose

### PURPOSE

To develop an artificial intelligence (AI) algorithm to assess axial T2W prostate MRI scans for motion corruption and overall quality to determine rescan necessity.

### METHODS AND MATERIALS

This three-site retrospective study included a total of 1412 axial T2W prostate MRI scans (median age, 67 years). Four experienced uro-radiologists (NT, AF, AK, JL) provided quality scores of the scans on an interval scale from 0-3 (0: uninterpretable, 1: marginally interpretable, 2: adequately diagnostic, 3: more than adequately diagnostic) with 65 of the scans scored by all four reviewers and 138 scans scored by exactly two reviewers. These scores were then collated and used as ground truth labels for a convolutional neural network (CNN). The 203 scans scored by two or more reviewers were left as a test set. The remaining data was split into a training set (1007 scans) and a validation set (203 scans). Of the 12 models developed, the chosen model was a 3D-DenseNet of depth 169, and performance was evaluated using Cohen's ? scores, accuracy, and area under the receiver operating characteristic curve (AUC). Results were binned into non-diagnostic (0 or 1) and diagnostic (2 or 3) to assess the model's ability to predict whether a rescan is required. These rescan predictions were then compared to the number of rescans performed clinically on a subset of 174 exams at one of the sites.

### RESULTS

On the test set, the chosen model accurately predicts expert radiologist quality assessment scores with a Cohen's ? of 0.658, indicating moderate agreement. This is comparable to the inter-rater reliability among the four reviewers (Cohen's ? scores between 0.688 and 0.791). The model also yielded rescan predictions at similar reliability to radiologists (model Cohen's ? = 0.537, reviewer ? between 0.577 and 0.703). The rescan prediction AUC was 0.867, suggesting a very strong ability to differentiate between diagnostic and non-diagnostic scans. Using the model, the clinical unnecessary rescan rate could be reduced by 35%.

### CONCLUSION

The proposed deep learning model accurately mimics expert radiologist image quality scores for axial T2W prostate MRI scans. Compared to the clinical operating point, the model could be used to guide MR technologists and decrease unnecessary rescans while maintaining the same rate of correct rescanning.

### CLINICAL RELEVANCE/APPLICATION

To optimize time management for prostate MRI, it is pertinent to ensure that scans are repeated only when necessary. In our clinic, the decision to rescan is made subjectively by an MR technologist during an exam. Guiding that process using the proposed AI model could greatly reduce the unnecessary rescan rate without compromising appropriate rescans.

## W3-SSGU05-2 MULTIPLE CENTRE EXTERNAL VALIDATION INTEGRATING CLINICAL DATA WITH AI TO OPTIMISE DECISION-MAKING IN PROSTATE MRI

Paul R. Burn, MD (*Abstract Co-Author*) Nothing to Disclose
Tristan Barrett, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Aarti Shah, MBBCh, MRCP (*Abstract Co-Author*) Nothing to Disclose
Francesco Giganti, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nadia Moreira Da Silva (*Abstract Co-Author*) Employee, Lucida Medical
Mark Hinton (*Abstract Co-Author*) Employee, Lucida Medical

Giles Maskell (*Abstract Co-Author*) Nothing to Disclose
Lucy Davies (*Abstract Co-Author*) Nothing to Disclose
Jobie Budd (*Abstract Co-Author*) Nothing to Disclose
Adrian Andreou (*Abstract Co-Author*) Nothing to Disclose
Alison Bradley (*Abstract Co-Author*) Nothing to Disclose
Jonathan Aning (*Abstract Co-Author*) Nothing to Disclose
Anwar R. Padhani, MBBS, FRCR (*Abstract Co-Author*) Advisory Board, Siemens AG;Speakers Bureau, Siemens AG;Advisory Board, Lucida Medical Ltd;Stockholder, Lucida Medical Ltd
Mohamed Ahmed Hussein Ibrahim (*Abstract Co-Author*) Nothing to Disclose
Antony Rix, MEng, PhD (*Abstract Co-Author*) Stockholder, Lucida Medical Ltd;Director, Lucida Medical Ltd
Nikhil Vasdev (*Abstract Co-Author*) Nothing to Disclose
Richard Hindley (*Abstract Co-Author*) Nothing to Disclose
Sidath Liyanage (*Abstract Co-Author*) Nothing to Disclose
Raj Persad (*Abstract Co-Author*) Nothing to Disclose
Evis Sala, MD, PhD (*Presenter*) Co-founder, Lucida Medical Ltd

**PURPOSE**

Evaluate potential improvements to false-positive rates when combining prostate MRI AI-based decision support, clinical data and radiologists' PI-RADS scores for the detection of Gleason grade group (GGG) =2 cancers.

**METHODS AND MATERIALS**

Clinical data (MRI, PSA, histopathology) and PI-RADS scores were obtained retrospectively. AI software was developed using biparametric (bpMRI) data from 5 study sites together with PROSTATEx (794 patients, GGG=2, prevalence 34%) to calculate prostate and transition zone (TZ) volume for PSA density (PSAD), segment lesions and score patients for likelihood of GGG=2 disease. Histological data from biopsy were used as ground truth, with MRI-negative patients not undergoing biopsy assumed negative. The impact of clinical data integration was tested using a blinded validation set of data from 6 sites (252 patients, 42 per site, 31% GGG=2), including 6 scanner models from 2 vendors, with different field strengths (1.5T/3T) and acquisition protocols. One site was unseen during development, and validation data from the other sites were from a later period than the development set. Models combining bpMRI AI, PSAD and PI-RADS data were trained using the development data. Validation data was used to obtain AUC metrics, and specificity was interpolated from a fixed sensitivity of 0.9. 95% confidence intervals were obtained via bootstrapping.

**RESULTS**

On the validation set, GGG=2 was detected by bpMRI AI with an AUC of 0.90 (0.87-0.94). Whole prostate PSAD alone had an AUC of 0.85 (0.8 - 0.89), and TZ-PSAD an AUC of 0.86 (0.82-0.90). At a sensitivity of 0.90, combining AI score with TZ-PSAD significantly improved specificity from 0.72 (0.55-0.80) to 0.81 (0.57-0.86, KS test p-value<0.001) and AUC to 0.91 (0.88-0.94). The original PI-RADS =3 scores, given by the radiologists working in a multidisciplinary team setting, had an AUC 0.95 (0.92-0.97). At a sensitivity of 0.90, incorporating AI, TZ-PSAD and PI-RADS scores significantly improved specificity from 0.88 (0.85-0.9) to 0.90 (0.86-0.94, KS tes p-value<0.001) and AUC to 0.96 (0.95-0.98, DeLong test p-value 0.013). GGG=2 cancer was found in 4/27 patients with PI-RADS 3. For this group, the model combining PI-RADS, AI score and TZ-PSAD missed 2 GGG=2 cancers but would have allowed 21 negative patients (12% of negative patients in the validation set) to avoid biopsy.

**CONCLUSION**

Combining PI-RADS, PSAD and AI offers substantial specificity improvement compared to AI or PI-RADS assessments alone. The use of AI and PSAD to risk-stratify is particularly relevant for PIRADS 3 cases.

**CLINICAL RELEVANCE/APPLICATION**

Specificity improvements through integration of AI in the clinical setting can potentially reduce false positive cases, further aiding patient selection for biopsy using MRI.

## W3-SSGU05-3 EVALUATION OF ARTIFICIAL INTELLIGENCE-ASSISTED TRANSPERINEAL BIOPSY PLANNING FOR PROSTATE CANCER DIAGNOSIS: A PROSPECTIVE COHORT STUDY

Anwar R. Padhani, MBBS, FRCR (*Abstract Co-Author*) Advisory Board, Siemens AG;Speakers Bureau, Siemens AG;Advisory Board, Lucida Medical Ltd;Stockholder, Lucida Medical Ltd
Tobias Penzkofer, MD (*Abstract Co-Author*) Researcher, Aprea Therapeutics AB;Researcher, Astellas Group;Researcher, AstraZeneca PLC;Researcher, Bristol-Myers Squibb Company;Researcher, Genmab A/S;Researcher, Incyte Corporation;Researcher, Lion Biotechnologies, Inc;Researcher, Takeda Pharmaceutical Company Limited
Patrick Asbach, MD (*Abstract Co-Author*) Institutional research support, Siemens AG;Institutional research support, Canon Medical Systems Corporation;Speaker, b.e.imaging GmbH;Travel support, b.e.imaging GmbH
Charlie A. Hamm, MD,PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to evaluate the diagnostic efficacy of an FDA-cleared computer-assisted diagnosis (CAD) software compared to PI-RADS reporting in identifying prostate cancer (PCa) in men undergoing transperineal MRI-transrectal ultrasound fusion biopsies (MRI-TRUS TPB).

**METHODS AND MATERIALS**

Between January and July 2022, 262 patients were prospectively enrolled. Targeted biopsies were conducted based on radiological findings from reports of 27 different radiological practices and regions of interest (ROI) identified by the CAD software. Additionally, systematic biopsies were performed using a reduced scheme. The primary objective was clinically significant (cs)PCa detection based on PI-RADS and CAD reporting. Secondary objectives included evaluating agreement between the localization of index lesions in MRI reports and the CAD software, PCa detection in additional ROIs, and false positive rates for PI-RADS and CAD software reporting. Performance was assessed using free-response receiver operating characteristic curves and the exact Fisher-Yates test.

**RESULTS**

The median patient age was 68 years (IQR: 61-74), PSA level was 6.57ng/ml (4.98-10.73), and prostate volume was 46ml (33-62). Overall, csPCa was detected in 56% (146/262) of men, with a sensitivity of 92% and 97% (p=0.007) for PI-RADS- and CAD-directed TPB, respectively. In 4% (10/262) of cases, csPCa was solely detected by CAD-directed biopsies, while in 8% (22/262) additional csPCa lesions were identified. However, the number of targeted lesions increased by 54% (518 vs. 336), and the false-positive rate doubled (0.66 vs. 1.39; p=0.009).

**CONCLUSION**

The CAD-tool tested for TPB planning enhances csPCa detection but results in an increased number of sampled lesions and false positives.

### CLINICAL RELEVANCE/APPLICATION

AI-assisted biopsy planning improves sensitivity and detects multifocality of prostate cancer in men but increases biopsy targets by 54% and doubles false-positive cores. This may enable more personalized biopsy planning based on urological and patient preferences.

## W3-SSGU05-4 DEEP LEARNING-ACCELERATED ULTRAFAST MR IMAGING OF THE PELVIS TO IMPROVE SCREENING OF PELVIC METASTASES IN PATIENTS WITH SUSPICION FOR PROSTATE CANCER

Ralph Strecker (*Abstract Co-Author*) Employee, Siemens AG
Hannes Engel, MD (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Benedict Oerther, MD (*Abstract Co-Author*) Nothing to Disclose
Maximilian Russe, MD (*Abstract Co-Author*) Nothing to Disclose
Marcel D. Nickel (*Abstract Co-Author*) Employee, Siemens AG
Andrea Nedelcu (*Abstract Co-Author*) Nothing to Disclose
Tobias Scheef, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study was to compare the image quality and diagnostic confidence of prospectively accelerated deep learning (DL) reconstructed T1-weighted (T1w) imaging with conventional accelerated T1w imaging for the screening of pelvic metastases in prostate MRI.

### METHODS AND MATERIALS

In this prospective study, consecutive patients with clinical suspicion of prostate cancer were included. All patients underwent PI-RADS conform multiparametric MRI at 3T. In addition to the conventional T1w VIBE Dixon sequence, a research DL-accelerated sequence was acquired after intravenous contrast administration, both with 2 mm slice thickness. Image quality (sharpness, subjective noise, artifacts, and overall image quality) and diagnostic confidence regarding lymph nodes and bone lesions were assessed independently by two radiologists in random order and blinded to the type of sequence using a 5-point Likert scale (5=excellent). For quantitative assessment, signal homogeneity was measured in the piriformis muscle by calculating the coefficient of variation (CV). Wilcoxon signed-rank tests were used to compare the different image sets and the CV.

### RESULTS

A total of 50 patients were included (mean age 68±6.6). The DL-accelerated sequences showed a significantly shorter acquisition time (0:15 vs. 2:23 min; p-value < 0.001). Qualitative ratings revealed a higher overall image quality and sharpness compared to the conventional sequence for both readers (p-value < 0.01). One reader reported significantly fewer artifacts with the DL-accelerated sequence. The diagnostic confidence for lymph nodes and bone lesions was excellent for both sequences, with significant difference only for lymph nodes in favor of the DL-accelerated sequence for one reader (p-value < 0.05). There was no significant difference between the CV (0.031 for the DL-accelerated sequence and 0.029 for the standard sequence).

### CONCLUSION

DL-accelerated ultrafast T1w VIBE Dixon imaging demonstrated superior image quality and improved or equal diagnostic confidence for pelvic lymph nodes and bone lesions in patients with suspicion for prostate cancer compared to conventional T1w VIBE Dixon imaging with a tremendously shorter acquisition time.

### CLINICAL RELEVANCE/APPLICATION

In recent years, there has been a growing demand for prostate MRI, a trend that is expected to continue with the establishment of systematic screening programs worldwide. To meet this demand, DL-accelerated sequences are emerging as a compelling option. Here, we show that DL-accelerated ultrafast T1w VIBE Dixon sequences allow screening for pelvic metastases in a fraction of the original scan time, while providing superior image quality and improved or equal diagnostic confidence compared to conventional imaging.

## W3-SSGU05-5 EVALUATING BIPARAMETRIC MRI-BASED AI AND RADIOLOGIST PERFORMANCE IN PROSTATE CANCER VOLUMETRIC ANALYSIS USING HISTOPATHOLOGICALLY MAPPED DIGITIZED WHOLE-MOUNT SLIDES

Stephanie A. Harmon, PhD (*Abstract Co-Author*) Nothing to Disclose
Rosina Lis, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Pinto (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;License agreement, Koninklijke Philips NV;
Sandeep Gurram (*Abstract Co-Author*) Nothing to Disclose
David Gelikman (*Abstract Co-Author*) Nothing to Disclose
Peter L. Choyke, MD (*Abstract Co-Author*) Nothing to Disclose
Bradford J. Wood, MD (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;Researcher, Koninklijke Philips NV;Intellectual property, Koninklijke Philips NV;Equipment Support, Koninklijke Philips NV;Researcher, Celsion Corporation;Research Grant, Celsion Corporation;Researcher, BTG International Ltd;Intellectual property, BTG International Ltd;Researcher, Boston Scientific Corporation;Research Grant, Boston Scientific Corporation;Intellectual property, Boston Scientific Corporation;Researcher, Siemens AG;Equipment Support, Siemens AG;Researcher, Sarasota Interventional Radiology;Researcher, NVIDIA Corporation;Research Grant, NVIDIA Corporation;Equipment support, AngioDynamics, Inc;Equipment support, Profound Medical Inc;Researcher, Canon Medical Systems Corporation;License agreement, Canon Medical Systems Corporation;Researcher, AstraZeneca PLC;Researcher, Exact Imaging Inc
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Merino, MD (*Abstract Co-Author*) Nothing to Disclose
Omer Esengur, MD (*Abstract Co-Author*) Nothing to Disclose
Enis Yilmaz, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the performance of a biparametric MRI (bpMRI)-based AI model in estimating overall prostate cancer (PCa) and clinically significant prostate cancer (csPCa) volume on whole-mount (WM) histopathology using detailed histopathological mapping.

### METHODS AND MATERIALS

This single-center retrospective study included patients who underwent multiparametric MRI and subsequent radical prostatectomy between January 2014 and November 2021. All scans underwent prospective assessment by an expert genitourinary radiologist who volumetrically contoured each intraprostatic lesion. An automated prostate lesion detection model which was developed on a multi-institutional dataset of 1240 treatment-naļve patients on bpMRI was tested using thresholds set at 50% (flexible), 63% (default), and 75% (strict). A genitourinary pathologist delineated all tumors on digitized WM slides and assigned Gleason Grade Groups (GG) to each neoplastic focus. WM tumor volumes were determined from histopathological

annotations, incorporating a shrinkage correction factor of 1.15. csPCa was defined as GG=2. Volumetric contours by the radiologist and AI at several thresholds were compared to WM specimen volumes using the Wilcoxon signed-rank test and Kendall t coefficient.

**RESULTS**

A total of 108 patients (median age, 63; interquartile range [IQR], 57-68 years) with a median prostate-specific antigen of 7.3 ng/mL (IQR, 5.4-10.7 ng/mL) were included. The median tumor burden on WM was 2.3 mL (IQR, 1.2-4.9 mL) for overall PCa and 2.3 mL (IQR, 1.1-4.9 mL) for csPCa. The median volume per radiologist contours (2.1 mL) were higher than that of flexible (1.2 mL, P<.001), default (0.9 mL, P<.001) and strict (0.7 mL, P<.001) AI thresholds. The WM volume demonstrated significant correlations with flexible (tPCa=0.51, tcsPCa=0.49), default (tPCa=0.51, tcsPCa=0.49), strict AI (tPCa=0.49, tcsPCa=0.47) thresholds and with the radiologist (tPCa=0.47, tcsPCa=0.46). Bland-Altman analyses revealed the highest concordance between radiologist-delineated contours and WM volumes for both PCa and csPCa, with the strict-threshold AI showing the least agreement. In patients with PI-RADS 4 index lesions (n=39), the radiologist estimate (1.3 mL) was similar to median tumor volumes on WM for PCa (1.3 mL, P=.20) and csPCa (1.2 mL, P=.35).

**CONCLUSION**

A bpMRI-based AI model achieved the best performance for PCa volume estimation at the flexible threshold. Expert-derived volumetric contours are more representative of the actual tumor burden compared to the AI segmentations.

**CLINICAL RELEVANCE/APPLICATION**

An automated prostate lesion detection model could be used to estimate the tumor volume at a flexible threshold on whole-mount pathology without utilizing dynamic contrast enhanced MRI.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

W3-SSIN05

**Imaging Informatics (Dice the Slice - Cutting-Edge Segmentation Research)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E351

Nathaniel Braman, PhD (*Moderator*) Former Employee, Tempus Labs;Intellectual property, Tempus Labs;Stockholder, Tempus Labs;Employee, Picture Health;Intellectual property, Picture Health;Stockholder, Picture Health;
Maggie Chung, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W3-SSIN05-1 THE BRAIN TUMOR SEGMENTATION (BRATS-METS) CHALLENGE 2024 AND BEYOND: BRAIN METASTASIS SEGMENTATION ON PRE AND POST-TREATMENT MRI

Marius G. Linguraru, DPhil, MSc (*Abstract Co-Author*) Co-founder, PediaMetrix Inc
Jeffrey Rudie, MD, PhD (*Abstract Co-Author*) Medical Advisory Board, Cortechs.ai;Consultant, Cortechs.ai;Stockholder, Cortechs.ai;Medical Advisory Board, Subtle Medical, Inc;Consultant, Subtle Medical, Inc;Stockholder, Subtle Medical, Inc
Ujjwal R. Baid, PhD (*Abstract Co-Author*) Nothing to Disclose
Gian Marco Conte, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Anastasia Yevgeniyivna Janas (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Raisa Amiruddin, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mariam S. Aboian, MD, PhD (*Abstract Co-Author*) Researcher, Blue Earth Diagnostics Ltd;Researcher, Fusion Pharmaceuticals;Research collaboration, Pro Medicus Limited
Fatima Memon, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Evan D. Calabrese, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nourel Hoda M. Tahon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Maruf Adewole, MD (*Abstract Co-Author*) Nothing to Disclose
Udunna Anazodo, PhD (*Abstract Co-Author*) Nothing to Disclose
Dominic LaBella, MD (*Abstract Co-Author*) Nothing to Disclose
Nazanin Maleki, MD (*Abstract Co-Author*) Nothing to Disclose
Nader Ashraf, MBBS (*Abstract Co-Author*) Nothing to Disclose
Anahita Fathi Kazerooni (*Abstract Co-Author*) Nothing to Disclose
Brats Consortium (*Abstract Co-Author*) Nothing to Disclose
Aly H. Abayazeed, MBChB (*Abstract Co-Author*) Nothing to Disclose
Ahmed W. Moawad, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The Brain Tumor Segmentation - Metastases (BraTS-METS) challenge focuses on volumetric assessment metastatic disease to the brain using MRI. It addresses the significant variability in lesion size, appearance and post-treatment changes. While BraTS-METS 2023 challenge include pre-treatment cases showing promising results, BraTS-METS 2024 is an extension of the 2023 challenge to add post-treatment cases and evaluate segmentations based on lesionwise detection across the different algorithms.

### METHODS AND MATERIALS

The BraTS-METS dataset is a retrospective collection of MRI from patients scanned on varying MRI imaging quality across different vendors and different sites. The scans are pre-processed using different algorithms then refined by a pool of annotators with different expertise in medical imaging. The dataset is finally reviewed carefully by two independent board certified neuroradiologists. The data is divided into Training, validation and testing dataset. The challenge will be evaluated based on weighted lesionwise detection score of enhancing tumor, whole tumor, tumor core and post-treatment changes.

### RESULTS

Data was collected from 9 different sites includes MRI of patients with brain metastasis on either pre-treatment or post-treatment scans. There are 2,712 cases received from various institutions. 966 cases were released during BraTS-METS 2023 challenge contain 3,433 brain lesions. The rest will be released as part of BraTS-METS 2024 challenge containing post-treatment cases. Seven different teams enrolled in the challenge during MICCAI conference. The top teams detect 70% of the brain metastasis with 80% senstivity of detection small lesions. We are currently in the recruitment phase for the 2024 challenge which will be held in October 2024. Plans are made to hold the challenge beyond 2024 and to include more labels, more data from different sites and timepoints.

### CONCLUSION

Throughout the 2023 BraTS-METS challenge, we have confronted both technical and practical challenges in the development and application of machine learning algorithms for BM segmentation. The challenge has highlighted the critical need for algorithms capable of detecting even the smallest lesions, which are often overlooked due to human error or obscured by the limitations of imaging data.

### CLINICAL RELEVANCE/APPLICATION

The development of refined segmentation algorithms that effectively balance sensitivity with specificity is therefore essential. The BraTS-METS challenge has been instrumental in advancing these developments, pushing forward the creation of models that are robust and adaptable across varied clinical environments. This endeavor not only tests the precision of these algorithms but also evaluates their practical applicability.

## W3-SSIN05-2 LEARNING WITHOUT FORGETTING FOR CONTINUAL ABDOMINAL MULTI-ORGAN AND TUMOR SEGMENTATION

Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Yixiao Zhang (*Abstract Co-Author*) Nothing to Disclose
Xiaoxi Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To enable AI to learn new classes of organs and tumors while retaining previously learned classes, preventing forgetting.

### METHODS AND MATERIALS

We propose a novel continual multi-organ and tumor segmentation method that overcomes the forgetting problem with little memory and computation overhead. First, we propose to generate soft pseudo annotations for the previous classes on new data. This enables us to keep old knowledge without saving the old data. Second, we propose image-aware class-specific heads for each class on top of the shared encoder and decoder. These heads allow a single backbone and easy extension to new classes while bringing little computational cost. Third, we propose to encode the class names with CLIP, which encodes semantic information of each class through large-scale image-text co-training. We evaluate our method using three abdominal CT datasets, i.e., BTCV, LiTS, and JHH. We define two learning trajectories. (1) First segment 13 organs in the BTCV dataset and then segment liver tumors in the LiTS dataset. (2) Segment 13 organs in the JHH dataset, followed by continual segmentation of 4 gastrointestinal tracts (GT), and 6 cardiovascular system structures (CSS).

### RESULTS

We compare the proposed method with baseline methods LwF, ILT, and PLOP. On the JHH dataset, our method achieves a Dice of 0.783 on old organ classes, 0.3% better than the best baseline, and a Dice of 0.695 on GT and 0.636 on CSS, higher than the best baseline by a margin of 4.2% and 15.2%, respectively. On the BTCV and LiTS datasets, our method also achieves a Dice of 0.817 on old organ classes and 0.466 on the new tumor class, 1.8% and 1.0% better than the best baseline models, respectively. Empirical results show the proposed method enjoys the least forgetting in old classes and a better ability to adapt to new classes. We further conduct ablation studies on the proposed organ-specific heads and CLIP encoding on the JHH dataset. The use of organ-specific heads brings a 1.0% improvement in old organ classes and a 14.4% improvement in new GT classes. Using CLIP encoding further brings a 1.0% improvement in old organ classes and 2.1% in new GT classes.

### CONCLUSION

We propose a continual multiple organ and tumor segmentation method in 3D abdominal CT images. The proposed method is evaluated on public and private datasets in continual learning. Empirical results demonstrate that the proposed method outperforms the continual learning baseline methods in this challenging task.

### CLINICAL RELEVANCE/APPLICATION

Due to privacy regulations, institutions usually have limited access to the data for a pre-trained model from another source. The proposed method offers the ability to extend a pre-trained model to new data with little forgetting of its knowledge of previous data.

## W3-SSIN05-3 TRAJECTORIES OF BODY COMPOSITION IN THE GENERAL POPULATION: REFERENCE VALUES FROM OVER 66.000 INDIVIDUALS

Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Susanne Rospleszcz (*Abstract Co-Author*) Nothing to Disclose
Michael T. Lu, MD, MPH (*Abstract Co-Author*) Stockholder, NVIDIA Corporation;Institutional Research Grant, Kowa Company, Ltd;Institutional Research Grant, AstraZeneca PLC;Stockholder, Advanced Micro Devices, Inc;Stockholder, Intel Corporation
Marco Reisert (*Abstract Co-Author*) Nothing to Disclose
Vineet K. Raghu, PhD (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Matthias Jung, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Imaging-based body composition (BC) measures play an important role for risk estimation in patients with cardiometabolic disease and cancer. With advances in AI, automated and accurate quantification of BC from imaging studies has become feasible, but reference values for BC measures are still missing. Here, we developed and tested a fully automated deep learning framework to quantify BC from magnetic resonance imaging (MRI) to calculate normative reference curves similar to the concept of growth charts in pediatric care.

### METHODS AND MATERIALS

The framework was developed to quantify BC from whole-body MRI using data from the UK Biobank (UKBB) and the German National Cohort (NAKO). Whole-body BC was derived as 3D segmentation masks for (i) subcutaneous (SAT), (ii) visceral (VAT), (iii) skeletal muscle (SM), SM fat fraction (SMFF), and (iv) intramuscular adipose tissue (IMAT). The 3D BC segmentation masks were used to compute changes in each BC measure across age, stratified by sex and body height. Normative reference curves based on age, sex, and height were generated for each BC measure using generalized additive models.

### RESULTS

Among 66,608 individuals (mean age: 57.7±12.9 years; mean BMI: 26.2±4.5 kg/m2, 48.3% female) BC analysis revealed sex differences in volumes and distributions with stepwise increases in SAT, VAT, SMFF, and IMAT over age decades, and stepwise decreases in SM (all $p < 0.001$). Spatial craniocaudal distribution analysis revealed age- and sex-related shifts in BC distribution: With increasing age, SAT shifted from the gluteal region to the chest, VAT from the pelvis to the abdomen, SM from the gluteal region to the trunk and chest in females and from the chest to the gluteal region in males. Paraspinal IMAT shifted from the lower lumbar spine to the upper thoracic spine. Normative BC reference curves based on age, sex, and body height showed that BC variance and volume were significantly more body height dependent in males than in females.

### CONCLUSION

This study provides normative reference curves, similar to growth charts in pediatric care, for body composition from a large general population. These are key to tracking normal and abnormal changes in BC across the lifespan.

### CLINICAL RELEVANCE/APPLICATION

As there is increasing evidence that changes in BC over the course of diseases may provide important prognostic information in cardiometabolic and oncologic diseases and may be related to treatment tolerability, the normative curves provided in this study may help clinicians and researchers to quantitatively assess abnormal BC. Reference curves will be made publicly available via a tool that allows researchers and clinicians to normalize and compare BC metrics of their own datasets to reference values of a large Western-European population.

## W3-SSIN05-4 DEEP LEARNING TO PREDICT MORTALITY FROM WHOLE-BODY MAGNETIC RESONANCE IMAGING IN THE GENERAL POPULATION

Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Hanna Rieder (*Abstract Co-Author*) Nothing to Disclose
Vineet K. Raghu, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael T. Lu, MD, MPH (*Abstract Co-Author*) Stockholder, NVIDIA Corporation;Institutional Research Grant, Kowa Company, Ltd;Institutional Research Grant, AstraZeneca PLC;Stockholder, Advanced Micro Devices, Inc;Stockholder, Intel Corporation
Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Reisert (*Abstract Co-Author*) Nothing to Disclose
Matthias Jung, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Manually extracted single-slice (2D) body composition (BC) measures have shown associations with clinical outcomes in patients with cardiometabolic disease and cancer. With advances in artificial intelligence, fully automated 3D segmentation approaches are now possible, but whether these measures carry prognostic value to predict mortality in the general population is unknown. Here, we developed and tested a deep learning framework to automatically quantify 3D BC from whole-body magnetic resonance imaging (MRI) and investigated their prognostic value to predict mortality in the general population.

### METHODS AND MATERIALS

The framework was developed using data from two large population-based cohort studies, the UK Biobank (UKBB) and the German National Cohort (NAKO). BC was defined as subcutaneous (SAT), visceral (VAT), skeletal muscle (SM), SM fat fraction (SMFF), and intramuscular adipose tissue (IMAT). The prognostic value of the BC measures was assessed in the UKBB only using Cox regression analysis. In addition, we extracted 2D BC areas for every level of the thoracic and lumbar spine 1) to compare the proposed 3D approach to the currently established 2D approach on the height of the L3 vertebra and 2) to investigate the correlation between 3D volumes and 2D single slice areas on the level of each vertebral body.

### RESULTS

In 36,317 UKBB participants ( 65.1±7.8y, 51.7% female; 1.7% [633/36,317] all-cause deaths; median follow-up 4.8 years), Cox regression revealed an independent association between 3D SM (aHR: 0.71, 95% CI [0.58-0.86], p<0.001), 3D SMFF (aHR: 1.2, 95% CI [1.06-1.36], p=0.004), and 3D IMAT (aHR: 1.12, 95% CI [1.03-1.21], p=0.009) and mortality after adjustment for demographics (age, sex, BMI, race) and cardiometabolic risk factors (alcohol consumption, smoking status, hypertension, diabetes, history of cancer, blood serum markers). This signal was not seen when using traditional 2D measures, despite high correlation between 3D and 2D metrics including R=0.96 at L5 for SAT, 0.95 at L5 for SMFF and at L3 for VAT (R=0.98), SM (R=0.94), and IMAT (R=0.76) (all p<0.001). A similar pattern was found in 23,725 NAKO participants (53.9±8.3y, 44.9% female). No significant association was found between SAT or VAT and all-cause mortality.

### CONCLUSION

Automated 3D BC assessment from whole-body MRI predicted mortality in the general population beyond traditional clinical risk factors. 2D were highly correlated with 3D measures but the association with mortality attenuated after multivariable adjustment.

### CLINICAL RELEVANCE/APPLICATION

As 3D BC measures are increasingly accessible using automated techniques, they could help to identify high-risk individuals to improve personalized prevention and lifestyle interventions.

## W3-SSIN05-5 ABDOMENATLAS: AI AND RADIOLOGISTS UNITE TO MAP THE ABDOMEN

Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Wenxuan Li, BS (*Presenter*) Nothing to Disclose

### PURPOSE

To leverage the synergy between medical professionals and artificial intelligence algorithms to create the largest annotated multi-organ dataset to date.

### METHODS AND MATERIALS

We have developed the largest annotated CT dataset, named AbdomenAtlas, which includes 22,532 three-dimensional CT volumes from 94 hospitals, providing 684,752 high-quality masks of anatomical structures.The annotation involved 20 radiologists at JHU and associated institutes—14 senior radiologists with 8-15 years of experience and 6 junior radiologists with 3-5 years of experience. Typically, senior radiologists spent 30-60 minutes annotating each organ or tumor in a CT volume. To reduce this workload, we developed an efficient annotation method using a blend of three AI models trained on public datasets of labeled abdominal scans to minimize bias. These AI models initially annotated unlabeled datasets, highlighting key areas with color-coordinated attention maps for focused manual review by radiologists. This iterative process of AI prediction followed by human verification accelerated the annotation rate by a factor of 168, achieving a quality comparable to that of manual annotations by experienced radiologists.

### RESULTS

Three editions of AbdomenAtlas have been developed: (I) AbdomenAtlas 1.0 is publicly accessible, licensed under CC BY-NC-ND, and represents the largest public CT dataset currently available. Collected from 26 centers, 1.0 provides per-voxel annotations for 9 anatomical structures for 5,195 CT volumes (1.9M images). (II) AbdomenAtlas 2.0, set for full release in late 2024 with a CC BY-NC-ND license, includes per-voxel annotations for 73 anatomical structures and seven tumor types (e.g., liver, pancreas, kidney, colon, lung) for 9,262 CT volumes (3.5M images), collected from 88 centers.

(III) AbdomenAtlas Pro is reserved for internal studies at JHU and includes per-voxel annotations for 142 anatomical structures and all types of tumors for 22,682 CT volumes (8.5M images). Pro was collected from 102 centers.

## CONCLUSION

Creating datasets of such scale (22K CT volumes) conventionally requires an impractical 209.5 years of continuous annotation by a single radiologist. Our study demonstrates that AI significantly streamlines this process by pre-annotating clear boundaries and time-intensive sections. This human-AI collaboration dramatically reduces the time required, making the annotation of extensive medical datasets feasible within a manageable timeframe for expert radiologists (e.g., 1.25 years to create AbdomenAtlas).

## CLINICAL RELEVANCE/APPLICATION

AbdomenAtlas automates the identification and delineation of 142 anatomical structures, significantly reducing manual contouring efforts for organ shape/volume measurement.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W3-SSIN06

**Imaging Informatics (Leveraging AI for Diagnosis and Screening)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E450B

Fides Schwartz, MD (*Moderator*) Nothing to Disclose
Elias Kikano, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W3-SSIN06-1 LARGE LANGUAGE MODEL-ENHANCED PREDICTION OF COMBINED INTRAPARENCHYMAL HEMORRHAGE AND INTRAVENTRICULAR HEMORRHAGE EXPANSION FROM CT DATA AND CLINICAL INFORMATION

Liting Shi (*Abstract Co-Author*) Nothing to Disclose
Lequn Zhu (*Abstract Co-Author*) Nothing to Disclose
Lei Shi (*Abstract Co-Author*) Nothing to Disclose
Yinyu Lan (*Abstract Co-Author*) Nothing to Disclose
Hui Xu (*Abstract Co-Author*) Nothing to Disclose
Yulong Yang (*Abstract Co-Author*) Nothing to Disclose
Zhenwei Yao (*Abstract Co-Author*) Nothing to Disclose
Jianlin Wang (*Abstract Co-Author*) Nothing to Disclose
Xianjing Zhao (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to evaluate the effectiveness of using a Large Language Model (LLM) to predict combined intraparenchymal hemorrhage (IPH) and intraventricular hemorrhage (IVH) growth, consequential complications of intracerebral hemorrhage (ICH) that significantly impact patient outcomes. The study will explore the potential of incorporating CT reports and clinical information to improve the predictions made by LLM. Additionally, the study will compare the performance of LLM with predictions made by a senior doctor and a junior doctor separately, to assess its accuracy.

### METHODS AND MATERIALS

This retrospective multicenter study included radiological and clinical data from ICH patients across three hospitals. Non-contrast CT scans were used to determine IPH volume, IVH volume, IPH location, and IPH markers, while the presence of subarachnoid hemorrhage was also noted. CT reports were included as inputs for the model. Clinical presentations included age, gender, time interval from symptom onset to baseline CT, and Glasgow Coma Scale (GCS) score upon admission. Ground truth for IPH and IVH expansion was determined from 24-hour follow-up CT scans, where an increase in IPH volume of =6ml and/or any expansion of IVH was considered significant. The dataset was divided into training and testing sets in an 8:2 ratio. The LLaMa 7B model was chosen, and the LoRA fine-tuning method was used for optimization. The predictions of one senior doctor and one junior doctor, with 3 and 20 years of experience in neuroradiology respectively, were independently compared with the predictions made by the LLaMa 7B model. The performance of the LLaMa 7B model was evaluated using area under the receiver operating characteristic curve (AUC), precision, recall, and F1 score. The DeLong test compared AUCs of the model and two doctors.

### RESULTS

A total of 718 patients (median age: 62 years; majority male) were included in the study. The LLaMa 7B model achieved an AUC of 0.741, precision of 0.686, recall of 0.889, and F1 score of 0.774. The junior doctors' predicted AUC was 0.574, while the senior doctor's predicted AUC was 0.704. The LLM outperformed the predictions made by the junior doctors significantly (p=0.027). Although the AUC of the LLaMa 7B model was slightly higher than that of the senior doctor's predictions, the difference was not statistically significant (p=0.518).

### CONCLUSION

LLM demonstrated superior performance in predicting IPH and IVH expansion, outperforming the prediction made by junior doctors.

### CLINICAL RELEVANCE/APPLICATION

LLM has the potential to enhance the prediction of combined intraparenchymal hemorrhage and intraventricular hemorrhage expansion.

## W3-SSIN06-2 CLINICAL IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN THE DIAGNOSIS OF ACUTE PULMONARY EMBOLISM

Matthew A. Barish, MD (*Abstract Co-Author*) -[Stockholder, Blackford Analysis Ltd]; -[Consultant, Calyx.AI]; -[President,SBQ Radiology]; -[Medical Advisory Board, Nuance]
Rakesh D. Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Pina C. Sanelli, MD, MPH (*Abstract Co-Author*) Research support, Siemens AGInvestigator, Siemens AG
Amir Gandomi (*Abstract Co-Author*) Nothing to Disclose
David S. Hirschorn, MD (*Abstract Co-Author*) Nothing to Disclose
Shlomit Goldberg-Stein, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Evaluate concordance rates between radiologists and an AI algorithm for detection of acute pulmonary embolism (PE) on PE protocol CT (CTPE) across an integrated healthcare network.

**METHODS AND MATERIALS**

This IRB approved prospective observational study included consecutive CTPE exams in adults (9/9/21-2/20/23). In our clinical workflow, CTPE were evaluated by an FDA-approved AI algorithm (AIDOC) and subsequent interpretation by radiologists, who were aware of AI results at the time of interpretation. Disagreements between AI and interpreting radiologists were resolved by expert adjudicators. We calculated concordance between interpreting radiologists and AI and analyzed adjudicator concordance with interpreting radiologists or AI. Confidence intervals for proportions and Clopper-Pearson method via the 'beta' method in Python's library was used.

**RESULTS**

A total of 32,501 CTPE exams were included in the analysis and yielded 97.82% (CI 97.66,97.98) concordance between interpreting radiologists and AI for the diagnosis of acute PE. For the remaining 2.18% (n=708), adjudicators agreed with the interpreting radiologist in 76.98% (n=545); these agreements were higher for positive PE (n=392, 71.93%) vs. negative PE (n=153, 28.07%). Of 485 cases where the interpreting radiologist diagnosed PE where AI did not, adjudicators agreed with the interpreting radiologist in 85% of cases (n=392). There were 3,137 positive exams for acute PE, after expert adjudication of discordant cases. Overall, the rate of enhanced PE detection by the interpreting radiologist alone (where AI did not diagnose PE) was 12.5% (n=392) of all positive PE exams (n=3,137). The rate of enhanced PE detection by AI alone (where interpreting radiologists did not diagnose PE), was 2.96% (n=93) of all positive PE exams (n=3,137).

**CONCLUSION**

There was high concordance of AI with interpreting radiologists (98%) for acute PE detection. AI enhances radiologists' diagnosis of acute PE in the clinical environment, adding 3% of positive PE not detected by the radiologist. Radiologists should not be swayed against a positive diagnosis of PE when not detected by AI, given high concordance with adjudicators for positive PE (85%). What remains unknown is the true added value of AI in detection of PE that would otherwise go undetected by radiologist since radiologists were aware of AI results prior to interpretation.

**CLINICAL RELEVANCE/APPLICATION**

This is the largest study to date evaluating clinical implementation of AI for acute PE, allowing for subset analysis, and a deeper understanding of optimal utilization of AI in clinical practice.

## W3-SSIN06-3 IDENTIFY AND MITIGATE BIASES IN SYNTHETIC IMAGING DATA TO IMPROVE RELIABILITY OF AI DIAGNOSIS MODELS

Jules H. Sumkin, DO (*Abstract Co-Author*) Research Grant, Hologic, Inc;
Margarita L. Zuley, MD (*Abstract Co-Author*) Investigator, Hologic, Inc
Dooman Arefan, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Degan Hao, MS (*Abstract Co-Author*) Intern, F. Hoffmann-La Roche Ltd
Shandong Wu, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

With the surge of generative AI, an increasing amount of synthetic medical imaging data are being produced. Synthetic data can increase sample sizes and benefit machine learning, but the generation of synthetic data may inherent/amplify potential biases in the original real data or introduce new biases (e.g., spurious correlations), leading to degraded model performance or integrity. This study aims to develop a new method to identify and mitigate potential spurious correlation biases in synthetic data to improve AI model training.

**METHODS AND MATERIALS**

This IRB-approved study employed a convolutional neural network on mammogram images from 1,284 patients (per biopsy, 366 breast cancer and 918 benign/negative cases) for breast cancer diagnosis. These patients have 4,346 real mammogram images, and a generative adversarial network was trained to generate another set of 4,346 synthetic images with several different settings of inserting or removing tumorous tissues on images to create various new samples. We propose a novel method, namely, Bias-Resilient Fine Tuning (BRFT; see attached figure) to mitigate biases in synthetic data to improve model training. BRFT identifies robust features on real and synthetic data, measures feature correlation, and uses a feature swapping strategy to improve training. In experiments we first follow regular training to train a model only using real or synthetic data to examine potential biases, then we incorporate BRFT for training to evaluate the corresponding model effects. The model's performance is measured by Area Under the ROC Curve (AUC) under five-fold cross-validation.

**RESULTS**

Regular training on real data alone shows a test AUC of 0.615 ± 0.016, but on the synthetic data alone the test AUC is 0.946 ± 0.074 on synthetic test data, indicating a seriously skewed performance due to spurious correlation biases in the synthetic data. When BRFT is applied, it leads to a synthetic data test AUC of 0.610 ±0.040 (which is close to the real data AUC of 0.615), showing BRFT can effectively mitigate biases in the synthetic data to reduce inflated AUCs. In addition, the use of BRFT also increases the real data test AUC from 0.615 ± 0.016 to 0.633 ± 0.015, showing the improved model performance attributed to use of the additional synthetic data.

**CONCLUSION**

Generative AI and synthetic data are being promoted for medical imaging applications, where detecting and mitigating potential biases in synthetic data are critical to ensure reliability and fairness of AI models for clinical uses.

**CLINICAL RELEVANCE/APPLICATION**

Generative AI and synthetic data are being promoted for medical imaging applications, where detecting and mitigating potential biases in synthetic data are critical to ensure reliability and fairness of AI models.

## W3-SSIN06-5 AUTOMATED ELECTRONIC HEALTH RECORDS TOOLS FOR IMPROVING HEPATOCELLULAR CARCINOMA SCREENING AND SURVEILLANCE

Yuko Kono, MD, PhD (*Abstract Co-Author*) Equipment support, Canon Medical Systems Corporation;Equipment support, General Electric Company;Support, Lantheus Holdings;Support, Bracco Group
Kathryn J. Fowler, MD (*Abstract Co-Author*) Consultant, Bayer AG;Research support, General Electric Company;Research Grant, Pfizer Inc;Institutional Grant, MEDIAN Technologies;Consultant, General Electric Company

Yesenia Covarrubias, MS (*Abstract Co-Author*) Nothing to Disclose
Ruth C. Carlos, MD, MS (*Abstract Co-Author*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company
Claude B. Sirlin, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC
Paul M. Murphy II, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Soudabeh Fazeli, MD,MPH (*Abstract Co-Author*) Nothing to Disclose
Julie Y. An, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Diagnostic imaging plays a critical role in the detection and diagnosis of hepatocellular carcinoma (HCC). Patients with cirrhosis and/or chronic hepatitis B are at elevated risk for developing HCC and are recommended 6-months interval screening/surveillance imaging exams. With the ever-growing busy clinical practice and advancements in EHR capabilities, we saw an opportunity to build an integrated tool to aid in improving compliance of imaging-based HCC surveillance.

**METHODS AND MATERIALS**

Our collaborative team of physicians and IT specialists developed a population-health-based framework within the EHR to identify and mark eligible patient due for surveillance imaging. We then defined specific criteria, based on published recommendations and subspecialty expertise, to trigger a Best Practice Advisory (BPA) for patients due or overdue for imaging. This allowed clinicians to review clinical data quickly and place orders within the tool. Feedback was solicited at each design and implementation step. EHR use-data and clinical outcomes were collected post-implementation (11/13/23-3/6/24). A secondary patient-reported assessment evaluated potential barriers to surveillance and patient attitudes towards potential reminders.

**RESULTS**

Qualitative feedback led to modifications in the framework, including refining patient inclusion/exclusion criteria and optimizing the human-machine workflow. Clinicians reported overall improvement in workflow but noted multiple false positive BPA alerts due to initial over-inclusion. Among 225 eligible patients who received a BPA during clinical encounters, 136 (60%) resulted in imaging orders (62% US, 28% MRI, 7% CT, and 4% abbreviated MRI). Of the completed exams after a 3-month follow-up, 2/81 were diagnostic of HCC, and 1/81 was considered indeterminate (LI-RADS 3), requiring short interval follow-up. In the secondary analysis of patient-reported preferences, 100% (20/20) of patients desired direct reminders via their mobile app for future HCC surveillance exams, which could be incorporated in future updates.

**CONCLUSION**

An automated, EHR-integrated tool can help improve compliance of in preventative care measures. In our implementation study, we created and deployed a tool built into our EHR system which provided targeted reminders to clinicians managing the care of at-risk patients. Our tool improved HCC screening/surveillance compliance above that of

**CLINICAL RELEVANCE/APPLICATION**

Modern EHR tools can be optimized to aid in accurate tracking and reminding of recommended health maintenance tasks, including imaging-based HCC surveillance. We hope our experience will provide a framework for others interested in similar efforts.

## W3-SSIN06-6 AI-ENABLED RADIOGRAMMETRY FOR OPPORTUNISTIC OSTEOPOROSIS SCREENING: A REAL-WORLD FEASIBILITY STUDY

Jyhwen Chai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Qingzong TSENG (*Abstract Co-Author*) Nothing to Disclose
SHENG CHE HSIAO (*Abstract Co-Author*) Nothing to Disclose
CHENG WEI LIN (*Abstract Co-Author*) Nothing to Disclose
Hsuan-Yin Lin, BMedSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Osteoporosis(OP), characterized by reduced BMD and increased fragility fracture risk, is a growing epidemic due to aging populations. Despite the potential for prevention, it remains underdiagnosed due to DXA access. Opportunistic screening, utilizing existing medical images, offers a cost-effective way for OP identification. While AI-assisted radiogrammetry has been explored, pelvic and hip X-rays are not routinely obtained in standard health examinations and chest X-rays lack hip BMD data - critical for assessing fracture risk. Plain abdomen X-rays (KUB), however, are routinely ordered and provide both lumbar and hip information. This study aims to validate the use of AI to facilitate OP screening using KUB radiographs.

**METHODS AND MATERIALS**

The institutional review board approved this prospective study (TCVGH-IRB No. SF23547B). The performance of an AI software (DeepXray Coxa, Alpha Intelligence Manifolds, Inc.) was first validated using retrospectively collected data of DXA BMD values and KUB obtained at Taichung Veterans General Hospital between 2011-2022. The study used DXA BMD measurements conducted on a Lunar iDXA (GE, Chicago, USA). After excluding images with incomplete femur or implants on the region of interest (ROI) (n=15784), tags on the ROI (n=1577) and suboptimal quality (n=855), 3,850 paired DXA-KUB were enrolled for further AI analysis [78% Female; mean age 71.8 ± 11.8 years]. This study then employed the AI algorithm combining the feature extraction capabilities of a convolutional neural network with established radiogrammetric principles, for prospective BMD estimation.

**RESULTS**

34.97% of KUB are eligible for AI analysis. On the internal test set (942 hips from 365 individuals), the AI model demonstrated a root mean square difference (RMSD) of 0.059 g/cm² and a Pearson correlation of 0.88 compared to DXA-measured BMD, achieving an AUROC of 0.924 for predicting T-scores = -2.5 (PPV/NPV: 84%/87%, OP prevalence: 27%). In a subsequent prospective feasibility study (116 hips from 61 patients), the AI model maintained an RMSD of 0.062 g/cm² and a Pearson correlation of 0.87. To minimize false positives and unnecessary referrals, we employed a conservative detection threshold of T-score = -2.8. The AI model achieved a 100% PPV and 83.6% NPV.

**CONCLUSION**

This paper presents an AI model that is capable of using routine KUB to estimate hip BMD, which is highly correlated with DXA measurements. A prospective study confirms its effectiveness in opportunistic screening for high-risk OP cases in a real-world setting while minimizing false alarms.

**CLINICAL RELEVANCE/APPLICATION**

This AI model enables opportunistic OP screening using a widely available method, potentially facilitating early treatment and reducing medical financial burdens.

# Abstract Archives of the RSNA, 2024

W3-SSMK08

**Musculoskeletal Imaging (Muscle, Tendon and Nerve)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: E450A

Claudia B. Camara, MD (*Moderator*) Nothing to Disclose
Daniel E. Wessell, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W3-SSMK08-1 ULTRA-PROCESSED FOOD CONSUMPTION IS ASSOCIATED WITH HIGHER INTRAMUSCULAR FAT INFILTRATION IN INDIVIDUALS WITHOUT RADIOGRAPHIC OSTEOARTHRITIS OR FREQUENT PAIN IN THE KNEE AND HIP: DATA FROM THE OSTEOARTHRITIS INITIATIVE

Gabby B. Joseph (*Abstract Co-Author*) Nothing to Disclose
Wynton Sims (*Abstract Co-Author*) Nothing to Disclose
Zehra Akkaya (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD (*Abstract Co-Author*) Research Consultant, General Electric Company
John A. Lynch, PhD (*Abstract Co-Author*) Nothing to Disclose
Katharina Ziegeler, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The loss of contractile muscle tissue is associated with poor health outcomes in a variety of diseases, including osteoarthritis (OA). While lifestyle factors may impact muscle quality, little is known about the influence of low-quality nutrition, specifically ultra-processed foods (UPF). The aim of this study was to assess the association of UPF intake and intramuscular fatty degeneration.

### METHODS AND MATERIALS

Participants from the Osteoarthritis Initiative at risk of but without radiological hip/ knee OA (KL grade =1) or self-reported knee/hip pain on either side at enrollment were included in this cross-sectional study. Participants without 3T thigh MRI or plausible dietary data based on Block Brief 2000 food frequency questionnaire (FFQ) were excluded. Intramuscular fat was assessed using semi-quantitative 5-level Goutallier grades (GG), ranging between 0 (no fatty streaks in the muscle) to 4(>50% fatty signal), on axial T1W images. Each muscle was scored on both thighs per participant; sum GG scores across all muscles (GGall), bilateral flexors (GGflex) (semimebranosus, semitendinosus, biceps femoris), extensors (GGext) (rectus femoris, vastus medialis, vastus lateralis, vastus intermedialis), and adductors (GGadd) (adductors, gracilis, sartorius) were calculated. Standardized values for UPF proportion in overall annual diet (%) were extracted from the FFQ based on the NOVA Classification, which classifies food and beverages into 4 groups based on their level of processing. UPF represents NOVA group 4, indicating industrial-scale processing for increased palatability and shelf-life. Linear regression models were used to assess the relationship between dietary UPF and GG. All models were adjusted for age, sex, race, BMI, total daily caloric intake, physical activity, depression, education, and income levels.

### RESULTS

There were 666 participants (45% men, mean age 59.9 [±9] years, mean BMI 27.1 [±4.3] kg/m2). Mean GG scores and UPF are presented in Table 1A. Highest and lowest GG scores were noted for extensors and flexors, respectively (Table 1A). The relationship between UPF and GG scores was significant for GGall (ß 0.86 [95% CI 0.13, 1.58], p=0.021), indicating an increase of GG by almost 1 grade for each SD increase in UPF. Significant results were also found for GGadd and GGflex but not for GGext (Table 1B).

### CONCLUSION

In a normative cohort of patients, at risk for but free of knee or hip OA by radiographic and clinical criteria, the consumption of UPF is associated with higher intramuscular fat, independent of total daily caloric intake, physical activity, or BMI.

### CLINICAL RELEVANCE/APPLICATION

Quality of nutrition may impact muscle quality and represents a potential target for non-invasive or preventive therapeutic approaches.

## W3-SSMK08-2 SCAN-RESCAN REPEATABILITY OF QUANTITATIVE T1RHO MAPPING ON EXTRAOCULAR MUSCLES IN A HEALTHY COHORT

Min Deng (*Abstract Co-Author*) Nothing to Disclose
Winnie C. Chu, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Yiyou Sun (*Abstract Co-Author*) Nothing to Disclose
Weitian Chen (*Abstract Co-Author*) Nothing to Disclose
Ziqiang Yu (*Abstract Co-Author*) Nothing to Disclose
Ziqin Zhou, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

This prospective study aims to assess the different-day same-scanner repeatability of T1rho mapping on extraocular muscles (EOMs), and to present the normative values of EOMs T1rho in healthy cohort.

**METHODS AND MATERIALS**

Sixteen healthy volunteers (age: 24-32 years; 8 women and 8 men) underwent 3 repeated orbit MRI exams on day 1(baseline), day 2 (short-term repeat), day 7(mid-term repeat). Native T1rho weighted images were acquired on a 3T MR scanner using B1 and B0 compensated spin-lock preparation pulses at spin-lock frequency of 500Hz, with spin-lock times (TSL) of 0, 10, 30 and 50ms. Single-shot turbo spin echo with Half-Fourier sampling was used to accelerate image acquisition, while minimizing EOMs distortion due to eyeball motion. T1rho maps were depicted by fitting images at different TSL to a mono-exponential decay model on pixel-by-pixel basis (Fig 1). Regions of interest were manually drawn by a trained analyst on bilateral EOMs, i.e., medial, lateral, superior, inferior rectus (MR, LR, SR, IR), temporalis (TM) and white matter (WM), excluding observable vessels and artifacts. Repeatability was estimated by intraclass correlation coefficient (ICC), Bland-Altman plots, within-subject coefficient of variation (CV).

**RESULTS**

EOMs showed overall good T1rho scan-rescan repeatability (ICCs:0.766-0.891), comparable to WM (ICCs: 0.813-0.830) and inferior to TM (ICCs: 0.914-0.954). Short-term ICCs were nearly equivalent in four recti (0.818-0.891). Mid-term ICCs remained favorable in MR, LR, and SR (0.842-0.880), but declined in IR with large 95% confidence interval of 0.416-0.919 (Table 1). 95% limits of agreement in the short-term were -7.0 to 6.1 for MR, -8.0 to 5.6 for LR, -10.2 to 8.7 for SR, -29.2 to 32.3 ms for IR, respectively; and in the mid-term were -6.6 to 8.5 for MR, -9.9 to 10.7 for LR, -8.7 to 7.0 for SR, -43.4 to 32.4 ms for IR, respectively (Fig 2), indicating that satisfactory repeatability was gained on all recti except for IR. EOMs scan variability was lowest in MR and highest in LR (short-term CVs: 3.4 -9.3%; mid-term CVs: 4.1-14.5%). When omitting the IR having relatively poor reliability in presence of strong susceptibility near air-filled sinuses, normative T1 rho value was similar in recti (68.99, 69.01, 66.38 ms in MR, LR, SR, respectively; mean: 68.16 ms) (Table 1).

**CONCLUSION**

Orbit T1rho mapping at 3T enables repeatable T1rho measures of EOMs in healthy adults. However, there is still room for improvement in repeatability on IR susceptible to strong B0 inhomogeneity.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative T1rho MRI has been first extended to small-sized EOMs. This paves the way for translating T1rho metric to a new clinically applicable imaging biomarker reflective of EOMs impairments, like inflammation and degeneration.

## W3-SSMK08-3 EVALUATING THE RELATIONSHIP BETWEEN LUMBAR SPINE 4 BONE MARROW FAT FRACTION AND ABDOMINAL/PARASPINAL MUSCLE FAT INFILTRATION: INSIGHTS FROM MRI AND QCT IN PEOPLE LIVING WITH HIV AND HEALTHY INDIVIDUALS

Roland Krug, PhD (*Abstract Co-Author*) Nothing to Disclose
Phyllis Tien, MD (*Abstract Co-Author*) Research Grant, Gilead Sciences, Inc
Nico Sollmann, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Zehra Akkaya (*Abstract Co-Author*) Nothing to Disclose
Gabby B. Joseph (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD (*Abstract Co-Author*) Research Consultant, General Electric Company
Bo Fan, MD (*Abstract Co-Author*) Nothing to Disclose
Fan Bo JR (*Abstract Co-Author*) Nothing to Disclose
Galateia J. Kazakia, PhD (*Abstract Co-Author*) Nothing to Disclose
Fatemeh Dehghani Firouzabadi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study investigates the relationships between bone marrow fat fraction (BMFF) at the lumbar spine and abdominal muscle quality, specifically intramuscular fat area and lean muscle area in the psoas, lateral abdominal, rectus, and paraspinal muscles.

**METHODS AND MATERIALS**

52 People Living with HIV(PLWH) and 52 seronegative controls were included in our study. Chemical shift-based water-fat separation MR images were obtained with a 3T GE scanner; BMFF was calculated from mean density fat fraction maps within the L4 vertebral body. Single slice abdominal QCT images at the L4 level were obtained on a GE scanner; fat and lean areas within segmented muscle groups were calculated using in house segmentation software. Linear regression models were utilized to examine the associations between BMFF and intramuscular fat and lean areas. All models were adjusted for age and sex, with additional sensitivity analyses for group (PLWH and controls).

**RESULTS**

The mean age of individuals was 59.2 ± 4.92 years. Of the total cases, 60 (58%) were males. The analysis of fat infiltration in the paraspinal muscles revealed a significant positive correlation with vertebral BMFF, even after adjusting for age and sex. This association remained robust across sensitivity analyses for PLWH status (coeff=0.63, 95% CI: 0.23-1.04, p-value=0.002). Similarly, fat infiltration in the psoas muscle exhibited a positive association with vertebral BMFF. Although not statistically significant, the effect size was larger (coeff=1.01, 95% CI: -1.71-3.75; p=0.46). Conversely, lean area of the paraspinal and psoas muscles demonstrated a negative association with vertebral BMFF. This was significant in the psoas, even after adjustments and sensitivity analyses (coeff=-0.36, 95% CI: -0.64- -0.07; p=0.01).In the lateral abdominal and rectus muscles, no significant associations were found between vertebral BMFF and fat and lean areas.

**CONCLUSION**

Our findings revealed positive associations between vertebral BMFF and fat infiltration within the psoas and paraspinal muscles, which are anatomically close to the lumbar spine as compared to lateral abdominal and rectus muscles. We also found negative associations between vertebral BMFF and muscle lean area within the psoas and paraspinal muscles. These findings were independent of HIV status.

**CLINICAL RELEVANCE/APPLICATION**

Our results suggest that fat infiltration across marrow and muscle may develop from a common mechanism, and that anatomical proximity may determine the extent of similarity in fat infiltration across tissues. Combined with the established inverse association between BMFF and bone quality, these findings have clinical implications for understanding, preventing, and treating vertebral bone loss.

## W3-SSMK08-4 3D COLOR-RENDERED MR NEUROGRAPHY HEATMAPS IN VISUALIZING NORMAL LUMBOSACRAL (LS) PLEXUS AND INCREASING CONSPICUITY OF LS PLEXOPATHY

Dhilip Andrew, MBBS (*Abstract Co-Author*) Nothing to Disclose
Parham Pezeshk, MD (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Alireza Eajazi, MD (*Abstract Co-Author*) Nothing to Disclose
George Ray III, DO (*Abstract Co-Author*) Nothing to Disclose
Rifat Karatas, MD, RDMS (*Abstract Co-Author*) Nothing to Disclose
Angela He, BS, BA (*Presenter*) Nothing to Disclose

### PURPOSE

To determine whether color-rendered 3D MR neurography (MRN) images (heatmaps) improve diagnostic accuracy, reader confidence levels, and time savings to assess lesions compared to the conventional greyscale images.

### METHODS AND MATERIALS

A cross-sectional study included adults of all genders with MRN of LS plexus and known reference standards of normal or neuropathy (plexopathy / radiculopathy). Heatmaps were constructed using 3D MRN STIR images and color rendered with higher intensity to yellow and lower intensity to darker-red colors in 1-2 minutes and were available on PACS for the readers. 2D plus 3D greyscale MIP images and 2D plus 3D MIP heatmaps were analyzed by four musculoskeletal radiologists (two faculty and two fellows) in 2 separate rounds blinded to the final diagnosis. Readers evaluated: neuropathy and number of nerves affected (neuropathy score: 0 - normal; 1 - one nerve affected; 2 - two or more nerves affected); final diagnosis; confidence levels; and time taken to evaluate the studies.

### RESULTS

Among 70 MRNs from 70 patients, there were 32 males and 38 females with average age ± SD of 54.8 ± 20.1 and 49.9 ± 16.6 years, respectively. There were 30 normals and 40 of LS plexus lesion scans. Interreader agreements were moderate to good for conventional imaging and heat maps (Conger's kappa: 0.65; 95% CI: 0.55, 0.73 and 0.59; 95% CI: 0.47, 0.69), respectively. The mean neuropathy score and final diagnosis accuracies were similar in both rounds 85.7% ± 0.1% vs 83.2% ± 0.1% (P=0.13), and 83.6% ± 0.1% vs 80.0% ± 0.1%; P=0.16), respectively. Time savings were significant when using heatmaps for all readers (P<0.001). Time savings using heatmaps ranged from 57.7%-74.6% and 56.3%-75% of the original time for the fellows and faculty respectively. Average confidence levels for neuropathy score significantly increased using heatmaps for one fellow and one faculty ($P < 0.05$), while average confidence levels for final diagnosis improved for both fellows and one faculty ($P < 0.05$).

### CONCLUSION

3D color-rendered MRN heatmaps show comparable diagnostic accuracy to conventional MRN imaging but with significant time savings to identify LS plexus lesions.

### CLINICAL RELEVANCE/APPLICATION

3D color-rendered heatmaps increase time efficiency in evaluating MRNs of LS plexus, allowing for improved radiologist productivity and diagnostic confidence.

## W3-SSMK08-5 NEUROFIBROMATOSIS TYPE 1(NF1)-RELATED PRE-MALIGNANT/MALIGNANT PERIPHERAL NERVE SHEATH (MPNST) TUMORS: CAN MRI PREDICT HISTOLOGY?

Laura M. Fayad, MD (*Abstract Co-Author*) Nothing to Disclose
Jenifer Pitman, MD (*Abstract Co-Author*) Nothing to Disclose
Shivani Ahlawat, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Ghasemi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the qualitative and quantitative anatomic and functional magnetic resonance imaging (MRI) features of atypical/low-grade MPNST (managed with marginal resection) versus high-grade MPNST (managed with wide excision and/or chemotherapy or radiotherapy) in patients with neurofibromatosis type 1 (NF1).

### METHODS AND MATERIALS

This retrospective single-center study enrolled consecutive participants with NF1 with histological diagnosis of atypical (atypical neurofibromatous neoplasm of unknown biologic potential), low-grade MPNST and high-grade MPNST, and pre-diagnosis MRI from 02/2014-02/2024. In addition to demographic data, qualitative (heterogeneity, architecture ("target sign"), margins, and surrounding plexiform tumor at T2-weighted, T1-weighted pre-contrast, and T1-weighted post-contrast images) and quantitative (size and minimum apparent diffusion coefficient (ADC min) on diffusion weighted imaging (DWI)) MRI features were recorded. Chi square and Spearman's correlation tests were used accordingly for statistical analysis.

### RESULTS

A total of 41 tumors in 40 patients were included (20 (49%) females [median age: 38, range: 14-66] with high-grade (n = 29) and ANNUBP/low-grade (n = 12) MPNSTs). The presence of intralesional necrosis, perilesional edema, and perilesional enhancement ($p = 0.001$, $p = 0.007$, and $p = 0.005$, respectively); a higher largest diameter and average diameter (Spearman's $?=0.363$ ($p=0.02$), and $S? = 0.374$ ($p = 0.016$), respectively); and a lower ADCmin ($S? = -0.509$ ($p = 0.001$)) were associated with high histologic grade. The remaining qualitative and quantitative features, including the presence of a "target sign" on T2 or DWI ($p = 1.0$) or a plexiform background ($p = 0.631$), did not correlate with the grade.

### CONCLUSION

The presence of intralesional necrosis, perilesional enhancement and edema, larger diameters, and a lower ADCmin are associated with high-grade NF1-related MPNSTs when compared with atypical/low-grade MPNSTs.

### CLINICAL RELEVANCE/APPLICATION

MRI using qualitative and quantitative routine anatomic and advanced functional sequences can distinguish premalignant/low-grade MPNST from high-grade MPNST in patients with NF1. The addition of DWI/ADC mapping to a routine MRI protocol reliably distinguishes benign from pre-malignant/low-

grade MPNST in patients with NF1. In the absence of serial imaging with volumetric tumor measurements or PET imaging, a single-time point MRI with DWI will potentially impact therapy and may be useful for the development of imaging-based prognostic features.

## W3-SSMK08-6 CORRELATING DIFFUSION TENSOR IMAGING PARAMETERS WITH LUMBAR PARASPINAL MUSCLE FAT INFILTRATION: IMPLICATIONS FOR SARCOPENIA DIAGNOSIS

Fengyun Zhou (*Abstract Co-Author*) Nothing to Disclose
Xiaoguang Cheng (*Abstract Co-Author*) Nothing to Disclose
Yandong Liu (*Abstract Co-Author*) Nothing to Disclose
Ling Wang (*Abstract Co-Author*) Nothing to Disclose
Yi Yuan (*Abstract Co-Author*) Nothing to Disclose
Yanglei Wu (*Abstract Co-Author*) Nothing to Disclose
Wenshuang Zhang, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to investigate the correlation between DTI quantitative parameters and the extent of fat infiltration in paraspinal muscles, as measured by the Dixon proton density fat fraction (PDFF). The goal is to identify DTI imaging biomarkers that accurately depict paraspinal muscle degeneration and atrophy, providing a fresh perspective for the diagnosis and evaluation of sarcopenia.

### METHODS AND MATERIALS

This study enrolled 16 volunteers with chronic lumbar discomfort (5 males and 11 females) with an average age of 45.2±13.4 years. Participants underwent MRI examinations, including T1-vibe, Q-dixon, and DTI sequences. To analyze the data, at L5/S1 and L4/5 levels, precise delineation and measurement of ROIs were carried out on both side of the paravertebral muscles for each subject, totaling 64 ROIs. The steps to determine the ROIs in detail were as follows: Firstly, DWI was registered to T1-weighted images to ensure precise anatomical matching. For accurate ROI delineation at the L5/S1 and L4/5 levels, the central intervertebral discs were identified as anatomical landmarks on T1-weighted MRI. Subsequently, the paravertebral muscles on each side, including the erector spinae and multifidus, were individually outlined, with the intermuscular fascia included to maintain the integrity of the muscle groups in the analysis. Post-processing of DTI and Q-Dixon data was conducted using FSL, ITK-SNAP, and DSI Studio software. Scatterplots and Spearman correlation coefficients were employed to assess the relationship between DTI quantitative measurements and Q-Dixon PDFF.

### RESULTS

This study successfully demonstrated the feasibility of employing DTI for fiber tracking within the lumbar paraspinal muscles. The three-dimensional visualization of fiber tracking (Figure1) vividly showcased the fibrous structure of the paraspinal muscles, offering clear and notable insights. An analysis of the 64 regions of interest (ROIs) yielded histograms illustrating the distribution of PDFF, FA, MD, AD, and RD values (Figure2). Additionally, scatterplots unveiled significant positive correlations between FA values and PDFF, MD, AD, and RD values (all $p < .01$), as detailed in Figure 3.

### CONCLUSION

This study demonstrates that DTI quantitative parameters are associated with the extent of fat infiltration in lumbar paraspinal muscles, presenting novel tools for the imaging diagnosis of muscle degenerative diseases, such as sarcopenia.

### CLINICAL RELEVANCE/APPLICATION

The study reveals a correlation between DTI imaging parameters and lumbar paraspinal muscle fat infiltration, highlighting their potential as imaging biomarkers for diagnosing muscle degeneration and sarcopenia, with further implications for clinical application.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

W3-SSNR10

**Neuroradiology (Brain: Interventional and Non-Stroke Vascular)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: S406B

Jae W. Song, MD, MS (*Moderator*) Nothing to Disclose
Virginia B. Hill, MD (*Moderator*) Medical Science Liaison, Alphabet Inc;;

**Sub-Events**

## W3-SSNR10-1 VISUAL ASSESSMENT OF ANEURYSM WALL ENHANCEMENT COMPARED TO THREE-DIMENSIONAL QUANTIFICATION OF SIGNAL INTENSITY

Yean P. Silva Hidalgo, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda N. Avalos, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Jaramillo (*Abstract Co-Author*) Nothing to Disclose
Edgar Samaniego (*Abstract Co-Author*) Nothing to Disclose
Elena Sagues (*Abstract Co-Author*) Nothing to Disclose
Navami Shenoy (*Abstract Co-Author*) Nothing to Disclose
Leonardo F. Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Gudino (*Abstract Co-Author*) Nothing to Disclose
Daniela Molina (*Abstract Co-Author*) Nothing to Disclose
Justin Kerby II, MD (*Abstract Co-Author*) Nothing to Disclose
Sultan Alhajahjeh, MD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Sanchez (*Abstract Co-Author*) Nothing to Disclose
Carlos Dier, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In clinical practice, aneurysm wall enhancement (AWE) relies on visual adjudication, which can be biased and not very reproducible. Therefore, a novel three-dimensional (3D) method for quantifying the aneurysm wall's signal intensity (SI) can help experts' AWE assessment. We compared visual and objective determination of AWE.

### METHODS AND MATERIALS

Patients with saccular intracranial aneurysms (IAs) were imaged with 3T magnetic resonance imaging (MRI) between May 2018 and November 2023 at the University of Iowa. Clinical information was retrieved and morphological metrics such as size, size ratio, aspect ratio, and shape were obtained using digital subtraction angiography. Images were reviewed on Carestream viewer. AWE was visually determined by three experienced neuroradiologists if the degree of enhancement was equal or higher than the pituitary stalk and was not present before gadolinium (Gd) administration. 3D segmentations of the IAs were created utilizing 3D Slicer. A previous MATLAB pipeline was used to calculate the SI distribution across the aneurysm wall. A region of interest was marked in the corpus callosum for SI normalization. On T1+Gd MRI, the mean SI was computed and defined as the objective measurement. If this metric was higher than one, an aneurysm was objectively “enhancing.” Cohen’s kappa coefficient was used to analyze the inter-rater variability of AWE adjudication. Univariate regressions were performed to identify which morphological characteristics influenced accurate visual adjudication of AWE based on 3D quantification of SI.

### RESULTS

A total of 113 IAs were reviewed, and the agreement among experts on AWE visual assessment was moderate (k = 0.631). Out of these, 49.5% of IAs (56) were classified as "enhancing" and 50.5% (57) as "non-enhancing". However, there was minimal consensus between the visual assessment of AWE and the 3D method for SI quantification (K= 0.163, p = 0.021). The visual adjudication of enhancement was less accurate (PPV: 25%) compared to the 3D method. However, neuroradiologists were reliable in adjudicating the absence of enhancement (NPV: 91%). Experts were more likely to visually adjudicate as "enhancing" IAs larger than 7 mm (OR: 0.33, CI 0.15 - 0.72, p= 0.006), as well as those with a higher size ratio (OR: 0.69, CI: 0.49 - 0.95, p=0.027) despite being objectively "non-enhancing".

### CONCLUSION

Visual assessment of AWE varies among readers; however, it is reliable when adjudicating the absence of enhancement. 3D quantification of SI can avoid overestimating enhancement, particularly when evaluating aneurysms larger than 7 mm.

### CLINICAL RELEVANCE/APPLICATION

Three-dimensional quantification of SI of the aneurysm wall can improve experts' accuracy on AWE assessment.

## W3-SSNR10-3 ADVANCING CSVD DIAGNOSIS: INTEGRATING QUANTITATIVE SUSCEPTIBILITY MAPPING WITH MRI-BASED RADIOMICS

Xianglin Li (*Abstract Co-Author*) Nothing to Disclose
Meng Li (*Abstract Co-Author*) Nothing to Disclose
Changhu Liang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yiwen Chen (*Abstract Co-Author*) Nothing to Disclose
Pengcheng Liang (*Abstract Co-Author*) Nothing to Disclose
Lingfei Guo, MD (*Abstract Co-Author*) Nothing to Disclose
Zhenyu Cheng (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the potential of combining quantitative susceptibility mapping (QSM) and radiomics features as a quantitative imaging marker for diagnosing cerebral small vessel disease (CSVD), and to investigate how features from specific brain regions correlate with cognitive impairment (CI).

### METHODS AND MATERIALS

A total of 118 CSVD patients and 127 healthy controls underwent quantitative susceptibility mapping (QSM) and 3D-T1 scans, and all completed multiple cognitive tests. Lasso regression was used to select features, and the radiomics model was constructed based on the regression coefficients of these features. The test set was used to evaluate the effectiveness of the diagnostic criteria for CSVD, and the area under the receiver operating characteristic curve (AUC) was calculated. A hybrid model was constructed by combining the radiomics model with clinical cognitive and motor tests. All models were cross-validated to analyze the generalization ability of the models. Partial Least Squares (PLS) was used to screen the brain regions related to the cognitive tests in the model, and hierarchical regression was used to explore the effect of structural changes on cognitive performance and whether this relationship was changed by CSVD.

### RESULTS

A total of 245 participants were divided into training set, internal test set and validation set. The AUCs of radiomics and hybrid model were 0.80 and 0.87 in the internal test set, and 0.77 and 0.79 in the validation set, demonstrating the superior decision-making efficiency of the hybrid model. The Trail-Making Test (TMT), which is used to enhance the diagnostic performance of the model, is associated with multiple brain regions, especially the right cortical nuclei and the right fimbria. The volume reduction of these brain regions is related to the role of TMT in enhancing the diagnostic performance.

### CONCLUSION

The hybrid model based on radiomics features and cognitive tests can achieve quantitative diagnosis of CSVD and improve the diagnostic efficiency. Furthermore, the reduced processing capacity due to atrophy of the right cortical nucleus and right fimbria suggests the importance of these regions in improving the diagnostic accuracy of the model.

### CLINICAL RELEVANCE/APPLICATION

The hybrid model combining QSM, radiomics features and cognitive tests provides a highly accurate tool for the diagnosis of CSVD. This model can achieve early detection and quantitative diagnosis of CSVD, which is essential for timely intervention and management. In addition, it identifies specific brain regions associated with cognitive impairment, which may provide a reference for clinical treatment.

## W3-SSNR10-4 INCREASED DIAGNOSTIC ACCURACY AND QUANTITATIVE MEASUREMENT CONSISTENCY OF SMALL INTRACRANIAL ANEURYSMS USING ULTRA-HIGH-RESOLUTION PHOTON-COUNTING DETECTOR CT ANGIOGRAPHY

Zhihan Xu, MD (*Abstract Co-Author*) Nothing to Disclose
Yong Lu (*Abstract Co-Author*) Nothing to Disclose
Fuhua Yan, MS (*Abstract Co-Author*) Nothing to Disclose
Naying He, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Haiying Lyu, MD, BMedSc (*Presenter*) Nothing to Disclose

### PURPOSE

1) To assess the accuracy of ultra-high-resolution (UHR) photon-counting detector CT angiography (PCCTA) for diagnosis of cerebral aneurysms 5mm or smaller, compared with standard-resolution (SR) PCCT, with digital subtraction angiography (DSA) as the reference standard. 2) To evaluate the aneurysms quantitative measurement consistency between UHR PCCTA and DSA, and between SR PCCTA and DSA.

### METHODS AND MATERIALS

In this prospective study (IRB approved), a total of 54 consecutive patients were included, who underwent UHR PCCTA with SR reconstruction and subsequent DSA examination within a month. We assessed the diagnostic performance with DSA as the reference standard through calculation of sensitivity, specificity, and accuracy on a per-aneurysm basis. And we also compared the quantitative measures of intracranial aneurysm on PCCTA, including absolute height (AH), perpendicular height (PH), neck diameter (ND), aspect ratio (AR), size ratio (SR), etc., to the same variables measured on DSA by two blinded readers, and the intraclass correlation coefficients (ICC) were also calculated.

### RESULTS

Of 54 patients, 28 patients had a total number of 34 aneurysms at DSA. By using DSA as the reference standard, the respective sensitivity, specificity, and accuracy of PCCTA for detection of aneurysms were 100% vs 67.65% (UHR vs SR) and 96.77% vs 77.42% and 98.46% vs 72.31%, and those for detection of small aneurysms (5mm or smaller) were 100% vs 60.71%, and 96.77% vs 77.42%, and 98.31% vs 69.49% using UHR PCCTA, and SR PCCTA, respectively. The sensitivities of UHR PCCTA were higher for detection of small aneurysms, even for those smaller than 3mm. Quantitative aneurysm measurement consistency of PCCTA and DSA was also much better in UHR PCCTA (ICC: 0.89-0.98) than that of SR PCCTA (ICC: 0.21-0.82).

### CONCLUSION

UHR PCCTA has sufficient diagnostic accuracy and quantitative ability for small intracranial aneurysms compared with conventional SR PCCTA, with DSA as the gold standard.

### CLINICAL RELEVANCE/APPLICATION

Owing to its higher resolution and increased contrast-to-noise ratio, the photon-counting detector CT angiography can sufficiently improve the visualization of intracranial aneurysms and increase the diagnostic confidence for small intracranial aneurysms.

# Abstract Archives of the RSNA, 2024

W3-SSNR11

**Neuroradiology (Spine)**

Wednesday, Dec. 4 9:30AM - 10:30AM Room: S404

Gayle R. Salama, MD (*Moderator*) Nothing to Disclose
Amit Aggarwal, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W3-SSNR11-2 SHORT TERM COMPARISON BETWEEN INTRAARTICULAR INJECTION AND MEDIAL RAMUS NERVE BLOCK IN LUMBAR FACET JOINT SYNDROME

Fernando Ruiz Santiago, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This work in progress compares the effectiveness of intraarticular injection versus facet test by blocking the medial branch of the dorsal rami of the spinal nerve to diagnose and treat facet joints syndrome, at 1 month of follow-up.

### METHODS AND MATERIALS

This is an evaluator-blinded randomized trial including 54 patients (30 females). 26 patients with facet joints syndrome were randomly allocated to bilateral intraarticular injection of L3-L4 to L5-S1 (group 1) and 28 to bilateral medial branch of the dorsal rami nerve block from L4 to S1 (group 2). The procedures were performed under CT guidance.Included patients were assessed clinically by VAS score and the modified Oswestry index. Injection consisted of 10 ml of 1% mepivacaine and 40 mg of triamcinolone distributed in the six locations (6 joints, or 6 transverse process bases).Follow-up was performed by phone calls, at 1 month of follow-up. VAS score, Oswestry index, and a 4-point Likert scale were used for clinical assessment.Statistical analysis was performed by unpaired Student’s t-test and chi-square test.

### RESULTS

No age or clinical measures differences were found at presentation between groups 1 and 2 (VAS: 8.54± 0.3 versus 8.46± 0.2).Improvement in VAS score was superior in the nerve block group than in the intraarticular group (2.14± 0.5 versus 3.85± 0.6; p=0.41), but no statistical differences in the Oswestry index were found. The percentage of satisfaction was 85.7% in the nerve block versus 69.2% in the intraarticular group, although reaching no statistical significance.

### CONCLUSION

Although intraarticular injection and nerve block are useful methods to diagnose and treat facet joints syndrome, nerve block is superior in relieving pain.

### CLINICAL RELEVANCE/APPLICATION

This work confirms that the nerve block of the medial branch of the dorsal rami of the spinal nerve is superior to intraarticular injection in relieving pain and should be the preferred method to diagnose and select patients for further procedures, such as rhizolysis.

## W3-SSNR11-3 SHIFTING PATTERNS IN SINGLE-LEVEL VERTEBRAL AUGMENTATION PROCEDURES: A DECLINE IN VERTEBROPLASTY UTILIZATION COMPARED TO KYPHOPLASTY FROM 2010 TO 2021

Philip Ratnasamy (*Abstract Co-Author*) Nothing to Disclose
Albert Rancu (*Abstract Co-Author*) Nothing to Disclose
Jonathan Grauer (*Abstract Co-Author*) Nothing to Disclose
Rahul Jayaram, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Vertebral augmentation procedures, such as kyphoplasty and vertebroplasty, are common interventional spine procedures performed to treat vertebral compression fractures. While these procedures are often studied together, literature comparing trends, utilization, and costs of kyphoplasty relative to vertebroplasty is limited. The current study aimed to characterize trends in usage, predictive factors, and overall reimbursements of kyphoplasty compared to vertebroplasty using a large, national, multi-insurance, administrative database.

### METHODS AND MATERIALS

Cases of single-level kyphoplasty and vertebroplasty were identified using the 2010 to 2021 PearlDiver M161 database. Numerical and proportional utilization of these procedures were assessed for each year over the study interval. Univariate and multivariate logistic regression analyses were performed to identify clinical factors (age, sex, and Elixhauser Comorbidity Index [ECI]) and non-clinical factors (insurance and geographic region) for undergoing kyphoplasty over vertebroplasty. Average 90-day overall reimbursements of kyphoplasty and vertebroplasty were calculated and compared.

### RESULTS

From 2010 through 2021, 135,840 kyphoplasties and 31,891 vertebroplasties were performed. The proportional utilization of kyphoplasty compared to vertebroplasty increased from 2010 to 2021 (69.79% versus 87.55%, p<0.001). Independent predictors of having kyphoplasty relative to vertebroplasty included: age (per decade increase odds ratio [OR] 1.01), ECI (relative to 0, incrementally greater for ECI 1-2 [OR 1.28], ECI 3-4 [OR: 1.41], and ECI = 5 [OR: 1.51]), insurance plan (relative to commercial, Medicare [OR 0.97]), and geographic variation (compared to Midwest, West [OR 1.24], South [OR 1.98], and Northeast [OR 1.80]) (p<0.001 for all). There was no difference in 90-day overall reimbursement.

### CONCLUSION

Kyphoplasty increased from 69.79% of vertebral augmentation procedures in 2010 to 87.55% in 2021 (corresponding to a decreased utilization of vertebroplasty). Variations in utilization of one versus the other were associated with both clinical and non-clinical factors.

### CLINICAL RELEVANCE/APPLICATION

Drawing upon a vast national database, the current study is the largest to date to evaluate trends and predictive factors for utilization of single-level kyphoplasty versus vertebroplasty. Given similar overall healthcare system costs/reimbursements, evolving to best practices seems indicated.

## W3-SSNR11-4 ASSESSING THE IMPACT OF AN AI-ASSISTED PRIORITIZATION SYSTEM ON CERVICAL SPINE FRACTURE DETECTION THROUGH CT IMAGING IN THE OUTPATIENT SETTING

Mahmud Mossa-Basha, MD (*Abstract Co-Author*) Nothing to Disclose
Domenico Mastrodicasa, MD (*Abstract Co-Author*) Stockholder, Segmed, Inc;Consultant, Segmed, Inc
Jonathan R. Medverd, MD (*Abstract Co-Author*) Nothing to Disclose
Sarabjeet Singh, MD, MBA (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Toshiba Corporation;Research Grant, General Electric Company;Research Grant, Koninklijke Philips NV
Karthika Devi D S, MBBS (*Abstract Co-Author*) Nothing to Disclose
Dushyant Sahani, MD (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV;Advisory Board, Canon Medical Systems Corporation;Advisory Board, General Electric Company;
Arash Mahdavi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to assess the workflow impact of a computer-aided detection and prioritization artificial intelligence (AI) algorithm in the outpatient (OP) setting for suspected cervical spine fracture in patients undergoing cervical spine CT. By evaluating the impact of this AI algorithm on reducing wait times for radiologist interpretation of positive cervical spine fractures, we seek to explore its potential for expediting case diagnosis.

### METHODS AND MATERIALS

Prospective OP imaging data was collected between September 2023 and March 2024 at a multisite, quaternary care, academic healthcare system. Cervical spine CT studies processed with an FDA-approved AI algorithm for detecting cervical spine fracture were selected. For all cases included, a wait time metric measuring the duration from the completion of study acquisition to the time a radiologist initiated the case for dictation was calculated. Median wait times were compared between AI-positive and radiologist-notified cases (AI+) and cases determined as negative and not flagged by the AI system (AI-). Statistical testing for differences between the AI+/AI- groups was performed using Mood's median test.

### RESULTS

A total of 2,009 CT scans of the cervical spine were included, with 1,938 (96.5%) categorized as AI- and 71 (3.5%) as AI+. The AI+ scans exhibited a significantly reduced median wait time of 99.0 minutes (IQR: 458.9) compared to 225.7 minutes (IQR: 1187.6) for the AI- scans. This resulted in an observed wait time reduction of 126.7 minutes (56.1%, p<0.05).

### CONCLUSION

The integration of a computer-aided detection and prioritization AI solution led to a statistically significant reduction in wait times for radiologist review initiation in patients with suspected cervical spine fractures.

### CLINICAL RELEVANCE/APPLICATION

The utilization of an AI-powered solution for prioritizing CT scans showing positive cervical spine fractures in the OP setting demonstrated a reduction in wait times. Faster interpretation for spine fractures has potential clinical implications, as it enables faster communication and management, which might lead to improved patient outcomes and resource utilization.

## W3-SSNR11-5 UTILITY OF AN ABBREVIATED MRI PROTOCOL IN SCREENING FOR ACUTE CORD COMPRESSION

Marie Hausner, ARRT, RT (*Abstract Co-Author*) Nothing to Disclose
Jay K. Pahade, MD (*Abstract Co-Author*) Consultant, General Electric Company;Consultant, Clario Medical Imaging, Inc;
Rudra V. Joshi, MD (*Abstract Co-Author*) Nothing to Disclose
Josiah Sherman (*Abstract Co-Author*) Nothing to Disclose
Amit Mahajan, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

Acute cord compression (ACC) of the spinal cord is a surgical emergency and may cause permanent neurological deficits if not treated promptly. ACC may be due to multiple etiologies that are often nonspecific by history physical. MRI is considered the gold standard for spinal cord evaluation, but can be time-consuming and may delay surgical decompression. To minimize the resources necessary to evaluate ACC while ensuring time-sensitive diagnosis and treatment, we aimed to evaluate the efficacy of a limited non contrast two-sequence total spine screening protocol MRI to detect ACC.

### METHODS AND MATERIALS

Medical records were reviewed of patients who underwent a shortened, two-sequence total spine MRI protocol to screen for ACC after presenting to a large academic tertiary medical center emergency department from April 2018 to August 2022. The findings of the MRI were recorded, in addition to patient discharge disposition/admission status, receipt of surgery for ACC treatment, whether a repeat spine MRI using the standard spine protocol was performed within 15 days of the screening MRI, and if so, if undetected significant findings were subsequently identified.

### RESULTS

A total of 363 patients underwent the ACC protocol. 297 (82%) did not undergo further spine MRI within 15 days. 155 (43%) had no additional spine MRI within study period while 134 (64%) had additional spinal MRI done after 15 days. 66 patients underwent an additional spine MRI within 15 days, prior to

further disposition. 131 patients (44%) had no evidence of ACC on MRI, while 24 (15.5%) had findings of ACC on MRI. Of the 24 patients who demonstrated evidence of ACC on screening MRI, 19 (79%) underwent surgical decompression while 5 (21%) were treated conservatively. Of the 66 patients who required repeat imaging within 15 days, 16 (22%) underwent nonemergent surgical decompression, while 21 had no cord compression.

**CONCLUSION**

Most (80%) ED patients undergoing an abbreviated total spine ACC protocol had no imaging findings of acute cord compression. The ACC protocol is effective at ruling out and ruling in ACC with 79% of patients in our cohort undergoing operative decompression. Additional studies are necessary to quantify the cost benefit of using screening MRI protocols for evaluate ACC in the ED.

**CLINICAL RELEVANCE/APPLICATION**

In the current state of healthcare with high demand for imaging resources, throughput must be balanced with providing appropriate care. Our study demonstrates that an abbreviated screening protocol can allow for prompt diagnosis and free up more time for other high acuity cases to be scanned. If necessary, additional protocols can be added at the radiologist's discretion to guide characterization. Abbreviated protocols may allow for improved triaging of surgical emergencies.

## W3-SSNR11-6 RATES OF CERVICAL SPINE FRACTURES IN PATIENTS YOUNGER OR OLDER THAN 65

David M. Yousem, MD, MBA (*Abstract Co-Author*) Royalties, RELX;Speaker, MRI Online;Board Member, MRI Online;
Shuchi Zinzuwadia, MD (*Abstract Co-Author*) Nothing to Disclose
Armin Tafazolimoghadam (*Abstract Co-Author*) Nothing to Disclose
Mahla Radmard, MD (*Abstract Co-Author*) Nothing to Disclose
Akua Amoah, MD, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

There was a distinction made in the 2001 Canadian Cervical Spine Rule (CCR) regarding patients 65 and over and younger than 65 studied from 1996-1999 as far as indications for cervical spine computed tomography (CSCT) scanning in the trauma setting. We sought to determine if the data on fracture differences and age are still relevant in 2024. Should age 65 and older alone be an indication for CSCT in the ED?

**METHODS AND MATERIALS**

This IRB-approved retrospective study reviewed five years of cervical spine CT data from trauma patients in two emergency departments. We analyzed variables including age, fracture types and sites, treatments, and injury mechanisms, categorizing patients by symptomatic status and age (above/below 65 years). Asymptomatic patients were cognitively capable with no indications of cervical spine injuries. Results from 2018-2023 were compared with historical data from 1996-1999, which identified fracture rates of 1.7% in patients under 65 and 6.6% in those 65 and older (NEJM, 2003).

**RESULTS**

In the 65 and older age group, we found 190 fractures (2.0%) among 9455 CSCTs (112 females); 29 (0.3%) were in asymptomatic patients. In the age group less than 65 there were 199 (1.6%) fractures out of 12531 CSCTs of which 19 (0.15%) were asymptomatic. Looking at subsets of the data, the rates of fractures in the 65-75 age range (1.7%) paralleled the 1.7% quoted in the less than 65 age group in 2003. There were no distinguishing features as to the mechanism of injury, cervical spine level, or part of the vertebra fractured between asymptomatic and symptomatic patients. The older age group showed more C1 and C2 fractures [52 (27.4%) and 78 (41.1%) respectively] and fewer motor vehicle collisions [23 (12.1%) compared to the younger group (89 (44.7%)] as a cause of their fractures. Patients < 75 years old who are asymptomatic showed rates of fractures that were less than 0.25%; those 40 years old or less had a less than 0.1% asymptomatic fracture rate (Table 1).

**CONCLUSION**

The difference in fracture rates reported from the data that inspired the CCR (1.4-1.7%) fracture rate in trauma patients < 65 and 5.2%-6.6% in = 65 years old) differ from our data collected in 2018-2023. Our cohort at age 65-70 has a similar rate of fractures (1.7%) to the CCR < 65 group. Because of successful aging, healthier elderly, and safety features now in cars, it may be appropriate to extend the CCR age criterion to 70-75 years old.

**CLINICAL RELEVANCE/APPLICATION**

The study supports updating the Canadian Cervical Spine Rule to raise the age threshold for CSCT scans in trauma patients, which could reduce unnecessary scans and optimize emergency department resources.

# Abstract Archives of the RSNA, 2024

W3-STCE1

**Science Session (Multiomic and Multicenter Radiology AI)**

Wednesday, Dec. 4 10:00AM - 10:30AM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## W3-STCE1-1 GENERALIZING AI ALGORITHMS TO MULTICENTER ABDOMINAL CT SCANS FOR PANCREATIC TUMOR DETECTION

Yu-Cheng Chou, BSc (*Abstract Co-Author*) Nothing to Disclose
Jieneng Chen (*Abstract Co-Author*) Nothing to Disclose
Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Xinze Zhou (*Abstract Co-Author*) Nothing to Disclose
Wenxuan Li, BS (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate how well an AI algorithm generalized to out-of-distribution datasets from other resources on the task of detecting pancreatic neoplasms including Pancreatic Ductal Adenocarcinoma (PDAC), Cysts, and Pancreatic Neuroendocrine Tumors (PNET).

### METHODS AND MATERIALS

We collected and annotated 2,599 dual-phase contrast-enhanced CT scans to create our in-house JHH datasets, and split it to training (N=1,594) and test (N=1,005) sets. The JHH dataset was used to train AI algorithms and conduct internal validation. Moreover, we collected five datasets of normal patients, i.e., BTCV (N=47), Pancreas-CT (N=42), CHAOS (N=20), TraumaDet (N=4,706), and HeidelbergN (N=364), to assess AI's Specificity and three datasets of pancreatic tumor patients, i.e., MSD-Pancreas (N=89), JHH-OUT (N=389), and HeidelbergP (N=196), to assess AI's Sensitivity. These external datasets were sourced from various hospitals worldwide. To enhance AI generalizability, we developed three strategies: data augmentation, an improved AI algorithm, and post-processing. Our data augmentation included rotations, translations, and intensity variations. The AI algorithm leverages the strengths of both CNN and transformer architectures to enhance algorithmic capacity. Post-processing was applied to eliminate predicted tumors located outside the pancreas or those with a radius less than 4mm. Furthermore, synthetic tumors supplemented the annotated data for training, providing the AI with additional training examples of small tumors, which are rare and difficult to detect in most datasets.

### RESULTS

For internal validation, our AI achieved a sensitivity of 95.2% and a specificity of 95.7%. On the MSD-Pancreas dataset, the sensitivity was 91.0%. For external validation, our AI yielded a Sensitivity of 91.8% and 92.3% when detecting pancreatic tumors on JHH-OUT and HeidelbergP, respectively. When dealing with normal patients, the AI showed a Specificity of 100%, 90.0%, 95.2%, 91.3%, and 96.4% on BTCV, CHAOS, Pancreas-CT, TraumaDet, and HeidelbergN.

### CONCLUSION

The performance of AI algorithm on external datasets showed a slight decrease compared to the JHH dataset but remained within acceptable ranges, demonstrating notably better results on two external datasets. This indicates AI algorithm exhibits strong generalizability and can be integrated into clinical routines, aiding radiologists in making reliable and, possibly, near-perfect detections.

### CLINICAL RELEVANCE/APPLICATION

The encouraging results from our study, achieved using CT scans from a variety of scanners and protocols for external validation, suggest that AI algorithms could eventually be incorporated into clinical practice.

## W3-STCE1-2 EVALUATING OPEN AND CLOSED-SOURCE LANGUAGE AND VISION-LANGUAGE MODELS FOR MULTICENTER IMAGE-BASED DIAGNOSIS IN RADIOLOGY: A COMPARATIVE STUDY WITH READER PERFORMANCE

Chang Min Park, MD, PhD (*Abstract Co-Author*) Research Grant, Lunit Inc;Stock options, Lunit Inc;Research Grant, Coreline Soft, Co Ltd;Stock options, Coreline Soft, Co Ltd;Stockholder, Promedius Inc
Ji Young Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Dabin Min (*Abstract Co-Author*) Nothing to Disclose
Kyungmin Jeon (*Abstract Co-Author*) Nothing to Disclose
Donguk Kim (*Abstract Co-Author*) Nothing to Disclose
Gihun Cho, BS (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate open and closed-source Large Language Models (LLMs) and Vision-Language Models (VLMs) for multicenter image-based diagnosis in radiology, assessing fine-tuning impact and comparing with reader performance.

### METHODS AND MATERIALS

We analyzed 9,409 Radiopaedia cases (19 body systems, 13 modalities, 592 centers, 61+ countries) and 175 Korean Society of Thoracic Radiology (KSTR) chest cases (2 modalities, 1 center). Radiopaedia data was split into 7,527 training and 1,882 test cases; KSTR cases were used only for testing. We evaluated seven open-source LLMs (include Llama3), two open-source VLMs (include OpenFlamingo), and two closed-source models (GPT-4 and Claude) under three input settings: History and Findings (HF, text-only), Image, History and Findings (IHF), and Image and History (IH). Models were tested in both zero-shot and fine-tuned scenarios. Diagnostic accuracy (DxAcc) was defined as the proportion of GPT-4's perfect 5-point scores, with a radiologist validating a subset of these scores. We created a 200-case multiple-choice question (MCQ) from Radiopaedia for circular evaluation, measuring consistent correct answers across four iterations with rotated options. Additionally, we compared model performance with reader accuracy on 162 KSTR cases.

### RESULTS

A radiologist's review validated the DxAcc metric, showing 98.79% (408/413) agreement. Claude outperformed other models, achieving DxAcc of 64.8% (Radiopaedia, IHF), 60.0% (KSTR, HF), and 89.5% accuracy (MCQ, HF). Among open-source models, Llama3-70B performed best with DxAcc of 53.5% (Radiopaedia, HF), 38.6% (KSTR, HF), and 78.5% accuracy (MCQ, HF). Fine-tuning improved open-source models' DxAcc by 9.2%±4.3 on Radiopaedia, 3.8%±3.2 on KSTR, and accuracy by 9.7%±11.8 on MCQ. Notably, while Claude surpassed reader accuracy (41.8%±26.9) on KSTR in HF/IHF settings ($P < .001$), all models underperformed readers in the IH setting ($P < .001$). Closed-source models showed slight improvements in IHF versus HF (GPT-4: 59.4% to 62.2%, Claude: 60.2% to 64.8% on Radiopaedia). All models showed significant performance degradation in IH settings compared to IHF ($P < .001$), with Claude's DxAcc dropping by 38.2% on Radiopaedia and 50.3% on KSTR.

### CONCLUSION

LLMs and VLMs show potential for image-based radiology diagnosis, with fine-tuning improving performance. While open-source models showed lower performance compared to closed-source alternatives, all models, including closed-source ones, underperformed readers particularly when image findings were not provided.

### CLINICAL RELEVANCE/APPLICATION

This study demonstrates the potential for AI integration in radiology workflows, highlighting both the promise and the limitations of LLMs/VLMs in diagnosis.

## W3-STCE1-3 BEYOND BMI: AI-DRIVEN INSIGHTS ON BODY COMPOSITION'S IMPACT ON BRAIN HEALTH

Saqib Basar (*Abstract Co-Author*) Nothing to Disclose
Madhurima Datta (*Abstract Co-Author*) Nothing to Disclose
Thanh Duc Nguyen (*Abstract Co-Author*) Nothing to Disclose
Nasrin Akbari (*Abstract Co-Author*) Nothing to Disclose
Sam Hashemi, MSc (*Abstract Co-Author*) Nothing to Disclose
Saurabh Garg (*Abstract Co-Author*) Nothing to Disclose
Ahmed Gouda, MSc (*Abstract Co-Author*) Nothing to Disclose
Soojin Lee (*Presenter*) Nothing to Disclose

### PURPOSE

While BMI is commonly used to determine obesity, it does not account for body composition and relies solely on body weight and height. This study investigates the impact of body composition on brain health using quantitative metrics from AI models applied to whole-body MR imaging.

### METHODS AND MATERIALS

We used 3D nnU-Net segmentation models to analyze 1.5T whole-body MRI scans from 2,839 participants across the US and Canada. Total skeletal muscle mass percentage (SMP) and fat mass percentage (FMP) were derived by converting segmentation volumes to mass and normalizing by weight. Volume- and thickness-based 97 brain metrics were normalized by intracranial volume.We matched 300 pairs of participants for age, sex, height, BMI, type 2 diabetes, and hypertension, but differing in SMP by over 5%. Participants with higher SMP were classified into the HighSMP group, while their matched counterparts were placed in the LowSMP group. The two groups were compared using two-sample t-tests with false discovery rate correction. We used multiple linear regression to examine brain metrics in relation to SMP and FMP, controlling for the aforementioned participants' characteristics as well as pack year and alcohol intake.

### RESULTS

The HighSMP and LowSMP groups differ significantly not only in body composition characteristics but also in 48.5% of brain metrics. The LowSMP group had reduced total brain ($p < .001$) and hippocampus ($p < .001$) volumes and increased inferior lateral ventricle volume ($p < .001$). Cortical thickness, particularly in the temporal lobe, was also lower in the LowSMP group ($p < .001$). These differences were consistent in both normal and overweight participants. Regression analysis showed brain volumes and thickness positively associated with SMP and negatively with FMP, with the effect size of SMP being around four times greater.

### CONCLUSION

Even with the same BMI, body composition significantly impacts brain volumes and cortical thickness. Higher SMP is linked to greater brain volume and cortical thickness, regardless of BMI categories. The influence of skeletal muscle mass on brain metrics surpasses that of fat mass.

### CLINICAL RELEVANCE/APPLICATION

AI-based automated segmentation holds significant potential for identifying cross-organ correlations. Our study demonstrates that body composition offers crucial insights, surpassing the traditionally used BMI measure in assessing brain health.

# Abstract Archives of the RSNA, 2024

W3-STCE2

**Science Session (Low-Field and Mobile MRI)**

Wednesday, Dec. 4 10:00AM - 10:30AM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## W3-STCE2-1 EFFECTIVENESS AND FEASIBILITY OF MOBILE MRI USE IN THE PUBLIC HEALTH SYSTEM. EIGHTEEN YEARS OF EXPERIENCE. "ACTIONS SPEAK LOUDER THAN WORDS"

Alfonso Iglesias, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alfonso Iglesias Arias (*Abstract Co-Author*) Nothing to Disclose
Mercedes Arias Gonzalez, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study is to evaluate the effectiveness and feasibility of mobile magnetic resonance imaging (MRI) in providing diagnostic imaging services in remote and underserved areas in a public health system environment.

### METHODS AND MATERIALS

Mobile MRI units were deployed to various locations, including seven second level hospitals with no in-house magnets and five third level hospitals with in-house magnets in order to reduce waiting lists. During the last 18 years, 279.143 MR scans in 231.210 patients were performed using a 1.5T MRI system, with standardized protocols to ensure image quality. Quality was assessed with annual surveys of patients and requesting doctors. Operational metrics, including setup time, patient throughput and kilometers avoided by patients were recorded.

### RESULTS

Mobile MRI units reached mean satisfaction levels of 95% in the patient survey and 98% in the survey of requesting doctors. The most common indications for MRI included neurological conditions (60%), musculoskeletal disorders (31%), and abdominal issues (9%). Operationally, the mobile units demonstrated an average setup time of 25,5 minutes and a patient throughput of 24 scans per day, with minimal logistical challenges reported. More than 16 million of kilometers of travel were avoided to patients.

### CONCLUSION

Mobile MRI is a viable solution for delivering high-quality diagnostic imaging in remote and underserved populations in a public health system environment. The study demonstrates that mobile MRI can achieve comparable image quality to fixed-site facilities while significantly improving accessibility and equity to the MRI technique.

### CLINICAL RELEVANCE/APPLICATION

This study highlights the potential of mobile MRI to enhance access to essential imaging services, improve patient care, accessibility and equity to the MRI technique in underserved areas.

## W3-STCE2-2 BENEFITS OF QUANTUM MRI COILS FOR LOW-FIELD MRI

Grum Teklemariam, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

A major challenge faced by low-field MRI (LFM) is the low signal-to-noise (SNR) of the signal received from the subject. Despite this issue, there has been significant advances in the development of LFM scanners for more than a decade. A notable example is the success of Hyperfine Inc offering a head only, portable MRI scanner able to be transported on wheels and used in point-of-care (PoC) settings. Other similar applications have been developed from diagnosing NASH (Livivos Inc) to portable MRI Mammography systems and dedicated prenatal scanners. In all these applications, a rf coil receiver with significant SNR increases over current performance would be extremely beneficial. The SNR of any sensor depends on a fundamental level on the coupling strength between the detector, the MRI coil, and the signal, the electromagnetic field generated by the subject nuclei or spin [1]. Amongst other factors, such as coil geometry and noise, there is an intrinsic quantum coupling strength set by vacuum electromagnetic fluctuations. Aspects of this interaction can be enhanced by engineering the properties of a resonator to increase the SNR through a stronger spin coupling [2].

### METHODS AND MATERIALS

Model: A theoretical model for the room temperature quantum enhancement was developed confirming the SNR increase. Based on this, a study was conducted of a low pass, rf head birdcage coil using Ansys HFSS 2023. To demonstrate the enhancement effect, both a conventional birdcage coil and a quantum enhanced birdcage type coil was built. The comparisons were conducted on bench tests and phantom tests on a Siemens Avanto 1.5T scanner. Coil Designs: For fast prototyping, the formers were 3D printed using PETG and the conductors were directly placed on these formers with the necessary tuning and matching reactive elements.

## RESULTS

The scanner tests were conducted on an Avanto 1.5T (63.6 MHz) on a standard 2-liter phantom. SNR measurements were done using a gradient echo (GRE) sequence. The scan parameters are listed below: The scanner results confirm our expected doubling of the measured SNR as shown below. To protect the scanner from potential spurious signals, the receiver gain was set to low. In some instances, additional interface cabling was required to match the input impedance of the scanner preamp for optimal SNR performance.

## CONCLUSION

The central axial signal of a birdcage coil has been shown to have near optimal SNR under ultimate intrinsic SNR theory. Comparing these coils using a birdcage coil shows that indeed the spin coupling is being enhanced. In the images above, we used the same ROIs to compare across the three coils we scanned. The flex coil gives us a reference signal since a surface coil with a smaller diameter inherently yields a higher signal. Based on these results, an improved design has been developed that shows factor of 2 increase over the current quantum coil and a new enhanced coil is being built to test in a scanner to confirm the bench test results.

## CLINICAL RELEVANCE/APPLICATION

These developments affect all MRI scanners but can be of great benefit for low-field MRI scanners.

# W3-STCE2-3 UTILIZING 0.55T MRI FOR THE EVALUATION OF EMERGENCY DEPARTMENT PATIENTS PRESENTING WITH RIGHT UPPER QUADRANT PAIN- PRELIMINARY EXPERIENCE

Hero K. Hussain, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Christopher Fung (*Abstract Co-Author*) Nothing to Disclose
Jacob Richardson (*Abstract Co-Author*) Nothing to Disclose
Vikas Gulani, MD, PhD (*Abstract Co-Author*) Research support, Siemens AG;Consulting, Cook Group Incorporated
Nicole Seiberlich, PhD (*Abstract Co-Author*) Royalties, Siemens AG;Research support, Siemens AG
Radhika Rajeev, MD (*Presenter*) Nothing to Disclose

## PURPOSE

To assess performance of standard and deep-learning (DL) reconstructed unenhanced 0.55T MRI in Emergency Department (ED) patients presenting with right upper quadrant (RUQ) pain, and compare MRI diagnoses with standard-of-care imaging (CT/US) and clinical diagnosis.

## METHODS AND MATERIALS

IRB-approved prospective study of patients presenting to ED with acute, nontraumatic RUQ pain. After undergoing standard-of-care imaging tests (CT and/or US) patients underwent standard unenhanced MRI abdomen and pelvis on commercial 0.55T MRI (MAGNETOM Free.Max, Siemens Healthineers AG, Erlangen, Germany). Imaging protocol: coronal and axial T2w HASTE, axial fat suppressed T2w BLADE, axial DWI (b=50, b=800 s/mm2), axial OP/IP GRE, axial FS T1w 3D VIBE, and 3D T2w TSE MRCP. In the latter phase of the study, the coronal axial HASTE, axial FS T2w TSE, and DWI b50 ,b800 sequences were replaced with deep-learning (DL) versions of the same sequences applying super-resolution processing that uses neural networks trained with high-resolution images. 2 abdominal radiologists blinded to standard-of-care imaging independently interpreted images and rendered a diagnosis. Each radiologist's interpretation was assessed for agreement with standard-of-care imaging study and final clinical diagnosis. Interrater reliability was assessed with Cohen's kappa. The acquisition time of standard 0.55T and DL-0.55T sequences were compared.

## RESULTS

15 patients were scanned, initial 10 with standard 0.55T sequences and last five with DL-sequences. Standard of care imaging (only CECT n=4, only USG-n=4, USG and CECT n= 4, combination of USG, CT and MRI 1.5T- n=2, USG and HIDA n=1) was performed in all patients. Clinical diagnoses were: acute pyelonephritis(n=2), acute appendicitis (n=1), acute cholecystitis (n=1), acute small bowel obstruction (n=1) gallstone pancreatitis, (n=1), cholangitis and liver abscess (n=1), pancreatic head mass (n=1), mild diffuse colitis (n=1) and no cause was identified on MRI (n=1). At standard 0.55T MRI, concordance between radiologists' interpretation of 0.55T images and standard-of-care imaging was 8/10 cases (reader 1) and 9/10 cases (reader 2). Both radiologists diagnosed acute pyelonephritis before it was visualized on CT/ clinically diagnosed. Both radiologists missed acute pancreatitis on MRI which was detected on USG and clinical diagnosis. Concordance between clinical diagnosis and 0.55T MRI was 8/10 and 9/10, respectively. Agreement between the two radiologists was 90% (kappa = 0.61). For 0.55T DL-MRI, the clinical diagnoses were: cholelithiasis (n=4) and acute cholelithiasis (n=1). Concordance between radiologists' interpretation and standard-of-care imaging was 4/5 cases (readers 1 and 2). Both radiologists did not report cholelithiasis seen on USG. Concordance between clinical diagnosis and DL-0.55T was 5/5 for both readers. Agreement between the two radiologists was 100% (kappa =1). MRI revealed findings not visible on CT (pyelonephritis, small abscess in ruptured appendicitis and small liver abscess in patient with cholangitis). Average acquisition time for standard 0.55T was 64.4 ± 9.05 mins. with FS T2w TSE being longest (11.56 ± 4.33 mins) compared to 58.2 ± 5.32 mins for DL-0.55T. Compared to standard 0.55T sequences, acquisition times of the DL-0.55T sequences were shorter for coronal HASTE (47% decrease) and axial HASTE (45% decrease), and longer for DWI (15% increase) and FS T2W TSE (12% increase).

## CONCLUSION

Low-field unenhanced MRI is a viable alternative to establish cause of RUQ pain in ED patients and has potential to replace standard-of-care enhanced CT and US. Deep learning algorithm reduced acquisition time of the HASTE sequence only.

## CLINICAL RELEVANCE/APPLICATION

Unenhanced MRI at 0.55T has potential to replace contrast enhanced CT and US for the definitive diagnosis of suspected hepatobiliary and pancreatic disease in patients presenting to the ED with RUQ pain.

# Abstract Archives of the RSNA, 2024

W6-SSIR03

**Science Session with Keynote: Interventional Radiology (Device Development and Advances in Embolotherapies)**

Wednesday, Dec. 4 1:30PM - 2:30PM Room: E353A

Romaric Loffroy, MD, PhD (*Moderator*) Nothing to Disclose
Khashayar Farsad, MD, PhD (*Moderator*) Co-founder, Auxetics, Inc;Stockholder, Auxetics, Inc;Consulant, Cook Group Incorporated;Consultant, BTG International Ltd;Research Grant, Guerbet SA;Advisory Board, F. Hoffmann-La Roche Ltd;Educator, NeuWave Medical, Inc

**Sub-Events**

## W6-SSIR03-1 SELECTIVE CONVENTIONAL TRANSARTERIAL CHEMOEMBOLIZATION USING A GLASS MEMBRANE EMULSIFICATION DEVICE IN HEPATOCELLULAR CARCINOMA: MULTICENTER CLINICAL TRIAL IN JAPAN

Satoru Sueyoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Masada (*Abstract Co-Author*) Nothing to Disclose
Shohei Toyoda (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Anai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideyuki Nishiofuku (*Abstract Co-Author*) Nothing to Disclose
Takeshi Matsumoto (*Abstract Co-Author*) Nothing to Disclose
Takeshi Sato (*Presenter*) Nothing to Disclose

### PURPOSE

To verify the proportion of complete response (CR) achieved using selective conventional transarterial chemoembolization (cTACE) with a porous glass membrane pumping emulsification device in hepatocellular carcinoma (HCC).

### METHODS AND MATERIALS

Between January 2021 and June 2023, 50 cases of HCC with tumor diameter =5 cm and liver function classified as Child-Pugh A or B were enrolled in a multicenter clinical trial (jRCTs052200095). An emulsion, created by mixing epirubicin solution and lipiodol using the emulsification device, was injected into the feeding arteries of the target lesions followed by embolization with gelatin sponge particles. The primary endpoint was the proportion of CR at three months post-treatment. Secondary endpoints included the proportion of CR at one month and the incidence of adverse events. Results were compared using the exact binomial test with a prior study using an emulsion prepared by a three-way stopcock method (JIVROSG-1302).

### RESULTS

Two cases were deemed ineligible after registration, leaving 48 subjects (SS) who underwent the protocol treatment. An additional three cases were found ineligible post-TACE, creating an analysis set (FAS) of 45 subjects. Both one-month and three-month CR rates in the FAS were 97.9% [95% confidence interval: 88.2, 99.9], which was significantly higher than in the prior study (75.2% at three months, 84.2% at one month; $P<0.001$, $P=0.008$). The incidence of serious adverse events in SS included increased AST (50.0%), increased ALT (29.2%), decreased platelets (2.1%), and decreased ALP (2.1%), showing no significant difference compared to the prior study. The deterioration rate of the ALBI score at three months post-TACE in the FAS was 17.8%.

### CONCLUSION

Selective cTACE using an emulsion prepared with a porous glass membrane pumping emulsification device for HCC demonstrated a higher CR rate compared to traditional methods using a three-way stopcock, with equivalent safety, suggesting its efficacy and security in clinical use.

### CLINICAL RELEVANCE/APPLICATION

cTACE utilizing W/O emulsion achieves an impressive 98% complete response rate, indicating its efficacy.The incorporation of glass membrane emulsification device technology contributes to enhancing the outcomes of TACE, suggesting its potential to increase the power of cTACE.

## W6-SSIR03-2 FACTORS IMPACTING SURVIVAL AFTER TRANSARTERIAL RADIOEMBOLIZATION IN PATIENTS WITH UNRESECTABLE INTRAHEPATIC CHOLANGIOCARCINOMA: A COMBINED ANALYSIS OF THE PROSPECTIVE CIRT AND CIRT-FR STUDIES

Valerie Vilgrain, MD (*Abstract Co-Author*) Expert Witness, Bayer AG;Speaker, Canon Medical Systems Corporation;Speaker, General Electric Company;Advisory Board, Guerbet SA;Expert Witness, Guerbet SA;Expert Witness, Zimmer Biomet Holdings, Inc;Speaker, Sirtex Medical Ltd;Expert Witness, Sirtex Medical Ltd;Investigator, AIdream Group LLC;Expert Witness, Terumo Corporation;;
Graham J. Munneke, MBBS (*Abstract Co-Author*) Nothing to Disclose
Geert Maleux, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Romaric Loffroy, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maxime Ronot, MD, PhD (*Abstract Co-Author*) Speaker, General Electric Company;Speaker, Ipsen SA;Speaker, Canon Medical Systems Corporation;Speaker, Alexion Pharmaceuticals, Inc;Speaker, Guerbet SA;Speaker, Sirtex Medical Ltd

Christian Sengel (*Abstract Co-Author*) Nothing to Disclose
Bruno Sangro, MD, PhD (*Abstract Co-Author*) Consultant, Adaptimmune;Consultant, AstraZeneca PLC;Consultant, Bayer AG;Consultant, Bristol-Myers Squibb Company;Consultant, BTG International Ltd;Consultant, Eli Lilly and Company;Consultant, Onxeo;Consultant, Sirtex Medical Ltd;Speakers Bureau, Bayer AG;Speakers Bureau, Bristol-Myers Squibb Company;Speakers Bureau, Sirtex Medical Ltd;Speakers Bureau, Terumo Corporation;Research Grant, Bristol-Myers Squibb Company;Research Grant, Onxeo;Research Grant, Sirtex Medical Ltd
Peter Reimer, MD, MBA (*Presenter*) Nothing to Disclose

**PURPOSE**

This combined analysis of the prospective observational CIRT (CIRSE Registry for SIR-Spheres Therapy) and CIRT-FR (CIRSE Registry for SIR-Spheres Therapy in France) studies aimed to tackle the challenges as to what is the best timing for transarterial radioembolization (TARE) with Yttrium-90 resin microspheres for intrahepatic cholangiocarcinoma (ICC) in multimodal treatment approaches

**METHODS AND MATERIALS**

174 ICC patients from CIRT (120) and CIRT-FR (54) enrolled between Jan 2015-Dec 2017 and Aug 2017-Aug 2020, respectively were analysed. Patient characteristics and treatment-related data were collected at baseline. Four treatment groups based on the position of TARE in the treatment strategy were assessed. Safety and follow-up data were collected every three months.

**RESULTS**

Statistically significant differences in overall survival (OS) across different treatment groups were found (p=0.0028). Patients receiving first-line TARE in addition to any systemic treatment had a median OS of 32.5 months. Patients selected for first-line TARE alone showed a median OS of 16.2 months, whereas TARE as 2nd or further treatment-line resulted in a median OS of 12 and 9.3 months, respectively. Partition model dosimetry was an independent predictor for better OS (p=0.0259). Overall, 89 patients (51.1%) experienced =1 adverse event, while grade 3-4 adverse events occurred in 28 (16.1%) patients.

**CONCLUSION**

Results from this combined analysis point towards the benefits of TARE in combination with systemic therapy for the treatment of unresectable ICC and consolidate the evidence on safety and effectiveness of TARE in this cohort. Adequate dose-determination techniques play an important role in the effectiveness of TARE.

**CLINICAL RELEVANCE/APPLICATION**

TARE in combination with systemic therapy shall be considered for the treatment of unresectable ICC. Personalized dosimetry improves OS ensuring higher dose requirements for ICC.

## W6-SSIR03-4 TOWARD A "NO-MAPPING" PROTOCOL IN THE ERA OF ABLATIVE RADIOEMBOLIZATION: A RETROSPECTIVE STUDY OF 235 SOLITARY HEPATOCELLULAR CARCINOMAS

Charles Hua, MD,MS (*Abstract Co-Author*) Nothing to Disclose
Hugh McGregor (*Abstract Co-Author*) Nothing to Disclose
Sandeep Vaidya, MD (*Abstract Co-Author*) Nothing to Disclose
Grace Laidlaw, MD (*Abstract Co-Author*) Nothing to Disclose
Guy E. Johnson, MD (*Abstract Co-Author*) Consultant, Boston Scientific Corporation
Wayne L. Monsky, MD, PhD (*Abstract Co-Author*) Research Consultant, Merit Medical Systems, Inc
Harika Barri, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Toward the goal of identifying patients with hepatocellular carcinoma (HCC) in which mapping angiography can be omitted before radioembolization, the purpose of this study was to identify patient and tumor characteristics associated with low hepatopulmonary shunting and predictable treatment volumes.

**METHODS AND MATERIALS**

All yttrium-90 transarterial radioembolizations (TARE) for solitary HCC performed from 2019 to 2023 were reviewed. Clinical and laboratory data including patient age, presence of cirrhosis, and prior TIPS procedures were recorded. Imaging data including tumor size, tumor distance from the liver capsule, and macrovascular invasion were obtained from pre-procedural imaging. Lung shunt fraction (LSF) obtained from planar scintigraphy after Tc-99m MAA infusion was recorded. Treatment volume was measured on post-treatment Bremsstrahlung SPECT/CT images. Univariable and multivariable analyses of clinical and imaging data were performed to identify variables associated with high LSFs (>10%) and large treatment volumes (>300 mL).

**RESULTS**

235 patients with solitary HCC underwent TARE during the study period. Mean age was 68 +/- 10 years (range 24 to 92) and 219 patients had cirrhosis. 9 patients had previously undergone TIPS. Mean tumor size was 3.7 +/- 2.3 cm (range 1.0 to 13.7). 8 tumors were central in location (>4 cm from liver capsule). Macrovascular invasion was present in 15 patients. Mean LSF was 4.5 +/- 3.8% (range 0.6 to 25.8). Mean treatment volume was 208 +/- 232 mL (range 25.1 to 2068.1). Previous TIPS and macrovascular invasion were associated with a LSF >10%, with odds ratios (OR) of 6.9 and 11.1 respectively. Tumor size >5 cm and central location were associated with treatment volumes >300 mL, with ORs of 40.8 and 3.8 respectively. 162 patients had peripheral tumors <5 cm without macrovascular invasion and had no history of TIPS. In this group, the maximum treatment volume was 297.9 mL and the maximum LSF was 9.7%. Using a partition dosimetry model with a tumor to normal parenchyma vascularity ratio of 2:1, 1.7 GBq of Y90 microspheres would be required to reach a tumor dose of >400 Gy. The lung dose in this scenario would be 9.6 Gy.

**CONCLUSION**

In patients without macrovascular invasion or history of TIPS, peripheral solitary HCCs <5 cm in size have predictable LSFs and treatment volumes. Safe lung doses and ablative tumor doses may be achieved by ordering a standardized activity in these cases, without the need for mapping angiography.

**CLINICAL RELEVANCE/APPLICATION**

Maximum lung dose and minimum tumor dose can be predicted based on clinical and imaging characteristics in solitary HCC. Mapping angiography prior to TARE in a subset of patients may not be necessary, saving time and resources while maintaining safety and efficacy.

## W6-SSIR03-5 PORTAL VEIN EMBOLIZATION AND HEPATIC VEIN EMBOLIZATION VERSUS PORTAL VENOUS EMBOLIZATION ALONE IN CIRRHOTIC AND NON-CIRRHOTIC SWINE

Annabella Shewarega (*Abstract Co-Author*) Nothing to Disclose
David C. Madoff, MD (*Abstract Co-Author*) Advisory Board, Zimmer Biomet Holdings, Inc;Consultant, General Electric Company;Consultant, Guerbet

SA;Consultant, Merck & Co, Inc;Consultant, Sirtex Medical Ltd;Consultant, Boston Scientific Corporation;Consultant, Johnson & Johnson;Consultant, Siemens AG
Ellen Meister (*Abstract Co-Author*) Nothing to Disclose
Tabea Kao (*Abstract Co-Author*) Nothing to Disclose
Julius Chapiro, MD, PhD (*Abstract Co-Author*) Research Grant, Guerbet SA;Consultant, Guerbet SA;Research Grant, Boston Scientific Corporation;Consultant, AstraZeneca PLC;Consultant, Bayer AG
Nickolai Matuschewski (*Abstract Co-Author*) Nothing to Disclose
Vinzent H. Kahl (*Abstract Co-Author*) Nothing to Disclose
Martin B. Mutonga, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan Bitar, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Tefera, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the efficacy of portal vein embolization (PVE) combined with hepatic vein embolization (HVE) versus PVE alone in inducing growth of the future liver remnant (FLR) in a porcine model.

**METHODS AND MATERIALS**

Sixteen swine were divided into two groups: eight with induced cirrhosis (CG) and eight with healthy livers (NCG). In both the CG (n = 8) and the NCG (n = 8), two subjects were subjected to a sham procedure, while three subjects underwent either PVE only or a combined HVE and PVE. For PVE, 100-300µm microspheres (BeadBlock, Boston Scientific, Marlborough, MA, USA) were injected via an ipsilateral approach, and 5-12mm detachable coils (Interlock Embolization Coils, Boston Scientific, MA, USA) were placed at the right and right-middle lobe portal vein origins. HVE was performed by deploying a vascular plug in the right hepatic vein (Amplatzer Vascular Plug II, Abbott Medical, MN, USA). Portal pressures and non-targeted liver biopsies were obtained before each procedure. Computed tomography (CT) scans with intravenous contrast of the liver were acquired on the day of as well as two and four weeks after the procedure. Total liver and left lobe volumes were segmented on portal-venous phase CT scans using the 3D Slicer software (Version 5.0.3 r30893 / 7ea0f43, Harvard University National Institutes of Health, Boston, USA). Student's t-tests were used with the significance level set at $P < 0.05$. All statistical analyses were carried out in GraphPad Prism (Version 9.5.1; GraphPad, CA, USA).

**RESULTS**

Hepatic cirrhosis was achieved in all swine of the CG and confirmed on histological staining with Masson's trichrome. In all swine, the FLR was greater after the combination procedure of PVE and HVE (24.12% [95% CI: 15.36%, 32.88%]) compared to PVE only (12.75% [95% CI: 7.43%, 18.07%]) ($P = 0.021$) two and four weeks after embolization (23.23% [95% CI: 15.79%, 33.47%] and 15.08% [95% CI: 9.98%, 20.87%] ($p=.043$). Similarly, in the CG, the degree of hypertrophy was greater after PVE combined with HVE (20.85% [95% CI: 14.40% 27.30%]) than PVE alone (8.66% [95% CI: 6.47%, 10.86%]) ($p=.0089$) at two as well as four weeks after embolization (19.27% [95% CI: 17.87%, 20.67%] and 13.33% [95% CI: 9.23%, 13.33%]) ($p=.0003$).

**CONCLUSION**

PVE combined with HVE resulted in a greater degree of hypertrophy of the FLR in this porcine model than PVE alone two and four weeks after embolization. This combination also achieved a greater degree of hypertrophy in cirrhotic swine.

**CLINICAL RELEVANCE/APPLICATION**

Combined PVE and HVE may achieve more effective hypertrophy than PVE alone in patients with cirrhosis who require a larger future liver remnant after partial hepatectomy. This could improve resectability in cirrhotic patients with significant liver tumor burden.

## W6-SSIR03-6 Keynote Speaker

Romaric Loffroy, MD, PhD (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-SSNMMI06

**Nuclear Medicine and Molecular Imaging (Prostate Cancer Therapy)**

Wednesday, Dec. 4 1:30PM - 2:30PM Room: S405

Don C. Yoo, MD (*Moderator*) Consultant, Konica Minolta, Inc
Aileen O'Shea, MBBCh (*Moderator*) Nothing to Disclose

**Sub-Events**

## W6-SSNMMI06-1 INITIAL EXPERIENCE WITH [177LU]LU-PSMA-617 POST-APPROVAL FOR METASTATIC CASTRATION-RESISTANT PROSTATE CANCER AT A MAJOR U.S. ACADEMIC CENTER: EFFICACY, SAFETY, AND OUTCOME PREDICTION

Somya Shesadri, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The goal of our study was to investigate efficacy, safety, and outcome predictors of [177Lu]Lu-PSMA-617 at a major U.S. academic center, since its approval from the FDA in March 2022.

### METHODS AND MATERIALS

Metastatic castration-resistant prostate cancer patients who received [177Lu]Lu-PSMA-617 (Pluvicto) at Johns Hopkins Outpatient Center outside clinical trials were screened for inclusion. Patients who completed treatment or received 4 cycles of [177Lu]Lu-PSMA-617 and had outcome data available were included. Outcome data included PSA response (50% decline), PSA progression-free survival (PSA-PFS), and overall survival (OS).Baseline circulating tumor DNA (ctDNA) mutational status in homologous recombination deficiency (HRD), PI3K alteration pathway, and aggressive variant prostate cancer (AVPC)-associated genes were tested for associations with treatment outcome. Baseline PSMA-PET/CT images were analyzed using SelectPSMA, an artificial intelligence algorithm, to make treatment outcome predictions, and associations with observed outcome were evaluated.

### RESULTS

Of 86 screened metastatic castration-prostate cancer patients who received [177Lu]Lu-PSMA-617, 76 (88%) met inclusion criteria. PSA response was achieved in 30/74 (41%) patients. The median PSA-PFS was 4.1 months (95%CI, 2.0-6.2) and the median OS was 13.7 months (95%CI, 11.3-16.1). Mutational status in HRD, PI3K pathway, or AVPC genes was not associated with treatment outcome. 18/71 (25%) patients classified by SelectPSMA as non-responders had significantly lower rates of PSA response (6% vs 51%; $p<0.001$), shorter PSA-PFS (median: 1.3 vs 6.3 months; $p<0.001$), and shorter OS (median: 6.3 vs 14.5 months; $p=0.046$) compared to patients classified as non-responders.

### CONCLUSION

[177Lu]Lu-PSMA-617 offered in real-world setting after regulatory approval in the U.S. showed similar efficacy and toxicity profile with previously reported German real-world data. Artificial intelligence-based analysis of baseline PSMA-PET/CT images may improve patient selection.

### CLINICAL RELEVANCE/APPLICATION

In this study we evaluated, to our knowledge, for the first time the efficacy and toxicity of [177Lu]Lu-PSMA-617 in real-world setting in the U.S. in post-approval era. Additionally, identifying candidates for [177Lu]Lu-PSMA radioligand therapy who are unlikely to benefit from treatment is an urgent unmet need and this study attempted to investigate a sensitive screening test modality to enhance patient selection.

## W6-SSNMMI06-2 UTILITY OF COMBINATION EXTERNAL BEAM RADIATION WITH $^{177}$LU-PSMA-617 THERAPY FOR PATIENT MANAGEMENT IN THE REAL-WORLD SETTING

Pedram Heidari, MD (*Abstract Co-Author*) Nothing to Disclose
Heather Jacene, MD (*Abstract Co-Author*) Consultant, Novartis AG;Research support, Siemens AG;Research support, GTx, Inc;Speaker, Blue Earth Diagnostics Ltd
Thomas S. Ng, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bashar S. Kako, MD (*Abstract Co-Author*) Nothing to Disclose
Shadi Abdar Esfahani, MD, MPH (*Abstract Co-Author*) Scientific Advisory Board, RefleXion Medical Inc;Scientific Advisory Board, ImaginAb, Inc;Scientific Advisory Board, General Electric Company;Scientific Advisory Board, Trevarx Biomedical, Inc;Consultant, General Electric Company;Spouse, CEO, Trevarx Biomedical, Inc;Spouse, Owner, Trevarx Biomedical, Inc
Jason Efstathiou (*Abstract Co-Author*) Consultant, Blue Earth Diagnostics LtdConsultant, TARIS BioMedical, IncConsultant, Bayer AGAdvisory Board, Merck KGaA
Sophia C. Kamran, MD (*Abstract Co-Author*) Nothing to Disclose
Sedra Mohammadi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

LuPSMA (177Lu-vipivotide tetraxetan) is an effective therapy for metastatic castration-resistant prostate cancer (mCRPC), providing well-tolerated systemic radiation delivery1. While the advantage of LuPSMA therapy is the ability to treat systemic disease with radiation, additional localized disease control may be required2. In this context, targeted external beam radiation therapy (RT) may be used as an adjunct, but the indications, efficacy, and safety/toxicity of combining RT with LuPSMA are unclear3. Here, we report our experience with RT in patients receiving LuPSMA therapy and assess local disease control/palliation outcomes.

### METHODS AND MATERIALS

This retrospective IRB-exempted study reviewed patients who received LuPSMA therapy at 2 academic cancer centers in 5/2022-3/2024. Inclusion criteria required patients to receive RT within 6 months of starting LuPSMA and complete at least 1 cycle. The study examined parameters such as RT rationale, lesion locations, symptoms, and outcomes.

### RESULTS

We reviewed 52 out of 244 mCRPC patients receiving LuPSMA across our institutions who met the above criteria at the time of analysis. Patients received radiation doses and techniques tailored to their specific disease conditions. 28/52 (48%) patients received RT before LuPSMA, 7 during, 14 after, and 3 underwent RT twice with LuPSMA. RT was administered to 33 patients for impending pathological fractures, and 15 for intracranial and epidural diseases. Notable adverse effects based on the PRO-CTCAE and CTCAE criteria included general pain in 11.5% of patients at severity level =1, and thrombocytopenia in 3.8% at severity level =3. At a median follow-up of 5 months, 32 individuals showed symptom improvement, and 20 died from disease progression. At the time of review, 38% (20/52) of patients demonstrated a =50% PSA reduction from baseline at any time during RT/LuPSMA therapy (PSA50) - this was slightly lower but not significantly different compared to the general LuPSMA population reviewed at our institutions (PSA50 of a subset of the general population:50%, 122/244, Chi-squared proportional test: p=0.13). Furthermore, the PSA response was markedly heterogeneous (best PSA% change median: 70%, range: 2- 86.3%).

### CONCLUSION

In our clinical experience, RT was mainly indicated for localized tumor control and symptom management, especially for osseous and CNS lesions. In these settings, patients tolerated RT with limited toxicity, which likely facilitated their LuPSMA treatment.

### CLINICAL RELEVANCE/APPLICATION

Our findings suggested that the integration of RT with LuPSMA effectively controls localized disease and manages symptoms, enhancing patients' quality of life and functional status while enabling uninterrupted LuPSMA treatment.

## W6-SSNMMI06-3 PSMA AND FDG PET-BASED THERAP ELIGIBILITY AND OUTCOME OF PATIENTS WITH METASTATIC CASTRATION-RESISTANT PROSTATE CANCER WHO RECEIVED 177LU-PSMA-617

Heather Cheng (*Abstract Co-Author*) Research Grant, Clovis Oncology, Inc;Research Grant, Color Genomics;Research Grant, Johnson & Johnson;Research Grant, Pfizer Inc;Research Grant, Phosplatin;Research Grant, Groupe Sanofi;Research Consultant, AstraZeneca PLC
Michael Schweizer (*Abstract Co-Author*) Consultant, Groupe Sanofi;Speaker, Groupe Sanofi;Consultant, AstraZeneca PLC;Speaker, AstraZeneca PLC;Consultant, PharmaIN, Corp;Speaker, PharmaIN, Corp;Consultant, Resverlogix Corp;Speaker, Resverlogix Corp;Institutional research support, Zenith Epigenetics;Institutional research support, Bristol-Myers Squibb Company;Institutional research support, Merck & Co, Inc;Institutional research support, Immunomedics, Inc;Institutional research support, Johnson & Johnson;Institutional research support, AstraZeneca PLC;Institutional research support, Pfizer Inc;Institutional research support, Madison Vaccines, Inc
Jessica Hawley (*Abstract Co-Author*) Institutional research support, Regeneron Pharmaceuticals, Inc;Institutional research support, Sanpower Group Co., Ltd;Consultant, Merck & Co, Inc
Bruce Montgomery (*Abstract Co-Author*) Nothing to Disclose
Todd Yezefski (*Abstract Co-Author*) Consultant, Sanpower Group Co., Ltd;Speaker, Pfizer Inc;Speaker, Sumitomo Chemical Co, Ltd
Delphine L. Chen, MD (*Abstract Co-Author*) Grant, Telix Pharmaceuticals Limited;Speaker, Telix Pharmaceuticals Limited
Sanaz Behnia, MD (*Abstract Co-Author*) Nothing to Disclose
Alireza Ghodsi, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Iravani, MD (*Abstract Co-Author*) Nothing to Disclose
Evan Yu (*Abstract Co-Author*) Research Consultant, Advanced Accelerator Applications;Research Consultant, Bayer AG;Research Consultant, Exelixis, Inc;Research Consultant, Johnson & Johnson;Research Consultant, Merck & Co, Inc;Research Consultant, Oncternal;Research Grant, Bayer AG;Research Grant, Blue Earth Diagnostics Ltd;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Sanpower Group Co., Ltd;Research Grant, Lantheus Holdings;Research Grant, Merck & Co, Inc;Research Grant, Otsuka Holdings Co, Ltd
Roman Gulati (*Abstract Co-Author*) Nothing to Disclose
Michael Haffner (*Abstract Co-Author*) Nothing to Disclose
Ridvan A. Demirci, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Optimal thresholds for PET-based patient selection criteria for 177Lu-PSMA-617 (LuPSMA) therapy are yet to be defined. Landmark VISION and TheraP trials introduced different imaging criteria. TheraP used higher PSMA uptake threshold and required an additional pre-treatment FDG-PET to exclude patients with discordant findings, likely helping to increase the PSA50 response rate (66% vs 46%) at the cost of higher screen failure (28% vs 12.6%). In this study, we aimed to evaluate the association of PSMA and FDG PET-based eligibility criteria defined by the TheraP trial and its subgroups with the outcomes in VISION-eligible patients.

### METHODS AND MATERIALS

Consecutive patients treated with LuPSMA who met criteria for treatment as defined in the VISION trial were included in this analysis. Patients had pre-treatment PSMA and FDG PET and were blindly classified by two nuclear medicine physicians as TheraP eligible (TheraP-E) and TheraP ineligible (TheraP-I). Further subclassification was made based on reasons of ineligibility: low PSMA and discordant findings. The endpoints of interest were PSA50 response (i.e. =50% decline in PSA from baseline), PSA progression-free survival (PFS), and overall survival. Odds ratio (OR) and hazard ratio (HR) were computed using logistic and Cox regressions, respectively.

### RESULTS

A total of 75 patients with a median age of 74 years (IQR, 70-79) were included. 69/75 (92%) patients received chemotherapy prior to LuPSMA (38/75[51%] 1 regimen, 31/75[41%] 2 or more regimens). Median follow-up time was 14.5 months (95% confidence interval [CI] 12.2,17). TheraP-I patients had a lower PSA50 rate compared to TheraP-E patients (28% vs 67%, OR= 0.19, 95% CI 0.06-0.52, p= 0.002) and lower PSA PFS (HR= 2.0, 95% CI 1.2-3.3, p= 0.007). Overall survival in the TheraP-I group was numerically shorter than in the TheraP-E group but the comparison was only marginally significant (10.4 vs not reached [NR] months, HR= 1.9, 95% CI 1.0-3.7, p= 0.054). Patients classified as TheraP-I due to low PSMA had no statistically significant different risk of death (p=0.9) compared to the TheraP-E group, but patients with discordant findings had statistically significantly higher risk of death (HR=2.3, 95% CI1.1-4.6, p=0.02).

### CONCLUSION

In VISION-eligible patients who were treated with LuPSMA, TheraP-ineligible patients due to discordant FDG PET findings had lower PSA50, PSA-PFS, and possibly shorter OS. Our study suggests that the shorter OS of TheraP-I patients is mainly driven by the presence of FDG-avid discordant disease.

### CLINICAL RELEVANCE/APPLICATION

Understanding the value of PSMA expression thresholds and the influence of dual tracer imaging findings will allow more appropriate patient selection for LuPSMA

## W6-SSNMMI06-5 IS ALKALINE PHOSPHATASE OR PROSTATE SPECIFIC ANTIGEN A BETTER BIOMARKER OF PSMA-AVID DISEASE IN PATIENTS TREATED WITH LUTETIUM-177 PSMA?

Madison N. Crank, MD, BS (*Abstract Co-Author*) Nothing to Disclose
Turgut Bora Cengiz, MD (*Abstract Co-Author*) Nothing to Disclose
Yong C. Bradley, MD (*Abstract Co-Author*) Nothing to Disclose
Marc D. Benayoun, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyle Atcheson, MD (*Abstract Co-Author*) Nothing to Disclose
Karol L. Cardenas Montalvo, MD (*Abstract Co-Author*) Nothing to Disclose
Jackson Sullivan, BS (*Abstract Co-Author*) Nothing to Disclose
Caroline Wilson, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Prostate-specific antigen (PSA) is a widely used marker for prostate cancer, however, its role and accuracy for disease progression has yet to be vetted. Alkaline phosphatase (ALP) has been shown to be a useful biomarker for osseous disease burden, especially in patients receiving radium-223 dichloride. There is a paucity of data on each biomarker and their role in evaluation for treatment response. This study aims to determine the role of PSA and ALP as biomarkers in patients undergoing Lutetium-177 PSMA therapy (Pluvicto).

### METHODS AND MATERIALS

All patients with PSMA-avid metastatic castration-resistant prostate cancer undergoing Pluvicto were enrolled. Baseline and follow-up PSMA (F-18 DCFPyL) PET/CTs were segmented using MIM Software® (Beachwood, OH) to analyze total, osseous and soft tissue tumor burden and activity. PSA and ALP levels prior to starting Pluvicto (200 mCi, every 6 weeks) therapy, and 4 weeks after each cycle were recorded. Total, osseous and soft tissue tumor volumes (TV), lesion activity (LA) and PSMA expression (SUVmax, SUV mean, SUVmin) were correlated with Spearman correlation to measure the relationship between pre-therapy, post-therapy and the difference between pre-and post-therapy.

### RESULTS

A total of 47 patients were identified, of which 20 patients had two consecutive PSMA PET/CTs. Both the PSA and ALP measurements (spearman correlation and p value, respectively) showed significant correlation with baseline total TV (0.62 and 0.50, p-values <.001) and change in total TV (0.71 vs 0.66, $p<0.001$), however only ALP was correlated with follow-up PET/CT total TV (0.51, $p=0.02$). While both biomarkers showed correlation with bone TV in pre-, post-therapy and difference between pre and post values, ALP had a stronger correlation than PSA ($p<0.05$). Both PSA and ALP had mild-to-moderate correlation total LA and bone LA, except for PSA in post-therapy PET/CTs. PSA demonstrated a mild correlation with soft tissue TV (0.53, $p=0.01$) and soft tissue LA (0.5, $p=0.02$), whereas ALP did not show any correlation with neither soft tissue TV nor LA. Neither of the biomarkers showed any correlation with SUVmax, SUVmean or SUVmin.

### CONCLUSION

This study supports that both PSA and ALP have significant roles in pre-therapy, post-therapy and treatment response evaluation for Pluvicto therapy. Our results support the use of ALP in bone tumor burden measurement over PSA, and PSA for soft tissue disease burden over ALP.

### CLINICAL RELEVANCE/APPLICATION

ALP and PSA values have an important role in evaluation of PSMA PET/CTs. This study shows that ALP can be used to detect changes in bone tumor volume throughout the treatment course. PSA is also accurate in terms of total tumor burden and for the evaluation of soft tissue disease burden.

## W6-SSNMMI06-6 PERFORMANCE OF CHATGPT-4 AND GEMINI CHATBOTS IN RESPONDING TO COMMON PATIENT QUESTIONSON PROSTATE CANCER $^{177}$LU-PSMA-617 THERAPY

Ann Packard, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew P. Thorpe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Geoffrey Johnson, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Childs (*Abstract Co-Author*) Nothing to Disclose
Jacob Orme (*Abstract Co-Author*) Nothing to Disclose
Ayse T. Karagulle Kendi, MD (*Abstract Co-Author*) Investigator, Novartis AG
Brian J. Burkett, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Irbaz B. Riaz, MBBS,MS (*Abstract Co-Author*) Nothing to Disclose
Oliver Sartor (*Abstract Co-Author*) Nothing to Disclose
Cem Bilgin, MD (*Abstract Co-Author*) Nothing to Disclose
Derek R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Thorvardur Halfdanarson (*Abstract Co-Author*) Research Consultant, Curium SAS;Research Consultant, Lexicon Pharmaceuticals, Inc;Research Consultant, Advanced Accelerator Applications SA;Research Grant, Ipsen SA;Research Grant, Thermo Fisher Scientific Inc
Gokce Belge Bilgin, MD (*Presenter*) Nothing to Disclose

### PURPOSE

As artificial intelligence (AI) chatbots are becoming increasingly popular, many patients are expected to turn to them as a rapid source of health information. This raises important questions about the reliability and effectiveness of AI chatbots in delivering accurate and understandable information. The aim of this study was to evaluate and compare the accuracy, conciseness, and readability of responses from OpenAI's ChatGPT-4 and Google's Gemini (formerly known as Bard) to patient inquiries concerning the novel LuPSMA therapy for prostate cancer.

### METHODS AND MATERIALS

Two experts listed the 12 most commonly asked questions by patients on LuPSMA therapy. These twelve questions were prompted to ChatGPT-4 and Gemini. AI-generated responses were distributed using an online survey platform (Qualtrics) and blindly rated by eight experts. The performances of the AI chatbots were evaluated and recorded across three domains: accuracy, conciseness, and readability. Accuracy and conciseness of responses were

evaluated on a 4-point scale, and readability was assessed on a 3-point scale. Additionally, potential safety concerns associated with AI-generated answers were also examined. Responses with an accuracy score of = 2 were categorized as misleading answers. The Mann-Whitney U and chi-square (?²) tests were utilized to compare the performances of AI chatbots.

**RESULTS**

Eight experts participated in the survey, evaluating 12 AI-generated responses across the three domains of accuracy, conciseness, and readability, resulting in 96 assessments (12 responses x 8 experts) for each domain per chatbot. ChatGPT-4 provided more accurate answers than Gemini (2.95 ± 0.671 vs 2.73 ± 0.732, p=0.027). Gemini's responses had better readability than ChatGPT-4 (2.79 ± 0.408 vs 2.94 ± 0.243, p=0.003). Both ChatGPT-4 and Gemini achieved comparable conciseness scores (3.14 ± 0.659 vs 3.11 ± 0.679, p=0.798). Experts categorized the AI-generated responses as incorrect or partially correct at a rate of 16/96 for ChatGPT-4 and 28/96 for Gemini. Gemini's answers contained significantly more misleading information than those of ChatGPT-4 (p = 0.039).

**CONCLUSION**

While Gemini's responses were assessed as easier to understand, ChatGPT-4 demonstrated higher accuracy. However, neither provided completely accurate answers to all questions.

**CLINICAL RELEVANCE/APPLICATION**

AI chatbots have gained significant attention, and their performance is continuously improving. Nonetheless, these technologies still need further improvements to be considered reliable and credible sources for patients seeking medical information on LuPSMA therapy.

# Abstract Archives of the RSNA, 2024

W6-SSOB03

**Science Session with Keynote: OB/Gynecology (Uterus and Ovaries: Endometriosis and Endometrial Cancer)**

Wednesday, Dec. 4 1:30PM - 2:30PM Room: E351

Pamela I. Causa Andrieu, MD (*Moderator*) Nothing to Disclose
Mark D. Sugi, MD (*Moderator*) Consultant, Nextrast, Inc;Author with royalties, RELX

**Sub-Events**

## W6-SSOB03-1 COMPARISON OF ENDOMETRIOSIS DETECTION IN MRI PELVIS PROTOCOLS WITH AND WITHOUT RECTAL CONTRAST

Nicole M. Hindman, MD (*Abstract Co-Author*) Nothing to Disclose
Myles T. Taffel, MD (*Abstract Co-Author*) Nothing to Disclose
Amelia Kernizan, MD (*Abstract Co-Author*) Nothing to Disclose
Luke A. Ginocchio, MD (*Abstract Co-Author*) Nothing to Disclose
Erica Dun (*Abstract Co-Author*) Nothing to Disclose
Angela Tong, MD (*Presenter*) Equipment support, Siemens AG

### PURPOSE

To evaluate the efficacy of rectal contrast gel to assist in pelvic MRI detection of rectal endometriosis

### METHODS AND MATERIALS

Before 3/2018, our institution routinely administered rectal contrast gel (RCG) in our MRI pelvis protocol to assess endometriosis. We subsequently discontinued the use of RCG but maintained the remaining protocol. We included 71 consecutive adult patients who had MRI pelvis with RCG for pelvic pain or endometriosis and surgical/pathologic follow up within 1 year. As a comparison, we included 73 consecutive patients who had MRI pelvis without RCG, matched by surgical findings and meeting the same inclusion/exclusion criteria. The exams were anonymized, randomized and presented on our clinical PACS to 3 readers (R1 18 yrs, R2 3 yrs, and R3 1 yr experience). Readers evaluated for rectal lesions, mural involvement, and overall disease severity utilizing deep pelvic endometriosis index system. Comparison of rectal lesion detection to the gold standards of surgical findings were made and sensitivity (Sn), specificity (Sp), positive predictive value (PPV), and negative predictive value (NPV) were obtained and compared between with and without RCG for each reader using Fischer's Exact test. Fleiss' Kappa was obtained for all readers for all studies, with RCG only, and without RCG only.

### RESULTS

Diagnostic statistics for WITH and WITHOUT RCG respectively: R1 (Sn 0.58, 0.75 (p=0.67), Sp 0.69, 0.72 (p=0.84), PPV 0.28, 0.35 (p=0.76), NPV 0.89, 0.94 (p=0.49); R2 (Sn 0.42, 0.58 (p=0.68), Sp 0.90, 0.87 (p=0.78), PPV 0.45, 0.47 (p=0.31), NPV 0.88, 0.91 (p=0.76); R3 (Sn 0.42, 0.75 (p=0.21), Sp 0.83, 0.82 (p=1.00), PPV 0.33, 0.45 (p=0.73), NPV 0.88, 0.94 (p=0.32). Kappa for readers in detecting bowel lesions with RC: 0.51; without RC: 0.71. Kappa for readers in disease severity with RC: 0.61; without RC: 0.62. % of lesions proximal to level of RCG: R1: 39%, R2: 58%, R3: 48%.

### CONCLUSION

RCG does not significantly impact detection and diagnosis of rectal lesions in deep endometriosis. Readers agreement on detecting lesions is better without RCG than with RCG. Agreement on assessing disease severity is similar with or without RCG.

### CLINICAL RELEVANCE/APPLICATION

Administering RCG requires time, extra budget, and skilled personnel without benefits of improved lesion detection or interreader variability. Other interventions may be considered for optimal imaging of rectal endometriosis.

## W6-SSOB03-2 ADVANCING ENDOMETRIOSIS DETECTION: A DEEP LEARNING-ENHANCED MULTI-SEQUENCE MRI ANALYTICAL MODEL

Candice Bookwalter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kristina T. Flicek, MD (*Abstract Co-Author*) Nothing to Disclose
Lekui Xiao, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Ceylan Colak, MD (*Abstract Co-Author*) Nothing to Disclose
Tatnai Burnett (*Abstract Co-Author*) Nothing to Disclose
Shahriar Faghani, MD (*Abstract Co-Author*) Nothing to Disclose
Mana Moassefi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the efficacy of deep learning (DL) tools in enhancing the accuracy of multi-sequence MRI-based detection of endometriosis.

**METHODS AND MATERIALS**

We gathered a patient cohort from our institutional database, composed of patients with surgically and pathologically confirmed endometriosis from 2015-2024. We collected their gynecologic MRIs three months prior to the diagnostic surgery. We also created an age-matched control group that underwent a similar MR protocol but without a diagnosis of endometriosis. For our analysis, we used sagittal T1-weighted(T1) pre- and post-contrast, as well as T2-weighted(T2) MRIs. We allocated one-eighth of the dataset for testing and conducted seven-fold cross-validation on the remainder. MR images were analyzed using various convolutional neural network (CNN) architectures. Simultaneously, two abdominal radiologists and one fellow reviewed a random selection of images and documented their endometriosis detection.

**RESULTS**

594 patients were included in the case and control group. The final DenseNet-121 classifier model demonstrated robust performance. Our findings indicated the most accurate predictions were obtained from T1 pre- and post-contrast images in our validation sets, employing seven-fold cross-validation across 520 cases. In this setup, the model achieved average values on 7 folds as follows: F1 Score of 0.792, area under the receiver operating characteristic curve (AUROCC) of 0.898, sensitivity of 0.854, and specificity of 0.861. Further testing on the separate set of 74 cases using T2 and T1 pre- and post-contrast MRI and ensemble technique resulted in an F1 Score of 0.911, AUROCC of 0.881, sensitivity of 0.976, and specificity of 0.720. In addition, occlusion map visualizations provided insights into the model's focus areas, further confirming the model's diagnostic accuracy in identifying endometriosis lesions. Our radiologist readers achieved an 86.66% accuracy in disease detection.

**CONCLUSION**

The study introduced the first DL model to use multi-sequence MRI on a large cohort, showing results nearly equivalent to human detection in identifying endometriosis. Further external validation of the model is in progress.

**CLINICAL RELEVANCE/APPLICATION**

Endometriosis, a condition characterized by the growth of endometrial-like tissue outside the uterus, affects 5-10% of women of reproductive age, leading to chronic pelvic pain, infertility, and malignancy. Despite its prevalence, the diagnosis of endometriosis through imaging remains challenging and requires at least 2 years of specialized training. Advances in DL, particularly through CNNs, are changing the diagnosis and management of this complex condition and fostering patient-centered treatment.

## W6-SSOB03-3 AUTOMATED DETECTION, QUANTIFICATION AND ENUMERATION OF OVARIAN FOLLICLES ON T2-WEIGHTED MR IMAGING IN A LARGE PATIENT COHORT OF 2781 REPRODUCTIVE AGE WOMEN

Yosef G. Chodakiewitz, MD (*Abstract Co-Author*) Nothing to Disclose
Sam Hashemi, MSc (*Abstract Co-Author*) Nothing to Disclose
Ahmed Gouda, MSc (*Abstract Co-Author*) Nothing to Disclose
Javad Khaghani, MSc (*Abstract Co-Author*) Nothing to Disclose
Siavash Khallaghi (*Abstract Co-Author*) Nothing to Disclose
Saqib Basar (*Abstract Co-Author*) Nothing to Disclose
Soojin Lee (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to develop an automated deep learning model to quantify and enumerate ovaries and follicles, providing valuable insights into women's reproductive health, aiding clinical decision making.

**METHODS AND MATERIALS**

We utilized a U-Net semantic segmentation network trained on 328 sagittal T2-weighted pelvis scans to detect ovaries, enabling quantification of ovarian volume and extraction of the ovarian region of interest (RoI) mask. Subsequently, a Retina U-Net instance detection network was trained on 198 ovarian RoIs from sagittal T2-weighted pelvis scans of 99 patients to detect individual follicles within each ovary. During inference, ovarian RoIs were obtained using the U-Net network, and individual follicles within each ovarian RoI were detected using the Retina U-Net solution. Normative aging- and menstrual-cycle curves were derived based on the models' predictions over a large general population (N=2781) of patients aged 20 to 55 years, with the last menstrual period (LMP) within the past 29 days. This allowed for comparison of ovarian and follicle measurements against the general population by age and days since the LMP and monitoring of the dominant follicle development throughout the cycle.

**RESULTS**

The normative graphs depict expected trends in ovarian volume and follicle size across the reproductive lifespan of women. Ovarian volume typically increases until around age 25, reflecting peak fertility, before gradually decreasing. Additionally, the dominant follicle's volume and dimensions tend to increase leading up to ovulation midpoint, then decrease post-ovulation.

**CONCLUSION**

Leveraging the power of artificial intelligence, our model enables the automated detection and quantification of ovarian follicles using T2-weighted pelvic MRI.

**CLINICAL RELEVANCE/APPLICATION**

Analyzing detected follicles across a large population yields normative curves for follicle count and distribution, offering valuable insights into ovarian function and reproductive health. This approach provides an efficient tool for clinical research, enabling reliable assessment of ovarian characteristics and their variations within populations. The automated approach also facilitates longitudinal monitoring of ovarian follicle development, enabling personalized interventions and fertility management strategies. Further, by analyzing the follicle distribution pattern using the proposed tool, the model may assist clinicians with identifying characteristic features associated with polycystic ovary syndrome (PCOS).

## W6-SSOB03-4 EVALUATION OF ROUTINE TRANSVAGINAL ULTRASOUND FOR DETECTING ENDOMETRIOSIS: RETROSPECTIVE COHORT STUDY BASED ON SRU CONSENSUS CLASSIFICATION

Priyanka Jha, MBBS (*Abstract Co-Author*) Nothing to Disclose
Richa D. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Luyao Shen, MD (*Abstract Co-Author*) Nothing to Disclose
Stephan Altmayer, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Aya Kamaya, MD (*Abstract Co-Author*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation
Martina Z. Francisco, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The recent Society of Radiologists in Ultrasound (SRU) Consensus on routine pelvic ultrasound (US) for endometriosis has established the clinical criteria to perform augmented pelvic US (APU). Our goal was to evaluate a retrospective cohort of patients undergoing routine transvaginal US (TVUS) to identify findings suggestive of endometriosis.

**METHODS AND MATERIALS**

We performed a retrospective cohort including consecutive patients aged 16 to 55 years old undergoing TVUS for any cause in December 2019 to allow for at least 4 years of follow-up. Our exclusion criteria were obstetric US or technically inadequate US. We implemented the SRU consensus classification for the interpretation of US: normal (APU-1), equivocal for endometriosis (APU-2), positive for endometriosis (APU-3). Two readers with 5 and 10 years of experience evaluated the imaging findings in consensus. Medical records were evaluated to determine if APU was indicated at the time of the routine US according to the SRU consensus criteria. Follow-up imaging or procedures were also evaluated to determine if the patient was ever diagnosed with endometriosis before or after the routine US.

**RESULTS**

A total of 76 consecutive patients were identified with a mean age of 44.6 years (SD 8.1 years). Among the total, 24 patients (31.5%) would have met clinical criteria for performance of APU at the time of the exam. Five patients (6.6%) had imaging findings equivocal for endometriosis on routine TVUS, two of which were found to have prior history of endometriosis, while the other three have not yet established a diagnosis. Sixteen patients (21.0%) had imaging findings positive for endometriosis. Of those, three (18.7%) had a known history of endometriosis, two (12.5%) had a follow-up MRI consistent with endometriosis, and the remaining eleven (68.7%) have not yet established a diagnosis of endometriosis during the follow-up. Among the 21 patients with equivocal or positive findings on routine TVUS, eleven (52.3%) met clinical criteria for performance of APU. Of the 24 patients who met clinical criteria for performance of APU, eight (33.3%) were classified as positive for endometriosis.

**CONCLUSION**

Nearly 29% of patients undergoing routine TVUS for any cause were found to have equivocal or positive US findings of endometriosis. Most of these patients have not yet established the diagnosis of endometriosis. Among the patients who met clinical criteria for performance of APU, 33.3% were classified as positive for endometriosis (APU-3).

**CLINICAL RELEVANCE/APPLICATION**

Endometriosis often goes undiagnosed for many years. A significant proportion of routine pelvic ultrasounds performed for any reason demonstrate signs suggestive of endometriosis, which may assist in early diagnosis.

## W6-SSOB03-6 DW MRI RADIOMICS IN PREDICTING THE HISTOPATHOLOGICAL RISK FACTORS AND MOLECULAR CLASSIFICATIONS FOR 2023 FIGO STAGING OF ENDOMETRIAL CANCER

Yu-Fu Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Gigin Lin, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The study aims to construct a radiomics risk model utilizing standard DW MRI to predict the histopathological factors and molecular classifications for the 2023 FIGO staging of endometrial cancer.

**METHODS AND MATERIALS**

From 2015 to 2023, a total of 541 patients were enrolled, age 52+/-11 years, with each patient having 105 volumetric radiomic features extracted from their whole tumor on pre-treatment DW MRI. Radiomic risk scores (Rad-Scores) were formulated using the LASSO regression model to predict risk factors pertinent to the 2023 FIGO staging of endometrial cancer in a training cohort (n=433), and subsequently validated in an independent testing cohort (n=108). A significance level of $P < .05$ was employed for statistical analysis.

**RESULTS**

In the testing dataset, the Rad-Scores exhibited precise predictions of histopathological factors, achieving accuracies accuracy of 0.74 for aggressive histological type, 0.77 for deep myometrial invasion, 0.74 for cervical stromal invasion, 0.78 for adnexal involvement, 0.72 for lymphovascular space invasion (LVSI), and 0.73 for lymph node metastasis. Moreover, the Rad-Scores demonstrated promising capabilities in forecasting molecular classifications, attaining accuracies of 0.83 for DNA polymerase epsilon mutation (POLEmut), 0.80 for mismatch repair deficient (MMRd), and 0.65 for p53 abnormal (p53abn). These Rad-Scores histopathological factors and molecular classifications translated into the prediction of overall survival and disease-free survival ($P < .05$).

**CONCLUSION**

DW MRI radiomics exhibits promising potential in predicting histopathological factors and molecular classifications of endometrial carcinoma. Integration of radiomics with the 2023 FIGO staging system could offer a more evidence-based framework for treatment recommendations, thus enhancing outcomes and survival rates.

**CLINICAL RELEVANCE/APPLICATION**

By developing a radiomic risk score using routine DW MRI and establishing its association with histopathological factors and molecular classifications for the 2023 FIGO staging, this study shows promising translational relevance in providing a personalized approach to therapy selection for endometrial cancer patients.

## W6-SSOB03-7 Keynote Speaker

Priyanka Jha, MBBS (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W6-SSPH10

**Physics (Generative Deep Learning in Imaging)**

Wednesday, Dec. 4 1:30PM - 2:30PM Room: S404

Joseph W. Stayman, PhD (*Moderator*) Research Grant, Fischer Medical;Research Grant, General Electric Company;Research Grant, Canon Medical Systems Corporation;Research collaboration, Koninklijke Philips NV;Research collaboration, Siemens AG;Researcher, Varex Imaging Corporation
Emil Y. Sidky, BS, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W6-SSPH10-2 PORTABLE BRAIN CT MOTION CORRECTION USING GENERATIVE DIFFUSION MODEL

Dufan Wu, PhD (*Abstract Co-Author*) Nothing to Disclose
Rajiv Gupta, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Quanzheng Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Quirin Strotzer, MD (*Abstract Co-Author*) Nothing to Disclose
Rehab N. Khalid, MBBS (*Abstract Co-Author*) Nothing to Disclose
Zhennong Chen, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Portable Computed Tomography (CT) for brain often encounters motion artifacts due to the prolonged scanning time and critically ill patients who are unable to cooperate or hold still. We proposed a generative diffusion model to reduce motion artifacts in portable brain CT images.

### METHODS AND MATERIALS

The model is a 3D conditional diffusion model that progressively generates a corresponding motion-free 3D brain CT under the guidance of a motion-corrupted 3D brain CT volume using the diffusion sampling process. 3D patch-wise training was employed for training efficiency, but the model was applied to the entire full-resolution volume during testing. The training data were generated from 80 motion-free CT volumes acquired from fixed CT scanners, where 10 samples of motion-corrupted volumes were simulated from each volume using the portable CT geometry. All CT images were reconstructed using the soft-tissue kernel.The trained model was first tested on 200 simulated motion-corrupted CT volumes from 20 different patients for quantitative evaluation. It was then tested on 30 motion-degraded portable brain CT scans acquired by CereTom (Neurologica, USA) from ICU patients. Two radiologists reviewed each dataset before and after the correction and scored the corrected images for motion artifacts, diagnostic value, and preference in the range of -2 to +2. The reviewers scored the pre- and post-correction images, in a randomized, blinded fashion after a washout time to account for recollection bias.

### RESULTS

Our method demonstrated significant correction of motion artifacts in both skull and brain. In simulated testing data, our method significantly reduced MAE from 183+-40HU to 54+-16HU, reduced RMSE from 353+-61HU to 130+-37HU, improved SSIM from 0.62+-0.11 to 0.95+-0.03, ($p<0.01$ under one-tailed t-test). It achieved the same level of contrast-to-noise-ratio as motion-free ground truth images. Our method also outperformed the convolutional neural network (CNN)-based method quantitatively and visually.In the real testing data, the motion corrected CT had better or equal score than the original CT on all the 30 scans for all 3 criteria. Out of the 30 scans, Radiologist-A rated motion-corrected images to be superior 29:1 in terms of artifacts, 25:5 for overall image quality, and 17:13 for improved diagnostic value. For Radiologist-B, these scores were 26:4, 26:4, and 23:7, respectively.

### CONCLUSION

A generative diffusion model can significantly reduce motion artifacts in portable brain CT scans.

### CLINICAL RELEVANCE/APPLICATION

Motion artifacts is one of the major image limitations in portable brain CT scans. Our method can significantly reduce its motion artifact and enhance the diagnostic value of portable CT in all clinical settings.

## W6-SSPH10-3 MOTION-COMPENSATED BLADE-MRI IMAGE RECONSTRUCTION USING GENERATIVE NEURAL NETWORKS

Daniel Rueckert, PhD (*Abstract Co-Author*) Consultant, IXICO Limited;Consultant, HeartFlow, Inc
Sergios Gatidis, MD (*Abstract Co-Author*) Nothing to Disclose
Kerstin Hammernik, MSc (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, MBA (*Abstract Co-Author*) Advisory Panel, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Advisory Panel, Bayer AG;Speakers Bureau, Bayer AG;Research Grant, Bayer AG
Thomas Kuestner, DIPLENG (*Abstract Co-Author*) Nothing to Disclose
Bin Yang, PhD,DIPLENG (*Abstract Co-Author*) Nothing to Disclose
Andreas Peter Wagner, MD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Motion artifacts originating during MRI acquisition pose a problem in the clinical field. In the abdomen, respiratory-induced motion artifacts limit the diagnostic value. In free-breathing acquisitions or in scan conditions when navigator triggering fails, the complex and highly localized deformations are challenging to compensate by current techniques (e.g., BLADE).

**METHODS AND MATERIALS**

Deep Learning-based (DL) generative approaches currently show promising results in compensating motion artifacts. However, current approaches do not guarantee data fidelity to the acquired k-space.We propose the reformulation of motion correction as an image reconstruction task and present a reconstruction network incorporating a generative learnable regularizer and data consistency layers within an adversarial training. Investigations are carried out for T2 weighted abdominal BLADE imaging. A supervised training with simulated motion artifacts is used during network training in a cohort of 113 patients. Testing is performed on prospective data acquired under free-breathing in 8 patients.

**RESULTS**

The performance of the proposed network is evaluated on simulated motion (breathing as cosine waveforms) and actual motion (free-breathing patients). It achieves high qualitative and quantitative (SSIM, PSNR, NMSE) performance on simulated and actual motion in comparison to common neural networks or compressed sensing reconstruction. Fidelity to the acquired data was achieved.

**CONCLUSION**

Formulating the task of motion compensation as a reconstruction problem yields feasible results with superior image quality to comparable neural networks or classical motion reconstruction methods.Prior motion estimation and optimization is needed for high performance scanner integration. For understanding and controlling the motion correction capabilities, further analysis, e.g., uncertainty estimation, is needed.

**CLINICAL RELEVANCE/APPLICATION**

The number of multiple breath-hold maneuvers during acquisition could be reduced or eliminated, resulting in increased diagnostic value in patients who are unable to perform extensive breathing maneuvers due to their condition.Due to the similarity of the problems, undersampled data acquisition and downstream compensation in the pipeline could accelerate the whole MRI examination, allowing more patients to be examined and costs to be reduced.

## W6-SSPH10-4 SCALABLE PHYSICS-INFORMED GENERATIVE NEURAL NETWORK FOR SYNTHESIZING SCANNER- AND ALGORITHM-SPECIFIC LOW-DOSE CT DATA WITH VARIABLE RECONSTRUCTION SETTINGS

Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Shaojie Chang, PhD (*Abstract Co-Author*) Nothing to Disclose
Timothy Winfree, BS, MS (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Scott S. Hsieh, PhD (*Abstract Co-Author*) Nothing to Disclose
Hao Gong, PhD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Low-dose CT simulation is needed to assess reconstruction and dose reduction techniques. Projection domain noise insertion requires manufacturers' proprietary information. Image domain methods have been established for filtered back projection (FBP) but are hard to extend to iterative and deep-learning reconstruction and different reconstruction settings. We aim to address these challenges using a scalable physics informed generative neural network for simulating scanner- and algorithm-specific low dose CT exams (PALETTE)

**METHODS AND MATERIALS**

PALETTE included physics-based noise prior generation (NPG), Noise2Noisier (N2Nr) network, and noise texture synthesis (NTS) network. NPG injected Poisson noise in forward projection of routine dose images and created a noise prior via back projection. N2Nr derived the bias prior at low dose. NTS used noise and bias prior as inputs to predict difference images between routine and reference low dose images. PALETTE used custom transformers to harmonize different sampling frequencies at variable field of view. The encoded reconstruction types were used as an input to modulate intrinsic filter response to differentiate noise texture types in networks. Custom regularizations were developed, including constraints on noise correlations and frequency distribution. We evaluated PALETTE using data from 3 CT scanners, including 1 photon counting CT. For each scanner, 30 patient cases were collected (10 training, 20 testing). A clinically validated projection domain noise insertion tool was used to create the lower dose references (50% and 25% dose). FBP and 3 iterative reconstruction algorithms were used, including 6 filters / denoising strengths and various field-of-views (FOV diameter 340 - 460 mm). Phantom data was acquired to assess noise power spectra (NPS) using peak frequency and mean absolute error (MAE). In patient cases, local and global noise texture and the corresponding frequency distributions were inspected. Noise level was compared in uniform liver parenchyma using mean absolute percent difference (MAPD)

**RESULTS**

PALETTE-derived and reference NPS showed consistent peak frequency and MAE < 0.7 HU2cm2. In patient cases, PALETTE-simulated images were well matched to the reference across all reconstruction settings, showing similar local and global noise structure and frequency distribution (mean Jensen-Shannon divergence <0.1). MAPD of noise level was <6% and not statistically significant (Student's t-test $p>0.05$)

**CONCLUSION**

PALETTE generalized well across reconstruction algorithms and settings on different CT scanners

**CLINICAL RELEVANCE/APPLICATION**

PALETTE can provide high quality scalable low dose CT simulation using only image data to facilitate optimizing CT protocols and dose

## W6-SSPH10-5 A NOVEL APPROACH TO DENOISE CT IMAGES USING A LATENT DIFFUSION-BASED DEEP LEARNING MODEL: A PHANTOM STUDY COMPARED TO A DEEP LEARNING RECONSTRUCTION METHOD

Won Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Yoon Jin Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Young Hoon Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Jungheum Cho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jongmin Jee, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to evaluate the denoising performance of CT images using a latent diffusion-based deep learning model (LDM), compared to a deep learning-based image reconstruction method (DLR, TrueFidelity™).

**METHODS AND MATERIALS**

Our proposed model utilized an encoder-decoder architecture enhanced by a latent diffusion process, with training structured in two phases. Initially, the encoder-decoder architecture was trained to extract and reconstruct features from the input data. Then, the latent diffusion model was trained using a cold diffusion process to align the diffusion endpoint with the latent space of low-dose CT images. The transformed latent representation was synthesized by the decoder into a denoised image. The model was trained on 100 patient datasets, which included routine-dose (100%) and simulated low-dose abdominal CT images (13%, 25%, and 50%). The model's performance was evaluated using a multi-sized image quality phantom acquired under six different radiation dose levels (0.48, 0.97, 1.93, 3.87, 7.74, and 15.47 mGy). The images were reconstructed using filtered back projection (FBP) and three strength levels of the DLR (low, medium, high). The FBP images were denoised using the LDM. We compared the detectability index (d'), a task-based detection performance metric that reflected spatial resolution and noise properties, between LDM and DLR using these images. The d' values were obtained under various combinations of three target sizes (10, 5, and 1 mm), five inlet contrasts (CT value differences with the background: -895, 50, 90, 335, and 1000 HU), and five phantom diameters (36, 31, 26, 21, and 16 cm). An increase in d' was observed in LDM compared to DLR-low, DLR-medium, and DLR-high.

**RESULTS**

The overall mean d' values measured in LDM increased by 86% (range: -21~297%) compared to DLR-low, by 56% (-31~240%) compared to DLR-medium, and by 22% (-49~164%) compared to DLR-high. Overall, there was an improvement in performance, but occasionally, a few values suffered at high contrast inlets with low dose conditions.

**CONCLUSION**

The mean detectability of the LDM was shown to be superior to that of the vendor-specific DLR at all strengths.

**CLINICAL RELEVANCE/APPLICATION**

This denoising model may provide a potential solution for enhancing the detectability of low-contrast objects while simultaneously preserving diagnostic details, thereby improving clinical outcomes.

## W6-SSPH10-6 CONSISTENCY OF LARGE LANGUAGE MODEL (LLM)-AIDED MODEL FOR FIVE-YEAR POST-CYSTECTOMY SURVIVAL PREDICTION OF BLADDER CANCER PATIENTS

Elaine M. Caoili, MD, MS (*Abstract Co-Author*) Steering Committee, ProKidney, LLC
Chuan Zhou, PhD (*Abstract Co-Author*) Scientific Advisory Board, Perception Vision Medical Technology Co., Ltd
Vikas Gulani, MD, PhD (*Abstract Co-Author*) Research support, Siemens AG;Consulting, Cook Group Incorporated
Ajjai S. Alva, MD (*Abstract Co-Author*) Advisory Board, Merck & Co, Inc;Institutional Research Grant, Merck & Co, Inc;Advisory Board, Bristol-Myers Squibb Company;Institutional Research Grant, Bristol-Myers Squibb Company;Advisory Board, AstraZeneca PLC;Institutional Research Grant, AstraZeneca PLC;Institutional Research Grant, Prometheus Pharmaceuticals;Institutional Research Grant, Lantheus Holdings;Institutional Research Grant, Bolt Biotherapeutics, Inc;
Richard H. Cohan, MD (*Abstract Co-Author*) Co-author, Wolters Kluwer nv
Lubomir M. Hadjiiski, PhD (*Abstract Co-Author*) Nothing to Disclose
John Gormley (*Abstract Co-Author*) Nothing to Disclose
Grace Bruno (*Abstract Co-Author*) Nothing to Disclose
Heang-Ping Chan, PhD (*Abstract Co-Author*) Nothing to Disclose
Di Sun, MEng, BEng (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the performance consistency of a large language model (LLM)-aided survival prediction model that combined clinical, radiomic, and deep learning (CRD) information, for 5-year post-cystectomy survival prediction of bladder cancer patients.

**METHODS AND MATERIALS**

With IRB approval, we identified 781 patients with bladder cancer. Inclusion criteria were (1) having undergone neoadjuvant chemotherapy (NAC); (2) having CT Urogram (CTU) before and after NAC; (3) having undergone radical cystectomy; and (4) having a known 5-year survival status post-cystectomy that could be used as ground truth. The criteria were met by 163 patients, and they were split into three sets: training (56%: 55 alive (A); 37 deceased (D)); validation (4%: 4 A; 3 D); and test (40%: 20 A; 44 D). The predictive model, CRD, was based on clinical descriptors, including pathological stage, lymph nodes stage, and lymphovascular invasion status, extracted by GPT-4 from the medical records, and radiomics and deep-learning features extracted from CTU images. The clinical and imaging information were fused with a neural network to provide survival prediction. We tested the performance consistency of the trained CRD model due to the variabilities in information extraction by GPT-4 when different prompts were used or repeated queries with the same prompt by different users. We designed two prompts for information extraction: Prompt1 (P1, concise) and Prompt2 (P2, detailed and with constraints). P2 was used by two users (User1 and User2) to test the reproducibility of GPT-4. The area under the ROC curve (AUC) was used to assess the CRD model classification performance on the test set. The Kaplan-Meier survival analysis was used to evaluate the CRD predictions. The consistency of CRD predictions when using different prompts or when repeated queries were performed was evaluated by the Intraclass Correlation Coefficient (ICC).

**RESULTS**

The CRD model achieved AUCs of 0.86±0.05 (P1), 0.83±0.05 (P2-User1), and 0.86±0.05 (P2-User2). Regardless of the prompt or the users, the model could significantly stratify the deceased and alive groups ($p<0.001$). The agreement of CRD prediction between (1) P1 and P2-User1 and (2) P2-User1 and P2-User2 was ICC=0.979 and ICC=0.995, respectively.

**CONCLUSION**

While larger data sets are needed for further validation, this study demonstrates the robustness of the CRD model in terms of different prompts and repeated queries with the same prompt, in predicting the 5-year survival of bladder cancer patients post-cystectomy.

## CLINICAL RELEVANCE/APPLICATION

Accurate five-year survival prediction for bladder cancer patients post-cystectomy can provide valuable information for treatment planning, patient counseling, decision-making, and resource allocation.
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W6-STCE1

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Wednesday, Dec. 4 1:30PM - 2:00PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## W6-STCE1-1 ASSESSING THE IMPACT OF THE COVID-19 PANDEMIC ON RADIOLOGY IMAGING VOLUMES AND EFFICIENCY: A QUALITY IMPROVEMENT REPORT

Judy Burleson (*Abstract Co-Author*) Nothing to Disclose
Mike Simanowith (*Abstract Co-Author*) Nothing to Disclose
Mythreyi Bhargavan-Chatfield, PhD (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Davenport, MD (*Abstract Co-Author*) Royalties, Wolters Kluwer nv
Haniyeh Zamani, BS (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the effects of the COVID-19 pandemic on radiology imaging volumes and radiologist productivity. The study focuses on changes in efficiency, sustainability, and health equity across diverse radiology facilities in the United States.

### METHODS AND MATERIALS

A comprehensive analysis was conducted on imaging volumes from 197 radiology facilities and 1,600 radiologists across 23 states, including academic institutions (N=5), community hospitals (N=79), multi-specialty clinics (N=5), freestanding imaging centers (N=109), and other facilities (N=5). Data from 12.4 million imaging examinations were collected from December 1, 2017, to February 28, 2023, covering pre-pandemic, pandemic, and post-pandemic periods. Six modalities were analyzed: computed tomography (CT), mammography, magnetic resonance imaging (MRI), X-ray, ultrasound, and positron emission tomography (PET)-CT. Workforce numbers, workload, non-physician practitioner (NPI) attrition, and turnover were tracked quarterly using the American College of Radiology (ACR) General Radiography Improvement Database (GRID), with National Provider Identifiers (NPIs) used to identify individual radiologists.

### RESULTS

Of the 1,600 radiologists, 804 (50%) participated throughout the study, with 581 (36%) maintaining a consistent volume of at least 100 examinations per quarter. The average number of exams read per day increased by 1.4% from 2017 to 2023 (from 49.5 to 50.9), following a notable 35% decline per quarter during the peak pandemic period (March-May 2020, from 2,015,150 to 1,304,748). High-productivity radiologists experienced a 25.4% increase in exams read per day (from 52.3 to 65.6) and a 24.4% rise in clinical days worked per quarter (from 37.7 to 46.9) from 2017 to 2022. Despite significant turnover, the number of unique radiologists grew from 997 to 1,144, with days worked per NPI per quarter remaining stable (40 days vs. 39 days).

### CONCLUSION

The study reveals a full recovery in radiology imaging volumes and improved efficiency post-pandemic, with notable increases in productivity among high-volume radiologists. These findings highlight the resilience of radiology practices and underscore the need for a sustainable solution to the mismatch between imaging demand and radiologist supply.

### CLINICAL RELEVANCE/APPLICATION

The insights gained can inform policy-making and operational adjustments to better address future disruptions and support radiology care delivery into the future.

## W6-STCE1-2 COMPARATIVE ANALYSIS OF ENERGY CONSUMPTION FOR VIRTUAL AND CLINICAL TRIALS IN RADIOLOGY

Francesco Ria, DMP (*Abstract Co-Author*) Metis Health Analytics
Mina Mohammadi (*Abstract Co-Author*) Nothing to Disclose
Ehsan Samei, PHD (*Abstract Co-Author*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc
Liesbeth Vancoillie, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Evaluate and compare the energy consumption of virtual computed tomography (CT) simulations versus real clinical CT studies, to assess the potential sustainability advantages of virtual trials.

### METHODS AND MATERIALS

We analyzed energy consumption for a clinical abdominal CT scan and a virtual chest-abdomen CT scan. For the virtual scan, we selected an anthropomorphic computational XCAT phantom from a previously established database. The phantom was imaged using a scanner-specific CT simulator (DukeSim, Duke University) running on a cluster with 8 GPUs. The baseline energy consumption of the cluster during idle time needed to be calculated by measuring the energy usage without any active jobs. These results were compared to clinical abdominal CT imaging energy consumption data reported in literature.

### RESULTS

Running the simulation on the cluster, we recorded a total energy consumption of 0.305 kWh over 52 minutes, including a baseline consumption of 0.085 kWh for idle time and 0.221 kWh for active usage. In comparison, literature estimates for clinical abdominal CT scans range from 0.2 kWh to 11.4 kWh, depending on whether only the scan time or the total patient room time is considered. Including the total patient room time accounts for the idle time of the CT scanner as well. A typical clinical patient room visit took around 20 minutes, with only about one minute dedicated to the scan itself. This places the energy consumption of virtual trials at the lower end of the clinical range. Notably, the idle time for the cluster (0.085 kWh) is considerably lower than the energy consumption for patient room time with a CT scanner (2.9 kWh). The virtual simulation, instead, required longer time (52 minutes), but ran in the background with minimal direct human intervention.

### CONCLUSION

Virtual trials demonstrate comparable energy consumption to clinical CT scans, and even significantly lower consumption when accounting for the idle time. Because virtual trials offer time, cost, ethical, and sustainability benefits, they can be implemented to design and test optimization actions before clinical applications. Additionally, imaging physical phantoms in virtual environments could further reduce both energy consumption and runtime due to their simpler structure.

### CLINICAL RELEVANCE/APPLICATION

Integrating virtual simulations into clinical research not only provides known advantages in terms of time, cost, and ethics but also offers significant sustainability benefits. Hospitals seeking optimization or innovation should strongly consider initial investigations through virtual trials.

## W6-STCE1-3 GLOBAL VALIDATION OF OSTEOPOROSIS SCREENING ON CHEST RADIOGRAPHS

Namkug Kim, PhD (*Abstract Co-Author*) Stockholder, Anymedi, Inc
Miso Jang (*Abstract Co-Author*) Nothing to Disclose
Minjee Kim (*Abstract Co-Author*) Nothing to Disclose
Jinhoon Jeong (*Presenter*) Nothing to Disclose

### PURPOSE

Osteoporosis, a global health concern, affects 19.7% of the population worldwide, with a higher prevalence in developing countries. Previous studies suggest that osteoporosis screening can effectively reduce societal costs by preventing osteoporotic fractures. The incidence of fragility fractures and their associated healthcare expenditures are expected to increase in the coming years due to demographic shifts towards an aging population. To address this issue, we propose a cost-effective screening method utilizing chest radiographs, which offer superior accessibility and cost-efficiency compared to other diagnostic tools.

### METHODS AND MATERIALS

We evaluated our osteoporosis screening model using four external datasets, which comprised chest radiograph (CXR) data paired with dual-energy X-ray absorptiometry (DXA) results from individuals aged over 50 years. We utilized data from four distinct external datasets. Dataset A is sourced from a tertiary university hospital. Dataset B originates from a secondary care hospital specializing in spine and joint care, which has a relatively lower proportion of osteoporosis patients. Dataset C is from a hospital for veterans, representing diverse settings within the healthcare system and featuring a higher proportion of males and elderly individuals. Datasets A, B, and C are all based in South Korea. Conversely, dataset D was obtained from a global medical imaging platform, with most data sourced from the United States and Brazil. A commercial AI tool (PROS® CXR: OSTEO, PROMEDIUS INC, Seoul, Korea) was retrospectively applied to CXRs to predict osteoporosis. CXR manufactures of each hospital were very different .The accuracy of this AI tool was assessed by comparing its predictions to osteoporosis diagnoses made using DEXA scans, which served as the reference standard. We evaluated the area under the receiver operating characteristic curves (AUCs), sensitivity, specificity, and F1 score.

### RESULTS

Dataset A comprised 1,089 individuals, with 969 females (mean age 58 years) and 120 males (mean age 59 years), and an osteoporosis prevalence of 29.2%. Dataset B included 3,338 individuals, with 1,854 females (mean age 59 years) and 1,484 males (mean age 59 years), showing an osteoporosis prevalence of 6.0%. Dataset C consisted of 937 individuals, with 411 females (mean age 72 years) and 526 males (mean age 74 years), with an osteoporosis prevalence of 24.9%. Dataset D included 295 individuals, with 288 females (mean age 66 years) and 7 males (mean age 69 years), and an osteoporosis prevalence of 18.3%. In the A dataset, the performance was AUC 0.89, sensitivity 0.84, specificity 0.76, and F1 score 0.70. In the datasets B, C, and D, AUC was 0.92, 0.89, and 0.81, sensitivity was 0.71, 0.85, and 0.39, specificity was 0.92, 0.77, and 0.94, and F1 score was 0.48, 0.67, and 0.47, respectively.

### CONCLUSION

Osteoporosis screening using CXR demonstrated excellent performances of general usability across a variety of quality and multiple machines of chest radiographs from multiple hospitals with various conditions.

### CLINICAL RELEVANCE/APPLICATION

Osteoporosis diagnosis is critical for initiating timely interventions to prevent fractures. This study proposes leveraging CXRs, which are widely accessible and routinely performed, as an innovative screening tool for osteoporosis, particularly in resource-constrained settings. This approach has the potential to expand diagnostic capabilities and promote earlier treatment initiation across a broader patient demographic, thereby improving detection of osteoporosis and reducing the burden of osteoporotic fractures especially in developing countries.

# Abstract Archives of the RSNA, 2024

W6-STCE2

**Science Session (Theranostics)**

Wednesday, Dec. 4 1:30PM - 2:00PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## W6-STCE2-2 CARDIAC MRI AND ENDOMYOCARDIAL BIOPSY IN FULMINANT MYOCARDITIS: INSIGHTS FROM DIAGNOSIS TO PROGNOSIS

Minjie Lu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shihua Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Yining Wang (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to compare the role of cardiac magnetic resonance imaging (MRI) and endomyocardial biopsy (EMB) findings in the diagnosis, choice of therapeutic strategy, and risk stratification of patients with FM.

### METHODS AND MATERIALS

Data were collected from 75 adult patients with clinically suspected myocarditis who underwent both 3.0T cardiac MRI and EMB. Receiver operating characteristic curves were used to assess the ability of cardiac MRI parameters to diagnose FM, and the cut-off values obtained were used to establish the MRI criteria. Major adverse cardiovascular events were defined as cardiac death and cardiac transplantation. The impact of the selected variables on prognosis was analyzed using univariate Cox analysis and Kaplan-Meier survival curves.

### RESULTS

32 patients (42.7%) were assigned to the FM group, of which 24 (75.0%) were confirmed by EMB and 29 (90.6%) by cardiac MRI, with areas under the curve of 0.90 and 0.63, respectively. Patients who meet the MRI criteria were more likely to undergo temporary mechanical circulatory assistance, and patients confirmed by EMB used corticosterone and or immunoglobulin more often. After a median of 912 days of follow-up, 12 patients experienced adverse cardiovascular events, including 9 cardiac deaths and 3 heart transplants. Giant cell myocarditis, left ventricular anterior wall late gadolinium enhancement (LGE), and transmural LGE were the strongest prognostic predictors.

### CONCLUSION

By providing a comprehensive assessment of myocardial with more precise tissue characterization, cardiac MRI will help cardiologists and intensive care unit doctors to quickly confirm FM and identify high-risk patients. The combination of imaging information and pathological findings will also help to better determine the severity of myocardial inflammation and improve therapeutic strategies accordingly.

### CLINICAL RELEVANCE/APPLICATION

By providing information on myocardial tissue characteristics, cardiac magnetic resonance imaging can accurately diagnose fulminant myocarditis, as well as provide further prognostic and therapeutic guidance, complementing endomyocardial biopsy. Early imaging and pathological examination and universal access to certain technologies, such as quantitative parametric mapping and immunohistochemistry, will provide important insights for the effective management of the disease. Future efforts could target the different roles of cardiac MRI and EMB in the diagnosis and prognostic prediction of FM, as well as standardizing and updating the management guidelines of myocarditis to maximize patient benefits.

## W6-STCE2-3 PERILESIONAL ENHANCEMENT ON MRI PREDICTS PROGNOSIS IN PATIENTS UNDERGOING IMMUNOTHERAPY FOLLOWED BY RADICAL SURGERY FOR INTRAHEPATIC CHOLANGIOCARCINOMA

Liheng Liu (*Abstract Co-Author*) Nothing to Disclose
Jingjing Liu (*Abstract Co-Author*) Nothing to Disclose
Tingting Mu (*Abstract Co-Author*) Nothing to Disclose
Gengyun Miao (*Presenter*) Nothing to Disclose

### PURPOSE

Intrahepatic cholangiocarcinoma (ICC) is a highly invasive cancer with a poor prognosis, where surgery is often the only curative option. Due to the advanced stage at which ICC is often diagnosed, neoadjuvant therapy can transform locally advanced or unresectable tumors into resectable ones. Recently, immunotherapy has gained attention as a treatment strategy for ICC. This study aimed to investigate the correlation between imaging features and the prognosis of patients with ICC who received immunotherapy before surgery.

### METHODS AND MATERIALS

This retrospective study included 77 patients with surgically resected ICC who had undergone immunotherapy prior to surgery. All patients underwent magnetic resonance imaging (MRI) before immunotherapy. Qualitative and quantitative MRI characteristics evaluated included tumor morphology,

intrahepatic duct dilatation, hepatic capsule retraction, target sign on diffusion-weighted imaging (DWI), arterial-phase enhancement pattern, venous- and delayed-phase enhancement patterns, perilesional enhancement, tumor size, number of tumors, and the mean apparent diffusion coefficient. Additional clinicopathological features were also assessed for their prognostic value. Univariate and multivariate Cox proportional hazards models were used to analyze the relationship between MRI features and ICC prognosis, with P values < 0.05 indicating statistical significance.

**RESULTS**

Univariate Cox analysis identified the number of tumors, perilesional enhancement, and microvascular invasion (MVI) on pathology as being correlated with prognosis (P = 0.031, 0.032, and 0.001, respectively). Multivariate Cox analysis demonstrated that perilesional enhancement and pathologic MVI were independent risk factors for poor prognosis in ICC patients (P = 0.031, 0.004, respectively).

**CONCLUSION**

The number of tumors, perilesional enhancement, and pathologic MVI are significant predictive factors for prognosis in ICC patients who received immunotherapy before surgery. Specifically, perilesional enhancement and pathologic MVI are independent risk factors for poor prognosis in these patients.

**CLINICAL RELEVANCE/APPLICATION**

Identifying predictive factors for prognosis in patients with intrahepatic cholangiocarcinoma (ICC) undergoing immunotherapy followed by radical surgery is crucial for optimizing treatment strategies and improving patient outcomes. This study demonstrates that perilesional enhancement on MRI and pathologic microvascular invasion (MVI) are significant independent risk factors for poor prognosis in this patient population. Clinically, these findings suggest that incorporating MRI-based evaluation of perilesional enhancement into preoperative assessment protocols can help in stratifying patients based on their risk and guiding treatment decisions. Furthermore, recognizing patients with high-risk features such as perilesional enhancement and patho-MVI may prompt closer monitoring and more aggressive therapeutic approaches post-surgery, ultimately enhancing the management and survival rates of patients with ICC.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

W7-SSBR09

**Breast Imaging (Risk Models for Disease Detection and Treatment)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S406A

Despina Kontos, PhD (*Moderator*) Institutional Research Grant, Hologic, Inc;Institutional Research Grant, iCAD, Inc
Thomas H. Helbich, MD, MBA (*Moderator*) Grant, Siemens AG;Grant, Bracco Group;Grant, Guerbet SA;Grant, Hologic, Inc;Grant, Novomed GmbH

**Sub-Events**

## W7-SSBR09-1 COMPARATIVE 15-YEAR PERFORMANCE OF MAMMOGRAPHY ARTIFICIAL INTELLIGENCE, CLINICAL BREAST CANCER RISK, AND POLYGENIC RISK MODELS

Nola M. Hylton, PhD (*Abstract Co-Author*) Institutional research support, General Electric Company;Institutional research support, Kheiron Medical Technologies Ltd
Joe Rothstein (*Abstract Co-Author*) Nothing to Disclose
Albert Pu (*Abstract Co-Author*) Nothing to Disclose
Tejomay Gadgil (*Abstract Co-Author*) Nothing to Disclose
Stacey Alexeeff (*Abstract Co-Author*) Nothing to Disclose
Yiwey Shieh (*Abstract Co-Author*) Nothing to Disclose
Jeffery Tice (*Abstract Co-Author*) Nothing to Disclose
Laurel Habel (*Abstract Co-Author*) Nothing to Disclose
Ninah Achacoso (*Abstract Co-Author*) Nothing to Disclose
Lawrence Kushi (*Abstract Co-Author*) Nothing to Disclose
Jun Shan (*Abstract Co-Author*) Nothing to Disclose
Li Shen, PhD (*Abstract Co-Author*) Nothing to Disclose
Catherine Lee (*Abstract Co-Author*) Nothing to Disclose
Amethyst Leimpeter (*Abstract Co-Author*) Nothing to Disclose
Mark Westley (*Abstract Co-Author*) Nothing to Disclose
Marvella Villasenor (*Abstract Co-Author*) Nothing to Disclose
Laura J. Esserman, MD (*Abstract Co-Author*) Nothing to Disclose
Weiva Sieh, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Lori Sakoda (*Abstract Co-Author*) Nothing to Disclose
Lawrence Gerstley (*Abstract Co-Author*) Nothing to Disclose
Vignesh A. Arasu, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the relative performance of three domains of breast cancer risk models—the Mirai mammography artificial intelligence (AI) algorithm, the Breast Cancer Surveillance Consortium version 3 (BCSC v3) clinical risk model, and a polygenic risk score (PRS)—alone and in combination over 15-year time horizon.

### METHODS AND MATERIALS

A prospective cohort was drawn from >400,000 patients enrolled in a large research study as part of an integrated US health system between 2008 and 2011. Women with a history of breast cancer were excluded. At enrollment, participants answered a health survey, which was used with data from the electronic health record to generate the BCSC v3 5-year risk score. The full-field digital screening mammogram performed closest in time to enrollment as part of routine care was used to generate the Mirai algorithm 5-year risk score. The mammogram date defined the study index time. Participants also provided saliva that was genotyped with an Affymetrix Axiom array and used to generate a PRS. Incident cancer outcomes were ascertained using the regional Tumor Registry. Cancers occurring in the first 3 months after the mammogram were removed to separate the effect of future risk vs. AI-aided detection. Risk estimates for incident breast cancer 0.25 to 15 years after the initial mammographic examination were calculated using a time-dependent area under the receiver operating characteristic curve (AUC). Combined models using two or more individual risk models were fit using a Cox model, with 10-fold cross-validation used to estimate the time-dependent AUC.

### RESULTS

We present preliminary analysis for 42,098 women with complete data for Mirai AI, BCSC v3 risk score, and in-progress genotype data. There were 2055 incident cancers. The time-dependent AUC for BCSC vs. Mirai was 0.63 vs. 0.68 at 5 years, 0.60 vs. 0.65 at 10 years, and 0.58 vs. 0.67 at 15 years. The top 30% of Mirai risk predicted 50% of cancers, whereas the top 30% of BCSC risk predicted 41% of cancers. The AUCs for the combined Mirai and BCSC models were lower than for the Mirai model alone.

### CONCLUSION

The Mirai model risk model predicts future risk of breast cancer better than the BCSC v3 clinical model out to 15 years. Performance of all models decreased at 10- and 15-year time horizons, but Mirai continued to have relatively higher performance than BCSC. The addition of BCSC to Mirai in a combined model worsened performance. PRS results are near completion and will be shared if accepted for presentation.

### CLINICAL RELEVANCE/APPLICATION

Mirai mammographic AI model continues to demonstrates strong long term future breast cancer risk prediction at a 15 year time horizon, better than the BCSC clinical risk model.

## W7-SSBR09-2 DEEP LEARNING EXTRACTION OF BREAST DENSITY RELATED FEATURES FOR RISK PREDICTION

Daan Van Den Oever (*Abstract Co-Author*) Nothing to Disclose
Ioannis Sechopoulos, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research Grant, Sectra AB;Research Grant, ScreenPoint Medical BV;Research Grant, Volpara Health Technologies Limited
Raneim Nabil Hossni Mohamed (*Presenter*) Nothing to Disclose

### PURPOSE

To capture the intrinsic patterns of fibroglandular tissue from a single mammogram as an initial step towards quantifying longitudinal dense tissue pattern changes for improved breast cancer risk prediction.

### METHODS AND MATERIALS

The study was conducted on retrospectively collected raw and processed digital mammography exams (N = 3,000) of women participating in the Dutch breast cancer screening program between 2008 and 2018. Density maps were generated from the raw mammograms with a commercially available automated software program. The maps represent the amount of fibroglandular tissue in mm. A modified U-Net was trained to extract features from mammograms by predicting the density map from the processed mammogram. The density features are extracted from the last layer of the encoder part of the network. To ensure that the features are density related, the model is trained with a loss combining the mean square error (MSE) of the density map and a cosine embedding loss. The cosine embedding loss compares the features of the proposed network to the features of a helper U-Net, pre-trained to compress density maps. The performance of the density map generation was evaluated using the structural similarity index measurement (SSIM) (0: no similarity, 1: perfect similarity) and MSE inside the breast region. The similarity between features of the network with the helper network was measured by using the cosine similarity. All values are given in median (95% confidence interval).

### RESULTS

The model achieved an SSIM of 0.87 (0.86 - 0.87) and an MSE of 4.17 (3.35 - 4.99). The helper network, compressing density maps, achieved an SSIM of 0.99 (0.99 - 0.99) and an MSE of 0.49 (0.18 - 0.82). The cosine similarity between the features was 0.82 (0.81 - 0.82). Visual inspection shows similar density patterns between predicted density maps and ground truth.

### CONCLUSION

The proposed model was able to extract features from processed mammograms similar to those of the helper model. Simultaneously, the model generates realistic density maps. This indicates that the model can generate features from processed mammograms that capture density patterns.

### CLINICAL RELEVANCE/APPLICATION

The proposed model could be leveraged as an initial step for downstream tasks such as predicting breast cancer risk, treatment effects, and recurrence based on changes to the dense tissue pattern in mammograms.

## W7-SSBR09-3 PROGNOSTIC VALUE OF DL-BASED QUANTIFICATION OF BREAST ARTERY CALCIFICATION FROM ROUTINE MAMMOGRAPHY FOR CARDIOVASCULAR DISEASE AND MORTALITY RISK PREDICTION

Marly Van Assen, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
William C. O'Neill, MD (*Abstract Co-Author*) Nothing to Disclose
Aisha Urooj (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Imon Banerjee, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Gershon, BS (*Abstract Co-Author*) Nothing to Disclose
Theodorus Dapamede, MD, PhD (*Presenter*) Intern, MARS BioImaging Ltd

### PURPOSE

Breast artery calcification (BAC), often incidentally detected during mammography, is rarely reported or quantified by radiologists, despite its potential as an independent cardiovascular disease (CVD) risk factor. This study evaluates the prognostic value of BAC in predicting CVD outcomes and mortality in a population who underwent cardiac CT scans to identify populations that may benefit most from BAC quantification.

### METHODS AND MATERIALS

We included 4,668 patients who underwent cardiac CT (Coronary Artery Calcium [CAC] Scoring CT or Coronary CT Angiography [CCTA]) and had a screening mammogram between 2010 and 2023. Structural CTAs were excluded. If a patient had multiple mammograms, the mammogram closest to the cardiac CT was included. First Cardiovascular Event (angina, atherosclerosis, transient ischemic attack, etc), Hard Event (MACE), and Death were studied as primary outcomes. Patients were grouped into: screening population with CAC scoring only (Screening), Screening Subgroup with CAC score of zero (CAC-zero), symptomatic patients with CCTA +/- CAC scoring (Symptomatic), and Symptomatic Subgroup with Heart Failure (Symptomatic-HF). Using a previously validated deep learning (DL) model, we calculated BAC area using the mediolateral oblique (MLO) views of screening mammograms and categorized patients into three BAC grades (<10 mm2, 10-40 mm2, and >40 mm2). Univariable and multivariable Cox Proportional Hazard (CPH) and Hazard Ratios (HR) were calculated.

### RESULTS

In the Screening group, all BAC grades were strong univariate and multivariate predictor for First Event, Hard Event, and Death. For prediction of Hard Events, HR for BAC was greater (2.84 (95%CI: 1.36 - 5.92, p=0.01) than CAC score (HR: 1.88, 95%CI: 1.35-2.63, p<0.005). In the CAC-zero group, BAC was a strong univariable predictor for First Event (HR: 1.95, 95%CI: 1.14 - 3.33, p=0.02) and Hard Event (HR: 7.98, 95%CI: 2.02 - 31.58, p<0.005). BAC was also a strong univariate (HR: 5.59, 95%CI: 2.06-15.19, p<0.005) and multivariate (HR: 3.69, 95%CI: 1.17-11.65) predictor for Hard Events in the Symptomatic group. BAC was not a significant predictor of events in the Symptomatic-HF subgroup in both univariate and multivariate analysis.

### CONCLUSION

Our study underscores the significant prognostic value of BAC in predicting CVD outcomes and mortality, particularly in populations where CAC scoring is not feasible or when patients have no detectable CAC.

### CLINICAL RELEVANCE/APPLICATION

DL-based BAC quantification can serve as a screening tool available to over 40M women annually who undergo screening mammography. This would enable early identification and risk stratification of CVD in females who are primarily underdiagnosed compared to their male counterparts.

## W7-SSBR09-4 CHALLENGES IN AI-BASED DIAGNOSTIC IMAGE QUALITY ASSESSMENT OF MAMMOGRAMS

Solveig S. Hofvind (*Abstract Co-Author*) Nothing to Disclose
Stefano Gianolini, PhD (*Abstract Co-Author*) Nothing to Disclose
Malik Galijasevic, MD (*Abstract Co-Author*) Nothing to Disclose
Wolfram Santner, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie Frei (*Abstract Co-Author*) Nothing to Disclose
Johanne-Gro Stalheim (*Abstract Co-Author*) Nothing to Disclose
Gerlig Widmann, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Tina Santner, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

In mammography, diagnostic image quality with high positioning accuracy is substantial. The rise of artificial intelligence (AI) in radiology could open up new opportunities to facilitate, accelerate and objectify diagnostic quality assessment in daily routine.Purpose of the present work was to compare results from a prototype AI software to those of human expert readers as a framework for AI-based quality assessment.

### METHODS AND MATERIALS

From an extensive multicenter PGMI case collection (13 institutions, 3 vendors), 130 random cases (520 images) and 70 challenging cases (280 images) were selected. Three expert radiographers and one screening radiologist classified all images by consensus review using the PGMI system (perfect, good, moderate, inadequate). For comparison, a deep-learning based prototype software, trained in a multi-task manner for segmentation, detection, and classification of quality features was used.The PGMI categories from human and AI reading were analyzed for agreement using Cohen's Kappa and Landis and Koch classification. Frequency and reasons for disagreement were evaluated.

### RESULTS

CC view: "Pectoral muscle visibility" showed best values with substantial to almost perfect agreement. Most other categories showed fair agreement in the random sample, decreasing to slight or poor in the challenging sample. "Medial gland" and "lateral gland" showed slight and poor agreement in both samples.MLO view: "Pectoralis angle" showed moderate agreement in the random and fair agreement in the challenging sample. The other categories showed fair or slight agreement in the random sample, decreasing to poor agreement for the "pectoralis nipple line" and "nipple in profile" in the challenging sample.Skinfold detection was not an available feature of the AI software at the time of the study.The summary PGMI grade per image showed a total agreement and difference in one grade in 50.77% and 44.04% in the random sample and 49.64% and 43.93% in the challenging sample.Total agreement on inadequate images showed 6/51 cases in the random and 7/69 cases in the challenging sample, with difference in one grade in 30 and 54 cases, respectively.The work-up of disagreement identified misinterpretations of anatomical landmarks and causality issues in the categorization.

### CONCLUSION

Transformation of the PGMI system into a fully automated AI algorithm is challenging and may differ substantially between subcategories.

### CLINICAL RELEVANCE/APPLICATION

AI-based diagnostic quality evaluation of mammograms showed total agreement in PGMI classification of only about 50% and needs further refinement before full integration as an objective real-time quality management tool.

## W7-SSBR09-5 DEVELOPMENT OF MACHINE LEARNING MODELS FOR PREDICTION OF PATHOLOGIC COMPLETE RESPONSE IN BREAST CANCER USING CLINICAL, MRI-RADIOMIC AND MRI-QUALITATIVE DATA

Corinne Balleyguier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tarek Assi (*Abstract Co-Author*) Nothing to Disclose
Charles Aboudaram (*Abstract Co-Author*) Nothing to Disclose
Nathalie B. Lassau, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rami Hajri, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Pathological complete response (pCR) is considered to be a prognostic surrogate endpoint for superior long-term clinical outcomes in some histological subtypes of breast cancer patients treated with neoadjuvant therapy. The objective of this study is to develop and evaluate machine learning-based biomarkers to predict pCR and recurrence-free survival (RFS).

### METHODS AND MATERIALS

This retrospective, monocentric analysis included 235 women (mean age 46) with non-metastatic breast cancer, treated with neoadjuvant therapy. We performed an analysis of the clinical features (age, genetic mutations, TNM staging, hormonal receptors expression, HER2 status and histological grade), in addition to morphologic and radiomic data extracted from pre-treatment MRI. We developed different models trained on these three sources of data and their combinations: clinical features, qualitative analysis of breast MRI by the radiologist according to ACR BI-RADS Atlas (size, analysis of T2 signal and surrounding edema), and the radiomic data extracted from the conventional pre-therapeutic MRI sequences (T1-weighted contrast-enhanced and T2-weighted images). Patients were separated into a training group and a test group with different MRI models to ensure the reproducibility of the results. A customized Machine Learning pipeline was used to handle these different types of data consisting of a feature selection and a classifier.

### RESULTS

The prediction ability of the best model was superior using radiomics features, with the best model achieving an AUC of 0.72. A split into subgroups in the cohort was performed in order to reflect the differences according to the molecular profiles. The optimal performance was recorded among triple-negative

(AUC of 0.80) and HER2+ subgroups (AUC of 0.65). Due to short follow-up of patients and low sample size, the prediction of RFS was promising with relatively acceptable AUC values, but lacked statistical power.

**CONCLUSION**

This study suggests that machine learning models based on clinical data and pre-treatment MRI morphologic and radiomic data can help predict the pCR in breast cancer patients receiving neoadjuvant therapy, regardless of MRI's model.

**CLINICAL RELEVANCE/APPLICATION**

With potentially growing indications of neoadjuvant therapy in breast cancer patients, prediction of the pCR could eventually lead to optimized treatment tailoring thus improving the personalization of therapeutic strategies and may even in the future avoid surgery in some cases.

## W7-SSBR09-6 CLINICAL APPLICATION OF NOVEL MOBILE AI SOLUTION FOR REAL-TIME DETECTION AND DIFFERENTIAL DIAGNOSIS IN BREAST ULTRASOUND: A FIRST PROSPECTIVE FEASIBILITY STUDY

Won Hwa Kim, MD, PhD (*Abstract Co-Author*) Stockholder, BeamWorks
Hye Jung Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Jaeil Kim, PhD (*Presenter*) Stockholder, BeamWorks, Inc.

**PURPOSE**

Conventional artificial intelligence (AI) solutions for breast ultrasound are designed to aid in the process of differential diagnosis, serving as computer-aided diagnosis (CADx) systems. However, prior to conducting a differential diagnosis, ultrasound requires the process of detection to ensure that clinically significant lesions are not missed during scanning. We suggest a mobile AI solution to supports detection (CADe) and differential diagnosis (CADx) in real-time during scanning. This study aims to evaluate the feasibility of a mobile AI solution prospectively in real-world clinical settings.

**METHODS AND MATERIALS**

From August to December 2023, a feasibility study was conducted in tertiary medical center of Taiwan using mobile AI solution (CadAI-B for breast, BeamWorks Inc., Korea). CadAI-B is connected to an ultrasound equipment using tablet PC. It supports healthcare providers to detect suspicious breast lesions by highlighting suspicious area during breast ultrasound scanning, and to make a differential diagnosis by providing BI-RADS categories and malignancy score (0-100%). The rate of real-time detection in malignancies and area under the receiver operating characteristic curve (AUC) was calculated. Distribution of BI-RADS categorized by CadAI-B were compared with those by breast imaging experts on independent review.

**RESULTS**

The analysis included 33 patients with an average age of 47 years (IQR, 44 - 62). There were 14 malignancies, 17 benign lesions, and 2 normal cases, and 30 patients (90.9%) underwent biopsy. For patients with malignancies, CadAI-B successfully identified all malignancies. Overall diagnostic performance, as AUCs calculated by the malignancy score and BI-RADS, was 0.835 and 0.850, respectively. The per-patient sensitivity of CadAI-B was 100.0%, while the specificity was 52.6%. The BI-RADS distribution between CadAI-B and expert was the same in malignant cases. In benign cases, CadAI-B categorized 9 cases (50.0%) as C4A or C4B, while experts classified 13 cases (72.2%), indicating a potential reduction in the need for biopsy.

**CONCLUSION**

This study demonstrates that real-time processing capabilities of CadAI-B enable the identification of critical lesions during breast ultrasound, helping to reduce unnecessary biopsy. These findings may helpful in diagnostic decisions and training of non-experts in clinical settings and offer the potential to improve workflow efficiency.

**CLINICAL RELEVANCE/APPLICATION**

This mobile real-time AI solution could aid in diagnostic decision-making and the training of non-experts. Of particular significance is the potential to facilitate ultrasound-based triage for breast cancer screening in low-resource settings or remote areas.

# Abstract Archives of the RSNA, 2024

W7-SSCA08

**Cardiac Imaging (Risk Prediction and Outcomes)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E353C

Suhny Abbara, MD (*Moderator*) Royalties, RELX
Monika Radike, MD, PhD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W7-SSCA08-1 MACHINE LEARNING FOR PREDICTION OF MAJOR ADVERSE CARDIAC EVENTS IN HYPERTROPHIC CARDIOMYOPATHY

Joao F. Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Vishesh Sood, MD (*Abstract Co-Author*) Nothing to Disclose
Chris McIntosh (*Abstract Co-Author*) Nothing to Disclose
Hayley McKee, MSc, BSc (*Abstract Co-Author*) Nothing to Disclose
Thomas Geyer, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Existing methods for risk stratification in patients with hypertrophic cardiomyopathy (HCM) are imperfect. The objective of this study was to develop a machine learning (ML)-based model to identify individual HCM patients who are at high risk of developing major adverse cardiac events (MACE).

### METHODS AND MATERIALS

In this single center study, adult patients who had undergone cardiac MRI for evaluation of HCM between 2015-2022 were retrospectively evaluated. Cardiac MRI was performed at 1.5T or 3T (Siemens, Germany) including balanced cine steady state-free precession (bSSFP), native T1 and T2 mapping, and late gadolinium enhancement (LGE). Native T1 and T2 were converted to z-scores using scanner-specific local reference values. The primary outcome of MACE was defined as a composite of cardiovascular death, resuscitated sudden cardiac death, or heart failure hospitalization. A ML algorithm was applied including clinical, cardiovascular risk factors, demographic, genetic, echocardiography and cardiac MRI variables using 250 repeats of repeated random sub-sampling cross-validation (80% training and 20% testing splits). For each training set a random forest model was trained using ML (n=34 variables), and validated on the testing set. A feature map using Shapley Additive exPlanation (SHAP) values was created. The performance of this model was compared to the sudden cardiac death risk model by the European Society of Cardiology (ESC). Performance statistics were calculated across splits.

### RESULTS

604 patients were included (69% male, mean age 52±15 years). Median follow-up time was 3.0 years. The random forest model exhibited favorable predictive performance for MACE (area under the receiver operator characteristic curve [95% CI]: 0.70 [0.45-0.86]), surpassing that of the ESC risk model (0.63 [0.53-0.72]), although the difference did not reach statistical significance (p=0.078). SHAP values showed that native T1 z-scores had the highest impact on model performance, followed by indexed left ventricular mass, indexed left ventricular end-systolic volume, and left atrial diameter.

### CONCLUSION

A ML-based prediction model comprised of routinely available clinical and cardiac MRI variables performed well in predicting risk of MACE in patients with HCM.

### CLINICAL RELEVANCE/APPLICATION

Further study is needed to determine the value of this ML model for risk-stratification in patients with HCM in independent samples.

## W7-SSCA08-2 EPICARDIAL FAT VOLUME PREDICTS OBSTRUCTIVE CORONARY ARTERY DISEASE AND MAJOR ADVERSE CARDIOVASCULAR EVENTS IN PATIENTS WITH "ZERO" CORONARY ARTERY CALCIUM SCORE

Vidiyala Pujitha, MBBS (*Abstract Co-Author*) Nothing to Disclose
Priya Jagia, MD (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Kumar, MBBS,MD (*Abstract Co-Author*) Nothing to Disclose
Niraj N. Pandey, MBBS, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study sought to investigate the role of epicardial fat volume (EFV) in prediction of the presence of obstructive coronary artery disease (CAD) and occurrence of major adverse cardiovascular events (MACE) in patients with "zero" coronary artery calcium score (CACS).

### METHODS AND MATERIALS

799 consecutive patients referred for coronary CT angiography with atypical chest pain and clinical suspicion of CAD were included in this retrospective analysis. 477 (59.7%) patients had a "zero" CACS and were included in the final analysis. Quantification of EFV was performed on non-contrast images used for CACS estimation. CT angiography was evaluated for presence of obstructive CAD. Patients were followed up on subsequent outpatient visits or on phone using standard questionnaire or by review of medical records, for occurrence of MACE.

### RESULTS

Of 477 patients (median age [interquartile range; IQR]: 50 [45-57] years, 51.4% males) with "zero" CACS, obstructive CAD (=50% stenosis) on CT angiography was present in 51 (10.7%) patients. Of the 341 patients for whom follow-up was available, MACE was observed in 37 (10.9%) patients (median follow-up: 15 months [IQR: 12-19 months]). A significantly higher EFV was seen in patients with obstructive CAD (158.2mL [IQR: 114.6-195.1] vs. 120.9mL [IQR: 93.4-153.0]; p=0.0001) and in patients experiencing MACE (165.2mL [IQR: 124.4-202.1] vs. 117.5mL [IQR: 91.8-151.5]; p<0.0001). EFV showed a significant association with obstructive CAD (unadjusted Odd's ratio (OR) [95%CI]: 1.0114 [1.0056-1.0171]; p=0.0001) and MACE (unadjusted OR [95%CI]: 1.0165 [1.0095-1.0236] in univariate analysis, which remained significant in multivariate analysis. Adding EFV to conventional coronary risk factors in the pre-test probability models increased the area-under-curve (AUC) for prediction of both obstructive CAD (AUC [95%CI]: 0.814 [0.776-0.848] vs. 0.796 [0.757-0.832]) and MACE (AUC [95%CI]: 0.961 [0.935-0.979] vs. 0.942 [0.912-0.964]), although not reaching statistical significance.

### CONCLUSION

A "zero" CACS does not exclude obstructive CAD nor the occurrence of MACE. EFV is an independent predictor of obstructive CAD and MACE in patients with "zero" CACS. Addition of EFV to traditional cardiovascular risk factors improves estimation for pretest probability of obstructive CAD and MACE.

### CLINICAL RELEVANCE/APPLICATION

Addition of EFV to traditional cardiovascular risk factors offers a more accurate prediction of obstructive CAD and MACE, which may help to improve the initial management of patients with atypical chest pain. Since EFV is derived from the same dataset used for quantifying CACS, it may also allow for better definition of cardiovascular risk in patients undergoing only coronary artery calcium scoring.

## W7-SSCA08-3 CARDIAC MRI-BASED RIGHT AND LEFT VENTRICULAR BLOOD POOL T2 RATIO: A NOVEL POTENTIAL PREDICTOR OF POOR PROGNOSIS IN PATIENTS WITH DILATED CARDIOMYOPATHY

Yangzhen Hou (*Abstract Co-Author*) Nothing to Disclose
Jing Luo (*Abstract Co-Author*) Nothing to Disclose
Hui Zhou, MD (*Abstract Co-Author*) Nothing to Disclose
Ji Yang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the prognostic value of right-to-left ventricular blood pool T2 ratio (RV/LV T2 ratio) in patients with dilated cardiomyopathy(DCM).

### METHODS AND MATERIALS

This retrospectively study enrolled consecutive 128 patients with DCM who underwent cardiac magnetic resonance(CMR) from January 2019 to December 2021. Thirty healthy controls were also included for comparison. LV and RV blood pool T2(RVT2) values were measured by placing circular ROIs within the LV and RV blood pools in the basal, middle and apical short-axis view. The average values were used and calculated RV/LV T2 ratio. The primary endpoint of major adverse cardiac events(MACE) was defined as composite of all-cause mortality, heart failure-related hospitalizations, and aborted sudden cardiac death.

### RESULTS

RVT2 value and RV/LV T2 ratio were significantly decreased in DCM patients compared to healthy controls ($p < 0.001$). 38 patients reached the primary endpoint (median follow-up: 30 [IQR: 19.0-37.8] months). The area under the curve(AUC) analysis showed that the primary endpoints were associated with RV/LV T2 ratio (AUC, 0.73 [95% CI: 0.65, 0.81], P <0 .001) and RVT2 value (AUC, 0.67 [95% CI: 0.59, 0.75], P <0 .001). Notably, RV/LV T2 ratio (above or below 0.49 based on the cutoff value) was associated with the outcome, irrespective of RVT2 value, suggesting that RV/LV T2 ratio was the most discriminating T2 mapping derived parameter. According to Kaplan-Meier analysis, the risk of MACE increased significantly with decreasing RV/LV T2 ratio tertiles (log-rank $p < 0.001$). Kaplan-Meier analysis of patients stratified by the highest and lowest tertiles of RV/LV T2 ratio showed that patients with the lowest RV/LV T2 ratio tertile had a significantly higher incidence of MACE, irrespective of LVEF and late gadolinium-enhanced(LGE) extent. After adjustment for clinical and imaging risk factors, RV/LV T2 ratio (HR: 1.77 per 0.1 decrease, p=0.002) was independent predictors of MACE. A model combining RV/LV T2 ratio with other clinical and conventional imaging risk factors (C statistic, 0.758; likelihood ratio, 35.24) showed improved discrimination and calibration for the primary endpoints compared with models with clinical variables (C statistic, 0.719; likelihood ratio, 25.85; both $P < 0.01$).

### CONCLUSION

RV/LV T2 ratio was an independent predictor of MACE in patients with DCM, providing incremental prognostic value when combined in a model with clinical and conventional CMR risk factors.

### CLINICAL RELEVANCE/APPLICATION

CMR T2 mapping derived RV/LV T2 ratio may be a convenient prognostic indicator for patients with DCM, which is better than LVEF and LGE and can be easily acquired during routine scanning without specialized commercial software and complex post-processing capabilities.

## W7-SSCA08-4 PROGNOSTIC SIGNIFICANCE OFCARDIAC MRI IN GENE-POSITIVE ARRHYTHMOGENIC CARDIOMYOPATHY

Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Melanie Care (*Abstract Co-Author*) Nothing to Disclose
Sarin Lekchuensakul (*Abstract Co-Author*) Nothing to Disclose
Danna Spears (*Abstract Co-Author*) Nothing to Disclose
Farah Cadour, MD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Cardiac MRI is frequently used to assess tissue and functional abnormalities in patients with arrhythmogenic cardiomyopathy (ACM). However, there is limited data on the prognostic significance of cardiac MRI findings in gene-positive ACM in relation to various genotypes. The purpose of this study was to evaluate the prognostic significance of cardiac MRI findings in patients with gene-positive ACM in relation to genetic variants.

### METHODS AND MATERIALS

In this retrospective cohort study, consecutive adult patients with a pathogenic or likely pathogenic variant in a gene associated with ACM and meeting clinical criteria for ACM with at least one cardiac MRI between 2004-2023 and minimum 1 year follow-up were included. Cardiac MRI evaluation included quantification of left ventricular (LV) and right ventricular (RV) volumes and function, late gadolinium enhancement (LGE) and native T1/T2 mapping. Major adverse cardiac events (MACE) was defined as a composite of sustained ventricular tachycardia, appropriate ICD discharge, heart transplantation, hospital admission for heart failure requiring therapy, and cardiac death. Statistical analysis included Cox proportional hazard models.

### RESULTS

213 ACM patients were included (101 women, mean age 39±16 years) with pathogenic or likely pathogenic variants in desmosomal genes in 103 (48%) and non-desmosomal genes in 110 (52%). With respect to Padua phenotype, 13% were right-dominant, 23% left-dominant, 34% biventricular, and 29% indeterminant. After median clinical follow-up of 5.4 years (IQR 2.8, 9.4), 49 (24%) patients experienced MACE which varied between phenotypic groups (37% biventricular vs 28% left-dominant vs. 21% right-dominant vs. 3% indeterminant, p<0.001). After adjusting for patient age, sex, genotype and phenotype group, each 1% increase in LVEF was associated with a 2% reduction in the hazard of MACE (HR 0.98, 95%CI 0.96-0.99, p=0.03), each 1 unit increase in T2 mapping z-score was associated with a 37% increase in the hazard of MACE (HR 1.37, 95%CI 1.08-1.75, p=0.011), and presence of LGE was associated with 4 times higher hazard of MACE (HR 4.00, 95%CI 1.75-9.17, p=0.001). Native T1 and LV/RVEDV did not independently predict MACE.

### CONCLUSION

Gene-positive ACM with biventricular phenotype is associated with worst prognosis compared to other phenotypes. Cardiac MRI parameters including LVEF, LGE and native T2 add independent prognostic value even after adjustment for clinically relevant potential confounders.

### CLINICAL RELEVANCE/APPLICATION

Given the independent prognostic value of LGE in gene-positive ACM, LGE sequences should be included in all ACM protocols at least at baseline evaluation. Future study is needed to determine the prognostic value of LGE extent and progression.

## W7-SSCA08-5 OPPORTUNISTIC ASSESSMENT OF AORTIC ARTERY CALCIFICATION USING ARTIFICIAL INTELLIGENCE (AI) AND ITS ASSOCIATION WITH CORONARY ARTERY CALCIFICATION AND CARDIOVASCULAR EVENTS

Soterios Gyftopoulos, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Eduardo Iturrate (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Berger (*Abstract Co-Author*) Nothing to Disclose
Michael P. Recht, MD (*Abstract Co-Author*) Nothing to Disclose
Bari Dane, MD (*Abstract Co-Author*) Nothing to Disclose
Malte Westerhoff (*Abstract Co-Author*) Employee, Pro Medicus Limited;Stockholder, Pro Medicus Limited
Judy Zhong (*Abstract Co-Author*) Nothing to Disclose
Miriam A. Bredella, MD, MBA (*Presenter*) Nothing to Disclose

### PURPOSE

Cardiovascular disease (CVD) is the leading cause of death in the US and coronary artery calcium (CAC) scanning using ECG-triggered CTs can discriminate coronary artery disease and predict major adverse cardiovascular events (MACE). Abdominal CT is commonly performed in adults at risk for CVD, and aortic artery calcification (AAC) can be quantified automatically using artificial intelligence (AI) on CTs performed for other clinical purposes (opportunistic CT). The purpose of our study was to determine the clinical utility of fully-automated AAC quantification for the development of MACE.

### METHODS AND MATERIALS

A fully-automated AI algorithm to quantify AAC using the Agatston score was retrospectively applied to a cohort of patient that underwent both abdominal and CAC CT scanning. Subsequent MACE (death/MI/stroke/coronary revascularization) and clinical risk factors were identified via electronic health record (EHR) review. Kaplan-Meier Curve analyses and Cox proportional regression were performed to evaluate associations between AAC and CAC and the development of MACE.

### RESULTS

Our cohort included 3662 patients (median age: 60 (Interquartile Range 11) years, 62% male, 74% White) who had an evaluable abdominal CT and cardiac CT. There was a positive correlation between presence of CAC and AAC (r=0.56, p<0.001). MACE occurred after CT in 324 patients (9%). The incidence of MACE was 0.85 (95% CI 0.64-1.11) and 2.85 (95% CI 2.53-3.21) per 1000 person-month in the AAC absent and AAC present groups, respectively (P<0.001). Following adjustment for age, sex, race/ethnicity, BMI, diabetes mellitus, hypertension, and statin use, presence of AAC was associated with a significant risk of MACE (adjHR 2.24, 95% CI 1.51-3.32, P<0.001).

### CONCLUSION

AAC, quantified on opportunistic abdominal CT using a fully-automated AI algorithm, correlates significantly with CAC and is independently associated with incident MACE. These data support the use of opportunistic imaging in patients for cardiovascular risk assessment. Future studies should investigate whether opportunistic imaging can help guide appropriate cardiovascular prevention strategies.

### CLINICAL RELEVANCE/APPLICATION

Opportunistic CT using a fully-automated AI algorithm can be used to screen for abdominal aortic calcifications, thereby allowing for the initiation of therapy to prevent future major adverse cardiovascular events.

## W7-SSCA08-6 BREAST ARTERIAL CALCIFICATIONS DETECTED BY ARTIFICIAL INTELLIGENCE MODEL ARE ASSOCIATED WITH SIGNIFICANT PREVALENCE OF CARDIOVASCULAR DISEASE: A STUDY OF OVER 18,000 WOMEN

Alyssa T. Watanabe, MD (*Presenter*) Officer, CureMetrix, Inc;Stockholder, CureMetrix, Inc

### PURPOSE

We studied the correlation between breast arterial calcification presence on mammograms and the prevalence of various acute and chronic cardiovascular events and risk factors in 18,092 women.

### METHODS AND MATERIALS

A retrospective study examined a dataset containing 33,167 digital mammogram screening exams, involving 18,092 women (with a mean age of 56.8 +/- 11 years), alongside electronic health records collected from 2007 to 2016 at a sole academic institution. BAC presence was determined using an

artificial intelligence (AI) device (cmAngio, San Diego, CA). Logistic regression analyses were employed to calculate odds ratios (OR) between BAC presence and different health conditions, adjusting for age and Framingham covariates.

## RESULTS

The overall prevalence of BAC at the time of patients' first recorded mammograms was 19.7%. Age-adjusted analyses revealed significant associations between BAC presence and the prevalence of various health conditions. Individuals diagnosed as BAC-positive exhibited notably higher correlation with the prevalence of acute and chronic conditions. For instance, the OR for pooled acute conditions was 2.37 (95% CI: 1.91-2.94), and for pooled chronic conditions, it was 1.51 (95% CI: 1.39-1.65). The OR for specific conditions such as heart failure, heart attack, and chronic kidney disease exceeded 2.0, indicating a strong correlation between BAC presence and disease prevalence.

## CONCLUSION

Opportunistic reporting of BAC presence on mammogram reports could aid in improved risk stratification for women potentially leading to and early intervention strategies for asymptomatic women and improved cardiovascular outcomes.

## CLINICAL RELEVANCE/APPLICATION

Opportunistic reporting of BAC presence on mammogram reports could aid in risk stratification and early intervention strategies for asymptomatic women, potentially leading to improved patient outcomes.

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# Abstract Archives of the RSNA, 2024

W7-SSCH07

**Chest Imaging (Lung Cancer)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E451A

Emily B. Tsai, MD (*Moderator*) Nothing to Disclose
Jonathan H. Chung, MD (*Moderator*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd

**Sub-Events**

## W7-SSCH07-2 OPPORTUNISTIC DETECTION OF EARLY-STAGE LUNG CANCER ON CORONARY ARTERY CALCIUM SCORE COMPUTED TOMOGRAPHY

Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Leslie Ciancibello, RT (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Syed Muhammad Awais Bukhari, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Given that CVD and lung cancer share several common risk factors, many lung cancers are detected in asymptomatic patients undergoing Coronary Artery Calcium Score Computed Tomography (CACCT) exams. Our study aims to demonstrate the utility of CACCT for opportunistic detection of early-stage lung cancer, which is usually diagnosed at a late stage such as Stage 3 or Stage 4, after it has spread to nearby tissues or distant organs. Early detection is crucial, as survival rates are significantly higher for lung cancer diagnosed at Stage 1 or Stage 2. We also explored the role of reviewing full field of view reconstructions when interpreting CACCT exams.

### METHODS AND MATERIALS

We conducted a retrospective review of 30,679 consecutive patients who underwent CACCT between January 1, 2013, and February 29, 2019, under an IRB-approved study protocol. The patient population was cross-referenced with an existing cancer registry through natural language processing (NLP) and checked against the Electronic Medical Record for pathologically confirmed cancers. Subset analyses were conducted focusing on the sex, smoking history, and cancer stage within the cohort diagnosed with lung cancer. The imaging was also reviewed for distribution of the lung cancers on small (cardiac) FOV versus wide FOV exams by board certified radiologist.

### RESULTS

Out of 30,679 individuals who underwent a CACCT, 2,887 (9.4%) had a cancer diagnosis at the time of scan. Among this subset, 170 patients (5.9% of the total cancer cases) had lung cancer detectable via CACCT. Of these lung cancer cases, 55 patients (16 males, 39 females) had their lung malignancy first identified through the CACCT scan. The smoking status distribution among these 55 cases was as follows: 25 were former smokers (45.4%), 18 had an unknown smoking status (32.7%), 10 were never smokers (18.2%), and 2 were current smokers (3.6%). Stage-wise analysis revealed that 39 (70%) were diagnosed at Stage 1B or earlier, and 52 (94.5%) were diagnosed earlier than Stage 4. FOV data analysis revealed that 18 out of these 55 cases (32.7%) would have gone undetected in the absence of full FOV reconstruction.

### CONCLUSION

The study findings reveal that coronary artery calcium score computed tomography (CACCT) can identify a substantial number of lung cancers at an early stage, with approximately 70% of cases diagnosed at Stage 1B or earlier, offering patients a significant opportunity for complete cure. It also highlights the importance of utilization of wide FOV image reconstruction.

### CLINICAL RELEVANCE/APPLICATION

Our study underscores the importance of incidental lung nodule observation, reporting, and follow-up in calcium score exams for early lung cancer detection and treatment.

## W7-SSCH07-3 UTILIZING CT-DERIVED BODY COMPOSITION TO PREDICT LUNG NODULE MALIGNANCY AND DYNAMIC GROWTH IN SCREENING SETTINGS

Tong Yu (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to explore whether incorporating body composition can improve the assessment of malignancy in screen-detected indeterminate pulmonary nodules (IPNs) and elucidate the potential impact of body composition on the dynamic growth of such nodules.

### METHODS AND MATERIALS

A dataset of 216 subjects from a low-dose CT lung cancer screening program was used in this study. These subjects had IPNs identified at baselines and at least one follow-up CT scans. Artificial intelligence algorithms were used to automatically segment and quantify IPNs and five body compositions depicted on baseline and follow-up CT scans. Logistic Regression (LR) analyses were performed. The area under the receiver operating characteristic curve (ROC-AUC) was used to assess the performance via the 10-fold cross-validation method. Average feature importance was evaluated in several machine learning models. Causal relationships were analyzed and visualized using a novel directed graph method. Correlation analyses were employed to study the association between body composition features and malignancy at baseline, as well as the relationship between body composition dynamic changes and nodule growth rate with the last CT examinations. Gender was emphasized in all analyses.

### RESULTS

The feature skeletal muscle density showed statistically significance in both men and women in univariate analysis. The multivariate LR model, incorporating body composition and nodule features, yielded a maximum AUC of 0.87 (95% CI: 0.82 - 0.91). In terms of feature importance, skeletal muscle density, intramuscular adipose tissue mass and density were high-ranked among body tissue features, with skeletal muscle density retaining its significance even after adjusting clinical and nodule features. The causal AI method identified two nodule features, mean Intensity, and irregularity, and one body tissue feature, skeletal muscle density, as directly (causally) linked to malignancy. Correlation analysis identified several nodule dynamic growth indicators, including nodule features, irregularity, mean diameter and mean intensity, and body tissue features, skeletal muscle density, and intramuscular adipose tissue density in both men and women.

### CONCLUSION

The body compositions, notably skeletal muscle density, hold significant promise in distinguishing between malignant and benign nodules, as well as evaluating the dynamic growth of nodules over time. Integrating body composition with nodule features can significantly improve the assessment of an IPN’s malignancy.

### CLINICAL RELEVANCE/APPLICATION

Approximately 96% of IPNs detected in lung cancer screening turn out to be false positives, which often lead to unnecessary follow-up procedures, such as follow-up imaging and biopsy.

## W7-SSCH07-4 IMPLICATIONS OF 2D SINGLE SLICE VS. 3D WHOLE-CHEST BODY COMPOSITION PHENOTYPING ON OUTCOME PREDICTION: INSIGHTS FROM THE NATIONAL LUNG SCREENING TRIAL

Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias Jung, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Reisert (*Abstract Co-Author*) Nothing to Disclose
Fabian Bernhard Pallasch, MD (*Abstract Co-Author*) Nothing to Disclose
Johannes Jahn, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Measures of body composition (BC) are associated with clinical outcomes in patients with cardiovascular (CV) disease and cancer. BC is typically estimated from a single slice at the 3rd lumbar vertebra, given the high correlation with whole-body volumes. Standardized heights for chest imaging are not well-established, and whether 3D volumes can further improve prognostication is unknown. Here, we used a fully automated deep learning network 1) to investigate the correlation between 2D single slice areas and 3D whole-chest volumes and 2) to explore the association between these BC measures with mortality in heavy smokers.

### METHODS AND MATERIALS

We used data from the first screening round of the National Lung Screening Trial (NLST). Body composition was estimated on chest CT and defined as skeletal muscle (SM), intramuscular (IMAT) and subcutaneous adipose tissue (SAT). First, the highest correlation between 2D slices for each thoracic vertebra and 3D chest volumes was explored. Second, the association between BC measures and mortality was assessed for both approaches. The primary outcome was all-cause mortality; additional outcomes were CV and lung cancer mortality. Kaplan-Meier survival curves were calculated (categories <15%; 15-85%; >85%) to investigate time to mortality. Cox regression assessed the association between BC measures and mortality adjusted for demographics and CV risk factors.

### RESULTS

Among 23,319 individuals (mean age 61.4±5, 41.9% female), 1,590 (6.8%) all-cause deaths occurred over a median follow-up of 6.3 years. The best correlation between single slice and the 3D volumes was observed at the T4 vertebra for SM and IMAT, and at T7 for SAT. For 3D volumes, Kaplan-Meier curves showed higher rates of mortality for low SM and high IMAT groups (all $p<0.0001$). No effect was found for SAT. Univariable Cox regression revealed an association between the low SM and high IMAT group, which remained robust after multivariable adjustment for risk factors (aHR: 1.34, 95% CI 1.18-1.52, $p<0.001$ and aHR: 1.58, 95% CI: 1.39-1.81, $p<0.001$, respectively). No significant association was found for SAT. Survival analyses for the 2D measures yielded similar results as for the 3D approach. Largely similar patterns were found for CV and lung cancer mortality for both 3D and 2D measures.

### CONCLUSION

Low SM and high IMAT are independent predictors for mortality in heavy smokers beyond traditional clinical risk factors. 3D and 2D measures showed largely similar results and can be used interchangeably.

### CLINICAL RELEVANCE/APPLICATION

Automated and opportunistic quantification of BC from chest CT may help to identify high-risk individuals participating in lung cancer screening with the potential to improve personalized prevention beyond established strategies.

## W7-SSCH07-5 USEFULNESS OF AUTOMATIC DEEP LEARNING-BASED LUNG CT ANALYSIS IN PREDICTING THE OCCURRENCE OF SYMPTOMATIC RADIATION PNEUMONITIS AFTER STEREOTACTIC BODY RADIOTHERAPY FOR LUNG MALIGNANCIES

Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Makiko Kubooka (*Abstract Co-Author*) Nothing to Disclose
Shuichi Murashima, MD (*Abstract Co-Author*) Nothing to Disclose

Tae Iwasawa, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, Ziosoft Inc;Speaker, FUJIFILM Holdings Corporation;Speaker, Boehringer Ingelheim GmbH
Yoshihito Nomoto (*Abstract Co-Author*) Nothing to Disclose
Satoshi Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Yutaka Toyomasu, MD (*Abstract Co-Author*) Nothing to Disclose
Yasutaka Ichikawa, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the utility of automatic deep learning (DL)-based lung CT analysis in predicting the occurrence of symptomatic radiation pneumonitis (RP) after stereotactic body radiotherapy (SBRT) for lung malignancies.

**METHODS AND MATERIALS**

One hundred three patients who underwent SBRT for lung malignancies and had chest CT performed prior to SBRT were studied. The pre-SBRT chest CT was evaluated using an automatic DL-based lung CT analysis (QZIP-ILD). The analysis system can segment the lung on CT into the following nine regions and calculate the volume of each: normal (N), airspace/hyperinflationary region (A), emphysema (E), ground glass opacity (G), consolidation (C), traction bronchiectasis (T), reticulation (R), honeycombing (H), and fibrosis (F). The relation between the volume of each lung region and the occurrence of symptomatic RP (grade =2) was evaluated. RP was defined per multidisciplinary clinician consensus using CTCAE v5.0.

**RESULTS**

Eleven (11%) of the subjects developed symptomatic RP. Symptomatic RPs had significantly lower N volume (median 3111.8cc, interquartile range (IQR) 2367.7-3617.5cc) and A+N volume (median 3148.4cc, IQR 2381.8-3663.9cc) compared to asymptomatic RPs (N: median 3827.6cc, IQR 3086.2-4493.5cc, p=0.022; A+N, median 4074.5, IQR 3344.6-4756.7cc, p=0.0015) (Figure 1), while no significant differences in other indices (E, G, C, T, R, H, F or their combinations) were found between symptomatic and asymptomatic RPs. Receiver operating characteristic (ROC) analysis for predicting symptomatic RP showed that the area under the curve were 0.71 (95%CI 0.66-0.91) for N and 0.79 (95%CI 0.57-0.85) for A+N. With the cutoff values (N, 3719.2 cc; A+N, 3741.1 cc) obtained from the ROC analysis, a high sensitivity (N, 82%; A+N, 82%) and negative predictive value (N, 96%; A+N, 97%) for predicting symptomatic RP were observed.

**CONCLUSION**

The volumes of normal lung and normal lung + airspace/hyperinflation region identified by automatic DL-based lung CT analysis are significantly associated with symptomatic RP caused by SBRT and are useful indices to predict symptomatic RP with high sensitivity and negative predictive value.

**CLINICAL RELEVANCE/APPLICATION**

Automatic DL-based lung CT analysis provides a useful objective measure for predicting the occurrence of symptomatic RP after SBRT for lung malignancies.

## W7-SSCH07-6 SHORT-TERM TEMPORAL ANALYSIS OF INTRA- AND PERI-TUMORAL CT RADIOMICS FOR PREDICTING MAJOR PATHOLOGICAL RESPONSE TO NEOADJUVANT CHEMOIMMUNOTHERAPY IN NON-SMALL CELL LUNG CANCER

Yajia Gu (*Abstract Co-Author*) Nothing to Disclose
Jing Gong, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Neoadjuvant chemoimmunotherapy holds promise for improving outcomes in non-small cell lung cancer (NSCLC) treatment, yet accurately predicting patient response remains a clinical challenge. This study aims to develop a short-term temporal CT radiomics model to predict the major pathological response (MPR) to neoadjuvant chemoimmunotherapy (NCI) in NSCLC by decoding the intra- and peri-tumoral imaging phenotypes.

**METHODS AND MATERIALS**

We enrolled 352 patients undergoing curative surgery after NCI for IB-III NSCLC at two centers to establish a training cohort (n=186), an internal validation cohort (n=80), and an external validation cohort (n=86). We first segmented the primary tumor on pre- and after-NCI CT images manually. Then, we computed the intra- and peri-tumoral CT radiomics to reveal the imaging phenotypes of tumor microenvironment. After feature standardization with z-score method, we employed a two-step feature selection process to reduce the redundant features, which included an ANOVA F-value based feature selection and a recursive feature elimination configuring with least absolute shrinkage and selection operator. To balance the training dataset, we used a synthetic minority over-sampling technique to resample the dataset. Finally, we used a support machine vector classifier to build the short-term temporal model by computing the changes in radiomics features.

**RESULTS**

Short-term temporal predictive model incorporating intra- and peri-tumoral radiomic features achieved AUC values of 0.88, 0.76 and 0.74 in three datasets, which was significantly higher than that of RECIST model and pre-treatment model.

**CONCLUSION**

The results demonstrated that short-term temporal analysis of intra- and peri-tumoral CT radiomics holds promise for predicting MPR to neoadjuvant chemoimmunotherapy in NSCLC.

**CLINICAL RELEVANCE/APPLICATION**

These findings highlight the potential of radiomics as a non-invasive tool for treatment response assessment and personalized therapy selection in NSCLC patients.

# Abstract Archives of the RSNA, 2024

W7-SSCH08

**Chest Imaging (Vascular)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E351

Carole A. Ridge, FFR(RCSI) (*Moderator*) Nothing to Disclose
Carlos Andres Rojas, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W7-SSCH08-1 ENHANCING PULMONARY EMBOLISM MANAGEMENT: THE IMPACT OF AI-BASED TRIAGE AND PRIORITIZATION ON DIAGNOSTIC TIMELINESS AND TREATMENT INITIATION

Ian Holland, MD (*Abstract Co-Author*) Nothing to Disclose
Zahra Chakeri, MD (*Abstract Co-Author*) Nothing to Disclose
Ariana Garabedian (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Diaz, MD (*Abstract Co-Author*) Nothing to Disclose
Mehrzad Shafiei, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

AI-based triage and prioritization systems have improved the management of patients with pulmonary embolism (PE) by providing quicker and more accurate assessments. These systems utilize machine learning algorithms to analyze CT chest pulmonary angiography (CTPA) images for the rapid detection of PE, which can help reduce the time to inform ordering clinicians and ultimately begin treatment. This improvement in process efficiency can enhance patient outcomes by allowing for timely treatment and better use of healthcare resources, thereby supporting more effective care delivery for PE patients.

### METHODS AND MATERIALS

A retrospective analysis was conducted encompassing patients who underwent CTPA for PE detection, between September 2023 and March 2024 of an AI-based triage and prioritization software. Data regarding the time interval between the finalization of CTPA scans and communication with clinical teams (notification time, NT), as well as the time taken to initiate anticoagulation treatment (time to anticoagulation, TTA), were collected through a review of radiology reports and patient charts. Exclusion criteria comprised cases of chronic PE without new embolism. Statistical analysis employed the Mann-Whitney U test due to the skewed distribution of data.

### RESULTS

The pre-AI group consisted of 325 patients, while the post-AI group comprised 157 patients. Analysis revealed a statistically significant decrease (p-value $< 0.05$) in NT in the post-AI group (mean=33.54 min, IQR=25 min) compared to the pre-AI group (mean=64.41 min, IQR=28 min). Similarly, TTA was significantly reduced (p-value $< 0.05$) in the post-AI group (mean=149.22, IQR=93.75 min) compared to the pre-AI group (mean=248, IQR=197 min).

### CONCLUSION

The introduction of an AI-based triage and prioritization system for detecting pulmonary embolism at our large tertiary care center has significantly shortened the time to notify clinicians and initiate anticoagulation treatment. These findings highlight the potential of AI to streamline diagnostic processes and expedite clinical responses, contributing to improved patient management and outcomes.

### CLINICAL RELEVANCE/APPLICATION

The integration of an AI-based triage and prioritization solution into the conventional diagnosis of acute PE holds promise for enhancing patient care by expediting notification to clinicians and initiating timely treatment, thereby potentially improving outcomes in patients with acute PE.

## W7-SSCH08-2 INDICATORS FOR HOSPITALIZATION IN ACUTE PULMONARY EMBOLISM: UNCOVER THE ASSOCIATION BETWEEN D-DIMER LEVELS, THROMBUS VOLUME AND RADIOMICS

Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ibrahim Yel, MD (*Abstract Co-Author*) Nothing to Disclose
Leon D. Gruenewald, MD (*Abstract Co-Author*) Nothing to Disclose
Mirela Dimitrova (*Abstract Co-Author*) Nothing to Disclose
Katrin Eichler, MD (*Abstract Co-Author*) Nothing to Disclose
Renate M. Hammerstingl, MD (*Abstract Co-Author*) Nothing to Disclose
Simon S. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Scherwin Mahmoudi, MD (*Abstract Co-Author*) Nothing to Disclose
Vitali Koch, MD (*Abstract Co-Author*) Nothing to Disclose

Christian Booz, MD (*Abstract Co-Author*) Speaker, Siemens AG
Jennifer Gotta (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to examine the correlation between D-dimer levels and thrombus size in acute pulmonary embolism (PE) combining dual-energy CT (DECT) and radiomics and to investigate the diagnostic utility of a machine learning classifier based on dual-energy computed tomography (DECT) radiomics for identifying patients with a complicated course, defined as at least hospitalization at IMC.

**METHODS AND MATERIALS**

The study was conducted including 136 participants who underwent pulmonary artery CT angiography from January 2015 to March 2022. Based on DECT imaging, 107 radiomic features were extracted for each patient using standardized image processing. After dividing the dataset into training and test sets, stepwise feature reduction based on reproducibility, variable importance and correlation analyses were performed to select the most relevant features; these were used to train and validate the gradient-boosted tree models.Receiver operating characteristics (ROC) analysis was utilized to evaluate the association between volumetric, laboratory data and adverse outcomes.

**RESULTS**

In the central PE group, we observed a significant correlation between thrombus volumetrics and D-dimer levels ($p = 0.0037$), as well as between thrombus volumetrics and hospitalization at the Intermediate Care Unit (IMC) ($p = 0.0001$). In contrast, no statistically significant differences were identified in thrombus sizes between patients who experienced complications and those who had a favorable course ($p = 0.3162$). The trained machine learning classifier achieved an accuracy of 61% and 55% in identifying patients with a complicated course, as indicated by an area under the ROC curve of 0.63 and 0.58.

**CONCLUSION**

In conclusion, our findings indicate a positive correlation between D-dimer levels and central PE's pulmonary embolic burden. Thrombus volumetrics may serve as an indicator for complications and outcomes in acute PE patients. Thus, thrombus volumetrics, as opposed to D-dimers, could be an additional marker for evaluating embolic disease severity. Moreover, DECT-derived radiomic feature models show promise in identifying patients with a complicated course, such as hospitalization at IMC.

**CLINICAL RELEVANCE/APPLICATION**

The association between thrombus volumetrics and potential complications in acute PE patients highlights its importance as a predictive marker for assessing disease severity and prognosis. Thus, thrombus volumetrics may offer valuable insights beyond D-dimer levels, enhancing our ability to manage and prognosticate acute embolic events more effectively.

## W7-SSCH08-3 UTILITY OF MACHINE LEARNING FOR PREDICTING SEVERE CHRONIC THROMBOEMBOLIC PULMONARY HYPERTENSION BASED ON CT METRICS IN A SURGICAL COHORT

John T. Granton, MD (*Abstract Co-Author*) Nothing to Disclose
Sangwook Kim (*Abstract Co-Author*) Nothing to Disclose
Marc Deperrot, MD (*Abstract Co-Author*) Nothing to Disclose
Micheal McInnis, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Bayer AG
Gauri R. Karur, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Chris McIntosh (*Abstract Co-Author*) Nothing to Disclose
Micah Grubert Van Iderstine, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

The right to left ventricle (RV/LV) ratio is a validated predictor of outcome in acute pulmonary embolism (PE), independent of clot burden scores. In chronic thromboembolic pulmonary hypertension (CTEPH), the interplay between RV/LV ratio, clot burden on CT, and pulmonary hypertension has not been fully explored. The aim of this study was to evaluate RV/LV ratio as a predictor of severe pulmonary hypertension (PH) and to develop machine learning (ML) models to identify additional radiologic features associated with severe PH in surgical CTEPH.

**METHODS AND MATERIALS**

Patients were included after multidisciplinary review if they had a diagnosis of CTEPH according to 2022 European Society of Cardiology guidelines, a preoperative CT pulmonary angiogram, and pulmonary endarterectomy between 01/2017 and 06/2022. A mean pulmonary artery pressure of >50 mmHg was classified as severe on pre-operative right heart catheter. CTs were scored by a masked thoracic radiologist who classified each of the 32 pulmonary artery (PA) vessels as containing a web, eccentric thickening, an occlusion, or subsegmental disease. The RV, LV, main PA, and ascending aorta (Ao) diameters were measured in short axis. XGBoost models were developed to predict CTEPH feature importance and the models were compared to a logistic regression model using an RV/LV ratio input. 200-fold random shuffled stratified sampling with synthetic minority oversampling and a 20% test sample was employed. Model performance was evaluated based on sensitivity, specificity, receiver operating curve analysis, and F1 score.

**RESULTS**

There were 184 patients included. Similar to acute PE, clot burden was not helpful in identifying severe PH. The RV/LV ratio logistic regression model performed well (AUC 0.76) with a cut-off of 1.4 having a sensitivity of 71% and specificity of 56%. A baseline ML model (RLV0) including only the RV, LV, Pa, and Ao measures and their ratios yielded an average AUC of 0.66 +/- 0.10. When the 32 raw vessel scores were added, the average AUC was 0.72 +/- 0.08. The addition of demographics and statistics summarizing the CT findings raised the AUC to 0.75 +/- 0.08 (F1 score 0.41). The most impactful variables by Shapley values were RV/LV and PA/Ao metrics, patient gender, individual segmental CT scores and total number of webs.

**CONCLUSION**

While measures of clot burden had little bearing on PH severity independently, incorporation of clot burden and patient demographics improves performance of machine learning models. Future work will employ similar imaging-based models to predict clinically meaningful patient outcomes in CTEPH.

**CLINICAL RELEVANCE/APPLICATION**

Radiologists can identify patients with severe PH through measuring the RV/LV ratio in CTEPH with an optimal cut-off of 1.4.

## W7-SSCH08-4 CHRONIC PULMONARY EMBOLISM QUANTIFICATION DISTINGUISHES BETWEEN CHRONIC THROMBOEMBOLIC PULMONARY DISEASE (CTEPD) WITHOUT AND WITH PULMONARY HYPERTENSION (CTEPH) WITH HIGH ACCURACY

Micheal McInnis, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Bayer AG
Laura Donahoe (*Abstract Co-Author*) Nothing to Disclose
John T. Granton, MD (*Abstract Co-Author*) Nothing to Disclose
Marc Deperrot, MD (*Abstract Co-Author*) Nothing to Disclose
Dayana Davoudi (*Abstract Co-Author*) Nothing to Disclose
Katherine Lajkosz (*Abstract Co-Author*) Nothing to Disclose
Colin McQuade, MBBCh, FFR(RCSI) (*Presenter*) Nothing to Disclose

**PURPOSE**

Persistent perfusion defects are common after acute pulmonary embolism and, when symptomatic, the entity is termed CTEPD, and some develop CTEPH. Few studies show no or limited difference in clot burden between CTEPD and CTEPH but new clinical guidelines have since revised the mean pulmonary artery pressure threshold for a diagnosis of CTEPH from 25 mmHg to 20 mmHg. The purpose of this study was to evaluate difference in clot burden type and distribution in CTEPD versus CTEPH using new diagnostic criteria.

**METHODS AND MATERIALS**

This retrospective study evaluated patients with a multidisciplinary diagnosis of CTEPD or CTEPH in 2021or 2022 by right heart catheter using the ESC/ERS 2022 guidelines. Two CTEPH cases were randomly selected for each CTEPD case. CTPA studies were reviewed by a masked thoracic radiologist, scoring 32 vessels per case (main, interlobar, lobar, lingula, descending branches and segmental vessels) for chronic PE with the single most obstructive lesion recorded per vessel (occlusion, eccentric thickening, or web). Subsegmental disease was noted if present. Comparisons were made across clinical characteristics, clot distribution by most proximal lesion (UCSD level), Qanadli index, lesion number, type and location. Receiver operator characteristic (ROC) curve analysis was used to evaluate diagnostic performance of individual features.

**RESULTS**

There were 44 CTEPD and 88 CTEPH patients with no difference in mean age (58 yrs), BMI (29.8), and sex (50% female). Functional class was similar ($p=0.7$) but patients with CTEPH had measurably worse six-minute walk distance (379 vs 463 m, $p=0.001$), and right ventricular dilation ($p<0.001$) and dysfunction ($p<0.001$) by echocardiography. Co-morbidities were similar except a higher prevalence of deep vein thrombosis in CTEPD (52% vs 33%, $p=0.03$). CT identified more lesions in the CTEPH group (21.2 vs. 10.0 lesions/case, $p<0.001$) and it was a more diffuse process involving more lobes per case (mean 5 vs 3, $p<0.001$), though the right lower lobe was nearly always involved in both CTEPD (93%) and CTEPH (99%, $p=0.11$). The most proximal disease was more commonly main/lobar in CTEPH (UCSD level 1/2: 70% vs 36%, $p<0.001$). Qanadli index revealed 51% obstruction in CTEPH compared to 26% in CTEPD ($p<0.001$). ROC curve analysis demonstrated the total number of lesions to best discriminate between CTEPH and CTEPD with an AUC of 0.91 and an optimal cut-off of 16 lesions (sensitivity 90%, specificity 84%).

**CONCLUSION**

CTEPD and CTEPH are radiologically distinct with twice as much vascular obstruction seen in CTEPH.

**CLINICAL RELEVANCE/APPLICATION**

Both CTEPD and CTEPH patients can have significant functional impairment, but radiologists should suspect CTEPH when half of the vascular bed is involved on careful review.

## W7-SSCH08-6 HIGH-ACCURACY DEEP LEARNING-BASED CLASSIFICATION MODEL FOR AUTOMATIC AORTIC DISSECTION ON CHEST CT ANGIOGRAPHY

Yuehua Li (*Abstract Co-Author*) Nothing to Disclose
Dinggang Shen (*Abstract Co-Author*) Nothing to Disclose
Tong Li (*Abstract Co-Author*) Nothing to Disclose
Yanyuan Su (*Abstract Co-Author*) Nothing to Disclose
Xiang S. Zhou (*Abstract Co-Author*) Nothing to Disclose
Dijia Wu, PhD (*Abstract Co-Author*) Nothing to Disclose
Beibei Liu (*Abstract Co-Author*) Nothing to Disclose
Yiqiang Zhan, PhD (*Abstract Co-Author*) Nothing to Disclose
Pengbo Jiang (*Abstract Co-Author*) Nothing to Disclose
Feng Shi (*Presenter*) Employee, Shanghai United Imaging Healthcare Co, Ltd

**PURPOSE**

To develop and evaluate the performance of a deep learning-based methodology for automatic identification of aortic dissection on chest CT angiography.

**METHODS AND MATERIALS**

This study included chest CT angiography of 1,373 patients with suspected acute aortic conditions, excluding those with a history of aortic surgery. The dataset is divided into training and testing sets, and further classified into three categories according to the Stanford classification system. The training set consists of 857 cases, including 84 Type A, 379 Type B, and 394 negative cases. The testing set comprises 516 cases, with 78 Type A, 121 Type B, and 317 negative cases. A two-stage deep learning algorithm based on V-Net was developed in this study, significantly enhancing the algorithm's capability to distinguish aortic dissection from similar conditions such as aortic intramural hematoma or penetrating aortic ulcer. The model performance was evaluated using sensitivity and specificity to measure its accuracy in diagnosing aortic dissection.

**RESULTS**

On the test cohort of 516 cases, the deep learning algorithm exhibited commendable capability in discerning aortic dissections. It achieved a sensitivity of 0.995 and specificity of 0.987, evidencing a high degree of accuracy in positive and negative case differentiation. With regard to the subtypes of aortic dissections, the model reached a sensitivity of 0.974 and a specificity of 0.984 for Stanford Type A, and for type B, the sensitivity was 0.950 with the specificity of 0.985.

**CONCLUSION**

Deep learning algorithms have demonstrated the capability for high-precision identification of aortic dissections on chest CT angiography, as well as high-accuracy classification of dissection subtypes.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning algorithms show good potential to facilitate reliable triage for patients with aortic dissection, helping enhancing clinical decision-making and expediting the workflow.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

W7-SSGI15

**Gastrointestinal Imaging (Quantitative Imaging)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E451B

David T. Fetzer, MD (*Moderator*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research support, Siemens AG;Consultant, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Consultant, General Electric Company;Advisory Board, General Electric Company
Madhvi Deol, BS, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W7-SSGI15-1 BASELINE PREDICTORS INFLUENCING ADIPOSE TISSUE PROTON DENSITY FAT FRACTION (PDFF) REDUCTION IN PARTICIPANTS WITH OBESITY UNDERGOING METABOLIC BARIATRIC SURGERY

Ryan Sappenfield (*Abstract Co-Author*) Nothing to Disclose
Garth Jacobsen (*Abstract Co-Author*) Nothing to Disclose
Rashmi Agni (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC
Walter Henderson (*Abstract Co-Author*) Nothing to Disclose
Danielle N. Batakis, BS (*Abstract Co-Author*) Nothing to Disclose
David T. Harris, PhD (*Abstract Co-Author*) Nothing to Disclose
Luke Funk (*Abstract Co-Author*) Nothing to Disclose
Ryan Broderick (*Abstract Co-Author*) Nothing to Disclose
Scott B. Reeder, MD, PhD (*Abstract Co-Author*) Owner, Calimetrix;Owner, Reveal Pharmaceuticals;Owner, Cellectar Biosciences, Inc;Owner, Elucent Medical;Owner, HeartVista, Inc;;
Eduardo Grunvald (*Abstract Co-Author*) Nothing to Disclose
Jeffrey B. Schwimmer, MD (*Abstract Co-Author*) Nothing to Disclose
Tanya Wolfson, MS (*Abstract Co-Author*) Nothing to Disclose
Yesenia Covarrubias, MS (*Abstract Co-Author*) Nothing to Disclose
Melissa Lou Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor F. Martins, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Obesity is a global health epidemic affecting ~42% of the US population, leading to metabolic complications including accumulation of ectopic fat in and around organs. Proton density fat fraction (PDFF) is a quantitative MRI biomarker for ectopic fat, traditionally used in the liver. Recently, investigators have used PDFF to evaluate other depots such as visceral and subcutaneous adipose tissue (VAT and SAT, respectively), finding that adipose tissue PDFF correlates positively with BMI and decreases with weight loss. The predictors that influence adipose tissue PDFF reduction during weight loss, however, remains a gap in knowledge. This study aims to identify the baseline predictors for VAT and SAT PDFF reduction after metabolic bariatric surgery (MBS).

### METHODS AND MATERIALS

Adults with obesity scheduled for MBS were prospectively recruited to an ongoing dual-center study which included collection of baseline clinical parameters (age, sex, BMI), fasting labs (glucose, HbA1c, insulin, lipid panel), and non-contrast MR exams (MRI-PDFF) on a clinical 3.0T MRI system (GE Signa Premier or GE Discovery MR750, GE Healthcare, Waukesha WI) at 2 timepoints (baseline and 12 months post-MBS). PDFF was measured in VAT and SAT by two study-trained analysts independently. Homeostatic model assessment for insulin resistance (HOMA-IR) was calculated from glucose and insulin. During MBS, participants underwent wedge biopsy of the left liver lobe for assessment of metabolic dysfunction-associated steatohepatitis (MASH). Bayesian Information Criterion based stepwise linear regression was used to identify baseline predictors of VAT and SAT PDFF change.

### RESULTS

51 adults with obesity (47 female, mean age 44.7 years, mean BMI 46.4 kg/m2, 24 sleeve gastrectomy [SG] and 27 Roux-en-Y gastric bypass [RYGB]) were recruited to date and included in this study. VAT and SAT PDFF had absolute changes of -5.8% and -4.3% after MBS ($p < 0.001$), respectively. For VAT PDFF change, the model selected surgery type and baseline HOMA-IR ($p < 0.001$, $r = 0.504$); RYGB and lower baseline HOMA-IR were significantly associated with greater VAT PDFF reduction. For SAT PDFF change, the model selected surgery type, MASH status, and baseline fasting glucose ($p < 0.001$, $r = 0.547$); RYGB, negative MASH status, and lower baseline glucose were significantly associated with greater SAT PDFF reduction.

### CONCLUSION

Participants with healthier metabolic profiles at baseline and those who underwent RYGB had greater reductions in VAT and SAT PDFF 12 months after MBS.

### CLINICAL RELEVANCE/APPLICATION

With further validation, adipose tissue PDFF could potentially be used to monitor metabolic health in patients with obesity and help inform management decisions including MBS procedure.

## W7-SSGI15-2 HEPATIC-ASSOCIATED VASCULAR MORPHOLOGICAL ASSESSMENT TO PREDICT OVERT HEPATIC ENCEPHALOPATHY BEFORE TIPS: A MULTICENTER STUDY

Chongyang Duan (*Abstract Co-Author*) Nothing to Disclose
Yujie Zhao (*Abstract Co-Author*) Nothing to Disclose
Zhaochen Liu (*Abstract Co-Author*) Nothing to Disclose
Jinqiang Chen (*Abstract Co-Author*) Nothing to Disclose
Xiaoqiong Chen (*Abstract Co-Author*) Nothing to Disclose
Sirui Fu, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To provide patients the chance of accepting curative transjugular intrahepatic portosystemic shunt (TIPS) rather than palliative treatments for portal hypertension-related variceal bleeding and ascites, we aimed to assess hepatic-associated vascular morphological change to improve the predictive accuracy of overt hepatic encephalopathy (HE) risks.

### METHODS AND MATERIALS

Patients who underwent TIPS between January 2012 and January 2022 were included in this multicenter retrospective study. 621 patients undergoing TIPS were subdivided into training (413 cases from three hospitals) and external validation datasets (208 cases from another three hospitals). Besides traditional clinical factors, we assessed hepatic-associated vascular morphological change by maximum diameter (including the absolute and ratio values). Three predictive models (clinical, hepatic-associated vascular, and combined) were constructed using logistic regression. Their discrimination and calibration were compared to test the necessity of hepatic-associated vascular assessment and identify the optimal model. Further, to verify the improved performance of ModelC-V, we compared it with four previous models, both in discrimination and calibration.

### RESULTS

621 patients were subdivided into training (413 cases: mean age, 52.0 years ± 11.4 [SD]; 95 women) and external validation (208 cases: mean age, 56.0 years ± 11.0 [SD]; 40 women) datasets. The combined model outperformed the clinical and hepatic-associated vascular models (training: 0.814, 0.754, 0.727; validation: 0.781, 0.679, 0.776; $P < 0.050$) and had the best calibration. Compared to previous models, ModelC-V showed superior performance in discrimination. The high-, middle-, and low-risk populations displayed significantly different overt HE incidence ($P < 0.001$). Particularly, despite the limited ability of pre-TIPS ammonia to predict overt HE risks, the combined model displayed a satisfactory ability for overt HE risks, both in low- and high-ammonia subgroups. Accordingly, an applet for ModelC-V was constructed.

### CONCLUSION

Hepatic-associated vascular assessment improved the predictive accuracy of overt HE, ensuring curative chances by TIPS for suitable patients and providing insights for cirrhosis-related studies.

### CLINICAL RELEVANCE/APPLICATION

We constructed a combined model that could predict post-TIPS overt HE based on the hepatic-associated vascular morphological assessment. Assisted by our model, patients with low risk may be able to accept alternative TIPS treatment.

## W7-SSGI15-3 DEVELOPMENT AND VALIDATION OF MRI PDFF CUT-OFFS FOR LIVING LIVER DONOR ELIGIBILITY ASSESSMENT

So Yeon Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seung Soo Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Sun Kyung Jeon, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Hae Young Kim, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to derive MRI proton density fat fraction (PDFF) cut-offs for detecting various degrees of hepatic steatosis (HS) in potential living liver donors, using large droplet fat fraction as the histological reference standard.

### METHODS AND MATERIALS

This retrospective study included consecutive potential living liver donors who underwent MRI and liver biopsy between 2013 and 2023 at two tertiary institutions, each as development (n = 3062; 2015 men; median [interquartile range] age of 32 [25-38] years) and external validation (n = 472; 287 men; 35 [26-44] years) datasets. PDFF was measured using dedicated MRI sequences. Histologic HS defined as large droplet fat fraction was used as the reference standard. Dual PDFF cut-offs aimed at 95% sensitivity or 95% specificity, for diagnosing histologic HS of =10%, =20%, =30%, and =40%, were determined in the development dataset using ten-fold cross validation. The cut-offs were then validated in the external validation dataset. Equation for estimating histologic HS from PDFF was also derived using linear regression.

### RESULTS

The PDFF cut-offs for histologic HS of =10%, =20%, =30%, and =40%, targeting 95% sensitivity, were 3.7%, 5.5%, 8.0%, and 10.0%, respectively. External validation demonstrated high sensitivities = 97.9% with specificities ranging from 60.9% to 95.1%. The PDFF cut-offs targeting 95% specificity were 6.3%, 8.0%, 9.1%, and 10.1%, respectively. External validation rendered high specificities ranging from 88.5% to 95.3% with sensitivities ranging from 76.6% to 100%. For diagnosing histologic HS =30%, which is the most prevalently used threshold for living liver donor eligibility assessment, the PDFF cut-offs achieved sensitivities and specificities of both over 90%. The equation of (Histologic HS = -2.95 + 1.93 * PDFF) was derived.

### CONCLUSION

This study established and validated PDFF cut-off values for detecting HS in potential living liver donors. For diagnosis of hepatic steatosis =30%, which is the most widely used criterion in living liver donor evaluation, our PDFF cut-offs yielded sensitivities and specificities exceeding 90% in both internal and external validation.

### CLINICAL RELEVANCE/APPLICATION

This study was conducted using large droplet fat relevant to graft survival as the reference standard, as per Banff consensus recommendations. The dual cut-off values targeting high sensitivity or high specificity may facilitate donor evaluation by excluding potential donors with a high probability of

substantial steatosis from further work-up, or expediting the work-up for potential donors unlikely to have steatosis exceeding the eligibility limit.

## W7-SSGI15-4 BI-REGIONAL DYNAMIC CONTRAST-ENHANCED MRI FOR PREDICTION OF MICROVASCULAR INVASION IN SOLITARY BCLC STAGE A HEPATOCELLULAR CARCINOMA AND ITS SIGNIFICANCE FOR PROGNOSIS AND TREATMENT

Xinming Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Wei Cai (*Abstract Co-Author*) Nothing to Disclose
Yongjian Zhu, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Prediction of microvascular invasion (MVI) in hepatocellular carcinoma (HCC) preoperatively is challenging but essential for reducing tumor recurrence. We aimed to construct a nomogram based on bi-regional quantitative dynamic contrast-enhanced MRI (DCE-MRI), as well as and clinical-radiological (CR) features for predicting MVI, and to assess its ability for stratifying the risk of recurrence after hepatectomy.

### METHODS AND MATERIALS

Patients with solitary HCC less than 5.0 cm were prospective collected, and were randomly divided into a training (n = 93) and validation set (n = 40). Quantitative DCE-MRI parameters were obtained in both intra-tumoral region (ITR) and peritumoral region (PTR). Combined DCE perfusion parameters (CDCE) were constructed to predict MVI. MR imaging features were also evaluated. Nomogram incorporating CDCE and CR features was developed and evaluated. The prognostic significance of the nomogram and the survival benefits of hepatectomy approaches (anatomical resection [AR] or non-anatomical resection [NAR]) were also assessed.

### RESULTS

A total of 133 patients with MVI (n = 45) and without MVI (n = 88) were included. Total blood flow in ITR and arterial fraction in PTR exhibited the best predictive performance for MVI with areas under the curve (AUCs) of 0.790 and 0.792, respectively. CDCE demonstrated a predictive performance with AUCs of 0.868 and 0.857 in the training set and validation set, respectively. A combined nomogram integrated with the a-fetoprotein, corona enhancement, two-trait predictor of venous invasion, and CDCE showed effective discrimination in both the training and validation set (AUC = 0.966 and 0.937, respectively). Survival analysis demonstrated that the nomogram could stratify HCC patients in terms of recurrence-free survival (RFS). AR was associated with better RFS than NAR in the high-risk group ($P < 0.05$).No significant difference between AR and NAR was observed in low-risk group ($P > 0.05$).

### CONCLUSION

Quantitative DCE-MRI provides a promising tool for predicting MVI in HCC noninvasive and preoperatively. Additionally, the combined nomogram based on CR features and quantitative DCE-MRI parameters of ITR and PTR achieves excellent prediction performance. The predicted MVI risk classification can stratify the risk of recurrence after radical hepatectomy and aid in selection of optimal surgical approaches.

### CLINICAL RELEVANCE/APPLICATION

MVI is a significant predictor of prognosis in HCC. The combined model incorporating bi-regional DCE-MRI parameters and clinical-radiological CR features could predict MVI preoperatively, which could stratify the risk of recurrence and aid in in choosing appropriate treatment strategies.

## W7-SSGI15-6 METABOLIC DYSFUNCTION-ASSOCIATED STEATOHEPATITIS (MASH) DAMPENS LIVER FAT REDUCTION IN PARTICIPANTS WITH OBESITY AFTER METABOLIC BARIATRIC SURGERY

Ryan Sappenfield (*Abstract Co-Author*) Nothing to Disclose
Garth Jacobsen (*Abstract Co-Author*) Nothing to Disclose
Eduardo Grunvald (*Abstract Co-Author*) Nothing to Disclose
Rashmi Agni (*Abstract Co-Author*) Nothing to Disclose
Walter Henderson (*Abstract Co-Author*) Nothing to Disclose
Danielle N. Batakis, BS (*Abstract Co-Author*) Nothing to Disclose
David T. Harris, PhD (*Abstract Co-Author*) Nothing to Disclose
Luke Funk (*Abstract Co-Author*) Nothing to Disclose
Ryan Broderick (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC
Scott B. Reeder, MD, PhD (*Abstract Co-Author*) Owner, Calimetrix;Owner, Reveal Pharmaceuticals;Owner, Cellectar Biosciences, Inc;Owner, Elucent Medical;Owner, HeartVista, Inc;;
Jeffrey B. Schwimmer, MD (*Abstract Co-Author*) Nothing to Disclose
Tanya Wolfson, MS (*Abstract Co-Author*) Nothing to Disclose
Yesenia Covarrubias, MS (*Abstract Co-Author*) Nothing to Disclose
Vitor F. Martins, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Obesity is a critical public health concern due to its rising prevalence and morbidity. Patients with obesity have increased propensity to develop metabolic dysfunction-associated steatotic liver disease (MASLD) and its advanced form metabolic dysfunction-associated steatohepatitis (MASH). MASH is associated with increased systemic inflammation and insulin resistance, leading to difficulty with weight loss, however if this translates to dampened liver fat reduction during weight loss is unknown. We hypothesized that MASH would be associated with reduced liver fat reduction, independent of baseline liver fat content, in adults with obesity after metabolic bariatric surgery (MBS).

### METHODS AND MATERIALS

Adults with obesity scheduled for MBS were prospectively recruited to participate in an ongoing dual-center study with collection of baseline clinical parameters (age, sex, BMI), fasting labs (glucose, HbA1c, insulin, lipid panel, liver panel), and non-contrast MR examinations (MRI-PDFF) on a clinical 3.0T MRI system (GE Signa Premier or GE Discovery MR750, GE Healthcare, Waukesha WI) at 2 timepoints (baseline and 12 months post-MBS). During MBS, participants underwent wedge biopsy of the left liver lobe. Two pathologists in consensus scored the histology and classified participants as MASH or not. Mann-Whitney test was used for baseline differences between participants with and without MASH. Variables associated with MASH were used in multivariable linear regression to model changes in liver PDFF post-MBS. Bonferroni's correction for multiple comparisons was used for baseline ($a=0.005$) and multivariable analyses ($a=0.01$).

## RESULTS

52 adults with obesity (47 female, mean age 45.5 years, mean BMI 46.9 Kg/m2, 11 MASH) were recruited to date and included in this study. Participants with MASH had higher liver PDFF (20.9% v 6.7%, p<0.001), ALT (38 U/L v 23 U/L,p=0.003), triglycerides (180 mg/dL v 112 mg/dL, p<0.001), and insulin (24 mIU/L v 16 mIU/L, p<0.001). When controlling for baseline liver PDFF, MASH status (p=0.007, ß = -2.6%), ALT (p=0.005) and AST (p=0.004) were significant negative independent predictors of PDFF reduction after MBS, while triglyceride and insulin were not.

## CONCLUSION

Participants with MASH had 2.6 percentage points less reduction of liver PDFF after MBS, when controlling for baseline PDFF. Liver transaminases were also significant negative independent predictors of PDFF reduction while triglyceride and insulin were not, suggesting hepatic inflammation rather than hepatic insulin resistance may interfere with liver fat reduction.

## CLINICAL RELEVANCE/APPLICATION

For patients with obesity and MASH, adjuvant treatment may be needed to achieve the same goal reduction in liver fat as patients without MASH.
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W7-SSGI16

**Gastrointestinal Imaging (Monitoring Response to Therapy)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S405

Benjamin Mervak, MD (*Moderator*) Nothing to Disclose
Anum Aslam, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W7-SSGI16-1 LI-RADS TREATMENT RESPONSE ALGORITHM VERSION 2024 VERSUS VERSION 2017: DIAGNOSTIC PERFORMANCE OF HEPATOCELLULAR CARCINOMA AFTER NONRADIATION-BASED LOCOREGIONAL TREATMENT

Yuan-Cheng Wang (*Abstract Co-Author*) Nothing to Disclose
Shuwei Zhou (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the performance of the Liver Imaging Reporting and Data System CT/MRI Nonradiation Treatment Response algorithm version 2024 (LR-TRA v2024) compared to LR-TRA v2017 and modified Response Evaluation Criteria in Solid Tumors (mRECIST) in detecting the pathologic viability of hepatocellular carcinomas (HCCs) treated with nonradiation-based local-regional therapies (LRT), and to evaluate whether incorporating ancillary features [LR-TRA v2024 (AFs)] improves diagnostic precision.

**METHODS AND MATERIALS**

This retrospective study included patients with HCCs who underwent nonradiation-based LRT followed by liver resection or transplantation between January 2017 and December 2022. Each treated lesion underwent categorization of treatment response criteria based on consensus readings by three radiologists, according to the LR-TRA v2024, LR-TRA v2017, and mRECIST criteria. The diagnostic performance of different TR criteria were compared intraindividually using the McNemar test, with pathologic tumor viability serving as the reference standard.

**RESULTS**

A total of 306 treated lesion (249 viable) in 269 patients (198 men; median age, 56 years) were evaluated. For predicting incomplete pathologic tumor necrosis, LR-TRA v2024-Viable and LR-TRA v2024 (AFs)-Viable exhibited sensitivities of 81.1% (202 of 249) and 85.9% (214 of 249), specificities of 75.4% (43 of 57) and 73.7% (42 of 57), and accuracy of 80.1% (245 of 306) and 83.7% (256 of 306). LR-TRA v2024 (AFs)-Viable exhibited an enhanced sensitivity (79.5%, 198 of 249) and accuracy (83.7%, 256 of 306) than LR-TRA v2017-Viable (both P = .006), as well as a marginally improved sensitivity and a significantly higher specificity than mRECIST-Viable (P = .016, P = .001, respectively). LR-TR-Equivocal was least assigned on LR-TRA v2024 (AFs) (4.9% [15 of 306]). For predicting complete pathologic tumor necrosis, LR-TRA v2024-Nonviable and LR-TRA v2017-Nonviable demonstrated the identical sensitivity, which was comparable to that of mRECIST-Nonviable (P = .108). Furthermore, they demonstrated significantly higher specificity and accuracy than mRECIST-Nonviable (P < .001, P = .047, respectively).

**CONCLUSION**

LR-TRA v2024 performs well in predicting pathologic tumor viability for HCCs treated with nonradiation-based LRT. Furthermore, LR-TRA v2024 (AFs)-Viable, utilizing ancillary features, reduced use of Equivocal category while significantly improving sensitivity and accuracy, without sacrificing specificity.

**CLINICAL RELEVANCE/APPLICATION**

A comprehensive understanding of the diagnostic performance of the newly published LR-TRA v2024, holds paramount importance in determining the efficacy of treatment for HCCs and guiding subsequent management decisions.

## W7-SSGI16-2 TUMOR VASCULAR SIGN IN THE RESPONSE ASSESSMENT OF GASTROINTESTINAL STROMAL TUMOR TREATED WITH RIPRETINIB: A MULTICENTER STUDY

Xiaoting Li (*Abstract Co-Author*) Nothing to Disclose
Sai Ge (*Abstract Co-Author*) Nothing to Disclose
Jian Li (*Abstract Co-Author*) Nothing to Disclose
Lin Shen (*Abstract Co-Author*) Nothing to Disclose
Zhilong Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Lei Tang, MD (*Abstract Co-Author*) Nothing to Disclose
Jia-Zheng Li (*Abstract Co-Author*) Nothing to Disclose
Yiyuan Wei (*Abstract Co-Author*) Nothing to Disclose
Meng He, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the occurrence and distribution of tumor vascular sign (TVS) in metastatic gastrointestinal stromal tumor (GIST), and the role of TVS in tumor response assessment in GIST with ripretinib treatment.

**METHODS AND MATERIALS**

This study followed a lesion-by-lesion-based design. 81 patients with advanced GIST in 8 medical centers were retrospectively and continuously included. All patients received ripretinib as later-line treatment after failure of imatinib, sunitinib or regorafenib. Abdominopelvic enhanced CT were analyzed at baseline and the first follow-up (2±1 months after treatment). All target lesions (the longest transverse diameter=10mm) were observed and recorded. Lesions were classified into poor-response group and good-response group based on size (RECIST) and density (Choi) changes at 6 months after treatment. TVS were categorized into intra-tumor vessel sign (iTVS) and peri-tumor vessel sign (pTVS). Multivariate logistic regression analysis was employed to identify the independent predictor of poor responder, and prediction models were established. The performance of the model was evaluated by calculating the area under the receiver operating characteristic (ROC) curve (AUC).

**RESULTS**

530 metastatic lesions were analyzed. Among the metastatic sites, hepatic metastases were prone to developing more iTVS than pTVS (P=0.139), while peritoneal metastases were more likely to exhibit pTVS (P=0.025). At baseline, the positive rate of iTVS was higher in poor-response group than that in good-response group (50.4% vs. 38.4%, P=0.016), however, the positive rate of pTVS did not show significant difference between the two groups (78.8% vs. 71.2%, P=0.093). Progressive iTVS was the independent risk factor of poor response. A combined model 1 was established using iTVS and size change (formula 1 = iTVS progression ×1.386+diameter progression × 2.169), which showed good efficacy in predicting progression at 6 months (AUC=0.78), superior to diameter alone (AUC=0.74,P=0.003) or iTVS alone (AUC=0.65,P<0.001). A joint model 2 was established using iTVS and density (formula 2 = iTVS progression × 1.117+ Choi progression × 2.612), presenting good efficacy in predicting 6-month progression (AUC=0.82), superior to Choi alone (AUC=0.79, P=0.006).

**CONCLUSION**

iTVS and pTVS were commonly observed in metastatic GIST. The presence of iTVS and its changes after ripretinib were associated with tumor response. The combination of iTVS with size or density may aid in the identification of progressive lesions.

**CLINICAL RELEVANCE/APPLICATION**

The TVSs and their changes monitored by enhanced CT scan may be a meaningful imaging sign that contributes to the early assessment of therapeutic response after ripretinib treatment for GIST.

## W7-SSGI16-3 ADDED VALUE OF HISTOGRAM ANALYSIS OF INTRAVOXEL INCOHERENT MOTION AND DIFFUSION KURTOSIS IMAGING FOR THE EVALUATION OF COMPLETE RESPONSE TO NEOADJUVANT THERAPY IN LOCALLY ADVANCED RECTAL CANCER

Peng Sun, MD,MD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Yuan Liu (*Abstract Co-Author*) Nothing to Disclose
Si Xu (*Abstract Co-Author*) Nothing to Disclose
Lan Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Xin Li, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yiwan Guo (*Abstract Co-Author*) Nothing to Disclose
Fan Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Chuansheng Zheng, MD (*Abstract Co-Author*) Nothing to Disclose
Ziwei Jin (*Presenter*) Nothing to Disclose

**PURPOSE**

Standard methods for assessing complete response (CR) in locally advanced rectal cancer (LARC) include digital rectal examination (DRE), endoscopy, and MRI. However, DRE and endoscopy provide limited visualization, often failing to detect residual tumors within or around the rectal wall. The diagnostic efficacy of conventional MRI falls short of clinical demand.As advanced diffusion models, diffusion kurtosis imaging (DKI) provides insights into tissue structural connectivity, while intravoxel incoherent motion (IVIM) offers information on microvascular perfusion and diffusion of water molecules within living tissues.This study aims to evaluate how IVIM and DKI histogram analysis contribute to assessing CR to neoadjuvant therapy (NAT) in LARC.

**METHODS AND MATERIALS**

In this prospective study, fifty-nine participants with LARC (T3-4N0M0 or T1-4N+M0), who underwent NAT and subsequent surgery, with adequate MR image quality, were enrolled from November 2021 to March 2023. Conventional MRI (T2WI and DWI), IVIM, and DKI were performed before NAT (pre-NAT) and within two weeks before surgery (post-NAT). Image evaluation and analysis were independently performed by two experienced radiologists. Pathologic complete response (pCR) was used as the reference standard. An IVIM-DKI-added model (combination of IVIM and DKI histogram parameters with T2WI and DWI) was constructed. Receiver operating characteristic (ROC) curves were generated to evaluate the diagnostic performance of conventional MRI and the IVIM-DKI-added model.

**RESULTS**

A total of 59 participants (median age: 58.00 years [IQR 52.00, 62.00]; 38 [64%] men) were evaluated, including 21 pCR and 38 non-pCR cases. The histogram parameters of DKI, including skewness of kurtosis post-NAT (Post-K Skewness) and root mean squared of change ratio of diffusivity (?%D DKI-Root Mean Squared), were entered into the IVIM-DKI-added model. The area under the ROC curve (AUC) of the IVIM-DKI-added model for assessing CR to NAT was found to be significantly higher than that of conventional MRI (0.855 [95% CI: 0.749, 0.960] vs 0.685 [95% CI: 0.565, 0.806], P < 0.001).

**CONCLUSION**

IVIM and DKI provide added value to conventional MRI in the evaluation of complete response to neoadjuvant therapy in locally advanced rectal cancer.

**CLINICAL RELEVANCE/APPLICATION**

Leveraging the noninvasive nature of IVIM and DKI can help mitigate uncertainty in diagnosing CR to NAT using conventional MRI.

## W7-SSGI16-4 ESPRESSO BREAK (+/- 15 SEC) STUDY FOR TEST-RETEST REPRODUCIBILITY OF COLORECTAL LIVER METASTASES VOLUMES: POTENTIAL IMPLICATIONS FOR RECIST

Yun Shin Chun, MD (*Abstract Co-Author*) Nothing to Disclose
Xiujiang J. Rong, PhD (*Abstract Co-Author*) Nothing to Disclose

Natalie Gangai (*Abstract Co-Author*) Nothing to Disclose
Jacob Peoples (*Abstract Co-Author*) Nothing to Disclose
Maida Wasim (*Abstract Co-Author*) Nothing to Disclose
Hyunseon C. Kang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Amber Simpson (*Abstract Co-Author*) Nothing to Disclose
Mohammad Hamghalam (*Abstract Co-Author*) Nothing to Disclose
Richard Kinh Gian Do, MD, PhD (*Presenter*) Author, RELX;Consultant, General Electric Company;Consultant, Bayer AG;Spouse, Author, Wolters Kluwer nv;Spouse, Committee Member, ALK-Abello A/S;Spouse, Consultant, JDP Therapeutics Inc;Spouse, Consultant, F. Hoffmann-La Roche Ltd

**PURPOSE**

The effect of contrast injection timing on tumor volume and diameter measurements on portal venous phase contrast-enhanced (CE)CT is not established. This study aims to investigate the reproducibility of volume and diameter measurements in the setting of variable contrast timing. Patients with colorectal liver metastases (CRLM) were imaged with consecutive CECTs within ±15 sec.

**METHODS AND MATERIALS**

Patients with CRLM at two institutions consented for this IRB-approved prospective study to undergo a clinical CECT with fixed contrast timing (80 second) and an additional research CECT with one of the following time gap: ±5, ±10, or ±15 second. Ground truth segmentations were generated for the clinical CECT by a board-certified radiologist. An nnUNET segmentation model was trained with the clinical CECT and then used to obtain total tumor volume (TTV), largest tumor volume (LTV), largest tumor diameter (LTD) on the research CECT. Concordance correlation coefficients (CCC) were used to measure reproducibility for TTV, LTV, and LTD between clinical and research CECTs.

**RESULTS**

95 patients to date were analyzed. 31, 34, and 30 patients underwent 2 CECTs with ±5, 10, and 15 second gap, respectively. LTD mean was 43.5 mm (range 8.5 to 148.3 mm). CCCs were nearly perfect for TTV (0.9992), LTV (0.9988), and LTD (0.9916). Differences for TTV between clinical and research CECT increased with larger time gaps, with mean difference of 4.9%/6.6%/8.1% at 5/10/15 second gaps respectively. LTD difference over 20% were found in 0/31, 2/34, and 1/30 patients for the 5, 10, and 15 second time gap cohorts.

**CONCLUSION**

CRLM volume and diameter vary with the timing of a portal venous phase CECT, with larger differences observed for larger time gaps in a prospective test-retest setting. In some cases, the impact on the largest tumor volume exceeds 20%, which would have a significant impact on RECIST category.

**CLINICAL RELEVANCE/APPLICATION**

This prospective study offers a unique cohort to evaluate test-retest reproducibility of liver tumor volumetrics. Future studies on radiomics reproducibility are planned.

## W7-SSGI16-5 RESPONSE EVALUATION CRITERIA FOR PORTAL VEIN TUMOR THROMBUS IN PATIENTS WITH HEPATOCELLULAR CARCINOMA POST TARGETED RADIATION BASED TREATMENTS

Amit Mehndiratta (*Abstract Co-Author*) Nothing to Disclose
Sonal Krishan, MD (*Abstract Co-Author*) Nothing to Disclose
Advitya Kaushik (*Abstract Co-Author*) Nothing to Disclose
Debolina Kabiraj, MBBS (*Presenter*) Nothing to Disclose

**PURPOSE**

Hepatocellular carcinoma (HCC) associated with portal vein tumor thrombosis (PVTT) has a grim prognosis. Despite Milan's criteria contraindicating curative interventions, some centers, including ours, have shown promising outcomes with locoregional therapies (LRTs) such as stereotactic-body-radiotherapy (SBRT) and transarterial-radioembolization (TARE). These therapies not only improve outcomes but also facilitate liver resection by downstaging or as a bridge to liver transplantation (LT). However, a standard criterion for response evaluation of PVTT is currently lacking. This study aims to develop an objective semiquantitative criterion for assessing PVTT response post-SBRT and/or TARE.

**METHODS AND MATERIALS**

This observational study involved 45 patients diagnosed with HCC and PVTT who underwent SBRT and/or TARE as bridging treatment to LT. Multiphasic CT performed and post-processing done by generating quantitative color arterial, portal and venous enhancement fraction maps. PVTT volume and percentage change in differential enhancement fraction calculated. Radiologists' assessment using the LI-RADS criteria recorded, and post-LT pathological correlation done. Non-parametric statistical analysis (Mann Whitney test) and receiver operator characteristic curve analysis used to identify responders (R) and non-responders (NR) based on differential arterial, portal, and venous enhancement parameters (DAE, DPE, and DVE), with statistical significance ($p<0.05$). Accuracy of the test cohort data assessed in the validation cohort.

**RESULTS**

Comparison of radiologist assessment with histopathology revealed a sensitivity and specificity of 86.2% and 64.4%, with accuracy of 64.4%. Statistically significant differences were observed between R and NR in terms of DAE ($p=0.001$) and DVE ($p=0.024$) and used to predict response status in the validation cohort. DAE threshold obtained from test patient data was 24.8%. A reduction of 24.8% or more in volumetric arterial enhancement fraction in PVTT post-treatment demonstrated sensitivity, specificity, and accuracy of 73.3%, 60%, and 70%, respectively in the validation group. Combining subjective and semiquantitative assessment, the accuracy was as high as 87%.

**CONCLUSION**

The volumetric differential change in enhancement fraction of PVTT, particularly DAE, demonstrates higher specificity and accuracy in identifying R and NR. Thus, it could serve as a semiquantitative objective criterion to assess PVTT response post SBRT and/or TARE.

**CLINICAL RELEVANCE/APPLICATION**

Integrating the above criterion as an adjunct to the current clinical scoring mechanism holds immense promise for enhancing radiologists' confidence in reporting PVTT treatment response and standardizing the process.

## W7-SSGI16-6 MR MORPHOMETRIC ASSESSMENT TO PREDICT CHEMOTHERAPY RESPONSE IN COLORECTAL LIVER METASTASIS: A PROSPECTIVE COMPARISON WITH DCE FUNCTIONAL PARAMETERS

Tong Tong, PHD (*Abstract Co-Author*) Nothing to Disclose
HUAN ZHANG (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the predictive significance of MR morphological features in assessing chemotherapy response among patients with colorectal liver metastasis (CRLM) and to compare its predictive power with dynamic contrast-enhanced (DCE) functional parameters.

## METHODS AND MATERIALS

Between August 2016 and July 2022, 161 patients with CRLM receiving standard first-line chemotherapy were prospectively enrolled. DCE-MR imaging was performed prior to treatment and after one cycle of chemotherapy using a MAGNETOM Skyra 3T scanner. A comprehensive analysis was conducted on baseline and early post-treatment morphological MR features, along with DCE functional parameters. Responses were evaluated according to RECIST criteria. A total of 18 morphological features and 90 DCE functional parameters were screened using lasso and logistic regression to identify significant predictors. Predictive models were subsequently developed and internally validated through bootstrap resampling to assess their prediction performance.

## RESULTS

Among the 161 patients, 77 were classified as responders and 84 as non-responders. Four morphological characteristics, including nonsmooth tumor margin ($p=0.002$), diameter increase ($p=0.001$), target sign ($p=0.018$), and tumor shrinkage ratio at early post-treatment ($p<0.001$), as well as two functional metrics, specifically the AT ratio between the interface and liver ($p=0.002$), and the difference in AT ratios between the peripheral tumor and liver before and after treatment ($p=0.017$), emerged as independent predictors. The morphological model offered superior predictive effectiveness compared to the functional one. Notably, the inclusion of functional and clinical factors did not significantly enhance the predictive power of the morphological model. The AUC of Internal validation through bootstrap resampling reached 0.939(95% CI: 0.902-0.977) with a high consistency with the training set(kappa=0.709). The accuracy, sensitivity and specificity were 85.5%, 87.2% and 84.1%, respectively.

## CONCLUSION

This study underscores the potential role of morphological criteria in predicting chemotherapy response in CRLM. A clinically relevant and straightforward predictive model based on morphological features has been developed, offering potential for widespread application in clinical practice.

## CLINICAL RELEVANCE/APPLICATION

Given the potential toxicities associated with chemotherapy, it is crucial to identify effective imaging features that can predict treatment response. The proposed morphological model offers clinicians a valuable tool for predicting chemotherapy response probabilities early in the treatment course and enabling personalized treatment planning.

# Abstract Archives of the RSNA, 2024

W7-SSMK09

**Musculoskeletal Imaging (Pelvis and Hip)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: N228

Leon Berenstein, MD (*Moderator*) Nothing to Disclose
Jade A. Anderson, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W7-SSMK09-1 DIAGNOSTIC PERFORMANCE OF HIP MRI FOR THE DETECTION OF LABRAL AND CARTILAGE ABNORMALITIES: A COMPARATIVE STUDY OF DEEP LEARNING AND STANDARD TECHNIQUES USING HIP ARTHROSCOPY AS STANDARD OF REFERENCE

Kilian Weiss, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Felix Meurer (*Abstract Co-Author*) Nothing to Disclose
Klaus Woertler, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Neumann, MD (*Abstract Co-Author*) Nothing to Disclose
Dimitrios C. Karampinos (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Sarah C. Foreman, MD (*Abstract Co-Author*) Nothing to Disclose
Marcus R. Makowski (*Abstract Co-Author*) Nothing to Disclose
Vanessa Twardy (*Abstract Co-Author*) Nothing to Disclose
Ingo Banke (*Abstract Co-Author*) Nothing to Disclose
Alexander W. Marka, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the diagnostic performance of high-resolution deep learning-based hip MRI sequences compared to standard-resolution compressed sense (CS) sequences for detecting labral and cartilage lesions in femoroacetabular impingement syndrome (FAIS) using hip arthroscopy as reference.

### METHODS AND MATERIALS

Thirty-two patients suffering from FAIS underwent hip MR imaging at 3T. Coronal and sagittal intermediate-weighted scans with fat saturation were acquired using both standard-resolution CS and high-resolution Compressed Sense Artificial Intelligence (CSAI) sequences. MR scans were assessed by a radiology resident, a musculoskeletal (MSK) fellow, a fellowship-trained MSK radiologist, and a hip arthroscopy surgeon. Images were assessed for presence or absence of labral abnormalities and cartilage defects in five separate cartilage zones of the femur and the acetabulum. All patients underwent highest resolution 4K hip arthroscopy for FAIS. Sensitivity, specificity, and accuracy were calculated, using arthroscopy as standard of reference.

### RESULTS

Excellent sensitivity and specificity was found for the detection of labral abnormalities with a sensitivity ranging from 97-100% in both CSAI and CS sequences for radiology readers and between 81% (CS) to 91% (CSAI) for the hip surgeon. The specificity for the detection of labral abnormalities was 100% for all readers. Overall sensitivity for all readers for the detecting cartilage lesions was relatively low in CS (37%) with only moderate improvement in high-resolution CSAI sequences (42%). Sensitivity for radiology readers (CS: 37-45%; CSAI: 45%) and slightly lower for the hip surgeon (CS: 27%, CSAI: 32%). The highest overall sensitivity assessed for all readers was found in the acetabular weight-bearing zone (superolateral; CS: 81%, CSAI: 88%). The overall specificity was similar between CS and CSAI (CS: 81%, CSAI: 79%). The femoral weight-bearing zone (superolateral) showed the lowest overall specificity (CS: 47%, CSAI: 37%).

### CONCLUSION

Performance of non-arthrographic hip MRI showed excellent results for diagnosing labral abnormalities. While CSAI sequences improved the detection of cartilage abnormalities compared to CS, the overall diagnostic performance was low. These results underline the limitations of non-arthrographic MRI for detecting cartilage abnormalities, even with high-resolution MR sequences.

### CLINICAL RELEVANCE/APPLICATION

MRI is an important tool for diagnosing hip joint pathologies, but limitations for detecting abnormalities of the acetabular and femoral cartilage should be noted. Integrating CSAI may improve diagnostic accuracy. Further technical developments and investigations are needed to improve non-arthrographic hip MRI performance.

## W7-SSMK09-2 OPPORTUNISTIC SCREENING FOR OSTEOPOROSIS IN THE LUMBAR VERTEBRA AND PROXIMAL FEMUR OF PATIENTS UNDERGOING ABDOMINAL CT SCANS IN A BRITISH POPULATION

Nikolaos Papadakos (*Abstract Co-Author*) Advisory Board, Pfizer Inc
Muskan Nafis (*Abstract Co-Author*) Nothing to Disclose
Katie Moss (*Abstract Co-Author*) Nothing to Disclose

Manjiri Joshi, MBChB (*Abstract Co-Author*) Nothing to Disclose
Pardis Zalmay, FRCR (*Presenter*) Nothing to Disclose

**PURPOSE**

Osteoporosis is an underdiagnosed and undertreated condition predisposing people to debilitating fragility fractures. While CT scans have been explored for lumbar spine osteoporosis screening, research on their use in diagnosing hip osteoporosis is scarce. In this work-in-progress report, we examine the potential of CT in opportunistically detecting osteoporosis in both lumbar vertebra and the proximal femur, a novel approach in a British population.

**METHODS AND MATERIALS**

Retrospective analysis of CT and DEXA scans obtained within a 12-month interval from the same adult cohort was performed. BMD and T-scores from DEXA were compared with Hounsfield unit (HU) values from CT scans of the abdomen and pelvis. Various HU measurements were tested at the proximal femur in order to find a measurement technique that was most useful. CT scans obtained with intravenous contrast and on a Siemens Definition Dual-Drive machine (tube voltages 80-110 kVP).

**RESULTS**

Analysis of 118 patients revealed weak positive correlations between vertebral HU values and BMD, the strongest being 0.448 at L1. Stronger positive correlations were found for proximal femoral measurements, especially at the axial femoral neck (0.697). ROC curves at the lumbar levels demonstrated poor diagnostic performance but at the proximal femur showed promising diagnostic potential, particularly with an HU threshold of 82 at the axial femoral neck (78% sensitivity and 75% specificity).

**CONCLUSION**

While CT values correlated positively with lumbar and hip BMD, lumbar osteoporosis diagnosis via CT was less effective than previously reported. A proposed explanation for this is the utilisation of automated tube voltage selection (ATVS) in the CT scanner used for this study. ATVS tailors the tube voltage to the patient being scanned in order to reduce radiation dose. Altering tube voltage in turn significantly alters HU measurement. Previous studies have either used the same tube voltage (120 kVP) or not reported tube voltage. Despite this, CT measurement at the axial femoral neck showed promise for osteoporosis detection.

**CLINICAL RELEVANCE/APPLICATION**

Contrary to prior research based on older CT scan technology, caution is warranted in interpreting lumbar HU values due to the influence of modern dose-reduction technologies which are becoming increasingly common. Nonetheless, opportunistic assessment of the proximal femur on CT holds potential for osteoporosis detection and warrants further investigation. This study is a work-in-progress. Going ahead we aim to include CT scans performed on the other scanners in our centre, as well as scans performed without intravenous contrast.

## W7-SSMK09-4 INCIDENCE OF NON-TRAUMATIC OSTEONECROSIS OF THE FEMORAL HEAD (ONFH) ON SCREENING HIP MRI: A POSSIBLE LONG-TERM MANIFESTATION IN PATIENTS SURVIVED TO SEVERE COVID-19 IN THE FIRST PANDEMIC PEAK

Sandro Sironi, MD (*Abstract Co-Author*) Nothing to Disclose
Nicola Guindani (*Abstract Co-Author*) Nothing to Disclose
Mario Gaffuri (*Abstract Co-Author*) Nothing to Disclose
Federico Chiodini (*Abstract Co-Author*) Nothing to Disclose
Clarissa Valle, MD (*Abstract Co-Author*) Nothing to Disclose
Claudio Carlo Castelli (*Abstract Co-Author*) Nothing to Disclose
Pietro A. Bonaffini, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the incidence and the clinical profile of non-traumatic osteonecrosis of the femoral head (ONFH) in patients survived to severe COVID-19 during the first pandemic peak, treated with steroids, and scanned for screening with hip MRI.

**METHODS AND MATERIALS**

We prospectively enrolled adult patients (<60 years): a) survived to severe first peak COVID-19 (February-May 2020); b) hospitalised in ICU >25 days; c) treated with steroids (total cumulative dose >2g). Two years after disease onset. all patients underwent hip MRI (coronal-axial SE-T1 and STIR) for screening purposes: ONFH presence/absence, unilateral/bilateral involvement, and eventual femoral head(s) collapse were recorded. Among clinical data, the following parameters were collected: total corticosteroid therapy, symptoms (hip pain) presence/absence, quality of life ( EQ-5L score), the Oxford Hip Score (OHS) and presence of thrombosis or sepsis during ICU hospitalisation.

**RESULTS**

Twenty-five patients (mean age at ICU admission 54 years, range 42-60.75; mean age at time of MRI 56.4 years, range 44-63) were included. MRI demonstrated ONFH in 4/25 (16%) cases: 2 with bilateral involvement and no collapse, and 2 with unilateral involvement (1 collapse). Symptoms at time of MRI were present in 10/25 (40%) cases: in 3/10 ONFH was present, 3/10 MRI were completely normal and in 4/10 MRI was negative for ONFH but presumable alternative causes explaining hip symptoms were highlighted (right psoas bursitis 1, coxarthrosis 3). The mean EQ-5L score was 72.42 (range 45-100) and the mean Oxford Hip Score 47.46 (range 32-72) but no significant correlation with ONFH presence was found. The mean cumulative dose of steroids was: 6.3 g (range 2-16) for all patients, 9.6 g (range 5.6-16) for 4/25 with ONFH and 5.6 g (range 2-13.9) for 21/25 without ONFH. During ICU hospitalization 15/25 patients (60%) developed sepsis (4), thrombosis (6) or both (5). However, a past history of ICU sepsis was present only in 2 symptomatic patients with ONFH.

**CONCLUSION**

Patients survived to severe COVID-19 and treated with steroids demonstrated, 2 years after infection onset, about 15% incidence of ONFH; this seems correlated with a higher cumulative dose of steroids but not with thrombosis during ICU hospitalization. No correlation was found with symptoms, EQ-5L and Oxford Hip Score.

**CLINICAL RELEVANCE/APPLICATION**

ONFH in patients who survived severe COVID-19 during the first peak represent a possible but not frequent long-COVID manifestation (2 years) and may be more related to higher cumulative steroids dose rather than microvascular damage. This may suggest, in these categories of patients, the rationale of hip MRI screening.

## W7-SSMK09-5 A MULTI-MODAL PIPELINE FOR BUILDING LARGE-SCALE NORMATIVE DATABASE TO ASSIST WITH PERSONALIZED CARE OF HIP DISORDERS

Mohammadreza Movahhedi, PhD (*Abstract Co-Author*) Nothing to Disclose
Sarah D. Bixby, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Young-Jo Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Novais (*Abstract Co-Author*) Nothing to Disclose
Nazgol Tavabi, PhD (*Abstract Co-Author*) Nothing to Disclose
Ata Kiapour, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and leverage a robust multi-modal fully automated pipeline to generate a large-scale registry of normal hip 3D morphological features from clinically available hip and pelvic CT scans to study normal development of hip the joint.

**METHODS AND MATERIALS**

Following IRB approval, a multi-modal pipeline was developed to generate a comprehensive registry of normal hip morphology during skeletal growth. The pipeline included natural language processing (NLP) module to process the clinical and radiology notes to identify any documented musculoskeletal pathology related to the hip joint pathology in patients with available pelvis CT scans at our hospital (2012-2022). The selected "normal" hip CT scans were then segmented into 3D models using a UNet-based deep learning module. A comprehensive rule-based pipeline was then used to measure 40+ hip anatomical features in 3D including femoral measurements, acetabular measurements and hip coverage.

**RESULTS**

The NLP pipeline achieved an accuracy of 0.98 in identify hip pathology from radiology reports. The 3D reconstruction and landmark detection pipeline resulted in average Dice coefficient of 0.98±0.03 and average surface error of <1 mm. The morphology measurement pipeline resulted in an average error of <2 mm and <6 degrees. From a total of 52,360 CT scans, we identified and analyzed 9,721 "good quality" normal CT scans (49.3% Females; Age: 7 to 25 years, average: 14±4 years; 19,442 hips). On average, females had smaller femoral heads, epiphyseal tubercle, femoral necks, acetabulum, and alpha angles along with greater peripheral cupping, coronal head-neck tilt, femoral head-neck offset, overall femoral head coverage, acetabular anteversion, and posterior-superior center-edge angles (P<0.001). There were no clinically meaningful sex-differences in anterior-superior center-edge angles and sacro-pelvic sagittal alignments.

**CONCLUSION**

Leveraging existing multi-modal medical data, we developed a fully automated pipeline that extracts anatomical features from the hip joint in 3D, specify the measurements that fall outside of the normal range compared to its population (same age, same sex), and precisely reveal the abnormalities. This rich database is currently being used to develop normative growth charts for detailed anatomical features of the hip throughout the skeletal growth and maturation. We are planning to publicly release this data to assist with personalized assessment of hip dysmorphology.

**CLINICAL RELEVANCE/APPLICATION**

The current project highlights the feasibility of multi-modal approaches to process existing clinical data to generate large-scale registries, which can then be used to improve care through evidence-based personalized diagnosis and treatment planning.

## W7-SSMK09-6 ACCELERATED 3D MRI OF THE HIP. QUALITY AND EFFICIENCY OF DEEP LEARNING-BASED COMPRESSED SENSING

Zhenlin Li (*Abstract Co-Author*) Nothing to Disclose
Chunchao Xia (*Abstract Co-Author*) Nothing to Disclose
Xu Xu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purposes of the present study were to explore the feasibility of the DL-based 3D CS proton density weighted image in hip MRI, and compare the image quality and diagnosis performance with conventional sense and CS sequences.

**METHODS AND MATERIALS**

The consecutive 70 patients (75 hips) who underwent the hip MRI from February 2023 to April 2023 were included in this study. All images were acquired on a 3T MR system using 16-channel elbow coil (Elition, Philips Healthcare). Objective image quality was assessed by signal-to-noise ratios (SNRs) of bone and muscle and contrast to noise ratios (CNRs). Delineative imaging quality, diagnostic certainty and artifacts were assessed on a five-point-scale.

**RESULTS**

Scan time decreased with increasing CS factor (sense4, CS4, DL-CS4: 5min34s; DL-CS8:2min56s). DL-CS4 showed the highest SNRs ($p < 0.01$) and CNR, while the SENSE 4 had significantly lower SNRs and CNR values (all $p < 0.05$). We found no evidence of differences between DL-CS4 and DL-CS8 for SNRs. For diagnostic certainty and artifacts, no overt differences were found between SENSE4 and CS4, DL-CS4 and DL-CS8. For delineative imaging quality, there were no differences between SENSE 4 and CS4. Meanwhile, we found no difference between DL-CS4 and DL-CS8 in evaluation of labrum and cartilage (all $p>0.05$) although DL-CS4 yielded slightly higher image scores. However, DL-CS8 yielded lower image scores than CS4 ($p=0.02$) and DL-CS4 ($p<0.05$) in evaluation of bony trabecula. Moreover, the inter-method agreements among patient group sequences were good or excellent.

**CONCLUSION**

DL-CS4 improves image quality with approximately the same scanning time as conventional PI and CS for 3D STIR TSE in the hip, and DL-CS8 reduces scanning time compared with conventional PI and CS while maintaining comparable image quality.

**CLINICAL RELEVANCE/APPLICATION**

In this study, DL-CS4 and DL-CS8 showed higher SNRs and CNRs than the other sequences. This demonstrated the feasibility of DL-CS in reducing noise with preserved contrast. Therefore, DL-CS8 has the potential to make 3D scans faster to increase the comfort and compliance of patients and to improve the workflow of hip MRI.

# Abstract Archives of the RSNA, 2024

W7-SSMK10

**Musculoskeletal Imaging (Shoulder)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E450A

Aline Serfaty Sr, MD, PhD (*Moderator*) Nothing to Disclose
Richard E. Walker, MD, FRCPC (*Moderator*) Nothing to Disclose

**Sub-Events**

## W7-SSMK10-1 SHOULDER MR ARTHROGRAPHY USING AN IRON-BASED POSITIVE T1 CONTRAST AGENT (NEMO-103): COMPARISON WITH GADOLINIUM-BASED CONTRAST

Hong Seon Lee, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To demonstrate that in shoulder MR arthrography, NEMO-103 is interchangeable with gadolinium-based contrast agents (GBCAs) and exhibits superior diagnostic efficiency during the delayed phase (attributed to the longer joint-cavity residence times).

### METHODS AND MATERIALS

We retrospectively evaluated NEMO-103-based shoulder MR arthrography in phases I (30 minutes) and II (60 minutes) in eight patients (3 females [37.5%], age [mean±standard deviation]: 38.0±7.8 years; Comparison 1); and 31 NEMO-based (11 females [35.5%], age: 40.0±13.0 years) and 38 GBCA-based phase I MRIs (14 females [36.8%]; age: 49.4±18.7 years; Comparison 2). In Comparison 3, the eight aforementioned NEMO-103-based and 12 GBCA-based phase II MRIs (5 females [41.7%], age: 56.2±15.7 years) were compared. The study included demographic details and assessed the contrast-to-noise ratio (CNR), joint distension, and subjective image quality. Visual Turing tests were conducted on axial-plane MR images for Comparisons 1 and 2. NEMO-103 MRI scans were obtained from previous clinical phase 1/2a trials.

### RESULTS

Comparison 1 revealed no significant differences in image quality between the NEMO-103-based MR shoulder arthrography images in phases I and II. In Comparison 2, NEMO-103-based images showed no CNR difference but had improved distension, resulting in higher overall image quality scores than GBCA-based images (4.7±0.5 vs. 4.4±0.5; p=0.034). Comparison 3 favored NEMO-103-based arthrography, showing a higher CNR (92.9±26.7 vs. 61.5±29.7; p=0.027), more pronounced joint distension, and superior overall image quality scores (4.9±0.2 vs. 4.2±0.9; p=0.020) compared with GBCA-based images. In the two-step visual Turing tests, were 46.8% and 53.3%, respectively; this was not significantly different from random guessing (50.0%).

### CONCLUSION

NEMO-103-based and GBCA-based shoulder MR arthrography were interchangeable regarding CNR, joint distension, subjective image quality, and visual Turing test results. Additionally, NEMO-103 exhibited enhanced resistance to contrast resorption over time, suggesting its potential to extend the imaging window.

### CLINICAL RELEVANCE/APPLICATION

NEMO-103-based shoulder MR arthrography is interchangeable with gadolinium-based arthrography, with enhanced resistance to contrast resorption in the delayed phase, suggesting the potential for extended imaging windows.

## W7-SSMK10-2 CLINICAL IMPLEMENTATION OF 6-MINUTE DEEP LEARNING SUPER RESOLUTION MRI OF THE SHOULDER: ARTHROSCOPY-VALIDATED ASSESSMENT OF DIAGNOSTIC PERFORMANCE

Aline Serfaty Sr, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatiane C. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Fritz, MD (*Abstract Co-Author*) Institutional research support, Siemens AG;Scientific Advisor, Siemens AG;Patent agreement, Siemens AG;Institutional research support, Johnson & Johnson;Institutional research support, Zimmer Biomet Holdings, Inc;Institutional research support, BTG International Ltd
Meghan Jardon, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Donners, MD (*Abstract Co-Author*) Nothing to Disclose
Yannik Leonhardt (*Abstract Co-Author*) Nothing to Disclose
Shana G. Neumann, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Vosshenrich, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the diagnostic performance of DL-augmented 6-minute 3-fold parallel imaging (PI) accelerated super-resolution MRI of the shoulder.

### METHODS AND MATERIALS

Patients who underwent 3-fold PI-accelerated 3T shoulder MRI between March 2023 and November 2023 and had arthroscopic shoulder surgery within 90 days were included. MRI studies were independently reviewed by seven musculoskeletal radiologists for image quality using 5-point Likert scales (1 = lowest score to 5 = highest score) and the presence of rotator cuff tendon tears, superior and anterior labral tears, biceps tendon tears, cartilage defects, Hill-Sachs lesions, Bankart fractures, subacromial-subdeltoid bursitis and AC-joint degeneration. Rotator cuff tears and cartilage lesions were divided into partial- and full-thickness defects. Statistical computations included kappa-based interreader agreements and diagnostic performance measures (significance level p<.05).

### RESULTS

121 adults (mean age: 55±14 years; 75 men) who underwent arthroscopy within a median of 39 days (range: 1-90) were evaluated. Image quality was rated good (median: 4 [IQR: 4,4]) with minimal motion artifacts (median: 4 [4;4]). Interreader agreement for detecting arthroscopy-confirmed abnormalities was good to very good (? = 0.68-0.94). Diagnostic performance testing indicated good to excellent performance for most intra- and periarticular abnormalities (AUCs = 0.67-1.00). Consensus sensitivities/specificities/accuracies were 89%/90%/89% for supraspinatus-infraspinatus tendon tears (n=102), 82%/63%/68% for subscapularis tendon tears (n=31), 93%/73%/86% for superior labral tears (n=81), 100%/100%/100% for anterior labral tears (n=16), 68%/90%/82% for biceps tendon tears (n=48), 42%/93%/81% for cartilage defects (n=65), 93%/99%/98% for Hill-Sachs deformities (n=14), 100%/99%/99% for bony Bankart lesions (n=4), 97%/63%/92% for subacromial-subdeltoid bursitis (n=102), and 98%/70%/93% for AC-joint degeneration (n=101).

### CONCLUSION

DL-augmented 3-fold PI-accelerated 6-minute super-resolution shoulder MRI has good to excellent diagnostic performance for diagnosing tendinous, labral, and osteocartilaginous abnormalities.

### CLINICAL RELEVANCE/APPLICATION

Deep learning-augmented fast shoulder MRI maximizes scan efficiency while maintaining high image quality and diagnostic accuracy.

## W7-SSMK10-3 DIAGNOSTIC VALUE OF DUAL-ENERGY CT MONOCHROMATIC IMAGING FOR ROTATOR CUFF INJURY: A COMPARISON WITH STANDARD CT

Suwei Liu (*Presenter*) Nothing to Disclose

### PURPOSE

This study evaluates the diagnostic value of dual-energy CT (DECT) monochromatic imaging compared to standard Computed Tomography (SCT) in assessing rotator cuff injury.

### METHODS AND MATERIALS

This retrospective study included patients who underwent GE Revolution ES CT and 3.0T MRI scans and arthroscopic surgery within 7 days from December 2023 to May 2024. Three radiologists independently assessed SCT, mono+50keV, mono+90keV, and MRI images for the visualization of supraspinatus tendon injury and recorded their diagnostic confidence. Reference standards were established using MRI diagnoses, and regions of interest (ROI) were delineated to measure CT values at tear, degeneration areas, and normal tendon areas on SCT, mono+50keV, and mono+90keV images to quantitatively evaluate the differences between tear and degeneration areas, between degeneration and normal tendon areas.

### RESULTS

The study included 100 patients with supraspinatus tendon injuries (mean age 55.9 ± 12.2 years; 46 males). CT values at the tear sites on SCT, mono+50keV, and mono+90keV images were significantly lower than those in degeneration areas ($p < 0.001$), with optimal cutoff values of 17.4 HU, 28.0HU, and 14.2HU, respectively, and AUCs of 0.920, 0.978, and 0.938. CT values in degeneration areas were significantly lower than in normal tendon areas ($p < 0.001$), with optimal cutoff values of 23.8HU, 36.1HU, and 19.6HU, respectively, and AUCs of 0.967, 0.970, and 0.946. There was no significant statistical difference in the diagnostic performance of MRI and DECT for supraspinatus tendon injuries ($p = 0.66$).

### CONCLUSION

DECT demonstrates high diagnostic accuracy and reliability in both qualitative and quantitative assessments of rotator cuff injury.

### CLINICAL RELEVANCE/APPLICATION

DECT offers an effective and reliable alternative to MRI for diagnosing rotator cuff injury, potentially serving as an alternative method for evaluating tendon integrity and detecting incidental rotator cuff injury.

## W7-SSMK10-4 ENHANCING ROTATOR CUFF TEAR DETECTION AND CLASSIFICATION: VALIDATION OF A DEEP LEARNING MODEL

Judith Herrmann, MD (*Abstract Co-Author*) Nothing to Disclose
Reza Dehdab, MD (*Abstract Co-Author*) Nothing to Disclose
Saif Afat, MD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Gassenmaier, MD (*Abstract Co-Author*) Nothing to Disclose
Haidara Al Mansour, MD, MEng (*Abstract Co-Author*) Nothing to Disclose
Sebastian Werner, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To validate a prototype deep-learning (DL) model capable of detecting and classifying rotator cuff tears in shoulder magnetic resonance imaging (MRI).

### METHODS AND MATERIALS

Shoulder MRI scans from 103 patients from one institution were retrospectively analyzed. A DL algorithm processed proton-density weighted fat-suppressed sequences in three planes from each scan. The algorithm detects and classifies rotator cuff tears of the supraspinatus, infraspinatus and subscapularis muscles. Classification distinguishes between no tear, partial tear (low grade or high grade), and full-thickness tear. The reference standard was set by experienced musculoskeletal radiologists' readings.

### RESULTS

In the muscle-based analysis, the algorithm achieved an overall diagnostic accuracy for detecting any type of tear of 80% (70% sensitivity, 83% specificity). In the patient-based analysis for each single muscle, the accuracy was highest for the supraspinatus at 85% (74% sensitivity, 93%

specificity), followed by the infraspinatus at 77% (93% sensitivity, 74% specificity) and subscapularis at 77% (41% sensitivity, 86% specificity). Regarding different grades of tears, there were no statistically significant differences between the model and radiologists with accuracies for full, partial, low-grade and high-grade partial tears at 96% (82% sensitivity, 97% specificity), 77% (42% sensitivity, 86% specificity), 83% (29% sensitivity, 92% specificity) and 88% (21% sensitivity, 94% specificity), respectively.

**CONCLUSION**

The application of deep learning to diagnose rotator cuff tears worked best in diagnosing supraspinatus tears and full-thickness tears. For the diagnosis of infraspinatus, subscapularis, and partial-thickness tears, specificity was markedly higher than sensitivity, suggesting it rather as a tool of exclusion.

**CLINICAL RELEVANCE/APPLICATION**

The DL-based software can support the diagnosis of full-thickness supraspinatus tears and the exclusion of infraspinatus and subscapularis tears. The model's diagnostic performance does not reach that of experienced musculoskeletal radiologists, but it could be helpful for less experienced or non-expert radiologists.

## W7-SSMK10-5 OSTEOLYSIS: NOT JUST THE DISTAL CLAVICLE

Jeffrey A. Belair, MD (*Abstract Co-Author*) Nothing to Disclose
Blaire Adler (*Abstract Co-Author*) Nothing to Disclose
Aishwarya Gulati, MD, MBBS (*Presenter*) Nothing to Disclose

**PURPOSE**

Distal clavicular osteolysis (DCO) is a commonly encountered cause of shoulder pain, particularly in young males, and may result from repetitive overuse or antecedent trauma. We propose a variant of DCO in which subchondral resorptive changes span the acromioclavicular joint (ACJ), involving both the distal clavicle and the anterior acromion.

**METHODS AND MATERIALS**

A retrospective PACS query identified patients scanned in 2023 with reported DCO on shoulder MRIs performed on at least 1.5 T scanners using a dedicated shoulder protocol. Those with underlying ACJ osteoarthritis were excluded. Demographics and pre-MRI patient questionnaires were reviewed. Each case was re-reviewed to identify cases with additional resorptive changes involving the anterior acromion. The demographics of each patient population and any significant difference were then analyzed by binomial regression using SPSS.

**RESULTS**

128 cases (127 patients) meeting inclusion criteria were identified (93 males). Mean age was 39.5 years (SD 11.3). Average symptom duration before MRI was 408.6 days (13.4 months) (n=110). 45.3% had a history of antecedent trauma, 62.5% reported lifting weights, 38.2% reported overhead activities/sports, and 32% reported other repetitive movements. Of the 128 cases, 42 had subchondral edema and resorption in the acromion in addition to the clavicle. Maximum weight bench pressed was the only statistically significant factor associated with acromial involvement (p=0.02). There was no statistically significant difference between patient groups with respect to sex, trauma, weightlifting, overhead activities, repetitive motion, or duration of symptoms.

**CONCLUSION**

DCO is described as painful bone resorption with subchondral cyst formation, loss of cortical contour, and erosion of the distal clavicle. DCO may result from antecedent trauma or due to repetitive microtrauma, classically described in weightlifters. We identified a variant of DCO with resorptive changes on both sides of the ACJ. Maximum bench press weight was the only clinically significant factor associated with acromial involvement. This suggests that increased load-bearing may result in more extensive involvement of the ACJ. A larger patient population is needed to further elucidate any other associations.

**CLINICAL RELEVANCE/APPLICATION**

Patients with DCO may demonstrate resorptive changes on both sides of the ACJ, which should be recognized as a forme fruste of mechanical osteolysis. This should not be confused with ACJ arthropathy or an underlying inflammatory process, as patients may be amenable to conservative treatment with activity modification.

## W7-SSMK10-6 EFFECTIVE CROSS-SECTIONAL AREA OF ROTATOR CUFF MUSCLE USING MRI DIXON SEQUENCE AFFECT ON BIODEX ISOKINETIC TEST FOR THE SHOULDER

Woong-Kyo Jeong, MD (*Abstract Co-Author*) Nothing to Disclose
Chang Ho Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Kyung-Sik Ahn, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Woo Young Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Hee-Gone Lee (*Abstract Co-Author*) Nothing to Disclose
Baek Hyun Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Euddeum Shim (*Abstract Co-Author*) Nothing to Disclose
Kyu-Chong Lee, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the correlation between the effective cross-sectional area (eCSA) of the rotator cuff muscle using the Dixon MRI sequence and the Biodex isokinetic test for the shoulder.

**METHODS AND MATERIALS**

A total of 87 patients who underwent both shoulder MRI and isokinetic strength test were enrolled. One radiologist drew the cross-sectional area (CSA) of the subscapularis (SSc), supraspinatus (SST), and infraspinatus+teres minor (ISTM) on the sagittal Y-view. The eCSA was calculated by multiplying the CSA and fat fraction based on the Dixon sequence. Eight shoulder movements (FL60, EX60, FL180, EX180, ER60, IR60, ER180, and IR180) each with four parameters (peak torque, peak torque/body weight [BW], torque at 30° [TQ30], and total work [TW]) were recorded in an isokinetic strength test. A multivariate general linear model was used to identify the correlation between eCSA and 32 Biodex parameters. Sex, body mass index (BMI), rotator cuff tear, long head of biceps tendon (LHBT) tear, and lifestyle habits were adjusted according to Wilk's lambda.

**RESULTS**

All shoulder Biodex parameters were adjusted with sex and BMI. ER180 was associated with IST and SSc tendon tear. IR180 was associated with SSc and LHBT tears. The eCSA of SSc was significantly correlated with TQ30 at FL60 and IR180 (p=0.009 and 0.025, respectively). The eCSA of SST and ISTM

was correlated with multiple Biodex parameters. TW showed the highest ß-coefficient among the four parameters, while BW showed no correlation with eCSA. TW at FL60, EX180, ER60, IR60, and ER180 was correlated with eCSA of both SST and ISTM. However, TW at EX60 was correlated with SST and TW at FL180 was correlated with ISTM (p=0.001 and 0.006, respectively).

**CONCLUSION**

A notable relationship was observed between the eCSA of the rotator cuff muscle using Dixon sequence and the Biodex test results. Furthermore, SSc tendon, IST tendon, and LHBT tears, as well as lifestyle habits, were also found to affect the outcomes of the Biodex test.

**CLINICAL RELEVANCE/APPLICATION**

Three specific Biodex parameters, namely TQ30 at IR180, TW at EX60, and TW at FL180, showed potential as valuable markers for SSc, SST, and IST muscle functions, respectively.

# Abstract Archives of the RSNA, 2024

W7-SSNR12

**Neuroradiology (Neoplasms: Diagnosis and Classification)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S406B

Jana Ivanidze, MD, PhD (*Moderator*) Research Grant, Novartis AG;

**Sub-Events**

## W7-SSNR12-1 OXYGEN METABOLIC AND NEOVASCULARIZATION TUMOR MICROENVIRONMENT MAPPING FOR DIFFERENTIATION BETWEEN GLIOBLASTOMAS AND SOLITARY BRAIN METASTASES

Gui-Hua Jiang (*Abstract Co-Author*) Nothing to Disclose
Ouyang Qunhui (*Abstract Co-Author*) Nothing to Disclose
Wan-Yi Zheng, MD (*Abstract Co-Author*) Nothing to Disclose
Ping Liu, MD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Glioblastomas (GB) and solitary brain metastases (BM) are the most common brain tumors in adults. Their management strategies, however, are quite different with significant consequences on clinical outcome. The aim of this study was to differentiate GB from BM employing MRI-derived neovascularization and oxygen metabolism tumor microenvironment (TME) mapping.

### METHODS AND MATERIALS

Thirty-seven patients with newly diagnosed, untreated, and histopathologically confirmed GB or BM preoperatively undergo the MRI including quantitative blood-oxygen-level-dependent (qBOLD) imaging and vascular architecture mapping (VAM). Imaging biomarker about oxygen metabolism and neovascularization were fused for classification different TMEs: necrosis, hypoxia with/without neovascularization, oxidative phosphorylation (OxPhos), and glycolysis with/without neovascularization. Different TME volume fractions and the oxygen metabolism - neovascularization parameters in different subregions were compared. The receiver operator characteristic curve analysis was performed for differentiation.

### RESULTS

For the distribution of the TME compartments, GBM showed lower hypoxia without neovascularization and total hypoxia (p=0.004 and 0.001, respectively), whereas, exhibited higher aerobic glycolysis and vital tumor (p = 0.001, respectively). The vital tumor had the highest diagnostic performance (AUC,0.906)for differentiation GBM and BM. For oxygen metabolism - neovascularization biomarkers, necrosis displayed higher tissue oxygen tension (PO2, p = 0.047) in GB. The GBM showed apparently higher volume ratio of viable tumor parts (31%, p = 0.036), along with lower OEF (19%, p = 0.019),higher tissue oxygen tension (PO2, p = 0.004) and higher microvessel density (MVD, p = 0.004). Of which, the OEF in the edema region showed best differentiate performance with the AUC of 0.911.

### CONCLUSION

MRI-derived oxygen metabolic and neovascularization TME characterization may be helpful to noninvasively distinguish GB and BM based on pathophysiological differences.

### CLINICAL RELEVANCE/APPLICATION

Combination of the MRI-derived oxygen metabolism and neovascularization provides insights into the complexity and heterogeneity TME of the solitary brain tumor in clinical routine. Which have the potential for more precise noninvasive determine the tumor pathophysiology, and further facilitating to improve the glioma management.

## W7-SSNR12-2 MRI DEFINES CSF2RA'S GENETIC COMMUNITY AS REGULATOR OF HYPOXIA RESPONSE AND PROGRESSION IN THE INVASIVE NON-ENHANCING RIM OF HIGH GRADE GLIOMA

Leland S. Hu, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew Flick (*Abstract Co-Author*) Nothing to Disclose
Ramon F. Barajas JR, MD (*Presenter*) Nothing to Disclose

### PURPOSE

High-grade glioma (HGG) is the most common and aggressive form of primary brain cancer with poor prognosis. Standard of care surgery employs Magnetic Resonance Imaging to identify the contrast enhancing (CE) core for resection, leaving behind a non-enhancing (NE) invasive rim of tumor which invariably contributes to recurrence. The hypoxic tumor microenvironment is thought to drive invasion into healthy brain tissue, and understanding cellular responses to hypoxia may provide key insight into combatting recurrence. Here, we employ graph network analyses on a unique dataset of multi-regional spatially-localized CE and NE biopsies from a large cohort of patients with HGG to identify gene networks influencing hypoxia response and invasion.

**METHODS AND MATERIALS**

159 IDH-wildtype tumor biopsy samples from NE and CE regions of 74 glioma patients were profiled by RNA sequencing. 1159 differentially expressed genes (DEG) (EdgeR) were represented as nodes in a Neo4j graph network. Modularity optimization identified communities of densely connected nodes. Genes exclusively in NE communities were localized by cell type using single-cell RNAseq datasets and identified as source node candidates for NE network random walks. CSF2RA was selected as a source (walk length = 5; 10,000 walks/source node). Random walks traversing samples with significantly elevated CSF2RA expression (one-tailed test) were kept for analysis. Genes occurring at high frequency (one-tailed test) on random walks were ranked by correlation with CSF2RA expression in NE samples and analyzed by gene set enrichment analysis (GSEA) using clusterProfiler. Pearson's correlation of expression for hypoxia response genes with CSF2RA used Bonferroni correction for multiple testing.

**RESULTS**

CSF2RA, an immune signaling receptor gene, was upregulated (logFC = 0.789) in NE samples and uniquely occurred within NE communities. We confirm its enrichment in myeloid populations in single cell HGG datasets and the Glycolytic/Plurimetabolic glioma subtype. NE network random walks identified 46 DEGs associated with CSF2RA. GSEA revealed upregulation of proliferative and metabolic signatures and downregulation of signaling pathways within CSF2RA's network. CSF2RA correlated negatively with all hypoxia response genes across all samples and NE/CE separately.

**CONCLUSION**

CSF2RA's network in NE tumor reveals a possible mechanism for priming glioma progression through altered hypoxic response.

**CLINICAL RELEVANCE/APPLICATION**

As CSF2 ligand is expressed by glioma cells and has a role in myeloid recruitment during tumor progression, modulating the CSF2RA gene network is a promising direction for target signaling and microenvironmental features critical in glioma invasion.

## W7-SSNR12-4 MRI HISTOGRAM AND VISUALLY ACCESABLE REMBRANDT IMAGES FEATURES NOMOGRAM TO PREDICT PD-L1 LEVELS IN GLIOBLASTOMA

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Bin Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

To delineate the prognostic impact of the programmed death-ligand 1 (PD-L1) expression level in glioblastoma (GBM) patients and investigate the value of using magnetic resonance imaging (MRI) histograms, and Visually Accessible Rembrandt Images (VASARI) features to preoperatively predict the expression level of PD-L1 in GBM.

**METHODS AND MATERIALS**

The clinical and MRI data of 124 patients with GBM at our institution between November 2018 and April 2023 were retrospectively analyzed. The PD-L1 expression level in tumor tissue samples obtained from patients were quantified using immunohistochemical staining. The optimal cutoff PD-L1 level was determined using the X-tile program by Kaplan-Meier survival analysis and log-rank test, and categorized into PD-L1 low and PD-L1 high groups. The MRI histogram and VASARI features of the patients in the high and low PD-L1 expression groups were recorded. Manually traced the volumes of interest in all GBMs margin along the axial T1-weighted contrast-enhanced (T1C) images to encompass the entirety of the tumor, then the Firevoxel software automatically generated a grayscale histogram contains 18 histogram parameters. The VASARI features set contains 25 visual description features of images based on different MRI sequences and 2 measured numerical variables. The predictive models for PD-L1 expression level were constructed using logistic regression, and a nomogram was generated.

**RESULTS**

The GBM patients with high PD-L1 expression had an unfavorable overall survival. The T1C histogram features mean, 1st, 5th, 10th, 25th, 50th, and 75th percentiles and the VASARI feature F5 proportion enhancing were statistically significantly different between groups (all $p<0.05$). Multivariate logistic regression analysis showed that mean, 5th, 10th, and 50th percentiles, and F5 proportion enhancing were independent risk factors for predicting PD-L1 expression in GBM patients. The logistic regression model based on these 5 features showed a better predictive performance, and the area under the curve, accuracy, sensitivity, specificity were 0.795, 0.726, 0.887, and 0.621, respectively.

**CONCLUSION**

The nomogram based on MRI histogram and VASARI features can show promise to non-invasively predict the level of PD-L1 expression in GBM and could be helpful in guiding immune checkpoint inhibitors therapy and predicting patient prognosis.

**CLINICAL RELEVANCE/APPLICATION**

PD-L1 expression level may serve as a potential companion biomarker to trigger the use of immune checkpoint inhibitors therapy in GBM. The nomogram based on MRI histogram and VASARI features was a reliable tool for non-invasively predict the level of PD-L1 expression in GBM and could be helpful in guiding ICI therapy and predicting patient prognosis.

## W7-SSNR12-5 5.0 T MRI T1RHO MAPPING FOR GRADING GLIOMA AND CORRELATING IDH MUTATION STATUS: ADDED VALUE TO AMIDE PROTON TRANSFER-WEIGHTED IMAGING

Lijun Dong (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic performance of the longitudinal relaxation time in the rotating frame (T1rho) mapping and amide proton transfer (APT)-weighted imaging alone and in combination in grading gliomas and correlating isocitrate dehydrogenase (IDH) mutation status by using 5.0 T ultrahigh-field MRI.

**METHODS AND MATERIALS**

Forty-one consecutive patients with histopathologically confirmed glioma were evaluated by 5.0 T MRI examinations. Including T2-weighted imaging, T1-weighted imaging (T1WI), fluid-attenuated inversion recovery imaging, T1rho-weighted imaging, APT-weighted imaging, and contrast-enhanced T1WI. For each patient, regions of interest were marked accurately in the solid portion of tumor, peritumoral edema, and contralateral normal-appearing white matter, respectively on anatomic images. Differences between the low-grade glioma (LGG) versus high-grade glioma (HGG) groups and between the IDH mutant-type versus IDH wild-type groups were evaluated for all parameters using independent- and paired-samples t tests. receiver operating characteristics (ROC) analyses were performed to assess the diagnostic performance of each parameter and the combination of the T1rho values and APT signals.

**RESULTS**

Patients with HGG showed significantly higher T1rho values and APT signals in both the solid portion and peritumoral edema areas compared with LGG ($P<0.05$). The ROC analyses showed that the T1rho values in peritumoral edema areas achieved the highest area under the curve (AUC, 0.791) for glioma grading. By adding the T1rho values to the APT signals, the diagnostic ability of the combined parameters improved from 0.791 to 0.812. The T1rho values in solid portion of tumor achieved the highest AUC (0.763) in correlating the IDH mutation status, and the diagnostic ability improved to 0.790 by adding it to the APT signals.

**CONCLUSION**

Both T1rho mapping and APT-weighted imaging could be used to grade glioma and correlate IDH mutation status, and the diagnostic performance could be improved by combining the two techniques.

**CLINICAL RELEVANCE/APPLICATION**

It is possible to applying the combination of T1rho mapping and APT-weighted imaging in assessing the histologic grade and IDH mutation status of gliomas. And it should be considered for implementation in the routine workup of glioma patients.

## W7-SSNR12-6 DEVELOPMENT AND VALIDATION OF MRI-BASED ON DEEP LEARNING RADIOMICS SIGNATURES TO PREDICT EIGHT CORE MOLECULAR BIOMAKERS IN ADULT DIFFUSE GLIOMA: A MULTICOHORT STUDY

Junjie Li (*Abstract Co-Author*) Nothing to Disclose
Yaou Liu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhizheng Zhuo (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to develop a Deep Learning and Radiomics signature (DLR) model and a combined DLRC (Deep Learning and Radiomics with Clinical signature) model using MRI to predict eight core molecular pathological biomakers for adult diffuse glioma.

**METHODS AND MATERIALS**

A retrospective study was conducted on 1151 adult diffuse glioma patients in our hospital. Multi-parameter MRI images (T2 and T1C) and pathological information, including IDH mutation, 1p/19q co-deletion, MGMT methylation, TERT mutation, EGFR amplification, +7/-10, and KI67 expression were collected. Patients were randomly divided into a training set (n=805) and an internal test set (n=346). Subsequently, 3562 radiomics features and 4096 DL features were extracted. After feature reduction and selection, the MLP was used to build radiomics and DL model. The DLR model base on radiomics and DL results from MLP. Finally, logistic regression was used to integrate the DLR and clinical prediction model to build the DLRC prediction model. The DLR model and DLRC models were tested in external test sets from JL Hospital (n=118), TCGA (n=237), and UCSF (n=477).

**RESULTS**

The DLR model showed AUCs of 0.829 to 0.927 for predicting IDH mutation in internal, JL, TCGA, and UCSF test sets, AUCs of 0.805 to 0.880 for predicting 1p/19q co-deletion, AUCs of 0.531 to 0.714 for predicting MGMT methylation, and AUCs of 0.725 to 0.761 for predicting TERT mutation. In the internal test set, the DLR model showed an AUC of 0.753 for predicting EGFR amplification, an AUC of 0.832 for predicting +7/-10, an AUC of 0.792 for predicting CDKN2A/B co-deletion, and an AUC of 0.883 for predicting KI67 expression. In the internal, JL, TCGA, and UCSF test sets, the DLRC model showed AUCs of 0.899 to 0.966 for predicting IDH mutation, AUCs of 0.825 to 0.896 for predicting 1p/19q co-deletion, AUCs of 0.530 to 0.716 for predicting MGMT methylation, and AUCs of 0.620 to 0.844 for predicting TERT mutation. In the internal test set, the DLRC model showed an AUC of 0.775 for predicting EGFR amplification, an AUC of 0.849 for predicting +7/-10, an AUC of 0.815 for predicting CDKN2A/B co-deletion, and an AUC of 0.890 for predicting KI67 expression.

**CONCLUSION**

The DLR and DLRC models based on MRI make it possible to non-invasively predict eight core molecular pathological biomakers of adult diffuse glioma.

**CLINICAL RELEVANCE/APPLICATION**

The study verified the DLR and DLRC demonstrated high diagnostic performance in identifying eight molecular biomakers with adult diffuse glioma patients at MRI. Our approach has the potential to facilitate timely diagnoses and management of adult diffuse glioma patients encountered in routine clinical practice.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

W7-SSNR13

**Neuroradiology (Neoplasms: Post-Treatment Evaluation)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: N229

Ana M. Franceschi, MD, PhD (*Moderator*) Consultant, Biogen Idec Inc
Matthew D. Lee, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W7-SSNR13-1 IMAGE-GUIDED GLIOBLASTOMA THERAPY WITH DUAL-ENZYME ACTIVATED THERANOSTIC NANOPARTICLES

Laura J. Pisani (*Abstract Co-Author*) Nothing to Disclose
Jie Wang (*Abstract Co-Author*) Nothing to Disclose
Manoj Kumar, MS, PhD (*Abstract Co-Author*) Nothing to Disclose
Vidyani Suryadevara, MD (*Abstract Co-Author*) Nothing to Disclose
Heike E. Daldrup-Link, MD (*Abstract Co-Author*) Managing director, Monasteria Press LLC Research Grant, MegaPro Inc
Edwina M Chang (*Abstract Co-Author*) Nothing to Disclose
Zahra Shokri Varniab, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Glioblastoma (GBM) therapy remains challenging because the blood-brain barrier (BBB) prevents tumor-delivery of therapeutic drugs and GBM give rise to tumor recurrences. Matrix Metalloproteinases-14 (MMP-14) and Cathepsin-B (Cat-B) are overexpressed in GBM, making them attractive targets for prodrug activation strategies. We developed two distinct tumor-enzyme activatable theranostic nanoprobes (TNP): TNP-MMP-14 is activated by MMP-14 and opens the BBB, TNP-Cat-B is activated by Cat-B and targets GBM cells. We hypothesized that opening the BBB first with TNP-MMP-14 will maximize the efficacy of TNP-Cat-B.

### METHODS AND MATERIALS

We synthesized (1) ferumoxytol nanoparticles conjugated with the vascular disrupting agent azademethylcolchicine through an MMP-14-cleavable linker and (2) ferumoxytol conjugated with the tubulin inhibitor monomethyl auristatin-E through a cathepsin-B-cleavable linker. Thirty-six NSG mice with stereotactically implanted luciferase-expressing GBM39 were treated with TNP-MMP-14 and TNP-Cat-B (group 1), TNP-Cat-B only (group 2) or saline sham therapy (group 3). All mice underwent pre- and post-treatment MRI and bioluminescence imaging (BLI). Tumor T2* relaxation times and BLI flux data were compared before and after treatment using Wilcoxon Matched-Pairs Signed-Rank Test and $p<0.05$.

### RESULTS

Group 1 tumors demonstrated a significantly stronger reduction in T2* relaxation times (pre-treatment 24.32±2.57ms, post-treatment 13.42±4.22ms; $p=0.0003$), compared to group 2 tumors (pre-treatment 25.16 ± 3.07ms, post-treatment 21.09 ±4.51ms; $p=0.02$). Group 3 tumors did not show significant changes in T2* signal. At ten days post-treatment, BLI flux was significantly reduced in group 1 tumors (pre-treatment 5.26E+09, post-treatment 3.91E+08; $p<0.05$), stable in group 2 tumors (pre-treatment 2.7E+9; post-treatment 3.38E+9; $p=0.50$) and and increased in group 3 tumors (base of 2.99E+9; post-treatment 1.99E+10; $p=0.03$). Histopathological correlations demonstrated significantly higher caspase-3 expression in group 1 compared to group 2 ($p=0.002$) and group 3 ($p=0.002$).

### CONCLUSION

MRI showed significantly improved drug delivery for GBM treated with combined vascular disrupting TNP and tumor cell targeted TNP compared to monotherapy.

### CLINICAL RELEVANCE/APPLICATION

MRI can be a valuable tool for evaluating the effectiveness of nanocarrier-based combination therapies for GBM. Our study also introduces a new approach using two different TNP to treat GBM.

## W7-SSNR13-2 HIERARCHICAL MULTI-TASK TRANSFORMER FOR TUMOR SEGMENTATION AND RESPONSE ASSESSMENT IN PATIENTS WITH MALIGNANT GLIOMAS VIA STRUCTURAL AND AMIDE PROTON TRANSFER-WEIGHTED MRI

Qianqi Huang (*Abstract Co-Author*) Nothing to Disclose
Jingpu Wu (*Abstract Co-Author*) Nothing to Disclose
Jinyuan Zhou, PhD (*Abstract Co-Author*) Inventor, Koninklijke Philips NV;Institutional license agreement, Koninklijke Philips NV;Speaker, Koninklijke Philips NV
Shanshan Jiang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Puyang Wang, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Amide protein transfer weighted (APTw) MRI has been validated to accurately detect recurrent malignant gliomas across different studies. However, APTw image interpretation is time consuming and requires professional knowledge. Our goal was to develop a reliable, automated imaging diagnostic tool to assess malignant glioma response to therapies are urgently needed.

**METHODS AND MATERIALS**

We proposed Hierarchical Multi-task Transformer framework to address both tumor segmentation and response assessment in patients with malignant gliomas. 3 key components of proposed framework are as follows: (1) Pixel branch to provide anchor queries to the lesion branch for initial pixel-wise segmentation. (2) Lesion branch composed of the transformer decoder in Mask2Former with improved segmentation loss to enhance recall of small enhancing tumor (ET) regions. (3) Patient branch to make dedicated scan-level predictions with a lesion-patient consistency loss. Pixel and lesion branches are designed to output the progression-aware segmentation map that further divide ET and non-enhancing tumor region (NER) into stable, improved or increasing regions. A total of 126 MRI scans (T1w, T2w, FLAIR, APTw, and contrast enhanced T1w) from 83 patients post-treated malignant gliomas were reassessed. Each scan was annotated as "response" to treatment or "progressive disease" according to the RANO criteria and pixel-wise annotated following the protocol in BraTs Challenge with ET, NER and the peritumoral edematous tissue. 5-fold cross-validation with random patient-level 80%/20% splits of imaging dataset was performed to evaluate the performance of tumor recurrence classification and volumetric and distance metrics of tumor sub-region segmentation.

**RESULTS**

For the response assessment, the proposed model without APTw images as input achieved an AUC of 0.84 (sensitivity, 0.91; specificity, 0.84). By adding the APTw images to the input, the classification result improved to AUC 0.87 (sensitivity, 0.86; specificity, 0.92). For brain tumor segmentation, by adding APTw images to the input, the Dice coefficient increased the most for the enhancing tumor core region from 0.64 to 0.76, suggesting that APTw imaging can help to distinguish tumor boundary.

**CONCLUSION**

The proposed framework utilizing multi-parametric MRIs with both structural and APTw images showed promising results in brain tumor segmentation and distinguishing between tumor progression and response post-treatment.

**CLINICAL RELEVANCE/APPLICATION**

The proposed framework could be a highly efficient solution for clinical experts to make precise diagnoses for patients with post-treatment malignant gliomas and further prognosis analysis.

## W7-SSNR13-3 ASSESSMENT OF HYPOXIA AND ITS DYNAMIC EVOLUTION IN GLIOBLASTOMA VIA QBOLD MRI

Bo Yin (*Abstract Co-Author*) Nothing to Disclose
Yiping Lu (*Abstract Co-Author*) Nothing to Disclose
Dong Dong Wang (*Abstract Co-Author*) Nothing to Disclose
Xuanxuan Li (*Abstract Co-Author*) Nothing to Disclose
Yinwei Ying (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the accuracy of quantitative blood oxygen level-dependent (qBOLD) imaging in detecting hypoxia in malignant glioma based on pathological findings, and explore the dynamic changes in tumor oxygenation status of glioma with and without the administration of metformin, a potential anti-hypoxia drug.

**METHODS AND MATERIALS**

Three healthy rats and seven C6-bearing rats were scanned with qBOLD imaging after anesthesia by 7.0T MRI. The qBOLD data were post-processed to generate parameters including Oxygen Extraction Fraction (OEF) and Cerebral Metabolism Rate of O2 (CMRO2). After the scan, the tumor tissues were stained by HIF-1a and pimonidazole for hypoxia detection and the results were analyzed by HALO software. The correlation between the expression of hypoxia markers and the corresponding qBOLD-related parameters were analyzed. Another six C6-bearing rats were randomly divided into metformin-treated and control group equally for dynamic qBOLD observation. The rats in treatment group were injected with metformin intraperitoneally daily from the 12th day after tumor implantation. Rats in both groups received qBOLD scans on the 12th, 15th and 18th day respectively after the tumor implantation.

**RESULTS**

In healthy rats, higher T2, T2*, CBV, CBF and CMRO2 values were detected in grey matter compared with the white matter, while the OEF the opposite ($p<0.05$). Compared with contralateral normal-appearing white matter, the mean values of T2, T2*, CBV and CBF are notably higher in tumor, but decreased values in OEF and CMRO2 were detected ($p<0.05$). Tumor tissue achieved remarkable high staining scores in both HIF-1a and pimonidazole, however, no significant correlation was detected in corresponding regions($p=0.11$). T2* ($r=0.44$, $p=0.014$) and T2 ($r=0.43$, $p=0.017$) values demonstrated significantly negative relationships with the expression score of pimonidazole in tumor regions. OEF values in tumor tissue increased with larger variations as tumor progressed, while CMRO2 declined. In metformin-treated group, delayed decreases of T2 and T2* values were observed on Day 15th. After metformin delivery, OEF in tumor stayed low and CMRO2 gradually declined, differing significantly from the control group on Day 18th (OEF: 12.87 ± 3.74% vs 26.73 ± 7.62, $p<0.001$; CMRO2: 0.72 ± 0.17 vs 1.25 ± 0.31umol/min/100g, $p<0.001$).

**CONCLUSION**

T2* and T2 value was related to hypoxia status of glioma in C6-bearing rats, while other qBOLD-derived parameters were not. Via qBOLD dynamic observation, the administration of metformin has the potential to change the oxygen metabolism status of glioma and delay the process of hypoxia in glioma.

**CLINICAL RELEVANCE/APPLICATION**

The findings could help pinpoint the ideal patient group for metformin therapy.

## W7-SSNR13-4 MAPPING TUMOR HABITATS IN IDH-WILD TYPE GLIOBLASTOMA: INTEGRATING MR IMAGING, PATHOLOGIC, AND RNA DATA FROM IVY GLIOBLASTOMA ATLAS PROJECT

Ho Sung Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ha-Kyung Jung, MD (*Abstract Co-Author*) Nothing to Disclose
DONGJUN LEE, MD (*Abstract Co-Author*) Nothing to Disclose

Nakyoung Kim (*Abstract Co-Author*) Nothing to Disclose
Ji Eun Park, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To spatially validate intratumoral subregions (tumor habitat) using physiologic MRI on pathology of the isocitrate dehydrogenase (IDH)-wildtype whole-glioblastoma sample.

**METHODS AND MATERIALS**

Data of 20 patients (168 slides) were obtained from the Ivy Glioblastoma Atlas Project. On MRI, tumor habitats were defined using voxel-wise clustering of apparent diffusion coefficient (ADC) and cerebral blood volume (CBV) maps for contrast-enhancing lesion (CEL) and non-enhancing lesion (NEL). On pathology slides, normalized areas of leading edge (LE), infiltrating tumor (IT), cellular tumor (CT), hypervascular lesion (CThypervascular), and perinecrotic lesion (CTperinecrotic) were obtained. Gross specimen was co-registered on MRI and correlation between pathology-MRI habitats was calculated. RNA sequencing of 67 samples was assessed using 4 Neftel subtypes and further correlated with pathology.

**RESULTS**

Six tumor habitats were identified: hypervascular, hypovascular cellular, and hypovascular hypocellular habitats for CEL and NEL. CT was correlated with hypovascular cellular habitat in CEL ($r= 0.238$, $p =.005$). IT was correlated with hypovascular cellular habitat in NEL ($r= 0.294$, $p =.017$). CThypervascular was correlated with hypervascular habitat in NEL ($r= 0.195$, $p = .023$). CTperinecrotic was correlated with imaging necrosis ($r= 0.199$, $p =.005$). Astrocyte-like subtypes were correlated with IT ($r= 0.256$, $p <.001$), while mesenchymal-like subtypes were correlated with CTperinecrotic area ($r= 0.246$, $p <.001$).

**CONCLUSION**

Pathologically matched tumor subregions were cellular tumor with hypovascular cellular habitat in CEL and infiltrative tumor with hypovascular cellular habitat in NEL. Identification of the most aggressive as well as infiltrative tumor portion can be achieved using non-invasive MRI tumor habitats.

**CLINICAL RELEVANCE/APPLICATION**

The biologic validation of tumor subregions in glioblastoma, IDH-wild type, is important in tumor imaging; however, it has been limited due to lack of complete dataset of imaging and pathology. We utilized IvyGAP data to facilitate spatially validated MRI-based tumor subregions and pathologic slides with full physiologic MRI, pathology, and RNA sequencing data. Topological biologic validation showed a positive correlation between hypovascular cellular habitat in CEL and cellular tumor, as well as hypocellular habitat in NEL and infiltrative tumor. Based on noninvasive identification of the most aggressive cellular tumor portion and infiltrative tumor portion based on topological biologic validation with pathologic slides, our spatial MRI tumor habitat analysis enables accurate treatment monitoring and can potentially guide local therapy.

## W7-SSNR13-5 CEST MRI UNVEIL OF THE DISTINGUISHED TREATMENT DRIVEN PERITUMORAL REGIONS PATTERN IN NEWLY DIAGNOSED MALIGNANT GLIOMA

Qianqi Huang (*Abstract Co-Author*) Nothing to Disclose
Jingpu Wu (*Abstract Co-Author*) Nothing to Disclose
Shanshan Jiang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jinyuan Zhou, PhD (*Abstract Co-Author*) Inventor, Koninklijke Philips NV;Institutional license agreement, Koninklijke Philips NV;Speaker, Koninklijke Philips NV
Puyang Wang, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Our objective is to investigate whether CEST MRI is capable to provide any distinguishable patterns regarding tumor recurrence vs. treatment effect, and to unveil the underline potential mechanism of maliciously invasive behavior of high grade gliomas.

**METHODS AND MATERIALS**

Patient enrollment The study included a dataset comprising 48 scans collected from a total of 46 patients. Each patient had all study-related MRI data after their standard chemoradiation regimen completion. MRI protocol The sequences performed on Philips 3T included T1 mapping; T2 mapping; FLAIR; and Gd-T1w. A 3D imaging acquisition scheme was used for volumetric APTw imaging (saturation power = 2 μT; saturation time = 2s). Data postprocessing T1 and T2 maps, APTw and CEST@2ppm MRI data were uniformly rescaled and aligned through a co-registration process. A researcher manually annotated the peritumoral zones characterized by abnormal FLAIR/T2-weighted signal intensities surrounding gadolinium enhanced tumor core. Statistical analysis The histogram method was utilized to derive features from the ROI. MRI Parameters that achieved statistical significance ($P<0.05$) were selected by the U test and receiver operating characteristic (ROC) analysis then used to construct and train multivariate logistic regression models. 5-folds evaluation method was used with the aim of assessing the efficacy of combined MR images.

**RESULTS**

20 scans were confirmed as treatment effects from 19 patients, and 28 scans were tumor recurrence from 27 patients. The Z-spectra and MTRasym spectra exhibit treatment effects with higher Z-spectra and tumor recurrence with higher MTRasym values across chemical shift offsets. Some histogram parameters from T1, T2, CEST@2ppm and APTw shows significant difference between two groups especially mode value in CEST@2ppm, Kurtosis in T1, 25th percentile in APTw. The combination of APTw, T1 map, T2 map, and CEST@2ppm yields the highest differentiating performance with a mean AUC of $0.85 \pm 0.07$, indicating a strong predictive capability.

**CONCLUSION**

Our study found APTw and CEST@2ppm MRI show that PER had higher CEST signal intensities in tumor recurrence than treatment treatments. It might be associated with higher protein concentrations from local invasive tumor cells and creatine which promote invasion in the PER.

**CLINICAL RELEVANCE/APPLICATION**

The different progressive patterns in peritumoral regions between treatment effects and tumor recurrence are assessable by CEST MRI. It provide a potential imaging maker matrix to unveil the mechanism of invasive behavior of malignant gliomas.

## W7-SSNR13-6 FRACTAL DIMENSION ANALYSIS FOR IDH-1 WILD-TYPE HIGH-GRADE GLIOMA: TOWARDS A SURVIVAL MATHEMATICAL PREDICTION MODEL MATHEMATICAL PREDICTION MODEL

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Xi Huaze, MMedSc, BMBCh (*Presenter*) Nothing to Disclose

## PURPOSE

This study investigates the utility of fractal dimension (FD) in assessing the mutation status of the isocitrate dehydrogenase 1 (IDH-1) gene and the proliferation activity of tumor cells in high-grade glioblastoma (HGG). Additionally, the study aims to construct a mathematical model for predicting the survival of patients with IDH-1 wild-type HGG.

## METHODS AND MATERIALS

A total of 75 patients with HGG confirmed by pathology and IDH-1 mutation status and Ki-67 index were collected, including 52 cases of IDH-1 wild type and 23 cases of IDH-1 mutant. The tumor boundary and peritumoral edema range were automatically delineated on the maximum level of T1WI, T2WI, and DWI images and the two levels above and below. The FD value of the outer edge was measured, and the average value of the three levels was used as the measured value. Postoperative recovery and survival of patients were followed up, and the difference in FD values between IDH-1 mutant and wild-type groups was compared. The receiver operating characteristic (ROC) curve was used to analyze the efficacy of different FD values for predicting IDH-1 mutation. Logistic regression analysis was used to evaluate the independent risk factors related to death in IDH-1 wild-type patients, and a mathematical model for predicting the survival of patients was constructed based on these parameters.

## RESULTS

The T1 (tumor) -FD, T2 (tumor) -FD, T2 (edema) -FD, and DWI (tumor) -FD of IDH-1 wild type were higher than those of IDH-1 mutant type (all $P<0.05$). The FD value on DWI had the highest diagnostic efficiency, with an AUC of 0.868, a specificity of 0.696, and a sensitivity of 0.923. All FD values were positively correlated with the Ki-67 index, and T2 (tumor) -FD had the highest correlation with the Ki-67 index ($r=0.4853$, $P<0.0001$). DWI (tumor) -FD, Ki67 index, age, [1] and maximum tumor cross-sectional perimeter are independent risk factors for predicting the survival of IDH-1 wild-type HGG patients, and BMI is a protective factor for poor prognosis of patients.A, B, and C

## CONCLUSION

FD can evaluate the IDH-1 gene mutation status of patients, and it is positively correlated with Ki-67 index. The mathematical model based on FD and other multi-parameters can predict death events in patients.

## CLINICAL RELEVANCE/APPLICATION

FD is a parameter that describes the complexity of morphology. Different from the analysis of the internal gray level and texture of the image in radiomics, FD can quantitatively describe the abstract morphology of tumor growth, which is a relatively new morphological parameter. Therefore, preoperative evaluation of IDH-1 mutation status and Ki-67 index is of great significance for the selection of treatment options. The mathematical model based on FD can predict the probability of death of patients.

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# Abstract Archives of the RSNA, 2024

W7-SSPD04

**Science Session with Keynote: Pediatric Imaging (Intervention-Oncology)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: E350

Lisa J. States, MD (*Moderator*) Nothing to Disclose
Lisa H. Kang, MD (*Moderator*) Nothing to Disclose

**Sub-Events**

## W7-SSPD04-1 CHOLECYSTOCHOLANGIOGRAPHIC PATTERNS IN PATIENTS WITH SUSPECTED BILIARY ATRESIA

Naif H. Alsaikhan, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ganesh Krishnamurthy, MBBS (*Abstract Co-Author*) Nothing to Disclose
Seth Vatsky, DO (*Abstract Co-Author*) Nothing to Disclose
Abhay S. Srinivasan, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando A. Escobar, MD (*Abstract Co-Author*) Nothing to Disclose
Michael R. Acord, MD (*Abstract Co-Author*) Nothing to Disclose
Anne Marie Cahill, MBBCh (*Abstract Co-Author*) Advisory Committee, Siemens AG;Speakers Bureau, Avanos Medical, Inc
Gyan Moorthy, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate cholecystocholangiographic (CCG) patterns in infants with suspected biliary atresia (BA).

### METHODS AND MATERIALS

IRB-approved retrospective review of imaging and clinical records of infants with suspected BA between September 2012 and April 2024 was performed. CCGs were interpreted independently by two study authors. Biopsy at portoenterostomy was used as the reference standard for a diagnosis of BA; other diagnoses were established through appropriate testing and clinical follow up.

### RESULTS

96 infants (46 female; mean age 65 ± 31 days, range: 9-201 d) with suspected BA underwent 100 CCG. 81 CCG were performed by general surgeons (GS) after laparotomy, and 19 were performed percutaneously by interventional radiologists (IR); four IR CCG were repeated intraoperatively.Abnormal CCG patterns were: A, failed opacification, consistent with Kasai Types IIb or III BA (n=20); B, gallbladder with or without a cystic duct, consistent with Kasai Types IIb or III BA (n=16); C, gallbladder with common bile duct only, consistent with Kasai Type IIa BA (n=22); D, gallbladder with common hepatic duct and wispy intrahepatic ducts, consistent with Kasai Type I BA (n=9); and E, gallbladder with common bile duct and common hepatic duct but with wispy intrahepatic ducts (n=4).Fifteen of 19 infants (corresponding to 16/20 CCG, 80%) with pattern A CCG had BA; of the other four, three infants had hepatitis and one had CF and TPN cholestasis. Fifteen of 16 infants (15/16 CCG, 94%) with pattern B CCG had BA; the other had CF and TPN cholestasis. All 20 infants (21/21 CCG, 100%) with pattern C CCG had BA. All nine infants (9/9 CCG, 100%) with pattern D CCG had BA. Two of five infants (2/5 CCG, 40%) with pattern E CCG had BA, although one also had a-1-antitrypsin deficiency (a1ATD); of the other three, one had hepatitis, one had a1ATD alone and one had an Alagille-like syndrome.Normal CCG was observed in 29 infants, and none (0/29 CCG, 0%) had BA. The most common diagnoses were hepatitis and TPN cholestasis. 12 normal CCG were performed percutaneously by IR, thus avoiding laparotomy.Two infants with IR CCG repeated by GS had pattern A IR CCG but pattern B or normal GS CCG, accounting for some apparent repetition and discrepancy in numbers of infants and CCG by pattern.

### CONCLUSION

In this large series evaluating CCG patterns in patients with suspected BA, normal CCG was highly prevalent and had high negative predictive value. Percutaneous technique may obviate the need for laparotomy. Patterns B, C and D were reliably diagnostic of BA.

### CLINICAL RELEVANCE/APPLICATION

Better understanding of CCG patterns may speed a diagnosis of BA and further establish the role of CCG in the work-up of BA, minimizing laparotomy. BA CCG classification could later inform type-specific surgical outcomes analysis.

## W7-SSPD04-2 PERCUTANEOUS PORTAL VEIN RECANALIZATION IN PEDIATRIC PATIENTS WITH EXTRAHEPATIC PORTAL VEIN OBSTRUCTION

Francesco S. Carbone, MD (*Abstract Co-Author*) Nothing to Disclose
Ludovico Dulcetta, MD (*Abstract Co-Author*) Nothing to Disclose
Sandro Sironi, MD (*Abstract Co-Author*) Nothing to Disclose
Pietro A. Bonaffini, MD (*Abstract Co-Author*) Nothing to Disclose
Riccardo Muglia (*Abstract Co-Author*) Nothing to Disclose
Paolo Marra, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Portal hypertension resulting from extrahepatic portal vein obstruction (EHPVO) in children has been managed primarily through surgical intervention involving Meso-Rex shunt creation, but only 30-50% of patients have a viable Rex vein, which is required by surgery. The aim of the study is to report a preliminary series of patients who underwent interventional radiology attempts at portal vein recanalization (PVR) prior to consider any type of other intervention.

**METHODS AND MATERIALS**

A cohort of consecutive patients presenting with EHPVO at our institution from 2021-2024 was retrospectively collected. After a preliminary transjugular wedge hepatic venography to evaluate the patency of the native intrahepatic portal system, or in the same session, a percutaneous transhepatic and transplenic portal venography was carried out to recanalize the native portal vein. Patients who failed recanalization were listed for meso-portal bypass, if feasible, or considered for other shunts including TIPS. Clinical and procedural data, technical and clinical success, complications and follow up data were recorded. Technical success was considered at least the partial revascularization of the native portal system.

**RESULTS**

Twelve patients (7 males; median age 8 years) with severe portal hypertension due to EHPVO underwent 16 percutaneous transhepatic (n=1), transplenic (n=12) or simultaneous transhepatic/transplenic (n=3) attempts at portal vein recanalization. Rex vein was patent in 4/12 (33%). Successful recanalization was achieved in 6/12 patients (50%), 2/6 with obliterated Rex vein. No major adverse events were observed. After successful angioplasty, 5/6 patients required metal stenting to obtain sustained patency. None of the failed patients was considered suitable for Meso-Rex shunt creation and underwent TIPS (n=2), splenectomy (n=1), surgical shunt (n=1). Two patients were followed-up without further interventions. After a median follow-up of 4.5 months patency of the main portal vein was demonstrated for all the patients who achieved PVR, without clinical and laboratory improvement of portal hypertension.

**CONCLUSION**

Our preliminary experience suggests that 50% of children with EHPVO can restore the portal flow by endovascular treatment, even when the Rex vein is obliterated and Meso-Rex surgery unfeasible. In EHPVO, thanks to its low invasiveness, percutaneous recanalization of the portal vein may be regarded as the primary intervention, before considering the meso-portal bypass.

**CLINICAL RELEVANCE/APPLICATION**

Innovative percutaneous procedures may have a revolutionary impact and overcome the conventional surgical approach in the management of EHPVO and its complications in children.

## W7-SSPD04-3 PEDIATRIC INTERVENTIONAL RADIOLOGY EXPERIENCE IN THE TREATMENT OF MOREL-LAVALLEE LESIONS: TREATMENT VARIABILITY AND OUTCOMES

Anne Marie Cahill, MBBCh (*Abstract Co-Author*) Advisory Committee, Siemens AG;Speakers Bureau, Avanos Medical, Inc
Ganesh Krishnamurthy, MBBS (*Abstract Co-Author*) Nothing to Disclose
Abhay S. Srinivasan, MD (*Abstract Co-Author*) Nothing to Disclose
Seth Vatsky, DO (*Abstract Co-Author*) Nothing to Disclose
Fernando A. Escobar, MD (*Abstract Co-Author*) Nothing to Disclose
Michael R. Acord, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie C. Cajigas-Loyola, MD (*Abstract Co-Author*) Nothing to Disclose
Sean Schoeman, MBChB (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate our experience and outcomes in treating Morel-Lavallée lesions over the last 6 years.

**METHODS AND MATERIALS**

Patients from a single institution who underwent sclerotherapy in interventional radiology (IR) were retrospectively reviewed following IRB exemption. Imaging and medical records were reviewed for indications, procedure details and outcomes.

**RESULTS**

Nine patients [5 female, median age 15.9 years (IQR: 15.4 - 17.7 years) and median weight 55 kg (IQR: 50 - 70 kg)] were included. A total of 9 lower limb lesions, secondary to trauma, were treated: thigh (2), hip (1), shin (1), calf (2), and knee (3). Preprocedural imaging included ultrasound (100%), X-ray (78%), MRI (44%) and CT (22%). Median interval from injury to IR treatment was 112 days (IQR: 20 - 177 days). Prior to IR referral, management was variable. 4 patients' lesions had no or conservative management. Five patients had either aspiration or incision and drainage by surgery. There were 18 IR treatment cycles performed in the 9 patients: 5 therapies (1), 3 therapies (1), 2 therapies (3), and monotherapy (4). Aspiration was followed by sclerosant administration in 94% (n=17) using Doxycycline (100%), ethanol (35%), sodium tetradecyl sulphate (29%), and betadine (12%). Multiple sclerosant agents were used in 41% (n=7) of cases. In 61% (n = 11) of procedures a drain was placed and 56% (n = 10) included multiday treatment with repeat doxycycline injection. A cytology brush was used to disrupt the lesion capsule in 4 procedures. Clinical success with lesion resolution occurred in 6/9 patients (67%), after 5 treatment episodes in 1 patient, 2 treatment episodes in 3 patients and a single treatment episode in 2 patients. All the successfully treated lesions occurred at the level of the knee or below. In 4/6 patients there was a multi-day component to the treatment protocol. Three patients with lesions involving the thigh (2) and hip (1) required surgical excision after recurrence following 1-3 treatment episodes.

**CONCLUSION**

Based on our small cohort, injury at or below the level of the knee had the highest response rates to percutaneous sclerotherapy. Further research, after protocol standardization, will be critical for establishing optimal patient selection, sclerosant type, frequency, and post intervention management.

**CLINICAL RELEVANCE/APPLICATION**

Although there is no established treatment algorithm for the management of post-traumatic Morel-Lavallée lesions in the pediatric population, we have defined a group that may be responsive to percutaneous therapy. Further research will be required to describe a suitable algorithm.

## W7-SSPD04-4 STANDARDIZED UPTAKE VALUES AND APPARENT DIFFUSION COEFFICIENT AS PREDICTIVE BIOMARKERS FOR TREATMENT RESPONSE IN METASTATIC PEDIATRIC EWING SARCOMA: A MULTICENTER PROSPECTIVE STUDY

Shashi Singh, MBBS (*Abstract Co-Author*) Nothing to Disclose
Heike E. Daldrup-Link, MD (*Abstract Co-Author*) Managing director, Monasteria Press LLC Research Grant, MegaPro Inc

Lisa C. Adams, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ricarda V. von Kruchten, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate correlations of tumor metabolism and tumor cell diffusion (an indirect measure of tumor cell density) in metastatic Ewing Sarcoma at baseline and after induction chemotherapy. Additionally, potential correlations with overall survival in children and adolescents were explored.

**METHODS AND MATERIALS**

We performed a secondary review of patients with metastatic Ewing sarcoma who were enrolled in the prospective, multicenter phase III Children's Oncology Group trial AEWS1221. A subgroup of 21 patients (12 females and 9 males, mean age 14.10 ± 4.67 years) underwent MRI and 18F-FDG PET-CT scans at baseline and post-induction chemotherapy. We measured the standardized maximum uptake values (SUVmax) and the mean and minimum apparent diffusion coefficient (ADCmean and ADCmin) of the whole primary tumor and the viable tumor, excluding central necrosis. For each modality, we compared measurements of the whole tumor and viable tumor with paired t-tests. We calculated Pearson's correlation coefficients to assess a correlation between SUVmax and ADCmin as well as imaging measures and progression-free survival (PFS).

**RESULTS**

At baseline, whole tumor SUVmax did not correlate with whole tumor ADCmin, but viable tumor SUVmax correlated inversely with viable tumor ADCmean ($R = -0.51$, $p = 0.022$). This was due to differences in ADC since whole tumor SUVmax and viable tumor SUVmax were not significantly different, while whole tumor ADCmin and viable tumor ADCmean differed significantly. After induction therapy, whole tumor SUVmax correlated with whole tumor ADCmin ($R = -0.59$; $p = 0.028$), and viable tumor SUVmax did not correlate with viable tumor ADCmean ($R = -0.15$; $p = 0.62$). Pre-minus-posttreatment change in tumor volume correlated with both whole tumor ADCmin ($R = -1.07$; $p = 0.01$), as well as viable tumor ADCmean ($R = -0.02$; $p = 0.21$). However, none of the measurements correlated with PFS.

**CONCLUSION**

At baseline, SUVmax and ADCmean of the viable tumor only, excluding necrosis, are promising biomarkers for local tumor response. Post-induction therapy, SUVmax, and ADCmin across the entire tumor, including necrotic portions, indicate treatment-related changes. If differences between pretreatment and post-treatment measures are calculated, then both whole tumor ADCmin and viable tumor ADCmean can be used as biomarkers for changes in tumor volume.

**CLINICAL RELEVANCE/APPLICATION**

A more nuanced approach to tumor ADC measurements can improve therapy response predictions, and thereby, help guide treatment decisions and potentially tailor therapy intensity based on the predicted tumor behavior.

## W7-SSPD04-5 INTEGRATED METABOLIC AND FUNCTIONAL IMAGING THROUGH PET/MRI FOR PEDIATRIC HODGKIN LYMPHOMA: EXPLORING THE COMPLEMENTARY ROLE OF 18F-FDG UPTAKE AND DIFFUSION RESTRICTION

Ilias Tsiflikas, MD (*Abstract Co-Author*) Nothing to Disclose
Sergios Gatidis, MD (*Abstract Co-Author*) Nothing to Disclose
Josephine Berger (*Presenter*) Nothing to Disclose

**PURPOSE**

In an effort to address the challenges of assessing tumor heterogeneity and therapeutic response in pediatric classic Hodgkin lymphoma (cHL) we explored the complimentary roles of 18F-FDG uptake and diffusion restriction with an integrated PET/MRI system. We propose that tumor dynamics are too complex to be expressed by a single marker; thus, a complementary approach is needed rather than merely comparing two methods.

**METHODS AND MATERIALS**

A cohort of twenty-five patients (mean age 15 ± 2.5y, 15 female) from our prospective PET/MRI study underwent baseline and ERA imaging on an integrated clinical PET/MRI system. Using dedicated software (Multiparametric Analysis, Siemens Healthcare), we performed a voxel-by-voxel analysis of fused ADC, PET, and T2-weighted images. The volume of interest (VOI) was covering the whole lesion. Data were exported to statistical software for Gaussian mixture model (GMM) clustering and contingency analysis.

**RESULTS**

At baseline, 156 lesions and after two cycles of chemotherapy, 48 lesions were analyzed. Lesions were excluded due to complete remission or technical issues. We identified three clusters (C1, C2, C3) with a significant negative correlation between ADC and SUV in C1 and a weak positive correlation in C2 and C3 (all $p < 0.001$), which increased after treatment. The results of Wilcoxon signed-rank test showed that nodular sclerosis type of cHL had a significantly different distribution of voxels in C2 and C3 than lymphocyte-rich and mixed cellularity cHL ($p < 0,05$). For ERA, this difference among cHL types is only significant in C3 ($p < 0,05$). There was also a substantial difference in the distribution of C3 lesions at ERA in patients with relapse compared to patients without relapse ($p=0.001$).

**CONCLUSION**

Our voxel-wise analysis identified specific subvolumes within cHL lesions that responded differently to chemotherapy, highlighting tumor complexity and heterogeneity. Specifically, parts of tumors lacking the expected negative correlation between SUV and ADC differed histologically and could have prognostic implications. The study's limitations include its small sample size from a single center and uneven distribution of histological subtypes within cHL.

**CLINICAL RELEVANCE/APPLICATION**

By incorporating more imaging and clinical variables in larger cohorts with cHL and other cancers and employing advanced methods such as hyperpolarized 13C-MRI, we could offer an even more comprehensive view of tumor metabolism, potentially leading to improved diagnostics and personalized treatment strategies.

## W7-SSPD04-6 Keynote Speaker

Sabah Servaes, MD (*Science Invited Presenter*) Nothing to Disclose

# Abstract Archives of the RSNA, 2024

W7-SSPH11

**Physics (CT Image Quality II)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S404

Scott S. Hsieh, PhD (*Moderator*) Nothing to Disclose
Wenying Wang (*Moderator*) Research scientist, UIH America, Inc

**Sub-Events**

## W7-SSPH11-1 FEASIBILITY STUDY OF A MULTI-MATERIAL PHOTOPOLYMER BASED 3D-PRINTED PATIENT-REALISTIC HEAD CT ANGIOGRAPHY PHANTOM

Jiri Ferda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael Grasruck, PhD (*Abstract Co-Author*) Employee, Siemens AG
Stefan Popescu (*Abstract Co-Author*) Nothing to Disclose
Thomas Allmendinger, PhD (*Abstract Co-Author*) Employee, Siemens AG
Ido Bitan, BSC (*Abstract Co-Author*) Nothing to Disclose
Bernhard Schmidt, PhD (*Presenter*) Employee, Siemens AG

### PURPOSE

Phantoms are important tools for the assessment and performance verification process in computed tomography (CT). Modern CT system increasingly incorporate algorithms, which rely on a realistic depiction of human anatomy.This study utilizes a 3D-printing solution used to create patient-realistic CT phantoms in combination with the PolyJet multi-material photopolymer 3D printing technology (VoxelPrint, StrataSys Ltd.).

### METHODS AND MATERIALS

A dedicated software prototype was developed for the pixel-to-pixel based mapping process between clinical CT images and three polymer materials which exhibit different CT designed radiopacities (RadioMatrix™, StrataSys Ltd.). These three materials realize support points with a fixed Hounsfield value for a given x-ray spectra in the resulting phantom derived images. All intermediate Hounsfield values are generated by mixture of these materials in relative fractions by a separately determined calibration table. (Siemens Healthineers).A high-resolution head CT angiography spiral data set acquired with a first-generation dual source photon counting scanner (NAEOTOM Alpha, Siemens Healthineers) is used as input. The printed phantom was identical in its size as the original data with an in-plane diameter of around 160 mm and coverage of 140 mm starting at the cerebellar fossa. It was evaluated in terms of realized contrast, noise texture and resolution at different image quality levels and compared to the original clinical data set by repeated acquisitions.

### RESULTS

Qualitatively, CT images of the patient-based phantom closely resemble the original CT images, both in texture and contrast levels with clearly visible vascular vessel, soft tissue and fat structure. Density and geometrical accuracies between phantom and patient images were evaluated for the Circle of Willis vasculature. Regions-of-interest (ROIs) comparing Hounsfield values demonstrated differences below 10 HU for the iodine enhanced vessels (e.g. basilar artery) and soft tissue structures. An increase in contrast in the vessels was observed for 90kV tube voltage mimicking the behavior of iodine observed in clinical angiography data. Repeating a visual assessment at different reconstruction sharpness levels revealed a loss only for the reconstruction close to the sharpness of the original input images, while no artefacts or structures associated to printer resolution effects were observed.

### CONCLUSION

Our study demonstrates the feasibility of a 3D-printed patient-realistic head CT angiography phantom with accurate geometry, texture, and contrast reproduction that should enable protocol optimization, CT research and development.

### CLINICAL RELEVANCE/APPLICATION

quality control, protocol optimization, CT research

## W7-SSPH11-2 LOW-CONTRAST DETECTABILITY OF PHOTON-COUNTING-DETECTOR CT AT STANDARD AND ULTRA-HIGH-RESOLUTION MODES COMPARED TO ENERGY-INTEGRATING-DETECTOR CT

Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Jarod Wellinghoff (*Abstract Co-Author*) Nothing to Disclose
Michael R. Bruesewitz, RT (*Abstract Co-Author*) Nothing to Disclose
Zhongxing Zhou, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Photon-counting-detector (PCD) CT has demonstrated advantages over energy-integrating-detector (EID) CT with its improved spatial resolution, enhanced iodine contrast-to-noise ratio, and reduced electronic noise. However, the low-contrast detection performance of PCD-CT in comparison with EID-CT remains unclear. The purpose of this work is to compare the low-contrast detectability of PCD-CT and EID-CT across different scan modes and kernels using a channelized Hotelling observer (CHO).

**METHODS AND MATERIALS**

A custom-designed phantom with objects of different contrasts (6, 10, 20, 30 HU) and sizes (3,6,9,12 mm) was scanned on a PCD-CT scanner (NAEOTOM Alpha, Siemens) using two modes: standard resolution (SR) (detector configuration: 144x0.4 mm) and ultra-high-resolution (UHR) (120x0.2 mm), and an EID scanner (Siemens SOMATOM Force), each at 3 dose levels (CTDIvol = 6, 12, and 24 mGy). The low-energy threshold ("T3D") image was used for PCD-CT. Each dose level was scanned 3 times at 120 kV. Images were reconstructed using both filtered-back-projection (FBP) and iterative reconstruction (IR) with a slice thickness of 3 mm and closely matched smooth (Br40), medium-sharp (Br56/Br54), and sharp (Br68/Br69) kernels. A previously optimized CHO method (3 repeated scans, 2 sets of background regions, and 4-channel Gabor filter) was used to calculate the low-contrast detectability (d') for each of the 12 objects, 3 dose levels, 2 scan modes, and 2 reconstruction conditions. A weighted average of d' over all lesion and dose conditions (12x3) was calculated for each scan mode and reconstruction condition, which was used as a summary metric to compare between PCD-CT and EID-CT.

**RESULTS**

For smooth kernel and FBP, significant differences in d' were found between and EID: EID>PCD-UHR>PCD-SR ($p<0.01$). For smooth kernel and IR, PCD-UHR had a higher d' over EID ($p<0.01$), but no significant difference was found between PCD-UHR and PCD-SR, or PCD-SR and EID. For medium-sharp kernel and FBP, EID had a higher d' than PCD-SR ($P<0.01$), but no significant differences were found between EID and PCD-UHR, or between PCD-UHR and PCD-SR. For medium-sharp kernel and IR, PCD-UHR gained higher d' than PCD-SR ($p<0.05$) and EID ($p<0.01$), but there was no significant difference between PCD-SR and EID. For sharp kernel, PCD-UHR and PCD-SR were both superior to EID for both FBP and IR ($p<0.01$).

**CONCLUSION**

PCD-CT demonstrated non-superiority with FBP and non-inferiority with IR in terms of d' compared to EID-CT for smooth kernel reconstructions. With increased sharpness, PCD-CT tends to show greater advantages in low-contrast detectability over EID-CT.

**CLINICAL RELEVANCE/APPLICATION**

PCD-CT significantly improves low-contrast detectability over EID-CT when a sharper kernel is used.

## W7-SSPH11-3 3D-PRINTED DEFORMABLE LUNG PHANTOM FOR RESPIRATORY MOTION APPLICATIONS IN CT

Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Michael Geagan (*Abstract Co-Author*) Nothing to Disclose
Sven Kabus, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Neghemi Micah (*Abstract Co-Author*) Nothing to Disclose
Kai Mei, PhD (*Abstract Co-Author*) Nothing to Disclose
Amy Perkins (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jessica Im, BEng (*Presenter*) Nothing to Disclose

**PURPOSE**

Respiratory motion in 4-dimensional computed tomography (4DCT) reduces image quality and tumor tracking accuracy. Addressing these challenges requires advancements in technologies like respiratory gating and tumor tracking, necessitating more realistic respiratory motion phantoms (RMPs). Current lung RMPs are too simplistic and rigid, failing to replicate complex lung motion. This study introduces a lifelike, deformable lung phantom that accurately mimics lung deformations on CT.

**METHODS AND MATERIALS**

The lung phantom in this study was fabricated based on the end inhalation image of a patient 4DCT. The PixelPrint method was used to convert the image of the right lung to 3D-printer instructions, where density of printed material is continuously modulated to match the patient attenuation profile. This phantom was 3D-printed using a flexible thermoplastic polyurethane (TPU) material. A CT scan of the phantom was acquired, and its attenuation profile was compared to the patient. To assess the phantom's deformation characteristics, a simple linear compression device was designed. The phantom was compressed by various amounts between 0 - 14.8 mm in the superior/inferior (SI) direction, such that the displacements of the phantom's base matched the patient diaphragm displacements on 4DCT. The phantom was scanned at each compression level, and deformable image registration was used to quantify the displacements of structures in the phantom and patient.

**RESULTS**

The lung phantom exhibits realistic anatomic structures on CT imaging including the tumor, vessels, bronchi, and lung fissures. The attenuation profile measured across an axial slice of the phantom had a mean difference of 18 Hounsfield Units (HU) compared to the patient. Furthermore, displacements of several structures in the lung demonstrated mean errors of 0.5, 0.7, and 1.3 mm in the SI, right/left, and anterior/posterior directions compared to the patient. These fall within the size of about one voxel on the patient image, suggesting high accuracy in the phantom's ability to mimic lung deformations, especially in the SI direction.

**CONCLUSION**

This lung phantom has the potential to provide a more realistic testing environment for technologies addressing respiratory motion. Furthermore, the 3D-printing approach outlined in this study is highly customizable, which enables incorporation into different motion actuation systems, as well as development of patient-specific RMPs for personalized treatment planning.

**CLINICAL RELEVANCE/APPLICATION**

The introduction of this realistic, deformable lung phantom will enable more precise initial testing of technologies designed to address respiratory motion. This will speed up and improve the transfer of research findings to clinical settings.

## W7-SSPH11-4 IMAGE NOISE ANALYSIS OF TIN FILTERED-BASED SPECTRAL CT TECHNIQUE: A PHANTOM STUDY EVALUATING THE SIZE AND RADIATION DOSE DEPENDENCY

Colin Shan (*Abstract Co-Author*) Nothing to Disclose
Xinhui Duan, PhD (*Abstract Co-Author*) Nothing to Disclose

Liqiang Ren, PhD (*Abstract Co-Author*) Nothing to Disclose
Yue Zhang, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the dependency of phantom size and radiation dose of a tin-filtered spectral shaping CT technique on image noise.

**METHODS AND MATERIALS**

ACR CT accreditation phantom (20cmX20cm) and two body rings (33cmX26cm and 40cmX30cm) were arranged to simulate three patient sizes from small to large, and scanned on a dual-source dual-energy CT (SOMATOM Force, Siemens) in single-energy mode at 120kV, Sn100 kV and Sn150 kV (Sn: tin; thickness: 0.6mm). The initial radiation dose levels (CTDIvol) were determined as 3, 8, and 12 mGy for the three phantoms, respectively, and matched for the three kVs. Except that Sn100 kV was not able to reach 12 mGy. So for 40cm phantom, 6 and 3 mGy were used with Sn100 kV. All scans were repeated at 50% and 25% of the initial dose levels, namely 1.5 and 0.75 mGy, 4 and 2 mGy, and 6 and 3 mGy for small, medium, and large phantoms, respectively. All images were reconstructed using an iterative reconstruction algorithm (ADMIRE-3), a regular body kernel (Br44) at slice thickness/increment of 1mm x 0.5mm, and a fixed filed-of-view of 210mm. The reconstructed CT images were uploaded to CTPro (ctpro.net; a web-based software platform for CT image quality evaluation and radiation dose optimization). The uniformity module of ACR CT phantom was selected for noise evaluations including noise magnitude and two-dimensional noise power spectrum (NPS) using the NPS software tool in CTPro. For each measurement, 12 square region-of-interests (ROIs) were placed on each slice and repeated for the central 50 consecutive slices.

**RESULTS**

For both small and medium phantoms, NPS curves demonstrated that Sn100 and Sn150 kV decreased the noise level at all spatial frequencies compared to 120 kV scans at all matched dose levels. For 40 cm phantom, NPS curves showed that, at the same dose level, Sn150 kV had a decreased noise level at lower spatial frequencies, while increased at higher spatial frequencies. Compared to 120 kV, Sn100 kV decreased the overall noise levels by 10-18%, 23-34%, 16-25% for small, medium, and large phantoms, whereas Sn150 kV decreased by 3-6% and 11-12% for small and medium phantoms. Sn150 kV decreased the noise by 4% and 5% for 12 mGy and 3 mGy, but increased by 6% for 6 mGy of the large phantom.

**CONCLUSION**

The noise reduction performance of the tin-filtered spectral shaping CT technique is size and dose dependent, and Sn150 kV can potentially increase the noise for large sizes.

**CLINICAL RELEVANCE/APPLICATION**

The use of the additional filter can achieve more noise reduction with a lower tube potential (e.g., 100 kV versus 150 kV) and the Sn150 kV may be dose inefficient when it is used for larger patients.

## W7-SSPH11-5 IDENTIFICATION OF REPRODUCIBLE CT TEXTURE METRICS BASED ON IMAGES OF A 3D-PRINTED TEXTURE PHANTOM ACROSS MULTIPLE CT VENDORS

Steven Cen, PhD (*Abstract Co-Author*) Nothing to Disclose
Bino A. Varghese, PhD (*Abstract Co-Author*) Nothing to Disclose
David J. Goodenough, PhD (*Abstract Co-Author*) Consultant, The Phantom Laboratory
Kristin Jensen, PhD, MSc (*Abstract Co-Author*) Departmental contract, The Phantom Laboratory
Xiaomeng Lei (*Abstract Co-Author*) Nothing to Disclose
Huawei Han (*Abstract Co-Author*) Nothing to Disclose
Andrew Turangan (*Abstract Co-Author*) Nothing to Disclose
Vinay A. Duddalwar, MD, FRCR (*Abstract Co-Author*) Consultant, Radmetrix Inc;Consultant, DeepTek Inc;Consultant, Cohere Inc;Consultant, Westat Inc;Research Grant, Samsung Electronics Co, Ltd
Neha Yadav (*Abstract Co-Author*) Nothing to Disclose
Joshua Levy (*Presenter*) Stockholder, The Phantom Laboratory;President, The Phantom Laboratory ;Stockholder, Image Owl, Inc;CEO, Image Owl, Inc;

**PURPOSE**

To evaluate the reproducibility of CT texture analysis (CTTA) metrics extracted from CT images of a 3D printed phantom with varying textural heterogeneity placed within an anthropomorphic liver phantom (Phantom Laboratory, NY) and imaged across two different CT vendors.

**METHODS AND MATERIALS**

Scans were acquired on a Siemens Somatom Definition Flash CT scanner (conventional bore) and a 16 cm detector GE Revolution Apex Edition CT scanner, respectively, with variations across slice thicknesses (0.6mm, 1.5mm, 3mm), dose levels (CTDIvol of 13.86 mGy standard, 40% reduction and 60% reduction), tube voltages (100 kVp and 120 kVp), and reconstruction methods (filtered back projection and iterative method). By varying these parameters, 18 distinct volumetric CT images were acquired. Manual segmentation was performed to identify 7 circular volumes of interest (VOIs)—in the liver phantom, these were contoured around the seven 3D-printed texture inserts. Feature extraction was performed using Pyradiomics' open-source software to obtain 57 features belonging to 6 subgroups of texture extraction methods. The intra-class correlation coefficient (ICC) of 2-way random/mixed* model was used to assess the consistency between the CTTA values acquired across the two CT vendors and imaging/ reconstruction protocols. A heat map was constructed to identify reproducible radiomic metrics across the various settings.

**RESULTS**

While a total of 34.34% features showed good reproducibility (ICC3.1 = 0.6), only 5.64% features showed an ICC3.1= 0.8. Of the six texture subgroups, first-order metrics such as intensity and histogram showed better reproducibility than others. Of the neighborhood-based texture subgroups, graylevel co-occurrence matrix approach showed better reproducibility than the other approaches. Among imaging variables, changes in slice thickness affected all metrics more intensely compared to other imaging variables in reducing the ICC3.1.

**CONCLUSION**

CT vendor/protocols impact different CT texture metrics differently. For example, some CTTA metrics, especially those from neighboring gray tone difference matrix (NGTDM) family, lack reproducibility across CT vendors.

**CLINICAL RELEVANCE/APPLICATION**

Identifying reproducible CTTA metrics from the large radiomic feature set reduces feature dimensionality errors, mitigates overfitting, and reduces the chances of erroneous conclusions in multisite radiomic studies.

## W7-SSPH11-6 THE COLOR OF CLARITY: X-RAY ENERGY AND ITS IMPACT ON SPATIAL RESOLUTION IN PHOTON COUNTING CT

Ke Li, PhD (*Abstract Co-Author*) Research Consultant, Pulmera Inc.
Guang-Hong Chen, PhD (*Abstract Co-Author*) Nothing to Disclose
Linying Zhan, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Photon counting detector CT (PCD-CT) is widely acclaimed for its superb spatial resolution. This study extends beyond traditional comparisons with energy integrating detector CT (EID-CT) to examine a novel aspect of PCD-CT: the significant influence of x-ray energy on spatial resolution. This parameter can be analogously described as the 'color' of x-rays, introducing a color dimension to spatial resolution analysis. The study also aims to pinpoint whether the noted improvements in resolution with PCD-CT are predominantly attributable to the photon counting mechanism or to a sophisticated interaction with the spectral characteristics of x-ray energy.

**METHODS AND MATERIALS**

Pre-sampling MTF of a CdTe-based direct conversion PCD (0.1 mm pixel pitch) were experimentally measured at 13 different energy thresholds ranging from 5 to 60 keV. At each threshold, the measurement was repeated 1000 times to establish uncertainty range. The obtained experimental data served as validation for a detector model capable of estimating MTF across arbitrary energy thresholds. By eliminating low energy thresholding and applying photon energy-based weighting, the detector model effectively simulates the transformation of the PCD into a direct conversion EID with matching sensor thickness, bias voltage, and pixel pitch. Subsequently, we measured the MTF of this EID and compared it against the MTF of the original PCD.

**RESULTS**

The spatial resolution of the PCD consistently improves as the energy threshold level increases, particularly when set above 25 keV to reject reabsorbed K-fluorescence photon signals. Across energy threshold levels of 5, 15, 25, 40, and 60 keV, the measured MTF50 values for the PCD are 3.1±0.04, 3.2±0.02, 3.3±0.02, 4.0±0.08, and 4.4±0.1 lp/mm, respectively; the MTF10 values are 6.3±0.04, 6.6±0.04, 6.8±0.07, 7.4±0.1, and 7.9±0.06 lp/mm, respectively. In comparison, utilizing the CdTe direct-conversion detector in EID mode yields an MTF50 of 3.1 lp/mm and an MTF10 of 6.2 lp/mm.

**CONCLUSION**

This study establishes that the spatial resolution of PCD-CT significantly improves with higher x-ray energy thresholds, highlighting the profound impact of x-ray 'color' on spatial resolution. The observed spatial resolution enhancements in MTF50 and MTF10 values confirm that PCD-CT's superior performance is intricately linked to both the photon counting mechanism and its interaction with x-ray spectral characteristics. This dual influence suggests promising avenues for advancing CT imaging through spectral optimization.

**CLINICAL RELEVANCE/APPLICATION**

This study elucidates the core advantages of using PCDs for high-resolution clinical CT imaging applications and suggests promising avenues for advancing CT imaging through spectral optimization.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

W7-SSPH12

**Physics (Radiation Dose)**

Wednesday, Dec. 4 3:00PM - 4:00PM Room: S401

Megan C. Jacobsen, PhD (*Moderator*) Honorarium and Travel, Kyoto Kagaku
Michael F. McNitt-Gray, PhD (*Moderator*) Institutional research agreement, Siemens AG;Research Grant, Siemens AG;Scientific Advisory Board, Hura Imaging, LLC

**Sub-Events**

## W7-SSPH12-1 EVALUATING SPATIAL-TEMPORAL IMAGE QUALITY AND DOSE IN ANGIOGRAPHY WITH MONTE CARLO SIMULATIONS: WOULD A NEW ANTISCATTER GRID PROTOTYPE WITH LARGE AIR GAP INCREASE STAFF AND PATIENT EFFECTIVE DOSES?

Hilde Bosmans, PhD (*Abstract Co-Author*) Stockholder, Qaelum NV;Research Grant, Siemens AG;Research Grant, General Electric Company
Nicholas Marshall (*Abstract Co-Author*) Nothing to Disclose
Rodrigo T. Massera, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

A new high-ratio antiscatter grid (ASG) for cardioangiography requires a source-to-detector distance (SID) of 120 cm. This increases geometric magnification and removes the image receptor from the patient exit plane, potentially impacting operator protection. This work studied the impact increased SID on staff effective dose and system performance using a task-based figure of merit.

### METHODS AND MATERIALS

A validated optimization framework for angiography procedures combining analytical calculations and Monte Carlo (MC) simulations (modified PENELOPE/penEasy) was implemented. Mathematical (ORNL) and voxelized (ICRP 110/male) anthropomorphic phantoms represented the patient and physician, respectively. Patient thorax thickness was 28 cm. The physician, protected with lead apron and glasses, ceiling shield and table shield, was positioned at the femoral artery access point. Image quality was quantified with a signal-to-noise ratio (SNR(u)) weighted by MTF-based factors to describe the effect of object size and geometric blurring from patient motion and focus size. The optimization was performed by maximizing a Figure of Merit (FOM) defined as SDNR(u)2/D where D was alternatively the patient incident air kerma, patient effective dose or operator effective dose. The x-ray beam was collimated at the chest of the patient, positioned at the isocenter, 75 cm from the source. Optimal x-ray technique factors (exposure time, tube current, kV and additional filtration) to reach a target $SDNR^2(u)$ value. Tube potential was varied from 40 to 120 kV, and spectral filtration from 0.0 to 0.9 mm Cu. Scenario A modelled standard current technique, with a 105 cm SID, field-of-view (FOV) of 22 cm and ASG of ratio (r) 15 and frequency (f) 80 cm-1, while scenario B modelled a 120 cm SID (airgap of 29 cm), 25 cm FOV and new ASG with r=29 and f=80 cm-1.

### RESULTS

For the same x-ray tube parameters (kV, filtration and mAs), scenario B resulted in a 2% higher staff effective dose, on average, than scenario A. However, when the x-ray tube parameters (considering its limitations) were optimized for incident air kerma and adjusted to provide the target image quality value, scenario B respectively reduced incident air kerma and staff doses up to 24% and 16%, respectively.

### CONCLUSION

Optimized exposure parameters for a new high-ratio antiscatter grid with a longer SID reduced patient and staff doses for the angiography application considered. The increased air gap between patient and detector used with the new grid did not result in higher patient or staff doses.

### CLINICAL RELEVANCE/APPLICATION

Lower staff and patient doses could be achieved for the same image quality if an optimized SID and antiscatter grid is used in angiography systems.

## W7-SSPH12-2 ORGAN-SPECIFIC COMPARISON OF IMAGING AND THERAPEUTIC DOSES FROM YTTRIUM-90 RADIOEMBOLIZATION

Stephanie Leon, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Oliver Paucar (*Abstract Co-Author*) Nothing to Disclose
Dante E. Roa, PhD (*Abstract Co-Author*) Nothing to Disclose
Edmond Olguin, PhD (*Abstract Co-Author*) Nothing to Disclose
Andres Gonzales Galvez (*Abstract Co-Author*) Nothing to Disclose
Terrance Moretti, PhD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Patients receiving Yttrium-90 Transarterial Radioembolization (TARE) undergo at least two interventional imaging procedures, the first for treatment planning and the second for administration of the microspheres. These procedures may exceed multiple Gy in dose to the reference point, but are not

typically considered in treatment planning. Dose concerns are elevated for patients who receive multiple Y90 treatments, which further increases the cumulative imaging dose, potentially pushing certain doses above thresholds for deterministic effects. This work evaluates the organ doses from the imaging and therapeutic components of TARE and compares their magnitudes.

**METHODS AND MATERIALS**

With IRB approval, ten TARE patients treated for hepatocellular carcinoma were selected for retrospective image-based dosimetry. All patients had received imaging in one interventional suite for which a previously-validated Monte Carlo (MC) model existed. Voxelized models of these patients were subjected to simulated irradiation conditions which matched those recorded in the radiation dose structured reports for both imaging procedures for one Y90 treatment. The pre-treatment planning SPECT/CT was used as the Y90 source model. All doses were summed on a per-voxel level. Doses were assessed by imaging acquisition mode (fluoroscopy, DSA, or CBCT) and percentage of total from Y90. Relative contributions were broken down for several potential organs-at-risk.

**RESULTS**

Within the liver, more than 95% of the dose came from Y90 on average across all patients. Outside of the liver, the mean percentage contribution of Y90 to total dose ranged from 26% to 94%. Lung dose was much more dependent on relative position of the tumor than the dose calculated during treatment planning. The largest imaging dose contribution overall was from DSA (14.7%), followed by fluoroscopy (9.3%), and CBCT (7.4%).

**CONCLUSION**

For a single administration of Y90, no patient received a lung dose from imaging which would cause a TARE dose threshold to be reached or exceeded, but for patients receiving multiple administrations, these thresholds may be crossed. Imaging dose to other structures was not at levels warranting concern for a single TARE treatment, but patients receiving multiple TARE treatments should be given extra consideration, particularly if the doses to these other structures are high from the microsphere treatment.

**CLINICAL RELEVANCE/APPLICATION**

The addition of imaging dose to the therapeutic dose from TARE may explain clinical cases of radiation pneumonitis in patients near the threshold for deterministic effects calculated from the microspheres. Understanding the largest contributions to imaging doses can help interventionalists apply dose-saving measures more effectively.

## W7-SSPH12-3 COMPARISON OF STANDARD BREAST DOSIMETRY PROTOCOL WITH NEW APPM-TG282 METHODOLOGY BY USING BREAST COMPOSITION DATA FOR A SCREENING POPULATION

Ioannis Delakis, MSc, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the new breast dosimetry methodology presented by the American Association of Physicists in Medicine (AAPM) Task Group (TG) 282 with the standard breast dosimetry protocol, by using breast composition information derived from digital mammography screening exams.

**METHODS AND MATERIALS**

The study included over 20,000 mammography exams performed at breast screening clinics equipped with Full-Field Digital Mammography (FFDM) systems of two different vendors at each site. All images were analyzed using the Volpara software to determine breast glandularity. The Average Glandular Dose (AGD) for each exposure was calculated using client-specific volumetric breast density and applying the standard breast dosimetry protocol (Dance model) and the new dosimetry methodology presented by AAPM TG282. This provided individualized AGD values for each dataset, one for each methodology. The calculation was repeated without using client-specific breast glandularity information but instead using the median breast density assumed by each dosimetry methodology for the screened individual's age and breast thickness. This provided conventional AGD values for standard and AAPM TG282 methodologies.

**RESULTS**

The ratio of conventional-to-individualised AGD values calculated using the standard breast dosimetry protocol showed positive correlation with breast thickness (Pearson Correlation Coefficient: 0.55-0.65) indicating that individualised AGD is higher than conventional AGD in smaller breasts with the effect reversed above approximately 80mm breast thickness. On the other hand, the ratio of conventional-to-individualised AGD using the AAPM TG282 model showed no dependence on breast thickness (Pearson Correlation Coefficient: <0.1). These results, which were independent of the FFDM vendor and were consistent across sites, can be explained by the different breast glandularity assumptions in each method, with the AAPM TG282 providing a closer approximation of the breast density distribution seen in our screening population than the standard breast dosimetry protocol.

**CONCLUSION**

Individualised AGD calculations for our breast screening population demonstrated that the AAPM TG282 breast dosimetry methodology can provide a better estimation of AGD than the standard breast dosimetry protocol. Using client-specific volumetric breast density can also be a useful tool to further tailor AGD calculations, albeit with the limitation of not considering glandular tissue spatial distribution.

**CLINICAL RELEVANCE/APPLICATION**

The choice of AGD calculation method for breast exams can result in differences due to the different breast density models used. This is critical in risk-benefit analysis and radiation dose optimization for breast exams.

## W7-SSPH12-4 PEAK SKIN DOSE CALCULATOR FOR PATIENTS UNDERGOING RADIOGRAPHY AND FLUOROSCOPY

Choonsik Lee, PhD (*Abstract Co-Author*) Nothing to Disclose
Haegin Han, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The NCIRF software, developed by the National Cancer Institute, provides a user-friendly tool for assessing organ and effective doses for patients undergoing radiography and fluoroscopy. The software performs Monte-Carlo particle transport simulations, considering the X-ray spectrum, C-arm position, and patient-specific characteristics, such as age and sex, to deliver accurate dose calculations. However, it lacks the ability to evaluate peak skin dose (PSD) and skin dose distribution, which are of crucial interest. This study aimed to develop and integrate a module for evaluating PSD and skin dose distribution into the NCIRF software.

**METHODS AND MATERIALS**

For calculating skin dose distribution, voxel-wise radiation doses for skin voxels were computed by incorporating NCIRF phantoms into the Geant4 simulation toolkit. To avoid overestimating PSD due to high uncertainty in individual voxel measurements, in the present study, a dedicated algorithm was

developed. A 2D heat map of skin dose distribution for the front and back sides of the phantom was generated and processed using an iterative procedure that employed image smoothing and noise assessment techniques. That is, the heat map was smoothened until the noise level reaches the empirically decided value. Then, the highest dose on the heat map was identified and selected to represent the PSD.

**RESULTS**

The methodology was applied to four cases varying in peak voltage, phantom ages, and exposure levels. It successfully mapped skin dose distributions and yielded PSD estimates that aligned with those from large particle number (1010) simulations with the error of the highest voxel-wise dose lower than 1%: for the simulation with the particle number of 105 and 106, the differences were at most 9% and 1%, respectively. Note that when Tested on a MacBook M2, simulation times for the particle number of 106 were less than 10 seconds.

**CONCLUSION**

The new NCIRF module offers PSD calculation via Monte-Carlo simulation, providing a precise and accessible measurement method. The module's user-friendly interface and capability to consider specific dose calculation conditions allow users of all expertise levels to estimate PSD and skin dose distributions under varied exposure scenarios. This aids large-scale epidemiological research and offers a valuable resource for investigating PSD-related skin injuries in fluoroscopic procedures.

**CLINICAL RELEVANCE/APPLICATION**

The integration of Monte-Carlo simulations with NCIRF provides an accurate and time-efficient approach for estimating PSD and skin dose distribution in fluoroscopic procedures, assisting clinicians and researchers in assessing potential radiation-induced skin injuries and enabling better patient care.

## W7-SSPH12-5 TYPICAL DOSE VALUES FOR PRE-Y90 HEPATIC ARTERIAL MAPPING PROCEDURES PERFORMED IN A HYBRID CT-ANGIO SUITE

Manuel M. Arreola, PhD (*Abstract Co-Author*) Nothing to Disclose
Bryan C. Schwarz, PhD (*Abstract Co-Author*) Nothing to Disclose
Emily Marshall, PhD (*Abstract Co-Author*) Scientific Advisory Board, Bayer AG;Consultant, Bayer AG;Scientific Advisory Board, Radimetrics Dosimetry Services;Consultant, Radimetrics Dosimetry Services
Megan Glassell, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniella Fabri, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Integration of hybrid imaging modalities, such as CT and fluoroscopy, has become increasingly prevalent in clinical practice. Understanding the typical dose values (TD) and procedure details for these hybrid procedures is essential for optimizing patient safety, ensuring efficient workflow, and maintaining diagnostic and treatment accuracy.

**METHODS AND MATERIALS**

A retrospective analysis was conducted, 629 cases from a CT-Angio suite from 01/2023 to 09/2023. The most frequently hybrid performed procedure (i.e. cases utilizing Angio and CT during the procedure) in this suite, were pre-Y90 hepatic arterial mappings, thus a sub-analysis was performed on this procedure type. Dose and procedural data were retrieved utilizing the institutional dose management system, supplemented by information from PACS where necessary. With case-specific information, an estimate of pre-Y90 hepatic arterial mapping TD values were made. The ICRP's TD corresponds to the median value of a dose parameters distribution. TD values include CTDIvol, DLP, DAP, cumulative air kerma (CAK), fluoroscopy peak skin dose (PSD), CT PSD, and an estimation of the cumulative PSD. CT PSD was estimated using a previously validated relationship between CTDIvol and entrance skin dose from CT.

**RESULTS**

A total of 86 cases of pre y-90 mappings were included (8 of them PSD information was missing), corresponding to 14% of total cases and 53% of hybrid cases . A median of 78.5 irradiation events (32 to 228) were performed in the included cases and 9 CT (2-22) acquisitions. These cases had a TD CTDIvol of 93 mGy (23.4mGy - 250.3mGy), DLP of 1657 mGycm (375 mGycm-8668 mGycm), DAP of 1142.84 mGycm2 (547.92 mGycm2 - 9422.8mGycm2), and CAK of 1142.8 mGy (275.2 mGy - 4946.5 mGy). The typical fluoroscopy PSD was 1030 mGy (170 mGy - 4320 mGy) and a CT PSD of 178.59 mGy (44.87 mGy -480.68 mGy). The typical cumulative PSD was 1240 mGy (270mGy - 4660) mGy.

**CONCLUSION**

We offer a comprehensive analysis of typical doses for pre-Y90 hepatic arterial mapping in a hybrid CT-Angio suite. By examining a case dataset, we clarified fluoroscopic irradiation and CT acquisitions, contributing to efforts in comparing imaging outcomes and enhancing patient safety in hybrid imaging.

**CLINICAL RELEVANCE/APPLICATION**

Integration of hybrid imaging has transformed healthcare procedures. This study's insights into typical dose values for pre-Y90 hepatic arterial mapping in a hybrid CT-Angio suite are clinically significant, offering valuable guidance to healthcare practitioners. This information not only allows for the refinement of techniques and minimization of patient radiation exposure but also supports informed resource allocation to enhance procedures with clear added benefits of the angio-CT capabilities within the Hybrid room.

## W7-SSPH12-6 USEFULNESS OF DOSE REDUCTION AT HIGH-KVP TECHNIQUE ON CHEST X-RAY: COMPARISON OF 26 ORGANS BASED ON ICRP

Youngseok Ji, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Chest X-ray Radiography is a high proportion of overall radiography, and its high importance in diagnosis. Many studies, such as the use of additional filters, are being conducted to reduce the radiation dose, and the High-kVp Technique is actively used in clinical practice because it has the advantage of reducing the radiation dose by shortening the exposure time. Chest AP (Ch-AP) is generally adopted when Chest PA (Ch-PA) is not possible, however there has been no study analyzing the exact difference in dose from the perspective of radiation exposure dose for each organ of the human body. Therefore, this study aims to present quantitative results by comparatively analyzing the doses to 26 organs, focusing on Ch-PA (High-kVp) and Ch-AP (General kVp).

**METHODS AND MATERIALS**

Monte Carlo N-Particle Transport Code (MCNP6, Los Alamos National Security) was used to measure the dose for each organ (26 ea), and human phantom used a computational phantom (HDRK; High-Definition Reference Korean-Man) (Figure 1). For normalization of simulation and actual data, DAP

(Dose Area Product) value from stational X-ray (GC85A, Samsung Electronics) and Mobile X-ray (GM85, Samsung Electronics). Parameters were based on our institution that meet domestic and international Chest-DRLs. Ch-PA was 125 kVp / 2 mAs, SID (180 cm), and FOV (17x17 inch). Ch-AP was 75 kVp / 4 mAs, SID (110 cm), and FOV (17x17 inch). Human organs were comparatively analyzed based on 26 organs specified in ICRP Publication 103 (Table 1).

**RESULTS**

The total dose (26 organs) of Ch-PA and Ch-AP was calculated to be 0.18 mSv and 1.15 mSv, respectively. It was confirmed that the dose of Ch-PA applied High-kVp was 15.65% compared to Ch-AP. However, Certain organs of Ch-PA showed higher doses than Ch-AP; Lung (1.17 μSv, 1.6 times higher), Esophagus (0.25 μSv, 3.0 times higher), Thyroid (0.21 μSv, 4.4 times higher), Adrenal (0.18 μSv, 1.1 times higher), Kidney (0.34 μSv, 1.3 times higher). Brain and Thymus showed the same dose of 0.01 μSv, 0.03 μSv, respectively. In the other 19 organs, Ch-AP showed a high dose (Figure 2).

**CONCLUSION**

Ch-PA applied with High-kVp showed an 84.35% dose reduction from Ch-AP. However, since higher doses were confirmed in seven organs than Ch-AP, High-kVp Technique did not show a dose reduction in all organs.

**CLINICAL RELEVANCE/APPLICATION**

It is known that Monte-Carlo is the most realistic method to measure doses for each organ, and this study increased reliability by combining actual DAP data. In addition, this is the first study to model a realistic wall-bucky stand to reflect the clinical situation, thus organ dose also includes scattered X-ray from detector materials.

# Abstract Archives of the RSNA, 2024

W7-STCE1

**Science Session (Low-Field and Mobile MRI)**

Wednesday, Dec. 4 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 1

**Sub-Events**

## W7-STCE1-1 IMPLEMENTATION, FEASIBILITY, AND POSSIBILITIES OF LOW-FIELD MAGNETIC RESONANCE IMAGING: EXPERIENCES FROM PAKISTAN

Latika Giri (*Abstract Co-Author*) Nothing to Disclose
Saroj Jha (*Abstract Co-Author*) Nothing to Disclose
Muhammad Umair, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the feasibility, implementation, and clinical relevance of low-field Magnetic Resonance Imaging (LF MRI) in Pakistan, focusing on its potential to improve healthcare accessibility and quality in resource-limited settings.

### METHODS AND MATERIALS

We analyzed cases performed at the low field MR systems (<=0.5 Tesla) in a multicentric imaging practice in Pakistan (a few case studies are included here for reference) from neurological, musculoskeletal, and abdominal imaging for the quality and clinical relevance. Data on scanner models, patient outcomes, and diagnostic accuracy were collected for the reported cases. Additionally, advancements in LF MRI technology and its application in cardiovascular magnetic resonance (CMR) imaging were reviewed from the existing literature.

### RESULTS

LF MRI demonstrated adaptability across various clinical scenarios, with acceptable imaging quality and diagnostic outcomes. Despite lower SNR, advanced image reconstruction techniques provided sufficient diagnostic quality. Key findings include:
- Neurological imaging Effective identification of structural abnormalities with reduced artifacts and improved patient comfort due to lower acoustic noise levels.
- Musculoskeletal Imaging Enhanced imaging of ligaments and cartilage, resulting in improved T2 contrast.
- Abdominal Imaging Adequate visualization of the abdominal organs, with optimized pulse sequences compensating for lower field strengths. LF MRI scanners, including Hitachi Airis II (0.3T), Hitachi Aperto (0.4T), Hitachi Aperto Inspire (0.4T) and GE Signa Profile (0.2T), provided diagnostic images of acceptable quality for clinical decision-making. Urban centers had better LF MRI coverage compared to rural areas, highlighting a disparity in access.

### CONCLUSION

LF MRI enhances diagnostic imaging in LMICs, addressing healthcare disparities caused by limited access to high-field MRI. Successful integration in Pakistan demonstrates its potential to provide cost-effective, reliable diagnostic imaging. Technological advancements, such as improved gradient systems and advanced reconstruction techniques, mitigate challenges associated with lower SNR and longer scan times.

### CLINICAL RELEVANCE/APPLICATION

LF MRI offers a practical and accessible imaging alternative for LMICs, delivering reliable diagnostic information at a lower cost and with fewer technical complexities. Its implementation in Pakistan highlights its potential to improve healthcare outcomes, particularly in underserved areas. This early investigation supports the broader adoption of LF MRI to bridge the healthcare gap in Pakistan's healthcare ecosystem and other resource-constrained regions, promoting equitable access to advanced diagnostic imaging.

## W7-STCE1-2 INITIAL STUDY FOR FEMALE PELVIC PHANTOM IN LOW-FIELD (60MT) MRI SYSTEM

Selin Chiragzada (*Abstract Co-Author*) Nothing to Disclose
Hiya Ghosh (*Abstract Co-Author*) Nothing to Disclose
Dinesh Kumar, PhD, MBA (*Abstract Co-Author*) Nothing to Disclose
Jae Eun Song, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Low-field MRIs are gaining popularity as they provide the added benefit of MR imaging with easy accessibility for patients and physicians. Promaxo MRI is a commercial interventional MR system for surgical localization of prostate cancer. This paper presents early phantom results using the Promaxo single-sided low-field MRI system for female pelvic imaging.

### METHODS AND MATERIALS

Phantom Experiments: The female pelvic phantom was developed using 3D printed structures derived from a high-resolution MRI of a 25-year-old cis-female woman using Avizo and Blender processing. The hollowed out structures corresponding to the anatomy were filled with five different materials based on the T2 contrast of the materials. Bladder, rectum, uterus, vagina, and coccyx were filled with filtered water, mineral oil, olive oil, silicone oil, and

10mM $CuSO_4$, respectively. Acquisition and Reconstruction: Promaxo's single-sided low-field (60mT) MRI system was used to image the phantoms and a standard 2-channel receive coil. The sequence has echo train length varying from 8 to 12 echoes, a TR = 1.45 sec, and with an echo spacing varying from 5.4 to 3.2 millisecs. Images were reconstructed with 1.5 mm x 1.5 mm in plane resolution, an effective field of view of 180 mm x 180 mm x 100 mm, and a slice thickness of 2.75 mm. The reconstruction was performed using an iterative, conjugate gradient least square (CGLS) method with Tikhonov regularization.

## RESULTS

The female pelvic phantom shows different T2 contrasts for different compartments. The dimensions of the bladder and uterus were measured from the 3D printed phantom and the low-field MR image. The low-field MR image was segmented using Slicer software. The error of the low-field MR image was less than 10% for both organs (5.5±3.5) with slice thickness, partial volume effect, and operator variability as potential sources of error.

## CONCLUSION

We present results for female pelvic imaging with a low-field MRI system using a phantom constructed based on real human data. For future work, we will extend imaging to female patients diagnosed with pelvic disease.

## CLINICAL RELEVANCE/APPLICATION

Our ability to visualize female pelvic organs is useful for the diagnosis of female pelvic conditions, such as pelvic organ prolapse (POP). POP often goes undiagnosed until symptoms begin to appear, and diagnosis usually involves a simple pelvic exam and an assessment of the patient's symptoms. While there are existing protocols for diagnosis and staging of POP using MRI, they are rarely used due to costs and inaccessibility to conventional MRIs. An office-based MRI system would allow patients to get scanned during a routine check-up and enable earlier diagnosis of POP.

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# Abstract Archives of the RSNA, 2024

W7-STCE2

**Science Session (Value Based, Equitable and Sustainable Radiology)**

Wednesday, Dec. 4 2:30PM - 3:00PM Room: LEARNING CENTER THEATER 2

**Sub-Events**

## W7-STCE2-1 A NOVEL METHOD FOR SYNTHESIZING HIGH-RESOLUTION 3D FLAIR BRAIN MR IMAGES BASED ON CLINICAL LOW-RESOLUTION 2D IMAGES

Zechen Zhou (*Abstract Co-Author*) Nothing to Disclose
Zheng Zhang (*Abstract Co-Author*) Nothing to Disclose
Yuehua Li (*Abstract Co-Author*) Nothing to Disclose
Xin-Yu Song (*Abstract Co-Author*) Nothing to Disclose
Lei Xiang (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Arnold, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

3D high-resolution (HR) MR imaging is a useful tool for lesion detection. However, routine clinical practice often favors the acquisition of low-resolution (LR) 2D images to minimize scanning time. This study proposes a deep learning network for synthesizing HR 3D fluid-attenuated inversion recovery (FLAIR) images from LR 2D acquisitions, and evaluates the image quality of the synthesized images.

### METHODS AND MATERIALS

This retrospective study included 60 patients who underwent multimodal 3T brain magnetic resonance imaging, dividing them into a training set of 50 patients and a test set of 10 patients. Utilizing our developed 2.5D-based Visual State Space (VSS) model depicted in Fig. A, we input 2D LR FLAIR sequences and 3D high-resolution time-of-flight magnetic resonance angiography images to synthesize HR FLAIR images. Quantitative metrics were used to evaluate the quality of the synthesized HR FLAIR images (Syn-HR FLAIR). Additionally, two experienced radiologists independently rated the visual quality of images in axial and coronal planes on a three-point scale (1 = poor; 2 = modest; 3 = good). The efficacy of Syn-HR FLAIR images was assessed by comparing the visual quality scores of gray-white matter interface and lesion resolution, as well as quantitative measurements of lesion volume, among LR FLAIR, Syn-HR FLAIR, and real HR FLAIR images.

### RESULTS

The Syn-HR FLAIR images accelerated the scan time by 12 fold (2D FLAIR:28s, 3D FLAIR:342s) on average and showed high similarity to real HR FLAIR images as shown in Fig. B (normalized mean absolute error, 0.013 for the test set; peak signal-to-noise ratio, 32.06 dB; structural similarity, 0.936). The visual score (VS) of Syn-HR FLAIR was comparable to real HR FLAIR in both planes (gray-white matter interface: $P > 0.99$ and $P > 0.99$, respectively; lesion resolution: $P = 0.10$ and $P = 0.06$) and significantly better than LR FLAIR ($P < 0.05$). Lesion volumes were smaller in LR images compared to Syn-HR images (Mean of differences = $2.5 \pm 1.8$; $P < 0.001$), with both being smaller than in HR images as shown in Fig. D and E.

### CONCLUSION

The proposed deep learning model can accurately synthesize 3D HR FLAIR images comparable to acquired 3D HR FLAIR images, providing an efficient method to obtain HR images for either prospective brain protocol acceleration or retrospective resolution enhancement.

### CLINICAL RELEVANCE/APPLICATION

The proposed image synthesis method allows reconstruction of 3D HR brain images from rapid 2D scans and supports downstream quantitative volumetric analysis for lesions, which largely improves the scan efficiency while maintaining the diagnostic quality.

## W7-STCE2-2 IMPROVING GENERALIST SCREENING MAMMOGRAM PERFORMANCE WITH SUSTAINABLE AI-DRIVEN TARGETED REVIEW

Bryan Haslam, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Jiye G. Kim, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Leeann Louis, BS, PhD (*Abstract Co-Author*) Researcher, RadNet, Inc
Edgar Wakelin (*Abstract Co-Author*) Nothing to Disclose
Matthew McCabe, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

A major challenge in screening mammography (MG) is variability in interpretation quality. Radiologists who specialize in breast imaging (Specialists) have higher cancer detection rates (CDRs) than other radiologists (Generalists). Generalists therefore represent a greater risk of missed cancer diagnosis. In order to sustainably mitigate this risk, we developed an AI-driven review workflow to efficiently allocate specialist resources to exams most at risk for cancer. We evaluated the ability of this workflow, termed “Safeguard Review” (SR), to improve performance statistics of Generalists and Specialists.

### METHODS AND MATERIALS

In the SR program, MGs were interpreted by a primary radiologist. An FDA-cleared breast cancer AI model also evaluated MGs and assigned a cancer suspicion score. If an exam was scored by the AI in the top 8% of cancer suspicion, but the primary radiologist did not recall the patient, the exam was routed to a Specialist for review. We evaluated the impact of this program on the performance of 10 radiologists (6 Specialists, 4 Generalists; "Specialist" defined as a Radiologist for whom >75% of their workload during the study period was breast imaging) who collectively read 36,444 screening MGs between July 2021 and May 2022. Performance was assessed using recall rate (RR), cancer detection rate (CDR), and positive predictive value of recalls (PPV1), and results were compared without and with SR. Statistical analysis was performed by bootstrap resampling exams.

### RESULTS

Out of 36,444 MGs, 2,208 went through SR (6%). There were 2,935 recalls (123 from SR; 4%) and 248 cancers (41 from SR; 17%). Without SR, Generalists were comparable to Specialists in RR (G: 7.12, S: 7.79, p=0.067), but significantly worse in CDR (G: 3.27, S: 5.98, p = 0.007) and PPV1 (G: 4.59, S: 7.67, p=0.016). We found that the relative impact of SR on CDR was significantly greater for Generalists (76% increase; 95% CI: 23-167%) than for Specialists (16.6% increase; 95% CI: 10.6-23.5%, p = 0.007). We similarly found that the relative impact of SR on PPV1 was significantly greater for Generalists (65% increase; 95% CI: 19.1-134.7%) than for Specialists (11.9% increase; 95% CI: 6.8-17.5%, p = 0.006). Further, we found the Generalists and Specialists with SR did not differ significantly on any metric (RR: G: 7.55, S: 8.12, p=0.093; CDR: G: 5.53, S: 6.96, p=0.135; PPV1: G: 7.33, S: 8.58, p=0.231).

### CONCLUSION

The SR program is a sustainable approach to improving radiologist performance in which generalist radiologists report the greatest improvement while only reviewing 6% of exams.

### CLINICAL RELEVANCE/APPLICATION

"Safeguard Review" sustainably improved Generalist radiologist performance to that of a Specialist.

## W7-STCE2-3 ENGAGING A MULTIDISCIPLINARY GREEN RADIOLOGY COMMITTEE IN ANNUAL GOAL PLANNING TO DRIVE ACTIONS FOR SUSTAINABLE AND IMPACTFUL CHANGE MANAGEMENT

Hayley Panet (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Ania Kielar (*Presenter*) Nothing to Disclose

### PURPOSE

Health care contributes over 5% of total global greenhouse gas (GHG) emissions. Within the hospital setting, medical imaging departments are one of the largest contributors. An essential driver for change management is staff engagement. The role of an interdisciplinary Green Radiology program has been to set direction and influence collaboration to advance sustainability and impact. Therefore, we sought to develop targeted goals aimed to improve impact on GHG emissions and create sustainable change management strategies.

### METHODS AND MATERIALS

We engaged a multidisciplinary group of leaders, physicians, engineers and hospital administrators interested in promoting sustainability in medical imaging to form the Green Radiology committee. This leadership structure fostered collaboration and determined annual goals through a series of brainstorming sessions aimed to engage departmental members in authentic actions for sustainable change management. Subsequently, a dedicated implementation plan was established to further share accountability and engage staff in achieving green radiology goals. Quarterly status updates monitored outcomes and ensured progress was achieved.

### RESULTS

The development of a formal Green Radiology committee helped accelerate the engagement and foundational support to design and establish sustainability initiatives. The Green Radiology committee identified three goals to achieve within the year. The first priority identified was to commit to gathering energy and power data. This was achieved with the purchase and installation of new power meters supported by hospital electrician and biomedical engineering. The second priority was to develop a visual campaign of Top 10 ideas to share with frontline staff sharing ideas on changes that can have a positive impact on sustainability. Lastly, the team developed a baseline survey to assess current state practices and knowledge about green radiology and sustainability practices. Each of these goals have provided a foundational action plan for future improvements and next steps to guide the Green Radiology committee.

### CONCLUSION

By setting an annual action plan with targeted and realistic goals, the interdisciplinary Green Radiology Committee was able to establish accountability, achieve progress, and engage and promote sustainable changes.

### CLINICAL RELEVANCE/APPLICATION

All radiology medical imaging departments can form an interdisciplinary Green Radiology committee and establish meaningful actions to drive sustainable and impactful changes. In addition, these learnings can help other medical imaging and hospital departments establish and formulate Green Radiology programs that drives engagement and positive sustainable goals.

# Abstract Archives of the RSNA, 2024

BREE

## Breast Imaging Education Exhibits

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

### BREE-1 KEEPING UP WITH THE CUTTING EDGE: MULTIMODALITY REVIEW OF ONCOPLASTIC BREAST SURGERY

**Awards**
**Certificate of Merit**

Alexander Kuehne, MD (*Abstract Co-Author*) Nothing to Disclose
William J. Hoover, MD (*Abstract Co-Author*) Nothing to Disclose
John M. Lewin, MD (*Abstract Co-Author*) Officer, Novian Health Inc
Caroline Merriam, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Surgical management of breast cancer continues to evolve as oncoplastic surgery (OPS) grows in popularity.
- OPS allows for tumor resection with lumpectomy or mastectomy, followed by breast reconstruction.
- To improve cosmetic outcomes after breast reconstruction, several plastic surgery techniques are utilized including volume replacement, volume rearragement, and volume displacement.
- This educational exhibit will provide a description and illustration of several common oncoplastic breast surgeries.
- For each procedure, we will review expected post-operative imaging features on mammogram, ultrasound, and breast MRI.
- The exhibit will conclude with a discussion of acute and long-term complications of OPS including breast abscess, fat necrosis, hematoma, flap necrosis, and breast cancer recurrence.

**TABLE OF CONTENTS/OUTLINE**

1. Brief history of oncoplastic breast surgery (OPS)2. Who is a candidate for OPS?3. Pictorial review of eight OPS techniques, including expected post-operative imaging findings for each technique:
- Reduction mammoplasty
- Nipple areolar complex centralization
- Latissimus dorsi flap
- Deep inferior epigastric perforator (DIEP) flap
- Transverse rectus abdominis myocutaneous (TRAM) flap
- Superior gluteal artery flap
- Autologous fat grafting
- Omental flap4. Case-based review of acute and long-term complications of OPS

### BREE-10 WHEN A MASS IS MELANOMA: VARIABLE IMAGING PRESENTATIONS OF A RARE BREAST DIAGNOSIS

Molly Hill, MD (*Abstract Co-Author*) Nothing to Disclose
Allison Aripoli, MD (*Abstract Co-Author*) Nothing to Disclose
Ashley I. Huppe, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica K. Peterson, MD (*Abstract Co-Author*) Nothing to Disclose
Camron B. Smith, DO (*Abstract Co-Author*) Nothing to Disclose
Onalisa D. Winblad, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela E. Wermuth, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Extramammary metastases to the breast are rare, with melanoma being the most common.2. Metastatic melanoma to the breast may be identified in symptomatic or asymptomatic patients with or without a known history of melanoma.3. Imaging features of melanoma metastases to the breast overlap with findings of primary breast malignancy.4. A thorough understanding of common and unusual imaging presentations of metastatic melanoma is key to maintaining a high clinical suspicion, with biopsy ultimately necessary for diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. Background: Review the prevalence of melanoma metastases (including those to the breast), mechanism of metastatic spread, timeline of presentation, and appropriate workup.2. Case-based imaging review: Multimodality examples of metastatic melanoma to the breast, emphasizing common and unique imaging presentations on:- Mammography- Ultrasound- MRI3. Clinical importance: Discuss the frequency of melanoma, importance of careful clinical history and accurate diagnosis, and general prognosis of melanoma metastases to the breast.

### BREE-100 THE RADIOLOGIST'S ROADMAP TO BREAST IMPLANT EVALUATION: A RESIDENT'S TUTORIAL

**Cum Laude**

Tatiana C. Tucunduva, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela P. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Jacqueline Herica Watanabe, MD (*Abstract Co-Author*) Nothing to Disclose
Aracava M. Marcia, MD (*Abstract Co-Author*) Nothing to Disclose
Luciano F. Chala, MD (*Abstract Co-Author*) Nothing to Disclose
Tomie H. Ichihara, MD (*Abstract Co-Author*) Nothing to Disclose
Giselle G. Mello, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Understanding Implant Types and Anatomy - Imaging Techniques for Implant Assessment - MRI Protocols and Implant Evaluation - Managing Complications and Reviewing Cases

**TABLE OF CONTENTS/OUTLINE**

Basic Principles of Breast Implant Evaluation: Understand implant types (saline vs. silicone, single vs. double lumen, expanders), relevant anatomy, and terminology. Imaging Methods for Implant Evaluation: Mammography: Use and limitations in implant evaluation; Ultrasound: Applicability in detecting ruptures and other changes; MRI Imaging: Exam protocols, essential sequences (T1, T2, STIR, fat-suppression sequences), and its importance in the comprehensive evaluation of implants and surrounding tissue. MRI Exam Protocols: Recommended sequences for a detailed evaluation; Location and positioning of the patient. Implant Evaluation: Identification and interpretation of normal findings (position, lumen integrity); Recognition of changes and complications: folds, axis rotation, ruptures (intracapsular and extracapsular), capsular contracture; Complications and Associated Pathologies: Granulomas: Identification and implications; Breast Implant-Associated Anaplastic Large Cell Lymphoma (BIA-ALCL): Signs, symptoms, and imaging diagnosis; Hemangioma: Imaging characteristics and relevance. Management of Complications: Strategies for early diagnosis of complications; Multidisciplinary approach in managing complications and pathologies associated with implants. Case Discussion and Literature Review: Analysis of case studies to illustrate the principles of evaluation and management; Updated literature review on the latest trends and findings related to breast implants.

## BREE-101 ASSOCIATION BETWEEN BREAST ARTERIAL CALCIFICATIONS AND INCREASED CARDIOVASCULAR RISK: REPORTING CONSIDERATIONS, CLINICAL IMPLICATIONS, AND ROLE IN PREVENTIVE CARE

Elsie Nguyen, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Jean M. Seely, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Charlotte J. Yong-Hing, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Roisin Heaney, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Hayley McKee, MSc, BSc (*Abstract Co-Author*) Nothing to Disclose
Kaitlin M. Zaki-Metias, MD, FRCPC (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this educational exhibit is to review the association of breast arterial calcifications (BAC) and cardiovascular disease (CVD), detection and reporting methods, and perceptions of radiologists, referring physicians, and patients. 1. BAC are associated with an increased risk of CVD, incident CVD events, and correlate with other methods of cardiovascular risk stratification. 2. BAC are positively correlated with multiparity, menopausal status, metabolic syndrome, hyperlipidemia, hypertension, diabetes, and chronic renal disease, among other comorbidities. 3. Several methods of BAC detection and reporting have been proposed, including binary assessment, subjective quantification or grading, digital measurement, and AI-based detection and reporting models. 4. Reporting of BAC on mammography may allow for supplementary screening for CVD on screening and diagnostic mammography, leading to earlier identification of asymptomatic individuals at high risk for adverse cardiac events and allowing for more targeted preventive care.

**TABLE OF CONTENTS/OUTLINE**

1. Understand the association between BAC on mammography and cardiovascular risk. 2. Review the various methods to identify, quantify, and grade BAC including visual binary assessment, subjective severity grading, digital measurement and quantification, and artificial intelligence-based models. 3. Discuss the awareness and attitudes surrounding BAC of radiologists, referring physicians, and patients over the past 5 years. 4. Describe the current gaps, next steps, and challenges in implementation of BAC reporting and clinical management guidelines, including the necessity of interdisciplinary collaboration.

## BREE-102 MULTIMODALITY DETECTION OF BREAST CANCER RECURRENCE

Jean M. Kunjummen, DO (*Abstract Co-Author*) Nothing to Disclose
Maria Piraner, MD (*Abstract Co-Author*) Nothing to Disclose
Rebecca L. Seidel, MD (*Abstract Co-Author*) Consultant, Therapixel SA;Consultant, Delphinus Medical Technologies, Inc
Nishitha Reddy, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Breast cancer is the most common cancer in the female population, for which oncologic and surgical treatment options continue to be developed. Breast cancer recurrence rates vary from 5-20% depending on the tumor subtype. Expected postoperative changes of the breast can be difficult to distinguish from tumor recurrence. Knowledge of multimodality appearances of the postsurgical breast is essential to detecting breast cancer recurrence. Understanding the role of multimodality breast cancer surveillance (ultrasound, mammography, MRI, PET/CT) allows for early detection of recurrent or new breast cancer.

**TABLE OF CONTENTS/OUTLINE**

Review the risk factors for breast cancer recurrence. Review current postsurgical breast screening recommendations. Evaluate the role of multimodality imaging, specifically pertaining to the postsurgical breast. Distinguish between expected postsurgical change versus features suspicious for breast cancer recurrence.

## BREE-103 POSTSURGICAL BREAST REDUCTION IMAGING

Laurie R. Margolies, MD (*Abstract Co-Author*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical
Stephanie B. Shamir, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Reduction mammoplasty is a common surgery that results in predictable imaging patterns. 2. Reduction mammoplasty can result in imaging changes such as new asymmetries, calcifications, architectural distortion, and areas of enhancement that may appear suspicious, especially when a surgical history is not provided. 3. It is important to not dismiss potentially concerning asymmetries as part of post-surgical change unless they clearly follow the specific expected imaging patterns.

**TABLE OF CONTENTS/OUTLINE**

1. Background • Reduction mammoplasty is performed using classic surgical techniques involving removal and displacement of parenchymal tissue, particularly from the inferior breast • The procedure results in a predictable post-surgical appearance 2. Demonstrate normal post-reduction imaging features • Asymmetries, architectural distortions, fat necrosis and calcifications are expected • Scarring should typically stabilize or decrease with time, and calcifications should coarsen 3. Case Series • Cases of invasive cancer in the post-surgical breast that illustrate ways to recognize areas to be further queried 4. Considerations • Consideration of pre-operative mammogram to confirm the absence of pre-existing malignancy, and to establish a baseline imaging appearance prior to surgery 5. References

## BREE-104 IS IT A RECURRENCE OR NOT? MULTIMODALITY IMAGING OF BREAST CANCER RECURRENCE: LITERATURE REVIEW AND CASE BASED PRESENTATION

Inci Kizildag Yirgin (*Abstract Co-Author*) Nothing to Disclose
Mustafa Durmaz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The timely and accurate follow-up of patients with a history of breast cancer is mandatory. Women with a personal history of breast cancer are at an increased risk of either a local recurrence or a new primary breast cancer. Local recurrence can increase the risk of distant metastasis or breast cancer-related deaths, and previous studies have shown that early detection of second breast cancers can decrease the mortality rates.Surveillance is essential for the detection of recurrent disease at the earliest possible stage, allowing for prompt treatment, and potentially improving overall survival. International guidelines recommend annual mammography as the only surveillance technique (ASCO, NCCN, ESMO), but a mammogram is less sensitive in the post-surgical period due to post-treatment changes (fat necrosis, surgical scars). Breast MRI is a highly sensitive imaging modality to detect local recurrence in certain patient groups. The purpose of this educational exhibit will be to learn the role of imaging methods and findings due to treatment and findings of recurrence in breast cancer surveillance patients.

**TABLE OF CONTENTS/OUTLINE**

Review of incidence, risk factors, diagnostic performance of multimodality surveillance, and presentation of breast cancer recurrence. Review of post-breast-conserving treatment imaging findings and their timing of evolution. Review of available guidelines for multimodality surveillance after curative treatment for locoregional breast cancer. To learn to deal with complex findings between different imaging methods to avoid unnecessary biopsies. To learn the importance of serial follow-up Imaging. Case-based review of different presentations of breast cancer recurrence.

## BREE-105 UNCOMMON BENIGN LESIONS THAT MIMIC BREAST CARCINOMA

Laura Escudero, MD (*Abstract Co-Author*) Nothing to Disclose
Carlota Garcia Baron (*Abstract Co-Author*) Nothing to Disclose
Maria J. Ciudad, MD (*Abstract Co-Author*) Nothing to Disclose
Myriam F. Montes, MD (*Abstract Co-Author*) Nothing to Disclose
Nancy Sanchez Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Lannegrand Menendez (*Abstract Co-Author*) Nothing to Disclose
Virginia Luxmila Arias Torrealba, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The majority of brest lesions found in breast routine studies are benign and incidental findings. Most lesions have identifiable radiological characteristics suggesting benign findings without the need for additional tests. To a lesser extent, others require radiological followup tests, with diagnosis possibly achieved solely through imaging behavior. There is a group of uncommon benign lesions that, due to their imaging characteristics and clinical findings, may mimic a suspicious malignancy, requiring definitive diagnosis through a biopsy. The objective of this presentation is to provide a guide to the radiological characteristics of sarcoidosis, granulomatous mastitis, diabetic mastopathy, pseudoangiomatous stromal hyperplasia, and traumatic neuroma at the mastectomy site, in different imaging studies available to us today (mammography, ultrasound, and MRI), allowing for a more detailed characterization, as these particular lesions exhibit significant radiological similarity to malignant lesions. We will briefly describe their clinical, epidemiological, and pathological manifestations. Our description help broaden the diagnostic options when faced with a suspicious image of malignancy in patients presenting some of the clinical-radiological characteristics described here.

**TABLE OF CONTENTS/OUTLINE**

1. Sarcoidosis.2. Neutrophilic granulomatous mastitis.3. Diabetic mastopathy.4. Pseudoangiomatous stromal hyperplasia.5. Traumatic neuroma at the mastectomy site.

## BREE-106 THE MORE YOU KNOW: TEACHING POINTS OF DISCORDANT BREAST BIOPSIES

Ann L. Brown, MD (*Abstract Co-Author*) Consultant, Elucent Medical
Rifat A. Wahab, DO (*Abstract Co-Author*) Nothing to Disclose
Kyle M. Lewis, MD (*Abstract Co-Author*) Nothing to Disclose
Erich J. Boomgarden, MD (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Abstract Co-Author*) Nothing to Disclose
Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine Mulquin, DO, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Define radiology-pathology concordance as it pertains to breast imaging interventions.2) Detail scenarios in clinical practice that can contribute to biopsy discordance.3) Review clinical implications of discordant biopsies and management strategies including instituting breast radiology-pathology correlation conference.

**TABLE OF CONTENTS/OUTLINE**

1) Definitions of benign discordant and malignant discordant biopsies2) Specific and non-specific discordance3) Overview of 5 major categories that contribute to discordant biopsieso Technical Factors--Undersampling (small gauge needle, low number of samples)--Missing the targeted lesion (small

target, difficult location)o Complications (bleeding after first sample, vasovagal reaction)o Multiple suspicious lesionso Large or heterogenous finding--Cystic/Necrotic MassNew finding in region with extensive post-treatment changes4) Benefit of incorporating radiology-pathology correlation conference into breast practiceso Consensus management to maximize cancer detection, identify discordant cases in a timely fashion, and avoid unnecessary followup/surgeryCONCLUSIONS1. Discordant biopsies are uncommon, but they can result in delays of care or misdiagnosis when they occur.2. Identification of imaging and clinical features associated with discordant biopsies is important for timely and accurate diagnoses.

## BREE-107 FEELING GOOD AND FEELING NEW (BREAST MASSES) ON GLUCAGON-LIKE PEPTIDE-1 (GLP-1) AGONISTS

Bonmyong Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Sophia R. O'Brien, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. McDonald, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Samantha P. Zuckerman, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph J. Villavicencio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Use of glucagon-like peptide-1 (GLP-1) agonists for weight loss is associated with both mammographic changes and clinical breast symptoms.2. Patients may present with symptoms (lumps, pain) following the use of GLP-1 agonists that warrant ultrasound evaluation. This may yield actionable findings that may have otherwise been occult on screening mammography. 3. Changes in density following the use of GLP-1 agonists may obfuscate previously identified findings; this may create a clinical dilemma in the setting of actionable BI-RADS findings. 4. Changes in density following the use of GLP-1 agonists may prompt more recommendations for supplemental screening. 5. There may be no discernible mammographic changes even in cases of significant weight loss while on GLP-1 agonists.

### TABLE OF CONTENTS/OUTLINE

Case 1: 41F, screening. Interval decrease in breast size and increased breast density following 50 lb weight loss on semaglutide. Case 2: 44F, screening. Interval decrease in breast size and increased breast density following 40 lb weight loss on semaglutide with obfuscation of a focal asymmetry.Case 3: 62F with a palpable right axillary lymph node following 50 lb weight loss on tirzepatide and semaglutide. Targeted ultrasound of the right axilla demonstrated an abnormal lymph node yielding metastatic breast cancer which was mammographically occult. Subsequent breast MR demonstrates a correlate for a primary malignancy in the right breast. Weight loss may have prompted a palpable finding.Case 4: 60F with new palpable areas of concern in the bilateral breasts which demonstrate benign findings on ultrasound evaluation. Case 5: 60F, screening. No significant change on mammography despite 50 lb weight loss.

## BREE-108 IS THERE ANY SECRET REGARDING TO IDIOPATHIC GRANULOMATOUS MASTITIS?

Leire Ormaetxe Albeniz, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Santamaria, MD (*Abstract Co-Author*) Nothing to Disclose
Ruth Gonzalez Sanchez (*Abstract Co-Author*) Nothing to Disclose
Elena Cintora Leon (*Abstract Co-Author*) Nothing to Disclose
Ana L. Legorburu, MD (*Abstract Co-Author*) Nothing to Disclose
Ines Alonso Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Udondo Gonzalez del Tanago, MD (*Abstract Co-Author*) Nothing to Disclose
Loreto De Llano (*Abstract Co-Author*) Nothing to Disclose
Olatz Gorrino Angulo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the clinical and radiological manifestations of Idiopathic Granulomatous Mastitis (IGM). Explain the diagnostic approach and appropriate management. Describe the main entities included in the differential diagnosis

### TABLE OF CONTENTS/OUTLINE

IGM is a rare chronic inflammatory disease that can mimic carcinoma. Typically affects young women with history of pregnancy and breastfeeding. IGM is usually presented as palpable painful breast lump with inflammatory skin changes. It can also associate fluid collections and sinus tracts. Radiological findings in the different imaging modalities are non-specific and a percutaneous biopsy is always needed for diagnosis. We will revise a series of cases diagnosed with IGM in the last eight years, to illustrate the most frequent radiological findings and go through the main steps we should take to achieve the final diagnosis. Depending on age, radiological studies started with ultrasound or a mammography, but all the patients underwent an us-guided biopsy to confirm the diagnosis. The most common us-findings in our cases were hypoechoic images of tubular and nodular morphology with a tendency to join, hypoechoic irregular masses and sinus tracts. Some patients also had fluid collections and axillary involvement. All the women in our series were treated conservatively with good results, except for two who needed surgery.

## BREE-109 WHAT CALCIFICATIONS? RADIOLOGIC PRESENTATIONS OF NONCALCIFIED DCIS WITH PATHOLOGIC CORRELATION

Vidushani S. Perera, MD (*Abstract Co-Author*) Nothing to Disclose
Ayah Ali (*Abstract Co-Author*) Nothing to Disclose
Amy Maduram, MD (*Abstract Co-Author*) Nothing to Disclose
Syeda R. Zaidi, MD (*Abstract Co-Author*) Nothing to Disclose
Michelle Kraay, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) DCIS represents 20 to 25% of all breast cancer diagnoses in the United States and is considered to be a precursor of invasive breast cancer. Although the majority of DCIS (80-90%) presents as calcifications seen on mammography, 10-20% of DCIS diagnoses may present as noncalcified findings on mammography, ultrasound, and MRI. It is vital for radiologists to be aware of the different presentations of noncalcified DCIS, including as a palpable mass, bloody nipple discharge, noncalcified findings on mammography such as architectural distortion and focal asymmetry, and non-mass enhancement on MRI. (2) DCIS is a heterogeneous lesion with five major architectural patterns seen on pathology, including comedo, cribriform, micropapillary, papillary, and solid. The comedo type is most commonly associated with the formation of calcifications mammographically. (3) Noncalcified DCIS lesions may be larger at presentation than calcified DCIS due to the difficulty in mammographic detection and has a reported upgrade rate of 21.8% at a single institution. DCIS can be treated with a combination of surgery, radiation, and hormone therapy.

### TABLE OF CONTENTS/OUTLINE

(1) Overview of DCIS epidemiology and histopathology. (2) Common imaging presentation of DCIS as calcifications. (3) Noncalcified DCIS cases presenting as a palpable mass, focal asymmetry, architectural distortion, non-mass enhancement on MR with corresponding pathology. (4) Cases

presenting as symptoms including bloody nipple discharge, Paget's disease, and pregnancy-associated enlarging fibroadenoma. (5) Management of DCIS. (6) Self-assessment quiz.

## BREE-11 BEYOND CONVENTIONAL: ADVANCED T2 WEIGHTED IMAGING IN BREAST MRI - EMPOWERING EDUCATION AND DIAGNOSIS

Mami Iima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazushige Ichikawa (*Abstract Co-Author*) Nothing to Disclose
Shinji Naganawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Satoko Ishigaki, MD (*Abstract Co-Author*) Nothing to Disclose
Yutaka Kato (*Abstract Co-Author*) Nothing to Disclose
Hiroko Satake, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Advanced T2-weighted imaging (T2WI) techniques, such as 3D T2WI and deep learning (DL) based T2WI, are explored in breast imaging. We start with an overview of conventional T2WI, discussing its fundamental role in diagnosing breast cancer. The focus then shifts to advanced methods that reduce scan times and improve image resolution, highlighting their benefits in educational settings. Detailed analyses illustrate how these advancements enhance the visualization of crucial T2WI findings like focal edema and intratumoral necrosis in breast cancer. Additionally, the educational value of these technologies in teaching radiologic-pathologic correlation through case studies is explored. The session also addresses the challenges and opportunities presented by cases with lymph node (LN) metastasis, proposing strategies to incorporate these insights to improve diagnostic skills in breast imaging.

### TABLE OF CONTENTS/OUTLINE

1. Imaging Sequence• Overview of conventional T2WI in breast MRI• Introduction to advanced T2WI such as 3D or DL-based T2WI, emphasizing the reduced acquisition time with high resolution2. Focal Edema and Intratumoral Necrosis in Breast Cancer• Detailed analysis of how advanced T2WI can improve the visualization• Discussion on the clinical relevance of these findings in diagnosis3. Radiologic-Pathologic Correlation• Exploration of morphology and signal intensity using advanced T2WI• Case studies highlighting the correlation between radiologic findings and pathologic results, demonstrating the educational value of breast imaging4. Challenges in the Diagnosis of LN Metastasis• Addressing the challenges and learning opportunities presented by cases with LN metastasis

## BREE-110 NEOADJUVANT ENDOCRINE THERAPY MONITORING OF PRIMARY BREAST CANCER: COMBINED ASSESSMENT USING FES-DEDICATED BREAST PET AND DYNAMIC CONTRAST-ENHANCED MRI

Laura J. Esserman, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita Watkins (*Abstract Co-Author*) Nothing to Disclose
Diane Heditsian (*Abstract Co-Author*) Nothing to Disclose
Susie Brain (*Abstract Co-Author*) Nothing to Disclose
Courtney A. Lawhn-Heath, MD (*Abstract Co-Author*) Nothing to Disclose
Kamala Pullakhandam (*Abstract Co-Author*) Nothing to Disclose
Soumya Gottipati (*Abstract Co-Author*) Nothing to Disclose
Kimberly M. Ray, MD (*Abstract Co-Author*) Nothing to Disclose
Natsuko Onishi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Rita Mukhtar (*Abstract Co-Author*) Nothing to Disclose
Julia C. Carmona-Bozo, MD (*Abstract Co-Author*) Nothing to Disclose
Astrid Quirarte (*Abstract Co-Author*) Nothing to Disclose
Jessica Gibbs (*Abstract Co-Author*) Nothing to Disclose
Teffany Joy Bareng (*Abstract Co-Author*) Nothing to Disclose
Nola M. Hylton, PhD (*Abstract Co-Author*) Institutional research support, General Electric Company;Institutional research support, Kheiron Medical Technologies Ltd
Bonnie N. Joe, MD, PhD (*Abstract Co-Author*) Institutional Research Grant, Kheiron Medical Technologies Ltd;Institutional research agreement, General Electric Company;Institutional research agreement, Siemens AG
Wen Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Ella F. Jones, PhD (*Abstract Co-Author*) Nothing to Disclose
Jo Chien (*Abstract Co-Author*) Nothing to Disclose
Pouya Metanat, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Learn the clinical and biological features of 18F-fluoroestradiol (FES), an estrogen receptor targeting PET tracer. • Learn characteristics of dedicated breast PET (dbPET) imaging in comparison with whole body PET imaging. • Learn differences and similarities between dynamic contrast enhanced (DCE) breast MRI and FES-dbPET imaging. • Learn potential clinical benefit of FES-dbPET when used in conjunction with DCE breast MRI for treatment response evaluation during neoadjuvant endocrine therapy (NET).

### TABLE OF CONTENTS/OUTLINE

1. 18F-fluoroestradiol (FES) - Biological characteristics of FES - Review of literature on whole-body PET with FES 2. Dedicated breast PET (dbPET) - dbPET scanner characteristics - Imaging protocol 3. Clinical workflow of FES-dbPET 4. Comparison of DCE breast MRI and FES-dbPET 5. Case presentation of FES-dbPET and DCE breast MRI during neoadjuvant endocrine therapy (NET) 6. Discussion of the imaging findings of the cases presented at #5 - mechanisms of underlying tumor depiction at FES-dbPET vs. DCE breast MRI - influence of menopausal status on FES-dbPET - influence of NET regimen on FES-dbPET findings 7. Future directions of dbPET application in breast cancer therapy 8. Summary of the educational points

## BREE-111 A SINISTER TREND: MORE YOUNG WOMEN ARE GETTING BREAST CANCER; WHO, WHY, AND WHAT DO WE KNOW?

**Awards**
**Certificate of Merit**

Jaimee E. Mannix, MD (*Abstract Co-Author*) Nothing to Disclose
Kate Walter (*Abstract Co-Author*) Nothing to Disclose
Nawar Aljundi (*Abstract Co-Author*) Nothing to Disclose
Gianmarco Calderara (*Abstract Co-Author*) Nothing to Disclose
Julia C. Kirsten, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Discuss increased incidence of breast cancer in women aged 20-49 over the past 20 years, with significant increase after 2016.2. Review differences in breast cancer incidence rates by age group, race, hormone receptor status, and stage.3. Discuss modifiable risk factors and social determinants of health which may play a role in increased incidence.

**TABLE OF CONTENTS/OUTLINE**

1) Clinical manifestations/pathology of breast cancer in young patients. Recommended diagnostic workup in young patients.2) Incidence of breast cancer is increasing over time in young women aged 20-49, especially after 2016.3) Differences in breast cancer incidence rates by age group, race, hormone receptor status, and stage.4) New data regarding trends and incidence in young women with breast cancer.(a) Increased incidence is due almost entirely to an increase in tumors which are estrogen-receptor positive. Higher rates of breast cancer are seen among Black women, especially among those ages 20 to 29.(b) An increase in diagnosis of stage 1 and 4 tumors in young women has been observed. Data suggests that when stage 1 tumors are missed in younger women, the tumors tend not to be found until they reach stage 4.5) Differences in overall survival and disease free survival rates in young patients vs those diagnosed when older.6) Identification of risk factors for breast cancer such as maternal parity, age of first birth, and family history as well as modifiable risk factors such as obesity, caloric intake, alcohol intake, smoking, chemical exposures, and exercise.7) Treatment differences in young women versus older women and evaluation of effect on quality of life, sexuality, and fertility.8) Role of support groups with age matched peers.9) Conclusion

## BREE-112 INCIDENTAL BREAST FINDINGS ON NON-BREAST IMAGING: A COMPREHENSIVE REVIEW FROM BENIGN TO ACTIONABLE

Fatima Salah, MD, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This educational exhibit aims to: 1. Present example cases and outcomes of incidental breast findings seen on non-breast imaging: both benign and malignant. 2. Review suspicious findings that warrant additional work-up with dedicated breast imaging. 3. Illustrate examples in which additional imaging could have been omitted. 4. Highlight value of accurate evaluation of incidental breast findings and their effect on subsequent patient management.

**TABLE OF CONTENTS/OUTLINE**

1. Define and introduce importance of incidental breast findings on non-breast cross sectional imaging. 2. Illustrate cases whereby breast findings were clearly negative or benign, BIRADS 1 or 2. 3. Present incidental breast findings in which additional dedicated breast imaging was warranted in both benign and malignant outcomes: a. BIRADS 4: Benign outcome after recommended biopsy. b. Malignant Outcome: Primary breast cancer and Metastasis.

## BREE-113 THE ARMPIT: A PLACE TO BE EXPLORED

Erica Endo, MD (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, MD (*Abstract Co-Author*) Nothing to Disclose
Naomi Murakami SR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Adriana Kumagai, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rosseto Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Approaching axillary findings by ultrasound, mammography, CT scan and MRI. Differential diagnosis for axillary findings. Significance of accurate diagnosis in disease management

**TABLE OF CONTENTS/OUTLINE**

There are numerous diseases that can lead to axillary masses or lymphadenopathy, each requiring a specific approach. Some may benefit from percutaneous biopsies, others may need blood tests or specific diagnostic tools. Radiologists must be proficient in distinguishing axillary lesions originating from other sites to ensure optimal patient care. To comprehensively understand the patient's condition, it's crucial to study not only the lesion itself but also its location, associated findings, patient epidemiology and personal history.This study presents a series of cases involving axillary lesions caused by atypical conditions. It aims to familiarize radiologists with a wide range of non-breast lesions affecting axillary tissue, enabling them to provide accurate diagnoses.Axillary anatomySkin and appendages (Epidermoid cyst - Apocrine sweat gland adenocarcinoma)Fat and connective tissues (Axillary lipoma - Rhabdomyosarcoma - Hemangioma)Vascular abnormalities (Traumatic axillary artery pseudoaneurysm - Mondor disease)Lymph nodes metastasis (Ovarian cancer - Sarcoma -Thymus cancer)Reactive lymph nodes, systemic diseases (Cat scratch disease - Human Immunodeficiency Virus)Congenital anomalies (Fibroadenoma and cysts in axillary accessory breast)Axillary post-surgical complications (Lymphocele - Abscess)Musculoskeletal (Synovial cyst)

## BREE-114 HIGH-FREQUENCY ULTRASOUND FOR EVALUATING SKIN LESIONS ON THE BREAST SEEN ON MAGNETIC RESONANCE IMAGING (MRI)

Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marina Morais (*Abstract Co-Author*) Nothing to Disclose
Ivana Gibbons (*Abstract Co-Author*) Nothing to Disclose
Candida Maria A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Mariah C. Wanderley (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Felipe SR, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The objectives of this presentation are:1. To demonstrate through a case review the correlation of focal breast skin enhancements on MRI with high-frequency dermatological ultrasound.2. To correlate skin lesions observed during physical examination and dermatoscopy with high-frequency ultrasound.3. Radiologists who work with breast imaging should be aware of the typical findings of benign and malignant skin lesions to avoid unnecessary procedures and delays in diagnosing potential malignancies.

**TABLE OF CONTENTS/OUTLINE**

1. Cutaneous Hemangioma.a. Enhancement pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic and dermatoscopic evaluation.2. Paget's Disease in a Breast Previously Subjected to Mastectomy for Neoplasia.a. Enhancement pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic and dermatoscopic evaluation.3. Cutaneous Angiosarcoma.a. Enhancement pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic evaluation and surgical specimen after mastectomy.4. Seborrheic Keratosis.a. Enhancement

pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic and dermatoscopic evaluation.5. Hypertrophic Scar.a. Enhancement pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic and dermatoscopic evaluation.

## BREE-115 BRCA1 AND 2 MUTATION- THE RADIOLOGIST'S PIVOTAL ROLE IN CHANGING PATIENT'S FATE

Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Aline D. Guimaraes, MD, MBA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

BRCA 1 and 2 mutation carriers have an increased risk of developing breast cancer. They have 3% greater risk before 30 years and their lifetime risk increases 50 to 80% by the age of 70 years. The increased risk and the early onset of cancer implies a different screening strategy with guidelines around the world recommending to start breast cancer screening at an earlier age and to include MRI as an adjunct to mammography. Furthermore, there are differences between these two groups of high-risk patients regarding the age of appearance of breast cancer, the histologic and nuclear grades, molecular subtypes, lesion's location and imaging features at different breast imaging modalities. It is essential that the radiologists know the epidemiological aspects involved in BRCA1 and BRCA2 mutation carriers, as well as the imaging aspects most commonly found in these patients, specially because BRCA1 carriers tend to present lesions with benign morphological aspects, despite the aggressive pathological features, imposing increased caution on this group of patients. In this case based didactic exhibit, we will explore the clinical, pathological and imaging features in this two subgroups of patients, discuss the screening implications and demonstrate that the radiologist has a pivotal role in changing the fate of these mutation carriers.

### TABLE OF CONTENTS/OUTLINE

1) BRCA1 and 2 Epidemiology 2) Screening recommendation in BRCA1 and 2 mutation carriers 3) Differences between BRCA1 and 2 breast cancer 3.1) Clinical 3.2) Pathological 3.3) Imaging 3.3.1) Mammography, 3.3.2) Ultrasound 3.3.3) MRI 4) Multimodality case based review (BRCA1 and 2 breast cancers) 5) Implications of the knowledge acquired in the radiologist’s practice

## BREE-116 AUGMENTED BUT CHALLENGED - IMPLANT DIAGNOSTIC DILEMMAS

Dunya M. Imad, MD (*Abstract Co-Author*) Nothing to Disclose
Jenna Pellegrino, MD (*Abstract Co-Author*) Nothing to Disclose
Priscilla J. Slanetz, MD, MPH (*Presenter*) Royalties, Wolters Kluwer nv

### TEACHING POINTS

Introduced in the 1960’s, breast implant augmentation has become one of the most popular cosmetic procedures globally. As a result, there are a substantial number of women with implants that present for imaging, whether it be for cancer screening or for a symptom such as a lump or pain. In most cases, radiologists can readily determine if a breast implant is intact or if there is a rupture. However, the imaging evaluation can sometimes be more challenging as not all patients present with classic findings. Therefore, breast radiologists need to develop problem-solving skills to troubleshoot such cases so that any issue with an implant is quickly diagnosed and addressed.

### TABLE OF CONTENTS/OUTLINE

In this exhibit, we will provide a systematic approach to evaluating breast implants for rupture or other complications, such as implant-associated malignancy, capsular fat necrosis, implant infection, postoperative collections/hematomas, and alloderm grafting. We will then present examples of challenging cases where clinical history and multi-modality imaging allowed the radiologist to accurately characterize the implant complication.

## BREE-117 WHAT IS THAT ENHANCING ASYMMETRY? A SERIES OF MALIGNANT AND BENIGN CONTRAST ENHANCED MAMMOGRAPHY-GUIDED BREAST BIOPSIES

Ceren Yalniz, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie A. Woodard, DO (*Abstract Co-Author*) Investigator, Bracco Group Institutional research support, Bracco Group
Kathryn W. Zamora, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Stefanie B. Zalasin, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie D. Colvin, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand indications for contrast enhanced mammography-guided biopsies (CEM-Bx). Apply appropriate BI-RADS terminology to contrast enhanced mammography (CEM) findings. Review cases of CEM-Bx performed at our institution. Correlate radiology imaging findings and pathology results for malignant and benign cases.

### TABLE OF CONTENTS/OUTLINE

Background: CEM is an emerging technology with increasing popularity and utilization. Contrast enhanced imaging demonstrates a higher sensitivity for detection of breast cancer and detects abnormalities not identified on non-contrast examinations. CEM has many indications including screening of high-risk patients who cannot undergo magnetic resonance imaging (MRI). CEM-Bx enables sampling of enhancing lesions that are occult on other modalities including 2D/synthesized mammogram, tomosynthesis, and ultrasound. CEM-Bx also has potential to improve cancer detection in our most at-risk patient population that cannot be screened by MRI. Malignant cases: Present a series of at least 5 breast cancer cases diagnosed by CEM-Bx at our institution. Benign cases: Present a series of at least 5 benign cases diagnosed by CEM-Bx at our institution.

## BREE-118 BREAST IMAGING FINDINGS OF MESENCHYMAL MASSES WITH CLINICAL-RADIOLOGIC-PATHOLOGIC CORRELATION

**Awards**
**Certificate of Merit**

Ramapriya Ganti, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shanna Mayorov, BS, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Describe the constellation of imaging findings of breast masses of mesenchymal origin. ; Delineate classic mimickers of mesenchymal tumors. ; Familiarize readers with radiologic-histopathologic correlation. ; Discuss available management options for each entity.

**TABLE OF CONTENTS/OUTLINE**

1. Background : Mesenchymal masses pose a diagnostic challenge for the breast imager as this category of lesions encompasses both benign and malignant masses, demonstrates similar imaging appearances, and has varied pathologic and treatment related paradigms. Both groups typically manifest in the breast as a single mass that is often palpable. 2. Discussion: Pictorial review of approximately 12 breast masses of mesenchymal origin with emphasis on imaging findings, including benign lipoma, hamartoma, angiolipoma, hemangioma, pseudoangiomatous stromal hyperplasia, leiomyoma, phyllodes tumor, primary and secondary sarcoma, neurogenic tumors, granular cell tumors, myofibroblastoma, and desmoid tumors. Brief epidemiology, clinical symptoms if any, diagnostic assessment including imaging findings, the role of biopsy, histopathologic correlation including staining techniques and their role in identification, and treatment considerations will be described. 3. Conclusion: Knowledge of the imaging manifestations, histopathologic features, and management strategies of mesenchymal tumors allows breast radiologists to improve the identification of these lesions and direct appropriate work-up and management.

## BREE-119 BREAST IMAGING OF PATIENTS WITH LI-FRAUMENI SYNDROME WITH UPDATED REVIEW OF BREAST SCREENING GUIDELINES

**Awards**
**Magna Cum Laude**

Tanya W. Moseley, MD, PhD (*Abstract Co-Author*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC
Emily S. Nia, MD (*Abstract Co-Author*) Nothing to Disclose
Gaiane M. Rauch, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Elsa M. Arribas, MD (*Abstract Co-Author*) Stockholder, 3D Systems, Inc
Miral M. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Megha M. Kapoor, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Understand the clinical implications of Li-Fraumeni Syndrome (LFS) in women • Review the current breast cancer screening guidelines for LFS in women • Review the appropriateness criteria of breast imaging modalities to screen women with LFS • Illustrate imaging findings of LFS in the breast

**TABLE OF CONTENTS/OUTLINE**

1. Review the biology and inheritance pattern of Li-Fraumeni Syndrome (LFS). 2. Review the tumors which patients with LFS are susceptible to, with a particular emphasis on the types of breast cancers associated with LFS. 3. Highlight the screening guidelines and appropriateness criteria in patients with LFS. 4. Showcase illustrative breast imaging cases in patients with LFS.

## BREE-12 "DO THEY MATCH?" HOW TO ACHIEVE AN ACCURATE SECOND LOOK ULTRASOUND FOR BREAST LESIONS IDENTIFIED AT MR IMAGING. PICTORIAL REVIEW FOR RADIOLOGISTS IN TRAINING

Maria P. Swiecicki, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
Giannina M. Secco, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To help localize MRI detected lesions at second look ultrasound by giving imaging tips for the radiologist in training.2. To illustrate with clinical cases the correlation between both imaging techniques.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction.2. Technique for a good second look US using lesion morphology and localization within the breast.3. Anatomical details that can assist in proper lesion localization.4. Illustration with clinical cases to show how to achieve an adequate correlation between MRI and US images for an accurate lesion localization.5. Conclusions.In conclusion, this educational exhibit is intended to be a guide for radiologists in training that are beginning to perform second look US, describing the technique and illustrating parameters that can assist them in this task.

## BREE-120 ONE-STEP QUALITATIVE AND QUANTITATIVE EVALUATION OF AXILLARY LYMPH NODE METASTASIS IN BREAST CANCER USING DUAL-ENERGY SPECTRAL CT COMBINED WITH CONTRAST ENHANCED SPECTRAL MAMMOGRAPHY: THE EVIDENCE AND ITS LIMITS

Huizhi Cao (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Contrast-enhanced spectral mammography (CESM) and dual-energy spectral CT (DECT) are both exciting technology in potential clinical application. The focus of this presentation is: 1. To understand the concepts and imaging principles of contrast-enhanced mammography and spectral CT imaging technology.2. To learn about how CESM combined with CT spectral imaging technology can assess axillary lymph node metastasis in preoperative breast cancer. 3. To delve into qualitative and quantitative evaluation criteria derived from pathological results of axillary lymph node metastasis post-surgery. 4. To understanding the pros and cons of CESM and spectral CT imaging technology in axillary lymph node metastasis evaluation.

**TABLE OF CONTENTS/OUTLINE**

1. Background introduction to contrast-enhanced mammography and spectral CT Imaging technology, along with post-processing techniques such as monochromatic Images (keV) and material density images (iodine-based, calcium-based), and spectral Hounsfield unit curve analysis.2. Strategies for preoperative diagnosis of metastatic sentinel lymph nodes in breast cancer utilizing DECT and CESM.3. Clinical exemplification of CESM coupled with spectral CT imaging technology in evaluating axillary lymph node metastasis in preoperative breast cancer.4. Qualitative and quantitative evaluation methods for assessing breast cancer axillary lymph node metastasis using CESM and spectral CT technology.5. Examination of advantages and limitations of both technologies in axillary lymph node metastasis evaluation.

## BREE-121 MASTITIS UNMASKED: EXPECTED AND UNUSUAL FINDINGS

Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose

Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Mastitis is an inflammation of the mammary gland that can affect different parts of the breast, such as the tissue, nipple, areola, ducts, and skin. It can occur with or without the presence of bacteria. There are various forms of mastitis, including those related to the neonatal and pubertal periods, as well as more common cases during the postpartum period. Additionally, there are less common specific inflammations, such as tuberculosis, syphilis, and actinomycosis. These inflammations can be classified as lactational (during breastfeeding) or non-lactational. Ultrasound is used as the initial method to evaluate women with acute mastitis, especially when abscesses are suspected. Ultrasound imaging findings include edema of the skin and subcutaneous tissue, areas with increased echogenicity permeated by parenchymal areas, loss of definition of the breast planes, hyperechogenicity of perilobular fat and axillary lymph nodes with cortical thickening. Mammography is recommended to rule out cancer and can be performed outside the peripartum period, especially for women over 30 years old. Magnetic resonance imaging (MRI) is not usually necessary and is reserved for atypical cases. The main differential diagnosis to consider is inflammatory carcinoma when a patient presents with redness and swelling in the breast, without evidence of abscess on ultrasound.

**TABLE OF CONTENTS/OUTLINE**

- Review clinical, pathophysiological, and imaging aspects of mastitis.- Illustrate common and uncommon findings of mastitis in a didactic manner.

## BREE-122 SEEING BEYOND MASSES: NON-MASS LESIONS PERSPECTIVES ON ULTRASOUND

Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The probable changes for the sixth edition of BI-RADS® (Breast Imaging Reporting and Data System) have already been made available, including the introduction of "non-mass lesion" in the ultrasound lexicon. It is defined as a discrete echotexture alteration area, distinct from the adjacent parenchyma, that does not meet the criteria for nodule, identifiable in at least two planes, but may be visualized in only one plane. In most cases, it has a benign etiology, but it can be the initial manifestation of breast cancer, most commonly in situ. It is cathegorized by terms of echogenicity, distribution and associated findings. Calcifications, architectural distortion, posterior acoustic shadowing, abnormal ductal extension or changes, echogenic halo and hypervascularity are examples of associated findings that suggest malignancy. In the face of a non-mass lesion finding on the ultrasound, it is important to correlate it with other imaging exams, as the identification in different methods can increase the degree of suspicion, as well as association with papillary flow or palpable alteration. Definitive diagnosis is made by tissue sampling, most commonly percutaneous core-needle biopsy.

**TABLE OF CONTENTS/OUTLINE**

- To be familiar with the likely changes in the next edition of BI-RADS®, in order to standardize its description.- Suggest the description of ultrasound, in accordance with the expectations of the lexicon changes of the new BI-RADS®, correlating with other imaging modalities.

## BREE-123 SO, YOU THINK YOU CAN IDENTIFY BREAST CANCER? UNCOMMON PRESENTATIONS OF THE MOST COMMON CANCER IN WOMEN

Himeghna Deepak (*Abstract Co-Author*) Nothing to Disclose
Milin Rana, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel Klapper, MD (*Abstract Co-Author*) Nothing to Disclose
Nayanatara Swamy, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.Breast cancers exhibit a diverse array of imaging presentations, staying updated on these presentations will help us detect them early. 2.Fat containing masses in the breast are largely benign, except in those cases where the breast cancer has engulfed fat. 3.Although rare, interval breast cancers do occur. Therefore, it's crucial to educate women not to disregard a palpable lump, even if they had a benign screening mammogram within the past year. 4.Identifying suspicious asymmetries and focal asymmetries can be challenging on screening mammography. By learning from both positive and negative call-backs, we can set our threshold of suspicion optimally. 5.Maintaining high standards for image quality of screening mammograms will help ensure that the cancers located far posteriorly and anteriorly are identified. 6.Women who have undergone reduction mammoplasty have post-operative changes which make identification of breast cancers daunting. 7.Cross-sectional imaging can be a useful tool in identifying breast cancers in subsets of the population that do not yet undergo routine screening mammography.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Case-based review o The fat engulfing breast cancer o The interval breast cancer o The low density mass o The subtle asymmetry o The subtle focal asymmetry o The anteriorly located breast Cancer o The posteriorly located breast cancer - not one, but two masses!! o DCIS presenting as microcalcifications and a mass in same patient o DCIS detected by breast MRI (focal asymmetry on mammogram) o Breast cancers in two women with history of reduction mammoplasty o The Breast cancer initially detected by PET-CT o The breast cancer initially detected by CT 3. Conclusion

## BREE-124 INTRUDERS UNMASKED: DELVING INTO FOREIGN BODIES IN THE MAMMOGRAMS

Carla C. Benetti, MD (*Abstract Co-Author*) Nothing to Disclose
Ligia P. Mazi, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Abstract Co-Author*) Nothing to Disclose
Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Erika M. Negrao (*Abstract Co-Author*) Nothing to Disclose
Edmundo C. Mauad, MD,PhD (*Abstract Co-Author*) Nothing to Disclose

Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Ruth H. Bonini, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Foreign bodies in the breast topography are uncommon and exhibit a variable imaging spectrum, contingent upon the nature and location of the material. The most frequently encountered foreign bodies are those intentionally inserted by radiologists, such as metallic clips during or after biopsy procedures and pre-surgical localization wires or by breast surgeons in surgical interventions. Less frequently, metallic foreign bodies associated with trauma, such gunshot fragments or glass fragments related to car accidents may be encountered.Materials related to cosmetic procedures, and even implantable medical devices like pacemakers and catheters are other foreign bodies that can be present and sometimes interfere with mammography interpretation.Patients may either be asymptomatic or present with localized pain or abscess. A comprehensive clinical history linked with prior mammograms will often lead to a conclusive or presumptive diagnosis, without the need for additional diagnostic tests or unnecessary biopsies.

**TABLE OF CONTENTS/OUTLINE**

In a didactic manner several cases of breast or thoracic foreign bodies seen on mammograms, selected from the digital archives of our institutions, will be presented. Illustrate instances where foreign bodies within or next to the breast impede the thorough evaluation of examinations.

## BREE-125 EXTREME AGES IN BREAST CANCER: TWO SIDES OF THE SAME COIN

Maria P. Swiecicki, MD (*Abstract Co-Author*) Nothing to Disclose
Ana G. Luna (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
MONICA OTILIA MACHUCA CASTILLO (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.To Understand the imaging features of breast cancer in young women (<40 years old) and elderly women (>80 years old).2.To Identify the challenges and limitations of different imaging modalities in diagnosing breast cancer at both ends of life.3.To Discuss the implications of age-related factors on breast cancer prognosis and treatment planning.

**TABLE OF CONTENTS/OUTLINE**

IntroductionBreast cancer manifests with distinct characteristics across different age groups, particularly in the extremes of life - the very young (<40 years old) and elderly women (>80 years old).Imaging Appearance of Cancer at Both Ends of Life.Clinical Case.Management.In conclusion, this abstract highlight the importance of recognizing age-specific variations in breast cancer characteristics and the pivotal role of imaging in facilitating early detection and personalized treatment strategies.

## BREE-128 ARTIFACTS IN BREAST MRI AND CHALLENGES IN THEIR INTERPRETATION

Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
Griselda Choque Leniz, MEd,MEd (*Abstract Co-Author*) Nothing to Disclose
Fatima Quispe Villca SR, MMed (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Identify the different types of artifacts in breast magnetic resonance imaging. Several examples of technical and patient-related artifacts that one might encounter will be illustrated.

**TABLE OF CONTENTS/OUTLINE**

Breast magnetic resonance imaging has become an important tool for high risk screening, breast cancer staging, response to treatment, assessment of recurrence after treatment, and evaluation of breast implants. However, the challenge arises in identifying artifacts generated in breast magnetic resonance images that can degrade image quality and obscure important diagnostic findings. The present work aims to recognize the artifacts and understand how to address them and optimize breast magnetic resonance image quality and avoid interpretive errors.

## BREE-13 BEYOND THE SURFACE: A COMPREHENSIVE EXPLORATION OF BREAST LYMPHOMAS THROUGH MULTIMODALITY IMAGING AND HISTOPATHOLOGY

Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Mitva J. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Randy C. Miles, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Rifat A. Wahab, DO (*Abstract Co-Author*) Nothing to Disclose
Serine E. Baydoun, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren E. Rosen, MD (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Describe typical and atypical multimodality imaging findings on mammogram, ultrasound, and MRI of breast lymphomas.2. Highlight clinical presentations seen with each breast lymphoma type in the radiology setting.3. Discuss current treatment and management recommendations of the various types of breast lymphomas.4. Review pathology and key immunohistochemistry profiles of these breast lymphomas.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction to various types of breast lymphomas2) Review of B vs. T cell origin3) Incidence breakdown of each lymphoma type4) Comparison of primary verses secondary breast lymphomas5) Case-by-case review with imaging, key information, and management discussion--Diffuse large B-cell lymphoma--Extranodal marginal zone lymphoma (MALT lymphoma)--Follicular lymphoma--Burkitt lymphoma--B- and T-lymphoblastic lymphoma/leukemia (CLL/SLL)--Anaplastic large cell lymphoma with emphasis on breast-implant associated type6) Discussion of optimal biopsy and tissue collection techniques in breast imaging

## BREE-130 LYMPHOCYTES IN MY BREAST, WHAT DOES IT MEAN? LYMPHOMA, TILS (TUMOR INFILTRATING LYMPHOCYTES) AND BEYOND. A PICTORIAL REVIEW OF LYMPHOCYTE-CONTAINING BREAST LESIONS

Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Abstract Co-Author*) Nothing to Disclose

Soledad Alonso Garcia (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia-Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-To review the different breast lesions containing lymphocytes. - To describe features of breast lymphomas. - To analyze the concept of TILS (tumor infiltrating lymphocytes) in breast tumors. - To illustrate imaging findings in different imaging modalities (CEM, US, MRI) with correlation with pathology. - To emphasize pitfalls, diagnostic difficulties, and differential diagnosis

**TABLE OF CONTENTS/OUTLINE**

Lesions containing different types of lymphocytic infiltration may appear within the breast. Understanding TILS concept and knowledge of lymphocyte containing lesions is essential for the radiologist.We present: - Lymphoid tissue in the breast. Anatomy and physiology. - Breast lymphoma. Images of primary and secondary breast lymphomas from our series will be presented. Usually, non-specific, most frequently enlarging masses. -Medullary carcinoma. A circumscribed mass in which lymphocytic infiltrate is a key diagnostic criterion. -Lymphocytic mastitis/diabetic mastopathy. Lymphocytes may also appear in inflammatory lesions. Lymphocytic mastitis is unusual and probably immune-mediated. If associated with diabetes called Diabetic mastopathy, with lobular atrophy and sclerosis called Sclerosing type. Usually, non-circumscribed masses or focal asymmetry. -TILS are clinically relevant regarding implications on response to treatment and prognosis. This lymphocytic infiltrate might represent a form of host resistance to the tumor. TILS are most frequently found in triple negative breast cancer, followed by HER2 positive and less frequently in luminal breast cancer.

## BREE-131 ENHANCING DIAGNOSTIC VALUE WITH CONTRAST-ENHANCED SPECTRAL MAMMOGRAPHY THROUGH QUANTITATIVE ENHANCEMENT ANALYSIS

Huizhi Cao (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To understand the mechanism and clinical utility of contrast-enhanced spectral mammography (CESM) in breast cancer screening, staging, and treatment monitoring. 2. To demonstrate quantitative variables and kinetic enhancement patterns of breast lesions on CESM in enhancing diagnostic accuracy and differential diagnosis. 3. To discuss the diagnostic performance of radiomics in combination with CESM for suspicious malignant lesions characterization. 4. To present case studies with the integration of history, imaging findings, and tissue diagnosis for utilizing quantitative CESM characteristics in challenging or equivocal mammographic abnormalities.

**TABLE OF CONTENTS/OUTLINE**

1. To introduce the principle of CESM, contrast protocol, abnormal enhancing characteristics and illustrative cases in demonstrating CESM's role in BIRADS assessment and management of equivocal mammographic lesions. 2. To demonstrate quantitative analysis of kinetic enhancement patterns on CESM in distinguishing benign from malignant breast lesions. 3. To understand the concept of radiomics and its integration with CESM in identifying suspicious malignant microcalcifications (BIRADS 4). 4. To discuss strategies for appropriately utilizing quantitative CESM characteristics in complex or ambiguous mammographic abnormalities.

## BREE-132 ENHANCING PREDICTIVE POWER OF CONTRAST-ENHANCED SPECTRAL MAMMOGRAPHY (CESM) IN ASSESSING RESPONSE TO NEO-ADJUVANT CHEMOTHERAPY

Huizhi Cao (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To grasp the technical foundations of contrast-enhanced spectral mammography (CESM) and its Operationalization. 2. To identify lesion types amenable to evaluation via CESM. 3. To unveil CESM's capacity for accurate assessment of tumor response post Neo-adjuvant chemotherapy (NAC), comparable to MRI. 4. To employe quantitative objective measures in predicting response to NAC through RECIST 1.1 and combined evaluation approaches. 5. To appreciate the scope and nuances of CESM's utility in treatment monitoring.

**TABLE OF CONTENTS/OUTLINE**

1. Unveiling the underlying principles and physics of contrast-enhanced spectral mammography. 2. Exploring CESM's clinical application as a promising follow-up modality post-NAC. 3. Understanding the variables influencing tumor shrinkage and assessment during NAC, including primary tumor Size, edema, or necrosis. 4. Qualitative and quantitative assessment of CESM in predicting response to NAC. 5. Weighing the advantages and constraints of CESM.

## BREE-134 AXILLARY IMAGING: PEARLS AND PITFALLS

Caroline Merriam, DO (*Abstract Co-Author*) Nothing to Disclose
Liva Andrejeva-Wright, MD (*Abstract Co-Author*) Nothing to Disclose
Manroop Kaur, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The axilla is normally comprised of lymph nodes, axillary neurovascular bundles, and adipose tissue.2. Accessory breast tissue is categorized into classes, and the axilla is the most common location for fibroglandular accessory breast tissue (Class IV).3. Recognizing abnormalities in ectopic breast tissue is important as malignancies may arise at an earlier age in aberrant tissue.4. The purpose of the exhibit is to review benign and malignant pathologies in the axilla through a multi-modality case-based presentation.5. Benign features of axillary lesions include well-circumscribed margins in parallel orientation with posterior acoustic enhancement and absence of early enhancement. 6. Malignant features of axillary lesions include spiculated/angulated margins in taller than wide orientation, posterior acoustic shadowing, and early enhancement characteristics.

**TABLE OF CONTENTS/OUTLINE**

1. Normal anatomical structure of the breast and axilla.2. Imaging characteristics of normal axillary tissue versus accessory breast tissue.3. Multi-modality case-based review of benign pathologies in the axilla: accessory breast tissue, fibroadenoma, sebaceous cyst, Hidranitis suppurativa, reactive lymph nodes, lymphatic malformation, capillary hemangioma 4. Multi-modality case-based (US, Mammography, MRI) review of malignant pathologies in the axilla: primary breast cancer (DCIS/LCIS), metastatic lymph nodes from breast-primary cancer, metastatic lymph nodes from non-breast primary cancer. 5. BI-RADS application for lesions in the axilla and next steps for follow-up.

## BREE-135 MAXIMIZING SENSITIVITY: THE ART OF MAMMOGRAPHY POSITIONING AND ITS IMPACT ON EARLY DETECTION OF BREAST CANCER

Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela C. Ferracini, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Oliveira Gloria, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Mammography assumes a pivotal role in breast cancer screening, renowned for its efficacy in early disease detection and subsequent reduction in mortality rates. Nevertheless, the efficacy of mammography is contingent upon various factors, encompassing the proficiency of mammography technologists, accurate calibration of equipment parameters, and the unique anatomical features of each patient. These multifaceted considerations can attenuate the sensitivity of the modality. Among the manifold factors influencing the interpretability of mammograms, improper breast positioning stands as a principal adversary, precipitating a cascade of adverse outcomes including unwarranted re-examinations, escalated radiation exposure, elevated recall rates, and potential diagnostic delays. Emerging research endeavors are leveraging artificial intelligence (AI) as a complementary tool to identify and rectify positioning errors during mammographic examinations. However, notwithstanding the integration of AI support, the indispensable role of radiologists and technologists in discerning the hallmarks of a meticulously executed mammography remains unequivocal. Their proficiency is imperative in mitigating the propensity for unnecessary recalls, mitigating radiation exposure, curtailing healthcare expenditures, assuaging patient apprehensions, alleviating procedural discomfort, and averting diagnostic delays.

### TABLE OF CONTENTS/OUTLINE

This study aims to emphasize the importance of obtaining high-quality mammographic images by evaluating factors such as the patient's medical history, anatomy, equipment parameters, with a strong emphasis on proper positioning during the exam.

## BREE-136 EXPLORING IMAGING CHARACTERISTICS IN EXTRAMAMMARY METASTASES IN BREAST: A MULTIMODALITY APPROACH

Bong Joo Kang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Han Song Mun, MD (*Abstract Co-Author*) Nothing to Disclose
Sung Hun Kim (*Abstract Co-Author*) Nothing to Disclose
Ga-Eun Park, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

*Metastases to the breast are rare, with a reported incidence of 0.3-2%. Among these, lymphoma is the most common, followed by melanoma, lung, ovarian, and gastrointestinal tract origins. *Breast tissue confirmation is performed to verify the origin in patients with extensive metastasis. Additionally, breast biopsy is conducted as clinically indicated in patients with known cancer origins, given the rarity of metastases to the breast despite breast cancer's prevalence. *Imaging features may vary depending on the primary tumor and route of dissemination, with a circumscribed solid mass being the most frequent presentation. Hematogenous metastases, in particular, often manifest as multiple or bilateral masses.

### TABLE OF CONTENTS/OUTLINE

1. Literature reviews on breast metastasis. 2. Analysis of incidence and origin distribution. 3. Cases with various imaging characteristics using a multimodality approach.

## BREE-137 CONE BEAM BREAST CT IMAGE CHARACTERISTICS OF DIFFERENT PATHOLOGICAL TYPES OF BREAST PAPILLARY CARCINOMA

Wei Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Xin Zhao I (*Abstract Co-Author*) Nothing to Disclose
Dan Ke Su (*Abstract Co-Author*) Nothing to Disclose
Zhixing Zhang (*Abstract Co-Author*) Nothing to Disclose
Li Dong Liu (*Abstract Co-Author*) Nothing to Disclose
Yang Zhao (*Abstract Co-Author*) Nothing to Disclose
Jie Shi (*Abstract Co-Author*) Nothing to Disclose
Yanxia Huang (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The distinct image characteristics of different pathological types of papillary carcinoma on Cone Beam Breast CT (CBBCT)

### TABLE OF CONTENTS/OUTLINE

1.Objective To explore the image characteristics of different pathological types of papillary carcinoma using Cone Beam Breast CT (CBBCT).2. Methods: Retrospective analysis was conducted on CBBCT image characteristics and time-density curves from 23 cases of different pathological types of papillary carcinoma, confirmed by pathology at our hospital between July 2019 and December 2023. 3. Results: 13 had intraductal papillary carcinoma, primarily characterized by multi-focal tumors of equal density, with clear boundaries. The long axis of these lesions generally aligned with the breast ducts and was often accompanied by calcification. The time-density curve was predominantly type II. Two cases had invasive papillary carcinoma, mainly with presenting as oval cystic- solid masses. They had indistinct margins, with heterogeneous internal enhancement patterns and prominently enhanced wall nodules. The cystic areas were smooth and with a time-density curve of type III. Two cases were of encapsulated papillary carcinoma, mainly with cystic- solid masses, circumscribed margins and smooth cystic walls, featuring a single enhanced wall nodule and a type III time-density curve. Six cases had solid papillary carcinoma, mainly with multiple cystic- solid masses or a diffuse enhancement pattern. They had indistinct margins, with lobulation and spiculation, and were accompanied by enhanced wall nodules, with time-density curves of mainly type II.4. Conclusion: CBBCT can be effective in differentiating between the various pathological types of papillary carcinoma.

## BREE-138 CLINICAL PERFORMANCE OF NEW IMAGE RECOMBINATION ALGORITHM (NIRA) FOR ARTIFACT REDUCTION IN CONTRAST-ENHANCED MAMMOGRAPHY

Huizhi Cao (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Contrast-enhanced mammography (CEM) emerges as a promising imaging tool for breast cancer diagnosis. However, CEM is susceptible to artifacts that can compromise image quality and diagnostic accuracy. The objectives of this exhibit are: 1. To introduce readers to contrast-enhanced mammography (CEM) as an emerging modality for breast imaging and discuss its implementation. 2. To examine common artifacts encountered in contrast-enhanced mammography, including those related to patients, contrast agents, such as ripple artifact, scatter radiation artifact, and misregistration artifact. 3. To showcase the efficacy of the New Image Recombination Algorithm (NIRA) in reducing artifacts on CEM images through practical application and clinical examples. 4. To highlight the clinical value of NIRA in quality assurance for CEM images, thereby reducing interpretation errors. 5. To explore technical and diagnostic limitations, including false-negative and false-positive results, associated with contrast-enhanced mammography.

**TABLE OF CONTENTS/OUTLINE**

1. Brief overview of different approaches in contrast-enhanced mammography and their features in imaging interpretation. 2. Identification and illustration of artifacts apparent on CEM images, including those caused during image acquisition, contrast agent-related artifacts, and typical digital mammography artifacts. 3. Practical application of the NIRA technique, accompanied by illustrated clinical examples, to demonstrate its effectiveness in reducing various artifacts. 4. Discussion on technical and diagnostic limitations, including false-negative and false-positive results, encountered in contrast-enhanced mammography.

## BREE-139 BLEEDING RISKS IN IMAGING-GUIDED BREAST BIOPSIES; A PRIMER FOR RADIOLOGISTS

Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Amy M. Fowler, MD, PhD (*Abstract Co-Author*) Author with royalties, RELX
Thomas Loduca, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Nemr (*Abstract Co-Author*) Nothing to Disclose
Lonie R. Salkowski, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberta M. Strigel, MD, MS (*Abstract Co-Author*) Research support, General Electric Company
Ryan W. Woods, MD, MPH (*Abstract Co-Author*) Author, MRI Online
Alison R. Gegios, MD (*Abstract Co-Author*) Nothing to Disclose
Mai A. Elezaby, MD (*Presenter*) Investigator, Exact Sciences Corporation;Research Grant, Exact Sciences Corporation

**TEACHING POINTS**

Image-guided breast biopsies (BrBx) are the standard of care for suspicious breast findings. Bleeding complications of BrBx can lead to patient anxiety, additional imaging exams, and increased treatment costs. Historically, paucity of national data and lack of guidelines for management of periprocedural bleeding risk of BrBx is reflected in the significant variability among practicing radiologists. The Society of Interventional Radiology in 2019 published consensus-based approach for assessment of bleeding risk in patients undergoing interventional procedures. However, the management of patients on AT medications and those with inheritable bleeding disorders is still a source of confusion and can potentially delay critical interventions. Recent breast-specific data on risk of significant bleeding in BrBx, even without cessation of antithrombotic (AT) medications, is low (1%). This data weighed against thrombotic risk from temporarily stopping AT medications may warrant updated management protocols. Thus, clinical need dictates for better understanding of the complex coagulation pathway, learn the current antithrombotic medications as well as understand risk management protocols before, during, and after BrBx. In addition, the knowledge of proper management strategies if bleeding occurs is critical for improved patient care and outcomes.

**TABLE OF CONTENTS/OUTLINE**

- Pathophysiology of coagulation pathway and pharmacokinetics of common AT medications.
- Recent data on incidence and significance of bleeding complications after BrBx
- Steps to decrease bleeding risk before, during, and after BrBx.
- How to recognize and manage bleeding complications of BrBx through case-based, image-rich examples.

## BREE-14 ARTIFACTS IN BREAST ELASTOGRAPHY AND HOW TO RECOGNIZE AND AVOID THEM

Jonathan Langdon, MD (*Abstract Co-Author*) Nothing to Disclose
Richard G. Barr, MD, PhD (*Presenter*) Consultant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Consultant, Canon Medical Systems Corporation;Advisor, Hologic, Inc;Research Grant, Hologic, Inc

**TEACHING POINTS**

1. Artifacts in breast elastography are common and can lead to false positive and false negative results. 2. Recognizing breast elastography artifacts and knowing how to avoid them is critical for accurate breast lesion assessment 3. Artifacts can occur both in strain and shear wave elastography 4. Performing both strain and shear wave elastography will help recognize artifacts 5. Learn the optimal technique for both strain and shear wave elastography

**TABLE OF CONTENTS/OUTLINE**

A. Review of the principals of strain and shear wave elastography of the breast B. Review the literature on strain and shear wave imaging of the breast C. Describe common breast elastography artifacts and how to recognize them and avoid them 1. Artifacts associated with cystic lesions 2. The "blue" or "soft" cancers 3. The Bang artifact 4. Artifacts due to poor position of the transducer 5. How to recognize noise 6. The sliding artifact 7. The effect of precompression or preload8. Use of the quality map in shear wave elastography D. Summary of the optimal technique for both strain and shear wave elastography for breast lesion evaluation

## BREE-140 DECODING BENIGN BREAST LESIONS: IMAGING CHALLENGES & CHEMO-RESPONSE

Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
Lidia B. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD (*Abstract Co-Author*) Nothing to Disclose
Erica Endo, MD (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Oliveira Gatto, MD (*Abstract Co-Author*) Nothing to Disclose
Naomi Murakami SR, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Fibroadenoma is a benign breast neoplasm characterized by a composition of fibrous and glandular tissue, representing the most prevalent benign neoplasm of the female breast and is typically observed in women under 30 years of age, although it can occur at any point in the reproductive years.2. After chemotherapy, fibroadenomas and other benign breast lesions can exhibit changes in their imaging features. They may show decreased enhancement or may demonstrate a reduction in size on Magnetic Resonance Imaging (MRI) or Computed Tomography (CT). Such changes can sometimes make it challenging to distinguish between a benign and a malignant lesion.3. In cases where lesions exhibiting benign imaging characteristics have responded to chemotherapy, the decision regarding further management should take into consideration the initial level of suspicion.

**TABLE OF CONTENTS/OUTLINE**

1. Emphasize the importance of benign breast lesions findings in the different methods, as it is a common finding of benign breast lesions.2. Show the pathology, epidemiology, histological origin, imaging aspects in the different methods of benign breast lesions.3. Review on imaging findings of the effects of neoadjuvant or adjuvant chemotherapy on fibroadenomas and other benign breast lesions through illustrative cases with different imaging methods, including Ultrasound, Mammography, Tomosynthesis, Magnetic Resonance Imaging and Computed Tomography.4. Discuss the management approach in cases where a lesion presents imaging characteristics indicative of benignity, yet demonstrates decreased enhancement or dimensions following chemotherapy.

## BREE-141 FREE MARGINS AFTER BREAST CANCER SURGERY: USEFULNESS OF MRI GUIDED ROLL, RADIOGUIDED OCCULT LESION LOCALIZATION, TECHNIQUE

Javier Sanchez-Bordona Marques, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paula Andrea Arias Cadena, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel R. Recio Rodriguez, PhD (*Abstract Co-Author*) Nothing to Disclose
Leire Alvarez Perez, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Vicente Martinez de Vega, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Presurgical MRI guided ROLL/SNOLL localization in breast cancer may be useful in selected cases to obtain surgical free margins. This technique is accurate, safe and fast. How to perform radioguided breast surgery for those malignant lesions displayed only with breast MRI and sentinel node detection.

**TABLE OF CONTENTS/OUTLINE**

Suspicious lesions detected only seen by MRI (not seen with mammography or ultrasound) require histological diagnosis. This is performed by an MRI-guided VAB, after which a marker is left in case the patient requires surgery. Titanium markers placed can move because of the relatively large size of the resulting cavity and subsequent hematoma formation after the procedure.On the other hand, in some cases, the malignant lesion detected by MRI is more extensive than that visualized by mammography and ultrasound.In both situations, marking the previously biopsied lesion or its boundaries with MRI-guided procedure reduces the number of surgical positive margins.Radioguided occult lesion localization (ROLL) has emerged as a novel technique in surgery for non-palpable breast lesions, inspired by sentinel node biopsy (SNB). With MRI guidance, we can practice the ROLL technique and add SNOLL (sentinel node and occult lesion localization) in the same procedure.We present our experience in presurgical MRI guided ROLL/SNOLL localization in 93 patients.

## BREE-142 DEFINING SUCCESS IN CRYOABLATION: LONG TERM OUTCOMES FROM A SINGLE INSTITUTION

Sehar Salman, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Mary Schwartz, MD (*Abstract Co-Author*) Nothing to Disclose
Modupe M. Adeyefa, MD (*Abstract Co-Author*) Nothing to Disclose
Luz A. Venta, MD (*Abstract Co-Author*) Nothing to Disclose
Mimi Haghshenas, MD (*Abstract Co-Author*) Nothing to Disclose
Sasha Kurumety, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The goal of this presentation is to educate radiology trainees on the use of cryoablation as a treatment option for breast malignancies, when cryoablation may be appropriate, and outcomes that can be deemed successful when cryoablation is used for breast malignancies. Using a select series of cases from our institution, we will describe the multiple potential roles of cryoablation and mechanism of action, as well as demonstrate post treatment imaging findings over the course of months to years. After this presentation, learners will be able to describe the utility of cryoablation in treating breast malignancies, long term outcomes and imaging findings after treatment, and future directions for cryoablation.

**TABLE OF CONTENTS/OUTLINE**

Background: Current FDA approved indications for cryoablation and investigation of cryoablation in breast cancer. Discussion of ongoing trials (ICE3, FROST). Goals of cryoablation when used for malignancies: palliative vs curative, long term outcomes of cryoablation when used in breast malignancies. Discussion of mechanisms of action: Direct freezing and cell death, indirect immune response activation. Cryoablation at our institution: Cases of cryoablation with pathologic findings on biopsies, intraprocedural imaging, and sequential long term follow up imaging findings. Comparison of outcomes to standard of care without cryoablation. Future directions: Defining indications of cryoablation, increasing accessibility, utility with palliative intent.

## BREE-143 METHOD OF DETECTION IN BREAST CANCER IMAGING: PROOF OF CONCEPT OF AUTOMATED MOD DESIGNATION

Laurie R. Margolies, MD (*Abstract Co-Author*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical
Arielle Sasson (*Presenter*) Medical Advisory Board, Screenpoint Medical

**TEACHING POINTS**

• Method of Detection (MOD) is the first clinical event or imaging study to trigger a workup which may lead to the diagnosis of breast cancer. It is expected to be included in the 6th edition of the BI-RADS atlas.• Documenting MOD allows quantification of the impact of breast cancer screening on treatment and patient outcomes.• Some breast radiology reporting tools provide an advanced algorithm to automate MOD assignment to simplify MOD data collection.

**TABLE OF CONTENTS/OUTLINE**

• **Background**• Ongoing debate related to breast cancer screening frequency and age range• These controversies are in part due to dependence on old film screen historical clinical trial data and varying interpretations/misinterpretations of the data. Additionally, this data may not speak for the diversity of the current population, increasing incidence of breast cancer and/or recent advances made in breast cancer imaging.• Many nations utilize a centralized

breast cancer screening program that monitors the results of screening mammography for every patient.• **What is MOD and why should we care about it?**• Comprehensive definition and proposed categories of initial MOD• Reasons why we should track initial MOD data for every patient• Methods of assigning MOD• Retrospective versus prospective assignment of MOD• Breast radiology reporting tools can automate MOD assignment• Present example images of MOD automation • Discuss difficult scenarios in assigning MOD, such as when a patient presents with a palpable abnormality in one breast but malignancy is detected in the opposite breast • Barriers to collecting MOD data• **References**

### BREE-144 NAVIGATING THROUGH THE FOG: MAMMOGRAPHIC FINDINGS IN THE CONTEXT OF SYSTEMIC DISEASES

Rosaura E. Fuentes Corona, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Rios Valencia (*Abstract Co-Author*) Nothing to Disclose
Sara Eugenia Vazquez Manjarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Denny Lara Nunez, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Amaya, MD (*Abstract Co-Author*) Nothing to Disclose
Ernesto D. Elizondo Zepeda, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To describe and to recognize the most common findings of Systemic Diseases reflected in mammography. To learn that understanding the patients' pathological background is important to comprehend the described findings.

#### TABLE OF CONTENTS/OUTLINE

Introduction Mammographic findings in Systemic Diseases:- Autoimmune / Autoinflammatory- Endocrine- Cutaneous- Infectious- Edema- Extramammary malignancies Conclusions

### BREE-145 REVOLUTIONIZING DETECTION: LOCALLY ADVANCED BREAST CANCER IN YOUNG WOMEN UNVEILED BY AB MRI DESPITE MORPHOLOGICALLY NEGATIVE EXAMS

Flavia B. Sarquis, MD (*Abstract Co-Author*) Nothing to Disclose
Maria A. Acha I, MD (*Abstract Co-Author*) Nothing to Disclose
Angelica M. Rivera (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Breast cancer is the second leading cause of cancer deaths in women aged 20-39, and it often presents with more aggressive features compared to breast cancer in older women.Mammography is the standard imaging modality for breast cancer detection, but it has limitations.Young women with locally advanced breast cancer may have negative mammograms and ultrasounds due to their dense breast tissue. It is generally associated with palpatory findings not related to mastitis.Abbreviated Breast MRI (AB-MRI) can detect locally advanced breast cancer in young women with negative mammograms and ultrasounds.AB-MRI can provide valuable information to clinicians for early detection and treatment of breast cancer in young women.After reading this educational exhibit, the radiologist will know :AB-MRI can be used as an imaging modality in young women with negative mammograms and ultrasounds for early detection and treatment of breast cancer, avoiding delays in diagnosis.

#### TABLE OF CONTENTS/OUTLINE

Introduction: The Challenge of Detecting Breast Cancer in Young Women.AB-MRI in Young Women with Negative Mammograms and Ultrasound.AB-MRI vs. Mammography: Comparing Sensitivity and Specificity.Future Directions: The Potential of AB-MRI in Breast Cancer Diagnosis and Management.Conclusion

### BREE-15 BREAST OR NOT BREAST: CHEST WALL AND AXILLARY ABNORMALITIES IN BREAST IMAGING

Muhayman Sadiq, MBBS (*Abstract Co-Author*) Nothing to Disclose
Claudia Cotes, MD (*Abstract Co-Author*) Nothing to Disclose
Tiffany A. Kumala (*Abstract Co-Author*) Nothing to Disclose
Vidhyulatha Sanata, MD, MBBS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

It's not uncommon for patients with chest wall and axillary abnormalities unrelated to the breast to initially present to the breast imaging department. Mammography and breast ultrasound, although helpful for excluding breast related malignancies, may not always be the most suitable modalities for evaluation, often leading to inconclusive results. These scenarios present challenges for radiologists, particularly concerning biopsy approaches and appropriate recommendations for additional imaging to comprehensively assess these patients. This exhibit showcases the chest wall and axillary anatomy on mammography, breast ultrasound, and breast MRI, delineates the role of breast imagers in the evaluation of abnormalities within these regions, and offers guidance on the subsequent imaging steps and biopsy approaches for evaluating non-breast chest wall and axillary findings through illustrative case examples.

#### TABLE OF CONTENTS/OUTLINE

1. Chest wall and axillary anatomy: Mammography, Ultrasound, Breast MRI 2. Differential diagnoses based on location:Chest wall: Anterior chest wall muscle: Poland syndrome, Physiological hypertrophy, Pectoralis muscle Lipoma, Spindle cell sarcoma Ribs: Osteomyelitis, Benign and Malignant Bone tumors Posterolateral Chest wall: Lipoma, Elastofibroma Dorsi, Lymphatic malformations Axilla: Muscle: Sarcoma Lymphatic system: Atypical Lymphoma, Lymphangioma Shoulder Joint: Ganglion Cyst

### BREE-16 DECIPHERING ATYPICAL DUCTAL HYPERPLASIA: NAVIGATING IMAGING FINDINGS, DIAGNOSIS, AND EXPLORING MRI POTENTIAL

Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Atypical ductal hyperplasia (ADH) is part of the high-risk lesions group due to its association and potential progression to ductal carcinoma in situ (DCIS) and invasive carcinoma, being found in about 5 to 20% of biopsies performed. The histopathological features of ADH and DCIS are highly similar, distinguished primarily by size (less than 2 mm) and involvement in fewer than two ducts. The risk of progression to invasive carcinoma is estimated to range from 3.7% to 22%. ADH does not present defined radiological characteristics on its own. Mammography may reveal nodules, asymmetric densities, calcifications, and architectural distortions, often with amorphous calcifications within the lesion. On ultrasound, lesions typically appear as hypoechoic nodules with irregular shape, microlobulated margins, and abrupt interface, often due to coexisting processes. Magnetic resonance imaging (MRI) shows non-nodular enhancement, with patterns varying from progressive to plateau or wash-out. Given the potential for diagnostic underestimation and its propensity to coexist with DCIS and invasive carcinoma, surgical excision is advised post its histopathological diagnosis. Recent studies have been discussing the role of MRI in cases of ADH where no suspicious enhancement is observed in the biopsied area, which could potentially obviate the need for surgery in these cases.

**TABLE OF CONTENTS/OUTLINE**

To explore the histopathological characteristics of ADH, differential diagnoses, and its relationship with breast carcinoma, demonstrate the imaging findings of ADH across various imaging modalities using cases from our institution, discuss the role of MRI in the treatment decision-making.

## BREE-17 CLARITY IN CONTRAST: THE PICTORIAL ATLAS OF BENIGN BREAST LESIONS

Ernesto D. Elizondo Zepeda, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Eugenia Vazquez Manjarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Rosaura E. Fuentes Corona, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Rios Valencia (*Abstract Co-Author*) Nothing to Disclose
Mariana Amaya, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Case-based presentation of benign breast lesions on diverse imaging modalities, with special focus on contrast-enhanced mammography.Every case has pathological correlation, enhancing diagnostic accuracy, some cases with histology images to augment understanding of lesion characteristics.Some of the featured lesions to review: Abscess, Mastitis, PASH, Simple Cyst, Adenosis, Ductal Hyperplasia, Fibrocystic Changes, Adenomas, and Fibroadenomas.Discussion on the utility of advanced imaging techniques in characterizing benign breast lesions. Highlighting key imaging features that aid in the differentiation of benign lesions from malignant ones, including shape, margin characteristics, internal architecture, and enhancement patterns.Exploration of potential challenges encountered in diagnosing benign breast lesions, with strategies for overcoming them.Consideration of the impact of patient demographics, such as age and hormonal status, on the imaging appearance of benign breast lesions, with implications for management decisions.

**TABLE OF CONTENTS/OUTLINE**

IntroductionAbscess and mastitis: Imaging CharacteristicsPseudoangiomatous Stromal Hyperplasia (PASH): A Comprehensive Imaging ReviewSimple Cyst: Diagnostic Imaging Findings and Clinical ImplicationsAdenosis: Imaging Spectrum and Differential DiagnosisDuctal Hyperplasia: Radiologic Patterns.Fibrocystic Changes: Imaging Manifestations.Adenomas: Radiological Features and Pathological CorrelationFibroadenomas: Imaging Spectrum and Patient ConsiderationsConclusion

## BREE-18 RADIOLOGICAL INSIGHTS: UNDERSTANDING BREAST PATHOLOGY IN PREGNANCY AND LACTATION

Pilar Alonso-Bartolome (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Merino (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review physiological breast tissue changes and illustrate common breast disorders during pregnancy and lactation.Discuss the radiological approach to breast pathology in this period and deepen the understanding of pregnancy-associated breast cancer.

**TABLE OF CONTENTS/OUTLINE**

Breast pathology during pregnancy and lactation poses diagnostic challenges. Radiologists must be well-versed in the physiological changes and specific conditions of this period, considering the strengths and limitations of each imaging method. A multidisciplinary approach is paramount for optimal outcomes. Clinical manifestations include palpable mass, pain, or nipple discharge. While most lesions are benign, consideration of pregnancy-associated breast is crucial concerning prognosis impact.Radiological evaluation is pivotal in characterizing breast pathologies in these states. Ultrasound is the first-line choice for its safety and real-time evaluation. Mammography remains a complementary tool, especially in lactation and malignancy. MRI is reserved for clear risk-benefit ratio situations and local-regional staging in lactating women. Core biopsy is necessary for new/growing masses.Frequent findings include engorgement, lactational changes, benign lesions (fibroadenomas, galactoceles), and, rarely, breast cancer. Overlapping features and hormonal influences complicate interpretation. Timely diagnosis is crucial to guide subsequent management, balancing safety with diagnostic accuracy.This poster provides a pictorial review of illustrative cases from our institution encompassing benign, inflammatory, and malignant conditions underlying the hallmark findings that lead to accurate diagnosis.

## BREE-19 EXPLORING VISUAL TRAPS IN CONTRAST MAMMOGRAPHY

Rosaura E. Fuentes Corona, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Eugenia Vazquez Manjarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio D. Tovar Aldana I, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To identify artifacts of image in CEM to avoid misdiagnosisExplain the underlying causes and mechanisms that contribute to the formation of artifacts in CEM, including technical, biological, and physical factors

**TABLE OF CONTENTS/OUTLINE**

-Brief definitions-Technical considerations-Artifices in contrasted mammographyTechnical Artifacts Patient related Artifacts Contrast Agent-related Artifacts -False positive diagnoses - Incomplete or Inadequate visualization in CEM- Conclusions

## BREE-2 DERMAL DILEMMAS: A REVIEW OF BREAST ABNORMALITIES INVOLVING THE EPIDERMIS, DERMIS, AND HYPODERMIS

**Awards**
**Certificate of Merit**

John M. Lewin, MD (*Abstract Co-Author*) Officer, Novian Health Inc
Manroop Kaur, MD (*Abstract Co-Author*) Nothing to Disclose
William J. Hoover, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- The breast skin is comprised of three distinct layers - epidermis, dermis, and hypodermis.
- Each layer harbors unique anatomic components, which may give rise to benign and malignant abnormalities.
- Breast skin lesions may pose a diagnostic challenge when detected incidentally on breast imaging.
- Several hallmark features, such as a sonographic “claw sign” or “dermal tail”, can localize and narrow the differential diagnoses for a breast skin lesion.
- This exhibit will discuss normal breast skin anatomy, and will illustrate the expected appearance of dermal layers on ultrasound, mammogram, and breast MRI.
- The presentation will include a case-based review of benign and malignant breast skin abnormalities.
- For each skin abnormality, we will describe the typical clinical presentation, multimodality imaging features, malignant potential, and appropriate next steps of management.

**TABLE OF CONTENTS/OUTLINE**

- Review of normal breast skin anatomy.
- Expected appearance of dermal layers on ultrasound, mammogram, and breast MRI.
- Key imaging features indicating dermal origin of a breast lesion.
- Multimodality imaging review of breast skin abnormalities, which will be organized into the following categories:
- Inherited abnormalities
- Vascular lesions
- Dermal cystic lesions
- Abnormal skin thickening
- Infectious and inflammatory lesions
- Malignancy

## BREE-20 LUMPECTOMY AND MASTECTOMY RECURRENCE: CASE REVIEW AND WHAT THE RADIOLOGIST CAN LEARN

Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Ann L. Brown, MD (*Abstract Co-Author*) Consultant, Elucent Medical
Erich J. Boomgarden, MD (*Abstract Co-Author*) Nothing to Disclose
Brian J. Guarnieri, MD (*Abstract Co-Author*) Nothing to Disclose
Rifat A. Wahab, DO (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Abstract Co-Author*) Nothing to Disclose
Asir Chishti, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) List treatment options after diagnosing breast malignancy, including breast conservation, and review associated recurrence rates.2) Recognize risk factors which can lead to higher incidence of recurrent malignancy.3) Compare and contrast imaging findings consistent with recurrent malignancy and post-therapeutic changes.4) Review imaging pitfalls leading to misdiagnosis of recurrence and post-therapeutic changes.5) Discuss the management and treatment of recurrent malignancy.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction2) Review of surgical and therapeutic options including breast conservation therapy.3) Discuss rates of recurrence associated with different types of therapy.4) Risk factors associated with higher rate of recurrence, including the following:- Tumor size- Positive margins- Type of malignancy and biomarkers- Lack of staging MRI- Incomplete management therapy5) Discussion of imaging and clinical surveillance for recurrence.6) Review of multimodality imaging findings suggestive of post-therapeutic changes versus recurrent malignancy.7) Cases reinforcing imaging findings consistent with post-therapeutic changes and recurrent malignancy.8) Overview of management and prognosis of recurrent breast malignancy.9) Multiple choice questions to reinforce key teaching points.

## BREE-21 MULTIMODALITY IMAGING REVIEW OF BREAST SARCOMAS

**Awards**
**Cum Laude**

Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren E. Rosen, MD (*Abstract Co-Author*) Nothing to Disclose
Erich J. Boomgarden, MD (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Leon (*Abstract Co-Author*) Nothing to Disclose
Brian J. Guarnieri, MD (*Abstract Co-Author*) Nothing to Disclose
Tristan A. Toca, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Provide an overview of sarcomas of the breast including risk factors, presentation, prognosis, and imaging characteristics2) Recognize unique imaging and clinical features of the different breast sarcomas3) Understand the importance of early diagnosis given the aggressive nature breast sarcomas as well as their management and treatment4) Review histopathologic similarities and differences between sarcomas within the breast

**TABLE OF CONTENTS/OUTLINE**

1) Introduction2) Graphic breakdown of the different types of sarcomas in the breast3) Risk Factors4) Characteristics and imaging overview of breast sarcomas5) Overview of prognosis, management, and treatment6) Case by case review including unique imaging findings, teaching points, and management-- Angiosarcoma-- Leiomyosarcoma-- Dermatofibrosarcoma Protuberans-- Spindle Cell Sarcoma-- Liposarcoma-- Fibrosarcoma-- Malignant Fibrous Histiocytoma-- Sarcomatous Transformation of a Phyllodes Tumor7) Review histopathologic features of sarcomas including similarities and differences8) Multiple choice questions to wrap up learning and reinforce important teaching points

## BREE-22 SPECIAL SUBTYPES OF INVASIVE BREAST CARCINOMA: UPDATE ON MULTIMODALITY IMAGING FINDINGS AND MANAGEMENT

Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Ann L. Brown, MD (*Abstract Co-Author*) Consultant, Elucent Medical
Rifat A. Wahab, DO (*Abstract Co-Author*) Nothing to Disclose
Kyle M. Lewis, MD (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren E. Rosen, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Levine (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Review the most current WHO pathologic classification of breast tumors.2) Recognize sonographic, mammographic, and MRI findings that are specific to the special subtypes of invasive breast carcinoma.3) Characterize histopathology of the special subtypes.4) Discuss special considerations of each special subtype with the goal of targeted management and improved pathologic correlation.

**TABLE OF CONTENTS/OUTLINE**

IntroductionWHO ClassificationGraphic breakdown of invasive no special type versus these Special SubtypesOverview of imaging workup (Screening and Diagnostic)-Mammogram-Ultrasound-MRI Detailed Cases with Histopathology:-Mucinous-Micropapillary-Neuroendocrine-Tubular-Cribriform-Papillary-Medullary-Metaplastic-Lobular-Metaplastic-Apocrine-Salivary gland-type tumors (Acinic cell, Adenoid cystic, Secretory, etc.)Summary tableReview questionsConclusions: 1) Improved knowledge of specific sonographic, mammographic, and MRI findings of these special subtypes of invasive breast carcinoma is important for developing a comprehensive differential.2) Appropriate histopathologic correlation leads to improved targeted management of these special subtypes avoiding delays in care.

## BREE-23 SHARPENING SKILLS, SHAPING FUTURES: NEXT-LEVEL BREAST BIOPSY TECHNIQUES FOR RESIDENTS

Fernanda Louise Sothe, MD (*Abstract Co-Author*) Nothing to Disclose
Lucy T. Sato, MD (*Abstract Co-Author*) Nothing to Disclose
Giselle G. Mello, PhD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela P. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Luciano F. Chala, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana C. Tucunduva, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Training Importance: Stress on training residents before they begin procedures.
- Percutaneous Biopsy Skills: Enable residents to perform core needle biopsy, fine needle aspiration, vacuum-assisted biopsy (ultrasound and stereotaxy-guided), and pre-surgical marking (ultrasound, mammography, stereotaxy-guided).
- Preparation Areas:
- Conducting focused pre-procedure anamnesis.
- Informing patients about procedure steps and risks.
- Executing procedures with correct technique.
- Handling in-procedure complications and queries.
- Managing post-procedure complications (e.g., hematomas, infections).

**TABLE OF CONTENTS/OUTLINE**

- Precision in Detection: Crucial for invasive breast procedures, affecting diagnostics and treatment.
- Specialized Training: Key for resident safety and efficacy in breast procedures.
- Innovative Training Methods:
- Core biopsy with olives in chicken for nodules.
- Stereotactic biopsy with eggshells in mortadella for microcalcifications.
- FNA with water in gloves for cysts.
- Ultrasound biopsy with quail eggs for solid-cystic lesions.
- Pre-surgical marking with chicken and metallic clips.
- Training Structure: Merges theory and practice over a month with weekly skill sessions.
- Training Objectives: Prepare residents for real scenarios, focusing on technical skills and decision-making.
- Professional Development Impact: Enhances skills, precision, and efficiency, transitioning novices to experts.
- Patient Safety Contribution: Simulations reduce learning risks, lower complications, and improve outcomes.

## BREE-24 BEYOND THE LINES: UNVEILING ARCHITECTURAL DISTORTION THROUGH IMAGING MODALITIES

Carla C. Benetti, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose

Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Defined as a distortion of the usual architecture of the breast parenchyma without visible nodules, architectural distortion (AD) is the third most commonly observed abnormality in cases of false-negative mammography and the third most common finding in nonpalpable breast cancer; - The AD can be an associated finding with other alterations and involves benign causes such as complex sclerosing lesion, radial scar, fat necrosis, post-surgical changes, and others; - Digital breast tomosynthesis (DBT) has played a relevant role in detecting AD, especially in dense breasts, by reducing overlapping tissue, allowing for better visualization of true lesions. However, literature studies demonstrate that AD found in DBT have a lower chance of representing malignancy and the AD is less likely to represent malignancy if there is no ultrasound correlation. Though, even in these cases, biopsy is still necessary since there is a risk of about 30% malignancy.

**TABLE OF CONTENTS/OUTLINE**

- To explore the imaging patterns of AD across various imaging modalities using cases from our institution and correlate them with histopathological findings; - To discuss the significant role of DBT in cases of AD; To discuss the malignant and benign causes of AD and their management.

## BREE-25 CURRENT INSIGHTS INTO COMMON GENETIC MUTATIONS IN BREAST CANCER: A COMPREHENSIVE REVIEW OF GUIDELINES AND IMAGING FINDINGS

Su Kim Hsieh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Aiah Alatoum, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Genetic mutations increase the risk of developing breast cancer. Mutations in genes BRCA1, BRCA2, TP53, PTEN, CDH1, STK11, ATM, CHEK2, and PALB2 are being considered to change recommendations for screening and management.
- Genetic panels are evolving, and the Institutional guidelines frequently update their recommendations.
- Some genetic mutations are more associated with specific biomarkers, for instance, BRCA 1 and 2 mutation carriers have a higher prevalence of triple negative cancers.
- Identifying a genetic mutation in a patient can impact their family members, and they should be tested.
- The knowledge of a particular genetic mutation can lead to a more extensive surgical treatment like mastectomy and contralateral prophylactic mastectomy or expand treatment options, like the use of poly (ADP-ribose) polymerase (PARP) inhibitor therapy for early-stage HER-2 negative cancer or metastatic disease.

**TABLE OF CONTENTS/OUTLINE**

1. Definition of somatic and germline mutations. 2. Definition of a wild gene and low and moderate-risk genes. 3. Definition of the possible genetic testing results. 4. Review the main genetic mutations that increase the risk of breast cancer. 5. Review of current indications for genetic testing. 6. Review of recommendations for patients with positive genetic testing regarding screening, treatment management, and prophylaxis. 7. Review of characteristics of breast cancer and lesions with potential for upgrade in patients with genetic mutation. 8. Illustrative cases of patients with genetic mutations and breast cancer or lesions with potential for an upgrade from our Institution.

## BREE-26 NON MASS LESIONS (NMLS) ON BREAST ULTRASOUND - THE GOOD, THE BAD AND THE UGLY

Alexandra Pop, MD (*Abstract Co-Author*) Nothing to Disclose
Roxana Pintican, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The incidence of non-mass lesions (NMLs) in breast US has been reported to range from 1% to 5.3%, with malignancy accounting for 6.3% to 53.8%, underscoring the importance of their accurate identification and diagnosis. GOALS:1. Describe the NML terminology on US2. Present typical benign (The GOOD) and malignant (The BAD) NML cases together with their pathology correlates: a. The GOOD - fibro-cystic changes, fibrosis, adenosis, ductal epithelial hyperplasia (typical and atypical), plasma cell mastitis, idiopathic granulomatous mastitis b. The BAD - DCIS with/without invasive component, IDC, invasive lobular carcinoma, solid papillary carcinoma, adenoid cystic carcinoma3. Discuss challenging cases (The UGLY) where NMLs may obscure or mimic benign/malignant features, leading to diagnostic uncertainty or misinterpretation; emphasize the added role of mammography and breast MR4. Provide a brief literature overview of different scoring and malignancy predicting systems a. The GOOD - presence of small cysts, absence of microcalcifications b. The BAD - linear-segmental distribution (50-76.6% associated with malignancy, mainly DCIS), associated microcalcifications (OR = 11.7), architectural distortion (OR 3.14), hypervascularity (Adler 3), stiffness (elasticity score 4 or 5, OR = 5.84).

**TABLE OF CONTENTS/OUTLINE**

1. Overview of NML definitions 2. The GOOD - benign NML 3. The BAD - malignant NML 4. The UGLY - masking/pitfalls NML 5. Scoring and malignancy prediction NML systems

## BREE-27 INTERPRETATIVE AND NON-INTERPRETATIVE USES OF ARTIFICIAL INTELLIGENCE IN BREAST IMAGING: A GUIDE FOR PRACTICING RADIOLOGISTS

Mai A. Elezaby, MD (*Abstract Co-Author*) Investigator, Exact Sciences Corporation;Research Grant, Exact Sciences Corporation
Roberta M. Strigel, MD, MS (*Abstract Co-Author*) Research support, General Electric Company
Pamela A. Propeck, MD (*Abstract Co-Author*) Nothing to Disclose
Lonie R. Salkowski, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan W. Woods, MD, MPH (*Abstract Co-Author*) Author, MRI Online
Alison R. Gegios, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. Burnside, MD, MPH (*Abstract Co-Author*) Research Grant, Hologic, Inc
Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thanh Phuong Nguyen, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Artificial intelligence (AI) algorithms have reinvigorated interest in its utility in radiology. Breast imaging is uniquely poised to both evaluate the utility of assistive AI and advance the integration of AI into real world clinical practice. Since AI is a diverse field, it has the potential to impact both non-

interpretive and interpretive applications extending beyond breast cancer detection. This exhibit reviews current and potential real world clinical applications of AI in breast imaging before, during, and after the acquisition of imaging examinations.

**TABLE OF CONTENTS/OUTLINE**

1. Artificial Intelligence Definitions 2. Historical challenges (a. Medicolegal/liability, b. Quality assurance, c. Racial biases, d. Variability in image sizes/quality, e. Multimodality imaging) 3. Unique features of breast imaging for AI applications (a. Standardized technique for screening mammography, b. BI-RADS lexicon and structured reporting, c. Mandated accreditation systems, d. Large repository of images, reports, and outcomes, e. Implications for individual and population health) 4. Non-interpretive AI for breast imaging (a. Patient scheduling and outreach, b. Patient education and communication, c. Cancer risk assessment, d. Workflow triage, e. Image enhancement, f. Image quality assessment) 5. Interpretive AI for breast imaging (a. Lesion detection, b. Decision support, c. Breast density assessment, d. Response to neoadjuvant therapy) 6. Anticipated barriers for integration (a. Payment models for individual and population health, b. Accessibility in low resource settings, c. Interpretation of audit metrics, d. Impact on training/assessments of physicians, residents, and fellows)

## BREE-28 ACE THE BREAST IMAGING TUMOR BOARD: A MULTIDISCIPLINARY APPROACH TO BREAST CANCER

Charisma DeSai, MD (*Abstract Co-Author*) Nothing to Disclose
Kiran N. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Cotes, MD (*Abstract Co-Author*) Nothing to Disclose
Vidhyulatha Sanata, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Radiology, pathology, and surgical/oncological treatment discussions are common practices in the management of breast cancer patients. Trainees, including residents and fellows, often participate in such discussions. In the era of personalized cancer treatment, it is crucial to understand not only the imaging findings of breast malignancies, but to correlate imaging and pathological characteristics to define molecular subtypes and guide oncological and surgical treatment strategies. This exhibit simplifies receptor definitions, breast cancer molecular subtypes and radiology-pathology correlation. Through representative radiological tumor board cases, we highlight patient treatments and outcomes. The goal is to prepare trainees and early radiologists with the necessary knowledge to provide valuable contributions to patient care and ace the breast imaging tumor board!

**TABLE OF CONTENTS/OUTLINE**

Receptor definitions: ER, PR, HER 2, Ki67 Breast Cancer Molecular Subgroups: Luminal A, Luminal B, HER 2 Positive, Basal-Like Imaging features of the different molecular subtypes on mammography, ultrasound, and MRI. Cancer treatment: Surgical and oncological treatment based on receptor status with review of patient's expected outcomes.

## BREE-29 THINK OUTSIDE THE BREAST: A PICTORAL ESSAY OF EXTRAMAMMARY LESIONS FOUND ON BREAST MRI AND HOW YOU DO NOT LOSE THEM

Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The primary utility of breast magnetic resonance imaging (MRI) is in screening of high-risk patients, detecting breast lesions, staging breast cancer, and assessing neoadjuvant treatment and breast implants. Although the examination primarily focuses on the breasts, it also allows visualization of surrounding structures. Between 17% to 34% of cases reveal at least one extramammary incidental finding, with around 20% of these findings being malignant and 14% to 20% clinically relevant benign conditions. The liver is the most common site of reported incidental findings (52-60%), followed by the lung and pleural cavity, with the gastrointestinal tract being the least common on Breast MRI. Breast MRI is primarily utilized for breast cancer staging and high-risk screening, findings in these extramammary structures hold significant importance, often influencing diagnostic investigation and subsequent follow-up.

**TABLE OF CONTENTS/OUTLINE**

To investigate the imaging of numerous extramammary findings using cases from our institution and correlate them with personal history. To examine the significance of describing these findings on breast MRI. To assess the prevalence of extramammary malignant lesions detected in the images and their subsequent therapeutic management. To give hints and tips for general radiologists of how they can remember to evaluate these structures on breast exams.

## BREE-3 MULTI-MODALITY REVIEW OF VASCULAR CONDITIONS OF THE BREAST

**Awards**
**Certificate of Merit**

Roberta M. Strigel, MD, MS (*Abstract Co-Author*) Research support, General Electric Company
Ryan W. Woods, MD, MPH (*Abstract Co-Author*) Author, MRI Online
Mai A. Elezaby, MD (*Abstract Co-Author*) Investigator, Exact Sciences Corporation;Research Grant, Exact Sciences Corporation
Thomas Loduca, MD (*Abstract Co-Author*) Nothing to Disclose
Lonie R. Salkowski, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Amy M. Fowler, MD, PhD (*Abstract Co-Author*) Author with royalties, RELX
Alison R. Gegios, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This educational exhibit aims to establish a framework for radiologists to identify imaging characteristics of vascular breast conditions, including those of arterial, venous, and lymphatic origins, and associated management recommendations. Although most vascular breast conditions are benign, it is important to recognize imaging findings that necessitate a biopsy to evaluate for possible underlying malignancy. It also may be helpful to communicate benign vascular conditions to the clinician as intervention for symptomatic relief or treatment of underlying systemic conditions may be indicated.

**TABLE OF CONTENTS/OUTLINE**

1. Review of Vascular Anatomy of the Breast 2. Overview of Techniques to Evaluate Vascularity in the Breast 3. Benign Vascular Conditions of the Breast (including systemic conditions) a. Atherosclerosis b. Congestive Heart Failure c. Unilateral breast edema secondary to central venous obstruction 4. Benign Vascular Lesions of the Breast a. Pseudoaneurysm b. Superficial thrombophlebitis (Mondor Disease) c. Lymphatic malformation d. Venous malformation e. Hemangioma and variants of hemangiomas (e.g., infantile hemangioma) 5. Role of Radiologic-Pathologic Correlation in Management of Certain Vascular Variants (e.g., anastomosing hemangioma) 6. Malignant Vascular Conditions of the Breast and Sequelae of Breast Malignancy a. Angiosarcoma b. Solitary Fibrous Tumor c. Portal Vein Tumor Thrombus

## BREE-30 PALPABLE BREAST LUMPS IN THE PEDIATRIC AND ADOLESCENT POPULATION: SONOGRAPHIC REVIEW OF COMMON AND LESS COMMON BENIGN DISORDERS

**Awards**
**Certificate of Merit**

Cory Z. Trivax, MD (*Abstract Co-Author*) Nothing to Disclose
Mehrvaan Kaur, MBBS (*Abstract Co-Author*) Nothing to Disclose
Alexander Satei, MBBS (*Abstract Co-Author*) Nothing to Disclose
Tima Tawil, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to learn about the normal development of the female breast, including in-utero, prepubertal, and pubertal stages. Understanding normal sonographic findings of the different Tanner stages of breast development can help radiologists recognize underlying abnormal breast disorders. Discussion of breast disorders in the pediatric and adolescent population will focus primarily on sonographic findings with review of etiology, pathology, follow up imaging/management if applicable, and more. Covered breast disorders will include, for example, juvenile fibroadenoma, gynecomastia, asymmetric breast buds, non-puerperal abscess, subcutaneous cyst, and others. Understanding benign and self-limiting breast disorders will help radiologists recognize suspicious sonographic findings warranting further investigation and/or management.

**TABLE OF CONTENTS/OUTLINE**

Normal breast development at birth and during puberty. Tanner stages of normal breast development. Normal sonographic findings of Tanner stages. Case-based discussion of variant developmental processes including: Premature thelarche, asymmetric breast bud development, gynecomastia. Case-based discussion of miscellaneous lesions including abscess, furuncle, lymph node, and subcutaneous cyst. Case-based discussion of benign neoplastic lesions including fibroadenoma/juvenile fibroadenoma, pseudoangiomatous stromal hyperplasia of the breast, and juvenile papillomatosis. Suspicious sonographic features prompting further imaging evaluation.

## BREE-31 MRI'S ROLE IN THE PUZZLE OF PAPILLARY BREAST LESIONS

Paula C. Moraes, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Abstract Co-Author*) Nothing to Disclose
Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian S. Ogata, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:1. To highlight the significance of papillary breast lesions and their varied diagnostic considerations.2. To delineate the characteristics of papillary breast neoplasms as depicted by magnetic resonance imaging (MRI) and establish correlations across different modalities such as ultrasound (US), mammography (MG), and tomosynthesis (TS).3. To underscore the pivotal role of MRI in the management of papillary neoplasms and explore its potential in guiding appropriate treatment strategies. 4. To explore MRI protocols tailored for evaluating breast papillary lesions. To exemplify, through clinical cases, how MRI can augment daily practice in assessing papillary lesions.

**TABLE OF CONTENTS/OUTLINE**

The presentation will follow the following structure: - Reviewing Breast Papillary Lesions and Their Differential Diagnosis; - Illustrating Papillary Lesions Cases on MRI with Correlations to Mammography, Ultrasound, and Pathology; - Demonstrating the Role of MRI in the Management of Papillary Lesions; - Evaluating the Optimal Timing and Method for Biopsy Procedures; - Summary and conclusion.

## BREE-32 PEDIATRIC BREAST ASSESSMENT: WHAT CAN WE FIND?

Tatiane M. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Galdino S. Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro Dias Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Julio Nather, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Elias JR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Larissa De Andrade Defendi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Pediatric breast complaints are relatively common in the general and pediatric radiologist's routine. Although breast pathology in this population is mostly benign, ruling out malignant neoplasms and pointing out differential diagnosis to guide management is crucial. Ultrasonography is the main tool to evaluate pediatric breast changes. The aim of this exhibit is: 1. To describe the sonographic technique in the assessment of pediatric breast pathology, highlighting tips and for an adequate evaluation in the pediatric scenario; 2. To review clinical and radiological features of common and unusual breast pathology in children.

**TABLE OF CONTENTS/OUTLINE**

1) Brief review of breast development and physiology; 2) Ultrasonography of the pediatric breast: exam technique, value of B-Mode and Doppler, imaging acquisition/documentation; 3) Practical tips to ensure child's collaboration; 4) Breast pathology in the pediatric population: epidemiology, brief clinical aspects regarding presentation, outcome and follow up; 5) Radiological features of usual and rare pediatric breast findings: a) Developmental Disorders (neonatal breast hypertrophy; gynecomastia); b) Infection (abscess); c) Benign masses (fibrocystic changes; juvenile fibroadenoma; venolymphatic malformation; hamartoma; lipoma; steatonecrosis; pseudoangiomatous stromal hyperplasia); d) Malignant masses (primary carcinoma); 6) When biopsy should be performed: clinical and radiological findings that elicit referral.

## BREE-33 IT IS NOT ONLY A FEMALE PROBLEM: RADIOLOGIC FINDINGS IN IMAGING MALE BREAST

Santos Simao (*Abstract Co-Author*) Nothing to Disclose
Monique Lambrakos (*Abstract Co-Author*) Nothing to Disclose
Marina Matos (*Abstract Co-Author*) Nothing to Disclose
Anna Campos (*Abstract Co-Author*) Nothing to Disclose
Beatriz Souza (*Abstract Co-Author*) Nothing to Disclose
Adriene Moraes Campos (*Abstract Co-Author*) Nothing to Disclose
ANA MACHADO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Outline and describe the various male breast diseases, exploring the most common, benign and non benign neoplasms, and how they relate to the imaging findings.Describe different imaging methods and their significance in distinguishing differential diagnosis.Discuss the significance of understanding the male breast disease, especially as the diagnosis is more delayed.Build a flowchart to describe differential diagnosis on male breast disease.

**TABLE OF CONTENTS/OUTLINE**

Introduction;Clinical and epidemiological aspects of different male breast diseases; A flowchart to summarize differential diagnosis on male breast disease;A case-based review of original cases from breast centers of a tertiary hospital and a specialized clinic, showing different imaging findings aimed to improve diagnostic efficiency;Explore the imaging features of each male breast disease described in this education exhibit to assist in early detection;Take-home messages;References.

## BREE-34 BREAST CANCER STAGING USING CONTRAST-ENHANCED IMAGING: ROLE OF MRI, CEM AND MDCT

Laura S. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Felipe SR, PhD (*Abstract Co-Author*) Nothing to Disclose
Mariana Galupo (*Abstract Co-Author*) Nothing to Disclose
Mariah C. Wanderley (*Abstract Co-Author*) Nothing to Disclose
Leticia Cavalcante (*Abstract Co-Author*) Nothing to Disclose
Soraia Damiao, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Contrast-enhanced breast imaging methods can improve locoregional staging compared to conventional non-enhanced breast imaging (mammography, DBT, and ultrasound).• Breast MRI with dynamic contrast enhancement (DCE) is the most accurate method to assess breast cancer extent through measurement of tumor size, detection of intraductal components and additional lesions, as well as signs of invasion of the nipple, skin, and chest wall.• Contrast-enhanced mammography (CEM) has emerged as an alternative for locoregional staging, with similar accuracy to breast MRI to assess tumor size and additional lesions. However, CEM is not widely available yet, and it has limited value in some cases, such as in patients with implants and peripherally or posteriorly located tumors.• Contrast-enhanced multidetector computed tomography (MDCT) with contrast enhancement is used for distant staging in advanced breast cancer patients. Studies show it can also assess breast lesions when performed in a prone position with a dedicated breast evaluation protocol, without additional radiation or contrast doses. MDCT is a viable alternative to MRI and contrast-enhanced mammography, particularly in low- to middle-income regions.

**TABLE OF CONTENTS/OUTLINE**

Overview of contrast-enhanced breast imaging methods (MRI, CEM, and MDCT) and its role in breast cancer management.Examples of breast cancer locoregional staging using MRI, CEM, and MDCT for tumor size assessment and detection of intraductal components, additional lesions, and invasion of the nipple, skin, and chest wall.Suggested decision-making workflow for selecting the appropriate imaging technique based on clinical needs, imaging availability, and cost-effectiveness.

## BREE-35 ORIGIN OR SPREAD - MULTIMODALITY IMAGING APPROACH FOR DISTINGUISHING BREAST METASTASES AND PRIMARY MALIGNANCIES

Juliana A. Souza (*Abstract Co-Author*) Nothing to Disclose
Bruna Isabela S. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Cavalcante (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Victoria Pacheco, MD (*Abstract Co-Author*) Nothing to Disclose
Laura B. De Melo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To distinguish the most common multimodality imaging features between breast metastases from extramammary cancer and primary breast malignancies.2. To understand the relevance of integrating multiple imaging techniques alongside the clinical context to discern between primary and secondary breast lesions, establishing an accurate diagnosis, staging, and treatment plan.

**TABLE OF CONTENTS/OUTLINE**

BREAST METASTASES FROM EXTRAMAMMARY CANCERS1. Location: Typically peripheral and superficial, notably in the upper outer quadrant.2. Imaging Features: Exhibits variability, often appearing as round or oval masses with well-defined margins; presentation varies based on the primary tumor3. Clinical Context: Typically associated with a known metastatic cancerPRIMARY BREAST CARCINOMAS1. Locations: Varied, with a higher prevalence in the central breast (fibroglandular tissue area)2. Imaging Features: Spiculated margins, calcifications, posterior acoustic shadowing, and axillary lymph node involvement are suggestive features of primary breast cancer3. Clinical Context: More prevalent than metastases, even in patients with documented extramammary neoplasms.

## BREE-36 CHOSEN: THE IMPACT OF BREAST BIOPSY MARKER (CLIP) SELECTION ON BREAST IMAGING PROCEDURES, FOLLOW-UP, AND COSTS

Christine U. Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Miral M. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Megha M. Kapoor, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Gary J. Whitman, MD (*Abstract Co-Author*) Consultant, Siemens AG;Editor, Wolters Kluwer nv

Elsa M. Arribas, MD (*Abstract Co-Author*) Stockholder, 3D Systems, Inc
Tanya W. Moseley, MD, PhD (*Presenter*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC

**TEACHING POINTS**

1. Review the history and the role of biopsy markers in breast imaging 2. Review the features of markers from the lenses of radiologists, pathologists, and surgeons 3. Review the impact of marker selection on subsequent breast imaging interpretation and costs 4. Evaluate best practices for identifying markers on ultrasound

**TABLE OF CONTENTS/OUTLINE**

I. History and role of biopsy markers II. Features of markers A. Size and configuration B. Makeup 1. Consideration for patients with allergies and inflammatory reactions C. Embedding materials 1. Consideration for patients with allergies and inflammatory reactions III. Impact of marker selection A. Visibility and stability of markers on various breast imaging modalities B. Visibility of markers in the breast and lymph nodes after neoadjuvant chemotherapy C. Localization of clips on follow-up imaging and surgical planning D. Markers for patients with nickel allergies E. Costs IV. Best marker practices V. Conclusion VI. References

## BREE-37 MULTIMODALITY IMAGING REVIEW OF CALCIFIED AND NONCALCIFIED DCIS WITH RADIOLOGIC-PATHOLOGIC CORRELATION

Janice Thai, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel E. Grenier, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) DCIS can manifest as both calcifications and noncalcified lesions. 2) Pathologic subtypes of DCIS are classified based on microscopic growth pattern.

**TABLE OF CONTENTS/OUTLINE**

1) Review of multimodality imaging appearances of calcified and noncalcified DCIS. 2) Review of the spectrum of pathologic subtypes of DCIS and variants. 3) Review of current management options for DCIS.

## BREE-38 DISTINGUISHING MALIGNANT FROM BENIGN CAUSES OF BREAST SIZE CHANGES: A CASE-BASED PRIMER FOR THE RADIOLOGIST

**Awards**
**Cum Laude**

Wendi A. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
Fara Y. Shikoh, MD (*Abstract Co-Author*) Nothing to Disclose
Aurela I. Clark, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaoqin J. Wang, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hannah Conley, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review current literature for guidance in the evaluation and management of breast size changes. Illustrate the imaging features of both malignant and non-malignant causes of breast shrinkage and enlargement. Elucidate clinical context that aids in distinguishing malignant from benign causes of breast size fluctuations. Highlight teaching points for each case to bolster confidence in making a timely diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Not infrequently, women visit breast clinics with concerns of breast size changes. Radiologists play a pivotal role in combining clinical findings and imaging features to guide appropriate management. We will stress the importance of a thorough clinical history and physical exam and provide evidence-based guidance of management for radiologists encountering patients with this concern. Notably, the "shrinking breast" in invasive lobular carcinoma (ILC) which comprises 10-15% of breast cancer will be highlighted. Imaging features of ILC are often occult and a high level of suspicion must be maintained when clinical complaints are present. Conversely, swollen breasts raise concern for inflammatory breast cancer (IBC) which presents with the characteristic imaging findings of diffuse skin thickening ("peau d'orange"). When available, imaging findings will be correlated to histopathologic diagnosis. Numerous benign conditions can also influence breast size changes and will be contrasted with malignant causes. We will educate learners on the telltale benign versus malignant imaging features and provide a summary of teaching points.

## BREE-39 PASH RADIOLOGICAL PRESENTATION

Ligia A. Yamashita, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia A. De Camargo Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela G. Giannotti, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa Moyses, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian N. Omura, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Saccarelli, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela F. Vieira Vendramini (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael R. Santos Ferreira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Pseudoangiomatous stromal hyperplasia (PASH) is a benign stromal proliferation that mimics a vascular lesion histologically. It affects individuals of varying ages, including men, with women in reproductive age and elderly women on estrogen replacement therapy being the most affected group. Clinically, PASH may present as a mass or thickening upon physical examination, with incidental histological findings being the most common presentation. While a hormonal etiology is considered, the pathophysiology is not fully understood. On mammography, PASH typically appears as focal asymmetry, while on ultrasound it presents as a solid, well-defined, non-calcified mass. PASH has a varied appearance on MRI but most commonly manifests as a region of non-mass enhancement with persistent kinetic features.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Classical PASH images on US and MG. 3. Diferent forms of PASH presentantion on US. 4. PASH being a diferential diagnosis from invasive breast carcinoma. 5. PASH associated with gigantomastia on a teenager.

## BREE-4 COMPLEX SOLID AND CYSTIC BREAST LESIONS

Liva Andrejeva-Wright, MD (*Abstract Co-Author*) Nothing to Disclose
Riddhi Borse, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The exhibit focuses on enhancing the interpreting radiologist's ability for evaluating complex solid and cystic breast lesions using different modalities including ultrasound, computed tomography, and magnetic resonance imaging.2. It will enlist various examples of benign and malignant complex solid and cystic breast lesions visualized on different imaging modalities.3. The exhibit will provide insights into key differentiating imaging features of benign versus malignant complex and cystic breast lesions using several case examples and illustrations to help radiologists build an appropriate understanding of reassuring versus worrisome imaging findings.4. It will help the interpreting radiologist build optimal use of BIRADS nomenclature to help efficiently report complex solid and cystic breast lesions and ultimately guide efficient clinical management.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to use of different imaging modalities for assessment of solid and cystic lesions of the breast.2. Enlisting salient imaging features, illustrations and case examples of benign complex solid and cystic lesions of the breast using different imaging modalities. 3. Enlisting salient imaging features, illustrations and case examples of malignant complex solid and cystic lesions of the breast using different imaging modalities. 4. Comparison and contrast of various imaging features to help differentiate benign from malignant cystic and solid lesions including reassuring vs worrisome findings.5. Optimal use of BIRADS nomenclature to help efficiently report complex solid and cystic breast lesions and guide clinical management.

## BREE-40 HEAR YE, HEAR YE: HOW TO BE AN EFFECTIVE ADVOCATE

Amy K. Patel, MD (*Abstract Co-Author*) Medical Advisor, Kheiron Medical Technologies Ltd;Consultant, Hologic, Inc
Priscilla J. Slanetz, MD, MPH (*Abstract Co-Author*) Royalties, Wolters Kluwer nv
Stamatia V. Destounis, MD (*Abstract Co-Author*) Medical Advisory Board, iCad, Inc
Ann L. Brown, MD (*Abstract Co-Author*) Consultant, Elucent Medical
Fatima Elahi, DO, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In breast imaging, ensuring equitable access to cancer screening is critical to improving health outcomes for all women, especially those from vulnerable groups. Ensuring appropriate reimbursement for existing and emerging imaging techniques is also important. Therefore, it is essential that all breast radiologists possess the skills to be effective advocates for our subspecialty and patients.

### TABLE OF CONTENTS/OUTLINE

In this exhibit, we will provide a step-by-step guide covering the essential skills to become an effective advocate. The topics that will be covered include: personal and practice branding, social media use, public speaking tips, developing an elevator speech, coalition building, lobbying tactics, impactful written communication including drafting resolutions and legislative bills and creating fact sheets, story telling, and leadership skills.

## BREE-41 THE MULTIPLE FACES OF BREAST VASCULAR PATHOLOGY; TUMORS AND BEYOND

Maria Guerrero Martin (*Abstract Co-Author*) Nothing to Disclose
Nancy Sanchez Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Myriam F. Montes, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Lopez Herrero, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

There is a great variety of breast vascular diseases, with abnormalities that affect both arteries and veins, as well as benign and malignant tumors. These lesions are unusual, unknown and may appear on imaging in different ways; therefore, several techniques are frequently required to approach the diagnosis (even histologic study if there is a mass). For these reasons, the objectives of this presentation are to know the anatomy of breast vasculature and to identify its main disorders, with their typical and multimodal imaging features. Particular attention is focused on tumors, with radio-pathologic correlation; this aspect is especially important for breast imagers, because they need to ensure the concordance after biopsy. Thus, the radiologist will be able to reach an accurate diagnosis, and the patient will get a correct treatment or follow-up plan.

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Normal breast vasculature. 3. Vascular disorders of the breast: atherosclerosis, congestive heart failure, superficial thrombophlebitis, breast varyx and other entities. 4. Vascular tumors of the breast 4.1. Benign proliferations: hemangioma (cavernous and others), angiolipoma and papillary endothelial hyperplasia (Masson’s tumor). 4.2. Malignant proliferations: angiosarcoma (primary and secondary). 5. Differential diagnosis of vascular tumors of the breast (pathologic mimics): pseudoangiomatous stromal hyperplasia, myofibroblastoma, Phyllodes tumor and metaplastic carcinoma. 6. Conclusions.

## BREE-42 RADIOLOGIC-DERMATOLOGIC ATLAS OF SKIN PATHOLOGIES FOR THE BREAST RADIOLOGIST

**Awards**
**Cum Laude**

Derek L. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Dorothy A. Lowell, MD (*Abstract Co-Author*) Nothing to Disclose
Shelby Breit, BS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Skin changes of the breast such as rashes, erythema, or raised cutaneous lesions frequently present as a diagnostic challenge for breast imaging radiologists. These patients often present with either no relevant imaging findings or imaging findings which are nonspecific. Currently, there are limited resources available that serve as a clinical reference atlas for breast radiologists concerning skin pathologies associated with the breast. It is imperative for breast radiologists to assess the patient's clinical history in conjunction with any cutaneous changes and imaging findings, in order to determine whether a skin punch biopsy is warranted. The purpose of this educational exhibit is to provide a detailed review of common benign and malignant cutaneous conditions of the breast, enhanced with dermatologic and radiologic images, to serve as a comprehensive reference for breast imaging radiologists.

**TABLE OF CONTENTS/OUTLINE**

1. Review the normal anatomy of the skin of the breast as well as the normal mammographic, ultrasound and MRI appearance. 2. Review common benign dermatologic conditions of the skin of the breast with clinical photos and multimodality imaging correlates including epidermal inclusion/sebaceous cysts, folliculitis, candidiasis infections, herpes zoster, mastitis, edema, keloids, neurofibromas, and granular cell tumors.3. Review malignant cutaneous manifestations of the breast with clinical photos and multimodality imaging correlates including inflammatory breast cancer, local recurrence, angiosarcoma, Paget's disease, and melanoma.

## BREE-43 BI-RADS 3 IN BREAST MRI INTERPRETATION: APPROPRIATE AND INAPPROPRIATE USE

**Awards**
**Certificate of Merit**

Laura Heacock, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Alana A. Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriu Reig, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Criteria for use of BI-RADS 3 in MRI are less well-established than for MG and US. 2. Oval T2 hyperintense mass with circumscribed margins and homogeneous internal enhancement or dark internal septations on baseline MRI may be given BI-RADS 3. 3. Masses lacking T2 hyperintensity, with suspicious morphologic or kinetic characteristics, new or enlarging findings, and most nonmass enhancements should not be given BI-RADS 3.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Criteria for use of BI-RADS 3 in MRI have not been well-established b. Frequency of use of BI-RADS 3 c. Cancer yield i. Population undergoing MRI screening is different than population undergoing mammography or ultrasound 2. Indications for BI-RADS 3 a. Mass on baseline MR with benign morphologic and kinetic features b. Unique focus i. Exercise caution if new or enlarging ii. Balance of sensitivity with specificity and PPV. Some foci will represent small cancers, which will be identified on subsequent exam. c. Regional NME on baseline 3. Inappropriate use a. BPE should be BI-RADS 2 b. NME - new, asymmetric, or suspicious distributions should be BI-RADS 4 c. Patients beginning breast cancer treatment 4. Follow up interval a. 5th edition of BI-RADS Atlas recommends 6 mo f/u b. Evidence 12 mo f/u may be appropriate c. Evidence for 6 mo f/u after benign concordant biopsy 5. Future directions a. Expected changes with the next BI-RADS atlas i. Goal: </= 5% of examinations given BI-RADS 3 ii. Indications iii. Focus no longer part of the lexicon b. Improving specificity using DWI, AI c. Impact of abbreviated MRI i. Do patients on a yearly MRI schedule need six month follow up of BI-RADS 3 lesions? ii. Lack of T2 d. Using personalized risk assessment to refine BI-RADS assessments

## BREE-44 BREAST CANCER SUBTYPES BASED ON MAMMOGRAMS: APPROACH FOR NEW RADIOMICS FEATURES USING VISION TRANSFORMER

Hideaki Tamori (*Abstract Co-Author*) Nothing to Disclose
Akifumi Yoshida, MSc, RT (*Abstract Co-Author*) Konica Minolta, Inc
Satoshi Kasai, PhD (*Abstract Co-Author*) Konica Minolta, Inc;TOITU Co, Ltd;Marubeni Corporation
Chiharu Kai (*Presenter*) Former Employee, Konica Minolta, Inc

**TEACHING POINTS**

We will present our research that have applied new Radiomics features to classifying subtypes of breast cancers on mammograms. The purpose of this exhibit is to: - Understand an overview of Radiomics research and the diversified Radiomics features, - Recognize Radiomics features using Vision Transformer (ViT), - Learn about a new model for calculating Radiomics features combining ViT, Convolutional Neural Network (CNN) and Principal Component Analysis (PCA), - Review mammograms with cancers, and how related to the new Radiomics features with breast subtype classification.

**TABLE OF CONTENTS/OUTLINE**

1) Common Radiomics research, 2) Types of Radiomics features, 3) Radiomics features with ViT, 4) The new model for calculating Radiomics features combining ViT, CNN, and PCA •ViT (global features): identifying relationships between distant regions •CNN (Local features): identifying relationships between close regions •PCA (Super-global features): identifying the image features of an entire image, 5) The advantage of the combining new model, 6) Our research: classifying subtypes of breast cancers on mammograms •The results of the classification •The characteristics of the feature importance of the top five features •To review mammograms with cancers and the new Radiomic features : triple-negative, HER2, Luminal A, Luminal B breast cancers •Scatter plots for each feature importance, 7) Summary

## BREE-45 AN ATLAS OF BIRADS FOR CONTRAST ENHANCED MAMMOGRAPHY: BEARING THE WEIGHT OF PRECISE REPORTING

**Awards**
**Certificate of Merit**

Derek L. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Sujata V. Ghate, MD (*Abstract Co-Author*) Research Grant, Bracco Group;Reader, QT Ultrasound, LLC;Travel support, QT Ultrasound, LLC
Eun L. Langman, MD (*Abstract Co-Author*) Nothing to Disclose
Victoria A. Wells, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Contrast enhanced mammography (CEM), similar to MRI, is a functional imaging technique with a higher sensitivity for breast cancer detection than mammography or ultrasound. In 2011, the FDA approved CEM as an adjunct diagnostic tool, resulting in increased implementation of CEM in breast imaging practices. CEM can be utilized to evaluate breast symptoms or screen detected abnormalities, to assess extent of newly diagnosed breast cancer, response to neoadjuvant chemotherapy, and to interrogate for occult breast malignancy in the setting of metastatic axillary lymphadenopathy with unknown primary. It is an effective alternative to MRI for those with a contraindication or intolerance. More recently in 2022, the BIRADS lexicon for CEM was introduced to ensure consistency of reporting through standardized terminology. Therefore, it is important for breast imaging radiologists to be familiar with the technique and lexicon to ensure proper use and accurate reporting. Utilizing a case-based approach, this exhibit will demonstrate the utility of CEM in different clinical indications and provide examples of appropriate use of the BIRADS CEM lexicon.

**TABLE OF CONTENTS/OUTLINE**

- Review CEM technique. - Present commonly encountered benign and malignant breast findings on CEM with appropriate BI-RADS descriptors - Discuss the diagnostic clinical indications for CEM using case-based examples. - For each case, highlight the imaging findings using the appropriate BIRADS lexicon.

## BREE-46 NEW BREASTS MAY NOT BE BEST: IMAGING OF BREAST AUGMENTATION AND ENHANCEMENT PROCEDURES AND THEIR COMPLICATIONS

Mine Sorkun, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Sasse, BA (*Abstract Co-Author*) Nothing to Disclose
Douglas S. Katz, MD (*Abstract Co-Author*) Nothing to Disclose
Liva Andrejeva-Wright, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Nadia Solomon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Riddhi Borse, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. This exhibit will help the radiologist build a foundation in recognizing salient imaging features of breast implants and injectables, understanding their medical and surgical implications, and facilitate accurate reporting to best guide medical and surgical teams. 2. It will describe the imaging appearances of different types of breast implants and injectables, including normal post-operative findings and the range of short and long-term complications which can be seen. 3. Cases examples will also be used to highlight which imaging modality - ultrasound, CT, or MRI - would be best employed for optimal assessment of normal and critical findings.

### TABLE OF CONTENTS/OUTLINE

1. Imaging features of Saline implants:a. Appearance on Mammography vs ultrasound.b. Normal vs ruptured implants. 2. Imaging features of Silicone implants:a. Intracapsular vs Extracapsular rupture.b. Contractures, herniations, leaks and folds. 3. Imaging appearance of various cosmetic injectables:a. Fat injections.b. Silicone and other cosmetic injectables. 4. Infection and inflammation of breast implants: Salient imaging features. 5. Fluid collections associated with implants: Hematoma, Seroma, Abscess etc.

## BREE-47 BIRADS 3 UNVEILED: YOUR MULTIMODAL MAP TO SAFETY

Andrea Di Ninno, MD (*Abstract Co-Author*) Nothing to Disclose
Luciano F. Chala, MD (*Abstract Co-Author*) Nothing to Disclose
Giselle G. Mello, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatiana C. Tucunduva, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius Nobre, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understanding BIRADS 3 Classification: Emphasize the definition, criteria, and significance of BIRADS 3 in breast imaging, highlighting its role as an indicator for probably benign findings with a recommendation for short-term follow-up.
- Decision-Making Process: Discuss the critical thinking process involved in categorizing a finding as BIRADS 3, including the evaluation of imaging characteristics and patient history.
- Management Strategies: Outline the recommended follow-up protocols for BIRADS 3 findings, such as the appropriate intervals for re-imaging and factors influencing the decision to advance to biopsy.
- Risk Assessment and Communication: Teach how to assess the risk associated with BIRADS 3 lesions and the next steps.

### TABLE OF CONTENTS/OUTLINE

- Introduction to BIRADS 3: Overview of the BIRADS system, focusing on the BIRADS 3 category, its purpose, and importance.
- Criteria for BIRADS 3 Classification: Examination of imaging features and patient history that justify a BIRADS 3 classification, with examples.
- Imaging Modalities and BIRADS 3: How different imaging modalities contribute to identifying and classifying BIRADS 3 findings.
- Follow-Up Protocols for BIRADS 3 Lesions: Guidelines for monitoring, including follow-up intervals and additional imaging tests.
- Biopsy Considerations for BIRADS 3 Findings: When a biopsy may be considered for a BIRADS 3 lesion, including patient-specific factors.
- Case Studies and Review of Literature: Analysis of case studies and literature review on the management of BIRADS 3 lesions.

## BREE-48 BEFORE IT POPS: MRI FEATURES OF BREAST AUGMENTATION SURGERY AND IMPLANT COMPLICATIONS

Ilany L. Valdivia I, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica A. Perdomo SR, MD (*Abstract Co-Author*) Nothing to Disclose
Rocio D. Trevino, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Garza, MD (*Abstract Co-Author*) Nothing to Disclose
Elena M. Sanchez Siller, MD (*Abstract Co-Author*) Nothing to Disclose
Yesika Davila Zablah, MD (*Abstract Co-Author*) Nothing to Disclose
Ia M. Sanchez Carenzo, MD (*Abstract Co-Author*) Nothing to Disclose
Karla I. Soto, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Guerra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize the normal imaging appearance of breast implants with MRI.- Describe the technical characteristics of the MRI protocol for patients who have undergone breast augmentation surgery.- Discuss the normal findings after breast augmentation surgery by MRI.- Identify imaging signs of early and late complications of breast augmentation surgery.

### TABLE OF CONTENTS/OUTLINE

- MRI protocol in the evaluation of the augmented breast- Implant locations- Implant types- Normal findings after breast augmentation surgery- Acute complications:Peri-implant fluid: hematoma, infection, seromaInfection- Late complications: Rupture: intracapsular rupture, extracapsular rupture. Capsular contracture. Fat necrosis and gel bleed. Anaplastic large cell lymphoma

## BREE-49 BEYOND THE SCAN: UNDERSTANDING THE JOURNEY OF YOUNG WOMEN WITH BREAST CANCER

Amy K. Patel, MD (*Abstract Co-Author*) Medical Advisor, Kheiron Medical Technologies Ltd;Consultant, Hologic, Inc
Lakshmi Priya, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Breast cancer cases in young women are rising and are often more aggressive and present in later stages due to delay in screening. Risk factors include genetic mutations, smoking, alcohol use, OCPs, older age of first pregnancy, high BMI, sedentary lifestyles, and low socioeconomic status. All women should undergo a risk assessment by age 25 and if high risk adhere to the latest screening guidelines. Breast cancer in young women can present in various forms, and this exhibit will review the multimodality presentation of some common forms of breast cancer in young women. Multimodal treatment options are available with special consideration of treatment impact on breast conservation, fertility, and mental health in young women. Clinicians should recognize that mammography is safe during breast feeding and pregnancy to prevent delays in diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Background, epidemiology, and clinical presentation Risk factors and genetics High-risk screening guidelines Case based imaging review of breast cancer in young women Managment, treatment, and breast conserving techniques Psychosocial impact and effect on fertility Imaging guidelines during breast feeding and pregnancy

## BREE-50 A SPECTRUM OF BREAST SARCOMAS WITH RADIOLOGIC-PATHOLOGIC CORRELATION

Katja Pinker-Domenig, MD, PhD (*Abstract Co-Author*) Speakers Bureau, European Society of Breast Imaging;Speakers Bureau, Siemens AG;Speakers Bureau, IDKD;Speakers Bureau, Canon Medical Systems Corporation;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Merantix Healthcare;Consultant, AURA Health
Dilip Giri (*Abstract Co-Author*) Nothing to Disclose
Jorge L. Huayanay, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Primary breast sarcomas are a very rare and heterogeneous group of aggressive malignant neoplasms that arise from connective tissue. Sarcomas constitute less than 1% of all breast cancers and account for less than 5% of all soft tissue sarcomas. 2. This exhibit will review the spectrum of imaging and histopathology features of breast sarcomas. 3. This review will emphasize diagnostic difficulties, potential imaging pitfalls and differential diagnoses.

**TABLE OF CONTENTS/OUTLINE**

The goals of this exhibit are to: Provide a pictorial review of the diverse imaging appearances of breast sarcomas. Discuss specific imaging and pathological characteristics of breast sarcomas. Familiarize the audience with the imaging features of breast sarcomas, thereby helping to provide a complete differential diagnosis. These major featured entities include: • Angiosarcoma • Leiomyosarcoma • Osteosarcoma • Rhabdomyosarcoma • Synovial sarcoma • Undifferentiated pleomorphic sarcoma • Malignant phyllodes tumors and metaplastic carcinomas that develop areas of sarcomatous differentiation.

## BREE-51 UNDERSTANDING UNIQUE BREAST CANCER RISK FACTORS AMONG WOMEN VETERANS

Lucy B. Spalluto, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Pooja Agrawal, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Guideline-based early and supplemental breast cancer screening for women at high risk for breast cancer is an evidence-based practice that improves morbidity and mortality through early detection and treatment. 2. Young women Veterans represent a unique population who may be at high risk for breast cancer due to additional risk factors beyond those of the general population. 3. Understanding the unique risk factors of young women Veterans diagnosed with breast cancer may offer an opportunity to reduce morbidity and mortality among women Veterans.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: a) Describe breast cancer morbidity and mortality statistics, including existing disparities, for women in the general U.S. population, b) Compare these statistics to those of women Veterans. 2. Breast cancer risk factors: a) Review breast cancer risk factors for the general population, b) Review unique breast cancer risk factors among women Veterans, such as chemicals (agent Orange, contaminated water), radiation (nuclear weapons), air pollutants (burn pit smoke), occupational hazards (asbestos, industrial solvents), warfare agents (chemical and biological weapons). 3. Case review: a) Present an example case (with supplemental imaging) of a young woman Veteran with breast cancer to showcase the patient's diagnosis and outcome. 4. Conclusion: a) Understanding unique breast cancer risk factors among young women Veterans can facilitate strategies that can ultimately reduce breast cancer mortality in this population.

## BREE-52 ATYPICALS FIBROADENOMAS: REBELS WITHOUT A CAUSE OR JUST MISUNDERSTOOD?

Daniel Sandoval Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Sara S. Herrera Lemus, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Balbas Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Luz E. Bastidas Caicedo, MD (*Abstract Co-Author*) Nothing to Disclose
Kictzia Yigal Larios Cruz (*Abstract Co-Author*) Nothing to Disclose
Ilse G. Gonzalez Palma I, BMBCh (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Investigate the clinical and radiological characteristics of atypical fibroadenomas to enhance their diagnosis and clinical management.• Evaluate the diagnostic accuracy of different imaging modalities, such as mammography and ultrasound, in identifying atypical fibroadenomas.• Analyze the risk factors associated with the development of atypical fibroadenomas and their relationship with progression to malignancy.• Explore current therapeutic approaches and their impact on clinical outcomes in patients with atypical fibroadenomas.• Investigate the correlation between imaging findings and pathological characteristics of atypical fibroadenomas to improve diagnostic accuracy and clinical management. • Determine the effectiveness of a multidisciplinary approach including coordination among radiologists, pathologists, and surgeons.

**TABLE OF CONTENTS/OUTLINE**

This study examines atypical fibroadenomas, an important variant of benign breast tumors, which present diagnostic and therapeutic challenges. Imaging modalities are reviewed, highlighting characteristics on mammography and ultrasound, as well as the importance of imaging-pathology correlation in accurate diagnosis. Additionally, therapeutic approaches, including observation, image-guided biopsy, and surgical excision, are discussed. The importance of a multidisciplinary approach to optimize management of patients with atypical fibroadenomas is emphasized. This abstract provides a comprehensive and updated insight into this clinical entity, offering relevant information for clinicians and radiologists involved in the diagnosis and treatment of atypical fibroadenomas. Presentation Type: Research Abstract.

## BREE-53 ENCOUTERING INTRUDERS: FOREIN BODIES DETECTED IN MAMMOGRAPHY

Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Regina C. Pereira SR, MD (*Abstract Co-Author*) Nothing to Disclose
Aline Morley (*Abstract Co-Author*) Nothing to Disclose
Camila D. Figueiredo, MMed (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Help radiologists to recognize different types of foreign bodies in mammograms, including medical devices, aesthetic procedures, metal artifacts and devices related to diagnosis and treatment of breast cancer.Identify mammographic characteristics that help distinguish a several foreign bodies.Avoid additional investigations due to misinterpretations.

**TABLE OF CONTENTS/OUTLINE**

Foreign bodies definitionOverview of the importance of recognizing foreign bodies in mammography.Description of various foreign bodies usual and unusual encountered in mammography divided into medical devices, aesthetic procedures, metal artifacts and devices related to diagnosis and treatment of breast cancer, and others.Presentation of several cases illustrating the recognition, localizations, and management of foreign bodies in mammographySummary of key points covered and final thoughts on the importance of recognizing foreign bodies in mammography.

## BREE-54 IMPLANTS ILLUSTRATED: A TUTORIAL FOR ULTRASONOGRAPHIC EVALUATION OF IMPLANTS

Erica E. Francolin Federicci, PhD (*Abstract Co-Author*) Nothing to Disclose
Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Silva Malta, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Racy, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Colombo, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
Renato L. Ribeiro, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To teach ultrasound technique parameters to an adequate evaluation while avoiding common pitfalls;To describe normal appearance and the usual composition of breast implants on ultrasound;To show cases of complications related to breast implants on this method;To propose a checklist to evaluate implants and to diagnose complications;To provide tools and examples in order to write a structured report.

**TABLE OF CONTENTS/OUTLINE**

A significant change in the 2022 Food and Drug Administration (FDA) guidelines affecting radiologists is the inclusion of ultrasound as an alternative to magnetic resonance imaging for initial imaging surveillance for implant ruptures in asymptomatic patients and it is essential for any radiologist interpreting these studies.Breast implants are frequently encountered in breast imaging studies. There are many variations in lumens, positioning, morphology and other components among implants. Ultrasonographic characterization serves as a powerful tool in identifying gross structural abnormalities, ruptures and other complications.This pictorial essay aims to delve into the normal and abnormal imaging appearances of breast implants on ultrasound, including illustrative cases of ruptures, fractures and complications.Moreover, we will propose a checklist for recognizing the type of implant and identifying potential abnormalities or complications. We will also present strategies for equipping radiologists with the tools necessary to compose a structured report. This comprehensive approach aims to improve the understanding and management of breast implants using ultrasound imaging.

## BREE-55 INVASIVE LOBULAR CARCINOMA: CATCH ME EARLY, IF YOU CAN!

Patricia M. Gomes El Bacha, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Couto De Mores, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Invasive lobular carcinoma (ILC) is the second most common type of breast cancer. It originates in the lobes of the glands, invades the surrounding tissues and often does not form a palpable nodule. The diagnosis of ILC is challenging, especially in MG and clinical examinations, and is often diagnosed by MRI or US. Understanding the radiological features of ILC is essential for accurate diagnosis. It is often clinically silent, resulting in late-stage diagnosis and more frequently manifests with distant metastatic disease. It tends to occur in older women with a maximum incidence in postmenopausal. The hormone replacement therapy increases the risk of ILC. The US is better than MG to detect non mass lesions and for evaluation of axillary nodes. Hypoechoic irregular mass is the most common ultrasonographic appearance, but non-mass lesions may occur on US and MRI less frequently. In histopathological evaluation, the pleomorphic pattern there is little or no desmoplastic reaction of the invaded tissue. In the macroscopy it often presents as irregular and poorly delimited tumors that can be difficult to define macroscopically due to the diffuse growth pattern of the cellular infiltrate.The objective of this exhibition is to present, through illustrative cases, a practical approach to the imaging and histopathological findings of ILC manifestations.

**TABLE OF CONTENTS/OUTLINE**

Introduction. Histopathological and imaging aspects. A case-based review of original cases from the breast department of hospitals showing characteristics of manifestations and challenges in the diagnosis of ILC, through the perspective and purpose of a practical approach. Take-home messages. References.

## BREE-56 BENEATH THE SURFACE: A RADIOLOGICAL VOYAGE INTO DEEP LESIONS ON BREAST EXAMS

Paula C. Moraes, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa M. Yano, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Abstract Co-Author*) Nothing to Disclose
Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian S. Ogata, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To discuss the basic breast anatomy and to define the three breast zones: premammary, mammary and retromammary;To present the anatomical landmarks and imaging clues to determine the origin of such lesions as mammary or not;To present the radiological aspects of various posterior breast

lesions, pectoralis and chest wall lesions, illustrating these with multimodality imaging from our archives.To familiarize general radiologists with such findings in order to improve the diagnostic rate and avoid misinterpretation and pitfalls of such lesions, reducing false positive rates and unnecessary biopsies.

**TABLE OF CONTENTS/OUTLINE**

The human breast's basic anatomy can be categorized into three distinct zones: the premammary, mammary, and retromammary zones.Located posterior to the retromammary fat is the pectoralis muscle. It's important to note that this is not considered an anatomical component of the chest wall, and therefore, it is not interpreted as such for staging and management purposes.However, these structures are contemplated in breast exams and should be well-known to radiologists.The task of differentiating primary lesions of the mammary parenchyma from those originating from the pectoral musculature and the thoracic wall can be challenging. Nevertheless, it is crucial for the effective management and diagnosis of such lesions.There exist certain anatomical parameters and defining image criteria that assist in determining the origin of these lesions and the extent of tumor involvement. These include the presence of enhancement or the angle between the lesions and the structures of interest. These factors play a significant role in the diagnosis and subsequent treatment of these conditions.

## BREE-57 UNMASKING THE MYSTERY: A DEEP DIVE INTO IDIOPATHIC GRANULOMATOUS MASTITIS

Antonio Jose Cueva Guerrero, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Understand the typical presentation of IGM in women of childbearing age and its variable symptoms. • Recognize the diverse mammographic, ultrasound, and MRI findings associated with IGM, including masses, distortion, and skin thickening. • Distinguish IGM from breast cancer and other inflammatory breast lesions using key imaging features. • Emphasize the crucial role of core needle biopsy with pathological confirmation for definitive diagnosis of IGM. • Briefly discuss the treatment options for IGM, including medical management and surgical intervention.

**TABLE OF CONTENTS/OUTLINE**

- Introduction- Anatomy - Pathogenesis - Clinical presentation - Differential diagnosis - Imaging methods- Management strategies - Conclusions

## BREE-58 CURRENT USES OF CONTRAST-ENHANCED MAMMOGRAPHY (CEM). A PICTORIAL REVIEW OF THE UTILITY OF CEM IN DIFFERENT SETTINGS

Carlos Oliva Fonte (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-To review contrast-enhanced mammography (CEM) technique. -To analyze the different applications of contrast-enhanced mammography (CEM) including work-up of symptoms or equivocal findings, breast cancer detection and local staging, supplemental technique for screening, follow-up of breast cancer, monitoring neoadjuvant systemic therapy response. - To illustrate imaging findings of CEM with correlation with imaging (US, MRI) and pathology. - To emphasize pitfalls, diagnostic difficulties, and differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

We review current applications and state-of-the-art of contrast-enhanced mammography highlighting the benefits and potential use in different settings. We present:
- Basics and technique of contrast enhanced mammography (CEM)
- Indications of CEM. CEM increases sensitivity and specificity of digital mammography.
- Imaging in different settings: -breast cancer diagnosis in symptomatic patients: palpable mass, nipple retraction, breast pain, or bloody nipple discharge; - problem solving for inconclusive findings; - recalls from screening: CEM helps in detection of multiple lesions and to safely reduce benign breast biopsies;- local staging and surgical planning: accurate size correlation with surgical specimen, US and MRI and detection of multifocal and bilateral disease similar to MRI with less false positives;- follow-up of breast conservation therapy;- neoadjuvant chemotherapy response evaluation, CEM shows similar sensitivity and PPV than MRI to detect residual lesion and detects pathological complete response better than MRI.
- Future directions. Screening in dense breast, high risk, intermediate risk.

## BREE-59 THE USE OF VERY HIGH FREQUENCY TRANSDUCERS BEYOND DERMATOLOGY - DIAGNOSIS AND FOLLOW-UP OF BREAST LESIONS

Luciana Graziano, MD (*Abstract Co-Author*) Nothing to Disclose
Laura B. De Melo, MD (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bruna Isabela S. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Felipe SR, PhD (*Abstract Co-Author*) Nothing to Disclose
Soraia Damiao, MD (*Abstract Co-Author*) Nothing to Disclose
Mariah C. Wanderley (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Demonstrate how the development of transducers with frequencies above 15MHz, initially aimed at dermatological ultrasound, has shown an important role in the evaluation of breast lesions;- Present the main applications of very high frequency transducers in the diagnosis, follow-up and image-guided biopsies of breast lesions;- Differentiate breast from skin lesions and offer a better definition for the analysis of ducts and subcutaneous tissue;- Describe the use of very high frequency transducers in guiding ultrasound biopsies through radiological correlation between imaging methods.

**TABLE OF CONTENTS/OUTLINE**

Physical characteristics of linear transducers traditionally used for screening and diagnosing breast lesions and the very high frequency transducers;Ductal ectasias, intraductal masses and retroareolar lesions:utilizing very high-frequency transducers for detailed analysis;advantages of monitoring and biopsying these lesions using very high frequency transducers.Skin calcifications:detecting skin calcifications when mammographic findings are inconclusive.Ultrasound-guided biopsy of calcifications with the use of very high frequency transducers:cases of very superficial or retroareolar suspicious calcifications, whose location is a limiting factor for stereotaxis and traditional transducers do not guarantee adequate image definition;Identification of calcifications via ultrasound, placement of a metallic marker on the skin surface covering the calcifications, followed by tangential mammography to validate the correspondence between the calcifications visualized in mammography and ultrasound, enabling the biopsy procedure to proceed.Final considerations.

## BREE-6 LESS IS MORE: DE-ESCALATION OF SURGERY IN THE BREAST AND AXILLA - THE ROLE OF IMAGING

**Certificate of Merit**

Elsa M. Arribas, MD (*Abstract Co-Author*) Stockholder, 3D Systems, Inc
Tanya W. Moseley, MD, PhD (*Abstract Co-Author*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC
Emily S. Nia, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Abstract Co-Author*) Nothing to Disclose
Wei T. Yang, MD, FRCR (*Abstract Co-Author*) Royalties, Reed Elsevier;Advisory Board, Lux Capital
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Henry M. Kuerer, MD (*Abstract Co-Author*) Editor, NEJM Group;Editor, The McGraw-Hill Companies;Editor, Wolters Kluwer nv;Speakers Bureau, Physicians Education Resource, LLC;Global Advisory Board, Genomic Health, Inc;Advisory Board, Cardinal Health Inc
Miral M. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Megha M. Kapoor, MD (*Abstract Co-Author*) Nothing to Disclose
Gaiane M. Rauch, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.Breast cancer management has transformed significantly over the last decades, specifically through the integration of neoadjuvant systemic therapy (NST) and the evolving understanding of tumor biology, enabling more tailored treatment strategies.2.Increasing adaptation of limited axillary surgery, such as sentinel lymph node biopsy and targeted axillary dissection raised questions on role of imaging for axillary nodal disease assessment.3.Advances in NST with up to 60-70% of patients achieving pathologic complete response for certain biological subtypes of breast cancer produced growing evidence on potential omission of surgery based on use of minimally invasive biopsy.4.Radiologists should be familiar with contemporary evidence and role of the imaging and image guided procedures for de-escalation of breast and axillary surgery in breast cancer patients.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction II. Axillary management • Clinically node negative breast cancer & 7; Role of imaging & 7; Overview of clinical trials • Clinically node positive breast cancer undergoing NST & 7; Role of imaging & 7; Overview of clinical trials III. Omission of breast surgery in exceptional responders to NST based on tumor biology • Proof of concept • Minimally invasive image guided biopsy• Overview of clinical trials IV. De-escalation of breast surgery in patients with DCIS • Role of imaging • Overview of clinical trials V. Future directions •Advancements in imaging and image guided procedures • Artificial Intelligence VI. Conclusion VII. References

## BREE-60 STABILITY IS NOT SYNONYMOUS WITH BENIGNITY: THE DIAGNOSTIC CHALLENGE OF SLOW-GROWING BREAST CANCERS

**Awards**
**Certificate of Merit**

Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Caio D. Pinheiro, MD (*Abstract Co-Author*) Nothing to Disclose
Aline Lemgruber Prado Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta Linhares, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Colombo, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Erica E. Francolin Federicci, PhD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Silva Malta, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To describe the main histological types of tumors that have slow growth;To review the most recent literature on sensitivity, specificity and diagnostic accuracy regarding this matter;To evaluate of the false negatives cases retrospectively for a more comprehensive characterization of the diagnosis;To propose strategies to prevent diagnostic imaging errors in these types of cancer.

**TABLE OF CONTENTS/OUTLINE**

Slow-growing breast tumors are mostly indolent and have lower mortality rates. However, they are responsible for a significant portion of false negatives in screening exams due to their slow growth. Additionally, difficulty of these lesions from potentially invasive ones can lead to imaging diagnostic errors and it is essential for any radiologist interpreting these studies.The main histological subtypes of slow-growing breast tumors include ductal carcinoma in situ, invasive non-specific luminal carcinoma, invasive tubular carcinoma and invasive lobular carcinoma. It stands out as the ductal carcinoma in situ (DCIS) that represents most common lesions that remain indolent.This review thoroughly explains the histological types of slow-growing breast cancer and shows information of the natural history, about mortality or survival rates.Furthermore, recent literature on the sensitivity, specificity, and diagnostic accuracy of slow-growing breast cancer will be discussed, accompanied by illustrative cases of false negatives to highlight diagnostic pitfalls.Strategies to prevent diagnostic imaging errors in these types of cancer are proposed to aid in clinical management.

## BREE-61 NAVIGATING THROUGH TUBERCULOSIS MASTITIS: RADIOLOGICAL PRESENTATIONS AND DIAGNOSIS RELEVANCE IN TROPICAL COUNTRIES

**Awards**
**Certificate of Merit**

Erica Endo, MD (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra d. Borges, MD (*Abstract Co-Author*) Nothing to Disclose
Lidia B. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda de Oliveira Cirino, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Tuberculosis (TB) mastitis is a rare extrapulmonary condition caused by Mycobacterium tuberculosis. It can affect the breast either primarily (through abrasions) or secondarily (via lymphatic backflow or contiguity with intrathoracic foci). It presents in varied clinical and radiological forms, often mimicking various other chronic granulomatous conditions, infectious and otherwise, and is frequently diagnosed late due to its nonspecific imaging

characteristics.It is important to emphasize that although mammary tuberculosis is not the primary cause of chronic granulomatous mastitis, it remains epidemiologically relevant in tropical countries and has considerable clinical importance.In this context, this exhibition reviews clinical findings, main radiological findings and proposes a workflow for diagnosis and management, highlighting tips that may help the diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Review the epidemiology and the most clinical findings of Tuberculosis (TB) mastitis and their differential diagnosis.Explore the main radiological findings on ultrasound (US), mammography (MG), and magnetic resonance imaging (MRI) of Tuberculosis (TB) mastitis illustrating with different cases.Demonstrate the role of the appropriate investigation for TB mastitis and the workflow that may help an early diagnosis

## BREE-62 LEARNING THE ROPES: CONTRAST-ENHANCED MAMMOGRAPHY

Ekta Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Suzanne McElligott, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica J. DeSabato, MD (*Abstract Co-Author*) Nothing to Disclose
Nina S. Vincoff, MD (*Abstract Co-Author*) Nothing to Disclose
Amna Aslam (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Contrast-enhanced mammography (CEM) is an emerging diagnostic and screening tool in breast imaging that uses iodinated contrast to visualize tumor vascularity. In CEM, a dual-energy mammogram is acquired 2 minutes after the IV injection of iodinated contrast. Low and high energy views offer excellent anatomic detail and breast perfusion. CEM has higher sensitivity for detecting breast cancer compared to digital mammography, tomosynthesis, and ultrasound combined. It has comparable sensitivity and specificity to breast MRI for cancer detection at lower cost and greater comfort for patients who are unable to undergo breast MRI (4,5,6). In this review, we will discuss our experience interpreting CEM and discuss common artifacts and pitfalls. CEM is new for many breast imagers. As it continues to grow in clinical practice, it is important that radiologists understand how CEM can be utilized, how to read and interpret these images, perform CEM biopsies when needed and tackle challenges faced with these cases.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction and Background 2. Indications a. Screening b. Diagnostic i. Symptomatic patients ii. Screen recall iii. Extent of disease 3. Imaging Protocol and Acquisition a. Artifacts 4. Reporting findings a. BPE b. BI-RADS c. Lesion description i. Benign ii. Malignant 5. Biopsy of CEM findings - early experience and challenges 6. Conclusion and References

## BREE-63 BREAKING THE ICE: CRYOABLATION'S ROLE IN BREAST LESIONS

**Awards**
**Certificate of Merit**

Caroline Colombo, MD (*Abstract Co-Author*) Nothing to Disclose
Silvio E. Bromberg (*Abstract Co-Author*) Nothing to Disclose
Antonio Rahal Junior (*Abstract Co-Author*) Nothing to Disclose
Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Sanvido (*Abstract Co-Author*) Nothing to Disclose
Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Silva Malta, MD (*Abstract Co-Author*) Nothing to Disclose
Afonso C. Nazario (*Abstract Co-Author*) Nothing to Disclose
Caio D. Pinheiro, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna M. Tachibana, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To demystify the mechanism of cellular injury due to cryoablation;To illustrate how cryoablation is performed in practice on breast lesions as well as the subsequent imaging repercussions with cases from our digital archive;To clarify the clinical scenarios where cryoablation is indicated and its limitations.

**TABLE OF CONTENTS/OUTLINE**

Cryoablation involves the application of successive cycles of freezing and thawing of neoplastic tissue using cryoprobes inserted into the tumor under radiological guidance (typically ultrasound), promoting tissue destruction through rupture of cell membranes.The hallmark of cryoablation technique is the formation of an "ice sphere" in the tissue, ideally encompassing the tumor with a safety margin of at least 5 mm, easily identified by conventional imaging methods, resulting from tissue necrosis.The freezing mechanism occurs through the thermodynamic properties of argon or nitrogen gasses, which suffer significant heat loss during their expansion. Defrosting is achieved by helium gas, which allows the system to heat up.Its indications include benign breast lesions such as fibroadenomas and malignant tumors smaller than 2,5 cm, breast carcinomas of any histological subtype without distant metastases and with clinically negative axilla.To provide a comprehensive understanding of cryoablation, we have compiled a series of cases from our institution's digital archive. These cases illustrate the step-by-step technique of cryoablation, its imaging consequences, and the clinical rationale behind its use, as well as the method's inherent limitations.

## BREE-64 BEWARE OF THE RARE: A PICTORIAL CASE-BASED REVIEW OF MESENCHYMAL BREAST TUMORS

Norma P. Arroyo Lopez, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To know the origin and histologic classification of mesenchymal breast tumors Identify characteristics clinical and pathological of each tumor Identify imaging key features of each tumor of cases from our databases

**TABLE OF CONTENTS/OUTLINE**

Introduction. WHO classification of mesenchymal breast tumors. Clinical features and histological Imaging findings by ultrasound and mammography modalities. Illustrative cases of mesenchymal breast tumors. Conclusions References

## BREE-65 EXPANDING THE BRACKET: OPTIMIZING LOCALIZATION TECHNIQUES FOR MULTIFOCAL AND MULTICENTRIC DISEASE

Neha Khemani, MD (*Abstract Co-Author*) Nothing to Disclose
Amy Maduram, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

(1) Breast surgeries are progressively trending towards de-escalation of therapy such as breast conserving surgery (BCS), downstaging cancer after neoadjuvant therapy, and lower number of axillary nodes removed. Radiologists play an important role in planning localizations and interpreting specimen radiographs for BCS. (2) Although multifocal and multicentric disease is often thought as an exclusion criterion for BCS, it is possible to achieve comparable disease free and overall survival rates to mastectomy in select patients when negative margins are achieved. Therefore, it is increasingly important for radiologists to have the technical acumen to approach complex localizations utilizing 3-4 wires or covering multiple quadrants of the breast with confidence. (3) Feedback on surgical specimen radiographs play a vital partnership with surgeons in achieving negative final pathology margins and improving patient outcomes.

**TABLE OF CONTENTS/OUTLINE**

(1) Overview of trends towards BCS and introduction to wire-guided localization. (2) Cases of multicentric and multifocal malignancy requiring 4 wire localization with technical pearls and pitfalls. (3) Cases of multi-wire lesion localization using tomosynthesis and complications requiring follow-up imaging. (4) Guidelines for optimal surgical margins of invasive cancer, DCIS, and pleomorphic LCIS. (5) Cases of actionable specimen radiographs requiring notification to the surgeon. (6) Review of pathologic description of margin assessment. (7) Self-assessment quiz.

## BREE-66 RADIANT CLARITY: DISCOVERING THE BEAUTY OF CONTRAST MAMMOGRAPHY IN THE DETECTION OF MALIGNANT CALCIFICATIONS

Rosaura E. Fuentes Corona, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Eugenia Vazquez Manjarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Alma Cintia Medrano Romero, MD (*Abstract Co-Author*) Nothing to Disclose
Rocio D. Cortes Quezada, MD (*Abstract Co-Author*) Nothing to Disclose
Arturo Jimenez Bello, MD (*Abstract Co-Author*) Nothing to Disclose
Elsa Cecilia Molina Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Yamell Alexandra Sanchez Almanzar, MD (*Abstract Co-Author*) Nothing to Disclose
Isa S. Oros I, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Although there are few published studies of false negatives at CEM, one study reported that up to 16% of cases of DCIS with associated calcifications lacked enhancement at CEM. Other studies that evaluated calcifications at CEM reported that 96% of calcifications without enhancement represented a false-positive finding, whereas 80% of calcifications with enhancement represented a true-positive cancer

**TABLE OF CONTENTS/OUTLINE**

•Introduction•Classification of calcifications•What is contrast mammography?•application of contrast-enhanced mammography in the assessment of microcalcifications•Radiological cases •Conclusions

## BREE-67 NO TUMOR LEFT BEHIND: IMAGING ASSESSMENT OF POSTOPERATIVE RESIDUAL BREAST CANCER

Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Caio D. Pinheiro, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
Rodrigo O. Seleti, MD (*Abstract Co-Author*) Nothing to Disclose
Tais C. Batista, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Silva Malta, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela Soveral, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Renata Feres, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo Z. Bringel Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Colombo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To explain the role of imaging in the detection of residual postoperative breast cancer for optimal therapeutic management;To discuss the possible causes of residual tumor after breast-conserving surgery or mastectomy;To explain the role of specimen mammogram and histological evaluation of surgical margins as a means to avoid residual cancer.

**TABLE OF CONTENTS/OUTLINE**

The main goal of surgery in the treatment of breast cancer, whether breast-conserving surgery or mastectomy, is the removal of all malignant lesions. Nevertheless, postoperative residual breast cancer is a possible outcome after any surgery, regardless if surgical margins are positive or negative. In the setting of residual cancer, re-excision is the standard treatment.The main cause of residual cancer is underestimation of lesion size prior to surgery; preoperative breast MRI is the optimal imaging modality for local staging, determining tumor extent and multifocal disease. Other causes include inappropriate surgical choice, errors in preoperative lesion localization and incomplete axillary dissection of metastatic lymph nodes. Prevention of residual cancer can be achieved by performing specimen mammograms of mammography-visible lesions (calcifications, biopsy markers) and histological evaluation of surgical margins. In patients with positive surgical margins, imaging aids in determining extent of residual disease prior to re-excision. In patients with negative margins, residual cancer may be detected in subsequent screening exams.We have compiled a series of cases from our institution's digital archive to discuss possible causes of residual tumors and the role of imaging in reducing them.

## BREE-68 EMERGENCY BREAST IMAGING UNCOVERED: NAVIGATING TRIAGE, IMAGING FEATURES, MIMICS, TREATMENT, AND FOLLOW-UP

Shruti Kumar, MBBS (*Abstract Co-Author*) Nothing to Disclose
George K. Vilanilam, MD (*Abstract Co-Author*) Nothing to Disclose
Aditi Chaurasia, MBBS (*Abstract Co-Author*) Nothing to Disclose
Giridhar Dasegowda, MD (*Abstract Co-Author*) Nothing to Disclose
Heta Ladumor, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Identify causes of breast-related complaints presenting to the emergency department 2. Describe characteristic imaging features of common and uncommon emergent breast conditions and mimics 3. Discuss triage, management, and appropriate follow-up protocol

**TABLE OF CONTENTS/OUTLINE**

A. Traumatic: contusions/hematoma/seatbelt injury, fat necrosis (mimics cancer) B. Non traumatic B.1 Inflammatory: puerperal mastitis, Mondor's disease B.2 Infectious: non-puerperal mastitis, granulomatous mastitis (mimics cancer) C. Implant related: infection, rupture following trauma D. Post-procedural: hematoma, pseudoaneurysm E. Mimics: cancer F. Non emergent findings in the emergency department: palpable mass, discharge, skin changes

## BREE-69 ALWAYS LOOK BEYOND THE BREAST: EXTRAMAMMARY FINDINGS ON MRI

**Awards**
**Certificate of Merit**

Karla I. Soto, MD (*Abstract Co-Author*) Nothing to Disclose
Yesika Davila Zablah, MD (*Abstract Co-Author*) Nothing to Disclose
Ia M. Sanchez Carenzo, MD (*Abstract Co-Author*) Nothing to Disclose
Ilany L. Valdivia I, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Garza, MD (*Abstract Co-Author*) Nothing to Disclose
Elena M. Sanchez Siller, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica A. Perdomo SR, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to describe extramammary findings discovered on breast magnetic resonance images, including location, frequency and relevance. Review the imaging characteristics of the extramammary findings and the appropriate imaging modality when further evaluation is required. Identify suspicious features that may suggest malignancy among extramammary lesions. Learn a systematic assessment for active search of extramammary lesions. Recognize when additional imaging work-up or follow-up is necessary for further characterization of extramammary findings.

**TABLE OF CONTENTS/OUTLINE**

We review the location and features of extramammary findings on breast magnetic resonance, presenting the most frequent locations of benign and malignant findings, including an approach for further imaging work-up and follow-up. Benign findings: liver cyst, pleural effusion, liver hemangiomas, sternum hemangiomas, lung atelectasis, post-radiation changes, mesenteric cyst, mediastinum cyst, epidermal inclusion cyst, accessory spleen, axillary lipoma, pulmonary nodules, cervical reactive lymph node, rib hemangiomas, lung consolidation, thyroid nodule. Malignant findings: muscle, bone, lymph nodes, pulmonary and liver metastases and malignant pleural effusion. A systematic approach when evaluating extramammary structures.

## BREE-7 EXPLORING THE AXILLARY REGION IN BREAST CANCER PATIENTS: CT FINDINGS

Miguel Chiva de Agustin (*Abstract Co-Author*) Nothing to Disclose
Irene Vicente Zapata, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa Antolinos Macho, MD (*Abstract Co-Author*) Nothing to Disclose
Teresa Presa, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Describe the imaging appearances of normal and abnormal axillary nodes on CT in breast cancer patients, with focus on morphology and localization • Explain how the axillary node burden can be assessed with CT before and after NAC • Describe axillary CT findings in follow up breast cancer patients

**TABLE OF CONTENTS/OUTLINE**

1. Describe the normal and abnormal appearances of axillary nodes on CT staging and its role in therapeutic management decisions for breast cancer patients. a. The Amonkar classification used in ultrasound has similar appearances on CT and categorizes nodes as: i. Normal: UN2, UN3 ii. Abnormal or suspicious: UN4 and UN5 b. The Berge levels aid in localizing nodes: i. Level 1: lower axilla, lateral to the minor pectoralis muscle ii. Level 2: middle axilla, behind the minor pectoralis muscle iii. Level 3: upper axilla, medial to the minor pectoralis muscle iv. Interpectoral region2. Describe axillary node burden and the importance of understanding diagnostic procedures (SNB, LA, TAD) for successful treatment: a. Pre-neoadjuvant chemotherapy: crucial for node counting and localization: i. Patients with <3 nodes in level 1: candidates for targeted axillary dissection (avoiding LA) ii. Patients with >3 nodes or nodes in level 2: candidates for lymphadenectomy (LA) b. Post-NAC evaluation should report: i. Good response - nodes return to normal size or >50% reduction ii. No response - no changes 3. Evaluate CT findings in follow-up breast cancer patients: a. Postsurgical changes from SNB or LA b. Surgical techniques and complications: extracapsular silicone in breast reconstruction, autologous reconstructions, or postsurgical seromas c. Axillary recurrence.

## BREE-70 NON CALCIFIED DUCTAL CARCINOMA IN SITU

Dayana K. Pastor Gutierrez, PhD (*Abstract Co-Author*) Nothing to Disclose
Cecilia E. Castro Bueno, RT (*Abstract Co-Author*) Nothing to Disclose
Claudia E. Rivera Otazu, MD (*Abstract Co-Author*) Nothing to Disclose
Marycarmen E. Flores Duenas, MD (*Abstract Co-Author*) Nothing to Disclose
Liana M. Falcon, MD (*Abstract Co-Author*) Nothing to Disclose
Liliana M. Bustamante Rodas, MD (*Abstract Co-Author*) Nothing to Disclose
Esmeralda S. Bayona, MD (*Abstract Co-Author*) Nothing to Disclose
Lisett N. Cruzado-Quiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Rowena A. Hammond, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia P. Guillen-Bravo, MD (*Abstract Co-Author*) Nothing to Disclose
Karla X. Gutierrez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Non-calcified ductal carcinoma in situ presents with different appearances: mass, asymmetries or distortions.2. Non-calcifield DCIS can be occult on screening mammography.3. Non-calcifield DCIS is common to find it on staging or screening MRI as a non-mass enhacement lesion.

**TABLE OF CONTENTS/OUTLINE**

Non calcified ductal carcinoma in situPathologic featuresMultimodality imaging findingsMRI biopsyCases

## BREE-71 BREAST EDEMA. UNDERSTANDING THE UNDERLYING PATHOLOGY. A PICTORIAL REVIEW

Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
Karen L. Caro, PhD (*Abstract Co-Author*) Nothing to Disclose
Liliana Pacheco Mendoza (*Abstract Co-Author*) Nothing to Disclose
Maria P. Swiecicki, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To display the different pathologies that can clinically manifest with breast edema: mastitis, granulomatous mastitis, inflammatory breast carcinoma, post radiotherapy edema and systemic diseases such as renal failure or congestive heart failure.2. To illustrate using clinical cases tips and tricks that can help achieve a proper diagnosis of these entities.

### TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Physiopathology of breast edema.3. Mastitis: puerperal, non-puerperal and granulomatous mastitis.4. Breast edema after conserving treatment, post radiotherapy edema.5. Inflammatory breast cancer.6. Systemic diseases that can produce breast edema: renal failure, congestive heart failure.7. Conclusions.In conclusion, this educational exhibit is intended to aid the radiologists in training in understanding the multiple differential diagnosis that should be considered when encountering a patient with breast edema and give them tips for achieving an accurate diagnosis within this broad spectrum of entities.

## BREE-72 BEYOND METASTATIC LYMPHADENOPATHY IN BREAST CANCER: AN APPROACH TO AXILLARY MASSES

**Awards**
**Certificate of Merit**

Tanya W. Moseley, MD, PhD (*Abstract Co-Author*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC
Gaiane M. Rauch, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Emily S. Nia, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Miral M. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Megha M. Kapoor, MD (*Abstract Co-Author*) Nothing to Disclose
Elsa M. Arribas, MD (*Presenter*) Stockholder, 3D Systems, Inc

### TEACHING POINTS

• Review the differential diagnosis of benign and malignant masses in the axillary region. • Review the imaging modalities and key imaging features used in the assessment of axillary masses. • Highlight the importance of appropriate correlation of the patient's clinical presentation, pertinent clinical history, and imaging clues to distinguish these.• Review biopsy techniques and challenges.• Discuss the clinical management.

### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. Algorithm on how to approach benign and malignant masses in the axillary region across different imaging modalities. III. Highlight the importance of correlation of the patient's clinical symptoms and their clinical history to establish the differential diagnosis. IV. Review of the different imaging techniques to biopsy axillary masses. V. Tips, pitfalls, and practical approaches will be emphasized through a case-based multi-modality approach. VI. Rad-path correlation of the axillary pathology.

## BREE-73 THE DIAGNOSTIC VALUE OF A NEW MAMMOGRAPHY TECHNIQUE IN BREAST DISEASES: CONTRAST-ENHANCED SPECTRAL MAMMOGRAPHY (CESM)

Ruixue Cao (*Presenter*) Nothing to Disclose

### TEACHING POINTS

CESM greatly increased the positive detection rate for breast cancer.Various methods have been applied to the diagnosis of breast diseases alone or in combination in clinical application. This exhibition aims to demonstrate the value of CESM in breast disease diagnosis by conducting research surveys on previous studies.

### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) CESM imaging principle : CESM based on dual-energy breast exposure after contrast administration, It reflects the blood flow dynamics of the lesion by utilizing the uptake of iodine contrast agent in the tumor tissue. 3) Technique and protocols: contrast dose of 1.5 mL/kg, factory-set kVp ranges for low- and high-energy acquisitions, beginning image acquisition after 2min from contrast agent injection and completing the examination within 8 min. 4) Diagnostic value: a. evaluation of symptomatic women b. screening recalls c. local staging d. pre-and post-operative evaluations e. neoadjuvant chemotherapy response monitoring f. guide biopsy for the lesion 5) Advantages and limitations of CESM

## BREE-74 FROM ATYPIA TO CARCINOMA A REVIEW OF LOBULAR NEOPLASIAS OF THE BREAST

Harnoor Singh, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Elaine G. Khalil, MD (*Abstract Co-Author*) Nothing to Disclose
Muhayman Sadiq, MBBS (*Abstract Co-Author*) Nothing to Disclose
Kiran N. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Cotes, MD (*Abstract Co-Author*) Nothing to Disclose
Shima Aran, MD (*Abstract Co-Author*) Nothing to Disclose
Abeer H. Abdel Hameed, MBChB (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Definition of Lobular neoplasia LN and invasive lobular carcinoma ILC Pathological classification of LN .Clinical presentation and epidemiology of LN and ILC Review of common imaging findings in LN and ILC Review of imaging caveats and radiological pathological concordance Review of the multidisciplinary approach for management of LN and ILC

**TABLE OF CONTENTS/OUTLINE**

Definition of LN Including Atypical lobular hyperplasia ALH Lobular carcinoma in situ LCIS and invasive lobular carcinoma ILCReview of common imaging findingsOutline the breast radiologist role inDetection of subtle imaging findings in cases of ILCAssessment of multifocal multicentric disease and the contralateral breast in ILClocal staging of ILC and planning for surgical managementSelection of sampling method and targetDetermine radiological pathological concordanceProper follow up for non surgical patients Factors influencing radiological pathological concordancePatient factorsLesion factorsThe biopsy modality guidanceNumber of biopsy core samples needle Gauge successful targetingSize of original lesion Residual non sampled abnormality Management of LN and ILCUpfront surgical management versus neo adjuvant systemic therapy for ILCFactors influencing management of LNClinical presentation Pathological factors Number of involved TDLU and presence of other high risk breast lesions.Patient lifetime risk for breast cancer.Radiological pathological concordance.Consideration of chemo-preventive treatment.Proper choice of imaging modality for follow up.

## BREE-75 SUPERFICIAL AND SKIN LESIONS IN BREAST IMAGING.MULTIMODALITY IMAGING ANDDIFFERENTIAL DIAGNOSIS

Brian D. Norena Rengifo, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Saldarriaga, MD (*Abstract Co-Author*) Nothing to Disclose
Haydee Ojeda-Fournier, MD (*Abstract Co-Author*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando Ahumada (*Abstract Co-Author*) Nothing to Disclose
Ana Beatriz Luengas (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Superficial lesions in the breast can be an incidental finding or can manifestas a palpable abnormality.Knowledge of the skin anatomy is crucial in the assessment of superficiallesions in breast.Breast ultrasound is the imaging of choice for characterization of superficiallesions in breast imaging. A meticulous technique is necessary to determinelesion localization.Establishing a differential diagnosis according to the localization of thesuperficial lesion is critical to avoid a cancer misdiagnosis.

**TABLE OF CONTENTS/OUTLINE**

This educational electronic exhibit will review the anatomy of the skin,multimodality imaging findings and differential diagnosis of superficial and skinlesions in the breast. An overview of the US technique to evaluate superficial andskin lesions will be given.

## BREE-76 NEW STRATEGIES IN CANCER SURVEILLANCE AFTER BREAST CANCER TREATMENT

Lorena Melian Iribar, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Teresa Montero Alameda (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review current strategies of surveillance of patients after breast cancer surgical treatment. 2. To discuss the specific management of those patients, including imaging and interventional procedures. 3. To illustrate imaging in different techniques including contrast-enhanced mammography, US, MRI, CT, and PET with pathologic correlation in cases of cancer recurrence and in different benign postoperative entities (fat necrosis, seroma, mastitis). 4. To emphasize pitfalls, diagnostic difficulties, and differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

The different therapeutic options employed for breast disease cause different breast changes, complications and frequently difficulties in diagnosis. We present: 1. Current recommendations in surveillance after different breast cancer surgical treatment strategies (mastectomy, breast reconstruction, breast conserving surgery). 2. Techniques in evaluation of treated breasts. Contrast-enhanced mammography, US, MRI, CT, PET. 3. Imaging findings. Postsurgery changes acute/subacute (architectural distortion, hematoma, seroma, fat necrosis, residual lesion), late (scar, fibrous reaction, suture granuloma, breast Implant rupture and silicone granuloma, lymphadenopathy). Posttreatment changes: Hormonotherapy (Increased density), Radiotherapy (skin thickening, edema). Breast cancer recurrence, metachronous breast cancer. 4. Tips for differential diagnosis, diagnostic work-up and recommendations for management

## BREE-77 DON’T FORGET TO DESCRIBE THE BREAST FINDINGS ON CHEST TC.TIPS AND PEARLS TO IDENTIFY THEM

Maria P. Swiecicki, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
MONICA OTILIA MACHUCA CASTILLO (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
Karen L. Caro, PhD (*Abstract Co-Author*) Nothing to Disclose
Agustina Graziani, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To describe breast and axillary findings on chest computed tomography.Recognize breast and axillary findings of clinical significance that must be reported in chest CT scan.To discuss the clinical management of these findings.

**TABLE OF CONTENTS/OUTLINE**

1-Introduction:Chest CT is a frequently performed radiologic study and can reveal breast and axillary findings in both genders. Radiology residents should be accurate in reporting these findings is essential to guide clinical decision-making and prevent unnecessary procedures.2-Normal Appearance of Breasts and Axilla on Chest CT:The normal appearance of breast parenchyma on chest CT can vary based on breast density. Familiarity with normal variations in breast density is crucial to avoid misinterpretation of findings. The axilla should also be carefully evaluated for lymph nodes.3-Benign and malignant Imaging findings in female breast on Chest CT4-Benign Imaging Findings in Male Breast on Chest CT:Gynecomastia is a common benign finding in the male breast on chest CT. It is important to recognize and accurately describe this finding in the report to prevent unnecessary workup.5-Malignant imaging findings in male breast on Chest CT6-Clinical Cases:Several clinical cases will be presented to illustrate the accurate reporting of breast and axillary findings on chest CT scans.7-Management.

## BREE-78 BREAST RESONANCE, FINDINGS THAT SHINE ON T2, A PICTORIAL REVIEW

Dayana K. Pastor Gutierrez, PhD (*Abstract Co-Author*) Nothing to Disclose
Karla X. Gutierrez, MD (*Abstract Co-Author*) Nothing to Disclose

Liliana M. Bustamante Rodas, MD (*Abstract Co-Author*) Nothing to Disclose
Liana M. Falcon, MD (*Abstract Co-Author*) Nothing to Disclose
Rowena A. Hammond, MD (*Abstract Co-Author*) Nothing to Disclose
Federica Pediconi, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia P. Guillen-Bravo, MD (*Abstract Co-Author*) Nothing to Disclose
Marycarmen E. Flores Duenas, MD (*Abstract Co-Author*) Nothing to Disclose
Lisett N. Cruzado-Quiroz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Most lesions that shine on T2 are benign, however there are some malignant lesions that also shine on T2.The most common benign hyperintense lesions on T2 are: cysts, fibroadenomas, lymph nodes, fat necrosis, etc.Mucinous carcinomas, papillary carcinomas, triple negative tumors with a necrotic component, etc., are malignant lesions that present high signal on T2.A single sequence does not make the diagnosis. In MRI, it is important to evaluate the morphological and dynamic sequences in parallel, which will help us narrow the differential diagnosis.In this presentation, we want to illustrate the MRI features of most common and rare T2 hyperintense breast lesions, with emphasis on morphologic features and differential diagnoses.

**TABLE OF CONTENTS/OUTLINE**

Breast cancer; MRI; malignant lesions; T2 hyperintense; necrotic component; papillary carcinomas; mucinous carcinomas.

## BREE-79 MORE THAN WORDS: COMPLETE REPORT FOR OPTIMAL TREATMENT TNM 8TH EDITION

Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
Karen L. Caro, PhD (*Abstract Co-Author*) Nothing to Disclose
MONICA OTILIA MACHUCA CASTILLO (*Abstract Co-Author*) Nothing to Disclose
Maria P. Swiecicki, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
Agustina Graziani, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To analyze the 8th edition of the breast cancer staging system.To discuss the modifications in the 8th edition.Describe findings that cannot be missing from the report.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: Breast cancer is an heterogeneous tumor, very frequent among women and, if not diagnosed and treated in timely manner, leads to significant morbidity and mortality 2. 8th TNM edition: Anatomic staging: considering tumor extension (according to size), affects lymph nodes (classified according to their level) and the presence or absence of metastases.Prognostic staging part: based on the expression of hormone receptors and oncogenes (estrogen, progesterone and HER2 receptors) and tumor grade (low, intermediate and high) and the results of the multigentics panel (evaluates genes in order to predict the probability of recurrence). Genomic analysis helps to understand the biological behavior of breast cancer that causes changes in the management and treatment of the patients.3. Modifications in the 8th edition of the TNM.4. Clinical Cases:Several clinical cases will be presented to illustrate the findings that should be taken into account for anatomic staging and tips for remembering them.5. Conclusion: Although the role of the radiologist is crucial in the anatomical stage, as the 8th edition of the TNM also takes into account prognostic staging, it is necessary to have knowledge about tumor genes and hormone receptors in order to provide patients with the optimal treatment.

## BREE-8 PRIMARY AND SECONDARY BREAST ANGIOSARCOMA: MULTIMODALITY IMAGING APPROACH WITH PATHOLOGIC CORRELATION

**Awards**
**Certificate of Merit**

Priscilla J. Slanetz, MD, MPH (*Abstract Co-Author*) Royalties, Wolters Kluwer nv
Jordana Phillips, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Consultant, General Electric Company;Consultant, Hologic, Inc
Jenna Pellegrino, MD (*Abstract Co-Author*) Nothing to Disclose
Dunya M. Imad, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Breast angiosarcoma, an infrequent yet highly aggressive cancer, originates from spindle cells and is more prevalent in the breast compared to any other organ. It manifests in two primary forms: sporadic angiosarcoma and post-radiation angiosarcoma. A causative factor remains unidentified in primary breast angiosarcomas. Conversely, secondary breast sarcomas are associated to previous radiation therapy (RT) and conditions leading to chronic lymphedema. Despite its rarity, this disease necessitates specialized diagnostic and therapeutic approaches, necessitating collaboration among radiologists, oncologists, surgeons, and pathologists.

**TABLE OF CONTENTS/OUTLINE**

In this exhibit, we will discuss the various presentations of primary and secondary angiosarcoma, conduct a systematic review of clinical findings, and examine multimodality radiological findings through case studies, including PET-CT. Additionally, we will explore treatment modalities and discuss prognosis to provide a comprehensive understanding of this challenging condition.

## BREE-80 CONTRAST ENCHANCED MAMMOGRAPHY APPLICATIONS: A CASE BASED REVIEW

Kictzia Y. Larios Cruz, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Luz E. Bastidas Caicedo, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Balbas Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Nora I. Moguel, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Sandoval Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Sara S. Herrera Lemus, MD (*Abstract Co-Author*) Nothing to Disclose
Angela J. Urbina Ibarra SR, MD,BSC (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Contrast mastography uses intravenous contrast agents, being an effective technique to improve the early detection of breast cancer and reduce the false positive rate, as well as to evaluate the extension and occult cancers among other indications, due to the accurate characterization of lesions.Contrast mastography stands out for its ability to improve the detection of breast lesions, especially in cases of dense breast tissue or inconclusive findings on conventional mammography. Its role in preoperative evaluation is illustrated, allowing a more accurate characterization of the extent of disease and optimal surgical planning. Indications, contraindications and practical considerations for performing the study are also reviewed. This review highlights the

value of contrast-enhanced mastography as an important diagnostic tool in the comprehensive management of breast pathologies, with important implications for early detection and personalized treatment of patients.*Review contrast enchanced mammography basics (acquisition protocol, diagnostic performance, and current indications).*Ilustrate the applications and added value of contrast enchanced mammography through the review of everyday clinical scenarios.

**TABLE OF CONTENTS/OUTLINE**

1.Contrast enchanced mammography lexicón overview (categories, terms, features and definitions)2.Ilustrated case based review2a. Staging2b. Microcalcifications2c. Occult breast cancer2d.Residual and recurrent disease2e.Paget disease2f.Telorrhage2g.High risk screening2h.Focal asymmetry. 3. Conclusions

## BREE-81 LOOK WHAT YOU MADE ME DO...A CORRELATION BETWEEN MRI FINDINGS AND TUMORAL INMUNOPHENOTYPE OF BREAST CANCER

Elena M. Sanchez Siller, MD (*Abstract Co-Author*) Nothing to Disclose
Karla I. Soto, MD (*Abstract Co-Author*) Nothing to Disclose
Yesika Davila Zablah, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica A. Perdomo SR, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Garza, MD (*Abstract Co-Author*) Nothing to Disclose
Ilany L. Valdivia I, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Ia M. Sanchez Carenzo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The main objective of this work is to communicate if there is a relationship between breast cancer findings by MRI and immunohistochemistry, and how we get to that information. The secondary objective is to make a practical and concise description of the findings that we can identify in breast cancer lesions on MRI, as well as the appropriate vocabulary to use about these characteristics. Present more relevant information about the usefulness of the BI-RADS and the Kaiser Score for the proper classification of breast cancer lesions. Review the basic acquisition protocol recommended for the evaluation of suspected or proven breast cancer lesions by MRI, as well as the key points to have an appropriately structured report that contains all the required information about the findings.

**TABLE OF CONTENTS/OUTLINE**

The usefulness of performing immunohistochemistry in patients diagnosed with breast cancer for the management of the disease. The importance of correct and complete evaluation of lesions by MRI, following a protocol in both the acquisition and interpretation of the images, in order to be a guide for those residents in training who are starting out on the subject. Concise descriptions are included with illustrations and real examples representative of our institution that include mass and non-mass lesions with all those characteristics that must be identified and characterized in the interpretation. The information included is how the statistical analysis was performed, selection and exclusion of patients, and results on the prevalence of the reviewed characteristics as well as their correlation with the types of immunophenotype in our study population.

## BREE-82 PET/MRI IN BREAST CANCER: WHAT RADIOLOGY RESIDENTS NEED TO KNOW

**Awards**
**Certificate of Merit**

Itzell Reyes Garcia, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• To review: Breast Anatomy in MRI• To understand the basics of PET-MRI• To recognize the opportunities for synergistic use of multimodal information• To present protocols and procedures for Breast PET-MRI• To discuss the advantages and disadvantages of PET-MRI in breast cancer

**TABLE OF CONTENTS/OUTLINE**

• Introduction• Breast Anatomy in MRI• Principles of PET/MRI and Clinical Applications• Most Common Radiotracers Used in Breast PET-MRI• Representative Cases on Breast Cancera. Stagingb. Prognosisd. Treatment Response Assessment• Take home points• Discussion• Conclusion

## BREE-83 DEEP LEARNING FOR BREAST CANCER RISK PREDICTION: LEARNING FROM THE PAST TO ENSURE AN EQUITABLE FUTURE

Laura Heacock, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Alana A. Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriu Reig, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Including imaging information such as breast density improves the accuracy of clinical models of breast cancer risk. 2. Accurate risk assessment identifies women who would benefit from supplemental screening and/or chemoprevention. 3. Training and validating models on a multi-racial and multi-ethnic dataset is essential to ensure accurate risk assessment across groups.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Risk prediction using clinical models b. Imaging data incorporated into Tyrer-Cuzick and other models c. Time-frame of risk prediction: near-term versus long-term risk 2. Summary of risk prediction research a. FFDM i. Radiomics evaluation of parenchymal complexity ii. Deep learning models including Mirai b. DBT - challenge of generalizing FFDM models to DBT c. US - parenchymal echogenicity reflects glandular composition d. MRI - BPE as a marker of risk 3. Future directions a. Multimodality b. Incorporating prior studies c. Including polygenic risk scores d. Modeling the impact of different screening intervals 4. Improving generalizability and equity a. Deep learning models show similar performance across racial and ethnic groups, compared to clinical models that have poor performance in non-white groups b. Importance of multi-racial and multi-ethnic datasets, validation

## BREE-84 GRANULOMATOUS MASTITIS. A RARE BENIGN ENTITY THAT CAN SIMULATE BREAST CANCER. WHAT THE RADIOLOGIST SHOULD KNOW!

Maria C. Ona Hurtado SR, MMed,BA (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1 Analyze the imaging characteristics of the (IMG) 2 Discuss the management of the heterogeneous group of IGM •Introduction and review of the literature •Review of the imaging characteristics •Description of the results of the IGM images in mammograms, ultrasounds and MRI •Clinical cases •Diagnostic algorithm

**TABLE OF CONTENTS/OUTLINE**

Granulomatous mastitis(GM) is a benign inflammatory breast disease that its becoming more commonly seen during our daily practice of unknown etiology, has a persistent and recurrent clinical course and occurs most commonly in parous women; it typically manifests as a tender palpable mass and inflammatory breast changes characterized by granulomatous inflammation at histopathologic analysis.The most common clinical sign is a painful palpable mass associated with erythema, and purulent discharge. However, the nonspecific manifestations and varied demographic features of this condition, as well as the other similar-appearing and superimposed breast entities, pose substantial diagnostic challenges, like inflammatory breast cancer(IBC), infective mastitis, foreign body injection granulomas, mammary duct ectasia, diabetic fibrous mastopathy, and systemic granulomatous processes and tuberculosis. Targeted ultrasonography, mammography, and less commonly, magnetic resonance imaging have proven to be useful for imaging evaluation. Core-needle biopsy, with or without fine-needle aspiration for cytopathologic examination, and culture analysis are usually required to exclude IBC and other benign inflammatory processes.

## BREE-85 EXTRAMAMMARY FINDINGS ON BREAST MRI FOR THE BREAST RADIOLOGIST

Sujata V. Ghate, MD (*Abstract Co-Author*) Research Grant, Bracco Group;Reader, QT Ultrasound, LLC;Travel support, QT Ultrasound, LLC
Victoria A. Wells, MD (*Abstract Co-Author*) Nothing to Disclose
Jay A. Baker, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Karen S. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Derek L. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Theresa X. Pham, MD, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Breast Magnetic Resonance Imaging (MRI) is frequently utilized in breast imaging for high-risk screening, evaluation of implant integrity, evaluation of disease extent in the preoperative setting, and evaluation of tumor response to neoadjuvant chemotherapy. Given the varying field of view of breast MRI examinations, incidental extramammary findings may be visible in the lower cervical neck, thorax, upper abdomen, and even thoracic spine. Therefore, it is important for breast radiologists to include these areas in their search pattern and to have a comprehensive understanding of the distinctive imaging findings and pathology—both benign and malignant—observed in these anatomical areas. The purpose of this educational exhibit is to review cases with incidental extramammary findings on breast MRI and to highlight the importance of looking at all of the imaging sequences, including localizers, and areas beyond the breasts.

**TABLE OF CONTENTS/OUTLINE**

1. Highlight and discuss the importance of looking at all the available MRI sequences for incidental extramammary findings on breast MRI.2. Review common extramammary benign and malignant imaging findings that can be incidentally detected on breast MRI.3. Present image-rich multimodality case examples of incidental extramammary findings detected on breast MRI.

## BREE-86 BEYOND CANCER: REVEALING BI-RADS 5 MIMICS

Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa M. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Cardoso Ern, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Identify the BI-RADS 5 imaging standards for ultrasound, mammography, and MRI;- Outline and illustrate the main benign differential diagnoses for BI-RADS 5;- Propose a diagnostic flowchart to determine biopsy concordance;

**TABLE OF CONTENTS/OUTLINE**

The system currently used to report and classify mammography, ultrasound, and breast MRI findings is the BI-RADS system. It ensures uniformity in the lexicon and a degree of homogeneity in the interpretation of exams. The ACR BI-RADS 5 classification is used when the probability of malignancy is greater than or equal to 95%.However, not all lesions classified as BI-RADS 5 are malignant. Some pathologies have imaging features that mimic findings characteristic of highly malignant lesions and are ultimately classified with them, such as atypical infections, radiated scar, fat necrosis, desmoid tumor, granulosa cell tumor, mastitis (inflammatory, lymphocytic/diabetic, and infectious) and myofibroblastoma.his is a retrospective study using images from the database of a quaternary hospital that is a national reference for highly complex cases. Ultrasound, mammography, and MRI scans between 2015 and 2023 were used, all with anatomical-radiological matching.The breast radiologist must be aware of this group of agents and determine whether a new biopsy is necessary in the case of a discordant result, or whether the result is benign and concordant according to well-established criteria.

## BREE-87 CONTRAST-ENHANCED MAMMOGRAPHY FINDINGS. A PICTORIAL REVIEW OF BENIGN AND MALIGNANT LESIONS WITH RADIOLOGIC-PATHOLOGIC CORRELATION

**Awards**
**Certificate of Merit**

Elena Romero (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Soledad Alonso Garcia (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-To describe contrast-enhanced mammography (CEM) technique.-To review the appearances of benign and malignant lesions in CEM, including different patterns of enhancement and correlation with low-energy images. - To illustrate imaging findings of CEM with correlation with imaging (US, MRI) and pathology. - To emphasize pitfalls, diagnostic difficulties and differential diagnosis and discussion of management.

**TABLE OF CONTENTS/OUTLINE**

Contrast-enhanced mammography (CEM) is currently used in diagnostic work-up of breast lesions. Advantages include well-tolerated studies, short duration, lower cost than MRI, and immediate review of results after the study. Radiologists should be familiar with normal findings and commonly encountered benign and malignant entities on CEM.
- Basics and technique of CEM.
- Study evaluation: low-energy findings (mass, calcifications, architectural distortion, asymmetries), patterns of enhancement (background parenchymal enhancement, mass, non-mass enhancement, and enhancing asymmetry).
- Images in different pathologic entities. Through sample cases, a variety of imaging and pathology findings from lesions detected in CEM studies with correlation with US, MRI and pathology, illustrating benign lesions (cyst, fibroadenoma, phyllodes tumor, papilloma, fat necrosis, pseudoangiomatous stromal hyperplasia (PASH), skin-related lesions, lymph nodes, granulomatous and lymphocytic mastitis, abscess), malignant entities (DCIS, ductal and lobular invasive cancer, colloid and papillary cancer, lymphoma) and high risk lesions (atypical ductal hyperplasia (ADH), radial scar, flat epithelial atypia).
- Clues for differential diagnosis and pitfalls.

## BREE-88 THE CHALLENGE OF DEPICTING BREAST MICROCALCIFICATIONS ON PHOTON-COUNTING DETECTOR CT

Marehiko Hiroshima, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yuki Yasuda (*Abstract Co-Author*) Nothing to Disclose
Takayuki Noro, MD (*Abstract Co-Author*) Nothing to Disclose
Nobuo Kitera, RT, MSc (*Abstract Co-Author*) Nothing to Disclose
Kazuya Ohashi, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Masaya Kisohara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seita Watanabe, RT (*Abstract Co-Author*) Nothing to Disclose
Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Misugi Urano, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Photon-counting detector computed tomography (PCD-CT) has several advantages over conventional energy-integrating computed tomography (EID-CT). The higher spatial resolution of PCD-CT may provide a precise visualization of microcalcifications related to breast cancer. This can contribute to preoperative planning by identifying the distribution of microcalcifications.This presentation will focus on depicting breast microcalcifications in breast cancer patients on PCD-CT, comparing it to EID-CT and other imaging modalities, including mammography, tomosynthesis, ultrasound, and magnetic resonance imaging, with pathological results. We will also discuss the reconstruction settings of kernel sharpness, iterative reconstruction, or slice thickness to depict and identify breast microcalcifications on PCD-CT.

**TABLE OF CONTENTS/OUTLINE**

1. The types of breast calcifications 2. The reconstruction settings, including kernel sharpness, iterative reconstruction, or slice thickness of PCD-CT to depict and identify breast microcalcifications 3. Case-based review of breast calcifications on PCD-CT compared to EID-CT, other imaging modalities, and pathological results 4. Discussion of the advantages and pitfalls of breast microcalcifications on PCD-CT compared to other modalities

## BREE-89 LATERAL ARM APPROACH FOR STEREOTACTIC BREAST GUIDED BIOPSIES: PEARLS AND PITFALLS

Alejandra Varela, MD (*Abstract Co-Author*) Nothing to Disclose
Agostina B. Peralta (*Abstract Co-Author*) Nothing to Disclose
Daniel C. Mysler SR, MD (*Abstract Co-Author*) Nothing to Disclose
Tiare A. Pineiro, MD (*Abstract Co-Author*) Nothing to Disclose
Maria L. Negri (*Abstract Co-Author*) Nothing to Disclose
Leandro Rodriguez Ramirez, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Cosaka (*Abstract Co-Author*) Nothing to Disclose
Andrea Noelia Seco (*Abstract Co-Author*) Nothing to Disclose
Claudia A. Fernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Leidy Imitola Romo (*Abstract Co-Author*) Nothing to Disclose
Maria C. Freire, DMD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Discuss the basic principles for performing a lateral arm approach stereotactic breast guided biopsy.-Describe the patient’s indications for carrying out this approach.-Recognize potential challenging cases and complications when performing a lateral arm approach stereotactic breast guided biopsy.-Illustrate techniques to overcome problems and successfully resolve challenging cases.

**TABLE OF CONTENTS/OUTLINE**

Stereotactic breast biopsies have proven to be a feasible alternative to surgical breast biopsies. Nowadays, this method is the standard of care in patients with suspicious findings on mammography or tomosynthesis. Performing a successful stereotactic breast guided biopsy requires planning and a correct evaluation of the lesion location and of the patient’s breast anatomy. When this procedure can not be safely performed a surgical approach should be considered. The lateral arm approach for stereotactic breast biopsies permits procedures to be done using a needle insertion parallel to the compression plate allowing to successfully sample lesions that would have been excluded with a conventional approach, therefore avoiding surgical biopsy as well as improving patients care and comfort. -Illustrate the basic principles of this technique.-Discuss how to plan, patient select and perform a lateral arm stereotactic breast biopsy.-Examine advantages and limitations of this approach. -Identificate and illustrate with case examples potentially challenging cases as well as provide tips and tricks to troubleshoot and successfully perform this procedure.

## BREE-9 RADIAL SCLEROSING LESIONS - IMAGING FINDINGS AND MANAGEMENT

Patricia A. De Camargo Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela G. Giannotti, MD (*Abstract Co-Author*) Nothing to Disclose
Thais Mayor Simonatto, MD (*Abstract Co-Author*) Nothing to Disclose
Ulisses Ferreira (*Abstract Co-Author*) Nothing to Disclose
Ligia A. Yamashita, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa Moyses, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian N. Omura, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela F. Vieira Vendramini (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Saccarelli, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Describe the histological pattern of radial sclerosing lesions (RSL).-Describe and define the possible imaging presentations of radial sclerosing lesions, according to different imaging methods, such as mammogram (MG), ultrasound (US) and magnetic resonance (MRI).-Discuss the malignancy upgrade rates of radial scars according to it's histological associations and the possibility of follow-up of these lesions.

**TABLE OF CONTENTS/OUTLINE**

-Review the histological findings defining RSL, in addition to its possible histological patterns and associations to malignant lesions or atypia.-Enlist the possible differential diagnosis of RSL.-Illustrate RSL characteristics on various imaging methods, which can or cannot occur simultaneously.-Correlate simultaneous findings in each method. Discuss the possibility of malignancy upgrade of the RSL lesions, and correlate these rates with imaging and histological findings.-Discuss the different managing propositions of these lesions, according to its imaging and histological patterns. -Summary and take home messages.

## BREE-90 UNRAVELING THE UNCOMMON: RARE BREAST CANCER VARIANTS AND COMMON IMAGING FINDINGS

Erica Endo, MD (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda de Oliveira Cirino, MD (*Abstract Co-Author*) Nothing to Disclose
Lidia B. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra d. Borges, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Recognition of the radiological peculiarities of rare types of breast cancer in mammography, ultrasonography, and magnetic resonance imaging. Special histological subtypes are rare in breast cancer and knowing some of their peculiarities helps us recognize atypical imaging patterns and make appropriate anatomopathological correlations.

**TABLE OF CONTENTS/OUTLINE**

Malignant Phyllodes Tumor: Large solid or complex solid-cystic mass; differential diagnosis with rapidly growing fibroadenoma. Mucinous Carcinoma: High signal intensity in T2. Medullary Carcinoma: Mass with circumscribed or microlobulated margins with posterior enhancement.Ring enhancement with internal septations. Tubular Carcinoma Slow growth small spiculated mass associated with architectural distortion and calcifications. Heterogeneous enhancement with washout curve. High association with DCIS. Invasive Papillary Carcinoma: solid or complex solid-cystic mass; calcifications are common. May present with ductal dilatation. Hemorrhage with high signal in T1WI. Pleomorphic Lobular Carcinoma: Larger spiculated masses with calcifications, architectural distortion and local invasiveness. May present as focal asymmetry. Non-mass enhancement and necrosis. Metaplastic Carcinoma Large, rapidly growing, round and circumscribed mass. Heterogeneous and ring enhancement with necrosis or intratumoral hemorrhage. Neuroendocrine Carcinoma Spiculated mass or asymmetry with calcifications, architectural distortion. Diffusion restriction and washout curve. Micropapillary Carcinoma: Spiculated mass with calcifications, architectural distortion. Lymph node metastasis are common even in small lesions.

## BREE-91 TRIANGULATION AND ADDITIONAL VIEWS IN MAMMOGRAPHY. BACK TO BASICS OF PROBLEM- SOLVING TECHNIQUES STILL ALIVE

**Awards**
**Magna Cum Laude**

Rodrigo Pastorin (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Candela Munoz Roldan (*Abstract Co-Author*) Nothing to Disclose
Maria Teresa Montero Alameda (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To review the basics of breast triangulation in mammography.
- To illustrate the correlation of lesion position on mammograms through diagrams and illustrative cases of US and MRI.
- To describe additional views employed in work-up of mammographic findings.
- To emphasize pitfalls, diagnostic difficulties and provide clue points.

**TABLE OF CONTENTS/OUTLINE**

- Introduction. Despite the use of new technologies in mammography, different problems may still occur in standard two view mammograms. We review the classic and basic problem-solving approach.
- Breast triangulation. Mammograms are essential to detect non-palpable breast lesions. The relative lack of anatomical landmarks in the breast, makes sometimes correlation of the location of the lesions a problem even more important with the frequent detection of multiple lesions with new technologies such as contrast-enhanced mammography. We review the basic geometric concept of triangulation, discuss common mistakes in lesion location estimates and their causes.
- Additional views. Magnification and spot-compression views. Tangential views for dermal calcifications (rarely employed with the use of tomosynthesis). 'Exaggerated' views for lesions included in the oblique but not in craniocaudal views ('Cleopatra' view).
- Quiz with difficult cases from our series of mammograms with correlation with US and MRI.

## BREE-92 WHEN THE UGLY IS NOT SO BAD: COMMON AND RARE BENIGN BREAST LESIONS THAT CAN MIMIC MALIGNANCY

Nilton Onari (*Abstract Co-Author*) Nothing to Disclose
Erika M. Negrao (*Abstract Co-Author*) Nothing to Disclose
Silvia M. Sabino, MD (*Abstract Co-Author*) Nothing to Disclose
Edmundo C. Mauad, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ligia P. Mazi, MD (*Abstract Co-Author*) Nothing to Disclose
Jane C. Picone, MSc (*Abstract Co-Author*) Nothing to Disclose
Anapaula H. Watanabe, MD (*Abstract Co-Author*) Nothing to Disclose

Chrissie Amirati (*Abstract Co-Author*) Nothing to Disclose
Ruth H. Bonini, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The BI-RADS categories 4C and 5 are used when the suspicion of malignancy ranges between 50-95% and is >95%, respectively and histopathological investigation is mandatory, typically through percutaneous biopsy. Following a biopsy, encountering a benign result in a lesion classified in these categories can be challenging for the radiologist, particularly in category 5. According to BI-RADS, any non-malignant diagnosis from a needle biopsy in category 5 should be considered discordant, necessitating a recommendation for repeat biopsy, often surgical. Some breast conditions can mimic malignancy, and in these scenarios, it is crucial to be familiar with these benign entities, some of which may be unfamiliar even to breast imaging specialists. After a thorough radiological-pathological correlation, taking into account biopsy technical aspects, lesion characteristics across different imaging modalities, and the patient's clinical history, some results may be accepted, potentially averting the need for additional biopsies or surgeries. The objective of this presentation is to acquaint the radiologist with both common and rare benign lesions that can mimic malignancy through cases encountered in daily practice.

**TABLE OF CONTENTS/OUTLINE**

In a didactic manner, several cases selected from our institution's archive of benign lesions, histological proven, with mammographic and ultrasonographic correlations will be presented. These cases encompass lesions of infectious/inflammatory origin, autoimmune diseases, benign proliferative conditions, and benign tumors.The common clinical and imaging manifestations of these entities will be discussed, along with a review of the pathological aspects.

## BREE-93 ULTRAFAST DYNAMIC CONTRAST ENHANCED BREAST MRI WITH A MODIFIED SENSE ACCELERATED 3DTFE SEQUENCE: CASE BASED REVIEW

Shreya Poddar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Nirali S. Mehta, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Smruti Mulani, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Ultrafast Breast MRI [UFBMRI] can be performed using conventional parallel imaging with accelerated 3DTFE sequence on conventional scanners.2. Qualitative assessment of UFBMRI adds to the diagnostic specificity and guides patient management by indicating the possible extent of vascularity and hence aggressiveness of the lesion. Hence, optimal site for tissue sampling can be determined. 3.UFBMRI can be incorporated in routine practice on most scanner platforms without additional postprocessing, ensuring accessibility to a larger patient population.

**TABLE OF CONTENTS/OUTLINE**

Introduction: UFBMRI requires acceleration techniques like k-space sharing, compressed sensing and/or AI based reconstruction. These techniques are available only on newer scanners and not all centers performing breast MR have access to them. Furthermore, UFBMRI data has been analyzed quantitatively using Max Slope of Increase and TTE [Time to enhance] as compared to Aorta which involve additional calculations. Methods: We set up a Ultrafast Dynamic Contrast Enhanced [UFDCE] protocol using a 3DTFE sequence with parallel imaging, to achieve a temporal resolution of 6secs. We analyzed the images qualitatively, with reference to the presence, synchronicity and rapidity of enhancement. Principle of UFDCE, Sequence parameters and Breast MRI protocol will be discussed. Representative cases will be presented where qualitative analysis of UFBMRI contributed to the histopathologic diagnosis and patient management. Conclusion: Qualitative assessment of SENSE accelerated UFDCE sequence using 3D Fast Gradient Echo sequence [temporal resolution ~ 6secs] can also improve the diagnostic specificity and guide patient management.

## BREE-94 CAN FAST MRI AND NON-CONTRAST MRI REPLACE CONVENTIONAL DYNAMIC CONTRAST MRI? - FOCUS ON MORPHOLOGICAL EVALUATION AND IMAGE QUALITY IN BREAST MRI

Yoshito Ichiba, RT (*Abstract Co-Author*) Employee, Siemens AG
Masako Y. Kataoka, MD, PhD (*Abstract Co-Author*) Speaker, Siemens AG Speaker, Bayer AG Speaker, Devicor Medical Products, Inc Speaker, Guerbet SA
Rie Ota, MD (*Abstract Co-Author*) Nothing to Disclose
Aika Okazawa (*Abstract Co-Author*) Nothing to Disclose
Mami Iima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuta Urushibata (*Abstract Co-Author*) Employee, Siemens AG
Tsutomu Okada, MD (*Abstract Co-Author*) Nothing to Disclose
Yuji Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maya Honda, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Ultrafast dynamic contrast-enhanced (UF-DCE) MRI and DWI are novel sequences in the breast that have accumulated evidence for diagnosing and characterization of breast cancer, though are not used as stand-alone sequences. One of the strengths of these sequences is that they can be evaluated quantitatively (time-intensity curves (TIC) and apparent diffusion coefficient (ADC). On the other hand, various methods have been devised to reduce artifacts or increase the spatial resolution of these sequences to improve qualitative assessment. Some DWI sequences like readout segmentation of long variable echo-trains (RESOLVE) and diffusion-weighted spatiotemporal encoding (SPEN), can achieve higher in-plane resolution than conventional single-shot echo-planar DWI, and tumor morphology assessment using them is being investigated. Currently, Breast Imaging and Data System (BI-RADS) prioritizes morphological evaluation to estimate the malignant potential of breast lesions. Therefore, morphological evaluation may be the key for these sequences to be used as alternatives to conventional DCE MRI. This exhibit will focus on the morphological evaluation and image quality of UF-DCE MRI and DWI in the breast.

**TABLE OF CONTENTS/OUTLINE**

1: Image quality and morphological evaluation using UF-DCE MRI: A) view sharing technique B) compressed sensing C) pitfalls in TIC evaluation2: Image quality and morphological evaluation using DWI: A) RESOLVE B) SPEN C) other sequences

## BREE-95 AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE: SCREENING GUIDELINES AND IMAGING OF BREAST CANCER IN BRCA MUTATION CARRIERS

Katerina Dodelzon, MD (*Abstract Co-Author*) Nothing to Disclose
Alexia R. Tatem, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Tatiana Kelil, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Ye (*Abstract Co-Author*) Nothing to Disclose
Loretta M. Strachowski, MD (*Abstract Co-Author*) Royalties, RELX;Speaker, World Class CME
Heather I. Greenwood, MD (*Presenter*) Support, Endomagnetics Ltd;Support, Devicor Medical Products, Inc

**TEACHING POINTS**

1. To review the recently updated American College of Radiology (ACR) high-risk screening guidelines for BRCA1 and BRCA2 mutation carriers including transgender patients 2.To review the different imaging features of BRCA1 and BRCA2 specific tumors and correlate the imaging features with histopathology 3. To review the evidence behind various imaging modalities for screening patients with BRCA1 and BRCA2 mutations

**TABLE OF CONTENTS/OUTLINE**

1. Background information reviewing BRCA1 and BRCA2 genes: transmission, lifetime risk of cancers, prevalence in overall population and specific higher risk populations, risk assessment 2. Review of the 2023 updated ACR high-risk screening breast cancer guidelines, with emphasis on updates for BRCA1 and BRCA2 mutation carriers 3. Review the current state of available data and guidelines for high-risk screening in transgender BRCA mutation carrier patients 4. Multi-modality case examples of BRCA1 vs BRCA2 associated tumors: imaging features with histopathologic correlation 5. Review of the evidence behind various imaging modalities in screening BRCA1 and BRCA2 mutation carriers with imaging examples: Digital Mammography/Digital Breast Tomosynthesis, Ultrasound, Dynamic Contrast Enhanced Breast MRI (DCE-MRI), Abbreviated Breast MRI (AB-MRI), Contrast Enhanced Mammography (CEM)

## BREE-96 UNLOCKING THE SECRETS OF BREAST FIBROEPITHELIAL LESIONS: A COMPREHENSIVE GUIDE FOR RADIOLOGISTS

Daniela B. Grammatico, PhD (*Abstract Co-Author*) Nothing to Disclose
Marilia P. Royero, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Johana Mariel Porres (*Abstract Co-Author*) Nothing to Disclose
Lennny P. Ticona Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Julieta Jaime (*Abstract Co-Author*) Nothing to Disclose
Flavia B. Sarquis, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Embark on an exciting journey through the complex world of breast fibroepithelial lesions (FELs) with our interactive learning center exhibit. FELs are a diverse group of tumors that originate from the stromal and epithelial tissues of the breast, and can range from benign to malignant. This exhibit focuses on three main types of FELs: fibroadenomas, phyllodes tumors, and benign fibroepithelial tumors.By exploring this exhibit, radiologists will:Gain a deep understanding of the diverse spectrum of breast fibroepithelial lesions.Master the latest diagnostic imaging techniques for detecting and characterizing FELs.Appreciate the crucial role of imaging in differential diagnosis and management of FELs.Stay up-to-date with the latest emerging imaging modalities and guidelines for FELs.Enhance multidisciplinary collaboration and communication for optimal patient care.Join us in this exciting learning journey and unlock the secrets of breast fibroepithelial lesions.

**TABLE OF CONTENTS/OUTLINE**

Introduction to breast fibroepithelial lesions.Pathophysiology and histopathological features.Clinical presentation and diagnostic workup: Learn how to recognize and diagnose FELs through our daily practice case studies and clinical pearls.Multidisciplinary approach to management.Future directions.Conclusion and summary

## BREE-97 UNRAVELING THE COMPLEXITY OF BREAST MASSES WITH ASSOCIATED NECROSIS: SIGNIFICANCE AND MANAGEMENT

**Awards**
**Certificate of Merit**

Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Soudabeh Fazeli, MD,MPH (*Abstract Co-Author*) Nothing to Disclose
Tara A. Retson, MD, PhD (*Abstract Co-Author*) Research Consultant, CureMetrix, IncStock options, CureMetrix, Inc
Rebecca Rakow-Penner, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Consultant, Human Longevity Inc;Stockholder, CureMetrix, Inc;Stock options, CorTechs Labs, Inc
James Stepenosky, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Abstract Co-Author*) Nothing to Disclose
Haydee Ojeda-Fournier, MD (*Presenter*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc

**TEACHING POINTS**

Breast masses with associated necrotic changes pose a diagnostic and management challenge for radiologists. Both benign and malignant etiologies can lead to a mass presenting with central necrosis. Triple-negative breast cancer is notorious for presenting with necrosis. However, tumor necrosis has not been associated as an imaging characteristic to predict response to systemic therapy. Benign masses that grow rapidly can demonstrate necrosis or infarction and can, in rare instances, become infected. Multimodality imaging is critical for formulating a differential and guiding biopsy into a non-necrotic region to obtain an accurate histopathologic diagnosis. By the end of this educational exhibit, learners will: 1. Define tumor necrosis 2. Explain the mechanisms that lead to necrosis 3. List benign and malignant etiologies associated with central necrosis 4. Choose the appropriate location to biopsy the lesion with necrosis

**TABLE OF CONTENTS/OUTLINE**

Introduction; Definition of tumor necrosis; Incidence of, and risk factors that lead to, necrotic masses; Mechanisms of tumor necrosis; Clinical presentation of necrotic masses; Differential considerations including benign and malignant etiologies; Distinguishing necrotic tumors from abscess and fluid collections. Multimodality imaging examples of necrotic masses including necrotic lymph nodes; Systematic approach for characterization of masses associated with necrosis; Pitfalls in the sonographic assessment of necrotic masses; Strategies for successful core biopsy and radiology-pathology correlation. Algorithm for management of benign and malignant necrotic masses; Conclusion.

## BREE-98 MULTIMODALITY EVALUATION OF REGIONAL BREAST LYMPH NODES: IMPACT OF BI-RADS 6$^{TH}$EDITION

James Stepenosky, MD (*Abstract Co-Author*) Nothing to Disclose
Soudabeh Fazeli, MD,MPH (*Abstract Co-Author*) Nothing to Disclose
Tara A. Retson, MD, PhD (*Abstract Co-Author*) Research Consultant, CureMetrix, IncStock options, CureMetrix, Inc
Haydee Ojeda-Fournier, MD (*Presenter*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc

**TEACHING POINTS**

Evaluation of regional breast lymph nodes is an integral part of breast cancer imaging, it will affect clinical management. The radiologist must understand how to evaluate lymph nodes, stage the axilla, be proficient in image-guided interventions involving lymph nodes, and select the most appropriate

imaging modalities to evaluate breast regional lymph nodes. Ultrasound-guided core biopsy or fine needle aspiration can be performed for histologic confirmation of nodal metastasis. In the expected 6th edition of BI-RDS, lymph nodes will be their own category across modalities with expanded discussion regarding location and morphology. The purpose of this educational exhibit is to preview expected BI-RADS 6th edition changes that will impact the evaluation of regional lymph nodes. By the end of this educational exhibit, learners will: 1. List morphologic criteria for lymph node assessment; 2. Identify the location of lymph nodes; 3. Recognize the relationship of the pectoralis minor to axillary lymph node levels; 4. Summarize expected lymph node updates in BI-RADS 6th edition.

**TABLE OF CONTENTS/OUTLINE**

Introduction; Morphology of lymph nodes; lymph node locations: intramammary, axillary, internal mammary, supra-clavicular; Clinical presentation of adenopathy; Differential considerations of abnormal lymph nodes; Multimodality imaging regional lymph nodes: Mammogram, US, MRI; Learn a systematic approach to the characterization of abnormal lymph nodes; How to apply BI-RADS 6th edition lexicon for regional lymph nodes appropriately; Pitfalls in providing nodes BI-RADS categories; Image-guided interventions to assess nodes; Algorithm for management of regional lymph node findings; Conclusion.

## BREE-99 DON'T BE RASH, IT'S JUST PASH !

Bruna M. Thompson, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fabiana C. Policeni, MD (*Abstract Co-Author*) Nothing to Disclose
Danielli Matsuura (*Abstract Co-Author*) Nothing to Disclose
Fabiola P. Kestelman, MD (*Abstract Co-Author*) Nothing to Disclose
Su Kim Hsieh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Japnit Singh, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Breast pseudoangiomatous breast hyperplasia (PASH) can have a variety of different presentations. It can be asymptomatic, found incidentally on a breast biopsy or present itself as a mass, asymmetry or gigantomastia. PASH can be found in a wide age range but is more common in pre-menopausal and post-menopausal women on hormone replacement therapy. It has been commonly seen associated with gynecomastia. Even though benign, PASH can be admixed with malignancies, hence warrants a careful imaging-pathology correlation to establish concordance with biopsy. In some patients, PASH can have an uncommon presentation and outcome, such as a large and fast-growing mass leading to gigantomastia. In such cases, extreme treatments, like mastectomy may be required for local control. In order to help clinicians make the right treatment decision, an effective diagnosis can be made by correlating imaging findings with pathological features.

**TABLE OF CONTENTS/OUTLINE**

To illustrate the various imaging aspects of breast pseudoangiomatous stromal hyperplasia (PASH) and its correlation with pathologic and clinical findings. To review the clinical presentations, key pathologic features along with current management of PASH. Lastly, to illustrate the imaging and pathological differential diagnosis of PASH.

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# Abstract Archives of the RSNA, 2024

BREE-1

## KEEPING UP WITH THE CUTTING EDGE: MULTIMODALITY REVIEW OF ONCOPLASTIC BREAST SURGERY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Alexander Kuehne, MD (*Abstract Co-Author*) Nothing to Disclose
William J. Hoover, MD (*Abstract Co-Author*) Nothing to Disclose
John M. Lewin, MD (*Abstract Co-Author*) Officer, Novian Health Inc
Caroline Merriam, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Surgical management of breast cancer continues to evolve as oncoplastic surgery (OPS) grows in popularity.
- OPS allows for tumor resection with lumpectomy or mastectomy, followed by breast reconstruction.
- To improve cosmetic outcomes after breast reconstruction, several plastic surgery techniques are utilized including volume replacement, volume rearragement, and volume displacement.
- This educational exhibit will provide a description and illustration of several common oncoplastic breast surgeries.
- For each procedure, we will review expected post-operative imaging features on mammogram, ultrasound, and breast MRI.
- The exhibit will conclude with a discussion of acute and long-term complications of OPS including breast abscess, fat necrosis, hematoma, flap necrosis, and breast cancer recurrence.

### TABLE OF CONTENTS/OUTLINE

1. Brief history of oncoplastic breast surgery (OPS)2. Who is a candidate for OPS?3. Pictorial review of eight OPS techniques, including expected post-operative imaging findings for each technique:
- Reduction mammoplasty
- Nipple areolar complex centralization
- Latissimus dorsi flap
- Deep inferior epigastric perforator (DIEP) flap
- Transverse rectus abdominis myocutaneous (TRAM) flap
- Superior gluteal artery flap
- Autologous fat grafting
- Omental flap4. Case-based review of acute and long-term complications of OPS

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# Abstract Archives of the RSNA, 2024

BREE-10

## WHEN A MASS IS MELANOMA: VARIABLE IMAGING PRESENTATIONS OF A RARE BREAST DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Molly Hill, MD (*Abstract Co-Author*) Nothing to Disclose
Allison Aripoli, MD (*Abstract Co-Author*) Nothing to Disclose
Ashley I. Huppe, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica K. Peterson, MD (*Abstract Co-Author*) Nothing to Disclose
Camron B. Smith, DO (*Abstract Co-Author*) Nothing to Disclose
Onalisa D. Winblad, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela E. Wermuth, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Extramammary metastases to the breast are rare, with melanoma being the most common.2. Metastatic melanoma to the breast may be identified in symptomatic or asymptomatic patients with or without a known history of melanoma.3. Imaging features of melanoma metastases to the breast overlap with findings of primary breast malignancy.4. A thorough understanding of common and unusual imaging presentations of metastatic melanoma is key to maintaining a high clinical suspicion, with biopsy ultimately necessary for diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Background: Review the prevalence of melanoma metastases (including those to the breast), mechanism of metastatic spread, timeline of presentation, and appropriate workup.2. Case-based imaging review: Multimodality examples of metastatic melanoma to the breast, emphasizing common and unique imaging presentations on:- Mammography- Ultrasound- MRI3. Clinical importance: Discuss the frequency of melanoma, importance of careful clinical history and accurate diagnosis, and general prognosis of melanoma metastases to the breast.

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# Abstract Archives of the RSNA, 2024

BREE-100

## THE RADIOLOGIST'S ROADMAP TO BREAST IMPLANT EVALUATION: A RESIDENT'S TUTORIAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Tatiana C. Tucunduva, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela P. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Jacqueline Herica Watanabe, MD (*Abstract Co-Author*) Nothing to Disclose
Aracava M. Marcia, MD (*Abstract Co-Author*) Nothing to Disclose
Luciano F. Chala, MD (*Abstract Co-Author*) Nothing to Disclose
Tomie H. Ichihara, MD (*Abstract Co-Author*) Nothing to Disclose
Giselle G. Mello, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understanding Implant Types and Anatomy - Imaging Techniques for Implant Assessment - MRI Protocols and Implant Evaluation - Managing Complications and Reviewing Cases

### TABLE OF CONTENTS/OUTLINE

Basic Principles of Breast Implant Evaluation: Understand implant types (saline vs. silicone, single vs. double lumen, expanders), relevant anatomy, and terminology. Imaging Methods for Implant Evaluation: Mammography: Use and limitations in implant evaluation; Ultrasound: Applicability in detecting ruptures and other changes; MRI Imaging: Exam protocols, essential sequences (T1, T2, STIR, fat-suppression sequences), and its importance in the comprehensive evaluation of implants and surrounding tissue. MRI Exam Protocols: Recommended sequences for a detailed evaluation; Location and positioning of the patient. Implant Evaluation: Identification and interpretation of normal findings (position, lumen integrity); Recognition of changes and complications: folds, axis rotation, ruptures (intracapsular and extracapsular), capsular contracture; Complications and Associated Pathologies: Granulomas: Identification and implications; Breast Implant-Associated Anaplastic Large Cell Lymphoma (BIA-ALCL): Signs, symptoms, and imaging diagnosis; Hemangioma: Imaging characteristics and relevance. Management of Complications: Strategies for early diagnosis of complications; Multidisciplinary approach in managing complications and pathologies associated with implants. Case Discussion and Literature Review: Analysis of case studies to illustrate the principles of evaluation and management; Updated literature review on the latest trends and findings related to breast implants.

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# Abstract Archives of the RSNA, 2024

BREE-101

## ASSOCIATION BETWEEN BREAST ARTERIAL CALCIFICATIONS AND INCREASED CARDIOVASCULAR RISK: REPORTING CONSIDERATIONS, CLINICAL IMPLICATIONS, AND ROLE IN PREVENTIVE CARE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elsie Nguyen, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Jean M. Seely, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Charlotte J. Yong-Hing, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Roisin Heaney, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Hayley McKee, MSc, BSc (*Abstract Co-Author*) Nothing to Disclose
Kaitlin M. Zaki-Metias, MD, FRCPC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this educational exhibit is to review the association of breast arterial calcifications (BAC) and cardiovascular disease (CVD), detection and reporting methods, and perceptions of radiologists, referring physicians, and patients. 1. BAC are associated with an increased risk of CVD, incident CVD events, and correlate with other methods of cardiovascular risk stratification. 2. BAC are positively correlated with multiparity, menopausal status, metabolic syndrome, hyperlipidemia, hypertension, diabetes, and chronic renal disease, among other comorbidities. 3. Several methods of BAC detection and reporting have been proposed, including binary assessment, subjective quantification or grading, digital measurement, and AI-based detection and reporting models. 4. Reporting of BAC on mammography may allow for supplementary screening for CVD on screening and diagnostic mammography, leading to earlier identification of asymptomatic individuals at high risk for adverse cardiac events and allowing for more targeted preventive care.

### TABLE OF CONTENTS/OUTLINE

1. Understand the association between BAC on mammography and cardiovascular risk. 2. Review the various methods to identify, quantify, and grade BAC including visual binary assessment, subjective severity grading, digital measurement and quantification, and artificial intelligence-based models. 3. Discuss the awareness and attitudes surrounding BAC of radiologists, referring physicians, and patients over the past 5 years. 4. Describe the current gaps, next steps, and challenges in implementation of BAC reporting and clinical management guidelines, including the necessity of interdisciplinary collaboration.

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# Abstract Archives of the RSNA, 2024

BREE-102

## MULTIMODALITY DETECTION OF BREAST CANCER RECURRENCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jean M. Kunjummen, DO (*Abstract Co-Author*) Nothing to Disclose
Maria Piraner, MD (*Abstract Co-Author*) Nothing to Disclose
Rebecca L. Seidel, MD (*Abstract Co-Author*) Consultant, Therapixel SA;Consultant, Delphinus Medical Technologies, Inc
Nishitha Reddy, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Breast cancer is the most common cancer in the female population, for which oncologic and surgical treatment options continue to be developed. Breast cancer recurrence rates vary from 5-20% depending on the tumor subtype. Expected postoperative changes of the breast can be difficult to distinguish from tumor recurrence. Knowledge of multimodality appearances of the postsurgical breast is essential to detecting breast cancer recurrence. Understanding the role of multimodality breast cancer surveillance (ultrasound, mammography, MRI, PET/CT) allows for early detection of recurrent or new breast cancer.

### TABLE OF CONTENTS/OUTLINE

Review the risk factors for breast cancer recurrence. Review current postsurgical breast screening recommendations. Evaluate the role of multimodality imaging, specifically pertaining to the postsurgical breast. Distinguish between expected postsurgical change versus features suspicious for breast cancer recurrence.

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# Abstract Archives of the RSNA, 2024

BREE-103

## POSTSURGICAL BREAST REDUCTION IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laurie R. Margolies, MD (*Abstract Co-Author*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical
Stephanie B. Shamir, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Reduction mammoplasty is a common surgery that results in predictable imaging patterns. 2. Reduction mammoplasty can result in imaging changes such as new asymmetries, calcifications, architectural distortion, and areas of enhancement that may appear suspicious, especially when a surgical history is not provided. 3. It is important to not dismiss potentially concerning asymmetries as part of post-surgical change unless they clearly follow the specific expected imaging patterns.

### TABLE OF CONTENTS/OUTLINE

1. Background • Reduction mammoplasty is performed using classic surgical techniques involving removal and displacement of parenchymal tissue, particularly from the inferior breast • The procedure results in a predictable post-surgical appearance 2. Demonstrate normal post-reduction imaging features • Asymmetries, architectural distortions, fat necrosis and calcifications are expected • Scarring should typically stabilize or decrease with time, and calcifications should coarsen 3. Case Series • Cases of invasive cancer in the post-surgical breast that illustrate ways to recognize areas to be further queried 4. Considerations • Consideration of pre-operative mammogram to confirm the absence of pre-existing malignancy, and to establish a baseline imaging appearance prior to surgery 5. References

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# Abstract Archives of the RSNA, 2024

BREE-104

## IS IT A RECURRENCE OR NOT? MULTIMODALITY IMAGING OF BREAST CANCER RECURRENCE: LITERATURE REVIEW AND CASE BASED PRESENTATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Inci Kizildag Yirgin (*Abstract Co-Author*) Nothing to Disclose
Mustafa Durmaz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The timely and accurate follow-up of patients with a history of breast cancer is mandatory. Women with a personal history of breast cancer are at an increased risk of either a local recurrence or a new primary breast cancer. Local recurrence can increase the risk of distant metastasis or breast cancer-related deaths, and previous studies have shown that early detection of second breast cancers can decrease the mortality rates.Surveillance is essential for the detection of recurrent disease at the earliest possible stage, allowing for prompt treatment, and potentially improving overall survival. International guidelines recommend annual mammography as the only surveillance technique (ASCO, NCCN, ESMO), but a mammogram is less sensitive in the post-surgical period due to post-treatment changes (fat necrosis, surgical scars). Breast MRI is a highly sensitive imaging modality to detect local recurrence in certain patient groups. The purpose of this educational exhibit will be to learn the role of imaging methods and findings due to treatment and findings of recurrence in breast cancer surveillance patients.

### TABLE OF CONTENTS/OUTLINE

Review of incidence, risk factors, diagnostic performance of multimodality surveillance, and presentation of breast cancer recurrence. Review of post-breast-conserving treatment imaging findings and their timing of evolution. Review of available guidelines for multimodality surveillance after curative treatment for locoregional breast cancer. To learn to deal with complex findings between different imaging methods to avoid unnecessary biopsies. To learn the importance of serial follow-up Imaging. Case-based review of different presentations of breast cancer recurrence.

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# Abstract Archives of the RSNA, 2024

BREE-105

## UNCOMMON BENIGN LESIONS THAT MIMIC BREAST CARCINOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura Escudero, MD (*Abstract Co-Author*) Nothing to Disclose
Carlota Garcia Baron (*Abstract Co-Author*) Nothing to Disclose
Maria J. Ciudad, MD (*Abstract Co-Author*) Nothing to Disclose
Myriam F. Montes, MD (*Abstract Co-Author*) Nothing to Disclose
Nancy Sanchez Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Lannegrand Menendez (*Abstract Co-Author*) Nothing to Disclose
Virginia Luxmila Arias Torrealba, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The majority of brest lesions found in breast routine studies are benign and incidental findings. Most lesions have identifiable radiological characteristics suggesting benign findings without the need for additional tests. To a lesser extent, others require radiological followup tests, with diagnosis possibly achieved solely through imaging behavior. There is a group of uncommon benign lesions that, due to their imaging characteristics and clinical findings, may mimic a suspicious malignancy, requiring definitive diagnosis through a biopsy. The objective of this presentation is to provide a guide to the radiological characteristics of sarcoidosis, granulomatous mastitis, diabetic mastopathy, pseudoangiomatous stromal hyperplasia, and traumatic neuroma at the mastectomy site, in different imaging studies available to us today (mammography, ultrasound, and MRI), allowing for a more detailed characterization, as these particular lesions exhibit significant radiological similarity to malignant lesions. We will briefly describe their clinical, epidemiological, and pathological manifestations. Our description help broaden the diagnostic options when faced with a suspicious image of malignancy in patients presenting some of the clinical-radiological characteristics described here.

### TABLE OF CONTENTS/OUTLINE

1. Sarcoidosis.2. Neutrophilic granulomatous mastitis.3. Diabetic mastopathy.4. Pseudoangiomatous stromal hyperplasia.5. Traumatic neuroma at the mastectomy site.

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# Abstract Archives of the RSNA, 2024

BREE-106

## THE MORE YOU KNOW: TEACHING POINTS OF DISCORDANT BREAST BIOPSIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ann L. Brown, MD (*Abstract Co-Author*) Consultant, Elucent Medical
Rifat A. Wahab, DO (*Abstract Co-Author*) Nothing to Disclose
Kyle M. Lewis, MD (*Abstract Co-Author*) Nothing to Disclose
Erich J. Boomgarden, MD (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Abstract Co-Author*) Nothing to Disclose
Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine Mulquin, DO, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Define radiology-pathology concordance as it pertains to breast imaging interventions.2) Detail scenarios in clinical practice that can contribute to biopsy discordance.3) Review clinical implications of discordant biopsies and management strategies including instituting breast radiology-pathology correlation conference.

### TABLE OF CONTENTS/OUTLINE

1) Definitions of benign discordant and malignant discordant biopsies2) Specific and non-specific discordance3) Overview of 5 major categories that contribute to discordant biopsieso Technical Factors--Undersampling (small gauge needle, low number of samples)--Missing the targeted lesion (small target, difficult location)o Complications (bleeding after first sample, vasovagal reaction)o Multiple suspicious lesionso Large or heterogenous finding--Cystic/Necrotic MassNew finding in region with extensive post-treatment changes4) Benefit of incorporating radiology-pathology correlation conference into breast practiceso Consensus management to maximize cancer detection, identify discordant cases in a timely fashion, and avoid unnecessary followup/surgeryCONCLUSIONS1. Discordant biopsies are uncommon, but they can result in delays of care or misdiagnosis when they occur.2. Identification of imaging and clinical features associated with discordant biopsies is important for timely and accurate diagnoses.

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# Abstract Archives of the RSNA, 2024

BREE-107

## FEELING GOOD AND FEELING NEW (BREAST MASSES) ON GLUCAGON-LIKE PEPTIDE-1 (GLP-1) AGONISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bonmyong Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Sophia R. O'Brien, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. McDonald, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Samantha P. Zuckerman, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph J. Villavicencio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Use of glucagon-like peptide-1 (GLP-1) agonists for weight loss is associated with both mammographic changes and clinical breast symptoms.2. Patients may present with symptoms (lumps, pain) following the use of GLP-1 agonists that warrant ultrasound evaluation. This may yield actionable findings that may have otherwise been occult on screening mammography. 3. Changes in density following the use of GLP-1 agonists may obfuscate previously identified findings; this may create a clinical dilemma in the setting of actionable BI-RADS findings. 4. Changes in density following the use of GLP-1 agonists may prompt more recommendations for supplemental screening. 5. There may be no discernible mammographic changes even in cases of significant weight loss while on GLP-1 agonists.

### TABLE OF CONTENTS/OUTLINE

Case 1: 41F, screening. Interval decrease in breast size and increased breast density following 50 lb weight loss on semaglutide. Case 2: 44F, screening. Interval decrease in breast size and increased breast density following 40 lb weight loss on semaglutide with obfuscation of a focal asymmetry.Case 3: 62F with a palpable right axillary lymph node following 50 lb weight loss on tirzepatide and semaglutide. Targeted ultrasound of the right axilla demonstrated an abnormal lymph node yielding metastatic breast cancer which was mammographically occult. Subsequent breast MR demonstrates a correlate for a primary malignancy in the right breast. Weight loss may have prompted a palpable finding.Case 4: 60F with new palpable areas of concern in the bilateral breasts which demonstrate benign findings on ultrasound evaluation. Case 5: 60F, screening. No significant change on mammography despite 50 lb weight loss.

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# Abstract Archives of the RSNA, 2024

BREE-108

## IS THERE ANY SECRET REGARDING TO IDIOPATHIC GRANULOMATOUS MASTITIS?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leire Ormaetxe Albeniz, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Santamaria, MD (*Abstract Co-Author*) Nothing to Disclose
Ruth Gonzalez Sanchez (*Abstract Co-Author*) Nothing to Disclose
Elena Cintora Leon (*Abstract Co-Author*) Nothing to Disclose
Ana L. Legorburu, MD (*Abstract Co-Author*) Nothing to Disclose
Ines Alonso Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Udondo Gonzalez del Tanago, MD (*Abstract Co-Author*) Nothing to Disclose
Loreto De Llano (*Abstract Co-Author*) Nothing to Disclose
Olatz Gorrino Angulo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the clinical and radiological manifestations of Idiopathic Granulomatous Mastitis (IGM). Explain the diagnostic approach and appropriate management. Describe the main entities included in the differential diagnosis

### TABLE OF CONTENTS/OUTLINE

IGM is a rare chronic inflammatory disease that can mimic carcinoma. Typically affects young women with history of pregnancy and breastfeeding. IGM is usually presented as palpable painful breast lump with inflammatory skin changes. It can also associate fluid collections and sinus tracts. Radiological findings in the different imaging modalities are non-specific and a percutaneous biopsy is always needed for diagnosis. We will revise a series of cases diagnosed with IGM in the last eight years, to illustrate the most frequent radiological findings and go through the main steps we should take to achieve the final diagnosis. Depending on age, radiological studies started with ultrasound or a mammography, but all the patients underwent an us-guided biopsy to confirm the diagnosis. The most common us-findings in our cases were hypoechoic images of tubular and nodular morphology with a tendency to join, hypoechoic irregular masses and sinus tracts. Some patients also had fluid collections and axillary involvement. All the women in our series were treated conservatively with good results, except for two who needed surgery.

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# Abstract Archives of the RSNA, 2024

BREE-109

## WHAT CALCIFICATIONS? RADIOLOGIC PRESENTATIONS OF NONCALCIFIED DCIS WITH PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vidushani S. Perera, MD (*Abstract Co-Author*) Nothing to Disclose
Ayah Ali (*Abstract Co-Author*) Nothing to Disclose
Amy Maduram, MD (*Abstract Co-Author*) Nothing to Disclose
Syeda R. Zaidi, MD (*Abstract Co-Author*) Nothing to Disclose
Michelle Kraay, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) DCIS represents 20 to 25% of all breast cancer diagnoses in the United States and is considered to be a precursor of invasive breast cancer. Although the majority of DCIS (80-90%) presents as calcifications seen on mammography, 10-20% of DCIS diagnoses may present as noncalcified findings on mammography, ultrasound, and MRI. It is vital for radiologists to be aware of the different presentations of noncalcified DCIS, including as a palpable mass, bloody nipple discharge, noncalcified findings on mammography such as architectural distortion and focal asymmetry, and non-mass enhancement on MRI. (2) DCIS is a heterogeneous lesion with five major architectural patterns seen on pathology, including comedo, cribriform, micropapillary, papillary, and solid. The comedo type is most commonly associated with the formation of calcifications mammographically. (3) Noncalcified DCIS lesions may be larger at presentation than calcified DCIS due to the difficulty in mammographic detection and has a reported upgrade rate of 21.8% at a single institution. DCIS can be treated with a combination of surgery, radiation, and hormone therapy.

### TABLE OF CONTENTS/OUTLINE

(1) Overview of DCIS epidemiology and histopathology. (2) Common imaging presentation of DCIS as calcifications. (3) Noncalcified DCIS cases presenting as a palpable mass, focal asymmetry, architectural distortion, non-mass enhancement on MR with corresponding pathology. (4) Cases presenting as symptoms including bloody nipple discharge, Paget’s disease, and pregnancy-associated enlarging fibroadenoma. (5) Management of DCIS. (6) Self-assessment quiz.

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# Abstract Archives of the RSNA, 2024

BREE-11

## BEYOND CONVENTIONAL: ADVANCED T2 WEIGHTED IMAGING IN BREAST MRI - EMPOWERING EDUCATION AND DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mami Iima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazushige Ichikawa (*Abstract Co-Author*) Nothing to Disclose
Shinji Naganawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Satoko Ishigaki, MD (*Abstract Co-Author*) Nothing to Disclose
Yutaka Kato (*Abstract Co-Author*) Nothing to Disclose
Hiroko Satake, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Advanced T2-weighted imaging (T2WI) techniques, such as 3D T2WI and deep learning (DL) based T2WI, are explored in breast imaging. We start with an overview of conventional T2WI, discussing its fundamental role in diagnosing breast cancer. The focus then shifts to advanced methods that reduce scan times and improve image resolution, highlighting their benefits in educational settings. Detailed analyses illustrate how these advancements enhance the visualization of crucial T2WI findings like focal edema and intratumoral necrosis in breast cancer. Additionally, the educational value of these technologies in teaching radiologic-pathologic correlation through case studies is explored. The session also addresses the challenges and opportunities presented by cases with lymph node (LN) metastasis, proposing strategies to incorporate these insights to improve diagnostic skills in breast imaging.

### TABLE OF CONTENTS/OUTLINE

1. Imaging Sequence• Overview of conventional T2WI in breast MRI• Introduction to advanced T2WI such as 3D or DL-based T2WI, emphasizing the reduced acquisition time with high resolution2. Focal Edema and Intratumoral Necrosis in Breast Cancer• Detailed analysis of how advanced T2WI can improve the visualization• Discussion on the clinical relevance of these findings in diagnosis3. Radiologic-Pathologic Correlation• Exploration of morphology and signal intensity using advanced T2WI• Case studies highlighting the correlation between radiologic findings and pathologic results, demonstrating the educational value of breast imaging4. Challenges in the Diagnosis of LN Metastasis• Addressing the challenges and learning opportunities presented by cases with LN metastasis

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# Abstract Archives of the RSNA, 2024

BREE-110

## NEOADJUVANT ENDOCRINE THERAPY MONITORING OF PRIMARY BREAST CANCER: COMBINED ASSESSMENT USING FES-DEDICATED BREAST PET AND DYNAMIC CONTRAST-ENHANCED MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura J. Esserman, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita Watkins (*Abstract Co-Author*) Nothing to Disclose
Diane Heditsian (*Abstract Co-Author*) Nothing to Disclose
Susie Brain (*Abstract Co-Author*) Nothing to Disclose
Courtney A. Lawhn-Heath, MD (*Abstract Co-Author*) Nothing to Disclose
Kamala Pullakhandam (*Abstract Co-Author*) Nothing to Disclose
Soumya Gottipati (*Abstract Co-Author*) Nothing to Disclose
Kimberly M. Ray, MD (*Abstract Co-Author*) Nothing to Disclose
Natsuko Onishi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Rita Mukhtar (*Abstract Co-Author*) Nothing to Disclose
Julia C. Carmona-Bozo, MD (*Abstract Co-Author*) Nothing to Disclose
Astrid Quirarte (*Abstract Co-Author*) Nothing to Disclose
Jessica Gibbs (*Abstract Co-Author*) Nothing to Disclose
Teffany Joy Bareng (*Abstract Co-Author*) Nothing to Disclose
Nola M. Hylton, PhD (*Abstract Co-Author*) Institutional research support, General Electric Company;Institutional research support, Kheiron Medical Technologies Ltd
Bonnie N. Joe, MD, PhD (*Abstract Co-Author*) Institutional Research Grant, Kheiron Medical Technologies Ltd;Institutional research agreement, General Electric Company;Institutional research agreement, Siemens AG
Wen Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Ella F. Jones, PhD (*Abstract Co-Author*) Nothing to Disclose
Jo Chien (*Abstract Co-Author*) Nothing to Disclose
Pouya Metanat, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Learn the clinical and biological features of 18F-fluoroestradiol (FES), an estrogen receptor targeting PET tracer. • Learn characteristics of dedicated breast PET (dbPET) imaging in comparison with whole body PET imaging. • Learn differences and similarities between dynamic contrast enhanced (DCE) breast MRI and FES-dbPET imaging. • Learn potential clinical benefit of FES-dbPET when used in conjunction with DCE breast MRI for treatment response evaluation during neoadjuvant endocrine therapy (NET).

### TABLE OF CONTENTS/OUTLINE

1. 18F-fluoroestradiol (FES) - Biological characteristics of FES - Review of literature on whole-body PET with FES 2. Dedicated breast PET (dbPET) - dbPET scanner characteristics - Imaging protocol 3. Clinical workflow of FES-dbPET 4. Comparison of DCE breast MRI and FES-dbPET 5. Case presentation of FES-dbPET and DCE breast MRI during neoadjuvant endocrine therapy (NET) 6. Discussion of the imaging findings of the cases presented at #5 - mechanisms of underlying tumor depiction at FES-dbPET vs. DCE breast MRI - influence of menopausal status on FES-dbPET - influence of NET regimen on FES-dbPET findings 7. Future directions of dbPET application in breast cancer therapy 8. Summary of the educational points

# Abstract Archives of the RSNA, 2024

BREE-111

## A SINISTER TREND: MORE YOUNG WOMEN ARE GETTING BREAST CANCER; WHO, WHY, AND WHAT DO WE KNOW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Jaimee E. Mannix, MD (*Abstract Co-Author*) Nothing to Disclose
Kate Walter (*Abstract Co-Author*) Nothing to Disclose
Nawar Aljundi (*Abstract Co-Author*) Nothing to Disclose
Gianmarco Calderara (*Abstract Co-Author*) Nothing to Disclose
Julia C. Kirsten, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss increased incidence of breast cancer in women aged 20-49 over the past 20 years, with significant increase after 2016.2. Review differences in breast cancer incidence rates by age group, race, hormone receptor status, and stage.3. Discuss modifiable risk factors and social determinants of health which may play a role in increased incidence.

### TABLE OF CONTENTS/OUTLINE

1) Clinical manifestations/pathology of breast cancer in young patients. Recommended diagnostic workup in young patients.2) Incidence of breast cancer is increasing over time in young women aged 20-49, especially after 2016.3) Differences in breast cancer incidence rates by age group, race, hormone receptor status, and stage.4) New data regarding trends and incidence in young women with breast cancer.(a) Increased incidence is due almost entirely to an increase in tumors which are estrogen-receptor positive. Higher rates of breast cancer are seen among Black women, especially among those ages 20 to 29.(b) An increase in diagnosis of stage 1 and 4 tumors in young women has been observed. Data suggests that when stage 1 tumors are missed in younger women, the tumors tend not to be found until they reach stage 4.5) Differences in overall survival and disease free survival rates in young patients vs those diagnosed when older.6) Identification of risk factors for breast cancer such as maternal parity, age of first birth, and family history as well as modifiable risk factors such as obesity, caloric intake, alcohol intake, smoking, chemical exposures, and exercise.7) Treatment differences in young women versus older women and evaluation of effect on quality of life, sexuality, and fertility.8) Role of support groups with age matched peers.9) Conclusion

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# Abstract Archives of the RSNA, 2024

BREE-112

## INCIDENTAL BREAST FINDINGS ON NON-BREAST IMAGING: A COMPREHENSIVE REVIEW FROM BENIGN TO ACTIONABLE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fatima Salah, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This educational exhibit aims to: 1. Present example cases and outcomes of incidental breast findings seen on non-breast imaging: both benign and malignant. 2. Review suspicious findings that warrant additional work-up with dedicated breast imaging. 3. Illustrate examples in which additional imaging could have been omitted. 4. Highlight value of accurate evaluation of incidental breast findings and their effect on subsequent patient management.

### TABLE OF CONTENTS/OUTLINE

1. Define and introduce importance of incidental breast findings on non-breast cross sectional imaging. 2. Illustrate cases whereby breast findings were clearly negative or benign, BIRADS 1 or 2. 3. Present incidental breast findings in which additional dedicated breast imaging was warranted in both benign and malignant outcomes: a. BIRADS 4: Benign outcome after recommended biopsy. b. Malignant Outcome: Primary breast cancer and Metastasis.

# Abstract Archives of the RSNA, 2024

BREE-113

## THE ARMPIT: A PLACE TO BE EXPLORED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Erica Endo, MD (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, MD (*Abstract Co-Author*) Nothing to Disclose
Naomi Murakami SR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Adriana Kumagai, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rosseto Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Approaching axillary findings by ultrasound, mammography, CT scan and MRI. Differential diagnosis for axillary findings. Significance of accurate diagnosis in disease management

### TABLE OF CONTENTS/OUTLINE

There are numerous diseases that can lead to axillary masses or lymphadenopathy, each requiring a specific approach. Some may benefit from percutaneous biopsies, others may need blood tests or specific diagnostic tools. Radiologists must be proficient in distinguishing axillary lesions originating from other sites to ensure optimal patient care. To comprehensively understand the patient's condition, it's crucial to study not only the lesion itself but also its location, associated findings, patient epidemiology and personal history.This study presents a series of cases involving axillary lesions caused by atypical conditions. It aims to familiarize radiologists with a wide range of non-breast lesions affecting axillary tissue, enabling them to provide accurate diagnoses.Axillary anatomySkin and appendages (Epidermoid cyst - Apocrine sweat gland adenocarcinoma)Fat and connective tissues (Axillary lipoma - Rhabdomyosarcoma - Hemangioma)Vascular abnormalities (Traumatic axillary artery pseudoaneurysm - Mondor disease)Lymph nodes metastasis (Ovarian cancer - Sarcoma -Thymus cancer)Reactive lymph nodes, systemic diseases (Cat scratch disease - Human Immunodeficiency Virus)Congenital anomalies (Fibroadenoma and cysts in axillary accessory breast)Axillary post-surgical complications (Lymphocele - Abscess)Musculoskeletal (Synovial cyst)

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

BREE-114

## HIGH-FREQUENCY ULTRASOUND FOR EVALUATING SKIN LESIONS ON THE BREAST SEEN ON MAGNETIC RESONANCE IMAGING (MRI)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marina Morais (*Abstract Co-Author*) Nothing to Disclose
Ivana Gibbons (*Abstract Co-Author*) Nothing to Disclose
Candida Maria A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Mariah C. Wanderley (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Felipe SR, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The objectives of this presentation are:1. To demonstrate through a case review the correlation of focal breast skin enhancements on MRI with high-frequency dermatological ultrasound.2. To correlate skin lesions observed during physical examination and dermatoscopy with high-frequency ultrasound.3. Radiologists who work with breast imaging should be aware of the typical findings of benign and malignant skin lesions to avoid unnecessary procedures and delays in diagnosing potential malignancies.

### TABLE OF CONTENTS/OUTLINE

1. Cutaneous Hemangioma.a. Enhancement pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic and dermatoscopic evaluation.2. Paget's Disease in a Breast Previously Subjected to Mastectomy for Neoplasia.a. Enhancement pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic and dermatoscopic evaluation.3. Cutaneous Angiosarcoma.a. Enhancement pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic evaluation and surgical specimen after mastectomy.4. Seborrheic Keratosis.a. Enhancement pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic and dermatoscopic evaluation.5. Hypertrophic Scar.a. Enhancement pattern seen on MRI.b. Representation in high-frequency ultrasound.c. Ectoscopic and dermatoscopic evaluation.

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# Abstract Archives of the RSNA, 2024

BREE-115

## BRCA1 AND 2 MUTATION- THE RADIOLOGIST'S PIVOTAL ROLE IN CHANGING PATIENT'S FATE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Aline D. Guimaraes, MD, MBA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

BRCA 1 and 2 mutation carriers have an increased risk of developing breast cancer. They have 3% greater risk before 30 years and their lifetime risk increases 50 to 80% by the age of 70 years. The increased risk and the early onset of cancer implies a different screening strategy with guidelines around the world recommending to start breast cancer screening at an earlier age and to include MRI as an adjunct to mammography. Furthermore, there are differences between these two groups of high-risk patients regarding the age of appearance of breast cancer, the histologic and nuclear grades, molecular subtypes, lesion's location and imaging features at different breast imaging modalities. It is essential that the radiologists know the epidemiological aspects involved in BRCA1 and BRCA2 mutation carriers, as well as the imaging aspects most commonly found in these patients, specially because BRCA1 carriers tend to present lesions with benign morphological aspects, despite the aggressive pathological features, imposing increased caution on this group of patients. In this case based didactic exhibit, we will explore the clinical, pathological and imaging features in this two subgroups of patients, discuss the screening implications and demonstrate that the radiologist has a pivotal role in changing the fate of these mutation carriers.

### TABLE OF CONTENTS/OUTLINE

1) BRCA1 and 2 Epidemiology 2) Screening recommendation in BRCA1 and 2 mutation carriers 3) Differences between BRCA1 and 2 breast cancer 3.1) Clinical 3.2) Pathological 3.3) Imaging 3.3.1) Mammography, 3.3.2) Ultrasound 3.3.3) MRI 4) Multimodality case based review (BRCA1 and 2 breast cancers) 5) Implications of the knowledge acquired in the radiologist’s practice

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# Abstract Archives of the RSNA, 2024

BREE-116

## AUGMENTED BUT CHALLENGED - IMPLANT DIAGNOSTIC DILEMMAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Dunya M. Imad, MD (*Abstract Co-Author*) Nothing to Disclose
Jenna Pellegrino, MD (*Abstract Co-Author*) Nothing to Disclose
Priscilla J. Slanetz, MD, MPH (*Presenter*) Royalties, Wolters Kluwer nv

### TEACHING POINTS

Introduced in the 1960's, breast implant augmentation has become one of the most popular cosmetic procedures globally. As a result, there are a substantial number of women with implants that present for imaging, whether it be for cancer screening or for a symptom such as a lump or pain. In most cases, radiologists can readily determine if a breast implant is intact or if there is a rupture. However, the imaging evaluation can sometimes be more challenging as not all patients present with classic findings. Therefore, breast radiologists need to develop problem-solving skills to troubleshoot such cases so that any issue with an implant is quickly diagnosed and addressed.

### TABLE OF CONTENTS/OUTLINE

In this exhibit, we will provide a systematic approach to evaluating breast implants for rupture or other complications, such as implant-associated malignancy, capsular fat necrosis, implant infection, postoperative collections/hematomas, and alloderm grafting. We will then present examples of challenging cases where clinical history and multi-modality imaging allowed the radiologist to accurately characterize the implant complication.

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# Abstract Archives of the RSNA, 2024

BREE-117

## WHAT IS THAT ENHANCING ASYMMETRY? A SERIES OF MALIGNANT AND BENIGN CONTRAST ENHANCED MAMMOGRAPHY-GUIDED BREAST BIOPSIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ceren Yalniz, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie A. Woodard, DO (*Abstract Co-Author*) Investigator, Bracco Group Institutional research support, Bracco Group
Kathryn W. Zamora, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Stefanie B. Zalasin, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie D. Colvin, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand indications for contrast enhanced mammography-guided biopsies (CEM-Bx). Apply appropriate BI-RADS terminology to contrast enhanced mammography (CEM) findings. Review cases of CEM-Bx performed at our institution. Correlate radiology imaging findings and pathology results for malignant and benign cases.

### TABLE OF CONTENTS/OUTLINE

Background: CEM is an emerging technology with increasing popularity and utilization. Contrast enhanced imaging demonstrates a higher sensitivity for detection of breast cancer and detects abnormalities not identified on non-contrast examinations. CEM has many indications including screening of high-risk patients who cannot undergo magnetic resonance imaging (MRI). CEM-Bx enables sampling of enhancing lesions that are occult on other modalities including 2D/synthesized mammogram, tomosynthesis, and ultrasound. CEM-Bx also has potential to improve cancer detection in our most at-risk patient population that cannot be screened by MRI. Malignant cases: Present a series of at least 5 breast cancer cases diagnosed by CEM-Bx at our institution. Benign cases: Present a series of at least 5 benign cases diagnosed by CEM-Bx at our institution.

# Abstract Archives of the RSNA, 2024

BREE-118

## BREAST IMAGING FINDINGS OF MESENCHYMAL MASSES WITH CLINICAL-RADIOLOGIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ramapriya Ganti, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shanna Mayorov, BS, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Describe the constellation of imaging findings of breast masses of mesenchymal origin. ; Delineate classic mimickers of mesenchymal tumors. ; Familiarize readers with radiologic-histopathologic correlation. ; Discuss available management options for each entity.

### TABLE OF CONTENTS/OUTLINE

1. Background : Mesenchymal masses pose a diagnostic challenge for the breast imager as this category of lesions encompasses both benign and malignant masses, demonstrates similar imaging appearances, and has varied pathologic and treatment related paradigms. Both groups typically manifest in the breast as a single mass that is often palpable. 2. Discussion: Pictorial review of approximately 12 breast masses of mesenchymal origin with emphasis on imaging findings, including benign lipoma, hamartoma, angiolipoma, hemangioma, pseudoangiomatous stromal hyperplasia, leiomyoma, phyllodes tumor, primary and secondary sarcoma, neurogenic tumors, granular cell tumors, myofibroblastoma, and desmoid tumors. Brief epidemiology, clinical symptoms if any, diagnostic assessment including imaging findings, the role of biopsy, histopathologic correlation including staining techniques and their role in identification, and treatment considerations will be described. 3. Conclusion: Knowledge of the imaging manifestations, histopathologic features, and management strategies of mesenchymal tumors allows breast radiologists to improve the identification of these lesions and direct appropriate work-up and management.

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# Abstract Archives of the RSNA, 2024

BREE-119

## BREAST IMAGING OF PATIENTS WITH LI-FRAUMENI SYNDROME WITH UPDATED REVIEW OF BREAST SCREENING GUIDELINES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Tanya W. Moseley, MD, PhD (*Abstract Co-Author*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC
Emily S. Nia, MD (*Abstract Co-Author*) Nothing to Disclose
Gaiane M. Rauch, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Elsa M. Arribas, MD (*Abstract Co-Author*) Stockholder, 3D Systems, Inc
Miral M. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Megha M. Kapoor, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Understand the clinical implications of Li-Fraumeni Syndrome (LFS) in women • Review the current breast cancer screening guidelines for LFS in women • Review the appropriateness criteria of breast imaging modalities to screen women with LFS • Illustrate imaging findings of LFS in the breast

### TABLE OF CONTENTS/OUTLINE

1. Review the biology and inheritance pattern of Li-Fraumeni Syndrome (LFS). 2. Review the tumors which patients with LFS are susceptible to, with a particular emphasis on the types of breast cancers associated with LFS. 3. Highlight the screening guidelines and appropriateness criteria in patients with LFS. 4. Showcase illustrative breast imaging cases in patients with LFS.

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# Abstract Archives of the RSNA, 2024

BREE-12

## "DO THEY MATCH?" HOW TO ACHIEVE AN ACCURATE SECOND LOOK ULTRASOUND FOR BREAST LESIONS IDENTIFIED AT MR IMAGING. PICTORIAL REVIEW FOR RADIOLOGISTS IN TRAINING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria P. Swiecicki, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
Giannina M. Secco, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To help localize MRI detected lesions at second look ultrasound by giving imaging tips for the radiologist in training.2. To illustrate with clinical cases the correlation between both imaging techniques.

### TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Technique for a good second look US using lesion morphology and localization within the breast.3. Anatomical details that can assist in proper lesion localization.4. Illustration with clinical cases to show how to achieve an adequate correlation between MRI and US images for an accurate lesion localization.5. Conclusions.In conclusion, this educational exhibit is intended to be a guide for radiologists in training that are beginning to perform second look US, describing the technique and illustrating parameters that can assist them in this task.

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# Abstract Archives of the RSNA, 2024

BREE-120

## ONE-STEP QUALITATIVE AND QUANTITATIVE EVALUATION OF AXILLARY LYMPH NODE METASTASIS IN BREAST CANCER USING DUAL-ENERGY SPECTRAL CT COMBINED WITH CONTRAST ENHANCED SPECTRAL MAMMOGRAPHY: THE EVIDENCE AND ITS LIMITS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Huizhi Cao (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Contrast-enhanced spectral mammography (CESM) and dual-energy spectral CT (DECT) are both exciting technology in potential clinical application. The focus of this presentation is: 1. To understand the concepts and imaging principles of contrast-enhanced mammography and spectral CT imaging technology.2. To learn about how CESM combined with CT spectral imaging technology can assess axillary lymph node metastasis in preoperative breast cancer. 3. To delve into qualitative and quantitative evaluation criteria derived from pathological results of axillary lymph node metastasis post-surgery. 4. To understanding the pros and cons of CESM and spectral CT imaging technology in axillary lymph node metastasis evaluation.

### TABLE OF CONTENTS/OUTLINE

1. Background introduction to contrast-enhanced mammography and spectral CT Imaging technology, along with post-processing techniques such as monochromatic Images (keV) and material density images (iodine-based, calcium-based), and spectral Hounsfield unit curve analysis.2. Strategies for preoperative diagnosis of metastatic sentinel lymph nodes in breast cancer utilizing DECT and CESM.3. Clinical exemplification of CESM coupled with spectral CT imaging technology in evaluating axillary lymph node metastasis in preoperative breast cancer.4. Qualitative and quantitative evaluation methods for assessing breast cancer axillary lymph node metastasis using CESM and spectral CT technology.5. Examination of advantages and limitations of both technologies in axillary lymph node metastasis evaluation.

# Abstract Archives of the RSNA, 2024

BREE-121

## MASTITIS UNMASKED: EXPECTED AND UNUSUAL FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Mastitis is an inflammation of the mammary gland that can affect different parts of the breast, such as the tissue, nipple, areola, ducts, and skin. It can occur with or without the presence of bacteria. There are various forms of mastitis, including those related to the neonatal and pubertal periods, as well as more common cases during the postpartum period. Additionally, there are less common specific inflammations, such as tuberculosis, syphilis, and actinomycosis. These inflammations can be classified as lactational (during breastfeeding) or non-lactational. Ultrasound is used as the initial method to evaluate women with acute mastitis, especially when abscesses are suspected. Ultrasound imaging findings include edema of the skin and subcutaneous tissue, areas with increased echogenicity permeated by parenchymal areas, loss of definition of the breast planes, hyperechogenicity of perilobular fat and axillary lymph nodes with cortical thickening. Mammography is recommended to rule out cancer and can be performed outside the peripartum period, especially for women over 30 years old. Magnetic resonance imaging (MRI) is not usually necessary and is reserved for atypical cases. The main differential diagnosis to consider is inflammatory carcinoma when a patient presents with redness and swelling in the breast, without evidence of abscess on ultrasound.

### TABLE OF CONTENTS/OUTLINE

- Review clinical, pathophysiological, and imaging aspects of mastitis.- Illustrate common and uncommon findings of mastitis in a didactic manner.

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# Abstract Archives of the RSNA, 2024

BREE-122

## SEEING BEYOND MASSES: NON-MASS LESIONS PERSPECTIVES ON ULTRASOUND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The probable changes for the sixth edition of BI-RADS® (Breast Imaging Reporting and Data System) have already been made available, including the introduction of “non-mass lesion” in the ultrasound lexicon. It is defined as a discrete echotexture alteration area, distinct from the adjacent parenchyma, that does not meet the criteria for nodule, identifiable in at least two planes, but may be visualized in only one plane. In most cases, it has a benign etiology, but it can be the initial manifestation of breast cancer, most commonly in situ. It is cathegorized by terms of echogenicity, distribution and associated findings. Calcifications, architectural distortion, posterior acoustic shadowing, abnormal ductal extension or changes, echogenic halo and hypervascularity are examples of associated findings that suggest malignancy. In the face of a non-mass lesion finding on the ultrasound, it is important to correlate it with other imaging exams, as the identification in different methods can increase the degree of suspicion, as well as association with papillary flow or palpable alteration. Definitive diagnosis is made by tissue sampling, most commonly percutaneous core-needle biopsy.

### TABLE OF CONTENTS/OUTLINE

- To be familiar with the likely changes in the next edition of BI-RADS®, in order to standardize its description.- Suggest the description of ultrasound, in accordance with the expectations of the lexicon changes of the new BI-RADS®, correlating with other imaging modalities.

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# Abstract Archives of the RSNA, 2024

BREE-123

## SO, YOU THINK YOU CAN IDENTIFY BREAST CANCER? UNCOMMON PRESENTATIONS OF THE MOST COMMON CANCER IN WOMEN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Himeghna Deepak (*Abstract Co-Author*) Nothing to Disclose
Milin Rana, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel Klapper, MD (*Abstract Co-Author*) Nothing to Disclose
Nayanatara Swamy, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.Breast cancers exhibit a diverse array of imaging presentations, staying updated on these presentations will help us detect them early. 2.Fat containing masses in the breast are largely benign, except in those cases where the breast cancer has engulfed fat. 3.Although rare, interval breast cancers do occur. Therefore, it's crucial to educate women not to disregard a palpable lump, even if they had a benign screening mammogram within the past year. 4.Identifying suspicious asymmetries and focal asymmetries can be challenging on screening mammography. By learning from both positive and negative call-backs, we can set our threshold of suspicion optimally. 5.Maintaining high standards for image quality of screening mammograms will help ensure that the cancers located far posteriorly and anteriorly are identified. 6.Women who have undergone reduction mammoplasty have post-operative changes which make identification of breast cancers daunting. 7.Cross-sectional imaging can be a useful tool in identifying breast cancers in subsets of the population that do not yet undergo routine screening mammography.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Case-based review o The fat engulfing breast cancer o The interval breast cancer o The low density mass o The subtle asymmetry o The subtle focal asymmetry o The anteriorly located breast Cancer o The posteriorly located breast cancer - not one, but two masses!! o DCIS presenting as microcalcifications and a mass in same patient o DCIS detected by breast MRI (focal asymmetry on mammogram) o Breast cancers in two women with history of reduction mammoplasty o The Breast cancer initially detected by PET-CT o The breast cancer initially detected by CT 3. Conclusion

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# Abstract Archives of the RSNA, 2024

BREE-124

## INTRUDERS UNMASKED: DELVING INTO FOREIGN BODIES IN THE MAMMOGRAMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carla C. Benetti, MD (*Abstract Co-Author*) Nothing to Disclose
Ligia P. Mazi, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Abstract Co-Author*) Nothing to Disclose
Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Erika M. Negrao (*Abstract Co-Author*) Nothing to Disclose
Edmundo C. Mauad, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Ruth H. Bonini, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Foreign bodies in the breast topography are uncommon and exhibit a variable imaging spectrum, contingent upon the nature and location of the material. The most frequently encountered foreign bodies are those intentionally inserted by radiologists, such as metallic clips during or after biopsy procedures and pre-surgical localization wires or by breast surgeons in surgical interventions. Less frequently, metallic foreign bodies associated with trauma, such gunshot fragments or glass fragments related to car accidents may be encountered.Materials related to cosmetic procedures, and even implantable medical devices like pacemakers and catheters are other foreign bodies that can be present and sometimes interfere with mammography interpretation.Patients may either be asymptomatic or present with localized pain or abscess. A comprehensive clinical history linked with prior mammograms will often lead to a conclusive or presumptive diagnosis, without the need for additional diagnostic tests or unnecessary biopsies.

### TABLE OF CONTENTS/OUTLINE

In a didactic manner several cases of breast or thoracic foreign bodies seen on mammograms, selected from the digital archives of our institutions, will be presented. Illustrate instances where foreign bodies within or next to the breast impede the thorough evaluation of examinations.

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# Abstract Archives of the RSNA, 2024

BREE-125

## EXTREME AGES IN BREAST CANCER: TWO SIDES OF THE SAME COIN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria P. Swiecicki, MD (*Abstract Co-Author*) Nothing to Disclose
Ana G. Luna (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
MONICA OTILIA MACHUCA CASTILLO (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.To Understand the imaging features of breast cancer in young women (<40 years old) and elderly women (>80 years old).2.To Identify the challenges and limitations of different imaging modalities in diagnosing breast cancer at both ends of life.3.To Discuss the implications of age-related factors on breast cancer prognosis and treatment planning.

### TABLE OF CONTENTS/OUTLINE

IntroductionBreast cancer manifests with distinct characteristics across different age groups, particularly in the extremes of life - the very young (<40 years old) and elderly women (>80 years old).Imaging Appearance of Cancer at Both Ends of Life.Clinical Case.Management.In conclusion, this abstract highlight the importance of recognizing age-specific variations in breast cancer characteristics and the pivotal role of imaging in facilitating early detection and personalized treatment strategies.

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# Abstract Archives of the RSNA, 2024

BREE-128

## ARTIFACTS IN BREAST MRI AND CHALLENGES IN THEIR INTERPRETATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
Griselda Choque Leniz, MEd,MEd (*Abstract Co-Author*) Nothing to Disclose
Fatima Quispe Villca SR, MMed (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Identify the different types of artifacts in breast magnetic resonance imaging. Several examples of technical and patient-related artifacts that one might encounter will be illustrated.

### TABLE OF CONTENTS/OUTLINE

Breast magnetic resonance imaging has become an important tool for high risk screening, breast cancer staging, response to treatment, assessment of recurrence after treatment, and evaluation of breast implants. However, the challenge arises in identifying artifacts generated in breast magnetic resonance images that can degrade image quality and obscure important diagnostic findings. The present work aims to recognize the artifacts and understand how to address them and optimize breast magnetic resonance image quality and avoid interpretive errors.

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# Abstract Archives of the RSNA, 2024

BREE-13

## BEYOND THE SURFACE: A COMPREHENSIVE EXPLORATION OF BREAST LYMPHOMAS THROUGH MULTIMODALITY IMAGING AND HISTOPATHOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Mitva J. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Randy C. Miles, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Rifat A. Wahab, DO (*Abstract Co-Author*) Nothing to Disclose
Serine E. Baydoun, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren E. Rosen, MD (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Describe typical and atypical multimodality imaging findings on mammogram, ultrasound, and MRI of breast lymphomas.2. Highlight clinical presentations seen with each breast lymphoma type in the radiology setting.3. Discuss current treatment and management recommendations of the various types of breast lymphomas.4. Review pathology and key immunohistochemistry profiles of these breast lymphomas.

### TABLE OF CONTENTS/OUTLINE

1) Introduction to various types of breast lymphomas2) Review of B vs. T cell origin3) Incidence breakdown of each lymphoma type4) Comparison of primary verses secondary breast lymphomas5) Case-by-case review with imaging, key information, and management discussion--Diffuse large B-cell lymphoma--Extranodal marginal zone lymphoma (MALT lymphoma)--Follicular lymphoma--Burkitt lymphoma--B- and T-lymphoblastic lymphoma/leukemia (CLL/SLL)--Anaplastic large cell lymphoma with emphasis on breast-implant associated type6) Discussion of optimal biopsy and tissue collection techniques in breast imaging

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# Abstract Archives of the RSNA, 2024

BREE-130

## LYMPHOCYTES IN MY BREAST, WHAT DOES IT MEAN? LYMPHOMA, TILS (TUMOR INFILTRATING LYMPHOCYTES) AND BEYOND. A PICTORIAL REVIEW OF LYMPHOCYTE-CONTAINING BREAST LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Abstract Co-Author*) Nothing to Disclose
Soledad Alonso Garcia (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia-Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To review the different breast lesions containing lymphocytes. - To describe features of breast lymphomas. - To analyze the concept of TILS (tumor infiltrating lymphocytes) in breast tumors. - To illustrate imaging findings in different imaging modalities (CEM, US, MRI) with correlation with pathology. - To emphasize pitfalls, diagnostic difficulties, and differential diagnosis

### TABLE OF CONTENTS/OUTLINE

Lesions containing different types of lymphocytic infiltration may appear within the breast. Understanding TILS concept and knowledge of lymphocyte containing lesions is essential for the radiologist.We present: - Lymphoid tissue in the breast. Anatomy and physiology. - Breast lymphoma. Images of primary and secondary breast lymphomas from our series will be presented. Usually, non-specific, most frequently enlarging masses. -Medullary carcinoma. A circumscribed mass in which lymphocytic infiltrate is a key diagnostic criterion. -Lymphocytic mastitis/diabetic mastopathy. Lymphocytes may also appear in inflammatory lesions. Lymphocytic mastitis is unusual and probably immune-mediated. If associated with diabetes called Diabetic mastopathy, with lobular atrophy and sclerosis called Sclerosing type. Usually, non-circumscribed masses or focal asymmetry. -TILS are clinically relevant regarding implications on response to treatment and prognosis. This lymphocytic infiltrate might represent a form of host resistance to the tumor. TILS are most frequently found in triple negative breast cancer, followed by HER2 positive and less frequently in luminal breast cancer.

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# Abstract Archives of the RSNA, 2024

BREE-131

## ENHANCING DIAGNOSTIC VALUE WITH CONTRAST-ENHANCED SPECTRAL MAMMOGRAPHY THROUGH QUANTITATIVE ENHANCEMENT ANALYSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Huizhi Cao (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand the mechanism and clinical utility of contrast-enhanced spectral mammography (CESM) in breast cancer screening, staging, and treatment monitoring. 2. To demonstrate quantitative variables and kinetic enhancement patterns of breast lesions on CESM in enhancing diagnostic accuracy and differential diagnosis. 3. To discuss the diagnostic performance of radiomics in combination with CESM for suspicious malignant lesions characterization. 4. To present case studies with the integration of history, imaging findings, and tissue diagnosis for utilizing quantitative CESM characteristics in challenging or equivocal mammographic abnormalities.

### TABLE OF CONTENTS/OUTLINE

1. To introduce the principle of CESM, contrast protocol, abnormal enhancing characteristics and illustrative cases in demonstrating CESM's role in BIRADS assessment and management of equivocal mammographic lesions. 2. To demonstrate quantitative analysis of kinetic enhancement patterns on CESM in distinguishing benign from malignant breast lesions. 3. To understand the concept of radiomics and its integration with CESM in identifying suspicious malignant microcalcifications (BIRADS 4). 4. To discuss strategies for appropriately utilizing quantitative CESM characteristics in complex or ambiguous mammographic abnormalities.

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# Abstract Archives of the RSNA, 2024

BREE-132

## ENHANCING PREDICTIVE POWER OF CONTRAST-ENHANCED SPECTRAL MAMMOGRAPHY (CESM) IN ASSESSING RESPONSE TO NEO-ADJUVANT CHEMOTHERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Huizhi Cao (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To grasp the technical foundations of contrast-enhanced spectral mammography (CESM) and its Operationalization. 2. To identify lesion types amenable to evaluation via CESM. 3. To unveil CESM's capacity for accurate assessment of tumor response post Neo-adjuvant chemotherapy (NAC), comparable to MRI. 4. To employe quantitative objective measures in predicting response to NAC through RECIST 1.1 and combined evaluation approaches. 5. To appreciate the scope and nuances of CESM's utility in treatment monitoring.

### TABLE OF CONTENTS/OUTLINE

1. Unveiling the underlying principles and physics of contrast-enhanced spectral mammography. 2. Exploring CESM's clinical application as a promising follow-up modality post-NAC. 3. Understanding the variables influencing tumor shrinkage and assessment during NAC, including primary tumor Size, edema, or necrosis. 4. Qualitative and quantitative assessment of CESM in predicting response to NAC. 5. Weighing the advantages and constraints of CESM.

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# Abstract Archives of the RSNA, 2024

BREE-134

## AXILLARY IMAGING: PEARLS AND PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Caroline Merriam, DO (*Abstract Co-Author*) Nothing to Disclose
Liva Andrejeva-Wright, MD (*Abstract Co-Author*) Nothing to Disclose
Manroop Kaur, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The axilla is normally comprised of lymph nodes, axillary neurovascular bundles, and adipose tissue.2. Accessory breast tissue is categorized into classes, and the axilla is the most common location for fibroglandular accessory breast tissue (Class IV).3. Recognizing abnormalities in ectopic breast tissue is important as malignancies may arise at an earlier age in aberrant tissue.4. The purpose of the exhibit is to review benign and malignant pathologies in the axilla through a multi-modality case-based presentation.5. Benign features of axillary lesions include well-circumscribed margins in parallel orientation with posterior acoustic enhancement and absence of early enhancement. 6. Malignant features of axillary lesions include spiculated/angulated margins in taller than wide orientation, posterior acoustic shadowing, and early enhancement characteristics.

### TABLE OF CONTENTS/OUTLINE

1. Normal anatomical structure of the breast and axilla.2. Imaging characteristics of normal axillary tissue versus accessory breast tissue.3. Multi-modality case-based review of benign pathologies in the axilla: accessory breast tissue, fibroadenoma, sebaceous cyst, Hidranitis suppurativa, reactive lymph nodes, lymphatic malformation, capillary hemangioma 4. Multi-modality case-based (US, Mammography, MRI) review of malignant pathologies in the axilla: primary breast cancer (DCIS/LCIS), metastatic lymph nodes from breast-primary cancer, metastatic lymph nodes from non-breast primary cancer. 5. BI-RADS application for lesions in the axilla and next steps for follow-up.

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# Abstract Archives of the RSNA, 2024

BREE-135

## MAXIMIZING SENSITIVITY: THE ART OF MAMMOGRAPHY POSITIONING AND ITS IMPACT ON EARLY DETECTION OF BREAST CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela C. Ferracini, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Oliveira Gloria, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Mammography assumes a pivotal role in breast cancer screening, renowned for its efficacy in early disease detection and subsequent reduction in mortality rates. Nevertheless, the efficacy of mammography is contingent upon various factors, encompassing the proficiency of mammography technologists, accurate calibration of equipment parameters, and the unique anatomical features of each patient. These multifaceted considerations can attenuate the sensitivity of the modality. Among the manifold factors influencing the interpretability of mammograms, improper breast positioning stands as a principal adversary, precipitating a cascade of adverse outcomes including unwarranted re-examinations, escalated radiation exposure, elevated recall rates, and potential diagnostic delays. Emerging research endeavors are leveraging artificial intelligence (AI) as a complementary tool to identify and rectify positioning errors during mammographic examinations. However, notwithstanding the integration of AI support, the indispensable role of radiologists and technologists in discerning the hallmarks of a meticulously executed mammography remains unequivocal. Their proficiency is imperative in mitigating the propensity for unnecessary recalls, mitigating radiation exposure, curtailing healthcare expenditures, assuaging patient apprehensions, alleviating procedural discomfort, and averting diagnostic delays.

### TABLE OF CONTENTS/OUTLINE

This study aims to emphasize the importance of obtaining high-quality mammographic images by evaluating factors such as the patient's medical history, anatomy, equipment parameters, with a strong emphasis on proper positioning during the exam.

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# Abstract Archives of the RSNA, 2024

BREE-136

## EXPLORING IMAGING CHARACTERISTICS IN EXTRAMAMMARY METASTASES IN BREAST: A MULTIMODALITY APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bong Joo Kang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Han Song Mun, MD (*Abstract Co-Author*) Nothing to Disclose
Sung Hun Kim (*Abstract Co-Author*) Nothing to Disclose
Ga-Eun Park, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

*Metastases to the breast are rare, with a reported incidence of 0.3-2%. Among these, lymphoma is the most common, followed by melanoma, lung, ovarian, and gastrointestinal tract origins. *Breast tissue confirmation is performed to verify the origin in patients with extensive metastasis. Additionally, breast biopsy is conducted as clinically indicated in patients with known cancer origins, given the rarity of metastases to the breast despite breast cancer's prevalence. *Imaging features may vary depending on the primary tumor and route of dissemination, with a circumscribed solid mass being the most frequent presentation. Hematogenous metastases, in particular, often manifest as multiple or bilateral masses.

### TABLE OF CONTENTS/OUTLINE

1. Literature reviews on breast metastasis. 2. Analysis of incidence and origin distribution. 3. Cases with various imaging characteristics using a multimodality approach.

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# Abstract Archives of the RSNA, 2024

BREE-137

## CONE BEAM BREAST CT IMAGE CHARACTERISTICS OF DIFFERENT PATHOLOGICAL TYPES OF BREAST PAPILLARY CARCINOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Wei Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Xin Zhao I (*Abstract Co-Author*) Nothing to Disclose
Dan Ke Su (*Abstract Co-Author*) Nothing to Disclose
Zhixing Zhang (*Abstract Co-Author*) Nothing to Disclose
Li Dong Liu (*Abstract Co-Author*) Nothing to Disclose
Yang Zhao (*Abstract Co-Author*) Nothing to Disclose
Jie Shi (*Abstract Co-Author*) Nothing to Disclose
Yanxia Huang (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The distinct image characteristics of different pathological types of papillary carcinoma on Cone Beam Breast CT (CBBCT)

### TABLE OF CONTENTS/OUTLINE

1.Objective To explore the image characteristics of different pathological types of papillary carcinoma using Cone Beam Breast CT (CBBCT).2. Methods: Retrospective analysis was conducted on CBBCT image characteristics and time-density curves from 23 cases of different pathological types of papillary carcinoma, confirmed by pathology at our hospital between July 2019 and December 2023. 3. Results: 13 had intraductal papillary carcinoma, primarily characterized by multi-focal tumors of equal density, with clear boundaries. The long axis of these lesions generally aligned with the breast ducts and was often accompanied by calcification. The time-density curve was predominantly type II. Two cases had invasive papillary carcinoma, mainly with presenting as oval cystic- solid masses. They had indistinct margins, with heterogeneous internal enhancement patterns and prominently enhanced wall nodules. The cystic areas were smooth and with a time-density curve of type III. Two cases were of encapsulated papillary carcinoma, mainly with cystic- solid masses, circumscribed margins and smooth cystic walls, featuring a single enhanced wall nodule and a type III time-density curve. Six cases had solid papillary carcinoma, mainly with multiple cystic- solid masses or a diffuse enhancement pattern. They had indistinct margins, with lobulation and spiculation, and were accompanied by enhanced wall nodules, with time-density curves of mainly type II.4. Conclusion: CBBCT can be effective in differentiating between the various pathological types of papillary carcinoma.

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# Abstract Archives of the RSNA, 2024

BREE-138

## CLINICAL PERFORMANCE OF NEW IMAGE RECOMBINATION ALGORITHM (NIRA) FOR ARTIFACT REDUCTION IN CONTRAST-ENHANCED MAMMOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Huizhi Cao (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Contrast-enhanced mammography (CEM) emerges as a promising imaging tool for breast cancer diagnosis. However, CEM is susceptible to artifacts that can compromise image quality and diagnostic accuracy. The objectives of this exhibit are: 1. To introduce readers to contrast-enhanced mammography (CEM) as an emerging modality for breast imaging and discuss its implementation. 2. To examine common artifacts encountered in contrast-enhanced mammography, including those related to patients, contrast agents, such as ripple artifact, scatter radiation artifact, and misregistration artifact. 3. To showcase the efficacy of the New Image Recombination Algorithm (NIRA) in reducing artifacts on CEM images through practical application and clinical examples. 4. To highlight the clinical value of NIRA in quality assurance for CEM images, thereby reducing interpretation errors. 5. To explore technical and diagnostic limitations, including false-negative and false-positive results, associated with contrast-enhanced mammography.

### TABLE OF CONTENTS/OUTLINE

1. Brief overview of different approaches in contrast-enhanced mammography and their features in imaging interpretation. 2. Identification and illustration of artifacts apparent on CEM images, including those caused during image acquisition, contrast agent-related artifacts, and typical digital mammography artifacts. 3. Practical application of the NIRA technique, accompanied by illustrated clinical examples, to demonstrate its effectiveness in reducing various artifacts. 4. Discussion on technical and diagnostic limitations, including false-negative and false-positive results, encountered in contrast-enhanced mammography.

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# Abstract Archives of the RSNA, 2024

BREE-139

## BLEEDING RISKS IN IMAGING-GUIDED BREAST BIOPSIES; A PRIMER FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Amy M. Fowler, MD, PhD (*Abstract Co-Author*) Author with royalties, RELX
Thomas Loduca, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Nemr (*Abstract Co-Author*) Nothing to Disclose
Lonie R. Salkowski, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberta M. Strigel, MD, MS (*Abstract Co-Author*) Research support, General Electric Company
Ryan W. Woods, MD, MPH (*Abstract Co-Author*) Author, MRI Online
Alison R. Gegios, MD (*Abstract Co-Author*) Nothing to Disclose
Mai A. Elezaby, MD (*Presenter*) Investigator, Exact Sciences Corporation;Research Grant, Exact Sciences Corporation

### TEACHING POINTS

Image-guided breast biopsies (BrBx) are the standard of care for suspicious breast findings. Bleeding complications of BrBx can lead to patient anxiety, additional imaging exams, and increased treatment costs. Historically, paucity of national data and lack of guidelines for management of periprocedural bleeding risk of BrBx is reflected in the significant variability among practicing radiologists. The Society of Interventional Radiology in 2019 published consensus-based approach for assessment of bleeding risk in patients undergoing interventional procedures. However, the management of patients on AT medications and those with inheritable bleeding disorders is still a source of confusion and can potentially delay critical interventions. Recent breast-specific data on risk of significant bleeding in BrBx, even without cessation of antithrombotic (AT) medications, is low (1%). This data weighed against thrombotic risk from temporarily stopping AT medications may warrant updated management protocols. Thus, clinical need dictates for better understanding of the complex coagulation pathway, learn the current antithrombotic medications as well as understand risk management protocols before, during, and after BrBx. In addition, the knowledge of proper management strategies if bleeding occurs is critical for improved patient care and outcomes.

### TABLE OF CONTENTS/OUTLINE

- Pathophysiology of coagulation pathway and pharmacokinetics of common AT medications.
- Recent data on incidence and significance of bleeding complications after BrBx
- Steps to decrease bleeding risk before, during, and after BrBx.
- How to recognize and manage bleeding complications of BrBx through case-based, image-rich examples.

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# Abstract Archives of the RSNA, 2024

BREE-14

## ARTIFACTS IN BREAST ELASTOGRAPHY AND HOW TO RECOGNIZE AND AVOID THEM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jonathan Langdon, MD (*Abstract Co-Author*) Nothing to Disclose
Richard G. Barr, MD, PhD (*Presenter*) Consultant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Consultant, Canon Medical Systems Corporation;Advisor, Hologic, Inc;Research Grant, Hologic, Inc

### TEACHING POINTS

1. Artifacts in breast elastography are common and can lead to false positive and false negative results. 2. Recognizing breast elastography artifacts and knowing how to avoid them is critical for accurate breast lesion assessment 3. Artifacts can occur both in strain and shear wave elastography 4. Performing both strain and shear wave elastography will help recognize artifacts 5. Learn the optimal technique for both strain and shear wave elastography

### TABLE OF CONTENTS/OUTLINE

A. Review of the principals of strain and shear wave elastography of the breast B. Review the literature on strain and shear wave imaging of the breast C. Describe common breast elastography artifacts and how to recognize them and avoid them 1. Artifacts associated with cystic lesions 2. The "blue" or "soft" cancers 3. The Bang artifact 4. Artifacts due to poor position of the transducer 5. How to recognize noise 6. The sliding artifact 7. The effect of precompression or preload8. Use of the quality map in shear wave elastography D. Summary of the optimal technique for both strain and shear wave elastography for breast lesion evaluation

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# Abstract Archives of the RSNA, 2024

BREE-140

## DECODING BENIGN BREAST LESIONS: IMAGING CHALLENGES & CHEMO-RESPONSE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
Lidia B. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD (*Abstract Co-Author*) Nothing to Disclose
Erica Endo, MD (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Oliveira Gatto, MD (*Abstract Co-Author*) Nothing to Disclose
Naomi Murakami SR, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Fibroadenoma is a benign breast neoplasm characterized by a composition of fibrous and glandular tissue, representing the most prevalent benign neoplasm of the female breast and is typically observed in women under 30 years of age, although it can occur at any point in the reproductive years.2. After chemotherapy, fibroadenomas and other benign breast lesions can exhibit changes in their imaging features. They may show decreased enhancement or may demonstrate a reduction in size on Magnetic Resonance Imaging (MRI) or Computed Tomography (CT). Such changes can sometimes make it challenging to distinguish between a benign and a malignant lesion.3. In cases where lesions exhibiting benign imaging characteristics have responded to chemotherapy, the decision regarding further management should take into consideration the initial level of suspicion.

### TABLE OF CONTENTS/OUTLINE

1. Emphasize the importance of benign breast lesions findings in the different methods, as it is a common finding of benign breast lesions.2. Show the pathology, epidemiology, histological origin, imaging aspects in the different methods of benign breast lesions.3. Review on imaging findings of the effects of neoadjuvant or adjuvant chemotherapy on fibroadenomas and other benign breast lesions through illustrative cases with different imaging methods, including Ultrasound, Mammography, Tomosynthesis, Magnetic Resonance Imaging and Computed Tomography.4. Discuss the management approach in cases where a lesion presents imaging characteristics indicative of benignity, yet demonstrates decreased enhancement or dimensions following chemotherapy.

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# Abstract Archives of the RSNA, 2024

BREE-141

## FREE MARGINS AFTER BREAST CANCER SURGERY: USEFULNESS OF MRI GUIDED ROLL, RADIOGUIDED OCCULT LESION LOCALIZATION, TECHNIQUE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Javier Sanchez-Bordona Marques, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paula Andrea Arias Cadena, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel R. Recio Rodriguez, PhD (*Abstract Co-Author*) Nothing to Disclose
Leire Alvarez Perez, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Vicente Martinez de Vega, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Presurgical MRI guided ROLL/SNOLL localization in breast cancer may be useful in selected cases to obtain surgical free margins. This technique is accurate, safe and fast. How to perform radioguided breast surgery for those malignant lesions displayed only with breast MRI and sentinel node detection.

### TABLE OF CONTENTS/OUTLINE

Suspicious lesions detected only seen by MRI (not seen with mammography or ultrasound) require histological diagnosis. This is performed by an MRI-guided VAB, after which a marker is left in case the patient requires surgery. Titanium markers placed can move because of the relatively large size of the resulting cavity and subsequent hematoma formation after the procedure.On the other hand, in some cases, the malignant lesion detected by MRI is more extensive than that visualized by mammography and ultrasound.In both situations, marking the previously biopsied lesion or its boundaries with MRI-guided procedure reduces the number of surgical positive margins.Radioguided occult lesion localization (ROLL) has emerged as a novel technique in surgery for non-palpable breast lesions, inspired by sentinel node biopsy (SNB). With MRI guidance, we can practice the ROLL technique and add SNOLL (sentinel node and occult lesion localization) in the same procedure.We present our experience in presurgical MRI guided ROLL/SNOLL localization in 93 patients.

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# Abstract Archives of the RSNA, 2024

BREE-142

## DEFINING SUCCESS IN CRYOABLATION: LONG TERM OUTCOMES FROM A SINGLE INSTITUTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sehar Salman, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Mary Schwartz, MD (*Abstract Co-Author*) Nothing to Disclose
Modupe M. Adeyefa, MD (*Abstract Co-Author*) Nothing to Disclose
Luz A. Venta, MD (*Abstract Co-Author*) Nothing to Disclose
Mimi Haghshenas, MD (*Abstract Co-Author*) Nothing to Disclose
Sasha Kurumety, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The goal of this presentation is to educate radiology trainees on the use of cryoablation as a treatment option for breast malignancies, when cryoablation may be appropriate, and outcomes that can be deemed successful when cryoablation is used for breast malignancies. Using a select series of cases from our institution, we will describe the multiple potential roles of cryoablation and mechanism of action, as well as demonstrate post treatment imaging findings over the course of months to years. After this presentation, learners will be able to describe the utility of cryoablation in treating breast malignancies, long term outcomes and imaging findings after treatment, and future directions for cryoablation.

### TABLE OF CONTENTS/OUTLINE

Background: Current FDA approved indications for cryoablation and investigation of cryoablation in breast cancer. Discussion of ongoing trials (ICE3, FROST). Goals of cryoablation when used for malignancies: palliative vs curative, long term outcomes of cryoablation when used in breast malignancies. Discussion of mechanisms of action: Direct freezing and cell death, indirect immune response activation. Cryoablation at our institution: Cases of cryoablation with pathologic findings on biopsies, intraprocedural imaging, and sequential long term follow up imaging findings. Comparison of outcomes to standard of care without cryoablation. Future directions: Defining indications of cryoablation, increasing accessibility, utility with palliative intent.

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# Abstract Archives of the RSNA, 2024

BREE-143

## METHOD OF DETECTION IN BREAST CANCER IMAGING: PROOF OF CONCEPT OF AUTOMATED MOD DESIGNATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laurie R. Margolies, MD (*Abstract Co-Author*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical
Arielle Sasson (*Presenter*) Medical Advisory Board, Screenpoint Medical

### TEACHING POINTS

• Method of Detection (MOD) is the first clinical event or imaging study to trigger a workup which may lead to the diagnosis of breast cancer. It is expected to be included in the 6th edition of the BI-RADS atlas.• Documenting MOD allows quantification of the impact of breast cancer screening on treatment and patient outcomes.• Some breast radiology reporting tools provide an advanced algorithm to automate MOD assignment to simplify MOD data collection.

### TABLE OF CONTENTS/OUTLINE

• **Background**• Ongoing debate related to breast cancer screening frequency and age range• These controversies are in part due to dependence on old film screen historical clinical trial data and varying interpretations/misinterpretations of the data. Additionally, this data may not speak for the diversity of the current population, increasing incidence of breast cancer and/or recent advances made in breast cancer imaging.• Many nations utilize a centralized breast cancer screening program that monitors the results of screening mammography for every patient.• **What is MOD and why should we care about it?**• Comprehensive definition and proposed categories of initial MOD• Reasons why we should track initial MOD data for every patient• Methods of assigning MOD• Retrospective versus prospective assignment of MOD• Breast radiology reporting tools can automate MOD assignment• Present example images of MOD automation • Discuss difficult scenarios in assigning MOD, such as when a patient presents with a palpable abnormality in one breast but malignancy is detected in the opposite breast • Barriers to collecting MOD data• **References**

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# Abstract Archives of the RSNA, 2024

BREE-144

## NAVIGATING THROUGH THE FOG: MAMMOGRAPHIC FINDINGS IN THE CONTEXT OF SYSTEMIC DISEASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rosaura E. Fuentes Corona, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Rios Valencia (*Abstract Co-Author*) Nothing to Disclose
Sara Eugenia Vazquez Manjarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Denny Lara Nunez, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Amaya, MD (*Abstract Co-Author*) Nothing to Disclose
Ernesto D. Elizondo Zepeda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe and to recognize the most common findings of Systemic Diseases reflected in mammography. To learn that understanding the patients' pathological background is important to comprehend the described findings.

### TABLE OF CONTENTS/OUTLINE

Introduction Mammographic findings in Systemic Diseases:- Autoimmune / Autoinflammatory- Endocrine- Cutaneous- Infectious- Edema- Extramammary malignancies Conclusions

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# Abstract Archives of the RSNA, 2024

BREE-145

## REVOLUTIONIZING DETECTION: LOCALLY ADVANCED BREAST CANCER IN YOUNG WOMEN UNVEILED BY AB MRI DESPITE MORPHOLOGICALLY NEGATIVE EXAMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Flavia B. Sarquis, MD (*Abstract Co-Author*) Nothing to Disclose
Maria A. Acha I, MD (*Abstract Co-Author*) Nothing to Disclose
Angelica M. Rivera (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Breast cancer is the second leading cause of cancer deaths in women aged 20-39, and it often presents with more aggressive features compared to breast cancer in older women.Mammography is the standard imaging modality for breast cancer detection, but it has limitations.Young women with locally advanced breast cancer may have negative mammograms and ultrasounds due to their dense breast tissue. It is generally associated with palpatory findings not related to mastitis.Abbreviated Breast MRI (AB-MRI) can detect locally advanced breast cancer in young women with negative mammograms and ultrasounds.AB-MRI can provide valuable information to clinicians for early detection and treatment of breast cancer in young women.After reading this educational exhibit, the radiologist will know :AB-MRI can be used as an imaging modality in young women with negative mammograms and ultrasounds for early detection and treatment of breast cancer, avoiding delays in diagnosis.

### TABLE OF CONTENTS/OUTLINE

Introduction: The Challenge of Detecting Breast Cancer in Young Women.AB-MRI in Young Women with Negative Mammograms and Ultrasound.AB-MRI vs. Mammography: Comparing Sensitivity and Specificity.Future Directions: The Potential of AB-MRI in Breast Cancer Diagnosis and Management.Conclusion

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# Abstract Archives of the RSNA, 2024

BREE-15

## BREAST OR NOT BREAST: CHEST WALL AND AXILLARY ABNORMALITIES IN BREAST IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Muhayman Sadiq, MBBS (*Abstract Co-Author*) Nothing to Disclose
Claudia Cotes, MD (*Abstract Co-Author*) Nothing to Disclose
Tiffany A. Kumala (*Abstract Co-Author*) Nothing to Disclose
Vidhyulatha Sanata, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

It's not uncommon for patients with chest wall and axillary abnormalities unrelated to the breast to initially present to the breast imaging department. Mammography and breast ultrasound, although helpful for excluding breast related malignancies, may not always be the most suitable modalities for evaluation, often leading to inconclusive results. These scenarios present challenges for radiologists, particularly concerning biopsy approaches and appropriate recommendations for additional imaging to comprehensively assess these patients. This exhibit showcases the chest wall and axillary anatomy on mammography, breast ultrasound, and breast MRI, delineates the role of breast imagers in the evaluation of abnormalities within these regions, and offers guidance on the subsequent imaging steps and biopsy approaches for evaluating non-breast chest wall and axillary findings through illustrative case examples.

### TABLE OF CONTENTS/OUTLINE

1. Chest wall and axillary anatomy: Mammography, Ultrasound, Breast MRI 2. Differential diagnoses based on location:Chest wall: Anterior chest wall muscle: Poland syndrome, Physiological hypertrophy, Pectoralis muscle Lipoma, Spindle cell sarcoma Ribs: Osteomyelitis, Benign and Malignant Bone tumors Posterolateral Chest wall: Lipoma, Elastofibroma Dorsi, Lymphatic malformations Axilla: Muscle: Sarcoma Lymphatic system: Atypical Lymphoma, Lymphangioma Shoulder Joint: Ganglion Cyst

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# Abstract Archives of the RSNA, 2024

BREE-16

## DECIPHERING ATYPICAL DUCTAL HYPERPLASIA: NAVIGATING IMAGING FINDINGS, DIAGNOSIS, AND EXPLORING MRI POTENTIAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Atypical ductal hyperplasia (ADH) is part of the high-risk lesions group due to its association and potential progression to ductal carcinoma in situ (DCIS) and invasive carcinoma, being found in about 5 to 20% of biopsies performed. The histopathological features of ADH and DCIS are highly similar, distinguished primarily by size (less than 2 mm) and involvement in fewer than two ducts. The risk of progression to invasive carcinoma is estimated to range from 3.7% to 22%. ADH does not present defined radiological characteristics on its own. Mammography may reveal nodules, asymmetric densities, calcifications, and architectural distortions, often with amorphous calcifications within the lesion. On ultrasound, lesions typically appear as hypoechoic nodules with irregular shape, microlobulated margins, and abrupt interface, often due to coexisting processes. Magnetic resonance imaging (MRI) shows non-nodular enhancement, with patterns varying from progressive to plateau or wash-out. Given the potential for diagnostic underestimation and its propensity to coexist with DCIS and invasive carcinoma, surgical excision is advised post its histopathological diagnosis. Recent studies have been discussing the role of MRI in cases of ADH where no suspicious enhancement is observed in the biopsied area, which could potentially obviate the need for surgery in these cases.

### TABLE OF CONTENTS/OUTLINE

To explore the histopathological characteristics of ADH, differential diagnoses, and its relationship with breast carcinoma, demonstrate the imaging findings of ADH across various imaging modalities using cases from our institution, discuss the role of MRI in the treatment decision-making.

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# Abstract Archives of the RSNA, 2024

BREE-17

## CLARITY IN CONTRAST: THE PICTORIAL ATLAS OF BENIGN BREAST LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ernesto D. Elizondo Zepeda, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Eugenia Vazquez Manjarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Rosaura E. Fuentes Corona, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Rios Valencia (*Abstract Co-Author*) Nothing to Disclose
Mariana Amaya, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Case-based presentation of benign breast lesions on diverse imaging modalities, with special focus on contrast-enhanced mammography.Every case has pathological correlation, enhancing diagnostic accuracy, some cases with histology images to augment understanding of lesion characteristics.Some of the featured lesions to review: Abscess, Mastitis, PASH, Simple Cyst, Adenosis, Ductal Hyperplasia, Fibrocystic Changes, Adenomas, and Fibroadenomas.Discussion on the utility of advanced imaging techniques in characterizing benign breast lesions. Highlighting key imaging features that aid in the differentiation of benign lesions from malignant ones, including shape, margin characteristics, internal architecture, and enhancement patterns.Exploration of potential challenges encountered in diagnosing benign breast lesions, with strategies for overcoming them.Consideration of the impact of patient demographics, such as age and hormonal status, on the imaging appearance of benign breast lesions, with implications for management decisions.

### TABLE OF CONTENTS/OUTLINE

IntroductionAbscess and mastitis: Imaging CharacteristicsPseudoangiomatous Stromal Hyperplasia (PASH): A Comprehensive Imaging ReviewSimple Cyst: Diagnostic Imaging Findings and Clinical ImplicationsAdenosis: Imaging Spectrum and Differential DiagnosisDuctal Hyperplasia: Radiologic Patterns.Fibrocystic Changes: Imaging Manifestations.Adenomas: Radiological Features and Pathological CorrelationFibroadenomas: Imaging Spectrum and Patient ConsiderationsConclusion

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# Abstract Archives of the RSNA, 2024

BREE-18

## RADIOLOGICAL INSIGHTS: UNDERSTANDING BREAST PATHOLOGY IN PREGNANCY AND LACTATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pilar Alonso-Bartolome (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Merino (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review physiological breast tissue changes and illustrate common breast disorders during pregnancy and lactation.Discuss the radiological approach to breast pathology in this period and deepen the understanding of pregnancy-associated breast cancer.

### TABLE OF CONTENTS/OUTLINE

Breast pathology during pregnancy and lactation poses diagnostic challenges. Radiologists must be well-versed in the physiological changes and specific conditions of this period, considering the strengths and limitations of each imaging method. A multidisciplinary approach is paramount for optimal outcomes. Clinical manifestations include palpable mass, pain, or nipple discharge. While most lesions are benign, consideration of pregnancy-associated breast is crucial concerning prognosis impact.Radiological evaluation is pivotal in characterizing breast pathologies in these states. Ultrasound is the first-line choice for its safety and real-time evaluation. Mammography remains a complementary tool, especially in lactation and malignancy. MRI is reserved for clear risk-benefit ratio situations and local-regional staging in lactating women. Core biopsy is necessary for new/growing masses.Frequent findings include engorgement, lactational changes, benign lesions (fibroadenomas, galactoceles), and, rarely, breast cancer. Overlapping features and hormonal influences complicate interpretation. Timely diagnosis is crucial to guide subsequent management, balancing safety with diagnostic accuracy.This poster provides a pictorial review of illustrative cases from our institution encompassing benign, inflammatory, and malignant conditions underlying the hallmark findings that lead to accurate diagnosis.

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# Abstract Archives of the RSNA, 2024

BREE-19

## EXPLORING VISUAL TRAPS IN CONTRAST MAMMOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rosaura E. Fuentes Corona, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Eugenia Vazquez Manjarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio D. Tovar Aldana I, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To identify artifacts of image in CEM to avoid misdiagnosisExplain the underlying causes and mechanisms that contribute to the formation of artifacts in CEM, including technical, biological, and physical factors

### TABLE OF CONTENTS/OUTLINE

-Brief definitions-Technical considerations-Artifices in contrasted mammographyTechnical Artifacts Patient related Artifacts Contrast Agent-related Artifacts -False positive diagnoses - Incomplete or Inadequate visualization in CEM- Conclusions

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# Abstract Archives of the RSNA, 2024

BREE-2

## DERMAL DILEMMAS: A REVIEW OF BREAST ABNORMALITIES INVOLVING THE EPIDERMIS, DERMIS, AND HYPODERMIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

John M. Lewin, MD (*Abstract Co-Author*) Officer, Novian Health Inc
Manroop Kaur, MD (*Abstract Co-Author*) Nothing to Disclose
William J. Hoover, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- The breast skin is comprised of three distinct layers - epidermis, dermis, and hypodermis.
- Each layer harbors unique anatomic components, which may give rise to benign and malignant abnormalities.
- Breast skin lesions may pose a diagnostic challenge when detected incidentally on breast imaging.
- Several hallmark features, such as a sonographic “claw sign” or “dermal tail”, can localize and narrow the differential diagnoses for a breast skin lesion.
- This exhibit will discuss normal breast skin anatomy, and will illustrate the expected appearance of dermal layers on ultrasound, mammogram, and breast MRI.
- The presentation will include a case-based review of benign and malignant breast skin abnormalities.
- For each skin abnormality, we will describe the typical clinical presentation, multimodality imaging features, malignant potential, and appropriate next steps of management.

### TABLE OF CONTENTS/OUTLINE

- Review of normal breast skin anatomy.
- Expected appearance of dermal layers on ultrasound, mammogram, and breast MRI.
- Key imaging features indicating dermal origin of a breast lesion.
- Multimodality imaging review of breast skin abnormalities, which will be organized into the following categories:
- Inherited abnormalities
- Vascular lesions
- Dermal cystic lesions
- Abnormal skin thickening
- Infectious and inflammatory lesions
- Malignancy

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# Abstract Archives of the RSNA, 2024

BREE-20

## LUMPECTOMY AND MASTECTOMY RECURRENCE: CASE REVIEW AND WHAT THE RADIOLOGIST CAN LEARN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Ann L. Brown, MD (*Abstract Co-Author*) Consultant, Elucent Medical
Erich J. Boomgarden, MD (*Abstract Co-Author*) Nothing to Disclose
Brian J. Guarnieri, MD (*Abstract Co-Author*) Nothing to Disclose
Rifat A. Wahab, DO (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Abstract Co-Author*) Nothing to Disclose
Asir Chishti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) List treatment options after diagnosing breast malignancy, including breast conservation, and review associated recurrence rates.2) Recognize risk factors which can lead to higher incidence of recurrent malignancy.3) Compare and contrast imaging findings consistent with recurrent malignancy and post-therapeutic changes.4) Review imaging pitfalls leading to misdiagnosis of recurrence and post-therapeutic changes.5) Discuss the management and treatment of recurrent malignancy.

### TABLE OF CONTENTS/OUTLINE

1) Introduction2) Review of surgical and therapeutic options including breast conservation therapy.3) Discuss rates of recurrence associated with different types of therapy.4) Risk factors associated with higher rate of recurrence, including the following:- Tumor size- Positive margins- Type of malignancy and biomarkers- Lack of staging MRI- Incomplete management therapy5) Discussion of imaging and clinical surveillance for recurrence.6) Review of multimodality imaging findings suggestive of post-therapeutic changes versus recurrent malignancy.7) Cases reinforcing imaging findings consistent with post-therapeutic changes and recurrent malignancy.8) Overview of management and prognosis of recurrent breast malignancy.9) Multiple choice questions to reinforce key teaching points.

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# Abstract Archives of the RSNA, 2024

BREE-21

## MULTIMODALITY IMAGING REVIEW OF BREAST SARCOMAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren E. Rosen, MD (*Abstract Co-Author*) Nothing to Disclose
Erich J. Boomgarden, MD (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Leon (*Abstract Co-Author*) Nothing to Disclose
Brian J. Guarnieri, MD (*Abstract Co-Author*) Nothing to Disclose
Tristan A. Toca, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Provide an overview of sarcomas of the breast including risk factors, presentation, prognosis, and imaging characteristics2) Recognize unique imaging and clinical features of the different breast sarcomas3) Understand the importance of early diagnosis given the aggressive nature breast sarcomas as well as their management and treatment4) Review histopathologic similarities and differences between sarcomas within the breast

### TABLE OF CONTENTS/OUTLINE

1) Introduction2) Graphic breakdown of the different types of sarcomas in the breast3) Risk Factors4) Characteristics and imaging overview of breast sarcomas5) Overview of prognosis, management, and treatment6) Case by case review including unique imaging findings, teaching points, and management-- Angiosarcoma-- Leiomyosarcoma-- Dermatofibrosarcoma Protuberans-- Spindle Cell Sarcoma-- Liposarcoma-- Fibrosarcoma-- Malignant Fibrous Histiocytoma-- Sarcomatous Transformation of a Phyllodes Tumor7) Review histopathologic features of sarcomas including similarities and differences8) Multiple choice questions to wrap up learning and reinforce important teaching points

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# Abstract Archives of the RSNA, 2024

BREE-22

## SPECIAL SUBTYPES OF INVASIVE BREAST CARCINOMA: UPDATE ON MULTIMODALITY IMAGING FINDINGS AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mary C. Mahoney, MD (*Abstract Co-Author*) Nothing to Disclose
Ann L. Brown, MD (*Abstract Co-Author*) Consultant, Elucent Medical
Rifat A. Wahab, DO (*Abstract Co-Author*) Nothing to Disclose
Kyle M. Lewis, MD (*Abstract Co-Author*) Nothing to Disclose
Charmi Vijapura, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren E. Rosen, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Levine (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Review the most current WHO pathologic classification of breast tumors.2) Recognize sonographic, mammographic, and MRI findings that are specific to the special subtypes of invasive breast carcinoma.3) Characterize histopathology of the special subtypes.4) Discuss special considerations of each special subtype with the goal of targeted management and improved pathologic correlation.

### TABLE OF CONTENTS/OUTLINE

IntroductionWHO ClassificationGraphic breakdown of invasive no special type versus these Special SubtypesOverview of imaging workup (Screening and Diagnostic)-Mammogram-Ultrasound-MRI Detailed Cases with Histopathology:-Mucinous-Micropapillary-Neuroendocrine-Tubular-Cribriform-Papillary-Medullary-Metaplastic-Lobular-Metaplastic-Apocrine-Salivary gland-type tumors (Acinic cell, Adenoid cystic, Secretory, etc.)Summary tableReview questionsConclusions: 1) Improved knowledge of specific sonographic, mammographic, and MRI findings of these special subtypes of invasive breast carcinoma is important for developing a comprehensive differential.2) Appropriate histopathologic correlation leads to improved targeted management of these special subtypes avoiding delays in care.

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# Abstract Archives of the RSNA, 2024

BREE-23

## SHARPENING SKILLS, SHAPING FUTURES: NEXT-LEVEL BREAST BIOPSY TECHNIQUES FOR RESIDENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fernanda Louise Sothe, MD (*Abstract Co-Author*) Nothing to Disclose
Lucy T. Sato, MD (*Abstract Co-Author*) Nothing to Disclose
Giselle G. Mello, PhD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela P. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Luciano F. Chala, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana C. Tucunduva, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Training Importance: Stress on training residents before they begin procedures.
- Percutaneous Biopsy Skills: Enable residents to perform core needle biopsy, fine needle aspiration, vacuum-assisted biopsy (ultrasound and stereotaxy-guided), and pre-surgical marking (ultrasound, mammography, stereotaxy-guided).
- Preparation Areas:
- Conducting focused pre-procedure anamnesis.
- Informing patients about procedure steps and risks.
- Executing procedures with correct technique.
- Handling in-procedure complications and queries.
- Managing post-procedure complications (e.g., hematomas, infections).

### TABLE OF CONTENTS/OUTLINE

- Precision in Detection: Crucial for invasive breast procedures, affecting diagnostics and treatment.
- Specialized Training: Key for resident safety and efficacy in breast procedures.
- Innovative Training Methods:
- Core biopsy with olives in chicken for nodules.
- Stereotactic biopsy with eggshells in mortadella for microcalcifications.
- FNA with water in gloves for cysts.
- Ultrasound biopsy with quail eggs for solid-cystic lesions.
- Pre-surgical marking with chicken and metallic clips.
- Training Structure: Merges theory and practice over a month with weekly skill sessions.
- Training Objectives: Prepare residents for real scenarios, focusing on technical skills and decision-making.
- Professional Development Impact: Enhances skills, precision, and efficiency, transitioning novices to experts.
- Patient Safety Contribution: Simulations reduce learning risks, lower complications, and improve outcomes.

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# Abstract Archives of the RSNA, 2024

BREE-24

## BEYOND THE LINES: UNVEILING ARCHITECTURAL DISTORTION THROUGH IMAGING MODALITIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carla C. Benetti, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Defined as a distortion of the usual architecture of the breast parenchyma without visible nodules, architectural distortion (AD) is the third most commonly observed abnormality in cases of false-negative mammography and the third most common finding in nonpalpable breast cancer; - The AD can be an associated finding with other alterations and involves benign causes such as complex sclerosing lesion, radial scar, fat necrosis, post-surgical changes, and others; - Digital breast tomosynthesis (DBT) has played a relevant role in detecting AD, especially in dense breasts, by reducing overlapping tissue, allowing for better visualization of true lesions. However, literature studies demonstrate that AD found in DBT have a lower chance of representing malignancy and the AD is less likely to represent malignancy if there is no ultrasound correlation. Though, even in these cases, biopsy is still necessary since there is a risk of about 30% malignancy.

### TABLE OF CONTENTS/OUTLINE

- To explore the imaging patterns of AD across various imaging modalities using cases from our institution and correlate them with histopathological findings; - To discuss the significant role of DBT in cases of AD; To discuss the malignant and benign causes of AD and their management.

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# Abstract Archives of the RSNA, 2024

BREE-25

## CURRENT INSIGHTS INTO COMMON GENETIC MUTATIONS IN BREAST CANCER: A COMPREHENSIVE REVIEW OF GUIDELINES AND IMAGING FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Su Kim Hsieh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Aiah Alatoum, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Genetic mutations increase the risk of developing breast cancer. Mutations in genes BRCA1, BRCA2, TP53, PTEN, CDH1, STK11, ATM, CHEK2, and PALB2 are being considered to change recommendations for screening and management.
- Genetic panels are evolving, and the Institutional guidelines frequently update their recommendations.
- Some genetic mutations are more associated with specific biomarkers, for instance, BRCA 1 and 2 mutation carriers have a higher prevalence of triple negative cancers.
- Identifying a genetic mutation in a patient can impact their family members, and they should be tested.
- The knowledge of a particular genetic mutation can lead to a more extensive surgical treatment like mastectomy and contralateral prophylactic mastectomy or expand treatment options, like the use of poly (ADP-ribose) polymerase (PARP) inhibitor therapy for early-stage HER-2 negative cancer or metastatic disease.

### TABLE OF CONTENTS/OUTLINE

1. Definition of somatic and germline mutations. 2. Definition of a wild gene and low and moderate-risk genes. 3. Definition of the possible genetic testing results. 4. Review the main genetic mutations that increase the risk of breast cancer. 5. Review of current indications for genetic testing. 6. Review of recommendations for patients with positive genetic testing regarding screening, treatment management, and prophylaxis. 7. Review of characteristics of breast cancer and lesions with potential for upgrade in patients with genetic mutation. 8. Illustrative cases of patients with genetic mutations and breast cancer or lesions with potential for an upgrade from our Institution.

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# Abstract Archives of the RSNA, 2024

BREE-26

## NON MASS LESIONS (NMLS) ON BREAST ULTRASOUND - THE GOOD, THE BAD AND THE UGLY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alexandra Pop, MD (*Abstract Co-Author*) Nothing to Disclose
Roxana Pintican, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The incidence of non-mass lesions (NMLs) in breast US has been reported to range from 1% to 5.3%, with malignancy accounting for 6.3% to 53.8%, underscoring the importance of their accurate identification and diagnosis. GOALS:1. Describe the NML terminology on US2. Present typical benign (The GOOD) and malignant (The BAD) NML cases together with their pathology correlates: a. The GOOD - fibro-cystic changes, fibrosis, adenosis, ductal epithelial hyperplasia (typical and atypical), plasma cell mastitis, idiopathic granulomatous mastitis b. The BAD - DCIS with/without invasive component, IDC, invasive lobular carcinoma, solid papillary carcinoma, adenoid cystic carcinoma3. Discuss challenging cases (The UGLY) where NMLs may obscure or mimic benign/malignant features, leading to diagnostic uncertainty or misinterpretation; emphasize the added role of mammography and breast MR4. Provide a brief literature overview of different scoring and malignancy predicting systems a. The GOOD - presence of small cysts, absence of microcalcifications b. The BAD - linear-segmental distribution (50-76.6% associated with malignancy, mainly DCIS), associated microcalcifications (OR = 11.7), architectural distortion (OR 3.14), hypervascularity (Adler 3), stiffness (elasticity score 4 or 5, OR = 5.84).

### TABLE OF CONTENTS/OUTLINE

1. Overview of NML definitions 2. The GOOD - benign NML 3. The BAD - malignant NML 4. The UGLY - masking/pitfalls NML 5. Scoring and malignancy prediction NML systems

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# Abstract Archives of the RSNA, 2024

BREE-27

## INTERPRETATIVE AND NON-INTERPRETATIVE USES OF ARTIFICIAL INTELLIGENCE IN BREAST IMAGING: A GUIDE FOR PRACTICING RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mai A. Elezaby, MD (*Abstract Co-Author*) Investigator, Exact Sciences Corporation;Research Grant, Exact Sciences Corporation
Roberta M. Strigel, MD, MS (*Abstract Co-Author*) Research support, General Electric Company
Pamela A. Propeck, MD (*Abstract Co-Author*) Nothing to Disclose
Lonie R. Salkowski, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan W. Woods, MD, MPH (*Abstract Co-Author*) Author, MRI Online
Alison R. Gegios, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth S. Burnside, MD, MPH (*Abstract Co-Author*) Research Grant, Hologic, Inc
Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thanh Phuong Nguyen, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Artificial intelligence (AI) algorithms have reinvigorated interest in its utility in radiology. Breast imaging is uniquely poised to both evaluate the utility of assistive AI and advance the integration of AI into real world clinical practice. Since AI is a diverse field, it has the potential to impact both non-interpretive and interpretive applications extending beyond breast cancer detection. This exhibit reviews current and potential real world clinical applications of AI in breast imaging before, during, and after the acquisition of imaging examinations.

### TABLE OF CONTENTS/OUTLINE

1. Artificial Intelligence Definitions 2. Historical challenges (a. Medicolegal/liability, b. Quality assurance, c. Racial biases, d. Variability in image sizes/quality, e. Multimodality imaging) 3. Unique features of breast imaging for AI applications (a. Standardized technique for screening mammography, b. BI-RADS lexicon and structured reporting, c. Mandated accreditation systems, d. Large repository of images, reports, and outcomes, e. Implications for individual and population health) 4. Non-interpretive AI for breast imaging (a. Patient scheduling and outreach, b. Patient education and communication, c. Cancer risk assessment, d. Workflow triage, e. Image enhancement, f. Image quality assessment) 5. Interpretive AI for breast imaging (a. Lesion detection, b. Decision support, c. Breast density assessment, d. Response to neoadjuvant therapy) 6. Anticipated barriers for integration (a. Payment models for individual and population health, b. Accessibility in low resource settings, c. Interpretation of audit metrics, d. Impact on training/assessments of physicians, residents, and fellows)

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# Abstract Archives of the RSNA, 2024

BREE-28

## ACE THE BREAST IMAGING TUMOR BOARD: A MULTIDISCIPLINARY APPROACH TO BREAST CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Charisma DeSai, MD (*Abstract Co-Author*) Nothing to Disclose
Kiran N. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Cotes, MD (*Abstract Co-Author*) Nothing to Disclose
Vidhyulatha Sanata, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiology, pathology, and surgical/oncological treatment discussions are common practices in the management of breast cancer patients. Trainees, including residents and fellows, often participate in such discussions. In the era of personalized cancer treatment, it is crucial to understand not only the imaging findings of breast malignancies, but to correlate imaging and pathological characteristics to define molecular subtypes and guide oncological and surgical treatment strategies. This exhibit simplifies receptor definitions, breast cancer molecular subtypes and radiology-pathology correlation. Through representative radiological tumor board cases, we highlight patient treatments and outcomes. The goal is to prepare trainees and early radiologists with the necessary knowledge to provide valuable contributions to patient care and ace the breast imaging tumor board!

### TABLE OF CONTENTS/OUTLINE

Receptor definitions: ER, PR, HER 2, Ki67 Breast Cancer Molecular Subgroups: Luminal A, Luminal B, HER 2 Positive, Basal-Like Imaging features of the different molecular subtypes on mammography, ultrasound, and MRI. Cancer treatment: Surgical and oncological treatment based on receptor status with review of patient’s expected outcomes.

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# Abstract Archives of the RSNA, 2024

BREE-29

## THINK OUTSIDE THE BREAST: A PICTORAL ESSAY OF EXTRAMAMMARY LESIONS FOUND ON BREAST MRI AND HOW YOU DO NOT LOSE THEM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aline C. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Leticia T. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Livia P. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia B. Maksoud, MD (*Abstract Co-Author*) Nothing to Disclose
Carla C. Benetti, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle Teles Leal (*Abstract Co-Author*) Nothing to Disclose
Carla C. Tajima (*Abstract Co-Author*) Nothing to Disclose
Isabela Ferreira (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The primary utility of breast magnetic resonance imaging (MRI) is in screening of high-risk patients, detecting breast lesions, staging breast cancer, and assessing neoadjuvant treatment and breast implants. Although the examination primarily focuses on the breasts, it also allows visualization of surrounding structures. Between 17% to 34% of cases reveal at least one extramammary incidental finding, with around 20% of these findings being malignant and 14% to 20% clinically relevant benign conditions. The liver is the most common site of reported incidental findings (52-60%), followed by the lung and pleural cavity, with the gastrointestinal tract being the least common on Breast MRI. Breast MRI is primarily utilized for breast cancer staging and high-risk screening, findings in these extramammary structures hold significant importance, often influencing diagnostic investigation and subsequent follow-up.

### TABLE OF CONTENTS/OUTLINE

To investigate the imaging of numerous extramammary findings using cases from our institution and correlate them with personal history. To examine the significance of describing these findings on breast MRI. To assess the prevalence of extramammary malignant lesions detected in the images and their subsequent therapeutic management. To give hints and tips for general radiologists of how they can remember to evaluate these structures on breast exams.

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# Abstract Archives of the RSNA, 2024

BREE-3

## MULTI-MODALITY REVIEW OF VASCULAR CONDITIONS OF THE BREAST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Roberta M. Strigel, MD, MS (*Abstract Co-Author*) Research support, General Electric Company
Ryan W. Woods, MD, MPH (*Abstract Co-Author*) Author, MRI Online
Mai A. Elezaby, MD (*Abstract Co-Author*) Investigator, Exact Sciences Corporation;Research Grant, Exact Sciences Corporation
Thomas Loduca, MD (*Abstract Co-Author*) Nothing to Disclose
Lonie R. Salkowski, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Amy M. Fowler, MD, PhD (*Abstract Co-Author*) Author with royalties, RELX
Alison R. Gegios, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This educational exhibit aims to establish a framework for radiologists to identify imaging characteristics of vascular breast conditions, including those of arterial, venous, and lymphatic origins, and associated management recommendations. Although most vascular breast conditions are benign, it is important to recognize imaging findings that necessitate a biopsy to evaluate for possible underlying malignancy. It also may be helpful to communicate benign vascular conditions to the clinician as intervention for symptomatic relief or treatment of underlying systemic conditions may be indicated.

### TABLE OF CONTENTS/OUTLINE

1. Review of Vascular Anatomy of the Breast 2. Overview of Techniques to Evaluate Vascularity in the Breast 3. Benign Vascular Conditions of the Breast (including systemic conditions) a. Atherosclerosis b. Congestive Heart Failure c. Unilateral breast edema secondary to central venous obstruction 4. Benign Vascular Lesions of the Breast a. Pseudoaneurysm b. Superficial thrombophlebitis (Mondor Disease) c. Lymphatic malformation d. Venous malformation e. Hemangioma and variants of hemangiomas (e.g., infantile hemangioma) 5. Role of Radiologic-Pathologic Correlation in Management of Certain Vascular Variants (e.g., anastomosing hemangioma) 6. Malignant Vascular Conditions of the Breast and Sequelae of Breast Malignancy a. Angiosarcoma b. Solitary Fibrous Tumor c. Portal Vein Tumor Thrombus

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# Abstract Archives of the RSNA, 2024

BREE-30

## PALPABLE BREAST LUMPS IN THE PEDIATRIC AND ADOLESCENT POPULATION: SONOGRAPHIC REVIEW OF COMMON AND LESS COMMON BENIGN DISORDERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Cory Z. Trivax, MD (*Abstract Co-Author*) Nothing to Disclose
Mehrvaan Kaur, MBBS (*Abstract Co-Author*) Nothing to Disclose
Alexander Satei, MBBS (*Abstract Co-Author*) Nothing to Disclose
Tima Tawil, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to learn about the normal development of the female breast, including in-utero, prepubertal, and pubertal stages. Understanding normal sonographic findings of the different Tanner stages of breast development can help radiologists recognize underlying abnormal breast disorders. Discussion of breast disorders in the pediatric and adolescent population will focus primarily on sonographic findings with review of etiology, pathology, follow up imaging/management if applicable, and more. Covered breast disorders will include, for example, juvenile fibroadenoma, gynecomastia, asymmetric breast buds, non-puerperal abscess, subcutaneous cyst, and others. Understanding benign and self-limiting breast disorders will help radiologists recognize suspicious sonographic findings warranting further investigation and/or management.

### TABLE OF CONTENTS/OUTLINE

Normal breast development at birth and during puberty. Tanner stages of normal breast development. Normal sonographic findings of Tanner stages. Case-based discussion of variant developmental processes including: Premature thelarche, asymmetric breast bud development, gynecomastia. Case-based discussion of miscellaneous lesions including abscess, furuncle, lymph node, and subcutaneous cyst. Case-based discussion of benign neoplastic lesions including fibroadenoma/juvenile fibroadenoma, pseudoangiomatous stromal hyperplasia of the breast, and juvenile papillomatosis. Suspicious sonographic features prompting further imaging evaluation.

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# Abstract Archives of the RSNA, 2024

BREE-31

## MRI'S ROLE IN THE PUZZLE OF PAPILLARY BREAST LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Paula C. Moraes, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Abstract Co-Author*) Nothing to Disclose
Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian S. Ogata, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:1. To highlight the significance of papillary breast lesions and their varied diagnostic considerations.2. To delineate the characteristics of papillary breast neoplasms as depicted by magnetic resonance imaging (MRI) and establish correlations across different modalities such as ultrasound (US), mammography (MG), and tomosynthesis (TS).3. To underscore the pivotal role of MRI in the management of papillary neoplasms and explore its potential in guiding appropriate treatment strategies. 4. To explore MRI protocols tailored for evaluating breast papillary lesions. To exemplify, through clinical cases, how MRI can augment daily practice in assessing papillary lesions.

### TABLE OF CONTENTS/OUTLINE

The presentation will follow the following structure: - Reviewing Breast Papillary Lesions and Their Differential Diagnosis; - Illustrating Papillary Lesions Cases on MRI with Correlations to Mammography, Ultrasound, and Pathology; - Demonstrating the Role of MRI in the Management of Papillary Lesions; - Evaluating the Optimal Timing and Method for Biopsy Procedures; - Summary and conclusion.

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# Abstract Archives of the RSNA, 2024

BREE-32

## PEDIATRIC BREAST ASSESSMENT: WHAT CAN WE FIND?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatiane M. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Galdino S. Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro Dias Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Julio Nather, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Elias JR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Larissa De Andrade Defendi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pediatric breast complaints are relatively common in the general and pediatric radiologist's routine. Although breast pathology in this population is mostly benign, ruling out malignant neoplasms and pointing out differential diagnosis to guide management is crucial. Ultrasonography is the main tool to evaluate pediatric breast changes. The aim of this exhibit is: 1. To describe the sonographic technique in the assessment of pediatric breast pathology, highlighting tips and for an adequate evaluation in the pediatric scenario; 2. To review clinical and radiological features of common and unusual breast pathology in children.

### TABLE OF CONTENTS/OUTLINE

1) Brief review of breast development and physiology; 2) Ultrasonography of the pediatric breast: exam technique, value of B-Mode and Doppler, imaging acquisition/documentation; 3) Practical tips to ensure child's collaboration; 4) Breast pathology in the pediatric population: epidemiology, brief clinical aspects regarding presentation, outcome and follow up; 5) Radiological features of usual and rare pediatric breast findings: a) Developmental Disorders (neonatal breast hypertrophy; gynecomastia); b) Infection (abscess); c) Benign masses (fibrocystic changes; juvenile fibroadenoma; venolymphatic malformation; hamartoma; lipoma; steatonecrosis; pseudoangiomatous stromal hyperplasia); d) Malignant masses (primary carcinoma); 6) When biopsy should be performed: clinical and radiological findings that elicit referral.

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# Abstract Archives of the RSNA, 2024

BREE-33

## IT IS NOT ONLY A FEMALE PROBLEM: RADIOLOGIC FINDINGS IN IMAGING MALE BREAST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Julia Stefanne Santos Simao (*Abstract Co-Author*) Nothing to Disclose
Monique Lambrakos (*Abstract Co-Author*) Nothing to Disclose
Marina Matos (*Abstract Co-Author*) Nothing to Disclose
Anna Campos (*Abstract Co-Author*) Nothing to Disclose
Beatriz Souza (*Abstract Co-Author*) Nothing to Disclose
Adriene Moraes Campos (*Abstract Co-Author*) Nothing to Disclose
ANA MACHADO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Outline and describe the various male breast diseases, exploring the most common, benign and non benign neoplasms, and how they relate to the imaging findings.Describe different imaging methods and their significance in distinguishing differential diagnosis.Discuss the significance of understanding the male breast disease, especially as the diagnosis is more delayed.Build a flowchart to describe differential diagnosis on male breast disease.

### TABLE OF CONTENTS/OUTLINE

Introduction;Clinical and epidemiological aspects of different male breast diseases; A flowchart to summarize differential diagnosis on male breast disease;A case-based review of original cases from breast centers of a tertiary hospital and a specialized clinic, showing different imaging findings aimed to improve diagnostic efficiency;Explore the imaging features of each male breast disease described in this education exhibit to assist in early detection;Take-home messages;References.

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# Abstract Archives of the RSNA, 2024

BREE-34

## BREAST CANCER STAGING USING CONTRAST-ENHANCED IMAGING: ROLE OF MRI, CEM AND MDCT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura S. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Felipe SR, PhD (*Abstract Co-Author*) Nothing to Disclose
Mariana Galupo (*Abstract Co-Author*) Nothing to Disclose
Mariah C. Wanderley (*Abstract Co-Author*) Nothing to Disclose
Leticia Cavalcante (*Abstract Co-Author*) Nothing to Disclose
Soraia Damiao, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Contrast-enhanced breast imaging methods can improve locoregional staging compared to conventional non-enhanced breast imaging (mammography, DBT, and ultrasound).• Breast MRI with dynamic contrast enhancement (DCE) is the most accurate method to assess breast cancer extent through measurement of tumor size, detection of intraductal components and additional lesions, as well as signs of invasion of the nipple, skin, and chest wall.• Contrast-enhanced mammography (CEM) has emerged as an alternative for locoregional staging, with similar accuracy to breast MRI to assess tumor size and additional lesions. However, CEM is not widely available yet, and it has limited value in some cases, such as in patients with implants and peripherally or posteriorly located tumors.• Contrast-enhanced multidetector computed tomography (MDCT) with contrast enhancement is used for distant staging in advanced breast cancer patients. Studies show it can also assess breast lesions when performed in a prone position with a dedicated breast evaluation protocol, without additional radiation or contrast doses. MDCT is a viable alternative to MRI and contrast-enhanced mammography, particularly in low- to middle-income regions.

### TABLE OF CONTENTS/OUTLINE

Overview of contrast-enhanced breast imaging methods (MRI, CEM, and MDCT) and its role in breast cancer management.Examples of breast cancer locoregional staging using MRI, CEM, and MDCT for tumor size assessment and detection of intraductal components, additional lesions, and invasion of the nipple, skin, and chest wall.Suggested decision-making workflow for selecting the appropriate imaging technique based on clinical needs, imaging availability, and cost-effectiveness.

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# Abstract Archives of the RSNA, 2024

BREE-35

## ORIGIN OR SPREAD - MULTIMODALITY IMAGING APPROACH FOR DISTINGUISHING BREAST METASTASES AND PRIMARY MALIGNANCIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Juliana A. Souza (*Abstract Co-Author*) Nothing to Disclose
Bruna Isabela S. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Cavalcante (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Victoria Pacheco, MD (*Abstract Co-Author*) Nothing to Disclose
Laura B. De Melo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To distinguish the most common multimodality imaging features between breast metastases from extramammary cancer and primary breast malignancies.2. To understand the relevance of integrating multiple imaging techniques alongside the clinical context to discern between primary and secondary breast lesions, establishing an accurate diagnosis, staging, and treatment plan.

### TABLE OF CONTENTS/OUTLINE

BREAST METASTASES FROM EXTRAMAMMARY CANCERS1. Location: Typically peripheral and superficial, notably in the upper outer quadrant.2. Imaging Features: Exhibits variability, often appearing as round or oval masses with well-defined margins; presentation varies based on the primary tumor3. Clinical Context: Typically associated with a known metastatic cancerPRIMARY BREAST CARCINOMAS1. Locations: Varied, with a higher prevalence in the central breast (fibroglandular tissue area)2. Imaging Features: Spiculated margins, calcifications, posterior acoustic shadowing, and axillary lymph node involvement are suggestive features of primary breast cancer3. Clinical Context: More prevalent than metastases, even in patients with documented extramammary neoplasms.

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# Abstract Archives of the RSNA, 2024

BREE-36

## CHOSEN: THE IMPACT OF BREAST BIOPSY MARKER (CLIP) SELECTION ON BREAST IMAGING PROCEDURES, FOLLOW-UP, AND COSTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Christine U. Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Miral M. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Megha M. Kapoor, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Gary J. Whitman, MD (*Abstract Co-Author*) Consultant, Siemens AG;Editor, Wolters Kluwer nv
Elsa M. Arribas, MD (*Abstract Co-Author*) Stockholder, 3D Systems, Inc
Tanya W. Moseley, MD, PhD (*Presenter*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC

### TEACHING POINTS

1. Review the history and the role of biopsy markers in breast imaging 2. Review the features of markers from the lenses of radiologists, pathologists, and surgeons 3. Review the impact of marker selection on subsequent breast imaging interpretation and costs 4. Evaluate best practices for identifying markers on ultrasound

### TABLE OF CONTENTS/OUTLINE

I. History and role of biopsy markers II. Features of markers A. Size and configuration B. Makeup 1. Consideration for patients with allergies and inflammatory reactions C. Embedding materials 1. Consideration for patients with allergies and inflammatory reactions III. Impact of marker selection A. Visibility and stability of markers on various breast imaging modalities B. Visibility of markers in the breast and lymph nodes after neoadjuvant chemotherapy C. Localization of clips on follow-up imaging and surgical planning D. Markers for patients with nickel allergies E. Costs IV. Best marker practices V. Conclusion VI. References

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# Abstract Archives of the RSNA, 2024

BREE-37

## MULTIMODALITY IMAGING REVIEW OF CALCIFIED AND NONCALCIFIED DCIS WITH RADIOLOGIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Janice Thai, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel E. Grenier, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) DCIS can manifest as both calcifications and noncalcified lesions. 2) Pathologic subtypes of DCIS are classified based on microscopic growth pattern.

### TABLE OF CONTENTS/OUTLINE

1) Review of multimodality imaging appearances of calcified and noncalcified DCIS. 2) Review of the spectrum of pathologic subtypes of DCIS and variants. 3) Review of current management options for DCIS.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

BREE-38

## DISTINGUISHING MALIGNANT FROM BENIGN CAUSES OF BREAST SIZE CHANGES: A CASE-BASED PRIMER FOR THE RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Wendi A. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
Fara Y. Shikoh, MD (*Abstract Co-Author*) Nothing to Disclose
Aurela I. Clark, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaoqin J. Wang, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hannah Conley, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review current literature for guidance in the evaluation and management of breast size changes. Illustrate the imaging features of both malignant and non-malignant causes of breast shrinkage and enlargement. Elucidate clinical context that aids in distinguishing malignant from benign causes of breast size fluctuations. Highlight teaching points for each case to bolster confidence in making a timely diagnosis.

### TABLE OF CONTENTS/OUTLINE

Not infrequently, women visit breast clinics with concerns of breast size changes. Radiologists play a pivotal role in combining clinical findings and imaging features to guide appropriate management. We will stress the importance of a thorough clinical history and physical exam and provide evidence-based guidance of management for radiologists encountering patients with this concern. Notably, the "shrinking breast" in invasive lobular carcinoma (ILC) which comprises 10-15% of breast cancer will be highlighted. Imaging features of ILC are often occult and a high level of suspicion must be maintained when clinical complaints are present. Conversely, swollen breasts raise concern for inflammatory breast cancer (IBC) which presents with the characteristic imaging findings of diffuse skin thickening ("peau d'orange"). When available, imaging findings will be correlated to histopathologic diagnosis. Numerous benign conditions can also influence breast size changes and will be contrasted with malignant causes. We will educate learners on the telltale benign versus malignant imaging features and provide a summary of teaching points.

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# Abstract Archives of the RSNA, 2024

BREE-39

## PASH RADIOLOGICAL PRESENTATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ligia A. Yamashita, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia A. De Camargo Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela G. Giannotti, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa Moyses, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian N. Omura, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Saccarelli, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela F. Vieira Vendramini (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael R. Santos Ferreira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pseudoangiomatous stromal hyperplasia (PASH) is a benign stromal proliferation that mimics a vascular lesion histologically. It affects individuals of varying ages, including men, with women in reproductive age and elderly women on estrogen replacement therapy being the most affected group. Clinically, PASH may present as a mass or thickening upon physical examination, with incidental histological findings being the most common presentation. While a hormonal etiology is considered, the pathophysiology is not fully understood. On mammography, PASH typically appears as focal asymmetry, while on ultrasound it presents as a solid, well-defined, non-calcified mass. PASH has a varied appearance on MRI but most commonly manifests as a region of non-mass enhancement with persistent kinetic features.

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Classical PASH images on US and MG. 3. Diferent forms of PASH presentantion on US. 4. PASH being a diferential diagnosis from invasive breast carcinoma. 5. PASH associated with gigantomastia on a teenager.

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# Abstract Archives of the RSNA, 2024

BREE-4

## COMPLEX SOLID AND CYSTIC BREAST LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Liva Andrejeva-Wright, MD (*Abstract Co-Author*) Nothing to Disclose
Riddhi Borse, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The exhibit focuses on enhancing the interpreting radiologist's ability for evaluating complex solid and cystic breast lesions using different modalities including ultrasound, computed tomography, and magnetic resonance imaging.2. It will enlist various examples of benign and malignant complex solid and cystic breast lesions visualized on different imaging modalities.3. The exhibit will provide insights into key differentiating imaging features of benign versus malignant complex and cystic breast lesions using several case examples and illustrations to help radiologists build an appropriate understanding of reassuring versus worrisome imaging findings.4. It will help the interpreting radiologist build optimal use of BIRADS nomenclature to help efficiently report complex solid and cystic breast lesions and ultimately guide efficient clinical management.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to use of different imaging modalities for assessment of solid and cystic lesions of the breast.2. Enlisting salient imaging features, illustrations and case examples of benign complex solid and cystic lesions of the breast using different imaging modalities. 3. Enlisting salient imaging features, illustrations and case examples of malignant complex solid and cystic lesions of the breast using different imaging modalities. 4. Comparison and contrast of various imaging features to help differentiate benign from malignant cystic and solid lesions including reassuring vs worrisome findings.5. Optimal use of BIRADS nomenclature to help efficiently report complex solid and cystic breast lesions and guide clinical management.

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# Abstract Archives of the RSNA, 2024

BREE-40

## HEAR YE, HEAR YE: HOW TO BE AN EFFECTIVE ADVOCATE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amy K. Patel, MD (*Abstract Co-Author*) Medical Advisor, Kheiron Medical Technologies Ltd;Consultant, Hologic, Inc
Priscilla J. Slanetz, MD, MPH (*Abstract Co-Author*) Royalties, Wolters Kluwer nv
Stamatia V. Destounis, MD (*Abstract Co-Author*) Medical Advisory Board, iCad, Inc
Ann L. Brown, MD (*Abstract Co-Author*) Consultant, Elucent Medical
Fatima Elahi, DO, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In breast imaging, ensuring equitable access to cancer screening is critical to improving health outcomes for all women, especially those from vulnerable groups. Ensuring appropriate reimbursement for existing and emerging imaging techniques is also important. Therefore, it is essential that all breast radiologists possess the skills to be effective advocates for our subspecialty and patients.

### TABLE OF CONTENTS/OUTLINE

In this exhibit, we will provide a step-by-step guide covering the essential skills to become an effective advocate. The topics that will be covered include: personal and practice branding, social media use, public speaking tips, developing an elevator speech, coalition building, lobbying tactics, impactful written communication including drafting resolutions and legislative bills and creating fact sheets, story telling, and leadership skills.

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# Abstract Archives of the RSNA, 2024

BREE-41

## THE MULTIPLE FACES OF BREAST VASCULAR PATHOLOGY; TUMORS AND BEYOND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria Guerrero Martin (*Abstract Co-Author*) Nothing to Disclose
Nancy Sanchez Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Myriam F. Montes, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Lopez Herrero, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

There is a great variety of breast vascular diseases, with abnormalities that affect both arteries and veins, as well as benign and malignant tumors. These lesions are unusual, unknown and may appear on imaging in different ways; therefore, several techniques are frequently required to approach the diagnosis (even histologic study if there is a mass). For these reasons, the objectives of this presentation are to know the anatomy of breast vasculature and to identify its main disorders, with their typical and multimodal imaging features. Particular attention is focused on tumors, with radio-pathologic correlation; this aspect is especially important for breast imagers, because they need to ensure the concordance after biopsy. Thus, the radiologist will be able to reach an accurate diagnosis, and the patient will get a correct treatment or follow-up plan.

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Normal breast vasculature. 3. Vascular disorders of the breast: atherosclerosis, congestive heart failure, superficial thrombophlebitis, breast varyx and other entities. 4. Vascular tumors of the breast 4.1. Benign proliferations: hemangioma (cavernous and others), angiolipoma and papillary endothelial hyperplasia (Masson’s tumor). 4.2. Malignant proliferations: angiosarcoma (primary and secondary). 5. Differential diagnosis of vascular tumors of the breast (pathologic mimics): pseudoangiomatous stromal hyperplasia, myofibroblastoma, Phyllodes tumor and metaplastic carcinoma. 6. Conclusions.

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# Abstract Archives of the RSNA, 2024

BREE-42

## RADIOLOGIC-DERMATOLOGIC ATLAS OF SKIN PATHOLOGIES FOR THE BREAST RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Derek L. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Dorothy A. Lowell, MD (*Abstract Co-Author*) Nothing to Disclose
Shelby Breit, BS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Skin changes of the breast such as rashes, erythema, or raised cutaneous lesions frequently present as a diagnostic challenge for breast imaging radiologists. These patients often present with either no relevant imaging findings or imaging findings which are nonspecific. Currently, there are limited resources available that serve as a clinical reference atlas for breast radiologists concerning skin pathologies associated with the breast. It is imperative for breast radiologists to assess the patient's clinical history in conjunction with any cutaneous changes and imaging findings, in order to determine whether a skin punch biopsy is warranted. The purpose of this educational exhibit is to provide a detailed review of common benign and malignant cutaneous conditions of the breast, enhanced with dermatologic and radiologic images, to serve as a comprehensive reference for breast imaging radiologists.

### TABLE OF CONTENTS/OUTLINE

1. Review the normal anatomy of the skin of the breast as well as the normal mammographic, ultrasound and MRI appearance. 2. Review common benign dermatologic conditions of the skin of the breast with clinical photos and multimodality imaging correlates including epidermal inclusion/sebaceous cysts, folliculitis, candidiasis infections, herpes zoster, mastitis, edema, keloids, neurofibromas, and granular cell tumors.3. Review malignant cutaneous manifestations of the breast with clinical photos and multimodality imaging correlates including inflammatory breast cancer, local recurrence, angiosarcoma, Paget’s disease, and melanoma.

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# Abstract Archives of the RSNA, 2024

BREE-43

## BI-RADS 3 IN BREAST MRI INTERPRETATION: APPROPRIATE AND INAPPROPRIATE USE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Laura Heacock, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Alana A. Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriu Reig, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Criteria for use of BI-RADS 3 in MRI are less well-established than for MG and US. 2. Oval T2 hyperintense mass with circumscribed margins and homogeneous internal enhancement or dark internal septations on baseline MRI may be given BI-RADS 3. 3. Masses lacking T2 hyperintensity, with suspicious morphologic or kinetic characteristics, new or enlarging findings, and most nonmass enhancements should not be given BI-RADS 3.

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Criteria for use of BI-RADS 3 in MRI have not been well-established b. Frequency of use of BI-RADS 3 c. Cancer yield i. Population undergoing MRI screening is different than population undergoing mammography or ultrasound 2. Indications for BI-RADS 3 a. Mass on baseline MR with benign morphologic and kinetic features b. Unique focus i. Exercise caution if new or enlarging ii. Balance of sensitivity with specificity and PPV. Some foci will represent small cancers, which will be identified on subsequent exam. c. Regional NME on baseline 3. Inappropriate use a. BPE should be BI-RADS 2 b. NME - new, asymmetric, or suspicious distributions should be BI-RADS 4 c. Patients beginning breast cancer treatment 4. Follow up interval a. 5th edition of BI-RADS Atlas recommends 6 mo f/u b. Evidence 12 mo f/u may be appropriate c. Evidence for 6 mo f/u after benign concordant biopsy 5. Future directions a. Expected changes with the next BI-RADS atlas i. Goal: </= 5% of examinations given BI-RADS 3 ii. Indications iii. Focus no longer part of the lexicon b. Improving specificity using DWI, AI c. Impact of abbreviated MRI i. Do patients on a yearly MRI schedule need six month follow up of BI-RADS 3 lesions? ii. Lack of T2 d. Using personalized risk assessment to refine BI-RADS assessments

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# Abstract Archives of the RSNA, 2024

BREE-44

## BREAST CANCER SUBTYPES BASED ON MAMMOGRAMS: APPROACH FOR NEW RADIOMICS FEATURES USING VISION TRANSFORMER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hideaki Tamori (*Abstract Co-Author*) Nothing to Disclose
Akifumi Yoshida, MSc, RT (*Abstract Co-Author*) Konica Minolta, Inc
Satoshi Kasai, PhD (*Abstract Co-Author*) Konica Minolta, Inc;TOITU Co, Ltd;Marubeni Corporation
Chiharu Kai (*Presenter*) Former Employee, Konica Minolta, Inc

### TEACHING POINTS

We will present our research that have applied new Radiomics features to classifying subtypes of breast cancers on mammograms. The purpose of this exhibit is to: - Understand an overview of Radiomics research and the diversified Radiomics features, - Recognize Radiomics features using Vision Transformer (ViT), - Learn about a new model for calculating Radiomics features combining ViT, Convolutional Neural Network (CNN) and Principal Component Analysis (PCA), - Review mammograms with cancers, and how related to the new Radiomics features with breast subtype classification.

### TABLE OF CONTENTS/OUTLINE

1) Common Radiomics research, 2) Types of Radiomics features, 3) Radiomics features with ViT, 4) The new model for calculating Radiomics features combining ViT, CNN, and PCA •ViT (global features): identifying relationships between distant regions •CNN (Local features): identifying relationships between close regions •PCA (Super-global features): identifying the image features of an entire image, 5) The advantage of the combining new model, 6) Our research: classifying subtypes of breast cancers on mammograms •The results of the classification •The characteristics of the feature importance of the top five features •To review mammograms with cancers and the new Radiomic features : triple-negative, HER2, Luminal A, Luminal B breast cancers •Scatter plots for each feature importance, 7) Summary

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# Abstract Archives of the RSNA, 2024

BREE-45

## AN ATLAS OF BIRADS FOR CONTRAST ENHANCED MAMMOGRAPHY: BEARING THE WEIGHT OF PRECISE REPORTING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Derek L. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Sujata V. Ghate, MD (*Abstract Co-Author*) Research Grant, Bracco Group;Reader, QT Ultrasound, LLC;Travel support, QT Ultrasound, LLC
Eun L. Langman, MD (*Abstract Co-Author*) Nothing to Disclose
Victoria A. Wells, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Contrast enhanced mammography (CEM), similar to MRI, is a functional imaging technique with a higher sensitivity for breast cancer detection than mammography or ultrasound. In 2011, the FDA approved CEM as an adjunct diagnostic tool, resulting in increased implementation of CEM in breast imaging practices. CEM can be utilized to evaluate breast symptoms or screen detected abnormalities, to assess extent of newly diagnosed breast cancer, response to neoadjuvant chemotherapy, and to interrogate for occult breast malignancy in the setting of metastatic axillary lymphadenopathy with unknown primary. It is an effective alternative to MRI for those with a contraindication or intolerance. More recently in 2022, the BIRADS lexicon for CEM was introduced to ensure consistency of reporting through standardized terminology. Therefore, it is important for breast imaging radiologists to be familiar with the technique and lexicon to ensure proper use and accurate reporting. Utilizing a case-based approach, this exhibit will demonstrate the utility of CEM in different clinical indications and provide examples of appropriate use of the BIRADS CEM lexicon.

### TABLE OF CONTENTS/OUTLINE

- Review CEM technique. - Present commonly encountered benign and malignant breast findings on CEM with appropriate BI-RADS descriptors - Discuss the diagnostic clinical indications for CEM using case-based examples. - For each case, highlight the imaging findings using the appropriate BIRADS lexicon.

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# Abstract Archives of the RSNA, 2024

BREE-46

## NEW BREASTS MAY NOT BE BEST: IMAGING OF BREAST AUGMENTATION AND ENHANCEMENT PROCEDURES AND THEIR COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mine Sorkun, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Sasse, BA (*Abstract Co-Author*) Nothing to Disclose
Douglas S. Katz, MD (*Abstract Co-Author*) Nothing to Disclose
Liva Andrejeva-Wright, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Nadia Solomon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Riddhi Borse, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. This exhibit will help the radiologist build a foundation in recognizing salient imaging features of breast implants and injectables, understanding their medical and surgical implications, and facilitate accurate reporting to best guide medical and surgical teams. 2. It will describe the imaging appearances of different types of breast implants and injectables, including normal post-operative findings and the range of short and long-term complications which can be seen. 3. Cases examples will also be used to highlight which imaging modality - ultrasound, CT, or MRI - would be best employed for optimal assessment of normal and critical findings.

### TABLE OF CONTENTS/OUTLINE

1. Imaging features of Saline implants:a. Appearance on Mammography vs ultrasound.b. Normal vs ruptured implants. 2. Imaging features of Silicone implants:a. Intracapsular vs Extracapsular rupture.b. Contractures, herniations, leaks and folds. 3. Imaging appearance of various cosmetic injectables:a. Fat injections.b. Silicone and other cosmetic injectables. 4. Infection and inflammation of breast implants: Salient imaging features. 5. Fluid collections associated with implants: Hematoma, Seroma, Abscess etc.

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# Abstract Archives of the RSNA, 2024

BREE-47

## BIRADS 3 UNVEILED: YOUR MULTIMODAL MAP TO SAFETY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andrea Di Ninno, MD (*Abstract Co-Author*) Nothing to Disclose
Luciano F. Chala, MD (*Abstract Co-Author*) Nothing to Disclose
Giselle G. Mello, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatiana C. Tucunduva, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius Nobre, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understanding BIRADS 3 Classification: Emphasize the definition, criteria, and significance of BIRADS 3 in breast imaging, highlighting its role as an indicator for probably benign findings with a recommendation for short-term follow-up.
- Decision-Making Process: Discuss the critical thinking process involved in categorizing a finding as BIRADS 3, including the evaluation of imaging characteristics and patient history.
- Management Strategies: Outline the recommended follow-up protocols for BIRADS 3 findings, such as the appropriate intervals for re-imaging and factors influencing the decision to advance to biopsy.
- Risk Assessment and Communication: Teach how to assess the risk associated with BIRADS 3 lesions and the next steps.

### TABLE OF CONTENTS/OUTLINE

- Introduction to BIRADS 3: Overview of the BIRADS system, focusing on the BIRADS 3 category, its purpose, and importance.
- Criteria for BIRADS 3 Classification: Examination of imaging features and patient history that justify a BIRADS 3 classification, with examples.
- Imaging Modalities and BIRADS 3: How different imaging modalities contribute to identifying and classifying BIRADS 3 findings.
- Follow-Up Protocols for BIRADS 3 Lesions: Guidelines for monitoring, including follow-up intervals and additional imaging tests.
- Biopsy Considerations for BIRADS 3 Findings: When a biopsy may be considered for a BIRADS 3 lesion, including patient-specific factors.
- Case Studies and Review of Literature: Analysis of case studies and literature review on the management of BIRADS 3 lesions.

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# Abstract Archives of the RSNA, 2024

BREE-48

## BEFORE IT POPS: MRI FEATURES OF BREAST AUGMENTATION SURGERY AND IMPLANT COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ilany L. Valdivia I, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica A. Perdomo SR, MD (*Abstract Co-Author*) Nothing to Disclose
Rocio D. Trevino, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Garza, MD (*Abstract Co-Author*) Nothing to Disclose
Elena M. Sanchez Siller, MD (*Abstract Co-Author*) Nothing to Disclose
Yesika Davila Zablah, MD (*Abstract Co-Author*) Nothing to Disclose
Ia M. Sanchez Carenzo, MD (*Abstract Co-Author*) Nothing to Disclose
Karla I. Soto, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Guerra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize the normal imaging appearance of breast implants with MRI.- Describe the technical characteristics of the MRI protocol for patients who have undergone breast augmentation surgery.- Discuss the normal findings after breast augmentation surgery by MRI.- Identify imaging signs of early and late complications of breast augmentation surgery.

### TABLE OF CONTENTS/OUTLINE

- MRI protocol in the evaluation of the augmented breast- Implant locations- Implant types- Normal findings after breast augmentation surgery- Acute complications:Peri-implant fluid: hematoma, infection, seromaInfection- Late complications: Rupture: intracapsular rupture, extracapsular rupture. Capsular contracture. Fat necrosis and gel bleed. Anaplastic large cell lymphoma

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# Abstract Archives of the RSNA, 2024

BREE-49

## BEYOND THE SCAN: UNDERSTANDING THE JOURNEY OF YOUNG WOMEN WITH BREAST CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amy K. Patel, MD (*Abstract Co-Author*) Medical Advisor, Kheiron Medical Technologies Ltd;Consultant, Hologic, Inc
Lakshmi Priya, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Breast cancer cases in young women are rising and are often more aggressive and present in later stages due to delay in screening. Risk factors include genetic mutations, smoking, alcohol use, OCPs, older age of first pregnancy, high BMI, sedentary lifestyles, and low socioeconomic status. All women should undergo a risk assessment by age 25 and if high risk adhere to the latest screening guidelines. Breast cancer in young women can present in various forms, and this exhibit will review the multimodality presentation of some common forms of breast cancer in young women. Multimodal treatment options are available with special consideration of treatment impact on breast conservation, fertility, and mental health in young women. Clinicians should recognize that mammography is safe during breast feeding and pregnancy to prevent delays in diagnosis.

### TABLE OF CONTENTS/OUTLINE

Background, epidemiology, and clinical presentation Risk factors and genetics High-risk screening guidelines Case based imaging review of breast cancer in young women Managment, treatment, and breast conserving techniques Psychosocial impact and effect on fertility Imaging guidelines during breast feeding and pregnancy

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# Abstract Archives of the RSNA, 2024

BREE-50

## A SPECTRUM OF BREAST SARCOMAS WITH RADIOLOGIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Katja Pinker-Domenig, MD, PhD (*Abstract Co-Author*) Speakers Bureau, European Society of Breast Imaging;Speakers Bureau, Siemens AG;Speakers Bureau, IDKD;Speakers Bureau, Canon Medical Systems Corporation;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Merantix Healthcare;Consultant, AURA Health
Dilip Giri (*Abstract Co-Author*) Nothing to Disclose
Jorge L. Huayanay, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Primary breast sarcomas are a very rare and heterogeneous group of aggressive malignant neoplasms that arise from connective tissue. Sarcomas constitute less than 1% of all breast cancers and account for less than 5% of all soft tissue sarcomas. 2. This exhibit will review the spectrum of imaging and histopathology features of breast sarcomas. 3. This review will emphasize diagnostic difficulties, potential imaging pitfalls and differential diagnoses.

### TABLE OF CONTENTS/OUTLINE

The goals of this exhibit are to: Provide a pictorial review of the diverse imaging appearances of breast sarcomas. Discuss specific imaging and pathological characteristics of breast sarcomas. Familiarize the audience with the imaging features of breast sarcomas, thereby helping to provide a complete differential diagnosis. These major featured entities include: • Angiosarcoma • Leiomyosarcoma • Osteosarcoma • Rhabdomyosarcoma • Synovial sarcoma • Undifferentiated pleomorphic sarcoma • Malignant phyllodes tumors and metaplastic carcinomas that develop areas of sarcomatous differentiation.

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# Abstract Archives of the RSNA, 2024

BREE-51

## UNDERSTANDING UNIQUE BREAST CANCER RISK FACTORS AMONG WOMEN VETERANS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lucy B. Spalluto, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Pooja Agrawal, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Guideline-based early and supplemental breast cancer screening for women at high risk for breast cancer is an evidence-based practice that improves morbidity and mortality through early detection and treatment. 2. Young women Veterans represent a unique population who may be at high risk for breast cancer due to additional risk factors beyond those of the general population. 3. Understanding the unique risk factors of young women Veterans diagnosed with breast cancer may offer an opportunity to reduce morbidity and mortality among women Veterans.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: a) Describe breast cancer morbidity and mortality statistics, including existing disparities, for women in the general U.S. population, b) Compare these statistics to those of women Veterans. 2. Breast cancer risk factors: a) Review breast cancer risk factors for the general population, b) Review unique breast cancer risk factors among women Veterans, such as chemicals (agent Orange, contaminated water), radiation (nuclear weapons), air pollutants (burn pit smoke), occupational hazards (asbestos, industrial solvents), warfare agents (chemical and biological weapons). 3. Case review: a) Present an example case (with supplemental imaging) of a young woman Veteran with breast cancer to showcase the patient’s diagnosis and outcome. 4. Conclusion: a) Understanding unique breast cancer risk factors among young women Veterans can facilitate strategies that can ultimately reduce breast cancer mortality in this population.

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# Abstract Archives of the RSNA, 2024

BREE-52

## ATYPICALS FIBROADENOMAS: REBELS WITHOUT A CAUSE OR JUST MISUNDERSTOOD?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Sandoval Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Sara S. Herrera Lemus, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Balbas Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Luz E. Bastidas Caicedo, MD (*Abstract Co-Author*) Nothing to Disclose
Kictzia Yigal Larios Cruz (*Abstract Co-Author*) Nothing to Disclose
Ilse G. Gonzalez Palma I, BMBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Investigate the clinical and radiological characteristics of atypical fibroadenomas to enhance their diagnosis and clinical management.• Evaluate the diagnostic accuracy of different imaging modalities, such as mammography and ultrasound, in identifying atypical fibroadenomas.• Analyze the risk factors associated with the development of atypical fibroadenomas and their relationship with progression to malignancy.• Explore current therapeutic approaches and their impact on clinical outcomes in patients with atypical fibroadenomas.• Investigate the correlation between imaging findings and pathological characteristics of atypical fibroadenomas to improve diagnostic accuracy and clinical management. • Determine the effectiveness of a multidisciplinary approach including coordination among radiologists, pathologists, and surgeons.

### TABLE OF CONTENTS/OUTLINE

This study examines atypical fibroadenomas, an important variant of benign breast tumors, which present diagnostic and therapeutic challenges. Imaging modalities are reviewed, highlighting characteristics on mammography and ultrasound, as well as the importance of imaging-pathology correlation in accurate diagnosis. Additionally, therapeutic approaches, including observation, image-guided biopsy, and surgical excision, are discussed. The importance of a multidisciplinary approach to optimize management of patients with atypical fibroadenomas is emphasized. This abstract provides a comprehensive and updated insight into this clinical entity, offering relevant information for clinicians and radiologists involved in the diagnosis and treatment of atypical fibroadenomas. Presentation Type: Research Abstract.

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# Abstract Archives of the RSNA, 2024

BREE-53

## ENCOUTERING INTRUDERS: FOREIN BODIES DETECTED IN MAMMOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ana Claudia M. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Regina C. Pereira SR, MD (*Abstract Co-Author*) Nothing to Disclose
Aline Morley (*Abstract Co-Author*) Nothing to Disclose
Camila D. Figueiredo, MMed (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Help radiologists to recognize different types of foreign bodies in mammograms, including medical devices, aesthetic procedures, metal artifacts and devices related to diagnosis and treatment of breast cancer.Identify mammographic characteristics that help distinguish a several foreign bodies.Avoid additional investigations due to misinterpretations.

### TABLE OF CONTENTS/OUTLINE

Foreign bodies definitionOverview of the importance of recognizing foreign bodies in mammography.Description of various foreign bodies usual and unusual encountered in mammography divided into medical devices, aesthetic procedures, metal artifacts and devices related to diagnosis and treatment of breast cancer, and others.Presentation of several cases illustrating the recognition, localizations, and management of foreign bodies in mammographySummary of key points covered and final thoughts on the importance of recognizing foreign bodies in mammography.

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# Abstract Archives of the RSNA, 2024

BREE-54

## IMPLANTS ILLUSTRATED: A TUTORIAL FOR ULTRASONOGRAPHIC EVALUATION OF IMPLANTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Erica E. Francolin Federicci, PhD (*Abstract Co-Author*) Nothing to Disclose
Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Silva Malta, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Racy, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Colombo, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
Renato L. Ribeiro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To teach ultrasound technique parameters to an adequate evaluation while avoiding common pitfalls;To describe normal appearance and the usual composition of breast implants on ultrasound;To show cases of complications related to breast implants on this method;To propose a checklist to evaluate implants and to diagnose complications;To provide tools and examples in order to write a structured report.

### TABLE OF CONTENTS/OUTLINE

A significant change in the 2022 Food and Drug Administration (FDA) guidelines affecting radiologists is the inclusion of ultrasound as an alternative to magnetic resonance imaging for initial imaging surveillance for implant ruptures in asymptomatic patients and it is essential for any radiologist interpreting these studies.Breast implants are frequently encountered in breast imaging studies. There are many variations in lumens, positioning, morphology and other components among implants. Ultrasonographic characterization serves as a powerful tool in identifying gross structural abnormalities, ruptures and other complications.This pictorial essay aims to delve into the normal and abnormal imaging appearances of breast implants on ultrasound, including illustrative cases of ruptures, fractures and complications.Moreover, we will propose a checklist for recognizing the type of implant and identifying potential abnormalities or complications. We will also present strategies for equipping radiologists with the tools necessary to compose a structured report. This comprehensive approach aims to improve the understanding and management of breast implants using ultrasound imaging.

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# Abstract Archives of the RSNA, 2024

BREE-55

## INVASIVE LOBULAR CARCINOMA: CATCH ME EARLY, IF YOU CAN!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Patricia M. Gomes El Bacha, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Couto De Mores, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Invasive lobular carcinoma (ILC) is the second most common type of breast cancer. It originates in the lobes of the glands, invades the surrounding tissues and often does not form a palpable nodule. The diagnosis of ILC is challenging, especially in MG and clinical examinations, and is often diagnosed by MRI or US. Understanding the radiological features of ILC is essential for accurate diagnosis. It is often clinically silent, resulting in late-stage diagnosis and more frequently manifests with distant metastatic disease. It tends to occur in older women with a maximum incidence in postmenopausal. The hormone replacement therapy increases the risk of ILC. The US is better than MG to detect non mass lesions and for evaluation of axillary nodes. Hypoechoic irregular mass is the most common ultrasonographic appearance, but non-mass lesions may occur on US and MRI less frequently. In histopathological evaluation, the pleomorphic pattern there is little or no desmoplastic reaction of the invaded tissue. In the macroscopy it often presents as irregular and poorly delimited tumors that can be difficult to define macroscopically due to the diffuse growth pattern of the cellular infiltrate.The objective of this exhibition is to present, through illustrative cases, a practical approach to the imaging and histopathological findings of ILC manifestations.

### TABLE OF CONTENTS/OUTLINE

Introduction. Histopathological and imaging aspects. A case-based review of original cases from the breast department of hospitals showing characteristics of manifestations and challenges in the diagnosis of ILC, through the perspective and purpose of a practical approach. Take-home messages. References.

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# Abstract Archives of the RSNA, 2024

BREE-56

## BENEATH THE SURFACE: A RADIOLOGICAL VOYAGE INTO DEEP LESIONS ON BREAST EXAMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Paula C. Moraes, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa M. Yano, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Zanetta, MD (*Abstract Co-Author*) Nothing to Disclose
Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian S. Ogata, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To discuss the basic breast anatomy and to define the three breast zones: premammary, mammary and retromammary;To present the anatomical landmarks and imaging clues to determine the origin of such lesions as mammary or not;To present the radiological aspects of various posterior breast lesions, pectoralis and chest wall lesions, illustrating these with multimodality imaging from our archives.To familiarize general radiologists with such findings in order to improve the diagnostic rate and avoid misinterpretation and pitfalls of such lesions, reducing false positive rates and unnecessary biopsies.

### TABLE OF CONTENTS/OUTLINE

The human breast’s basic anatomy can be categorized into three distinct zones: the premammary, mammary, and retromammary zones.Located posterior to the retromammary fat is the pectoralis muscle. It’s important to note that this is not considered an anatomical component of the chest wall, and therefore, it is not interpreted as such for staging and management purposes.However, these structures are contemplated in breast exams and should be well-known to radiologists.The task of differentiating primary lesions of the mammary parenchyma from those originating from the pectoral musculature and the thoracic wall can be challenging. Nevertheless, it is crucial for the effective management and diagnosis of such lesions.There exist certain anatomical parameters and defining image criteria that assist in determining the origin of these lesions and the extent of tumor involvement. These include the presence of enhancement or the angle between the lesions and the structures of interest. These factors play a significant role in the diagnosis and subsequent treatment of these conditions.

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# Abstract Archives of the RSNA, 2024

BREE-57

## UNMASKING THE MYSTERY: A DEEP DIVE INTO IDIOPATHIC GRANULOMATOUS MASTITIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Antonio Jose Cueva Guerrero, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Understand the typical presentation of IGM in women of childbearing age and its variable symptoms. • Recognize the diverse mammographic, ultrasound, and MRI findings associated with IGM, including masses, distortion, and skin thickening. • Distinguish IGM from breast cancer and other inflammatory breast lesions using key imaging features. • Emphasize the crucial role of core needle biopsy with pathological confirmation for definitive diagnosis of IGM. • Briefly discuss the treatment options for IGM, including medical management and surgical intervention.

### TABLE OF CONTENTS/OUTLINE

- Introduction- Anatomy - Pathogenesis - Clinical presentation - Differential diagnosis - Imaging methods- Management strategies - Conclusions

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# Abstract Archives of the RSNA, 2024

BREE-58

## CURRENT USES OF CONTRAST-ENHANCED MAMMOGRAPHY (CEM). A PICTORIAL REVIEW OF THE UTILITY OF CEM IN DIFFERENT SETTINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos Oliva Fonte (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To review contrast-enhanced mammography (CEM) technique. -To analyze the different applications of contrast-enhanced mammography (CEM) including work-up of symptoms or equivocal findings, breast cancer detection and local staging, supplemental technique for screening, follow-up of breast cancer, monitoring neoadjuvant systemic therapy response. - To illustrate imaging findings of CEM with correlation with imaging (US, MRI) and pathology. - To emphasize pitfalls, diagnostic difficulties, and differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

We review current applications and state-of-the-art of contrast-enhanced mammography highlighting the benefits and potential use in different settings. We present:
- Basics and technique of contrast enhanced mammography (CEM)
- Indications of CEM. CEM increases sensitivity and specificity of digital mammography.
- Imaging in different settings: -breast cancer diagnosis in symptomatic patients: palpable mass, nipple retraction, breast pain, or bloody nipple discharge; - problem solving for inconclusive findings; - recalls from screening: CEM helps in detection of multiple lesions and to safely reduce benign breast biopsies;- local staging and surgical planning: accurate size correlation with surgical specimen, US and MRI and detection of multifocal and bilateral disease similar to MRI with less false positives;- follow-up of breast conservation therapy;- neoadjuvant chemotherapy response evaluation, CEM shows similar sensitivity and PPV than MRI to detect residual lesion and detects pathological complete response better than MRI.
- Future directions. Screening in dense breast, high risk, intermediate risk.

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# Abstract Archives of the RSNA, 2024

BREE-59

## THE USE OF VERY HIGH FREQUENCY TRANSDUCERS BEYOND DERMATOLOGY - DIAGNOSIS AND FOLLOW-UP OF BREAST LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luciana Graziano, MD (*Abstract Co-Author*) Nothing to Disclose
Laura B. De Melo, MD (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bruna Isabela S. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Felipe SR, PhD (*Abstract Co-Author*) Nothing to Disclose
Soraia Damiao, MD (*Abstract Co-Author*) Nothing to Disclose
Mariah C. Wanderley (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Demonstrate how the development of transducers with frequencies above 15MHz, initially aimed at dermatological ultrasound, has shown an important role in the evaluation of breast lesions;- Present the main applications of very high frequency transducers in the diagnosis, follow-up and image-guided biopsies of breast lesions;- Differentiate breast from skin lesions and offer a better definition for the analysis of ducts and subcutaneous tissue;- Describe the use of very high frequency transducers in guiding ultrasound biopsies through radiological correlation between imaging methods.

### TABLE OF CONTENTS/OUTLINE

Physical characteristics of linear transducers traditionally used for screening and diagnosing breast lesions and the very high frequency transducers;Ductal ectasias, intraductal masses and retroareolar lesions:utilizing very high-frequency transducers for detailed analysis;advantages of monitoring and biopsying these lesions using very high frequency transducers.Skin calcifications:detecting skin calcifications when mammographic findings are inconclusive.Ultrasound-guided biopsy of calcifications with the use of very high frequency transducers:cases of very superficial or retroareolar suspicious calcifications, whose location is a limiting factor for stereotaxis and traditional transducers do not guarantee adequate image definition;Identification of calcifications via ultrasound, placement of a metallic marker on the skin surface covering the calcifications, followed by tangential mammography to validate the correspondence between the calcifications visualized in mammography and ultrasound, enabling the biopsy procedure to proceed.Final considerations.

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# Abstract Archives of the RSNA, 2024

BREE-6

## LESS IS MORE: DE-ESCALATION OF SURGERY IN THE BREAST AND AXILLA - THE ROLE OF IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Elsa M. Arribas, MD (*Abstract Co-Author*) Stockholder, 3D Systems, Inc
Tanya W. Moseley, MD, PhD (*Abstract Co-Author*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC
Emily S. Nia, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Abstract Co-Author*) Nothing to Disclose
Wei T. Yang, MD, FRCR (*Abstract Co-Author*) Royalties, Reed Elsevier;Advisory Board, Lux Capital
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Henry M. Kuerer, MD (*Abstract Co-Author*) Editor, NEJM Group;Editor, The McGraw-Hill Companies;Editor, Wolters Kluwer nv;Speakers Bureau, Physicians Education Resource, LLC;Global Advisory Board, Genomic Health, Inc;Advisory Board, Cardinal Health Inc
Miral M. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Megha M. Kapoor, MD (*Abstract Co-Author*) Nothing to Disclose
Gaiane M. Rauch, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.Breast cancer management has transformed significantly over the last decades, specifically through the integration of neoadjuvant systemic therapy (NST) and the evolving understanding of tumor biology, enabling more tailored treatment strategies.2.Increasing adaptation of limited axillary surgery, such as sentinel lymph node biopsy and targeted axillary dissection raised questions on role of imaging for axillary nodal disease assessment.3.Advances in NST with up to 60-70% of patients achieving pathologic complete response for certain biological subtypes of breast cancer produced growing evidence on potential omission of surgery based on use of minimally invasive biopsy.4.Radiologists should be familiar with contemporary evidence and role of the imaging and image guided procedures for de-escalation of breast and axillary surgery in breast cancer patients.

### TABLE OF CONTENTS/OUTLINE

I. Introduction II. Axillary management • Clinically node negative breast cancer & 7; Role of imaging & 7; Overview of clinical trials • Clinically node positive breast cancer undergoing NST & 7; Role of imaging & 7; Overview of clinical trials III. Omission of breast surgery in exceptional responders to NST based on tumor biology • Proof of concept • Minimally invasive image guided biopsy• Overview of clinical trials IV. De-escalation of breast surgery in patients with DCIS • Role of imaging • Overview of clinical trials V. Future directions •Advancements in imaging and image guided procedures • Artificial Intelligence VI. Conclusion VII. References

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# Abstract Archives of the RSNA, 2024

BREE-60

## STABILITY IS NOT SYNONYMOUS WITH BENIGNITY: THE DIAGNOSTIC CHALLENGE OF SLOW-GROWING BREAST CANCERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Caio D. Pinheiro, MD (*Abstract Co-Author*) Nothing to Disclose
Aline Lemgruber Prado Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta Linhares, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Colombo, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Erica E. Francolin Federicci, PhD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Silva Malta, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe the main histological types of tumors that have slow growth;To review the most recent literature on sensitivity, specificity and diagnostic accuracy regarding this matter;To evaluate of the false negatives cases retrospectively for a more comprehensive characterization of the diagnosis;To propose strategies to prevent diagnostic imaging errors in these types of cancer.

### TABLE OF CONTENTS/OUTLINE

Slow-growing breast tumors are mostly indolent and have lower mortality rates. However, they are responsible for a significant portion of false negatives in screening exams due to their slow growth. Additionally, difficulty of these lesions from potentially invasive ones can lead to imaging diagnostic errors and it is essential for any radiologist interpreting these studies.The main histological subtypes of slow-growing breast tumors include ductal carcinoma in situ, invasive non-specific luminal carcinoma, invasive tubular carcinoma and invasive lobular carcinoma. It stands out as the ductal carcinoma in situ (DCIS) that represents most common lesions that remain indolent.This review thoroughly explains the histological types of slow-growing breast cancer and shows information of the natural history, about mortality or survival rates.Furthermore, recent literature on the sensitivity, specificity, and diagnostic accuracy of slow-growing breast cancer will be discussed, accompanied by illustrative cases of false negatives to highlight diagnostic pitfalls.Strategies to prevent diagnostic imaging errors in these types of cancer are proposed to aid in clinical management.

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# Abstract Archives of the RSNA, 2024

BREE-61

## NAVIGATING THROUGH TUBERCULOSIS MASTITIS: RADIOLOGICAL PRESENTATIONS AND DIAGNOSIS RELEVANCE IN TROPICAL COUNTRIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Erica Endo, MD (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra d. Borges, MD (*Abstract Co-Author*) Nothing to Disclose
Lidia B. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda de Oliveira Cirino, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Tuberculosis (TB) mastitis is a rare extrapulmonary condition caused by Mycobacterium tuberculosis. It can affect the breast either primarily (through abrasions) or secondarily (via lymphatic backflow or contiguity with intrathoracic foci). It presents in varied clinical and radiological forms, often mimicking various other chronic granulomatous conditions, infectious and otherwise, and is frequently diagnosed late due to its nonspecific imaging characteristics.It is important to emphasize that although mammary tuberculosis is not the primary cause of chronic granulomatous mastitis, it remains epidemiologically relevant in tropical countries and has considerable clinical importance.In this context, this exhibition reviews clinical findings, main radiological findings and proposes a workflow for diagnosis and management, highlighting tips that may help the diagnosis.

### TABLE OF CONTENTS/OUTLINE

Review the epidemiology and the most clinical findings of Tuberculosis (TB) mastitis and their differential diagnosis.Explore the main radiological findings on ultrasound (US), mammography (MG), and magnetic resonance imaging (MRI) of Tuberculosis (TB) mastitis illustrating with different cases.Demonstrate the role of the appropriate investigation for TB mastitis and the workflow that may help an early diagnosis

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# Abstract Archives of the RSNA, 2024

BREE-62

## LEARNING THE ROPES: CONTRAST-ENHANCED MAMMOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ekta Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Suzanne McElligott, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica J. DeSabato, MD (*Abstract Co-Author*) Nothing to Disclose
Nina S. Vincoff, MD (*Abstract Co-Author*) Nothing to Disclose
Amna Aslam (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Contrast-enhanced mammography (CEM) is an emerging diagnostic and screening tool in breast imaging that uses iodinated contrast to visualize tumor vascularity. In CEM, a dual-energy mammogram is acquired 2 minutes after the IV injection of iodinated contrast. Low and high energy views offer excellent anatomic detail and breast perfusion. CEM has higher sensitivity for detecting breast cancer compared to digital mammography, tomosynthesis, and ultrasound combined. It has comparable sensitivity and specificity to breast MRI for cancer detection at lower cost and greater comfort for patients who are unable to undergo breast MRI (4,5,6). In this review, we will discuss our experience interpreting CEM and discuss common artifacts and pitfalls. CEM is new for many breast imagers. As it continues to grow in clinical practice, it is important that radiologists understand how CEM can be utilized, how to read and interpret these images, perform CEM biopsies when needed and tackle challenges faced with these cases.

### TABLE OF CONTENTS/OUTLINE

1. Introduction and Background 2. Indications a. Screening b. Diagnostic i. Symptomatic patients ii. Screen recall iii. Extent of disease 3. Imaging Protocol and Acquisition a. Artifacts 4. Reporting findings a. BPE b. BI-RADS c. Lesion description i. Benign ii. Malignant 5. Biopsy of CEM findings - early experience and challenges 6. Conclusion and References

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# Abstract Archives of the RSNA, 2024

BREE-63

## BREAKING THE ICE: CRYOABLATION'S ROLE IN BREAST LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Caroline Colombo, MD (*Abstract Co-Author*) Nothing to Disclose
Silvio E. Bromberg (*Abstract Co-Author*) Nothing to Disclose
Antonio Rahal Junior (*Abstract Co-Author*) Nothing to Disclose
Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Sanvido (*Abstract Co-Author*) Nothing to Disclose
Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Silva Malta, MD (*Abstract Co-Author*) Nothing to Disclose
Afonso C. Nazario (*Abstract Co-Author*) Nothing to Disclose
Caio D. Pinheiro, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna M. Tachibana, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To demystify the mechanism of cellular injury due to cryoablation;To illustrate how cryoablation is performed in practice on breast lesions as well as the subsequent imaging repercussions with cases from our digital archive;To clarify the clinical scenarios where cryoablation is indicated and its limitations.

### TABLE OF CONTENTS/OUTLINE

Cryoablation involves the application of successive cycles of freezing and thawing of neoplastic tissue using cryoprobes inserted into the tumor under radiological guidance (typically ultrasound), promoting tissue destruction through rupture of cell membranes.The hallmark of cryoablation technique is the formation of an "ice sphere" in the tissue, ideally encompassing the tumor with a safety margin of at least 5 mm, easily identified by conventional imaging methods, resulting from tissue necrosis.The freezing mechanism occurs through the thermodynamic properties of argon or nitrogen gasses, which suffer significant heat loss during their expansion. Defrosting is achieved by helium gas, which allows the system to heat up.Its indications include benign breast lesions such as fibroadenomas and malignant tumors smaller than 2,5 cm, breast carcinomas of any histological subtype without distant metastases and with clinically negative axilla.To provide a comprehensive understanding of cryoablation, we have compiled a series of cases from our institution's digital archive. These cases illustrate the step-by-step technique of cryoablation, its imaging consequences, and the clinical rationale behind its use, as well as the method's inherent limitations.

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# Abstract Archives of the RSNA, 2024

BREE-64

## BEWARE OF THE RARE: A PICTORIAL CASE-BASED REVIEW OF MESENCHYMAL BREAST TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Norma P. Arroyo Lopez, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To know the origin and histologic classification of mesenchymal breast tumors Identify characteristics clinical and pathological of each tumor Identify imaging key features of each tumor of cases from our databases

### TABLE OF CONTENTS/OUTLINE

Introduction. WHO classification of mesenchymal breast tumors. Clinical features and histological Imaging findings by ultrasound and mammography modalities. Illustrative cases of mesenchymal breast tumors. Conclusions References

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# Abstract Archives of the RSNA, 2024

BREE-65

## EXPANDING THE BRACKET: OPTIMIZING LOCALIZATION TECHNIQUES FOR MULTIFOCAL AND MULTICENTRIC DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Neha Khemani, MD (*Abstract Co-Author*) Nothing to Disclose
Amy Maduram, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) Breast surgeries are progressively trending towards de-escalation of therapy such as breast conserving surgery (BCS), downstaging cancer after neoadjuvant therapy, and lower number of axillary nodes removed. Radiologists play an important role in planning localizations and interpreting specimen radiographs for BCS. (2) Although multifocal and multicentric disease is often thought as an exclusion criterion for BCS, it is possible to achieve comparable disease free and overall survival rates to mastectomy in select patients when negative margins are achieved. Therefore, it is increasingly important for radiologists to have the technical acumen to approach complex localizations utilizing 3-4 wires or covering multiple quadrants of the breast with confidence. (3) Feedback on surgical specimen radiographs play a vital partnership with surgeons in achieving negative final pathology margins and improving patient outcomes.

### TABLE OF CONTENTS/OUTLINE

(1) Overview of trends towards BCS and introduction to wire-guided localization. (2) Cases of multicentric and multifocal malignancy requiring 4 wire localization with technical pearls and pitfalls. (3) Cases of multi-wire lesion localization using tomosynthesis and complications requiring follow-up imaging. (4) Guidelines for optimal surgical margins of invasive cancer, DCIS, and pleomorphic LCIS. (5) Cases of actionable specimen radiographs requiring notification to the surgeon. (6) Review of pathologic description of margin assessment. (7) Self-assessment quiz.

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# Abstract Archives of the RSNA, 2024

BREE-66

## RADIANT CLARITY: DISCOVERING THE BEAUTY OF CONTRAST MAMMOGRAPHY IN THE DETECTION OF MALIGNANT CALCIFICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rosaura E. Fuentes Corona, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Eugenia Vazquez Manjarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Alma Cintia Medrano Romero, MD (*Abstract Co-Author*) Nothing to Disclose
Rocio D. Cortes Quezada, MD (*Abstract Co-Author*) Nothing to Disclose
Arturo Jimenez Bello, MD (*Abstract Co-Author*) Nothing to Disclose
Elsa Cecilia Molina Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Yamell Alexandra Sanchez Almanzar, MD (*Abstract Co-Author*) Nothing to Disclose
Isa S. Oros I, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Although there are few published studies of false negatives at CEM, one study reported that up to 16% of cases of DCIS with associated calcifications lacked enhancement at CEM. Other studies that evaluated calcifications at CEM reported that 96% of calcifications without enhancement represented a false-positive finding, whereas 80% of calcifications with enhancement represented a true-positive cancer

### TABLE OF CONTENTS/OUTLINE

•Introduction•Classification of calcifications•What is contrast mammography?•application of contrast-enhanced mammography in the assessment of microcalcifications•Radiological cases •Conclusions

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# Abstract Archives of the RSNA, 2024

BREE-67

## NO TUMOR LEFT BEHIND: IMAGING ASSESSMENT OF POSTOPERATIVE RESIDUAL BREAST CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Heni D. Skaf, MD (*Abstract Co-Author*) Nothing to Disclose
Caio D. Pinheiro, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
Rodrigo O. Seleti, MD (*Abstract Co-Author*) Nothing to Disclose
Tais C. Batista, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Silva Malta, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela Soveral, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Renata Feres, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo Z. Bringel Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Colombo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To explain the role of imaging in the detection of residual postoperative breast cancer for optimal therapeutic management;To discuss the possible causes of residual tumor after breast-conserving surgery or mastectomy;To explain the role of specimen mammogram and histological evaluation of surgical margins as a means to avoid residual cancer.

### TABLE OF CONTENTS/OUTLINE

The main goal of surgery in the treatment of breast cancer, whether breast-conserving surgery or mastectomy, is the removal of all malignant lesions. Nevertheless, postoperative residual breast cancer is a possible outcome after any surgery, regardless if surgical margins are positive or negative. In the setting of residual cancer, re-excision is the standard treatment.The main cause of residual cancer is underestimation of lesion size prior to surgery; preoperative breast MRI is the optimal imaging modality for local staging, determining tumor extent and multifocal disease. Other causes include inappropriate surgical choice, errors in preoperative lesion localization and incomplete axillary dissection of metastatic lymph nodes. Prevention of residual cancer can be achieved by performing specimen mammograms of mammography-visible lesions (calcifications, biopsy markers) and histological evaluation of surgical margins. In patients with positive surgical margins, imaging aids in determining extent of residual disease prior to re-excision. In patients with negative margins, residual cancer may be detected in subsequent screening exams.We have compiled a series of cases from our institution's digital archive to discuss possible causes of residual tumors and the role of imaging in reducing them.

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# Abstract Archives of the RSNA, 2024

BREE-68

## EMERGENCY BREAST IMAGING UNCOVERED: NAVIGATING TRIAGE, IMAGING FEATURES, MIMICS, TREATMENT, AND FOLLOW-UP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shruti Kumar, MBBS (*Abstract Co-Author*) Nothing to Disclose
George K. Vilanilam, MD (*Abstract Co-Author*) Nothing to Disclose
Aditi Chaurasia, MBBS (*Abstract Co-Author*) Nothing to Disclose
Giridhar Dasegowda, MD (*Abstract Co-Author*) Nothing to Disclose
Heta Ladumor, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Identify causes of breast-related complaints presenting to the emergency department 2. Describe characteristic imaging features of common and uncommon emergent breast conditions and mimics 3. Discuss triage, management, and appropriate follow-up protocol

### TABLE OF CONTENTS/OUTLINE

A. Traumatic: contusions/hematoma/seatbelt injury, fat necrosis (mimics cancer) B. Non traumatic B.1 Inflammatory: puerperal mastitis, Mondor’s disease B.2 Infectious: non-puerperal mastitis, granulomatous mastitis (mimics cancer) C. Implant related: infection, rupture following trauma D. Post-procedural: hematoma, pseudoaneurysm E. Mimics: cancer F. Non emergent findings in the emergency department: palpable mass, discharge, skin changes

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# Abstract Archives of the RSNA, 2024

BREE-69

## ALWAYS LOOK BEYOND THE BREAST: EXTRAMAMMARY FINDINGS ON MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Karla I. Soto, MD (*Abstract Co-Author*) Nothing to Disclose
Yesika Davila Zablah, MD (*Abstract Co-Author*) Nothing to Disclose
Ia M. Sanchez Carenzo, MD (*Abstract Co-Author*) Nothing to Disclose
Ilany L. Valdivia I, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Garza, MD (*Abstract Co-Author*) Nothing to Disclose
Elena M. Sanchez Siller, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica A. Perdomo SR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to describe extramammary findings discovered on breast magnetic resonance images, including location, frequency and relevance. Review the imaging characteristics of the extramammary findings and the appropriate imaging modality when further evaluation is required. Identify suspicious features that may suggest malignancy among extramammary lesions. Learn a systematic assessment for active search of extramammary lesions. Recognize when additional imaging work-up or follow-up is necessary for further characterization of extramammary findings.

### TABLE OF CONTENTS/OUTLINE

We review the location and features of extramammary findings on breast magnetic resonance, presenting the most frequent locations of benign and malignant findings, including an approach for further imaging work-up and follow-up. Benign findings: liver cyst, pleural effusion, liver hemangiomas, sternum hemangiomas, lung atelectasis, post-radiation changes, mesenteric cyst, mediastinum cyst, epidermal inclusion cyst, accessory spleen, axillary lipoma, pulmonary nodules, cervical reactive lymph node, rib hemangiomas, lung consolidation, thyroid nodule. Malignant findings: muscle, bone, lymph nodes, pulmonary and liver metastases and malignant pleural effusion. A systematic approach when evaluating extramammary structures.

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# Abstract Archives of the RSNA, 2024

BREE-7

## EXPLORING THE AXILLARY REGION IN BREAST CANCER PATIENTS: CT FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Miguel Chiva de Agustin (*Abstract Co-Author*) Nothing to Disclose
Irene Vicente Zapata, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa Antolinos Macho, MD (*Abstract Co-Author*) Nothing to Disclose
Teresa Presa, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Describe the imaging appearances of normal and abnormal axillary nodes on CT in breast cancer patients, with focus on morphology and localization • Explain how the axillary node burden can be assessed with CT before and after NAC • Describe axillary CT findings in follow up breast cancer patients

### TABLE OF CONTENTS/OUTLINE

1. Describe the normal and abnormal appearances of axillary nodes on CT staging and its role in therapeutic management decisions for breast cancer patients. a. The Amonkar classification used in ultrasound has similar appearances on CT and categorizes nodes as: i. Normal: UN2, UN3 ii. Abnormal or suspicious: UN4 and UN5 b. The Berge levels aid in localizing nodes: i. Level 1: lower axilla, lateral to the minor pectoralis muscle ii. Level 2: middle axilla, behind the minor pectoralis muscle iii. Level 3: upper axilla, medial to the minor pectoralis muscle iv. Interpectoral region2. Describe axillary node burden and the importance of understanding diagnostic procedures (SNB, LA, TAD) for successful treatment: a. Pre-neoadjuvant chemotherapy: crucial for node counting and localization: i. Patients with <3 nodes in level 1: candidates for targeted axillary dissection (avoiding LA) ii. Patients with >3 nodes or nodes in level 2: candidates for lymphadenectomy (LA) b. Post-NAC evaluation should report: i. Good response - nodes return to normal size or >50% reduction ii. No response - no changes 3. Evaluate CT findings in follow-up breast cancer patients: a. Postsurgical changes from SNB or LA b. Surgical techniques and complications: extracapsular silicone in breast reconstruction, autologous reconstructions, or postsurgical seromas c. Axillary recurrence.

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# Abstract Archives of the RSNA, 2024

BREE-70

## NON CALCIFIED DUCTAL CARCINOMA IN SITU

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Dayana K. Pastor Gutierrez, PhD (*Abstract Co-Author*) Nothing to Disclose
Cecilia E. Castro Bueno, RT (*Abstract Co-Author*) Nothing to Disclose
Claudia E. Rivera Otazu, MD (*Abstract Co-Author*) Nothing to Disclose
Marycarmen E. Flores Duenas, MD (*Abstract Co-Author*) Nothing to Disclose
Liana M. Falcon, MD (*Abstract Co-Author*) Nothing to Disclose
Liliana M. Bustamante Rodas, MD (*Abstract Co-Author*) Nothing to Disclose
Esmeralda S. Bayona, MD (*Abstract Co-Author*) Nothing to Disclose
Lisett N. Cruzado-Quiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Rowena A. Hammond, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia P. Guillen-Bravo, MD (*Abstract Co-Author*) Nothing to Disclose
Karla X. Gutierrez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Non-calcified ductal carcinoma in situ presents with different appearances: mass, asymmetries or distortions.2. Non-calcifield DCIS can be occult on screening mammography.3. Non-calcifield DCIS is common to find it on staging or screening MRI as a non-mass enhacement lesion.

### TABLE OF CONTENTS/OUTLINE

Non calcified ductal carcinoma in situPathologic featuresMultimodality imaging findingsMRI biopsyCases

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# Abstract Archives of the RSNA, 2024

BREE-71

## BREAST EDEMA. UNDERSTANDING THE UNDERLYING PATHOLOGY. A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
Karen L. Caro, PhD (*Abstract Co-Author*) Nothing to Disclose
Liliana Pacheco Mendoza (*Abstract Co-Author*) Nothing to Disclose
Maria P. Swiecicki, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To display the different pathologies that can clinically manifest with breast edema: mastitis, granulomatous mastitis, inflammatory breast carcinoma, post radiotherapy edema and systemic diseases such as renal failure or congestive heart failure.2. To illustrate using clinical cases tips and tricks that can help achieve a proper diagnosis of these entities.

### TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Physiopathology of breast edema.3. Mastitis: puerperal, non-puerperal and granulomatous mastitis.4. Breast edema after conserving treatment, post radiotherapy edema.5. Inflammatory breast cancer.6. Systemic diseases that can produce breast edema: renal failure, congestive heart failure.7. Conclusions.In conclusion, this educational exhibit is intended to aid the radiologists in training in understanding the multiple differential diagnosis that should be considered when encountering a patient with breast edema and give them tips for achieving an accurate diagnosis within this broad spectrum of entities.

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# Abstract Archives of the RSNA, 2024

BREE-72

## BEYOND METASTATIC LYMPHADENOPATHY IN BREAST CANCER: AN APPROACH TO AXILLARY MASSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Tanya W. Moseley, MD, PhD (*Abstract Co-Author*) Consultant, Hologic, Inc;Consultant, Merit Medical Systems, Inc;Owner, TW Moseley, LLC;CEO, TW Moseley, LLC
Gaiane M. Rauch, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Emily S. Nia, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Miral M. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Megha M. Kapoor, MD (*Abstract Co-Author*) Nothing to Disclose
Elsa M. Arribas, MD (*Presenter*) Stockholder, 3D Systems, Inc

### TEACHING POINTS

• Review the differential diagnosis of benign and malignant masses in the axillary region. • Review the imaging modalities and key imaging features used in the assessment of axillary masses. • Highlight the importance of appropriate correlation of the patient's clinical presentation, pertinent clinical history, and imaging clues to distinguish these.• Review biopsy techniques and challenges.• Discuss the clinical management.

### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. Algorithm on how to approach benign and malignant masses in the axillary region across different imaging modalities. III. Highlight the importance of correlation of the patient's clinical symptoms and their clinical history to establish the differential diagnosis. IV. Review of the different imaging techniques to biopsy axillary masses. V. Tips, pitfalls, and practical approaches will be emphasized through a case-based multi-modality approach. VI. Rad-path correlation of the axillary pathology.

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# Abstract Archives of the RSNA, 2024

BREE-73

## THE DIAGNOSTIC VALUE OF A NEW MAMMOGRAPHY TECHNIQUE IN BREAST DISEASES: CONTRAST-ENHANCED SPECTRAL MAMMOGRAPHY (CESM)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ruixue Cao (*Presenter*) Nothing to Disclose

### TEACHING POINTS

CESM greatly increased the positive detection rate for breast cancer.Various methods have been applied to the diagnosis of breast diseases alone or in combination in clinical application. This exhibition aims to demonstrate the value of CESM in breast disease diagnosis by conducting research surveys on previous studies.

### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) CESM imaging principle : CESM based on dual-energy breast exposure after contrast administration, It reflects the blood flow dynamics of the lesion by utilizing the uptake of iodine contrast agent in the tumor tissue. 3) Technique and protocols: contrast dose of 1.5 mL/kg, factory-set kVp ranges for low- and high-energy acquisitions, beginning image acquisition after 2min from contrast agent injection and completing the examination within 8 min. 4) Diagnostic value: a. evaluation of symptomatic women b. screening recalls c. local staging d. pre-and post-operative evaluations e. neoadjuvant chemotherapy response monitoring f. guide biopsy for the lesion 5) Advantages and limitations of CESM

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# Abstract Archives of the RSNA, 2024

BREE-74

## FROM ATYPIA TO CARCINOMA A REVIEW OF LOBULAR NEOPLASIAS OF THE BREAST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Harnoor Singh, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Elaine G. Khalil, MD (*Abstract Co-Author*) Nothing to Disclose
Muhayman Sadiq, MBBS (*Abstract Co-Author*) Nothing to Disclose
Kiran N. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Cotes, MD (*Abstract Co-Author*) Nothing to Disclose
Shima Aran, MD (*Abstract Co-Author*) Nothing to Disclose
Abeer H. Abdel Hameed, MBChB (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Definition of Lobular neoplasia LN and invasive lobular carcinoma ILC Pathological classification of LN .Clinical presentation and epidemiology of LN and ILC Review of common imaging findings in LN and ILC Review of imaging caveats and radiological pathological concordance Review of the multidisciplinary approach for management of LN and ILC

### TABLE OF CONTENTS/OUTLINE

Definition of LN Including Atypical lobular hyperplasia ALH Lobular carcinoma in situ LCIS and invasive lobular carcinoma ILCReview of common imaging findingsOutline the breast radiologist role inDetection of subtle imaging findings in cases of ILCAssessment of multifocal multicentric disease and the contralateral breast in ILClocal staging of ILC and planning for surgical managementSelection of sampling method and targetDetermine radiological pathological concordanceProper follow up for non surgical patients Factors influencing radiological pathological concordancePatient factorsLesion factorsThe biopsy modality guidanceNumber of biopsy core samples needle Gauge successful targetingSize of original lesion Residual non sampled abnormality Management of LN and ILCUpfront surgical management versus neo adjuvant systemic therapy for ILCFactors influencing management of LNClinical presentation Pathological factors Number of involved TDLU and presence of other high risk breast lesions.Patient lifetime risk for breast cancer.Radiological pathological concordance.Consideration of chemo-preventive treatment.Proper choice of imaging modality for follow up.

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# Abstract Archives of the RSNA, 2024

BREE-75

## SUPERFICIAL AND SKIN LESIONS IN BREAST IMAGING.MULTIMODALITY IMAGING ANDDIFFERENTIAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Brian D. Norena Rengifo, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Saldarriaga, MD (*Abstract Co-Author*) Nothing to Disclose
Haydee Ojeda-Fournier, MD (*Abstract Co-Author*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc
Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando Ahumada (*Abstract Co-Author*) Nothing to Disclose
Ana Beatriz Luengas (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Superficial lesions in the breast can be an incidental finding or can manifestas a palpable abnormality.Knowledge of the skin anatomy is crucial in the assessment of superficiallesions in breast.Breast ultrasound is the imaging of choice for characterization of superficiallesions in breast imaging. A meticulous technique is necessary to determinelesion localization.Establishing a differential diagnosis according to the localization of thesuperficial lesion is critical to avoid a cancer misdiagnosis.

### TABLE OF CONTENTS/OUTLINE

This educational electronic exhibit will review the anatomy of the skin,multimodality imaging findings and differential diagnosis of superficial and skinlesions in the breast. An overview of the US technique to evaluate superficial andskin lesions will be given.

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# Abstract Archives of the RSNA, 2024

BREE-76

## NEW STRATEGIES IN CANCER SURVEILLANCE AFTER BREAST CANCER TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lorena Melian Iribar, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Teresa Montero Alameda (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review current strategies of surveillance of patients after breast cancer surgical treatment. 2. To discuss the specific management of those patients, including imaging and interventional procedures. 3. To illustrate imaging in different techniques including contrast-enhanced mammography, US, MRI, CT, and PET with pathologic correlation in cases of cancer recurrence and in different benign postoperative entities (fat necrosis, seroma, mastitis). 4. To emphasize pitfalls, diagnostic difficulties, and differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

The different therapeutic options employed for breast disease cause different breast changes, complications and frequently difficulties in diagnosis. We present: 1. Current recommendations in surveillance after different breast cancer surgical treatment strategies (mastectomy, breast reconstruction, breast conserving surgery). 2. Techniques in evaluation of treated breasts. Contrast-enhanced mammography, US, MRI, CT, PET. 3. Imaging findings. Postsurgery changes acute/subacute (architectural distortion, hematoma, seroma, fat necrosis, residual lesion), late (scar, fibrous reaction, suture granuloma, breast Implant rupture and silicone granuloma, lymphadenopathy). Posttreatment changes: Hormonotherapy (Increased density), Radiotherapy (skin thickening, edema). Breast cancer recurrence, metachronous breast cancer. 4. Tips for differential diagnosis, diagnostic work-up and recommendations for management

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# Abstract Archives of the RSNA, 2024

BREE-77

## DON’T FORGET TO DESCRIBE THE BREAST FINDINGS ON CHEST TC.TIPS AND PEARLS TO IDENTIFY THEM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria P. Swiecicki, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
MONICA OTILIA MACHUCA CASTILLO (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
Karen L. Caro, PhD (*Abstract Co-Author*) Nothing to Disclose
Agustina Graziani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe breast and axillary findings on chest computed tomography.Recognize breast and axillary findings of clinical significance that must be reported in chest CT scan.To discuss the clinical management of these findings.

### TABLE OF CONTENTS/OUTLINE

1-Introduction:Chest CT is a frequently performed radiologic study and can reveal breast and axillary findings in both genders. Radiology residents should be accurate in reporting these findings is essential to guide clinical decision-making and prevent unnecessary procedures.2-Normal Appearance of Breasts and Axilla on Chest CT:The normal appearance of breast parenchyma on chest CT can vary based on breast density. Familiarity with normal variations in breast density is crucial to avoid misinterpretation of findings. The axilla should also be carefully evaluated for lymph nodes.3-Benign and malignant Imaging findings in female breast on Chest CT4-Benign Imaging Findings in Male Breast on Chest CT:Gynecomastia is a common benign finding in the male breast on chest CT. It is important to recognize and accurately describe this finding in the report to prevent unnecessary workup.5-Malignant imaging findings in male breast on Chest CT6-Clinical Cases:Several clinical cases will be presented to illustrate the accurate reporting of breast and axillary findings on chest CT scans.7-Management.

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# Abstract Archives of the RSNA, 2024

BREE-78

## BREAST RESONANCE, FINDINGS THAT SHINE ON T2, A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Dayana K. Pastor Gutierrez, PhD (*Abstract Co-Author*) Nothing to Disclose
Karla X. Gutierrez, MD (*Abstract Co-Author*) Nothing to Disclose
Liliana M. Bustamante Rodas, MD (*Abstract Co-Author*) Nothing to Disclose
Liana M. Falcon, MD (*Abstract Co-Author*) Nothing to Disclose
Rowena A. Hammond, MD (*Abstract Co-Author*) Nothing to Disclose
Federica Pediconi, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia P. Guillen-Bravo, MD (*Abstract Co-Author*) Nothing to Disclose
Marycarmen E. Flores Duenas, MD (*Abstract Co-Author*) Nothing to Disclose
Lisett N. Cruzado-Quiroz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Most lesions that shine on T2 are benign, however there are some malignant lesions that also shine on T2.The most common benign hyperintense lesions on T2 are: cysts, fibroadenomas, lymph nodes, fat necrosis, etc.Mucinous carcinomas, papillary carcinomas, triple negative tumors with a necrotic component, etc., are malignant lesions that present high signal on T2.A single sequence does not make the diagnosis. In MRI, it is important to evaluate the morphological and dynamic sequences in parallel, which will help us narrow the differential diagnosis.In this presentation, we want to illustrate the MRI features of most common and rare T2 hyperintense breast lesions, with emphasis on morphologic features and differential diagnoses.

### TABLE OF CONTENTS/OUTLINE

Breast cancer; MRI; malignant lesions; T2 hyperintense; necrotic component; papillary carcinomas; mucinous carcinomas.

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# Abstract Archives of the RSNA, 2024

BREE-79

## MORE THAN WORDS: COMPLETE REPORT FOR OPTIMAL TREATMENT TNM 8TH EDITION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria Jose Chico (*Abstract Co-Author*) Nothing to Disclose
Karen L. Caro, PhD (*Abstract Co-Author*) Nothing to Disclose
MONICA OTILIA MACHUCA CASTILLO (*Abstract Co-Author*) Nothing to Disclose
Maria P. Swiecicki, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Pesce, PhD (*Abstract Co-Author*) Nothing to Disclose
Agustina Graziani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To analyze the 8th edition of the breast cancer staging system.To discuss the modifications in the 8th edition.Describe findings that cannot be missing from the report.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: Breast cancer is an heterogeneous tumor, very frequent among women and, if not diagnosed and treated in timely manner, leads to significant morbidity and mortality 2. 8th TNM edition: Anatomic staging: considering tumor extension (according to size), affects lymph nodes (classified according to their level) and the presence or absence of metastases.Prognostic staging part: based on the expression of hormone receptors and oncogenes (estrogen, progesterone and HER2 receptors) and tumor grade (low, intermediate and high) and the results of the multigentics panel (evaluates genes in order to predict the probability of recurrence). Genomic analysis helps to understand the biological behavior of breast cancer that causes changes in the management and treatment of the patients.3. Modifications in the 8th edition of the TNM.4. Clinical Cases:Several clinical cases will be presented to illustrate the findings that should be taken into account for anatomic staging and tips for remembering them.5. Conclusion: Although the role of the radiologist is crucial in the anatomical stage, as the 8th edition of the TNM also takes into account prognostic staging, it is necessary to have knowledge about tumor genes and hormone receptors in order to provide patients with the optimal treatment.

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# Abstract Archives of the RSNA, 2024

BREE-8

## PRIMARY AND SECONDARY BREAST ANGIOSARCOMA: MULTIMODALITY IMAGING APPROACH WITH PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Priscilla J. Slanetz, MD, MPH (*Abstract Co-Author*) Royalties, Wolters Kluwer nv
Jordana Phillips, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Consultant, General Electric Company;Consultant, Hologic, Inc
Jenna Pellegrino, MD (*Abstract Co-Author*) Nothing to Disclose
Dunya M. Imad, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Breast angiosarcoma, an infrequent yet highly aggressive cancer, originates from spindle cells and is more prevalent in the breast compared to any other organ. It manifests in two primary forms: sporadic angiosarcoma and post-radiation angiosarcoma. A causative factor remains unidentified in primary breast angiosarcomas. Conversely, secondary breast sarcomas are associated to previous radiation therapy (RT) and conditions leading to chronic lymphedema. Despite its rarity, this disease necessitates specialized diagnostic and therapeutic approaches, necessitating collaboration among radiologists, oncologists, surgeons, and pathologists.

### TABLE OF CONTENTS/OUTLINE

In this exhibit, we will discuss the various presentations of primary and secondary angiosarcoma, conduct a systematic review of clinical findings, and examine multimodality radiological findings through case studies, including PET-CT. Additionally, we will explore treatment modalities and discuss prognosis to provide a comprehensive understanding of this challenging condition.

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# Abstract Archives of the RSNA, 2024

BREE-80

## CONTRAST ENCHANCED MAMMOGRAPHY APPLICATIONS: A CASE BASED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kictzia Y. Larios Cruz, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Luz E. Bastidas Caicedo, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Balbas Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Nora I. Moguel, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Sandoval Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Sara S. Herrera Lemus, MD (*Abstract Co-Author*) Nothing to Disclose
Angela J. Urbina Ibarra SR, MD,BSC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Contrast mastography uses intravenous contrast agents, being an effective technique to improve the early detection of breast cancer and reduce the false positive rate, as well as to evaluate the extension and occult cancers among other indications, due to the accurate characterization of lesions.Contrast mastography stands out for its ability to improve the detection of breast lesions, especially in cases of dense breast tissue or inconclusive findings on conventional mammography. Its role in preoperative evaluation is illustrated, allowing a more accurate characterization of the extent of disease and optimal surgical planning. Indications, contraindications and practical considerations for performing the study are also reviewed. This review highlights the value of contrast-enhanced mastography as an important diagnostic tool in the comprehensive management of breast pathologies, with important implications for early detection and personalized treatment of patients.*Review contrast enchanced mammography basics (acquisition protocol, diagnostic performance, and current indications).*Ilustrate the applications and added value of contrast enchanced mammography through the review of everyday clinical scenarios.

### TABLE OF CONTENTS/OUTLINE

1.Contrast enchanced mammography lexicón overview (categories, terms, features and definitions)2.Ilustrated case based review2a. Staging2b. Microcalcifications2c. Occult breast cancer2d.Residual and recurrent disease2e.Paget disease2f.Telorrhage2g.High risk screening2h.Focal asymmetry. 3. Conclusions

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# Abstract Archives of the RSNA, 2024

BREE-81

## LOOK WHAT YOU MADE ME DO...A CORRELATION BETWEEN MRI FINDINGS AND TUMORAL INMUNOPHENOTYPE OF BREAST CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elena M. Sanchez Siller, MD (*Abstract Co-Author*) Nothing to Disclose
Karla I. Soto, MD (*Abstract Co-Author*) Nothing to Disclose
Yesika Davila Zablah, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica A. Perdomo SR, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita L. Garza, MD (*Abstract Co-Author*) Nothing to Disclose
Ilany L. Valdivia I, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Ia M. Sanchez Carenzo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The main objective of this work is to communicate if there is a relationship between breast cancer findings by MRI and immunohistochemistry, and how we get to that information. The secondary objective is to make a practical and concise description of the findings that we can identify in breast cancer lesions on MRI, as well as the appropriate vocabulary to use about these characteristics. Present more relevant information about the usefulness of the BI-RADS and the Kaiser Score for the proper classification of breast cancer lesions. Review the basic acquisition protocol recommended for the evaluation of suspected or proven breast cancer lesions by MRI, as well as the key points to have an appropriately structured report that contains all the required information about the findings.

### TABLE OF CONTENTS/OUTLINE

The usefulness of performing immunohistochemistry in patients diagnosed with breast cancer for the management of the disease. The importance of correct and complete evaluation of lesions by MRI, following a protocol in both the acquisition and interpretation of the images, in order to be a guide for those residents in training who are starting out on the subject. Concise descriptions are included with illustrations and real examples representative of our institution that include mass and non-mass lesions with all those characteristics that must be identified and characterized in the interpretation. The information included is how the statistical analysis was performed, selection and exclusion of patients, and results on the prevalence of the reviewed characteristics as well as their correlation with the types of immunophenotype in our study population.

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# Abstract Archives of the RSNA, 2024

BREE-82

## PET/MRI IN BREAST CANCER: WHAT RADIOLOGY RESIDENTS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Itzell Reyes Garcia, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To review: Breast Anatomy in MRI• To understand the basics of PET-MRI• To recognize the opportunities for synergistic use of multimodal information• To present protocols and procedures for Breast PET-MRI• To discuss the advantages and disadvantages of PET-MRI in breast cancer

### TABLE OF CONTENTS/OUTLINE

• Introduction• Breast Anatomy in MRI• Principles of PET/MRI and Clinical Applications• Most Common Radiotracers Used in Breast PET-MRI• Representative Cases on Breast Cancera. Stagingb. Prognosisd. Treatment Response Assessment• Take home points• Discussion• Conclusion

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# Abstract Archives of the RSNA, 2024

BREE-83

## DEEP LEARNING FOR BREAST CANCER RISK PREDICTION: LEARNING FROM THE PAST TO ENSURE AN EQUITABLE FUTURE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura Heacock, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Alana A. Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriu Reig, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Including imaging information such as breast density improves the accuracy of clinical models of breast cancer risk. 2. Accurate risk assessment identifies women who would benefit from supplemental screening and/or chemoprevention. 3. Training and validating models on a multi-racial and multi-ethnic dataset is essential to ensure accurate risk assessment across groups.

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Risk prediction using clinical models b. Imaging data incorporated into Tyrer-Cuzick and other models c. Time-frame of risk prediction: near-term versus long-term risk 2. Summary of risk prediction research a. FFDM i. Radiomics evaluation of parenchymal complexity ii. Deep learning models including Mirai b. DBT - challenge of generalizing FFDM models to DBT c. US - parenchymal echogenicity reflects glandular composition d. MRI - BPE as a marker of risk 3. Future directions a. Multimodality b. Incorporating prior studies c. Including polygenic risk scores d. Modeling the impact of different screening intervals 4. Improving generalizability and equity a. Deep learning models show similar performance across racial and ethnic groups, compared to clinical models that have poor performance in non-white groups b. Importance of multi-racial and multi-ethnic datasets, validation

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# Abstract Archives of the RSNA, 2024

BREE-84

## GRANULOMATOUS MASTITIS. A RARE BENIGN ENTITY THAT CAN SIMULATE BREAST CANCER. WHAT THE RADIOLOGIST SHOULD KNOW!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria C. Ona Hurtado SR, MMed,BA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1 Analyze the imaging characteristics of the (IMG) 2 Discuss the management of the heterogeneous group of IGM •Introduction and review of the literature •Review of the imaging characteristics •Description of the results of the IGM images in mammograms, ultrasounds and MRI •Clinical cases •Diagnostic algorithm

### TABLE OF CONTENTS/OUTLINE

Granulomatous mastitis(GM) is a benign inflammatory breast disease that its becoming more commonly seen during our daily practice of unknown etiology, has a persistent and recurrent clinical course and occurs most commonly in parous women; it typically manifests as a tender palpable mass and inflammatory breast changes characterized by granulomatous inflammation at histopathologic analysis.The most common clinical sign is a painful palpable mass associated with erythema, and purulent discharge. However, the nonspecific manifestations and varied demographic features of this condition, as well as the other similar-appearing and superimposed breast entities, pose substantial diagnostic challenges, like inflammatory breast cancer(IBC), infective mastitis, foreign body injection granulomas, mammary duct ectasia, diabetic fibrous mastopathy, and systemic granulomatous processes and tuberculosis. Targeted ultrasonography, mammography, and less commonly, magnetic resonance imaging have proven to be useful for imaging evaluation. Core-needle biopsy, with or without fine-needle aspiration for cytopathologic examination, and culture analysis are usually required to exclude IBC and other benign inflammatory processes.

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# Abstract Archives of the RSNA, 2024

BREE-85

## EXTRAMAMMARY FINDINGS ON BREAST MRI FOR THE BREAST RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sujata V. Ghate, MD (*Abstract Co-Author*) Research Grant, Bracco Group;Reader, QT Ultrasound, LLC;Travel support, QT Ultrasound, LLC
Victoria A. Wells, MD (*Abstract Co-Author*) Nothing to Disclose
Jay A. Baker, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Karen S. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Derek L. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Theresa X. Pham, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Breast Magnetic Resonance Imaging (MRI) is frequently utilized in breast imaging for high-risk screening, evaluation of implant integrity, evaluation of disease extent in the preoperative setting, and evaluation of tumor response to neoadjuvant chemotherapy. Given the varying field of view of breast MRI examinations, incidental extramammary findings may be visible in the lower cervical neck, thorax, upper abdomen, and even thoracic spine. Therefore, it is important for breast radiologists to include these areas in their search pattern and to have a comprehensive understanding of the distinctive imaging findings and pathology—both benign and malignant—observed in these anatomical areas. The purpose of this educational exhibit is to review cases with incidental extramammary findings on breast MRI and to highlight the importance of looking at all of the imaging sequences, including localizers, and areas beyond the breasts.

### TABLE OF CONTENTS/OUTLINE

1. Highlight and discuss the importance of looking at all the available MRI sequences for incidental extramammary findings on breast MRI.2. Review common extramammary benign and malignant imaging findings that can be incidentally detected on breast MRI.3. Present image-rich multimodality case examples of incidental extramammary findings detected on breast MRI.

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# Abstract Archives of the RSNA, 2024

BREE-86

## BEYOND CANCER: REVEALING BI-RADS 5 MIMICS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa M. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Cardoso Ern, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Identify the BI-RADS 5 imaging standards for ultrasound, mammography, and MRI;- Outline and illustrate the main benign differential diagnoses for BI-RADS 5;- Propose a diagnostic flowchart to determine biopsy concordance;

### TABLE OF CONTENTS/OUTLINE

The system currently used to report and classify mammography, ultrasound, and breast MRI findings is the BI-RADS system. It ensures uniformity in the lexicon and a degree of homogeneity in the interpretation of exams. The ACR BI-RADS 5 classification is used when the probability of malignancy is greater than or equal to 95%.However, not all lesions classified as BI-RADS 5 are malignant. Some pathologies have imaging features that mimic findings characteristic of highly malignant lesions and are ultimately classified with them, such as atypical infections, radiated scar, fat necrosis, desmoid tumor, granulosa cell tumor, mastitis (inflammatory, lymphocytic/diabetic, and infectious) and myofibroblastoma.his is a retrospective study using images from the database of a quaternary hospital that is a national reference for highly complex cases. Ultrasound, mammography, and MRI scans between 2015 and 2023 were used, all with anatomical-radiological matching.The breast radiologist must be aware of this group of agents and determine whether a new biopsy is necessary in the case of a discordant result, or whether the result is benign and concordant according to well-established criteria.

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# Abstract Archives of the RSNA, 2024

BREE-87

## CONTRAST-ENHANCED MAMMOGRAPHY FINDINGS. A PICTORIAL REVIEW OF BENIGN AND MALIGNANT LESIONS WITH RADIOLOGIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Elena Romero (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Soledad Alonso Garcia (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To describe contrast-enhanced mammography (CEM) technique.-To review the appearances of benign and malignant lesions in CEM, including different patterns of enhancement and correlation with low-energy images. - To illustrate imaging findings of CEM with correlation with imaging (US, MRI) and pathology. - To emphasize pitfalls, diagnostic difficulties and differential diagnosis and discussion of management.

### TABLE OF CONTENTS/OUTLINE

Contrast-enhanced mammography (CEM) is currently used in diagnostic work-up of breast lesions. Advantages include well-tolerated studies, short duration, lower cost than MRI, and immediate review of results after the study. Radiologists should be familiar with normal findings and commonly encountered benign and malignant entities on CEM.
- Basics and technique of CEM.
- Study evaluation: low-energy findings (mass, calcifications, architectural distortion, asymmetries), patterns of enhancement (background parenchymal enhancement, mass, non-mass enhancement, and enhancing asymmetry).
- Images in different pathologic entities. Through sample cases, a variety of imaging and pathology findings from lesions detected in CEM studies with correlation with US, MRI and pathology, illustrating benign lesions (cyst, fibroadenoma, phyllodes tumor, papilloma, fat necrosis, pseudoangiomatous stromal hyperplasia (PASH), skin-related lesions, lymph nodes, granulomatous and lymphocytic mastitis, abscess), malignant entities (DCIS, ductal and lobular invasive cancer, colloid and papillary cancer, lymphoma) and high risk lesions (atypical ductal hyperplasia (ADH), radial scar, flat epithelial atypia).
- Clues for differential diagnosis and pitfalls.

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# Abstract Archives of the RSNA, 2024

BREE-88

## THE CHALLENGE OF DEPICTING BREAST MICROCALCIFICATIONS ON PHOTON-COUNTING DETECTOR CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marehiko Hiroshima, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yuki Yasuda (*Abstract Co-Author*) Nothing to Disclose
Takayuki Noro, MD (*Abstract Co-Author*) Nothing to Disclose
Nobuo Kitera, RT, MSc (*Abstract Co-Author*) Nothing to Disclose
Kazuya Ohashi, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Masaya Kisohara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seita Watanabe, RT (*Abstract Co-Author*) Nothing to Disclose
Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Misugi Urano, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Photon-counting detector computed tomography (PCD-CT) has several advantages over conventional energy-integrating computed tomography (EID-CT). The higher spatial resolution of PCD-CT may provide a precise visualization of microcalcifications related to breast cancer. This can contribute to preoperative planning by identifying the distribution of microcalcifications.This presentation will focus on depicting breast microcalcifications in breast cancer patients on PCD-CT, comparing it to EID-CT and other imaging modalities, including mammography, tomosynthesis, ultrasound, and magnetic resonance imaging, with pathological results. We will also discuss the reconstruction settings of kernel sharpness, iterative reconstruction, or slice thickness to depict and identify breast microcalcifications on PCD-CT.

### TABLE OF CONTENTS/OUTLINE

1. The types of breast calcifications 2. The reconstruction settings, including kernel sharpness, iterative reconstruction, or slice thickness of PCD-CT to depict and identify breast microcalcifications 3. Case-based review of breast calcifications on PCD-CT compared to EID-CT, other imaging modalities, and pathological results 4. Discussion of the advantages and pitfalls of breast microcalcifications on PCD-CT compared to other modalities

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# Abstract Archives of the RSNA, 2024

BREE-89

## LATERAL ARM APPROACH FOR STEREOTACTIC BREAST GUIDED BIOPSIES: PEARLS AND PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alejandra Varela, MD (*Abstract Co-Author*) Nothing to Disclose
Agostina B. Peralta (*Abstract Co-Author*) Nothing to Disclose
Daniel C. Mysler SR, MD (*Abstract Co-Author*) Nothing to Disclose
Tiare A. Pineiro, MD (*Abstract Co-Author*) Nothing to Disclose
Maria L. Negri (*Abstract Co-Author*) Nothing to Disclose
Leandro Rodriguez Ramirez, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Cosaka (*Abstract Co-Author*) Nothing to Disclose
Andrea Noelia Seco (*Abstract Co-Author*) Nothing to Disclose
Claudia A. Fernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Leidy Imitola Romo (*Abstract Co-Author*) Nothing to Disclose
Maria C. Freire, DMD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Discuss the basic principles for performing a lateral arm approach stereotactic breast guided biopsy.-Describe the patient’s indications for carrying out this approach.-Recognize potential challenging cases and complications when performing a lateral arm approach stereotactic breast guided biopsy.-Illustrate techniques to overcome problems and successfully resolve challenging cases.

### TABLE OF CONTENTS/OUTLINE

Stereotactic breast biopsies have proven to be a feasible alternative to surgical breast biopsies. Nowadays, this method is the standard of care in patients with suspicious findings on mammography or tomosynthesis. Performing a successful stereotactic breast guided biopsy requires planning and a correct evaluation of the lesion location and of the patient’s breast anatomy. When this procedure can not be safely performed a surgical approach should be considered. The lateral arm approach for stereotactic breast biopsies permits procedures to be done using a needle insertion parallel to the compression plate allowing to successfully sample lesions that would have been excluded with a conventional approach, therefore avoiding surgical biopsy as well as improving patients care and comfort. -Illustrate the basic principles of this technique.-Discuss how to plan, patient select and perform a lateral arm stereotactic breast biopsy.-Examine advantages and limitations of this approach. -Identificate and illustrate with case examples potentially challenging cases as well as provide tips and tricks to troubleshoot and successfully perform this procedure.

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# Abstract Archives of the RSNA, 2024

BREE-9

## RADIAL SCLEROSING LESIONS - IMAGING FINDINGS AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Patricia A. De Camargo Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela G. Giannotti, MD (*Abstract Co-Author*) Nothing to Disclose
Thais Mayor Simonatto, MD (*Abstract Co-Author*) Nothing to Disclose
Ulisses Ferreira (*Abstract Co-Author*) Nothing to Disclose
Ligia A. Yamashita, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa Moyses, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian N. Omura, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela F. Vieira Vendramini (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Saccarelli, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Describe the histological pattern of radial sclerosing lesions (RSL).-Describe and define the possible imaging presentations of radial sclerosing lesions, according to different imaging methods, such as mammogram (MG), ultrasound (US) and magnetic resonance (MRI).-Discuss the malignancy upgrade rates of radial scars according to it’s histological associations and the possibility of follow-up of these lesions.

### TABLE OF CONTENTS/OUTLINE

-Review the histological findings defining RSL, in addition to its possible histological patterns and associations to malignant lesions or atypia.-Enlist the possible differential diagnosis of RSL.-Illustrate RSL characteristics on various imaging methods, which can or cannot occur simultaneously.-Correlate simultaneous findings in each method. Discuss the possibility of malignancy upgrade of the RSL lesions, and correlate these rates with imaging and histological findings.-Discuss the different managing propositions of these lesions, according to its imaging and histological patterns. -Summary and take home messages.

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# Abstract Archives of the RSNA, 2024

BREE-90

## UNRAVELING THE UNCOMMON: RARE BREAST CANCER VARIANTS AND COMMON IMAGING FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Erica Endo, MD (*Abstract Co-Author*) Nothing to Disclose
Marco A. Costenaro, MD (*Abstract Co-Author*) Nothing to Disclose
Vera Christina C. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda de Oliveira Cirino, MD (*Abstract Co-Author*) Nothing to Disclose
Lidia B. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana H. Catani, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Shimizu, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra d. Borges, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recognition of the radiological peculiarities of rare types of breast cancer in mammography, ultrasonography, and magnetic resonance imaging. Special histological subtypes are rare in breast cancer and knowing some of their peculiarities helps us recognize atypical imaging patterns and make appropriate anatomopathological correlations.

### TABLE OF CONTENTS/OUTLINE

Malignant Phyllodes Tumor: Large solid or complex solid-cystic mass; differential diagnosis with rapidly growing fibroadenoma. Mucinous Carcinoma: High signal intensity in T2. Medullary Carcinoma: Mass with circumscribed or microlobulated margins with posterior enhancement.Ring enhancement with internal septations. Tubular Carcinoma Slow growth small spiculated mass associated with architectural distortion and calcifications. Heterogeneous enhancement with washout curve. High association with DCIS. Invasive Papillary Carcinoma: solid or complex solid-cystic mass; calcifications are common. May present with ductal dilatation. Hemorrhage with high signal in T1WI. Pleomorphic Lobular Carcinoma: Larger spiculated masses with calcifications, architectural distortion and local invasiveness. May present as focal asymmetry. Non-mass enhancement and necrosis. Metaplastic Carcinoma Large, rapidly growing, round and circumscribed mass. Heterogeneous and ring enhancement with necrosis or intratumoral hemorrhage. Neuroendocrine Carcinoma Spiculated mass or asymmetry with calcifications, architectural distortion. Diffusion restriction and washout curve. Micropapillary Carcinoma: Spiculated mass with calcifications, architectural distortion. Lymph node metastasis are common even in small lesions.

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# Abstract Archives of the RSNA, 2024

BREE-91

## TRIANGULATION AND ADDITIONAL VIEWS IN MAMMOGRAPHY. BACK TO BASICS OF PROBLEM- SOLVING TECHNIQUES STILL ALIVE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Rodrigo Pastorin (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Candela Munoz Roldan (*Abstract Co-Author*) Nothing to Disclose
Maria Teresa Montero Alameda (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To review the basics of breast triangulation in mammography.
- To illustrate the correlation of lesion position on mammograms through diagrams and illustrative cases of US and MRI.
- To describe additional views employed in work-up of mammographic findings.
- To emphasize pitfalls, diagnostic difficulties and provide clue points.

### TABLE OF CONTENTS/OUTLINE

- Introduction. Despite the use of new technologies in mammography, different problems may still occur in standard two view mammograms. We review the classic and basic problem-solving approach.
- Breast triangulation. Mammograms are essential to detect non-palpable breast lesions. The relative lack of anatomical landmarks in the breast, makes sometimes correlation of the location of the lesions a problem even more important with the frequent detection of multiple lesions with new technologies such as contrast-enhanced mammography. We review the basic geometric concept of triangulation, discuss common mistakes in lesion location estimates and their causes.
- Additional views. Magnification and spot-compression views. Tangential views for dermal calcifications (rarely employed with the use of tomosynthesis). ‘Exaggerated’ views for lesions included in the oblique but not in craniocaudal views (‘Cleopatra’ view).
- Quiz with difficult cases from our series of mammograms with correlation with US and MRI.

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# Abstract Archives of the RSNA, 2024

BREE-92

## WHEN THE UGLY IS NOT SO BAD: COMMON AND RARE BENIGN BREAST LESIONS THAT CAN MIMIC MALIGNANCY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nilton Onari (*Abstract Co-Author*) Nothing to Disclose
Erika M. Negrao (*Abstract Co-Author*) Nothing to Disclose
Silvia M. Sabino, MD (*Abstract Co-Author*) Nothing to Disclose
Edmundo C. Mauad, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ligia P. Mazi, MD (*Abstract Co-Author*) Nothing to Disclose
Jane C. Picone, MSc (*Abstract Co-Author*) Nothing to Disclose
Anapaula H. Watanabe, MD (*Abstract Co-Author*) Nothing to Disclose
Chrissie Amirati (*Abstract Co-Author*) Nothing to Disclose
Ruth H. Bonini, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The BI-RADS categories 4C and 5 are used when the suspicion of malignancy ranges between 50-95% and is >95%, respectively and histopathological investigation is mandatory, typically through percutaneous biopsy. Following a biopsy, encountering a benign result in a lesion classified in these categories can be challenging for the radiologist, particularly in category 5. According to BI-RADS, any non-malignant diagnosis from a needle biopsy in category 5 should be considered discordant, necessitating a recommendation for repeat biopsy, often surgical. Some breast conditions can mimic malignancy, and in these scenarios, it is crucial to be familiar with these benign entities, some of which may be unfamiliar even to breast imaging specialists. After a thorough radiological-pathological correlation, taking into account biopsy technical aspects, lesion characteristics across different imaging modalities, and the patient's clinical history, some results may be accepted, potentially averting the need for additional biopsies or surgeries. The objective of this presentation is to acquaint the radiologist with both common and rare benign lesions that can mimic malignancy through cases encountered in daily practice.

### TABLE OF CONTENTS/OUTLINE

In a didactic manner, several cases selected from our institution's archive of benign lesions, histological proven, with mammographic and ultrasonographic correlations will be presented. These cases encompass lesions of infectious/inflammatory origin, autoimmune diseases, benign proliferative conditions, and benign tumors.The common clinical and imaging manifestations of these entities will be discussed, along with a review of the pathological aspects.

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# Abstract Archives of the RSNA, 2024

BREE-93

## ULTRAFAST DYNAMIC CONTRAST ENHANCED BREAST MRI WITH A MODIFIED SENSE ACCELERATED 3DTFE SEQUENCE: CASE BASED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shreya Poddar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Nirali S. Mehta, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Smruti Mulani, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Ultrafast Breast MRI [UFBMRI] can be performed using conventional parallel imaging with accelerated 3DTFE sequence on conventional scanners.2. Qualitative assessment of UFBMRI adds to the diagnostic specificity and guides patient management by indicating the possible extent of vascularity and hence aggressiveness of the lesion. Hence, optimal site for tissue sampling can be determined. 3.UFBMRI can be incorporated in routine practice on most scanner platforms without additional postprocessing, ensuring accessibility to a larger patient population.

### TABLE OF CONTENTS/OUTLINE

Introduction: UFBMRI requires acceleration techniques like k-space sharing, compressed sensing and/or AI based reconstruction. These techniques are available only on newer scanners and not all centers performing breast MR have access to them. Furthermore, UFBMRI data has been analyzed quantitatively using Max Slope of Increase and TTE [Time to enhance] as compared to Aorta which involve additional calculations. Methods: We set up a Ultrafast Dynamic Contrast Enhanced [UFDCE] protocol using a 3DTFE sequence with parallel imaging, to achieve a temporal resolution of 6secs. We analyzed the images qualitatively, with reference to the presence, synchronicity and rapidity of enhancement. Principle of UFDCE, Sequence parameters and Breast MRI protocol will be discussed. Representative cases will be presented where qualitative analysis of UFBMRI contributed to the histopathologic diagnosis and patient management. Conclusion: Qualitative assessment of SENSE accelerated UFDCE sequence using 3D Fast Gradient Echo sequence [temporal resolution ~ 6secs] can also improve the diagnostic specificity and guide patient management.

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# Abstract Archives of the RSNA, 2024

BREE-94

## CAN FAST MRI AND NON-CONTRAST MRI REPLACE CONVENTIONAL DYNAMIC CONTRAST MRI? - FOCUS ON MORPHOLOGICAL EVALUATION AND IMAGE QUALITY IN BREAST MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yoshito Ichiba, RT (*Abstract Co-Author*) Employee, Siemens AG
Masako Y. Kataoka, MD, PhD (*Abstract Co-Author*) Speaker, Siemens AG Speaker, Bayer AG Speaker, Devicor Medical Products, Inc Speaker, Guerbet SA
Rie Ota, MD (*Abstract Co-Author*) Nothing to Disclose
Aika Okazawa (*Abstract Co-Author*) Nothing to Disclose
Mami Iima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuta Urushibata (*Abstract Co-Author*) Employee, Siemens AG
Tsutomu Okada, MD (*Abstract Co-Author*) Nothing to Disclose
Yuji Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maya Honda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Ultrafast dynamic contrast-enhanced (UF-DCE) MRI and DWI are novel sequences in the breast that have accumulated evidence for diagnosing and characterization of breast cancer, though are not used as stand-alone sequences. One of the strengths of these sequences is that they can be evaluated quantitatively (time-intensity curves (TIC) and apparent diffusion coefficient (ADC). On the other hand, various methods have been devised to reduce artifacts or increase the spatial resolution of these sequences to improve qualitative assessment. Some DWI sequences like readout segmentation of long variable echo-trains (RESOLVE) and diffusion-weighted spatiotemporal encoding (SPEN), can achieve higher in-plane resolution than conventional single-shot echo-planar DWI, and tumor morphology assessment using them is being investigated. Currently, Breast Imaging and Data System (BI-RADS) prioritizes morphological evaluation to estimate the malignant potential of breast lesions. Therefore, morphological evaluation may be the key for these sequences to be used as alternatives to conventional DCE MRI. This exhibit will focus on the morphological evaluation and image quality of UF-DCE MRI and DWI in the breast.

### TABLE OF CONTENTS/OUTLINE

1: Image quality and morphological evaluation using UF-DCE MRI: A) view sharing technique B) compressed sensing C) pitfalls in TIC evaluation2: Image quality and morphological evaluation using DWI: A) RESOLVE B) SPEN C) other sequences

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# Abstract Archives of the RSNA, 2024

BREE-95

## AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE: SCREENING GUIDELINES AND IMAGING OF BREAST CANCER IN BRCA MUTATION CARRIERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Katerina Dodelzon, MD (*Abstract Co-Author*) Nothing to Disclose
Alexia R. Tatem, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Tatiana Kelil, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Ye (*Abstract Co-Author*) Nothing to Disclose
Loretta M. Strachowski, MD (*Abstract Co-Author*) Royalties, RELX;Speaker, World Class CME
Heather I. Greenwood, MD (*Presenter*) Support, Endomagnetics Ltd;Support, Devicor Medical Products, Inc

### TEACHING POINTS

1. To review the recently updated American College of Radiology (ACR) high-risk screening guidelines for BRCA1 and BRCA2 mutation carriers including transgender patients 2.To review the different imaging features of BRCA1 and BRCA2 specific tumors and correlate the imaging features with histopathology 3. To review the evidence behind various imaging modalities for screening patients with BRCA1 and BRCA2 mutations

### TABLE OF CONTENTS/OUTLINE

1. Background information reviewing BRCA1 and BRCA2 genes: transmission, lifetime risk of cancers, prevalence in overall population and specific higher risk populations, risk assessment 2. Review of the 2023 updated ACR high-risk screening breast cancer guidelines, with emphasis on updates for BRCA1 and BRCA2 mutation carriers 3. Review the current state of available data and guidelines for high-risk screening in transgender BRCA mutation carrier patients 4. Multi-modality case examples of BRCA1 vs BRCA2 associated tumors: imaging features with histopathologic correlation 5. Review of the evidence behind various imaging modalities in screening BRCA1 and BRCA2 mutation carriers with imaging examples: Digital Mammography/Digital Breast Tomosynthesis, Ultrasound, Dynamic Contrast Enhanced Breast MRI (DCE-MRI), Abbreviated Breast MRI (AB-MRI), Contrast Enhanced Mammography (CEM)

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# Abstract Archives of the RSNA, 2024

BREE-96

## UNLOCKING THE SECRETS OF BREAST FIBROEPITHELIAL LESIONS: A COMPREHENSIVE GUIDE FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniela B. Grammatico, PhD (*Abstract Co-Author*) Nothing to Disclose
Marilia P. Royero, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Johana Mariel Porres (*Abstract Co-Author*) Nothing to Disclose
Lennny P. Ticona Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Julieta Jaime (*Abstract Co-Author*) Nothing to Disclose
Flavia B. Sarquis, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Embark on an exciting journey through the complex world of breast fibroepithelial lesions (FELs) with our interactive learning center exhibit. FELs are a diverse group of tumors that originate from the stromal and epithelial tissues of the breast, and can range from benign to malignant. This exhibit focuses on three main types of FELs: fibroadenomas, phyllodes tumors, and benign fibroepithelial tumors.By exploring this exhibit, radiologists will:Gain a deep understanding of the diverse spectrum of breast fibroepithelial lesions.Master the latest diagnostic imaging techniques for detecting and characterizing FELs.Appreciate the crucial role of imaging in differential diagnosis and management of FELs.Stay up-to-date with the latest emerging imaging modalities and guidelines for FELs.Enhance multidisciplinary collaboration and communication for optimal patient care.Join us in this exciting learning journey and unlock the secrets of breast fibroepithelial lesions.

### TABLE OF CONTENTS/OUTLINE

Introduction to breast fibroepithelial lesions.Pathophysiology and histopathological features.Clinical presentation and diagnostic workup: Learn how to recognize and diagnose FELs through our daily practice case studies and clinical pearls.Multidisciplinary approach to management.Future directions.Conclusion and summary

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# Abstract Archives of the RSNA, 2024

BREE-97

## UNRAVELING THE COMPLEXITY OF BREAST MASSES WITH ASSOCIATED NECROSIS: SIGNIFICANCE AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Beatriz E. Adrada, MD (*Abstract Co-Author*) Nothing to Disclose
Soudabeh Fazeli, MD,MPH (*Abstract Co-Author*) Nothing to Disclose
Tara A. Retson, MD, PhD (*Abstract Co-Author*) Research Consultant, CureMetrix, IncStock options, CureMetrix, Inc
Rebecca Rakow-Penner, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Consultant, Human Longevity Inc;Stockholder, CureMetrix, Inc;Stock options, CorTechs Labs, Inc
James Stepenosky, MD (*Abstract Co-Author*) Nothing to Disclose
Mary S. Guirguis, MD (*Abstract Co-Author*) Nothing to Disclose
Haydee Ojeda-Fournier, MD (*Presenter*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc

### TEACHING POINTS

Breast masses with associated necrotic changes pose a diagnostic and management challenge for radiologists. Both benign and malignant etiologies can lead to a mass presenting with central necrosis. Triple-negative breast cancer is notorious for presenting with necrosis. However, tumor necrosis has not been associated as an imaging characteristic to predict response to systemic therapy. Benign masses that grow rapidly can demonstrate necrosis or infarction and can, in rare instances, become infected. Multimodality imaging is critical for formulating a differential and guiding biopsy into a non-necrotic region to obtain an accurate histopathologic diagnosis. By the end of this educational exhibit, learners will: 1. Define tumor necrosis 2. Explain the mechanisms that lead to necrosis 3. List benign and malignant etiologies associated with central necrosis 4. Choose the appropriate location to biopsy the lesion with necrosis

### TABLE OF CONTENTS/OUTLINE

Introduction; Definition of tumor necrosis; Incidence of, and risk factors that lead to, necrotic masses; Mechanisms of tumor necrosis; Clinical presentation of necrotic masses; Differential considerations including benign and malignant etiologies; Distinguishing necrotic tumors from abscess and fluid collections. Multimodality imaging examples of necrotic masses including necrotic lymph nodes; Systematic approach for characterization of masses associated with necrosis; Pitfalls in the sonographic assessment of necrotic masses; Strategies for successful core biopsy and radiology-pathology correlation. Algorithm for management of benign and malignant necrotic masses; Conclusion.

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# Abstract Archives of the RSNA, 2024

BREE-98

## MULTIMODALITY EVALUATION OF REGIONAL BREAST LYMPH NODES: IMPACT OF BI-RADS 6TH EDITION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

James Stepenosky, MD (*Abstract Co-Author*) Nothing to Disclose
Soudabeh Fazeli, MD,MPH (*Abstract Co-Author*) Nothing to Disclose
Tara A. Retson, MD, PhD (*Abstract Co-Author*) Research Consultant, CureMetrix, IncStock options, CureMetrix, Inc
Haydee Ojeda-Fournier, MD (*Presenter*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc

### TEACHING POINTS

Evaluation of regional breast lymph nodes is an integral part of breast cancer imaging, it will affect clinical management. The radiologist must understand how to evaluate lymph nodes, stage the axilla, be proficient in image-guided interventions involving lymph nodes, and select the most appropriate imaging modalities to evaluate breast regional lymph nodes. Ultrasound-guided core biopsy or fine needle aspiration can be performed for histologic confirmation of nodal metastasis. In the expected 6th edition of BI-RDS, lymph nodes will be their own category across modalities with expanded discussion regarding location and morphology. The purpose of this educational exhibit is to preview expected BI-RADS 6th edition changes that will impact the evaluation of regional lymph nodes. By the end of this educational exhibit, learners will: 1. List morphologic criteria for lymph node assessment; 2. Identify the location of lymph nodes; 3. Recognize the relationship of the pectoralis minor to axillary lymph node levels; 4. Summarize expected lymph node updates in BI-RADS 6th edition.

### TABLE OF CONTENTS/OUTLINE

Introduction; Morphology of lymph nodes; lymph node locations: intramammary, axillary, internal mammary, supra-clavicular; Clinical presentation of adenopathy; Differential considerations of abnormal lymph nodes; Multimodality imaging regional lymph nodes: Mammogram, US, MRI; Learn a systematic approach to the characterization of abnormal lymph nodes; How to apply BI-RADS 6th edition lexicon for regional lymph nodes appropriately; Pitfalls in providing nodes BI-RADS categories; Image-guided interventions to assess nodes; Algorithm for management of regional lymph node findings; Conclusion.

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# Abstract Archives of the RSNA, 2024

BREE-99

## DON'T BE RASH, IT'S JUST PASH !

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bruna M. Thompson, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fabiana C. Policeni, MD (*Abstract Co-Author*) Nothing to Disclose
Danielli Matsuura (*Abstract Co-Author*) Nothing to Disclose
Fabiola P. Kestelman, MD (*Abstract Co-Author*) Nothing to Disclose
Su Kim Hsieh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Japnit Singh, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Breast pseudoangiomatous breast hyperplasia (PASH) can have a variety of different presentations. It can be asymptomatic, found incidentally on a breast biopsy or present itself as a mass, asymmetry or gigantomastia. PASH can be found in a wide age range but is more common in pre-menopausal and post-menopausal women on hormone replacement therapy. It has been commonly seen associated with gynecomastia. Even though benign, PASH can be admixed with malignancies, hence warrants a careful imaging-pathology correlation to establish concordance with biopsy. In some patients, PASH can have an uncommon presentation and outcome, such as a large and fast-growing mass leading to gigantomastia. In such cases, extreme treatments, like mastectomy may be required for local control. In order to help clinicians make the right treatment decision, an effective diagnosis can be made by correlating imaging findings with pathological features.

### TABLE OF CONTENTS/OUTLINE

To illustrate the various imaging aspects of breast pseudoangiomatous stromal hyperplasia (PASH) and its correlation with pathologic and clinical findings. To review the clinical presentations, key pathologic features along with current management of PASH. Lastly, to illustrate the imaging and pathological differential diagnosis of PASH.

# Abstract Archives of the RSNA, 2024

CAEE

## Cardiac Imaging Education Exhibits

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

### CAEE-1 HOW TO REPORT A CT CORONARY ANGIOGRAM? - A STEP BY STEP GUIDE FOR THE NOVICE READER

Srujana Ganti, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Bimal Mayur Kumar Vora (*Abstract Co-Author*) Nothing to Disclose
Kang Ren Yong, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Understand how to report a CTCA study, in a step by step manner.

**TABLE OF CONTENTS/OUTLINE**

CT Coronary Angiograms (CTCAs) are rapidly becoming entrenched as mainstream, routine examinations performed for the assessment of coronary artery disease, in various settings, including acute, inpatient and outpatient settings.This poster will take the novice CT Coronary Angiogram (CTCA) reader through the reading of the study in a step by step fashion, covering all crucial aspects, review areas and highlighting the importance of each of these. It will cover the factors that need to be considered in optimising the patient, such as patient education and nursing management, as well as the technical parameters to ensure the best possible images are obtained.It will outline, in a systematic fashion, how the scan should be reviewed, providing review checklists covering the cardiac findings as well as the extra-cardiac findings. Crucial factors in reporting and critical alert notification will be discussed with a sample report template included. A series of cases will also be provided, with annotations, to demonstrate both common and uncommon pathology so that the reader will not only obtain a sound framework to use as a basis to commence CTCA reporting but also gain an understanding of the pathologies encountered.

### CAEE-10 CHARTING THE COURSE: RADIOLOGICAL ASSESSMENT OF CARDIAC SARCOIDOSIS

Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandra Somoano Marfull (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Abstract Co-Author*) Nothing to Disclose
Aranzazu Sanchez Gabin, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Cayon Somacarrera, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Revuelta Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Fernandez Lobo (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Sutil (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review cardiac sarcoidosis diagnostic criteria. Illustrate cardiac sarcoidosis imaging features in MRI, outlining the significance of late gadolinium enhancement (LGE). Highlight the prognostic implications of prompt diagnosis, emphasizing the importance of imaging in enhancing accuracy and predicting outcomes.

**TABLE OF CONTENTS/OUTLINE**

Cardiac sarcoidosis, a potentially life-threatening manifestation of systemic sarcoidosis, presents diagnostic challenges due to its variable clinical presentations and limited biopsy yield. Early assessment and a multidisciplinary approach are crucial for improved outcomes, given the potential for sudden cardiac events.Diagnostic criteria have evolved, with current guidelines underscoring the importance of advanced imaging in its detection and evaluation. Cardiac MRI offers a multi-dimensional assessment, allowing detection of myocardial inflammation, characterizing tissue involvement, assessing cardiac function and guiding treatment. PET-CT identifies active inflammation, enabling risk stratification, follow-up post-ICD implantation, and targeted biopsies.The primary MRI finding is the presence of LGE, typically exhibiting a sub-epicardial and mid-wall pattern along the basal septum or inferolateral wall, indicating fibrosis. Additional features encompass myocardial edema, perfusion defects, and abnormal 18-FDG uptake.Imaging findings hold prognostic significance, with extensive LGE patterns and impaired left ventricular function predicting a high risk of adverse cardiac events.We gathered representative cases of cardiac sarcoidosis at our institution to highlight the hallmark findings that leads to accurate diagnosis.

### CAEE-11 REVEALING THE HEART`S SKELETON: THE POWER OF WHOLE-HEART HIGH-RESOLUTION LATE GADOLINIUM ENHANCED IMAGING

Daniel Lee (*Abstract Co-Author*) Research Grant, Abbott Laboratories;Spouse, Employee, Takeda Pharmaceutical Company Limited
Golnoosh Ansari, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Davo Jimenez, MD (*Abstract Co-Author*) Nothing to Disclose

Daniel Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyung-Pyo Hong, PhD (*Abstract Co-Author*) Nothing to Disclose
Cagdas Topel, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• To demonstrate fibrous structures of the heart including valves and related structures, the right and the left fibrous trigons, aorto-mitral continuity and membranous septum on Whole-Heart, High-Resolution late gadolinium enhanced (LGE) images.• To review the clinical applications of Whole-Heart High-Resolution LGE.

**TABLE OF CONTENTS/OUTLINE**

1. Late Gadolinium Enhancement in Clinical Routinea. The principle of LGEb. Conventional LGE techniquec. The importance of LGE in Clinical Routine2. High-Resolution Late Gadolinium Enhancementa. From conventional LGE to HR-LGEb. Advantages and limitations of HR-LGE3. Atrial HR-LGE4. Ventricular HR-LGE5. HR-LGE on fibrous structures of the heart and congenital heart diseases6. Conclusions

## CAEE-12 CLINICAL CORRELATION FOR LVAD IMAGING

Lynne M. Hurwitz Koweek, MD (*Abstract Co-Author*) Departmental Research Grant, Siemens AG;Departmental Research Grant, HeartFlow, Inc;Departmental Research Grant, Verily Lifesciences LLC
Michael R. Harowicz, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Cheng, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Left ventricular devices (LVADs) are utilized as either destination therapy or bridge to cardiac transplant for patients with end-stage heart failure. Computed tomography (CT) has been a useful imaging modality to evaluate complications of LVAD devices. Knowledge of the clinical evaluation of patients with LVADs including altered flow dynamics and laboratory workup can be a useful tool for the radiologist. The purpose of this abstract is to review the normal appearance and configuration of LVADs and the various complications with their correlating clinical presentations.

**TABLE OF CONTENTS/OUTLINE**

1. Review normal anatomy and configuration of LVADs2. Review the altered physiology of patients with LVADs3. Illustrate the complications that can arise with LVADs with their correlating clinical presentation

## CAEE-13 HEART OF DARKNESS - INTRAMYOCARDIAL HEMORRHAGE AND MICROVASCULAR OBSTRUCTION: IMAGING FINDINGS AND PROGNOSTIC IMPLICATIONS

Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Thomas Geyer, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe S. Torres, MD, PhD (*Abstract Co-Author*) Research support, Altis Labs
Farah Cadour, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Elsie Nguyen, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Rushali Gandhi, BSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

We discuss the pathophysiology of intramyocardial hemorrhage (IMH), demonstrate CMR imaging and prognostic features of IMH, and its connection with microvascular obstruction (MVO). CMR is the gold standard for detecting IMH and MVO. MVO, also known as "no-reflow", is related to severe microcirculatory alterations with obstructed microvasculature and can occur alone or concomitantly with IMH. IMH is a reperfusion injury, related to extravasation of erythrocytes through severely damaged endothelial walls. Both IMH and MVO are associated with worse prognosis following acute MI.

**TABLE OF CONTENTS/OUTLINE**

IMH and MVO Pathophysiology and Evolution Post MI: Exact mechanism of microvascular injury and repair and temporal evolution of IMH and MVO are not well understood. These entities are early/subacute findings in the setting of acute MI, and typically resolve. Typical Imaging Features: MVO is identified as a subendocardial unenhanced region in the infarcted area due to lack of contrast within obstructed microvasculature. T2*-weighted sequences have higher sensitivity for demonstrating IMH. IMH can also appear as hypointense zone surrounded by myocardial edema (high T2 signal). Prognostic Value: The presence of IMH and MVO are strong predictors of adverse left ventricle remodelling and major adverse cardiovascular events after acute MI.

## CAEE-14 4D FLOW: EXPLORING CARDIOVASCULAR DYNAMICS AND PATHOLOGIES IN FULL DIMENSION

Carlos S. Tapia SR, MD (*Abstract Co-Author*) Nothing to Disclose
ANDREA SALAS (*Abstract Co-Author*) Nothing to Disclose
Moises Jimenez (*Abstract Co-Author*) Nothing to Disclose
LAURA TORRES (*Abstract Co-Author*) Nothing to Disclose
Claudia Mendoza, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

4D flow imaging represents an innovative technique that offers a comprehensive understanding of cardiovascular hemodynamics and related pathologies. This method provides functional cardiac information through the use of time-resolved four-dimensional cine sequences combined with 3D velocity encoding. The protocol enables the assessment of hemodynamic effects on vessel walls, myocardium, and flow pathways within the cardiovascular system. This imaging modality facilitates the evaluation of various cardiovascular pathologies, by analyzing multidirectional blood flow velocity data, providing valuable insights into conditions such as recurrent coarctation, aortic aneurysms, and valvular heart disease, contributing to the understanding of the natural history of cardiovascular disease. A notable example is the assessment of aortic dissection, where the technique identifies small fenestrations and characterizes flow dynamics between true and false lumens. This enhances patient risk assessment and treatment planning. In conclusion, 4D flow imaging emerges as a valuable tool for the comprehensive evaluation of cardiovascular hemodynamics and the precise diagnosis of associated pathologies. Its integration into clinical practice shows promise for optimizing patient management and treatment outcomes.

**TABLE OF CONTENTS/OUTLINE**

Introduction. Principles. Protocol. Applications review. Case examples.

## CAEE-15 WHAT RADIOLOGISTS MUST KNOW ABOUT PULMONARY HYPERTENSION

James C. Carr, MD (*Abstract Co-Author*) Institutional Research Grant, Siemens AG;Advisory Board, Siemens AG;Travel support, Siemens AG;Institutional Research Grant, Bayer AG;Advisory Board, Bayer AG;Travel support, Bayer AG;Speaker, Bayer AG;Institutional Research Grant, Guerbet SA;Advisory Board, Bracco Group
Amir A. Rahsepar, MD (*Abstract Co-Author*) Nothing to Disclose
Justin J. Baraboo, MS (*Abstract Co-Author*) Nothing to Disclose
Thara Nallamothu (*Abstract Co-Author*) Nothing to Disclose
Sandra Quinn (*Abstract Co-Author*) Nothing to Disclose
Melika Shafeghat, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pulmonary hypertension (PH) is a serious condition characterized by a gradual increase in mean pulmonary arterial pressure. The gold standard method to diagnose PH is right heart catheterization. However, heart catheterization is invasive and associated with a low, but not insignificant, risk of major complications, including fatality. Using noninvasive imaging modalities such as echocardiogram, chest CT, and cardiac MRI would be therefore more desirable as an alternative diagnostic method. While an echocardiogram is operator-dependent, and CT exposes the patient to ionizing radiation, MRI offers a comprehensive evaluation of cardiac anatomy, function, and focal and interstitial myocardial fibrosis without the risks associated with right heart catheterization or radiation exposure.

### TABLE OF CONTENTS/OUTLINE

1- What are the different types of PH, along with their WHO classification? 2- What are the etiologies of PH and its pathophysiology? 3 - What are the right heart catheterization findings as a gold standard method of diagnosis? 4- What are the noninvasive imaging modalities to diagnose PH? a. Echocardiogram findings in patients with PH along with pros and cons of echocardiogram to diagnose PH b. Chest CT findings in patients with PH and imaging features suggestive of PH b.1. Comparison of non-contrast chest CT vs. CT angiogram c. Cardiac MRI and 4D flow MRI imaging findings in patients with PH c.1. Comprehensive review of imaging sequences particularly CINE imaging, T1 mapping, delayed myocardial enhancement, 2D phase contrast, and 4D flow MRI

## CAEE-16 COMPLICATIONS OF THE CARDIOVASCULAR SURGERY WHAT RADIOLOGISTS SHOULD KNOW?

Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Furkan Ufuk, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Radiologists play a critical role in identifying early and late complications of cardiovascular surgery, which can improve patient outcomes.
- Familiarity with normal postoperative imaging appearances and common complications is essential.
- Key complications include infection, bleeding, edema, pseudoaneurysm and structural abnormalities.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Importance of imaging in cardiovascular surgery follow-up
- Role of the radiologist
- Normal Postoperative Appearances
- Typical imaging findings following different types of cardiovascular surgeries
- Early Complications
- Bleeding: Locations and imaging signs
- Infection: Diagnostic clues on imaging
- Graft Failure: Types and radiologic identification
- Late Complications
- Chronic graft occlusion
- Structural abnormalities: Valve malfunctions, aneurysm/pseudoaneurysm
- Advanced Imaging Techniques
- Use of CT, MRI, and ultrasound in the detection of complications
- Recent advances and their clinical applications
- Conclusion
- Summary of the radiologist’s role in managing post-surgical patients
- Future perspectives in imaging for cardiovascular surgery complications

## CAEE-17 GENETIC CARDIOMYOPATHY MINDSET: A PRACTICAL IMAGING APPROACH

Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Rafaela Vieira Franklin Tapias (*Abstract Co-Author*) Nothing to Disclose
Marcus Vinicius Silva Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Fuzissima (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the key concepts of the classification of cardiomyopathies, highlighting their classic phenotypes.2. To illustrate key imaging findings in the most important inherited cardiomyopathies, with genetic and epigenetic correlations.3. To discuss the value of cardiac MRI in identifying phenocopies and rare cardiomyopathies.4. To emphasize how the correlation between genotype and phenotypic expression can contribute to earlier diagnosis, risk stratification, prognostication and decision-making in patients with cardiomyopathy.

### TABLE OF CONTENTS/OUTLINE

1. Background Classification of the cardiomyopathies: contemporary definitions 2. Precision medicine and next-generation sequencing technologies: basic conceptsClassic phenotypes of cardiomyopathies and their expression in cardiac MRI 3. Identifying the main genomic variants and genotype-based classification in genetic cardiomyopathies: a practical approach4. The genotype-based classification background, pathophysiology, clinical presentation, and outcomes of patients with hereditary cardiomyopathy5. Genetic cardiomyopathies and genotype-phenotype correlations: a case-based review with cardiac MRI Pearls, pitfalls, and challenges6. Future directions: Multiomics research7. Take home messages

## CAEE-18 THE IMAGING APPEARANCE OF THORACIC AORTIC REPAIRS AND COMMON ASSOCIATED COMPLICATIONS

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ronald Gathagan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Aortic repair remains a critical aspect of cardiovascular medicine, with traditional surgical approaches continuing to play a prevalent role in addressing thoracic aortic pathologies. However, the landscape of aortic repair has significantly evolved with the advent of endovascular techniques, and multiple methods are often integrated for broader anatomical coverage, bringing increasing complexity to aortic disease management.By understanding the expected appearances of key components in thoracic aortic repair, radiologists can effectively identify deviations indicative of complications. Adopting a structured approach can aid in navigating the complex appearance of these complications. Specifically, attention should be given to the status of the aortic valve, the aortic root (including the sinuses of Valsalva), the ascending aorta, and the aortic arch as all of these structures may be repaired individually or repaired as a unit.Additionally, attention should be given to the management of coronary arteries when necessary. Similarly, if the repair extends into the region of the aortic arch, there must be further consideration of the management of the arch vessels. By implementing a systematic approach, radiologists can effectively identify and describe the majority of repairs, even with the constant advent of novel techniques.

### TABLE OF CONTENTS/OUTLINE

1. Describe the normal anatomy of the thoracic aorta including the ascending aorta and the aortic arch.2. Provide a brief overview of common variant anatomy.3. Review the types of ascending aortic repair techniques and their appearance on diagnostic imaging.4. Discuss common complications associated with thoracic aortic repair.

## CAEE-19 ATRIAL SEPTAL DEFECTS "WHAT RADIOLOGISTS NEED TO KNOW"

Shaimaa A. Fadl, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand the types of Atrial Septal Defects (ASD). Understand the associated anomalies. Understand imaging techniques for the full evaluation of ASD.Learn the role of imaging in different management options.

### TABLE OF CONTENTS/OUTLINE

Primum septal defectSecundum septal defectSinus venousus defectCoronary sinus defectThe role of imaging in the diagnosis and management in patients with septal defects.

## CAEE-2 NON-ATHEROSCLEROTIC CORONARY ARTERY DISEASE: A PICTORIAL REVIEW

Artur S. Santos SR, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Serra, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo E. Catarina, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Antonio Martins De Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Jose R. Parga, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago De Gaultier Paulo, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin De Paula (*Abstract Co-Author*) Nothing to Disclose
Andre Vaz (*Abstract Co-Author*) Nothing to Disclose
Fernanda Ragonetti (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Ingrid Stefanie Sarmento Debaco (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Although the majority of acute coronary events are the result of atherosclerotic lesions, some cases of myocardial infarction and sudden cardiac death may be related to non-atherosclerotic causes.The 2021 AHA Guideline for the Evaluation and Diagnosis of Chest Pain promotes the use of coronary computed tomography angiography (CCTA) as a diagnostic test in patients with an intermediate to high pretest probability of coronary artery disease (CAD), especially those younger than 65 years of age or when less obstructive CAD is suspected.CCTA provides information on intraluminal characteristics, and details of the coronary artery wall and surrounding tissue.

### TABLE OF CONTENTS/OUTLINE

IntroductionCAD is a diverse group of diseases with variable pathophysiology associated with myocardial infarction and sudden death, mostly in younger individuals. We review the imaging findings and the importance of the role of CCTA in the management of the major non-congenital causes of nonatherosclerotic CAD.MethodsNon-atherosclerotic CAD causes undergoing CCTA were retrospectively selected. Images were presented in the axial, sagittal, coronal, and curved multiplanar reconstruction planes. Conventional coronary angiography or 3D formatted images were added when available.Results DiscussionAmong other diagnoses, cases of dissection, thrombosis, coronary aneurysm, and extrinsic compression of the coronary arteries were included.An overview of CCTA findings and the role of imaging in the diagnostic process were provided.ConclusionThe increasing availability of CCTA and improvements in its technology have resulted in increased detection of nonatherosclerotic CADs, which was previously considered rare.

## CAEE-20 CAN YOU HEAR THE SYSTOLIC CLICK? YOU'D BETTER WATCH IT: MULTIMODALITY IMAGING OF MITRAL VALVE PROLAPSE

Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Alejandra Somoano Marfull (*Abstract Co-Author*) Nothing to Disclose
Victor Fernandez Lobo (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Revuelta Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review in detail the anatomy of the mitral valve and adjacent related structures. 2. To understand the different pathophysiological processes and their evolutionary stages by which the valve prolapses. 3. To analyse the utility of different imaging techniques in the diagnosis of prolapse and related features, planning of valve repair or replacement procedures and risk stratification.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Anatomy of the valvular and subvalvular apparatus and its relation to adjacent structures. 3. Etiopathogenes of mitral valve degeneration: fibroelastic defficiency and myxomatous degeneration (Barlow's disease) . 4. Comparative utility and findings of different imaging techniques: 4.1. Echocardiography: TTE and TEE. 4.2. CT: coronary arteries and cardiac CT of morphology and function. 4.3. MRI. 5. Prognosis evaluation: 5.1. Severity of mitral insufficiency. 5.2. Severe myxomatous degeneration (Barlow's disease). 5.3. Mitral annulus disjuntion. 5.4. Late Gadolinium Enhacement of mitral apparatus: papillary muscles and myocardium.5.5. Other sequences 6. Treatment: percutaneous repair, surgical repair or valve replacement (multidisciplinary committees). 7. Conclusions. 8. Bibliography.

## CAEE-21 STRESSED ON CALL? YOUR GUIDE TO RECOGNIZING CLASSIC CARDIAC SIGNS ON A CHEST RADIOGRAPH

Nanditha Guruvaiah, MD (*Abstract Co-Author*) Nothing to Disclose
Namratha Guruvaiah Sridhara, MD, BSc (*Abstract Co-Author*) Nothing to Disclose
Janardhana Ponnatapura, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A plain chest radiograph remains as the initial imaging modality of choice in evaluating patients with a history of cardiac pathology. A chest radiograph is convenient as it is easily accessible, low-cost, and a non-invasive diagnostic tool. A chest radiograph plays a key role in providing valuable information regarding underlying cardiac conditions. We aim to provide classic imaging signs of cardiac pathologies on a chest radiograph to boost the confidence and sharpen the skills of radiology residents and medical students. Since a chest radiograph is the initial imaging modality for patients with cardiac conditions, these classic signs can aid radiology residents and students to quickly recognize the underlying conditions and provide an accurate diagnosis for further patient management.

**TABLE OF CONTENTS/OUTLINE**

Introduction to normal cardiac silhouetteChest radiograph signs of cardiac pathologies case-based learning:- Double density sign- Hoffman-Rigler sign- Walking man sign- Oreo cookie sign- Straight left heart sign- Wide carina sign- Water bottle sign- Continuous diaphragm sign- Small heart sign- Left atrial impression on the esophagus in barium swallow- Third mogul sign- Stag’s antlers sign / reverse mustache sign

## CAEE-22 MRI OF NONISCHEMIC CARDIOMYOPATHY:THE INTERSECTION OF NEW DIAGNOSTICS AND THERAPEUTICS

Soheil Kooraki, MD (*Abstract Co-Author*) Nothing to Disclose
Albert Hsiao, MD, PhD (*Abstract Co-Author*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging
Arash Bedayat, MD (*Abstract Co-Author*) Nothing to Disclose
Roshun Sankaran, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Kimberly Hong (*Abstract Co-Author*) Nothing to Disclose
Melina Hosseiny, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Cardiac MR Imaging Techniques for CardiomyopathySSFP (Bright blood): Morphology and FunctionDouble inversion recovery (Black blood): Anatomic detail and myocardial edemaT1 and T2 mapping: Fibrosis and edemaPhasecontrast flow: HemodynamicsStrain: MechanicsCase-Based Review: Nonischemic Cardiomyopathy Hereditary CardiomyopathiesInflammatory CardiomyopathiesInfiltrative CardiomyopathiesStress-induced CardiomyopathyNon-compaction CardiomyopathyDifferentiating between types of nonischemic cardiomyopathiesDifferential imaging diagnosis of thickened myocardium: HCM, amyloid, hypertension, or other infiltrative diseasesDifferential imaging diagnosis of myocardial delayed enhancementThe Evolving Roles and Interactions of Genetics and Cardiac MR for Diagnosis of Nonischemic CardiomyopathyHistorical perspective and recent advancementsAdded value of the current imaging and genomic technologies

**TABLE OF CONTENTS/OUTLINE**

Cardiac MR Imaging Protocols and Recent Advancements Tissue Characterization in Arrhythmogenic CardiomyopathyMechanics, Flow and prognostic value of CMR in Hypertrophic CardiomyopathyInflammatory/Infectious Cardiomyopathies: Myocarditis, SarcoidosisInfiltrative Cardiomyopathies: Amyloidosis, SiderosisStress-induced CardiomyopathyNon-compaction cardiomyopathyThe Evolving Roles and Interactions of Genetics And Cardiac MR for Diagnosis of Nonischemic CardiomyopathyAdded Value of the Current Genomic Technology

## CAEE-23 FFRCT: UPCOMING APPLICATIONS IN THE AI ERA

Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Freire, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose
Jose R. Parga, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz F. de Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto N. Dantas JR, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Tenorio, MD (*Abstract Co-Author*) Nothing to Disclose
Thamara C. Morais, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:Presenting challenging cases: illustrates the role of FFRCT in complex diagnostic scenarios, including coronary stents, myocardial bridging, and anomalous pathways.FFRCT appropriateness and interpretation recommendation: Discussion on the appropriateness criteria and interpretation recommendations for FFRCT, highlighting its role in guiding clinical decisions.Defining Software Concepts: FFRCT Computational Fluid Dynamics-based Software (CFD- FFRCT) and FFRCT Deep Learning-based Software (DL-FFRCT).Exploring Software Solutions: illustrate a variety of software solutions based on Computational Fluid Dynamics and Deep Learning, and their respective pros and cons to inform decision-making in clinical practice.AI's Impact on Software Development: enhances diagnostic accuracy and enables fast on-site results.

**TABLE OF CONTENTS/OUTLINE**

1.Challenging Cases in FFRCT1.1 Coronary Stents1.2 Myocardial Bridging1.3 Anomalous Pathways - Interarterial Course2.Role of FFRCT in Clinical Decision Making: A Flowchart 3.OverviewExploring FFRCT Software Solutions:3.1 Overview of CFD- FFRCT3.1.1 Introducing the concept of CFD-based FFRCT software.3.1.2 Pros and Cons Comparison of each software3.2 Overview of DL-FFRCT3.2.1 Introducing the concept of DL-based FFRCT software3.2.2 Pros and Cons Comparison of each software4.AI-driven innovations in FFRCT softwares development

## CAEE-24 UNVEILING THE PHENOTYPIC DIVERSITY OF SARCOMERIC HYPERTROPHIC CARDIOMYOPATHY USING IMAGING IN THE ERA OF PRECISION MEDICINE

Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Luigia D'Errico, MD (*Abstract Co-Author*) Nothing to Disclose
Julian Vega (*Abstract Co-Author*) Nothing to Disclose
Anastasia Oikonomou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia Alegria, MD (*Abstract Co-Author*) Nothing to Disclose
Christian P. Houbois, MD (*Abstract Co-Author*) Nothing to Disclose
Juan J. Urbina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Purpose of this exhibit: 1. Explore the diverse phenotypic landscape of sarcomeric hypertrophic cardiomyopathy (HCM) within the era of modern precision medicine. 2. Delve into diagnostic challenges of the left ventricular hypertrophy (LVH) phenotypes. 3. Showcase the seamless integration of genetic testing with cardiac magnetic resonance (CMR) to precisely identify the etiology of LVH.

### TABLE OF CONTENTS/OUTLINE

1. Background: Epidemiology and Pathophysiology of HCM. 2. Genetic mutations involved in sarcomeric HCM. 3. Phenotypic spectrum of HCM -EARLY HCM a. Non-hypertrophic (crypts, mitral valve, and papillary abnormalities), b. Incipient LVH (LVH does not fulfill diagnostic criteria). ESTABLISHED HCM c. Symmetric (concentric) HCM, d. Asymmetric septal, e. Asymmetric apical, f. Focal HCM, g. Midventricular HCM, h. Masslike HCM, i. Noncontiguous HCM, j. Sigmoidal, k. Reverse curve. ADVANCED HCM l. HCM in the active-inflammatory phase ("Hot HCM"), m. HCM with left ventricular systolic dysfunction (LVSD), n. Dilated with extensive fibrosis HCM ("burned-out"). 4. HCM post septal reduction therapy: ablation-myomectomy and myosin inhibitors. 5. HCM phenocopies: the role of integrating genetic testing a. Storage and infiltrative cardiomyopathies i. Amyloidosis (mutant TTR), ii. Cardiac sarcoidosis, iii. Hemochromatosis, iv. Lysosomal storage disease: 1. Anderson-Fabry, 2. Hurler's syndrome. v. Glycogen storage disease: 1. Danon disease, 2. PRKAG2, Desminopathy, RASopathies, 3. Pompe's, vi. Mitochondrial (MELAS, MIDD), vii. Syndromic HCM: 1. Friedrich Ataxia, 2. Noonan, 3. Leopard. b. Other differential diagnosis i. Athlete's heart ii, Hypertensive cardiomyopathy iii, Aortic stenosis.

## CAEE-25 OPTIMIZING RADIOLOGICAL APPROACH TO PREGNANCY-RELATED CARDIOVASCULAR DISEASES: STRATEGIES AND AWARENESS

Riccardo Marano, MD (*Abstract Co-Author*) Nothing to Disclose
Alessio Perazzolo, MD (*Abstract Co-Author*) Nothing to Disclose
Luigi Natale, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Rovere (*Abstract Co-Author*) Nothing to Disclose
Francesco Lauriero (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To enhance the awareness of radiologists in cardiovascular diseases (CVDs) during pregnancy. To highlight the role of imaging in diagnosing specific pregnancy-related CVDs. To illustrate strategies for minimizing radiation exposure and limiting the use of contrast agents when feasible.

### TABLE OF CONTENTS/OUTLINE

Background CVDs represent the primary cause of non-obstetric morbidity and mortality during or early after pregnancy in western countries. Timely diagnosis and effective management are crucial in mitigating these risks. Imaging plays a pivotal role in diagnosing some of the pregnancy-related CVDs, although radiation exposure and use of contrast agents should be minimized, adhering to the principle of as low as reasonably achievable (ALARA). If the disease occurs in late pregnancy, emergency cesarean delivery may be considered to prevent fetal exposure to radiation. Otherwise, magnetic resonance (MR) imaging is preferred over imaging examinations with ionizing radiation, particularly computed tomography (CT), whenever possible. Findings We present a series of illustrative cases focusing on the most common CVDs occurring in pregnant women, radiologists may run into their routine practice. We showcase different imaging techniques for each pathology, highlighting their distinct features and essential findings for accurate diagnosis. The discussed pathologies include pulmonary embolism (PE), sudden coronary artery dissection (SCAD), peripartum cardiomyopathy (PPCM), and aortic dissection. Conclusion Awareness of radiologists on pregnancy-related CVDs and radiation risks during gestation is crucial for optimizing imaging examination selection, diagnosis, and clinical management.

## CAEE-26 SEARCHING FOR SYNCHRONY: RADIOGRAPHY OF CONTEMPORARY CARDIAC DEVICES

Alan Wimmer (*Abstract Co-Author*) Nothing to Disclose
Melissa L. Rosado de Christenson, MD (*Abstract Co-Author*) Nothing to Disclose
Sherief Garrana, MD (*Abstract Co-Author*) Author, Reed Elsevier;Author, Oxford University Press
Santiago Martinez-Jimenez, MD (*Abstract Co-Author*) Support, Reed Elsevier
Alan V. Godfrey, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cardiovascular implantable electronic devices include a variety of technologies which are frequently visualized and assessed on chest radiography. Knowledge of the appropriate anatomical course and location of these devices is critical for radiologists in order to appropriately interpret chest radiographs and recognize device-related complications. An understanding of emerging devices and new approaches for their placement enables the radiologist to provide accurate information to the clinician, thus enhancing patient care. Furthermore, radiologists play a central role in identifying complications associated with hardware placement and on follow-up imaging evaluation of these devices. The goals of this exhibit are to help the learner: 1. Understand the radiographic anatomy pertinent to contemporary cardiac implantable devices and emerging techniques in device and lead placement 2. Identify common and critical complications associated with contemporary cardiac devices

### TABLE OF CONTENTS/OUTLINE

1. Introduction - Review radiographic anatomy as it relates to cardiac implantable conduction devices and leads 2. Overview of current electrophysiologic techniques and devices with emphasis on lead location on radiography 3. Discussion of radiographic features of common and critical complications associated with cardiac implantable devices 4. Conclusion

## CAEE-27 THE HEART IS BROKEN: A COMPREHENSIVE GUIDE FOR RADIOLOGISTS

Matthew D. Cham, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose

Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Reviewing mechanisms of blunt cardiac trauma Highlighting the various types of blunt cardiac trauma Multimodality pictorial review of imaging findings in blunt cardiac trauma. Reviewing the current surgical techniques for management of blunt cardiac trauma with focus on imaging findings.

**TABLE OF CONTENTS/OUTLINE**

Mechanisms of injury in blunt cardiac trauma Update on imaging protocols for ideal detection of blunt cardiac trauma. Direct and indirect imaging findings in different cardiac trauma entities including: 1- Pericardium: Hemopericardium Pericardial tamponade Pericardial perforation/laceration Cardiac herniation 2- Myocardium: Myocardial contusion Myocardial hematoma Ventricular pseudoaneurysm Myocardial rupture 3-Endocardium and intracardiac: Endocardial laceration Valve and papillary muscle injury Intracardiac thrombosis Intracardiac air embolism 4. Vascular injuries Coronary artery injuries Aortic root injuries Pulmonary artery injuries IVC and SVC injuries Surgical and interventional treatment options for blunt cardiac trauma.

## CAEE-28 TOTAL ECLIPSE OF THE HEART: TURNING AROUND THE PERICARDIUM

**Awards**
**Cum Laude**

Bernardo S. Oliveira, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Daniel Giunchetti Strabelli, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Sartim, MD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To review usual and unusual cases related to the pericardium, pericardial sinuses and recesses. 2. To correlate important findings with the anatomy, embryology, and pathophysiology, focusing on their clinical-radiological correlations. 3. To understand the classification of the pericardium 4. To highlight their characteristics in order to familiarize radiologists, preventing unfavorable patient outcome. 5. To review CT and MRI protocols in the evaluation of patients with suspected pericardium involvement. 6. To correlate with the impact on the onco-image.

**TABLE OF CONTENTS/OUTLINE**

1. Applied embryology and anatomy of the pericardium, its sinuses and recesses. 2. Techniques: X-ray, CT and MRI - pros and cons 3. Applications: a case-based review (a) Normal anatomy (b) Anatomical variants (c) Congenital (d) Inflammatory and infectious: acute and chronic (e) Vascular (f) Neoplasm (g) Foreign body (h) Intervention (i) Miscellaneous and other findings 4. Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics. 5. Future directions 6. Summary and take-home messages.

## CAEE-29 BREAKING HEARTS: CORONARY DISSECTION AND ITS COMPLICATIONS

Roberto Sasdelli Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Walther Y. Ishikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Merigue, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Katriny Couto, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Nadjaneyre Casimiro, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Damaso, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz Raphael P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Nycole B. Cortez Lima, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

I. Explore the use of coronary computed tomography angiography (CCTA) in the initial assessment and follow-up of patients suspected to have coronary dissection.II. Examine changes observed during post-evaluation and emphasize crucial aspects to include in reporting.III. Identify potential complications related to coronary dissection on CCTA.IV. Correlate CCTA with invasive coronary angiography in cases of coronary dissection

**TABLE OF CONTENTS/OUTLINE**

Relevant epidemiology and clinical features of coronary dissectionPathophysiology of coronary dissection and its complicationsClassification for coronary spontaneous dissections base on the National Heart, Lung and Blood Institute (NHLBI):A) Type 1B) Type 2 (the most commonly diagnosed)C) Type 3Imaging findings on CCTAImaging findings on invasive coronary angiographyImaging coronary dissection complications: what the radiologist needs to look for

## CAEE-3 TIPS AND TRICKS TO IDENTIFY AND PROPERLY DIAGNOSE VASCULAR RINGS AND SLINGS

Omar Andres Pantoja Burbano, MD (*Abstract Co-Author*) Nothing to Disclose
Julian F. Forero, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Aluja, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Laura Acosta, MD (*Abstract Co-Author*) Nothing to Disclose
Andres F. Mejia Leon, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Utilizing embryology and normal anatomy as a framework, delineate the process through which vascular rings and pulmonary slings develop, making a comparison with the normal development of mediastinal vascular structures.2. Recognize distinct radiologic patterns indicative of vascular rings and pulmonary slings across imaging modalities for accurate diagnosis.3. Explore the repercussions of airway and esophageal compression caused by vascular rings and pulmonary slings, emphasizing their influence on blood flow dynamics and respiratory function.4. Understand how to differentiate vascular anomalies from other mediastinal masses and congenital heart diseases based on imaging characteristics to guide appropriate patient management.

**TABLE OF CONTENTS/OUTLINE**

-Embryological basis and developmental insights-Anatomy and classification on imaging-Radiological features aiding differential diagnosis-Pitfalls in imaging interpretation-Key take-home points for clinical practice.

## CAEE-30 IMPACT OF CMR MULTIPARAMETRIC MAPPING ON AUTOIMMUNE RHEUMATIC DISEASES (ARDS) - RELATED INFLAMMATORY CARDIOMYOPATHY DETECTION

**Awards**
**Certificate of Merit**

Francesco Lauriero (*Abstract Co-Author*) Nothing to Disclose
Agostino Meduri, MD (*Abstract Co-Author*) Nothing to Disclose
Giacomo Ottoni (*Abstract Co-Author*) Nothing to Disclose
Riccardo Marano, MD (*Abstract Co-Author*) Nothing to Disclose
Alessio Perazzolo, MD (*Abstract Co-Author*) Nothing to Disclose
Luigi Natale, MD (*Abstract Co-Author*) Nothing to Disclose
Camilla Vittoria Vita, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To overview inflammatory cardiomyopathy (I-CMP) in autoimmune rheumatic diseases (ARDs). To demonstrate the leading role of cardiac magnetic resonance (CMR) in detecting early cardiac inflammatory involvement in ARDs. To showcase imaging findings on multiparametric CMR approach of I-CMP in different ARDs.

### TABLE OF CONTENTS/OUTLINE

Introduction. Cardiac involvement is a common feature in ARDs. Traditional imaging varies in the diagnostic accuracy depending on pretest probability, type and severity of involvement. Conversely, CMR is the primary imaging tool for diagnosing I-CMP, offering unparalleled tissue characterization. The 2018 Lake Louise Criteria (LLC) enhanced its sensitivity, especially for early detection, leading to a rise in I-CMP incidence and revealing diverse CMR myocarditis patterns. Material and Methods. We showcase a series of CMR examination on ARDs patients with suspected myocarditis. Images were acquired following SCMR standard protocol (2020 update). Results. All patients met 2018 LLC criteria. Edema was not always evident in conventional T2-weighted images and distinct pattern of late gadolinium enhancement (LGE) were found. T1, T2 mapping, and ECV values were consistently elevated. Conclusions. Our aim is to emphasize the role of multiparametric mapping in detecting I-CMP in ARDs patients. Conventional T2-weighted images lack sensitivity for diffuse myocardial edema and different LGE patterns exist. Multiparametric mapping may overcome these limitations, providing quantitative maps of myocardial changes. Given the CMR sensitivity in I-CMP, even at early stages, a CMR screening for asymptomatic patients might increase ARDs-related I-CMP improving their prognosis.

## CAEE-31 PRACTICAL APPROACH TO IMAGING CHALLENGING AORTIC ARCH ANOMALIES: DOUBLE ARCH WITH ATRESIA AND MIMICS

Beverley M. Newman, MD, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Felipe A. Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Alonso-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Osami Honjo (*Abstract Co-Author*) Nothing to Disclose
Frandics P. Chan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Presenter*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

### TEACHING POINTS

1. Double aortic arch is the most frequent cause of a symptomatic congenital vascular ring as the trachea and esophagus are completely encircled; typically, the right arch is higher and more cephalic than the left arch2. Part of the double arch can be atretic and replaced by a fibrosis cord, which is difficult to detect on imaging due to lack of luminal contrast in the atretic segment3. Double arch with atretic segment can mimic right aortic arch variants, depending on the level of atresia; however, timely differentiation is critical to guide management4. Double aortic arch with atresia distal to the left subclavian artery can mimic right aortic arch with type 1 mirror image branching5. Double aortic arch with atresia between the left common carotid and left subclavian arteries can mimic right aortic arch with aberrant retroesophageal left subclavian artery6. Key imaging features to differentiate double aortic arch with an atretic segment from mimics include 1) presence of 4 symmetrical arch branches at an axial level just above the arch, 2) posterior direction of the proximal aspect of the first arch branch, 3) tethering or tenting of the posterior segment of the patent segment of the left arch, and 4) anteriorly-directed diverticular outpouching from the descending aorta.

### TABLE OF CONTENTS/OUTLINE

1. Review aortic arch anomalies and congenital vascular rings: epidemiology, embryology, clinical presentation, and management2. Demonstrate imaging findings in typical double aortic arches3. Illustrate variants of double aortic arches with atretic segments and right aortic arch mimics4. Identify key imaging features to differentiate double aortic arch with atretic segment from mimics

## CAEE-32 NEW INSIGHTS INTO CARDIAC AMYLOIDOSIS IMAGING: A PRACTICAL GUIDE TO DIAGNOSIS, FOLLOW-UP AND OPTIMAL MANAGEMENT

Roberto N. Dantas JR, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Fuzissima (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thamara C. Morais, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the imaging approach of myocardial thickening to early identify Cardiac Amyloidosis and other phenocopiesTo discuss the clinical value and specific advantages / disadvantages of LGE, T1 map and ECV, T2 map and myocardial strain on Cardiac Amyloidosis To illustrate the main applications of T1 map, ECV and T2 map analysis in different clinical scenarios, focusing on its limitations and perspectives in clinical decision making.

### TABLE OF CONTENTS/OUTLINE

Phenocopies Imaging Approach: Differential diagnosis of myocardial thickeningStructural, functional e structural features in CA at CMRT2 Map on CA and other phenocopiesNew perspectives on T1 mapping and ECVBasic Technics, Accuracy and Clinical Applications Post-processing and Interpretation Tips and PitfallsChallenges and ParadigmsCMR-feature tracking Strain: intra- and intermodality agreement and variations Clinical applicationsHeart failure with preserved ejection fractionQuantification of systolic and diastolic left ventricular functionRisk assessment and prognosisSudden Cardiac Death Risk

CalculatorTherapeutic Target Management and therapeutic response evaluationFuture perspectives: standardization, automated image analysis and artificial intelligence tools

## CAEE-33 LATEST ADVANCES IN MULTI-MODAL APPROACH TO THE IMAGING OF CARDIAC AND PULMONARY SARCOIDOSIS WITH PATHOLOGICAL CORRELATION

Nikhil Gupta (*Abstract Co-Author*) Nothing to Disclose
Rita Maria Lahoud, MD (*Abstract Co-Author*) Nothing to Disclose
Robert Freund, MD (*Abstract Co-Author*) Nothing to Disclose
Elie Najem, MD (*Abstract Co-Author*) Nothing to Disclose
Susannah Kay, MD (*Abstract Co-Author*) Nothing to Disclose
John Beute (*Abstract Co-Author*) Nothing to Disclose
Rosaura Suazo Aguero, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Sarcoidosis is a systemic disease characterized by the formation of non-necrotizing granulomas. It presents with respiratory symptoms in up to 53% of patients, and cardiac granulomas are present in up to 46.9% of cases. Radiography and CT are the most common imaging modalities used in the evaluation of thoracic sarcoidosis. However, 18F FDG-PET/CT have been shown to be increasingly useful. Findings include symmetric hilar and mediastinal lymphadenopathy, pulmonary nodules, subpleural reticular markings, groundglass changes, and pulmonary fibrosis.Findings of pulmonary sarcoid should prompt the evaluation for cardiac sarcoid.With respect to cardiac sarcoidosis, MRI and 18F FDG-PET/CT are useful tools. On MRI, cardiac sarcoidosis is typically associated with patchy and multifocal late gadolinium enhancement in the septum and lateral wall. The mid-myocardium and epicardium are commonly affected, whereas the subendocardium is usually spared. On 18 F FDG-PET/CT, cardiac sarcoidosis appears as patchy focal FDG uptake.Myocardial perfusion imaging using SPECT-CT can also be useful in the diagnosis of cardiac sarcoidosis by identifying focal perfusion defects at rest. Fixed defects or those that demonstrate reverse redistribution following vasodilation can distinguish cardiac sarcoidosis from non-sarcoid cardiac pathologies.

### TABLE OF CONTENTS/OUTLINE

1. Introduction on sarcoidosis and its systemic manifestations2. Focus on pulmonary and cardiac sarcoidosis3. Imaging findings with a focus on chest CT, cardiac MRI, and 18F FDG-PET/CT4. Case examples of sequential multi-modality evaluation for pulmonary and cardiac sarcoidosis5. Advances and future prospects in the imaging of sarcoidosis

## CAEE-34 MITRAL ANNULUS DISJUNCTION: A NOT SO RARE ENTITY. WHAT THE RADIOLOGIST NEEDS TO KNOW

Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Fernandez-Lobo (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To familiarize the radiologist with Mitral Annular Disjunction (MAD), a little known and potentially fatal pathology, with the secondary objective that its knowledge will improve the detection and reporting rates within clinical practice.To review the role of imaging techniques in the diagnosis of this entity, especially cardiac magnetic resonance.

### TABLE OF CONTENTS/OUTLINE

MAD is an abnormal displacement of the mitral valve (MV) posterior leaflet onto the left atrial wall with separation between the MV attachment and the atrium MV junction. This entity has been associated with a progressive risk of malignant ventricular arrhythmias and sudden cardiac death, likely related to progressive mitral apparatus fibrosis. Therefore, recognition of this anomaly and its risk stratification are highly important. Its diagnosis is done by cardiac imaging. However, a reference imaging technique has not yet been established.MAD is commonly found in patients with mitral valve prolapse (MVP) or myxomatose MV disease but can also occur in the absence of mitral valve pathology. In either case it has been shown by multiple studies to be associated with life-threatening arrhythmic events.Transthoracic or transesophageal echocardiography and cardiac magnetic resonance (CMR) are useful noninvasive imaging tools for the diagnosis of MAD. It will manifest as an absence of myocardium during systole between the posterior mitral valve annulus and adjacent basal segments of the ventricular wall. CMR offers a detailed anatomic three-dimensional imaging that provides useful information for risk stratification and prognosis, being considered the gold standard.

## CAEE-35 A PICTORIAL REVIEW: LEARNING CONGENITAL HEART DISEASE WITH EMBRYOLOGY

Katsutoshi Horiuchi, MD (*Abstract Co-Author*) Nothing to Disclose
Aya Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Kyosuke Matsuda (*Abstract Co-Author*) Nothing to Disclose
Dan Yamamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Nagaaki Marugami (*Abstract Co-Author*) Nothing to Disclose
Ryosuke Taiji, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Congenital heart disease is considered a multifactorial genetic disorder in which cardiac morphogenesis during the embryonic period is caused by fetal genetic abnormalities or maternal environmental factors. Understanding cardiac embryology is very important for diagnosing the morphology of congenital heart disease, understanding the pathogenesis of heart disease. This exhibit aims to: Review congenital heart disease with embryology Discuss how to comprehend the radiological findings of congenital heart disease

### TABLE OF CONTENTS/OUTLINE

l Determination of left-right axis Heterotaxia Right isomerism, asplenia Left isomerism, polysplenia Situs inversus l Development of first heart field Dextrocardia Hypoplastic right ventricle Single ventricle l Development of second heart field Outflow tract Persistent truncus arteriosus (PTA) Double outlet right ventricle (DORV) Tetralogy of Fallot (TOF) Transposition of Great Arteries (TGA) Inflow tract Pulmonary atresia with intact ventricular septum Hypoplastic left heart syndrome (HLHS) l Completion of atrial and ventricular septum Atrial septal defect (ASD) Ventricular septal defect (VSD) Atrio-Ventricular Septal Defect (AVSD)

## CAEE-36 THE ROLE OF CORONARY COMPUTED TOMOGRAPHY ANGIOGRAPHY (CCTA) IN SPONTANEOUS CORONARY ARTERY DISSECTIONS (SCAD): WHAT RADIOLOGISTS NEED TO KNOW

Lojo, MD (*Abstract Co-Author*) Nothing to Disclose
Susana A. Otero Muinelo, MD (*Abstract Co-Author*) Nothing to Disclose
Carla Suarez Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Blanca Perez Perez-Lafuente, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Martinez-Sapina Llanas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The gold standard for the diagnosis of spontaneous coronary artery dissections (SCAD) is invasive coronariography angiography (ICA). Coronary computed tomography angiography (CCTA) can be the first diagnosis tool in haemodynamically stable patients and it´s very important in the follow-up. To present the role of CCTA in the diagnosis and follow-up of SCAD, with the different types of dissections and the differential diagnosis with other type of coronary occlusion. Also to describe the role of CCTA in the diagnosis of extracoronary arteriopathies related to SCAD.

**TABLE OF CONTENTS/OUTLINE**

SCAD is a cause of myocardial infarction, and it accounts for at least 4% of all acute coronary syndromes. It is more common among young women and pregnant. The clinical presentation is variable, ranging from chest pain to cardiac death, most patients presenting with myocardial injury biomarkers increase. Fibromuscular dysplasia is the most common co-existing condition, also an association with connective diseases has also been reported. SCAD diagnosis is usually made by ICA, but CCTA can be the first diagnostic-tool in haemodynamically stable patients. Although dissection flap occurs in minority of cases, this is the easiest pattern to recognize on CCTA. Most often a stenosis or oclusion occurs and it´s challenging to distinguish between SCAD and other causes of vessel occlusion, so it´s important to observe other findings. Most patients are treated conservatively, unless they have ischaemia or haemodymically instability. Most patients are completely cured in 120 days and up to 30 % present a new SCAD. That is why the main role of CCTA is during follow-up period for assessment of dissection healing, 3/6 months after the SCAD event.

## CAEE-37 MYOCARDIAL T1 MAPPING FOR CHARACTERIZING MYOCARDIAL DISEASES: STATE OF THE ART

Priya Jagia, MD (*Abstract Co-Author*) Nothing to Disclose
Niraj N. Pandey, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Kumar, MBBS,MD (*Abstract Co-Author*) Nothing to Disclose
Vineeta Ojha, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. T1 mapping is a robust tool for evaluating myocardial diseases by quantifying changes in myocardial tissue composition.2. T1 mapping complements late gadolinium enhancement (LGE) imaging by detecting diffuse interstitial fibrosis, which LGE might miss.3. The utility of T1 mapping spans a diverse spectrum of cardiac conditions that influence both therapeutic strategies and clinical outcomes.After going through the exhibit, the reader will be able to explain the physics and principles behind T1 mapping, acquisition and interpretation, and applications of T1 and ECV mapping for diagnosis, prognostication, treatment and follow-up for various myocardial pathologies.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction2. Principles of T1 Mapping: Acquisition, post processing and interpretation3. Overview of T1 mapping indices and histological correlates: native T1, post contrast T1, and Extracellular Volume (ECV) Fraction4. Normal ranges5. T1-Mapping Techniquesa. Inversion Recovery-Based Techniquesb. Saturation Recovery-Based Techniquesc. Other techniques6. T1 Mapping in Ischemic Heart Diseasea. Acute Myocardial Infarctionb. Chronic Myocardial Infarction7. T1 Mapping in Non-Ischemic Cardiomyopathya. Non-Ischemic Dilated Cardiomyopathy (NIDCM)b. Takotsubo Cardiomyopathyc. Genetic Cardiomyopathies i. Hypertrophic Cardiomyopathy ii. Arrhythmogenic Right Ventricular Cardiomyopathy iii. Left Ventricular Noncompactiond. Post heart transplant e. Miscellaneous 8. Inflammatory Cardiomyopathiesa. Acute myocarditisb. Cardiac Sarcoidosis9. Infiltrative Cardiomyopathiesa. Cardiac Amyloidosisb. Anderson-Fabry Diseasec. Cardiac Siderosis10. Valvular Heart Disease11. Conclusions

## CAEE-38 ADVANTAGES OF DUAL-SOURCE PHOTON-COUNTING DETECTOR CT FOR MYOCARDIAL EXTRACELLULAR VOLUME QUANTIFICATION

Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Misugi Urano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazuya Ohashi, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Masaya Kisohara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shibuki Matsui (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nobuo Kitera, RT, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Non-invasive quantification of the extracellular volume (ECV) is a method for the evaluation of focal and diffuse myocardial fibrosis, potentially obviating the need for invasive endomyocardial biopsy. 2. Quantification of ECV is an established method in MRI. However, quantification of ECV using CT (CT-ECV) is lower-cost, more accessible and faster than that of ECV using MRI (MR-ECV), and is also available even for patients where MRI is contraindicated. 3. Dual-source photon-counting detector CT (DS-PCD-CT) always provides spectral information. Moreover, this information can be obtained by ECG-gated scan mode and high-pitch spiral scan mode, which is unavailable with energy-integrating detector dual-source CT. 4. The new DS-PCD-CT option allow for more accurate CT-ECV quantification, which remains robust to variability of heart rate without the need for increased radiation dose.

**TABLE OF CONTENTS/OUTLINE**

1. Utility of ECV for cardiac diseases 2. Non-invasive quantification of ECV-CT in comparison to ECV-MRI 3. Advantages of DS PCD-CT in cardiac imaging 4. Validation of the accuracy of data acquisition method specific to DS-PCD-CT 5. Advantages and disadvantages of CT-ECV and development with DS-PCD-CT

## CAEE-39 SUPRA-AORTIC TENDON: AN ENIGMA ON CARDIAC IMAGING RESEMBLING AORTIC DISSECTION

Satinder P. Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Mostafa Abozeed, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Ibrahim, MD (*Abstract Co-Author*) Nothing to Disclose
Inayat Grewal (*Abstract Co-Author*) Nothing to Disclose
Naga Sai Rasagna Mareddy, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Understand the embryological basis and origin of the supra-aortic tendon; Gain insight into the challenges of diagnosing this rare entity on cardiac imaging and become familiar with its mimics; Identify the clinical significance and limitations of conventional cardiac imaging modalities in assessing for this entity.; Describe the imaging features of supra-aortic tendon that help to distinguish it from type A aortic dissection

**TABLE OF CONTENTS/OUTLINE**

; Overview of embryological development of supra-aortic tendon; Explanation of how to diagnose supra-aortic tendon on cardiac imaging:a) Understanding the limited role of echocardiogram and non-gated cardiac CTA to differentiate the two entities.b) Discussion of importance of gated Cardiac CT to better evaluate the aortic root.c) Discussion of impact of accurate diagnosis of this condition on patient management; Identification of specific imaging features found in patients with type A aortic dissection to better understand the similarities and differences in both conditions on imaging; Strategies for Radiologists who encounter similar cases in their practice.

## CAEE-4 CARDIOPULMONARY COMPLICATIONS OF CANCER THERAPEUTICS

Anastasia Oikonomou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Christian P. Houbois, MD (*Abstract Co-Author*) Nothing to Disclose
Issac Y. Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Binita R. Chacko, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Lan-chau T. Kha, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Asutosh Sahu, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This educational exhibit will illustrate the cardiac and thoracic complications associated with new cancer agents such as immune checkpoint inhibitors (ICI). These treatments allow for substantial survival benefits in patients previously treated as palliative. However, treatment comes with an increased risk of cardiovascular and pulmonary side effects.
- Familiarize the reader with common cardiac and pulmonary complications resulting from cancer therapies with ICI, including immune myocarditis, pericardial diseases, pneumonitis, pulmonary embolism etc.
- To discuss the value of CT and MRI in identifying and differentiating between complications.
- To describe the range and overlap of critical imaging features based on specific clinical case scenarios.

**TABLE OF CONTENTS/OUTLINE**

- Background of cardiac and pulmonary toxicities:
- Epidemiology
- ICI drugs and common side effects
- Value of imaging with CT and MRI in the detection and monitoring of complications.
- Cardiac and thoracic side effects are illustrated by case examples.
- The role of radiologist in a multidisciplinary team:
- The importance of multidisciplinary collaboration in managing affected patients.

## CAEE-40 INTERSECTING VISTAS: CORONARY AND PULMONARY ARTERY FISTULAS IN CARDIAC CT IMAGING

Ali F. Tekin, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This presentation aims to delineate various manifestations of a coronary artery - pulmonary artery fistulas (CPAFs) and assess their possible hemodynamic consequences. Additionally, it highlights the critical role of coronary CT angiography (CCTA) in identifying these uncommon vascular anomalies, illustrated through several CT imaging examples.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to coronary artery - pulmonary artery fistulas Coronary artery - pulmonary artery fistulas (CPAFs) are rare vascular anomalies that create an abnormal connection between the coronary arteries and the pulmonary artery, bypassing the myocardial capillary network. 2. Coronary CT angiography (CCTA) Imaging Coronary CT angiography (CCTA) is a non-invasive, precise imaging technique crucial for diagnosing CPAFs. It requires a controlled heart rate, achieved through medications, and uses advanced imaging technologies to detail the fistula's characteristics. CCTA employs either prospective or retrospective ECG-triggered acquisition methods depending on the patient's heart rhythm stability. 4. ConclusionsIn conclusion, CCTA's role in diagnosing CPAFs has become more critical with its ability to detect these anomalies incidentally, emphasizing the need for radiologists to be proficient in using this technology for effective diagnosis and management.

## CAEE-41 ULTRASOUND IN CARDIOPULMONARY RESUSCITATION: HOW TO APPLY THE C.A.U.S.E PROTOCOL?

Marcelo R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Victor A. Jabour, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Francisco Neto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Cesar Passos Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Ariel Ejzenbaum (*Abstract Co-Author*) Nothing to Disclose
Andre Luiz Fernandes (*Abstract Co-Author*) Nothing to Disclose
Guilherme C. del Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Izabela Camuri Firmino Carlos (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Point-of-care Ultrasound (POCUS) is a methods of evaluating patients at the bedside during cardiac arrest to enable an efficient response and the CAUSE (Cardiac Arrest Ultrasound Exam) protocol is a guide for the use of thoracic ultrasound in care for cardiac arrest in a non-shockable rhythm.- When applied correctly, the CAUSE protocol allows for the identification of potentially reversible causes, minimizing the time of cardiac arrest.- With the determination of a non-shockable rhythm through clinical history and monitoring, the use of ultrasound is indicated - through the subcostal, apical, pulmonary, and parasternal windows - which can provide an effective prognosis.- This review addresses techniques for identifying causes of cardiac arrest, such as pneumothorax, cardiac tamponade, pulmonary embolism, and hypovolemia.- The competence and training of the professional in using bedside ultrasound has the potential to increase clinical precision and significantly contribute to reducing morbidity and mortality in the emergency context.

**TABLE OF CONTENTS/OUTLINE**

- Introduction on using bedside ultrasound in the emergency context.- Evaluation of a literature review regarding the CAUSE protocol.- Discussion on the use of ultrasound during cardiac arrest with the aim of identifying potentially reversible causes.- Importance of mastering techniques for evaluating windows for a good prognosis.

## CAEE-42 BLOOD UNDER THE BRIDGE: IMAGE ASPECTS OF CORONARY ARTERY BYPASS GRAFT SURGERY AND STENTING

**Awards**
**Certificate of Merit**

Cesar H. Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Freire, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz F. de Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto N. Dantas JR, MD (*Abstract Co-Author*) Nothing to Disclose
Jose R. Parga, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thamara C. Morais, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Tenorio, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Coronary artery disease (CAD) is one of the main causes of death in the world and the management by means of coronary stenting and coronary artery bypass graft surgery (CABG) are well-established techniques.2. The assessment of coronary stents and myocardial revascularization plays a crucial role in post-procedural management and predicting patient clinical outcomes.3. Coronary CT angiography, a well-established technique in chronic CAD, offers a non-invasive and effective approach to this evaluation.4. This presentation aims to illustrate the role of CT angiography in assessing coronary stenting and CABG imaging, correlating them to conventional angiography, intravascular ultrasound, and optical coherence tomography.

**TABLE OF CONTENTS/OUTLINE**

1. Applied techniques of CABG and coronary stenting.2. Milestones in the evolution of percutaneous coronary intervention over the years.3. Techniques: CT angiography, conventional angiography, intravascular ultrasound, and optical coherence tomography - pros e cons.4. Coronary CT angiography protocols5. Coronary stenting:(a) Coronary anomalies(b) Restenosis and stent thrombosis(c) Coronary CT angiography-derived Fractional Flow Reserve testing (FFR-CT)(d) Artifacts: blooming and beam hardening(e) Complications6. CABG:(a) Types: arterial and venous(c) Complications7. Miscellaneous and other findings8. Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics.9. Future directions: artificial intelligence10. Summary and take-home messages.

## CAEE-43 CT AND CMR IN AORTIC VALVE DIASESE: THE ULTIMATE GUIDE

**Awards**
**Certificate of Merit**

Javier Royuela (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD, PhD (*Abstract Co-Author*) Speaker, General Electric Company
Rob J. van der Geest, PhD (*Abstract Co-Author*) Nothing to Disclose
Pankaj Garg (*Abstract Co-Author*) Nothing to Disclose
Javier Sanchez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jordi Broncano, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To evaluate the role of CMR in the evaluation of aortic valve disease, main sequences, protocol design and implementation in clinical practice. 2. To review the main CMR derived imaging biomarkers in aortic stenosis, aortic regurgitation, bicuspid aortic valve (BAV) as well as the repercussion in left side cardiac chambers and prognosis.

**TABLE OF CONTENTS/OUTLINE**

1. Aortic valve disease (AVD). Definition and epidemiology.2. Cardiac imaging in AVD. Role of CT and CMR2.1. CT acquisition and post-processing2.1.1. CMR Basic sequences: 2.1.2. Cine SSFP and SPGR2.1.3. 2D - Phase contrast imaging2.1.4. Late gadolinium enhancement2.2. Advanced sequences: 2.2.1. Accelerated cine SSFP/3D cine SSFP2.2.2. 4D flow imaging2.2.3. Parametric mapping2.3. CMR protocoling: From conventional to fast - MRI protocols3. Severity grading: 3.1. Aortic valve area3.2. AV calcification. Role in Low Flow Low Gradient aortic stenosis.3.3. Peak velocity and gradient3.4. Regurgitant volume and fraction3.5. Valve tracking and Conservation Mass Principle3.6. Assessment of multivalvular heart disease4. AVD related aortopathy5. Myocardial involvement in AVD (Valvular heart disease)6. AV tumor - like lesions7. AV neoplasms8. Multimodality imaging in AV disease and prognostic factors9. Conclusions

## CAEE-44 GAPS IN THE HEART: ATRIAL SEPTAL DEFECTS REVISITED

**Awards**
**Certificate of Merit**

Lorna Browne, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Ocazionez-Trujillo, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Camila Urzua Fresno, MD, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Understand the steps in the development of the interatrial septum and its relationship with the anatomic location of the different types of ASDs2) Name and identify the different types of morphologic and physiologic ASDs3) List the most common associated anomalies seen with the different types of ASD4) Describe the different modalities used to characterize ASDs, their advantages and disadvantages, and identify basic imaging protocols for CT and MR imaging of ASD5) Identify the relevant measurement, anatomical relations, and pertinent anomalies or lack thereof to include in the radiology report for pre-procedural assessment of ASDs, and the post-procedural / post-operative appearances of ASD closure.

**TABLE OF CONTENTS/OUTLINE**

Review of embryology, anatomy, and physiology of ASDASD classification and imaging findingsScanning parameters and recommendations for CT and CMRTroubleshooting and pitfallsPre-procedural / pre-operative assessmentPost-operative evaluationAssociated anomaliesFuture directions

## CAEE-45 DECODING THE MAP OF THE HEART: CMR PARAMETRIC MAPPING SEQUENCES FOR MYOCARDIAL TISSUE CHARACTERIZATION

Manuel Rafael Lopez De La Torre Carretero (*Abstract Co-Author*) Nothing to Disclose
Ana Ezponda, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Del Nido Recio (*Abstract Co-Author*) Nothing to Disclose
Carmen Mbongo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To describe the fundamentals of parametric mapping methods in CMR and their clinical applications.To review and illustrate the role of T1 and T2 mapping in the characterization and assessment of different cardiomyopathies through different cases.

**TABLE OF CONTENTS/OUTLINE**

Cardiovascular magnetic resonance (CMR) is the gold standard imaging modality for myocardial tissue characterization. The development of native parametric mapping sequences has allowed a change from visual to quantitative evaluation of the myocardium. Absolute native T1 and T2 mapping values are particularly useful in detecting diffuse alterations (interstitial oedema or fibrosis), especially when the rest of the CMR protocol shows no significant findings.1. Brief review of technical aspects of sequence acquisition and imaging protocol.2. Tips for adequate interpretation of T1 and T2 parametric mapping sequences.3. Clinical applications. Although changes of T1 and T2 mapping values are not disease-specific, they indicate alteration in myocardial tissue composition and may serve as diagnostic and prognostic tools in the context of a specific clinical scenario.Acute myocardial injury- Acute coronary syndrome with obstructive coronary disease.- Troponin-positive non-obstructive coronary artery disease (TpNOCA). Infiltrative cardiac diseaseDiffuse global fibrosisCardiac massesParametric T1 and T2 mapping sequences increase the diagnostic capabilities of CMR by quantifying both focal and diffuse alterations in myocardial tissue. Changes in these parameters represent valuable biomarkers for making diagnosis, determining prognosis and monitoring therapy

## CAEE-46 BASICS OF NONINVASIVE FRACTIONAL FLOW RESERVE (FFR) CT, PLAQUE ANALYSIS AND PLAQUE QUANTIFICATION - CURRENT TRENDS IN CORONARY CT EVALUATION

Camila Urzua Fresno, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Ranish D. Khawaja, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Basics of FFR-CT analysis for the radiologists and cardiac imagers.- Role of FFR-CT can help improve diagnostic ability to assess for stenosis with most clinical impact.- Case examples to show-case various lesions identified on CT with their correlation on FFR-CT (easy to moderate level of complexity with interactive features).

**TABLE OF CONTENTS/OUTLINE**

- Discussion of the basic physiology and methodology of noninvasive fractional flow reserve (FFR-CT) technology.- Discussion of the role FFR-CT in evaluation of cardiac CT examinations in the current practice, and discuss the limitations.- Discussion of plaque burden, plaque morphology and plaque quantification using the CT data for characterization of plaque.- Showcase interactive CT-FFR cases and correlation with the CT-imaging to help navigate high-risk lesions, and complex cases.

## CAEE-48 RIGHT AT HEART: IMAGING INSIGHTS INTO THE TRICUSPID AND PULMONIC VALVES

**Awards**
**Certificate of Merit**

Katherine A. Kaproth-Joslin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lianne Mulvihill (*Abstract Co-Author*) Nothing to Disclose
John Piserchio, MD (*Abstract Co-Author*) Nothing to Disclose
Aaron Shang (*Abstract Co-Author*) Nothing to Disclose
Farhan Bajwa (*Abstract Co-Author*) Nothing to Disclose
Brian Nguyen, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Review the epidemiology of tricuspid and pulmonic valve disease, including congenital and acquired (both primary and secondary) causes. 2) Discuss the morbidity and mortality of right-sided valvular disease in recognition of its importance as an independent, often-overlooked clinical entity. 3) Provide an overview of structural and functional assessment of the normal tricuspid and pulmonic valves. 4) Discuss the relative advantages and disadvantages of echocardiography, CT, and cardiac MR for the purpose of right-heart valve evaluation. 5) Discuss the imaging findings associated with pulmonic and tricuspid regurgitation and stenosis. 6) Review interesting cases of right heart valve disease including: carcinoid syndrome, rheumatic disease, endocarditis, and Ebstein anomaly. 7) Review current treatment options for the tricuspid and pulmonic valves as well as post-treatment imaging findings.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction and epidemiology of tricuspid and pulmonic valve disease2) Morbidity and mortality3) Congenital and acquired etiologies4) Normal structure and function 5) In situ anatomy with illustration 6) Normal appearance and planes on echocardiogram, CT, MR7) Advantages and disadvantages of echo, CT, MR 8) Quantification of normal function 9) Defining tricuspid and pulmonic regurgitation/stenosis10) Case review: Acquired causes e.g. Carcinoid syndrome, Endocarditis 11) Case review: Congenital causes e.g. Ebstein anomaly, Tetralogy of Fallot12) Brief overview of surgical and catheter-based interventions 13) Post treatment imaging appearances

## CAEE-49 READING THE SURGEON'S INTENT: DISCERNING INTENTIONAL FROM UN-INTENTIONAL IN THE POST-OPERATIVE COMPLEX CONGENITAL HEART DISEASE PATIENT

Sayedomid Ebrahimzadeh, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan A. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Ahn, MD (*Abstract Co-Author*) Nothing to Disclose
Shravan Sridhar, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Imaging of the post-operative congenital heart disease patient can be difficult even for radiologists who routinely read these exams. Having a framework to recognize atypical but intended post-surgical changes ensures diagnostic accuracy and informs approach to detecting complications. Here, we present concepts underlying atypical appearances following congenital heart surgery including intentional post-surgical and physiologic changes that mimic pathology and address where an atypical appearance could be pathologic but still intentional (risk vs benefit dilemma), reviewing complications/pitfalls where appropriate.

**TABLE OF CONTENTS/OUTLINE**

1. Title, disclosure2. Abbreviations3. Overview4. Operations + timelinea. PA band in initial palliation vs branch PA stenosisb. Post-op appearance aortic atresia vs DKS anastomotic stenosisc. ASD in single vs BiV repaird. VSD in single vs BiV repaire. mBTT ligation vs occlusionf. RV-PA conduit stump vs pseudoaneurysmg. PDA maintenance vs abnormal patencyh. Fontan types atriopulmonary vs extracardiaci. Fontan fenestration vs baffle leakj. Unifocalization MAPCAs vs pulmonary veins5. Physiology and natural coursea. Absent Fontan conduit in 1.5V repair vs azygos/hemiazygos continuation of IVC vs BiV conversionb. Occluded hepatic-PA conduit + collaterals vs acute Fontan thrombosisc. RA baffle distension vs chamber dilationd. Transannular patch distension vs RVOT pseudo/aneurysm6. The surgeon's dilemma of risk vs benefita. Shunts with Qp:Qs < 1.5b. Pulmonic valve regurgitation, RV EDVI and RVHc. RPA band post-Fontan vs bilateral PA bands unrepaired TOFd. Aortic mycotic pseudoaneurysm7. Case summary8. Summary: Operative timeline9. References

## CAEE-5 IMAGING OF ADULT PRESENTATION OF UNTREATED CONGENITAL HEART DISEASE-EXPECT THE UNEXPECTED

Ameya J. Baxi, MBBS,DMRD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas-Zapata, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Vijay K. Aggarwal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Dhruti Maisuri, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Prevalence of congenital heart disease(CHD) in adults has increased and currently adults more than children have these malformations.2. Most common undiagnosed adult CHD includes bicuspid aortic valve, aortic coarctation, occult shunts (VSD, ASD, PFO, PDA) and uncomplicated tetralogy of Fallot.3. The spectrum of imaging findings of previously undiagnosed congenital heart disease in adults will be discussed.4. Multimodality imaging provides comprehensive assessment of morphology and function including flow analysis from the central to the more peripheral vasculature.5. Common pitfalls in evaluation of adult heart structure on CT/MRI will be reviewed.

**TABLE OF CONTENTS/OUTLINE**

Occasionally, radiologists are confronted with late presentation of undiagnosed or untreated congenital heart disease in the adult patient. Conditions like bicuspid aortic valve, coarctation, occult shunts, (ASD, VSD PDA) may represent up 10% -of all congenital cardiac anomalies. Rarely anomalous venous return, tetralogy of Fallot, congenitally corrected L-transposition of great vessels, Ebstein's anomaly, cor-triatrium may also be seen with late presentation in life. Functional assessment of the right heart represents an important aspect of imaging in ACHD patients. CT scan with excellent temporal and spatial resolution is an excellent imaging modality for assessing heart structure. MRI provides comprehensive functional information for both cardiac chambers and vasculature. It is important for the radiologists to be able to recognise common undiagnosed congenital heart disease in adult patient, even as an incidental finding.

## CAEE-50 CHALLENGING ANATOMIC AND PATHOLOGIC FEATURES FOR TAVR PROCESSING: PEARLS AND PITFALLS FROM THE 3D IMAGING LABORATORY

Frank J. Rybicki III, MD, PhD (*Abstract Co-Author*) Medical Director, Imagia Cybernetics Inc
Michael F. Morris, MD (*Abstract Co-Author*) Educator, Medtronic plc
Kimberly Hatch, ARRT, BA (*Abstract Co-Author*) Nothing to Disclose
Richard L. Hallett II, MD (*Presenter*) Consultant, Bracco Group

**TEACHING POINTS**

3D segmentation and post-processing of CT datasets is essential for safe and successful transcatheter aortic valve replacement (TAVR) procedural planning. High quality 3D Imaging Laboratory output contributes to shortened procedural times, improved patient safety, and supports excellent clinical outcomes.This presentation will: Review challenging anatomic, pathologic, and iatrogenic findings that may be encountered during 3D processing for TAVR planning. Provide practical processing techniques to overcome challenging and/or unexpected anatomy and generate highly accurate output for TAVR procedural planning. Examples include annular sizing, coronary anatomy, bicuspid aortic valve / aortic root / LVOT geometry, and challenging access considerations. Review processing pitfalls that may adversely impact processing output and procedural success.

**TABLE OF CONTENTS/OUTLINE**

A. Aortic valve / root / LVOT considerations: 1. Bicuspid aortic 2. Valve Valve in Valve (ViV) 3. Valve in TAVRB. Challenging annular configurations: 1. Subannular / LVOT calcification and alterationC. Coronary artery challenges: 1. coronary height, origin, and courseD. Access Considerations: 1. Aortic pathology 2. Iliofemoral segment pathology 3. Subclavian / carotid artery pathology 4. Direct access (aorta, LV apex)

## CAEE-51 HEMOPERICARDIUM: CASE BASED REVIEW OF POTENTIAL ETIOLOGIES AND KEY IMAGING FINDINGS

**Awards**
**Certificate of Merit**

Larry A. Latson JR, MS,MD (*Abstract Co-Author*) Nothing to Disclose
Geraldine T. Brusca-Augello, DO (*Abstract Co-Author*) Nothing to Disclose
Joanna G. Escalon, MD (*Abstract Co-Author*) Research Consultant, Vingroup
David Jones (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Hemopericardium is the accumulation of blood in the pericardial space. It often signals a life-threatening event and finding the source of bleeding is essential in expediting appropriate care. Furthermore, depending on the rate of accumulation, hemopericardium in and of itself can be fatal due to the development of cardiac tamponade. In order to quickly make this essential diagnosis, the radiologist must be familiar with the imaging findings of hemopericardium and tamponade and the potential causes.

**TABLE OF CONTENTS/OUTLINE**

1. Imaging findings of hemopericardium and tamponade. 2. Case-based review of the causes of hemopericardium including associated key imaging features and associated findings, including: (A) Acute vascular disease - i. ruptured aortic dissection, ii. ruptured myocardial infarction, (B) Iatrogenic - i. pacemaker perforation, ii. Mediport malposition, iii. Post-CABG; (C) Post-traumatic - i. cardiopulmonary resuscitation; (D) Other - i. pericarditis, ii. malignancy, iii. anti-coagulation therapy.

## CAEE-52 TIPS AND TRICKS TO AVOID PITFALLS IN INTERPRETATION OF CORONARY CT ANGIOGRAPHY

**Awards**
**Certificate of Merit**

Baskaran Sundaram, MD (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To highlight key pitfalls that are encountered in coronary CTA interpretation 2. To illustrate the recognition of these pitfalls using representative case examples

**TABLE OF CONTENTS/OUTLINE**

1. False negative stenosis a) Non-calcific plaque not obvious in axial plane, e.g. left main- Use orthogonal, MIP, VR b) Plaque ignored as partial voluming (mid LAD, distal RCA)- Use orthogonal plane c) "Blind spots", LAD near diagonal, LCx near OM, RCA near PDA- Thin MIPs d) Small vessels- thin slice, sharp kernels e) Bypass graft landing zone, runoff f) Stent with distal contrast- Contrast attenuation in stent g) Subtle/absent stenosis- Evaluate regional wall motion/ perfusion defect 2. False positive stenosis a) Ghosting- Absent in another cardiac phase b) Misregistration - Confirm in another plane and phase c) Low attenuation in vessel without plaque - Confirm absence of plaque d) Low attenuation of beam hardening of calcified plaque e) Dense calcified plaques- Curved MPR 3. Overestimation of stenosis a) Using single cross sectional plane-Orthogonal views, cMPR b) Quantifying outer-to-outer diameters instead of inner-to-inner diameters- remodeling c) Using tiny distal vessel beyond bifurcation as reference d) Calcium blooming -wider window, sharper kernel, thinner slices, 100 keV VMI e) Poor contrast enhancement- Different windowing (e.g 700/250) f) Intense contrast enhancement- Different windowing (1000/200) 4. Underestimation of plaque a) Calcified plaque in contrast CT b) Motion 5. Strategies to avoid pitfalls a) Systematic review b) Multiple reconstruction techniques- MPR, cMPR, MIP, VR c) Multiple planes- Axial, orthogonal, longitudinal, cross-sectional

## CAEE-53 CT GUIDANCE FOR PERCUTANEOUS CORONARY ARTERY INTERVENTIONS

**Awards**
**Certificate of Merit**

Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review the expanding role of CT in the guidance of percutaneous coronary interventions (PCI) 2. To discuss the role of CT in determining suitability for PCI 3. To highlight the utility of CT in cath lab resource optimization and real-time guidance

**TABLE OF CONTENTS/OUTLINE**

A. Need for PCI 1) Stenosis severity 2) Flow-limiting stenosis- FFRct/CTperfusion(CTP) B. Suitability for PCI 1) Focal lesion + FFRct < 0.8 2) FFRct virtual planner 3) FFRct virtual pullback C. Planning PCI 1) Risk-stratification- High-risk plaque increases MI, no-reflow 2) Coronary ostial origin- Atypical position needs different catheters 3) Anomalies- Change approach 4) Proximal lesion- deep cannulation obscures lesion 5) Optimal fluoroscopy angles for specific segments 6) Lesion length- Stent sizing 7) Extensive calcifications-need lithotripsy/atherectomy 8) Soft plaque at landing zone- dissection risk 9) Ostial lesions- Precise demarcation 10) Bifurcation lesions-Side branch demarcation, virtual FFRct, subtended myocardium 11) 3D calcium model- planning additional procedures 12) Wire simulator D. Real-time procedural guidance Fusion of 3D CT plaque map E. Planning complex multivessel CAD 1) CABGvsPCI, CT-SYNTAX 2) Lesion severity,length,focality 3) Landing zone, run off 4) Calcification 5) CTP- subtended myocardium, scar 6) LAD-D1 distance-sequential graft 7) RIMA,LIMA 8) Redo CABG- sternal relationships, aortic calcification F. Planning Chronic total occlusion 1) Poor outcome predictors- > 15 mm long, calcification > 5.5 mm / > 50 % of area, shrinkage, bend angle > 45° 2) Risk scores- JCO,CT RECTOR,KCCT G. Planning for redo revascularization 1) Repeat PCI- CTP for defect 2) PCI after CABG- CTA improves procedure planning

## CAEE-54 UTILITY OF CT IN TRANSCATHETER CLOSURE OF PARAVALVULAR LEAKS

**Awards**
**Certificate of Merit**

Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review the etiology and pathophysiology of paravalvular leaks (PVL) 2. To understand the utility of CT in evaluating these patients 4. To illustrate the important CT measurements and clinical significance 5. To review the CT findings of common complications after PVL closure

**TABLE OF CONTENTS/OUTLINE**

Table of contents 1. Paravalvular leaks a) Etiology- Suture dehiscence, endocarditis, inflammation, degeneration b) Symptoms- CHF, hemolysis 2. Role of multimodality imaging in diagnosis and management a) Echo-limitations b) MRI- limitations c) CT 3. CT protocol- Retrospective ECG gating, delayed phase, non con 4. CT for diagnosis a) Diagnostic criteria b) Pitfalls- surgical material, metals, small c) Differentials-pseudoaneurysm, abscess 5. Management a) Indications for closure- symptoms, significant PVL b) Transcatheter vs surgical c) Transcatheter- high surgical risk, suitable anatomy 6. Devices for PVL closure- Vascular, ductal or septal occluder devices- Amplatzer vacular plug (I, II) 7. Access routes- Transeptal, transapical, retrograde arterial 8. Role of CT in planning PVL closure a) No acoustic shadows or artifacts b) Higher temporal resolution than 3D color doppler c) Characterization d) Most valuable in complex tract 9. CT parameters a) Location - Clockface position- Mitral anteromedial (10/11 o clock) or posterolateral (5/6 o clock) b) Size c) Shape d) Course e) Tract f) Fluoroscopic angles g) Contraindications- Infection, abscess, rupture 10. 3D printing a) Virtual device placement 11. Procedure technique - CT fluoro fusion 12. Follow-up protocol 13. Post-procedural CT- Normal appearances 14. Complications- Device migration, recurrent leak, infection, rupture 15. Conclusion

## CAEE-55 MYOCARDIUM IN DISARRAY: THE BASIC PHYSIQUES OF HYPERTROPHIC CARDIOMYOPATHY AND BEYOND

Jose A. Maldonado, MD (*Abstract Co-Author*) Nothing to Disclose
Ellis D. Mejias Febres, BS (*Abstract Co-Author*) Nothing to Disclose

Alejandro M. Linera Asencio, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Acosta (*Abstract Co-Author*) Nothing to Disclose
Kevin Hornedo, BS (*Abstract Co-Author*) Nothing to Disclose
Santiago A. Saldana Mendez, MD, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A. Review the pathophysiology and clinical picture of Hypertrophic Cardiomyopathy (HCM). B. Discuss HCM diagnosis and cardiac magnetic resonance imaging (MRI) findings C. Provide an overview of the different HCM morphologies including epidemiology, prognosis, and treatment implications. D. Examine late gadolinium enhancement (LGE) quantification analysis E. Highlight additional key imaging findings for optimal risk stratification for Sudden Cardiac Death (SCD).HCM is one of the leading causes of SCD among young people. The degree and pattern of left ventricular wall thickening have implications that impact the clinical course of patients with HCM. Our goal is to provide radiology trainees, radiologists, and clinicians an overview of the different phenotypes of HCM. We will do so by using cardiac MRI case examples, while highlighting the indispensable role of cardiac MRI in the assessment of HCM. We will also examine the pivotal role of LGE quantification analysis and other key imaging findings for optimal risk-stratification for SDC.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction Objectives II. HCM A. Pathophysiology Clinical presentation B. Diagnosis C. Cardiac MRI Imaging findings III. Overview of HCM phenotypic presentations A. Prevalence, epidemiology, prognosis, and treatment B. MRI case examples IV. Examine LGE Quantification Analysis V. Risk-Stratification for SCD VI. Discuss the role of cardiac MRI VII. Conclusion

## CAEE-56 UNDERSTANDING EXERCISE CMR: A REVIEW OF ITS QUALITIES, METHODS AND CLINICAL APPLICATIONS

Ming-Yen Ng, BMBS, FRCR (*Abstract Co-Author*) Education Grant, General Electric Company;Education Grant, Bayer AG;Education Grant, Circle Cardiovascular Imaging Inc;Education Grant, TeraRecon, Inc;Education Grant, Arterys Inc;Speakers Bureau, Boehringer Ingelheim GmbH
Calvin Chin (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Chit Wai Chan (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Understanding the (1) Roles of exercise CMR (Ex-CMR), its principles, and how Ex-CMR compares against other forms of stress tests. (2) Different types of Ex-CMR, their respective strengths and limitations. (3) How Ex-CMR is performed, challenges associated with acquiring images and safety considerations associated with exercise stress testing. (4) Clinical applications of Ex-CMR in terms of diagnosing coronary artery disease (CAD) and differentiating between dilated cardiomyopathy (DCM) and exercise-induced cardiac remodeling (EICR). (5) Interpreting the results of Ex-CMR using real case examples.

**TABLE OF CONTENTS/OUTLINE**

(1) Overview: An overview of Ex-CMR, including the principles behind it, the different forms of Ex-CMR and their respective strengths and limitations, and an evaluation of the strengths and limitations of Ex-CMR compared against other methods. (2) Performing the scan: the typical protocol for Ex-CMR is explained. We also explain the challenges in Ex-CMR in terms of achieving an adequate spatial-temporal resolution with free breathing sequence, with an example scan to illustrate the point. Safety considerations including contraindications to Ex-CMR and indications for test termination are overviewed. (3) Clinical applications: we review the clinical applications of Ex-CMR using 2 examples: diagnosing CAD and differentiating between DCM and EICR in athletes. (4) Case examples: we present 2 case examples to illustrate the aforementioned clinical applications of Ex-CMR with annotated and labeled scans and an explanation of how the scans are interpreted. (5) The future of Ex-CMR: a brief overview of the future developments related to Ex-CMR is presented.

## CAEE-57 LATE GADOLINIUM ENHANCEMENT FINDINGS IN HOSPITALIZED COVID-19 PATIENTS: A FOCUS ON THE POST-ACUTE PHASE

Maria Davo Jimenez, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lee (*Abstract Co-Author*) Research Grant, Abbott Laboratories;Spouse, Employee, Takeda Pharmaceutical Company Limited
Daniel Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Suvai Gunasekaran, PhD (*Abstract Co-Author*) Nothing to Disclose
Golnoosh Ansari, MD (*Abstract Co-Author*) Nothing to Disclose
Brandon Benefield (*Abstract Co-Author*) Nothing to Disclose
Kevin Wojciechowski (*Abstract Co-Author*) Nothing to Disclose
Cagdas Topel, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To demonstrate late gadolinium enhancement (LGE) findings in 12 patients who underwent cardiac magnetic resonance (CMR) during the peak phase of the COVID-19 pandemic

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to cardiovascular impact of COVID-19 infection• Recent studies indicate that 26% to 60% of hospitalized COVID-19 survivors show CMR abnormalities, such as functional impairment, myocardial injuries, late gadolinium enhancement, or pericardial abnormalities.2. Literature review of the LGE findings in patients with COVID-19• A wide range of "myocarditis-like" or "ischemic-like" LGE patterns can be found.3. LGE features in different phases of myocardial injury• Presentation of cases with various LGE findings at different stages.4. Conclusions• A variety of LGE patterns were found in patients with a history of hospitalization due to COVID-19.• LGE can be observed after the acute phase of the disease, with normalized T1, T2 and extracellular volume (ECV) fraction.

## CAEE-58 MYOCARDIAL STRAIN - A PRACTICAL APROACH

Ana Garcia de Vicente, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Torres Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Jesus Javier Martin Pinacho, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Angeles Fernandez-Mendez (*Abstract Co-Author*) Nothing to Disclose
Alvaro Arribas Marcos, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Siguenza-Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Alarcon Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

After reviewing this exhibit, the reader should: -Understand the concept of cardiac strain, its correlation with cardiac anatomy, and its significance in the pathophysiology of the cardiac cycle. - Comprehend the advantage provided by using cardiac strain over ejection fraction in the assessment of cardiac pathology. - Describing available techniques, their limitations, and the importance of strain assessment methods using MRI. -Be familiar with Fast-SENC sequences: Indications, technique application, postprocessing techniques. - Apply the acquired knowledge to real-life cases.

**TABLE OF CONTENTS/OUTLINE**

- Introduction - Pathophysiology - MRI techniques for strain assessment o Tagging o Feature tracking o Fast-SENC - Fast-SENC o Acquisition o Post-processing - Practical cases o Patients at risk of developing cardiotoxicity caused by anticancer treatment o Postinfectious heart failure: Chagas o Heart failure with normal FEVI parameters o Congenital cardiomyopathies o Other cardiac pathology - Conclusions

## CAEE-59 MALIGNANCY IN CONGENITAL HEART DISEASE

**Awards**
**Cum Laude**

Swati S. Mody, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Aparna Joshi, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Joynt (*Abstract Co-Author*) Nothing to Disclose
Michael Dimaria (*Abstract Co-Author*) Nothing to Disclose
Adam L. Dorfman, MD (*Abstract Co-Author*) Nothing to Disclose
Sowmya Balasubramanian, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Prachi P. Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Jimmy C. Lu, MD (*Abstract Co-Author*) Nothing to Disclose
Tobias Else (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Lee, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Cancer is more prevalent in patients with congenital heart disease (CHD) than the general population due to genetic and environmental risk factors including radiation exposure from imaging, genetic disorders, and alterations in physiology which promote tumorigenesis. 2. Cardiac hepatopathy increases the risk of hepatocellular carcinoma. Screening with US and alpha-fetoprotein levels in patients with single ventricle physiology, chronic heart failure and after Fontan palliation may help identify this complication. 3. Pheochromocytomas and paragangliomas develop in patients with cyanotic heart disease at higher rates than the general population and those with non-cyanotic CHD. 4. Genetic disorders can predispose to both CHD and tumors, for example Down syndrome (CHD risk and leukemia, testicular germ cell tumors). 5. Those patients receiving transplant for CHD are at elevated risk of various tumors including viral induced lymphomas as well as various solid organ tumors. 6. With increasing survival of patients into adulthood and the higher predisposition to cancer, adherence to screening is essential, although observational studies suggest lower screening rates in CHD patients.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: Risk of tumors in CHD. 2. Factors which may contribute to increased risk of cancer in congenital heart disease: radiation exposure from diagnostic and therapeutic procedures, specific tumors related to CHD physiology (hepatocellular carcinoma, neuroendocrine tumors), genetic disorders predisposing to CHD and tumors, cancers which develop after cardiac transplant for congenital heart disease (lymphoma, solid organ tumors) 3. Screening for malignancy in CHD population

## CAEE-6 IMAGING REVIEW OF ACUTE CHEST PAIN WITH FOCUS ON CT AND MRI IN THE EMERGENCY SETTING

Thurl Cledera, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Acute chest pain is one of the most common complaints in the emergency department. Imaging with the help of proper clinical examination is a crucial component of evaluation in these patients. While ECG is mandatory in examinations for screening STEMI and NSTEMI, and chest radiography is a standard imaging examination, CT and/or MRI is valuable in the immediate detection or exclusion of a myriad of conditions presenting with acute chest pain. The appropriate choice of imaging test is affected by the suspected diagnosis and availability of the modality in question. This exhibit will present imaging modalities pertinent to acute chest pain and scenarios pertaining to acute coronary syndrome, cardiac, and noncardiac causes of chest pain. The objectives of this exhibit are: 1) To discuss current guidelines in assessing acute chest pain and how it intersects with the role of noninvasive imaging, 2) To review imaging features of cardiac and noncardiac causes of acute chest pain, and 3) To enable the radiologist to recommend appropriate imaging modalities and guide proper treatment

**TABLE OF CONTENTS/OUTLINE**

I. Introduction II. Acute Versus Stable Chest Pain III. Considerations in the Patient Presenting with Acute Chest Pain IV. Overview of Imaging Modalities A. Anatomic Testing B. Functional/Stress Testing V. Imaging Scenarios A. Acute Coronary Syndromes B. Myocardial Infarction with Nonobstructive Coronary Arteries (MINOCA) C. Prior CABG Surgery D. Suspected Myopericarditis E. Valvular Heart Disease F. Acute Aortic Syndrome G. Thromboembolism H. Noncardiac Causes VI. Teaching Points VII. Conclusion

## CAEE-60 PERICARDIAL PRIMER: AN IMAGING REVIEW OF ABNORMALITIES INVOLVING THE PERICARDIUM

Justin Sindoni, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Describe normal pericardial anatomy and the expected appearance of the pericardium on CT and MRI.
- Review CT and MRI features of congenital, infectious, inflammatory, traumatic, and malignant pericardial abnormalities.
- For each pericardial abnormality, describe the associated clinical presentation, differential diagnoses, potential complications, and recommendations for next steps in management.Background: The pericardium is comprised of an inner visceral layer and an outer parietal layer, which create a potential space containing approximately 30-50mL of serous fluid. The pericardium surrounds the heart and great vessel origins, and normally measures less than 2mm in thickness. In addition to creating a physical barrier between the heart and lung pleura, the pericardium also regulates cardiac chamber pressures and optimizes cardiac motion. As a result, congenital and acquired pericardial abnormalities can be extremely detrimental to a patient's cardiovascular function. This exhibit will review the myriad of congenital, infectious, inflammatory, traumatic, and malignant abnormalities that can involve the pericardium. The goal of this exhibit is to expedite diagnosis and management of clinically significant pericardial pathologies seen on CT and MRI.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Review of normal pericardial anatomy
- Discussion of expected appearance of the pericardium on CT and MRI
- Case-based review of pericardial pathologies, organized into the following broad categories:
- Congenital
- Infectious
- Inflammatory
- Traumatic
- Primary pericardial malignancy
- Pericardial metastasis

## CAEE-61 IMAGING OF CARDIAC DEVISE MIGRATION: A ROAD LESS TRAVELLED

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Sachin S. Saboo, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Avanish Sunnapwar (*Abstract Co-Author*) Nothing to Disclose
Dhruti Maisuri, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ameya J. Baxi, MBBS,DMRD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To recognize various cardiac devices on radiological imaging. Discuss indication proper positioning of various cardiac device placement Detect malposition, complication, common pitfalls of device

**TABLE OF CONTENTS/OUTLINE**

In recent years, there is increase in the number of implanted cardiac devices. Device migration/complications associated with cardiac device can occur because of local erosion, excessive tension during deployment, inadvertent deployment, inappropriate device sizing or due to congenital or surgical/procedural defects. Multiple factors can contribute to delayed diagnosis of a migrated device, including lack of familiarity with the device, cognitive errors, radiographic technique. It may be challenging, but important to radiologist as how they appear on imaging, normal positions, complications. Radiologists must employ multiple strategies like comparing images with prior studies, reading recent relevant literature about interventional/surgical procedures implanted devices, and clinic notes. Radiologists play critical role in ensuring appropriate placement may be the first medical professionals to suggest unsuspected device migration. This review gives concise summary of various cardiac devices and complicationsAims/Objectives
- Introduction
- Pathology, role of imaging, imaging findings of malposition, complication, common pitfalls
- PICC line
- Pacemaker/ intracardiac defibrillator
- PCWP catheter
- ASD closure device
- Prosthetic aortic valve
- Prosthetic mitral valve
- Mitral valve clips
- TRANSCATHETER VALVES AND VALVE REPAIR
- Aortic stent
- Watchman device
- VENTRICULAR ASSIST DEVICES
- ECMO
- IMPLANTABLE LOOP RECORDER
- Miscellaneous
- Differential diagnosis
- Conclusion

## CAEE-62 CT CORONARY ANGIOGRAPHY FRACTIONAL FLOW RESERVE ($FFR_{CT}$) IN ASSESSMENT OF PATIENTS WITH CORONARY ARTERY DISEASE: A PRIMER FOR A RADIOLOGIST

Charit R. Tippareddy, MD (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Syed Muhammad Awais Bukhari, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamin Parker, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.To review how fractional flow is derived2.To review landmark clinical trials supporting the clinical usage of FFRCT3.To highlight clinical cases where FFRCT can influence management4.To highlight important limitations of FFRCT technology5.To discuss the future role and newer tools of non-invasive ischemia/plaque assessment

**TABLE OF CONTENTS/OUTLINE**

1) FFRCT: basics, workflow and reportinga. Computational flow dynamics and fractional flow reserve.b. FFRCT vs FFR Invasive -> pros and consc. Recommendations for interpretation of FFRCT results2) Literature supporting FFRCT in the clinical practicea. PRECISEb. TARGETc. FORECASTd. PLATFORMe. NXTf. DeFACTOg. DISCOVER-FLOW3) Clinical instances where FFRCT can augment diagnostic confidence and patient managementa. Borderline stenosis (50-70 %) on visual analysis.b. Isolated severe branch vessel disease.c. Heavily calcified coronary arteries.d. Tandem stenoses.e. Noninvasive preoperative clearance for coronary artery disease4) Limitations/Challenges of FFRCT analysis:a. Image Quality is central to study accuracy: Electrocardiographic (EKG) misregistration, Motion artifacts and increased noise precludes accurate assessment.b. Vessel Tortuosity, Stents and grafts.c. False positive results: Due to motion, suboptimal coronary vasodilatation and ventricular hypertrophy.d. False negative results: Due to motion, ultrashort segment plaque, manual segmentation error.e. Workflow and Reimbursement5) Future directionsa. Appropriate use of FFRCTb. Prediction of post-stenting FFRc. Plaque analysis

## CAEE-63 A PRACTICAL GUIDE TO IMPLEMENTATION OF PHOTON COUNTING DETECTOR CT (PCD-CT) IN CARDIAC IMAGING

**Awards**
**Certificate of Merit**

Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Brooke Nordine (*Abstract Co-Author*) Nothing to Disclose
Mitchell Owen (*Abstract Co-Author*) Nothing to Disclose
Holly Kasten (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Prabhakar Rajiah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Nikkole Weber, ARRT, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Explain unique technologic advantages of Photon Counting Detector CT (PCD-CT) that improve cardiac imaging Describe steps and provide key information for protocol development and optimization of imaging parameters specific to PCD scanners Discuss downstream challenges in image reconstruction, analysis and advanced post processing applications Demonstrate optimized cardiac imaging parameters through case review

**TABLE OF CONTENTS/OUTLINE**

Technologic advantages of PCD Ultra-high resolution (UHR) (0.2mm)- Small vessels, stents, plaques Multi energy (ME) (0.4mm) - High iodine signal, less artifacts, material characterization, k-edge Improved radiation dose efficiency Increased iodine contrast to noise ratio (CNR) Decreased noise Patient prep changes Protocol development Scan modes UHR (without ME)- Spiral (sequential-not preferred) Standard resolution with ME- Spiral with retrospective ECG gating, sequential, high-pitch helical Mode selection- indication, heart rate, heart rate variability, body habitus Tube potential selection Slice thickness/ interval Kernels- sharp vs smooth, body regular, body vascular, quantum regular Matrix- 512 vs 1024 Image types VMI- Single energy like (T3D) VMIs Virtual non-contrast Iodine map Virtual calcium removal Virtual non-iodine Auto post processing done at scanner increased efficiency Coronary calcium scoring Curved planar reformats of coronary arteries VR models of heart Downstream effects and challenges PACS - Image numbers, storage Advanced imaging 3D visualization FFRct 3D printing Plaque Analysis Artifacts- Noise in UHR mode, motion artifacts, artificial appearing images, edge enhancement Case review with optimized imaging parameters

## CAEE-64 30-MINUTE EXAM OF CARDIAC MAGNETIC RESONANCE IMAGING WITH DEEP LEARNING-BASED HIGHLY-ACCELERATED CARDIAC CINE AND SINGLE-SHOT MYOCARDIAL DELAYED ENHANCEMENT WITH DEEP LEARNING RECONSTRUCTION

Kunihiro Yoshioka, MD (*Abstract Co-Author*) Nothing to Disclose
Tsuyoshi Sugawara (*Abstract Co-Author*) Nothing to Disclose
Makoto Orii (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Society for Cardiovascular Magnetic Resonance offer a basic 30-min cardiac magnetic resonance (CMR) exam that answers many of the common clinical questions in cardiovascular practice (Figure 1). But in the real world, historic time slots of 60 min or longer hinder improved access to CMR. The total exam time can be reduced if high-quality 2D cine images can be collected post-contrast to minimize non-scanning time prior to myocardial delayed enhancement (MDE) imaging. Recent development of deep learning-based highly-accelerated cardiac cine (DL cine) has the potential to reduce scan time while preserving image quality (Figure 2). With the use of DL cine, 2D cine imaging can be performed after contrast injection during a waiting time for MDE imaging. Moreover, the diagnostic performance of DL cine pre- and post-contrast injection is expected to be comparable in terms of image quality and quantification of biventricular volume and function (Figure 3). Single-shot MDE (SSMDE) with deep learning reconstruction (DLR) could acquire each slice in a single heartbeat and allows for image acquisition of entire left ventricle in a few breath-holds (Figure 4). Several studies have reported that SSMDE with DLR provides similar diagnostic accuracy compared to conventional approach. Combined 2D DL cine and SSMDE with DLR, we could achieve a basic 30-min CMR exam with routine techniques that answers many of the common clinical questions (Figure 5).

**TABLE OF CONTENTS/OUTLINE**

Figure 1: Classical workflow of CMR. Figure 2: 2D DL cine. Figure 3: Comparison of pre- and post-contrast short-axis DL cine images of a patient with cardiac sarcoidosis. Figure 4: SSMDE with DLR. Figure 5: New 30-min workflow of CMR using DL cine and SSMDE with DLR.

## CAEE-65 THE IMPACT OF PHOTON-COUNTING DETECTOR CT IN ASSESSMENT OF CARDIAC DISEASE

Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Misugi Urano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seita Watanabe, RT (*Abstract Co-Author*) Nothing to Disclose
Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nobuo Kitera, RT, MSc (*Abstract Co-Author*) Nothing to Disclose
Shibuki Matsui (*Abstract Co-Author*) Nothing to Disclose
Masaya Kisohara, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. True semiconductors such as CdTe are energetically stable. Photons above the band gap form electron-hole pairs in semiconductors. CdTe is used in photon-counting detectors (PCD) and scintillators are used in energy-integrating detectors (EID).2. The unique structure of the photon-counting CT includes an application specific integrated circuit (ASIC), which counts the electrons converted from photons at each threshold value.3. PCD-CT can provide low-noise, high-resolution images and has excellent imaging performance, especially in the evaluation of coronary arteries.4. PCD-CT is capable to obtain spectral data with single pair of X-ray tube and detector, and dual energy analysis on high temporal resolution can be performed using dual-source PCD-CT (DS-PCD-CT)5. Cardiac extracellular volume (ECV) can now be realistically quantified by the iodine method thanks to the availability of high temporal resolution iodine values.

**TABLE OF CONTENTS/OUTLINE**

1. Physical properties of semiconductor which is used in PCD-CT and scintillator which is used in EID-CT.2. The principle of photon counting by ASIC and its features.3. Differences in the ability of EID-CT and PCD-CT to visualize stents after percutaneous coronary intervention.4. A case in which an iodine map obtained from DS-PCD-CT with high temporal resolution allowed the assessment of contrast failure and late iodine enhancement reflecting myocardial ischemia.5. Quantification of cardiac ECV by the Iodine method made possible by high temporal resolution using DS-PCD-CT.

## CAEE-66 INSIGHTS INTO LEFT VENTRICULAR HYPERTROPHY: CARDIAC MAGNETIC RESONANCE IN DIFFERENTIAL DIAGNOSIS

Andres Enriquez-Puga, MBChB, MSc (*Abstract Co-Author*) Nothing to Disclose
Maria M. Merideno Garcia, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Calero Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Mar Cespedes Mas (*Abstract Co-Author*) Nothing to Disclose
Victoria Esteban Izquierdo, MD (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To provide a thorough overview of the differential diagnosis of left ventricular hypertrophy (LVH) using cardiac magnetic resonance (CMR), with specific emphasis on achieving the following key learning objectives: - To comprehend the most valuable CMR sequences and their respective informative contributions. - To identify the various underlying diseases associated with the phenotypic expression of LVH.- To provide a succinct and pragmatic summary that facilitates clinical practice.

### TABLE OF CONTENTS/OUTLINE

- Objectives - Role of cardiac magnetic resonance in the assessment of LVH and the most useful sequences: 'steady state free precession' (SSFP) to study morphology and function, native T1 mapping for myocardial tissue characterization, and late gadolinium enhancement for evaluating fibrosis in various regional distributions. - Epidemiological data, clinical and therapeutic management, and CMR findings in the main diagnostic entities following LVH: hypertensive heart disease, hypertrophic cardiomyopathy, cardiac amyloidosis, Fabry disease, athlete's heart, aortic valve stenosis, and cardiac sarcoidosis. - Conclusions, summary of various diseases, and a table to aid in the clinical practice - References

## CAEE-67 STRATEGIES FOR BETTER IMAGING CORONARY STENTS AFTER PERCUTANEOUS CORONARY INTERVENTION (PCI) IN CORONARY CT ANGIOGRAPHY

Jianying Li, PhD (*Abstract Co-Author*) Employee, General Electric Company
Jianxin Guo (*Abstract Co-Author*) Nothing to Disclose
Tingting Qu (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Point out the limitations of displaying coronary stents in conventional coronary CT angiography (CCTA).2) Demonstrate the advantage of SSF2 in CCTA compared to standard algorithm without motion correction (STD) and with the first-generation snapshot freeze (SSF1).3)Demonstrate the strategies to improve the clarity of coronary stent display.

### TABLE OF CONTENTS/OUTLINE

1)Limitations of coronary stent display in CCTA• The high density of coronary stents in CT images naturally affects the observation of coronary artery within the stent.• The dual effects of motion artifacts and metal artifacts seriously affect the display of the stent and the in-stent lumen.• Artifacts caused by the stent in the coronary lumen may lead to misdiagnosis.2) Advantages of SSF2• SSF2 reduces both coronary motion artifacts and overall cardiac motion artifacts.• Reduce the motion artifacts of the stent and its surrounding tissues to enable clearer display of the stent. • Highly inclusive, provides excellent for patients with irregular heart rate and inability to hold their breath.3) Strategies• Iterative reconstruction or Deep learning reconstruction to reduce image noise.• Using high-resolution scanning protocol (high kVp, low mA, and small focal spot).• Using SSF2 reconstruction to reduce motion artifacts.

## CAEE-68 INFECTIVE ENDOCARDITIS: THE MANY FACES OF DEATH

Fernanda Ragonetti (*Abstract Co-Author*) Nothing to Disclose
Jose R. Parga, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Vaz (*Abstract Co-Author*) Nothing to Disclose
Luiz Carlos D. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo E. Catarina, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin De Paula (*Abstract Co-Author*) Nothing to Disclose
Joao Antonio Martins De Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Artur S. Santos SR, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Ingrid Stefanie Sarmento Debaco (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Serra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

TP1: [Infective endocarditis (IE) can affect both native and prosthetic valves, leading to valvular (vegetations, leaflet perforation, and prosthetic dehiscence) or perivalvular complications (abscess, pseudoaneurysm, and fistula)]TP2: [Cardiac computed tomography angiography (CTA) is recommended by the European Society of Cardiology (ESC) guidelines to aid in the diagnosis and treatment planning of IE]TP3: [Electrocardiographic gating significantly increases the accuracy of CTA for the diagnosis of valvular or perivalvular complications]TP4: [CTA is particularly useful in patients with poor acoustic windows, complex cardiac anatomy, detection of distant lesions, preoperative assessment of coronary artery disease, and investigation of alternative diagnoses]

### TABLE OF CONTENTS/OUTLINE

I. IntroductionA. Overview of the role of CTA according to recent ESC guidelinesB. Significance of cardiac CTA in improving the accuracy for infective endocarditisII. MethodsA. Selection of confirmed cases of IE who underwent cardiac CTAB. CTA protocol descriptionIII. Results DiscussionA. Presentation of CTA images demonstrating valvular and paravalvular findings (extracardiac features were also briefly addressed)B. Definition, risk factors, clinical significance, and impact on patient management were reviewed for each complicationIV. Conclusion

## CAEE-69 TESTING THE WATERS: A COMPREHENSIVE REVIEW OF ENTITIES CAUSING MYOCARDIAL EDEMA WITH SYSTEMATIC AND CASE-BASED APPROACH

**Awards**
**Magna Cum Laude**

Emrah Duman, MD (*Abstract Co-Author*) Nothing to Disclose
Zehavit Kirshenboim (*Abstract Co-Author*) Nothing to Disclose
Timothy Wong (*Abstract Co-Author*) Nothing to Disclose
Chad Kosanovich (*Abstract Co-Author*) Nothing to Disclose
Omer Onder, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Myocardial edema is characterized by abnormal myocardial fluid accumulation due to impaired fluid homeostasis, triggered by a complex interplay of cellular, molecular, and hemodynamic factors. 2. It is a complex pathological phenomenon with diverse clinical manifestations, playing a pivotal role in the pathophysiology of various cardiovascular conditions such as ischemic, inflammatory, infiltrative, toxic, infectious, and autoimmune diseases. 3. Familiarity with diagnostic challenges/strategies, differential diagnoses of myocardial edema-associated conditions, and the implications of myocardial edema for risk stratification can enable radiologists to contribute significantly to patient management. This presentation will examine the role of cardiac MRI in characterizing myocardial edema through various case examples and a comprehensive review of existing literature.

**TABLE OF CONTENTS/OUTLINE**

A. Pathophysiological basis of myocardial edema B. Radiological evaluation - Image acquisition post-processing - Image interpretation: Pearls Pitfalls - Pattern-based approach: Focal, regional, patchy diffuse involvement C. Differential diagnosis clinical importance of myocardial edema with case examples - Myocardial ischemia/infarction - Post-arrest/post-surgical - Heart transplantation - Heart failure myocardial remodeling - Myocarditis - Stress-induced cardiomyopathy - Toxic/drug-induced cardiomyopathy - Hypertrophic cardiomyopathy - Dilated cardiomyopathy - Sarcoidosis - Amyloidosis - Rheumatologic diseases - Miscellaneous: Chronic kidney disease, sepsis, systemic pulmonary hypertension, myocardial contusion, other cardiomyopathies D. Summary conclusion

## CAEE-7 HEARTBREAK AND HEALING: UNDERSTANDING TAKOTSUBO SYNDROME

Udane Oiartzabal, MD (*Abstract Co-Author*) Nothing to Disclose
Virginia Diaz (*Abstract Co-Author*) Nothing to Disclose
Leire Ormaetxe Albeniz, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Uxue Martinez Urabayen, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rodriguez Ripalda, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the pathophysiology of Takotsubo syndrome.Identify the manifestations of Takotsubo syndrome on MRI, as well as its main differential diagnoses.

**TABLE OF CONTENTS/OUTLINE**

Takotsubo syndrome, also known as broken heart syndrome or stress cardiomyopathy, presents as an acquired cardiomyopathy causing transient and reversible systolic dysfunction without obstructive coronary artery disease. It is typically triggered by a stressful event and predominantly affects postmenopausal women. This syndrome shares clinical and electrocardiographic characteristics with acute coronary syndrome, initially making it difficult to distinguish between the two.During the initial diagnostic evaluation, echocardiography and cardiac catheterization typically reveal apical dyskinesia without significant evidence of coronary artery obstruction.Magnetic Resonance Imaging (MRI) plays a crucial role in diagnosing and monitoring these patients, providing an accurate assessment of global ventricular function, defining wall motion abnormalities, assessing myocardial edema and detecting complications.We present a case review highlighting the MRI features of Takotsubo cardiomyopathy and its complications, focusing on differentiating this condition from acute myocardial infarction and acute myocarditis. Although this condition generally follows a benign course with a good prognosis, its acute phase may involve complications, with heart failure being the most common.

## CAEE-72 EXTREMELY RARE ISOLATED ATRIAL LESIONS WITH SIMILAR DIFFUSE ATRIAL WALL THICKENING FROM COMPLETELY DIFFERENT ETIOLOGIES: IMAGING FINDINGS, MANAGEMENT, AND COMPLICATIONS

**Awards**
**Certificate of Merit**

Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Masafumi Takafuji, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Haruno Ito (*Abstract Co-Author*) Nothing to Disclose
Shintaro Yamaguchi (*Abstract Co-Author*) Nothing to Disclose
Masaki Ishida, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Suguru Araki (*Abstract Co-Author*) Nothing to Disclose
Miyuko Fujita (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To discuss the clinical and imaging mimickers with diffuse atrial wall thickening but completely different etiologies. 2. To discuss the imaging findings and management strategies for isolated atrial lesions with diffuse atrial wall thickening. 3. To review the biopsy and pathologic findings isolated atrial lesions with diffuse atrial wall thickening. 4. To discuss the complications related to isolated atrial lesions with diffuse atrial wall thickening.

**TABLE OF CONTENTS/OUTLINE**

A) Differential diagnosis of clinical and imaging mimickers with diffuse atrial wall thickening but completely different etiologies: IgG4-related atrial cardiomyopathy, isolated atrial amyloidosis, atrial giant cell myocarditis. B) Typical imaging findings of isolated atrial lesions with diffuse atrial wall thickening: echocardiography, CT, cardiac MRI, FDG-PET/CT C) Clinical management of isolated atrial lesions with diffuse atrial wall thickening. D) Biopsy as a mandatory procedure for the final diagnosis in rare disease E) Complication of isolated atrial lesions with diffuse atrial wall thickening i. Atrial fibrillation ii. Atrial dysfunction iii. Atrial thrombus iv. Intramural atrial hemorrhagic dissection F) Case presentation: typical imaging findings, the course of treatment and the pathologic findings. i. IgG4-related atrial cardiomyopathy ii. isolated atrial amyloidosis iii. Atrial giant cell myocarditis

## CAEE-73 NAVIGATING ACROSS CORONARY ARTERIES: CT ANGIOGRAPHY CHARACTERIZATION OF CORONARY ATHEROSCLEROTIC PLAQUES ACCORDING TO THEIR CAD-RADS

Doris Licely Canche Aguilar, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Manuel Pineda Cordoba, MD (*Abstract Co-Author*) Nothing to Disclose
Luis Enrique Nunez Castellanos (*Abstract Co-Author*) Nothing to Disclose
Diego Leonardo Meza Neri (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To provide a pathophysiological overview of the formation of atherosclerotic coronary plaque and its cardiovascular impact on coronary heart disease.- Describe normal coronary anatomy.- Detail the specific radiological characteristics of a high-risk plaque to learn to recognize them.- Describe the pathophysiology of atherosclerotic plaque formation.- Learn to recognize the radiological features in healthy coronary arteries without atherosclerotic plaques and their significance.- Identify calcified and non-calcified coronary plaques through clinical cases.- Qualitatively assess the severity of coronary plaques.- Correctly interpret the CAD-RADS classification.- Understand the role of the radiologist in the interpretation of coronary CT angiography.- Describe the diagnostic and therapeutic conduct to follow according to the CAD-RADS classification.

**TABLE OF CONTENTS/OUTLINE**

1. Normal coronary anatomy in coronary CT angiography 1.1 Coronary segmentation2. Fundamentals of atherosclerotic plaque: What should the imaging specialist understand? 2.1 Epidemiology 2.2 Etiology 2.3 Main imaging characteristics of atherosclerotic plaques 2.4 Pathophysiology3. Principles and applications of coronary angiotomography in atheromatous plaque. 3.1 CAD-RADS implications and classification4. Radiological characterization of atherosclerotic plaque by AngioTAC according to CAD-RADS.4.1 High risk plaque 4.2 Low risk plaque 4.3 Diagnostic and therapeutic conduct according to CAD-RADS classification

## CAEE-74 UNUSUAL PERICARDIAL SPACES MIMICKING MEDIASTINAL TUMOR

Yo Won Choi, MD (*Abstract Co-Author*) Nothing to Disclose
Chang Guk Kim (*Abstract Co-Author*) Nothing to Disclose
Seung-Jin Yoo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review of the normal anatomy of the pericardial space 2. Review of the typical CT findings of the pericardial space. 3. Pericardial spaces mimicking mediastinal mass or lymphadenopathy. 4. How to differentiate mass-mimicking pericardial spaces from lymph nodes/mediastinal mass.

**TABLE OF CONTENTS/OUTLINE**

1. Normal anatomy of pericardial space 2. Review of typical CT findings of the pericardial space 3. Review of pericardial spaces mimicking mediastinal mass or lymph node. A. Sterno-pericardial ligament B. High-riding superior pericardial recess C. Pericardial diverticulum from superior pericardial recess 4. Differentiation between pericardial space with lymph nodes/mediastinal mass. 5. Summary

## CAEE-75 COMPREHENSIVE REVIEW OF NON-ATHEROSCLEROTIC CORONARY ARTERY DISEASES MIMICKING ACUTE CORONARY SYNDROME (ACS): ETIOPATHOGENESIS, IMAGING FINDINGS, AND DIFFERENTIAL DIAGNOSIS

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Sachin S. Saboo, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ameya J. Baxi, MBBS,DMRD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To discuss non-atherosclerotic coronary artery disease (CAD) 2. To study the role of imaging in the diagnosis and evaluation of these conditions 3. To discuss imaging based differential diagnosis

**TABLE OF CONTENTS/OUTLINE**

Atherosclerotic CAD is the most common cause of ACS, however, non-atherosclerotic processes are also contribute to a substantial number of ACS events and as such require different diagnostic and therapeutic strategies. Non-obstructive conditions can also cause same symptoms as obstructive CAD. In the absence of obstructive CAD, increased awareness together with a high index of suspicion for other important causes of ACS is crucial to delineate the underlying etiology. Recognizing typical imaging manifestations with adequate clinical correlation is essential for timely and accurate diagnosis as well as optimized patient care. In this exhibit, we discuss the characteristic multimodality imaging findings and differential diagnosis of non-atherosclerotic causes of ACS. Aims/Objectives · Introduction · Taxonomy · Pathologic and cross-sectional imaging findings role of imaging § Malignant coronary artery origin anomalies § Coronary artery ectasia/Coronary artery aneurysms § Coronary artery dissection § Coronary artery fistula § Coronary artery embolism § Coronary artery vasospasm § Different types of Vasculitis § Myocardial bridging § Stress- induced cardiomyopathy · Differential diagnosis · Conclusion

## CAEE-76 IMAGING OF MITRAL VALVE PATHOLOGY: WHAT RADIOLOGIST SHOULD KNOW

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Sachin S. Saboo, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ameya J. Baxi, MBBS,DMRD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To discuss relevant Mitral Valva (MV) anatomy To review various congenital and acquired pathologies involving MV To increase imaging appearances differential diagnosis of congenital and acquired MV diseases

**TABLE OF CONTENTS/OUTLINE**

Knowledge of MV valve anatomy function is essential to understand diagnose pathology. MV complex consists of anterior posterior leaflets, fibrous annulus subvalvular apparatus, consisting of the chordae tendineae papillary muscles. Main manifestations of MV disease are regurgitation stenosis caused by spectrum of various pathologies. Echocardiography, CT, cardiac MR imaging are main modalities used for evaluation of MV pathologies, each with its own advantage and limitations. Cardiothoracic radiologist should be well versed with echocardiography, MDCT, and CMR, in order to optimize preprocedural patient selection, procedural planning, post-procedural assessment of MV including postoperative complications. Knowledge of natural history, clinical manifestations, salient imaging features is essential for accurate diagnosis guiding treatment. In this exhibit, we discuss characteristic multimodality imaging findings and differential diagnosis of normal and diseased MV. Aims/Objectives · Introduction · Anatomy · Pathology, role of imaging imaging findings Shone Complex , Mitral Annular Calcification, Mitral Annular Disjunction, Prolapse, MV rupture, Mitral Stenosis, Mitral Regurgitation, Endocarditis, Thrombosis, Tumors-Primary and Secondary, MV Devices § Miscellaneous · Role of imaging in preoperative and reintervention planning · Postprocedural postoperative complications · Differential diagnosis · Conclusion

## CAEE-77 IMAGING SPECTRUM OF CONOTRUNCAL ABNORMALITIES WITH MALALIGNMENT TYPE VENTRICULAR SEPTAL DEFECTS

Jerald Garvin S. Lim, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Niemierko, MD (*Abstract Co-Author*) Nothing to Disclose

Franklin S. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Thurl Cledera, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Malalignment ventricular septal defects encompass a spectrum of anomalies characterized by the malalignment and absence of fusion between the outlet/conal septum and the ventricular septum. Malalignment defects are secondary to abnormalities in the elongation of the outflow tract during the different phases of cardiac looping. These defects have also been found to be associated with other cardiac anomalies, such as conotruncal abnormalities such as Tetralogy of Fallot, Transposition of the Great Arteries, Double Outlet Right Ventricle, and others. Knowledge of septal malalignment can help in determining the concordance of heart structures and outflow tracts. The objectives of this exhibit are: 1) Understand embryologic concepts behind the normal development of the outflow tract of the heart, 2) Use a systematic approach in identifying malalignment ventricular septal defects, and 3) Recognize key imaging features and anatomic landmarks in assessing these congenital defects

**TABLE OF CONTENTS/OUTLINE**

I. Introduction II. Embryology Review III. Characterizing Malalignment Ventricular Septal Defects IV. Imaging Modalities V. Conotruncal Abnormalities A. Tetralogy of Fallot B. Double Outlet Right and Left Ventricle C. Double Inlet Right and Left Ventricle D. Truncus Arteriosus E. Transposition of the Great Arteries VI. Considerations in Post-operative Imaging and Follow-up VII. Conclusion

## CAEE-8 JOURNEY INTO THE HEART: RADIOLOGICAL ASSESSMENT OF CARDIAC MASSES

Alba Lopez-Castello, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Pereiro Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Perez Costas, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Robles Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Sabela Garcia Benito, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review the most representative cases of cardiac masses in our center and summarize the clinical presentation and the most characteristic imaging findings.

**TABLE OF CONTENTS/OUTLINE**

- Cardiac masses are part of a broad and heterogeneous spectrum of pathology, with a clinical presentation that depends on both the nature of the mass (benign or malignant) and its location in the cardiac cavity (asymptomatic, ischemic events, arrhythmic, embolic, pericardial effusion, etc). - The initial imaging test when a cardiac mass is suspected is echocardiography (transthoracic or transesophageal), and depending on the findings and the patient's baseline condition, further evaluation with magnetic tesonance imaging or computed tomography may be considered, each with its specific protocols. -The location and imaging characteristics of the cardiac masses are essential for achieving an accurate diagnostic approach and for distinguishing between the main types of cardiac masses: non-neoplastic masses (intracavitary thrombus, vegetation, caseous calcification of the mitral annulus, pericardial cyst), primary benign tumors (myxoma, fibroelastoma, lipoma, hemangioma, rhabdomyoma, fibroma, etc.), malignant tumors (sarcoma, angiosarcoma, lymphoma, mesothelioma, etc.), and cardiac metastases.

## CAEE-9 CARDIAC CT APPLICATION OF SUPER RESOLUTION DEEP LEARNING RECONSTRUCTION

Yuji Kaga, RT (*Abstract Co-Author*) Nothing to Disclose
TOSHIKI KATO (*Abstract Co-Author*) Nothing to Disclose
Koichi Chida, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Sota (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Haga, PhD, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Computed tomography (CT) images have evolved over time. Recently, deep learning technology has been used for reconfiguration techniques. In particular, Precise IQ Engine (PIQE) is a super-resolution image reconstruction technology that uses deep learning and Aquilion Precision's high-resolution data. This is Super Resolution Deep Learning Reconstruction (SR-DLR) developed by Canon Medical Systems. The use of PIQE for coronary CT angiography (CCTA) allows for more accurate diagnosis than previously possible. The purpose of this objective is to examine the use of PIQE for CCTA and the accuracy of stent lumen assessment.

**TABLE OF CONTENTS/OUTLINE**

1.To understand Precise IQ Engine(PIQE) using deep learning techniques2.To understand how it differs from other reconstruction methods (Iterative Dose Reduction 3D and advanced intelligent Clear-IQ Engine)3.To understand the importance of assessing the severity of in-stent stenosis on coronary CT angiography (CCTA)4. To evaluate the in-stent stenosis of < 3.0-mm stent diameter5. To understand the characteristics of coronary atherosclerotic plaque detected by CCTA (including positive remodeling, low-attenuation plaque, and mottled calcification)6. To understanding the application of PIQE to the cardiovascular field

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

CAEE-1

## HOW TO REPORT A CT CORONARY ANGIOGRAM? - A STEP BY STEP GUIDE FOR THE NOVICE READER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Srujana Ganti, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Bimal Mayur Kumar Vora (*Abstract Co-Author*) Nothing to Disclose
Kang Ren Yong, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand how to report a CTCA study, in a step by step manner.

### TABLE OF CONTENTS/OUTLINE

CT Coronary Angiograms (CTCAs) are rapidly becoming entrenched as mainstream, routine examinations performed for the assessment of coronary artery disease, in various settings, including acute, inpatient and outpatient settings.This poster will take the novice CT Coronary Angiogram (CTCA) reader through the reading of the study in a step by step fashion, covering all crucial aspects, review areas and highlighting the importance of each of these. It will cover the factors that need to be considered in optimising the patient, such as patient education and nursing management, as well as the technical parameters to ensure the best possible images are obtained.It will outline, in a systematic fashion, how the scan should be reviewed, providing review checklists covering the cardiac findings as well as the extra-cardiac findings. Crucial factors in reporting and critical alert notification will be discussed with a sample report template included. A series of cases will also be provided, with annotations, to demonstrate both common and uncommon pathology so that the reader will not only obtain a sound framework to use as a basis to commence CTCA reporting but also gain an understanding of the pathologies encountered.

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# Abstract Archives of the RSNA, 2024

CAEE-10

## CHARTING THE COURSE: RADIOLOGICAL ASSESSMENT OF CARDIAC SARCOIDOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandra Somoano Marfull (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Abstract Co-Author*) Nothing to Disclose
Aranzazu Sanchez Gabin, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Cayon Somacarrera, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Revuelta Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Fernandez Lobo (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Sutil (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review cardiac sarcoidosis diagnostic criteria. Illustrate cardiac sarcoidosis imaging features in MRI, outlining the significance of late gadolinium enhancement (LGE). Highlight the prognostic implications of prompt diagnosis, emphasizing the importance of imaging in enhancing accuracy and predicting outcomes.

### TABLE OF CONTENTS/OUTLINE

Cardiac sarcoidosis, a potentially life-threatening manifestation of systemic sarcoidosis, presents diagnostic challenges due to its variable clinical presentations and limited biopsy yield. Early assessment and a multidisciplinary approach are crucial for improved outcomes, given the potential for sudden cardiac events.Diagnostic criteria have evolved, with current guidelines underscoring the importance of advanced imaging in its detection and evaluation. Cardiac MRI offers a multi-dimensional assessment, allowing detection of myocardial inflammation, characterizing tissue involvement, assessing cardiac function and guiding treatment. PET-CT identifies active inflammation, enabling risk stratification, follow-up post-ICD implantation, and targeted biopsies.The primary MRI finding is the presence of LGE, typically exhibiting a sub-epicardial and mid-wall pattern along the basal septum or inferolateral wall, indicating fibrosis. Additional features encompass myocardial edema, perfusion defects, and abnormal 18-FDG uptake.Imaging findings hold prognostic significance, with extensive LGE patterns and impaired left ventricular function predicting a high risk of adverse cardiac events.We gathered representative cases of cardiac sarcoidosis at our institution to highlight the hallmark findings that leads to accurate diagnosis.

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# Abstract Archives of the RSNA, 2024

CAEE-11

## REVEALING THE HEART`S SKELETON: THE POWER OF WHOLE-HEART HIGH-RESOLUTION LATE GADOLINIUM ENHANCED IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Lee (*Abstract Co-Author*) Research Grant, Abbott Laboratories;Spouse, Employee, Takeda Pharmaceutical Company Limited
Golnoosh Ansari, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Davo Jimenez, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyung-Pyo Hong, PhD (*Abstract Co-Author*) Nothing to Disclose
Cagdas Topel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To demonstrate fibrous structures of the heart including valves and related structures, the right and the left fibrous trigons, aorto-mitral continuity and membranous septum on Whole-Heart, High-Resolution late gadolinium enhanced (LGE) images.• To review the clinical applications of Whole-Heart High-Resolution LGE.

### TABLE OF CONTENTS/OUTLINE

1. Late Gadolinium Enhancement in Clinical Routinea. The principle of LGEb. Conventional LGE techniquec. The importance of LGE in Clinical Routine2. High-Resolution Late Gadolinium Enhancementa. From conventional LGE to HR-LGEb. Advantages and limitations of HR-LGE3. Atrial HR-LGE4. Ventricular HR-LGE5. HR-LGE on fibrous structures of the heart and congenital heart diseases6. Conclusions

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# Abstract Archives of the RSNA, 2024

CAEE-12

## CLINICAL CORRELATION FOR LVAD IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lynne M. Hurwitz Koweek, MD (*Abstract Co-Author*) Departmental Research Grant, Siemens AG;Departmental Research Grant, HeartFlow, Inc;Departmental Research Grant, Verily Lifesciences LLC
Michael R. Harowicz, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Cheng, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Left ventricular devices (LVADs) are utilized as either destination therapy or bridge to cardiac transplant for patients with end-stage heart failure. Computed tomography (CT) has been a useful imaging modality to evaluate complications of LVAD devices. Knowledge of the clinical evaluation of patients with LVADs including altered flow dynamics and laboratory workup can be a useful tool for the radiologist. The purpose of this abstract is to review the normal appearance and configuration of LVADs and the various complications with their correlating clinical presentations.

### TABLE OF CONTENTS/OUTLINE

1. Review normal anatomy and configuration of LVADs2. Review the altered physiology of patients with LVADs3. Illustrate the complications that can arise with LVADs with their correlating clinical presentation

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# Abstract Archives of the RSNA, 2024

CAEE-13

## HEART OF DARKNESS - INTRAMYOCARDIAL HEMORRHAGE AND MICROVASCULAR OBSTRUCTION: IMAGING FINDINGS AND PROGNOSTIC IMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Thomas Geyer, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe S. Torres, MD, PhD (*Abstract Co-Author*) Research support, Altis Labs
Farah Cadour, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Elsie Nguyen, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Rushali Gandhi, BSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

We discuss the pathophysiology of intramyocardial hemorrhage (IMH), demonstrate CMR imaging and prognostic features of IMH, and its connection with microvascular obstruction (MVO). CMR is the gold standard for detecting IMH and MVO. MVO, also known as "no-reflow", is related to severe microcirculatory alterations with obstructed microvasculature and can occur alone or concomitantly with IMH. IMH is a reperfusion injury, related to extravasation of erythrocytes through severely damaged endothelial walls. Both IMH and MVO are associated with worse prognosis following acute MI.

### TABLE OF CONTENTS/OUTLINE

IMH and MVO Pathophysiology and Evolution Post MI: Exact mechanism of microvascular injury and repair and temporal evolution of IMH and MVO are not well understood. These entities are early/subacute findings in the setting of acute MI, and typically resolve. Typical Imaging Features: MVO is identified as a subendocardial unenhanced region in the infarcted area due to lack of contrast within obstructed microvasculature. T2*-weighted sequences have higher sensitivity for demonstrating IMH. IMH can also appear as hypointense zone surrounded by myocardial edema (high T2 signal). Prognostic Value: The presence of IMH and MVO are strong predictors of adverse left ventricle remodelling and major adverse cardiovascular events after acute MI.

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# Abstract Archives of the RSNA, 2024

CAEE-14

## 4D FLOW: EXPLORING CARDIOVASCULAR DYNAMICS AND PATHOLOGIES IN FULL DIMENSION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos S. Tapia SR, MD (*Abstract Co-Author*) Nothing to Disclose
ANDREA SALAS (*Abstract Co-Author*) Nothing to Disclose
Moises Jimenez (*Abstract Co-Author*) Nothing to Disclose
LAURA TORRES (*Abstract Co-Author*) Nothing to Disclose
Claudia Mendoza, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

4D flow imaging represents an innovative technique that offers a comprehensive understanding of cardiovascular hemodynamics and related pathologies. This method provides functional cardiac information through the use of time-resolved four-dimensional cine sequences combined with 3D velocity encoding. The protocol enables the assessment of hemodynamic effects on vessel walls, myocardium, and flow pathways within the cardiovascular system. This imaging modality facilitates the evaluation of various cardiovascular pathologies, by analyzing multidirectional blood flow velocity data, providing valuable insights into conditions such as recurrent coarctation, aortic aneurysms, and valvular heart disease, contributing to the understanding of the natural history of cardiovascular disease. A notable example is the assessment of aortic dissection, where the technique identifies small fenestrations and characterizes flow dynamics between true and false lumens. This enhances patient risk assessment and treatment planning. In conclusion, 4D flow imaging emerges as a valuable tool for the comprehensive evaluation of cardiovascular hemodynamics and the precise diagnosis of associated pathologies. Its integration into clinical practice shows promise for optimizing patient management and treatment outcomes.

### TABLE OF CONTENTS/OUTLINE

Introduction. Principles. Protocol. Applications review. Case examples.

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# Abstract Archives of the RSNA, 2024

CAEE-15

## WHAT RADIOLOGISTS MUST KNOW ABOUT PULMONARY HYPERTENSION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

James C. Carr, MD (*Abstract Co-Author*) Institutional Research Grant, Siemens AG;Advisory Board, Siemens AG;Travel support, Siemens AG;Institutional Research Grant, Bayer AG;Advisory Board, Bayer AG;Travel support, Bayer AG;Speaker, Bayer AG;Institutional Research Grant, Guerbet SA;Advisory Board, Bracco Group
Amir A. Rahsepar, MD (*Abstract Co-Author*) Nothing to Disclose
Justin J. Baraboo, MS (*Abstract Co-Author*) Nothing to Disclose
Thara Nallamothu (*Abstract Co-Author*) Nothing to Disclose
Sandra Quinn (*Abstract Co-Author*) Nothing to Disclose
Melika Shafeghat, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pulmonary hypertension (PH) is a serious condition characterized by a gradual increase in mean pulmonary arterial pressure. The gold standard method to diagnose PH is right heart catheterization. However, heart catheterization is invasive and associated with a low, but not insignificant, risk of major complications, including fatality. Using noninvasive imaging modalities such as echocardiogram, chest CT, and cardiac MRI would be therefore more desirable as an alternative diagnostic method. While an echocardiogram is operator-dependent, and CT exposes the patient to ionizing radiation, MRI offers a comprehensive evaluation of cardiac anatomy, function, and focal and interstitial myocardial fibrosis without the risks associated with right heart catheterization or radiation exposure.

### TABLE OF CONTENTS/OUTLINE

1- What are the different types of PH, along with their WHO classification? 2- What are the etiologies of PH and its pathophysiology? 3 - What are the right heart catheterization findings as a gold standard method of diagnosis? 4- What are the noninvasive imaging modalities to diagnose PH? a. Echocardiogram findings in patients with PH along with pros and cons of echocardiogram to diagnose PH b. Chest CT findings in patients with PH and imaging features suggestive of PH b.1. Comparison of non-contrast chest CT vs. CT angiogram c. Cardiac MRI and 4D flow MRI imaging findings in patients with PH c.1. Comprehensive review of imaging sequences particularly CINE imaging, T1 mapping, delayed myocardial enhancement, 2D phase contrast, and 4D flow MRI

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# Abstract Archives of the RSNA, 2024

CAEE-16

## COMPLICATIONS OF THE CARDIOVASCULAR SURGERY WHAT RADIOLOGISTS SHOULD KNOW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Furkan Ufuk, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Radiologists play a critical role in identifying early and late complications of cardiovascular surgery, which can improve patient outcomes.
- Familiarity with normal postoperative imaging appearances and common complications is essential.
- Key complications include infection, bleeding, edema, pseudoaneurysm and structural abnormalities.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Importance of imaging in cardiovascular surgery follow-up
- Role of the radiologist
- Normal Postoperative Appearances
- Typical imaging findings following different types of cardiovascular surgeries
- Early Complications
- Bleeding: Locations and imaging signs
- Infection: Diagnostic clues on imaging
- Graft Failure: Types and radiologic identification
- Late Complications
- Chronic graft occlusion
- Structural abnormalities: Valve malfunctions, aneurysm/pseudoaneurysm
- Advanced Imaging Techniques
- Use of CT, MRI, and ultrasound in the detection of complications
- Recent advances and their clinical applications
- Conclusion
- Summary of the radiologist’s role in managing post-surgical patients
- Future perspectives in imaging for cardiovascular surgery complications

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# Abstract Archives of the RSNA, 2024

CAEE-17

## GENETIC CARDIOMYOPATHY MINDSET: A PRACTICAL IMAGING APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Rafaela Vieira Franklin Tapias (*Abstract Co-Author*) Nothing to Disclose
Marcus Vinicius Silva Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Fuzissima (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the key concepts of the classification of cardiomyopathies, highlighting their classic phenotypes.2. To illustrate key imaging findings in the most important inherited cardiomyopathies, with genetic and epigenetic correlations.3. To discuss the value of cardiac MRI in identifying phenocopies and rare cardiomyopathies.4. To emphasize how the correlation between genotype and phenotypic expression can contribute to earlier diagnosis, risk stratification, prognostication and decision-making in patients with cardiomyopathy.

### TABLE OF CONTENTS/OUTLINE

1. Background Classification of the cardiomyopathies: contemporary definitions 2. Precision medicine and next-generation sequencing technologies: basic conceptsClassic phenotypes of cardiomyopathies and their expression in cardiac MRI 3. Identifying the main genomic variants and genotype-based classification in genetic cardiomyopathies: a practical approach4. The genotype-based classification background, pathophysiology, clinical presentation, and outcomes of patients with hereditary cardiomyopathy5. Genetic cardiomyopathies and genotype-phenotype correlations: a case-based review with cardiac MRI Pearls, pitfalls, and challenges6. Future directions: Multiomics research7. Take home messages

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# Abstract Archives of the RSNA, 2024

CAEE-18

## THE IMAGING APPEARANCE OF THORACIC AORTIC REPAIRS AND COMMON ASSOCIATED COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ronald Gathagan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Aortic repair remains a critical aspect of cardiovascular medicine, with traditional surgical approaches continuing to play a prevalent role in addressing thoracic aortic pathologies. However, the landscape of aortic repair has significantly evolved with the advent of endovascular techniques, and multiple methods are often integrated for broader anatomical coverage, bringing increasing complexity to aortic disease management.By understanding the expected appearances of key components in thoracic aortic repair, radiologists can effectively identify deviations indicative of complications. Adopting a structured approach can aid in navigating the complex appearance of these complications. Specifically, attention should be given to the status of the aortic valve, the aortic root (including the sinuses of Valsalva), the ascending aorta, and the aortic arch as all of these structures may be repaired individually or repaired as a unit.Additionally, attention should be given to the management of coronary arteries when necessary. Similarly, if the repair extends into the region of the aortic arch, there must be further consideration of the management of the arch vessels. By implementing a systematic approach, radiologists can effectively identify and describe the majority of repairs, even with the constant advent of novel techniques.

### TABLE OF CONTENTS/OUTLINE

1. Describe the normal anatomy of the thoracic aorta including the ascending aorta and the aortic arch.2. Provide a brief overview of common variant anatomy.3. Review the types of ascending aortic repair techniques and their appearance on diagnostic imaging.4. Discuss common complications associated with thoracic aortic repair.

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# Abstract Archives of the RSNA, 2024

CAEE-19

## ATRIAL SEPTAL DEFECTS "WHAT RADIOLOGISTS NEED TO KNOW"

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shaimaa A. Fadl, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand the types of Atrial Septal Defects (ASD). Understand the associated anomalies. Understand imaging techniques for the full evaluation of ASD.Learn the role of imaging in different management options.

### TABLE OF CONTENTS/OUTLINE

Primum septal defectSecundum septal defectSinus venousus defectCoronary sinus defectThe role of imaging in the diagnosis and management in patients with septal defects.

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# Abstract Archives of the RSNA, 2024

CAEE-2

## NON-ATHEROSCLEROTIC CORONARY ARTERY DISEASE: A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Artur S. Santos SR, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Serra, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo E. Catarina, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Antonio Martins De Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Jose R. Parga, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago De Gaultier Paulo, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin De Paula (*Abstract Co-Author*) Nothing to Disclose
Andre Vaz (*Abstract Co-Author*) Nothing to Disclose
Fernanda Ragonetti (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Ingrid Stefanie Sarmento Debaco (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Although the majority of acute coronary events are the result of atherosclerotic lesions, some cases of myocardial infarction and sudden cardiac death may be related to non-atherosclerotic causes.The 2021 AHA Guideline for the Evaluation and Diagnosis of Chest Pain promotes the use of coronary computed tomography angiography (CCTA) as a diagnostic test in patients with an intermediate to high pretest probability of coronary artery disease (CAD), especially those younger than 65 years of age or when less obstructive CAD is suspected.CCTA provides information on intraluminal characteristics, and details of the coronary artery wall and surrounding tissue.

### TABLE OF CONTENTS/OUTLINE

IntroductionCAD is a diverse group of diseases with variable pathophysiology associated with myocardial infarction and sudden death, mostly in younger individuals. We review the imaging findings and the importance of the role of CCTA in the management of the major non-congenital causes of nonatherosclerotic CAD.MethodsNon-atherosclerotic CAD causes undergoing CCTA were retrospectively selected. Images were presented in the axial, sagittal, coronal, and curved multiplanar reconstruction planes. Conventional coronary angiography or 3D formatted images were added when available.Results DiscussionAmong other diagnoses, cases of dissection, thrombosis, coronary aneurysm, and extrinsic compression of the coronary arteries were included.An overview of CCTA findings and the role of imaging in the diagnostic process were provided.ConclusionThe increasing availability of CCTA and improvements in its technology have resulted in increased detection of nonatherosclerotic CADs, which was previously considered rare.

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# Abstract Archives of the RSNA, 2024

CAEE-20

## CAN YOU HEAR THE SYSTOLIC CLICK? YOU'D BETTER WATCH IT: MULTIMODALITY IMAGING OF MITRAL VALVE PROLAPSE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Alejandra Somoano Marfull (*Abstract Co-Author*) Nothing to Disclose
Victor Fernandez Lobo (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Revuelta Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review in detail the anatomy of the mitral valve and adjacent related structures. 2. To understand the different pathophysiological processes and their evolutionary stages by which the valve prolapses. 3. To analyse the utility of different imaging techniques in the diagnosis of prolapse and related features, planning of valve repair or replacement procedures and risk stratification.

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Anatomy of the valvular and subvalvular apparatus and its relation to adjacent structures. 3. Etiopathogenes of mitral valve degeneration: fibroelastic defficiency and myxomatous degeneration (Barlow's disease) . 4. Comparative utility and findings of different imaging techniques: 4.1. Echocardiography: TTE and TEE. 4.2. CT: coronary arteries and cardiac CT of morphology and function. 4.3. MRI. 5. Prognosis evaluation: 5.1. Severity of mitral insufficiency. 5.2. Severe myxomatous degeneration (Barlow's disease). 5.3. Mitral annulus disjuntion. 5.4. Late Gadolinium Enhacement of mitral apparatus: papillary muscles and myocardium.5.5. Other sequences 6. Treatment: percutaneous repair, surgical repair or valve replacement (multidisciplinary committees). 7. Conclusions. 8. Bibliography.

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# Abstract Archives of the RSNA, 2024

CAEE-21

## STRESSED ON CALL? YOUR GUIDE TO RECOGNIZING CLASSIC CARDIAC SIGNS ON A CHEST RADIOGRAPH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nanditha Guruvaiah, MD (*Abstract Co-Author*) Nothing to Disclose
Namratha Guruvaiah Sridhara, MD, BSc (*Abstract Co-Author*) Nothing to Disclose
Janardhana Ponnatapura, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A plain chest radiograph remains as the initial imaging modality of choice in evaluating patients with a history of cardiac pathology. A chest radiograph is convenient as it is easily accessible, low-cost, and a non-invasive diagnostic tool. A chest radiograph plays a key role in providing valuable information regarding underlying cardiac conditions. We aim to provide classic imaging signs of cardiac pathologies on a chest radiograph to boost the confidence and sharpen the skills of radiology residents and medical students. Since a chest radiograph is the initial imaging modality for patients with cardiac conditions, these classic signs can aid radiology residents and students to quickly recognize the underlying conditions and provide an accurate diagnosis for further patient management.

### TABLE OF CONTENTS/OUTLINE

Introduction to normal cardiac silhouetteChest radiograph signs of cardiac pathologies case-based learning:- Double density sign- Hoffman-Rigler sign- Walking man sign- Oreo cookie sign- Straight left heart sign- Wide carina sign- Water bottle sign- Continuous diaphragm sign- Small heart sign- Left atrial impression on the esophagus in barium swallow- Third mogul sign- Stag’s antlers sign / reverse mustache sign

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# Abstract Archives of the RSNA, 2024

CAEE-22

## MRI OF NONISCHEMIC CARDIOMYOPATHY:THE INTERSECTION OF NEW DIAGNOSTICS AND THERAPEUTICS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Soheil Kooraki, MD (*Abstract Co-Author*) Nothing to Disclose
Albert Hsiao, MD, PhD (*Abstract Co-Author*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging
Arash Bedayat, MD (*Abstract Co-Author*) Nothing to Disclose
Roshun Sankaran, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Kimberly Hong (*Abstract Co-Author*) Nothing to Disclose
Melina Hosseiny, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cardiac MR Imaging Techniques for CardiomyopathySSFP (Bright blood): Morphology and FunctionDouble inversion recovery (Black blood): Anatomic detail and myocardial edemaT1 and T2 mapping: Fibrosis and edemaPhasecontrast flow: HemodynamicsStrain: MechanicsCase-Based Review: Nonischemic Cardiomyopathy Hereditary CardiomyopathiesInflammatory CardiomyopathiesInfiltrative CardiomyopathiesStress-induced CardiomyopathyNon-compaction CardiomyopathyDifferentiating between types of nonischemic cardiomyopathiesDifferential imaging diagnosis of thickened myocardium: HCM, amyloid, hypertension, or other infiltrative diseasesDifferential imaging diagnosis of myocardial delayed enhancementThe Evolving Roles and Interactions of Genetics and Cardiac MR for Diagnosis of Nonischemic CardiomyopathyHistorical perspective and recent advancementsAdded value of the current imaging and genomic technologies

### TABLE OF CONTENTS/OUTLINE

Cardiac MR Imaging Protocols and Recent Advancements Tissue Characterization in Arrhythmogenic CardiomyopathyMechanics, Flow and prognostic value of CMR in Hypertrophic CardiomyopathyInflammatory/Infectious Cardiomyopathies: Myocarditis, SarcoidosisInfiltrative Cardiomyopathies: Amyloidosis, SiderosisStress-induced CardiomyopathyNon-compaction cardiomyopathyThe Evolving Roles and Interactions of Genetics And Cardiac MR for Diagnosis of Nonischemic CardiomyopathyAdded Value of the Current Genomic Technology

# Abstract Archives of the RSNA, 2024

CAEE-23

## FFRCT: UPCOMING APPLICATIONS IN THE AI ERA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Freire, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose
Jose R. Parga, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz F. de Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto N. Dantas JR, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Tenorio, MD (*Abstract Co-Author*) Nothing to Disclose
Thamara C. Morais, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:Presenting challenging cases: illustrates the role of FFRCT in complex diagnostic scenarios, including coronary stents, myocardial bridging, and anomalous pathways.FFRCT appropriateness and interpretation recommendation: Discussion on the appropriateness criteria and interpretation recommendations for FFRCT, highlighting its role in guiding clinical decisions.Defining Software Concepts: FFRCT Computational Fluid Dynamics-based Software (CFD- FFRCT) and FFRCT Deep Learning-based Software (DL-FFRCT).Exploring Software Solutions: illustrate a variety of software solutions based on Computational Fluid Dynamics and Deep Learning, and their respective pros and cons to inform decision-making in clinical practice.AI's Impact on Software Development: enhances diagnostic accuracy and enables fast on-site results.

### TABLE OF CONTENTS/OUTLINE

1.Challenging Cases in FFRCT1.1 Coronary Stents1.2 Myocardial Bridging1.3 Anomalous Pathways - Interarterial Course2.Role of FFRCT in Clinical Decision Making: A Flowchart 3.OverviewExploring FFRCT Software Solutions:3.1 Overview of CFD- FFRCT3.1.1 Introducing the concept of CFD-based FFRCT software.3.1.2 Pros and Cons Comparison of each software3.2 Overview of DL-FFRCT3.2.1 Introducing the concept of DL-based FFRCT software3.2.2 Pros and Cons Comparison of each software4.AI-driven innovations in FFRCT softwares development

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CAEE-24

## UNVEILING THE PHENOTYPIC DIVERSITY OF SARCOMERIC HYPERTROPHIC CARDIOMYOPATHY USING IMAGING IN THE ERA OF PRECISION MEDICINE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Luigia D'Errico, MD (*Abstract Co-Author*) Nothing to Disclose
Julian Vega (*Abstract Co-Author*) Nothing to Disclose
Anastasia Oikonomou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia Alegria, MD (*Abstract Co-Author*) Nothing to Disclose
Christian P. Houbois, MD (*Abstract Co-Author*) Nothing to Disclose
Juan J. Urbina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Purpose of this exhibit: 1. Explore the diverse phenotypic landscape of sarcomeric hypertrophic cardiomyopathy (HCM) within the era of modern precision medicine. 2. Delve into diagnostic challenges of the left ventricular hypertrophy (LVH) phenotypes. 3. Showcase the seamless integration of genetic testing with cardiac magnetic resonance (CMR) to precisely identify the etiology of LVH.

### TABLE OF CONTENTS/OUTLINE

1. Background: Epidemiology and Pathophysiology of HCM. 2. Genetic mutations involved in sarcomeric HCM. 3. Phenotypic spectrum of HCM -EARLY HCM a. Non-hypertrophic (crypts, mitral valve, and papillary abnormalities), b. Incipient LVH (LVH does not fulfill diagnostic criteria). ESTABLISHED HCM c. Symmetric (concentric) HCM, d. Asymmetric septal, e. Asymmetric apical, f. Focal HCM, g. Midventricular HCM, h. Masslike HCM, i. Noncontiguous HCM, j. Sigmoidal, k. Reverse curve. ADVANCED HCM l. HCM in the active-inflammatory phase ("Hot HCM"), m. HCM with left ventricular systolic dysfunction (LVSD), n. Dilated with extensive fibrosis HCM ("burned-out"). 4. HCM post septal reduction therapy: ablation-myomectomy and myosin inhibitors. 5. HCM phenocopies: the role of integrating genetic testing a. Storage and infiltrative cardiomyopathies i. Amyloidosis (mutant TTR), ii. Cardiac sarcoidosis, iii. Hemochromatosis, iv. Lysosomal storage disease: 1. Anderson-Fabry, 2. Hurler's syndrome. v. Glycogen storage disease: 1. Danon disease, 2. PRKAG2, Desminopathy, RASopathies, 3. Pompe's, vi. Mitochondrial (MELAS, MIDD), vii. Syndromic HCM: 1. Friedrich Ataxia, 2. Noonan, 3. Leopard. b. Other differential diagnosis i. Athlete's heart ii, Hypertensive cardiomyopathy iii, Aortic stenosis.

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CAEE-25

## OPTIMIZING RADIOLOGICAL APPROACH TO PREGNANCY-RELATED CARDIOVASCULAR DISEASES: STRATEGIES AND AWARENESS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Riccardo Marano, MD (*Abstract Co-Author*) Nothing to Disclose
Alessio Perazzolo, MD (*Abstract Co-Author*) Nothing to Disclose
Luigi Natale, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Rovere (*Abstract Co-Author*) Nothing to Disclose
Francesco Lauriero (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To enhance the awareness of radiologists in cardiovascular diseases (CVDs) during pregnancy. To highlight the role of imaging in diagnosing specific pregnancy-related CVDs. To illustrate strategies for minimizing radiation exposure and limiting the use of contrast agents when feasible.

### TABLE OF CONTENTS/OUTLINE

Background CVDs represent the primary cause of non-obstetric morbidity and mortality during or early after pregnancy in western countries. Timely diagnosis and effective management are crucial in mitigating these risks. Imaging plays a pivotal role in diagnosing some of the pregnancy-related CVDs, although radiation exposure and use of contrast agents should be minimized, adhering to the principle of as low as reasonably achievable (ALARA). If the disease occurs in late pregnancy, emergency cesarean delivery may be considered to prevent fetal exposure to radiation. Otherwise, magnetic resonance (MR) imaging is preferred over imaging examinations with ionizing radiation, particularly computed tomography (CT), whenever possible. Findings We present a series of illustrative cases focusing on the most common CVDs occurring in pregnant women, radiologists may run into their routine practice. We showcase different imaging techniques for each pathology, highlighting their distinct features and essential findings for accurate diagnosis. The discussed pathologies include pulmonary embolism (PE), sudden coronary artery dissection (SCAD), peripartum cardiomyopathy (PPCM), and aortic dissection. Conclusion Awareness of radiologists on pregnancy-related CVDs and radiation risks during gestation is crucial for optimizing imaging examination selection, diagnosis, and clinical management.

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# Abstract Archives of the RSNA, 2024

CAEE-26

## SEARCHING FOR SYNCHRONY: RADIOGRAPHY OF CONTEMPORARY CARDIAC DEVICES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alan Wimmer (*Abstract Co-Author*) Nothing to Disclose
Melissa L. Rosado de Christenson, MD (*Abstract Co-Author*) Nothing to Disclose
Sherief Garrana, MD (*Abstract Co-Author*) Author, Reed Elsevier;Author, Oxford University Press
Santiago Martinez-Jimenez, MD (*Abstract Co-Author*) Support, Reed Elsevier
Alan V. Godfrey, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cardiovascular implantable electronic devices include a variety of technologies which are frequently visualized and assessed on chest radiography. Knowledge of the appropriate anatomical course and location of these devices is critical for radiologists in order to appropriately interpret chest radiographs and recognize device-related complications. An understanding of emerging devices and new approaches for their placement enables the radiologist to provide accurate information to the clinician, thus enhancing patient care. Furthermore, radiologists play a central role in identifying complications associated with hardware placement and on follow-up imaging evaluation of these devices. The goals of this exhibit are to help the learner: 1. Understand the radiographic anatomy pertinent to contemporary cardiac implantable devices and emerging techniques in device and lead placement 2. Identify common and critical complications associated with contemporary cardiac devices

### TABLE OF CONTENTS/OUTLINE

1. Introduction - Review radiographic anatomy as it relates to cardiac implantable conduction devices and leads 2. Overview of current electrophysiologic techniques and devices with emphasis on lead location on radiography 3. Discussion of radiographic features of common and critical complications associated with cardiac implantable devices 4. Conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-27

## THE HEART IS BROKEN: A COMPREHENSIVE GUIDE FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Matthew D. Cham, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Reviewing mechanisms of blunt cardiac trauma Highlighting the various types of blunt cardiac trauma Multimodality pictorial review of imaging findings in blunt cardiac trauma. Reviewing the current surgical techniques for management of blunt cardiac trauma with focus on imaging findings.

### TABLE OF CONTENTS/OUTLINE

Mechanisms of injury in blunt cardiac trauma Update on imaging protocols for ideal detection of blunt cardiac trauma. Direct and indirect imaging findings in different cardiac trauma entities including: 1- Pericardium: Hemopericardium Pericardial tamponade Pericardial perforation/laceration Cardiac herniation 2- Myocardium: Myocardial contusion Myocardial hematoma Ventricular pseudoaneurysm Myocardial rupture 3-Endocardium and intracardiac: Endocardial laceration Valve and papillary muscle injury Intracardiac thrombosis Intracardiac air embolism 4. Vascular injuries Coronary artery injuries Aortic root injuries Pulmonary artery injuries IVC and SVC injuries Surgical and interventional treatment options for blunt cardiac trauma.

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# Abstract Archives of the RSNA, 2024

CAEE-28

## TOTAL ECLIPSE OF THE HEART: TURNING AROUND THE PERICARDIUM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Bernardo S. Oliveira, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Daniel Giunchetti Strabelli, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Sartim, MD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is: 1. To review usual and unusual cases related to the pericardium, pericardial sinuses and recesses. 2. To correlate important findings with the anatomy, embryology, and pathophysiology, focusing on their clinical-radiological correlations. 3. To understand the classification of the pericardium 4. To highlight their characteristics in order to familiarize radiologists, preventing unfavorable patient outcome. 5. To review CT and MRI protocols in the evaluation of patients with suspected pericardium involvement. 6. To correlate with the impact on the onco-image.

### TABLE OF CONTENTS/OUTLINE

1. Applied embryology and anatomy of the pericardium, its sinuses and recesses. 2. Techniques: X-ray, CT and MRI - pros and cons 3. Applications: a case-based review (a) Normal anatomy (b) Anatomical variants (c) Congenital (d) Inflammatory and infectious: acute and chronic (e) Vascular (f) Neoplasm (g) Foreign body (h) Intervention (i) Miscellaneous and other findings 4. Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics. 5. Future directions 6. Summary and take-home messages.

# Abstract Archives of the RSNA, 2024

CAEE-29

## BREAKING HEARTS: CORONARY DISSECTION AND ITS COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto Sasdelli Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Walther Y. Ishikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Merigue, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Katriny Couto, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Nadjaneyre Casimiro, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Damaso, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz Raphael P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Nycole B. Cortez Lima, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

I. Explore the use of coronary computed tomography angiography (CCTA) in the initial assessment and follow-up of patients suspected to have coronary dissection.II. Examine changes observed during post-evaluation and emphasize crucial aspects to include in reporting.III. Identify potential complications related to coronary dissection on CCTA.IV. Correlate CCTA with invasive coronary angiography in cases of coronary dissection

### TABLE OF CONTENTS/OUTLINE

Relevant epidemiology and clinical features of coronary dissectionPathophysiology of coronary dissection and its complicationsClassification for coronary spontaneous dissections base on the National Heart, Lung and Blood Institute (NHLBI):A) Type 1B) Type 2 (the most commonly diagnosed)C) Type 3Imaging findings on CCTAImaging findings on invasive coronary angiographyImaging coronary dissection complications: what the radiologist needs to look for

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# Abstract Archives of the RSNA, 2024

CAEE-3

## TIPS AND TRICKS TO IDENTIFY AND PROPERLY DIAGNOSE VASCULAR RINGS AND SLINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Omar Andres Pantoja Burbano, MD (*Abstract Co-Author*) Nothing to Disclose
Julian F. Forero, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Aluja, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Laura Acosta, MD (*Abstract Co-Author*) Nothing to Disclose
Andres F. Mejia Leon, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Utilizing embryology and normal anatomy as a framework, delineate the process through which vascular rings and pulmonary slings develop, making a comparison with the normal development of mediastinal vascular structures.2. Recognize distinct radiologic patterns indicative of vascular rings and pulmonary slings across imaging modalities for accurate diagnosis.3. Explore the repercussions of airway and esophageal compression caused by vascular rings and pulmonary slings, emphasizing their influence on blood flow dynamics and respiratory function.4. Understand how to differentiate vascular anomalies from other mediastinal masses and congenital heart diseases based on imaging characteristics to guide appropriate patient management.

### TABLE OF CONTENTS/OUTLINE

-Embryological basis and developmental insights-Anatomy and classification on imaging-Radiological features aiding differential diagnosis-Pitfalls in imaging interpretation-Key take-home points for clinical practice.

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# Abstract Archives of the RSNA, 2024

CAEE-30

## IMPACT OF CMR MULTIPARAMETRIC MAPPING ON AUTOIMMUNE RHEUMATIC DISEASES (ARDS) - RELATED INFLAMMATORY CARDIOMYOPATHY DETECTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Francesco Lauriero (*Abstract Co-Author*) Nothing to Disclose
Agostino Meduri, MD (*Abstract Co-Author*) Nothing to Disclose
Giacomo Ottoni (*Abstract Co-Author*) Nothing to Disclose
Riccardo Marano, MD (*Abstract Co-Author*) Nothing to Disclose
Alessio Perazzolo, MD (*Abstract Co-Author*) Nothing to Disclose
Luigi Natale, MD (*Abstract Co-Author*) Nothing to Disclose
Camilla Vittoria Vita, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To overview inflammatory cardiomyopathy (I-CMP) in autoimmune rheumatic diseases (ARDs). To demonstrate the leading role of cardiac magnetic resonance (CMR) in detecting early cardiac inflammatory involvement in ARDs. To showcase imaging findings on multiparametric CMR approach of I-CMP in different ARDs.

### TABLE OF CONTENTS/OUTLINE

Introduction. Cardiac involvement is a common feature in ARDs. Traditional imaging varies in the diagnostic accuracy depending on pretest probability, type and severity of involvement. Conversely, CMR is the primary imaging tool for diagnosing I-CMP, offering unparalleled tissue characterization. The 2018 Lake Louise Criteria (LLC) enhanced its sensitivity, especially for early detection, leading to a rise in I-CMP incidence and revealing diverse CMR myocarditis patterns. Material and Methods. We showcase a series of CMR examination on ARDs patients with suspected myocarditis. Images were acquired following SCMR standard protocol (2020 update). Results. All patients met 2018 LLC criteria. Edema was not always evident in conventional T2-weighted images and distinct pattern of late gadolinium enhancement (LGE) were found. T1, T2 mapping, and ECV values were consistently elevated. Conclusions. Our aim is to emphasize the role of multiparametric mapping in detecting I-CMP in ARDs patients. Conventional T2-weighted images lack sensitivity for diffuse myocardial edema and different LGE patterns exist. Multiparametric mapping may overcome these limitations, providing quantitative maps of myocardial changes. Given the CMR sensitivity in I-CMP, even at early stages, a CMR screening for asymptomatic patients might increase ARDs-related I-CMP improving their prognosis.

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# Abstract Archives of the RSNA, 2024

CAEE-31

## PRACTICAL APPROACH TO IMAGING CHALLENGING AORTIC ARCH ANOMALIES: DOUBLE ARCH WITH ATRESIA AND MIMICS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Beverley M. Newman, MD, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Felipe A. Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Alonso-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Osami Honjo (*Abstract Co-Author*) Nothing to Disclose
Frandics P. Chan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Presenter*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

### TEACHING POINTS

1. Double aortic arch is the most frequent cause of a symptomatic congenital vascular ring as the trachea and esophagus are completely encircled; typically, the right arch is higher and more cephalic than the left arch2. Part of the double arch can be atretic and replaced by a fibrosis cord, which is difficult to detect on imaging due to lack of luminal contrast in the atretic segment3. Double arch with atretic segment can mimic right aortic arch variants, depending on the level of atresia; however, timely differentiation is critical to guide management4. Double aortic arch with atresia distal to the left subclavian artery can mimic right aortic arch with type 1 mirror image branching5. Double aortic arch with atresia between the left common carotid and left subclavian arteries can mimic right aortic arch with aberrant retroesophageal left subclavian artery6. Key imaging features to differentiate double aortic arch with an atretic segment from mimics include 1) presence of 4 symmetrical arch branches at an axial level just above the arch, 2) posterior direction of the proximal aspect of the first arch branch, 3) tethering or tenting of the posterior segment of the patent segment of the left arch, and 4) anteriorly-directed diverticular outpouching from the descending aorta.

### TABLE OF CONTENTS/OUTLINE

1. Review aortic arch anomalies and congenital vascular rings: epidemiology, embryology, clinical presentation, and management2. Demonstrate imaging findings in typical double aortic arches3. Illustrate variants of double aortic arches with atretic segments and right aortic arch mimics4. Identify key imaging features to differentiate double aortic arch with atretic segment from mimics

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# Abstract Archives of the RSNA, 2024

CAEE-32

## NEW INSIGHTS INTO CARDIAC AMYLOIDOSIS IMAGING: A PRACTICAL GUIDE TO DIAGNOSIS, FOLLOW-UP AND OPTIMAL MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto N. Dantas JR, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Fuzissima (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thamara C. Morais, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the imaging approach of myocardial thickening to early identify Cardiac Amyloidosis and other phenocopiesTo discuss the clinical value and specific advantages / disadvantages of LGE, T1 map and ECV, T2 map and myocardial strain on Cardiac Amyloidosis To illustrate the main applications of T1 map, ECV and T2 map analysis in different clinical scenarios, focusing on its limitations and perspectives in clinical decision making.

### TABLE OF CONTENTS/OUTLINE

Phenocopies Imaging Approach: Differential diagnosis of myocardial thickeningStructural, functional e structural features in CA at CMRT2 Map on CA and other phenocopiesNew perspectives on T1 mapping and ECVBasic Technics, Accuracy and Clinical Applications Post-processing and Interpretation Tips and PitfallsChallenges and ParadigmsCMR-feature tracking Strain: intra- and intermodality agreement and variations Clinical applicationsHeart failure with preserved ejection fractionQuantification of systolic and diastolic left ventricular functionRisk assessment and prognosisSudden Cardiac Death Risk CalculatorTherapeutic Target Management and therapeutic response evaluationFuture perspectives: standardization, automated image analysis and artificial intelligence tools

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# Abstract Archives of the RSNA, 2024

CAEE-33

## LATEST ADVANCES IN MULTI-MODAL APPROACH TO THE IMAGING OF CARDIAC AND PULMONARY SARCOIDOSIS WITH PATHOLOGICAL CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nikhil Gupta (*Abstract Co-Author*) Nothing to Disclose
Rita Maria Lahoud, MD (*Abstract Co-Author*) Nothing to Disclose
Robert Freund, MD (*Abstract Co-Author*) Nothing to Disclose
Elie Najem, MD (*Abstract Co-Author*) Nothing to Disclose
Susannah Kay, MD (*Abstract Co-Author*) Nothing to Disclose
John Beute (*Abstract Co-Author*) Nothing to Disclose
Rosaura Suazo Aguero, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Sarcoidosis is a systemic disease characterized by the formation of non-necrotizing granulomas. It presents with respiratory symptoms in up to 53% of patients, and cardiac granulomas are present in up to 46.9% of cases. Radiography and CT are the most common imaging modalities used in the evaluation of thoracic sarcoidosis. However, 18F FDG-PET/CT have been shown to be increasingly useful. Findings include symmetric hilar and mediastinal lymphadenopathy, pulmonary nodules, subpleural reticular markings, groundglass changes, and pulmonary fibrosis.Findings of pulmonary sarcoid should prompt the evaluation for cardiac sarcoid.With respect to cardiac sarcoidosis, MRI and 18F FDG-PET/CT are useful tools. On MRI, cardiac sarcoidosis is typically associated with patchy and multifocal late gadolinium enhancement in the septum and lateral wall. The mid-myocardium and epicardium are commonly affected, whereas the subendocardium is usually spared. On 18 F FDG-PET/CT, cardiac sarcoidosis appears as patchy focal FDG uptake.Myocardial perfusion imaging using SPECT-CT can also be useful in the diagnosis of cardiac sarcoidosis by identifying focal perfusion defects at rest. Fixed defects or those that demonstrate reverse redistribution following vasodilation can distinguish cardiac sarcoidosis from non-sarcoid cardiac pathologies.

### TABLE OF CONTENTS/OUTLINE

1. Introduction on sarcoidosis and its systemic manifestations2. Focus on pulmonary and cardiac sarcoidosis3. Imaging findings with a focus on chest CT, cardiac MRI, and 18F FDG-PET/CT4. Case examples of sequential multi-modality evaluation for pulmonary and cardiac sarcoidosis5. Advances and future prospects in the imaging of sarcoidosis

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# Abstract Archives of the RSNA, 2024

CAEE-34

## MITRAL ANNULUS DISJUNCTION: A NOT SO RARE ENTITY. WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Fernandez-Lobo (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To familiarize the radiologist with Mitral Annular Disjunction (MAD), a little known and potentially fatal pathology, with the secondary objective that its knowledge will improve the detection and reporting rates within clinical practice.To review the role of imaging techniques in the diagnosis of this entity, especially cardiac magnetic resonance.

### TABLE OF CONTENTS/OUTLINE

MAD is an abnormal displacement of the mitral valve (MV) posterior leaflet onto the left atrial wall with separation between the MV attachment and the atrium MV junction. This entity has been associated with a progressive risk of malignant ventricular arrhythmias and sudden cardiac death, likely related to progressive mitral apparatus fibrosis. Therefore, recognition of this anomaly and its risk stratification are highly important. Its diagnosis is done by cardiac imaging. However, a reference imaging technique has not yet been established.MAD is commonly found in patients with mitral valve prolapse (MVP) or myxomatose MV disease but can also occur in the absence of mitral valve pathology. In either case it has been shown by multiple studies to be associated with life-threatening arrhythmic events.Transthoracic or transesophageal echocardiography and cardiac magnetic resonance (CMR) are useful noninvasive imaging tools for the diagnosis of MAD. It will manifest as an absence of myocardium during systole between the posterior mitral valve annulus and adjacent basal segments of the ventricular wall. CMR offers a detailed anatomic three-dimensional imaging that provides useful information for risk stratification and prognosis, being considered the gold standard.

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# Abstract Archives of the RSNA, 2024

CAEE-35

## A PICTORIAL REVIEW: LEARNING CONGENITAL HEART DISEASE WITH EMBRYOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Katsutoshi Horiuchi, MD (*Abstract Co-Author*) Nothing to Disclose
Aya Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Kyosuke Matsuda (*Abstract Co-Author*) Nothing to Disclose
Dan Yamamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Nagaaki Marugami (*Abstract Co-Author*) Nothing to Disclose
Ryosuke Taiji, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Congenital heart disease is considered a multifactorial genetic disorder in which cardiac morphogenesis during the embryonic period is caused by fetal genetic abnormalities or maternal environmental factors. Understanding cardiac embryology is very important for diagnosing the morphology of congenital heart disease, understanding the pathogenesis of heart disease. This exhibit aims to: Review congenital heart disease with embryology Discuss how to comprehend the radiological findings of congenital heart disease

### TABLE OF CONTENTS/OUTLINE

l Determination of left-right axis Heterotaxia Right isomerism, asplenia Left isomerism, polysplenia Situs inversus l Development of first heart field Dextrocardia Hypoplastic right ventricle Single ventricle l Development of second heart field Outflow tract Persistent truncus arteriosus (PTA) Double outlet right ventricle (DORV) Tetralogy of Fallot (TOF) Transposition of Great Arteries (TGA) Inflow tract Pulmonary atresia with intact ventricular septum Hypoplastic left heart syndrome (HLHS) l Completion of atrial and ventricular septum Atrial septal defect (ASD) Ventricular septal defect (VSD) Atrio-Ventricular Septal Defect (AVSD)

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# Abstract Archives of the RSNA, 2024

CAEE-36

## THE ROLE OF CORONARY COMPUTED TOMOGRAPHY ANGIOGRAPHY (CCTA) IN SPONTANEOUS CORONARY ARTERY DISSECTIONS (SCAD): WHAT RADIOLOGISTS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Silvia Duran Lojo, MD (*Abstract Co-Author*) Nothing to Disclose
Susana A. Otero Muinelo, MD (*Abstract Co-Author*) Nothing to Disclose
Carla Suarez Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Blanca Perez Perez-Lafuente, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Martinez-Sapina Llanas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The gold standard for the diagnosis of spontaneous coronary artery dissections (SCAD) is invasive coronariography angiography (ICA). Coronary computed tomography angiography (CCTA) can be the first diagnosis tool in haemodynamically stable patients and it´s very important in the follow-up. To present the role of CCTA in the diagnosis and follow-up of SCAD, with the different types of dissections and the differential diagnosis with other type of coronary occlusion. Also to describe the role of CCTA in the diagnosis of extracoronary arteriopathies related to SCAD.

### TABLE OF CONTENTS/OUTLINE

SCAD is a cause of myocardial infarction, and it accounts for at least 4% of all acute coronary syndromes. It is more common among young women and pregnant. The clinical presentation is variable, ranging from chest pain to cardiac death, most patients presenting with myocardial injury biomarkers increase. Fibromuscular dysplasia is the most common co-existing condition, also an association with connective diseases has also been reported. SCAD diagnosis is usually made by ICA, but CCTA can be the first diagnostic-tool in haemodynamically stable patients. Although dissection flap occurs in minority of cases, this is the easiest pattern to recognize on CCTA. Most often a stenosis or oclusion occurs and it´s challenging to distinguish between SCAD and other causes of vessel occlusion, so it´s important to observe other findings. Most patients are treated conservatively, unless they have ischaemia or haemodymically instability. Most patients are completely cured in 120 days and up to 30 % present a new SCAD. That is why the main role of CCTA is during follow-up period for assessment of dissection healing, 3/6 months after the SCAD event.

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# Abstract Archives of the RSNA, 2024

CAEE-37

## MYOCARDIAL T1 MAPPING FOR CHARACTERIZING MYOCARDIAL DISEASES: STATE OF THE ART

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Priya Jagia, MD (*Abstract Co-Author*) Nothing to Disclose
Niraj N. Pandey, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Kumar, MBBS,MD (*Abstract Co-Author*) Nothing to Disclose
Vineeta Ojha, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. T1 mapping is a robust tool for evaluating myocardial diseases by quantifying changes in myocardial tissue composition.2. T1 mapping complements late gadolinium enhancement (LGE) imaging by detecting diffuse interstitial fibrosis, which LGE might miss.3. The utility of T1 mapping spans a diverse spectrum of cardiac conditions that influence both therapeutic strategies and clinical outcomes.After going through the exhibit, the reader will be able to explain the physics and principles behind T1 mapping, acquisition and interpretation, and applications of T1 and ECV mapping for diagnosis, prognostication, treatment and follow-up for various myocardial pathologies.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Principles of T1 Mapping: Acquisition, post processing and interpretation3. Overview of T1 mapping indices and histological correlates: native T1, post contrast T1, and Extracellular Volume (ECV) Fraction4. Normal ranges5. T1-Mapping Techniquesa. Inversion Recovery-Based Techniquesb. Saturation Recovery-Based Techniquesc. Other techniques6. T1 Mapping in Ischemic Heart Diseasea. Acute Myocardial Infarctionb. Chronic Myocardial Infarction7. T1 Mapping in Non-Ischemic Cardiomyopathya. Non-Ischemic Dilated Cardiomyopathy (NIDCM)b. Takotsubo Cardiomyopathyc. Genetic Cardiomyopathies i. Hypertrophic Cardiomyopathy ii. Arrhythmogenic Right Ventricular Cardiomyopathy iii. Left Ventricular Noncompactiond. Post heart transplant e. Miscellaneous 8. Inflammatory Cardiomyopathiesa. Acute myocarditisb. Cardiac Sarcoidosis9. Infiltrative Cardiomyopathiesa. Cardiac Amyloidosisb. Anderson-Fabry Diseasec. Cardiac Siderosis10. Valvular Heart Disease11. Conclusions

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# Abstract Archives of the RSNA, 2024

CAEE-38

## ADVANTAGES OF DUAL-SOURCE PHOTON-COUNTING DETECTOR CT FOR MYOCARDIAL EXTRACELLULAR VOLUME QUANTIFICATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Misugi Urano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazuya Ohashi, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Masaya Kisohara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shibuki Matsui (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nobuo Kitera, RT, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Non-invasive quantification of the extracellular volume (ECV) is a method for the evaluation of focal and diffuse myocardial fibrosis, potentially obviating the need for invasive endomyocardial biopsy. 2. Quantification of ECV is an established method in MRI. However, quantification of ECV using CT (CT-ECV) is lower-cost, more accessible and faster than that of ECV using MRI (MR-ECV), and is also available even for patients where MRI is contraindicated. 3. Dual-source photon-counting detector CT (DS-PCD-CT) always provides spectral information. Moreover, this information can be obtained by ECG-gated scan mode and high-pitch spiral scan mode, which is unavailable with energy-integrating detector dual-source CT. 4. The new DS-PCD-CT option allow for more accurate CT-ECV quantification, which remains robust to variability of heart rate without the need for increased radiation dose.

### TABLE OF CONTENTS/OUTLINE

1. Utility of ECV for cardiac diseases 2. Non-invasive quantification of ECV-CT in comparison to ECV-MRI 3. Advantages of DS PCD-CT in cardiac imaging 4. Validation of the accuracy of data acquisition method specific to DS-PCD-CT 5. Advantages and disadvantages of CT-ECV and development with DS-PCD-CT

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# Abstract Archives of the RSNA, 2024

CAEE-39

## SUPRA-AORTIC TENDON: AN ENIGMA ON CARDIAC IMAGING RESEMBLING AORTIC DISSECTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Satinder P. Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Mostafa Abozeed, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Ibrahim, MD (*Abstract Co-Author*) Nothing to Disclose
Inayat Grewal (*Abstract Co-Author*) Nothing to Disclose
Naga Sai Rasagna Mareddy, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Understand the embryological basis and origin of the supra-aortic tendon; Gain insight into the challenges of diagnosing this rare entity on cardiac imaging and become familiar with its mimics; Identify the clinical significance and limitations of conventional cardiac imaging modalities in assessing for this entity.; Describe the imaging features of supra-aortic tendon that help to distinguish it from type A aortic dissection

### TABLE OF CONTENTS/OUTLINE

; Overview of embryological development of supra-aortic tendon; Explanation of how to diagnose supra-aortic tendon on cardiac imaging:a) Understanding the limited role of echocardiogram and non-gated cardiac CTA to differentiate the two entities.b) Discussion of importance of gated Cardiac CT to better evaluate the aortic root.c) Discussion of impact of accurate diagnosis of this condition on patient management; Identification of specific imaging features found in patients with type A aortic dissection to better understand the similarities and differences in both conditions on imaging; Strategies for Radiologists who encounter similar cases in their practice.

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# Abstract Archives of the RSNA, 2024

CAEE-4

## CARDIOPULMONARY COMPLICATIONS OF CANCER THERAPEUTICS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Anastasia Oikonomou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Christian P. Houbois, MD (*Abstract Co-Author*) Nothing to Disclose
Issac Y. Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Binita R. Chacko, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Lan-chau T. Kha, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Asutosh Sahu, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This educational exhibit will illustrate the cardiac and thoracic complications associated with new cancer agents such as immune checkpoint inhibitors (ICI). These treatments allow for substantial survival benefits in patients previously treated as palliative. However, treatment comes with an increased risk of cardiovascular and pulmonary side effects.
- Familiarize the reader with common cardiac and pulmonary complications resulting from cancer therapies with ICI, including immune myocarditis, pericardial diseases, pneumonitis, pulmonary embolism etc.
- To discuss the value of CT and MRI in identifying and differentiating between complications.
- To describe the range and overlap of critical imaging features based on specific clinical case scenarios.

### TABLE OF CONTENTS/OUTLINE

- Background of cardiac and pulmonary toxicities:
- Epidemiology
- ICI drugs and common side effects
- Value of imaging with CT and MRI in the detection and monitoring of complications.
- Cardiac and thoracic side effects are illustrated by case examples.
- The role of radiologist in a multidisciplinary team:
- The importance of multidisciplinary collaboration in managing affected patients.

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# Abstract Archives of the RSNA, 2024

CAEE-40

## INTERSECTING VISTAS: CORONARY AND PULMONARY ARTERY FISTULAS IN CARDIAC CT IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ali F. Tekin, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This presentation aims to delineate various manifestations of a coronary artery - pulmonary artery fistulas (CPAFs) and assess their possible hemodynamic consequences. Additionally, it highlights the critical role of coronary CT angiography (CCTA) in identifying these uncommon vascular anomalies, illustrated through several CT imaging examples.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to coronary artery - pulmonary artery fistulas Coronary artery - pulmonary artery fistulas (CPAFs) are rare vascular anomalies that create an abnormal connection between the coronary arteries and the pulmonary artery, bypassing the myocardial capillary network. 2. Coronary CT angiography (CCTA) Imaging Coronary CT angiography (CCTA) is a non-invasive, precise imaging technique crucial for diagnosing CPAFs. It requires a controlled heart rate, achieved through medications, and uses advanced imaging technologies to detail the fistula's characteristics. CCTA employs either prospective or retrospective ECG-triggered acquisition methods depending on the patient's heart rhythm stability. 4. ConclusionsIn conclusion, CCTA's role in diagnosing CPAFs has become more critical with its ability to detect these anomalies incidentally, emphasizing the need for radiologists to be proficient in using this technology for effective diagnosis and management.

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# Abstract Archives of the RSNA, 2024

CAEE-41

## ULTRASOUND IN CARDIOPULMONARY RESUSCITATION: HOW TO APPLY THE C.A.U.S.E PROTOCOL?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcelo R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Victor A. Jabour, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Francisco Neto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Cesar Passos Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Ariel Ejzenbaum (*Abstract Co-Author*) Nothing to Disclose
Andre Luiz Fernandes (*Abstract Co-Author*) Nothing to Disclose
Guilherme C. del Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Izabela Camuri Firmino Carlos (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Point-of-care Ultrasound (POCUS) is a methods of evaluating patients at the bedside during cardiac arrest to enable an efficient response and the CAUSE (Cardiac Arrest Ultrasound Exam) protocol is a guide for the use of thoracic ultrasound in care for cardiac arrest in a non-shockable rhythm.- When applied correctly, the CAUSE protocol allows for the identification of potentially reversible causes, minimizing the time of cardiac arrest.- With the determination of a non-shockable rhythm through clinical history and monitoring, the use of ultrasound is indicated - through the subcostal, apical, pulmonary, and parasternal windows - which can provide an effective prognosis.- This review addresses techniques for identifying causes of cardiac arrest, such as pneumothorax, cardiac tamponade, pulmonary embolism, and hypovolemia.- The competence and training of the professional in using bedside ultrasound has the potential to increase clinical precision and significantly contribute to reducing morbidity and mortality in the emergency context.

### TABLE OF CONTENTS/OUTLINE

- Introduction on using bedside ultrasound in the emergency context.- Evaluation of a literature review regarding the CAUSE protocol.- Discussion on the use of ultrasound during cardiac arrest with the aim of identifying potentially reversible causes.- Importance of mastering techniques for evaluating windows for a good prognosis.

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# Abstract Archives of the RSNA, 2024

CAEE-42

## BLOOD UNDER THE BRIDGE: IMAGE ASPECTS OF CORONARY ARTERY BYPASS GRAFT SURGERY AND STENTING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Cesar H. Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Freire, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz F. de Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto N. Dantas JR, MD (*Abstract Co-Author*) Nothing to Disclose
Jose R. Parga, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thamara C. Morais, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Tenorio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Coronary artery disease (CAD) is one of the main causes of death in the world and the management by means of coronary stenting and coronary artery bypass graft surgery (CABG) are well-established techniques.2. The assessment of coronary stents and myocardial revascularization plays a crucial role in post-procedural management and predicting patient clinical outcomes.3. Coronary CT angiography, a well-established technique in chronic CAD, offers a non-invasive and effective approach to this evaluation.4. This presentation aims to illustrate the role of CT angiography in assessing coronary stenting and CABG imaging, correlating them to conventional angiography, intravascular ultrasound, and optical coherence tomography.

### TABLE OF CONTENTS/OUTLINE

1. Applied techniques of CABG and coronary stenting.2. Milestones in the evolution of percutaneous coronary intervention over the years.3. Techniques: CT angiography, conventional angiography, intravascular ultrasound, and optical coherence tomography - pros e cons.4. Coronary CT angiography protocols5. Coronary stenting:(a) Coronary anomalies(b) Restenosis and stent thrombosis(c) Coronary CT angiography-derived Fractional Flow Reserve testing (FFR-CT)(d) Artifacts: blooming and beam hardening(e) Complications6. CABG:(a) Types: arterial and venous(c) Complications7. Miscellaneous and other findings8. Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics.9. Future directions: artificial intelligence10. Summary and take-home messages.

# Abstract Archives of the RSNA, 2024

CAEE-43

## CT AND CMR IN AORTIC VALVE DIASESE: THE ULTIMATE GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Javier Royuela (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD, PhD (*Abstract Co-Author*) Speaker, General Electric Company
Rob J. van der Geest, PhD (*Abstract Co-Author*) Nothing to Disclose
Pankaj Garg (*Abstract Co-Author*) Nothing to Disclose
Javier Sanchez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jordi Broncano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To evaluate the role of CMR in the evaluation of aortic valve disease, main sequences, protocol design and implementation in clinical practice. 2. To review the main CMR derived imaging biomarkers in aortic stenosis, aortic regurgitation, bicuspid aortic valve (BAV) as well as the repercussion in left side cardiac chambers and prognosis.

### TABLE OF CONTENTS/OUTLINE

1. Aortic valve disease (AVD). Definition and epidemiology.2. Cardiac imaging in AVD. Role of CT and CMR2.1. CT acquisition and post-processing2.1.1. CMR Basic sequences: 2.1.2. Cine SSFP and SPGR2.1.3. 2D - Phase contrast imaging2.1.4. Late gadolinium enhancement2.2. Advanced sequences: 2.2.1. Accelerated cine SSFP/3D cine SSFP2.2.2. 4D flow imaging2.2.3. Parametric mapping2.3. CMR protocoling: From conventional to fast - MRI protocols3. Severity grading: 3.1. Aortic valve area3.2. AV calcification. Role in Low Flow Low Gradient aortic stenosis.3.3. Peak velocity and gradient3.4. Regurgitant volume and fraction3.5. Valve tracking and Conservation Mass Principle3.6. Assessment of multivalvular heart disease4. AVD related aortopathy5. Myocardial involvement in AVD (Valvular heart disease)6. AV tumor - like lesions7. AV neoplasms8. Multimodality imaging in AV disease and prognostic factors9. Conclusions

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

CAEE-44

## GAPS IN THE HEART: ATRIAL SEPTAL DEFECTS REVISITED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Lorna Browne, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Ocazionez-Trujillo, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Camila Urzua Fresno, MD, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Understand the steps in the development of the interatrial septum and its relationship with the anatomic location of the different types of ASDs2) Name and identify the different types of morphologic and physiologic ASDs3) List the most common associated anomalies seen with the different types of ASD4) Describe the different modalities used to characterize ASDs, their advantages and disadvantages, and identify basic imaging protocols for CT and MR imaging of ASD5) Identify the relevant measurement, anatomical relations, and pertinent anomalies or lack thereof to include in the radiology report for pre-procedural assessment of ASDs, and the post-procedural / post-operative appearances of ASD closure.

### TABLE OF CONTENTS/OUTLINE

Review of embryology, anatomy, and physiology of ASDASD classification and imaging findingsScanning parameters and recommendations for CT and CMRTroubleshooting and pitfallsPre-procedural / pre-operative assessmentPost-operative evaluationAssociated anomaliesFuture directions

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# Abstract Archives of the RSNA, 2024

CAEE-45

## DECODING THE MAP OF THE HEART: CMR PARAMETRIC MAPPING SEQUENCES FOR MYOCARDIAL TISSUE CHARACTERIZATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manuel Rafael Lopez De La Torre Carretero (*Abstract Co-Author*) Nothing to Disclose
Ana Ezponda, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Del Nido Recio (*Abstract Co-Author*) Nothing to Disclose
Carmen Mbongo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe the fundamentals of parametric mapping methods in CMR and their clinical applications.To review and illustrate the role of T1 and T2 mapping in the characterization and assessment of different cardiomyopathies through different cases.

### TABLE OF CONTENTS/OUTLINE

Cardiovascular magnetic resonance (CMR) is the gold standard imaging modality for myocardial tissue characterization. The development of native parametric mapping sequences has allowed a change from visual to quantitative evaluation of the myocardium. Absolute native T1 and T2 mapping values are particularly useful in detecting diffuse alterations (interstitial oedema or fibrosis), especially when the rest of the CMR protocol shows no significant findings.1. Brief review of technical aspects of sequence acquisition and imaging protocol.2. Tips for adequate interpretation of T1 and T2 parametric mapping sequences.3. Clinical applications. Although changes of T1 and T2 mapping values are not disease-specific, they indicate alteration in myocardial tissue composition and may serve as diagnostic and prognostic tools in the context of a specific clinical scenario.Acute myocardial injury- Acute coronary syndrome with obstructive coronary disease.- Troponin-positive non-obstructive coronary artery disease (TpNOCA). Infiltrative cardiac diseaseDiffuse global fibrosisCardiac massesParametric T1 and T2 mapping sequences increase the diagnostic capabilities of CMR by quantifying both focal and diffuse alterations in myocardial tissue. Changes in these parameters represent valuable biomarkers for making diagnosis, determining prognosis and monitoring therapy

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# Abstract Archives of the RSNA, 2024

CAEE-46

## BASICS OF NONINVASIVE FRACTIONAL FLOW RESERVE (FFR) CT, PLAQUE ANALYSIS AND PLAQUE QUANTIFICATION - CURRENT TRENDS IN CORONARY CT EVALUATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Camila Urzua Fresno, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Ranish D. Khawaja, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Basics of FFR-CT analysis for the radiologists and cardiac imagers.- Role of FFR-CT can help improve diagnostic ability to assess for stenosis with most clinical impact.- Case examples to show-case various lesions identified on CT with their correlation on FFR-CT (easy to moderate level of complexity with interactive features).

### TABLE OF CONTENTS/OUTLINE

- Discussion of the basic physiology and methodology of noninvasive fractional flow reserve (FFR-CT) technology.- Discussion of the role FFR-CT in evaluation of cardiac CT examinations in the current practice, and discuss the limitations.- Discussion of plaque burden, plaque morphology and plaque quantification using the CT data for characterization of plaque.- Showcase interactive CT-FFR cases and correlation with the CT-imaging to help navigate high-risk lesions, and complex cases.

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# Abstract Archives of the RSNA, 2024

CAEE-48

## RIGHT AT HEART: IMAGING INSIGHTS INTO THE TRICUSPID AND PULMONIC VALVES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Katherine A. Kaproth-Joslin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lianne Mulvihill (*Abstract Co-Author*) Nothing to Disclose
John Piserchio, MD (*Abstract Co-Author*) Nothing to Disclose
Aaron Shang (*Abstract Co-Author*) Nothing to Disclose
Farhan Bajwa (*Abstract Co-Author*) Nothing to Disclose
Brian Nguyen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Review the epidemiology of tricuspid and pulmonic valve disease, including congenital and acquired (both primary and secondary) causes. 2) Discuss the morbidity and mortality of right-sided valvular disease in recognition of its importance as an independent, often-overlooked clinical entity. 3) Provide an overview of structural and functional assessment of the normal tricuspid and pulmonic valves. 4) Discuss the relative advantages and disadvantages of echocardiography, CT, and cardiac MR for the purpose of right-heart valve evaluation. 5) Discuss the imaging findings associated with pulmonic and tricuspid regurgitation and stenosis. 6) Review interesting cases of right heart valve disease including: carcinoid syndrome, rheumatic disease, endocarditis, and Ebstein anomaly. 7) Review current treatment options for the tricuspid and pulmonic valves as well as post-treatment imaging findings.

### TABLE OF CONTENTS/OUTLINE

1) Introduction and epidemiology of tricuspid and pulmonic valve disease2) Morbidity and mortality3) Congenital and acquired etiologies4) Normal structure and function 5) In situ anatomy with illustration 6) Normal appearance and planes on echocardiogram, CT, MR7) Advantages and disadvantages of echo, CT, MR 8) Quantification of normal function 9) Defining tricuspid and pulmonic regurgitation/stenosis10) Case review: Acquired causes e.g. Carcinoid syndrome, Endocarditis 11) Case review: Congenital causes e.g. Ebstein anomaly, Tetralogy of Fallot12) Brief overview of surgical and catheter-based interventions 13) Post treatment imaging appearances

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# Abstract Archives of the RSNA, 2024

CAEE-49

## READING THE SURGEON'S INTENT: DISCERNING INTENTIONAL FROM UN-INTENTIONAL IN THE POST-OPERATIVE COMPLEX CONGENITAL HEART DISEASE PATIENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sayedomid Ebrahimzadeh, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan A. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Ahn, MD (*Abstract Co-Author*) Nothing to Disclose
Shravan Sridhar, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Imaging of the post-operative congenital heart disease patient can be difficult even for radiologists who routinely read these exams. Having a framework to recognize atypical but intended post-surgical changes ensures diagnostic accuracy and informs approach to detecting complications. Here, we present concepts underlying atypical appearances following congenital heart surgery including intentional post-surgical and physiologic changes that mimic pathology and address where an atypical appearance could be pathologic but still intentional (risk vs benefit dilemma), reviewing complications/pitfalls where appropriate.

### TABLE OF CONTENTS/OUTLINE

1. Title, disclosure2. Abbreviations3. Overview4. Operations + timelinea. PA band in initial palliation vs branch PA stenosisb. Post-op appearance aortic atresia vs DKS anastomotic stenosisc. ASD in single vs BiV repaird. VSD in single vs BiV repaire. mBTT ligation vs occlusionf. RV-PA conduit stump vs pseudoaneurysmg. PDA maintenance vs abnormal patencyh. Fontan types atriopulmonary vs extracardiaci. Fontan fenestration vs baffle leakj. Unifocalization MAPCAs vs pulmonary veins5. Physiology and natural coursea. Absent Fontan conduit in 1.5V repair vs azygos/hemiazygos continuation of IVC vs BiV conversionb. Occluded hepatic-PA conduit + collaterals vs acute Fontan thrombosisc. RA baffle distension vs chamber dilationd. Transannular patch distension vs RVOT pseudo/aneurysm6. The surgeon’s dilemma of risk vs benefita. Shunts with Qp:Qs < 1.5b. Pulmonic valve regurgitation, RV EDVI and RVHc. RPA band post-Fontan vs bilateral PA bands unrepaired TOFd. Aortic mycotic pseudoaneurysm7. Case summary8. Summary: Operative timeline9. References

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# Abstract Archives of the RSNA, 2024

CAEE-5

## IMAGING OF ADULT PRESENTATION OF UNTREATED CONGENITAL HEART DISEASE-EXPECT THE UNEXPECTED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ameya J. Baxi, MBBS,DMRD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas-Zapata, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Vijay K. Aggarwal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Dhruti Maisuri, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Prevalence of congenital heart disease(CHD) in adults has increased and currently adults more than children have these malformations.2. Most common undiagnosed adult CHD includes bicuspid aortic valve, aortic coarctation, occult shunts (VSD, ASD, PFO, PDA) and uncomplicated tetralogy of Fallot.3. The spectrum of imaging findings of previously undiagnosed congenital heart disease in adults will be discussed.4. Multimodality imaging provides comprehensive assessment of morphology and function including flow analysis from the central to the more peripheral vasculature.5. Common pitfalls in evaluation of adult heart structure on CT/MRI will be reviewed.

### TABLE OF CONTENTS/OUTLINE

Occasionally, radiologists are confronted with late presentation of undiagnosed or untreated congenital heart disease in the adult patient. Conditions like bicuspid aortic valve, coarctation, occult shunts, (ASD, VSD PDA) may represent up 10% -of all congenital cardiac anomalies. Rarely anomalous venous return, tetralogy of Fallot, congenitally corrected L-transposition of great vessels, Ebstein’s anomaly, cor-triatrium may also be seen with late presentation in life. Functional assessment of the right heart represents an important aspect of imaging in ACHD patients. CT scan with excellent temporal and spatial resolution is an excellent imaging modality for assessing heart structure. MRI provides comprehensive functional information for both cardiac chambers and vasculature. It is important for the radiologists to be able to recognise common undiagnosed congenital heart disease in adult patient, even as an incidental finding.

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# Abstract Archives of the RSNA, 2024

CAEE-50

## CHALLENGING ANATOMIC AND PATHOLOGIC FEATURES FOR TAVR PROCESSING: PEARLS AND PITFALLS FROM THE 3D IMAGING LABORATORY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Frank J. Rybicki III, MD, PhD (*Abstract Co-Author*) Medical Director, Imagia Cybernetics Inc
Michael F. Morris, MD (*Abstract Co-Author*) Educator, Medtronic plc
Kimberly Hatch, ARRT, BA (*Abstract Co-Author*) Nothing to Disclose
Richard L. Hallett II, MD (*Presenter*) Consultant, Bracco Group

### TEACHING POINTS

3D segmentation and post-processing of CT datasets is essential for safe and successful transcatheter aortic valve replacement (TAVR) procedural planning. High quality 3D Imaging Laboratory output contributes to shortened procedural times, improved patient safety, and supports excellent clinical outcomes.This presentation will: Review challenging anatomic, pathologic, and iatrogenic findings that may be encountered during 3D processing for TAVR planning. Provide practical processing techniques to overcome challenging and/or unexpected anatomy and generate highly accurate output for TAVR procedural planning. Examples include annular sizing, coronary anatomy, bicuspid aortic valve / aortic root / LVOT geometry, and challenging access considerations. Review processing pitfalls that may adversely impact processing output and procedural success.

### TABLE OF CONTENTS/OUTLINE

A. Aortic valve / root / LVOT considerations: 1. Bicuspid aortic 2. Valve Valve in Valve (ViV) 3. Valve in TAVRB. Challenging annular configurations: 1. Subannular / LVOT calcification and alterationC. Coronary artery challenges: 1. coronary height, origin, and courseD. Access Considerations: 1. Aortic pathology 2. Iliofemoral segment pathology 3. Subclavian / carotid artery pathology 4. Direct access (aorta, LV apex)

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# Abstract Archives of the RSNA, 2024

CAEE-51

## HEMOPERICARDIUM: CASE BASED REVIEW OF POTENTIAL ETIOLOGIES AND KEY IMAGING FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Larry A. Latson JR, MS,MD (*Abstract Co-Author*) Nothing to Disclose
Geraldine T. Brusca-Augello, DO (*Abstract Co-Author*) Nothing to Disclose
Joanna G. Escalon, MD (*Abstract Co-Author*) Research Consultant, Vingroup
David Jones (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Hemopericardium is the accumulation of blood in the pericardial space. It often signals a life-threatening event and finding the source of bleeding is essential in expediting appropriate care. Furthermore, depending on the rate of accumulation, hemopericardium in and of itself can be fatal due to the development of cardiac tamponade. In order to quickly make this essential diagnosis, the radiologist must be familiar with the imaging findings of hemopericardium and tamponade and the potential causes.

### TABLE OF CONTENTS/OUTLINE

1. Imaging findings of hemopericardium and tamponade. 2. Case-based review of the causes of hemopericardium including associated key imaging features and associated findings, including: (A) Acute vascular disease - i. ruptured aortic dissection, ii. ruptured myocardial infarction, (B) Iatrogenic - i. pacemaker perforation, ii. Mediport malposition, iii. Post-CABG; (C) Post-traumatic - i. cardiopulmonary resuscitation; (D) Other - i. pericarditis, ii. malignancy, iii. anti-coagulation therapy.

# Abstract Archives of the RSNA, 2024

CAEE-52

## TIPS AND TRICKS TO AVOID PITFALLS IN INTERPRETATION OF CORONARY CT ANGIOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Baskaran Sundaram, MD (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To highlight key pitfalls that are encountered in coronary CTA interpretation 2. To illustrate the recognition of these pitfalls using representative case examples

### TABLE OF CONTENTS/OUTLINE

1. False negative stenosis a) Non-calcific plaque not obvious in axial plane, e.g. left main- Use orthogonal, MIP, VR b) Plaque ignored as partial voluming (mid LAD, distal RCA)- Use orthogonal plane c) “Blind spots”, LAD near diagonal, LCx near OM, RCA near PDA- Thin MIPs d) Small vessels- thin slice, sharp kernels e) Bypass graft landing zone, runoff f) Stent with distal contrast- Contrast attenuation in stent g) Subtle/absent stenosis- Evaluate regional wall motion/ perfusion defect 2. False positive stenosis a) Ghosting- Absent in another cardiac phase b) Misregistration - Confirm in another plane and phase c) Low attenuation in vessel without plaque - Confirm absence of plaque d) Low attenuation of beam hardening of calcified plaque e) Dense calcified plaques- Curved MPR 3. Overestimation of stenosis a) Using single cross sectional plane-Orthogonal views, cMPR b) Quantifying outer-to-outer diameters instead of inner-to-inner diameters- remodeling c) Using tiny distal vessel beyond bifurcation as reference d) Calcium blooming -wider window, sharper kernel, thinner slices, 100 keV VMI e) Poor contrast enhancement- Different windowing (e.g 700/250) f) Intense contrast enhancement- Different windowing (1000/200) 4. Underestimation of plaque a) Calcified plaque in contrast CT b) Motion 5. Strategies to avoid pitfalls a) Systematic review b) Multiple reconstruction techniques- MPR, cMPR, MIP, VR c) Multiple planes- Axial, orthogonal, longitudinal, cross-sectional

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# Abstract Archives of the RSNA, 2024

CAEE-53

## CT GUIDANCE FOR PERCUTANEOUS CORONARY ARTERY INTERVENTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the expanding role of CT in the guidance of percutaneous coronary interventions (PCI) 2. To discuss the role of CT in determining suitability for PCI 3. To highlight the utility of CT in cath lab resource optimization and real-time guidance

### TABLE OF CONTENTS/OUTLINE

A. Need for PCI 1) Stenosis severity 2) Flow-limiting stenosis- FFRct/CTperfusion(CTP) B. Suitability for PCI 1) Focal lesion + FFRct < 0.8 2) FFRct virtual planner 3) FFRct virtual pullback C. Planning PCI 1) Risk-stratification- High-risk plaque increases MI, no-reflow 2) Coronary ostial origin- Atypical position needs different catheters 3) Anomalies- Change approach 4) Proximal lesion- deep cannulation obscures lesion 5) Optimal fluoroscopy angles for specific segments 6) Lesion length- Stent sizing 7) Extensive calcifications-need lithotripsy/atherectomy 8) Soft plaque at landing zone- dissection risk 9) Ostial lesions- Precise demarcation 10) Bifurcation lesions-Side branch demarcation, virtual FFRct, subtended myocardium 11) 3D calcium model- planning additional procedures 12) Wire simulator D. Real-time procedural guidance Fusion of 3D CT plaque map E. Planning complex multivessel CAD 1) CABGvsPCI, CT-SYNTAX 2) Lesion severity,length,focality 3) Landing zone, run off 4) Calcification 5) CTP- subtended myocardium, scar 6) LAD-D1 distance-sequential graft 7) RIMA,LIMA 8) Redo CABG- sternal relationships, aortic calcification F. Planning Chronic total occlusion 1) Poor outcome predictors- > 15 mm long, calcification > 5.5 mm / > 50 % of area, shrinkage, bend angle > 45° 2) Risk scores- JCO,CT RECTOR,KCCT G. Planning for redo revascularization 1) Repeat PCI- CTP for defect 2) PCI after CABG- CTA improves procedure planning

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# Abstract Archives of the RSNA, 2024

CAEE-54

## UTILITY OF CT IN TRANSCATHETER CLOSURE OF PARAVALVULAR LEAKS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the etiology and pathophysiology of paravalvular leaks (PVL) 2. To understand the utility of CT in evaluating these patients 4. To illustrate the important CT measurements and clinical significance 5. To review the CT findings of common complications after PVL closure

### TABLE OF CONTENTS/OUTLINE

Table of contents 1. Paravalvular leaks a) Etiology- Suture dehiscence, endocarditis, inflammation, degeneration b) Symptoms- CHF, hemolysis 2. Role of multimodality imaging in diagnosis and management a) Echo-limitations b) MRI- limitations c) CT 3. CT protocol- Retrospective ECG gating, delayed phase, non con 4. CT for diagnosis a) Diagnostic criteria b) Pitfalls- surgical material, metals, small c) Differentials-pseudoaneurysm, abscess 5. Management a) Indications for closure- symptoms, significant PVL b) Transcatheter vs surgical c) Transcatheter- high surgical risk, suitable anatomy 6. Devices for PVL closure- Vascular, ductal or septal occluder devices- Amplatzer vacular plug (I, II) 7. Access routes- Transeptal, transapical, retrograde arterial 8. Role of CT in planning PVL closure a) No acoustic shadows or artifacts b) Higher temporal resolution than 3D color doppler c) Characterization d) Most valuable in complex tract 9. CT parameters a) Location - Clockface position- Mitral anteromedial (10/11 o clock) or posterolateral (5/6 o clock) b) Size c) Shape d) Course e) Tract f) Fluoroscopic angles g) Contraindications- Infection, abscess, rupture 10. 3D printing a) Virtual device placement 11. Procedure technique - CT fluoro fusion 12. Follow-up protocol 13. Post-procedural CT- Normal appearances 14. Complications- Device migration, recurrent leak, infection, rupture 15. Conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-55

## MYOCARDIUM IN DISARRAY: THE BASIC PHYSIQUES OF HYPERTROPHIC CARDIOMYOPATHY AND BEYOND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose A. Maldonado, MD (*Abstract Co-Author*) Nothing to Disclose
Ellis D. Mejias Febres, BS (*Abstract Co-Author*) Nothing to Disclose
Alejandro M. Linera Asencio, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Acosta (*Abstract Co-Author*) Nothing to Disclose
Kevin Hornedo, BS (*Abstract Co-Author*) Nothing to Disclose
Santiago A. Saldana Mendez, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A. Review the pathophysiology and clinical picture of Hypertrophic Cardiomyopathy (HCM). B. Discuss HCM diagnosis and cardiac magnetic resonance imaging (MRI) findings C. Provide an overview of the different HCM morphologies including epidemiology, prognosis, and treatment implications. D. Examine late gadolinium enhancement (LGE) quantification analysis E. Highlight additional key imaging findings for optimal risk stratification for Sudden Cardiac Death (SCD).HCM is one of the leading causes of SCD among young people. The degree and pattern of left ventricular wall thickening have implications that impact the clinical course of patients with HCM. Our goal is to provide radiology trainees, radiologists, and clinicians an overview of the different phenotypes of HCM. We will do so by using cardiac MRI case examples, while highlighting the indispensable role of cardiac MRI in the assessment of HCM. We will also examine the pivotal role of LGE quantification analysis and other key imaging findings for optimal risk-stratification for SDC.

### TABLE OF CONTENTS/OUTLINE

I. Introduction Objectives II. HCM A. Pathophysiology Clinical presentation B. Diagnosis C. Cardiac MRI Imaging findings III. Overview of HCM phenotypic presentations A. Prevalence, epidemiology, prognosis, and treatment B. MRI case examples IV. Examine LGE Quantification Analysis V. Risk-Stratification for SCD VI. Discuss the role of cardiac MRI VII. Conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-56

## UNDERSTANDING EXERCISE CMR: A REVIEW OF ITS QUALITIES, METHODS AND CLINICAL APPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ming-Yen Ng, BMBS, FRCR (*Abstract Co-Author*) Education Grant, General Electric Company;Education Grant, Bayer AG;Education Grant, Circle Cardiovascular Imaging Inc;Education Grant, TeraRecon, Inc;Education Grant, Arterys Inc;Speakers Bureau, Boehringer Ingelheim GmbH
Calvin Chin (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Chit Wai Chan (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understanding the (1) Roles of exercise CMR (Ex-CMR), its principles, and how Ex-CMR compares against other forms of stress tests. (2) Different types of Ex-CMR, their respective strengths and limitations. (3) How Ex-CMR is performed, challenges associated with acquiring images and safety considerations associated with exercise stress testing. (4) Clinical applications of Ex-CMR in terms of diagnosing coronary artery disease (CAD) and differentiating between dilated cardiomyopathy (DCM) and exercise-induced cardiac remodeling (EICR). (5) Interpreting the results of Ex-CMR using real case examples.

### TABLE OF CONTENTS/OUTLINE

(1) Overview: An overview of Ex-CMR, including the principles behind it, the different forms of Ex-CMR and their respective strengths and limitations, and an evaluation of the strengths and limitations of Ex-CMR compared against other methods. (2) Performing the scan: the typical protocol for Ex-CMR is explained. We also explain the challenges in Ex-CMR in terms of achieving an adequate spatial-temporal resolution with free breathing sequence, with an example scan to illustrate the point. Safety considerations including contraindications to Ex-CMR and indications for test termination are overviewed. (3) Clinical applications: we review the clinical applications of Ex-CMR using 2 examples: diagnosing CAD and differentiating between DCM and EICR in athletes. (4) Case examples: we present 2 case examples to illustrate the aforementioned clinical applications of Ex-CMR with annotated and labeled scans and an explanation of how the scans are interpreted. (5) The future of Ex-CMR: a brief overview of the future developments related to Ex-CMR is presented.

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# Abstract Archives of the RSNA, 2024

CAEE-57

## LATE GADOLINIUM ENHANCEMENT FINDINGS IN HOSPITALIZED COVID-19 PATIENTS: A FOCUS ON THE POST-ACUTE PHASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria Davo Jimenez, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lee (*Abstract Co-Author*) Research Grant, Abbott Laboratories;Spouse, Employee, Takeda Pharmaceutical Company Limited
Daniel Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Suvai Gunasekaran, PhD (*Abstract Co-Author*) Nothing to Disclose
Golnoosh Ansari, MD (*Abstract Co-Author*) Nothing to Disclose
Brandon Benefield (*Abstract Co-Author*) Nothing to Disclose
Kevin Wojciechowski (*Abstract Co-Author*) Nothing to Disclose
Cagdas Topel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To demonstrate late gadolinium enhancement (LGE) findings in 12 patients who underwent cardiac magnetic resonance (CMR) during the peak phase of the COVID-19 pandemic

### TABLE OF CONTENTS/OUTLINE

1. Introduction to cardiovascular impact of COVID-19 infection• Recent studies indicate that 26% to 60% of hospitalized COVID-19 survivors show CMR abnormalities, such as functional impairment, myocardial injuries, late gadolinium enhancement, or pericardial abnormalities.2. Literature review of the LGE findings in patients with COVID-19• A wide range of “myocarditis-like” or “ischemic-like” LGE patterns can be found.3. LGE features in different phases of myocardial injury• Presentation of cases with various LGE findings at different stages.4. Conclusions• A variety of LGE patterns were found in patients with a history of hospitalization due to COVID-19.• LGE can be observed after the acute phase of the disease, with normalized T1, T2 and extracellular volume (ECV) fraction.

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# Abstract Archives of the RSNA, 2024

CAEE-58

## MYOCARDIAL STRAIN - A PRACTICAL APROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ana Garcia de Vicente, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Torres Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Jesus Javier Martin Pinacho, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Angeles Fernandez-Mendez (*Abstract Co-Author*) Nothing to Disclose
Alvaro Arribas Marcos, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Siguenza-Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Alarcon Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After reviewing this exhibit, the reader should: -Understand the concept of cardiac strain, its correlation with cardiac anatomy, and its significance in the pathophysiology of the cardiac cycle. - Comprehend the advantage provided by using cardiac strain over ejection fraction in the assessment of cardiac pathology. - Describing available techniques, their limitations, and the importance of strain assessment methods using MRI. -Be familiar with Fast-SENC sequences: Indications, technique application, postprocessing techniques. - Apply the acquired knowledge to real-life cases.

### TABLE OF CONTENTS/OUTLINE

- Introduction - Pathophysiology - MRI techniques for strain assessment o Tagging o Feature tracking o Fast-SENC - Fast-SENC o Acquisition o Post-processing - Practical cases o Patients at risk of developing cardiotoxicity caused by anticancer treatment o Postinfectious heart failure: Chagas o Heart failure with normal FEVI parameters o Congenital cardiomyopathies o Other cardiac pathology - Conclusions

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# Abstract Archives of the RSNA, 2024

CAEE-59

## MALIGNANCY IN CONGENITAL HEART DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Swati S. Mody, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Aparna Joshi, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Joynt (*Abstract Co-Author*) Nothing to Disclose
Michael Dimaria (*Abstract Co-Author*) Nothing to Disclose
Adam L. Dorfman, MD (*Abstract Co-Author*) Nothing to Disclose
Sowmya Balasubramanian, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Prachi P. Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Jimmy C. Lu, MD (*Abstract Co-Author*) Nothing to Disclose
Tobias Else (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Lee, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Cancer is more prevalent in patients with congenital heart disease (CHD) than the general population due to genetic and environmental risk factors including radiation exposure from imaging, genetic disorders, and alterations in physiology which promote tumorigenesis. 2. Cardiac hepatopathy increases the risk of hepatocellular carcinoma. Screening with US and alpha-fetoprotein levels in patients with single ventricle physiology, chronic heart failure and after Fontan palliation may help identify this complication. 3. Pheochromocytomas and paragangliomas develop in patients with cyanotic heart disease at higher rates than the general population and those with non-cyanotic CHD. 4. Genetic disorders can predispose to both CHD and tumors, for example Down syndrome (CHD risk and leukemia, testicular germ cell tumors). 5. Those patients receiving transplant for CHD are at elevated risk of various tumors including viral induced lymphomas as well as various solid organ tumors. 6. With increasing survival of patients into adulthood and the higher predisposition to cancer, adherence to screening is essential, although observational studies suggest lower screening rates in CHD patients.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: Risk of tumors in CHD. 2. Factors which may contribute to increased risk of cancer in congenital heart disease: radiation exposure from diagnostic and therapeutic procedures, specific tumors related to CHD physiology (hepatocellular carcinoma, neuroendocrine tumors), genetic disorders predisposing to CHD and tumors, cancers which develop after cardiac transplant for congenital heart disease (lymphoma, solid organ tumors) 3. Screening for malignancy in CHD population

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# Abstract Archives of the RSNA, 2024

CAEE-6

## IMAGING REVIEW OF ACUTE CHEST PAIN WITH FOCUS ON CT AND MRI IN THE EMERGENCY SETTING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thurl Cledera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Acute chest pain is one of the most common complaints in the emergency department. Imaging with the help of proper clinical examination is a crucial component of evaluation in these patients. While ECG is mandatory in examinations for screening STEMI and NSTEMI, and chest radiography is a standard imaging examination, CT and/or MRI is valuable in the immediate detection or exclusion of a myriad of conditions presenting with acute chest pain. The appropriate choice of imaging test is affected by the suspected diagnosis and availability of the modality in question. This exhibit will present imaging modalities pertinent to acute chest pain and scenarios pertaining to acute coronary syndrome, cardiac, and noncardiac causes of chest pain. The objectives of this exhibit are: 1) To discuss current guidelines in assessing acute chest pain and how it intersects with the role of noninvasive imaging, 2) To review imaging features of cardiac and noncardiac causes of acute chest pain, and 3) To enable the radiologist to recommend appropriate imaging modalities and guide proper treatment

### TABLE OF CONTENTS/OUTLINE

I. Introduction II. Acute Versus Stable Chest Pain III. Considerations in the Patient Presenting with Acute Chest Pain IV. Overview of Imaging Modalities A. Anatomic Testing B. Functional/Stress Testing V. Imaging Scenarios A. Acute Coronary Syndromes B. Myocardial Infarction with Nonobstructive Coronary Arteries (MINOCA) C. Prior CABG Surgery D. Suspected Myopericarditis E. Valvular Heart Disease F. Acute Aortic Syndrome G. Thromboembolism H. Noncardiac Causes VI. Teaching Points VII. Conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-60

## PERICARDIAL PRIMER: AN IMAGING REVIEW OF ABNORMALITIES INVOLVING THE PERICARDIUM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Justin Sindoni, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Describe normal pericardial anatomy and the expected appearance of the pericardium on CT and MRI.
- Review CT and MRI features of congenital, infectious, inflammatory, traumatic, and malignant pericardial abnormalities.
- For each pericardial abnormality, describe the associated clinical presentation, differential diagnoses, potential complications, and recommendations for next steps in management.Background: The pericardium is comprised of an inner visceral layer and an outer parietal layer, which create a potential space containing approximately 30-50mL of serous fluid. The pericardium surrounds the heart and great vessel origins, and normally measures less than 2mm in thickness. In addition to creating a physical barrier between the heart and lung pleura, the pericardium also regulates cardiac chamber pressures and optimizes cardiac motion. As a result, congenital and acquired pericardial abnormalities can be extremely detrimental to a patient's cardiovascular function. This exhibit will review the myriad of congenital, infectious, inflammatory, traumatic, and malignant abnormalities that can involve the pericardium. The goal of this exhibit is to expedite diagnosis and management of clinically significant pericardial pathologies seen on CT and MRI.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Review of normal pericardial anatomy
- Discussion of expected appearance of the pericardium on CT and MRI
- Case-based review of pericardial pathologies, organized into the following broad categories:
- Congenital
- Infectious
- Inflammatory
- Traumatic
- Primary pericardial malignancy
- Pericardial metastasis

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# Abstract Archives of the RSNA, 2024

CAEE-61

## IMAGING OF CARDIAC DEVISE MIGRATION: A ROAD LESS TRAVELLED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Sachin S. Saboo, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Avanish Sunnapwar (*Abstract Co-Author*) Nothing to Disclose
Dhruti Maisuri, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ameya J. Baxi, MBBS,DMRD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To recognize various cardiac devices on radiological imaging. Discuss indication proper positioning of various cardiac device placement Detect malposition, complication, common pitfalls of device

### TABLE OF CONTENTS/OUTLINE

In recent years, there is increase in the number of implanted cardiac devices. Device migration/complications associated with cardiac device can occur because of local erosion, excessive tension during deployment, inadvertent deployment, inappropriate device sizing or due to congenital or surgical/procedural defects. Multiple factors can contribute to delayed diagnosis of a migrated device, including lack of familiarity with the device, cognitive errors, radiographic technique. It may be challenging, but important to radiologist as how they appear on imaging, normal positions, complications. Radiologists must employ multiple strategies like comparing images with prior studies, reading recent relevant literature about interventional/surgical procedures implanted devices, and clinic notes. Radiologists play critical role in ensuring appropriate placement may be the first medical professionals to suggest unsuspected device migration. This review gives concise summary of various cardiac devices and complicationsAims/Objectives
- Introduction
- Pathology, role of imaging, imaging findings of malposition, complication, common pitfalls
- PICC line
- Pacemaker/ intracardiac defibrillator
- PCWP catheter
- ASD closure device
- Prosthetic aortic valve
- Prosthetic mitral valve
- Mitral valve clips
- TRANSCATHETER VALVES AND VALVE REPAIR
- Aortic stent
- Watchman device
- VENTRICULAR ASSIST DEVICES
- ECMO
- IMPLANTABLE LOOP RECORDER
- Miscellaneous
- Differential diagnosis
- Conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-62

## CT CORONARY ANGIOGRAPHY FRACTIONAL FLOW RESERVE ($FFR_{CT}$) IN ASSESSMENT OF PATIENTS WITH CORONARY ARTERY DISEASE: A PRIMER FOR A RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Charit R. Tippareddy, MD (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Syed Muhammad Awais Bukhari, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamin Parker, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.To review how fractional flow is derived2.To review landmark clinical trials supporting the clinical usage of FFRCT3.To highlight clinical cases where FFRCT can influence management4.To highlight important limitations of FFRCT technology5.To discuss the future role and newer tools of non-invasive ischemia/plaque assessment

### TABLE OF CONTENTS/OUTLINE

1) FFRCT: basics, workflow and reportinga. Computational flow dynamics and fractional flow reserve.b. FFRCT vs FFR Invasive -> pros and consc. Recommendations for interpretation of FFRCT results2) Literature supporting FFRCT in the clinical practicea. PRECISEb. TARGETc. FORECASTd. PLATFORMe. NXTf. DeFACTOg. DISCOVER-FLOW3) Clinical instances where FFRCT can augment diagnostic confidence and patient managementa. Borderline stenosis (50-70 %) on visual analysis.b. Isolated severe branch vessel disease.c. Heavily calcified coronary arteries.d. Tandem stenoses.e. Noninvasive preoperative clearance for coronary artery disease4) Limitations/Challenges of FFRCT analysis:a. Image Quality is central to study accuracy: Electrocardiographic (EKG) misregistration, Motion artifacts and increased noise precludes accurate assessment.b. Vessel Tortuosity, Stents and grafts.c. False positive results: Due to motion, suboptimal coronary vasodilatation and ventricular hypertrophy.d. False negative results: Due to motion, ultrashort segment plaque, manual segmentation error.e. Workflow and Reimbursement5) Future directionsa. Appropriate use of FFRCTb. Prediction of post-stenting FFRc. Plaque analysis

# Abstract Archives of the RSNA, 2024

CAEE-63

## A PRACTICAL GUIDE TO IMPLEMENTATION OF PHOTON COUNTING DETECTOR CT (PCD-CT) IN CARDIAC IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Brooke Nordine (*Abstract Co-Author*) Nothing to Disclose
Mitchell Owen (*Abstract Co-Author*) Nothing to Disclose
Holly Kasten (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Prabhakar Rajiah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Nikkole Weber, ARRT, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Explain unique technologic advantages of Photon Counting Detector CT (PCD-CT) that improve cardiac imaging Describe steps and provide key information for protocol development and optimization of imaging parameters specific to PCD scanners Discuss downstream challenges in image reconstruction, analysis and advanced post processing applications Demonstrate optimized cardiac imaging parameters through case review

### TABLE OF CONTENTS/OUTLINE

Technologic advantages of PCD Ultra-high resolution (UHR) (0.2mm)- Small vessels, stents, plaques Multi energy (ME) (0.4mm) - High iodine signal, less artifacts, material characterization, k-edge Improved radiation dose efficiency Increased iodine contrast to noise ratio (CNR) Decreased noise Patient prep changes Protocol development Scan modes UHR (without ME)- Spiral (sequential-not preferred) Standard resolution with ME- Spiral with retrospective ECG gating, sequential, high-pitch helical Mode selection- indication, heart rate, heart rate variability, body habitus Tube potential selection Slice thickness/ interval Kernels- sharp vs smooth, body regular, body vascular, quantum regular Matrix- 512 vs 1024 Image types VMI- Single energy like (T3D) VMIs Virtual non-contrast Iodine map Virtual calcium removal Virtual non-iodine Auto post processing done at scanner increased efficiency Coronary calcium scoring Curved planar reformats of coronary arteries VR models of heart Downstream effects and challenges PACS - Image numbers, storage Advanced imaging 3D visualization FFRct 3D printing Plaque Analysis Artifacts- Noise in UHR mode, motion artifacts, artificial appearing images, edge enhancement Case review with optimized imaging parameters

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# Abstract Archives of the RSNA, 2024

CAEE-64

## 30-MINUTE EXAM OF CARDIAC MAGNETIC RESONANCE IMAGING WITH DEEP LEARNING-BASED HIGHLY-ACCELERATED CARDIAC CINE AND SINGLE-SHOT MYOCARDIAL DELAYED ENHANCEMENT WITH DEEP LEARNING RECONSTRUCTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kunihiro Yoshioka, MD (*Abstract Co-Author*) Nothing to Disclose
Tsuyoshi Sugawara (*Abstract Co-Author*) Nothing to Disclose
Makoto Orii (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Society for Cardiovascular Magnetic Resonance offer a basic 30-min cardiac magnetic resonance (CMR) exam that answers many of the common clinical questions in cardiovascular practice (Figure 1). But in the real world, historic time slots of 60 min or longer hinder improved access to CMR. The total exam time can be reduced if high-quality 2D cine images can be collected post-contrast to minimize non-scanning time prior to myocardial delayed enhancement (MDE) imaging. Recent development of deep learning-based highly-accelerated cardiac cine (DL cine) has the potential to reduce scan time while preserving image quality (Figure 2). With the use of DL cine, 2D cine imaging can be performed after contrast injection during a waiting time for MDE imaging. Moreover, the diagnostic performance of DL cine pre- and post-contrast injection is expected to be comparable in terms of image quality and quantification of biventricular volume and function (Figure 3). Single-shot MDE (SSMDE) with deep learning reconstruction (DLR) could acquire each slice in a single heartbeat and allows for image acquisition of entire left ventricle in a few breath-holds (Figure 4). Several studies have reported that SSMDE with DLR provides similar diagnostic accuracy compared to conventional approach. Combined 2D DL cine and SSMDE with DLR, we could achieve a basic 30-min CMR exam with routine techniques that answers many of the common clinical questions (Figure 5).

### TABLE OF CONTENTS/OUTLINE

Figure 1: Classical workflow of CMR. Figure 2: 2D DL cine. Figure 3: Comparison of pre- and post-contrast short-axis DL cine images of a patient with cardiac sarcoidosis. Figure 4: SSMDE with DLR. Figure 5: New 30-min workflow of CMR using DL cine and SSMDE with DLR.

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# Abstract Archives of the RSNA, 2024

CAEE-65

## THE IMPACT OF PHOTON-COUNTING DETECTOR CT IN ASSESSMENT OF CARDIAC DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Misugi Urano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seita Watanabe, RT (*Abstract Co-Author*) Nothing to Disclose
Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nobuo Kitera, RT, MSc (*Abstract Co-Author*) Nothing to Disclose
Shibuki Matsui (*Abstract Co-Author*) Nothing to Disclose
Masaya Kisohara, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. True semiconductors such as CdTe are energetically stable. Photons above the band gap form electron-hole pairs in semiconductors. CdTe is used in photon-counting detectors (PCD) and scintillators are used in energy-integrating detectors (EID).2. The unique structure of the photon-counting CT includes an application specific integrated circuit (ASIC), which counts the electrons converted from photons at each threshold value.3. PCD-CT can provide low-noise, high-resolution images and has excellent imaging performance, especially in the evaluation of coronary arteries.4. PCD-CT is capable to obtain spectral data with single pair of X-ray tube and detector, and dual energy analysis on high temporal resolution can be performed using dual-source PCD-CT (DS-PCD-CT)5. Cardiac extracellular volume (ECV) can now be realistically quantified by the iodine method thanks to the availability of high temporal resolution iodine values.

### TABLE OF CONTENTS/OUTLINE

1. Physical properties of semiconductor which is used in PCD-CT and scintillator which is used in EID-CT.2. The principle of photon counting by ASIC and its features.3. Differences in the ability of EID-CT and PCD-CT to visualize stents after percutaneous coronary intervention.4. A case in which an iodine map obtained from DS-PCD-CT with high temporal resolution allowed the assessment of contrast failure and late iodine enhancement reflecting myocardial ischemia.5. Quantification of cardiac ECV by the Iodine method made possible by high temporal resolution using DS-PCD-CT.

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# Abstract Archives of the RSNA, 2024

CAEE-66

## INSIGHTS INTO LEFT VENTRICULAR HYPERTROPHY: CARDIAC MAGNETIC RESONANCE IN DIFFERENTIAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andres Enriquez-Puga, MBChB, MSc (*Abstract Co-Author*) Nothing to Disclose
Maria M. Merideno Garcia, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Calero Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Mar Cespedes Mas (*Abstract Co-Author*) Nothing to Disclose
Victoria Esteban Izquierdo, MD (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To provide a thorough overview of the differential diagnosis of left ventricular hypertrophy (LVH) using cardiac magnetic resonance (CMR), with specific emphasis on achieving the following key learning objectives: - To comprehend the most valuable CMR sequences and their respective informative contributions. - To identify the various underlying diseases associated with the phenotypic expression of LVH.- To provide a succinct and pragmatic summary that facilitates clinical practice.

### TABLE OF CONTENTS/OUTLINE

- Objectives - Role of cardiac magnetic resonance in the assessment of LVH and the most useful sequences: ‘steady state free precession’ (SSFP) to study morphology and function, native T1 mapping for myocardial tissue characterization, and late gadolinium enhancement for evaluating fibrosis in various regional distributions. - Epidemiological data, clinical and therapeutic management, and CMR findings in the main diagnostic entities following LVH: hypertensive heart disease, hypertrophic cardiomyopathy, cardiac amyloidosis, Fabry disease, athlete’s heart, aortic valve stenosis, and cardiac sarcoidosis. - Conclusions, summary of various diseases, and a table to aid in the clinical practice - References

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CAEE-67

## STRATEGIES FOR BETTER IMAGING CORONARY STENTS AFTER PERCUTANEOUS CORONARY INTERVENTION (PCI) IN CORONARY CT ANGIOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jianying Li, PhD (*Abstract Co-Author*) Employee, General Electric Company
Jianxin Guo (*Abstract Co-Author*) Nothing to Disclose
Tingting Qu (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Point out the limitations of displaying coronary stents in conventional coronary CT angiography (CCTA).2) Demonstrate the advantage of SSF2 in CCTA compared to standard algorithm without motion correction (STD) and with the first-generation snapshot freeze (SSF1).3)Demonstrate the strategies to improve the clarity of coronary stent display.

### TABLE OF CONTENTS/OUTLINE

1)Limitations of coronary stent display in CCTA• The high density of coronary stents in CT images naturally affects the observation of coronary artery within the stent.• The dual effects of motion artifacts and metal artifacts seriously affect the display of the stent and the in-stent lumen.• Artifacts caused by the stent in the coronary lumen may lead to misdiagnosis.2) Advantages of SSF2• SSF2 reduces both coronary motion artifacts and overall cardiac motion artifacts.• Reduce the motion artifacts of the stent and its surrounding tissues to enable clearer display of the stent. • Highly inclusive, provides excellent for patients with irregular heart rate and inability to hold their breath.3) Strategies• Iterative reconstruction or Deep learning reconstruction to reduce image noise.• Using high-resolution scanning protocol (high kVp, low mA, and small focal spot).• Using SSF2 reconstruction to reduce motion artifacts.

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# Abstract Archives of the RSNA, 2024

CAEE-68

## INFECTIVE ENDOCARDITIS: THE MANY FACES OF DEATH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fernanda Ragonetti (*Abstract Co-Author*) Nothing to Disclose
Jose R. Parga, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Vaz (*Abstract Co-Author*) Nothing to Disclose
Luiz Carlos D. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo E. Catarina, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin De Paula (*Abstract Co-Author*) Nothing to Disclose
Joao Antonio Martins De Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Artur S. Santos SR, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Ingrid Stefanie Sarmento Debaco (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Serra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

TP1: [Infective endocarditis (IE) can affect both native and prosthetic valves, leading to valvular (vegetations, leaflet perforation, and prosthetic dehiscence) or perivalvular complications (abscess, pseudoaneurysm, and fistula)]TP2: [Cardiac computed tomography angiography (CTA) is recommended by the European Society of Cardiology (ESC) guidelines to aid in the diagnosis and treatment planning of IE]TP3: [Electrocardiographic gating significantly increases the accuracy of CTA for the diagnosis of valvular or perivalvular complications]TP4: [CTA is particularly useful in patients with poor acoustic windows, complex cardiac anatomy, detection of distant lesions, preoperative assessment of coronary artery disease, and investigation of alternative diagnoses]

### TABLE OF CONTENTS/OUTLINE

I. IntroductionA. Overview of the role of CTA according to recent ESC guidelinesB. Significance of cardiac CTA in improving the accuracy for infective endocarditisII. MethodsA. Selection of confirmed cases of IE who underwent cardiac CTAB. CTA protocol descriptionIII. Results DiscussionA. Presentation of CTA images demonstrating valvular and paravalvular findings (extracardiac features were also briefly addressed)B. Definition, risk factors, clinical significance, and impact on patient management were reviewed for each complicationIV. Conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-69

## TESTING THE WATERS: A COMPREHENSIVE REVIEW OF ENTITIES CAUSING MYOCARDIAL EDEMA WITH SYSTEMATIC AND CASE-BASED APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Emrah Duman, MD (*Abstract Co-Author*) Nothing to Disclose
Zehavit Kirshenboim (*Abstract Co-Author*) Nothing to Disclose
Timothy Wong (*Abstract Co-Author*) Nothing to Disclose
Chad Kosanovich (*Abstract Co-Author*) Nothing to Disclose
Omer Onder, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Myocardial edema is characterized by abnormal myocardial fluid accumulation due to impaired fluid homeostasis, triggered by a complex interplay of cellular, molecular, and hemodynamic factors. 2. It is a complex pathological phenomenon with diverse clinical manifestations, playing a pivotal role in the pathophysiology of various cardiovascular conditions such as ischemic, inflammatory, infiltrative, toxic, infectious, and autoimmune diseases. 3. Familiarity with diagnostic challenges/strategies, differential diagnoses of myocardial edema-associated conditions, and the implications of myocardial edema for risk stratification can enable radiologists to contribute significantly to patient management. This presentation will examine the role of cardiac MRI in characterizing myocardial edema through various case examples and a comprehensive review of existing literature.

### TABLE OF CONTENTS/OUTLINE

A. Pathophysiological basis of myocardial edema B. Radiological evaluation - Image acquisition post-processing - Image interpretation: Pearls Pitfalls - Pattern-based approach: Focal, regional, patchy diffuse involvement C. Differential diagnosis clinical importance of myocardial edema with case examples - Myocardial ischemia/infarction - Post-arrest/post-surgical - Heart transplantation - Heart failure myocardial remodeling - Myocarditis - Stress-induced cardiomyopathy - Toxic/drug-induced cardiomyopathy - Hypertrophic cardiomyopathy - Dilated cardiomyopathy - Sarcoidosis - Amyloidosis - Rheumatologic diseases - Miscellaneous: Chronic kidney disease, sepsis, systemic pulmonary hypertension, myocardial contusion, other cardiomyopathies D. Summary conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-7

## HEARTBREAK AND HEALING: UNDERSTANDING TAKOTSUBO SYNDROME

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Udane Oiartzabal, MD (*Abstract Co-Author*) Nothing to Disclose
Virginia Diaz (*Abstract Co-Author*) Nothing to Disclose
Leire Ormaetxe Albeniz, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Uxue Martinez Urabayen, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rodriguez Ripalda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the pathophysiology of Takotsubo syndrome.Identify the manifestations of Takotsubo syndrome on MRI, as well as its main differential diagnoses.

### TABLE OF CONTENTS/OUTLINE

Takotsubo syndrome, also known as broken heart syndrome or stress cardiomyopathy, presents as an acquired cardiomyopathy causing transient and reversible systolic dysfunction without obstructive coronary artery disease. It is typically triggered by a stressful event and predominantly affects postmenopausal women. This syndrome shares clinical and electrocardiographic characteristics with acute coronary syndrome, initially making it difficult to distinguish between the two.During the initial diagnostic evaluation, echocardiography and cardiac catheterization typically reveal apical dyskinesia without significant evidence of coronary artery obstruction.Magnetic Resonance Imaging (MRI) plays a crucial role in diagnosing and monitoring these patients, providing an accurate assessment of global ventricular function, defining wall motion abnormalities, assessing myocardial edema and detecting complications.We present a case review highlighting the MRI features of Takotsubo cardiomyopathy and its complications, focusing on differentiating this condition from acute myocardial infarction and acute myocarditis. Although this condition generally follows a benign course with a good prognosis, its acute phase may involve complications, with heart failure being the most common.

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# Abstract Archives of the RSNA, 2024

CAEE-72

## EXTREMELY RARE ISOLATED ATRIAL LESIONS WITH SIMILAR DIFFUSE ATRIAL WALL THICKENING FROM COMPLETELY DIFFERENT ETIOLOGIES: IMAGING FINDINGS, MANAGEMENT, AND COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Masafumi Takafuji, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Haruno Ito (*Abstract Co-Author*) Nothing to Disclose
Shintaro Yamaguchi (*Abstract Co-Author*) Nothing to Disclose
Masaki Ishida, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Suguru Araki (*Abstract Co-Author*) Nothing to Disclose
Miyuko Fujita (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To discuss the clinical and imaging mimickers with diffuse atrial wall thickening but completely different etiologies. 2. To discuss the imaging findings and management strategies for isolated atrial lesions with diffuse atrial wall thickening. 3. To review the biopsy and pathologic findings isolated atrial lesions with diffuse atrial wall thickening. 4. To discuss the complications related to isolated atrial lesions with diffuse atrial wall thickening.

### TABLE OF CONTENTS/OUTLINE

A) Differential diagnosis of clinical and imaging mimickers with diffuse atrial wall thickening but completely different etiologies: IgG4-related atrial cardiomyopathy, isolated atrial amyloidosis, atrial giant cell myocarditis. B) Typical imaging findings of isolated atrial lesions with diffuse atrial wall thickening: echocardiography, CT, cardiac MRI, FDG-PET/CT C) Clinical management of isolated atrial lesions with diffuse atrial wall thickening. D) Biopsy as a mandatory procedure for the final diagnosis in rare disease E) Complication of isolated atrial lesions with diffuse atrial wall thickening i. Atrial fibrillation ii. Atrial dysfunction iii. Atrial thrombus iv. Intramural atrial hemorrhagic dissection F) Case presentation: typical imaging findings, the course of treatment and the pathologic findings. i. IgG4-related atrial cardiomyopathy ii. isolated atrial amyloidosis iii. Atrial giant cell myocarditis

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# Abstract Archives of the RSNA, 2024

CAEE-73

## NAVIGATING ACROSS CORONARY ARTERIES: CT ANGIOGRAPHY CHARACTERIZATION OF CORONARY ATHEROSCLEROTIC PLAQUES ACCORDING TO THEIR CAD-RADS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Doris Licely Canche Aguilar, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Manuel Pineda Cordoba, MD (*Abstract Co-Author*) Nothing to Disclose
Luis Enrique Nunez Castellanos (*Abstract Co-Author*) Nothing to Disclose
Diego Leonardo Meza Neri (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To provide a pathophysiological overview of the formation of atherosclerotic coronary plaque and its cardiovascular impact on coronary heart disease.- Describe normal coronary anatomy.- Detail the specific radiological characteristics of a high-risk plaque to learn to recognize them.- Describe the pathophysiology of atherosclerotic plaque formation.- Learn to recognize the radiological features in healthy coronary arteries without atherosclerotic plaques and their significance.- Identify calcified and non-calcified coronary plaques through clinical cases.- Qualitatively assess the severity of coronary plaques.- Correctly interpret the CAD-RADS classification.- Understand the role of the radiologist in the interpretation of coronary CT angiography.- Describe the diagnostic and therapeutic conduct to follow according to the CAD-RADS classification.

### TABLE OF CONTENTS/OUTLINE

1. Normal coronary anatomy in coronary CT angiography 1.1 Coronary segmentation2. Fundamentals of atherosclerotic plaque: What should the imaging specialist understand? 2.1 Epidemiology 2.2 Etiology 2.3 Main imaging characteristics of atherosclerotic plaques 2.4 Pathophysiology3. Principles and applications of coronary angiotomography in atheromatous plaque. 3.1 CAD-RADS implications and classification4. Radiological characterization of atherosclerotic plaque by AngioTAC according to CAD-RADS.4.1 High risk plaque 4.2 Low risk plaque 4.3 Diagnostic and therapeutic conduct according to CAD-RADS classification

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# Abstract Archives of the RSNA, 2024

CAEE-74

## UNUSUAL PERICARDIAL SPACES MIMICKING MEDIASTINAL TUMOR

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yo Won Choi, MD (*Abstract Co-Author*) Nothing to Disclose
Chang Guk Kim (*Abstract Co-Author*) Nothing to Disclose
Seung-Jin Yoo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review of the normal anatomy of the pericardial space 2. Review of the typical CT findings of the pericardial space. 3. Pericardial spaces mimicking mediastinal mass or lymphadenopathy. 4. How to differentiate mass-mimicking pericardial spaces from lymph nodes/mediastinal mass.

### TABLE OF CONTENTS/OUTLINE

1. Normal anatomy of pericardial space 2. Review of typical CT findings of the pericardial space 3. Review of pericardial spaces mimicking mediastinal mass or lymph node. A. Sterno-pericardial ligament B. High-riding superior pericardial recess C. Pericardial diverticulum from superior pericardial recess 4. Differentiation between pericardial space with lymph nodes/mediastinal mass. 5. Summary

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# Abstract Archives of the RSNA, 2024

CAEE-75

## COMPREHENSIVE REVIEW OF NON-ATHEROSCLEROTIC CORONARY ARTERY DISEASES MIMICKING ACUTE CORONARY SYNDROME (ACS): ETIOPATHOGENESIS, IMAGING FINDINGS, AND DIFFERENTIAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Sachin S. Saboo, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ameya J. Baxi, MBBS,DMRD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To discuss non-atherosclerotic coronary artery disease (CAD) 2. To study the role of imaging in the diagnosis and evaluation of these conditions 3. To discuss imaging based differential diagnosis

### TABLE OF CONTENTS/OUTLINE

Atherosclerotic CAD is the most common cause of ACS, however, non-atherosclerotic processes are also contribute to a substantial number of ACS events and as such require different diagnostic and therapeutic strategies. Non-obstructive conditions can also cause same symptoms as obstructive CAD. In the absence of obstructive CAD, increased awareness together with a high index of suspicion for other important causes of ACS is crucial to delineate the underlying etiology. Recognizing typical imaging manifestations with adequate clinical correlation is essential for timely and accurate diagnosis as well as optimized patient care. In this exhibit, we discuss the characteristic multimodality imaging findings and differential diagnosis of non-atherosclerotic causes of ACS. Aims/Objectives · Introduction · Taxonomy · Pathologic and cross-sectional imaging findings role of imaging § Malignant coronary artery origin anomalies § Coronary artery ectasia/Coronary artery aneurysms § Coronary artery dissection § Coronary artery fistula § Coronary artery embolism § Coronary artery vasospasm § Different types of Vasculitis § Myocardial bridging § Stress- induced cardiomyopathy · Differential diagnosis · Conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-76

## IMAGING OF MITRAL VALVE PATHOLOGY: WHAT RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Sachin S. Saboo, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ameya J. Baxi, MBBS,DMRD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To discuss relevant Mitral Valva (MV) anatomy To review various congenital and acquired pathologies involving MV To increase imaging appearances differential diagnosis of congenital and acquired MV diseases

### TABLE OF CONTENTS/OUTLINE

Knowledge of MV valve anatomy function is essential to understand diagnose pathology. MV complex consists of anterior posterior leaflets, fibrous annulus subvalvular apparatus, consisting of the chordae tendineae papillary muscles. Main manifestations of MV disease are regurgitation stenosis caused by spectrum of various pathologies. Echocardiography, CT, cardiac MR imaging are main modalities used for evaluation of MV pathologies, each with its own advantage and limitations. Cardiothoracic radiologist should be well versed with echocardiography, MDCT, and CMR, in order to optimize preprocedural patient selection, procedural planning, post-procedural assessment of MV including postoperative complications. Knowledge of natural history, clinical manifestations, salient imaging features is essential for accurate diagnosis guiding treatment. In this exhibit, we discuss characteristic multimodality imaging findings and differential diagnosis of normal and diseased MV. Aims/Objectives · Introduction · Anatomy · Pathology, role of imaging imaging findings Shone Complex , Mitral Annular Calcification, Mitral Annular Disjunction, Prolapse, MV rupture, Mitral Stenosis, Mitral Regurgitation, Endocarditis, Thrombosis, Tumors-Primary and Secondary, MV Devices § Miscellaneous · Role of imaging in preoperative and reintervention planning · Postprocedural postoperative complications · Differential diagnosis · Conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-77

## IMAGING SPECTRUM OF CONOTRUNCAL ABNORMALITIES WITH MALALIGNMENT TYPE VENTRICULAR SEPTAL DEFECTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jerald Garvin S. Lim, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Niemierko, MD (*Abstract Co-Author*) Nothing to Disclose
Franklin S. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Thurl Cledera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Malalignment ventricular septal defects encompass a spectrum of anomalies characterized by the malalignment and absence of fusion between the outlet/conal septum and the ventricular septum. Malalignment defects are secondary to abnormalities in the elongation of the outflow tract during the different phases of cardiac looping. These defects have also been found to be associated with other cardiac anomalies, such as conotruncal abnormalities such as Tetralogy of Fallot, Transposition of the Great Arteries, Double Outlet Right Ventricle, and others. Knowledge of septal malalignment can help in determining the concordance of heart structures and outflow tracts. The objectives of this exhibit are: 1) Understand embryologic concepts behind the normal development of the outflow tract of the heart, 2) Use a systematic approach in identifying malalignment ventricular septal defects, and 3) Recognize key imaging features and anatomic landmarks in assessing these congenital defects

### TABLE OF CONTENTS/OUTLINE

I. Introduction II. Embryology Review III. Characterizing Malalignment Ventricular Septal Defects IV. Imaging Modalities V. Conotruncal Abnormalities A. Tetralogy of Fallot B. Double Outlet Right and Left Ventricle C. Double Inlet Right and Left Ventricle D. Truncus Arteriosus E. Transposition of the Great Arteries VI. Considerations in Post-operative Imaging and Follow-up VII. Conclusion

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# Abstract Archives of the RSNA, 2024

CAEE-8

## JOURNEY INTO THE HEART: RADIOLOGICAL ASSESSMENT OF CARDIAC MASSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alba Lopez-Castello, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Pereiro Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Perez Costas, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Robles Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Sabela Garcia Benito, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the most representative cases of cardiac masses in our center and summarize the clinical presentation and the most characteristic imaging findings.

### TABLE OF CONTENTS/OUTLINE

- Cardiac masses are part of a broad and heterogeneous spectrum of pathology, with a clinical presentation that depends on both the nature of the mass (benign or malignant) and its location in the cardiac cavity (asymptomatic, ischemic events, arrhythmic, embolic, pericardial effusion, etc). - The initial imaging test when a cardiac mass is suspected is echocardiography (transthoracic or transesophageal), and depending on the findings and the patient's baseline condition, further evaluation with magnetic tesonance imaging or computed tomography may be considered, each with its specific protocols. -The location and imaging characteristics of the cardiac masses are essential for achieving an accurate diagnostic approach and for distinguishing between the main types of cardiac masses: non-neoplastic masses (intracavitary thrombus, vegetation, caseous calcification of the mitral annulus, pericardial cyst), primary benign tumors (myxoma, fibroelastoma, lipoma, hemangioma, rhabdomyoma, fibroma, etc.), malignant tumors (sarcoma, angiosarcoma, lymphoma, mesothelioma, etc.), and cardiac metastases.

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# Abstract Archives of the RSNA, 2024

CAEE-9

## CARDIAC CT APPLICATION OF SUPER RESOLUTION DEEP LEARNING RECONSTRUCTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yuji Kaga, RT (*Abstract Co-Author*) Nothing to Disclose
TOSHIKI KATO (*Abstract Co-Author*) Nothing to Disclose
Koichi Chida, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Sota (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Haga, PhD, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Computed tomography (CT) images have evolved over time. Recently, deep learning technology has been used for reconfiguration techniques. In particular, Precise IQ Engine (PIQE) is a super-resolution image reconstruction technology that uses deep learning and Aquilion Precision's high-resolution data. This is Super Resolution Deep Learning Reconstruction (SR-DLR) developed by Canon Medical Systems. The use of PIQE for coronary CT angiography (CCTA) allows for more accurate diagnosis than previously possible. The purpose of this objective is to examine the use of PIQE for CCTA and the accuracy of stent lumen assessment.

### TABLE OF CONTENTS/OUTLINE

1.To understand Precise IQ Engine(PIQE) using deep learning techniques2.To understand how it differs from other reconstruction methods (Iterative Dose Reduction 3D and advanced intelligent Clear-IQ Engine)3.To understand the importance of assessing the severity of in-stent stenosis on coronary CT angiography (CCTA)4. To evaluate the in-stent stenosis of < 3.0-mm stent diameter5. To understand the characteristics of coronary atherosclerotic plaque detected by CCTA (including positive remodeling, low-attenuation plaque, and mottled calcification)6. To understanding the application of PIQE to the cardiovascular field

# Abstract Archives of the RSNA, 2024

CHEE

**Chest Imaging Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## CHEE-10 IS BLOOD THICKER THAN TISSUE? A RADIOLOGIST'S GUIDE TO LIQUID BIOPSY IN LUNG CANCER

**Awards**
**Certificate of Merit**

Chiemezie Amadi, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed M. Sayyouh, MSc (*Abstract Co-Author*) Nothing to Disclose
Shotaro Naganawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Prachi P. Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Jerald Garvin S. Lim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Introduce liquid biopsy, and its methods, as a non-invasive method for analyzing circulating analytes • Explain the current applications of liquid biopsy in guiding monitoring and treatment decisions in non-small cell lung cancer • Address challenges of liquid biopsy and its implementation in routine clinical practice • Enumerate some of the potential and future applications of liquid biopsy • Emphasize the multidisciplinary collaboration between oncologists, radiologists, and pathologists to leverage both liquid biopsy and imaging data effectively, ultimately improving patient outcomes and personalized treatment strategies.

### TABLE OF CONTENTS/OUTLINE

1. What is liquid biopsy and how is it done? 2. Common biomarkers and techniques utilized in liquid biopsy 3. Current application of liquid biopsy in non-small cell lung cancer 3.1. Tumor genotyping (e.g., KRAS, EGFR, other changes in molecular profile) 4. Advantages and disadvantages of liquid biopsy vs. percutaneous tissue biopsy. Can liquid biopsy replace tissue biopsy? 5. Current status of liquid biopsies and potential impact on radiology 6. Potential future applications of liquid biopsy 6.1. Enhance screening and early detection efforts in high-risk populations, as well as disease interception 6.2. Monitoring while on immunotherapy and targeted therapy 6.3. Identifying post-surgical patients that would benefit most from adjuvant therapy(ies) 6.4. Determining optimal duration of consolidation and adjuvant therapies 6.5. Early detection of disease progression prior to radiographic manifestation

## CHEE-100 POST-RADIOTHERAPY LUNG CHANGES, THE MAJOR MIMICKERS: NORMAL PATTERNS AND COMPLICATIONS

Camilo A. Caicedo Montano, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Alejandra Amaya, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Aluja, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Omar Andres Pantoja Burbano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

o It is necessary to clearly understand the approach to post-radiotherapy lung in diagnostic images, focusing on four fundamental aspects: previous studies, irradiated area, technique used, and elapsed time between treatment and the evaluated study.o The irradiated areas can acquire a wide variety of patterns on CT, especially in patients undergoing high-precision radiotherapy. Therefore, it is necessary to be familiar with them, as they often present findings similar to other pathologies.o The radiologist must recognize the key points to differentiate between radiotherapy patterns, infectious pathologies, or recurrenceo Post-radiotherapy complications must be promptly recognized and differentiated from usual changes.

### TABLE OF CONTENTS/OUTLINE

o Introduction.o Pathway for addressing expected findings in the post-radiotherapy lung.o Types of radiotherapy.o Acute and chronic post-radiotherapy changes in the lung.o Main patterns that can be visualized in the irradiated areas and their differential diagnoses.o Main complications.

## CHEE-101 INNOCENT-LIKE MIMICKERS: THE MEETING OF X-RAY WITH CINEMATIC AND 3D RENDERING TO REACH THE TRUTH

Omer Onder, MD (*Abstract Co-Author*) Nothing to Disclose
Zehavit Kirshenboim (*Abstract Co-Author*) Nothing to Disclose
Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Julian Fazi, MD (*Abstract Co-Author*) Nothing to Disclose
Emrah Duman, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Differentiate radiologist workflows and their impact on diagnostic accuracy in thoracic imaging.-An assessment of how findings that are difficult to detect or appear innocent on X-ray, a projection method, actually correspond to pathologies and how they are represented in high-quality 3D and cinematic rendering.-Detail the subtle presentations of thoracic pathologies and their propensity to mimic adjacent anatomical structures.-Highlight the need for careful scrutiny in regions commonly harboring lung masses and vascular anomalies.-Discuss the diagnostic challenges posed by the complex interplay of pneumothorax, effusion, and other thoracic conditions.-Address the pitfalls of anatomical superimposition in image interpretation.

**TABLE OF CONTENTS/OUTLINE**

•Trachea:-Identification of tracheal pathologies, often obscured or resembling adjacent structures.-Strategies for recognizing subtle tracheal anomalies in a busy clinical setting.•Lung:-The challenge of diagnosing lung pathologies that mimic the surrounding anatomy.•Cardiophrenic Region:-The cardiophrenic region as a potential site for pathology, complicated by its proximity to the heart and diaphragm.•Hilum:-The importance of meticulous examination to uncover hilar pathologies.•Pleura:-Pneumothorax and effusion as diagnostic challenges, with a focus on their masquerading aspects.-Techniques and pearls to differentiate these conditions from other pleural diseases.•Bones and Soft Tissues:-Superimpositions in thoracic imaging and their impact on the interpretation of bone and soft tissue anomalies.-Correcting misinterpretations of normal anatomical variants and pathological conditions.

## CHEE-102 PULMONARY FUNGAL DISEASE: A GUIDE FOR RESIDENTS

Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Amanda Acevedo (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jessica Gemmell (*Abstract Co-Author*) Nothing to Disclose
Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pratik P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Alysson Roncally Carvalho, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Tan-Lucien H. Mohammed, MD (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana Barreto Caldas De Lima (*Abstract Co-Author*) Nothing to Disclose
Ian Griffin (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Delineate the radiologic signatures of common pulmonary fungal diseases, including aspergillosis, histoplasmosis, and cryptococcosis. ; Highlight the significance of immune status on the radiologic appearance of fungal infections. ; Discuss the importance of recognizing endemic regions in the imaging interpretation of fungal diseases.

**TABLE OF CONTENTS/OUTLINE**

● Introduction to Pulmonary Fungal Infections ○ Prevalence and Public Health Impact ○ Risk Factors and Patient Populations ● Imaging Hallmarks of Fungal Diseases ○ Aspergillosis: Nodules, Air Crescent Sign ○ Histoplasmosis: Calcifications, Lymphadenopathy ○ Cryptococcosis: Mass-like Lesions, "Soap Bubble" Lytic Bone Lesions ● Diagnostic Challenges ○ Overlap with Malignant and Non-infectious Pathologies ○ Case-based Approach to Differential Diagnosis ● Clinical and Imaging Correlation ○ Impact of HIV, Transplantation, and Immunosuppression on Disease Presentation ○ Imaging Protocols Tailored to Suspected Fungal Etiology ● Conclusion ○ Summary of Radiologic Criteria for Diagnosis ○ Role in Guiding Interventional Procedures

## CHEE-103 PURSUING THE UNUSUAL : IMAGING AND INTERVENTION STRATEGIES IN ATYPICAL SYSTEMIC VASCULAR SOURCES OF HAEMOPTYSIS

Amal Antony, MD (*Abstract Co-Author*) Nothing to Disclose
Vimal C. Mondy, MBBS,MD (*Abstract Co-Author*) Nothing to Disclose
Sai K. Deepalam JR, MD (*Abstract Co-Author*) Nothing to Disclose
Navya Paulson Mangali (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Imaging and endovascular interventions are pivotal in managing haemoptysis, a potentially life-threatening emergency. 2. Multidetector CT angiography (MDCTA) is the preferred imaging modality, allowing for a comprehensive evaluation of lung parenchyma, thoracic vasculature, and soft tissues. It enables precise identification of the source of hemoptysis, thereby aiding in the planning subsequent interventions. 3. In the majority of cases, hypertrophied bronchial arteries are responsible for haemoptysis, while atypical sources account for about five percent. Identifying these uncommon systemic vascular sources is crucial before planning intervention. 4. The role of endovascular intervention in the management of haemoptysis is increasing, offering a less invasive and effective alternative. The choice of endovascular treatment is tailored to the cause of haemoptysis. 5. Radiologists plays a central role in the multidisciplinary team, and should possess knowledge of the sources and mechanisms of haemoptysis, its imaging characteristics, and the available endovascular treatments.

**TABLE OF CONTENTS/OUTLINE**

1. Common source of haemoptysis: Orthoptic Bronchial Arteries 2. Uncommon systemic vascular sources of haemoptysis: 2.1 Ectopic Bronchial Arteries 2.2 Non-bronchial systemic collaterals 2.3 Atypical configurations of systemic arteries 2.4 Aneurysm/pseudoaneurysm of systemic arteries 2.5 Systemic supply in sequestration 2.6 Aortopulmonary Collateral Arteries 3. Role of Imaging: MDCTA 4. Endovascular treatment options

## CHEE-104 CHEST MRI: ANOTHER ALLY TO UNTANGLE ILD DIAGNOSIS AND FOLLOW-UP

Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sandro B. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Hiren Mehta, MD (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alysson Roncally Carvalho, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ronak Kundalia (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Computed tomography (CT) is considered the gold standard imaging modality for interstitial lung disease (ILD); however, it is associated with a concerning amount of ionizing radiation exposure in patients with CT who require serial scans throughout their disease course. Magnetic resonance imaging (MRI) is emerging as a viable diagnostic modality for ILD that can accurately diagnose early stages of disease and trace its progression.

**TABLE OF CONTENTS/OUTLINE**

1. Main findings in MRI - honeycombing and traction bronchiectasis2. T2 CT MR Correlation3. T1 Times4. DELAYED enhancement5. Elastography

## CHEE-105 BEVACIZUMAB AND THORACIC RADIOTHERAPY: A DANGEROUS COMBINATION FOR RESPIRATORY TRACT FISTULAS

Bruno L. Moreira, MD (*Abstract Co-Author*) Nothing to Disclose
Augusto K. Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo d. Peixoto, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Rydz P. Santana, MD (*Abstract Co-Author*) Speaker, AstraZeneca PLC;Speaker, Boehringer Ingelheim GmbH
Camila P. Reifegerste, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Bevacizumab is a monoclonal antibody against the vascular endothelial growth factor (VEGF), which prevents the development of new blood vessels necessary for tumor growth. It has been used in the treatment of various neoplasms. In addition to its known adverse effects such as hypertension, proteinuria, thromboembolic and hemorrhagic events, recent reports highlight a rare but highly fatal complication: airway fistula. Reported types include tracheoesophageal, tracheomediastinal and bronchopleural fistulas. The mechanism behind these fistulas is not fully understood, but Bevacizumab's interference with angiogenesis may delay wound healing, predisposing the airways to fistula formation. Thus, any lesion in the airways could predispose to the formation of a fistula, and the main risk factor indicated in the literature for these lesions is a history of thoracic radiotherapy. This presentation will illustrate cases of airway fistula related to the combination of Bevacizumab and a history of thoracic radiotherapy, alerting radiologists to the possibility of this diagnosis. Despite its rarity, the high mortality rate associated with airway fistulas underscores the critical need for awareness, enabling early diagnosis and effective treatment.

**TABLE OF CONTENTS/OUTLINE**

Introduction to Bevacizumab and brief review of its mechanism of action/pharmacology; cases of airway fistula related to Bevacizumab + thoracic radiotherapy; discussion; conclusion.

## CHEE-106 VERTICAL VENOUS STRUCTURES OF THE LEFT VERTEX

Tatiana Arroyave, MEd (*Abstract Co-Author*) Nothing to Disclose
Manuela Restrepo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The right vertex of the mediastinum includes the most important vascular and lymphatic structures of the body. In unusual circumstances, these structures have developmental malformations that are incidentally recognized on imaging as vertical venous structures of the left vertex. It is essential to recognize because of its clinical and surgical importance.2. Persistent left superior vena cava (SVC) is the most common congenital anomaly seen in the thorax. In this case, the right SVC might be normal, small or absent. When the right SVC is also present, it is considered a duplicated vena cava. In unusual cases the brachiocephalic vein passes posterior or surrounding to the aorta. An atypical case of circumaortic SVC is presented.3. The anomalous supracardiac venous drainage is a congenital anomaly in which the pulmonary veins converge in one single vertical vein on the left vertex of the thorax, that drains to the systemic circulation, either to the SVC, brachiocephalic vein or the right atrium. 4. The anomalies of the thoracic duct are rare, and it is important to recognize the normal anatomy to identify when possible anomalies exist, including complete left sided course, cystic dilatation, duplications, plexiform variation and absence of the cisterna chyli.

**TABLE OF CONTENTS/OUTLINE**

Learning objectives. Normal anatomy. Duplicated and single left SVC. Circumaortic SVC. Abnormal supracardiac venous drainage. Thoracic duct reflux. Retroaortic innominate vein. Summary

## CHEE-107 BRIDGE OR DESTINATION: AN UPDATE ON VENTRICULAR ASSIST DEVICES

**Awards**
**Certificate of Merit**

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Linda B. Haramati, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Anna S. Bader, MD (*Abstract Co-Author*) Nothing to Disclose
Manroop Kaur, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Temporary ventricular assist devices (VAD) can be used in the acute setting supporting both the left and right ventricle.Long-term VADs are indicated for patients in the Class IV HF category, though cardiac transplant is the definitive treatment, assist devices can be used as a bridge to transplant, or destination therapy in those who do not qualify.Retrospective ECG gating through the entire cardiac cycle is recommended for optimal imaging of ventricular assist devices.Complications of VADs include malposition, hemopericardium, mediastinal hematoma, soft tissue hematoma, driveline infection/abscess, outflow graft thrombus, aortic stenosis, Heyde syndrome, bio-debris resulting in graft stenosis/occlusion.The purpose of this exhibit is to provide a review of the mechanics and appearances of traditional and newer ventricular support devices and illustrate common and uncommon complications through a multi-modality case-based review.

**TABLE OF CONTENTS/OUTLINE**

1. Cardiac anatomy and pathophysiology of heart failure. 2. Heart failure classification and indication for ventricular assist devices.3. CT protocols for appropriate evaluation of ventricular assist devices. 4. Appropriate placement of ventricular assist devices through a multi-modality case review with pitfalls in malpositioned devices.5. Case-based imaging review of acute and chronic complications from ventricular assist devices including acute renal failure, ischemic colitis, hematomas, driveline infection, LV/RV thrombus, aortic stenosis, outflow graft stenosis (thrombus and bio-debris), and twisting of the outflow graft. 6. Identification of thrombus versus bio-debris deposition in the outflow graft.

## CHEE-108 BETWEEN THE WALLS: INTRATHORACIC PSEUDOANEURYSM PATHOGENESIS AND IMAGING

Saurabh Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Terrance T. Healey, MD (*Abstract Co-Author*) Nothing to Disclose
Brandon H. Koo, MD,BS (*Abstract Co-Author*) Nothing to Disclose
Samika S. Kanekar (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Provide a review of thoracic pseudoaneurysms and how to differentiate between other vascular pathologies.Discuss current imaging techniques used in diagnosis of pseudoaneurysm.Review common and rare pathologies of pseudoaneurysms using case-based examples, focusing on clinical disease courses, imaging features, treatment, prognosis, and complications.

**TABLE OF CONTENTS/OUTLINE**

1. Review of the Arterial Wall2. Pseudoaneurysm vs. True Aneurysm3. Imaging Techniques and Findings4. Case Based Review of Pseudoaneurysm Pathologies5. Treatment and Prognosis6. Complications of Thoracic PseudoaneurysmsOutlinePseudoaneurysms have a higher risk of rupture than true aneurysms due to greater instability. Identification of pseudoaneurysms are key to determining management and decreasing adverse events. We review a wide variety of etiologies of thoracic pseudoaneurysm, including inflammatory, iatrogenic, infectious, and traumatic causes.

## CHEE-109 PULMONARY NODULES IN MAGNETIC RESONANCE: WHERE WE CAN HELP?

Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Alysson Roncally Carvalho, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Tan-Lucien H. Mohammed, MD (*Abstract Co-Author*) Nothing to Disclose
Pratik P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sandro B. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana Barreto Caldas De Lima (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Kenneth Davis (*Abstract Co-Author*) Nothing to Disclose
Kayla Davis (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Examine the indications for MRI in the evaluation of pulmonary nodules. Discuss the MRI characteristics of benign versus malignant pulmonary nodules. Understand the emerging role of MRI in lung cancer screening and surveillance.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to pulmonary nodules: A. Prevalence and clinical significance. B. Current imaging modalities and limitations. 2. MRI and pulmonary nodule assessment: A. Technological advances in thoracic MRI. B. MRI protocol for nodule characterization. 3. Comparative analysis: A. MRI Versus CT: Sensitivity, Specificity, and Safety. B. Case examples illustrating diagnostic dilemmas resolved by MRI. 4. Conclusion: A. The future of MRI thoracic oncology. B. Recommendations for practice and research.

## CHEE-11 MULTIPLE LUNG CANCER: COMPREHENSIVE REVIEW AND REVIEW OF CURRENT MANAGEMENT STRATEGY

Hyun-ju Lee, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To understand current staging system of multiple lung cancer 2. To review the results of CT based analysis for the differentiation between multiple primary cancers and intrapulmonary metastasis 3. To review prognostic CT findings in multiple lung cancer 4. To review the results of genetic analysis 5. To introduce current concepts of oligo-metastasis of lung cancers 6. To review current management strategies

**TABLE OF CONTENTS/OUTLINE**

1. Histologic features and current staging system of multiple lung cancer 2. CT analysis 2A. Differentiation between multiple primary cancers and intrapulmonary metastasis 2B. Prognostic CT findings in multiple lung cancer 3. Genetic analysis 3A. Results of chromosomal rearrangement studies 3B. Results of targeted sequencing analysis 3C. Results of oncogenic driver mutation studies 4. Current concepts of oligo-metastasis of lung cancers 5. Current management strategies 6. Future direction of research

## CHEE-110 DEMYSTIFYING TRAPPED LUNG:NOMENCLATURE, EMERGING CONCEPTS, IMAGING FINDINGS AND DIFFERENTIAL DIAGNOSIS THAT RADIOLOGIST SHOULD KNOW

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Rajeev Suri, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Ameya J. Baxi, MBBS,DMRD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review nomenclature, etiopathogenesis and clinical features of trapped lungTo review radiographic and computed tomography imaging features of trapped lungTo review emerging concepts/recent literature update

**TABLE OF CONTENTS/OUTLINE**

The term 'trapped lung' is used when the lung in unable to expand secondary to defective healing of the pleural space leading to stiff pleura restricting expansion of the lung. The diagnosis requires documentation of chronicity absence of active inflammatory or malignant pleural process, bronchial obstruction, or severe underlying lung disease. Trapped lung is usually seen secondary to inadequately treated chronic parapneumonic effusion or empyema, post-cardiac injury syndrome, post-cardiac surgery, hepatic hydrothorax, uremia, radiation, hemothorax, and rheumatoid pleuritis. Due to its rarity, occasional case reports are published and limited radiology literature is available in regards to natural history, etiopathogenesis, radiological manifestations. A more accurate precise terminology of trapped lung is a need of time is proposed. Imaging plays a critical role in patient management and at times eliminates invasive diagnostic or therapeutic procedures. Following are discussed: Aims/objectives, Nomenclature, Pathogenesis and imaging features of trapped lung, Differential diagnosis, Review of literature, Management, Post treatment follow up, Teaching points, and Conclusionp class="MsoNormal">

## CHEE-111 EMPYEMA: INFECTION TO INTERVENTION - A PRIMER FOR THE RESIDENTS

Mariana Travieso Diffoot (*Abstract Co-Author*) Nothing to Disclose
Adrian Naoun (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose

Manuel Garcia (*Abstract Co-Author*) Nothing to Disclose
Carol Sanchez Santana (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Ultrasound imaging can play an important role in the diagnosis, quantification, and staging of empyema. A sinusoid sign on ultrasound can predict lung expansion following empyema drainage. A positive sinusoid sign favors lung re-expansion after empyema drainage. Chest tube drainage output can be an indicator for response to antibiotic treatment. If output gradually decreases, it means the patient is responding to treatment. When the output is <100ml tube can be removed."Lung entrapment" is a reversible condition where the patient is symptomatic, with possible mediastinal shift to the opposite side, and surgical treatment like decortication offers immediate response. "Trapped lung" is irreversible, and an ex-vacuo pneumothorax can be present on imaging. Decortication is optional and performed for symptomatic relief.MRI imaging can help to differentiate empyema from necrotizing pneumonia.

**TABLE OF CONTENTS/OUTLINE**

Role of imaging in the diagnosis of empyema with a focus on quantification, staging, follow-up. Describe the imaging features of etiology of empyema: empyema from pneumonia, hematogenous spread, and infection spread from contiguous structures like osteomyelitis (bone infection), empyema following surgical procedures. Describe imaging features of complications of empyema: empyema necessitans, post-pyothorax lymphoma, fibrothorax. Describe imaging findings of treatment procedures for empyema: tube thoracostomy, thoracomyoplasty, pleural decortication, Clagett window, Eloesser flaps. Describe complications of treatment procedures including non-expanding lung-like formation of pleural rind, lung atelectasis, endobronchial obstruction, bronchopleural fistula.

## CHEE-112 ASSESSING USUAL AND UNUSUAL DEVICES COMPLICATIONS IN CARDIOTHORACIC RADIOLOGY - BE PREPARED FOR THE UNEXPECTED

Rodrigo Moreira Bello, MD (*Abstract Co-Author*) Nothing to Disclose
Otavio Augusto Ferreira Dalla Pria, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Heming, MD (*Abstract Co-Author*) Nothing to Disclose
Hanna R. Ferreira Dalla Pria, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Sravani Mannuru, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Cardiothoracic devices represent an important aspect of evaluation in radiographs and tomography for trainees and experienced radiologists who critically assess their positioning and potential complications. However, although they are part of the daily routine, they also become challenging due to the multiple types of devices available, which increase yearly. It's essential to become familiar with and updated on these devices in order to identify what is expected and abnormal, especially regarding malfunctioning, malpositioning, and other potential complications.This exhibit aims: 1. To review the most used cardiothoracic devices, emphasizing the newest ones. 2. To illustrate cases of misposition, malfunctioning, and/or complications related to devices that appear in cardiothoracic radiology.

**TABLE OF CONTENTS/OUTLINE**

Section A- Introduction/Objectives: Brief review of relevant radiological concepts of cardiothoracic devices: 1. Pacemakers and Implantable cardioverter-defibrillators, 2. Loop recorders, 3. Valve replacement and repair, 4. Closure devices, 5. Vascular stents, surgery clips (CABG), 6. Left ventricular assist device, 7. Impella, 8. Intra-aortic balloon pump, 9. Pleural devices, 10. I Tracheal/bronchial, and II esophageal devices, 11. Vascular catheters, 12. And miscellaneous, such as hypoglossal nerve stimulator, embolization coils, and the antibiotic spacer. Section B - Case-based approach: Present/illustrate cases among the ones listed above with typical and unexpected complications, malpositioning, and malfunctioning of these devices.

## CHEE-113 CHEST BEDSIDE APPLICATIONS OF PORTABLE DYNAMIC DIGITAL RADIOGRAPHY (DDR): BRINGING THE DYNAMIC ACQUISITION TO THE PATIENTS' BED

Tatiana Lisnic (*Abstract Co-Author*) Nothing to Disclose
Marcello A. Orsi, MD (*Abstract Co-Author*) Nothing to Disclose
Giancarlo Oliva (*Abstract Co-Author*) Nothing to Disclose
Paolo F. Felisaz, MD (*Abstract Co-Author*) Nothing to Disclose
Maurizio Ce, MD,BA (*Abstract Co-Author*) Nothing to Disclose
Laura Macri (*Abstract Co-Author*) Nothing to Disclose
Francesca Lucrezia Rabaiotti (*Abstract Co-Author*) Nothing to Disclose
Michaela Cellina (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To learn applications of portable DDR for chest investigation at the patient's bedside.

**TABLE OF CONTENTS/OUTLINE**

DDR is a new high-resolution technique, that applies pulsed X-ray to acquire multi-frame fast-paced sequential acquisition of targeted anatomical areas, then reproduced in cine-loops.Different conditions may result in diaphragmatic dysfunction, including vascular disorders, post-traumatic abnormalities, infections, muscular and neuro-muscular diseases, and neoplasms. DDR provides functional, structural, and morphological information and shows the pattern of diaphragmatic motion over time in colored curves, quantifying the range of motion to support the diagnosis of diaphragmatic dysfunction. DDR allows the evaluation of lung motility and the presence of abnormal motion related to adhesions or post-surgical conditions, useful in diagnosing breathing abnormalities in lung cancer patients. Lung Ventilation can be assessed through automatic reconstructions of colored maps, which provide information on the changes in pixel density and related signal over time that can be used to identify regional differences in ventilation and to assess the effectiveness of different respiratory treatments in Intensive Care Units patients. Pulmonary perfusion abnormalities related to chronic and acute conditions can be investigated with DDR without the need for any contrast media, allowing the acquisition in patients with severe allergies or altered renal function. The acquisition of dynamic imaging at the patient's bed can also increase the X-ray sensitivity in detecting post-procedural complications, such as pneumothorax, that can be easily detected and followed up without moving the patient.

## CHEE-114 IMAGING AND CLINICAL FEATURES OF CYSTIC LUNG DISEASES: A PRACTICAL GUIDE FOR RADIOLOGISTS

Tassia R. Yamanari, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Hipolito Bachion (*Abstract Co-Author*) Nothing to Disclose
Chang K. Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Sousa Santana De Paula (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose

Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Pulmonary cysts are a common finding in routine CT scans. Solitary/incidental cysts in asymptomatic individuals may represent part of the normal aging process. However, lung cysts can be a manifestation of an underlying disease and the diagnosis might be challenging. 1) Review the main imaging findings of cystic lung diseases (CLD). 2) Recognize the different causes of CLD based on their causes, location and distribution of the cysts, and associated findings. 3) Propose a practical and systematic approach to interpret the CLD based on the main imaging findings and clinical features. 4) Present helpful clues and key points to narrow down the differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction 2) Differential diagnosis of air-filled lung lesions 3)Histopathology of pulmonary cysts 4)Main causes of cystic lung disease 5)Solitary/localized cysts 6)Multiple/diffuse cysts not commonly associated with other pulmonary findings 7)Multiple/diffuse cysts associated with ground-glass opacities 8)Multiple/diffuse cysts associated with pulmonary nodules 9)Multiple/diffuse cysts associated with fibrotic changes 10)Conclusion/Take-home messages

## CHEE-115 PULMONARY SARCOIDOSIS: AN UPDATE FOR CT FINDINGS

**Awards**
**Certificate of Merit**

Lydia Chelala, MD (*Abstract Co-Author*) Nothing to Disclose
Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Erhan Akpinar, MD (*Abstract Co-Author*) Nothing to Disclose
Furkan Ufuk, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• To review the typical and less common findings of pulmonary sarcoidosis on chest CT.• To describe the chest CT phenotypes of sarcoidosis and examines the pathophysiological insights gained from chest CT. • To review the role of chest CT in monitoring the sarcoidosis and in prognostication.

**TABLE OF CONTENTS/OUTLINE**

1. Non-fibrotic Subtypes a. Perilymphatic Micronodules Innumerable small nodules along the bronchovascular bundles, fissures, and subpleural regions. b. Large Peri-bronchovascular Nodules: Characterized by large nodules centered around the bronchovascular structures, potentially showing the "galaxy sign". c. Scattered Large Nodules Characterized by large nodules that are scattered and appear unrelated to the bronchovascular structures. d. Consolidation Lung consolidation which may suggest alveolar filling processes. e. Other rare conditions Air trapping, reversed halo sign, mass-like lesions, and ground-glass opacification. 2. Likely to be Fibrotic Subtypes a. Bronchocentric Reticulation without Cavitation Characterized by reticular patterns focused around the bronchovascular structures without evidence of cavitation. b. Bronchocentric Reticulation and Dense Parenchymal Opacification with Cavitation Characterized by bronchocentric reticulation accompanied by areas of dense opacification and cavitation. c. Large Bronchocentric Masses Characterized by large, dense, bronchocentric masses that mimic the appearance of progressive massive fibrosis. 3. Grey Zones and Unknowns: • Mosaic attenuation and interlobular septal thickening. • The link between specific CT appearances and with their clinical significance. Rare imaging findings of pulmonary sarcoidosis.

## CHEE-116 TIPS, TRICKS AND PEARLS IN THE RADIOLOGICAL DIAGNOSIS OF PLEURAL MESOTHELIOMA

Ainhoa Clemente Idoate, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Helena Gomez Herrero (*Abstract Co-Author*) Nothing to Disclose
Elia Lecumberri, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To describe the optimal technical computed tomography (CT) acquisition in order to evaluate pleural thickening. Review the semiology of mesothelioma on CT. To illustrate the radiological findings associated with asbestos exposure that can provide clues in the diagnosis of pleural malignancy. To discuss the different interventional procedures available for diagnosis, focusing on those guided by imaging.

**TABLE OF CONTENTS/OUTLINE**

1. Chest CT scan studies with venous phase acquisition for better detection of pleural thickening in suspected malignant effusion. 2. Typical CT imaging findings in mesothelioma, considering subtle and more specific radiological signs. 3. Asbestosis and pleural plaques associated with asbestos exposure in the context of a pleural effusion suspicious for malignancy, along with recommendations for precise detection. 4. A review of various interventional techniques for diagnosing mesothelioma as reported in medical literature, including thoracentesis, blind pleural biopsy, image-guided pleural biopsy, and surgical procedures. 5. The importance of reviewing positron emission tomography (PET) studies before conducting image-guided biopsies to optimize results.

## CHEE-117 SILICOSIS AND SILICA EXPOSURE RELATED DISEASES: WHAT RADIOLOGISTS SHOULD KNOW

Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo G. Marcelino, MD (*Abstract Co-Author*) Nothing to Disclose
Jean Meneguetti (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joao S. Pais, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago De Gaultier Paulo, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo E. Catarina, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

I. Review the epidemiology and clinical characteristics of silicosis, as well as the main diseases related to silica exposure. II. Illustrate the imaging findings of silicosis and diseases associated with silica exposure. III. Propose a diagnostic approach to the radiological findings of silicosis, considering its differential diagnoses, associated diseases and complications.

**TABLE OF CONTENTS/OUTLINE**

Silicosis overview:- Silicosis is the primary manifestation resulting from exposure to silica crystals. It entails irreversible diffuse interstitial lung disease.- Epidemiological data:-About 2.3 million Americans are exposed to inhalable silica particles.Other Associated Diseases: Silica exposure is strongly

associated to various diseases beyond silicosis (lung cancer, tuberculosis, chronic obstructive pulmonary disease (COPD)).Additionally, less prevalent ailments like autoimmune diseases (especially rheumatoid arthritis and systemic sclerosis), sarcoidosis, and vasculitis.Clinical Importance Understanding the presentation of pulmonary silicosis and its associated diseases is crucial.This knowledge aids radiologists and pulmonologists in early diagnosis and complication prevention.Purpose of Review: Provide a comprehensive understanding of silica exposure-related conditions

## CHEE-118 CYSTIC LUNG DISEASES: BLEND OF CLASSIC KNOWLEDGE AND CONTEMPORARY INSIGHTS

Felipe S. Torres, MD, PhD (*Abstract Co-Author*) Research support, Altis Labs
Micheal McInnis, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Bayer AG
Patrik Rogalla, MD, MBA (*Abstract Co-Author*) Institutional Research Grant, Canon Medical Systems Corporation;Institutional Research Grant, KA Imaging
Tae Bong Chung, MD (*Abstract Co-Author*) Nothing to Disclose
Jonatas Favero Prietto Dos Santos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- A cyst appears as a circumscribed parenchymal low attenuating area, usually with thin and regular walls. - Solitary or few small thin-walled lung cysts incidentally detected on CT may be part of the normal aging process. - In scenarios involving young patients with multiple lung cysts, careful evaluation of cyst characteristics, distribution, and ancillary radiologic findings is paramount. - Cystic lung cancers are an underrecognized condition on CT, often missed at early stages. - Suspicious cyst features include thick or asymmetric walls, associated nodules, internal septations, and growth. - A change in the morphologic features of a cyst and surrounding tissues should raise suspicion for cancer.

### TABLE OF CONTENTS/OUTLINE

1) Review basic imaging concepts through examples, including the updated terminology from the new Fleischner Society glossary of terms for Thoracic Imaging. 2) Distinguish between non-pathological and pathological lung cysts, focusing on their clinical significance and associated findings that aid in diagnosing diffuse lung cystic diseases. 3) Overview of classical cystic lung pathologies. 4) Revisit congenital, infectious, and non-infectious abnormalities that may present with cysts. 5) Unveil the evolving landscape of cystic lung cancers, integrating recent updates from LUNG-RADS. 6) Through a blend of classic knowledge and contemporary insights, this exhibit endeavors to provide radiologists with a nuanced understanding of cystic lung diseases, enhancing diagnostic accuracy and patient care.

## CHEE-119 FINDING PNEUMO: ADVANCED PULMONARY FUNCTIONAL IMAGING METHODS

**Awards**
**Cum Laude**

Marcelo B. Amato, MD (*Abstract Co-Author*) Nothing to Disclose
Shotaro Naganawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Prachi P. Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Andreas Voskrebenzev (*Abstract Co-Author*) Nothing to Disclose
Ka Kit Wong, MBBS (*Abstract Co-Author*) Nothing to Disclose
Yuzo Yamasaki, MD, PhD (*Abstract Co-Author*) Research Grant, Konica Minolta, Inc
Agilo L. Kern (*Abstract Co-Author*) Nothing to Disclose
Filip Klimes (*Abstract Co-Author*) Nothing to Disclose
Jens Vogel-Claussen, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio S. Galizia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Traditional medical imaging methods, such as radiography, CT and MRI can depict structural spatial variation in the lungs but not function. Recently several imaging methods have been developed that are able to depict the local distribution of functional parameters, such as ventilation and perfusion. • Some techniques involve the application of software analysis to images obtained with standard hospital equipment. They include analysis of ventilation on fluoroscopic or CT images, as well as modeling airway flow with computational fluid dynamics methods. • Some techniques involve technical changes in standard imaging modalities, and they could be CT-based (e.g. dual-energy CT) or MRI-based (e.g. hyperpolarized gas MRI). • Some techniques involve the use of dedicated hardware, such as dynamic digital radiography and electrical impedance tomography. • We will describe several imaging methods capable of depicting lung function, such as ventilation and perfusion. Pros and cons of each method will be highlighted.

### TABLE OF CONTENTS/OUTLINE

• Nuclear-medicine methods: o Scintigraphy o SPECTPET • Radiography-based methods: o Dynamic digital radiography o X-Ray Velocimetry Lung Ventilation Analysis Software • CT-based methods: o Parametric response map o Xenon CTDual-energy CT o CT Lung Ventilation Analysis Software o Functional Respiratory Imaging • MRI-based methods: o Hyperpolarized gas MRI o Fluorinated gas MRI o Oxygen-enhanced MRI o Fourier-decomposition MRI o Phase-resolved functional lung MRI o Dynamic contrast-enhanced perfusion MRI o Contrast-enhanced MR angiography o Non-contrast MR angiography (arterial spin labelling) • Electrical Impedance Tomography

## CHEE-12 A COMPREHENSIVE VIEW OF ACUTE AORTIC SYNDROME THROUGH ANGIOTOMOGRAPHY

Magali Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Primavera (*Abstract Co-Author*) Nothing to Disclose
Ignacio Grimoldi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To distinguish the pathologies included in acute aortic syndrome. To review the multiphase angiotomography protocol for the study of acute aortic syndrome, the frequent findings in each phase and for each entity on images. To explore the different existing classifications of aortic dissection. To characterize the imaging differences of the aortic dissection flap morphology according to the evolution of an acute to chronic state. To review the most frequent treatment techniques and their complications through cases. To recognize the typical findings of flow entry into the false lumen and its classification system. To detail the components that should not be missing in the follow-up aortic imaging report.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Acute Aortic Syndrome: distinct characteristics of aortic dissection, intramural hematoma and penetrating atherosclerotic ulcer. 2. Diagnosis CTA imaging: protocol and frequent findings in each phase. 3. Classification Systems, a) DeBakey system b) Stanford Classification System c) Society of Vascular Surgeons and the Society of Thoracic Surgeons (SVS/STS) classification system d) The European update of the Stanford classification: the type/entry/malperfusion (TEM) classification. 4. Common surgical procedures and their complications. 5. Follow-up CTA imaging and report. 6. Classification system for describing flow to the false lumen.

## CHEE-13 THROMBOTIC AND NON-THROMBOTIC PULMONARY EMBOLISM - IS IT REALLY A CHALLENGE FOR ROUTINE PRACTICE? AN ERROR-BASED LEARNING APPROACH

Philippe Khafagy (*Abstract Co-Author*) Consultant, Gleamer
Ernest Martinez Schargel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pulmonary artery artefacts (kinetic, beam hardening and flow artefacts specifically due to left-to-right shunt) can be resolved by adapted protocols such as using aorto-pulmonary injection timing. Density measurement of an embolus may be useful in determining its nature. Bilateral central ground glass opacities can refer to pulmonary edema, hemorrhage or infection (especially PCP) and can be the only finding in non-thrombotic PE such as fatty PE. Knowledge of anatomical distribution and morphology of lymph nodes is important to distinguish them from vascular lesions. MPR is useful for anatomical evaluation. Presence of an endovascular tumor invasion may help identify pulmonary tumor embolisms. Consolidation in septic emboli may present features similar to infarcts in the acute phase (before cavitation). MPR and minIP are essential to identify signs of chronic thromboembolic pulmonary hypertension. Sometimes pulmonary infarction may be nodular and difficult to recognize at first glance.

### TABLE OF CONTENTS/OUTLINE

Our 5 chosen cases will lead us to discuss the challenges encountered in routine practice for diagnosis of thrombotic and non-thrombotic PE. We will distinguish first readers' opinion from that of a second reader, which will provide tips to reach the right diagnosis. Each case will distinctly refer to a category of embolism, and will allow for an in-depth discussion of each of these categories. Case 1 : Shortness of breath and elevated D-Dimers. PE ? Case 2 : Elevated D-dimers and retrosternal pain. PE ? Case 3 : Follow-up CT of a patient known for signet ring cell adenocarcinoma Case 4 : Trauma and lumbar pain. Initially, no further context given Case 5 : Dyspnea of unknown origin, suspicious nodules on CT PET-CT

## CHEE-14 ULTRA-HIGH-RESOLUTION CT FINDINGS OF PRE-INVASIVE ADENOCARCINOMA AND MINIMALLY-INVASIVE ADENOCARCINOMA OF THE LUNG

Motoharu Hakozaki (*Abstract Co-Author*) Nothing to Disclose
Kenji Fujii (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Kouji Hashimoto I (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Chiba I (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Moriya, MD, PhD (*Presenter*) Advisor, California Capital Equity, LLC;Research Grant, Canon Medical Systems Corporation

### TEACHING POINTS

With the spread of CT screening, the chances of small lung nodule and early lung cancer are increasing. Therefore, the following points are presented by comparing the ultra-high resolution CT (UHRCT) and pathological findings of resected specimens. 1. Classification of Lung Adenocarcinoma2. Pathological invasion criteria of lung adenocarcinoma 3. Spatial resolution of UHRCT4. UHRCT findings of of pre-invasive adenocarcinoma and minimally-invasive adenocarcinoma5. Comparison of UHRCT findings and pathological findings

### TABLE OF CONTENTS/OUTLINE

1. pre-invasive adenocarcinoma (AAH, AIS) and minimally-invasive adenocarcinoma (MIA) of the lung (confirmed by pathological diagnosis of resected specimens) were reviewed.2. The definition of "pathological non-invasion" is lepidic growth and the absence of reactive fibroblast growth factor, vascular / lymphatic vessel invasion, pleural invasion, and STATS. These are diagnoses by microscopic pathological findings, immunostaining, and genetic diagnosis, and are not directly reflected in the macroscopic image morphology.3. UHRCT is a CT that achieves high spatial resolution by reducing the detector size to 1/4. In the previous studies, bronchi with an inner diameter of 0.4 mm are delineated. By improving the resolution, it has become possible to display the intralobular structure. 4. AIS is mainly based on ground glass opacity, but there may be collapsed parts that have lost aeration inside. Ground glass opacity is a finding found in the lepidic extension, but also in the papillary extension. There are also invasive adenocarcinomas mainly composed of ground glass opacity. Some MIA presents solid nodules without aeration.

## CHEE-15 DIFFERENCES BY MORPHOLOGICAL PATTERN IN PROGRESSION OF PULMONARY FIBROSIS ON HRCT

Takahiko Nakazono, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ken Yamaguchi, MD (*Abstract Co-Author*) Nothing to Disclose
Ryoko Egashira, MD, PhD (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, AstraZeneca PLC;Speakers Bureau, Shionogi & Co, Ltd;Speakers Bureau, KYORIN Holdings, Inc;Speakers Bureau, DAIICHI SANKYO Group;Speakers Bureau, Bayer AG;Speakers Bureau, Otsuka Holdings Co, Ltd;

### TEACHING POINTS

The HRCT diagnosis of interstitial lung disease (ILD) is made by a combination of several non-specific findings.MDD is important because it provides a more practical diagnosis by reading the pathology from the images and combining it with the clinical background and histological diagnosis. Progressive pulmonary fibrosis (PPF) applies to ILDs other than IPF showing progressive clinical, functional or radiological fibrosis over a one-year period, in which the radiologist also has an important role to play in this decision. It is important to know where to focus on each morphological pattern, as the way fibrosis progresses differs according to the morphological pattern.

### TABLE OF CONTENTS/OUTLINE

Diagnostic approach to fibrotic ILD on HRCT. Summarize the current classification/guidelines of interstitial pneumonias/idiopathic pulmonary fibrosis/PPF. Presentation of the differences in the fibrotic progression by morphological patterns. In the UIP pattern, fibrosis results from abnormal alveolar epithelium "wound healing" after invisible injury, with alveolar collapse and collagen build-up causing volume loss and honeycombing. Small lesion accumulation makes detecting the increase of fibrosis on HRCT challenging. In NSIP/fibrosing OP, inflammation injures more extensive lung areas, transitioning to fibrosis and causing alveolar septa thickening and volume loss. This process, unlike UIP, is visible on HRCT, where ground-glass opacities evolve into reticulations. The newer PPFE pattern's pathogenesis remains unclear, but involves epithelial damage leading to lung collapse and induration, detectable on HRCT as volume reduction and collapsed sclerotic lesions, without prior inflammation.

## CHEE-16 DON'T GET LOST IN THE ILD MAZE: 4 STEPS TO APPROACH PATTERNS AND DIAGNOSIS

**Awards**
**Certificate of Merit**

Manuel Conde Blanco, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia D. Gambetta I, MD, MD (*Abstract Co-Author*) Nothing to Disclose
JOSEFINA MEDINA (*Abstract Co-Author*) Nothing to Disclose
Joaquin Martinez Pereira, MD (*Abstract Co-Author*) Nothing to Disclose

Maria C. Ferrario, MD (*Abstract Co-Author*) Nothing to Disclose
Agustina Picarel, MD (*Abstract Co-Author*) Nothing to Disclose
Maria S. Fernandez Castillo Odena, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To provide a stepwise approach to identify pulmonary fibrosis and classifying into the most common specific patterns.To review the primary characteristic of usual interstitial pneumonia, nonspecific interstitial pneumonia and fibrotic hypersensitivity pneumonitis.To learn how to differentiate between idiopathic pulmonary fibrosis and its secondary causes.To recognize how to orientate our final diagnosis, using every tool from the imaging findings to the patient clinical history.

**TABLE OF CONTENTS/OUTLINE**

Step by step to guide pulmonary fibrosis : 1. Is it fibrotic pulmonary disease? 2. How is the distribution of the findings? 3. Which CT pattern predominates? 4. What to look for in the clinical history? Ancillary findings? Main characteristics of UIP pattern: Idiopathic Pulmonary Fibrosis: Differentiate with Probable UIP Main characteristics of UIP pattern: Secondary causes with ancillary findings: CT-ILDAsbestosisDrug InducedIgG4 Disease. Main characteristics of NSIP pattern and its probable causes with ancillary findings: CT-ILDInfectionsDrug toxicityMain characteristics of Fibrotic Hypersensitivity Pneumonitis: Inorganic Particulate Matter.Summarize the main differences between the three patterns

## CHEE-17 THE ROLE OF CHEST CT IN MONITORING CYSTIC FIBROSIS MODULATOR THERAPY

Laura Jimenez-Juan, MD (*Abstract Co-Author*) Nothing to Disclose
Matias F. Callejas, MD (*Abstract Co-Author*) Nothing to Disclose
Djeven P. Deva, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Jose Miguel Castro Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Ji-Yeon Han, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Low-dose chest CT is used to assess cystic fibrosis patients initiating and undergoing cystic fibrosis transmembrane conductance regulator (CFTR) modulator therapy.- Reduction in bronchial wall thickening, mucous plugging, air trapping, and parenchymal abnormalities have been described in cystic fibrosis patients undergoing modulator therapy.- The extent and caliber of bronchiectasis remain stable in the vast majority of cases despite modulator therapy because bronchiectasis is, for the most part, an irreversible structural change.- CT quantification could be useful for predicting clinical outcomes, such as exacerbations and survival, but it has not yet been integrated into daily practice.

**TABLE OF CONTENTS/OUTLINE**

I. IntroductionII. Recent Advances in Modulator Therapy for Cystic FibrosisIII. Response of Structural Lung Changes to Modulator Therapy1. Thin-section CT Surveillance: Key Indicators in Daily Practice__Bronchiectasis__Bronchial Wall Thickening__Mucous Plugging__Mosaic Attenuation and Air Trapping__Atelectasis and Consolidation2. Effects on Lung Complications: Superimposed infections, ExacerbationIV. Change in Qualitative CT Scoring After Treatment__Currently available CT scoring system__Implementation in Pre- and Post-Treatment ImagingV. Proposal for Quantification in Monitoring Treatment ResponseVI. Conclusion

## CHEE-18 GLOSSARY OF TERMS USED IN LUNG CANCER DIAGNOSIS, STAGING AND TREATMENT

**Awards**
**Cum Laude**

Jo-Anne O. Shepard, MD (*Abstract Co-Author*) Editor with royalties, RELX
Susan K. Hobbs, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Kaproth-Joslin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Abhishek Chaturvedi, MD (*Abstract Co-Author*) Nothing to Disclose
Karen Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Chen (*Abstract Co-Author*) Nothing to Disclose
Maria Clara N. Lorca, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This educational exhibit reviews the basic terms frequently used in the diagnosis, staging and treatment of lung tumor, making it a quick and reliable resource for radiologists participating in interdisciplinary conferences.This glossary of terms is an image rich, case-based guide designed to shape imaging interpretation in a way that creates concise but complete summaries, providing the necessary information needed to be conveyed to the different participants of interdisciplinary conferences.Briefly review the new proposed 9th TNM classification, including the new N guidelines. Discuss the expected imaging appearances of: The most common thoracic surgery approaches for lung cancer treatment: including segmentectomies, wedge resections, lobectomy and pneumonectomy. Compare and discuss the different CT-guided localization methods of pulmonary nodules, including fiducial and microcoil markers placement. Stereotactic ablative radiotherapy (SABR), aka stereotactic body radiotherapy (SBRT), chemotherapy, and immunotherapy. -Lung ablation therapy. Imaging pitfalls to be aware post precision therapy.

**TABLE OF CONTENTS/OUTLINE**

This education exhibit reviews different types of surgeries for lung cancer treatment and the expected radiological appearance post-therapy.Creates a checklist with all the necessary information the radiologist is expected to report when diagnosing and/or following lung cancer, as well as the most common post treatment findings.Depict the new subtypes of lung cancers, included in the 2021 WHO classification of the tumors of the lung, including SMARCA4 and bronchiolar adenoma.

## CHEE-19 PERICARDIAL AND PLEURAL TUMORS: CLASSIFYING THE CHEST'S UNWELCOME GUESTS

Maria Clara N. Lorca, MD (*Abstract Co-Author*) Nothing to Disclose
Aadya Chaturvedi (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Kaproth-Joslin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Irene Chen (*Abstract Co-Author*) Nothing to Disclose
Anna Kelly, MD (*Abstract Co-Author*) Nothing to Disclose
Steve Stephen, BS, MBA (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This educational exhibit will: 1. Summarize the 2021 WHO Classification of both pericardial and pleural tumors 2. Highlight imaging characteristics of the different pleural and pericardial tumors

**TABLE OF CONTENTS/OUTLINE**

This exhibit aims to provide a comprehensive overview of pleural and pericardial tumors using biopsy-proven case examples. Cases will be systematically reviewed, utilizing the framework presented in the 2021 WHO guidelines and how the knowledge of histological tumor subtypes has become important in the clinical scenario of precision therapy treatment. Radiological findings of tumors will be presented alongside respective pathology correlates. Tumors to be covered include: Benign and preinvasive mesothelial tumors of the pleura, pleural mesothelioma in situ, localized mesotheliomas, malignant pleural mesotheliomas (MPM), aka diffuse mesotheliomas, benign and malignant primary tumors of the pericardium and metastases to the pleura and pericardium, pericardial angiosarcoma and others.References: 1. WHO Classification of Tumours Editorial Board. Thoracic tumours. Lyon (France): International Agency for Research on Cancer; 2021. 2. Sauter JL, Dacic S, Galateau-Salle F, et al. The 2021 WHO Classification of Tumors of the Pleura: Advances Since the 2015 Classification. J Thorac Oncol. 2022;17(5):608-622. doi:10.1016/j.jtho.2021.12.014 3. Baas P, Zalcman G; et al. First-line nivolumab plus ipilimumab in unresectable malignant pleural mesothelioma (CheckMate 743): a multicentre, randomised, open-label, phase 3 trial. Lancet. 2021 Jan 30;397(10272):375-386. 4. Restrepo CS , et al. Primary pericardial tumors. Radiographics. 2013;33(6):1613-30.

## CHEE-2 REVISIONS IN THE TNM CLASSIFICATION FOR LUNG CANCER: A PRIMER FOR RADIOLOGISTS

Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Isabella De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• The forthcoming 9th edition TNM classification (TNM-9) for lung cancer will introduce refined subcategories for nodal involvement and metastatic disease classification, addressing the need for improved precision in staging and treatment decisions. • The subcategorization of N2 into N2a and N2b resulted in new TN subsets, including T1N2a, assigned to stage IIB, which reflect changes in the prognosis prediction. • The subcategorization of M1c into M1c1 and M1c2 is also relevant to refine prognosis, even though it doesn’t imply a change of stage (both remain in stage IVB). • The clinical importance of these changes reinforces the necessity for precise evaluation and reporting of mediastinal nodal disease and distant metastases through comprehensive imaging, notably CT and PET-CT. • This presentation aims to review key concepts and revisions of TNM-9 in a practical approach tailored for radiologists and residents.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: principles of cancer staging; 2. Lung cancer staging state-of-the-art: (a) Multimodality imaging (b) 8th edition of the TNM Classification; 3. IASLC Lung Cancer Staging Project: methods and guiding principles; 4. Revisions of the TNM Descriptors in the Forthcoming 9th edition of the TNM Classification: (a) N Descriptors (b) M Descriptors (c) Summary and practical approach; 5. Illustrative cases with multimodality imaging: a comparative review; 6. Future perspectives: liquid biopsy and artificial intelligence; 7. Take home messages

## CHEE-20 NONTUBERCULOUS MYCOBACTERIAL INFECTION: REVIEW OF CLINICAL AND IMAGING MANIFESTATIONS

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe A. Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Ocazionez-Trujillo, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Patricia Puello Baron, Md (*Abstract Co-Author*) Nothing to Disclose
Markus Y. Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Nontuberculous mycobacteria (NTM) are a group of ubiquitous, low grade pathogens that cause pulmonary infections in immunocompetent and immunocompromised people worldwide, with particularly high prevalence in the US and Japan.This exhibit will:a. Discuss the epidemiological and microbiological underpinnings on NTMb. Recognize the different clinical and imaging presentation of the two main forms of the disease.c. Review imaging features of less common types of presentation including scenarios with altered pulmonary parenchymal architecture, immunocompromised hosts, congenital heart disease, etc. As well as review common and rare complicationsd. Discuss the role of imaging in the pharmacologic and surgical management of these patients.

**TABLE OF CONTENTS/OUTLINE**

1. Epidemiology and Microbiological Background 2. Diagnosis 3. Imaging Findings a. Classic (Cavitary Form) b. Non-Classic (Bronchiectatic Form) c. Hypersensitivity Pneumonitis (Hot Tub Lung) d. Immunocompromised Host e. Other Predisposing Conditions (e.g. ILD, Cystic Fibrosis, Organ Transplant) f. Complications 4. Imaging Role in Treatment Strategies a. Pharmacologic Treatment Imaging Follow Up b. Pre-operative and Post-operative Evaluation 5. Role of Alternative Imaging Modalities (MRI, PETCT)

## CHEE-21 ACUTE THORACIC FINDINGS AND COMPLICATIONS RELATED TO CANCER TREATMENT

Tassia R. Yamanari, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Camila S. Franco, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo V. Auad, MD (*Abstract Co-Author*) Nothing to Disclose
Thais C. Lima (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Campos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the most common modalities of local treatment of thoracic neoplasms.- Recognize the expected changes related to each modality of local treatment and the potential acute complications.- Review the imaging findings of the acute thoracic complications related to systemic cancer therapy.

**TABLE OF CONTENTS/OUTLINE**

Acute thoracic findings in oncology patients can be related to local or systemic therapy. It might vary from expected changes related to local treatment to acute complications that can be life threatening. Beyond that, these findings can be misinterpreted as tumor recurrence and compromise the appropriate treatment.The aim of this pictorial review is to present1. Expected acute imaging findings related to the most common local cancer treatment modalities in the chest, including surgery, ablation therapy and radiation therapy.2. A systematic review of the imaging findings of acute complications related to local and systemic cancer therapy, based on treatment modality and organ system (airways and lung, pleura, cardiovascular and mediastinum).

## CHEE-22 PERSPECTIVES IN PIXELS: THORACIC IMAGING'S VIEW ON RHEUMATOLOGICAL DISEASES

Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Prasandeep Rath, MBBS,MD (*Abstract Co-Author*) Nothing to Disclose
Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Anandamoyee Dhar (*Abstract Co-Author*) Nothing to Disclose
Harshita Arora, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Role of CT in detecting and characterizing various thoracic manifestations in rheumatic diseases, including pulmonary involvement, pleural abnormalities, and mediastinal changes. • Overview of thoracic manifestations of common rheumatological conditions. • Use of follow-up CT scans for the monitoring of disease. • Highlight typical and atypical imaging findings for such conditions. • Case based approach to reinforce learning in this topic. • Emphasize role of imaging in early detection, disease severity assessment, and treatment guidance. • Discuss mimics of such conditions • Identification of associated complications such as infection, pulmonary embolism, and malignancy, which may occur concurrently or as a result of immunosuppressive therapy.

**TABLE OF CONTENTS/OUTLINE**

- Introduction: Overview of Thoracic Imaging in Rheumatological Disorders
- Role of CT in Detecting and Characterizing Thoracic Manifestations
- Thoracic Manifestations of Common Rheumatological Conditions: Rheumatoid Arthritis; Systemic Lupus Erythematosus; Systemic Sclerosis; Wegener's Granulomatosis; Dermatomyositis; Ankylosing Spondylitis
- Importance in Treatment Response Evaluation
- Adjustment of Therapeutic Strategies
- Case-Based Approach for Learning Reinforcement
- Mimics :Infectious Diseases; Malignancies; Idiopathic Interstitial Pneumonias
- Associated complications: Infection; Pulmonary Embolism; Malignancy

## CHEE-23 'WRECK'-REATIONAL DRUG INDUCED LUNG INJURY

Saurabh Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Terrance T. Healey, MD (*Abstract Co-Author*) Nothing to Disclose
Samika S. Kanekar (*Abstract Co-Author*) Nothing to Disclose
Brandon H. Koo, MD,BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this educational exhibit is to: 1. Review current epidemiologic trends of recreational substance use 2. Discuss current chest imaging techniques and imaging findings of recreational drug induced lung injury 3. Review the pathophysiology and routes of lung injury and long-term damage caused by different recreational substances through representative cases 4. Discuss the complications, prognosis, and treatments of recreational substance induced lung injury and damage.

**TABLE OF CONTENTS/OUTLINE**

The majority of Americans now live in a state where recreational use of marijuana is legal, with usage trends mirroring increased accessibility; similar increased usage trends of e-cigarettes and vaping products have been noted nationwide. With more widespread use of recreational substances with the potential for substance induced lung injury, this exhibit aims to provide a timely review of key imaging features and patterns of both acute lung injury and long-term damage related to a myriad of substance use including marijuana, e-cigarettes/vaping, conventional tobacco products, talcosis, and crack cocaine.

## CHEE-24 TAKE A BREATH! PATTERNS OF POST-PRIMARY PULMONARY TUBERCULOSIS

Alair Arantes (*Abstract Co-Author*) Nothing to Disclose
Erica A. Naves, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel De Figueiredo Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho (*Abstract Co-Author*) Nothing to Disclose
Guilherme C. del Guerra, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibition is to delve into the characteristic CT findings that aid in the diagnosis and understanding of post-primary pulmonary tuberculosis, also known as reactivation tuberculosis or secondary tuberculosis. There are plenty of patterns that may be associated with post-primary pulmonary tuberculosis, such as lobar pneumonia, cavitations, tree-in-bud opacities, ground-glass opacities, centrilobular nodules, tuberculomas and/or pseudomasses. Demonstrating illustrative cases, this exhibition aims to assist radiologists in reporting chest CT scans in a post-primary pulmonary tuberculosis scenario.

**TABLE OF CONTENTS/OUTLINE**

This exhibition initiates with a summary of the relevance, worldwide prevalence and pathology of the post-primary pulmonary tuberculosis. The next slides present the types of presentation and expected findings of the post-primary pulmonary tuberculosis on chest CT, with illustrative cases of each main form of presentation, identifying the most important radiological finding on each image. The collection contains cases of miliary tuberculosis, tuberculomas/pseudotumors, lobar pneumonia, atypical forms, such as inferior and anterior involvement, and multi-drug resistant pulmonary tuberculosis findings, including bilateral cavitations. The potential signs of active disease are subsequently highlighted. The presentation ends with relevant take-home messages.

## CHEE-25 EXPLORING 68-GA-FAPI PET-CT IN LUNG CANCER: ADVANTAGES AND LIMITATIONS COMPARED TO 18-FDG PET-CT

Barboza (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Solange A. Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Taise Vitor (*Abstract Co-Author*) Nothing to Disclose
Oren Smaletz, MD (*Abstract Co-Author*) Stockholder: AstraZeneca, GlaxoSmithKline, ; Novartis, Roche and Sanofi;Speaker Bureau: AstraZeneca Astellas Pharma;Research Funding: Janssen, Bristol-Myers Squibb;
Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Jairo Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Claudia Camargo (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Lilian Y. Yamaga (*Abstract Co-Author*) Nothing to Disclose
Nadjaneyre Casimiro, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Gallium-68-labeled Fibroblast Activation Protein Inhibitor (FAPI-PET) represents an exciting advancement in molecular imaging as it targets proteins directly involved in tumor microenvironment. This presentation will present and review the uses of this novel tracer, focusing on lung cancer: - Describe the diagnostic performance and limitations of the 68-Ga-FAPI PET-CT and 18-FDG PET-CT.- Demonstrate the application of the 68-Ga-FAPI PET-CT in oncology with didactic cases of lung cancer through cross-sectional imaging.- Discuss the role of 68-Ga-FAPI versus 18-FDG PET-CT imaging in staging lung cancer using a case-based approach.

**TABLE OF CONTENTS/OUTLINE**

- General concepts of the role of imaging in staging primary and metastatic lung cancer using both 18-FDG and 68-Ga-FAPIEffectiveness diagnostic performance.- Illustrative cases: Radiological features in false negative and false positive cases.- The main challenges and perspectives of implementing in routine clinical. - Conclusion / Take-home messages.

## CHEE-26 STERNUM SPOTLIGHT - EVERY (STERNUM) HAS HIS DAY

**Awards**
**Certificate of Merit**

Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Macedo, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Abstract Co-Author*) Nothing to Disclose
Murilo M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This exhibit serves the following purposes:• Exploring the anatomy of the sternum and its diagnostic assessment through a comprehensive multimodality approach.• Discussing the spectrum of anatomical variants of the sternum, encompassing component disproportions, sternal foramina, xiphoid shape variations, and associated conditions such as pectus carinatum and pectus excavatum. • Analyzing mechanical and inflammatory conditions and their imaging manifestations, such as arthritis, mechanical overloads, spondyloarthropathy, and SAPHO syndrome. • Examining traumatic injuries involving the sternum, including sternoclavicular dislocations, as well as acute and chronic fractures. • Analyzing infectious diseases affecting the sternum, with a focus on septic arthritis, alongside discussion of rarer infections like sporotrichosis. • Identifying the expected image patterns of benign and malignant sternum tumors, notably enchondroma and chondrosarcoma. • Recognizing various post-operative sternum conditions, including pseudoarthrosis, acute mediastinitis, secondary osteomyelitis, and complications associated with sternal prostheses.

**TABLE OF CONTENTS/OUTLINE**

• Sternum anatomy. • Imaging modalities. • Sternal anatomical variations. • Mechanical and inflammatory pathologies. • Traumatic injuries. • Infectious diseases. • Tumors. • Post-operative complications.

## CHEE-27 BEYOND THE BELLY: IMAGING OF THORACIC MANIFESTATIONS OF OBSTETRIC AND GYNECOLOGIC DISEASE

**Awards**
**Certificate of Merit**

Aletta Ann Frazier, MD (*Abstract Co-Author*) Nothing to Disclose
Alan M. Ropp, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas Battey, MD (*Abstract Co-Author*) Nothing to Disclose
Leah Smith (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

While the majority of obstetric and gynecologic disease presents in the abdominal cavity, many of these conditions can manifest in the thorax. Related imaging findings may be subtle, unexpected, or overlooked. Radiologists must consider these entities and familiarize themselves with the associated findings to enable prompt and accurate diagnosis and treatment. This case series presents a comprehensive review of obstetric and gynecologic diseases manifesting findings in thoracic imaging. After reviewing this exhibit, the learner will recognize thoracic imaging findings related to obstetric and gynecologic disease, understand optimal modalities and techniques for safely imaging pregnant patients, and define relevant recommendations for management and follow up of the presented imaging findings.

**TABLE OF CONTENTS/OUTLINE**

Cardiothoracic Complications of Pregnancy Emboli (thrombotic, amniotic fluid, and air) - Imaging protocols and other considerations in pregnant patients; Peripartum Cardiomyopathy; Eclampsia/Pre-Eclampsia; Pneumonia and Aspiration. Gynecologic Disease in the Thorax: Thoracic endometriosis syndromes (Catamenial Pneumothorax/Hemothorax, Hemoptysis, Pulmonary Endometrioma); Ovarian Hyperstimulation Syndrome; Benign Metastasizing Leiomyoma; Meigs Syndrome. Thoracic Patterns of Gynecologic Metastasis: Virchow's Node; Pleural/Diaphragmatic Metastases; Isolated Bilateral Axillary Metastases.

## CHEE-28 EXPLORING THE MANY FACES OF FAMILIAL PULMONARY FIBROSIS: RADIOLOGIC AND PATHOLOGIC FEATURES

Israel Missrie, MD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd
Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Camila S. Franco, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Vinicius A. Cavalieri, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Brigagao (*Abstract Co-Author*) Nothing to Disclose
Lais F. Pimentel, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the tomographic patterns of possible phenotypes found in familial pulmonary fibrosis using schematic illustrations and imaging studies.- Display a set of cases of familial pulmonary fibrosis exposing the heterogeneity of presentations.- Correlate imaging findings with pathological characteristics.

**TABLE OF CONTENTS/OUTLINE**

Familial pulmonary fibrosis (FPF) is defined as any fibrotic interstitial lung disease in at least two first or second-degree relatives in the family. Although it is not a consensual definition, it is highly accepted. It is known that several genetic mutations are associated with the presence of this entity, which results in a wide diversity of phenotypic, radiological and pathological characteristics, including overlap between them. Imaging plays a fundamental role in the investigation and suspicion of interstitial lung diseases. Therefore, we propose a systematic approach and review of the image characteristics found on computed tomography. This pictorial review will discuss:1. Introduction2. Pathogenesis and epidemiology3. Review of the main tomographic and anatomopathological patterns of familial interstitial fibrosis- Usual interstitial pneumonia- Cryptogenic organizing pneumonia- Undetermined fibrosis pattern- Non-specific interstitial pneumonia- Fibrotic hypersensitivity pneumonitis- Aspiration-related

## CHEE-29 NON-INFECTIOUS PULMONARY COMPLICATIONS IN HEMATOLOGICAL MALIGNANCY

Rishi Agrawal, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH
Jeremy J. Erasmus, MD (*Abstract Co-Author*) Nothing to Disclose
Girish S. Shroff, MD (*Abstract Co-Author*) Nothing to Disclose
Mylene T. Truong, MD (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MBBS, FRCR (*Presenter*) Director, Grayscale Ltd;Co-owner, Grayscale Ltd;

**TEACHING POINTS**

Infection is the predominant cause of acute diffuse lung disease in hematological malignancy. However, 10-20% of presentations are due to alternative non-infectious etiologies. Familiarity with the radiological appearances, their timeline of evolution, and specific clinical scenarios when these occur aids diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Cases from tertiary cancer center, with pathological/clinical correlation of common and rare conditions. Cases are categorized by clinical scenario/evolution timelines. Clinical indicators that should suggest non-infectious etiologies and radiology management recommendations are highlighted.To include:• Post Bone Marrow Transplantation (Edema, Hemorrhage, Idiopathic Pneumonia Syndrome) - timelines and differentiating features• Small Molecule Drug Toxicity (e.g. Bleomycin) - radiological/clinical risk factors• Novel therapy complications (CAR T-cell cytokine release syndrome, ATRA differentiation syndrome)• Transfusion Reactions (TACO, TRALI, FNHTR, etc.)• Secondary Alveolar Proteinosis• Pulmonary Interstitial Extramedullary Hematopoiesis• Leukemic Infiltration, Leukostasis, Leukemic Cell Lysis Pneumopathy

## CHEE-3 INTERSTITIAL LUNG ABNORMALITIES: WHEN RADIOLOGISTS SHOULD MAKE THIS CALL

Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ian Griffin (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Sandro B. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica Gemmell (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Elucidate the imaging features of interstitial lung abnormalities (ILA) that necessitate reporting on CT scans.; Provide a simple algorithm for the differential diagnosis of ILA, improving accuracy and efficiency.; Stress the significance of communication between radiologists and pulmonologists for ILA management.

**TABLE OF CONTENTS/OUTLINE**

● Overview of Interstitial Lung Abnormalities (ILA) ○ Definition and Epidemiological Relevance
○ Patterns of ILA on CT: Reticular, Nodular, Cystic, and Ground-Glass Opacities● Radiologic Approach to ILA
○ Criteria for Identification and Reporting of ILA ○ ILA versus Artefact: Ensuring Diagnostic Precision● Differential Diagnosis Simplified
○ Algorithmic Approach to Common and Uncommon Causes of ILA ○ Radiological Illustrations to Guide Pattern Recognition● Clinical Context and Management
○ When to Suggest Further Evaluation for ILA ○ Integrating Clinical Data in Radiological Interpretation● Conclusion
○ Summary of Best Practices for ILA Reporting ○ Call to Action for Standardization of Reporting Protocols

## CHEE-30 REVISITING THE LOWER RESPIRATORY TRACT: CORRELATION WITH BRONCHOSCOPY

Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose

Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael R. Santos Ferreira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Chest CT is a non-invasive method capable of mapping and identifying lesions of the trachea and bronchi, as well as assisting in the biopsy and surgery planning of suspected findings. - Flexible bronchoscopy (FB) is the gold standard method for directly visualising the airways, allowing for many diagnostic and therapeutic interventions. - Virtual bronchoscopy (VB) is a technique for reconstructing three-dimensional images from CT scans, simulating a flexible bronchoscopy. - This presentation aims to illustrate the correlations between CT imaging findings and those obtained through FB and VB in diferent clinical setttings.

**TABLE OF CONTENTS/OUTLINE**

1) Background; 2) Techniques: Conventional CT, VB, FB (pros and cons); 3) Applications: a case-based review (- anatomical variants - inflammatory and infectious diseases - neoplasms - blood clots - foreign bodies - other findings - intervention mapping - surgical planning - post-surgical changes - miscellaneous); 4) Future directions: Artificial Intelligence for navigation planning; 5) Summary and take home messages;

## CHEE-31 INJURIES FROM EXTREME EXERCISE: LOTS OF PAIN, NO GAIN

Roberto Sasdelli Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Hamilton Shoji, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Paulo Teixeira E Torres (*Abstract Co-Author*) Speaker, Boehringer Ingelheim GmbH;Speaker, AstraZeneca PLC
Katriny Couto, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo B. Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Nycole B. Cortez Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Izabel d. Karam, MD (*Abstract Co-Author*) Nothing to Disclose
Nadjaneyre Casimiro, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Damaso, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Merigue, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Demonstrate a variety of radiological findings of thoracic complications such as alveolar edema/hemorrhage and pulmonary fat embolism associated with different forms of strenuous physical exercise.-Explain the mechanisms of injury involved in exercise-induced pulmonary complications.-Illustrate these conditions based on cases from our radiology group.-Provide insights into the role of radiology in the early detection and proper management of exercise-induced pulmonary complications.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION-Pathophysiological mechanism of pulmonary edema and hemorrhage caused by extreme physical exercise-Pathophysiological mechanism of pulmonary fat embolism caused by a long bone fracture during a extreme physical exercise-Pathophysiological mechanism of muscle injuries after weightlifting.CASE-BASED REVIEW-Pulmonary fat embolism following a long bone fracture sustained during a CrossFit session.-Alveolar edema/hemorrhage after cycling-Alveolar edema/hemorrhage after swimming-Pulmonary edema after running in high altitude-Muscle injuries after weightlifting.FINAL CONSIDERATIONSREFERENCES

## CHEE-32 OPTIMIZATION TECHNIQUES FOR RESCAN OF PROBLEMATIC CT PULMONARY ANGIOGRAMS

Eduardo J. Mortani Barbosa JR, MD, MBA (*Abstract Co-Author*) Research Consultant, FLUIDDA nv;Research Grant, Siemens AG
Achala Donuru, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Colfer (*Abstract Co-Author*) Nothing to Disclose
Harold I. Litt, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV
Yvonne Su, BA (*Abstract Co-Author*) Nothing to Disclose
Scott A. Simpson, DO, MEd (*Abstract Co-Author*) Nothing to Disclose
Julia C. Jacob, MD (*Abstract Co-Author*) Nothing to Disclose
Priscilla Stecher, MD (*Abstract Co-Author*) Nothing to Disclose
Arun C. Nachiappan, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Detect technical problems in nondiagnostic and low-quality CT pulmonary angiograms (CTPA). 2. Select which optimization technique to utilize for a potential rescan. 3. Compare pre- and post-intervention images to determine effectiveness of optimization techniques for rescan of problematic CTPA exams.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction/Background 2. Case-based review and demonstration of 13 technical problems in CTPA, with a comparison of the initial scan to the rescan performed with the optimization technique specific to each problem a) Transient interruption of contrast b) Bronchial artery inflow artifact c) Status post Fontan procedure d) Scan timing challenges - Parenchymal disease - Flow-related artifact - Tachycardia - ROI incorrectly placed on aorta e) Suboptimal contrast opacification f) Streak artifact from the SVC g) Pulmonary motion artifact h) Image noise i) Iodinated contrast anaphylaxis j) Concurrent technical problems 3. Conclusion

## CHEE-33 DECIPHERING ENIGMATIC CARDIOTHORACIC IMAGING IN END STAGE RENAL DISEASE (ESRD)

Ramya S. Gaddikeri, MD (*Abstract Co-Author*) Nothing to Disclose
Palmi N. Shah, MD (*Abstract Co-Author*) Research Grant, Abbott Laboratories
Emily M. Trudeau, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Unusual cardiothoracic imaging in ESRD can be diagnostic dilemmas. Metastatic pulmonary calcifications (MPC) with noncalcified centrilobular nodules: mimics infection. Hyperdense consolidations: simulate amiodarone toxicity. Positive bubble echo due to chronic central venous obstruction and contrast

shunting into the pulmonary veins. Miliary lung nodules in secondary pulmonary hemosiderosis from ESA: mimics miliary infection.Endplate erosion and vertebral collapse in Dialysis related spondyloarthropathy (DSA) mimics spondylodiscitis. Nodular pulmonary amyloidosis when non calcified /cavitating, mistaken for malignancy. Diffuse bone uptake on PET-CT secondary to ESA: confused for infiltrative processLarge IV contrast in ESRD patients can cause hyperdense fluid and muscles even after 24hrs, confused for hemorrhage. Post-transplant medication induced pneumonitis: mimics edema.

**TABLE OF CONTENTS/OUTLINE**

Imaging findings will be subcategorized with DD: Lungs/Pleura: Hyperdense consolidation, MPC, Secondary pulmonary hemosiderosis, pulmonary amyloidosis, Premature tracheal calcifications, hyperdense effusions from contrast staining, Chronic effusions and round atelectasis. Heart/Vessels: Premature Coronary calcifications and accelerated CAD, Coronary aneurysm (In PCKD), Uremic pleuro-pericarditis, Cardiac amyloidosis, venous collaterals shunting to pulmonary veins, pericardial calcifications. Bones/Soft tissueRenal osteodystrophy, Distal clavicle resorption, DSA, calciphylaxis, Post ESA diffuse FDG uptake in bones, brown tumor. Post-transplant complicationsInfections due to immune-compromised state, ex PJP pneumonia. Tacrolimus induced lung injury.

## CHEE-34 RETURN OF THE MAC: NON-TUBERCULOSIS MYCOBACTERIAL INFECTIONS

**Awards**
**Cum Laude**

Demetrios A. Raptis, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The classic manifestations of non-tuberculosis mycobacterial (NTM) infection in the chest have a unique clinical and radiographic presentation. These infectious processes can exist on a spectrum that can be life threatening or result in minor symptoms and require no treatment. The Runyon classification for non-tuberculosis in the current era has become more historical than clinically relevant, making the diagnosis challenging. We review a multi-disciplinary approach to making the diagnosis and directing treatment. While doing so we review a classification scheme for NTM infections and how imaging findings and clinical information can direct management.

**TABLE OF CONTENTS/OUTLINE**

• Review imaging findings of non-tuberculosis mycobacteria (NTM) infections with emphasis on the thorax • Develop/review a classification scheme based on the imaging findings • Discuss multi-disciplinary approach to making diagnosis (and differentiating from M. tuberculosis) and directing treatmentMycobacterial avium complex (MAC):• Classic - upper lobe predominant fibrocavitary/cavitary pattern • Disseminated disease - cavitary disease, necrotic lymphadenopathy, and hepatosplenomegaly• Lady Windemere Syndrome - bronchiectasis, centrilobular nodules• Hypersensitivity (aka hot tube lung) - subacute hypersensitivity pattern• MAC can be associated with other conditions:• Achalasia• CF• Immunodeficiency Not all mycobaceterial infections in the chest are caused by MAC. Discuss clinical presentation and overlapping imaging findings of other mycobacterial infections in the chest including:• Kansasii• Xenopus• Abscessus • Fortuitum

## CHEE-35 FIBROSING MEDIASTINITIS IN HISTOPLASMOSIS: WHAT THE RADIOLOGIST SHOULD KNOW

**Awards**
**Certificate of Merit**

Glenda Peres (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe C. Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
LOUISE FATIMA GOMES DE ALMEIDA (*Abstract Co-Author*) Nothing to Disclose
Bruna Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Daniella B. Parente, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Luiz Carlos Goncalves Motta (*Abstract Co-Author*) Nothing to Disclose
Eleonora Silva (*Abstract Co-Author*) Nothing to Disclose
Marina Da Silva, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Recognize the imaging modalities and protocols of choice for proper evaluation of mediastinal structures in patients with histoplasmosis.• Present the main forms and complications of fibrosing mediastinitis in histoplasmosis cases.• Show the other main differential diagnoses for fibrosing mediastinitis.

**TABLE OF CONTENTS/OUTLINE**

• INTRODUCTIONo General overview and definitions of histoplasmosis and fibrosing mediastinitis;o Prevalence, relevance, costs;o Review of mediastinal and pulmonary vascular anatomy;o Overview of physiopathology.• IMAGING TECHNIQUEo Imaging modalities of choice;o Computed tomography;o Angio tomography;o Magnetic resonance;o Perfusion/dual energy CT studies.• IMAGING INTERPRETATIONo Structured imaging analysis;o Main findings of thoracic histoplasmosis;o Airway, arterial, venous and pleural involvement in fibrosing mediastinitis;o What to include in the radiology report.• INTERACTIVE CASE-BASED DIDACTICSo Illustrative cases.• STRATEGIES TO OVERCOME THE CHALLENGING CASESo Imaging characteristics that help in the differential diagnosis;o Key clinical and laboratorial findings;o What to recommend in difficult scenarios.• IMPACT IN PATIENT MORBIDITYo Treatment options;o Post-surgery and follow-up evaluation;o Prognosis.

## CHEE-36 HYPERPOLARIZED XENON GAS LUNG MRI IN THE HEALTHY AND DISEASED LUNG

Mohamed A. Ebada, MD (*Abstract Co-Author*) Nothing to Disclose
Robert P. Thomen, PhD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey R. Kunin, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Talissa A. Altes, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Ummul Afia Shammi, PhD (*Abstract Co-Author*) Nothing to Disclose
Cody Thornburgh, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Hyperpolarized Xenon Gas (HXG) MRI is a relatively new-to-market FDA approved imaging agent to evaluate lung ventilation.2. Small airway diseases, like asthma, COPD, and Cystic Fibrosis, have MR ventilation features that increase confidence in diagnosis and assessment of disease severity.3. Xenon gas diffuses from the airways into the lung tissues and blood. HXG MRI allows simultaneously imaging of these various states of xenon gas, termed "dissolved phase imaging."4. Ongoing research of HXG MRI is revealing new applications for medical imaging, which may aid in the diagnosis of pulmonary hypertension and management of disease.

**TABLE OF CONTENTS/OUTLINE**

1. Background/Objectives2. Brief Review of Technique---a. Drug Preparation---b. MR Scanner Configuration---c. Data Analysis3. Ventilation Imaging Characteristics---a. Normal---b. Pathological disease states------i. COPD and Emphysema------ii. Asthma------iii. Cystic Fibrosis------iv. COVID-19------v. Interstitial Lung Diseases4. Dissolved Phase Imaging Characteristics---a. Normal---b. Pathological findings of Small Airway Diseases---c. Pathological findings of Pulmonary Hypertension5. Future Frontiers---a. RBC oscillation and pulmonary hypertension---b. Therapeutic agent monitoring

## CHEE-37 COMPLICATIONS OF THE PULMONARY SURGERY WHAT RADIOLOGISTS NEED TO KNOW?

Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Furkan Ufuk, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Radiologists are vital in detecting complications following pulmonary surgery, impacting patient management and outcomes.
- Recognizing imaging signs of common and critical complications ensures timely intervention.
- Key complications include infection, air leaks, and vascular complications.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Role of imaging in the follow-up of pulmonary surgery
- Essential knowledge for radiologists
- Normal Postoperative Imaging
- Expected changes on imaging after common pulmonary surgeries
- Early Complications
- Pneumothorax: Identification and implications
- Hemorrhage: Expected vs. excessive bleeding
- Air Leaks: Manifestations and management
- Infectious Complications
- Empyema: Diagnostic imaging criteria
- Pneumonia: Distinguishing postoperative changes from infection
- Late Complications
- Bronchopleural fistula
- Lung torsion
- Lung hernia
- Pulmonary fibrosis and lung volume reduction
- Advanced Imaging Modalities
- Role of CT, X-ray, and MRI in detecting subtle complications
- The utility of imaging in guiding interventional procedures
- Conclusion
- Overview of critical findings for effective postoperative care
- Future directions in imaging technologies for pulmonary surgery

## CHEE-38 SMOKE SIGNALS: A JOURNEY THROUGH SMOKING RELATED PULMONARY PATHOLOGY

Sukrita Menon, MD (*Abstract Co-Author*) Nothing to Disclose
Ernest M. Scalzetti, MD (*Abstract Co-Author*) Nothing to Disclose
Harikrishnan Nandakumar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Defining the spectrum of entities comprising Smoking Related-Interstitial Lung Diseases (SR- ILD). 2. Exploring the pathogenesis of SR- ILD. 3. Exploring various SR-ILDs including Respiratory bronchiolitis ILD (RB-ILD), Pulmonary Langerhans Cell Histiocytosis (PLCH), Desquamative Interstitial Pneumonitis (DIP), Idiopathic Pulmonary Fibrosis (IPF), and Combined Pulmonary Fibrosis with Emphysema (CPFE) by reviewing the clinical features, characteristic multimodality imaging findings, and pathologic findings. 4. Exploring Electronic Cigarette or Vaping Product Use-associated Lung Injury (EVALI) by reviewing the clinical features, characteristic multimodality imaging findings, and pathologic findings. 5. Discussion of potential imaging conundrums and confounders of each entity within the spectrum and defining specific features that could help direct imaging interpretation, diagnosis and clinical management of patients.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to SR-ILDs: Definition and illustration of spectrum of entities. 2. Pathogenesis of SR-ILDs. 3. Exploring the cigarette smoking related entities: clinical features, characteristic multimodality imaging findings, and pathologic findings.a. RB-ILDb. PLCHc. DIPd. IPFe. CPFE. 4. Exploring the electronic cigarette smoking related patterns of injury: clinical features, characteristic multimodality imaging findings, and pathologic findings. a. Organizing Pneumonia. b. Diffuse alveolar damage. c. Diffuse alveolar hemorrhage. d. Mild nonspecific inflammation. e. Granulomatous pneumonitis. f. Exogenous lipoid pneumonia. g. Respiratory bronchiolitis. 5. Potential imaging conundrums and confounders.

## CHEE-39 EPIPERICARDIAL FAT NECROSIS (EFN): ILLUMINATING A HIDDEN CULPRIT IN CHEST PAIN

Danilo P. Bianco, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Abstract Co-Author*) Nothing to Disclose
Rodrigo B. Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Hamilton Shoji, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Caio Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Epipericardial fat necrosis (EFN) often lurks in the shadows of differential diagnoses for chest pain. While clinicians and radiologists diligently explore common culprits such as pulmonary thromboembolism and acute coronary syndrome, EFN remains overlooked. Despite patients experiencing excruciating chest pain, both laboratory tests and electrocardiograms (ECGs) frequently yield normal results. In such cases, the diagnosis relies on imaging exams, usually chest CT scans.This presentation will shed light on ENF: we will discuss the pathophysiology, imaging findings (with focus on chest CT), associated findings, differential diagnosis and follow-up imaging findings.

**TABLE OF CONTENTS/OUTLINE**

- Epidemiology and clinical features- EFN findings on Chest CT- EFN findings on other imaging modalities (MRI, PET/CT)- Differential diagnosis that shouldn't be forgotten- Imaging follow-up findings after EFN

## CHEE-4 INDIRECT SIGNS OF PULMONARY EMBOLISM: SELF-ASSESSMENT AND REVIEW OF CONCEPTS

**Awards**
**Certificate of Merit**

Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Paulo T. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Danilo P. Bianco, MD (*Abstract Co-Author*) Nothing to Disclose
Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Gabriel Figueiredo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Demonstrate that the diagnosis of pulmonary thromboembolism may not be suspected in the initial clinical evaluation, prompting non-targeted studies such as chest radiographs and non-contrast chest tomographies.- Demonstrate the wide range of clinical presentations and imaging findings related to pulmonary embolism.- Review the most common imaging findings of pulmonary embolism in non-targeted studies through self-assessment questions, expanding the radiologist's repertoire.- It is essential for radiologists to remain aware of indirect signs of PE in non-targeted studies (without contrast or without dedicated angiographic technique), in which this diagnosis may not have been initially suspected clinically.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTIONHighlight the variety of clinical presentations and imaging findings that may come to the radiologist's attention in the context of PE, summarizing the indirect signs to look for in non-directed studies.DIRECT SIGNSHighlight through different imaging studies what is considered a direct sign of PE.INDIRECT SIGNS• PULMONARY PARENCHYMA:Summarize the imaging features of pulmonary infarctions, differentiate from other conditions, discuss suspicion criteria, early signs, and progression.Explain the mosaic perfusion pattern, its appearance, differentials, and imaging representation.Demonstrate hyperperfusion edema in PE, its imaging aspects, and mechanism.• VASCULAR CALIBER VARIATIONS:Show how thrombi can alter vascular caliber in acute and chronic contexts, or how they can be detected in non-directed exams.• IODINE MAP:Demonstrate the imaging appearance of the iodine map and how it aids and suggests the diagnosis of PE.

## CHEE-40 A (W)HOLE-SOME APPROACH TO CYSTIC LUNG DISEASE

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Ajith Varrior, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To differentiate a true pulmonary cyst(s) from its mimics2. To learn the step-wise approach to narrow down the list of differential diagnoses and arrive at a specific diagnosis3. To discuss specific cystic lung diseases

**TABLE OF CONTENTS/OUTLINE**

1. What is cystic lung disease (air-filled structures versus fluid filled in rest of the body)? 2. Differentiation of true pulmonary cysts from cystic appearing lesions (cavity, bulla, pneumatocele, emphysema, honey combing, cystic bronchiectasis)3. Number of cysts: Are cysts solitary or localized versus multiple or diffuse?4. What is the distribution of cysts (upper lobe or lower lobe or subpleural)?5. Association with other pulmonary (nodules, ground glass) and extra-pulmonary findings (like renal tumors, plasma cell dyscrasia, autoimmune conditions)6. Algorithmic approach to cystic lung disease7. Discussion of specific entitiesLangerhans cell histiocytosis (LCH), Lymphangiomyomatosis (LAM), Lymphoid interstitial pneumonia (LIP), Birt Hogg Dube syndrome (BHD), amyloidosis, tracheobronchial papillomatosis, neurofibromatosis, cystic metastasis, congenital pulmonary airway malformation (CPAM) and bronchogenic cysts, Pneumocystis carini pneumonia (PCP) and desquamative interstitial pneumonia (DIP), cystic metastasis

## CHEE-41 IMAGING SPECTRUM OF PULMONARY HISTOPLASMOSIS

Marcela Rosa, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Paulo T. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Abstract Co-Author*) Nothing to Disclose
Elaine Yanata, MD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Nunes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Histoplasmosis stands as the most prevalent endemic fungal disease in the U.S., with significant incidence in Central and South America. While primarily targeting the lungs, it can disseminate systemically based on the patient’s immune status and the quantity of inhaled fungus.The disease poses a significant diagnostic challenge, given the limited availability and sensitivity of non-invasive tests. Consequently, imaging examinations are usually part of the diagnostic process. Histoplasmosis manifests in diverse patterns on chest X-rays and computed tomography scans, varying with the disease stage and

patient's immune response.It is paramount that radiologists remain cognizant of these potential findings. This presentation offers a didactic exploration of radiological findings across various clinical stages and forms of histoplasmosis, complemented by pertinent literature review.

**TABLE OF CONTENTS/OUTLINE**

Brief review of relevant epidemiology and pathophysiologyClinical presentations: acute pulmonary histoplasmosis X subacute pulmonary histoplasmosis X chronic pulmonary histoplasmosis X disseminated progressive histoplasmosis Different presentations on chest CT: calcified lung nodules, disseminated micronodular disease, solitary pulmonary nodule (histoplasmoma), heterogeneous consolidation with enlarged lymph nodes, isolated enlarged lymph nodes, fibrosing mediastinitis, central airway involvementDiscussion of 18-FDG PET/CT as a complementary imaging modality (flip-flop sign as a potential auxiliary finding to differentiate histoplasmosis from lung cancer)Relevant differential diagnosis Conclusion and take home messages

## CHEE-42 A CASE BASED REVIEW OF INHALATIONAL LUNG DISEASES: IMAGING FINDINGS AND CLINICAL FEATURES

Ryosuke Taiji, MD (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Nagaaki Marugami (*Abstract Co-Author*) Nothing to Disclose
Dan Yamamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Aya Yamada, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Inhalational lung diseases are caused by dust exposure, residential environment, smoking habits, pet keeping, and poisoning. These diseases occasionally show an upper lobe-predominant distribution with various imaging findings. Radiologists need to know more about each disease and obtain a detailed medical and exposure history.The purposes of this exhibit are: To depict typical imaging findings of inhalational lung diseasesTo discuss the clinical and radiological findings, and differential diagnosis

**TABLE OF CONTENTS/OUTLINE**

1. Hypersensitivity pneumonitis (HP) Nonfibrotic HP: Fungi (e.g. Summer-type and Humidifier lung) Bird fancier’s lung Hot tub lung (Mycobacterium avium) Fibrotic HP: Bird fancier’s lung 2. Occupational lung disease Dust and fume inhalation: Pneumoconiosis (e.g. Silica, Fume and Stainless-steel) Asbestos-related diseases: Pleural plaque Benign asbestos pleural effusion, Diffuse pleural thickening, Round atelectasis Malignant pleural mesothelioma 3. Smoking-related disease Emphysema Airspace enlargement with fibrosis (AEF) Respiratory bronchiolitis-associated interstitial lung disease (RB-ILD) Desquamative interstitial pneumonia (DIP) Langerhans cell histiocytosis (LCH) 4. Poisoning and miscellaneous Chemical inhalation (e.g. Disinfectant and Bleach) Burn injury and smoke inhalation Lipoid pneumonia (e.g. Petroleum and Toluene)

## CHEE-43 THORACIC IMAGING MANIFESTATIONS OF IGG-4 RELATED DISEASE

**Awards**
**Certificate of Merit**

Caroline Novis, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leticia Cardoso Ern, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Camila S. Franco, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Thiago Matheus Santos Rios, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

IgG4-related disease (IgG4-RD) is a systemic fibroinflammatory disorder with characteristic histologic findings (tumefactive lesions with IgG4-positive plasma cells and lymphocytic infiltration associated fibrosis), and may or may not coincide with elevated serum IgG4 levels. Diagnosis relies on histopathologic, serological, and radiological features. Chest involvement in IgG4-RD includes lymph node enlargements, pleuropulmonary involvement, and cardiovascular disease. Radiologists should consider IgG4-RD in their diagnoses due to significant diagnostic and prognostic value.1. Prototype the thoracic findings of IgG4-RD;2. Identify the key thoracic findings of IgG4-RD in cases with histopathological confirmation;3. Determine the importance of maintaining IgG4-RD as a differential diagnosis in the appropriate clinical-radiologic context.

**TABLE OF CONTENTS/OUTLINE**

1. Introductiona) Epidemiology, physiopathology and clinical aspects of the IgG4-RD.2. The recent diagnostic criteria of American College of Rheumatology/European League against Rheumatism (ACR/EULAR) for IgG4-RD probability - repercussions in clinical practice and recommendations3. IgG4-RD associated thoracic imaging features - Case-by-case discussion reviewa) Paravertebralb) Retromediastinal fibrosisc) Cardiac Interstitial diseased) Ground-glass opacitiesPeribronchovascular involvemente) Lymph node enlargementf) Pleural disease4. The mimics of IgG4-RD in thoracic manifestations - including vascular, pleural, mediastinal and airway involvement.5. Conclusions "take-home messages"

## CHEE-44 FROM SCAN TO INCISION: A COMPREHENSIVE GUIDE FOR RADIOLOGISTS TO EMPOWER SURGEONS IN IDEAL MANAGEMENT OF BLUNT TRAUMATIC AORTIC INJURY

Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaz Asadian, MD (*Abstract Co-Author*) Nothing to Disclose
Nastaran Hosseini (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Familiarize radiologists with the latest surgical classifications of blunt aortic injuries.Highlight the details surgeons need from radiologists for ideal management of different blunt traumatic aortic injuries.Review multimodality imaging features of blunt traumatic aortic injury.Review current recommendations and surgical managements for different blunt traumatic aortic injuries.Review Imaging pitfalls and mimics of blunt traumatic aortic injuries.

**TABLE OF CONTENTS/OUTLINE**

Review the anatomy and histology of aorta relevant to traumatic injuries.Updated grading and classification systems used by surgeons for blunt traumatic injuries.Role of multimodality imaging in detection and follow up of blunt traumatic injuries.Overview of imaging protocols ideal for detection of blunt traumatic injuries in emergency settings.Review of the definition, key imaging findings, and what surgeons need to know for:• minimal aortic injury• aortic laceration• pseudoaneurysm• intramural hematoma• aortic transectionExpected and unexpected imaging findings in post treatment imaging of

blunt traumatic aorta injuries.Review imaging pitfalls and mimics of blunt traumatic aortic injuries with emphasis on improving protocols for imaging the aorta.

## CHEE-45 THIS CHEST LOOKS ABNORMAL: SEQUEL OF INFANT AND CHILDHOOD DISORDERS

Azadeh Hojreh, MD (*Abstract Co-Author*) Nothing to Disclose
Daria Kifjak, MD (*Abstract Co-Author*) Nothing to Disclose
Svitlana Pochepnia (*Abstract Co-Author*) Nothing to Disclose
Benedikt H. Heidinger, MD (*Abstract Co-Author*) Nothing to Disclose
Helmut Prosch, MD (*Abstract Co-Author*) Support, Boehringer Ingelheim GmbH;Support, F. Hoffmann-La Roche Ltd;Support, Merck & Co, Inc;Support, Bristol-Myers Squibb Company;Support, Novartis AG;Support, AstraZeneca PLC;Support, Takeda Pharmaceutical Company Limited;Support, Siemens AG;Support, Bayer
Lucian Beer, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Aida Korajac, MD (*Abstract Co-Author*) Nothing to Disclose
Ruxandra-Iulia Milos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) The diagnosis of developmental lung anomalies or infancy-acquired lung disorders later in adulthood can be challenging and often mistaken for something threatening. 2) The main categories can be divided in: diseases of the tracheobronchial system; diseases of the lung parenchyma, including congenital lung lesions, prematurity-related chronic lung disease, surfactant function disorders and post infectious abnormalities; and diseases of the vascular system. 3) Systematic approach and analysis of the imaging features on chest X-ray, CT and MRI are useful in facilitating the diagnosis.

### TABLE OF CONTENTS/OUTLINE

1) Diseases of the tracheobronchial system include primary ciliary dyskinesia, cystic fibrosis, alpha-1 antitrypsin deficiency, as well as the tracheobronchial branching abnormalities. 2) Congenital lung lesions most often encountered are the congenital pulmonary airway malformations (CPAMs), the bronchopulmonary sequestration (BPS), congenital lobar emphysema (CLE) and the bronchogenic cysts. 3) The prematurity-related chronic lung disease is related to the bronchopulmonary dysplasia (BPD) that often develops after mechanical ventilation in prematurely born infants with respiratory failure. 4) Disturbance of surfactant homeostasis can lead to development of pulmonary alveolar proteinosis and nonspecific interstitial pneumonia. 5) Postinfectious bronchiolitis obliterans or the hyperlucent lung syndrome is a rare complication of pulmonary infections in the childhood. 6) Vascular anomalies include interruption or absence of a main pulmonary artery, anomalous origin of the pulmonary arteries, anomalous pulmonary venous drainage, and pulmonary arteriovenous malformations.

## CHEE-46 PARENCHYMAL PULMONARY COMPLICATIONS IN PATIENTS WITH LUNG NEOPLASMS TREATED WITH RADIATION THERAPY

Santiago Carbullanca, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Gayete Cara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose Maria Maiques Llacer, MD (*Abstract Co-Author*) Nothing to Disclose
Gemma Solana, MD (*Abstract Co-Author*) Nothing to Disclose
Alvaro Martinez (*Abstract Co-Author*) Nothing to Disclose
Diego Ramal, MD (*Abstract Co-Author*) Nothing to Disclose
Flavio Zuccarino, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Ivan Martinez Cano, MD (*Abstract Co-Author*) Nothing to Disclose
Francesco Amorelli (*Abstract Co-Author*) Nothing to Disclose
Paulina Miranda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The goal is to identify the different radiological patterns caused by radiation therapy in the lung parenchyma, along with their frequency and progression. It also aims to recognize the warning signs that help differentiate between expected post-radiation therapy changes and tumor recurrence.

### TABLE OF CONTENTS/OUTLINE

Radiation therapy provides local treatment for pulmonary neoplasms but can cause damage to surrounding tissues, particularly the lung parenchyma. Thus, distinguishing between post-radiation therapy changes and potential tumor recurrence or other non-radiation-induced pulmonary pathologies is crucial.In this work:- Classification: Post-radiation therapy changes are classified into early ( < 6 months) and late ( > 6 months). - Imaging Findings: We analyze the most common imaging findings: peri-bronchial consolidation, ground-glass opacities, and mass-like or scar patterns. - Complications: We evaluate potential complications. - Correlation: We correlate these findings with the radiation therapy plan, including duration, dose, and irradiated field. - Warning Signs: We highlight key warning signs indicating tumor recurrence or non-radiation-induced pathology, such as lesions outside the irradiated area, changes in lesion size after 12 months post-radiation therapy, or new-onset atelectasis.Radiation therapy is crucial in managing thoracic neoplastic lesions. Radiologists must understand post-treatment changes and potential complications, and be able to recognize warning signs of tumor recurrence or non-radiation-induced pathologies

## CHEE-47 ARTIFICIAL INTELLIGENCE APPLICATIONS IN LUNG CANCER: CURRENT STATUS AND FUTURE PERSPECTIVES

Vita Ida Gallone, MD (*Abstract Co-Author*) Nothing to Disclose
Gianluca Milanese, MD (*Abstract Co-Author*) Nothing to Disclose
Carlotta Zilioli, MD (*Abstract Co-Author*) Nothing to Disclose
Nicola Sverzellati, MD (*Abstract Co-Author*) Nothing to Disclose
Rebecca Mura, MD (*Abstract Co-Author*) Nothing to Disclose
Ludovica Leo (*Abstract Co-Author*) Nothing to Disclose
Cristina Marrocchio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Have a comprehensive view of the possible applications of AI in lung cancer, from screening to prediction of treatment response2. Review the main AI techniques that can be used, including radiomics, machine learning, deep learning, and large language model3. Have detailed information and examples on the roles of AI in improving image quality, detecting lung cancer, assessing patients' comorbidities, and generating predictive models4. Be informed on current limitations and future developments in the field

### TABLE OF CONTENTS/OUTLINE

1. Main applications of artificial intelligence (AI) in lung cancer, from image acquisition to predictive models1. of 2. Review the basic knowledge of AI tools, including radiomics and machine learning, deep learning, large language models1. 3. Applications in lung cancer screening:• Risk prediction•

Nodule identification and classification• Comorbidities assessment• Report writing and communication with patients4. 1. Applications in providing clinically important information on the identified lesion:• Lesion characterization, e.g., histological type• Prediction models, including response to treatments and recurrence

## CHEE-48 CHEST WALL TUMORS, WHAT THE RADIOLOGIST NEEDS TO KNOW

Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Pividori (*Abstract Co-Author*) Nothing to Disclose
Marcos A. Mestas Nunez SR, MD (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Dulcich SR, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Aylen Gonzalez Gonzalez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Chest wall neoplasms are uncommon entities that represent approximately 5% of all thoracic malignancies. Unfamiliarity with these lesions can pose a diagnostic dilemma. Radiologists must be acquainted with the imaging findings, differential diagnoses and complications of these neoplasms. With this exhibit we will:Review the typical imaging findings of chest wall neoplasms.Review the classification based on a wide range of tissues of origin.Discuss the usefulness of imaging methods to elucidate the origin and/or tissue composition of these lesions along with reviewing the evaluation for vascularization and local invasion.

### TABLE OF CONTENTS/OUTLINE

1. Introduction and Clinical characteristics2. Role of different modalities.3. Entities based on tissue originPrimary tumorsi. Cartilaginous and osseous tumors: 1. Fibrous dysplasia2. Osteochondroma3. Enchondroma 4. Chondrosarcoma5. Osteosarcoma6. Ewing sarcoma7. Multiple Myeloma. ii. Soft-tissue tumors:1. Lipoma2. Liposarcoma3.. Schwannoma4. Neurofibroma5. Elastofibroma dorsi6. Desmoid tumor7. Undifferentiated pleomorphic sarcomaSecondaryi. Metastasisii. Lymphomaiii. Radiation induced malignancy4. Differential diagnosisi. Infectionsii. Congenital anomaliesiii. Post-traumatic injuriesiv. Vascular malformations5. Conclusions - Summary

## CHEE-49 BEYOND THE SMOKE: EXPLORING LUNG CANCER IN NON-SMOKERS

Efren J. Flores, MD (*Abstract Co-Author*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria D. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Farouk Dako, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Gabriel Camareno-Soto, BSc (*Abstract Co-Author*) Nothing to Disclose
Delmarie Rivera Rodriguez, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Roughly 10-20% of lung cancers (LC) arise in non-smokers, presenting unique risk factors and biological traits crucial for accurate diagnosis and management. Radiologists must cultivate a knowledge-based toolkit to discern distinctive imaging features, enhancing precision in diagnosis and management recommendations for LC in this patient cohort. Attendees will leave prepared to handle LC challenges in non-smokers, armed with insights into future epidemiological trends, new risk factors, and cutting-edge imaging. Thus, the purpose of this exhibit is to:1. Provide an overview of the epidemiology related to LC among non-smokers and pertinent risk factors, such as environmental exposures, and genetic risk factors. 2. Review the distinctive imaging features including variations in tumor location, morphology, and response to treatment. 3. Describe advancements in risk modeling, utilizing imaging technology and data science, to address LC in non-smokers.

### TABLE OF CONTENTS/OUTLINE

1. Introduction:a. LC trends in non-smokers b. Epidemiological risk factors for developing lung cancer in non-smokers c. Eligibility criteria for LC screening 2. Case based radiological patterns of LC in non-smokers: a.Variations in tumor location and morphology b.Imaging characteristics of different histological subtypes 3. Future directions for early detection, diagnosis and monitoring using imaging modalities a. Overview of new risk stratification models that incorporate exposures and genetics as risk factors for LC in non-smokers. b. Discuss the role of computed tomography, magnetic resonance imaging, and molecular imaging to aid in diagnosis of LC. 4. Conclusion

## CHEE-5 CLINICOPATHOLOGICAL CORRELATION OF MULTIPLE CYSTIC LESIONS IN THE LUNG

Tomoe Sawazumi (*Abstract Co-Author*) Nothing to Disclose
Takashi Ogura, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Shionogi & Co, Ltd;Speakers Bureau, Astellas Group
Ryo Aoki (*Abstract Co-Author*) Nothing to Disclose
Ryota Otoshi (*Abstract Co-Author*) Nothing to Disclose
MAI MATSUMURA (*Abstract Co-Author*) Nothing to Disclose
Tomohisa Baba, MD (*Abstract Co-Author*) Speaker, AstraZeneca PLC;Consultant, AstraZeneca PLC;Speaker, DAIICHI SANKYO Group;Consultant, DAIICHI SANKYO Group;Speaker, Merck KGaA;Consultant, Merck KGaA;Speaker, Boston Scientific Corporation;Speaker, The Nippon Synthetic Chemical Industry Co, Ltd;Speaker, Boehringer Ingelheim GmbH;Speaker, Toray Industries, Inc;Speaker, Shionogi & Co, Ltd;Speaker, Astellas Group;Speaker, AMCO Inc;Speaker, Asahi Kasei Medical Co, Ltd;Speaker, Otsuka Holdings Co, Ltd;Speaker, Ono Pharmaceutical Co, Ltd;Speaker, Bristol-Myers Squibb Company;;;;;
Tamiko Takemura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
NAOFUMI YASUDA (*Abstract Co-Author*) Nothing to Disclose
Tae Iwasawa, MD, PhD (*Presenter*) Support, Canon Medical Systems Corporation;Support, Ziosoft Inc;Speaker, FUJIFILM Holdings Corporation;Speaker, Boehringer Ingelheim GmbH

### TEACHING POINTS

A cyst is any circumscribed and well-defined air-containing structure in the lung parenchyma. Cystic lesions occur due to various mechanisms such as airway obstruction with distal airspace dilatation (a check-valve mechanism), necrosis of airway walls, or lung parenchymal destruction by proteases. Cysts typically contain air, although, in some cases, they may be filled with fluid.In this exhibit, we will present computed tomography images and the histology of patients with multiple cystic lesions to explore their pathogenesis. Some cystic lesions increase in size over time, and we will illustrate the progression of the cystic lesions.

### TABLE OF CONTENTS/OUTLINE

1, Rare cystic lung disease Langerhans cell histiocytosis, Birt-Hogg-Dubé syndrome, lymphoid interstitial pneumonia, lymphangioleiomyomatosis (Figure 1) 2, Cystic lesions in genetic diseases; Neurofibromatosis, Down syndrome 3, Cystic lesions in infectious disease; pneumocystis pneumonia 4, Cystic lesions in collagen vascular diseases; Sjögren syndrome (Figure 2), antineutrophilic cytoplasmic antibody-associated vasculitis (Figure 3) 5, Cystic lesions

in smokers; admixed emphysema and thick-walled large cysts as observed in combined pulmonary fibrosis and emphysema (Figure 4) 6, Others; cyst formation in multicentric Castleman's disease, benign metastasizing leiomyoma (Figure 5)

## CHEE-50 ROLE OF IMAGING IN DIAGNOSIS AND CHARACTERIZATION OF PROGRESSIVE FIBROTIC INTERSTITIAL LUNG DISEASE

Stephen Hobbs, MD (*Abstract Co-Author*) Author with royalties, Wolters Kluwer nv;Author with royalties, RELX
Jeffrey P. Kanne, MD (*Abstract Co-Author*) Research Consultant, PAREXEL International Corporation;
Sreeja Sanampudi, MD (*Abstract Co-Author*) Nothing to Disclose
Kiran Batra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Interstitial lung disease (ILD) is a broad spectrum of pulmonary conditions that include idiopathic pulmonary fibrosis (IPF), connective tissue disease-ILD (CTD-ILD), hypersensitivity pneumonitis (HP), sarcoidosis, non-specific interstitial pneumonia (NSIP), amongst others. These non-IPF disease entities can present as fibrotic interstitial lung disease (F-ILD) or progressive F-ILD (also known as progressive pulmonary fibrosis (PPF)), which is disease progression despite adequate treatment. There is a growing prevalence of ILD and PPF, and clinicians face certain challenges regarding ambiguous categorization of disease, poor risk stratification, and lack of guidelines regarding the use of antifibrotic therapy. Diagnosis of PPF on high resolution computed tomography (HRCT) has recently been validated within a subset of criteria that can help identify a progressive phenotype in individuals with non-IPF ILD.

### TABLE OF CONTENTS/OUTLINE

• Define Progressive Fibrotic ILD and differentiate between Progressive fibrotic ILD and fibrotic ILD • Importance and role of imaging in diagnosing Progressive Fibrotic ILD • Schematic representation of the prevalence of the ILDs that may be associated with "Progressive Pulmonary Fibrosis (despite management)". • Describe the HRCT phenotypes and signs of progression. • Identify role of automated methods for identifying disease progression in the above setting.

## CHEE-51 THORACIC ULTRASOUND MADE SIMPLE: A COMPREHENSIVE GUIDE

Joaquin Martinez Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Agustina Picarel, MD (*Abstract Co-Author*) Nothing to Disclose
Pilar Navarro Azurmendi, MD (*Abstract Co-Author*) Nothing to Disclose
Maria C. Ferrario, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos J. Padin, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Francisco Linan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the essentials of thoracic anatomy in ultrasound.To approach the proper examination protocols and technique. To discuss the various clinical applications of thoracic ultrasound.Pleural effusion.Pneumothorax.Pulmonary consolidations.Empyema.Rib fracture.To highlight the advantages and disadvantages of thoracic ultrasound, in comparison with other modalities.To ensure the radiologist role and the unique ability of thoracic ultrasound to provide dynamic, real-time information, facilitating rapid decision-making in acute clinical situations.

### TABLE OF CONTENTS/OUTLINE

Introduction to thoracic ultrasound.Anatomy and examination Technique.Anatomical approachB-modeM-modeLinear and convex transducer.Clinical ApplicationsPleural effusion.Pneumothorax.Pulmonary consolidations.Empyema.Rib fracture.Comparison with other diagnostic modalities.Conclusion

## CHEE-52 EXPLORING IMMUNOSEROLOGY AND LUNG IMAGING IN RHEUMATIC DISORDERS: A RADIOLOGIST'S GUIDE

Omar Andres Pantoja Burbano, MD (*Abstract Co-Author*) Nothing to Disclose
Maria C. Perez Alvarado, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Aluja, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Andres F. Mejia Leon, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Interpretation of immunoserological findings in the context of different rheumatic conditions, is key for radiologists' daily practice, to overcome diagnostic challenges and improve accuracy in clinical decision-making. • Correlating characteristic imaging findings associated with rheumatic lung manifestations and different seroinmunological markers can guide the interpretation of lung imaging studies. • A proper correlation between immunoserological profiles and lung imaging findings in different rheumatic disorders can improve clinical outcomes. • Is important to recognize common pitfalls in the interpretation of immunoserology and lung imaging in rheumatic disorders.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Chest CT manifestations and histopathologic patterns seen in rheumatic diseases.
- Chest findings, beyond the lung parenchyma.
- Main serologic tests based on HRCT or Histologic Pattern on biopsy, or both, in the context of the absence of a clear phenotype.
- Clues to identify pulmonary disease and suspect underlying rheumatic syndrome.
- Schematic representation of the most used serologic tests.
- Expected radiological appearance and common pitfalls.
- Take home points!

## CHEE-53 LUNG CANCER IN ASIA - A BURGEONING CRISIS

Srujana Ganti, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Bimal Mayur Kumar Vora (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 1.To raise awareness of the Lung cancer burden in Asia2. 2.Highlight how lung cancer in Asia is different to that in the West3. 3.Discuss lung cancer screening problems that are specific to the Asian continent4. 4.Discuss some potential solutions

**TABLE OF CONTENTS/OUTLINE**

Lung cancer is a one of the most lethal cancers worldwide. Lung cancer in Asia, specifically, makes up a significant proportion of the global burden and the tumour biology as well as risk factors are different to that in the west. The poster will give an overview of lung cancer and its subtypes.It will then discuss the disease burden in Asia, ephasising the magnitude of the problem. The various risk factors, in addition to tobacco will be reviewed. The differences in tumour biology of Lung cancer in Asia to the west will be discussed, highlighting how this would affect treatment and management of lung cancer. Lung cancer screening has the potential to improve the early detection of cancer and improve mortality. However, it comes at significant healthcare costs and a robust infrastructure is required to be in place. The poster will give an overview of some of the existing screening programmes in Asia and also some of the challenges that are faced. Some potential solutions will also be discussed.

## CHEE-54 REVIEW OF NAVIGATIONAL BRONCHOSCOPY PLANNING

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Gange JR, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc Stockholder, Bristol-Myers Squibb Company Research Consultant, Bayer AG Medical Advisory Board, AIxSCAN, Inc Shareholder, AIxSCAN, Inc
Colby Shreve (*Abstract Co-Author*) Nothing to Disclose
Mamta Gupta (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

•Identification of key anatomical structures relevant to bronchoscopy navigation.? •Recognition of anatomical variations and their impact on procedural success.? •Techniques for precise lesion localization using imaging landmarks.? •Importance of accurate targeting for successful biopsy or treatment.? •Utilization of imaging data to create virtual bronchoscopy maps.? •Assessment of potential risks based on imaging findings.? •Strategies for minimizing risks during bronchoscopy procedures.? •Case based discussion on challenging cases and decision-making processes.

**TABLE OF CONTENTS/OUTLINE**

• Overview of navigational bronchoscopy. • Role of imaging in procedural planning. •Discussion on optimal CT protocol Integration of Imaging with Navigational Systems and creation of virtual bronchoscopy maps from imaging data. •Assessment of procedural risks based on imaging. •Discussion of potential complications. •Review of case examples demonstrating planning.

## CHEE-55 AI-DRIVEN LUNG CANCER SCREENING PROGRAM: OPPORTUNITIES AND CHALLENGES

Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Abstract Co-Author*) Nothing to Disclose
Syed Muhammad Awais Bukhari, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To outline key statistics of lung cancer and review the current state of lung cancer screening in United States. 2. To learn about various currently available AI models and their role in lung cancer screening program 3. To understand the process of clinical deployment of AI technologies in lung cancer screening and the challenges involved.

**TABLE OF CONTENTS/OUTLINE**

1. Lung Cancer: Clinical and Epidemiological Considerations o Risk Factors o Disease Burden in the USA o Current State of Screening Programs 2. Low Dose Lung Cancer Screening: Rationale o Trials: NLCST and NELSON trial o Lung-RADS o USPSTF Recommendations 3. Utility of AI technologies in the Lung Cancer Screening Program o Role in Imaging Analysis > Deep CNN-based AI algorithms > NLP and Dashboards o Role in Histopathological Analysis e.g. diagnosis and staging of tumor o Role in Biomarker Quantification: e.g. PDL-1 status o Role in Radiogenomics: e.g. tumor mutation burden determination o Additional Applications § Quality control and image enhancement § Reduction of observation errors and false negatives § Efficiency and Workflow Optimizations 4. Clinical Deployment of AI Tools in Lung Cancer Program and Involved Challenges o End-to-end pipeline for the clinical deployment of AI tools in the Lung Cancer Program o Challenges § Issues with Generalizability and data bias § Ethical and Regulatory Considerations § Integration dilemmas into clinical practice 5. Future Directions o Prescreening risk assessment characterization o Generation of patient-centric CT report o Liquid biopsies o Virtual biopsy technique o AI-aided ultra-low dose PET/CTs o AI-aided ultrashort echo time MR scanners

## CHEE-56 BURNING OUT? TRY THE MRSA (MAKING REPORTING SEXY AGAIN) PILL WITH 50 MG AI AND 5 MG LLMS!

Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Shambo Guha Roy, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Lina Karout, MD (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Parisa Kaviani, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Understanding the etiology and characteristics of burnout in radiology 2. Knowledge of available quantitative AI tools for reducing onerous aspects of radiology reporting 3. Strategies for the substance of AI outputs with the style of LLMs for bringing joy and efficiency to radiology reporting. 4. Understanding the operating and breaking scenarios for different AI tools in thoracic imaging

**TABLE OF CONTENTS/OUTLINE**

1. Graphic summary of spiraling workload and burnout in radiology 2. Understanding the mundane, repetitive tasks in radiology reporting 3. Strengths and weakness of multi-vendor artificial intelligence (AI) tools for thoracic imaging 4. Where and how AI and large language models (LLMs) deliver the MRSA pill?

## CHEE-57 APPLICATIONS OF LARGE LANGUAGE MODELS IN CARDIOTHORACIC IMAGING: A PRIMER FOR RADIOLOGISTS AND CARDIOLOGISTS

Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Abstract Co-Author*) Nothing to Disclose
Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Syed Muhammad Awais Bukhari, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To understand various Large Language Models (LLMs) and their functionality 2. To review currently available LLMs in the cardiothoracic imaging space 3. To highlight the role and applicability of LLMs in cardiothoracic imaging

**TABLE OF CONTENTS/OUTLINE**

1. Large Language Models: A Primer o What are LLMs and their types? o Evolution of LLMs 2. LLMs in Radiology Workspace o RadBERT o ClinicalRadioBERT o Custom GPTs 3. Potential applications of LLMs in cardiothoracic imaging o Radiology reporting • Proofreading the reports • Potential time-saving with chest X-ray • Summarization of clinical history • Assisting with cardiac MRI reporting (structuring and adding guidelines) • Patient-centric reports and education (Simplifying the complex reports for patients) o Educational Applications • Instant Information Source • Evidence-based interactive learning • Case-based Exam Preparation • Quick Literature Review o Simplifying Complex Classifications e.g. Fleischner o Intelligent differential diagnosis o Information curation for lung cancer tumor board and ILD multidisciplinary discussions (combining Radiological, pathological, and Clinical information) o Assistance with Reporting to ACR for lung cancer screening program (Capture all the necessary elements to meet the ACR certification ) 4. Limitations of LLMs and mitigation tactics o Dependency on Training Data o Inaccurate Response Generation (Hallucination) o Poor complex reasoning o Probabilistic Nature (Stochasticity) o HIPAA Compliance o Bias o Radiologist Over-reliance o Operation costs 5. Future Directions o Need for robust radiology-specific LLMs o Multimodal medical LLMs o Seamless integration with EHR, RIS, and PACS

## CHEE-58 FEBRILE NEUTROPENIA: A PRACTICAL APPROACH

Alex Ha (*Abstract Co-Author*) Nothing to Disclose
Maya Vella, MD (*Abstract Co-Author*) Nothing to Disclose
Adam J. Yen, MD (*Abstract Co-Author*) Nothing to Disclose
Shravan Sridhar, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Febrile neutropenia presents a challenging clinical dilemma and treatment success relies on early diagnosis and targeted antimicrobial therapy. Often, clinical teams look to radiologists to help narrow the differential diagnosis when a neutropenic patient’s thoracic CT contains findings concerning for infection. Here, we examine the role of imaging and CT-guided biopsy in the management of febrile neutropenia, present an approach wherein clinical information is paired with a CT pattern to help the radiologist make an educated guess as to the underlying causative agent, and specify where either clinical information or imaging appearance can serve more useful.

**TABLE OF CONTENTS/OUTLINE**

1. Introduce the problem2. Clinical presentation3. Initial workup (including imaging workup)4. Patternsa. Consolidation (±satellite nodules)b. Cavitary consolidationc. Nodulesd. GGOe. Halof. Reverse halog. Thoracic wall involvement5. Helpful clinical informationa. Time courseb. Antimicrobial responsec. Procalcitonind. B-D-Glucane. Galactomannanf. Serologiesg. BAL aspirate microscopyh. Cultures6. Less than 1 week from onseta. Consolidation/nodules - common bacteria i. Gram+ bacteria (MRSA, VRE) ii. Gram- (pseudomonas)b. GGO - mostly viral i. EBV, CMV, other viruses ii. PJP7. Consolidation/nodules + non-response to broad spectrum antibiotics - fungia. Candidab. Aspergillusc. Mucormycosisd. Tb8. Other organisms to consider - uncommon bacteriaa. Nocardiab. Actinomycesc. Tb9. Utility of biopsya. Fungal infectionb. Malignancyc. Non-diagnostic biopsyd. Platelet management10. Summary by imaging appearance11. Summary by helpful clinical information12. References

## CHEE-59 THE SMOKING GUN: SMOKING RELATED PULMONARY PARENCHYMAL DISEASE

Rocio Perez Johnston, MD (*Abstract Co-Author*) Nothing to Disclose
Carlyne Cool, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos A. Mestas Nunez SR, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Tami J. Bang, MD (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Dulcich SR, BMedSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Cigarette smoking continues to have a significant impact on the general population's health. The majority of morbidity and mortality from smoking is secondary to lung cancer, coronary artery disease, and chronic obstructive pulmonary disease (COPD). Additionally, a significant number of patients will develop diffuse parenchymal involvement related to smoking.Smoking related diffuse lung diseases comprise a heterogeneous group of disorders that can be classified into inflammatory (mostly chronic) and fibrotic entities. Despite their characteristic imaging findings with good pathologic correlation, they may overlap and it is not uncommon to see more than one entity in pathology. With this exhibit we will:- Review the imaging findings COPD related lung disease- Review clinical, imaging and pathological appearance of smoking related diffuse lung diseases- Highlight the spectrum of fibrotic findings related to smoking - Brief review of vaping and marijuana users associated lung injury

**TABLE OF CONTENTS/OUTLINE**

1) Overview2) Entitiesa) COPD relatedChronic Bronchitis EmphysemaVanishing lung syndromeb) Smoking related diffuse lung disease i) InflammatoryAcute eosinophilic pneumoniaRespiratory bronchiolitisDesquamative Interstitial PneumoniaPLCHII) FibroticIPFSmoking related fibrosis (SRIF - AEF)CPFE3) ILAs4) Vaping - Marijuana users injury 5) Conclusions

## CHEE-6 DIAGNOSTIC IMAGING OF ESOPHAGEAL FISTULAS: INDIRECT AND DIRECT SIGNS

**Awards**
**Certificate of Merit**

Linda B. Haramati, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Ami N. Rubinowitz, MD (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Mamta Gupta (*Abstract Co-Author*) Nothing to Disclose
Abhishek R. Keraliya, MD (*Abstract Co-Author*) Nothing to Disclose
Mihai O. Andreca, MD, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The esophageal wall is inherently weak because it lacks a serosal layer which makes it vulnerable to perforation.2. Chest CT with oral contrast and upper GI fluoroscopy are the imaging modalities of choice to establish the diagnosis3. A tract/ communication between the esophagus and an adjacent structure like trachea, or left atrium, is a direct sign of fistula formation.4. Indirect signs of esophageal fistulas include the presence of esophageal contents (oral contrast or food) in unexpected locations (such as pleura), presence of stranding/ induration of the mediastinal fat with the esophageal wall in close proximity to an adjacent organ, and visualization of extraluminal gas with discontinuity of the esophageal wall.

**TABLE OF CONTENTS/OUTLINE**

1. Describe the anatomy of the esophagus with relationship to adjacent organs2. Imaging modalities for evaluation• Plain radiographs• Upper GI fluoroscopy• CT with oral contrast3. Signs of fistula on imaging• Direct signs- communication between the esophagus and an adjacent structure• Indirect signs- the presence of esophageal contents (oral contrast or food) in unexpected locations or extra-luminal gas4. Examples of various esophageal fistulas with a focus on imaging findings• Tracheoesophageal fistula• Bronchoesophageal fistula• Esophagopulmonary fistula• Atrio-esophageal fistula• Aorto-esophageal fistula• Pericardioesophageal fistula• Esophagopleural fistula• Esophagocutaneous fistula• Tumor-esophagus fistula

## CHEE-60 SIZE IS NOT ALL THAT MATTERS: EXPLORING THE MORPHOLOGICAL AND METABOLIC CHARACTERISTICS OF SOLITARY PULMONARY NODULES

**Awards**
**Certificate of Merit**

Maria G. Gracia Munoz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The incidental encounter of solitary pulmonary nodules (SPNs) is highly common in the daily tasks of radiologists. The differential diagnosis of SPNs is extensive, and a significant percentage are malignant. Since timely detection of lung cancer has a crucial impact on patient prognosis, radiologists must be able to distinguish benign from malignant nodules with the highest possible precision and in early stages, while avoiding unnecessary follow-up studies and invasive diagnostic procedures. Ultimately, the determining factor regarding recommendations is the size, but taking into account the morphological and metabolic evaluation of the nodules can increase diagnostic accuracy in SPN assessment.

**TABLE OF CONTENTS/OUTLINE**

Definition. General Imaging RecommendationsMorphological Characteristics: Attenuation, Shape and Margins, Internal Characteristics (calcifications, fat attenuation, cavitation), Complex Findings (pleural retraction, air bronchogram, bubble-like lucencies, cystic airspace), Location and Enhancement.Metabolic Characteristics: PET/CT with FDG. Indications, Metabolism of Different Neoplasms, Limitations, Use of Other Radiopharmaceuticals.Recommendations on How to Measure Pulmonary Nodules according to the Fleischner Society (in QA format).Fleischner Society Guidelines for Management of Incidental Pulmonary Nodules (General Characteristics, Risk Estimation, and Description of Recommendations)

## CHEE-61 IMAGING FINDINGS OF RECURRENT NEOPLASTIC DISEASE ON SURVEILLANCE IMAGING OF THE CHEST

Cheng Ting Lin, MD (*Abstract Co-Author*) Nothing to Disclose
Preetham Bachina, BS (*Abstract Co-Author*) Nothing to Disclose
Dilek Oncel, MD (*Abstract Co-Author*) Nothing to Disclose
Wenchi Hsu, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Illei, MD (*Abstract Co-Author*) Nothing to Disclose
Raheel Anwar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

* Primary lung and extrathoracic tumors demonstrate diverse patterns of metastatic spread, leading to varying radiographic appearances on chest CT.* Surgery and radiotherapy cause distortions of the pulmonary anatomy that pose challenges in interpreting surveillance imaging and require understanding of expected post-treatment changes.* Accurate review of pulmonary findings on follow-up scans is essential for guiding optimal clinical management.

**TABLE OF CONTENTS/OUTLINE**

* Chest CT surveillance for patients at risk for metastatic disease* Treatment-related disease: surgical resection, radiotherapy (radiation pneumonitis, organizing pneumonia, radiation fibrosis), immunotherapy (checkpoint inhibitor pneumonitis, pseudoprogression)* Intra-pulmonary spread: hematogenous metastases, lepidic spread, lymphangitic carcinomatosis, aerogenous metastases* Extra-pulmonary spread: nodal involvement, pleural dissemination, pericardial/cardiac metastases, osseous metastases

## CHEE-62 NOT SO NICE COUNTERTOPS: A PICTORIAL REVIEW OF THE NEW SILICOSIS EPIDEMIC AMONG ENGINEERED STONE WORKERS

Sheiphali Gandhi (*Abstract Co-Author*) Nothing to Disclose
Andrea Oh, MD (*Abstract Co-Author*) Nothing to Disclose
Jane Fazio (*Abstract Co-Author*) Nothing to Disclose
Nader Kamangar (*Abstract Co-Author*) Nothing to Disclose
Robert J. Tallaksen, MD, MA (*Abstract Co-Author*) Nothing to Disclose
Jonathan H. Chung, MD (*Abstract Co-Author*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd
Karoly Viragh, MD (*Abstract Co-Author*) Nothing to Disclose
Sundus Lateef, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Silicosis is the oldest-recognized and most commonly diagnosed pneumoconiosis, historically associated with mining. In the last decade, there has been a surge of silicosis cases globally among stone countertop workers exposed to engineered stone (e.g. quartz) dusts. Silicosis has previously been uncommon among countertop workers, leading to delay in diagnosis, often due to difficulty differentiating imaging findings from sarcoidosis or atypical infection often favored as initial diagnoses. The goal of the current educational exhibit is to (1) raise awareness to the new silicosis epidemic, (2) depict the typical and atypical imaging features with clinicopathologic correlation when available, and (3) address important research questions. In addition to the rich imaging illustrations selected from one of the largest countertop manufacturer silicosis patient cohorts available in the USA, interactive (board-exam type) pointers will also be provided.

**TABLE OF CONTENTS/OUTLINE**

1. Silicosis - historical perspective;2. Silicosis - pathophysiology, clinical presentation, management;3. Imaging technique (brief review of the ILO and ICOERD systems);4. Imaging illustration: Parenchyma abnormalities (small and large nodular opacities, septal thickening, fibrosis, consolidations); Airway abnormalities; Pleural abnormalities (effusions, pseudoplaque); Mediastinal abnormalities (lymphadenopathy); Complications;5. Cases: Acute silicosis; Accelerated silicosis; Chronic simple silicosis; Chronic complicated silicosis with progressive massive fibrosis; Silicosis with pneumothorax; Superimposed infections (e.g. mycobacterium); Differential diagnosis cases (sarcoidosis, infections)

## CHEE-63 RADIOLOGIC APPROACH TO EVALUATING PERSISTENT CONSOLIDATIONS

**Awards**
**Certificate of Merit**

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos A. Mestas Nunez SR, MD (*Abstract Co-Author*) Nothing to Disclose
Mariano Lorea (*Abstract Co-Author*) Nothing to Disclose
Guadalupe Comadran (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Dulcich SR, BMedSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Consolidation is a common imaging finding defined as an opacity that completely obscures the underlying bronchi and vessels. In most cases, it is evidence of a pathologic process primarily within the air spaces when alveolar air is replaced by fluid, pus, blood, cells, or other material. Patients with parenchymal consolidation may have an acute or subacute/chronic presentation. Despite this classification, there is no precise definition to differentiate them. Persistent consolidation represents opacity that is still present at follow-up examinations and does not resolve in the expected time and after initial treatment. In these cases, imaging findings along with specific clinical information can help narrow the differential and guide management.Review the typical imaging appearance of different causes of persistent consolidation on CTEmphasis on the importance of distribution and clinical information as diagnostic keys.Discuss an imaging and clinical based approach when encountering patients with persistent consolidation

**TABLE OF CONTENTS/OUTLINE**

Introduction and definitionApproach to persistent consolidationCausesInfectious Slowly resolving pneumoniaMycobacterial pneumoniaFungal pneumonia Atypical bacterial pneumoniaInflammatory Organizing PneumoniaVasculitis Chronic Eosinophilic PneumoniaLipoid PneumoniaRadiation PneumonitisSarcoidosisNeoplasticAdenocarcinoma LymphomaMiscellaneous Bronchopulmonary SequestrationInflammatory PseudotumorPulmonary embolism Venous infarctPitfalls Troubleshooting: role of iodinated contrast, PET CT and MRIConclusions

## CHEE-64 PULMONARY VESSEL ANOMALIES: RUNNING THROUGH ALTERNATIVE ROUTES

Daniel Giunchetti Strabelli, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Sartim, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar H. Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bernardo S. Oliveira, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To review usual and unusual cases related to the pulmonary vessels anomalies. 2. To correlate important findings with the anatomy, embryology, and pathophysiology, focusing on their clinical-radiological correlations. 3. To highlight their characteristics in order to familiarize radiologists, preventing unfavorable patient outcome. 4. To review CT and MRI protocols in the evaluation of patients with suspected pulmonary vessels anomalies.

**TABLE OF CONTENTS/OUTLINE**

1. Applied embryology and anatomy of pulmonary artery and veins. 2. Techniques: X-ray, CT and MRI - pros and cons 3. Pulmonary artery anomalies: (a) origination and course (conotruncal abnormalities, atresia, sling); (b) intrinsic pulmonary artery anatomy (proximal interruption of the pulmonary artery, hypoplasia, stenosis); (c) pulmonary termination (arteriovenous malformations); (d) anastomotic vessels (anomalous origin of the coronary artery from the pulmonary artery, patent ductus arteriosus). 4. Pulmonary veins anomalies: (a) Total anomalous pulmonary venous return (TAPVR). (b) Partial anomalous pulmonary venous return (PAPVR). & 7; Type I: Supracardiac & 7; Type II: Cardiac & 7; Type III: Infracardiac & 7; Type IV: Mixed 5. Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics. 6. Future directions 7. Summary and take-home messages.

## CHEE-65 PNEUMONIA IN THE IMMUNOCOMPROMISED HOST

Mark M. Hammer, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Identify the types of immunocompromise encountered in different clinical settings and associate these with specific opportunistic organisms.2. Describe the patterns of mycobacterial disease seen in HIV patients at different levels of CD4 count.3. Describe the imaging appearance of viral and fungal infections in neutropenic patients.

**TABLE OF CONTENTS/OUTLINE**

1. Types of Immunocompromise: T-cell depletion, neutropenia, IgG deficiency, nonspecific2. Causes of pulmonary disease in immunocompromised patients: pulmonary edema, drug toxicity, radiation pneumonitis, malignancy, infection: community-acquired or opportunistic3. HIV infected patients: Tuberculosis, Pneumocystis, CMV pneumonia, Disseminated NTM, Kaposi's sarcoma4. Organ transplants: fungi, mycobacteria, Nocardia, PTLD5. Neutropenic patients: Aspergillus, Mucor6. Bone marrow transplant: fungi, CMV pneumonia, idiopathic pneumonia syndrome

## CHEE-66 HOW TO PERFORM CLINICALLY RELEVANT LUNG CANCER STAGING

Mark M. Hammer, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Clinically relevant staging goes beyond simple AJCC categories and should include clinically important local factors for the primary tumor.2. Understand which lymph node stations upstage a lung cancer.3. Understand how surgeons may need to modify their approach given abutment or invasion of various structures.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of AJCC staging system for lung cancer2. Local factorsa. Proximity to central bronchi or arteries necessitating sleeve resection or arterioplastyb. For sublobar resection, identifying segmental anatomyc. Invasion of pericardium, focal versus disseminatedd. Invasion of pleura or mediastinal fat, and early pleural metastasese. Chest wall invasionf. Diaphragm invasion3. Lymph node staging: ipsilateral versus contralateral mediastinal nodes4. Evaluation of distant metastatic disease, and common mimics

## CHEE-68 PICTORIAL REVIEW OF THORACIC HEMATOMAS

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Emma C. Ferguson, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Ocazionez-Trujillo, MD (*Abstract Co-Author*) Nothing to Disclose
Erika G. Odisio, MD (*Abstract Co-Author*) Nothing to Disclose
Catalina Jaramillo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Aortic Intramural hematoma is part of the aortic dissection spectrum and is diagnosed by crescentic hyperdensity of the aortic wall seen on unenhanced CT images. Additional findings associated with IMH include intramural blood pools and ulcer-like projections.2)A rare complication of Type A aortic dissection is the development of a pulmonary artery (PA) sheath hematoma, which can occur due to the shared adventitial layer between the ascending aorta and the PA, allowing dissection to extend between these vessels and possibly leading to PA lumen compromise.3)Pericardial hematomas can be secondary to blunt or penetrating chest trauma, post cardiac surgery and ventricular rupture. 4)Intramural hematomas of the esophagus can be spontaneous, emetogenic or iatrogenic in the setting of EGD. These hematomas vary in length and may obliterate the esophageal lumen.5)An extrapleural hematoma demonstrates the “fat sign” on CT, where thoracic soft tissues are pushed toward the ribs by intermediate/high density fluid in the extrapleural space. 6)Prevertebral hematoma usually indicates recent injury, as significant hematoma is uncommon after 2-3 weeks. Differential considerations for chronic prevertebral hematomas include infection or tumor.

**TABLE OF CONTENTS/OUTLINE**

1) Great Vessels: Intramural hematoma of the aorta, traumatic aortic injury, adventitial sheath hematoma of the pulmonary artery. 2) Pericardium: Pericardial hematoma. 3) Mediastinum: Spontaneous hematoma of the mediastinum. 4) Esophagus: Intramural Hematoma of the Esophagus. 5) Pleura: Pleural hematoma, extrapleural hematoma. 6) Thoracic Spine: Paravertebral hematoma 7) Chest Wall and soft tissues: Breast hematoma, intramuscular hematoma.

## CHEE-69 PRIMARY PULMONARY LYMPHOMA: WHAT THE RADIOLOGIST NEEDS TO KNOW

Maria Borba, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Pedro C. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Abdo De Almeida (*Abstract Co-Author*) Nothing to Disclose
Lucas Rostom, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Magna, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Kenji Ota (*Abstract Co-Author*) Nothing to Disclose
Bruna P. De Oliveira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- The purpose of this presentation is to demonstrate and help the radiologist deal with the variety of imaging manifestation patterns of primary pulmonary lymphoma, highlighting a case of primary MALT pulmonary lymphoma, an extremely rare disease, but the most common primary pulmonary lymphoma.- This article shows the radiological variability of primary pulmonary lymphoma in patients treated at a reference hospital, focusing on the importance of diagnostic methods: which of them are most sensitive for early diagnosis of the disease, the role in guidance procedures and monitoring response to treatment.

**TABLE OF CONTENTS/OUTLINE**

-A compilation with the list of patients, epidemiological and clinical data, histopathological diagnosis, some microscopy images, some guided biopsy images, imaging patterns of diagnostic methods and their main role in the disease treatment line.- Examples of different imaging presentations of primary lung lymphoma, including an extremely rare case of primary MALT lung lymphoma, with details on how diagnostic methods are also important in assessing the evolution of response to treatment, providing resources to direct management and determine therapeutic success.

## CHEE-7 NOT ONLY LOW GRADE BUT ALSO THE ART OF SLOW TRADE: UNDERSTANDING ADENOCARCINOMA OF THE LUNG DEVELOPING FROM CYSTIC AND SUBSOLID NODULES

**Awards**
**Magna Cum Laude**

Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Emrah Duman, MD (*Abstract Co-Author*) Nothing to Disclose
Brittany Cody (*Abstract Co-Author*) Nothing to Disclose
Zehavit Kirshenboim (*Abstract Co-Author*) Nothing to Disclose
Omer Onder, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1- Subsolid and cystic nodules, as well as the resulting primary lung neoplasms, are notable for their slow-growing nature. However, they can sometimes be overlooked or misclassified as elements of infectious or inflammatory conditions. 2- Being aware of the possible imaging findings of these lesions and current recommendations regarding follow-up is crucial for patient management. With the introduction of new guidelines, such as Lung-RADS 2022, there has been a shift towards a more comprehensive approach that includes these types of nodules, thereby highlighting their clinical significance. 3- This educational exhibit aims to enhance awareness among radiologists regarding primary lung neoplasms that may originate from or potentially evolve from subsolid and/or cystic nodules via a variety of case examples, further enriched by the inclusion of histopathologic examination images obtained after surgical resections.

**TABLE OF CONTENTS/OUTLINE**

A. Introduction objectives B. Subsolid nodules - Nodule types and definitions -Adenocarcinoma spectrum - Lung-RADS 2022 recommendations - Pearls Pitfalls - Case examples important considerations C. Cystic nodules -Cystic lung cancer -Terminology and Lung-RADS 2022 recommendations -Pearls Pitfalls -Case examples important considerations D. Summary E. Conclusion

## CHEE-70 LUNG TRANSPLANT EVALUATION: COMPLICATIONS ON A TIMELINE

Markus Y. Wu, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review history, indication/contraindication, and surgical techniques of lung transplantation.2. Highlight expected and unexpected imaging findings following lung transplantation.3. Present a concise imaging approach to evaluation of transplant- treatment-related complications

**TABLE OF CONTENTS/OUTLINE**

1. History and indications/contraindications.2. Donor selection.3. Surgical techniques.4. Postop imaging protocols.5. Complications on a timeline.6. Immediate complications including malpositioned lines, size mismatch, hyperacute rejection, and pulmonary torsion.7. Early complications including reperfusion injury and acute pleural complications.8. Intermediate complications including acute rejection, bronchial anastomotic complications, and infections.9. Primary late complications including bronchial stenosis, vascular complications, viral and fungal infection.10. Secondary late complications including chronic rejection, organizing pneumonia, PTLD, lung cancer.

## CHEE-71 IMAGING OF THE THORACIC AORTA: EVERYTHING YOU NEED TO KNOW

Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Syed Muhammad Awais Bukhari, MD (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Omar Altabbakh, DO (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Discuss the importance of the thoracic aorta and summarize key points for radiologists using the latest multidisciplinary surgical and clinical guidelines. 2. Illustrate the proper technique for measuring the thoracic aorta in a reproducible way and discuss the normal size and cutoff for pathologic enlargement (e.g. dilated vs aneurysm). 3. Understand the radiologist's role in evaluating pathology of the aorta and recommended imaging surveillance. 4. Discuss acute aortic syndromes and how they should be approached with the latest nomenclature. 5. Review the operative management, post-operative complications, and post-operative surveillance of the aorta. 6. Demonstrate the clinical implementation of artificial intelligence in cardiovascular disease/imaging.

**TABLE OF CONTENTS/OUTLINE**

1. Embryology/Anatomy/Histology 2. Modalities for imaging the thoracic aorta 3. Defining normal size and correct measurement technique 4. Aneurysm Definition 5. Causes of thoracic aortic aneurysms a. Genetic (Ehlers-Danlos, Marfan’s, Loeys-Dietz) b. Congenital (bicuspid, Turner's, coarctation) c. Hypertension/Atherosclerosis d. Inflammatory aortitis 6. Recommended Screening/Surveillance 7. Acute aortic pathology a. Svensson classification b. Society of Vascular surgery reporting system c. Dissection d. Intramural Hematoma e. Penetrating Atherosclerotic Ulcer f. Atypical acute aortic pathologies 8. Operative Management of Aortic Pathology a. Post-operative aorta Complications b. Surveillance of post-operative aortic repairs 9. Artificial intelligence in Cardiovascular Imaging a. Clinical implementation of artificial intelligence into a PACs workflow

## CHEE-72 TRACHEOBRONCHIAL PAPILLOMATOSIS: WHAT RADIOLOGISTS NEED TO KNOW

Alexandre M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana A. Grill, MD (*Abstract Co-Author*) Nothing to Disclose
Tamires Morita, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Brenda N. Lahlou, MD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the etiology and the pathological mechanism of papillomatosis. Highlight the main organs affected in the respiratory system and their imaging characteristics. Emphasize pulmonary involvement and the risk of malignant transformation.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction.2. Etiological agent and forms of transmission.3. Pathological mechanism and histological features.4. Epidemiology and clinical findings.5. Tracheobronchial involvement.6. Pulmonary involvement and possible complications.7. Malignant transformation into squamous cell carcinoma.8. Therapeutic challenges.9. Take home message.

## CHEE-73 CYSTIC LUNG CANCER - A PICTORIAL REPRESENTATION OF MORPHOLOGICAL TYPES BASED ON CT, GROWTH PATTERNS AND FDG PET UTILIZATION

Thomas Taylor (*Abstract Co-Author*) Nothing to Disclose
Mohamed J. Thouseef, MD (*Abstract Co-Author*) Nothing to Disclose
Angela McKinnie (*Abstract Co-Author*) Nothing to Disclose
Chary Duraikannu, FRCR, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Morphological types: We outline four patterns of cystic lung malignancies, as described by Mascalchi et al: Type I - Cyst with exophytic solid component; Type II - Cyst with endophytic solid component; Type III - Cyst with wall thickening; Type IV - Multi-cystic lesion.2. Pathogenesis: prevailing theories include cyst formation via a check valve mechanism secondary to microscopic malignancy or growth along pre-existing bullae.3. Growth pattern: gradual replacement of cystic components by solid tissue observed during follow-up. 4. Histology: predominantly manifest as adenocarcinomas followed by squamous cell carcinoma. 5. Guidelines: current guidelines offer limited guidance on follow-up protocols. In our multidisciplinary meeting, we usually recommend an initial follow up period of 3 months for suspected cystic malignancy. PET imaging would be indicated if notable solid component.

**TABLE OF CONTENTS/OUTLINE**

Background: Lung cancer remains a significant public health concern and ranks as the leading cause of cancer-related mortality in the UK, making up 21% of all cancer deaths between 2017 and 2019. Despite established screening protocols and expedited diagnostic pathways, the diverse presentations of primary lung tumours pose challenges for timely recognition, often leading to diagnostic delays. Through a series of illustrative cases, we aim to showcase the morphological and growth pattern of cystic lung cancers.

## CHEE-74 EVOLVING LANDSCAPE OF CHEST WALL RECONSTRUCTION: A MULTIMODALITY IMAGING APPROACH

Achala Donuru, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Chest wall reconstruction is a complex surgical procedure aiming to restore anatomical and functional integrity after chest wall injury or resection.
- Various imaging modalities play crucial roles in different stages of chest wall reconstruction, each offering unique advantages.
- Pre-operative planning: Imaging helps assess the extent of the defect, guide implant selection and sizing, and identify potential complications.
- Intra-operative guidance: Imaging provides real-time visualization of anatomical structures, facilitating precise implant placement and minimizing complications.
- Post-operative assessment: Imaging monitors healing progress, detects complications like infection or implant failure, and guides further management decisions.

**TABLE OF CONTENTS/OUTLINE**

Introduction:
- Brief overview of chest wall reconstruction and its clinical significance.
- Importance of imaging in various stages of chest wall reconstruction. Pre-operative Imaging:
- Role of CT scans in defect characterization, implant planning, and surgical simulation.
- Advantages of MRI for soft tissue assessment and vascular mapping. Intra-operative Imaging:
- Utility of fluoroscopy and cone-beam CT for real-time guidance and accurate implant placement. Post-operative Imaging:
- Role of CT and MRI in evaluating healing progress, graft integration, and identifying complications.
- Potential applications of PET/CT for detecting early signs of infection or implant rejection. Multimodality Imaging Approach:
- Benefits of combining different imaging modalities for a comprehensive assessment throughout the reconstruction process.
- Examples of how each modality complements the others in different stages.

## CHEE-75 EXPLORING CAVITARY LUNG LESIONS: PERSPECTIVES ON DIFFERENTIAL DIAGNOSIS

Manuel Sebastian Paez Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Esnelly F. Berrios Bonilla, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Enriquez-Puga, MBChB, MSc (*Abstract Co-Author*) Nothing to Disclose
Andrea Calero Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Maria M. Merideno Garcia, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Elisabetta Ponte, MD (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The main objective of this study is to provide insights for proper characterization of cavitary lesions. To achieve this, we aim to fulfill the following three teaching points: firstly, ensuring that we are dealing with a true cavitary lesion and not a mimicker; secondly, once a cavitary lesion is confirmed, explaining how to evaluate it in 10 steps; and finally, elucidating the various entities that arise after cavitation, along with their respective clinical and imaging characteristics.

**TABLE OF CONTENTS/OUTLINE**

- Objectives. - Definition of cavitation and examples of imaging. - Mimickers of cavitation and their definition: cyst, cystic bronchiectasis, emphysema, and bullae. Imaging examples of each. - Evaluation of cavitation in ten steps: confirming the cavity, assessing wall characteristics, identifying intracavitary material, recognizing enhancing foci, evaluating pleural communication, observing surrounding changes and ancillary findings, correlating with history and clinical presentation, assessing temporal evolution, determining the location of the cavity, and determining the number of cavities (solitary vs multiple). - Detailed presentation and explanation of the different entities following the semiological finding of cavitation, illustrating several cases of each: cancer, rheumatoid arthritis, vasculitis, infections (aspergillus, tuberculosis), septic emboli, etc. - Conclusions. - References.

## CHEE-76 THE PE PUZZLE: IDENTIFYING AND DIFFERENTIATING MIMICS ON CTPA

Daniel Ocazionez-Trujillo, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Emma C. Ferguson, MD (*Abstract Co-Author*) Nothing to Disclose
Cihan Duran, MD (*Abstract Co-Author*) Nothing to Disclose
Catalina Jaramillo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Clues to distinguish mixing artifacts from true PE include poorly defined margins, attenuation >78 HU, unilateral lesions, and lesions that do not alter vessel caliber.• Distinguishing whether the defect occurs within the vessel lumen is crucial, as adjacent lymphadenopathy and endobronchial mucous plugging potentially create PE-like lesions.• Metastatic leiomyoma can extend to involve the right sided heart chambers and pulmonary arteries.• Primary sarcoma of the pulmonary artery generally demonstrates enhancement, luminal expansion and loss of the wall contours “eclipse sign”, that distinguishes it from real PE.

**TABLE OF CONTENTS/OUTLINE**

CT Pulmonary Angiography (CTPA) is the study of choice for the evaluation of Pulmonary Embolism (PE), yet its interpretation is filled with challenges. This exhibit aims to clarify the technical and pathologic conditions that mimic PE on CTPA.Artifactsa) Cardiac and respiratory motion artifactb) Pulmonary artery mixing “smoke” artifact from slow flow and ipsilateral parenchymal abnormalities such as bronchiectasisc) Contrast bolus interruptiond) Pulmonary artery devicesPseudo-defects due to pathology at nearby anatomic structuresa) Hilar lymphadenopathyb) Endobronchial aspirationc) Pulmonary Vein ThrombosisTumorala) Direct tumoral invasion from bronchogenic carcinomab) Tumoral metastasis from renal cell carcinoma and uterine leiomyomac)

Primary sarcoma of the pulmonary arteryMimickers of Chronic PEa) Thrombosis in situ secondary to chronic pulmonary hypertensionb) Pulmonary artery sheath hematoma in the setting of aortic dissectionc) Pulmonary artery thickening as a manifestation of vasculitis

## CHEE-77 THE ATOLL WITHIN: A DEEP DIVE INTO THE REVERSE HALO SIGN IN CHEST CT

Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Furkan Ufuk, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Define the reverse halo sign and its diagnostic relevance in chest CT imaging. • Review the various etiologies associated with the reverse halo sign, emphasizing the differentiation between infectious, neoplastic, and inflammatory causes. • Illustrate the significance of integrating clinical history and other diagnostic tools to accurately interpret the reverse halo sign.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to the Reverse Halo Sign Definition and visual characteristics Historical context and significance in radiology 2. Etiological Spectrum a) Idiopathic Organizing Pneumonia: The most common cause, involves inflammation and scarring of the small airways and alveoli. b) Fungal Infections: Various fungal infections can cause the reverse halo sign, including mucormycosis and aspergillosis. c) Bacterial Pneumonia: Certain bacterial infections, including tuberculosis and atypical mycobacterial infections, can sometimes manifest with this sign. d) Viral Infections: Viral pneumonias, such as those caused by influenza, COVID-19, can occasionally show a reverse halo sign. e) Pulmonary Infarction: Pulmonary embolism can result in a reverse halo sign due to hemorrhagic infarction. f) Malignancies: Rare, such as adenocarcinomas of the lung or lymphomatoid granulomatosis might present with a reverse halo sign. g) Autoimmune Diseases: Diseases like granulomatosis with polyangiitis and rheumatoid arthritis can sometimes show this pattern. h) Sarcoidosis: Although less common, sarcoidosis can occasionally present with a reverse halo sign. i) Treatment related: Drug or radiation induced pneumonitis. 3. Conclusion • Summary of key points • Future directions in research and imaging techniques

## CHEE-78 CATCH A RIDE ON THE TRAM TRACKS: IMAGING REVIEW AND DIFFERENTIAL DIAGNOSIS OF BRONCHIECTASIS

**Awards**
**Certificate of Merit**

Anna S. Bader, MD (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Ami N. Rubinowitz, MD (*Abstract Co-Author*) Nothing to Disclose
Linda B. Haramati, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Gange JR, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc Stockholder, Bristol-Myers Squibb Company Research Consultant, Bayer AG Medical Advisory Board, AIxSCAN, Inc Shareholder, AIxSCAN, Inc
Leah Traube, MD (*Abstract Co-Author*) Nothing to Disclose
Alan Gao, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Bronchiectasis is a common condition characterized by irreversible dilatation of the bronchi. It results from a wide range of infectious, inflammatory, neoplastic, and congenital disease processes. Recurrent infections and hemoptysis are the most common complications, both of which contribute substantially to morbidity and mortality. Imaging plays a key role in the initial diagnosis of bronchiectasis, evaluation for progression, and detection of complications. This exhibit will review the imaging features of bronchiectasis and highlight disease-specific differences in anatomic distribution, imaging appearance, and clinical features, which can aid in narrowing the differential diagnosis or in certain cases provide a confident diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction (Definition, Pathophysiology, CXR/CT Findings, Mimics) 2. Case Examples: a. Focal (Bronchial Atresia, Carcinoid, Endobronchial Metastases, Aspirated Foreign Body) b. Central (ABPA, Cystic Fibrosis, Ciliary Dyskinesia, Mounier-Kuhn, Williams-Campbell) c. Upper Lobe (Cystic Fibrosis, Sarcoidosis, Silicosis, Berylliosis, Prior TB, Fibrotic HP) d. Lower Lobe (Infectious, Aspiration, Fibrotic ILD, Alpha-1 Antitrypsin Deficiency, Hypogammaglobulinemia) e. Right Middle Lobe and Lingula (Atypical Mycobacterium) f. Variable (Radiation Fibrosis, Bronchiolitis Obliterans) 3. Complications (Infection, Hemoptysis)

## CHEE-79 CT MANIFESTATIONS OF HIV-ASSOCIATED PULMONARY INFECTIONS IN THE ERA OF ANTIRETROVIRAL THERAPY

**Awards**
**Magna Cum Laude**

David C. Kraft, MD (*Abstract Co-Author*) Nothing to Disclose
Muhammad Naeem, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Carlos Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Sagar B. Amin, MD (*Abstract Co-Author*) Nothing to Disclose
Michael A. Beal, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Volin, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy Arleo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Since the discovery of human immunodeficiency virus (HIV), the imaging findings of the numerous opportunistic infections have been extensively described. However, the high variability of imaging findings and multitude of opportunistic infections may be difficult to differentiate and present a diagnostic challenge. The purpose of this abstract is to present a comprehensive overview of the pulmonary infections seen in immunocompromised patients, as well as propose a pattern-based approach for differentiating pulmonary pathology. Teaching points include the following: 1. Define AIDS defining illness and review the relationship between CD4 levels and opportunistic infection 2. Review the imaging patterns and differential diagnoses of pulmonary infections among immunocompromised patients 3. Discuss non-infectious pulmonary pathology that is characteristic among immunocompromised patients and differentiate it from infectious processes

### TABLE OF CONTENTS/OUTLINE

1. Overview pulmonary infections in immunocompromised patients by CD4 and infection type 2. Review AIDs-defining illnesses 3. Present a CT pattern-based approach to pulmonary pathology, including the following imaging patterns: consolidation, cavitation, cyst, peribronchovascular opacity, halo/reverse halo, nodule/septal line, and ground glass 4. Differentiate imaging mimickers (for example, differentiate pneumatocele/blebs from a cavity or cyst) 5. Discuss non-infectious pulmonary pathology in immunocompromised patients, including immune reconstitution inflammatory syndrome and infection-associated pulmonary malignancy

## CHEE-8 A PICTORIAL REVIEW: ANTERIOR MEDIASTINAL MASSES - ESSENTIAL KNOWLEDGE FOR RADIOLOGISTS

Nagaaki Marugami (*Abstract Co-Author*) Nothing to Disclose
Ryosuke Taiji, MD (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Aya Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Dan Yamamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Ikeno (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Anterior mediastinal masses have various etiologies, such as neoplastic or non-neoplastic pathology. These masses are located in the anterior mediastinum and originate from the thymus or other adjacent organs. Radiologists should be familiar with imaging findings and clinical courses.This exhibit aims to:Depict typical imaging findings of Anterior mediastinal massesDiscuss the clinical and radiological findings, and differential diagnosis

### TABLE OF CONTENTS/OUTLINE

Thymic epithelial tumor Thymoma Thymic carcinoma l Mediastinal lymphoma Non-Hodgkin lymphoma Thymic MALT lymphoma Primary mediastinal (thymic) large B-cell lymphoma T-cell lymphoblastic lymphoma Classical Hodgkin lymphoma (CHL) Nodular sclerosis CHL Mixed cellularity CHL l Anterior mediastinal germ cell tumor Mature teratoma Immature teratoma Mixed germ cell tumor l Thymic neuroendocrine tumor (TNETs) Carcinoid l Mediastinal goiter l Thymic cyst l Thymic hyperplasia

## CHEE-80 THE NIGHTMARE NEIGHBOR NEXT DOOR; SHARED SHEATH HEMATOMAS AND MIMICS

Satinder P. Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Inayat Grewal (*Abstract Co-Author*) Nothing to Disclose
Scott A. Grumley, MD (*Abstract Co-Author*) Nothing to Disclose
Donald G. Benson JR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mostafa Abozeed, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Naga Sai Rasagna Mareddy, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mohamed Ibrahim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Shared sheath pulmonary artery hematoma is a rare and underreported complication of Stanford type A aortic dissection. • Identify imaging features of acute type A aortic dissection and possible mimics. • Understanding the embryological development and anatomical relationship between the aorta and pulmonary arteries.

### TABLE OF CONTENTS/OUTLINE

• Embryological Development and Anatomical Relationship: - Overview of embryological development leading to the formation of the heart tube and aorticopulmonary septum. - Discussion of the anatomical relationship between the aorta and pulmonary arteries, including the presence of shared structures like the common aortopulmonary adventitia. - Highlighting how understanding embryology and anatomy enhances comprehension of pathological processes like aortic dissection. • Clinical Implications and Historical Descriptions: - Overview of clinical implications associated with acute type A aortic dissection, including potential complications and prognostic factors. - Historical descriptions of aortic dissection and its complications, including the concept of acquired aortopulmonary fistula. • Imaging protocol and features: o Discuss the imaging protocol in suspected acute chest pain scenario o Discuss the imaging features of shared sheath hematoma and its potential mimics o Discuss variety of acute dissection imaging findings and its mimics

## CHEE-81 EFFECTS OF RADIATION THERAPY IN THORACIC ONCOLOGY REVISITED

Elena Garcia Garrigos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marina Sirera Matilla, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa Feliu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
David Ferrandez Ferrandez (*Abstract Co-Author*) Nothing to Disclose
Juan Arenas-Jimenez, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Both radiation and medical therapies for thoracic malignancies have evolved with combination and sequential strategies being an alternative to many tumors of the chest, mainly lung and breast cancer. Our goals are: To show how radiation therapy affects tumoral and non-tumoral tissues and how imaging can show those effects, with special emphasis on their chronology. To describe how radiation therapy has evolved from classic methods into more precise multiple beam stereotactic techniques thus expanding its indications and leading to more complex manifestations. To depict imaging findings related to radiation therapy, its associated complications and the effect of combining medical therapies such as immunotherapy with radiotherapy.

### TABLE OF CONTENTS/OUTLINE

1. Definition of radiation therapy types and their effects on tumoral and non-tumoral tissues 2. Differences between conventional radiotherapy and new techniques and indications. 3. Frequent effects of radiotherapy in the lungs, mediastinum, pleura and chest wall and their chronology. 4. Specific complications of radiotherapy and their differential diagnosis. 5. Radiological presentation of uncommon radiation therapy-related conditions: abscopal effect, delayed organizing pneumonia, radiation recall pneumonitis, radiation induced neoplasms. 6. Clues for diagnosing tumor recurrence in radiated lesions 7. Discussion of evidences about relationship of preexisting radiological interstitial lung abnormalities and immunotherapy with lung complications after radiation therapy. 8. Conclusions.

## CHEE-82 VASCULAR TUMORS IN THE THORAX: IMAGING CHARACTERISTICS, BIOPSY, AND MANAGEMENT OF ASSOCIATED COMPLICATIONS

**Awards**
**Certificate of Merit**

Abhishek Chaturvedi, MD (*Abstract Co-Author*) Nothing to Disclose
Swati P. Deshmane, MBBS (*Abstract Co-Author*) Nothing to Disclose
Andrew C. Clark, DO (*Abstract Co-Author*) Nothing to Disclose
Adam Dykie, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Vascular tumors of the thorax have complex imaging findings; however, there also may be difficulty distinguishing them from other benign or malignant lesions. Vascular lesions can be present in the major vessels, mediastinum, lung parenchyma, or soft tissues and osseous structures of the chest wall. Cross sectional imaging with CT/MR and PET is essential in workup, although additional studies and biopsy may be needed for diagnosis. Deciding whether to biopsy, which technique to use, and which lesion to biopsy depends on various factors. Complications of image-guided biopsy and management of these complications should be considered, particularly given the increased concern for bleeding.

**TABLE OF CONTENTS/OUTLINE**

This exhibit will provide background on vascular tumors including their subcategories and locations within the chest. Imaging characteristics of different vascular lesions on modalities such as CT, MRI, and PET will be reviewed, including techniques such as pre- and post-contrast imaging. Considerations for biopsy, such as malignant versus benign features, location, concern for bleeding, and treatment planning will then be discussed. Different methods for tissue sampling will be reviewed along with basic biopsy technique for vascular lesions. Biopsy may include ultrasound-guided, CT-guided, excisional, or intraluminal approaches. Complications of biopsy and their management will be discussed. Finally, conclusions will be drawn on the workup of vascular thoracic tumors through imaging characterization and biopsy.

## CHEE-83 HIDDEN IN FIBROSIS: APPROACH TO DIAGNOSIS AND PITFALLS OF LUNG CANCER IN PATIENTS WITH FIBROTIC INTERSTITIAL LUNG DISEASE

**Awards**
**Certificate of Merit**

Jaewon Jung (*Abstract Co-Author*) Nothing to Disclose
Brett M. Elicker, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Sohn, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Shravan Sridhar, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Tician Schnitzler, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Interstitial lung disease (ILD) patients are known to have elevated risk for lung cancer with odds ratio ranging from 3.5-7.3. Lung cancer in ILD is often difficult to detect due to significant background reticulation and potential superimposed acute exacerbation that may obscure malignancy. However, accurate detection of lung cancer has important implications for clinical management and potential lung transplant candidacy. The purpose of this exhibit is to review the epidemiology of lung cancer in ILD patients, present a case-based approach to diagnosing lung cancer in patients with ILD, and review pitfalls of imaging ILD patients who also have lung cancer including cases in which lung cancer was initially missed.

**TABLE OF CONTENTS/OUTLINE**

1. Title 2. Table of contents 3. Overview 4. Demographics and epidemiology 5. Pathogenesis 6. Histopathology of lung cancer in ILD vs normal lung 7. CT diagnosis a. Inconsistent with lung cancer i. Infection/inflammation 1. Acute exacerbation 2. Aspiration 3. Mycetoma ii. Manifestation of ILD 1. NSIP-OP 2. PPFE 3. PMF iii. Iatrogenic 1. Bronch bite hematoma b. Consistent with lung cancer i. Characteristic CT features nodules ii. Characteristic CT features lymphadenopathy/(asymmetric) iii. Time course iv. Evolution on CT 8. When suspicious finding identified 9. Tissue sampling 10. Utility of CT lung biopsy 11. CT lung biopsy complications 12. Confirming the diagnosis a. Confirmed i. Staging ii. Implication on transplant candidacy b. Non-malignant result i. Non-malignant vs non-diagnostic ii. Accept vs reject result iii. Utility of repeat CT lung biopsy 13. Case overview 14. Cases 15. Challenging cases and pitfalls 16. Summary 17. References

## CHEE-84 UNDERSTANDING CYSTIC LUNG LESIONS IN SMOKERS WITH INTERSTITIAL LUNG DISEASE: RADIOLOGIC-PATHOLOGIC CORRELATION

**Awards**
**Cum Laude**

Almudena I. Urena Vacas, MD (*Abstract Co-Author*) Nothing to Disclose
LETICIA GRACIA Saenz (*Abstract Co-Author*) Nothing to Disclose
Svetlana Shalygina (*Abstract Co-Author*) Nothing to Disclose
CRISTINA ALENDA Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Juan Arenas-Jimenez, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Due to destructive, fibrotic and remodeling mechanisms, we can find a varied constellation of aerated lung lesions in chest CT scans of smoker patients that pose a diagnostic challenge for both the radiologists and pathologists. Radiologic terminology used for cystic lung lesions is complex and sometimes confusing, and the same applies to their pathologic correlation, with different names for similar findings. In this setting, the goals of this exhibit are to make an approach to these lesions trying to allow the reader: 1. To differentiate among the pathologic findings that characterize each type of aerated lung lesion in smokers. 2. To define the clue radiological findings and the diagnostic meaning of each subtype of cystic lung lesions in smokers. 3. To avoid pitfalls when interpreting aerated lung lesions in CT of smoker patients.

**TABLE OF CONTENTS/OUTLINE**

1.Pathologic descriptions of airspaces enlargement and cystic lesions associated to fibrosis in the lungs of smokers: centrilobular and paraseptal emphysema, emphysema with fibrosis, smoking related interstitial fibrosis, airspace enlargement with fibrosis, smoking-related diffuse cystic lung disease and honeycombing. 2. Radiologic description of cystic lung lesions described in smokers and their meaning: emphysema, thin-walled cysts, thick-walled cysts, traction emphysema, cysts associated to desquamative interstitial pneumonia, smoking-related cysts and honeycombing cysts. 3. Pitfalls when interpreting cystic lesions. 4.Conclusions and quiz: how do I call this cyst?

## CHEE-85 CLEARING THE AIR: STATE OF THE ART IMAGING OF INTRALUMINAL AIRWAY OCCLUSIONS AND MUCUS PLUGGING

Prachi P. Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. del Carpio Bellido Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Njira L. Lugogo (*Abstract Co-Author*) Nothing to Disclose
Wassim Labaki, MD (*Abstract Co-Author*) Nothing to Disclose
Chiemezie Amadi, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Lee, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. There is a spectrum of etiologies and imaging appearance of filling defects in the airways. 2. Mucous plugs are a common finding on CT and although often dismissed, are associated with adverse outcomes in specific patient populations. 3. Understanding the importance of mucus plugging in muco-obstructive diseases and asthma is important for all radiologists. 4. Apart from mucus plugging, segmental and subsegmental intraluminal airway occlusions can be due to myriad conditions including infection, foreign bodies and neoplasms. 5. If high density is identified in airway occlusions specific entities including broncholiths and foreign bodies should be considered. 6. Opportunities and challenges relating to the evolving role of advanced imaging techniques in airways disease include air trapping quantification using parametric response mapping, airway wall thickness quantification and mucous plug quantification. These can provide prognostic information and may help quantify treatment response.

**TABLE OF CONTENTS/OUTLINE**

1. Spectrum of intraluminal airway occlusions including: Muco-obstructive diseases (COPD, cystic fibrosis, primary ciliary dyskinesia, and non-cystic fibrosis bronchiectasis), asthma, allergic bronchopulmonary aspergillosis, obstruction leading to distal mucus plugging (neoplasms, bronchial atresia) and other etiologies (Diffuse: endobronchial infection, blood, plastic bronchitis, aspiration; Focal: foreign body, broncholiths, tumors) 2. Prognostic significance and current evidence related to mucus plugging in muco-obstructive diseases and asthma. 3. New techniques for quantification of airway wall thickening, mucus impaction and air trapping

## CHEE-86 NON-TUBERCULOUS MYCOBACTERIA (NTM): RADIOLOGICAL INSIGHTS FOR A CHALLENGING DIAGNOSIS

Tan-Lucien H. Mohammed, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sandro B. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Pratik P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alysson Roncally Carvalho, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica Gemmell (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Amanda Acevedo (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Identify imaging characteristics of non-tuberculous mycobacteria (NTM) infections across different patient populations.2. Understand the importance of differential diagnosis in imaging to distinguish NTM from other pulmonary conditions, including tuberculosis.3. Recognize the role of radiologists in the multidisciplinary management of NTM, emphasizing early detection and monitoring treatment response.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to Non-tuberculous Mycobacteria a. Definition and Epidemiology b. Clinical Significance2. Imaging Features of NTM Infection a. Pulmonary NTM: Key Findings on Chest X-ray and CT b. Extra-pulmonary NTM: Diagnostic Challenges3. Differential Diagnosis a. Differentiating NTM from Tuberculosis and Other Lung Pathologies b. Role of Imaging in Guiding Biopsy and Further Testing4. Case Studies and Imaging Gallery a. Representative cases highlighting diagnostic features and pitfalls5. Conclusion a. Summary of Radiologist's Role in NTM Detection and Management6. PDF Upload Supplementary material includes detailed imaging studies, expanded case discussions, and a comprehensive review of NTM treatment protocols. This content aims to enhance understanding and provide a visual guide to assist radiologists in diagnosing and managing NTM infections effectively.

## CHEE-87 THORACIC FISTULAS - A MULTIFACETED CHALLENGE

Vinay V. Kandula, MBBS (*Abstract Co-Author*) Nothing to Disclose
Achala Donuru, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Early diagnosis and management of thoracic fistulas is critical for improving patient outcomes.
- Understanding the different causes (infection vs. malignancy) guides treatment decisions.
- Multimodality imaging, particularly MDCT, is essential for accurate diagnosis and fistula characterization.
- Management strategies involve addressing the underlying cause and potential fistula closure techniques.

**TABLE OF CONTENTS/OUTLINE**

Diagnosis: Clinical suspicion is paramount, considering symptoms like cough, dyspnea, chest pain, recurrent infections, and nutritional issues.Imaging: CT scan with intravenous contrast is the mainstay for detailed fistula characterization, demonstrating the fistula tract and adjacent structures.Bronchoscopy: Valuable for evaluating airway fistulas, allowing visualization of the internal opening and potential foreign body removal.Esophagram: Useful for identifying esophageal fistulas, demonstrating contrast extravasation from the esophagus.Angiography: May be necessary for definitive diagnosis of vascular fistulas, depicting abnormal blood flow patterns.Management: The approach depends on fistula type and severity. Conservative management with antibiotics and nutritional support might be attempted for small fistulas. Endoscopic closure using stents or glue may be suitable for specific fistulas. Surgical repair is often definitive therapy, particularly for complex or large fistulas.

## CHEE-88 WHAT YOU CAN LEARN FROM FALSE-NEGATIVE STUDIES IN AN ACADEMIC LUNG CANCER SCREENING PROGRAM

**Awards**
**Certificate of Merit**

Suzanne Byrne, MD (*Abstract Co-Author*) Nothing to Disclose
Ariadne DeSimone, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Kathryn Schulz, MD (*Abstract Co-Author*) Nothing to Disclose
Mark M. Hammer, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Arora, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The most common causes of errors in diagnostic radiology are underreading, satisfaction of search, faculty reasoning, and location.2. Missed lung cancers tend to be paramediastinal or perihilar in location, therefore a radiologist should be aware of these blind spots, incorporate these locations into their search pattern, and consider integration of computer-aided detection software and AI algorithms.3. Missed lung cancers tend to be endobronchial lesions, therefore a radiologist should ensure comprehensive evaluation of the tracheobronchial tree on every examination.

**TABLE OF CONTENTS/OUTLINE**

• Review types/causes of diagnostic errors in radiology• Review proposed methods to decrease errors in radiology• Highlight peer learning opportunity of monthly lung cancer screening (LCS) program conference and in learning from diagnostic errors • Define 'false-negative studies' within a LCS program• Review cases of missed lung cancers within a LCS program and discuss potential reasons for the 'false negative'• Review cases of interval lung cancers within a LCS program• Review cases of slow-growing ground-glass or part-solid or cystic nodules within a LCS program

## CHEE-89 NEW TERMINOLOGY IN ILD: PROGRESIVE PULMONARY FIBROSIS (PPF)

Santiago Martinez-Jimenez, MD (*Abstract Co-Author*) Support, Reed Elsevier
Aura Ramirez, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Leonardo Galindo Pedraza (*Abstract Co-Author*) Nothing to Disclose
Jorge Carrillo, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Alvarado, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The term progressive pulmonary fibrosis (PPF), refers to progression in fibrosing interstitial lung diseases (ILDs) other than idiopathic pulmonary fibrosis (IPF). PPF is not a disease, but rather a behavior that different subtypes of fibrosing ILDs may develop overtime. A significant proportion of ILDs show progression, being more common in fibrosing hypersensitivity pneumonitis follow by ILDs associated with systemic autoimmune diseases and sarcoidosis. In patients with a pre-existing ILD, PPF is defined as prove of progression within the previous 12 months, with at least two of the following three criteria: worsening respiratory symptoms, physiological and radiological evidence of disease progression. Radiological findings of disease progression include: Increased extent or severity of traction bronchiectasis and bronchiolectasis, new ground-glass opacity with traction bronchiectasis, new fine reticulation, increased extent or coarseness of reticular abnormality, new or increased honeycombing and increased lobar volume loss. Progression of fibrosis is typically assessed visually. Semiquantitative assessment of the percentage of lung volume containing fibrotic feature may be a predictor of mortality.The assessment of ILDs needs a multidisciplinary approach including clinical, functional, imaging, and histopathological data to integrate a clinical probability for an accurate diagnosis and to assess the likelihood of progression.

**TABLE OF CONTENTS/OUTLINE**

Introduction; Epidemiology; Physiopathology of pulmonary fibrosis; Definition criteria of PPF; Imaging approach to PPF; Differential diagnosis; Clinical Considerations: Treatment, Prognosis, and the role of imaging.

## CHEE-9 NOVEL APPROACH FOR COMPREHENSIVE PERIOPERATIVE ASSESSMENT OF RESPIRATORY MALIGNANCY VIA ULTRA-LOW-DOSE LUNG CT UTILIZING AG FILTER AND DEEP LEARNING RECONSTRUCTION

Hirofumi Uehara, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Ichinohe (*Abstract Co-Author*) Nothing to Disclose
Koichi Osuda, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

In the current local treatment of respiratory malignancies, there are cases in which multiple CT examinations are required to prevent complications caused by intervention procedures.It includes (1)coil marking + Video-Assisted Thoracoscopic Surgery (VATS) partial resection for small lung cancer and (2)lung Radiofrequency Ablation.Ultra-low-dose lung CT examination combined with Ag filter and Deep Learning image Reconstruction (DLR) significantly reduce radiation dose, and reliably provides image quality sufficient for preoperative and postoperative assessment.We summarize the potential benefits of incorporating ultra-low-dose CT imaging into clinical practice in the management of respiratory malignancies.

**TABLE OF CONTENTS/OUTLINE**

High-definition thin-section CT is performed for initial diagnostic assessment, judging surgical indication, and the detailed scan data allowed to simulate bronchoscopic coil-marking technique.Ultra-low-dose CT using Ag filter have been taken for confirm the marking-site immediately before surgery.In addition, it is used to assess the complications such as pneumothorax and hemothorax after surgery and for early pneumonia.We emphasize the importance of reducing radiation exposure while maintaining both diagnostic accuracy and intervention technique safety, and propose comprehensive approach for supporting respiratory malignancy treatment using appropriate scan protocol.

## CHEE-90 STAY CURRENT WITH LUNG-RADS® V2022: A QUESTION-BASED REVIEW

Hamilton Shoji, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela Rosa, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Docema, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Figueiredo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Aquino (*Abstract Co-Author*) Nothing to Disclose
Maria Carolina Bueno da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo C. Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Macedo, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Lung cancer, characterized by high morbidity and mortality rates, ranks among the most prevalent cancers, with smoking as its primary risk factor. The U.S. Preventive Services Task Force advises annual low-dose computed tomography (LDCT) screening for individuals aged 50 to 80 years with a 20-pack-year smoking history or who quit within the last 15 years. To standardize terminology and management guidelines, the American College of Radiology developed the Lung CT Screening Reporting and Data System (Lung-RADS®), recently updated in 2022. Early diagnosis is imperative for facilitating curative treatment and improving patient survival. Lung cancer screening with low-dose CT has demonstrated a 20% reduction in mortality compared to unscreened patients. Given the ongoing scientific advancements, radiologists must stay abreast of updates to identify suspicious lesions and determine appropriate management.

**TABLE OF CONTENTS/OUTLINE**

Interactive Case-Based Learning Image characteristics according to Lung-RADS® v.2022 will be demonstrated, accompanied by respective recommendations, through an interactive question and answer format (quiz):-Atypical Pulmonary Cysts-Juxtapleural Nodules-Airway Nodules-Infectious or Inflammatory FindingsGeneral Summary: A comprehensive overview of LungRADS v2022 categories and concepts based on cases and illustrations

## CHEE-91 USING IMAGING BIOMARKERS FOR COMPREHENSIVE LUNG PATHOLOGY DIAGNOSIS

Vinay V. Kandula, MBBS (*Abstract Co-Author*) Nothing to Disclose
Achala Donuru, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Differentiating between benign, infectious, and malignant lung pathologies remains a diagnostic challenge. This presentation explores the power of imaging biomarkers identified on CT, PET, MRI, and PET/MRI in guiding radiologists towards a confident diagnosis.By leveraging the expanding repertoire of imaging biomarkers, radiologists can enhance diagnostic accuracy across a spectrum of lung pathologies, ultimately leading to optimal patient management.

**TABLE OF CONTENTS/OUTLINE**

CT Biomarkers for Pinpointing Pathology• Malignancy: Size and spiculation, attenuation, calcification• Infection: Consolidation, cavitation• Benign Conditions: Honeycombing, cyst characteristicsPET Scan Biomarkers for Metabolic ActivityMalignancy: Increased FDG uptake on PET/CT signifies hypermetabolic activity, a hallmark of lung cancer. Some infections and inflammatory processes can also show FDG avidity, requiring correlation with CT findings.MRI Biomarkers for Soft Tissue CharacterizationMalignancy: While not a first-line modality, MRI can offer valuable insights by differentiating between tumors and benign lesions based on signal intensity on T1 and T2 weighted images. Restricted diffusion on diffusion-weighted MRI can suggest malignancy.PET/MRI Scan BiomarkersParticularly beneficial for patients with contraindications to CT scans due to radiation concerns or kidney issues with contrast agents.Emerging Biomarkers and Advanced Techniques• Dotatate PET scans: Can be helpful in diagnosing lung carcinoid tumors.• Hyperpolarized gas MRI offers unique insights into gas exchange, alveolar integrity, and ventilation defects.• Dual tracer PET • Beyond FDG: Choline analogs, amino acid tracers

## CHEE-92 THE SNIFF TEST: HOW WE DO IT

Rachna Madan, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mark M. Hammer, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review of prior anatomic imaging is helpful to focus the sniff exam and interpret the results.2. Adequate deep, rapid sniff maneuver is key to providing definitive diagnosis of paralysis.3. If paralysis is not present, review of anatomic imaging can provide the diagnosis for mimics.

**TABLE OF CONTENTS/OUTLINE**

1. Review the differential diagnosis for an elevated hemidiaphragm2. Review causes of diaphragm paralysis.3. Review sniff test: patient positioning, fluoroscopy technique, and the sniff maneuver.4. Interpreting the sniff test results, i.e. paradoxical motion.5. Mimics: eventration, hernia, lung volume loss.

## CHEE-93 AUTOMATIC PULMONARY ARTERIOVENOUS SEPARATION IN NON-CONTRAST CT BY USING STATE-OF-THE-ART IMAGE PROCESSING TECHNOLOGY

Shuuji Ishikawa (*Abstract Co-Author*) Nothing to Disclose
Masayuki Kamoshita (*Abstract Co-Author*) Nothing to Disclose
Hideki Yashiro, MD (*Abstract Co-Author*) Nothing to Disclose
KITARO IRWAN BIN MOHD AZLAN (*Abstract Co-Author*) Nothing to Disclose
Akihiro Saitou (*Abstract Co-Author*) Nothing to Disclose
Wataru Fujishiro, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

•Importance of understanding pulmonary arteriovenous anatomy before pulmonary segmentectomy •Visualization of pulmonary arteries (PA) and pulmonary veins (PV) by 3D-CT images •Benefits of non-contrast CT for the separation of PA and PV •Accuracy of automatic pulmonary arteriovenous separation by non-contrast CT and contrast CT •Optimal reconstruction parameters for automatic separation by non-contrast CT

**TABLE OF CONTENTS/OUTLINE**

1. Pulmonary arteriovenous anatomy and critical anatomical variants 2. Explanation of the conventional methods and the novel method for 3D-CT images of pulmonary arteriovenous separation 3. Benefits: a) Does not require contrast media b) Eliminate artifacts c) Reduce radiation dose 4. Comparison of non-contrast and contrast 3D-CT images of pulmonary arteriovenous Outline: 3D-CT images of the pulmonary arteriovenous helps perform safe navigation during video-assisted thoracic surgery (VATS), which anatomically involves variety of blood vessels. Conventionally, 3D-CT images are reconstructed from contrast-enhanced CT data using a workstation semi-automatically. However, some patients are allergic to contrast media, have impaired renal function, or are receiving biguanides, and extreme caution must be exercised when performing contrast CT in these patients. We present a method to reconstruct 3D images of PA and PV automatically separated from non-contrast CT data by using state-of-the-art image processing technology. This method allows 3D-CT images of the pulmonary arteriovenous to be reconstructed without contrast, with low radiation, and high accuracy. 3D images of the pulmonary arteriovenous with non-contrast CT useful in VATS just as contrast-enhanced CT.

## CHEE-94 THORACIC MRI FOR THE CHARACTERIZATION OF MEDIASTINAL ANTERIOR MASSES

Caroline Caramella (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Mediastinal anterior masses (MAM) represent an uncommon finding on CT. Whether there are clinical symptoms suggesting myasthenia or not, it is of the utmost importance to differentiate thymic hyperplasia from thymic epithelial tumours (thymoma or thymic carcinoma) and to rull out other diagnosis such as benign thymic cysts or other types of tumours (germinal-cell tumors, lymphoma, paraganglioma, ?). It will completely change the treatment strategy (surgery vs chemotherapy or withholding). In addition to FDG-PET-CT, MRI enables better identification of the tissue composition (cystic, presence of fat, ..). It also is useful in the surgical planning of mediastinal tumours by giving precious information on the cardio-vascular structures that can be involved in the mass, and on the possible presence of metastasis, especially in the pleura. Thoracic MRI is however rarely used in this context, due to

misconception of its poor performances in lung imaging. We will present a simple MR protocol that enables MAM characterization and work-up, and give tips for dealing with a fortuitously discovered (or not) MMA.

**TABLE OF CONTENTS/OUTLINE**

Table of content: - Thoracic MRI protocol - Different anterior mediastinal tumour types Reasoning algorithm

## CHEE-95 COMPLICATIONS UNRAVELED: A RADIOLOGIST'S GUIDE TO POST-LUNG TRANSPLANT IMAGING

Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Fernandez Lobo (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Maria J. Galante I, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Lung transplantation is a very complex life-saving treatment for patients with end-stage lung disease. The radiologist represents an important part of the process, from the presurgical imaging to postoperative control. Postsurgical imaging can be challenging since a wide spectrum of postoperative complications can appear. This work shows a comprehensive overview of post-transplant imaging from presurgical imaging to complications through a radiological perspective, hoping to serve as a guide for radiologists and clinicians involved in this complex procedure. With a systematic review of common and more rare post-transplant complications including rejection, haemorrage, airway complications, etc. , this educational poster highlights the highly important role of radiological imaging in early detection, and accurate diagnosis that may lead to a prompt intervention if needed.The main objectives are: - To review the main types of pulmonary transplants and surgical techniques. - To discuss pretransplant imaging- To suggests imaging protocols for the assesmento of complications- By knowing the main surgical techniques, predict the normal postsurgical changes. - To describe the main immediate, early, intermediate and late complications of this surgery- To provide images that can illustrate these complications

**TABLE OF CONTENTS/OUTLINE**

1) Indications of lung transplant2) Contraindications3) Types of pulmonary transplants4) Surgical techniques5) Imaging pre-surgical assesment6) Immediate Complications7) Intermediate Complications8) Late Complications

## CHEE-96 RADIOLOGICAL PERSPECTIVES OF LUNG DISEASE IN IDIOPATHIC INFLAMMATORY MYOPATHIES

Carlos Arteaga (*Abstract Co-Author*) Nothing to Disclose
Javier Leonardo Galindo Pedraza (*Abstract Co-Author*) Nothing to Disclose
Jorge Carrillo, MD (*Abstract Co-Author*) Nothing to Disclose
Jenny Londono (*Abstract Co-Author*) Nothing to Disclose
Santiago Martinez-Jimenez, MD (*Abstract Co-Author*) Support, Reed Elsevier
Ana M. Alvarado, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Idiopathic inflammatory myopathies (IIM) include a heterogeneous group of systemic autoimmune diseases characterized by varying degree of skeletal muscle inflammation and extramuscular manifestations. The main subtypes of IIM are dermatomyositis, polymyositis, clinically amyopathic dermatomyositis, antisynthetase syndrome, overlap syndrome, inclusion body myositis, and immune mediated necrotizing myopathy. Pulmonary involvement in the form of interstitial lung disease (ILD) is the most common extramuscular manifestation of IIM, contributing to an estimated 50% excess mortality. In up to 20% of cases, ILD precedes muscular symptoms, challenging early IIM diagnosis due to its unpredictable onset.The diversity within IIM clinical phenotypes is due to various autoantibodies, which include: myositis-specific autoantibodies (MSAs) and myositis-associated autoantibodies (MAAs). Some MSAs are associated with increased risk of ILD, such as Anti-synthetase autoantibodies, particularly Anti-Jo1 (up to 90%). Non-specific interstitial pneumonia is the most common HRCT finding in this grup. Myositis-associated rapidly progressive ILD is related with anti-MDA-5, which comes with increased mortality (up to 50%). Organizing pneumonia is the main HRCT pattern. Anti-Pl-7 and anti-Pl-12 are associated with higher incidence of ILD in the absence of clinical myositis.Other pulmonary manifestations of MII include: opportunistic infections, pulmonary hypertension, aspiration pneumonia, neoplasia and drug-induced pneumonitis.

**TABLE OF CONTENTS/OUTLINE**

Definition; Classification; Clinical presentation; HRCT patterns; Other pulmonary manifestations of MII.

## CHEE-97 LUNGS EXPOSED: A RADIOLOGICAL APPROACH TO OCCUPATIONAL LUNG DISEASES

Marie Bambrick, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Micheal McInnis, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Bayer AG
Jimin Lee (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Occupational lung diseases often manifest over decades, challenging clinicians to identify the disease.- Progressive massive fibrosis has become increasingly common in recent years due to the popularity of artificial stones.- Chrysotile asbestos was still used and imported into the United States until the Environmental Protection Agency banned the material in March 2024.- Inhaled hard metal dust can result in giant cell interstitial lung disease or desquamative interstitial pneumonia.- Occupational lung diseases have characteristic appearances on high-resolution computed tomography and chest radiographs.- Mesothelioma most commonly arises from the pleura and presents with nodular pleural thickening.

**TABLE OF CONTENTS/OUTLINE**

- Overview of various occupational lung diseases (pneumoconioses, occupational asthma, hypersensitivity pneumonitis) and their clinical presentations- Review of causative agents and environments for occupational lung diseases in the modern era- Overview of clinical and radiologic approach to diagnosing occupational lung diseases- Review of hallmark imaging abnormalities on computed tomography and radiographs through sample patient cases

## CHEE-98 THE MYRIAD FACES OF NON THROMBOTIC PULMONARY EMBOLISM

Rachna Madan, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mark M. Hammer, MD (*Abstract Co-Author*) Nothing to Disclose
Anupama Ramachandran, MD (*Presenter*) Siemens AG

**TEACHING POINTS**

To review the spectrum of imaging manifestations of non-thrombotic pulmonary artery embolism (NTPE).

**TABLE OF CONTENTS/OUTLINE**

•NTPE represents embolization of nonthrombotic material, such as tumoral cells (or other cells types), organisms, gas or foreign material, into the pulmonary circulation.•In addition to causing occlusion of pulmonary micro- or macro-circulation, NTPE are often accompanied by endothelial and/or parenchymal injury, with an inflammatory reaction both in the systemic and pulmonary circulation.•Hence on imaging, NTPE maybe associated with a constellation of vascular and parenchymal imaging findings depending on the underlying etiology.•The etiologies can be grouped in 4 categories as follows:o Neoplastic entities: Pulmonary artery sarcoma, pulmonary tumor embolism, intravascular leiomyomatosis.o Inflammatory entities: Pulmonary arterial IgG4-related disease, Takayasu arteritis, Behcet diseaseo Iatrogenic entities: Pulmonary embolization of intravascular device (central venous catheter fragment, fractured pacemaker lead), coils from thoracic duct, cement embolization, air embolism, FDG hot clot artifact.o Miscellaneous entities: Septic embolism, fat embolism.•In this educational exhibit, we discuss the etiology and the spectrum of imaging findings of NTPE.

## CHEE-99 EXPLORING THE FRONTIER OF THORACIC RADIOLOGY: THE POWER OF RADIOMICS UNVEILED

Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Leonardo C. Machado, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:• To present the main concepts, processes, and applications of radiomics.• To provide a step-by-step illustrative model of the radiomic processes developed by our service.• To highlight the main challenges and perspectives of implementing radiomics in routine clinical decision-making processes.

**TABLE OF CONTENTS/OUTLINE**

• Background.• Illustrative model of radiomics utilization in assessing subsolid pulmonary nodules to predict the degree of invasion of lung adenocarcinomas.• Radiomics' contribution to the detection, diagnosis, therapeutic response, monitoring, and prognosis of the patient.• Challenges and Perspectives.• Conclusion.

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# Abstract Archives of the RSNA, 2024

CHEE-10

## IS BLOOD THICKER THAN TISSUE? A RADIOLOGIST'S GUIDE TO LIQUID BIOPSY IN LUNG CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Chiemezie Amadi, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed M. Sayyouh, MSc (*Abstract Co-Author*) Nothing to Disclose
Shotaro Naganawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Prachi P. Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Jerald Garvin S. Lim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Introduce liquid biopsy, and its methods, as a non-invasive method for analyzing circulating analytes • Explain the current applications of liquid biopsy in guiding monitoring and treatment decisions in non-small cell lung cancer • Address challenges of liquid biopsy and its implementation in routine clinical practice • Enumerate some of the potential and future applications of liquid biopsy • Emphasize the multidisciplinary collaboration between oncologists, radiologists, and pathologists to leverage both liquid biopsy and imaging data effectively, ultimately improving patient outcomes and personalized treatment strategies.

### TABLE OF CONTENTS/OUTLINE

1. What is liquid biopsy and how is it done? 2. Common biomarkers and techniques utilized in liquid biopsy 3. Current application of liquid biopsy in non-small cell lung cancer 3.1. Tumor genotyping (e.g., KRAS, EGFR, other changes in molecular profile) 4. Advantages and disadvantages of liquid biopsy vs. percutaneous tissue biopsy. Can liquid biopsy replace tissue biopsy? 5. Current status of liquid biopsies and potential impact on radiology 6. Potential future applications of liquid biopsy 6.1. Enhance screening and early detection efforts in high-risk populations, as well as disease interception 6.2. Monitoring while on immunotherapy and targeted therapy 6.3. Identifying post-surgical patients that would benefit most from adjuvant therapy(ies) 6.4. Determining optimal duration of consolidation and adjuvant therapies 6.5. Early detection of disease progression prior to radiographic manifestation

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# Abstract Archives of the RSNA, 2024

CHEE-100

## POST-RADIOTHERAPY LUNG CHANGES, THE MAJOR MIMICKERS: NORMAL PATTERNS AND COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Camilo A. Caicedo Montano, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Alejandra Amaya, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Aluja, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Omar Andres Pantoja Burbano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

o It is necessary to clearly understand the approach to post-radiotherapy lung in diagnostic images, focusing on four fundamental aspects: previous studies, irradiated area, technique used, and elapsed time between treatment and the evaluated study.o The irradiated areas can acquire a wide variety of patterns on CT, especially in patients undergoing high-precision radiotherapy. Therefore, it is necessary to be familiar with them, as they often present findings similar to other pathologies.o The radiologist must recognize the key points to differentiate between radiotherapy patterns, infectious pathologies, or recurrenceo Post-radiotherapy complications must be promptly recognized and differentiated from usual changes.

### TABLE OF CONTENTS/OUTLINE

o Introduction.o Pathway for addressing expected findings in the post-radiotherapy lung.o Types of radiotherapy.o Acute and chronic post-radiotherapy changes in the lung.o Main patterns that can be visualized in the irradiated areas and their differential diagnoses.o Main complications.

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# Abstract Archives of the RSNA, 2024

CHEE-101

## INNOCENT-LIKE MIMICKERS: THE MEETING OF X-RAY WITH CINEMATIC AND 3D RENDERING TO REACH THE TRUTH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Omer Onder, MD (*Abstract Co-Author*) Nothing to Disclose
Zehavit Kirshenboim (*Abstract Co-Author*) Nothing to Disclose
Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Julian Fazi, MD (*Abstract Co-Author*) Nothing to Disclose
Emrah Duman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Differentiate radiologist workflows and their impact on diagnostic accuracy in thoracic imaging.-An assessment of how findings that are difficult to detect or appear innocent on X-ray, a projection method, actually correspond to pathologies and how they are represented in high-quality 3D and cinematic rendering.-Detail the subtle presentations of thoracic pathologies and their propensity to mimic adjacent anatomical structures.-Highlight the need for careful scrutiny in regions commonly harboring lung masses and vascular anomalies.-Discuss the diagnostic challenges posed by the complex interplay of pneumothorax, effusion, and other thoracic conditions.-Address the pitfalls of anatomical superimposition in image interpretation.

### TABLE OF CONTENTS/OUTLINE

•Trachea:-Identification of tracheal pathologies, often obscured or resembling adjacent structures.-Strategies for recognizing subtle tracheal anomalies in a busy clinical setting.•Lung:-The challenge of diagnosing lung pathologies that mimic the surrounding anatomy.•Cardiophrenic Region:-The cardiophrenic region as a potential site for pathology, complicated by its proximity to the heart and diaphragm.•Hilum:-The importance of meticulous examination to uncover hilar pathologies.•Pleura:-Pneumothorax and effusion as diagnostic challenges, with a focus on their masquerading aspects.-Techniques and pearls to differentiate these conditions from other pleural diseases.•Bones and Soft Tissues:-Superimpositions in thoracic imaging and their impact on the interpretation of bone and soft tissue anomalies.-Correcting misinterpretations of normal anatomical variants and pathological conditions.

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# Abstract Archives of the RSNA, 2024

CHEE-102

## PULMONARY FUNGAL DISEASE: A GUIDE FOR RESIDENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Amanda Acevedo (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jessica Gemmell (*Abstract Co-Author*) Nothing to Disclose
Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pratik P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Alysson Roncally Carvalho, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Tan-Lucien H. Mohammed, MD (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana Barreto Caldas De Lima (*Abstract Co-Author*) Nothing to Disclose
Ian Griffin (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Delineate the radiologic signatures of common pulmonary fungal diseases, including aspergillosis, histoplasmosis, and cryptococcosis. ; Highlight the significance of immune status on the radiologic appearance of fungal infections. ; Discuss the importance of recognizing endemic regions in the imaging interpretation of fungal diseases.

### TABLE OF CONTENTS/OUTLINE

● Introduction to Pulmonary Fungal Infections ○ Prevalence and Public Health Impact ○ Risk Factors and Patient Populations ● Imaging Hallmarks of Fungal Diseases ○ Aspergillosis: Nodules, Air Crescent Sign ○ Histoplasmosis: Calcifications, Lymphadenopathy ○ Cryptococcosis: Mass-like Lesions, "Soap Bubble" Lytic Bone Lesions ● Diagnostic Challenges ○ Overlap with Malignant and Non-infectious Pathologies ○ Case-based Approach to Differential Diagnosis ● Clinical and Imaging Correlation ○ Impact of HIV, Transplantation, and Immunosuppression on Disease Presentation ○ Imaging Protocols Tailored to Suspected Fungal Etiology ● Conclusion ○ Summary of Radiologic Criteria for Diagnosis ○ Role in Guiding Interventional Procedures

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# Abstract Archives of the RSNA, 2024

CHEE-103

## PURSUING THE UNUSUAL : IMAGING AND INTERVENTION STRATEGIES IN ATYPICAL SYSTEMIC VASCULAR SOURCES OF HAEMOPTYSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amal Antony, MD (*Abstract Co-Author*) Nothing to Disclose
Vimal C. Mondy, MBBS,MD (*Abstract Co-Author*) Nothing to Disclose
Sai K. Deepalam JR, MD (*Abstract Co-Author*) Nothing to Disclose
Navya Paulson Mangali (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Imaging and endovascular interventions are pivotal in managing haemoptysis, a potentially life-threatening emergency. 2. Multidetector CT angiography (MDCTA) is the preferred imaging modality, allowing for a comprehensive evaluation of lung parenchyma, thoracic vasculature, and soft tissues. It enables precise identification of the source of hemoptysis, thereby aiding in the planning subsequent interventions. 3. In the majority of cases, hypertrophied bronchial arteries are responsible for haemoptysis, while atypical sources account for about five percent. Identifying these uncommon systemic vascular sources is crucial before planning intervention. 4. The role of endovascular intervention in the management of haemoptysis is increasing, offering a less invasive and effective alternative. The choice of endovascular treatment is tailored to the cause of haemoptysis. 5. Radiologists plays a central role in the multidisciplinary team, and should possess knowledge of the sources and mechanisms of haemoptysis, its imaging characteristics, and the available endovascular treatments.

### TABLE OF CONTENTS/OUTLINE

1. Common source of haemoptysis: Orthoptic Bronchial Arteries 2. Uncommon systemic vascular sources of haemoptysis: 2.1 Ectopic Bronchial Arteries 2.2 Non-bronchial systemic collaterals 2.3 Atypical configurations of systemic arteries 2.4 Aneurysm/pseudoaneurysm of systemic arteries 2.5 Systemic supply in sequestration 2.6 Aortopulmonary Collateral Arteries 3. Role of Imaging: MDCTA 4. Endovascular treatment options

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# Abstract Archives of the RSNA, 2024

CHEE-104

## CHEST MRI: ANOTHER ALLY TO UNTANGLE ILD DIAGNOSIS AND FOLLOW-UP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sandro B. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Hiren Mehta, MD (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alysson Roncally Carvalho, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ronak Kundalia (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Computed tomography (CT) is considered the gold standard imaging modality for interstitial lung disease (ILD); however, it is associated with a concerning amount of ionizing radiation exposure in patients with CT who require serial scans throughout their disease course. Magnetic resonance imaging (MRI) is emerging as a viable diagnostic modality for ILD that can accurately diagnose early stages of disease and trace its progression.

### TABLE OF CONTENTS/OUTLINE

1. Main findings in MRI - honeycombing and traction bronchiectasis2. T2 CT MR Correlation3. T1 Times4. DELAYED enhancement5. Elastography

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# Abstract Archives of the RSNA, 2024

CHEE-105

## BEVACIZUMAB AND THORACIC RADIOTHERAPY: A DANGEROUS COMBINATION FOR RESPIRATORY TRACT FISTULAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bruno L. Moreira, MD (*Abstract Co-Author*) Nothing to Disclose
Augusto K. Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo d. Peixoto, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Rydz P. Santana, MD (*Abstract Co-Author*) Speaker, AstraZeneca PLC;Speaker, Boehringer Ingelheim GmbH
Camila P. Reifegerste, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Bevacizumab is a monoclonal antibody against the vascular endothelial growth factor (VEGF), which prevents the development of new blood vessels necessary for tumor growth. It has been used in the treatment of various neoplasms. In addition to its known adverse effects such as hypertension, proteinuria, thromboembolic and hemorrhagic events, recent reports highlight a rare but highly fatal complication: airway fistula. Reported types include tracheoesophageal, tracheomediastinal and bronchopleural fistulas. The mechanism behind these fistulas is not fully understood, but Bevacizumab's interference with angiogenesis may delay wound healing, predisposing the airways to fistula formation. Thus, any lesion in the airways could predispose to the formation of a fistula, and the main risk factor indicated in the literature for these lesions is a history of thoracic radiotherapy. This presentation will illustrate cases of airway fistula related to the combination of Bevacizumab and a history of thoracic radiotherapy, alerting radiologists to the possibility of this diagnosis. Despite its rarity, the high mortality rate associated with airway fistulas underscores the critical need for awareness, enabling early diagnosis and effective treatment.

### TABLE OF CONTENTS/OUTLINE

Introduction to Bevacizumab and brief review of its mechanism of action/pharmacology; cases of airway fistula related to Bevacizumab + thoracic radiotherapy; discussion; conclusion.

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# Abstract Archives of the RSNA, 2024

CHEE-106

## VERTICAL VENOUS STRUCTURES OF THE LEFT VERTEX

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatiana Arroyave, MEd (*Abstract Co-Author*) Nothing to Disclose
Manuela Restrepo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The right vertex of the mediastinum includes the most important vascular and lymphatic structures of the body. In unusual circumstances, these structures have developmental malformations that are incidentally recognized on imaging as vertical venous structures of the left vertex. It is essential to recognize because of its clinical and surgical importance.2. Persistent left superior vena cava (SVC) is the most common congenital anomaly seen in the thorax. In this case, the right SVC might be normal, small or absent. When the right SVC is also present, it is considered a duplicated vena cava. In unusual cases the brachiocephalic vein passes posterior or surrounding to the aorta. An atypical case of circumaortic SVC is presented.3. The anomalous supracardiac venous drainage is a congenital anomaly in which the pulmonary veins converge in one single vertical vein on the left vertex of the thorax, that drains to the systemic circulation, either to the SVC, brachiocephalic vein or the right atrium. 4. The anomalies of the thoracic duct are rare, and it is important to recognize the normal anatomy to identify when possible anomalies exist, including complete left sided course, cystic dilatation, duplications, plexiform variation and absence of the cisterna chyli.

### TABLE OF CONTENTS/OUTLINE

Learning objectives. Normal anatomy. Duplicated and single left SVC. Circumaortic SVC. Abnormal supracardiac venous drainage. Thoracic duct reflux. Retroaortic innominate vein. Summary

# Abstract Archives of the RSNA, 2024

CHEE-107

## BRIDGE OR DESTINATION: AN UPDATE ON VENTRICULAR ASSIST DEVICES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Linda B. Haramati, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Anna S. Bader, MD (*Abstract Co-Author*) Nothing to Disclose
Manroop Kaur, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Temporary ventricular assist devices (VAD) can be used in the acute setting supporting both the left and right ventricle.Long-term VADs are indicated for patients in the Class IV HF category, though cardiac transplant is the definitive treatment, assist devices can be used as a bridge to transplant, or destination therapy in those who do not qualify.Retrospective ECG gating through the entire cardiac cycle is recommended for optimal imaging of ventricular assist devices.Complications of VADs include malposition, hemopericardium, mediastinal hematoma, soft tissue hematoma, driveline infection/abscess, outflow graft thrombus, aortic stenosis, Heyde syndrome, bio-debris resulting in graft stenosis/occlusion.The purpose of this exhibit is to provide a review of the mechanics and appearances of traditional and newer ventricular support devices and illustrate common and uncommon complications through a multi-modality case-based review.

### TABLE OF CONTENTS/OUTLINE

1. Cardiac anatomy and pathophysiology of heart failure. 2. Heart failure classification and indication for ventricular assist devices.3. CT protocols for appropriate evaluation of ventricular assist devices. 4. Appropriate placement of ventricular assist devices through a multi-modality case review with pitfalls in malpositioned devices.5. Case-based imaging review of acute and chronic complications from ventricular assist devices including acute renal failure, ischemic colitis, hematomas, driveline infection, LV/RV thrombus, aortic stenosis, outflow graft stenosis (thrombus and bio-debris), and twisting of the outflow graft. 6. Identification of thrombus versus bio-debris deposition in the outflow graft.

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# Abstract Archives of the RSNA, 2024

CHEE-108

## BETWEEN THE WALLS: INTRATHORACIC PSEUDOANEURYSM PATHOGENESIS AND IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Saurabh Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Terrance T. Healey, MD (*Abstract Co-Author*) Nothing to Disclose
Brandon H. Koo, MD,BS (*Abstract Co-Author*) Nothing to Disclose
Samika S. Kanekar (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Provide a review of thoracic pseudoaneurysms and how to differentiate between other vascular pathologies.Discuss current imaging techniques used in diagnosis of pseudoaneurysm.Review common and rare pathologies of pseudoaneurysms using case-based examples, focusing on clinical disease courses, imaging features, treatment, prognosis, and complications.

### TABLE OF CONTENTS/OUTLINE

1. Review of the Arterial Wall2. Pseudoaneurysm vs. True Aneurysm3. Imaging Techniques and Findings4. Case Based Review of Pseudoaneurysm Pathologies5. Treatment and Prognosis6. Complications of Thoracic PseudoaneurysmsOutlinePseudoaneurysms have a higher risk of rupture than true aneurysms due to greater instability. Identification of pseudoaneurysms are key to determining management and decreasing adverse events. We review a wide variety of etiologies of thoracic pseudoaneurysm, including inflammatory, iatrogenic, infectious, and traumatic causes.

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# Abstract Archives of the RSNA, 2024

CHEE-109

## PULMONARY NODULES IN MAGNETIC RESONANCE: WHERE WE CAN HELP?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Alysson Roncally Carvalho, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Tan-Lucien H. Mohammed, MD (*Abstract Co-Author*) Nothing to Disclose
Pratik P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sandro B. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana Barreto Caldas De Lima (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Kenneth Davis (*Abstract Co-Author*) Nothing to Disclose
Kayla Davis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Examine the indications for MRI in the evaluation of pulmonary nodules. Discuss the MRI characteristics of benign versus malignant pulmonary nodules. Understand the emerging role of MRI in lung cancer screening and surveillance.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to pulmonary nodules: A. Prevalence and clinical significance. B. Current imaging modalities and limitations. 2. MRI and pulmonary nodule assessment: A. Technological advances in thoracic MRI. B. MRI protocol for nodule characterization. 3. Comparative analysis: A. MRI Versus CT: Sensitivity, Specificity, and Safety. B. Case examples illustrating diagnostic dilemmas resolved by MRI. 4. Conclusion: A. The future of MRI thoracic oncology. B. Recommendations for practice and research.

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# Abstract Archives of the RSNA, 2024

CHEE-11

## MULTIPLE LUNG CANCER: COMPREHENSIVE REVIEW AND REVIEW OF CURRENT MANAGEMENT STRATEGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hyun-ju Lee, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand current staging system of multiple lung cancer 2. To review the results of CT based analysis for the differentiation between multiple primary cancers and intrapulmonary metastasis 3. To review prognostic CT findings in multiple lung cancer 4. To review the results of genetic analysis 5. To introduce current concepts of oligo-metastasis of lung cancers 6. To review current management strategies

### TABLE OF CONTENTS/OUTLINE

1. Histologic features and current staging system of multiple lung cancer 2. CT analysis 2A. Differentiation between multiple primary cancers and intrapulmonary metastasis 2B. Prognostic CT findings in multiple lung cancer 3. Genetic analysis 3A. Results of chromosomal rearrangement studies 3B. Results of targeted sequencing analysis 3C. Results of oncogenic driver mutation studies 4. Current concepts of oligo-metastasis of lung cancers 5. Current management strategies 6. Future direction of research

# Abstract Archives of the RSNA, 2024

CHEE-110

## DEMYSTIFYING TRAPPED LUNG:NOMENCLATURE, EMERGING CONCEPTS, IMAGING FINDINGS AND DIFFERENTIAL DIAGNOSIS THAT RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Rajeev Suri, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Ameya J. Baxi, MBBS,DMRD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review nomenclature, etiopathogenesis and clinical features of trapped lungTo review radiographic and computed tomography imaging features of trapped lungTo review emerging concepts/recent literature update

### TABLE OF CONTENTS/OUTLINE

The term 'trapped lung' is used when the lung in unable to expand secondary to defective healing of the pleural space leading to stiff pleura restricting expansion of the lung. The diagnosis requires documentation of chronicity absence of active inflammatory or malignant pleural process, bronchial obstruction, or severe underlying lung disease. Trapped lung is usually seen secondary to inadequately treated chronic parapneumonic effusion or empyema, post-cardiac injury syndrome, post-cardiac surgery, hepatic hydrothorax, uremia, radiation, hemothorax, and rheumatoid pleuritis. Due to its rarity, occasional case reports are published and limited radiology literature is available in regards to natural history, etiopathogenesis, radiological manifestations. A more accurate precise terminology of trapped lung is a need of time is proposed. Imaging plays a critical role in patient management and at times eliminates invasive diagnostic or therapeutic procedures. Following are discussed: Aims/objectives, Nomenclature, Pathogenesis and imaging features of trapped lung, Differential diagnosis, Review of literature, Management, Post treatment follow up, Teaching points, and Conclusionp class="MsoNormal">

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# Abstract Archives of the RSNA, 2024

CHEE-111

## EMPYEMA: INFECTION TO INTERVENTION - A PRIMER FOR THE RESIDENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mariana Travieso Diffoot (*Abstract Co-Author*) Nothing to Disclose
Adrian Naoun (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Manuel Garcia (*Abstract Co-Author*) Nothing to Disclose
Carol Sanchez Santana (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Ultrasound imaging can play an important role in the diagnosis, quantification, and staging of empyema. A sinusoid sign on ultrasound can predict lung expansion following empyema drainage. A positive sinusoid sign favors lung re-expansion after empyema drainage. Chest tube drainage output can be an indicator for response to antibiotic treatment. If output gradually decreases, it means the patient is responding to treatment. When the output is <100ml tube can be removed.“Lung entrapment” is a reversible condition where the patient is symptomatic, with possible mediastinal shift to the opposite side, and surgical treatment like decortication offers immediate response. “Trapped lung” is irreversible, and an ex-vacuo pneumothorax can be present on imaging. Decortication is optional and performed for symptomatic relief.MRI imaging can help to differentiate empyema from necrotizing pneumonia.

### TABLE OF CONTENTS/OUTLINE

Role of imaging in the diagnosis of empyema with a focus on quantification, staging, follow-up. Describe the imaging features of etiology of empyema: empyema from pneumonia, hematogenous spread, and infection spread from contiguous structures like osteomyelitis (bone infection), empyema following surgical procedures. Describe imaging features of complications of empyema: empyema necessitans, post-pyothorax lymphoma, fibrothorax. Describe imaging findings of treatment procedures for empyema: tube thoracostomy, thoracomyoplasty, pleural decortication, Clagett window, Eloesser flaps. Describe complications of treatment procedures including non-expanding lung-like formation of pleural rind, lung atelectasis, endobronchial obstruction, bronchopleural fistula.

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# Abstract Archives of the RSNA, 2024

CHEE-112

## ASSESSING USUAL AND UNUSUAL DEVICES COMPLICATIONS IN CARDIOTHORACIC RADIOLOGY - BE PREPARED FOR THE UNEXPECTED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rodrigo Moreira Bello, MD (*Abstract Co-Author*) Nothing to Disclose
Otavio Augusto Ferreira Dalla Pria, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Heming, MD (*Abstract Co-Author*) Nothing to Disclose
Hanna R. Ferreira Dalla Pria, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Sravani Mannuru, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cardiothoracic devices represent an important aspect of evaluation in radiographs and tomography for trainees and experienced radiologists who critically assess their positioning and potential complications. However, although they are part of the daily routine, they also become challenging due to the multiple types of devices available, which increase yearly. It’s essential to become familiar with and updated on these devices in order to identify what is expected and abnormal, especially regarding malfunctioning, malpositioning, and other potential complications.This exhibit aims: 1. To review the most used cardiothoracic devices, emphasizing the newest ones. 2. To illustrate cases of misposition, malfunctioning, and/or complications related to devices that appear in cardiothoracic radiology.

### TABLE OF CONTENTS/OUTLINE

Section A- Introduction/Objectives: Brief review of relevant radiological concepts of cardiothoracic devices: 1. Pacemakers and Implantable cardioverter-defibrillators, 2. Loop recorders, 3. Valve replacement and repair, 4. Closure devices, 5. Vascular stents, surgery clips (CABG), 6. Left ventricular assist device, 7. Impella, 8. Intra-aortic balloon pump, 9. Pleural devices, 10. I Tracheal/bronchial, and II esophageal devices, 11. Vascular catheters, 12. And miscellaneous, such as hypoglossal nerve stimulator, embolization coils, and the antibiotic spacer. Section B - Case-based approach: Present/illustrate cases among the ones listed above with typical and unexpected complications, malpositioning, and malfunctioning of these devices.

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# Abstract Archives of the RSNA, 2024

CHEE-113

## CHEST BEDSIDE APPLICATIONS OF PORTABLE DYNAMIC DIGITAL RADIOGRAPHY (DDR): BRINGING THE DYNAMIC ACQUISITION TO THE PATIENTS' BED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatiana Lisnic (*Abstract Co-Author*) Nothing to Disclose
Marcello A. Orsi, MD (*Abstract Co-Author*) Nothing to Disclose
Giancarlo Oliva (*Abstract Co-Author*) Nothing to Disclose
Paolo F. Felisaz, MD (*Abstract Co-Author*) Nothing to Disclose
Maurizio Ce, MD,BA (*Abstract Co-Author*) Nothing to Disclose
Laura Macri (*Abstract Co-Author*) Nothing to Disclose
Francesca Lucrezia Rabaiotti (*Abstract Co-Author*) Nothing to Disclose
Michaela Cellina (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To learn applications of portable DDR for chest investigation at the patient’s bedside.

### TABLE OF CONTENTS/OUTLINE

DDR is a new high-resolution technique, that applies pulsed X-ray to acquire multi-frame fast-paced sequential acquisition of targeted anatomical areas, then reproduced in cine-loops.Different conditions may result in diaphragmatic dysfunction, including vascular disorders, post-traumatic abnormalities, infections, muscular and neuro-muscular diseases, and neoplasms. DDR provides functional, structural, and morphological information and shows the pattern of diaphragmatic motion over time in colored curves, quantifying the range of motion to support the diagnosis of diaphragmatic dysfunction. DDR allows the evaluation of lung motility and the presence of abnormal motion related to adhesions or post-surgical conditions, useful in diagnosing breathing abnormalities in lung cancer patients. Lung Ventilation can be assessed through automatic reconstructions of colored maps, which provide information on the changes in pixel density and related signal over time that can be used to identify regional differences in ventilation and to assess the effectiveness of different respiratory treatments in Intensive Care Units patients. Pulmonary perfusion abnormalities related to chronic and acute conditions can be investigated with DDR without the need for any contrast media, allowing the acquisition in patients with severe allergies or altered renal function. The acquisition of dynamic imaging at the patient’s bed can also increase the X-ray sensitivity in detecting post-procedural complications, such as pneumothorax, that can be easily detected and followed up without moving the patient.

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# Abstract Archives of the RSNA, 2024

CHEE-114

## IMAGING AND CLINICAL FEATURES OF CYSTIC LUNG DISEASES: A PRACTICAL GUIDE FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tassia R. Yamanari, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Hipolito Bachion (*Abstract Co-Author*) Nothing to Disclose
Chang K. Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Sousa Santana De Paula (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pulmonary cysts are a common finding in routine CT scans. Solitary/incidental cysts in asymptomatic individuals may represent part of the normal aging process. However, lung cysts can be a manifestation of an underlying disease and the diagnosis might be challenging. 1) Review the main imaging findings of cystic lung diseases (CLD). 2) Recognize the different causes of CLD based on their causes, location and distribution of the cysts, and associated findings. 3) Propose a practical and systematic approach to interpret the CLD based on the main imaging findings and clinical features. 4) Present helpful clues and key points to narrow down the differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Differential diagnosis of air-filled lung lesions 3)Histopathology of pulmonary cysts 4)Main causes of cystic lung disease 5)Solitary/localized cysts 6)Multiple/diffuse cysts not commonly associated with other pulmonary findings 7)Multiple/diffuse cysts associated with ground-glass opacities 8)Multiple/diffuse cysts associated with pulmonary nodules 9)Multiple/diffuse cysts associated with fibrotic changes 10)Conclusion/Take-home messages

# Abstract Archives of the RSNA, 2024

CHEE-115

## PULMONARY SARCOIDOSIS: AN UPDATE FOR CT FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Lydia Chelala, MD (*Abstract Co-Author*) Nothing to Disclose
Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Erhan Akpinar, MD (*Abstract Co-Author*) Nothing to Disclose
Furkan Ufuk, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To review the typical and less common findings of pulmonary sarcoidosis on chest CT.• To describe the chest CT phenotypes of sarcoidosis and examines the pathophysiological insights gained from chest CT. • To review the role of chest CT in monitoring the sarcoidosis and in prognostication.

### TABLE OF CONTENTS/OUTLINE

1. Non-fibrotic Subtypes a. Perilymphatic Micronodules Innumerable small nodules along the bronchovascular bundles, fissures, and subpleural regions. b. Large Peri-bronchovascular Nodules: Characterized by large nodules centered around the bronchovascular structures, potentially showing the "galaxy sign". c. Scattered Large Nodules Characterized by large nodules that are scattered and appear unrelated to the bronchovascular structures. d. Consolidation Lung consolidation which may suggest alveolar filling processes. e. Other rare conditions Air trapping, reversed halo sign, mass-like lesions, and ground-glass opacification. 2. Likely to be Fibrotic Subtypes a. Bronchocentric Reticulation without Cavitation Characterized by reticular patterns focused around the bronchovascular structures without evidence of cavitation. b. Bronchocentric Reticulation and Dense Parenchymal Opacification with Cavitation Characterized by bronchocentric reticulation accompanied by areas of dense opacification and cavitation. c. Large Bronchocentric Masses Characterized by large, dense, bronchocentric masses that mimic the appearance of progressive massive fibrosis. 3. Grey Zones and Unknowns: • Mosaic attenuation and interlobular septal thickening. • The link between specific CT appearances and with their clinical significance. Rare imaging findings of pulmonary sarcoidosis.

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# Abstract Archives of the RSNA, 2024

CHEE-116

## TIPS, TRICKS AND PEARLS IN THE RADIOLOGICAL DIAGNOSIS OF PLEURAL MESOTHELIOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ainhoa Clemente Idoate, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Helena Gomez Herrero (*Abstract Co-Author*) Nothing to Disclose
Elia Lecumberri, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe the optimal technical computed tomography (CT) acquisition in order to evaluate pleural thickening. Review the semiology of mesothelioma on CT. To illustrate the radiological findings associated with asbestos exposure that can provide clues in the diagnosis of pleural malignancy. To discuss the different interventional procedures available for diagnosis, focusing on those guided by imaging.

### TABLE OF CONTENTS/OUTLINE

1. Chest CT scan studies with venous phase acquisition for better detection of pleural thickening in suspected malignant effusion. 2. Typical CT imaging findings in mesothelioma, considering subtle and more specific radiological signs. 3. Asbestosis and pleural plaques associated with asbestos exposure in the context of a pleural effusion suspicious for malignancy, along with recommendations for precise detection. 4. A review of various interventional techniques for diagnosing mesothelioma as reported in medical literature, including thoracentesis, blind pleural biopsy, image-guided pleural biopsy, and surgical procedures. 5. The importance of reviewing positron emission tomography (PET) studies before conducting image-guided biopsies to optimize results.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

CHEE-117

## SILICOSIS AND SILICA EXPOSURE RELATED DISEASES: WHAT RADIOLOGISTS SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo G. Marcelino, MD (*Abstract Co-Author*) Nothing to Disclose
Jean Meneguetti (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joao S. Pais, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago De Gaultier Paulo, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo E. Catarina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

I. Review the epidemiology and clinical characteristics of silicosis, as well as the main diseases related to silica exposure. II. Illustrate the imaging findings of silicosis and diseases associated with silica exposure. III. Propose a diagnostic approach to the radiological findings of silicosis, considering its differential diagnoses, associated diseases and complications.

### TABLE OF CONTENTS/OUTLINE

Silicosis overview:- Silicosis is the primary manifestation resulting from exposure to silica crystals. It entails irreversible diffuse interstitial lung disease.- Epidemiological data:-About 2.3 million Americans are exposed to inhalable silica particles.Other Associated Diseases: Silica exposure is strongly associated to various diseases beyond silicosis (lung cancer, tuberculosis, chronic obstructive pulmonary disease (COPD)).Additionally, less prevalent ailments like autoimmune diseases (especially rheumatoid arthritis and systemic sclerosis), sarcoidosis, and vasculitis.Clinical Importance Understanding the presentation of pulmonary silicosis and its associated diseases is crucial.This knowledge aids radiologists and pulmonologists in early diagnosis and complication prevention.Purpose of Review: Provide a comprehensive understanding of silica exposure-related conditions

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# Abstract Archives of the RSNA, 2024

CHEE-118

## CYSTIC LUNG DISEASES: BLEND OF CLASSIC KNOWLEDGE AND CONTEMPORARY INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Felipe S. Torres, MD, PhD (*Abstract Co-Author*) Research support, Altis Labs
Micheal McInnis, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Bayer AG
Patrik Rogalla, MD, MBA (*Abstract Co-Author*) Institutional Research Grant, Canon Medical Systems Corporation;Institutional Research Grant, KA Imaging
Tae Bong Chung, MD (*Abstract Co-Author*) Nothing to Disclose
Jonatas Favero Prietto Dos Santos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- A cyst appears as a circumscribed parenchymal low attenuating area, usually with thin and regular walls. - Solitary or few small thin-walled lung cysts incidentally detected on CT may be part of the normal aging process. - In scenarios involving young patients with multiple lung cysts, careful evaluation of cyst characteristics, distribution, and ancillary radiologic findings is paramount. - Cystic lung cancers are an underrecognized condition on CT, often missed at early stages. - Suspicious cyst features include thick or asymmetric walls, associated nodules, internal septations, and growth. - A change in the morphologic features of a cyst and surrounding tissues should raise suspicion for cancer.

### TABLE OF CONTENTS/OUTLINE

1) Review basic imaging concepts through examples, including the updated terminology from the new Fleischner Society glossary of terms for Thoracic Imaging. 2) Distinguish between non-pathological and pathological lung cysts, focusing on their clinical significance and associated findings that aid in diagnosing diffuse lung cystic diseases. 3) Overview of classical cystic lung pathologies. 4) Revisit congenital, infectious, and non-infectious abnormalities that may present with cysts. 5) Unveil the evolving landscape of cystic lung cancers, integrating recent updates from LUNG-RADS. 6) Through a blend of classic knowledge and contemporary insights, this exhibit endeavors to provide radiologists with a nuanced understanding of cystic lung diseases, enhancing diagnostic accuracy and patient care.

# Abstract Archives of the RSNA, 2024

CHEE-119

## FINDING PNEUMO: ADVANCED PULMONARY FUNCTIONAL IMAGING METHODS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Marcelo B. Amato, MD (*Abstract Co-Author*) Nothing to Disclose
Shotaro Naganawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Prachi P. Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Andreas Voskrebenzev (*Abstract Co-Author*) Nothing to Disclose
Ka Kit Wong, MBBS (*Abstract Co-Author*) Nothing to Disclose
Yuzo Yamasaki, MD, PhD (*Abstract Co-Author*) Research Grant, Konica Minolta, Inc
Agilo L. Kern (*Abstract Co-Author*) Nothing to Disclose
Filip Klimes (*Abstract Co-Author*) Nothing to Disclose
Jens Vogel-Claussen, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio S. Galizia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Traditional medical imaging methods, such as radiography, CT and MRI can depict structural spatial variation in the lungs but not function. Recently several imaging methods have been developed that are able to depict the local distribution of functional parameters, such as ventilation and perfusion. • Some techniques involve the application of software analysis to images obtained with standard hospital equipment. They include analysis of ventilation on fluoroscopic or CT images, as well as modeling airway flow with computational fluid dynamics methods. • Some techniques involve technical changes in standard imaging modalities, and they could be CT-based (e.g. dual-energy CT) or MRI-based (e.g. hyperpolarized gas MRI). • Some techniques involve the use of dedicated hardware, such as dynamic digital radiography and electrical impedance tomography. • We will describe several imaging methods capable of depicting lung function, such as ventilation and perfusion. Pros and cons of each method will be highlighted.

### TABLE OF CONTENTS/OUTLINE

• Nuclear-medicine methods: o Scintigraphy o SPECTPET • Radiography-based methods: o Dynamic digital radiography o X-Ray Velocimetry Lung Ventilation Analysis Software • CT-based methods: o Parametric response map o Xenon CTDual-energy CT o CT Lung Ventilation Analysis Software o Functional Respiratory Imaging • MRI-based methods: o Hyperpolarized gas MRI o Fluorinated gas MRI o Oxygen-enhanced MRI o Fourier-decomposition MRI o Phase-resolved functional lung MRI o Dynamic contrast-enhanced perfusion MRI o Contrast-enhanced MR angiography o Non-contrast MR angiography (arterial spin labelling) • Electrical Impedance Tomography

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# Abstract Archives of the RSNA, 2024

CHEE-12

## A COMPREHENSIVE VIEW OF ACUTE AORTIC SYNDROME THROUGH ANGIOTOMOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Magali Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Primavera (*Abstract Co-Author*) Nothing to Disclose
Ignacio Grimoldi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To distinguish the pathologies included in acute aortic syndrome. To review the multiphase angiotomography protocol for the study of acute aortic syndrome, the frequent findings in each phase and for each entity on images. To explore the different existing classifications of aortic dissection. To characterize the imaging differences of the aortic dissection flap morphology according to the evolution of an acute to chronic state. To review the most frequent treatment techniques and their complications through cases. To recognize the typical findings of flow entry into the false lumen and its classification system. To detail the components that should not be missing in the follow-up aortic imaging report.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Acute Aortic Syndrome: distinct characteristics of aortic dissection, intramural hematoma and penetrating atherosclerotic ulcer. 2. Diagnosis CTA imaging: protocol and frequent findings in each phase. 3. Classification Systems, a) DeBakey system b) Stanford Classification System c) Society of Vascular Surgeons and the Society of Thoracic Surgeons (SVS/STS) classification system d) The European update of the Stanford classification: the type/entry/malperfusion (TEM) classification. 4. Common surgical procedures and their complications. 5. Follow-up CTA imaging and report. 6. Classification system for describing flow to the false lumen.

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# Abstract Archives of the RSNA, 2024

CHEE-13

## THROMBOTIC AND NON-THROMBOTIC PULMONARY EMBOLISM - IS IT REALLY A CHALLENGE FOR ROUTINE PRACTICE? AN ERROR-BASED LEARNING APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Philippe Khafagy (*Abstract Co-Author*) Consultant, Gleamer
Ernest Martinez Schargel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pulmonary artery artefacts (kinetic, beam hardening and flow artefacts specifically due to left-to-right shunt) can be resolved by adapted protocols such as using aorto-pulmonary injection timing. Density measurement of an embolus may be useful in determining its nature. Bilateral central ground glass opacities can refer to pulmonary edema, hemorrhage or infection (especially PCP) and can be the only finding in non-thrombotic PE such as fatty PE. Knowledge of anatomical distribution and morphology of lymph nodes is important to distinguish them from vascular lesions. MPR is useful for anatomical evaluation. Presence of an endovascular tumor invasion may help identify pulmonary tumor embolisms. Consolidation in septic emboli may present features similar to infarcts in the acute phase (before cavitation). MPR and minIP are essential to identify signs of chronic thromboembolic pulmonary hypertension. Sometimes pulmonary infarction may be nodular and difficult to recognize at first glance.

### TABLE OF CONTENTS/OUTLINE

Our 5 chosen cases will lead us to discuss the challenges encountered in routine practice for diagnosis of thrombotic and non-thrombotic PE. We will distinguish first readers' opinion from that of a second reader, which will provide tips to reach the right diagnosis. Each case will distinctly refer to a category of embolism, and will allow for an in-depth discussion of each of these categories. Case 1 : Shortness of breath and elevated D-Dimers. PE ? Case 2 : Elevated D-dimers and retrosternal pain. PE ? Case 3 : Follow-up CT of a patient known for signet ring cell adenocarcinoma Case 4 : Trauma and lumbar pain. Initially, no further context given Case 5 : Dyspnea of unknown origin, suspicious nodules on CT PET-CT

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# Abstract Archives of the RSNA, 2024

CHEE-14

## ULTRA-HIGH-RESOLUTION CT FINDINGS OF PRE-INVASIVE ADENOCARCINOMA AND MINIMALLY-INVASIVE ADENOCARCINOMA OF THE LUNG

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Motoharu Hakozaki (*Abstract Co-Author*) Nothing to Disclose
Kenji Fujii (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Kouji Hashimoto I (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Chiba I (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Moriya, MD, PhD (*Presenter*) Advisor, California Capital Equity, LLC;Research Grant, Canon Medical Systems Corporation

### TEACHING POINTS

With the spread of CT screening, the chances of small lung nodule and early lung cancer are increasing. Therefore, the following points are presented by comparing the ultra-high resolution CT (UHRCT) and pathological findings of resected specimens. 1. Classification of Lung Adenocarcinoma2. Pathological invasion criteria of lung adenocarcinoma 3. Spatial resolution of UHRCT4. UHRCT findings of of pre-invasive adenocarcinoma and minimally-invasive adenocarcinoma5. Comparison of UHRCT findings and pathological findings

### TABLE OF CONTENTS/OUTLINE

1. pre-invasive adenocarcinoma (AAH, AIS) and minimally-invasive adenocarcinoma (MIA) of the lung (confirmed by pathological diagnosis of resected specimens) were reviewed.2. The definition of "pathological non-invasion" is lepidic growth and the absence of reactive fibroblast growth factor, vascular / lymphatic vessel invasion, pleural invasion, and STATS. These are diagnoses by microscopic pathological findings, immunostaining, and genetic diagnosis, and are not directly reflected in the macroscopic image morphology.3. UHRCT is a CT that achieves high spatial resolution by reducing the detector size to 1/4. In the previous studies, bronchi with an inner diameter of 0.4 mm are delineated. By improving the resolution, it has become possible to display the intralobular structure. 4. AIS is mainly based on ground glass opacity, but there may be collapsed parts that have lost aeration inside. Ground glass opacity is a finding found in the lepidic extension, but also in the papillary extension. There are also invasive adenocarcinomas mainly composed of ground glass opacity. Some MIA presents solid nodules without aeration.

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# Abstract Archives of the RSNA, 2024

CHEE-15

## DIFFERENCES BY MORPHOLOGICAL PATTERN IN PROGRESSION OF PULMONARY FIBROSIS ON HRCT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Takahiko Nakazono, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ken Yamaguchi, MD (*Abstract Co-Author*) Nothing to Disclose
Ryoko Egashira, MD, PhD (*Presenter*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, AstraZeneca PLC;Speakers Bureau, Shionogi & Co, Ltd;Speakers Bureau, KYORIN Holdings, Inc;Speakers Bureau, DAIICHI SANKYO Group;Speakers Bureau, Bayer AG;Speakers Bureau, Otsuka Holdings Co, Ltd;

### TEACHING POINTS

The HRCT diagnosis of interstitial lung disease (ILD) is made by a combination of several non-specific findings.MDD is important because it provides a more practical diagnosis by reading the pathology from the images and combining it with the clinical background and histological diagnosis. Progressive pulmonary fibrosis (PPF) applies to ILDs other than IPF showing progressive clinical, functional or radiological fibrosis over a one-year period, in which the radiologist also has an important role to play in this decision. It is important to know where to focus on each morphological pattern, as the way fibrosis progresses differs according to the morphological pattern.

### TABLE OF CONTENTS/OUTLINE

Diagnostic approach to fibrotic ILD on HRCT. Summarize the current classification/guidelines of interstitial pneumonias/idiopathic pulmonary fibrosis/PPF. Presentation of the differences in the fibrotic progression by morphological patterns. In the UIP pattern, fibrosis results from abnormal alveolar epithelium "wound healing" after invisible injury, with alveolar collapse and collagen build-up causing volume loss and honeycombing. Small lesion accumulation makes detecting the increase of fibrosis on HRCT challenging. In NSIP/fibrosing OP, inflammation injures more extensive lung areas, transitioning to fibrosis and causing alveolar septa thickening and volume loss. This process, unlike UIP, is visible on HRCT, where ground-glass opacities evolve into reticulations. The newer PPFE pattern's pathogenesis remains unclear, but involves epithelial damage leading to lung collapse and induration, detectable on HRCT as volume reduction and collapsed sclerotic lesions, without prior inflammation.

# Abstract Archives of the RSNA, 2024

CHEE-16

## DON'T GET LOST IN THE ILD MAZE: 4 STEPS TO APPROACH PATTERNS AND DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Manuel Conde Blanco, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia D. Gambetta I, MD, MD (*Abstract Co-Author*) Nothing to Disclose
JOSEFINA MEDINA (*Abstract Co-Author*) Nothing to Disclose
Joaquin Martinez Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Maria C. Ferrario, MD (*Abstract Co-Author*) Nothing to Disclose
Agustina Picarel, MD (*Abstract Co-Author*) Nothing to Disclose
Maria S. Fernandez Castillo Odena, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To provide a stepwise approach to identify pulmonary fibrosis and classifying into the most common specific patterns.To review the primary characteristic of usual interstitial pneumonia, nonspecific interstitial pneumonia and fibrotic hypersensitivity pneumonitis.To learn how to differentiate between idiopathic pulmonary fibrosis and its secondary causes.To recognize how to orientate our final diagnosis, using every tool from the imaging findings to the patient clinical history.

### TABLE OF CONTENTS/OUTLINE

Step by step to guide pulmonary fibrosis : 1. Is it fibrotic pulmonary disease? 2. How is the distribution of the findings? 3. Which CT pattern predominates? 4. What to look for in the clinical history? Ancillary findings? Main characteristics of UIP pattern: Idiopathic Pulmonary Fibrosis: Differentiate with Probable UIP Main characteristics of UIP pattern: Secondary causes with ancillary findings: CT-ILDAsbestosisDrug InducedIgG4 Disease. Main characteristics of NSIP pattern and its probable causes with ancillary findings: CT-ILDInfectionsDrug toxicityMain characteristics of Fibrotic Hypersensitivity Pneumonitis: Inorganic Particulate Matter.Summarize the main differences between the three patterns

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# Abstract Archives of the RSNA, 2024

CHEE-17

## THE ROLE OF CHEST CT IN MONITORING CYSTIC FIBROSIS MODULATOR THERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura Jimenez-Juan, MD (*Abstract Co-Author*) Nothing to Disclose
Matias F. Callejas, MD (*Abstract Co-Author*) Nothing to Disclose
Djeven P. Deva, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Jose Miguel Castro Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Ji-Yeon Han, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Low-dose chest CT is used to assess cystic fibrosis patients initiating and undergoing cystic fibrosis transmembrane conductance regulator (CFTR) modulator therapy.- Reduction in bronchial wall thickening, mucous plugging, air trapping, and parenchymal abnormalities have been described in cystic fibrosis patients undergoing modulator therapy.- The extent and caliber of bronchiectasis remain stable in the vast majority of cases despite modulator therapy because bronchiectasis is, for the most part, an irreversible structural change.- CT quantification could be useful for predicting clinical outcomes, such as exacerbations and survival, but it has not yet been integrated into daily practice.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

CHEE-18

## GLOSSARY OF TERMS USED IN LUNG CANCER DIAGNOSIS, STAGING AND TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Jo-Anne O. Shepard, MD (*Abstract Co-Author*) Editor with royalties, RELX
Susan K. Hobbs, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Kaproth-Joslin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Abhishek Chaturvedi, MD (*Abstract Co-Author*) Nothing to Disclose
Karen Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Chen (*Abstract Co-Author*) Nothing to Disclose
Maria Clara N. Lorca, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This educational exhibit reviews the basic terms frequently used in the diagnosis, staging and treatment of lung tumor, making it a quick and reliable resource for radiologists participating in interdisciplinary conferences.This glossary of terms is an image rich, case-based guide designed to shape imaging interpretation in a way that creates concise but complete summaries, providing the necessary information needed to be conveyed to the different participants of interdisciplinary conferences.Briefly review the new proposed 9th TNM classification, including the new N guidelines. Discuss the expected imaging appearances of: The most common thoracic surgery approaches for lung cancer treatment: including segmentectomies, wedge resections, lobectomy and pneumonectomy. Compare and discuss the different CT-guided localization methods of pulmonary nodules, including fiducial and microcoil markers placement. Stereotactic ablative radiotherapy (SABR), aka stereotactic body radiotherapy (SBRT), chemotherapy, and immunotherapy. -Lung ablation therapy. Imaging pitfalls to be aware post precision therapy.

### TABLE OF CONTENTS/OUTLINE

This education exhibit reviews different types of surgeries for lung cancer treatment and the expected radiological appearance post-therapy.Creates a checklist with all the necessary information the radiologist is expected to report when diagnosing and/or following lung cancer, as well as the most common post treatment findings.Depict the new subtypes of lung cancers, included in the 2021 WHO classification of the tumors of the lung, including SMARCA4 and bronchiolar adenoma.

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# Abstract Archives of the RSNA, 2024

CHEE-19

## PERICARDIAL AND PLEURAL TUMORS: CLASSIFYING THE CHEST'S UNWELCOME GUESTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria Clara N. Lorca, MD (*Abstract Co-Author*) Nothing to Disclose
Aadya Chaturvedi (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Kaproth-Joslin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Irene Chen (*Abstract Co-Author*) Nothing to Disclose
Anna Kelly, MD (*Abstract Co-Author*) Nothing to Disclose
Steve Stephen, BS, MBA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This educational exhibit will: 1. Summarize the 2021 WHO Classification of both pericardial and pleural tumors 2. Highlight imaging characteristics of the different pleural and pericardial tumors

### TABLE OF CONTENTS/OUTLINE

This exhibit aims to provide a comprehensive overview of pleural and pericardial tumors using biopsy-proven case examples. Cases will be systematically reviewed, utilizing the framework presented in the 2021 WHO guidelines and how the knowledge of histological tumor subtypes has become important in the clinical scenario of precision therapy treatment. Radiological findings of tumors will be presented alongside respective pathology correlates. Tumors to be covered include: Benign and preinvasive mesothelial tumors of the pleura, pleural mesothelioma in situ, localized mesotheliomas, malignant pleural mesotheliomas (MPM), aka diffuse mesotheliomas, benign and malignant primary tumors of the pericardium and metastases to the pleura and pericardium, pericardial angiosarcoma and others.References: 1. WHO Classification of Tumours Editorial Board. Thoracic tumours. Lyon (France): International Agency for Research on Cancer; 2021. 2. Sauter JL, Dacic S, Galateau-Salle F, et al. The 2021 WHO Classification of Tumors of the Pleura: Advances Since the 2015 Classification. J Thorac Oncol. 2022;17(5):608-622. doi:10.1016/j.jtho.2021.12.014 3. Baas P, Zalcman G; et al. First-line nivolumab plus ipilimumab in unresectable malignant pleural mesothelioma (CheckMate 743): a multicentre, randomised, open-label, phase 3 trial. Lancet. 2021 Jan 30;397(10272):375-386. 4. Restrepo CS , et al. Primary pericardial tumors. Radiographics. 2013;33(6):1613-30.

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# Abstract Archives of the RSNA, 2024

CHEE-2

## REVISIONS IN THE TNM CLASSIFICATION FOR LUNG CANCER: A PRIMER FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Isabella De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• The forthcoming 9th edition TNM classification (TNM-9) for lung cancer will introduce refined subcategories for nodal involvement and metastatic disease classification, addressing the need for improved precision in staging and treatment decisions. • The subcategorization of N2 into N2a and N2b resulted in new TN subsets, including T1N2a, assigned to stage IIB, which reflect changes in the prognosis prediction. • The subcategorization of M1c into M1c1 and M1c2 is also relevant to refine prognosis, even though it doesn’t imply a change of stage (both remain in stage IVB). • The clinical importance of these changes reinforces the necessity for precise evaluation and reporting of mediastinal nodal disease and distant metastases through comprehensive imaging, notably CT and PET-CT. • This presentation aims to review key concepts and revisions of TNM-9 in a practical approach tailored for radiologists and residents.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: principles of cancer staging; 2. Lung cancer staging state-of-the-art: (a) Multimodality imaging (b) 8th edition of the TNM Classification; 3. IASLC Lung Cancer Staging Project: methods and guiding principles; 4. Revisions of the TNM Descriptors in the Forthcoming 9th edition of the TNM Classification: (a) N Descriptors (b) M Descriptors (c) Summary and practical approach; 5. Illustrative cases with multimodality imaging: a comparative review; 6. Future perspectives: liquid biopsy and artificial intelligence; 7. Take home messages

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# Abstract Archives of the RSNA, 2024

CHEE-20

## NONTUBERCULOUS MYCOBACTERIAL INFECTION: REVIEW OF CLINICAL AND IMAGING MANIFESTATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe A. Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Ocazionez-Trujillo, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Patricia Puello Baron, Md (*Abstract Co-Author*) Nothing to Disclose
Markus Y. Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Nontuberculous mycobacteria (NTM) are a group of ubiquitous, low grade pathogens that cause pulmonary infections in immunocompetent and immunocompromised people worldwide, with particularly high prevalence in the US and Japan.This exhibit will:a. Discuss the epidemiological and microbiological underpinnings on NTMb. Recognize the different clinical and imaging presentation of the two main forms of the disease.c. Review imaging features of less common types of presentation including scenarios with altered pulmonary parenchymal architecture, immunocompromised hosts, congenital heart disease, etc. As well as review common and rare complicationsd. Discuss the role of imaging in the pharmacologic and surgical management of these patients.

### TABLE OF CONTENTS/OUTLINE

1. Epidemiology and Microbiological Background 2. Diagnosis 3. Imaging Findings a. Classic (Cavitary Form) b. Non-Classic (Bronchiectatic Form) c. Hypersensitivity Pneumonitis (Hot Tub Lung) d. Immunocompromised Host e. Other Predisposing Conditions (e.g. ILD, Cystic Fibrosis, Organ Transplant) f. Complications 4. Imaging Role in Treatment Strategies a. Pharmacologic Treatment Imaging Follow Up b. Pre-operative and Post-operative Evaluation 5. Role of Alternative Imaging Modalities (MRI, PETCT)

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# Abstract Archives of the RSNA, 2024

CHEE-21

## ACUTE THORACIC FINDINGS AND COMPLICATIONS RELATED TO CANCER TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tassia R. Yamanari, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Camila S. Franco, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Hye J. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo V. Auad, MD (*Abstract Co-Author*) Nothing to Disclose
Thais C. Lima (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Campos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the most common modalities of local treatment of thoracic neoplasms.- Recognize the expected changes related to each modality of local treatment and the potential acute complications.- Review the imaging findings of the acute thoracic complications related to systemic cancer therapy.

### TABLE OF CONTENTS/OUTLINE

Acute thoracic findings in oncology patients can be related to local or systemic therapy. It might vary from expected changes related to local treatment to acute complications that can be life threatening. Beyond that, these findings can be misinterpreted as tumor recurrence and compromise the appropriate treatment.The aim of this pictorial review is to present1. Expected acute imaging findings related to the most common local cancer treatment modalities in the chest, including surgery, ablation therapy and radiation therapy.2. A systematic review of the imaging findings of acute complications related to local and systemic cancer therapy, based on treatment modality and organ system (airways and lung, pleura, cardiovascular and mediastinum).

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# Abstract Archives of the RSNA, 2024

CHEE-22

## PERSPECTIVES IN PIXELS: THORACIC IMAGING'S VIEW ON RHEUMATOLOGICAL DISEASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Prasandeep Rath, MBBS,MD (*Abstract Co-Author*) Nothing to Disclose
Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Anandamoyee Dhar (*Abstract Co-Author*) Nothing to Disclose
Harshita Arora, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Role of CT in detecting and characterizing various thoracic manifestations in rheumatic diseases, including pulmonary involvement, pleural abnormalities, and mediastinal changes. • Overview of thoracic manifestations of common rheumatological conditions. • Use of follow-up CT scans for the monitoring of disease. • Highlight typical and atypical imaging findings for such conditions. • Case based approach to reinforce learning in this topic. • Emphasize role of imaging in early detection, disease severity assessment, and treatment guidance. • Discuss mimics of such conditions • Identification of associated complications such as infection, pulmonary embolism, and malignancy, which may occur concurrently or as a result of immunosuppressive therapy.

### TABLE OF CONTENTS/OUTLINE

- Introduction: Overview of Thoracic Imaging in Rheumatological Disorders
- Role of CT in Detecting and Characterizing Thoracic Manifestations
- Thoracic Manifestations of Common Rheumatological Conditions: Rheumatoid Arthritis; Systemic Lupus Erythematosus; Systemic Sclerosis; Wegener’s Granulomatosis; Dermatomyositis; Ankylosing Spondylitis
- Importance in Treatment Response Evaluation
- Adjustment of Therapeutic Strategies
- Case-Based Approach for Learning Reinforcement
- Mimics :Infectious Diseases; Malignancies; Idiopathic Interstitial Pneumonias
- Associated complications: Infection; Pulmonary Embolism; Malignancy

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# Abstract Archives of the RSNA, 2024

CHEE-23

## 'WRECK'-REATIONAL DRUG INDUCED LUNG INJURY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Saurabh Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Terrance T. Healey, MD (*Abstract Co-Author*) Nothing to Disclose
Samika S. Kanekar (*Abstract Co-Author*) Nothing to Disclose
Brandon H. Koo, MD,BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this educational exhibit is to: 1. Review current epidemiologic trends of recreational substance use 2. Discuss current chest imaging techniques and imaging findings of recreational drug induced lung injury 3. Review the pathophysiology and routes of lung injury and long-term damage caused by different recreational substances through representative cases 4. Discuss the complications, prognosis, and treatments of recreational substance induced lung injury and damage.

### TABLE OF CONTENTS/OUTLINE

The majority of Americans now live in a state where recreational use of marijuana is legal, with usage trends mirroring increased accessibility; similar increased usage trends of e-cigarettes and vaping products have been noted nationwide. With more widespread use of recreational substances with the potential for substance induced lung injury, this exhibit aims to provide a timely review of key imaging features and patterns of both acute lung injury and long-term damage related to a myriad of substance use including marijuana, e-cigarettes/vaping, conventional tobacco products, talcosis, and crack cocaine.

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# Abstract Archives of the RSNA, 2024

CHEE-24

## TAKE A BREATH! PATTERNS OF POST-PRIMARY PULMONARY TUBERCULOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alair Arantes (*Abstract Co-Author*) Nothing to Disclose
Erica A. Naves, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel De Figueiredo Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho (*Abstract Co-Author*) Nothing to Disclose
Guilherme C. del Guerra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibition is to delve into the characteristic CT findings that aid in the diagnosis and understanding of post-primary pulmonary tuberculosis, also known as reactivation tuberculosis or secondary tuberculosis. There are plenty of patterns that may be associated with post-primary pulmonary tuberculosis, such as lobar pneumonia, cavitations, tree-in-bud opacities, ground-glass opacities, centrilobular nodules, tuberculomas and/or pseudomasses. Demonstrating illustrative cases, this exhibition aims to assist radiologists in reporting chest CT scans in a post-primary pulmonary tuberculosis scenario.

### TABLE OF CONTENTS/OUTLINE

This exhibition initiates with a summary of the relevance, worldwide prevalence and pathology of the post-primary pulmonary tuberculosis. The next slides present the types of presentation and expected findings of the post-primary pulmonary tuberculosis on chest CT, with illustrative cases of each main form of presentation, identifying the most important radiological finding on each image. The collection contains cases of miliary tuberculosis, tuberculomas/pseudotumors, lobar pneumonia, atypical forms, such as inferior and anterior involvement, and multi-drug resistant pulmonary tuberculosis findings, including bilateral cavitations. The potential signs of active disease are subsequently highlighted. The presentation ends with relevant take-home messages.

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# Abstract Archives of the RSNA, 2024

CHEE-25

## EXPLORING 68-GA-FAPI PET-CT IN LUNG CANCER: ADVANTAGES AND LIMITATIONS COMPARED TO 18-FDG PET-CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marycel Barboza (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Solange A. Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Taise Vitor (*Abstract Co-Author*) Nothing to Disclose
Oren Smaletz, MD (*Abstract Co-Author*) Stockholder: AstraZeneca, GlaxoSmithKline, ; Novartis, Roche and Sanofi;Speaker Bureau: AstraZeneca Astellas Pharma;Research Funding: Janssen, Bristol-Myers Squibb;
Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Jairo Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Claudia Camargo (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Lilian Y. Yamaga (*Abstract Co-Author*) Nothing to Disclose
Nadjaneyre Casimiro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Gallium-68-labeled Fibroblast Activation Protein Inhibitor (FAPI-PET) represents an exciting advancement in molecular imaging as it targets proteins directly involved in tumor microenvironment. This presentation will present and review the uses of this novel tracer, focusing on lung cancer: - Describe the diagnostic performance and limitations of the 68-Ga-FAPI PET-CT and 18-FDG PET-CT.- Demonstrate the application of the 68-Ga-FAPI PET-CT in oncology with didactic cases of lung cancer through cross-sectional imaging.- Discuss the role of 68-Ga-FAPI versus 18-FDG PET-CT imaging in staging lung cancer using a case-based approach.

### TABLE OF CONTENTS/OUTLINE

- General concepts of the role of imaging in staging primary and metastatic lung cancer using both 18-FDG and 68-Ga-FAPIEffectiveness diagnostic performance.- Illustrative cases: Radiological features in false negative and false positive cases.- The main challenges and perspectives of implementing in routine clinical. - Conclusion / Take-home messages.

# Abstract Archives of the RSNA, 2024

CHEE-26

## STERNUM SPOTLIGHT - EVERY (STERNUM) HAS HIS DAY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Macedo, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Abstract Co-Author*) Nothing to Disclose
Murilo M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This exhibit serves the following purposes:• Exploring the anatomy of the sternum and its diagnostic assessment through a comprehensive multimodality approach.• Discussing the spectrum of anatomical variants of the sternum, encompassing component disproportions, sternal foramina, xiphoid shape variations, and associated conditions such as pectus carinatum and pectus excavatum. • Analyzing mechanical and inflammatory conditions and their imaging manifestations, such as arthritis, mechanical overloads, spondyloarthropathy, and SAPHO syndrome. • Examining traumatic injuries involving the sternum, including sternoclavicular dislocations, as well as acute and chronic fractures. • Analyzing infectious diseases affecting the sternum, with a focus on septic arthritis, alongside discussion of rarer infections like sporotrichosis. • Identifying the expected image patterns of benign and malignant sternum tumors, notably enchondroma and chondrosarcoma. • Recognizing various post-operative sternum conditions, including pseudoarthrosis, acute mediastinitis, secondary osteomyelitis, and complications associated with sternal prostheses.

### TABLE OF CONTENTS/OUTLINE

• Sternum anatomy. • Imaging modalities. • Sternal anatomical variations. • Mechanical and inflammatory pathologies. • Traumatic injuries. • Infectious diseases. • Tumors. • Post-operative complications.

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# Abstract Archives of the RSNA, 2024

CHEE-27

## BEYOND THE BELLY: IMAGING OF THORACIC MANIFESTATIONS OF OBSTETRIC AND GYNECOLOGIC DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Aletta Ann Frazier, MD (*Abstract Co-Author*) Nothing to Disclose
Alan M. Ropp, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas Battey, MD (*Abstract Co-Author*) Nothing to Disclose
Leah Smith (*Presenter*) Nothing to Disclose

### TEACHING POINTS

While the majority of obstetric and gynecologic disease presents in the abdominal cavity, many of these conditions can manifest in the thorax. Related imaging findings may be subtle, unexpected, or overlooked. Radiologists must consider these entities and familiarize themselves with the associated findings to enable prompt and accurate diagnosis and treatment. This case series presents a comprehensive review of obstetric and gynecologic diseases manifesting findings in thoracic imaging. After reviewing this exhibit, the learner will recognize thoracic imaging findings related to obstetric and gynecologic disease, understand optimal modalities and techniques for safely imaging pregnant patients, and define relevant recommendations for management and follow up of the presented imaging findings.

### TABLE OF CONTENTS/OUTLINE

Cardiothoracic Complications of Pregnancy Emboli (thrombotic, amniotic fluid, and air) - Imaging protocols and other considerations in pregnant patients; Peripartum Cardiomyopathy; Eclampsia/Pre-Eclampsia; Pneumonia and Aspiration. Gynecologic Disease in the Thorax: Thoracic endometriosis syndromes (Catamenial Pneumothorax/Hemothorax, Hemoptysis, Pulmonary Endometrioma); Ovarian Hyperstimulation Syndrome; Benign Metastasizing Leiomyoma; Meigs Syndrome. Thoracic Patterns of Gynecologic Metastasis: Virchow's Node; Pleural/Diaphragmatic Metastases; Isolated Bilateral Axillary Metastases.

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# Abstract Archives of the RSNA, 2024

CHEE-28

## EXPLORING THE MANY FACES OF FAMILIAL PULMONARY FIBROSIS: RADIOLOGIC AND PATHOLOGIC FEATURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Israel Missrie, MD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd
Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Camila S. Franco, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Vinicius A. Cavalieri, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Brigagao (*Abstract Co-Author*) Nothing to Disclose
Lais F. Pimentel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the tomographic patterns of possible phenotypes found in familial pulmonary fibrosis using schematic illustrations and imaging studies.- Display a set of cases of familial pulmonary fibrosis exposing the heterogeneity of presentations.- Correlate imaging findings with pathological characteristics.

### TABLE OF CONTENTS/OUTLINE

Familial pulmonary fibrosis (FPF) is defined as any fibrotic interstitial lung disease in at least two first or second-degree relatives in the family. Although it is not a consensual definition, it is highly accepted. It is known that several genetic mutations are associated with the presence of this entity, which results in a wide diversity of phenotypic, radiological and pathological characteristics, including overlap between them. Imaging plays a fundamental role in the investigation and suspicion of interstitial lung diseases. Therefore, we propose a systematic approach and review of the image characteristics found on computed tomography. This pictorial review will discuss:1. Introduction2. Pathogenesis and epidemiology3. Review of the main tomographic and anatomopathological patterns of familial interstitial fibrosis- Usual interstitial pneumonia- Cryptogenic organizing pneumonia- Undetermined fibrosis pattern- Non-specific interstitial pneumonia- Fibrotic hypersensitivity pneumonitis- Aspiration-related

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# Abstract Archives of the RSNA, 2024

CHEE-29

## NON-INFECTIOUS PULMONARY COMPLICATIONS IN HEMATOLOGICAL MALIGNANCY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rishi Agrawal, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH
Jeremy J. Erasmus, MD (*Abstract Co-Author*) Nothing to Disclose
Girish S. Shroff, MD (*Abstract Co-Author*) Nothing to Disclose
Mylene T. Truong, MD (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MBBS, FRCR (*Presenter*) Director, Grayscale Ltd;Co-owner, Grayscale Ltd;

### TEACHING POINTS

Infection is the predominant cause of acute diffuse lung disease in hematological malignancy. However, 10-20% of presentations are due to alternative non-infectious etiologies. Familiarity with the radiological appearances, their timeline of evolution, and specific clinical scenarios when these occur aids diagnosis.

### TABLE OF CONTENTS/OUTLINE

Cases from tertiary cancer center, with pathological/clinical correlation of common and rare conditions. Cases are categorized by clinical scenario/evolution timelines. Clinical indicators that should suggest non-infectious etiologies and radiology management recommendations are highlighted.To include:• Post Bone Marrow Transplantation (Edema, Hemorrhage, Idiopathic Pneumonia Syndrome) - timelines and differentiating features• Small Molecule Drug Toxicity (e.g. Bleomycin) - radiological/clinical risk factors• Novel therapy complications (CAR T-cell cytokine release syndrome, ATRA differentiation syndrome)• Transfusion Reactions (TACO, TRALI, FNHTR, etc.)• Secondary Alveolar Proteinosis• Pulmonary Interstitial Extramedullary Hematopoiesis• Leukemic Infiltration, Leukostasis, Leukemic Cell Lysis Pneumopathy

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

CHEE-3

## INTERSTITIAL LUNG ABNORMALITIES: WHEN RADIOLOGISTS SHOULD MAKE THIS CALL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ian Griffin (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Sandro B. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica Gemmell (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Elucidate the imaging features of interstitial lung abnormalities (ILA) that necessitate reporting on CT scans.; Provide a simple algorithm for the differential diagnosis of ILA, improving accuracy and efficiency.; Stress the significance of communication between radiologists and pulmonologists for ILA management.

### TABLE OF CONTENTS/OUTLINE

● Overview of Interstitial Lung Abnormalities (ILA) ○ Definition and Epidemiological Relevance
○ Patterns of ILA on CT: Reticular, Nodular, Cystic, and Ground-Glass Opacities● Radiologic Approach to ILA
○ Criteria for Identification and Reporting of ILA ○ ILA versus Artefact: Ensuring Diagnostic Precision● Differential Diagnosis Simplified
○ Algorithmic Approach to Common and Uncommon Causes of ILA ○ Radiological Illustrations to Guide Pattern Recognition● Clinical Context and Management
○ When to Suggest Further Evaluation for ILA ○ Integrating Clinical Data in Radiological Interpretation● Conclusion
○ Summary of Best Practices for ILA Reporting ○ Call to Action for Standardization of Reporting Protocols

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# Abstract Archives of the RSNA, 2024

CHEE-30

## REVISITING THE LOWER RESPIRATORY TRACT: CORRELATION WITH BRONCHOSCOPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael R. Santos Ferreira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Chest CT is a non-invasive method capable of mapping and identifying lesions of the trachea and bronchi, as well as assisting in the biopsy and surgery planning of suspected findings. - Flexible bronchoscopy (FB) is the gold standard method for directly visualising the airways, allowing for many diagnostic and therapeutic interventions. - Virtual bronchoscopy (VB) is a technique for reconstructing three-dimensional images from CT scans, simulating a flexible bronchoscopy. - This presentation aims to illustrate the correlations between CT imaging findings and those obtained through FB and VB in diferent clinical setttings.

### TABLE OF CONTENTS/OUTLINE

1) Background; 2) Techniques: Conventional CT, VB, FB (pros and cons); 3) Applications: a case-based review (- anatomical variants - inflammatory and infectious diseases - neoplasms - blood clots - foreign bodies - other findings - intervention mapping - surgical planning - post-surgical changes - miscellaneous); 4) Future directions: Artificial Intelligence for navigation planning; 5) Summary and take home messages;

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# Abstract Archives of the RSNA, 2024

CHEE-31

## INJURIES FROM EXTREME EXERCISE: LOTS OF PAIN, NO GAIN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto Sasdelli Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Hamilton Shoji, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Paulo Teixeira E Torres (*Abstract Co-Author*) Speaker, Boehringer Ingelheim GmbH;Speaker, AstraZeneca PLC
Katriny Couto, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo B. Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Nycole B. Cortez Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Izabel d. Karam, MD (*Abstract Co-Author*) Nothing to Disclose
Nadjaneyre Casimiro, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Damaso, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Merigue, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Demonstrate a variety of radiological findings of thoracic complications such as alveolar edema/hemorrhage and pulmonary fat embolism associated with different forms of strenuous physical exercise.-Explain the mechanisms of injury involved in exercise-induced pulmonary complications.-Illustrate these conditions based on cases from our radiology group.-Provide insights into the role of radiology in the early detection and proper management of exercise-induced pulmonary complications.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION-Pathophysiological mechanism of pulmonary edema and hemorrhage caused by extreme physical exercise-Pathophysiological mechanism of pulmonary fat embolism caused by a long bone fracture during a extreme physical exercise-Pathophysiological mechanism of muscle injuries after weightlifting.CASE-BASED REVIEW-Pulmonary fat embolism following a long bone fracture sustained during a CrossFit session.-Alveolar edema/hemorrhage after cycling-Alveolar edema/hemorrhage after swimming-Pulmonary edema after running in high altitude-Muscle injuries after weightlifting.FINAL CONSIDERATIONSREFERENCES

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# Abstract Archives of the RSNA, 2024

CHEE-32

## OPTIMIZATION TECHNIQUES FOR RESCAN OF PROBLEMATIC CT PULMONARY ANGIOGRAMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduardo J. Mortani Barbosa JR, MD, MBA (*Abstract Co-Author*) Research Consultant, FLUIDDA nv;Research Grant, Siemens AG
Achala Donuru, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Colfer (*Abstract Co-Author*) Nothing to Disclose
Harold I. Litt, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV
Yvonne Su, BA (*Abstract Co-Author*) Nothing to Disclose
Scott A. Simpson, DO, MEd (*Abstract Co-Author*) Nothing to Disclose
Julia C. Jacob, MD (*Abstract Co-Author*) Nothing to Disclose
Priscilla Stecher, MD (*Abstract Co-Author*) Nothing to Disclose
Arun C. Nachiappan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Detect technical problems in nondiagnostic and low-quality CT pulmonary angiograms (CTPA). 2. Select which optimization technique to utilize for a potential rescan. 3. Compare pre- and post-intervention images to determine effectiveness of optimization techniques for rescan of problematic CTPA exams.

### TABLE OF CONTENTS/OUTLINE

1. Introduction/Background 2. Case-based review and demonstration of 13 technical problems in CTPA, with a comparison of the initial scan to the rescan performed with the optimization technique specific to each problem a) Transient interruption of contrast b) Bronchial artery inflow artifact c) Status post Fontan procedure d) Scan timing challenges - Parenchymal disease - Flow-related artifact - Tachycardia - ROI incorrectly placed on aorta e) Suboptimal contrast opacification f) Streak artifact from the SVC g) Pulmonary motion artifact h) Image noise i) Iodinated contrast anaphylaxis j) Concurrent technical problems 3. Conclusion

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# Abstract Archives of the RSNA, 2024

CHEE-33

## DECIPHERING ENIGMATIC CARDIOTHORACIC IMAGING IN END STAGE RENAL DISEASE (ESRD)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ramya S. Gaddikeri, MD (*Abstract Co-Author*) Nothing to Disclose
Palmi N. Shah, MD (*Abstract Co-Author*) Research Grant, Abbott Laboratories
Emily M. Trudeau, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Unusual cardiothoracic imaging in ESRD can be diagnostic dilemmas. Metastatic pulmonary calcifications (MPC) with noncalcified centrilobular nodules: mimics infection. Hyperdense consolidations: simulate amiodarone toxicity. Positive bubble echo due to chronic central venous obstruction and contrast shunting into the pulmonary veins. Miliary lung nodules in secondary pulmonary hemosiderosis from ESA: mimics miliary infection.Endplate erosion and vertebral collapse in Dialysis related spondyloarthropathy (DSA) mimics spondylodiscitis. Nodular pulmonary amyloidosis when non calcified /cavitating, mistaken for malignancy. Diffuse bone uptake on PET-CT secondary to ESA: confused for infiltrative processLarge IV contrast in ESRD patients can cause hyperdense fluid and muscles even after 24hrs, confused for hemorrhage. Post-transplant medication induced pneumonitis: mimics edema.

### TABLE OF CONTENTS/OUTLINE

Imaging findings will be subcategorized with DD: Lungs/Pleura: Hyperdense consolidation, MPC, Secondary pulmonary hemosiderosis, pulmonary amyloidosis, Premature tracheal calcifications, hyperdense effusions from contrast staining, Chronic effusions and round atelectasis. Heart/Vessels: Premature Coronary calcifications and accelerated CAD, Coronary aneurysm (In PCKD), Uremic pleuro-pericarditis, Cardiac amyloidosis, venous collaterals shunting to pulmonary veins, pericardial calcifications. Bones/Soft tissueRenal osteodystrophy, Distal clavicle resorption, DSA, calciphylaxis, Post ESA diffuse FDG uptake in bones, brown tumor. Post-transplant complicationsInfections due to immune-compromised state, ex PJP pneumonia. Tacrolimus induced lung injury.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

CHEE-34

## RETURN OF THE MAC: NON-TUBERCULOSIS MYCOBACTERIAL INFECTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Demetrios A. Raptis, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The classic manifestations of non-tuberculosis mycobacterial (NTM) infection in the chest have a unique clinical and radiographic presentation. These infectious processes can exist on a spectrum that can be life threatening or result in minor symptoms and require no treatment. The Runyon classification for non-tuberculosis in the current era has become more historical than clinically relevant, making the diagnosis challenging. We review a multi-disciplinary approach to making the diagnosis and directing treatment. While doing so we review a classification scheme for NTM infections and how imaging findings and clinical information can direct management.

### TABLE OF CONTENTS/OUTLINE

• Review imaging findings of non-tuberculosis mycobacteria (NTM) infections with emphasis on the thorax • Develop/review a classification scheme based on the imaging findings • Discuss multi-disciplinary approach to making diagnosis (and differentiating from M. tuberculosis) and directing treatmentMycobacterial avium complex (MAC):• Classic - upper lobe predominant fibrocavitary/cavitary pattern • Disseminated disease - cavitary disease, necrotic lymphadenopathy, and hepatosplenomegaly• Lady Windemere Syndrome - bronchiectasis, centrilobular nodules• Hypersensitivity (aka hot tube lung) - subacute hypersensitivity pattern• MAC can be associated with other conditions:• Achalasia• CF• Immunodeficiency Not all mycobaceterial infections in the chest are caused by MAC. Discuss clinical presentation and overlapping imaging findings of other mycobacterial infections in the chest including:• Kansasii• Xenopus• Abscessus • Fortuitum

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# Abstract Archives of the RSNA, 2024

CHEE-35

## FIBROSING MEDIASTINITIS IN HISTOPLASMOSIS: WHAT THE RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Glenda Peres (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe C. Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
LOUISE FATIMA GOMES DE ALMEIDA (*Abstract Co-Author*) Nothing to Disclose
Bruna Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Daniella B. Parente, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Luiz Carlos Goncalves Motta (*Abstract Co-Author*) Nothing to Disclose
Eleonora Silva (*Abstract Co-Author*) Nothing to Disclose
Marina Da Silva, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Recognize the imaging modalities and protocols of choice for proper evaluation of mediastinal structures in patients with histoplasmosis.• Present the main forms and complications of fibrosing mediastinitis in histoplasmosis cases.• Show the other main differential diagnoses for fibrosing mediastinitis.

### TABLE OF CONTENTS/OUTLINE

• INTRODUCTIONo General overview and definitions of histoplasmosis and fibrosing mediastinitis;o Prevalence, relevance, costs;o Review of mediastinal and pulmonary vascular anatomy;o Overview of physiopathology.• IMAGING TECHNIQUEo Imaging modalities of choice;o Computed tomography;o Angio tomography;o Magnetic resonance;o Perfusion/dual energy CT studies.• IMAGING INTERPRETATIONo Structured imaging analysis;o Main findings of thoracic histoplasmosis;o Airway, arterial, venous and pleural involvement in fibrosing mediastinitis;o What to include in the radiology report.• INTERACTIVE CASE-BASED DIDACTICSo Illustrative cases.• STRATEGIES TO OVERCOME THE CHALLENGING CASESo Imaging characteristics that help in the differential diagnosis;o Key clinical and laboratorial findings;o What to recommend in difficult scenarios.• IMPACT IN PATIENT MORBIDITYo Treatment options;o Post-surgery and follow-up evaluation;o Prognosis.

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# Abstract Archives of the RSNA, 2024

CHEE-36

## HYPERPOLARIZED XENON GAS LUNG MRI IN THE HEALTHY AND DISEASED LUNG

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mohamed A. Ebada, MD (*Abstract Co-Author*) Nothing to Disclose
Robert P. Thomen, PhD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey R. Kunin, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Talissa A. Altes, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Ummul Afia Shammi, PhD (*Abstract Co-Author*) Nothing to Disclose
Cody Thornburgh, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Hyperpolarized Xenon Gas (HXG) MRI is a relatively new-to-market FDA approved imaging agent to evaluate lung ventilation.2. Small airway diseases, like asthma, COPD, and Cystic Fibrosis, have MR ventilation features that increase confidence in diagnosis and assessment of disease severity.3. Xenon gas diffuses from the airways into the lung tissues and blood. HXG MRI allows simultaneously imaging of these various states of xenon gas, termed “dissolved phase imaging.”4. Ongoing research of HXG MRI is revealing new applications for medical imaging, which may aid in the diagnosis of pulmonary hypertension and management of disease.

### TABLE OF CONTENTS/OUTLINE

1. Background/Objectives2. Brief Review of Technique---a. Drug Preparation---b. MR Scanner Configuration---c. Data Analysis3. Ventilation Imaging Characteristics---a. Normal---b. Pathological disease states------i. COPD and Emphysema------ii. Asthma------iii. Cystic Fibrosis------iv. COVID-19------v. Interstitial Lung Diseases4. Dissolved Phase Imaging Characteristics---a. Normal---b. Pathological findings of Small Airway Diseases---c. Pathological findings of Pulmonary Hypertension5. Future Frontiers---a. RBC oscillation and pulmonary hypertension---b. Therapeutic agent monitoring

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# Abstract Archives of the RSNA, 2024

CHEE-37

## COMPLICATIONS OF THE PULMONARY SURGERY WHAT RADIOLOGISTS NEED TO KNOW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Furkan Ufuk, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Radiologists are vital in detecting complications following pulmonary surgery, impacting patient management and outcomes.
- Recognizing imaging signs of common and critical complications ensures timely intervention.
- Key complications include infection, air leaks, and vascular complications.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Role of imaging in the follow-up of pulmonary surgery
- Essential knowledge for radiologists
- Normal Postoperative Imaging
- Expected changes on imaging after common pulmonary surgeries
- Early Complications
- Pneumothorax: Identification and implications
- Hemorrhage: Expected vs. excessive bleeding
- Air Leaks: Manifestations and management
- Infectious Complications
- Empyema: Diagnostic imaging criteria
- Pneumonia: Distinguishing postoperative changes from infection
- Late Complications
- Bronchopleural fistula
- Lung torsion
- Lung hernia
- Pulmonary fibrosis and lung volume reduction
- Advanced Imaging Modalities
- Role of CT, X-ray, and MRI in detecting subtle complications
- The utility of imaging in guiding interventional procedures
- Conclusion
- Overview of critical findings for effective postoperative care
- Future directions in imaging technologies for pulmonary surgery

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# Abstract Archives of the RSNA, 2024

CHEE-38

## SMOKE SIGNALS: A JOURNEY THROUGH SMOKING RELATED PULMONARY PATHOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sukrita Menon, MD (*Abstract Co-Author*) Nothing to Disclose
Ernest M. Scalzetti, MD (*Abstract Co-Author*) Nothing to Disclose
Harikrishnan Nandakumar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Defining the spectrum of entities comprising Smoking Related-Interstitial Lung Diseases (SR- ILD). 2. Exploring the pathogenesis of SR- ILD. 3. Exploring various SR-ILDs including Respiratory bronchiolitis ILD (RB-ILD), Pulmonary Langerhans Cell Histiocytosis (PLCH), Desquamative Interstitial Pneumonitis (DIP), Idiopathic Pulmonary Fibrosis (IPF), and Combined Pulmonary Fibrosis with Emphysema (CPFE) by reviewing the clinical features, characteristic multimodality imaging findings, and pathologic findings. 4. Exploring Electronic Cigarette or Vaping Product Use-associated Lung Injury (EVALI) by reviewing the clinical features, characteristic multimodality imaging findings, and pathologic findings. 5. Discussion of potential imaging conundrums and confounders of each entity within the spectrum and defining specific features that could help direct imaging interpretation, diagnosis and clinical management of patients.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to SR-ILDs: Definition and illustration of spectrum of entities. 2. Pathogenesis of SR-ILDs. 3. Exploring the cigarette smoking related entities: clinical features, characteristic multimodality imaging findings, and pathologic findings.a. RB-ILDb. PLCHc. DIPd. IPFe. CPFE. 4. Exploring the electronic cigarette smoking related patterns of injury: clinical features, characteristic multimodality imaging findings, and pathologic findings. a. Organizing Pneumonia. b. Diffuse alveolar damage. c. Diffuse alveolar hemorrhage. d. Mild nonspecific inflammation. e. Granulomatous pneumonitis. f. Exogenous lipoid pneumonia. g. Respiratory bronchiolitis. 5. Potential imaging conundrums and confounders.

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# Abstract Archives of the RSNA, 2024

CHEE-39

## EPIPERICARDIAL FAT NECROSIS (EFN): ILLUMINATING A HIDDEN CULPRIT IN CHEST PAIN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Danilo P. Bianco, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Abstract Co-Author*) Nothing to Disclose
Rodrigo B. Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Hamilton Shoji, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Caio Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Epipericardial fat necrosis (EFN) often lurks in the shadows of differential diagnoses for chest pain. While clinicians and radiologists diligently explore common culprits such as pulmonary thromboembolism and acute coronary syndrome, EFN remains overlooked. Despite patients experiencing excruciating chest pain, both laboratory tests and electrocardiograms (ECGs) frequently yield normal results. In such cases, the diagnosis relies on imaging exams, usually chest CT scans.This presentation will shed light on ENF: we will discuss the pathophysiology, imaging findings (with focus on chest CT), associated findings, differential diagnosis and follow-up imaging findings.

### TABLE OF CONTENTS/OUTLINE

- Epidemiology and clinical features- EFN findings on Chest CT- EFN findings on other imaging modalities (MRI, PET/CT)- Differential diagnosis that shouldn't be forgotten- Imaging follow-up findings after EFN

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# Abstract Archives of the RSNA, 2024

CHEE-4

## INDIRECT SIGNS OF PULMONARY EMBOLISM: SELF-ASSESSMENT AND REVIEW OF CONCEPTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Paulo T. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Danilo P. Bianco, MD (*Abstract Co-Author*) Nothing to Disclose
Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Gabriel Figueiredo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Demonstrate that the diagnosis of pulmonary thromboembolism may not be suspected in the initial clinical evaluation, prompting non-targeted studies such as chest radiographs and non-contrast chest tomographies.- Demonstrate the wide range of clinical presentations and imaging findings related to pulmonary embolism.- Review the most common imaging findings of pulmonary embolism in non-targeted studies through self-assessment questions, expanding the radiologist's repertoire.- It is essential for radiologists to remain aware of indirect signs of PE in non-targeted studies (without contrast or without dedicated angiographic technique), in which this diagnosis may not have been initially suspected clinically.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTIONHighlight the variety of clinical presentations and imaging findings that may come to the radiologist's attention in the context of PE, summarizing the indirect signs to look for in non-directed studies.DIRECT SIGNSHighlight through different imaging studies what is considered a direct sign of PE.INDIRECT SIGNS• PULMONARY PARENCHYMA:Summarize the imaging features of pulmonary infarctions, differentiate from other conditions, discuss suspicion criteria, early signs, and progression.Explain the mosaic perfusion pattern, its appearance, differentials, and imaging representation.Demonstrate hyperperfusion edema in PE, its imaging aspects, and mechanism.• VASCULAR CALIBER VARIATIONS:Show how thrombi can alter vascular caliber in acute and chronic contexts, or how they can be detected in non-directed exams.• IODINE MAP:Demonstrate the imaging appearance of the iodine map and how it aids and suggests the diagnosis of PE.

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# Abstract Archives of the RSNA, 2024

CHEE-40

## A (W)HOLE-SOME APPROACH TO CYSTIC LUNG DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Ajith Varrior, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To differentiate a true pulmonary cyst(s) from its mimics2. To learn the step-wise approach to narrow down the list of differential diagnoses and arrive at a specific diagnosis3. To discuss specific cystic lung diseases

### TABLE OF CONTENTS/OUTLINE

1. What is cystic lung disease (air-filled structures versus fluid filled in rest of the body)? 2. Differentiation of true pulmonary cysts from cystic appearing lesions (cavity, bulla, pneumatocele, emphysema, honey combing, cystic bronchiectasis)3. Number of cysts: Are cysts solitary or localized versus multiple or diffuse?4. What is the distribution of cysts (upper lobe or lower lobe or subpleural)?5. Association with other pulmonary (nodules, ground glass) and extra-pulmonary findings (like renal tumors, plasma cell dyscrasia, autoimmune conditions)6. Algorithmic approach to cystic lung disease7. Discussion of specific entitiesLangerhans cell histiocytosis (LCH), Lymphangiomyomatosis (LAM), Lymphoid interstitial pneumonia (LIP), Birt Hogg Dube syndrome (BHD), amyloidosis, tracheobronchial papillomatosis, neurofibromatosis, cystic metastasis, congenital pulmonary airway malformation (CPAM) and bronchogenic cysts, Pneumocystis carini pneumonia (PCP) and desquamative interstitial pneumonia (DIP), cystic metastasis

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# Abstract Archives of the RSNA, 2024

CHEE-41

## IMAGING SPECTRUM OF PULMONARY HISTOPLASMOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcela Rosa, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Paulo T. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Abstract Co-Author*) Nothing to Disclose
Elaine Yanata, MD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Nunes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Histoplasmosis stands as the most prevalent endemic fungal disease in the U.S., with significant incidence in Central and South America. While primarily targeting the lungs, it can disseminate systemically based on the patient’s immune status and the quantity of inhaled fungus.The disease poses a significant diagnostic challenge, given the limited availability and sensitivity of non-invasive tests. Consequently, imaging examinations are usually part of the diagnostic process. Histoplasmosis manifests in diverse patterns on chest X-rays and computed tomography scans, varying with the disease stage and patient's immune response.It is paramount that radiologists remain cognizant of these potential findings. This presentation offers a didactic exploration of radiological findings across various clinical stages and forms of histoplasmosis, complemented by pertinent literature review.

### TABLE OF CONTENTS/OUTLINE

Brief review of relevant epidemiology and pathophysiologyClinical presentations: acute pulmonary histoplasmosis X subacute pulmonary histoplasmosis X chronic pulmonary histoplasmosis X disseminated progressive histoplasmosis Different presentations on chest CT: calcified lung nodules, disseminated micronodular disease, solitary pulmonary nodule (histoplasmoma), heterogeneous consolidation with enlarged lymph nodes, isolated enlarged lymph nodes, fibrosing mediastinitis, central airway involvementDiscussion of 18-FDG PET/CT as a complementary imaging modality (flip-flop sign as a potential auxiliary finding to differentiate histoplasmosis from lung cancer)Relevant differential diagnosis Conclusion and take home messages

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# Abstract Archives of the RSNA, 2024

CHEE-42

## A CASE BASED REVIEW OF INHALATIONAL LUNG DISEASES: IMAGING FINDINGS AND CLINICAL FEATURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ryosuke Taiji, MD (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Nagaaki Marugami (*Abstract Co-Author*) Nothing to Disclose
Dan Yamamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Aya Yamada, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Inhalational lung diseases are caused by dust exposure, residential environment, smoking habits, pet keeping, and poisoning. These diseases occasionally show an upper lobe-predominant distribution with various imaging findings. Radiologists need to know more about each disease and obtain a detailed medical and exposure history.The purposes of this exhibit are: To depict typical imaging findings of inhalational lung diseasesTo discuss the clinical and radiological findings, and differential diagnosis

### TABLE OF CONTENTS/OUTLINE

1. Hypersensitivity pneumonitis (HP) Nonfibrotic HP: Fungi (e.g. Summer-type and Humidifier lung) Bird fancier’s lung Hot tub lung (Mycobacterium avium) Fibrotic HP: Bird fancier’s lung 2. Occupational lung disease Dust and fume inhalation: Pneumoconiosis (e.g. Silica, Fume and Stainless-steel) Asbestos-related diseases: Pleural plaque Benign asbestos pleural effusion, Diffuse pleural thickening, Round atelectasis Malignant pleural mesothelioma 3. Smoking-related disease Emphysema Airspace enlargement with fibrosis (AEF) Respiratory bronchiolitis-associated interstitial lung disease (RB-ILD) Desquamative interstitial pneumonia (DIP) Langerhans cell histiocytosis (LCH) 4. Poisoning and miscellaneous Chemical inhalation (e.g. Disinfectant and Bleach) Burn injury and smoke inhalation Lipoid pneumonia (e.g. Petroleum and Toluene)

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# Abstract Archives of the RSNA, 2024

CHEE-43

## THORACIC IMAGING MANIFESTATIONS OF IGG-4 RELATED DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Caroline Novis, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leticia Cardoso Ern, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Camila S. Franco, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Thiago Matheus Santos Rios, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

IgG4-related disease (IgG4-RD) is a systemic fibroinflammatory disorder with characteristic histologic findings (tumefactive lesions with IgG4-positive plasma cells and lymphocytic infiltration associated fibrosis), and may or may not coincide with elevated serum IgG4 levels. Diagnosis relies on histopathologic, serological, and radiological features. Chest involvement in IgG4-RD includes lymph node enlargements, pleuropulmonary involvement, and cardiovascular disease. Radiologists should consider IgG4-RD in their diagnoses due to significant diagnostic and prognostic value.1. Prototype the thoracic findings of IgG4-RD;2. Identify the key thoracic findings of IgG4-RD in cases with histopathological confirmation;3. Determine the importance of maintaining IgG4-RD as a differential diagnosis in the appropriate clinical-radiologic context.

### TABLE OF CONTENTS/OUTLINE

1. Introductiona) Epidemiology, physiopathology and clinical aspects of the IgG4-RD.2. The recent diagnostic criteria of American College of Rheumatology/European League against Rheumatism (ACR/EULAR) for IgG4-RD probability - repercussions in clinical practice and recommendations3. IgG4-RD associated thoracic imaging features - Case-by-case discussion reviewa) Paravertebralb) Retromediastinal fibrosisc) Cardiac Interstitial diseased) Ground-glass opacitiesPeribronchovascular involvemente) Lymph node enlargementf) Pleural disease4. The mimics of IgG4-RD in thoracic manifestations - including vascular, pleural, mediastinal and airway involvement.5. Conclusions "take-home messages"

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# Abstract Archives of the RSNA, 2024

CHEE-44

## FROM SCAN TO INCISION: A COMPREHENSIVE GUIDE FOR RADIOLOGISTS TO EMPOWER SURGEONS IN IDEAL MANAGEMENT OF BLUNT TRAUMATIC AORTIC INJURY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaz Asadian, MD (*Abstract Co-Author*) Nothing to Disclose
Nastaran Hosseini (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Familiarize radiologists with the latest surgical classifications of blunt aortic injuries.Highlight the details surgeons need from radiologists for ideal management of different blunt traumatic aortic injuries.Review multimodality imaging features of blunt traumatic aortic injury.Review current recommendations and surgical managements for different blunt traumatic aortic injuries.Review Imaging pitfalls and mimics of blunt traumatic aortic injuries.

### TABLE OF CONTENTS/OUTLINE

Review the anatomy and histology of aorta relevant to traumatic injuries.Updated grading and classification systems used by surgeons for blunt traumatic injuries.Role of multimodality imaging in detection and follow up of blunt traumatic injuries.Overview of imaging protocols ideal for detection of blunt traumatic injuries in emergency settings.Review of the definition, key imaging findings, and what surgeons need to know for:• minimal aortic injury• aortic laceration• pseudoaneurysm• intramural hematoma• aortic transectionExpected and unexpected imaging findings in post treatment imaging of blunt traumatic aorta injuries.Review imaging pitfalls and mimics of blunt traumatic aortic injuries with emphasis on improving protocols for imaging the aorta.

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# Abstract Archives of the RSNA, 2024

CHEE-45

## THIS CHEST LOOKS ABNORMAL: SEQUEL OF INFANT AND CHILDHOOD DISORDERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Azadeh Hojreh, MD (*Abstract Co-Author*) Nothing to Disclose
Daria Kifjak, MD (*Abstract Co-Author*) Nothing to Disclose
Svitlana Pochepnia (*Abstract Co-Author*) Nothing to Disclose
Benedikt H. Heidinger, MD (*Abstract Co-Author*) Nothing to Disclose
Helmut Prosch, MD (*Abstract Co-Author*) Support, Boehringer Ingelheim GmbH;Support, F. Hoffmann-La Roche Ltd;Support, Merck & Co, Inc;Support, Bristol-Myers Squibb Company;Support, Novartis AG;Support, AstraZeneca PLC;Support, Takeda Pharmaceutical Company Limited;Support, Siemens AG;Support, Bayer
Lucian Beer, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Aida Korajac, MD (*Abstract Co-Author*) Nothing to Disclose
Ruxandra-Iulia Milos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) The diagnosis of developmental lung anomalies or infancy-acquired lung disorders later in adulthood can be challenging and often mistaken for something threatening. 2) The main categories can be divided in: diseases of the tracheobronchial system; diseases of the lung parenchyma, including congenital lung lesions, prematurity-related chronic lung disease, surfactant function disorders and post infectious abnormalities; and diseases of the vascular system. 3) Systematic approach and analysis of the imaging features on chest X-ray, CT and MRI are useful in facilitating the diagnosis.

### TABLE OF CONTENTS/OUTLINE

1) Diseases of the tracheobronchial system include primary ciliary dyskinesia, cystic fibrosis, alpha-1 antitrypsin deficiency, as well as the tracheobronchial branching abnormalities. 2) Congenital lung lesions most often encountered are the congenital pulmonary airway malformations (CPAMs), the bronchopulmonary sequestration (BPS), congenital lobar emphysema (CLE) and the bronchogenic cysts. 3) The prematurity-related chronic lung disease is related to the bronchopulmonary dysplasia (BPD) that often develops after mechanical ventilation in prematurely born infants with respiratory failure. 4) Disturbance of surfactant homeostasis can lead to development of pulmonary alveolar proteinosis and nonspecific interstitial pneumonia. 5) Postinfectious bronchiolitis obliterans or the hyperlucent lung syndrome is a rare complication of pulmonary infections in the childhood. 6) Vascular anomalies include interruption or absence of a main pulmonary artery, anomalous origin of the pulmonary arteries, anomalous pulmonary venous drainage, and pulmonary arteriovenous malformations.

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# Abstract Archives of the RSNA, 2024

CHEE-46

## PARENCHYMAL PULMONARY COMPLICATIONS IN PATIENTS WITH LUNG NEOPLASMS TREATED WITH RADIATION THERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Santiago Carbullanca, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Gayete Cara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose Maria Maiques Llacer, MD (*Abstract Co-Author*) Nothing to Disclose
Gemma Solana, MD (*Abstract Co-Author*) Nothing to Disclose
Alvaro Martinez (*Abstract Co-Author*) Nothing to Disclose
Diego Ramal, MD (*Abstract Co-Author*) Nothing to Disclose
Flavio Zuccarino, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Ivan Martinez Cano, MD (*Abstract Co-Author*) Nothing to Disclose
Francesco Amorelli (*Abstract Co-Author*) Nothing to Disclose
Paulina Miranda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The goal is to identify the different radiological patterns caused by radiation therapy in the lung parenchyma, along with their frequency and progression. It also aims to recognize the warning signs that help differentiate between expected post-radiation therapy changes and tumor recurrence.

### TABLE OF CONTENTS/OUTLINE

Radiation therapy provides local treatment for pulmonary neoplasms but can cause damage to surrounding tissues, particularly the lung parenchyma. Thus, distinguishing between post-radiation therapy changes and potential tumor recurrence or other non-radiation-induced pulmonary pathologies is crucial.In this work:- Classification: Post-radiation therapy changes are classified into early ( < 6 months) and late ( > 6 months). - Imaging Findings: We analyze the most common imaging findings: peri-bronchial consolidation, ground-glass opacities, and mass-like or scar patterns. - Complications: We evaluate potential complications. - Correlation: We correlate these findings with the radiation therapy plan, including duration, dose, and irradiated field. - Warning Signs: We highlight key warning signs indicating tumor recurrence or non-radiation-induced pathology, such as lesions outside the irradiated area, changes in lesion size after 12 months post-radiation therapy, or new-onset atelectasis.Radiation therapy is crucial in managing thoracic neoplastic lesions. Radiologists must understand post-treatment changes and potential complications, and be able to recognize warning signs of tumor recurrence or non-radiation-induced pathologies

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# Abstract Archives of the RSNA, 2024

CHEE-47

## ARTIFICIAL INTELLIGENCE APPLICATIONS IN LUNG CANCER: CURRENT STATUS AND FUTURE PERSPECTIVES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vita Ida Gallone, MD (*Abstract Co-Author*) Nothing to Disclose
Gianluca Milanese, MD (*Abstract Co-Author*) Nothing to Disclose
Carlotta Zilioli, MD (*Abstract Co-Author*) Nothing to Disclose
Nicola Sverzellati, MD (*Abstract Co-Author*) Nothing to Disclose
Rebecca Mura, MD (*Abstract Co-Author*) Nothing to Disclose
Ludovica Leo (*Abstract Co-Author*) Nothing to Disclose
Cristina Marrocchio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Have a comprehensive view of the possible applications of AI in lung cancer, from screening to prediction of treatment response2. Review the main AI techniques that can be used, including radiomics, machine learning, deep learning, and large language model3. Have detailed information and examples on the roles of AI in improving image quality, detecting lung cancer, assessing patients' comorbidities, and generating predictive models4. Be informed on current limitations and future developments in the field

### TABLE OF CONTENTS/OUTLINE

1. Main applications of artificial intelligence (AI) in lung cancer, from image acquisition to predictive models1. of 2. Review the basic knowledge of AI tools, including radiomics and machine learning, deep learning, large language models1. 3. Applications in lung cancer screening:• Risk prediction• Nodule identification and classification• Comorbidities assessment• Report writing and communication with patients4. 1. Applications in providing clinically important information on the identified lesion:• Lesion characterization, e.g., histological type• Prediction models, including response to treatments and recurrence

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# Abstract Archives of the RSNA, 2024

CHEE-48

## CHEST WALL TUMORS, WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Pividori (*Abstract Co-Author*) Nothing to Disclose
Marcos A. Mestas Nunez SR, MD (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Dulcich SR, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Aylen Gonzalez Gonzalez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Chest wall neoplasms are uncommon entities that represent approximately 5% of all thoracic malignancies. Unfamiliarity with these lesions can pose a diagnostic dilemma. Radiologists must be acquainted with the imaging findings, differential diagnoses and complications of these neoplasms. With this exhibit we will:Review the typical imaging findings of chest wall neoplasms.Review the classification based on a wide range of tissues of origin.Discuss the usefulness of imaging methods to elucidate the origin and/or tissue composition of these lesions along with reviewing the evaluation for vascularization and local invasion.

### TABLE OF CONTENTS/OUTLINE

1. Introduction and Clinical characteristics2. Role of different modalities.3. Entities based on tissue originPrimary tumorsi. Cartilaginous and osseous tumors: 1. Fibrous dysplasia2. Osteochondroma3. Enchondroma 4. Chondrosarcoma5. Osteosarcoma6. Ewing sarcoma7. Multiple Myeloma. ii. Soft-tissue tumors:1. Lipoma2. Liposarcoma3.. Schwannoma4. Neurofibroma5. Elastofibroma dorsi6. Desmoid tumor7. Undifferentiated pleomorphic sarcomaSecondaryi. Metastasisii. Lymphomaiii. Radiation induced malignancy4. Differential diagnosisi. Infectionsii. Congenital anomaliesiii. Post-traumatic injuriesiv. Vascular malformations5. Conclusions - Summary

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# Abstract Archives of the RSNA, 2024

CHEE-49

## BEYOND THE SMOKE: EXPLORING LUNG CANCER IN NON-SMOKERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Efren J. Flores, MD (*Abstract Co-Author*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria D. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Farouk Dako, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Gabriel Camareno-Soto, BSc (*Abstract Co-Author*) Nothing to Disclose
Delmarie Rivera Rodriguez, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Roughly 10-20% of lung cancers (LC) arise in non-smokers, presenting unique risk factors and biological traits crucial for accurate diagnosis and management. Radiologists must cultivate a knowledge-based toolkit to discern distinctive imaging features, enhancing precision in diagnosis and management recommendations for LC in this patient cohort. Attendees will leave prepared to handle LC challenges in non-smokers, armed with insights into future epidemiological trends, new risk factors, and cutting-edge imaging. Thus, the purpose of this exhibit is to:1. Provide an overview of the epidemiology related to LC among non-smokers and pertinent risk factors, such as environmental exposures, and genetic risk factors. 2. Review the distinctive imaging features including variations in tumor location, morphology, and response to treatment. 3. Describe advancements in risk modeling, utilizing imaging technology and data science, to address LC in non-smokers.

### TABLE OF CONTENTS/OUTLINE

1. Introduction:a. LC trends in non-smokers b. Epidemiological risk factors for developing lung cancer in non-smokers c. Eligibility criteria for LC screening 2. Case based radiological patterns of LC in non-smokers: a.Variations in tumor location and morphology b.Imaging characteristics of different histological subtypes 3. Future directions for early detection, diagnosis and monitoring using imaging modalities a. Overview of new risk stratification models that incorporate exposures and genetics as risk factors for LC in non-smokers. b. Discuss the role of computed tomography, magnetic resonance imaging, and molecular imaging to aid in diagnosis of LC. 4. Conclusion

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# Abstract Archives of the RSNA, 2024

CHEE-5

## CLINICOPATHOLOGICAL CORRELATION OF MULTIPLE CYSTIC LESIONS IN THE LUNG

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tomoe Sawazumi (*Abstract Co-Author*) Nothing to Disclose
Takashi Ogura, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Shionogi & Co, Ltd;Speakers Bureau, Astellas Group
Ryo Aoki (*Abstract Co-Author*) Nothing to Disclose
Ryota Otoshi (*Abstract Co-Author*) Nothing to Disclose
MAI MATSUMURA (*Abstract Co-Author*) Nothing to Disclose
Tomohisa Baba, MD (*Abstract Co-Author*) Speaker, AstraZeneca PLC;Consultant, AstraZeneca PLC;Speaker, DAIICHI SANKYO Group;Consultant, DAIICHI SANKYO Group;Speaker, Merck KGaA;Consultant, Merck KGaA;Speaker, Boston Scientific Corporation;Speaker, The Nippon Synthetic Chemical Industry Co, Ltd;Speaker, Boehringer Ingelheim GmbH;Speaker, Toray Industries, Inc;Speaker, Shionogi & Co, Ltd;Speaker, Astellas Group;Speaker, AMCO Inc;Speaker, Asahi Kasei Medical Co, Ltd;Speaker, Otsuka Holdings Co, Ltd;Speaker, Ono Pharmaceutical Co, Ltd;Speaker, Bristol-Myers Squibb Company;;;;;
Tamiko Takemura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
NAOFUMI YASUDA (*Abstract Co-Author*) Nothing to Disclose
Tae Iwasawa, MD, PhD (*Presenter*) Support, Canon Medical Systems Corporation;Support, Ziosoft Inc;Speaker, FUJIFILM Holdings Corporation;Speaker, Boehringer Ingelheim GmbH

### TEACHING POINTS

A cyst is any circumscribed and well-defined air-containing structure in the lung parenchyma. Cystic lesions occur due to various mechanisms such as airway obstruction with distal airspace dilatation (a check-valve mechanism), necrosis of airway walls, or lung parenchymal destruction by proteases. Cysts typically contain air, although, in some cases, they may be filled with fluid.In this exhibit, we will present computed tomography images and the histology of patients with multiple cystic lesions to explore their pathogenesis. Some cystic lesions increase in size over time, and we will illustrate the progression of the cystic lesions.

### TABLE OF CONTENTS/OUTLINE

1, Rare cystic lung disease Langerhans cell histiocytosis, Birt-Hogg-Dubé syndrome, lymphoid interstitial pneumonia, lymphangioleiomyomatosis (Figure 1) 2, Cystic lesions in genetic diseases; Neurofibromatosis, Down syndrome 3, Cystic lesions in infectious disease; pneumocystis pneumonia 4, Cystic lesions in collagen vascular diseases; Sjögren syndrome (Figure 2), antineutrophilic cytoplasmic antibody-associated vasculitis (Figure 3) 5, Cystic lesions in smokers; admixed emphysema and thick-walled large cysts as observed in combined pulmonary fibrosis and emphysema (Figure 4) 6, Others; cyst formation in multicentric Castleman’s disease, benign metastasizing leiomyoma (Figure 5)

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# Abstract Archives of the RSNA, 2024

CHEE-50

## ROLE OF IMAGING IN DIAGNOSIS AND CHARACTERIZATION OF PROGRESSIVE FIBROTIC INTERSTITIAL LUNG DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Stephen Hobbs, MD (*Abstract Co-Author*) Author with royalties, Wolters Kluwer nv;Author with royalties, RELX
Jeffrey P. Kanne, MD (*Abstract Co-Author*) Research Consultant, PAREXEL International Corporation;
Sreeja Sanampudi, MD (*Abstract Co-Author*) Nothing to Disclose
Kiran Batra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Interstitial lung disease (ILD) is a broad spectrum of pulmonary conditions that include idiopathic pulmonary fibrosis (IPF), connective tissue disease-ILD (CTD-ILD), hypersensitivity pneumonitis (HP), sarcoidosis, non-specific interstitial pneumonia (NSIP), amongst others. These non-IPF disease entities can present as fibrotic interstitial lung disease (F-ILD) or progressive F-ILD (also known as progressive pulmonary fibrosis (PPF)), which is disease progression despite adequate treatment. There is a growing prevalence of ILD and PPF, and clinicians face certain challenges regarding ambiguous categorization of disease, poor risk stratification, and lack of guidelines regarding the use of antifibrotic therapy. Diagnosis of PPF on high resolution computed tomography (HRCT) has recently been validated within a subset of criteria that can help identify a progressive phenotype in individuals with non-IPF ILD.

### TABLE OF CONTENTS/OUTLINE

• Define Progressive Fibrotic ILD and differentiate between Progressive fibrotic ILD and fibrotic ILD • Importance and role of imaging in diagnosing Progressive Fibrotic ILD • Schematic representation of the prevalence of the ILDs that may be associated with "Progressive Pulmonary Fibrosis (despite management)". • Describe the HRCT phenotypes and signs of progression. • Identify role of automated methods for identifying disease progression in the above setting.

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# Abstract Archives of the RSNA, 2024

CHEE-51

## THORACIC ULTRASOUND MADE SIMPLE: A COMPREHENSIVE GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joaquin Martinez Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Agustina Picarel, MD (*Abstract Co-Author*) Nothing to Disclose
Pilar Navarro Azurmendi, MD (*Abstract Co-Author*) Nothing to Disclose
Maria C. Ferrario, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos J. Padin, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Francisco Linan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the essentials of thoracic anatomy in ultrasound.To approach the proper examination protocols and technique. To discuss the various clinical applications of thoracic ultrasound.Pleural effusion.Pneumothorax.Pulmonary consolidations.Empyema.Rib fracture.To highlight the advantages and disadvantages of thoracic ultrasound, in comparison with other modalities.To ensure the radiologist role and the unique ability of thoracic ultrasound to provide dynamic, real-time information, facilitating rapid decision-making in acute clinical situations.

### TABLE OF CONTENTS/OUTLINE

Introduction to thoracic ultrasound.Anatomy and examination Technique.Anatomical approachB-modeM-modeLinear and convex transducer.Clinical ApplicationsPleural effusion.Pneumothorax.Pulmonary consolidations.Empyema.Rib fracture.Comparison with other diagnostic modalities.Conclusion

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# Abstract Archives of the RSNA, 2024

CHEE-52

## EXPLORING IMMUNOSEROLOGY AND LUNG IMAGING IN RHEUMATIC DISORDERS: A RADIOLOGIST'S GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Omar Andres Pantoja Burbano, MD (*Abstract Co-Author*) Nothing to Disclose
Maria C. Perez Alvarado, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Aluja, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Andres F. Mejia Leon, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Interpretation of immunoserological findings in the context of different rheumatic conditions, is key for radiologists' daily practice, to overcome diagnostic challenges and improve accuracy in clinical decision-making. • Correlating characteristic imaging findings associated with rheumatic lung manifestations and different seroinmunological markers can guide the interpretation of lung imaging studies. • A proper correlation between immunoserological profiles and lung imaging findings in different rheumatic disorders can improve clinical outcomes. • Is important to recognize common pitfalls in the interpretation of immunoserology and lung imaging in rheumatic disorders.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Chest CT manifestations and histopathologic patterns seen in rheumatic diseases.
- Chest findings, beyond the lung parenchyma.
- Main serologic tests based on HRCT or Histologic Pattern on biopsy, or both, in the context of the absence of a clear phenotype.
- Clues to identify pulmonary disease and suspect underlying rheumatic syndrome.
- Schematic representation of the most used serologic tests.
- Expected radiological appearance and common pitfalls.
- Take home points!

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# Abstract Archives of the RSNA, 2024

CHEE-53

## LUNG CANCER IN ASIA - A BURGEONING CRISIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Srujana Ganti, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Bimal Mayur Kumar Vora (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 1.To raise awareness of the Lung cancer burden in Asia2. 2.Highlight how lung cancer in Asia is different to that in the West3. 3.Discuss lung cancer screening problems that are specific to the Asian continent4. 4.Discuss some potential solutions

### TABLE OF CONTENTS/OUTLINE

Lung cancer is a one of the most lethal cancers worldwide. Lung cancer in Asia, specifically, makes up a significant proportion of the global burden and the tumour biology as well as risk factors are different to that in the west. The poster will give an overview of lung cancer and its subtypes.It will then discuss the disease burden in Asia, ephasising the magnitude of the problem. The various risk factors, in addition to tobacco will be reviewed. The differences in tumour biology of Lung cancer in Asia to the west will be discussed, highlighting how this would affect treatment and management of lung cancer. Lung cancer screening has the potential to improve the early detection of cancer and improve mortality. However, it comes at significant healthcare costs and a robust infrastructure is required to be in place. The poster will give an overview of some of the existing screening programmes in Asia and also some of the challenges that are faced. Some potential solutions will also be discussed.

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CHEE-54

## REVIEW OF NAVIGATIONAL BRONCHOSCOPY PLANNING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Gange JR, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc Stockholder, Bristol-Myers Squibb Company Research Consultant, Bayer AG Medical Advisory Board, AIxSCAN, Inc Shareholder, AIxSCAN, Inc
Colby Shreve (*Abstract Co-Author*) Nothing to Disclose
Mamta Gupta (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•Identification of key anatomical structures relevant to bronchoscopy navigation.? •Recognition of anatomical variations and their impact on procedural success.? •Techniques for precise lesion localization using imaging landmarks.? •Importance of accurate targeting for successful biopsy or treatment.? •Utilization of imaging data to create virtual bronchoscopy maps.? •Assessment of potential risks based on imaging findings.? •Strategies for minimizing risks during bronchoscopy procedures.? •Case based discussion on challenging cases and decision-making processes.

### TABLE OF CONTENTS/OUTLINE

• Overview of navigational bronchoscopy. • Role of imaging in procedural planning. •Discussion on optimal CT protocol Integration of Imaging with Navigational Systems and creation of virtual bronchoscopy maps from imaging data. •Assessment of procedural risks based on imaging. •Discussion of potential complications. •Review of case examples demonstrating planning.

# Abstract Archives of the RSNA, 2024

CHEE-55

## AI-DRIVEN LUNG CANCER SCREENING PROGRAM: OPPORTUNITIES AND CHALLENGES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Abstract Co-Author*) Nothing to Disclose
Syed Muhammad Awais Bukhari, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To outline key statistics of lung cancer and review the current state of lung cancer screening in United States. 2. To learn about various currently available AI models and their role in lung cancer screening program 3. To understand the process of clinical deployment of AI technologies in lung cancer screening and the challenges involved.

### TABLE OF CONTENTS/OUTLINE

1. Lung Cancer: Clinical and Epidemiological Considerations o Risk Factors o Disease Burden in the USA o Current State of Screening Programs 2. Low Dose Lung Cancer Screening: Rationale o Trials: NLCST and NELSON trial o Lung-RADS o USPSTF Recommendations 3. Utility of AI technologies in the Lung Cancer Screening Program o Role in Imaging Analysis > Deep CNN-based AI algorithms > NLP and Dashboards o Role in Histopathological Analysis e.g. diagnosis and staging of tumor o Role in Biomarker Quantification: e.g. PDL-1 status o Role in Radiogenomics: e.g. tumor mutation burden determination o Additional Applications § Quality control and image enhancement § Reduction of observation errors and false negatives § Efficiency and Workflow Optimizations 4. Clinical Deployment of AI Tools in Lung Cancer Program and Involved Challenges o End-to-end pipeline for the clinical deployment of AI tools in the Lung Cancer Program o Challenges § Issues with Generalizability and data bias § Ethical and Regulatory Considerations § Integration dilemmas into clinical practice 5. Future Directions o Prescreening risk assessment characterization o Generation of patient-centric CT report o Liquid biopsies o Virtual biopsy technique o AI-aided ultra-low dose PET/CTs o AI-aided ultrashort echo time MR scanners

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# Abstract Archives of the RSNA, 2024

CHEE-56

## BURNING OUT? TRY THE MRSA (MAKING REPORTING SEXY AGAIN) PILL WITH 50 MG AI AND 5 MG LLMS!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Shambo Guha Roy, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Lina Karout, MD (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Parisa Kaviani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understanding the etiology and characteristics of burnout in radiology 2. Knowledge of available quantitative AI tools for reducing onerous aspects of radiology reporting 3. Strategies for the substance of AI outputs with the style of LLMs for bringing joy and efficiency to radiology reporting. 4. Understanding the operating and breaking scenarios for different AI tools in thoracic imaging

### TABLE OF CONTENTS/OUTLINE

1. Graphic summary of spiraling workload and burnout in radiology 2. Understanding the mundane, repetitive tasks in radiology reporting 3. Strengths and weakness of multi-vendor artificial intelligence (AI) tools for thoracic imaging 4. Where and how AI and large language models (LLMs) deliver the MRSA pill?

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# Abstract Archives of the RSNA, 2024

CHEE-57

## APPLICATIONS OF LARGE LANGUAGE MODELS IN CARDIOTHORACIC IMAGING: A PRIMER FOR RADIOLOGISTS AND CARDIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Abstract Co-Author*) Nothing to Disclose
Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Syed Muhammad Awais Bukhari, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand various Large Language Models (LLMs) and their functionality 2. To review currently available LLMs in the cardiothoracic imaging space 3. To highlight the role and applicability of LLMs in cardiothoracic imaging

### TABLE OF CONTENTS/OUTLINE

1. Large Language Models: A Primer o What are LLMs and their types? o Evolution of LLMs 2. LLMs in Radiology Workspace o RadBERT o ClinicalRadioBERT o Custom GPTs 3. Potential applications of LLMs in cardiothoracic imaging o Radiology reporting • Proofreading the reports • Potential time-saving with chest X-ray • Summarization of clinical history • Assisting with cardiac MRI reporting (structuring and adding guidelines) • Patient-centric reports and education (Simplifying the complex reports for patients) o Educational Applications • Instant Information Source • Evidence-based interactive learning • Case-based Exam Preparation • Quick Literature Review o Simplifying Complex Classifications e.g. Fleischner o Intelligent differential diagnosis o Information curation for lung cancer tumor board and ILD multidisciplinary discussions (combining Radiological, pathological, and Clinical information) o Assistance with Reporting to ACR for lung cancer screening program (Capture all the necessary elements to meet the ACR certification ) 4. Limitations of LLMs and mitigation tactics o Dependency on Training Data o Inaccurate Response Generation (Hallucination) o Poor complex reasoning o Probabilistic Nature (Stochasticity) o HIPAA Compliance o Bias o Radiologist Over-reliance o Operation costs 5. Future Directions o Need for robust radiology-specific LLMs o Multimodal medical LLMs o Seamless integration with EHR, RIS, and PACS

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# Abstract Archives of the RSNA, 2024

CHEE-58

## FEBRILE NEUTROPENIA: A PRACTICAL APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alex Ha (*Abstract Co-Author*) Nothing to Disclose
Maya Vella, MD (*Abstract Co-Author*) Nothing to Disclose
Adam J. Yen, MD (*Abstract Co-Author*) Nothing to Disclose
Shravan Sridhar, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Febrile neutropenia presents a challenging clinical dilemma and treatment success relies on early diagnosis and targeted antimicrobial therapy. Often, clinical teams look to radiologists to help narrow the differential diagnosis when a neutropenic patient's thoracic CT contains findings concerning for infection. Here, we examine the role of imaging and CT-guided biopsy in the management of febrile neutropenia, present an approach wherein clinical information is paired with a CT pattern to help the radiologist make an educated guess as to the underlying causative agent, and specify where either clinical information or imaging appearance can serve more useful.

### TABLE OF CONTENTS/OUTLINE

1. Introduce the problem2. Clinical presentation3. Initial workup (including imaging workup)4. Patternsa. Consolidation (±satellite nodules)b. Cavitary consolidationc. Nodulesd. GGOe. Halof. Reverse halog. Thoracic wall involvement5. Helpful clinical informationa. Time courseb. Antimicrobial responsec. Procalcitonind. B-D-Glucane. Galactomannanf. Serologiesg. BAL aspirate microscopyh. Cultures6. Less than 1 week from onseta. Consolidation/nodules - common bacteria i. Gram+ bacteria (MRSA, VRE) ii. Gram- (pseudomonas)b. GGO - mostly viral i. EBV, CMV, other viruses ii. PJP7. Consolidation/nodules + non-response to broad spectrum antibiotics - fungia. Candidab. Aspergillusc. Mucormycosisd. Tb8. Other organisms to consider - uncommon bacteriaa. Nocardiab. Actinomycesc. Tb9. Utility of biopsya. Fungal infectionb. Malignancyc. Non-diagnostic biopsyd. Platelet management10. Summary by imaging appearance11. Summary by helpful clinical information12. References

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CHEE-59

## THE SMOKING GUN: SMOKING RELATED PULMONARY PARENCHYMAL DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rocio Perez Johnston, MD (*Abstract Co-Author*) Nothing to Disclose
Carlyne Cool, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos A. Mestas Nunez SR, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Tami J. Bang, MD (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Dulcich SR, BMedSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cigarette smoking continues to have a significant impact on the general population's health. The majority of morbidity and mortality from smoking is secondary to lung cancer, coronary artery disease, and chronic obstructive pulmonary disease (COPD). Additionally, a significant number of patients will develop diffuse parenchymal involvement related to smoking.Smoking related diffuse lung diseases comprise a heterogeneous group of disorders that can be classified into inflammatory (mostly chronic) and fibrotic entities. Despite their characteristic imaging findings with good pathologic correlation, they may overlap and it is not uncommon to see more than one entity in pathology. With this exhibit we will:- Review the imaging findings COPD related lung disease- Review clinical, imaging and pathological appearance of smoking related diffuse lung diseases- Highlight the spectrum of fibrotic findings related to smoking - Brief review of vaping and marijuana users associated lung injury

### TABLE OF CONTENTS/OUTLINE

1) Overview2) Entitiesa) COPD relatedChronic Bronchitis EmphysemaVanishing lung syndromeb) Smoking related diffuse lung disease i) InflammatoryAcute eosinophilic pneumoniaRespiratory bronchiolitisDesquamative Interstitial PneumoniaPLCHII) FibroticIPFSmoking related fibrosis (SRIF - AEF)CPFE3) ILAs4) Vaping - Marijuana users injury 5) Conclusions

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# Abstract Archives of the RSNA, 2024

CHEE-6

## DIAGNOSTIC IMAGING OF ESOPHAGEAL FISTULAS: INDIRECT AND DIRECT SIGNS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Linda B. Haramati, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Ami N. Rubinowitz, MD (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Mamta Gupta (*Abstract Co-Author*) Nothing to Disclose
Abhishek R. Keraliya, MD (*Abstract Co-Author*) Nothing to Disclose
Mihai O. Andreca, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The esophageal wall is inherently weak because it lacks a serosal layer which makes it vulnerable to perforation.2. Chest CT with oral contrast and upper GI fluoroscopy are the imaging modalities of choice to establish the diagnosis3. A tract/ communication between the esophagus and an adjacent structure like trachea, or left atrium, is a direct sign of fistula formation.4. Indirect signs of esophageal fistulas include the presence of esophageal contents (oral contrast or food) in unexpected locations (such as pleura), presence of stranding/ induration of the mediastinal fat with the esophageal wall in close proximity to an adjacent organ, and visualization of extraluminal gas with discontinuity of the esophageal wall.

### TABLE OF CONTENTS/OUTLINE

1. Describe the anatomy of the esophagus with relationship to adjacent organs2. Imaging modalities for evaluation• Plain radiographs• Upper GI fluoroscopy• CT with oral contrast3. Signs of fistula on imaging• Direct signs- communication between the esophagus and an adjacent structure• Indirect signs- the presence of esophageal contents (oral contrast or food) in unexpected locations or extra-luminal gas4. Examples of various esophageal fistulas with a focus on imaging findings• Tracheoesophageal fistula• Bronchoesophageal fistula• Esophagopulmonary fistula• Atrio-esophageal fistula• Aorto-esophageal fistula• Pericardioesophageal fistula• Esophagopleural fistula• Esophagocutaneous fistula• Tumor-esophagus fistula

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# Abstract Archives of the RSNA, 2024

CHEE-60

## SIZE IS NOT ALL THAT MATTERS: EXPLORING THE MORPHOLOGICAL AND METABOLIC CHARACTERISTICS OF SOLITARY PULMONARY NODULES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Maria G. Gracia Munoz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The incidental encounter of solitary pulmonary nodules (SPNs) is highly common in the daily tasks of radiologists. The differential diagnosis of SPNs is extensive, and a significant percentage are malignant. Since timely detection of lung cancer has a crucial impact on patient prognosis, radiologists must be able to distinguish benign from malignant nodules with the highest possible precision and in early stages, while avoiding unnecessary follow-up studies and invasive diagnostic procedures. Ultimately, the determining factor regarding recommendations is the size, but taking into account the morphological and metabolic evaluation of the nodules can increase diagnostic accuracy in SPN assessment.

### TABLE OF CONTENTS/OUTLINE

Definition. General Imaging RecommendationsMorphological Characteristics: Attenuation, Shape and Margins, Internal Characteristics (calcifications, fat attenuation, cavitation), Complex Findings (pleural retraction, air bronchogram, bubble-like lucencies, cystic airspace), Location and Enhancement.Metabolic Characteristics: PET/CT with FDG. Indications, Metabolism of Different Neoplasms, Limitations, Use of Other Radiopharmaceuticals.Recommendations on How to Measure Pulmonary Nodules according to the Fleischner Society (in QA format).Fleischner Society Guidelines for Management of Incidental Pulmonary Nodules (General Characteristics, Risk Estimation, and Description of Recommendations)

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# Abstract Archives of the RSNA, 2024

CHEE-61

## IMAGING FINDINGS OF RECURRENT NEOPLASTIC DISEASE ON SURVEILLANCE IMAGING OF THE CHEST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Cheng Ting Lin, MD (*Abstract Co-Author*) Nothing to Disclose
Preetham Bachina, BS (*Abstract Co-Author*) Nothing to Disclose
Dilek Oncel, MD (*Abstract Co-Author*) Nothing to Disclose
Wenchi Hsu, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Illei, MD (*Abstract Co-Author*) Nothing to Disclose
Raheel Anwar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

* Primary lung and extrathoracic tumors demonstrate diverse patterns of metastatic spread, leading to varying radiographic appearances on chest CT.* Surgery and radiotherapy cause distortions of the pulmonary anatomy that pose challenges in interpreting surveillance imaging and require understanding of expected post-treatment changes.* Accurate review of pulmonary findings on follow-up scans is essential for guiding optimal clinical management.

### TABLE OF CONTENTS/OUTLINE

* Chest CT surveillance for patients at risk for metastatic disease* Treatment-related disease: surgical resection, radiotherapy (radiation pneumonitis, organizing pneumonia, radiation fibrosis), immunotherapy (checkpoint inhibitor pneumonitis, pseudoprogression)* Intra-pulmonary spread: hematogenous metastases, lepidic spread, lymphangitic carcinomatosis, aerogenous metastases* Extra-pulmonary spread: nodal involvement, pleural dissemination, pericardial/cardiac metastases, osseous metastases

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

CHEE-62

## NOT SO NICE COUNTERTOPS: A PICTORIAL REVIEW OF THE NEW SILICOSIS EPIDEMIC AMONG ENGINEERED STONE WORKERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sheiphali Gandhi (*Abstract Co-Author*) Nothing to Disclose
Andrea Oh, MD (*Abstract Co-Author*) Nothing to Disclose
Jane Fazio (*Abstract Co-Author*) Nothing to Disclose
Nader Kamangar (*Abstract Co-Author*) Nothing to Disclose
Robert J. Tallaksen, MD, MA (*Abstract Co-Author*) Nothing to Disclose
Jonathan H. Chung, MD (*Abstract Co-Author*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd
Karoly Viragh, MD (*Abstract Co-Author*) Nothing to Disclose
Sundus Lateef, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Silicosis is the oldest-recognized and most commonly diagnosed pneumoconiosis, historically associated with mining. In the last decade, there has been a surge of silicosis cases globally among stone countertop workers exposed to engineered stone (e.g. quartz) dusts. Silicosis has previously been uncommon among countertop workers, leading to delay in diagnosis, often due to difficulty differentiating imaging findings from sarcoidosis or atypical infection often favored as initial diagnoses. The goal of the current educational exhibit is to (1) raise awareness to the new silicosis epidemic, (2) depict the typical and atypical imaging features with clinicopathologic correlation when available, and (3) address important research questions. In addition to the rich imaging illustrations selected from one of the largest countertop manufacturer silicosis patient cohorts available in the USA, interactive (board-exam type) pointers will also be provided.

### TABLE OF CONTENTS/OUTLINE

1. Silicosis - historical perspective;2. Silicosis - pathophysiology, clinical presentation, management;3. Imaging technique (brief review of the ILO and ICOERD systems);4. Imaging illustration: Parenchyma abnormalities (small and large nodular opacities, septal thickening, fibrosis, consolidations); Airway abnormalities; Pleural abnormalities (effusions, pseudoplaque); Mediastinal abnormalities (lymphadenopathy); Complications;5. Cases: Acute silicosis; Accelerated silicosis; Chronic simple silicosis; Chronic complicated silicosis with progressive massive fibrosis; Silicosis with pneumothorax; Superimposed infections (e.g. mycobacterium); Differential diagnosis cases (sarcoidosis, infections)

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# Abstract Archives of the RSNA, 2024

CHEE-63

## RADIOLOGIC APPROACH TO EVALUATING PERSISTENT CONSOLIDATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos A. Mestas Nunez SR, MD (*Abstract Co-Author*) Nothing to Disclose
Mariano Lorea (*Abstract Co-Author*) Nothing to Disclose
Guadalupe Comadran (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Dulcich SR, BMedSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Consolidation is a common imaging finding defined as an opacity that completely obscures the underlying bronchi and vessels. In most cases, it is evidence of a pathologic process primarily within the air spaces when alveolar air is replaced by fluid, pus, blood, cells, or other material. Patients with parenchymal consolidation may have an acute or subacute/chronic presentation. Despite this classification, there is no precise definition to differentiate them. Persistent consolidation represents opacity that is still present at follow-up examinations and does not resolve in the expected time and after initial treatment. In these cases, imaging findings along with specific clinical information can help narrow the differential and guide management.Review the typical imaging appearance of different causes of persistent consolidation on CTEmphasis on the importance of distribution and clinical information as diagnostic keys.Discuss an imaging and clinical based approach when encountering patients with persistent consolidation

### TABLE OF CONTENTS/OUTLINE

Introduction and definitionApproach to persistent consolidationCausesInfectious Slowly resolving pneumoniaMycobacterial pneumoniaFungal pneumonia Atypical bacterial pneumoniaInflammatory Organizing PneumoniaVasculitis Chronic Eosinophilic PneumoniaLipoid PneumoniaRadiation PneumonitisSarcoidosisNeoplasticAdenocarcinoma LymphomaMiscellaneous Bronchopulmonary SequestrationInflammatory PseudotumorPulmonary embolism Venous infarctPitfalls Troubleshooting: role of iodinated contrast, PET CT and MRIConclusions

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# Abstract Archives of the RSNA, 2024

CHEE-64

## PULMONARY VESSEL ANOMALIES: RUNNING THROUGH ALTERNATIVE ROUTES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Giunchetti Strabelli, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Sartim, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar H. Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bernardo S. Oliveira, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Roberto V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is: 1. To review usual and unusual cases related to the pulmonary vessels anomalies. 2. To correlate important findings with the anatomy, embryology, and pathophysiology, focusing on their clinical-radiological correlations. 3. To highlight their characteristics in order to familiarize radiologists, preventing unfavorable patient outcome. 4. To review CT and MRI protocols in the evaluation of patients with suspected pulmonary vessels anomalies.

### TABLE OF CONTENTS/OUTLINE

1. Applied embryology and anatomy of pulmonary artery and veins. 2. Techniques: X-ray, CT and MRI - pros and cons 3. Pulmonary artery anomalies: (a) origination and course (conotruncal abnormalities, atresia, sling); (b) intrinsic pulmonary artery anatomy (proximal interruption of the pulmonary artery, hypoplasia, stenosis); (c) pulmonary termination (arteriovenous malformations); (d) anastomotic vessels (anomalous origin of the coronary artery from the pulmonary artery, patent ductus arteriosus). 4. Pulmonary veins anomalies: (a) Total anomalous pulmonary venous return (TAPVR). (b) Partial anomalous pulmonary venous return (PAPVR). & 7; Type I: Supracardiac & 7; Type II: Cardiac & 7; Type III: Infracardiac & 7; Type IV: Mixed 5. Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics. 6. Future directions 7. Summary and take-home messages.

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# Abstract Archives of the RSNA, 2024

CHEE-65

## PNEUMONIA IN THE IMMUNOCOMPROMISED HOST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mark M. Hammer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Identify the types of immunocompromise encountered in different clinical settings and associate these with specific opportunistic organisms.2. Describe the patterns of mycobacterial disease seen in HIV patients at different levels of CD4 count.3. Describe the imaging appearance of viral and fungal infections in neutropenic patients.

### TABLE OF CONTENTS/OUTLINE

1. Types of Immunocompromise: T-cell depletion, neutropenia, IgG deficiency, nonspecific2. Causes of pulmonary disease in immunocompromised patients: pulmonary edema, drug toxicity, radiation pneumonitis, malignancy, infection: community-acquired or opportunistic3. HIV infected patients: Tuberculosis, Pneumocystis, CMV pneumonia, Disseminated NTM, Kaposi’s sarcoma4. Organ transplants: fungi, mycobacteria, Nocardia, PTLD5. Neutropenic patients: Aspergillus, Mucor6. Bone marrow transplant: fungi, CMV pneumonia, idiopathic pneumonia syndrome

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# Abstract Archives of the RSNA, 2024

CHEE-66

## HOW TO PERFORM CLINICALLY RELEVANT LUNG CANCER STAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mark M. Hammer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Clinically relevant staging goes beyond simple AJCC categories and should include clinically important local factors for the primary tumor.2. Understand which lymph node stations upstage a lung cancer.3. Understand how surgeons may need to modify their approach given abutment or invasion of various structures.

### TABLE OF CONTENTS/OUTLINE

1. Overview of AJCC staging system for lung cancer2. Local factorsa. Proximity to central bronchi or arteries necessitating sleeve resection or arterioplastyb. For sublobar resection, identifying segmental anatomyc. Invasion of pericardium, focal versus disseminatedd. Invasion of pleura or mediastinal fat, and early pleural metastasese. Chest wall invasionf. Diaphragm invasion3. Lymph node staging: ipsilateral versus contralateral mediastinal nodes4. Evaluation of distant metastatic disease, and common mimics

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# Abstract Archives of the RSNA, 2024

CHEE-68

## PICTORIAL REVIEW OF THORACIC HEMATOMAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Emma C. Ferguson, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Ocazionez-Trujillo, MD (*Abstract Co-Author*) Nothing to Disclose
Erika G. Odisio, MD (*Abstract Co-Author*) Nothing to Disclose
Catalina Jaramillo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Aortic Intramural hematoma is part of the aortic dissection spectrum and is diagnosed by crescentic hyperdensity of the aortic wall seen on unenhanced CT images. Additional findings associated with IMH include intramural blood pools and ulcer-like projections.2)A rare complication of Type A aortic dissection is the development of a pulmonary artery (PA) sheath hematoma, which can occur due to the shared adventitial layer between the ascending aorta and the PA, allowing dissection to extend between these vessels and possibly leading to PA lumen compromise.3)Pericardial hematomas can be secondary to blunt or penetrating chest trauma, post cardiac surgery and ventricular rupture. 4)Intramural hematomas of the esophagus can be spontaneous, emetogenic or iatrogenic in the setting of EGD. These hematomas vary in length and may obliterate the esophageal lumen.5)An extrapleural hematoma demonstrates the “fat sign” on CT, where thoracic soft tissues are pushed toward the ribs by intermediate/high density fluid in the extrapleural space. 6)Prevertebral hematoma usually indicates recent injury, as significant hematoma is uncommon after 2-3 weeks. Differential considerations for chronic prevertebral hematomas include infection or tumor.

### TABLE OF CONTENTS/OUTLINE

1) Great Vessels: Intramural hematoma of the aorta, traumatic aortic injury, adventitial sheath hematoma of the pulmonary artery. 2) Pericardium: Pericardial hematoma. 3) Mediastinum: Spontaneous hematoma of the mediastinum. 4) Esophagus: Intramural Hematoma of the Esophagus. 5) Pleura: Pleural hematoma, extrapleural hematoma. 6) Thoracic Spine: Paravertebral hematoma 7) Chest Wall and soft tissues: Breast hematoma, intramuscular hematoma.

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# Abstract Archives of the RSNA, 2024

CHEE-69

## PRIMARY PULMONARY LYMPHOMA: WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria Borba, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Pedro C. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Abdo De Almeida (*Abstract Co-Author*) Nothing to Disclose
Lucas Rostom, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Magna, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Kenji Ota (*Abstract Co-Author*) Nothing to Disclose
Bruna P. De Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- The purpose of this presentation is to demonstrate and help the radiologist deal with the variety of imaging manifestation patterns of primary pulmonary lymphoma, highlighting a case of primary MALT pulmonary lymphoma, an extremely rare disease, but the most common primary pulmonary lymphoma.- This article shows the radiological variability of primary pulmonary lymphoma in patients treated at a reference hospital, focusing on the importance of diagnostic methods: which of them are most sensitive for early diagnosis of the disease, the role in guidance procedures and monitoring response to treatment.

### TABLE OF CONTENTS/OUTLINE

-A compilation with the list of patients, epidemiological and clinical data, histopathological diagnosis, some microscopy images, some guided biopsy images, imaging patterns of diagnostic methods and their main role in the disease treatment line.- Examples of different imaging presentations of primary lung lymphoma, including an extremely rare case of primary MALT lung lymphoma, with details on how diagnostic methods are also important in assessing the evolution of response to treatment, providing resources to direct management and determine therapeutic success.

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# Abstract Archives of the RSNA, 2024

CHEE-7

## NOT ONLY LOW GRADE BUT ALSO THE ART OF SLOW TRADE: UNDERSTANDING ADENOCARCINOMA OF THE LUNG DEVELOPING FROM CYSTIC AND SUBSOLID NODULES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Emrah Duman, MD (*Abstract Co-Author*) Nothing to Disclose
Brittany Cody (*Abstract Co-Author*) Nothing to Disclose
Zehavit Kirshenboim (*Abstract Co-Author*) Nothing to Disclose
Omer Onder, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1- Subsolid and cystic nodules, as well as the resulting primary lung neoplasms, are notable for their slow-growing nature. However, they can sometimes be overlooked or misclassified as elements of infectious or inflammatory conditions. 2- Being aware of the possible imaging findings of these lesions and current recommendations regarding follow-up is crucial for patient management. With the introduction of new guidelines, such as Lung-RADS 2022, there has been a shift towards a more comprehensive approach that includes these types of nodules, thereby highlighting their clinical significance. 3- This educational exhibit aims to enhance awareness among radiologists regarding primary lung neoplasms that may originate from or potentially evolve from subsolid and/or cystic nodules via a variety of case examples, further enriched by the inclusion of histopathologic examination images obtained after surgical resections.

### TABLE OF CONTENTS/OUTLINE

A. Introduction objectives B. Subsolid nodules - Nodule types and definitions -Adenocarcinoma spectrum - Lung-RADS 2022 recommendations - Pearls Pitfalls - Case examples important considerations C. Cystic nodules -Cystic lung cancer -Terminology and Lung-RADS 2022 recommendations -Pearls Pitfalls -Case examples important considerations D. Summary E. Conclusion

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# Abstract Archives of the RSNA, 2024

CHEE-70

## LUNG TRANSPLANT EVALUATION: COMPLICATIONS ON A TIMELINE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Markus Y. Wu, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review history, indication/contraindication, and surgical techniques of lung transplantation.2. Highlight expected and unexpected imaging findings following lung transplantation.3. Present a concise imaging approach to evaluation of transplant- treatment-related complications

### TABLE OF CONTENTS/OUTLINE

1. History and indications/contraindications.2. Donor selection.3. Surgical techniques.4. Postop imaging protocols.5. Complications on a timeline.6. Immediate complications including malpositioned lines, size mismatch, hyperacute rejection, and pulmonary torsion.7. Early complications including reperfusion injury and acute pleural complications.8. Intermediate complications including acute rejection, bronchial anastomotic complications, and infections.9. Primary late complications including bronchial stenosis, vascular complications, viral and fungal infection.10. Secondary late complications including chronic rejection, organizing pneumonia, PTLD, lung cancer.

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# Abstract Archives of the RSNA, 2024

CHEE-71

## IMAGING OF THE THORACIC AORTA: EVERYTHING YOU NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Syed Muhammad Awais Bukhari, MD (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Omar Altabbakh, DO (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss the importance of the thoracic aorta and summarize key points for radiologists using the latest multidisciplinary surgical and clinical guidelines. 2. Illustrate the proper technique for measuring the thoracic aorta in a reproducible way and discuss the normal size and cutoff for pathologic enlargement (e.g. dilated vs aneurysm). 3. Understand the radiologist's role in evaluating pathology of the aorta and recommended imaging surveillance. 4. Discuss acute aortic syndromes and how they should be approached with the latest nomenclature. 5. Review the operative management, post-operative complications, and post-operative surveillance of the aorta. 6. Demonstrate the clinical implementation of artificial intelligence in cardiovascular disease/imaging.

### TABLE OF CONTENTS/OUTLINE

1. Embryology/Anatomy/Histology 2. Modalities for imaging the thoracic aorta 3. Defining normal size and correct measurement technique 4. Aneurysm Definition 5. Causes of thoracic aortic aneurysms a. Genetic (Ehlers-Danlos, Marfan’s, Loeys-Dietz) b. Congenital (bicuspid, Turner's, coarctation) c. Hypertension/Atherosclerosis d. Inflammatory aortitis 6. Recommended Screening/Surveillance 7. Acute aortic pathology a. Svensson classification b. Society of Vascular surgery reporting system c. Dissection d. Intramural Hematoma e. Penetrating Atherosclerotic Ulcer f. Atypical acute aortic pathologies 8. Operative Management of Aortic Pathology a. Post-operative aorta Complications b. Surveillance of post-operative aortic repairs 9. Artificial intelligence in Cardiovascular Imaging a. Clinical implementation of artificial intelligence into a PACs workflow

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# Abstract Archives of the RSNA, 2024

CHEE-72

## TRACHEOBRONCHIAL PAPILLOMATOSIS: WHAT RADIOLOGISTS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alexandre M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana A. Grill, MD (*Abstract Co-Author*) Nothing to Disclose
Tamires Morita, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Brenda N. Lahlou, MD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the etiology and the pathological mechanism of papillomatosis. Highlight the main organs affected in the respiratory system and their imaging characteristics. Emphasize pulmonary involvement and the risk of malignant transformation.

### TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Etiological agent and forms of transmission.3. Pathological mechanism and histological features.4. Epidemiology and clinical findings.5. Tracheobronchial involvement.6. Pulmonary involvement and possible complications.7. Malignant transformation into squamous cell carcinoma.8. Therapeutic challenges.9. Take home message.

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# Abstract Archives of the RSNA, 2024

CHEE-73

## CYSTIC LUNG CANCER - A PICTORIAL REPRESENTATION OF MORPHOLOGICAL TYPES BASED ON CT, GROWTH PATTERNS AND FDG PET UTILIZATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thomas Taylor (*Abstract Co-Author*) Nothing to Disclose
Mohamed J. Thouseef, MD (*Abstract Co-Author*) Nothing to Disclose
Angela McKinnie (*Abstract Co-Author*) Nothing to Disclose
Chary Duraikannu, FRCR, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Morphological types: We outline four patterns of cystic lung malignancies, as described by Mascalchi et al: Type I - Cyst with exophytic solid component; Type II - Cyst with endophytic solid component; Type III - Cyst with wall thickening; Type IV - Multi-cystic lesion.2. Pathogenesis: prevailing theories include cyst formation via a check valve mechanism secondary to microscopic malignancy or growth along pre-existing bullae.3. Growth pattern: gradual replacement of cystic components by solid tissue observed during follow-up. 4. Histology: predominantly manifest as adenocarcinomas followed by squamous cell carcinoma. 5. Guidelines: current guidelines offer limited guidance on follow-up protocols. In our multidisciplinary meeting, we usually recommend an initial follow up period of 3 months for suspected cystic malignancy. PET imaging would be indicated if notable solid component.

### TABLE OF CONTENTS/OUTLINE

Background: Lung cancer remains a significant public health concern and ranks as the leading cause of cancer-related mortality in the UK, making up 21% of all cancer deaths between 2017 and 2019. Despite established screening protocols and expedited diagnostic pathways, the diverse presentations of primary lung tumours pose challenges for timely recognition, often leading to diagnostic delays. Through a series of illustrative cases, we aim to showcase the morphological and growth pattern of cystic lung cancers.

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# Abstract Archives of the RSNA, 2024

CHEE-74

## EVOLVING LANDSCAPE OF CHEST WALL RECONSTRUCTION: A MULTIMODALITY IMAGING APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Achala Donuru, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Chest wall reconstruction is a complex surgical procedure aiming to restore anatomical and functional integrity after chest wall injury or resection.
- Various imaging modalities play crucial roles in different stages of chest wall reconstruction, each offering unique advantages.
- Pre-operative planning: Imaging helps assess the extent of the defect, guide implant selection and sizing, and identify potential complications.
- Intra-operative guidance: Imaging provides real-time visualization of anatomical structures, facilitating precise implant placement and minimizing complications.
- Post-operative assessment: Imaging monitors healing progress, detects complications like infection or implant failure, and guides further management decisions.

### TABLE OF CONTENTS/OUTLINE

Introduction:
- Brief overview of chest wall reconstruction and its clinical significance.
- Importance of imaging in various stages of chest wall reconstruction. Pre-operative Imaging:
- Role of CT scans in defect characterization, implant planning, and surgical simulation.
- Advantages of MRI for soft tissue assessment and vascular mapping. Intra-operative Imaging:
- Utility of fluoroscopy and cone-beam CT for real-time guidance and accurate implant placement. Post-operative Imaging:
- Role of CT and MRI in evaluating healing progress, graft integration, and identifying complications.
- Potential applications of PET/CT for detecting early signs of infection or implant rejection. Multimodality Imaging Approach:
- Benefits of combining different imaging modalities for a comprehensive assessment throughout the reconstruction process.
- Examples of how each modality complements the others in different stages.

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# Abstract Archives of the RSNA, 2024

CHEE-75

## EXPLORING CAVITARY LUNG LESIONS: PERSPECTIVES ON DIFFERENTIAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manuel Sebastian Paez Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Esnelly F. Berrios Bonilla, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Enriquez-Puga, MBChB, MSc (*Abstract Co-Author*) Nothing to Disclose
Andrea Calero Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Maria M. Merideno Garcia, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Elisabetta Ponte, MD (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The main objective of this study is to provide insights for proper characterization of cavitary lesions. To achieve this, we aim to fulfill the following three teaching points: firstly, ensuring that we are dealing with a true cavitary lesion and not a mimicker; secondly, once a cavitary lesion is confirmed, explaining how to evaluate it in 10 steps; and finally, elucidating the various entities that arise after cavitation, along with their respective clinical and imaging characteristics.

### TABLE OF CONTENTS/OUTLINE

- Objectives. - Definition of cavitation and examples of imaging. - Mimickers of cavitation and their definition: cyst, cystic bronchiectasis, emphysema, and bullae. Imaging examples of each. - Evaluation of cavitation in ten steps: confirming the cavity, assessing wall characteristics, identifying intracavitary material, recognizing enhancing foci, evaluating pleural communication, observing surrounding changes and ancillary findings, correlating with history and clinical presentation, assessing temporal evolution, determining the location of the cavity, and determining the number of cavities (solitary vs multiple). - Detailed presentation and explanation of the different entities following the semiological finding of cavitation, illustrating several cases of each: cancer, rheumatoid arthritis, vasculitis, infections (aspergillus, tuberculosis), septic emboli, etc. - Conclusions. - References.

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# Abstract Archives of the RSNA, 2024

CHEE-76

## THE PE PUZZLE: IDENTIFYING AND DIFFERENTIATING MIMICS ON CTPA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Ocazionez-Trujillo, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos S. Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Emma C. Ferguson, MD (*Abstract Co-Author*) Nothing to Disclose
Cihan Duran, MD (*Abstract Co-Author*) Nothing to Disclose
Catalina Jaramillo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Clues to distinguish mixing artifacts from true PE include poorly defined margins, attenuation >78 HU, unilateral lesions, and lesions that do not alter vessel caliber.• Distinguishing whether the defect occurs within the vessel lumen is crucial, as adjacent lymphadenopathy and endobronchial mucous plugging potentially create PE-like lesions.• Metastatic leiomyoma can extend to involve the right sided heart chambers and pulmonary arteries.• Primary sarcoma of the pulmonary artery generally demonstrates enhancement, luminal expansion and loss of the wall contours “eclipse sign”, that distinguishes it from real PE.

### TABLE OF CONTENTS/OUTLINE

CT Pulmonary Angiography (CTPA) is the study of choice for the evaluation of Pulmonary Embolism (PE), yet its interpretation is filled with challenges. This exhibit aims to clarify the technical and pathologic conditions that mimic PE on CTPA.Artifactsa) Cardiac and respiratory motion artifactb) Pulmonary artery mixing “smoke” artifact from slow flow and ipsilateral parenchymal abnormalities such as bronchiectasisc) Contrast bolus interruptiond) Pulmonary artery devicesPseudo-defects due to pathology at nearby anatomic structuresa) Hilar lymphadenopathyb) Endobronchial aspirationc) Pulmonary Vein ThrombosisTumorala) Direct tumoral invasion from bronchogenic carcinomab) Tumoral metastasis from renal cell carcinoma and uterine leiomyomac) Primary sarcoma of the pulmonary arteryMimickers of Chronic PEa) Thrombosis in situ secondary to chronic pulmonary hypertensionb) Pulmonary artery sheath hematoma in the setting of aortic dissectionc) Pulmonary artery thickening as a manifestation of vasculitis

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# Abstract Archives of the RSNA, 2024

CHEE-77

## THE ATOLL WITHIN: A DEEP DIVE INTO THE REVERSE HALO SIGN IN CHEST CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Iclal Ocak, MD (*Abstract Co-Author*) Nothing to Disclose
Furkan Ufuk, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Define the reverse halo sign and its diagnostic relevance in chest CT imaging. • Review the various etiologies associated with the reverse halo sign, emphasizing the differentiation between infectious, neoplastic, and inflammatory causes. • Illustrate the significance of integrating clinical history and other diagnostic tools to accurately interpret the reverse halo sign.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to the Reverse Halo Sign Definition and visual characteristics Historical context and significance in radiology 2. Etiological Spectrum a) Idiopathic Organizing Pneumonia: The most common cause, involves inflammation and scarring of the small airways and alveoli. b) Fungal Infections: Various fungal infections can cause the reverse halo sign, including mucormycosis and aspergillosis. c) Bacterial Pneumonia: Certain bacterial infections, including tuberculosis and atypical mycobacterial infections, can sometimes manifest with this sign. d) Viral Infections: Viral pneumonias, such as those caused by influenza, COVID-19, can occasionally show a reverse halo sign. e) Pulmonary Infarction: Pulmonary embolism can result in a reverse halo sign due to hemorrhagic infarction. f) Malignancies: Rare, such as adenocarcinomas of the lung or lymphomatoid granulomatosis might present with a reverse halo sign. g) Autoimmune Diseases: Diseases like granulomatosis with polyangiitis and rheumatoid arthritis can sometimes show this pattern. h) Sarcoidosis: Although less common, sarcoidosis can occasionally present with a reverse halo sign. i) Treatment related: Drug or radiation induced pneumonitis. 3. Conclusion • Summary of key points • Future directions in research and imaging techniques

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# Abstract Archives of the RSNA, 2024

CHEE-78

## CATCH A RIDE ON THE TRAM TRACKS: IMAGING REVIEW AND DIFFERENTIAL DIAGNOSIS OF BRONCHIECTASIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Anna S. Bader, MD (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Ami N. Rubinowitz, MD (*Abstract Co-Author*) Nothing to Disclose
Linda B. Haramati, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Gange JR, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc Stockholder, Bristol-Myers Squibb Company Research Consultant, Bayer AG Medical Advisory Board, AIxSCAN, Inc Shareholder, AIxSCAN, Inc
Leah Traube, MD (*Abstract Co-Author*) Nothing to Disclose
Alan Gao, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Bronchiectasis is a common condition characterized by irreversible dilatation of the bronchi. It results from a wide range of infectious, inflammatory, neoplastic, and congenital disease processes. Recurrent infections and hemoptysis are the most common complications, both of which contribute substantially to morbidity and mortality. Imaging plays a key role in the initial diagnosis of bronchiectasis, evaluation for progression, and detection of complications. This exhibit will review the imaging features of bronchiectasis and highlight disease-specific differences in anatomic distribution, imaging appearance, and clinical features, which can aid in narrowing the differential diagnosis or in certain cases provide a confident diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction (Definition, Pathophysiology, CXR/CT Findings, Mimics) 2. Case Examples: a. Focal (Bronchial Atresia, Carcinoid, Endobronchial Metastases, Aspirated Foreign Body) b. Central (ABPA, Cystic Fibrosis, Ciliary Dyskinesia, Mounier-Kuhn, Williams-Campbell) c. Upper Lobe (Cystic Fibrosis, Sarcoidosis, Silicosis, Berylliosis, Prior TB, Fibrotic HP) d. Lower Lobe (Infectious, Aspiration, Fibrotic ILD, Alpha-1 Antitrypsin Deficiency, Hypogammaglobulinemia) e. Right Middle Lobe and Lingula (Atypical Mycobacterium) f. Variable (Radiation Fibrosis, Bronchiolitis Obliterans) 3. Complications (Infection, Hemoptysis)

RSNA 2024
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# Abstract Archives of the RSNA, 2024

CHEE-79

## CT MANIFESTATIONS OF HIV-ASSOCIATED PULMONARY INFECTIONS IN THE ERA OF ANTIRETROVIRAL THERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

David C. Kraft, MD (*Abstract Co-Author*) Nothing to Disclose
Muhammad Naeem, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Carlos Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Sagar B. Amin, MD (*Abstract Co-Author*) Nothing to Disclose
Michael A. Beal, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Volin, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy Arleo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Since the discovery of human immunodeficiency virus (HIV), the imaging findings of the numerous opportunistic infections have been extensively described. However, the high variability of imaging findings and multitude of opportunistic infections may be difficult to differentiate and present a diagnostic challenge. The purpose of this abstract is to present a comprehensive overview of the pulmonary infections seen in immunocompromised patients, as well as propose a pattern-based approach for differentiating pulmonary pathology. Teaching points include the following: 1. Define AIDS defining illness and review the relationship between CD4 levels and opportunistic infection 2. Review the imaging patterns and differential diagnoses of pulmonary infections among immunocompromised patients 3. Discuss non-infectious pulmonary pathology that is characteristic among immunocompromised patients and differentiate it from infectious processes

### TABLE OF CONTENTS/OUTLINE

1. Overview pulmonary infections in immunocompromised patients by CD4 and infection type 2. Review AIDs-defining illnesses 3. Present a CT pattern-based approach to pulmonary pathology, including the following imaging patterns: consolidation, cavitation, cyst, peribronchovascular opacity, halo/reverse halo, nodule/septal line, and ground glass 4. Differentiate imaging mimickers (for example, differentiate pneumatocele/blebs from a cavity or cyst) 5. Discuss non-infectious pulmonary pathology in immunocompromised patients, including immune reconstitution inflammatory syndrome and infection-associated pulmonary malignancy

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# Abstract Archives of the RSNA, 2024

CHEE-8

## A PICTORIAL REVIEW: ANTERIOR MEDIASTINAL MASSES - ESSENTIAL KNOWLEDGE FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nagaaki Marugami (*Abstract Co-Author*) Nothing to Disclose
Ryosuke Taiji, MD (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Aya Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Dan Yamamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Ikeno (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Anterior mediastinal masses have various etiologies, such as neoplastic or non-neoplastic pathology. These masses are located in the anterior mediastinum and originate from the thymus or other adjacent organs. Radiologists should be familiar with imaging findings and clinical courses.This exhibit aims to:Depict typical imaging findings of Anterior mediastinal massesDiscuss the clinical and radiological findings, and differential diagnosis

### TABLE OF CONTENTS/OUTLINE

Thymic epithelial tumor Thymoma Thymic carcinoma l Mediastinal lymphoma Non-Hodgkin lymphoma Thymic MALT lymphoma Primary mediastinal (thymic) large B-cell lymphoma T-cell lymphoblastic lymphoma Classical Hodgkin lymphoma (CHL) Nodular sclerosis CHL Mixed cellularity CHL l Anterior mediastinal germ cell tumor Mature teratoma Immature teratoma Mixed germ cell tumor l Thymic neuroendocrine tumor (TNETs) Carcinoid l Mediastinal goiter l Thymic cyst l Thymic hyperplasia

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# Abstract Archives of the RSNA, 2024

CHEE-80

## THE NIGHTMARE NEIGHBOR NEXT DOOR; SHARED SHEATH HEMATOMAS AND MIMICS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Satinder P. Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Inayat Grewal (*Abstract Co-Author*) Nothing to Disclose
Scott A. Grumley, MD (*Abstract Co-Author*) Nothing to Disclose
Donald G. Benson JR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mostafa Abozeed, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Naga Sai Rasagna Mareddy, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mohamed Ibrahim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Shared sheath pulmonary artery hematoma is a rare and underreported complication of Stanford type A aortic dissection. • Identify imaging features of acute type A aortic dissection and possible mimics. • Understanding the embryological development and anatomical relationship between the aorta and pulmonary arteries.

### TABLE OF CONTENTS/OUTLINE

• Embryological Development and Anatomical Relationship: - Overview of embryological development leading to the formation of the heart tube and aorticopulmonary septum. - Discussion of the anatomical relationship between the aorta and pulmonary arteries, including the presence of shared structures like the common aortopulmonary adventitia. - Highlighting how understanding embryology and anatomy enhances comprehension of pathological processes like aortic dissection. • Clinical Implications and Historical Descriptions: - Overview of clinical implications associated with acute type A aortic dissection, including potential complications and prognostic factors. - Historical descriptions of aortic dissection and its complications, including the concept of acquired aortopulmonary fistula. • Imaging protocol and features: o Discuss the imaging protocol in suspected acute chest pain scenario o Discuss the imaging features of shared sheath hematoma and its potential mimics o Discuss variety of acute dissection imaging findings and its mimics

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# Abstract Archives of the RSNA, 2024

CHEE-81

## EFFECTS OF RADIATION THERAPY IN THORACIC ONCOLOGY REVISITED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elena Garcia Garrigos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marina Sirera Matilla, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa Feliu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
David Ferrandez Ferrandez (*Abstract Co-Author*) Nothing to Disclose
Juan Arenas-Jimenez, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Both radiation and medical therapies for thoracic malignancies have evolved with combination and sequential strategies being an alternative to many tumors of the chest, mainly lung and breast cancer. Our goals are: To show how radiation therapy affects tumoral and non-tumoral tissues and how imaging can show those effects, with special emphasis on their chronology. To describe how radiation therapy has evolved from classic methods into more precise multiple beam stereotactic techniques thus expanding its indications and leading to more complex manifestations. To depict imaging findings related to radiation therapy, its associated complications and the effect of combining medical therapies such as immunotherapy with radiotherapy.

### TABLE OF CONTENTS/OUTLINE

1. Definition of radiation therapy types and their effects on tumoral and non-tumoral tissues 2. Differences between conventional radiotherapy and new techniques and indications. 3. Frequent effects of radiotherapy in the lungs, mediastinum, pleura and chest wall and their chronology. 4. Specific complications of radiotherapy and their differential diagnosis. 5. Radiological presentation of uncommon radiation therapy-related conditions: abscopal effect, delayed organizing pneumonia, radiation recall pneumonitis, radiation induced neoplasms. 6. Clues for diagnosing tumor recurrence in radiated lesions 7. Discussion of evidences about relationship of preexisting radiological interstitial lung abnormalities and immunotherapy with lung complications after radiation therapy. 8. Conclusions.

# Abstract Archives of the RSNA, 2024

CHEE-82

## VASCULAR TUMORS IN THE THORAX: IMAGING CHARACTERISTICS, BIOPSY, AND MANAGEMENT OF ASSOCIATED COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Abhishek Chaturvedi, MD (*Abstract Co-Author*) Nothing to Disclose
Swati P. Deshmane, MBBS (*Abstract Co-Author*) Nothing to Disclose
Andrew C. Clark, DO (*Abstract Co-Author*) Nothing to Disclose
Adam Dykie, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Vascular tumors of the thorax have complex imaging findings; however, there also may be difficulty distinguishing them from other benign or malignant lesions. Vascular lesions can be present in the major vessels, mediastinum, lung parenchyma, or soft tissues and osseous structures of the chest wall. Cross sectional imaging with CT/MR and PET is essential in workup, although additional studies and biopsy may be needed for diagnosis. Deciding whether to biopsy, which technique to use, and which lesion to biopsy depends on various factors. Complications of image-guided biopsy and management of these complications should be considered, particularly given the increased concern for bleeding.

### TABLE OF CONTENTS/OUTLINE

This exhibit will provide background on vascular tumors including their subcategories and locations within the chest. Imaging characteristics of different vascular lesions on modalities such as CT, MRI, and PET will be reviewed, including techniques such as pre- and post-contrast imaging. Considerations for biopsy, such as malignant versus benign features, location, concern for bleeding, and treatment planning will then be discussed. Different methods for tissue sampling will be reviewed along with basic biopsy technique for vascular lesions. Biopsy may include ultrasound-guided, CT-guided, excisional, or intraluminal approaches. Complications of biopsy and their management will be discussed. Finally, conclusions will be drawn on the workup of vascular thoracic tumors through imaging characterization and biopsy.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

CHEE-83

## HIDDEN IN FIBROSIS: APPROACH TO DIAGNOSIS AND PITFALLS OF LUNG CANCER IN PATIENTS WITH FIBROTIC INTERSTITIAL LUNG DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Jaewon Jung (*Abstract Co-Author*) Nothing to Disclose
Brett M. Elicker, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Sohn, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Shravan Sridhar, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Tician Schnitzler, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Interstitial lung disease (ILD) patients are known to have elevated risk for lung cancer with odds ratio ranging from 3.5-7.3. Lung cancer in ILD is often difficult to detect due to significant background reticulation and potential superimposed acute exacerbation that may obscure malignancy. However, accurate detection of lung cancer has important implications for clinical management and potential lung transplant candidacy. The purpose of this exhibit is to review the epidemiology of lung cancer in ILD patients, present a case-based approach to diagnosing lung cancer in patients with ILD, and review pitfalls of imaging ILD patients who also have lung cancer including cases in which lung cancer was initially missed.

### TABLE OF CONTENTS/OUTLINE

1. Title 2. Table of contents 3. Overview 4. Demographics and epidemiology 5. Pathogenesis 6. Histopathology of lung cancer in ILD vs normal lung 7. CT diagnosis a. Inconsistent with lung cancer i. Infection/inflammation 1. Acute exacerbation 2. Aspiration 3. Mycetoma ii. Manifestation of ILD 1. NSIP-OP 2. PPFE 3. PMF iii. Iatrogenic 1. Bronch bite hematoma b. Consistent with lung cancer i. Characteristic CT features nodules ii. Characteristic CT features lymphadenopathy/(asymmetric) iii. Time course iv. Evolution on CT 8. When suspicious finding identified 9. Tissue sampling 10. Utility of CT lung biopsy 11. CT lung biopsy complications 12. Confirming the diagnosis a. Confirmed i. Staging ii. Implication on transplant candidacy b. Non-malignant result i. Non-malignant vs non-diagnostic ii. Accept vs reject result iii. Utility of repeat CT lung biopsy 13. Case overview 14. Cases 15. Challenging cases and pitfalls 16. Summary 17. References

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# Abstract Archives of the RSNA, 2024

CHEE-84

## UNDERSTANDING CYSTIC LUNG LESIONS IN SMOKERS WITH INTERSTITIAL LUNG DISEASE: RADIOLOGIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Almudena I. Urena Vacas, MD (*Abstract Co-Author*) Nothing to Disclose
LETICIA GRACIA Saenz (*Abstract Co-Author*) Nothing to Disclose
Svetlana Shalygina (*Abstract Co-Author*) Nothing to Disclose
CRISTINA ALENDA Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Juan Arenas-Jimenez, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Due to destructive, fibrotic and remodeling mechanisms, we can find a varied constellation of aerated lung lesions in chest CT scans of smoker patients that pose a diagnostic challenge for both the radiologists and pathologists. Radiologic terminology used for cystic lung lesions is complex and sometimes confusing, and the same applies to their pathologic correlation, with different names for similar findings. In this setting, the goals of this exhibit are to make an approach to these lesions trying to allow the reader: 1. To differentiate among the pathologic findings that characterize each type of aerated lung lesion in smokers. 2. To define the clue radiological findings and the diagnostic meaning of each subtype of cystic lung lesions in smokers. 3. To avoid pitfalls when interpreting aerated lung lesions in CT of smoker patients.

### TABLE OF CONTENTS/OUTLINE

1.Pathologic descriptions of airspaces enlargement and cystic lesions associated to fibrosis in the lungs of smokers: centrilobular and paraseptal emphysema, emphysema with fibrosis, smoking related interstitial fibrosis, airspace enlargement with fibrosis, smoking-related diffuse cystic lung disease and honeycombing. 2. Radiologic description of cystic lung lesions described in smokers and their meaning: emphysema, thin-walled cysts, thick-walled cysts, traction emphysema, cysts associated to desquamative interstitial pneumonia, smoking-related cysts and honeycombing cysts. 3. Pitfalls when interpreting cystic lesions. 4.Conclusions and quiz: how do I call this cyst?

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# Abstract Archives of the RSNA, 2024

CHEE-85

## CLEARING THE AIR: STATE OF THE ART IMAGING OF INTRALUMINAL AIRWAY OCCLUSIONS AND MUCUS PLUGGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Prachi P. Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. del Carpio Bellido Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Njira L. Lugogo (*Abstract Co-Author*) Nothing to Disclose
Wassim Labaki, MD (*Abstract Co-Author*) Nothing to Disclose
Chiemezie Amadi, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Lee, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. There is a spectrum of etiologies and imaging appearance of filling defects in the airways. 2. Mucous plugs are a common finding on CT and although often dismissed, are associated with adverse outcomes in specific patient populations. 3. Understanding the importance of mucus plugging in muco-obstructive diseases and asthma is important for all radiologists. 4. Apart from mucus plugging, segmental and subsegmental intraluminal airway occlusions can be due to myriad conditions including infection, foreign bodies and neoplasms. 5. If high density is identified in airway occlusions specific entities including broncholiths and foreign bodies should be considered. 6. Opportunities and challenges relating to the evolving role of advanced imaging techniques in airways disease include air trapping quantification using parametric response mapping, airway wall thickness quantification and mucous plug quantification. These can provide prognostic information and may help quantify treatment response.

### TABLE OF CONTENTS/OUTLINE

1. Spectrum of intraluminal airway occlusions including: Muco-obstructive diseases (COPD, cystic fibrosis, primary ciliary dyskinesia, and non-cystic fibrosis bronchiectasis), asthma, allergic bronchopulmonary aspergillosis, obstruction leading to distal mucus plugging (neoplasms, bronchial atresia) and other etiologies (Diffuse: endobronchial infection, blood, plastic bronchitis, aspiration; Focal: foreign body, broncholiths, tumors) 2. Prognostic significance and current evidence related to mucus plugging in muco-obstructive diseases and asthma. 3. New techniques for quantification of airway wall thickening, mucus impaction and air trapping

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# Abstract Archives of the RSNA, 2024

CHEE-86

## NON-TUBERCULOUS MYCOBACTERIA (NTM): RADIOLOGICAL INSIGHTS FOR A CHALLENGING DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tan-Lucien H. Mohammed, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sandro B. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Pratik P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alysson Roncally Carvalho, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica Gemmell (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Amanda Acevedo (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Identify imaging characteristics of non-tuberculous mycobacteria (NTM) infections across different patient populations.2. Understand the importance of differential diagnosis in imaging to distinguish NTM from other pulmonary conditions, including tuberculosis.3. Recognize the role of radiologists in the multidisciplinary management of NTM, emphasizing early detection and monitoring treatment response.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Non-tuberculous Mycobacteria a. Definition and Epidemiology b. Clinical Significance2. Imaging Features of NTM Infection a. Pulmonary NTM: Key Findings on Chest X-ray and CT b. Extra-pulmonary NTM: Diagnostic Challenges3. Differential Diagnosis a. Differentiating NTM from Tuberculosis and Other Lung Pathologies b. Role of Imaging in Guiding Biopsy and Further Testing4. Case Studies and Imaging Gallery a. Representative cases highlighting diagnostic features and pitfalls5. Conclusion a. Summary of Radiologist's Role in NTM Detection and Management6. PDF Upload Supplementary material includes detailed imaging studies, expanded case discussions, and a comprehensive review of NTM treatment protocols. This content aims to enhance understanding and provide a visual guide to assist radiologists in diagnosing and managing NTM infections effectively.

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# Abstract Archives of the RSNA, 2024

CHEE-87

## THORACIC FISTULAS - A MULTIFACETED CHALLENGE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vinay V. Kandula, MBBS (*Abstract Co-Author*) Nothing to Disclose
Achala Donuru, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Early diagnosis and management of thoracic fistulas is critical for improving patient outcomes.
- Understanding the different causes (infection vs. malignancy) guides treatment decisions.
- Multimodality imaging, particularly MDCT, is essential for accurate diagnosis and fistula characterization.
- Management strategies involve addressing the underlying cause and potential fistula closure techniques.

### TABLE OF CONTENTS/OUTLINE

Diagnosis: Clinical suspicion is paramount, considering symptoms like cough, dyspnea, chest pain, recurrent infections, and nutritional issues.Imaging: CT scan with intravenous contrast is the mainstay for detailed fistula characterization, demonstrating the fistula tract and adjacent structures.Bronchoscopy: Valuable for evaluating airway fistulas, allowing visualization of the internal opening and potential foreign body removal.Esophagram: Useful for identifying esophageal fistulas, demonstrating contrast extravasation from the esophagus.Angiography: May be necessary for definitive diagnosis of vascular fistulas, depicting abnormal blood flow patterns.Management: The approach depends on fistula type and severity. Conservative management with antibiotics and nutritional support might be attempted for small fistulas. Endoscopic closure using stents or glue may be suitable for specific fistulas. Surgical repair is often definitive therapy, particularly for complex or large fistulas.

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# Abstract Archives of the RSNA, 2024

CHEE-88

## WHAT YOU CAN LEARN FROM FALSE-NEGATIVE STUDIES IN AN ACADEMIC LUNG CANCER SCREENING PROGRAM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Suzanne Byrne, MD (*Abstract Co-Author*) Nothing to Disclose
Ariadne DeSimone, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Kathryn Schulz, MD (*Abstract Co-Author*) Nothing to Disclose
Mark M. Hammer, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Arora, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The most common causes of errors in diagnostic radiology are underreading, satisfaction of search, faculty reasoning, and location.2. Missed lung cancers tend to be paramediastinal or perihilar in location, therefore a radiologist should be aware of these blind spots, incorporate these locations into their search pattern, and consider integration of computer-aided detection software and AI algorithms.3. Missed lung cancers tend to be endobronchial lesions, therefore a radiologist should ensure comprehensive evaluation of the tracheobronchial tree on every examination.

### TABLE OF CONTENTS/OUTLINE

• Review types/causes of diagnostic errors in radiology• Review proposed methods to decrease errors in radiology• Highlight peer learning opportunity of monthly lung cancer screening (LCS) program conference and in learning from diagnostic errors • Define ‘false-negative studies’ within a LCS program• Review cases of missed lung cancers within a LCS program and discuss potential reasons for the ‘false negative’• Review cases of interval lung cancers within a LCS program• Review cases of slow-growing ground-glass or part-solid or cystic nodules within a LCS program

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# Abstract Archives of the RSNA, 2024

CHEE-89

## NEW TERMINOLOGY IN ILD: PROGRESIVE PULMONARY FIBROSIS (PPF)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Santiago Martinez-Jimenez, MD (*Abstract Co-Author*) Support, Reed Elsevier
Aura Ramirez, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Leonardo Galindo Pedraza (*Abstract Co-Author*) Nothing to Disclose
Jorge Carrillo, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Alvarado, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The term progressive pulmonary fibrosis (PPF), refers to progression in fibrosing interstitial lung diseases (ILDs) other than idiopathic pulmonary fibrosis (IPF). PPF is not a disease, but rather a behavior that different subtypes of fibrosing ILDs may develop overtime. A significant proportion of ILDs show progression, being more common in fibrosing hypersensitivity pneumonitis follow by ILDs associated with systemic autoimmune diseases and sarcoidosis. In patients with a pre-existing ILD, PPF is defined as prove of progression within the previous 12 months, with at least two of the following three criteria: worsening respiratory symptoms, physiological and radiological evidence of disease progression. Radiological findings of disease progression include: Increased extent or severity of traction bronchiectasis and bronchiolectasis, new ground-glass opacity with traction bronchiectasis, new fine reticulation, increased extent or coarseness of reticular abnormality, new or increased honeycombing and increased lobar volume loss. Progression of fibrosis is typically assessed visually. Semiquantitative assessment of the percentage of lung volume containing fibrotic feature may be a predictor of mortality.The assessment of ILDs needs a multidisciplinary approach including clinical, functional, imaging, and histopathological data to integrate a clinical probability for an accurate diagnosis and to assess the likelihood of progression.

### TABLE OF CONTENTS/OUTLINE

Introduction; Epidemiology; Physiopathology of pulmonary fibrosis; Definition criteria of PPF; Imaging approach to PPF; Differential diagnosis; Clinical Considerations: Treatment, Prognosis, and the role of imaging.

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# Abstract Archives of the RSNA, 2024

CHEE-9

## NOVEL APPROACH FOR COMPREHENSIVE PERIOPERATIVE ASSESSMENT OF RESPIRATORY MALIGNANCY VIA ULTRA-LOW-DOSE LUNG CT UTILIZING AG FILTER AND DEEP LEARNING RECONSTRUCTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hirofumi Uehara, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Ichinohe (*Abstract Co-Author*) Nothing to Disclose
Koichi Osuda, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In the current local treatment of respiratory malignancies, there are cases in which multiple CT examinations are required to prevent complications caused by intervention procedures.It includes (1)coil marking + Video-Assisted Thoracoscopic Surgery (VATS) partial resection for small lung cancer and (2)lung Radiofrequency Ablation.Ultra-low-dose lung CT examination combined with Ag filter and Deep Learning image Reconstruction (DLR) significantly reduce radiation dose, and reliably provides image quality sufficient for preoperative and postoperative assessment.We summarize the potential benefits of incorporating ultra-low-dose CT imaging into clinical practice in the management of respiratory malignancies.

### TABLE OF CONTENTS/OUTLINE

High-definition thin-section CT is performed for initial diagnostic assessment, judging surgical indication, and the detailed scan data allowed to simulate bronchoscopic coil-marking technique.Ultra-low-dose CT using Ag filter have been taken for confirm the marking-site immediately before surgery.In addition, it is used to assess the complications such as pneumothorax and hemothorax after surgery and for early pneumonia.We emphasize the importance of reducing radiation exposure while maintaining both diagnostic accuracy and intervention technique safety, and propose comprehensive approach for supporting respiratory malignancy treatment using appropriate scan protocol.

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# Abstract Archives of the RSNA, 2024

CHEE-90

## STAY CURRENT WITH LUNG-RADS® V2022: A QUESTION-BASED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hamilton Shoji, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela Rosa, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Docema, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Figueiredo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Aquino (*Abstract Co-Author*) Nothing to Disclose
Maria Carolina Bueno da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo C. Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Macedo, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Lung cancer, characterized by high morbidity and mortality rates, ranks among the most prevalent cancers, with smoking as its primary risk factor. The U.S. Preventive Services Task Force advises annual low-dose computed tomography (LDCT) screening for individuals aged 50 to 80 years with a 20-pack-year smoking history or who quit within the last 15 years. To standardize terminology and management guidelines, the American College of Radiology developed the Lung CT Screening Reporting and Data System (Lung-RADS®), recently updated in 2022. Early diagnosis is imperative for facilitating curative treatment and improving patient survival. Lung cancer screening with low-dose CT has demonstrated a 20% reduction in mortality compared to unscreened patients. Given the ongoing scientific advancements, radiologists must stay abreast of updates to identify suspicious lesions and determine appropriate management.

### TABLE OF CONTENTS/OUTLINE

Interactive Case-Based Learning Image characteristics according to Lung-RADS® v.2022 will be demonstrated, accompanied by respective recommendations, through an interactive question and answer format (quiz):-Atypical Pulmonary Cysts-Juxtapleural Nodules-Airway Nodules-Infectious or Inflammatory FindingsGeneral Summary: A comprehensive overview of LungRADS v2022 categories and concepts based on cases and illustrations

RSNA 2024
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# Abstract Archives of the RSNA, 2024

CHEE-91

## USING IMAGING BIOMARKERS FOR COMPREHENSIVE LUNG PATHOLOGY DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vinay V. Kandula, MBBS (*Abstract Co-Author*) Nothing to Disclose
Achala Donuru, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Differentiating between benign, infectious, and malignant lung pathologies remains a diagnostic challenge. This presentation explores the power of imaging biomarkers identified on CT, PET, MRI, and PET/MRI in guiding radiologists towards a confident diagnosis.By leveraging the expanding repertoire of imaging biomarkers, radiologists can enhance diagnostic accuracy across a spectrum of lung pathologies, ultimately leading to optimal patient management.

### TABLE OF CONTENTS/OUTLINE

CT Biomarkers for Pinpointing Pathology• Malignancy: Size and spiculation, attenuation, calcification• Infection: Consolidation, cavitation• Benign Conditions: Honeycombing, cyst characteristicsPET Scan Biomarkers for Metabolic ActivityMalignancy: Increased FDG uptake on PET/CT signifies hypermetabolic activity, a hallmark of lung cancer. Some infections and inflammatory processes can also show FDG avidity, requiring correlation with CT findings.MRI Biomarkers for Soft Tissue CharacterizationMalignancy: While not a first-line modality, MRI can offer valuable insights by differentiating between tumors and benign lesions based on signal intensity on T1 and T2 weighted images. Restricted diffusion on diffusion-weighted MRI can suggest malignancy.PET/MRI Scan BiomarkersParticularly beneficial for patients with contraindications to CT scans due to radiation concerns or kidney issues with contrast agents.Emerging Biomarkers and Advanced Techniques• Dotatate PET scans: Can be helpful in diagnosing lung carcinoid tumors.• Hyperpolarized gas MRI offers unique insights into gas exchange, alveolar integrity, and ventilation defects.• Dual tracer PET • Beyond FDG: Choline analogs, amino acid tracers

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

CHEE-92

## THE SNIFF TEST: HOW WE DO IT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rachna Madan, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mark M. Hammer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review of prior anatomic imaging is helpful to focus the sniff exam and interpret the results.2. Adequate deep, rapid sniff maneuver is key to providing definitive diagnosis of paralysis.3. If paralysis is not present, review of anatomic imaging can provide the diagnosis for mimics.

### TABLE OF CONTENTS/OUTLINE

1. Review the differential diagnosis for an elevated hemidiaphragm2. Review causes of diaphragm paralysis.3. Review sniff test: patient positioning, fluoroscopy technique, and the sniff maneuver.4. Interpreting the sniff test results, i.e. paradoxical motion.5. Mimics: eventration, hernia, lung volume loss.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

CHEE-93

## AUTOMATIC PULMONARY ARTERIOVENOUS SEPARATION IN NON-CONTRAST CT BY USING STATE-OF-THE-ART IMAGE PROCESSING TECHNOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shuuji Ishikawa (*Abstract Co-Author*) Nothing to Disclose
Masayuki Kamoshita (*Abstract Co-Author*) Nothing to Disclose
Hideki Yashiro, MD (*Abstract Co-Author*) Nothing to Disclose
KITARO IRWAN BIN MOHD AZLAN (*Abstract Co-Author*) Nothing to Disclose
Akihiro Saitou (*Abstract Co-Author*) Nothing to Disclose
Wataru Fujishiro, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•Importance of understanding pulmonary arteriovenous anatomy before pulmonary segmentectomy •Visualization of pulmonary arteries (PA) and pulmonary veins (PV) by 3D-CT images •Benefits of non-contrast CT for the separation of PA and PV •Accuracy of automatic pulmonary arteriovenous separation by non-contrast CT and contrast CT •Optimal reconstruction parameters for automatic separation by non-contrast CT

### TABLE OF CONTENTS/OUTLINE

1. Pulmonary arteriovenous anatomy and critical anatomical variants 2. Explanation of the conventional methods and the novel method for 3D-CT images of pulmonary arteriovenous separation 3. Benefits: a) Does not require contrast media b) Eliminate artifacts c) Reduce radiation dose 4. Comparison of non-contrast and contrast 3D-CT images of pulmonary arteriovenous Outline: 3D-CT images of the pulmonary arteriovenous helps perform safe navigation during video-assisted thoracic surgery (VATS), which anatomically involves variety of blood vessels. Conventionally, 3D-CT images are reconstructed from contrast-enhanced CT data using a workstation semi-automatically. However, some patients are allergic to contrast media, have impaired renal function, or are receiving biguanides, and extreme caution must be exercised when performing contrast CT in these patients. We present a method to reconstruct 3D images of PA and PV automatically separated from non-contrast CT data by using state-of-the-art image processing technology. This method allows 3D-CT images of the pulmonary arteriovenous to be reconstructed without contrast, with low radiation, and high accuracy. 3D images of the pulmonary arteriovenous with non-contrast CT useful in VATS just as contrast-enhanced CT.

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# Abstract Archives of the RSNA, 2024

CHEE-94

## THORACIC MRI FOR THE CHARACTERIZATION OF MEDIASTINAL ANTERIOR MASSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Caroline Caramella (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Mediastinal anterior masses (MAM) represent an uncommon finding on CT. Whether there are clinical symptoms suggesting myasthenia or not, it is of the utmost importance to differentiate thymic hyperplasia from thymic epithelial tumours (thymoma or thymic carcinoma) and to rull out other diagnosis such as benign thymic cysts or other types of tumours (germinal-cell tumors, lymphoma, paraganglioma, ?). It will completely change the treatment strategy (surgery vs chemotherapy or withholding). In addition to FDG-PET-CT, MRI enables better identification of the tissue composition (cystic, presence of fat, ..). It also is useful in the surgical planning of mediastinal tumours by giving precious information on the cardio-vascular structures that can be involved in the mass, and on the possible presence of metastasis, especially in the pleura. Thoracic MRI is however rarely used in this context, due to misconception of its poor performances in lung imaging. We will present a simple MR protocol that enables MAM characterization and work-up, and give tips for dealing with a fortuitously discovered (or not) MMA.

### TABLE OF CONTENTS/OUTLINE

Table of content: - Thoracic MRI protocol - Different anterior mediastinal tumour types Reasoning algorithm

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# Abstract Archives of the RSNA, 2024

CHEE-95

## COMPLICATIONS UNRAVELED: A RADIOLOGIST'S GUIDE TO POST-LUNG TRANSPLANT IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Fernandez Lobo (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Maria J. Galante I, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Lung transplantation is a very complex life-saving treatment for patients with end-stage lung disease. The radiologist represents an important part of the process, from the presurgical imaging to postoperative control. Postsurgical imaging can be challenging since a wide spectrum of postoperative complications can appear. This work shows a comprehensive overview of post-transplant imaging from presurgical imaging to complications through a radiological perspective, hoping to serve as a guide for radiologists and clinicians involved in this complex procedure. With a systematic review of common and more rare post-transplant complications including rejection, haemorrage, airway complications, etc. , this educational poster highlights the highly important role of radiological imaging in early detection, and accurate diagnosis that may lead to a prompt intervention if needed.The main objectives are: - To review the main types of pulmonary transplants and surgical techniques. - To discuss pretransplant imaging- To suggests imaging protocols for the assesmento of complications- By knowing the main surgical techniques, predict the normal postsurgical changes. - To describe the main immediate, early, intermediate and late complications of this surgery- To provide images that can illustrate these complications

### TABLE OF CONTENTS/OUTLINE

1) Indications of lung transplant2) Contraindications3) Types of pulmonary transplants4) Surgical techniques5) Imaging pre-surgical assesment6) Immediate Complications7) Intermediate Complications8) Late Complications

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# Abstract Archives of the RSNA, 2024

CHEE-96

## RADIOLOGICAL PERSPECTIVES OF LUNG DISEASE IN IDIOPATHIC INFLAMMATORY MYOPATHIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos Arteaga (*Abstract Co-Author*) Nothing to Disclose
Javier Leonardo Galindo Pedraza (*Abstract Co-Author*) Nothing to Disclose
Jorge Carrillo, MD (*Abstract Co-Author*) Nothing to Disclose
Jenny Londono (*Abstract Co-Author*) Nothing to Disclose
Santiago Martinez-Jimenez, MD (*Abstract Co-Author*) Support, Reed Elsevier
Ana M. Alvarado, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Idiopathic inflammatory myopathies (IIM) include a heterogeneous group of systemic autoimmune diseases characterized by varying degree of skeletal muscle inflammation and extramuscular manifestations. The main subtypes of IIM are dermatomyositis, polymyositis, clinically amyopathic dermatomyositis, antisynthetase syndrome, overlap syndrome, inclusion body myositis, and immune mediated necrotizing myopathy. Pulmonary involvement in the form of interstitial lung disease (ILD) is the most common extramuscular manifestation of IIM, contributing to an estimated 50% excess mortality. In up to 20% of cases, ILD precedes muscular symptoms, challenging early IIM diagnosis due to its unpredictable onset.The diversity within IIM clinical phenotypes is due to various autoantibodies, which include: myositis-specific autoantibodies (MSAs) and myositis-associated autoantibodies (MAAs). Some MSAs are associated with increased risk of ILD, such as Anti-synthetase autoantibodies, particularly Anti-Jo1 (up to 90%). Non-specific interstitial pneumonia is the most common HRCT finding in this grup. Myositis-associated rapidly progressive ILD is related with anti-MDA-5, which comes with increased mortality (up to 50%). Organizing pneumonia is the main HRCT pattern. Anti-PI-7 and anti-PI-12 are associated with higher incidence of ILD in the absence of clinical myositis.Other pulmonary manifestations of MII include: opportunistic infections, pulmonary hypertension, aspiration pneumonia, neoplasia and drug-induced pneumonitis.

### TABLE OF CONTENTS/OUTLINE

Definition; Classification; Clinical presentation; HRCT patterns; Other pulmonary manifestations of MII.

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# Abstract Archives of the RSNA, 2024

CHEE-97

## LUNGS EXPOSED: A RADIOLOGICAL APPROACH TO OCCUPATIONAL LUNG DISEASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marie Bambrick, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Micheal McInnis, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Bayer AG
Jimin Lee (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Occupational lung diseases often manifest over decades, challenging clinicians to identify the disease.- Progressive massive fibrosis has become increasingly common in recent years due to the popularity of artificial stones.- Chrysotile asbestos was still used and imported into the United States until the Environmental Protection Agency banned the material in March 2024.- Inhaled hard metal dust can result in giant cell interstitial lung disease or desquamative interstitial pneumonia.- Occupational lung diseases have characteristic appearances on high-resolution computed tomography and chest radiographs.- Mesothelioma most commonly arises from the pleura and presents with nodular pleural thickening.

### TABLE OF CONTENTS/OUTLINE

- Overview of various occupational lung diseases (pneumoconioses, occupational asthma, hypersensitivity pneumonitis) and their clinical presentations- Review of causative agents and environments for occupational lung diseases in the modern era- Overview of clinical and radiologic approach to diagnosing occupational lung diseases- Review of hallmark imaging abnormalities on computed tomography and radiographs through sample patient cases

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# Abstract Archives of the RSNA, 2024

CHEE-98

## THE MYRIAD FACES OF NON THROMBOTIC PULMONARY EMBOLISM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rachna Madan, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mark M. Hammer, MD (*Abstract Co-Author*) Nothing to Disclose
Anupama Ramachandran, MD (*Presenter*) Siemens AG

### TEACHING POINTS

To review the spectrum of imaging manifestations of non-thrombotic pulmonary artery embolism (NTPE).

### TABLE OF CONTENTS/OUTLINE

•NTPE represents embolization of nonthrombotic material, such as tumoral cells (or other cells types), organisms, gas or foreign material, into the pulmonary circulation.•In addition to causing occlusion of pulmonary micro- or macro-circulation, NTPE are often accompanied by endothelial and/or parenchymal injury, with an inflammatory reaction both in the systemic and pulmonary circulation.•Hence on imaging, NTPE maybe associated with a constellation of vascular and parenchymal imaging findings depending on the underlying etiology.•The etiologies can be grouped in 4 categories as follows:o Neoplastic entities: Pulmonary artery sarcoma, pulmonary tumor embolism, intravascular leiomyomatosis.o Inflammatory entities: Pulmonary arterial IgG4-related disease, Takayasu arteritis, Behcet diseaseo Iatrogenic entities: Pulmonary embolization of intravascular device (central venous catheter fragment, fractured pacemaker lead), coils from thoracic duct, cement embolization, air embolism, FDG hot clot artifact.o Miscellaneous entities: Septic embolism, fat embolism.•In this educational exhibit, we discuss the etiology and the spectrum of imaging findings of NTPE.

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# Abstract Archives of the RSNA, 2024

CHEE-99

## EXPLORING THE FRONTIER OF THORACIC RADIOLOGY: THE POWER OF RADIOMICS UNVEILED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo B. Teles, MD (*Abstract Co-Author*) Nothing to Disclose
Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Leonardo C. Machado, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:• To present the main concepts, processes, and applications of radiomics.• To provide a step-by-step illustrative model of the radiomic processes developed by our service.• To highlight the main challenges and perspectives of implementing radiomics in routine clinical decision-making processes.

### TABLE OF CONTENTS/OUTLINE

• Background.• Illustrative model of radiomics utilization in assessing subsolid pulmonary nodules to predict the degree of invasion of lung adenocarcinomas.• Radiomics' contribution to the detection, diagnosis, therapeutic response, monitoring, and prognosis of the patient.• Challenges and Perspectives.• Conclusion.

# Abstract Archives of the RSNA, 2024

EREE

**Emergency Radiology Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## EREE-1 NAVIGATING THE SLOPES: A COMPREHENSIVE REVIEW OF SNOWSPORTS MUSCULOSKELETAL INJURIES ENCOUNTERED IN THE EMERGENCY DEPARTMENT

Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Maryam Soltanolkotabi, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Brian Y. Chan, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda M. Crawford, MD (*Abstract Co-Author*) Nothing to Disclose
Ghazaleh Safazadeh, MD,MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Understanding the biomechanics of snowsports and how they contribute to injury patterns. -Recognition and classification of common musculoskeletal injuries encountered in snowsports. -Diagnostic imaging modalities and their role in evaluating snowsports injuries. -Treatment options and rehabilitation strategies for various snow sports-related injuries. -Injury prevention strategies and recommendations for safe participation in snowsports.

### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Overview of the popularity and diversity of snowsports. B. Importance of understanding radiologic findings of musculoskeletal injuries in snowsports. II. Biomechanics of Snowsports A. Overview of biomechanical forces involved in skiing, snowboarding, and other snowsports. B. Impact of terrain, speed, and equipment on injury risk. III. Common Musculoskeletal Injuries A. Upper Extremity Injuries -Shoulder Girdle Injuries: fracture/dislocations, rotator cuff injuries -Wrist/Hand Injuries: fracture/dislocations, ligamentous injuries B. Lower Extremity Injuries -Knee Injuries: ligamentous tears, meniscal injuries -Foot/Ankle Injuries: fractures, ligamentous injuries, tendon pathology C. Axial Injuries-Thoracolumbar spine injuries: compression/burst fractures, disc disease.-Pelvic injuries: stable vs unstable IV. Treatment and Rehabilitation A. Overview of conservative and surgical treatment options. B. Rehabilitation protocols for specific injuries. V. Injury Prevention A. Importance of proper equipment selection and fitting. B. Techniques for injury prevention and safe skiing/snowboarding practices. VI. Conclusion

## EREE-10 X-RAY ASSESSMENT OF ACUTE NEWBORN PATHOLOGIES

**Awards**
**Certificate of Merit**

Thurl Cledera, MD (*Abstract Co-Author*) Nothing to Disclose
Weronika Bernard, MD (*Abstract Co-Author*) Nothing to Disclose
Agata Nowelli (*Abstract Co-Author*) Nothing to Disclose
Muhammad Umair, MBBS (*Abstract Co-Author*) Nothing to Disclose
Caterina B. Monti, MD, PhD (*Abstract Co-Author*) Travel support, Bracco Group
Anna Jankowska, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Niemierko, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To discuss the role of radiological imaging in assessing newborns presenting with distress symptoms, differentiating pathologic from normal findings on newborn X-rays. 2. Discuss indications for X-ray imaging and radioprotection considerations in newborns. 3. Present a structured approach to chest and abdominal X-ray assessment in newborns. 4. Highlight X-ray findings seen in preterm and full-term newborns with respiratory distress, cardiovascular, and gastrointestinal abnormalities, providing insights into the differential diagnosis of conditions causing distress in newborns based on radiological findings. 6. Assess normal positions and courses of lines and tubes. 7. Emphasize the role of radiologists in guiding clinical decision-making and optimizing patient outcomes.

### TABLE OF CONTENTS/OUTLINE

A. Introduction B. Radiation safety and the ALARA concept C. Structured approach to X-ray assessment D. Neonate in distress - chest X-ray a. Surfactant deficiency disease b. Transient tachypnea of the newborn c. Meconium aspiration syndrome d. Bronchopulmonary dysplasia e. Pneumothorax f. Pneumonia g. Congenital Anomalies (e.g., congenital pulmonary lymphangiectasia, diaphragmatic hernia, congenital lobar overinflation, pulmonary sequestration). E. Neonate in distress - abdominal X-ray a. Esophageal, duodenal, jejunal, ileal, anal atresia b. Duodenal web c. Malrotation d. Meconium ileus e. Perforation f. Necrotizing enterocolitis g. Hypertrophic pyloric stenosis F. Assessment of Lines and Tubes a. Endotracheal Tube b. Nasogastric Tube c. Umbilical Arterial Catheter d. Umbilical Venous Catheter e. Peripherally inserted central catheter f. ECMO catheter G. Conclusion

## EREE-11 ROLE OF MRI IN UROGENITAL TRAUMA

Ryo Ueda (*Abstract Co-Author*) Nothing to Disclose
Christian Roest, MSc (*Abstract Co-Author*) Grant, Siemens AG
Thomas C. Kwee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akitoshi Inoue, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiromi Edo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuki Arita, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

CT, US, and urethrography have been the main imaging modalities for the evaluation of urogenital trauma, particularly in shock patients, thanks to their relatively short examination times. MRI is employed for evaluating urogenital trauma in hemodynamically stable patients because of the following advantages. (i) Higher contrast resolution allows for the depiction of more detailed anatomic information, which is essential in decision-making for surgical procedures, (ii) Its potential to detect mild parenchymal or luminal wall injury without contrast medium, and (iii) The lack of ionizing radiation, which is particularly important for (follow-up) examinations in younger patients. MRI may provide value in several settings. For example, in urethral trauma associated with pelvic fractures, MRI offers a detailed evaluation of the proximal urethral stump, essential for urethral reconstruction surgery. While ultrasound remains the preferred method for diagnosing testicular rupture due to blunt trauma, MRI can be crucial in cases in which a large hematoma obscures the rupture of the tunica albuginea, helping to assess the need for orchiectomy. This exhibit discusses the criteria for employing MRI in urogenital trauma, and illustrates MRI findings of various urogenital trauma cases, emphasizing its growing importance in the appropriate diagnosis and pre- and post surgical assessment of urogenital injuries.

**TABLE OF CONTENTS/OUTLINE**

1, Overview of the anatomy and trauma classification for the urogenital organ 2, Pros and Cons for imaging modalities (Fluoroscopy, CT, US, and MRI) 3, Recommended MR protocol and its imaging findings for each organ a. Kidney b. Bladder and Ureter c. Urethra d. Testis e. Penis 4, Summary

## EREE-12 "DON'T GET AIR-BALLED!" EMPHYSEMATOUS CONDITIONS OF THE ABDOMEN-PEARLS AND PITFALLS

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Ananya Panda, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Emphysematous conditions of abdomen are uncommon but potentially lethal conditions. It's important for radiologists to identify the correct pathology also avoid misdiagnosis and potential pitfalls. This exhibit also reviews pertinent clinical features that can help confirm diagnosis and avoid similar pitfalls. Lastly, we review management for better radiology reporting. At the end of the exhibit, the learner will be able to: 1. Review spectrum of emphysematous conditions of abdomen 2. Understand imaging mimics and clinical implications. 3. Be aware of next best steps as part of radiology reporting.

**TABLE OF CONTENTS/OUTLINE**

I. Emphysematous Gastritis. Pitfall: Hydrogen peroxide ingestion II. Gas Gangrene of Liver. Pitfall: Hepatic abscess Post-therapy changes III. Emphysematous Cholecystitis. Pitfall: Radiolucent gallstones Bilio-enteric fistula IV. Emphysematous Pancreatitis. Pitfall: Post-enteric fistula post-intervention changes V. Emphysematous Pyelonephritis. Pitfall: Emphysematous Pyelitis Post-therapy changes VI. Emphysematous Cystitis. Pitfall: Intraluminal Air Chyluria VII. Emphysematous Aortitis. Pitfall: Aorto-enteric fistula post-intervention changes VIII. Retroperitoneal Fasciitis. Pitfall: Pneumoretroperitoneum IX. Bowel Gangrene. Pitfall: Benign Pneumatosis Intestinalis Pneumatosis cystoides. X. Gas Gangrene of Abdomen Wall/ Fournier Gangrene. Pitfall: Benign Subcutaneous Emphysema XI. Gas Gangrene of Uterus. Pitfall: Endometritis Post-partum changes XII. Gas-forming Prostate Abscess Pitfall: Uro-symphyseal Fistula XIII. Emphysematous Vaginitis. Pitfall: Vaginal Tampon XIV. Emphysematous Epididymo-Orchitis. Pitfall: Air in Scrotum

## EREE-13 CT IMAGING OF SHOULDER GIRDLE AND PROXIMAL HUMERAL FRACTURES: BIOMECHANICAL PRINCIPLES, GRADING, AND SURGICAL RELEVANCE

David Dreizin, MD (*Abstract Co-Author*) Nothing to Disclose
Kathryn Champ, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

After completing the exhibit, participants will be able to: 1. Describe the role of CT and specific indications for this modality in the context of injuries to the superior suspensory complex of the shoulder (SSSC) and proximal humerus. 2. Explain the CT imaging features and parameters favoring surgical management for complex injuries including floating shoulder and bipolar glenohumeral fracture-dislocations. 3. List the common classification systems and subtypes for clavicular fractures, AC joint separations, and proximal humeral fractures, and imaging indications for surgical repair or reconstruction.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction: i. Clinical scenarios for which CT and 3D CT are advocated ii. Review of shoulder girdle and proximal humeral anatomy. iii. Injury biomechanics with pathoanatomy. II. Classification systems, key imaging features, and indications for surgical repair. i. Clavicle fractures: Allman and Neer classifications, telescoping, comminution, fracture displacement, and proximity to coracoclavicular ligaments. ii. AC separations: Rockwood classification, and surgical management of high-grade subtypes. iii. Sternoclavicular separation and scapulothoracic dissociation in severe trauma. iv. Glenoid and proximal humerus fracture-dislocations: Bankart, Hill-Sachs, and bipolar fractures; engaging lesions: glenoid track and Hill-Sachs interval concepts v. SSSC double disruptions and the floating shoulder: typical and atypical subtypes. vi. Proximal humeral fractures: Neer classification; calcar integrity, and varus collapse. III. Conclusion: summary table- key CT features and surgical management implications.

## EREE-14 BABY ON BOARD: IMAGING OF BLUNT TRAUMA IN PREGNANCY

Jason A. Pietryga, MD (*Abstract Co-Author*) Consultant, Radiostics LLC
Kristen Olinger, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana R. Defreitas, MD (*Abstract Co-Author*) Nothing to Disclose
David E. Bartlett, MD (*Abstract Co-Author*) Nothing to Disclose
Esha Sharda, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Ruggiero, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

(1) Discuss appropriate imaging for blunt trauma in pregnancy. (2) Review risk of imaging to the mother and fetus. (3) Recognize findings of trauma and its mimics in imaging of the gravid patient.

**TABLE OF CONTENTS/OUTLINE**

I. Background A. 1 in 12 pregnancies are affected by trauma, a leading cause of cause of death in pregnancy.B. Emergency Radiologists must understand appropriate imaging, risk of imaging, and traumatic findings in the expecting mother.II. Imaging selection A. Ultrasound is a useful tool for initial screening. i. Benefits of portability, lack of radiation, and high specificity. ii. Poor sensitivity in trauma limits its use. B. CT is first line in trauma imaging: i. Dose generally below 50 mGy ii. Threshold is unlikely to increase risk of fetal anomalies or loss. iii. Other radiation risks, including carcinogenesis must be considered. C. MRI may be appropriate: i. Subject to availability and time constraints.III. Injury patterns A. Radiologists must recognize imaging findings of trauma in pregnancy: i. Pregnancy-specific. 1. Placental abruption and uterine rupture. 2. Mimics - normal structures: cotyledons, chorionic plate indentations, and venous lakes. ii. Other injuries. 1. Abdominal visceral injuries. 2. Thoracic injuries. 3. Osseous injuries.IV. Conclusion A. Trauma in pregnancy is a leading cause of maternal and fetal mortality. B. Radiologists must: i. Know risks and benefits of imaging in pregnancy. ii. Be familiar with findings associated with trauma in pregnancy.

## EREE-15 BODY MRI ON CALL- A PRIMER FOR RADIOLOGY TRAINEES

Carolina A. Heming, MD (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Maheen Rajput, MD (*Abstract Co-Author*) Nothing to Disclose
Ananya Panda, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

With expanded access to MR systems, there is increasing role of Body MRI in emergency department/emergent conditions. Body MRI on-call is primarily used for problem-solving when US/CT are non-diagnostic. MRI offers non-radiation alternative when CT is contraindicated. Superior soft-tissue resolution of MRI provides non-contrast alternative when contrast is contraindicated. Familiarity with diverse conditions encountered in emergent settings can help on-call radiology trainees gain confidence and allow for seamless transition from training to independent practice. At end of this exhibit, learners will be able to: 1. Review spectrum of conditions encountered during on-call for which MRI may be indicated. 2. Know key protocols and high-yield sequences. 3. Understand added value of MRI for problem-solving.

**TABLE OF CONTENTS/OUTLINE**

I. Hepatobiliary a. Choledocholiathiasis b. Mirizzi syndrome c. Post-cholecystectomy syndrome d. Complicated Cholecystitis e. Biliary leak f. Cholangitis g. Hepatic lesion- infection/hemorrhage/mass with hemoperitoneum h. Hepatic Infarct/Vascular Thrombosis i. Bile duct/Periportal tumor invasion II. Pancreas a. Acute Complicated Pancreatitis b. Pancreatic Trauma III. GU/Pelvis a. Renal mass with tumor thrombus b. Prostate Abscess c. Post-Radiation Complications IV. OBGYN a. Pregnant Patient: GI/GU conditions b. Adnexal Torsion c. Ectopic pregnancy d. Fibroids-Red degeneration e. Placenta/Post-partum complications V. Bowel a. Appendicitis b. Crohn’s disease complications c. Perianal abscess d. Diverticulitis/mimics VI. Penis/Scrotum a. Trauma b. Infection VII. Acute presentation of cancers a. Pancreatic Cancer b. Gall bladder Cancer c. Colorectal Cancer

## EREE-16 VASCULAR EMERGENCIES IN HOSPITALIZED PATIENTS: FROM CHEST TO TOES

**Awards**
**Certificate of Merit**

Albert Hsiao, MD, PhD (*Abstract Co-Author*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging
Brian Pogatchnik, MD (*Abstract Co-Author*) Nothing to Disclose
Sophie Y. Wong, MD (*Abstract Co-Author*) Nothing to Disclose
Stephan Altmayer, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Vascular emergencies commonly occur in the inpatient setting and must be quickly and accurately diagnosed to allow timely intervention. This exhibit will:1. Discuss common vascular imaging techniques and the terminology used to describe findings2. Illustrate a broad spectrum of disease categories through case examples, including body regions from the neck down3. Familiarize the reader with common pitfalls of vascular imaging

**TABLE OF CONTENTS/OUTLINE**

1. Imaging techniquesa. Triple phase scanb. Dual-energy scanc. Imaging optimization2. Acute bleed and pseudoaneurysma. Definition of conceptsb. Acute bleedingc. Pseudoaneurysm3. Ischemia and embolizationa. Sources of embolismb. Ischemia in the hospital4. Emergencies related to vascular devicesa. Linesb. ECMOc. IABPd. Others5. Pitfalls of vascular imaging

## EREE-17 A CHECKLIST APPROACH TO INTERPRETING CT ANGIOGRAPHY OF ABDOMINAL VASCULAR EMERGENCIES

Carlos S. Tapia SR, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Abdominal emergencies of vascular origin are a common cause of attention in emergency departments. CT angiography is the imaging method of choice to evaluate the abdominal vessels. The radiologist's evaluation with a checklist report allows for a faster and more precise diagnosis, offering all the dates the physician needs for a correct approach to the patient.The inferior vena cava is the most prominent vein in the body. The most common emergency is obstruction by a filling defect, usually a thrombus; based on the lack of expansion of the vessel lumen and the absence of enhancement of the filling defect, this can be differentiated from a tumoral thrombus.In cases of acute aortic syndrome, it is essential to identify the type: aortic dissection, acute intramural hematoma, and penetrating atherosclerotic ulcer. Then, classify in Stanford A or B, and do not forget to find signs of impending rupture. Acute arterial or venous mesenteric ischemia is a severe life-threatening condition. Early detection and treatment are of utmost importance, as any delay in diagnosis can lead to bowel necrosis, perforation, and septic shock.

**TABLE OF CONTENTS/OUTLINE**

Introduction. Abdominal vascular anatomy. Inferior vena cava thrombosis and congenital variants. Acute aortic syndrome. Aortic dissection. Acute intramural hematoma. Penetrating atherosclerotic ulcer. Signs of impending or contained rupture in abdominal aortic aneurysm. Vasculitis with abdominal vessel involvement. Venous bowel ischemia. Arterial Bowel ischemia. Bleeding angiodysplasia of the colon. Portal vein thrombosis and other emergencies. Pitfalls. Teaching points. Conclusions. Bibliography.

## EREE-18 ABDOMINAL PAIN IN PREGNANCY: BEYOND OBSTETRICS - INSIGHTS FROM MRI DIAGNOSTICS IN THE EMERGENCY ROOM

Camila B. Visconti, MEd (*Abstract Co-Author*) Nothing to Disclose
Patricia Leal, MD (*Abstract Co-Author*) Nothing to Disclose

Alice Schuch, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia H. Concatto, MD (*Abstract Co-Author*) Nothing to Disclose
Ariane Giovanaz (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Present illustrative cases of the most prevalent non-obstetric causes of abdominal pain in pregnant women, featuring classic imaging findings and critical diagnostic signs.Assess the advantages of utilizing magnetic resonance imaging (MRI), while establishing a standardized MRI protocol for this evaluation.

**TABLE OF CONTENTS/OUTLINE**

IntroductionEpidemiology and risk factors of the most prevalent non-obstetric causes of abdominal pain in pregnant women.MR technique and discussionDescribe the main protocol and sequences of MRI used for assessing abdominal pain during pregnancy.Imaging features and pathology correlationDemonstrate MRI's efficacy in identifying various etiologies, from benign to potentially life-threatening conditions in pregnant women experiencing acute abdominal pain.ConclusionDiscuss the value of MRI in shaping medical management decisions for pregnant individuals with acute abdominal pain.

## EREE-19 RADIOLOGY UNDER THE GUN: GUIDE TO BULLSEYE DIAGNOSIS

Robert J. Dym, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Jamil, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Giraldo Herrera, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The U.S. epidemic of gun violence saw recent increases in the incidence of firearm-related injuries and deaths, and these may present a wide variety of diagnostic challenges in emergency departments.2. Firearm-related injuries constitute a unique category of traumatic injury given the high velocity of bullets and their penetrating mechanism with high-energy transfer.3. Understanding these types of injuries enables radiologists to assess the trajectory of the bullet, differentiate between direct and blast injury, and recommend follow-up interventions based on associated findings such as gross or subtle vascular injury, hollow viscus, or diaphragmatic injuries.

**TABLE OF CONTENTS/OUTLINE**

1. Background and Review of the Literature. 2. Spectrum of organ lacerations, with AAST and operative specimen correlates. 3. Spectrum of vascular injuries with angiography correlates. 4. Thoracic injuries with percussive contusions. 5. Atypical cases: migratory bullets, shotgun and non-civilian firearms, and non-bullet projectiles.

## EREE-2 AFTERMATH OF A PUNCH TO THE GUT: IMAGING FOLLOWING SELECTIVE NONOPERATIVE MANAGEMENT OF ABDOMINAL TRAUMA

Angelo G. Marino, DO (*Abstract Co-Author*) Consultant, Inari Medical, Inc;Speaker, Inari Medical, Inc
Nadia Solomon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Douglas S. Katz, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Anne Sailer, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Nonoperative management (NOM) is frequently conducted in trauma centers in patients with penetrating abdominal trauma who are hemodynamically stable without signs of diffuse peritonitis or evisceration.2. Although NOM has been relatively widely adopted for abdominal stab wounds, the concept has not been as embraced for GSWs given the higher associated incidence of visceral and abdominal vascular injuries and the morbidity and mortality associated with missed injuries.3. Recommendations of post-imaging guidelines for NOM patients with abdominal trauma is essential to screen for injuries (hollow organ, diaphragm injury, and delayed hemorrhage) that could have been missed on the initial trauma scan.

**TABLE OF CONTENTS/OUTLINE**

1. Briefly review indications for NOM and the role of angiography with embolization, endoscopic retrograde cholangiopancreatography with stenting, and percutaneous drainage to increase the success of NOM. 2. Propose a follow-up imaging algorithm for patients who undergo surgical and NOM.3. Case based review of successful and unsuccessful NOM including cases of missed hollow organ injury, delayed hemorrhage, and many more to highlight potential blind spots.

## EREE-20 ABDOMINAL BLUNT TRAUMA…YOU'VE GOT TO BE KIDNEY ME: A PRIMER OF THE REVISED AAST KIDNEY INJURY SCALE FOR DIAGNOSTIC RADIOLOGY RESIDENTS

Adriana L. Vargas Figueroa, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo ALBINO CAMACHO (*Abstract Co-Author*) Nothing to Disclose
Jose A. Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Jean P. Inesta-Rivera, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Review the grading of kidney injuries as defined by the AAST (American Association for the Surgery of Trauma) Kidney Injury Scale (2018). -Provide anatomical diagrams of grade I-V kidney injuries. -Contribute case examples with pathognomonic imaging findings of grade I-V kidney injuries on CT.-Define the possible complications of AAST kidney injuries and their corresponding management.-Provide a self-assessment tool for the classification of kidney injuries.

**TABLE OF CONTENTS/OUTLINE**

- Educational Objectives and Introduction- AAST Kidney Injury Scale Grade I-V and Possible Complications- Anatomical diagrams, CT imaging findings, and management - Self-assessment with multiple cases in quiz format Renal injuries may result from both blunt and penetrating trauma, and thus a high index of suspicion for these should be maintained in patients presenting with post-traumatic microscopic or gross hematuria. Expectant or non-surgical management has become the standard of care for most renal injuries, primarily due to high rates of iatrogenic nephrectomies and poor postoperative renal function. However, surgical management remains the gold standard for severe renal injuries with a higher AAST grade. Consequently, performing an appropriate imaging evaluation and establishing an accurate renal injury grade are imperative for determining appropriate management. Contrast-enhanced CT in combination with the AAST Kidney Injury Scale have become the gold standard for evaluating renal injuries. Our aim is to provide a

review of the Renal Injury Grades established by the AAST Kidney Injury Scale, provide case examples, and discuss corresponding management and their possible complications.

### EREE-21 "FACE TIME WITH RADIOLOGY: UNMASKING LE FORT FRACTURES"

Jose A. Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Gonzalez, BS (*Abstract Co-Author*) Nothing to Disclose
Adriana Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- 1. Define Le Fort I-III maxillofacial fractures and review anatomy- 2. Discuss the underlying pathophysiology and its major implications- 3. Provide radiological CT imaging highlighting key features

#### TABLE OF CONTENTS/OUTLINE

- I. Educational Objectives and Introduction- II. Review anatomy- III. General information on Le Fort fractures and mechanisms of fractures- IV. CT Imaging findings of Le Fort fractures- V. Self-assessment with multiple cases in quiz format-VI. ConclusionLe Fort classification is used to guide the classification and management of complex midfacial fractures. These fractures are classified as LeFort I, II, and III based on the direction of the fracture: horizontal, pyramidal, or transverse. Moreover, common to all Le Fort fractures is involvement of the pterygoid processes. Complex facial fractures such as these compromise the airway and cause significant blood loss due to the high vascularity of the anatomical region and significant swelling of the involved structures. Le Fort I is characterized by a horizontal fracture resulting from a downward impact directed against the alveolar ridge with the involvement of the anterolateral margin of the nasal fossa. Le Fort II is due to high energy impact directed against the lower and/or mid maxilla, with involvement of the inferior orbital rim. Le Fort III is a transverse fracture resulting from an impact against the nasal bridge and the upper maxilla with Involvement of the zygomatic arch characterizes this fracture.

### EREE-22 STROKE 101: FIRST CONTACT TRAINEE'S GUIDE FOR BRAIN CT

Alejandra Isabel Villalobos Tzec, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

This exhibit serves as an essential resource for first-year residents, offering a comprehensive overview of stroke diagnosis. Stroke progresses through distinct stages: hyperacute, acute, subacute, and chronic. The hyperacute stage includes the hyperdense vessel sign, subtle loss of gray-white matter distinction, vanishing basal ganglia, and the absence of the cortical ribbon, termed the "insular ribbon sign." These patterns indicate reduced blood flow obstruction within the first six hours. Detecting these changes in typical stroke sites is crucial (MCA territory). Employ the ASPECTS score to assist physicians in selecting appropriate treatment strategies. Acute and subacute phase (6- 36 hours) will be depicted as hypodensities, sulci effacement, gyral swelling, and even “hemorrhagic” transformation may occur. Chronic stage (>36 hours): will be shown as focal and sometimes large areas of low attenuation, the key is to look for prominent sulci and gyrus, as well as, enlarged ventricles. Differential diagnosis to keep in mind when “hypodensities” are seen in the brain CT, include, enlarged perivascular spaces, leukoaraiosis and nonvascular causes, such as neoplasms, cerebral contusion, inflammation or thrombosis, During the first stages, differential diagnosis will include: high hematocrit (polycythemia) and other causes of diffuse cerebral edema.

#### TABLE OF CONTENTS/OUTLINE

Brain anatomy made simple. Protocol for CT acquisition.Learning how to read a CT. Stroke sequence. CT imaging according to stages of the ischemic cascade.Differential diagnosis for hypodensities; leukoaraiosis and enlarged perivascular spaces.

### EREE-23 PHOTON-COUNTING DETECTOR CT FOR FORENSIC PATHOLOGY: THE FIRST EXPERIENCE

Kojima Masatoshi, RT (*Abstract Co-Author*) Nothing to Disclose
Yohsuke Makino, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) While photon-counting detector CT (PCD-CT) is beginning to be used clinically, its use in forensic pathology is still minimal. 2) In our forensic autopsy facility, a prototype PCD-CT is being evaluated and used routinely with conventional energy-integrating detector CT (EID-CT) scanning for pre-autopsy examination. 3) Real cases with autopsy results are exhibited to show the PCD-CT effectiveness compared to EID-CT in forensic pathology. 4) Ultra-high-resolution mode of PCD-CT is highly useful in forensic practices such as fracture detection and coronary angiography. 5) Multi-energy discrimination also can be used some forensic practices such as bone marrow edema detection and drug overdose cases.

#### TABLE OF CONTENTS/OUTLINE

Introduction: Basic knowledge of PCD-CT that is useful in forensic medicineObjectiveUtility of ultra-high-resolution mode in forensic pathologyUtility of multi-energy-discrimination mode in forensic pathologySummary

### EREE-24 POSTPARTUM COMPLICATIONS: HEAD TO TOE

Robin B. Levenson, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana J. Tobler, MD (*Abstract Co-Author*) Nothing to Disclose
Alyssa Sherwill, MD (*Abstract Co-Author*) Nothing to Disclose
Carl C. Flink, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

-Normal CT and US appearance of the postpartum uterus: Twice its normal size with endometrium thicker than 2 cm with intracavitary gas s/p cesarian section(CS). CS scar appears as low attenuation in the LUS. Uterine Discontinuity is common.-Bladder flap hematoma (BFH): Heterogeneous collection between the uterus and bladder-Uterine Dehiscence: Incomplete rupture. Serosa remains intact. Associated with BFH larger than 5cm.-Uterine Rupture: separation of all the layers of the uterine wall communication with the peritoneum. Hemoperitoneum will be present.-Retained Products of Conception (RPOC): Persistent placental or trophoblastic tissue in the uterine cavity. postpartum hemorrhage.-Endometritis: #1 cause of postpartum fever. US first line. Heterogenous debris with gas-Primary Postpartum hemorrhage: Etiology: atony, trauma, BFH, rupture, abnormal placentation-Thrombosis: venous thrombus can progress to thrombophlebitis and thromboemolic events.-Eclampsia: may present with seizure. MR imaging showing edema or posterior reversible encephalopathy-Cardiomyopathy: Echocardiogram and Cardiac MRI will demonstrate systolic dysfunction. MRI may demonstrate delayed ventricular enhancement

**TABLE OF CONTENTS/OUTLINE**

-Introduction -Normal Postpartum Uterus -Postpartum Uterine Pathology -Bladder Flap Hematoma -Dehiscence Rupture -Retained Products of Conception -Endometritis -Postpartum Hemorrhage -Thrombosis/Thromboembolic Events -Gonadal v. thrombophlebitis -Pulmonary Emboli/DVT -Eclampsia-Cardiomyopathy

## EREE-25 AAST GRADING SYSTEM FOR COMMON EMERGENCY GENERAL SURGICAL (EGS) CONDITIONS OF THE ABDOMEN AND PELVIS

Azfar Siddiqui, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review AAST grading system for common emergency general surgical (EGS) conditions of the abdomen and pelvis. Provide pictorial review for various grades.

**TABLE OF CONTENTS/OUTLINE**

Background AAST EGS grades range from I through V, reflecting an escalating clinical progression from mild disease limited within the organ itself to severe disease that is widespread. 1. Bowel Ischemia 2. Intestinal obstruction 3. Hernia 4. Acute cholecystitis 5. Acute pancreatitis 6. Perforated peptic ulcer disease 7. Acute appendicitis 8. Acute diverticulitis 9. Perirectal abscess 10. Infectious colitis 11. Pelvic inflammatory disease Limitation

## EREE-26 RHEUMATOLOGIC DISEASES EMERGENCY: WHAT SHOULD RADIOLOGISTS KNOW?

Maryam Soltanolkotabi, MD (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Abstract Co-Author*) Nothing to Disclose
Parham Pezeshk, MD (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Pattana Wangaryattawanich, MD (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Behzad Aminzadeh (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

· Review the different rheumatologic diseases emergencies· Illustrate the pattern of involvement on different imaging modalities· Discuss the role of imaging in detecting emergencies in early stages

**TABLE OF CONTENTS/OUTLINE**

In this exhibit, we aim to provide a review of different rheumatologic diseases and emergency conditions affecting different organs. We will explore the specific features of emergencies of following diseases:· Rheumatoid arthritis:§ Atlantoaxial instability§ Tenosynovitis, tendon rupture§ Carpal tunnel syndrome§ Osteoporotic fracture§ Cricoarytenoid arthritis§ Ruptured of synovial cyst (pseudothrombophlebitis syndrome)§ Septic arthritis§ Pericarditis, myocarditis§ Pleuritis, interstitial lung disease, drug-induced lung disease§ Vasculitis: meningitis, alveolar hemorrhage, transverse myelitis, gastrointestinal (hemorrhage, bowl ischemia, necrotizing vasculitis)· Gouty arthritis:§ Acute gout attack§ Renal stones· Ankylosing spondylitis:§ Spinal fracture (chalk stick fracture)§ Cauda equina syndrome· Systemic lupus erythematosus§ Vasculitis: diffuse alveolar hemorrhage, CNS, mesenteric§ Thromboembolism: pulmonary embolism, dural sinus thrombosis, CNS stroke, avascular necrosis§ Infection: digital gangrene/ulcer, septic arthritis§ Inflmmation: pericarditis, acute lupus pneumonitis, transverse myelitis, Libman-Sacks endocarditis with valvular dysfunction· Scleroderma§ Aspiration pneumonitis§ MyocarditisFinally, we will describe different patterns of involvement that influence the imaging findings of rheumatologic diseases emergency.

## EREE-27 TWISTS OF FATE: MULTIMODALITY IMAGING OF INTERNAL ORGAN TORSION

Reham M. Ellessy, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maryam Rezvani, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Badawy, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Rogers, MD (*Abstract Co-Author*) Royalties, RELX
Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A. Understand the pathophysiology behind organ torsionB. Recognizing common clinical presentation of organ torsionC. Multimodality multiorgan imaging features of torsionD. Identify updates in management and Imaging follow-up

**TABLE OF CONTENTS/OUTLINE**

A. Introduction1. Risk factors for Organ torsion2. General pathophysiological considerationB. Torsion in Cardiothoracic Imaging1. Lung torsion2. Transplant lung torsion3. Pedunculated tumor torsion.C. Torsion in genitourinary Imaging1. Renal transplant torsion2. Testicular torsion, testicular appendage torsion3. Ovarian torsion4. Fallopian tube torsion5. Adnexal cyst torsionD. Other organ torsion1. Gall bladder torsion2. Splenic torsion3. Splenule torsion4. Omental and mesentric fat torsionE. Gastrointestinal torsion1. Gastric volvulus2. Mid-gut volvulus3. Cecal volvulus and cecal bascule4. Sigmoid volvulusF. Imaging pitfalls and common mimicsG. Management: Conservative and surgical updates in management

## EREE-28 SEAL THE DRIP: A MULTIMODALITY APPROACH FOR CSF LEAKAGE DIAGNOSIS AND MANAGEMENT

Ali Morshid, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Badawy, MD (*Abstract Co-Author*) Nothing to Disclose
Reham M. Ellessy, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Arwa Kaoud, MD (*Abstract Co-Author*) Nothing to Disclose
Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Describe the anatomy and physiology of CSF flow.• Outline the various etiologies of CSF leak as a cause of intracranial hypotension.• Describe the common imaging modalities used to diagnose CSF leak• Elaborate Imaging findings and pitfalls associated with CSF leak.• Discuss the role of IR (Interventional Radiology) in the management of CSF leak.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction:a. Anatomy of Dural spaces.b. Physiology of normal CSF circulation.2. Etiological classification of intracranial hypotension:a. Congenitalb. Acquired i. Traumatic ii. Iatrogenicc. Spontaneous3. Clinical presentation and diagnostic workup.4. Imaging features of intracranial hypotension5. Imaging findings of CSF leak:a. Conventional Myelography (standard and lateral decubitus) i. Technique ii. Image interpretationb. CT and MRI Cysternographyc. CT Myelogram (static and dynamic)d. MRI Myelogram (CSF leak protocol)6. Algorithmic imaging approach for the diagnosis of CSF leak7. Differential diagnoses, concurrent diagnoses, and imaging pitfalls8. Therapeutic interventionsa. Epidural blood patch (directed and multilevel)b. Epidural Fibrin patch injectionc. Epidural glue injectiond. Transvenous embolization for CSF venous fistulas9. Follow-up imaging.10. Conclusion and take-home message

## EREE-29 EXTREMITIES VASCULAR EMERGENCY: THE IMPACT OF IMAGING ON EARLY DIAGNOSIS AND MANAGEMENT

Sanaz Asadian, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Ethan W. Hua, MD (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Nastaran Hosseini (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Peter C. Thurlow, MD (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Yousefiasl, MPH (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the different vascular emergencies affecting extremities Illustrate the imaging findings of vascular trauma on different imaging modalities Identify the different interventional procedures for treatment of vascular injuries

**TABLE OF CONTENTS/OUTLINE**

Blunt trauma, iatrogenic and penetrating trauma may cause life-threatening vascular injuries necessitate prompt diagnosis in the emergency room. Limb function and proper management depend on rapid diagnosis as late diagnosis can lead to morbidity and mortality. CT angiography can detect these injuries with high sensitivity and specificity. It is essential for radiologists to be familiar with the different patterns of vascular injuries, from arterial transection and active bleeding to late complications such as arteriovenous fistula. Interventional radiology plays an important role in the management of these cases. In this exhibit, we will review the imaging findings of different traumatic vascular injuries as follows: Arterial injury: Acute pathologies: Arterial transection Iatrogenic injuries Traumatic and contusion injuries Active bleeding and extravasation Intimal flap Dissection Vasospasms Occlusion Late pathologies: Pseudoaneurysm AV-fistula True aneurysm Treatment of arterial injuries Venous injuries: Acute pathologies: Thrombosis Vessel wall injuries Chronic pathologies: Venous insufficiency Treatment of venous injuries

## EREE-3 NEW DIAGNOSIS OF CANCER IN THE EMERGENCY DEPARTMENT: AN EDUCATIONAL TOOL TO OPTIMIZE DIAGNOSTIC WORKUP

Natalie A. Sanders, BA (*Abstract Co-Author*) Nothing to Disclose
Kiran K. Maddu, MBBS (*Abstract Co-Author*) Nothing to Disclose
Hayden Smith (*Abstract Co-Author*) Nothing to Disclose
Mendel Lebowitz (*Abstract Co-Author*) Nothing to Disclose
Carrie N. Hoff, MD (*Abstract Co-Author*) Nothing to Disclose
Christian Gomez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Learn a systematic approach to reporting incidental cancers on Emergency Department studies.-Review imaging appearances and cancer staging guidelines for the most common cancers found in the ED.-Understand mimics, pitfalls, and special considerations-Discuss accurate reporting and appropriate recommendations for additional imaging.

**TABLE OF CONTENTS/OUTLINE**

Many cancers are incidentally found on imaging performed during the Emergency Department (ED) workup, with an estimated 20-50% of breast, colon and lung cancers diagnosed in the ED globally (PMID: 36622062). In a Medicare database study, 11% of cancer diagnoses were ED-mediated. Furthermore, cancer-related imaging in the ED has been shown to negatively affect report turnaround times and radiology workflow, which cause additional delays in patient care (PMID: 31759782).This exhibit will review newly diagnosed cancers in the Emergency Department utilizing an educational mnemonic and multimodal approach to help radiologists accurately triage these complex cases. Topics that will be discussed include:Educational Mnemonic "BIILD"?: Borders,? Internal?, Interfaces,? Lymph Nodes?, Distant Metastatic Lesions"BIILD" In Practice:? Breast Cancer?, Colorectal Cancer?, GU Cancer?, Lung Cancer,? Pancreatic Cancer?Special Considerations, Mimics, and Pitfalls. Topics include, but not limited to:? Indeterminate and Indolent lesions?, Benign "mass-like lesions?, Initial Presentation of Metastatic Disease?, Superimposed Findings?, Lymphadenopathy of Unknown Origin?, Infection/Inflammatory Disease?, Post-Treatment changes?, Non-contrast StudiesReporting Considerations

## EREE-30 DON'T DROP THE BALL: ULTRASOUND PRESENTATIONS OF THE PENIS AND TESTICLES IN THE EMERGENCY

Gabriel Pianowski Pajanoti, MD (*Abstract Co-Author*) Nothing to Disclose
Thais Rocha (*Abstract Co-Author*) Nothing to Disclose
Angelo C. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Diego R. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Lais Abduch, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Naves (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the main anatomical landmarks of the penis and testiclesHighlight the most frequent penile and testicular disorders in emergency servicesIllustrate and describe the ultrasound findings of these injuries

**TABLE OF CONTENTS/OUTLINE**

IntroductionMain anatomical landmarksUltrasound technique and normal featuresTesticles injuries: epididymitis and orchitis, testicular torsion, testicular trauma, testicular cancerPenile lesions: priapism, penile traumaTake home message

## EREE-31 ACUTE ISCHEMIC STROKE IN CHILDREN: NAVIGATING DIAGNOSTIC AND MANAGEMENT PATHWAYS - WHAT THE EMERGENCY RADIOLOGIST NEEDS TO KNOW

Manohar M. Shroff, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Vivek B. Pai, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Prakash Muthusami, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Neetika Gupta, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To highlight the distinct aetiopathogenesis, differential diagnosis and imaging features of acute ischemic stroke in pediatric population.2. To outline imaging protocols and enhanced imaging based diagnostic approaches in suspected pediatric acute ischemic stroke, including emerging roles of fast MRI and vessel wall imaging in the emergency setting. 3. To emphasize collaborative interdisciplinary approach and efficient 'stroke code' pathways to ensure prompt management, mitigate patient selection, and judicious use of endovascular thrombectomy in aptly selected cases.

**TABLE OF CONTENTS/OUTLINE**

The primary objective of the exhibit is to comprehensively evaluate the frequently encountered and rare imaging findings in pediatric acute ischemic stroke, focussing on imaging techniques and protocols and their implications for patient selection and management in the emergency setting. Typical and atypical causes and risk factors specifically associated with acute ischemic stroke in children will be discussed. This exhibit will illustrate the imaging findings pivotal in guiding such interventions with goals to improve outcomes. Mechanical thrombectomy is now being increasingly used in children with large vessel occlusion. There are specific contraindications to thrombectomy, such as focal cerebral arteriopathy. Using a case-based approach, we will demonstrate an imaging-based diagnostic approach for pediatric acute ischemic stroke, streamline emergency management protocols, guide intervention, and ultimately improve short- and long-term outcomes.

## EREE-32 BREAKING BARRIERS: A GUIDE TO TRAUMATIC DIAPHRAGMATIC INJURIES

Noah G. Ditkofsky, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Robert K. Moreland, MD (*Abstract Co-Author*) Nothing to Disclose
Yigal Frank, MD (*Abstract Co-Author*) Nothing to Disclose
Joel Kosowan, MD (*Abstract Co-Author*) Nothing to Disclose
David Gomez (*Abstract Co-Author*) Nothing to Disclose
Shobhit Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Vinu Mathew, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.To demonstrate various direct and indirect CT signs of traumatic diaphragmatic injury.2.To discuss the mimics of traumatic diaphragmatic injury. 3.To describe differences in approach while interpreting blunt and penetrating traumatic diaphragmatic injuries.4.To understand what the surgeons need to know to appropriately manage the patient

**TABLE OF CONTENTS/OUTLINE**

• Direct CT signs- Segmental diaphragmatic defect, dangling diaphragm, absent diaphragm. • Indirect CT signs related to herniation- Collar sign, humps and band sign, dependent viscera sign, herniation through a defect, sinus cutoff sign, elevated abdominal organ sign, abdominal content peripheral to the diaphragm or lung. • Indirect CT signs not related to herniation- Thickening of the diaphragm, diaphragmatic or per diaphragmatic contrast media extravasation, hypo enhancing diaphragm. • Mimics of diaphragmatic injury- Chronic eventration/elevation of the diaphragm, chronic hernias (Bochdelek, Morgagni, hiatal). • The importance of trajectory (‘trajectory sign’) in penetrating trauma. • Points to include in report: what the surgeon wants to know.

## EREE-33 THE IMPACT OF BLUNT TRAUMA ON THE DIAPHRAGM

Omar Jamil, MD (*Abstract Co-Author*) Nothing to Disclose
Robert J. Dym, MD (*Abstract Co-Author*) Nothing to Disclose
Nina E. Glass, MD (*Abstract Co-Author*) Nothing to Disclose
Inessa A. Goldman, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin Chu, BA, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

•Unlike penetrating diaphragmatic injuries which can be predicted with high accuracy by visualizing the trajectory of the insult, blunt diaphragmatic injuries represent a diagnostic challenge, requiring a high index of suspicion.•When a focal diaphragmatic defect is not directly visualized, diagnosis relies on recognition of key signs, such as “hump,” “collar," "dependent viscera," “band sign,” among others.•Blunt diaphragmatic ruptures require surgical treatment regardless of size due to possible catastrophic outcomes in case of missed or delayed diagnosis.•Understanding the anatomic relations, functional significance, and embryological development improves detection of diaphragmatic injuries and decreases incidence of “non-therapeutic” laparotomies.

**TABLE OF CONTENTS/OUTLINE**

•Overview of the anatomy and embryological development of the diaphragm with respect to blunt trauma and radiologic assessment•Imaging modalities: discussion of the utility and limitations of radiographs and CT in diagnosis•Comprehensive overview of imaging features and signs with examples.•Surgical context including Western Trauma Association guidelines and review of American Association for the Surgery of Trauma grading score•Common pitfalls and mimics, such as non-traumatic and congenital diaphragmatic defects

## EREE-34 LINES AND TUBES AND BALLOONS, OH MY!: A PRIMER ON ABDOMINOPELVIC SUPPORT DEVICES

Jason A. Pietryga, MD (*Abstract Co-Author*) Consultant, Radiostics LLC
Samuel J. Galgano, MD (*Abstract Co-Author*) Research support, Blue Earth Diagnostics Ltd;Research support, Novartis AG;Research Support, Curium SAS

Keon Mahmoudi, MD (*Abstract Co-Author*) Nothing to Disclose
John P. Nazarian, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas G. Rhodes, MD (*Abstract Co-Author*) Nothing to Disclose
Lindsey Shwayyat, MD (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Sidden, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Discuss support devices used in the gastrointestinal and genitourinary systems and indications for their use. 2. Review the normal imaging appearance of these devices and relevant anatomical landmarks. 3. Demonstrate relevant imaging findings in identifying support device malposition and resulting complications.

**TABLE OF CONTENTS/OUTLINE**

Radiologic confirmation of support device placement is standard clinical practice and accounts for many radiographic studies performed in the emergent setting. The large number of devices used in the gastrointestinal (GI) and genitourinary (GU) systems, some less commonly encountered, can make it challenging for the trainee to confirm their positioning on radiographs. A comprehensive reference detailing these devices will allow correct identification of appropriate device position and prompt recognition of device-related complications. This exhibit reviews GI and GU system support devices, including esophageal balloon tamponade devices, temperature probes, impedance-pH monitors, esophageal stents, gastrointestinal tubes, percutaneous and internally-placed cholecystostomy tubes, percutaneous nephrostomy tubes, urinary stents, suprapubic catheters, and urinary catheters. Radiographically visible device structural components, device utility, and indications for placement are discussed. Imaging findings indicative of appropriate and inappropriate device placement and complications associated with device malposition are shown.

## EREE-35 TRAUMATIC AORTIC INJURIES - IMAGING AND MANAGEMENT

Sanjeeva P. Kalva, MBBS, MD (*Abstract Co-Author*) Grants to the institution: NIH, BD, Black Swan, Trisalus, CRICO; Royalties: Elsevier, Springer, Thieme Consulting fee: Penumbra, Okami Medical, Boston Scientific, Medtronic, Covidien, Instylla, BD, Cannon, Varian, SIRTEX Stocks: Biogen Inc, Clover Health Investments Corp, Inovio Pharmaceuticals, Moderna Inc, Pfizer Inc, Novavax Inc, Orphazyme, Cassava Sciences Inc, Vivos Therapeutics Inc, Ardelyx Inc, Althea Health, Sarepta Therapeutics, Clover Health Investments Corp, CureVac BV, Immunoprecise Antibodies Ltd, Infinity Pharmaceuticals Inc, Zymergen Inc, BioNTech SE, Trillium Therapeutics Inc, Theravance Biopharma Inc, Doximity Inc, Eargo Inc, Allogent Therapeutics Inc, NRx Pharmaceuticals Inc, Atea Pharmaceuticals Inc,
Patrick D. Sutphin, MD, PhD (*Abstract Co-Author*) Stockholder, Gilead Sciences, Inc;Stockholder, Editas Medicine;Stockholder, CRISPR Therapeutics AG;Stockholder, Intellia Therapeutics;Stockholder, Amwell;Stockholder, Teladoc Health Inc;Stockholder, Jazz Pharmaceuticals plc;Stockholder, ViewRay, Inc;Research funded, TriSalus Life Sciences
Kausthubh Hegde, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Introduction to Traumatic Aortic Injuries (TAI)
- Imaging techniques - including multi-detector CT (MDCT), CT-angiogram (CTA) and intravascular ultrasound (IVUS)
- Management Evolution: transition from surgical to endovascular repair

**TABLE OF CONTENTS/OUTLINE**

- Traumatic Aortic Injury: epidemiology, common mechanisms of injury and impact on healthcare
- Diagnostic Imaging Strategies (with case-based examples)- Role of chest radiographs in initial assessment- Detailed exploration of MDCT, CTA, and IVUS capabilities in identifying TAI
- Classification Systems (Society for Vascular Surgery and Harborview classification) and imaging features of TAI: intimal flaps, pseudoaneurysms, and mediastinal hematomas
- Management protocols and role of radiologists- Historical perspective: from open surgical repair to endovascular approaches- Criteria for choosing between surgical and endovascular repair based on imaging findings- Post-operative imaging and long-term surveillance strategies
- Case Studies and Clinical Outcomes- Review of typical cases with imaging studies and treatment outcomes- Discussion of complex cases illustrating decision-making challenges

## EREE-36 THE ATYPICAL AND EQUIVOCAL APPENDIX

**Awards**
**Certificate of Merit**

Adnan M. Sheikh, MD (*Abstract Co-Author*) Nothing to Disclose
Rajesh Bhayana, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Abstract Co-Author*) Nothing to Disclose
Ankush Jajodia, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Bipin Nanda, MD (*Abstract Co-Author*) Nothing to Disclose
Shobhit Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Basso Dias, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Satheesh Krishna, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Air in appendix - is it appendicitis or not ? 2. Periappendicitis vs secondary appendicitis 3. Small bowel obstruction can mimic appendicitis and vice versa 4. Cecal diverticulitis can mimic appendicitis and vice versa 5. Terminal ileitis can mimic appendicitis and vice vera 6. Pelvic inflammatory disease can mimic appendicitis and vice versa 7. Appendiceal diverticulitis - identification and significance 8. Epiploic appendagitis of the appendix- identification and significance 9. Appendiceal mucocele - identification and significance 10. How to approach an equivocal appendix? How to report an equivocal appendix? What to do next ?

**TABLE OF CONTENTS/OUTLINE**

Imaging first approach in evaluation of suspected appendicitis, with algorithm to select appropriate imaging modality/protocol. Identification of equivocal appendicitis with emphasis on auxillary features that may lead to diagnosis. Ideal reporting and communication of the equivocal appendicitis. Differentiation between periappendicitis and secondary appendicitis. Appendicitis mimicking bowel obstruction and vice versa. Cecal diverticulitis mimicking appendicitis and vice versa. Other common mimickers and confounders in evaluation of appendicitis like terminal ileitis and pelvic inflammatory disease (with or without tuboovarian abscess). Appendiceal diverticulitis, imaging features and significance. Epiploic appendagitis of the appendix, imaging features and significance. Appendiceal mucocele, identification and differentiation from appendicitis. "Take Home" algorithm for the evaluation of atypical and equivocal appendix.

## EREE-37 POST CARDIAC ARREST SYNDROME: MULTIMODALITY IMAGING EVALUATION

Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Manroop Kaur, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Gange JR, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc Stockholder, Bristol-Myers Squibb Company Research Consultant, Bayer AG Medical Advisory Board, AIxSCAN, Inc Shareholder, AIxSCAN, Inc
Mamta Gupta (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Post cardiac arrest syndrome (PCAS) is a complex condition characterized by a myriad of physiological derangements following successful resuscitation from cardiac arrest. Integration of Multimodality Imaging: Understand the complementary roles of various imaging modalities in the comprehensive evaluation of post cardiac arrest syndrome (PCAS). 2. Identifying Myocardial Dysfunction: Recognize the imaging hallmarks of myocardial dysfunction to guide prognosis and management decisions.3. Assessment of Neurological Injury: Utilize advanced imaging techniques, including MRI and CT, to assess for hypoxic-ischemic brain injury, cerebral edema, and other neurological sequelae of cardiac arrest, aiding in prognostication and treatment planning.4. Evaluation of Systemic Complications: Appreciate the role of imaging in identifying systemic complications of PCAS, including pulmonary edema, acute respiratory distress syndrome (ARDS), and multiorgan dysfunction syndrome (MODS), to guide supportive care strategies.5. Prognostic Implications: Understand the prognostic value of imaging findings in PCAS, such as the extent of myocardial injury, presence of neurological damage, and severity of systemic complications,6. Therapeutic Decision-Making: Integrate imaging findings into the formulation of individualized treatment plans for patients with PCAS.

### TABLE OF CONTENTS/OUTLINE

• Introduction and overview of Post Cardiac Arrest Syndrome • Pathophysiology of Post Cardiac Arrest Syndrome • Role of Multimodality Imaging in PCAS Evaluation • Discussion of teaching Points and Key Imaging Findings on cases basis

## EREE-38 HEMOPTYSIS IN THE EMERGENCY DEPARTMENT: CHECK-LIST BASED APPROACH TO GUIDE THE INTERVENTIONAL RADIOLOGIST

Aurea Diez Tascon, MD (*Abstract Co-Author*) Nothing to Disclose
Amine Moultamis, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Aguilar Picapiedra (*Abstract Co-Author*) Nothing to Disclose
Milagros Marti de Gracia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Silvia Ossaba (*Abstract Co-Author*) Nothing to Disclose
Maria-Luz Parra Gordo, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Romero Guzman (*Abstract Co-Author*) Nothing to Disclose
Juan Diego De La Morena Molina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To illustrate the bronchial arteries anatomy and primary mechanisms of injury.2. To review the indications and optimal imaging modality for the evaluation of life-threatening hemoptysis. 3. To emphasize the utility of employing a structured report template to streamline targeted endovascular treatment planning.

### TABLE OF CONTENTS/OUTLINE

1. Review the anatomy, classification and branching patterns of the bronchial arteries through illustrations, CT, and correlation with arteriography. 2. Main mechanisms of bronchial arteries injury. Graphical representation of alterations in pulmonary vascularization under hypoxic conditions. 3. Imaging evaluation in the Emergency Department. When and how to perform the study? 3.1 Indications of urgent study. 3.2 Optimal imaging protocol. 4. Proposal of a structured report. Serving as a roadmap to the Interventional Radiologist employing a checklist-based approach utilizing four key descriptors. 4.1 Signs of alveolar hemorrhage. 4.2 Signs of hemorrhage in the airway. 4.3 Vascular signs: a) Hypertrophy of bronchial arteries; b) Pseudoaneurysms c) Arteriovenous malformations. 4.4 Identification of the responsible lesion. 5. Illustrated pearls and common pitfalls that could influence the optimal treatment. 6. Take home points.

## EREE-39 BUGS ON THE BRAIN: PARASITIC AND VECTOR-BORNE INFECTIONS OF THE HEAD, NECK, AND NERVOUS SYSTEM

Douglas S. Katz, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Donato (*Abstract Co-Author*) Nothing to Disclose
Jannatun Sikder, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mine Sorkun, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro L. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Vikram S. Dogra, MD (*Abstract Co-Author*) Nothing to Disclose
Francisco Calle Bernal, MD (*Abstract Co-Author*) Nothing to Disclose
Nadia Solomon, MD, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe a variety of parasitic and vector-borne diseases likely to bring patients to the emergency room due to neurologic and infectious symptoms associated with manifestations affecting the head, neck, and nervous system. Provide a brief introduction to these infections, including the epidemiology, clinical presentations, and medical sequelae/complications. Provide an array of case examples demonstrating imaging features associated with acute and chronic, and common and uncommon sequelae of these infections across multiple imaging modalities. Provide a brief overview of management and treatment of these infections.

**TABLE OF CONTENTS/OUTLINE**

This exhibit will review parasitic and vector-borne infections that are likely to result in emergency room visits due to disease manifestations within the brain, neck, and nervous system. This will include protozoan infections (e.g., Chagas disease, leishmaniasis, cerebral malaria, toxoplasmosis), helminthic infections (e.g., cystic echinococcosis, cysticercosis), and vector-transmitted bacterial (e.g., Lyme disease) and viral infections (e.g., Eastern equine encephalitis, Powassan virus). It will provide a multimodality review of imaging findings, although primarily focusing on computed tomography and magnetic resonance imaging. It will review specific (e.g., multiloculated cysts characteristic of cystic echinococcosis) and nonspecific (e.g., mosquito- or tick-borne viral encephalitis) imaging findings, as well as common (e.g., mucocutaneous leishmaniasis, orbital cysticercosis) and uncommon sequelae (e.g., neurological manifestations of Chagas) of these diseases which can be appreciated on imaging studies of the head and neck.

## EREE-4 THE AORTIC BLUEPRINT: UNDERSTANDING PATHOLOGIES, NAVIGATING COMPLICATIONS, AND APPROACHING TREATMENT

Mili Rohilla, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua R. Russell, DO (*Abstract Co-Author*) Nothing to Disclose
Kuldip S. Mann, MD (*Abstract Co-Author*) Nothing to Disclose
Samruddhi V. Jain JR, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Gain insight into the anatomy and pathophysiology underlying aortic pathologies. 2. A thorough review of imaging findings encompassing diverse aortic pathologies and associated complications. 3. Explore the treatment approaches including preoperative evaluation for endovascular interventions.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to aortic anatomy- • Overview of aortic structure and function • Pathophysiology 2. Role of CT imaging in the evaluation of acute pathologies, protocol, and imaging findings 3. Imaging of different aortic pathologies: • Acute aortic syndrome - - Aortic dissection- Ų Classification Ų Imaging findings Ų Treatment - Penetrating ulcer- Ų Definition Ų Imaging features - Intramural hematoma Ų Definition Ų Imaging features • Aortic aneurysm - Ų Definition Ų Etiology Ų Diagnostic Criteria Ų Treatment Planning and Follow-Up • Aortic atherosclerosis and acute thrombosis Ų Risk Factors Ų Imaging Evaluation Ų Clinical Implications and Management Strategies • Aortic fistula Ų Etiology Ų Imaging findings Ų Management 4. Imaging features of common complications: • Pericardial effusion/hemorrhage • Aortic dissection extending in coronary vessels • Ruptured aortic aneurysm 5. Endovascular aortic interventions with preoperative imaging evaluation. Comprehensive understanding, early diagnosis, and timely intervention are paramount in mitigating the impact of aortic diseases and improving patient outcomes. This abstract focuses on arming radiologists with comprehensive knowledge of various aortic pathologies. Moreover, it encompasses details regarding pre-operative imaging for TAVR surgeries, aiding radiologists in discerning crucial elements to include in their reports.

## EREE-40 AORTOILIOFEMORAL (AIF) LOWER EXTREMITY CT ANGIOGRAPHY

Richard Tsai, MD (*Abstract Co-Author*) Nothing to Disclose
David H. Ballard, MD (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Isah G. Webb, MD (*Abstract Co-Author*) Nothing to Disclose
Katharina Feister, MD (*Abstract Co-Author*) Nothing to Disclose
John Wiltshire, MD (*Abstract Co-Author*) Nothing to Disclose
Vincent M. Mellnick, MD (*Abstract Co-Author*) Nothing to Disclose
Demetrios A. Raptis, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto A. Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Derek T. Nhan, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Z. Rajput, MD (*Abstract Co-Author*) Nothing to Disclose
Muhammad Naeem, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lanier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Constantine A. Raptis, MD (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Lower extremity CT angiography is a frequently ordered exam in both the emergency and outpatient settings, for indications ranging from peripheral arterial disease and trauma to infectious and inflammatory conditions. Given the wide range of anatomic coverage, these studies place a premium on both optimal imaging technique and efficient but comprehensive interpretation. This exhibit will:1) Discuss the imaging technique and rationale for lower extremity CTA AIF2) Describe normal anatomy and key collateral vascular pathways3) Illustrate reporting strategies and image manipulation techniques for efficient interpretation and reporting4) Cover the spectrum of disease processes affecting the lower extremity vasculature, including peripheral arterial disease, trauma, and infectious and inflammatory disorders

**TABLE OF CONTENTS/OUTLINE**

- The role of CT AIF imaging- Anatomy: normal anatomy, variants and key collateral vascular pathways- Imaging technique: Timing, kVp, bolus tracking, repeat delayed imaging, advanced techniques (metal artifact reduction, spectral/photon counting CT); combining with chest and AAA imaging- Search pattern, reporting, and pitfalls: templated reporting, extravascular findings, bolus timing (outrunning of bolus or venous contamination), blooming, satisfaction of search- Peripheral arterial disease: stenosis, occlusion, bypass grafts, stents, embolic disease, peripheral aneurysms- Trauma: active extravasation, pseudoaneurysm, occlusion, vasospasm, transection, dissection, arteriovenous fistula, iatrogenic injury- Infectious/inflammatory: graft infection, mycotic pseudoaneurysms, cystic adventitial disease, Buerger’s disease

## EREE-41 HEAD SPIN

Mathew Storey, MBChB (*Abstract Co-Author*) Nothing to Disclose
Robert P. Barker, FRCR, MRCP (*Abstract Co-Author*) Nothing to Disclose
Nora Sangvik Grandal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Najeed Khan, BMBS, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Acute dizziness is a common reason for presentation to the Emergency Department, but rather than a diagnosis, it is an imprecise descriptor of symptoms with an estimated misdiagnosis rate of 80%. Distinguishing terms such as vertigo and light-headedness are unhelpful as symptom quality does not reliably predict the cause of dizziness. Indiscriminate application of CT and MRI has a low yield in acute dizziness. Despite this, over 50% of patients attending ED with dizziness will have a CT brain to exclude a posterior circulation stroke. This poster highlights a novel algorithm to stratify patients into 1

of 4 major syndrome categories: each with its own differential diagnoses, targeted examination techniques, and recommended imaging modality. By addressing the following teaching points, this educational exhibit aims to improve understanding of acute dizziness and equip the vetting radiologist with a framework to facilitate effective discussion with clinicians and ensure the appropriate use of medical imaging:
- Establish a practical definition of acute dizziness.
- Illustrate the relevant neuroanatomical principles behind eye movements and their relationship to the vestibular system.
- Provide a framework to establish the appropriate use of targeted radiological imaging for patients presenting with acute dizziness.
- Provide a variety of example cases with important radiological imaging findings in patients presenting with acute dizziness.

**TABLE OF CONTENTS/OUTLINE**

- Defining dizziness
- The Triage-TiTrATE-Test algorithm
- Triage
- Timing and Triggers
- Targeted examination and Tests
- Nystagmus and the Vestibulo-ocular reflex pathway
- Example cases with radiological findings
- Summary

## EREE-42 FALLING THROUGH THE CRACKS: PEER LEARNING IN TRAUMA TORSO CT

**Awards**
**Certificate of Merit**

Robin B. Levenson, MD (*Abstract Co-Author*) Nothing to Disclose
Karen S. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed G. Aboseria, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Trauma torso CT is a staple of Emergency Department (ED) trauma evaluation. Given time sensitivity, complexity, and various findings that may be encountered at CT, in addition to potential distractions in the acute setting, imaging findings may be inadvertently overlooked or misinterpreted. Contributory factors include inattentional blindness, satisfaction of search, framing bias due to the provided indication, and ambiguity effect due to unfamiliarity with a finding. Familiarity with these contributory factors can enhance a radiologist's search pattern and appropriate management.

**TABLE OF CONTENTS/OUTLINE**

This exhibit will focus on trauma torso CT peer learning cases from our institution, including contributory factors which may have led to the diagnostic error and teaching pearls to avoid potential pitfalls/biases in diagnosis. A) Case based imaging review of missed/misinterpreted thoracic findings on trauma torso CT including diaphragmatic rupture, aortic injury, and pulmonary embolism. B) Case based imaging review of missed/misinterpreted gastrointestinal findings on trauma torso CT including hepatic laceration, gastric perforation following gunshot wound, and diaphragmatic slip mistaken for hepatic subcapsular hematoma. C) Case based imaging review of missed/misinterpreted genitourinary findings on trauma torso CT including bladder rupture, placental abruption, and duplicated renal arteries mistaken for dissection. D) Case based imaging review of missed/misinterpreted musculoskeletal findings on trauma torso CT including misaligned right hip arthroplasty, mid thoracic spine fracture in the setting of DISH, and subtle right femoral neck fracture.

## EREE-43 INSIGHTS INTO ACUTE MESENTERIC ISCHEMIA: ESSENTIAL KNOWLEDGE FOR RADIOLOGY RESIDENTS

Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Rodriguez Ramirez, MD (*Abstract Co-Author*) Nothing to Disclose
Lorena Melian Iribar, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Cayon Somacarrera, MD (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Learn the correct computed tomography scan protocol. 2) Recognize the different subtypes of acute mesenteric ischemia in imagen tests. 3) Become familiar with gastrointestinal tract vascular anatomy. 4) Learn the typical computed tomography scan findings and indicators of irreversible ischemia.

**TABLE OF CONTENTS/OUTLINE**

Mesenteric ischemia can manifest as either acute (95%) or chronic (5%; typically associated with diffuse atherosclerotic disease). Acute Mesenteric Ischemia (AMI) is a critical medical condition resulting from reduced blood flow to the intestines. Subtypes of AMI include arterial occlusion (embolic and thrombotic), venous occlusion, non-occlusive mesenteric ischemia (NOMI), and closed-loop obstruction. Among these, arterial occlusion is the most prevalent subtype and carries the worst prognosis. The gastrointestinal tract receives perfusion from the celiac trunk, the superior mesenteric artery (SMA), and the inferior mesenteric artery (IMA). In cases of mesenteric ischemia, collateral pathways between these arteries become crucial, offering protective blood flow in patients with vascular stenosis or occlusion. Irreversible ischemic injury occurs within six hours following complete vascular occlusion. The diagnosis of AMI can be challenging because symptoms and laboratory tests are often nonspecific, requiring a high degree of clinical suspicion. Computed tomography (CT) is the most sensitive and specific imaging test for diagnosing AMI, making it the preferred imaging modality when suspicion arises. Moreover, CT enables the exclusion of alternative causes of acute abdominal pain.

## EREE-44 A PUNCH TO THE GUT: CT FINDINGS IN BLUNT TRAUMATIC INJURY TO THE BOWEL AND MESENTERY

Sarah Hickman, MBBS (*Abstract Co-Author*) Research collaboration, Vara;Research collaboration, ScreenPoint Medical BV;Research collaboration, Lunit Inc;Research collaboration, Kheiron Medical Technologies Ltd;Research collaboration, Alphabet Inc;Research collaboration, Volpara Health Technologies Limited
Gurinder Nandra, FRCR,MBChB (*Abstract Co-Author*) Nothing to Disclose
Saigeet Eleti, FRCR, MBBChir (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Bowel and mesenteric injuries are the third most common type of injury in blunt trauma to the abdomen; detected in 5% of patients at laparotomy. Bowel injury may often be occult at clinical presentation and physical examination is unreliable. Delayed diagnosis is associated with significant morbidity and mortality due to haemorrhage or perforation leading to peritonitis and sepsis. Multidetector CT is the modality of choice when evaluating trauma patients that are haemodynamically stable. It may be performed rapidly and has high sensitivity and specificity in identifying bowel and mesenteric

injuries. Through retrospective review of patients presenting to our Level 1 trauma centre, we present the range of CT imaging appearances of bowel and mesenteric injury in blunt abdominal trauma and correlate them with surgical findings.We use a split-bolus protocol which enables arterial and venous enhancement in a single pass of the CT gantry. Additional techniques such as oral contrast may be used for image optimisation. Dual energy CT may be used to increase conspicuity of bowel injury. CT findings of bowel injury include discontinuity of the bowel wall, extraluminal gas or contrast, bowel wall thickening, abnormal enhancement and adjacent haematoma/fat stranding which are variably specific for traumatic injury.CT findings of mesenteric injury include mesenteric haematoma, abrupt termination of a mesenteric vessel or vessel irregularity. Imaging findings may be subtle and it is important that the radiologist is aware of the spectrum of appearances to minimise delay in time to intervention.

**TABLE OF CONTENTS/OUTLINE**

IntroductionImaging Technique CT features Bowel InjuryCT features Mesenteric InjurySummary

## EREE-45 IMAGING REVIEW OF ACUTE MEDIASTINITIS BASED ON ETIOLOGY

Alberto Hidalgo, MD (*Abstract Co-Author*) Nothing to Disclose
VICTOR PINEDA SANCHEZ, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Noemi Canete, MD (*Abstract Co-Author*) Nothing to Disclose
Sergi Juanpere (*Abstract Co-Author*) Nothing to Disclose
Adria Roset Altadill, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Acute mediastinitis is a life-threatening condition depicted at CT by increased mediastinal fat attenuation, pneumomediastinum and organized fluid collections. Acute mediastinitis can be caused by iatrogenic procedures, head and neck infections, gastroesophageal perforation and osteoarticular infections. Specific imaging findings may point towards the origin of the infection, which is advantageous to guide treatment decisions.

**TABLE OF CONTENTS/OUTLINE**

Acute mediastinitis is a life-threatening condition that results from inflammation and infection of the soft tissues and fat contained within the mediastinum. The different etiologies of acute mediastinitis include iatrogenic causes, extension from head and neck infections, intestinal perforation, or spread from osteoarticular infections. CT is an essential examination to diagnose acute mediastinitis and determine the extent of the disease. Common imaging features include increased mediastinal fat attenuation, pneumomediastinum, organized fluid collections and pleural effusions. Additionally, certain findings may help identify the source of the infection, which is advantageous for appropriate management. Signs of sternal dehiscence with adjacent inflammatory changes point towards a postoperative origin. The existence of oropharyngeal or cervical (air-)fluid collections extending to the mediastinum are highly suggestive of descending necrotizing mediastinitis. Esophageal perforation can be inferred indirectly by esophageal wall thickening and extraluminal air. Finally, cortical bone disruption or widening of an articular joint with adjacent mediastinal spread may indicate an osteoarticular origin.

## EREE-46 CLOSED LOOP SMALL BOWEL OBSTRUCTION: WHEN TO EVOKE THIS DIAGNOSIS

**Awards**
**Certificate of Merit**

Spencer C. Behr, MD (*Abstract Co-Author*) Grant, Cancer Targeted Technology;Scientific Advisory Board, Novartis AG;Research Consultant, GenVivo
Andrew D. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Joelle Harwin, MD (*Abstract Co-Author*) Nothing to Disclose
Stephen G. Wahlig, MD (*Abstract Co-Author*) Nothing to Disclose
Alexia R. Tatem, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Masis Isikbay, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Closed Loop Small Bowel Obstruction (CLSBO) should always be considered when evaluating a case of small bowel obstruction (SBO).2. CLSBO is a mechanical diagnosis (an isolated loop of bowel) and secondary signs of bowel ischemia are not required to make the diagnosis (but should be evaluated).3. CLSBO is a devastating missed diagnosis and requires prompt surgical management.

**TABLE OF CONTENTS/OUTLINE**

INTROPathophysiology of CLSBO- Clinical presentation patterns- Prompt diagnosis is critical for management (decision to go to the operating room)- CT of the Abdomen/Pelvis is an important part of the workup CT FEATURESTo raise suspicion for CLSBO consider the following pathway:1. Evaluate for any presence of SBO (Figure 1), which is required for a CLSBO. Always consider CLSBO for any case of SBO.2. Look for more than one transition point next to one another ("closed loop" physiology, Figure 2).3. Evaluate for other common patterns of CLSBO: "balloons on a string" appearance (Figure 3), isolated portion of distended bowel, decompressed bowel proximal/distal to affected loop.4. Evaluate for signs of bowel inflammation (bowel wall thickening, mesenteric fat stranding, free fluid, Figure 4) and bowel ischemia/necrosis (bowel wall hypo-enhancement, Figure 5).5. Understand that it is a mechanical diagnosis (bowel inflammation is often present but NOT required to make the diagnosis especially if caught very early). SUMMARY-These key imaging features help raise suspicion for CLBSO- Definitive diagnosis will come from operative findings- If unsure ask for backup/help to avoid delaying care for the patient

## EREE-47 ROLE OF NON-CONTRAST MRI IN THE ED SETTING OF ACUTE ABDOMINOPELVIC PAIN

Frank H. Miller, MD (*Abstract Co-Author*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA
Camila L. Vendrami, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Courtney C. Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Dallas Sturdevant, DO (*Abstract Co-Author*) Nothing to Disclose
Pardeep K. Mittal, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas L. Estes JR, MD (*Abstract Co-Author*) Nothing to Disclose
Nikolas Brozovich, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.To review epidemiology of most common acute abdominal and pelvic pathologies. 2. To provide MRI findings of common causes of acute abdomen including appendicitis, acute cholecystitis, acute pancreatitis, diverticulitis, ovarian torsion, Meckel's diverticulum. TOA, Torsed fibroid. Testicular infarction. Testcular trauma, Prostatic abscess. Splenic infarct, and Crohns 3. Discuss abbreviated non-contrast MRI protocols for acute emergencies.

**TABLE OF CONTENTS/OUTLINE**

Epidemiology of acute abdomen and pelvis • MRI findings of - Appendicitis - Acute cholecystitis - Acute pancreatitis - Diverticulitis - Ovarian torsion - Meckel's diverticulum •-TOA, Torsed fibroid-Testicular infarction.-Testcular trauma-Prostatic abscess-Splenic infarct.-Crohns

## EREE-48 YOU'LL POKE YOUR EYE OUT KID! AN ORBITAL TRAUMA PRIMER FOR THE ON CALL RADIOLOGY RESIDENT

Han Zhong, MD (*Abstract Co-Author*) Nothing to Disclose
Emily R. Convery, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Orbital trauma is a common situation residents encounter on call. However, reading and interpreting orbital imaging can be overwhelming especially in cases of complex trauma or in cases where there is underlying orbital pathology. A systematic approach to investigating the orbits is key to making crucial findings. Understanding the anatomy of the orbit is helpful in creating a search pattern for residents to follow. Injury can occur to the orbital wall bones, the globe itself, the extraconal soft tissues, or a combination of those compartments. The mechanism of injury and elements of the physical exam in addition to imaging findings will guide clinician's decisions about patient management, specifically if the patient will require emergent surgery or if close follow up is sufficient. It is important for residents to know what clinicians are looking for so that information can be included in the radiology report for clinical decision-making.

### TABLE OF CONTENTS/OUTLINE

1) Overview of Orbital Anatomy2) Orbital Imaging Search Pattern3) Mechanisms of Injury4) Red flag symptoms5) Orbital wall fractures6) Complications of orbital wall fractures7) Globe Injury - rupture, anterior chamber injury, posterior chamber injury8) Extraconal soft tissue injury9) Management options

## EREE-49 INTERSTITIAL LUNG DISEASE WITH ACUTE MANIFESTATIONS: TIPS FOR THE GENERAL AND EMERGENCY RADIOLOGISTS

Elena Garcia Garrigos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Almudena I. Urena Vacas, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Sirera Matilla, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa Feliu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
David Ferrandez Ferrandez (*Abstract Co-Author*) Nothing to Disclose
Juan Arenas-Jimenez, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The differential diagnosis of patients presenting with acute diseases manifesting as diffuse lung abnormalities at chest CT is a challenge. Among the many possible causes, we can find interstitial lung diseases (ILD) presenting with acute manifestations both as a debut in previously undiagnosed conditions or as a complication of known ILD. In the acute setting, a correct radiological orientation can be the clue for an adequate clinical management, perhaps contributing to a better outcome. In this exhibit our goals are: 1. To describe the clinical and radiological characteristics of ILD manifesting as acute lung diseases. 2. To show imaging findings that should suggest an acute debut of an unknown ILD. 3. To depict characteristic radiological findings of acute complications in patients with known ILD.

### TABLE OF CONTENTS/OUTLINE

1.Introduction: Global overview of ILD with acute manifestations. 2. Tips for diagnosing ILD with acute presentation. 3. Radiological manifestations and clinical information that should suggest a new onset of ILD. 3. Acute complications of ILD (acute exacerbation of ILD, lung toxicity, specific infections related to therapy). 4. Discussion of specific conditions (acute interstitial pneumonia, organizing pneumonia, non-specific interstitial pneumonia, acute exacerbation of ILD, rapidly progressive ILD, hypersensitivity pneumonitis, lung toxicity, granulomatous and lymphocytic interstitial lung disease,?)

## EREE-5 SPONTANEOUS HEMOPERITONEUM: WHERE DOES THE BLOOD COME FROM?

Roberto Garcia Figueiras, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sandra Baleato Gonzalez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paula Buades, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Spontaneous hemoperitoneum (SH) is defined as the presence of blood within the peritoneal cavity coming from a non-traumatic origin. It is a challenging diagnosis in the emergency setting, often because of the absence of clinical suspicion and its low frequency. Radiologists play a fundamental role in the identification and location of the source of bleed, both essential to be able to deliver the best care possible for the patient. This exhibit aims to:1. Synthesize the potential causes of SH to facilitate a systematic search approach. 2. Summarize the different imaging techniques of significant value for the detection and characterization of SH, in order to ascertain which is the best course of action when assessing SH cases. 3. Review relevant diagnoses to consider when evaluating a patient with SH.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: overview of non-traumatic hemoperitoneum 2. Potential causes of bleeding within the peritoneum.2. Imaging techniques: US, CT and dual-energy CT, MRI. Diagnostic protocol based on imaging in the setting of SH. 3. Key clues to find the hemorrhagic source: not-to-miss signs on CT imaging, and relevant anatomical concepts.4. Cases: collection of cases presented schematically to best illustrate the main entities to think about when searching the origin of SH, focusing on significant differences between etiologies and hints to facilitate a correct diagnosis. These cases will be organized by pathophysiological groups: 4.1. Gynecological4.2. Post-surgical4.3. Neoplasms4.4. Hematological4.5. Vascular 4.6. Systemic conditions.5. Conclusion

## EREE-50 RADIOLOGICAL INSIGHTS: EXPLAINING FIREARM TRAUMA WITH BALLISTICS KNOW-HOW

Sofia Thais Escobar Narro, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Sierra, MD (*Abstract Co-Author*) Nothing to Disclose
Esteban Mayayo-Sinues (*Abstract Co-Author*) Nothing to Disclose
Paloma Briceno Torralba, MD (*Abstract Co-Author*) Nothing to Disclose
Amalia Aranaz Murillo, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Roldan Minana (*Abstract Co-Author*) Nothing to Disclose
Elena Pascual Perez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Ballistic effects studies the consequences of projectiles fired when they impact the target and this knowledge is fundamental for interpreting images of gunshot victims.2. The cavities a bullet creates are influenced by the type of firearm, bullet velocity and trajectory, and tissue penetrated.3. X-rays locate projectiles, CT scans evaluate organic damage and entry/exit points and MRI assesses injuries and potential long-term consequences

**TABLE OF CONTENTS/OUTLINE**

This poster aims to explore the characteristics of gunshot wounds inflicted by various types of firearms, delve into the field of ballistic effects, and assess the role of different imaging modalities.Forensic radiology, particularly ballistic effects, is a subdivision of ballistics that studies the mechanisms of action, effects, and consequences of projectiles when they impact the target. These depend on the kinetic energy of the bullet and the temporary and permanent cavity it creates. This knowledge is fundamental for interpreting images of gunshot victims and producing our radiological report.Radiological imaging plays a crucial role in emergency settings and future management. X-rays aid in identifying the location of projectiles and determining the composition of bullets. CT offers a detailed evaluation of organ damage and entry/exit points. MRI helps assess injuries and potential long-term consequences, crucially distinguishing ferromagnetic materials to prevent adverse effects from imaging procedures.

## EREE-51 THE INVISIBLE INJURY: A COMPREHENSIVE IMAGING REVIEW OF SCAPULOTHORACIC DISSOCIATION

Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Hector Figueroa-Monsanto (*Abstract Co-Author*) Nothing to Disclose
Mariana Travieso Diffoot (*Abstract Co-Author*) Nothing to Disclose
Max Schreiber (*Abstract Co-Author*) Nothing to Disclose
Carol Sanchez Santana (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the epidemiology and etiology of scapulothoracic dissociation and commonly associated injuries. Demonstrate key imaging features for the initial evaluation and detection of scapulothoracic dissociation and its associated vascular and neurological injuries on various imaging modalities. Discuss additional thoracic injuries affecting the lungs, pleura, and mediastinum. Explain Zelle's classification of injuries for determining the severity and management of scapulothoracic dissociation.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction- Definition, Problem statement- mortality/ morbidity data II. Anatomy of relevant structures III. Mechanism of injury- High energy trauma IV. Imaging modalities- Chest X-ray, Chest CT, Shoulder CT, CT Angiogram for vascular evaluation, MRI branchial plexus V. Injuries Bony and ligamentous injuries, Lung injuries- Contusions, Pleural injuries- Pneumothorax, hemothorax, Mediastinal injuries- Pneumomediastinum, Vascular injuries- Pseudoaneurysm, dissection, Neurological injuries- Brachial plexus injuries, epidural hematoma VI. Classification of injuries- Zelle's classification VII. Management

## EREE-52 ATRAUMATIC EMERGENCY IMAGING OF THE SPINE

Jisoo Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Albert D. Jiao, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Computed tomography is often the first-line spinal imaging in the emergency setting, and careful evaluation can expedite appropriate management. 2. MRI is the most sensitivity imaging modality for noncompressive spinal emergencies, which requires careful consideration of clinical history such as symptom character and distribution. 3. Certain spinal pathologies such as spinal cord infarct require modifications to existing imaging protocols or real-time decision making from the radiologist, and therefore high pre-test clinical suspicion.

**TABLE OF CONTENTS/OUTLINE**

Compressive:Epidural - Primary spinal tumors or metastases with mass effect, discitis-osteomyelitis, disc herniation, degenerative disease, epidural lipomatosis, extramedullary hematopoisisSubdural - Subdural hematoma/empyema/hygromaIntradural/Extramedullary - Primary spinal tumors and cysts (shwannoma, meningioma, epidermoid), leptomeningeal metastasesNoncompressive: Inflammatory/Infectious - Guillain-Barre, Arachnoiditis, Transverse Myelitis, Neurosarcoidosis, Radiation-InducedVascular - Infarct, Arteriovenous malformation and fistula, VasculitisToxic-Metabolic - Subacute combined degeneration, nitrous oxideDemyelinating - Multiple sclerosis, neuromyelitis optica, acute disseminated encephalomyelitisMimics and other diagnoses:Crowned Dens Syndrome/CPPD, Calcific Tendinitis of the longus colli muscle, Osteoid osteoma/osteoblastoma, Treatment-related effects, including immune related adverse events and radiation osteitis, Iatrogenic injury/Postsurgical, Congenital/syndromic - Scheurmann disease, syringomyelia, tethered cord syndrome, sickle cell pain

## EREE-53 EMERGENCY NON-TRAUMATIC CARDIAC IMAGING FOR THE NON-CARDIAC RADIOLOGIST

**Awards**
**Cum Laude**

Christian P. Houbois, MD (*Abstract Co-Author*) Nothing to Disclose
Elsie Nguyen, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Jonatas Favero Prietto Dos Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew Aitken, MBChB, FRANZCR (*Abstract Co-Author*) Nothing to Disclose
Michael N. Patlas, MD, FRCPC (*Abstract Co-Author*) Royalties, Holtzbrinck Publishing Group
Felipe S. Torres, MD, PhD (*Abstract Co-Author*) Research support, Altis Labs
Felipe A. Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Farah Cadour, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Presenter*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

**TEACHING POINTS**

1. Urgent cardiac abnormalities can be identified on non-gated chest imaging performed for another indication in patients presenting to the emergency department with non-traumatic acute chest pain, dyspnea or palpitations2. Coronary abnormalities identified on chest CT in the emergency department include plaque rupture resulting in myocardial ischemia and infarct, spontaneous coronary artery dissection, anomalous coronary artery origin with malignant course, and coronary vasculitis.3. Emergency non-coronary cardiac findings include aortic root dissection, stress-induced or other cardiomyopathy, cardiac masses and thrombus, epipericardial fat necrosis, myocarditis, pericarditis, and pericardial tamponade4. The heart should be evaluated on all thoracic imaging including the coronary arteries, cardiac chambers, pericardium, valves, and adjacent fat, with particular attention in patients presenting to the emergency department with acute chest pain, dyspnea, or palpitations where no other cause is identified

**TABLE OF CONTENTS/OUTLINE**

1. Review non-traumatic acute cardiac diseases and complications in the emergency department including incidence, presenting symptoms, pathophysiology, imaging findings, and clinical outcomes2. Describe the importance of evaluating the heart on emergency non-traumatic thoracic imaging performed for other indications such as evaluation of pulmonary embolism or aortic dissection3. Demonstrate acute cardiac abnormalities on chest x-ray

and chest CT performed for other indications in the emergency department including coronary artery, myocardial, pericardial, valvular and other cardiac abnormalities

## EREE-54 IMAGING FEATURES OF BLUNT THORACIC AORTIC INJURY: WHAT THE RADIOLOGIST NEEDS TO KNOW

**Awards**
**Certificate of Merit**

Andrew Sinensky, MD (*Abstract Co-Author*) Nothing to Disclose
Elana B. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Ishaan J. Bhatt, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Blunt traumatic aortic injuries (BTAI) are frequently classified using the Society of Vascular Surgery classification system. Management is based on injury grade and hemodynamic stability of the patient. 2. Proposed mechanisms for BTAI include shear/torsion forces, osseous pinch, and water-hammer phenomenon. 3. Cardiac, pulmonary, abdominal, and osseous injuries often occur concurrently with BTAI. End organ ischemia/infarcts may result from the vascular injury.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. CTA Techniques and Considerations• Whole-body CT• Cardiac gating• Bolus timing• Dual energy applications3. Injury Mechanism• Shear/Torsion• Osseous Pinch• Water-Hammer Phenomenon4. Injury locations5. Injury Grading - Society of Vascular Surgery• Grade I - Intimal Tear• Grade II - Intramural Hematoma• Grade III - Pseudoaneurysm• Grade IV - Rupture6. Associated Injuries and Complications7. Mimics of Injury - Non-traumatic pathologies, anatomic variants, and technical factors8. Management• Non-operative vs. endovascular vs. open• Treatment complications - infection, stent migration, endoleak, injury progression, fistula formation9. Summary

## EREE-55 THE NO-SO-CUTE ACUTE LIVER: PRESENTATIONS AND IMAGING OF EMERGENT LIVER PATHOLOGY

Joseph W. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Sophia Humphrey (*Abstract Co-Author*) Nothing to Disclose
Robert G. Meek (*Abstract Co-Author*) Nothing to Disclose
Sri Kanth Dommeti, MBBS (*Abstract Co-Author*) Nothing to Disclose
Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
Elhamy R. Heba, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Trae C. Brooks, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Abdominal pain is one of the most common reasons for visits to the emergency department, accounting for 5-10% of all visits (139.8 million in the US in 2021). The liver is the largest organ in the abdomen and has attributable pathology in 0.5-1% of these cases (non-biliary causes). CT and US are often complimentary examinations in the workup of suspected liver pathology in the ED, with US a modality of choice in the pediatric population to avoid radiation exposure when possible. MRI remains a problem-solving modality when other imaging is equivocal. When acute non-biliary liver pathology is suspected, the radiologist should be familiar with the imaging findings seen in various forms of liver pathology and should also be prepared to recommend the appropriate imaging examination to assist referring clinicians in reaching a diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Background and Epidemiology.2. Overview of Acute Non-biliary Liver Pathology.3. Multimodality Case Presentations.a.Trauma-Brief overview of current AAST guidelines for blunt/penetrating hepatic trauma,Discussion of key findings to distinguish between different AAST injury grades.b. Nonbiliary Hepatic Infection,Abscess,Hepatitis.c. Hepatic Vascular Emergencies- Budd-Chiari Syndrome,Portal vein thrombosis,Hepatic Artery Stenosisd. Emergent Complications of Hepatic Neoplasm-Adenoma,HCC,Diffuse metastasise. Post op/ Iatrogenic- Bilomas/fluid collection/hemorrhage,Vascular-Fistula (after biopsy),Pseudoaneurysm (liver transplants),Peripheral PVT after targeted therapy4. Summary and Recommendations5. References.

## EREE-56 RADIOLOGY AT THE FRONTLINE: EXPERIENCE OF THE MOBILE MILITARY HOSPITAL

Uliana Y. Pidvalna, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The term and description of "military trauma" are changing every time with new technologies of weapons. In parallel, the development of radiological modalities is a tool that could assist military doctors even on the frontline for prompt and precise decisions. In the case of the modern ongoing war, understanding evacuation steps with diagnostic modalities at each point is necessary. The purpose of this exhibit is: 1. To show the evacuation steps with accessible diagnostic modalities at different stages. 2. To illustrate imaging findings of frontline combat trauma at the mobile military hospital using different techniques (X-ray, US and CT). 3. To discuss the challenges and difficulties in assessing military trauma at the mobile military hospitals.

### TABLE OF CONTENTS/OUTLINE

1. Principles and application of evacuation steps from the frontline with accessible radiological modalities.2. Radiological imaging of head/chest/abdomen/pelvis/extremities on the frontline, including, but not limited to, pneumothorax, hemothorax, hemoperitoneum, bleeding, heart and great vessels injuries, traumatic amputations, brain injuries (X-ray, USG and non-contrast CT) at the mobile military hospital.3. Diagnostic modalities triage: experience of the mobile military hospital.

## EREE-57 FLAP TO FLOP: EMERGENCY IMAGING OF EXTRAMAMMARY COMPLICATIONS AFTER BREAST RECONSTRUCTION

**Awards**
**Cum Laude**

William J. Hoover, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Surgical management of breast cancer is evolving quickly, with several breast reconstruction options available to patients after mastectomy or lumpectomy.
- Many breast reconstruction procedures utilize muscle, fat, and skin derived from the patient's abdomen, back, or extremities.
- Breast reconstruction may result in complications at flap donor sites including abscess, hematoma, wound dehiscence, or cellulitis.
- Many patients with donor site complications initially present to the Emergency Department, where evaluation often includes CT abdomen/pelvis or soft tissue ultrasound.
- This exhibit will review multimodality emergency imaging of complications at flap donor sites.
- The presentation will also compare expected post-operative changes with acute "can't miss" complications at flap donor sites.

**TABLE OF CONTENTS/OUTLINE**

- Imaging review of complications that occur at flap donor sites. This exhibit will discuss acute and long-term donor site complications for seven common breast reconstruction surgeries:
- Transverse rectus abdominis myocutaneous (TRAM) flap
- Deep inferior epigastric perforator (DIEP) flap
- Latissimus dorsi flap
- Superior gluteal artery perforator (SGAP) flap
- Transverse upper gracilis (TUG) flap
- Autologous fat grafting
- Omental flap
- Brief description of each reconstructive procedure, focusing primarily on relevant anatomy in the abdomen, back, or extremities.

## EREE-58 A HEAD TURNER: CERVICAL SPINE INJURIES, MANAGEMENT, AND COMPLICATIONS

Elana B. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Fayhaa Doja, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Blunt cervical spine injuries most often result from motor vehicle accidents and falls. Direction of force contributes to injury type. 2. AO classification systems exist for the upper (C0-C3) and subaxial (C3-C7) cervical spine. Injuries are further classified by location, osseous/ligamentous involvement, and stability. 3. Knowledge of spinal cord tract structure and function allows for prediction of neurologic deficits. For example, Brown-Sequard Syndrome causes ipsilateral weakness and impaired proprioception and contralateral loss of pain and temperature due to involvement of the corticospinal tract, dorsal column, and spinothalamic tract, respectively. 4. The postoperative cervical spine can be complicated by hardware failure, infection, nonunion, and fluid collections. Tracheal and esophageal injuries are unique to anterior approach surgeries.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Anatomy - Osseous - Ligamentous - Spinal Canal Spaces (epidural, subdural, subarachnoid) - Spinal Cord 3. Imaging Indications, Modalities, and Technical Factors4. AO Cervical Spine Classification - Upper Cervical Spine Injury (C0-C3) - Subaxial Cervical Spine Injury (C3-C7)5. Spinal Cord Injuries - Compression - Contusion - Transection - Infarct 6. Management- Nonoperative - Operative (upper vs. subaxial cervical spine) - Post-operative complications & 7; Hardware-related (malpositioning, failure, subsidence)& 7; Infection & 7; Nonunion& 7; Fluid collections & 7; Tracheo-esophageal& 7; Neurovascular & 7; Heterotopic ossification7. Summary

## EREE-59 MELENA AND HEMATOCHEZIA: ACUTE UPPER AND LOWER GASTROINTESTINAL BLEEDING- DIFFERENTIAL DIAGNOSIS AND ROLE OF IMAGING

Manohar Roda, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thomas L. Estes JR, MD (*Abstract Co-Author*) Nothing to Disclose
Frank H. Miller, MD (*Abstract Co-Author*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA
Pardeep K. Mittal, MD (*Abstract Co-Author*) Nothing to Disclose
Camila L. Vendrami, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Nikolas Brozovich, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Discuss causes of acute upper and lower gastrointestinal bleeding(melena vs hematochezia) 2. Describe diagnostic approach according to patient's clinical presentation 3. Describe role of different imaging modalities in the setting of acute GI bleeding and their pitfalls

**TABLE OF CONTENTS/OUTLINE**

This exhibit will discuss the etiology of acute GI bleeding above and below the ligament of Treitz. CT, MR, US, Radionuclide Scanning, Catheter angiography, and Endoscopy imaging findings will be discussed. In addition, the role of Intervention Radiology in the treatment of GI bleeding will be discussed.Upper GI bleeding- Gastric/duodenal ulcer, Gastritis, Variceal bleeding, Mallory-Weiss tear, Vascular lesions, and Neoplasms.Lower GI bleeding- Diverticular disease, Angiodysplasia, Neoplasms, Colitis(Ischemic/Inflammatory/Granulomatous), Intussusception, Meckel's diverticulum, Hemorrhoids, Benign anorectal lesions, and Anal fissures.

## EREE-6 HIGH REPRODUCIBILITY 3D-CTA WITH GENERATIVE AI : GENERATION OF PSEUDO-CONTRAST-ENHANCED CT IMAGE

Atsushi Teramoto, PhD (*Abstract Co-Author*) Nothing to Disclose
Masayoshi Niwa, RT (*Abstract Co-Author*) Nothing to Disclose
Masato Yoshida, RT (*Abstract Co-Author*) Nothing to Disclose
Yosuke Kuratani, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

We developed a method using Cycle-GAN to convert non-contrast-enhanced CT (non-CECT) images into pseudo-contrast-enhanced CT (pseudo-CECT) images. These pseudo-CECT images facilitate more accurate region of interest (ROI) setting during bolus tracking (BT), thus optimizing the timing for 3D-CTA imaging. Our study involved mutual conversion between contrast-enhanced CT (CECT) and non-CECT images, followed by ROI setting tests. The trained Cycle-GAN successfully produced pseudo-CECT and pseudo-non-CECT images resembling true CECT images. In ROI tests with pseudo-CECT

images, accuracy improved to nearly 50% compared to non-CECT images, greatly assisting in identifying common carotid artery and internal carotid artery locations. This method significantly aids technicians in ROI setting.

**TABLE OF CONTENTS/OUTLINE**

1. Analyze the current problems. 2. Development of a technique to convert non-CECT to CECT using CycleGAN. 3. Visual evaluation of the accuracy of depicting carotid arteries in a manner similar to contrast-enhanced CT imaging. 4. Comparison of the accuracy of ROI placement between pseudo-contrast images and non-contrast images. 5. Clinical implications

## EREE-60 DON'T MISS HOMICIDE-RELATED POSTMORTEM CT FINDINGS

Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Yuko Nakamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shintaro Morishita (*Abstract Co-Author*) Nothing to Disclose
Wataru Fukumoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hidenori Mitani (*Abstract Co-Author*) Nothing to Disclose
Haruka Higashibori (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

One of the purposes of postmortem CT (PMCT) is to confirm or deny death by homicide. The differentiation between traumatic- and endogenous subarachnoid hemorrhage (SAH) is occasionally difficult. PMCT scans can reveal damage to gastrointestinal- and abdominal aortae due to blunt abdominal trauma elicited by trampling and punching; body surface inspection may not discover such damage. In stabbing victims, PMCT helps to determine the depth - and thus the type, size, and direction - of the weapon. Hyoid- and cricoid cartilage fractures point to strangulation. In decomposed corpses, anomalously vertebral separation may suggest homicide. Checking the airway of neonatal cadavers helps to determine whether the birth was normal or a stillbirth. However, in some instances PMCT findings may incorrectly point to homicide in natural-death cases and it does not reveal the cause of death in poisoning victims. We present homicide-related postmortem CT findings in forensic cases which radiologists should know.

**TABLE OF CONTENTS/OUTLINE**

1. Violent death •Traumatic subarachnoid hemorrhages (SAH) •Blunt abdominal trauma 2. Strangulation 3. Stabbing 4. Corpse mutilation 5. Neonatal corpses •Differentiation of normal births from stillbirths 6. Pitfall of homicide-related postmortem CT findings •Heat hematoma •Poisoning

## EREE-61 PELVIC INJURIES IN HIGH-VELOCITY TRAUMA: A CHECKLIST BASED APPROACH

Sameer B. Raniga, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Alok K. Mittal, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Manickam Kumaravel, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Shubham Arora, MD (*Abstract Co-Author*) Nothing to Disclose
Devpriyo Pal, MD,FRCR,MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To recognize various anatomic bony landmarks on pelvic radiographs and CT. To understand the pathophysiology and biomechanics of injuries in pelvic trauma To learn how to approach CT with pelvic binders. To be aware of the most commonly used pelvic trauma classification schemes.To recognize pelvic injury patterns for accurate diagnosis and characterization of pelvic injuries to guide management decisions to ensure optimal clinical outcomes.To understand the treatment options, including the role of CT in planning treatment.To evaluate the postoperative appearance

**TABLE OF CONTENTS/OUTLINE**

Review the anatomy of the pelvis using illustrations, radiographs, and CT.Illustrate the spectrum of pelvic injuries and highlight crucial concepts for accurate diagnosis on radiographs/CT.Classify pelvic traumatic injuries with examples.An algorithmic approach to accurately predict and identify subtle injuries.A review of common pitfalls will be included. Understanding management principles and imaging evaluation of postoperative pelvic trauma

## EREE-62 SEAT BELT AORTIC INJURY: A DIAGNOSTIC CHALLENGE WITHIN THE SEAT BELT SYNDROME

Nerea Quilez (*Abstract Co-Author*) Nothing to Disclose
Andoni Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Lain Ibanez, MD (*Abstract Co-Author*) Nothing to Disclose
Susana Borruel, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Martinez Chamorro (*Abstract Co-Author*) Nothing to Disclose
Miguel Diez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To review the key imaging findings of seat belt syndrome and to describe the seat belt aortic injury.
- To present the overall incidence of seat belt aortic injuries among 70 patients with seat belt signs.
- To illustrate the different types of vascular injuries and their locations, as well as the most commonly used classifications.
- To summarize the therapeutic management of seat-belt aortic injuries according to current guidelines. No one doubts the fact that seat belts save lives. However, when an individual is involved in a motor vehicle collision with properly positioned 3-point restraints, they can suffer potentially fatal injuries through multiple mechanisms. Seat belt vascular injuries, a condition with low incidence in the seat belt syndrome, can be a diagnostic challenge. This presentation aims to review the concept of seat belt aorta as well as other vascular injuries due to seat belt, providing images from real cases in our level 1 trauma center.

**TABLE OF CONTENTS/OUTLINE**

- What is seat belt syndrome? Summary of imaging findings on CT. - Seat belt aortic injury. Mechanism of injury.- Sites and types of injury. Imaging findings and current classification systems.- Evolution and current guideline-based therapeutic approaches.- Take home points.

## EREE-63 COMMON, UNCOMMON, AND RARE RENAL INFECTIONS AND OTHER SELECTED EMERGENCIES - WHAT THE RADIOLOGIST SHOULD KNOW

**Awards**
**Certificate of Merit**

Anne Sailer, MD (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Paul Nikolaidis, MD (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Lejla Aganovic, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review the role of imaging in the diagnosis and management of renal infections.2. Review the radiological findings and risk factors for acute and chronic renal infections and their complications.3. Discuss uncommon, rare, and opportunistic causes of renal infections.4. Overview of genitourinary infections in the renal transplant patient.5. Discuss a few other selected non-infectious renal emergencies.

**TABLE OF CONTENTS/OUTLINE**

1. Demographics and risk factors for renal infections.2. Imaging modalities used in the evaluation of renal infections.3. Role of imaging in the evaluation of renal infections: the immunocompromised patient, treatment non-responders, equivocal clinical diagnosis, evaluation of disease extent, renal transplant patients, and patients with congenital anomalies.4. Radiological findings with cases from our institution of acute renal infections: acute pyelonephritis, renal/perirenal abscesses, pyonephrosis, emphysematous pyelonephritis/pyelitis, emphysematous pyelonephritis in the renal transplant patient.5. Radiologic findings with cases from our institution of chronic renal infections: chronic pyelonephritis; xanthogranulomatous pyelonephritis.6. Uncommon causes of renal infections or infection-related renal disease: tuberculosis; parasites; COVID-related renal disease.7. Renal infection in the transplant patient: spectrum, complications, and sequelae.8. Spectrum of non-infectious renal emergencies: acute kidney injury (AKI), anuria, interstitial nephritis, rhabdomyolysis, hepatorenal syndrome, renal colic and renal stones, hematuria, renovascular disease, cholesterol embolism, and contrast nephropathy.

## EREE-64 MATTERS OF SUBSTANCE: CNS IMAGING OF RECREATIONAL DRUG USE

Mariana R. Defreitas, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Ruggiero, MD (*Abstract Co-Author*) Nothing to Disclose
David E. Bartlett, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Recognize common recreational drugs in the United States and their basic neurologic effects. 2. Understand the associated neuroimaging findings of complications.

**TABLE OF CONTENTS/OUTLINE**

Background A. Nearly 25% of surveyed U.S. Americans used illicit drugs in the last year. B. Common drugs of choice: cocaine, amphetamines, opioids, marijuana, nitrites, and industrial solvents.Relevance A. Given prevalence, radiologists must recognize imaging findings B. CNS imaging manifestations of recreational drug can present in imaging studies order through Emergency Department C. Radiologists can aid clinicians in providing timely and appropriate care.Implications of Imaging Findings: A. Appearance is dependent on factors such as drug of choice, route of consumption, and impurities present B. Imaging can mimic other disease processes C. Findings can be suggestive illicit drug use when clinical history is unavailable.Acute and Chronic Findings A. Neurovascular - Ischemic strokes, intracranial hemorrhage, posterior reversible encephalopathy syndrome (PRES), dissection, thrombosis, aneurysms, and AVFs. B. Encephalopathies (heroin and cocaine induced) C. Infectious (i) septic emboli, embolic strokes, and mycotic aneurysms indicates disseminated infection (ii) IVDU can also be associated with HIV infection and its complications, including CNS toxoplasmosis and primary CNS lymphoma.Conclusion A. Emergency Radiologists must be familiar with the neuroimaging findings of drug use

## EREE-65 WHAT'S GOING ON BACK THERE? PENETRATING RETROPERITONEAL TRAUMA!

Richard E. Healicon, BMBCh (*Abstract Co-Author*) Nothing to Disclose
Saigeet Eleti, FRCR, MBBChir (*Abstract Co-Author*) Nothing to Disclose
Susan Cross, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Lukasz Zielinski, MBBCHIR (*Abstract Co-Author*) Nothing to Disclose
Ansab Fazili I, MBBS,BSC (*Abstract Co-Author*) Nothing to Disclose
Sarah Hickman, MBBS (*Presenter*) Research collaboration, Vara;Research collaboration, ScreenPoint Medical BV;Research collaboration, Lunit Inc;Research collaboration, Kheiron Medical Technologies Ltd;Research collaboration, Alphabet Inc;Research collaboration, Volpara Health Technologies Limited

**TEACHING POINTS**

-Clear understanding of the retroperitoneal spaces and contents allows radiologists to infer patterns of injury and suspected organ involvement, for example by recognizing the tracking of fluid and haematoma. -Retroperitoneal hematoma is often not seen on a FAST scan as it tracks posteriorly and deep as well as is obscured by bowel gas. -Retroperitoneal haemorrhage can result in a significant loss of circulating blood volume, haemodynamic instability and precipitate need for urgent intervention. -Following the pattern of gas and soft tissue injury in penetrating wounds helps to infer which structures are involved. Indirect signs of injury include: hematoma, active blush of contrast, fat stranding and free gas. -MPR and MIP reconstructions are crucial in evaluation of penetrating trauma; they allow visualisation of overlapping structures and review of vascular injuries. -Different types of delayed phase CT imaging helps to further characterise injuries as well as look for complications, such as, active bleeding, pseudoaneurysm, and urinoma.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction to retroperitoneal anatomy - contents, fascia planes, and spaces 2) Phases of imaging in penetrating trauma 3) Vessel injury - IVC, aorta, internal thoracic and lumbar arteries + complications 4) Pancreatic injury + complications 5) Duodenal injury + complications 6) Kidney injury + complications 7) Conclusion

## EREE-66 ACUTE MESENTERIC ISCHEMIA (AMI): UNDERSTANDING THE IMAGING FINDINGS AND MAKING A CRITICAL DIAGNOSIS

**Awards**
**Certificate of Merit**

David H. Kim, MD (*Abstract Co-Author*) Shareholder, Elucent Medical
Perry J. Pickhardt, MD (*Abstract Co-Author*) Advisor, Bracco Group;Advisor, Zebra Medical Vision Ltd;Advisor, Nano X Imaging;
Giuseppe V. Toia, MD, MS (*Abstract Co-Author*) Research Consultant, General Electric Company;Research Grant, General Electric Company

Meghan G. Lubner, MD (*Abstract Co-Author*) Spouse, Consultant, Elephas Bio
Matthew H. Lee, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Acute mesenteric ischemia (AMI) is a bowel emergency that is infrequent but has high morbidity and mortality. 2. Imaging plays a central role in early diagnosis and management. 3. Most causes are arterial (embolus > in situ thrombosis). Other causes include mesenteric venous thrombosis and low flow states (non-occlusive mesenteric ischemia, NOMI). 4. Identifying clot in a mesenteric vessel (artery or vein) establishes the diagnosis. Bowel and mesentery then document location and severity. 5. Non-visualization of clot means NOMI or small clot not seen at imaging. 6. Decreased wall enhancement specific to arterial causes (decreased inflow), wall thickening can be venous (outflow obstruction) or arterial (reperfusion and injury).

**TABLE OF CONTENTS/OUTLINE**

1. Discuss the importance of identifying AMI and the role of imaging in establishing the diagnosis - high mortality, improved outcomes with early recognition. 2. Review the basic anatomy (vascular and bowel) and pathophysiology of AMI. 3. Describe the etiologies of primary AMI - embolic-arterial, thrombotic arterial, venous, NOMI - and secondary AMI (e.g. closed loop bowel obstruction). 4. Review the role of imaging including a basic review of CT/DECT performance along with the typical protocols and characteristic imaging features of AMI. 5. Present an interpretive approach to AMI with characteristic imaging findings - assess the SMA/SMV, evaluate the bowel and mesentery, use of DECT (iodine maps and virtual non-contrast). 6. Present case examples of AMI along with mimics.

## EREE-67 PEDIATRIC POLYTRAUMA. MECHANISMS OF INJURY AND RADIOLOGIC EVALUATION

MARIA PEREZ FERNANDEZ (*Abstract Co-Author*) Nothing to Disclose
Marta Sanmartin Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Anxo Martinez De Alegria, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Garcia Figueiras, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Ecenarro Montiel (*Abstract Co-Author*) Nothing to Disclose
Maria Mercedes Linares Paz (*Abstract Co-Author*) Nothing to Disclose
Lorena Maria Miguez Fortes (*Abstract Co-Author*) Nothing to Disclose
Maria V. Trujillo Ariza, MD (*Abstract Co-Author*) Nothing to Disclose
Amadeo Arango (*Presenter*) Research Consultant, ABEONA Therapeutics

**TEACHING POINTS**

1) To review the pediatric anatomic and physiologic differences compared to adults relevant for trauma.2) To explain the most common mechanisms of injury in children who suffer major trauma.3) To show examples of typical pediatric traumatic lesions that may be missed by an unexperienced eye.4) To suggest tips to optimize the radiologic evaluation of these patients.

**TABLE OF CONTENTS/OUTLINE**

1) The concept of polytrauma.2) Clinical management of pediatric polytrauma.2.1 The primary survey.2.2 The secondary and further surveys.3) Pediatric anatomic and physiologic special features.4) Mechanisms of injury.4.1 Traffic accident (seat-belt injuries).4.2 Bicycle accident (handlebar injuries).4.4 Fall from height.4.5 Sport-related injuries.4.6 Physical child abuse.5) Radiologic evaluation.5.1 Cervical trauma.5.2 Thoracic trauma.5.3 Abdominal trauma.6) Conclusions.

## EREE-7 AN IN-DEPTH LOOK AT THE OCULAR GLOBE, THE RADIOLOGIST'S BLIND SPOT

**Awards**
**Magna Cum Laude**

Maria Perez Costas, MD (*Abstract Co-Author*) Nothing to Disclose
Alvaro Jose de la Iglesia Salas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Lopez-Castello, MD (*Abstract Co-Author*) Nothing to Disclose
Sabela Garcia Benito, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Fernandez Blanco (*Abstract Co-Author*) Nothing to Disclose
Ana Robles Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Pereiro Perez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To review the relevant anatomy of the globe. - To discuss the key imaging findings in orbital emergencies encompassing traumatic, infectious, and vascular pathology. - To recognize potential incidental orbital findings and main post-surgical changes.

**TABLE OF CONTENTS/OUTLINE**

Traumatic, infectious, and vascular orbital pathology are a common reason for consultation in emergency departments, and imaging can play a crucial role in the diagnosis and proper therapeutic management, especially in cases where the clinical examination may be inconclusive. CT is preferred due to its high availability, resolution, and accuracy in assessing orbital structures and soft tissues, identifying foreign bodies, and ruling out collections. The poster will review ocular injuries including: I. Relevant globe anatomy. II. Infection - Preseptal vs post-septal cellulitis. III.Traumatic - Corneal laceration. - Lens injuries (lens dislocation and traumatic cataract). - Retinal detachment. - Vitreous hemorrhage. - Open-globe injury and potential mimics (phthisis bulbi, myopia, coloboma and Staphyloma). - Foreign bodies and potential mimics (optic drusen, scleral calcifications, and calcified cataract). IV. Post-surgical changes - Scleral buckle, vitrectomy, retinopexy, ocular prothesis, and gold eyelid weight. V. Vascular - Carotid cavernous fistula Understanding the basic anatomy and the key imaging findings of globe pathology in computed tomography, as well as potential incidental imaging findings, enables the radiologist to provide the physician with precise diagnostic information to guide proper therapeutic management and thereby prevent permanent vision loss and potential life-threatening complications.

## EREE-8 UNVEILING THE FLOW: STRATEGIES FOR DETECTING POSTTRAUMATIC ACTIVE ABDOMINAL BLEEDING FROM A LEVEL 1 TRAUMA CENTER

Chaitanya Ahuja, MD (*Abstract Co-Author*) Nothing to Disclose
Meghna Chadha, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro A. Tempra, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Strobel, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Soto-Davila, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Marrero-Castillo (*Abstract Co-Author*) Nothing to Disclose
Guillermo P. Sangster, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Prompt identification of the bleeding origin and detection of vascular injuries can increase the efficacy of surgical or angiographic treatment, mortality, and mobility during an abdominal trauma. 2. Dual-phase CT-scan is the gold standard imaging technique in hemodynamically stable patients due to its high sensitivity in distinguishing vascular injuries. Active bleeding is characterized by a jet or localized area of high attenuation within a hematoma. The focal area will vanish on delayed images into an enlarged, enhanced hematoma. 3. Vessel injury is identified by findings like an intimal dissection flap, absence of vascular enhancement caused by occlusion or spasm, vessel wall non-uniformity, and caliber changes. Delayed imaging is crucial to confirm vessel injury.

**TABLE OF CONTENTS/OUTLINE**

1. To identify different types of vessel injury, such as dissection, pseudoaneurysm, arteriovenous fistula, and active extravasation. 2. To Illustrate computed tomography (CT) common and uncommon imaging patterns in patients with active intrabdominal bleeding. 3. To differentiate active bleeding from other high-attenuation conditions: bone fragments, and dense foreign bodies. Early recognition of active traumatic abdominal bleeding positively impacts mobility and mortality, efficiently guiding pertinent surgical and interventional procedures. This educational exhibit will depict cases of acute posttraumatic abdominal bleeding from various etiologies. It will help radiologists familiarize themselves with classical signs, differential diagnosis of high-attenuation entities, and characterization of different types of vessel injury.

## EREE-9 IMAGING SPECTRUM OF AORTIC INTRAMURAL HEMATOMA (IMH): A RADIOLOGISTS' GUIDE

Maria Perez Costas, MD (*Abstract Co-Author*) Nothing to Disclose
Sabela Garcia Benito, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Pereiro Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Chavarri Sr, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Lopez-Castello, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Robles Gomez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Aortic intramural hematoma is a potentially life-threatening condition among the diseases processes that comprise the spectrum of acute aortic syndromes and require immediate medical attention. - Review IMH definition, classification and pathophysiology. - Review CT protocol. - Discuss characteristic IMH imaging findings, natural progression, potential complications and main differential diagnosis. - Review ulcer-like projections and blood pools pathophysiology and evolution. - Outline a practical approach for quick reporting.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction. II. IMH epidemiology, pathophysiology and classification. III. IMH CT findings, evolution, potential complications (aortic rupture, pulmonary artery intramural hematoma, aortic dissection...) and imaging risk predictors. IV. Ulcer-like projection and blood pool pathophysiology and evolution V. IMH differential diagnosis (aortitis, penetrating aortic ulcer, mural thrombus, retroperitoneal fibrosis, lymphoma...) VI. Report.

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# Abstract Archives of the RSNA, 2024

EREE-1

## NAVIGATING THE SLOPES: A COMPREHENSIVE REVIEW OF SNOWSPORTS MUSCULOSKELETAL INJURIES ENCOUNTERED IN THE EMERGENCY DEPARTMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Maryam Soltanolkotabi, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Brian Y. Chan, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda M. Crawford, MD (*Abstract Co-Author*) Nothing to Disclose
Ghazaleh Safazadeh, MD,MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Understanding the biomechanics of snowsports and how they contribute to injury patterns. -Recognition and classification of common musculoskeletal injuries encountered in snowsports. -Diagnostic imaging modalities and their role in evaluating snowsports injuries. -Treatment options and rehabilitation strategies for various snow sports-related injuries. -Injury prevention strategies and recommendations for safe participation in snowsports.

### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Overview of the popularity and diversity of snowsports. B. Importance of understanding radiologic findings of musculoskeletal injuries in snowsports. II. Biomechanics of Snowsports A. Overview of biomechanical forces involved in skiing, snowboarding, and other snowsports. B. Impact of terrain, speed, and equipment on injury risk. III. Common Musculoskeletal Injuries A. Upper Extremity Injuries -Shoulder Girdle Injuries: fracture/dislocations, rotator cuff injuries -Wrist/Hand Injuries: fracture/dislocations, ligamentous injuries B. Lower Extremity Injuries -Knee Injuries: ligamentous tears, meniscal injuries -Foot/Ankle Injuries: fractures, ligamentous injuries, tendon pathology C. Axial Injuries-Thoracolumbar spine injuries: compression/burst fractures, disc disease.-Pelvic injuries: stable vs unstable IV. Treatment and Rehabilitation A. Overview of conservative and surgical treatment options. B. Rehabilitation protocols for specific injuries. V. Injury Prevention A. Importance of proper equipment selection and fitting. B. Techniques for injury prevention and safe skiing/snowboarding practices. VI. Conclusion

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# Abstract Archives of the RSNA, 2024

EREE-10

## X-RAY ASSESSMENT OF ACUTE NEWBORN PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Thurl Cledera, MD (*Abstract Co-Author*) Nothing to Disclose
Weronika Bernard, MD (*Abstract Co-Author*) Nothing to Disclose
Agata Nowelli (*Abstract Co-Author*) Nothing to Disclose
Muhammad Umair, MBBS (*Abstract Co-Author*) Nothing to Disclose
Caterina B. Monti, MD, PhD (*Abstract Co-Author*) Travel support, Bracco Group
Anna Jankowska, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Niemierko, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To discuss the role of radiological imaging in assessing newborns presenting with distress symptoms, differentiating pathologic from normal findings on newborn X-rays. 2. Discuss indications for X-ray imaging and radioprotection considerations in newborns. 3. Present a structured approach to chest and abdominal X-ray assessment in newborns. 4. Highlight X-ray findings seen in preterm and full-term newborns with respiratory distress, cardiovascular, and gastrointestinal abnormalities, providing insights into the differential diagnosis of conditions causing distress in newborns based on radiological findings. 6. Assess normal positions and courses of lines and tubes. 7. Emphasize the role of radiologists in guiding clinical decision-making and optimizing patient outcomes.

### TABLE OF CONTENTS/OUTLINE

A. Introduction B. Radiation safety and the ALARA concept C. Structured approach to X-ray assessment D. Neonate in distress - chest X-ray a. Surfactant deficiency disease b. Transient tachypnea of the newborn c. Meconium aspiration syndrome d. Bronchopulmonary dysplasia e. Pneumothorax f. Pneumonia g. Congenital Anomalies (e.g., congenital pulmonary lymphangiectasia, diaphragmatic hernia, congenital lobar overinflation, pulmonary sequestration). E. Neonate in distress - abdominal X-ray a. Esophageal, duodenal, jejunal, ileal, anal atresia b. Duodenal web c. Malrotation d. Meconium ileus e. Perforation f. Necrotizing enterocolitis g. Hypertrophic pyloric stenosis F. Assessment of Lines and Tubes a. Endotracheal Tube b. Nasogastric Tube c. Umbilical Arterial Catheter d. Umbilical Venous Catheter e. Peripherally inserted central catheter f. ECMO catheter G. Conclusion

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# Abstract Archives of the RSNA, 2024

EREE-11

## ROLE OF MRI IN UROGENITAL TRAUMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ryo Ueda (*Abstract Co-Author*) Nothing to Disclose
Christian Roest, MSc (*Abstract Co-Author*) Grant, Siemens AG
Thomas C. Kwee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akitoshi Inoue, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiromi Edo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuki Arita, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

CT, US, and urethrography have been the main imaging modalities for the evaluation of urogenital trauma, particularly in shock patients, thanks to their relatively short examination times. MRI is employed for evaluating urogenital trauma in hemodynamically stable patients because of the following advantages. (i) Higher contrast resolution allows for the depiction of more detailed anatomic information, which is essential in decision-making for surgical procedures, (ii) Its potential to detect mild parenchymal or luminal wall injury without contrast medium, and (iii) The lack of ionizing radiation, which is particularly important for (follow-up) examinations in younger patients. MRI may provide value in several settings. For example, in urethral trauma associated with pelvic fractures, MRI offers a detailed evaluation of the proximal urethral stump, essential for urethral reconstruction surgery. While ultrasound remains the preferred method for diagnosing testicular rupture due to blunt trauma, MRI can be crucial in cases in which a large hematoma obscures the rupture of the tunica albuginea, helping to assess the need for orchiectomy. This exhibit discusses the criteria for employing MRI in urogenital trauma, and illustrates MRI findings of various urogenital trauma cases, emphasizing its growing importance in the appropriate diagnosis and pre- and post surgical assessment of urogenital injuries.

### TABLE OF CONTENTS/OUTLINE

1, Overview of the anatomy and trauma classification for the urogenital organ 2, Pros and Cons for imaging modalities (Fluoroscopy, CT, US, and MRI) 3, Recommended MR protocol and its imaging findings for each organ a. Kidney b. Bladder and Ureter c. Urethra d. Testis e. Penis 4, Summary

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# Abstract Archives of the RSNA, 2024

EREE-12

## "DON'T GET AIR-BALLED!" EMPHYSEMATOUS CONDITIONS OF THE ABDOMEN-PEARLS AND PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Ananya Panda, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Emphysematous conditions of abdomen are uncommon but potentially lethal conditions. It's important for radiologists to identify the correct pathology also avoid misdiagnosis and potential pitfalls. This exhibit also reviews pertinent clinical features that can help confirm diagnosis and avoid similar pitfalls. Lastly, we review management for better radiology reporting. At the end of the exhibit, the learner will be able to: 1. Review spectrum of emphysematous conditions of abdomen 2. Understand imaging mimics and clinical implications. 3. Be aware of next best steps as part of radiology reporting.

### TABLE OF CONTENTS/OUTLINE

I. Emphysematous Gastritis. Pitfall: Hydrogen peroxide ingestion II. Gas Gangrene of Liver. Pitfall: Hepatic abscess Post-therapy changes III. Emphysematous Cholecystitis. Pitfall: Radiolucent gallstones Bilio-enteric fistula IV. Emphysematous Pancreatitis. Pitfall: Post-enteric fistula post-intervention changes V. Emphysematous Pyelonephritis. Pitfall: Emphysematous Pyelitis Post-therapy changes VI. Emphysematous Cystitis. Pitfall: Intraluminal Air Chyluria VII. Emphysematous Aortitis. Pitfall: Aorto-enteric fistula post-intervention changes VIII. Retroperitoneal Fasciitis. Pitfall: Pneumoretroperitoneum IX. Bowel Gangrene. Pitfall: Benign Pneumatosis Intestinalis Pneumatosis cystoides. X. Gas Gangrene of Abdomen Wall/ Fournier Gangrene. Pitfall: Benign Subcutaneous Emphysema XI. Gas Gangrene of Uterus. Pitfall: Endometritis Post-partum changes XII. Gas-forming Prostate Abscess Pitfall: Uro-symphyseal Fistula XIII. Emphysematous Vaginitis. Pitfall: Vaginal Tampon XIV. Emphysematous Epididymo-Orchitis. Pitfall: Air in Scrotum

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# Abstract Archives of the RSNA, 2024

EREE-13

## CT IMAGING OF SHOULDER GIRDLE AND PROXIMAL HUMERAL FRACTURES: BIOMECHANICAL PRINCIPLES, GRADING, AND SURGICAL RELEVANCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David Dreizin, MD (*Abstract Co-Author*) Nothing to Disclose
Kathryn Champ, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After completing the exhibit, participants will be able to: 1. Describe the role of CT and specific indications for this modality in the context of injuries to the superior suspensory complex of the shoulder (SSSC) and proximal humerus. 2. Explain the CT imaging features and parameters favoring surgical management for complex injuries including floating shoulder and bipolar glenohumeral fracture-dislocations. 3. List the common classification systems and subtypes for clavicular fractures, AC joint separations, and proximal humeral fractures, and imaging indications for surgical repair or reconstruction.

### TABLE OF CONTENTS/OUTLINE

I. Introduction: i. Clinical scenarios for which CT and 3D CT are advocated ii. Review of shoulder girdle and proximal humeral anatomy. iii. Injury biomechanics with pathoanatomy. II. Classification systems, key imaging features, and indications for surgical repair. i. Clavicle fractures: Allman and Neer classifications, telescoping, comminution, fracture displacement, and proximity to coracoclavicular ligaments. ii. AC separations: Rockwood classification, and surgical management of high-grade subtypes. iii. Sternoclavicular separation and scapulothoracic dissociation in severe trauma. iv. Glenoid and proximal humerus fracture-dislocations: Bankart, Hill-Sachs, and bipolar fractures; engaging lesions: glenoid track and Hill-Sachs interval concepts v. SSSC double disruptions and the floating shoulder: typical and atypical subtypes. vi. Proximal humeral fractures: Neer classification; calcar integrity, and varus collapse. III. Conclusion: summary table- key CT features and surgical management implications.

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# Abstract Archives of the RSNA, 2024

EREE-14

## BABY ON BOARD: IMAGING OF BLUNT TRAUMA IN PREGNANCY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jason A. Pietryga, MD (*Abstract Co-Author*) Consultant, Radiostics LLC
Kristen Olinger, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana R. Defreitas, MD (*Abstract Co-Author*) Nothing to Disclose
David E. Bartlett, MD (*Abstract Co-Author*) Nothing to Disclose
Esha Sharda, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Ruggiero, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) Discuss appropriate imaging for blunt trauma in pregnancy. (2) Review risk of imaging to the mother and fetus. (3) Recognize findings of trauma and its mimics in imaging of the gravid patient.

### TABLE OF CONTENTS/OUTLINE

I. Background A. 1 in 12 pregnancies are affected by trauma, a leading cause of cause of death in pregnancy.B. Emergency Radiologists must understand appropriate imaging, risk of imaging, and traumatic findings in the expecting mother.II. Imaging selection A. Ultrasound is a useful tool for initial screening. i. Benefits of portability, lack of radiation, and high specificity. ii. Poor sensitivity in trauma limits its use. B. CT is first line in trauma imaging: i. Dose generally below 50 mGy ii. Threshold is unlikely to increase risk of fetal anomalies or loss. iii. Other radiation risks, including carcinogenesis must be considered. C. MRI may be appropriate: i. Subject to availability and time constraints.III. Injury patterns A. Radiologists must recognize imaging findings of trauma in pregnancy: i. Pregnancy-specific. 1. Placental abruption and uterine rupture. 2. Mimics - normal structures: cotyledons, chorionic plate indentations, and venous lakes. ii. Other injuries. 1. Abdominal visceral injuries. 2. Thoracic injuries. 3. Osseous injuries.IV. Conclusion A. Trauma in pregnancy is a leading cause of maternal and fetal mortality. B. Radiologists must: i. Know risks and benefits of imaging in pregnancy. ii. Be familiar with findings associated with trauma in pregnancy.

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# Abstract Archives of the RSNA, 2024

EREE-15

## BODY MRI ON CALL- A PRIMER FOR RADIOLOGY TRAINEES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carolina A. Heming, MD (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Maheen Rajput, MD (*Abstract Co-Author*) Nothing to Disclose
Ananya Panda, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

With expanded access to MR systems, there is increasing role of Body MRI in emergency department/emergent conditions. Body MRI on-call is primarily used for problem-solving when US/CT are non-diagnostic. MRI offers non-radiation alternative when CT is contraindicated. Superior soft-tissue resolution of MRI provides non-contrast alternative when contrast is contraindicated. Familiarity with diverse conditions encountered in emergent settings can help on-call radiology trainees gain confidence and allow for seamless transition from training to independent practice. At end of this exhibit, learners will be able to: 1. Review spectrum of conditions encountered during on-call for which MRI may be indicated. 2. Know key protocols and high-yield sequences. 3. Understand added value of MRI for problem-solving.

### TABLE OF CONTENTS/OUTLINE

I. Hepatobiliary a. Choledocholiathiasis b. Mirizzi syndrome c. Post-cholecystectomy syndrome d. Complicated Cholecystitis e. Biliary leak f. Cholangitis g. Hepatic lesion- infection/hemorrhage/mass with hemoperitoneum h. Hepatic Infarct/Vascular Thrombosis i. Bile duct/Periportal tumor invasion II. Pancreas a. Acute Complicated Pancreatitis b. Pancreatic Trauma III. GU/Pelvis a. Renal mass with tumor thrombus b. Prostate Abscess c. Post-Radiation Complications IV. OBGYN a. Pregnant Patient: GI/GU conditions b. Adnexal Torsion c. Ectopic pregnancy d. Fibroids-Red degeneration e. Placenta/Post-partum complications V. Bowel a. Appendicitis b. Crohn’s disease complications c. Perianal abscess d. Diverticulitis/mimics VI. Penis/Scrotum a. Trauma b. Infection VII. Acute presentation of cancers a. Pancreatic Cancer b. Gall bladder Cancer c. Colorectal Cancer

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# Abstract Archives of the RSNA, 2024

EREE-16

## VASCULAR EMERGENCIES IN HOSPITALIZED PATIENTS: FROM CHEST TO TOES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Albert Hsiao, MD, PhD (*Abstract Co-Author*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging
Brian Pogatchnik, MD (*Abstract Co-Author*) Nothing to Disclose
Sophie Y. Wong, MD (*Abstract Co-Author*) Nothing to Disclose
Stephan Altmayer, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Vascular emergencies commonly occur in the inpatient setting and must be quickly and accurately diagnosed to allow timely intervention. This exhibit will:1. Discuss common vascular imaging techniques and the terminology used to describe findings2. Illustrate a broad spectrum of disease categories through case examples, including body regions from the neck down3. Familiarize the reader with common pitfalls of vascular imaging

### TABLE OF CONTENTS/OUTLINE

1. Imaging techniquesa. Triple phase scanb. Dual-energy scanc. Imaging optimization2. Acute bleed and pseudoaneurysma. Definition of conceptsb. Acute bleedingc. Pseudoaneurysm3. Ischemia and embolizationa. Sources of embolismb. Ischemia in the hospital4. Emergencies related to vascular devicesa. Linesb. ECMOc. IABPd. Others5. Pitfalls of vascular imaging

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# Abstract Archives of the RSNA, 2024

EREE-17

## A CHECKLIST APPROACH TO INTERPRETING CT ANGIOGRAPHY OF ABDOMINAL VASCULAR EMERGENCIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos S. Tapia SR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Abdominal emergencies of vascular origin are a common cause of attention in emergency departments. CT angiography is the imaging method of choice to evaluate the abdominal vessels. The radiologist's evaluation with a checklist report allows for a faster and more precise diagnosis, offering all the dates the physician needs for a correct approach to the patient.The inferior vena cava is the most prominent vein in the body. The most common emergency is obstruction by a filling defect, usually a thrombus; based on the lack of expansion of the vessel lumen and the absence of enhancement of the filling defect, this can be differentiated from a tumoral thrombus.In cases of acute aortic syndrome, it is essential to identify the type: aortic dissection, acute intramural hematoma, and penetrating atherosclerotic ulcer. Then, classify in Stanford A or B, and do not forget to find signs of impending rupture. Acute arterial or venous mesenteric ischemia is a severe life-threatening condition. Early detection and treatment are of utmost importance, as any delay in diagnosis can lead to bowel necrosis, perforation, and septic shock.

### TABLE OF CONTENTS/OUTLINE

Introduction. Abdominal vascular anatomy. Inferior vena cava thrombosis and congenital variants. Acute aortic syndrome. Aortic dissection. Acute intramural hematoma. Penetrating atherosclerotic ulcer. Signs of impending or contained rupture in abdominal aortic aneurysm. Vasculitis with abdominal vessel involvement. Venous bowel ischemia. Arterial Bowel ischemia. Bleeding angiodysplasia of the colon. Portal vein thrombosis and other emergencies. Pitfalls. Teaching points. Conclusions. Bibliography.

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# Abstract Archives of the RSNA, 2024

EREE-18

## ABDOMINAL PAIN IN PREGNANCY: BEYOND OBSTETRICS - INSIGHTS FROM MRI DIAGNOSTICS IN THE EMERGENCY ROOM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Camila B. Visconti, MEd (*Abstract Co-Author*) Nothing to Disclose
Patricia Leal, MD (*Abstract Co-Author*) Nothing to Disclose
Alice Schuch, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia H. Concatto, MD (*Abstract Co-Author*) Nothing to Disclose
Ariane Giovanaz (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Present illustrative cases of the most prevalent non-obstetric causes of abdominal pain in pregnant women, featuring classic imaging findings and critical diagnostic signs.Assess the advantages of utilizing magnetic resonance imaging (MRI), while establishing a standardized MRI protocol for this evaluation.

### TABLE OF CONTENTS/OUTLINE

IntroductionEpidemiology and risk factors of the most prevalent non-obstetric causes of abdominal pain in pregnant women.MR technique and discussionDescribe the main protocol and sequences of MRI used for assessing abdominal pain during pregnancy.Imaging features and pathology correlationDemonstrate MRI's efficacy in identifying various etiologies, from benign to potentially life-threatening conditions in pregnant women experiencing acute abdominal pain.ConclusionDiscuss the value of MRI in shaping medical management decisions for pregnant individuals with acute abdominal pain.

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# Abstract Archives of the RSNA, 2024

EREE-19

## RADIOLOGY UNDER THE GUN: GUIDE TO BULLSEYE DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Robert J. Dym, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Jamil, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Giraldo Herrera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The U.S. epidemic of gun violence saw recent increases in the incidence of firearm-related injuries and deaths, and these may present a wide variety of diagnostic challenges in emergency departments.2. Firearm-related injuries constitute a unique category of traumatic injury given the high velocity of bullets and their penetrating mechanism with high-energy transfer.3. Understanding these types of injuries enables radiologists to assess the trajectory of the bullet, differentiate between direct and blast injury, and recommend follow-up interventions based on associated findings such as gross or subtle vascular injury, hollow viscus, or diaphragmatic injuries.

### TABLE OF CONTENTS/OUTLINE

1. Background and Review of the Literature. 2. Spectrum of organ lacerations, with AAST and operative specimen correlates. 3. Spectrum of vascular injuries with angiography correlates. 4. Thoracic injuries with percussive contusions. 5. Atypical cases: migratory bullets, shotgun and non-civilian firearms, and non-bullet projectiles.

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# Abstract Archives of the RSNA, 2024

EREE-2

## AFTERMATH OF A PUNCH TO THE GUT: IMAGING FOLLOWING SELECTIVE NONOPERATIVE MANAGEMENT OF ABDOMINAL TRAUMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Angelo G. Marino, DO (*Abstract Co-Author*) Consultant, Inari Medical, Inc;Speaker, Inari Medical, Inc
Nadia Solomon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Douglas S. Katz, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Anne Sailer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Nonoperative management (NOM) is frequently conducted in trauma centers in patients with penetrating abdominal trauma who are hemodynamically stable without signs of diffuse peritonitis or evisceration.2. Although NOM has been relatively widely adopted for abdominal stab wounds, the concept has not been as embraced for GSWs given the higher associated incidence of visceral and abdominal vascular injuries and the morbidity and mortality associated with missed injuries.3. Recommendations of post-imaging guidelines for NOM patients with abdominal trauma is essential to screen for injuries (hollow organ, diaphragm injury, and delayed hemorrhage) that could have been missed on the initial trauma scan.

### TABLE OF CONTENTS/OUTLINE

1. Briefly review indications for NOM and the role of angiography with embolization, endoscopic retrograde cholangiopancreatography with stenting, and percutaneous drainage to increase the success of NOM. 2. Propose a follow-up imaging algorithm for patients who undergo surgical and NOM.3. Case based review of successful and unsuccessful NOM including cases of missed hollow organ injury, delayed hemorrhage, and many more to highlight potential blind spots.

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# Abstract Archives of the RSNA, 2024

EREE-20

## ABDOMINAL BLUNT TRAUMA···YOU'VE GOT TO BE KIDNEY ME: A PRIMER OF THE REVISED AAST KIDNEY INJURY SCALE FOR DIAGNOSTIC RADIOLOGY RESIDENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Adriana L. Vargas Figueroa, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo ALBINO CAMACHO (*Abstract Co-Author*) Nothing to Disclose
Jose A. Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Jean P. Inesta-Rivera, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Review the grading of kidney injuries as defined by the AAST (American Association for the Surgery of Trauma) Kidney Injury Scale (2018). -Provide anatomical diagrams of grade I-V kidney injuries. -Contribute case examples with pathognomonic imaging findings of grade I-V kidney injuries on CT.-Define the possible complications of AAST kidney injuries and their corresponding management.-Provide a self-assessment tool for the classification of kidney injuries.

### TABLE OF CONTENTS/OUTLINE

- Educational Objectives and Introduction- AAST Kidney Injury Scale Grade I-V and Possible Complications- Anatomical diagrams, CT imaging findings, and management - Self-assessment with multiple cases in quiz format Renal injuries may result from both blunt and penetrating trauma, and thus a high index of suspicion for these should be maintained in patients presenting with post-traumatic microscopic or gross hematuria. Expectant or non-surgical management has become the standard of care for most renal injuries, primarily due to high rates of iatrogenic nephrectomies and poor postoperative renal function. However, surgical management remains the gold standard for severe renal injuries with a higher AAST grade. Consequently, performing an appropriate imaging evaluation and establishing an accurate renal injury grade are imperative for determining appropriate management. Contrast-enhanced CT in combination with the AAST Kidney Injury Scale have become the gold standard for evaluating renal injuries. Our aim is to provide a review of the Renal Injury Grades established by the AAST Kidney Injury Scale, provide case examples, and discuss corresponding management and their possible complications.

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# Abstract Archives of the RSNA, 2024

EREE-21

## "FACE TIME WITH RADIOLOGY: UNMASKING LE FORT FRACTURES"

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose A. Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Gonzalez, BS (*Abstract Co-Author*) Nothing to Disclose
Adriana Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- 1. Define Le Fort I-III maxillofacial fractures and review anatomy- 2. Discuss the underlying pathophysiology and its major implications- 3. Provide radiological CT imaging highlighting key features

### TABLE OF CONTENTS/OUTLINE

- I. Educational Objectives and Introduction- II. Review anatomy- III. General information on Le Fort fractures and mechanisms of fractures- IV. CT Imaging findings of Le Fort fractures- V. Self-assessment with multiple cases in quiz format-VI. ConclusionLe Fort classification is used to guide the classification and management of complex midfacial fractures. These fractures are classified as LeFort I, II, and III based on the direction of the fracture: horizontal, pyramidal, or transverse. Moreover, common to all Le Fort fractures is involvement of the pterygoid processes. Complex facial fractures such as these compromise the airway and cause significant blood loss due to the high vascularity of the anatomical region and significant swelling of the involved structures. Le Fort I is characterized by a horizontal fracture resulting from a downward impact directed against the alveolar ridge with the involvement of the anterolateral margin of the nasal fossa. Le Fort II is due to high energy impact directed against the lower and/or mid maxilla, with involvement of the inferior orbital rim. Le Fort III is a transverse fracture resulting from an impact against the nasal bridge and the upper maxilla with Involvement of the zygomatic arch characterizes this fracture.

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# Abstract Archives of the RSNA, 2024

EREE-22

## STROKE 101: FIRST CONTACT TRAINEE'S GUIDE FOR BRAIN CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alejandra Isabel Villalobos Tzec, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This exhibit serves as an essential resource for first-year residents, offering a comprehensive overview of stroke diagnosis. Stroke progresses through distinct stages: hyperacute, acute, subacute, and chronic. The hyperacute stage includes the hyperdense vessel sign, subtle loss of gray-white matter distinction, vanishing basal ganglia, and the absence of the cortical ribbon, termed the "insular ribbon sign." These patterns indicate reduced blood flow obstruction within the first six hours. Detecting these changes in typical stroke sites is crucial (MCA territory). Employ the ASPECTS score to assist physicians in selecting appropriate treatment strategies. Acute and subacute phase (6- 36 hours) will be depicted as hypodensities, sulci effacement, gyral swelling, and even “hemorrhagic” transformation may occur. Chronic stage (>36 hours): will be shown as focal and sometimes large areas of low attenuation, the key is to look for prominent sulci and gyrus, as well as, enlarged ventricles. Differential diagnosis to keep in mind when “hypodensities” are seen in the brain CT, include, enlarged perivascular spaces, leukoaraiosis and nonvascular causes, such as neoplasms, cerebral contusion, inflammation or thrombosis, During the first stages, differential diagnosis will include: high hematocrit (polycythemia) and other causes of diffuse cerebral edema.

### TABLE OF CONTENTS/OUTLINE

Brain anatomy made simple. Protocol for CT acquisition.Learning how to read a CT. Stroke sequence. CT imaging according to stages of the ischemic cascade.Differential diagnosis for hypodensities; leukoaraiosis and enlarged perivascular spaces.

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# Abstract Archives of the RSNA, 2024

EREE-23

## PHOTON-COUNTING DETECTOR CT FOR FORENSIC PATHOLOGY: THE FIRST EXPERIENCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kojima Masatoshi, RT (*Abstract Co-Author*) Nothing to Disclose
Yohsuke Makino, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) While photon-counting detector CT (PCD-CT) is beginning to be used clinically, its use in forensic pathology is still minimal. 2) In our forensic autopsy facility, a prototype PCD-CT is being evaluated and used routinely with conventional energy-integrating detector CT (EID-CT) scanning for pre-autopsy examination. 3) Real cases with autopsy results are exhibited to show the PCD-CT effectiveness compared to EID-CT in forensic pathology. 4) Ultra-high-resolution mode of PCD-CT is highly useful in forensic practices such as fracture detection and coronary angiography. 5) Multi-energy discrimination also can be used some forensic practices such as bone marrow edema detection and drug overdose cases.

### TABLE OF CONTENTS/OUTLINE

Introduction: Basic knowledge of PCD-CT that is useful in forensic medicineObjectiveUtility of ultra-high-resolution mode in forensic pathologyUtility of multi-energy-discrimination mode in forensic pathologySummary

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# Abstract Archives of the RSNA, 2024

EREE-24

## POSTPARTUM COMPLICATIONS: HEAD TO TOE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Robin B. Levenson, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana J. Tobler, MD (*Abstract Co-Author*) Nothing to Disclose
Alyssa Sherwill, MD (*Abstract Co-Author*) Nothing to Disclose
Carl C. Flink, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Normal CT and US appearance of the postpartum uterus: Twice its normal size with endometrium thicker than 2 cm with intracavitary gas s/p cesarian section(CS). CS scar appears as low attenuation in the LUS. Uterine Discontinuity is common.-Bladder flap hematoma (BFH): Heterogeneous collection between the uterus and bladder-Uterine Dehiscence: Incomplete rupture. Serosa remains intact. Associated with BFH larger than 5cm.-Uterine Rupture: separation of all the layers of the uterine wall communication with the peritoneum. Hemoperitoneum will be present.-Retained Products of Conception (RPOC): Persistent placental or trophoblastic tissue in the uterine cavity. postpartum hemorrhage.-Endometritis: #1 cause of postpartum fever. US first line. Heterogenous debris with gas-Primary Postpartum hemorrhage: Etiology: atony, trauma, BFH, rupture, abnormal placentation-Thrombosis: venous thrombus can progress to thrombophlebitis and thromboemolic events.-Eclampsia: may present with seizure. MR imaging showing edema or posterior reversible encephalopathy-Cardiomyopathy: Echocardiogram and Cardiac MRI will demonstrate systolic dysfunction. MRI may demonstrate delayed ventricular enhancement

### TABLE OF CONTENTS/OUTLINE

-Introduction -Normal Postpartum Uterus -Postpartum Uterine Pathology -Bladder Flap Hematoma -Dehiscence Rupture -Retained Products of Conception -Endometritis -Postpartum Hemorrhage -Thrombosis/Thromboembolic Events -Gonadal v. thrombophlebitis -Pulmonary Emboli/DVT -Eclampsia-Cardiomyopathy

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# Abstract Archives of the RSNA, 2024

EREE-25

## AAST GRADING SYSTEM FOR COMMON EMERGENCY GENERAL SURGICAL (EGS) CONDITIONS OF THE ABDOMEN AND PELVIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Azfar Siddiqui, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review AAST grading system for common emergency general surgical (EGS) conditions of the abdomen and pelvis. Provide pictorial review for various grades.

### TABLE OF CONTENTS/OUTLINE

Background AAST EGS grades range from I through V, reflecting an escalating clinical progression from mild disease limited within the organ itself to severe disease that is widespread. 1. Bowel Ischemia 2. Intestinal obstruction 3. Hernia 4. Acute cholecystitis 5. Acute pancreatitis 6. Perforated peptic ulcer disease 7. Acute appendicitis 8. Acute diverticulitis 9. Perirectal abscess 10. Infectious colitis 11. Pelvic inflammatory disease Limitation

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# Abstract Archives of the RSNA, 2024

EREE-26

## RHEUMATOLOGIC DISEASES EMERGENCY: WHAT SHOULD RADIOLOGISTS KNOW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maryam Soltanolkotabi, MD (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Abstract Co-Author*) Nothing to Disclose
Parham Pezeshk, MD (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Pattana Wangaryattawanich, MD (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Behzad Aminzadeh (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

· Review the different rheumatologic diseases emergencies· Illustrate the pattern of involvement on different imaging modalities· Discuss the role of imaging in detecting emergencies in early stages

### TABLE OF CONTENTS/OUTLINE

In this exhibit, we aim to provide a review of different rheumatologic diseases and emergency conditions affecting different organs. We will explore the specific features of emergencies of following diseases:· Rheumatoid arthritis:§ Atlantoaxial instability§ Tenosynovitis, tendon rupture§ Carpal tunnel syndrome§ Osteoporotic fracture§ Cricoarytenoid arthritis§ Ruptured of synovial cyst (pseudothrombophlebitis syndrome)§ Septic arthritis§ Pericarditis, myocarditis§ Pleuritis, interstitial lung disease, drug-induced lung disease§ Vasculitis: meningitis, alveolar hemorrhage, transverse myelitis, gastrointestinal (hemorrhage, bowl ischemia, necrotizing vasculitis)· Gouty arthritis:§ Acute gout attack§ Renal stones· Ankylosing spondylitis:§ Spinal fracture (chalk stick fracture)§ Cauda equina syndrome· Systemic lupus erythematosus§ Vasculitis: diffuse alveolar hemorrhage, CNS, mesenteric§ Thromboembolism: pulmonary embolism, dural sinus thrombosis, CNS stroke, avascular necrosis§ Infection: digital gangrene/ulcer, septic arthritis§ Inflmmation: pericarditis, acute lupus pneumonitis, transverse myelitis, Libman-Sacks endocarditis with valvular dysfunction· Scleroderma§ Aspiration pneumonitis§ MyocarditisFinally, we will describe different patterns of involvement that influence the imaging findings of rheumatologic diseases emergency.

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# Abstract Archives of the RSNA, 2024

EREE-27

## TWISTS OF FATE: MULTIMODALITY IMAGING OF INTERNAL ORGAN TORSION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Reham M. Ellessy, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maryam Rezvani, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Badawy, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Rogers, MD (*Abstract Co-Author*) Royalties, RELX
Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A. Understand the pathophysiology behind organ torsionB. Recognizing common clinical presentation of organ torsionC. Multimodality multiorgan imaging features of torsionD. Identify updates in management and Imaging follow-up

### TABLE OF CONTENTS/OUTLINE

A. Introduction1. Risk factors for Organ torsion2. General pathophysiological considerationB. Torsion in Cardiothoracic Imaging1. Lung torsion2. Transplant lung torsion3. Pedunculated tumor torsion.C. Torsion in genitourinary Imaging1. Renal transplant torsion2. Testicular torsion, testicular appendage torsion3. Ovarian torsion4. Fallopian tube torsion5. Adnexal cyst torsionD. Other organ torsion1. Gall bladder torsion2. Splenic torsion3. Splenule torsion4. Omental and mesentric fat torsionE. Gastrointestinal torsion1. Gastric volvulus2. Mid-gut volvulus3. Cecal volvulus and cecal bascule4. Sigmoid volvulusF. Imaging pitfalls and common mimicsG. Management: Conservative and surgical updates in management

# Abstract Archives of the RSNA, 2024

EREE-28

## SEAL THE DRIP: A MULTIMODALITY APPROACH FOR CSF LEAKAGE DIAGNOSIS AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ali Morshid, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Badawy, MD (*Abstract Co-Author*) Nothing to Disclose
Reham M. Ellessy, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Arwa Kaoud, MD (*Abstract Co-Author*) Nothing to Disclose
Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Describe the anatomy and physiology of CSF flow.• Outline the various etiologies of CSF leak as a cause of intracranial hypotension.• Describe the common imaging modalities used to diagnose CSF leak• Elaborate Imaging findings and pitfalls associated with CSF leak.• Discuss the role of IR (Interventional Radiology) in the management of CSF leak.

### TABLE OF CONTENTS/OUTLINE

1. Introduction:a. Anatomy of Dural spaces.b. Physiology of normal CSF circulation.2. Etiological classification of intracranial hypotension:a. Congenitalb. Acquired i. Traumatic ii. Iatrogenicc. Spontaneous3. Clinical presentation and diagnostic workup.4. Imaging features of intracranial hypotension5. Imaging findings of CSF leak:a. Conventional Myelography (standard and lateral decubitus) i. Technique ii. Image interpretationb. CT and MRI Cysternographyc. CT Myelogram (static and dynamic)d. MRI Myelogram (CSF leak protocol)6. Algorithmic imaging approach for the diagnosis of CSF leak7. Differential diagnoses, concurrent diagnoses, and imaging pitfalls8. Therapeutic interventionsa. Epidural blood patch (directed and multilevel)b. Epidural Fibrin patch injectionc. Epidural glue injectiond. Transvenous embolization for CSF venous fistulas9. Follow-up imaging.10. Conclusion and take-home message

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# Abstract Archives of the RSNA, 2024

EREE-29

## EXTREMITIES VASCULAR EMERGENCY: THE IMPACT OF IMAGING ON EARLY DIAGNOSIS AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sanaz Asadian, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Ethan W. Hua, MD (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Nastaran Hosseini (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Peter C. Thurlow, MD (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Yousefiasl, MPH (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the different vascular emergencies affecting extremities Illustrate the imaging findings of vascular trauma on different imaging modalities Identify the different interventional procedures for treatment of vascular injuries

### TABLE OF CONTENTS/OUTLINE

Blunt trauma, iatrogenic and penetrating trauma may cause life-threatening vascular injuries necessitate prompt diagnosis in the emergency room. Limb function and proper management depend on rapid diagnosis as late diagnosis can lead to morbidity and mortality. CT angiography can detect these injuries with high sensitivity and specificity. It is essential for radiologists to be familiar with the different patterns of vascular injuries, from arterial transection and active bleeding to late complications such as arteriovenous fistula. Interventional radiology plays an important role in the management of these cases. In this exhibit, we will review the imaging findings of different traumatic vascular injuries as follows: Arterial injury: Acute pathologies: Arterial transection Iatrogenic injuries Traumatic and contusion injuries Active bleeding and extravasation Intimal flap Dissection Vasospasms Occlusion Late pathologies: Pseudoaneurysm AV-fistula True aneurysm Treatment of arterial injuries Venous injuries: Acute pathologies: Thrombosis Vessel wall injuries Chronic pathologies: Venous insufficiency Treatment of venous injuries

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# Abstract Archives of the RSNA, 2024

EREE-3

## NEW DIAGNOSIS OF CANCER IN THE EMERGENCY DEPARTMENT: AN EDUCATIONAL TOOL TO OPTIMIZE DIAGNOSTIC WORKUP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Natalie A. Sanders, BA (*Abstract Co-Author*) Nothing to Disclose
Kiran K. Maddu, MBBS (*Abstract Co-Author*) Nothing to Disclose
Hayden Smith (*Abstract Co-Author*) Nothing to Disclose
Mendel Lebowitz (*Abstract Co-Author*) Nothing to Disclose
Carrie N. Hoff, MD (*Abstract Co-Author*) Nothing to Disclose
Christian Gomez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Learn a systematic approach to reporting incidental cancers on Emergency Department studies.-Review imaging appearances and cancer staging guidelines for the most common cancers found in the ED.-Understand mimics, pitfalls, and special considerations-Discuss accurate reporting and appropriate recommendations for additional imaging.

### TABLE OF CONTENTS/OUTLINE

Many cancers are incidentally found on imaging performed during the Emergency Department (ED) workup, with an estimated 20-50% of breast, colon and lung cancers diagnosed in the ED globally (PMID: 36622062). In a Medicare database study, 11% of cancer diagnoses were ED-mediated. Furthermore, cancer-related imaging in the ED has been shown to negatively affect report turnaround times and radiology workflow, which cause additional delays in patient care (PMID: 31759782).This exhibit will review newly diagnosed cancers in the Emergency Department utilizing an educational mnemonic and multimodal approach to help radiologists accurately triage these complex cases. Topics that will be discussed include:Educational Mnemonic “BIILD”?: Borders,? Internal?, Interfaces,? Lymph Nodes?, Distant Metastatic Lesions“BIILD” In Practice:? Breast Cancer?, Colorectal Cancer?, GU Cancer?, Lung Cancer,? Pancreatic Cancer?Special Considerations, Mimics, and Pitfalls. Topics include, but not limited to:? Indeterminate and Indolent lesions?, Benign “mass-like lesions?, Initial Presentation of Metastatic Disease?, Superimposed Findings?, Lymphadenopathy of Unknown Origin?, Infection/Inflammatory Disease?, Post-Treatment changes?, Non-contrast StudiesReporting Considerations

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# Abstract Archives of the RSNA, 2024

EREE-30

## DON’T DROP THE BALL: ULTRASOUND PRESENTATIONS OF THE PENIS AND TESTICLES IN THE EMERGENCY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gabriel Pianowski Pajanoti, MD (*Abstract Co-Author*) Nothing to Disclose
Thais Rocha (*Abstract Co-Author*) Nothing to Disclose
Angelo C. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Diego R. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Lais Abduch, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Naves (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the main anatomical landmarks of the penis and testiclesHighlight the most frequent penile and testicular disorders in emergency servicesIllustrate and describe the ultrasound findings of these injuries

### TABLE OF CONTENTS/OUTLINE

IntroductionMain anatomical landmarksUltrasound technique and normal featuresTesticles injuries: epididymitis and orchitis, testicular torsion, testicular trauma, testicular cancerPenile lesions: priapism, penile traumaTake home message

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# Abstract Archives of the RSNA, 2024

EREE-31

## ACUTE ISCHEMIC STROKE IN CHILDREN: NAVIGATING DIAGNOSTIC AND MANAGEMENT PATHWAYS - WHAT THE EMERGENCY RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manohar M. Shroff, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Vivek B. Pai, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Prakash Muthusami, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Neetika Gupta, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To highlight the distinct aetiopathogenesis, differential diagnosis and imaging features of acute ischemic stroke in pediatric population.2. To outline imaging protocols and enhanced imaging based diagnostic approaches in suspected pediatric acute ischemic stroke, including emerging roles of fast MRI and vessel wall imaging in the emergency setting. 3. To emphasize collaborative interdisciplinary approach and efficient 'stroke code' pathways to ensure prompt management, mitigate patient selection, and judicious use of endovascular thrombectomy in aptly selected cases.

### TABLE OF CONTENTS/OUTLINE

The primary objective of the exhibit is to comprehensively evaluate the frequently encountered and rare imaging findings in pediatric acute ischemic stroke, focussing on imaging techniques and protocols and their implications for patient selection and management in the emergency setting. Typical and atypical causes and risk factors specifically associated with acute ischemic stroke in children will be discussed. This exhibit will illustrate the imaging findings pivotal in guiding such interventions with goals to improve outcomes. Mechanical thrombectomy is now being increasingly used in children with large vessel occlusion. There are specific contraindications to thrombectomy, such as focal cerebral arteriopathy. Using a case-based approach, we will demonstrate an imaging-based diagnostic approach for pediatric acute ischemic stroke, streamline emergency management protocols, guide intervention, and ultimately improve short- and long-term outcomes.

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# Abstract Archives of the RSNA, 2024

EREE-32

## BREAKING BARRIERS: A GUIDE TO TRAUMATIC DIAPHRAGMATIC INJURIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Noah G. Ditkofsky, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Robert K. Moreland, MD (*Abstract Co-Author*) Nothing to Disclose
Yigal Frank, MD (*Abstract Co-Author*) Nothing to Disclose
Joel Kosowan, MD (*Abstract Co-Author*) Nothing to Disclose
David Gomez (*Abstract Co-Author*) Nothing to Disclose
Shobhit Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Vinu Mathew, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.To demonstrate various direct and indirect CT signs of traumatic diaphragmatic injury.2.To discuss the mimics of traumatic diaphragmatic injury. 3.To describe differences in approach while interpreting blunt and penetrating traumatic diaphragmatic injuries.4.To understand what the surgeons need to know to appropriately manage the patient

### TABLE OF CONTENTS/OUTLINE

• Direct CT signs- Segmental diaphragmatic defect, dangling diaphragm, absent diaphragm. • Indirect CT signs related to herniation- Collar sign, humps and band sign, dependent viscera sign, herniation through a defect, sinus cutoff sign, elevated abdominal organ sign, abdominal content peripheral to the diaphragm or lung. • Indirect CT signs not related to herniation- Thickening of the diaphragm, diaphragmatic or per diaphragmatic contrast media extravasation, hypo enhancing diaphragm. • Mimics of diaphragmatic injury- Chronic eventration/elevation of the diaphragm, chronic hernias (Bochdelek, Morgagni, hiatal). • The importance of trajectory (‘trajectory sign’) in penetrating trauma. • Points to include in report: what the surgeon wants to know.

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# Abstract Archives of the RSNA, 2024

EREE-33

## THE IMPACT OF BLUNT TRAUMA ON THE DIAPHRAGM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Omar Jamil, MD (*Abstract Co-Author*) Nothing to Disclose
Robert J. Dym, MD (*Abstract Co-Author*) Nothing to Disclose
Nina E. Glass, MD (*Abstract Co-Author*) Nothing to Disclose
Inessa A. Goldman, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin Chu, BA, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•Unlike penetrating diaphragmatic injuries which can be predicted with high accuracy by visualizing the trajectory of the insult, blunt diaphragmatic injuries represent a diagnostic challenge, requiring a high index of suspicion.•When a focal diaphragmatic defect is not directly visualized, diagnosis relies on recognition of key signs, such as “hump,” “collar," "dependent viscera," “band sign,” among others.•Blunt diaphragmatic ruptures require surgical treatment regardless of size due to possible catastrophic outcomes in case of missed or delayed diagnosis.•Understanding the anatomic relations, functional significance, and embryological development improves detection of diaphragmatic injuries and decreases incidence of “non-therapeutic” laparotomies.

### TABLE OF CONTENTS/OUTLINE

•Overview of the anatomy and embryological development of the diaphragm with respect to blunt trauma and radiologic assessment•Imaging modalities: discussion of the utility and limitations of radiographs and CT in diagnosis•Comprehensive overview of imaging features and signs with examples.•Surgical context including Western Trauma Association guidelines and review of American Association for the Surgery of Trauma grading score•Common pitfalls and mimics, such as non-traumatic and congenital diaphragmatic defects

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# Abstract Archives of the RSNA, 2024

EREE-34

## LINES AND TUBES AND BALLOONS, OH MY!: A PRIMER ON ABDOMINOPELVIC SUPPORT DEVICES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jason A. Pietryga, MD (*Abstract Co-Author*) Consultant, Radiostics LLC
Samuel J. Galgano, MD (*Abstract Co-Author*) Research support, Blue Earth Diagnostics Ltd;Research support, Novartis AG;Research Support, Curium SAS
Keon Mahmoudi, MD (*Abstract Co-Author*) Nothing to Disclose
John P. Nazarian, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas G. Rhodes, MD (*Abstract Co-Author*) Nothing to Disclose
Lindsey Shwayyat, MD (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Sidden, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss support devices used in the gastrointestinal and genitourinary systems and indications for their use. 2. Review the normal imaging appearance of these devices and relevant anatomical landmarks. 3. Demonstrate relevant imaging findings in identifying support device malposition and resulting complications.

### TABLE OF CONTENTS/OUTLINE

Radiologic confirmation of support device placement is standard clinical practice and accounts for many radiographic studies performed in the emergent setting. The large number of devices used in the gastrointestinal (GI) and genitourinary (GU) systems, some less commonly encountered, can make it challenging for the trainee to confirm their positioning on radiographs. A comprehensive reference detailing these devices will allow correct identification of appropriate device position and prompt recognition of device-related complications. This exhibit reviews GI and GU system support devices, including esophageal balloon tamponade devices, temperature probes, impedance-pH monitors, esophageal stents, gastrointestinal tubes, percutaneous and internally-placed cholecystostomy tubes, percutaneous nephrostomy tubes, urinary stents, suprapubic catheters, and urinary catheters. Radiographically visible device structural components, device utility, and indications for placement are discussed. Imaging findings indicative of appropriate and inappropriate device placement and complications associated with device malposition are shown.

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# Abstract Archives of the RSNA, 2024

EREE-35

## TRAUMATIC AORTIC INJURIES - IMAGING AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sanjeeva P. Kalva, MBBS, MD (*Abstract Co-Author*) Grants to the institution: NIH, BD, Black Swan, Trisalus, CRICO; Royalties: Elsevier, Springer, Thieme Consulting fee: Penumbra, Okami Medical, Boston Scientific, Medtronic, Covidien, Instylla, BD, Cannon, Varian, SIRTEX Stocks: Biogen Inc, Clover Health Investments Corp, Inovio Pharmaceuticals, Moderna Inc, Pfizer Inc, Novavax Inc, Orphazyme, Cassava Sciences Inc, Vivos Therapeutics Inc, Ardelyx Inc, Althea Health, Sarepta Therapeutics, Clover Health Investments Corp, CureVac BV, Immunoprecise Antibodies Ltd, Infinity Pharmaceuticals Inc, Zymergen Inc, BioNTech SE, Trillium Therapeutics Inc, Theravance Biopharma Inc, Doximity Inc, Eargo Inc, Allogent Therapeutics Inc, NRx Pharmaceuticals Inc, Atea Pharmaceuticals Inc,
Patrick D. Sutphin, MD, PhD (*Abstract Co-Author*) Stockholder, Gilead Sciences, Inc;Stockholder, Editas Medicine;Stockholder, CRISPR Therapeutics AG;Stockholder, Intellia Therapeutics;Stockholder, Amwell;Stockholder, Teladoc Health Inc;Stockholder, Jazz Pharmaceuticals plc;Stockholder, ViewRay, Inc;Research funded, TriSalus Life Sciences
Kausthubh Hegde, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Introduction to Traumatic Aortic Injuries (TAI)
- Imaging techniques - including multi-detector CT (MDCT), CT-angiogram (CTA) and intravascular ultrasound (IVUS)
- Management Evolution: transition from surgical to endovascular repair

### TABLE OF CONTENTS/OUTLINE

- Traumatic Aortic Injury: epidemiology, common mechanisms of injury and impact on healthcare
- Diagnostic Imaging Strategies (with case-based examples)- Role of chest radiographs in initial assessment- Detailed exploration of MDCT, CTA, and IVUS capabilities in identifying TAI
- Classification Systems (Society for Vascular Surgery and Harborview classification) and imaging features of TAI: intimal flaps, pseudoaneurysms, and mediastinal hematomas
- Management protocols and role of radiologists- Historical perspective: from open surgical repair to endovascular approaches- Criteria for choosing between surgical and endovascular repair based on imaging findings- Post-operative imaging and long-term surveillance strategies
- Case Studies and Clinical Outcomes- Review of typical cases with imaging studies and treatment outcomes- Discussion of complex cases illustrating decision-making challenges

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# Abstract Archives of the RSNA, 2024

EREE-36

## THE ATYPICAL AND EQUIVOCAL APPENDIX

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Adnan M. Sheikh, MD (*Abstract Co-Author*) Nothing to Disclose
Rajesh Bhayana, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Abstract Co-Author*) Nothing to Disclose
Ankush Jajodia, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Bipin Nanda, MD (*Abstract Co-Author*) Nothing to Disclose
Shobhit Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Basso Dias, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Satheesh Krishna, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Air in appendix - is it appendicitis or not ? 2. Periappendicitis vs secondary appendicitis 3. Small bowel obstruction can mimic appendicitis and vice versa 4. Cecal diverticulitis can mimic appendicitis and vice versa 5. Terminal ileitis can mimic appendicitis and vice vera 6. Pelvic inflammatory disease can mimic appendicitis and vice versa 7. Appendiceal diverticulitis - identification and significance 8. Epiploic appendagitis of the appendix- identification and significance 9. Appendiceal mucocele - identification and significance 10. How to approach an equivocal appendix? How to report an equivocal appendix? What to do next ?

### TABLE OF CONTENTS/OUTLINE

Imaging first approach in evaluation of suspected appendicitis, with algorithm to select appropriate imaging modality/protocol. Identification of equivocal appendicitis with emphasis on auxillary features that may lead to diagnosis. Ideal reporting and communication of the equivocal appendicitis. Differentiation between periappendicitis and secondary appendicitis. Appendicitis mimicking bowel obstruction and vice versa. Cecal diverticulitis mimicking appendicitis and vice versa. Other common mimickers and confounders in evaluation of appendicitis like terminal ileitis and pelvic inflammatory disease (with or without tuboovarian abscess). Appendiceal diverticulitis, imaging features and significance. Epiploic appendagitis of the appendix, imaging features and significance. Appendiceal mucocele, identification and differentiation from appendicitis. “Take Home” algorithm for the evaluation of atypical and equivocal appendix.

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# Abstract Archives of the RSNA, 2024

EREE-37

## POST CARDIAC ARREST SYNDROME: MULTIMODALITY IMAGING EVALUATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Manroop Kaur, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Gange JR, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc Stockholder, Bristol-Myers Squibb Company Research Consultant, Bayer AG Medical Advisory Board, AIxSCAN, Inc Shareholder, AIxSCAN, Inc
Mamta Gupta (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Post cardiac arrest syndrome (PCAS) is a complex condition characterized by a myriad of physiological derangements following successful resuscitation from cardiac arrest. Integration of Multimodality Imaging: Understand the complementary roles of various imaging modalities in the comprehensive evaluation of post cardiac arrest syndrome (PCAS). 2. Identifying Myocardial Dysfunction: Recognize the imaging hallmarks of myocardial dysfunction to guide prognosis and management decisions.3. Assessment of Neurological Injury: Utilize advanced imaging techniques, including MRI and CT, to assess for hypoxic-ischemic brain injury, cerebral edema, and other neurological sequelae of cardiac arrest, aiding in prognostication and treatment planning.4. Evaluation of Systemic Complications: Appreciate the role of imaging in identifying systemic complications of PCAS, including pulmonary edema, acute respiratory distress syndrome (ARDS), and multiorgan dysfunction syndrome (MODS), to guide supportive care strategies.5. Prognostic Implications: Understand the prognostic value of imaging findings in PCAS, such as the extent of myocardial injury, presence of neurological damage, and severity of systemic complications,6. Therapeutic Decision-Making: Integrate imaging findings into the formulation of individualized treatment plans for patients with PCAS.

### TABLE OF CONTENTS/OUTLINE

• Introduction and overview of Post Cardiac Arrest Syndrome • Pathophysiology of Post Cardiac Arrest Syndrome • Role of Multimodality Imaging in PCAS Evaluation • Discussion of teaching Points and Key Imaging Findings on cases basis

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# Abstract Archives of the RSNA, 2024

EREE-38

## HEMOPTYSIS IN THE EMERGENCY DEPARTMENT: CHECK-LIST BASED APPROACH TO GUIDE THE INTERVENTIONAL RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aurea Diez Tascon, MD (*Abstract Co-Author*) Nothing to Disclose
Amine Moultamis, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Aguilar Picapiedra (*Abstract Co-Author*) Nothing to Disclose
Milagros Marti de Gracia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Silvia Ossaba (*Abstract Co-Author*) Nothing to Disclose
Maria-Luz Parra Gordo, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Romero Guzman (*Abstract Co-Author*) Nothing to Disclose
Juan Diego De La Morena Molina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To illustrate the bronchial arteries anatomy and primary mechanisms of injury.2. To review the indications and optimal imaging modality for the evaluation of life-threatening hemoptysis. 3. To emphasize the utility of employing a structured report template to streamline targeted endovascular treatment planning.

### TABLE OF CONTENTS/OUTLINE

1. Review the anatomy, classification and branching patterns of the bronchial arteries through illustrations, CT, and correlation with arteriography. 2. Main mechanisms of bronchial arteries injury. Graphical representation of alterations in pulmonary vascularization under hypoxic conditions. 3. Imaging evaluation in the Emergency Department. When and how to perform the study? 3.1 Indications of urgent study. 3.2 Optimal imaging protocol. 4. Proposal of a structured report. Serving as a roadmap to the Interventional Radiologist employing a checklist-based approach utilizing four key descriptors. 4.1 Signs of alveolar hemorrhage. 4.2 Signs of hemorrhage in the airway. 4.3 Vascular signs: a) Hypertrophy of bronchial arteries; b) Pseudoaneurysms c) Arteriovenous malformations. 4.4 Identification of the responsible lesion. 5. Illustrated pearls and common pitfalls that could influence the optimal treatment. 6. Take home points.

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# Abstract Archives of the RSNA, 2024

EREE-39

## BUGS ON THE BRAIN: PARASITIC AND VECTOR-BORNE INFECTIONS OF THE HEAD, NECK, AND NERVOUS SYSTEM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Douglas S. Katz, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Donato (*Abstract Co-Author*) Nothing to Disclose
Jannatun Sikder, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mine Sorkun, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro L. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Vikram S. Dogra, MD (*Abstract Co-Author*) Nothing to Disclose
Francisco Calle Bernal, MD (*Abstract Co-Author*) Nothing to Disclose
Nadia Solomon, MD, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe a variety of parasitic and vector-borne diseases likely to bring patients to the emergency room due to neurologic and infectious symptoms associated with manifestations affecting the head, neck, and nervous system. Provide a brief introduction to these infections, including the epidemiology, clinical presentations, and medical sequelae/complications. Provide an array of case examples demonstrating imaging features associated with acute and chronic, and common and uncommon sequelae of these infections across multiple imaging modalities. Provide a brief overview of management and treatment of these infections.

### TABLE OF CONTENTS/OUTLINE

This exhibit will review parasitic and vector-borne infections that are likely to result in emergency room visits due to disease manifestations within the brain, neck, and nervous system. This will include protozoan infections (e.g., Chagas disease, leishmaniasis, cerebral malaria, toxoplasmosis), helminthic infections (e.g., cystic echinococcosis, cysticercosis), and vector-transmitted bacterial (e.g., Lyme disease) and viral infections (e.g., Eastern equine encephalitis, Powassan virus). It will provide a multimodality review of imaging findings, although primarily focusing on computed tomography and magnetic resonance imaging. It will review specific (e.g., multiloculated cysts characteristic of cystic echinococcosis) and nonspecific (e.g., mosquito- or tick-borne viral encephalitis) imaging findings, as well as common (e.g., mucocutaneous leishmaniasis, orbital cysticercosis) and uncommon sequelae (e.g., neurological manifestations of Chagas) of these diseases which can be appreciated on imaging studies of the head and neck.

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# Abstract Archives of the RSNA, 2024

EREE-4

## THE AORTIC BLUEPRINT: UNDERSTANDING PATHOLOGIES, NAVIGATING COMPLICATIONS, AND APPROACHING TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mili Rohilla, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua R. Russell, DO (*Abstract Co-Author*) Nothing to Disclose
Kuldip S. Mann, MD (*Abstract Co-Author*) Nothing to Disclose
Samruddhi V. Jain JR, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Gain insight into the anatomy and pathophysiology underlying aortic pathologies. 2. A thorough review of imaging findings encompassing diverse aortic pathologies and associated complications. 3. Explore the treatment approaches including preoperative evaluation for endovascular interventions.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to aortic anatomy- • Overview of aortic structure and function • Pathophysiology 2. Role of CT imaging in the evaluation of acute pathologies, protocol, and imaging findings 3. Imaging of different aortic pathologies: • Acute aortic syndrome - - Aortic dissection- Ų Classification Ų Imaging findings Ų Treatment - Penetrating ulcer- Ų Definition Ų Imaging features - Intramural hematoma Ų Definition Ų Imaging features • Aortic aneurysm - Ų Definition Ų Etiology Ų Diagnostic Criteria Ų Treatment Planning and Follow-Up • Aortic atherosclerosis and acute thrombosis Ų Risk Factors Ų Imaging Evaluation Ų Clinical Implications and Management Strategies • Aortic fistula Ų Etiology Ų Imaging findings Ų Management 4. Imaging features of common complications: • Pericardial effusion/hemorrhage • Aortic dissection extending in coronary vessels • Ruptured aortic aneurysm 5. Endovascular aortic interventions with preoperative imaging evaluation. Comprehensive understanding, early diagnosis, and timely intervention are paramount in mitigating the impact of aortic diseases and improving patient outcomes. This abstract focuses on arming radiologists with comprehensive knowledge of various aortic pathologies. Moreover, it encompasses details regarding pre-operative imaging for TAVR surgeries, aiding radiologists in discerning crucial elements to include in their reports.

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# Abstract Archives of the RSNA, 2024

EREE-40

## AORTOILIOFEMORAL (AIF) LOWER EXTREMITY CT ANGIOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Richard Tsai, MD (*Abstract Co-Author*) Nothing to Disclose
David H. Ballard, MD (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Isah G. Webb, MD (*Abstract Co-Author*) Nothing to Disclose
Katharina Feister, MD (*Abstract Co-Author*) Nothing to Disclose
John Wiltshire, MD (*Abstract Co-Author*) Nothing to Disclose
Vincent M. Mellnick, MD (*Abstract Co-Author*) Nothing to Disclose
Demetrios A. Raptis, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto A. Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Derek T. Nhan, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Z. Rajput, MD (*Abstract Co-Author*) Nothing to Disclose
Muhammad Naeem, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lanier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Constantine A. Raptis, MD (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Lower extremity CT angiography is a frequently ordered exam in both the emergency and outpatient settings, for indications ranging from peripheral arterial disease and trauma to infectious and inflammatory conditions. Given the wide range of anatomic coverage, these studies place a premium on both optimal imaging technique and efficient but comprehensive interpretation. This exhibit will:1) Discuss the imaging technique and rationale for lower extremity CTA AIF2) Describe normal anatomy and key collateral vascular pathways3) Illustrate reporting strategies and image manipulation techniques for efficient interpretation and reporting4) Cover the spectrum of disease processes affecting the lower extremity vasculature, including peripheral arterial disease, trauma, and infectious and inflammatory disorders

### TABLE OF CONTENTS/OUTLINE

- The role of CT AIF imaging- Anatomy: normal anatomy, variants and key collateral vascular pathways- Imaging technique: Timing, kVp, bolus tracking, repeat delayed imaging, advanced techniques (metal artifact reduction, spectral/photon counting CT); combining with chest and AAA imaging- Search pattern, reporting, and pitfalls: templated reporting, extravascular findings, bolus timing (outrunning of bolus or venous contamination), blooming, satisfaction of search- Peripheral arterial disease: stenosis, occlusion, bypass grafts, stents, embolic disease, peripheral aneurysms- Trauma: active extravasation, pseudoaneurysm, occlusion, vasospasm, transection, dissection, arteriovenous fistula, iatrogenic injury- Infectious/inflammatory: graft infection, mycotic pseudoaneurysms, cystic adventitial disease, Buerger’s disease

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# Abstract Archives of the RSNA, 2024

EREE-41

**HEAD SPIN**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mathew Storey, MBChB (*Abstract Co-Author*) Nothing to Disclose
Robert P. Barker, FRCR, MRCP (*Abstract Co-Author*) Nothing to Disclose
Nora Sangvik Grandal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Najeed Khan, BMBS, MSc (*Presenter*) Nothing to Disclose

## TEACHING POINTS

Acute dizziness is a common reason for presentation to the Emergency Department, but rather than a diagnosis, it is an imprecise descriptor of symptoms with an estimated misdiagnosis rate of 80%. Distinguishing terms such as vertigo and light-headedness are unhelpful as symptom quality does not reliably predict the cause of dizziness. Indiscriminate application of CT and MRI has a low yield in acute dizziness. Despite this, over 50% of patients attending ED with dizziness will have a CT brain to exclude a posterior circulation stroke. This poster highlights a novel algorithm to stratify patients into 1 of 4 major syndrome categories: each with its own differential diagnoses, targeted examination techniques, and recommended imaging modality. By addressing the following teaching points, this educational exhibit aims to improve understanding of acute dizziness and equip the vetting radiologist with a framework to facilitate effective discussion with clinicians and ensure the appropriate use of medical imaging:
- Establish a practical definition of acute dizziness.
- Illustrate the relevant neuroanatomical principles behind eye movements and their relationship to the vestibular system.
- Provide a framework to establish the appropriate use of targeted radiological imaging for patients presenting with acute dizziness.
- Provide a variety of example cases with important radiological imaging findings in patients presenting with acute dizziness.

## TABLE OF CONTENTS/OUTLINE

- Defining dizziness
- The Triage-TiTrATE-Test algorithm
- Triage
- Timing and Triggers
- Targeted examination and Tests
- Nystagmus and the Vestibulo-ocular reflex pathway
- Example cases with radiological findings
- Summary

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# Abstract Archives of the RSNA, 2024

EREE-42

## FALLING THROUGH THE CRACKS: PEER LEARNING IN TRAUMA TORSO CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Robin B. Levenson, MD (*Abstract Co-Author*) Nothing to Disclose
Karen S. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed G. Aboseria, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Trauma torso CT is a staple of Emergency Department (ED) trauma evaluation. Given time sensitivity, complexity, and various findings that may be encountered at CT, in addition to potential distractions in the acute setting, imaging findings may be inadvertently overlooked or misinterpreted. Contributory factors include inattentional blindness, satisfaction of search, framing bias due to the provided indication, and ambiguity effect due to unfamiliarity with a finding. Familiarity with these contributory factors can enhance a radiologist's search pattern and appropriate management.

### TABLE OF CONTENTS/OUTLINE

This exhibit will focus on trauma torso CT peer learning cases from our institution, including contributory factors which may have led to the diagnostic error and teaching pearls to avoid potential pitfalls/biases in diagnosis. A) Case based imaging review of missed/misinterpreted thoracic findings on trauma torso CT including diaphragmatic rupture, aortic injury, and pulmonary embolism. B) Case based imaging review of missed/misinterpreted gastrointestinal findings on trauma torso CT including hepatic laceration, gastric perforation following gunshot wound, and diaphragmatic slip mistaken for hepatic subcapsular hematoma. C) Case based imaging review of missed/misinterpreted genitourinary findings on trauma torso CT including bladder rupture, placental abruption, and duplicated renal arteries mistaken for dissection. D) Case based imaging review of missed/misinterpreted musculoskeletal findings on trauma torso CT including misaligned right hip arthroplasty, mid thoracic spine fracture in the setting of DISH, and subtle right femoral neck fracture.

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# Abstract Archives of the RSNA, 2024

EREE-43

## INSIGHTS INTO ACUTE MESENTERIC ISCHEMIA: ESSENTIAL KNOWLEDGE FOR RADIOLOGY RESIDENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Javier Azpeitia Arman, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Rodriguez Ramirez, MD (*Abstract Co-Author*) Nothing to Disclose
Lorena Melian Iribar, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Cayon Somacarrera, MD (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Learn the correct computed tomography scan protocol. 2) Recognize the different subtypes of acute mesenteric ischemia in imagen tests. 3) Become familiar with gastrointestinal tract vascular anatomy. 4) Learn the typical computed tomography scan findings and indicators of irreversible ischemia.

### TABLE OF CONTENTS/OUTLINE

Mesenteric ischemia can manifest as either acute (95%) or chronic (5%; typically associated with diffuse atherosclerotic disease). Acute Mesenteric Ischemia (AMI) is a critical medical condition resulting from reduced blood flow to the intestines. Subtypes of AMI include arterial occlusion (embolic and thrombotic), venous occlusion, non-occlusive mesenteric ischemia (NOMI), and closed-loop obstruction. Among these, arterial occlusion is the most prevalent subtype and carries the worst prognosis. The gastrointestinal tract receives perfusion from the celiac trunk, the superior mesenteric artery (SMA), and the inferior mesenteric artery (IMA). In cases of mesenteric ischemia, collateral pathways between these arteries become crucial, offering protective blood flow in patients with vascular stenosis or occlusion. Irreversible ischemic injury occurs within six hours following complete vascular occlusion. The diagnosis of AMI can be challenging because symptoms and laboratory tests are often nonspecific, requiring a high degree of clinical suspicion. Computed tomography (CT) is the most sensitive and specific imaging test for diagnosing AMI, making it the preferred imaging modality when suspicion arises. Moreover, CT enables the exclusion of alternative causes of acute abdominal pain.

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# Abstract Archives of the RSNA, 2024

EREE-44

## A PUNCH TO THE GUT: CT FINDINGS IN BLUNT TRAUMATIC INJURY TO THE BOWEL AND MESENTERY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sarah Hickman, MBBS (*Abstract Co-Author*) Research collaboration, Vara;Research collaboration, ScreenPoint Medical BV;Research collaboration, Lunit Inc;Research collaboration, Kheiron Medical Technologies Ltd;Research collaboration, Alphabet Inc;Research collaboration, Volpara Health Technologies Limited
Gurinder Nandra, FRCR,MBChB (*Abstract Co-Author*) Nothing to Disclose
Saigeet Eleti, FRCR, MBBChir (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Bowel and mesenteric injuries are the third most common type of injury in blunt trauma to the abdomen; detected in 5% of patients at laparotomy. Bowel injury may often be occult at clinical presentation and physical examination is unreliable. Delayed diagnosis is associated with significant morbidity and mortality due to haemorrhage or perforation leading to peritonitis and sepsis. Multidetector CT is the modality of choice when evaluating trauma patients that are haemodynamically stable. It may be performed rapidly and has high sensitivity and specificity in identifying bowel and mesenteric injuries. Through retrospective review of patients presenting to our Level 1 trauma centre, we present the range of CT imaging appearances of bowel and mesenteric injury in blunt abdominal trauma and correlate them with surgical findings.We use a split-bolus protocol which enables arterial and venous enhancement in a single pass of the CT gantry. Additional techniques such as oral contrast may be used for image optimisation. Dual energy CT may be used to increase conspicuity of bowel injury. CT findings of bowel injury include discontinuity of the bowel wall, extraluminal gas or contrast, bowel wall thickening, abnormal enhancement and adjacent haematoma/fat stranding which are variably specific for traumatic injury.CT findings of mesenteric injury include mesenteric haematoma, abrupt termination of a mesenteric vessel or vessel irregularity. Imaging findings may be subtle and it is important that the radiologist is aware of the spectrum of appearances to minimise delay in time to intervention.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

EREE-45

## IMAGING REVIEW OF ACUTE MEDIASTINITIS BASED ON ETIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alberto Hidalgo, MD (*Abstract Co-Author*) Nothing to Disclose
VICTOR PINEDA SANCHEZ, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Noemi Canete, MD (*Abstract Co-Author*) Nothing to Disclose
Sergi Juanpere (*Abstract Co-Author*) Nothing to Disclose
Adria Roset Altadill, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Acute mediastinitis is a life-threatening condition depicted at CT by increased mediastinal fat attenuation, pneumomediastinum and organized fluid collections. Acute mediastinitis can be caused by iatrogenic procedures, head and neck infections, gastroesophageal perforation and osteoarticular infections. Specific imaging findings may point towards the origin of the infection, which is advantageous to guide treatment decisions.

### TABLE OF CONTENTS/OUTLINE

Acute mediastinitis is a life-threatening condition that results from inflammation and infection of the soft tissues and fat contained within the mediastinum. The different etiologies of acute mediastinitis include iatrogenic causes, extension from head and neck infections, intestinal perforation, or spread from osteoarticular infections. CT is an essential examination to diagnose acute mediastinitis and determine the extent of the disease. Common imaging features include increased mediastinal fat attenuation, pneumomediastinum, organized fluid collections and pleural effusions. Additionally, certain findings may help identify the source of the infection, which is advantageous for appropriate management. Signs of sternal dehiscence with adjacent inflammatory changes point towards a postoperative origin. The existence of oropharyngeal or cervical (air-)fluid collections extending to the mediastinum are highly suggestive of descending necrotizing mediastinitis. Esophageal perforation can be inferred indirectly by esophageal wall thickening and extraluminal air. Finally, cortical bone disruption or widening of an articular joint with adjacent mediastinal spread may indicate an osteoarticular origin.

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# Abstract Archives of the RSNA, 2024

EREE-46

## CLOSED LOOP SMALL BOWEL OBSTRUCTION: WHEN TO EVOKE THIS DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Spencer C. Behr, MD (*Abstract Co-Author*) Grant, Cancer Targeted Technology;Scientific Advisory Board, Novartis AG;Research Consultant, GenVivo
Andrew D. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Joelle Harwin, MD (*Abstract Co-Author*) Nothing to Disclose
Stephen G. Wahlig, MD (*Abstract Co-Author*) Nothing to Disclose
Alexia R. Tatem, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Masis Isikbay, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Closed Loop Small Bowel Obstruction (CLSBO) should always be considered when evaluating a case of small bowel obstruction (SBO).2. CLSBO is a mechanical diagnosis (an isolated loop of bowel) and secondary signs of bowel ischemia are not required to make the diagnosis (but should be evaluated).3. CLSBO is a devastating missed diagnosis and requires prompt surgical management.

### TABLE OF CONTENTS/OUTLINE

INTROPathophysiology of CLSBO- Clinical presentation patterns- Prompt diagnosis is critical for management (decision to go to the operating room)- CT of the Abdomen/Pelvis is an important part of the workup CT FEATURESTo raise suspicion for CLSBO consider the following pathway:1. Evaluate for any presence of SBO (Figure 1), which is required for a CLSBO. Always consider CLSBO for any case of SBO.2. Look for more than one transition point next to one another (“closed loop” physiology, Figure 2).3. Evaluate for other common patterns of CLSBO: “balloons on a string” appearance (Figure 3), isolated portion of distended bowel, decompressed bowel proximal/distal to affected loop.4. Evaluate for signs of bowel inflammation (bowel wall thickening, mesenteric fat stranding, free fluid, Figure 4) and bowel ischemia/necrosis (bowel wall hypo-enhancement, Figure 5).5. Understand that it is a mechanical diagnosis (bowel inflammation is often present but NOT required to make the diagnosis especially if caught very early). SUMMARY-These key imaging features help raise suspicion for CLBSO- Definitive diagnosis will come from operative findings- If unsure ask for backup/help to avoid delaying care for the patient

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# Abstract Archives of the RSNA, 2024

EREE-47

## ROLE OF NON-CONTRAST MRI IN THE ED SETTING OF ACUTE ABDOMINOPELVIC PAIN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Frank H. Miller, MD (*Abstract Co-Author*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA
Camila L. Vendrami, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Courtney C. Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Dallas Sturdevant, DO (*Abstract Co-Author*) Nothing to Disclose
Pardeep K. Mittal, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas L. Estes JR, MD (*Abstract Co-Author*) Nothing to Disclose
Nikolas Brozovich, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.To review epidemiology of most common acute abdominal and pelvic pathologies. 2. To provide MRI findings of common causes of acute abdomen including appendicitis, acute cholecystitis, acute pancreatitis, diverticulitis, ovarian torsion, Meckel's diverticulum. TOA, Torsed fibroid. Testicular infarction. Testcular trauma, Prostatic abscess. Splenic infarct, and Crohns 3. Discuss abbreviated non-contrast MRI protocols for acute emergencies.

### TABLE OF CONTENTS/OUTLINE

Epidemiology of acute abdomen and pelvis • MRI findings of - Appendicitis - Acute cholecystitis - Acute pancreatitis - Diverticulitis - Ovarian torsion - Meckel's diverticulum •-TOA, Torsed fibroid-Testicular infarction.-Testcular trauma-Prostatic abscess-Splenic infarct.-Crohns

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# Abstract Archives of the RSNA, 2024

EREE-48

## YOU'LL POKE YOUR EYE OUT KID! AN ORBITAL TRAUMA PRIMER FOR THE ON CALL RADIOLOGY RESIDENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Han Zhong, MD (*Abstract Co-Author*) Nothing to Disclose
Emily R. Convery, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Orbital trauma is a common situation residents encounter on call. However, reading and interpreting orbital imaging can be overwhelming especially in cases of complex trauma or in cases where there is underlying orbital pathology. A systematic approach to investigating the orbits is key to making crucial findings. Understanding the anatomy of the orbit is helpful in creating a search pattern for residents to follow. Injury can occur to the orbital wall bones, the globe itself, the extraconal soft tissues, or a combination of those compartments. The mechanism of injury and elements of the physical exam in addition to imaging findings will guide clinician's decisions about patient management, specifically if the patient will require emergent surgery or if close follow up is sufficient. It is important for residents to know what clinicians are looking for so that information can be included in the radiology report for clinical decision-making.

### TABLE OF CONTENTS/OUTLINE

1) Overview of Orbital Anatomy2) Orbital Imaging Search Pattern3) Mechanisms of Injury4) Red flag symptoms5) Orbital wall fractures6) Complications of orbital wall fractures7) Globe Injury - rupture, anterior chamber injury, posterior chamber injury8) Extraconal soft tissue injury9) Management options

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# Abstract Archives of the RSNA, 2024

EREE-49

## INTERSTITIAL LUNG DISEASE WITH ACUTE MANIFESTATIONS: TIPS FOR THE GENERAL AND EMERGENCY RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elena Garcia Garrigos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Almudena I. Urena Vacas, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Sirera Matilla, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa Feliu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
David Ferrandez Ferrandez (*Abstract Co-Author*) Nothing to Disclose
Juan Arenas-Jimenez, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The differential diagnosis of patients presenting with acute diseases manifesting as diffuse lung abnormalities at chest CT is a challenge. Among the many possible causes, we can find interstitial lung diseases (ILD) presenting with acute manifestations both as a debut in previously undiagnosed conditions or as a complication of known ILD. In the acute setting, a correct radiological orientation can be the clue for an adequate clinical management, perhaps contributing to a better outcome. In this exhibit our goals are: 1. To describe the clinical and radiological characteristics of ILD manifesting as acute lung diseases. 2. To show imaging findings that should suggest an acute debut of an unknown ILD. 3. To depict characteristic radiological findings of acute complications in patients with known ILD.

### TABLE OF CONTENTS/OUTLINE

1.Introduction: Global overview of ILD with acute manifestations. 2. Tips for diagnosing ILD with acute presentation. 3. Radiological manifestations and clinical information that should suggest a new onset of ILD. 3. Acute complications of ILD (acute exacerbation of ILD, lung toxicity, specific infections related to therapy). 4. Discussion of specific conditions (acute interstitial pneumonia, organizing pneumonia, non-specific interstitial pneumonia, acute exacerbation of ILD, rapidly progressive ILD, hypersensitivity pneumonitis, lung toxicity, granulomatous and lymphocytic interstitial lung disease,?)

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# Abstract Archives of the RSNA, 2024

EREE-5

## SPONTANEOUS HEMOPERITONEUM: WHERE DOES THE BLOOD COME FROM?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto Garcia Figueiras, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sandra Baleato Gonzalez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paula Buades, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Spontaneous hemoperitoneum (SH) is defined as the presence of blood within the peritoneal cavity coming from a non-traumatic origin. It is a challenging diagnosis in the emergency setting, often because of the absence of clinical suspicion and its low frequency. Radiologists play a fundamental role in the identification and location of the source of bleed, both essential to be able to deliver the best care possible for the patient. This exhibit aims to:1. Synthesize the potential causes of SH to facilitate a systematic search approach. 2. Summarize the different imaging techniques of significant value for the detection and characterization of SH, in order to ascertain which is the best course of action when assessing SH cases. 3. Review relevant diagnoses to consider when evaluating a patient with SH.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: overview of non-traumatic hemoperitoneum 2. Potential causes of bleeding within the peritoneum.2. Imaging techniques: US, CT and dual-energy CT, MRI. Diagnostic protocol based on imaging in the setting of SH. 3. Key clues to find the hemorrhagic source: not-to-miss signs on CT imaging, and relevant anatomical concepts.4. Cases: collection of cases presented schematically to best illustrate the main entities to think about when searching the origin of SH, focusing on significant differences between etiologies and hints to facilitate a correct diagnosis. These cases will be organized by pathophysiological groups: 4.1. Gynecological4.2. Post-surgical4.3. Neoplasms4.4. Hematological4.5. Vascular 4.6. Systemic conditions.5. Conclusion

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# Abstract Archives of the RSNA, 2024

EREE-50

## RADIOLOGICAL INSIGHTS: EXPLAINING FIREARM TRAUMA WITH BALLISTICS KNOW-HOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sofia Thais Escobar Narro, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Sierra, MD (*Abstract Co-Author*) Nothing to Disclose
Esteban Mayayo-Sinues (*Abstract Co-Author*) Nothing to Disclose
Paloma Briceno Torralba, MD (*Abstract Co-Author*) Nothing to Disclose
Amalia Aranaz Murillo, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Roldan Minana (*Abstract Co-Author*) Nothing to Disclose
Elena Pascual Perez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Ballistic effects studies the consequences of projectiles fired when they impact the target and this knowledge is fundamental for interpreting images of gunshot victims.2. The cavities a bullet creates are influenced by the type of firearm, bullet velocity and trajectory, and tissue penetrated.3. X-rays locate projectiles, CT scans evaluate organic damage and entry/exit points and MRI assesses injuries and potential long-term consequences

### TABLE OF CONTENTS/OUTLINE

This poster aims to explore the characteristics of gunshot wounds inflicted by various types of firearms, delve into the field of ballistic effects, and assess the role of different imaging modalities.Forensic radiology, particularly ballistic effects, is a subdivision of ballistics that studies the mechanisms of action, effects, and consequences of projectiles when they impact the target. These depend on the kinetic energy of the bullet and the temporary and permanent cavity it creates. This knowledge is fundamental for interpreting images of gunshot victims and producing our radiological report.Radiological imaging plays a crucial role in emergency settings and future management. X-rays aid in identifying the location of projectiles and determining the composition of bullets. CT offers a detailed evaluation of organ damage and entry/exit points. MRI helps assess injuries and potential long-term consequences, crucially distinguishing ferromagnetic materials to prevent adverse effects from imaging procedures.

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# Abstract Archives of the RSNA, 2024

EREE-51

## THE INVISIBLE INJURY: A COMPREHENSIVE IMAGING REVIEW OF SCAPULOTHORACIC DISSOCIATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Hector Figueroa-Monsanto (*Abstract Co-Author*) Nothing to Disclose
Mariana Travieso Diffoot (*Abstract Co-Author*) Nothing to Disclose
Max Schreiber (*Abstract Co-Author*) Nothing to Disclose
Carol Sanchez Santana (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the epidemiology and etiology of scapulothoracic dissociation and commonly associated injuries. Demonstrate key imaging features for the initial evaluation and detection of scapulothoracic dissociation and its associated vascular and neurological injuries on various imaging modalities. Discuss additional thoracic injuries affecting the lungs, pleura, and mediastinum. Explain Zelle's classification of injuries for determining the severity and management of scapulothoracic dissociation.

### TABLE OF CONTENTS/OUTLINE

I. Introduction- Definition, Problem statement- mortality/ morbidity data II. Anatomy of relevant structures III. Mechanism of injury- High energy trauma IV. Imaging modalities- Chest X-ray, Chest CT, Shoulder CT, CT Angiogram for vascular evaluation, MRI branchial plexus V. Injuries Bony and ligamentous injuries, Lung injuries- Contusions, Pleural injuries- Pneumothorax, hemothorax, Mediastinal injuries- Pneumomediastinum, Vascular injuries- Pseudoaneurysm, dissection, Neurological injuries- Brachial plexus injuries, epidural hematoma VI. Classification of injuries- Zelle's classification VII. Management

# Abstract Archives of the RSNA, 2024

EREE-52

## ATRAUMATIC EMERGENCY IMAGING OF THE SPINE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jisoo Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Albert D. Jiao, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Computed tomography is often the first-line spinal imaging in the emergency setting, and careful evaluation can expedite appropriate management. 2. MRI is the most sensitivity imaging modality for noncompressive spinal emergencies, which requires careful consideration of clinical history such as symptom character and distribution. 3. Certain spinal pathologies such as spinal cord infarct require modifications to existing imaging protocols or real-time decision making from the radiologist, and therefore high pre-test clinical suspicion.

### TABLE OF CONTENTS/OUTLINE

Compressive:Epidural - Primary spinal tumors or metastases with mass effect, discitis-osteomyelitis, disc herniation, degenerative disease, epidural lipomatosis, extramedullary hematopoisisSubdural - Subdural hematoma/empyema/hygromaIntradural/Extramedullary - Primary spinal tumors and cysts (shwannoma, meningioma, epidermoid), leptomeningeal metastasesNoncompressive: Inflammatory/Infectious - Guillain-Barre, Arachnoiditis, Transverse Myelitis, Neurosarcoidosis, Radiation-InducedVascular - Infarct, Arteriovenous malformation and fistula, VasculitisToxic-Metabolic - Subacute combined degeneration, nitrous oxideDemyelinating - Multiple sclerosis, neuromyelitis optica, acute disseminated encephalomyelitisMimics and other diagnoses:Crowned Dens Syndrome/CPPD, Calcific Tendinitis of the longus colli muscle, Osteoid osteoma/osteoblastoma, Treatment-related effects, including immune related adverse events and radiation osteitis, Iatrogenic injury/Postsurgical, Congenital/syndromic - Scheurmann disease, syringomyelia, tethered cord syndrome, sickle cell pain

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

EREE-53

## EMERGENCY NON-TRAUMATIC CARDIAC IMAGING FOR THE NON-CARDIAC RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Christian P. Houbois, MD (*Abstract Co-Author*) Nothing to Disclose
Elsie Nguyen, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Jonatas Favero Prietto Dos Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew Aitken, MBChB, FRANZCR (*Abstract Co-Author*) Nothing to Disclose
Michael N. Patlas, MD, FRCPC (*Abstract Co-Author*) Royalties, Holtzbrinck Publishing Group
Felipe S. Torres, MD, PhD (*Abstract Co-Author*) Research support, Altis Labs
Felipe A. Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Farah Cadour, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Presenter*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

### TEACHING POINTS

1. Urgent cardiac abnormalities can be identified on non-gated chest imaging performed for another indication in patients presenting to the emergency department with non-traumatic acute chest pain, dyspnea or palpitations2. Coronary abnormalities identified on chest CT in the emergency department include plaque rupture resulting in myocardial ischemia and infarct, spontaneous coronary artery dissection, anomalous coronary artery origin with malignant course, and coronary vasculitis.3. Emergency non-coronary cardiac findings include aortic root dissection, stress-induced or other cardiomyopathy, cardiac masses and thrombus, epipericardial fat necrosis, myocarditis, pericarditis, and pericardial tamponade4. The heart should be evaluated on all thoracic imaging including the coronary arteries, cardiac chambers, pericardium, valves, and adjacent fat, with particular attention in patients presenting to the emergency department with acute chest pain, dyspnea, or palpitations where no other cause is identified

### TABLE OF CONTENTS/OUTLINE

1. Review non-traumatic acute cardiac diseases and complications in the emergency department including incidence, presenting symptoms, pathophysiology, imaging findings, and clinical outcomes2. Describe the importance of evaluating the heart on emergency non-traumatic thoracic imaging performed for other indications such as evaluation of pulmonary embolism or aortic dissection3. Demonstrate acute cardiac abnormalities on chest x-ray and chest CT performed for other indications in the emergency department including coronary artery, myocardial, pericardial, valvular and other cardiac abnormalities

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# Abstract Archives of the RSNA, 2024

EREE-54

## IMAGING FEATURES OF BLUNT THORACIC AORTIC INJURY: WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Andrew Sinensky, MD (*Abstract Co-Author*) Nothing to Disclose
Elana B. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Ishaan J. Bhatt, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Blunt traumatic aortic injuries (BTAI) are frequently classified using the Society of Vascular Surgery classification system. Management is based on injury grade and hemodynamic stability of the patient. 2. Proposed mechanisms for BTAI include shear/torsion forces, osseous pinch, and water-hammer phenomenon. 3. Cardiac, pulmonary, abdominal, and osseous injuries often occur concurrently with BTAI. End organ ischemia/infarcts may result from the vascular injury.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. CTA Techniques and Considerations• Whole-body CT• Cardiac gating• Bolus timing• Dual energy applications3. Injury Mechanism• Shear/Torsion• Osseous Pinch• Water-Hammer Phenomenon4. Injury locations5. Injury Grading - Society of Vascular Surgery• Grade I - Intimal Tear• Grade II - Intramural Hematoma• Grade III - Pseudoaneurysm• Grade IV - Rupture6. Associated Injuries and Complications7. Mimics of Injury - Non-traumatic pathologies, anatomic variants, and technical factors8. Management• Non-operative vs. endovascular vs. open• Treatment complications - infection, stent migration, endoleak, injury progression, fistula formation9. Summary

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# Abstract Archives of the RSNA, 2024

EREE-55

## THE NO-SO-CUTE ACUTE LIVER: PRESENTATIONS AND IMAGING OF EMERGENT LIVER PATHOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joseph W. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Sophia Humphrey (*Abstract Co-Author*) Nothing to Disclose
Robert G. Meek (*Abstract Co-Author*) Nothing to Disclose
Sri Kanth Dommeti, MBBS (*Abstract Co-Author*) Nothing to Disclose
Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
Elhamy R. Heba, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Trae C. Brooks, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Abdominal pain is one of the most common reasons for visits to the emergency department, accounting for 5-10% of all visits (139.8 million in the US in 2021). The liver is the largest organ in the abdomen and has attributable pathology in 0.5-1% of these cases (non-biliary causes). CT and US are often complimentary examinations in the workup of suspected liver pathology in the ED, with US a modality of choice in the pediatric population to avoid radiation exposure when possible. MRI remains a problem-solving modality when other imaging is equivocal. When acute non-biliary liver pathology is suspected, the radiologist should be familiar with the imaging findings seen in various forms of liver pathology and should also be prepared to recommend the appropriate imaging examination to assist referring clinicians in reaching a diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Background and Epidemiology.2. Overview of Acute Non-biliary Liver Pathology.3. Multimodality Case Presentations.a.Trauma-Brief overview of current AAST guidelines for blunt/penetrating hepatic trauma,Discussion of key findings to distinguish between different AAST injury grades.b. Nonbiliary Hepatic Infection,Abscess,Hepatitis.c. Hepatic Vascular Emergencies- Budd-Chiari Syndrome,Portal vein thrombosis,Hepatic Artery Stenosisd. Emergent Complications of Hepatic Neoplasm-Adenoma,HCC,Diffuse metastasise. Post op/ Iatrogenic- Bilomas/fluid collection/hemorrhage,Vascular-Fistula (after biopsy),Pseudoaneurysm (liver transplants),Peripheral PVT after targeted therapy4. Summary and Recommendations5. References.

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# Abstract Archives of the RSNA, 2024

EREE-56

## RADIOLOGY AT THE FRONTLINE: EXPERIENCE OF THE MOBILE MILITARY HOSPITAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Uliana Y. Pidvalna, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The term and description of "military trauma" are changing every time with new technologies of weapons. In parallel, the development of radiological modalities is a tool that could assist military doctors even on the frontline for prompt and precise decisions. In the case of the modern ongoing war, understanding evacuation steps with diagnostic modalities at each point is necessary. The purpose of this exhibit is: 1. To show the evacuation steps with accessible diagnostic modalities at different stages. 2. To illustrate imaging findings of frontline combat trauma at the mobile military hospital using different techniques (X-ray, US and CT). 3. To discuss the challenges and difficulties in assessing military trauma at the mobile military hospitals.

### TABLE OF CONTENTS/OUTLINE

1. Principles and application of evacuation steps from the frontline with accessible radiological modalities.2. Radiological imaging of head/chest/abdomen/pelvis/extremities on the frontline, including, but not limited to, pneumothorax, hemothorax, hemoperitoneum, bleeding, heart and great vessels injuries, traumatic amputations, brain injuries (X-ray, USG and non-contrast CT) at the mobile military hospital.3. Diagnostic modalities triage: experience of the mobile military hospital.

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# Abstract Archives of the RSNA, 2024

EREE-57

## FLAP TO FLOP: EMERGENCY IMAGING OF EXTRAMAMMARY COMPLICATIONS AFTER BREAST RECONSTRUCTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

William J. Hoover, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Surgical management of breast cancer is evolving quickly, with several breast reconstruction options available to patients after mastectomy or lumpectomy.
- Many breast reconstruction procedures utilize muscle, fat, and skin derived from the patient's abdomen, back, or extremities.
- Breast reconstruction may result in complications at flap donor sites including abscess, hematoma, wound dehiscence, or cellulitis.
- Many patients with donor site complications initially present to the Emergency Department, where evaluation often includes CT abdomen/pelvis or soft tissue ultrasound.
- This exhibit will review multimodality emergency imaging of complications at flap donor sites.
- The presentation will also compare expected post-operative changes with acute "can't miss" complications at flap donor sites.

### TABLE OF CONTENTS/OUTLINE

- Imaging review of complications that occur at flap donor sites. This exhibit will discuss acute and long-term donor site complications for seven common breast reconstruction surgeries:
- Transverse rectus abdominis myocutaneous (TRAM) flap
- Deep inferior epigastric perforator (DIEP) flap
- Latissimus dorsi flap
- Superior gluteal artery perforator (SGAP) flap
- Transverse upper gracilis (TUG) flap
- Autologous fat grafting
- Omental flap
- Brief description of each reconstructive procedure, focusing primarily on relevant anatomy in the abdomen, back, or extremities.

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# Abstract Archives of the RSNA, 2024

EREE-58

## A HEAD TURNER: CERVICAL SPINE INJURIES, MANAGEMENT, AND COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elana B. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Fayhaa Doja, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Blunt cervical spine injuries most often result from motor vehicle accidents and falls. Direction of force contributes to injury type. 2. AO classification systems exist for the upper (C0-C3) and subaxial (C3-C7) cervical spine. Injuries are further classified by location, osseous/ligamentous involvement, and stability. 3. Knowledge of spinal cord tract structure and function allows for prediction of neurologic deficits. For example, Brown-Sequard Syndrome causes ipsilateral weakness and impaired proprioception and contralateral loss of pain and temperature due to involvement of the corticospinal tract, dorsal column, and spinothalamic tract, respectively. 4. The postoperative cervical spine can be complicated by hardware failure, infection, nonunion, and fluid collections. Tracheal and esophageal injuries are unique to anterior approach surgeries.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Anatomy - Osseous - Ligamentous - Spinal Canal Spaces (epidural, subdural, subarachnoid) - Spinal Cord 3. Imaging Indications, Modalities, and Technical Factors4. AO Cervical Spine Classification - Upper Cervical Spine Injury (C0-C3) - Subaxial Cervical Spine Injury (C3-C7)5. Spinal Cord Injuries - Compression - Contusion - Transection - Infarct 6. Management- Nonoperative - Operative (upper vs. subaxial cervical spine) - Post-operative complications & 7; Hardware-related (malpositioning, failure, subsidence)& 7; Infection & 7; Nonunion& 7; Fluid collections & 7; Tracheo-esophageal& 7; Neurovascular & 7; Heterotopic ossification7. Summary

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# Abstract Archives of the RSNA, 2024

EREE-59

## MELENA AND HEMATOCHEZIA: ACUTE UPPER AND LOWER GASTROINTESTINAL BLEEDING- DIFFERENTIAL DIAGNOSIS AND ROLE OF IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manohar Roda, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thomas L. Estes JR, MD (*Abstract Co-Author*) Nothing to Disclose
Frank H. Miller, MD (*Abstract Co-Author*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA
Pardeep K. Mittal, MD (*Abstract Co-Author*) Nothing to Disclose
Camila L. Vendrami, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Nikolas Brozovich, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss causes of acute upper and lower gastrointestinal bleeding(melena vs hematochezia) 2. Describe diagnostic approach according to patient's clinical presentation 3. Describe role of different imaging modalities in the setting of acute GI bleeding and their pitfalls

### TABLE OF CONTENTS/OUTLINE

This exhibit will discuss the etiology of acute GI bleeding above and below the ligament of Treitz. CT, MR, US, Radionuclide Scanning, Catheter angiography, and Endoscopy imaging findings will be discussed. In addition, the role of Intervention Radiology in the treatment of GI bleeding will be discussed.Upper GI bleeding- Gastric/duodenal ulcer, Gastritis, Variceal bleeding, Mallory-Weiss tear, Vascular lesions, and Neoplasms.Lower GI bleeding- Diverticular disease, Angiodysplasia, Neoplasms, Colitis(Ischemic/Inflammatory/Granulomatous), Intussusception, Meckel's diverticulum, Hemorrhoids, Benign anorectal lesions, and Anal fissures.

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# Abstract Archives of the RSNA, 2024

EREE-6

## HIGH REPRODUCIBILITY 3D-CTA WITH GENERATIVE AI : GENERATION OF PSEUDO-CONTRAST-ENHANCED CT IMAGE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Atsushi Teramoto, PhD (*Abstract Co-Author*) Nothing to Disclose
Masayoshi Niwa, RT (*Abstract Co-Author*) Nothing to Disclose
Masato Yoshida, RT (*Abstract Co-Author*) Nothing to Disclose
Yosuke Kuratani, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

We developed a method using Cycle-GAN to convert non-contrast-enhanced CT (non-CECT) images into pseudo-contrast-enhanced CT (pseudo-CECT) images. These pseudo-CECT images facilitate more accurate region of interest (ROI) setting during bolus tracking (BT), thus optimizing the timing for 3D-CTA imaging. Our study involved mutual conversion between contrast-enhanced CT (CECT) and non-CECT images, followed by ROI setting tests. The trained Cycle-GAN successfully produced pseudo-CECT and pseudo-non-CECT images resembling true CECT images. In ROI tests with pseudo-CECT images, accuracy improved to nearly 50% compared to non-CECT images, greatly assisting in identifying common carotid artery and internal carotid artery locations. This method significantly aids technicians in ROI setting.

### TABLE OF CONTENTS/OUTLINE

1. Analyze the current problems. 2. Development of a technique to convert non-CECT to CECT using CycleGAN. 3. Visual evaluation of the accuracy of depicting carotid arteries in a manner similar to contrast-enhanced CT imaging. 4. Comparison of the accuracy of ROI placement between pseudo-contrast images and non-contrast images. 5. Clinical implications

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# Abstract Archives of the RSNA, 2024

EREE-60

## DON'T MISS HOMICIDE-RELATED POSTMORTEM CT FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Yuko Nakamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shintaro Morishita (*Abstract Co-Author*) Nothing to Disclose
Wataru Fukumoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hidenori Mitani (*Abstract Co-Author*) Nothing to Disclose
Haruka Higashibori (*Presenter*) Nothing to Disclose

### TEACHING POINTS

One of the purposes of postmortem CT (PMCT) is to confirm or deny death by homicide. The differentiation between traumatic- and endogenous subarachnoid hemorrhage (SAH) is occasionally difficult. PMCT scans can reveal damage to gastrointestinal- and abdominal aortae due to blunt abdominal trauma elicited by trampling and punching; body surface inspection may not discover such damage. In stabbing victims, PMCT helps to determine the depth - and thus the type, size, and direction - of the weapon. Hyoid- and cricoid cartilage fractures point to strangulation. In decomposed corpses, anomalously vertebral separation may suggest homicide. Checking the airway of neonatal cadavers helps to determine whether the birth was normal or a stillbirth. However, in some instances PMCT findings may incorrectly point to homicide in natural-death cases and it does not reveal the cause of death in poisoning victims. We present homicide-related postmortem CT findings in forensic cases which radiologists should know.

### TABLE OF CONTENTS/OUTLINE

1. Violent death •Traumatic subarachnoid hemorrhages (SAH) •Blunt abdominal trauma 2. Strangulation 3. Stabbing 4. Corpse mutilation 5. Neonatal corpses •Differentiation of normal births from stillbirths 6. Pitfall of homicide-related postmortem CT findings •Heat hematoma •Poisoning

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# Abstract Archives of the RSNA, 2024

EREE-61

## PELVIC INJURIES IN HIGH-VELOCITY TRAUMA: A CHECKLIST BASED APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sameer B. Raniga, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Alok K. Mittal, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Manickam Kumaravel, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Shubham Arora, MD (*Abstract Co-Author*) Nothing to Disclose
Devpriyo Pal, MD,FRCR,MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To recognize various anatomic bony landmarks on pelvic radiographs and CT. To understand the pathophysiology and biomechanics of injuries in pelvic trauma To learn how to approach CT with pelvic binders. To be aware of the most commonly used pelvic trauma classification schemes.To recognize pelvic injury patterns for accurate diagnosis and characterization of pelvic injuries to guide management decisions to ensure optimal clinical outcomes.To understand the treatment options, including the role of CT in planning treatment.To evaluate the postoperative appearance

### TABLE OF CONTENTS/OUTLINE

Review the anatomy of the pelvis using illustrations, radiographs, and CT.Illustrate the spectrum of pelvic injuries and highlight crucial concepts for accurate diagnosis on radiographs/CT.Classify pelvic traumatic injuries with examples.An algorithmic approach to accurately predict and identify subtle injuries.A review of common pitfalls will be included. Understanding management principles and imaging evaluation of postoperative pelvic trauma

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EREE-62

## SEAT BELT AORTIC INJURY: A DIAGNOSTIC CHALLENGE WITHIN THE SEAT BELT SYNDROME

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nerea Quilez (*Abstract Co-Author*) Nothing to Disclose
Andoni Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Lain Ibanez, MD (*Abstract Co-Author*) Nothing to Disclose
Susana Borruel, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Martinez Chamorro (*Abstract Co-Author*) Nothing to Disclose
Miguel Diez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To review the key imaging findings of seat belt syndrome and to describe the seat belt aortic injury.
- To present the overall incidence of seat belt aortic injuries among 70 patients with seat belt signs.
- To illustrate the different types of vascular injuries and their locations, as well as the most commonly used classifications.
- To summarize the therapeutic management of seat-belt aortic injuries according to current guidelines. No one doubts the fact that seat belts save lives. However, when an individual is involved in a motor vehicle collision with properly positioned 3-point restraints, they can suffer potentially fatal injuries through multiple mechanisms. Seat belt vascular injuries, a condition with low incidence in the seat belt syndrome, can be a diagnostic challenge. This presentation aims to review the concept of seat belt aorta as well as other vascular injuries due to seat belt, providing images from real cases in our level 1 trauma center.

### TABLE OF CONTENTS/OUTLINE

- What is seat belt syndrome? Summary of imaging findings on CT. - Seat belt aortic injury. Mechanism of injury.- Sites and types of injury. Imaging findings and current classification systems.- Evolution and current guideline-based therapeutic approaches.- Take home points.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

EREE-63

## COMMON, UNCOMMON, AND RARE RENAL INFECTIONS AND OTHER SELECTED EMERGENCIES - WHAT THE RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Anne Sailer, MD (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Paul Nikolaidis, MD (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Lejla Aganovic, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review the role of imaging in the diagnosis and management of renal infections.2. Review the radiological findings and risk factors for acute and chronic renal infections and their complications.3. Discuss uncommon, rare, and opportunistic causes of renal infections.4. Overview of genitourinary infections in the renal transplant patient.5. Discuss a few other selected non-infectious renal emergencies.

### TABLE OF CONTENTS/OUTLINE

1. Demographics and risk factors for renal infections.2. Imaging modalities used in the evaluation of renal infections.3. Role of imaging in the evaluation of renal infections: the immunocompromised patient, treatment non-responders, equivocal clinical diagnosis, evaluation of disease extent, renal transplant patients, and patients with congenital anomalies.4. Radiological findings with cases from our institution of acute renal infections: acute pyelonephritis, renal/perirenal abscesses, pyonephrosis, emphysematous pyelonephritis/pyelitis, emphysematous pyelonephritis in the renal transplant patient.5. Radiologic findings with cases from our institution of chronic renal infections: chronic pyelonephritis; xanthogranulomatous pyelonephritis.6. Uncommon causes of renal infections or infection-related renal disease: tuberculosis; parasites; COVID-related renal disease.7. Renal infection in the transplant patient: spectrum, complications, and sequelae.8. Spectrum of non-infectious renal emergencies: acute kidney injury (AKI), anuria, interstitial nephritis, rhabdomyolysis, hepatorenal syndrome, renal colic and renal stones, hematuria, renovascular disease, cholesterol embolism, and contrast nephropathy.

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# Abstract Archives of the RSNA, 2024

EREE-64

## MATTERS OF SUBSTANCE: CNS IMAGING OF RECREATIONAL DRUG USE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mariana R. Defreitas, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Ruggiero, MD (*Abstract Co-Author*) Nothing to Disclose
David E. Bartlett, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Recognize common recreational drugs in the United States and their basic neurologic effects. 2. Understand the associated neuroimaging findings of complications.

### TABLE OF CONTENTS/OUTLINE

Background A. Nearly 25% of surveyed U.S. Americans used illicit drugs in the last year. B. Common drugs of choice: cocaine, amphetamines, opioids, marijuana, nitrites, and industrial solvents.Relevance A. Given prevalence, radiologists must recognize imaging findings B. CNS imaging manifestations of recreational drug can present in imaging studies order through Emergency Department C. Radiologists can aid clinicians in providing timely and appropriate care.Implications of Imaging Findings: A. Appearance is dependent on factors such as drug of choice, route of consumption, and impurities present B. Imaging can mimic other disease processes C. Findings can be suggestive illicit drug use when clinical history is unavailable.Acute and Chronic Findings A. Neurovascular - Ischemic strokes, intracranial hemorrhage, posterior reversible encephalopathy syndrome (PRES), dissection, thrombosis, aneurysms, and AVFs. B. Encephalopathies (heroin and cocaine induced) C. Infectious (i) septic emboli, embolic strokes, and mycotic aneurysms indicates disseminated infection (ii) IVDU can also be associated with HIV infection and its complications, including CNS toxoplasmosis and primary CNS lymphoma.Conclusion A. Emergency Radiologists must be familiar with the neuroimaging findings of drug use

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# Abstract Archives of the RSNA, 2024

EREE-65

## WHAT'S GOING ON BACK THERE? PENETRATING RETROPERITONEAL TRAUMA!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Richard E. Healicon, BMBCh (*Abstract Co-Author*) Nothing to Disclose
Saigeet Eleti, FRCR, MBBChir (*Abstract Co-Author*) Nothing to Disclose
Susan Cross, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Lukasz Zielinski, MBBCHIR (*Abstract Co-Author*) Nothing to Disclose
Ansab Fazili I, MBBS,BSC (*Abstract Co-Author*) Nothing to Disclose
Sarah Hickman, MBBS (*Presenter*) Research collaboration, Vara;Research collaboration, ScreenPoint Medical BV;Research collaboration, Lunit Inc;Research collaboration, Kheiron Medical Technologies Ltd;Research collaboration, Alphabet Inc;Research collaboration, Volpara Health Technologies Limited

### TEACHING POINTS

-Clear understanding of the retroperitoneal spaces and contents allows radiologists to infer patterns of injury and suspected organ involvement, for example by recognizing the tracking of fluid and haematoma. -Retroperitoneal hematoma is often not seen on a FAST scan as it tracks posteriorly and deep as well as is obscured by bowel gas. -Retroperitoneal haemorrhage can result in a significant loss of circulating blood volume, haemodynamic instability and precipitate need for urgent intervention. -Following the pattern of gas and soft tissue injury in penetrating wounds helps to infer which structures are involved. Indirect signs of injury include: hematoma, active blush of contrast, fat stranding and free gas. -MPR and MIP reconstructions are crucial in evaluation of penetrating trauma; they allow visualisation of overlapping structures and review of vascular injuries. -Different types of delayed phase CT imaging helps to further characterise injuries as well as look for complications, such as, active bleeding, pseudoaneurysm, and urinoma.

### TABLE OF CONTENTS/OUTLINE

1) Introduction to retroperitoneal anatomy - contents, fascia planes, and spaces 2) Phases of imaging in penetrating trauma 3) Vessel injury - IVC, aorta, internal thoracic and lumbar arteries + complications 4) Pancreatic injury + complications 5) Duodenal injury + complications 6) Kidney injury + complications 7) Conclusion

# Abstract Archives of the RSNA, 2024

EREE-66

## ACUTE MESENTERIC ISCHEMIA (AMI): UNDERSTANDING THE IMAGING FINDINGS AND MAKING A CRITICAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

David H. Kim, MD (*Abstract Co-Author*) Shareholder, Elucent Medical
Perry J. Pickhardt, MD (*Abstract Co-Author*) Advisor, Bracco Group;Advisor, Zebra Medical Vision Ltd;Advisor, Nano X Imaging;
Giuseppe V. Toia, MD, MS (*Abstract Co-Author*) Research Consultant, General Electric Company;Research Grant, General Electric Company
Meghan G. Lubner, MD (*Abstract Co-Author*) Spouse, Consultant, Elephas Bio
Matthew H. Lee, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Acute mesenteric ischemia (AMI) is a bowel emergency that is infrequent but has high morbidity and mortality. 2. Imaging plays a central role in early diagnosis and management. 3. Most causes are arterial (embolus > in situ thrombosis). Other causes include mesenteric venous thrombosis and low flow states (non-occlusive mesenteric ischemia, NOMI). 4. Identifying clot in a mesenteric vessel (artery or vein) establishes the diagnosis. Bowel and mesentery then document location and severity. 5. Non-visualization of clot means NOMI or small clot not seen at imaging. 6. Decreased wall enhancement specific to arterial causes (decreased inflow), wall thickening can be venous (outflow obstruction) or arterial (reperfusion and injury).

### TABLE OF CONTENTS/OUTLINE

1. Discuss the importance of identifying AMI and the role of imaging in establishing the diagnosis - high mortality, improved outcomes with early recognition. 2. Review the basic anatomy (vascular and bowel) and pathophysiology of AMI. 3. Describe the etiologies of primary AMI - embolic-arterial, thrombotic arterial, venous, NOMI - and secondary AMI (e.g. closed loop bowel obstruction). 4. Review the role of imaging including a basic review of CT/DECT performance along with the typical protocols and characteristic imaging features of AMI. 5. Present an interpretive approach to AMI with characteristic imaging findings - assess the SMA/SMV, evaluate the bowel and mesentery, use of DECT (iodine maps and virtual non-contrast). 6. Present case examples of AMI along with mimics.

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# Abstract Archives of the RSNA, 2024

EREE-67

## PEDIATRIC POLYTRAUMA. MECHANISMS OF INJURY AND RADIOLOGIC EVALUATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

MARIA PEREZ FERNANDEZ (*Abstract Co-Author*) Nothing to Disclose
Marta Sanmartin Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Anxo Martinez De Alegria, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Garcia Figueiras, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Ecenarro Montiel (*Abstract Co-Author*) Nothing to Disclose
Maria Mercedes Linares Paz (*Abstract Co-Author*) Nothing to Disclose
Lorena Maria Miguez Fortes (*Abstract Co-Author*) Nothing to Disclose
Maria V. Trujillo Ariza, MD (*Abstract Co-Author*) Nothing to Disclose
Amadeo Arango (*Presenter*) Research Consultant, ABEONA Therapeutics

### TEACHING POINTS

1) To review the pediatric anatomic and physiologic differences compared to adults relevant for trauma.2) To explain the most common mechanisms of injury in children who suffer major trauma.3) To show examples of typical pediatric traumatic lesions that may be missed by an unexperienced eye.4) To suggest tips to optimize the radiologic evaluation of these patients.

### TABLE OF CONTENTS/OUTLINE

1) The concept of polytrauma.2) Clinical management of pediatric polytrauma.2.1 The primary survey.2.2 The secondary and further surveys.3) Pediatric anatomic and physiologic special features.4) Mechanisms of injury.4.1 Traffic accident (seat-belt injuries).4.2 Bicycle accident (handlebar injuries).4.4 Fall from height.4.5 Sport-related injuries.4.6 Physical child abuse.5) Radiologic evaluation.5.1 Cervical trauma.5.2 Thoracic trauma.5.3 Abdominal trauma.6) Conclusions.

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# Abstract Archives of the RSNA, 2024

EREE-7

## AN IN-DEPTH LOOK AT THE OCULAR GLOBE, THE RADIOLOGIST'S BLIND SPOT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Maria Perez Costas, MD (*Abstract Co-Author*) Nothing to Disclose
Alvaro Jose de la Iglesia Salas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Lopez-Castello, MD (*Abstract Co-Author*) Nothing to Disclose
Sabela Garcia Benito, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Fernandez Blanco (*Abstract Co-Author*) Nothing to Disclose
Ana Robles Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Pereiro Perez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To review the relevant anatomy of the globe. - To discuss the key imaging findings in orbital emergencies encompassing traumatic, infectious, and vascular pathology. - To recognize potential incidental orbital findings and main post-surgical changes.

### TABLE OF CONTENTS/OUTLINE

Traumatic, infectious, and vascular orbital pathology are a common reason for consultation in emergency departments, and imaging can play a crucial role in the diagnosis and proper therapeutic management, especially in cases where the clinical examination may be inconclusive. CT is preferred due to its high availability, resolution, and accuracy in assessing orbital structures and soft tissues, identifying foreign bodies, and ruling out collections. The poster will review ocular injuries including: I. Relevant globe anatomy. II. Infection - Preseptal vs post-septal cellulitis. III.Traumatic - Corneal laceration. - Lens injuries (lens dislocation and traumatic cataract). - Retinal detachment. - Vitreous hemorrhage. - Open-globe injury and potential mimics (phthisis bulbi, myopia, coloboma and Staphyloma). - Foreign bodies and potential mimics (optic drusen, scleral calcifications, and calcified cataract). IV. Post-surgical changes - Scleral buckle, vitrectomy, retinopexy, ocular prothesis, and gold eyelid weight. V. Vascular - Carotid cavernous fistula Understanding the basic anatomy and the key imaging findings of globe pathology in computed tomography, as well as potential incidental imaging findings, enables the radiologist to provide the physician with precise diagnostic information to guide proper therapeutic management and thereby prevent permanent vision loss and potential life-threatening complications.

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# Abstract Archives of the RSNA, 2024

EREE-8

## UNVEILING THE FLOW: STRATEGIES FOR DETECTING POSTTRAUMATIC ACTIVE ABDOMINAL BLEEDING FROM A LEVEL 1 TRAUMA CENTER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Chaitanya Ahuja, MD (*Abstract Co-Author*) Nothing to Disclose
Meghna Chadha, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro A. Tempra, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Strobel, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Soto-Davila, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Marrero-Castillo (*Abstract Co-Author*) Nothing to Disclose
Guillermo P. Sangster, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Prompt identification of the bleeding origin and detection of vascular injuries can increase the efficacy of surgical or angiographic treatment, mortality, and mobility during an abdominal trauma. 2. Dual-phase CT-scan is the gold standard imaging technique in hemodynamically stable patients due to its high sensitivity in distinguishing vascular injuries. Active bleeding is characterized by a jet or localized area of high attenuation within a hematoma. The focal area will vanish on delayed images into an enlarged, enhanced hematoma. 3. Vessel injury is identified by findings like an intimal dissection flap, absence of vascular enhancement caused by occlusion or spasm, vessel wall non-uniformity, and caliber changes. Delayed imaging is crucial to confirm vessel injury.

### TABLE OF CONTENTS/OUTLINE

1. To identify different types of vessel injury, such as dissection, pseudoaneurysm, arteriovenous fistula, and active extravasation. 2. To Illustrate computed tomography (CT) common and uncommon imaging patterns in patients with active intrabdominal bleeding. 3. To differentiate active bleeding from other high-attenuation conditions: bone fragments, and dense foreign bodies. Early recognition of active traumatic abdominal bleeding positively impacts mobility and mortality, efficiently guiding pertinent surgical and interventional procedures. This educational exhibit will depict cases of acute posttraumatic abdominal bleeding from various etiologies. It will help radiologists familiarize themselves with classical signs, differential diagnosis of high-attenuation entities, and characterization of different types of vessel injury.

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# Abstract Archives of the RSNA, 2024

EREE-9

## IMAGING SPECTRUM OF AORTIC INTRAMURAL HEMATOMA (IMH): A RADIOLOGISTS' GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria Perez Costas, MD (*Abstract Co-Author*) Nothing to Disclose
Sabela Garcia Benito, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Pereiro Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Chavarri Sr, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Lopez-Castello, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Robles Gomez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Aortic intramural hematoma is a potentially life-threatening condition among the diseases processes that comprise the spectrum of acute aortic syndromes and require immediate medical attention. - Review IMH definition, classification and pathophysiology. - Review CT protocol. - Discuss characteristic IMH imaging findings, natural progression, potential complications and main differential diagnosis. - Review ulcer-like projections and blood pools pathophysiology and evolution. - Outline a practical approach for quick reporting.

### TABLE OF CONTENTS/OUTLINE

I. Introduction. II. IMH epidemiology, pathophysiology and classification. III. IMH CT findings, evolution, potential complications (aortic rupture, pulmonary artery intramural hematoma, aortic dissection...) and imaging risk predictors. IV. Ulcer-like projection and blood pool pathophysiology and evolution V. IMH differential diagnosis (aortitis, penetrating aortic ulcer, mural thrombus, retroperitoneal fibrosis, lymphoma...) VI. Report.

# Abstract Archives of the RSNA, 2024

GIEE

**Gastrointestinal Imaging Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## GIEE-1 FACES OF FRANTZ: EXPLORING THE SPECTRUM OF A RARE PANCREATIC TUMOR

**Awards**
**Certificate of Merit**

Daniel A. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Beatriz Ferreira Obara, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia O. Menezes, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Bekhor, MD (*Abstract Co-Author*) Nothing to Disclose
Aley Talans, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna G. Busoletto Tripode SR, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula Fraga Cintra Gonzaga (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Provide an overview of Frantz tumor (solid pseudopapillary tumor of the pancreas). Discuss typical and atypical cases with an emphasis on image characteristics. Review the main differential diagnoses of Frantz tumor with a didactic approach.Offer helpful tips for challenging cases to improve accurate diagnosis and patient outcomes.Develop a radiological survival guide for the interpretation of pancreatic lesions with solid and cystic components.

### TABLE OF CONTENTS/OUTLINE

This presentation aims to provide a comprehensive overview of the main features of Frantz Tumor, including epidemiology, associations, pathology, radiographic features, prognosis, and treatment. Using case-based presentations, we will explore the classic and uncommon imaging manifestations of Frantz tumor, including multiplicity, ductal obstruction, simulation of other tumors such as neuroendocrine, intratumoral calcification, occurrence in male patients and children, distant metastasis, parenchymal and extracapsular invasion.We will discuss how to differentiate from benign lesions and malignant neoplasms, including pancreatic pseudocyst, mucinous cystadenoma, neuroendocrine tumors, gastrointestinal stromal tumors, and pancreatic adenocarcinoma. Provide tips for challenging cases where the diagnosis may not be apparent from imaging alone, and radiologists can still play a key role in contributing to better patient outcomes.

## GIEE-10 ASSESSMENT PRIOR TO LIVER RESECTION; WHAT A RADIOLOGIST SHOULD KNOW?!

**Awards**
**Certificate of Merit**

Sergio Klimkowski, MD (*Abstract Co-Author*) Nothing to Disclose
Imran Ahmed, MD (*Abstract Co-Author*) Nothing to Disclose
Mindy X. Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Ann A. Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 1. Introduce the complexity, nature, epidemiology, diagnostic and therapeutic approaches. 2. 2. Discuss the indications of liver resection. 3. 3. Discuss radiologists' roles in detection, proper characterization and staging of the cause. 4. 4. Demonstrate the proper localization. 5. 5. Discuss the criteria for technical resectability. 6. 6. Summarize different types of surgical resection.

### TABLE OF CONTENTS/OUTLINE

1) - Introduction to importance of preresection liver assessment a) Complexity of disease. b) The occult nature of the disease. c) The changing epidemiology. d) The rapidly evolving diagnostic and therapeutic approaches.2) - Indications of liver resection a) Common malignant indications include: - HCC - Cholangiocarcinoma - Metastases (commonly colorectal) b) Liver transplant.3) - Role of Imaging: a) Detection b) Proper characterization c) Localization d) Staging e) Anatomical variants-4) - Resectability criteria a) Technical resectability criteria. b) Future liver remnant volume.5) - Types of surgical resection: a) Anatomic resection. b) Non-anatomic (wedge).

## GIEE-100 BEYOND FISTULAS: IMAGING OF ANORECTAL, PERIANAL, AND PERINEAL PATHOLOGIES

Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana Ramacho Rolim Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Velloni, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Gomes De Menezes JR, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. This review aims to discuss and to recognize the differential diagnosis of perianal, perineal and anorectal diseases besides fistulas, which often represent a radiological challenge.2. Illustrate with cases the imaging features of main differential diagnosis using computed tomography (CT) and magnetic resonance imaging (MRI).3. Provide a diagnostic approach with a workflow proposal for the differential diagnosis of perianal, perineal and anorectal diseases.

**TABLE OF CONTENTS/OUTLINE**

1 - Introduction 2- Anatomy- Perineal- Anal canal and rectum 3 - Compartmental Approach- Perineal- Anal Canal and Rectum 4 - Diseases? Infection And Inflammation- Pilonidal Disease- Hidradenitis Suppurativa- Fournier Gangrene- Vulvar Abscess- Infectious Myositis- Endometriosis? Neoplasm- Urogenital - Female reproductive tract - Male reproductive tract- Anorectal- Epithelial- Non-epithelial- Carcinoid- Secondary? Vascular- Hemorrhoidal disease / Anorectal varices- Vascular malformation- Congestive Edema? Congenital- Middle Raphe Cyst- Retrorectal developmental cysts? Miscellaneous- Trauma- Pudendal Nerve Entrapment Syndrome 5 - Conclusion

## GIEE-101 INTESTINAL COMPLICATIONS IN THE ONCOLOGIC PATIENT: SPECTRUM OF CT FINDINGS AND IMAGING-BASED DIAGNOSTIC APPROACH

Eduard Andia Navarro (*Abstract Co-Author*) Nothing to Disclose
Marisol Rodriguez Arias (*Abstract Co-Author*) Nothing to Disclose
ANA SANCHEZ MARQUEZ (*Abstract Co-Author*) Nothing to Disclose
Eva Maria Merino Serra (*Abstract Co-Author*) Nothing to Disclose
Maria Pardo Antunez (*Abstract Co-Author*) Nothing to Disclose
David Martinez De La Haza (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:1. To review the variety of symptomatic and potentially serious intestinal complications that may occur in patients with oncologic pathology, many of which might be related to previous or ongoing therapies2. To evaluate CT findings in these patients, emphasizing the signs that might lead us to a correct diagnosis3. To gain an awareness of the importance of the global context of the patient (including clinical manifestations and underlying treatment such as chemotherapy, radiation therapy and immunotherapy) in the diagnostic approach.

**TABLE OF CONTENTS/OUTLINE**

- INTRODUCTION- CLINICAL CONTEXT1. Symptoms (diarrhea, obstruction, pseudo-obstruction, other) and blood test parameters2. Oncologic background: primary neoplasm (visceral or hematologic), oncologic therapy- SPECTRUM OF CT FINDINGS1. Mural thickening: type, distribution, extension, severity2. Abnormal enhancement3. Intestinal distension4. Strictures5. Other: pneumoperitoneum, pneumatosis intestinalis, fluid collections- TYPE OF COMPLICATIONSA. Infectious enterocolitis (viral, bacterial, pseudomembranous colitis)B. Neutropenic enterocolitisC. Immunotherapy-mediated enterocolitisD. Radiation-induced enteritisE. Graft vs host diseaseF. Tumor progression-relatedG: Other: ischemic colitis, stercoral colitis, perforation, iatrogenic- TAKE-HOME POINTS

## GIEE-102 PORTOSYSTEMIC SHUNTS: ANATOMY, TREATMENT, AND COMPLICATIONS WITH 3D CINEMATIC RENDERING CORRELATES

**Awards**
**Certificate of Merit**

Shanna A. Matalon, MD (*Abstract Co-Author*) Nothing to Disclose
Khushboo Jhala, MD,MBA (*Abstract Co-Author*) Nothing to Disclose
Bardia Nadim, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Spontaneous portosystemic shunts occur in portal hypertension due to reconstitution of embryonic venous channels in order to act as “release valves.”2. Major complications of portal hypertension include acute variceal bleeding and hepatic encephalopathy.3. 3D cinematic rendering is able to show contiguous pathways and highlight complex vascular anatomy related to portosystemic shunts, which can sometimes be difficult to conceptualize on standard CT reformats due to tortuosity.4. Transjugular intrahepatic portosystemic shunt (TIPS) can be used for refractory esophageal variceal bleeding and ascites, and balloon-occluded retrograde transvenous obliteration (BRTO) can be used to treat gastric varices with large gastrorenal or splenorenal shunts.5. CT evident complications of TIPS and BRTO include stent occlusion, and clinical presentation is often similar to the original manifestations of portal hypertension.

**TABLE OF CONTENTS/OUTLINE**

1. Normal portal and mesenteric venous anatomy2. Pathophysiology of Portal Hypertensiona. Prehepaticb. Intrahepaticc. Posthepatic3. Anatomic Collateral Pathways Complications4. Interventional Procedures and Complicationsa. Transjugular intrahepatic portosystemic shunt (TIPS): for refractory esophageal variceal bleeding and ascitesi. Anatomyii. Imagingiii. Complicationsb. Transvenous obliteration of varices: for gastric ectopic varices (not esophageal)i. Anatomy1. Gastrorenal shunt 2. Splenorenal shuntii. Imagingiii. Complicationsc. Balloon dilation of hepatic vein (for thrombosis/web in hepatic vein)d. Transhepatic clot thrombolysis (PV thrombosis)e. Splenic artery embolization (sinistral portal hypertension)

## GIEE-104 IMAGING APPROACH TO THE DIAGNOSIS OF SOLITARY SOLID PANCREATIC HEAD MASSES

Azfar Siddiqui, MD (*Abstract Co-Author*) Nothing to Disclose
Amjad N. Mohammed I, MRCS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Mohamed Elbanan, MD (*Abstract Co-Author*) Nothing to Disclose
Nourel Hoda M. Tahon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Ayesha Nasrullah, MD,FRCR (*Abstract Co-Author*) Nothing to Disclose
Maaz Ghouri, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
David L. Raj, MD (*Abstract Co-Author*) Nothing to Disclose

Nanda Deepa Thimmappa, MD (*Abstract Co-Author*) Nothing to Disclose
Amr S. Abdelaziz, MD (*Abstract Co-Author*) Nothing to Disclose
Joe Jose, MD (*Abstract Co-Author*) Nothing to Disclose
Kazi A. Irfan, MD, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Explain the imaging signs of pancreatic ductal adenocarcinoma arising in the head of the pancreas-Discuss the hypoenhancing pancreatic head masses, which can mimic pancreatic ductal adenocarcinoma-Highlight the different imaging appearances of pancreatic neuroendocrine neoplasms-Review the differentials of hyperenhancing pancreatic masses-Enumerate the different masses that can arise adjacent to the head of the pancreas, which can mimic a pancreatic head mass-Illustrate the cystic pancreatic lesions which can have an imaging appearance of a solid pancreatic mass

**TABLE OF CONTENTS/OUTLINE**

-Spectrum of pancreatic head lesions-Imaging techniques in the evaluation of focal pancreatic lesions-Typical imaging appearance of pancreatic ductal adenocarcinoma-Pancreatic head masses that can mimic pancreatic ductal adenocarcinoma*Neoplastic*Non-neoplastic*Extrapancreatic masses arising adjacent to the pancreas*Cystic pancreatic lesions-Features that can help differentiate between pancreatic ductal adenocarcinoma and its mimics-Imaging appearance of pancreatic neuroendocrine tumors-Other hyperenhancing pancreatic head masses-Algorithm for differentiating between different pancreatic head masses

## GIEE-105 TRUE BEAUTY COMES FROM WITHIN: WHEN INTESTINAL CONTENTS HELP YOU GET THE DIAGNOSIS

Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Velloni, MD (*Abstract Co-Author*) Nothing to Disclose
Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Martin Horwarth, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

•When assessing for gastrointestinal conditions, while radiologists focus on the patters of distention, wall thickening and enhancement of bowel loops, the assessment of the contents of the involved loops can often be forgotten or neglected, potentially leading to wrong or delayed diagnosis.•Many intestinal and systemic diseases can alter the contents of the small intestine and the colon. The identification of these pathological intestinal contents can assist in the diagnosis of specific pathologies.•Equally important is recognizing luminal intestinal findings that do not correspond to any pathology, but are rather physiological or variants of normality.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction.2. Review of the anatomy of the digestive tract, the path of the food bolus and its changes along the way.3. Image of physiological intestinal contents.4. Findings of intestinal contents that have no clinical significance (tablets, contents of different densities, fruit seeds, medical devices, foreign body?).5. Pathological findings of intestinal contents (steatorrhea, gallstones, blood, bezoar, food impactation).6. Assessment of specific pathologies (foreign body ingestion, bezoar, gallstone ileus, Bouveret syndrome, cystic fibrosis?).7. Take home notes.8 .Bibliography.

## GIEE-106 ASSESSMENT OF DISEASE ACTIVITY IN PATIENTS WITH CROHN'S DISEASE: CORRELATION BETWEEN MAGNETIC RESONANCE ENTEROGRAPHY AND INTESTINAL ULTRASOUND

Myung-Won You, MD (*Abstract Co-Author*) Nothing to Disclose
Choongwui Cho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-compare the diagnostic yield of intestinal ultrasound(IUS) and MR enterography (MRE) for disease activity in patients with Crohn's disease(CD)-assess the correlation between IUS and MRE in the diagnosis of disease activity in patients with CD

**TABLE OF CONTENTS/OUTLINE**

1) Twenty-six cases with CD who underwent IUS and MRE within a 3-month interval- per-segment diagnosis: 7 divided segments of small and large bowels2) Diagnostic criteria of active inflammation- qualitative criteria/quantitative criteria on IUS- qualitative criteria/quantitative criteria on MRE3) Comparison of diagnosis of active inflammation on IUS vs. MRE- percentage and location of active inflammation- percentage and location of complication4) Correlation between MaRIA and IBUS-SAS scores5) Diagnostic performance of IUS with MaRIA>11 cut-off6) Concordant/discordant cases between IUS and MRE

## GIEE-107 DUAL-ENERGY COMPUTED TOMOGRAPHY 2.0 IN GASTROINTESTINAL IMAGING: QUANTITATIVE IMAGING, BIOMARKERS, AND OTHER DEVELOPMENTS

Ramiro Mendez (*Abstract Co-Author*) Nothing to Disclose
Sandra Baleato Gonzalez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlos Fraga Pineiro (*Abstract Co-Author*) Instructor, General Electric Company
Gabriel C. Fernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD, PhD (*Abstract Co-Author*) Speaker, General Electric Company
Eliseo Vano Galvan, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Cano, DIPLPHYS (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Tardaguila de la Fuente, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Girones Sanguesa (*Abstract Co-Author*) Nothing to Disclose
Roberto Garcia Figueiras, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Dual-energy CT (DECT) imaging has broadened the potential of CT imaging by offering multiple types of DECT-derived images. DECT shows profound capabilities to improve diagnosis in gastrointestinal (GI) imaging based on its superior material differentiation, but also on the use of DECT-derived quantitative values that have considerable potential to serve as imaging-based biomarkers in multiple clinical applications.The aim of this exhibit is:-To review physical concepts of DECT and technical parameters influencing image quality and DECT quantification.-To discuss advantages and limitations of quantitative DECT imaging in different clinical scenarios-To provide a comprehensive and practical overview of possible diagnostic pitfalls that may be encountered using quantitative DECT imaging.-To evaluate future perspectives for quantitative DECT imaging and photon-counting technology.

**TABLE OF CONTENTS/OUTLINE**

-Basic concepts of DECT: atomic numbers, energy levels, and other physics concepts.-Understanding the different types of DECT-derived images and their use in GI imaging.-Principles of quantitative DECT imaging: iodine, fat, and iron concentrations / extracellular volume, effective atomic number, and electron-density values.-Cutting-edge applications of quantitative DECT in GI imaging: lesion detection and characterization, accurate tumor staging, prognostic and predictive value, therapy planning, treatment response assessment, and body composition.-Pitfalls and artifacts in quantitative DECT imaging: how to avoid them.-Future directions: from quantitative DECT-derived biomarkers (radiomics and radiogenomics) to photon-counting CT in GI imaging.-Conclusions

## GIEE-108 UNRAVELING BODY PACKER: RADIOLOGISTS KEY INSIGHTS

Mohammad Mohsin Arshad, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Background, terminology, and epidemiology of body packing.-Understand the usual clinical and radiological signs displayed by individuals who conceal illicit materials internally and investigate the importance of employing multiple imaging methods such as X-rays, ultrasounds, CT scans, and MRIs to assess and address such situations.

**TABLE OF CONTENTS/OUTLINE**

1. Concept/background of body packing.2. Clinical presentation of body packers.3. A radiological assessment that needs to be done.4. What radiologists need to know!5. Case-based review.

## GIEE-109 HEPATIC VENOUS MALFORMATION (HEMANGIOMA): RADIOLOGIC SPECTRUM, DIFFERENTIAL DIAGNOSIS, AND MANAGEMENT STRATEGIES

Faeze Salahshour (*Abstract Co-Author*) Nothing to Disclose
Mohammad Mehdi M. Mehrabi Nejad (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Radiologic Presentation Variability Understanding the spectrum of typical and atypical radiologic presentations of Hepatic Venous Malformations (HVMs). 2. Red Flags: Identifying key indicators suggesting alternative diagnoses beyond HVM. 3. Imaging Mimics Exploring conditions that closely resemble HVM on various imaging modalities. 4. Management Strategies Discussing approaches to the management and treatment of HVM.

**TABLE OF CONTENTS/OUTLINE**

1. Definition and Characteristics of HVM 2. Diagnostic Criteria and Modalities 3. Typical Imaging Presentations of HVM 4. Atypical Imaging Presentations of HVM a. Liver Hemangiomatosis b. Sclerosant HVM c. Flash-filling HVM d. HVM with shunt 5. Red Flags Requiring Attention a. Medical history correlates: liver disease or cancer c. Heterogeneous signal in MRI e. Diffusion restriction on DWI and ADC map f. Atypical enhancement patterns 6. Mimickers of HVM a. Angiosarcoma b. Retroperitoneal Paraganglioma c. Neuroendocrine Metastasis d. Choriocarcinoma Metastasis e. Colorectal Metastasis f. Inactive Hydatid Cyst g. Calcified Foci Post-Metastatic Treatment 7. Complication a. Budd-Chiari syndrome b. Kasabach-Merritt Syndrome c. Rupture 8. Biopsy Indications 9. Management Approaches for HVM 10. Take-Home Message

## GIEE-11 LOST ART OF BARIUM SWALLOW

Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Bhavya Arora, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Barium swallow is a radiographic exam using contrast to evaluate esophagus's structure and some functions. It helps diagnose conditions like motility disorders, strictures, and perforations, as well as distal issues such as hiatal hernias and reflux. Despite CT imaging, it remains useful. While it can identify common pathologies, more complex swallowing issues may require a modified barium swallow evaluation.

**TABLE OF CONTENTS/OUTLINE**

Anatomy of esophagus: The normal course, appearance and constrictions.Indications: Dysphagia, GERD, hiatus hernia, Repeated vomiting, epigastric pain, post-operative leakTechnique: Initial scout film to rule out any foreign body and as control for post-contrast study followed by swallowing barium under video fluoroscopy in upright lateral position for pharynx and to rule out aspiration. Image with patient instructed to say ‘Eeee’ is taken to visualize the hypopharynx. As the patient swallows, frontal and oblique views are taken. Prone in right anterior oblique to assess motility of esophagus and competence of the gastro-esophageal junction. Single contrast versus double contrast barium swallow Clinical significance: Structural: Diverticulum, Stricture, Hiatus herniaNeoplastic: Lipoma, Leiomyoma, AdenocarcinomaMobility: Achalasia, Hypoperistalsis, Diffuse esophageal spasmsTraumatic: Iatrogenic, Perforation, Post caustic injuryPediatric: Tacheo-esophageal fistula, Esophageal atresiaContraindication: Relative contraindications is perforation.Complications: Aspiration, leakage from a perforation

## GIEE-110 ROLE OF IMAGING IN THE MANAGEMENT OF PATIENTS WITH INFLAMMATORY BOWEL DISEASE (IBD): A CASE-BASED REVIEW

**Awards**
**Certificate of Merit**

Elena Serrano Tamayo, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Garcia Latorre, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Canales Lachen (*Abstract Co-Author*) Nothing to Disclose
Ana Villanueva, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Inflammatory bowel disease (IBD) is a chronic condition affecting the gastrointestinal tract that is comprised of two disorders: Crohn’s disease (CD) and ulcerative colitis (UC). They are relapsing and destructive diseases that can result in progressive bowel damage if not adequately treated, with the

resultant impairment of the quality of life of patients.Therefore, clinicians need clear and objective information on disease activity and extent to adequately adapt the treatment in IBD patients (drug change or optimization, endoscopic dilatation or surgical treatment).Magnetic resonance enterography (MRE) and intestinal ultrasonography (IUS) can accurately evaluate these parameters, currently playing a pivotal role in the monitoring and management of IBD patients, while computed tomography (CT) is usually reserved to the emergency setting.

**TABLE OF CONTENTS/OUTLINE**

Introduction:- IBD: definition and clinical course- Imaging techniques used for the monitoring of IBD diagnosed patients.- Treatment modalities available in IBD and its indications: pharmacological treatment, endoscopic dilatation and surgery.Review of the role of imaging in the management of IBD patients through a case-series in which different clinical scenarios and outcomes are shown.ConclusionsReferences

## GIEE-111 THE ROLE OF MRI IN RECTAL CANCER IN THE ERA OF NEW NEOADJUVANT THERAPEUTIC STRATEGIES, WATCH & WAIT, AND MINIMALLY INVASIVE SURGERY

**Awards**
**Certificate of Merit**

Sandra Baleato Gonzalez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Stephanie Nougaret, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Marhuenda, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD, PhD (*Abstract Co-Author*) Speaker, General Electric Company
David H. Kim, MD (*Abstract Co-Author*) Shareholder, Elucent Medical
Joan C. Vilanova, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Juan-Ramon R. Ayuso, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto Garcia Figueiras, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Rectal cancer (RC) presents significant diagnostic and therapeutic challenges. The introduction of new neoadjuvant therapeutic strategies (total neoadjuvant therapy [TNT], RC treatment without radiation, immunotherapy [IT]), minimally invasive surgery, and non-surgical options (watch and wait [WW] strategy) in RC is mainly based on MRI findings that provide essential information for treatment selection. MRI serves an increasingly pivotal role in the diagnosis, staging, treatment stratification, response assessment, and follow-up of patients with RC. MRI can assess both the anatomical extent of invasion (offering a surgical roadmap) and the pattern of tumor infiltration with factors involved in local spread and tumor relapse and factors involved in systemic dissemination not included in the usual TNM staging.The aim of this exhibit is:-To review the implications for prognosis and choice of treatment of MRI findings of local tumor spread (depth of invasion, mesorectal fascia [MRF] involvement, lymph node metastases, perineural and lymphatic invasion) and systemic dissemination (extramural vascular invasion and tumor deposits).-To evaluate limitations of MRI to assess some key pathological, molecular, and genetic features in RC.-To discuss the role of MRI in the era of new therapeutic strategies in RC.-To review the limitations of MRI in the assessment of RC response.

**TABLE OF CONTENTS/OUTLINE**

-Basic concepts of MRI in RC: TNM-staging and MRI-based surgical roadmap.-MR-derived prognostic features in RC.-The changing role of MRI in RC with TNT, IT, WW, and minimally invasive surgery for staging, restaging, and follow up in RC.-Future role of functional MRI and radiomics in RC.-Conclusions

## GIEE-112 BUBBLE INSIGHTS: NAVIGATING CEUS LI-RADS AND ITS DISTINCTIONS FROM CT-MRI LI-RADS

Hyun-Jung Jang, MD (*Abstract Co-Author*) Nothing to Disclose
Tae Kyoung Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Emphasizing the efficacy of contrast-enhanced ultrasound (CEUS) in characterizing hepatic observations among high-risk populations for hepatocellular carcinoma (HCC). 2. Exploring the key differences of CEUS LI-RADS from CT/MRI LI-RADS: - Real-time imaging capabilities.- Purely intravascular contrast agents.- Option for repeated injections and replenishments.- Suitability for patients with renal failure. 3. Presenting illustrative cases to highlight crucial differences between CEUS LI-RADS and CT/MRI LI-RADS.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: - Overview of CEUS LI-RADS and microbubble contrast agents.2. Real-time imaging: - Detection and assessment of arterial phase hyperenhancement (APHE).- Evaluation of APHE patterns.3. Purely intravascular contrast agents:- Significance of the timing and degree of washout.- Consistent demonstration of washout in non-HCC malignancies.- Utilization of CEUS-guided biopsy for small isoechoic malignancies.- Discrepancies in LR-M criteria between CEUS and CT/MRI.4. Availability of repeated injections and replenishments:- Minimization of failed examinations due to timing issues or patient's motion/breathing.- Utility in the assessment of APHE patterns.5. Suitability for patients with renal failure:- No known renal toxicity of microbubble contrast agents.6. Clinical Applications:- Literature review relevant literature, including recent studies on the utility of CEUS LI-RADS across various indications and prospects.

## GIEE-113 ALCOHOL-RELATED PANCREATITIS: PATHOPHYSIOLOGY, NATURAL HISTORY, AND IMAGING CORRELATIONS

Abhijit A. Raut, MD (*Abstract Co-Author*) Nothing to Disclose
Anoushka Maheshwari (*Abstract Co-Author*) Nothing to Disclose
Sachin Kumar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD (*Abstract Co-Author*) Nothing to Disclose
Sharad Maheshwari, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Alcohol abuse imposes a substantial burden on our healthcare system. Addressing this issue with appropriate public health strategies is paramount, given its modifiable nature. Alcohol-induced pancreatitis ranks as the second most common cause following gallstones, contributing to nearly one-third of acute pancreatitis cases in the US. Its spectrum encompasses acute interstitial pancreatitis, acute pancreatic necrosis, recurrent acute pancreatitis, and can progress to chronic pancreatitis with sustained alcohol use, which becomes irreversible. Understanding the unique natural history of alcohol-related pancreatitis aids in diagnosis and guides management effectively. Computed Tomography (CECT) stands as the imaging modality of choice in acute settings. Meanwhile, Magnetic Resonance Imaging (MRI) proves more sensitive for detecting subtle changes and offers both morphological and functional insights in chronic cases. The exhibit will elucidate the imaging implications of this distinctive disease spectrum.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Epidemiology 3. Pathophysiology Natural History 4. Patterns of Excessive Drinking: a. Binge drinking b. High-intensity drinking 5. Imaging Techniques 6. Imaging Features: a. Mild Acute Pancreatitis b. Severe Acute Pancreatitis c. Acute Recurrent Pancreatitis d. Early Chronic Pancreatitis e. Late or Irreversible Chronic Pancreatitis

## GIEE-114 INSIGHTS INTO SICKLE CELL DISEASE: UNVEILING ABDOMINAL IMAGING FINDINGS

Daniella B. Parente, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Luana Alves, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Explore the abnormal hemoglobin structure in Sickle Cell Disease (SCD) and its correlation with sickling and red blood cell damage.
- Define the common abdominal and pelvic manifestations of SCD, elucidating their characteristic imaging features using CT scan and MRI, and discuss findings in each organ.
- Understand the role of imaging in diagnosing acute crises, potential complications, and chronic consequences of SCD in the abdomen and pelvis.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction
- Understand the basic mechanisms of Sickle Cell Disease (SCD): abnormal hemoglobin causing red blood cell sickling and vaso-occlusion.
- Emphasize the importance of abdominal and pelvic imaging for diagnosing and managing complications arising from SCD. II. Abdominal and Pelvic Manifestations of SCD
- Recognize how SCD leads to abdominal disorders through vaso-occlusion and hemolysis.
- Discuss the potential complications of chronic hemolysis, such as iron overload in the liver:
- Vaso-occlusion and its consequence: tissue and organ ischemia and infarction
- Hemolysis
- Functional asplenia and increased risk of infection III. Imaging Findings of SCD in the Abdomen and Pelvis
- Extramedullary hematopoiesis
- Organ-specific findings based on imaging:
- Liver
- Gallbladder
- Spleen
- Kidneys
- Gastrointestinal tract
- Male reproductive organs IV. Conclusion
- Early recognition of abdominal complications through imaging allows for prompt management and improved patient outcomes.

## GIEE-115 BEYOND THE BASICS: UNCOMMON ANORECTAL NEOPLASMS

Maialen Imizcoz, MD (*Abstract Co-Author*) Nothing to Disclose
Jokin Zabalza Unzue (*Abstract Co-Author*) Nothing to Disclose
Laida Etxeberria Kaiuela, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To describe and illustrate the radiological and histopathological findings of uncommon anorectal neoplasms. 2. To highlight the radiological differentiating features that may prove useful to reach an accurate diagnosis in anorectal mases.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: Why is it important to recognise uncommon anorectal neoplasms by imaging tests? 2. Essential anatomy of the anorectum. 3. Uncommon anorectal neoplasms: radiological and histopathological findings. • Rectal gastrointestinal stromal tumor • Anorectal malignant melanoma • Rectal neuroendocrine tumor • Rectal lymphoma • Rectum sarcoma • Carcinoma arising from anal fistula • Linitis plastica of the rectum 4. Review of differentiating radiological features of uncommon anorectal neoplasms on CT/MRI. 5.Conclusion

## GIEE-116 NAVIGATING POST-LOCOREGIONAL THERAPY IMAGING IN HCC: INSIGHTS AND UPDATES

Ozerk Turan (*Abstract Co-Author*) Nothing to Disclose
Jade J. Wong-You-Cheong, MD (*Abstract Co-Author*) Author, Reed Elsevier
Barton F. Lane, MD (*Abstract Co-Author*) Research support, Siemens AG;License agreement, Siemens AG
Izzet Altun, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1- Locoregional treatment (LRT) is widely used for hepatocellular carcinoma (HCC), with radiologists playing a critical role in assessing treatment response. 2-The LI-RADS Treatment Response Algorithm (LR-TRA) is a standardized system for evaluating treatment response after LRT for HCC, introducing a new approach in 2024 based on radiation and non-radiation therapies. 3-This educational exhibit will focus on imaging techniques and features of post-LRT HCC, incorporating updates on LR-TRA v2024.

**TABLE OF CONTENTS/OUTLINE**

1-Indications, role, and basic concepts of locoregional therapies, including radiofrequency ablation, microwave ablation, cryoablation, stereotactic radiation, transarterial chemoembolization, and radioembolization. 2-CT and MRI study protocols for HCC. 3- Review of CT and MRI imaging features after LRT for HCC. 4- Case-based overview of the 2024 LI-RADS non-radiation and radiation TRA. 5- Discussion on the role of contrast-enhanced ultrasound in monitoring treatment response after LRT. 5- Summarization of LRT techniques and imaging features for HCC with LR-TRA v2024 updates.

## GIEE-117 CANCER-ASSOCIATED FIBROSIS: WHAT RADIOLOGISTS NEED TO KNOW

Mariko Irizato (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose

Kiyoyuki Minamiguchi (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to review the components and role of fibrous extracellular matrix (ECM) in cancer, to understand representative cases of abdominal cancer with abundant fibrosis (e.g., gastrointestinal, hepatobiliary, and pancreatic) in multimodality imaging, and to focus on imaging feature of cancer-associated fibrosis that are relevant to clinical outcomes.

**TABLE OF CONTENTS/OUTLINE**

ECM plays an important role in cancer progression. Cancer-associated fibrosis (e.g., fibrous capsule and fibrous stroma) is excessive accumulation of fibrous proteins such as collagen and laminin in the ECM, dramatically altering the biological properties of the cancer. The impact of the cancer-associated fibrosis on clinical prognosis is a matter of interest, but controversial for each cancer: fibrous capsule in colorectal liver metastases is involved in a favorable prognosis by physiologically confining cancer cells, whereas fibrous stroma in cholangiocarcinoma in poor prognosis by promoting cancer growth. Multimodality imaging to infer cancer-associated fibrosis is useful not only for diagnosis but also for predicting clinical prognosis such as overall survival, recurrence free survival, and treatment response. Table of contents is as follows;1) Overview of cancer-associated fibrosis2) Representative case presentation 3) Clinical application of multimodality imaging reflecting cancer-associated fibrosis

## GIEE-118 COLORECTAL CANCER AMONG GEN X, MILLENNIALS, AND GEN Z: CURRENT UPDATE ON PATHOLOGY, IMAGING FINDINGS, AND MANAGEMENT OF EARLY-ONSET COLORECTAL CANCER

Sukeshi Arora (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Exelixis, Inc;Advisory Board, AstraZeneca PLC;Advisory Board, BridgeBio Pharma;Institutional research support, Faron Pharmaceuticals;Institutional research support, Caris Life Sciences;Institutional research support, Ipsen SA;Institutional research support, Lexicon Pharmaceuticals, Inc;Institutional research support, Eli Lilly and Company;Institutional research support, BeiGene, Ltd;Institutional research support, Isofol Medical AB;;;;
Aishwarya Vemula (*Abstract Co-Author*) Nothing to Disclose
Sriram Jaganathan, MD (*Abstract Co-Author*) Nothing to Disclose
Alia Nazarullah (*Abstract Co-Author*) Nothing to Disclose
Shahedur Rahman (*Abstract Co-Author*) Nothing to Disclose
Ebe Ewere, BS (*Abstract Co-Author*) Nothing to Disclose
Venkata S. Katabathina, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Discuss the increasing incidence, risk factors and unique characteristics of early-onset colorectal cancer (EOCRC)
- Review genetic features, molecular biology, prognosis natural history of EOCRC
- Describe salient imaging findings of primary/metastatic EOCRC discuss role of CT/MRI/PET-CT in management.
- Discuss current screening guidelines, targeted therapeutics future directions in early diagnosis treatment

**TABLE OF CONTENTS/OUTLINE**

; EOCRC: Cancer in younger than 50 years old. ; Epidemiology ; Risk factors: genetics, obesity, sedentary lifestyle, sweetened beverages, westernized lifestyle, inflammation gut microbiome ; Comparing EOCRC vs. late-onset CRC in pathogenesis, genetics, pathology, molecular biology, clinical features, treatment, prognosis natural history ; Genetics molecular biology: 30% are genetic; Microsatellite Instability-High, TP53, CTNNB1 ; Grading and Staging ; Imaging Techniques: Radiography, Contrast enema, CT, MRI PET/CT ; Salient imaging findings ; Radiogenomics ; Management Prognosis ; Current screening guidelines and the role of CT Colonography ; Lifestyle modifications ; Future screening directions (new screening modalities and ways to identify at-risk population) ; Targeted Therapeutics ; Conclusion EOCRC is an emerging clinical problem that affects an increasing number of young patients. Salient features of EOCRC include left colon/rectal distribution, mucinous/signet ring histology, higher pathologic grade, poorer cell differentiation, more advanced stage poor prognosis. Radiologists play a pivotal role in timely diagnosis, screening, and management of EOCRC. Imaging helps in surveillance testing efficacy of novel drugs.

## GIEE-119 THE JEOPARDY OF CROHN'S DISEASE: CAN YOU IDENTIFY ALL THE SIGNS AND SYMPTOMS?

Lindsay Duy, MD (*Abstract Co-Author*) Nothing to Disclose
Madison N. Crank, MD, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Optimization of fluoroscopic technique and use of CT and MR enterography to identify fistulous tractsReview the diagnostic findings suggesting Crohn's disease using consensus definitions, including extraintestinal manifestationsReview the complications of Inflammatory Bowel Disease (IBD), focusing on fistulous tracts

**TABLE OF CONTENTS/OUTLINE**

Using an interactive slideshow/gameshow format designed for resident education, review high yield facts about Crohn's with the following teaching points:Overview of IBD with a focus on Crohn's diseaseA. Crohn's diseaseB. Ulcerative colitisImaging techniques, protocols, and utility in assessing for Crohn'sA. CT enterographyB. MR enterographyC. Fluoroscopy a. Small bowel follow through b. FistulagramSeries of cases with teaching points to educate residents on the common diagnostic findings of Crohn's, including consensus definitionsA. Wall ThickeningB. Mural wall stratification: a. Target sign b. Fat halo signC. Mesenteric changes: a. Comb sign b. Creeping fat c. AdenopathyD. Diminished motilityE. Extraintestinal manifestations: a. Primary Sclerosing Cholangitis b. Arthritis c. Renal stonesSeries of cases reviewing complications of Crohn's disease and potential pitfallsA. Stricture: a. Fibrotic stricture b. Inflammatory stricture with string signB. Fistula: a. Simple fistula b. Complex fistula with clover leaf or star signC. Ulceration: a. Aphthous ulcer b. Deep ulcerationD. CobblestoningE. SacculationF. Sinus tractG. Inflammatory mass versus colonic adenocarcinomaH. Misdiagnosis of ulcerative colitis

## GIEE-12 ESOPHAGRAM REGAINING STRENGTH IN ACHALASIA

Manuel Alejandro Garrido, MD (*Abstract Co-Author*) Nothing to Disclose
Mildreth Juliana Acuna Rojas, MEd (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Achalasia is an esophageal motility disorder, characterized by impaired relaxation of the lower esophageal sphincter.The global incidence ranging from 0.03 to 1.63 per 100,000 persons per year and the prevalence its 1.8 to 12.6 per 100,000 persons per year.Exists functional loss of myenteric plexus ganglion cells in the distal esophagus and lower esophageal sphincter. The diagnosis started with clinical suspiction, the syntoms are dysphagia to solids and liquids, regurgitation, occasional chest pain with or without weight loss, perform high resolution manometry, endoscopic and esophagram.The achalasia is relacionated with systemic diseases, tumors and others esophagus trastorns.The radiological technique consists of a series of fluoroscopy

images of the pacient, specifically to esophagus while ingesting contrast medium.It is important to keep in mind that the esophagram is a study with greater accessibility, fewer risks and lower cost compared to endoscopy, which is why it represents a great option for diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Introduction, Epidemiology, Anatomic review, Physiology, Pathophysiology, Diagnosis, Radiological technique, Clinical case, Conclusions, References.

## GIEE-120 ROLE OF IMAGING IN BARIATRIC SURGICAL PROCEDURES

Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ayesha Nasrullah, MD,FRCR (*Abstract Co-Author*) Nothing to Disclose
Azfar Siddiqui, MD (*Abstract Co-Author*) Nothing to Disclose
Nourel Hoda M. Tahon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Mohamed Elbanan, MD (*Abstract Co-Author*) Nothing to Disclose
David L. Raj, MD (*Abstract Co-Author*) Nothing to Disclose
Nanda Deepa Thimmappa, MD (*Abstract Co-Author*) Nothing to Disclose
Amr S. Abdelaziz, MD (*Abstract Co-Author*) Nothing to Disclose
Maged Algazzar, MD (*Abstract Co-Author*) Nothing to Disclose
Kazi A. Irfan, MD, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Different types of bariatric surgeries, advantages and disadvantages of each surgery. Surgical technique. Expected normal post-operative imaging appearance Multimodality imaging of postoperative complications after bariatric surgeries

**TABLE OF CONTENTS/OUTLINE**

Types of bariatric surgical procedures-Restrictive Adjustable gastric banding -Sleeve gastrectomy -Vertical banded gastroplasty (fixed pouch size) -Bypass (malabsorptive) -Biliopancreatic diversion -Duodenal switch -Jejuno-ileal bypass -Combined Roux-en-Y gastric bypass Surgical techinques, expected surgical changes and surgical complications post sleeve gastrectomy, laparoscopic gastric banding, Roux-en-Y gastric bypass, biliopancreatic diversion with duodenal switch and vertical banded gastroplasty Imaging techniques- the role of Computed Tomography and FluoroscopyImaging algorithm in evaluation of expected post-surgical changes and post-operative complications Multimodality imaging features of post-surgical complications

## GIEE-121 ARTIFICIAL INTELLIGENCE IN IMAGING DIAGNOSIS OF LIVER TUMORS: CURRENT STATUS AND FUTURE PROSPECTS

Takamichi Murakami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Keitaro Sofue, MD (*Abstract Co-Author*) Nothing to Disclose
Yuki Suzuki, PhD (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Hori, MD, PhD (*Presenter*) Research Grant, Canon Medical Systems Corporation

**TEACHING POINTS**

1. Explore artificial intelligence (AI) applications in liver tumor imaging, including lesion detection, differentiation, segmentation, image quality enhancement, and radiomics. 2. Examine the integration of AI in liver tumor diagnostics within clinical practice. 3. Discuss how radiologists utilize AI in diagnosing liver tumors. 4. Review future advancements in AI technologies and their potential impact on patient management.

**TABLE OF CONTENTS/OUTLINE**

A. IntroductionB. Detection of Liver Tumors Using AI B-1. Principles of AI in tumor detection B-2. Features of liver tumor detection AI: Comparison with AI used in other organs such as lungs B-3. Case studies in clinical practice C. Characterization of Liver Tumors Using AI C-1. Principles of AI in tumor characterization C-2. Comparative features of liver tumor AI applications D. Segmentation Using AI D-1. Segmentation of the liver D-2. Automatic Segmentation of the Anatomical Liver Segments D-3. Tumor segmentation D-4. Clinical implementation E. Deep Learning Reconstruction E-1. Benefits in spatial resolution improvement E-2. Contributions to image noise reduction E-3. Reduction of radiation exposure in CT E-4. Reduction in MRI imaging times enhances patient throughput and comfort F. Radiomics F-1. Principles of radiomic feature extraction and analysis F-2. Advantages for patients with liver tumors G. Clinical Roles and Prospects of AI in Evaluating Liver Tumors G-1. Impact on clinical decision-making G-2. Future developments and their potential impact H. Conclusion

## GIEE-122 NAVIGATING THE COMPLEXITY OF HEPATIC INFLAMMATORY PSEUDOTUMORS IN IMAGING

Takashi Matsubara (*Abstract Co-Author*) Nothing to Disclose
Saya Igarashi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Kotaro Yoshida, MD (*Abstract Co-Author*) Nothing to Disclose
Azusa Kitao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Dai Inoue (*Abstract Co-Author*) Nothing to Disclose
Takahiro Komori (*Abstract Co-Author*) Nothing to Disclose
Matsui Osamu, MD (*Abstract Co-Author*) Nothing to Disclose
Norihide Yoneda (*Abstract Co-Author*) Nothing to Disclose
Gabata Toshifumi (*Abstract Co-Author*) Nothing to Disclose
Junichi Matsumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Taichi Kitagawa, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuto Kozaka, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

In the context of inflammatory pseudotumors (IPT) of the liver, there exists a dichotomy between pathologically well-defined disease entities and those clinically employed with ambiguity. This educational exhibit aims to categorize these into narrow-sense IPT and broad-sense IPT, consolidating the clinical and radiographic hallmarks of the various diseases within each classification to enhance the diagnostician’s comprehension.

**TABLE OF CONTENTS/OUTLINE**

1. Narrow-sense Inflammatory Pseudotumor of the Liver (Specifically defined entities at the view point of pathology)To resolve the confusion regarding IPT of the liver, we will explain the histopathological classification and imaging findings. This includes an explanation of the fibrohistiocytosis type and lymphoplasmacytosis type (IgG4 related IPT of the liver), as well as pseudolymphoma.2. Broad-sense Inflammatory Pseudotumor of the Liver (Broad

Definition of IPT, including liver abscess) We will focus on the changes in imaging findings at wide spectrum of Inflammatory Pseudotumors.3. Differential Diagnosis and Miscellaneous lesions: We will discuss intrahepatic cholangiocarcinoma, inflammatory myofibroblastic tumors (including those related to Epstein-Barr virus), atypical forms of hepatocellular carcinoma, and other conditions such as iatrogenic IPT and recurrent liver masses of unknown etiology.

## GIEE-123 INSIDE OUT: NAVIGATING LYMPH NODES IN RECTAL ADENOCARCINOMA WITH MRI - FROM ANATOMY TO NEOADJUVANT THERAPY

**Awards**
**Cum Laude**

Mona H. Hassan, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Provide short overview of rectal adenocarcinoma and its significance. Gain a deep understanding of lymph node anatomy draining the rectal area. Learn how MRI provides a detailed roadmap for assessing lymph nodes in rectal adenocarcinoma and how it is superior over the other imaging modalities. Discover the telltale signs that help differentiate between benign and malignant lymph nodes. Explain the normal lymph node characteristics: size, shape and signal intensity features indicating the abnormal lymph nodes as morphology and signal changes. Decoding lymph node status and learn when they are loco-regional and when they are distant metastasis. Uncover insights into treatment response through a comparison of pre and post therapy MRI images. Discuss the changes observed in lymph nodes after neoadjuvant therapy and their implication for treatment. Identify common traps in lymph node assessment with MRI and learn how to avoid these traps. Explore real life case studies and discover how accurate MRI lymph node assessment improves patient outcomes. Understand the important key elements of an MRI report.

### TABLE OF CONTENTS/OUTLINE

Introduction Lymph node stations for rectal adenocarcinoma MRI technique Role of MRI in primary L.N staging and important anatomic landmarks Detection of suspicious lymph node at MRI: benign vs. malignant lymph nodes Criteria of diagnosis: lymph node size, signal and morphology, what is more important and when? Is it loco-regional or distant metastatic lymph node? Role of MRI in lymph node assessment after therapy The effect of proper staging on clinical implication and treatment planning Common traps in lymph node assessment How to avoid pitfalls and traps Key elements of an MRI report Conclusion

## GIEE-124 NAVIGATING THE PANCREATIC DUCT: AN UP-TO-DATERADIOLOGICAL EXPEDITION THROUGH THE INTRALUMINAL PATHOLOGIES

Venkat Abhinav Katabathina (*Abstract Co-Author*) Nothing to Disclose
Anil K. Dasyam, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Borhani, MD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Ka-Kei Ngan, MD (*Abstract Co-Author*) Nothing to Disclose
Varaha Tammisetti, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Nikhil Vaishnav Tirukkovalur (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. In addition to iatrogenic devices, biologic material may form in the duct or extend into the duct with potentially deleterious short-term and long-term clinical consequences. 2. Several premalignant and malignant neoplasms can arise in or grow into the pancreatic duct (PD) lumen. Imaging manifestations can sometimes be challenging.

### TABLE OF CONTENTS/OUTLINE

1. Embryology, histology and normal anatomy of PD 2. Role of imaging modalities in assessment of pancreatic duct - advantages and limitations of each 3. Congenital anomalies of pancreatic duct, acquired PD disruption and their clinical implications 4. Alterations in normal composition of pancreatic juice - clinical implications and relevant imaging manifestations - Alterations in pH, enzymes (exocrine pancreatic insufficiency) and DNA 5. Expected and unexpected Iatrogenic devices /foreign material in the PD 6. Non-neoplastic pathologic biologic material in the pancreatic ducal lumen a. Formed in the PD lumen - Protein plugs, calculi and mucin b. Extraneous elements extending into the PD lumen - Blood (hemosuccus pancreaticus), pus (abscess), bile (pancreatobiliary fistula), urine (pancreaticoureteral fistula) and enteric contents/gas from pancreato-enteric fistula 7. Neoplastic entities in the PD lumen a. Primary intraductal neoplastic entities i. Pancreatic intraepithelial neoplasia ii. Intraductal papillary mucinous neoplasm iii. Intraductal oncocytic papillary neoplasm iv. Intraductal tubulopapillary neoplasm v. Colloid carcinoma b. Neoplastic entities growing into PD lumen i. NET ii. PDAC 8. Summary

## GIEE-125 BURSTING THE BUBBLE: A REVIEW OF PNEUMATOSIS INTESTINALIS

Manjiri K. Dighe, MD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Research Grant, General Electric Company
Rajat Bhargava, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Minal C. Jagtiani, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Saubhagya Srivastava, MBBS (*Abstract Co-Author*) Nothing to Disclose
Karthika Devi D S, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thomas Perez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss the causes and hypothesis of pneumatosis intestinalis (PI) 2. Types of PI: Benign and life-threatening 3. Elaborate the hypotheses for development of PI and discuss the causes for rising incidence 4. Discuss the available treatment options

### TABLE OF CONTENTS/OUTLINE

1. Pneumatosis Intestinalis (PI) - Prevalence and overview 2. Clinical scenarios encountered: ischemia related to thromboembolic events, hypoperfusion, abdominal trauma, post-surgical intervention, pulmonary disease (COPD), systemic disease (autoimmune myositis, SLE), immunocompromised states, post solid organ transplantation 3. Current hypotheses for the development of pneumatosis intestinalis: benign or pathological: Commonly discussed theories: mechanical and bacteria. Mechanical theory proposes that pressurized intraluminal air dissects through the mucosa of compromised bowel and tracks along mesenteric vessels, propagated by peristalsis. Bacterial theory states that gas-producing bacteria invade intramural compartments and congregate in small gas cysts, which is supported by improvement following antibiotic use 4. Pneumatosis post-solid organ transplant- what additional factors do we need to consider? Benign/ life threatening, clinical indicators, immunosuppression and predisposition to PI 5. Current treatment options for pneumatosis intestinalis: emergent survival intervention and revascularization versus medical management (antibiotics, elemental diet and oxygen therapy) 6. Post-surgical pneumatosis: commonly discussed outcomes

## GIEE-126 PANCREATIC TUMOR IMAGING PITFALLS AND HOW TO AVOID THEM

Eric P. Tamm, MD (*Abstract Co-Author*) Institutional Research Grant, General Electric Company. This relationship ended 8/31/21 with end of the period of grant support.
Achal Sarna, MD (*Abstract Co-Author*) Nothing to Disclose
Ott Le, MD (*Abstract Co-Author*) Nothing to Disclose
Mahmoud M. Al-Hawary, MD (*Abstract Co-Author*) Nothing to Disclose
Juan J. Ibarra-Rovira, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaz Javadi, MD (*Abstract Co-Author*) Nothing to Disclose
Priya R. Bhosale, MD (*Abstract Co-Author*) Nothing to Disclose
Vincenzo K. Wong, MD (*Abstract Co-Author*) Nothing to Disclose
Mamie Gao, MD (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Gillis G. Schwartz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) illustrate where pancreatic tumor imaging pitfalls may arise 2) approaches to overcome/avoid pitfalls for a variety of pancreatic tumor types

**TABLE OF CONTENTS/OUTLINE**

Pitfalls of imaging technique and how to avoid them. Pitfalls of management/interpretation. For pancreatic cancer (PDAC), staging issues including pancreatitis and use of short term follow-up, hepatic steatosis and the use of MRI, and strategies for postop monitoring to detect subtle recurrence including careful use of postop baseline, common and uncommon recurrence sites including pancreatic remnant, and use of PET/CT. Will also address pancreatic cancer mimics including metastases from other primaries (e.g. renal cell carcinoma), tumors near pancreas, inflammatory conditions, post-surgical changes, and normal fatty changes. For pancreatic neuroendocrine tumors (PNET), tools for staging (DOTATATE vs FDG PET), treatment response (MR imaging including T2 and delayed gadoxetate for following liver metastases), and for differential diagnosis (heat-damaged Tc-99m RBC SPECT CT to identify accessory splenic tissue). For pancreatic cystic lesions, monitoring for solid lesions developing in pancreas remote from cysts, need for history as abscesses and pseudocysts can mimic cystic neoplasms, and review of old studies e.g. given possible cystic evolution of PNETs. In screening populations at high risk for PDAC, inspecting also for primary cancers outside pancreas, i.e. BRCA (e.g. breast, ovarian, prostate and melanoma).

## GIEE-127 WHEN RADIOLOGISTS JOIN THE FBI: FOREIGN BODY INVESTIGATION; AN IMAGING REVIEW OF GASTROINTESTINAL FOREIGN BODIES AND THEIR CLINICAL SIGNIFICANCE, MANAGEMENT, AND COMPLICATIONS

Frank J. Santisi, MD (*Abstract Co-Author*) Nothing to Disclose
Veniamin Barshay, MD (*Abstract Co-Author*) Nothing to Disclose
Sunil Jeph, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mary M. Woodruff, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Foreign bodies in the gastrointestinal tract, while infrequently encountered, provide memorable cases. In this case based review, we aim to provide the clinical significance and medical management of these foreign bodies. Recognizing and identifying the location and potential complications of a foreign body in the gastrointestinal tract provides a key role in the clinical patient management. We aim to provide a comprehensive review of gastrointestinal foreign bodies using highlighted cases of common and more uncommon complications. Selected cases focus on foreign bodies below the diaphragm.

**TABLE OF CONTENTS/OUTLINE**

Identifying different materials of foreign bodies on imaging.Clinical management and interventions based on type and location of foreign body.Case based review of complications from foreign bodies with key imaging findings and management. Sample cases include:Bowel perforation with liver abscess from ingested plastic spoonBowel and bladder perforation from ingested penBowel obstruction from ingested rubber toyBowel perforation with abdominal wall involvement from ingested penFocal inflammatory reaction from unknown foreign bodyHighlighted teaching cases with key imaging findings and clinical management. Sample cases include:Ingested materials including nail clippers, pen, pencil, pulse ox probe, glass, coins Migrated iatrogenic foreign bodies, various malpositioned gastrointestinal stents and surgical clipsBezoarAttempted overdose with ingested pills

## GIEE-128 A PRACTICAL GUIDE TO CROHN'S IMAGING, THE GOOD, THE BAD AND THE UGLY: TIPS FROM TWO CONTINENTS

Arun Gupta, MBChB (*Abstract Co-Author*) Nothing to Disclose
Alex Fitzhugh, MBBS (*Abstract Co-Author*) Nothing to Disclose
Saubhagya Srivastava, MBBS (*Abstract Co-Author*) Nothing to Disclose
Karthika Devi D S, MBBS (*Abstract Co-Author*) Nothing to Disclose
Minal C. Jagtiani, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Palveer Bhogal, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Provide a brief overview of Crohn's disease (CD) with epidemiology, phenotype classification, pathophysiology 2. Compare the spectrum of findings in CD with US, CT and MR Enterography - discussing the strengths, limitations and practical problems faced in daily practice 3. Discuss standardized acquisition protocol for MRE and the significance of sequences used: Europe vs North American protocols (including anti-peristaltic agents) 4. To provide a schematic description of how imaging findings can affect the clinical management strategy

**TABLE OF CONTENTS/OUTLINE**

1. Crohn's disease - Overview and epidemiology 2. US small bowel (SB) preparation and benefits: High resolution and dynamic imaging, practical/economic efficiencies 3. US SB findings: Mural, extraluminal, doppler and motility assessment 4. MR Enterography protocol a. Contrast agents - oral and IV b. Role of antiperistaltic agents: specific differences in two continents c. Sequences utilized and their significance: delayed post contrast imaging in detecting fibrotic stricturing, diffusion-weighted imaging (DWI) d. Role of fluoroscopic sequences 5. MRE/ CTE mural findings: Intramural edema, segmental mural hyperenhancement, bowel wall thickening, ulcerations, sacculations and fibrosis 6. MRE/ CTE mesenteric and extraintestinal findings: Perienteric edema, fibrofatty proliferation, reactive lymphadenopathy, "comb sign", penetrating and perianal CD 7. Signs of active vs chronic inflammation, utility of MRE activity scores 8. Structured reporting: Updated terminology 9. How do imaging findings affect clinical management strategies in CD?

## GIEE-129 OOPS I DROPPED IT AGAIN: MULTI-MODALITY REVIEW OF DROPPED GALLSTONE EVOLUTION, IMAGING APPEARANCE, AND RELEVANT MANAGEMENT

Tasmia Amjad (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Dropped gallstones exhibit a highly variable appearance based on imaging modality, extent of calcification, and scaring or active inflammation. Apparent growth is often due to edema, fibrosis, or shifting calculi. Complications are uncommon. However, they are important to recognize as abscesses and fistulae involving dropped gallstones usually require surgical management.

**TABLE OF CONTENTS/OUTLINE**

Brief discussion of epidemiology and clinical relevance of dropped gallstones. Discussion of the relevant anatomy and both expected and less common locations of dropped gallstone pathology. Examples of variable appearance of dropped gallstones across multiple modalities and changes that occur with time. Discussion of drop gallstone induced complications. Case based review of key learning points and potential pitfalls.

## GIEE-13 CHOLANGIOCARCINOMA: ONE WORD, MANY FACES. A PRIMER FOR RADIOLOGY RESIDENTS

Tatiana J. Ludena Camacho I, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Garrido Urincho, MD (*Abstract Co-Author*) Nothing to Disclose
Dulce A. Sanchez Nava, MD (*Abstract Co-Author*) Nothing to Disclose
Aura Maria M. Gonzalez Peralta, MD, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• To analyze the role of state-of-the-art imaging techniques in the diagnosis and staging of cholangiocarcinomas.• To describe magnetic resonance imaging features in the spectrum of cholangiocarcinoma, associated with imaging techniques additional.• To discuss management and prognostic implications of classifications according to growth pattern of CCA.• To review the additional value of magnetic resonance cholangiopancreatography in the evaluation of a periductal infiltrating or intraductal growth type tumor.

**TABLE OF CONTENTS/OUTLINE**

Introduction.Anatomic Considerations.Classification.Technique and protocol MRI.Case-based review.Teaching points.Conclusions.

## GIEE-130 CONTRAST ENHANCED US (CEUS) EVALUATION OF HEPATOCELLULAR CARCINOMA TREATED WITH NONRADIATION LOCOREGIONAL THERAPIES

**Awards**
**Magna Cum Laude**

Andrej Lyshchik, MD, PhD (*Abstract Co-Author*) Royalties, RELX;Speaker, General Electric Company;Consultant, General Electric Company;Research support, General Electric Company;Consultant, BioClinica, Inc;Consultant, WCC, Inc;Consultant, Bracco Group;Advisory Board, Bracco Group
Aman Khurana, MD (*Abstract Co-Author*) Nothing to Disclose
Krishna Mundada, MBBS,MBBS (*Abstract Co-Author*) Nothing to Disclose
Mojdeh Mirmomen, MD (*Abstract Co-Author*) Nothing to Disclose
David T. Fetzer, MD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research support, Siemens AG;Consultant, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Consultant, General Electric Company;Advisory Board, General Electric Company
Adam C. Searleman, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yuko Kono, MD, PhD (*Abstract Co-Author*) Equipment support, Canon Medical Systems Corporation;Equipment support, General Electric Company;Support, Lantheus Holdings;Support, Bracco Group
Fregenet Gichamo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Review LI-RADS® CEUS NONRADIATION TRA v2024.; Discuss a standardized CEUS imaging protocol for post-treatment assessment of HCC.; Describe typical CEUS enhancement patterns of HCC following nonradiation locoregional therapy, including Transarterial chemoembolization (TACE), Transarterial bland embolization (TAE), Radiofrequency ablation (RFA), Microwave ablation (MWA) or Percutaneous ethanol ablation (PEA).; Discuss diagnostic criteria for tumor viability using CEUS after non-radiation locoregional therapy of HCC.; Identify possible pitfalls of CEUS categorization of treated HCC and explore scenarios where CEUS is not appropriate for post-treatment assessment.; Explore future directions for post-treatment CEUS of liver lesions and the importance of individualised patient care.

**TABLE OF CONTENTS/OUTLINE**

Overview of LI-RADS® CEUS Nonradiation TRA v2024 algorithm; Treated lesion definitions.; CEUS Imaging criteria for intralesional and perilesional tumor viability.; Case-based review of CEUS LR-Viable, LR-TR Nonviable and LR-TR Equivocal after different locoregional treatment modalities, including TACE, TAE, RFA, MWA or PEA.; Suggested imaging workup options time intervals for different treatment modalities. Limiting factors for CEUS only post-treatment assessment; Location, depth and size of treatment cavity.; Time required to assess multiple lesions.; Detection of new lesions.; US artifacts typically seen with treatment cavities. Research Gaps and future studies• Individualized patient care with CEUS- To identify ideal patient cohort based on tumor characteristics and guide in recommending most appropriate follow up imaging modality amongst CEUS, MRI and CT.

## GIEE-131 HIATAL HERNIAE: FILLING IN THE INFORMATION HIATUS

Alberto Martinez-Isla (*Abstract Co-Author*) Nothing to Disclose
Philip J. Shorvon, FRCR, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Minal C. Jagtiani, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Palveer Bhogal, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Define a hiatal hernia (HH). Describe prevalence, types and variants 2. Discuss the imaging modalities with pictorial review 3. Outline the imaging findings in HH 4. Discuss the available surgical and endoscopic options for correction and discuss the relevance of imaging findings 5. Discuss the complications of surgery and available imaging investigations used post operatively

**TABLE OF CONTENTS/OUTLINE**

1. Definition - herniation of stomach through the esophageal hiatus. Other organs can also herniate 2. Prevalence: Natural incidence increases with age: 60% people over 60 years. High prevalence in GERD patients; exact mechanism discussed 3. Clinical importance: Prevalence and health impact. About 6% of all primary care prescriptions are for proton pump inhibitors, many for reflux associated with hiatal herniae 4. Types • 1 Sliding • 2 Paraesophageal • 3 Mixed • 4 Additional herniation of other viscera • Paracrural: Rare and not true hiatal hernia but must be differentiated 5. Complications Cameron lesions, ischemia, strictures, Barrett's esophagus, volvulus, throat symptoms 6. Investigative imaging modalities and findings 7. Presurgical planning:

what information does the surgeon need from a radiology report? 8. Surgical (and endoscopic) options • Surgical repair (Mostly laparoscopic. Other options included open repair - transabdominal or transthoracic approach. Use of fundoplication, mesh and gastropexy discussed) • Endoscopic suturing / plication 9. Complications and their imaging: Pneumothorax, infection, bleeding, perforation/ leak, recurrence 10. Post op investigation/prognosis: plain film, fluoroscopy, CT

### GIEE-132 PANCREATIC CYSTIC LESIONS: CT, MR AND ECHO-ENDOSCOPIC CORRELATION

Lourdes del Campo, PhD (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Silvia Cayon Somacarrera, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- To depict the different types of pancreatic cystic lesions with their corresponding image characteristics on CT, MR and echo-endoscopy - To identify the image characteristics that help to evaluate the potencial degree of aggressiveness of each one of them

#### TABLE OF CONTENTS/OUTLINE

The term pancreatic cystic lesion encompasses a wide range of lesions that range from completely benign to potentially malignant entities. Given the increasing incidental detection of pancreatic cystic lesions, it is important for radiologists to know the characteristics of each of them and the radiological signs suspicious of malignancy, thus avoiding surgical interventions and unnecessary healthcare costs. In addition, it is also important to determine the need for follow-up. We have reviewed all pancreatic cystic neoplasms detected in our center since 2005. Their radiological characteristics are shown through the use of CT, MR and echo-endoscopy when available. We also describe the signs that lead to suspicion of malignancy and the follow-up diagnostic algorithm developed by the multidisciplinary committee of our center.

### GIEE-133 PHYSICS INSIGHTS INTO LIVER MRI: EDUCATIONAL GUIDANCE FOR PROTOCOL OPTIMIZATION

Simon Gauvin, MD (*Abstract Co-Author*) Nothing to Disclose
Evan McNabb (*Abstract Co-Author*) Nothing to Disclose
Khaled Alanazi (*Abstract Co-Author*) Nothing to Disclose
Veronique Fortier (*Abstract Co-Author*) Nothing to Disclose
Caroline Reinhold, MD, MSc (*Abstract Co-Author*) Research Grant, Imagia Cybernetics Inc
Jeremy Dana, MD, PhD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

MRI quality can be defined by the signal-to-noise ratio, contrast-to-noise ratio, and spatial resolution. - Signal-to-noise ratio is inversely proportional to spatial resolution and proportional to scan time, leading to necessary clinically relevant compromises. - Field-of-view should be adjusted to the patient's width to improve spatial resolution, e.g. conspicuity of the biliary tree, while maintaining the matrix size and being time neutral. - Conventional TSE should be preferred over radial TSE or HASTE/SSFSE to achieve optimal liver contrast-to-noise ratio, especially for tumoral characterization or detection. - Multi-shot echo planar diffusion-weighted imaging is more robust than single-shot to distortion artifacts from air-filled structures but more time-consuming.

#### TABLE OF CONTENTS/OUTLINE

1. MRI quality: signal-to-noise ratio, contrast-to-noise ratio, spatial resolution. 2. Understanding the impact of key technical parameters (field-of-view, matrix size, slice thickness, averages, etc.) on MRI quality and scan time. 3. Understanding tissue contrast (T1 T2) and how to image it (TR, TE, Flip angle). 4. Understanding different types of pulse sequence and their applications in liver imaging in the perspective of their strengths and limitations: TSE (conventional, radial, driven equilibrium, single-shot), DWI/ADC (acquisition modes, etc.), MRCP, fat suppression techniques, contrast agent (dynamic acquisition and impact on other pulse sequences). 5. Insight into quantitative liver MRI: fat and iron quantification, MR Elastography. 6. Insight into acceleration techniques and deep learning reconstructions. 7. Revelling the hidden companions of MRI: respiration, quality control.

### GIEE-134 BEYOND THE WHITE PAPERS: AN UPDATE ON THE MANAGEMENT OF INCIDENTAL FINDINGS SEEN ON IMAGING STUDIES OF THE ABDOMEN AND PELVIS

Michael T. Corwin, MD (*Abstract Co-Author*) Consultant, Corcept Therapeutics Inc
Michael C. Larson, MD, PhD (*Abstract Co-Author*) Stockholder, D3Sciences;Stockholder, Emagine Solutions Technology
Ramit Lamba, MD (*Abstract Co-Author*) Nothing to Disclose
Ghaneh Fananapazir, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamin Carney, MS, MD (*Abstract Co-Author*) Nothing to Disclose
Chirag Govardhan, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1) To discuss the imaging findings and management recommendations for common incidental findings seen on imaging studies of the abdomen and pelvis that are not covered by the existing ACR White Papers. 2) To review up-to-date evidence regarding incidental findings that support or contradict existing White Paper recommendations.

#### TABLE OF CONTENTS/OUTLINE

1) The importance of incidental findings. 2) What are the White Papers? 3) Hepatic: Topics not covered by the White Papers include hyperechoic lesions and solid hypoechoic lesions on ultrasound. Updates on hepatic topics include hyperenhancing lesions on contrast-enhanced CT. 4) Biliary: Updates on biliary topics include extrahepatic biliary ductal dilatation, focal fundal gallbladder wall thickening, and gallbladder polyps. 5) Renal: Topics not covered by the White Papers include hyperechoic lesions on ultrasound and T1-hyperintense lesions on MRI. Updates on renal topics include indeterminate homogeneous renal masses on contrast-enhanced CT (21-39 HU range). 6) Bowel: Topics not covered by the White Papers include incidental intussusception of the small bowel and colon. 7) Mesentery: Topics not covered by the White Papers include misty mesentery/sclerosing mesenteritis. 8) Testicular: Topics not covered by the White Papers include microlithiasis and isolated right-sided varicoceles. 9) Spleen: Updates on splenic topics include cystic lesions and solid lesions.

### GIEE-135 PROGNOSTIC AND PREDICTIVE IMAGING MARKERS OF HEPATOCELLULAR CARCINOMA: A PICTORIAL ESSAY

**Awards**
**Certificate of Merit**

Claude B. Sirlin, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC

Jessica Murphy-Lavallee, MD,FRCPC (*Abstract Co-Author*) Nothing to Disclose
Victoria Chernyak, MD, MS (*Abstract Co-Author*) Consultant, Bayer AG
Damien Olivie, MD, MS (*Abstract Co-Author*) Nothing to Disclose
An Tang, MD, MSc (*Abstract Co-Author*) Equipment support, Siemens AG
Kathryn J. Fowler, MD (*Abstract Co-Author*) Consultant, Bayer AG;Research support, General Electric Company;Research Grant, Pfizer Inc;Institutional Grant, MEDIAN Technologies;Consultant, General Electric Company
Kim-Nhien Vu, MD (*Abstract Co-Author*) Nothing to Disclose
Hanyu Jiang (*Abstract Co-Author*) Nothing to Disclose
Joseph R. Dadour, MD (*Abstract Co-Author*) Nothing to Disclose
Bich Nguyen (*Abstract Co-Author*) Nothing to Disclose
Banmeet Padda (*Abstract Co-Author*) Nothing to Disclose
Jean-Sebastien S. Billiard, MD,FRCPC (*Abstract Co-Author*) Nothing to Disclose
Claudia Deyirmendjian, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Recognize known prognostic markers in hepatocellular carcinoma (HCC);
- Understand imaging features associated with HCC prognosis;
- Identify these features on CT and MRI.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction distinction between prognostic markers (predict natural history or outcome) vs. predictive features (predict responsiveness or lack of response to therapy before the therapy is applied), novel imaging markers of HCC to improve patient management. 2) Prognostic pathologic features epidemiology, histologic classification, associated prognosis. 3) Prognostic molecular features proliferative versus non-proliferative HCC, molecular subclasses, genetic features, main signaling pathways, epigenetic features. 4) Emerging prognostic imaging features radiologic characteristics associated with proliferative and non-proliferative HCC, LI-RADS categories, case examples, biologic rationale, predictors of microvascular invasion, limitations of discussed imaging features. 5) Management and predictive features medical and interventional or surgical therapies, current role of biomarkers, considerations for specific pathologic and molecular subtypes. 6) Future directions validation of prognostic and predictive markers, integration of such markers into the radiology LI-RADS report.

## GIEE-136 MULTI-PHASE CT OR SPLIT BOLUS CT: SPLIT BOLUS CT CAN REDUCE RADIATION DOSE AND IMPROVE DIAGNOSTIC ACCURACY IN ABDOMINAL CONTRAST-ENHANCED CT

Koji Muroga (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To learn the reduction of radiation exposure in the abdominal multi-phase CT.To learn the advantages of decreasing the number of scans.To learn the methods for decreasing the number of scans.To learn split bolus CT to acquire the images with combined dual-contrast phases.To learn the advantages of split bolus CT.

**TABLE OF CONTENTS/OUTLINE**

A. Reduction of radiation exposure in abdominal contrast-enhanced CT. B. Advantages of reducing number of scans. C. Images with combined dual-contrast phases. D. Method of obtaining images combined arterial and venous phases. E. Advantages of split-bolus CT. / Split-bolus CT can obtain the images combined arterial and venous phases by a single-phase scanning in abdominal contrast-enhancement CT. As a result, split-bolus CT can reduce the radiation dose by 46% by reducing the number of scans compared to multi-phase CT. In addition, Split-bolus CT can obtain the CT images without misregistration. This allows simultaneous and accurate assessment of the position and size of vessels, organs, and tumors, improving diagnostic accuracy, and is particularly beneficial before gastrointestinal laparoscopic surgery. High diagnostic accuracy on reduced CT images can improve efficiency and reduce the workload for radiologists and surgeons.

## GIEE-137 FIRST STOPS ON A DIRE ROUTE: MAPPING GI CANCER'S NODAL METASTASIS

Fernanda L. Mazzucato, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia L. Borborema, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna K. Andreucci, MD (*Abstract Co-Author*) Nothing to Disclose
Julia De Toledo Mendes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Delineate the specific pathways of first nodal metastasis corresponding to tumor sites within the esophagus, stomach, liver, gallbladder, small bowel, and colorectum. 2. Explore pertinent clinical and radiological data for assessing adenopathies in patients diagnosed with these tumor types, alongside the staging classification systems employed for their evaluation, illustrated with clinical radiological examples. 3. Analysis of the functions and constraints of imaging methods, focusing on CT and MRI.

**TABLE OF CONTENTS/OUTLINE**

1.Global burden from the major cancers of the gastrointestinal tract. 2. Common Pathways of first nodal metastasis of the gastrointestinal tract. 3. Illustrations of common pathways. 4. The TNM Classification of gastrointestinal malignancies and its key clinical value in guiding patient management decision-making. 5.Case-based presentation of the main gastrointestinal malignancies with first nodal metastasis in MRI and CT imaging, encompassing conditions such as gastric, gallbladder, distal ileum, right colon, rectal, and anal neoplasms. 6.Outlining key take-home messages.

## GIEE-138 DIAGNOSTIC ERRORS IN ULTRASOUND OF THE PANCREAS - A COMPREHENSIVE CASE-BASED REVIEW ON LESSONS LEARNT FROM QUALITY ASSURANCE ROUNDS

**Awards**
**Certificate of Merit**

Irene Ai Linn Wong (*Abstract Co-Author*) Nothing to Disclose
Denise Simin Lau (*Abstract Co-Author*) Nothing to Disclose
Catherine Wan Ting Tan (*Abstract Co-Author*) Nothing to Disclose
Yuet Wah Wong (*Abstract Co-Author*) Nothing to Disclose

Rafidah Abu Bakar, MMedSc (*Abstract Co-Author*) Nothing to Disclose
Voon Chee Ma (*Abstract Co-Author*) Nothing to Disclose
Nanda Venkatanarasimha, FRCR, FRANZCR (*Abstract Co-Author*) Nothing to Disclose
Ying Ying Kho (*Abstract Co-Author*) Nothing to Disclose
Gaik Mooi Tan Florence (*Abstract Co-Author*) Nothing to Disclose
Si Min Teo, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Provide a comprehensive review of the sonographic features of the normal pancreas, anatomical variants, common and uncommon pathologies including their mimics. 2. Illustrate and discuss potential errors/misdiagnosis on ultrasound pancreas based on lessons learnt from quality assurance rounds. 3. Discuss tips and tricks that can help prevent these errors and improve diagnostic accuracy.

**TABLE OF CONTENTS/OUTLINE**

1. Review anatomy and anatomical variants on ultrasound 2. Scanning techniques 3. Case-based review of a wide variety of diagnostic errors encountered in pancreatic ultrasound, which include: (i) Perceptual errors, such as false negatives involving neoplasms and intrapancreatic splenunculus. (ii) Interpretive errors, including mimics of neoplasms, inflammatory conditions and focal fatty sparing. (iii) Errors related to information transfer, involving inaccurate interpretation of neoplasms, pseudocyst and splenosis due inadequate correlation with clinical history. (iv) Errors related to processes, encompassing undetected malignancy attributed to incomplete assessment, and inadequate assessment of cystic neoplasms. 4.Correlative imaging studies and illustrations will be reviewed. 5. Tips to mitigate these potential errors will be highlighted.

## GIEE-139 LOOKING BEHIND THE RECTUM. A COMPREHENSIVE GUIDE TO RETRORECTAL-PRESACRAL SPACE WITH RADIOLOGIC-PATHOLOGIC CORRELATION

**Awards**
**Certificate of Merit**

Sara Moron Hodge (*Abstract Co-Author*) Nothing to Disclose
Eva Pena Burgos (*Abstract Co-Author*) Nothing to Disclose
Maria del Mar Tapia Vine, MD (*Abstract Co-Author*) Nothing to Disclose
Amine Moultamis, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Romero Guzman (*Abstract Co-Author*) Nothing to Disclose
Paula A. Hidalgo, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Martin Hervas (*Abstract Co-Author*) Nothing to Disclose
Nuria Saturio Galan (*Abstract Co-Author*) Nothing to Disclose
Maria Aguilar Picapiedra (*Abstract Co-Author*) Nothing to Disclose
Juan Diego De La Morena Molina, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To illustrate the anatomy and embryology of the retrorectal-presacral space.2. To propose a stepwise-based imaging approach to facilitate the differential diagnosis of retrorectal-presacral masses and review its related lesions.

**TABLE OF CONTENTS/OUTLINE**

1. Review the anatomy and embryology of the retrorectal-presacral space through illustrations, MRI images, and cadaveric correlation. 2. Classification of the spectrum of masses from a histopathological perspective to globally assess the heterogeneity of lesions in this location. 3. Imaging evaluation. 3.1 Diagnostic clues for assessing posterior pelvic-space dependency. 3.2 Morphological evaluation of the lesion. 3.2.1 Learn to identify red flags indicative of malignancy. 3.2.2 Stratify the lesions into cystic or solid-complex, and into the presence or absence of fat content. 4. Develop an algorithm approach that facilitates the differential diagnosis for retrorectal-presacral masses grouping the lesions according to the descriptors mentioned previously into: 4.1 Non-fat containing cystic masses. 4.2 Fat containing cystic masses. 4.3 Non-fat containing solid-complex masses. 4.4 Fat-containing solid-complex masses. 5. Present multimodality imaging of these lesions following this approach with radio-pathologic correlation. 6. Review of the management of retrorectal-presacral lesions. Focus on indications for biopsy and access route. 7. Take home points.

## GIEE-14 CHALLENGES AND PITFALLS IN RECTAL CANCER MRI: FROM IMAGE ACQUISITION TO INTERPRETATION

Christopher A. Mejias, MD (*Abstract Co-Author*) Nothing to Disclose
Achille Mileto, MD (*Abstract Co-Author*) Consultant, Bayer AG
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Lindsey Durowoju (*Abstract Co-Author*) Nothing to Disclose
Guilherme M. Cunha, MD (*Abstract Co-Author*) Nothing to Disclose
Yongjun Liu (*Abstract Co-Author*) Nothing to Disclose
Karthika Devi D S, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Currently faced challenges in optimized preparation and acquisition techniques in rectal cancer MRI.2) Review challenging concepts in reporting of initial staging of rectal cancer.3) Assessing rectal cancer response to treatment and pitfalls in reporting post-treatment MRI.4) Challenges of management of rectal cancer post-neo-adjuvant treatment from surgeons' standpoint.5) Review imaging patterns and management of rectal cancer recurrence.6) Discuss the future role of radiology in rectal cancer patients.

**TABLE OF CONTENTS/OUTLINE**

1. Importance of Optimized Preparation and Acquisition TechniqueUse of spasmolyticsBowel prepMicro-enemaBladder emptyingRectal gelIV contrast2. ReportingStagingTumor to anal verge distance measurementsT staging for cancers with anal sphincter complex involvementDefinition of T stage based on MRF vs peritoneal involvementDefinitions for lymph node vs tumor depositsDefinitions to assess regional and non-regional lymph nodesAssessment of EMVI in locally advanced rectal cancer-Sensitivity specificity of MRI-Role of DWI-Prognostic significance.3. Post treatment/ re-stagingMutinous tumormTRG/post-treatment scan T staging in anal canal involvementHigh inter-reader variability in post treatment settingRates of rad-path discordance clinical outcomesChallenges of the surgeon in post-treatment cases.4. Pelvic recurrence of rectal cancerImaging patternsPrognosisManagement5. Future directionsMotion mitigation strategies (AI-enabled denoising methods, faster MRI acquisition, etc)Texture analysis and combined approaches.

## GIEE-140 "MISS ME NOT"- THE MANY FACES OF MECKEL'S DIVERTICULUM

**Awards**
**Cum Laude**

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmad I. Farah, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ananya Panda, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Review the embryology and anatomy of Meckel's Diverticulum (MD) • Review role of radiology and normal appearances of MD • Discuss multimodality imaging of complications of MD

**TABLE OF CONTENTS/OUTLINE**

I. Embryology and Anatomy of Meckel's Diverticulum (MD) II. Normal MD on different imaging modalities III. Role of Radiology IV. Complications of MD 1. MD with heterotopic gastric /pancreatic mucosa 2. MD with enteroliths/ foreign bodies 3. Meckel's diverticulitis a) Uncomplicated Meckel's diverticulitis b) Meckel's diverticulitis with Perforation c) Meckel's diverticulitis with Abscess 4. MD with small bowel obstruction a). Due to Volvulus b). Due to Inverted MD c). Due to Internal hernia d). Littre's Hernia e). Intussusception 5. MD with active GI bleeding 6. MD associated with malignancy (neuroendocrine tumor, gastrointestinal stromal tumor, etc.) V. Common Differential Diagnosis and Imaging Pearls.

## GIEE-141 UPDATE IN ESOPHAGEAL SURGERY: TECHNIQUES, EXPECTED FINDINGS AND POSTOPERATIVE COMPLICATIONS

Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Acosta Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Tramblin De La Moneda, MBBS (*Abstract Co-Author*) Nothing to Disclose
Esther Garcia Casado (*Abstract Co-Author*) Nothing to Disclose
Sara Siguenza-Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To describe the main esophageal surgical techniques currently used and which are the expected findings after the procedures.2. To review the complications that may occur after esophageal surgery and their radiological evaluation, focusing on pearls and potential pitfalls.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction2. Surgical techniques and expected findings2.1. Transthoracic esophagectomy: Ivor-Lewis, McKeown and left thoracoabdominal access2.2. Transhiatal esophagectomy: Orringer2.3. Minimally invasive esophagectomy (MIE)2.4. Conduits and routes3. Complications after esophageal surgery3.1. Pulmonary complications: pneumonia, bronchoaspiration, atelectasis, pleural effusion, pneumothorax, adult respiratory distress syndrome (ARDS), pulmonary edema, pulmonary embolism3.2. Anastomotic leak3.3. Technical complications: iatrogenic bleeding, diaphragmatic hernia, chylothorax, tracheobronchial tree injury, airway-gastric fistula, recurrent laryngeal nerve paralysis3.4. Functional complications: delayed gastric emptying, dumping syndrome, esophageal reflux3.5. Late complications: anastomotic stricture, disease recurrence (local, regional and distant)4. Conclusions5. References

## GIEE-143 MRI OF RECTAL CANCER AFTER NEOADJUVANT TREATMENT: IMAGING PEARLS

Raquel Garcia Latorre, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Villanueva, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Salgado Parente, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Canales Lachen (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Brief description of the current situation, epidemiology and therapeutic options for rectal cancer. Watch and Wait strategy. Review of anorectal anatomy in MRI and semiology of rectal adenocarcinoma.Review of the study acquisition protocol: need for oblique sequences to the tumor.Review of imaging findings after radio-chemotherapy treatment by using illustrative cases. Degree of response and main false positives.Proposal of structured report and simple conceptual classification.

**TABLE OF CONTENTS/OUTLINE**

Colorectal cancer represents the second most frequent tumor diagnosed in the population after breast and prostate. Given its high prevalence and the fact that its incidence is increasing in young patients, an "organ-preserving" therapeutic management is currently preferred after achieving a complete tumor response with effective neoadjuvant chemoradiotherapy; thus, avoiding the harmful effects and morbidity of surgery. This strategy is known as "Watch Wait" and consists of a close follow-up where MRI plays a leading role. Therefore, correct acquisition of the study is essential, using high-resolution T2 morphological and diffusion sequences angled to the tumor, which allow us to accurately assess and rule out tumor remnants or recurrences. In addition, it is necessary to have a deep knowledge of the imaging findings in response after treatment, both of the primary tumor and lymph node involvement, as well as to identify the main pitfalls. All this with the aim of providing useful and accurate information to the clinician.

## GIEE-144 TECHNIQUES FOR OPTIMIZING SONOGRAPHIC ANALYSIS OF GALLBLADDER POLYPS

Malak Itani, MD (*Abstract Co-Author*) Nothing to Disclose
Katerina Konstantinoff, MD (*Abstract Co-Author*) Nothing to Disclose
William D. Middleton, MD (*Abstract Co-Author*) Nothing to Disclose
Aya Kamaya, MD (*Abstract Co-Author*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation
Christopher I. Fung, MD (*Abstract Co-Author*) Stockholder, Mikata Health
Sharlene A. Teefey, MD (*Abstract Co-Author*) Nothing to Disclose
Katharina Feister, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

In 2022, the Society of Radiologists in Ultrasound (SRU) Consensus Conference updated the risk-stratification and management guidelines for gallbladder polyps (GBP) based on their shape size. Optimizing sonographic diagnosis analysis of a GBP is important as it allows appropriate classification clinical decision making. This exhibit will:1. Review the SRU GBP management guidelines 2. Discuss sonographic techniques for optimizing gray scale Doppler parameters useful in diagnosing analyzing GBPs

**TABLE OF CONTENTS/OUTLINE**

1. General techniques for evaluating the GB: fasting state, subcostal intercostal scans, tips if GB is difficult to identify2. Techniques to diagnose GBPs: a. Exclude shadowing: highest transmit frequency, single focal zone at the level of interest, turn off real time compounding b. Exclude mobility: scan in different positions (upright, prone, RPO) c. Document internal vascularity: optimize Doppler parameters with low pulse repetition frequency wall filter, high gain color threshold, adjust transmit frequency based on depth d. Exclude signs of adenomyomatosis: Comet tail/Twinkle artifacts, cystic spaces3. Techniques for analyzing polyps: a. Measurement: largest diameter of largest GBP, round to nearest mm b. Shape (pedunculated vs sessile): increase transmit frequency, decrease depth image width, magnify image, cine clips to show wiggle c. Other signs: adjacent wall thickening, liver invasion/metastasis, adenopathy4. Alternative/further imaging: a. Follow up US: poor exam, contracted GB, can't distinguish sludge vs GBP b. CEUS for sludge vs GBP analysis of GBP enhancement c. CT vs MRI

## GIEE-145 OPTIMIZING SONOGRAPHIC ANALYSIS OF SUPERFICIAL SOFT TISSUE MASSES

Sharlene A. Teefey, MD (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD (*Abstract Co-Author*) Nothing to Disclose
William D. Middleton, MD (*Abstract Co-Author*) Nothing to Disclose
Katharina Feister, MD (*Abstract Co-Author*) Nothing to Disclose
Katerina Konstantinoff, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The Society of Radiologists in Ultrasound (SRU) recently published a consensus conference statement that provided guidelines for categorization management of superficial soft tissue masses (SSTM). This included an unillustrated review of techniques for optimizing the examination.This exhibit aims to: Expand elaborate on optimal US techniques for imaging SSTMs and provide an illustrated review. Provide abundant examples of how optimal technique leads to improved diagnosis. Summarize SRU guidelines for SSTMs.

**TABLE OF CONTENTS/OUTLINE**

1. Required equipment - Essential: Multiple linear probes of varying frequency, grayscale with harmonic imaging spatial compounding, color, power spectral Doppler. Useful but non-essential: Bedside table adjustable stool, panoramic scans, dual screen grayscale/Doppler, advanced techniques (e.g. contrast enhanced US)2. Generic imaging protocol - Longitudinal transverse grayscale images, static images cine clips at rest with dynamic maneuvers, measurement in 3 orthogonal planes, Doppler3. Optimizing imaging techniques with case examples - Adjusting transmit frequency to match the depth of lesion, comparison to surrounding tissues contralateral side when applicable, dynamic maneuvers - compression, muscle contraction, Valsalva etc., Doppler settings - scale, frequency, gain etc.4. Characterize lesions based on sonographic appearance - Composition (solid, cystic, mixed), echogenicity, margins, internal architecture, location/relationship to adjacent structures, vascularity, classic benign lesions5. Summarize SRU consensus guidelines for categorization management of SSTMs

## GIEE-147 SIMPLE MUCINOUS CYST OF PANCREAS: IS IT REALLY A BENIGN LESION?

Bengi Gurses (*Abstract Co-Author*) Nothing to Disclose
Duygu Atasoy, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Develop an understanding of simple mucinous cysts (SMC)
- Understand difference of SMC from other mucinous cysts in pancreas
- Learn imaging features of SMC
- Compare SMC to other similar cystic lesions to make differential diagnosis.
- Discuss relation of SMC and PDAC

**TABLE OF CONTENTS/OUTLINE**

- Cystic Lesions of Pancreas
- Mucinous Cysts of Pancreas
- Definition of Simple Mucinous Cysts
- Pathologic Definition of SMC
- Imaging Features of SMC
- Differential Diagnosis of SMC
- Misnomer or Not: Are SMCs Truly Simple?
- Malignancy Potential of SMC
- SMC and PDAC: Is There a Relationship?

## GIEE-148 RARE CYSTIC LESIONS OF PANCREAS

Bengi Gurses (*Abstract Co-Author*) Nothing to Disclose
Duygu Atasoy, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Learn classification of pancreatic cystic lesions
- Develop an awareness of rare pancreatic cystic lesions
- Learn imaging features of retention cysts, squamoid cysts of pancreatic ducts, simple mucinous cysts
- Learn to make differential diagnosis.
- Discuss malignancy potential of rare pancreatic cysts

**TABLE OF CONTENTS/OUTLINE**

- Cystic Lesions of Pancreas
- Classification of Cystic Lesions
- Neoplastic Cysts of Pancreas
- Non-neoplastic Cysts of Pancreas
- Retention Cysts

- Simple Mucinous Cysts
- Squamoid Cyst of Pancreatic Ducts
- Lymphoepithelial Cysts
- Awareness: Radiologic Differentiation of Rare Cystic Lesions from Other Pancreatic Lesions
- Attention: Clinical Importance of Rare Cystic Lesions
- Fear: Malignancy Potential of Rare Pancreatic Cystic Lesions

## GIEE-149 JOURNEY EXPLORING THE VALUABLE IMAGING QUANTITATIVE PARAMETERS IN HEPATOCELLULAR CARCINOMA: CURRENT USE AND POTENTIAL APPLICATIONS

**Awards**
**Certificate of Merit**

Tetsuya Tachiiri (*Abstract Co-Author*) Nothing to Disclose
Nagaaki Marugami (*Abstract Co-Author*) Nothing to Disclose
Kiyoyuki Minamiguchi (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Mariko Irizato (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to review various quantitative values (e.g.,tumor steatosis, stiffness, vascularity, etc.) of multimodality imaging reported in hepatocellular carcinoma (HCC), to clarify the background that these quantitative values reflect (e.g., histopathology and immunopathology), and to discuss the potential application of these quantitative values in the coming era of personalized therapy for HCC.

### TABLE OF CONTENTS/OUTLINE

In HCC, there have been many reports of quantitative parameters using MRI, perfusion-CT, PET-CT, etc. with the aim of improved clinical prognosis and clarification of the tumor biology. However, no report has summarized these parameters previously reported, resulting in a sporadic situation. Additionally, in recent years, there has been an exponential increase in reports on radiomics, an emerging field in image analysis for characterizing HCC. Understanding these quantitative parameters as well as the background they represent will help clinicians consider about treatment strategy based on these values.Table of contents is as follows.1) Overview of quantitative values reported in HCC2) Association of the quantitative values with their background through representative case3) Potential application of these quantitative values to current treatment strategy in HCC

## GIEE-15 THE REAL QUESTION- IS IT RESECTABLE? RESPONSE EVALUATION AFTER NEOADJUVANT THERAPY IN PANCREATIC CARCINOMA: A GREEN SIGNAL FOR SURGERY

Jitin Goyal, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Neoadjuvant treatment (NAT) aims to downstage borderline resectable and locally advanced pancreatic adenocarcinomas to make patients amenable to surgery with R0 resection and prolongation of overall survival.Contrast Enhanced Computed tomography (CT) remains the primary imaging tool for assessing treatment response after neoadjuvant therapy due to higher spatial resolution and multiplanar reconstruction. Nevertheless, the interpretation of imaging findings remains challenging, due to similarity between viable tumor and treatment-related changes following NAT. In various studies ,changes in tumor size or volume following neoadjuvant therapy were not significantly associated with R0 resection or survival outcomes. Increased tumor attenuation in the arterial and venous phases after neoadjuvant therapy was associated with R0 resection in patients with locally advanced and borderline resectable tumors. Partial regression of tumor-vessel contact after neoadjuvant therapy had 100% positive predictive value for R0 resection, regardless of the degree of either reduction in tumor size or residual vascular involvement.Decreased venous stenosis or decreased contour deformation indicates improved venous involvement after NAT.

### TABLE OF CONTENTS/OUTLINE

Favorable imaging findings on Contrast Enhanced Computed tomography after neoadjuvant therapy include partial regression of tumor contact with peripancreatic vessels, a mild fat-stranding perivascular halo in place of solid tumor contact with a vessel, and reduction in tumor size according to RECIST 1.1 guidelines.

## GIEE-150 IMPACT OF FAT ESTIMATION OF PANCREATIC PARENCHYMA

Atsushi Higaki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshihiko Fukukura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Tamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akira Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kiyoka Maeba, MD (*Abstract Co-Author*) Nothing to Disclose
Akihiko Kanki, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this presentation is:1) To demonstrate the epidemiology of intrapancreatic fat and the characteristic imaging findings of computed tomography and magnetic resonance imaging, including the radiologic-pathologic correlations.2) To learn about the relationship between intrapancreatic fat and various metabolic diseases, pancreatitis, pancreatic cancer, and intraductal papillary mucinous neoplasm.

### TABLE OF CONTENTS/OUTLINE

CONTENTS ORGANIZATIONThe fat in pancreatic parenchyma for1. Metabolic diseases2. Pancreatitis3. Pancreatic fistula4. Intraductal papillary mucinous neoplasm5. Pancreatic cancer

## GIEE-151 IMAGING SPECTRUM AND DIAGNOSTIC CHALLENGES OF ATYPICAL HEPATOCELLULAR CARCINOMA

Igor Goykhman, DO (*Abstract Co-Author*) Nothing to Disclose
Joseph Nenow, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian W. Huang, DO (*Abstract Co-Author*) Nothing to Disclose
Angelica Patino, MD (*Abstract Co-Author*) Nothing to Disclose
Zahraa Al-Turaihi, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan J. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Zachary B. Hoskins, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Hepatocellular carcinoma (HCC) is a high mortality malignancy, with imaging playing a crucial role in early detection. 2. Recognize the typical imaging features of hepatocellular carcinoma. 3. Infiltrative HCC can have features which overlap with typical HCC, or can look markedly abnormal with features including tumor-in-vein. 4. Identify features found in biphenotypic tumors and their overlap with HCC and cholangiocarcinoma. 5. Infiltrative HCC and biphenotypic tumors do not behave like typical HCC, therefore a radiologist should have a high index of suspicion for these entities in patients with chronic liver disease.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction a. Mortality of HCC b. Imaging utilization in the pre-operative evaluation II. Typical HCC a. Arterial phase hyperenhancement and washout i. Physiology ii. CT iii. MRI b. Ancillary features c. Ultrasound III. Infiltrative HCC, on a spectrum of cases that resemble typical HCC to more atypical. a. Mimickers b. Cases which retain features of typical HCC c. Cases which are difficult to characterize d. Cases with tumor-in-vein i. MRI appearance ii. Ultrasound 1. Spectral Doppler 2. Differentiation from bland thrombus IV. Combined HCC/cholangiocarcinoma a. Statistics in chronic liver disease b. Imaging findings of typical cholangiocarcinoma c. Imaging characteristics i. Cases that resemble HCC ii. Cases that resemble cholangiocarcinoma

## GIEE-152 BEYOND THE BULGE: A FOUNDATIONAL REVIEW OF DYNAMIC ULTRAOUND OF THE ABDOMINAL WALL

Young H. Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Aniket Pandya, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Svrcek, MD (*Abstract Co-Author*) Nothing to Disclose
Christine Yao, BA, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Our educational exhibit aims to provide a foundation for the ultrasound (US) evaluation of abdominal wall "bulges" or hernias, particularly with the use of dynamic maneuvers. First, a comprehensive understanding of the variations in abdominal wall anatomy to the level of the inguinal region is crucial to the diagnostic process. Using both positional changes (upright, supine) and manipulation of intra-abdominal pressure (Valsalva, coughing) during ultrasound examination will allow for real-time assessment of the behaviors and movement of herniated contents. Effective use of dynamic maneuvers can increase sensitivity and accuracy of US, which can eliminate the need for more costly cross-sectional imaging with CT or MRI. When assessing a hernia, we will highlight the importance of documenting features such as size, sac contents, and estimated fascial defect. Additionally, we will review post-operatively imaging such as expected and unexpected surgical changes. Finally, we will also cover both common and rare differential diagnoses or mimics of hernias when evaluating for an abdominal wall palpable complaint.

**TABLE OF CONTENTS/OUTLINE**

1. Learn overview of anterior abdominal anatomy with specific attention to ultrasound appearance and the common locations for abdominal wall hernias to arise. 2. Recognize classic imaging features of abdominal wall hernias and hernia sac contents. ?3. Understand how dynamic imaging maneuvers such as (positional changes, Valsalva, etc.) is key to the evaluation of an abdominal hernia. 4. Review the expected post-operative appearance of a hernia repair and common post-operative complications. 5. Appreciate imaging features of common and rare mimics of abdominal wall hernias.

## GIEE-153 HEPATIC ELASTOGRAPHY: THE IMPORTANCE OF ITS INTERPRETATION

Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Luiz Nascimento (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Fernanda Fleming (*Abstract Co-Author*) Nothing to Disclose
Victor Arthur Ohannesian (*Abstract Co-Author*) Nothing to Disclose
Pedro Carani (*Abstract Co-Author*) Nothing to Disclose
Marcelo R. Silva, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Ultrasound elastography was described for the first time in 2003 as a novel method for assessing and staging liver fibrosis.- Together with B-mode and Doppler study evaluation, both able to be performed simultaneously with elastography, a complete liver profile is created with a single exam.- Adequate interpretation of elastography results requires the patient's clinical condition and laboratory exams to be taken into context by the radiologist.- Multiple factors, such as high-intensity physical activity, beta-blocker use, and recent excessive alcohol consumption, can affect elastography results.- It is fundamental that the radiologist has knowledge to not only perform the elastography exam but also interpret results considering each patient's clinical context.

**TABLE OF CONTENTS/OUTLINE**

- Introduction on hepatic ultrasound elastography- Confounding factors that increase liver stiffness- Interpretation of elastography on patients with viral hepatitis and non-alcoholic fatty liver disease- Clinical cases and discussion

## GIEE-154 PANCREATIC NEUROENDOCRINE TUMORS: CT FEATURES TO HELP PREDICT TUMOR GRADE

Elliot K. Fishman, MD (*Abstract Co-Author*) Co-founder, HipGraphics, Inc Stockholder, HipGraphics, Inc Institutional Grant support, Siemens AG Institutional Grant support, General Electric Company Consultant, Exact Sciences Corporation Consultant, Imaging Endpoints II LLC
Linda C. Chu, MD (*Abstract Co-Author*) Nothing to Disclose
Satomi Kawamoto, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Pancreatic neuroendocrine tumors (PanNETs) are increasingly diagnosed in the recent decades, and treatment strategy of PanNETs have been evolved due to better understanding of tumor biology 2. Tumor stage and grade are critical for guide treatment and predict prognosis. 3. CT features to help predict histological tumors grade are presented and discussed. However, accurate prediction of tumor grade is difficult on imaging alone. 4. Radiomics has emerged as a valuable tool and applied to predict grading of PanNET. Review and discuss pros and cons of this technique in predicting tumor grade.

**TABLE OF CONTENTS/OUTLINE**

1. Review pathological tumor grade according to WHO classification. 2. CT features to suggest low grade PanNETs. (a) Tumor size: small PanNETs are typically low grade, but not all tumors. (b) Tumor vascularity/enhancement: low grade PanNETs are typically hypervascular with intense homogeneous enhancement, but not all tumors. (c) Cystic/necrotic tumors: Small cystic PanNETs are often low grade, and necrosis are often associated with high grade PanNET, but they may be difficult to differentiate on CT. (d) Presence of calcification: Calcifications are more often associated with higher grade PanNETs but can be seen in low grade PanNETs. (e) Biliary duct, pancreatic duct, vascular and adjacent organ involvement are more commonly associated with

higher grade PanNETs, though there are exceptions. 3. Review and discuss recent advances of radiomics technique and current limitations in predicting PanNET tumor grade compared to CT imaging features alone.

## GIEE-155 LYMPHOMAS OFF THE BEATEN PATH: EXPLORING UNCOMMON ABDOMINAL MANIFESTATIONS

Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Bekhor, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Levi B. Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To overview the pathophysiology and clinical manifestations of lymphomas. - To highlight the main radiological aspects and sites of involvement. - To alert about less common manifestations and unusual sites of involvement and discuss differential diagnoses.

### TABLE OF CONTENTS/OUTLINE

This presentation will overview the classics findings in abdominal lymphomas, that frequently involve nodal and extranodal structures, for knowledge of the usual presentation of the disease. The most classical findings include nodal disease, with solitary or multiple enlarged nodes, with a huge round mass or a lobular homogeneous density with uniform enhancement. When in extranodal involvement, the studies describe the spleen, liver, gastrointestinal tract, pancreas, abdominal wall, genitourinary tract, adrenal, peritoneal cavity, and biliary tract, in decreasing order of frequency. We describe and illustrate with schematic figures and imagens, rare cases of lymphoma with lymph nodes necrosis in patients without treatment, primary commitment of liver, pancreas, bilateral adrenal, non-Hodgkin peritoneum involvement, ovary, testicle, kidney, stomach, and bowel. A brief literature review of these rare manifestations and discuss why they are unusual, bringing frequency and epidemiological data for the radiology community keep in mind these unusual aspects to suspect when faced with challenging cases.

## GIEE-156 EXAMINE THE PECULIAR PHENOMENA OF BONE MARROW ACTIVITY MIGRATING TO NEW SITES

Aley Talans, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Eduardo Borher Moreira (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bruna K. Andreucci, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia De Toledo Mendes, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia Goncalves Dias (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Provide an overview of Extramedullary Hematopoiesis (EMH).Define the profile of patients with EMH from a clinical and laboratory point of view. Review typical and atypical presentations of EMH with emphasis on abdominal imaging. Present the main differential diagnoses.

### TABLE OF CONTENTS/OUTLINE

Review of the pathophysiology of EMH, with an understanding of the emergence of lesions made up of erythroid precursors (generally irregular aggregates of erythroblasts, immature granulocytes, and occasional megakaryocytes), as well as their usual and unusual distribution in the abdomen. Presentation of the patient's epidemiological profile through real cases with clinical and laboratory data, facilitating the understanding of the disease, and revealing in which situations EMH should be considered as a diagnostic possibility and in which its probability becomes remote. As well as the presentation of image stigmas that may reveal that the patient evaluated has sickle cell anemia, thalassemia, myelofibrosis, or chronic myeloid leukemia, among the most common causes. Exposure of a series of cases with typical and atypical presentation of EMH, with emphasis on the usual findings of the disease, which involve paraspinal nodules, expansion of the ribs, organomegaly, focal masses in the liver or spleen, renal involvement (parenchymal, intrapelvic or perirenal), lymphnode involvement, nodules or peritoneal masses and masses at sites of splenectomy or nephrectomies. Presentation of differential diagnoses from an imaging point of view, highlighting the importance of clinical and epidemiological knowledge for a correct diagnostic approach.

## GIEE-157 PRE AND POST-OPERATIVE EVALUATION OF SURGICALLY MANAGED BOWEL ENDOMETRIOSIS: GUIDING THE BETTER CHOICE, MONITORING THE OUTCOME

Lucas R. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia A. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula C. Moura, MSc, MSc (*Abstract Co-Author*) Nothing to Disclose
Ana Paula Fraga Cintra Gonzaga (*Abstract Co-Author*) Nothing to Disclose
Bruna G. Busoletto Tripode SR, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To present the intestinal surgical approach techniques for endometriosis and the indication of each approach according to the degree and site of the lesions. Expose the imaging aspects after laparoscopic resections and anastomoses of intestinal endometriosis lesions. Correlate post-surgical MRI findings, transvaginal ultrasound, and colonoscopy. Distinguish usual post-surgical findings from complications and residual disease.

### TABLE OF CONTENTS/OUTLINE

Bowel involvement is one the most severe forms of deep endometriosis, present in up to 30-40% of patients with deep endometriosis, and many of them will require surgical intervention.Several types of surgery have been used for the management of bowel endometriosis. Most of resection techniques are unknow for the radiologists, and the postoperative findings following bowel resection will depend on the surgical technique applied. To present the surgical techniques currently used to treat intestinal endometriosis through didactic drawings and illustrations of surgical steps depending on the characteristics of the lesion and its location in the rectosigmoid, cecum, appendix or ileum, proposing a clinical reasoning flowchart for choosing the most appropriate surgical procedure.Case-based review in a multimodality approach (US, MRI, colonoscopy and surgical specimens), following a timeline, with positive outcomes, demonstrating usual postoperative findings as well related complications. Practical tips illustrated by cases to assist radiologists in the differential diagnosis of post-surgical changes and residual endometriotic disease.

## GIEE-16 SHIFTING PERSPECTIVE: EFFECTIVELY INCORPORATING THE DIXON METHOD INTO ABDOMINAL AND PELVIC MRI INTERPRETATIONS

Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
Kyle Kleiman (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Ronak Patel, BS (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
Elhamy R. Heba, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Dixon method creates four image sets from a single acquisition: in-phase and out-of-phase images, acquired via a dual-echo technique, and fat-only and water-only images, reconstructed created from dual-phase source data, showing fat or water T1-signal intensity, respectively. These images provide information to allow confident identification of: (1) Macroscopic (adipocytes) and microscopic fat (or small volume) through India ink artifact and signal loss on out-phase images and (2) substances causing magnetic susceptibility (e.g. gas, iron, blood products, and metal) through signal loss on out-of-phase images. Fat-only images provide an alternative sequence for identifying fat while water-only images yield a T1-weighted fat suppressed sequence. These sequences can be integrated into imaging protocols for the abdomen and pelvis and incorporated in radiologist's search patterns. Knowledge of basic physics principles behind image generation can facilitate understanding of imaging appearances and improve diagnostic confidence.

### TABLE OF CONTENTS/OUTLINE

1. Review of physics principles underlying Dixon chemical-shift imaging 2. Case-based approach using the Dixon method to characterize diffuse and focal abnormalities in the abdomen and pelvis on MRI: Use of dual-phase gradient echo imaging to identify lipid through use of signal loss and India ink artifact Use of T2* effects/magnetic susceptibility artifact to identify gas, iron, blood products, and metal Use of fat-only images as an alternative sequence for identifying fat Use of water-only images as a fat-suppressed sequence 3. Discussion of integration into imaging protocols and search patterns to maximize benefits and limiting image overload

## GIEE-17 EVALUATION AND MANAGEMENT OF COMPLICATIONS AFTER LIVING DONOR LIVER TRANSPLANTS REQUIRING COMPLEX BILIARY ANASTOMOSES

**Awards**
**Certificate of Merit**

Karthik M. Sundaram, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Richard D. Shlansky-Goldberg, MD (*Abstract Co-Author*) Nothing to Disclose
Ann T. Foran, MBBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Due to the limited availability of deceased donor liver transplants (DDLTs), living donor liver transplants (LDLTs) are becoming more common. 2) However, variant intrahepatic ductal anatomy, can increase risk of complications and exclusion of optimal donors. 3) New surgical techniques has allowed for the creation of complex biliary anastomoses, increasing the number of successful LDLTs. 4) Biliary complications following LDLT requiring multiple biliary anastomoses are higher compared to DDLTs. 5) Post-operative imaging allows for identifying the variant reconstructed biliary anatomy complications to ensure timely treatment. 6) In this exhibit, we illustrate pre- post-operative magnetic resonance imaging/ magnetic resonance cholangiopancreatography (MRI/MRCP) of donors recipients after LDLTs requiring complex biliary anastomoses. 7) We focus on recognizing the most common biliary complications mimics as well as management approaches.

### TABLE OF CONTENTS/OUTLINE

1) Discuss surgical techniques including ductoplasty, creation of a single orifice containing multiple ducts in a Roux limb, the presence of multiple separate anastomoses. 2) Evaluation of the pre-operative variant intrahepatic ductal anatomy and post-operative imaging appearances of LDLTs after multiple anastomoses by MRCP and hepatobiliary phase MRI. 3) Review complications and mimics following LDLT including anastomotic and non-anastomotic strictures, cholestasis, anastomotic leak, biliary cast syndrome, cholangitis, and biliary sepsis. 4) Management options for biliary complications including medical, ERCP in the cases of hepaticojejunostomy, placement of external/internal drains, the need for retransplant.

## GIEE-18 ACR LI-RADS ULTRASOUND SURVEILLANCE V2024: UPDATE OF ULTRASOUND LI-RADS V2017

Aya Kamaya, MD (*Abstract Co-Author*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation
David T. Fetzer, MD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research support, Siemens AG;Consultant, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Consultant, General Electric Company;Advisory Board, General Electric Company
Shuchi K. Rodgers, MD (*Presenter*) Royalties, RELX

### TEACHING POINTS

1. ACR LI-RADS and the American Association for the Study of Liver Disease (AASLD) recommend hepatocellular cancer surveillance in at-risk individuals with ultrasound and serum alpha-fetoprotein (AFP) every six months. 2. LI-RADS Ultrasound Surveillance is a framework for performance, interpretation, and reporting of HCC surveillance US and is composed of an US Category (US-1, US-2, or US-3) and a Visualization Score (VIS A, VIS B, or VIS C). 3. The LI-RADS Ultrasound Surveillance v2024 offers a pathway for alternative surveillance modalities in cases of VIS C-scored exams and elevated AFP without sonographic correlate. 4. Due to the low likelihood of malignancy, there is a reduced surveillance interval for US-2 Subthreshold observations in v2024.

### TABLE OF CONTENTS/OUTLINE

1. Offer rationale for hepatocellular cancer surveillance 2. Review evidence and published literature on US LI-RADS v2017 3. Discuss rationale for LI-RADS US Surveillance v2024 updates 4. Present updated LI-RADS US Surveillance v2024 algorithm 5. Compare AASLD and ACR LI-RADS US Surveillance recommendations 6. Highlight tips and tricks for implementing LI-RADS US Surveillance 7. Present case examples

## GIEE-19 AGE-RELATED PANCREATIC HYPERINTENSITY A PROMISING INDICATOR FOR LOCALIZED AUTOIMMUNE PANCREATITIS SUBTITLE ABDOMINAL ULTRASONOGRAPHY AS A VALUABLE TOOL FOR EARLY DETECTION OF AUTOIMMUNE PANCREATITIS DISEASE WITH LESIONS SMALLER THAN 20MM

Norifumi Nishi (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Adjustments to the settings of the ultrasound device, including magnification, filtering, gain, and sensitivity time control, are necessary to depict localized lesions accurately. Autoimmune pancreatitis tends to occur more frequently in the elderly population, typically around the age of 65, with a higher incidence in middle-aged to elderly individuals. In ultrasound images of the pancreas, aging-related effects often result in increased brightness, making localized lesions easier to detect. Autoimmune pancreatitis typically exhibits irregular contours and internal patchy or punctate hyperechoic spots in localized lesions of approximately 20 mm in size. Early detection via ultrasound examination not only facilitates prompt diagnosis but also makes differentiation from other modalities easier.

**TABLE OF CONTENTS/OUTLINE**

Adjustments of ultrasound device settings to confirm the contours and internal structure of localized lesions. Age-related changes in pancreatic brightness enhancing the detectability of localized lesions, particularly in the middle-aged to elderly population. Characteristics of autoimmune pancreatitis with localized lesions of approximately 20 mm, including contour and internal features. Facilitation of evaluation of lesions of approximately 20 mm identified via ultrasound examination using other diagnostic modalities. Early diagnosis enables treatment to progress before the condition worsens.

## GIEE-2 PANCREATIC LESIONS 101: A BEGINNER'S GUIDE

Monica Chapa-Ibarguengoitia, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Bethsabel Rodriguez Encinas, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Isabel I. Leon Garcia (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Understand the basic anatomy of the pancreas and its anatomical relationships. Identify the main characteristics of cystic and solid lesions through multimodality imaging techniques. Recognize key data that assist in the differential diagnosis of pancreatic lesions. Distinguish features of benignity and malignancy. Correlate radiological images with histopathological diagnoses

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: - Anatomy of the pancreas - Anatomical relationships2. Solid pancreatic lesions: - Pancreatic Adenocarcinoma - Pancreatic Metastasis - Solid Pseudopapillary Tumor - Pancreatic Neuroendocrine Tumor - Focal Pancreatitis - Intrapancreatic Accessory Spleen3. Cystic pancreatic lesions: - Mucinous Neoplasm - Serous Cystoadenoma - Intraductal Papillary Mucinous Neoplasm - Intrapancreatic Gastric Duplication Cyst4. Summary: - Key Points

## GIEE-20 TOTAL PANCREATECTOMY AND ISLET AUTOTRANSPLANTATION (TPIAT): IMAGING OF EXPECTED FINDINGS AND COMPLICATIONS

Laura R. Carucci, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan D. Clayton, MD (*Abstract Co-Author*) Nothing to Disclose
Jill Bruno, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

TPIAT is performed throughout the US, with increasing prevalence over the last two decades. Goals of TPIAT are to alleviate pain due to debilitating chronic or acute recurrent pancreatitis and to prevent development of brittle diabetes by infusion of pancreatic islet cells. Imaging plays a key role in evaluating patients who have undergone TPIAT. Radiologists must be aware of the surgical procedure, expected post-operative findings on imaging studies, complications and role of imaging, and potential imaging pitfalls.

**TABLE OF CONTENTS/OUTLINE**

Review TPIAT background, indications and goals. Discuss surgical procedure and expected imaging findings of TPIAT. Describe expected post-surgical anatomy following TPIAT. Demonstrate imaging of post-operative complications and sequelae of TPIAT. Complications may include: leak (bowel, bile), abscess, hematoma, biliary stricture, bowel obstruction (anastomotic stricture, adhesions, incisional or internal hernia), delayed gastric emptying, bezoar, vascular abnormalities (thrombosis, pseudoaneurysm), omental infarcts, nodular hepatic steatosis. Show imaging of expected post-surgical findings and pitfalls.

## GIEE-21 IT'S PERITONEUM O'CLOCK! A PRACTICAL APPROACH ON PERITONEAL DISSEMINATION OF MALIGNANT DISEASES

Mauricio Zapparoli, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Vitor L. Vieira, MD (*Abstract Co-Author*) Nothing to Disclose
Oscar Orozco (*Abstract Co-Author*) Nothing to Disclose
Fabio Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Da Silva Eli, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Taborda, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Peritoneum dissemination of malignant diseases is common, and its imaging assessment may be challenging.CT is still the workhorse of peritoneal evaluation, and in experienced hands has similar accuracy compared to MRI.PCI is an important tool in the preoperative setting to evaluate the extent of peritoneal disease.Standardized PCI evaluation methods can improve accuracy and reduce misdiagnosis. MRI evaluation should include high-resolution T2 non-fat sat, DWI, and T1 fat sat contrast-enhanced sequences.Coronal DWI gives a wider panorama of the abdominal cavity and reduces the chance of missing lesions in the abdominopelvic transition.

**TABLE OF CONTENTS/OUTLINE**

IntroductionReview the diseases that can potentially disseminate through the peritoneumMain location and pathophysiology of peritoneal lesions.Pros and cons of different imaging methods used to evaluate the peritoneum.Peritoneal Cancer Index (PCI)Use and indications of Radiological PCI assessment in the preoperative settingExamples of different PCI scores.Suggested standardized methodology to calculate PCI - Peritoneum O'Clock.Post-treatment evaluationImportance of baseline studies performed immediately after CRS and HIPEC.Remission and relapse cases.Standard protocolSuggestion of standard MRI protocol with optimal sequences to evaluate the peritoneum.

## GIEE-22 3 FOREIGN-BODIES PROBLEMS: THE CHALLENGES IN THE EVALUATION OF ABDOMINAL FOREIGN BODIES

Lais Abduch, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah De Menezes (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Brenda N. Lahlou, MD (*Abstract Co-Author*) Nothing to Disclose
Priscila Akemi d. Takitani, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Priscilla Claudia Raddo Venancio, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel B. Montel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To simplify the three major issues related to the evaluation of foreign bodies in the abdomen: their characterization, detection of complications, and description in the report.To explore the utility of various imaging techniques, including plain radiography, CT, MRI, and ultrasound, for the identification and characterization of abdominal foreign bodies.To highlight the potential complications arising from abdominal foreign bodies, such as perforation, obstruction, or infection. Delineate the role of radiologists in identifying complications, aiding in management decisions, and tracking post-removal outcomes.To guide the preparation of the medical report, considering medical and legal factors.

### TABLE OF CONTENTS/OUTLINE

Introduction.Image evaluation and foreign body detection.Expected attenuation of the different foreign body material (metal, plastic, wood, glass, bones, etc).Foreign bodies in the gastrointestinal and genitourinary tract arising from ingestion or introduction through natural orifices, such as anus, vagina, and, less frequently, the urethra.Foreign bodies complications such as perforation, gatrointestinal occlusion, and infection. Iatrogenic post-surgical foreign bodies.How to report abdominal foreign bodies.Conclusion.

## GIEE-23 THE ROLE OF ABDOMINAL IMAGING IN EVALUATING PATIENT SUITABILITY FOR HIPEC

Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Ifeanyi Ekpunobi, BS (*Abstract Co-Author*) Nothing to Disclose
Michaela Cooley, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cytoreduction with hyperthermic intraperitoneal chemotherapy (HIPEC) has been developed and become more prominent over the last 20 years. Due to its use at primarily high volume and specialized institutions, important imaging findings, especially those related to prediction of patient outcomes after HIPEC, are not widely known. This educational exhibit takes the reader through learning about the cytoreduction/HIPEC procedure, opt-in criteria, and common imaging findings before and after treatment.

### TABLE OF CONTENTS/OUTLINE

1. What is hyperthermic intraperitoneal chemotherapy (HIPEC)? a. Definition; b. Benefits over traditional chemotherapy; c. Candidacy requirements; d. Origins of cancers typically treated with HIPEC2. Opt-in criteria for HIPEC. a. Patient factors for candidacy; b. Imaging modalities used in evaluation; c. Highlight on why CT is the preferred modality3. Common CT imaging findings of carcinomatosis. a. Common imaging findings discussed and shown on CT; b. Discussion of the pathophysiology of each imaging finding; c. Discussion on how to evaluate each imaging finding4. CT findings that relate to prognosis if HIPEC is performed. a. Imaging findings related to worsening prognosi; b. Pathophysiology of why some imaging findings correlate to worse outcomes; c. Discussion on who should be excluded from HIPEC treatment5. Disease burden and complications post-HIPEC; a. Possible outcomes after HIPEC and cytoreduction surgery; b. Complications of HIPEC and cytoreduction; c. How imaging plays a role in surveillance of disease; d. Discussion on frequency of imaging and notable findings

## GIEE-24 DON'T RELY ON LUCK - HAVE A PROPER LOOK! POST OPERATIVE COLORECTAL CANCER IMAGING: A GUIDE TO HELPING YOUR SEARCH PATTERN

Snehal Lapsia, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Sophie Cheshire, MBChB, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Common post operative colorectal cancer surgeries highlighting anatomy Tips and tricks including where to look for subtle recurrence Mimics of recurrent disease

### TABLE OF CONTENTS/OUTLINE

This multimodality pictorial review aims to enhance the skills of the radiologist when reviewing colorectal cancer follow up imaging. Knowledge of surgical technique and post operative anatomy is crucial when identifying residual, recurrent or metastatic disease on post treatment imaging. It is vital to have a focused search pattern of key review areas to identify early recurrence in a timely manner to allow appropriate treatment or reintervention. We present an overview of post surgical anatomy for common colorectal surgeries with an emphasis on the draining vascular and lymph node pathways. Early disease recurrence based on these pathways is demonstrated on an array of imaging including CT, PET CT and MRI. Tips and tricks are provided to overcome common blindspots and potential errors. Examples include: mesocolic nodal recurrence post right hemicolectomy, rectal stump recurrence post anterior resection, IMA suture recurrence vs suture granuloma at the IMA division, presacral recurrence post abdominal perineal resection and detection of mucinous nodal disease on MR.

## GIEE-25 A PREVALENT HEALTH PROBLEM: CASE-BASED REVIEW OF THE PATHOPHYSIOLOGY, IMAGING FEATURES, AND CONFOUNDING IMPACT OF HEPATIC STEATOSIS IN DIAGNOSTIC IMAGING

Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda C. Gibson, DO (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Owen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review the pathophysiology of hepatic steatosis including alcoholic and non-alcoholic steatohepatitis, NASH cirrhosis, focal steatosis, and transient steatosis2. Discuss the patterns of steatosis including but not limited to diffuse, geographic, focal and multifocal through case examples.3. Illustrate with

case based approach, how steatosis can mimic other pathology.

**TABLE OF CONTENTS/OUTLINE**

Pathophysiology of steatosis1. Hepatic metabolism of fat, alcohol and toxins2. Alterations in perfusion affecting steatosis deposition3. Inflammation and the progression to cirrhosisVariants of Steatosis1. Acute2. Transient3. Chronic4. Focal/multifocalCased based illustration of diagnostic challenges presented by hepatic steatosis1. Incidental indeterminate liver lesions2. Staging of colorectal cancer and other malignancies3. Cholangitis mimicking perivascular steatosisSummary: The incidence of steatosis is increasing and recognizing the subtypes and imaging patterns of steatosis can reduce uncertainty and improve patient management.

## GIEE-26 RADIOLOGY'S ROLE IN THE DIAGNOSIS AND MANAGEMENT OF CONSTIPATION -DETECTION, CLASSIFICATION, COMPLICATIONS AND TREATMENT

Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
Aman Khurana, MD (*Abstract Co-Author*) Nothing to Disclose
Rohan Kulkarni (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Owen, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Differentiate and classify different forms of colonic disfunction to distinguish neurogenic, drug-induced, metabolic, functional, and mechanical causes of constipation2. Identify and describe radiological features of constipation and its complications3. Explain the role of abdominal radiographs, CT, fluoroscopic defecography, and MR defecography in detection and classification of constipation.4. Recommend the next appropriate step in management and describe potential image-guided intervention that can contribute to treatment of constipation

**TABLE OF CONTENTS/OUTLINE**

Defining ConstipationDefecatory straining, hard lumpy stools, sensation of incomplete evacuation, sensation of anorectal obstruction or blockage, need for manual maneuvers such as digital evacuation, and or fewer than 3 stools per week.Etiologies of Constipation 1. Neurogenic: Diabetes mellitus, Hirschsprung's Disease, Intestinal Pseudo obstruction 2. Drug-Induced: Anticholinergics, Neutrally active agents 3. Metabolic: Hypokalemia, hypothyroidism 4. Functional: Pelvic floor dysfunction 5. Mechanical: Neoplasm, stricture, volvulusRadiologic features of constipation and its complications on Radiographs, CT, Fluoroscopy and MR 1. Colonic dilation2. Fecaloma or fecal impaction3. Wall thickening4. Pericolic stranding5. Perforation6. AbscessTreatment of Constipation 1. Laxative/enemas2. Manual dis-impaction 3. Water soluble fluoroscopic enema 4. Biofeedback 5. Surgery

## GIEE-27 CEVICHE, TOO SPICY TO HANDLE: OVERVIEW OF UNUSUAL RECTAL TUMORS

Mark Guelfguat, DO (*Abstract Co-Author*) Nothing to Disclose
Yanet Y. Torres Maza (*Abstract Co-Author*) Nothing to Disclose
Jorge L. Huayanay, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Rioja (*Abstract Co-Author*) Nothing to Disclose
Alexander Acevedo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To emphasize the importance of a comprehensive approach to differential diagnosis for rectal tumors, incorporating imaging features alongside the patient's medical history and clinical context.To educate the audience regarding the growth patterns of the different rectal tumors. To achieve a better understanding of the rectal tumor imaging features through pathological correlation. To propose a thorough differential diagnosis based on clarification of the growth patterns and likely anatomical origin.

**TABLE OF CONTENTS/OUTLINE**

The goals of this exhibit are to:Provide a pictorial review of the diverse imaging appearances of uncommon rectal tumors. Discuss specific imaging and pathological characteristics of uncommon rectal tumors. Familiarize the audience with the imaging features of uncommon rectal tumors, thereby helping in formulation of a complete differential diagnosis.These major featured rectal neoplasms include: rectal gastrointestinal stromal tumors (GIST), anorectal melanoma, rectal neuroendocrine neoplasms (G1-3 and poorly differentiated), primary rectal lymphoma, leiomyoma, lipoma, leiomyosarcoma, Kaposi's Sarcoma, rhabdomyosarcoma, extramammary Paget's disease

## GIEE-28 HYDATID DISEASE ON ULTRASOUND: CORRELATION WITH CT AND MRI, DIFFERENTIAL DIAGNOSIS, AND COMPLICATIONS

Leticia Gutierrez Velasco, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Francisco Sallaberry Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Garcia del Salto, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Fraga Rivas, MD (*Abstract Co-Author*) Investigator, General Electric Company
Jaime de Miguel Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Sastre, MD (*Abstract Co-Author*) Nothing to Disclose
Cristian Rodriguez Robles (*Abstract Co-Author*) Nothing to Disclose
Sandra Robledo (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Describe the different stages of hydatid disease on ultrasound and its correlation with CT and MRI. Show less common alternative locations to the liver.Display the main differential diagnosis of hydatidosis. Review the main complications.

**TABLE OF CONTENTS/OUTLINE**

Hydatid disease, caused by Echinococcus granulosus and less frequently by Echinococcus multilocularis, remains a global health problem. It is characterized by the formation of hydatid cysts with a three-layered structure. Ultrasound is the initial diagnostic tool that allows distinguishing the evolutionary stages. The Gharbi and WHO classifications are the most used, especially in the liver, although they can be applied to other less common locations, such as lung or spleen, among others. They classify hydatid lesions into five main types based on ultrasound findings and, although both are not directly comparable, an approximate comparison based on imaging characteristics is provided. The differential diagnosis includes simple and complex cysts, abscesses, hematomas and tumors. Hydatid cysts, typically asymptomatic, may be incidentally detected on imaging tests or lead to complications such as mass effect, rupture and infection. For a comprehensive evaluation of cysts and their complications, CT and MRI are essential complements to ultrasound, making it important to know how to correlate the findings.

## GIEE-29 CYST ME MORE: ABDOMINAL CYSTIC LESIONS OF THE MESENTERY AND PERITONEUM

Elena Uceda,
MD (*Abstract Co-Author*) Nothing to Disclose
Marta Dominguez Fraga, MD (*Abstract Co-Author*) Nothing to Disclose
Paola Pizano, MD (*Abstract Co-Author*) Nothing to Disclose
Begona Jimenez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Radiological evaluation of cystic lesions using different imaging techniques.Review of the classification of abdominal cystic lesions that affect the mesentery and peritoneum.Overview the main pathological and radiological features of the entities comprising the differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Imaging technique and findings of cystic lesions 3. Benign mesenteric cyst: 3.1 Peritoneal simple mesothelial cyst; 3.2 Chylolymphatic mesenteric cyst; 3.3 Cystic lymphangioma; 3.4 Enteric duplication cyst/enteric cyst 4. Cystic neoplasms: 4.1 Multicystic peritoneal mesothelioma; 4.2 Mucinous cystic neoplasm; 4.3 Pseudomyxoma peritonei; 4.4 Mature cystic teratoma; 4.5 Tumoral degeneration or myxoid component 5. Infectious and inflammatory cyst: 5.1 Abscess; 5.2 Nonpancreatic pseudocyst; 5.3 Peritoneal hydatidosis; 5.4 Necrotic lymph nodes 6. Iatrogenic or traumatic cyst: 6.1 Nonpancreatic pseudocyst; 6.2 Gossypiboma 7. Conclusions

## GIEE-3 LI-RADS V2024: A NEW HOPE FOR HEPATOCELLULAR CARCINOMA TREATMENT RESPONSE

Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Velloni, MD (*Abstract Co-Author*) Nothing to Disclose
Hilton M. Leao Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre K. Wakote Teruya, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1 - The Liver Imaging Reporting and Data System (LI-RADS) has been updated with a new treatment response algorithm (TRA v2024) including two separate nonradiation and radiation Cores, previously incorporated within a single algorithm. 2 - In the updated version there is a new specific algorithm for internal and external beam radiation-based locoregional therapies (LRT) such as transarterial radioembolization (TARE) and stereotactic beam radiation therapy (SBRT). It also introduced a new treatment response category (LR-TR nonprogressing) for radiation TRA. 3 - This exhibit aims to discuss and describe how to apply the ancillary features enabling the upgrade from LR-TR equivocal to viable or from LR-TR nonprogressing to viable.

**TABLE OF CONTENTS/OUTLINE**

1 - Introduction to the new LI-RADS v2024 CT/MRI treatment response algorithm. 2 - Case-based and illustrative guides applying the ancillary features and the feature of viability. 3 - Provide practical considerations and diagnostic tips to improve accuracy and prevent misinterpretation in applying the updated LI-RADS v2024 TRA.

## GIEE-30 DIAGNOSIS OF HIATAL HERNIAS, POST-SURGICAL CHANGES AND COMPLICATIONS ON FLUOROSCOPY IMAGES: AN EASY GUIDE FOR RESIDENTS

Lourdes M. Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Bethsabel Rodriguez Encinas, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Renee Acuna Barrera, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Recognize the normal anatomy of the gastroesophageal junction and stomach on barium swallow studies.Identify the main characteristics of different types of hiatal hernias through barium swallow studies. Understand the management of hiatal hernias and recognize the normal post-surgical changes.Explain the complications associated with post-surgical changes in fundoplications according to the Hinder classification.

**TABLE OF CONTENTS/OUTLINE**

Introduction: Normal anatomy of the gastroesophageal junction and stomach on FluoroscopyTypes of hiatal hernias.Anatomical changes and characteristics of hiatal hernias.Hiatal hernias management and treatment: Management according to the type of hiatal hernia.Types of surgical management.Post-surgical complications of fundoplication:Types of complications of fundoplication.Classification based on radiological images.Clinical cases Comparison between fluoroscopy studies before and after surgical management.Description on fluoroscopy images of post-surgical complications according to Hinder classification. Summary Key points.

## GIEE-31 NAVIGATING IPMN MANAGEMENT: INSIGHTS FROM THE 2024 KYOTO GUIDELINES

Yuki Tashiro, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Learning about the image evaluation of IPMN, particularly worrisome feature and high risk stigmata, through specific examples as per the latest Kyoto Guidelines, and 2) Understanding the pitfalls and mimickers of worrisome feature and high risk stigmata through specific examples to enhance everyday clinical practice.

**TABLE OF CONTENTS/OUTLINE**

Pancreatic cystic diseases encompass a broad spectrum of conditions, ranging from benign to malignant tumors. Given the difficulty in obtaining tissue samples, imaging plays a crucial role in diagnosis. The most frequently observed cystic tumor is the intraductal papillary mucinous neoplasm (IPMN), which possesses malignant potential. Not only is differentiation from other diseases necessary, but also risk assessment. The Kyoto Guidelines, published in 2024, are a key management strategy for IPMNs, detailing risk assessments and surveillance methods. Imaging criteria are included in worrisome features (WF) and high-risk stigmata (HRS).Following the latest guidelines, this presentation elucidates these findings, and also introduces potential pitfalls and mimicker.Besides IPMN, various other pancreatic cystic diseases require differential diagnosis through imaging due to differing risks and treatment approaches. Although these cystic diseases sometimes present similar imaging findings, making differential diagnosis challenging, the discussion will also cover how to manage such pitfalls while contrasting with IPMN.

## GIEE-32 BUBBLES AND BILE: BENEFITS OF CONTRAST-ENHANCED ULTRASOUND FOR THE GALLBLADDER

David T. Fetzer, MD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research support, Siemens AG;Consultant, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Consultant, General Electric Company;Advisory Board, General

Electric Company
Kanupriya Vijay, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Razan Noorelahi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Contrast-enhanced ultrasound (CEUS) has multiple unique advantages including high spatial and temporal resolution, high signal-to-background, and the use of an exclusively intravascular contrast agent. These features result in a powerful tool with impactful applications for the gallbladder.CEUS can help characterize intraluminal filling defects and differentiate vascularized masses from avascular mimickers such as tumefactive sludge.CEUS is useful in interrogating wall abnormalities with characteristics features, such as adenomyomatosis, and atypical or complicated cholecystitis. CEUS may be utilized in interventional procedures such as in the assessment of cystic duct patency via cholecystostomy tube instillation.

**TABLE OF CONTENTS/OUTLINE**

Introduction: CEUS:Structure and pharmacokinetics of ultrasound contrast agents. Administration and safety considerations.Normal GB: Appearance on CEUS.GB Pathology: Bile salt imbalance: Gallstones, biliary precipitate, tumefactive sludge. Inflammation: Adenomyomatosis, acute cholecystitis, chronic cholecystitis, xanthogranulomatous cholecystitis, gangrenous and perforated cholecystitis, nonneoplastic polypoid growths, cholesterol and inflammatory polyps. Neoplastic growths: Adenoma and malignancy.Interventional applications: Assessment of cystic duct patency via cholecystostomy tube and percutaneous image-guided biopsy.

## GIEE-33 ALL ABOUT THE PANCREATIC DUCT: A COMPREHENSIVE REVIEW

Juan Fernando Casanova Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar A. Ortiz-Andrade (*Abstract Co-Author*) Nothing to Disclose
Alex Espinal Colominas, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Arce (*Abstract Co-Author*) Nothing to Disclose
Nuria Roson Gradaille, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Anatomical Variants: Discuss the importance of recognizing and reporting anatomical variants of the pancreatic duct system. Pancreatic Disorders: Knowledge of the different forms of involvement of the pancreatic duct system by inflammatory, neoplastic and traumatic conditions is essential for a correct diagnosis. Ductal Signs: Recognition of the different pancreatic ductal signs in imaging studies is crucial for adequate differentiation between inflammatory and neoplastic pathologies. Disconnected pancreatic duct syndrome: Highlight the necessity of suspecting this condition when identifying intra-abdominal collections near the pancreas. MPD involvement: Stress the importance of considering the pancreatic duct's involvement when pancreatic lesions exhibit a morphology that follows its longitudinal axis. Utility of MRCP: Highlight the role of Magnetic Resonance Cholangiopancreatography in evaluating the pancreatic duct system.

**TABLE OF CONTENTS/OUTLINE**

Embryology: Description of the embryonic development of the pancreatic duct system. Normal Anatomy: Description of the normal features of the pancreatic duct system. Congenital Anomalies: Discussion of congenital variants of the pancreas involving the duct system. Inflammatory Conditions: Review of the forms of involvement of the pancreatic duct system due to inflammatory conditions like acute and chronic pancreatitis. Pancreatic Neoplasms: Review of tumors involving the MPD, the branch ducts or both. Traumatic/Iatrogenic: Evaluation of injuries caused by trauma or medical procedures, highlighting lacerations and accidental injuries. Conclusion and Key Points: Synthesis of the key points and the main conclusions of the review.

## GIEE-34 WHAT'S BEHIND THE LIVER- DEMYSTIFYING UNCOMMON LIVER MASSES

Ramy Shoela, MD (*Abstract Co-Author*) Nothing to Disclose
Zeshan Ali (*Abstract Co-Author*) Nothing to Disclose
Lin Gu, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Dilli (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review uncommon hepatic masses. Describe their imaging appearance and differences from their differentials. Review important clinical history and laboratory work-up that should raise suspicion for potential less common diagnoses. Discuss pathology of these masses.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to liver masses Common liver masses and imaging Utility in expanding the differential with unique history, laboratory or radiographic findings 2. Hepatic myeloid sarcoma in patient with AML Case Review of relevant clinical history, imaging, and pathology 3. Hepatic lymphoma in patient with Hep C and no cirrhosis Case Review of relevant clinical history, imaging, and pathology 4. EBV-associated smooth muscle tumor in patient with chronic immunosuppression for renal transplant Case Review of relevant clinical history, imaging, and pathology 5. Combined HCC and cholangiocarcinoma Case Review of relevant laboratory work-up (elevated AFP and CA 19-9), imaging, and pathology 6. Hepatic and renal angiomyolipomas in patient with tuberous sclerosis Case Review of relevant clinical history with tuberous sclerosis, imaging, and pathology 7. Hepatoblastoma in 3 year old patient Case Review of relevant clinical history (such as age), imaging, and pathology 8. Focal carcinoma arising from widespread intraductal papillary neoplasm Case Review of relevant differentials, imaging, and pathology 9. Acute cholangitis presenting as a mass in patient with fever Case Review of relevant clinical history, imaging, and pathology 10. Mucinous cystic neoplasm Case Review of relevant imaging and pathology

## GIEE-35 EXPLORING THE DEPTHS OF DIFFUSION IN RECTAL CANCER MAGNETIC RESONANCE IMAGING: COMPREHENSIVE INSIGHTS FROM THEORY TO PRACTICE

Joao Manoel M. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Miriana E. Mariussi, MD (*Abstract Co-Author*) Nothing to Disclose
Jose De Arimateia Batista Araujo Filho (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Role of Rectal Magnetic Resonance Imaging (MRI) in local staging of rectal cancer, assisting in treatment planning and disease management according to established protocols.- Principles of diffusion-weighted imaging (DWI), including optimal acquisition parameters and identification of artifacts.- Common pitfalls of DWI and strategies to mitigate misinterpretations.- Physical principles of apparent diffusion coefficient (ADC) and Intravoxel Incoherent Motion (IVIM) as DWI-derived techniques that complement image interpretation, particularly in post-treatment follow-up of rectal cancer.- Implementation of DWI within the diagnostic imaging service.- DWI patterns and their correlation with T2-weighted sequence patterns and treatment response, facilitating assessment of treatment efficacy and differentiation of tumor tissue from surrounding areas.- Interpretation of diffusion characteristics in lymph node evaluation.

**TABLE OF CONTENTS/OUTLINE**

- Overview of Rectal Cancer- Role of MRI in Rectal Cancer, including protocol selection for diagnosis, treatment planning, and follow-up, and the integration of DWI into diagnostic imaging services- Physical principles of Diffusion-Weighted Imaging and its derivatives, such as Apparent Diffusion Coefficient and Intravoxel Incoherent Motion- Interpretation of DWI, addressing artifacts, pitfalls, and correlation with derived sequences- How to interpret DWI-derived sequences- Patterns identified in DWI and their relationship with treatment response and standardized methods, including T2-weighted imaging- Illustrative cases and educational points

## GIEE-36 UPPER GASTROINTESTINAL SERIES: RADIOLOGIST'S PRIMER

Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Renata Emy Ogawa, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago M. Baraviera, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the technique of the upper gastrointestinal (GI) series.Describe the anatomy of the esophagus, stomach, and duodenum based on the upper GI series.Discuss the typical and atypical pathologies involving the esophagus, stomach, and duodenum.Demonstrate what to expect and what is unexpected after surgical procedures.Show complex cases solved by upper GI series.

**TABLE OF CONTENTS/OUTLINE**

Review based on cases and illustrationsTechniquePositioning, dynamic maneuvers, contrast media, and documentation standards.Anatomy physiology of the esophagus, stomach, and duodenumEsophagus: Reflux/Esophagitis; Achalasia; Motility disorders; Strictures; Diverticulum; broncho-esophageal fistula; StomachUlcers; Hernias; Volvulus; Motility disordersDuodenumDiverticulum; MembranesPostoperative normal and complications findings: Fundoplication; bariatric surgery.GI surgery reconstructions. Beyond "by-the-book" cases!

## GIEE-37 ACUTE SMALL BOWEL DILATATION DECODED: AN ILLUSTRATED RESOURCE FOR RADIOLOGY RESIDENTS

Juan C. Spina JR, MD (*Abstract Co-Author*) Nothing to Disclose
Guadalupe Comadran (*Abstract Co-Author*) Nothing to Disclose
Roy Lopez Grove, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela Soloaga (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Acute abdomen in the context of small bowel dilatation is a frequent consultation in the emergency department. Its evaluation on computed tomography (CT) requires a systematic approach and careful analysis of the characteristics of the intestinal wall.The pattern of small bowel wall thickening and its enhancement characteristics provide important clues to the underlying etiology.Identifying the presence or absence of a transition point on CT is a crucial step in evaluating small bowel dilatation. Awareness of potential complications and their imaging manifestations on CT allows for timely diagnosis and appropriate management to prevent further bowel compromise and systemic sequelae.

**TABLE OF CONTENTS/OUTLINE**

Introduction.Normal findings of the bowel wall.Pathological findings of the small bowel wall.Wall Thickening i) Focal thickening ii) Diffuse thickening iii) Segmental thickeningEnhancement Patternsi) Homogeneous enhancement ii) Stratified enhancement. Target sign. iii) Decreased/absent enhancementEndoluminal Findingsi) Gallstone ileus ii) Foreign bodies and bezoarOther findingsRadiological signs to look for.i) Transition point and small bowel obstruction (SBO) ii) Small bowel feces signExtrinsic causesExtra-intestinal findingsComplications

## GIEE-38 HEPATOCELLULAR CARCINOMA (HCC) AFTER LOCOREGIONAL THERAPIES: WHAT'S NEW IN THE LIRADS TREATMENT RESPONSE ALGORITHM V2024?

Arthur S. Joseph, DO (*Abstract Co-Author*) Nothing to Disclose
Venkata S. Katabathina, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew V. Chesley, MD (*Abstract Co-Author*) Nothing to Disclose
Sriram Jaganathan, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

· Review various locoregional therapies for HCC and discuss their indications and contraindications · Difference between Non-radiation based and Radiation based treatment response algorithm [TRA] core - v2024. · Management options based on the LR TR category in non-radiation-based and radiation-based TRA

**TABLE OF CONTENTS/OUTLINE**

Introduction to HCC and LIRADS applicable population. Various treatment modalities available for HCC - Non-radiation-based therapies Radiation based therapies. Specific indication of different treatment modalities including ablation, Trans arterial chemoembolization [TACE], Tran-arterial Radioembolization [TARE], and Stereotactic Body Radiotherapy [SBRT]. Expected post-procedural changes in different modalities What is New in LIRADS Treatment Response Algorithm v2024? Role of different imaging modalities in treatment assessment Define LR TR categories in Non-radiation based TRA v2024 with imaging appearances Define LR TR categories in Radiation based TRA v2024 with imaging appearances Describe with examples the Mass-like enhancement [any degree in any phase] - the only major criteria as per ACR LR TRA v2024 The difference between radiation-based and non-radiation-based treatment response algorithm version 2024 and the rationale behind the modification.Conclusion LIRADS treatment response algorithm utilizing multiphasic CT or MRI liver helps in clear and uniform communication between the radiologists and other providers involved in the loco regional therapies

of HCC. The current updated version 2024 has two cores - Non-radiation TRA and Radiation TRA. It is imperative to understand the categories for effective and optimal management of patients with HCC.

## GIEE-39 WHEN THE RADIOLOGIST'S STOMACH IS IN KNOTS! A PICTORIAL REVIEW OF ESOPHAGECTOMY TECHNIQUES AND COMPLICATIONS

Raul D. Pellon, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Herran de la Gala, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandra Somoano Marfull (*Abstract Co-Author*) Nothing to Disclose
Aranzazu Sanchez Gabin, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand the main surgical techniques of esophagectomy.2. To review its normal findings on postoperative CT and fluoroscopy. 3. To recognize the different complications and its management (drainages, endoscopic devices and surgery).

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Imaging protocol for postoperative evaluation (CT and fluoroscopy). 3. Surgical techniques, indications, advantages and disadvantages and normal postoperative findings on different imaging techniques (CT, fluoroscopy and endoscopy) : 3.1. Transthoracic esophagectomy: 3.1.1. Ivor Lewis technique. 3.1.2. McKeown's. 3.2. Transhiatal esophagectomy. 3.3. Interposition approach (colon and jejunum). 4. Esophaguectomy complications and management: 4.1. Anastomotic leakage. 4.2. Anastomotic stricture. 4.3. Tracheo-esophageal and broncho-oesophageal fistula. 4.4. Conduit ischaemia or necrosis. 4.5. Chylothorax . 4.6. Pleuro-pulmonary complications. 4.7. Tumor relapse (common sites and complications related to it). 5. Conclusions. 6. Bibliography.

## GIEE-4 MULTIDISCIPLINARY APPROACH TO THE TREATMENT OF GIST: A CASE-BASED REVIEW

**Awards**
**Certificate of Merit**

Noor Fatima Majeed, MD (*Abstract Co-Author*) Nothing to Disclose
Hernan R. Bello Velez, MD (*Abstract Co-Author*) Nothing to Disclose
Aarti Sekhar, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy Arleo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Gastrointestinal stromal tumors (GISTs), mesenchymal tumors affecting the GI tract and beyond, present with diverse symptoms, disease burden, and aggressiveness. Effective management necessitates a multidisciplinary approach, where radiologists play a pivotal role. With highly variable imaging features, some of which overlap with other abdominal tumors, GIST can present a diagnostic challenge. Moreover, early identification on imaging is crucial in guiding biopsy approach, as percutaneous biopsy risks peritoneal seeding. Additionally, anatomical nuances of GIST tumors impact surgical management. Our educational exhibit aims to: 1. Review the common imaging characteristics of GIST 2. Distinguish GIST from other similar appearing abdominal tumors 3. Overview a multidisciplinary treatment approach, with emphasis placed on the radiologist's role 4. Highlight anatomic considerations that influence surgical candidacy

### TABLE OF CONTENTS/OUTLINE

1. Overview epidemiology and pathogenesis 2. Review a multidisciplinary treatment approach, with emphasis placed on the radiologist's role 3. Case-based review of common imaging findings 4. Discuss the role of medical and surgical treatment 5. Consider common surgical approaches based on involvement of anatomic structures 6. Assess recurrence risk based on size, location, pathologic features, and pseudocapsule rupture7. Case-based review of metastatic and recurrent disease

## GIEE-40 JOURNEY INTO PANCREATIC CARCINOGENESIS WHERE IMAGING MEETS GENOMIC TERRAIN

Diego A. Aguirre, MD (*Abstract Co-Author*) Nothing to Disclose
John L. Torres Castiblanco SR, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Borrero, MD (*Abstract Co-Author*) Nothing to Disclose
Santiago Aristizabal (*Abstract Co-Author*) Nothing to Disclose
Diana Romero Mayorga I, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Overview: Provide an overview of the primary precursor lesions associated with pancreatic carcinogenesis.Progression from Precursor Lesions to Cancer: Illustrate the stepwise progression from precursor lesions (e.g., PanIN, IPMN) to invasive carcinoma, emphasizing the genetic alterations and imaging features associated with each stage of disease evolution.Integration of Genetics and Imaging: Emphasize the synergistic relationship between genetic insights and imaging techniques in early detection and risk stratificationFutures directions: highlighting the potential for precision medicine approaches in pancreatic cancer management.

### TABLE OF CONTENTS/OUTLINE

Precursors Lesions Pancreatic intraepithelial neoplasiaOverview Genetic LandscapeImaging signs for high grade lesionsCasesIntraductal papillary mucinous neoplasms OverviewGenetic LandscapeImaging signs for high grade lesionsCasesPancreatic Ductal AdenocarcinomaOverviewGenetic LandscapeImaging features CasesFuture DirectionsRole of imaging biomarkers in early detectionConclusions

## GIEE-41 MODELS OF BOWEL ULTRASOUND INTEGRATION INTO THE CLINICAL PRACTICE TO ASSESS AND MONITOR INFLAMMATORY BOWEL DISEASE

Stephanie R. Wilson, MD (*Abstract Co-Author*) Equipment support, Koninklijke Philips NV;Equipment support, Siemens AG;Equipment support, Samsung Electronics Co, Ltd;Research support, Samsung Electronics Co, Ltd;
Sudha A. Anupindi, MD (*Abstract Co-Author*) Nothing to Disclose
David Bruining, MD (*Abstract Co-Author*) Consultant, Medtronic plc;Research support, Medtronic plc;Research support, Takeda Pharmaceutical Company Limited

Alexandra Medellin, MD (*Abstract Co-Author*) Nothing to Disclose
Bari Dane, MD (*Abstract Co-Author*) Nothing to Disclose
Safa Hoodeshenas, MD (*Abstract Co-Author*) Nothing to Disclose
Kathryn A. Robinson, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The expanding inflammatory bowel disease (IBD) medication armamentarium has fueled the need for non-invasive, accurate and low-cost disease activity monitoring tools. Bowel ultrasound (US) is an emerging tool, increasingly used by gastroenterologists and radiologists. It is an accurate, noninvasive tool for detecting disease activity and IBD complications. It has been used for many decades in Europe and Canada and is now being utilized in the USA for initial assessment, monitoring disease and treatment response. Our aim is to 1) highlight the clinical utility of bowel US in assessment of IBD and monitoring patients post treatment with Crohn's disease and ulcerative colitis, 2) discuss the benefits of various models of bowel US integration into the clinical practice, 3) highlight collaboration with gastroenterologists to know appropriate escalation of imaging beyond bowel US.

**TABLE OF CONTENTS/OUTLINE**

Introduction 1. Review conventional approach to IBD monitoring in the USA. 2. Discuss limitations of the conventional model of IBD monitoring. 3. Discuss why imaging is important in IBD assessment. 4. Review US features of Crohn's Disease and Ulcerative Colitis 5. Review models of Bowel US integration into the Clinical practice a. Point of Care Ultrasound only i. Grey scale, Doppler b. Clinical Radiology Ultrasound only i. Grey scale, Doppler, elastography, contrast enhanced, microvessel imaging. c. Combined Hybrid model between gastroenterology and radiology 6. Future- Patient Handheld US, US with AI Conclusions

## GIEE-42 BILIARY ANASTOMOSIS IN CENTRAL BILE DUCT INJURY: WHAT INFORMATION IS ESSENTIAL FORASSESSMENT?

Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela L. Mendieta Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Arizaga, MD (*Abstract Co-Author*) Nothing to Disclose
Karly Cristhelly Garrido Estrella, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To explain the anatomical variations of the intrahepatic bile ducts. To identify the most commonly used classifications for benign biliary tract lesions. To explain the common surgical techniques for biliodigestive anastomosis. To review the expected radiological findings.

**TABLE OF CONTENTS/OUTLINE**

Introduction. Anatomy of the bile duct. Most used classifications of bile duct injuries. Classification and surgical techniques of anastomosis. Imaging of biliodigestive anastomosis. Conclusions. References.

## GIEE-43 BOWEL AND BEYOND IN THE ANGRY GUT: IMAGING OF INTESTINAL AND EXTRA-INTESTINAL MALIGNANCIES IN INFLAMMATORY BOWEL DISEASE

Harshna V. Vadvala, MD (*Abstract Co-Author*) Nothing to Disclose
Rakhee S. Gawande, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammadreza Shaghaghi, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Inflammatory bowel disease (IBD) with its 2 subtypes, Crohn’s disease (CD) and ulcerative colitis (UC), is characterized by a chronic inflammation of the intestine. In IBD, both, Inflammation and cancer affects intestinal and extra-intestinal sites. Risk factors for cancer development include severe inflammatory activity , prolonged duration of structuring or penetrating disease?, young age of diagnosis, male sex, smoking? and use of steroids and immunomodulators (6-mercaptopurine, azathioprine or anti-TNF drugs). In this educational exhibit we will discuss the incidence, pathologic and imaging features of small bowel, colon, rectal and anal cancers associated with IBD. We will also discuss manifestations of hepatobiliary cancers in IBD. Although imaging surveillance is not routinely recommended in IBD, cross-sectional imaging plays a crucial role for detection of malignancies, staging of cancer, detection of cancer in bowel segments which cannot be assessed by colonoscopy and also for detection of treatment-related neoplasms.

**TABLE OF CONTENTS/OUTLINE**

1. Background 2. Pathogenesis of cancers in IBD 3. Risk and protecting factors 4. Imaging modalities 5. Colon cancer in UC 6. Small bowel adenocarcinoma in CD 7. Other bowel cancers in CD: Neuroendocrine tumors and Lymphoma 8. Peri-anal and vulvovaginal cancers in CD 9. Hepatobiliary cancers in IBD 10. Surveillances of cancers in IBD

## GIEE-44 SPECTRUM OF IMAGING FINDINGS IN SINUSOIDAL OBSTRUCTION SYNDROME (SOS)

**Awards**
**Certificate of Merit**

Manjiri K. Dighe, MD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Research Grant, General Electric Company
Theodore J. Dubinsky, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme M. Cunha, MD (*Abstract Co-Author*) Nothing to Disclose
Manish Dhyani, MD (*Abstract Co-Author*) Nothing to Disclose
Rajat Bhargava, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Saubhagya Srivastava, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Provide an overview of SOS, previously known as Veno-Occlusive disease (VOD) - definition, epidemiology, pathophysiology and etiologies.2. Briefly discuss the current clinical diagnostic criteria utilized in VOD/SOS - historic and current standards.3. Provide detailed radiological and schematic depictions of imaging findings of VOD/SOS across various imaging modalities.4. Provide a brief note on evaluation of progression and management including Defibrotide.

**TABLE OF CONTENTS/OUTLINE**

1. Veno-occlusive disease (VOD)/ Sinusoidal obstruction syndrome (SOS) a. Definition, Epidemiology, and Pathophysiology. b. Etiology - Detailed discussion of causes of VOD/SOS and common drugs causing VOD/SOS: i. Differential diagnoses including Budd-Chiari syndrome, graft versus host disease, medication-induced and viral hepatitis, mycotic infections, and acute heart failure.2. Clinical diagnostic criteria: a. Modified Seattle criteria. b. Baltimore criteria. c. Currently used European Society for Blood and Marrow Transplantation (EBMT) criteria - adult and pediatric criteria.3. Ultrasound (US) in SOS: a. Role of sonography, advantages, and disadvantages. b. Conventional high-resolution B-mode US findings. c. Color and spectral Doppler

US findings.d. US-Elastography findings - ARFI, SWE, and TE. e. Contrast-enhanced ultrasound (CEUS) findings. f. Lassau's criteria HokUS-10 criteria4. Contrast-enhanced CT (CECT) in SOS: a. CECT findings associated with SOS. b. Role of CT in problem-solving of clinically difficult cases5. MRI in SOS: a. MRI findings associated with SOS. b. Role of MRI in problem-solving of clinically difficult cases6. Grading severity of VOD /SOS and Management - Defibrotide

## GIEE-45 LATERAL PELVIC LYMPH NODES IN RECTAL CANCER: TAKE IT OR LEAVE IT

Joao Manoel M. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Cotti (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recognize the anatomy of the rectum on the magnetic resonance imaging (MRI). Understand aspects related to rectal cancer and disease spread. Detailed knowledge on identifying and characterizing lateral pelvic lymph nodes (LPLN) in MRI and their prognostic significance. Insight into the decision-making process for managing LPLN in locally advanced rectal cancer (LARC), balancing oncological outcomes with quality of life considerations.

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION: Overview of rectal anatomy and MRI anatomical landmarks. Pathophysiology of LARC and lymphatic dissemination patterns. The pivotal role of LPLN in rectal cancer spread and patient prognosis. 2. DIAGNOSIS AND IMAGING FINDINGS: Criteria for malignant LPLN characterization on MRI. The process of staging and restaging LARC with MRI post-neoadjuvant chemoradiotherapy (nCRT). Prognostic implications of LPLN involvement. Treatment strategies: Evaluating nCRT, lateral pelvic lymph node dissection (LPLND), and selective LPLND. 3. SUMMARY AND SYSTEMATIC APPROACH: A streamlined approach to integrating imaging findings with clinical decision-making. 4. TAKE HOME MESSAGES.

## GIEE-46 HEPATIC ABSCESS: THE TIP OF AN ICEBERG - A STEP BY STEP TO ITS ORIGIN

Marilia A. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Lais F. Pimentel, MD (*Abstract Co-Author*) Nothing to Disclose
Isabella Torres de Lima, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the main diseases that cause liver abscesses and provide tips for evaluating imaging tests.- Discuss the main causes of a liver abscess and its pathophysiology.- Systematize the search for the etiology of liver abscess.

### TABLE OF CONTENTS/OUTLINE

An abscess is a well-defined, low-attenuation, round mass containing necrotic inflammatory material. The hepatic abscess is the most common of visceral abscesses and is usually a consequence of other changes, such as infections, trauma, or tumors, which must be identified for better patient management.Therefore, when identifying a liver abscess, the radiologist's analysis cannot stop there. They must keep in mind the most common causes and look for the possible origin of the abscess, since the clinical symptoms can be nonspecific and imaging exams play a fundamental role in this investigation.By following three simple steps: firstly, using clinical information; secondly, understanding the main origins of liver abscesses and their pathophysiology; and finally, combining the first two steps to identify findings, it is possible to detect the majority of conditions causing liver abscess, thus assisting the attending physician in the care of the patient.

## GIEE-47 TORSION AND VOLVULUS: A TALE OF TWISTS AND TURNS IN THE BELLY

Sarah K. Oh, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda S. Mazzariol, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine Eacobacci, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Multiplanar CT review is important in cases of large bowel volvulus to discern the anatomy: “X marks the spot” in mesentero-axial volvulus and “split wall-sign” in organo-axial volvulus. 2. Hyperdense, unenhanced bowel wall with mural hemorrhage is the single best predictor of irreversible ischemia and may be mistaken for wall enhancement on contrast CT. 3. J-pouch torsion can occur as part of afferent limb syndrome due to progressive dilatation of the ileum, or as efferent limb syndrome with a stapled anastomosis. 4. Gastric axis rotation is commonly seen with large hiatal hernias, but is often asymptomatic. Gastric volvulus is rare, but is a surgical emergency. Recognition of Borchardt’s triad along with key imaging findings is critical. 5. Gallbladder torsion is rare, often occurs in elderly women, and simulates cholecystitis on imaging. It requires urgent cholecystectomy and the diagnosis is often made at surgery. 6. Pedunculated uterine fibroid torsion may be confused with adnexal torsion because the pedicle is thin and difficult to visualize. 7. Splenic torsion is rare but can be fatal. Abnormal location of the avascular spleen is a clue. 8. If the abnormal position of the transplanted kidney is not recognized, renal transplant torsion may be mistaken for donor vein obstruction or arterial stenosis.

### TABLE OF CONTENTS/OUTLINE

Illustrated review of pathophysiology and clinical features of abdominal viscera torsion and volvulus while emphasizing pearls and pitfalls of imaging. Multimodality examples of volvulus and torsion including but not restricted to: Gut (sigmoid colon, transverse colon, cecum, small bowel, gastric and J pouch), Renal transplant, Gallbladder, Uterus, Uterine fibroid, Spleen and splenule

## GIEE-48 ESOPHAGEAL STRICTURES: THE KEYS TO DIAGNOSIS BY PNEUMO-CT

**Awards**
**Certificate of Merit**

Mariano Lorea (*Abstract Co-Author*) Nothing to Disclose
Paula Gimena Ortiz Suarez (*Abstract Co-Author*) Nothing to Disclose
Fiorella Conca, MD (*Abstract Co-Author*) Nothing to Disclose
Roy Lopez Grove, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Pneumo-CT provides key information by facilitating additional esophageal distension, aiding in the evaluation of esophageal wall thickening and extraesophageal disease in a single examination.2) Benign strictures exhibit reduced esophageal distensibility in pneumo-CT due to fibrotic wall changes. The primary cause is gastroesophageal reflux disease, typically manifesting as concentric, symmetric, soft-edged wall thickening in the distal esophagus associated with a hiatal hernia.3) Personal history is pertinent for diagnosing the underlying cause of a benign stricture.4) Malignant strictures present with rapid onset of symptoms including dysphagia and weight loss. They appear as asymmetric and irregular thickening of the esophageal wall, sometimes accompanied by adenopathy and involvement of surrounding fat planes, depending on the extent of tumor infiltration.5) The differential diagnosis primarily involves esophageal dilatation, predominantly caused by dysmotility.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction.2) Diagnostic algorithm for esophageal strictures: Upper endoscopy, barium esophagogram, pneumo-CT.3) Pneumo-CT technique.4) Key findings in pneumo-CT. Esophageal wall: Margins, narrowing, contour, mucosal surface, enhancement. Extraluminal findings: fat, lymph nodes, metastases.5) Benign strictures: Pathophysiology. Causes.6) Malignant strictures: Pathophysiology. Causes.7) Differential diagnoses.

## GIEE-49 ATYPICAL PANCREATIC MASSES AND TUMOR-LIKE LESIONS - BEYOND DUCTAL ADENOCARCINOMA

**Awards**
**Magna Cum Laude**

Mariano Volpacchio, MD (*Abstract Co-Author*) Nothing to Disclose
German Espil (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To overview imaging findings of tumors anda tumor-like lesions in the pįncreas according to WHO classification- To review unusual pancreatic masses clinical, pathologic and imaging features with a case-based approach- To provide diagnostic clues useful to assist in proper diagnosis and management

**TABLE OF CONTENTS/OUTLINE**

1. Introduction2. Ephitelial exocrine tumor3. Neuroendocrine neoplasms4. Mesenchimal tumours5. Hematologic tumours6. Secondary tumours7. Tumor - Like lesion8. Summary

## GIEE-5 BELOW THE DIAPHRAGM AND AROUND OF EQUATOR: A PICTORIAL REVIEW ON ABDOMINAL MANIFESTATIONS OF TROPICAL ENDEMIC DISEASES

Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Bekhor, MD (*Abstract Co-Author*) Nothing to Disclose
Francisco C. Brasil (*Abstract Co-Author*) Nothing to Disclose
Bruna K. Andreucci, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea L. Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Julia De Toledo Mendes, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia Goncalves Dias (*Abstract Co-Author*) Nothing to Disclose
Aley Talans, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Present diseases endemic to tropical regions. - Review key epidemiological and clinical features of tropical diseases. - Discuss imaging characteristics of tropical diseases, both common and uncommon. - Emphasize the radiologist's pivotal role in expanding diagnostic considerations and assessing disease extent for improved outcomes.

**TABLE OF CONTENTS/OUTLINE**

Tropical diseases (TDs) impact underserved areas, caused by various pathogens like bacteria, viruses, parasites, and fungi. These diseases have significant health, social, and economic impacts. With increased global travel, recognizing these diseases quickly is vital for radiologists to improve patient care through prompt diagnosis and treatment. This presentation delivers insights into abdominopelvic imaging for major TDs through engaging cases, covering: 1. Demonstrate typical and atypical abdominal imaging manifestations of major tropical diseases via educational cases. 2. Detail epidemiology and imaging findings of abdominopelvic presentations in: a. Parasitic: Helminth infections such as Schistosomiasis, Echinococcosis, Ascariasis, Strongyloidiasis; and Protozoal infections including Leishmaniasis and Chagas disease. b. Bacterial: Specifically, Tuberculosis. c. Fungal: Highlighting Paracoccidiomycosis and Histoplasmosis. d. Viral: Covering Dengue fever. 3. Provide an understanding of the main risk factors, along with the prevalence and incidence of the most encountered endemic tropical infectious diseases.

## GIEE-50 INFLAMMATORY AND NON-INFLAMMATORY ABDOMINAL CONDITIONS: STAY ALERT FOR YOUR NEOPLASTIC COMPLICATIONS

**Awards**
**Certificate of Merit**

Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Velloni, MD (*Abstract Co-Author*) Nothing to Disclose
Glaucy L. Neme, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Renata S. Nascimento, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• List the main abdominal inflammatory diseases that increase the risk of neoplasms • List the main non-inflammatory abdominal conditions that increase the risk of neoplasms • Illustrate with cases the characteristics of chronic inflammatory diseases and non-inflammatory abdominal conditions that have evolved into neoplasms using computed tomography (CT) and magnetic resonance imaging (MRI) • Enhance the recognition and interpretation of neoplastic complications in patients with pre-malignant inflammatory and non-inflammatory changes • Demonstrate the importance of understanding the neoplastic complications of inflammatory and non-inflammatory abdominal conditions

**TABLE OF CONTENTS/OUTLINE**

Describing the imaging presentations of chronic inflammatory diseases and their neoplastic complications Primary sclerosing cholangitis • Cholangiocarcinoma Inflammatory bowel disease • Adenocarcinoma of the small bowel Hereditary pancreatitis • Pancreatic adenocarcinoma Metabolic dysfunction associated steatotic liver disease (MASLD) • Hepatocellular carcinoma Describing the imaging presentations of non-inflammatory abdominal conditions that increase the risk of neoplasms and their malignant complications Cryptorchidism • Testicular germ cell tumor Urachal remnant • Bladder adenocarcinoma Bladder diverticulum • Urothelial neoplasia Endometriosis• Endometrioid carcinoma or clear cell carcinoma

## GIEE-51 UNVEILING THE DIFFERENT TONES OF CROHNS

Jose A. Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia B. Sotomayor Rivera (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Abstract Co-Author*) Nothing to Disclose
Adriana Perez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Identify early, chronic, and severe signs of active inflammatory Crohn’s disease and recognize how imaging findings can overlapReview the major gastrointestinal anatomy involved in this pathology and understand its pathophysiologyGo over severity score in active Crohn's disease to provide a complete radiological assessment of the disease.Understand major radiological differences between stricturing and penetrating and highlight the most common complications

**TABLE OF CONTENTS/OUTLINE**

I. IntroductionII. ObjectivesIII. Anatomical diagrams of areas affected by Crohn's disease and pathophysiologyVI. Gastrointestinal features of Crohn's disease on CT and MRI 1. Active versus non-active/chronic disease 2. Penetrating versus stricturing disease 3. Common complications 4. Radiological severity score of active inflammatory diseaseVII. Self-assessment with multiple cases in quiz format VIII. ConclusionHistorically a higher incidence of IBD has been reported in Caucasians and lower rates in Black and Hispanic populations however, during the past decades these differences have decreased. There has been an increase in IBD in blacks, Hispanics, and Asians. With increased incidence among a broader population it is vital for radiologists to be familiar with what was only classically found in a specific population. Through this educational exhibit, we will provide a comprehensive review of classic radiological features of active and non-active Crohn's disease, stricturing versus penetrating disease, and its associated complications as seen on CT and MR. Our aim is to increase awareness of this disease among radiologists in order to assist physicians in early detection and treatment.

## GIEE-52 IBD THERAPEUTICS: MECHANISM OF ACTION, MONITORING, POTENTIAL SIDE EFFECTS AND RISKS

**Awards**
**Certificate of Merit**

Rony Kampalath, MD (*Abstract Co-Author*) Nothing to Disclose
Parakkal Deepak, MBBS (*Abstract Co-Author*) Consultant, Johnson & Johnson;Advisory Board, Johnson & Johnson;Consultant, Pfizer Inc;Advisory Board, Pfizer Inc;Consultant, Prometheus Pharmaceuticals;Advisory Board, Prometheus Pharmaceuticals;Consultant, Boehringer Ingelheim GmbH;Advisory Board, Boehringer Ingelheim GmbH;Grant, Boehringer Ingelheim GmbH;Consultant, Arena Pharmaceuticals;Advisory Board, Arena Pharmaceuticals;Grant, Arena Pharmaceuticals;Grant, Takeda Pharmaceutical Company Limited;Grant, Bristol-Myers Squibb Company;;;
David Bruining, MD (*Abstract Co-Author*) Consultant, Medtronic plc;Research support, Medtronic plc;Research support, Takeda Pharmaceutical Company Limited
Jalpa Devi (*Abstract Co-Author*) Nothing to Disclose
Safa Hoodeshenas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• To review briefly recent advancements in therapeutic approaches to inflammatory bowel disease (IBD)• To describe the current understanding of the mechanisms of action of different IBD medications• To highlight the side effect profiles and risks that radiologists need to aware of

**TABLE OF CONTENTS/OUTLINE**

1.Introduction to IBD and the expanding medication armamentarium2.Imaging to guide management decisions3.Mechanisms of Action of IBD Therapeutics and their potential side effects§ Aminosalicylates (5-ASAs)§ Corticosteroids§ Immunomodulators (e.g., Azathioprine, 6-Mercaptopurine, methotrexate)§ Biologic agents: Anti-TNF agents (e.g., Infliximab, Adalimumab, Certolizumab Pegol, and Golimumab),Integrin receptor antagonists (e.g., Vedolizumab, Mirikizumab), Interleukin inhibitors (e.g., Ustekinumab, Risankizumab)§ Small molecule drugs: JAK inhibitors (e.g., Tofacitinib, Upadacitinib) and sphingosine-1-phosphate receptor modulators (Ozanimod, Etrasimod)

## GIEE-53 ACUTE CHOLANGITIS, WHAT THE RADIOLOGIST NEEDS TO KNOW

Israel Vicente Toledo Coronado, MD (*Abstract Co-Author*) Nothing to Disclose
Tania D. Grimaldo Galeana, MD (*Abstract Co-Author*) Nothing to Disclose
Hector Alvarez-Manzo, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Alpizar, MD,MEd (*Abstract Co-Author*) Nothing to Disclose
Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa De Jesus Ramos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To describe the anatomy and physiology of the biliary tree. To list the diagnostic criteria of acute cholangitis.To describe the main imaging techniques for the evaluation of the biliary tract.With the help of representative images of acute cholangitis, and acute/chronic complications , to review the typical imaging findings of an abnormal biliary tree.To evaluate the differential diagnosis of cholangitis through representative images of congenital and acquired pathologies, as well as neoplasm that affect the biliary tree.To describe the role of interventional radiology in the treatment of complicated cholangitis.

**TABLE OF CONTENTS/OUTLINE**

-Anatomy and physiology of the biliary tree. -Acute cholangitis: Definition, classification, etiology, epidemiology, pathophysiology, clinical and laboratory findings, diagnostic criteria (Tokyo guidelines) and radiologic diagnosis (ultrasound, computed tomography, magnetic resonance imaging, magnetic cholangioresonance, cholangiography and contrast-enhanced ultrasound (CEUS)). -Acute complications: Pericholangitic and liver abscesses, sepsis, portal vein thrombosis. -Chronic complications: Biliary stricture, secondary sclerosing cholangitis and cholangiocarcinoma. -Differential diagnosis: Choledocholithiasis, gallbladder perforation, primary sclerosing cholangitis, biliary pancreatitis, liver metastases, primary biliary cholangitis, cholangiocarcinoma, periampullary tumors and drug-induced liver injury. -Cholangitis post liver transplantation: Diagnosis with computed tomography and Doppler ultrasound. -Treatment with interventional radiology: Percutaneous transhepatic biliary drainage.

## GIEE-54 IMMUNE-MEDIATED LIVER DISEASE: MULTIMODALITY IMAGING AND PATHOLOGY CORRELATION

Douglas M. Rogers, MD (*Abstract Co-Author*) Royalties, RELX
Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Maryam Rezvani, MD (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Linda C. Kelahan, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Reham M. Ellessy, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Understand normal autoimmune regulation mechanisms.• Described different patterns of hepatic involvement in autoimmune diseases.• Imaging features and pathology correlation of common immune-mediated liver disease.

### TABLE OF CONTENTS/OUTLINE

• Introduction- Pathophysiology of immune-mediated disease- Immunocompromised patients• Main regulators of the immune response• Vascular involvement- Autoimmune vasculitis- Autoimmune coagulopathies.• Autoimmune associated biliary disease- Primary biliary cholangitis- Primary sclerosing cholangitis- IgG-4 mediated hepatobiliary disease• Autoimmune mediated liver parenchymal disease- Autoimmune hepatitis• Special groups- Liver transplantation- Acute rejection- Hyper acute rejection- Chronic rejection- Graft versus host disease- The immunocompromised patient- Infections- Malignancies

## GIEE-55 MULTIMODALITY IMAGING OF FOCAL PANCREATIC LESIONS: THE ADDED ADVANTAGE OF ENDOSCOPIC ULTRASOUND

Shrivalli Nandikoor, MBBS (*Abstract Co-Author*) Nothing to Disclose
Halkurike Jayadevappa Vijay Kumar (*Abstract Co-Author*) Nothing to Disclose
Gayathri S Menon, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pancreatic focal lesions can be malignant or benign, cystic, solid or solid-cystic, with varying presentations. Multiple imaging modalities are used for diagnosis of pancreatic lesions including MDCT, MRI, USG ,PET-CT and Endoscopic ultrasound(EUS). EUS has the added advantage of high resolution imaging and the possibility of targeted tissue sampling simultaneously. This helps in detailed characterization of lesions with detection of details that can be otherwise missed in other imaging modalities. Aim of this exhibit is multimodality imaging review of spectrum pancreatic focal lesions and special emphasis on the added value of endoscopic ultrasound in characterization and diagnosis of these lesions

### TABLE OF CONTENTS/OUTLINE

Case based multimodality imaging review of pancreatic focal lesions and comparison with endoscopic ultrasound evaluation for characterization and diagnosis. The exhibit will include spectrum of cases including simple cyst, pseudocyst, serous cystadenoma, mucinous cystic neoplasm, IPMN,SPEN, NETs, Adenocarcinoma pancreas, metastatic deposits, focal pancreatitis.

## GIEE-56 INFILTRATIVE HEPATOCELLULAR CARCINOMA: CHALLENGING CASES AND ITS BENIGN MIMICS WITH RAD-PATH CORRELATION

Rashmi T. Nair, MD (*Abstract Co-Author*) Nothing to Disclose
Michael J. Nisiewicz, MD (*Abstract Co-Author*) Nothing to Disclose
Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
Kyle Kleiman (*Abstract Co-Author*) Nothing to Disclose
Ronak Patel, BS (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmed M. Sobieh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Harit Kapoor, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
Elhamy R. Heba, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Hepatocellular carcinoma is one of the leading causes of cancer related death worldwide. Various histopathologic and morphologic subtypes of HCC are described throughout the literature. Among all these subtypes, infiltrative type HCC is the most challenging to detect clinically and radiographically. Infiltrative HCC is characterized by diffuse infiltrative spread throughout the liver parenchyma, without forming a mass-like lesion, in a way that sometimes it is difficult to detect on a background of already abnormal liver parenchyma. The infiltrative fashion of this disease makes other infiltrative liver diseases mimic the appearance of this malignancy on imaging. This includes confluent fibrosis, diffuse hepatic steatosis or iron deposition, diffuse metastatic disease, cholangiocarcinoma, and hepatic micro abscesses. Distinguishing infiltrative HCC mimics on imaging is crucial due to difference in management and the poor prognosis of this infiltrative malignancy. We will show challenging cases of infiltrative HCC and mimics of infiltrative HCC using a case-based approach with Rad-Path correlation.

### TABLE OF CONTENTS/OUTLINE

1. Incidence and prevalence of infiltrative HCC. 2. Review imaging features of infiltrative HCC, including multimodality case-based review of challenging cases of infiltrative HCC with pathological correlation. 3. Portal vein thrombosis (including tumor thrombus) as a common finding in infiltrative HCC. 4. Case-based review of infiltrative HCC mimics including confluent fibrosis, diffuse hepatic steatosis/iron deposition, diffuse metastatic disease, cholangiocarcinoma, and hepatic micro abscesses. 5. Review of prognosis and management of infiltrative HCC.

## GIEE-57 EXPLORING ESOPHAGOGRAM PATHOLOGIES: BUMPS, DOTS AND BEYOND

Monica Chapa-Ibarguengoitia, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Alpizar, MD,MEd (*Abstract Co-Author*) Nothing to Disclose
Nicolas Serrano III, MD (*Abstract Co-Author*) Nothing to Disclose
Lourdes M. Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Jonahi S. Serrano Heredia, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the classic findings of esophageal pathologyDiscuss the utility of dynamic esophagram studiesIntegrate imaging findings with systemic diseases.

**TABLE OF CONTENTS/OUTLINE**

BackgroundEsophagogram anatomyFunctional diseasesAnatomical defectsVascularTumorsImmunologicalInfectiousCased based review of dynamic studies (Gift and video form) with quiz.

## GIEE-58 DIFFERENTIATING THE COLORECTAL MUCINOUS METASTASIS FROM OTHER HEPATIC LESIONS: TIPS AND TRICKS

Giovanni Morana, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
COSTANTINA DAL MAGRO (*Abstract Co-Author*) Nothing to Disclose
Luisa Tomaiuolo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To illustrate with some interesting cases the appearance of the hepatic mucinous metastasis from colorectal primary malignancy and give some tips and tricks for the achievement of the correct diagnosis.

**TABLE OF CONTENTS/OUTLINE**

The radiological features of mucinous carcinoma metastasis in the liver are sometimes unclear and dependent on the mucinous/fibrosis component proportion. Distinguishing these lesions from cholangiocarcinoma or benign entities such as angioma and solitary necrotic nodules can be challenging for radiologists. This essay discusses with some examples the key characteristics of hepatic mucinous metastasis observed in TC and MR imaging, focusing on the lesion morphology, the vascular pattern and the restriction on the DWI sequences. Finally, we outline the primary differential diagnoses and their imaging behaviors on CT/MRI.CT/MRI imaging features of mucinous colorectal metastasis in the liver could be a challenging diagnosis for radiologists. The patient history and the evolution of the lesion are crucial, especially with small lesions

## GIEE-59 LIVER STORAGE DISEASES: WHAT RADIOLOGISTS NEED TO KNOW

Aldara Naveiras Calvo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The liver is the fundamental organ for human metabolism. A multitude of factors, from hereditary diseases to alcohol or an unhealthy lifestyle habit, can lead to the accumulation of substances in the liver, eventually leading to the development of chronic liver disease. Radiologists play a crucial role in the early diagnosis of such diseases and knowing how to detect and measure them, and rule out complications is critical. We focus on the two substances most commonly deposited, fat and iron, while also mentioning less frequent causes such as copper, lysosomal storage diseases, and amyloidosis. We emphasize some pitfalls that can arise from such depositions and to what extent they can aid us in diagnosing lesions.

**TABLE OF CONTENTS/OUTLINE**

- Steatosic liver- Liver iron overload- Other causes: copper, lisosomal storage diseases, amyloidosis

## GIEE-6 UPDATE ON NOVEL BIOLOGIC THERAPIES FOR CROHN'S DISEASE AND IMPACT OF IMAGING ON CLINICAL DECISION-MAKING

Kian Keyashian (*Abstract Co-Author*) Nothing to Disclose
Michael S. Gee, MD, PhD (*Abstract Co-Author*) Researcher, General Electric Company Researcher, Siemens AG Researcher, Motilent LLC
Richa D. Patel, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review novel Crohn's biologic therapies GI perspective on therapy algorithms2. Describe clinical scenarios in which imaging prompts therapy change with case examples3. Discuss imaging features associated with biologic treatment response

**TABLE OF CONTENTS/OUTLINE**

• Intro to Crohn's Disease (CD)• Imaging:§ Rationale for certain studies (CTE, MRE, XR)§ When to image (asymptomatic, symptomatic, coordinate with therapy)§ How imaging integrates with endoscopic findings biomarkers• Treatment algorithm:§ Top-down vs step up• GI rationale for deciding therapy• Flowchart of treatment pathway exceptions§ Agents:• Molecular target, administration route, dose• Indication:o Penetrating stricturing CDo Small bowel vs colonico Perianal CD• Complications prompting therapy change• Imaging CD on biologics:§ Treatment endpoints• Mucosal healing• Deep remission• Radiologic response§ What radiologists look for on imaging• Findings pivotal to affecting management on therapy (switch agents, add agents, endoscopic/surgical therapy)o Fistulizing CDo Perianal CDo Stricturing CD +/- active inflammation§ Radiologic vs non-radiologic assessment of CD response• How biomarkers symptoms correlate with imaging§ Case-based review of scenarios where imaging influences therapy why• Strictures• Enteric perianal fistulas• Resection• Mild CD not requiring therapy• Severe CD requiring immediate surgery vs therapy with agent switch§ Therapy selection (factors affecting therapy selection change):• Clinical factorso Symptomso Endoscopic radiologic signs of healing or progression, biomarkers• Patient factorso Cost/insurance coverageo Administration routeo Social constraints (access, compliance)

## GIEE-60 ALL YOU NEED TO KNOW IN IMAGING OF LIVER INFECTIONS

Sung Yoon Park, MD (*Abstract Co-Author*) Nothing to Disclose
Rajat Bhargava, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Smooth outline and liquified core either in a single locule or multiple small locules are critical to diagnosis of abscess Double Target appearance is the most specific sign Klebsiella Pneumoniae often produces multilocular pyogenic abscesses Parasitic infections often have peripheral eosinophilia Embroyonal sarcoma, cholangiocarcinoma often mimic Abscesses.

**TABLE OF CONTENTS/OUTLINE**

1. Objectives 2. Imaging spectrum by morphology 3. Imaging signs 4. Imaging spectrum by organism 5. Tumors masquerading as Abscesses

## GIEE-61 SEEING BEYOND THE SURFACE: IMAGING OF ACUTE ABDOMINAL COMPLICATIONS IN ONCOLOGICAL PATIENTS

Graziela C. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina P. Abud, MD (*Abstract Co-Author*) Nothing to Disclose
Marina M. Costa (*Abstract Co-Author*) Nothing to Disclose
Lhuanna Maria Barbosa Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Camila P. Reifegerste, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Batista Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Uski, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Helena N. Pedroso (*Abstract Co-Author*) Nothing to Disclose
Heloise Miranda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The increasing incidence of neoplasms, has also increased cancer-related complications, including abdominal ones. These complications may be related to the direct effect of the tumor, through compression or infiltration, systemic changes or due to invasive procedures (diagnostic or therapeutic).The purpose of this ehxibit is to: • Highlight signs of acute abdominal complications in patients with known neoplasia on computed tomography (CT) and magnetic resonance imaging (MRI); • Identify possible signs of malignancy in patients with an acute abdominal condition as the initial manifestation of an unknown neoplasia; • Explore acute abdominal manifestations that can affect patients with cancer, including hemorrhage, bowel obstruction, perforation, fistula, ischemia and cholangitis; • Correlate between clinical information, histological studies and imaging findings, in order to refine the differential diagnosis; • Provide practical information and pitfalls in the interpretation of imaging findings.

### TABLE OF CONTENTS/OUTLINE

• Introduction; • Imaging aspects - case based didatic review of the radiological appearance of abdominal complications in oncological patients, including hemorrhage, bowel obstruction, perforation, fistulas, ischemia and cholangitis; • Pearls and Pitfalls; • Conclusion/Take home message; • References.

## GIEE-62 GET INTO THE GROOVE: A PICTORIAL REVIEW OF PANCREATICODUODENAL GROOVE PATHOLOGIES

Cammillo R. Talei Franzesi (*Abstract Co-Author*) Nothing to Disclose
Davide Ippolito, MD (*Abstract Co-Author*) Nothing to Disclose
Rocco Corso, MD (*Abstract Co-Author*) Nothing to Disclose
Cesare Maino, MD (*Abstract Co-Author*) Nothing to Disclose
Paolo N. Franco, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The pancreaticoduodenal groove (PDG) is a space between the second duodenal portion and the head of the pancreas. Superiorly, it’s delimitated by the duodenal bulb, posteriorly by the inferior vena cava, and anteriorly by the third duodenal part. PDG is also traversed by the distal portion of the common bile duct (CBD) and contains fat and nodes. Due to the critical anatomical structures surrounding it, various entities can originate inside or close to this region.Pathologies of PDG may be classified by their origin. Many benign (groove pancreatitis, autoimmune pancreatitis) and malignant (adenocarcinoma, NETs, lymphomas) pancreatic diseases may arise in the PDG. The di"erential diagnosis between groove pancreatitis and pancreatic adenocarcinoma is the most challenging due to similar imaging findings. However, some di"erences can be spotted to aid in the correct diagnosis. Duodenal diseases involving the groove are diverticula, inflammation, and neoplasms (adenocarcinomas, GISTs, and lymphomas). Among CBD pathologies, the most frequent are distal cholangiocarcinoma and choledochal cysts. Finally, ampulla of Water and lymph nodes diseases may also a"ect this space. PDG lesions management encompasses follow- up controls, endoscopic resection, or complex surgical procedures. Consequently, a correct diagnosis and pre-operative imaging assessment are pivotal.

### TABLE OF CONTENTS/OUTLINE

1. PDG anatomy2. Imaging findings of pancreatic pathologies involving the PDG3. Imaging findings of duodenal pathologies involving the PDGG4. Imaging findings of common bile duct pathologies involving the PDG5. Imaging findings of other structures pathologies involving the PDG.

## GIEE-63 UNDERSTANDING PORTAL VEIN THROMBOSIS: CRUCIAL CONSIDERATIONS IN LIVER TRANSPLANTATION

Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Regis Otaviano Bezerra, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fabio P. Pereira (*Abstract Co-Author*) Nothing to Disclose
Paola Beninca, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understanding the classification of portal vein thrombosis (PVT), its epidemiology, and imaging features. - Exploring technical challenges posed by PVT during liver transplantation. - Discussing pre-transplant management strategies for PVT. - Identifying imaging findings that may contraindicate or complicate liver transplantation in the context of PVT.

### TABLE OF CONTENTS/OUTLINE

Introduction:- Overview of portal vein thrombosis and its significance in liver transplantation.- Role of imaging in assessing PVT and its implications for surgery.Portal Vein Thrombosis:- Definition, epidemiology, and clinical presentation.- Imaging features of PVT and differentiation from other vascular conditions.- Surgical considerations and challenges in patients with PVT undergoing liver transplantation.Pre-transplant Management:- Strategies for managing PVT before liver transplantation.- Role of radiological interventions and imaging surveillance in pre-transplant evaluation.Imaging in Liver Transplantation:- Assessment of imaging findings that may contraindicate or complicate liver transplantation in PVT patients.Case-Based Review:- Illustrative cases demonstrating imaging findings of PVT and their impact on liver transplantation.Future Directions:- Emerging techniques and advancements in imaging for PVT evaluation and management.- Potential areas for improving outcomes in liver transplantation for patients with PVT.Conclusion:- Summary of key considerations for radiologists in the context of PVT and liver transplantation.- Importance of multidisciplinary collaboration between radiologists, surgeons, and other specialists in optimizing patient care.

## GIEE-64 BETWEEN DUCTS AND DILATIONS: THE INTRIGUING WORLD OF IPMN

(*Abstract Co-Author*) Nothing to Disclose
Luiz Rodrigues Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Nara Vedoveli (*Abstract Co-Author*) Nothing to Disclose
Viviane B. Amorim, MD (*Abstract Co-Author*) Nothing to Disclose
Barbara De Melo Gedeon, MD (*Abstract Co-Author*) Nothing to Disclose
Igor J N Leite, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Reviewing the radiological anatomy of the pancreas and related structures. - Detailing imaging features of malignant transformation of intraductal papillary mucinous neoplasms (IPMN); - Discuss the characteristics and differences between the possible imaging methods used in the evaluation of the pancreas in the context of IPMN; - Exemplify the main imaging findings, with emphasis on magnetic resonance imaging, used for risk stratification in IPNM; - Describe the management and recommendations for imaging follow-up of diagnosed or presumed IPMN.

**TABLE OF CONTENTS/OUTLINE**

- Anatomy review- What are the cystic lesions of the pancreas and how to find them?- Narrowing the diagnostic.- Stratify the risk.- Guide the conduct.- When, where and how to follow up an IPNM?

## GIEE-65 ULTRASOUND FINDINGS OF COMPLICATIONS IN LIVER TRANSPLANTATION: AN EDUCATIONAL OVERVIEW

Teresa A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Saez, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Pividori (*Abstract Co-Author*) Nothing to Disclose
Aylen Gonzalez Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Miguel Manzanares, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Despite advancements in surgical techniques and postoperative care, complications following liver transplantation remain a significant concern. Ultrasound imaging is a pivotal tool due to its non-invasive nature and ability to provide real-time assessment. Radiologists must be acquainted with the imaging findings and complications. In this exhibit we will:Review vascular complications, including hepatic artery thrombosis and stenosis, and portal vein stenosis, manifest as alterations in blood flow patterns and vessel caliber, discernible through Doppler ultrasound.Review biliary complications, such as bile duct strictures and leaks, present as dilatation of the intrahepatic and extrahepatic ducts with associated periductal fluid collections. Discuss parenchymal abnormalities post-liver transplantation, including graft rejection, hepatic steatosis, and infections.Present the most common extra hepatic anomalies found after liver transplant, some of them related to the aforementioned predicaments.Correlate, if needed, the ultrasound findings with complementary methods of evaluation, like magnetic resonance or computed tomography.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction2. Imaging method key points3. Review the strengths and role of Doppler ultrasonography.4. Transitory alterations in the immediate post-transplant5. Classification of complications of liver transplant: Clinical parameters (age, type of transplant, postoperative time, symptoms) and sonographic findings (resistance index, velocity, waveform) are consider.VascularBiliaryParenchymal abnormalitiesGraft rejectionHepatic steatosisInfections6. Summary (table)7. Conclusions

## GIEE-66 PNEUMO PET-CT: ROLE IN ESOPHAGO-GASTRIC CANCER

**Awards**
**Cum Laude**

Pablo E. Biedak, MD (*Abstract Co-Author*) Nothing to Disclose
Roy Lopez Grove, MD (*Abstract Co-Author*) Nothing to Disclose
Fiorella A. Conca, MD (*Abstract Co-Author*) Nothing to Disclose
Valentina Garralda (*Abstract Co-Author*) Nothing to Disclose
Mariano Lorea (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Pneumo PET-CT is a distension-based CT technique combining with PET scan with FDG.Great utility in the staging of esophagogastric cancer in order to plan therapeutic strategy.Gives essential information to oncologists and surgeons about tumor extension, deep wall involvement, lymph node and distant metastasis in a single study, reducing radiation and iodinated-contrast media exposureEvaluates neoadjuvant therapy response on changes in FDG uptake

**TABLE OF CONTENTS/OUTLINE**

1- Introductiona) Epidemiological scenario in gastroesophageal cancerb) Advantages and disadvantages of current staging methods2- Pneumo PET-CT techniquea) Materialsb) Method to assess great lumen distension3- Findings in the staging of esophagus, gastroesophageal junction and gastric cancera) Imagenological key findings in T stagingb) Lymph nodes and distant metastasis (NM)4- Use in pre-surgical assessment and neoadjuvant therapya) Treatment response criteriab) Changes in FDG uptake5- Pitfalls and limitationsa) Insufficient gastric distension simulating an infiltrating tumorb) Overdistention mimicking adjacent organ infiltrationc) Residual liquid or food in the gastric lumen6- Conclusions

## GIEE-67 BENIGN FOCAL HEPATIC LESIONS: SEEKING ASSERTIVENESS AND RECOGNIZING LIMITS

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thiago M. Baraviera, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucas Aquino (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purposes of this exhibit are:To review the main topics of the differential diagnosis of focal benign hepatic lesions, taking into consideration imaging aspects and clinical context.To discuss, through didactic cases, the limits of assertiveness in the differential diagnosis of the main focal benign hepatic lesions.To alert about the presence of findings that act as pitfalls for the radiologist, potentially simulating benign and malignant lesions, creating doubts and diagnostic challenges.To assist the performance of radiologists as a guide in clinical management in different scenarios related to the theme.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION:To expose the existence of situations in which the presence of atypical characteristics and the clinical context may reduce the radiologist's assertiveness in the evaluation of benign focal hepatic lesions.DISCUSSION:To present, by means of a review based on didactic cases, the main points of the differential diagnosis, as well as the limits of assertiveness of imaging studies in the evaluation of benign focal hepatic lesions (cystic lesions; hemangiomas and metastases; hepatocellular lesions; pseudolesions and pitfalls).CONCLUSION:To summarize the main covered topics, reinforcing the importance of the radiologist's role as a guide for clinical management, with a direct impact on patient care pathways.

## GIEE-68 THE ROLE OF IMAGING IN ESOPHAGEAL CANCER: RADIOLOGIC PATTERNS WITH RADIOLOGIC-PATHOLOGIC CORRELATION

Gianpietro Zanchettin (*Abstract Co-Author*) Nothing to Disclose
Michele Valmasoni (*Abstract Co-Author*) Nothing to Disclose
Chiara Zerbato (*Abstract Co-Author*) Nothing to Disclose
Giovanni Sussan, MD (*Abstract Co-Author*) Nothing to Disclose
Matteo Scordari, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Moletta (*Abstract Co-Author*) Nothing to Disclose
Emilia Giugliano, MD (*Abstract Co-Author*) Nothing to Disclose
Matteo Pittacolo (*Abstract Co-Author*) Nothing to Disclose
Giovanni Capovilla (*Abstract Co-Author*) Nothing to Disclose
Renato Salvador (*Abstract Co-Author*) Nothing to Disclose
Emilio Quaia, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Filippo Crimi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Francesco Bigolin, MD (*Abstract Co-Author*) Nothing to Disclose
Francesca Galuppini (*Abstract Co-Author*) Nothing to Disclose
Carlo D'Alessandro, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

State of the art treatment for esophageal cancer is multimodal and involves combined surgical and medical therapy. CT has a central role in the staging of esophageal cancer, being the method of choice for this purpose; positron emission tomography (PET) and magnetic resonance imaging (MRI) [MOU1] can help to evaluate the metabolic activity of tumors, identify distant metastases, and assess treatment response. Serial imaging studies, including CT scans and PET scans, allow clinicians to assess the efficacy of therapeutic interventions, identify residual or recurrent disease, and modify treatment strategies accordingly. Emerging techniques, such as radiomics and molecular imaging, hold promise for enhancing the accuracy of diagnosis, predicting treatment response and guiding personalized therapy.

**TABLE OF CONTENTS/OUTLINE**

1. Concepts of normal and pathologic esophageal radiologic anatomy and lymphatic and hematogenous tumor spread pathways are explained.2.Illustrative cases of early-stage, locally advanced and oligometastatic esophageal cancer with clinical staging obtained by CT imaging applying the TNM 8th edition classification. Correlation of CT images with pathologic results is shown by detailed explanation of the findings.3. Emerging techniques: radiomics and molecular imaging for enhancing the accuracy of diagnosis, predicting treatment response, and guiding personalized therapy

## GIEE-69 US OF THE LIVER AND UPPER ABDOMEN FOR BEGINNERS: UNDERSTANDING WHAT TO DO, WHY DO IT, AND HOW TO DO IT

Monica Lucia Lopez Salazar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Understand why to carry out the study.- Remember liver anatomy.- Understand what structures we are seeing during the study, with anatomical and CT correlation.- Realization technique for adequate characterization and measurement of the liver and upper abdominal structures.-differentiate normal from abnormal findings and most common pathological findings in the liver:Hepatic steatosisChanges due to chronic liver damage (cirrhosis, portal hypertension, portal thrombosis)Focal lesions (Cyst, hemangioma, hepatocellular carcinoma)Data of non-specific inflammatory process (periportal edema, elevated hepatic artery velocity and resistance index)

**TABLE OF CONTENTS/OUTLINE**

Table of Contents: 1. Introduction: - Introduction to ultrasound and importance of liver and upper abdomen ultrasound in medical care. 2. Basic considerations before the study 3. Realization technique for adequate characterization and measurement of the following structures. - Evaluation of the left hepatic lobe. - Evaluation of the right hepatic lobe. - Evaluation of the portal vein. - Evaluation of the hepatic artery. - Evaluation of the hepatic veins. - Evaluation of the gallbladder. - Kidney evaluation. - Evaluation of the spleen. - Evaluation of the pancreas. 4. Most frequent pathological findings in the liver: - Hepatic steatosis - Changes due to chronic liver damage. - Focal lesions. - Data of non-specific inflammatory process. 5. Conclusions.

## GIEE-7 IMAGING FINDINGS FOR HEPATOCELLULAR CARCINOMA ON MAGNETIC RESONANCE IMAGING: PREDICTIVE FEATURES AND FUTURE PERSPECTIVES FOR IMMUNE CHECKPOINT INHIBITOR BASED THERAPY

DARA LOPES DIAS FONSECA (*Abstract Co-Author*) Nothing to Disclose
Haruka Higashibori (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Keigo Narita (*Abstract Co-Author*) Nothing to Disclose
Shogo Maeda, MD (*Abstract Co-Author*) Nothing to Disclose
Yuko Nakamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shota Kondo (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

a. For advanced stage hepatocellular carcinoma (HCC), systemic therapy is the mainstay of treatment, with immune checkpoint inhibitors (ICI) based therapy being the first choice. b. Peritumoral enhancement on arterial phase may indicate proliferative HCCs and peritumoral hypointensity on gadoxetic acid-enhanced hepatobiliary phase (HBP) may indicate PD-L1 positivity of HCCs. Both might be predictive for ICI-based therapy response. c. Hyper HCCs which show high signal intensity at HBP may indicates poor response to ICI monotherapy because both OATP1B3 expression, main uptake transporter of EOB, and immune exclusion class of HCCs are related to Wnt/ß-catenin signaling pathway. However, relationship between combined therapy such as atezolizumab plus bevacizumab and hyper HCCs is controversial and should be determined. d. Steatotic findings of HCCs may predict better therapeutic response to ICI-based therapy. e. Best treatment method may be predicted by integrating findings above, other findings from various modalities and also clinical information. A method that integrates all information is required.

**TABLE OF CONTENTS/OUTLINE**

1. Therapeutic algorism for HCCs 2. Mechanism of ICI-based therapy 3. Promising predictive MR imaging findings for ICI-based therapy 4. Future prospective role of imaging for ICI-based therapy

## GIEE-70 2022 UPDATES IN THE MANAGEMENT OF NON-INFECTIOUS CYSTIC LIVER LESIONS

Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Eugenio Zalaquett, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Ryan Bitar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review clinical presentation, pathology, and imaging features of major non-infectious hepatic cystic lesions2. Comment on each pathological entity's associated clinical presentation/symptoms, pathology, and prognostic/clinical implications.3. Discuss the 2022 European association study of the liver updates for management of imaging surveillance and management recommendations for each pathological entity.

**TABLE OF CONTENTS/OUTLINE**

1. Relevant imaging modalities for evaluation of hepatic cystic structures a. CT (+/- contrast) b. MRI (T1, T2, MRCP, +/- contrast) c. Ultrasound (gray scale and color Doppler) 2. Simple hepatic cysts a. Imaging features b. Presentation (i.e incidental vs symptomatic) c. Indications for surveillance and management (drainage/sclerotherapy) 3. Complex cystic structures a. Features which infer complexity (i.e. nodularity and enhancement) b. Hemorrhagic/proteinaceous cysts c. Mucinous cystic neoplasms d. Clinical implications and management 4. Biliary hamartomas (Von Meyenburg's complexes) a. Imaging features: (notably on US and MRI) b. Pathology/presentation c. Management: (i.e. indications for follow-up) 5. (Caroli's disease) a. Imaging features: (most notably on US and MRI/MRCP) b. Pathology/presentation: (Caroli syndrome versus disease) c. Management: (surveillance for cholangiocarcinoma) d. Associated complications 6. Peribiliary cysts a. Imaging features b. Pathology/presentation c. Management (indications for follow-up imaging) 7. Polycystic liver disease: a. Imaging features and definition b. Significant genetic/prognostic features c. Management: (associated complications and treatment modalities)

## GIEE-71 PERITONEAL CARCINOMATOSIS INDEX: DIGITAL TOOLS AND STRATEGIES FOR PRECISE AND SUCCESSFUL SURGICAL PLANNING

Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Camila P. Reifegerste, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Theresa Duarte Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Rhillary S. Santana Sa (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Barbara Moreira De Lima (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Peritoneal Carcinomatosis (PC): Advanced secondary cancer, affecting 15-45% of patients with colorectal, gastric, and ovarian cancer, associated with malignant ascites and a median survival of 2-5 months.Peritoneal Cancer Index (PCI): Assesses tumor extent, with PCI > 20 contraindicating cytoreductive surgery.Artificial Intelligence (AI): Assists radiologists in calculating the Peritoneal Carcinomatosis Index (PCI), improving diagnostic accuracy.Integration of CT and MRI: Enhances disease characterization, optimizing surgical planning.

**TABLE OF CONTENTS/OUTLINE**

Peritoneal Carcinomatosis (PC) is an advanced stage of secondary cancer that arises from the spread of tumor cells to the peritoneum. Associated with malignant ascites, it results in compromised quality of life and a grim prognosis, with a median survival of 2 to 5 months. The Peritoneal Cancer Index (PCI) is crucial for assessing tumor extent and dissemination, influencing treatment; patients with PCI > 20 are generally deemed unfit for cytoreductive surgery. Artificial Intelligence (AI) can assist radiologists in evaluating the Peritoneal Carcinomatosis Index (PCI), contributing to more accurate assessment. Imaging methods such as CT, MRI are the methods of choice. Integrating MRI with CT in preoperative evaluations can provide a more precise characterization of peritoneal disease extension, optimizing surgical planning. The study demonstrates the efficacy of combining CT and MRI in predicting surgical PCI, highlighting the complementary role of AI in assessing PCI, aiming to improve efficiency, accuracy, and quality of evaluation, potentially resulting in better clinical outcomes for patients.

## GIEE-72 THE STATE OF THE ART OF SCLEROSING CHOLANGITIS: CLINICAL AND RADIOLOGICAL CHARACTERISTICS, DIFFERENTIATION

**Awards**
**Certificate of Merit**

Katsuhiro Sano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akiyoshi Suzuki (*Abstract Co-Author*) Nothing to Disclose
Hiroya Ojiri, MD (*Abstract Co-Author*) Nothing to Disclose
Shigeki Aoki, MD, PhD (*Abstract Co-Author*) Speakers Bureau, DAIICHI SANKYO Group;Speakers Bureau, General Electric Company;Speakers Bureau, Bayer AG;Speakers Bureau, Canon Medical Systems Corporation;Speakers Bureau, Guerbet SA;Speakers Bureau, Bracco Group;Speakers Bureau, Eisai Co, Ltd;Speakers Bureau, FUJIFILM Holdings Corporation;Research Grant, DAIICHI SANKYO Group;Research Grant, General Electric Company;Research Grant, Guerbet SA;Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;
Ryohei Kuwatsuru, MD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Fukuda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tsuyoshi Tajima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jun Woo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A. Primary sclerosing cholangitis (PSC) is a disease with a poor prognosis that leads to liver cirrhosis and liver failure due to persistent cholestasis and an increased risk of hepatobiliary malignancies, mainly cholangiocarcinoma. B. PSC shows characteristic imaging findings on MRCP. MRCP is recommended as the imaging standard for diagnosis and follow-up in patients with PSC by some guidelines, including the International Primary Sclerosing cholangitis Study Group (IPSCSG). C. Some common imaging findings of PSC, such as the appearance of band-like strictures reflecting fibrotic narrowing of the lumen caused by peribiliary inflammatory cell infiltration and fibrosis, and the bead-like appearance that occurs as the disease progresses, are nonspecific, which may be a pitfall. D. Among secondary sclerosing cholangitis, diseases, including IgG4-related sclerosing cholangitis, exhibit images of stricture of the bile duct different from those of PSC, and diseases, including ICI-related sclerosing cholangitis, present imaging findings similar to those of PSC.

**TABLE OF CONTENTS/OUTLINE**

a. Clinical characteristics, prognosis, and complications of PSC. b. MRI characteristics of PSC: sensitivities and specificities. c. MRI characteristics of IgG4-related sclerosing cholangitisd. d. Clinical and MRI characteristics of secondary sclerosing cholangitis that require differentiation from primary sclerosing cholangitis.

## GIEE-73 MULTIMODALITY IMAGING OF HEPATIC HYDATID DISEASE WITH A FOCUS ON ULTRASONOGRAPHIC CHARACTERISTICS

**Awards**
**Certificate of Merit**

Yasin Farrokhi Khajeh-Pasha, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Mohammad Mehdi M. Mehrabi Nejad (*Abstract Co-Author*) Nothing to Disclose
Niloofar Ayoobi Yazdi (*Abstract Co-Author*) Nothing to Disclose
Sina Dadgar (*Abstract Co-Author*) Nothing to Disclose
Faeze Salahshour (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Understanding the Morphologic Radiologic Correlation of Hydatid Cysts Across Various Imaging Modalities 2) Identifying Conditions Resembling Hydatid Cysts on Different Imaging Techniques3) Recognizing and Managing Various Complications Associated with Hydatid Cysts4) Interpreting the Typical Post-Surgical Imaging Changes

**TABLE OF CONTENTS/OUTLINE**

1) Epidemiology and Life Cycle of Echinococcus granulosus2) Cyst Evolution 3) Clinical Manifestations4) Diagnostic Approach 5) Computed Tomography Imaging 6) Magnetic Resonance Imaging 7) Ultrasonographic Features 1. Typical Appearance 2. WHO Classification 8) Mimics 1. Simple Cyst (Uncomplicated or Complicated) 2. Neoplasm 3. Hepatic Vascular Malformations 4. Postoperative Changes 5. Biloma 6. Hematoma 7. Abscess9) Complications of Hepatic Hydatid Cysts 1. Cyst Rupture and Infection 2. Exophytic Growth 3. Biliary Communication 4. Portal Venous Involvement 5. Perforation into Hollow Organs 6. Peritoneal Spillage 7. Abdominal Wall Involvement 8. Purulent Pericarditis 9. Hepatic Vein Compression and Obstruction (Budd-Chiari Syndrome) 10. Hepatic Infarction 10) Post-Surgical Management Imaging 1. Typical Changes 2. Recurrence

## GIEE-74 THE SHINING: ENHANCEMENT-PATTERN APPROACH TO DIAGNOSE LIVER LESIONS AND HEPATIC INFLAMMATORY PROCESSES: A GUIDE FOR THE RADIOLOGY RESIDENT

Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Karly Cristhelly Garrido Estrella, MD (*Abstract Co-Author*) Nothing to Disclose
Maria C. Arizaga, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela L. Mendieta Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Rebeca Arizaga (*Abstract Co-Author*) Nothing to Disclose
Sofia Arizaga, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

after the exhibit the reader would be able- Identify normal liver enhancement pattern with contrast computed tomography (CT), magnetic resonance imaging and Gadoxetic Acid enhanced MRI.- To differentiate several benign and malignant liver lesions based on their enhancement pattern with CT, MRI and Gadoxetic Acid enhanced MRI.- To review abnormal enhancement of Inflammatory Liver Disease.

**TABLE OF CONTENTS/OUTLINE**

- Introduction- To review normal liver enhancement pattern with computed tomography (CT), magnetic resonance imaging (MRI) and Gadoxetic Acid enhanced MRI.- Characterize the different types of arterial, venous, and late enhancement of benign and malignant liver lesions by computed tomography (CT), magnetic resonance imaging and Gadoxetic Acid enhanced MRI.- To review abnormal enhancement pattern of diffuse liver desease.- To understand the physiologic basis of liver enhancement after administration of Gadoxetic Acid enhanced MRI and the applications of gadoxetic Acid in Hepatobiliary Disorders.- Take home points.

## GIEE-75 SIBLING'S SPECIALTIES: THE BOUNDARIES AND INTERSECTIONS OF RADIOLOGY AND ENDOSCOPY

Jose C. Ardengh (*Abstract Co-Author*) Nothing to Disclose
Thais C. Lima (*Abstract Co-Author*) Nothing to Disclose
Fernanda C. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Panizza, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Knowledge about the applications, indications and contraindications of endoscopic modalities is vital for the abdominal radiologist.Minimally invasive interventional procedures related to these specialties are growing rapidly due to better results and lower morbidity.

**TABLE OF CONTENTS/OUTLINE**

Radiological and endoscopic imaging modalities play an important role in the diagnosis and treatment of a spectrum of gastrointestinal and respiratory conditions, sometimes with synergy in clinical practice between these sister specialties. Radiology and endoscopy are fundamental in the evaluation of hepatobiliary, pancreatic, small bowel and rectal diseases, each offering unique diagnostic and interventional capabilities. This synergy is critical in conditions such as biliary tree neoplasms, pancreatic disorders and inflammatory bowel disease, guiding management decisions from diagnostic clarity to therapeutic interventions. The summary further explores how advances, especially in artificial intelligence, are poised to improve the accuracy and integration of these modalities. Understanding the indications and contraindications for each method allows clinicians to optimize patient outcomes, illustrating a future where collaborative diagnoses and interventions continue to evolve, driven by technological innovation and improved clinical understanding.

## GIEE-76 GOING WITH THE FLOW: NAVIGATING COLIC PERFUSION FOR OPTIMAL SURGICAL OUTCOMES

Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlos Augusto Martinez (*Abstract Co-Author*) Nothing to Disclose
Renan D. Turci, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1 - Review the usual anatomy of the main colic vessels it's main branches both arterial and venous presentations. 2 - Assess the most common imaging findings for vascular variations that affect surgical procedures involving colorectal cancer resections, in both CT and Angio CT scans. 3 - Reassure the radiologist's role on identifying vascular abnormalities and communicating them to the surgical team to avoid complications.

**TABLE OF CONTENTS/OUTLINE**

1 - Illustration of normal anatomy 2 - Brief review of the development of the colic vessels 3 - Most common vascular variations of the abdominal vasculature, including the superior and inferior mesenteric arteries and vein, the right, mean and left colic vessels, as well as the Riolan's arch and the Griffit's point, illustrated in CT and Angio CT scans 4 - How abdominal surgical procedures can be affected by vascular variations and the importance of the radiologist report on identifying theses scenarios.

## GIEE-77 ANOTHER BRICK IN THE WALL: IMAGE EVALUATION OF THE POSTOPERATIVE ABDOMINAL WALL

Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Priscilla Claudia Raddo Venancio, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Lopes Fioratti, MD (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Max Yunior Orsi Salazar, MD (*Abstract Co-Author*) Nothing to Disclose
Filipe Chaves, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Guilherme Nunes Pozzer, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel B. Montel, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

•Normal anatomy of the abdominal wall •Image protocol for evaluation of the postoperative abdominal wall. •Early and late postoperative complications of the abdominal wall •Classification of incisional abdominal wall hernias and important characteristics •Other causes of abdominal wall weakness in the postoperative period •Understanding surgical techniques for hernia and diastasis recti repair, from classic to robotic approaches, and their imaging appearance •Surgical mesh: material differences, surgical techniques, topography in relation to abdominal wall layers, and related complications •Loss of domain in hernia cases •Surgical techniques for repair of large ventral hernias and postoperative imaging appearance •Types of stomas, expected findings, and related complications •Image findings related to cosmetic surgery procedures, myo-adipose graft harvesting surgeries, and abdominal wall bone flap preservation •Essential information for the surgeon in the radiology reports.

**TABLE OF CONTENTS/OUTLINE**

•Understanding of the normal anatomy of the abdominal wall and its potential weaknesses, including incisional hernias, diastasis recti, and other causes of abdominal wall defects. •Become familiar with various surgical techniques for abdominal wall reconstruction and hernia repair, recognizing their specific imaging appearances on different modalities, including the identification of mesh materials and potential complications. •Recognize different types of stomas on imaging studies and identify potential stoma-related complications like hernias, prolapse, and retraction. •Understand the essential information surgeons need from radiology reports.

## GIEE-78 THE FUNDAMENTAL ROLE OF THE RADIOLOGIST IN THE ACUTE CHOLECYSTITIS AND ACUTE CHOLANGITIS (TOKYO GUIDELINES)

Jose A. Cienfuegos Alvear, MD (*Abstract Co-Author*) Nothing to Disclose
Axel A. Torres Monarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Alpizar, MD,MEd (*Abstract Co-Author*) Nothing to Disclose
Rodolfo De Jesus Martinez Marquez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Recognize the primary role of the radiologist in diagnosis and treatment of acute cholecystitis and acute cholangitis.2. Identify imaging findings of acute cholecystitis and acute cholangitis in different imaging modalities used in radiology.3. Review the flowchart for the management of acute cholecystitis and the initial response to acute biliary infection.4. Identify common and unusual causes of acute biliary infection. Review clinical cases and treatment.5. Become familiar with indications and techniques of gallbladder and biliary drainage.6. Emphasize on percutaneous gallbladder drainage and percutaneous biliary drainage.7. Analyze potential complications of acute cholecystitis and acute cholangitis percutaneous treatment and how to treat them.

**TABLE OF CONTENTS/OUTLINE**

1. Diagnostic criteria of acute cholecystitis on different imaging modalities.Severity grading.Flowchart for the management of acute cholecystitis.2. Management strategies for gallbladder drainage.Percutaneous transhepatic gallbladder drainage (with videos).Percutaneous transperitoneal gallbladder drainage (with videos).3. Clinical cases of acute cholecystitis and their gallbladder drainage4. Diagnostic criteria of acute biliary infection on different imaging modalities.Severity grading.Flowchart for acute cholangitis.5. Common and unusual causes of acute biliary infection (clinical cases)5. Indications and techniques of biliary drainage.Percutaneous treatment (with videos).6. Complications of percutaneous treatment for acute cholecystitis and cholangitis.7. Conclusions.

## GIEE-79 REVISITING BOWEL DISEASES: AN ALGORITHMIC APPROACH FOR BOWEL WALL THICKENING

Antonio E. Silva JR, BDS (*Abstract Co-Author*) Nothing to Disclose
Heitor Passeri, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Beraldo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review normal bowel anatomy on CT and MRI.2. Suggest a radiological algorithmic approach for evaluating bowel diseases, emphasizing key intestinal and extra-intestinal findings.3. Detail each of the algorithmic steps, reviewing the differential diagnosis of bowel wall thickening with illustrative cases.

**TABLE OF CONTENTS/OUTLINE**

1. Normal bowel anatomy, correlating didactic illustrations with CT and MRI.2. Different types of intestinal wall thickening with schematic figures.Algorithmic approach for bowel diseases, based on bowel wall thickening: STEP 1: Assess signs of neoplasia; STEP 2: Assess signs of ischemia;

STEP 3: Assess inflammatory signs.3. Review the different differential diagnoses for intestinal wall thickening, with imaging findings and illustrative cases: a. Intestinal neoplasm; b. Ischemic enteritis and colitis; c. Infectious enterocolitis (highlighting intestinal Tuberculosis, Whipple disease and Pseudomembranous colitis); d. Non-infectious inflammatory intestinal diseases (highlighting Crohn's disease, ulcerative colitis and celiac disease); e. Actinic enterocolitis; f. Portal hypertensive colopathy;g. Intestinal endometriosis.

## GIEE-8 THROUGH CYSTIC LESION TO THE MORPHOLOGICAL ABNORMALITIES: CURRENT FINDINGS AND ISSUES IN EARLY PANCREATIC CANCER

Osamu Abe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shohei Inui, MD (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Manabu Minami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomohiko Masumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Wataru Gonoi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yudai Nakai, MD (*Abstract Co-Author*) Nothing to Disclose
Sota Masuoka, MD (*Abstract Co-Author*) Nothing to Disclose
Moto Nakaya, MD (*Abstract Co-Author*) Nothing to Disclose
Shintaro Kano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pancreatic cancer is the third leading cause of cancer death in the United States on its way to be the second. A multidisciplinary approach is crucial in clinical practice, and radiologists play an important role in early detection. In recent years, there has been progress in understanding the radiologic features and pathologic backgrounds of early pancreatic cancer and its precursor lesions. Intraductal papillary mucinous neoplasm (IPMN) is a well-known cystic lesion with malignant potential. Pancreatic ductal adenocarcinoma concomitant with IPMN, distinct from carcinoma that sequentially develops from IPMN itself, is also gathering attention. Morphological abnormalities of the pancreas are considered to precede the development of cancer. Radiologists need to pay attention not only to cystic lesions but also to morphological abnormalities of the pancreas. From a clinical perspective, there remains some controversial issues. In particular, there is no consensus on the follow-up interval for high-risk patients.The purposes of this exhibit are1. To learn the up-to-date radiologic findings and pathologic hypotheses of early pancreatic cancer and its precursor lesions.2. To review literature focusing on three clinical questions: (1) Modality: What is the optimal imaging modality for early pancreatic cancer detection and surveillance? (2) Eligibility: Who should be included in and excluded from routine surveillance? (3) Interval: How should the follow-up interval be determined if no abnormalities or equivocal findings are detected?

### TABLE OF CONTENTS/OUTLINE

1. Pathogenesis of pancreatic cancer2. Radiologic signs of early pancreatic cancer3. Clinical questions4. Conclusion

## GIEE-80 BEYOND MALIGNANCY: A RADIOLOGIST'S GUIDE TO BENIGN PERITONEAL DISEASES

Lucas Bauer Pasqualini (*Abstract Co-Author*) Nothing to Disclose
Lucas Augusto, MD (*Abstract Co-Author*) Nothing to Disclose
Camila C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio J. de Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Ariel Teixeira Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Pedro Panizza, MD (*Abstract Co-Author*) Nothing to Disclose
Rafaelle M. De Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Lisa Umeda, MD (*Abstract Co-Author*) Nothing to Disclose
Nicoli T. Yoshimi, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela M. De Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Irla A. Dantas, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Maria Rosas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Elucidate the anatomical relationships and forms of dissemination related to peritoneal diseases, as well as the radiological analysis of the structures involved. Discuss the pathophysiology involved in the spread of each group of benign diseases that affects the peritoneum. Provide a radiological algorithm to the dissemination of benign peritoneal diseases and correlate the clinical history that may help in the diagnosis. Highlight the possible complications related to each benign pathology of peritoneal dissemination. Present the main malignant differential diagnoses related to each benign pathology of peritoneal dissemination.

### TABLE OF CONTENTS/OUTLINE

Classification of benign peritoneal diseases dissemination into subgroups according to the main imaging aspects.Description of the imaging aspects of solid, mixed and cystic diseases.Individual characteristics of each benign lesion of the peritoneum and their main differential diagnoses in relation to malignant peritoneal involvement.

## GIEE-81 ULTRASONOGRAPHY IN ABDOMINAL HERNIAS: A PICTORIAL REVIEW

Eduardo D. Chiovatto, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Person de almeida, MMed,MMed (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Carotenuto Ramos, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Wagner Iared (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Geovana Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Moreli Antonine (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This study aims to:Analyze the main types of hernias and points of weakness in the abdominal wall.Technique for assessing abdominal wall hernias using ultrasonography.Anatomical parameters that allow differentiation between direct and indirect inguinal hernias.Complications of hernias and how to diagnose them with ultrasound.

**TABLE OF CONTENTS/OUTLINE**

Anatomy and reference pointsTypes of hernias:IncisionalUmbilicalEpigastricHypogastricLateral (Spiegel or Semilunar)Inguinal hernias (direct and indirect)Femoral HerniaLumbar Hernias (Grynfelt-Lesshaft abd Petit hernia)Ultrasound technicComplications (Ultrasonographic diagnosis of complications)

## GIEE-82 LIVER-OGRAPHY OF THE DIFFUSE HEPATIC DISEASES AND IT'S PITFALLS

Rogerio J. de Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Panizza, MD (*Abstract Co-Author*) Nothing to Disclose
Nicoli T. Yoshimi, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela M. De Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hilton M. Leao Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucas Bauer Pasqualini (*Abstract Co-Author*) Nothing to Disclose
Lucas Augusto, MD (*Abstract Co-Author*) Nothing to Disclose
Camila C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Ariel Teixeira Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Irla A. Dantas, MD (*Abstract Co-Author*) Nothing to Disclose
Rafaelle M. De Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Maria Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Lisa Umeda, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Diffuse hepatic diseases are usually non-specific character in the middle of the radiology. Biopsy is known to be the gold standard for many of these pathologies. This presentation aims to presente with the recent technologies of radiological modalities so that the diagnosis can be suggested without being invasive. Provide a radiological overview of diffuse liver diseases, the pathophysiology involved in the dissemination of each group. Highlight the differential diagnoses related to each diseases, with the main findings in the different modalities.

**TABLE OF CONTENTS/OUTLINE**

Main liver diseases of inflammatory and infectious origin and their typical findings. The different aspects of liver storage diseases. Assessment of images in chronic liver disease patients and autoimmune hepatitis. Recognition of liver pathologies of vascular origin. Main findings related to post-transplant liver complications, including vascular, hepatic infartion and rejection.

## GIEE-83 LI-RADS TRA 2024 UPDATE: WHAT RADIOLOGISTS SHOULD KNOW

**Awards**
**Certificate of Merit**

Antonio E. Silva JR, BDS (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Luiz T. Siqueira, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Naves (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Provide a practical guide to the new LI-RADS TRA guidelines reviewing critical changes and imaging features for each TRA category. - Present the expected imaging features for each locoregional treatment and possible complications. - Highlight possible pitfals when applying LR-TR. - Provide sample reports in clinical cases to highlight key information for oncologists, surgeons and transplant comitees.

**TABLE OF CONTENTS/OUTLINE**

● Introduction ○ Review of modalities for local treatment ○ Overview of LR-TR categories ○ Correct measurement technique ● LR-TR Nonradiation treatment response ○ Review of treatment categories including definition, criteria and examples. ● LR-TR Radiation treatment response ○ Review of treatment categories including definition, criteria and examples. ● Conclusion

## GIEE-84 A NOVEL APPROACH TO CHARACTERISING LIVER LESIONS

Snehal Lapsia, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Sophie Cheshire, MBChB, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Table method for radiology residents to problem solve liver lesion diagnosis on MRI

**TABLE OF CONTENTS/OUTLINE**

We have used this table method at our UK teaching hospital whilst training radiology residents to equip them with a tool which allows for a methodical approach to interpreting liver MRI. It can be quite easy to lose focus with all the details and MR enhancement patterns of the multitude of benign and malignant lesions when evaluating multiple liver MR sequences at once. Therefore, we propose this method which evaluates each sequence in isolation of the others. Formulating a table populating each sequence with what the lesion can be, what it could be (but unlikely) and what it cannot be. In combination with a final review of the background liver, any relevant history and tumour markers allows final diagnosis of the lesion, often providing a close differential. The method can also be utilised as a problem solving tool when evaluating difficult cases. Within this education piece we will present the method with the following examples: HCC, IHC, metastasis, FNH, adenoma, cyst and other rarer lesions.

## GIEE-85 PANCREATIC NEUROENDOCRINE NEOPLASMS: CONCEPTS, CLASSIFICATION, ROLE OF IMAGE AND ANATOMOPATHOLOGICAL CORRELATION

Ana Claudia Vincenzi Raduan Uski (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Pancreatic neuroendocrine neoplasms (panNENs) present characteristic clinical, histomorphological and prognostic features. There have been updates regarding the pathogenesis, classification and staging of these neoplasms and familiarity with the imaging findings is essential for optimal treatment. Therefore, the objectives of this work are: - Demonstrate the radiological findings that favor the diagnosis and evolutionary behavior of panNENs; -

Review changes in the classification system according to WHO (2017) and in staging (TNM of the AJCC 8th edition); - Review the genetic concepts and pathogenesis of sporadic and syndromic tumors.

**TABLE OF CONTENTS/OUTLINE**

• Introduction; • WHO classification and latest AJCC TNM staging system for pancreatic neuroendocrine neoplasms; • Discussion of the pathogenesis of pancreatic tumors and carcinomas and description of genetic mutations that affect prognosis and treatment; • Imaging findings of these tumors and correlation with histological grades; • Curiosities and their main mimiters; • Summary and flowchart of conducts; • References

## GIEE-86 RADIOLOGIST IN THE MULTIDISCIPLINARY TEAM MANAGING GASTROENTEROPANCREATIC NEUROENDOCRINE NEOPLASMS

Nikhil H. Ramaiya, MD (*Abstract Co-Author*) Nothing to Disclose
Rachana Gurudu (*Abstract Co-Author*) Nothing to Disclose
Qiubai Li, MD (*Abstract Co-Author*) Nothing to Disclose
Sreeharsha Tirumani, MD (*Abstract Co-Author*) Nothing to Disclose
Kaustav Bera, MD (*Abstract Co-Author*) Nothing to Disclose
Amr Mohamed (*Abstract Co-Author*) Nothing to Disclose
Sohrab Afshari Mirak, MD (*Abstract Co-Author*) Nothing to Disclose
Jack Zhao, BA (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Radiologist is an integral part of the MDT managing GEP NEN
- Imaging key in every step in the management of GEP-NEN
- Multiphasic CT and MRI are workhorses for anatomic imaging
- Knowledge of immunohistochemistry can help radiologists in challenging cases of GEP-NEN, especially in the setting of unknown primary
- Important to recognize changes of carcinoid heart disease on restaging scans and differentiate NEN from non-NEN entities
- MRI better suited for post therapy response assessment
- Familiarity with response criteria used in GEP-NEN can help in appropriate assessment in day-to-day clinical practice
- Attention should be payed to disease recurrence and treatment related complications on restaging scans

**TABLE OF CONTENTS/OUTLINE**

- Understand the role of radiologist in multi-disciplinary management of GEP-NEN
- Familiarize clinical and pathology clues which can help radiologist in diagnosis and management
- Understand the role of immunohistochemistry in day-today practice of radiologists
- Demonstrate the value of knowing response criteria and complications of GEP- NET therapies

## GIEE-87 COMPREHENSIVE MR IMAGING OF PERIANAL FISTULAS: FROM ANATOMY AND DIAGNOSIS TO PERIANAL CROHN'S TREATMENT MONITORING

Michael H. Lanier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vincent M. Mellnick, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Parakkal Deepak, MBBS (*Abstract Co-Author*) Consultant, Johnson & Johnson;Advisory Board, Johnson & Johnson;Consultant, Pfizer Inc;Advisory Board, Pfizer Inc;Consultant, Prometheus Pharmaceuticals;Advisory Board, Prometheus Pharmaceuticals;Consultant, Boehringer Ingelheim GmbH;Advisory Board, Boehringer Ingelheim GmbH;Grant, Boehringer Ingelheim GmbH;Consultant, Arena Pharmaceuticals;Advisory Board, Arena Pharmaceuticals;Grant, Arena Pharmaceuticals;Grant, Takeda Pharmaceutical Company Limited;Grant, Bristol-Myers Squibb Company;;;
David H. Ballard, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to:1. Illustrate normal perianal anatomy on MR, provide a search pattern, and discuss types of perianal fistulas2. Provide a case-based review of the appearance of common and complex fistula patterns3. Discuss perianal fistulas in Crohn disease and the role of MR in monitoring response to therapy

**TABLE OF CONTENTS/OUTLINE**

1. Anatomy: Internal and external sphincters, anorectal junction, and intersphincteric spacea. Appearance on diagram vs. MR2. Imaging rationala. MR modality of choiceb. Fistula and abscess on CT3. MR techniquea. Sequences of perianal MR protocol 2. Pairing a perianal MR protocol with MR enterography4. Patterns of perianal fistulasa. What is 'complexity' in perianal fistulasb. Inter-, trans-, supra- and extra-sphincteric perianal fistulasc. Parks and St. James classification systems5. Pitfalls and special considerationsa. Setons tract on MR - is it considered a fistula?b. Fistulizing to adjacent genitourinary structuresc. Hemmoroid mimicking perianal fistula6. Implications of MR findings for patient managementa. Innovations including 3D printing and virtual reality7. Perianal fistula in Crohn diseasea. Prevalence and treatment optionsb. MR imaging as a response to medical therapyc. MR scoring systemsi. Modified Van Assche index, MAGNIFI-CD, and othersii. Practical approach to reporting treatment perianal Crohn responsed. Cases of long-standing (5+ years) perianal Crohn across multiple studies8. Cancer-associated with perianal fistulaa. Perianal Crohn at increased risk for anal and rectal cancerb. Fistula-related mucinous adenocarcinomac. Squamous cell carcinoma Wound or risk factor (HIV/HPV/receptive anal intercourse)

## GIEE-88 PANCREATIC CANCER SCREENING AND EARLY DETECTION: DOES IMAGING MAKE A DIFFERENCE?

**Awards**
**Cum Laude**

Carlos Fernandez-Del Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Avinash R. Kambadakone, MD, FRCR (*Abstract Co-Author*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer
Soumyadeep Ghosh, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Shravya Srinivas Rao, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Background Pancreatic cancer is the third most common cause of cancer-related deaths in the United States. The potential challenges in early detection involve the identification of individuals in the general population who are at risk and would gain from ongoing monitoring programs. Pancreatic cancer

often presents at advanced stages, limiting treatment options and survival rates. Imaging plays a crucial role in early detection, offering opportunities for timely intervention and improved outcomes.Learning Objectives/Aims: • To discuss the necessity of early detection of pancreatic cancer • To recognize the subgroups with higher-than-average risk for pancreatic ductal adenocarcinoma (PDAC) • To evaluate the role of imaging in early diagnosis of pancreatic cancer • To review challenges and future prospects in detection of early pancreatic cancer

**TABLE OF CONTENTS/OUTLINE**

• Introduction to pancreatic ductal adenocarcinoma • Describe modifiable and non-modifiable risk factors • Identify subgroups with higher-than-average risk for PDAC • Discuss precancerous lesions and their imaging surveillance o Mucinous cystic neoplasm o IPMN o Worrisome features and high-risk stigmata according to Tanaka consensus • Role of imaging in early detection of pancreatic cancer • Discuss the rationale of pancreatic protocol CT and MRI • Imaging features of early PDAC o Duct cut-off sign o Double duct sign o Focal abnormal enhancement o Focal parenchymal atrophy o Focal change in duct caliber • Current research on advanced imaging and other biomarkers for early diagnosis of PDAC

## GIEE-9 "FIERY AND IRRITATED BILE DUCTS": CURRENT UPDATE ON PATHOLOGY, IMAGING, AND MANAGEMENT OF ACUTE AND CHRONIC CHOLANGITIS

Venkata S. Katabathina, MD (*Abstract Co-Author*) Nothing to Disclose
John A. Walker, MD, PhD (*Abstract Co-Author*) Speaker, Shionogi & Co, Ltd;Consultant, Shionogi & Co, Ltd
Sriram Jaganathan, MD (*Abstract Co-Author*) Nothing to Disclose
Narayan Lath, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Rajeev Pathapati (*Abstract Co-Author*) Nothing to Disclose
Anil K. Dasyam, MD (*Abstract Co-Author*) Nothing to Disclose
Alia Nazarullah (*Abstract Co-Author*) Nothing to Disclose
Abdelrahman A. Abusaif, MBBCh (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Review the anatomy and physiology of bile ducts pathophysiology of bile duct inflammation. • List obstructive, infectious, inflammatory, immunologic, toxic miscellaneous etiologies of acute and chronic cholangiopathies • Discuss current updates on the pathogenesis of primary sclerosing cholangitis, primary biliary cholangitis other acute/chronic cholangitis, including novel etiologies • Describe MRI/MRCP imaging spectrum role of other imaging modalities • Discuss updates in endoscopic/interventional radiology management of acute/chronic cholangitis

**TABLE OF CONTENTS/OUTLINE**

• Introduction • Anatomy/physiology: Cholangiocytes, Arterial/venous bile production • Current Updates on pathogenesis • Etiology of cholangitis: Acute, chronic acute on chronic • Imaging Techniques: US, CT, MRI/MRCP, MR Elastography, ERCP, PTC, EUS Cholangioscopy • Acute cholangitis: infectious/obstructive; periductal T2 hyperintensity, enhancement, abscesses thrombosis • Primary sclerosing cholangitis associated conditions • Primary Biliary Cholangitis • IgG4-cholangiopathy • Infectious: Recurrent pyogenic cholangitis, AIDS cholangiopathy, bacterial parasites (Fasciola Hydatid) • Covid-19 Cholangiopathy Covid-vaccine induced • Post-liver transplant: Ischemic, anastomotic biliary cast syndrome • Drug-induced: Immune therapy, chemotherapy • Secondary sclerosing cholangitis in critically-ill patients • Miscellaneous: radiation, Mirizzi, Lemmel syndrome congenital • Management: Medical/Endoscopic/IR • Novel therapeutic targets • ConclusionNew etiologies significant updates in pathogenesis acute/chronic cholangitis; imaging is pivotal in timely diagnosis.

## GIEE-90 MULTIMODALITY DIAGNOSTIC IMAGING AND ROLE OF INTERVENTIONAL RADIOLOGY FOR PANCREAS TRANSPLANT

**Awards**
**Certificate of Merit**

Eric Fromke, MD (*Abstract Co-Author*) Nothing to Disclose
Rachita Khot, MD (*Abstract Co-Author*) Nothing to Disclose
John F. Angle, MD (*Abstract Co-Author*) Consultant, Terumo CorporationResearch Grant, Seimens AG
Klaus D. Hagspiel, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Hideyuki Torikai, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Pancreas transplant is performed primarily for patients with type 1 diabetes mellitus who experience difficulties in managing their condition with conventional therapies. This educational exhibit offers the comprehensive review of multimodality diagnostic imaging and interventional radiology. The exhibit aims to: 1. Discuss the indications and epidemiology of pancreas transplant 2. Understand pre-transplant pancreatic anatomy for accurate imaging interpretation, crucial for surgical planning 3. Discuss expected post-transplant imaging findings versus early signs of complications 4. Gain insight into the surgical techniques and their implications for post-operative complications 5. Recognize post-transplant complications, focusing on diagnostic imaging features and the role of Interventional Radiology in management

**TABLE OF CONTENTS/OUTLINE**

Indication and Epidemiology Anatomy: Arterial, venous and enteric anatomy Surgical technique based on the anastomosis Imaging technique: US, contrast-enhanced US, CT, MRI, and Angiography Normal Imaging findings Complications Arterial complications 1. Bleeding/Pseudoaneurysm and embolization 2. Thrombosis and thrombolysis/thrombectomy 3. Stenosis and angioplasty 4. Arteriovenous fistula and embolization Venous complications 1. Thrombosis and thrombolysis/thrombectomy 2. Stenosis and angioplasty Exocrine complications 1. Duodenoenterostomy leak 2. Duodenovesicostomy leak 3. Duodenal stump leak 4. Leak following anastomotic conversion Parenchymal complications 1. Graft rejection and Image-guided biopsy 2. Graft pancreatitis 3. Peripancreatic fluid collection and drainage Other complications 1. PTLD 2. Small bowel obstruction

## GIEE-91 INS AND OUTS: HERNIAS OF THE ABDOMINAL WALL ON CT

Rochelle Lamb, BMBS (*Abstract Co-Author*) Nothing to Disclose
Sathi A. Sukumar, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ben Layton, BMBS, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

With use of CT imaging and accompanying detailed original illustrations combined with the most up to date literature we will:• Review the myofascial anatomy of the abdominal to provide a foundation for the of assessing hernias and understanding surgical techniques• Provide an approach to reporting hernias on CT with a particular focus on what the surgeon needs to know about large ventral hernias• Highlight what not to miss in hernia reports including the spectrum of complications of hernias specific to their subtype and location, hernia mimics and malignancy within a hernia sac.

**TABLE OF CONTENTS/OUTLINE**

1. Myofascial anatomy of the abdominal wall with an overview of ventral hernia closure techniques 2. What to tell the surgeon on a CT report with case examples interlinking with surgical options. Including important surgical planning information: domain loss, sarcopenia, rectus defect ratio, component separation measurements 3. Abdominal wall hernia classification including midline, lateral and lumbar types with relevance to the surgeon explained 4. Uncommon abdominal wall hernia types and their clinical relevance explained including subtypes of interstitial hernias (with Spigelian and rectus sheath types) 5. Acute and chronic complications with case examples specific to the location such as ureteric obstruction in a lumbar hernia and appendix in Spigelian hernia. 6. Tips and tricks! Including assessment of hernia content for malignancy and sidestepping hernia mimics such as various abdominal wall masses 7. Summary and recommendations

## GIEE-92 ENDOSCOPIC ESOPHAGEAL CANCER PRACTICE: WHAT RADIOLOGISTS NEED TO KNOW

Tatsushi Kobayashi, MD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation
Takashi Hiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hirofumi Kuno, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomohiro Kadota (*Abstract Co-Author*) Nothing to Disclose
Shioto Oda, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Gastrointestinal endoscopy is the mainstay of treatment for upper gastrointestinal treatment, particularly esophageal cancer, and plays a major role in improving patient prognosis and quality of life through a wide variety of procedures. Recent advancements in endoscopic techniques have been remarkable, including new topics such as endoscopic ultrasound (EUS) and photodynamic treatment (PDT) for treating local recurrent lesions after radiotherapy. Familiarity with related CT imaging evaluation is crucial for pre- and post-procedure evaluations, but there are limited comprehensive reports on this topic.The purpose of this presentation is to review the anatomical considerations essential to diagnosing esophageal cancer, provide an overview of radiographic imaging about TNM staging, and discuss the imaging features encountered in the endoscopic practice of esophageal cancer.The purpose of this presentation is:1. To describe key imaging features associated with endoscopic diagnosis for pre-treatment staging2. To review key imaging features after endoscopic treatment

**TABLE OF CONTENTS/OUTLINE**

1. Background.2. Review of Anatomy Related to Endoscopic Esophageal Cancer Practice.3. Case Illustrations of Endoscopic Esophageal Cancer Practice3.1. Pre-treatment Imaging3.2. Post-treatment Imaging3.3. Imaging Associated with Other Endoscopic Procedures.4. Summary

## GIEE-93 DUAL CONTRAST LIVER MRI: ONE-STOP SHOPPING FOR LIVER LESION CHARACTERIZATION

**Awards**
**Certificate of Merit**

Tyler J. Fraum, MD (*Abstract Co-Author*) Research support, Siemens AG ;Speaker, Ultimate Opinions in Medicine LLC
Justin Dumrongkulraksa, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Tsai, MD (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sayan Manna, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel R. Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Z. Rajput, MD (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lanier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Govind Mattay, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The choice of liver MRI contrast agent among extracellular, hepatobiliary (e.g., gadoxetate), or hybrid (e.g., gadobenate) types is a challenge in protocolling liver MRI examinations for focal liver lesion characterization. Each agent has advantages and disadvantages, including the quality of various contrast phases, potential artifacts, and hepatobiliary phase contrast-to-background ratios. A dual-contrast strategy employing initial administration of an extracellular agent followed by subsequent administration of gadoxetate offers high-quality arterial phase imaging, a predictable appearance of hemangiomas in the equilibrium and early delayed (< 5 min) phases, and a high-quality hepatobiliary phase. This exhibit will:1) Discuss liver MRI contrast agents and their strengths and weaknesses2) Provide a framework for characterizing indeterminate liver lesions and how contrast agent choice affects diagnostic certainty3) Describe the dual-contrast protocol and how to construct it efficiently4) Illustrate the advantages of dual-contrast liver MRI compared to single-agent examinations, including examples in which gadobenate as a single hybrid agent can be misleading

**TABLE OF CONTENTS/OUTLINE**

- liver MRI contrast agents: characteristics, strengths, and weaknesses- Indeterminate liver lesion MRI: imaging features and how contrast choice affects diagnostic certainty or uncertainty in various clinical scenarios- dual contrast liver MRI protocol: building blocks, sequence ordering, contrast dosing- case illustrations: depict how the advantages a dual contrast protocol offers compared to single agent extracellular, gadoxetate, and gadobenate exams for focal liver lesion characterization

## GIEE-94 HYPERINTENSE LIVER LESIONS AT HEPATOBILIARY PHASE OF GADOXETIC ACID-ENHANCED MR IMAGING: A CLINICAL APPROACH AND IT'S CLINICAL SIGNIFICANCE

Kumi Ozaki, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The insight of paradoxical hyperintensity at hepatobiliary phase of gadoxetic acid-enhanced MR imaging can help the accurate imaging diagnoses and can provide us additional information as imaging biomarkers such as prognosis and therapeutic effectiveness. The purposes of this presentation are; 1) to review several kinds of tumor showing paradoxical hyperintensity at hepatobiliary phase; 2) to review the role of the imaging biomarkers of hyperintense lesions of hepatobiliary phase images

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. What is the gadoxetic acid? 3. The mechanism of uptake and excretion of gadoxetic acid and three types of mechanisms of hyperintensity during hepatobiliary phase 4. Presenting several hyperintense lesions of hepatobiliary phase images. For example, hepatocellular carcinoma (HCC); hyperintense HCC at HB phase, heterogeneous intense HCC at HB phase, nodule in nodule during multi-step hepatocarcinogenesis , peritumoral hyperintensity 5. Hepatocellular adenoma with ß-catenin mutation 6. Focal nodular hyperplasia (FNH) and FNH-like lesion 7. Regenerative nodules in cirrhosis and other benign hepatocellular lesions 8. Cloud sign of intrahepatic cholangiocarcinoma 9. Heterogeneous hyperintensity of liver

metastases of colorectal cancer, pancreatic adenocarcinoma, and breast cancer 10. Peritumoral hyperintensity of neuroendocrine tumor 11. Periportal hyperintensity in porto-sinusoidal vascular diseaseand liver cirrhosis 12. Peritumoral hyperintensity of hypervascular tumors 13. Focusing on the role of the imaging biomarkers of hyperintense lesions of hepatobiliary phase images 14. Conclusion.

### GIEE-95 ESOPHAGOGRAPHY ON THE MOST CHALLENGING PATIENTS: IT CAN BE DONE! (HINTS AND TRICKS TO GET A DIAGNOSTIC STUDY)

Mary A. Turner, MD (*Abstract Co-Author*) Nothing to Disclose
Laura R. Carucci, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

• Esophagography is an increasing proportion of GI fluoroscopy studies performed, providing functional and structural information often not readily obtained with cross-sectional imaging or endoscopy. • Overall trend towards increasing number of complex studies that do not allow for a "traditional esophagram" -more challenging patients with special circumstances (debilitated, elderly, postop, ICU patients). • Need to tailor study to patient's needs and capabilities • Procedural modifications allow for esophagography on even the sickest patients including patients who are debilitated, intubated, postoperative, or aspirating and patients who can't drink. • Challenging cases to perform and interpret• Important for radiologists to be aware of diagnostic challenges and how to best examine patients safely, modifying techniques to obtain necessary diagnostic information.

#### TABLE OF CONTENTS/OUTLINE

• Review GI fluoroscopy trends • Discuss how to perform an esophagram in challenging circumstances including procedural modifications for the sickest patients • Describe detailed techniques, tricks and tips on how to perform an esophagram for: Debilitated patients, Intubated patients, Aspirating patients, Patients who can't swallow on command, Possible tracheoesophageal fistula, Suspected impacted foreign body or food bolus, Post-operative patients including post laryngectomy, esophagectomy, myotomy, and Zenker repair. • Discuss potential pitfalls. • Important pathology can be identified on these studies, often providing information that is not readily obtained with alternative methods.

### GIEE-96 DEEP DIVE IN DIVERTICULA: PICTORIAL REVIEW OF GI TRACT CASES

Jose D. Fernandes SR (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Gaetan Afonso, MD (*Abstract Co-Author*) Nothing to Disclose
Cassio G. Reis JR (*Abstract Co-Author*) Nothing to Disclose
Gabriela Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Arthur H. Godeiro, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Diverticula can be found in various parts of the digestive tract, such as the esophagus, stomach, duodenum, jejunum, ileum, appendix, and colon. Prevalence varies according to each segment, being very common in the colon and rarer in other segments. Their clinical manifestations are generally vague, which makes diagnosis difficult and increases the risk of complications. Radiologists play a fundamental role in detecting and characterizing a wide range of gastrointestinal conditions, including the different types of diverticula in the gastrointestinal tract. Therefore, it is essential for radiology professionals to be familiar with all types of diverticula, from common colon diverticula to rare cases such as Zenker's, Killian-Jamieson's, Meckel's, duodenal, and gastric diverticula.

#### TABLE OF CONTENTS/OUTLINE

Through a pictorial review, we intend to present an overview of the various types of diverticula in the gastrointestinal tract, including rarely described cases in the literature, as well as to discuss the incidence, symptoms, and prognosis of this clinical condition. We aim to highlight the role of various imaging modalities in aiding diagnosis, with emphasis on cases identified in imaging studies of lower technological complexity, such as radiographic contrast studies. We also intend to highlight possible pitfalls in the assessment of exams in this context, especially concerning the differentiation between pseudodiverticula and true diverticula in imaging exams.

### GIEE-97 LIVER INFECTIONS: IMAGING, DIFFERENTIAL DIAGNOSIS, PEARLS, ANDPITFALLS

Mustafa Koc, MD (*Abstract Co-Author*) Nothing to Disclose
Sukru Mehmet Erturk, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG;Speaker, General Electric Company ;Consultant, Siemens AG
Sukru Sahin, MD (*Abstract Co-Author*) Nothing to Disclose
Ali H. Baykan, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To describe imaging findings of infectious liver diseases 2. To discuss the role of cross-sectional imaging in the diagnostic work-up of infectious liver diseases 3. To discuss the imaging differential diagnosis of infectious liver diseases

#### TABLE OF CONTENTS/OUTLINE

• Introduction • Transmission routes of infectious agents, pathophysiology, and effects on the liver • Key imaging findings of infectious liver diseases, including bacterial, viral, parasitic, and fungal infections • Pearls and pitfalls in the differential diagnosis of infectious liver diseases • Conclusion

### GIEE-98 UNCOMMON CT AND MR MANIFESTATIONS OF SOLID PSEUDO-PAPILLARY TUMOR OF THE PANCREAS

Yan Zhou (*Abstract Co-Author*) Nothing to Disclose
Xuhua Gong (*Abstract Co-Author*) Nothing to Disclose
Jianrong Xu (*Abstract Co-Author*) Nothing to Disclose
Hainan Ren, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Li Jun Qian, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To illustrate and review the uncommon CT and MR manifestations of solid pseudo-papillary tumor of the pancreas (SPT)2. Discuss the crucial points for diagnosis of uncommon SPT.Conclusion: The major teaching points of this exhibit are:1. SPT may be associated with a variety of uncommon CT and MR manifestations.2. Knowledge of the uncommon imaging spectrum is useful in identification of the disease.

**TABLE OF CONTENTS/OUTLINE**

1. SPT in male patients2. small SPT3. SPT with minimal solid component 4. SPT with minimal cystic component 5. SPT with dense central calcification6. Extrapancreatic SPT7. Aggressive SPT with metastatic disease8. SPT with dorsal pancreas agenesis9. Technical considerations

## GIEE-99 SPECTRUM OF GASTROINTESTINAL MESENCHYMAL LESIONS: MULTIMODALITY IMAGING AND DIAGNOSTIC APPROACHES

Ba D. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Kenneth N. Huynh, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review the common and uncommon mesenchymal lesions of the GI tract with histopathologic findings, differential diagnosis, and prognosis. 2. To characterize imaging features of each GI tract mesenchymal lesion to narrow diagnostic possibilities using CT, MR, PET/CT, and ultrasound.

**TABLE OF CONTENTS/OUTLINE**

Soft tissue mesenchymal lesions are ubiquitously found throughout the body but rarely occur distinctively in the gastrointestinal (GI) tract. Gastrointestinal stromal tumors account for 90% of GI mesenchymal lesions but only less than 1% of overall GI tract tumors. Less common mesenchymal lesions range from benign schwannoma, leiomyoma, inflammatory fibroid polyp, granular cell tumor, and gangliocytic paraganglioma to malignant lesions such as leiomyosarcoma, clear cell sarcoma, inflammatory myofibroblastic tumor, and primary GI melanoma. Radiologic appearances and characteristics of these lesions frequently overlap and lead to a broad differential diagnosis. Accurate diagnosis is crucial as otherwise treatable lesions with malignant potential may be mistaken for benign processes. This exhibit will present the imaging spectrum of GI tract mesenchymal lesions on CT, MR, PET/CT, and ultrasound. These lesions include the benign and malignant entities mentioned in the above paragraph. This exhibit will also review the typical locations of occurrence along the GI tract and discuss a simplified approach to formulate and narrow the differential diagnosis of these lesions.

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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

GIEE-1

## FACES OF FRANTZ: EXPLORING THE SPECTRUM OF A RARE PANCREATIC TUMOR

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Daniel A. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Beatriz Ferreira Obara, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia O. Menezes, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Bekhor, MD (*Abstract Co-Author*) Nothing to Disclose
Aley Talans, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna G. Busoletto Tripode SR, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula Fraga Cintra Gonzaga (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Provide an overview of Frantz tumor (solid pseudopapillary tumor of the pancreas). Discuss typical and atypical cases with an emphasis on image characteristics. Review the main differential diagnoses of Frantz tumor with a didactic approach.Offer helpful tips for challenging cases to improve accurate diagnosis and patient outcomes.Develop a radiological survival guide for the interpretation of pancreatic lesions with solid and cystic components.

### TABLE OF CONTENTS/OUTLINE

This presentation aims to provide a comprehensive overview of the main features of Frantz Tumor, including epidemiology, associations, pathology, radiographic features, prognosis, and treatment. Using case-based presentations, we will explore the classic and uncommon imaging manifestations of Frantz tumor, including multiplicity, ductal obstruction, simulation of other tumors such as neuroendocrine, intratumoral calcification, occurrence in male patients and children, distant metastasis, parenchymal and extracapsular invasion.We will discuss how to differentiate from benign lesions and malignant neoplasms, including pancreatic pseudocyst, mucinous cystadenoma, neuroendocrine tumors, gastrointestinal stromal tumors, and pancreatic adenocarcinoma. Provide tips for challenging cases where the diagnosis may not be apparent from imaging alone, and radiologists can still play a key role in contributing to better patient outcomes.

# Abstract Archives of the RSNA, 2024

GIEE-10

## ASSESSMENT PRIOR TO LIVER RESECTION; WHAT A RADIOLOGIST SHOULD KNOW?!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Sergio Klimkowski, MD (*Abstract Co-Author*) Nothing to Disclose
Imran Ahmed, MD (*Abstract Co-Author*) Nothing to Disclose
Mindy X. Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Ann A. Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 1. Introduce the complexity, nature, epidemiology, diagnostic and therapeutic approaches. 2. 2. Discuss the indications of liver resection. 3. 3. Discuss radiologists' roles in detection, proper characterization and staging of the cause. 4. 4. Demonstrate the proper localization. 5. 5. Discuss the criteria for technical resectability. 6. 6. Summarize different types of surgical resection.

### TABLE OF CONTENTS/OUTLINE

1) - Introduction to importance of preresection liver assessment a) Complexity of disease. b) The occult nature of the disease. c) The changing epidemiology. d) The rapidly evolving diagnostic and therapeutic approaches.2) - Indications of liver resection a) Common malignant indications include: - HCC - Cholangiocarcinoma - Metastases (commonly colorectal) b) Liver transplant.3) - Role of Imaging: a) Detection b) Proper characterization c) Localization d) Staging e) Anatomical variants-4) - Resectability criteria a) Technical resectability criteria. b) Future liver remnant volume.5) - Types of surgical resection: a) Anatomic resection. b) Non-anatomic (wedge).

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# Abstract Archives of the RSNA, 2024

GIEE-100

## BEYOND FISTULAS: IMAGING OF ANORECTAL, PERIANAL, AND PERINEAL PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana Ramacho Rolim Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Velloni, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Gomes De Menezes JR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. This review aims to discuss and to recognize the differential diagnosis of perianal, perineal and anorectal diseases besides fistulas, which often represent a radiological challenge.2. Illustrate with cases the imaging features of main differential diagnosis using computed tomography (CT) and magnetic resonance imaging (MRI).3. Provide a diagnostic approach with a workflow proposal for the differential diagnosis of perianal, perineal and anorectal diseases.

### TABLE OF CONTENTS/OUTLINE

1 - Introduction 2- Anatomy- Perineal- Anal canal and rectum 3 - Compartmental Approach- Perineal- Anal Canal and Rectum 4 - Diseases? Infection And Inflammation- Pilonidal Disease- Hidradenitis Suppurativa- Fournier Gangrene- Vulvar Abscess- Infectious Myositis- Endometriosis? Neoplasm- Urogenital - Female reproductive tract - Male reproductive tract- Anorectal- Epithelial- Non-epithelial- Carcinoid- Secondary? Vascular- Hemorrhoidal disease / Anorectal varices- Vascular malformation- Congestive Edema? Congenital- Middle Raphe Cyst- Retrorectal developmental cysts? Miscellaneous- Trauma- Pudendal Nerve Entrapment Syndrome 5 - Conclusion

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# Abstract Archives of the RSNA, 2024

GIEE-101

## INTESTINAL COMPLICATIONS IN THE ONCOLOGIC PATIENT: SPECTRUM OF CT FINDINGS AND IMAGING-BASED DIAGNOSTIC APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduard Andia Navarro (*Abstract Co-Author*) Nothing to Disclose
Marisol Rodriguez Arias (*Abstract Co-Author*) Nothing to Disclose
ANA SANCHEZ MARQUEZ (*Abstract Co-Author*) Nothing to Disclose
Eva Maria Merino Serra (*Abstract Co-Author*) Nothing to Disclose
Maria Pardo Antunez (*Abstract Co-Author*) Nothing to Disclose
David Martinez De La Haza (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:1. To review the variety of symptomatic and potentially serious intestinal complications that may occur in patients with oncologic pathology, many of which might be related to previous or ongoing therapies2. To evaluate CT findings in these patients, emphasizing the signs that might lead us to a correct diagnosis3. To gain an awareness of the importance of the global context of the patient (including clinical manifestations and underlying treatment such as chemotherapy, radiation therapy and immunotherapy) in the diagnostic approach.

### TABLE OF CONTENTS/OUTLINE

- INTRODUCTION- CLINICAL CONTEXT1. Symptoms (diarrhea, obstruction, pseudo-obstruction, other) and blood test parameters2. Oncologic background: primary neoplasm (visceral or hematologic), oncologic therapy- SPECTRUM OF CT FINDINGS1. Mural thickening: type, distribution, extension, severity2. Abnormal enhancement3. Intestinal distension4. Strictures5. Other: pneumoperitoneum, pneumatosis intestinalis, fluid collections- TYPE OF COMPLICATIONSA. Infectious enterocolitis (viral, bacterial, pseudomembranous colitis)B. Neutropenic enterocolitisC. Immunotherapy-mediated enterocolitisD. Radiation-induced enteritisE. Graft vs host diseaseF. Tumor progression-relatedG: Other: ischemic colitis, stercoral colitis, perforation, iatrogenic- TAKE-HOME POINTS

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# Abstract Archives of the RSNA, 2024

GIEE-102

## PORTOSYSTEMIC SHUNTS: ANATOMY, TREATMENT, AND COMPLICATIONS WITH 3D CINEMATIC RENDERING CORRELATES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Shanna A. Matalon, MD (*Abstract Co-Author*) Nothing to Disclose
Khushboo Jhala, MD,MBA (*Abstract Co-Author*) Nothing to Disclose
Bardia Nadim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Spontaneous portosystemic shunts occur in portal hypertension due to reconstitution of embryonic venous channels in order to act as "release valves."2. Major complications of portal hypertension include acute variceal bleeding and hepatic encephalopathy.3. 3D cinematic rendering is able to show contiguous pathways and highlight complex vascular anatomy related to portosystemic shunts, which can sometimes be difficult to conceptualize on standard CT reformats due to tortuosity.4. Transjugular intrahepatic portosystemic shunt (TIPS) can be used for refractory esophageal variceal bleeding and ascites, and balloon-occluded retrograde transvenous obliteration (BRTO) can be used to treat gastric varices with large gastrorenal or splenorenal shunts.5. CT evident complications of TIPS and BRTO include stent occlusion, and clinical presentation is often similar to the original manifestations of portal hypertension.

### TABLE OF CONTENTS/OUTLINE

1. Normal portal and mesenteric venous anatomy2. Pathophysiology of Portal Hypertensiona. Prehepaticb. Intrahepaticc. Posthepatic3. Anatomic Collateral Pathways Complications4. Interventional Procedures and Complicationsa. Transjugular intrahepatic portosystemic shunt (TIPS): for refractory esophageal variceal bleeding and ascitesi. Anatomyii. Imagingiii. Complicationsb. Transvenous obliteration of varices: for gastric ectopic varices (not esophageal)i. Anatomy1. Gastrorenal shunt 2. Splenorenal shuntii. Imagingiii. Complicationsc. Balloon dilation of hepatic vein (for thrombosis/web in hepatic vein)d. Transhepatic clot thrombolysis (PV thrombosis)e. Splenic artery embolization (sinistral portal hypertension)

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# Abstract Archives of the RSNA, 2024

GIEE-104

## IMAGING APPROACH TO THE DIAGNOSIS OF SOLITARY SOLID PANCREATIC HEAD MASSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Azfar Siddiqui, MD (*Abstract Co-Author*) Nothing to Disclose
Amjad N. Mohammed I, MRCS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Mohamed Elbanan, MD (*Abstract Co-Author*) Nothing to Disclose
Nourel Hoda M. Tahon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Ayesha Nasrullah, MD,FRCR (*Abstract Co-Author*) Nothing to Disclose
Maaz Ghouri, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
David L. Raj, MD (*Abstract Co-Author*) Nothing to Disclose
Nanda Deepa Thimmappa, MD (*Abstract Co-Author*) Nothing to Disclose
Amr S. Abdelaziz, MD (*Abstract Co-Author*) Nothing to Disclose
Joe Jose, MD (*Abstract Co-Author*) Nothing to Disclose
Kazi A. Irfan, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Explain the imaging signs of pancreatic ductal adenocarcinoma arising in the head of the pancreas-Discuss the hypoenhancing pancreatic head masses, which can mimic pancreatic ductal adenocarcinoma-Highlight the different imaging appearances of pancreatic neuroendocrine neoplasms-Review the differentials of hyperenhancing pancreatic masses-Enumerate the different masses that can arise adjacent to the head of the pancreas, which can mimic a pancreatic head mass-Illustrate the cystic pancreatic lesions which can have an imaging appearance of a solid pancreatic mass

### TABLE OF CONTENTS/OUTLINE

-Spectrum of pancreatic head lesions-Imaging techniques in the evaluation of focal pancreatic lesions-Typical imaging appearance of pancreatic ductal adenocarcinoma-Pancreatic head masses that can mimic pancreatic ductal adenocarcinoma*Neoplastic*Non-neoplastic*Extrapancreatic masses arising adjacent to the pancreas*Cystic pancreatic lesions-Features that can help differentiate between pancreatic ductal adenocarcinoma and its mimics-Imaging appearance of pancreatic neuroendocrine tumors-Other hyperenhancing pancreatic head masses-Algorithm for differentiating between different pancreatic head masses

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# Abstract Archives of the RSNA, 2024

GIEE-105

## TRUE BEAUTY COMES FROM WITHIN: WHEN INTESTINAL CONTENTS HELP YOU GET THE DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Velloni, MD (*Abstract Co-Author*) Nothing to Disclose
Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Martin Horwarth, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•When assessing for gastrointestinal conditions, while radiologists focus on the patters of distention, wall thickening and enhancement of bowel loops, the assessment of the contents of the involved loops can often be forgotten or neglected, potentially leading to wrong or delayed diagnosis.•Many intestinal and systemic diseases can alter the contents of the small intestine and the colon. The identification of these pathological intestinal contents can assist in the diagnosis of specific pathologies.•Equally important is recognizing luminal intestinal findings that do not correspond to any pathology, but are rather physiological or variants of normality.

### TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Review of the anatomy of the digestive tract, the path of the food bolus and its changes along the way.3. Image of physiological intestinal contents.4. Findings of intestinal contents that have no clinical significance (tablets, contents of different densities, fruit seeds, medical devices, foreign body?).5. Pathological findings of intestinal contents (steatorrhea, gallstones, blood, bezoar, food impactation).6. Assessment of specific pathologies (foreign body ingestion, bezoar, gallstone ileus, Bouveret syndrome, cystic fibrosis?).7. Take home notes.8 .Bibliography.

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# Abstract Archives of the RSNA, 2024

GIEE-106

## ASSESSMENT OF DISEASE ACTIVITY IN PATIENTS WITH CROHN'S DISEASE: CORRELATION BETWEEN MAGNETIC RESONANCE ENTEROGRAPHY AND INTESTINAL ULTRASOUND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Myung-Won You, MD (*Abstract Co-Author*) Nothing to Disclose
Choongwui Cho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-compare the diagnostic yield of intestinal ultrasound(IUS) and MR enterography (MRE) for disease activity in patients with Crohn's disease(CD)-assess the correlation between IUS and MRE in the diagnosis of disease activity in patients with CD

### TABLE OF CONTENTS/OUTLINE

1) Twenty-six cases with CD who underwent IUS and MRE within a 3-month interval- per-segment diagnosis: 7 divided segments of small and large bowels2) Diagnostic criteria of active inflammation- qualitative criteria/quantitative criteria on IUS- qualitative criteria/quantitative criteria on MRE3) Comparison of diagnosis of active inflammation on IUS vs. MRE- percentage and location of active inflammation- percentage and location of complication4) Correlation between MaRIA and IBUS-SAS scores5) Diagnostic performance of IUS with MaRIA>11 cut-off6) Concordant/discordant cases between IUS and MRE

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# Abstract Archives of the RSNA, 2024

GIEE-107

## DUAL-ENERGY COMPUTED TOMOGRAPHY 2.0 IN GASTROINTESTINAL IMAGING: QUANTITATIVE IMAGING, BIOMARKERS, AND OTHER DEVELOPMENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ramiro Mendez (*Abstract Co-Author*) Nothing to Disclose
Sandra Baleato Gonzalez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlos Fraga Pineiro (*Abstract Co-Author*) Instructor, General Electric Company
Gabriel C. Fernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD, PhD (*Abstract Co-Author*) Speaker, General Electric Company
Eliseo Vano Galvan, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Cano, DIPLPHYS (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Tardaguila de la Fuente, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Girones Sanguesa (*Abstract Co-Author*) Nothing to Disclose
Roberto Garcia Figueiras, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Dual-energy CT (DECT) imaging has broadened the potential of CT imaging by offering multiple types of DECT-derived images. DECT shows profound capabilities to improve diagnosis in gastrointestinal (GI) imaging based on its superior material differentiation, but also on the use of DECT-derived quantitative values that have considerable potential to serve as imaging-based biomarkers in multiple clinical applications.The aim of this exhibit is:-To review physical concepts of DECT and technical parameters influencing image quality and DECT quantification.-To discuss advantages and limitations of quantitative DECT imaging in different clinical scenarios-To provide a comprehensive and practical overview of possible diagnostic pitfalls that may be encountered using quantitative DECT imaging.-To evaluate future perspectives for quantitative DECT imaging and photon-counting technology.

### TABLE OF CONTENTS/OUTLINE

-Basic concepts of DECT: atomic numbers, energy levels, and other physics concepts.-Understanding the different types of DECT-derived images and their use in GI imaging.-Principles of quantitative DECT imaging: iodine, fat, and iron concentrations / extracellular volume, effective atomic number, and electron-density values.-Cutting-edge applications of quantitative DECT in GI imaging: lesion detection and characterization, accurate tumor staging, prognostic and predictive value, therapy planning, treatment response assessment, and body composition.-Pitfalls and artifacts in quantitative DECT imaging: how to avoid them.-Future directions: from quantitative DECT-derived biomarkers (radiomics and radiogenomics) to photon-counting CT in GI imaging.-Conclusions

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# Abstract Archives of the RSNA, 2024

GIEE-108

## UNRAVELING BODY PACKER: RADIOLOGISTS KEY INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mohammad Mohsin Arshad, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Background, terminology, and epidemiology of body packing.-Understand the usual clinical and radiological signs displayed by individuals who conceal illicit materials internally and investigate the importance of employing multiple imaging methods such as X-rays, ultrasounds, CT scans, and MRIs to assess and address such situations.

### TABLE OF CONTENTS/OUTLINE

1. Concept/background of body packing.2. Clinical presentation of body packers.3. A radiological assessment that needs to be done.4. What radiologists need to know!5. Case-based review.

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# Abstract Archives of the RSNA, 2024

GIEE-109

## HEPATIC VENOUS MALFORMATION (HEMANGIOMA): RADIOLOGIC SPECTRUM, DIFFERENTIAL DIAGNOSIS, AND MANAGEMENT STRATEGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Faeze Salahshour (*Abstract Co-Author*) Nothing to Disclose
Mohammad Mehdi M. Mehrabi Nejad (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Radiologic Presentation Variability Understanding the spectrum of typical and atypical radiologic presentations of Hepatic Venous Malformations (HVMs). 2. Red Flags: Identifying key indicators suggesting alternative diagnoses beyond HVM. 3. Imaging Mimics Exploring conditions that closely resemble HVM on various imaging modalities. 4. Management Strategies Discussing approaches to the management and treatment of HVM.

### TABLE OF CONTENTS/OUTLINE

1. Definition and Characteristics of HVM 2. Diagnostic Criteria and Modalities 3. Typical Imaging Presentations of HVM 4. Atypical Imaging Presentations of HVM a. Liver Hemangiomatosis b. Sclerosant HVM c. Flash-filling HVM d. HVM with shunt 5. Red Flags Requiring Attention a. Medical history correlates: liver disease or cancer c. Heterogeneous signal in MRI e. Diffusion restriction on DWI and ADC map f. Atypical enhancement patterns 6. Mimickers of HVM a. Angiosarcoma b. Retroperitoneal Paraganglioma c. Neuroendocrine Metastasis d. Choriocarcinoma Metastasis e. Colorectal Metastasis f. Inactive Hydatid Cyst g. Calcified Foci Post-Metastatic Treatment 7. Complication a. Budd-Chiari syndrome b. Kasabach-Merritt Syndrome c. Rupture 8. Biopsy Indications 9. Management Approaches for HVM 10. Take-Home Message

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

GIEE-11

## LOST ART OF BARIUM SWALLOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Bhavya Arora, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Barium swallow is a radiographic exam using contrast to evaluate esophagus's structure and some functions. It helps diagnose conditions like motility disorders, strictures, and perforations, as well as distal issues such as hiatal hernias and reflux. Despite CT imaging, it remains useful. While it can identify common pathologies, more complex swallowing issues may require a modified barium swallow evaluation.

### TABLE OF CONTENTS/OUTLINE

Anatomy of esophagus: The normal course, appearance and constrictions.Indications: Dysphagia, GERD, hiatus hernia, Repeated vomiting, epigastric pain, post-operative leakTechnique: Initial scout film to rule out any foreign body and as control for post-contrast study followed by swallowing barium under video fluoroscopy in upright lateral position for pharynx and to rule out aspiration. Image with patient instructed to say ‘Eeee’ is taken to visualize the hypopharynx. As the patient swallows, frontal and oblique views are taken. Prone in right anterior oblique to assess motility of esophagus and competence of the gastro-esophageal junction. Single contrast versus double contrast barium swallow Clinical significance: Structural: Diverticulum, Stricture, Hiatus herniaNeoplastic: Lipoma, Leiomyoma, AdenocarcinomaMobility: Achalasia, Hypoperistalsis, Diffuse esophageal spasmsTraumatic: Iatrogenic, Perforation, Post caustic injuryPediatric: Tacheo-esophageal fistula, Esophageal atresiaContraindication: Relative contraindications is perforation.Complications: Aspiration, leakage from a perforation

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

GIEE-110

## ROLE OF IMAGING IN THE MANAGEMENT OF PATIENTS WITH INFLAMMATORY BOWEL DISEASE (IBD): A CASE-BASED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Elena Serrano Tamayo, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Garcia Latorre, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Canales Lachen (*Abstract Co-Author*) Nothing to Disclose
Ana Villanueva, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Inflammatory bowel disease (IBD) is a chronic condition affecting the gastrointestinal tract that is comprised of two disorders: Crohn’s disease (CD) and ulcerative colitis (UC). They are relapsing and destructive diseases that can result in progressive bowel damage if not adequately treated, with the resultant impairment of the quality of life of patients.Therefore, clinicians need clear and objective information on disease activity and extent to adequately adapt the treatment in IBD patients (drug change or optimization, endoscopic dilatation or surgical treatment).Magnetic resonance enterography (MRE) and intestinal ultrasonography (IUS) can accurately evaluate these parameters, currently playing a pivotal role in the monitoring and management of IBD patients, while computed tomography (CT) is usually reserved to the emergency setting.

### TABLE OF CONTENTS/OUTLINE

Introduction:- IBD: definition and clinical course- Imaging techniques used for the monitoring of IBD diagnosed patients.- Treatment modalities available in IBD and its indications: pharmacological treatment, endoscopic dilatation and surgery.Review of the role of imaging in the management of IBD patients through a case-series in which different clinical scenarios and outcomes are shown.ConclusionsReferences

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# Abstract Archives of the RSNA, 2024

GIEE-111

## THE ROLE OF MRI IN RECTAL CANCER IN THE ERA OF NEW NEOADJUVANT THERAPEUTIC STRATEGIES, WATCH & WAIT, AND MINIMALLY INVASIVE SURGERY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Sandra Baleato Gonzalez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Stephanie Nougaret, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Marhuenda, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD, PhD (*Abstract Co-Author*) Speaker, General Electric Company
David H. Kim, MD (*Abstract Co-Author*) Shareholder, Elucent Medical
Joan C. Vilanova, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Juan-Ramon R. Ayuso, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto Garcia Figueiras, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Rectal cancer (RC) presents significant diagnostic and therapeutic challenges. The introduction of new neoadjuvant therapeutic strategies (total neoadjuvant therapy [TNT], RC treatment without radiation, immunotherapy [IT]), minimally invasive surgery, and non-surgical options (watch and wait [WW] strategy) in RC is mainly based on MRI findings that provide essential information for treatment selection. MRI serves an increasingly pivotal role in the diagnosis, staging, treatment stratification, response assessment, and follow-up of patients with RC. MRI can assess both the anatomical extent of invasion (offering a surgical roadmap) and the pattern of tumor infiltration with factors involved in local spread and tumor relapse and factors involved in systemic dissemination not included in the usual TNM staging.The aim of this exhibit is:-To review the implications for prognosis and choice of treatment of MRI findings of local tumor spread (depth of invasion, mesorectal fascia [MRF] involvement, lymph node metastases, perineural and lymphatic invasion) and systemic dissemination (extramural vascular invasion and tumor deposits).-To evaluate limitations of MRI to assess some key pathological, molecular, and genetic features in RC.-To discuss the role of MRI in the era of new therapeutic strategies in RC.-To review the limitations of MRI in the assessment of RC response.

### TABLE OF CONTENTS/OUTLINE

-Basic concepts of MRI in RC: TNM-staging and MRI-based surgical roadmap.-MR-derived prognostic features in RC.-The changing role of MRI in RC with TNT, IT, WW, and minimally invasive surgery for staging, restaging, and follow up in RC.-Future role of functional MRI and radiomics in RC.-Conclusions

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# Abstract Archives of the RSNA, 2024

GIEE-112

## BUBBLE INSIGHTS: NAVIGATING CEUS LI-RADS AND ITS DISTINCTIONS FROM CT-MRI LI-RADS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hyun-Jung Jang, MD (*Abstract Co-Author*) Nothing to Disclose
Tae Kyoung Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Emphasizing the efficacy of contrast-enhanced ultrasound (CEUS) in characterizing hepatic observations among high-risk populations for hepatocellular carcinoma (HCC). 2. Exploring the key differences of CEUS LI-RADS from CT/MRI LI-RADS: - Real-time imaging capabilities.- Purely intravascular contrast agents.- Option for repeated injections and replenishments.- Suitability for patients with renal failure. 3. Presenting illustrative cases to highlight crucial differences between CEUS LI-RADS and CT/MRI LI-RADS.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: - Overview of CEUS LI-RADS and microbubble contrast agents.2. Real-time imaging: - Detection and assessment of arterial phase hyperenhancement (APHE).- Evaluation of APHE patterns.3. Purely intravascular contrast agents:- Significance of the timing and degree of washout.- Consistent demonstration of washout in non-HCC malignancies.- Utilization of CEUS-guided biopsy for small isoechoic malignancies.- Discrepancies in LR-M criteria between CEUS and CT/MRI.4. Availability of repeated injections and replenishments:- Minimization of failed examinations due to timing issues or patient’s motion/breathing.- Utility in the assessment of APHE patterns.5. Suitability for patients with renal failure:- No known renal toxicity of microbubble contrast agents.6. Clinical Applications:- Literature review relevant literature, including recent studies on the utility of CEUS LI-RADS across various indications and prospects.

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GIEE-113

## ALCOHOL-RELATED PANCREATITIS: PATHOPHYSIOLOGY, NATURAL HISTORY, AND IMAGING CORRELATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Abhijit A. Raut, MD (*Abstract Co-Author*) Nothing to Disclose
Anoushka Maheshwari (*Abstract Co-Author*) Nothing to Disclose
Sachin Kumar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD (*Abstract Co-Author*) Nothing to Disclose
Sharad Maheshwari, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Alcohol abuse imposes a substantial burden on our healthcare system. Addressing this issue with appropriate public health strategies is paramount, given its modifiable nature. Alcohol-induced pancreatitis ranks as the second most common cause following gallstones, contributing to nearly one-third of acute pancreatitis cases in the US. Its spectrum encompasses acute interstitial pancreatitis, acute pancreatic necrosis, recurrent acute pancreatitis, and can progress to chronic pancreatitis with sustained alcohol use, which becomes irreversible. Understanding the unique natural history of alcohol-related pancreatitis aids in diagnosis and guides management effectively. Computed Tomography (CECT) stands as the imaging modality of choice in acute settings. Meanwhile, Magnetic Resonance Imaging (MRI) proves more sensitive for detecting subtle changes and offers both morphological and functional insights in chronic cases. The exhibit will elucidate the imaging implications of this distinctive disease spectrum.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Epidemiology 3. Pathophysiology Natural History 4. Patterns of Excessive Drinking: a. Binge drinking b. High-intensity drinking 5. Imaging Techniques 6. Imaging Features: a. Mild Acute Pancreatitis b. Severe Acute Pancreatitis c. Acute Recurrent Pancreatitis d. Early Chronic Pancreatitis e. Late or Irreversible Chronic Pancreatitis

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# Abstract Archives of the RSNA, 2024

GIEE-114

## INSIGHTS INTO SICKLE CELL DISEASE: UNVEILING ABDOMINAL IMAGING FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniella B. Parente, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Luana Alves, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Explore the abnormal hemoglobin structure in Sickle Cell Disease (SCD) and its correlation with sickling and red blood cell damage.
- Define the common abdominal and pelvic manifestations of SCD, elucidating their characteristic imaging features using CT scan and MRI, and discuss findings in each organ.
- Understand the role of imaging in diagnosing acute crises, potential complications, and chronic consequences of SCD in the abdomen and pelvis.

### TABLE OF CONTENTS/OUTLINE

I. Introduction
- Understand the basic mechanisms of Sickle Cell Disease (SCD): abnormal hemoglobin causing red blood cell sickling and vaso-occlusion.
- Emphasize the importance of abdominal and pelvic imaging for diagnosing and managing complications arising from SCD. II. Abdominal and Pelvic Manifestations of SCD
- Recognize how SCD leads to abdominal disorders through vaso-occlusion and hemolysis.
- Discuss the potential complications of chronic hemolysis, such as iron overload in the liver:
- Vaso-occlusion and its consequence: tissue and organ ischemia and infarction
- Hemolysis
- Functional asplenia and increased risk of infection III. Imaging Findings of SCD in the Abdomen and Pelvis
- Extramedullary hematopoiesis
- Organ-specific findings based on imaging:
- Liver
- Gallbladder
- Spleen
- Kidneys
- Gastrointestinal tract
- Male reproductive organs IV. Conclusion
- Early recognition of abdominal complications through imaging allows for prompt management and improved patient outcomes.

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# Abstract Archives of the RSNA, 2024

GIEE-115

## BEYOND THE BASICS: UNCOMMON ANORECTAL NEOPLASMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maialen Imizcoz, MD (*Abstract Co-Author*) Nothing to Disclose
Jokin Zabalza Unzue (*Abstract Co-Author*) Nothing to Disclose
Laida Etxeberria Kaiuela, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To describe and illustrate the radiological and histopathological findings of uncommon anorectal neoplasms. 2. To highlight the radiological differentiating features that may prove useful to reach an accurate diagnosis in anorectal mases.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: Why is it important to recognise uncommon anorectal neoplasms by imaging tests? 2. Essential anatomy of the anorectum. 3. Uncommon anorectal neoplasms: radiological and histopathological findings. • Rectal gastrointestinal stromal tumor • Anorectal malignant melanoma • Rectal neuroendocrine tumor • Rectal lymphoma • Rectum sarcoma • Carcinoma arising from anal fistula • Linitis plastica of the rectum 4. Review of differentiating radiological features of uncommon anorectal neoplasms on CT/MRI. 5.Conclusion

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

GIEE-116

## NAVIGATING POST-LOCOREGIONAL THERAPY IMAGING IN HCC: INSIGHTS AND UPDATES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ozerk Turan (*Abstract Co-Author*) Nothing to Disclose
Jade J. Wong-You-Cheong, MD (*Abstract Co-Author*) Author, Reed Elsevier
Barton F. Lane, MD (*Abstract Co-Author*) Research support, Siemens AG;License agreement, Siemens AG
Izzet Altun, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1- Locoregional treatment (LRT) is widely used for hepatocellular carcinoma (HCC), with radiologists playing a critical role in assessing treatment response. 2-The LI-RADS Treatment Response Algorithm (LR-TRA) is a standardized system for evaluating treatment response after LRT for HCC, introducing a new approach in 2024 based on radiation and non-radiation therapies. 3-This educational exhibit will focus on imaging techniques and features of post-LRT HCC, incorporating updates on LR-TRA v2024.

### TABLE OF CONTENTS/OUTLINE

1-Indications, role, and basic concepts of locoregional therapies, including radiofrequency ablation, microwave ablation, cryoablation, stereotactic radiation, transarterial chemoembolization, and radioembolization. 2-CT and MRI study protocols for HCC. 3- Review of CT and MRI imaging features after LRT for HCC. 4- Case-based overview of the 2024 LI-RADS non-radiation and radiation TRA. 5- Discussion on the role of contrast-enhanced ultrasound in monitoring treatment response after LRT. 5- Summarization of LRT techniques and imaging features for HCC with LR-TRA v2024 updates.

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# Abstract Archives of the RSNA, 2024

GIEE-117

## CANCER-ASSOCIATED FIBROSIS: WHAT RADIOLOGISTS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mariko Irizato (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Kiyoyuki Minamiguchi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to review the components and role of fibrous extracellular matrix (ECM) in cancer, to understand representative cases of abdominal cancer with abundant fibrosis (e.g., gastrointestinal, hepatobiliary, and pancreatic) in multimodality imaging, and to focus on imaging feature of cancer-associated fibrosis that are relevant to clinical outcomes.

### TABLE OF CONTENTS/OUTLINE

ECM plays an important role in cancer progression. Cancer-associated fibrosis (e.g., fibrous capsule and fibrous stroma) is excessive accumulation of fibrous proteins such as collagen and laminin in the ECM, dramatically altering the biological properties of the cancer. The impact of the cancer-associated fibrosis on clinical prognosis is a matter of interest, but controversial for each cancer: fibrous capsule in colorectal liver metastases is involved in a favorable prognosis by physiologically confining cancer cells, whereas fibrous stroma in cholangiocarcinoma in poor prognosis by promoting cancer growth. Multimodality imaging to infer cancer-associated fibrosis is useful not only for diagnosis but also for predicting clinical prognosis such as overall survival, recurrence free survival, and treatment response. Table of contents is as follows;1) Overview of cancer-associated fibrosis2) Representative case presentation 3) Clinical application of multimodality imaging reflecting cancer-associated fibrosis

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# Abstract Archives of the RSNA, 2024

GIEE-118

## COLORECTAL CANCER AMONG GEN X, MILLENNIALS, AND GEN Z: CURRENT UPDATE ON PATHOLOGY, IMAGING FINDINGS, AND MANAGEMENT OF EARLY-ONSET COLORECTAL CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sukeshi Arora (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Exelixis, Inc;Advisory Board, AstraZeneca PLC;Advisory Board, BridgeBio Pharma;Institutional research support, Faron Pharmaceuticals;Institutional research support, Caris Life Sciences;Institutional research support, Ipsen SA;Institutional research support, Lexicon Pharmaceuticals, Inc;Institutional research support, Eli Lilly and Company;Institutional research support, BeiGene, Ltd;Institutional research support, Isofol Medical AB;;;;
Aishwarya Vemula (*Abstract Co-Author*) Nothing to Disclose
Sriram Jaganathan, MD (*Abstract Co-Author*) Nothing to Disclose
Alia Nazarullah (*Abstract Co-Author*) Nothing to Disclose
Shahedur Rahman (*Abstract Co-Author*) Nothing to Disclose
Ebe Ewere, BS (*Abstract Co-Author*) Nothing to Disclose
Venkata S. Katabathina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Discuss the increasing incidence, risk factors and unique characteristics of early-onset colorectal cancer (EOCRC)
- Review genetic features, molecular biology, prognosis natural history of EOCRC
- Describe salient imaging findings of primary/metastatic EOCRC discuss role of CT/MRI/PET-CT in management.
- Discuss current screening guidelines, targeted therapeutics future directions in early diagnosis treatment

### TABLE OF CONTENTS/OUTLINE

; EOCRC: Cancer in younger than 50 years old. ; Epidemiology ; Risk factors: genetics, obesity, sedentary lifestyle, sweetened beverages, westernized lifestyle, inflammation gut microbiome ; Comparing EOCRC vs. late-onset CRC in pathogenesis, genetics, pathology, molecular biology, clinical features, treatment, prognosis natural history ; Genetics molecular biology: 30% are genetic; Microsatellite Instability-High, TP53, CTNNB1 ; Grading and Staging ; Imaging Techniques: Radiography, Contrast enema, CT, MRI PET/CT ; Salient imaging findings ; Radiogenomics ; Management Prognosis ; Current screening guidelines and the role of CT Colonography ; Lifestyle modifications ; Future screening directions (new screening modalities and ways to identify at-risk population) ; Targeted Therapeutics ; Conclusion EOCRC is an emerging clinical problem that affects an increasing number of young patients. Salient features of EOCRC include left colon/rectal distribution, mucinous/signet ring histology, higher pathologic grade, poorer cell differentiation, more advanced stage poor prognosis. Radiologists play a pivotal role in timely diagnosis, screening, and management of EOCRC. Imaging helps in surveillance testing efficacy of novel drugs.

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# Abstract Archives of the RSNA, 2024

GIEE-119

## THE JEOPARDY OF CROHN'S DISEASE: CAN YOU IDENTIFY ALL THE SIGNS AND SYMPTOMS?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lindsay Duy, MD (*Abstract Co-Author*) Nothing to Disclose
Madison N. Crank, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Optimization of fluoroscopic technique and use of CT and MR enterography to identify fistulous tractsReview the diagnostic findings suggesting Crohn's disease using consensus definitions, including extraintestinal manifestationsReview the complications of Inflammatory Bowel Disease (IBD), focusing on fistulous tracts

### TABLE OF CONTENTS/OUTLINE

Using an interactive slideshow/gameshow format designed for resident education, review high yield facts about Crohn's with the following teaching points:Overview of IBD with a focus on Crohn's diseaseA. Crohn's diseaseB. Ulcerative colitisImaging techniques, protocols, and utility in assessing for Crohn'sA. CT enterographyB. MR enterographyC. Fluoroscopy a. Small bowel follow through b. FistulagramSeries of cases with teaching points to educate residents on the common diagnostic findings of Crohn's, including consensus definitionsA. Wall ThickeningB. Mural wall stratification: a. Target sign b. Fat halo signC. Mesenteric changes: a. Comb sign b. Creeping fat c. AdenopathyD. Diminished motilityE. Extraintestinal manifestations: a. Primary Sclerosing Cholangitis b. Arthritis c. Renal stonesSeries of cases reviewing complications of Crohn's disease and potential pitfallsA. Stricture: a. Fibrotic stricture b. Inflammatory stricture with string signB. Fistula: a. Simple fistula b. Complex fistula with clover leaf or star signC. Ulceration: a. Aphthous ulcer b. Deep ulcerationD. CobblestoningE. SacculationF. Sinus tractG. Inflammatory mass versus colonic adenocarcinomaH. Misdiagnosis of ulcerative colitis

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# Abstract Archives of the RSNA, 2024

GIEE-12

## ESOPHAGRAM REGAINING STRENGTH IN ACHALASIA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manuel Alejandro Garrido, MD (*Abstract Co-Author*) Nothing to Disclose
Mildreth Juliana Acuna Rojas, MEd (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Achalasia is an esophageal motility disorder, characterized by impaired relaxation of the lower esophageal sphincter.The global incidence ranging from 0.03 to 1.63 per 100,000 persons per year and the prevalence its 1.8 to 12.6 per 100,000 persons per year.Exists functional loss of myenteric plexus ganglion cells in the distal esophagus and lower esophageal sphincter. The diagnosis started with clinical suspiction, the syntoms are dysphagia to solids and liquids, regurgitation, occasional chest pain with or without weight loss, perform high resolution manometry, endoscopic and esophagram.The achalasia is relacionated with systemic diseases, tumors and others esophagus trastorns.The radiological technique consists of a series of fluoroscopy images of the pacient, specifically to esophagus while ingesting contrast medium.It is important to keep in mind that the esophagram is a study with greater accessibility, fewer risks and lower cost compared to endoscopy, which is why it represents a great option for diagnosis.

### TABLE OF CONTENTS/OUTLINE

Introduction, Epidemiology, Anatomic review, Physiology, Pathophysiology, Diagnosis, Radiological technique, Clinical case, Conclusions, References.

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# Abstract Archives of the RSNA, 2024

GIEE-120

## ROLE OF IMAGING IN BARIATRIC SURGICAL PROCEDURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ayesha Nasrullah, MD,FRCR (*Abstract Co-Author*) Nothing to Disclose
Azfar Siddiqui, MD (*Abstract Co-Author*) Nothing to Disclose
Nourel Hoda M. Tahon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Mohamed Elbanan, MD (*Abstract Co-Author*) Nothing to Disclose
David L. Raj, MD (*Abstract Co-Author*) Nothing to Disclose
Nanda Deepa Thimmappa, MD (*Abstract Co-Author*) Nothing to Disclose
Amr S. Abdelaziz, MD (*Abstract Co-Author*) Nothing to Disclose
Maged Algazzar, MD (*Abstract Co-Author*) Nothing to Disclose
Kazi A. Irfan, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Different types of bariatric surgeries, advantages and disadvantages of each surgery. Surgical technique. Expected normal post-operative imaging appearance Multimodality imaging of postoperative complications after bariatric surgeries

### TABLE OF CONTENTS/OUTLINE

Types of bariatric surgical procedures-Restrictive Adjustable gastric banding -Sleeve gastrectomy -Vertical banded gastroplasty (fixed pouch size) -Bypass (malabsorptive) -Biliopancreatic diversion -Duodenal switch -Jejuno-ileal bypass -Combined Roux-en-Y gastric bypass Surgical techinques, expected surgical changes and surgical complications post sleeve gastrectomy, laparoscopic gastric banding, Roux-en-Y gastric bypass, biliopancreatic diversion with duodenal switch and vertical banded gastroplasty Imaging techniques- the role of Computed Tomography and FluoroscopyImaging algorithm in evaluation of expected post-surgical changes and post-operative complications Multimodality imaging features of post-surgical complications

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# Abstract Archives of the RSNA, 2024

GIEE-121

## ARTIFICIAL INTELLIGENCE IN IMAGING DIAGNOSIS OF LIVER TUMORS: CURRENT STATUS AND FUTURE PROSPECTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Takamichi Murakami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Keitaro Sofue, MD (*Abstract Co-Author*) Nothing to Disclose
Yuki Suzuki, PhD (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Hori, MD, PhD (*Presenter*) Research Grant, Canon Medical Systems Corporation

### TEACHING POINTS

1. Explore artificial intelligence (AI) applications in liver tumor imaging, including lesion detection, differentiation, segmentation, image quality enhancement, and radiomics. 2. Examine the integration of AI in liver tumor diagnostics within clinical practice. 3. Discuss how radiologists utilize AI in diagnosing liver tumors. 4. Review future advancements in AI technologies and their potential impact on patient management.

### TABLE OF CONTENTS/OUTLINE

A. IntroductionB. Detection of Liver Tumors Using AI B-1. Principles of AI in tumor detection B-2. Features of liver tumor detection AI: Comparison with AI used in other organs such as lungs B-3. Case studies in clinical practice C. Characterization of Liver Tumors Using AI C-1. Principles of AI in tumor characterization C-2. Comparative features of liver tumor AI applications D. Segmentation Using AI D-1. Segmentation of the liver D-2. Automatic Segmentation of the Anatomical Liver Segments D-3. Tumor segmentation D-4. Clinical implementation E. Deep Learning Reconstruction E-1. Benefits in spatial resolution improvement E-2. Contributions to image noise reduction E-3. Reduction of radiation exposure in CT E-4. Reduction in MRI imaging times enhances patient throughput and comfort F. Radiomics F-1. Principles of radiomic feature extraction and analysis F-2. Advantages for patients with liver tumors G. Clinical Roles and Prospects of AI in Evaluating Liver Tumors G-1. Impact on clinical decision-making G-2. Future developments and their potential impact H. Conclusion

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# Abstract Archives of the RSNA, 2024

GIEE-122

## NAVIGATING THE COMPLEXITY OF HEPATIC INFLAMMATORY PSEUDOTUMORS IN IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Takashi Matsubara (*Abstract Co-Author*) Nothing to Disclose
Saya Igarashi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Kotaro Yoshida, MD (*Abstract Co-Author*) Nothing to Disclose
Azusa Kitao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Dai Inoue (*Abstract Co-Author*) Nothing to Disclose
Takahiro Komori (*Abstract Co-Author*) Nothing to Disclose
Matsui Osamu, MD (*Abstract Co-Author*) Nothing to Disclose
Norihide Yoneda (*Abstract Co-Author*) Nothing to Disclose
Gabata Toshifumi (*Abstract Co-Author*) Nothing to Disclose
Junichi Matsumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Taichi Kitagawa, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuto Kozaka, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In the context of inflammatory pseudotumors (IPT) of the liver, there exists a dichotomy between pathologically well-defined disease entities and those clinically employed with ambiguity. This educational exhibit aims to categorize these into narrow-sense IPT and broad-sense IPT, consolidating the clinical and radiographic hallmarks of the various diseases within each classification to enhance the diagnostician’s comprehension.

### TABLE OF CONTENTS/OUTLINE

1. Narrow-sense Inflammatory Pseudotumor of the Liver (Specifically defined entities at the view point of pathology)To resolve the confusion regarding IPT of the liver, we will explain the histopathological classification and imaging findings. This includes an explanation of the fibrohistiocytosis type and lymphoplasmacytosis type (IgG4 related IPT of the liver), as well as pseudolymphoma.2. Broad-sense Inflammatory Pseudotumor of the Liver (Broad Definition of IPT, including liver abscess) We will focus on the changes in imaging findings at wide spectrum of Inflammatory Pseudotumors.3. Differential Diagnosis and Miscellaneous lesions: We will discuss intrahepatic cholangiocarcinoma, inflammatory myofibroblastic tumors (including those related to Epstein-Barr virus), atypical forms of hepatocellular carcinoma, and other conditions such as iatrogenic IPT and recurrent liver masses of unknown etiology.

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# Abstract Archives of the RSNA, 2024

GIEE-123

## INSIDE OUT: NAVIGATING LYMPH NODES IN RECTAL ADENOCARCINOMA WITH MRI - FROM ANATOMY TO NEOADJUVANT THERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Mona H. Hassan, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Provide short overview of rectal adenocarcinoma and its significance. Gain a deep understanding of lymph node anatomy draining the rectal area. Learn how MRI provides a detailed roadmap for assessing lymph nodes in rectal adenocarcinoma and how it is superior over the other imaging modalities. Discover the telltale signs that help differentiate between benign and malignant lymph nodes. Explain the normal lymph node characteristics: size, shape and signal intensity features indicating the abnormal lymph nodes as morphology and signal changes. Decoding lymph node status and learn when they are loco-regional and when they are distant metastasis. Uncover insights into treatment response through a comparison of pre and post therapy MRI images. Discuss the changes observed in lymph nodes after neoadjuvant therapy and their implication for treatment. Identify common traps in lymph node assessment with MRI and learn how to avoid these traps. Explore real life case studies and discover how accurate MRI lymph node assessment improves patient outcomes. Understand the important key elements of an MRI report.

### TABLE OF CONTENTS/OUTLINE

Introduction Lymph node stations for rectal adenocarcinoma MRI technique Role of MRI in primary L.N staging and important anatomic landmarks Detection of suspicious lymph node at MRI: benign vs. malignant lymph nodes Criteria of diagnosis: lymph node size, signal and morphology, what is more important and when? Is it loco-regional or distant metastatic lymph node? Role of MRI in lymph node assessment after therapy The effect of proper staging on clinical implication and treatment planning Common traps in lymph node assessment How to avoid pitfalls and traps Key elements of an MRI report Conclusion

# Abstract Archives of the RSNA, 2024

GIEE-124

## NAVIGATING THE PANCREATIC DUCT: AN UP-TO-DATERADIOLOGICAL EXPEDITION THROUGH THE INTRALUMINAL PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Venkat Abhinav Katabathina (*Abstract Co-Author*) Nothing to Disclose
Anil K. Dasyam, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Borhani, MD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Ka-Kei Ngan, MD (*Abstract Co-Author*) Nothing to Disclose
Varaha Tammisetti, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Nikhil Vaishnav Tirukkovalur (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. In addition to iatrogenic devices, biologic material may form in the duct or extend into the duct with potentially deleterious short-term and long-term clinical consequences. 2. Several premalignant and malignant neoplasms can arise in or grow into the pancreatic duct (PD) lumen. Imaging manifestations can sometimes be challenging.

### TABLE OF CONTENTS/OUTLINE

1. Embryology, histology and normal anatomy of PD 2. Role of imaging modalities in assessment of pancreatic duct - advantages and limitations of each 3. Congenital anomalies of pancreatic duct, acquired PD disruption and their clinical implications 4. Alterations in normal composition of pancreatic juice - clinical implications and relevant imaging manifestations - Alterations in pH, enzymes (exocrine pancreatic insufficiency) and DNA 5. Expected and unexpected Iatrogenic devices /foreign material in the PD 6. Non-neoplastic pathologic biologic material in the pancreatic ducal lumen a. Formed in the PD lumen - Protein plugs, calculi and mucin b. Extraneous elements extending into the PD lumen - Blood (hemosuccus pancreaticus), pus (abscess), bile (pancreatobiliary fistula), urine (pancreaticoureteral fistula) and enteric contents/gas from pancreato-enteric fistula 7. Neoplastic entities in the PD lumen a. Primary intraductal neoplastic entities i. Pancreatic intraepithelial neoplasia ii. Intraductal papillary mucinous neoplasm iii. Intraductal oncocytic papillary neoplasm iv. Intraductal tubulopapillary neoplasm v. Colloid carcinoma b. Neoplastic entities growing into PD lumen i. NET ii. PDAC 8. Summary

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# Abstract Archives of the RSNA, 2024

GIEE-125

## BURSTING THE BUBBLE: A REVIEW OF PNEUMATOSIS INTESTINALIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manjiri K. Dighe, MD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Research Grant, General Electric Company
Rajat Bhargava, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Minal C. Jagtiani, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Saubhagya Srivastava, MBBS (*Abstract Co-Author*) Nothing to Disclose
Karthika Devi D S, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thomas Perez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss the causes and hypothesis of pneumatosis intestinalis (PI) 2. Types of PI: Benign and life-threatening 3. Elaborate the hypotheses for development of PI and discuss the causes for rising incidence 4. Discuss the available treatment options

### TABLE OF CONTENTS/OUTLINE

1. Pneumatosis Intestinalis (PI) - Prevalence and overview 2. Clinical scenarios encountered: ischemia related to thromboembolic events, hypoperfusion, abdominal trauma, post-surgical intervention, pulmonary disease (COPD), systemic disease (autoimmune myositis, SLE), immunocompromised states, post solid organ transplantation 3. Current hypotheses for the development of pneumatosis intestinalis: benign or pathological: Commonly discussed theories: mechanical and bacteria. Mechanical theory proposes that pressurized intraluminal air dissects through the mucosa of compromised bowel and tracks along mesenteric vessels, propagated by peristalsis. Bacterial theory states that gas-producing bacteria invade intramural compartments and congregate in small gas cysts, which is supported by improvement following antibiotic use 4. Pneumatosis post-solid organ transplant- what additional factors do we need to consider? Benign/ life threatening, clinical indicators, immunosuppression and predisposition to PI 5. Current treatment options for pneumatosis intestinalis: emergent survival intervention and revascularization versus medical management (antibiotics, elemental diet and oxygen therapy) 6. Post-surgical pneumatosis: commonly discussed outcomes

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# Abstract Archives of the RSNA, 2024

GIEE-126

## PANCREATIC TUMOR IMAGING PITFALLS AND HOW TO AVOID THEM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eric P. Tamm, MD (*Abstract Co-Author*) Institutional Research Grant, General Electric Company. This relationship ended 8/31/21 with end of the period of grant support.
Achal Sarna, MD (*Abstract Co-Author*) Nothing to Disclose
Ott Le, MD (*Abstract Co-Author*) Nothing to Disclose
Mahmoud M. Al-Hawary, MD (*Abstract Co-Author*) Nothing to Disclose
Juan J. Ibarra-Rovira, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaz Javadi, MD (*Abstract Co-Author*) Nothing to Disclose
Priya R. Bhosale, MD (*Abstract Co-Author*) Nothing to Disclose
Vincenzo K. Wong, MD (*Abstract Co-Author*) Nothing to Disclose
Mamie Gao, MD (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Gillis G. Schwartz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) illustrate where pancreatic tumor imaging pitfalls may arise 2) approaches to overcome/avoid pitfalls for a variety of pancreatic tumor types

### TABLE OF CONTENTS/OUTLINE

Pitfalls of imaging technique and how to avoid them. Pitfalls of management/interpretation. For pancreatic cancer (PDAC), staging issues including pancreatitis and use of short term follow-up, hepatic steatosis and the use of MRI, and strategies for postop monitoring to detect subtle recurrence including careful use of postop baseline, common and uncommon recurrence sites including pancreatic remnant, and use of PET/CT. Will also address pancreatic cancer mimics including metastases from other primaries (e.g. renal cell carcinoma), tumors near pancreas, inflammatory conditions, post-surgical changes, and normal fatty changes. For pancreatic neuroendocrine tumors (PNET), tools for staging (DOTATATE vs FDG PET), treatment response (MR imaging including T2 and delayed gadoxetate for following liver metastases), and for differential diagnosis (heat-damaged Tc-99m RBC SPECT CT to identify accessory splenic tissue). For pancreatic cystic lesions, monitoring for solid lesions developing in pancreas remote from cysts, need for history as abscesses and pseudocysts can mimic cystic neoplasms, and review of old studies e.g. given possible cystic evolution of PNETs. In screening populations at high risk for PDAC, inspecting also for primary cancers outside pancreas, i.e. BRCA (e.g. breast, ovarian, prostate and melanoma).

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GIEE-127

## WHEN RADIOLOGISTS JOIN THE FBI: FOREIGN BODY INVESTIGATION; AN IMAGING REVIEW OF GASTROINTESTINAL FOREIGN BODIES AND THEIR CLINICAL SIGNIFICANCE, MANAGEMENT, AND COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Frank J. Santisi, MD (*Abstract Co-Author*) Nothing to Disclose
Veniamin Barshay, MD (*Abstract Co-Author*) Nothing to Disclose
Sunil Jeph, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mary M. Woodruff, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Foreign bodies in the gastrointestinal tract, while infrequently encountered, provide memorable cases. In this case based review, we aim to provide the clinical significance and medical management of these foreign bodies. Recognizing and identifying the location and potential complications of a foreign body in the gastrointestinal tract provides a key role in the clinical patient management. We aim to provide a comprehensive review of gastrointestinal foreign bodies using highlighted cases of common and more uncommon complications. Selected cases focus on foreign bodies below the diaphragm.

### TABLE OF CONTENTS/OUTLINE

Identifying different materials of foreign bodies on imaging.Clinical management and interventions based on type and location of foreign body.Case based review of complications from foreign bodies with key imaging findings and management. Sample cases include:Bowel perforation with liver abscess from ingested plastic spoonBowel and bladder perforation from ingested penBowel obstruction from ingested rubber toyBowel perforation with abdominal wall involvement from ingested penFocal inflammatory reaction from unknown foreign bodyHighlighted teaching cases with key imaging findings and clinical management. Sample cases include:Ingested materials including nail clippers, pen, pencil, pulse ox probe, glass, coins Migrated iatrogenic foreign bodies, various malpositioned gastrointestinal stents and surgical clipsBezoarAttempted overdose with ingested pills

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# Abstract Archives of the RSNA, 2024

GIEE-128

## A PRACTICAL GUIDE TO CROHN'S IMAGING, THE GOOD, THE BAD AND THE UGLY: TIPS FROM TWO CONTINENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Arun Gupta, MBChB (*Abstract Co-Author*) Nothing to Disclose
Alex Fitzhugh, MBBS (*Abstract Co-Author*) Nothing to Disclose
Saubhagya Srivastava, MBBS (*Abstract Co-Author*) Nothing to Disclose
Karthika Devi D S, MBBS (*Abstract Co-Author*) Nothing to Disclose
Minal C. Jagtiani, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Palveer Bhogal, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Provide a brief overview of Crohn's disease (CD) with epidemiology, phenotype classification, pathophysiology 2. Compare the spectrum of findings in CD with US, CT and MR Enterography - discussing the strengths, limitations and practical problems faced in daily practice 3. Discuss standardized acquisition protocol for MRE and the significance of sequences used: Europe vs North American protocols (including anti-peristaltic agents) 4. To provide a schematic description of how imaging findings can affect the clinical management strategy

### TABLE OF CONTENTS/OUTLINE

1. Crohn's disease - Overview and epidemiology 2. US small bowel (SB) preparation and benefits: High resolution and dynamic imaging, practical/economic efficiencies 3. US SB findings: Mural, extraluminal, doppler and motility assessment 4. MR Enterography protocol a. Contrast agents - oral and IV b. Role of antiperistaltic agents: specific differences in two continents c. Sequences utilized and their significance: delayed post contrast imaging in detecting fibrotic stricturing, diffusion-weighted imaging (DWI) d. Role of fluoroscopic sequences 5. MRE/ CTE mural findings: Intramural edema, segmental mural hyperenhancement, bowel wall thickening, ulcerations, sacculations and fibrosis 6. MRE/ CTE mesenteric and extraintestinal findings: Perienteric edema, fibrofatty proliferation, reactive lymphadenopathy, "comb sign", penetrating and perianal CD 7. Signs of active vs chronic inflammation, utility of MRE activity scores 8. Structured reporting: Updated terminology 9. How do imaging findings affect clinical management strategies in CD?

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GIEE-129

## OOPS I DROPPED IT AGAIN: MULTI-MODALITY REVIEW OF DROPPED GALLSTONE EVOLUTION, IMAGING APPEARANCE, AND RELEVANT MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tasmia Amjad (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Dropped gallstones exhibit a highly variable appearance based on imaging modality, extent of calcification, and scaring or active inflammation. Apparent growth is often due to edema, fibrosis, or shifting calculi. Complications are uncommon. However, they are important to recognize as abscesses and fistulae involving dropped gallstones usually require surgical management.

### TABLE OF CONTENTS/OUTLINE

Brief discussion of epidemiology and clinical relevance of dropped gallstones. Discussion of the relevant anatomy and both expected and less common locations of dropped gallstone pathology. Examples of variable appearance of dropped gallstones across multiple modalities and changes that occur with time. Discussion of drop gallstone induced complications. Case based review of key learning points and potential pitfalls.

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# Abstract Archives of the RSNA, 2024

GIEE-13

## CHOLANGIOCARCINOMA: ONE WORD, MANY FACES. A PRIMER FOR RADIOLOGY RESIDENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatiana J. Ludena Camacho I, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Garrido Urincho, MD (*Abstract Co-Author*) Nothing to Disclose
Dulce A. Sanchez Nava, MD (*Abstract Co-Author*) Nothing to Disclose
Aura Maria M. Gonzalez Peralta, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To analyze the role of state-of-the-art imaging techniques in the diagnosis and staging of cholangiocarcinomas.• To describe magnetic resonance imaging features in the spectrum of cholangiocarcinoma, associated with imaging techniques additional.• To discuss management and prognostic implications of classifications according to growth pattern of CCA.• To review the additional value of magnetic resonance cholangiopancreatography in the evaluation of a periductal infiltrating or intraductal growth type tumor.

### TABLE OF CONTENTS/OUTLINE

Introduction.Anatomic Considerations.Classification.Technique and protocol MRI.Case-based review.Teaching points.Conclusions.

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# Abstract Archives of the RSNA, 2024

GIEE-130

## CONTRAST ENHANCED US (CEUS) EVALUATION OF HEPATOCELLULAR CARCINOMA TREATED WITH NONRADIATION LOCOREGIONAL THERAPIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Andrej Lyshchik, MD, PhD (*Abstract Co-Author*) Royalties, RELX;Speaker, General Electric Company;Consultant, General Electric Company;Research support, General Electric Company;Consultant, BioClinica, Inc;Consultant, WCC, Inc;Consultant, Bracco Group;Advisory Board, Bracco Group
Aman Khurana, MD (*Abstract Co-Author*) Nothing to Disclose
Krishna Mundada, MBBS,MBBS (*Abstract Co-Author*) Nothing to Disclose
Mojdeh Mirmomen, MD (*Abstract Co-Author*) Nothing to Disclose
David T. Fetzer, MD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research support, Siemens AG;Consultant, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Consultant, General Electric Company;Advisory Board, General Electric Company
Adam C. Searleman, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yuko Kono, MD, PhD (*Abstract Co-Author*) Equipment support, Canon Medical Systems Corporation;Equipment support, General Electric Company;Support, Lantheus Holdings;Support, Bracco Group
Fregenet Gichamo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Review LI-RADS® CEUS NONRADIATION TRA v2024.; Discuss a standardized CEUS imaging protocol for post-treatment assessment of HCC.; Describe typical CEUS enhancement patterns of HCC following nonradiation locoregional therapy, including Transarterial chemoembolization (TACE), Transarterial bland embolization (TAE), Radiofrequency ablation (RFA), Microwave ablation (MWA) or Percutaneous ethanol ablation (PEA).; Discuss diagnostic criteria for tumor viability using CEUS after non-radiation locoregional therapy of HCC.; Identify possible pitfalls of CEUS categorization of treated HCC and explore scenarios where CEUS is not appropriate for post-treatment assessment.; Explore future directions for post-treatment CEUS of liver lesions and the importance of individualised patient care.

### TABLE OF CONTENTS/OUTLINE

Overview of LI-RADS® CEUS Nonradiation TRA v2024 algorithm; Treated lesion definitions.; CEUS Imaging criteria for intralesional and perilesional tumor viability.; Case-based review of CEUS LR-Viable, LR-TR Nonviable and LR-TR Equivocal after different locoregional treatment modalities, including TACE, TAE, RFA, MWA or PEA.; Suggested imaging workup options time intervals for different treatment modalities. Limiting factors for CEUS only post-treatment assessment; Location, depth and size of treatment cavity.; Time required to assess multiple lesions.; Detection of new lesions.; US artifacts typically seen with treatment cavities. Research Gaps and future studies• Individualized patient care with CEUS- To identify ideal patient cohort based on tumor characteristics and guide in recommending most appropriate follow up imaging modality amongst CEUS, MRI and CT.

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# Abstract Archives of the RSNA, 2024

GIEE-131

## HIATAL HERNIAE: FILLING IN THE INFORMATION HIATUS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alberto Martinez-Isla (*Abstract Co-Author*) Nothing to Disclose
Philip J. Shorvon, FRCR, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Minal C. Jagtiani, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Palveer Bhogal, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Define a hiatal hernia (HH). Describe prevalence, types and variants 2. Discuss the imaging modalities with pictorial review 3. Outline the imaging findings in HH 4. Discuss the available surgical and endoscopic options for correction and discuss the relevance of imaging findings 5. Discuss the complications of surgery and available imaging investigations used post operatively

### TABLE OF CONTENTS/OUTLINE

1. Definition - herniation of stomach through the esophageal hiatus. Other organs can also herniate 2. Prevalence: Natural incidence increases with age: 60% people over 60 years. High prevalence in GERD patients; exact mechanism discussed 3. Clinical importance: Prevalence and health impact. About 6% of all primary care prescriptions are for proton pump inhibitors, many for reflux associated with hiatal herniae 4. Types • 1 Sliding • 2 Paraesophageal • 3 Mixed • 4 Additional herniation of other viscera • Paracrural: Rare and not true hiatal hernia but must be differentiated 5. Complications Cameron lesions, ischemia, strictures, Barrett's esophagus, volvulus, throat symptoms 6. Investigative imaging modalities and findings 7. Presurgical planning: what information does the surgeon need from a radiology report? 8. Surgical (and endoscopic) options • Surgical repair (Mostly laparoscopic. Other options included open repair - transabdominal or transthoracic approach. Use of fundoplication, mesh and gastropexy discussed) • Endoscopic suturing / plication 9. Complications and their imaging: Pneumothorax, infection, bleeding, perforation/ leak, recurrence 10. Post op investigation/prognosis: plain film, fluoroscopy, CT

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# Abstract Archives of the RSNA, 2024

GIEE-132

## PANCREATIC CYSTIC LESIONS: CT, MR AND ECHO-ENDOSCOPIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lourdes del Campo, PhD (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Silvia Cayon Somacarrera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To depict the different types of pancreatic cystic lesions with their corresponding image characteristics on CT, MR and echo-endoscopy - To identify the image characteristics that help to evaluate the potencial degree of aggressiveness of each one of them

### TABLE OF CONTENTS/OUTLINE

The term pancreatic cystic lesion encompasses a wide range of lesions that range from completely benign to potentially malignant entities. Given the increasing incidental detection of pancreatic cystic lesions, it is important for radiologists to know the characteristics of each of them and the radiological signs suspicious of malignancy, thus avoiding surgical interventions and unnecessary healthcare costs. In addition, it is also important to determine the need for follow-up. We have reviewed all pancreatic cystic neoplasms detected in our center since 2005. Their radiological characteristics are shown through the use of CT, MR and echo-endoscopy when available. We also describe the signs that lead to suspicion of malignancy and the follow-up diagnostic algorithm developed by the multidisciplinary committee of our center.

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# Abstract Archives of the RSNA, 2024

GIEE-133

## PHYSICS INSIGHTS INTO LIVER MRI: EDUCATIONAL GUIDANCE FOR PROTOCOL OPTIMIZATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Simon Gauvin, MD (*Abstract Co-Author*) Nothing to Disclose
Evan McNabb (*Abstract Co-Author*) Nothing to Disclose
Khaled Alanazi (*Abstract Co-Author*) Nothing to Disclose
Veronique Fortier (*Abstract Co-Author*) Nothing to Disclose
Caroline Reinhold, MD, MSc (*Abstract Co-Author*) Research Grant, Imagia Cybernetics Inc
Jeremy Dana, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

MRI quality can be defined by the signal-to-noise ratio, contrast-to-noise ratio, and spatial resolution. - Signal-to-noise ratio is inversely proportional to spatial resolution and proportional to scan time, leading to necessary clinically relevant compromises. - Field-of-view should be adjusted to the patient's width to improve spatial resolution, e.g. conspicuity of the biliary tree, while maintaining the matrix size and being time neutral. - Conventional TSE should be preferred over radial TSE or HASTE/SSFSE to achieve optimal liver contrast-to-noise ratio, especially for tumoral characterization or detection. - Multi-shot echo planar diffusion-weighted imaging is more robust than single-shot to distortion artifacts from air-filled structures but more time-consuming.

### TABLE OF CONTENTS/OUTLINE

1. MRI quality: signal-to-noise ratio, contrast-to-noise ratio, spatial resolution. 2. Understanding the impact of key technical parameters (field-of-view, matrix size, slice thickness, averages, etc.) on MRI quality and scan time. 3. Understanding tissue contrast (T1 T2) and how to image it (TR, TE, Flip angle). 4. Understanding different types of pulse sequence and their applications in liver imaging in the perspective of their strengths and limitations: TSE (conventional, radial, driven equilibrium, single-shot), DWI/ADC (acquisition modes, etc.), MRCP, fat suppression techniques, contrast agent (dynamic acquisition and impact on other pulse sequences). 5. Insight into quantitative liver MRI: fat and iron quantification, MR Elastography. 6. Insight into acceleration techniques and deep learning reconstructions. 7. Revelling the hidden companions of MRI: respiration, quality control.

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# Abstract Archives of the RSNA, 2024

GIEE-134

## BEYOND THE WHITE PAPERS: AN UPDATE ON THE MANAGEMENT OF INCIDENTAL FINDINGS SEEN ON IMAGING STUDIES OF THE ABDOMEN AND PELVIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Michael T. Corwin, MD (*Abstract Co-Author*) Consultant, Corcept Therapeutics Inc
Michael C. Larson, MD, PhD (*Abstract Co-Author*) Stockholder, D3Sciences;Stockholder, Emagine Solutions Technology
Ramit Lamba, MD (*Abstract Co-Author*) Nothing to Disclose
Ghaneh Fananapazir, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamin Carney, MS, MD (*Abstract Co-Author*) Nothing to Disclose
Chirag Govardhan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) To discuss the imaging findings and management recommendations for common incidental findings seen on imaging studies of the abdomen and pelvis that are not covered by the existing ACR White Papers. 2) To review up-to-date evidence regarding incidental findings that support or contradict existing White Paper recommendations.

### TABLE OF CONTENTS/OUTLINE

1) The importance of incidental findings. 2) What are the White Papers? 3) Hepatic: Topics not covered by the White Papers include hyperechoic lesions and solid hypoechoic lesions on ultrasound. Updates on hepatic topics include hyperenhancing lesions on contrast-enhanced CT. 4) Biliary: Updates on biliary topics include extrahepatic biliary ductal dilatation, focal fundal gallbladder wall thickening, and gallbladder polyps. 5) Renal: Topics not covered by the White Papers include hyperechoic lesions on ultrasound and T1-hyperintense lesions on MRI. Updates on renal topics include indeterminate homogeneous renal masses on contrast-enhanced CT (21-39 HU range). 6) Bowel: Topics not covered by the White Papers include incidental intussusception of the small bowel and colon. 7) Mesentery: Topics not covered by the White Papers include misty mesentery/sclerosing mesenteritis. 8) Testicular: Topics not covered by the White Papers include microlithiasis and isolated right-sided varicoceles. 9) Spleen: Updates on splenic topics include cystic lesions and solid lesions.

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# Abstract Archives of the RSNA, 2024

GIEE-135

## PROGNOSTIC AND PREDICTIVE IMAGING MARKERS OF HEPATOCELLULAR CARCINOMA: A PICTORIAL ESSAY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Claude B. Sirlin, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC
Jessica Murphy-Lavallee, MD,FRCPC (*Abstract Co-Author*) Nothing to Disclose
Victoria Chernyak, MD, MS (*Abstract Co-Author*) Consultant, Bayer AG
Damien Olivie, MD, MS (*Abstract Co-Author*) Nothing to Disclose
An Tang, MD, MSc (*Abstract Co-Author*) Equipment support, Siemens AG
Kathryn J. Fowler, MD (*Abstract Co-Author*) Consultant, Bayer AG;Research support, General Electric Company;Research Grant, Pfizer Inc;Institutional Grant, MEDIAN Technologies;Consultant, General Electric Company
Kim-Nhien Vu, MD (*Abstract Co-Author*) Nothing to Disclose
Hanyu Jiang (*Abstract Co-Author*) Nothing to Disclose
Joseph R. Dadour, MD (*Abstract Co-Author*) Nothing to Disclose
Bich Nguyen (*Abstract Co-Author*) Nothing to Disclose
Banmeet Padda (*Abstract Co-Author*) Nothing to Disclose
Jean-Sebastien S. Billiard, MD,FRCPC (*Abstract Co-Author*) Nothing to Disclose
Claudia Deyirmendjian, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize known prognostic markers in hepatocellular carcinoma (HCC);
- Understand imaging features associated with HCC prognosis;
- Identify these features on CT and MRI.

### TABLE OF CONTENTS/OUTLINE

1) Introduction distinction between prognostic markers (predict natural history or outcome) vs. predictive features (predict responsiveness or lack of response to therapy before the therapy is applied), novel imaging markers of HCC to improve patient management. 2) Prognostic pathologic features epidemiology, histologic classification, associated prognosis. 3) Prognostic molecular features proliferative versus non-proliferative HCC, molecular subclasses, genetic features, main signaling pathways, epigenetic features. 4) Emerging prognostic imaging features radiologic characteristics associated with proliferative and non-proliferative HCC, LI-RADS categories, case examples, biologic rationale, predictors of microvascular invasion, limitations of discussed imaging features. 5) Management and predictive features medical and interventional or surgical therapies, current role of biomarkers, considerations for specific pathologic and molecular subtypes. 6) Future directions validation of prognostic and predictive markers, integration of such markers into the radiology LI-RADS report.

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# Abstract Archives of the RSNA, 2024

GIEE-136

## MULTI-PHASE CT OR SPLIT BOLUS CT: SPLIT BOLUS CT CAN REDUCE RADIATION DOSE AND IMPROVE DIAGNOSTIC ACCURACY IN ABDOMINAL CONTRAST-ENHANCED CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Koji Muroga (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To learn the reduction of radiation exposure in the abdominal multi-phase CT.To learn the advantages of decreasing the number of scans.To learn the methods for decreasing the number of scans.To learn split bolus CT to acquire the images with combined dual-contrast phases.To learn the advantages of split bolus CT.

### TABLE OF CONTENTS/OUTLINE

A. Reduction of radiation exposure in abdominal contrast-enhanced CT. B. Advantages of reducing number of scans. C. Images with combined dual-contrast phases. D. Method of obtaining images combined arterial and venous phases. E. Advantages of split-bolus CT. / Split-bolus CT can obtain the images combined arterial and venous phases by a single-phase scanning in abdominal contrast-enhancement CT. As a result, split-bolus CT can reduce the radiation dose by 46% by reducing the number of scans compared to multi-phase CT. In addition, Split-bolus CT can obtain the CT images without misregistration. This allows simultaneous and accurate assessment of the position and size of vessels, organs, and tumors, improving diagnostic accuracy, and is particularly beneficial before gastrointestinal laparoscopic surgery. High diagnostic accuracy on reduced CT images can improve efficiency and reduce the workload for radiologists and surgeons.

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# Abstract Archives of the RSNA, 2024

GIEE-137

## FIRST STOPS ON A DIRE ROUTE: MAPPING GI CANCER'S NODAL METASTASIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fernanda L. Mazzucato, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia L. Borborema, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna K. Andreucci, MD (*Abstract Co-Author*) Nothing to Disclose
Julia De Toledo Mendes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Delineate the specific pathways of first nodal metastasis corresponding to tumor sites within the esophagus, stomach, liver, gallbladder, small bowel, and colorectum. 2. Explore pertinent clinical and radiological data for assessing adenopathies in patients diagnosed with these tumor types, alongside the staging classification systems employed for their evaluation, illustrated with clinical radiological examples. 3. Analysis of the functions and constraints of imaging methods, focusing on CT and MRI.

### TABLE OF CONTENTS/OUTLINE

1.Global burden from the major cancers of the gastrointestinal tract. 2. Common Pathways of first nodal metastasis of the gastrointestinal tract. 3. Illustrations of common pathways. 4. The TNM Classification of gastrointestinal malignancies and its key clinical value in guiding patient management decision-making. 5.Case-based presentation of the main gastrointestinal malignancies with first nodal metastasis in MRI and CT imaging, encompassing conditions such as gastric, gallbladder, distal ileum, right colon, rectal, and anal neoplasms. 6.Outlining key take-home messages.

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# Abstract Archives of the RSNA, 2024

GIEE-138

## DIAGNOSTIC ERRORS IN ULTRASOUND OF THE PANCREAS - A COMPREHENSIVE CASE-BASED REVIEW ON LESSONS LEARNT FROM QUALITY ASSURANCE ROUNDS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Irene Ai Linn Wong (*Abstract Co-Author*) Nothing to Disclose
Denise Simin Lau (*Abstract Co-Author*) Nothing to Disclose
Catherine Wan Ting Tan (*Abstract Co-Author*) Nothing to Disclose
Yuet Wah Wong (*Abstract Co-Author*) Nothing to Disclose
Rafidah Abu Bakar, MMedSc (*Abstract Co-Author*) Nothing to Disclose
Voon Chee Ma (*Abstract Co-Author*) Nothing to Disclose
Nanda Venkatanarasimha, FRCR, FRANZCR (*Abstract Co-Author*) Nothing to Disclose
Ying Ying Kho (*Abstract Co-Author*) Nothing to Disclose
Gaik Mooi Tan Florence (*Abstract Co-Author*) Nothing to Disclose
Si Min Teo, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Provide a comprehensive review of the sonographic features of the normal pancreas, anatomical variants, common and uncommon pathologies including their mimics. 2. Illustrate and discuss potential errors/misdiagnosis on ultrasound pancreas based on lessons learnt from quality assurance rounds. 3. Discuss tips and tricks that can help prevent these errors and improve diagnostic accuracy.

### TABLE OF CONTENTS/OUTLINE

1. Review anatomy and anatomical variants on ultrasound 2. Scanning techniques 3. Case-based review of a wide variety of diagnostic errors encountered in pancreatic ultrasound, which include: (i) Perceptual errors, such as false negatives involving neoplasms and intrapancreatic splenunculus. (ii) Interpretive errors, including mimics of neoplasms, inflammatory conditions and focal fatty sparing. (iii) Errors related to information transfer, involving inaccurate interpretation of neoplasms, pseudocyst and splenosis due inadequate correlation with clinical history. (iv) Errors related to processes, encompassing undetected malignancy attributed to incomplete assessment, and inadequate assessment of cystic neoplasms. 4.Correlative imaging studies and illustrations will be reviewed. 5. Tips to mitigate these potential errors will be highlighted.

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# Abstract Archives of the RSNA, 2024

GIEE-139

## LOOKING BEHIND THE RECTUM. A COMPREHENSIVE GUIDE TO RETRORECTAL-PRESACRAL SPACE WITH RADIOLOGIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Sara Moron Hodge (*Abstract Co-Author*) Nothing to Disclose
Eva Pena Burgos (*Abstract Co-Author*) Nothing to Disclose
Maria del Mar Tapia Vine, MD (*Abstract Co-Author*) Nothing to Disclose
Amine Moultamis, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Romero Guzman (*Abstract Co-Author*) Nothing to Disclose
Paula A. Hidalgo, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Martin Hervas (*Abstract Co-Author*) Nothing to Disclose
Nuria Saturio Galan (*Abstract Co-Author*) Nothing to Disclose
Maria Aguilar Picapiedra (*Abstract Co-Author*) Nothing to Disclose
Juan Diego De La Morena Molina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To illustrate the anatomy and embryology of the retrorectal-presacral space.2. To propose a stepwise-based imaging approach to facilitate the differential diagnosis of retrorectal-presacral masses and review its related lesions.

### TABLE OF CONTENTS/OUTLINE

1. Review the anatomy and embryology of the retrorectal-presacral space through illustrations, MRI images, and cadaveric correlation. 2. Classification of the spectrum of masses from a histopathological perspective to globally assess the heterogeneity of lesions in this location. 3. Imaging evaluation. 3.1 Diagnostic clues for assessing posterior pelvic-space dependency. 3.2 Morphological evaluation of the lesion. 3.2.1 Learn to identify red flags indicative of malignancy. 3.2.2 Stratify the lesions into cystic or solid-complex, and into the presence or absence of fat content. 4. Develop an algorithm approach that facilitates the differential diagnosis for retrorectal-presacral masses grouping the lesions according to the descriptors mentioned previously into: 4.1 Non-fat containing cystic masses. 4.2 Fat containing cystic masses. 4.3 Non-fat containing solid-complex masses. 4.4 Fat-containing solid-complex masses. 5. Present multimodality imaging of these lesions following this approach with radio-pathologic correlation. 6. Review of the management of retrorectal-presacral lesions. Focus on indications for biopsy and access route. 7. Take home points.

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# Abstract Archives of the RSNA, 2024

GIEE-14

## CHALLENGES AND PITFALLS IN RECTAL CANCER MRI: FROM IMAGE ACQUISITION TO INTERPRETATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Christopher A. Mejias, MD (*Abstract Co-Author*) Nothing to Disclose
Achille Mileto, MD (*Abstract Co-Author*) Consultant, Bayer AG
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Lindsey Durowoju (*Abstract Co-Author*) Nothing to Disclose
Guilherme M. Cunha, MD (*Abstract Co-Author*) Nothing to Disclose
Yongjun Liu (*Abstract Co-Author*) Nothing to Disclose
Karthika Devi D S, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Currently faced challenges in optimized preparation and acquisition techniques in rectal cancer MRI.2) Review challenging concepts in reporting of initial staging of rectal cancer.3) Assessing rectal cancer response to treatment and pitfalls in reporting post-treatment MRI.4) Challenges of management of rectal cancer post-neo-adjuvant treatment from surgeons' standpoint.5) Review imaging patterns and management of rectal cancer recurrence.6) Discuss the future role of radiology in rectal cancer patients.

### TABLE OF CONTENTS/OUTLINE

1. Importance of Optimized Preparation and Acquisition TechniqueUse of spasmolyticsBowel prepMicro-enemaBladder emptyingRectal gelIV contrast2. ReportingStagingTumor to anal verge distance measurementsT staging for cancers with anal sphincter complex involvementDefinition of T stage based on MRF vs peritoneal involvementDefinitions for lymph node vs tumor depositsDefinitions to assess regional and non-regional lymph nodesAssessment of EMVI in locally advanced rectal cancer-Sensitivity specificity of MRI-Role of DWI-Prognostic significance.3. Post treatment/ re-stagingMutinous tumormTRG/post-treatment scan T staging in anal canal involvementHigh inter-reader variability in post treatment settingRates of rad-path discordance clinical outcomesChallenges of the surgeon in post-treatment cases.4. Pelvic recurrence of rectal cancerImaging patternsPrognosisManagement5. Future directionsMotion mitigation strategies (AI-enabled denoising methods, faster MRI acquisition, etc)Texture analysis and combined approaches.

# Abstract Archives of the RSNA, 2024

GIEE-140

## "MISS ME NOT"- THE MANY FACES OF MECKEL'S DIVERTICULUM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmad I. Farah, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ananya Panda, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Review the embryology and anatomy of Meckel's Diverticulum (MD) • Review role of radiology and normal appearances of MD • Discuss multimodality imaging of complications of MD

### TABLE OF CONTENTS/OUTLINE

I. Embryology and Anatomy of Meckel's Diverticulum (MD) II. Normal MD on different imaging modalities III. Role of Radiology IV. Complications of MD 1. MD with heterotopic gastric /pancreatic mucosa 2. MD with enteroliths/ foreign bodies 3. Meckel's diverticulitis a) Uncomplicated Meckel's diverticulitis b) Meckel's diverticulitis with Perforation c) Meckel's diverticulitis with Abscess 4. MD with small bowel obstruction a). Due to Volvulus b). Due to Inverted MD c). Due to Internal hernia d). Littre's Hernia e). Intussusception 5. MD with active GI bleeding 6. MD associated with malignancy (neuroendocrine tumor, gastrointestinal stromal tumor, etc.) V. Common Differential Diagnosis and Imaging Pearls.

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GIEE-141

## UPDATE IN ESOPHAGEAL SURGERY: TECHNIQUES, EXPECTED FINDINGS AND POSTOPERATIVE COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Acosta Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Tramblin De La Moneda, MBBS (*Abstract Co-Author*) Nothing to Disclose
Esther Garcia Casado (*Abstract Co-Author*) Nothing to Disclose
Sara Siguenza-Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To describe the main esophageal surgical techniques currently used and which are the expected findings after the procedures.2. To review the complications that may occur after esophageal surgery and their radiological evaluation, focusing on pearls and potential pitfalls.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Surgical techniques and expected findings2.1. Transthoracic esophagectomy: Ivor-Lewis, McKeown and left thoracoabdominal access2.2. Transhiatal esophagectomy: Orringer2.3. Minimally invasive esophagectomy (MIE)2.4. Conduits and routes3. Complications after esophageal surgery3.1. Pulmonary complications: pneumonia, bronchoaspiration, atelectasis, pleural effusion, pneumothorax, adult respiratory distress syndrome (ARDS), pulmonary edema, pulmonary embolism3.2. Anastomotic leak3.3. Technical complications: iatrogenic bleeding, diaphragmatic hernia, chylothorax, tracheobronchial tree injury, airway-gastric fistula, recurrent laryngeal nerve paralysis3.4. Functional complications: delayed gastric emptying, dumping syndrome, esophageal reflux3.5. Late complications: anastomotic stricture, disease recurrence (local, regional and distant)4. Conclusions5. References

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# Abstract Archives of the RSNA, 2024

GIEE-143

## MRI OF RECTAL CANCER AFTER NEOADJUVANT TREATMENT: IMAGING PEARLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Raquel Garcia Latorre, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Villanueva, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Salgado Parente, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Canales Lachen (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Brief description of the current situation, epidemiology and therapeutic options for rectal cancer. Watch and Wait strategy. Review of anorectal anatomy in MRI and semiology of rectal adenocarcinoma.Review of the study acquisition protocol: need for oblique sequences to the tumor.Review of imaging findings after radio-chemotherapy treatment by using illustrative cases. Degree of response and main false positives.Proposal of structured report and simple conceptual classification.

### TABLE OF CONTENTS/OUTLINE

Colorectal cancer represents the second most frequent tumor diagnosed in the population after breast and prostate. Given its high prevalence and the fact that its incidence is increasing in young patients, an "organ-preserving" therapeutic management is currently preferred after achieving a complete tumor response with effective neoadjuvant chemoradiotherapy; thus, avoiding the harmful effects and morbidity of surgery. This strategy is known as "Watch Wait" and consists of a close follow-up where MRI plays a leading role. Therefore, correct acquisition of the study is essential, using high-resolution T2 morphological and diffusion sequences angled to the tumor, which allow us to accurately assess and rule out tumor remnants or recurrences. In addition, it is necessary to have a deep knowledge of the imaging findings in response after treatment, both of the primary tumor and lymph node involvement, as well as to identify the main pitfalls. All this with the aim of providing useful and accurate information to the clinician.

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# Abstract Archives of the RSNA, 2024

GIEE-144

## TECHNIQUES FOR OPTIMIZING SONOGRAPHIC ANALYSIS OF GALLBLADDER POLYPS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Malak Itani, MD (*Abstract Co-Author*) Nothing to Disclose
Katerina Konstantinoff, MD (*Abstract Co-Author*) Nothing to Disclose
William D. Middleton, MD (*Abstract Co-Author*) Nothing to Disclose
Aya Kamaya, MD (*Abstract Co-Author*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation
Christopher I. Fung, MD (*Abstract Co-Author*) Stockholder, Mikata Health
Sharlene A. Teefey, MD (*Abstract Co-Author*) Nothing to Disclose
Katharina Feister, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In 2022, the Society of Radiologists in Ultrasound (SRU) Consensus Conference updated the risk-stratification and management guidelines for gallbladder polyps (GBP) based on their shape size. Optimizing sonographic diagnosis analysis of a GBP is important as it allows appropriate classification clinical decision making. This exhibit will:1. Review the SRU GBP management guidelines 2. Discuss sonographic techniques for optimizing gray scale Doppler parameters useful in diagnosing analyzing GBPs

### TABLE OF CONTENTS/OUTLINE

1. General techniques for evaluating the GB: fasting state, subcostal intercostal scans, tips if GB is difficult to identify2. Techniques to diagnose GBPs: a. Exclude shadowing: highest transmit frequency, single focal zone at the level of interest, turn off real time compounding b. Exclude mobility: scan in different positions (upright, prone, RPO) c. Document internal vascularity: optimize Doppler parameters with low pulse repetition frequency wall filter, high gain color threshold, adjust transmit frequency based on depth d. Exclude signs of adenomyomatosis: Comet tail/Twinkle artifacts, cystic spaces3. Techniques for analyzing polyps: a. Measurement: largest diameter of largest GBP, round to nearest mm b. Shape (pedunculated vs sessile): increase transmit frequency, decrease depth image width, magnify image, cine clips to show wiggle c. Other signs: adjacent wall thickening, liver invasion/metastasis, adenopathy4. Alternative/further imaging: a. Follow up US: poor exam, contracted GB, can't distinguish sludge vs GBP b. CEUS for sludge vs GBP analysis of GBP enhancement c. CT vs MRI

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# Abstract Archives of the RSNA, 2024

GIEE-145

## OPTIMIZING SONOGRAPHIC ANALYSIS OF SUPERFICIAL SOFT TISSUE MASSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sharlene A. Teefey, MD (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD (*Abstract Co-Author*) Nothing to Disclose
William D. Middleton, MD (*Abstract Co-Author*) Nothing to Disclose
Katharina Feister, MD (*Abstract Co-Author*) Nothing to Disclose
Katerina Konstantinoff, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Society of Radiologists in Ultrasound (SRU) recently published a consensus conference statement that provided guidelines for categorization management of superficial soft tissue masses (SSTM). This included an unillustrated review of techniques for optimizing the examination.This exhibit aims to: Expand elaborate on optimal US techniques for imaging SSTMs and provide an illustrated review. Provide abundant examples of how optimal technique leads to improved diagnosis. Summarize SRU guidelines for SSTMs.

### TABLE OF CONTENTS/OUTLINE

1. Required equipment - Essential: Multiple linear probes of varying frequency, grayscale with harmonic imaging spatial compounding, color, power spectral Doppler. Useful but non-essential: Bedside table adjustable stool, panoramic scans, dual screen grayscale/Doppler, advanced techniques (e.g. contrast enhanced US)2. Generic imaging protocol - Longitudinal transverse grayscale images, static images cine clips at rest with dynamic maneuvers, measurement in 3 orthogonal planes, Doppler3. Optimizing imaging techniques with case examples - Adjusting transmit frequency to match the depth of lesion, comparison to surrounding tissues contralateral side when applicable, dynamic maneuvers - compression, muscle contraction, Valsalva etc., Doppler settings - scale, frequency, gain etc.4. Characterize lesions based on sonographic appearance - Composition (solid, cystic, mixed), echogenicity, margins, internal architecture, location/relationship to adjacent structures, vascularity, classic benign lesions5. Summarize SRU consensus guidelines for categorization management of SSTMs

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# Abstract Archives of the RSNA, 2024

GIEE-147

## SIMPLE MUCINOUS CYST OF PANCREAS: IS IT REALLY A BENIGN LESION?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bengi Gurses (*Abstract Co-Author*) Nothing to Disclose
Duygu Atasoy, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Develop an understanding of simple mucinous cysts (SMC)
- Understand difference of SMC from other mucinous cysts in pancreas
- Learn imaging features of SMC
- Compare SMC to other similar cystic lesions to make differential diagnosis.
- Discuss relation of SMC and PDAC

### TABLE OF CONTENTS/OUTLINE

- Cystic Lesions of Pancreas
- Mucinous Cysts of Pancreas
- Definition of Simple Mucinous Cysts
- Pathologic Definition of SMC
- Imaging Features of SMC
- Differential Diagnosis of SMC
- Misnomer or Not: Are SMCs Truly Simple?
- Malignancy Potential of SMC
- SMC and PDAC: Is There a Relationship?

RSNA 2024
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# Abstract Archives of the RSNA, 2024

GIEE-148

## RARE CYSTIC LESIONS OF PANCREAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bengi Gurses (*Abstract Co-Author*) Nothing to Disclose
Duygu Atasoy, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Learn classification of pancreatic cystic lesions
- Develop an awareness of rare pancreatic cystic lesions
- Learn imaging features of retention cysts, squamoid cysts of pancreatic ducts, simple mucinous cysts
- Learn to make differential diagnosis.
- Discuss malignancy potential of rare pancreatic cysts

### TABLE OF CONTENTS/OUTLINE

- Cystic Lesions of Pancreas
- Classification of Cystic Lesions
- Neoplastic Cysts of Pancreas
- Non-neoplastic Cysts of Pancreas
- Retention Cysts
- Simple Mucinous Cysts
- Squamoid Cyst of Pancreatic Ducts
- Lymphoepithelial Cysts
- Awareness: Radiologic Differentiation of Rare Cystic Lesions from Other Pancreatic Lesions
- Attention: Clinical Importance of Rare Cystic Lesions
- Fear: Malignancy Potential of Rare Pancreatic Cystic Lesions

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# Abstract Archives of the RSNA, 2024

GIEE-149

## JOURNEY EXPLORING THE VALUABLE IMAGING QUANTITATIVE PARAMETERS IN HEPATOCELLULAR CARCINOMA: CURRENT USE AND POTENTIAL APPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Tetsuya Tachiiri (*Abstract Co-Author*) Nothing to Disclose
Nagaaki Marugami (*Abstract Co-Author*) Nothing to Disclose
Kiyoyuki Minamiguchi (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Tanaka (*Abstract Co-Author*) Nothing to Disclose
Mariko Irizato (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to review various quantitative values (e.g.,tumor steatosis, stiffness, vascularity, etc.) of multimodality imaging reported in hepatocellular carcinoma (HCC), to clarify the background that these quantitative values reflect (e.g., histopathology and immunopathology), and to discuss the potential application of these quantitative values in the coming era of personalized therapy for HCC.

### TABLE OF CONTENTS/OUTLINE

In HCC, there have been many reports of quantitative parameters using MRI, perfusion-CT, PET-CT, etc. with the aim of improved clinical prognosis and clarification of the tumor biology. However, no report has summarized these parameters previously reported, resulting in a sporadic situation. Additionally, in recent years, there has been an exponential increase in reports on radiomics, an emerging field in image analysis for characterizing HCC. Understanding these quantitative parameters as well as the background they represent will help clinicians consider about treatment strategy based on these values.Table of contents is as follows.1) Overview of quantitative values reported in HCC2) Association of the quantitative values with their background through representative case3) Potential application of these quantitative values to current treatment strategy in HCC

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# Abstract Archives of the RSNA, 2024

GIEE-15

## THE REAL QUESTION- IS IT RESECTABLE? RESPONSE EVALUATION AFTER NEOADJUVANT THERAPY IN PANCREATIC CARCINOMA: A GREEN SIGNAL FOR SURGERY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jitin Goyal, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Neoadjuvant treatment (NAT) aims to downstage borderline resectable and locally advanced pancreatic adenocarcinomas to make patients amenable to surgery with R0 resection and prolongation of overall survival.Contrast Enhanced Computed tomography (CT) remains the primary imaging tool for assessing treatment response after neoadjuvant therapy due to higher spatial resolution and multiplanar reconstruction. Nevertheless, the interpretation of imaging findings remains challenging, due to similarity between viable tumor and treatment-related changes following NAT. In various studies ,changes in tumor size or volume following neoadjuvant therapy were not significantly associated with R0 resection or survival outcomes. Increased tumor attenuation in the arterial and venous phases after neoadjuvant therapy was associated with R0 resection in patients with locally advanced and borderline resectable tumors. Partial regression of tumor-vessel contact after neoadjuvant therapy had 100% positive predictive value for R0 resection, regardless of the degree of either reduction in tumor size or residual vascular involvement.Decreased venous stenosis or decreased contour deformation indicates improved venous involvement after NAT.

### TABLE OF CONTENTS/OUTLINE

Favorable imaging findings on Contrast Enhanced Computed tomography after neoadjuvant therapy include partial regression of tumor contact with peripancreatic vessels, a mild fat-stranding perivascular halo in place of solid tumor contact with a vessel, and reduction in tumor size according to RECIST 1.1 guidelines.

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# Abstract Archives of the RSNA, 2024

GIEE-150

## IMPACT OF FAT ESTIMATION OF PANCREATIC PARENCHYMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Atsushi Higaki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshihiko Fukukura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Tamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akira Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kiyoka Maeba, MD (*Abstract Co-Author*) Nothing to Disclose
Akihiko Kanki, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this presentation is:1) To demonstrate the epidemiology of intrapancreatic fat and the characteristic imaging findings of computed tomography and magnetic resonance imaging, including the radiologic-pathologic correlations.2) To learn about the relationship between intrapancreatic fat and various metabolic diseases, pancreatitis, pancreatic cancer, and intraductal papillary mucinous neoplasm.

### TABLE OF CONTENTS/OUTLINE

CONTENTS ORGANIZATIONThe fat in pancreatic parenchyma for1. Metabolic diseases2. Pancreatitis3. Pancreatic fistula4. Intraductal papillary mucinous neoplasm5. Pancreatic cancer

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# Abstract Archives of the RSNA, 2024

GIEE-151

## IMAGING SPECTRUM AND DIAGNOSTIC CHALLENGES OF ATYPICAL HEPATOCELLULAR CARCINOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Igor Goykhman, DO (*Abstract Co-Author*) Nothing to Disclose
Joseph Nenow, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian W. Huang, DO (*Abstract Co-Author*) Nothing to Disclose
Angelica Patino, MD (*Abstract Co-Author*) Nothing to Disclose
Zahraa Al-Turaihi, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan J. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Zachary B. Hoskins, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Hepatocellular carcinoma (HCC) is a high mortality malignancy, with imaging playing a crucial role in early detection. 2. Recognize the typical imaging features of hepatocellular carcinoma. 3. Infiltrative HCC can have features which overlap with typical HCC, or can look markedly abnormal with features including tumor-in-vein. 4. Identify features found in biphenotypic tumors and their overlap with HCC and cholangiocarcinoma. 5. Infiltrative HCC and biphenotypic tumors do not behave like typical HCC, therefore a radiologist should have a high index of suspicion for these entities in patients with chronic liver disease.

### TABLE OF CONTENTS/OUTLINE

I. Introduction a. Mortality of HCC b. Imaging utilization in the pre-operative evaluation II. Typical HCC a. Arterial phase hyperenhancement and washout i. Physiology ii. CT iii. MRI b. Ancillary features c. Ultrasound III. Infiltrative HCC, on a spectrum of cases that resemble typical HCC to more atypical. a. Mimickers b. Cases which retain features of typical HCC c. Cases which are difficult to characterize d. Cases with tumor-in-vein i. MRI appearance ii. Ultrasound 1. Spectral Doppler 2. Differentiation from bland thrombus IV. Combined HCC/cholangiocarcinoma a. Statistics in chronic liver disease b. Imaging findings of typical cholangiocarcinoma c. Imaging characteristics i. Cases that resemble HCC ii. Cases that resemble cholangiocarcinoma

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# Abstract Archives of the RSNA, 2024

GIEE-152

## BEYOND THE BULGE: A FOUNDATIONAL REVIEW OF DYNAMIC ULTRAOUND OF THE ABDOMINAL WALL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Young H. Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Aniket Pandya, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Svrcek, MD (*Abstract Co-Author*) Nothing to Disclose
Christine Yao, BA, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Our educational exhibit aims to provide a foundation for the ultrasound (US) evaluation of abdominal wall "bulges" or hernias, particularly with the use of dynamic maneuvers. First, a comprehensive understanding of the variations in abdominal wall anatomy to the level of the inguinal region is crucial to the diagnostic process. Using both positional changes (upright, supine) and manipulation of intra-abdominal pressure (Valsalva, coughing) during ultrasound examination will allow for real-time assessment of the behaviors and movement of herniated contents. Effective use of dynamic maneuvers can increase sensitivity and accuracy of US, which can eliminate the need for more costly cross-sectional imaging with CT or MRI. When assessing a hernia, we will highlight the importance of documenting features such as size, sac contents, and estimated fascial defect. Additionally, we will review post-operatively imaging such as expected and unexpected surgical changes. Finally, we will also cover both common and rare differential diagnoses or mimics of hernias when evaluating for an abdominal wall palpable complaint.

### TABLE OF CONTENTS/OUTLINE

1. Learn overview of anterior abdominal anatomy with specific attention to ultrasound appearance and the common locations for abdominal wall hernias to arise. 2. Recognize classic imaging features of abdominal wall hernias and hernia sac contents. ?3. Understand how dynamic imaging maneuvers such as (positional changes, Valsalva, etc.) is key to the evaluation of an abdominal hernia. 4. Review the expected post-operative appearance of a hernia repair and common post-operative complications. 5. Appreciate imaging features of common and rare mimics of abdominal wall hernias.

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# Abstract Archives of the RSNA, 2024

GIEE-153

## HEPATIC ELASTOGRAPHY: THE IMPORTANCE OF ITS INTERPRETATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Luiz Nascimento (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Fernanda Fleming (*Abstract Co-Author*) Nothing to Disclose
Victor Arthur Ohannesian (*Abstract Co-Author*) Nothing to Disclose
Pedro Carani (*Abstract Co-Author*) Nothing to Disclose
Marcelo R. Silva, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Ultrasound elastography was described for the first time in 2003 as a novel method for assessing and staging liver fibrosis.- Together with B-mode and Doppler study evaluation, both able to be performed simultaneously with elastography, a complete liver profile is created with a single exam.- Adequate interpretation of elastography results requires the patient’s clinical condition and laboratory exams to be taken into context by the radiologist.- Multiple factors, such as high-intensity physical activity, beta-blocker use, and recent excessive alcohol consumption, can affect elastography results.- It is fundamental that the radiologist has knowledge to not only perform the elastography exam but also interpret results considering each patient’s clinical context.

### TABLE OF CONTENTS/OUTLINE

- Introduction on hepatic ultrasound elastography- Confounding factors that increase liver stiffness- Interpretation of elastography on patients with viral hepatitis and non-alcoholic fatty liver disease- Clinical cases and discussion

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# Abstract Archives of the RSNA, 2024

GIEE-154

## PANCREATIC NEUROENDOCRINE TUMORS: CT FEATURES TO HELP PREDICT TUMOR GRADE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elliot K. Fishman, MD (*Abstract Co-Author*) Co-founder, HipGraphics, Inc Stockholder, HipGraphics, Inc Institutional Grant support, Siemens AG Institutional Grant support, General Electric Company Consultant, Exact Sciences Corporation Consultant, Imaging Endpoints II LLC
Linda C. Chu, MD (*Abstract Co-Author*) Nothing to Disclose
Satomi Kawamoto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Pancreatic neuroendocrine tumors (PanNETs) are increasingly diagnosed in the recent decades, and treatment strategy of PanNETs have been evolved due to better understanding of tumor biology 2. Tumor stage and grade are critical for guide treatment and predict prognosis. 3. CT features to help predict histological tumors grade are presented and discussed. However, accurate prediction of tumor grade is difficult on imaging alone. 4. Radiomics has emerged as a valuable tool and applied to predict grading of PanNET. Review and discuss pros and cons of this technique in predicting tumor grade.

### TABLE OF CONTENTS/OUTLINE

1. Review pathological tumor grade according to WHO classification. 2. CT features to suggest low grade PanNETs. (a) Tumor size: small PanNETs are typically low grade, but not all tumors. (b) Tumor vascularity/enhancement: low grade PanNETs are typically hypervascular with intense homogeneous enhancement, but not all tumors. (c) Cystic/necrotic tumors: Small cystic PanNETs are often low grade, and necrosis are often associated with high grade PanNET, but they may be difficult to differentiate on CT. (d) Presence of calcification: Calcifications are more often associated with higher grade PanNETs but can be seen in low grade PanNETs. (e) Biliary duct, pancreatic duct, vascular and adjacent organ involvement are more commonly associated with higher grade PanNETs, though there are exceptions. 3. Review and discuss recent advances of radiomics technique and current limitations in predicting PanNET tumor grade compared to CT imaging features alone.

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# Abstract Archives of the RSNA, 2024

GIEE-155

## LYMPHOMAS OFF THE BEATEN PATH: EXPLORING UNCOMMON ABDOMINAL MANIFESTATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Bekhor, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Levi B. Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To overview the pathophysiology and clinical manifestations of lymphomas. - To highlight the main radiological aspects and sites of involvement. - To alert about less common manifestations and unusual sites of involvement and discuss differential diagnoses.

### TABLE OF CONTENTS/OUTLINE

This presentation will overview the classics findings in abdominal lymphomas, that frequently involve nodal and extranodal structures, for knowledge of the usual presentation of the disease. The most classical findings include nodal disease, with solitary or multiple enlarged nodes, with a huge round mass or a lobular homogeneous density with uniform enhancement. When in extranodal involvement, the studies describe the spleen, liver, gastrointestinal tract, pancreas, abdominal wall, genitourinary tract, adrenal, peritoneal cavity, and biliary tract, in decreasing order of frequency. We describe and illustrate with schematic figures and imagens, rare cases of lymphoma with lymph nodes necrosis in patients without treatment, primary commitment of liver, pancreas, bilateral adrenal, non-Hodgkin peritoneum involvement, ovary, testicle, kidney, stomach, and bowel. A brief literature review of these rare manifestations and discuss why they are unusual, bringing frequency and epidemiological data for the radiology community keep in mind these unusual aspects to suspect when faced with challenging cases.

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# Abstract Archives of the RSNA, 2024

GIEE-156

## EXAMINE THE PECULIAR PHENOMENA OF BONE MARROW ACTIVITY MIGRATING TO NEW SITES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aley Talans, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Eduardo Borher Moreira (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bruna K. Andreucci, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia De Toledo Mendes, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia Goncalves Dias (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Provide an overview of Extramedullary Hematopoiesis (EMH).Define the profile of patients with EMH from a clinical and laboratory point of view. Review typical and atypical presentations of EMH with emphasis on abdominal imaging. Present the main differential diagnoses.

### TABLE OF CONTENTS/OUTLINE

Review of the pathophysiology of EMH, with an understanding of the emergence of lesions made up of erythroid precursors (generally irregular aggregates of erythroblasts, immature granulocytes, and occasional megakaryocytes), as well as their usual and unusual distribution in the abdomen. Presentation of the patient’s epidemiological profile through real cases with clinical and laboratory data, facilitating the understanding of the disease, and revealing in which situations EMH should be considered as a diagnostic possibility and in which its probability becomes remote. As well as the presentation of image stigmas that may reveal that the patient evaluated has sickle cell anemia, thalassemia, myelofibrosis, or chronic myeloid leukemia, among the most common causes. Exposure of a series of cases with typical and atypical presentation of EMH, with emphasis on the usual findings of the disease, which involve paraspinal nodules, expansion of the ribs, organomegaly, focal masses in the liver or spleen, renal involvement (parenchymal, intrapelvic or perirenal), lymphnode involvement, nodules or peritoneal masses and masses at sites of splenectomy or nephrectomies. Presentation of differential diagnoses from an imaging point of view, highlighting the importance of clinical and epidemiological knowledge for a correct diagnostic approach.

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# Abstract Archives of the RSNA, 2024

GIEE-157

## PRE AND POST-OPERATIVE EVALUATION OF SURGICALLY MANAGED BOWEL ENDOMETRIOSIS: GUIDING THE BETTER CHOICE, MONITORING THE OUTCOME

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lucas R. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia A. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula C. Moura, MSc, MSc (*Abstract Co-Author*) Nothing to Disclose
Ana Paula Fraga Cintra Gonzaga (*Abstract Co-Author*) Nothing to Disclose
Bruna G. Busoletto Tripode SR, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To present the intestinal surgical approach techniques for endometriosis and the indication of each approach according to the degree and site of the lesions. Expose the imaging aspects after laparoscopic resections and anastomoses of intestinal endometriosis lesions. Correlate post-surgical MRI findings, transvaginal ultrasound, and colonoscopy. Distinguish usual post-surgical findings from complications and residual disease.

### TABLE OF CONTENTS/OUTLINE

Bowel involvement is one the most severe forms of deep endometriosis, present in up to 30-40% of patients with deep endometriosis, and many of them will require surgical intervention.Several types of surgery have been used for the management of bowel endometriosis. Most of resection techniques are unknow for the radiologists, and the postoperative findings following bowel resection will depend on the surgical technique applied. To present the surgical techniques currently used to treat intestinal endometriosis through didactic drawings and illustrations of surgical steps depending on the characteristics of the lesion and its location in the rectosigmoid, cecum, appendix or ileum, proposing a clinical reasoning flowchart for choosing the most appropriate surgical procedure.Case-based review in a multimodality approach (US, MRI, colonoscopy and surgical specimens), following a timeline, with positive outcomes, demonstrating usual postoperative findings as well related complications. Practical tips illustrated by cases to assist radiologists in the differential diagnosis of post-surgical changes and residual endometriotic disease.

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# Abstract Archives of the RSNA, 2024

GIEE-16

## SHIFTING PERSPECTIVE: EFFECTIVELY INCORPORATING THE DIXON METHOD INTO ABDOMINAL AND PELVIC MRI INTERPRETATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
Kyle Kleiman (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Ronak Patel, BS (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
Elhamy R. Heba, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Dixon method creates four image sets from a single acquisition: in-phase and out-of-phase images, acquired via a dual-echo technique, and fat-only and water-only images, reconstructed created from dual-phase source data, showing fat or water T1-signal intensity, respectively. These images provide information to allow confident identification of: (1) Macroscopic (adipocytes) and microscopic fat (or small volume) through India ink artifact and signal loss on out-phase images and (2) substances causing magnetic susceptibility (e.g. gas, iron, blood products, and metal) through signal loss on out-of-phase images. Fat-only images provide an alternative sequence for identifying fat while water-only images yield a T1-weighted fat suppressed sequence. These sequences can be integrated into imaging protocols for the abdomen and pelvis and incorporated in radiologist's search patterns. Knowledge of basic physics principles behind image generation can facilitate understanding of imaging appearances and improve diagnostic confidence.

### TABLE OF CONTENTS/OUTLINE

1. Review of physics principles underlying Dixon chemical-shift imaging 2. Case-based approach using the Dixon method to characterize diffuse and focal abnormalities in the abdomen and pelvis on MRI: Use of dual-phase gradient echo imaging to identify lipid through use of signal loss and India ink artifact Use of T2* effects/magnetic susceptibility artifact to identify gas, iron, blood products, and metal Use of fat-only images as an alternative sequence for identifying fat Use of water-only images as a fat-suppressed sequence 3. Discussion of integration into imaging protocols and search patterns to maximize benefits and limiting image overload

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# Abstract Archives of the RSNA, 2024

GIEE-17

## EVALUATION AND MANAGEMENT OF COMPLICATIONS AFTER LIVING DONOR LIVER TRANSPLANTS REQUIRING COMPLEX BILIARY ANASTOMOSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Karthik M. Sundaram, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Richard D. Shlansky-Goldberg, MD (*Abstract Co-Author*) Nothing to Disclose
Ann T. Foran, MBBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Due to the limited availability of deceased donor liver transplants (DDLTs), living donor liver transplants (LDLTs) are becoming more common. 2) However, variant intrahepatic ductal anatomy, can increase risk of complications and exclusion of optimal donors. 3) New surgical techniques has allowed for the creation of complex biliary anastomoses, increasing the number of successful LDLTs. 4) Biliary complications following LDLT requiring multiple biliary anastomoses are higher compared to DDLTs. 5) Post-operative imaging allows for identifying the variant reconstructed biliary anatomy complications to ensure timely treatment. 6) In this exhibit, we illustrate pre- post-operative magnetic resonance imaging/ magnetic resonance cholangiopancreatography (MRI/MRCP) of donors recipients after LDLTs requiring complex biliary anastomoses. 7) We focus on recognizing the most common biliary complications mimics as well as management approaches.

### TABLE OF CONTENTS/OUTLINE

1) Discuss surgical techniques including ductoplasty, creation of a single orifice containing multiple ducts in a Roux limb, the presence of multiple separate anastomoses. 2) Evaluation of the pre-operative variant intrahepatic ductal anatomy and post-operative imaging appearances of LDLTs after multiple anastomoses by MRCP and hepatobiliary phase MRI. 3) Review complications and mimics following LDLT including anastomotic and non-anastomotic strictures, cholestasis, anastomotic leak, biliary cast syndrome, cholangitis, and biliary sepsis. 4) Management options for biliary complications including medical, ERCP in the cases of hepaticojejunostomy, placement of external/internal drains, the need for retransplant.

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# Abstract Archives of the RSNA, 2024

GIEE-18

## ACR LI-RADS ULTRASOUND SURVEILLANCE V2024: UPDATE OF ULTRASOUND LI-RADS V2017

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aya Kamaya, MD (*Abstract Co-Author*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation
David T. Fetzer, MD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research support, Siemens AG;Consultant, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Consultant, General Electric Company;Advisory Board, General Electric Company
Shuchi K. Rodgers, MD (*Presenter*) Royalties, RELX

### TEACHING POINTS

1. ACR LI-RADS and the American Association for the Study of Liver Disease (AASLD) recommend hepatocellular cancer surveillance in at-risk individuals with ultrasound and serum alpha-fetoprotein (AFP) every six months. 2. LI-RADS Ultrasound Surveillance is a framework for performance, interpretation, and reporting of HCC surveillance US and is composed of an US Category (US-1, US-2, or US-3) and a Visualization Score (VIS A, VIS B, or VIS C). 3. The LI-RADS Ultrasound Surveillance v2024 offers a pathway for alternative surveillance modalities in cases of VIS C-scored exams and elevated AFP without sonographic correlate. 4. Due to the low likelihood of malignancy, there is a reduced surveillance interval for US-2 Subthreshold observations in v2024.

### TABLE OF CONTENTS/OUTLINE

1. Offer rationale for hepatocellular cancer surveillance 2. Review evidence and published literature on US LI-RADS v2017 3. Discuss rationale for LI-RADS US Surveillance v2024 updates 4. Present updated LI-RADS US Surveillance v2024 algorithm 5. Compare AASLD and ACR LI-RADS US Surveillance recommendations 6. Highlight tips and tricks for implementing LI-RADS US Surveillance 7. Present case examples

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# Abstract Archives of the RSNA, 2024

GIEE-19

## AGE-RELATED PANCREATIC HYPERINTENSITY A PROMISING INDICATOR FOR LOCALIZED AUTOIMMUNE PANCREATITIS SUBTITLE ABDOMINAL ULTRASONOGRAPHY AS A VALUABLE TOOL FOR EARLY DETECTION OF AUTOIMMUNE PANCREATITIS DISEASE WITH LESIONS SMALLER THAN 20MM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Norifumi Nishi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Adjustments to the settings of the ultrasound device, including magnification, filtering, gain, and sensitivity time control, are necessary to depict localized lesions accurately. Autoimmune pancreatitis tends to occur more frequently in the elderly population, typically around the age of 65, with a higher incidence in middle-aged to elderly individuals. In ultrasound images of the pancreas, aging-related effects often result in increased brightness, making localized lesions easier to detect. Autoimmune pancreatitis typically exhibits irregular contours and internal patchy or punctate hyperechoic spots in localized lesions of approximately 20 mm in size. Early detection via ultrasound examination not only facilitates prompt diagnosis but also makes differentiation from other modalities easier.

### TABLE OF CONTENTS/OUTLINE

Adjustments of ultrasound device settings to confirm the contours and internal structure of localized lesions. Age-related changes in pancreatic brightness enhancing the detectability of localized lesions, particularly in the middle-aged to elderly population. Characteristics of autoimmune pancreatitis with localized lesions of approximately 20 mm, including contour and internal features. Facilitation of evaluation of lesions of approximately 20 mm identified via ultrasound examination using other diagnostic modalities. Early diagnosis enables treatment to progress before the condition worsens.

# Abstract Archives of the RSNA, 2024

GIEE-2

## PANCREATIC LESIONS 101: A BEGINNER'S GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Monica Chapa-Ibarguengoitia, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Bethsabel Rodriguez Encinas, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Isabel I. Leon Garcia (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand the basic anatomy of the pancreas and its anatomical relationships. Identify the main characteristics of cystic and solid lesions through multimodality imaging techniques. Recognize key data that assist in the differential diagnosis of pancreatic lesions. Distinguish features of benignity and malignancy. Correlate radiological images with histopathological diagnoses

### TABLE OF CONTENTS/OUTLINE

1. Introduction: - Anatomy of the pancreas - Anatomical relationships2. Solid pancreatic lesions: - Pancreatic Adenocarcinoma - Pancreatic Metastasis - Solid Pseudopapillary Tumor - Pancreatic Neuroendocrine Tumor - Focal Pancreatitis - Intrapancreatic Accessory Spleen3. Cystic pancreatic lesions: - Mucinous Neoplasm - Serous Cystoadenoma - Intraductal Papillary Mucinous Neoplasm - Intrapancreatic Gastric Duplication Cyst4. Summary: - Key Points

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GIEE-20

## TOTAL PANCREATECTOMY AND ISLET AUTOTRANSPLANTATION (TPIAT): IMAGING OF EXPECTED FINDINGS AND COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura R. Carucci, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan D. Clayton, MD (*Abstract Co-Author*) Nothing to Disclose
Jill Bruno, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

TPIAT is performed throughout the US, with increasing prevalence over the last two decades. Goals of TPIAT are to alleviate pain due to debilitating chronic or acute recurrent pancreatitis and to prevent development of brittle diabetes by infusion of pancreatic islet cells. Imaging plays a key role in evaluating patients who have undergone TPIAT. Radiologists must be aware of the surgical procedure, expected post-operative findings on imaging studies, complications and role of imaging, and potential imaging pitfalls.

### TABLE OF CONTENTS/OUTLINE

Review TPIAT background, indications and goals. Discuss surgical procedure and expected imaging findings of TPIAT. Describe expected post-surgical anatomy following TPIAT. Demonstrate imaging of post-operative complications and sequelae of TPIAT. Complications may include: leak (bowel, bile), abscess, hematoma, biliary stricture, bowel obstruction (anastomotic stricture, adhesions, incisional or internal hernia), delayed gastric emptying, bezoar, vascular abnormalities (thrombosis, pseudoaneurysm), omental infarcts, nodular hepatic steatosis. Show imaging of expected post-surgical findings and pitfalls.

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GIEE-21

## IT'S PERITONEUM O'CLOCK! A PRACTICAL APPROACH ON PERITONEAL DISSEMINATION OF MALIGNANT DISEASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mauricio Zapparoli, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Vitor L. Vieira, MD (*Abstract Co-Author*) Nothing to Disclose
Oscar Orozco (*Abstract Co-Author*) Nothing to Disclose
Fabio Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Da Silva Eli, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Taborda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Peritoneum dissemination of malignant diseases is common, and its imaging assessment may be challenging.CT is still the workhorse of peritoneal evaluation, and in experienced hands has similar accuracy compared to MRI.PCI is an important tool in the preoperative setting to evaluate the extent of peritoneal disease.Standardized PCI evaluation methods can improve accuracy and reduce misdiagnosis. MRI evaluation should include high-resolution T2 non-fat sat, DWI, and T1 fat sat contrast-enhanced sequences.Coronal DWI gives a wider panorama of the abdominal cavity and reduces the chance of missing lesions in the abdominopelvic transition.

### TABLE OF CONTENTS/OUTLINE

IntroductionReview the diseases that can potentially disseminate through the peritoneumMain location and pathophysiology of peritoneal lesions.Pros and cons of different imaging methods used to evaluate the peritoneum.Peritoneal Cancer Index (PCI)Use and indications of Radiological PCI assessment in the preoperative settingExamples of different PCI scores.Suggested standardized methodology to calculate PCI - Peritoneum O'Clock.Post-treatment evaluationImportance of baseline studies performed immediately after CRS and HIPEC.Remission and relapse cases.Standard protocolSuggestion of standard MRI protocol with optimal sequences to evaluate the peritoneum.

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GIEE-22

## 3 FOREIGN-BODIES PROBLEMS: THE CHALLENGES IN THE EVALUATION OF ABDOMINAL FOREIGN BODIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lais Abduch, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah De Menezes (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Brenda N. Lahlou, MD (*Abstract Co-Author*) Nothing to Disclose
Priscila Akemi d. Takitani, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Priscilla Claudia Raddo Venancio, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel B. Montel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To simplify the three major issues related to the evaluation of foreign bodies in the abdomen: their characterization, detection of complications, and description in the report.To explore the utility of various imaging techniques, including plain radiography, CT, MRI, and ultrasound, for the identification and characterization of abdominal foreign bodies.To highlight the potential complications arising from abdominal foreign bodies, such as perforation, obstruction, or infection. Delineate the role of radiologists in identifying complications, aiding in management decisions, and tracking post-removal outcomes.To guide the preparation of the medical report, considering medical and legal factors.

### TABLE OF CONTENTS/OUTLINE

Introduction.Image evaluation and foreign body detection.Expected attenuation of the different foreign body material (metal, plastic, wood, glass, bones, etc).Foreign bodies in the gastrointestinal and genitourinary tract arising from ingestion or introduction through natural orifices, such as anus, vagina, and, less frequently, the urethra.Foreign bodies complications such as perforation, gatrointestinal occlusion, and infection. Iatrogenic post-surgical foreign bodies.How to report abdominal foreign bodies.Conclusion.

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GIEE-23

## THE ROLE OF ABDOMINAL IMAGING IN EVALUATING PATIENT SUITABILITY FOR HIPEC

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Ifeanyi Ekpunobi, BS (*Abstract Co-Author*) Nothing to Disclose
Michaela Cooley, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cytoreduction with hyperthermic intraperitoneal chemotherapy (HIPEC) has been developed and become more prominent over the last 20 years. Due to its use at primarily high volume and specialized institutions, important imaging findings, especially those related to prediction of patient outcomes after HIPEC, are not widely known. This educational exhibit takes the reader through learning about the cytoreduction/HIPEC procedure, opt-in criteria, and common imaging findings before and after treatment.

### TABLE OF CONTENTS/OUTLINE

1. What is hyperthermic intraperitoneal chemotherapy (HIPEC)? a. Definition; b. Benefits over traditional chemotherapy; c. Candidacy requirements; d. Origins of cancers typically treated with HIPEC2. Opt-in criteria for HIPEC. a. Patient factors for candidacy; b. Imaging modalities used in evaluation; c. Highlight on why CT is the preferred modality3. Common CT imaging findings of carcinomatosis. a. Common imaging findings discussed and shown on CT; b. Discussion of the pathophysiology of each imaging finding; c. Discussion on how to evaluate each imaging finding4. CT findings that relate to prognosis if HIPEC is performed. a. Imaging findings related to worsening prognosi; b. Pathophysiology of why some imaging findings correlate to worse outcomes; c. Discussion on who should be excluded from HIPEC treatment5. Disease burden and complications post-HIPEC; a. Possible outcomes after HIPEC and cytoreduction surgery; b. Complications of HIPEC and cytoreduction; c. How imaging plays a role in surveillance of disease; d. Discussion on frequency of imaging and notable findings

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GIEE-24

## DON’T RELY ON LUCK - HAVE A PROPER LOOK! POST OPERATIVE COLORECTAL CANCER IMAGING: A GUIDE TO HELPING YOUR SEARCH PATTERN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Snehal Lapsia, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Sophie Cheshire, MBChB, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Common post operative colorectal cancer surgeries highlighting anatomy Tips and tricks including where to look for subtle recurrence Mimics of recurrent disease

### TABLE OF CONTENTS/OUTLINE

This multimodality pictorial review aims to enhance the skills of the radiologist when reviewing colorectal cancer follow up imaging. Knowledge of surgical technique and post operative anatomy is crucial when identifying residual, recurrent or metastatic disease on post treatment imaging. It is vital to have a focused search pattern of key review areas to identify early recurrence in a timely manner to allow appropriate treatment or reintervention. We present an overview of post surgical anatomy for common colorectal surgeries with an emphasis on the draining vascular and lymph node pathways. Early disease recurrence based on these pathways is demonstrated on an array of imaging including CT, PET CT and MRI. Tips and tricks are provided to overcome common blindspots and potential errors. Examples include: mesocolic nodal recurrence post right hemicolectomy, rectal stump recurrence post anterior resection, IMA suture recurrence vs suture granuloma at the IMA division, presacral recurrence post abdominal perineal resection and detection of mucinous nodal disease on MR.

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GIEE-25

## A PREVALENT HEALTH PROBLEM: CASE-BASED REVIEW OF THE PATHOPHYSIOLOGY, IMAGING FEATURES, AND CONFOUNDING IMPACT OF HEPATIC STEATOSIS IN DIAGNOSTIC IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda C. Gibson, DO (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Owen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review the pathophysiology of hepatic steatosis including alcoholic and non-alcoholic steatohepatitis, NASH cirrhosis, focal steatosis, and transient steatosis2. Discuss the patterns of steatosis including but not limited to diffuse, geographic, focal and multifocal through case examples.3. Illustrate with case based approach, how steatosis can mimic other pathology.

### TABLE OF CONTENTS/OUTLINE

Pathophysiology of steatosis1. Hepatic metabolism of fat, alcohol and toxins2. Alterations in perfusion affecting steatosis deposition3. Inflammation and the progression to cirrhosisVariants of Steatosis1. Acute2. Transient3. Chronic4. Focal/multifocalCased based illustration of diagnostic challenges presented by hepatic steatosis1. Incidental indeterminate liver lesions2. Staging of colorectal cancer and other malignancies3. Cholangitis mimicking perivascular steatosisSummary: The incidence of steatosis is increasing and recognizing the subtypes and imaging patterns of steatosis can reduce uncertainty and improve patient management.

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GIEE-26

## RADIOLOGY'S ROLE IN THE DIAGNOSIS AND MANAGEMENT OF CONSTIPATION -DETECTION, CLASSIFICATION, COMPLICATIONS AND TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
Aman Khurana, MD (*Abstract Co-Author*) Nothing to Disclose
Rohan Kulkarni (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Owen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Differentiate and classify different forms of colonic disfunction to distinguish neurogenic, drug-induced, metabolic, functional, and mechanical causes of constipation2. Identify and describe radiological features of constipation and its complications3. Explain the role of abdominal radiographs, CT, fluoroscopic defecography, and MR defecography in detection and classification of constipation.4. Recommend the next appropriate step in management and describe potential image-guided intervention that can contribute to treatment of constipation

### TABLE OF CONTENTS/OUTLINE

Defining ConstipationDefecatory straining, hard lumpy stools, sensation of incomplete evacuation, sensation of anorectal obstruction or blockage, need for manual maneuvers such as digital evacuation, and or fewer than 3 stools per week.Etiologies of Constipation 1. Neurogenic: Diabetes mellitus, Hirschsprung's Disease, Intestinal Pseudo obstruction 2. Drug-Induced: Anticholinergics, Neutrally active agents 3. Metabolic: Hypokalemia, hypothyroidism 4. Functional: Pelvic floor dysfunction 5. Mechanical: Neoplasm, stricture, volvulusRadiologic features of constipation and its complications on Radiographs, CT, Fluoroscopy and MR 1. Colonic dilation2. Fecaloma or fecal impaction3. Wall thickening4. Pericolic stranding5. Perforation6. AbscessTreatment of Constipation 1. Laxative/enemas2. Manual dis-impaction 3. Water soluble fluoroscopic enema 4. Biofeedback 5. Surgery

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GIEE-27

## CEVICHE, TOO SPICY TO HANDLE: OVERVIEW OF UNUSUAL RECTAL TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mark Guelfguat, DO (*Abstract Co-Author*) Nothing to Disclose
Yanet Y. Torres Maza (*Abstract Co-Author*) Nothing to Disclose
Jorge L. Huayanay, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Rioja (*Abstract Co-Author*) Nothing to Disclose
Alexander Acevedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To emphasize the importance of a comprehensive approach to differential diagnosis for rectal tumors, incorporating imaging features alongside the patient's medical history and clinical context.To educate the audience regarding the growth patterns of the different rectal tumors. To achieve a better understanding of the rectal tumor imaging features through pathological correlation. To propose a thorough differential diagnosis based on clarification of the growth patterns and likely anatomical origin.

### TABLE OF CONTENTS/OUTLINE

The goals of this exhibit are to:Provide a pictorial review of the diverse imaging appearances of uncommon rectal tumors. Discuss specific imaging and pathological characteristics of uncommon rectal tumors. Familiarize the audience with the imaging features of uncommon rectal tumors, thereby helping in formulation of a complete differential diagnosis.These major featured rectal neoplasms include: rectal gastrointestinal stromal tumors (GIST), anorectal melanoma, rectal neuroendocrine neoplasms (G1-3 and poorly differentiated), primary rectal lymphoma, leiomyoma, lipoma, leiomyosarcoma, Kaposi’s Sarcoma, rhabdomyosarcoma, extramammary Paget’s disease

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GIEE-28

## HYDATID DISEASE ON ULTRASOUND: CORRELATION WITH CT AND MRI, DIFFERENTIAL DIAGNOSIS, AND COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leticia Gutierrez Velasco, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Francisco Sallaberry Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Garcia del Salto, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Fraga Rivas, MD (*Abstract Co-Author*) Investigator, General Electric Company
Jaime de Miguel Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Sastre, MD (*Abstract Co-Author*) Nothing to Disclose
Cristian Rodriguez Robles (*Abstract Co-Author*) Nothing to Disclose
Sandra Robledo (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe the different stages of hydatid disease on ultrasound and its correlation with CT and MRI. Show less common alternative locations to the liver.Display the main differential diagnosis of hydatidosis. Review the main complications.

### TABLE OF CONTENTS/OUTLINE

Hydatid disease, caused by Echinococcus granulosus and less frequently by Echinococcus multilocularis, remains a global health problem. It is characterized by the formation of hydatid cysts with a three-layered structure. Ultrasound is the initial diagnostic tool that allows distinguishing the evolutionary stages. The Gharbi and WHO classifications are the most used, especially in the liver, although they can be applied to other less common locations, such as lung or spleen, among others. They classify hydatid lesions into five main types based on ultrasound findings and, although both are not directly comparable, an approximate comparison based on imaging characteristics is provided. The differential diagnosis includes simple and complex cysts, abscesses, hematomas and tumors. Hydatid cysts, typically asymptomatic, may be incidentally detected on imaging tests or lead to complications such as mass effect, rupture and infection. For a comprehensive evaluation of cysts and their complications, CT and MRI are essential complements to ultrasound, making it important to know how to correlate the findings.

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GIEE-29

## CYST ME MORE: ABDOMINAL CYSTIC LESIONS OF THE MESENTERY AND PERITONEUM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elena Uceda, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Dominguez Fraga, MD (*Abstract Co-Author*) Nothing to Disclose
Paola Pizano, MD (*Abstract Co-Author*) Nothing to Disclose
Begona Jimenez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiological evaluation of cystic lesions using different imaging techniques.Review of the classification of abdominal cystic lesions that affect the mesentery and peritoneum.Overview the main pathological and radiological features of the entities comprising the differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Imaging technique and findings of cystic lesions 3. Benign mesenteric cyst: 3.1 Peritoneal simple mesothelial cyst; 3.2 Chylolymphatic mesenteric cyst; 3.3 Cystic lymphangioma; 3.4 Enteric duplication cyst/enteric cyst 4. Cystic neoplasms: 4.1 Multicystic peritoneal mesothelioma; 4.2 Mucinous cystic neoplasm; 4.3 Pseudomyxoma peritonei; 4.4 Mature cystic teratoma; 4.5 Tumoral degeneration or myxoid component 5. Infectious and inflammatory cyst: 5.1 Abscess; 5.2 Nonpancreatic pseudocyst; 5.3 Peritoneal hydatidosis; 5.4 Necrotic lymph nodes 6. Iatrogenic or traumatic cyst: 6.1 Nonpancreatic pseudocyst; 6.2 Gossypiboma 7. Conclusions

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GIEE-3

## LI-RADS V2024: A NEW HOPE FOR HEPATOCELLULAR CARCINOMA TREATMENT RESPONSE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Velloni, MD (*Abstract Co-Author*) Nothing to Disclose
Hilton M. Leao Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre K. Wakote Teruya, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1 - The Liver Imaging Reporting and Data System (LI-RADS) has been updated with a new treatment response algorithm (TRA v2024) including two separate nonradiation and radiation Cores, previously incorporated within a single algorithm. 2 - In the updated version there is a new specific algorithm for internal and external beam radiation-based locoregional therapies (LRT) such as transarterial radioembolization (TARE) and stereotactic beam radiation therapy (SBRT). It also introduced a new treatment response category (LR-TR nonprogressing) for radiation TRA. 3 - This exhibit aims to discuss and describe how to apply the ancillary features enabling the upgrade from LR-TR equivocal to viable or from LR-TR nonprogressing to viable.

### TABLE OF CONTENTS/OUTLINE

1 - Introduction to the new LI-RADS v2024 CT/MRI treatment response algorithm. 2 - Case-based and illustrative guides applying the ancillary features and the feature of viability. 3 - Provide practical considerations and diagnostic tips to improve accuracy and prevent misinterpretation in applying the updated LI-RADS v2024 TRA.

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GIEE-30

## DIAGNOSIS OF HIATAL HERNIAS, POST-SURGICAL CHANGES AND COMPLICATIONS ON FLUOROSCOPY IMAGES: AN EASY GUIDE FOR RESIDENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lourdes M. Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Bethsabel Rodriguez Encinas, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Renee Acuna Barrera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recognize the normal anatomy of the gastroesophageal junction and stomach on barium swallow studies.Identify the main characteristics of different types of hiatal hernias through barium swallow studies. Understand the management of hiatal hernias and recognize the normal post-surgical changes.Explain the complications associated with post-surgical changes in fundoplications according to the Hinder classification.

### TABLE OF CONTENTS/OUTLINE

Introduction: Normal anatomy of the gastroesophageal junction and stomach on FluoroscopyTypes of hiatal hernias.Anatomical changes and characteristics of hiatal hernias.Hiatal hernias management and treatment: Management according to the type of hiatal hernia.Types of surgical management.Post-surgical complications of fundoplication:Types of complications of fundoplication.Classification based on radiological images.Clinical cases Comparison between fluoroscopy studies before and after surgical management.Description on fluoroscopy images of post-surgical complications according to Hinder classification. Summary Key points.

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GIEE-31

## NAVIGATING IPMN MANAGEMENT: INSIGHTS FROM THE 2024 KYOTO GUIDELINES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yuki Tashiro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Learning about the image evaluation of IPMN, particularly worrisome feature and high risk stigmata, through specific examples as per the latest Kyoto Guidelines, and 2) Understanding the pitfalls and mimickers of worrisome feature and high risk stigmata through specific examples to enhance everyday clinical practice.

### TABLE OF CONTENTS/OUTLINE

Pancreatic cystic diseases encompass a broad spectrum of conditions, ranging from benign to malignant tumors. Given the difficulty in obtaining tissue samples, imaging plays a crucial role in diagnosis. The most frequently observed cystic tumor is the intraductal papillary mucinous neoplasm (IPMN), which possesses malignant potential. Not only is differentiation from other diseases necessary, but also risk assessment. The Kyoto Guidelines, published in 2024, are a key management strategy for IPMNs, detailing risk assessments and surveillance methods. Imaging criteria are included in worrisome features (WF) and high-risk stigmata (HRS).Following the latest guidelines, this presentation elucidates these findings, and also introduces potential pitfalls and mimicker.Besides IPMN, various other pancreatic cystic diseases require differential diagnosis through imaging due to differing risks and treatment approaches. Although these cystic diseases sometimes present similar imaging findings, making differential diagnosis challenging, the discussion will also cover how to manage such pitfalls while contrasting with IPMN.

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GIEE-32

## BUBBLES AND BILE: BENEFITS OF CONTRAST-ENHANCED ULTRASOUND FOR THE GALLBLADDER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David T. Fetzer, MD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research support, Siemens AG;Consultant, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Consultant, General Electric Company;Advisory Board, General Electric Company
Kanupriya Vijay, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Razan Noorelahi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Contrast-enhanced ultrasound (CEUS) has multiple unique advantages including high spatial and temporal resolution, high signal-to-background, and the use of an exclusively intravascular contrast agent. These features result in a powerful tool with impactful applications for the gallbladder.CEUS can help characterize intraluminal filling defects and differentiate vascularized masses from avascular mimickers such as tumefactive sludge.CEUS is useful in interrogating wall abnormalities with characteristics features, such as adenomyomatosis, and atypical or complicated cholecystitis. CEUS may be utilized in interventional procedures such as in the assessment of cystic duct patency via cholecystostomy tube instillation.

### TABLE OF CONTENTS/OUTLINE

Introduction: CEUS:Structure and pharmacokinetics of ultrasound contrast agents. Administration and safety considerations.Normal GB: Appearance on CEUS.GB Pathology: Bile salt imbalance: Gallstones, biliary precipitate, tumefactive sludge. Inflammation: Adenomyomatosis, acute cholecystitis, chronic cholecystitis, xanthogranulomatous cholecystitis, gangrenous and perforated cholecystitis, nonneoplastic polypoid growths, cholesterol and inflammatory polyps. Neoplastic growths: Adenoma and malignancy.Interventional applications: Assessment of cystic duct patency via cholecystostomy tube and percutaneous image-guided biopsy.

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GIEE-33

## ALL ABOUT THE PANCREATIC DUCT: A COMPREHENSIVE REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Juan Fernando Casanova Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar A. Ortiz-Andrade (*Abstract Co-Author*) Nothing to Disclose
Alex Espinal Colominas, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Arce (*Abstract Co-Author*) Nothing to Disclose
Nuria Roson Gradaille, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Anatomical Variants: Discuss the importance of recognizing and reporting anatomical variants of the pancreatic duct system. Pancreatic Disorders: Knowledge of the different forms of involvement of the pancreatic duct system by inflammatory, neoplastic and traumatic conditions is essential for a correct diagnosis. Ductal Signs: Recognition of the different pancreatic ductal signs in imaging studies is crucial for adequate differentiation between inflammatory and neoplastic pathologies. Disconnected pancreatic duct syndrome: Highlight the necessity of suspecting this condition when identifying intra-abdominal collections near the pancreas. MPD involvement: Stress the importance of considering the pancreatic duct's involvement when pancreatic lesions exhibit a morphology that follows its longitudinal axis. Utility of MRCP: Highlight the role of Magnetic Resonance Cholangiopancreatography in evaluating the pancreatic duct system.

### TABLE OF CONTENTS/OUTLINE

Embryology: Description of the embryonic development of the pancreatic duct system. Normal Anatomy: Description of the normal features of the pancreatic duct system. Congenital Anomalies: Discussion of congenital variants of the pancreas involving the duct system. Inflammatory Conditions: Review of the forms of involvement of the pancreatic duct system due to inflammatory conditions like acute and chronic pancreatitis. Pancreatic Neoplasms: Review of tumors involving the MPD, the branch ducts or both. Traumatic/Iatrogenic: Evaluation of injuries caused by trauma or medical procedures, highlighting lacerations and accidental injuries. Conclusion and Key Points: Synthesis of the key points and the main conclusions of the review.

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GIEE-34

## WHAT'S BEHIND THE LIVER- DEMYSTIFYING UNCOMMON LIVER MASSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ramy Shoela, MD (*Abstract Co-Author*) Nothing to Disclose
Zeshan Ali (*Abstract Co-Author*) Nothing to Disclose
Lin Gu, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Dilli (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review uncommon hepatic masses. Describe their imaging appearance and differences from their differentials. Review important clinical history and laboratory work-up that should raise suspicion for potential less common diagnoses. Discuss pathology of these masses.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to liver masses Common liver masses and imaging Utility in expanding the differential with unique history, laboratory or radiographic findings 2. Hepatic myeloid sarcoma in patient with AML Case Review of relevant clinical history, imaging, and pathology 3. Hepatic lymphoma in patient with Hep C and no cirrhosis Case Review of relevant clinical history, imaging, and pathology 4. EBV-associated smooth muscle tumor in patient with chronic immunosuppression for renal transplant Case Review of relevant clinical history, imaging, and pathology 5. Combined HCC and cholangiocarcinoma Case Review of relevant laboratory work-up (elevated AFP and CA 19-9), imaging, and pathology 6. Hepatic and renal angiomyolipomas in patient with tuberous sclerosis Case Review of relevant clinical history with tuberous sclerosis, imaging, and pathology 7. Hepatoblastoma in 3 year old patient Case Review of relevant clinical history (such as age), imaging, and pathology 8. Focal carcinoma arising from widespread intraductal papillary neoplasm Case Review of relevant differentials, imaging, and pathology 9. Acute cholangitis presenting as a mass in patient with fever Case Review of relevant clinical history, imaging, and pathology 10. Mucinous cystic neoplasm Case Review of relevant imaging and pathology

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# Abstract Archives of the RSNA, 2024

GIEE-35

## EXPLORING THE DEPTHS OF DIFFUSION IN RECTAL CANCER MAGNETIC RESONANCE IMAGING: COMPREHENSIVE INSIGHTS FROM THEORY TO PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joao Manoel M. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Miriana E. Mariussi, MD (*Abstract Co-Author*) Nothing to Disclose
Jose De Arimateia Batista Araujo Filho (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Role of Rectal Magnetic Resonance Imaging (MRI) in local staging of rectal cancer, assisting in treatment planning and disease management according to established protocols.- Principles of diffusion-weighted imaging (DWI), including optimal acquisition parameters and identification of artifacts.- Common pitfalls of DWI and strategies to mitigate misinterpretations.- Physical principles of apparent diffusion coefficient (ADC) and Intravoxel Incoherent Motion (IVIM) as DWI-derived techniques that complement image interpretation, particularly in post-treatment follow-up of rectal cancer.- Implementation of DWI within the diagnostic imaging service.- DWI patterns and their correlation with T2-weighted sequence patterns and treatment response, facilitating assessment of treatment efficacy and differentiation of tumor tissue from surrounding areas.- Interpretation of diffusion characteristics in lymph node evaluation.

### TABLE OF CONTENTS/OUTLINE

- Overview of Rectal Cancer- Role of MRI in Rectal Cancer, including protocol selection for diagnosis, treatment planning, and follow-up, and the integration of DWI into diagnostic imaging services- Physical principles of Diffusion-Weighted Imaging and its derivatives, such as Apparent Diffusion Coefficient and Intravoxel Incoherent Motion- Interpretation of DWI, addressing artifacts, pitfalls, and correlation with derived sequences- How to interpret DWI-derived sequences- Patterns identified in DWI and their relationship with treatment response and standardized methods, including T2-weighted imaging- Illustrative cases and educational points

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# Abstract Archives of the RSNA, 2024

GIEE-36

## UPPER GASTROINTESTINAL SERIES: RADIOLOGIST'S PRIMER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Renata Emy Ogawa, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago M. Baraviera, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the technique of the upper gastrointestinal (GI) series.Describe the anatomy of the esophagus, stomach, and duodenum based on the upper GI series.Discuss the typical and atypical pathologies involving the esophagus, stomach, and duodenum.Demonstrate what to expect and what is unexpected after surgical procedures.Show complex cases solved by upper GI series.

### TABLE OF CONTENTS/OUTLINE

Review based on cases and illustrationsTechniquePositioning, dynamic maneuvers, contrast media, and documentation standards.Anatomy physiology of the esophagus, stomach, and duodenumEsophagus: Reflux/Esophagitis; Achalasia; Motility disorders; Strictures; Diverticulum; broncho-esophageal fistula; StomachUlcers; Hernias; Volvulus; Motility disordersDuodenumDiverticulum; MembranesPostoperative normal and complications findings: Fundoplication; bariatric surgery.GI surgery reconstructions. Beyond "by-the-book" cases!

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# Abstract Archives of the RSNA, 2024

GIEE-37

## ACUTE SMALL BOWEL DILATATION DECODED: AN ILLUSTRATED RESOURCE FOR RADIOLOGY RESIDENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Juan C. Spina JR, MD (*Abstract Co-Author*) Nothing to Disclose
Guadalupe Comadran (*Abstract Co-Author*) Nothing to Disclose
Roy Lopez Grove, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela Soloaga (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Acute abdomen in the context of small bowel dilatation is a frequent consultation in the emergency department. Its evaluation on computed tomography (CT) requires a systematic approach and careful analysis of the characteristics of the intestinal wall.The pattern of small bowel wall thickening and its enhancement characteristics provide important clues to the underlying etiology.Identifying the presence or absence of a transition point on CT is a crucial step in evaluating small bowel dilatation. Awareness of potential complications and their imaging manifestations on CT allows for timely diagnosis and appropriate management to prevent further bowel compromise and systemic sequelae.

### TABLE OF CONTENTS/OUTLINE

Introduction.Normal findings of the bowel wall.Pathological findings of the small bowel wall.Wall Thickening i) Focal thickening ii) Diffuse thickening iii) Segmental thickeningEnhancement Patternsi) Homogeneous enhancement ii) Stratified enhancement. Target sign. iii) Decreased/absent enhancementEndoluminal Findingsi) Gallstone ileus ii) Foreign bodies and bezoarOther findingsRadiological signs to look for.i) Transition point and small bowel obstruction (SBO) ii) Small bowel feces signExtrinsic causesExtra-intestinal findingsComplications

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# Abstract Archives of the RSNA, 2024

GIEE-38

## HEPATOCELLULAR CARCINOMA (HCC) AFTER LOCOREGIONAL THERAPIES: WHAT'S NEW IN THE LIRADS TREATMENT RESPONSE ALGORITHM V2024?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Arthur S. Joseph, DO (*Abstract Co-Author*) Nothing to Disclose
Venkata S. Katabathina, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew V. Chesley, MD (*Abstract Co-Author*) Nothing to Disclose
Sriram Jaganathan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

· Review various locoregional therapies for HCC and discuss their indications and contraindications · Difference between Non-radiation based and Radiation based treatment response algorithm [TRA] core - v2024. · Management options based on the LR TR category in non-radiation-based and radiation-based TRA

### TABLE OF CONTENTS/OUTLINE

Introduction to HCC and LIRADS applicable population. Various treatment modalities available for HCC - Non-radiation-based therapies Radiation based therapies. Specific indication of different treatment modalities including ablation, Trans arterial chemoembolization [TACE], Tran-arterial Radioembolization [TARE], and Stereotactic Body Radiotherapy [SBRT]. Expected post-procedural changes in different modalities What is New in LIRADS Treatment Response Algorithm v2024? Role of different imaging modalities in treatment assessment Define LR TR categories in Non-radiation based TRA v2024 with imaging appearances Define LR TR categories in Radiation based TRA v2024 with imaging appearances Describe with examples the Mass-like enhancement [any degree in any phase] - the only major criteria as per ACR LR TRA v2024 The difference between radiation-based and non-radiation-based treatment response algorithm version 2024 and the rationale behind the modification.Conclusion LIRADS treatment response algorithm utilizing multiphasic CT or MRI liver helps in clear and uniform communication between the radiologists and other providers involved in the loco regional therapies of HCC. The current updated version 2024 has two cores - Non-radiation TRA and Radiation TRA. It is imperative to understand the categories for effective and optimal management of patients with HCC.

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# Abstract Archives of the RSNA, 2024

GIEE-39

## WHEN THE RADIOLOGIST'S STOMACH IS IN KNOTS! A PICTORIAL REVIEW OF ESOPHAGECTOMY TECHNIQUES AND COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Raul D. Pellon, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Herran de la Gala, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandra Somoano Marfull (*Abstract Co-Author*) Nothing to Disclose
Aranzazu Sanchez Gabin, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand the main surgical techniques of esophagectomy.2. To review its normal findings on postoperative CT and fluoroscopy. 3. To recognize the different complications and its management (drainages, endoscopic devices and surgery).

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Imaging protocol for postoperative evaluation (CT and fluoroscopy). 3. Surgical techniques, indications, advantages and disadvantages and normal postoperative findings on different imaging techniques (CT, fluoroscopy and endoscopy) : 3.1. Transthoracic esophagectomy: 3.1.1. Ivor Lewis technique. 3.1.2. McKeown’s. 3.2. Transhiatal esophagectomy. 3.3. Interposition approach (colon and jejunum). 4. Esophaguectomy complications and management: 4.1. Anastomotic leakage. 4.2. Anastomotic stricture. 4.3. Tracheo-esophageal and broncho-oesophageal fistula. 4.4. Conduit ischaemia or necrosis. 4.5. Chylothorax . 4.6. Pleuro-pulmonary complications. 4.7. Tumor relapse (common sites and complications related to it). 5. Conclusions. 6. Bibliography.

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# Abstract Archives of the RSNA, 2024

GIEE-4

## MULTIDISCIPLINARY APPROACH TO THE TREATMENT OF GIST: A CASE-BASED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Noor Fatima Majeed, MD (*Abstract Co-Author*) Nothing to Disclose
Hernan R. Bello Velez, MD (*Abstract Co-Author*) Nothing to Disclose
Aarti Sekhar, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy Arleo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Gastrointestinal stromal tumors (GISTs), mesenchymal tumors affecting the GI tract and beyond, present with diverse symptoms, disease burden, and aggressiveness. Effective management necessitates a multidisciplinary approach, where radiologists play a pivotal role. With highly variable imaging features, some of which overlap with other abdominal tumors, GIST can present a diagnostic challenge. Moreover, early identification on imaging is crucial in guiding biopsy approach, as percutaneous biopsy risks peritoneal seeding. Additionally, anatomical nuances of GIST tumors impact surgical management. Our educational exhibit aims to: 1. Review the common imaging characteristics of GIST 2. Distinguish GIST from other similar appearing abdominal tumors 3. Overview a multidisciplinary treatment approach, with emphasis placed on the radiologist's role 4. Highlight anatomic considerations that influence surgical candidacy

### TABLE OF CONTENTS/OUTLINE

1. Overview epidemiology and pathogenesis 2. Review a multidisciplinary treatment approach, with emphasis placed on the radiologist's role 3. Case-based review of common imaging findings 4. Discuss the role of medical and surgical treatment 5. Consider common surgical approaches based on involvement of anatomic structures 6. Assess recurrence risk based on size, location, pathologic features, and pseudocapsule rupture7. Case-based review of metastatic and recurrent disease

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# Abstract Archives of the RSNA, 2024

GIEE-40

## JOURNEY INTO PANCREATIC CARCINOGENESIS WHERE IMAGING MEETS GENOMIC TERRAIN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Diego A. Aguirre, MD (*Abstract Co-Author*) Nothing to Disclose
John L. Torres Castiblanco SR, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Borrero, MD (*Abstract Co-Author*) Nothing to Disclose
Santiago Aristizabal (*Abstract Co-Author*) Nothing to Disclose
Diana Romero Mayorga I, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Overview: Provide an overview of the primary precursor lesions associated with pancreatic carcinogenesis.Progression from Precursor Lesions to Cancer: Illustrate the stepwise progression from precursor lesions (e.g., PanIN, IPMN) to invasive carcinoma, emphasizing the genetic alterations and imaging features associated with each stage of disease evolution.Integration of Genetics and Imaging: Emphasize the synergistic relationship between genetic insights and imaging techniques in early detection and risk stratificationFutures directions: highlighting the potential for precision medicine approaches in pancreatic cancer management.

### TABLE OF CONTENTS/OUTLINE

Precursors Lesions Pancreatic intraepithelial neoplasiaOverview Genetic LandscapeImaging signs for high grade lesionsCasesIntraductal papillary mucinous neoplasms OverviewGenetic LandscapeImaging signs for high grade lesionsCasesPancreatic Ductal AdenocarcinomaOverviewGenetic LandscapeImaging features CasesFuture DirectionsRole of imaging biomarkers in early detectionConclusions

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# Abstract Archives of the RSNA, 2024

GIEE-41

## MODELS OF BOWEL ULTRASOUND INTEGRATION INTO THE CLINICAL PRACTICE TO ASSESS AND MONITOR INFLAMMATORY BOWEL DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Stephanie R. Wilson, MD (*Abstract Co-Author*) Equipment support, Koninklijke Philips NV;Equipment support, Siemens AG;Equipment support, Samsung Electronics Co, Ltd;Research support, Samsung Electronics Co, Ltd;
Sudha A. Anupindi, MD (*Abstract Co-Author*) Nothing to Disclose
David Bruining, MD (*Abstract Co-Author*) Consultant, Medtronic plc;Research support, Medtronic plc;Research support, Takeda Pharmaceutical Company Limited
Alexandra Medellin, MD (*Abstract Co-Author*) Nothing to Disclose
Bari Dane, MD (*Abstract Co-Author*) Nothing to Disclose
Safa Hoodeshenas, MD (*Abstract Co-Author*) Nothing to Disclose
Kathryn A. Robinson, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The expanding inflammatory bowel disease (IBD) medication armamentarium has fueled the need for non-invasive, accurate and low-cost disease activity monitoring tools. Bowel ultrasound (US) is an emerging tool, increasingly used by gastroenterologists and radiologists. It is an accurate, noninvasive tool for detecting disease activity and IBD complications. It has been used for many decades in Europe and Canada and is now being utilized in the USA for initial assessment, monitoring disease and treatment response. Our aim is to 1) highlight the clinical utility of bowel US in assessment of IBD and monitoring patients post treatment with Crohn's disease and ulcerative colitis, 2) discuss the benefits of various models of bowel US integration into the clinical practice, 3) highlight collaboration with gastroenterologists to know appropriate escalation of imaging beyond bowel US.

### TABLE OF CONTENTS/OUTLINE

Introduction 1. Review conventional approach to IBD monitoring in the USA. 2. Discuss limitations of the conventional model of IBD monitoring. 3. Discuss why imaging is important in IBD assessment. 4. Review US features of Crohn's Disease and Ulcerative Colitis 5. Review models of Bowel US integration into the Clinical practice a. Point of Care Ultrasound only i. Grey scale, Doppler b. Clinical Radiology Ultrasound only i. Grey scale, Doppler, elastography, contrast enhanced, microvessel imaging. c. Combined Hybrid model between gastroenterology and radiology 6. Future- Patient Handheld US, US with AI Conclusions

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# Abstract Archives of the RSNA, 2024

GIEE-42

## BILIARY ANASTOMOSIS IN CENTRAL BILE DUCT INJURY: WHAT INFORMATION IS ESSENTIAL FORASSESSMENT?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela L. Mendieta Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Arizaga, MD (*Abstract Co-Author*) Nothing to Disclose
Karly Cristhelly Garrido Estrella, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To explain the anatomical variations of the intrahepatic bile ducts. To identify the most commonly used classifications for benign biliary tract lesions. To explain the common surgical techniques for biliodigestive anastomosis. To review the expected radiological findings.

### TABLE OF CONTENTS/OUTLINE

Introduction. Anatomy of the bile duct. Most used classifications of bile duct injuries. Classification and surgical techniques of anastomosis. Imaging of biliodigestive anastomosis. Conclusions. References.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

GIEE-43

## BOWEL AND BEYOND IN THE ANGRY GUT: IMAGING OF INTESTINAL AND EXTRA-INTESTINAL MALIGNANCIES IN INFLAMMATORY BOWEL DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Harshna V. Vadvala, MD (*Abstract Co-Author*) Nothing to Disclose
Rakhee S. Gawande, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammadreza Shaghaghi, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Inflammatory bowel disease (IBD) with its 2 subtypes, Crohn's disease (CD) and ulcerative colitis (UC), is characterized by a chronic inflammation of the intestine. In IBD, both, Inflammation and cancer affects intestinal and extra-intestinal sites. Risk factors for cancer development include severe inflammatory activity , prolonged duration of structuring or penetrating disease?, young age of diagnosis, male sex, smoking? and use of steroids and immunomodulators (6-mercaptopurine, azathioprine or anti-TNF drugs). In this educational exhibit we will discuss the incidence, pathologic and imaging features of small bowel, colon, rectal and anal cancers associated with IBD. We will also discuss manifestations of hepatobiliary cancers in IBD. Although imaging surveillance is not routinely recommended in IBD, cross-sectional imaging plays a crucial role for detection of malignancies, staging of cancer, detection of cancer in bowel segments which cannot be assessed by colonoscopy and also for detection of treatment-related neoplasms.

### TABLE OF CONTENTS/OUTLINE

1. Background 2. Pathogenesis of cancers in IBD 3. Risk and protecting factors 4. Imaging modalities 5. Colon cancer in UC 6. Small bowel adenocarcinoma in CD 7. Other bowel cancers in CD: Neuroendocrine tumors and Lymphoma 8. Peri-anal and vulvovaginal cancers in CD 9. Hepatobiliary cancers in IBD 10. Surveillances of cancers in IBD

# Abstract Archives of the RSNA, 2024

GIEE-44

## SPECTRUM OF IMAGING FINDINGS IN SINUSOIDAL OBSTRUCTION SYNDROME (SOS)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Manjiri K. Dighe, MD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Research Grant, General Electric Company
Theodore J. Dubinsky, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme M. Cunha, MD (*Abstract Co-Author*) Nothing to Disclose
Manish Dhyani, MD (*Abstract Co-Author*) Nothing to Disclose
Rajat Bhargava, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Saubhagya Srivastava, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Provide an overview of SOS, previously known as Veno-Occlusive disease (VOD) - definition, epidemiology, pathophysiology and etiologies.2. Briefly discuss the current clinical diagnostic criteria utilized in VOD/SOS - historic and current standards.3. Provide detailed radiological and schematic depictions of imaging findings of VOD/SOS across various imaging modalities.4. Provide a brief note on evaluation of progression and management including Defibrotide.

### TABLE OF CONTENTS/OUTLINE

1. Veno-occlusive disease (VOD)/ Sinusoidal obstruction syndrome (SOS) a. Definition, Epidemiology, and Pathophysiology. b. Etiology - Detailed discussion of causes of VOD/SOS and common drugs causing VOD/SOS: i. Differential diagnoses including Budd-Chiari syndrome, graft versus host disease, medication-induced and viral hepatitis, mycotic infections, and acute heart failure.2. Clinical diagnostic criteria: a. Modified Seattle criteria. b. Baltimore criteria. c. Currently used European Society for Blood and Marrow Transplantation (EBMT) criteria - adult and pediatric criteria.3. Ultrasound (US) in SOS: a. Role of sonography, advantages, and disadvantages. b. Conventional high-resolution B-mode US findings. c. Color and spectral Doppler US findings.d. US-Elastography findings - ARFI, SWE, and TE. e. Contrast-enhanced ultrasound (CEUS) findings. f. Lassau's criteria HokUS-10 criteria4. Contrast-enhanced CT (CECT) in SOS: a. CECT findings associated with SOS. b. Role of CT in problem-solving of clinically difficult cases5. MRI in SOS: a. MRI findings associated with SOS. b. Role of MRI in problem-solving of clinically difficult cases6. Grading severity of VOD /SOS and Management - Defibrotide

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# Abstract Archives of the RSNA, 2024

GIEE-45

## LATERAL PELVIC LYMPH NODES IN RECTAL CANCER: TAKE IT OR LEAVE IT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joao Manoel M. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Cotti (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recognize the anatomy of the rectum on the magnetic resonance imaging (MRI). Understand aspects related to rectal cancer and disease spread. Detailed knowledge on identifying and characterizing lateral pelvic lymph nodes (LPLN) in MRI and their prognostic significance. Insight into the decision-making process for managing LPLN in locally advanced rectal cancer (LARC), balancing oncological outcomes with quality of life considerations.

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION: Overview of rectal anatomy and MRI anatomical landmarks. Pathophysiology of LARC and lymphatic dissemination patterns. The pivotal role of LPLN in rectal cancer spread and patient prognosis. 2. DIAGNOSIS AND IMAGING FINDINGS: Criteria for malignant LPLN characterization on MRI. The process of staging and restaging LARC with MRI post-neoadjuvant chemoradiotherapy (nCRT). Prognostic implications of LPLN involvement. Treatment strategies: Evaluating nCRT, lateral pelvic lymph node dissection (LPLND), and selective LPLND. 3. SUMMARY AND SYSTEMATIC APPROACH: A streamlined approach to integrating imaging findings with clinical decision-making. 4. TAKE HOME MESSAGES.

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# Abstract Archives of the RSNA, 2024

GIEE-46

## HEPATIC ABSCESS: THE TIP OF AN ICEBERG - A STEP BY STEP TO ITS ORIGIN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marilia A. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Lais F. Pimentel, MD (*Abstract Co-Author*) Nothing to Disclose
Isabella Torres de Lima, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the main diseases that cause liver abscesses and provide tips for evaluating imaging tests.- Discuss the main causes of a liver abscess and its pathophysiology.- Systematize the search for the etiology of liver abscess.

### TABLE OF CONTENTS/OUTLINE

An abscess is a well-defined, low-attenuation, round mass containing necrotic inflammatory material. The hepatic abscess is the most common of visceral abscesses and is usually a consequence of other changes, such as infections, trauma, or tumors, which must be identified for better patient management.Therefore, when identifying a liver abscess, the radiologist's analysis cannot stop there. They must keep in mind the most common causes and look for the possible origin of the abscess, since the clinical symptoms can be nonspecific and imaging exams play a fundamental role in this investigation.By following three simple steps: firstly, using clinical information; secondly, understanding the main origins of liver abscesses and their pathophysiology; and finally, combining the first two steps to identify findings, it is possible to detect the majority of conditions causing liver abscess, thus assisting the attending physician in the care of the patient.

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# Abstract Archives of the RSNA, 2024

GIEE-47

## TORSION AND VOLVULUS: A TALE OF TWISTS AND TURNS IN THE BELLY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sarah K. Oh, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda S. Mazzariol, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine Eacobacci, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Multiplanar CT review is important in cases of large bowel volvulus to discern the anatomy: "X marks the spot" in mesentero-axial volvulus and "split wall-sign" in organo-axial volvulus. 2. Hyperdense, unenhanced bowel wall with mural hemorrhage is the single best predictor of irreversible ischemia and may be mistaken for wall enhancement on contrast CT. 3. J-pouch torsion can occur as part of afferent limb syndrome due to progressive dilatation of the ileum, or as efferent limb syndrome with a stapled anastomosis. 4. Gastric axis rotation is commonly seen with large hiatal hernias, but is often asymptomatic. Gastric volvulus is rare, but is a surgical emergency. Recognition of Borchardt's triad along with key imaging findings is critical. 5. Gallbladder torsion is rare, often occurs in elderly women, and simulates cholecystitis on imaging. It requires urgent cholecystectomy and the diagnosis is often made at surgery. 6. Pedunculated uterine fibroid torsion may be confused with adnexal torsion because the pedicle is thin and difficult to visualize. 7. Splenic torsion is rare but can be fatal. Abnormal location of the avascular spleen is a clue. 8. If the abnormal position of the transplanted kidney is not recognized, renal transplant torsion may be mistaken for donor vein obstruction or arterial stenosis.

### TABLE OF CONTENTS/OUTLINE

Illustrated review of pathophysiology and clinical features of abdominal viscera torsion and volvulus while emphasizing pearls and pitfalls of imaging. Multimodality examples of volvulus and torsion including but not restricted to: Gut (sigmoid colon, transverse colon, cecum, small bowel, gastric and J pouch), Renal transplant, Gallbladder, Uterus, Uterine fibroid, Spleen and splenule

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# Abstract Archives of the RSNA, 2024

GIEE-48

## ESOPHAGEAL STRICTURES: THE KEYS TO DIAGNOSIS BY PNEUMO-CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Mariano Lorea (*Abstract Co-Author*) Nothing to Disclose
Paula Gimena Ortiz Suarez (*Abstract Co-Author*) Nothing to Disclose
Fiorella Conca, MD (*Abstract Co-Author*) Nothing to Disclose
Roy Lopez Grove, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Pneumo-CT provides key information by facilitating additional esophageal distension, aiding in the evaluation of esophageal wall thickening and extraesophageal disease in a single examination.2) Benign strictures exhibit reduced esophageal distensibility in pneumo-CT due to fibrotic wall changes. The primary cause is gastroesophageal reflux disease, typically manifesting as concentric, symmetric, soft-edged wall thickening in the distal esophagus associated with a hiatal hernia.3) Personal history is pertinent for diagnosing the underlying cause of a benign stricture.4) Malignant strictures present with rapid onset of symptoms including dysphagia and weight loss. They appear as asymmetric and irregular thickening of the esophageal wall, sometimes accompanied by adenopathy and involvement of surrounding fat planes, depending on the extent of tumor infiltration.5) The differential diagnosis primarily involves esophageal dilatation, predominantly caused by dysmotility.

### TABLE OF CONTENTS/OUTLINE

1) Introduction.2) Diagnostic algorithm for esophageal strictures: Upper endoscopy, barium esophagogram, pneumo-CT.3) Pneumo-CT technique.4) Key findings in pneumo-CT. Esophageal wall: Margins, narrowing, contour, mucosal surface, enhancement. Extraluminal findings: fat, lymph nodes, metastases.5) Benign strictures: Pathophysiology. Causes.6) Malignant strictures: Pathophysiology. Causes.7) Differential diagnoses.

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# Abstract Archives of the RSNA, 2024

GIEE-49

## ATYPICAL PANCREATIC MASSES AND TUMOR-LIKE LESIONS - BEYOND DUCTAL ADENOCARCINOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Mariano Volpacchio, MD (*Abstract Co-Author*) Nothing to Disclose
German Espil (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To overview imaging findings of tumors anda tumor-like lesions in the pįncreas according to WHO classification- To review unusual pancreatic masses clinical, pathologic and imaging features with a case-based approach- To provide diagnostic clues useful to assist in proper diagnosis and management

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Ephitelial exocrine tumor3. Neuroendocrine neoplasms4. Mesenchimal tumours5. Hematologic tumours6. Secondary tumours7. Tumor - Like lesion8. Summary

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# Abstract Archives of the RSNA, 2024

GIEE-5

## BELOW THE DIAPHRAGM AND AROUND OF EQUATOR: A PICTORIAL REVIEW ON ABDOMINAL MANIFESTATIONS OF TROPICAL ENDEMIC DISEASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Bekhor, MD (*Abstract Co-Author*) Nothing to Disclose
Francisco C. Brasil (*Abstract Co-Author*) Nothing to Disclose
Bruna K. Andreucci, MD (*Abstract Co-Author*) Nothing to Disclose
Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea L. Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Julia De Toledo Mendes, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia Goncalves Dias (*Abstract Co-Author*) Nothing to Disclose
Aley Talans, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Present diseases endemic to tropical regions. - Review key epidemiological and clinical features of tropical diseases. - Discuss imaging characteristics of tropical diseases, both common and uncommon. - Emphasize the radiologist's pivotal role in expanding diagnostic considerations and assessing disease extent for improved outcomes.

### TABLE OF CONTENTS/OUTLINE

Tropical diseases (TDs) impact underserved areas, caused by various pathogens like bacteria, viruses, parasites, and fungi. These diseases have significant health, social, and economic impacts. With increased global travel, recognizing these diseases quickly is vital for radiologists to improve patient care through prompt diagnosis and treatment. This presentation delivers insights into abdominopelvic imaging for major TDs through engaging cases, covering: 1. Demonstrate typical and atypical abdominal imaging manifestations of major tropical diseases via educational cases. 2. Detail epidemiology and imaging findings of abdominopelvic presentations in: a. Parasitic: Helminth infections such as Schistosomiasis, Echinococcosis, Ascariasis, Strongyloidiasis; and Protozoal infections including Leishmaniasis and Chagas disease. b. Bacterial: Specifically, Tuberculosis. c. Fungal: Highlighting Paracoccidiomycosis and Histoplasmosis. d. Viral: Covering Dengue fever. 3. Provide an understanding of the main risk factors, along with the prevalence and incidence of the most encountered endemic tropical infectious diseases.

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# Abstract Archives of the RSNA, 2024

GIEE-50

## INFLAMMATORY AND NON-INFLAMMATORY ABDOMINAL CONDITIONS: STAY ALERT FOR YOUR NEOPLASTIC COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Velloni, MD (*Abstract Co-Author*) Nothing to Disclose
Glaucy L. Neme, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Renata S. Nascimento, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• List the main abdominal inflammatory diseases that increase the risk of neoplasms • List the main non-inflammatory abdominal conditions that increase the risk of neoplasms • Illustrate with cases the characteristics of chronic inflammatory diseases and non-inflammatory abdominal conditions that have evolved into neoplasms using computed tomography (CT) and magnetic resonance imaging (MRI) • Enhance the recognition and interpretation of neoplastic complications in patients with pre-malignant inflammatory and non-inflammatory changes • Demonstrate the importance of understanding the neoplastic complications of inflammatory and non-inflammatory abdominal conditions

### TABLE OF CONTENTS/OUTLINE

Describing the imaging presentations of chronic inflammatory diseases and their neoplastic complications Primary sclerosing cholangitis • Cholangiocarcinoma Inflammatory bowel disease • Adenocarcinoma of the small bowel Hereditary pancreatitis • Pancreatic adenocarcinoma Metabolic dysfunction associated steatotic liver disease (MASLD) • Hepatocellular carcinoma Describing the imaging presentations of non-inflammatory abdominal conditions that increase the risk of neoplasms and their malignant complications Cryptorchidism • Testicular germ cell tumor Urachal remnant • Bladder adenocarcinoma Bladder diverticulum • Urothelial neoplasia Endometriosis• Endometrioid carcinoma or clear cell carcinoma

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# Abstract Archives of the RSNA, 2024

GIEE-51

## UNVEILING THE DIFFERENT TONES OF CROHNS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose A. Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia B. Sotomayor Rivera (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Abstract Co-Author*) Nothing to Disclose
Adriana Perez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Identify early, chronic, and severe signs of active inflammatory Crohn’s disease and recognize how imaging findings can overlapReview the major gastrointestinal anatomy involved in this pathology and understand its pathophysiologyGo over severity score in active Crohn's disease to provide a complete radiological assessment of the disease.Understand major radiological differences between stricturing and penetrating and highlight the most common complications

### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. ObjectivesIII. Anatomical diagrams of areas affected by Crohn's disease and pathophysiologyVI. Gastrointestinal features of Crohn's disease on CT and MRI 1. Active versus non-active/chronic disease 2. Penetrating versus stricturing disease 3. Common complications 4. Radiological severity score of active inflammatory diseaseVII. Self-assessment with multiple cases in quiz format VIII. ConclusionHistorically a higher incidence of IBD has been reported in Caucasians and lower rates in Black and Hispanic populations however, during the past decades these differences have decreased. There has been an increase in IBD in blacks, Hispanics, and Asians. With increased incidence among a broader population it is vital for radiologists to be familiar with what was only classically found in a specific population. Through this educational exhibit, we will provide a comprehensive review of classic radiological features of active and non-active Crohn's disease, stricturing versus penetrating disease, and its associated complications as seen on CT and MR. Our aim is to increase awareness of this disease among radiologists in order to assist physicians in early detection and treatment.

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# Abstract Archives of the RSNA, 2024

GIEE-52

## IBD THERAPEUTICS: MECHANISM OF ACTION, MONITORING, POTENTIAL SIDE EFFECTS AND RISKS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Rony Kampalath, MD (*Abstract Co-Author*) Nothing to Disclose
Parakkal Deepak, MBBS (*Abstract Co-Author*) Consultant, Johnson & Johnson;Advisory Board, Johnson & Johnson;Consultant, Pfizer Inc;Advisory Board, Pfizer Inc;Consultant, Prometheus Pharmaceuticals;Advisory Board, Prometheus Pharmaceuticals;Consultant, Boehringer Ingelheim GmbH;Advisory Board, Boehringer Ingelheim GmbH;Grant, Boehringer Ingelheim GmbH;Consultant, Arena Pharmaceuticals;Advisory Board, Arena Pharmaceuticals;Grant, Arena Pharmaceuticals;Grant, Takeda Pharmaceutical Company Limited;Grant, Bristol-Myers Squibb Company;;;
David Bruining, MD (*Abstract Co-Author*) Consultant, Medtronic plc;Research support, Medtronic plc;Research support, Takeda Pharmaceutical Company Limited
Jalpa Devi (*Abstract Co-Author*) Nothing to Disclose
Safa Hoodeshenas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To review briefly recent advancements in therapeutic approaches to inflammatory bowel disease (IBD)• To describe the current understanding of the mechanisms of action of different IBD medications• To highlight the side effect profiles and risks that radiologists need to aware of

### TABLE OF CONTENTS/OUTLINE

1.Introduction to IBD and the expanding medication armamentarium2.Imaging to guide management decisions3.Mechanisms of Action of IBD Therapeutics and their potential side effects§ Aminosalicylates (5-ASAs)§ Corticosteroids§ Immunomodulators (e.g., Azathioprine, 6-Mercaptopurine, methotrexate)§ Biologic agents: Anti-TNF agents (e.g., Infliximab, Adalimumab, Certolizumab Pegol, and Golimumab),Integrin receptor antagonists (e.g., Vedolizumab, Mirikizumab), Interleukin inhibitors (e.g., Ustekinumab, Risankizumab)§ Small molecule drugs: JAK inhibitors (e.g., Tofacitinib, Upadacitinib) and sphingosine-1-phosphate receptor modulators (Ozanimod, Etrasimod)

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# Abstract Archives of the RSNA, 2024

GIEE-53

## ACUTE CHOLANGITIS, WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Israel Vicente Toledo Coronado, MD (*Abstract Co-Author*) Nothing to Disclose
Tania D. Grimaldo Galeana, MD (*Abstract Co-Author*) Nothing to Disclose
Hector Alvarez-Manzo, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Alpizar, MD,MEd (*Abstract Co-Author*) Nothing to Disclose
Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa De Jesus Ramos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe the anatomy and physiology of the biliary tree. To list the diagnostic criteria of acute cholangitis.To describe the main imaging techniques for the evaluation of the biliary tract.With the help of representative images of acute cholangitis, and acute/chronic complications , to review the typical imaging findings of an abnormal biliary tree.To evaluate the differential diagnosis of cholangitis through representative images of congenital and acquired pathologies, as well as neoplasm that affect the biliary tree.To describe the role of interventional radiology in the treatment of complicated cholangitis.

### TABLE OF CONTENTS/OUTLINE

-Anatomy and physiology of the biliary tree. -Acute cholangitis: Definition, classification, etiology, epidemiology, pathophysiology, clinical and laboratory findings, diagnostic criteria (Tokyo guidelines) and radiologic diagnosis (ultrasound, computed tomography, magnetic resonance imaging, magnetic cholangioresonance, cholangiography and contrast-enhanced ultrasound (CEUS)). -Acute complications: Pericholangitic and liver abscesses, sepsis, portal vein thrombosis. -Chronic complications: Biliary stricture, secondary sclerosing cholangitis and cholangiocarcinoma. -Differential diagnosis: Choledocholithiasis, gallbladder perforation, primary sclerosing cholangitis, biliary pancreatitis, liver metastases, primary biliary cholangitis, cholangiocarcinoma, periampullary tumors and drug-induced liver injury. -Cholangitis post liver transplantation: Diagnosis with computed tomography and Doppler ultrasound. -Treatment with interventional radiology: Percutaneous transhepatic biliary drainage.

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# Abstract Archives of the RSNA, 2024

GIEE-54

## IMMUNE-MEDIATED LIVER DISEASE: MULTIMODALITY IMAGING AND PATHOLOGY CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Douglas M. Rogers, MD (*Abstract Co-Author*) Royalties, RELX
Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Maryam Rezvani, MD (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Linda C. Kelahan, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Reham M. Ellessy, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Understand normal autoimmune regulation mechanisms.• Described different patterns of hepatic involvement in autoimmune diseases.• Imaging features and pathology correlation of common immune-mediated liver disease.

### TABLE OF CONTENTS/OUTLINE

• Introduction- Pathophysiology of immune-mediated disease- Immunocompromised patients• Main regulators of the immune response• Vascular involvement- Autoimmune vasculitis- Autoimmune coagulopathies.• Autoimmune associated biliary disease- Primary biliary cholangitis- Primary sclerosing cholangitis- IgG-4 mediated hepatobiliary disease• Autoimmune mediated liver parenchymal disease- Autoimmune hepatitis• Special groups- Liver transplantation- Acute rejection- Hyper acute rejection- Chronic rejection- Graft versus host disease- The immunocompromised patient- Infections- Malignancies

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# Abstract Archives of the RSNA, 2024

GIEE-55

## MULTIMODALITY IMAGING OF FOCAL PANCREATIC LESIONS: THE ADDED ADVANTAGE OF ENDOSCOPIC ULTRASOUND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shrivalli Nandikoor, MBBS (*Abstract Co-Author*) Nothing to Disclose
Halkurike Jayadevappa Vijay Kumar (*Abstract Co-Author*) Nothing to Disclose
Gayathri S Menon, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pancreatic focal lesions can be malignant or benign, cystic, solid or solid-cystic, with varying presentations. Multiple imaging modalities are used for diagnosis of pancreatic lesions including MDCT, MRI, USG ,PET-CT and Endoscopic ultrasound(EUS). EUS has the added advantage of high resolution imaging and the possibility of targeted tissue sampling simultaneously. This helps in detailed characterization of lesions with detection of details that can be otherwise missed in other imaging modalities. Aim of this exhibit is multimodality imaging review of spectrum pancreatic focal lesions and special emphasis on the added value of endoscopic ultrasound in characterization and diagnosis of these lesions

### TABLE OF CONTENTS/OUTLINE

Case based multimodality imaging review of pancreatic focal lesions and comparison with endoscopic ultrasound evaluation for characterization and diagnosis. The exhibit will include spectrum of cases including simple cyst, pseudocyst, serous cystadenoma, mucinous cystic neoplasm, IPMN,SPEN, NETs, Adenocarcinoma pancreas, metastatic deposits, focal pancreatitis.

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# Abstract Archives of the RSNA, 2024

GIEE-56

## INFILTRATIVE HEPATOCELLULAR CARCINOMA: CHALLENGING CASES AND ITS BENIGN MIMICS WITH RAD-PATH CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rashmi T. Nair, MD (*Abstract Co-Author*) Nothing to Disclose
Michael J. Nisiewicz, MD (*Abstract Co-Author*) Nothing to Disclose
Andres R. Ayoob, MD (*Abstract Co-Author*) Nothing to Disclose
Kyle Kleiman (*Abstract Co-Author*) Nothing to Disclose
Ronak Patel, BS (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmed M. Sobieh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Harit Kapoor, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Joseph W. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
Elhamy R. Heba, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Hepatocellular carcinoma is one of the leading causes of cancer related death worldwide. Various histopathologic and morphologic subtypes of HCC are described throughout the literature. Among all these subtypes, infiltrative type HCC is the most challenging to detect clinically and radiographically. Infiltrative HCC is characterized by diffuse infiltrative spread throughout the liver parenchyma, without forming a mass-like lesion, in a way that sometimes it is difficult to detect on a background of already abnormal liver parenchyma. The infiltrative fashion of this disease makes other infiltrative liver diseases mimic the appearance of this malignancy on imaging. This includes confluent fibrosis, diffuse hepatic steatosis or iron deposition, diffuse metastatic disease, cholangiocarcinoma, and hepatic micro abscesses. Distinguishing infiltrative HCC mimics on imaging is crucial due to difference in management and the poor prognosis of this infiltrative malignancy. We will show challenging cases of infiltrative HCC and mimics of infiltrative HCC using a case-based approach with Rad-Path correlation.

### TABLE OF CONTENTS/OUTLINE

1. Incidence and prevalence of infiltrative HCC. 2. Review imaging features of infiltrative HCC, including multimodality case-based review of challenging cases of infiltrative HCC with pathological correlation. 3. Portal vein thrombosis (including tumor thrombus) as a common finding in infiltrative HCC. 4. Case-based review of infiltrative HCC mimics including confluent fibrosis, diffuse hepatic steatosis/iron deposition, diffuse metastatic disease, cholangiocarcinoma, and hepatic micro abscesses. 5. Review of prognosis and management of infiltrative HCC.

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# Abstract Archives of the RSNA, 2024

GIEE-57

## EXPLORING ESOPHAGOGRAM PATHOLOGIES: BUMPS, DOTS AND BEYOND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Monica Chapa-Ibarguengoitia, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Alpizar, MD,MEd (*Abstract Co-Author*) Nothing to Disclose
Nicolas Serrano III, MD (*Abstract Co-Author*) Nothing to Disclose
Lourdes M. Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Jonahi S. Serrano Heredia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the classic findings of esophageal pathologyDiscuss the utility of dynamic esophagram studiesIntegrate imaging findings with systemic diseases.

### TABLE OF CONTENTS/OUTLINE

BackgroundEsophagogram anatomyFunctional diseasesAnatomical defectsVascularTumorsImmunologicalInfectiousCased based review of dynamic studies (Gift and video form) with quiz.

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# Abstract Archives of the RSNA, 2024

GIEE-58

## DIFFERENTIATING THE COLORECTAL MUCINOUS METASTASIS FROM OTHER HEPATIC LESIONS: TIPS AND TRICKS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Giovanni Morana, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
COSTANTINA DAL MAGRO (*Abstract Co-Author*) Nothing to Disclose
Luisa Tomaiuolo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To illustrate with some interesting cases the appearance of the hepatic mucinous metastasis from colorectal primary malignancy and give some tips and tricks for the achievement of the correct diagnosis.

### TABLE OF CONTENTS/OUTLINE

The radiological features of mucinous carcinoma metastasis in the liver are sometimes unclear and dependent on the mucinous/fibrosis component proportion. Distinguishing these lesions from cholangiocarcinoma or benign entities such as angioma and solitary necrotic nodules can be challenging for radiologists. This essay discusses with some examples the key characteristics of hepatic mucinous metastasis observed in TC and MR imaging, focusing on the lesion morphology, the vascular pattern and the restriction on the DWI sequences. Finally, we outline the primary differential diagnoses and their imaging behaviors on CT/MRI.CT/MRI imaging features of mucinous colorectal metastasis in the liver could be a challenging diagnosis for radiologists. The patient history and the evolution of the lesion are crucial, especially with small lesions

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# Abstract Archives of the RSNA, 2024

GIEE-59

## LIVER STORAGE DISEASES: WHAT RADIOLOGISTS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aldara Naveiras Calvo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The liver is the fundamental organ for human metabolism. A multitude of factors, from hereditary diseases to alcohol or an unhealthy lifestyle habit, can lead to the accumulation of substances in the liver, eventually leading to the development of chronic liver disease. Radiologists play a crucial role in the early diagnosis of such diseases and knowing how to detect and measure them, and rule out complications is critical. We focus on the two substances most commonly deposited, fat and iron, while also mentioning less frequent causes such as copper, lysosomal storage diseases, and amyloidosis. We emphasize some pitfalls that can arise from such depositions and to what extent they can aid us in diagnosing lesions.

### TABLE OF CONTENTS/OUTLINE

- Steatosic liver- Liver iron overload- Other causes: copper, lisosomal storage diseases, amyloidosis

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# Abstract Archives of the RSNA, 2024

GIEE-6

## UPDATE ON NOVEL BIOLOGIC THERAPIES FOR CROHN'S DISEASE AND IMPACT OF IMAGING ON CLINICAL DECISION-MAKING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kian Keyashian (*Abstract Co-Author*) Nothing to Disclose
Michael S. Gee, MD, PhD (*Abstract Co-Author*) Researcher, General Electric Company Researcher, Siemens AG Researcher, Motilent LLC
Richa D. Patel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review novel Crohn's biologic therapies GI perspective on therapy algorithms2. Describe clinical scenarios in which imaging prompts therapy change with case examples3. Discuss imaging features associated with biologic treatment response

### TABLE OF CONTENTS/OUTLINE

• Intro to Crohn's Disease (CD)• Imaging:§ Rationale for certain studies (CTE, MRE, XR)§ When to image (asymptomatic, symptomatic, coordinate with therapy)§ How imaging integrates with endoscopic findings biomarkers• Treatment algorithm:§ Top-down vs step up• GI rationale for deciding therapy• Flowchart of treatment pathway exceptions§ Agents:• Molecular target, administration route, dose• Indication:o Penetrating stricturing CDo Small bowel vs colonico Perianal CD• Complications prompting therapy change• Imaging CD on biologics:§ Treatment endpoints• Mucosal healing• Deep remission• Radiologic response§ What radiologists look for on imaging• Findings pivotal to affecting management on therapy (switch agents, add agents, endoscopic/surgical therapy)o Fistulizing CDo Perianal CDo Stricturing CD +/- active inflammation§ Radiologic vs non-radiologic assessment of CD response• How biomarkers symptoms correlate with imaging§ Case-based review of scenarios where imaging influences therapy why• Strictures• Enteric perianal fistulas• Resection• Mild CD not requiring therapy• Severe CD requiring immediate surgery vs therapy with agent switch§ Therapy selection (factors affecting therapy selection change):• Clinical factorso Symptomso Endoscopic radiologic signs of healing or progression, biomarkers• Patient factorso Cost/insurance coverageo Administration routeo Social constraints (access, compliance)

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# Abstract Archives of the RSNA, 2024

GIEE-60

## ALL YOU NEED TO KNOW IN IMAGING OF LIVER INFECTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sung Yoon Park, MD (*Abstract Co-Author*) Nothing to Disclose
Rajat Bhargava, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Smooth outline and liquified core either in a single locule or multiple small locules are critical to diagnosis of abscess Double Target appearance is the most specific sign Klebsiella Pneumoniae often produces multilocular pyogenic abscesses Parasitic infections often have peripheral eosinophilia Embroyonal sarcoma, cholangiocarcinoma often mimic Abscesses.

### TABLE OF CONTENTS/OUTLINE

1. Objectives 2. Imaging spectrum by morphology 3. Imaging signs 4. Imaging spectrum by organism 5. Tumors masquerading as Abscesses

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# Abstract Archives of the RSNA, 2024

GIEE-61

## SEEING BEYOND THE SURFACE: IMAGING OF ACUTE ABDOMINAL COMPLICATIONS IN ONCOLOGICAL PATIENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Graziela C. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina P. Abud, MD (*Abstract Co-Author*) Nothing to Disclose
Marina M. Costa (*Abstract Co-Author*) Nothing to Disclose
Lhuanna Maria Barbosa Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Camila P. Reifegerste, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Batista Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Uski, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Helena N. Pedroso (*Abstract Co-Author*) Nothing to Disclose
Heloise Miranda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The increasing incidence of neoplasms, has also increased cancer-related complications, including abdominal ones. These complications may be related to the direct effect of the tumor, through compression or infiltration, systemic changes or due to invasive procedures (diagnostic or therapeutic).The purpose of this ehxibit is to: • Highlight signs of acute abdominal complications in patients with known neoplasia on computed tomography (CT) and magnetic resonance imaging (MRI); • Identify possible signs of malignancy in patients with an acute abdominal condition as the initial manifestation of an unknown neoplasia; • Explore acute abdominal manifestations that can affect patients with cancer, including hemorrhage, bowel obstruction, perforation, fistula, ischemia and cholangitis; • Correlate between clinical information, histological studies and imaging findings, in order to refine the differential diagnosis; • Provide practical information and pitfalls in the interpretation of imaging findings.

### TABLE OF CONTENTS/OUTLINE

• Introduction; • Imaging aspects - case based didatic review of the radiological appearance of abdominal complications in oncological patients, including hemorrhage, bowel obstruction, perforation, fistulas, ischemia and cholangitis; • Pearls and Pitfalls; • Conclusion/Take home message; • References.

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# Abstract Archives of the RSNA, 2024

GIEE-62

## GET INTO THE GROOVE: A PICTORIAL REVIEW OF PANCREATICODUODENAL GROOVE PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Cammillo R. Talei Franzesi (*Abstract Co-Author*) Nothing to Disclose
Davide Ippolito, MD (*Abstract Co-Author*) Nothing to Disclose
Rocco Corso, MD (*Abstract Co-Author*) Nothing to Disclose
Cesare Maino, MD (*Abstract Co-Author*) Nothing to Disclose
Paolo N. Franco, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The pancreaticoduodenal groove (PDG) is a space between the second duodenal portion and the head of the pancreas. Superiorly, it’s delimitated by the duodenal bulb, posteriorly by the inferior vena cava, and anteriorly by the third duodenal part. PDG is also traversed by the distal portion of the common bile duct (CBD) and contains fat and nodes. Due to the critical anatomical structures surrounding it, various entities can originate inside or close to this region.Pathologies of PDG may be classified by their origin. Many benign (groove pancreatitis, autoimmune pancreatitis) and malignant (adenocarcinoma, NETs, lymphomas) pancreatic diseases may arise in the PDG. The di"erential diagnosis between groove pancreatitis and pancreatic adenocarcinoma is the most challenging due to similar imaging findings. However, some di"erences can be spotted to aid in the correct diagnosis. Duodenal diseases involving the groove are diverticula, inflammation, and neoplasms (adenocarcinomas, GISTs, and lymphomas). Among CBD pathologies, the most frequent are distal cholangiocarcinoma and choledochal cysts. Finally, ampulla of Water and lymph nodes diseases may also a"ect this space. PDG lesions management encompasses follow- up controls, endoscopic resection, or complex surgical procedures. Consequently, a correct diagnosis and pre-operative imaging assessment are pivotal.

### TABLE OF CONTENTS/OUTLINE

1. PDG anatomy2. Imaging findings of pancreatic pathologies involving the PDG3. Imaging findings of duodenal pathologies involving the PDGG4. Imaging findings of common bile duct pathologies involving the PDG5. Imaging findings of other structures pathologies involving the PDG.

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GIEE-63

## UNDERSTANDING PORTAL VEIN THROMBOSIS: CRUCIAL CONSIDERATIONS IN LIVER TRANSPLANTATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Regis Otaviano Bezerra, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fabio P. Pereira (*Abstract Co-Author*) Nothing to Disclose
Paola Beninca, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understanding the classification of portal vein thrombosis (PVT), its epidemiology, and imaging features. - Exploring technical challenges posed by PVT during liver transplantation. - Discussing pre-transplant management strategies for PVT. - Identifying imaging findings that may contraindicate or complicate liver transplantation in the context of PVT.

### TABLE OF CONTENTS/OUTLINE

Introduction:- Overview of portal vein thrombosis and its significance in liver transplantation.- Role of imaging in assessing PVT and its implications for surgery.Portal Vein Thrombosis:- Definition, epidemiology, and clinical presentation.- Imaging features of PVT and differentiation from other vascular conditions.- Surgical considerations and challenges in patients with PVT undergoing liver transplantation.Pre-transplant Management:- Strategies for managing PVT before liver transplantation.- Role of radiological interventions and imaging surveillance in pre-transplant evaluation.Imaging in Liver Transplantation:- Assessment of imaging findings that may contraindicate or complicate liver transplantation in PVT patients.Case-Based Review:- Illustrative cases demonstrating imaging findings of PVT and their impact on liver transplantation.Future Directions:- Emerging techniques and advancements in imaging for PVT evaluation and management.- Potential areas for improving outcomes in liver transplantation for patients with PVT.Conclusion:- Summary of key considerations for radiologists in the context of PVT and liver transplantation.- Importance of multidisciplinary collaboration between radiologists, surgeons, and other specialists in optimizing patient care.

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GIEE-64

## BETWEEN DUCTS AND DILATIONS: THE INTRIGUING WORLD OF IPMN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luiz Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz Rodrigues Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Nara Vedoveli (*Abstract Co-Author*) Nothing to Disclose
Viviane B. Amorim, MD (*Abstract Co-Author*) Nothing to Disclose
Barbara De Melo Gedeon, MD (*Abstract Co-Author*) Nothing to Disclose
Igor J N Leite, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Reviewing the radiological anatomy of the pancreas and related structures. - Detailing imaging features of malignant transformation of intraductal papillary mucinous neoplasms (IPMN); - Discuss the characteristics and differences between the possible imaging methods used in the evaluation of the pancreas in the context of IPMN; - Exemplify the main imaging findings, with emphasis on magnetic resonance imaging, used for risk stratification in IPNM; - Describe the management and recommendations for imaging follow-up of diagnosed or presumed IPMN.

### TABLE OF CONTENTS/OUTLINE

- Anatomy review- What are the cystic lesions of the pancreas and how to find them?- Narrowing the diagnostic.- Stratify the risk.- Guide the conduct.- When, where and how to follow up an IPNM?

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GIEE-65

## ULTRASOUND FINDINGS OF COMPLICATIONS IN LIVER TRANSPLANTATION: AN EDUCATIONAL OVERVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Teresa A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Saez, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Pividori (*Abstract Co-Author*) Nothing to Disclose
Aylen Gonzalez Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Miguel Manzanares, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Despite advancements in surgical techniques and postoperative care, complications following liver transplantation remain a significant concern. Ultrasound imaging is a pivotal tool due to its non-invasive nature and ability to provide real-time assessment. Radiologists must be acquainted with the imaging findings and complications. In this exhibit we will:Review vascular complications, including hepatic artery thrombosis and stenosis, and portal vein stenosis, manifest as alterations in blood flow patterns and vessel caliber, discernible through Doppler ultrasound.Review biliary complications, such as bile duct strictures and leaks, present as dilatation of the intrahepatic and extrahepatic ducts with associated periductal fluid collections. Discuss parenchymal abnormalities post-liver transplantation, including graft rejection, hepatic steatosis, and infections.Present the most common extra hepatic anomalies found after liver transplant, some of them related to the aforementioned predicaments.Correlate, if needed, the ultrasound findings with complementary methods of evaluation, like magnetic resonance or computed tomography.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Imaging method key points3. Review the strengths and role of Doppler ultrasonography.4. Transitory alterations in the immediate post-transplant5. Classification of complications of liver transplant: Clinical parameters (age, type of transplant, postoperative time, symptoms) and sonographic findings (resistance index, velocity, waveform) are consider.VascularBiliaryParenchymal abnormalitiesGraft rejectionHepatic steatosisInfections6. Summary (table)7. Conclusions

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GIEE-66

## PNEUMO PET-CT: ROLE IN ESOPHAGO-GASTRIC CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Pablo E. Biedak, MD (*Abstract Co-Author*) Nothing to Disclose
Roy Lopez Grove, MD (*Abstract Co-Author*) Nothing to Disclose
Fiorella A. Conca, MD (*Abstract Co-Author*) Nothing to Disclose
Valentina Garralda (*Abstract Co-Author*) Nothing to Disclose
Mariano Lorea (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pneumo PET-CT is a distension-based CT technique combining with PET scan with FDG.Great utility in the staging of esophagogastric cancer in order to plan therapeutic strategy.Gives essential information to oncologists and surgeons about tumor extension, deep wall involvement, lymph node and distant metastasis in a single study, reducing radiation and iodinated-contrast media exposureEvaluates neoadjuvant therapy response on changes in FDG uptake

### TABLE OF CONTENTS/OUTLINE

1- Introductiona) Epidemiological scenario in gastroesophageal cancerb) Advantages and disadvantages of current staging methods2- Pneumo PET-CT techniquea) Materialsb) Method to assess great lumen distension3- Findings in the staging of esophagus, gastroesophageal junction and gastric cancera) Imagenological key findings in T stagingb) Lymph nodes and distant metastasis (NM)4- Use in pre-surgical assessment and neoadjuvant therapya) Treatment response criteriab) Changes in FDG uptake5- Pitfalls and limitationsa) Insufficient gastric distension simulating an infiltrating tumorb) Overdistention mimicking adjacent organ infiltrationc) Residual liquid or food in the gastric lumen6- Conclusions

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# Abstract Archives of the RSNA, 2024

GIEE-67

## BENIGN FOCAL HEPATIC LESIONS: SEEKING ASSERTIVENESS AND RECOGNIZING LIMITS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thiago M. Baraviera, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucas Aquino (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are:To review the main topics of the differential diagnosis of focal benign hepatic lesions, taking into consideration imaging aspects and clinical context.To discuss, through didactic cases, the limits of assertiveness in the differential diagnosis of the main focal benign hepatic lesions.To alert about the presence of findings that act as pitfalls for the radiologist, potentially simulating benign and malignant lesions, creating doubts and diagnostic challenges.To assist the performance of radiologists as a guide in clinical management in different scenarios related to the theme.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION:To expose the existence of situations in which the presence of atypical characteristics and the clinical context may reduce the radiologist's assertiveness in the evaluation of benign focal hepatic lesions.DISCUSSION:To present, by means of a review based on didactic cases, the main points of the differential diagnosis, as well as the limits of assertiveness of imaging studies in the evaluation of benign focal hepatic lesions (cystic lesions; hemangiomas and metastases; hepatocellular lesions; pseudolesions and pitfalls).CONCLUSION:To summarize the main covered topics, reinforcing the importance of the radiologist's role as a guide for clinical management, with a direct impact on patient care pathways.

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# Abstract Archives of the RSNA, 2024

GIEE-68

## THE ROLE OF IMAGING IN ESOPHAGEAL CANCER: RADIOLOGIC PATTERNS WITH RADIOLOGIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gianpietro Zanchettin (*Abstract Co-Author*) Nothing to Disclose
Michele Valmasoni (*Abstract Co-Author*) Nothing to Disclose
Chiara Zerbato (*Abstract Co-Author*) Nothing to Disclose
Giovanni Sussan, MD (*Abstract Co-Author*) Nothing to Disclose
Matteo Scordari, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Moletta (*Abstract Co-Author*) Nothing to Disclose
Emilia Giugliano, MD (*Abstract Co-Author*) Nothing to Disclose
Matteo Pittacolo (*Abstract Co-Author*) Nothing to Disclose
Giovanni Capovilla (*Abstract Co-Author*) Nothing to Disclose
Renato Salvador (*Abstract Co-Author*) Nothing to Disclose
Emilio Quaia, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Filippo Crimi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Francesco Bigolin, MD (*Abstract Co-Author*) Nothing to Disclose
Francesca Galuppini (*Abstract Co-Author*) Nothing to Disclose
Carlo D'Alessandro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

State of the art treatment for esophageal cancer is multimodal and involves combined surgical and medical therapy. CT has a central role in the staging of esophageal cancer, being the method of choice for this purpose; positron emission tomography (PET) and magnetic resonance imaging (MRI) [MOU1] can help to evaluate the metabolic activity of tumors, identify distant metastases, and assess treatment response. Serial imaging studies, including CT scans and PET scans, allow clinicians to assess the efficacy of therapeutic interventions, identify residual or recurrent disease, and modify treatment strategies accordingly. Emerging techniques, such as radiomics and molecular imaging, hold promise for enhancing the accuracy of diagnosis, predicting treatment response and guiding personalized therapy.

### TABLE OF CONTENTS/OUTLINE

1. Concepts of normal and pathologic esophageal radiologic anatomy and lymphatic and hematogenous tumor spread pathways are explained.2.Illustrative cases of early-stage, locally advanced and oligometastatic esophageal cancer with clinical staging obtained by CT imaging applying the TNM 8th edition classification. Correlation of CT images with pathologic results is shown by detailed explanation of the findings.3. Emerging techniques: radiomics and molecular imaging for enhancing the accuracy of diagnosis, predicting treatment response, and guiding personalized therapy

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# Abstract Archives of the RSNA, 2024

GIEE-69

## US OF THE LIVER AND UPPER ABDOMEN FOR BEGINNERS: UNDERSTANDING WHAT TO DO, WHY DO IT, AND HOW TO DO IT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Monica Lucia Lopez Salazar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understand why to carry out the study.- Remember liver anatomy.- Understand what structures we are seeing during the study, with anatomical and CT correlation.- Realization technique for adequate characterization and measurement of the liver and upper abdominal structures.-differentiate normal from abnormal findings and most common pathological findings in the liver:Hepatic steatosisChanges due to chronic liver damage (cirrhosis, portal hypertension, portal thrombosis)Focal lesions (Cyst, hemangioma, hepatocellular carcinoma)Data of non-specific inflammatory process (periportal edema, elevated hepatic artery velocity and resistance index)

### TABLE OF CONTENTS/OUTLINE

Table of Contents: 1. Introduction: - Introduction to ultrasound and importance of liver and upper abdomen ultrasound in medical care. 2. Basic considerations before the study 3. Realization technique for adequate characterization and measurement of the following structures. - Evaluation of the left hepatic lobe. - Evaluation of the right hepatic lobe. - Evaluation of the portal vein. - Evaluation of the hepatic artery. - Evaluation of the hepatic veins. - Evaluation of the gallbladder. - Kidney evaluation. - Evaluation of the spleen. - Evaluation of the pancreas. 4. Most frequent pathological findings in the liver: - Hepatic steatosis - Changes due to chronic liver damage. - Focal lesions. - Data of non-specific inflammatory process. 5. Conclusions.

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# Abstract Archives of the RSNA, 2024

GIEE-7

## IMAGING FINDINGS FOR HEPATOCELLULAR CARCINOMA ON MAGNETIC RESONANCE IMAGING: PREDICTIVE FEATURES AND FUTURE PERSPECTIVES FOR IMMUNE CHECKPOINT INHIBITOR BASED THERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

DARA LOPES DIAS FONSECA (*Abstract Co-Author*) Nothing to Disclose
Haruka Higashibori (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Keigo Narita (*Abstract Co-Author*) Nothing to Disclose
Shogo Maeda, MD (*Abstract Co-Author*) Nothing to Disclose
Yuko Nakamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shota Kondo (*Presenter*) Nothing to Disclose

### TEACHING POINTS

a. For advanced stage hepatocellular carcinoma (HCC), systemic therapy is the mainstay of treatment, with immune checkpoint inhibitors (ICI) based therapy being the first choice. b. Peritumoral enhancement on arterial phase may indicate proliferative HCCs and peritumoral hypointensity on gadoxetic acid-enhanced hepatobiliary phase (HBP) may indicate PD-L1 positivity of HCCs. Both might be predictive for ICI-based therapy response. c. Hyper HCCs which show high signal intensity at HBP may indicates poor response to ICI monotherapy because both OATP1B3 expression, main uptake transporter of EOB, and immune exclusion class of HCCs are related to Wnt/ß-catenin signaling pathway. However, relationship between combined therapy such as atezolizumab plus bevacizumab and hyper HCCs is controversial and should be determined. d. Steatotic findings of HCCs may predict better therapeutic response to ICI-based therapy. e. Best treatment method may be predicted by integrating findings above, other findings from various modalities and also clinical information. A method that integrates all information is required.

### TABLE OF CONTENTS/OUTLINE

1. Therapeutic algorism for HCCs 2. Mechanism of ICI-based therapy 3. Promising predictive MR imaging findings for ICI-based therapy 4. Future prospective role of imaging for ICI-based therapy

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# Abstract Archives of the RSNA, 2024

GIEE-70

## 2022 UPDATES IN THE MANAGEMENT OF NON-INFECTIOUS CYSTIC LIVER LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Eugenio Zalaquett, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Ryan Bitar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review clinical presentation, pathology, and imaging features of major non-infectious hepatic cystic lesions2. Comment on each pathological entity's associated clinical presentation/symptoms, pathology, and prognostic/clinical implications.3. Discuss the 2022 European association study of the liver updates for management of imaging surveillance and management recommendations for each pathological entity.

### TABLE OF CONTENTS/OUTLINE

1. Relevant imaging modalities for evaluation of hepatic cystic structures a. CT (+/- contrast) b. MRI (T1, T2, MRCP, +/- contrast) c. Ultrasound (gray scale and color Doppler) 2. Simple hepatic cysts a. Imaging features b. Presentation (i.e incidental vs symptomatic) c. Indications for surveillance and management (drainage/sclerotherapy) 3. Complex cystic structures a. Features which infer complexity (i.e. nodularity and enhancement) b. Hemorrhagic/proteinaceous cysts c. Mucinous cystic neoplasms d. Clinical implications and management 4. Biliary hamartomas (Von Meyenburg's complexes) a. Imaging features: (notably on US and MRI) b. Pathology/presentation c. Management: (i.e. indications for follow-up) 5. (Caroli's disease) a. Imaging features: (most notably on US and MRI/MRCP) b. Pathology/presentation: (Caroli syndrome versus disease) c. Management: (surveillance for cholangiocarcinoma) d. Associated complications 6. Peribiliary cysts a. Imaging features b. Pathology/presentation c. Management (indications for follow-up imaging) 7. Polycystic liver disease: a. Imaging features and definition b. Significant genetic/prognostic features c. Management: (associated complications and treatment modalities)

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# Abstract Archives of the RSNA, 2024

GIEE-71

## PERITONEAL CARCINOMATOSIS INDEX: DIGITAL TOOLS AND STRATEGIES FOR PRECISE AND SUCCESSFUL SURGICAL PLANNING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Camila P. Reifegerste, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Theresa Duarte Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Rhillary S. Santana Sa (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Barbara Moreira De Lima (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Peritoneal Carcinomatosis (PC): Advanced secondary cancer, affecting 15-45% of patients with colorectal, gastric, and ovarian cancer, associated with malignant ascites and a median survival of 2-5 months.Peritoneal Cancer Index (PCI): Assesses tumor extent, with PCI > 20 contraindicating cytoreductive surgery.Artificial Intelligence (AI): Assists radiologists in calculating the Peritoneal Carcinomatosis Index (PCI), improving diagnostic accuracy.Integration of CT and MRI: Enhances disease characterization, optimizing surgical planning.

### TABLE OF CONTENTS/OUTLINE

Peritoneal Carcinomatosis (PC) is an advanced stage of secondary cancer that arises from the spread of tumor cells to the peritoneum. Associated with malignant ascites, it results in compromised quality of life and a grim prognosis, with a median survival of 2 to 5 months. The Peritoneal Cancer Index (PCI) is crucial for assessing tumor extent and dissemination, influencing treatment; patients with PCI > 20 are generally deemed unfit for cytoreductive surgery. Artificial Intelligence (AI) can assist radiologists in evaluating the Peritoneal Carcinomatosis Index (PCI), contributing to more accurate assessment. Imaging methods such as CT, MRI are the methods of choice. Integrating MRI with CT in preoperative evaluations can provide a more precise characterization of peritoneal disease extension, optimizing surgical planning. The study demonstrates the efficacy of combining CT and MRI in predicting surgical PCI, highlighting the complementary role of AI in assessing PCI, aiming to improve efficiency, accuracy, and quality of evaluation, potentially resulting in better clinical outcomes for patients.

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# Abstract Archives of the RSNA, 2024

GIEE-72

## THE STATE OF THE ART OF SCLEROSING CHOLANGITIS: CLINICAL AND RADIOLOGICAL CHARACTERISTICS, DIFFERENTIATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Katsuhiro Sano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akiyoshi Suzuki (*Abstract Co-Author*) Nothing to Disclose
Hiroya Ojiri, MD (*Abstract Co-Author*) Nothing to Disclose
Shigeki Aoki, MD, PhD (*Abstract Co-Author*) Speakers Bureau, DAIICHI SANKYO Group;Speakers Bureau, General Electric Company;Speakers Bureau, Bayer AG;Speakers Bureau, Canon Medical Systems Corporation;Speakers Bureau, Guerbet SA;Speakers Bureau, Bracco Group;Speakers Bureau, Eisai Co, Ltd;Speakers Bureau, FUJIFILM Holdings Corporation;Research Grant, DAIICHI SANKYO Group;Research Grant, General Electric Company;Research Grant, Guerbet SA;Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;
Ryohei Kuwatsuru, MD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Fukuda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tsuyoshi Tajima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jun Woo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A. Primary sclerosing cholangitis (PSC) is a disease with a poor prognosis that leads to liver cirrhosis and liver failure due to persistent cholestasis and an increased risk of hepatobiliary malignancies, mainly cholangiocarcinoma. B. PSC shows characteristic imaging findings on MRCP. MRCP is recommended as the imaging standard for diagnosis and follow-up in patients with PSC by some guidelines, including the International Primary Sclerosing cholangitis Study Group (IPSCSG). C. Some common imaging findings of PSC, such as the appearance of band-like strictures reflecting fibrotic narrowing of the lumen caused by peribiliary inflammatory cell infiltration and fibrosis, and the bead-like appearance that occurs as the disease progresses, are nonspecific, which may be a pitfall. D. Among secondary sclerosing cholangitis, diseases, including IgG4-related sclerosing cholangitis, exhibit images of stricture of the bile duct different from those of PSC, and diseases, including ICI-related sclerosing cholangitis, present imaging findings similar to those of PSC.

### TABLE OF CONTENTS/OUTLINE

a. Clinical characteristics, prognosis, and complications of PSC. b. MRI characteristics of PSC: sensitivities and specificities. c. MRI characteristics of IgG4-related sclerosing cholangitisd. d. Clinical and MRI characteristics of secondary sclerosing cholangitis that require differentiation from primary sclerosing cholangitis.

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# Abstract Archives of the RSNA, 2024

GIEE-73

## MULTIMODALITY IMAGING OF HEPATIC HYDATID DISEASE WITH A FOCUS ON ULTRASONOGRAPHIC CHARACTERISTICS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Yasin Farrokhi Khajeh-Pasha, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Mohammad Mehdi M. Mehrabi Nejad (*Abstract Co-Author*) Nothing to Disclose
Niloofar Ayoobi Yazdi (*Abstract Co-Author*) Nothing to Disclose
Sina Dadgar (*Abstract Co-Author*) Nothing to Disclose
Faeze Salahshour (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Understanding the Morphologic Radiologic Correlation of Hydatid Cysts Across Various Imaging Modalities 2) Identifying Conditions Resembling Hydatid Cysts on Different Imaging Techniques3) Recognizing and Managing Various Complications Associated with Hydatid Cysts4) Interpreting the Typical Post-Surgical Imaging Changes

### TABLE OF CONTENTS/OUTLINE

1) Epidemiology and Life Cycle of Echinococcus granulosus2) Cyst Evolution 3) Clinical Manifestations4) Diagnostic Approach 5) Computed Tomography Imaging 6) Magnetic Resonance Imaging 7) Ultrasonographic Features 1. Typical Appearance 2. WHO Classification 8) Mimics 1. Simple Cyst (Uncomplicated or Complicated) 2. Neoplasm 3. Hepatic Vascular Malformations 4. Postoperative Changes 5. Biloma 6. Hematoma 7. Abscess9) Complications of Hepatic Hydatid Cysts 1. Cyst Rupture and Infection 2. Exophytic Growth 3. Biliary Communication 4. Portal Venous Involvement 5. Perforation into Hollow Organs 6. Peritoneal Spillage 7. Abdominal Wall Involvement 8. Purulent Pericarditis 9. Hepatic Vein Compression and Obstruction (Budd-Chiari Syndrome) 10. Hepatic Infarction 10) Post-Surgical Management Imaging 1. Typical Changes 2. Recurrence

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# Abstract Archives of the RSNA, 2024

GIEE-74

## THE SHINING: ENHANCEMENT-PATTERN APPROACH TO DIAGNOSE LIVER LESIONS AND HEPATIC INFLAMMATORY PROCESSES: A GUIDE FOR THE RADIOLOGY RESIDENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Karly Cristhelly Garrido Estrella, MD (*Abstract Co-Author*) Nothing to Disclose
Maria C. Arizaga, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela L. Mendieta Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Rebeca Arizaga (*Abstract Co-Author*) Nothing to Disclose
Sofia Arizaga, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

after the exhibit the reader would be able- Identify normal liver enhancement pattern with contrast computed tomography (CT), magnetic resonance imaging and Gadoxetic Acid enhanced MRI.- To differentiate several benign and malignant liver lesions based on their enhancement pattern with CT, MRI and Gadoxetic Acid enhanced MRI.- To review abnormal enhancement of Inflammatory Liver Disease.

### TABLE OF CONTENTS/OUTLINE

- Introduction- To review normal liver enhancement pattern with computed tomography (CT), magnetic resonance imaging (MRI) and Gadoxetic Acid enhanced MRI.- Characterize the different types of arterial, venous, and late enhancement of benign and malignant liver lesions by computed tomography (CT), magnetic resonance imaging and Gadoxetic Acid enhanced MRI.- To review abnormal enhancement pattern of diffuse liver desease.- To understand the physiologic basis of liver enhancement after administration of Gadoxetic Acid enhanced MRI and the applications of gadoxetic Acid in Hepatobiliary Disorders.- Take home points.

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# Abstract Archives of the RSNA, 2024

GIEE-75

## SIBLING'S SPECIALTIES: THE BOUNDARIES AND INTERSECTIONS OF RADIOLOGY AND ENDOSCOPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose C. Ardengh (*Abstract Co-Author*) Nothing to Disclose
Thais C. Lima (*Abstract Co-Author*) Nothing to Disclose
Fernanda C. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Blasbalg, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Panizza, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Knowledge about the applications, indications and contraindications of endoscopic modalities is vital for the abdominal radiologist.Minimally invasive interventional procedures related to these specialties are growing rapidly due to better results and lower morbidity.

### TABLE OF CONTENTS/OUTLINE

Radiological and endoscopic imaging modalities play an important role in the diagnosis and treatment of a spectrum of gastrointestinal and respiratory conditions, sometimes with synergy in clinical practice between these sister specialties. Radiology and endoscopy are fundamental in the evaluation of hepatobiliary, pancreatic, small bowel and rectal diseases, each offering unique diagnostic and interventional capabilities. This synergy is critical in conditions such as biliary tree neoplasms, pancreatic disorders and inflammatory bowel disease, guiding management decisions from diagnostic clarity to therapeutic interventions. The summary further explores how advances, especially in artificial intelligence, are poised to improve the accuracy and integration of these modalities. Understanding the indications and contraindications for each method allows clinicians to optimize patient outcomes, illustrating a future where collaborative diagnoses and interventions continue to evolve, driven by technological innovation and improved clinical understanding.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

GIEE-76

## GOING WITH THE FLOW: NAVIGATING COLIC PERFUSION FOR OPTIMAL SURGICAL OUTCOMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlos Augusto Martinez (*Abstract Co-Author*) Nothing to Disclose
Renan D. Turci, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1 - Review the usual anatomy of the main colic vessels it’s main branches both arterial and venous presentations. 2 - Assess the most common imaging findings for vascular variations that affect surgical procedures involving colorectal cancer resections, in both CT and Angio CT scans. 3 - Reassure the radiologist’s role on identifying vascular abnormalities and communicating them to the surgical team to avoid complications.

### TABLE OF CONTENTS/OUTLINE

1 - Illustration of normal anatomy 2 - Brief review of the development of the colic vessels 3 - Most common vascular variations of the abdominal vasculature, including the superior and inferior mesenteric arteries and vein, the right, mean and left colic vessels, as well as the Riolan’s arch and the Griffit’s point, illustrated in CT and Angio CT scans 4 - How abdominal surgical procedures can be affected by vascular variations and the importance of the radiologist report on identifying theses scenarios.

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# Abstract Archives of the RSNA, 2024

GIEE-77

## ANOTHER BRICK IN THE WALL: IMAGE EVALUATION OF THE POSTOPERATIVE ABDOMINAL WALL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Priscilla Claudia Raddo Venancio, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius C. Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Lopes Fioratti, MD (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Max Yunior Orsi Salazar, MD (*Abstract Co-Author*) Nothing to Disclose
Filipe Chaves, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Guilherme Nunes Pozzer, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel B. Montel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•Normal anatomy of the abdominal wall •Image protocol for evaluation of the postoperative abdominal wall. •Early and late postoperative complications of the abdominal wall •Classification of incisional abdominal wall hernias and important characteristics •Other causes of abdominal wall weakness in the postoperative period •Understanding surgical techniques for hernia and diastasis recti repair, from classic to robotic approaches, and their imaging appearance •Surgical mesh: material differences, surgical techniques, topography in relation to abdominal wall layers, and related complications •Loss of domain in hernia cases •Surgical techniques for repair of large ventral hernias and postoperative imaging appearance •Types of stomas, expected findings, and related complications •Image findings related to cosmetic surgery procedures, myo-adipose graft harvesting surgeries, and abdominal wall bone flap preservation •Essential information for the surgeon in the radiology reports.

### TABLE OF CONTENTS/OUTLINE

•Understanding of the normal anatomy of the abdominal wall and its potential weaknesses, including incisional hernias, diastasis recti, and other causes of abdominal wall defects. •Become familiar with various surgical techniques for abdominal wall reconstruction and hernia repair, recognizing their specific imaging appearances on different modalities, including the identification of mesh materials and potential complications. •Recognize different types of stomas on imaging studies and identify potential stoma-related complications like hernias, prolapse, and retraction. •Understand the essential information surgeons need from radiology reports.

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# Abstract Archives of the RSNA, 2024

GIEE-78

## THE FUNDAMENTAL ROLE OF THE RADIOLOGIST IN THE ACUTE CHOLECYSTITIS AND ACUTE CHOLANGITIS (TOKYO GUIDELINES)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose A. Cienfuegos Alvear, MD (*Abstract Co-Author*) Nothing to Disclose
Axel A. Torres Monarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Alpizar, MD,MEd (*Abstract Co-Author*) Nothing to Disclose
Rodolfo De Jesus Martinez Marquez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Recognize the primary role of the radiologist in diagnosis and treatment of acute cholecystitis and acute cholangitis.2. Identify imaging findings of acute cholecystitis and acute cholangitis in different imaging modalities used in radiology.3. Review the flowchart for the management of acute cholecystitis and the initial response to acute biliary infection.4. Identify common and unusual causes of acute biliary infection. Review clinical cases and treatment.5. Become familiar with indications and techniques of gallbladder and biliary drainage.6. Emphasize on percutaneous gallbladder drainage and percutaneous biliary drainage.7. Analyze potential complications of acute cholecystitis and acute cholangitis percutaneous treatment and how to treat them.

### TABLE OF CONTENTS/OUTLINE

1. Diagnostic criteria of acute cholecystitis on different imaging modalities.Severity grading.Flowchart for the management of acute cholecystitis.2. Management strategies for gallbladder drainage.Percutaneous transhepatic gallbladder drainage (with videos).Percutaneous transperitoneal gallbladder drainage (with videos).3. Clinical cases of acute cholecystitis and their gallbladder drainage4. Diagnostic criteria of acute biliary infection on different imaging modalities.Severity grading.Flowchart for acute cholangitis.5. Common and unusual causes of acute biliary infection (clinical cases)5. Indications and techniques of biliary drainage.Percutaneous treatment (with videos).6. Complications of percutaneous treatment for acute cholecystitis and cholangitis.7. Conclusions.

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# Abstract Archives of the RSNA, 2024

GIEE-79

## REVISITING BOWEL DISEASES: AN ALGORITHMIC APPROACH FOR BOWEL WALL THICKENING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Antonio E. Silva JR, BDS (*Abstract Co-Author*) Nothing to Disclose
Heitor Passeri, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Beraldo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review normal bowel anatomy on CT and MRI.2. Suggest a radiological algorithmic approach for evaluating bowel diseases, emphasizing key intestinal and extra-intestinal findings.3. Detail each of the algorithmic steps, reviewing the differential diagnosis of bowel wall thickening with illustrative cases.

### TABLE OF CONTENTS/OUTLINE

1. Normal bowel anatomy, correlating didactic illustrations with CT and MRI.2. Different types of intestinal wall thickening with schematic figures.Algorithmic approach for bowel diseases, based on bowel wall thickening: STEP 1: Assess signs of neoplasia; STEP 2: Assess signs of ischemia; STEP 3: Assess inflammatory signs.3. Review the different differential diagnoses for intestinal wall thickening, with imaging findings and illustrative cases: a. Intestinal neoplasm; b. Ischemic enteritis and colitis; c. Infectious enterocolitis (highlighting intestinal Tuberculosis, Whipple disease and Pseudomembranous colitis); d. Non-infectious inflammatory intestinal diseases (highlighting Crohn's disease, ulcerative colitis and celiac disease); e. Actinic enterocolitis; f. Portal hypertensive colopathy;g. Intestinal endometriosis.

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# Abstract Archives of the RSNA, 2024

GIEE-8

## THROUGH CYSTIC LESION TO THE MORPHOLOGICAL ABNORMALITIES: CURRENT FINDINGS AND ISSUES IN EARLY PANCREATIC CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Osamu Abe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shohei Inui, MD (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Manabu Minami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomohiko Masumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Wataru Gonoi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yudai Nakai, MD (*Abstract Co-Author*) Nothing to Disclose
Sota Masuoka, MD (*Abstract Co-Author*) Nothing to Disclose
Moto Nakaya, MD (*Abstract Co-Author*) Nothing to Disclose
Shintaro Kano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pancreatic cancer is the third leading cause of cancer death in the United States on its way to be the second. A multidisciplinary approach is crucial in clinical practice, and radiologists play an important role in early detection. In recent years, there has been progress in understanding the radiologic features and pathologic backgrounds of early pancreatic cancer and its precursor lesions. Intraductal papillary mucinous neoplasm (IPMN) is a well-known cystic lesion with malignant potential. Pancreatic ductal adenocarcinoma concomitant with IPMN, distinct from carcinoma that sequentially develops from IPMN itself, is also gathering attention. Morphological abnormalities of the pancreas are considered to precede the development of cancer. Radiologists need to pay attention not only to cystic lesions but also to morphological abnormalities of the pancreas. From a clinical perspective, there remains some controversial issues. In particular, there is no consensus on the follow-up interval for high-risk patients.The purposes of this exhibit are1. To learn the up-to-date radiologic findings and pathologic hypotheses of early pancreatic cancer and its precursor lesions.2. To review literature focusing on three clinical questions: (1) Modality: What is the optimal imaging modality for early pancreatic cancer detection and surveillance? (2) Eligibility: Who should be included in and excluded from routine surveillance? (3) Interval: How should the follow-up interval be determined if no abnormalities or equivocal findings are detected?

### TABLE OF CONTENTS/OUTLINE

1. Pathogenesis of pancreatic cancer2. Radiologic signs of early pancreatic cancer3. Clinical questions4. Conclusion

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# Abstract Archives of the RSNA, 2024

GIEE-80

## BEYOND MALIGNANCY: A RADIOLOGIST'S GUIDE TO BENIGN PERITONEAL DISEASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lucas Bauer Pasqualini (*Abstract Co-Author*) Nothing to Disclose
Lucas Augusto, MD (*Abstract Co-Author*) Nothing to Disclose
Camila C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio J. de Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Ariel Teixeira Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Pedro Panizza, MD (*Abstract Co-Author*) Nothing to Disclose
Rafaelle M. De Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Lisa Umeda, MD (*Abstract Co-Author*) Nothing to Disclose
Nicoli T. Yoshimi, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela M. De Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Irla A. Dantas, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Maria Rosas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Elucidate the anatomical relationships and forms of dissemination related to peritoneal diseases, as well as the radiological analysis of the structures involved. Discuss the pathophysiology involved in the spread of each group of benign diseases that affects the peritoneum. Provide a radiological algorithm to the dissemination of benign peritoneal diseases and correlate the clinical history that may help in the diagnosis. Highlight the possible complications related to each benign pathology of peritoneal dissemination. Present the main malignant differential diagnoses related to each benign pathology of peritoneal dissemination.

### TABLE OF CONTENTS/OUTLINE

Classification of benign peritoneal diseases dissemination into subgroups according to the main imaging aspects.Description of the imaging aspects of solid, mixed and cystic diseases.Individual characteristics of each benign lesion of the peritoneum and their main differential diagnoses in relation to malignant peritoneal involvement.

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# Abstract Archives of the RSNA, 2024

GIEE-81

## ULTRASONOGRAPHY IN ABDOMINAL HERNIAS: A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduardo D. Chiovatto, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Person de almeida, MMed,MMed (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Carotenuto Ramos, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Wagner Iared (*Abstract Co-Author*) Nothing to Disclose
Natalia Orthmann, MD (*Abstract Co-Author*) Nothing to Disclose
Geovana Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Moreli Antonine (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This study aims to:Analyze the main types of hernias and points of weakness in the abdominal wall.Technique for assessing abdominal wall hernias using ultrasonography.Anatomical parameters that allow differentiation between direct and indirect inguinal hernias.Complications of hernias and how to diagnose them with ultrasound.

### TABLE OF CONTENTS/OUTLINE

Anatomy and reference pointsTypes of hernias:IncisionalUmbilicalEpigastricHypogastricLateral (Spiegel or Semilunar)Inguinal hernias (direct and indirect)Femoral HerniaLumbar Hernias (Grynfelt-Lesshaft abd Petit hernia)Ultrasound technicComplications (Ultrasonographic diagnosis of complications)

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# Abstract Archives of the RSNA, 2024

GIEE-82

## LIVER-OGRAPHY OF THE DIFFUSE HEPATIC DISEASES AND IT'S PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rogerio J. de Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Panizza, MD (*Abstract Co-Author*) Nothing to Disclose
Nicoli T. Yoshimi, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela M. De Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lahan-Martins, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hilton M. Leao Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucas Bauer Pasqualini (*Abstract Co-Author*) Nothing to Disclose
Lucas Augusto, MD (*Abstract Co-Author*) Nothing to Disclose
Camila C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Ariel Teixeira Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Irla A. Dantas, MD (*Abstract Co-Author*) Nothing to Disclose
Rafaelle M. De Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Maria Rosas, MD (*Abstract Co-Author*) Nothing to Disclose
Lisa Umeda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Diffuse hepatic diseases are usually non-specific character in the middle of the radiology. Biopsy is known to be the gold standard for many of these pathologies. This presentation aims to presente with the recent technologies of radiological modalities so that the diagnosis can be suggested without being invasive. Provide a radiological overview of diffuse liver diseases, the pathophysiology involved in the dissemination of each group. Highlight the differential diagnoses related to each diseases, with the main findings in the different modalities.

### TABLE OF CONTENTS/OUTLINE

Main liver diseases of inflammatory and infectious origin and their typical findings. The different aspects of liver storage diseases. Assessment of images in chronic liver disease patients and autoimmune hepatitis. Recognition of liver pathologies of vascular origin. Main findings related to post-transplant liver complications, including vascular, hepatic infartion and rejection.

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# Abstract Archives of the RSNA, 2024

GIEE-83

## LI-RADS TRA 2024 UPDATE: WHAT RADIOLOGISTS SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Antonio E. Silva JR, BDS (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Luiz T. Siqueira, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Naves (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Provide a practical guide to the new LI-RADS TRA guidelines reviewing critical changes and imaging features for each TRA category. - Present the expected imaging features for each locoregional treatment and possible complications. - Highlight possible pitfals when applying LR-TR. - Provide sample reports in clinical cases to highlight key information for oncologists, surgeons and transplant comitees.

### TABLE OF CONTENTS/OUTLINE

● Introduction ○ Review of modalities for local treatment ○ Overview of LR-TR categories ○ Correct measurement technique ● LR-TR Nonradiation treatment response ○ Review of treatment categories including definition, criteria and examples. ● LR-TR Radiation treatment response ○ Review of treatment categories including definition, criteria and examples. ● Conclusion

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# Abstract Archives of the RSNA, 2024

GIEE-84

## A NOVEL APPROACH TO CHARACTERISING LIVER LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Snehal Lapsia, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Sophie Cheshire, MBChB, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Table method for radiology residents to problem solve liver lesion diagnosis on MRI

### TABLE OF CONTENTS/OUTLINE

We have used this table method at our UK teaching hospital whilst training radiology residents to equip them with a tool which allows for a methodical approach to interpreting liver MRI. It can be quite easy to lose focus with all the details and MR enhancement patterns of the multitude of benign and malignant lesions when evaluating multiple liver MR sequences at once. Therefore, we propose this method which evaluates each sequence in isolation of the others. Formulating a table populating each sequence with what the lesion can be, what it could be (but unlikely) and what it cannot be. In combination with a final review of the background liver, any relevant history and tumour markers allows final diagnosis of the lesion, often providing a close differential. The method can also be utilised as a problem solving tool when evaluating difficult cases. Within this education piece we will present the method with the following examples: HCC, IHC, metastasis, FNH, adenoma, cyst and other rarer lesions.

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# Abstract Archives of the RSNA, 2024

GIEE-85

## PANCREATIC NEUROENDOCRINE NEOPLASMS: CONCEPTS, CLASSIFICATION, ROLE OF IMAGE AND ANATOMOPATHOLOGICAL CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ana Claudia Vincenzi Raduan Uski (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pancreatic neuroendocrine neoplasms (panNENs) present characteristic clinical, histomorphological and prognostic features. There have been updates regarding the pathogenesis, classification and staging of these neoplasms and familiarity with the imaging findings is essential for optimal treatment. Therefore, the objectives of this work are: - Demonstrate the radiological findings that favor the diagnosis and evolutionary behavior of panNENs; - Review changes in the classification system according to WHO (2017) and in staging (TNM of the AJCC 8th edition); - Review the genetic concepts and pathogenesis of sporadic and syndromic tumors.

### TABLE OF CONTENTS/OUTLINE

• Introduction; • WHO classification and latest AJCC TNM staging system for pancreatic neuroendocrine neoplasms; • Discussion of the pathogenesis of pancreatic tumors and carcinomas and description of genetic mutations that affect prognosis and treatment; • Imaging findings of these tumors and correlation with histological grades; • Curiosities and their main mimiters; • Summary and flowchart of conducts; • References

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# Abstract Archives of the RSNA, 2024

GIEE-86

## RADIOLOGIST IN THE MULTIDISCIPLINARY TEAM MANAGING GASTROENTEROPANCREATIC NEUROENDOCRINE NEOPLASMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nikhil H. Ramaiya, MD (*Abstract Co-Author*) Nothing to Disclose
Rachana Gurudu (*Abstract Co-Author*) Nothing to Disclose
Qiubai Li, MD (*Abstract Co-Author*) Nothing to Disclose
Sreeharsha Tirumani, MD (*Abstract Co-Author*) Nothing to Disclose
Kaustav Bera, MD (*Abstract Co-Author*) Nothing to Disclose
Amr Mohamed (*Abstract Co-Author*) Nothing to Disclose
Sohrab Afshari Mirak, MD (*Abstract Co-Author*) Nothing to Disclose
Jack Zhao, BA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Radiologist is an integral part of the MDT managing GEP NEN
- Imaging key in every step in the management of GEP-NEN
- Multiphasic CT and MRI are workhorses for anatomic imaging
- Knowledge of immunohistochemistry can help radiologists in challenging cases of GEP-NEN, especially in the setting of unknown primary
- Important to recognize changes of carcinoid heart disease on restaging scans and differentiate NEN from non-NEN entities
- MRI better suited for post therapy response assessment
- Familiarity with response criteria used in GEP-NEN can help in appropriate assessment in day-to-day clinical practice
- Attention should be payed to disease recurrence and treatment related complications on restaging scans

### TABLE OF CONTENTS/OUTLINE

- Understand the role of radiologist in multi-disciplinary management of GEP-NEN
- Familiarize clinical and pathology clues which can help radiologist in diagnosis and management
- Understand the role of immunohistochemistry in day-today practice of radiologists
- Demonstrate the value of knowing response criteria and complications of GEP- NET therapies

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

GIEE-87

## COMPREHENSIVE MR IMAGING OF PERIANAL FISTULAS: FROM ANATOMY AND DIAGNOSIS TO PERIANAL CROHN'S TREATMENT MONITORING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Michael H. Lanier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vincent M. Mellnick, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Parakkal Deepak, MBBS (*Abstract Co-Author*) Consultant, Johnson & Johnson;Advisory Board, Johnson & Johnson;Consultant, Pfizer Inc;Advisory Board, Pfizer Inc;Consultant, Prometheus Pharmaceuticals;Advisory Board, Prometheus Pharmaceuticals;Consultant, Boehringer Ingelheim GmbH;Advisory Board, Boehringer Ingelheim GmbH;Grant, Boehringer Ingelheim GmbH;Consultant, Arena Pharmaceuticals;Advisory Board, Arena Pharmaceuticals;Grant, Arena Pharmaceuticals;Grant, Takeda Pharmaceutical Company Limited;Grant, Bristol-Myers Squibb Company;;;
David H. Ballard, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to:1. Illustrate normal perianal anatomy on MR, provide a search pattern, and discuss types of perianal fistulas2. Provide a case-based review of the appearance of common and complex fistula patterns3. Discuss perianal fistulas in Crohn disease and the role of MR in monitoring response to therapy

### TABLE OF CONTENTS/OUTLINE

1. Anatomy: Internal and external sphincters, anorectal junction, and intersphincteric spacea. Appearance on diagram vs. MR2. Imaging rationala. MR modality of choiceb. Fistula and abscess on CT3. MR techniquea. Sequences of perianal MR protocol 2. Pairing a perianal MR protocol with MR enterography4. Patterns of perianal fistulasa. What is 'complexity' in perianal fistulasb. Inter-, trans-, supra- and extra-sphincteric perianal fistulasc. Parks and St. James classification systems5. Pitfalls and special considerationsa. Setons tract on MR - is it considered a fistula?b. Fistulizing to adjacent genitourinary structuresc. Hemmoroid mimicking perianal fistula6. Implications of MR findings for patient managementa. Innovations including 3D printing and virtual reality7. Perianal fistula in Crohn diseasea. Prevalence and treatment optionsb. MR imaging as a response to medical therapyc. MR scoring systemsi. Modified Van Assche index, MAGNIFI-CD, and othersii. Practical approach to reporting treatment perianal Crohn responsed. Cases of long-standing (5+ years) perianal Crohn across multiple studies8. Cancer-associated with perianal fistulaa. Perianal Crohn at increased risk for anal and rectal cancerb. Fistula-related mucinous adenocarcinomac. Squamous cell carcinoma Wound or risk factor (HIV/HPV/receptive anal intercourse)

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# Abstract Archives of the RSNA, 2024

GIEE-88

## PANCREATIC CANCER SCREENING AND EARLY DETECTION: DOES IMAGING MAKE A DIFFERENCE?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Carlos Fernandez-Del Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Avinash R. Kambadakone, MD, FRCR (*Abstract Co-Author*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer
Soumyadeep Ghosh, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Shravya Srinivas Rao, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Background Pancreatic cancer is the third most common cause of cancer-related deaths in the United States. The potential challenges in early detection involve the identification of individuals in the general population who are at risk and would gain from ongoing monitoring programs. Pancreatic cancer often presents at advanced stages, limiting treatment options and survival rates. Imaging plays a crucial role in early detection, offering opportunities for timely intervention and improved outcomes.Learning Objectives/Aims: • To discuss the necessity of early detection of pancreatic cancer • To recognize the subgroups with higher-than-average risk for pancreatic ductal adenocarcinoma (PDAC) • To evaluate the role of imaging in early diagnosis of pancreatic cancer • To review challenges and future prospects in detection of early pancreatic cancer

### TABLE OF CONTENTS/OUTLINE

• Introduction to pancreatic ductal adenocarcinoma • Describe modifiable and non-modifiable risk factors • Identify subgroups with higher-than-average risk for PDAC • Discuss precancerous lesions and their imaging surveillance o Mucinous cystic neoplasm o IPMN o Worrisome features and high-risk stigmata according to Tanaka consensus • Role of imaging in early detection of pancreatic cancer • Discuss the rationale of pancreatic protocol CT and MRI • Imaging features of early PDAC o Duct cut-off sign o Double duct sign o Focal abnormal enhancement o Focal parenchymal atrophy o Focal change in duct caliber • Current research on advanced imaging and other biomarkers for early diagnosis of PDAC

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# Abstract Archives of the RSNA, 2024

GIEE-9

## "FIERY AND IRRITATED BILE DUCTS": CURRENT UPDATE ON PATHOLOGY, IMAGING, AND MANAGEMENT OF ACUTE AND CHRONIC CHOLANGITIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Venkata S. Katabathina, MD (*Abstract Co-Author*) Nothing to Disclose
John A. Walker, MD, PhD (*Abstract Co-Author*) Speaker, Shionogi & Co, Ltd;Consultant, Shionogi & Co, Ltd
Sriram Jaganathan, MD (*Abstract Co-Author*) Nothing to Disclose
Narayan Lath, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Rajeev Pathapati (*Abstract Co-Author*) Nothing to Disclose
Anil K. Dasyam, MD (*Abstract Co-Author*) Nothing to Disclose
Alia Nazarullah (*Abstract Co-Author*) Nothing to Disclose
Abdelrahman A. Abusaif, MBBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Review the anatomy and physiology of bile ducts pathophysiology of bile duct inflammation. • List obstructive, infectious, inflammatory, immunologic, toxic miscellaneous etiologies of acute and chronic cholangiopathies • Discuss current updates on the pathogenesis of primary sclerosing cholangitis, primary biliary cholangitis other acute/chronic cholangitis, including novel etiologies • Describe MRI/MRCP imaging spectrum role of other imaging modalities • Discuss updates in endoscopic/interventional radiology management of acute/chronic cholangitis

### TABLE OF CONTENTS/OUTLINE

• Introduction • Anatomy/physiology: Cholangiocytes, Arterial/venous bile production • Current Updates on pathogenesis • Etiology of cholangitis: Acute, chronic acute on chronic • Imaging Techniques: US, CT, MRI/MRCP, MR Elastography, ERCP, PTC, EUS Cholangioscopy • Acute cholangitis: infectious/obstructive; periductal T2 hyperintensity, enhancement, abscesses thrombosis • Primary sclerosing cholangitis associated conditions • Primary Biliary Cholangitis • IgG4-cholangiopathy • Infectious: Recurrent pyogenic cholangitis, AIDS cholangiopathy, bacterial parasites (Fasciola Hydatid) • Covid-19 Cholangiopathy Covid-vaccine induced • Post-liver transplant: Ischemic, anastomotic biliary cast syndrome • Drug-induced: Immune therapy, chemotherapy • Secondary sclerosing cholangitis in critically-ill patients • Miscellaneous: radiation, Mirizzi, Lemmel syndrome congenital • Management: Medical/Endoscopic/IR • Novel therapeutic targets • ConclusionNew etiologies significant updates in pathogenesis acute/chronic cholangitis; imaging is pivotal in timely diagnosis.

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# Abstract Archives of the RSNA, 2024

GIEE-90

## MULTIMODALITY DIAGNOSTIC IMAGING AND ROLE OF INTERVENTIONAL RADIOLOGY FOR PANCREAS TRANSPLANT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Eric Fromke, MD (*Abstract Co-Author*) Nothing to Disclose
Rachita Khot, MD (*Abstract Co-Author*) Nothing to Disclose
John F. Angle, MD (*Abstract Co-Author*) Consultant, Terumo CorporationResearch Grant, Seimens AG
Klaus D. Hagspiel, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Hideyuki Torikai, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pancreas transplant is performed primarily for patients with type 1 diabetes mellitus who experience difficulties in managing their condition with conventional therapies. This educational exhibit offers the comprehensive review of multimodality diagnostic imaging and interventional radiology. The exhibit aims to: 1. Discuss the indications and epidemiology of pancreas transplant 2. Understand pre-transplant pancreatic anatomy for accurate imaging interpretation, crucial for surgical planning 3. Discuss expected post-transplant imaging findings versus early signs of complications 4. Gain insight into the surgical techniques and their implications for post-operative complications 5. Recognize post-transplant complications, focusing on diagnostic imaging features and the role of Interventional Radiology in management

### TABLE OF CONTENTS/OUTLINE

Indication and Epidemiology Anatomy: Arterial, venous and enteric anatomy Surgical technique based on the anastomosis Imaging technique: US, contrast-enhanced US, CT, MRI, and Angiography Normal Imaging findings Complications Arterial complications 1. Bleeding/Pseudoaneurysm and embolization 2. Thrombosis and thrombolysis/thrombectomy 3. Stenosis and angioplasty 4. Arteriovenous fistula and embolization Venous complications 1. Thrombosis and thrombolysis/thrombectomy 2. Stenosis and angioplasty Exocrine complications 1. Duodenoenterostomy leak 2. Duodenovesicostomy leak 3. Duodenal stump leak 4. Leak following anastomotic conversion Parenchymal complications 1. Graft rejection and Image-guided biopsy 2. Graft pancreatitis 3. Peripancreatic fluid collection and drainage Other complications 1. PTLD 2. Small bowel obstruction

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# Abstract Archives of the RSNA, 2024

GIEE-91

## INS AND OUTS: HERNIAS OF THE ABDOMINAL WALL ON CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rochelle Lamb, BMBS (*Abstract Co-Author*) Nothing to Disclose
Sathi A. Sukumar, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ben Layton, BMBS, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

With use of CT imaging and accompanying detailed original illustrations combined with the most up to date literature we will:• Review the myofascial anatomy of the abdominal to provide a foundation for the of assessing hernias and understanding surgical techniques• Provide an approach to reporting hernias on CT with a particular focus on what the surgeon needs to know about large ventral hernias• Highlight what not to miss in hernia reports including the spectrum of complications of hernias specific to their subtype and location, hernia mimics and malignancy within a hernia sac.

### TABLE OF CONTENTS/OUTLINE

1. Myofascial anatomy of the abdominal wall with an overview of ventral hernia closure techniques 2. What to tell the surgeon on a CT report with case examples interlinking with surgical options. Including important surgical planning information: domain loss, sarcopenia, rectus defect ratio, component separation measurements 3. Abdominal wall hernia classification including midline, lateral and lumbar types with relevance to the surgeon explained 4. Uncommon abdominal wall hernia types and their clinical relevance explained including subtypes of interstitial hernias (with Spigelian and rectus sheath types) 5. Acute and chronic complications with case examples specific to the location such as ureteric obstruction in a lumbar hernia and appendix in Spigelian hernia. 6. Tips and tricks! Including assessment of hernia content for malignancy and sidestepping hernia mimics such as various abdominal wall masses 7. Summary and recommendations

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# Abstract Archives of the RSNA, 2024

GIEE-92

## ENDOSCOPIC ESOPHAGEAL CANCER PRACTICE: WHAT RADIOLOGISTS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatsushi Kobayashi, MD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation
Takashi Hiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hirofumi Kuno, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomohiro Kadota (*Abstract Co-Author*) Nothing to Disclose
Shioto Oda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Gastrointestinal endoscopy is the mainstay of treatment for upper gastrointestinal treatment, particularly esophageal cancer, and plays a major role in improving patient prognosis and quality of life through a wide variety of procedures. Recent advancements in endoscopic techniques have been remarkable, including new topics such as endoscopic ultrasound (EUS) and photodynamic treatment (PDT) for treating local recurrent lesions after radiotherapy. Familiarity with related CT imaging evaluation is crucial for pre- and post-procedure evaluations, but there are limited comprehensive reports on this topic.The purpose of this presentation is to review the anatomical considerations essential to diagnosing esophageal cancer, provide an overview of radiographic imaging about TNM staging, and discuss the imaging features encountered in the endoscopic practice of esophageal cancer.The purpose of this presentation is:1. To describe key imaging features associated with endoscopic diagnosis for pre-treatment staging2. To review key imaging features after endoscopic treatment

### TABLE OF CONTENTS/OUTLINE

1. Background.2. Review of Anatomy Related to Endoscopic Esophageal Cancer Practice.3. Case Illustrations of Endoscopic Esophageal Cancer Practice3.1. Pre-treatment Imaging3.2. Post-treatment Imaging3.3. Imaging Associated with Other Endoscopic Procedures.4. Summary

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# Abstract Archives of the RSNA, 2024

GIEE-93

## DUAL CONTRAST LIVER MRI: ONE-STOP SHOPPING FOR LIVER LESION CHARACTERIZATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Tyler J. Fraum, MD (*Abstract Co-Author*) Research support, Siemens AG ;Speaker, Ultimate Opinions in Medicine LLC
Justin Dumrongkulraksa, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Tsai, MD (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sayan Manna, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel R. Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Z. Rajput, MD (*Abstract Co-Author*) Nothing to Disclose
Michael H. Lanier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Govind Mattay, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The choice of liver MRI contrast agent among extracellular, hepatobiliary (e.g., gadoxetate), or hybrid (e.g., gadobenate) types is a challenge in protocolling liver MRI examinations for focal liver lesion characterization. Each agent has advantages and disadvantages, including the quality of various contrast phases, potential artifacts, and hepatobiliary phase contrast-to-background ratios. A dual-contrast strategy employing initial administration of an extracellular agent followed by subsequent administration of gadoxetate offers high-quality arterial phase imaging, a predictable appearance of hemangiomas in the equilibrium and early delayed (< 5 min) phases, and a high-quality hepatobiliary phase. This exhibit will:1) Discuss liver MRI contrast agents and their strengths and weaknesses2) Provide a framework for characterizing indeterminate liver lesions and how contrast agent choice affects diagnostic certainty3) Describe the dual-contrast protocol and how to construct it efficiently4) Illustrate the advantages of dual-contrast liver MRI compared to single-agent examinations, including examples in which gadobenate as a single hybrid agent can be misleading

### TABLE OF CONTENTS/OUTLINE

- liver MRI contrast agents: characteristics, strengths, and weaknesses- Indeterminate liver lesion MRI: imaging features and how contrast choice affects diagnostic certainty or uncertainty in various clinical scenarios- dual contrast liver MRI protocol: building blocks, sequence ordering, contrast dosing- case illustrations: depict how the advantages a dual contrast protocol offers compared to single agent extracellular, gadoxetate, and gadobenate exams for focal liver lesion characterization

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# Abstract Archives of the RSNA, 2024

GIEE-94

## HYPERINTENSE LIVER LESIONS AT HEPATOBILIARY PHASE OF GADOXETIC ACID-ENHANCED MR IMAGING: A CLINICAL APPROACH AND IT'S CLINICAL SIGNIFICANCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kumi Ozaki, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The insight of paradoxical hyperintensity at hepatobiliary phase of gadoxetic acid-enhanced MR imaging can help the accurate imaging diagnoses and can provide us additional information as imaging biomarkers such as prognosis and therapeutic effectiveness. The purposes of this presentation are; 1) to review several kinds of tumor showing paradoxical hyperintensity at hepatobiliary phase; 2) to review the role of the imaging biomarkers of hyperintense lesions of hepatobiliary phase images

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. What is the gadoxetic acid? 3. The mechanism of uptake and excretion of gadoxetic acid and three types of mechanisms of hyperintensity during hepatobiliary phase 4. Presenting several hyperintense lesions of hepatobiliary phase images. For example, hepatocellular carcinoma (HCC); hyperintense HCC at HB phase, heterogeneous intense HCC at HB phase, nodule in nodule during multi-step hepatocarcinogenesis , peritumoral hyperintensity 5. Hepatocellular adenoma with ß-catenin mutation 6. Focal nodular hyperplasia (FNH) and FNH-like lesion 7. Regenerative nodules in cirrhosis and other benign hepatocellular lesions 8. Cloud sign of intrahepatic cholangiocarcinoma 9. Heterogeneous hyperintensity of liver metastases of colorectal cancer, pancreatic adenocarcinoma, and breast cancer 10. Peritumoral hyperintensity of neuroendocrine tumor 11. Periportal hyperintensity in porto-sinusoidal vascular diseaseand liver cirrhosis 12. Peritumoral hyperintensity of hypervascular tumors 13. Focusing on the role of the imaging biomarkers of hyperintense lesions of hepatobiliary phase images 14. Conclusion.

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GIEE-95

## ESOPHAGOGRAPHY ON THE MOST CHALLENGING PATIENTS: IT CAN BE DONE! (HINTS AND TRICKS TO GET A DIAGNOSTIC STUDY)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mary A. Turner, MD (*Abstract Co-Author*) Nothing to Disclose
Laura R. Carucci, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Esophagography is an increasing proportion of GI fluoroscopy studies performed, providing functional and structural information often not readily obtained with cross-sectional imaging or endoscopy. • Overall trend towards increasing number of complex studies that do not allow for a "traditional esophagram" -more challenging patients with special circumstances (debilitated, elderly, postop, ICU patients). • Need to tailor study to patient's needs and capabilities • Procedural modifications allow for esophagography on even the sickest patients including patients who are debilitated, intubated, postoperative, or aspirating and patients who can't drink. • Challenging cases to perform and interpret• Important for radiologists to be aware of diagnostic challenges and how to best examine patients safely, modifying techniques to obtain necessary diagnostic information.

### TABLE OF CONTENTS/OUTLINE

• Review GI fluoroscopy trends • Discuss how to perform an esophagram in challenging circumstances including procedural modifications for the sickest patients • Describe detailed techniques, tricks and tips on how to perform an esophagram for: Debilitated patients, Intubated patients, Aspirating patients, Patients who can't swallow on command, Possible tracheoesophageal fistula, Suspected impacted foreign body or food bolus, Post-operative patients including post laryngectomy, esophagectomy, myotomy, and Zenker repair. • Discuss potential pitfalls. • Important pathology can be identified on these studies, often providing information that is not readily obtained with alternative methods.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

GIEE-96

## DEEP DIVE IN DIVERTICULA: PICTORIAL REVIEW OF GI TRACT CASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose D. Fernandes SR (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Gaetan Afonso, MD (*Abstract Co-Author*) Nothing to Disclose
Cassio G. Reis JR (*Abstract Co-Author*) Nothing to Disclose
Gabriela Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Arthur H. Godeiro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Diverticula can be found in various parts of the digestive tract, such as the esophagus, stomach, duodenum, jejunum, ileum, appendix, and colon. Prevalence varies according to each segment, being very common in the colon and rarer in other segments. Their clinical manifestations are generally vague, which makes diagnosis difficult and increases the risk of complications. Radiologists play a fundamental role in detecting and characterizing a wide range of gastrointestinal conditions, including the different types of diverticula in the gastrointestinal tract. Therefore, it is essential for radiology professionals to be familiar with all types of diverticula, from common colon diverticula to rare cases such as Zenker's, Killian-Jamieson's, Meckel's, duodenal, and gastric diverticula.

### TABLE OF CONTENTS/OUTLINE

Through a pictorial review, we intend to present an overview of the various types of diverticula in the gastrointestinal tract, including rarely described cases in the literature, as well as to discuss the incidence, symptoms, and prognosis of this clinical condition. We aim to highlight the role of various imaging modalities in aiding diagnosis, with emphasis on cases identified in imaging studies of lower technological complexity, such as radiographic contrast studies. We also intend to highlight possible pitfalls in the assessment of exams in this context, especially concerning the differentiation between pseudodiverticula and true diverticula in imaging exams.

# Abstract Archives of the RSNA, 2024

GIEE-97

## LIVER INFECTIONS: IMAGING, DIFFERENTIAL DIAGNOSIS, PEARLS, ANDPITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mustafa Koc, MD (*Abstract Co-Author*) Nothing to Disclose
Sukru Mehmet Erturk, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG;Speaker, General Electric Company ;Consultant, Siemens AG
Sukru Sahin, MD (*Abstract Co-Author*) Nothing to Disclose
Ali H. Baykan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To describe imaging findings of infectious liver diseases 2. To discuss the role of cross-sectional imaging in the diagnostic work-up of infectious liver diseases 3. To discuss the imaging differential diagnosis of infectious liver diseases

### TABLE OF CONTENTS/OUTLINE

• Introduction • Transmission routes of infectious agents, pathophysiology, and effects on the liver • Key imaging findings of infectious liver diseases, including bacterial, viral, parasitic, and fungal infections • Pearls and pitfalls in the differential diagnosis of infectious liver diseases • Conclusion

Printed on: 05/28/25

RSNA 2024
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# Abstract Archives of the RSNA, 2024

GIEE-98

## UNCOMMON CT AND MR MANIFESTATIONS OF SOLID PSEUDO-PAPILLARY TUMOR OF THE PANCREAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yan Zhou (*Abstract Co-Author*) Nothing to Disclose
Xuhua Gong (*Abstract Co-Author*) Nothing to Disclose
Jianrong Xu (*Abstract Co-Author*) Nothing to Disclose
Hainan Ren, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Li Jun Qian, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To illustrate and review the uncommon CT and MR manifestations of solid pseudo-papillary tumor of the pancreas (SPT)2. Discuss the crucial points for diagnosis of uncommon SPT.Conclusion: The major teaching points of this exhibit are:1. SPT may be associated with a variety of uncommon CT and MR manifestations.2. Knowledge of the uncommon imaging spectrum is useful in identification of the disease.

### TABLE OF CONTENTS/OUTLINE

1. SPT in male patients2. small SPT3. SPT with minimal solid component 4. SPT with minimal cystic component 5. SPT with dense central calcification6. Extrapancreatic SPT7. Aggressive SPT with metastatic disease8. SPT with dorsal pancreas agenesis9. Technical considerations

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# Abstract Archives of the RSNA, 2024

GIEE-99

## SPECTRUM OF GASTROINTESTINAL MESENCHYMAL LESIONS: MULTIMODALITY IMAGING AND DIAGNOSTIC APPROACHES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ba D. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Kenneth N. Huynh, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the common and uncommon mesenchymal lesions of the GI tract with histopathologic findings, differential diagnosis, and prognosis. 2. To characterize imaging features of each GI tract mesenchymal lesion to narrow diagnostic possibilities using CT, MR, PET/CT, and ultrasound.

### TABLE OF CONTENTS/OUTLINE

Soft tissue mesenchymal lesions are ubiquitously found throughout the body but rarely occur distinctively in the gastrointestinal (GI) tract. Gastrointestinal stromal tumors account for 90% of GI mesenchymal lesions but only less than 1% of overall GI tract tumors. Less common mesenchymal lesions range from benign schwannoma, leiomyoma, inflammatory fibroid polyp, granular cell tumor, and gangliocytic paraganglioma to malignant lesions such as leiomyosarcoma, clear cell sarcoma, inflammatory myofibroblastic tumor, and primary GI melanoma. Radiologic appearances and characteristics of these lesions frequently overlap and lead to a broad differential diagnosis. Accurate diagnosis is crucial as otherwise treatable lesions with malignant potential may be mistaken for benign processes. This exhibit will present the imaging spectrum of GI tract mesenchymal lesions on CT, MR, PET/CT, and ultrasound. These lesions include the benign and malignant entities mentioned in the above paragraph. This exhibit will also review the typical locations of occurrence along the GI tract and discuss a simplified approach to formulate and narrow the differential diagnosis of these lesions.

# Abstract Archives of the RSNA, 2024

GUEE

## Genitourinary Imaging Education Exhibits

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

### GUEE-1 MASS LESIONS OF TRANSPLANTED KIDNEYS

Kumaresan Sandrasegaran, MD (*Abstract Co-Author*) Nothing to Disclose
Mark D. Sugi, MD (*Abstract Co-Author*) Consultant, Nextrast, Inc;Author with royalties, RELX
Alecio F. Lombardi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• 1. Masses of transplanted kidneys include benign and malignant tumors, infections and inflammatory pseudotumors • 2. Some lesions seen in transplant kidneys, such as mycobacterial abscess, are not usually seen in native kidneys • 3. Benign lesions, such as infiltrative fungal infection, may mimic malignant tumors on imaging

**TABLE OF CONTENTS/OUTLINE**

1. 1. Optimal imaging of transplant (Tx) kidney tumors 2. Malignant tumors of transplant kidneys a. Differences in frequency of renal cell cancers in native and transplant kidneys b. Treatment of Renal Cell Cancer (RCC) in transplant kidneys 3. Hematologic tumors: PTLD, extra-osseous myeloma 4. Sarcomas and mesenchymal tumors 5. Infection of transplant kidneys: bacterial, mycobacterial and fungal 6. Unusual lesions of transplant kidneys: perinephric myxoid pseudotumor, amyloidoma 7. Value of image guided biopsy

### GUEE-10 PENILE DOPPLER WITH DRUG-DIRECTED DIAGNOSIS OF ERECTILE DYSFUNCTION, WHAT THE RADIOLOGIST SHOULD KNOW

Mildreth Juliana Acuna Rojas, MEd (*Abstract Co-Author*) Nothing to Disclose
Manuel Alejandro Garrido, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Introduction to the generalities of color Doppler in the diagnosis of erectile dysfunction, precise definition of erectile dysfunction, the correct indications to apply the study and when to apply them. Carry out an anatomical review of the penis, and physiological mechanism of the erection, that subsequently allows a diagnosis that adequately guides the doctor for a correct treatment. Know the radiological technique of the Doppler of the penis, a close look at each of the steps to elucidate and correctly present its findings. Learn criteria to think about the erectile dysfunction, taking into consideration patient signs and symptoms, clinical background, and ultrasonographic classification. Present two clinical cases of patients with erectile dysfunction, with their intrinsic repercussions in quality of life, each with independent risk factors and variable causes

**TABLE OF CONTENTS/OUTLINE**

Introduction, Epidemiology, Etiology, Anatomic review, Physiology, Pathophysiology, Diagnosis, Radiological technique, Clinical cases, Conclusions, References.

### GUEE-11 GUIDELINES REVIEW OF ADRENAL INCIDENTALOMA: RADIOLOGIST'S PRIMER

**Awards**
**Certificate of Merit**

Julia A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Lais F. Pimentel, MD (*Abstract Co-Author*) Nothing to Disclose
Madson Almeida (*Abstract Co-Author*) Nothing to Disclose
Maria C. Fragoso (*Abstract Co-Author*) Nothing to Disclose
Felipe Ledesma (*Abstract Co-Author*) Nothing to Disclose
Lucas Aquino (*Abstract Co-Author*) Nothing to Disclose
Juliana Salviano, MD (*Abstract Co-Author*) Nothing to Disclose
Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Camila S. Franco, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Katriny Couto, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduarda d. Cunha, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Jose Luis Chambo (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the past and current concepts of adrenal incidentalomas.- Describe the main imaging findings of typical adrenal disorders.- Review the current adrenal imaging literature focusing on indeterminate lesions.- Explore the European Society of Endocrinology (ESE) guideline for adrenal lesions based on didactic clinical-radiological-pathological correlation.- Brief review of the American College of Radiology (ACR) White Paper guideline: Is it time to change?

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION- Epidemiology- Anatomy- Histology- Overview of adrenal incidentalomasIMAGING FEATURES ASSESSMENT - Adenoma- Myelolipoma- Neural orign tumor- Pheochromocytoma- Adrenocortical carcinoma- Miscellaneous- Critical review of indeterminate adrenal lesions literatureESE GUIDELINE- Explore the updated concepts and guidance- Perform a didactic clinical-radiological-pathological correlation.ACR GUIDELINE- Brief overview of the White Paper document- Are there gaps in improving the radiological approach for adrenal incidentaloma?

## GUEE-12 ADRENAL LESIONS - NOT ALWAYS AN ADRENAL ADENOMA

Anju Sahdev, FRCR (*Abstract Co-Author*) Nothing to Disclose
Katherine Ordidge, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Michael Thomas, MBBS (*Abstract Co-Author*) Nothing to Disclose
James Fish, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Adrenal incidentalomas are commonly found in routine practice on up to 5% of all abdominal CT imaging.Clear guidelines exist as to the management of adrenal incidentalomas; including their initial characterisation on imaging (CT, MRI and PET-CT).Confident imaging characterisation of adrenal lesions helps ensure that patients follow the correct clinical management pathways and avoid expensive and unnecessary follow-up, including adrenal biopsy.

**TABLE OF CONTENTS/OUTLINE**

Case based educational exhibit with examples of both benign and malignant adrenal conditions and their associations with referenced teaching points to include: Benign Adrenal lesions:Evaluation of classical imaging characteristics of adrenal adenomas on CT and MRI imaging including lipid-rich and lipid-poor subtypes with cross-correlation to functional status. Wide range of benign adrenal pathology distinct from adrenal adenomas including paragangliomas, adrenal rests, myelolipomas, angiomyolipomas, congenital adrenal hyperplasia (CAH), adrenal cysts and ganglioneuromas. Malignant Adrenal lesions: Delineate imaging characteristics which raise the suspicion of adrenal malignancy; both primary and secondary malignancy and in turn avoid unnecessary investigations or upstaging of patients. Array of malignant adrenal pathology including phaeochromocytomas, adrenocortical carcinomas, metastases to the adrenal gland, malignant neuroendocrine tumors and composite tumors.Indeterminate Adrenal lesions: What to do when lesions remain indeterminate including correlation with biochemical status, clinical assessment and further imaging modalities, e.g. nuclear medicine investigations

## GUEE-13 WHO IS THAT INCIDENTALOMA? A PICTORIAL REVIEW OF AN ADRENAL MASS

Alejandro Sanchez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Review the anatomy, embryology, and function of the adrenal gland.• Describe de role of different imaging modalities techniques (CT, MRI, PET-CT) in the diagnosis of adrenal lesions. • Discuss clinical-radiological-histopathological key findings to help differentiate adrenal gland lesions (benign vs malignant). • Analyze what treatment and follow-up is necessary for each adrenal mass.• Treatment and follow-up of adrenal lesions.• How to do a good report of an adrenal mass.

**TABLE OF CONTENTS/OUTLINE**

Description of general characteristics of adrenal gland and adrenal mass. Adrenal gland anatomy and physiology. Review multimodality adrenal protocols ( MRI, CT, PET-CT) Review of MRI and CT cases, common findings, imaging tips and pitfalls.Typical and atypical adrenal lesions. Adenoma, pheochromocytoma, lymphoma, myelolipoma, metastasis, carcinoma, neuroblastoma, nodular hyperplasia and neuroblastoma.- Histopathological findingsSummary Pearls and take home points.

## GUEE-14 THE URETER: THE UNLOVED CONDUIT BETWEEN THE KIDNEY AND BLADDER

**Awards**
**Cum Laude**

Cary L. Siegel, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew T. Simpson, MD (*Abstract Co-Author*) Nothing to Disclose
Bogdana Schmidt (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Rogers, MD (*Abstract Co-Author*) Royalties, RELX
Grace G. Zhu, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to:1) Describe ureteral anatomy and function with a discussion of the imaging strategies to evaluate for ureteral pathology.2) Provide a review of ureteral pathology and divide the different processes into broad categories of congenital, intrinsic, and extrinsic pathology.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction/Backgrounda. Ureteral anatomyb. Imaging modalities2) Congenitala. Duplicated Ectopic Uretersb. Ureteral budc. Ureteroceled. Retrocaval ureter3) Intrinsic Ureteral Processesa. Ureteral strictureb. Ureteral neoplasmsi. Fibrovascular polypii. Urothelial carcinomac. Inflammatoryi. Ureteritis cystica ii. Infectiond. Other/Miscellaneousi. Post-operative complicationsii. Pseudodiverticulosis4) Extrinsic Ureteral Processesa. Pregnancy Pelviectasisb. Local mass effectc. Local inflammatory process

## GUEE-15 THE ROLE OF IMAGING IN EVALUATING PROSTATE CANCER AND ITS NATURAL HISTORY OVER TIME

Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Michaela Cooley, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Prostate cancer is the second leading cause of cancer death in men in the US. Despite this, there is debate about the utility of prostate cancer screening markers and the optimal treatment course. This educational exhibit takes the reader through diagnosing prostate cancer, evaluating risk for metastasis, surveillance imaging, and treatment options. All discussion points relate back to the imaging markers that are essential to look out for or are important in prognosis.

**TABLE OF CONTENTS/OUTLINE**

1. Epidemiology of prostate cancer. a. Demographics; b. Incidence, prevalence; c. Role of screening. 2. Natural history of prostate cancer. a. How prostate cancer grows and metastasizes; b. Development of treatment resistance (e.g., androgen insensitivity); c. Gleason score; d. Percentages of patients with disease progression and death after diagnosis. 3. Evaluating risk though medical imaging. a. Imaging modalities used for initial diagnosis (e.g., MRI, US); b. Advantages and disadvantages of each imaging modality; c. Typical and atypical features of prostate cancer; d. Imaging characteristics used to differentiate local cancer from extracapsular extension.4. Surveillance imaging, metastasis, and whole-body imaging. a. Surveillance imaging modalities and timeline after initial treatment; b. Imaging markers indicating metastasis and what characteristics to look for; c. Indications for whole body imaging.5. Treatment options and selection. a. Local disease traditional treatment options; b. Discussion on new treatment options for local disease; c. Metastatic disease traditional and recent treatment options; d. How imaging plays a role in treatment selection.

## GUEE-16 JOURNEY INTO THE SCROTAL ULTRASOUND DEPTHS: ANDROLOGISTS' PERSPECTIVES

Silvia Martinez Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Yady V. Hurtado Burbano, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Guillermo Tarra Romero, MD (*Abstract Co-Author*) Nothing to Disclose
Laura M. Garcia Ramirez, BMedSc, BMedSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Spermatogenesis is the process in which spermatogonia give rise to spermatocytes, while spermiogenesis is the stage in which spermatids mature into spermatozoa, forming part of the overall process of spermatogenesis.
- In patients with fertility disorders, while a semen analysis is crucial, it is essential to complement this with the evaluation of testicular volume and the use of ultrasound to detect abnormalities. This comprehensive approach is vital for accurately assessing male infertility, identifying potential underlying causes, and guiding appropriate treatment to improve male fertility rates.
- When predisposing risk factors are present, there is a clear association between testicular cancer and microlithiasis, emphasizing the need for a thorough evaluation.
- Sequelae of surgical manipulation, orchidopexy, or biopsies can be detected as alterations in the echogenicity of the parenchyma.
- Recent studies have revealed that a correction factor of 0.71 is likely the most accurate for estimating calculated testicular volume.
- A variation greater than 25% between the volumes of the two testes is considered significant.
- Ultrasound abnormalities, such as ectasia of the rete testis, dilation of epididymal ductules, and intratesticular cysts, are correlated with seminal parameters. These findings clearly indicate an obstructive etiology of infertility.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Embryology 3. Functional Anatomy 4. Workup of Male Infertility 5. Ultrasound Findings
- Echogenicity
- Volume
- Epididymis
- Vascularity
- Spermatic Cord
- Inguinal Canal 6. Take-Home Messages 7. Conclusions 8. Bibliography

## GUEE-17 DIAGNOSTIC IMAGING TECHNIQUES IN RENAL TRANSPLANTATION

Steven S. Raman, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Merck & Co, Inc;Consultant, Amgen Inc;Consultant, Profound Medical Inc
Alex Chung, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Imaging evaluation of the living kidney donor involves detailed evaluation of vascular anatomic information for surgical planning via CT Angiogram (CTA) or MR angiogram (MRA).Evaluation of renal allograft in the early posttransplant period involves evaluating for allograft size, collecting system dilation, periallograft fluid collection, signs of rejection and vascular flow via ultrasound, CT, MRI and nuclear medicine scintigraphy.Core needle biopsy of the transplanted kidney help determine the etiology of graft dysfunction when clinical evaluation and noninvasive diagnostic tests are nonspecific and commonly is performed to distinguish ATN from acute rejection and nephritis.Investigational MRI techniques that can eventually applied in post-transplant renal imaging include blood oxygenation level-dependent (BOLD) imaging, diffusion weighted imaging (DWI), diffusion tensor imaging (DTI), ferumoxytol enhanced MRA, Inflow Inversion Recovery, Arterial spin labeling, Phase contrast MRI, T1 relaxometry, MR Elastography and Magnetization Transfer Imaging.

**TABLE OF CONTENTS/OUTLINE**

1. Imaging evaluation of living kidney donor.1a. CTA evaluation.1b. MRA evaluation.2. Imaging evaluation in early post-transplant period.2a. US evaluation2b. CT evaluation.2c. MRI evaluation2d. Scintigraphy evaluation.3. Core needle biopsy of the transplanted kidney: Indication, technique and complications.4. Investigational MRI techniques.

## GUEE-18 ROLE OF IMAGING IN MANAGING SURGICAL BED COMPLICATIONS AFTER PROSTATECTOMY

**Awards**
**Cum Laude**

Bohyun Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Adam T. Froemming, MD (*Abstract Co-Author*) Nothing to Disclose
Ashish R. Khandelwal, MD (*Abstract Co-Author*) Nothing to Disclose
Garima Suman, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Imaging is increasingly being utilized to evaluate post-prostatectomy complications and guide treatment decisions. These include early complications, such as infection, hematoma, urine leak; and late complications, such as anastomotic strictures, urinary fistula, lymphocele. 2. MRI has become the gold standard for detection and characterization of urosymphyseal fistula due to high failure rate and complications associated with cystoscopy. 3. Incorporating Dynamic Voiding MRI enhances insights into urethral adhesions, mobility, strictures and improves detection of urinary fistula. 4. MRI enables precise characterization of the fistula defect relative to the urinary sphincter complex and rectum, that are critical considerations for surgical planning.

**TABLE OF CONTENTS/OUTLINE**

1. Case-based review of surgical bed complications and spectrum of imaging findings, including : a) Urethral stricture; b) Urosymphyseal fistula; c) Rectourethral fistula; d) urine leak ; e)Soft tissue and osseous infections such as myositis and osteomyelitis 2. MRI protocol including Dynamic Voiding sequences for urethral strictures and fistula post-prostatectomy. 3. Role of CT angiography for presurgical vascular assessment and CT-guided bone biopsy for antimicrobial management prior to urethral reconstructive surgery. 4. How do MRI findings correlate with cystoscopy and influence surgical decision-making in urethral strictures and fistula (conservative management vs urethral reconstruction vs pelvic exenteration). 5. Limitations and pitfalls in MR interpretation, such as urethral recess mimicking fistula, infected urinoma mimicking recurrent cancer, and reactive osteitis resembling osteomyelitis.

## GUEE-19 DEMYSTIFYING THE CONGENITAL, ACUTE, CHRONIC, AND NEOPLASTIC MANIFESTATIONS OF THE BLADDER. WHAT A GENERAL RADIOLOGIST NEEDS TO KNOW

Eduardo J. Matta, MD (*Abstract Co-Author*) Nothing to Disclose
Akilan Gopal, MD (*Abstract Co-Author*) Nothing to Disclose
Kaustubh Shiralkar, MD (*Abstract Co-Author*) Nothing to Disclose
Steven S. Chua, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan Molina, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Outline the most common bladder pathologies in both the adult and pediatric population. Delineate bladder pathologies into four broad categories: congenital, acute non-neoplastic acquired, chronic non-neoplastic acquired, and neoplastic. List the common pathologies within each category, provide imaging correlates for each pathology, recognize the salient imaging features including more complex topics including the urachal abnormalities and malignancy.

**TABLE OF CONTENTS/OUTLINE**

The bladder is often underemphasized in radiology training and can be a confusing organ . In this exhibit, we aim to demystify the myriad of bladder pathologies. We provide a flowchart separating bladder pathologies into four broad categories: congenital, acute, chronic, and neoplastic and highlight the salient imaging features to improve diagnostic acumen of trainees and the general radiologists and facilitate optimal treatment to improve the outcome of patients. Congenital pathologies described will include posterior urethral valves, prune belly syndrome, cloaca, exstrophy of the bladder, urachal abnormalities, reflux, and ureterocele. Acute pathologies will detail rupture (intraperitoneal, extraperitoneal), cystitis, and bladder stones. Chronic pathologies will involve bladder outlet obstruction, bladder diverticulum, and fistulization from chronic inflammatory conditions. Neoplastic pathologies will describe urothelial cell carcinoma, transitional cell carcinoma adenocarcinoma, squamous cell carcinoma, and metastases.

## GUEE-2 BEYOND THE FILTER: A COMPREHENSIVE EXPLORATION OF ADULT RENAL TUMOR DIVERSITY

Eugenio A. Leite, MD (*Abstract Co-Author*) Nothing to Disclose
Henzo Ota, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Gabriela Cintra Borba (*Abstract Co-Author*) Nothing to Disclose
Victor D. Nishimura, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas P. Caldas, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Mario Porfirio Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna P. De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Vieira Dos Santos (*Abstract Co-Author*) Nothing to Disclose
Rodrigo V. Negri, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Magna, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Rossi Corregliano, MD (*Abstract Co-Author*) Nothing to Disclose
Ligia C. Germek, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Abdo De Almeida (*Abstract Co-Author*) Nothing to Disclose
Joao Pedro C. Lino, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Renal cell carcinoma is the most common kidney cancer, with various subtypes presenting distinct imaging characteristics. Clear cell RCC appears as a hypervascular mass with ‘halo’ on contrast-enchanced CT/MRI. Papillary RCC exhibits heterogeneous enhancement with cystic components. Chromophobe RCC presents as a hypovascular mass with peripheral enhancement. Collecting duct carcinoma is agressive, showing infiltrative growth and low attenuation. Multilocular cystic neoplasm of a low malignant potential is a benign tumor with multilocular cysts and thin septa. Sarcomatoid RCC is agressive, often with hemorrhage or necrosis. Unclassified RCC requires detailed histopathological evaluation. Other renal tumors include angiomyolipoma with macroscopic fat, oncocytoma with central scarring, and rare primary renal lymphoma. Renal metastases show variable characteristis. Transitional cell carcinoma appears as a filling defect. Retroperitoneal tumors include liposarcoma, pleomorphic sarcoma and leiomyosarcoma. Renal pseudotumors, like xantogranulomatous pyelonephritis, mimic tumors on imaging, requiring differentiation.

**TABLE OF CONTENTS/OUTLINE**

Renal cell carcinoma Subtypes
- Clear cell RCC
- Papillary RCC
- Chromophobe RCC
- Collecting duct (Bellini)
- Multilocular cystic neoplasm of low malignant potential
- Sarcomatoid RCC
- Unclassified RCC Others renal tumors
- Angiomyolipoma
- Oncocytoma

- Renal lymphoma
- Renal metastasis Direct extension of neighboring tumors
- Transitional cell carcinoma / Urothelial cancer
- Retroperitoneal tumors Pseudotumors
- Xanthogranulomatous pyelonephritis

## GUEE-20 RETROPERITONEAL INFECTIONS: ANATOMY, PATHOGENESIS, SPREAD, IMAGING FEATURES AND IMPACT ON MANAGEMENT

**Awards**
**Certificate of Merit**

Corey T. Jensen, MD (*Abstract Co-Author*) Research Grant, General Electric Company
Muhammad O. Awiwi, MD (*Abstract Co-Author*) Nothing to Disclose
James M. Jing, MD (*Abstract Co-Author*) Nothing to Disclose
Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To review the anatomy of the retroperitoneum. - To illustrate the pathways of disease spread in the retroperitoneal spaces. -To localize and describe the spectrum of imaging appearances of various retroperitoeneal infections - To discuss the impact of imaging findings on management.

### TABLE OF CONTENTS/OUTLINE

- Introduction - Pathophysiology and pathways of disease spread - Relevant clinical picture - Correlation of findings on imaging with anatomical background, locatization based on the primary disease process - Review of a spectrum of imaging findings with pathologic correlation (including pancreatic abscesses, duodonal perforation, duodenal diverticulitis, colon perforation into the retroperitoneum, different types of pyelonephritis, adrenal infections, puerperal septic thrombophlebitis, mycotic aortic aneurysm, retroperitoneal abscesses related to Pott's disease or osteomyelitis/spondylodiscitis, and hematogenously disseminated infections such as hydatid/echinococcal cyst, tuberculosis, histoplasmosis, coccidiomycosis, cat scratch disease, and disseminated Mucor). - Differential diagnoses - Mimics and clues to correct diagnosis - Impact of imaging features on management options

## GUEE-21 KIDNEY TRANSPLANT COMPLICATIONS

Terri A. Williams-Weekes, MD (*Abstract Co-Author*) Nothing to Disclose
Rita Maria Lahoud, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Dippre, MD (*Abstract Co-Author*) Nothing to Disclose
Hillary Bui, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand the modalities used to evaluate renal transplants.Understand typically seen anatomy and ultrasound findings for renal transplants.Understand the timeline of expected non-infectious renal transplant complications.Understand expected imaging findings for common renal transplant complications.

### TABLE OF CONTENTS/OUTLINE

1. Renal Transplant Anatomy2. Modalities for Assessment of Renal Transplant3. Normal Renal Transplant Imaging Findings4. Timeline of Expected Non-Infectious Complications5. Early Complications (Pseudoaneurysm, Hematoma, Renal Artery Thrombosis)6. Intermediate Complications (Ureteral Stricture, Renal Calculi, Renal Artery Stenosis)7. Late Complications (PTLD, Abdominal/Pelvic Complications)8. Anytime Post Transplantation Complications (Abscess, Post-Biopsy AV Fistula)

## GUEE-22 NEPHRON-SPARING TECHNIQUES IN THE TREATMENT OF SMALL RENAL MASSES: A PRIMER FOR RADIOLOGISTS

Amr Kalander, MD (*Abstract Co-Author*) Nothing to Disclose
Joao S. Pais, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Menezes, MD (*Abstract Co-Author*) Nothing to Disclose
Regis Otaviano Bezerra, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Vivas Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Sousa Santana De Paula (*Abstract Co-Author*) Nothing to Disclose
Guilherme L. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor Nascimento, MD (*Abstract Co-Author*) Nothing to Disclose
Jose G. Maluf, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Understand key concepts about small renal masses and their potential treatment options; • Learn about the main indications of partial nephrectomy and thermal ablation in that context; • Understand the tumor characteristics that influence their management and treatment; • Recognize expected imaging features related to each kind of treatment; • Identify unexpected imaging findings and the main complications of these procedures, highlighting pearls and pitfalls for this assessment.

### TABLE OF CONTENTS/OUTLINE

• Introduction - General concepts about small renal masses and their different approaches o Current context and definitions o Treatment options o Partial nephrectomy o Thermal ablation o Active surveillance o Indications and contraindications o Advantages and disadvantages • Imaging features o Partial nephrectomy o Pre-procedural planning o Post-procedural imaging features o Thermal ablation o Pre-procedural planning o Post-procedural imaging features • Case- based review, with pearls and pitfalls o Complications related to partial nephrectomy o Complications related to thermal ablation • Future perspectives • Conclusions and key takeaways

## GUEE-23 DON'T PANIC, IT'S JUST A PEEK: A COMPREHENSIVE LOOK AT MALE URETHRAL IMAGING

LOUISE FATIMA GOMES DE ALMEIDA (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose

Eleonora Silva (*Abstract Co-Author*) Nothing to Disclose
Andre Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Daniella Braz Parente (*Abstract Co-Author*) Nothing to Disclose
Luana Alves, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Compare Conventional Voiding Cystourethrography (VCUG) Retrograde Urethrography (RUG) vs. Magnetic Resonance Urethrography (MRU) to evaluate the male urethra.- Review the step-by-step procedures for each imaging method.- Analyze the advantages and limitations of VCUG/RUG and MRU.- Recognize key findings in urethral images for each technique.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: Understanding the Urethra- Briefly explore anatomy, urination function, and common issues (strictures, injuries, infections).2. Imaging TechniquesA) Fluoroscopic Techniques: 1. VCUG:- Protocol: Step-by-step explanation of the VCUG procedure.- Patient Preparation: Instructions for patients before undergoing VCUG.2. RUG:- Protocol- Patient PreparationB) MRU- Protocol- Patient PreparationC) Comparison among Urethral Imaging: strengths and weaknesses of each techniqueD) Overcoming Difficulties Addressing challenges associated with each imaging method and solutions for optimal results.3. Choosing Wisely
- Visualization strengths (VCUG/RUG vs. MRU)
- Radiation exposure (VCUG/RUG vs. MRU)
- Cost
- Patient comfort4. Interpreting the Images
- Key Findings Pitfalls Recognize crucial details and avoid misinterpretations.
- Surgical Considerations Ensure imaging reports provide what surgeons need.5. Common Urethral Surgeries brief descriptions of procedures like urethroplasty for strictures.6. Interactive Case Studies solidify image interpretation skills.7. Conclusions summary of key points and the importance of accurate urethral imaging for diagnosis and treatment planning.

## GUEE-24 DEVELOPMENT OF A DEEP PELVIC ENDOMETRIOSIS REPORTING AND DATA SYSTEM (ENDO-RADS) USING MRI

Vlad V. Simianu, MD (*Abstract Co-Author*) Nothing to Disclose
Megan Loring (*Abstract Co-Author*) Nothing to Disclose
Achille Mileto, MD (*Abstract Co-Author*) Consultant, Bayer AG
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Karisma Gupta, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

We developed and herein present a Reporting and Data System for deep pelvic endometriosis (Endo-RADS). Endo-RADS is a scoring system determined by appearance and MRI signal characteristics of endometriotic lesions (lesion type) and location in the deep pelvis. The greater the Endo-RADS cumulative score, the higher the stage of deep pelvic endometriosis. While Endo-RADS is based on MRI findings, it also takes into account prior demonstration of deep pelvic endometriosis by laparoscopy or ultrasound. Endo-RADS can provide simplified and standardized terminology to solve complex narrative endometriosis reports.Learning Objectives:- To discuss shortcomings of previously proposed classifications for deep pelvic endometriosis.- To illustrate currently unmet needs and limitations of reporting systems for deep pelvic endometriosis.- To introduce Endo-RADS (Endometriosis Reporting and Data System).- To showcase how Endo-RADS scores are assigned based on MRI signal characteristics and location of the lesions.

**TABLE OF CONTENTS/OUTLINE**

- To review epidemiology, clinical significance, and morbidity of deep pelvic endometriosis.- To highlight commonly encountered imaging findings of deep pelvic endometriosis at MRI.- To introduce the Endo-RADS scoring system.- To discuss anticipated imitations of Endo-RADS.- To illustrate future directions for Endo-RADS.

## GUEE-25 ADNEXAL AGONY: A DIAGNOSTIC ODYSSEY IN EMERGENCY SCENARIOS

Guillermo P. Sangster, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Strobel, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Previgliano, MD (*Abstract Co-Author*) Nothing to Disclose
Meghna Chadha, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Marrero-Castillo (*Abstract Co-Author*) Nothing to Disclose
Carolina Soto-Davila, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review the acute clinical presentation of various adnexal disorders and subsequent abdominal complications.2. Describe the multi-modality imaging findings of adnexal emergencies such as ovarian torsion, massive ovarian edema (MOE), isolated fallopian tube torsion, rupture of cystic teratoma, and rupture of endometrioma.3. Review clinicopathologic follow-up to establish a final diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. To outline common and uncommon acute pathologies of the adnexa.2. To depict typical and atypical imaging appearances on ultrasound (US), computed tomography (CT), and magnetic resonance (MRI) exams.3. To discuss the most relevant differential diagnosis.Due to ambiguous and overlapping physical and laboratory findings, early and accurate diagnosis of acute adnexal pathology will help initiate appropriate management and fertility preservation. This educational exhibit will aid the radiologist in accurately and timely diagnose adnexal findings.

## GUEE-26 SYSTEMIC STAGING AND RESTAGING ON TESTICULAR CANCER: WHAT RADIOLOGIST SHOULD KNOW

Gustavo C. Lemos, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Willy Baccaglini, MD (*Abstract Co-Author*) Nothing to Disclose
Arie Carneiro, MD (*Abstract Co-Author*) Nothing to Disclose
Nadjaneyre Casimiro, MD (*Abstract Co-Author*) Nothing to Disclose
Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Oren Smaletz, MD (*Abstract Co-Author*) Stockholder: AstraZeneca, GlaxoSmithKline, ; Novartis, Roche and Sanofi;Speaker Bureau: AstraZeneca Astellas Pharma;Research Funding: Janssen, Bristol-Myers Squibb;
Fernando M. Coelho, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

. Briefly review testicular tumor management. Describe sites of lymphatic and hematogenous cancer spread. Discuss the role of imaging in staging and restaging testicular cancer. Demonstrate didactic cases of testicular cancer through cross-sectional imaging

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION- Testicular cancer epidemiology- General concepts of the role of imaging in staging and restagingTESTICULAR CANCER MANAGEMENT - Overview based on main guidelines- Role of imaging on systemic oncological assessmentTESTICULAR CANCER SPREAD ROUTES- Lymphatic- HematogenicIMAGING ASSESSMENT Staging- Lymph nodes- Distant metastasesRestaging - Residual disease after first-line chemotherapy (seminoma vs. non-seminoma)- Teratoma challenge on non-seminoma neoplasm- Role of PET/CT- Imaging findings after surgical managementDIDACTIC CASE-BASED REVIEW

## GUEE-27 PI-QUAL SCORE: A CASE-BASED USER GUIDE FOR OBJECTIVE ASSESSMENT OF PROSTATE MRI IMAGE QUALITY

Khyrul A. Khan (*Abstract Co-Author*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Raphael Lanz (*Abstract Co-Author*) Nothing to Disclose
Andres Hernandez (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The Prostate Imaging Quality (PI-QUAL) scoring system has been increasingly adopted for the objective assessment and reporting of prostate MRI image quality. PI-QUAL consists of scores ranging from 1 to 5 based on technical parameters and the visual assessment of prostate MRI, with higher scores denoting superior imaging quality and enhanced diagnostic certainty. However, many radiologists are still unfamiliar with the PI-QUAL scoring system, which hinders its integration into prostate MRI reports, especially at non-academic centers. This exhibit provides a case-based user guide to facilitate the understanding of key rules of the PI-QUAL scoring system, to promote its widespread adoption into practice.

**TABLE OF CONTENTS/OUTLINE**

1. Why should you include the PI-QUAL scoring system in your report? 2. Main components of the PI-QUAL scoring system: a. Technical parameters b. Visual assessment c. How is image quality scored? 3. A Case-Based User Guide: a. PI-QUAL Score 1 b. PI-QUAL Score 2 c. PI-QUAL Score 3 d. PI-QUAL Score 4 e. PI-QUAL Score 5 4. Test your knowledge! a. Case 1 b. Case 2

## GUEE-28 APPLICATIONS OF DECT IN RENAL IMAGING

Pablo G. Verdu, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Puig (*Abstract Co-Author*) Nothing to Disclose
Polina Rudenko, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Monton Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Santos Blasco, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Fontenla Martinez (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Describe the basic physical principles of DECT.- Explain the post-processed DECT maps.- Exhibit the main applications of DECT in renal imaging.

**TABLE OF CONTENTS/OUTLINE**

Imaging is key in the diagnosis of urological pathology, from incidental neoplasms to acute renal colic or hematuria. The introduction of dual-energy computed tomography (DECT) has significantly expanded diagnostic possibilities in radiology, impacting the field of urology as well.While conventional CT provides limited information by overlaying all data into a single CT sequence, DETC enables the analysis of the continuous energy spectrum of X-rays. This facilitates better tissue characterization through the analysis of the post-processing maps.Imaging Findings 1. Focal Lesions: Differentiate between cystic and solid lesions and guide the histological subtype and aggressiveness.2. Renal Vascularization: Better vascular evaluation prior to treatment procedures and distinguish tumor thrombus from soft thrombus.3. Follow-up of Treated Lesions: Distinguish between post-treatment intralesional changes and residual tumor after percutaneous treatments.4. Inflammatory Diseases: Detection of inflamed kidney foci in acute pyelonephritis.5. Lithiasis: Characterization lithiasis composition. 6. Staging: Low energy monoenergetic maps facilitate the detection of metastases, whether hyper- or hypovascular, due to increased contrast between structures.Conclusion:DECT offers multiple advantages in renal imaging, from lesion characterization to vascular evaluation and treatment monitoring. Knowing their applications is crucial for its effective application in daily practice.

## GUEE-29 CYSTIC GENITOURINARY LESIONS IN THE PELVIS: PEARLS AND PITFALLS

Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahdi Hamade (*Abstract Co-Author*) Nothing to Disclose
Rachita Khot, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Cary L. Siegel, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph E. Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
David H. Ballard, MD (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Cystic lesions in the male and female pelvis have a wide differential. This exhibit will present cystic lesions of the lower genitourinary (GU) tract along with their mimics and highlight important pearls and pitfalls. The focus of this exhibit will be on the bladder, urethra, and deep pelvis excluding adnexal lesions given existing imaging guidelines. The goal of this exhibit is to: (1) Provide a detailed review of cystic lesions of the bladder and urethra; (2) Showcase variable etiologies of periurethral cystic lesions in the female pelvis, including uterine, cervical, vaginal, and vulvar lesions, with an algorithmic approach to differential considerations; (3) Present variable cystic lesions in the male pelvis with focus on genitourinary lesions

**TABLE OF CONTENTS/OUTLINE**

A. Cystic lesions of the bladder and urethra: Diverticula Urachal abnormalities Infectious lesions Mimics and less common lesions (simple cyst, Brunn’s cyst, cloacal cyst, everted ureterocele, cystitis cystica, obturator hernia, implantable devices and injectables) B. Cystic lesions in the female pelvis: Uterine and cervical origin lesions: endosalpingiosis, cystic fibroids, adenomyomas, Nabothian cysts, tunnel cluster, cervicitis, adenoma malignum,

endocervicosis. Vaginal lesions: Gartner's duct cyst, vaginal cuff cyst, inclusion cysts. Vulvar and perineal lesions: Bartholin gland cyst or abscess, Skene duct cyst, canal of Nuck cyst. C. Cystic lesions in the male pelvis Utricle cyst Mullerian duct cyst Seminal vesicle cyst Ejaculatory duct cyst Cowper duct syringocele Mimics and other lesions (cystic BPH nodules, prostate retention cysts, hindgut cyst, angiomyxoma)

## GUEE-3 DISEASES WITH THORACIC AND GENITOURINARY INVOLVEMENT: A REVIEW FOR THE GENERAL RADIOLOGIST

Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Macedo, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Paulo T. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Carolina Bueno da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Docema, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Various pathologies can affect thoracic organs and the genitourinary system. Syndromes like Birt-Hogg-Dubé and tuberous sclerosis, with characteristic pulmonary changes, can predispose to renal lesions, including carcinomas.Granulomatous diseases such as tuberculosis have primary pulmonary forms, but can also involve genitourinary organs, including the kidneys, adrenals, seminal vesicles and testes.Similarly, various pulmonary neoplasms can metastasize to the genitourinary system, with adrenal involvement, for example. Lungs are also a common site for renal metastases, among others.Thus, the general radiologist who interprets chest and abdomen exams may encounter conditions that affect both systems, and knowing how to recognize them is crucial for reaching the correct diagnosis and recommending additional tests if necessary.The aim of this pictorial essay is to review the main pathologies with thoracic and genitourinary involvement, familiarizing the general radiologist who might encounter them in their daily work.

### TABLE OF CONTENTS/OUTLINE

A literature review was conducted under the guidance of radiologists specialized in thoracic and genitourinary imaging.Pathologies involving both the pulmonary and genitourinary systems were included, covering conditions affecting the lungs, kidneys, adrenals, bladder, prostate, testicles and vascular structures.

## GUEE-30 RETROPERITONEUM AND PELVIC EXTRAPERITONEUM: ANATOMIC LANDMARKS, IMAGING FEATURES, AND PATTERNS OF DISEASE SPREAD

Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jennifer Sammon, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Mohamed Badawy, MD (*Abstract Co-Author*) Nothing to Disclose
Maged Algazzar, MD (*Abstract Co-Author*) Nothing to Disclose
Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Peter S. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Kazi A. Irfan, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review anatomy and anatomic landmarks of retroperitoneal (RP) and pelvic extraperitoneal spaces2. Illustrate the intercommunications among different spaces and their impact on spread of related diseases3. Discuss imaging workup and imaging features of different pathologic entities and pathways of disease spread4. Provide algorithmic approach to differential considerations5. Highlight management options

### TABLE OF CONTENTS/OUTLINE

1- Introduction2- Anatomy of retroperitoneal (RP) and pelvic extraperitoneal spaces with diagrammatic illustrations3- Differentiation of intraperitoneal from extraperitoneal pathology4- Imaging features of different pathologic entities including, extraluminal gas, fluid collections, and masses5- Pathways of disease spread6. Case presentation6- Algorithmic approach to differential considerations7- Summary and conclusion

## GUEE-31 THE CHALLENGES IN THE DETECTION AND DIAGNOSIS OF TRANSITIONAL CELL CARCINOMA OF THE KIDNEY: HOW TO OPTIMIZE LESION DETECTION

Elliot K. Fishman, MD (*Presenter*) Co-founder, HipGraphics, Inc Stockholder, HipGraphics, Inc Institutional Grant support, Siemens AG Institutional Grant support, General Electric Company Consultant, Exact Sciences Corporation Consultant, Imaging Endpoints II LLC

### TEACHING POINTS

1. Transitional Cell Carcinoma of the kidney is often a challenging diagnosis because lesions are often small and can mimic otherPathologies2. Detection of Transitional Cell Carcinoma of the kidney is dependent on proper scan protocols as well as scan display (MPR, MIP, VRT)3.Transitional Cell Carcinoma of the kidney have a range of CT appearances from infiltration of a calycx, to infiltration of the kidney, to focal fillingdefects to calyceal amputation4. Transitional Cell Carcinoma of the kidney can also be confused with other renal tumors as well as renal inflammatoryDisease5. early detection is critical for outcome and attention to spread of disease including multifocal disease will be addressed

### TABLE OF CONTENTS/OUTLINE

1. Demographics of Transitional Cell Carcinoma of the kidney including staging2. scan protocols and display protocols for the detection of Transitional Cell Carcinoma of the kidney3. case studies showing the various appearances of Transitional Cell Carcinoma of thekidney including infiltrative form (focal or diffuse), focal masses in the renal pelvis, and mass like appearance4. case studies illustrating the pitfalls in the diagnosis of Transitional Cell Carcinoma of the kidney including both neoplastic and inflammatory mimickers.5. pearls and pitfalls in the diagnosis of Transitional Cell Carcinoma of the kidney will be addressed with case examples

## GUEE-33 MRI FOR PENILE TRAUMA AND TUMORS: WHAT THE RADIOLOGIST SHOULD KNOW

Diana Murcia, MD (*Abstract Co-Author*) Nothing to Disclose
Noor Fatima Majeed, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

MRI is increasingly being used for evaluation of penile conditions, including post-traumatic and neoplastic etiologies. Previously used as a problem-solving tool in patients who had undergone ultrasound for penile trauma or neoplasm, it is now increasingly being used as a primary modality for evaluation of these conditions and is a useful adjunct to physical examination. With its excellent contrast resolution, MRI can be used evaluate the integrity of the tunica albuginea, urethra, and vasculature and thereby differentiate a contusion from a fracture, helping direct management (surgical versus non-surgical). It can also be used for accurate tumor staging - including assessment of local extent, nodal and distant metastatic disease - and for surveillance following resection.

**TABLE OF CONTENTS/OUTLINE**

Review of penile anatomyPenile MRI protocol, including protocol challengesCase-based review of penile trauma on MRIPenile cancer types and staging of penile squamous cell carcinomaCase-based review of penile cancer stages on MRIPostoperative appearance following penectomy (partial/total), including tumor recurrence

## GUEE-34 VARIANTS OF UTERINE FIBROIDS: LET'S TALK ABOUT THEM

Silvia E. Gimenez, MS (*Abstract Co-Author*) Nothing to Disclose
Teresa A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Saez, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Toscano, MD (*Abstract Co-Author*) Nothing to Disclose
MARIA BELEN DASS CORREA (*Abstract Co-Author*) Nothing to Disclose
Maria N. Napoli, MD (*Abstract Co-Author*) Nothing to Disclose
Leonela Panaccio (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Leiomyomas are the most common gynecological neoplasm.- Uterine leiomyomas and leiomyosarcomas are the two extremes within smooth muscle tumors, with diverse histological variants in the middle, including cellular histology, bizarre or atypical nuclei, mitotically active fibroids, and uterine smooth muscle tumor (STUM) lesions.- These variants present a distinctive histological profile and the characteristics may generate uncertainty in diagnostic interpretation.- There are no clear significant findings that can reliably distinguish fibroid variants, however there are some characteristics suggestive of non-typical or ordinary leiomyomas.- It´s essential for the radiologist to be aware of both the typical and atypical findings to best guide for diagnosis and management decisions- The definitive diagnosis of a leiomyoma variant is through post-surgical pathological examination.

**TABLE OF CONTENTS/OUTLINE**

- Comprehensive description in imaging findings of leiomyoma variants and their pathologic features.- Comparative analysis of the features of uterine leiomyomas in ultrasound and magnetic resonance imaging that may be suggestive of one of the variants.- Demonstrate the significance of imaging findings in facilitating early detection, informing treatment strategies, and guiding patient monitoring for individuals affected by uterine leiomyomas.- Exemplify with cases.

## GUEE-35 COMPREHENSIVE IMAGING AND DIAGNOSTIC APPROACH TO UPPER TRACT UROTHELIAL CANCERS: INSTITUTIONAL INSIGHTS AND CLINICAL IMPLICATIONS

Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Sravani Gampala, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Understand the distribution of upper tract urothelial cancers (UTUC) and their most common locations and presentations.2. Explore various clinical scenarios to raise the possibility of UTUC by interpreting radiologists.3. Discuss the best imaging modalities and optimal protocols for the diagnoses of UTUC based on our institutional experience.4. Recognize papillary, flat and infiltrative types and sub-types of the UTUC with relevant imaging from our institution. Differentiate tumors from pseudo tumors based on imaging to appropriately guide clinical management.5. Discuss the sequential involvement of UTUC and bladder cancer; educate trainees to carefully evaluate the urinary tract and bladder if they find any one of the cancers.

**TABLE OF CONTENTS/OUTLINE**

1. Discuss the epidemiology, risk factors, and clinical presentation of the UTUC.2. Explore the distribution and association with concomitant or recurrent bladder cancer and contralateral urinary tract cancer.3. Discuss the optimal imaging protocols will be outlined in general and used at our institution for better evaluation of tumors from pseudo tumors.4. Present a case-based review of different types of UTUCs, including papillary, flat, and infiltrative types. Present a unique case of histologically different but synchronous UTUC involving the renal pelvis and ureter.5. Discuss various differential diagnoses, which mimic UTUC including blood clots, hypertrophied papilla, renal papillary necrosis (ball on tee sign), inflammation, retroperitoneal fibrosis, renal cell carcinomas, and renal lymphomas. Review of different imaging findings will be presentedusing a multimodality case-based approach.

## GUEE-36 POST-ABLATION IMAGING CHANGES ON PROSTATE CANCER AND PI-FAB SCORE SYSTEM: CASE-BASED REVIEW

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gustavo C. Lemos, MD (*Abstract Co-Author*) Nothing to Disclose
Ivan Duarte (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo G. Garcia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Guilherme C. Mariotti, MD (*Abstract Co-Author*) Nothing to Disclose
Arie Carneiro, MD (*Abstract Co-Author*) Nothing to Disclose
Aline Pasquarelli, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Briefly review the prostate cancer focal treatment options.- Understand the current indications of high-intensity focused ultrasound (HIFU) and irreversible electroporation (IRE) and its technique procedures.- Review the prostate multiparametric MR imaging technique and zonal anatomy of the prostate.- Discuss the expected and unexpected post-ablation MR imaging findings.- Recognize the importance of DCE and DWI MRI sequences to detect prostate cancer recurrence afterablation.- Comprehend the new proposal PI-FAB score system and its role in patient follow-up.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION

● Overview of prostate cancer and focal therapy options
● New guidelines for HIFU for prostate cancer
HIFU AND IRE FOR PROSTATE CANCER
● What: Current concepts
● When: Potential candidates
● Where: Procedure description
● How: Tissue effects and limitations
PROSTATE IMAGING EVALUATION
● MRI protocol
● Prostate zonal anatomy at MRI
● The new scoring system for focal ablation (PI-FAB)
○ General concepts and rationale for using PI-FAB score system
○ When and how apply PI-FAB score system, correlating didactic cases.
○ Clinical management based on PI-FAB score
CASE-BASED REVIEW
● Expect and unexpected post-ablation MRI findings
● Normal temporal changes
● Residual or recurrent prostate cancer
● Pitfalls

## GUEE-37 CRACKING THE CYSTS: MASTERING THE V2019 BOSNIAK CLASSIFICATION WITH A QUIZ-BASED APPROACH

Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Khyrul A. Khan (*Abstract Co-Author*) Nothing to Disclose
Ifeanyi Ekpunobi, BS (*Abstract Co-Author*) Nothing to Disclose
Andres Hernandez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Bosniak Classification v2019 provides a framework for classifying cystic lesions based on their complexity and likelihood of malignancy, with Bosniak classifications ranging from I to IV. Examination questions regarding focal renal lesions is a recurrent theme in medical training, such as in the US Medical Licensing Examination (USMLE). However, students often lack sufficient exposure to the principles of renal cyst imaging throughout their training. This exhibit aims to enhance the training of medical students and radiology residents by offering a quiz-based approach to the Bosniak Classification system in the form of a question bank, a popular exam preparation tool used by medical trainees.

### TABLE OF CONTENTS/OUTLINE

1. Main components of the Bosniak Classification system a. Separate CT and MRI criteria in the Bosniak Classification v2019 b. Overview of Bosniak classes I through IV 2. Cracking the cysts questions: translating imaging features into simple language for trainees a. Bosniak classification of a small, well-defined cystic lesion with no septa or calcifications i. Q1: Bosniak class I criteria ii. Q2: Follow-up for Bosniak I b. Bosniak classification of a small, well-defined cystic lesion with thin, non-enhancing septa i. Q3: Bosniak class II criteria ii. Q4: Follow-up for Bosniak II c. Bosniak classification of a cystic lesion with a minimally thickened enhancing wall i. Q5: Bosniak class IIF criteria ii. Q6: Follow-up for Bosniak IIF d. Bosniak classification of a cystic lesion with enhancing thick septa i. Q7: Bosniak class III criteria ii. Q8: Follow-up for Bosniak III e. Bosniak classification of a cystic lesion with enhancing nodules i. Q9: Bosniak class IV criteria ii. Q10: Follow-up for Bosniak IV

## GUEE-38 RADIOLOGIST ROLE IN MR GUIDED FOCAL LASER ABLATION FOR LOCALIZED PROSTATE CANCER: LESSONS LEARNED AND ADVANCEMENTS IN PATIENT CARE

Sangeet Ghai, MD (*Abstract Co-Author*) Research Grant, INSIGHTEC Ltd
Nathan Perlis (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Basso Dias, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Abreu Gomez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Radiologist leadership enhances Focal Laser Ablation (FLA) performance and promotes procedure standardization through a systematic approach focused on safety and technical consistency.- MRI guidance enables precise lesion localization enhancing delineation of lesion boundaries and facilitating the planning of ablation volumes. Real-time MRI thermal monitoring facilitates intra-procedural optimization of ablation temperatures and treatment margins.- FLA is acknowledged as a safe and efficient method for executing targeted therapy, controlling disease target while preserving healthy prostatic tissue and reducing the likelihood of adverse effects.- Patient related factors such as motion or anatomical distortion resulting from the insertion and repositioning of the treatment device may hinder the achievement of a successful ablation.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Benefits and Constraints of MRI Guidance3. MRI-Guided Focal Laser Ablation (FLA) Technique4. Essential Components for MRI-Guided FLA4.1 Personnel Requirements4.2 Scheduling and Duration of Procedure4.3 Patient Preparation4.4 Necessary Equipment4.5 Patient Positioning and Anesthesia Protocol5. Intraprocedural steps5.1 Insertion of Laser Fiber5.2 Baseline Position Verification with MRI5.3 Lesion Identification5.4 Positioning and Advancement of Laser Fiber - verification of lesion localization5.5 Intraprocedural Monitoring - MR Thermography and Verification of Ablated Margins5.6 Patient Recovery6. Complex Cases and Insights6.1 Learning Curve and Motion-related Challenges6.2 Prostate Distortion6.3 Complex Target Locations7. Radiologist Leadership and standardization8. Take home messages

## GUEE-39 UROLOGIC APPLICATIONS OF DUAL-ENERGY CT: WHAT THE RADIOLOGIST AND UROLOGIST NEED TO KNOW

Isao Tanaka (*Abstract Co-Author*) Nothing to Disclose
Rika Fukui (*Abstract Co-Author*) Nothing to Disclose
Etsuko Tate, MD (*Abstract Co-Author*) Nothing to Disclose
Hidenori Yamaguchi (*Abstract Co-Author*) Nothing to Disclose
Yuta Hirose, MSc (*Abstract Co-Author*) Nothing to Disclose
Yun Shen, PhD (*Abstract Co-Author*) Employee, General Electric CompanyResearcher, General Electric Company
Makiko Nishikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Haruhiko Machida, MD (*Abstract Co-Author*) Nothing to Disclose
Wakana Samejima (*Abstract Co-Author*) Nothing to Disclose
Hitoshi Takeuchi, MD (*Abstract Co-Author*) Nothing to Disclose

Toshiya Kariyasu (*Abstract Co-Author*) Nothing to Disclose
Shingo Harashima (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To introduce current limitations in urologic applications of single-energy CT (SECT) 2. To describe basic principles and various imaging/analyzing techniques of dual-energy CT (DECT) 3. To illustrate clinical utilities of DECT over SECT in urologic applications by presenting various clinical images

**TABLE OF CONTENTS/OUTLINE**

1. Current limitations in urologic applications of SECT a) Limited image quality assessment of urinary tumor/stone composition b) Greater radiation/contrast media (CM) dose 2. Basic principles imaging/analyzing techniques of DECT a) Virtual monochromatic (VMI)/material decomposition imaging (MDI) b) Spectral HU (keV-HU) curve/effective Z analysis c) Metallic artifact reduction software (MARS) d) Iterative (IR)/deep-learning reconstruction (DLR) 3. Clinical utilities of DECT over SECT in urologic applications a) Improved image contrast/reduced CM dose: low-keV VMI/IR/DLR b) Reduced beam-hardening/metallic artifact: high-keV VMI/MARS c) Differentiation of cystic solid masses (e.g., complicated cysts): iodine-enhanced MDI d) Assessment of tumor grade/viability/response to chemotherapy: iodine-enhanced MDI e) Virtual non-contrast CT/reduced radiation dose: iodine-suppressed MDI/IR/DLR f) Bone metastasis detection: hydroxyapatite/calcium-suppressed MDI g) Lipid-rich lesion (e.g., renal angiomyolipoma) detection: fat-enhanced MDI/spectral HU curve/effective Z analysis h) Urinary stone composition analysis: uric acid/calcium MDI effective Z analysis

## GUEE-4 WHICH KIDNEY TO EXTRACT, SECTIONAL CT OF LIVING RENAL DONORS. WE TELL YOU

**Awards**
**Certificate of Merit**

Carlos M. Campana SR, MD (*Abstract Co-Author*) Nothing to Disclose
Mary E. Arevalo Molina, MD (*Abstract Co-Author*) Nothing to Disclose
Omar A. Gamboa Abundis, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Kidney failure is a major health problem that affects approximately 7.2% of the world's population. There are multiple kidney replacement therapies; however, the only definitive one is kidney transplant, which offers a better quality of life. It is important for the resident physician and radiologist to develop a radiological reporting system with the necessary pre-surgical information for the surgeon and to specify the exclusion criteria for a probable kidney donor. The left kidney is preferred for donation due to the greater length of the renal vein. Presence of more than two arteries within a kidney exclude the donor. Unilateral agenesis, horseshoe kidney, cortical atrophy, polycystic kidney disease, medullary sponge kidney, and necrosis exclude the donor. A gonadal vein greater than 5mm in diameter should be reported as it alters the surgical technique.

**TABLE OF CONTENTS/OUTLINE**

1. Objectives and introduction to renal insufficiency. 2. Low-dose radiation protocol for tomographic acquisition of the potential donor. 3. Checklist of key points to consider in the radiological report of the living kidney donor. 4. Location and size of the kidneys. 5. Number of renal arteries and veins. 6. Type and diameter of accessory renal arteries. 7. Location and distance of the first segmental arterial bifurcation. 8. Type and diameter of renal veins. 9. Frequent and infrequent vascular anatomical variants. 10. Perinephric fat and urinary tract11. Exclusion criteria for living kidney donors. 11. Common pathology. 12. Development of a radiological reporting system with the necessary preoperative information. 13. Conclusion and teaching points

## GUEE-40 BLADDER INJURY: WHAT TO LOOK FOR AND HOW TO FIND IT

**Awards**
**Certificate of Merit**

Pablo Penalver Calero, MD (*Abstract Co-Author*) Nothing to Disclose
Ramiro Mendez (*Abstract Co-Author*) Nothing to Disclose
Jeronimo Barrera Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Manuel Espejo Dominguez (*Abstract Co-Author*) Nothing to Disclose
Sebastian M. Gill, MD (*Abstract Co-Author*) Nothing to Disclose
Alvaro Rueda-de-Eusebio, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-To review the techniques and protocols used for the study of bladder injury, emphasizing the correlation between different imaging modalities. - To explain the anatomical basis and mechanisms of injury that determine the different types of bladder rupture. - To illustrate the different existing classifications that can be used to describe bladder injury.

**TABLE OF CONTENTS/OUTLINE**

Introduction: Bladder perforation, rupture or trauma is the laceration of the bladder wall, whether full-thickness or incomplete. These can be very subtle injuries, which can be easily overlooked in the setting of trauma patients. If this happens, complications such as urinary tract infections, incontinence or fistulas may occur. Therefore, it is important for radiologists to be aware of this entity and the methods available for its study. Imaging techniques: In this presentation we explain the different imaging modalities that can be used when bladder injury is suspected. Not only conventional cystography and CT-cystography, but also covering US, non-contrast CT and MRI. We will explain protocols, advantages and disadvantages of each technique and provide details that, in our experience, make the difference. Mechanism of injury: We review the anatomy and the possible mechanisms of injury (spontaneous and traumatic, whether closed, penetrating or iatrogenic). Classifications: We will cover both Sandler and AAST classifications. Sandler's is the most used one and divides ruptures into intramural hematoma or contusion, intraperitoneal rupture, extraperitoneal rupture and intra- and extraperitoneal rupture. For all of the above, we will use representative images from our series of more than 50 cases.

## GUEE-41 DEMYSTIFYING MRI PENILE PROSTHESIS EVALUATION: INTRODUCTION FOR NOVICES

Noor Fatima Majeed, MD (*Abstract Co-Author*) Nothing to Disclose
Diana Murcia, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Penile prosthesis is the ultimate treatment for erectile dysfunction. Dedicated penile MR protocol is the imaging of choice for evaluation of penile prostheses as it allows a three-in-one assessment of position, functionality, and penile anatomy. The currently most common prostheses include the 3-piece inflatable penile prosthesis (IPP), followed by the 2-piece IPP, and the malleable or semi-rigid penile prosthesis (MPP). Complications of any type and any component include fracture, infection, malposition, hematoma, and encapsulation. Inflatable type specific complications include kinking or buckling resulting in floppy glans syndrome, aneurysmal dilatation, and leakage. Knowledge of penile MR anatomical structures is crucial for the appropriate diagnosis of these complications.

**TABLE OF CONTENTS/OUTLINE**

Penile MR protocol specific pre and post inflation sequences for IPP. Penile MR anatomy review. Types of penile prostheses: 2-piece Inflatable (IPP), 3-piece IPP, Malleable or semi rigid (MPP). Evaluation of anatomic location and functionality. Common complications.

## GUEE-42 VIRADS: OUR WEAKNESS IN THE FACE OF HONEST MISTAKES

German Ramos Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Mast Vilaseca (*Abstract Co-Author*) Nothing to Disclose
Nuria Roson Gradaille, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Alberti Sancho, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Serrano Burgos (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.- Be careful when you look at the T2 sequences to avoid overdiagnosis when slightly hyperintense signal is present. 2.- Some bladder and patient conditions may complicate the accuracy of the VIRADS system. 3.- All sequences should be considered globally to assign a final VIRADS score.

**TABLE OF CONTENTS/OUTLINE**

1.- Introduction to the VIRADS System: Overview, Importance, and Applications in Clinical Practice. 2.- Our Initial Results in Implementing VIRADS: Early Findings and Statistical Outcomes. 3.- Learning from Practical Cases: - Technical Aspects Related to VIRADS and MRI. - Issues Related to the Patient Variability. - Tumor Characteristics. 4.- Conclusions: Summary of Key Findings with Final Thoughts on Improving VIRADS Implementation

## GUEE-43 PROSTATE CANCER ACTIVE SURVEILLANCE PRECISE V2: WHAT HAS CHANGED AND CLINICAL IMPLICATIONS

Pamela Grazielle Correa De Oliveira (*Abstract Co-Author*) Nothing to Disclose
Jorge Elias JR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Isadora Balderama Canedo, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Gouvea, MD (*Abstract Co-Author*) Nothing to Disclose
Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Francesco Giganti, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Andre De Freitas Secaf, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos M. Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Cecilia V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Arthur Ogata, MD (*Abstract Co-Author*) Nothing to Disclose
Thalyne Lima (*Abstract Co-Author*) Nothing to Disclose
Valdair F. Muglia, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Active surveillance for prostate cancer is a management strategy employed in cases of low-risk and favorable intermediate-risk cancer. Its goal is to avoid invasive treatment options while maintaining a curative perspective. Several studies have highlighted the promising role of MRI in these cases, directly influencing clinical decisions and aiding urologists in providing optimal patient care.In 2016, the European School of Oncology established an international task force of experts, resulting in the publication of the PRECISE version 1 guidelines. These guidelines aimed to standardize the description of serial MRIs in both research studies and clinical practice. In 2024, Precise version 2 was released, with significant improvements discussed by an international panel comprising experts from various countries.The purpose of this educational exhibit is to explore the key differences between the first and current versions of PRECISE, emphasizing areas of improvement. Additionally, we aim to illustrate the clinical application of the current PRECISE classification using real cases from our institution.Finally, we will engage in a discussion about the current version of PRECISE, particularly discussing the areas for potential improvement.

**TABLE OF CONTENTS/OUTLINE**

Introduction; Objetives; Main updates in PRECISE version 2; Illustration base on clinical cases of the applicability of PRECISE V2; Discuss its limitations and areas of improvement; Conclusion.

## GUEE-44 LET THE BUBBLES BURST!: ROLE OF CONTRAST ENHANCED US IN THE RENAL CYSTIC AND SOLID MASSES. FROM DIAGNOSIS TO TREATMENT.

**Awards**
**Certificate of Merit**

Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Fernandez Florez, MD (*Abstract Co-Author*) Nothing to Disclose
Aranzazu Sanchez Gabin, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To understand the usefulness of contrast-enhanced ultrasound for the characterisation of renal cystic lesions and other renal masses. 2. To review the main differences that should be made when using the Bosniak classification in CEUS compared to the existing one for CT and MRI and when not to use this classification. 3. To analyse the role of CEUS in the context of pre- and post-ablative treatments.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction. In the USA, the use of contrast-enhanced ultrasound is only approved by the FDA for liver indications. Therefore, for kidney and other organs it is used off-label. CEUS has significant differences from CT and MRI in terms of contrast and temporal resolution (among others), so the characterisation of cystic renal masses requires certain specifications. It also provides greater sensitivity in the characterisation of enhancement in papillary tumours. 2. General considerations on renal contrast-enhanced ultrasonography. 3. Renal cystic lesions: 3.1. Definition. 3.2. Evaluation by CEUS (compared to CT) based on the Bosniak classification (pictorial review): 3.2.1. Bosniak I. 3.2.2. Bosniak II and IIF. 3.2.3. Bosniak III. 3.2.4. Bosniak IV. 3.3. When not to use the Bosniak classification: 3.3.1. Inflammatory-infectious. 3.3.2. Masses with cystic-necrotic component. 3.3.3. Vascular. 4. Problem solving: cysts and other renal masses. Limitations of CEUS. 5. Analyze the different type of treatments: multidisciplinary committees. 6. Usefulness of

CEUS in local treatments. 6.1. Planning of ablation treatments. 6.2. Detection of early complications post-ablation. 6.3. Surveillance after ablative treatment (proposal of treatment and follow-up algorithm). 7. Conclusions.

## GUEE-45 HOW TO CRACK THE NUT: WHAT RADIOLOGISTS NEED TO KNOW ABOUT BENIGN TESTICULAR LESIONS

Felippe D. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Caio P. Martinel, MD (*Abstract Co-Author*) Nothing to Disclose
Janaina Moreira (*Abstract Co-Author*) Nothing to Disclose
Jose Lucas S. Galvao I, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Froeder Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Gomes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Ultrasonography of the scrotum is a very important tool for evaluating the testicles as well as their adjacent structures, providing important anatomical details with the possibility of real-time assessment of vascularization through the Color Doppler feature in a non-invasive way.Testicular pouch changes encompass a spectrum from benign to serious conditions. In relation to benign changes, acute scrotum refers to sudden onset scrotal pain and swelling, often due to serious conditions like testicular torsion, epididymitis, or trauma. US is crucial for accurate diagnosis and timely intervention to prevent complications and preserve testicular function. In pediatrics, cryptorchidism refers to undescended testicles, where one or both testes fail to descend into the scrotum. US is valuable for diagnosing, visualizing the testicles position and assessing any associated abnormalities. Retractable testicles, on the other hand, can retract into the inguinal canal but are otherwise normal. The method helps differentiate between these two pathologies.Ultrasound of the testicular sac is vital for evaluating various chronic disorders such as hydrocele, scrotal lithiasis, and epididymal cysts. Overall, US provides crucial imaging information for precise diagnosis, treatment planning, and monitoring of these conditions, ensuring optimal patient care.

### TABLE OF CONTENTS/OUTLINE

This work aims to differentiate the main benign testicular lesions as well as the main ultrasound findings.

## GUEE-46 NON-TRAUMATIC GENITOURINARY EMERGENCIES: WHAT RESIDENTS SHOULD KNOW

Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Antonio Santana Veliz, MD, BSN (*Abstract Co-Author*) Nothing to Disclose
Sukrita Menon, MD (*Abstract Co-Author*) Nothing to Disclose
Gilberto J. Aquino, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Guide residents through different emergencies involving the genitourinary system in a non-traumatic setting.• Recognize multiple patterns of renal parenchymal pathologies that may require immediate action. • Review time-sensitive pathologies of the male and female genital systems.

### TABLE OF CONTENTS/OUTLINE

Kidneys/ureters• Renal Infarction • Renal vein thrombosis• Renal Hemorrhage (non-traumatic causes)• Renal Abscess• Acute Pyelonephritis• Emphysematous pyelonephritis• Pyonephrosis• Renal Cortical necrosis• Renal Papillary Necrosis• Obstructive Uropathy Bladder• Emphysematous cystitis Adrenals• Adrenal Hemorrhage (non-traumatic causes) Male Genital• Testicular Infarction• Testicular Torsion• Epididymo-orchitis• Testicular Abscess• Prostatitis and Abscess• Fournier's gangreneFemale Genital • Pelvic Inflammatory Disease• Acute Adnexal Torsion • Ovarian Infarction• Ovarian Vein Thrombosis• Pyomyoma

## GUEE-47 BALLS TO THE WALLS: A JOURNEY THROUGH TESTICULAR MRI PROTOCOLS AND CLINICAL APPLICATIONS

Raphael Lanz (*Abstract Co-Author*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Khyrul A. Khan (*Abstract Co-Author*) Nothing to Disclose
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Ultrasound is the most common imaging modality for the evaluation of the testicles. However, testicular MRI plays a crucial role in the diagnosis and characterization of various testicular conditions, encompassing non-neoplastic, benign neoplastic, and neoplastic entities. Despite its significance, this imaging technique is relatively unfamiliar to a considerable portion of the radiology community. This exhibit offers a comprehensive overview, exploring testicular MRI protocols, their clinical applications, common cases encountered in practice, and a glimpse into the evolving future of this diagnostic tool.

### TABLE OF CONTENTS/OUTLINE

1. Navigating Testicular MRI Clinical Indications, a. Non-neoplastic conditions, b. Benign neoplastic conditions, c. Neoplastic conditions. 2. How to structure a testicular MRI protocol in your institution, a. Patient preparation and positioning, b. Technical protocols for non-contrast and contrast-enhanced examinations. 3. How to read a testicular MRI? 4. Learning with cases, a. Case 1: a normal-appearing testicular MRI, b. Case 2: a benign condition, c. Case 3: a neoplastic condition. 5. Future perspectives for testicular MRI, a. The emergence of quantitative imaging techniques for the testicles, b. Potential future clinical applications of testicular MRI.

## GUEE-48 PEEKING INSIDE THE ADRENAL GLAND: A RADIOLOGICAL JOURNEY THROUGH UNUSUAL AND RARE ADRENAL TUMORS AND TUMORLIKE CONDITIONS WITH PATHOLOGICAL CORRELATION"

James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Joanie M. Garratt, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmed Taher, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Describe the imaging approach for evaluating unusual and rare adrenal tumors.• Illustrate imaging manifestations of a spectrum of rare adrenal tumors and tumorlike conditions.• Correlate the imaging features with pathological findings.• Identify potential pitfalls in imaging of unusual and rare adrenal tumors and tumorlike conditions. • Discuss the impact of imaging features on management.

**TABLE OF CONTENTS/OUTLINE**

• Introduction • Epidemiology, pathological classification and pathogenesis of unusual and rare adrenal tumors • Epidemiology, pathological classification of Tumorlike conditions involving the adrenal gland. • Multimodality imaging features of unusual and rare adrenal tumors o Primary bening tumors: § Hemangioma § Lymphangioma § Schwannoma § Oncocytoma § Ganglioneuroma § Teratoma § Lipoma § Mason's Tumor § Lipomatous metaplasia/degeneration o Primary malignant tumors: § Angiosarcoma § Pleomorphic sarcoma. § Lymphoma (could be primary or secondary) § Neuroblastoma/Ganglioneuroblastoma § Malignant nerve sheath tumor o Tumorlike conditions involving the adrenal gland § Extramedullary Hematopoiesis § Mucinous cyst § Pseudocyst § Hematoma § Adrenalitis § Histoplasmosis § Abscess • Differential diagnosis, diagnostic approach, and management • Summary and conclusion

## GUEE-49 UPPER TRACT UROTHELIAL CANCER AND ITS MIMICS: A PRIMER FOR TRAINEES

Avinash R. Kambadakone, MD, FRCR (*Abstract Co-Author*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer
Aoife Kilcoyne, MBBCh (*Abstract Co-Author*) Royalties, Wolters Kluwer nv;Author, Wolters Kluwer nv
Anuradha S. Shenoy-Bhangle, MD (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD (*Abstract Co-Author*) Nothing to Disclose
Onofrio Catalano, MD,PhD (*Abstract Co-Author*) Research Grant, Bayer AG;Researcher, Sofie Biosciences;Consultant, Johnson & Johnson;Fellowship funded, IBM Corporation;Speaker, Siemens AG
Shravya Srinivas Rao, MD (*Abstract Co-Author*) Nothing to Disclose
Soumyadeep Ghosh, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. CT Urogram is considered the imaging modality of choice for diagnosis; staging and follow-up of upper tract urothelial cancers.2. Spontaneous sub-urothelial hemorrhage can appear as hyperdense urothelial thickening on the non-enhanced phase with no or minimal enhancement. Follow-up imaging showing complete resolution should be obtained to avoid missing an underlying tumor that may have caused the hemorrhage.3. Pitfalls related to CTU and MRU techniques can mimic urothelial malignancy, and Radiologists should be aware of these while interpreting these studies.4. Radiologists should be cognizant of multimodality imaging appearances, ureteroscopy, and histopathology findings to accurately diagnose upper tract urothelial cancers and differentiate them from their mimics, to guide appropriate treatment.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to Urothelial Cancer with pertinent anatomy2. Imaging: Role of CT and MR urography in identifying upper urinary tract urothelial cancer3. Role of ureteroscopy and histopathology 4. Mimics and their imaging appearances

## GUEE-5 IMAGING OF RENAL TUMORS BASED ON WHO CLASSIFICATION OF TUMORS (2022), 5TH EDITION

Toyonori Tsuzuki (*Abstract Co-Author*) Nothing to Disclose
Athina Tsili, MD (*Abstract Co-Author*) Nothing to Disclose
Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Akira Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Holger Moch (*Abstract Co-Author*) Nothing to Disclose
Samuel J. Withey, MBBS (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Presenter*) Support, Canon Medical Systems Corporation;Support, General Electric Company

**TEACHING POINTS**

The WHO Classification of Tumors is published to standardize tumor names and diagnostic criteria to promote international comparative research on malignant tumors. Renal tumors are included in the volume titled "Urinary Male Genital Tumors," which was revised for the first time in six years as the 5th edition in 2022. From this edition, both pathologists and radiologists have joined as contributors, considering the extent to which diverse pathological classifications can be reflected in images. In the future, as the presence of genetic mutations becomes increasingly reflected in diagnostic names alongside histological features, radiologists will find it increasingly important to consider imaging findings from the perspective of imaging-genetic correlations, not just as a position of radiologic-pathologic correlation. In this paper, we will discuss the key points of this revision compared to the 4th edition, and we will also present how this classification can be reflected in imaging. (1) To introduce the WHO Classification of Renal Tumors 5th edition (WHO 2022)(2) To present imaging findings of major subtypes based on the WHO 2022(3) To present imaging features of relatively rare renal tumors following the WHO 2022 classification.

**TABLE OF CONTENTS/OUTLINE**

(1) Introduction (the points of revision of WHO 2022) (2) Protocols and Useful findings of US, CT or MRI (3) Diagnosis of major subtypes of renal tumors (Expansile growth and Invasive growth)(including Bosniak classification update 2019 and Clear Cell Likelihood Score) (4) Diagnosis of other renal tumors (Mucinous tubular and spindle cell carcinoma, etc) (5) Diagnosis of molecularly defined renal carcinoma (FH deficient RCC, etc)

## GUEE-50 ADVANCES IN PROSTATE CANCER IMAGING (FROM DETECTION TO POST-TREATMENT): A PICTORIAL REVIEW OF SCORING AND REPORTING SYSTEMS BEYOND PI-RADS

**Awards**
**Certificate of Merit**

Alice Schuch, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Giovanna S. Torre (*Abstract Co-Author*) Nothing to Disclose
Mauricio Zapparoli, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Marilia Da Cruz Fagundes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the timeline of scoring and reporting systems developed to date.- Describe mpMRI protocol, limitations, and pitfalls.- Discuss the need for effective scoring and reporting systems and reader training to reduce interobserver variability.- Review of the Prostate Imaging Reporting and Data System (PI-RADS).- Construct a guide with case illustrations for the application of newer systems: Prostate Imaging Quality (PI-QUAL), Prostate Cancer Radiologic Estimation of Change in Sequential Evaluation (PRECISE), Prostate Imaging for Recurrence Reporting (PI-RR), and Prostate Imaging after Focal Ablation (PI-FAB).- Present emerging technologies such as PET/MRI and the use of radiolabeled PSMA.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION- PCa epidemiology and risk factors- Prostate anatomy on mpMRI- Timeline of scoring and reporting systemsIMAGING PROTOCOLS- Proper mpMRI protocol- Limitations and pitfallsPICTORIAL REVIEW AND USER GUIDE- PI-RADS- PI-QUAL- PRECISE- PI-RR- PI-FABEMERGING TECHNOLOGIES- Integration of mpMRI and PET PSMA- Future directions

## GUEE-51 PENILE ANATOMY AND PATHOLOGIES UNDER THE MRI: AN ACADEMIC SHOWCASE

Fernando Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Rolando Alfonso Cocio Arcos, MD (*Abstract Co-Author*) Nothing to Disclose
Giancarlo Schiappacasse, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Labra, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas G. Molina Vasquez, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando Vivanco, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Magnetic Resonance Imaging (MRI) offers a detailed anatomical assessment of penile structures, including the corpus spongiosum, cavernosum, and tunica albuginea, with specific signal characteristics on various sequences. A standardized acquisition protocol is necessary to ensure optimal imaging quality for evaluating penile pathologies. MRI is useful in the context of neoplasms, Peyronie's disease, trauma, and vascular pathology.

**TABLE OF CONTENTS/OUTLINE**

Anatomic review on MRI: Both corpus spongiosum (CS) and cavernosum (CC) show high signal on T2-weighted imaging (T2WI) and intermediate signal on T1-weighted imaging (T1WI). Urethral musculature appears hypointense compared to CS on T2WI. Tunica albuginea (TU) demonstrates low signal on both T1WI and T2WI. Contrast-enhanced MRI reveals gradual/centrifugal enhancement in CC and early enhancement in CS.The acquisition protocol requires patient supine with the penis flexed over the scrotum, small FOV (160 mm) and thin slices (2-3 mm). Sequences obtained are T2WI in three orthogonal planes, coronal/sagittal T1WI, axial small field of view diffusion-weighted imaging (DWI), dynamic contrast-enhanced sequences with fat saturation, and subtraction.Among the most frequent pathologies where MRI proves invaluable is in the characterization of primary and secondary neoplasms. Another spectrum of conditions in which MRI demonstrates utility includes Peyronie's disease, playing a crucial preoperative role. MRI shows remarkable sensitivity (99%) and specificity (87%) in trauma cases. Furthermore, in vascular pathology, notably cavernous body thrombosis, MRI offers crucial insights into thrombosis extension and associated findings.

## GUEE-52 THE STRANGE WORLD OF RENAL AND URINARY VARIATIONS

Victor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Rocha, MD (*Abstract Co-Author*) Nothing to Disclose
Thais De Castro Barboza (*Abstract Co-Author*) Nothing to Disclose
Brainner Campos Barbosa Januzzi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Thiago O. Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe De Paula (*Abstract Co-Author*) Nothing to Disclose
Danilo Goncalves Filho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

I. Emphasize the uncommon nature and the unique associated conditions of congenital anomalies in the urinary tract. This accentuates the critical need for a detailed and comprehensive imaging approach, aiming to ensure the early and accurate identification of these rare anomalies. Such a focused strategy is essential for optimizing patient outcomes and guiding effective management plans. II. Review advanced imaging techniques and their application in diagnosing congenital urinary tract anomalies, focusing on the benefits of 3D reconstruction and contrast-enhanced studies in understanding the anatomical complexities and functional implications of these conditions. III. Underline the indispensable role of the radiologist in multidisciplinary teams managing congenital urinary tract anomalies, from prenatal imaging to postoperative assessment, emphasizing how radiologic expertise contributes to tailored treatment plans and optimizes patient prognoses.

**TABLE OF CONTENTS/OUTLINE**

1. Embriology of urinary tract formation. 2. The role of computed tomography (CT) in evaluating congenital anomalies affecting the urinary tract. 3. Different presentations and examples of congenital anomalies affecting the urinary tract. a) Pancake kidney (discoid kidney) b) Renal cell carcinoma in a horseshoe kidney c) Supernumerary kidney d) Crossed renal ectopia e) Zinner Syndrome

## GUEE-53 MALE PELVIS NON-NEOPLASTIC LESIONS - WHAT RADIOLOGISTS NEEDS TO KNOW

Antonio E. Silva JR, BDS (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Beraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Cleo F. Souza, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Heitor Passeri, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the normal anatomy of the male pelvis.Illustrate the most prevalent non-neoplastic lesions of the prostate, seminal vesicle, duct deferens, urethra, testicles and penis.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction:Review normal anatomy2)Prostate:Acute prostatitisChronic prostatitisGranulomatous prostatitisAbscess3)Seminal vesicle:Inflammation / infectionHemorrhage4)Deferens duct:Vasitis5)Urethra:Posterior urethral valveHypospadiaEpyspadia6)Testicle:TorsionSegmental infarctionInfectionLymphedema6)Penis:Peyronie DiseasePriapismPartial thrombosis of the corpus cavernosumSpontaneous hematoma7)Conclusion and "take-home messages"

## GUEE-54 ULTRASOUND OF TESTICULAR MASSES IN A "CEC"

Alejandra Valenzuela (*Abstract Co-Author*) Nothing to Disclose
Carlos F. Guardado Martinez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

remember the different types of testicular tumors and the demographic and ultrasonographic characteristics that help in their identification

**TABLE OF CONTENTS/OUTLINE**

GERM CELL TUMORS:¬ Seminomas: This is the most common pure tumor and is associated with TCG¬NS in older patients, around 40 years of age. Non-seminomatous germ cell tumors (NSGCT): These are often heterogeneous in echotexture, and the presence of cystic spaces and calcifications is much more common in this group.Mixed germ cell tumor: This is much more common than pure forms. The average age of presentation is around 30 years, and its ultrasound appearance varies depending on the histological types that compose it.•Embryonal carcinoma: Ultrasound shows it as a heterogeneous lesion with poorly defined borders.•Yolk sac tumors or endodermal sinus tumors: These represent 80% of testicular tumors in children, with most cases appearing before 2 years of age. In adults, the pure form is rare and is present in approximately half of mixed tumor cases.• Teratoma: This is the second most common type in children and appears before 4 years of age. The pure form in adults is very rare and is found in half of mixed tumors. Ultrasound shows it as a well-defined complex mass that may have cysts, calcifications, and areas of fibrosis.STROMAL TUMORS OF THE SEX CORDS:These represent about 5% of testicular tumors, with a prevalence of 10¬-30% in the pediatric age group. 90% of them are benign, but there are no specific radiological criteria to differentiate them.

## GUEE-55 HYPOVASCULAR RENAL LESIONS: CAN WE HIT THE TARGET?

Anton Aubanell, MD (*Abstract Co-Author*) Nothing to Disclose
German Ramos Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Serrano Burgos (*Abstract Co-Author*) Nothing to Disclose
Alex Espinal Colominas, MD (*Abstract Co-Author*) Nothing to Disclose
Mar Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Alberti Sancho, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Fernando Casanova Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Mast Vilaseca (*Abstract Co-Author*) Nothing to Disclose
Sandra Lopez Coello, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Renal tumors comprise a spectrum of hypovascular lesions, including papillary and chromophobe renal carcinoma, alongside rare entities with diverse imaging presentations.- Distinguishing subtypes remains challenging due to overlapping imaging features, especially in small lesions.- Certain features like small size, regular margins, and angular interface sign lean towards benignity in renal lesions.- Low fat content angiomyolipomas resemble RCC, while cystic masses with calcifications and fat should raise suspicion of atypical papillary carcinoma.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction- Overview of hypovascular renal tumors and their diagnostic challenges.2. Imaging modalities in renal mass assessment- CT and MRI protocols for evaluating renal masses.3. Benign lesions- Angiomyolipomas: classic and fat-poor variants.- Tubulocystic oncocytoma: Mimicking chromophobe or papillary RCC.- Inflammatory conditions and pseudotumors: tuberculosis mimicking solid renal masses.4. Malignant lesions- Papillary RCC: Imaging characteristics and atypical presentations.- Chromophobe RCC: homogeneous or heterogeneous appearance.- Rare malignant tumors: metanephric adenoma, mucinous tubular and spindle cell carcinoma, and tubulocystic RCC.- Hematopoietic and lymphoid tumors: renal involvement in lymphoma and leukemia.5. Diagnostic algorithm6. ConclusionsImportance of recognizing diverse renal tumor types for prognosis and management decisions.

## GUEE-56 MULTIMODALITY IMAGING MANIFESTATIONS OF SURGICAL COMPLICATIONS AFTER PROSTATIC INTERVENTIONS

**Awards**
**Certificate of Merit**

Akira Kawashima, MD (*Abstract Co-Author*) Nothing to Disclose
Stephen M. Broski, MD (*Abstract Co-Author*) Nothing to Disclose
Naoki Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
David A. Woodrum, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adam T. Froemming, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Takahashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cole P. Thompson, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A wide range of interventions are employed in the management of benign prostatic hyperplasia (BPH) and prostate cancer (PCa). In BPH, recent innovations in minimally invasive procedures have expanded the options for treatment of lower urinary tract symptoms beyond transurethral resection of the prostate. Common interventions for PCa include ablation, radiation therapy, and surgery. On imaging, differentiation between the normal post-interventional appearance of the prostate and various complications has important implications for clinical management. These complications include those related to vascular injury; injury to the surrounding structures, including the urethra, bladder, and rectum; anastomotic leak; urethral stricture and bladder outlet obstruction; infection, including musculoskeletal involvement; and radiation injury to the pelvic organs. Radiologists should be familiar with the appearance of these complications on CT, MR, US, fluoroscopy and PET to ensure prompt identification and treatment. This educational exhibit will serve as a comprehensive multimodality review of the imaging manifestations of surgical complications after prostatic interventions.

**TABLE OF CONTENTS/OUTLINE**

- Review of the different types of interventions available for management of BPH and PCa.
- Normal post-interventional appearance of the prostate.
- Multimodality imaging findings of complications, including those related to BPH interventions; prostate biopsy; placement of fiducial markers and SpaceOAR hydrogel for radiotherapy planning; and ablation, surgery, and radiation therapy for prostate cancer.
- Common pitfalls in post-procedural imaging interpretation.
- Summary.

## GUEE-57 PRIMARY RETROPERITONEAL CYSTIC LESIONS

**Awards**
**Certificate of Merit**

Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maryam Rezvani, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Rogers, MD (*Abstract Co-Author*) Royalties, RELX
Akram M. Shaaban, MBBCh (*Presenter*) Royalties, RELX

**TEACHING POINTS**

1. Recognize the different entities that can present as a retroperitoneal cystic lesions2. Discuss how to reach a reasonable differential diagnosis based on imaging appearance, demographics, and location of the lesion

**TABLE OF CONTENTS/OUTLINE**

I. Neoplastic1.Cystic lymphangioma2.Mucinous cystadenoma/cystadenocarcinoma3.Cystic teratoma4. Cystic mesothelioma5. Mullerian cyst6. Epidermoid cyst7. Tailgut cyst8. Bronchogenic cyst9. Cystic change in solid neoplasm10. Pseudomyxoma retroperitoneiII. Non-neoplastic1. Pancreatic pseudocyst2. Lymphocele3. Urinoma4. Hematoma

## GUEE-58 THE IMPORTANT CONSIDERATIONS IN PERMANENT PROSTATE BRACHYTHERAPY WITH A FOCUS ON IMAGING DIAGNOSTICS

Chiyoko Tsuji (*Abstract Co-Author*) Nothing to Disclose
Yusaku Miyata (*Abstract Co-Author*) Nothing to Disclose
Shuichi Tanoue, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryosuke Akeda (*Abstract Co-Author*) Nothing to Disclose
Shiori Edamitsu (*Abstract Co-Author*) Nothing to Disclose
Chikayuki Hattori (*Abstract Co-Author*) Nothing to Disclose
Koichiro Muraki, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Iodine-125 (I-125) seeds, measuring 970 μm in diameter and 4.5 mm in length, are commonly used in low dose rate brachytherapy (LDR-BT) for prostate cancer. Due to their small size, these seeds can occasionally migrate through the venous system and lodge in peripheral blood vessels of various organs. Consequently, incidental findings of migrated seeds on plain radiographs or CT scans are not uncommon in patients with a history of LDR-BT.The development of hydrogel spacers, inserted between the prostate and rectum, has contributed to a decrease in the risk of grade 3 or higher rectal toxicity.The purpose of this presentation is to outline the imaging considerations for I-125 permanent seed placement for prostate cancer, focusing on two important aspects: (1) seed placement and migration; and (2) imaging changes and complications associated with hydrogel spacers. By understanding these imaging features, radiologists can better interpret post-treatment findings and guide patient management.1. Discuss the importance of Modified Peripheral Loading in Low Dose Rate Brachytherapy (LDR-BT) for prostate cancer.2. Highlight key points in imaging diagnostics for seed migration.3. Explore the effectiveness and precautions of using a Hydrogel Spacer in brachytherapy.4. By the end of this course, participants will: Understand the role of postoperative Xp/CT/MRI in LDR-BT. Grasp key concepts related to seed migration, spacers, and complications.

**TABLE OF CONTENTS/OUTLINE**

1. Concept and technique of Modified Peripheral Loading in LDR-BT. 2. Key points in postoperative imaging evaluation. 3. Imaging diagnostics for postoperative complications. 4. Summary.

## GUEE-59 MULTIPARAMETRIC MRI PRE AND POST FOCAL CRYOABLATION FOR PROSTATE CANCER: PEARLS AND PITFALLS FOR THE REPORTING RADIOLOGIST

**Awards**
**Certificate of Merit**

Jyothirmayi Velaga, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Narayan Lath, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Yan Mee Law, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Kae Jack Tay, MBBS, MRCS (*Abstract Co-Author*) Nothing to Disclose
Chooi Yan Anna Lois Lai, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A. Review aspects of focal therapy (FT) in treatment of localised prostate cancer B. Discuss pretreatment considerations on multiparametric MRI (mpMRI) C. Review expected post FT changes in the prostate D. Review in- and out-field tumor recurrence using case review E. Discuss pearls and pitfalls in mpMRI detection of post FT tumor recurrence F. Review aspects in surveillance of the post FT prostate

**TABLE OF CONTENTS/OUTLINE**

Focal therapy (FT) is an emerging middle ground between active surveillance and radical whole gland therapy for treatment of localized prostate cancer in the era of precision medicine. Pretreatment considerations on mpMRI for appropriate patient selection include accurate risk stratification through tumor detection and staging as well as determination of tumor location and volume through judicious use of DCE. Low volume clinically significant cancer and MRI-occult cancers present challenges in pretreatment mpMRI.Post FT surveillance with mpMRI is critical for assessing oncologic efficacy. Post FT mpMRI is challenging as treatment changes distort the prostate gland and alter the signal intensity of treated and untreated parenchyma. DCE is the dominant sequence for assessing recurrent cancer post FT. With histology proven case reviews, we showcase the use of PI-FAB score for in-field and PI-RADS v2.1 for out-field recurrences in medium and long term surveillance. We discuss the pearls and pitfalls of mpMRI in post FT surveillance including tumor mimics and the use of ADC in guiding post treatment biopsy decisions. Limitations of mpMRI staging post FT recurrence are discussed including management of post FT tumor recurrence.

## GUEE-6 PENILE ULTRASOUND, EVERYTHING THE RADIOLOGIST SHOULD KNOW

Sandro C. Mandaloufas (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Guilherme C. del Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo C. Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Cesar Passos Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Figueiredo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Gulinelli, MD (*Abstract Co-Author*) Nothing to Disclose

Eliane E. Dutenhefner, MD, BDS (*Abstract Co-Author*) Nothing to Disclose
Victor A. Jabour, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Ventura, PhD, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purposes of this exhibit are:1. Importance of learning the penile anatomy.2. Understand the ultrasound technique to better perform the exam.3. Differentiate the normal and pathological appearance of the penis.4. Understand the different types of diseases and their ultrasound presentations.5. Managing Doppler study techniques are extremely important for diagnosis and assistance in defining treatment.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION• Penile anatomy.• Ultrasound technique used to evaluate the penis and vascular structures, main adjustments, parameters and what should be analyzed.• Illustrate with case reports from our department the main pathologies:CASE-BASED REVIEW- Peyronie`s Disease- Penile Trauma- Erectile Dysfunction- Balanoposthitis

## GUEE-60 BEYOND PI-RADS - STRUCTURED REPORTING AND QUALITY IN MULTI-MODALITY PROSTATE IMAGING

Asim Afaq, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine Hyde, BS (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Xiaosong Meng (*Abstract Co-Author*) Nothing to Disclose
Orhan K. Oz, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ivan Pedrosa, MD, PhD (*Abstract Co-Author*) Scientific Advisor, Health Tech International;Scientific Advisor, Merck & Co, Inc
Gaurav Khatri, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel N. Costa, MD (*Abstract Co-Author*) Research support, Bayer AG
Robert C. Sibley III, MD (*Abstract Co-Author*) Nothing to Disclose
Michael D. Bass, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Prostate cancer (PCa) care is rapidly evolving with multi-modality imaging, particularly multiparametric MRI, new ultrasound technologies, and molecular imaging now playing a key role in diagnosis, staging and treatment.2. Multiple reporting systems have been proposed to help standardize multi-modality image assessment and to facilitate communication with patients and referring physicians.3. We provide an illustrated, case-based review of the several proposed criteria used for assessment of MR image quality, detection and risk stratification of primary PCa, staging metastatic disease, and recurrence after conventional or focal therapy.

**TABLE OF CONTENTS/OUTLINE**

1.Quality and Structured ReportingA. Pillars of Quality in Prostate Imaging: Image, Interpretation and BiopsyB. Advantages and Disadvantages2.Rationale, basic principles and illustrated review of standardized frameworks for reporting prostate imaging findings beyond PI-RADS A. MR image quality (PI-QUAL v1 and v2)B. Active surveillance (PRECISE)C. Post-treatment follow-up (PI-RR and PI-FAB)D. Micro-ultrasound (PRI-MUS)E. Molecular imaging (PSMA-RADS, PRIMARY)3.Implementation of multiple standardized frameworks in clinical practice - Practical RecommendationsA. Detection of primary PCaB. Characterization and risk assessment in primary PCaC. Detection of metastatic PCaD. Evaluation disease recurrence after conventional or focal therapy4.Challenges and OpportunitiesA. Use of Templates (picklists, references)B. Role of physician lead(s) (updates, radiologist training/feedback, communication with referring physicians) C. Integration of data from different systems and imaging-pathology data reconciliation

## GUEE-61 PSMA RADS VERSION 2.0: AN INSTITUTIONAL CASE BASED REVIEW OF THE UTILITY OF UPDATED PSMA RADS IN CLINICAL PROBLEM SOLVING

Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Sravani Gampala, MD (*Abstract Co-Author*) Nothing to Disclose
Arwa Elsamny, MBBCh (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Knowledge of the different radiotracers used for PSMA PET and the definition of physiological versus pathological uptake. 2. Review the PSMA RADS categories with emphasis on changes made to categories in PSMA-RADS 2.0. 3. Recognize the importance of the use of the updated PSMA RADS 2.0 for standardized reporting. 4. Understand how the application of PSMA RADS has helped direct management in clinically challenging situations.5. Acknowledge the limitations of the PSMA RADS classification and areas for reform.

**TABLE OF CONTENTS/OUTLINE**

1. Introductory about the history of the PSMA RADS classification.2. Different radiotracers /Ligands for PSMA PET (Ga 68 and F18) at the molecular level.3. Definition of physiologic Vs pathologic uptake of the radiotracers. Definition of increased uptake. 4. Navigating the New Frontier: Key Updates in PSMA-RADS version 2.0.5. Examples of PSMA RADS1, 2, 3A, 3B, 3C, 3D, 4, and 5 lesions with emphasis on management recommendations and changes to categories in PSMA RADS 2.0. 6. Example of a timeline for a patient followed by PSMA PET and an example of post-treatment changes. 7. Limitations of the current PSMA RADS 2.0. and suggestions for reform.

## GUEE-62 MAGNETIC RESONANCE UROGRAPHY (MRU): TECHNIQUE MASTERY AND ILLUSTRATIVE CASE REVIEWS

Mohamed Elbanan, MD (*Abstract Co-Author*) Nothing to Disclose
Nourel Hoda M. Tahon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Kazi A. Irfan, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Azfar Siddiqui, MD (*Abstract Co-Author*) Nothing to Disclose
David L. Raj, MD (*Abstract Co-Author*) Nothing to Disclose
Amr S. Abdelaziz, MD (*Abstract Co-Author*) Nothing to Disclose
Ayesha Nasrullah, MD,FRCR (*Abstract Co-Author*) Nothing to Disclose
Nanda Deepa Thimmappa, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Understand the unique roles of different imaging sequences used in MR Urography (MRU), including T2-weighted, T1-weighted, diffusion-weighted imaging (DWI), and dynamic contrast-enhanced (DCE) imaging for the diagnosis of various urological pathologies. 2. Explore how both contrast-enhanced and non-contrast MRU can effectively diagnose a wide range of urological conditions including pediatric anomalies, obstructive pathologies, and tumors within the urinary tract. Learn how the Vesical Imaging Reporting and Data System (VI-RADS) can be utilized by adding dedicated bladder sequences.3. Enhance diagnostic skills through review of illustrative cases that showcase the practical application of MRU in clinical practice. 4. Learn to identify and

manage common pitfalls in MRU, including imaging and technique-related artifacts. Learn optimizing MRU protocols and adjusting imaging parameters to reduce artifacts and enhance image quality. Gain knowledge on managing patients with contraindications to MRI contrast agents or renal impairment.

**TABLE OF CONTENTS/OUTLINE**

1. Technical Overview - Patient preparation and positioning for MRU. - Optimization of imaging sequences: T2-weighted, T1-weighted, DWI, and DCE. 2. Case Gallery - Pediatric Urology: Examples of congenital anomalies and their management, obstructive pathologies, urinary Tract Tumors: Identification and differentiation of benign versus malignant lesions. - Additional cases covering a range of common and rare conditions diagnosed via MRU. 3. Best Practices and Troubleshooting - Common imaging challenges and solutions. - Strategies for improving image quality. - Safety considerations with contrast-enhanced MRU.

## GUEE-63 CARCINOMA OF THE VULVA: WHAT RADIOLOGISTS NEED TO KNOW

Sanaz Behnia, MD (*Abstract Co-Author*) Nothing to Disclose
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Elham Taheri, MD (*Abstract Co-Author*) Nothing to Disclose
Priya O. Pathak, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Highlight the clinical features, prognostic factors and routes of spread of vulvar malignancies. 2. Review the multimodality imaging features of vulvar malignancies (multi-parametric MRI, F18-FDG PET-CT and PET-MRI) in conjunction with International Federation of Gynecology and Obstetrics (FIGO) guidelines. 3. Review the role of imaging in treatment planning: assessment for resectability, radiotherapy, chemotherapy. 4. Review the role of imaging in post treatment evaluation: treatment response evaluation, post-treatment complications and detection of recurrent disease.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction (a) Epidemiology and risk factors. (b) Normal perineal and vulvar anatomy. (c) Review pathological subtypes.2. 2021 Revised FIGO staging system: Stage I: Tumor confined to the vulva. Stage II: Tumor of any size with extension to lower 1/3rd of urethra, vagina and anus with negative nodes. Stage III: Tumor of any size with extension to upper part of perineal structures or with nonfixed, nonulcerated nodes. Stage IV: Tumor of any size fixed to the bone or with fixed/ulcerated nodes, or distant metastasis.3. Sentinel lymph node mapping (a) Tracer: 99mTc-Filtered sulfur colloid or Tilamanocept. (b) Planar imaging and SPECT-CT is performed of the pelvis to localize the sentinel node.4. Role of MRI (technique and review of cases).5. Role of FDG-PET (technique and review of cases).6. Role of PET-MRI (technique and review of cases).

## GUEE-64 NAVIGATING THE RADIOLOGICAL SPECTRUM OF HEMATURIA: FROM COMMON TO RARE CAUSES

Luciano B. Lovotti, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro J. Pacini (*Abstract Co-Author*) Nothing to Disclose
Martin M. Pesce, MD (*Abstract Co-Author*) Nothing to Disclose
Victorio Del Casale, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo S. Loto, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- It’s always important to review the embryology, anatomy, pathophysiology, and radiological signs of the urinary tract. - Review of urinary tract imaging protocols. This presentation highlights the pivotal role of MDCTU (Multidetector computed tomography urography) in the imaging of the patient with hematuria. - Recognize the important role of radiologists in the multidisciplinary setting to communicate and collaborate findings in emergent cases.

**TABLE OF CONTENTS/OUTLINE**

Hematuria has a wide range of causes:Causes of Hematuria:1. Kidney Stones: The presence of stones in the kidneys or urinary tract can lead to hematuria. We will emphasize some features (number, location, size, density, complications, post-op) to be able to carry out a detailed report.2. Urinary Tract Infections (UTIs): Many microorganisms can affect the urinary tract, and some of them can cause hematuria. An update: The urinary tract can be affected by numerous acute and chronic inflammatory processes that may be infectious or autoimmune.3. Trauma: Injuries to the urinary tract due to accidents, trauma, or medical procedures can cause hematuria. Grading injuries.4. Vascular: We will describe our most relevant cases that result in vascular-related hematuria.5. Neoplasm: Imaging features of urinary tract neoplasms. Tumor mimics.5. Miscellaneous: all those causes that we do not consider to be included in the previous ones.6. Take home points.In those most interesting and rare cases, we will review their pathophysiology and update the topic.

## GUEE-65 AN IN DEPTH REVIEW OF SOLID RENAL MASSES AND HEREDITARY RENAL CANCER SYNDROMES

Henry H. Tam, FRCR (*Abstract Co-Author*) Nothing to Disclose
Leila Kafaei, MBBS,BSC (*Abstract Co-Author*) Nothing to Disclose
Kavita Shapriya, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Andrea L. da Silva, MBBCh (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review the commonly encountered solid renal masses, both benign and malignant, and describe the imaging findings which could assist in identifying the type of mass. To describe limitations of current imaging modalities in characterising the various renal masses due to overlapping imaging features and to review potential imaging techniques to achieve better prediction. To review clinical syndromes that are associated with an increased risk of renal masses or renal cell carcinomas, in terms clinical features genetics and imaging findings (both renal and extra-renal, where applicable)To understand the best pathway for patients with these syndromes which would assist in guiding imaging follow-up, treatment and genetic counselling.

**TABLE OF CONTENTS/OUTLINE**

Solid renal masses Angiomyolipoma, oncocytoma, lobar nephronia, infarct, RCC, UCC, lymphoma, metastases Clinical features HistopathologyManagement Imaging features of solid renal masses Characteristic imaging findings of the above masses on CT, MRI and contrast ultrasound Other less common imaging techniques such as MIBI SPECT/CT, PSMA PET/ CT Inherited syndromes associated with an increased risk of solid renal masses, including von Hippel Landau, Birt-Hogg Dube syndrome, tuberous sclerosis, hereditary leiomyomatosis and renal cell carcinoma (HLRCC), hereditary papillary renal cell carcinoma (HPRCC), succinate dehydrogenase mutations, BAP1 mutation and sickle cell disease Review the clinical features and genetic mutations associated with these syndromes Imaging findings of the kidneys and extrarenal findings where applicable Role of screening in these patient

## GUEE-66 WHEN THINGS GO WRONG: UNEXPECTED FINDINGS AFTER URINARY SYSTEM INTERVENTIONS

German Ramos Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Alberti Sancho, MD (*Abstract Co-Author*) Nothing to Disclose

Ramon Almodovar, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa Merino, MD (*Abstract Co-Author*) Nothing to Disclose
Eva Castella-Fierro (*Abstract Co-Author*) Nothing to Disclose
Juan Fernando Casanova Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Mar Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Espinal Colominas, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Gilabert (*Abstract Co-Author*) Nothing to Disclose
Sandra Lopez Coello, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Various medical, minimally invasive, surgical, and radiation treatments may lead to iatrogenic complications affecting the urinary tract.- Multidetector CT is the preferred imaging modality for evaluating urinary tract injuries, offering detailed visualization of cortical, vascular, and collecting system injuries.- Imaging findings associated with specific procedures like extracorporeal shock wave lithotripsy (ESWL), nephron-sparing surgery, and percutaneous renal interventions are discussed, highlighting potential complications and their management.- Post-surgical CT scans revealing fluid accumulation and hydronephrosis should raise suspicion of ureteral injury, warranting additional delayed imaging.- Urinary catheter migration and misplacement cause significant morbidity, necessitating prompt detection.

**TABLE OF CONTENTS/OUTLINE**

- Imaging Technique:- Role of Multidetector CT in evaluating urinary tract injuries- Optimal CT imaging protocols for suspected urinary tract injuries- Iatrogenic injuries:- Renal complications:- Minimally invasive procedures: ESWL, surgery-related complications- Renal infection and vascular Injuries- Ureteral injuries:- Causes, presentation, and imaging FindingsUreterovaginal fistulas- Bladder Injuries:- Causes and postoperative evaluation with CT cystography- Catheters malposition/migration- Conclusions:- Importance of radiologists' awareness of Iatrogenic Urinary Tract Injuries- Role of imaging in prompt diagnosis and treatment planning- Overview of interventional radiologic procedures and their potential complications.

## GUEE-67 LOCALLY ADVANCED RENAL CELL CARCINOMA: DEVIL IS IN THE DETAILS

Angelica Patino, MD (*Abstract Co-Author*) Nothing to Disclose
Long Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Eric Li, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Limitations exist in cross-sectional imaging characterization of renal cell carcinoma (RCC), particularly for locally advanced cancer (Stage 3), and more specifically, T3a tumors. Availability of treatment options is predicated on accurate staging.-Surgical interventions involving nephron-sparing techniques are typically not advisable for Stage =T3a renal cancers. Therefore, suggesting locally advanced cancer stage by imaging features before surgery is paramount, particularly for central renal masses.-Review of salient imaging features crucial for staging during evaluation of renal masses suspicious for RCC (e.g. renal sinus fat invasion, perirenal fascia thickening, venous invasion, etc.).-Review of management guidelines (National Comprehensive Cancer Network [NCCN], American Urologic Association [AUA]) and surgical interventions (e.g. nephron-sparing surgery, radical nephrectomy).-Operative feasibility can be assessed using imaging-based supplementary scoring systems (e.g. RENAL Nephrometry Score).

**TABLE OF CONTENTS/OUTLINE**

1. Generala. Epidemiology of kidney cancer2. The Kidneya. Organb. Vascular and lymphatics3. Pathologya. The incidental renal mass and differential diagnosesb. Renal cell carcinoma and subtypes4. Imaginga. Imaging modalities (ultrasound, CT, MRI) and advantages/limitationsb. TNM classificationc. Stages 1-4 RCC with emphasis on Stage 3 and associated pearls/pitfalls5. Implicationsa. Management and guidelines (NCCN, AUA)b. Supplemental scoring systems: RENAL Nephrometry Score, Preoperative Aspects and Dimensions Used for an Anatomical Classification, Centrality index, and renal tumor contact surface area

## GUEE-68 THE EVALUATION METHOD OF CONVENTIONAL < AND > FUNCTIONAL MR IMAGING FOR CHRONIC KIDNEY DISEASE

Keita Nagawa (*Abstract Co-Author*) Nothing to Disclose
Kaiji Inoue, MD (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Inoue (*Abstract Co-Author*) Nothing to Disclose
Yuki Hara (*Abstract Co-Author*) Nothing to Disclose
EITO KOZAWA, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The major teaching points have been modified as follows:1. Traditional morphological assessment criteria and renal functional MR imaging techniques are promising methods for utilizing the kidney as a biomarker.2. In the evaluation of chronic kidney disease, there are limitations to both conventional MR imaging methods < and > functional MR imaging methods, highlighting the need for a more comprehensive diagnostic approach < and > further advancements.

**TABLE OF CONTENTS/OUTLINE**

This exhibit aims to:1. Highlight the role of conventional MRI in assessing the kidney's structure (medulla-cortex ratio, cortical size) for grading chronic kidney disease (CKD).2. Introduce the basic principles of functional kidney MRI techniques, including blood oxygen level-dependent (BOLD) diffusion-weighted MR imaging (DWI), diffusion-tensor imaging (DTI), < and > Intravoxel incoherent motion (IVIM), for CKD.3. Discuss the benefits < and > the added value of functional MR imaging in managing chronic kidney disease.Content Organization:1. Depiction of normal and diseased kidneys in conventional MRI.The effectiveness < and > limitations of conventional MRI in diagnosing CKD.Presentation of CKD through functional MR imaging modalities (BOLD, DWI, DTI, IVIM).2. Evaluation of the utility < and > constraints of functional MR imaging in CKD.3. Future directions for enhancing the diagnostic capabilities of functional kidney MR imaging such as twelve-layer concentric objects method, texture analysis, deep learning < and > auto segmentation.

## GUEE-69 ARE YOU SURE YOUR PROSTATE MPMRI REPORT IS COMPLETE?. LOOK FOR EXTRAPROSTATIC FINDINGS

Diana Romero Mayorga I, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Borrero, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Aguirre, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Abreu Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
John L. Torres Castiblanco SR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The use of Prostate mpMRI has extended beyond detection of clinically significant prostate cancer, and is currently used for staging and treatment planning, active surveillance and post-treatment evaluation.Obtained MR images have a field of view centered on the prostate; however, adjacent extraprostatic and pelvic structures are included.The role of the radiologist must go beyond the search for extraprostatic extension and we must include in our report other relevant findings in neighboring organs included in the images.In order to achieve this objective, it is necessary that the radiologist systematically evaluates other extraprostatic structures, which we suggest: 1. Abdominal wall, 2. Bowel. 3. Musculoskeletal and 4. Genitourinary. The objectives of the following presentation are as follows:• Describe the frequency of the different extraprostatic findings on prostate mpMRI.• To provide an anatomic landmark to look for extraprostatic findings on prostate mpMRI.• To demonstrate the most frequent extraprostatic findings, per suggested anatomic segmentation, its relevance and clinical impact• To propose a structured report and follow up recommendations to improve communication and management of incidental findings to referring clinicians

### TABLE OF CONTENTS/OUTLINE

• Introduction: current recommended protocol for multiparametric Prostate mpMRI• Extraprostatic anatomical sites included in multiparametric Prostate mpMRI• Where to look for extraprostatic findings; bowel, genitourinary, abdominal wall, musculoskeletal.• A pictoral review of incidental findings on prostate mpMRI

## GUEE-7 EXPLORING PERIRENAL PATHOLOGY: A CASE-BASED REVIEW INTO MULTIMODAL DIAGNOSIS

Inmaculada Ansio Vazquez (*Abstract Co-Author*) Nothing to Disclose
Mariano Jose Parada-Blazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Rus, MD (*Abstract Co-Author*) Nothing to Disclose
Mario Sanchez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The objective of this poster is to provide a review of pathological conditions involving the perinephric space and to describe their key imaging characteristics, with a case-based approach using cross-sectional imaging.

### TABLE OF CONTENTS/OUTLINE

The perirenal space is the middle retroperitoneal space, sits between the anterior and posterior renal fascia and contains the kidney and adrenal glands. A variety of differential diagnoses can cause pathology within this space, often without specific clinical signs or symptoms. Sometimes it is not possible to differentiate the subcapsular or perinephric origin of a lesion, and these processes may be overlapping, so the differential diagnosis includes subcapsular disease. An understanding of commonly encountered conditions affecting the perirenal space, along with its main characteristics, can help narrow the potential diagnosis, however in some cases the diagnosis can only be done by histopathologic analysis.Pathology may be classified by their location and distribution as solitary or multifocal masses or rindlike soft-tissue lesions, as well as based on their etiology as neoplastic (sarcoma, renal or adrenal mases, lymphoma, metastasis) or non-neoplastic lesions (fluido colections, retroperitoneal fibrosis, systemic disease, extramedullary hematopoiesis).

## GUEE-70 INDETERMINATE RENAL LESIONS: THE ROLE OF CONTRAST ENHANCED ULTRASOUND IN ASSESSMENT AND FOLLOW UP

Henry H. Tam, FRCR (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Harvey, MBBS (*Abstract Co-Author*) Nothing to Disclose
Andrea L. da Silva, MBBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

renal lesions (both cystic and solid) are often encountered incidentally in radiology practice (especially at ultrasound). They can create more expense to the department with regards to further evaluation and/or follow up by use of CT/MRI. Contrast enhanced ultrasound provides a real-time assessment of renal lesions and their complexity. It can be used to classify cystic lesions, according to the Bosniak classification, and for follow up on non-surgical cystic renal lesions. Furthermore, it can assist in evaluation of indeterminate lesions - streaming patients into a management pathway sooner than should they be followed up with interval CT/MRI, as greater detail can be assessed. Aims: 1. Understand the classification of renal cysts with regards to the Bosniak classification of 2005 and proposed updates of version of 2019 with follow up recommendations. 2. Gain an understanding of solid renal lesions and imaging characteristics. 3. Review the currently used imaging modalities and protocols in the assessment of renal lesions and their costs, compared to contrast enhanced ultrasound: risk and benefits. 4. Review ultrasound contrast agents compared to CT/MR contrast agents. 5. The role of contrast enhanced ultrasound in assessment and follow up of renal lesions and case examples.

### TABLE OF CONTENTS/OUTLINE

Renal cysts - Bosniak classification system - review v2005 and updates proposed by v2019 Overview of solid renal lesions Current imaging techniques used in assessment of renal cystic lesions protocols and cost to department Introduction to contrast enhanced ultrasound: History Benefits and risks Costs Considerations when planning contrast enhanced ultrasound list Case examples of contrast enhanced ultrasound

## GUEE-71 THE TYPICAL AND PECULIAR PERINEAL TEARS: EMPHASIS ON MRI

**Awards**
**Certificate of Merit**

Toqa El-Gohary, MD (*Abstract Co-Author*) Nothing to Disclose
Rania F. Elsayed, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ahmed W. Ali, MSc,MBBS (*Abstract Co-Author*) Nothing to Disclose
Asmaa Yahia (*Abstract Co-Author*) Nothing to Disclose
Hebatallah M. Azzam (*Abstract Co-Author*) Nothing to Disclose
Asmaa Abdelzaher, MD (*Abstract Co-Author*) Nothing to Disclose
Hadeer Radwan (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. Abdelatty, MD,MSc,MBBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the complex anatomy of the perineum with emphasis on MRI imaging.2. Appreciate the differences in perineal anatomy between males and females.3. Understand the mode of injury in obstetric/childbirth-related traumas.4. Understand the mode of injury in non-obstetric injuries, including iatrogenic causes.5. Provide practical reporting tips for simple and complex perineal tears on MRI.

**TABLE OF CONTENTS/OUTLINE**

1. MR Anatomical considerations in female and male perineum. 2. Perineal trauma according to mode of injury Obstetric/childbirth-related trauma.• Other:Blunt trauma, Stab injuries, Fall from height, Road traffic accidents, Iatrogenic.3. Perineal trauma according to involved parts Superficial perineal tears, Perineal muscles, Anal sphincter injury, Ano-vaginal fistula, penile fractures, scrotal injuries. 4. Quick review of associated pelvic structures injury: Urethral injury, Urinary bladder injury, Bowel injury, Vascular injury, Pelvic bone fractures.

## GUEE-72 NAVIGATING THE MAZE OF PI-RADS 3 LESIONS

Lauren Fane, BEng (*Abstract Co-Author*) Nothing to Disclose
Anna Luu (*Abstract Co-Author*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Michaela Cooley, PhD (*Abstract Co-Author*) Nothing to Disclose
Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Prostate MRI adhering to PI-RADS v2.1 guidelines has been increasingly adopted for the detection and characterization of prostate cancer. Nonetheless, suboptimal reproducibility and the relatively high number of false-positive MRIs are still challenges, limiting the impact of MRI in prostate cancer diagnostic workflows worldwide. One of the key factors associated with these limitations is PI-RADS 3 ("equivocal") lesions. This exhibit explores the nature of PI-RADS 3 lesions, their clinical implications, and strategies for their management.

**TABLE OF CONTENTS/OUTLINE**

1. What's a PI-RADS 3 lesion? a. PI-RADS 3 lesions in the peripheral zone b. PI-RADS 3 lesions in the transition zone 2. Do you know how to identify a PI-RADS 3 lesion? Learn with cases! a. Case 1: PI-RADS 3 lesion in the peripheral zone and a negative prostate biopsy b. Case 2: PI-RADS 3 lesion in the peripheral zone and a positive prostate biopsy c. Case 3: PI-RADS 3 lesion in the transition zone and a negative prostate biopsy d. Case 4: PI-RADS 3 lesion in the transition zone and a positive prostate biopsy 3. Understanding the challenges and implications of PI-RADS 3 a. Factors contributing to higher prevalence of PI-RADS 3 Scores b. Implications of a higher prevalence of PI-RADS 3 Scores c. Strategies to mitigate the prevalence of PI-RADS 3 Scores in your practice 4. Dealing with PI-RADS 3 a. The role of MRI in Diagnostic Pathways of Prostate Cancer b. Dealing with PI-RADS 3 in MRI-Based Diagnostic Pathways c. Dealing with PI-RADS 3 in Risk-Based Diagnostic Pathways 5. What does the future hold for PI-RADS 3? a. MRI innovations b. Ancillary biomarkers c. Upgrading rules and Diagnostic Pathways

## GUEE-73 IMAGING OF THREE-PIECE INFLATABLE PENILE PROSTHESIS

**Awards**
**Magna Cum Laude**

Yashant Aswani, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Erectile dysfunction (ED) is the inability to achieve or maintain erection sufficient for satisfactory sexual performance. It has a prevalence of 26/100 men in the age group of 40-70 years. ED unresponsive to pharmacotherapy or presence of penile fibrosis, are some of the many indications for penile prosthesis. Three-piece inflatable penile prosthesis (IPP) comprises paired cylinders, reservoir and pump. At the conclusion of this exhibit, the readers will be able to:1) Enumerate indications of penile prosthesis2) Describe imaging in three-piece inflatable penile prosthesis (IPP)3) Discuss complications of three-piece IPP

**TABLE OF CONTENTS/OUTLINE**

1) Erectile dysfunction and 2018 American Urological association guidelines for management 2) Indications and contraindications for penile prosthesis 3) Types of penile prostheses 4) Role of Imaging 5) MRI protocol 6) Normal imaging appearance of 3-piece inflatable penile prosthesis 7) Complications of cylinder (mal positioning and mechanical failure) 8) Complications of rear tip extender (migration, extrusion) 9) Complications of reservoir (migration, leakage, collapse of low-profile reservoir, bowel obstruction, vascular compression) 10) Complications of pump (migration, stiction syndrome) 11) Complications of tubing (fracture, leakage, tail pipe penis) 12) Common complications (infection, hematoma, capsule formation) 13) Proposed template for reporting

## GUEE-74 THE EPIDIDYMIS - WHO SAYS SIZE MATTERS

Sharon Gordon, MD (*Abstract Co-Author*) Nothing to Disclose
Rona J. Orentlicher, MD (*Abstract Co-Author*) Nothing to Disclose
Barak Friedman, MD (*Abstract Co-Author*) Nothing to Disclose
Monika Misra, MD (*Abstract Co-Author*) Nothing to Disclose
Kamran Ali, MD (*Abstract Co-Author*) Nothing to Disclose
Melody W. Lin, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- The epididymis plays an essential role in sperm production and transport.- Ultrasound is the primary modality to evaluate the epididymis, with problem solving using CT and MRI.- Infection is the most common pathology in the epididymis, often presenting with concurrent orchitis, funiculitis, and cellulitis. Imaging is helpful to assess for secondary abscess or testicular torsion.- Appendix epididymis, the most common congenital variant, can present with sudden pain from torsion.- Cystic and solid epididymal masses are often benign. The majority are cysts. Soft tissue masses include adenomatoid tumors, leiomyoma, and lipoma. After ultrasound, MRI is the preferred modality to evaluate an epididymal mass given superior soft tissue contrast and lack of ionizing radiation. Since often benign, follow up ultrasound is commonly used to ensure stability.- Epididymal rhabdomyosarcoma is uncommon in children and rare in adults, presenting as a painless, solid, vascular mass, with a high rate of metastases.- Tubular ectasia, secondary to ductus deferens obstruction, is often seen post vasectomy but can also be idiopathic.- Epididymal trauma is rare but can be seen associated with testicular trauma.

**TABLE OF CONTENTS/OUTLINE**

- Essential role of the epididymis in male reproduction with regards to anatomy, biology and function.- Congenital, infectious, inflammatory, cystic or solid masses, and traumatic abnormalities.- Multimodality imaging of epididymal pathology, predominantly ultrasound, with the aid of CT and MRI.- Differential diagnoses, complications and treatments.

## GUEE-75 TESTY SITUATIONS: A COMPREHENSIVE MULTIMODALITY IMAGING REVIEW OF THE ACUTE SCROTUM

**Awards**
**Certificate of Merit**

Mahan Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Balaji Rao, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Roberts, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Acute scrotal pain is a common scenario in clinical practice. Etiologies include common entities, such as testicular torsion or epididymitis, to uncommon pathologies such as segmental testicular infarcts or Amyand hernia with appendicitis. Prompt recognition is essential in order to guide appropriate management and may require evaluation on multiple imaging modalities. This presentation will explore various causes of acute scrotal pathologies and at the conclusion of the module, the learner should be able to: • Elucidate role of imaging in a patient with acute scrotal pain • Recognize imaging findings and complications associated with common etiologies of acute scrotal pain • Describe imaging findings of uncommon causes of acute scrotal pain

### TABLE OF CONTENTS/OUTLINE

• Normal scrotal anatomy • Imaging of epididymitis, epididymo-orchitis, isolated orchitis and complications (abscess, infarct) • Radiology of scrotal trauma (including fracture, rupture, hematoma, hematocele) • Imaging of testicular torsion (complete, partial, torsion-detorsion, associated waveform analysis and complications) • Torsion of appendices • Review of uncommon etiologies of acute scrotal pain, including, but not limited to: • Fournier gangrene • Segmental testicular infarct • Thrombosed varicocele • Sigmoid diverticulitis contained within an inguinal hernia • Acute appendicitis in an inguinal hernia • Neoplasms presenting as acute scrotal pain • Pancreatic necrosis extending inferiorly into the scrotum

## GUEE-76 TO REDUCE PREOPERATIVE EVALUATION OF LIVING RENAL DONORS FROM 4 PHASE TO 1 PHASE-SCAN

Kousuke Aoyagi (*Abstract Co-Author*) Nothing to Disclose
Natsuki Mashikawa (*Abstract Co-Author*) Nothing to Disclose
Daisuke Kinoshita (*Abstract Co-Author*) Nothing to Disclose
Toshimitsu Shimizu (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To learn about the need for preoperative imaging for renal transplantation.2. To learn about the problems with the conventional scan.3. To Learn about the imaging technique for performing 1-phase scan Dual energy.4. To learn the value of dual energy and triple split injection obtained images.

### TABLE OF CONTENTS/OUTLINE

1. The preoperative radiologic evaluation plays a crucial role in laparoscopic nephrectomy by providing assistance in surgical planning and aiding in the prevention of potential complications.2. Misregistration and exposure due to multiphase imaging are common issues encountered with conventional imaging methods. A new imaging technique using Triple Split and Dual energy allows visualization of stones, arteries, veins, and ureters in a single scan.3. Utilizing dual energy, the acquired images can retain sufficient CT values and can be evaluated for all abnormal formations.4. The new imaging method can reduce exposure by up to 75% without misregistration. Thus, donors benefit greatly.

## GUEE-77 THE GUIDELINE MATRIX: DECODING EURO-AMERICAN GUIDELINES FOR UPPER TRACT UROLOGICAL CARCINOMA (UTUC)

Claudia Mercader Barrull (*Abstract Co-Author*) Nothing to Disclose
Carmen Sebastia Cerqueda, MD (*Abstract Co-Author*) Nothing to Disclose
Lidia Fortuny, MD (*Abstract Co-Author*) Nothing to Disclose
Meritxell Costa-Grau (*Abstract Co-Author*) Nothing to Disclose
Daniel Corominas, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Nicolau, MD (*Abstract Co-Author*) Nothing to Disclose
Lledo Cabedo Esteve, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Jimenez Arjona, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Paredes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1-To review radiological points that appear in the European Association of Urology (EAU) and the American Urological Association (AUA) for Upper Urinary Tract Carcinoma (UTUC) guidelines and to show their meaning for radiologists. 2- To describe radiological findings that are conclusive or inconclusive of UTUC by CT- and MR-urography and how to make the differential. 3- To detail the meaning of invasive/noninvasive, hydronephrosis/obstruction by image, to describe radiological patterns in high and low risk UTUC and to depict what a suspicious node is. 4- To review radiological follow-up in UTUC protocols. 5- To show tips on how to do an adequate UTUC presurgical radiological map.

### TABLE OF CONTENTS/OUTLINE

· CT and MR urography protocols for UTUC diagnosis: tips and tricks · Anatomy of upper urinary tract: urologist and radiologist agreement · Unequivocal and equivocal radiological findings of UTUC: management in guidelines · Differential diagnosis of UTUCs presented as renal masses, upper urinary tract papillary masses or sessile wall thickening: clues for the differential · Meaning of noninvasive aspect/local invasion by CT (EAU) · Low-risk, high-risk and favorable and unfavorable UTUC in AUA guidelines: role of imaging · Hydronephrosis and Obstruction - what do they mean? · Radiological signs in T3, T4, N1 and M1 UTUC TNM classification · How to diagnose N1 and M1 radiologically · Correlation between radiological and ureteroscopy findings to guide UTUC diagnosis and treatment. · Radiological tools to perform a high standard UTUC presurgical map in kidney-sparing management · Neoadjuvant and adjuvant treatment: radiological findings · Radiological follow-up after initial UTUC treatment: EAU and AUA comparison

## GUEE-78 INCIDENTAL EXTRAPROSTATIC FINDINGS IN MULTIPARAMETRIC MR IMAGING OF THE PROSTATE

Pardeep K. Mittal, MD (*Abstract Co-Author*) Nothing to Disclose
Manohar Roda, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thomas L. Estes JR, MD (*Abstract Co-Author*) Nothing to Disclose
Frank H. Miller, MD (*Abstract Co-Author*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA
Nikolas Brozovich, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Discuss the significance of incidental findings in multiparametric magnetic resonance (mp-MR) of the prostate 2. Systematic search pattern to reduce the likelihood of missing key incidental extraprostatic findings 3. Review clinical cases with multi-system (Gastrointestinal, Genitourinary, and Musculoskeletal) incidental findings in mp-MR of the prostate

**TABLE OF CONTENTS/OUTLINE**

Mp-MR has significantly increased in popularity for the detection and surveillance of prostate cancer in recent years. This imaging method facilitates screening, surveillance, and post treatment follow-up with notable advantages over other modalities. Due to the increased use in MR imaging, an increased detection rate of incidentalomas has been reported.Our presentation will discuss the spectrum of extraprostatic findings noted on MR imaging of the prostate and provide a case-based review.

## GUEE-79 IMAGING CHARACTERISTICS OF RETROPERITONEAL TUMORS: DIAGNOSTIC CLUES, DIFFERENTIAL DIAGNOSIS AND HISTOPATHOLOGICAL CORRELATION

Pardeep K. Mittal, MD (*Abstract Co-Author*) Nothing to Disclose
Manohar Roda, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Frank H. Miller, MD (*Abstract Co-Author*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA
Camila L. Vendrami, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Dallas Sturdevant, DO (*Abstract Co-Author*) Nothing to Disclose
Nikolas Brozovich, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Demonstrate diagnostic challenges including tumor localization, extent of invasion, and characterization of specific pathology.2. Illustrate tumor components, tumor vascularity, and patterns of spread to help narrow the differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Imaging findings and characterization of retroperitoneal(RP) tumors with histopathology correlates will be discussed. Primary RP tumors originating in the RP but outside the major RP organs are uncommon. Accurate localization and extent of disease of retroperitoneal lesions can be difficult. Identifying the organ of origin, involvement of adjacent structures, vascular invasion, and fat content is valuable in evaluating RP tumors, particularly in staging. Specific diagnosis might be difficult to achieve due overlapping features but certain clues help narrow the differential diagnosis. Case discussion will include liposarcoma, leiomysarcoma, solitary fibrous tumor, extragonadal germ cell tumor, lymphoma, paraganglioma, and others.

## GUEE-8 SOLID RENAL MASSES: WHAT THE UROLOGISTS WANT TO KNOW FOR SURGICAL TREATMENT

Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
William Nahas, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Cordeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Kenji N. Mitsutake, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Colodette, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review imaging features for histological prediction.- Create a didactic approach to preoperative imaging staging, emphasizing tips and tricks for avoiding pathological upstaging and achieving positive surgical margins.- Discuss the relevance of vascular surgical planning in nephron-sparing surgeries.- Show didactic imaging findings on post-treatment for kidney cancer.

**TABLE OF CONTENTS/OUTLINE**

Introduction- Epidemiology of renal tumors.- Current management of kidney cancer based on AUA and EAU guidelines.- Main surgical techniques for managing renal masses.Role of imaging in the assessment of solid renal masses- Impact of histological prediction on surgical management.- How to perform local imaging staging.- Evaluation of vascular surgical planning in nephron-sparing approaches.- Expected and unexpected post-treatment imaging findings.- AI e radiomics to predict aggressiveness on cytoreduction nephrectomies.A didactic evaluation of renal masses with illustrated teaching cases from our department

## GUEE-81 A PICTORIAL REVIEW OF THE URETHRA: A RADIOLOGIST'S GUIDE TO KEY CLUES IN INTERPRETATION

**Awards**
**Certificate of Merit**

Ana Ines Rubio Aguilera, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Romero (*Abstract Co-Author*) Nothing to Disclose
Lorena Melian Iribar, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Candela Munoz Roldan (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To illustrate imaging findings of male and female urethra including normal anatomy, variants, inflammatory/infectious diseases, benign and malignant tumors. To analyze the correlation between cystourethrogram, IVU, US, CT, and MRI imaging features with pathology in urethral lesions. To emphasize pitfalls, diagnostic difficulties, and differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Retrograde urethrography and voiding cystourethrography are the modalities of choice for imaging the urethra. Several benign and malignant entities should be included in the differential diagnosis of urethral lesions. Through sample cases, a variety of imaging and pathology findings from lesions of the urethra with management discussion and clues to interpretation will be demonstrated in a quiz format. Imaging findings (cystourethrogram, IVU, US, CT, and MRI) and pathologic correlation will be presented. How pathologic correlation informs imaging interpretation will be highlighted. The list of cases presented includes congenital abnormalities, strictures, trauma, urethral or periurethral tumors, calculi, diverticula, postsurgical complications.

## GUEE-82 IMPROVING PROSTATE MRI COLLABORATIVELY: LESSONS LEARNED FROM THE ACR PROSTATE MR IMAGE QUALITY IMPROVEMENT COLLABORATIVE

David B. Larson, MD, MBA (*Abstract Co-Author*) Research Grant, Siemens AG ;Advisor, Bunkerhill Health;Shareholder, Bunkerhill Health
Mythreyi Bhargavan-Chatfield, PhD (*Abstract Co-Author*) Nothing to Disclose
Kay Zacharias-Andrews (*Abstract Co-Author*) Nothing to Disclose
Kandice Garcia, RN, MS (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Purysko, MD (*Presenter*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;

### TEACHING POINTS

1. Prostate MR image quality can affect prostate cancer detection on MRI.2. Adherence to PI-RADS technical standards is necessary for exam reproducibility and requires an effective protocol management process.3. Various methods for patient preparation can help reduce susceptibility artifacts on diffusion-weighted images and motion on T2-weighted images.4. Frontline staff training on image quality standards and troubleshooting of artifacts are essential to achieving high-quality images consistently.5. A reliable method for auditing the quality of prostate MR images allows the identification and remediation of issues contributing to poor image quality.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. The ACR Learning Network Prostate MR Image Quality Improvement Collaborative Aims and Framework3. Prostate Image Quality (PI-QUAL) System4. Key Drivers and Interventions4a. Protocol Management4b. Patient Preparation4c. Personnel Training4d. Process for Auditing the Images5. Beyond Image Quality Improvement6. Conclusions

## GUEE-83 ABDOMINAL INCIDENTALOMA: THE *ADRENAL*IN OF THE UNKNOWN

Ines Ocampo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1- To identify adrenal incidentalomas requiring follow-up, further study, or biopsy/surgery based on recommendations from the American College of Radiology and the European Society of Endocrinology.2- To understand the acquisition protocol and recognize the importance of wash-out phase in CT scan and in phase/out phase (IP/OP) in MRI for the evaluation of the adrenal glands.3- To discuss the most prevalent adrenal pathologies, differentiating them into benign and indeterminate lesions based on imaging and clinical features.

### TABLE OF CONTENTS/OUTLINE

Given recent advancements in radiology, the detection of adrenal incidentalomas has become relatively frequent. Thus, radiologists need to stay updated with guidelines and recommendations in order to clarify the multiple possible diagnoses. Benign non-functioning lipid-rich adenomas represent the most prevalent lesions. Their imaging diagnosis relies on identifying the presence of microscopic fat within the adenoma. Therefore, the measurement of Hounsfield units and the wash-out protocol in CT scans, as well as the IP/OP images of a chemical-shift MRI, are used. Timely confirmation of benign nature avoids unnecessary imaging and radiation exposure. Likewise, it is important to suspect malignancy since it would require aggressive treatment. Each individual case presents a challenge, so current guidelines recommend standardized protocols and a multidisciplinary expert team for accurate decision-making.

## GUEE-84 KEEPING YOUR REAR IN THE CLEAR: IMAGING OF SPACEOAR HYDROGEL

Mahan Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Sandeep S. Arora, MBBS (*Abstract Co-Author*) Research support, Profound Medical Inc
Gary M. Israel, MD (*Abstract Co-Author*) Nothing to Disclose
Pavlo Mishyn, DO (*Abstract Co-Author*) Nothing to Disclose
Shadi Ebrahimian, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Epidemiology of prostate cancer and treatment options? Prostate cancer is the most common malignancy diagnosed in men in the United States. Besides surgery, radiation therapy is the standard therapy for prostate cancer. However, it may cause damage to the surrounding organs including rectum. 2. What is SpaceOAR? SpaceOAR hydrogel, is an FDA approved spacer, which is injected between the prostate and rectum and increases the distance between these structures, reducing rectal radiation exposure and associated complications.3. Indications of SpaceOAR placement? Patients with prostate cancer undergoing radiation therapy and those with significant proximity of rectum and prostate. 4. Techniques for SpaceOAR placement? SpaceOAR is placed in outpatient setting after administration of local anesthesia and under the guide of ultrasound and using a trans perineal approach.5. How is SpaceOAR characterized in CT and MRI? SpaceOAR has a hypodense opacity on CT, low signal on T1 and high signal on T2-weighted images.6. Optimally placed SpaceOARA? uniform and symmetric distribution of SpaceOAR between prostate and rectum is characterized as optimally placed.7. Suboptimal placement of the SpaceOAR and associated complications? Hydrogel migration, inadequate rectal sparing, rectal wall infiltration, etc.

### TABLE OF CONTENTS/OUTLINE

1. Overview to prostate cancer 2. Brief introduction to SpaceOAR and its history 3. Candidates for SpaceOAR placement 4. Techniques of placement 5. Appearance of SpaceOAR on CT and MRI 6. Optimal SpaceOAR placement 7. SpaceOAR related complications

## GUEE-85 VENOUS TUMORAL THROMBOSIS, LOOKING BEYOND CLEAR CELL RENAL CARCINOMA

Sebastian Pelaez SR, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana Arroyave, MEd (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Neoplastic intraluminal venous invasion is a form of advanced disease involvement. It is important to differentiate it from malignancy associated soft thrombus. Tumoral thrombus present contiguity with the primary tumor, enhance with the contrast medium, generate expansion of the blood vessel, are avid for fluorodeoxyglucose and restricted to diffusion.2.The renal tumor that most commonly presents with vein thrombus is clear cell renal carcinoma (90%), the most common subtype is clear cell. Transitional cell and papillary carcinoma rarely invades vascular structures. There are also some case reports of neuroectodermal tumors, squamous cell tumors and primary sarcomas of the kidney with renal venous involvement. The main benign renal tumor with vascular invasion into the renal vein is angiomyolipoma. However, it should be considered beyond renal cell carcinoma.3.The vascular invasion of tumors has implications on the prognosis and treatment of patients. In the TNM classification, renal tumors progress on stage if there is presence of intraluminal vascular invasion. The Mayo Clinic classification for the extent of tumor thrombus allows determination of the type of thrombectomy as well as the surgical implications in the patient with renal cell carcinoma.

**TABLE OF CONTENTS/OUTLINE**

Teaching points.Introduction.Diagnostic intraluminal vascular invasion.Primary renal tumors with thrombosis.Benign renal tumors with thrombosis.Renal metastases with thrombosis.Summary

## GUEE-86 EXPLORING PATHOLOGIES: CHALLENGING BLADDER CASES BEYOND UROTHELIAL NEOPLASMS

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Figueiredo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the imaging feature of bladder urothelial carcinoma. - Describe the main oncological and non-oncological differential diagnosis of urothelial carcinoma. - Demonstrate didactic cases involving the bladder. - Suggest tips and tricks to narrow the differential diagnosis of bladder mass.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION: Review typical findings of urothelial carcinoma; Describe the broad spectrum of diseases that may involve the bladder;DIDACTIC CASES: Demonstrate a case-based didactic review of bladder pathologies and some tips and tricks to narrow the diagnosis: Inflammatory; Infectious; Non-urothelial tumors; Endometriosis; Foreign bodies;

## GUEE-87 GOOD OLD CONVENTIONAL URETHROGRAPHY: CURRENT ROLE IN CLINICAL PRACTICE

Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Akshey Sehgal, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Uroradiology includes essential procedures like Retrograde Urethrography (RGU) and Micturating Cystourethrogram (MCU), serves as a cornerstone in diagnosing and treating urological conditions even in the current era of advanced imaging. RGU allows for a detailed examination of the urethra, aiding in the identification of strictures, injuries, or abnormalities, and guiding customized treatment plans. MCU offers real-time visualization of the bladder and urethra, enabling detection of reflux, urinary dysfunction, or structural anomalies.

**TABLE OF CONTENTS/OUTLINE**

• Anatomy:- varies between the male and female urethra. The male urethra has anterior and posterior portions. The female urethra begins at the internal urethral meatus at the bladder neck and opens in the vestibule of the vagina.• Technique: Care should be taken in insertion of catheter with all aseptic measures. Appropriate positioning and radiograph exposures to be performed. • Clinical significance: Play pivotal role in identifying and evaluating conditions such as trauma, urethral strictures, urethral diverticula, infections, reflux nephropathy and posterior urethral valve abnormalities.• Complications: Infection; adverse reactions from contrast medium; catheter trauma leading to symptoms like dysuria, frequency, hematuria, and urinary retention, as well as potential complications such as perforation by the catheter. Additionally, there's risk of inadvertent catheterization of the vagina or ectopic ureteral orifice. Understanding and managing these complications are crucial for ensuring patient safety and optimizing procedural outcomes in urological practice.

## GUEE-88 COMPREHENSIVE IMAGING REVIEW OF TESTICULAR PATHOLOGIES ON ULTRASOUND AND MAGNETIC RESONANCE IMAGING: A PICTORIAL REVIEW

Giancarlo Schiappacasse, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas G. Molina Vasquez, MD (*Abstract Co-Author*) Nothing to Disclose
John Mac Kinnon, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Labra, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Aris (*Abstract Co-Author*) Nothing to Disclose
Fernando Vivanco, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Accurate diagnosis and management of testicular pathologies heavily relies on clinical presentation and ultrasound (US), forming the cornerstone of initial assessment. Magnetic resonance imaging (MRI) complements US, aiding in differentiating and characterizing suspicious testicular and paratesticular lesions for precise diagnosis and treatment. Ultrasound remains primary for evaluation in emergency departments, including inflammatory conditions like epididymitis-orchitis, as well as traumatic testicular injuries, enabling prompt identification and management of complications such as hematomas or torsions.

**TABLE OF CONTENTS/OUTLINE**

Cases selected from our institutional experience aim to showcase key findings of various testicular pathologies.Testicular Neoplasms: Most common are germ cell-derived, hypoechoic lesions on ultrasound. MRI is useful to characterize indeterminate lessons and to determine the extension of the tumor.Paratesticular Lesions: Adenomatoid tumors, common benign lesions, diagnosed primarily via ultrasound. MRI aids in characterizing indeterminate lesions or suspected malignancies like paratesticular rhabdomyosarcoma.Cystic Lesions: Typically simple lesions diagnosed by ultrasound, appearing as homogeneous hypoechoic lesions with defined edges. MRI may be used if an underlying lesion is suspected.Inflammatory: Epididymitis-orchitis, common in emergency services, is often diagnosed via ultrasound. MRI benefits in assessing chronic infections or suspected complications.Traumatic: Initial evaluation with US aims to rule out hematomas, twists, ruptures, or infarctions.

## GUEE-89 ADRENAL INFECTIONS UPDATE: HOW RADIOLOGISTS CAN ENHANCE PATIENT CARE

Patrick Navin, MBBCh, FFR(RCSI) (*Abstract Co-Author*) Nothing to Disclose
Antonio C. Westphalen, MD, PhD (*Abstract Co-Author*) Shareholder, ScanMed, LLC;Research funded, BotImage, Inc
Vanessa Murad, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Abreu Gomez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Adrenal infections are considered clinically important but often go unrecognized. Radiologists play a key role in detection of involvement early in the course of disease to improve patient outcomes- Although adrenal infectious involvement is uncommon, it should be considered in the differential diagnosis of patients with widespread inflammation, taking into account the host's hormonal/immune status and the geographic region where certain

infective agents are more prevalent- The vascular-rich configuration of the adrenal gland, coupled with increased cortisol levels from zona fasciculata, creates an ideal microenvironment for the reservoir and replication of microorganisms- Adrenal thickening with associated stranding constitutes the radiological hallmark of adrenalitis, typically bilateral in histoplasmosis and tuberculosis and unilateral/variable in COVID-19, bacterial, HIV, and cytomegalovirus infections- Destruction of the adrenal parenchyma results in loss of endocrine adrenal function, contributing to a high mortality rate. Early radiological identification and awareness by the clinical team are pivotal for prompt patient management and preservation/recovery of endocrine function

**TABLE OF CONTENTS/OUTLINE**

1. Background2. Imaging techniques in the assessment of adrenal infections3. Bacterial adrenalitis and hemorrhage3.1 Adrenal Abscess3.2 Tuberculosis and Adrenal BCG granulomatosis 4. Viral adrenalitis5. Adrenal involvement in patients with SARS COVID-19 infection6. Fungal infections7. Parasitic infections8. Conclusion

## GUEE-9 LOOK AT THE KIDNEY! WHAT TO LOOK FOR IN THE FACE OF MULTISYSTEM DISEASE

Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Lais F. Pimentel, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the main multisystem disorders with renal involvement.- Describe the renal imaging findings in the face of multisystem disease.- Create a systematic assessment and discuss tips for targeted analysis.

**TABLE OF CONTENTS/OUTLINE**

Multisystem diseases often affect the kidneys, resulting in diverse patterns of renal involvement. Radiologists play a crucial role in identifying focal or diffuse lesions, and it is essential to detect renal lesions assertively.INTRODUCTIONSYSTEMATIC APPROACH FOR EVALUATING IMAGES CASE-BASED REVIEW- Hereditary syndromes. Tuberous sclerosis. Von Hippel-Lindau disease. Birt-Hogg-Dubé syndrome. Autosomal Dominant Polycystic Kidney Disease. Autosomal Recessive Polycystic Kidney Disease- Neoplastic. Renal lymphoma. Urothelial cell carcinoma. Renal cell carcinoma. Plasmacytoma. Metastasis. Plexiform neurofibromas- Deposit diseases. Amyloidosis. Paroxysmal nocturnal hemoglobinuria. Extramedullary hematopoiesis- Inflammatory / Infection. Renal tuberculosis. IgG4-related disease. Erdheim-Chester disease

## GUEE-90 SCROTUM CROSS-SECTIONAL IMAGING EVALUATION: FROM BENIGN TO MALIGNANT CONDITIONS

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Zapparoli, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Alice Schuch, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Camilo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the anatomy of the scrotum and its radiological and surgical implications.
- Propose an approach for recognizing the most usual imaging patterns of benign and malignant scrotal tumors.
- Review patterns of benign testicular lesions on magnetic resonance imaging (MRI) exams.
- Assess imaging findings of malignant testicular germ cell tumors on MRI.
- Describe key MRI findings for local staging and surgical planning.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION
- Describe the usual anatomic features of the scrotum in the most common imaging methods used at the investigation and correlate didactic illustrations with ultrasound (US) and MRI.
- Elucidate the surgical implications of radiological anatomy of the scrotum.INDICATIONS AND TECHNIQUE
- Indications of the main imaging methods, their appropriate technique, limitations, and pitfalls.
- MRI protocol.STEP-BY-STEP EVALUATION
- Systematic approach to classifying testicular lesions.
- Evaluation of their origin, imaging features, and correlation with clinical and laboratory informationBENIGN TESTICULAR LESIONS
- Typical and atypical cases of testicular and paratesticular lesions on US and MRI.
- What information should the surgeon know to plan the appropriate approach?
- Correlation with pathological and surgical findings.MALIGNANT TESTICULAR LESIONS
- Typical cases of testicular cancer and their radiological appearances.
- Review of its epidemiology and risk factors.
- Importance of allying tumor markers and other clinical information.
- Local staging/ treatment response/ recurrence detection.THERAPEUTIC TECHNIQUES
- Types of surgical approaches in testicular and paratesticular masses.
- Sparing surgery and alternative therapy in testicular cancer.

## GUEE-91 PRACTICAL CONSIDERATIONS IN THE CONTRAST ENHANCED ULTRASOUND (CEUS) EVALUATION OF RENAL MASSES

Melanie P. Caserta, MD (*Abstract Co-Author*) Nothing to Disclose
Mary J. Clingan, MD (*Abstract Co-Author*) Nothing to Disclose
Neema J. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Madhura A. Desai, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• CEUS is a safe option in patients who may not be able to undergo contrast CT or MR and offers particular benefit to patients with ESRD. • CEUS has high sensitivity and specificity when discriminating between solid and cystic lesions. • The high temporal and spatial resolution of CEUS enables accurate characterization and surveillance of complex cystic renal lesions. • As on CT and MR, overlapping patterns of enhancement can make it difficult to discriminate benign from malignant solid lesions or between RCC subtypes by perfusion characteristics alone.

**TABLE OF CONTENTS/OUTLINE**

1. US Contrast Agents a. Technical Factors b. Considerations/Comparison to CT and MR 2. Advantages of CEUS a. High Spatial Resolution i. Characterization of cyst complexity ii. Active surveillance b. High Contrast Resolution i. Sensitive to minimal flow ii. High NPV for excluding flow c. High Temporal Resolution i. Mitigate motion artifact ii. Dynamic contrast evaluation iii. Stored cine images 3. Limitations of CEUS (some generalized from US) a. Limited Visualization i. Large body habitus or deep-seated lesions ii. Lesions obscured by overlying bone or gas b. Limited FOV i. Limit exam to single or few targets ii. Multiple interrogations for larger lesion c. Technical Requirements specific to CEUS i. Patient IV access ii. Extra personnel iii. CEUS software 4. Characterization of Cystic Renal Masses a. Cystic or Solid b. Simple or Complex 5. Characterization of Solid Renal Masses a. Evaluation of Enhancement i. Corticomedullary enhancement relative to renal cortex ii. Washout iii. Heterogeneity b. Features of Common Benign Solid Lesions c. Features of Common RCC Subtypes

## GUEE-92 ROLE OF CROSS-SECTIONAL IMAGING ON MALE GENITOURINARY INFLAMMATORY AND INFECTIOUS DISORDERS: WHAT RESIDENTS NEED TO KNOW

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Laura Damaso, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the main inflammatory and infectious conditions in the genitourinary (GU) system.Describe the cross-sectional imaging protocols for GU inflammatory and infectious disorders.Recognize the key imaging features for the detection and differentiation of these entities.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION
- Inflammatory and infectious diseases overview.
- Describe the imaging evaluation role based on current guidelines.IMAGING EVALUATION
- CT technique
- MRI technique IMAGING EVALUATION PER ORGANAdrenal glands
- Adrenalitis
- Infectious (paracoccidioidomycosis)Kidney and ureters
- IgG4-related disease
- Xanthogranulomatous pyelonephritisBladder
- Chronic cystitis
- Urachal cyst infectionProstate and seminal vesiclesPenis
- Peyronie diseaseScrotum
- Orchitis
- Scrotal tuberculosis

## GUEE-93 BEYOND VI-RADS: CURRENT ROLE OF BLADDER MRI, SPECIAL INDICATIONS AND ASSESSMENT OF OTHER PATHOLOGIES

Teresa A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Julio R. Coronil, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio R. Oropeza Gutierrez II (*Abstract Co-Author*) Nothing to Disclose
Mailen Sarobe, MD (*Abstract Co-Author*) Nothing to Disclose
Agostina Sarobe, MD, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-To describe multiparametric MRI protocol and the implementation of VI-RADS score in bladder cancer with pathology correlation. -To review special indications of bladder MRI such as bladder tumors located at the ureteral orifice, bladder diverticulum tumors and post neoadjuvant and TURB evaluation.-To display sample cases of different pathologies that could represent potential pitfalls in the use of bladder MRI.

**TABLE OF CONTENTS/OUTLINE**

-Image acquisition protocol and technique.-Recognize the normal MRI anatomy of the bladder.-Description of imaging characteristics of VI-RADS categories 1 to 5 with sample cases.-Review of the special indications of bladder MRI and sample cases. -Potential pitfalls in the use of MRI and VI-RADS

## GUEE-94 REVOLUTIONIZING COMFORT: THE PESSARY SOLUTION FOR OPTIMAL SUPPORT AND RELIEF!

Gaurav Khatri, MD (*Abstract Co-Author*) Nothing to Disclose
Cinthia Cruz Romero, MD (*Abstract Co-Author*) Nothing to Disclose
Renata R. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Karthika Devi D S, MBBS (*Abstract Co-Author*) Nothing to Disclose
Manjiri K. Dighe, MD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Research Grant, General Electric Company
Minal C. Jagtiani, FRCR,MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This exhibit aims to discuss the anatomy of the (pre or post) menopausal pelvis, indications for insertion of vaginal pessaries, types of pessaries, and identify the common (and uncommon) post insertion complications and their appearances.

**TABLE OF CONTENTS/OUTLINE**

1. Post menopausal pelvic anatomy: describe the normal appearance of the postmenopausal uterus and ovaries 2. Discuss etiology of laxity of the pelvic floor, risk factors for pelvic prolapse, levels of pelvic organ prolapse 3. Describe the types of pessaries available and their appearances on various modalities: donut, ring, lever, Gellhorn, cube 4. Identify the indications for vaginal pessaries in the post-menopausal age group and explain the intended mechanism of action 5. Discuss the potential complications with specific consideration to appearances post pessary insertion: pain, bleeding, infection, altered lymphatics with increased chance of pelvic congestion syndrome

## GUEE-95 ASCENDING EXCELLENCE: GUIDING RENAL TUMOR TREATMENT STEP BY STEP WITH RENAL SCORE

Mauro Herrero (*Abstract Co-Author*) Nothing to Disclose
Lina M. Robledo (*Abstract Co-Author*) Nothing to Disclose
German Espil, MD (*Abstract Co-Author*) Nothing to Disclose
Nebil Larranaga (*Abstract Co-Author*) Nothing to Disclose
Lina Meza Galeano, MD (*Abstract Co-Author*) Nothing to Disclose
Shigeru Kozima (*Abstract Co-Author*) Nothing to Disclose
Daniela Pratto, MD (*Abstract Co-Author*) Nothing to Disclose
Paula M. Marinhas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Evaluate the utility of the RENAL SCORE scoring system in determining therapeutic approaches for patients with renal tumors evaluated in a retrospective study at a Municipal General Hospital of South America, where this condition is highly prevalent.Determining the effectiveness of this system in our specific medical environment.Analyze its applicability in making therapeutic decisions for patients with renal tumors.Record and document the development and results obtained through its use, to provide data to support the effectiveness and efficiency of the score.Strengthen the role of the radiologist in managing renal tumors through its effective implementation

### TABLE OF CONTENTS/OUTLINE

AbstractIntroductionDescription of the RENAL SCORE SystemMaterials and MethodsResultsRadiological findings and RENAL SCORE scores in correlation with pathological anatomy resultsTreatment and management of renal tumorsDiscussionImplications of the resultsStudy LimitationsConclusionsReferences

## GUEE-96 RENAL ONCOCYTIC NEOPLASMS - UNRAVEL THE CONUNDRUM

**Awards**
**Cum Laude**

Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Myles T. Taffel, MD (*Abstract Co-Author*) Nothing to Disclose
Stuart G. Silverman, MD (*Abstract Co-Author*) Nothing to Disclose
Nicola Schieda, MD (*Abstract Co-Author*) Nothing to Disclose
Rajesh Bhayana, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Antonio Finelli (*Abstract Co-Author*) Nothing to Disclose
Susan Prendeville (*Abstract Co-Author*) Nothing to Disclose
Sreeharsha Tirumani, MD (*Abstract Co-Author*) Nothing to Disclose
Sungmin Woo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Satheesh Krishna, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Oncocytomas are the largest cause of nephrectomy in benign masses, due to inability of imaging and biopsy to reliably distinguish between benign oncocytomas and malignant chromophobe RCC. Emergence of ‘in-between’ entities considered together as ‘Oncocytic renal neoplasm of low malignant potential’ have further complicated diagnostic and management pathways.

### TABLE OF CONTENTS/OUTLINE

There have been numerous nomenclature changes. What is the latest classification of oncocytic neoplasm? What are the emerging entities (eosinophilic vacuolated tumor, low grade oncocytic tumor)? Which entities are benign, which are indolent and which are malignant? (Pathology images will be provided) - Are there other entities which mimic oncocytic neoplasms? - Why is imaging or biopsy in isolation not helpful? (what is the discordance rate between biopsy and surgery?). Where do these fall in the CCLS (clear cell likelihood score) or CT-renal score? - We present a hybrid (imaging + biopsy approach) in risk stratifying these masses - Chromophobe RCC - can we further risk stratify grade based on imaging? - How does hybrid neoplasms complicate the landscape? What are the oncocytic tumors with hereditary connotations (SDH-deficient, low grade FH-deficient, eosinophilic solid and cystic RCC -TSC associated, HOCT - Birt Hogg Dube associated)? Can genetic alterations (FLCN) provide insight? - What are the challenges in active surveillance of oncocytomas? Can benign oncocytomas metastasize? Do enlarging oncocytomas affect renal function? Does bilaterality and multifocality further complicate management? - Does Sestamibi have a role in management pathway? What is the ideal management strategy? Role of ablation and embolization?

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# Abstract Archives of the RSNA, 2024

GUEE-1

## MASS LESIONS OF TRANSPLANTED KIDNEYS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kumaresan Sandrasegaran, MD (*Abstract Co-Author*) Nothing to Disclose
Mark D. Sugi, MD (*Abstract Co-Author*) Consultant, Nextrast, Inc;Author with royalties, RELX
Alecio F. Lombardi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• 1. Masses of transplanted kidneys include benign and malignant tumors, infections and inflammatory pseudotumors • 2. Some lesions seen in transplant kidneys, such as mycobacterial abscess, are not usually seen in native kidneys • 3. Benign lesions, such as infiltrative fungal infection, may mimic malignant tumors on imaging

### TABLE OF CONTENTS/OUTLINE

1. 1. Optimal imaging of transplant (Tx) kidney tumors 2. Malignant tumors of transplant kidneys a. Differences in frequency of renal cell cancers in native and transplant kidneys b. Treatment of Renal Cell Cancer (RCC) in transplant kidneys 3. Hematologic tumors: PTLD, extra-osseous myeloma 4. Sarcomas and mesenchymal tumors 5. Infection of transplant kidneys: bacterial, mycobacterial and fungal 6. Unusual lesions of transplant kidneys: perinephric myxoid pseudotumor, amyloidoma 7. Value of image guided biopsy

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# Abstract Archives of the RSNA, 2024

GUEE-10

## PENILE DOPPLER WITH DRUG-DIRECTED DIAGNOSIS OF ERECTILE DYSFUNCTION, WHAT THE RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mildreth Juliana Acuna Rojas, MEd (*Abstract Co-Author*) Nothing to Disclose
Manuel Alejandro Garrido, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Introduction to the generalities of color Doppler in the diagnosis of erectile dysfunction, precise definition of erectile dysfunction, the correct indications to apply the study and when to apply them. Carry out an anatomical review of the penis, and physiological mechanism of the erection, that subsequently allows a diagnosis that adequately guides the doctor for a correct treatment. Know the radiological technique of the Doppler of the penis, a close look at each of the steps to elucidate and correctly present its findings. Learn criteria to think about the erectile dysfunction, taking into consideration patient signs and symptoms, clinical background, and ultrasonographic classification. Present two clinical cases of patients with erectile dysfunction, with their intrinsic repercussions in quality of life, each with independent risk factors and variable causes

### TABLE OF CONTENTS/OUTLINE

Introduction, Epidemiology, Etiology, Anatomic review, Physiology, Pathophysiology, Diagnosis, Radiological technique, Clinical cases, Conclusions, References.

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# Abstract Archives of the RSNA, 2024

GUEE-11

## GUIDELINES REVIEW OF ADRENAL INCIDENTALOMA: RADIOLOGIST'S PRIMER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Julia A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Lais F. Pimentel, MD (*Abstract Co-Author*) Nothing to Disclose
Madson Almeida (*Abstract Co-Author*) Nothing to Disclose
Maria C. Fragoso (*Abstract Co-Author*) Nothing to Disclose
Felipe Ledesma (*Abstract Co-Author*) Nothing to Disclose
Lucas Aquino (*Abstract Co-Author*) Nothing to Disclose
Juliana Salviano, MD (*Abstract Co-Author*) Nothing to Disclose
Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Camila S. Franco, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Katriny Couto, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduarda d. Cunha, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Jose Luis Chambo (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the past and current concepts of adrenal incidentalomas.- Describe the main imaging findings of typical adrenal disorders.- Review the current adrenal imaging literature focusing on indeterminate lesions.- Explore the European Society of Endocrinology (ESE) guideline for adrenal lesions based on didactic clinical-radiological-pathological correlation.- Brief review of the American College of Radiology (ACR) White Paper guideline: Is it time to change?

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION- Epidemiology- Anatomy- Histology- Overview of adrenal incidentalomasIMAGING FEATURES ASSESSMENT - Adenoma- Myelolipoma- Neural orign tumor- Pheochromocytoma- Adrenocortical carcinoma- Miscellaneous- Critical review of indeterminate adrenal lesions literatureESE GUIDELINE- Explore the updated concepts and guidance- Perform a didactic clinical-radiological-pathological correlation.ACR GUIDELINE- Brief overview of the White Paper document- Are there gaps in improving the radiological approach for adrenal incidentaloma?

# Abstract Archives of the RSNA, 2024

GUEE-12

## ADRENAL LESIONS - NOT ALWAYS AN ADRENAL ADENOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Anju Sahdev, FRCR (*Abstract Co-Author*) Nothing to Disclose
Katherine Ordidge, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Michael Thomas, MBBS (*Abstract Co-Author*) Nothing to Disclose
James Fish, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Adrenal incidentalomas are commonly found in routine practice on up to 5% of all abdominal CT imaging.Clear guidelines exist as to the management of adrenal incidentalomas; including their initial characterisation on imaging (CT, MRI and PET-CT).Confident imaging characterisation of adrenal lesions helps ensure that patients follow the correct clinical management pathways and avoid expensive and unnecessary follow-up, including adrenal biopsy.

### TABLE OF CONTENTS/OUTLINE

Case based educational exhibit with examples of both benign and malignant adrenal conditions and their associations with referenced teaching points to include: Benign Adrenal lesions:Evaluation of classical imaging characteristics of adrenal adenomas on CT and MRI imaging including lipid-rich and lipid-poor subtypes with cross-correlation to functional status. Wide range of benign adrenal pathology distinct from adrenal adenomas including paragangliomas, adrenal rests, myelolipomas, angiomyolipomas, congenital adrenal hyperplasia (CAH), adrenal cysts and ganglioneuromas. Malignant Adrenal lesions: Delineate imaging characteristics which raise the suspicion of adrenal malignancy; both primary and secondary malignancy and in turn avoid unnecessary investigations or upstaging of patients. Array of malignant adrenal pathology including phaeochromocytomas, adrenocortical carcinomas, metastases to the adrenal gland, malignant neuroendocrine tumors and composite tumors.Indeterminate Adrenal lesions: What to do when lesions remain indeterminate including correlation with biochemical status, clinical assessment and further imaging modalities, e.g. nuclear medicine investigations

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# Abstract Archives of the RSNA, 2024

GUEE-13

## WHO IS THAT INCIDENTALOMA? A PICTORIAL REVIEW OF AN ADRENAL MASS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alejandro Sanchez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Review the anatomy, embryology, and function of the adrenal gland.• Describe de role of different imaging modalities techniques (CT, MRI, PET-CT) in the diagnosis of adrenal lesions. • Discuss clinical-radiological-histopathological key findings to help differentiate adrenal gland lesions (benign vs malignant). • Analyze what treatment and follow-up is necessary for each adrenal mass.• Treatment and follow-up of adrenal lesions.• How to do a good report of an adrenal mass.

### TABLE OF CONTENTS/OUTLINE

Description of general characteristics of adrenal gland and adrenal mass. Adrenal gland anatomy and physiology. Review multimodality adrenal protocols ( MRI, CT, PET-CT) Review of MRI and CT cases, common findings, imaging tips and pitfalls.Typical and atypical adrenal lesions. Adenoma, pheochromocytoma, lymphoma, myelolipoma, metastasis, carcinoma, neuroblastoma, nodular hyperplasia and neuroblastoma.- Histopathological findingsSummary Pearls and take home points.

# Abstract Archives of the RSNA, 2024

GUEE-14

## THE URETER: THE UNLOVED CONDUIT BETWEEN THE KIDNEY AND BLADDER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Cary L. Siegel, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew T. Simpson, MD (*Abstract Co-Author*) Nothing to Disclose
Bogdana Schmidt (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Rogers, MD (*Abstract Co-Author*) Royalties, RELX
Grace G. Zhu, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to:1) Describe ureteral anatomy and function with a discussion of the imaging strategies to evaluate for ureteral pathology.2) Provide a review of ureteral pathology and divide the different processes into broad categories of congenital, intrinsic, and extrinsic pathology.

### TABLE OF CONTENTS/OUTLINE

1) Introduction/Backgrounda. Ureteral anatomyb. Imaging modalities2) Congenitala. Duplicated Ectopic Uretersb. Ureteral budc. Ureteroceled. Retrocaval ureter3) Intrinsic Ureteral Processesa. Ureteral strictureb. Ureteral neoplasmsi. Fibrovascular polypii. Urothelial carcinomac. Inflammatoryi. Ureteritis cystica ii. Infectiond. Other/Miscellaneousi. Post-operative complicationsii. Pseudodiverticulosis4) Extrinsic Ureteral Processesa. Pregnancy Pelviectasisb. Local mass effectc. Local inflammatory process

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# Abstract Archives of the RSNA, 2024

GUEE-15

## THE ROLE OF IMAGING IN EVALUATING PROSTATE CANCER AND ITS NATURAL HISTORY OVER TIME

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Michaela Cooley, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Prostate cancer is the second leading cause of cancer death in men in the US. Despite this, there is debate about the utility of prostate cancer screening markers and the optimal treatment course. This educational exhibit takes the reader through diagnosing prostate cancer, evaluating risk for metastasis, surveillance imaging, and treatment options. All discussion points relate back to the imaging markers that are essential to look out for or are important in prognosis.

### TABLE OF CONTENTS/OUTLINE

1. Epidemiology of prostate cancer. a. Demographics; b. Incidence, prevalence; c. Role of screening. 2. Natural history of prostate cancer. a. How prostate cancer grows and metastasizes; b. Development of treatment resistance (e.g., androgen insensitivity); c. Gleason score; d. Percentages of patients with disease progression and death after diagnosis. 3. Evaluating risk though medical imaging. a. Imaging modalities used for initial diagnosis (e.g., MRI, US); b. Advantages and disadvantages of each imaging modality; c. Typical and atypical features of prostate cancer; d. Imaging characteristics used to differentiate local cancer from extracapsular extension.4. Surveillance imaging, metastasis, and whole-body imaging. a. Surveillance imaging modalities and timeline after initial treatment; b. Imaging markers indicating metastasis and what characteristics to look for; c. Indications for whole body imaging.5. Treatment options and selection. a. Local disease traditional treatment options; b. Discussion on new treatment options for local disease; c. Metastatic disease traditional and recent treatment options; d. How imaging plays a role in treatment selection.

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# Abstract Archives of the RSNA, 2024

GUEE-16

## JOURNEY INTO THE SCROTAL ULTRASOUND DEPTHS: ANDROLOGISTS' PERSPECTIVES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Silvia Martinez Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Yady V. Hurtado Burbano, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Guillermo Tarra Romero, MD (*Abstract Co-Author*) Nothing to Disclose
Laura M. Garcia Ramirez, BMedSc, BMedSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Spermatogenesis is the process in which spermatogonia give rise to spermatocytes, while spermiogenesis is the stage in which spermatids mature into spermatozoa, forming part of the overall process of spermatogenesis.
- In patients with fertility disorders, while a semen analysis is crucial, it is essential to complement this with the evaluation of testicular volume and the use of ultrasound to detect abnormalities. This comprehensive approach is vital for accurately assessing male infertility, identifying potential underlying causes, and guiding appropriate treatment to improve male fertility rates.
- When predisposing risk factors are present, there is a clear association between testicular cancer and microlithiasis, emphasizing the need for a thorough evaluation.
- Sequelae of surgical manipulation, orchidopexy, or biopsies can be detected as alterations in the echogenicity of the parenchyma.
- Recent studies have revealed that a correction factor of 0.71 is likely the most accurate for estimating calculated testicular volume.
- A variation greater than 25% between the volumes of the two testes is considered significant.
- Ultrasound abnormalities, such as ectasia of the rete testis, dilation of epididymal ductules, and intratesticular cysts, are correlated with seminal parameters. These findings clearly indicate an obstructive etiology of infertility.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Embryology 3. Functional Anatomy 4. Workup of Male Infertility 5. Ultrasound Findings
- Echogenicity
- Volume
- Epididymis
- Vascularity
- Spermatic Cord
- Inguinal Canal 6. Take-Home Messages 7. Conclusions 8. Bibliography

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# Abstract Archives of the RSNA, 2024

GUEE-17

## DIAGNOSTIC IMAGING TECHNIQUES IN RENAL TRANSPLANTATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Steven S. Raman, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Merck & Co, Inc;Consultant, Amgen Inc;Consultant, Profound Medical Inc
Alex Chung, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Imaging evaluation of the living kidney donor involves detailed evaluation of vascular anatomic information for surgical planning via CT Angiogram (CTA) or MR angiogram (MRA).Evaluation of renal allograft in the early posttransplant period involves evaluating for allograft size, collecting system dilation, periallograft fluid collection, signs of rejection and vascular flow via ultrasound, CT, MRI and nuclear medicine scintigraphy.Core needle biopsy of the transplanted kidney help determine the etiology of graft dysfunction when clinical evaluation and noninvasive diagnostic tests are nonspecific and commonly is performed to distinguish ATN from acute rejection and nephritis.Investigational MRI techniques that can eventually applied in post-transplant renal imaging include blood oxygenation level-dependent (BOLD) imaging, diffusion weighted imaging (DWI), diffusion tensor imaging (DTI), ferumoxytol enhanced MRA, Inflow Inversion Recovery, Arterial spin labeling, Phase contrast MRI, T1 relaxometry, MR Elastography and Magnetization Transfer Imaging.

### TABLE OF CONTENTS/OUTLINE

1. Imaging evaluation of living kidney donor.1a. CTA evaluation.1b. MRA evaluation.2. Imaging evaluation in early post-transplant period.2a. US evaluation2b. CT evaluation.2c. MRI evaluation2d. Scintigraphy evaluation.3. Core needle biopsy of the transplanted kidney: Indication, technique and complications.4. Investigational MRI techniques.

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# Abstract Archives of the RSNA, 2024

GUEE-18

## ROLE OF IMAGING IN MANAGING SURGICAL BED COMPLICATIONS AFTER PROSTATECTOMY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Bohyun Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Adam T. Froemming, MD (*Abstract Co-Author*) Nothing to Disclose
Ashish R. Khandelwal, MD (*Abstract Co-Author*) Nothing to Disclose
Garima Suman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Imaging is increasingly being utilized to evaluate post-prostatectomy complications and guide treatment decisions. These include early complications, such as infection, hematoma, urine leak; and late complications, such as anastomotic strictures, urinary fistula, lymphocele. 2. MRI has become the gold standard for detection and characterization of urosymphyseal fistula due to high failure rate and complications associated with cystoscopy. 3. Incorporating Dynamic Voiding MRI enhances insights into urethral adhesions, mobility, strictures and improves detection of urinary fistula. 4. MRI enables precise characterization of the fistula defect relative to the urinary sphincter complex and rectum, that are critical considerations for surgical planning.

### TABLE OF CONTENTS/OUTLINE

1. Case-based review of surgical bed complications and spectrum of imaging findings, including : a) Urethral stricture; b) Urosymphyseal fistula; c) Rectourethral fistula; d) urine leak ; e)Soft tissue and osseous infections such as myositis and osteomyelitis 2. MRI protocol including Dynamic Voiding sequences for urethral strictures and fistula post-prostatectomy. 3. Role of CT angiography for presurgical vascular assessment and CT-guided bone biopsy for antimicrobial management prior to urethral reconstructive surgery. 4. How do MRI findings correlate with cystoscopy and influence surgical decision-making in urethral strictures and fistula (conservative management vs urethral reconstruction vs pelvic exenteration). 5. Limitations and pitfalls in MR interpretation, such as urethral recess mimicking fistula, infected urinoma mimicking recurrent cancer, and reactive osteitis resembling osteomyelitis.

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# Abstract Archives of the RSNA, 2024

GUEE-19

## DEMYSTIFYING THE CONGENITAL, ACUTE, CHRONIC, AND NEOPLASTIC MANIFESTATIONS OF THE BLADDER. WHAT A GENERAL RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduardo J. Matta, MD (*Abstract Co-Author*) Nothing to Disclose
Akilan Gopal, MD (*Abstract Co-Author*) Nothing to Disclose
Kaustubh Shiralkar, MD (*Abstract Co-Author*) Nothing to Disclose
Steven S. Chua, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan Molina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Outline the most common bladder pathologies in both the adult and pediatric population. Delineate bladder pathologies into four broad categories: congenital, acute non-neoplastic acquired, chronic non-neoplastic acquired, and neoplastic. List the common pathologies within each category, provide imaging correlates for each pathology, recognize the salient imaging features including more complex topics including the urachal abnormalities and malignancy.

### TABLE OF CONTENTS/OUTLINE

The bladder is often underemphasized in radiology training and can be a confusing organ . In this exhibit, we aim to demystify the myriad of bladder pathologies. We provide a flowchart separating bladder pathologies into four broad categories: congenital, acute, chronic, and neoplastic and highlight the salient imaging features to improve diagnostic acumen of trainees and the general radiologists and facilitate optimal treatment to improve the outcome of patients. Congenital pathologies described will include posterior urethral valves, prune belly syndrome, cloaca, exstrophy of the bladder, urachal abnormalities, reflux, and ureterocele. Acute pathologies will detail rupture (intraperitoneal, extraperitoneal), cystitis, and bladder stones. Chronic pathologies will involve bladder outlet obstruction, bladder diverticulum, and fistulization from chronic inflammatory conditions. Neoplastic pathologies will describe urothelial cell carcinoma, transitional cell carcinoma adenocarcinoma, squamous cell carcinoma, and metastases.

# Abstract Archives of the RSNA, 2024

GUEE-2

## BEYOND THE FILTER: A COMPREHENSIVE EXPLORATION OF ADULT RENAL TUMOR DIVERSITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eugenio A. Leite, MD (*Abstract Co-Author*) Nothing to Disclose
Henzo Ota, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Gabriela Cintra Borba (*Abstract Co-Author*) Nothing to Disclose
Victor D. Nishimura, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas P. Caldas, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Mario Porfirio Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna P. De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Vieira Dos Santos (*Abstract Co-Author*) Nothing to Disclose
Rodrigo V. Negri, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Magna, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Rossi Corregliano, MD (*Abstract Co-Author*) Nothing to Disclose
Ligia C. Germek, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Abdo De Almeida (*Abstract Co-Author*) Nothing to Disclose
Joao Pedro C. Lino, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Renal cell carcinoma is the most common kidney cancer, with various subtypes presenting distinct imaging characteristics. Clear cell RCC appears as a hypervascular mass with ‘halo’ on contrast-enchanced CT/MRI. Papillary RCC exhibits heterogeneous enhancement with cystic components. Chromophobe RCC presents as a hypovascular mass with peripheral enhancement. Collecting duct carcinoma is agressive, showing infiltrative growth and low attenuation. Multilocular cystic neoplasm of a low malignant potential is a benign tumor with multilocular cysts and thin septa. Sarcomatoid RCC is agressive, often with hemorrhage or necrosis. Unclassified RCC requires detailed histopathological evaluation. Other renal tumors include angiomyolipoma with macroscopic fat, oncocytoma with central scarring, and rare primary renal lymphoma. Renal metastases show variable characteristis. Transitional cell carcinoma appears as a filling defect. Retroperitoneal tumors include liposarcoma, pleomorphic sarcoma and leiomyosarcoma. Renal pseudotumors, like xantogranulomatous pyelonephritis, mimic tumors on imaging, requiring differentiation.

### TABLE OF CONTENTS/OUTLINE

Renal cell carcinoma Subtypes
- Clear cell RCC
- Papillary RCC
- Chromophobe RCC
- Collecting duct (Bellini)
- Multilocular cystic neoplasm of low malignant potential
- Sarcomatoid RCC
- Unclassified RCC Others renal tumors
- Angiomyolipoma
- Oncocytoma
- Renal lymphoma
- Renal metastasis Direct extension of neighboring tumors
- Transitional cell carcinoma / Urothelial cancer
- Retroperitoneal tumors Pseudotumors
- Xanthogranulomatous pyelonephritis

# Abstract Archives of the RSNA, 2024

GUEE-20

## RETROPERITONEAL INFECTIONS: ANATOMY, PATHOGENESIS, SPREAD, IMAGING FEATURES AND IMPACT ON MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Corey T. Jensen, MD (*Abstract Co-Author*) Research Grant, General Electric Company
Muhammad O. Awiwi, MD (*Abstract Co-Author*) Nothing to Disclose
James M. Jing, MD (*Abstract Co-Author*) Nothing to Disclose
Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Ayman H. Gaballah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To review the anatomy of the retroperitoneum. - To illustrate the pathways of disease spread in the retroperitoneal spaces. -To localize and describe the spectrum of imaging appearances of various retroperitoeneal infections - To discuss the impact of imaging findings on management.

### TABLE OF CONTENTS/OUTLINE

- Introduction - Pathophysiology and pathways of disease spread - Relevant clinical picture - Correlation of findings on imaging with anatomical background, locatization based on the primary disease process - Review of a spectrum of imaging findings with pathologic correlation (including pancreatic abscesses, duodonal perforation, duodenal diverticulitis, colon perforation into the retroperitoneum, different types of pyelonephritis, adrenal infections, puerperal septic thrombophlebitis, mycotic aortic aneurysm, retroperitoneal abscesses related to Pott's disease or osteomyelitis/spondylodiscitis, and hematogenously disseminated infections such as hydatid/echinococcal cyst, tuberculosis, histoplasmosis, coccidiomycosis, cat scratch disease, and disseminated Mucor). - Differential diagnoses - Mimics and clues to correct diagnosis - Impact of imaging features on management options

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# Abstract Archives of the RSNA, 2024

GUEE-21

## KIDNEY TRANSPLANT COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Terri A. Williams-Weekes, MD (*Abstract Co-Author*) Nothing to Disclose
Rita Maria Lahoud, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Dippre, MD (*Abstract Co-Author*) Nothing to Disclose
Hillary Bui, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand the modalities used to evaluate renal transplants.Understand typically seen anatomy and ultrasound findings for renal transplants.Understand the timeline of expected non-infectious renal transplant complications.Understand expected imaging findings for common renal transplant complications.

### TABLE OF CONTENTS/OUTLINE

1. Renal Transplant Anatomy2. Modalities for Assessment of Renal Transplant3. Normal Renal Transplant Imaging Findings4. Timeline of Expected Non-Infectious Complications5. Early Complications (Pseudoaneurysm, Hematoma, Renal Artery Thrombosis)6. Intermediate Complications (Ureteral Stricture, Renal Calculi, Renal Artery Stenosis)7. Late Complications (PTLD, Abdominal/Pelvic Complications)8. Anytime Post Transplantation Complications (Abscess, Post-Biopsy AV Fistula)

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# Abstract Archives of the RSNA, 2024

GUEE-22

## NEPHRON-SPARING TECHNIQUES IN THE TREATMENT OF SMALL RENAL MASSES: A PRIMER FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amr Kalander, MD (*Abstract Co-Author*) Nothing to Disclose
Joao S. Pais, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Menezes, MD (*Abstract Co-Author*) Nothing to Disclose
Regis Otaviano Bezerra, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Vivas Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Sousa Santana De Paula (*Abstract Co-Author*) Nothing to Disclose
Guilherme L. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor Nascimento, MD (*Abstract Co-Author*) Nothing to Disclose
Jose G. Maluf, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Understand key concepts about small renal masses and their potential treatment options; • Learn about the main indications of partial nephrectomy and thermal ablation in that context; • Understand the tumor characteristics that influence their management and treatment; • Recognize expected imaging features related to each kind of treatment; • Identify unexpected imaging findings and the main complications of these procedures, highlighting pearls and pitfalls for this assessment.

### TABLE OF CONTENTS/OUTLINE

• Introduction - General concepts about small renal masses and their different approaches o Current context and definitions o Treatment options o Partial nephrectomy o Thermal ablation o Active surveillance o Indications and contraindications o Advantages and disadvantages • Imaging features o Partial nephrectomy o Pre-procedural planning o Post-procedural imaging features o Thermal ablation o Pre-procedural planning o Post-procedural imaging features • Case- based review, with pearls and pitfalls o Complications related to partial nephrectomy o Complications related to thermal ablation • Future perspectives • Conclusions and key takeaways

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# Abstract Archives of the RSNA, 2024

GUEE-23

## DON'T PANIC, IT'S JUST A PEEK: A COMPREHENSIVE LOOK AT MALE URETHRAL IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

LOUISE FATIMA GOMES DE ALMEIDA (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Eleonora Silva (*Abstract Co-Author*) Nothing to Disclose
Andre Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Daniella Braz Parente (*Abstract Co-Author*) Nothing to Disclose
Luana Alves, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Compare Conventional Voiding Cystourethrography (VCUG) Retrograde Urethrography (RUG) vs. Magnetic Resonance Urethrography (MRU) to evaluate the male urethra.- Review the step-by-step procedures for each imaging method.- Analyze the advantages and limitations of VCUG/RUG and MRU.- Recognize key findings in urethral images for each technique.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: Understanding the Urethra- Briefly explore anatomy, urination function, and common issues (strictures, injuries, infections).2. Imaging TechniquesA) Fluoroscopic Techniques: 1. VCUG:- Protocol: Step-by-step explanation of the VCUG procedure.- Patient Preparation: Instructions for patients before undergoing VCUG.2. RUG:- Protocol- Patient PreparationB) MRU- Protocol- Patient PreparationC) Comparison among Urethral Imaging: strengths and weaknesses of each techniqueD) Overcoming Difficulties Addressing challenges associated with each imaging method and solutions for optimal results.3. Choosing Wisely
- Visualization strengths (VCUG/RUG vs. MRU)
- Radiation exposure (VCUG/RUG vs. MRU)
- Cost
- Patient comfort4. Interpreting the Images
- Key Findings Pitfalls Recognize crucial details and avoid misinterpretations.
- Surgical Considerations Ensure imaging reports provide what surgeons need.5. Common Urethral Surgeries brief descriptions of procedures like urethroplasty for strictures.6. Interactive Case Studies solidify image interpretation skills.7. Conclusions summary of key points and the importance of accurate urethral imaging for diagnosis and treatment planning.

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# Abstract Archives of the RSNA, 2024

GUEE-24

## DEVELOPMENT OF A DEEP PELVIC ENDOMETRIOSIS REPORTING AND DATA SYSTEM (ENDO-RADS) USING MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vlad V. Simianu, MD (*Abstract Co-Author*) Nothing to Disclose
Megan Loring (*Abstract Co-Author*) Nothing to Disclose
Achille Mileto, MD (*Abstract Co-Author*) Consultant, Bayer AG
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Karisma Gupta, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

We developed and herein present a Reporting and Data System for deep pelvic endometriosis (Endo-RADS). Endo-RADS is a scoring system determined by appearance and MRI signal characteristics of endometriotic lesions (lesion type) and location in the deep pelvis. The greater the Endo-RADS cumulative score, the higher the stage of deep pelvic endometriosis. While Endo-RADS is based on MRI findings, it also takes into account prior demonstration of deep pelvic endometriosis by laparoscopy or ultrasound. Endo-RADS can provide simplified and standardized terminology to solve complex narrative endometriosis reports.Learning Objectives:- To discuss shortcomings of previously proposed classifications for deep pelvic endometriosis.- To illustrate currently unmet needs and limitations of reporting systems for deep pelvic endometriosis.- To introduce Endo-RADS (Endometriosis Reporting and Data System).- To showcase how Endo-RADS scores are assigned based on MRI signal characteristics and location of the lesions.

### TABLE OF CONTENTS/OUTLINE

- To review epidemiology, clinical significance, and morbidity of deep pelvic endometriosis.- To highlight commonly encountered imaging findings of deep pelvic endometriosis at MRI.- To introduce the Endo-RADS scoring system.- To discuss anticipated imitations of Endo-RADS.- To illustrate future directions for Endo-RADS.

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# Abstract Archives of the RSNA, 2024

GUEE-25

## ADNEXAL AGONY: A DIAGNOSTIC ODYSSEY IN EMERGENCY SCENARIOS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Guillermo P. Sangster, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Strobel, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Previgliano, MD (*Abstract Co-Author*) Nothing to Disclose
Meghna Chadha, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Marrero-Castillo (*Abstract Co-Author*) Nothing to Disclose
Carolina Soto-Davila, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review the acute clinical presentation of various adnexal disorders and subsequent abdominal complications.2. Describe the multi-modality imaging findings of adnexal emergencies such as ovarian torsion, massive ovarian edema (MOE), isolated fallopian tube torsion, rupture of cystic teratoma, and rupture of endometrioma.3. Review clinicopathologic follow-up to establish a final diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. To outline common and uncommon acute pathologies of the adnexa.2. To depict typical and atypical imaging appearances on ultrasound (US), computed tomography (CT), and magnetic resonance (MRI) exams.3. To discuss the most relevant differential diagnosis.Due to ambiguous and overlapping physical and laboratory findings, early and accurate diagnosis of acute adnexal pathology will help initiate appropriate management and fertility preservation. This educational exhibit will aid the radiologist in accurately and timely diagnose adnexal findings.

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# Abstract Archives of the RSNA, 2024

GUEE-26

## SYSTEMIC STAGING AND RESTAGING ON TESTICULAR CANCER: WHAT RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gustavo C. Lemos, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Willy Baccaglini, MD (*Abstract Co-Author*) Nothing to Disclose
Arie Carneiro, MD (*Abstract Co-Author*) Nothing to Disclose
Nadjaneyre Casimiro, MD (*Abstract Co-Author*) Nothing to Disclose
Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Oren Smaletz, MD (*Abstract Co-Author*) Stockholder: AstraZeneca, GlaxoSmithKline, ; Novartis, Roche and Sanofi;Speaker Bureau: AstraZeneca Astellas Pharma;Research Funding: Janssen, Bristol-Myers Squibb;
Fernando M. Coelho, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

. Briefly review testicular tumor management. Describe sites of lymphatic and hematogenous cancer spread. Discuss the role of imaging in staging and restaging testicular cancer. Demonstrate didactic cases of testicular cancer through cross-sectional imaging

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION- Testicular cancer epidemiology- General concepts of the role of imaging in staging and restagingTESTICULAR CANCER MANAGEMENT - Overview based on main guidelines- Role of imaging on systemic oncological assessmentTESTICULAR CANCER SPREAD ROUTES- Lymphatic- HematogenicIMAGING ASSESSMENT Staging- Lymph nodes- Distant metastasesRestaging - Residual disease after first-line chemotherapy (seminoma vs. non-seminoma)- Teratoma challenge on non-seminoma neoplasm- Role of PET/CT- Imaging findings after surgical managementDIDACTIC CASE-BASED REVIEW

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# Abstract Archives of the RSNA, 2024

GUEE-27

## PI-QUAL SCORE: A CASE-BASED USER GUIDE FOR OBJECTIVE ASSESSMENT OF PROSTATE MRI IMAGE QUALITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Khyrul A. Khan (*Abstract Co-Author*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Raphael Lanz (*Abstract Co-Author*) Nothing to Disclose
Andres Hernandez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Prostate Imaging Quality (PI-QUAL) scoring system has been increasingly adopted for the objective assessment and reporting of prostate MRI image quality. PI-QUAL consists of scores ranging from 1 to 5 based on technical parameters and the visual assessment of prostate MRI, with higher scores denoting superior imaging quality and enhanced diagnostic certainty. However, many radiologists are still unfamiliar with the PI-QUAL scoring system, which hinders its integration into prostate MRI reports, especially at non-academic centers. This exhibit provides a case-based user guide to facilitate the understanding of key rules of the PI-QUAL scoring system, to promote its widespread adoption into practice.

### TABLE OF CONTENTS/OUTLINE

1. Why should you include the PI-QUAL scoring system in your report? 2. Main components of the PI-QUAL scoring system: a. Technical parameters b. Visual assessment c. How is image quality scored? 3. A Case-Based User Guide: a. PI-QUAL Score 1 b. PI-QUAL Score 2 c. PI-QUAL Score 3 d. PI-QUAL Score 4 e. PI-QUAL Score 5 4. Test your knowledge! a. Case 1 b. Case 2

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# Abstract Archives of the RSNA, 2024

GUEE-28

## APPLICATIONS OF DECT IN RENAL IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pablo G. Verdu, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Puig (*Abstract Co-Author*) Nothing to Disclose
Polina Rudenko, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Monton Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Santos Blasco, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Fontenla Martinez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Describe the basic physical principles of DECT.- Explain the post-processed DECT maps.- Exhibit the main applications of DECT in renal imaging.

### TABLE OF CONTENTS/OUTLINE

Imaging is key in the diagnosis of urological pathology, from incidental neoplasms to acute renal colic or hematuria. The introduction of dual-energy computed tomography (DECT) has significantly expanded diagnostic possibilities in radiology, impacting the field of urology as well.While conventional CT provides limited information by overlaying all data into a single CT sequence, DETC enables the analysis of the continuous energy spectrum of X-rays. This facilitates better tissue characterization through the analysis of the post-processing maps.Imaging Findings 1. Focal Lesions: Differentiate between cystic and solid lesions and guide the histological subtype and aggressiveness.2. Renal Vascularization: Better vascular evaluation prior to treatment procedures and distinguish tumor thrombus from soft thrombus.3. Follow-up of Treated Lesions: Distinguish between post-treatment intralesional changes and residual tumor after percutaneous treatments.4. Inflammatory Diseases: Detection of inflamed kidney foci in acute pyelonephritis.5. Lithiasis: Characterization lithiasis composition. 6. Staging: Low energy monoenergetic maps facilitate the detection of metastases, whether hyper- or hypovascular, due to increased contrast between structures.Conclusion:DECT offers multiple advantages in renal imaging, from lesion characterization to vascular evaluation and treatment monitoring. Knowing their applications is crucial for its effective application in daily practice.

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# Abstract Archives of the RSNA, 2024

GUEE-29

## CYSTIC GENITOURINARY LESIONS IN THE PELVIS: PEARLS AND PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahdi Hamade (*Abstract Co-Author*) Nothing to Disclose
Rachita Khot, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Cary L. Siegel, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph E. Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
David H. Ballard, MD (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cystic lesions in the male and female pelvis have a wide differential. This exhibit will present cystic lesions of the lower genitourinary (GU) tract along with their mimics and highlight important pearls and pitfalls. The focus of this exhibit will be on the bladder, urethra, and deep pelvis excluding adnexal lesions given existing imaging guidelines. The goal of this exhibit is to: (1) Provide a detailed review of cystic lesions of the bladder and urethra; (2) Showcase variable etiologies of periurethral cystic lesions in the female pelvis, including uterine, cervical, vaginal, and vulvar lesions, with an algorithmic approach to differential considerations; (3) Present variable cystic lesions in the male pelvis with focus on genitourinary lesions

### TABLE OF CONTENTS/OUTLINE

A. Cystic lesions of the bladder and urethra: Diverticula Urachal abnormalities Infectious lesions Mimics and less common lesions (simple cyst, Brunn’s cyst, cloacal cyst, everted ureterocele, cystitis cystica, obturator hernia, implantable devices and injectables) B. Cystic lesions in the female pelvis: Uterine and cervical origin lesions: endosalpingiosis, cystic fibroids, adenomyomas, Nabothian cysts, tunnel cluster, cervicitis, adenoma malignum, endocervicosis. Vaginal lesions: Gartner’s duct cyst, vaginal cuff cyst, inclusion cysts. Vulvar and perineal lesions: Bartholin gland cyst or abscess, Skene duct cyst, canal of Nuck cyst. C. Cystic lesions in the male pelvis Utricle cyst Mullerian duct cyst Seminal vesicle cyst Ejaculatory duct cyst Cowper duct syringocele Mimics and other lesions (cystic BPH nodules, prostate retention cysts, hindgut cyst, angiomyxoma)

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# Abstract Archives of the RSNA, 2024

GUEE-3

## DISEASES WITH THORACIC AND GENITOURINARY INVOLVEMENT: A REVIEW FOR THE GENERAL RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Macedo, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Paulo T. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Carolina Bueno da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Marcelo B. Funari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Docema, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Various pathologies can affect thoracic organs and the genitourinary system. Syndromes like Birt-Hogg-Dubé and tuberous sclerosis, with characteristic pulmonary changes, can predispose to renal lesions, including carcinomas.Granulomatous diseases such as tuberculosis have primary pulmonary forms, but can also involve genitourinary organs, including the kidneys, adrenals, seminal vesicles and testes.Similarly, various pulmonary neoplasms can metastasize to the genitourinary system, with adrenal involvement, for example. Lungs are also a common site for renal metastases, among others.Thus, the general radiologist who interprets chest and abdomen exams may encounter conditions that affect both systems, and knowing how to recognize them is crucial for reaching the correct diagnosis and recommending additional tests if necessary.The aim of this pictorial essay is to review the main pathologies with thoracic and genitourinary involvement, familiarizing the general radiologist who might encounter them in their daily work.

### TABLE OF CONTENTS/OUTLINE

A literature review was conducted under the guidance of radiologists specialized in thoracic and genitourinary imaging.Pathologies involving both the pulmonary and genitourinary systems were included, covering conditions affecting the lungs, kidneys, adrenals, bladder, prostate, testicles and vascular structures.

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# Abstract Archives of the RSNA, 2024

GUEE-30

## RETROPERITONEUM AND PELVIC EXTRAPERITONEUM: ANATOMIC LANDMARKS, IMAGING FEATURES, AND PATTERNS OF DISEASE SPREAD

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jennifer Sammon, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Mohamed Badawy, MD (*Abstract Co-Author*) Nothing to Disclose
Maged Algazzar, MD (*Abstract Co-Author*) Nothing to Disclose
Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Peter S. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Kazi A. Irfan, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ayman H. Gaballah, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review anatomy and anatomic landmarks of retroperitoneal (RP) and pelvic extraperitoneal spaces2. Illustrate the intercommunications among different spaces and their impact on spread of related diseases3. Discuss imaging workup and imaging features of different pathologic entities and pathways of disease spread4. Provide algorithmic approach to differential considerations5. Highlight management options

### TABLE OF CONTENTS/OUTLINE

1- Introduction2- Anatomy of retroperitoneal (RP) and pelvic extraperitoneal spaces with diagrammatic illustrations3- Differentiation of intraperitoneal from extraperitoneal pathology4- Imaging features of different pathologic entities including, extraluminal gas, fluid collections, and masses5- Pathways of disease spread6. Case presentation6- Algorithmic approach to differential considerations7- Summary and conclusion

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GUEE-31

## THE CHALLENGES IN THE DETECTION AND DIAGNOSIS OF TRANSITIONAL CELL CARCINOMA OF THE KIDNEY: HOW TO OPTIMIZE LESION DETECTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elliot K. Fishman, MD (*Presenter*) Co-founder, HipGraphics, Inc Stockholder, HipGraphics, Inc Institutional Grant support, Siemens AG Institutional Grant support, General Electric Company Consultant, Exact Sciences Corporation Consultant, Imaging Endpoints II LLC

### TEACHING POINTS

1. Transitional Cell Carcinoma of the kidney is often a challenging diagnosis because lesions are often small and can mimic otherPathologies2. Detection of Transitional Cell Carcinoma of the kidney is dependent on proper scan protocols as well as scan display (MPR, MIP, VRT)3.Transitional Cell Carcinoma of the kidney have a range of CT appearances from infiltration of a calycx, to infiltration of the kidney, to focal fillingdefects to calyceal amputation4. Transitional Cell Carcinoma of the kidney can also be confused with other renal tumors as well as renal inflammatoryDisease5. early detection is critical for outcome and attention to spread of disease including multifocal disease will be addressed

### TABLE OF CONTENTS/OUTLINE

1. Demographics of Transitional Cell Carcinoma of the kidney including staging2. scan protocols and display protocols for the detection of Transitional Cell Carcinoma of the kidney3. case studies showing the various appearances of Transitional Cell Carcinoma of thekidney including infiltrative form (focal or diffuse), focal masses in the renal pelvis, and mass like appearance4. case studies illustrating the pitfalls in the diagnosis of Transitional Cell Carcinoma of the kidney including both neoplastic and inflammatory mimickers.5. pearls and pitfalls in the diagnosis of Transitional Cell Carcinoma of the kidney will be addressed with case examples

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# Abstract Archives of the RSNA, 2024

GUEE-33

## MRI FOR PENILE TRAUMA AND TUMORS: WHAT THE RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Diana Murcia, MD (*Abstract Co-Author*) Nothing to Disclose
Noor Fatima Majeed, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

MRI is increasingly being used for evaluation of penile conditions, including post-traumatic and neoplastic etiologies. Previously used as a problem-solving tool in patients who had undergone ultrasound for penile trauma or neoplasm, it is now increasingly being used as a primary modality for evaluation of these conditions and is a useful adjunct to physical examination. With its excellent contrast resolution, MRI can be used evaluate the integrity of the tunica albuginea, urethra, and vasculature and thereby differentiate a contusion from a fracture, helping direct management (surgical versus non-surgical). It can also be used for accurate tumor staging - including assessment of local extent, nodal and distant metastatic disease - and for surveillance following resection.

### TABLE OF CONTENTS/OUTLINE

Review of penile anatomyPenile MRI protocol, including protocol challengesCase-based review of penile trauma on MRIPenile cancer types and staging of penile squamous cell carcinomaCase-based review of penile cancer stages on MRIPostoperative appearance following penectomy (partial/total), including tumor recurrence

RSNA 2024
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# Abstract Archives of the RSNA, 2024

GUEE-34

## VARIANTS OF UTERINE FIBROIDS: LET'S TALK ABOUT THEM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Silvia E. Gimenez, MS (*Abstract Co-Author*) Nothing to Disclose
Teresa A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Saez, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Toscano, MD (*Abstract Co-Author*) Nothing to Disclose
MARIA BELEN DASS CORREA (*Abstract Co-Author*) Nothing to Disclose
Maria N. Napoli, MD (*Abstract Co-Author*) Nothing to Disclose
Leonela Panaccio (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Leiomyomas are the most common gynecological neoplasm.- Uterine leiomyomas and leiomyosarcomas are the two extremes within smooth muscle tumors, with diverse histological variants in the middle, including cellular histology, bizarre or atypical nuclei, mitotically active fibroids, and uterine smooth muscle tumor (STUM) lesions.- These variants present a distinctive histological profile and the characteristics may generate uncertainty in diagnostic interpretation.- There are no clear significant findings that can reliably distinguish fibroid variants, however there are some characteristics suggestive of non-typical or ordinary leiomyomas.- It´s essential for the radiologist to be aware of both the typical and atypical findings to best guide for diagnosis and management decisions- The definitive diagnosis of a leiomyoma variant is through post-surgical pathological examination.

### TABLE OF CONTENTS/OUTLINE

- Comprehensive description in imaging findings of leiomyoma variants and their pathologic features.- Comparative analysis of the features of uterine leiomyomas in ultrasound and magnetic resonance imaging that may be suggestive of one of the variants.- Demonstrate the significance of imaging findings in facilitating early detection, informing treatment strategies, and guiding patient monitoring for individuals affected by uterine leiomyomas.- Exemplify with cases.

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# Abstract Archives of the RSNA, 2024

GUEE-35

## COMPREHENSIVE IMAGING AND DIAGNOSTIC APPROACH TO UPPER TRACT UROTHELIAL CANCERS: INSTITUTIONAL INSIGHTS AND CLINICAL IMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Sravani Gampala, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the distribution of upper tract urothelial cancers (UTUC) and their most common locations and presentations.2. Explore various clinical scenarios to raise the possibility of UTUC by interpreting radiologists.3. Discuss the best imaging modalities and optimal protocols for the diagnoses of UTUC based on our institutional experience.4. Recognize papillary, flat and infiltrative types and sub-types of the UTUC with relevant imaging from our institution. Differentiate tumors from pseudo tumors based on imaging to appropriately guide clinical management.5. Discuss the sequential involvement of UTUC and bladder cancer; educate trainees to carefully evaluate the urinary tract and bladder if they find any one of the cancers.

### TABLE OF CONTENTS/OUTLINE

1. Discuss the epidemiology, risk factors, and clinical presentation of the UTUC.2. Explore the distribution and association with concomitant or recurrent bladder cancer and contralateral urinary tract cancer.3. Discuss the optimal imaging protocols will be outlined in general and used at our institution for better evaluation of tumors from pseudo tumors.4. Present a case-based review of different types of UTUCs, including papillary, flat, and infiltrative types. Present a unique case of histologically different but synchronous UTUC involving the renal pelvis and ureter.5. Discuss various differential diagnoses, which mimic UTUC including blood clots, hypertrophied papilla, renal papillary necrosis (ball on tee sign), inflammation, retroperitoneal fibrosis, renal cell carcinomas, and renal lymphomas. Review of different imaging findings will be presentedusing a multimodality case-based approach.

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# Abstract Archives of the RSNA, 2024

GUEE-36

## POST-ABLATION IMAGING CHANGES ON PROSTATE CANCER AND PI-FAB SCORE SYSTEM: CASE-BASED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gustavo C. Lemos, MD (*Abstract Co-Author*) Nothing to Disclose
Ivan Duarte (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo G. Garcia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Guilherme C. Mariotti, MD (*Abstract Co-Author*) Nothing to Disclose
Arie Carneiro, MD (*Abstract Co-Author*) Nothing to Disclose
Aline Pasquarelli, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Briefly review the prostate cancer focal treatment options.- Understand the current indications of high-intensity focused ultrasound (HIFU) and irreversible electroporation (IRE) and its technique procedures.- Review the prostate multiparametric MR imaging technique and zonal anatomy of the prostate.- Discuss the expected and unexpected post-ablation MR imaging findings.- Recognize the importance of DCE and DWI MRI sequences to detect prostate cancer recurrence afterablation.- Comprehend the new proposal PI-FAB score system and its role in patient follow-up.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION
● Overview of prostate cancer and focal therapy options
● New guidelines for HIFU for prostate cancer
HIFU AND IRE FOR PROSTATE CANCER
● What: Current concepts
● When: Potential candidates
● Where: Procedure description
● How: Tissue effects and limitations
PROSTATE IMAGING EVALUATION
● MRI protocol
● Prostate zonal anatomy at MRI
● The new scoring system for focal ablation (PI-FAB)
○ General concepts and rationale for using PI-FAB score system
○ When and how apply PI-FAB score system, correlating didactic cases.
○ Clinical management based on PI-FAB score
CASE-BASED REVIEW
● Expect and unexpected post-ablation MRI findings
● Normal temporal changes
● Residual or recurrent prostate cancer
● Pitfalls

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# Abstract Archives of the RSNA, 2024

GUEE-37

## CRACKING THE CYSTS: MASTERING THE V2019 BOSNIAK CLASSIFICATION WITH A QUIZ-BASED APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Khyrul A. Khan (*Abstract Co-Author*) Nothing to Disclose
Ifeanyi Ekpunobi, BS (*Abstract Co-Author*) Nothing to Disclose
Andres Hernandez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Bosniak Classification v2019 provides a framework for classifying cystic lesions based on their complexity and likelihood of malignancy, with Bosniak classifications ranging from I to IV. Examination questions regarding focal renal lesions is a recurrent theme in medical training, such as in the US Medical Licensing Examination (USMLE). However, students often lack sufficient exposure to the principles of renal cyst imaging throughout their training. This exhibit aims to enhance the training of medical students and radiology residents by offering a quiz-based approach to the Bosniak Classification system in the form of a question bank, a popular exam preparation tool used by medical trainees.

### TABLE OF CONTENTS/OUTLINE

1. Main components of the Bosniak Classification system a. Separate CT and MRI criteria in the Bosniak Classification v2019 b. Overview of Bosniak classes I through IV 2. Cracking the cysts questions: translating imaging features into simple language for trainees a. Bosniak classification of a small, well-defined cystic lesion with no septa or calcifications i. Q1: Bosniak class I criteria ii. Q2: Follow-up for Bosniak I b. Bosniak classification of a small, well-defined cystic lesion with thin, non-enhancing septa i. Q3: Bosniak class II criteria ii. Q4: Follow-up for Bosniak II c. Bosniak classification of a cystic lesion with a minimally thickened enhancing wall i. Q5: Bosniak class IIF criteria ii. Q6: Follow-up for Bosniak IIF d. Bosniak classification of a cystic lesion with enhancing thick septa i. Q7: Bosniak class III criteria ii. Q8: Follow-up for Bosniak III e. Bosniak classification of a cystic lesion with enhancing nodules i. Q9: Bosniak class IV criteria ii. Q10: Follow-up for Bosniak IV

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# Abstract Archives of the RSNA, 2024

GUEE-38

## RADIOLOGIST ROLE IN MR GUIDED FOCAL LASER ABLATION FOR LOCALIZED PROSTATE CANCER: LESSONS LEARNED AND ADVANCEMENTS IN PATIENT CARE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sangeet Ghai, MD (*Abstract Co-Author*) Research Grant, INSIGHTEC Ltd
Nathan Perlis (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Basso Dias, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Abreu Gomez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Radiologist leadership enhances Focal Laser Ablation (FLA) performance and promotes procedure standardization through a systematic approach focused on safety and technical consistency.- MRI guidance enables precise lesion localization enhancing delineation of lesion boundaries and facilitating the planning of ablation volumes. Real-time MRI thermal monitoring facilitates intra-procedural optimization of ablation temperatures and treatment margins.- FLA is acknowledged as a safe and efficient method for executing targeted therapy, controlling disease target while preserving healthy prostatic tissue and reducing the likelihood of adverse effects.- Patient related factors such as motion or anatomical distortion resulting from the insertion and repositioning of the treatment device may hinder the achievement of a successful ablation.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

GUEE-39

## UROLOGIC APPLICATIONS OF DUAL-ENERGY CT: WHAT THE RADIOLOGIST AND UROLOGIST NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Isao Tanaka (*Abstract Co-Author*) Nothing to Disclose
Rika Fukui (*Abstract Co-Author*) Nothing to Disclose
Etsuko Tate, MD (*Abstract Co-Author*) Nothing to Disclose
Hidenori Yamaguchi (*Abstract Co-Author*) Nothing to Disclose
Yuta Hirose, MSc (*Abstract Co-Author*) Nothing to Disclose
Yun Shen, PhD (*Abstract Co-Author*) Employee, General Electric CompanyResearcher, General Electric Company
Makiko Nishikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Haruhiko Machida, MD (*Abstract Co-Author*) Nothing to Disclose
Wakana Samejima (*Abstract Co-Author*) Nothing to Disclose
Hitoshi Takeuchi, MD (*Abstract Co-Author*) Nothing to Disclose
Toshiya Kariyasu (*Abstract Co-Author*) Nothing to Disclose
Shingo Harashima (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To introduce current limitations in urologic applications of single-energy CT (SECT) 2. To describe basic principles and various imaging/analyzing techniques of dual-energy CT (DECT) 3. To illustrate clinical utilities of DECT over SECT in urologic applications by presenting various clinical images

### TABLE OF CONTENTS/OUTLINE

1. Current limitations in urologic applications of SECT a) Limited image quality assessment of urinary tumor/stone composition b) Greater radiation/contrast media (CM) dose 2. Basic principles imaging/analyzing techniques of DECT a) Virtual monochromatic (VMI)/material decomposition imaging (MDI) b) Spectral HU (keV-HU) curve/effective Z analysis c) Metallic artifact reduction software (MARS) d) Iterative (IR)/deep-learning reconstruction (DLR) 3. Clinical utilities of DECT over SECT in urologic applications a) Improved image contrast/reduced CM dose: low-keV VMI/IR/DLR b) Reduced beam-hardening/metallic artifact: high-keV VMI/MARS c) Differentiation of cystic solid masses (e.g., complicated cysts): iodine-enhanced MDI d) Assessment of tumor grade/viability/response to chemotherapy: iodine-enhanced MDI e) Virtual non-contrast CT/reduced radiation dose: iodine-suppressed MDI/IR/DLR f) Bone metastasis detection: hydroxyapatite/calcium-suppressed MDI g) Lipid-rich lesion (e.g., renal angiomyolipoma) detection: fat-enhanced MDI/spectral HU curve/effective Z analysis h) Urinary stone composition analysis: uric acid/calcium MDI effective Z analysis

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# Abstract Archives of the RSNA, 2024

GUEE-4

## WHICH KIDNEY TO EXTRACT, SECTIONAL CT OF LIVING RENAL DONORS. WE TELL YOU

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Carlos M. Campana SR, MD (*Abstract Co-Author*) Nothing to Disclose
Mary E. Arevalo Molina, MD (*Abstract Co-Author*) Nothing to Disclose
Omar A. Gamboa Abundis, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Kidney failure is a major health problem that affects approximately 7.2% of the world's population. There are multiple kidney replacement therapies; however, the only definitive one is kidney transplant, which offers a better quality of life. It is important for the resident physician and radiologist to develop a radiological reporting system with the necessary pre-surgical information for the surgeon and to specify the exclusion criteria for a probable kidney donor. The left kidney is preferred for donation due to the greater length of the renal vein. Presence of more than two arteries within a kidney exclude the donor. Unilateral agenesis, horseshoe kidney, cortical atrophy, polycystic kidney disease, medullary sponge kidney, and necrosis exclude the donor. A gonadal vein greater than 5mm in diameter should be reported as it alters the surgical technique.

### TABLE OF CONTENTS/OUTLINE

1. Objectives and introduction to renal insufficiency. 2. Low-dose radiation protocol for tomographic acquisition of the potential donor. 3. Checklist of key points to consider in the radiological report of the living kidney donor. 4. Location and size of the kidneys. 5. Number of renal arteries and veins. 6. Type and diameter of accessory renal arteries. 7. Location and distance of the first segmental arterial bifurcation. 8. Type and diameter of renal veins. 9. Frequent and infrequent vascular anatomical variants. 10. Perinephric fat and urinary tract11. Exclusion criteria for living kidney donors. 11. Common pathology. 12. Development of a radiological reporting system with the necessary preoperative information. 13. Conclusion and teaching points

# Abstract Archives of the RSNA, 2024

GUEE-40

## BLADDER INJURY: WHAT TO LOOK FOR AND HOW TO FIND IT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Pablo Penalver Calero, MD (*Abstract Co-Author*) Nothing to Disclose
Ramiro Mendez (*Abstract Co-Author*) Nothing to Disclose
Jeronimo Barrera Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Manuel Espejo Dominguez (*Abstract Co-Author*) Nothing to Disclose
Sebastian M. Gill, MD (*Abstract Co-Author*) Nothing to Disclose
Alvaro Rueda-de-Eusebio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To review the techniques and protocols used for the study of bladder injury, emphasizing the correlation between different imaging modalities. - To explain the anatomical basis and mechanisms of injury that determine the different types of bladder rupture. - To illustrate the different existing classifications that can be used to describe bladder injury.

### TABLE OF CONTENTS/OUTLINE

Introduction: Bladder perforation, rupture or trauma is the laceration of the bladder wall, whether full-thickness or incomplete. These can be very subtle injuries, which can be easily overlooked in the setting of trauma patients. If this happens, complications such as urinary tract infections, incontinence or fistulas may occur. Therefore, it is important for radiologists to be aware of this entity and the methods available for its study. Imaging techniques: In this presentation we explain the different imaging modalities that can be used when bladder injury is suspected. Not only conventional cystography and CT-cystography, but also covering US, non-contrast CT and MRI. We will explain protocols, advantages and disadvantages of each technique and provide details that, in our experience, make the difference. Mechanism of injury: We review the anatomy and the possible mechanisms of injury (spontaneous and traumatic, whether closed, penetrating or iatrogenic). Classifications: We will cover both Sandler and AAST classifications. Sandler's is the most used one and divides ruptures into intramural hematoma or contusion, intraperitoneal rupture, extraperitoneal rupture and intra- and extraperitoneal rupture. For all of the above, we will use representative images from our series of more than 50 cases.

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# Abstract Archives of the RSNA, 2024

GUEE-41

## DEMYSTIFYING MRI PENILE PROSTHESIS EVALUATION: INTRODUCTION FOR NOVICES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Noor Fatima Majeed, MD (*Abstract Co-Author*) Nothing to Disclose
Diana Murcia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Penile prosthesis is the ultimate treatment for erectile dysfunction. Dedicated penile MR protocol is the imaging of choice for evaluation of penile prostheses as it allows a three-in-one assessment of position, functionality, and penile anatomy. The currently most common prostheses include the 3-piece inflatable penile prosthesis (IPP), followed by the 2-piece IPP, and the malleable or semi-rigid penile prosthesis (MPP). Complications of any type and any component include fracture, infection, malposition, hematoma, and encapsulation. Inflatable type specific complications include kinking or buckling resulting in floppy glans syndrome, aneurysmal dilatation, and leakage. Knowledge of penile MR anatomical structures is crucial for the appropriate diagnosis of these complications.

### TABLE OF CONTENTS/OUTLINE

Penile MR protocol specific pre and post inflation sequences for IPP. Penile MR anatomy review. Types of penile prostheses: 2-piece Inflatable (IPP), 3-piece IPP, Malleable or semi rigid (MPP). Evaluation of anatomic location and functionality. Common complications.

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# Abstract Archives of the RSNA, 2024

GUEE-42

## VIRADS: OUR WEAKNESS IN THE FACE OF HONEST MISTAKES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

German Ramos Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Mast Vilaseca (*Abstract Co-Author*) Nothing to Disclose
Nuria Roson Gradaille, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Alberti Sancho, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Serrano Burgos (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.- Be careful when you look at the T2 sequences to avoid overdiagnosis when slightly hyperintense signal is present. 2.- Some bladder and patient conditions may complicate the accuracy of the VIRADS system. 3.- All sequences should be considered globally to assign a final VIRADS score.

### TABLE OF CONTENTS/OUTLINE

1.- Introduction to the VIRADS System: Overview, Importance, and Applications in Clinical Practice. 2.- Our Initial Results in Implementing VIRADS: Early Findings and Statistical Outcomes. 3.- Learning from Practical Cases: - Technical Aspects Related to VIRADS and MRI. - Issues Related to the Patient Variability. - Tumor Characteristics. 4.- Conclusions: Summary of Key Findings with Final Thoughts on Improving VIRADS Implementation

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# Abstract Archives of the RSNA, 2024

GUEE-43

## PROSTATE CANCER ACTIVE SURVEILLANCE PRECISE V2: WHAT HAS CHANGED AND CLINICAL IMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pamela Grazielle Correa De Oliveira (*Abstract Co-Author*) Nothing to Disclose
Jorge Elias JR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Isadora Balderama Canedo, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Gouvea, MD (*Abstract Co-Author*) Nothing to Disclose
Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Francesco Giganti, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Andre De Freitas Secaf, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos M. Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Cecilia V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Arthur Ogata, MD (*Abstract Co-Author*) Nothing to Disclose
Thalyne Lima (*Abstract Co-Author*) Nothing to Disclose
Valdair F. Muglia, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Active surveillance for prostate cancer is a management strategy employed in cases of low-risk and favorable intermediate-risk cancer. Its goal is to avoid invasive treatment options while maintaining a curative perspective. Several studies have highlighted the promising role of MRI in these cases, directly influencing clinical decisions and aiding urologists in providing optimal patient care.In 2016, the European School of Oncology established an international task force of experts, resulting in the publication of the PRECISE version 1 guidelines. These guidelines aimed to standardize the description of serial MRIs in both research studies and clinical practice. In 2024, Precise version 2 was released, with significant improvements discussed by an international panel comprising experts from various countries.The purpose of this educational exhibit is to explore the key differences between the first and current versions of PRECISE, emphasizing areas of improvement. Additionally, we aim to illustrate the clinical application of the current PRECISE classification using real cases from our institution.Finally, we will engage in a discussion about the current version of PRECISE, particularly discussing the areas for potential improvement.

### TABLE OF CONTENTS/OUTLINE

Introduction; Objetives; Main updates in PRECISE version 2; Illustration base on clinical cases of the applicability of PRECISE V2; Discuss its limitations and areas of improvement; Conclusion.

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# Abstract Archives of the RSNA, 2024

GUEE-44

## LET THE BUBBLES BURST!: ROLE OF CONTRAST ENHANCED US IN THE RENAL CYSTIC AND SOLID MASSES. FROM DIAGNOSIS TO TREATMENT.

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Fernandez Florez, MD (*Abstract Co-Author*) Nothing to Disclose
Aranzazu Sanchez Gabin, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand the usefulness of contrast-enhanced ultrasound for the characterisation of renal cystic lesions and other renal masses. 2. To review the main differences that should be made when using the Bosniak classification in CEUS compared to the existing one for CT and MRI and when not to use this classification. 3. To analyse the role of CEUS in the context of pre- and post-ablative treatments.

### TABLE OF CONTENTS/OUTLINE

1. Introduction. In the USA, the use of contrast-enhanced ultrasound is only approved by the FDA for liver indications. Therefore, for kidney and other organs it is used off-label. CEUS has significant differences from CT and MRI in terms of contrast and temporal resolution (among others), so the characterisation of cystic renal masses requires certain specifications. It also provides greater sensitivity in the characterisation of enhancement in papillary tumours. 2. General considerations on renal contrast-enhanced ultrasonography. 3. Renal cystic lesions: 3.1. Definition. 3.2. Evaluation by CEUS (compared to CT) based on the Bosniak classification (pictorial review): 3.2.1. Bosniak I. 3.2.2. Bosniak II and IIF. 3.2.3. Bosniak III. 3.2.4. Bosniak IV. 3.3. When not to use the Bosniak classification: 3.3.1. Inflammatory-infectious. 3.3.2. Masses with cystic-necrotic component. 3.3.3. Vascular. 4. Problem solving: cysts and other renal masses. Limitations of CEUS. 5. Analyze the different type of treatments: multidisciplinary committees. 6. Usefulness of CEUS in local treatments. 6.1. Planning of ablation treatments. 6.2. Detection of early complications post-ablation. 6.3. Surveillance after ablative treatment (proposal of treatment and follow-up algorithm). 7. Conclusions.

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# Abstract Archives of the RSNA, 2024

GUEE-45

## HOW TO CRACK THE NUT: WHAT RADIOLOGISTS NEED TO KNOW ABOUT BENIGN TESTICULAR LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Felippe D. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Caio P. Martinel, MD (*Abstract Co-Author*) Nothing to Disclose
Janaina Moreira (*Abstract Co-Author*) Nothing to Disclose
Jose Lucas S. Galvao I, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Froeder Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Gomes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Ultrasonography of the scrotum is a very important tool for evaluating the testicles as well as their adjacent structures, providing important anatomical details with the possibility of real-time assessment of vascularization through the Color Doppler feature in a non-invasive way.Testicular pouch changes encompass a spectrum from benign to serious conditions. In relation to benign changes, acute scrotum refers to sudden onset scrotal pain and swelling, often due to serious conditions like testicular torsion, epididymitis, or trauma. US is crucial for accurate diagnosis and timely intervention to prevent complications and preserve testicular function. In pediatrics, cryptorchidism refers to undescended testicles, where one or both testes fail to descend into the scrotum. US is valuable for diagnosing, visualizing the testicles position and assessing any associated abnormalities. Retractable testicles, on the other hand, can retract into the inguinal canal but are otherwise normal. The method helps differentiate between these two pathologies.Ultrasound of the testicular sac is vital for evaluating various chronic disorders such as hydrocele, scrotal lithiasis, and epididymal cysts. Overall, US provides crucial imaging information for precise diagnosis, treatment planning, and monitoring of these conditions, ensuring optimal patient care.

### TABLE OF CONTENTS/OUTLINE

This work aims to differentiate the main benign testicular lesions as well as the main ultrasound findings.

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# Abstract Archives of the RSNA, 2024

GUEE-46

## NON-TRAUMATIC GENITOURINARY EMERGENCIES: WHAT RESIDENTS SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Antonio Santana Veliz, MD, BSN (*Abstract Co-Author*) Nothing to Disclose
Sukrita Menon, MD (*Abstract Co-Author*) Nothing to Disclose
Gilberto J. Aquino, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Guide residents through different emergencies involving the genitourinary system in a non-traumatic setting.• Recognize multiple patterns of renal parenchymal pathologies that may require immediate action. • Review time-sensitive pathologies of the male and female genital systems.

### TABLE OF CONTENTS/OUTLINE

Kidneys/ureters• Renal Infarction • Renal vein thrombosis• Renal Hemorrhage (non-traumatic causes)• Renal Abscess• Acute Pyelonephritis• Emphysematous pyelonephritis• Pyonephrosis• Renal Cortical necrosis• Renal Papillary Necrosis• Obstructive Uropathy Bladder• Emphysematous cystitis Adrenals• Adrenal Hemorrhage (non-traumatic causes) Male Genital• Testicular Infarction• Testicular Torsion• Epididymo-orchitis• Testicular Abscess• Prostatitis and Abscess• Fournier's gangreneFemale Genital • Pelvic Inflammatory Disease• Acute Adnexal Torsion • Ovarian Infarction• Ovarian Vein Thrombosis• Pyomyoma

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# Abstract Archives of the RSNA, 2024

GUEE-47

## BALLS TO THE WALLS: A JOURNEY THROUGH TESTICULAR MRI PROTOCOLS AND CLINICAL APPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Raphael Lanz (*Abstract Co-Author*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Khyrul A. Khan (*Abstract Co-Author*) Nothing to Disclose
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Ultrasound is the most common imaging modality for the evaluation of the testicles. However, testicular MRI plays a crucial role in the diagnosis and characterization of various testicular conditions, encompassing non-neoplastic, benign neoplastic, and neoplastic entities. Despite its significance, this imaging technique is relatively unfamiliar to a considerable portion of the radiology community. This exhibit offers a comprehensive overview, exploring testicular MRI protocols, their clinical applications, common cases encountered in practice, and a glimpse into the evolving future of this diagnostic tool.

### TABLE OF CONTENTS/OUTLINE

1. Navigating Testicular MRI Clinical Indications, a. Non-neoplastic conditions, b. Benign neoplastic conditions, c. Neoplastic conditions. 2. How to structure a testicular MRI protocol in your institution, a. Patient preparation and positioning, b. Technical protocols for non-contrast and contrast-enhanced examinations. 3. How to read a testicular MRI? 4. Learning with cases, a. Case 1: a normal-appearing testicular MRI, b. Case 2: a benign condition, c. Case 3: a neoplastic condition. 5. Future perspectives for testicular MRI, a. The emergence of quantitative imaging techniques for the testicles, b. Potential future clinical applications of testicular MRI.

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# Abstract Archives of the RSNA, 2024

GUEE-48

## PEEKING INSIDE THE ADRENAL GLAND: A RADIOLOGICAL JOURNEY THROUGH UNUSUAL AND RARE ADRENAL TUMORS AND TUMORLIKE CONDITIONS WITH PATHOLOGICAL CORRELATION"

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Joanie M. Garratt, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmed Taher, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Describe the imaging approach for evaluating unusual and rare adrenal tumors.• Illustrate imaging manifestations of a spectrum of rare adrenal tumors and tumorlike conditions.• Correlate the imaging features with pathological findings.• Identify potential pitfalls in imaging of unusual and rare adrenal tumors and tumorlike conditions. • Discuss the impact of imaging features on management.

### TABLE OF CONTENTS/OUTLINE

• Introduction • Epidemiology, pathological classification and pathogenesis of unusual and rare adrenal tumors • Epidemiology, pathological classification of Tumorlike conditions involving the adrenal gland. • Multimodality imaging features of unusual and rare adrenal tumors o Primary bening tumors: § Hemangioma § Lymphangioma § Schwannoma § Oncocytoma § Ganglioneuroma § Teratoma § Lipoma § Mason’s Tumor § Lipomatous metaplasia/degeneration o Primary malignant tumors: § Angiosarcoma § Pleomorphic sarcoma. § Lymphoma (could be primary or secondary) § Neuroblastoma/Ganglioneuroblastoma § Malignant nerve sheath tumor o Tumorlike conditions involving the adrenal gland § Extramedullary Hematopoiesis § Mucinous cyst § Pseudocyst § Hematoma § Adrenalitis § Histoplasmosis § Abscess • Differential diagnosis, diagnostic approach, and management • Summary and conclusion

# Abstract Archives of the RSNA, 2024

GUEE-49

## UPPER TRACT UROTHELIAL CANCER AND ITS MIMICS: A PRIMER FOR TRAINEES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Avinash R. Kambadakone, MD, FRCR (*Abstract Co-Author*) Advisory Board, Bayer AG Research Grant, General Electric Company Research Grant, Koninklijke Philips NV Research Grant, PanCAN Research Grant, Bayer
Aoife Kilcoyne, MBBCh (*Abstract Co-Author*) Royalties, Wolters Kluwer nv;Author, Wolters Kluwer nv
Anuradha S. Shenoy-Bhangle, MD (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD (*Abstract Co-Author*) Nothing to Disclose
Onofrio Catalano, MD,PhD (*Abstract Co-Author*) Research Grant, Bayer AG;Researcher, Sofie Biosciences;Consultant, Johnson & Johnson;Fellowship funded, IBM Corporation;Speaker, Siemens AG
Shravya Srinivas Rao, MD (*Abstract Co-Author*) Nothing to Disclose
Soumyadeep Ghosh, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. CT Urogram is considered the imaging modality of choice for diagnosis; staging and follow-up of upper tract urothelial cancers.2. Spontaneous sub-urothelial hemorrhage can appear as hyperdense urothelial thickening on the non-enhanced phase with no or minimal enhancement. Follow-up imaging showing complete resolution should be obtained to avoid missing an underlying tumor that may have caused the hemorrhage.3. Pitfalls related to CTU and MRU techniques can mimic urothelial malignancy, and Radiologists should be aware of these while interpreting these studies.4. Radiologists should be cognizant of multimodality imaging appearances, ureteroscopy, and histopathology findings to accurately diagnose upper tract urothelial cancers and differentiate them from their mimics, to guide appropriate treatment.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Urothelial Cancer with pertinent anatomy2. Imaging: Role of CT and MR urography in identifying upper urinary tract urothelial cancer3. Role of ureteroscopy and histopathology 4. Mimics and their imaging appearances

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# Abstract Archives of the RSNA, 2024

GUEE-5

## IMAGING OF RENAL TUMORS BASED ON WHO CLASSIFICATION OF TUMORS (2022), 5TH EDITION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Toyonori Tsuzuki (*Abstract Co-Author*) Nothing to Disclose
Athina Tsili, MD (*Abstract Co-Author*) Nothing to Disclose
Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Akira Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Holger Moch (*Abstract Co-Author*) Nothing to Disclose
Samuel J. Withey, MBBS (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Presenter*) Support, Canon Medical Systems Corporation;Support, General Electric Company

### TEACHING POINTS

The WHO Classification of Tumors is published to standardize tumor names and diagnostic criteria to promote international comparative research on malignant tumors. Renal tumors are included in the volume titled "Urinary Male Genital Tumors," which was revised for the first time in six years as the 5th edition in 2022. From this edition, both pathologists and radiologists have joined as contributors, considering the extent to which diverse pathological classifications can be reflected in images. In the future, as the presence of genetic mutations becomes increasingly reflected in diagnostic names alongside histological features, radiologists will find it increasingly important to consider imaging findings from the perspective of imaging-genetic correlations, not just as a position of radiologic-pathologic correlation. In this paper, we will discuss the key points of this revision compared to the 4th edition, and we will also present how this classification can be reflected in imaging. (1) To introduce the WHO Classification of Renal Tumors 5th edition (WHO 2022)(2) To present imaging findings of major subtypes based on the WHO 2022(3) To present imaging features of relatively rare renal tumors following the WHO 2022 classification.

### TABLE OF CONTENTS/OUTLINE

(1) Introduction (the points of revision of WHO 2022) (2) Protocols and Useful findings of US, CT or MRI (3) Diagnosis of major subtypes of renal tumors (Expansile growth and Invasive growth)(including Bosniak classification update 2019 and Clear Cell Likelihood Score) (4) Diagnosis of other renal tumors (Mucinous tubular and spindle cell carcinoma, etc) (5) Diagnosis of molecularly defined renal carcinoma (FH deficient RCC, etc)

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# Abstract Archives of the RSNA, 2024

GUEE-50

## ADVANCES IN PROSTATE CANCER IMAGING (FROM DETECTION TO POST-TREATMENT): A PICTORIAL REVIEW OF SCORING AND REPORTING SYSTEMS BEYOND PI-RADS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Alice Schuch, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Giovanna S. Torre (*Abstract Co-Author*) Nothing to Disclose
Mauricio Zapparoli, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Marilia Da Cruz Fagundes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the timeline of scoring and reporting systems developed to date.- Describe mpMRI protocol, limitations, and pitfalls.- Discuss the need for effective scoring and reporting systems and reader training to reduce interobserver variability.- Review of the Prostate Imaging Reporting and Data System (PI-RADS).- Construct a guide with case illustrations for the application of newer systems: Prostate Imaging Quality (PI-QUAL), Prostate Cancer Radiologic Estimation of Change in Sequential Evaluation (PRECISE), Prostate Imaging for Recurrence Reporting (PI-RR), and Prostate Imaging after Focal Ablation (PI-FAB).- Present emerging technologies such as PET/MRI and the use of radiolabeled PSMA.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION- PCa epidemiology and risk factors- Prostate anatomy on mpMRI- Timeline of scoring and reporting systemsIMAGING PROTOCOLS- Proper mpMRI protocol- Limitations and pitfallsPICTORIAL REVIEW AND USER GUIDE- PI-RADS- PI-QUAL- PRECISE- PI-RR- PI-FABEMERGING TECHNOLOGIES- Integration of mpMRI and PET PSMA- Future directions

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# Abstract Archives of the RSNA, 2024

GUEE-51

## PENILE ANATOMY AND PATHOLOGIES UNDER THE MRI: AN ACADEMIC SHOWCASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fernando Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Rolando Alfonso Cocio Arcos, MD (*Abstract Co-Author*) Nothing to Disclose
Giancarlo Schiappacasse, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Labra, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas G. Molina Vasquez, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando Vivanco, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Magnetic Resonance Imaging (MRI) offers a detailed anatomical assessment of penile structures, including the corpus spongiosum, cavernosum, and tunica albuginea, with specific signal characteristics on various sequences. A standardized acquisition protocol is necessary to ensure optimal imaging quality for evaluating penile pathologies. MRI is useful in the context of neoplasms, Peyronie's disease, trauma, and vascular pathology.

### TABLE OF CONTENTS/OUTLINE

Anatomic review on MRI: Both corpus spongiosum (CS) and cavernosum (CC) show high signal on T2-weighted imaging (T2WI) and intermediate signal on T1-weighted imaging (T1WI). Urethral musculature appears hypointense compared to CS on T2WI. Tunica albuginea (TU) demonstrates low signal on both T1WI and T2WI. Contrast-enhanced MRI reveals gradual/centrifugal enhancement in CC and early enhancement in CS.The acquisition protocol requires patient supine with the penis flexed over the scrotum, small FOV (160 mm) and thin slices (2-3 mm). Sequences obtained are T2WI in three orthogonal planes, coronal/sagittal T1WI, axial small field of view diffusion-weighted imaging (DWI), dynamic contrast-enhanced sequences with fat saturation, and subtraction.Among the most frequent pathologies where MRI proves invaluable is in the characterization of primary and secondary neoplasms. Another spectrum of conditions in which MRI demonstrates utility includes Peyronie's disease, playing a crucial preoperative role. MRI shows remarkable sensitivity (99%) and specificity (87%) in trauma cases. Furthermore, in vascular pathology, notably cavernous body thrombosis, MRI offers crucial insights into thrombosis extension and associated findings.

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# Abstract Archives of the RSNA, 2024

GUEE-52

## THE STRANGE WORLD OF RENAL AND URINARY VARIATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Victor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Rocha, MD (*Abstract Co-Author*) Nothing to Disclose
Thais De Castro Barboza (*Abstract Co-Author*) Nothing to Disclose
Brainner Campos Barbosa Januzzi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Thiago O. Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe De Paula (*Abstract Co-Author*) Nothing to Disclose
Danilo Goncalves Filho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

I. Emphasize the uncommon nature and the unique associated conditions of congenital anomalies in the urinary tract. This accentuates the critical need for a detailed and comprehensive imaging approach, aiming to ensure the early and accurate identification of these rare anomalies. Such a focused strategy is essential for optimizing patient outcomes and guiding effective management plans. II. Review advanced imaging techniques and their application in diagnosing congenital urinary tract anomalies, focusing on the benefits of 3D reconstruction and contrast-enhanced studies in understanding the anatomical complexities and functional implications of these conditions. III. Underline the indispensable role of the radiologist in multidisciplinary teams managing congenital urinary tract anomalies, from prenatal imaging to postoperative assessment, emphasizing how radiologic expertise contributes to tailored treatment plans and optimizes patient prognoses.

### TABLE OF CONTENTS/OUTLINE

1. Embriology of urinary tract formation. 2. The role of computed tomography (CT) in evaluating congenital anomalies affecting the urinary tract. 3. Different presentations and examples of congenital anomalies affecting the urinary tract. a) Pancake kidney (discoid kidney) b) Renal cell carcinoma in a horseshoe kidney c) Supernumerary kidney d) Crossed renal ectopia e) Zinner Syndrome

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# Abstract Archives of the RSNA, 2024

GUEE-53

## MALE PELVIS NON-NEOPLASTIC LESIONS - WHAT RADIOLOGISTS NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Antonio E. Silva JR, BDS (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Beraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Cleo F. Souza, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Heitor Passeri, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the normal anatomy of the male pelvis.Illustrate the most prevalent non-neoplastic lesions of the prostate, seminal vesicle, duct deferens, urethra, testicles and penis.

### TABLE OF CONTENTS/OUTLINE

1) Introduction:Review normal anatomy2)Prostate:Acute prostatitisChronic prostatitisGranulomatous prostatitisAbscess3)Seminal vesicle:Inflammation / infectionHemorrhage4)Deferens duct:Vasitis5)Urethra:Posterior urethral valveHypospadiaEpyspadia6)Testicle:TorsionSegmental infarctionInfectionLymphedema6)Penis:Peyronie DiseasePriapismPartial thrombosis of the corpus cavernosumSpontaneous hematoma7)Conclusion and “take-home messages”

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# Abstract Archives of the RSNA, 2024

GUEE-54

## ULTRASOUND OF TESTICULAR MASSES IN A "CEC"

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alejandra Valenzuela (*Abstract Co-Author*) Nothing to Disclose
Carlos F. Guardado Martinez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

remember the different types of testicular tumors and the demographic and ultrasonographic characteristics that help in their identification

### TABLE OF CONTENTS/OUTLINE

GERM CELL TUMORS:¬ Seminomas: This is the most common pure tumor and is associated with TCG¬NS in older patients, around 40 years of age. Non-seminomatous germ cell tumors (NSGCT): These are often heterogeneous in echotexture, and the presence of cystic spaces and calcifications is much more common in this group.Mixed germ cell tumor: This is much more common than pure forms. The average age of presentation is around 30 years, and its ultrasound appearance varies depending on the histological types that compose it.•Embryonal carcinoma: Ultrasound shows it as a heterogeneous lesion with poorly defined borders.•Yolk sac tumors or endodermal sinus tumors: These represent 80% of testicular tumors in children, with most cases appearing before 2 years of age. In adults, the pure form is rare and is present in approximately half of mixed tumor cases.• Teratoma: This is the second most common type in children and appears before 4 years of age. The pure form in adults is very rare and is found in half of mixed tumors. Ultrasound shows it as a well-defined complex mass that may have cysts, calcifications, and areas of fibrosis.STROMAL TUMORS OF THE SEX CORDS:These represent about 5% of testicular tumors, with a prevalence of 10¬-30% in the pediatric age group. 90% of them are benign, but there are no specific radiological criteria to differentiate them.

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# Abstract Archives of the RSNA, 2024

GUEE-55

## HYPOVASCULAR RENAL LESIONS: CAN WE HIT THE TARGET?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Anton Aubanell, MD (*Abstract Co-Author*) Nothing to Disclose
German Ramos Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Serrano Burgos (*Abstract Co-Author*) Nothing to Disclose
Alex Espinal Colominas, MD (*Abstract Co-Author*) Nothing to Disclose
Mar Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Alberti Sancho, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Fernando Casanova Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Mast Vilaseca (*Abstract Co-Author*) Nothing to Disclose
Sandra Lopez Coello, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Renal tumors comprise a spectrum of hypovascular lesions, including papillary and chromophobe renal carcinoma, alongside rare entities with diverse imaging presentations.- Distinguishing subtypes remains challenging due to overlapping imaging features, especially in small lesions.- Certain features like small size, regular margins, and angular interface sign lean towards benignity in renal lesions.- Low fat content angiomyolipomas resemble RCC, while cystic masses with calcifications and fat should raise suspicion of atypical papillary carcinoma.

### TABLE OF CONTENTS/OUTLINE

1. Introduction- Overview of hypovascular renal tumors and their diagnostic challenges.2. Imaging modalities in renal mass assessment- CT and MRI protocols for evaluating renal masses.3. Benign lesions- Angiomyolipomas: classic and fat-poor variants.- Tubulocystic oncocytoma: Mimicking chromophobe or papillary RCC.- Inflammatory conditions and pseudotumors: tuberculosis mimicking solid renal masses.4. Malignant lesions- Papillary RCC: Imaging characteristics and atypical presentations.- Chromophobe RCC: homogeneous or heterogeneous appearance.- Rare malignant tumors: metanephric adenoma, mucinous tubular and spindle cell carcinoma, and tubulocystic RCC.- Hematopoietic and lymphoid tumors: renal involvement in lymphoma and leukemia.5. Diagnostic algorithm6. ConclusionsImportance of recognizing diverse renal tumor types for prognosis and management decisions.

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# Abstract Archives of the RSNA, 2024

GUEE-56

## MULTIMODALITY IMAGING MANIFESTATIONS OF SURGICAL COMPLICATIONS AFTER PROSTATIC INTERVENTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Akira Kawashima, MD (*Abstract Co-Author*) Nothing to Disclose
Stephen M. Broski, MD (*Abstract Co-Author*) Nothing to Disclose
Naoki Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
David A. Woodrum, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adam T. Froemming, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Takahashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cole P. Thompson, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A wide range of interventions are employed in the management of benign prostatic hyperplasia (BPH) and prostate cancer (PCa). In BPH, recent innovations in minimally invasive procedures have expanded the options for treatment of lower urinary tract symptoms beyond transurethral resection of the prostate. Common interventions for PCa include ablation, radiation therapy, and surgery. On imaging, differentiation between the normal post-interventional appearance of the prostate and various complications has important implications for clinical management. These complications include those related to vascular injury; injury to the surrounding structures, including the urethra, bladder, and rectum; anastomotic leak; urethral stricture and bladder outlet obstruction; infection, including musculoskeletal involvement; and radiation injury to the pelvic organs. Radiologists should be familiar with the appearance of these complications on CT, MR, US, fluoroscopy and PET to ensure prompt identification and treatment. This educational exhibit will serve as a comprehensive multimodality review of the imaging manifestations of surgical complications after prostatic interventions.

### TABLE OF CONTENTS/OUTLINE

- Review of the different types of interventions available for management of BPH and PCa.
- Normal post-interventional appearance of the prostate.
- Multimodality imaging findings of complications, including those related to BPH interventions; prostate biopsy; placement of fiducial markers and SpaceOAR hydrogel for radiotherapy planning; and ablation, surgery, and radiation therapy for prostate cancer.
- Common pitfalls in post-procedural imaging interpretation.
- Summary.

# Abstract Archives of the RSNA, 2024

GUEE-57

## PRIMARY RETROPERITONEAL CYSTIC LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maryam Rezvani, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Rogers, MD (*Abstract Co-Author*) Royalties, RELX
Akram M. Shaaban, MBBCh (*Presenter*) Royalties, RELX

### TEACHING POINTS

1. Recognize the different entities that can present as a retroperitoneal cystic lesions2. Discuss how to reach a reasonable differential diagnosis based on imaging appearance, demographics, and location of the lesion

### TABLE OF CONTENTS/OUTLINE

I. Neoplastic1.Cystic lymphangioma2.Mucinous cystadenoma/cystadenocarcinoma3.Cystic teratoma4. Cystic mesothelioma5. Mullerian cyst6. Epidermoid cyst7. Tailgut cyst8. Bronchogenic cyst9. Cystic change in solid neoplasm10. Pseudomyxoma retroperitoneiII. Non-neoplastic1. Pancreatic pseudocyst2. Lymphocele3. Urinoma4. Hematoma

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

GUEE-58

## THE IMPORTANT CONSIDERATIONS IN PERMANENT PROSTATE BRACHYTHERAPY WITH A FOCUS ON IMAGING DIAGNOSTICS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Chiyoko Tsuji (*Abstract Co-Author*) Nothing to Disclose
Yusaku Miyata (*Abstract Co-Author*) Nothing to Disclose
Shuichi Tanoue, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryosuke Akeda (*Abstract Co-Author*) Nothing to Disclose
Shiori Edamitsu (*Abstract Co-Author*) Nothing to Disclose
Chikayuki Hattori (*Abstract Co-Author*) Nothing to Disclose
Koichiro Muraki, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Iodine-125 (I-125) seeds, measuring 970 μm in diameter and 4.5 mm in length, are commonly used in low dose rate brachytherapy (LDR-BT) for prostate cancer. Due to their small size, these seeds can occasionally migrate through the venous system and lodge in peripheral blood vessels of various organs. Consequently, incidental findings of migrated seeds on plain radiographs or CT scans are not uncommon in patients with a history of LDR-BT.The development of hydrogel spacers, inserted between the prostate and rectum, has contributed to a decrease in the risk of grade 3 or higher rectal toxicity.The purpose of this presentation is to outline the imaging considerations for I-125 permanent seed placement for prostate cancer, focusing on two important aspects: (1) seed placement and migration; and (2) imaging changes and complications associated with hydrogel spacers. By understanding these imaging features, radiologists can better interpret post-treatment findings and guide patient management.1. Discuss the importance of Modified Peripheral Loading in Low Dose Rate Brachytherapy (LDR-BT) for prostate cancer.2. Highlight key points in imaging diagnostics for seed migration.3. Explore the effectiveness and precautions of using a Hydrogel Spacer in brachytherapy.4. By the end of this course, participants will: Understand the role of postoperative Xp/CT/MRI in LDR-BT. Grasp key concepts related to seed migration, spacers, and complications.

### TABLE OF CONTENTS/OUTLINE

1. Concept and technique of Modified Peripheral Loading in LDR-BT. 2. Key points in postoperative imaging evaluation. 3. Imaging diagnostics for postoperative complications. 4. Summary.

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# Abstract Archives of the RSNA, 2024

GUEE-59

## MULTIPARAMETRIC MRI PRE AND POST FOCAL CRYOABLATION FOR PROSTATE CANCER: PEARLS AND PITFALLS FOR THE REPORTING RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Jyothirmayi Velaga, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Narayan Lath, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Yan Mee Law, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Kae Jack Tay, MBBS, MRCS (*Abstract Co-Author*) Nothing to Disclose
Chooi Yan Anna Lois Lai, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A. Review aspects of focal therapy (FT) in treatment of localised prostate cancer B. Discuss pretreatment considerations on multiparametric MRI (mpMRI) C. Review expected post FT changes in the prostate D. Review in- and out-field tumor recurrence using case review E. Discuss pearls and pitfalls in mpMRI detection of post FT tumor recurrence F. Review aspects in surveillance of the post FT prostate

### TABLE OF CONTENTS/OUTLINE

Focal therapy (FT) is an emerging middle ground between active surveillance and radical whole gland therapy for treatment of localized prostate cancer in the era of precision medicine. Pretreatment considerations on mpMRI for appropriate patient selection include accurate risk stratification through tumor detection and staging as well as determination of tumor location and volume through judicious use of DCE. Low volume clinically significant cancer and MRI-occult cancers present challenges in pretreatment mpMRI.Post FT surveillance with mpMRI is critical for assessing oncologic efficacy. Post FT mpMRI is challenging as treatment changes distort the prostate gland and alter the signal intensity of treated and untreated parenchyma. DCE is the dominant sequence for assessing recurrent cancer post FT. With histology proven case reviews, we showcase the use of PI-FAB score for in-field and PI-RADS v2.1 for out-field recurrences in medium and long term surveillance. We discuss the pearls and pitfalls of mpMRI in post FT surveillance including tumor mimics and the use of ADC in guiding post treatment biopsy decisions. Limitations of mpMRI staging post FT recurrence are discussed including management of post FT tumor recurrence.

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# Abstract Archives of the RSNA, 2024

GUEE-6

## PENILE ULTRASOUND, EVERYTHING THE RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sandro C. Mandaloufas (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Guilherme C. del Guerra, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo C. Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Cesar Passos Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Figueiredo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Gulinelli, MD (*Abstract Co-Author*) Nothing to Disclose
Eliane E. Dutenhefner, MD, BDS (*Abstract Co-Author*) Nothing to Disclose
Victor A. Jabour, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Ventura, PhD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are:1. Importance of learning the penile anatomy.2. Understand the ultrasound technique to better perform the exam.3. Differentiate the normal and pathological appearance of the penis.4. Understand the different types of diseases and their ultrasound presentations.5. Managing Doppler study techniques are extremely important for diagnosis and assistance in defining treatment.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION• Penile anatomy.• Ultrasound technique used to evaluate the penis and vascular structures, main adjustments, parameters and what should be analyzed.• Illustrate with case reports from our department the main pathologies:CASE-BASED REVIEW- Peyronie`s Disease- Penile Trauma- Erectile Dysfunction- Balanoposthitis

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# Abstract Archives of the RSNA, 2024

GUEE-60

## BEYOND PI-RADS - STRUCTURED REPORTING AND QUALITY IN MULTI-MODALITY PROSTATE IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Asim Afaq, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine Hyde, BS (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Xiaosong Meng (*Abstract Co-Author*) Nothing to Disclose
Orhan K. Oz, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ivan Pedrosa, MD, PhD (*Abstract Co-Author*) Scientific Advisor, Health Tech International;Scientific Advisor, Merck & Co, Inc
Gaurav Khatri, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel N. Costa, MD (*Abstract Co-Author*) Research support, Bayer AG
Robert C. Sibley III, MD (*Abstract Co-Author*) Nothing to Disclose
Michael D. Bass, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Prostate cancer (PCa) care is rapidly evolving with multi-modality imaging, particularly multiparametric MRI, new ultrasound technologies, and molecular imaging now playing a key role in diagnosis, staging and treatment.2. Multiple reporting systems have been proposed to help standardize multi-modality image assessment and to facilitate communication with patients and referring physicians.3. We provide an illustrated, case-based review of the several proposed criteria used for assessment of MR image quality, detection and risk stratification of primary PCa, staging metastatic disease, and recurrence after conventional or focal therapy.

### TABLE OF CONTENTS/OUTLINE

1.Quality and Structured ReportingA. Pillars of Quality in Prostate Imaging: Image, Interpretation and BiopsyB. Advantages and Disadvantages2.Rationale, basic principles and illustrated review of standardized frameworks for reporting prostate imaging findings beyond PI-RADS A. MR image quality (PI-QUAL v1 and v2)B. Active surveillance (PRECISE)C. Post-treatment follow-up (PI-RR and PI-FAB)D. Micro-ultrasound (PRI-MUS)E. Molecular imaging (PSMA-RADS, PRIMARY)3.Implementation of multiple standardized frameworks in clinical practice - Practical RecommendationsA. Detection of primary PCaB. Characterization and risk assessment in primary PCaC. Detection of metastatic PCaD. Evaluation disease recurrence after conventional or focal therapy4.Challenges and OpportunitiesA. Use of Templates (picklists, references)B. Role of physician lead(s) (updates, radiologist training/feedback, communication with referring physicians) C. Integration of data from different systems and imaging-pathology data reconciliation

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# Abstract Archives of the RSNA, 2024

GUEE-61

## PSMA RADS VERSION 2.0: AN INSTITUTIONAL CASE BASED REVIEW OF THE UTILITY OF UPDATED PSMA RADS IN CLINICAL PROBLEM SOLVING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Sravani Gampala, MD (*Abstract Co-Author*) Nothing to Disclose
Arwa Elsamny, MBBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Knowledge of the different radiotracers used for PSMA PET and the definition of physiological versus pathological uptake. 2. Review the PSMA RADS categories with emphasis on changes made to categories in PSMA-RADS 2.0. 3. Recognize the importance of the use of the updated PSMA RADS 2.0 for standardized reporting. 4. Understand how the application of PSMA RADS has helped direct management in clinically challenging situations.5. Acknowledge the limitations of the PSMA RADS classification and areas for reform.

### TABLE OF CONTENTS/OUTLINE

1. Introductory about the history of the PSMA RADS classification.2. Different radiotracers /Ligands for PSMA PET (Ga 68 and F18) at the molecular level.3. Definition of physiologic Vs pathologic uptake of the radiotracers. Definition of increased uptake. 4. Navigating the New Frontier: Key Updates in PSMA-RADS version 2.0.5. Examples of PSMA RADS1, 2, 3A, 3B, 3C, 3D, 4, and 5 lesions with emphasis on management recommendations and changes to categories in PSMA RADS 2.0. 6. Example of a timeline for a patient followed by PSMA PET and an example of post-treatment changes. 7. Limitations of the current PSMA RADS 2.0. and suggestions for reform.

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# Abstract Archives of the RSNA, 2024

GUEE-62

## MAGNETIC RESONANCE UROGRAPHY (MRU): TECHNIQUE MASTERY AND ILLUSTRATIVE CASE REVIEWS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mohamed Elbanan, MD (*Abstract Co-Author*) Nothing to Disclose
Nourel Hoda M. Tahon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Kazi A. Irfan, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Azfar Siddiqui, MD (*Abstract Co-Author*) Nothing to Disclose
David L. Raj, MD (*Abstract Co-Author*) Nothing to Disclose
Amr S. Abdelaziz, MD (*Abstract Co-Author*) Nothing to Disclose
Ayesha Nasrullah, MD,FRCR (*Abstract Co-Author*) Nothing to Disclose
Nanda Deepa Thimmappa, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the unique roles of different imaging sequences used in MR Urography (MRU), including T2-weighted, T1-weighted, diffusion-weighted imaging (DWI), and dynamic contrast-enhanced (DCE) imaging for the diagnosis of various urological pathologies. 2. Explore how both contrast-enhanced and non-contrast MRU can effectively diagnose a wide range of urological conditions including pediatric anomalies, obstructive pathologies, and tumors within the urinary tract. Learn how the Vesical Imaging Reporting and Data System (VI-RADS) can be utilized by adding dedicated bladder sequences.3. Enhance diagnostic skills through review of illustrative cases that showcase the practical application of MRU in clinical practice. 4. Learn to identify and manage common pitfalls in MRU, including imaging and technique-related artifacts. Learn optimizing MRU protocols and adjusting imaging parameters to reduce artifacts and enhance image quality. Gain knowledge on managing patients with contraindications to MRI contrast agents or renal impairment.

### TABLE OF CONTENTS/OUTLINE

1. Technical Overview - Patient preparation and positioning for MRU. - Optimization of imaging sequences: T2-weighted, T1-weighted, DWI, and DCE. 2. Case Gallery - Pediatric Urology: Examples of congenital anomalies and their management, obstructive pathologies, urinary Tract Tumors: Identification and differentiation of benign versus malignant lesions. - Additional cases covering a range of common and rare conditions diagnosed via MRU. 3. Best Practices and Troubleshooting - Common imaging challenges and solutions. - Strategies for improving image quality. - Safety considerations with contrast-enhanced MRU.

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# Abstract Archives of the RSNA, 2024

GUEE-63

## CARCINOMA OF THE VULVA: WHAT RADIOLOGISTS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sanaz Behnia, MD (*Abstract Co-Author*) Nothing to Disclose
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Elham Taheri, MD (*Abstract Co-Author*) Nothing to Disclose
Priya O. Pathak, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Highlight the clinical features, prognostic factors and routes of spread of vulvar malignancies. 2. Review the multimodality imaging features of vulvar malignancies (multi-parametric MRI, F18-FDG PET-CT and PET-MRI) in conjunction with International Federation of Gynecology and Obstetrics (FIGO) guidelines. 3. Review the role of imaging in treatment planning: assessment for resectability, radiotherapy, chemotherapy. 4. Review the role of imaging in post treatment evaluation: treatment response evaluation, post-treatment complications and detection of recurrent disease.

### TABLE OF CONTENTS/OUTLINE

1. Introduction (a) Epidemiology and risk factors. (b) Normal perineal and vulvar anatomy. (c) Review pathological subtypes.2. 2021 Revised FIGO staging system: Stage I: Tumor confined to the vulva. Stage II: Tumor of any size with extension to lower 1/3rd of urethra, vagina and anus with negative nodes. Stage III: Tumor of any size with extension to upper part of perineal structures or with nonfixed, nonulcerated nodes. Stage IV: Tumor of any size fixed to the bone or with fixed/ulcerated nodes, or distant metastasis.3. Sentinel lymph node mapping (a) Tracer: 99mTc-Filtered sulfur colloid or Tilamanocept. (b) Planar imaging and SPECT-CT is performed of the pelvis to localize the sentinel node.4. Role of MRI (technique and review of cases).5. Role of FDG-PET (technique and review of cases).6. Role of PET-MRI (technique and review of cases).

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# Abstract Archives of the RSNA, 2024

GUEE-64

## NAVIGATING THE RADIOLOGICAL SPECTRUM OF HEMATURIA: FROM COMMON TO RARE CAUSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luciano B. Lovotti, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro J. Pacini (*Abstract Co-Author*) Nothing to Disclose
Martin M. Pesce, MD (*Abstract Co-Author*) Nothing to Disclose
Victorio Del Casale, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo S. Loto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- It’s always important to review the embryology, anatomy, pathophysiology, and radiological signs of the urinary tract. - Review of urinary tract imaging protocols. This presentation highlights the pivotal role of MDCTU (Multidetector computed tomography urography) in the imaging of the patient with hematuria. - Recognize the important role of radiologists in the multidisciplinary setting to communicate and collaborate findings in emergent cases.

### TABLE OF CONTENTS/OUTLINE

Hematuria has a wide range of causes:Causes of Hematuria:1. Kidney Stones: The presence of stones in the kidneys or urinary tract can lead to hematuria. We will emphasize some features (number, location, size, density, complications, post-op) to be able to carry out a detailed report.2. Urinary Tract Infections (UTIs): Many microorganisms can affect the urinary tract, and some of them can cause hematuria. An update: The urinary tract can be affected by numerous acute and chronic inflammatory processes that may be infectious or autoimmune.3. Trauma: Injuries to the urinary tract due to accidents, trauma, or medical procedures can cause hematuria. Grading injuries.4. Vascular: We will describe our most relevant cases that result in vascular-related hematuria.5. Neoplasm: Imaging features of urinary tract neoplasms. Tumor mimics.5. Miscellaneous: all those causes that we do not consider to be included in the previous ones.6. Take home points.In those most interesting and rare cases, we will review their pathophysiology and update the topic.

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# Abstract Archives of the RSNA, 2024

GUEE-65

## AN IN DEPTH REVIEW OF SOLID RENAL MASSES AND HEREDITARY RENAL CANCER SYNDROMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Henry H. Tam, FRCR (*Abstract Co-Author*) Nothing to Disclose
Leila Kafaei, MBBS,BSC (*Abstract Co-Author*) Nothing to Disclose
Kavita Shapriya, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Andrea L. da Silva, MBBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the commonly encountered solid renal masses, both benign and malignant, and describe the imaging findings which could assist in identifying the type of mass. To describe limitations of current imaging modalities in characterising the various renal masses due to overlapping imaging features and to review potential imaging techniques to achieve better prediction. To review clinical syndromes that are associated with an increased risk of renal masses or renal cell carcinomas, in terms clinical features genetics and imaging findings (both renal and extra-renal, where applicable)To understand the best pathway for patients with these syndromes which would assist in guiding imaging follow-up, treatment and genetic counselling.

### TABLE OF CONTENTS/OUTLINE

Solid renal masses Angiomyolipoma, oncocytoma, lobar nephronia, infarct, RCC, UCC, lymphoma, metastases Clinical features HistopathologyManagement Imaging features of solid renal masses Characteristic imaging findings of the above masses on CT, MRI and contrast ultrasound Other less common imaging techniques such as MIBI SPECT/CT, PSMA PET/ CT Inherited syndromes associated with an increased risk of solid renal masses, including von Hippel Landau, Birt-Hogg Dube syndrome, tuberous sclerosis, hereditary leiomyomatosis and renal cell carcinoma (HLRCC), hereditary papillary renal cell carcinoma (HPRCC), succinate dehydrogenase mutations, BAP1 mutation and sickle cell disease Review the clinical features and genetic mutations associated with these syndromes Imaging findings of the kidneys and extrarenal findings where applicable Role of screening in these patient

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

GUEE-66

## WHEN THINGS GO WRONG: UNEXPECTED FINDINGS AFTER URINARY SYSTEM INTERVENTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

German Ramos Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Alberti Sancho, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa Merino, MD (*Abstract Co-Author*) Nothing to Disclose
Eva Castella-Fierro (*Abstract Co-Author*) Nothing to Disclose
Juan Fernando Casanova Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Mar Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Espinal Colominas, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Gilabert (*Abstract Co-Author*) Nothing to Disclose
Sandra Lopez Coello, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Various medical, minimally invasive, surgical, and radiation treatments may lead to iatrogenic complications affecting the urinary tract.- Multidetector CT is the preferred imaging modality for evaluating urinary tract injuries, offering detailed visualization of cortical, vascular, and collecting system injuries.- Imaging findings associated with specific procedures like extracorporeal shock wave lithotripsy (ESWL), nephron-sparing surgery, and percutaneous renal interventions are discussed, highlighting potential complications and their management.- Post-surgical CT scans revealing fluid accumulation and hydronephrosis should raise suspicion of ureteral injury, warranting additional delayed imaging.- Urinary catheter migration and misplacement cause significant morbidity, necessitating prompt detection.

### TABLE OF CONTENTS/OUTLINE

- Imaging Technique:- Role of Multidetector CT in evaluating urinary tract injuries- Optimal CT imaging protocols for suspected urinary tract injuries- Iatrogenic injuries:- Renal complications:- Minimally invasive procedures: ESWL, surgery-related complications- Renal infection and vascular Injuries- Ureteral injuries:- Causes, presentation, and imaging FindingsUreterovaginal fistulas- Bladder Injuries:- Causes and postoperative evaluation with CT cystography- Catheters malposition/migration- Conclusions:- Importance of radiologists' awareness of Iatrogenic Urinary Tract Injuries- Role of imaging in prompt diagnosis and treatment planning- Overview of interventional radiologic procedures and their potential complications.

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# Abstract Archives of the RSNA, 2024

GUEE-67

## LOCALLY ADVANCED RENAL CELL CARCINOMA: DEVIL IS IN THE DETAILS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Angelica Patino, MD (*Abstract Co-Author*) Nothing to Disclose
Long Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Eric Li, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Limitations exist in cross-sectional imaging characterization of renal cell carcinoma (RCC), particularly for locally advanced cancer (Stage 3), and more specifically, T3a tumors. Availability of treatment options is predicated on accurate staging.-Surgical interventions involving nephron-sparing techniques are typically not advisable for Stage =T3a renal cancers. Therefore, suggesting locally advanced cancer stage by imaging features before surgery is paramount, particularly for central renal masses.-Review of salient imaging features crucial for staging during evaluation of renal masses suspicious for RCC (e.g. renal sinus fat invasion, perirenal fascia thickening, venous invasion, etc.).-Review of management guidelines (National Comprehensive Cancer Network [NCCN], American Urologic Association [AUA]) and surgical interventions (e.g. nephron-sparing surgery, radical nephrectomy).-Operative feasibility can be assessed using imaging-based supplementary scoring systems (e.g. RENAL Nephrometry Score).

### TABLE OF CONTENTS/OUTLINE

1. Generala. Epidemiology of kidney cancer2. The Kidneya. Organb. Vascular and lymphatics3. Pathologya. The incidental renal mass and differential diagnosesb. Renal cell carcinoma and subtypes4. Imaginga. Imaging modalities (ultrasound, CT, MRI) and advantages/limitationsb. TNM classificationc. Stages 1-4 RCC with emphasis on Stage 3 and associated pearls/pitfalls5. Implicationsa. Management and guidelines (NCCN, AUA)b. Supplemental scoring systems: RENAL Nephrometry Score, Preoperative Aspects and Dimensions Used for an Anatomical Classification, Centrality index, and renal tumor contact surface area

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# Abstract Archives of the RSNA, 2024

GUEE-68

## THE EVALUATION METHOD OF CONVENTIONAL < AND > FUNCTIONAL MR IMAGING FOR CHRONIC KIDNEY DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Keita Nagawa (*Abstract Co-Author*) Nothing to Disclose
Kaiji Inoue, MD (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Inoue (*Abstract Co-Author*) Nothing to Disclose
Yuki Hara (*Abstract Co-Author*) Nothing to Disclose
EITO KOZAWA, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The major teaching points have been modified as follows:1. Traditional morphological assessment criteria and renal functional MR imaging techniques are promising methods for utilizing the kidney as a biomarker.2. In the evaluation of chronic kidney disease, there are limitations to both conventional MR imaging methods < and > functional MR imaging methods, highlighting the need for a more comprehensive diagnostic approach < and > further advancements.

### TABLE OF CONTENTS/OUTLINE

This exhibit aims to:1. Highlight the role of conventional MRI in assessing the kidney's structure (medulla-cortex ratio, cortical size) for grading chronic kidney disease (CKD).2. Introduce the basic principles of functional kidney MRI techniques, including blood oxygen level-dependent (BOLD) diffusion-weighted MR imaging (DWI), diffusion-tensor imaging (DTI), < and > Intravoxel incoherent motion (IVIM), for CKD.3. Discuss the benefits < and > the added value of functional MR imaging in managing chronic kidney disease.Content Organization:1. Depiction of normal and diseased kidneys in conventional MRI.The effectiveness < and > limitations of conventional MRI in diagnosing CKD.Presentation of CKD through functional MR imaging modalities (BOLD, DWI, DTI, IVIM).2. Evaluation of the utility < and > constraints of functional MR imaging in CKD.3. Future directions for enhancing the diagnostic capabilities of functional kidney MR imaging such as twelve-layer concentric objects method, texture analysis, deep learning < and > auto segmentation.

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# Abstract Archives of the RSNA, 2024

GUEE-69

## ARE YOU SURE YOUR PROSTATE MPMRI REPORT IS COMPLETE?. LOOK FOR EXTRAPROSTATIC FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Diana Romero Mayorga I, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Borrero, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Aguirre, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Abreu Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
John L. Torres Castiblanco SR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The use of Prostate mpMRI has extended beyond detection of clinically significant prostate cancer, and is currently used for staging and treatment planning, active surveillance and post-treatment evaluation.Obtained MR images have a field of view centered on the prostate; however, adjacent extraprostatic and pelvic structures are included.The role of the radiologist must go beyond the search for extraprostatic extension and we must include in our report other relevant findings in neighboring organs included in the images.In order to achieve this objective, it is necessary that the radiologist systematically evaluates other extraprostatic structures, which we suggest: 1. Abdominal wall, 2. Bowel. 3. Musculoskeletal and 4. Genitourinary. The objectives of the following presentation are as follows:• Describe the frequency of the different extraprostatic findings on prostate mpMRI.• To provide an anatomic landmark to look for extraprostatic findings on prostate mpMRI.• To demonstrate the most frequent extraprostatic findings, per suggested anatomic segmentation, its relevance and clinical impact• To propose a structured report and follow up recommendations to improve communication and management of incidental findings to referring clinicians

### TABLE OF CONTENTS/OUTLINE

• Introduction: current recommended protocol for multiparametric Prostate mpMRI• Extraprostatic anatomical sites included in multiparametric Prostate mpMRI• Where to look for extraprostatic findings; bowel, genitourinary, abdominal wall, musculoskeletal.• A pictoral review of incidental findings on prostate mpMRI

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# Abstract Archives of the RSNA, 2024

GUEE-7

## EXPLORING PERIRENAL PATHOLOGY: A CASE-BASED REVIEW INTO MULTIMODAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Inmaculada Ansio Vazquez (*Abstract Co-Author*) Nothing to Disclose
Mariano Jose Parada-Blazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Rus, MD (*Abstract Co-Author*) Nothing to Disclose
Mario Sanchez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The objective of this poster is to provide a review of pathological conditions involving the perinephric space and to describe their key imaging characteristics, with a case-based approach using cross-sectional imaging.

### TABLE OF CONTENTS/OUTLINE

The perirenal space is the middle retroperitoneal space, sits between the anterior and posterior renal fascia and contains the kidney and adrenal glands. A variety of differential diagnoses can cause pathology within this space, often without specific clinical signs or symptoms. Sometimes it is not possible to differentiate the subcapsular or perinephric origin of a lesion, and these processes may be overlapping, so the differential diagnosis includes subcapsular disease. An understanding of commonly encountered conditions affecting the perirenal space, along with its main characteristics, can help narrow the potential diagnosis, however in some cases the diagnosis can only be done by histopathologic analysis.Pathology may be classified by their location and distribution as solitary or multifocal masses or rindlike soft-tissue lesions, as well as based on their etiology as neoplastic (sarcoma, renal or adrenal mases, lymphoma, metastasis) or non-neoplastic lesions (fluido colections, retroperitoneal fibrosis, systemic disease, extramedullary hematopoiesis).

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# Abstract Archives of the RSNA, 2024

GUEE-70

## INDETERMINATE RENAL LESIONS: THE ROLE OF CONTRAST ENHANCED ULTRASOUND IN ASSESSMENT AND FOLLOW UP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Henry H. Tam, FRCR (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Harvey, MBBS (*Abstract Co-Author*) Nothing to Disclose
Andrea L. da Silva, MBBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

renal lesions (both cystic and solid) are often encountered incidentally in radiology practice (especially at ultrasound). They can create more expense to the department with regards to further evaluation and/or follow up by use of CT/MRI. Contrast enhanced ultrasound provides a real-time assessment of renal lesions and their complexity. It can be used to classify cystic lesions, according to the Bosniak classification, and for follow up on non-surgical cystic renal lesions. Furthermore, it can assist in evaluation of indeterminate lesions - streaming patients into a management pathway sooner than should they be followed up with interval CT/MRI, as greater detail can be assessed. Aims: 1. Understand the classification of renal cysts with regards to the Bosniak classification of 2005 and proposed updates of version of 2019 with follow up recommendations. 2. Gain an understanding of solid renal lesions and imaging characteristics. 3. Review the currently used imaging modalities and protocols in the assessment of renal lesions and their costs, compared to contrast enhanced ultrasound: risk and benefits. 4. Review ultrasound contrast agents compared to CT/MR contrast agents. 5. The role of contrast enhanced ultrasound in assessment and follow up of renal lesions and case examples.

### TABLE OF CONTENTS/OUTLINE

Renal cysts - Bosniak classification system - review v2005 and updates proposed by v2019 Overview of solid renal lesions Current imaging techniques used in assessment of renal cystic lesions protocols and cost to department Introduction to contrast enhanced ultrasound: History Benefits and risks Costs Considerations when planning contrast enhanced ultrasound list Case examples of contrast enhanced ultrasound

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# Abstract Archives of the RSNA, 2024

GUEE-71

## THE TYPICAL AND PECULIAR PERINEAL TEARS: EMPHASIS ON MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Toqa El-Gohary, MD (*Abstract Co-Author*) Nothing to Disclose
Rania F. Elsayed, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ahmed W. Ali, MSc,MBBS (*Abstract Co-Author*) Nothing to Disclose
Asmaa Yahia (*Abstract Co-Author*) Nothing to Disclose
Hebatallah M. Azzam (*Abstract Co-Author*) Nothing to Disclose
Asmaa Abdelzaher, MD (*Abstract Co-Author*) Nothing to Disclose
Hadeer Radwan (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. Abdelatty, MD,MSc,MBBCh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the complex anatomy of the perineum with emphasis on MRI imaging.2. Appreciate the differences in perineal anatomy between males and females.3. Understand the mode of injury in obstetric/childbirth-related traumas.4. Understand the mode of injury in non-obstetric injuries, including iatrogenic causes.5. Provide practical reporting tips for simple and complex perineal tears on MRI.

### TABLE OF CONTENTS/OUTLINE

1. MR Anatomical considerations in female and male perineum. 2. Perineal trauma according to mode of injury Obstetric/childbirth-related trauma.• Other:Blunt trauma, Stab injuries, Fall from height, Road traffic accidents, Iatrogenic.3. Perineal trauma according to involved parts Superficial perineal tears, Perineal muscles, Anal sphincter injury, Ano-vaginal fistula, penile fractures, scrotal injuries. 4. Quick review of associated pelvic structures injury: Urethral injury, Urinary bladder injury, Bowel injury, Vascular injury, Pelvic bone fractures.

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# Abstract Archives of the RSNA, 2024

GUEE-72

## NAVIGATING THE MAZE OF PI-RADS 3 LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lauren Fane, BEng (*Abstract Co-Author*) Nothing to Disclose
Anna Luu (*Abstract Co-Author*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Michaela Cooley, PhD (*Abstract Co-Author*) Nothing to Disclose
Refky Nicola, MSc, DO (*Abstract Co-Author*) Royalties, RELX
Eduardo Thadeu De Oliveira Correia, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Prostate MRI adhering to PI-RADS v2.1 guidelines has been increasingly adopted for the detection and characterization of prostate cancer. Nonetheless, suboptimal reproducibility and the relatively high number of false-positive MRIs are still challenges, limiting the impact of MRI in prostate cancer diagnostic workflows worldwide. One of the key factors associated with these limitations is PI-RADS 3 (“equivocal”) lesions. This exhibit explores the nature of PI-RADS 3 lesions, their clinical implications, and strategies for their management.

### TABLE OF CONTENTS/OUTLINE

1. What’s a PI-RADS 3 lesion? a. PI-RADS 3 lesions in the peripheral zone b. PI-RADS 3 lesions in the transition zone 2. Do you know how to identify a PI-RADS 3 lesion? Learn with cases! a. Case 1: PI-RADS 3 lesion in the peripheral zone and a negative prostate biopsy b. Case 2: PI-RADS 3 lesion in the peripheral zone and a positive prostate biopsy c. Case 3: PI-RADS 3 lesion in the transition zone and a negative prostate biopsy d. Case 4: PI-RADS 3 lesion in the transition zone and a positive prostate biopsy 3. Understanding the challenges and implications of PI-RADS 3 a. Factors contributing to higher prevalence of PI-RADS 3 Scores b. Implications of a higher prevalence of PI-RADS 3 Scores c. Strategies to mitigate the prevalence of PI-RADS 3 Scores in your practice 4. Dealing with PI-RADS 3 a. The role of MRI in Diagnostic Pathways of Prostate Cancer b. Dealing with PI-RADS 3 in MRI-Based Diagnostic Pathways c. Dealing with PI-RADS 3 in Risk-Based Diagnostic Pathways 5. What does the future hold for PI-RADS 3? a. MRI innovations b. Ancillary biomarkers c. Upgrading rules and Diagnostic Pathways

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# Abstract Archives of the RSNA, 2024

GUEE-73

## IMAGING OF THREE-PIECE INFLATABLE PENILE PROSTHESIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Yashant Aswani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Erectile dysfunction (ED) is the inability to achieve or maintain erection sufficient for satisfactory sexual performance. It has a prevalence of 26/100 men in the age group of 40-70 years. ED unresponsive to pharmacotherapy or presence of penile fibrosis, are some of the many indications for penile prosthesis. Three-piece inflatable penile prosthesis (IPP) comprises paired cylinders, reservoir and pump. At the conclusion of this exhibit, the readers will be able to:1) Enumerate indications of penile prosthesis2) Describe imaging in three-piece inflatable penile prosthesis (IPP)3) Discuss complications of three-piece IPP

### TABLE OF CONTENTS/OUTLINE

1) Erectile dysfunction and 2018 American Urological association guidelines for management 2) Indications and contraindications for penile prosthesis 3) Types of penile prostheses 4) Role of Imaging 5) MRI protocol 6) Normal imaging appearance of 3-piece inflatable penile prosthesis 7) Complications of cylinder (mal positioning and mechanical failure) 8) Complications of rear tip extender (migration, extrusion) 9) Complications of reservoir (migration, leakage, collapse of low-profile reservoir, bowel obstruction, vascular compression) 10) Complications of pump (migration, stiction syndrome) 11) Complications of tubing (fracture, leakage, tail pipe penis) 12) Common complications (infection, hematoma, capsule formation) 13) Proposed template for reporting

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# Abstract Archives of the RSNA, 2024

GUEE-74

## THE EPIDIDYMIS - WHO SAYS SIZE MATTERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sharon Gordon, MD (*Abstract Co-Author*) Nothing to Disclose
Rona J. Orentlicher, MD (*Abstract Co-Author*) Nothing to Disclose
Barak Friedman, MD (*Abstract Co-Author*) Nothing to Disclose
Monika Misra, MD (*Abstract Co-Author*) Nothing to Disclose
Kamran Ali, MD (*Abstract Co-Author*) Nothing to Disclose
Melody W. Lin, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- The epididymis plays an essential role in sperm production and transport.- Ultrasound is the primary modality to evaluate the epididymis, with problem solving using CT and MRI.- Infection is the most common pathology in the epididymis, often presenting with concurrent orchitis, funiculitis, and cellulitis. Imaging is helpful to assess for secondary abscess or testicular torsion.- Appendix epididymis, the most common congenital variant, can present with sudden pain from torsion.- Cystic and solid epididymal masses are often benign. The majority are cysts. Soft tissue masses include adenomatoid tumors, leiomyoma, and lipoma. After ultrasound, MRI is the preferred modality to evaluate an epididymal mass given superior soft tissue contrast and lack of ionizing radiation. Since often benign, follow up ultrasound is commonly used to ensure stability.- Epididymal rhabdomyosarcoma is uncommon in children and rare in adults, presenting as a painless, solid, vascular mass, with a high rate of metastases.- Tubular ectasia, secondary to ductus deferens obstruction, is often seen post vasectomy but can also be idiopathic.- Epididymal trauma is rare but can be seen associated with testicular trauma.

### TABLE OF CONTENTS/OUTLINE

- Essential role of the epididymis in male reproduction with regards to anatomy, biology and function.- Congenital, infectious, inflammatory, cystic or solid masses, and traumatic abnormalities.- Multimodality imaging of epididymal pathology, predominantly ultrasound, with the aid of CT and MRI.- Differential diagnoses, complications and treatments.

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# Abstract Archives of the RSNA, 2024

GUEE-75

## TESTY SITUATIONS: A COMPREHENSIVE MULTIMODALITY IMAGING REVIEW OF THE ACUTE SCROTUM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Mahan Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Balaji Rao, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Roberts, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Acute scrotal pain is a common scenario in clinical practice. Etiologies include common entities, such as testicular torsion or epididymitis, to uncommon pathologies such as segmental testicular infarcts or Amyand hernia with appendicitis. Prompt recognition is essential in order to guide appropriate management and may require evaluation on multiple imaging modalities. This presentation will explore various causes of acute scrotal pathologies and at the conclusion of the module, the learner should be able to: • Elucidate role of imaging in a patient with acute scrotal pain • Recognize imaging findings and complications associated with common etiologies of acute scrotal pain • Describe imaging findings of uncommon causes of acute scrotal pain

### TABLE OF CONTENTS/OUTLINE

• Normal scrotal anatomy • Imaging of epididymitis, epididymo-orchitis, isolated orchitis and complications (abscess, infarct) • Radiology of scrotal trauma (including fracture, rupture, hematoma, hematocele) • Imaging of testicular torsion (complete, partial, torsion-detorsion, associated waveform analysis and complications) • Torsion of appendices • Review of uncommon etiologies of acute scrotal pain, including, but not limited to: • Fournier gangrene • Segmental testicular infarct • Thrombosed varicocele • Sigmoid diverticulitis contained within an inguinal hernia • Acute appendicitis in an inguinal hernia • Neoplasms presenting as acute scrotal pain • Pancreatic necrosis extending inferiorly into the scrotum

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# Abstract Archives of the RSNA, 2024

GUEE-76

## TO REDUCE PREOPERATIVE EVALUATION OF LIVING RENAL DONORS FROM 4 PHASE TO 1 PHASE-SCAN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kousuke Aoyagi (*Abstract Co-Author*) Nothing to Disclose
Natsuki Mashikawa (*Abstract Co-Author*) Nothing to Disclose
Daisuke Kinoshita (*Abstract Co-Author*) Nothing to Disclose
Toshimitsu Shimizu (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To learn about the need for preoperative imaging for renal transplantation.2. To learn about the problems with the conventional scan.3. To Learn about the imaging technique for performing 1-phase scan Dual energy.4. To learn the value of dual energy and triple split injection obtained images.

### TABLE OF CONTENTS/OUTLINE

1. The preoperative radiologic evaluation plays a crucial role in laparoscopic nephrectomy by providing assistance in surgical planning and aiding in the prevention of potential complications.2. Misregistration and exposure due to multiphase imaging are common issues encountered with conventional imaging methods. A new imaging technique using Triple Split and Dual energy allows visualization of stones, arteries, veins, and ureters in a single scan.3. Utilizing dual energy, the acquired images can retain sufficient CT values and can be evaluated for all abnormal formations.4. The new imaging method can reduce exposure by up to 75% without misregistration. Thus, donors benefit greatly.

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# Abstract Archives of the RSNA, 2024

GUEE-77

## THE GUIDELINE MATRIX: DECODING EURO-AMERICAN GUIDELINES FOR UPPER TRACT UROLOGICAL CARCINOMA (UTUC)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Claudia Mercader Barrull (*Abstract Co-Author*) Nothing to Disclose
Carmen Sebastia Cerqueda, MD (*Abstract Co-Author*) Nothing to Disclose
Lidia Fortuny, MD (*Abstract Co-Author*) Nothing to Disclose
Meritxell Costa-Grau (*Abstract Co-Author*) Nothing to Disclose
Daniel Corominas, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Nicolau, MD (*Abstract Co-Author*) Nothing to Disclose
Lledo Cabedo Esteve, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Jimenez Arjona, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Paredes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1-To review radiological points that appear in the European Association of Urology (EAU) and the American Urological Association (AUA) for Upper Urinary Tract Carcinoma (UTUC) guidelines and to show their meaning for radiologists. 2- To describe radiological findings that are conclusive or inconclusive of UTUC by CT- and MR-urography and how to make the differential. 3- To detail the meaning of invasive/noninvasive, hydronephrosis/obstruction by image, to describe radiological patterns in high and low risk UTUC and to depict what a suspicious node is. 4- To review radiological follow-up in UTUC protocols. 5- To show tips on how to do an adequate UTUC presurgical radiological map.

### TABLE OF CONTENTS/OUTLINE

· CT and MR urography protocols for UTUC diagnosis: tips and tricks · Anatomy of upper urinary tract: urologist and radiologist agreement · Unequivocal and equivocal radiological findings of UTUC: management in guidelines · Differential diagnosis of UTUCs presented as renal masses, upper urinary tract papillary masses or sessile wall thickening: clues for the differential · Meaning of noninvasive aspect/local invasion by CT (EAU) · Low-risk, high-risk and favorable and unfavorable UTUC in AUA guidelines: role of imaging · Hydronephrosis and Obstruction - what do they mean? · Radiological signs in T3, T4, N1 and M1 UTUC TNM classification · How to diagnose N1 and M1 radiologically · Correlation between radiological and ureteroscopy findings to guide UTUC diagnosis and treatment. · Radiological tools to perform a high standard UTUC presurgical map in kidney-sparing management · Neoadjuvant and adjuvant treatment: radiological findings · Radiological follow-up after initial UTUC treatment: EAU and AUA comparison

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# Abstract Archives of the RSNA, 2024

GUEE-78

## INCIDENTAL EXTRAPROSTATIC FINDINGS IN MULTIPARAMETRIC MR IMAGING OF THE PROSTATE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pardeep K. Mittal, MD (*Abstract Co-Author*) Nothing to Disclose
Manohar Roda, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thomas L. Estes JR, MD (*Abstract Co-Author*) Nothing to Disclose
Frank H. Miller, MD (*Abstract Co-Author*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA
Nikolas Brozovich, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss the significance of incidental findings in multiparametric magnetic resonance (mp-MR) of the prostate 2. Systematic search pattern to reduce the likelihood of missing key incidental extraprostatic findings 3. Review clinical cases with multi-system (Gastrointestinal, Genitourinary, and Musculoskeletal) incidental findings in mp-MR of the prostate

### TABLE OF CONTENTS/OUTLINE

Mp-MR has significantly increased in popularity for the detection and surveillance of prostate cancer in recent years. This imaging method facilitates screening, surveillance, and post treatment follow-up with notable advantages over other modalities. Due to the increased use in MR imaging, an increased detection rate of incidentalomas has been reported.Our presentation will discuss the spectrum of extraprostatic findings noted on MR imaging of the prostate and provide a case-based review.

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# Abstract Archives of the RSNA, 2024

GUEE-79

## IMAGING CHARACTERISTICS OF RETROPERITONEAL TUMORS: DIAGNOSTIC CLUES, DIFFERENTIAL DIAGNOSIS AND HISTOPATHOLOGICAL CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pardeep K. Mittal, MD (*Abstract Co-Author*) Nothing to Disclose
Manohar Roda, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Frank H. Miller, MD (*Abstract Co-Author*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA
Camila L. Vendrami, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Dallas Sturdevant, DO (*Abstract Co-Author*) Nothing to Disclose
Nikolas Brozovich, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Demonstrate diagnostic challenges including tumor localization, extent of invasion, and characterization of specific pathology.2. Illustrate tumor components, tumor vascularity, and patterns of spread to help narrow the differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

Imaging findings and characterization of retroperitoneal(RP) tumors with histopathology correlates will be discussed. Primary RP tumors originating in the RP but outside the major RP organs are uncommon. Accurate localization and extent of disease of retroperitoneal lesions can be difficult. Identifying the organ of origin, involvement of adjacent structures, vascular invasion, and fat content is valuable in evaluating RP tumors, particularly in staging. Specific diagnosis might be difficult to achieve due overlapping features but certain clues help narrow the differential diagnosis. Case discussion will include liposarcoma, leiomysarcoma, solitary fibrous tumor, extragonadal germ cell tumor, lymphoma, paraganglioma, and others.

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# Abstract Archives of the RSNA, 2024

GUEE-8

## SOLID RENAL MASSES: WHAT THE UROLOGISTS WANT TO KNOW FOR SURGICAL TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
William Nahas, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Cordeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Kenji N. Mitsutake, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Colodette, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review imaging features for histological prediction.- Create a didactic approach to preoperative imaging staging, emphasizing tips and tricks for avoiding pathological upstaging and achieving positive surgical margins.- Discuss the relevance of vascular surgical planning in nephron-sparing surgeries.- Show didactic imaging findings on post-treatment for kidney cancer.

### TABLE OF CONTENTS/OUTLINE

Introduction- Epidemiology of renal tumors.- Current management of kidney cancer based on AUA and EAU guidelines.- Main surgical techniques for managing renal masses.Role of imaging in the assessment of solid renal masses- Impact of histological prediction on surgical management.- How to perform local imaging staging.- Evaluation of vascular surgical planning in nephron-sparing approaches.- Expected and unexpected post-treatment imaging findings.- AI e radiomics to predict aggressiveness on cytoreduction nephrectomies.A didactic evaluation of renal masses with illustrated teaching cases from our department

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# Abstract Archives of the RSNA, 2024

GUEE-81

## A PICTORIAL REVIEW OF THE URETHRA: A RADIOLOGIST'S GUIDE TO KEY CLUES IN INTERPRETATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ana Ines Rubio Aguilera, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Romero (*Abstract Co-Author*) Nothing to Disclose
Lorena Melian Iribar, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Candela Munoz Roldan (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To illustrate imaging findings of male and female urethra including normal anatomy, variants, inflammatory/infectious diseases, benign and malignant tumors. To analyze the correlation between cystourethrogram, IVU, US, CT, and MRI imaging features with pathology in urethral lesions. To emphasize pitfalls, diagnostic difficulties, and differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

Retrograde urethrography and voiding cystourethrography are the modalities of choice for imaging the urethra. Several benign and malignant entities should be included in the differential diagnosis of urethral lesions. Through sample cases, a variety of imaging and pathology findings from lesions of the urethra with management discussion and clues to interpretation will be demonstrated in a quiz format. Imaging findings (cystourethrogram, IVU, US, CT, and MRI) and pathologic correlation will be presented. How pathologic correlation informs imaging interpretation will be highlighted. The list of cases presented includes congenital abnormalities, strictures, trauma, urethral or periurethral tumors, calculi, diverticula, postsurgical complications.

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# Abstract Archives of the RSNA, 2024

GUEE-82

## IMPROVING PROSTATE MRI COLLABORATIVELY: LESSONS LEARNED FROM THE ACR PROSTATE MR IMAGE QUALITY IMPROVEMENT COLLABORATIVE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David B. Larson, MD, MBA (*Abstract Co-Author*) Research Grant, Siemens AG ;Advisor, Bunkerhill Health;Shareholder, Bunkerhill Health
Mythreyi Bhargavan-Chatfield, PhD (*Abstract Co-Author*) Nothing to Disclose
Kay Zacharias-Andrews (*Abstract Co-Author*) Nothing to Disclose
Kandice Garcia, RN, MS (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Purysko, MD (*Presenter*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;

### TEACHING POINTS

1. Prostate MR image quality can affect prostate cancer detection on MRI.2. Adherence to PI-RADS technical standards is necessary for exam reproducibility and requires an effective protocol management process.3. Various methods for patient preparation can help reduce susceptibility artifacts on diffusion-weighted images and motion on T2-weighted images.4. Frontline staff training on image quality standards and troubleshooting of artifacts are essential to achieving high-quality images consistently.5. A reliable method for auditing the quality of prostate MR images allows the identification and remediation of issues contributing to poor image quality.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. The ACR Learning Network Prostate MR Image Quality Improvement Collaborative Aims and Framework3. Prostate Image Quality (PI-QUAL) System4. Key Drivers and Interventions4a. Protocol Management4b. Patient Preparation4c. Personnel Training4d. Process for Auditing the Images5. Beyond Image Quality Improvement6. Conclusions

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# Abstract Archives of the RSNA, 2024

GUEE-83

## ABDOMINAL INCIDENTALOMA: THE *ADRENAL*IN OF THE UNKNOWN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ines Ocampo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1- To identify adrenal incidentalomas requiring follow-up, further study, or biopsy/surgery based on recommendations from the American College of Radiology and the European Society of Endocrinology.2- To understand the acquisition protocol and recognize the importance of wash-out phase in CT scan and in phase/out phase (IP/OP) in MRI for the evaluation of the adrenal glands.3- To discuss the most prevalent adrenal pathologies, differentiating them into benign and indeterminate lesions based on imaging and clinical features.

### TABLE OF CONTENTS/OUTLINE

Given recent advancements in radiology, the detection of adrenal incidentalomas has become relatively frequent. Thus, radiologists need to stay updated with guidelines and recommendations in order to clarify the multiple possible diagnoses. Benign non-functioning lipid-rich adenomas represent the most prevalent lesions. Their imaging diagnosis relies on identifying the presence of microscopic fat within the adenoma. Therefore, the measurement of Hounsfield units and the wash-out protocol in CT scans, as well as the IP/OP images of a chemical-shift MRI, are used. Timely confirmation of benign nature avoids unnecessary imaging and radiation exposure. Likewise, it is important to suspect malignancy since it would require aggressive treatment. Each individual case presents a challenge, so current guidelines recommend standardized protocols and a multidisciplinary expert team for accurate decision-making.

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# Abstract Archives of the RSNA, 2024

GUEE-84

## KEEPING YOUR REAR IN THE CLEAR: IMAGING OF SPACEOAR HYDROGEL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mahan Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Sandeep S. Arora, MBBS (*Abstract Co-Author*) Research support, Profound Medical Inc
Gary M. Israel, MD (*Abstract Co-Author*) Nothing to Disclose
Pavlo Mishyn, DO (*Abstract Co-Author*) Nothing to Disclose
Shadi Ebrahimian, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Epidemiology of prostate cancer and treatment options? Prostate cancer is the most common malignancy diagnosed in men in the United States. Besides surgery, radiation therapy is the standard therapy for prostate cancer. However, it may cause damage to the surrounding organs including rectum. 2. What is SpaceOAR? SpaceOAR hydrogel, is an FDA approved spacer, which is injected between the prostate and rectum and increases the distance between these structures, reducing rectal radiation exposure and associated complications.3. Indications of SpaceOAR placement? Patients with prostate cancer undergoing radiation therapy and those with significant proximity of rectum and prostate. 4. Techniques for SpaceOAR placement? SpaceOAR is placed in outpatient setting after administration of local anesthesia and under the guide of ultrasound and using a trans perineal approach.5. How is SpaceOAR characterized in CT and MRI? SpaceOAR has a hypodense opacity on CT, low signal on T1 and high signal on T2-weighted images.6. Optimally placed SpaceOARA? uniform and symmetric distribution of SpaceOAR between prostate and rectum is characterized as optimally placed.7. Suboptimal placement of the SpaceOAR and associated complications? Hydrogel migration, inadequate rectal sparing, rectal wall infiltration, etc.

### TABLE OF CONTENTS/OUTLINE

1. Overview to prostate cancer 2. Brief introduction to SpaceOAR and its history 3. Candidates for SpaceOAR placement 4. Techniques of placement 5. Appearance of SpaceOAR on CT and MRI 6. Optimal SpaceOAR placement 7. SpaceOAR related complications

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

GUEE-85

## VENOUS TUMORAL THROMBOSIS, LOOKING BEYOND CLEAR CELL RENAL CARCINOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sebastian Pelaez SR, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana Arroyave, MEd (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Neoplastic intraluminal venous invasion is a form of advanced disease involvement. It is important to differentiate it from malignancy associated soft thrombus. Tumoral thrombus present contiguity with the primary tumor, enhance with the contrast medium, generate expansion of the blood vessel, are avid for fluorodeoxyglucose and restricted to diffusion.2.The renal tumor that most commonly presents with vein thrombus is clear cell renal carcinoma (90%), the most common subtype is clear cell. Transitional cell and papillary carcinoma rarely invades vascular structures. There are also some case reports of neuroectodermal tumors, squamous cell tumors and primary sarcomas of the kidney with renal venous involvement. The main benign renal tumor with vascular invasion into the renal vein is angiomyolipoma. However, it should be considered beyond renal cell carcinoma.3.The vascular invasion of tumors has implications on the prognosis and treatment of patients. In the TNM classification, renal tumors progress on stage if there is presence of intraluminal vascular invasion. The Mayo Clinic classification for the extent of tumor thrombus allows determination of the type of thrombectomy as well as the surgical implications in the patient with renal cell carcinoma.

### TABLE OF CONTENTS/OUTLINE

Teaching points.Introduction.Diagnostic intraluminal vascular invasion.Primary renal tumors with thrombosis.Benign renal tumors with thrombosis.Renal metastases with thrombosis.Summary

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# Abstract Archives of the RSNA, 2024

GUEE-86

## EXPLORING PATHOLOGIES: CHALLENGING BLADDER CASES BEYOND UROTHELIAL NEOPLASMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Figueiredo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the imaging feature of bladder urothelial carcinoma. - Describe the main oncological and non-oncological differential diagnosis of urothelial carcinoma. - Demonstrate didactic cases involving the bladder. - Suggest tips and tricks to narrow the differential diagnosis of bladder mass.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION: Review typical findings of urothelial carcinoma; Describe the broad spectrum of diseases that may involve the bladder;DIDACTIC CASES: Demonstrate a case-based didactic review of bladder pathologies and some tips and tricks to narrow the diagnosis: Inflammatory; Infectious; Non-urothelial tumors; Endometriosis; Foreign bodies;

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# Abstract Archives of the RSNA, 2024

GUEE-87

## GOOD OLD CONVENTIONAL URETHROGRAPHY: CURRENT ROLE IN CLINICAL PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Akshey Sehgal, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Uroradiology includes essential procedures like Retrograde Urethrography (RGU) and Micturating Cystourethrogram (MCU), serves as a cornerstone in diagnosing and treating urological conditions even in the current era of advanced imaging. RGU allows for a detailed examination of the urethra, aiding in the identification of strictures, injuries, or abnormalities, and guiding customized treatment plans. MCU offers real-time visualization of the bladder and urethra, enabling detection of reflux, urinary dysfunction, or structural anomalies.

### TABLE OF CONTENTS/OUTLINE

• Anatomy:- varies between the male and female urethra. The male urethra has anterior and posterior portions. The female urethra begins at the internal urethral meatus at the bladder neck and opens in the vestibule of the vagina.• Technique: Care should be taken in insertion of catheter with all aseptic measures. Appropriate positioning and radiograph exposures to be performed. • Clinical significance: Play pivotal role in identifying and evaluating conditions such as trauma, urethral strictures, urethral diverticula, infections, reflux nephropathy and posterior urethral valve abnormalities.• Complications: Infection; adverse reactions from contrast medium; catheter trauma leading to symptoms like dysuria, frequency, hematuria, and urinary retention, as well as potential complications such as perforation by the catheter. Additionally, there's risk of inadvertent catheterization of the vagina or ectopic ureteral orifice. Understanding and managing these complications are crucial for ensuring patient safety and optimizing procedural outcomes in urological practice.

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# Abstract Archives of the RSNA, 2024

GUEE-88

## COMPREHENSIVE IMAGING REVIEW OF TESTICULAR PATHOLOGIES ON ULTRASOUND AND MAGNETIC RESONANCE IMAGING: A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Giancarlo Schiappacasse, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas G. Molina Vasquez, MD (*Abstract Co-Author*) Nothing to Disclose
John Mac Kinnon, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Labra, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Aris (*Abstract Co-Author*) Nothing to Disclose
Fernando Vivanco, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Accurate diagnosis and management of testicular pathologies heavily relies on clinical presentation and ultrasound (US), forming the cornerstone of initial assessment. Magnetic resonance imaging (MRI) complements US, aiding in differentiating and characterizing suspicious testicular and paratesticular lesions for precise diagnosis and treatment. Ultrasound remains primary for evaluation in emergency departments, including inflammatory conditions like epididymitis-orchitis, as well as traumatic testicular injuries, enabling prompt identification and management of complications such as hematomas or torsions.

### TABLE OF CONTENTS/OUTLINE

Cases selected from our institutional experience aim to showcase key findings of various testicular pathologies.Testicular Neoplasms: Most common are germ cell-derived, hypoechoic lesions on ultrasound. MRI is useful to characterize indeterminate lessons and to determine the extension of the tumor.Paratesticular Lesions: Adenomatoid tumors, common benign lesions, diagnosed primarily via ultrasound. MRI aids in characterizing indeterminate lesions or suspected malignancies like paratesticular rhabdomyosarcoma.Cystic Lesions: Typically simple lesions diagnosed by ultrasound, appearing as homogeneous hypoechoic lesions with defined edges. MRI may be used if an underlying lesion is suspected.Inflammatory: Epididymitis-orchitis, common in emergency services, is often diagnosed via ultrasound. MRI benefits in assessing chronic infections or suspected complications.Traumatic: Initial evaluation with US aims to rule out hematomas, twists, ruptures, or infarctions.

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# Abstract Archives of the RSNA, 2024

GUEE-89

## ADRENAL INFECTIONS UPDATE: HOW RADIOLOGISTS CAN ENHANCE PATIENT CARE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Patrick Navin, MBBCh, FFR(RCSI) (*Abstract Co-Author*) Nothing to Disclose
Antonio C. Westphalen, MD, PhD (*Abstract Co-Author*) Shareholder, ScanMed, LLC;Research funded, BotImage, Inc
Vanessa Murad, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge A. Abreu Gomez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Adrenal infections are considered clinically important but often go unrecognized. Radiologists play a key role in detection of involvement early in the course of disease to improve patient outcomes- Although adrenal infectious involvement is uncommon, it should be considered in the differential diagnosis of patients with widespread inflammation, taking into account the host's hormonal/immune status and the geographic region where certain infective agents are more prevalent- The vascular-rich configuration of the adrenal gland, coupled with increased cortisol levels from zona fasciculata, creates an ideal microenvironment for the reservoir and replication of microorganisms- Adrenal thickening with associated stranding constitutes the radiological hallmark of adrenalitis, typically bilateral in histoplasmosis and tuberculosis and unilateral/variable in COVID-19, bacterial, HIV, and cytomegalovirus infections- Destruction of the adrenal parenchyma results in loss of endocrine adrenal function, contributing to a high mortality rate. Early radiological identification and awareness by the clinical team are pivotal for prompt patient management and preservation/recovery of endocrine function

### TABLE OF CONTENTS/OUTLINE

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GUEE-9

## LOOK AT THE KIDNEY! WHAT TO LOOK FOR IN THE FACE OF MULTISYSTEM DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Lais F. Pimentel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the main multisystem disorders with renal involvement.- Describe the renal imaging findings in the face of multisystem disease.- Create a systematic assessment and discuss tips for targeted analysis.

### TABLE OF CONTENTS/OUTLINE

Multisystem diseases often affect the kidneys, resulting in diverse patterns of renal involvement. Radiologists play a crucial role in identifying focal or diffuse lesions, and it is essential to detect renal lesions assertively.INTRODUCTIONSYSTEMATIC APPROACH FOR EVALUATING IMAGES CASE-BASED REVIEW- Hereditary syndromes. Tuberous sclerosis. Von Hippel-Lindau disease. Birt-Hogg-Dubé syndrome. Autosomal Dominant Polycystic Kidney Disease. Autosomal Recessive Polycystic Kidney Disease- Neoplastic. Renal lymphoma. Urothelial cell carcinoma. Renal cell carcinoma. Plasmacytoma. Metastasis. Plexiform neurofibromas- Deposit diseases. Amyloidosis. Paroxysmal nocturnal hemoglobinuria. Extramedullary hematopoiesis- Inflammatory / Infection. Renal tuberculosis. IgG4-related disease. Erdheim-Chester disease

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# Abstract Archives of the RSNA, 2024

GUEE-90

## SCROTUM CROSS-SECTIONAL IMAGING EVALUATION: FROM BENIGN TO MALIGNANT CONDITIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Zapparoli, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Alice Schuch, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Camilo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the anatomy of the scrotum and its radiological and surgical implications.
- Propose an approach for recognizing the most usual imaging patterns of benign and malignant scrotal tumors.
- Review patterns of benign testicular lesions on magnetic resonance imaging (MRI) exams.
- Assess imaging findings of malignant testicular germ cell tumors on MRI.
- Describe key MRI findings for local staging and surgical planning.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION
- Describe the usual anatomic features of the scrotum in the most common imaging methods used at the investigation and correlate didactic illustrations with ultrasound (US) and MRI.
- Elucidate the surgical implications of radiological anatomy of the scrotum.INDICATIONS AND TECHNIQUE
- Indications of the main imaging methods, their appropriate technique, limitations, and pitfalls.
- MRI protocol.STEP-BY-STEP EVALUATION
- Systematic approach to classifying testicular lesions.
- Evaluation of their origin, imaging features, and correlation with clinical and laboratory informationBENIGN TESTICULAR LESIONS
- Typical and atypical cases of testicular and paratesticular lesions on US and MRI.
- What information should the surgeon know to plan the appropriate approach?
- Correlation with pathological and surgical findings.MALIGNANT TESTICULAR LESIONS
- Typical cases of testicular cancer and their radiological appearances.
- Review of its epidemiology and risk factors.
- Importance of allying tumor markers and other clinical information.
- Local staging/ treatment response/ recurrence detection.THERAPEUTIC TECHNIQUES
- Types of surgical approaches in testicular and paratesticular masses.
- Sparing surgery and alternative therapy in testicular cancer.

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# Abstract Archives of the RSNA, 2024

GUEE-91

## PRACTICAL CONSIDERATIONS IN THE CONTRAST ENHANCED ULTRASOUND (CEUS) EVALUATION OF RENAL MASSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Melanie P. Caserta, MD (*Abstract Co-Author*) Nothing to Disclose
Mary J. Clingan, MD (*Abstract Co-Author*) Nothing to Disclose
Neema J. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Madhura A. Desai, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• CEUS is a safe option in patients who may not be able to undergo contrast CT or MR and offers particular benefit to patients with ESRD. • CEUS has high sensitivity and specificity when discriminating between solid and cystic lesions. • The high temporal and spatial resolution of CEUS enables accurate characterization and surveillance of complex cystic renal lesions. • As on CT and MR, overlapping patterns of enhancement can make it difficult to discriminate benign from malignant solid lesions or between RCC subtypes by perfusion characteristics alone.

### TABLE OF CONTENTS/OUTLINE

1. US Contrast Agents a. Technical Factors b. Considerations/Comparison to CT and MR 2. Advantages of CEUS a. High Spatial Resolution i. Characterization of cyst complexity ii. Active surveillance b. High Contrast Resolution i. Sensitive to minimal flow ii. High NPV for excluding flow c. High Temporal Resolution i. Mitigate motion artifact ii. Dynamic contrast evaluation iii. Stored cine images 3. Limitations of CEUS (some generalized from US) a. Limited Visualization i. Large body habitus or deep-seated lesions ii. Lesions obscured by overlying bone or gas b. Limited FOV i. Limit exam to single or few targets ii. Multiple interrogations for larger lesion c. Technical Requirements specific to CEUS i. Patient IV access ii. Extra personnel iii. CEUS software 4. Characterization of Cystic Renal Masses a. Cystic or Solid b. Simple or Complex 5. Characterization of Solid Renal Masses a. Evaluation of Enhancement i. Corticomedullary enhancement relative to renal cortex ii. Washout iii. Heterogeneity b. Features of Common Benign Solid Lesions c. Features of Common RCC Subtypes

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

GUEE-92

## ROLE OF CROSS-SECTIONAL IMAGING ON MALE GENITOURINARY INFLAMMATORY AND INFECTIOUS DISORDERS: WHAT RESIDENTS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thais Mussi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Laura Damaso, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the main inflammatory and infectious conditions in the genitourinary (GU) system.Describe the cross-sectional imaging protocols for GU inflammatory and infectious disorders.Recognize the key imaging features for the detection and differentiation of these entities.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION
- Inflammatory and infectious diseases overview.
- Describe the imaging evaluation role based on current guidelines.IMAGING EVALUATION
- CT technique
- MRI technique IMAGING EVALUATION PER ORGANAdrenal glands
- Adrenalitis
- Infectious (paracoccidioidomycosis)Kidney and ureters
- IgG4-related disease
- XanthogranulomatousBladder pyelonephritis
- Chronic cystitis
- Urachal cyst infectionProstate and seminal vesiclesPenis
- Peyronie diseaseScrotum
- Orchitis
- Scrotal tuberculosis

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

GUEE-93

## BEYOND VI-RADS: CURRENT ROLE OF BLADDER MRI, SPECIAL INDICATIONS AND ASSESSMENT OF OTHER PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Teresa A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Julio R. Coronil, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio R. Oropeza Gutierrez II (*Abstract Co-Author*) Nothing to Disclose
Mailen Sarobe, MD (*Abstract Co-Author*) Nothing to Disclose
Agostina Sarobe, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To describe multiparametric MRI protocol and the implementation of VI-RADS score in bladder cancer with pathology correlation. -To review special indications of bladder MRI such as bladder tumors located at the ureteral orifice, bladder diverticulum tumors and post neoadjuvant and TURB evaluation.-To display sample cases of different pathologies that could represent potential pitfalls in the use of bladder MRI.

### TABLE OF CONTENTS/OUTLINE

-Image acquisition protocol and technique.-Recognize the normal MRI anatomy of the bladder.-Description of imaging characteristics of VI-RADS categories 1 to 5 with sample cases.-Review of the special indications of bladder MRI and sample cases. -Potential pitfalls in the use of MRI and VI-RADS

Printed on: 05/28/25

RSNA 2024
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# Abstract Archives of the RSNA, 2024

GUEE-94

## REVOLUTIONIZING COMFORT: THE PESSARY SOLUTION FOR OPTIMAL SUPPORT AND RELIEF!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gaurav Khatri, MD (*Abstract Co-Author*) Nothing to Disclose
Cinthia Cruz Romero, MD (*Abstract Co-Author*) Nothing to Disclose
Renata R. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Karthika Devi D S, MBBS (*Abstract Co-Author*) Nothing to Disclose
Manjiri K. Dighe, MD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Research Grant, General Electric Company
Minal C. Jagtiani, FRCR,MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This exhibit aims to discuss the anatomy of the (pre or post) menopausal pelvis, indications for insertion of vaginal pessaries, types of pessaries, and identify the common (and uncommon) post insertion complications and their appearances.

### TABLE OF CONTENTS/OUTLINE

1. Post menopausal pelvic anatomy: describe the normal appearance of the postmenopausal uterus and ovaries 2. Discuss etiology of laxity of the pelvic floor, risk factors for pelvic prolapse, levels of pelvic organ prolapse 3. Describe the types of pessaries available and their appearances on various modalities: donut, ring, lever, Gellhorn, cube 4. Identify the indications for vaginal pessaries in the post-menopausal age group and explain the intended mechanism of action 5. Discuss the potential complications with specific consideration to appearances post pessary insertion: pain, bleeding, infection, altered lymphatics with increased chance of pelvic congestion syndrome

RSNA 2024
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# Abstract Archives of the RSNA, 2024

GUEE-95

## ASCENDING EXCELLENCE: GUIDING RENAL TUMOR TREATMENT STEP BY STEP WITH RENAL SCORE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mauro Herrero (*Abstract Co-Author*) Nothing to Disclose
Lina M. Robledo (*Abstract Co-Author*) Nothing to Disclose
German Espil, MD (*Abstract Co-Author*) Nothing to Disclose
Nebil Larranaga (*Abstract Co-Author*) Nothing to Disclose
Lina Meza Galeano, MD (*Abstract Co-Author*) Nothing to Disclose
Shigeru Kozima (*Abstract Co-Author*) Nothing to Disclose
Daniela Pratto, MD (*Abstract Co-Author*) Nothing to Disclose
Paula M. Marinhas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Evaluate the utility of the RENAL SCORE scoring system in determining therapeutic approaches for patients with renal tumors evaluated in a retrospective study at a Municipal General Hospital of South America, where this condition is highly prevalent.Determining the effectiveness of this system in our specific medical environment.Analyze its applicability in making therapeutic decisions for patients with renal tumors.Record and document the development and results obtained through its use, to provide data to support the effectiveness and efficiency of the score.Strengthen the role of the radiologist in managing renal tumors through its effective implementation

### TABLE OF CONTENTS/OUTLINE

AbstractIntroductionDescription of the RENAL SCORE SystemMaterials and MethodsResultsRadiological findings and RENAL SCORE scores in correlation with pathological anatomy resultsTreatment and management of renal tumorsDiscussionImplications of the resultsStudy LimitationsConclusionsReferences

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# Abstract Archives of the RSNA, 2024

GUEE-96

## RENAL ONCOCYTIC NEOPLASMS - UNRAVEL THE CONUNDRUM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Myles T. Taffel, MD (*Abstract Co-Author*) Nothing to Disclose
Stuart G. Silverman, MD (*Abstract Co-Author*) Nothing to Disclose
Nicola Schieda, MD (*Abstract Co-Author*) Nothing to Disclose
Rajesh Bhayana, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Antonio Finelli (*Abstract Co-Author*) Nothing to Disclose
Susan Prendeville (*Abstract Co-Author*) Nothing to Disclose
Sreeharsha Tirumani, MD (*Abstract Co-Author*) Nothing to Disclose
Sungmin Woo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Satheesh Krishna, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Oncocytomas are the largest cause of nephrectomy in benign masses, due to inability of imaging and biopsy to reliably distinguish between benign oncocytomas and malignant chromophobe RCC. Emergence of 'in-between' entities considered together as 'Oncocytic renal neoplasm of low malignant potential' have further complicated diagnostic and management pathways.

### TABLE OF CONTENTS/OUTLINE

There have been numerous nomenclature changes. What is the latest classification of oncocytic neoplasm? What are the emerging entities (eosinophilic vacuolated tumor, low grade oncocytic tumor)? Which entities are benign, which are indolent and which are malignant? (Pathology images will be provided) - Are there other entities which mimic oncocytic neoplasms? - Why is imaging or biopsy in isolation not helpful? (what is the discordance rate between biopsy and surgery?). Where do these fall in the CCLS (clear cell likelihood score) or CT-renal score? - We present a hybrid (imaging + biopsy approach) in risk stratifying these masses - Chromophobe RCC - can we further risk stratify grade based on imaging? - How does hybrid neoplasms complicate the landscape? What are the oncocytic tumors with hereditary connotations (SDH-deficient, low grade FH-deficient, eosinophilic solid and cystic RCC -TSC associated, HOCT - Birt Hogg Dube associated)? Can genetic alterations (FLCN) provide insight? - What are the challenges in active surveillance of oncocytomas? Can benign oncocytomas metastasize? Do enlarging oncocytomas affect renal function? Does bilaterality and multifocality further complicate management? - Does Sestamibi have a role in management pathway? What is the ideal management strategy? Role of ablation and embolization?

# Abstract Archives of the RSNA, 2024

HNEE

**Head & Neck Imaging Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## HNEE-1 WHAT´S MAKING THIS NOISE? NON-PULSATILE TINNITUS

Suresh K. Mukherji, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Maira Sarpi, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta C. Andrade, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Detail the functional anatomy of inner ear• Review the main causes of non-pulsating tinnitus• Detail tumor causes• Detail non-tumor and non-vascular causes• Guide the radiologists to detail anatomical changes relevant that may be causing tinnitus• Evaluate the computed tomography (CT) imaging as a tool for identify possible causes of non-pulsating tinnitus

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Inner ear anatomy b. Inner ear functional anatomy c. Most common causes of non-pulsating tinnitus d. Clinical application of CT to identify possible causes of non-pulsating tinnitus2. CT image a. What should be evaluated: petrous apex, otic capsule or osseous (bony) labyrinth, internal ear canal, semicircular canals, stylohyoid complex, endolymphatic sac, vestibular aqueduct3. Tumor causes a. Jugular paraganglioma (glomus) b. Tympanic paragangliomas (glomus) c. Cavernous venous malformation (cevernoma) d. Vestibular schwannoma (acoustic neuromas) e. Meningioma f. Metastases g. Endolymphatic sac tumors4. Non-tumor causes a. Endolymphatic hydrops (Ménič re disease) b. Otospongiosis c. Semicircular canal dehiscence d. Cholesterol granuloma e. Chiari I malformation f. Patulous tube syndrome g. Idiopathic intracranial hypertension (IIH) h. Paget disease i. Eagle syndrome5. Take-home messages

## HNEE-10 UNLOCKING SINUS SECRETS: RADIOLOGICAL INSIGHTS

Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael R. Santos Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To discuss the diagnosis and radiological insights about sinus diseases, highlighting: - Definition and overview of sinusopathies, the importance of understanding sinus anatomy and function, and common causes and risk factors. - Sinus pathologies in a guide model, dividing into diffuse or unilateral involvement and also in acute or chronic pathology. - Potential complications of sinusopathies (e.g., orbital cellulitis, meningitis). Factors influencing prognosis and long-term outcomes and the importance of follow-up care and monitoring. - Research and Future Directions: Ongoing research in the field of sinusopathies with emerging treatments and technologies.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Anatomy of the paranasal cavities
- Guideline of sinusopathies diagnosis
- Acute diffuse involvement
- Inflammatory/Infectious involvement
- Traumatic/Surgical
- Potential complications
- Chronic diffuse involvement
- Nasosinusal polyposis

- Allergic fungal sinusitis
- Granulomatosis diseases
- Cocaine abuse
- Potential complications
- Predominantly unilateral acute involvement
- Odontogenic sinusitis
- Invasive fungical sinusitis
- Facial fractures
- Potential complications
- Predominantly unilateral chronic involvement
- Papilloma
- Fungal sinusitis
- Mucocele
- Neoplastic lesions
- Potential complications
- Future perspectives
- Take home messages

### HNEE-11 EXPLORING UNCOMMON PATHOLOGIES IN THE SELLAR/SUPRASELLAR REGION: IMAGING INSIGHTS

Rohan Samant, MBA (*Abstract Co-Author*) Nothing to Disclose
Rajan P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Deepali Bhalla (*Abstract Co-Author*) Nothing to Disclose
Manav Bhalla, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The sellar and suprasellar regions present a complex landscape of pathologies, often challenging clinicians with their diverse presentations and management nuances. Recognizing the diverse spectrum of atypical pathologies in the sellar/suprasellar region is crucial for accurate diagnosis and appropriate management. This abstract offers a comprehensive overview of uncommon sellar and suprasellar pathologies, atypical presentation of common entities, shedding light on their clinical features, diagnostic considerations, pathologic correlates, and potential therapeutic implications. From rare tumors to unusual inflammatory conditions, this exploration aims to equip diagnostic Radiologists with practical insights to enhance diagnostic accuracy and optimize patient care.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction to uncommon Sellar/Suprasellar Pathologies. 2. Atypical imaging presentation of relatively common entities. 3. Radiological Evaluation of Sellar/Suprasellar Lesions 4. Types of Atypical Pathologies - A. Rare Neoplasms B. Metastatic lesions C. Hypophysitis, Langerhans cell Histiocytosis, Rosai-Dorfman disease and Erdheim-Chester disease D. Secondary pituitary hyperplasia E. Craniopharyngiomas F. Atypical appearance of Rathke's cleft cyst 4. Differential Diagnosis and Diagnostic Challenges 5. Imaging Features and Characterization

### HNEE-12 PERINEURAL SPREAD IN HEAD AND NECK MALIGNANCIES

Amit Janu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Pranjal Rai, MBBS (*Abstract Co-Author*) Nothing to Disclose
Nivedita Chakrabarty (*Abstract Co-Author*) Nothing to Disclose
Arpita A. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Deepa Nair (*Abstract Co-Author*) Nothing to Disclose
SUYASH KULKARNI (*Abstract Co-Author*) Nothing to Disclose
Nitin S. Shetty, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Suman Kumar Ankathi, MBBS (*Abstract Co-Author*) Nothing to Disclose
Vasundhara Smriti, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understand the perineural spread. 2. Discuss the imaging protocol for perineural spread 3. Know the primary and secondary imaging features in perineural spread. 4. Detect the commonly involved nerves in perineural spread and know their anatomy. 5. Discuss the anatomical landmarks and pathway for perineural spread. 6. Describe the mimics of perineural spread

#### TABLE OF CONTENTS/OUTLINE

1. Anatomy of cranial nerves 2. Imaging features of perineural spread. 3. Know the possible routes of perineural spread in a given clinical condition. 4. Case-based discussion on the approach for various nerves involved. 5. Discuss the impact on management due to perineural spread

### HNEE-13 PLEOMORPHIC ADENOMA OR NOT? MASTERING THE DIAGNOSTIC RIDDLE OF SALIVARY GLAND TUMORS WITH MOUTH-WATERING CASES

**Awards**
**Certificate of Merit**

Yeliz Pekcevik, MD (*Abstract Co-Author*) Nothing to Disclose
Begum Ergin, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. To discuss the typical and atypical characteristics of benign salivary gland tumors in patients, with a specific emphasis on pleomorphic adenoma.2. To identify common and uncommon features of malignant salivary gland tumors in adults.3. To familiarize the radiologists with the typical and atypical presentations of salivary gland tumors and pitfalls by using a case-based approach.4. Review examples of congenital and acquired mimics of salivary gland tumors.

#### TABLE OF CONTENTS/OUTLINE

A. Background • MRI imaging of salivary glands (DWI, advanced MRI sequences) B. Mouth-Watering Cases • Common and Uncommon Features of Benign Salivary Gland Tumor 1. Typical and Atypical Pleomorphic Adenoma 2. Warthin Tumor 3. Oncocytoma 4. Schwannoma 5. Myofibroblastic Tumor 6. Lipoma 7. Infantile Hemangioma • Common and Uncommon Features of Malign Salivary Gland Tumors 1. Carcinoma Ex Pleomorphic Adenoma 2. Mucoepidermoid Carcinoma 3. Adenoid Cystic Carcinoma 4. Secretory Carcinoma 5. Lymphoma 6. Malign Melanoma • Non-neoplastic Salivary Gland Pathologies Mimicking

Salivary Gland Tumors 1. IG-G4 Related Disease 2. Intraparotid Lymph Nodes 3. Sjögren's Syndrome 4. Sialosis 5. Vascular Malformations 6. Branchial Cleft Cysts C. Take Home Points D. References

### HNEE-14 ACUTE COMPLICATIONS RELATED TO OTOMASTOIDITIS - A REVIEW ABOUT WHAT MAY OCCUR

Rainer G. Haetinger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Silvia M. Mello (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda Yukari H. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Acute otomastoiditis occurs when otitis media spreads beyond the mastoid air cells. A variety of infectious complications associated with the temporal bone are described, which may occur in cases of otomastoiditis. These include outer cortex erosion, resulting in the formation of a neck abscess (known as Bezold abscess), coalescent mastoiditis, petrous apicitis (Gradenigo's Syndrome), meningitis, venous sinus thrombosis, facial neuritis, bone cortex erosion potentially causing sigmoid sinus thrombosis or resulting in periauricular cellulitis with or without an abscess and intracranial extension, and suppurative labyrinthitis. This study aims to provide a briefly description of each case, from the most frequent to the rarest, correlate them with different imaging methods and didatic drawings.

#### TABLE OF CONTENTS/OUTLINE

- Introduction- Objective- Review of the complications related to otomastoiditis - Cases of the otomastoiditis complications in different imaging methods including a didatic drawings- References

### HNEE-15 MUSCLE MASTERCLASS: HEAD AND NECK ANATOMY IN ACTION

Shehbaz M. Ansari, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Surjith Vattoth, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Santhosh Gaddikeri, MD (*Abstract Co-Author*) Nothing to Disclose
Miral D. Jhaveri, MD, MBA (*Abstract Co-Author*) Royalties, RELX
Brian Mu, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Review muscular anatomy of the head and neck with a focus on routinely visualized but relatively overlooked deep muscles.2. Highlight important anatomic relationships between head and neck muscles as well as to adjacent structures.3. Describe relevant imaging findings involving these anatomical concepts and their associated underlying pathologies.

#### TABLE OF CONTENTS/OUTLINE

The head and neck comprise a rich and complex array of muscular anatomy that can be visualized in detail on routine imaging. Comprehensive knowledge of these muscles and sophisticated understanding of their relationships with each other and adjacent structures is requisite for the identification and interpretation of a diverse range of pathological findings. Additionally, head and neck muscles serve as important landmarks for demarcation of the deep spaces of the face and neck, cervical lymph node stations, and for surgical approaches. In this exhibit, we review the muscular anatomy of the head and neck in detail, including the prevertebral and paraspinal, scalene, suboccipital, floor of mouth, pharyngeal, laryngeal, and masticator muscles. The goal is to develop a three-dimensional understanding of intricate anatomy, such as the "stacked flower-pot" arrangement of the hypopharyngeal wall muscles. Special focus is given to areas of clinical significance, such as the role of the posterior belly of digastric as a surgical landmark for the glossopharyngeal and hypoglossal nerves in neck dissection. Sample cases are provided to demonstrate various pathologies and clinical applications of this anatomy.

### HNEE-16 BEYOND THE SURFACE: EXPLORING THE NASOPHARYNX FROM EMBRYOLOGY TO CANCER

Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Murilo B. Cintra (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel V. Sumi, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Alberto F. Coelho Neto, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

In this educational exhibit, our aim is to provide a comprehensive review of the nasopharyngeal anatomy and, through didactical cases, highlight the radiological features of common pathologies. We will discuss the role of imaging modalities in the diagnosis and management of nasopharyngeal disorders, with the key radiological findings in each pathology.

#### TABLE OF CONTENTS/OUTLINE

- Introduction - Nasopharyngeal embryology and anatomy- Radiological imaging modalities for nasopharyngeal evaluation- Congenital lesions, Inflammatory, and Infectious Conditions, including: branchial cleft cyst, craniopharyngeal canal, fossa navicularis, pharyngeal bursa, Tornwaldt cyst, retention cysts, glial heterotopia, infraselar craniopharyngioma, teratoma epignathus, adenoiditis, tuberculosis.- Vascular Conditions, including nasopharyngeal slow flow venous malformations- Benign and malignant neoplastic acquired lesions of the nasopharynx, including squamous cell carcinoma, rhabdomyosarcoma, inverted papilloma, juvenile nasopharyngeal angiofibroma and lymphomas.- TNM staging main featuresPost-treatment changes, including post-surgical and post-radiotherapy findings.- Conclusion

### HNEE-17 TOOTH BE TOLD: EXPLORING MANDIBULAR NEUROPATHY

**Awards**
**Cum Laude**

Thiago B. Fernandes Feitosa, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Mario Siqueira (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Martins (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This comprehensive review elucidates the anatomy and pathologies of the mandibular division of the trigeminal nerve (V3) through detailed MR neurography cases and schematic illustrations. The focus will be on the V3 nerve, particularly the lingual and inferior alveolar nerves, to explore both traumatic and non-traumatic lesions, and the Sunderland classification of nerve injuries.We aimed to demonstrate the correlation between MR neurography lesions and surgical findings and assess the utility of MR neurography in the evaluation of postsurgical recovery.

**TABLE OF CONTENTS/OUTLINE**

NORMAL ANATOMY OF THE MANDIBULAR NERVE (V3)• Didactic original drawings illustrating the V3 nerve and its branches.Detailed anatomy of the lingual and inferior alveolar nerves via MR neurography.MR NEUROGRAPHY SEQUENCES3D Double-Echo Steady-State with Water Excitation Sequence and contrast enhanced (3D) turbo spin echo with variable flip-angle (SPACE) short-tau inversion recovery (STIR) sequences MR NEUROGRAPHY AND NERVE INJURY CLASSIFICATION• Introduction to MR neurography as a diagnostic tool for nerve pathologies.• Review of the Sunderland classification for grading nerve injuries. CASES: CORRELATION OF MR NEUROGRAPHY WITH SUNDERLAND CLASSIFICATION• Detailed MR neurography cases correlated with nerve injury grades.Implications of Sunderland Classification on Treatment and Prognosis.• Comparison of MR neurography findings with intraoperative observations. POST-SURGICAL EVALUATION• Case studies highlighting postoperative recovery and follow-up MRI

## HNEE-18 HIDDEN ENEMY: DIFFERENT PRESENTATIONS AND CONSEQUENCES OF PARANASAL SINUS MUCOCELE

Adriano Magna, MD (*Abstract Co-Author*) Nothing to Disclose
Raissa M. Barradas Monteiro De Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Flavia Galvao Lopes, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mario Porfirio Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna P. De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Vitoria Lima Beltrao Vieira de Melo, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Pedro C. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Henzo Ota, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Gabriela Cintra Borba (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas P. Caldas, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Goncalves, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Paranasal sinus mucoceles are benign inflammatory lesions developing after obstruction of the sinus ostium. They are characterized by the accumulation of mucus secreted by mucosal cells, leading to the expansion of the affected sinus cavities. Radiological findings are varied, and knowledge of these is crucial for accurate diagnosis.The frontal and ethmoidal sinus are most commonly affected.Symptoms are nonspecific and may vary from rhinological to neurologic or ophthalmologic, depending on the location.Appears on Computed Tomography Scan (CT Scan) as a homogenous well circumscribed expansible lesion with soft tissue density, without contrast enhancement, associated with sinus expansion, sclerosis and bone erosion, in addition to extension to the intra orbital region.Magnetic Resonance Imaging (MRI) provides a more detailed evaluation of the lesion composition and extent, offering crucial information for surgical planning. The usual signal characteristics are a low intense T1 and a high intense T2 but any combination of signal intensity may be seen depending on the presence of blood products or the degree of hydration of the contents.

**TABLE OF CONTENTS/OUTLINE**

This study reports a series of cases with CT and MRI images of different presentations and consequences of paranasal sinus mucoceles, related to inflammatory processes, anatomical variations and traumatic sequelae, highlighting the imaging characteristics for diagnosis and surgical planning.

## HNEE-19 REVISITING THE ETHMOID ROOF AND ANTERIOR ETHMOIDAL ARTERIES- DANGER AREAS IN FUNCTIONAL ENDOSCOPIC SINUS SURGERY (ESS)

Alan I. Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Luis G. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Tamara Hernandes Ricci, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Diogo C. Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia C. Santos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the anatomy of the ethmoid roof, emphasizing significant anatomical features and critical variants that should be meticulously described in reports.- Present clinical cases from head and neck radiology indicating surgical treatment through endoscopic surgery (ESS). - Describe the areas of danger for potential post/intra-operative complications due to the unique anatomy.- Propose a step-by-step process for reviewing the anatomy of the ethmoid roof and anterior ethmoidal arteries (AEA) to guide surgical planning and minimize potential complications related to ESS.

**TABLE OF CONTENTS/OUTLINE**

1. The Endoscopic Sinus Surgery (ESS):- Illustrated imaging cases demonstrating some ESS indications- Key procedural points and radiologists' responsibilities in reporting 2. The Role of Imaging Anatomy:- Coronal diagram illustrating the components of the ethmoid roof- Coronal CT images depicting the anatomy of the AEA and their associated major anatomical structures 3. Key Points - a step-by-step guide for reporting:- Keros classification and the significance of olfactory fossa depth- The importance of the relationship between the lateral lamella and the cribriform plate- Identification of anatomical landmarks- The correlation between supraorbital pneumatization and the course of the AEA canal 4. Illustrated clinical cases of ethmoid roof and anterior ethmoidal artery anatomy:- Coronal CT images demonstrating anatomical landmarks, supraorbital pneumatization, and olfactory fossa depth

5. Critical areas of the anterior ethmoidal artery and the lateral lamella:- Coronal CT images illustrating critical areas during ESS- AEA injury during the procedure- Key take-home messages

### HNEE-2 LACRIMAL GLAND MASSES: A PRIMER FOR RADIOLOGISTS

Vasundhara Smriti, MD (*Abstract Co-Author*) Nothing to Disclose
Pranjal Rai, MBBS (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

• To understand the normal anatomy of the lacrimal glands. • To focus on the imaging features, pathogenesis and treatment options for different lacrimal gland masses and their benign mimickers. • To identify helpful; imaging clues to differentiate various pathologies from each other.

#### TABLE OF CONTENTS/OUTLINE

1. Normal lacrimal gland anatomy. 2. Localizing a true lacrimal lesion versus a lesion causing secondary involvement of the lacrimal gland. 3. Various lacrimal gland masses, their classification according to etiology, their pathogenesis, imaging characteristics, and brief discussion of their management strategies. 4. Benign mimickers of lacrimal lesions, and use of imaging features to differentiate them. 5. A flowchart to help narrow down a radiological differential diagnosis for a lacrimal gland lesion. 6. Surgical techniques for lacrimal gland lesions.

### HNEE-20 RADIOLOGICAL INSIGHTS AND CLINICAL MANAGEMENT STRATEGIES: AN EDUCATIONAL EXHIBIT ON MéNIèRE'S DISEASE

Patricia Cuadras Collsamata (*Abstract Co-Author*) Nothing to Disclose
Paloma Puyalto, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Angela Callejo (*Abstract Co-Author*) Nothing to Disclose
Fernando Orera (*Abstract Co-Author*) Nothing to Disclose
Ana Maria Quiles (*Abstract Co-Author*) Nothing to Disclose
MARIDELMA VILLANUEVA (*Abstract Co-Author*) Nothing to Disclose
Anna Oliva (*Abstract Co-Author*) Nothing to Disclose
Hernan Rivera (*Abstract Co-Author*) Nothing to Disclose
Carlos Ordonez (*Abstract Co-Author*) Nothing to Disclose
Giovanni Mattiello, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Ménič re's Disease (MD) is believed to be a result of abnormalities in the fluid balance within the inner ear, particularly those involving the endolymphatic system; is characterized by episodic vertigo, sensorineural hearing loss, tinnitus, and aural fullness and presents a significant challenge for otolaryngology specialists.MRI, particularly gadolinium contrast-enhanced delayed sequences 3D- FLAIR and 3D -IR , plays a critical role in confirming the diagnosis and assessing the severity of MD. This exhibit provides a comprehensive exploration of the fundamental role of MRI in understanding this entity and guiding its clinical management.Educational Objectives:To understand the role of radiological imaging in diagnosing and monitoring MD and to describe the main sequences used for the radiologic diagnosis and grading of endolymphatic hydrops, with special emphasis on the 3D-FLAIR and 3D-IR sequences, their pitfalls, and differential diagnosis.To present evidence-based clinical management strategies for MD, including pharmacological, rehabilitative, and surgical interventions.

#### TABLE OF CONTENTS/OUTLINE

Definition, demography, physiopathology and grading systems of MD.Radiological insights: MRI sequence protocol, postprocess, grading and volumetric assessment of the inner ear in patients with MD. Pitfalls and differential diagnosis.Clinical management strategies based on multidisciplinary approach to diagnosis analysis.

### HNEE-21 A MOUTHFUL: WHAT THE RADIOLOGIST NEEDS TO KNOW REGARDING ORTHOPANTOMOGRAPHY

Richard L. Barger JR, MD (*Abstract Co-Author*) Nothing to Disclose
Vijaya K. Kosaraju, MD (*Abstract Co-Author*) Nothing to Disclose
Navid Faraji, MD (*Abstract Co-Author*) Nothing to Disclose
Nathan Katragadda (*Abstract Co-Author*) Nothing to Disclose
Gregory R. Liller, DO (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

A growing body of evidence demonstrates strong associations between dental pathologies and systemic pathologies. As a result, there is an increased need for radiologists to understand and interpret dental imaging modalities to assess dental pathologies which could serve as risk factors for systemic pathologies. The Orthopantomogram (OPG), also known as Panorex, is a single-image radiograph used to visualize various gross anatomy and pathology of various oral and maxillofacial structures. It is often used as a screening and diagnostic tool in assessing dental and maxillofacial pathology, such as before cardiac valve surgery. The purpose of this exhibit is to:1. Discuss the acquisition process of OPGs.2. Review basic dental and facial anatomy visualized on an OPG.3. Discuss the different dental and facial pathologies and surgical changes seen on OPG.

#### TABLE OF CONTENTS/OUTLINE

1.Introduction discussing the history, epidemiology of dental and maxillofacial disease and ordering indications. 2. Assessing the technique of OPGs through discussion of equipment, acquisition, optimal imaging appearance and artifacts. 3. Discussion of basic oral and maxillofacial anatomy and physiology on OPGs including: tooth numbering and anatomy, dental embryology, stages of tooth eruption, and associated structures. 4. Evaluating various radiologic pathologies involving teeth (caries, impactions, and anomalies), periodontal disease, masses and mass-like lesions, anatomical variants, trauma, miscellaneous disorders, and dental and maxillofacial surgery, including mandibular arthroplasty and LeFort osteotomy.

### HNEE-22 BEYOND THE BLINK: NAVIGATING SUPERFICIAL PERIORBITAL LESIONS WITH HIGH-FREQUENCY ULTRASOUND AND MRI

**Awards**
**Certificate of Merit**

Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Claudia B. Camara, MD (*Abstract Co-Author*) Nothing to Disclose

MICHELLE GOMES (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The superficial periorbital lesions serve various functions, including protection. An understanding of the anatomy of superficial periorbital lesions is crucial for interpreting the imaging features of lesions that affect them. High-frequency ultrasound presents itself as an advantageous option for imaging periorbital lesions due to its cost-effectiveness and widespread availability. Utilizing a 3T MRI with surface coil can aid in identifying superficial and millimetric lesions affecting the periorbital region. Demonstrate the utilization of high-frequency probes and surface coil MRI and elucidate the examination technique to radiology residents. Compose a pictorial essay detailing the principal periorbital lesions and their differential diagnoses, encompassing skin cancer, cosmetic fillers, inflammatory lesions, and lacrimal gland lesions.

**TABLE OF CONTENTS/OUTLINE**

Anatomy of superficial periorbital lesionsCases of tumorous, inflammatory, and filler-related lesions.

## HNEE-23 DON'T FLUCTUATE: MR IMAGING CASE-BASED DIDACTICS OF ENDOLYMPHATIC HYDROPS IN MéNIèRE'S DISEASE

Suresh K. Mukherji, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Maira Sarpi, MD (*Abstract Co-Author*) Nothing to Disclose
Luis G. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo B. Cintra (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Camila S. Barbosa, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Understand the anatomy and physiology involved in endolymphatic hydrops • Review the MR protocol and specific sequences • Review methods for identifying and classifying the disease based on imaging findings • Illustrate concepts through a case-based review of the main grades in their classic presentations

**TABLE OF CONTENTS/OUTLINE**

• Ménière's Disease Imaging: Magnetic Resonance (MR) Sequences, Indications, Advanced Sequences • Relevant Anatomy of Ménière's Disease • Case-Based Didactics: Sample Cases to Illustrate Classification and Solidify Concepts • What's on the Horizon: Areas for Improvement • Approach to Differential Diagnosis

## HNEE-24 PRE- AND POST-OPERATIVE IMAGING OF CRANIOSYNOSTOSIS - WHAT RADIOLOGIST NEED TO KNOW?

**Awards**
**Cum Laude**

Elka Miller, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Shivaprakash B. Hiremath, DMRD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Neetika Gupta, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To explain the embryology and anatomy of the developing calvarium.2. To describe the imaging modalities and protocol in children with suspected craniosynostosis. 3. To highlight various types of craniosynostosis and associated anomalies along with syndromic association. 4. To elucidate the pre- and post-operative imaging in craniosynostosis emphasizing on the surgical techniques, complications and follow up.

**TABLE OF CONTENTS/OUTLINE**

1. Illustrate the embryology and imaging anatomy of the developing calvarium and normal variants. 2. Comprehensive discussion of the various types of craniosynostosis and syndromic association in children.3. Identify and familiarize with the imaging features that need to be focused in the pre surgical evaluation and assessed in post-operative period along with mention about the evolution of surgical findings.4. Systematic imaging-based approach could help in highlighting the necessary findings to guide appropriate management and genetic evaluation, aid in surgical decision making and avoid complications.

## HNEE-25 ANOSMIA: BEYOND COVID

Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael R. Santos Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This study intends to show the various etiologies that can cause anosmia. This theme has been widely publicized after the spread of the Sars-Cov 2, as it has been one of the most prevalent symptoms.The purpose of this exhibition is to:Review the path of smell formation.Show other etiologies to anosmia besides COVIDEvidence of different groups involved, such as congenital, infectious, inflammatory, trauma, and use of drugs. Illustrate such cases with radiological examples.

**TABLE OF CONTENTS/OUTLINE**

Smell pathway : • Overview of the normal anatomy, showing how the smell is formed going from the external nose to the cortex.Before we start... let's look at how it appears at COVID! • Given the importance of the pandemic that started in 2020, we dedicated this slide to evidence of how COVID can cause anosmia, while also exposing other etiologies.Inflammatory and infectious•Nasal polyposis, rhinosinusitis, and fungal infections are shown as examples of causes of anosmia.Septal disorders• Nasal fractures, cocaine abuse, and granulomatosis with polyangiitis enter as etiologies of anosmia

which affect the nasal septum.Others cases• We conclude the exhibit by showing other various etiologies: atrophic nasal turbinates, respiratory adenomatoid hamartoma, and Kallmann syndrome.

## HNEE-26 SHINE A LIGHT ON DIPLOPIA: UNLOCKING DIFFERENTIAL DIAGNOSES IN OUR MIND'S EYES

Jose Roberto F. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo D. Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Angela M. Wolosker (*Abstract Co-Author*) Nothing to Disclose
Helio Yamashita, MD (*Abstract Co-Author*) Nothing to Disclose
MARCELO DOS SANTOS BANDEIRA FILHO (*Abstract Co-Author*) Nothing to Disclose
Roberto Bastos, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Carmo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review unusual diseases that cause diplopia and are infrequent to diagnosis. To present diagnostic challenging cases of diplopia and their radiologic presentation. To be aware of life-threatening acute causes of diplopia which Imaging features can help with the diagnoses. To highlight the purpose of learning and evaluating rare diseases, adding experience to a better medical practice.

### TABLE OF CONTENTS/OUTLINE

Diplopia is a wide diagnosis made by ophthalmologists and neurologists. Numerous diseases occur with diplopia, leading to a late diagnosis when present in an infrequent disease. Diplopia itself can present as a challenge for radiologists, particularly when aiming for a differential diagnosis. This work can have a significant impact on patients with life-threatening diseases early diagnosed. Overview of the main diseases including diplopia. Key radiological findings in cross-section orbital images that aid in distinguishing rare pathologies. Didactic exposition of illustrative rare cases in which diplopia was included such as thyroid-associated orbitopathy, IgG4-related orbital disease, Tolosa-Hunt syndrome, a solitary fibrous tumor of the orbit, orbital lymphoma, sphenoid wing meningioma, conjugate gaze palsy and mechanisms, other causes of idiopathic orbital inflammation, orbital metastasis, chorioretinitis, and nuclei ischemic stroke of the oculomotor (III) and abducens (VI).

## HNEE-27 INSIGHTS INTO IMAGING PATTERNS OF GRANULOMATOUS DISEASES IN THE HEAD AND NECK

Henrique B. Zuppani, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Taisa Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Narriman P. Hazime, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

List and compartmentalize the different causes of granulomatous diseasesRecognize typical radiological aspects of their head and neck involvementImprove the approach of differential diagnosis by correlating multimodality imaging and clinical findings

### TABLE OF CONTENTS/OUTLINE

Introduction Definition of granuloma and its histological aspects Subdivision of various pathologies that can present granulomatous inflammation based on etiologyAutoimmune disorders: Granulomatosis with polyangiitis, Churg-Strauss syndrome, Behēet disease, systemic lupus erythematosus, rheumatoid arthritis, relapsing polychondritisHereditary condition: chronic granulomatous diseaseInfectious diseases:Fungal: blastomycosis, histoplasmosis, paracoccidioidomycosis, cryptococcosisBacterial: tuberculosis, cat-scratch disease, syphilis, leprosy, actinomycosis, rhinoscleroma, tularemiaParasitic: leishmaniasis, myiasis, toxoplasmosisIdiopathic disorders: Sarcoidosis, Kikuchi-Fujimoto disease, Kimura disease, Rosai-Dorfman disease, Langerhans cell histiocytosisSecondary granuloma: chemical exposure to vaccine, cocaine, talc, beryllium, silicosisPractical diagnostic approach for suspected granulomatous disorder

## HNEE-28 THE SKELETON MADE OF CARTILAGES: A PICTORIAL REVIEW OF LARYNGEAL CARTILAGINOUS SKELETON PATHOLOGIES FOR RADIOLOGY RESIDENTS

Janani Baradwaj, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Anu Kamalasanan, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thiru A. Sudarshan, DMRD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Janani Asogan Vaishnavi, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

--Trauma of the anterior neck may result in various injuries of the laryngeal soft tissues, cartilages and surrounding structures. MDCT is used as a first line examination in the acute trauma setting.--An understanding of the anatomy of head and neck cartilaginous structures is critical to correctly identifying the spectrum of cartilaginous lesions occurring in the head and neck.--The important imaging clues in diagnosis of the head and neck cartilaginous tumours include characteristic location, internal calcified chondroid matrix, and typical T2 hyper intense signal due to high water content in hyaline cartilage.--Knowledge of the age-related changes in the signal characteristics of the laryngeal cartilages may help to improve detection of tumour invasion.--Cartilage invasion by laryngeal cancer has a poor prognosis . Exclusion of cartilage invasion is important as its presence often precludes laryngeal conservation surgery.--Ultrasound and MRI can be used to differentiate unossified thyroid cartilage and reactive oedema from infiltration.

### TABLE OF CONTENTS/OUTLINE

1. Radiological anatomy of laryngeal cartilaginous skeleton including embryology.2. Pitfalls related to ossification patterns of laryngeal cartilages.3. Role of various imaging modalities in the evaluation of laryngeal cartilages including protocol and instructions during scanning such as quiet respiration, avoiding swallowing/coughing etc.4. Provide a pictorial review of various pathologies including traumatic, inflammatory, congenital, benign and malignant lesions.5. Briefly describe how to identify cartilage invasion in malignancy and how it affects the management.

## HNEE-29 DON'T GET LOST IN THE LABYRINTH! MÉNIÈRE'S DISEASE AND OTHER LABYRINTHOPATHIES

**Awards**
**Certificate of Merit**

Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose

Luiz R. Uchoa, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago B. Fernandes Feitosa, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Through this pictorial essay will be made a review based on cases and original drawings about Ménière's disease and pathologies of labyrinth. This will be addressed by typical imaging patterns to narrow down differential diagnoses. The purpose of this exhibition is to: - Review the anatomy of the labyrinth; - Review clinicopathological concepts of Ménière's disease; - Understand MRI protocol for adequate investigation of endolymphatic hydrops; - Recognize the main imaging patterns of other labyrinthopathies.

**TABLE OF CONTENTS/OUTLINE**

ANATOMICAL CONCEPTS• Anatomy of the labyrinthCLINICOPATHOLOGICAL CONCEPTS OF MÉNIČRE'S DISEASE• Clinical presentation• Diagnostic criteria IMAGING ASPECTS OF MÉNIČRE'S DISEASE• Review the specific MRI protocol• Endolymphatic hydrops classificationIMAGING ASPECTS OF OTHER LABYRINTHOPATHIES• Teaching points to narrow down differential diagnosesINTERACTIVE CASE-BASED DIDACTICS• Sample cases to illustrate and solidify the concepts

## HNEE-3 HAVE YOU HEARD THIS? A GUIDE TO WHAT SHOULD BE DESCRIBED IN REPORTS TO COCHLEAR IMPLANT

Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Gustavo S. Boasquevisque, MBBS (*Abstract Co-Author*) Nothing to Disclose
Maira Sarpi, MD (*Abstract Co-Author*) Nothing to Disclose
Luis G. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo B. Cintra (*Abstract Co-Author*) Nothing to Disclose
Niedja Santos Goncalves Tsuno (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Alberto F. Coelho Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta C. Andrade, MD (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Review the structural anatomy of temporal bone• Detail the cochlear implant structure and components• Evaluate the computed tomography (CT) imaging as a tool for identify anatomical changes and structures that may difficult the cochlear implant procedure and that may make the cochlear implant procedure impossible• Guide radiologists to detail anatomical changes and surgical anatomy and measures that must be taken to assists surgeons in procedure

**TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Cochlear implant components b. Inner and middle ear functional anatomy c. role of CT and MR images in pre-operative evaluation d. surgical anatomy2. Impedimental structural factors a. labyrinthine aplasia or complete isolated b. rudimentary otocyst c. labyrinthitis ossificans of cochlea d. absence/change in cochlear nerve3. Structural factors that interfere a. common cavity malformation b. cochlear hypoplasia c. cochlear incomplete partition d. absence/change in cochlear nerve e. large vestibular aqueduct syndrome f. round and oval hypoplastic windows g. cochlear opening abnormalities h. cochlear fibrosis i. otosclerosis j. cholesteatoma k. chronic otitis media l. labyrinthitis ossificans m. vestibular schwannoma4. Specific Measures a. Cochlear basal turn measure b. Cochlear openings amplitude c. Position of sigmoid sinuses in relation to posterior contour of mastoids d. Measure of longitudinal axes of cochleae e. Mastoid tegmen height f. Measurements of the level of mastoid tegmens in relation to limits tops of petrous pyramids g. Opening of internal auditory canal5. Structured Report 6. Take-home messages

## HNEE-30 DENTAL DEVELOPMENTAL ANOMALIES: WHAT RADIOLOGISTS SHOULD KNOW

**Awards**
**Certificate of Merit**

Daniel V. Sumi, MD (*Abstract Co-Author*) Nothing to Disclose
Suheyla P. Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Mauro M. Daniel, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Maffei Loureiro, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo Tames, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares (*Abstract Co-Author*) Nothing to Disclose
Maria Luiza Lacerda Ribeiro (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the imaging findings of dental developmental anomalies, encompassing variations of number, size, and form.Discuss how the various CT techniques, including multidetector CT, cone beam CT, and ultra-high resolution CT, can be employed to diagnose them accurately.Show how dental developmental anomalies can be misinterpreted as pathological conditions and may lead to aesthetic concerns, functional disorders, and failed dental procedures.

**TABLE OF CONTENTS/OUTLINE**

IntroductionTechniquePros and cons of multidetector computed tomography, cone beam CT, and ultra-high resolution CTNormal dental anatomyTypes of tooth development anomalies: NumberHypodontiaHyperdontiamesiodensdistodens / distomolarparamolarSizeMicrodontiaMacrodontiaFormDouble toothFusionGeminationConcrescenceDens invaginatusDens evaginatusTalon cuspBolk's cuspCarabelli's cuspEnamel pearlsTaurodontismDilacerationSupernumerary rootsPremolarsMandibular molarsRadix entomolarisRadix paramolarisHypercementosis

## HNEE-31 ENDOLYMPHATIC HYDROPS IMAGING: FROM MRI PROTOCOL TO STRUCTURED REPORTING

Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares (*Abstract Co-Author*) Nothing to Disclose
Rafael Maffei Loureiro, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Miranda (*Abstract Co-Author*) Nothing to Disclose

Mauro M. Daniel, MD (*Abstract Co-Author*) Nothing to Disclose
Lorena L. Bezerra, MD (*Abstract Co-Author*) Nothing to Disclose
Juarez Pimentel, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Luiza Lacerda Ribeiro (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the anatomy of the endolymphatic space for optimal image interpretation.Discuss the clinical presentation and characteristic MRI findings of endolymphatic hydrops (EH) in the cochlear and vestibular compartments.Propose a practical and customized MRI protocol for EH evaluation.Introduce a structured reporting template to ensure consistent and informative EH assessment

**TABLE OF CONTENTS/OUTLINE**

IntroductionAnatomy of the endolymphatic spaceDiagnostic Criteria of Menič̆re DiseaseMRI protocolPrimary Endolymphatic HydropsSecondary Endolymphatic HydropsPearls and PitfallsStructured ReportingConclusions

## HNEE-32 NEOPLASTIC LESIONS OF THE SKULL BASE: A COMPARTMENTAL APPROACH

Taisa Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Max Yunior Orsi Salazar, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique B. Zuppani, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanna S. Calfi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Tramonte Pereira (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Review the skull base anatomy and to stablish its compartments ; Recognize the imaging patterns of neoplastic lesions of the skull base and its compartment distribution to narrow the differential diagnosis ; Propose a flowchart of the location and imaging characteristics of the lesions to narrow the differential diagnosis

**TABLE OF CONTENTS/OUTLINE**

; Introduction: ; Review of the anatomy of the skull base and its compartments ; Anterior compartment: ; Esthesioneuroblastoma ; Sinonasal carcinoma ; Diagnostic flowchart proposal ; Middle compartment: ; Central compartment: ; Invasive macroadenoma ; Craniopharyngioma ; Nasopharyngeal carcinoma ; Paramedian/Paracentral: ; Juvenile nasopharyngeal angiofibroma ; Lateral: ; Langerhans cell histiocytosis ; Diagnostic flowchat proposal; Posterior compartment: ; Chordoma ; Chodrosarcoma ; Jugulotympanic paraganglioma ; Endolymphatic sac tumor ; Diagnostic flowchart proposal ; Multicompartmental lesions: ; Schwannoma ; Meningioma ; Solitary fibrous tumor ; Plasmacytoma ; Metastasis ; Mimics: ; Petrous apicitis ; Otogenic osteomyelitis ; Fibrous dysplasia ; Cholesterol granuloma ; Fungal invasive sinusitis ; Frontal mucocele ; Ecchodosis physaliphora ; Cephalocele ; Arrested pneumatization ; Conclusion ; General diagnostic flowchart

## HNEE-33 DECODING NASOPHARYNGEAL TUMOURS - WHAT THE TUMOUR BOARD WANTS TO KNOW

Janani Asogan Vaishnavi, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Anu Kamalasanan, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thiru A. Sudarshan, DMRD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Richard D. White, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Janani Baradwaj, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Most nasopharyngeal carcinomas originate in the posterolateral recess of the pharyngeal wall (82%) or midline (10%), with a small percentage (6%) presenting as normal at endoscopy MRI is the modality of choice for delineating the extent of NPC Key sequences : T1WI to identify skull base involvement and fat planes. CE-T1WI in detecting tumour extent, perineural spread, and intracranial extension. Diffusion-weighted imaging and MRI spectroscopy help to differentiate NPC from lymphoma CT is used to assess bony destruction and also for the purpose of RT planning . CT in combination with PET, is crucial for detecting distant metastasis and monitoring patients post-therapy for NPC recurrence. The presence of positive neck nodes is associated with higher incidence of disease recurrence. Nodes are measured in GREATEST DIMENSION in the neck in TNM staging and not in short axis diameter. Retropharyngeal nodes must be looked for in all cases. However these may be skipped and Level II nodes first involved in some cases.

**TABLE OF CONTENTS/OUTLINE**

Describe relevant imaging findings of nasopharyngeal tumours that would impact treatment decisions. Staging of the nasopharyngeal tumours and illustrate the route of spread of malignancy. Understand the general treatment considerations of Nasopharyngeal Tumours

## HNEE-34 POPPING OUT THE FACTS: A CLOSER LOOK AT THE CAUSES OF PROPTOSIS

Mariana Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Helio Yamashita, MD (*Abstract Co-Author*) Nothing to Disclose
Angela M. Wolosker (*Abstract Co-Author*) Nothing to Disclose
Jose R. Fonseca, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
MARCELO DOS SANTOS BANDEIRA FILHO (*Abstract Co-Author*) Nothing to Disclose
Roberto Bastos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

§ To outline and describe the diverse etiologies of ocular proptosis, emphasizing the importance of recognizing underlying conditions. § To illustrate the key imaging findings associated with each cause of proptosis, utilizing CT and MRI scans for effective diagnosis. § To underscore the crucial role of multidisciplinary collaboration in the diagnosis and management of patients with ocular proptosis, facilitating a timely and accurate treatment plan.

**TABLE OF CONTENTS/OUTLINE**

§ Introduction to Ocular Proptosis and its Clinical Significance. § Detailed Analysis of Causes: v Metabolic Causes: Focus on Thyroid Orbitopathy. v Neoplastic Conditions: Sphenoid wing meningioma, Lymphoma, Bone Metastasis. v Trauma-Induced Proptosis: Case Studies on Fractures. v Infectious Etiologies: Highlighting Subperiosteal Abscess. v Inflammatory Conditions: Idiopathic Inflammatory Orbitopathy. v Vascular Contributions: Carotid-Cavernous Fistula, Venous Malformations, and Lymphangioma.

## HNEE-35 PEARLS AND PITFALLS OF SKULL BASE CSF LEAK IMAGING

**Awards**
**Certificate of Merit**

Kyle Hunter, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Markovic, MD (*Abstract Co-Author*) Nothing to Disclose
Vikas Jain, MD (*Abstract Co-Author*) Nothing to Disclose
Evgeniia Grik, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Introduce imaging options for the evaluation of skull base CSF fistula. 2) Provide an overview of the diagnostic algorithm and importance of beta2-transferrin testing. 3) Review thin-section high-resolution CT of the skull base as the first-line imaging test. 4) Discuss pros and cons of other imaging tests such as CT- and MR-cisternography. 5) Emphasize proper technique and highlight pitfalls while performing and reporting CT cisternography.

### TABLE OF CONTENTS/OUTLINE

1) CSF leak is a serious condition and can lead to significant morbidity and mortality. We introduce classification of CSF fistulae and provide an overview of the relevant anatomy. 2) We outline the algorithm of diagnosis with thin-section high-resolution CT of the skull base as first-line imaging following positive beta2-transferrin testing. 3) CT- and MR-cisternography are performed in certain clinical scenarios. MR is excellent in diagnosing meningoencephaloceles and differentiation from mucosal thickening. 4) We outline the proper imaging technique for CT-cisternograms and potential preventable interpretive mistakes. 5) We address our teaching points with illustrative cases of CSF leaks of various presentations and etiologies: Idiopathic intracranial hypertension as a major cause of spontaneous CSF leaks. CSF leaks post-endoscopic surgery and risk factors. Multimodality approach to evaluation of CSF leaks and the role of CT-cisternogram. Avoiding false-negative studies by adhering to appropriate imaging technique. Pearls and pitfalls of CT-cisternogram reporting. Role of brain MR and correlation of MR findings with pathology. CSF leaks in the setting of acute trauma. Imaging of recurrent CSF leaks and postsurgical changes.

## HNEE-36 SECRETS OF SKULL-BASE: OPENING THE PANDORA'S BOX

Shehbaz M. Ansari, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Zubin Driver, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Better understanding of anatomy is a prerequisite for skull-base pathologies. 2. Localising pathology to the anterior, middle or posterior cranial fossa and ascertain its origin to the skull-base itself, intracranial or extracranial compartment is key to narrow down the differentials of a skull-base lesion aided by their imaging characteristics on cross-sectional imaging. 3. Role of radiology is not limited to diagnosis but also to describe the extent and relation to important neurovascular structures.

### TABLE OF CONTENTS/OUTLINE

Skull base has been a nightmare for radiologists, given its intricate anatomy and varied pathology. We intend to demystify the skull-base radiology by having a centre of origin-based approach. In this exhibit we will begin with the basics of skull-base anatomy as a building block using illustrations and cross-sectional imaging. This will be followed by application of centre of origin-based approach in diagnosing skull-base pathologies using case examples for each sub-category. In this approach, lesions will be categorised into anterior, middle and posterior cranial fossa with each category subdivided into extra-cranial, skull-base and intra-cranial as the centre of origin. For example, in the anterior cranial fossa category, fronto-ethmoidal meningoencephalocele, fibrous dysplasia and esthesioneuroblastoma represent lesions of intracranial, skull-base and extra-cranial origin. Similarly, lesions of middle and posterior cranial fossa will be discussed.

## HNEE-37 BOOST YOUR GPA KNOWLEDGE! UNMASKING THE HEAD AND NECK INVOLVEMENT IN GRANULOMATOSIS WITH POLYANGIITIS

Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Mario Padula, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo W. Murakoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Roberto Lelis B. Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize granulomatosis with polyangiitis (GPA) pathogenesis and clinical relevance.- Understand important imaging findings in head and neck involvement in GPA.- Recognize several differential diagnosis and their imaging findings.

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION:• Overview of granulomatosis with polyangiitis (GPA), including a brief overview of the pathophysiology, diagnosis and clinical significance, with emphasis on head and neck related symptoms.2. IMAGING IN GPA:• Case-based review of GPA imaging findings, especially in CT and MRI imaging, demonstrating:o Sinonasal involvement in initial, progressing, and advanced diseaseo Temporal bone involvemento Orbital Involvemento Upper airway involvement• Discussion of the diagnostic criteria for GPA, including laboratory tests, imaging studies, and histopathological findings, to aid in accurate and timely diagnosis.3. IMAGING OF DIFFERENTIAL DIAGNOSIS:• Case-based review of other diseases with similar findings, including sinonasal involvement in sarcoidosis, cocaine-induced lesions, Hansen's disease, invasive fungal rhinosinusitis, and more, with emphasis on red-flags that may suggest GPA or alternative diagnosis.4. CONCLUSION:• Take-home messages, focusing on key imaging findings in head and neck imaging involvement.

## HNEE-38 HEAR ME OUT: EMERGENCY IMAGING PATTERNS IN NECROTIZING OTITIS EXTERNA - EARLY DETECTION

Mario Porfirio Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna P. De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Gabriela Cintra Borba (*Abstract Co-Author*) Nothing to Disclose
Henzo Ota, MD (*Abstract Co-Author*) Nothing to Disclose
Vitoria Lima Beltrao Vieira de Melo, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Pedro C. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose

Adriano Magna, MD (*Abstract Co-Author*) Nothing to Disclose
Raissa M. Barradas Monteiro De Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Flavia Galvao Lopes, MBBS (*Abstract Co-Author*) Nothing to Disclose
Lucas P. Caldas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This study aims to assess the most common findings of the necrotizing otitis externa in the emergency context, and also show the most common dissemination patterns. Review the temporal bone anatomy, focusing on the main anatomical references that are affected by the disease.The purpose of this exhibition is to: Provide basic pathological concepts to help professionals to improve their skills to identify the main imaging findings and complications that should be actively looked for when reading a temporal bone CT in the emergency in patients with suspected necrotizing external otitis, helping to prevent delayed treatment due to diagnostic failure; Review the anatomical relation between the temporal bone, external ear and skull base, and the how the cervical spaces can be affected due to this relation in the disease dissemination, resulting in possible complications; Review subtle findings that may suggest that the patient could benefit from a MRI complementation study.

**TABLE OF CONTENTS/OUTLINE**

Schematic illustrations related to the pathophysiology of the external necrotizing otitis, correlating the temporal bone CT with the infection dissemination pattern through the anatomic references and cervical spaces; Demonstration of multiple cases with subtle imaging findings to help increase the early diagnosis rate.

## HNEE-39 BEHIND BULGING EYES: THE RADIOLOGIST HITCHHIKER'S GUIDE TO THE GRAVES OPHTHALMOPATHY

Denise D. Zantut-Wittmann (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Abstract Co-Author*) Nothing to Disclose
Caio Silveira, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Regis Coelho Guimaraes (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the normal anatomy of the orbits and the sumarize the current pathophysiology of Graves' ophthalmopathy. - Review and illustrate the imaging findings for Graves orbitophaty in MR, focus on provide an objective approach and for studying the anomalies. - Correlate MRI and CT with clinical images, to demonstrate what happens in the eye.

**TABLE OF CONTENTS/OUTLINE**

- Overview of Graves' ophthalmopathy as a complex autoimmune disorder- Description of the underlying autoimmune mechanisms- Pathophysiology: - Autoantibodies binding to thyrotropin receptors and insulin-like growth factor 1 receptors - Inflammatory response involving immune cells and cytokines - Differentiation of fibroblasts into adipocytes and myofibroblasts - Role of fibrocytes in tissue remodeling - Symptoms: exophthalmos, eyelid retraction - Complications: diplopia, restrictive strabismus - Association with hyperthyroidism- Radiological Findings - Importance for diagnosis and monitoring - Increased thickness and volume of extraocular muscles (EOM) in CT and MRI - Imaging during active inflammatory phase - Assessment of disease activity and complications - Compression of the optic nerve with apical crowding - Measurement of muscle diameters and impact on exophthalmos classification - Exploration of different imaging sequences - Evaluation of involvement of the lacrimal gland by MRI

## HNEE-4 DIFFUSE THYROID DISEASE: CT AND MR IMAGING APPROACH

Naoko Saito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryohei Kuwatsuru, MD (*Abstract Co-Author*) Nothing to Disclose
Osamu Sakai, MD, PhD (*Abstract Co-Author*) Consultant, Boston Imaging Core Lab LLC
Naoki Takemasa (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Diffuse thyroid enlargement is frequently encountered on CT and MRI with clinical symptoms or incidentally. A wide variety of diseases can affect the thyroid gland diffusely, ranging from thyroiditis to malignant tumors. Familiarity with the imaging and clinical characteristics of diffuse thyroid disease (DTD) is essential for prompt diagnosis and treatment. The teaching points are: 1. To review clinical and imaging findings of various DTD 2. To recognize important features that can help differentiate the various DTD 3. To learn the current knowledge about the therapy for DTD

**TABLE OF CONTENTS/OUTLINE**

1. Normal imaging findings of the thyroid gland 2. Review of various cases of diffuse thyroid enlargement: clinical and imaging findings and treatment a. Autoimmune thyroid diseases: Graves' disease, Hashimoto thyroiditis, postpartum thyroiditis, IgG4-related thyroiditis b. Nonautoimmune thyroid diseases: acute and subacute thyroiditis c. Depositions: amyloidosis d. Drug-induced thyroid disorders e. Acute transient thyroid swelling following FNA f. Benign tumors: adenomatous goiter, simple diffuse goiter g. Malignant tumors: anaplastic thyroid cancer, diffuse sclerosing papillary cancer, malignant lymphoma, metastatic tumor h. Fetal goiter i. Shock thyroid 3. Current topics of treatment for DTD (anaplastic thyroid cancer and advanced thyroid cancer) a. Molecular target drug b. Immune checkpoint inhibitor c. Genomic medicine 4. Suggested algorithms for the diagnosis of DTD

## HNEE-40 RIGHT UNDER YOUR NOSE - ULTRASOUND GUIDE TO POST-SURGICAL RHINOPLASTY EVALUATION

**Awards**
**Certificate of Merit**

Gabriel Da Silva Eli, MD (*Abstract Co-Author*) Nothing to Disclose
Amany Campoville, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana A. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Luis R. Ferreira (*Abstract Co-Author*) Nothing to Disclose
Matheus Taborda, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Sampaio, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Rhinoplasty or "nose job" is an ancient plastic surgery dating back to the time before Christ, with the first reports by Indian and Egyptian people. Despite being an old and frequently performed procedure, it still is considered challenging due to unexpected results and complications that can be related to the partially known anatomy prior to the procedure. Ultrasound (US) is an objective, accessible and widely used method for pre- and post-operative monitoring of many structures. Therefore, high-frequency nasal US should be included in the preoperative planning and in the postoperative follow-up of rhinoplasties.1. Review the structural anatomy of the nasal region on ultrasound;2. Introduce the different types of most common surgical rhinoplasty;3.

Review the ultrasound aspect of the most used surgical rhinoplasty techniques;4. Evaluate the materials commonly used in the procedure and their ultrasound appearances;5. Demonstrate what to expect in the post-operative period.

**TABLE OF CONTENTS/OUTLINE**

IntroductionUltrasound (US) nasal anatomyClinical and surgical benefits of US for nose proceduresSurgical RhinoplastyDifferent types of most common techniques (rhinoplasty, septoplasty, rhinectomy, maxillary antrostomy and uncinectomy, nasal turbinate surgery, ethmoidectomy, nasal prosthesis, etc)Grafts and materialsMaterials commonly used in nose jobUS aspect of most used materialsPost-surgical changesUS aspect of most used surgical rhinoplasty techniquesComplicationsSequelsTake-home messages

## HNEE-41 ARYEPIGLOTTIC FOLDS, A SMALL SPOT WITH BIG POSSIBILITIES. A CLINICO-RADIOLOGICAL AND ANATOMOPATHOLOGICAL REVIEW

Jose Maria Maiques Llacer, MD (*Abstract Co-Author*) Nothing to Disclose
Brigitte Beltran Marmol (*Abstract Co-Author*) Nothing to Disclose
Jaume Capellades, MD (*Abstract Co-Author*) Nothing to Disclose
Paulina Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Ivan Martinez Cano, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This educational poster presents a clinico-radiological and anatomopathological's review of pathology of the aryepiglottic folds (AEF) of the supraglottis, from the common to the rare and from the benign to the malignant based on cases observed in the head and neck tumor committee of our centre.

**TABLE OF CONTENTS/OUTLINE**

Laryngeal neoplasms account for about a quarter of all head and neck neoplasms. The supraglottis is the most common site for these neoplasms and can be subdivided into different anatomical spaces that have prognostic and management differences. The aryepiglottic fold is the border between the larynx and the hypopharynx and is an uncommon site for tumors. The vast majority of these have epidermal origin, but multiple lesions can arise from the structures that make up the EFA. The pathology harbored in this site usually presents with larval and non-specific clinical manifestations, making timely diagnosis difficult; this problem is compounded by unfamiliarity with the imaging of these lesions, making their diagnosis even more difficult. Sometimes benign pathology can be confused with neoplasia, which can be difficult to differentiate on imaging. However, clinics and some tools to determine the benign origin of these lesions (contrast enhancement behavior) can help to refine the diagnosis and avoid invasive procedures in patients. This review summarizes the clinical, radiological and anatomopathological differences between neoplasms and benign pathology that may occur in this space. In addition, we aim to provide useful imaging tools for the recognition of certain features of clinical and prognostic importance.

## HNEE-42 INTRATHYROIDAL PARATHYROID: YOU MUST REMEMBER THIS!

Carolina R. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Carrara Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Fabio Montenegro (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo Tames, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Magnabosco (*Abstract Co-Author*) Nothing to Disclose
Lucas O. Madeira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The concept of enlarged parathyroid represents the possibility of disease. Classically, the parathyroids are located in the thyroid contours, however they can be found in ectopic situations, including inside the thyroid gland, in regions clearly surrounded by the thyroid parenchyma. They can often be confused by thyroid nodules, sometimes with a high ACR TI-RADS classification. The purposes of this exhibit are: to make this diagnosis possible and incorporated into radiological practice, especially in the clinical context of hyperparathyroidism; to review the imaging method aspects of these glands; and to show the findings of the 10 original cases from our institutions, illustrated by different imaging methods. Results: scintigraphy: 100% with focal hyperuptake to the radiopharmaceutical;ultrasound: 100% with hypoechogenicity;CT scan (only 50%): hypoattenuating nodule;MRI (only 20%): hypersignal in T2.

**TABLE OF CONTENTS/OUTLINE**

Introduction: epidemiology, embryology and clinical aspects of the intrathyroidal parathyroid.Imaging methods of intrathyroidal parathyroids: Ultrasound, Scintigraphy, CT scan and MRI.Illustrative original cases with anatomopathological correlation: 80% adenoma, 10% hyperplasia, and 10% carcinoma.Possible atypical characteristics of these nodules.Recommendation for radiologists - in what context should we remember this diagnosis? Conclusion "take-home messages".

## HNEE-43 "THE RADIOLOGIST'S ROADMAP: MAPPING OUT JAW LESIONS AND MULTIMODALITY IMAGING FEATURES"

**Awards**
**Certificate of Merit**

Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Reham M. Ellessy, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Mohamed Badawy, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Discuss the different lesions in the Jaw. Review imaging features and clinical associations of odontogenic and non-odontogenic lesions. Describe a practical approach to narrow the differential diagnosis and identify the various lesions.

**TABLE OF CONTENTS/OUTLINE**

IntroductionClassification of the jaw lesionsRadiological characteristics Radiopaque vs radiolucentDifferent attenuation patterns (e.g. sclerotic, vs ground glass. Solid vs cystic)Margins (well vs ill-defined)Associated lesions.Clinical implications, e.g. prevalence, clinical presentation, behavior, treatment options.Differential diagnosis and practical approach to identify lesions according to the location and radiological features.RadiopaqueOdontogenicSclerotic: (odontoma, cementoblastoma, cemento osseous dysplasia, condensing osteitis)Ground glass: (cemento ossifying fibroma)NonodontogenicSclerotic: (Osteoma, Exostoses)Ground glass: (Fibrous dysplasia, Renal osteodystrophy, Paget disease of the Jaw)RadiolucentWell-defined marginsOdontogenicCystic lesions without mineralization (dentigerous cyst, Keratocyst, radicular cyst, residual cyst)Solid lesions without mineralization (Ameloblastoma)NonodontogenicCystic lesions ( Lingual Salivary Gland Inclusion Defect, simple bone, nasopalatine cysts)Solid lesions ( central joint cell granuloma, arteriovenous malformation, Langerhan cell histiocytosis)Ill-defined marginsOdontogenic (odontogenic

carcinoma, carcinosarcoma, sarcoma)Nonodontogenic Non neoplastic:(Osteomyelitis, osteonecrosis)Neoplastic: (distant metastasis, squamous cell carcinoma of the oral cavity, osteosarcoma/chondrosarcoma/fibrosarcoma of the jaw)

## HNEE-44 COCAINE-INDUCED MIDLINE DESTRUCTIVE LESIONS: WHAT DO WE HAVE TO LOOK FOR IN THE ENT AREA?

Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Marin-Diez, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Cobo Diaz Ramon (*Abstract Co-Author*) Nothing to Disclose
Angela Guitian Pinilla, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To review the anatomy of the nasal cavities and paranasal sinuses.- To describe the key radiological findings in Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) of cocaine-induced midline destructive lesions (CIMDL).- - To review the differential diagnosis with other pathologies that cause destructive midline lesions.

### TABLE OF CONTENTS/OUTLINE

A) Anatomy of the sinunasal areaB) Main ENT lesions- Perforation of the nasal septum.- Destruction of nasal turbinates.- Lateral nasal wall involvement.- Palate perforation.- Sinus neo-osteogenesis.- Orbital damage (obstruction of the nasolacrimal duct, destruction of the orbital bones, inflammatory mass..)- Otitis signs.- Skull base involvement (erosions of the anterior cranial fossa, encephalocele, CSF fistulae..)- Skin lesions/soft tissue destruction of the nasal area, mainly of the columella, alar cartilages, nasal philtrum and upper lip.C) Differential diagnosis- Traumatic lesions. - Infections (bacterial, fungi)- Toxic effect.- Inflammatory diseases.- Neoplasm.

## HNEE-45 TEMPORAL BONE OSTEODYSTROPHIES: EXPLORING OTOSCLEROSIS AND BEYOND

Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno C. Olivetti, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Toyama (*Abstract Co-Author*) Nothing to Disclose
Hugo Tames, MD (*Abstract Co-Author*) Nothing to Disclose
Isadora Campos De Matos (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To highlight the main characteristics and imaging findings of osteodystrophies of the temporal bone.- To review and illustrate dysplasias of the temporal bone with cases from our institution.- To familiarize radiologists with imaging aspects that aid in the differential diagnosis of these pathologies.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION- Organogram osteodystrophies of temporal bone organized into groups according to the predominant pattern of bone involvement (lytic, scleroticand mixed)Temporal bone disease with predominance of lytic pattern- Otosclerosis- Osteogenesis imperfecta- Otosyphilis Temporal bone disease with predominance of mixed pattern- Paget's disease- Fibrous dysplasia Temporal bone disease with predominance of sclerotic pattern- Osteopetrosis- Camurati-engelmann- Scleosteosis- Van buchemTAKE HOME MESSAGESTemporal Bone Osteodystrophies, such as otosclerosis and other bone dysplasias exhibit varied clinical presentations and genetic origins. By classifying them based on predominant bone involvement patterns, clinicians and radiologists can better understand their complexities and facilitate accurate diagnosis. Imaging modalities play a crucial role in delineating disease characteristics and guiding treatment strategies. Recognizing key features of each condition is imperative for tailored patient management and improved outcomes. In essence, a comprehensive understanding of temporal bone diseases empowers healthcare professionals to provide optimal care and support for affected individuals.

## HNEE-46 BRANCHIAL CLEFT ANOMALIES: EMBRYOLOGICAL DEVELOPMENT AND MULTIMODALITY IMAGING FINDINGS. WHAT THE RADIOLOGIST NEEDS TO KNOW

Maria J. Sarda, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo D. Sarda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review key embryological aspects of branchial arch development.Know the anatomical anomalies caused by failures in the embryological development of the branchial arch -usually presented as cysts, sinuses and fistulas.Identify the key imaging findings to establish the diagnosis of anomalies of the branchial arches: morphological characteristics, location of the lesion.Review the complications associated with anomalies of the branchial arches as well as their imaging findings: infections, persistent fistula.

### TABLE OF CONTENTS/OUTLINE

Embryological branchial arch development. - Temporary cavity of "Sinus of His": normal fusion.Failure of complete wall fusion: -branchial cleft cyst: type 1, type 2, type 3, type 4-Branchial cleft sinus-Branchial cleft fistulaKey multimodality imaging findings: -Branchial cleft cyst-Branchial cleft sinus-Branchial cleft fistulaComplications of branchial arches anomalies - and imaging findings-Infections-Persistent fistula -Collections

## HNEE-47 MERKEL CELL CARCINOMA MANIFESTATION IN HEAD AND NECK

Carlota Andreu Arasa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Inseon Ryoo, MD (*Abstract Co-Author*) Nothing to Disclose
Osamu Sakai, MD, PhD (*Abstract Co-Author*) Consultant, Boston Imaging Core Lab LLC
Karen Buch, MD (*Abstract Co-Author*) Nothing to Disclose
Serena Pham, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Merkel cell carcinoma (MCC) is a rare, aggressive neuroendocrine cutaneous malignancy, with a predilection for early local, regional and distant metastasis with frequent recurrence, and is associated with poor prognosis.1-9 Since MCC rapidly progresses and metastasizes, early detection and achievement of R0 excision of the primary lesion, with a safety margin of >1 cm in stage 1 disease and >2 cm in higher stages, as well as sentinel lymph

node biopsy and excision, are key to improving prognosis.1,4 While the gold-standard method of diagnosing MCC is pathologic analysis, imaging is essential for staging, management, and follow-up guidance.5-9 To date, there is no consensus for specific imaging algorithm for assisting diagnosing and staging of MCC.5,9 The purpose of this exhibit is to: 1) Review the MCC epidemiology and risk factors 2) Discuss various MCC manifestations in head and neck 3) Discuss management of MCC in head and neck 4) Discuss the role of the most recent imaging approach for diagnosing and staging of MCC in head and neck (Reference is available upon request.)

**TABLE OF CONTENTS/OUTLINE**

1) MCC epidemiology and risk factors 2) MCC manifestations in head and neck 3) Management of MCC in head and neck 4) Imaging approach for diagnosing and staging of MCC in head and neck

## HNEE-48 PARAPHARYNGEAL SPACE: THE GREAT UNKNOWN

Silvia Cisneros Carpio, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Legorburu Tona, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Castillo de Juan (*Abstract Co-Author*) Nothing to Disclose
Udane Oiartzabal, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rodriguez Ripalda, MD (*Abstract Co-Author*) Nothing to Disclose
Leire Ormaetxe Albeniz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review the boundaries and anatomical relationships of the parapharyngeal space.To describe the diversity of focal lesions affecting this space and the radiological key findings that lead their differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

The parapharyngeal space is a deep cervical compartment with inverted pyramid morphology, bounded laterally by the masticator and parotid spaces, posteriorly by the retropharyngeal and prevertebral spaces, and medially by the pharyngeal mucosal space, and divided into a pre-styloid and a post-styloid compartment by the tensor-vascular-styloid fascia.Although predominantly composed of fatty tissue, it also includes multiple vascular and nervous structures, minor salivary glands, and, occasionally, the retromandibular portion of the deep parotid lobe. Additionally, due to its location, it maintains a close relationship with multiple neighboring anatomical structures.The differential diagnosis of lesions affecting this space includes both primary lesions originating within the space itself and secondary lesions extending into it from adjacent structures. These encompass a wide range of pathologies, both congenital and acquired, including neoplastic, inflammatory, and infectious etiologies.A review of the main differential diagnosis of the parapharyngeal space lesions has been conducted, based on both anatomic references and key radiological findings, using cases from our institution.

## HNEE-49 IMAGING-DETECTED EXTRANODAL EXTENSION IN HEAD AND NECK CANCER: CLINICAL IMPLICATIONS AND DIAGNOSTIC CRITERIA IN THE ERA OF HIGH-RESOLUTION IMAGING INCLUDING PHOTON-COUNTING DETECTOR CT

**Awards**
**Magna Cum Laude**

Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takashi Hiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toshifumi Tomioka, MD (*Abstract Co-Author*) Nothing to Disclose
Shingo Sakashita, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsushi Kobayashi, MD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation
Hiroki Taguchi (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Ryutaro Onaga (*Abstract Co-Author*) Nothing to Disclose
Yoshihisa Muramatsu, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Tomoaki Sasaki, MD (*Abstract Co-Author*) Nothing to Disclose
Hirofumi Kuno, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Extranodal extension (ENE) is a significant adverse prognostic factor in head and neck squamous cell carcinoma (HNSCC), and pathologic ENE (pENE)/clinically evident ENE (cENE) are classified as N3b in p16-negative HNSCC based on the AJCC staging system. While imaging-detected ENE (iENE) without clinically apparent cENE is not included in the current N category, there has been active discussion regarding the importance of pretreatment iENE evaluation for accurate prognostication and treatment strategy as well as the many aspects of iENE that remain unresolved such as diagnostic criteria including the associated terminology. At the same time, the advent of high-resolution imaging techniques such as photon-counting detector CT with 1024 matrix capability allows for more detailed visualization of fine structures compared to conventional imaging.The objectives of this presentation are: 1) to review the clinical implications of iENE in patients with head and neck cancer, and 2) to discuss the diagnostic criteria for iENE in the era of high-resolution imaging with radiolo-pathologic / clinico-radiologic correlation.

**TABLE OF CONTENTS/OUTLINE**

1. Clinical background of ENE in the patient with head and neck cancer.2. Diagnostic criteria and the recently proposed grading of iENE.3. High-resolution CT including photon-counting CT4. Case discussion and clinical implications of iENE- iENE Grade 1- iENE Grade 2- iENE Grade 35. Summary

## HNEE-5 ENDOLYMPHATIC HYDROPS IN MRI, A DEEPER LOOK AT THE INNER EAR

Yukiyoshi Kimura, MD (*Abstract Co-Author*) Nothing to Disclose
Yumi Kimura Sandoval, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Calderon Cardenas SR, MD, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Establish an anatomical correlation of the inner ear and its visualization with MR images.2. Show the type of sequences used as well as the contrast administration and image acquisition times in the evaluation of patients with suspected endolymphatic hydrops.3. Explain and illustrate the importance of a step-by-step evaluation in patients with endolymphatic hydrops.4. Illustrate characteristic imaging findings in posterior fossa pathology considered as a differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

• Introduction• Indications• Anatomy of the inner ear• Image acquisition protocol (use of contrast media and administration times, sequence and acquisition times)• Endolymphatic hydrops: what is it? why is it produced?• Step-by-step evaluation on MRI • Classification systems used• Differential

diagnoses• Take home points• References

## HNEE-50 QUANTITATIVE AND QUALITATIVE ASSESSMENT OF THE PHARYNGOESOPHAGEAL SEGMENT (PES) IN THE VIDEOFLUOROSCOPIC SWALLOW STUDY (VFSS): A PRACTICAL APPROACH

Javier Azpeitia-Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Araceli Munoz Hernandez, MD, PHD (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To describe the normal anatomy of the pharyngoesophageal segment (PES).
- To analyze the normal physiology of the upper esophageal sphincter (UES)
- To propose a systematic approach for the study of pathology of the pharyngoesophageal segment.
- To illustrate common and uncommon imaging findings in videofluoroscopy swallow study (VFSS).
- To emphasize pitfalls and clues to differential diagnosis.
- To describe recommendations and rehabilitative strategies based on VFSS by evaluating the effectiveness of postures, maneuvers, bolus modifications, and sensory enhancements in improving swallowing safety and efficiency.

### TABLE OF CONTENTS/OUTLINE

The pharyngoesophageal segment (PES) is one of the only region of the swallowing mechanism that can be modified with therapy and surgery. The VFSS is the gold-standard tool for diagnosing PES dysfunction. A systematic approach to PES analysis ensures a comprehensive assessment of dysfunction. The systematic evaluation of the PES includes evaluation of pre-swallow PES fluoroscopic anatomy, laryngohyoid elevation, pharyngeal contractility, PES opening, evaluation of the posterior cricoid region, the posterior hypopharyngeal wall region and the esophageal function. We present different objective measures to study the PES pathology: the pharyngeal constriction ratio (PCR), UES opening diameter, Determination of the PES opening dimensions, UES closure, measurement of the cricopharyngeus bar to distinguish between obstructive and non-obstructive bars, and normalized residue ratio scale (NRRS).

## HNEE-51 PATHOLOGY OF THE OUTER, MIDDLE AND INNER EAR: TECHNIQUES, PROTOCOLS AND KEY FINDINGS

Paloma Briceno Torralba, MD (*Abstract Co-Author*) Nothing to Disclose
Joaquin Martin Cuartero (*Abstract Co-Author*) Nothing to Disclose
Celia Bernal Lafuente, MD (*Abstract Co-Author*) Nothing to Disclose
Amalia Aranaz Murillo, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Pascual Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Riera Marti (*Abstract Co-Author*) Nothing to Disclose
Jorge Gomez Madrona (*Abstract Co-Author*) Nothing to Disclose
Elena Sierra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; The temporal bone is an anatomical area of great complexity and harbors different pathologies.; The most suitable technique for examining the outer ear is Computed Tomography. However, CT is used to assess bone structures in the middle and inner ear, whether Magnetic Resonance Imaging is required for inflammatory or tumorous diseases.

### TABLE OF CONTENTS/OUTLINE

The temporal bone can present a variety of pathologies (infectious, traumatic, congenital, tumor) that can affect the outer, middle, or inner ear. This education exhibit aims to review the ear's anatomy showing the most appropriate techniques and protocols for basic findings that will allow the detection of different ear pathologies.; Most diseases of the outer ear are assessed by CT, sometimes with contrast (inflammatory and tumorous processes).; In the middle ear, CT without contrast allows the assessment of hearing loss, trauma, otitis, and cholesteatoma. CT with contrast medium is used for infectious processes with intracranial extension such as epidural abscesses or thromboses. MRI is used to assess tumor diseases and inflammatory diseases.; In the inner ear, MRI is the method of choice to identify cranial nerves and the labyrinth, using contrast agents for tumors and infectious diseases. CT can be used to assess congenital pathologies and other pathologies such as otosclerosis and dehiscence.

## HNEE-52 BEYOND THE ORDINARY: A DEEP DIVE INTO BRACHIAL PLEXITIS AND PLEXOPATHY

**Awards**
**Certificate of Merit**

Carlos H. Torres, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Vinil Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Lucia Brun, MD (*Abstract Co-Author*) Nothing to Disclose
Pierre Bourque (*Abstract Co-Author*) Nothing to Disclose
Azza Reda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

○ To review the common and uncommon causes of brachial plexitis and discuss the key imaging features that may aid in the differential diagnosis.○ To correlate the imaging features with the clinical findings of Brachial Plexitis.○ To understand the clinico-radiological and electrodiagnostic approach in the multidisciplinary assessment of brachial plexitis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction and Background2. Clinical approach and electrodiagnostic correlation3. MRI findings: A Case-Based Review- Viral plexitis- Immune-related plexitis- Post-radiation plexitis- Toxic plexitis (vaccines, drugs)- Heredofamilial Hypertrophic Neuropathies- Charcot-Marie-Tooth- CIDP- Idiopathic plexitis (Parsonage-Turner syndrome)- Miscellaneous cases 4. Conclusions and take-home pointsBrachial plexitis represents a clinical challenge as symptoms are vague and nonspecific. However, the combination of clinical history, EMG, NCS and MRI findings is helpful to reach the diagnosis.

## HNEE-53 DISEASES INVOLVING THE EXTRAOCULAR MUSCLES (EOM): IMAGING FINDINGS

**Awards**
**Certificate of Merit**

Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Gredilla (*Abstract Co-Author*) Nothing to Disclose
Juan S. Martinez San Millan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Montserrat Medina Diaz, PhD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Alba Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Juan V. Quintana Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The extraocular muscles (EOM) can be involved in a wide variety of diseases that can be local, regional or systemic. The conditions often have a similar clinical and radiological presentation, which can make differential diagnosis difficult.It is necessary to know the orbital anatomy, how to perform its radiological evaluation and the clinical and imaging manifestations of the diseases that may affect de EOM.The key points to evaluate for a systematic approach and differential diagnosis are:- Pattern of muscle involvement: how many muscles, which ones, and what part of them.- Involvement of one or both orbits and symmetry.- Involvement of other orbital or extraorbital structures.- Clinical presentation.The purpose of this work is to review the conditions that can affect the EOM, to describe and to illustrate their characteristic imaging findings, focusing on clues for differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction1.1. Orbital anatomy, focusing on the EOM1.2. Imaging modalities used for the evaluation of the orbit and the EOM and its radiological features2. Systematic approach and clues for differential diagnosis3. Diseases involving the extraocular muscles:3.1. Thyroid ophthalmopathy (Graves' disease)3.2. Orbital myositis: idiopathic orbital inflammation (orbital pseudotumor) and secondary myositis (associated to systemic or autoimmune diseases)3.3. Neoplasms: lymphoproliferative disorders and metastasis3.4. Orbital trauma and iatrogenic complications3.5. Infectious diseases: orbital cellulitis and other entities3.6. Miscellaneous: Brown syndrome, vascular conditions and others4. Conclusions5. References

## HNEE-54 RADIOGRAPHIC GUIDE TO CYSTIC ODONTOGENIC LESIONS: A MULTIMODAL IMAGING APPROACH

Michael Vaccaro, DO (*Abstract Co-Author*) Nothing to Disclose
Hannah Iqbal (*Abstract Co-Author*) Nothing to Disclose
Josef Iqbal (*Abstract Co-Author*) Nothing to Disclose
Nandor K. Pinter, MD (*Abstract Co-Author*) Consultant, Koninklijke Philips NV
Zakwan Uddin (*Abstract Co-Author*) Nothing to Disclose
Benjamin Morrish, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Introduction to Cystic Odontogenic Lesions: - Overview of cystic odontogenic lesions and their classification. Review differential diagnosis of cystic odontogenic lesions, including: radicular cyst, dentigerous cyst, odontogenic keratocyst, ameloblastoma, odontogenic myxoma, residual cyst, calcifying odontogenic cyst, etc.- Discuss the importance of the Radiologist in diagnosis and management of these lesions.Multimodal Imaging Approach:- Advantages in using a multimodal imaging approach, including radiography, computed tomography, magnetic resonance imaging.Radiographic Features:- Review the radiographic techniques used in imaging odontogenic lesions.- Typical radiographic appearance of discussed cystic odontogenic lesions.Computed Tomography Imaging - Discuss role of CT in evaluation and diagnosis of cystic odontogenic lesions.- Review the key CT findings for differentiating cystic odontogenic lesions.Magnetic Resonance Imaging - Utility of MRI in characterizing cystic lesions. Importance of evaluating adjacent soft tissues and internal cyst contents.- Discuss characteristic signal patterns for specific odontogenic lesions.

**TABLE OF CONTENTS/OUTLINE**

-Title Slide-Disclosures -Exhibit Learning Objectives-Introduction to Cystic Odontogenic Lesions, Importance of the Radiologist-Multimodality Approach in Diagnosing Cystic Odonotgenic Lesions (Radiography, CT, MRI)-Periapical Cyst (Radicular Cyst)-Dentigerous Cyst (Follicular Cyst)-Keratocystic Odontogenic Tumor (Odontogenic Keratocyst)-Ameloblastoma-Odontogenic Myxoma-Residual Cyst-Calcifying odontogenic cyst (Gorlin Cyst)-Summary-References

## HNEE-55 APPLICATION OF CT-LIKE MRI IN CRANIAL AND FACIAL BONE LESIONS

Masayuki Maeda, MD (*Abstract Co-Author*) Nothing to Disclose
Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Fumine Tanaka (*Abstract Co-Author*) Nothing to Disclose
Maki Umino, MD (*Abstract Co-Author*) Nothing to Disclose
Seiya Kishi (*Abstract Co-Author*) Nothing to Disclose
Ryota Kogue, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Recently, a new technique known as CT-like MRI has been developed that enhances MRI contrast similar to CT. We present our clinical experience using fast field-echo resembling a CT using restricted echo spacing (FRACTURE) MRI in comparison with CT in cranial and facial bone lesions. Our aim is1) to understand the principle of FRACTURE MRI.2) to demonstrate FRACTURE MRI cases of cranial and facial bone lesions compared with CT.3) to learn the diagnostic value and drawbacks of FRACTURE MRI in evaluating bone lesions.

**TABLE OF CONTENTS/OUTLINE**

1. Principle of FRACTURE MRI2. Delineation of osteolytic change indicates whether the lesion is malignant (permeative bone destruction) or benign (expansive bone destruction).3. Delineation of sclerotic change is useful for diagnosing fibrous dysplasia, osteochondroma, meningioma, etc.4. Benefit: FRACTURE MRI may omit CT examination in pediatric cases.5. Drawback: FRACTURE MRI may be difficult to assess the lesions near nasal/paranasal or mastoid air.6. Conclusion: FRACTURE MRI provides added value in the evaluation of cranial and facial bone lesions that is difficult with conventional MRI.

## HNEE-56 PATTERNS OF VISUAL FIELD DEFECT: THE KEY FOR SELECTING APPROPRIATE IMAGING MODALITY AND MAKING ACCURATE DIAGNOSIS

Yuhua Dou (*Abstract Co-Author*) Nothing to Disclose
Guanglei Tang, MBBS (*Abstract Co-Author*) Nothing to Disclose

Xueguo Liu, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jian Guan, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review the anatomy, physiology and normal imaging appearance of the visual pathway. 2. To know about the relevant clinical examination for visual field analysis 3. To recognize different visual field defect patterns associated with specific segment of the visual pathway, which can be assisting in lesion localization on imaging. 4. To learn unilateral and bilateral visual field defect based on cases.

**TABLE OF CONTENTS/OUTLINE**

1. The anatomy of the visual pathway and its normal appearance on CT and MRI imaging. 2. Relevant clinical examinations of visual field: (1)Testing of visual fields (including methods to study and analyze the visual field, as well as terminology relating to visual field defects); (2)Testing of the pupillary light reflex. 3. Different patterns of visual field defect, imaging findings and diagnosis: (1)Visual field defect with unilateral eye involved(central visual field defect, peripheral visual field defect, altitudinal hemianopsia, nasal hemianopsia and total visual loss) and related diseases. (2)Visual field defect with bilateral eyes involved (junctional scotoma, altitudinal hemianopsia, heteronymous visual field defect, homonymous visual field defect and quadranopsia) and related diseases. 4. Application of visual field defect and lesion localization in complex cases

## HNEE-57 STAYING IN ORBIT: A REVIEW OF INTRAORBITAL PATHOLOGY

Han Zhong, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Ciasullo, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review orbital anatomy. 2. Review the cross-sectional imaging appearance as well as typical patient presentation/demographics and management of non-traumatic orbital pathologies including inflammatory, neoplastic, and vascular etiologies.Summary As orbital pathology is infrequently encountered by many residents, it can become a source of anxiety and confusion. The myriad of entities that can manifest in such a small region of the human body may be overwhelming - a dilemma that this educational exhibit seeks to address. It will start with fundamental orbital anatomy and progress to key characteristics of multiple pathologies, broken down into more easily digestible categories. In addition, understanding common presenting symptoms and demographics for each pathology can often help narrow the differential. The objective is to instill confidence in residents not only as they prepare for board exams, but also to help form differential diagnoses as they encounter orbital imaging throughout their call shifts and career.

**TABLE OF CONTENTS/OUTLINE**

1. Orbital anatomy. 2. Cross-sectional imaging appearance as well as typical patient presentation/demographics and management of non-traumatic orbital pathologies. a. Inflammatory - optic neuritis, orbital pseudotumor, scleritis, thyroid orbitopathy. b. Neoplastic - optic nerve glioma, optic nerve sheath meningioma, orbital lymphoma. c. Vascular - orbital cavernous venous malformation, orbital infantile hemangioma, orbital lymphangioma.

## HNEE-58 MAGNETIC RESONANCE NEUROGRAPHY IN HEAD AND NECK: HOW TO DO AND WHAT TO VALUE

Andre F. Formiga, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo Tames, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia I. Cevasco, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamim W. Handfas, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Porto Cunha, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To provide an overview of cranial nerves neuropathies and their impact on patients' quality of life.To review essential anatomical landmarks in the origin and course of the cranial nerves.To outline the magnetic resonance imaging (MRI) neurography (MRN) techniques and protocols for assessing the main cranial nerves and their branches. To elucidate the neural anatomical locations and interpret lesion findings through the analysis of a selection of over 50 cases from our service.

**TABLE OF CONTENTS/OUTLINE**

IntroductionProposed study protocols with 3D PSIF and 3D STIRTrigeminal nerve protocolGlossopharyngeus, vagus, accessory and occipital major nerves protocolReview of cranial nerves anatomySensitive and motor nuclei anatomyMRI anatomy of the trigeminal nerve and its branchesMRI anatomy of the facial, glossopharyngeal, vagus, and accessory nervesNon-tumoral neural lesions MRI patterns: discontinuity, inflammation, and displacementIllustrative review of facial neuropathy casesDiscussion: limitations and conclusionsTake-Home messages

## HNEE-59 NON-ODONTOGENIC JAW LESIONS: A PICTORIAL REVIEW

Pablo Garces Marin, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei Daniel Onuta, MD (*Abstract Co-Author*) Nothing to Disclose
Victoria Esteban Izquierdo, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Calero Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Risco Fernandez (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Elisabetta Ponte, MD (*Abstract Co-Author*) Nothing to Disclose
Esnelly F. Berrios Bonilla, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The aim of this report is to review the various ways in which non-odontogenic jaw lesions manifest in adult and pediatric population.To describe how non odontogenic jaw lesions adjacent structures, and the best way to recognize them with their imaging characteristics at plain radiograph, ultrasound, computed tomography and resonance magnetic studies.To illustrate the main imaging features and to highlight associated injuries with-own experienced images.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Lesions 3. ConclusionNon-odontogenic jaw lesions represent a wide spectrumof pathologies that include benign inflammatory/infectious lesions, as well as more aggressive malignant lesions such as tumors.The classification of non-odontogenic mandibular lesions must be taken into account according to their histolology since they may have a hematological origin (plasmocytoma), derived from fat (lipoma), neoplastic (osteosarcoma...) etc

## HNEE-6 DETECTION OF PARATHYROID ADENOMAS AIDED BY THEIR TIME ENHANCEMENT CURVE: GETTING THE MOST OUT OF 4DCT

Steven Raeymaeckers, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Based on multiple cases we illustrate the embryology of the parathyroid glands using relevant antomical reference markers 2. Three different types of enhancement curves for parathyroid adenomas exist 3. Arterial wash-in of contrast is an effect that can be very shortlived and thus missed 4. Multiphase 4DCT allows for the contruction of time-density curves which can be used to easily detect and characterize even very small parathyroid adenomas

### TABLE OF CONTENTS/OUTLINE

1. Multiphase 4DCT: - Scanning protocol and dose - The different types of enhancement curves of parathyroid adenomas 2. Processing multiphase 4DCT images - Non rigid registration - 4D visualisation 3. Setting up a reading protocol - Embryology of the parathyroid glands using antomical references - What does the surgeon want to know?

## HNEE-60 PRACTICAL APPLICATION OF ULTRASOUND-GUIDED CERVICAL LYMPH NODE BIOPSY: TIPS AND PEARLS

Shi Tan (*Abstract Co-Author*) Nothing to Disclose
Yan Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Li Gang Cui, PhD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cervical lymphadenoma can be resulted from a variety of causes. It is necessary to identify the cause. Now ultrasound-guided core needle biopsy (a kind of interventional ultrasound) is generally accepted as the optimal diagnose way to make correct histopathological diagnosis in non-surgical condition. We will introduce the definition, tools, and basic methods of interventional ultrasound, and discuss the tips and pearls of ultrasound-guided cervical lymph node biopsy combing cases.After reviewing this slide presentation, participants will be able to learn: biopsy device and needle of interventional ultrasound; methods of ultrasound guidance procedure: needle-guide and free-hand biopsy; puncture approach: in-plane and out-plane biopsy; tips and pearls of ultrasound-guided cervical lymph node biopsy

### TABLE OF CONTENTS/OUTLINE

1 Introduction2 Learning objections3 Introduction of interventional ultrasound 3.1 Definition of interventional ultrasound 3.2 History of interventional ultrasound 3.3 Biopsy device and needle of interventional ultrasound 3.4 Methods of ultrasound guidance procedure 3.4.1 Biopsy device guided 3.4.2 Free-hand 3.4.2.1 Applicable conditions and disadvantages of in-plane 3.4.2.2 Applicable conditions and disadvantages of out-plane 4. Tips of cervical lymph node biopsy (demonstrated by cases) 4.1 Adjust the range according to the situation 4.2 Return to manual biopsy when the distance is limited 4.3 Hydrodissection 4.4 Use hydrodissection needle as a lever 4.5 Fine needle biopsy for lymph node metastasis 4.6 Use the flexibility of cervical fascia spaces 4.7 Use the contrast-enhanced ultrasound 5 Suggested Readings

## HNEE-61 PARRY-ROMBERG SYNDROME: HOW CAN DERMATOLOGICAL ULTRASOUND HELP? A CASE SERIES

Priscilla Foster, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana Lie Taya (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Explain the importance of radiological imaging to early diagnosis and monitoring of disease progression in five patients with Parry-Romberg Syndrome; Demonstrate the efficacy of dermatological Ultrasound to detect dermatological atrophy in these patients; Compare the dermatological findings versus the radiological findings to monitor the disease progression; Describe different degrees of dermal atrophy and radiological results in between the patients of this case series.

### TABLE OF CONTENTS/OUTLINE

1. Brief overview of Parry-Romberg Syndrome (clḵnical manifestations and epidemiology); 2. Why imaging is important in patients with Parry-Romberg Syndrome; 3. Explain the usage of multimodality imaging (dermatological ultrasound, TC and MRI) in patients with Parry-Romberg Syndrome; 4. How we performed the evaluation of patients in this case series; 5. Provide image-rich exemples and descriptions of five patients with Parry-Romberg Syndrome who underwent radiological imaging; 6. Discuss the dermatological finding and radiological findings; 7. Point out the importante of dermatological US in patients with Parry-Romberg Syndrome; 8. Conclusion and Take Home Message

## HNEE-62 ISOLATED PATHOLOGY OF THE SPHENOID SINUS: THINK TWICE

Siddhartha Gaddamanugu, MBBS (*Abstract Co-Author*) Nothing to Disclose
Andrew Ammons (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The sphenoid sinus is unique due to lack of localizing signs on physical exam and relative paucity of isolated disease compared to the other paranasal sinuses. 2. The sphenoid sinuses lies at an “anatomical crossroads”, with numerous important adjacent intracranial structures which can contribute to, or be affected by, disease. This makes the sinus a hotbed for unique and interesting pathologies which may be encountered by radiologists on imaging. In particular, CT imaging of isolated sphenoid sinus pathology can be misinterpreted as “sinusitis” due to its lower contrast resolution of identifying abnormalities in adjacent compartments. 3. While infectious and inflammatory conditions are the most common causes of sphenoid sinus pathology, other important etiologies that trainees should consider when forming their differential include vascular, neoplastic, developmental, and traumatic. Origin from nasopharynx, cavernous sinuses, pituitary, and middle skull base should be considered. A variety of such unique cases to the sphenoid sinus will be presented.

### TABLE OF CONTENTS/OUTLINE

I. Review sphenoid sinus anatomy. II. Important anatomic variants. III. Sphenoid pathologies which arise in the setting of variant anatomy including lateral cephaloceles, optic nerve canal dehiscence, etc. IV. Infectious and inflammatory pathologies including sinusitis (acute bacterial, invasive granulomatous fungal, etc.), mucocele, etc. V. Vascular pathologies. VI. Neoplastic processes (benign, e.g. pituitary adenoma, etc., and malignant, e.g. metastases, myeloma, lymphoma, nasopharyngeal carcinoma). VII. Miscellaneous Pathologies VIII. Conclusion.

## HNEE-63 THE POSTRADIATION NECK: A PRACTICAL GUIDE FOR RADIOLOGISTS

Matheus Carlota, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Head and neck neoplasms account for 4% of tumors, with 60% of cases diagnosed in advanced stages. Radiotherapy is frequently required as treatment. All tissues in the radiation field show actinic changes. Spectrum of soft tissue and cartilage changes following radiation therapy for head and neck tumors can range from acute ( tissue edema and inflammation) to chronic fibrosis, scarring, and atrophy. Image review requires systematic evaluation in order to avoid mistakes between expected changes and tumor persistence/recurrence. Focal thickening of mucosa or solid neck mass suggest residual or recurrent tumor/nodes. Persistent or enlarged mass on baseline posttreatment scan indicates treatment failure.

### TABLE OF CONTENTS/OUTLINE

The actinic changes in follow up imaging of head and neck cancer will be summarized: Acute phase after radiotherapy:1. Changes in the skin and subcutaneous tissue: Skin thickening and densification of subcutaneous tissues. 2. Mucosal changes: Edema of the laryngeal mucosa, notably supraglottis 3. Glandular alteration: Hyperenhancement and hypertrophy of the submandibular glands Chronic phase after radiotherapy:1. Glandular alteration: Atrophy of the submandibular, parotid and thyroid glands, Glandular liposubstitution; 2. Mucosal changes: Reduction of laryngeal thickening; 3. Change in the cricoid cartilage; 4. AtherosclerosisComplication after radiotherapy: 1. Jaw osteoradionecrosis; 2. Encephalic osteoradionecrosis

## HNEE-64 HOW CAN MULTIMODALITY IMAGING AND HISTOPATHOLOGIC CORRELATION DECODE PARATHYROID DISEASE?

Arianne Idaly Ramos Galvan, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana De Los Ssantos Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Juan P. Chavez Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Veronica Espinoza Cruz (*Abstract Co-Author*) Nothing to Disclose
Axel A. Torres Monarrez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Provide an overview of different imaging modalities used in parathyroid disease.• Emphasize the indications, limitations, and benefits of different imaging modalities evaluating the parathyroid gland.• Become familiar with descriptive terms for normal parathyroid gland in radiology.• Review the most common pathologies and provide case studies to illustrate the practical application of theoretical concepts.• Analyze differential diagnoses, tips, and tricks.• Discuss updates in imaging evaluation for parathyroid gland pathology.

### TABLE OF CONTENTS/OUTLINE

- Overview of Different Imaging Modalities Used in Radiology
- Discuss the evolution of these modalities and their increasing importance in modern medicine.
- Emphasize the Indications, Limitations, and Benefits of Different Imaging Modalities Evaluating the Parathyroid Gland
- Comparison of imaging techniques for the parathyroid gland: ultrasound, 4DCT, and SPECT/CT.
- Descriptive Terms for Normal Parathyroid Gland in Different Imaging Modalities
- Common Pathologies in the Parathyroid Gland
- Discuss parathyroid adenoma, multiglandular parathyroid disease, parathyroid carcinoma, atypical parathyroid adenoma, and metastasis in parathyroid gland.
- Analyze the Differential Diagnoses, Tips, and Tricks in Different Imaging Modalities
- Discuss Updates in Imaging Evaluation for Parathyroid Gland Pathology
- Explore future trends or emerging technologies in this field.
- Conclusion

## HNEE-65 A JOURNEY THROUGH THE INNER EAR: EXPLORING ANATOMY AND PATHOLOGY

Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Gredilla (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Juan S. Martinez San Millan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Montserrat Medina Diaz, PhD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Alba Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Juan V. Quintana Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize and understand the normal anatomy of the inner ear.- Review the technical aspects of MRI to study the anatomy of the inner ear and the essential sequences for each pathology.- Identify the key diagnostic features of main acquired inner ear pathologies by correlating different imaging techniques such as CT and MRI.

### TABLE OF CONTENTS/OUTLINE

1. Anatomy and physiology of the inner ear.2. Technical aspects: MRI protocol.3. Review of acquired pathology of the inner ear by a case-based approach learning.3.1 Inflammatory-infectious pathology: Labyrinthitis. 3.1.1 Diagnostic Keys and value of the FLAIR sequence.3.1.2 Differential Diagnosis with labyrinthitis ossificans and carcinomatous meningitis.3.2 Endolymphatic hydrops. 3.2.1 MRI protocol 3.2.2 Diagnostic criteria.3.2.3 Classification systems.3.3. Otospongiosis.3.3.1 MRI findings and correlation with other imaging techniques (CT).3.4 Vestibular Schwannoma. 3.4.1 Characteristic Findings. 3.4.2. Differential Diagnosis (cerebellopontine angle meningioma, epidermoid cyst).3.5. Peripheral facial paralysis.3.5.1 Bell palsy vs neoplastic palsy.3.6 Traumatic injury. 3.6.1 Labyrinthitis ossificans as a sequel to trauma.3.6.2 Intralabyrinthine haemorrhage.3.7 Miscellany: 3.7.1 Fibrous dysplasia.3.7.2. Osteogenesis imperfecta.3.7.3. Paget´s disease.4. Conclusion

## HNEE-66 IMMUNOTHERAPY FOR HEAD AND NECK ONCOLOGY: A PRIMER FOR RADIOLOGISTS. MECHANISMS, TREATMENT PARADIGMS, AND IMAGING EVALUATION

Khalaf, MD (*Abstract Co-Author*) Nothing to Disclose
Susana Calle, MD (*Abstract Co-Author*) Nothing to Disclose
Kim Learned, MD (*Abstract Co-Author*) Nothing to Disclose
Samir Dagher, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Dagher, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) To highlight the key mechanisms of small molecule and monoclonal antibodies, immune-checkpoint inhibitors (ICIs), CAR-T cells transfer therapy and T-VEC oncolytic virus. 2) To review the response evaluation guidelines for immunotherapy (iRECIST, imPERCIST). 3) To illustrate the immunotherapy tumor response patterns and their role in treatment paradigm and perioperative management. 4) To discuss clinical evaluation and recognize imaging findings for immunotherapy-related adverse events

**TABLE OF CONTENTS/OUTLINE**

1) Mechanism of action of targeted antibodies. a) Small molecules versus monoclonal antibodies: nomenclature and actions. b) Tyrosine Kinase Inhibitor, BRAF and MEK inhibitors in BRAF V600 mutation tumor. c) EGFR, CD20 monoclonal antibodies. 2) Mechanisms of action of ICIs. a) Cytotoxic T-lymphocyte antigen-4 (CTLA-4) Inhibitors. b) Programmed death-1 (PD-1) and programmed death ligand-1 (PD-L1) pathway inhibitors. 3) Mechanism of action of CAR-T cell and T-VEC. 4) Current applications of immunotherapy in curative, palliative, neoadjuvant and adjuvant treatment paradigms. 5) Response evaluation guidelines. a) RECIST 1.1 vs iRECIST. b) PERCIST 1.0 vs imPERCIST. 6) Atypical patterns of response to immunotherapy. a) Pseudoprogression. b) Hyperprogression. c) Dissociated response. d) Durable response. 7) Imaging of common immune-related adverse events. a) Skin rash, pneumonitis, sarcoidosis. b) Thyroiditis. c) Hypophysitis, encephalitis, CNS vasculitis. d) Immune effector cell-associated neurotoxicity syndrome (ICANS)

## HNEE-67 IMAGING OF THE CEREBELLOPONTINE ANGLE: PRACTICAL ANATOMY AND CASE-BASED DIAGNOSTIC APPROACHES FOR RADIOLOGISTS

Mehmet Simsar, MD (*Abstract Co-Author*) Nothing to Disclose
Yeliz Pekcevik, MD (*Abstract Co-Author*) Nothing to Disclose
Yesim Y. Yuruk, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Provides a comprehensive overview of the radiologic anatomy of the cerebellopontine angle (CPA) • Describes a practical approach for localizing the pathologies affecting the CPA • Reviews common and rare pathologies in the CPA using case-based examples, highlighting clinical and imaging features that can aid in the best diagnosis

**TABLE OF CONTENTS/OUTLINE**

1. The cerebellopontine angle anatomy and structures 2. Classification of the CPA tumors based on imaging features 3. Case-based review of the CPA tumors using signal intensities and contrast-enhancement features Outline • Knowledge of anatomy and structures is essential for describing a lesion in the CPA. • Understanding the contents and common/rare lesions of CPA is the first step in generating a differential diagnosis. • Obtaining relevant clinical history and recognizing specific imaging appearances can help provide the best diagnosis.

## HNEE-68 LEUKEMIA AND HEAD AND NECK: MORE THAN NODES

Diego Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Rainer G. Haetinger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia M. Mello (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: ; To review the epidemiology, clinical scenarios and imaging features of head and neck leukemia manifestations; ; To demonstrate the spectrum of pathologies associated with leukemia affecting head and neck strutures; ; To emphasize key imaging features to narrow the differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

; Introduction - Epidemiology - Clinical scenarios ; Typical imaging features of head and neck leukemia manifestations ; Series of cases of leukemia manifestations on head and neck; ; Differential diagnosis; ; Take-home messages.

## HNEE-69 IMAGING REVIEW OF OPTIC PERINEURITIS AND OPTIC NEURITIS WITH DIFFERENTIAL DIAGNOSIS CONSIDERATIONS

Gavin Wu, BA (*Abstract Co-Author*) Nothing to Disclose
Mohammad T. Shujaat, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Optic neuritis and perineuritis can present as common clinical manifestations of CNS inflammation related to a wide variety of autoimmune, infectious or demyelinating etiologies. However, while these pathologies may present with similar clinical and imaging findings, their disease course and treatment can differ. It is important for radiologists to distinguish between these pathologies and other non-inflammatory mimics to facilitate proper diagnosis and guide appropriate treatment. Our exhibit will demonstrate diagnostic clues, which will include imaging patterns and enhancement distribution and systemic involvement, to help in differentiating etiologies and formulate a clinically relevant differential diagnosis. As such, our teaching points will be to: 1. Review the relevant anatomy of the orbit, optic nerve and optic nerve sheath. 2. Examine inflammatory manifestations of the optic nerve complex and present the main imaging features of these pathologies. 3. Recognize and distinguish the spectrum of other optic nerve complex inflammatory etiologies with similar presentations.4. Highlight the importance of distinguishing these pathologies to facilitate proper diagnosis and guide appropriate treatment plans.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Inflammatory Manifestations In the Orbit 3. Importance of Differential Considerations 4. Optic Nerve-Sheath Complex Pathologies and Mimics 5. Summary and Conclusions

## HNEE-7 NORMAL INNER EAR ANATOMY AND COCHLEAR MORPHOMETRY FOR CONGENITAL INNER EAR MALFORMATION DIAGNOSIS AND COCHLEAR IMPLANT CANDIDACY

Savith Kumar, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Aysha Tamanna, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A thorough understanding of inner ear anatomy is important for diagnosing congenital inner ear malformations, interpreting imaging of this area, and providing essential preoperative information about the inner ear and the vestibulocochlear nerve. Pre-operative cochlear morphometry is pivotal for patient selection to rule out conditions that would make surgery impossible or that could compromise the procedure and to decide on the devices and access.

**TABLE OF CONTENTS/OUTLINE**

Pictorial representation of cochlea with its external and internal architecture, vestibule, semicircular canals, and internal auditory canal with their internal architecture and contents.Protocol and methods for morphometric analysis of cochlea including cochlear base diameter, cochlear duct length, diameter of each cochlear turns, cochlear height, cochlear aperture, cochlear rotation, internal auditory canal diameter, distance from vertical facial nerve to posterior annulus and to mastoid cortex and caliber of facial and cochlear nerves using computed tomography and magnetic resonance imaging along with the normal range of parameters and implication of each parameter prior to surgery.Approach to diagnosis of inner ear malformations including complete labyrinthine aplasia, cochlear aplasia, cochlear hypoplasia and types, common cavity, incomplete partition and types, enlarged vestibular aqueduct, cochlear aperture abnormalities, vestibular and semicircular canal malformations, inner ear anomalies and vestibulocochlear nerve anomalies with radiological and hand drawn illustrations.

## HNEE-8 CHRONIC RHINOSINUSITIS: CURRENT CONCEPT

Osamu Sakai, MD, PhD (*Abstract Co-Author*) Consultant, Boston Imaging Core Lab LLC
Inseon Ryoo, MD (*Abstract Co-Author*) Nothing to Disclose
Naoki Takemasa (*Abstract Co-Author*) Nothing to Disclose
Ryohei Kuwatsuru, MD (*Abstract Co-Author*) Nothing to Disclose
Naoko Saito, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Chronic rhinosinusitis (CRS) has been classified into CRS without nasal polyps (CRSsNP) and CRS with nasal polyps (CRSwNP). The previous classification system was based on the phenotype, whereas the current system is based on anatomical distribution and endotype dominance. The current system can predict the severity of disease and lead to the optimal personalized treatment. Since the current concept has become the foundation for daily practice, radiologists need to be familiar with this classification system. The teaching points are: 1. To describe the current changes in the classification of CRS 2. To become familiar with the inflammatory mechanisms of CRS 3. To review imaging features of various CRS based on current classification

**TABLE OF CONTENTS/OUTLINE**

1. Definition of CRS 2. Various classification systems of CRS a. Previous classification b. Based on EPOS2020 (European Position Paper on Rhinosinusitis and Nasal Polyps) c. Based on ICAR-RS-2021 (International Consensus Statement on Allergy and Rhinology: Rhinosinusitis) 3. Inflammatory mechanisms of CRS a. Type 2 response b. non-Type 2 response 4. Review of imaging and clinical features of CRS based on current classification a. Primary CRS: AFRS (allergic fungal rhinosinusitis), eCRS (eosinophilic CRS), CRSwNP, CCAD (central compartment allergic disease), non-eCRS, isolated sinusitis b. Secondary CRS: odontogenic, fungal ball, GPA (granulomatosis with polyangiitis), eGPA (eosinophilic GPA), primary ciliary dyskinesia

## HNEE-9 FOLLOW YOUR NOSE - ULTRASOUND ROLE IN THE AESTHETIC RHINOMODELATION

Matheus Taborda, MD (*Abstract Co-Author*) Nothing to Disclose
Joao P. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana A. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Sampaio, MD (*Abstract Co-Author*) Nothing to Disclose
Luis R. Ferreira (*Abstract Co-Author*) Nothing to Disclose
Nathalia Bonmann, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Da Silva Eli, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The amount of aesthetic rhinomodelation procedures has significantly increased in the past decades. This procedures are not risk-free, with associated complications such as accidental injection of fillers into the arterial branches that supply the nose. Consequently, high-frequence nasal ultrasonography (US) has emerged to help in the pre-procedural setting to assess the nasal anatomy and its variants in detail. Additionally, the US is capable of providing a detailed mapping of previously injected fillers, each one with specific imaging features.1. Review the structural anatomy of the nasal region on ultrasound;2. Detail the different types of materials used in non-surgical rhinoplasty;3. Evaluate the role of ultrasonography in the safety of rhinomodelation procedures 4. Review the ultrasound appearance of the most commonly used fillers.5. Elaboration of a facial map encompassing the different procedures and fillers used.

**TABLE OF CONTENTS/OUTLINE**

1. Introductiona. US nasal anatomyb.Clinical application of US to aesthetic procedures of the nosec. Main arteries that supply the nosed. Arterial variants that should be reported to increase procedure safety2. Fillersa. Differences between the main types of fillersb. Ultrasound appearance of fillers;c. Different roles and objectives of fillers in each nasal region.3. Extensive pre - and post procedure US imaging, including possible complications4. Elaboration of the nasal ultrasound report - What the dermatologists need to know.5. Take-home messages

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# Abstract Archives of the RSNA, 2024

HNEE-1

## WHAT´S MAKING THIS NOISE? NON-PULSATILE TINNITUS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Suresh K. Mukherji, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Maira Sarpi, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta C. Andrade, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Detail the functional anatomy of inner ear• Review the main causes of non-pulsating tinnitus• Detail tumor causes• Detail non-tumor and non-vascular causes• Guide the radiologists to detail anatomical changes relevant that may be causing tinnitus• Evaluate the computed tomography (CT) imaging as a tool for identify possible causes of non-pulsating tinnitus

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Inner ear anatomy b. Inner ear functional anatomy c. Most common causes of non-pulsating tinnitus d. Clinical application of CT to identify possible causes of non-pulsating tinnitus2. CT image a. What should be evaluated: petrous apex, otic capsule or osseous (bony) labyrinth, internal ear canal, semicircular canals, stylohyoid complex, endolymphatic sac, vestibular aqueduct3. Tumor causes a. Jugular paraganglioma (glomus) b. Tympanic paragangliomas (glomus) c. Cavernous venous malformation (cevernoma) d. Vestibular schwannoma (acoustic neuromas) e. Meningioma f. Metastases g. Endolymphatic sac tumors4. Non-tumor causes a. Endolymphatic hydrops (Ménič re disease) b. Otospongiosis c. Semicircular canal dehiscence d. Cholesterol granuloma e. Chiari I malformation f. Patulous tube syndrome g. Idiopathic intracranial hypertension (IIH) h. Paget disease i. Eagle syndrome5. Take-home messages

# Abstract Archives of the RSNA, 2024

HNEE-10

## UNLOCKING SINUS SECRETS: RADIOLOGICAL INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael R. Santos Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To discuss the diagnosis and radiological insights about sinus diseases, highlighting: - Definition and overview of sinusopathies, the importance of understanding sinus anatomy and function, and common causes and risk factors. - Sinus pathologies in a guide model, dividing into diffuse or unilateral involvement and also in acute or chronic pathology. - Potential complications of sinusopathies (e.g., orbital cellulitis, meningitis). Factors influencing prognosis and long-term outcomes and the importance of follow-up care and monitoring. - Research and Future Directions: Ongoing research in the field of sinusopathies with emerging treatments and technologies.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Anatomy of the paranasal cavities
- Guideline of sinusopathies diagnosis
- Acute diffuse involvement
- Inflammatory/Infectious involvement
- Traumatic/Surgical
- Potential complications
- Chronic diffuse involvement
- Nasosinusal polyposis
- Allergic fungal sinusitis
- Granulomatosis diseases
- Cocaine abuse
- Potential complications
- Predominantly unilateral acute involvement
- Odontogenic sinusitis
- Invasive fungical sinusitis
- Facial fractures
- Potential complications
- Predominantly unilateral chronic involvement
- Papilloma
- Fungal sinusitis
- Mucocele
- Neoplastic lesions
- Potential complications
- Future perspectives
- Take home messages

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

HNEE-11

## EXPLORING UNCOMMON PATHOLOGIES IN THE SELLAR/SUPRASELLAR REGION: IMAGING INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rohan Samant, MBA (*Abstract Co-Author*) Nothing to Disclose
Rajan P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Deepali Bhalla (*Abstract Co-Author*) Nothing to Disclose
Manav Bhalla, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The sellar and suprasellar regions present a complex landscape of pathologies, often challenging clinicians with their diverse presentations and management nuances. Recognizing the diverse spectrum of atypical pathologies in the sellar/suprasellar region is crucial for accurate diagnosis and appropriate management. This abstract offers a comprehensive overview of uncommon sellar and suprasellar pathologies, atypical presentation of common entities, shedding light on their clinical features, diagnostic considerations, pathologic correlates, and potential therapeutic implications. From rare tumors to unusual inflammatory conditions, this exploration aims to equip diagnostic Radiologists with practical insights to enhance diagnostic accuracy and optimize patient care.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to uncommon Sellar/Suprasellar Pathologies. 2. Atypical imaging presentation of relatively common entities. 3. Radiological Evaluation of Sellar/Suprasellar Lesions 4. Types of Atypical Pathologies - A. Rare Neoplasms B. Metastatic lesions C. Hypophysitis, Langerhans cell Histiocytosis, Rosai-Dorfman disease and Erdheim-Chester disease D. Secondary pituitary hyperplasia E. Craniopharyngiomas F. Atypical appearance of Rathke's cleft cyst 4. Differential Diagnosis and Diagnostic Challenges 5. Imaging Features and Characterization

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# Abstract Archives of the RSNA, 2024

HNEE-12

## PERINEURAL SPREAD IN HEAD AND NECK MALIGNANCIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amit Janu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Pranjal Rai, MBBS (*Abstract Co-Author*) Nothing to Disclose
Nivedita Chakrabarty (*Abstract Co-Author*) Nothing to Disclose
Arpita A. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Deepa Nair (*Abstract Co-Author*) Nothing to Disclose
SUYASH KULKARNI (*Abstract Co-Author*) Nothing to Disclose
Nitin S. Shetty, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Suman Kumar Ankathi, MBBS (*Abstract Co-Author*) Nothing to Disclose
Vasundhara Smriti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the perineural spread. 2. Discuss the imaging protocol for perineural spread 3. Know the primary and secondary imaging features in perineural spread. 4. Detect the commonly involved nerves in perineural spread and know their anatomy. 5. Discuss the anatomical landmarks and pathway for perineural spread. 6. Describe the mimics of perineural spread

### TABLE OF CONTENTS/OUTLINE

1. Anatomy of cranial nerves 2. Imaging features of perineural spread. 3. Know the possible routes of perineural spread in a given clinical condition. 4. Case-based discussion on the approach for various nerves involved. 5. Discuss the impact on management due to perineural spread

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# Abstract Archives of the RSNA, 2024

HNEE-13

## PLEOMORPHIC ADENOMA OR NOT? MASTERING THE DIAGNOSTIC RIDDLE OF SALIVARY GLAND TUMORS WITH MOUTH-WATERING CASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Yeliz Pekcevik, MD (*Abstract Co-Author*) Nothing to Disclose
Begum Ergin, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To discuss the typical and atypical characteristics of benign salivary gland tumors in patients, with a specific emphasis on pleomorphic adenoma.2. To identify common and uncommon features of malignant salivary gland tumors in adults.3. To familiarize the radiologists with the typical and atypical presentations of salivary gland tumors and pitfalls by using a case-based approach.4. Review examples of congenital and acquired mimics of salivary gland tumors.

### TABLE OF CONTENTS/OUTLINE

A. Background • MRI imaging of salivary glands (DWI, advanced MRI sequences) B. Mouth-Watering Cases • Common and Uncommon Features of Benign Salivary Gland Tumor 1. Typical and Atypical Pleomorphic Adenoma 2. Warthin Tumor 3. Oncocytoma 4. Schwannoma 5. Myofibroblastic Tumor 6. Lipoma 7. Infantile Hemangioma • Common and Uncommon Features of Malign Salivary Gland Tumors 1. Carcinoma Ex Pleomorphic Adenoma 2. Mucoepidermoid Carcinoma 3. Adenoid Cystic Carcinoma 4. Secretory Carcinoma 5. Lymphoma 6. Malign Melanoma • Non-neoplastic Salivary Gland Pathologies Mimicking Salivary Gland Tumors 1. IG-G4 Related Disease 2. Intraparotid Lymph Nodes 3. Sjögren’s Syndrome 4. Sialosis 5. Vascular Malformations 6. Branchial Cleft Cysts C. Take Home Points D. References

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# Abstract Archives of the RSNA, 2024

HNEE-14

## ACUTE COMPLICATIONS RELATED TO OTOMASTOIDITIS - A REVIEW ABOUT WHAT MAY OCCUR

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rainer G. Haetinger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Silvia M. Mello (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda Yukari H. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Acute otomastoiditis occurs when otitis media spreads beyond the mastoid air cells. A variety of infectious complications associated with the temporal bone are described, which may occur in cases of otomastoiditis. These include outer cortex erosion, resulting in the formation of a neck abscess (known as Bezold abscess), coalescent mastoiditis, petrous apicitis (Gradenigo's Syndrome), meningitis, venous sinus thrombosis, facial neuritis, bone cortex erosion potentially causing sigmoid sinus thrombosis or resulting in periauricular cellulitis with or without an abscess and intracranial extension, and suppurative labyrinthitis. This study aims to provide a briefly description of each case, from the most frequent to the rarest, correlate them with different imaging methods and didatic drawings.

### TABLE OF CONTENTS/OUTLINE

- Introduction- Objective- Review of the complications related to otomastoiditis - Cases of the otomastoiditis complications in different imaging methods including a didatic drawings- References

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# Abstract Archives of the RSNA, 2024

HNEE-15

## MUSCLE MASTERCLASS: HEAD AND NECK ANATOMY IN ACTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shehbaz M. Ansari, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Surjith Vattoth, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Santhosh Gaddikeri, MD (*Abstract Co-Author*) Nothing to Disclose
Miral D. Jhaveri, MD, MBA (*Abstract Co-Author*) Royalties, RELX
Brian Mu, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review muscular anatomy of the head and neck with a focus on routinely visualized but relatively overlooked deep muscles.2. Highlight important anatomic relationships between head and neck muscles as well as to adjacent structures.3. Describe relevant imaging findings involving these anatomical concepts and their associated underlying pathologies.

### TABLE OF CONTENTS/OUTLINE

The head and neck comprise a rich and complex array of muscular anatomy that can be visualized in detail on routine imaging. Comprehensive knowledge of these muscles and sophisticated understanding of their relationships with each other and adjacent structures is requisite for the identification and interpretation of a diverse range of pathological findings. Additionally, head and neck muscles serve as important landmarks for demarcation of the deep spaces of the face and neck, cervical lymph node stations, and for surgical approaches. In this exhibit, we review the muscular anatomy of the head and neck in detail, including the prevertebral and paraspinal, scalene, suboccipital, floor of mouth, pharyngeal, laryngeal, and masticator muscles. The goal is to develop a three-dimensional understanding of intricate anatomy, such as the “stacked flower-pot” arrangement of the hypopharyngeal wall muscles. Special focus is given to areas of clinical significance, such as the role of the posterior belly of digastric as a surgical landmark for the glossopharyngeal and hypoglossal nerves in neck dissection. Sample cases are provided to demonstrate various pathologies and clinical applications of this anatomy.

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# Abstract Archives of the RSNA, 2024

HNEE-16

## BEYOND THE SURFACE: EXPLORING THE NASOPHARYNX FROM EMBRYOLOGY TO CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Murilo B. Cintra (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel V. Sumi, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Alberto F. Coelho Neto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In this educational exhibit, our aim is to provide a comprehensive review of the nasopharyngeal anatomy and, through didactical cases, highlight the radiological features of common pathologies. We will discuss the role of imaging modalities in the diagnosis and management of nasopharyngeal disorders, with the key radiological findings in each pathology.

### TABLE OF CONTENTS/OUTLINE

- Introduction - Nasopharyngeal embryology and anatomy- Radiological imaging modalities for nasopharyngeal evaluation- Congenital lesions, Inflammatory, and Infectious Conditions, including: branchial cleft cyst, craniopharyngeal canal, fossa navicularis, pharyngeal bursa, Tornwaldt cyst, retention cysts, glial heterotopia, infraselar craniopharyngioma, teratoma epignathus, adenoiditis, tuberculosis.- Vascular Conditions, including nasopharyngeal slow flow venous malformations- Benign and malignant neoplastic acquired lesions of the nasopharynx, including squamous cell carcinoma, rhabdomyosarcoma, inverted papilloma, juvenile nasopharyngeal angiofibroma and lymphomas.- TNM staging main featuresPost-treatment changes, including post-surgical and post-radiotherapy findings.- Conclusion

# Abstract Archives of the RSNA, 2024

HNEE-17

## TOOTH BE TOLD: EXPLORING MANDIBULAR NEUROPATHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Thiago B. Fernandes Feitosa, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Mario Siqueira (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Martins (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This comprehensive review elucidates the anatomy and pathologies of the mandibular division of the trigeminal nerve (V3) through detailed MR neurography cases and schematic illustrations. The focus will be on the V3 nerve, particularly the lingual and inferior alveolar nerves, to explore both traumatic and non-traumatic lesions, and the Sunderland classification of nerve injuries.We aimed to demonstrate the correlation between MR neurography lesions and surgical findings and assess the utility of MR neurography in the evaluation of postsurgical recovery.

### TABLE OF CONTENTS/OUTLINE

NORMAL ANATOMY OF THE MANDIBULAR NERVE (V3)• Didactic original drawings illustrating the V3 nerve and its branches.Detailed anatomy of the lingual and inferior alveolar nerves via MR neurography.MR NEUROGRAPHY SEQUENCES3D Double-Echo Steady-State with Water Excitation Sequence and contrast enhanced (3D) turbo spin echo with variable flip-angle (SPACE) short-tau inversion recovery (STIR) sequences MR NEUROGRAPHY AND NERVE INJURY CLASSIFICATION• Introduction to MR neurography as a diagnostic tool for nerve pathologies.• Review of the Sunderland classification for grading nerve injuries. CASES: CORRELATION OF MR NEUROGRAPHY WITH SUNDERLAND CLASSIFICATION• Detailed MR neurography cases correlated with nerve injury grades.Implications of Sunderland Classification on Treatment and Prognosis.• Comparison of MR neurography findings with intraoperative observations. POST-SURGICAL EVALUATION• Case studies highlighting postoperative recovery and follow-up MRI

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# Abstract Archives of the RSNA, 2024

HNEE-18

## HIDDEN ENEMY: DIFFERENT PRESENTATIONS AND CONSEQUENCES OF PARANASAL SINUS MUCOCELE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Adriano Magna, MD (*Abstract Co-Author*) Nothing to Disclose
Raissa M. Barradas Monteiro De Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Flavia Galvao Lopes, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mario Porfirio Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna P. De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Vitoria Lima Beltrao Vieira de Melo, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Pedro C. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Henzo Ota, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Gabriela Cintra Borba (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas P. Caldas, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Goncalves, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Paranasal sinus mucoceles are benign inflammatory lesions developing after obstruction of the sinus ostium. They are characterized by the accumulation of mucus secreted by mucosal cells, leading to the expansion of the affected sinus cavities. Radiological findings are varied, and knowledge of these is crucial for accurate diagnosis.The frontal and ethmoidal sinus are most commonly affected.Symptoms are nonspecific and may vary from rhinological to neurologic or ophthalmologic, depending on the location.Appears on Computed Tomography Scan (CT Scan) as a homogenous well circumscribed expansible lesion with soft tissue density, without contrast enhancement, associated with sinus expansion, sclerosis and bone erosion, in addition to extension to the intra orbital region.Magnetic Resonance Imaging (MRI) provides a more detailed evaluation of the lesion composition and extent, offering crucial information for surgical planning. The usual signal characteristics are a low intense T1 and a high intense T2 but any combination of signal intensity may be seen depending on the presence of blood products or the degree of hydration of the contents.

### TABLE OF CONTENTS/OUTLINE

This study reports a series of cases with CT and MRI images of different presentations and consequences of paranasal sinus mucoceles, related to inflammatory processes, anatomical variations and traumatic sequelae, highlighting the imaging characteristics for diagnosis and surgical planning.

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# Abstract Archives of the RSNA, 2024

HNEE-19

## REVISITING THE ETHMOID ROOF AND ANTERIOR ETHMOIDAL ARTERIES- DANGER AREAS IN FUNCTIONAL ENDOSCOPIC SINUS SURGERY (ESS)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alan I. Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Luis G. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Tamara Hernandes Ricci, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Diogo C. Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia C. Santos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the anatomy of the ethmoid roof, emphasizing significant anatomical features and critical variants that should be meticulously described in reports.- Present clinical cases from head and neck radiology indicating surgical treatment through endoscopic surgery (ESS). - Describe the areas of danger for potential post/intra-operative complications due to the unique anatomy.- Propose a step-by-step process for reviewing the anatomy of the ethmoid roof and anterior ethmoidal arteries (AEA) to guide surgical planning and minimize potential complications related to ESS.

### TABLE OF CONTENTS/OUTLINE

1. The Endoscopic Sinus Surgery (ESS):- Illustrated imaging cases demonstrating some ESS indications- Key procedural points and radiologists' responsibilities in reporting 2. The Role of Imaging Anatomy:- Coronal diagram illustrating the components of the ethmoid roof- Coronal CT images depicting the anatomy of the AEA and their associated major anatomical structures 3. Key Points - a step-by-step guide for reporting:- Keros classification and the significance of olfactory fossa depth- The importance of the relationship between the lateral lamella and the cribriform plate- Identification of anatomical landmarks- The correlation between supraorbital pneumatization and the course of the AEA canal 4. Illustrated clinical cases of ethmoid roof and anterior ethmoidal artery anatomy:- Coronal CT images demonstrating anatomical landmarks, supraorbital pneumatization, and olfactory fossa depth 5. Critical areas of the anterior ethmoidal artery and the lateral lamella:- Coronal CT images illustrating critical areas during ESS- AEA injury during the procedure- Key take-home messages

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HNEE-2

## LACRIMAL GLAND MASSES: A PRIMER FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vasundhara Smriti, MD (*Abstract Co-Author*) Nothing to Disclose
Pranjal Rai, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To understand the normal anatomy of the lacrimal glands. • To focus on the imaging features, pathogenesis and treatment options for different lacrimal gland masses and their benign mimickers. • To identify helpful; imaging clues to differentiate various pathologies from each other.

### TABLE OF CONTENTS/OUTLINE

1. Normal lacrimal gland anatomy. 2. Localizing a true lacrimal lesion versus a lesion causing secondary involvement of the lacrimal gland. 3. Various lacrimal gland masses, their classification according to etiology, their pathogenesis, imaging characteristics, and brief discussion of their management strategies. 4. Benign mimickers of lacrimal lesions, and use of imaging features to differentiate them. 5. A flowchart to help narrow down a radiological differential diagnosis for a lacrimal gland lesion. 6. Surgical techniques for lacrimal gland lesions.

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# Abstract Archives of the RSNA, 2024

HNEE-20

## RADIOLOGICAL INSIGHTS AND CLINICAL MANAGEMENT STRATEGIES: AN EDUCATIONAL EXHIBIT ON MéNIèRE'S DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Patricia Cuadras Collsamata (*Abstract Co-Author*) Nothing to Disclose
Paloma Puyalto, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Angela Callejo (*Abstract Co-Author*) Nothing to Disclose
Fernando Orera (*Abstract Co-Author*) Nothing to Disclose
Ana Maria Quiles (*Abstract Co-Author*) Nothing to Disclose
MARIDELMA VILLANUEVA (*Abstract Co-Author*) Nothing to Disclose
Anna Oliva (*Abstract Co-Author*) Nothing to Disclose
Hernan Rivera (*Abstract Co-Author*) Nothing to Disclose
Carlos Ordonez (*Abstract Co-Author*) Nothing to Disclose
Giovanni Mattiello, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Ménič re's Disease (MD) is believed to be a result of abnormalities in the fluid balance within the inner ear, particularly those involving the endolymphatic system; is characterized by episodic vertigo, sensorineural hearing loss, tinnitus, and aural fullness and presents a significant challenge for otolaryngology specialists.MRI, particularly gadolinium contrast-enhanced delayed sequences 3D- FLAIR and 3D -IR , plays a critical role in confirming the diagnosis and assessing the severity of MD. This exhibit provides a comprehensive exploration of the fundamental role of MRI in understanding this entity and guiding its clinical management.Educational Objectives:To understand the role of radiological imaging in diagnosing and monitoring MD and to describe the main sequences used for the radiologic diagnosis and grading of endolymphatic hydrops, with special emphasis on the 3D-FLAIR and 3D-IR sequences, their pitfalls, and differential diagnosis.To present evidence-based clinical management strategies for MD, including pharmacological, rehabilitative, and surgical interventions.

### TABLE OF CONTENTS/OUTLINE

Definition, demography, physiopathology and grading systems of MD.Radiological insights: MRI sequence protocol, postprocess, grading and volumetric assessment of the inner ear in patients with MD. Pitfalls and differential diagnosis.Clinical management strategies based on multidisciplinary approach to diagnosis analysis.

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# Abstract Archives of the RSNA, 2024

HNEE-21

## A MOUTHFUL: WHAT THE RADIOLOGIST NEEDS TO KNOW REGARDING ORTHOPANTOMOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Richard L. Barger JR, MD (*Abstract Co-Author*) Nothing to Disclose
Vijaya K. Kosaraju, MD (*Abstract Co-Author*) Nothing to Disclose
Navid Faraji, MD (*Abstract Co-Author*) Nothing to Disclose
Nathan Katragadda (*Abstract Co-Author*) Nothing to Disclose
Gregory R. Liller, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A growing body of evidence demonstrates strong associations between dental pathologies and systemic pathologies. As a result, there is an increased need for radiologists to understand and interpret dental imaging modalities to assess dental pathologies which could serve as risk factors for systemic pathologies. The Orthopantomogram (OPG), also known as Panorex, is a single-image radiograph used to visualize various gross anatomy and pathology of various oral and maxillofacial structures. It is often used as a screening and diagnostic tool in assessing dental and maxillofacial pathology, such as before cardiac valve surgery. The purpose of this exhibit is to:1. Discuss the acquisition process of OPGs.2. Review basic dental and facial anatomy visualized on an OPG.3. Discuss the different dental and facial pathologies and surgical changes seen on OPG.

### TABLE OF CONTENTS/OUTLINE

1.Introduction discussing the history, epidemiology of dental and maxillofacial disease and ordering indications. 2. Assessing the technique of OPGs through discussion of equipment, acquisition, optimal imaging appearance and artifacts. 3. Discussion of basic oral and maxillofacial anatomy and physiology on OPGs including: tooth numbering and anatomy, dental embryology, stages of tooth eruption, and associated structures. 4. Evaluating various radiologic pathologies involving teeth (caries, impactions, and anomalies), periodontal disease, masses and mass-like lesions, anatomical variants, trauma, miscellaneous disorders, and dental and maxillofacial surgery, including mandibular arthroplasty and LeFort osteotomy.

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# Abstract Archives of the RSNA, 2024

HNEE-22

## BEYOND THE BLINK: NAVIGATING SUPERFICIAL PERIORBITAL LESIONS WITH HIGH-FREQUENCY ULTRASOUND AND MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Claudia B. Camara, MD (*Abstract Co-Author*) Nothing to Disclose
MICHELLE GOMES (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The superficial periorbital lesions serve various functions, including protection. An understanding of the anatomy of superficial periorbital lesions is crucial for interpreting the imaging features of lesions that affect them. High-frequency ultrasound presents itself as an advantageous option for imaging periorbital lesions due to its cost-effectiveness and widespread availability. Utilizing a 3T MRI with surface coil can aid in identifying superficial and millimetric lesions affecting the periorbital region. Demonstrate the utilization of high-frequency probes and surface coil MRI and elucidate the examination technique to radiology residents. Compose a pictorial essay detailing the principal periorbital lesions and their differential diagnoses, encompassing skin cancer, cosmetic fillers, inflammatory lesions, and lacrimal gland lesions.

### TABLE OF CONTENTS/OUTLINE

Anatomy of superficial periorbital lesionsCases of tumorous, inflammatory, and filler-related lesions.

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# Abstract Archives of the RSNA, 2024

HNEE-23

## DON'T FLUCTUATE: MR IMAGING CASE-BASED DIDACTICS OF ENDOLYMPHATIC HYDROPS IN MéNIèRE'S DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Suresh K. Mukherji, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Maira Sarpi, MD (*Abstract Co-Author*) Nothing to Disclose
Luis G. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo B. Cintra (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Camila S. Barbosa, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Understand the anatomy and physiology involved in endolymphatic hydrops • Review the MR protocol and specific sequences • Review methods for identifying and classifying the disease based on imaging findings • Illustrate concepts through a case-based review of the main grades in their classic presentations

### TABLE OF CONTENTS/OUTLINE

• Ménič re's Disease Imaging: Magnetic Resonance (MR) Sequences, Indications, Advanced Sequences • Relevant Anatomy of Ménič re's Disease • Case-Based Didactics: Sample Cases to Illustrate Classification and Solidify Concepts • What's on the Horizon: Areas for Improvement • Approach to Differential Diagnosis

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# Abstract Archives of the RSNA, 2024

HNEE-24

## PRE- AND POST-OPERATIVE IMAGING OF CRANIOSYNOSTOSIS - WHAT RADIOLOGIST NEED TO KNOW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Elka Miller, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Shivaprakash B. Hiremath, DMRD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Neetika Gupta, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To explain the embryology and anatomy of the developing calvarium.2. To describe the imaging modalities and protocol in children with suspected craniosynostosis. 3. To highlight various types of craniosynostosis and associated anomalies along with syndromic association. 4. To elucidate the pre- and post-operative imaging in craniosynostosis emphasizing on the surgical techniques, complications and follow up.

### TABLE OF CONTENTS/OUTLINE

1. Illustrate the embryology and imaging anatomy of the developing calvarium and normal variants. 2. Comprehensive discussion of the various types of craniosynostosis and syndromic association in children.3. Identify and familiarize with the imaging features that need to be focused in the pre surgical evaluation and assessed in post-operative period along with mention about the evolution of surgical findings.4. Systematic imaging-based approach could help in highlighting the necessary findings to guide appropriate management and genetic evaluation, aid in surgical decision making and avoid complications.

# Abstract Archives of the RSNA, 2024

HNEE-25

## ANOSMIA: BEYOND COVID

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael R. Santos Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This study intends to show the various etiologies that can cause anosmia. This theme has been widely publicized after the spread of the Sars-Cov 2, as it has been one of the most prevalent symptoms.The purpose of this exhibition is to:Review the path of smell formation.Show other etiologies to anosmia besides COVIDEvidence of different groups involved, such as congenital, infectious, inflammatory, trauma, and use of drugs. Illustrate such cases with radiological examples.

### TABLE OF CONTENTS/OUTLINE

Smell pathway : • Overview of the normal anatomy, showing how the smell is formed going from the external nose to the cortex.Before we start... let’s look at how it appears at COVID! • Given the importance of the pandemic that started in 2020, we dedicated this slide to evidence of how COVID can cause anosmia, while also exposing other etiologies.Inflammatory and infectious•Nasal polyposis, rhinosinusitis, and fungal infections are shown as examples of causes of anosmia.Septal disorders• Nasal fractures, cocaine abuse, and granulomatosis with polyangiitis enter as etiologies of anosmia which affect the nasal septum.Others cases• We conclude the exhibit by showing other various etiologies: atrophic nasal turbinates, respiratory adenomatoid hamartoma, and Kallmann syndrome.

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# Abstract Archives of the RSNA, 2024

HNEE-26

## SHINE A LIGHT ON DIPLOPIA: UNLOCKING DIFFERENTIAL DIAGNOSES IN OUR MIND'S EYES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose Roberto F. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo D. Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Angela M. Wolosker (*Abstract Co-Author*) Nothing to Disclose
Helio Yamashita, MD (*Abstract Co-Author*) Nothing to Disclose
MARCELO DOS SANTOS BANDEIRA FILHO (*Abstract Co-Author*) Nothing to Disclose
Roberto Bastos, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Carmo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review unusual diseases that cause diplopia and are infrequent to diagnosis. To present diagnostic challenging cases of diplopia and their radiologic presentation. To be aware of life-threatening acute causes of diplopia which Imaging features can help with the diagnoses. To highlight the purpose of learning and evaluating rare diseases, adding experience to a better medical practice.

### TABLE OF CONTENTS/OUTLINE

Diplopia is a wide diagnosis made by ophthalmologists and neurologists. Numerous diseases occur with diplopia, leading to a late diagnosis when present in an infrequent disease. Diplopia itself can present as a challenge for radiologists, particularly when aiming for a differential diagnosis. This work can have a significant impact on patients with life-threatening diseases early diagnosed. Overview of the main diseases including diplopia. Key radiological findings in cross-section orbital images that aid in distinguishing rare pathologies. Didactic exposition of illustrative rare cases in which diplopia was included such as thyroid-associated orbitopathy, IgG4-related orbital disease, Tolosa-Hunt syndrome, a solitary fibrous tumor of the orbit, orbital lymphoma, sphenoid wing meningioma, conjugate gaze palsy and mechanisms, other causes of idiopathic orbital inflammation, orbital metastasis, chorioretinitis, and nuclei ischemic stroke of the oculomotor (III) and abducens (VI).

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# Abstract Archives of the RSNA, 2024

HNEE-27

## INSIGHTS INTO IMAGING PATTERNS OF GRANULOMATOUS DISEASES IN THE HEAD AND NECK

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Henrique B. Zuppani, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Taisa Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Narriman P. Hazime, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

List and compartmentalize the different causes of granulomatous diseasesRecognize typical radiological aspects of their head and neck involvementImprove the approach of differential diagnosis by correlating multimodality imaging and clinical findings

### TABLE OF CONTENTS/OUTLINE

Introduction Definition of granuloma and its histological aspects Subdivision of various pathologies that can present granulomatous inflammation based on etiologyAutoimmune disorders: Granulomatosis with polyangiitis, Churg-Strauss syndrome, Behēet disease, systemic lupus erythematosus, rheumatoid arthritis, relapsing polychondritisHereditary condition: chronic granulomatous diseaseInfectious diseases:Fungal: blastomycosis, histoplasmosis, paracoccidioidomycosis, cryptococcosisBacterial: tuberculosis, cat-scratch disease, syphilis, leprosy, actinomycosis, rhinoscleroma, tularemiaParasitic: leishmaniasis, myiasis, toxoplasmosisIdiopathic disorders: Sarcoidosis, Kikuchi-Fujimoto disease, Kimura disease, Rosai-Dorfman disease, Langerhans cell histiocytosisSecondary granuloma: chemical exposure to vaccine, cocaine, talc, beryllium, silicosisPractical diagnostic approach for suspected granulomatous disorder

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# Abstract Archives of the RSNA, 2024

HNEE-28

## THE SKELETON MADE OF CARTILAGES: A PICTORIAL REVIEW OF LARYNGEAL CARTILAGINOUS SKELETON PATHOLOGIES FOR RADIOLOGY RESIDENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Janani Baradwaj, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Anu Kamalasanan, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thiru A. Sudarshan, DMRD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Janani Asogan Vaishnavi, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

--Trauma of the anterior neck may result in various injuries of the laryngeal soft tissues, cartilages and surrounding structures. MDCT is used as a first line examination in the acute trauma setting.--An understanding of the anatomy of head and neck cartilaginous structures is critical to correctly identifying the spectrum of cartilaginous lesions occurring in the head and neck.--The important imaging clues in diagnosis of the head and neck cartilaginous tumours include characteristic location, internal calcified chondroid matrix, and typical T2 hyper intense signal due to high water content in hyaline cartilage.--Knowledge of the age-related changes in the signal characteristics of the laryngeal cartilages may help to improve detection of tumour invasion.--Cartilage invasion by laryngeal cancer has a poor prognosis . Exclusion of cartilage invasion is important as its presence often precludes laryngeal conservation surgery.--Ultrasound and MRI can be used to differentiate unossified thyroid cartilage and reactive oedema from infiltration.

### TABLE OF CONTENTS/OUTLINE

1. Radiological anatomy of laryngeal cartilaginous skeleton including embryology.2. Pitfalls related to ossification patterns of laryngeal cartilages.3. Role of various imaging modalities in the evaluation of laryngeal cartilages including protocol and instructions during scanning such as quiet respiration, avoiding swallowing/coughing etc.4. Provide a pictorial review of various pathologies including traumatic, inflammatory, congenital, benign and malignant lesions.5. Briefly describe how to identify cartilage invasion in malignancy and how it affects the management.

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# Abstract Archives of the RSNA, 2024

HNEE-29

## DON’T GET LOST IN THE LABYRINTH! MÉNIÈRE’S DISEASE AND OTHER LABYRINTHOPATHIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz R. Uchoa, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago B. Fernandes Feitosa, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Through this pictorial essay will be made a review based on cases and original drawings about Méničre’s disease and pathologies of labyrinth. This will be addressed by typical imaging patterns to narrow down differential diagnoses. The purpose of this exhibition is to: - Review the anatomy of the labyrinth; - Review clinicopathological concepts of Méničre’s disease; - Understand MRI protocol for adequate investigation of endolymphatic hydrops; - Recognize the main imaging patterns of other labyrinthopathies.

### TABLE OF CONTENTS/OUTLINE

ANATOMICAL CONCEPTS• Anatomy of the labyrinthCLINICOPATHOLOGICAL CONCEPTS OF MÉNIČRE’S DISEASE• Clinical presentation• Diagnostic criteria IMAGING ASPECTS OF MÉNIČRE’S DISEASE• Review the specific MRI protocol• Endolymphatic hydrops classificationIMAGING ASPECTS OF OTHER LABYRINTHOPATHIES• Teaching points to narrow down differential diagnosesINTERACTIVE CASE-BASED DIDACTICS• Sample cases to illustrate and solidify the concepts

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# Abstract Archives of the RSNA, 2024

HNEE-3

## HAVE YOU HEARD THIS? A GUIDE TO WHAT SHOULD BE DESCRIBED IN REPORTS TO COCHLEAR IMPLANT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Gustavo S. Boasquevisque, MBBS (*Abstract Co-Author*) Nothing to Disclose
Maira Sarpi, MD (*Abstract Co-Author*) Nothing to Disclose
Luis G. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo B. Cintra (*Abstract Co-Author*) Nothing to Disclose
Niedja Santos Goncalves Tsuno (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Alberto F. Coelho Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta C. Andrade, MD (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Review the structural anatomy of temporal bone• Detail the cochlear implant structure and components• Evaluate the computed tomography (CT) imaging as a tool for identify anatomical changes and structures that may difficult the cochlear implant procedure and that may make the cochlear implant procedure impossible• Guide radiologists to detail anatomical changes and surgical anatomy and measures that must be taken to assists surgeons in procedure

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Cochlear implant components b. Inner and middle ear functional anatomy c. role of CT and MR images in pre-operative evaluation d. surgical anatomy2. Impedimental structural factors a. labyrinthine aplasia or complete isolated b. rudimentary otocyst c. labyrinthitis ossificans of cochlea d. absence/change in cochlear nerve3. Structural factors that interfere a. common cavity malformation b. cochlear hypoplasia c. cochlear incomplete partition d. absence/change in cochlear nerve e. large vestibular aqueduct syndrome f. round and oval hypoplastic windows g. cochlear opening abnormalities h. cochlear fibrosis i. otosclerosis j. cholesteatoma k. chronic otitis media l. labyrinthitis ossificans m. vestibular schwannoma4. Specific Measures a. Cochlear basal turn measure b. Cochlear openings amplitude c. Position of sigmoid sinuses in relation to posterior contour of mastoids d. Measure of longitudinal axes of cochleae e. Mastoid tegmen height f. Measurements of the level of mastoid tegmens in relation to limits tops of petrous pyramids g. Opening of internal auditory canal5. Structured Report 6. Take-home messages

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# Abstract Archives of the RSNA, 2024

HNEE-30

## DENTAL DEVELOPMENTAL ANOMALIES: WHAT RADIOLOGISTS SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Daniel V. Sumi, MD (*Abstract Co-Author*) Nothing to Disclose
Suheyla P. Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Mauro M. Daniel, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Maffei Loureiro, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo Tames, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares (*Abstract Co-Author*) Nothing to Disclose
Maria Luiza Lacerda Ribeiro (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the imaging findings of dental developmental anomalies, encompassing variations of number, size, and form.Discuss how the various CT techniques, including multidetector CT, cone beam CT, and ultra-high resolution CT, can be employed to diagnose them accurately.Show how dental developmental anomalies can be misinterpreted as pathological conditions and may lead to aesthetic concerns, functional disorders, and failed dental procedures.

### TABLE OF CONTENTS/OUTLINE

IntroductionTechniquePros and cons of multidetector computed tomography, cone beam CT, and ultra-high resolution CTNormal dental anatomyTypes of tooth development anomalies: NumberHypodontiaHyperdontiamesiodensdistodens / distomolarparamolarSizeMicrodontiaMacrodontiaFormDouble toothFusionGeminationConcrescenceDens invaginatusDens evaginatusTalon cuspBolk's cuspCarabelli's cuspEnamel pearlsTaurodontismDilacerationSupernumerary rootsPremolarsMandibular molarsRadix entomolarisRadix paramolarisHypercementosis

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# Abstract Archives of the RSNA, 2024

HNEE-31

## ENDOLYMPHATIC HYDROPS IMAGING: FROM MRI PROTOCOL TO STRUCTURED REPORTING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares (*Abstract Co-Author*) Nothing to Disclose
Rafael Maffei Loureiro, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Miranda (*Abstract Co-Author*) Nothing to Disclose
Mauro M. Daniel, MD (*Abstract Co-Author*) Nothing to Disclose
Lorena L. Bezerra, MD (*Abstract Co-Author*) Nothing to Disclose
Juarez Pimentel, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Luiza Lacerda Ribeiro (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the anatomy of the endolymphatic space for optimal image interpretation.Discuss the clinical presentation and characteristic MRI findings of endolymphatic hydrops (EH) in the cochlear and vestibular compartments.Propose a practical and customized MRI protocol for EH evaluation.Introduce a structured reporting template to ensure consistent and informative EH assessment

### TABLE OF CONTENTS/OUTLINE

IntroductionAnatomy of the endolymphatic spaceDiagnostic Criteria of Menič̆re DiseaseMRI protocolPrimary Endolymphatic HydropsSecondary Endolymphatic HydropsPearls and PitfallsStructured ReportingConclusions

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# Abstract Archives of the RSNA, 2024

HNEE-32

## NEOPLASTIC LESIONS OF THE SKULL BASE: A COMPARTMENTAL APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Taisa Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Max Yunior Orsi Salazar, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique B. Zuppani, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanna S. Calfi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Tramonte Pereira (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Review the skull base anatomy and to stablish its compartments ; Recognize the imaging patterns of neoplastic lesions of the skull base and its compartment distribution to narrow the differential diagnosis ; Propose a flowchart of the location and imaging characteristics of the lesions to narrow the differential diagnosis

### TABLE OF CONTENTS/OUTLINE

; Introduction: ; Review of the anatomy of the skull base and its compartments ; Anterior compartment: ; Esthesioneuroblastoma ; Sinonasal carcinoma ; Diagnostic flowchart proposal ; Middle compartment: ; Central compartment: ; Invasive macroadenoma ; Craniopharyngioma ; Nasopharyngeal carcinoma ; Paramedian/Paracentral: ; Juvenile nasopharyngeal angiofibroma ; Lateral: ; Langerhans cell histiocytosis ; Diagnostic flowchat proposal; Posterior compartment: ; Chordoma ; Chodrosarcoma ; Jugulotympanic paraganglioma ; Endolymphatic sac tumor ; Diagnostic flowchart proposal ; Multicompartmental lesions: ; Schwannoma ; Meningioma ; Solitary fibrous tumor ; Plasmacytoma ; Metastasis ; Mimics: ; Petrous apicitis ; Otogenic osteomyelitis ; Fibrous dysplasia ; Cholesterol granuloma ; Fungal invasive sinusitis ; Frontal mucocele ; Ecchodosis physaliphora ; Cephalocele ; Arrested pneumatization ; Conclusion ; General diagnostic flowchart

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# Abstract Archives of the RSNA, 2024

HNEE-33

## DECODING NASOPHARYNGEAL TUMOURS - WHAT THE TUMOUR BOARD WANTS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Janani Asogan Vaishnavi, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Anu Kamalasanan, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Thiru A. Sudarshan, DMRD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Richard D. White, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Janani Baradwaj, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Most nasopharyngeal carcinomas originate in the posterolateral recess of the pharyngeal wall (82%) or midline (10%), with a small percentage (6%) presenting as normal at endoscopy MRI is the modality of choice for delineating the extent of NPC Key sequences : T1WI to identify skull base involvement and fat planes. CE-T1WI in detecting tumour extent, perineural spread, and intracranial extension. Diffusion-weighted imaging and MRI spectroscopy help to differentiate NPC from lymphoma CT is used to assess bony destruction and also for the purpose of RT planning . CT in combination with PET, is crucial for detecting distant metastasis and monitoring patients post-therapy for NPC recurrence. The presence of positive neck nodes is associated with higher incidence of disease recurrence. Nodes are measured in GREATEST DIMENSION in the neck in TNM staging and not in short axis diameter. Retropharyngeal nodes must be looked for in all cases. However these may be skipped and Level II nodes first involved in some cases.

### TABLE OF CONTENTS/OUTLINE

Describe relevant imaging findings of nasopharyngeal tumours that would impact treatment decisions. Staging of the nasopharyngeal tumours and illustrate the route of spread of malignancy. Understand the general treatment considerations of Nasopharyngeal Tumours

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# Abstract Archives of the RSNA, 2024

HNEE-34

## POPPING OUT THE FACTS: A CLOSER LOOK AT THE CAUSES OF PROPTOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mariana Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Helio Yamashita, MD (*Abstract Co-Author*) Nothing to Disclose
Angela M. Wolosker (*Abstract Co-Author*) Nothing to Disclose
Jose R. Fonseca, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
MARCELO DOS SANTOS BANDEIRA FILHO (*Abstract Co-Author*) Nothing to Disclose
Roberto Bastos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

§ To outline and describe the diverse etiologies of ocular proptosis, emphasizing the importance of recognizing underlying conditions. § To illustrate the key imaging findings associated with each cause of proptosis, utilizing CT and MRI scans for effective diagnosis. § To underscore the crucial role of multidisciplinary collaboration in the diagnosis and management of patients with ocular proptosis, facilitating a timely and accurate treatment plan.

### TABLE OF CONTENTS/OUTLINE

§ Introduction to Ocular Proptosis and its Clinical Significance. § Detailed Analysis of Causes: v Metabolic Causes: Focus on Thyroid Orbitopathy. v Neoplastic Conditions: Sphenoid wing meningioma, Lymphoma, Bone Metastasis. v Trauma-Induced Proptosis: Case Studies on Fractures. v Infectious Etiologies: Highlighting Subperiosteal Abscess. v Inflammatory Conditions: Idiopathic Inflammatory Orbitopathy. v Vascular Contributions: Carotid-Cavernous Fistula, Venous Malformations, and Lymphangioma.

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# Abstract Archives of the RSNA, 2024

HNEE-35

## PEARLS AND PITFALLS OF SKULL BASE CSF LEAK IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Kyle Hunter, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Markovic, MD (*Abstract Co-Author*) Nothing to Disclose
Vikas Jain, MD (*Abstract Co-Author*) Nothing to Disclose
Evgeniia Grik, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Introduce imaging options for the evaluation of skull base CSF fistula. 2) Provide an overview of the diagnostic algorithm and importance of beta2-transferrin testing. 3) Review thin-section high-resolution CT of the skull base as the first-line imaging test. 4) Discuss pros and cons of other imaging tests such as CT- and MR-cisternography. 5) Emphasize proper technique and highlight pitfalls while performing and reporting CT cisternography.

### TABLE OF CONTENTS/OUTLINE

1) CSF leak is a serious condition and can lead to significant morbidity and mortality. We introduce classification of CSF fistulae and provide an overview of the relevant anatomy. 2) We outline the algorithm of diagnosis with thin-section high-resolution CT of the skull base as first-line imaging following positive beta2-transferrin testing. 3) CT- and MR-cisternography are performed in certain clinical scenarios. MR is excellent in diagnosing meningoencephaloceles and differentiation from mucosal thickening. 4) We outline the proper imaging technique for CT-cisternograms and potential preventable interpretive mistakes. 5) We address our teaching points with illustrative cases of CSF leaks of various presentations and etiologies: Idiopathic intracranial hypertension as a major cause of spontaneous CSF leaks. CSF leaks post-endoscopic surgery and risk factors. Multimodality approach to evaluation of CSF leaks and the role of CT-cisternogram. Avoiding false-negative studies by adhering to appropriate imaging technique. Pearls and pitfalls of CT-cisternogram reporting. Role of brain MR and correlation of MR findings with pathology. CSF leaks in the setting of acute trauma. Imaging of recurrent CSF leaks and postsurgical changes.

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# Abstract Archives of the RSNA, 2024

HNEE-36

## SECRETS OF SKULL-BASE: OPENING THE PANDORA'S BOX

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shehbaz M. Ansari, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Zubin Driver, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Better understanding of anatomy is a prerequisite for skull-base pathologies. 2. Localising pathology to the anterior, middle or posterior cranial fossa and ascertain its origin to the skull-base itself, intracranial or extracranial compartment is key to narrow down the differentials of a skull-base lesion aided by their imaging characteristics on cross-sectional imaging. 3. Role of radiology is not limited to diagnosis but also to describe the extent and relation to important neurovascular structures.

### TABLE OF CONTENTS/OUTLINE

Skull base has been a nightmare for radiologists, given its intricate anatomy and varied pathology. We intend to demystify the skull-base radiology by having a centre of origin-based approach. In this exhibit we will begin with the basics of skull-base anatomy as a building block using illustrations and cross-sectional imaging. This will be followed by application of centre of origin-based approach in diagnosing skull-base pathologies using case examples for each sub-category. In this approach, lesions will be categorised into anterior, middle and posterior cranial fossa with each category subdivided into extra-cranial, skull-base and intra-cranial as the centre of origin. For example, in the anterior cranial fossa category, fronto-ethmoidal meningoencephalocele, fibrous dysplasia and esthesioneuroblastoma represent lesions of intracranial, skull-base and extra-cranial origin. Similarly, lesions of middle and posterior cranial fossa will be discussed.

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# Abstract Archives of the RSNA, 2024

HNEE-37

## BOOST YOUR GPA KNOWLEDGE! UNMASKING THE HEAD AND NECK INVOLVEMENT IN GRANULOMATOSIS WITH POLYANGIITIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Mario Padula, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo W. Murakoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Roberto Lelis B. Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize granulomatosis with polyangiitis (GPA) pathogenesis and clinical relevance.- Understand important imaging findings in head and neck involvement in GPA.- Recognize several differential diagnosis and their imaging findings.

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION:• Overview of granulomatosis with polyangiitis (GPA), including a brief overview of the pathophysiology, diagnosis and clinical significance, with emphasis on head and neck related symptoms.2. IMAGING IN GPA:• Case-based review of GPA imaging findings, especially in CT and MRI imaging, demonstrating:o Sinonasal involvement in initial, progressing, and advanced diseaseo Temporal bone involvemento Orbital Involvemento Upper airway involvement• Discussion of the diagnostic criteria for GPA, including laboratory tests, imaging studies, and histopathological findings, to aid in accurate and timely diagnosis.3. IMAGING OF DIFFERENTIAL DIAGNOSIS:• Case-based review of other diseases with similar findings, including sinonasal involvement in sarcoidosis, cocaine-induced lesions, Hansen's disease, invasive fungal rhinosinusitis, and more, with emphasis on red-flags that may suggest GPA or alternative diagnosis.4. CONCLUSION:• Take-home messages, focusing on key imaging findings in head and neck imaging involvement.

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# Abstract Archives of the RSNA, 2024

HNEE-38

## HEAR ME OUT: EMERGENCY IMAGING PATTERNS IN NECROTIZING OTITIS EXTERNA - EARLY DETECTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mario Porfirio Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna P. De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Gabriela Cintra Borba (*Abstract Co-Author*) Nothing to Disclose
Henzo Ota, MD (*Abstract Co-Author*) Nothing to Disclose
Vitoria Lima Beltrao Vieira de Melo, MD (*Abstract Co-Author*) Nothing to Disclose
Ula Passos, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Pedro C. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Magna, MD (*Abstract Co-Author*) Nothing to Disclose
Raissa M. Barradas Monteiro De Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Flavia Galvao Lopes, MBBS (*Abstract Co-Author*) Nothing to Disclose
Lucas P. Caldas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This study aims to assess the most common findings of the necrotizing otitis externa in the emergency context, and also show the most common dissemination patterns. Review the temporal bone anatomy, focusing on the main anatomical references that are affected by the disease.The purpose of this exhibition is to: Provide basic pathological concepts to help professionals to improve their skills to identify the main imaging findings and complications that should be actively looked for when reading a temporal bone CT in the emergency in patients with suspected necrotizing external otitis, helping to prevent delayed treatment due to diagnostic failure; Review the anatomical relation between the temporal bone, external ear and skull base, and the how the cervical spaces can be affected due to this relation in the disease dissemination, resulting in possible complications; Review subtle findings that may suggest that the patient could benefit from a MRI complementation study.

### TABLE OF CONTENTS/OUTLINE

Schematic illustrations related to the pathophysiology of the external necrotizing otitis, correlating the temporal bone CT with the infection dissemination pattern through the anatomic references and cervical spaces; Demonstration of multiple cases with subtle imaging findings to help increase the early diagnosis rate.

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# Abstract Archives of the RSNA, 2024

HNEE-39

## BEHIND BULGING EYES: THE RADIOLOGIST HITCHHIKER'S GUIDE TO THE GRAVES OPHTHALMOPATHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Denise D. Zantut-Wittmann (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Abstract Co-Author*) Nothing to Disclose
Caio Silveira, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Regis Coelho Guimaraes (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the normal anatomy of the orbits and the sumarize the current pathophysiology of Graves' ophthalmopathy. - Review and illustrate the imaging findings for Graves orbitophaty in MR, focus on provide an objective approach and for studying the anomalies. - Correlate MRI and CT with clinical images, to demonstrate what happens in the eye.

### TABLE OF CONTENTS/OUTLINE

- Overview of Graves' ophthalmopathy as a complex autoimmune disorder- Description of the underlying autoimmune mechanisms- Pathophysiology: - Autoantibodies binding to thyrotropin receptors and insulin-like growth factor 1 receptors - Inflammatory response involving immune cells and cytokines - Differentiation of fibroblasts into adipocytes and myofibroblasts - Role of fibrocytes in tissue remodeling - Symptoms: exophthalmos, eyelid retraction - Complications: diplopia, restrictive strabismus - Association with hyperthyroidism- Radiological Findings - Importance for diagnosis and monitoring - Increased thickness and volume of extraocular muscles (EOM) in CT and MRI - Imaging during active inflammatory phase - Assessment of disease activity and complications - Compression of the optic nerve with apical crowding - Measurement of muscle diameters and impact on exophthalmos classification - Exploration of different imaging sequences - Evaluation of involvement of the lacrimal gland by MRI

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# Abstract Archives of the RSNA, 2024

HNEE-4

## DIFFUSE THYROID DISEASE: CT AND MR IMAGING APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Naoko Saito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryohei Kuwatsuru, MD (*Abstract Co-Author*) Nothing to Disclose
Osamu Sakai, MD, PhD (*Abstract Co-Author*) Consultant, Boston Imaging Core Lab LLC
Naoki Takemasa (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Diffuse thyroid enlargement is frequently encountered on CT and MRI with clinical symptoms or incidentally. A wide variety of diseases can affect the thyroid gland diffusely, ranging from thyroiditis to malignant tumors. Familiarity with the imaging and clinical characteristics of diffuse thyroid disease (DTD) is essential for prompt diagnosis and treatment. The teaching points are: 1. To review clinical and imaging findings of various DTD 2. To recognize important features that can help differentiate the various DTD 3. To learn the current knowledge about the therapy for DTD

### TABLE OF CONTENTS/OUTLINE

1. Normal imaging findings of the thyroid gland 2. Review of various cases of diffuse thyroid enlargement: clinical and imaging findings and treatment a. Autoimmune thyroid diseases: Graves' disease, Hashimoto thyroiditis, postpartum thyroiditis, IgG4-related thyroiditis b. Nonautoimmune thyroid diseases: acute and subacute thyroiditis c. Depositions: amyloidosis d. Drug-induced thyroid disorders e. Acute transient thyroid swelling following FNA f. Benign tumors: adenomatous goiter, simple diffuse goiter g. Malignant tumors: anaplastic thyroid cancer, diffuse sclerosing papillary cancer, malignant lymphoma, metastatic tumor h. Fetal goiter i. Shock thyroid 3. Current topics of treatment for DTD (anaplastic thyroid cancer and advanced thyroid cancer) a. Molecular target drug b. Immune checkpoint inhibitor c. Genomic medicine 4. Suggested algorithms for the diagnosis of DTD

# Abstract Archives of the RSNA, 2024

HNEE-40

## RIGHT UNDER YOUR NOSE - ULTRASOUND GUIDE TO POST-SURGICAL RHINOPLASTY EVALUATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Gabriel Da Silva Eli, MD (*Abstract Co-Author*) Nothing to Disclose
Amany Campoville, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana A. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Luis R. Ferreira (*Abstract Co-Author*) Nothing to Disclose
Matheus Taborda, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Sampaio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Rhinoplasty or “nose job” is an ancient plastic surgery dating back to the time before Christ, with the first reports by Indian and Egyptian people. Despite being an old and frequently performed procedure, it still is considered challenging due to unexpected results and complications that can be related to the partially known anatomy prior to the procedure. Ultrasound (US) is an objective, accessible and widely used method for pre- and post-operative monitoring of many structures. Therefore, high-frequency nasal US should be included in the preoperative planning and in the postoperative follow-up of rhinoplasties.1. Review the structural anatomy of the nasal region on ultrasound;2. Introduce the different types of most common surgical rhinoplasty;3. Review the ultrasound aspect of the most used surgical rhinoplasty techniques;4. Evaluate the materials commonly used in the procedure and their ultrasound appearances;5. Demonstrate what to expect in the post-operative period.

### TABLE OF CONTENTS/OUTLINE

IntroductionUltrasound (US) nasal anatomyClinical and surgical benefits of US for nose proceduresSurgical RhinoplastyDifferent types of most common techniques (rhinoplasty, septoplasty, rhinectomy, maxillary antrostomy and uncinectomy, nasal turbinate surgery, ethmoidectomy, nasal prosthesis, etc)Grafts and materialsMaterials commonly used in nose jobUS aspect of most used materialsPost-surgical changesUS aspect of most used surgical rhinoplasty techniquesComplicationsSequelsTake-home messages

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# Abstract Archives of the RSNA, 2024

HNEE-41

## ARYEPIGLOTTIC FOLDS, A SMALL SPOT WITH BIG POSSIBILITIES. A CLINICO-RADIOLOGICAL AND ANATOMOPATHOLOGICAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose Maria Maiques Llacer, MD (*Abstract Co-Author*) Nothing to Disclose
Brigitte Beltran Marmol (*Abstract Co-Author*) Nothing to Disclose
Jaume Capellades, MD (*Abstract Co-Author*) Nothing to Disclose
Paulina Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Ivan Martinez Cano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This educational poster presents a clinico-radiological and anatomopathological's review of pathology of the aryepiglottic folds (AEF) of the supraglottis, from the common to the rare and from the benign to the malignant based on cases observed in the head and neck tumor committee of our centre.

### TABLE OF CONTENTS/OUTLINE

Laryngeal neoplasms account for about a quarter of all head and neck neoplasms. The supraglottis is the most common site for these neoplasms and can be subdivided into different anatomical spaces that have prognostic and management differences. The aryepiglottic fold is the border between the larynx and the hypopharynx and is an uncommon site for tumors. The vast majority of these have epidermal origin, but multiple lesions can arise from the structures that make up the EFA. The pathology harbored in this site usually presents with larval and non-specific clinical manifestations, making timely diagnosis difficult; this problem is compounded by unfamiliarity with the imaging of these lesions, making their diagnosis even more difficult. Sometimes benign pathology can be confused with neoplasia, which can be difficult to differentiate on imaging. However, clinics and some tools to determine the benign origin of these lesions (contrast enhancement behavior) can help to refine the diagnosis and avoid invasive procedures in patients. This review summarizes the clinical, radiological and anatomopathological differences between neoplasms and benign pathology that may occur in this space. In addition, we aim to provide useful imaging tools for the recognition of certain features of clinical and prognostic importance.

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# Abstract Archives of the RSNA, 2024

HNEE-42

## INTRATHYROIDAL PARATHYROID: YOU MUST REMEMBER THIS!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carolina R. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Carrara Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Fabio Montenegro (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo Tames, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Magnabosco (*Abstract Co-Author*) Nothing to Disclose
Lucas O. Madeira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The concept of enlarged parathyroid represents the possibility of disease. Classically, the parathyroids are located in the thyroid contours, however they can be found in ectopic situations, including inside the thyroid gland, in regions clearly surrounded by the thyroid parenchyma. They can often be confused by thyroid nodules, sometimes with a high ACR TI-RADS classification. The purposes of this exhibit are: to make this diagnosis possible and incorporated into radiological practice, especially in the clinical context of hyperparathyroidism; to review the imaging method aspects of these glands; and to show the findings of the 10 original cases from our institutions, illustrated by different imaging methods. Results: scintigraphy: 100% with focal hyperuptake to the radiopharmaceutical;ultrasound: 100% with hypoechogenicity;CT scan (only 50%): hypoattenuating nodule;MRI (only 20%): hypersignal in T2.

### TABLE OF CONTENTS/OUTLINE

Introduction: epidemiology, embryology and clinical aspects of the intrathyroidal parathyroid.Imaging methods of intrathyroidal parathyroids: Ultrasound, Scintigraphy, CT scan and MRI.Illustrative original cases with anatomopathological correlation: 80% adenoma, 10% hyperplasia, and 10% carcinoma.Possible atypical characteristics of these nodules.Recommendation for radiologists - in what context should we remember this diagnosis? Conclusion "take-home messages".

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# Abstract Archives of the RSNA, 2024

HNEE-43

## "THE RADIOLOGIST'S ROADMAP: MAPPING OUT JAW LESIONS AND MULTIMODALITY IMAGING FEATURES"

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Moataz Ahmed Sayed Mohammed Soliman, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Reham M. Ellessy, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Mohamed Badawy, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Discuss the different lesions in the Jaw. Review imaging features and clinical associations of odontogenic and non-odontogenic lesions. Describe a practical approach to narrow the differential diagnosis and identify the various lesions.

### TABLE OF CONTENTS/OUTLINE

IntroductionClassification of the jaw lesionsRadiological characteristics Radiopaque vs radiolucentDifferent attenuation patterns (e.g. sclerotic, vs ground glass. Solid vs cystic)Margins (well vs ill-defined)Associated lesions.Clinical implications, e.g. prevalence, clinical presentation, behavior, treatment options.Differential diagnosis and practical approach to identify lesions according to the location and radiological features.RadiopaqueOdontogenicSclerotic: (odontoma, cementoblastoma, cemento osseous dysplasia, condensing osteitis)Ground glass: (cemento ossifying fibroma)NonodontogenicSclerotic: (Osteoma, Exostoses)Ground glass: (Fibrous dysplasia, Renal osteodystrophy, Paget disease of the Jaw)RadiolucentWell-defined marginsOdontogenicCystic lesions without mineralization (dentigerous cyst, Keratocyst, radicular cyst, residual cyst)Solid lesions without mineralization (Ameloblastoma)NonodontogenicCystic lesions ( Lingual Salivary Gland Inclusion Defect, simple bone, nasopalatine cysts)Solid lesions ( central joint cell granuloma, arteriovenous malformation, Langerhan cell histiocytosis)Ill-defined marginsOdontogenic (odontogenic carcinoma, carcinosarcoma, sarcoma)Nonodontogenic Non neoplastic:(Osteomyelitis, osteonecrosis)Neoplastic: (distant metastasis, squamous cell carcinoma of the oral cavity, osteosarcoma/chondrosarcoma/fibrosarcoma of the jaw)

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# Abstract Archives of the RSNA, 2024

HNEE-44

## COCAINE-INDUCED MIDLINE DESTRUCTIVE LESIONS: WHAT DO WE HAVE TO LOOK FOR IN THE ENT AREA?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Marin-Diez, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Cobo Diaz Ramon (*Abstract Co-Author*) Nothing to Disclose
Angela Guitian Pinilla, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To review the anatomy of the nasal cavities and paranasal sinuses.- To describe the key radiological findings in Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) of cocaine-induced midline destructive lesions (CIMDL).- - To review the differential diagnosis with other pathologies that cause destructive midline lesions.

### TABLE OF CONTENTS/OUTLINE

A) Anatomy of the sinunasal areaB) Main ENT lesions- Perforation of the nasal septum.- Destruction of nasal turbinates.- Lateral nasal wall involvement.- Palate perforation.- Sinus neo-osteogenesis.- Orbital damage (obstruction of the nasolacrimal duct, destruction of the orbital bones, inflammatory mass..)- Otitis signs.- Skull base involvement (erosions of the anterior cranial fossa, encephalocele, CSF fistulae..)- Skin lesions/soft tissue destruction of the nasal area, mainly of the columella, alar cartilages, nasal philtrum and upper lip.C) Differential diagnosis- Traumatic lesions. - Infections (bacterial, fungi)- Toxic effect.- Inflammatory diseases.- Neoplasm.

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# Abstract Archives of the RSNA, 2024

HNEE-45

## TEMPORAL BONE OSTEODYSTROPHIES: EXPLORING OTOSCLEROSIS AND BEYOND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno C. Olivetti, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Toyama (*Abstract Co-Author*) Nothing to Disclose
Hugo Tames, MD (*Abstract Co-Author*) Nothing to Disclose
Isadora Campos De Matos (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To highlight the main characteristics and imaging findings of osteodystrophies of the temporal bone.- To review and illustrate dysplasias of the temporal bone with cases from our institution.- To familiarize radiologists with imaging aspects that aid in the differential diagnosis of these pathologies.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION- Organogram osteodystrophies of temporal bone organized into groups according to the predominant pattern of bone involvement (lytic, scleroticand mixed)Temporal bone disease with predominance of lytic pattern- Otosclerosis- Osteogenesis imperfecta- Otosyphilis Temporal bone disease with predominance of mixed pattern- Paget's disease- Fibrous dysplasia Temporal bone disease with predominance of sclerotic pattern- Osteopetrosis- Camurati-engelmann- Scleosteosis- Van buchemTAKE HOME MESSAGESTemporal Bone Osteodystrophies, such as otosclerosis and other bone dysplasias exhibit varied clinical presentations and genetic origins. By classifying them based on predominant bone involvement patterns, clinicians and radiologists can better understand their complexities and facilitate accurate diagnosis. Imaging modalities play a crucial role in delineating disease characteristics and guiding treatment strategies. Recognizing key features of each condition is imperative for tailored patient management and improved outcomes. In essence, a comprehensive understanding of temporal bone diseases empowers healthcare professionals to provide optimal care and support for affected individuals.

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# Abstract Archives of the RSNA, 2024

HNEE-46

## BRANCHIAL CLEFT ANOMALIES: EMBRYOLOGICAL DEVELOPMENT AND MULTIMODALITY IMAGING FINDINGS. WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria J. Sarda, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo D. Sarda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review key embryological aspects of branchial arch development.Know the anatomical anomalies caused by failures in the embryological development of the branchial arch -usually presented as cysts, sinuses and fistulas.Identify the key imaging findings to establish the diagnosis of anomalies of the branchial arches: morphological characteristics, location of the lesion.Review the complications associated with anomalies of the branchial arches as well as their imaging findings: infections, persistent fistula.

### TABLE OF CONTENTS/OUTLINE

Embryological branchial arch development. - Temporary cavity of "Sinus of His": normal fusion.Failure of complete wall fusion: -branchial cleft cyst: type 1, type 2, type 3, type 4-Branchial cleft sinus-Branchial cleft fistulaKey multimodality imaging findings: -Branchial cleft cyst-Branchial cleft sinus-Branchial cleft fistulaComplications of branchial arches anomalies - and imaging findings-Infections-Persistent fistula -Collections

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# Abstract Archives of the RSNA, 2024

HNEE-47

## MERKEL CELL CARCINOMA MANIFESTATION IN HEAD AND NECK

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlota Andreu Arasa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Inseon Ryoo, MD (*Abstract Co-Author*) Nothing to Disclose
Osamu Sakai, MD, PhD (*Abstract Co-Author*) Consultant, Boston Imaging Core Lab LLC
Karen Buch, MD (*Abstract Co-Author*) Nothing to Disclose
Serena Pham, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Merkel cell carcinoma (MCC) is a rare, aggressive neuroendocrine cutaneous malignancy, with a predilection for early local, regional and distant metastasis with frequent recurrence, and is associated with poor prognosis.1-9 Since MCC rapidly progresses and metastasizes, early detection and achievement of R0 excision of the primary lesion, with a safety margin of >1 cm in stage 1 disease and >2 cm in higher stages, as well as sentinel lymph node biopsy and excision, are key to improving prognosis.1,4 While the gold-standard method of diagnosing MCC is pathologic analysis, imaging is essential for staging, management, and follow-up guidance.5-9 To date, there is no consensus for specific imaging algorithm for assisting diagnosing and staging of MCC.5,9 The purpose of this exhibit is to: 1) Review the MCC epidemiology and risk factors 2) Discuss various MCC manifestations in head and neck 3) Discuss management of MCC in head and neck 4) Discuss the role of the most recent imaging approach for diagnosing and staging of MCC in head and neck (Reference is available upon request.)

### TABLE OF CONTENTS/OUTLINE

1) MCC epidemiology and risk factors 2) MCC manifestations in head and neck 3) Management of MCC in head and neck 4) Imaging approach for diagnosing and staging of MCC in head and neck

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# Abstract Archives of the RSNA, 2024

HNEE-48

## PARAPHARYNGEAL SPACE: THE GREAT UNKNOWN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Silvia Cisneros Carpio, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Legorburu Tona, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Castillo de Juan (*Abstract Co-Author*) Nothing to Disclose
Udane Oiartzabal, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rodriguez Ripalda, MD (*Abstract Co-Author*) Nothing to Disclose
Leire Ormaetxe Albeniz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the boundaries and anatomical relationships of the parapharyngeal space.To describe the diversity of focal lesions affecting this space and the radiological key findings that lead their differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

The parapharyngeal space is a deep cervical compartment with inverted pyramid morphology, bounded laterally by the masticator and parotid spaces, posteriorly by the retropharyngeal and prevertebral spaces, and medially by the pharyngeal mucosal space, and divided into a pre-styloid and a post-styloid compartment by the tensor-vascular-styloid fascia.Although predominantly composed of fatty tissue, it also includes multiple vascular and nervous structures, minor salivary glands, and, occasionally, the retromandibular portion of the deep parotid lobe. Additionally, due to its location, it maintains a close relationship with multiple neighboring anatomical structures.The differential diagnosis of lesions affecting this space includes both primary lesions originating within the space itself and secondary lesions extending into it from adjacent structures. These encompass a wide range of pathologies, both congenital and acquired, including neoplastic, inflammatory, and infectious etiologies.A review of the main differential diagnosis of the parapharyngeal space lesions has been conducted, based on both anatomic references and key radiological findings, using cases from our institution.

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# Abstract Archives of the RSNA, 2024

HNEE-49

## IMAGING-DETECTED EXTRANODAL EXTENSION IN HEAD AND NECK CANCER: CLINICAL IMPLICATIONS AND DIAGNOSTIC CRITERIA IN THE ERA OF HIGH-RESOLUTION IMAGING INCLUDING PHOTON-COUNTING DETECTOR CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takashi Hiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toshifumi Tomioka, MD (*Abstract Co-Author*) Nothing to Disclose
Shingo Sakashita, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsushi Kobayashi, MD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation
Hiroki Taguchi (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Ryutaro Onaga (*Abstract Co-Author*) Nothing to Disclose
Yoshihisa Muramatsu, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Tomoaki Sasaki, MD (*Abstract Co-Author*) Nothing to Disclose
Hirofumi Kuno, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Extranodal extension (ENE) is a significant adverse prognostic factor in head and neck squamous cell carcinoma (HNSCC), and pathologic ENE (pENE)/clinically evident ENE (cENE) are classified as N3b in p16-negative HNSCC based on the AJCC staging system. While imaging-detected ENE (iENE) without clinically apparent cENE is not included in the current N category, there has been active discussion regarding the importance of pretreatment iENE evaluation for accurate prognostication and treatment strategy as well as the many aspects of iENE that remain unresolved such as diagnostic criteria including the associated terminology. At the same time, the advent of high-resolution imaging techniques such as photon-counting detector CT with 1024 matrix capability allows for more detailed visualization of fine structures compared to conventional imaging.The objectives of this presentation are: 1) to review the clinical implications of iENE in patients with head and neck cancer, and 2) to discuss the diagnostic criteria for iENE in the era of high-resolution imaging with radiolo-pathologic / clinico-radiologic correlation.

### TABLE OF CONTENTS/OUTLINE

1. Clinical background of ENE in the patient with head and neck cancer.2. Diagnostic criteria and the recently proposed grading of iENE.3. High-resolution CT including photon-counting CT4. Case discussion and clinical implications of iENE- iENE Grade 1- iENE Grade 2- iENE Grade 35. Summary

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# Abstract Archives of the RSNA, 2024

HNEE-5

## ENDOLYMPHATIC HYDROPS IN MRI, A DEEPER LOOK AT THE INNER EAR

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yukiyoshi Kimura, MD (*Abstract Co-Author*) Nothing to Disclose
Yumi Kimura Sandoval, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Calderon Cardenas SR, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Establish an anatomical correlation of the inner ear and its visualization with MR images.2. Show the type of sequences used as well as the contrast administration and image acquisition times in the evaluation of patients with suspected endolymphatic hydrops.3. Explain and illustrate the importance of a step-by-step evaluation in patients with endolymphatic hydrops.4. Illustrate characteristic imaging findings in posterior fossa pathology considered as a differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

• Introduction• Indications• Anatomy of the inner ear• Image acquisition protocol (use of contrast media and administration times, sequence and acquisition times)• Endolymphatic hydrops: what is it? why is it produced?• Step-by-step evaluation on MRI • Classification systems used• Differential diagnoses• Take home points• References

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

HNEE-50

## QUANTITATIVE AND QUALITATIVE ASSESSMENT OF THE PHARYNGOESOPHAGEAL SEGMENT (PES) IN THE VIDEOFLUOROSCOPIC SWALLOW STUDY (VFSS): A PRACTICAL APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Javier Azpeitia-Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Abstract Co-Author*) Nothing to Disclose
Rosa M. Lorente-Ramos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Araceli Munoz Hernandez, MD, PHD (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To describe the normal anatomy of the pharyngoesophageal segment (PES).
- To analyze the normal physiology of the upper esophageal sphincter (UES)
- To propose a systematic approach for the study of pathology of the pharyngoesophageal segment.
- To illustrate common and uncommon imaging findings in videofluoroscopy swallow study (VFSS).
- To emphasize pitfalls and clues to differential diagnosis.
- To describe recommendations and rehabilitative strategies based on VFSS by evaluating the effectiveness of postures, maneuvers, bolus modifications, and sensory enhancements in improving swallowing safety and efficiency.

### TABLE OF CONTENTS/OUTLINE

The pharyngoesophageal segment (PES) is one of the only region of the swallowing mechanism that can be modified with therapy and surgery. The VFSS is the gold-standard tool for diagnosing PES dysfunction. A systematic approach to PES analysis ensures a comprehensive assessment of dysfunction. The systematic evaluation of the PES includes evaluation of pre-swallow PES fluoroscopic anatomy, laryngohyoid elevation, pharyngeal contractility, PES opening, evaluation of the posterior cricoid region, the posterior hypopharyngeal wall region and the esophageal function. We present different objective measures to study the PES pathology: the pharyngeal constriction ratio (PCR), UES opening diameter, Determination of the PES opening dimensions, UES closure, measurement of the cricopharyngeus bar to distinguish between obstructive and non-obstructive bars, and normalized residue ratio scale (NRRS).

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# Abstract Archives of the RSNA, 2024

HNEE-51

## PATHOLOGY OF THE OUTER, MIDDLE AND INNER EAR: TECHNIQUES, PROTOCOLS AND KEY FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Paloma Briceno Torralba, MD (*Abstract Co-Author*) Nothing to Disclose
Joaquin Martin Cuartero (*Abstract Co-Author*) Nothing to Disclose
Celia Bernal Lafuente, MD (*Abstract Co-Author*) Nothing to Disclose
Amalia Aranaz Murillo, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Pascual Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Riera Marti (*Abstract Co-Author*) Nothing to Disclose
Jorge Gomez Madrona (*Abstract Co-Author*) Nothing to Disclose
Elena Sierra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; The temporal bone is an anatomical area of great complexity and harbors different pathologies.; The most suitable technique for examining the outer ear is Computed Tomography. However, CT is used to assess bone structures in the middle and inner ear, whether Magnetic Resonance Imaging is required for inflammatory or tumorous diseases.

### TABLE OF CONTENTS/OUTLINE

The temporal bone can present a variety of pathologies (infectious, traumatic, congenital, tumor) that can affect the outer, middle, or inner ear. This education exhibit aims to review the ear’s anatomy showing the most appropriate techniques and protocols for basic findings that will allow the detection of different ear pathologies.; Most diseases of the outer ear are assessed by CT, sometimes with contrast (inflammatory and tumorous processes).; In the middle ear, CT without contrast allows the assessment of hearing loss, trauma, otitis, and cholesteatoma. CT with contrast medium is used for infectious processes with intracranial extension such as epidural abscesses or thromboses. MRI is used to assess tumor diseases and inflammatory diseases.; In the inner ear, MRI is the method of choice to identify cranial nerves and the labyrinth, using contrast agents for tumors and infectious diseases. CT can be used to assess congenital pathologies and other pathologies such as otosclerosis and dehiscence.

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# Abstract Archives of the RSNA, 2024

HNEE-52

## BEYOND THE ORDINARY: A DEEP DIVE INTO BRACHIAL PLEXITIS AND PLEXOPATHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Carlos H. Torres, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Vinil Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Lucia Brun, MD (*Abstract Co-Author*) Nothing to Disclose
Pierre Bourque (*Abstract Co-Author*) Nothing to Disclose
Azza Reda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

○ To review the common and uncommon causes of brachial plexitis and discuss the key imaging features that may aid in the differential diagnosis.○ To correlate the imaging features with the clinical findings of Brachial Plexitis.○ To understand the clinico-radiological and electrodiagnostic approach in the multidisciplinary assessment of brachial plexitis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction and Background2. Clinical approach and electrodiagnostic correlation3. MRI findings: A Case-Based Review- Viral plexitis- Immune-related plexitis- Post-radiation plexitis- Toxic plexitis (vaccines, drugs)- Heredofamilial Hypertrophic Neuropathies- Charcot-Marie-Tooth- CIDP- Idiopathic plexitis (Parsonage-Turner syndrome)- Miscellaneous cases 4. Conclusions and take-home pointsBrachial plexitis represents a clinical challenge as symptoms are vague and nonspecific. However, the combination of clinical history, EMG, NCS and MRI findings is helpful to reach the diagnosis.

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# Abstract Archives of the RSNA, 2024

HNEE-53

## DISEASES INVOLVING THE EXTRAOCULAR MUSCLES (EOM): IMAGING FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Gredilla (*Abstract Co-Author*) Nothing to Disclose
Juan S. Martinez San Millan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Montserrat Medina Diaz, PhD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Alba Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Juan V. Quintana Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The extraocular muscles (EOM) can be involved in a wide variety of diseases that can be local, regional or systemic. The conditions often have a similar clinical and radiological presentation, which can make differential diagnosis difficult.It is necessary to know the orbital anatomy, how to perform its radiological evaluation and the clinical and imaging manifestations of the diseases that may affect de EOM.The key points to evaluate for a systematic approach and differential diagnosis are:- Pattern of muscle involvement: how many muscles, which ones, and what part of them.- Involvement of one or both orbits and symmetry.- Involvement of other orbital or extraorbital structures.- Clinical presentation.The purpose of this work is to review the conditions that can affect the EOM, to describe and to illustrate their characteristic imaging findings, focusing on clues for differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction1.1. Orbital anatomy, focusing on the EOM1.2. Imaging modalities used for the evaluation of the orbit and the EOM and its radiological features2. Systematic approach and clues for differential diagnosis3. Diseases involving the extraocular muscles:3.1. Thyroid ophthalmopathy (Graves' disease)3.2. Orbital myositis: idiopathic orbital inflammation (orbital pseudotumor) and secondary myositis (associated to systemic or autoimmune diseases)3.3. Neoplasms: lymphoproliferative disorders and metastasis3.4. Orbital trauma and iatrogenic complications3.5. Infectious diseases: orbital cellulitis and other entities3.6. Miscellaneous: Brown syndrome, vascular conditions and others4. Conclusions5. References

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# Abstract Archives of the RSNA, 2024

HNEE-54

## RADIOGRAPHIC GUIDE TO CYSTIC ODONTOGENIC LESIONS: A MULTIMODAL IMAGING APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Michael Vaccaro, DO (*Abstract Co-Author*) Nothing to Disclose
Hannah Iqbal (*Abstract Co-Author*) Nothing to Disclose
Josef Iqbal (*Abstract Co-Author*) Nothing to Disclose
Nandor K. Pinter, MD (*Abstract Co-Author*) Consultant, Koninklijke Philips NV
Zakwan Uddin (*Abstract Co-Author*) Nothing to Disclose
Benjamin Morrish, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Introduction to Cystic Odontogenic Lesions: - Overview of cystic odontogenic lesions and their classification. Review differential diagnosis of cystic odontogenic lesions, including: radicular cyst, dentigerous cyst, odontogenic keratocyst, ameloblastoma, odontogenic myxoma, residual cyst, calcifying odontogenic cyst, etc.- Discuss the importance of the Radiologist in diagnosis and management of these lesions.Multimodal Imaging Approach:- Advantages in using a multimodal imaging approach, including radiography, computed tomography, magnetic resonance imaging.Radiographic Features:- Review the radiographic techniques used in imaging odontogenic lesions.- Typical radiographic appearance of discussed cystic odontogenic lesions.Computed Tomography Imaging - Discuss role of CT in evaluation and diagnosis of cystic odontogenic lesions.- Review the key CT findings for differentiating cystic odontogenic lesions.Magnetic Resonance Imaging - Utility of MRI in characterizing cystic lesions. Importance of evaluating adjacent soft tissues and internal cyst contents.- Discuss characteristic signal patterns for specific odontogenic lesions.

### TABLE OF CONTENTS/OUTLINE

-Title Slide-Disclosures -Exhibit Learning Objectives-Introduction to Cystic Odontogenic Lesions, Importance of the Radiologist-Multimodality Approach in Diagnosing Cystic Odonotgenic Lesions (Radiography, CT, MRI)-Periapical Cyst (Radicular Cyst)-Dentigerous Cyst (Follicular Cyst)-Keratocystic Odontogenic Tumor (Odontogenic Keratocyst)-Ameloblastoma-Odontogenic Myxoma-Residual Cyst-Calcifying odontogenic cyst (Gorlin Cyst)-Summary-References

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# Abstract Archives of the RSNA, 2024

HNEE-55

## APPLICATION OF CT-LIKE MRI IN CRANIAL AND FACIAL BONE LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Masayuki Maeda, MD (*Abstract Co-Author*) Nothing to Disclose
Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Fumine Tanaka (*Abstract Co-Author*) Nothing to Disclose
Maki Umino, MD (*Abstract Co-Author*) Nothing to Disclose
Seiya Kishi (*Abstract Co-Author*) Nothing to Disclose
Ryota Kogue, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recently, a new technique known as CT-like MRI has been developed that enhances MRI contrast similar to CT. We present our clinical experience using fast field-echo resembling a CT using restricted echo spacing (FRACTURE) MRI in comparison with CT in cranial and facial bone lesions. Our aim is1) to understand the principle of FRACTURE MRI.2) to demonstrate FRACTURE MRI cases of cranial and facial bone lesions compared with CT.3) to learn the diagnostic value and drawbacks of FRACTURE MRI in evaluating bone lesions.

### TABLE OF CONTENTS/OUTLINE

1. Principle of FRACTURE MRI2. Delineation of osteolytic change indicates whether the lesion is malignant (permeative bone destruction) or benign (expansive bone destruction).3. Delineation of sclerotic change is useful for diagnosing fibrous dysplasia, osteochondroma, meningioma, etc.4. Benefit: FRACTURE MRI may omit CT examination in pediatric cases.5. Drawback: FRACTURE MRI may be difficult to assess the lesions near nasal/paranasal or mastoid air.6. Conclusion: FRACTURE MRI provides added value in the evaluation of cranial and facial bone lesions that is difficult with conventional MRI.

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# Abstract Archives of the RSNA, 2024

HNEE-56

## PATTERNS OF VISUAL FIELD DEFECT: THE KEY FOR SELECTING APPROPRIATE IMAGING MODALITY AND MAKING ACCURATE DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yuhua Dou (*Abstract Co-Author*) Nothing to Disclose
Guanglei Tang, MBBS (*Abstract Co-Author*) Nothing to Disclose
Xueguo Liu, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jian Guan, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the anatomy, physiology and normal imaging appearance of the visual pathway. 2. To know about the relevant clinical examination for visual field analysis 3. To recognize different visual field defect patterns associated with specific segment of the visual pathway, which can be assisting in lesion localization on imaging. 4. To learn unilateral and bilateral visual field defect based on cases.

### TABLE OF CONTENTS/OUTLINE

1. The anatomy of the visual pathway and its normal appearance on CT and MRI imaging. 2. Relevant clinical examinations of visual field: (1)Testing of visual fields (including methods to study and analyze the visual field, as well as terminology relating to visual field defects); (2)Testing of the pupillary light reflex. 3. Different patterns of visual field defect, imaging findings and diagnosis: (1)Visual field defect with unilateral eye involved(central visual field defect, peripheral visual field defect, altitudinal hemianopsia, nasal hemianopsia and total visual loss) and related diseases. (2)Visual field defect with bilateral eyes involved (junctional scotoma, altitudinal hemianopsia, heteronymous visual field defect, homonymous visual field defect and quadranopsia) and related diseases. 4. Application of visual field defect and lesion localization in complex cases

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# Abstract Archives of the RSNA, 2024

HNEE-57

## STAYING IN ORBIT: A REVIEW OF INTRAORBITAL PATHOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Han Zhong, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Ciasullo, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review orbital anatomy. 2. Review the cross-sectional imaging appearance as well as typical patient presentation/demographics and management of non-traumatic orbital pathologies including inflammatory, neoplastic, and vascular etiologies.Summary As orbital pathology is infrequently encountered by many residents, it can become a source of anxiety and confusion. The myriad of entities that can manifest in such a small region of the human body may be overwhelming - a dilemma that this educational exhibit seeks to address. It will start with fundamental orbital anatomy and progress to key characteristics of multiple pathologies, broken down into more easily digestible categories. In addition, understanding common presenting symptoms and demographics for each pathology can often help narrow the differential. The objective is to instill confidence in residents not only as they prepare for board exams, but also to help form differential diagnoses as they encounter orbital imaging throughout their call shifts and career.

### TABLE OF CONTENTS/OUTLINE

1. Orbital anatomy. 2. Cross-sectional imaging appearance as well as typical patient presentation/demographics and management of non-traumatic orbital pathologies. a. Inflammatory - optic neuritis, orbital pseudotumor, scleritis, thyroid orbitopathy. b. Neoplastic - optic nerve glioma, optic nerve sheath meningioma, orbital lymphoma. c. Vascular - orbital cavernous venous malformation, orbital infantile hemangioma, orbital lymphangioma.

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# Abstract Archives of the RSNA, 2024

HNEE-58

## MAGNETIC RESONANCE NEUROGRAPHY IN HEAD AND NECK: HOW TO DO AND WHAT TO VALUE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andre F. Formiga, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo Tames, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia I. Cevasco, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamim W. Handfas, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Porto Cunha, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To provide an overview of cranial nerves neuropathies and their impact on patients' quality of life.To review essential anatomical landmarks in the origin and course of the cranial nerves.To outline the magnetic resonance imaging (MRI) neurography (MRN) techniques and protocols for assessing the main cranial nerves and their branches. To elucidate the neural anatomical locations and interpret lesion findings through the analysis of a selection of over 50 cases from our service.

### TABLE OF CONTENTS/OUTLINE

IntroductionProposed study protocols with 3D PSIF and 3D STIRTrigeminal nerve protocolGlossopharyngeus, vagus, accessory and occipital major nerves protocolReview of cranial nerves anatomySensitive and motor nuclei anatomyMRI anatomy of the trigeminal nerve and its branchesMRI anatomy of the facial, glossopharyngeal, vagus, and accessory nervesNon-tumoral neural lesions MRI patterns: discontinuity, inflammation, and displacementIllustrative review of facial neuropathy casesDiscussion: limitations and conclusionsTake-Home messages

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# Abstract Archives of the RSNA, 2024

HNEE-59

## NON-ODONTOGENIC JAW LESIONS: A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pablo Garces Marin, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei Daniel Onuta, MD (*Abstract Co-Author*) Nothing to Disclose
Victoria Esteban Izquierdo, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Calero Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Jose Risco Fernandez (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Elisabetta Ponte, MD (*Abstract Co-Author*) Nothing to Disclose
Esnelly F. Berrios Bonilla, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The aim of this report is to review the various ways in which non-odontogenic jaw lesions manifest in adult and pediatric population.To describe how non odontogenic jaw lesions adjacent structures, and the best way to recognize them with their imaging characteristics at plain radiograph, ultrasound, computed tomography and resonance magnetic studies.To illustrate the main imaging features and to highlight associated injuries with-own experienced images.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Lesions 3. ConclusionNon-odontogenic jaw lesions represent a wide spectrumof pathologies that include benign inflammatory/infectious lesions, as well as more aggressive malignant lesions such as tumors.The classification of non-odontogenic mandibular lesions must be taken into account according to their histolology since they may have a hematological origin (plasmocytoma), derived from fat (lipoma), neoplastic (osteosarcoma...) etc

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# Abstract Archives of the RSNA, 2024

HNEE-6

## DETECTION OF PARATHYROID ADENOMAS AIDED BY THEIR TIME ENHANCEMENT CURVE: GETTING THE MOST OUT OF 4DCT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Steven Raeymaeckers, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Based on multiple cases we illustrate the embryology of the parathyroid glands using relevant antomical reference markers 2. Three different types of enhancement curves for parathyroid adenomas exist 3. Arterial wash-in of contrast is an effect that can be very shortlived and thus missed 4. Multiphase 4DCT allows for the contruction of time-density curves which can be used to easily detect and characterize even very small parathyroid adenomas

### TABLE OF CONTENTS/OUTLINE

1. Multiphase 4DCT: - Scanning protocol and dose - The different types of enhancement curves of parathyroid adenomas 2. Processing multiphase 4DCT images - Non rigid registration - 4D visualisation 3. Setting up a reading protocol - Embryology of the parathyroid glands using antomical references - What does the surgeon want to know?

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# Abstract Archives of the RSNA, 2024

HNEE-60

## PRACTICAL APPLICATION OF ULTRASOUND-GUIDED CERVICAL LYMPH NODE BIOPSY: TIPS AND PEARLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shi Tan (*Abstract Co-Author*) Nothing to Disclose
Yan Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Li Gang Cui, PhD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cervical lymphadenoma can be resulted from a variety of causes. It is necessary to identify the cause. Now ultrasound-guided core needle biopsy (a kind of interventional ultrasound) is generally accepted as the optimal diagnose way to make correct histopathological diagnosis in non-surgical condition. We will introduce the definition, tools, and basic methods of interventional ultrasound, and discuss the tips and pearls of ultrasound-guided cervical lymph node biopsy combing cases.After reviewing this slide presentation, participants will be able to learn: biopsy device and needle of interventional ultrasound; methods of ultrasound guidance procedure: needle-guide and free-hand biopsy; puncture approach: in-plane and out-plane biopsy; tips and pearls of ultrasound-guided cervical lymph node biopsy

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

HNEE-61

## PARRY-ROMBERG SYNDROME: HOW CAN DERMATOLOGICAL ULTRASOUND HELP? A CASE SERIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Priscilla Foster, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana Lie Taya (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Explain the importance of radiological imaging to early diagnosis and monitoring of disease progression in five patients with Parry-Romberg Syndrome; Demonstrate the efficacy of dermatological Ultrasound to detect dermatological atrophy in these patients; Compare the dermatological findings versus the radiological findings to monitor the disease progression; Describe different degrees of dermal atrophy and radiological results in between the patients of this case series.

### TABLE OF CONTENTS/OUTLINE

1. Brief overview of Parry-Romberg Syndrome (clknical manifestations and epidemiology); 2. Why imaging is important in patients with Parry-Romberg Syndrome; 3. Explain the usage of multimodality imaging (dermatological ultrasound, TC and MRI) in patients with Parry-Romberg Syndrome; 4. How we performed the evaluation of patients in this case series; 5. Provide image-rich exemples and descriptions of five patients with Parry-Romberg Syndrome who underwent radiological imaging; 6. Discuss the dermatological finding and radiological findings; 7. Point out the importante of dermatological US in patients with Parry-Romberg Syndrome; 8. Conclusion and Take Home Message

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# Abstract Archives of the RSNA, 2024

HNEE-62

## ISOLATED PATHOLOGY OF THE SPHENOID SINUS: THINK TWICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Siddhartha Gaddamanugu, MBBS (*Abstract Co-Author*) Nothing to Disclose
Andrew Ammons (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The sphenoid sinus is unique due to lack of localizing signs on physical exam and relative paucity of isolated disease compared to the other paranasal sinuses. 2. The sphenoid sinuses lies at an “anatomical crossroads”, with numerous important adjacent intracranial structures which can contribute to, or be affected by, disease. This makes the sinus a hotbed for unique and interesting pathologies which may be encountered by radiologists on imaging. In particular, CT imaging of isolated sphenoid sinus pathology can be misinterpreted as “sinusitis” due to its lower contrast resolution of identifying abnormalities in adjacent compartments. 3. While infectious and inflammatory conditions are the most common causes of sphenoid sinus pathology, other important etiologies that trainees should consider when forming their differential include vascular, neoplastic, developmental, and traumatic. Origin from nasopharynx, cavernous sinuses, pituitary, and middle skull base should be considered. A variety of such unique cases to the sphenoid sinus will be presented.

### TABLE OF CONTENTS/OUTLINE

I. Review sphenoid sinus anatomy. II. Important anatomic variants. III. Sphenoid pathologies which arise in the setting of variant anatomy including lateral cephaloceles, optic nerve canal dehiscence, etc. IV. Infectious and inflammatory pathologies including sinusitis (acute bacterial, invasive granulomatous fungal, etc.), mucocele, etc. V. Vascular pathologies. VI. Neoplastic processes (benign, e.g. pituitary adenoma, etc., and malignant, e.g. metastases, myeloma, lymphoma, nasopharyngeal carcinoma). VII. Miscellaneous Pathologies VIII. Conclusion.

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HNEE-63

## THE POSTRADIATION NECK: A PRACTICAL GUIDE FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Matheus Carlota, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Head and neck neoplasms account for 4% of tumors, with 60% of cases diagnosed in advanced stages. Radiotherapy is frequently required as treatment. All tissues in the radiation field show actinic changes. Spectrum of soft tissue and cartilage changes following radiation therapy for head and neck tumors can range from acute ( tissue edema and inflammation) to chronic fibrosis, scarring, and atrophy. Image review requires systematic evaluation in order to avoid mistakes between expected changes and tumor persistence/recurrence. Focal thickening of mucosa or solid neck mass suggest residual or recurrent tumor/nodes. Persistent or enlarged mass on baseline posttreatment scan indicates treatment failure.

### TABLE OF CONTENTS/OUTLINE

The actinic changes in follow up imaging of head and neck cancer will be summarized: Acute phase after radiotherapy:1. Changes in the skin and subcutaneous tissue: Skin thickening and densification of subcutaneous tissues. 2. Mucosal changes: Edema of the laryngeal mucosa, notably supraglottis 3. Glandular alteration: Hyperenhancement and hypertrophy of the submandibular glands Chronic phase after radiotherapy:1. Glandular alteration: Atrophy of the submandibular, parotid and thyroid glands, Glandular liposubstitution; 2. Mucosal changes: Reduction of laryngeal thickening; 3. Change in the cricoid cartilage; 4. AtherosclerosisComplication after radiotherapy: 1. Jaw osteoradionecrosis; 2. Encephalic osteoradionecrosis

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# Abstract Archives of the RSNA, 2024

HNEE-64

## HOW CAN MULTIMODALITY IMAGING AND HISTOPATHOLOGIC CORRELATION DECODE PARATHYROID DISEASE?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Arianne Idaly Ramos Galvan, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana De Los Ssantos Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Juan P. Chavez Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Veronica Espinoza Cruz (*Abstract Co-Author*) Nothing to Disclose
Axel A. Torres Monarrez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Provide an overview of different imaging modalities used in parathyroid disease.• Emphasize the indications, limitations, and benefits of different imaging modalities evaluating the parathyroid gland.• Become familiar with descriptive terms for normal parathyroid gland in radiology.• Review the most common pathologies and provide case studies to illustrate the practical application of theoretical concepts.• Analyze differential diagnoses, tips, and tricks.• Discuss updates in imaging evaluation for parathyroid gland pathology.

### TABLE OF CONTENTS/OUTLINE

- Overview of Different Imaging Modalities Used in Radiology
- Discuss the evolution of these modalities and their increasing importance in modern medicine.
- Emphasize the Indications, Limitations, and Benefits of Different Imaging Modalities Evaluating the Parathyroid Gland
- Comparison of imaging techniques for the parathyroid gland: ultrasound, 4DCT, and SPECT/CT.
- Descriptive Terms for Normal Parathyroid Gland in Different Imaging Modalities
- Common Pathologies in the Parathyroid Gland
- Discuss parathyroid adenoma, multiglandular parathyroid disease, parathyroid carcinoma, atypical parathyroid adenoma, and metastasis in parathyroid gland.
- Analyze the Differential Diagnoses, Tips, and Tricks in Different Imaging Modalities
- Discuss Updates in Imaging Evaluation for Parathyroid Gland Pathology
- Explore future trends or emerging technologies in this field.
- Conclusion

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HNEE-65

## A JOURNEY THROUGH THE INNER EAR: EXPLORING ANATOMY AND PATHOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Gredilla (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Juan S. Martinez San Millan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Montserrat Medina Diaz, PhD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Alba Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Juan V. Quintana Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize and understand the normal anatomy of the inner ear.- Review the technical aspects of MRI to study the anatomy of the inner ear and the essential sequences for each pathology.- Identify the key diagnostic features of main acquired inner ear pathologies by correlating different imaging techniques such as CT and MRI.

### TABLE OF CONTENTS/OUTLINE

1. Anatomy and physiology of the inner ear.2. Technical aspects: MRI protocol.3. Review of acquired pathology of the inner ear by a case-based approach learning.3.1 Inflammatory-infectious pathology: Labyrinthitis. 3.1.1 Diagnostic Keys and value of the FLAIR sequence.3.1.2 Differential Diagnosis with labyrinthitis ossificans and carcinomatous meningitis.3.2 Endolymphatic hydrops. 3.2.1 MRI protocol 3.2.2 Diagnostic criteria.3.2.3 Classification systems.3.3. Otospongiosis.3.3.1 MRI findings and correlation with other imaging techniques (CT).3.4 Vestibular Schwannoma. 3.4.1 Characteristic Findings. 3.4.2. Differential Diagnosis (cerebellopontine angle meningioma, epidermoid cyst).3.5. Peripheral facial paralysis.3.5.1 Bell palsy vs neoplastic palsy.3.6 Traumatic injury. 3.6.1 Labyrinthitis ossificans as a sequel to trauma.3.6.2 Intralabyrinthine haemorrhage.3.7 Miscellany: 3.7.1 Fibrous dysplasia.3.7.2. Osteogenesis imperfecta.3.7.3. Paget´s disease.4. Conclusion

RSNA 2024
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# Abstract Archives of the RSNA, 2024

HNEE-66

## IMMUNOTHERAPY FOR HEAD AND NECK ONCOLOGY: A PRIMER FOR RADIOLOGISTS. MECHANISMS, TREATMENT PARADIGMS, AND IMAGING EVALUATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alexander M. Khalaf, MD (*Abstract Co-Author*) Nothing to Disclose
Susana Calle, MD (*Abstract Co-Author*) Nothing to Disclose
Kim Learned, MD (*Abstract Co-Author*) Nothing to Disclose
Samir Dagher, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Dagher, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) To highlight the key mechanisms of small molecule and monoclonal antibodies, immune-checkpoint inhibitors (ICIs), CAR-T cells transfer therapy and T-VEC oncolytic virus. 2) To review the response evaluation guidelines for immunotherapy (iRECIST, imPERCIST). 3) To illustrate the immunotherapy tumor response patterns and their role in treatment paradigm and perioperative management. 4) To discuss clinical evaluation and recognize imaging findings for immunotherapy-related adverse events

### TABLE OF CONTENTS/OUTLINE

1) Mechanism of action of targeted antibodies. a) Small molecules versus monoclonal antibodies: nomenclature and actions. b) Tyrosine Kinase Inhibitor, BRAF and MEK inhibitors in BRAF V600 mutation tumor. c) EGFR, CD20 monoclonal antibodies. 2) Mechanisms of action of ICIs. a) Cytotoxic T-lymphocyte antigen-4 (CTLA-4) Inhibitors. b) Programmed death-1 (PD-1) and programmed death ligand-1 (PD-L1) pathway inhibitors. 3) Mechanism of action of CAR-T cell and T-VEC. 4) Current applications of immunotherapy in curative, palliative, neoadjuvant and adjuvant treatment paradigms. 5) Response evaluation guidelines. a) RECIST 1.1 vs iRECIST. b) PERCIST 1.0 vs imPERCIST. 6) Atypical patterns of response to immunotherapy. a) Pseudoprogression. b) Hyperprogression. c) Dissociated response. d) Durable response. 7) Imaging of common immune-related adverse events. a) Skin rash, pneumonitis, sarcoidosis. b) Thyroiditis. c) Hypophysitis, encephalitis, CNS vasculitis. d) Immune effector cell-associated neurotoxicity syndrome (ICANS)

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# Abstract Archives of the RSNA, 2024

HNEE-67

## IMAGING OF THE CEREBELLOPONTINE ANGLE: PRACTICAL ANATOMY AND CASE-BASED DIAGNOSTIC APPROACHES FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mehmet Simsar, MD (*Abstract Co-Author*) Nothing to Disclose
Yeliz Pekcevik, MD (*Abstract Co-Author*) Nothing to Disclose
Yesim Y. Yuruk, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Provides a comprehensive overview of the radiologic anatomy of the cerebellopontine angle (CPA) • Describes a practical approach for localizing the pathologies affecting the CPA • Reviews common and rare pathologies in the CPA using case-based examples, highlighting clinical and imaging features that can aid in the best diagnosis

### TABLE OF CONTENTS/OUTLINE

1. The cerebellopontine angle anatomy and structures 2. Classification of the CPA tumors based on imaging features 3. Case-based review of the CPA tumors using signal intensities and contrast-enhancement features Outline • Knowledge of anatomy and structures is essential for describing a lesion in the CPA. • Understanding the contents and common/rare lesions of CPA is the first step in generating a differential diagnosis. • Obtaining relevant clinical history and recognizing specific imaging appearances can help provide the best diagnosis.

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# Abstract Archives of the RSNA, 2024

HNEE-68

## LEUKEMIA AND HEAD AND NECK: MORE THAN NODES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Diego Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Rainer G. Haetinger, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia M. Mello (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is: ; To review the epidemiology, clinical scenarios and imaging features of head and neck leukemia manifestations; ; To demonstrate the spectrum of pathologies associated with leukemia affecting head and neck strutures; ; To emphasize key imaging features to narrow the differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

; Introduction - Epidemiology - Clinical scenarios ; Typical imaging features of head and neck leukemia manifestations ; Series of cases of leukemia manifestations on head and neck; ; Differential diagnosis; ; Take-home messages.

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# Abstract Archives of the RSNA, 2024

HNEE-69

## IMAGING REVIEW OF OPTIC PERINEURITIS AND OPTIC NEURITIS WITH DIFFERENTIAL DIAGNOSIS CONSIDERATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gavin Wu, BA (*Abstract Co-Author*) Nothing to Disclose
Mohammad T. Shujaat, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Optic neuritis and perineuritis can present as common clinical manifestations of CNS inflammation related to a wide variety of autoimmune, infectious or demyelinating etiologies. However, while these pathologies may present with similar clinical and imaging findings, their disease course and treatment can differ. It is important for radiologists to distinguish between these pathologies and other non-inflammatory mimics to facilitate proper diagnosis and guide appropriate treatment. Our exhibit will demonstrate diagnostic clues, which will include imaging patterns and enhancement distribution and systemic involvement, to help in differentiating etiologies and formulate a clinically relevant differential diagnosis. As such, our teaching points will be to: 1. Review the relevant anatomy of the orbit, optic nerve and optic nerve sheath. 2. Examine inflammatory manifestations of the optic nerve complex and present the main imaging features of these pathologies. 3. Recognize and distinguish the spectrum of other optic nerve complex inflammatory etiologies with similar presentations.4. Highlight the importance of distinguishing these pathologies to facilitate proper diagnosis and guide appropriate treatment plans.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Inflammatory Manifestations In the Orbit 3. Importance of Differential Considerations 4. Optic Nerve-Sheath Complex Pathologies and Mimics 5. Summary and Conclusions

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# Abstract Archives of the RSNA, 2024

HNEE-7

## NORMAL INNER EAR ANATOMY AND COCHLEAR MORPHOMETRY FOR CONGENITAL INNER EAR MALFORMATION DIAGNOSIS AND COCHLEAR IMPLANT CANDIDACY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Savith Kumar, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Aysha Tamanna, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A thorough understanding of inner ear anatomy is important for diagnosing congenital inner ear malformations, interpreting imaging of this area, and providing essential preoperative information about the inner ear and the vestibulocochlear nerve. Pre-operative cochlear morphometry is pivotal for patient selection to rule out conditions that would make surgery impossible or that could compromise the procedure and to decide on the devices and access.

### TABLE OF CONTENTS/OUTLINE

Pictorial representation of cochlea with its external and internal architecture, vestibule, semicircular canals, and internal auditory canal with their internal architecture and contents.Protocol and methods for morphometric analysis of cochlea including cochlear base diameter, cochlear duct length, diameter of each cochlear turns, cochlear height, cochlear aperture, cochlear rotation, internal auditory canal diameter, distance from vertical facial nerve to posterior annulus and to mastoid cortex and caliber of facial and cochlear nerves using computed tomography and magnetic resonance imaging along with the normal range of parameters and implication of each parameter prior to surgery.Approach to diagnosis of inner ear malformations including complete labyrinthine aplasia, cochlear aplasia, cochlear hypoplasia and types, common cavity, incomplete partition and types, enlarged vestibular aqueduct, cochlear aperture abnormalities, vestibular and semicircular canal malformations, inner ear anomalies and vestibulocochlear nerve anomalies with radiological and hand drawn illustrations.

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# Abstract Archives of the RSNA, 2024

HNEE-8

## CHRONIC RHINOSINUSITIS: CURRENT CONCEPT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Osamu Sakai, MD, PhD (*Abstract Co-Author*) Consultant, Boston Imaging Core Lab LLC
Inseon Ryoo, MD (*Abstract Co-Author*) Nothing to Disclose
Naoki Takemasa (*Abstract Co-Author*) Nothing to Disclose
Ryohei Kuwatsuru, MD (*Abstract Co-Author*) Nothing to Disclose
Naoko Saito, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Chronic rhinosinusitis (CRS) has been classified into CRS without nasal polyps (CRSsNP) and CRS with nasal polyps (CRSwNP). The previous classification system was based on the phenotype, whereas the current system is based on anatomical distribution and endotype dominance. The current system can predict the severity of disease and lead to the optimal personalized treatment. Since the current concept has become the foundation for daily practice, radiologists need to be familiar with this classification system. The teaching points are: 1. To describe the current changes in the classification of CRS 2. To become familiar with the inflammatory mechanisms of CRS 3. To review imaging features of various CRS based on current classification

### TABLE OF CONTENTS/OUTLINE

1. Definition of CRS 2. Various classification systems of CRS a. Previous classification b. Based on EPOS2020 (European Position Paper on Rhinosinusitis and Nasal Polyps) c. Based on ICAR-RS-2021 (International Consensus Statement on Allergy and Rhinology: Rhinosinusitis) 3. Inflammatory mechanisms of CRS a. Type 2 response b. non-Type 2 response 4. Review of imaging and clinical features of CRS based on current classification a. Primary CRS: AFRS (allergic fungal rhinosinusitis), eCRS (eosinophilic CRS), CRSwNP, CCAD (central compartment allergic disease), non-eCRS, isolated sinusitis b. Secondary CRS: odontogenic, fungal ball, GPA (granulomatosis with polyangiitis), eGPA (eosinophilic GPA), primary ciliary dyskinesia

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# Abstract Archives of the RSNA, 2024

HNEE-9

## FOLLOW YOUR NOSE - ULTRASOUND ROLE IN THE AESTHETIC RHINOMODELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Matheus Taborda, MD (*Abstract Co-Author*) Nothing to Disclose
Joao P. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana A. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Sampaio, MD (*Abstract Co-Author*) Nothing to Disclose
Luis R. Ferreira (*Abstract Co-Author*) Nothing to Disclose
Nathalia Bonmann, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Da Silva Eli, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The amount of aesthetic rhinomodelation procedures has significantly increased in the past decades. This procedures are not risk-free, with associated complications such as accidental injection of fillers into the arterial branches that supply the nose. Consequently, high-frequence nasal ultrasonography (US) has emerged to help in the pre-procedural setting to assess the nasal anatomy and its variants in detail. Additionally, the US is capable of providing a detailed mapping of previously injected fillers, each one with specific imaging features.1. Review the structural anatomy of the nasal region on ultrasound;2. Detail the different types of materials used in non-surgical rhinoplasty;3. Evaluate the role of ultrasonography in the safety of rhinomodelation procedures 4. Review the ultrasound appearance of the most commonly used fillers.5. Elaboration of a facial map encompassing the different procedures and fillers used.

### TABLE OF CONTENTS/OUTLINE

1. Introductiona. US nasal anatomyb.Clinical application of US to aesthetic procedures of the nosec. Main arteries that supply the nosed. Arterial variants that should be reported to increase procedure safety2. Fillersa. Differences between the main types of fillersb. Ultrasound appearance of fillers;c. Different roles and objectives of fillers in each nasal region.3. Extensive pre - and post procedure US imaging, including possible complications4. Elaboration of the nasal ultrasound report - What the dermatologists need to know.5. Take-home messages

# Abstract Archives of the RSNA, 2024

INEE

**Imaging Informatics Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## INEE-1 WHAT IS A DIFFUSION MODEL? CONTRIBUTION TO MEDICINE USING CUTTING-EDGE TECHNOLOGY

Atsushi Teramoto, PhD (*Abstract Co-Author*) Nothing to Disclose
Noritaka Yoshioka (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Generative AI models, which have fueled the recent AI boom, are coming into their own in various fields. The medical field is no exception. Generative AI models are improving the accuracy and reliability of conventional AI models, enabling pathologists to make more accurate diagnoses and reduce their workload. This exhibition aims to teach the idea of the diffusion model, which is attracting more attention than any other generative AI model, and to show how it will contribute to the future development of medicine.

### TABLE OF CONTENTS/OUTLINE

Table of Contents1. Why diffusion models are attracting attention based on the challenges of conventional generative models2. Basic ideas of diffusion models3. What is possible with the diffusion model and examples of medical applicationsOutline1.Why the diffusion model? 2.Basis of the diffusion model- Forward method- Reverse method 3.What the diffusion model can do- Scope of application of diffusion model- Medical Applications

## INEE-10 REFOCUSING ON THE STEREOSCOPIC DISPLAY USING PHOTO-REALISTIC 3D-CT IMAGES AND CT COLONOGRAPHY

Hiroki Kawashima, PhD (*Abstract Co-Author*) Kyoto kagaku, Research collaboration
Katsuhiro Ichikawa, PhD (*Abstract Co-Author*) Nothing to Disclose
Shiori Yamashita, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Existing types of stereoscopic display for medical imaging. - Understand the limitations of stereo viewing with the conventional volume rendering (VR) images. - Explore the principles of photorealistic VR and its applications to three dimensional (3D) CT images and CT colonography. - Effectiveness of stereoscopic displays with polarized glasses using photorealistic VR (PRVR) images. - Experience of stereo viewing with PRVR images using the demonstration system of this exhibit.

### TABLE OF CONTENTS/OUTLINE

Introduction - Background of stereo display in medical imaging. - Motivation for refocusing on the stereo display using PRVR images. Methods - A new algorithm for realizing very fast rendering photorealistic 3D image and its specialization for stereo viewing with precise shading and shadowing using multiple light sources. - Measurements of the rendering speed. - Visual comparison between stereo viewings using conventional VR (CVR) and PRVR for depth perception and overall visiblility (observers: three radiological technologists with experiences of clinical 3D-CT image producing). Results - Rendering speed: approximately 25 ms per stereo frame. - Visual comparison: all observes rated the maximum score (PRVR >> CVR) - Demonstration of PRVR stereo images (Please manipulate the demonstration system.) Discussion - The PRVR's photo-reality, with its faithful shading and shadowing, was more emphasized on the stereo display. - Operational facility due to the photo-reality and fast rendering. - Future directions and potential applications. Conclusion - Photorealistic VR images ensured the usefulness of stereoscopic displays. - Potential clinical significance and implications for patient care.

## INEE-11 A RADIOLOGISTS PERSPECTIVE OF GROUNDBREAKING ADVANCEMENTS IN LARGE LANGUAGE MODELS: PAST, PRESENT AND FUTURE

Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Syed Muhammad Awais Bukhari, MD (*Abstract Co-Author*) Nothing to Disclose
Orlando M. Martinez (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Discuss the basics of LLMs and their utility within radiology • Explore the major breakthroughs and updates over this past year • Showcase the current LLMs available on the market o Compare and contrast the most popular options o Discuss strengths and weakness of each o Highlighting specific use cases of interest to radiologists

**TABLE OF CONTENTS/OUTLINE**

1. What is a Large Language Model (LLM) and why should we care? a. Brief history of LLMs b. Recent news headlines/articles c. Recently published radiology journal articles highlighting LLMs 2. Major breakthroughs in LLMs a. Emphasis on ChatGPT's breakthroughs and how other companies are following suit b. Multimodality LLMs c. Improvements in accuracy/precision 3. Examples of the top used LLMs that are currently available a. General chat engines vs trainable models b. Compare and contrast differences between LLMs c. Highlight strengths and weaknesses d. Explain best LLM for specific use cases (writing papers, research, education, etc?) 4. Biggest barriers for introduction of LLMs into radiology a. Discuss cases of how people/institutions have circumvented these barriers b. Explore potential pathways forward 5. Near Horizon and future of LLMs a. Rise of open source LLMs more compatible for medical use (HIPAA compliant) b. Enterprise based LLMs (company-specific) c. Improved accuracy and speed with new technological advancements (Self fact-checking) d. Artificial general intelligence

## INEE-12 STREAMLINING SUCCESS: ENHANCING RADIOLOGY READING ROOM EFFICIENCY WITH AUTOMATED PYTHON PIPELINES

Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Syed Muhammad Awais Bukhari, MD (*Abstract Co-Author*) Nothing to Disclose
Richard L. Barger JR, MD (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Discuss the integration of basic python coding to enhance radiology workflow in the reading room
- Compare and contrast the utility of python coding to large language models (LLMs)
- Showcase existing tools and future ideas
- Demonstrate how large language models can help radiologists with no programming background create useful tools

**TABLE OF CONTENTS/OUTLINE**

1. What is Python? a. Historical perspective b. Usage in fields including medicine. c. Appeal of Python in clinical settings due to simplicity and community support. 2. Compare and contrast Python vs LLMs 3. Capabilities of Python and useful downloadable packages a. PyAutoGUI, tkinter, EasyOCR, PyperClip for custom UI based programs b. NumPy, SciPy, and Pandas for data manipulation c. PyDicom for DICOM files handling. 4. Examples of programs using these packages a. AI generated output to final report (decode AI output into report verbiage) b. Copy forward tool (automate transfer of historical findings into new reports to save time) c. Updating comparisons on reporting software (import dates for past images that have been reviewed) d. Input series/image numbers with keybind (insert image series number and slice number into report for referencing) e. Manipulating PACS (look at a series number and slice number on a report, and directly open up to that image) 5. Implementation in clinical practice: a. Challenges/Barriers: i. Steep learning curve for non-programmers ii. System compatibility issues iii. Cultural shift required in adopting new technologies b. Solutions i. Education ii. Phased implementation iii. Involving IT support 6. Future of python coding 7. Tutorial for Non-programmers a. Installation guide b. Downloading packages c. Programming with LLMs

## INEE-13 STREAMLINING MEDICAL IMAGE ANNOTATION: MITK'S AI POWERED WORKFLOW FOR EFFICIENT SEGMENTATION TASKS

**Awards**
**Certificate of Merit**

Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Marco Nolden (*Abstract Co-Author*) Nothing to Disclose
Ralf Floca (*Abstract Co-Author*) Nothing to Disclose
Stefan Dinkelacker (*Abstract Co-Author*) Nothing to Disclose
Ashis Ravindran, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The Medical Imaging Interaction Toolkit (MITK) is a well-established open-source software for interactive medical image processing applications. Amongst others MITK showcases a feature rich toolkit for medical image segmentation, integrating state-of-the-art AI tools to enhance the accuracy and efficiency of segmentation tasks. Utilizing these tools, the MITK Workbench facilitates users to generate instance or semantic image segmentations to produce high quality annotations for supervised learning tasks or medical image analysis. MITK offers, besides classical tools, a user-friendly interface to popular interactive AI models like the Segment Anything Model MedSAM for interactive image segmentation, making it accessible adding 3D support. MITK also offers easy access to the ML-based automatic segmentation algorithms Totalsegmentator nnUNet. In addition, MITK also covers the gamut of MONAI world via its support of MONAI Label app. The available tools are also enhanced by interpolation options and support for 3D+t images. Additionally, MITK introduces the Segmentation Task Lists, an optimized workflow for batches of segmentation tasks based on user-defined task lists. This feature significantly streamlines annotation and review processes, allowing for efficient management of multiple segmentation tasks. Overall, by leveraging AI, MITK offers a comprehensive solution for medical image segmentation, enhancing the accuracy efficiency of medical imaging analysis.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. General segmentation tools 3. AI Segmentation tools 4. MONAI Label 5. Utilities 6. Segmentation Tasks Lists 7. Integration in annotation workflows 8. Conclusion and Future directions

## INEE-14 NOT MAGIC, MATHEMATICS! A RADIOLOGIST'S VISUAL GUIDE TO PERFORMANCE METRICS IN AI RESEARCH

Leticia M. Pessanha Alves, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

As Artificial Intelligence integration deepens within the radiology field, it becomes essential for radiologists to become familiar with the performance metrics of Machine Learning Models. This familiarity is not just crucial for the application but also for the critical evaluation of AI tools in clinical settings. However, the complexity of the mathematical concepts involved can present a significant barrier. This education exhibit aims to simplify these concepts through visual aids and correlate them with specific radiological tasks, making the information more accessible and comprehensible.

**TABLE OF CONTENTS/OUTLINE**

1. Types of Machine Learning applications in radiology and their corresponding performance metrics; 2. Accuracy; 3. Confusion Matrix; 4. Specificity; 5. Recall; 6. Precision; 7. F1-score; 8. ROC curve / AUC; 9. Dice Score; 10. Mean Absolute Error

## INEE-15 EMERGING HORIZONS: FDA-APPROVED AI TECHNOLOGIES IN ABDOMINAL IMAGING - PIONEERING PRECISION, REDEFINING PRACTICE

Panagiotis Korfiatis, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrew Missert, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan Dillard (*Abstract Co-Author*) Nothing to Disclose
Ashish R. Khandelwal, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy L. Kline, PhD (*Abstract Co-Author*) Nothing to Disclose
Pranav Ajmera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•Introduce the evolution of artificial intelligence (AI) in radiology, specifically focusing on its application to abdominal imaging. • Examine the FDA approval process for AI-driven medical devices and tools, highlighting the rigorous measures in place to ensure safety and efficacy. • Overview of existing FDA-approved AI technologies in abdominal imaging, detailing their applications across the liver, biliary system, intestine, prostate, kidney, bladder, and vascular imaging. • Impact of AI technologies on diagnostic accuracy, workflow optimization, patient care, and explore future directions for AI in abdominal radiology.

### TABLE OF CONTENTS/OUTLINE

Introduction • Overview of the transformative alliance between radiology and AI in modern medicine.FDA Approval Process• Explanation of the revamped FDA approval pathway for AI-driven software as medical devices in radiology.• Discuss the challenges and adaptations required for evaluating AI algorithms under the FDA's regulatory framework.Organ-Specific AI Applications • Utilize an organ-specific approach to examine FDA-approved AI technologies. • Overview of AI solutions, including their functionalities, applications, and impact on clinical practice. • Analysis of AI-driven advancements in image quality, noise reduction, longitudinal comparison, and anatomical descriptors across multi-organ systems.Limitations • Elaborate on data privacy, algorithmic bias, need for ongoing validation and monitoring.Conclusion • Reflect on the paradigm shift in healthcare due to AI and the importance of transparent collaboration between developers, regulatory bodies, and the medical community for ascertaining ethical, patient-safe usage.

## INEE-16 UNLOCKING HIDDEN INSIGHTS: LEVERAGING AI FOR OPPORTUNISTIC SCREENING IN RADIOLOGY

Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Seyed Mohammadreza Chavoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Theodorus Dapamede, MD, PhD (*Abstract Co-Author*) Intern, MARS BioImaging Ltd
Amirali Khosravi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the concept and potential benefits of opportunistic screening in radiology.2. Explore current applications of AI-driven opportunistic screening and their impact on patient care.3. Identify challenges and ethical concerns associated with the implementation of opportunistic screening.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Opportunistic Screening and AI in Radiology (a). Defining opportunistic screening and its role in early disease detection (b). Current trends and advancements in AI-assisted opportunistic screening research 2. Applications of AI-Driven Opportunistic Screening (a). General approaches to opportunistic screening using AI (b). Case studies: AI-based opportunistic screening using direct signal processing (c). Case studies: AI-based opportunistic screening using surrogate signal processing 3. Future Directions and Challenges (a). Expanding AI-based opportunistic screening to other diseases and imaging modalities (b). Collaborating with healthcare providers to optimize patient care and integrate AI-based screening into clinical workflows 4. Ethical Considerations (a). Informed consent and patient autonomy in the context of opportunistic screening (b). Potential misuse of AI-generated information by third parties (e.g., insurance companies) (c). Ensuring equitable access to AI-based screening technologies across diverse patient populations 5. Conclusion (a). Recap of the potential benefits and challenges of AI-driven opportunistic screening in radiology (b). Future directions for research and implementation to enhance patient care and outcomes

## INEE-17 LARGE LANGUAGE MODELS FOR RADIOLOGISTS: A STEP-BY-STEP PRIMER FOR EFFECTIVE USE

David A. Woodrum, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pouria Rouzrokh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Shahriar Faghani, MD (*Abstract Co-Author*) Nothing to Disclose
Mana Moassefi, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaz Vahdati, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Ganjizadeh, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

I. The Power of Context: LLMs vs. String Search: Unlike string search, which is limited to exact word matches, LLMs excel at grasping context and summarization. This makes them indispensable for tasks that require a deeper understanding of a text, such as identifying tumor recurrences or excluding false positives in radiology reports - particularly in retrospective studies.II. The Art of Crafting Effective Prompts for LLMs: The quality of your prompts can make all the difference in the output of your LLM. You can significantly influence the model's response by asking the right questions and providing clear instructions. To take it to the next level, combine effective prompting with reinforcement learning and human feedback (RLHF) to achieve the desired outcomes.III. Simplifying PHI Protection with Low-Code/No-Code Solutions: By leveraging no-code tools like Ollama, Llamafile, or GPT4all, you can run open-source models like LLaMA3 or Mixtral on your workstation, ensuring HIPAA compliance without massive computation power.

### TABLE OF CONTENTS/OUTLINE

I. LLMs vs. String Searcho Limitations of String Search: Understanding the limitations of exact word matcheso The Advantages of LLMs: context understanding and summarizationo Real-World Applications: Identifying tumor recurrences, excluding false positives in radiology reportsII. Crafting Effective Prompts for LLMso How prompts influence LLM outputo Strategies for asking the right questions and providing clear instructionso Taking it to the Next Level: Combining effective prompting with RLHFIII. Simplifying PHI Protection with Low-Code/No-Code Solutionso Running Open-Source Models Locally

## INEE-18 CLINICAL IMPLEMENTATION OF AI TOOLS: THINKING BEYOND FDA APPROVAL

**Awards**
**Certificate of Merit**

Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Abstract Co-Author*) Nothing to Disclose
Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Syed Muhammad Awais Bukhari, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the journey of AI from bench to bedside 2. Know about the importance of clinical implementation of AI tools utilizing a sample workflow 3. Understand how to overcome challenges associated with the clinical deployment of AI

### TABLE OF CONTENTS/OUTLINE

1. AI Use Cases in Radiology o Classification o Segmentation o Localization o Preprocessing o Detection o Prediction 2. Journey of an AI tool: From Bench to Bedside o Identification of a Clinical Problem o Dataset Selection o Dataset Preparation o Algorithm development and training o Clinical Implementation and Monitoring 3. FDA approval process o FDA oversight (ensure compliance, including premarket review, risk classification, and post-market surveillance.) o Software as a Medical Device (SaMD) o Risk Classification and Premarket approval (Most radiology tools fall under Class II or III, requiring premarket approval) o Federated learning (data privacy-preserving method for AI tool training) o Adaptive Learning (regulatory framework for adaptive AI models, ensuring they meet initial and ongoing standards) 4. Clinical Deployment of AI: Basic steps and Clinical applications o Knowing the availability of resources and strengths of the radiology system o Identifying and addressing the needs of your system o Creating unique workflows o Performance monitoring of AI o Involving clinical teams o Dealing with increasing complexities

## INEE-19 PIXEL-PERFECT PROTECTION: CYBERSECURITY TACTICS FOR RADIOLOGISTS

Tatiana C. Tucunduva, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Domingos De Sousa (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understanding Cyber Threats in Radiology highlights the range of cyber threats like ransomware and data breaches targeting radiology, aiming to increase awareness of system vulnerabilities.- Principles of Secure Data Management emphasize encrypting patient data and images, secure access, and regular backups to protect data's confidentiality, integrity, and availability.- Incident Response and Recovery Planning details steps for radiology departments to prepare for cyber incidents, including detection, containment, and recovery, emphasizing effective communication.

### TABLE OF CONTENTS/OUTLINE

- Introduction to Cybersecurity in Radiology offers an overview of cybersecurity's importance and challenges in radiology.- Common Cyber Threats and Vulnerabilities in Radiology explores cyber threats specific to radiology departments.- Fundamental Cybersecurity Practices for Radiologists introduces basic cybersecurity measures like strong passwords and secure internet practices.- Advanced Data Protection Techniques covers sophisticated strategies like encryption and anonymization of patient data.- Legal and Regulatory Considerations provides an overview of data protection laws in healthcare.- Developing a Cyber Resilient Culture in Radiology Departments discusses fostering cybersecurity awareness through training and simulations.

## INEE-2 USING ANATOMICAL SEGMENTATION ALGORITHMS FOR CONTEXT-SENSITIVE CT IMAGING RECONSTRUCTION

Nathalie Mertens (*Abstract Co-Author*) Nothing to Disclose
Peter De Jaeger, PhD (*Abstract Co-Author*) Nothing to Disclose
Kristof De Smet, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Thomas Ryckaert (*Abstract Co-Author*) Nothing to Disclose
Stijn Schatteman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

CT imaging workflows frequently entail the review of multiple reconstructions of the same anatomical region, customized to distinct structures. This process involves manipulating various image windows and applying different kernel reconstructions, which can be time-intensive.Context-Sensitive reconstruction represents an innovative method designed to alleviate this burden. Employing anatomical segmentation algorithms, this technique accurately identifies and delineates diverse organs and tissues within a standard CT scan. Subsequently, it adjusts reconstruction settings specific to each anatomical structure, including tailored windowing, kernel selection. This methodology was initially proposed by S. Dorn et al. in 2018.By enabling a single comprehensive image that integrates all necessary reconstructions, this approach significantly reduces redundancy. Context-Sensitive reconstruction not only streamlines the interpretation process but also enhances efficiency and diagnostic precision in CT imaging.We outline a practical application of this method using the MONAI framework. Utilizing the publicly accessible "total segmenter" tool by J. Wasserthal et al., we generate segmentation maps that inform customized reconstruction settings for each anatomical structure, culminating in a unified image.

### TABLE OF CONTENTS/OUTLINE

1) An overview of common reconstruction parameters.2) Introduce the concept of context-Sensitive reconstruction to streamline CT imaging interpretation.3) Demonstrate the practical implementation process using freely available tools.4) Case studies to illustrate the potential benefits and limitations of this technique in clinical settings.

## INEE-20 AN OVERVIEW OF THE APPLICATIONS OF ARTIFICIAL INTELLIGENCE/MACHINE LEARNING IN MEDICAL IMAGING AND THE PROCESS OF DEVELOPING SUPERVISED LEARNING MODELS

William Fan (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This education exhibit presentation covers some use-cases based on supervised machine learning models for medical imaging and provides a brief rationale for the impact of artificial intelligence in healthcare.It goes on to present a broad overview of the steps involved in the development of supervised machine learning projects, from problem selection all the way to model deployment and monitoring.An in-depth diagram describing the roles of different datasets used in the development process of a supervised model is also displayed.Finally, a mini-glossary with some of the key terms for projects of machine learning in healthcare is also presented.

**TABLE OF CONTENTS/OUTLINE**

1) Will artificial intelligence replace or augment doctors?2) Use-cases based on supervised machine learning in medical imaging3) Development steps of supervised machine learning (ML) models4) Overview of datasets involved in a supervised machine learning diagnostic algorithm5) Mini-glossary of technical terms for projects of machine learning in healthcare

## INEE-21 STANDARDIZING IMAGING FINDINGS REPRESENTATION: HARNESSING COMMON DATA ELEMENTS SEMANTICS AND FAST HEALTHCARE INTEROPERABILITY RESOURCES STRUCTURES

**Awards**
**Certificate of Merit**

Marc D. Kohli, MD (*Abstract Co-Author*) Founder, Alara Imaging;Stockholder, Alara Imaging
Teri M. Sippel Schmidt, MS (*Abstract Co-Author*) Nothing to Disclose
Kevin O'Donnell (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Brian Bialecki (*Abstract Co-Author*) Nothing to Disclose
Tarik K. Alkasab, MD, PhD (*Abstract Co-Author*) Consultant, Nuance Communications, Inc;Medical Advisory Board, Nuance Communications, Inc
Ali S. Tejani, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Introduce joint Radiological Society of North America (RSNA)/American College of Radiology (ACR) Common Data Elements (CDEs) project 2. Outline the emerging framework using CDEs as the semantic labels on standard FHIR structures 3. Review relationship between CDE Sets/Elements and radiology finding attributes 4. Review examples of findings encoded as Health Level 7 Fast Healthcare Interoperability Resources (HL7 FHIR) Observations using CDE Set/Element identifiers as standardized semantic labels ?

**TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Limitations of integrating information in radiology reports i. Heterogeneous reporting styles ii. Absence of a uniformly accepted standard for structured data iii. Difficult to extract meaningful insight at scale b. Introduce joint RSNA/ACR CDE project c. Introduce Health Level 7 Fast Healthcare Interoperability Resources (HL7 FHIR) d. Role of standard ontologies i. RadLex ii. SNOMED CT iii. LOINC 2. Propose CDEs as a Data Model and review terminology a. Hierarchy of Sets/Elements/Values b. Role of Set/Element IDs c. Structure of a Set Definition d. Representing CDE Sets/Elements with HL7 FHIR Observations 3. "Anatomy" of an observation encoded as a CDE 4. Specific use cases demonstrating model in practice a. Example coding structures for radiology findings i. Pulmonary nodule (RDES195) ii. CT Stroke (RDES22) iii. Acute diverticulitis (RDES138) b. Longitudinal tracking of findings over time c. AI result integration and monitoring

## INEE-22 POST DEPLOYMENT MONITORING AND POST-MARKET SURVEILLANCE IN RADIOLOGY AI: CURRENT PRACTICES, POSSIBILITIES, AND MANDATES

Abhishek Gupta (*Abstract Co-Author*) Employee, CARPL.ai
Vasantha Kumar Venugopal, MD (*Presenter*) Officer, CARPL.AI Inc

**TEACHING POINTS**

1. Continuous monitoring is crucial for ensuring that AI tools perform reliably and safely after deployment, aligning with both clinical needs and regulatory standards. 2. Critical metrics such as temporal stability and predictive divergence provide insights into an AI system's reliability and the necessity for periodic recalibration 3. Differentiating between what is currently required by law and what practices could be implemented to further enhance AI monitoring 4. Exploring how different levels of human involvement in monitoring (in-the-loop, out-of-the-loop, over-the-loop, on-the-loop) can impact the effectiveness and efficiency of AI systems 5. Identifying and addressing the practical challenges in implementing effective AI surveillance, including technological, operational, and regulatory hurdles

**TABLE OF CONTENTS/OUTLINE**

Current Monitoring Practices in Radiology AI: Detailed examination of human-in-the-loop and human-out-of-the-loop systems.Use of human-over-the-loop and human-on-the-loop as supervisory and alert-based monitoring methods.Potential Advancements in AI Surveillance: Innovations in AI monitoring techniques that could enhance efficacy and safety. Discussion of predictive analytics and automated systems for real-time anomaly detection.Regulatory Frameworks and Mandatory Practices: Overview of global regulatory mandates for AI monitoring in healthcare.Specific requirements for continuous monitoring and performance reporting.Challenges and Solutions in Implementing Effective Surveillance

## INEE-23 CLINICAL CONTEXT-BASED WORKFLOW AUTOMATION WITH LARGE LANGUAGE MODEL (CHAT-GPT 4): FROM ACQUISITION AND RECONSTRUCTION FACTORS TO IMAGE POSTPROCESSING AND AI MODEL AUTO-SELECTION

Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Michael Suhling, PhD (*Abstract Co-Author*) Employee, Siemens AG
Chelsea Dunning, PHD (*Abstract Co-Author*) Nothing to Disclose
Alexander Katzmann (*Abstract Co-Author*) Consultant, Siemens AG
Oliver Taubmann (*Abstract Co-Author*) Nothing to Disclose
Javier Contreras Yametti, MD (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Monica O. Bernardo, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias F. Froelich, MD (*Abstract Co-Author*) Consultant, Smart Reporting GmbH;Consultant, Guerbet SA
George S.K. Fung, PhD (*Abstract Co-Author*) Employee, Siemens AG
Parisa Kaviani, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Key elements of CT workflow from protocol selection, acquisition and reconstruction factors, image post-processing, and AI model selection 2. Manual workflow and importance of clinical context (reason for CT/prior radiology reports) for optimizing radiation dose and image processing 3. Application of large language model (Chat-GPT 4) extraction of relevant clinical context to automate radiology workflow based on customizable rules and guidelines.

**TABLE OF CONTENTS/OUTLINE**

1. Visual summary of manual workflow and pain points in current radiology workflow for incorporating clinical indications for CT and prior CT reports. 2. Elements of radiology workflow automating LLM augmented with >300 clinical rules/guidelines 3. Case-based demonstration of how the proposed LLM uses clinical context for automating workflow by picking the right CT protocol, the acquisition and reconstruction factors, image post-processing, and AI model 4. Real-world examples of how LLM handles exception cases with prior contrast allergies, metal implants, large body habitus and motion artifacts 5. Uses, strengths and limitations of proposed LLM in radiology workflow

## INEE-24 LIVER SEGMENTATION: PRACTICAL APPLICATIONS OF MACHINE LEARNING IN PREOPERATIVE ASSESSMENT, PREDICTION AND EVALUATION OF TREATMENT RESPONSE

John D. Hazle, PhD (*Abstract Co-Author*) Nothing to Disclose
Ahmed Marey, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Awj Twam (*Abstract Co-Author*) Nothing to Disclose
David Fuentes (*Abstract Co-Author*) Nothing to Disclose
Mohamed Eltaher, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Describe the role of machine learning in tumor segmentation. - Discuss the pros and cons of various segmentation methods.- List the imaging requirements for a liver segmentation project.- Illustrate the current clinical applications of liver segmentation, particularly in preoperative assessment and evaluation of treatment response. - Discuss future directions for liver segmentation.

**TABLE OF CONTENTS/OUTLINE**

1. The role of machine learning in liver segmentation. 2. Current applications of liver volumetry: a. Assessment of treatment response in hepatic malignancies. b. Prediction of patients' overall survival and time-to-progression. c. Future liver volume prior to major hepatectomy. d. Virtual surgical planning. 3. Illustration of available segmentation methods. 4. Comparison: pros and cons of each segmentation method. 5. Step by step tutorial for liver segmentation. 6. Current challenges facing automated liver segmentaion. 7. Future directions: a. Vascular sub-segmentation. b. Radiogenomics. c. Fully automated segmental volumetry. d. Automated volumetric RECIST measurements.

## INEE-25 NEEDLEPATH: AN OPEN SOURCE TOOL FOR OUT-OF-PLANE CT GUIDED NEEDLE PROCEDURES

Phillip M. Cheng, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

CT-guided needle placement is a common initial task required for a variety ofinterventional radiology procedures including biopsy, drainage, ablation, injection, fiducial placement, and catheter deployment. Most commonly, the body entry point and target can be imaged in the same axial plane ("in-plane" procedures). However, sometimes an in-plane needle trajectory is either impossible or unsafe.In this exhibit, we illustrate the challenging 3D geometry of out-of-plane CT guided needle placements. We have created an open source software program called NeedlePath, which we designed to allow easy measurement of in-plane and out-of-plane needle angles for these procedures. The program retrieves a series of DICOM images from the PACS, and allows the user to mark the start position and the target on the images. NeedlePath shows the in-plane and out-of-plane needle angles and the projected needle path.

**TABLE OF CONTENTS/OUTLINE**

1. In-plane versus out-of-plane CT procedures (biopsy, drain, fiducialplacement, ablation, injection). 3D geometry of out-of-plane procedures.2. Currently available solutions: patient repositioning, gantry tilt, optical or electromagnetic sensors, robotic systems, dead reckoning3. NeedlePath- open source software program we have created to easily calculate in- and out-of-plane angles, and 3D target distance. Details on mechanics of usage for planning out-of-plane CT procedures and calculating needle adjustments during procedures.

## INEE-26 UNDERSTANDING DICOM IMAGES AND PHI PROTECTION, OR "STAYING OUT OF JAIL", FOR CLINICAL AND RESEARCH PURPOSES

**Awards**
**Cum Laude**

Gabe Lafond (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

DICOM (Digital Imaging Communications in Medicine) images play a vital role in medical diagnostics research. DICOM files contain metadata, a blend of neutral scientific data sensitive protected health information (PHI). Scientific data is interesting to researchers, anonymous safe to share, but the presence of PHI necessitates de-identification/anonymization to uphold patient privacy in accordance with HIPAA. We delve into understanding the DICOM standard, scrutinizing metadata content with knowledge of its use abuse in the wild, the execution of thorough PHI cleansing while retaining useful scientific data. We share insights from our institution's experience data gathered while developing a computer program for anonymization of DICOM images for advanced imaging research purposes. Anonymizing DICOM files entails removal of PHI from metadata, sometimes with provisions for authorized personnel to recover patient identities when necessary. While traditional anonymization methods remove all private tags, leaving only a set of standard tags known to be safe, our recommended approach selectively removes private tags with information matching values from standard tags known to contain PHI. We have validated this method on diverse DICOM datasets, ensuring thorough PHI elimination while preserving scientific data compatibility with popular medical image processing programs.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to DICOM images Metadata2. Examples of HIPAA violations through DICOM Metadata its Consequences3. Understanding PHI in DICOM Metadata4. Anonymization Methods Challenges5. Selective Anonymization Approach6. Validation of the Method7. Conclusion Future Directions

## INEE-27 FROM CONCEPT TO CLINIC: A STEP-BY-STEP GUIDE TO INTEGRATION OF MEDICAL AI TOOLS INTO RADIOLOGY PRACTICE

Jonathan R. Medverd, MD (*Abstract Co-Author*) Nothing to Disclose
Dushyant Sahani, MD (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV;Advisory Board, Canon Medical Systems Corporation;Advisory Board, General Electric Company;
Mahmud Mossa-Basha, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Mahdavi, MD (*Abstract Co-Author*) Nothing to Disclose

Antonio C. Westphalen, MD, PhD (*Abstract Co-Author*) Shareholder, ScanMed, LLC;Research funded, BotImage, Inc
Negar Firoozeh, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Implement a road map to introduce AI/clinical informatics tools in radiology Review challenges with the initiation of AI implementation in a healthcare system Present the value of a team approach to establish a workflow for the validation of AI diagnostic and triage algorithms and future program growth

**TABLE OF CONTENTS/OUTLINE**

Introducing AI tools into a radiology department involves several steps: 1-Needs assessment: Evaluating challenges faced by the evolving radiology department based on patient needs. 2-AI platform selection: Finding the best option based on department needs, priorities, and plans considering available platform features, AI tools menu, and pricing. 3-Stakeholder engagement: A collaborative approach among radiologists, informatics, quality and safety, clinicians, imaging operators, trainees, and research teams. 4-Integration: Defining a workflow for PACS/EHR integration. 5-Piloting: Testing AI tools to assess workflow, efficacy, and potential pitfalls. 6-Education: Training stakeholders for clinical adoption. 7-Communication: Establishing a communication and feedback loop for continued learning and improvement. 8-Data analytics and validation: Validation of AI algorithms with data analytics, with collection, processing, and analysis of large data volumes. 9-Evaluation and optimization: Continued review of AI performance to identify opportunities for improvement, fulfilling unmet needs, and track performance drift.

## INEE-28 PROPOSED MEDICAL SCHOOL CURRICULA FOR 3D PRINTING

Richard L. Hallett II, MD (*Abstract Co-Author*) Consultant, Bracco Group
Summer J. Decker, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Ford, PhD (*Abstract Co-Author*) Nothing to Disclose
David H. Ballard, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle Heiser, BS (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Morris, MD (*Abstract Co-Author*) Consultant, Medtronic plc;Speaker, Medtronic plc;Consultant, Merit Medical Systems, Inc;Speaker, Merit Medical Systems, Inc;Consultant, Landauer Inc;Speaker, Johnson & Johnson
Michael F. Morris, MD (*Abstract Co-Author*) Educator, Medtronic plc
Prashanth Ravi, PhD (*Abstract Co-Author*) Nothing to Disclose
Owais Salahudeen, BS (*Abstract Co-Author*) Nothing to Disclose
Rayna Debellevue (*Abstract Co-Author*) Nothing to Disclose
Liane Ruddy (*Abstract Co-Author*) Nothing to Disclose
Jordan Mackner (*Abstract Co-Author*) Nothing to Disclose
Garrett Trang (*Abstract Co-Author*) Nothing to Disclose
Taaha Adamji, BA (*Abstract Co-Author*) Nothing to Disclose
Kimberly Hatch, ARRT, BA (*Abstract Co-Author*) Nothing to Disclose
Stacy Ruther, BA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD (*Presenter*) Medical Director, Imagia Cybernetics Inc

**TEACHING POINTS**

1 Medical students should and want to learn 3D printing2 While there are abundant, disparate learning resources, this exhibit aims to fill the unmet need to integrate and standardize 3D printing and its appropriateness into US medical education3 The 3D printing community outside of medicine thrives on free, open exchange of ideas and tools4 The 3 proposed curricula will be open source using a website that welcomes evaluation of outside material

**TABLE OF CONTENTS/OUTLINE**

1 LCME accredits US medical education, mandating content on modern biomedical sciences and organ systems; 3D printing aligns with LCME standards by supporting anatomy and organ system learning2 In response to student desire for learning and the need to align US medical education, multidisciplinary (medical leadership, radiologists, engineers, technologists) experts from five medical schools developed three curricula with medical students3 All curricula have common introduction slides, notes, and videos4 Clinically validated, deidentified .DCM .STL .OBJ files plus 3D PDFs and .JPG photos are available5 Primers focus on commonly used printers: material extrusion and inverted vat polymerization6 Hands-on learning will include end-to-end manufacturing: segmentation, Computer Aided Design, 3D printing, and post-processing. Troubleshooting will be emphasized7 Guidance for medical school leadership includes laboratory start-up and development to include space, technical support, and estimated costs8 Project ideas and proficiency testing will be openly shared9 Medical students will be provided the opportunity to learn how 3D printing is integrated into various specialtiesAll medical student authors contributed equally to this abstract

## INEE-29 AI STARTER: A BEGINNER'S GUIDE TO IMAGE ANALYSIS PROJECTS

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Tim Leiner, MD, PhD (*Abstract Co-Author*) Research support, Pie Medical Imaging BV;Advisory Board, Cart-Tech BV;Advisory Board, AI4MedImaging;Advisor, Quantib BV;Consultant, Guerbet SA
Yashbir Singh, PhD, MEng (*Abstract Co-Author*) Nothing to Disclose
Ivana Isgum, PhD (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV;Research Grant, 3mensio Medical Imaging BV;Research Grant, Koninklijke Philips NV;Research Grant, Esaote SpA;Co-founder, Quantib BV;Shareholder, Quantib BV;Researcher, Quantib BV;;;
Diana V. Vera-Garcia, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To understand machine learning project requirements and to review the types of resources required for different projects2. To review how to set up the software environment for machine learning projects by guiding learners through the process of software installation and introducing programming languages3. To discuss data preprocessing, the fundamentals of machine learning algorithm creation and validation

**TABLE OF CONTENTS/OUTLINE**

1. Introduction2. Defining the aim of your project3. What computer resources do you need?3.1 The kind of resources that your task requires- Small-scale projects using Machine Learning vs highly computational projects using Deep Learning- GPU, RAM, HARD DRIVE, cloud bases resources and tools4. What software do you need to install?4.1 Can I use the same software for different tasks? 5 How do you get started with coding?5.1 Selection of the best language for my task/project5.2 Which is the easiest way to learn coding? -Use development tools, start a coding project, or implement a use-case scenario problem 7. Preparing data for the project7.1 How much data do you need? 7.2 Data preprocessing, data collection, cleaning, splitting, transformation, and augmentation8. Creating your algorithm8.1 Training and fine-tuning the algorithm8.2 Creating the final model9. Validation and metrics for the algorithm9.1 Internal and external validation9.2 Determining the appropriate metrics for accuracy evaluation11. Code and data sharing11.1 Common platforms for sharing software code and data12. Implementation of already published algorithms12.1 Understanding the task and implementation details12.2 Compare your results with the original model

## INEE-3 THE PITFALLS OF UNDERSTANDING AI PRODUCTS - A RADIOLOGIST'S GUIDE

Bogdan Bercean (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiologists face an ever-increasing wide range of choices when comparing and selecting the right AI product. The lack of standardisation in technical specifications and the plethora of new AI-related technical terms could quickly become overwhelming and confusing. To this end, this exhibit uncovers some common pitfalls medical professionals are prone to make. After reviewing it, the radiologist will understand:1) When and how can AUROC be a misleading metric, and what to look for when understanding the quantitative performance of an AI product;2) How the overused "dataset size" selling point is not an absolute reference by itself;3) What types of research articles to look for and what distinctions are to be made;4) How to ask better questions when considering an AI product.

### TABLE OF CONTENTS/OUTLINE

1) Performance metrics and where does AUROC stand?a. continuous metrics;b. dichotomous metrics;2) Varying dataset sizes and types and their impact on different AI paradigms.3) Research types in radiological AI. Which ones are meant for radiologists?4) Top questions a radiologist should ask?

## INEE-30 A PRIMER ON THE FUNDAMENTALS OF GENERATIVE AI FOR MEDICAL IMAGING

Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Szymon Mazurek (*Abstract Co-Author*) Nothing to Disclose
Sarthak Pati, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recent advances in generative artificial intelligence (GenAI) have influenced nearly every industry, including healthcare. Their impact can be especially seen in the domain of medical imaging, where they enabled groundbreaking progress in the fields of denoising, data augmentation, and unsupervised feature extraction. Additionally, GenAI can be used to address clinical issues with a dataset, such as class imbalance. Finally, it can potentially add privacy guarantees in a collaborative training framework, such as federated learning. The landscape of possible approaches is massive, with each solution being characterized by its unique properties and requirements. Furthermore, GenAI often exhibits complex principles of operation and high sensitivity to the chosen hyperparameters. All these properties are potential obstacles for the users, especially the ones not deeply familiar with GenAI. We want to address these entry barriers by providing an overview of the available solutions, as well as showing practical examples of using such methodologies with various open-source frameworks. Additionally, we plan on highlighting specific methodologies (autoencoders, generative adversarial methods, diffusion models) along with their principles of operation using an extensive and open-source mammography dataset.

### TABLE OF CONTENTS/OUTLINE

The exhibit will present various techniques for the application of GenAI in medical imaging using open-source frameworks. Users will see practical examples of applying those methods to high-resolution mammography data, highlighting different aspects of using such models and properly configuring their architectures hyperparameters.

## INEE-31 AVOIDING AUTOMATION BIAS: CASE SERIES OF FALSE POSITIVES SEEN IN INTRACRANIAL HEMORRHAGE DETECTION ALGORITHMS

Steven A. Rothenberg, MD (*Abstract Co-Author*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC
Houman Sotoudeh, MD (*Abstract Co-Author*) Nothing to Disclose
Srini Tridandapani, MD, PhD (*Abstract Co-Author*) Co-founder, Camerad Technologies, LLC;Spouse, Co-founder, Camerad Technologies, LLC;Officer, Camerad Technologies, LLC;Spouse, Officer, Camerad Technologies, LLC
Jordan D. Perchik, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Background Intracranial hemorrhage (ICH) detection algorithms are some of the most widely used artificial intelligence (AI) applications in clinical radiology practice. These algorithms can assist radiologist in the detection of subtle ICH, and some algorithms interface with the worklist to triage positive exams. No algorithm is perfect, and when false positives occur, this can lead to inappropriate treatment, prolonged hospitalization, and misuse of hospital resources. Radiologists using these algorithms must know when to override the AI result and avoid automation bias. Teaching points The goal of this presentation is to demonstrate the different types of false positives that can be observed with ICH detection algorithms. Understanding how an AI algorithm determines true positives is key to understanding false positives. Examples of the different types of imaging artifacts, pathologic processes, and anatomic variants will be presented alongside an AI heatmap highlighting the image region contributing to the false positive finding.

### TABLE OF CONTENTS/OUTLINE

Example 1Presentation of the different types of imaging artifacts that can result in ICH false positives, including motion artifact and beam hardening. Example 2 Different pathologic processes can trigger a false positive ICH flag. These cases include cortical laminar necrosis, meningiomas, and cavernomas. Example 3 Some anatomic variants, and even normal anatomy, can sometimes cause ICH false positives. These include colloid cysts, the dural venous sinuses, and the choroid plexus.

## INEE-32 DEFINING AI MODELS AND DATASETS TO PROMOTE DISCOVERY AND INTEROPERABILITY

**Awards**
**Certificate of Merit**

Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Charles E. Kahn JR, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Safwan Halabi, MD (*Abstract Co-Author*) Advisor, Change Healthcare
Abhinav Suri, BA, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Describe ontologies and their role in radiology.2, Define the FAIR (Findability, Accessibility, Interoperability, and Reuse) principles.3. Identify gaps in current approaches to capture critical information about AI models and data.4. Understand how an ontology can make radiology AI models and datasets more discoverable and interoperable.

**TABLE OF CONTENTS/OUTLINE**

1. Ontologies a. Overview and definitions b. Why ontologies are useful c. Examples (RadLex, SNOMED CT, etc.)2. FAIR principles a. Overview and definitions b. Applications to radiology AI3. Current approaches a. Model cards b. Datasheets for datasets c. Shortcomings for radiology AI applications4. Radiology Model and Dataset Ontology (RMDO) a. Overview b. Example RMDO-based documents5. Discussion and Next Steps

## INEE-33 ADVANCING RADIOLOGY EDUCATION WITH AI: ENHANCING CURRICULUM PLANNING, IMPLEMENTATION, AND EVALUATION IN RADIOLOGY TRAINING

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Hillary W. Garner, MD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Pouria Rouzrokh, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Artificial intelligence (AI) applications in radiology practice have experienced exponential growth in recent years. Similarly, many radiology programs have incorporated AI education into their curricula. However, the potential impact of AI on radiology education itself remains underemphasized in current literature. While AI's contributions to medical education have been discussed for long, the recent emergence of advanced AI tools for imaging data and large language models holds the promise of significantly improving the quality of radiology education and automating its workflows. These AI tools may be as transformative as distance learning once was, reducing educational disparities and ultimately enhancing the quality of radiologist care and patient outcomes. This educational exhibit aims to provide a comprehensive review of possible strategies, opportunities, and limitations for applying AI to different aspects of radiology education.

**TABLE OF CONTENTS/OUTLINE**

A) Context: A-1) What are the current gaps in terms of using AI to advance radiology education?A-2) The SWOT Analysis of applying AI to radiology education.B) What are the strategies for applying AI to different stages of radiology curriculum planning (examples are provided in the PDF file)?B-1) Needs assessmentB-2) Aims and Objectives Planning B-3) Content collection B-4) Content organization B-5) Learning strategies B-6) Teaching methods B-7) Assessment methods B-8) Curriculum communication B-9) Educational environment B-10) Curriculum managementC) Where to start? C-1) A stepwise roadmap for the gradual introduction of AI to radiology education. C-2) Lesson learned from previous experiences in applying AI to medical education.

## INEE-34 FROM THE LABORATORY TO CLINICAL PRACTICE: CLINICAL TRIALS IN ASSESSING THE EFFICACY OF AI ALGORITHMS IN RADIOLOGY

Bruna Garbes Pinto (*Abstract Co-Author*) Nothing to Disclose
Henrique M. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Klaus Schumacher, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanna Mendes (*Abstract Co-Author*) Nothing to Disclose
Gabriel Ferracioli (*Abstract Co-Author*) Nothing to Disclose
Joselisa P. Paiva (*Abstract Co-Author*) Nothing to Disclose
Tayran Mila Mendes Olegario (*Abstract Co-Author*) Nothing to Disclose
Pedro Silva (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Present the main components (primary outcome, experimental design, and study population) of a randomized clinical trial (RCT) using illustrative examples. 2. Showcase the distinctions between RCTs for pharmacological interventions and AI-based screening tools, highlighting key differences in design and execution. 3. Discuss potential pitfalls encountered during the planning, execution, and analysis phases of RCTs for AI screening tools, along with strategies to mitigate these challenges. 4. Propose a comprehensive protocol for conducting an RCT evaluating an AI screening tool for the diagnosis of tuberculosis, emphasizing key considerations in study design and implementation. 5. Explore future perspectives of clinical trials for AI tools, including adaptations for remote conduct and potential advancements in trial methodologies. 6. Discuss future perspectives of clinical trials for AI tools and how they can adapt to be remotely conducted.

**TABLE OF CONTENTS/OUTLINE**

IntroductionUnderstanding RCTs: Purpose and ImportanceContrasting Classic RCTs with AI-Based TrialsChallenges Encountered in AI RCTsStrategies for Overcoming Trial PitfallsDesigning a Protocol: RCT for AI Tuberculosis DiagnosisFuture Directions: Remote Conduct of AI TrialsConclusionsReferences

## INEE-35 THE COMPREHENSIVE OPEN FEDERATED ECOSYSTEM (COFE): ENABLING IMPACTFUL HEALTHCARE STUDIES

**Awards**
**Certificate of Merit**

Sarthak Pati, MSc (*Abstract Co-Author*) Nothing to Disclose
Renato Umeton (*Abstract Co-Author*) Nothing to Disclose
Micah Sheller (*Abstract Co-Author*) Researcher, Intel Corporation;
Alexandros Karargyris (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Patrick Foley (*Abstract Co-Author*) Nothing to Disclose
Ujjwal R. Baid, PhD (*Abstract Co-Author*) Nothing to Disclose
Prashant Shah (*Abstract Co-Author*) Nothing to Disclose
Peter Mattson (*Abstract Co-Author*) Nothing to Disclose
Akis Linardos (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Emerging literature underscores the transformative potential of Artificial Intelligence (AI) in healthcare. Ensuring robustness and evaluating the generalizability of AI methods necessitates ample and diverse multi-site patient datasets. Yet, access is often hindered by bureaucratic processes, data ownership issues, and legal considerations tied to patient privacy. To address these challenges, we present the Comprehensive Open Federated Ecosystem (COFE), a community-driven initiative featuring multiple open-source tools. COFE aims to democratize distributed healthcare AI by leveraging zero/low code principles, enabling models to learn across data silos via Federated Learning (FL), and assessing their performance on diverse, previously unseen datasets through Federated Evaluation (FE). The exhibit's objectives are to: 1) enhance the community's understanding of FL FE, 2) demonstrate how users can employ FL to train a model across multiple sites, 3) present results using COFE (the inaugural real-world federation evaluation challenge across

71 collaborating sites focusing on brain tumors multi-site breast cancer risk assessment), 4) discuss privacy data protection concerns and COFE's proposed solutions, and 5) illustrate how users can utilize FE to generate generalizable statistics for AI methods.

**TABLE OF CONTENTS/OUTLINE**

This exhibit will present a community-driven open-source ecosystem to train evaluate AI models across multiple clinical sites in a data-private paradigm. Specific principles to protect data privacy will be described, along with common pitfalls to avoid when performing FL-based studies.

## INEE-36 DE-IDENTIFICATION OF RADIOLOGY IMAGING STUDIES: A COMPREHENSIVE REVIEW OF CURRENT PRACTICES AND FUTURE NEEDS IN THE AGE OF AI

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Shahriar Faghani, MD (*Abstract Co-Author*) Nothing to Disclose
Pouria Rouzrokh, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

De-identification (DiD) of radiology imaging studies is crucial for ensuring patient privacy during research endeavors, data transfers, and the development of artificial intelligence (AI) models. In this educational exhibit, we begin by reviewing what image DiD is, how it differs from image anonymization, and why it is an important step toward compliance with the Health Insurance Portability and Accountability Act (HIPAA) in radiology. We then review the most frequent formats for storing radiology imaging studies to set the scene for our main discussion. At the core of our content, we delve into four different levels of DiD: radiology reports, imaging file metadata, imaging markers, and morphological features. We will discuss what each of these steps involves and some of the most commonly used tools for implementing them. Most importantly, we will explore how AI algorithms can both threaten the reliability of such tools and be used to enhance each of these four levels. Finally, we wrap up by addressing several common questions and doubts about image DiD in radiology studies. We aim our presentation at general radiologists and strive to deliver our technical content in a language that is accessible to that audience.

**TABLE OF CONTENTS/OUTLINE**

A) Introduction A-1 ) What is image de-identification (DiD)? A-2) How is DiD different from anonymization? A-3) Why is DiD important? B) Frequent file formats for storing image data (DICOM, NIfTI, NRRD, etc.) C) DiD levels-1) Radiology report level: C-2) Imaging file metadata level C-3) Imaging marker level C-4) Morphological features D) How can AI threaten image DiD) E) How can AI improve image DiD) F) Commonly asked questions regarding image DiD.

## INEE-37 CLAIM 2024 AI REPORTING GUIDELINE -- WHAT'S NEW?

Seong Ho Park, MD (*Abstract Co-Author*) Nothing to Disclose
John Mongan, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Amazon Web Services, Inc;Royalties, General Electric Company;Spouse, Employee, Annexon, Inc;Spouse, Employee, AbbVie Inc
Linda Moy, MD (*Abstract Co-Author*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc
Ali S. Tejani, MD (*Abstract Co-Author*) Nothing to Disclose
Anthony Gatti, PhD,MSc (*Abstract Co-Author*) Nothing to Disclose
Michail Klontzas, MD,PhD (*Abstract Co-Author*) Trainee Board of Directors, RadioGraphics
Charles E. Kahn JR, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

* Understand how the Checklist for Artificial Intelligence in Medical Imaging (CLAIM) guideline promote complete and consistent reporting of AI science in medical imaging* Describe the process to update the guideline* Detail the changes incorporated into the CLAIM 2024 Update

**TABLE OF CONTENTS/OUTLINE**

1. Scientific reporting guidelines a. Reporting standards: STARD, CONSORT, TRIPOD b. Adaptations for AI: STARD-AI, CONSORT-AI, etc. c. Role of the EQUATOR Networkd. How to select an appropriate guideline2. CLAIM guideline a. Original checklist: motivation and development b. Research applications3. Process to update the CLAIM guideline a. Update panel enrollment b. Delphi consensus methods4. Changes incorporated into the updated checklist a. "Ground truth" b. "Validation"5. What's not included a. Radiomics b. Common data elements6. Conclusion

## INEE-38 WHAT LLM SHOULD I USE? NAVIGATING THE LANDSCAPE OF LARGE LANGUAGE MODELS IN RADIOLOGY

Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Saptarshi Purkayastha, PhD (*Abstract Co-Author*) Nothing to Disclose
Pouria Rouzrokh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Seyed Mohammadreza Chavoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Theodorus Dapamede, MD, PhD (*Abstract Co-Author*) Intern, MARS BioImaging Ltd
Amirali Khosravi (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Understand differences between various large language models (LLMs) and their implications for radiology applications2. Design experiments to systematically select the most appropriate LLM for specific radiology tasks3. Identify and interpret key performance metrics for evaluating LLMs in radiology research

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to Large Language Models in Radiology: (a) Overview of LLMs and their applications in radiology (b) Considerations for of LLM model selection and experimental design (c) Differences between Large Language Models (open vs proprietary; different number of parameters)2. Systematic approach for selecting an LLM use strategy: (a) Fully automatic labeling (b) Semi-automatic labeling3. Designing Experiments for Systematic LLM Model Selection: (a) Defining a radiology task and its complexity (b) Curating annotated datasets for LLM model evaluation (c) Considerations for selecting a range of LLM models with varying sizes and architectures (d) Implementing LLM prompting strategies, such as chain-of-thought (CoT) (e) Measuring

compute time and LLM resource requirements4. Key Performance Metrics for Evaluating LLMs in Radiology: (a) Relatively balanced set: Accuracy(b) Highly imbalance set: F1-score(c) Semi-automatic labeling: NPV5. Case Studies: End-to-end application of the Systematic Approach including task definition, LLM selection, data annotation, prompting, and evaluation: (a) Pneumothorax detection: Simple task complexity and the role of smaller models (b) Rib fracture identification: Moderate task complexity and the impact of model size (c) Cardiomegaly assessment: Complex tasks and the need for larger models6. Conclusion

## INEE-39 LOWERING BARRIERS FOR MEDICAL PRACTITIONERS TO UTILIZE AI: A GUIDE TO IMAGE CLASSIFICATION IN KAAPANA

Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Yannick Kirchhoff (*Abstract Co-Author*) Nothing to Disclose
Peter Neher (*Abstract Co-Author*) Nothing to Disclose
Philipp Schader (*Abstract Co-Author*) Nothing to Disclose
Stefan Denner (*Abstract Co-Author*) Nothing to Disclose
Maximilian Rokuss (*Abstract Co-Author*) Nothing to Disclose
Benjamin Hamm (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The integration of artificial intelligence (AI) in medical imaging has been hindered by complexities in AI tool utilization. Streamlining the application process can lower barriers and enable broader adoption by practitioners. This work introduces an automated workflow implemented in Kaapana, designed to facilitate 2D and 3D medical image classification without requiring extensive technical knowledge. This workflow supports various classification settings with a focus on enhancing user accessibility and efficiency in medical AI applications. The Classification Workflow automates several critical aspects of AI model training and application, including hyperparameter setting, preprocessing, and data augmentation. The default parameters are optimized based on principles derived from the successful nnUnet framework. A user-friendly interface allows real-time monitoring and easy adjustment of hyperparameters without coding, enabling experimentation and customization. Additionally, Kaapana’s Datasets View facilitates the tagging and annotation of image datasets, simplifying dataset creation. The Classification Workflow in Kaapana represents a significant step towards democratizing AI in medical imaging, offering a user-friendly tool that abstracts complex processes and allows medical practitioners to utilize the advantages of AI.

### TABLE OF CONTENTS/OUTLINE

- Introduction to Kaapana and AI in Medical Imaging- Overview of Automated Classification Workflow- Hyperparameter Automation, Preprocessing, and Data Augmentation- Showcasing Application Scenarios- User Interface for Hyperparameter Tuning- Real-Time Monitoring with Tensorboard- Dataset Creation via Datasets View

## INEE-4 EXTENDED REALITY RADIOLOGY EDUCATION AND IVR PRACTICE USING VIDEO PASS-THROUGH WEARABLE SPATIAL COMPUTING HEADSET

Takuya Sueyoshi (*Abstract Co-Author*) Holoeyes Inc. : Employment RIVERFIELD Inc. : Research grant Fujitsu Ltd. : Research grant Japan Society for the Promotion of Science (JSPS) : Grant-in-Aid for Scientific Research (KAKENHI)
Maki Sugimoto, MD, PhD (*Presenter*) Officer, Holoeyes Inc

### TEACHING POINTS

The utilization of wearable spatial computing headsets with video pass-through functionality in IVR practice and radiology education enhances diagnostic capabilities, treatment outcomes, and safety. Understanding technical advantages, such as imaging and sensor analysis, facilitates spatial assistance in medical image diagnosis, surgical planning, and therapeutic support. Practical examples demonstrate spatial computing's role in clinical procedures like TAVI, endovascular aneurysm repair, and percutaneous ultrasound-guided liver biopsy. Guidance is provided on overcoming challenges associated with integrating spatial computing into radiology education and clinical interventions.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Spatial Computing and Video Pass-Through in Radiology Education and IVR Practice.2. Mechanism and Technical Advantages of Device (Apple Vision Pro). Enhancing Spatial Diagnosis: Utilizing augmented reality overlays and real-time image integration.3. Facilitating Surgical Planning and Intervention in IVR.Therapeutic Support in IVR: Utilizing immersive simulations and interactive scenarios.4. Practical Applications in Clinical Procedures: Case-based exploration.5. Addressing Challenges and Pitfalls in Adopting Spatial Computing in Radiology.

## INEE-40 REAL-WORLD FEDERATED LEARNING IN RADIOLOGY: HURDLES TO OVERCOME AND BENEFITS TO GAIN

Andreas Bucher, MD (*Abstract Co-Author*) Travel support, Bayer AG Travel support, Guebert SA Travel support, Pharmacept
Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Peter Neher (*Abstract Co-Author*) Nothing to Disclose
Stefan Denner (*Abstract Co-Author*) Nothing to Disclose
Unal Akunal, MSc, BSc (*Abstract Co-Author*) Nothing to Disclose
Maximilian Zenk (*Abstract Co-Author*) Nothing to Disclose
Markus Bujotzek (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Federated Learning (FL) enables collaborative model training while keeping data locally, holding immense potential to enhance radiological diagnosis and therapy for rare diseases with scarce data. Currently, the majority of FL studies in radiology are simulated due to various hurdles impeding the translation into practice. The few existing real-world FL initiatives rarely communicate measures taken to overcome hurdles, leaving behind a significant knowledge gap. We categorized insights from FL literature with our findings based on their phase of occurrence while establishing a FL initiative. We built our own FL infrastructure within the nation-wide German Radiological Cooperative Network (RACOON) and demonstrated its functionality by training a FL model on a lung pathology segmentation task across six university hospitals. We evaluated FL against less complex alternatives in three evaluation scenarios.From gathered insights, we propose a detailed guide outlining steps, hurdles, and solutions to establish successful FL initiatives conducting real-world experiments. Our experimental results demonstrate superior performance of FL in all evaluation scenarios, justifying itself despite the efforts of real-world FL.The proposed guide aims to aid future FL researchers in circumventing pitfalls, thereby speeding up the translation of FL into practice. Our investigations highlight FL's superiority over alternative approaches, and the importance of strategic organization, robust handling of distributed data and infrastructure in the real world.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Implementing conducting real-world FL3. Guide to build real-world FL initiatives4. Discussion

## INEE-41 KAAPANA: A COMPREHENSIVE OPEN-SOURCE SOLUTION FOR INTEGRATING AI IN RADIOLOGICAL RESEARCH ENVIRONMENTS

Marco Nolden (*Abstract Co-Author*) Nothing to Disclose
Hanno Gao (*Abstract Co-Author*) Nothing to Disclose
Lorenz Feineis (*Abstract Co-Author*) Nothing to Disclose
Peter Neher (*Abstract Co-Author*) Nothing to Disclose
Philipp Schader (*Abstract Co-Author*) Nothing to Disclose
Benjamin Hamm (*Abstract Co-Author*) Nothing to Disclose
Santhosh Parampottupadam, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Stefan Denner (*Abstract Co-Author*) Nothing to Disclose
Markus Bujotzek (*Abstract Co-Author*) Nothing to Disclose
Mikulas Bankovic (*Abstract Co-Author*) Nothing to Disclose
Jens Beyermann (*Abstract Co-Author*) Nothing to Disclose
Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Ralf Floca (*Abstract Co-Author*) Nothing to Disclose
Jonas Scherer (*Abstract Co-Author*) Nothing to Disclose
Rajesh Baidya (*Abstract Co-Author*) Nothing to Disclose
Klaus Kades (*Abstract Co-Author*) Nothing to Disclose
Unal Akunal, MSc, BSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Integrating advanced computational tools into clinical environments is a significant challenge, often requiring specialized technical skills and the use of various separate applications in a diverse infrastructural landscape. Kaapana addresses these challenges by providing a comprehensive, open-source and customizable medical image analysis platform that seamlessly incorporates AI capabilities into existing clinical infrastructures. Kaapana enables radiologists and data scientists to train and execute state-of-the-art segmentation algorithms, such as nnU-Net and TotalSegmentator. It also allows users to create, curate, and visualize datasets; manage numerous workflows running in parallel; and train and evaluate new models as ready-to-use solutions. In addition to offering these advanced research tools, by employing the DICOM standard, Kaapana also allows for direct PACS interactions on the platform. The platform’s design enables extensive customizations for specific use cases, and facilitates the integration of new tools and workflows. With robust data protection capabilities, the capacity to manage vast datasets, and support for federated learning, Kaapana is an ideal choice for conducting large-scale, multi-center, interdisciplinary studies that can lead to significant advancements in medical research and patient care.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Deployment 3. Data Upload 4. Datasets 5. Workflow Management 6. Extension Management 7. Utilities 8. Conclusion Future Directions

## INEE-42 ELECTRONIC CLEANSING REIMAGINED: THE POWER OF DIFFUSION-BASED GENERATIVE AI IN CT COLONOGRAPHY

Hiroyuki Yoshida, PhD (*Abstract Co-Author*) Patent holder, Hologic, Inc;Patent holder, Median Technologies
Toru Hironaka (*Abstract Co-Author*) Nothing to Disclose
Janne J. Nappi, PhD (*Abstract Co-Author*) Patent holder, Median Technologies;Patent holder, Hologic, Inc;;
Masaki Okamoto (*Abstract Co-Author*) Stockholder, TOKYO analytica
Rie Tachibana, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of electronic cleansing (EC) is to subtract orally tagged fecal materials from CT colonography (CTC) images to improve the sensitivity of polyp detection in virtual endoscopic fly-through reading. Diffusion models are a powerful state-of-the-art generative AI technology that has recently achieved tremendous success in various computer vision tasks. This exhibit's teaching points are (1) to explain the role of EC in CTC, (2) to explain how generative AI can be used to perform EC, and (3) to demonstrate clinical outcomes of the state-of-the-art diffusion-based EC in CTC.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: (1.1) the importance of colon cancer screening; (1.2) the role of EC in CTC; (1.3) A brief history of EC methodologies. 2. Generative AI for EC: how it differs from traditional EC. 3. Diffusion-based EC: how it works. 4. Case studies: using a phantom study and clinical CTC cases, demonstrate how the image quality of diffusion-based EC outperforms those of existing EC methods.

## INEE-43 INNOVATIVE APPROACHES TO RADIOLOGY REPORTING: UNRAVELING THE POTENTIAL OF NATURAL LANGUAGE PROCESSING AND AI TECHNOLOGIES

Faiq Tariq (*Abstract Co-Author*) Nothing to Disclose
Pamela H. Nguyen, DO (*Abstract Co-Author*) Nothing to Disclose
Azwade F. Rahman, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Michael X. Jin, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Kian Avilla (*Abstract Co-Author*) Nothing to Disclose
Austin Young (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the role of natural language processing (NLP) in transforming radiology reporting2. Showcase ways that NLP software can be utilized to augment radiology practices3. Investigate the potential of voice-to-text software and generative AI to automate radiology reporting4. Explore the potential of automated impression generation in radiology reporting5. Highlight pilot studies conducted at our institution showcasing the potential of ChatGPT and natural language processing (NLP) technologies in radiology reporting

### TABLE OF CONTENTS/OUTLINE

1. Title SlideInnovative Approaches to Radiology Reporting: Unraveling the Potential of Natural Language Processing and AI Technologies2. Learning Objectives3. What is Natural Language Processing? Definition and overview of NLPExplanation of how NLP works 4. Examples of NLP Applications Overview of various applications of NLP in different domainsDiscussion on healthcare-related applicationsIntroduction to benefits/use cases of ChatGPT in healthcare settings5. NLP in RadiologyExploration of the potential of NLP in radiology reporting 6. Automated Report Generation Pilot StudyDescription of study design and methodologyResults and implications 7. Impression Generation Pilot StudyDescription of study design and methodologyResults and implications 8. Other Applications Explore other applications and studies published of NLP in radiology reporting 9. ConclusionSummary of key points

## INEE-5 CT IMAGING BIOMARKERS FOR PHENOTYPIC BIOLOGICAL AGING: OVERVIEW AND COMPARISON WITH OTHER RADIOLOGICAL AND NON-RADIOLOGICAL APPROACHES

Perry J. Pickhardt, MD (*Abstract Co-Author*) Advisor, Bracco Group;Advisor, Zebra Medical Vision Ltd;Advisor, Nano X Imaging;
John W. Garrett, PhD (*Abstract Co-Author*) Nothing to Disclose
Matthew H. Lee, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Chronological age (CA) and sex are drivers of important healthcare decisions (primary prevention, screening, intervention) but CA is an imperfect measure of "healthspan" and longevity. 2. Biological age (BA) attempts to capture the cumulative physiologic effect of genetic predisposition, lifestyle habits, genetic, and disease processes, and has been attempted for decades with limited success. 3. As opposed to existing "frailomics" used in existing BA models, CT-based tissue markers are accessible, reproducible, and reflect a "big picture" net effect of aging at the organ/tissue level. 4. Advances in technology, computing power, and emerging AI technologies make "explainable" and "black box" image-based BA models poised to revolutionize our understanding of aging and longevity. 5. CT-based, "phenotypic" cardiometabolic assessment shows potential for improved personalized prediction and augmentation of current models for predicting "healthspan" and longevity compared with typical demographics.

### TABLE OF CONTENTS/OUTLINE

1. Describe the difference between CA and BA as well as a brief overview of existing BA models. 2. Review common imaging and non-imaging-based models for determining BA. 3. Describe existing AI tools for deriving image-based tissue biomarkers. 4. Contrast "explainable" AI CT-based methodologies from more opaque "black box" deep learning approaches. 5. Discuss early experiences with image-based BA models using both explainable (e.g. fully-automated CT-based abdominal body composition markers) and "black box" AI tools (e.g. BA derived from CXRs). 6. Future directions - image-based AI tools allow for objective, large-scale, population-based investigation.

## INEE-6 A SOFT TISSUE SARCOMA RADIOMICS ATLAS: A VISUAL GUIDE

Matthew J. Nyflot, PhD (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Peter C. Thurlow, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Paul E. Kinahan, PhD (*Abstract Co-Author*) Co-founder, PET/X LLC
Gita Y. Karande, MMEd, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand what radiomics features are and how they are utilized in radiology research. 2. An exploration of what radiomic features look like in the context of soft tissue sarcoma imaging. 3. Look into some clinical cases in which an understanding of radiomics features can help with better assessment of the disease. 4. Look into some of the studies that used radiomics to predict various outcome in soft tissue sarcoma and what the most significant features from those studies mean.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Define radiomics features. b. Show example of the utility of radiomics features in assessment of soft tissue sarcoma. i. Radiomics in prediction of post-surgical tissue margin status. ii. Radiomics in prediction of treatment responsec. Explain the radiomics analysis pipeline. d. Overview of radiomics features families. 2. Imaging atlas of each major radiomics feature family a. First Order Statistics b. Shape Based c. Gray Level Co-occurrence Matrixd. Gray Level Run Length Matrixe. Gray Level Size Zone Matrix f. Neighboring Gray Tone Difference Matrixg. Gray Level Dependence Matrix 3. Example Clinical Cases a. Example cases of soft tissue sarcoma with positive and negative post-surgical tissue margin status and their respective radiomics features b. Example cases of soft tissue sarcoma with good and bad treatment response and their respective radiomics features 4. Conclusion a. Summarize the role of radiomics in soft tissue sarcoma assessment. b. Highlight the various families of radiomics features and their meaning.

## INEE-7 PRACTICAL GUIDE FOR CREATING 3D PRINTED MODELS FROM MEDICAL IMAGING STUDIES USING FREE SOFTWARE

Juan Francisco Sallaberry Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Gutierrez Velasco, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Garcia del Salto, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Fraga Rivas, MD (*Abstract Co-Author*) Investigator, General Electric Company
Jaime de Miguel Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Robledo (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Introduction to 3D printing for medical imaging studies.Selection of suitable images. Description and illustration of data conversion and segmentation steps using open-source software.Overview of printing materials and techniques. Clinical and educational impact examples.

### TABLE OF CONTENTS/OUTLINE

3D printing has emerged as a revolutionary tool in radiology, significantly enhancing surgical planning and medical education.A practical and accessible guide is presented for creating 3D printed models from medical imaging studies using free software. The process begins with the selection of suitable images, emphasizing the need for high resolution and contrast in CT and MRI studies. Subsequently, the segmentation of anatomical structures using free specialized software and the conversion of data to formats suitable for 3D printing are explained.Additionally, we provide insights into different printing materials and techniques available, highlighting the importance of choosing appropriately according to the clinical or educational purpose. Finally, the utility of 3D printed models in various medical applications is examined through cases from our own service.

## INEE-8 APPLYING AI TO MEDICAL IMAGING: HOW TO BUILD A PROJECT FROM THE GROUND UP

Christian Henriksen (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Aimed at radiologists with an interest in how to leverage AI for research but a lack of experience in machine learning, this presentation will use detailed but accessible language to provide an overview of the necessary steps to take a project from idea to full-fledged functional AI model. Teaching points will include an overview of current types of AI model and their capabilities as they relate to medical imaging, a review of current interpretability methods for

imaging AI, an outline of the components of a project to develop an AI model, and a discussion of two real example projects that I myself have developed.

**TABLE OF CONTENTS/OUTLINE**

1. What is AI? a. Deep Learning b. AI in Medical Imaging i. Convolutional Neural Networks ii. Vision Transformers 2. What Can AI Do? a. Classification b. Regression c. Segmentation. 3. What Can't AI Do? 4. A Note on Interpretability a. Saliency Maps. 5. Anatomy of a Project a. The Idea b. The Dataset i. The Input Data ii. The Output Data Ground Truth c. The Hardware d. The Software e. The Training f. The Evaluation. 6. Example Projects a. Bone Mineral Density from Computed Tomography b. Diagnosis of Normal Pressure Hydrocephalus from Head CT

## INEE-9 LEVERAGING DERIVATIVE DATASETS IN RADIOLOGY: POTENTIALS, CHALLENGES, AND FUTURE DIRECTIONS

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Saptarshi Purkayastha, PhD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Derivative datasets, created by generative AI models, closely resemble real-world medical data while preserving patient privacy and enabling data diversity. This educational exhibit aims to:1. Understand the concept of derivative datasets and their role in medical imaging research2. Explore the potentials and promises of generative AI in creating diverse, privacy-preserving, and versatile datasets3. Discuss the challenges and ethical considerations associated with the use of derivative datasets

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to derivative datasets and generative models in medical imaging: (a) Definition and concept of derivative datasets (b) Types of generative models (VAEs, GANs, DDPMs)(c) Role of derivative datasets in medical imaging research2. Potentials and promises of derivative datasets:(a) Increased dataset size and diversity:(b) Privacy-preserving nature(c) Versatility across tasks(d) Modeling complex biological phenomena3. Challenges and considerations (a) Patient privacy and data copying(b) Identification of source dataset and disclosure(c) Interpretability and explainability(d) Potential biases4. Future directions and conclusions:(a) Development of robust and standardized evaluation frameworks(b) Exploration of novel architectures and training strategies(c) Integration with other AI techniques (d) Addressing ethical and regulatory challenges (e) Importance of collaboration and responsible utilization

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

INEE-1

## WHAT IS A DIFFUSION MODEL? CONTRIBUTION TO MEDICINE USING CUTTING-EDGE TECHNOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Atsushi Teramoto, PhD (*Abstract Co-Author*) Nothing to Disclose
Noritaka Yoshioka (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Generative AI models, which have fueled the recent AI boom, are coming into their own in various fields. The medical field is no exception. Generative AI models are improving the accuracy and reliability of conventional AI models, enabling pathologists to make more accurate diagnoses and reduce their workload. This exhibition aims to teach the idea of the diffusion model, which is attracting more attention than any other generative AI model, and to show how it will contribute to the future development of medicine.

### TABLE OF CONTENTS/OUTLINE

Table of Contents1. Why diffusion models are attracting attention based on the challenges of conventional generative models2. Basic ideas of diffusion models3. What is possible with the diffusion model and examples of medical applicationsOutline1.Why the diffusion model? 2.Basis of the diffusion model- Forward method- Reverse method 3.What the diffusion model can do- Scope of application of diffusion model- Medical Applications

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# Abstract Archives of the RSNA, 2024

INEE-10

## REFOCUSING ON THE STEREOSCOPIC DISPLAY USING PHOTO-REALISTIC 3D-CT IMAGES AND CT COLONOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hiroki Kawashima, PhD (*Abstract Co-Author*) Kyoto kagaku, Research collaboration
Katsuhiro Ichikawa, PhD (*Abstract Co-Author*) Nothing to Disclose
Shiori Yamashita, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Existing types of stereoscopic display for medical imaging. - Understand the limitations of stereo viewing with the conventional volume rendering (VR) images. - Explore the principles of photorealistic VR and its applications to three dimensional (3D) CT images and CT colonography. - Effectiveness of stereoscopic displays with polarized glasses using photorealistic VR (PRVR) images. - Experience of stereo viewing with PRVR images using the demonstration system of this exhibit.

### TABLE OF CONTENTS/OUTLINE

Introduction - Background of stereo display in medical imaging. - Motivation for refocusing on the stereo display using PRVR images. Methods - A new algorithm for realizing very fast rendering photorealistic 3D image and its specialization for stereo viewing with precise shading and shadowing using multiple light sources. - Measurements of the rendering speed. - Visual comparison between stereo viewings using conventional VR (CVR) and PRVR for depth perception and overall visiblility (observers: three radiological technologists with experiences of clinical 3D-CT image producing). Results - Rendering speed: approximately 25 ms per stereo frame. - Visual comparison: all observes rated the maximum score (PRVR >> CVR) - Demonstration of PRVR stereo images (Please manipulate the demonstration system.) Discussion - The PRVR's photo-reality, with its faithful shading and shadowing, was more emphasized on the stereo display. - Operational facility due to the photo-reality and fast rendering. - Future directions and potential applications. Conclusion - Photorealistic VR images ensured the usefulness of stereoscopic displays. - Potential clinical significance and implications for patient care.

# Abstract Archives of the RSNA, 2024

INEE-11

## A RADIOLOGISTS PERSPECTIVE OF GROUNDBREAKING ADVANCEMENTS IN LARGE LANGUAGE MODELS: PAST, PRESENT AND FUTURE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Syed Muhammad Awais Bukhari, MD (*Abstract Co-Author*) Nothing to Disclose
Orlando M. Martinez (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Discuss the basics of LLMs and their utility within radiology • Explore the major breakthroughs and updates over this past year • Showcase the current LLMs available on the market o Compare and contrast the most popular options o Discuss strengths and weakness of each o Highlighting specific use cases of interest to radiologists

### TABLE OF CONTENTS/OUTLINE

1. What is a Large Language Model (LLM) and why should we care? a. Brief history of LLMs b. Recent news headlines/articles c. Recently published radiology journal articles highlighting LLMs 2. Major breakthroughs in LLMs a. Emphasis on ChatGPT's breakthroughs and how other companies are following suit b. Multimodality LLMs c. Improvements in accuracy/precision 3. Examples of the top used LLMs that are currently available a. General chat engines vs trainable models b. Compare and contrast differences between LLMs c. Highlight strengths and weaknesses d. Explain best LLM for specific use cases (writing papers, research, education, etc?) 4. Biggest barriers for introduction of LLMs into radiology a. Discuss cases of how people/institutions have circumvented these barriers b. Explore potential pathways forward 5. Near Horizon and future of LLMs a. Rise of open source LLMs more compatible for medical use (HIPAA compliant) b. Enterprise based LLMs (company-specific) c. Improved accuracy and speed with new technological advancements (Self fact-checking) d. Artificial general intelligence

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# Abstract Archives of the RSNA, 2024

INEE-12

## STREAMLINING SUCCESS: ENHANCING RADIOLOGY READING ROOM EFFICIENCY WITH AUTOMATED PYTHON PIPELINES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Syed Muhammad Awais Bukhari, MD (*Abstract Co-Author*) Nothing to Disclose
Richard L. Barger JR, MD (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Discuss the integration of basic python coding to enhance radiology workflow in the reading room
- Compare and contrast the utility of python coding to large language models (LLMs)
- Showcase existing tools and future ideas
- Demonstrate how large language models can help radiologists with no programming background create useful tools

### TABLE OF CONTENTS/OUTLINE

1. What is Python? a. Historical perspective b. Usage in fields including medicine. c. Appeal of Python in clinical settings due to simplicity and community support. 2. Compare and contrast Python vs LLMs 3. Capabilities of Python and useful downloadable packages a. PyAutoGUI, tkinter, EasyOCR, PyperClip for custom UI based programs b. NumPy, SciPy, and Pandas for data manipulation c. PyDicom for DICOM files handling. 4. Examples of programs using these packages a. AI generated output to final report (decode AI output into report verbiage) b. Copy forward tool (automate transfer of historical findings into new reports to save time) c. Updating comparisons on reporting software (import dates for past images that have been reviewed) d. Input series/image numbers with keybind (insert image series number and slice number into report for referencing) e. Manipulating PACS (look at a series number and slice number on a report, and directly open up to that image) 5. Implementation in clinical practice: a. Challenges/Barriers: i. Steep learning curve for non-programmers ii. System compatibility issues iii. Cultural shift required in adopting new technologies b. Solutions i. Education ii. Phased implementation iii. Involving IT support 6. Future of python coding 7. Tutorial for Non-programmers a. Installation guide b. Downloading packages c. Programming with LLMs

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# Abstract Archives of the RSNA, 2024

INEE-13

## STREAMLINING MEDICAL IMAGE ANNOTATION: MITK'S AI POWERED WORKFLOW FOR EFFICIENT SEGMENTATION TASKS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Marco Nolden (*Abstract Co-Author*) Nothing to Disclose
Ralf Floca (*Abstract Co-Author*) Nothing to Disclose
Stefan Dinkelacker (*Abstract Co-Author*) Nothing to Disclose
Ashis Ravindran, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Medical Imaging Interaction Toolkit (MITK) is a well-established open-source software for interactive medical image processing applications. Amongst others MITK showcases a feature rich toolkit for medical image segmentation, integrating state-of-the-art AI tools to enhance the accuracy and efficiency of segmentation tasks. Utilizing these tools, the MITK Workbench facilitates users to generate instance or semantic image segmentations to produce high quality annotations for supervised learning tasks or medical image analysis. MITK offers, besides classical tools, a user-friendly interface to popular interactive AI models like the Segment Anything Model MedSAM for interactive image segmentation, making it accessible adding 3D support. MITK also offers easy access to the ML-based automatic segmentation algorithms Totalsegmentator nnUNet. In addition, MITK also covers the gamut of MONAI world via its support of MONAI Label app. The available tools are also enhanced by interpolation options and support for 3D+t images. Additionally, MITK introduces the Segmentation Task Lists, an optimized workflow for batches of segmentation tasks based on user-defined task lists. This feature significantly streamlines annotation and review processes, allowing for efficient management of multiple segmentation tasks. Overall, by leveraging AI, MITK offers a comprehensive solution for medical image segmentation, enhancing the accuracy efficiency of medical imaging analysis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. General segmentation tools 3. AI Segmentation tools 4. MONAI Label 5. Utilities 6. Segmentation Tasks Lists 7. Integration in annotation workflows 8. Conclusion and Future directions

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# Abstract Archives of the RSNA, 2024

INEE-14

## NOT MAGIC, MATHEMATICS! A RADIOLOGIST'S VISUAL GUIDE TO PERFORMANCE METRICS IN AI RESEARCH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leticia M. Pessanha Alves, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

As Artificial Intelligence integration deepens within the radiology field, it becomes essential for radiologists to become familiar with the performance metrics of Machine Learning Models. This familiarity is not just crucial for the application but also for the critical evaluation of AI tools in clinical settings. However, the complexity of the mathematical concepts involved can present a significant barrier. This education exhibit aims to simplify these concepts through visual aids and correlate them with specific radiological tasks, making the information more accessible and comprehensible.

### TABLE OF CONTENTS/OUTLINE

1. Types of Machine Learning applications in radiology and their corresponding performance metrics; 2. Accuracy; 3. Confusion Matrix; 4. Specificity; 5. Recall; 6. Precision; 7. F1-score; 8. ROC curve / AUC; 9. Dice Score; 10. Mean Absolute Error

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# Abstract Archives of the RSNA, 2024

INEE-15

## EMERGING HORIZONS: FDA-APPROVED AI TECHNOLOGIES IN ABDOMINAL IMAGING - PIONEERING PRECISION, REDEFINING PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Panagiotis Korfiatis, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrew Missert, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan Dillard (*Abstract Co-Author*) Nothing to Disclose
Ashish R. Khandelwal, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy L. Kline, PhD (*Abstract Co-Author*) Nothing to Disclose
Pranav Ajmera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•Introduce the evolution of artificial intelligence (AI) in radiology, specifically focusing on its application to abdominal imaging. • Examine the FDA approval process for AI-driven medical devices and tools, highlighting the rigorous measures in place to ensure safety and efficacy. • Overview of existing FDA-approved AI technologies in abdominal imaging, detailing their applications across the liver, biliary system, intestine, prostate, kidney, bladder, and vascular imaging. • Impact of AI technologies on diagnostic accuracy, workflow optimization, patient care, and explore future directions for AI in abdominal radiology.

### TABLE OF CONTENTS/OUTLINE

Introduction • Overview of the transformative alliance between radiology and AI in modern medicine.FDA Approval Process• Explanation of the revamped FDA approval pathway for AI-driven software as medical devices in radiology.• Discuss the challenges and adaptations required for evaluating AI algorithms under the FDA's regulatory framework.Organ-Specific AI Applications • Utilize an organ-specific approach to examine FDA-approved AI technologies. • Overview of AI solutions, including their functionalities, applications, and impact on clinical practice. • Analysis of AI-driven advancements in image quality, noise reduction, longitudinal comparison, and anatomical descriptors across multi-organ systems.Limitations • Elaborate on data privacy, algorithmic bias, need for ongoing validation and monitoring.Conclusion • Reflect on the paradigm shift in healthcare due to AI and the importance of transparent collaboration between developers, regulatory bodies, and the medical community for ascertaining ethical, patient-safe usage.

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# Abstract Archives of the RSNA, 2024

INEE-16

## UNLOCKING HIDDEN INSIGHTS: LEVERAGING AI FOR OPPORTUNISTIC SCREENING IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Seyed Mohammadreza Chavoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Theodorus Dapamede, MD, PhD (*Abstract Co-Author*) Intern, MARS BioImaging Ltd
Amirali Khosravi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the concept and potential benefits of opportunistic screening in radiology.2. Explore current applications of AI-driven opportunistic screening and their impact on patient care.3. Identify challenges and ethical concerns associated with the implementation of opportunistic screening.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Opportunistic Screening and AI in Radiology (a). Defining opportunistic screening and its role in early disease detection (b). Current trends and advancements in AI-assisted opportunistic screening research 2. Applications of AI-Driven Opportunistic Screening (a). General approaches to opportunistic screening using AI (b). Case studies: AI-based opportunistic screening using direct signal processing (c). Case studies: AI-based opportunistic screening using surrogate signal processing 3. Future Directions and Challenges (a). Expanding AI-based opportunistic screening to other diseases and imaging modalities (b). Collaborating with healthcare providers to optimize patient care and integrate AI-based screening into clinical workflows 4. Ethical Considerations (a). Informed consent and patient autonomy in the context of opportunistic screening (b). Potential misuse of AI-generated information by third parties (e.g., insurance companies) (c). Ensuring equitable access to AI-based screening technologies across diverse patient populations 5. Conclusion (a). Recap of the potential benefits and challenges of AI-driven opportunistic screening in radiology (b). Future directions for research and implementation to enhance patient care and outcomes

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# Abstract Archives of the RSNA, 2024

INEE-17

## LARGE LANGUAGE MODELS FOR RADIOLOGISTS: A STEP-BY-STEP PRIMER FOR EFFECTIVE USE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David A. Woodrum, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pouria Rouzrokh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Shahriar Faghani, MD (*Abstract Co-Author*) Nothing to Disclose
Mana Moassefi, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaz Vahdati, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Ganjizadeh, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

I. The Power of Context: LLMs vs. String Search: Unlike string search, which is limited to exact word matches, LLMs excel at grasping context and summarization. This makes them indispensable for tasks that require a deeper understanding of a text, such as identifying tumor recurrences or excluding false positives in radiology reports - particularly in retrospective studies.II. The Art of Crafting Effective Prompts for LLMs: The quality of your prompts can make all the difference in the output of your LLM. You can significantly influence the model's response by asking the right questions and providing clear instructions. To take it to the next level, combine effective prompting with reinforcement learning and human feedback (RLHF) to achieve the desired outcomes.III. Simplifying PHI Protection with Low-Code/No-Code Solutions: By leveraging no-code tools like Ollama, Llamafile, or GPT4all, you can run open-source models like LLaMA3 or Mixtral on your workstation, ensuring HIPAA compliance without massive computation power.

### TABLE OF CONTENTS/OUTLINE

I. LLMs vs. String Searcho Limitations of String Search: Understanding the limitations of exact word matcheso The Advantages of LLMs: context understanding and summarizationo Real-World Applications: Identifying tumor recurrences, excluding false positives in radiology reportsII. Crafting Effective Prompts for LLMso How prompts influence LLM outputo Strategies for asking the right questions and providing clear instructionso Taking it to the Next Level: Combining effective prompting with RLHFIII. Simplifying PHI Protection with Low-Code/No-Code Solutionso Running Open-Source Models Locally

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# Abstract Archives of the RSNA, 2024

INEE-18

## CLINICAL IMPLEMENTATION OF AI TOOLS: THINKING BEYOND FDA APPROVAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Joshua Hunter, BS (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Charit R. Tippareddy, MD (*Abstract Co-Author*) Nothing to Disclose
Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Syed Muhammad Awais Bukhari, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the journey of AI from bench to bedside 2. Know about the importance of clinical implementation of AI tools utilizing a sample workflow 3. Understand how to overcome challenges associated with the clinical deployment of AI

### TABLE OF CONTENTS/OUTLINE

1. AI Use Cases in Radiology o Classification o Segmentation o Localization o Preprocessing o Detection o Prediction 2. Journey of an AI tool: From Bench to Bedside o Identification of a Clinical Problem o Dataset Selection o Dataset Preparation o Algorithm development and training o Clinical Implementation and Monitoring 3. FDA approval process o FDA oversight (ensure compliance, including premarket review, risk classification, and post-market surveillance.) o Software as a Medical Device (SaMD) o Risk Classification and Premarket approval (Most radiology tools fall under Class II or III, requiring premarket approval) o Federated learning (data privacy-preserving method for AI tool training) o Adaptive Learning (regulatory framework for adaptive AI models, ensuring they meet initial and ongoing standards) 4. Clinical Deployment of AI: Basic steps and Clinical applications o Knowing the availability of resources and strengths of the radiology system o Identifying and addressing the needs of your system o Creating unique workflows o Performance monitoring of AI o Involving clinical teams o Dealing with increasing complexities

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# Abstract Archives of the RSNA, 2024

INEE-19

## PIXEL-PERFECT PROTECTION: CYBERSECURITY TACTICS FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatiana C. Tucunduva, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Domingos De Sousa (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understanding Cyber Threats in Radiology highlights the range of cyber threats like ransomware and data breaches targeting radiology, aiming to increase awareness of system vulnerabilities.- Principles of Secure Data Management emphasize encrypting patient data and images, secure access, and regular backups to protect data's confidentiality, integrity, and availability.- Incident Response and Recovery Planning details steps for radiology departments to prepare for cyber incidents, including detection, containment, and recovery, emphasizing effective communication.

### TABLE OF CONTENTS/OUTLINE

- Introduction to Cybersecurity in Radiology offers an overview of cybersecurity's importance and challenges in radiology.- Common Cyber Threats and Vulnerabilities in Radiology explores cyber threats specific to radiology departments.- Fundamental Cybersecurity Practices for Radiologists introduces basic cybersecurity measures like strong passwords and secure internet practices.- Advanced Data Protection Techniques covers sophisticated strategies like encryption and anonymization of patient data.- Legal and Regulatory Considerations provides an overview of data protection laws in healthcare.- Developing a Cyber Resilient Culture in Radiology Departments discusses fostering cybersecurity awareness through training and simulations.

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# Abstract Archives of the RSNA, 2024

INEE-2

## USING ANATOMICAL SEGMENTATION ALGORITHMS FOR CONTEXT-SENSITIVE CT IMAGING RECONSTRUCTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nathalie Mertens (*Abstract Co-Author*) Nothing to Disclose
Peter De Jaeger, PhD (*Abstract Co-Author*) Nothing to Disclose
Kristof De Smet, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Thomas Ryckaert (*Abstract Co-Author*) Nothing to Disclose
Stijn Schatteman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

CT imaging workflows frequently entail the review of multiple reconstructions of the same anatomical region, customized to distinct structures. This process involves manipulating various image windows and applying different kernel reconstructions, which can be time-intensive.Context-Sensitive reconstruction represents an innovative method designed to alleviate this burden. Employing anatomical segmentation algorithms, this technique accurately identifies and delineates diverse organs and tissues within a standard CT scan. Subsequently, it adjusts reconstruction settings specific to each anatomical structure, including tailored windowing, kernel selection. This methodology was initially proposed by S. Dorn et al. in 2018.By enabling a single comprehensive image that integrates all necessary reconstructions, this approach significantly reduces redundancy. Context-Sensitive reconstruction not only streamlines the interpretation process but also enhances efficiency and diagnostic precision in CT imaging.We outline a practical application of this method using the MONAI framework. Utilizing the publicly accessible "total segmenter" tool by J. Wasserthal et al., we generate segmentation maps that inform customized reconstruction settings for each anatomical structure, culminating in a unified image.

### TABLE OF CONTENTS/OUTLINE

1) An overview of common reconstruction parameters.2) Introduce the concept of context-Sensitive reconstruction to streamline CT imaging interpretation.3) Demonstrate the practical implementation process using freely available tools.4) Case studies to illustrate the potential benefits and limitations of this technique in clinical settings.

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# Abstract Archives of the RSNA, 2024

INEE-20

## AN OVERVIEW OF THE APPLICATIONS OF ARTIFICIAL INTELLIGENCE/MACHINE LEARNING IN MEDICAL IMAGING AND THE PROCESS OF DEVELOPING SUPERVISED LEARNING MODELS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

William Fan (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This education exhibit presentation covers some use-cases based on supervised machine learning models for medical imaging and provides a brief rationale for the impact of artificial intelligence in healthcare.It goes on to present a broad overview of the steps involved in the development of supervised machine learning projects, from problem selection all the way to model deployment and monitoring.An in-depth diagram describing the roles of different datasets used in the development process of a supervised model is also displayed.Finally, a mini-glossary with some of the key terms for projects of machine learning in healthcare is also presented.

### TABLE OF CONTENTS/OUTLINE

1) Will artificial intelligence replace or augment doctors?2) Use-cases based on supervised machine learning in medical imaging3) Development steps of supervised machine learning (ML) models4) Overview of datasets involved in a supervised machine learning diagnostic algorithm5) Mini-glossary of technical terms for projects of machine learning in healthcare

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# Abstract Archives of the RSNA, 2024

INEE-21

## STANDARDIZING IMAGING FINDINGS REPRESENTATION: HARNESSING COMMON DATA ELEMENTS SEMANTICS AND FAST HEALTHCARE INTEROPERABILITY RESOURCES STRUCTURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Marc D. Kohli, MD (*Abstract Co-Author*) Founder, Alara Imaging;Stockholder, Alara Imaging
Teri M. Sippel Schmidt, MS (*Abstract Co-Author*) Nothing to Disclose
Kevin O'Donnell (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Brian Bialecki (*Abstract Co-Author*) Nothing to Disclose
Tarik K. Alkasab, MD, PhD (*Abstract Co-Author*) Consultant, Nuance Communications, Inc;Medical Advisory Board, Nuance Communications, Inc
Ali S. Tejani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Introduce joint Radiological Society of North America (RSNA)/American College of Radiology (ACR) Common Data Elements (CDEs) project 2. Outline the emerging framework using CDEs as the semantic labels on standard FHIR structures 3. Review relationship between CDE Sets/Elements and radiology finding attributes 4. Review examples of findings encoded as Health Level 7 Fast Healthcare Interoperability Resources (HL7 FHIR) Observations using CDE Set/Element identifiers as standardized semantic labels ?

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Limitations of integrating information in radiology reports i. Heterogeneous reporting styles ii. Absence of a uniformly accepted standard for structured data iii. Difficult to extract meaningful insight at scale b. Introduce joint RSNA/ACR CDE project c. Introduce Health Level 7 Fast Healthcare Interoperability Resources (HL7 FHIR) d. Role of standard ontologies i. RadLex ii. SNOMED CT iii. LOINC 2. Propose CDEs as a Data Model and review terminology a. Hierarchy of Sets/Elements/Values b. Role of Set/Element IDs c. Structure of a Set Definition d. Representing CDE Sets/Elements with HL7 FHIR Observations 3. “Anatomy” of an observation encoded as a CDE 4. Specific use cases demonstrating model in practice a. Example coding structures for radiology findings i. Pulmonary nodule (RDES195) ii. CT Stroke (RDES22) iii. Acute diverticulitis (RDES138) b. Longitudinal tracking of findings over time c. AI result integration and monitoring

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# Abstract Archives of the RSNA, 2024

INEE-22

## POST DEPLOYMENT MONITORING AND POST-MARKET SURVEILLANCE IN RADIOLOGY AI: CURRENT PRACTICES, POSSIBILITIES, AND MANDATES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Abhishek Gupta (*Abstract Co-Author*) Employee, CARPL.ai
Vasantha Kumar Venugopal, MD (*Presenter*) Officer, CARPL.AI Inc

### TEACHING POINTS

1. Continuous monitoring is crucial for ensuring that AI tools perform reliably and safely after deployment, aligning with both clinical needs and regulatory standards. 2. Critical metrics such as temporal stability and predictive divergence provide insights into an AI system's reliability and the necessity for periodic recalibration 3. Differentiating between what is currently required by law and what practices could be implemented to further enhance AI monitoring 4. Exploring how different levels of human involvement in monitoring (in-the-loop, out-of-the-loop, over-the-loop, on-the-loop) can impact the effectiveness and efficiency of AI systems 5. Identifying and addressing the practical challenges in implementing effective AI surveillance, including technological, operational, and regulatory hurdles

### TABLE OF CONTENTS/OUTLINE

Current Monitoring Practices in Radiology AI: Detailed examination of human-in-the-loop and human-out-of-the-loop systems.Use of human-over-the-loop and human-on-the-loop as supervisory and alert-based monitoring methods.Potential Advancements in AI Surveillance: Innovations in AI monitoring techniques that could enhance efficacy and safety. Discussion of predictive analytics and automated systems for real-time anomaly detection.Regulatory Frameworks and Mandatory Practices: Overview of global regulatory mandates for AI monitoring in healthcare.Specific requirements for continuous monitoring and performance reporting.Challenges and Solutions in Implementing Effective Surveillance

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INEE-23

## CLINICAL CONTEXT-BASED WORKFLOW AUTOMATION WITH LARGE LANGUAGE MODEL (CHAT-GPT 4): FROM ACQUISITION AND RECONSTRUCTION FACTORS TO IMAGE POSTPROCESSING AND AI MODEL AUTO-SELECTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Michael Suhling, PhD (*Abstract Co-Author*) Employee, Siemens AG
Chelsea Dunning, PHD (*Abstract Co-Author*) Nothing to Disclose
Alexander Katzmann (*Abstract Co-Author*) Consultant, Siemens AG
Oliver Taubmann (*Abstract Co-Author*) Nothing to Disclose
Javier Contreras Yametti, MD (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Monica O. Bernardo, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias F. Froelich, MD (*Abstract Co-Author*) Consultant, Smart Reporting GmbH;Consultant, Guerbet SA
George S.K. Fung, PhD (*Abstract Co-Author*) Employee, Siemens AG
Parisa Kaviani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Key elements of CT workflow from protocol selection, acquisition and reconstruction factors, image post-processing, and AI model selection 2. Manual workflow and importance of clinical context (reason for CT/prior radiology reports) for optimizing radiation dose and image processing 3. Application of large language model (Chat-GPT 4) extraction of relevant clinical context to automate radiology workflow based on customizable rules and guidelines.

### TABLE OF CONTENTS/OUTLINE

1. Visual summary of manual workflow and pain points in current radiology workflow for incorporating clinical indications for CT and prior CT reports. 2. Elements of radiology workflow automating LLM augmented with >300 clinical rules/guidelines 3. Case-based demonstration of how the proposed LLM uses clinical context for automating workflow by picking the right CT protocol, the acquisition and reconstruction factors, image post-processing, and AI model 4. Real-world examples of how LLM handles exception cases with prior contrast allergies, metal implants, large body habitus and motion artifacts 5. Uses, strengths and limitations of proposed LLM in radiology workflow

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INEE-24

## LIVER SEGMENTATION: PRACTICAL APPLICATIONS OF MACHINE LEARNING IN PREOPERATIVE ASSESSMENT, PREDICTION AND EVALUATION OF TREATMENT RESPONSE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

John D. Hazle, PhD (*Abstract Co-Author*) Nothing to Disclose
Ahmed Marey, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Awj Twam (*Abstract Co-Author*) Nothing to Disclose
David Fuentes (*Abstract Co-Author*) Nothing to Disclose
Mohamed Eltaher, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Describe the role of machine learning in tumor segmentation. - Discuss the pros and cons of various segmentation methods.- List the imaging requirements for a liver segmentation project.- Illustrate the current clinical applications of liver segmentation, particularly in preoperative assessment and evaluation of treatment response. - Discuss future directions for liver segmentation.

### TABLE OF CONTENTS/OUTLINE

1. The role of machine learning in liver segmentation. 2. Current applications of liver volumetry: a. Assessment of treatment response in hepatic malignancies. b. Prediction of patients' overall survival and time-to-progression. c. Future liver volume prior to major hepatectomy. d. Virtual surgical planning. 3. Illustration of available segmentation methods. 4. Comparison: pros and cons of each segmentation method. 5. Step by step tutorial for liver segmentation. 6. Current challenges facing automated liver segmentaion. 7. Future directions: a. Vascular sub-segmentation. b. Radiogenomics. c. Fully automated segmental volumetry. d. Automated volumetric RECIST measurements.

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# Abstract Archives of the RSNA, 2024

INEE-25

## NEEDLEPATH: AN OPEN SOURCE TOOL FOR OUT-OF-PLANE CT GUIDED NEEDLE PROCEDURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Phillip M. Cheng, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

CT-guided needle placement is a common initial task required for a variety ofinterventional radiology procedures including biopsy, drainage, ablation, injection, fiducial placement, and catheter deployment. Most commonly, the body entry point and target can be imaged in the same axial plane ("in-plane" procedures). However, sometimes an in-plane needle trajectory is either impossible or unsafe.In this exhibit, we illustrate the challenging 3D geometry of out-of-plane CT guided needle placements. We have created an open source software program called NeedlePath, which we designed to allow easy measurement of in-plane and out-of-plane needle angles for these procedures. The program retrieves a series of DICOM images from the PACS, and allows the user to mark the start position and the target on the images. NeedlePath shows the in-plane and out-of-plane needle angles and the projected needle path.

### TABLE OF CONTENTS/OUTLINE

1. In-plane versus out-of-plane CT procedures (biopsy, drain, fiducialplacement, ablation, injection). 3D geometry of out-of-plane procedures.2. Currently available solutions: patient repositioning, gantry tilt, optical or electromagnetic sensors, robotic systems, dead reckoning3. NeedlePath- open source software program we have created to easily calculate in- and out-of-plane angles, and 3D target distance. Details on mechanics of usage for planning out-of-plane CT procedures and calculating needle adjustments during procedures.

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# Abstract Archives of the RSNA, 2024

INEE-26

## UNDERSTANDING DICOM IMAGES AND PHI PROTECTION, OR "STAYING OUT OF JAIL", FOR CLINICAL AND RESEARCH PURPOSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Gabe Lafond (*Presenter*) Nothing to Disclose

### TEACHING POINTS

DICOM (Digital Imaging Communications in Medicine) images play a vital role in medical diagnostics research. DICOM files contain metadata, a blend of neutral scientific data sensitive protected health information (PHI). Scientific data is interesting to researchers, anonymous safe to share, but the presence of PHI necessitates de-identification/anonymization to uphold patient privacy in accordance with HIPAA. We delve into understanding the DICOM standard, scrutinizing metadata content with knowledge of its use abuse in the wild, the execution of thorough PHI cleansing while retaining useful scientific data. We share insights from our institution's experience data gathered while developing a computer program for anonymization of DICOM images for advanced imaging research purposes. Anonymizing DICOM files entails removal of PHI from metadata, sometimes with provisions for authorized personnel to recover patient identities when necessary. While traditional anonymization methods remove all private tags, leaving only a set of standard tags known to be safe, our recommended approach selectively removes private tags with information matching values from standard tags known to contain PHI. We have validated this method on diverse DICOM datasets, ensuring thorough PHI elimination while preserving scientific data compatibility with popular medical image processing programs.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to DICOM images Metadata2. Examples of HIPAA violations through DICOM Metadata its Consequences3. Understanding PHI in DICOM Metadata4. Anonymization Methods Challenges5. Selective Anonymization Approach6. Validation of the Method7. Conclusion Future Directions

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# Abstract Archives of the RSNA, 2024

INEE-27

## FROM CONCEPT TO CLINIC: A STEP-BY-STEP GUIDE TO INTEGRATION OF MEDICAL AI TOOLS INTO RADIOLOGY PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jonathan R. Medverd, MD (*Abstract Co-Author*) Nothing to Disclose
Dushyant Sahani, MD (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV;Advisory Board, Canon Medical Systems Corporation;Advisory Board, General Electric Company;
Mahmud Mossa-Basha, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Mahdavi, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio C. Westphalen, MD, PhD (*Abstract Co-Author*) Shareholder, ScanMed, LLC;Research funded, BotImage, Inc
Negar Firoozeh, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Implement a road map to introduce AI/clinical informatics tools in radiology Review challenges with the initiation of AI implementation in a healthcare system Present the value of a team approach to establish a workflow for the validation of AI diagnostic and triage algorithms and future program growth

### TABLE OF CONTENTS/OUTLINE

Introducing AI tools into a radiology department involves several steps: 1-Needs assessment: Evaluating challenges faced by the evolving radiology department based on patient needs. 2-AI platform selection: Finding the best option based on department needs, priorities, and plans considering available platform features, AI tools menu, and pricing. 3-Stakeholder engagement: A collaborative approach among radiologists, informatics, quality and safety, clinicians, imaging operators, trainees, and research teams. 4-Integration: Defining a workflow for PACS/EHR integration. 5-Piloting: Testing AI tools to assess workflow, efficacy, and potential pitfalls. 6-Education: Training stakeholders for clinical adoption. 7-Communication: Establishing a communication and feedback loop for continued learning and improvement. 8-Data analytics and validation: Validation of AI algorithms with data analytics, with collection, processing, and analysis of large data volumes. 9-Evaluation and optimization: Continued review of AI performance to identify opportunities for improvement, fulfilling unmet needs, and track performance drift.

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# Abstract Archives of the RSNA, 2024

INEE-28

## PROPOSED MEDICAL SCHOOL CURRICULA FOR 3D PRINTING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Richard L. Hallett II, MD (*Abstract Co-Author*) Consultant, Bracco Group
Summer J. Decker, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Ford, PhD (*Abstract Co-Author*) Nothing to Disclose
David H. Ballard, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle Heiser, BS (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Morris, MD (*Abstract Co-Author*) Consultant, Medtronic plc;Speaker, Medtronic plc;Consultant, Merit Medical Systems, Inc;Speaker, Merit Medical Systems, Inc;Consultant, Landauer Inc;Speaker, Johnson & Johnson
Michael F. Morris, MD (*Abstract Co-Author*) Educator, Medtronic plc
Prashanth Ravi, PhD (*Abstract Co-Author*) Nothing to Disclose
Owais Salahudeen, BS (*Abstract Co-Author*) Nothing to Disclose
Rayna Debellevue (*Abstract Co-Author*) Nothing to Disclose
Liane Ruddy (*Abstract Co-Author*) Nothing to Disclose
Jordan Mackner (*Abstract Co-Author*) Nothing to Disclose
Garrett Trang (*Abstract Co-Author*) Nothing to Disclose
Taaha Adamji, BA (*Abstract Co-Author*) Nothing to Disclose
Kimberly Hatch, ARRT, BA (*Abstract Co-Author*) Nothing to Disclose
Stacy Ruther, BA (*Abstract Co-Author*) Nothing to Disclose
Frank J. Rybicki III, MD, PhD (*Presenter*) Medical Director, Imagia Cybernetics Inc

### TEACHING POINTS

1 Medical students should and want to learn 3D printing2 While there are abundant, disparate learning resources, this exhibit aims to fill the unmet need to integrate and standardize 3D printing and its appropriateness into US medical education3 The 3D printing community outside of medicine thrives on free, open exchange of ideas and tools4 The 3 proposed curricula will be open source using a website that welcomes evaluation of outside material

### TABLE OF CONTENTS/OUTLINE

1 LCME accredits US medical education, mandating content on modern biomedical sciences and organ systems; 3D printing aligns with LCME standards by supporting anatomy and organ system learning2 In response to student desire for learning and the need to align US medical education, multidisciplinary (medical leadership, radiologists, engineers, technologists) experts from five medical schools developed three curricula with medical students3 All curricula have common introduction slides, notes, and videos4 Clinically validated, deidentified .DCM .STL .OBJ files plus 3D PDFs and .JPG photos are available5 Primers focus on commonly used printers: material extrusion and inverted vat polymerization6 Hands-on learning will include end-to-end manufacturing: segmentation, Computer Aided Design, 3D printing, and post-processing. Troubleshooting will be emphasized7 Guidance for medical school leadership includes laboratory start-up and development to include space, technical support, and estimated costs8 Project ideas and proficiency testing will be openly shared9 Medical students will be provided the opportunity to learn how 3D printing is integrated into various specialtiesAll medical student authors contributed equally to this abstract

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# Abstract Archives of the RSNA, 2024

INEE-29

## AI STARTER: A BEGINNER'S GUIDE TO IMAGE ANALYSIS PROJECTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Tim Leiner, MD, PhD (*Abstract Co-Author*) Research support, Pie Medical Imaging BV;Advisory Board, Cart-Tech BV;Advisory Board, AI4MedImaging;Advisor, Quantib BV;Consultant, Guerbet SA
Yashbir Singh, PhD, MEng (*Abstract Co-Author*) Nothing to Disclose
Ivana Isgum, PhD (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV;Research Grant, 3mensio Medical Imaging BV;Research Grant, Koninklijke Philips NV;Research Grant, Esaote SpA;Co-founder, Quantib BV;Shareholder, Quantib BV;Researcher, Quantib BV;;;
Diana V. Vera-Garcia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand machine learning project requirements and to review the types of resources required for different projects2. To review how to set up the software environment for machine learning projects by guiding learners through the process of software installation and introducing programming languages3. To discuss data preprocessing, the fundamentals of machine learning algorithm creation and validation

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Defining the aim of your project3. What computer resources do you need?3.1 The kind of resources that your task requires- Small-scale projects using Machine Learning vs highly computational projects using Deep Learning- GPU, RAM, HARD DRIVE, cloud bases resources and tools4. What software do you need to install?4.1 Can I use the same software for different tasks? 5 How do you get started with coding?5.1 Selection of the best language for my task/project5.2 Which is the easiest way to learn coding? -Use development tools, start a coding project, or implement a use-case scenario problem 7. Preparing data for the project7.1 How much data do you need? 7.2 Data preprocessing, data collection, cleaning, splitting, transformation, and augmentation8. Creating your algorithm8.1 Training and fine-tuning the algorithm8.2 Creating the final model9. Validation and metrics for the algorithm9.1 Internal and external validation9.2 Determining the appropriate metrics for accuracy evaluation11. Code and data sharing11.1 Common platforms for sharing software code and data12. Implementation of already published algorithms12.1 Understanding the task and implementation details12.2 Compare your results with the original model

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# Abstract Archives of the RSNA, 2024

INEE-3

## THE PITFALLS OF UNDERSTANDING AI PRODUCTS - A RADIOLOGIST'S GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bogdan Bercean (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiologists face an ever-increasing wide range of choices when comparing and selecting the right AI product. The lack of standardisation in technical specifications and the plethora of new AI-related technical terms could quickly become overwhelming and confusing. To this end, this exhibit uncovers some common pitfalls medical professionals are prone to make. After reviewing it, the radiologist will understand:1) When and how can AUROC be a misleading metric, and what to look for when understanding the quantitative performance of an AI product;2) How the overused "dataset size" selling point is not an absolute reference by itself;3) What types of research articles to look for and what distinctions are to be made;4) How to ask better questions when considering an AI product.

### TABLE OF CONTENTS/OUTLINE

1) Performance metrics and where does AUROC stand?a. continuous metrics;b. dichotomous metrics;2) Varying dataset sizes and types and their impact on different AI paradigms.3) Research types in radiological AI. Which ones are meant for radiologists?4) Top questions a radiologist should ask?

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# Abstract Archives of the RSNA, 2024

INEE-30

## A PRIMER ON THE FUNDAMENTALS OF GENERATIVE AI FOR MEDICAL IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Szymon Mazurek (*Abstract Co-Author*) Nothing to Disclose
Sarthak Pati, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recent advances in generative artificial intelligence (GenAI) have influenced nearly every industry, including healthcare. Their impact can be especially seen in the domain of medical imaging, where they enabled groundbreaking progress in the fields of denoising, data augmentation, and unsupervised feature extraction. Additionally, GenAI can be used to address clinical issues with a dataset, such as class imbalance. Finally, it can potentially add privacy guarantees in a collaborative training framework, such as federated learning. The landscape of possible approaches is massive, with each solution being characterized by its unique properties and requirements. Furthermore, GenAI often exhibits complex principles of operation and high sensitivity to the chosen hyperparameters. All these properties are potential obstacles for the users, especially the ones not deeply familiar with GenAI. We want to address these entry barriers by providing an overview of the available solutions, as well as showing practical examples of using such methodologies with various open-source frameworks. Additionally, we plan on highlighting specific methodologies (autoencoders, generative adversarial methods, diffusion models) along with their principles of operation using an extensive and open-source mammography dataset.

### TABLE OF CONTENTS/OUTLINE

The exhibit will present various techniques for the application of GenAI in medical imaging using open-source frameworks. Users will see practical examples of applying those methods to high-resolution mammography data, highlighting different aspects of using such models and properly configuring their architectures hyperparameters.

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# Abstract Archives of the RSNA, 2024

INEE-31

## AVOIDING AUTOMATION BIAS: CASE SERIES OF FALSE POSITIVES SEEN IN INTRACRANIAL HEMORRHAGE DETECTION ALGORITHMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Steven A. Rothenberg, MD (*Abstract Co-Author*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC
Houman Sotoudeh, MD (*Abstract Co-Author*) Nothing to Disclose
Srini Tridandapani, MD, PhD (*Abstract Co-Author*) Co-founder, Camerad Technologies, LLC;Spouse, Co-founder, Camerad Technologies, LLC;Officer, Camerad Technologies, LLC;Spouse, Officer, Camerad Technologies, LLC
Jordan D. Perchik, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Background Intracranial hemorrhage (ICH) detection algorithms are some of the most widely used artificial intelligence (AI) applications in clinical radiology practice. These algorithms can assist radiologist in the detection of subtle ICH, and some algorithms interface with the worklist to triage positive exams. No algorithm is perfect, and when false positives occur, this can lead to inappropriate treatment, prolonged hospitalization, and misuse of hospital resources. Radiologists using these algorithms must know when to override the AI result and avoid automation bias. Teaching points The goal of this presentation is to demonstrate the different types of false positives that can be observed with ICH detection algorithms. Understanding how an AI algorithm determines true positives is key to understanding false positives. Examples of the different types of imaging artifacts, pathologic processes, and anatomic variants will be presented alongside an AI heatmap highlighting the image region contributing to the false positive finding.

### TABLE OF CONTENTS/OUTLINE

Example 1Presentation of the different types of imaging artifacts that can result in ICH false positives, including motion artifact and beam hardening. Example 2 Different pathologic processes can trigger a false positive ICH flag. These cases include cortical laminar necrosis, meningiomas, and cavernomas. Example 3 Some anatomic variants, and even normal anatomy, can sometimes cause ICH false positives. These include colloid cysts, the dural venous sinuses, and the choroid plexus.

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# Abstract Archives of the RSNA, 2024

INEE-32

## DEFINING AI MODELS AND DATASETS TO PROMOTE DISCOVERY AND INTEROPERABILITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Charles E. Kahn JR, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Safwan Halabi, MD (*Abstract Co-Author*) Advisor, Change Healthcare
Abhinav Suri, BA, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Describe ontologies and their role in radiology.2, Define the FAIR (Findability, Accessibility, Interoperability, and Reuse) principles.3. Identify gaps in current approaches to capture critical information about AI models and data.4. Understand how an ontology can make radiology AI models and datasets more discoverable and interoperable.

### TABLE OF CONTENTS/OUTLINE

1. Ontologies a. Overview and definitions b. Why ontologies are useful c. Examples (RadLex, SNOMED CT, etc.)2. FAIR principles a. Overview and definitions b. Applications to radiology AI3. Current approaches a. Model cards b. Datasheets for datasets c. Shortcomings for radiology AI applications4. Radiology Model and Dataset Ontology (RMDO) a. Overview b. Example RMDO-based documents5. Discussion and Next Steps

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# Abstract Archives of the RSNA, 2024

INEE-33

## ADVANCING RADIOLOGY EDUCATION WITH AI: ENHANCING CURRICULUM PLANNING, IMPLEMENTATION, AND EVALUATION IN RADIOLOGY TRAINING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Hillary W. Garner, MD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Pouria Rouzrokh, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Artificial intelligence (AI) applications in radiology practice have experienced exponential growth in recent years. Similarly, many radiology programs have incorporated AI education into their curricula. However, the potential impact of AI on radiology education itself remains underemphasized in current literature. While AI's contributions to medical education have been discussed for long, the recent emergence of advanced AI tools for imaging data and large language models holds the promise of significantly improving the quality of radiology education and automating its workflows. These AI tools may be as transformative as distance learning once was, reducing educational disparities and ultimately enhancing the quality of radiologist care and patient outcomes. This educational exhibit aims to provide a comprehensive review of possible strategies, opportunities, and limitations for applying AI to different aspects of radiology education.

### TABLE OF CONTENTS/OUTLINE

A) Context: A-1) What are the current gaps in terms of using AI to advance radiology education?A-2) The SWOT Analysis of applying AI to radiology education.B) What are the strategies for applying AI to different stages of radiology curriculum planning (examples are provided in the PDF file)?B-1) Needs assessmentB-2) Aims and Objectives Planning B-3) Content collection B-4) Content organization B-5) Learning strategies B-6) Teaching methods B-7) Assessment methods B-8) Curriculum communication B-9) Educational environment B-10) Curriculum managementC) Where to start? C-1) A stepwise roadmap for the gradual introduction of AI to radiology education. C-2) Lesson learned from previous experiences in applying AI to medical education.

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# Abstract Archives of the RSNA, 2024

INEE-34

## FROM THE LABORATORY TO CLINICAL PRACTICE: CLINICAL TRIALS IN ASSESSING THE EFFICACY OF AI ALGORITHMS IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bruna Garbes Pinto (*Abstract Co-Author*) Nothing to Disclose
Henrique M. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Klaus Schumacher, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanna Mendes (*Abstract Co-Author*) Nothing to Disclose
Gabriel Ferracioli (*Abstract Co-Author*) Nothing to Disclose
Joselisa P. Paiva (*Abstract Co-Author*) Nothing to Disclose
Tayran Mila Mendes Olegario (*Abstract Co-Author*) Nothing to Disclose
Pedro Silva (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Present the main components (primary outcome, experimental design, and study population) of a randomized clinical trial (RCT) using illustrative examples. 2. Showcase the distinctions between RCTs for pharmacological interventions and AI-based screening tools, highlighting key differences in design and execution. 3. Discuss potential pitfalls encountered during the planning, execution, and analysis phases of RCTs for AI screening tools, along with strategies to mitigate these challenges. 4. Propose a comprehensive protocol for conducting an RCT evaluating an AI screening tool for the diagnosis of tuberculosis, emphasizing key considerations in study design and implementation. 5. Explore future perspectives of clinical trials for AI tools, including adaptations for remote conduct and potential advancements in trial methodologies. 6. Discuss future perspectives of clinical trials for AI tools and how they can adapt to be remotely conducted.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

INEE-35

## THE COMPREHENSIVE OPEN FEDERATED ECOSYSTEM (COFE): ENABLING IMPACTFUL HEALTHCARE STUDIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Sarthak Pati, MSc (*Abstract Co-Author*) Nothing to Disclose
Renato Umeton (*Abstract Co-Author*) Nothing to Disclose
Micah Sheller (*Abstract Co-Author*) Researcher, Intel Corporation;
Alexandros Karargyris (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Patrick Foley (*Abstract Co-Author*) Nothing to Disclose
Ujjwal R. Baid, PhD (*Abstract Co-Author*) Nothing to Disclose
Prashant Shah (*Abstract Co-Author*) Nothing to Disclose
Peter Mattson (*Abstract Co-Author*) Nothing to Disclose
Akis Linardos (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Emerging literature underscores the transformative potential of Artificial Intelligence (AI) in healthcare. Ensuring robustness and evaluating the generalizability of AI methods necessitates ample and diverse multi-site patient datasets. Yet, access is often hindered by bureaucratic processes, data ownership issues, and legal considerations tied to patient privacy. To address these challenges, we present the Comprehensive Open Federated Ecosystem (COFE), a community-driven initiative featuring multiple open-source tools. COFE aims to democratize distributed healthcare AI by leveraging zero/low code principles, enabling models to learn across data silos via Federated Learning (FL), and assessing their performance on diverse, previously unseen datasets through Federated Evaluation (FE). The exhibit's objectives are to: 1) enhance the community's understanding of FL FE, 2) demonstrate how users can employ FL to train a model across multiple sites, 3) present results using COFE (the inaugural real-world federation evaluation challenge across 71 collaborating sites focusing on brain tumors multi-site breast cancer risk assessment), 4) discuss privacy data protection concerns and COFE's proposed solutions, and 5) illustrate how users can utilize FE to generate generalizable statistics for AI methods.

### TABLE OF CONTENTS/OUTLINE

This exhibit will present a community-driven open-source ecosystem to train evaluate AI models across multiple clinical sites in a data-private paradigm. Specific principles to protect data privacy will be described, along with common pitfalls to avoid when performing FL-based studies.

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# Abstract Archives of the RSNA, 2024

INEE-36

## DE-IDENTIFICATION OF RADIOLOGY IMAGING STUDIES: A COMPREHENSIVE REVIEW OF CURRENT PRACTICES AND FUTURE NEEDS IN THE AGE OF AI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Shahriar Faghani, MD (*Abstract Co-Author*) Nothing to Disclose
Pouria Rouzrokh, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

De-identification (DiD) of radiology imaging studies is crucial for ensuring patient privacy during research endeavors, data transfers, and the development of artificial intelligence (AI) models. In this educational exhibit, we begin by reviewing what image DiD is, how it differs from image anonymization, and why it is an important step toward compliance with the Health Insurance Portability and Accountability Act (HIPAA) in radiology. We then review the most frequent formats for storing radiology imaging studies to set the scene for our main discussion. At the core of our content, we delve into four different levels of DiD: radiology reports, imaging file metadata, imaging markers, and morphological features. We will discuss what each of these steps involves and some of the most commonly used tools for implementing them. Most importantly, we will explore how AI algorithms can both threaten the reliability of such tools and be used to enhance each of these four levels. Finally, we wrap up by addressing several common questions and doubts about image DiD in radiology studies. We aim our presentation at general radiologists and strive to deliver our technical content in a language that is accessible to that audience.

### TABLE OF CONTENTS/OUTLINE

A) Introduction A-1 ) What is image de-identification (DiD)? A-2) How is DiD different from anonymization? A-3) Why is DiD important? B) Frequent file formats for storing image data (DICOM, NIfTI, NRRD, etc.) C) DiD levels-1) Radiology report level: C-2) Imaging file metadata level C-3) Imaging marker level C-4) Morphological features D) How can AI threaten image DiD) E) How can AI improve image DiD) F) Commonly asked questions regarding image DiD.

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INEE-37

## CLAIM 2024 AI REPORTING GUIDELINE -- WHAT'S NEW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Seong Ho Park, MD (*Abstract Co-Author*) Nothing to Disclose
John Mongan, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Amazon Web Services, Inc;Royalties, General Electric Company;Spouse, Employee, Annexon, Inc;Spouse, Employee, AbbVie Inc
Linda Moy, MD (*Abstract Co-Author*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc
Ali S. Tejani, MD (*Abstract Co-Author*) Nothing to Disclose
Anthony Gatti, PhD,MSc (*Abstract Co-Author*) Nothing to Disclose
Michail Klontzas, MD,PhD (*Abstract Co-Author*) Trainee Board of Directors, RadioGraphics
Charles E. Kahn JR, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

* Understand how the Checklist for Artificial Intelligence in Medical Imaging (CLAIM) guideline promote complete and consistent reporting of AI science in medical imaging* Describe the process to update the guideline* Detail the changes incorporated into the CLAIM 2024 Update

### TABLE OF CONTENTS/OUTLINE

1. Scientific reporting guidelines a. Reporting standards: STARD, CONSORT, TRIPOD b. Adaptations for AI: STARD-AI, CONSORT-AI, etc. c. Role of the EQUATOR Networkd. How to select an appropriate guideline2. CLAIM guideline a. Original checklist: motivation and development b. Research applications3. Process to update the CLAIM guideline a. Update panel enrollment b. Delphi consensus methods4. Changes incorporated into the updated checklist a. "Ground truth" b. "Validation"5. What's not included a. Radiomics b. Common data elements6. Conclusion

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# Abstract Archives of the RSNA, 2024

INEE-38

## WHAT LLM SHOULD I USE? NAVIGATING THE LANDSCAPE OF LARGE LANGUAGE MODELS IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Saptarshi Purkayastha, PhD (*Abstract Co-Author*) Nothing to Disclose
Pouria Rouzrokh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Seyed Mohammadreza Chavoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Theodorus Dapamede, MD, PhD (*Abstract Co-Author*) Intern, MARS BioImaging Ltd
Amirali Khosravi (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand differences between various large language models (LLMs) and their implications for radiology applications2. Design experiments to systematically select the most appropriate LLM for specific radiology tasks3. Identify and interpret key performance metrics for evaluating LLMs in radiology research

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Large Language Models in Radiology: (a) Overview of LLMs and their applications in radiology (b) Considerations for of LLM model selection and experimental design (c) Differences between Large Language Models (open vs proprietary; different number of parameters)2. Systematic approach for selecting an LLM use strategy: (a) Fully automatic labeling (b) Semi-automatic labeling3. Designing Experiments for Systematic LLM Model Selection: (a) Defining a radiology task and its complexity (b) Curating annotated datasets for LLM model evaluation (c) Considerations for selecting a range of LLM models with varying sizes and architectures (d) Implementing LLM prompting strategies, such as chain-of-thought (CoT) (e) Measuring compute time and LLM resource requirements4. Key Performance Metrics for Evaluating LLMs in Radiology: (a) Relatively balanced set: Accuracy(b) Highly imbalance set: F1-score(c) Semi-automatic labeling: NPV5. Case Studies: End-to-end application of the Systematic Approach including task definition, LLM selection, data annotation, prompting, and evaluation: (a) Pneumothorax detection: Simple task complexity and the role of smaller models (b) Rib fracture identification: Moderate task complexity and the impact of model size (c) Cardiomegaly assessment: Complex tasks and the need for larger models6. Conclusion

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# Abstract Archives of the RSNA, 2024

INEE-39

## LOWERING BARRIERS FOR MEDICAL PRACTITIONERS TO UTILIZE AI: A GUIDE TO IMAGE CLASSIFICATION IN KAAPANA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Yannick Kirchhoff (*Abstract Co-Author*) Nothing to Disclose
Peter Neher (*Abstract Co-Author*) Nothing to Disclose
Philipp Schader (*Abstract Co-Author*) Nothing to Disclose
Stefan Denner (*Abstract Co-Author*) Nothing to Disclose
Maximilian Rokuss (*Abstract Co-Author*) Nothing to Disclose
Benjamin Hamm (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The integration of artificial intelligence (AI) in medical imaging has been hindered by complexities in AI tool utilization. Streamlining the application process can lower barriers and enable broader adoption by practitioners. This work introduces an automated workflow implemented in Kaapana, designed to facilitate 2D and 3D medical image classification without requiring extensive technical knowledge. This workflow supports various classification settings with a focus on enhancing user accessibility and efficiency in medical AI applications. The Classification Workflow automates several critical aspects of AI model training and application, including hyperparameter setting, preprocessing, and data augmentation. The default parameters are optimized based on principles derived from the successful nnUnet framework. A user-friendly interface allows real-time monitoring and easy adjustment of hyperparameters without coding, enabling experimentation and customization. Additionally, Kaapana's Datasets View facilitates the tagging and annotation of image datasets, simplifying dataset creation. The Classification Workflow in Kaapana represents a significant step towards democratizing AI in medical imaging, offering a user-friendly tool that abstracts complex processes and allows medical practitioners to utilize the advantages of AI.

### TABLE OF CONTENTS/OUTLINE

- Introduction to Kaapana and AI in Medical Imaging- Overview of Automated Classification Workflow- Hyperparameter Automation, Preprocessing, and Data Augmentation- Showcasing Application Scenarios- User Interface for Hyperparameter Tuning- Real-Time Monitoring with Tensorboard- Dataset Creation via Datasets View

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# Abstract Archives of the RSNA, 2024

INEE-4

## EXTENDED REALITY RADIOLOGY EDUCATION AND IVR PRACTICE USING VIDEO PASS-THROUGH WEARABLE SPATIAL COMPUTING HEADSET

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Takuya Sueyoshi (*Abstract Co-Author*) Holoeyes Inc. : Employment RIVERFIELD Inc. : Research grant Fujitsu Ltd. : Research grant Japan Society for the Promotion of Science (JSPS) : Grant-in-Aid for Scientific Research (KAKENHI)
Maki Sugimoto, MD, PhD (*Presenter*) Officer, Holoeyes Inc

### TEACHING POINTS

The utilization of wearable spatial computing headsets with video pass-through functionality in IVR practice and radiology education enhances diagnostic capabilities, treatment outcomes, and safety. Understanding technical advantages, such as imaging and sensor analysis, facilitates spatial assistance in medical image diagnosis, surgical planning, and therapeutic support. Practical examples demonstrate spatial computing's role in clinical procedures like TAVI, endovascular aneurysm repair, and percutaneous ultrasound-guided liver biopsy. Guidance is provided on overcoming challenges associated with integrating spatial computing into radiology education and clinical interventions.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Spatial Computing and Video Pass-Through in Radiology Education and IVR Practice.2. Mechanism and Technical Advantages of Device (Apple Vision Pro). Enhancing Spatial Diagnosis: Utilizing augmented reality overlays and real-time image integration.3. Facilitating Surgical Planning and Intervention in IVR.Therapeutic Support in IVR: Utilizing immersive simulations and interactive scenarios.4. Practical Applications in Clinical Procedures: Case-based exploration.5. Addressing Challenges and Pitfalls in Adopting Spatial Computing in Radiology.

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# Abstract Archives of the RSNA, 2024

INEE-40

## REAL-WORLD FEDERATED LEARNING IN RADIOLOGY: HURDLES TO OVERCOME AND BENEFITS TO GAIN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andreas Bucher, MD (*Abstract Co-Author*) Travel support, Bayer AG Travel support, Guebert SA Travel support, Pharmacept
Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Peter Neher (*Abstract Co-Author*) Nothing to Disclose
Stefan Denner (*Abstract Co-Author*) Nothing to Disclose
Unal Akunal, MSc, BSc (*Abstract Co-Author*) Nothing to Disclose
Maximilian Zenk (*Abstract Co-Author*) Nothing to Disclose
Markus Bujotzek (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Federated Learning (FL) enables collaborative model training while keeping data locally, holding immense potential to enhance radiological diagnosis and therapy for rare diseases with scarce data. Currently, the majority of FL studies in radiology are simulated due to various hurdles impeding the translation into practice. The few existing real-world FL initiatives rarely communicate measures taken to overcome hurdles, leaving behind a significant knowledge gap. We categorized insights from FL literature with our findings based on their phase of occurrence while establishing a FL initiative. We built our own FL infrastructure within the nation-wide German Radiological Cooperative Network (RACOON) and demonstrated its functionality by training a FL model on a lung pathology segmentation task across six university hospitals. We evaluated FL against less complex alternatives in three evaluation scenarios.From gathered insights, we propose a detailed guide outlining steps, hurdles, and solutions to establish successful FL initiatives conducting real-world experiments. Our experimental results demonstrate superior performance of FL in all evaluation scenarios, justifying itself despite the efforts of real-world FL.The proposed guide aims to aid future FL researchers in circumventing pitfalls, thereby speeding up the translation of FL into practice. Our investigations highlight FL's superiority over alternative approaches, and the importance of strategic organization, robust handling of distributed data and infrastructure in the real world.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Implementing conducting real-world FL3. Guide to build real-world FL initiatives4. Discussion

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# Abstract Archives of the RSNA, 2024

INEE-41

## KAAPANA: A COMPREHENSIVE OPEN-SOURCE SOLUTION FOR INTEGRATING AI IN RADIOLOGICAL RESEARCH ENVIRONMENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marco Nolden (*Abstract Co-Author*) Nothing to Disclose
Hanno Gao (*Abstract Co-Author*) Nothing to Disclose
Lorenz Feineis (*Abstract Co-Author*) Nothing to Disclose
Peter Neher (*Abstract Co-Author*) Nothing to Disclose
Philipp Schader (*Abstract Co-Author*) Nothing to Disclose
Benjamin Hamm (*Abstract Co-Author*) Nothing to Disclose
Santhosh Parampottupadam, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Stefan Denner (*Abstract Co-Author*) Nothing to Disclose
Markus Bujotzek (*Abstract Co-Author*) Nothing to Disclose
Mikulas Bankovic (*Abstract Co-Author*) Nothing to Disclose
Jens Beyermann (*Abstract Co-Author*) Nothing to Disclose
Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Ralf Floca (*Abstract Co-Author*) Nothing to Disclose
Jonas Scherer (*Abstract Co-Author*) Nothing to Disclose
Rajesh Baidya (*Abstract Co-Author*) Nothing to Disclose
Klaus Kades (*Abstract Co-Author*) Nothing to Disclose
Unal Akunal, MSc, BSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Integrating advanced computational tools into clinical environments is a significant challenge, often requiring specialized technical skills and the use of various separate applications in a diverse infrastructural landscape. Kaapana addresses these challenges by providing a comprehensive, open-source and customizable medical image analysis platform that seamlessly incorporates AI capabilities into existing clinical infrastructures. Kaapana enables radiologists and data scientists to train and execute state-of-the-art segmentation algorithms, such as nnU-Net and TotalSegmentator. It also allows users to create, curate, and visualize datasets; manage numerous workflows running in parallel; and train and evaluate new models as ready-to-use solutions. In addition to offering these advanced research tools, by employing the DICOM standard, Kaapana also allows for direct PACS interactions on the platform. The platform’s design enables extensive customizations for specific use cases, and facilitates the integration of new tools and workflows. With robust data protection capabilities, the capacity to manage vast datasets, and support for federated learning, Kaapana is an ideal choice for conducting large-scale, multi-center, interdisciplinary studies that can lead to significant advancements in medical research and patient care.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Deployment 3. Data Upload 4. Datasets 5. Workflow Management 6. Extension Management 7. Utilities 8. Conclusion Future Directions

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# Abstract Archives of the RSNA, 2024

INEE-42

## ELECTRONIC CLEANSING REIMAGINED: THE POWER OF DIFFUSION-BASED GENERATIVE AI IN CT COLONOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hiroyuki Yoshida, PhD (*Abstract Co-Author*) Patent holder, Hologic, Inc;Patent holder, Median Technologies
Toru Hironaka (*Abstract Co-Author*) Nothing to Disclose
Janne J. Nappi, PhD (*Abstract Co-Author*) Patent holder, Median Technologies;Patent holder, Hologic, Inc;;
Masaki Okamoto (*Abstract Co-Author*) Stockholder, TOKYO analytica
Rie Tachibana, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of electronic cleansing (EC) is to subtract orally tagged fecal materials from CT colonography (CTC) images to improve the sensitivity of polyp detection in virtual endoscopic fly-through reading. Diffusion models are a powerful state-of-the-art generative AI technology that has recently achieved tremendous success in various computer vision tasks. This exhibit's teaching points are (1) to explain the role of EC in CTC, (2) to explain how generative AI can be used to perform EC, and (3) to demonstrate clinical outcomes of the state-of-the-art diffusion-based EC in CTC.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: (1.1) the importance of colon cancer screening; (1.2) the role of EC in CTC; (1.3) A brief history of EC methodologies. 2. Generative AI for EC: how it differs from traditional EC. 3. Diffusion-based EC: how it works. 4. Case studies: using a phantom study and clinical CTC cases, demonstrate how the image quality of diffusion-based EC outperforms those of existing EC methods.

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# Abstract Archives of the RSNA, 2024

INEE-43

## INNOVATIVE APPROACHES TO RADIOLOGY REPORTING: UNRAVELING THE POTENTIAL OF NATURAL LANGUAGE PROCESSING AND AI TECHNOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Faiq Tariq (*Abstract Co-Author*) Nothing to Disclose
Pamela H. Nguyen, DO (*Abstract Co-Author*) Nothing to Disclose
Azwade F. Rahman, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Michael X. Jin, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Kian Avilla (*Abstract Co-Author*) Nothing to Disclose
Austin Young (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the role of natural language processing (NLP) in transforming radiology reporting2. Showcase ways that NLP software can be utilized to augment radiology practices3. Investigate the potential of voice-to-text software and generative AI to automate radiology reporting4. Explore the potential of automated impression generation in radiology reporting5. Highlight pilot studies conducted at our institution showcasing the potential of ChatGPT and natural language processing (NLP) technologies in radiology reporting

### TABLE OF CONTENTS/OUTLINE

1. Title SlideInnovative Approaches to Radiology Reporting: Unraveling the Potential of Natural Language Processing and AI Technologies2. Learning Objectives3. What is Natural Language Processing? Definition and overview of NLPExplanation of how NLP works 4. Examples of NLP Applications Overview of various applications of NLP in different domainsDiscussion on healthcare-related applicationsIntroduction to benefits/use cases of ChatGPT in healthcare settings5. NLP in RadiologyExploration of the potential of NLP in radiology reporting 6. Automated Report Generation Pilot StudyDescription of study design and methodologyResults and implications 7. Impression Generation Pilot StudyDescription of study design and methodologyResults and implications 8. Other Applications Explore other applications and studies published of NLP in radiology reporting 9. ConclusionSummary of key points

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# Abstract Archives of the RSNA, 2024

INEE-5

## CT IMAGING BIOMARKERS FOR PHENOTYPIC BIOLOGICAL AGING: OVERVIEW AND COMPARISON WITH OTHER RADIOLOGICAL AND NON-RADIOLOGICAL APPROACHES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Perry J. Pickhardt, MD (*Abstract Co-Author*) Advisor, Bracco Group;Advisor, Zebra Medical Vision Ltd;Advisor, Nano X Imaging;
John W. Garrett, PhD (*Abstract Co-Author*) Nothing to Disclose
Matthew H. Lee, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Chronological age (CA) and sex are drivers of important healthcare decisions (primary prevention, screening, intervention) but CA is an imperfect measure of "healthspan" and longevity. 2. Biological age (BA) attempts to capture the cumulative physiologic effect of genetic predisposition, lifestyle habits, genetic, and disease processes, and has been attempted for decades with limited success. 3. As opposed to existing "frailomics" used in existing BA models, CT-based tissue markers are accessible, reproducible, and reflect a "big picture" net effect of aging at the organ/tissue level. 4. Advances in technology, computing power, and emerging AI technologies make "explainable" and "black box" image-based BA models poised to revolutionize our understanding of aging and longevity. 5. CT-based, "phenotypic" cardiometabolic assessment shows potential for improved personalized prediction and augmentation of current models for predicting "healthspan" and longevity compared with typical demographics.

### TABLE OF CONTENTS/OUTLINE

1. Describe the difference between CA and BA as well as a brief overview of existing BA models. 2. Review common imaging and non-imaging-based models for determining BA. 3. Describe existing AI tools for deriving image-based tissue biomarkers. 4. Contrast "explainable" AI CT-based methodologies from more opaque "black box" deep learning approaches. 5. Discuss early experiences with image-based BA models using both explainable (e.g. fully-automated CT-based abdominal body composition markers) and "black box" AI tools (e.g. BA derived from CXRs). 6. Future directions - image-based AI tools allow for objective, large-scale, population-based investigation.

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# Abstract Archives of the RSNA, 2024

INEE-6

## A SOFT TISSUE SARCOMA RADIOMICS ATLAS: A VISUAL GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Matthew J. Nyflot, PhD (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Peter C. Thurlow, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Paul E. Kinahan, PhD (*Abstract Co-Author*) Co-founder, PET/X LLC
Gita Y. Karande, MMEd, FRCR (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand what radiomics features are and how they are utilized in radiology research. 2. An exploration of what radiomic features look like in the context of soft tissue sarcoma imaging. 3. Look into some clinical cases in which an understanding of radiomics features can help with better assessment of the disease. 4. Look into some of the studies that used radiomics to predict various outcome in soft tissue sarcoma and what the most significant features from those studies mean.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Define radiomics features. b. Show example of the utility of radiomics features in assessment of soft tissue sarcoma. i. Radiomics in prediction of post-surgical tissue margin status. ii. Radiomics in prediction of treatment responsec. Explain the radiomics analysis pipeline. d. Overview of radiomics features families. 2. Imaging atlas of each major radiomics feature family a. First Order Statistics b. Shape Based c. Gray Level Co-occurrence Matrixd. Gray Level Run Length Matrixe. Gray Level Size Zone Matrix f. Neighboring Gray Tone Difference Matrixg. Gray Level Dependence Matrix 3. Example Clinical Cases a. Example cases of soft tissue sarcoma with positive and negative post-surgical tissue margin status and their respective radiomics features b. Example cases of soft tissue sarcoma with good and bad treatment response and their respective radiomics features 4. Conclusion a. Summarize the role of radiomics in soft tissue sarcoma assessment. b. Highlight the various families of radiomics features and their meaning.

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# Abstract Archives of the RSNA, 2024

INEE-7

## PRACTICAL GUIDE FOR CREATING 3D PRINTED MODELS FROM MEDICAL IMAGING STUDIES USING FREE SOFTWARE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Juan Francisco Sallaberry Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Gutierrez Velasco, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Garcia del Salto, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Fraga Rivas, MD (*Abstract Co-Author*) Investigator, General Electric Company
Jaime de Miguel Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Robledo (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Introduction to 3D printing for medical imaging studies.Selection of suitable images. Description and illustration of data conversion and segmentation steps using open-source software.Overview of printing materials and techniques. Clinical and educational impact examples.

### TABLE OF CONTENTS/OUTLINE

3D printing has emerged as a revolutionary tool in radiology, significantly enhancing surgical planning and medical education.A practical and accessible guide is presented for creating 3D printed models from medical imaging studies using free software. The process begins with the selection of suitable images, emphasizing the need for high resolution and contrast in CT and MRI studies. Subsequently, the segmentation of anatomical structures using free specialized software and the conversion of data to formats suitable for 3D printing are explained.Additionally, we provide insights into different printing materials and techniques available, highlighting the importance of choosing appropriately according to the clinical or educational purpose. Finally, the utility of 3D printed models in various medical applications is examined through cases from our own service.

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# Abstract Archives of the RSNA, 2024

INEE-8

## APPLYING AI TO MEDICAL IMAGING: HOW TO BUILD A PROJECT FROM THE GROUND UP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Christian Henriksen (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Aimed at radiologists with an interest in how to leverage AI for research but a lack of experience in machine learning, this presentation will use detailed but accessible language to provide an overview of the necessary steps to take a project from idea to full-fledged functional AI model. Teaching points will include an overview of current types of AI model and their capabilities as they relate to medical imaging, a review of current interpretability methods for imaging AI, an outline of the components of a project to develop an AI model, and a discussion of two real example projects that I myself have developed.

### TABLE OF CONTENTS/OUTLINE

1. What is AI? a. Deep Learning b. AI in Medical Imaging i. Convolutional Neural Networks ii. Vision Transformers 2. What Can AI Do? a. Classification b. Regression c. Segmentation. 3. What Can’t AI Do? 4. A Note on Interpretability a. Saliency Maps. 5. Anatomy of a Project a. The Idea b. The Dataset i. The Input Data ii. The Output Data Ground Truth c. The Hardware d. The Software e. The Training f. The Evaluation. 6. Example Projects a. Bone Mineral Density from Computed Tomography b. Diagnosis of Normal Pressure Hydrocephalus from Head CT

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# Abstract Archives of the RSNA, 2024

INEE-9

## LEVERAGING DERIVATIVE DATASETS IN RADIOLOGY: POTENTIALS, CHALLENGES, AND FUTURE DIRECTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Saptarshi Purkayastha, PhD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Derivative datasets, created by generative AI models, closely resemble real-world medical data while preserving patient privacy and enabling data diversity. This educational exhibit aims to:1. Understand the concept of derivative datasets and their role in medical imaging research2. Explore the potentials and promises of generative AI in creating diverse, privacy-preserving, and versatile datasets3. Discuss the challenges and ethical considerations associated with the use of derivative datasets

### TABLE OF CONTENTS/OUTLINE

1. Introduction to derivative datasets and generative models in medical imaging: (a) Definition and concept of derivative datasets (b) Types of generative models (VAEs, GANs, DDPMs)(c) Role of derivative datasets in medical imaging research2. Potentials and promises of derivative datasets:(a) Increased dataset size and diversity:(b) Privacy-preserving nature(c) Versatility across tasks(d) Modeling complex biological phenomena3. Challenges and considerations (a) Patient privacy and data copying(b) Identification of source dataset and disclosure(c) Interpretability and explainability(d) Potential biases4. Future directions and conclusions:(a) Development of robust and standardized evaluation frameworks(b) Exploration of novel architectures and training strategies(c) Integration with other AI techniques (d) Addressing ethical and regulatory challenges (e) Importance of collaboration and responsible utilization

# Abstract Archives of the RSNA, 2024

IREE

**Interventional Radiology Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## IREE-1 VASCULAR AND LYMPHATIC COMPLICATIONS AFTER RENAL TRANSPLANT

Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan D. Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Baron, MD (*Abstract Co-Author*) Nothing to Disclose
William R. Winter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Shelby K. Frantz, MD (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:- To review anatomy of transplanted kidneys- To identify common vascular and lymphatic complications post renal transplant- To discuss minimally invasive treatment options to manage vascular and lymphatic complications after renal transplant

### TABLE OF CONTENTS/OUTLINE

1. Anatomy of Transplanted Kidneysa) Location (RLQ v LLQ)b) Arterial and Venous Anastomosisc) Other normal structures in the region2. Common Vascular Complications a) Renal Artery Stenosis/Thrombosis b) Renal Vein Thrombosisc) Renal vascular complications related to native vascular anatomyi. Aortaii. Common/External Iliac Arteryiii. Inferior Vena Cavaiv. Common/External Iliac Vein3. Vascular Complications After Transplant Biopsy a) Bleedingb) AVFc) Pseudoaneurysm4. Endovascular Management of Vascular Complicationsa) Angiography/Venographyi. Contrastii. CO2b) Invasive Pressure Measurementsc) Stent Placementd) Thrombectomy/Thrombolysise) Embolizationi. Coilsii. Liquid Embolicf) Surgical Alternatives5. Lymphatic Complicationsa) Lymphatic Leakb) Lymphocele Formation6. Treatment of Lymphatic Complicationsa) Lymphangiogram and Embolization

## IREE-10 ENDOVASCULAR MANAGEMENT OF AORTOENTERIC FISTULA: NAVIGATING CHALLENGES AND ADVANCEMENTS

Beatriz Garcia Martinez (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Sanz Bellon (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To provide an overview of the evolving role of endovascular interventions in the management of Aortoenteric Fistula, highlighting the advantages, challenges, and emerging trends in this minimally invasive approach through our experience and literature review.

### TABLE OF CONTENTS/OUTLINE

Classification of Aortoenteric Fistula.Primary aortoenteric fistulaClinical manifestation/Diagnosis Secondary aortoenteric fistula.True secondary aortoenteric fistula/Secondary paraprosthetic fistula./Clinical manifestation( DiagnosisTreatment.Surgical optionsPrimary fistulae/ Secondary fistulae Endovascular treatment optionsStent graft deployment/Embolization techniquesAdvantages and Challenges of Endovascular Treatment. AdvantagesAlternative treatment for high surgical risk patients./Rapid bleeding control in unstable patients./Advantages associated with an earlier patient recovery./Mitigation of Surgical Intervention in a Challenging Abdominal Environment.Challenges Sepsis./Recurrent bleeding./ Patient selection./Is it a definitive treatment or a bridge to surgery?/Is it a feasible treatment for recurrent fistula?Our experience.Case 1: Recurrent Fistula treated with endoprosthesis placement and latter embolization./Case 2: Recurrent Fistula treated with embolization of the fistula's path and embolization of the aneurysmal sac./Case 3: Aorto-Esophageal Fistula (AEF) selected for embolization treatment who died during the procedure./Case 4: First episode of True Secondary AEF. Treated with endoprosthesis placement in a patient with melena, hypotension, and anemia./Case 5: Recurrent fistula treated with endoprosthesis and proximal cuff. Conclusion

## IREE-11 STREAMLINED RESIN Y90 RADIATION SEGMENTECTOMY FOR SMALL HEPATOCELLULAR CARCINOMA (HCC): ONE & DONE TRIAL

Nima Kokabi, MD (*Abstract Co-Author*) Research support, Sirtex Medical Ltd;Consultant, Sirtex Medical Ltd;;
Michael Mohnasky (*Abstract Co-Author*) Nothing to Disclose
Haneyeh Shahbazian, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Gad, BSc, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1-In patients with small (<5cm) hepatocellular carcinoma (HCC) and no radiographically aggressive feature, undergoing radiation segmentectomy with Y90, hepatopulmonary shunt evaluation can be safely eliminated without any additional adverse events.2-In such patients it is safe to eliminate Tc99-MAA hepatopulmonary scan and LSF calculation from treatment planning and condense the Y90 planning and treatment into 1 day as opposed to traditional 2-day period.

**TABLE OF CONTENTS/OUTLINE**

HCC is the 4th leading cause of cancer death worldwide. Conventionally, Y90 Transarterial Radioembolization (TARE) happens over 2 sessions. Mapping angiography and lung shunt calculation is the first session. The patient is then discharged home and returned approximately 2-3 weeks after for Y90 radioembolization. However, an increasing number of studies have shown that for small HCCs (<5 cm), and in the absence of macrovascular invasion and portosystemic shunt (TIPS), LSF is <10%.1,2Hence, based on typically administered activities and LSF, the projected dose to the lungs is significantly below the 30 Gy level, which is widely accepted as the dose to cause radiation-induced pneumonitis.3 Therefore, the LSF calculation can be safely omitted, which could, in turn, result in significant streamlining of Y90 TARE in patients with small HCC. This is particularly important to consider in patients who live in non-urban communities and commute long distances to undergo liver-directed therapy. The proposed exhibits highlight the safety and efficacy of streamlining the Y90 TARE procedure for patients with small HCC to a 1-day procedure.

## IREE-12 GASTROINTESTINAL VARICEAL BLEEDS: INTERVENTIONAL CONSIDERATIONS IN ACCESS AND TREATMENT

Kapil Wattamwar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Recognize the portal-mesenteric venous system as a potential source of gastrointestinal bleeding. Illustrate case examples of varices in various locations along the gastrointestinal tract with multi-modality imaging. Highlight typical inflow and outflow vessels associated with varices in different locations. Discuss interventional approaches to access variceal bleeds based on their location as well as strategies for decompression and embolization. Review potential embolic agents for variceal bleeds and examine specific use cases based on anatomical and flow-related considerations.

**TABLE OF CONTENTS/OUTLINE**

It is important to recognize that upper and lower gastrointestinal bleeds can arise from a portal-mesenteric venous source. 1. This exhibit will illustrate cases of variceal bleeds at several points along the gastrointestinal tract from the esophagus to the anus and highlight typical inflow and outflow vessels associated with each location. 2. Interventional techniques to treat such bleeds may involve various methods of decompression and/or embolization. 3. Approaches to access the portal-mesenteric venous system for intervention include through a TIPS, transvenous through a systemic outflow vein, transsplenic, transhepatic, transcaval and direct percutaneous puncture. 4. Factors such as the direction of flow, portosystemic pressure gradient and the impact of balloon occlusion on flow should be considered prior to embolization. 5. The choice of embolic should be tailored to the patient's anatomy and flow dynamics. Embolic agents include coils, plugs, and liquid embolics such as n-Butyl cyanoacrylate, ethylene vinyl alcohol copolymer, and sodium tetradecyl sulfate sclerosant.

## IREE-13 IVC INTERVENTIONS: SEEING ALL THE INTERVENTIONS

**Awards**
**Certificate of Merit**

Carlos B. Ortiz, MD (*Abstract Co-Author*) Consultant, Argon Medical Devices, Inc
Arthur S. Joseph, DO (*Abstract Co-Author*) Nothing to Disclose
Andrew V. Chesley, MD (*Abstract Co-Author*) Nothing to Disclose
James J. Oh, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Inferior vena cava (IVC) angioplasty, thrombolysis, mechanical thrombectomy, and stenting are important treatment options to recanalize an occluded or thrombosed IVC. Preprocedural evaluation and follow up are essential for postprocedural management of patient undergoing IVC recanalization. Long term indwelling IVC filters pose a risk of caval thrombosis and removal should be considered when clinically appropriate. Transcaval interventions provide alternate access for difficult to reach anatomic areas.

**TABLE OF CONTENTS/OUTLINE**

Introduction Pathogenesis of IVC occlusions in the setting of benign and malignant causes Imaging of IVC occlusion on US, CT, and diagnostic venogram, including review of collateral venous pathway formation Review of variant anatomy pertinent to IVC interventions. Current recanalization techniques employed in the treatment of IVC occlusions Use of transcaval access to perform lymph node biopsy and endoleak embolization Immediate complications and subsequent complications after IVC endovascular intervention Conclusion IVC and transcaval endovascular interventions are important therapies for a variety of pathologies. Knowledge of these advanced techniques is important for the interventionalist.

## IREE-14 A PRIMER ON APPROACHES FOR TRANSVENOUS BIOPSY OF INFERIOR VENA CAVA MASSES

Victoria Kim, MD (*Abstract Co-Author*) Nothing to Disclose
David R. Berezovsky, DO (*Abstract Co-Author*) Nothing to Disclose
Ilya Livshits (*Abstract Co-Author*) Nothing to Disclose
Francis Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Camden MacDowell, MD,PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Inferior vena cava (IVC) masses often require a biopsy for a definitive diagnosis of the underlying pathology. IVC masses are often biopsied using a percutaneous approach. However, percutaneous biopsy is not always feasible, for example, when there is no safe biopsy trajectory due to surrounding structures or the patient's anatomy. In such situations, an endovascular approach is necessary. The purpose of this educational exhibit is to review endovascular biopsy approaches for IVC masses and address the following teaching points: 1. Review central venous anatomy and highlight CT/MRI/Fluoroscopy features of IVC masses. 2. Illustrate example indications for transvenous biopsy of IVC masses. 3. Detail transvenous biopsy of IVC masses using biopsy forceps under fluoroscopy. 4. Detail transvenous biopsy of IVC masses using a transjugular liver biopsy set under combined fluoroscopy and cone-beam CT guidance. 5. Detail alternative transvenous biopsy of IVC masses such as suction biopsy. 6. Discuss risks of transvenous biopsies, including bleeding and hematologic seeding.

**TABLE OF CONTENTS/OUTLINE**

1. Central venous anatomy. 2. CT/MRI/Fluoroscopy findings of example IVC masses (e.g., leiomyosarcoma, Wilms tumor, adrenal cortical carcinomas). 3. Indication for transvenous biopsy of IVC masses. 4. Example case of transvenous biopsy with forceps. 5. Example case of transvenous biopsy with a modified transjugular liver biopsy set. 6. Alternative biopsy approach using transvenous suction biopsy. 7. Safety profile of transvenous biopsies and comparison with percutaneous approaches.

## IREE-15 ROLE OF INTERVENTIONAL RADIOLOGY IN ACUTE MESO-PORTAL VENOUS THROMBOSIS (MPVT): A PICTORIAL REVIEW

Manoj K. Kathuria, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Rakesh K. Varma, MD, MBBS (*Abstract Co-Author*) Speaker, Becton, Dickinson and Company
Seung Kwon Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Anil K. Pillai, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Jayesh Soni, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmad Arar (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Recognize key imaging characteristics associated with acute MPVT on cross-sectional imaging to facilitate early diagnosis2) Understand the clinical indications necessitating acute MPVT interventions and the goals of treatment3) Familiarize with treatment algorithms and the tips and tricks used to manage acute MPVT

**TABLE OF CONTENTS/OUTLINE**

1) Introduction and Clinical Impact2) Imaging findings of acute MPVT- Vascular: Absent flow on US and Doppler, filling defect, hyperdense clot, lack of portoportal collaterals- Non-Vascular: Hepatic necrosis, ascites, bowel wall thickening, lack of mural enhancement3) Indications for Endovascular Interventions:- Persistence of symptoms beyond 48-72 hours after anticoagulation initiation- Worsening symptoms- Extension of thrombus while on anticoagulation- Peritoneal signs on physical exam4) Comprehensive guide to endovascular techniques and algorithms for managing acute MPVT:- Systematic approach for treatment based on the location of the thrombus- Tips and tricksConclusion: Acute PV and SMV thrombosis pose risks of acute mesenteric ischemia or chronic portal hypertension. Endovascular interventions may be necessary for progression on anticoagulation or impending bowel infarction. Catheter Directed Thrombolysis is feasible but carries higher bleeding risks compared to anticoagulation alone. TIPS creation depends on post-intervention flow and PSG >10-12mmHg

## IREE-16 MULTIMODALITY IMAGING OF EMERGENT BILIARY DISORDERS

Naciye Turan, MD (*Abstract Co-Author*) Nothing to Disclose
Joanna Kee-Sampson, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Menendez, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos I. Gonzalez Baerga, MD (*Abstract Co-Author*) Nothing to Disclose
Mayur K. Virarkar, MD (*Abstract Co-Author*) Nothing to Disclose
Sean Wehry (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Biliary emergencies present as a spectrum of pathologies, each with unique radiologic characteristics across various imaging modalities. Accurate imaging interpretation is critical for diagnosing these potentially life-threatening pathologies, underscoring the importance of radiologists' proficiency in identifying relevant imaging findings. It is also vital for radiologists to be familiar with image-guided interventions that can manage these emergencies. 1. Describe common pathologies that lead to emergent situations in various parts of the biliary system and discuss their clinical presentations and etiologies. 2. Recognize the imaging features across different imaging modalities for each emergent biliary condition. 3. Discuss image guided interventions that help bridge patients with various biliary emergencies to definitive treatment, or treat these pathologies.

**TABLE OF CONTENTS/OUTLINE**

- Review of multimodality imaging findings: o Inflammatory: § Gallbladder: • Acute Cholecystitis o Calculous and acalculous • Gangrenous Cholecystitis • Hemorrhagic Cholecystitis § Bile Ducts: • Ascending cholangitis § Pancreas: • Acute Pancreatitis o Non-Inflammatory § Obstructive Jaundice • Choledocholithiasis • Mirizzi Syndrome • Malignancy § Bile Leak • Traumatic • Iatrogenic - Review of image guided interventions o Biliary diversion § Cholecystostomy § Percutaneous transhepatic biliary drainage o Biliary stents o Percutaneous management of cholelithiasis or choledocholithiasis

## IREE-17 NON-TRANSPLANT PEDIATRIC HEPATOBILIARY INTERVENTIONS

Darshan Variyam, MD (*Abstract Co-Author*) Nothing to Disclose
Bartley Thornburg, MD (*Abstract Co-Author*) Nothing to Disclose
Shankar Rajeswaran, MD (*Abstract Co-Author*) Nothing to Disclose
Ahsun Riaz, MD (*Abstract Co-Author*) Consultant, Boston Scientific Corporation
Joe B. Baker, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Husnain, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Describe congenital/acquired disease processes in the pediatric liver related to the portal, parenchymal, biliary, and lymphatic systems. 2. Diagnosis of these disease processes using various imaging modalities. 3. Highlight the techniques employed by interventional radiologists to treat these various conditions.

**TABLE OF CONTENTS/OUTLINE**

Portal Vein 1. Abernethy malformation a) Embryology b) Classification (anatomical variants) c) Clinical Presentation d) Diagnostic Imaging e) Treatment Options • Surgery (single session/staged closure) • Endovascular closure (single session/staged) • Combined surgical and endovascular closures2. Extrahepatic portal vein obstruction (EHPVO) a) Causes b) Clinical Presentation c) Diagnostic Imaging d) Treatment • Surgical Meso-Rex Shunt Creation • Endovascular options to treat malfunctioning shuntsParenchymal 1. Biopsies/Pressure Measurements a) Transjugular b) Percutaneous 2. Liver Tumors: Benign and Malignant a) Biopsies b) Hemangioma embolization c) RadioembolizationBiliary System1. Biliary Atresia a) Diagnostic Imaging b) Post-Kasai surveillance 2. Biliary Stricture a) Etiology b) Management • Percutaneous transhepatic cholangioplasty/stenting • Role of endoscopy 3. Biliary leak/biloma a) Etiology b) Management • Percutaneous drainage • Embolization of leaking duct 4. Stones/casts/debris a) Percutaneous endoscopic removal 5. Complications of biliary drainsLymphatic System 1. Protein-losing enteropathy (PLE) a) Pathophysiology of PLE in congenital heart disease patients b) Diagnostic Imaging c) Management • Percutaneous transhepatic lymphatic embolizationPeroral duodenal mucosal radiofrequency ablation

## IREE-19 A PRIMER ON RADIOGRAPHIC FEATURES AND MANAGEMENT OF ABERNETHY MALFORMATIONS

Natalie Y. Ring,

MD (*Abstract Co-Author*) Nothing to Disclose
Muhammad H. Malik, MD (*Abstract Co-Author*) Nothing to Disclose
Camden MacDowell, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Harjit Singh (*Abstract Co-Author*) Nothing to Disclose
Seulah Choi (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Abernethy malformation is a congenital extrahepatic portosystemic shunt associated with numerous sequalae including hepatic encephalopathy, hepatic malignances, and hepatopulmonary syndrome. Early diagnosis via imaging is critical for subsequent management of the malformation and sequalae. The purpose of this educational exhibit is to review the anatomy and imaging features of Abernethy malformations and to address the following teaching points: 1. Review central venous anatomy and collateral circulation. 2. Review the anatomy of Abernethy Malformation and the known anatomic variants. • Type Ia, Ib, and II 3. Detail the clinical presentation and management strategies of four example Abernethy cases. 4. Discuss the role of Diagnostic and Interventional Radiology in diagnosis and management of patients with Abernethy malformations.

**TABLE OF CONTENTS/OUTLINE**

TABLE OF CONTENTS/OUTLINE: I. Introduction and Anatomy of Abernethy Malformation A. Defining Abernethy Malformation and Its Prevalence B. The Anatomy of Type I and Type II Abernethy Malformations C. Understanding Physiology of Abernethy Malformation Variations and Associated Collateral Venous Drainage D. Investigating Implications of a Novel Abernethy Malformation Variant II. Case Studies (Examination of Type Ia case, Two Different Type II Cases, and Variant Type II Case) A. Clinical Presentation including Symptoms and Signs Associated with Abernethy Malformation B. Reviewing Surgical and Non-Surgical Approaches and Considerations Exploring Role of Interventional Radiology in both diagnosis and management

## IREE-2 SUPER-SELECTIVE SEGMENTAL ADRENAL VENOUS SAMPLING FOR PRIMARY ALDOSTERONISM: POSSIBILITIES AND LIMITATIONS

**Awards**
**Cum Laude**

Sota Oguro (*Abstract Co-Author*) Nothing to Disclose
Hiromitsu Tannai, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Adrenal venous sampling (AVS) is a diagnostic procedure for subtyping primary aldosteronism, which is a cause of secondary hypertension. Typically, blood is collected only from the main trunk of the adrenal vein. Segmental AVS, however, involves sampling blood from upstream tributaries using a microcatheter and can address certain diagnostic challenges. This presentation aims to: 1) Review the anatomy of the adrenal and surrounding venous structures, and identify diagnostic challenges associated with conventional AVS; 2) Describe the method of segmental AVS and provide examples where it is diagnostically beneficial; 3) Discuss techniques to manage challenging situations where achieving an accurate diagnosis remains difficult, even with segmental AVS.

**TABLE OF CONTENTS/OUTLINE**

1. Adrenal and surrounding venous anatomy, conventional AVS; 2. Adrenal tributaries and the practice of segmental AVS; 3. Cases where segmental AVS is diagnostically useful: High aldosterone levels detectable only in adrenal tributaries from adrenal adenomas, Dilution effects due to extrarenal veins joining the adrenal vein, Co-existing cortisol-producing tumors, Bilateral aldosterone-producing adenomas, Ipsilateral multiple adrenal nodules; 4. Sampling from venous routes other than the adrenal veins and considerations for CT during adrenal arteriovenography.

## IREE-20 POST HISTOTRIPSY IMAGING FINDINGS: WHAT TO EXPECT AS IT BEGINS CLINICAL ADOPTION

Joan Vidal-Jove, MD,PhD (*Abstract Co-Author*) Research Consultant, HistoSonics, Inc
Timothy J. Ziemlewicz, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Research support, Johnson & Johnson;Consultant, HistoSonics, Inc;Shareholde, HistoSonics, Inc;
Mishal Mendiratta-Lala, MD (*Abstract Co-Author*) Nothing to Disclose
Xavier Serres (*Abstract Co-Author*) Nothing to Disclose
Fred T. Lee JR, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Patent agreement, Medtronic plc;Royalties, Medtronic plc;Board of Directors, HistoSonics, Inc;Stockholder, HistoSonics, Inc;Stockholder, Elucent Medical
Meghan G. Lubner, MD (*Abstract Co-Author*) Spouse, Consultant, Elephas Bio
Paul F. Laeseke, MD, PhD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, NeuWave Medical, Inc;Shareholder, HistoSonics, Inc;Consultant, HistoSonics, Inc;Research Grant, HistoSonics, Inc;Shareholder, Elucent Medical;Consultant, Elucent Medical;Shareholder, McGinley Orthopaedic Innovations, LLC
Allison B. Couillard, MD (*Abstract Co-Author*) Nothing to Disclose
Edwarda Golden, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Histotripsy is an emerging focal therapy for liver tumors that has a non-invasive, mechanical mechanism of action leading to unique imaging features.2. Histotripsy spares collagenous structures, which can lead to patent vessels and bile ducts within the treatment zone. These structures should not be confused for residual or recurrent tumor.3. Histotripsy treatments can be associated with a transient perfusion defect peripheral to the treatment site that undergoes reperfusion and can be confused for a larger than intended treatment.4. Histotripsy treatment zones involute rapidly compared with existing locoregional treatments, potentially allowing early identification of residual or recurrent tumor.

**TABLE OF CONTENTS/OUTLINE**

Introduction to Histotripsy:• Mechanism of action• Clinical workflow• Trials performed to date from which these imaging findings are available. Expected Imaging Findings:• Recommended Imaging follow-up timeframe• Normal appearance of treatment zone post-histotripsy at various follow-up timepoints out to 2 years• Common variants of normal findings to not mistake as complication or incomplete treatment, including perfusion defects and patent vessels and bile ducts. Other findings:• Incomplete treatment appearance• Off-target effects

## IREE-21 DON'T MISS IT!: ARTERIAL FISTULA IN URINARY DIVERTED PATIENTS, FROM CT TO THE INTERVENTIONAL SUITE

**Awards**
**Certificate of Merit**

Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Garcia Martinez (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Revuelta Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Sutil (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To understand the pathophysiological mechanisms by which arteriourinary/arterioenteric fistulas develop and the risk factors for their formation. 2. Review the different forms of clinical presentation to know when to suspect them, the CT scan protocol and its findings. 3. Analyse the different forms of endovascular and surgical treatment.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Pathophysiological mechanism of arteriourinary and arterioenteric fistulas. 3. Risk factors and clinical suspect: urinary diverted patients. The importance of clinical suspicion. 4. CT protocol and findings. 4.1. Other diagnostic tests: cystoscopy, pyelography. 5. The interventional suite: from CT findings to confirmation and treatment, a pictorial review. 6. Multidisciplinary management algorithm: analysis of endovascular and surgical management, as well as medical treatment. 7. Pictorial review of complications following interventional procedures, including diagnosis and management. 8. Conclusions. 9. Bibliography.

## IREE-22 ACUTE CHOLECYSTITIS; CURRENT DIAGNOSIS, MANAGEMENT, AND EMERGING ROLE OF INTERVENTIONAL RADIOLOGY

Katsuhiro Kobayashi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1)Review current diagnosis of acute cholecystitis (AC) including imaging findings of AC. 2)Describe current management of AC according to Tokyo Guidelines 2018. 3)Discuss emerging role of interventional radiology in the management of AC.

**TABLE OF CONTENTS/OUTLINE**

1) Overview of AC. 2) Pathophysiology of AC. 3) Anatomy and anatomical variants of the gallbladder. 4) Imaging findings of AC and its complications (emphysematous/gangrenous cholecystitis, pericholecystic abscess, gallbladder rupture, etc.). 5) Diagnosis of AC and its severity grading according to Tokyo Guidelines 2018. 6) Initial management of AC according to Tokyo Guidelines 2018. 7) Technique used for cholecystostomy tube placement. 8) Complications associated with cholecystostomy. 9) Emerging techniques used following cholecystostomy for non-surgical patients.

## IREE-23 PRE-CLINICAL INVESTIGATION OF HISTOTRIPSY FOR TARGETING PANCREATIC TUMORS

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Warren Campbell, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Histotripsy offers advantages in both target precision with non-invasive options, but is limited by the tissue depth and gas obstructing ultrasound waves. In mice and pigs, preliminary studies indicate that tumors and be effectively targeted without damaging surrounding tissue, and can promote local tumor shrinkage with a systemic immune response. However, the technique requires further optimization to minimize risks off-target tissue damage. This technique may prove be a valuable non-invasive adjuvant therapy for patient with pancreatic cancer.

**TABLE OF CONTENTS/OUTLINE**

1. The Histotripsy Technique A. Compare and contrast the ablation techniques targeting solid tumors using thermal stress. B. Review the limitations of thermal techniques such difficulty targeting tumors near sensitive structures, and inability to achieve uniform cell death. C. Discuss the mechanics of histotripsy and the equipment used to generate mechanical force to break cells apart with high-amplitude pulses. D. Explain why this technique may be beneficial in precise, rapid tissue ablation of pancreatic tumors.2. Clinical Findings supporting pancreatic tumor targeting A. Discuss literature on histotripsy for pancreatic cancer in mice and pig models. B. Discuss results showing efficacy in destroying Pan02 pancreatic tumors in an immunocompetent subcutaneous mouse model. C. Discuss porcine models ablating pancreatic tumors in a novel SCID-like pig D. Review results demonstrating histotripsy's ability to target and induce ablation within the pancreas of certain subjects and the limiting factors.3. Review the unique elements of histotripsy and why this technique may be beneficial in the patient population with pancreatic tumors.

## IREE-25 INTERCOSTAL INSIGHTS: INTERVENTIONAL RADIOLOGY'S ROLE IN MANAGING RIB RELATED COMPLICATIONS

Jorge E. Lopera, MD (*Abstract Co-Author*) Shareholder, Tecnostent SA;Consultant, Merit Medical Systems, Inc;Research Grant, AngioDynamics, Inc
Andrew Ni (*Abstract Co-Author*) Nothing to Disclose
Kimberly D. Coffman, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review complications associated with interventional radiology procedures involving the ribs and adjacent structures. Review management and prevention strategies for rib complications

**TABLE OF CONTENTS/OUTLINE**

IntroductionReviewing the anatomy of the ribsIntercostal artery and neurovascular bundleDiscussion of types of interventional radiology procedures that can lead to rib complicationsThoracentesisThoracostomyTransjugular liver biopsyHepatobiliary proceduresCommon types of complicationsHemothorax from intercostal artery injuryHematemesis Osteonecrosis of the ribRib fracturesComplications involving the ribs from interventional radiology procedures are poorly documented in existing literature. This presentation reviews common rib complications associated with IR procedures, focusing on key imaging findings and bringing awareness to these complications and management options.

## IREE-26 PREVENTION AND MANAGEMENT OF AIR EMBOLISM DURING IR PROCEDURES

**Awards**
**Certificate of Merit**

Ghazwan M. Kroma, MD (*Abstract Co-Author*) Nothing to Disclose
Bernard Cheng, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Discuss pathophysiology, clinical diagnosis of intra-procedural air embolismReview best practices for prevention of air embolismDiscuss immediate steps following diagnosis of air embolism and definitive treatment including hyperbaric oxygen

**TABLE OF CONTENTS/OUTLINE**

IntroductionPathogenesis of air embolism during lung biopsyTechniques to reduce air embolism development - Patient positioning, sampling technique, new devicesWhen to suspect an intra-procedural air embolism - Common symptoms and signsAir embolism treatment - immediate steps and treatment with hyperbaric oxygen including mechanism of action and discussion of efficacy

## IREE-27 WEDGED HEPATIC VENOUS PORTOGRAPHY FOR MESO-REX BYPASS PLANNING IN CHILDREN WITH EXTRA-HEPATIC PORTAL VEIN OBSTRUCTION: WHY AND HOW TO DO IT, WHAT ARE THE FINDINGS, AND DOES IT MATTER?

**Awards**
**Certificate of Merit**

Dimitri A. Parra, MD, MMEd (*Abstract Co-Author*) Nothing to Disclose
Maria Gladkikh, MD,BSC (*Abstract Co-Author*) Nothing to Disclose
Afsaneh Amirabadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Victoria Vaughan (*Abstract Co-Author*) Nothing to Disclose
Maria F. Dien Esquivel, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Learning Objectives: 1. Define the indications for wedged hepatic venous portography (WHVP) in children with extra hepatic portal vein obstruction. 2. Describe the WHPE technique.3. Illustrate the WHPE findings and their interpretation in the context of surgical planning.4. Correlate specific cases with clinical and surgical outcomes.

**TABLE OF CONTENTS/OUTLINE**

• Introduction/Background• Learning Objectives• Normal Anatomy of the Intrahepatic Portal Venous System and Bertocchini Classification• Indications/Contraindications• Technique Description• Technical Tipso To improve the procedure planning and diagnostic accuracyo To obtain an adequate mapping of the patent intrahepatic portal system, by performing injections in different regions of the major hepatic veins .o To perform an adequate interpretation of findings and description of findings in the radiological report.• Illustrative Cases/Case Examples with surgical and clinical correlation.• Conclusions.

## IREE-28 NERVE BLOCKS: A PRIMER FOR INTERVENTIONAL RADIOLOGISTS

Christina Boyd, MD (*Abstract Co-Author*) Nothing to Disclose
Kenneth N. Huynh, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review the nerve distributions typically targeted for blockade and their relevant anatomy, from head to toe. 2. To review indications, techniques, technical considerations, pharmacology, and complications of nerve blocks. 3. To achieve a basic understanding of billing and coding for nerve block procedures.

**TABLE OF CONTENTS/OUTLINE**

As the complexity of interventional radiology (IR) procedures increase, the need for adequate sedation and analgesia becomes more critical to ensure patient comfort and procedural success. Nerve blocks involve the injection of local anesthetic near targeted nerves to temporarily interrupt pain signals to the brain, offering regional pain relief that can be both diagnostic and therapeutic. These techniques are helpful in acute pain management, particularly peri-operative pain, chronic pain conditions including cancer-related pain. They have been shown to enhance quality of life, reduce opioid consumption, and facilitate earlier mobilization. Using these techniques, interventional radiologists can readily provide targeted analgesia, optimize therapeutic outcomes, and mitigate the need for general anesthesia in high-risk patients. This educational exhibit will (1) review commonly targeted nerves and distributions, and relevant anatomy including intercostal, pudendal nerves, erector spinae, transverse abdominis plane, stellate ganglion, celiac plexus, superior hypogastric plexus, and ganglion impar, (2) discuss techniques, technical considerations, and pharmacologic agents used for nerve blocks, as well as managing complications such as local anesthetic systemic toxicity (LAST), and (3) discuss basic billing and coding for nerve block procedures.

## IREE-29 NOT JUST TACE. USE OF TACE GUIDANCE SOFTWARE PRODUCED

Naoki Hosoda (*Abstract Co-Author*) Nothing to Disclose
Hirotoshi Murakami (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To learn about the IVR in the Gastrointestinal Tract. To learn about the TACE Guidance Software Produced. To learn about the gastrointestinal IVR using TACE Guidance. To learn about the Benefits of TACE Guidance.

**TABLE OF CONTENTS/OUTLINE**

A. Gastrointestinal IVR and its Precaution B. TACE Guidance Software Produced C. About Appendiceal Bleeding CASE D. Benefits of TACE Guidance

## IREE-3 OVERVIEW OF PERCUTANEOUS TRANSHEPATIC BILIARY INTERVENTIONS: INDICATIONS AND BEST PRACTICES

Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Meaghan Dendy Case, MD (*Abstract Co-Author*) Nothing to Disclose
Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose

Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose
Tony Borgmann (*Abstract Co-Author*) Nothing to Disclose
William R. Winter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:1. To review normal and abnormal biliary tree anatomy2. To discuss types of biliary obstruction3. To provide an overview of percutaneous interventions for benign and malignant biliary pathology, including indications and best practices for each

**TABLE OF CONTENTS/OUTLINE**

1. Normal and Abnormal Biliary Tree Anatomya. Normalb. Post Roux-en-Y Gastric Bypassc. Hepaticojejunostomyd. Situs Inversuse. Intestinal Malrotation2. Indicationsa. Obstructioni. Benign (stone, stricture, PSC, PBC)ii. Malignantiii. High vs Low Biliary Obstructioniv. Symptoms (pruritus, jaundice)b. Leakc. Infection3. Transhepatic Cholangiographya. Right vs Left-sided Accessb. Dilated vs Non-Dilated4. Transhepatic Biliary Drainagea. External vs Internal/External Drainb. Drain Upsizingc. Drain Externalization and Removal5. Potential Biliary Interventionsa. Cholangioplastyb. Stent (plastic, metal)c. Biopsy (brush, forceps, FNA)d. Cholangioscopye. Lithotripsyf. Ablationg. Rendezvous with ERCP

## IREE-31 IMAGING CHARACTERISTICS OF A NEWLY APPROVED NANOCOMPOSITE HYDROGEL BASED EMBOLIC AGENT WITH TANTALUM MICROPARTICLES

Johannes Du Pisanie, MD (*Abstract Co-Author*) Nothing to Disclose
Nima Kokabi, MD (*Abstract Co-Author*) Research support, Sirtex Medical Ltd;Consultant, Sirtex Medical Ltd;;
Andrew Caddell (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Introductions: A new conformable embolic (OBSIDIO Boston Scientific, Marlborough, MA), received 510(k) approval for the embolization of hypervascular tumors and peripheral blood vessel as of July 20221. This nanocomposite hydrogel based embolic agent with tantalum microparticles (NHTM) produces unique imaging characteristics as compared to preexisting commonly utilized embolics.Teaching points: To describe the imaging characteristics of NHTM on various imaging modalities.

**TABLE OF CONTENTS/OUTLINE**

Angiographic Characteristics Dynamic Visualizations: NHTM is radio-opaque resulting in good visualization of the embolic during fluoroscopy and on radiographs2.CT Characteristics Reduced Streak Artifact: NHTM attenuates streak artifact compared to coil embolization. Contrast Differentiation: The K-edge of Tantalum is 67.4 keV, Iodine is 33.2 keV, Barium is 37.4 keV, Calcium is 4.0 keV, and Gadolinium 10.4 keV3. These differences may allow for differentiation on CT and dual energy CT based on Hounsfield unit density.MRI Characteristics Streak Artifact: NHTM does not produce streak artifact on MRI2. Variation Between Sequences: Based on the MRI properties of the hydrogel and the paramagnetic properties of tantalum sequence intensity is as follows. T2 High intensity. T1 Low intensity.https://www.accessdata.fda.gov/cdrh_docs/pdf21/K213385.pdfdoi:10.1002/advs.202003327skuld.bmsc.washington.edu/scatter/AS_periodic.html

## IREE-32 SYNERGY OF CAR-T THERAPY WITH INTERVENTIONAL RADIOLOGY: HOW IR PROCEDURES CAN IMPROVE IMMUNOTHERAPY OUTCOMES

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Warren Campbell, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Interventional radiology has the capability to improve CAR-T therapy by improving efficacy and reducing systemic toxicity in treating solid tumors. Vascular therapy can administer localized delivery of CAR-T cells beyond the barriers of the tumor microenvironment or areas of poor vasculature.Priming tumors with ablation can improve antigen presentation to immune cells and degrade extracellular matrix barriers to immune infiltration.Interventional delivered adjuvant therapy may help T-cells function for longer durations. IR also has a role in continued surveillance of therapy and tumor monitoring. Collectively, the role of IR procedures should continue to be studied to improve solid tumor targeting with CAR-T therapy.

**TABLE OF CONTENTS/OUTLINE**

1. review of T-cell therapy2. Locoregional therapies to deliver CAR-T therapy3. Evidence behind priming and adjuvant therapy of solid tumors in CAR-T therapy4. Role of IR in monitoring the efficacy of CAR-T therapy5. Conclusions

## IREE-33 MANAGEMENT OF COMPLICATIONS ASSOCIATED WITH TRANSJUGULAR INTRAHEPATIC PORTOSYSTEMIC SHUNT: TIPS FOR SUCCESSFUL TIPS

Jamaal Benjamin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Girish Kumar, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel L. Rice, MD (*Abstract Co-Author*) Nothing to Disclose
Anil K. Pillai, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Rakesh K. Varma, MD, MBBS (*Abstract Co-Author*) Speaker, Becton, Dickinson and Company
Seth Toomay, MD (*Abstract Co-Author*) Nothing to Disclose
Husameddin El Khudari, MBChB (*Abstract Co-Author*) Nothing to Disclose
Ahmad Arar (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To recognize the potential technical complications related to TIPS creation, in a stepwise manner.2. To understand the causes of TIPS related complications and recognize the corresponding imaging findings.3. To learn how to prevent and address complications associated with TIPS, thereby enhancing patient safety and optimizing outcomes

**TABLE OF CONTENTS/OUTLINE**

Outline: 1) Nonvascular and vascular complications prior to TIPS creation: Prevention is better than cure2) Handling Intraprocedural complications of TIPS- Nontarget TIPS insertion- Liver capsule Transgression3) TIPS device-related complications: Blame the fellow- Maldeployment- Migration- Biliary obstruction- Tipsitis4) TIPS malfunctioning: Early Occlusion, Stenosis, and Thrombosis5) Managing post-TIPS complications: Clearing the confusion- Acute Hepatic Encephalopathy- Spontaneous Shunts- Acute Hepatic Failure6) Variceal and arterial embolization in portal hypertension: Hemostasis beyond TIPS7) Miscellaneous Complications: Systemic and Radiation related

## IREE-34 MACHINE LEARNING (ML) VS CT/MRI-BASED VASCULAR MODEL FOR ASSESSING PORTAL HYPERTENSION: NON-INVASIVE ALTERNATIVE FOR PREDICTING HEPATIC VENOUS PRESSURE GRADIENT (HVPG)

Priya Mody, MD (*Abstract Co-Author*) Nothing to Disclose
Haneyeh Shahbazian, MD (*Abstract Co-Author*) Nothing to Disclose
Fahad S. Mohammed (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To educate radiologists on two non-invasive alternatives for predicting clinically significant portal hypertension (CSPH).

### TABLE OF CONTENTS/OUTLINE

IntroductionThe current gold standard for diagnosing clinically significant portal hypertension (CSPH) is the hepatic venous portal gradient (HVPG) procedure. Non-invasive models that predict CSPH would be a valuable tool for physicians assessing decompensation in patients with advanced chronic liver disease (ACLD). Two predictive models have recently been released to predict CSPH with either laboratory parameters using ML or imaging data from CT/MRI using a support vector machine. ML model• Readily Available Parameters- The 3P model uses platelet count, bilirubin, and international normalized ratio.• Online Tool- The study's online calculator calculates the probability of HPVG=10 and =16.• High AUC- When combined with liver stiffness measurement, the 3P model had an AUC of 0.858 for predicting portal pressure =10 mmHg, and the 5P model had an AUC of 0.901 for predicting portal pressure =16 mmHg.CT/MRI model• Usage of Imaging- The model utilizes geometric parameters extracted from segmented vessels within contrast-enhanced CT and MRIs to predict HPVG=10 using a support vector machine.• Detect Vasculature Changes: The model detects variations of the hepatic vascular systems (portal/hepatic vein) in CSPH, including reductions in mean whole-vessel volumes and length.• High AUC: The model had an AUC of 0.90 on the internal test set and 0.84-0.87 on external test sets.ConclusionsThe ML model predicts HPVG=10 and =16, while the CT/MRI model only predicts HPVG=10. Overall, both modalities are excellent non-invasive alternatives to HVPG procedures.

## IREE-35 CONTEMPORARY PRIMER ON THROMBECTOMY DEVICES IN THE MANAGEMENT OF LOWER EXTREMITY DVT: CURRENT STATE OF AFFAIRS AND EVOLVING APPLICATIONS

Mensur Koso, MD (*Abstract Co-Author*) Nothing to Disclose
Gavin Wu, BA (*Abstract Co-Author*) Nothing to Disclose
Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Nojan Bajestani, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Deep vein thrombosis (DVT) has high morbidity and potential mortality that can lead to post-thrombotic syndrome in approximately 50% of patients, characterized by chronic pain, swelling, and walking difficulties. Catheter-directed interventional therapies such as percutaneous mechanical thrombectomy (PMT), catheter-directed thrombolysis (CDT), and pharmacomechanical CDT (PCDT), and others have been developed to alleviate symptoms, restore venous flow, and preserve valve function sooner and more effectively than conventional treatment. Appropriate device selection is paramount and depends on clinical context.After this exhibit, viewers will:1) Explore the clinical indications for thrombectomy and thrombolysis in DVT management2) Learn about all thrombolytic devices including aspiration, rotational, rheolytic, and ultrasound-assisted techniques3) Understand proper device selection and their advantages and disadvantages

### TABLE OF CONTENTS/OUTLINE

1) Introduction to DVT and Endovascular Management2) Overview of Thrombectomy Devices, including Mechanical, Aspiration, Rotational, Rheolytic, and Ultrasound-assisted techniques3) Mechanisms of Actions and Indications4) Guidelines for Device SelectionTechnique Benefits and Risks5) Evidence-Based Outcomes and recent national guidelines6) Case-based and Device-Specific Reviews7) Current Research and Future Directions8) Summary and Conclusions

## IREE-36 DISTAL TRANSRADIAL ACCESS FOR NON-CARDIAC INTERVENTIONS IN THE ERA OF MINIMALLY INVASIVE ENDOVASCULAR THERAPY

**Awards**
**Certificate of Merit**

Kondo Hiroshi (*Abstract Co-Author*) Nothing to Disclose
Yamamoto Masayoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Wada, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are the following.1. To describe recent advances of distal transradial access in non-cardiac interventions, including its indications, feasibility, and safety 2. To illustrate the basic anatomy and techniques of distal transradial access 3. To demonstrate practical interventional procedures and complications of distal transradial access through case-based review

### TABLE OF CONTENTS/OUTLINE

1. Indication and patient selection of distal transradial access for non-cardiac interventions 2. Anatomy of the radial artery and surrounding structures in the snuff box to explain the techniques of distal transradial access and complications associated with the puncture 3. Details of the procedure presented through case-based review: angiography suite settings, device selection, puncture of the distal radial artery, cannulation for the targeted arteries, and navigation of microcatheters 4. Complications associated with distal transradial artery access and how to handle them

## IREE-37 ALL YOU NEED TO KNOW ABOUT SELECTIVE ARTERIAL CALCIUM INJECTIONS AND VENOUS SAMPLING FOR PANCREATIC NEUROENDOCRINE TUMORS

Nobuyuki Shiraga, MD (*Abstract Co-Author*) Nothing to Disclose
Masaaki Hori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fuyuki Washizuka (*Abstract Co-Author*) Nothing to Disclose
Masahiro Kobayashi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To understand the indications and objectives of selective arterial calcium injection (SACI) test for pancreatic neuroendocrine tumors (NETs).To review the anatomical vascular variations in pancreas.To understand how to perform SACI test including the appropriate injection sites according to patient's anatomical vascular variations and blood flow domination in pancreas.To learn how to interpret the sampling results for determining the localization of pancreatic NETs.

**TABLE OF CONTENTS/OUTLINE**

A. Diagnosis and imaging findings of pancreatic NETs.B. How to perform SACI test including the injection sites, sampling sites, and the sampling times.C. Appropriate injection sites according to the types of blood flow domination.D. Evaluation of the sampling results with case presentations.

## IREE-38 BRONCHIAL ARTERY INFUSION CHEMOTHERAPY: TIPS AND TRICKS

Dayhane H. De Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Rayssa A. Melo, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz T. Siqueira, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Luiza Teixeira (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To discuss and illustrate a Bronchial artery infusion of chemotherapy for lymphangitic carcinomatosis, that to our knowledge has never been published.

**TABLE OF CONTENTS/OUTLINE**

1 - To review the bibliography about Bronchial artery infusion of chemotherapy.2- To illustrate a case of pulmonary lymphangitic carcinomatosis, focusing on aspects related to imaging, procedures, treatments, and interventions.3 - Summary and take home messages.

## IREE-39 ABLATION OF OSSEOUS TUMORS: ESSENTIAL REVIEW OF NEURAL ANATOMY TO AVOID INJURY

Jemianne Bautista, MD (*Abstract Co-Author*) Nothing to Disclose
Jea Ho S. Yu, BS (*Abstract Co-Author*) Nothing to Disclose
Anthony Zamary (*Abstract Co-Author*) Nothing to Disclose
Kevin Zhou (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

: Percutaneous ablation of osseous tumors followed by kyphoplasty/cementoplasty offers a targeted, minimally invasive option for patients with symptomatic disease and can be performed as an adjunct treatment to Surgery and Radiation. However, damage to critical neural anatomy represents a significant risk, and avoiding complications requires a detailed understanding of neural anatomy. This exhibit will provide:(1) Detailed review of neural anatomy relevant to the most common sites of osseous tumor ablation, including spinal, pelvic, and lower extremities. (2) Review of specific nerve function. (3) Cases highlighting successful navigation of complex neural pathways during ablation procedures. (4) Specific considerations for each ablation modality (RFA, cryoablation, thermoablation, etc.) including placement of ablation probes and the monitoring of heat spread or ice formation to prevent neural damage.

**TABLE OF CONTENTS/OUTLINE**

(1) Overview of osseous tumors and indication for ablation therapy.(2) Neural anatomy associated with common sites of osseous tumor ablation.(3) Workup and procedural techniques to minimize the risk of neural injury.(4) High yield review of different ablation modalities (radiofrequency, cryoablation, microwave, and IRE) and their specific considerations regarding neural safety.(5) Case examples.

## IREE-4 PELVIC VENOUS REBUILDING: ILIOCAVAL RECONSTRUCTION TIPS, TRICKS AND CURRENT STANDARDS OF PRACTICE

LeAnn S. Stokes, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Tony Borgmann (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Exhibit viewers should be able to (A) understand indications and contraindications for iliocaval reconstruction, (B) review the imaging and anatomy to determine patient eligibility, (C) define the intervention techniques and equipment for iliocaval reconstruction, and (D) discuss short and long-term postoperative complications of the reconstruction

**TABLE OF CONTENTS/OUTLINE**

A. Indications and contraindications for iliocaval reconstitution a. Indications for Reconstruction i. Venous occlusion in the setting of recurrent deep venous thrombosis ii. Post-thrombotic syndrome iii. Limitations in activities of daily living b. Contradictions i. Hypersensitive to stent compounds ii. Contraindication to anticoagulation (relative) c. Alternatives i. Conservative therapy B. Imaging and Anatomy a. Duplex ultrasonography b. CTV or MRV c. Venography C. Intervention techniques and equipment a. Equipment i. Access sheath, various guide catheters, and guidewires ii. Stents iii. Intravascular ultrasound b. Access and Positioning i. Vascular access points depend on the level and extent of occlusion/inflow - common femoral, popliteal, greater saphenous, internal jugular ii. Prone positioning to facilitate popliteal access iii. Supine positioning for more proximal access c. Recanalization i. Blunt ii. Sharp d. Reconstruction i. Indications of indwelling catheter-directed thrombolysis ii. Indications for thrombectomy iii. Stent choice, location, and measurements D. Complications and Post-Procedure Care a. Complications i. Access site hematoma ii. Stent migration iii. Stent thrombosis occlusion b. Post Procedure care i. Anticoagulation ii. Clinic and imaging follow-up recommendations

## IREE-40 MR-GUIDED CRYOABLATION OF PROSTATE CANCER BONE METASTASES: A COMPREHENSIVE GUIDE

Scott M. Thompson, MD, PhD (*Abstract Co-Author*) Research Consultant, Boston Scientific Corporation
Aiming Lu, PhD (*Abstract Co-Author*) Nothing to Disclose
Setayesh Sotoudehnia Korani, MD (*Abstract Co-Author*) Nothing to Disclose
Aliza Mushtaq, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Lance A. Mynderse, MD (*Abstract Co-Author*) Researcher, Koninklijke Philips NV;Equipment support, Koninklijke Philips NV;Investigator, Nanospectra Biosciences, Inc;Researcher, Nanospectra Biosciences, Inc
Daniel A. Adamo, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Ganjizadeh, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• The advantages of MR-guided cryoablation over CT-guided cryoablation in treating prostate cancer bone metastases• Effective patient selection and interpretation of MR and PET scans for accurate diagnosis and treatment planning• Optimal treatment planning and follow-up strategies for successful outcomes

**TABLE OF CONTENTS/OUTLINE**

Introduction• Overview of MR-guided cryoablation: A minimally invasive, image-guided therapy for bone metastases• Advantages of MR guidance: Precision, safety, and efficacy in targeting bone metastasesPatient Selection and Imaging• Inclusion criteria for MR-guided cryoablation: Patient selection and evaluation• Role of PET/CT scans (11-C Choline and PSMA) in identifying metastatic sites• MR imaging characteristics of bone metastases: Visualization and interpretationTreatment Planning and Procedure• Procedure details: Utilization of 3-4 freeze/thaw cycles per session, with MRI and ultrasound assistance for needle placement• Importance of real-time monitoring of the ablation zone for complete treatmentFollow-up and Recurrence Management• Imaging schedule: Pre-operative planning and post-ablation follow-ups at 3, 6, and 12 months• Classification and management of recurrences:o In-field recurrences: Definition, examples, and treatment strategieso Out-of-field recurrences: Definition, instances, and treatment approaches

## IREE-41 THE SPECTRUM OF MOLECULAR IMAGING IN Y90 MICROSPHERE SELECTIVE INTERNAL RADIATION THERAPY (SIRT) FOR PRIMARY AND METASTATIC LIVER TUMORS

Shima Tafreshi, MD (*Abstract Co-Author*) Nothing to Disclose
Mehdi Djekidel, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Weinstein, MD (*Abstract Co-Author*) Nothing to Disclose
Amna Aslam (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Pre Y90 selective internal radiation therapy (SIRT) abnormal biodistribution will determine adjustment in therapy delivery planning• High yield radiolabeling of Tc99m MAA for pretherapy mapping is also essential in avoiding confounding extrahepatic stomach and duodenal uptake due to free pertechnetate.• SPECT-CT is essential to map extrahepatic uptake• Gallbladder uptake of Y90 typically occurs due to either non-target embolization or reflux of the microspheres. • Close assessment of falciform ligament uptake is essential and requires expertise and the use of advanced SPECT-CT techniques. • Post-treatment assessment via SPECT-CT allows for early detection of gallbladder uptake which can lead to radiation-induced cholecystitis and allows for prompt management of such potential complications.• The application of dosimetry techniques pre and post SIRT is crucial in optimizing patient outcomes.

**TABLE OF CONTENTS/OUTLINE**

Y90 SIRT has seen a huge increase in clinical utilization. Owing to numerous studies demonstrating outcome benefits for different indications it has gained in clinical acceptance and application. However, proper use requires expertise and a multilayered approach to patient selection and management. Molecular imaging plays an essential role in the overall successful delivery of this therapy. Optimized workflows and high-quality standards require expertise and knowledge of various aspects of the molecular imaging paradigm pre, during and post treatment. We offer to review the different aspects of molecular imaging involved in the care for Y90 liver SIRT patients including normal and abnormal biodistribution pre-, during and post-treatment, and dosimetry assessments.

## IREE-42 CYSTIC DUCT STENTING IN BENIGN DISEASE: AN OVERVIEW

Patrick D. Sutphin, MD, PhD (*Abstract Co-Author*) Stockholder, Gilead Sciences, Inc;Stockholder, Editas Medicine;Stockholder, CRISPR Therapeutics AG;Stockholder, Intellia Therapeutics;Stockholder, Amwell;Stockholder, Teladoc Health Inc;Stockholder, Jazz Pharmaceuticals plc;Stockholder, ViewRay, Inc;Research funded, TriSalus Life Sciences
Kausthubh Hegde, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review indications and techniques of cystic duct stenting in benign gall bladder disease as an alternative to surgery
- Evaluating technical success and complications: efficacy and safety of the procedure and common complications
- Long-term outcomes of patients' post-cystic duct stenting and feasibility of transitioning to surgery if the patient's condition improves

**TABLE OF CONTENTS/OUTLINE**

- Introduction to cystic duct stenting:- Indication and patient selection criteria for choosing stenting over traditional surgical methods in benign gall-bladder disease- Techniques of stenting and devices used during the procedure- Protocols for pre- and post-procedure care
- Evaluating technical success: clinical outcomes from recent studies and case series
- Complications and management:- Review common and serious complications and how to prevent them- Strategies to manage complications and improve patient outcomes- Case studies (image-based) highlighting specific incidents
- Overview of follow-up protocols and long-term care with a focus on transitioning from stenting to surgery: criteria and case examples

## IREE-43 VISUAL GUIDE TO THE MEDICAL MANAGEMENT OF SITUS INVERSUS

Husameddin El Khudari, MBChB (*Abstract Co-Author*) Nothing to Disclose
Ahmed Abdelgawad (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1- describe be the situs inversus spectrum and its radiologic findings2- To identify the implication of the altered anatomy on performing interventional procedures3- To present a case-by-case review of the common interventional procedures performed on situs inversus patients

**TABLE OF CONTENTS/OUTLINE**

Background: Situs solitus is the normal arrangement of the human viscera. Situs inversus is a rare genetic condition in which the organs of the chest and abdomen are positioned in a mirror image of normal human anatomy. The incidence of situs inversus totalis is approximately 1:10,000. Despite its rarity, these patient are still encountered in the IR world. Performing procedures on patients with situs inversus poses a unique challenge to interventionalist. Knowledge of the anatomical alterations and its implications on performing these interventions is very important for safe and successful performance of these procedures.Clinical Findings/Procedure Details:We present a case-by-case review of some of the common IR procedures performed on patients with situs inversus with special emphasis on technical aspects, tips and tricks to safely perform these procedures.We present the following cases:Angiogram and embolization in patient with GI bleeding
- Transarterial Chemoembolization/Y-90
- TIPS placement
- Gastrostomy placement
- Tunneled hemodialysis catheter placement
- Percutaneous transhepatic cholangiography
- IVC filter placementConclusion or Teaching Points: Situs inversus is a rare genetic condition that poses unique challenges to interventionalist. Understanding of the anatomic alteration and proper techniques is crucial to perform procedures safely and successfully on patient with situs inversus.

## IREE-44 LIVER HISTOTRIPSY: TIPS AND TRICKS FOR CLINICAL TREATMENT OF LIVER TUMORS

Mishal Mendiratta-Lala, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanna Fox (*Abstract Co-Author*) Nothing to Disclose
Neehar Parikh, MD (*Abstract Co-Author*) Grant, Bayer AG;Consultant, Bayer AG;Grant, Boston Scientific Corporation;Grant, Exact Imaging Inc;Consultant, Exact Imaging Inc;Grant, Glycotest, Inc;Grant, Exelixis, Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Eli Lilly and Company;Advisory Board, Eisai Co, Ltd;Advisory Board, F. Hoffmann-La Roche Ltd;Advisory Board, FUJIFILM Holdings Corporation
Farah Jawad-Makki, MA (*Abstract Co-Author*) Nothing to Disclose
Elaine M. Caoili, MD, MS (*Abstract Co-Author*) Steering Committee, ProKidney, LLC
Nathan E. Loudon, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Oserowsky, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Navarro, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Histotripsy is a new non-invasive locoregional therapy for liver tumors using mechanical cavitation for tissue destruction. 2. Histotripsy treatment configuration can be adapted per tumor, so that each ablation zone is unique per patient and per tumor, allowing for a personalized approach. 3. Histotripsy ablation spares collagenous structures, such as vessels and bile ducts, allowing for treatment of tumors that may otherwise be risky with invasive thermal ablation procedures. 4. There are restrictions to the application of histotripsy secondary to device limitations, the most critical being the inability to target tumors from an intercostal approach, which markedly limits clinical applicability of this technology. 5. Techniques such as pre-planning, patient positioning and coordination with anesthesiology can expand the scope of histotripsy by permitting treatment of lesions that would usually be precluded secondary to device limitations.

**TABLE OF CONTENTS/OUTLINE**

Introduction to Histotripsy Technology Mechanism of action Introduction to the Clinical Workflow for Histotripsy Evaluation Patient referral process Selection process of appropriate candidates for treatment Tips and Tricks to expand the scope of histotripsy treatment Pre-treatment evaluation of liver tumors How to perform histotripsy via an intercostal approach Optimal patient positioning Coordination with anesthesiology team

## IREE-45 SECTORAL ECHOBRONCHOSCOPY DEMYSTIFIED. ESSENTIAL KNOWLEDGE FOR DOCTORS

Rodrigo Gobbo (*Abstract Co-Author*) Nothing to Disclose
Marcia Jacomelli (*Abstract Co-Author*) Nothing to Disclose
Victor Arthur Ohannesian (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Preparation involves smears and Reaction of Other Excluding Substances (ROSE), emphasizing initial cytopathological analysis for identifying lymphocytes and adjacent lesions. -ROSE crucial for mediastinal staging in lung neoplasia, guiding therapeutic decisions with minimal complications, but high sensitivity and cost.-Sectoral echobronchoscopy is clinically relevant for diagnosing peribronchial lesions and lymph nodes, staging pulmonary and extrathoracic neoplasms precisely.-Its established use ensures accuracy in diagnosing peritracheal lesions and staging, influencing therapeutic decisions in lung neoplasia management.-Despite its high cost, sectoral echobronchoscopy proves indispensable in coagulation disorders, hemodynamic instability, and ventilatory contraindications, ensuring precise staging and management.

**TABLE OF CONTENTS/OUTLINE**

1.ANATOMY2.EQUIPMENT3.EXAM SYSTEMATIZATION4.MAIN INDICATIONS5.DIAGNOSTIC INCOME and SUMMARY OF EVIDENCE 6.CASES

## IREE-47 BREATHING NEW LIFE INTO BRONCHIAL ARTERY EMBOLIZATION (BAE): RECENT TECHNICAL AND CLINICAL OUTCOMES

Clayton W. Commander, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Thomas Turner (*Abstract Co-Author*) Nothing to Disclose
Estefania Gonzales, BA, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Indications for BAE include hemoptysis causing airway or respiratory compromise, moderate hemoptysis with 3 episodes within a week each over 100 mL, increasing blood volumes from chronic bleeding or sudden bloody sputum, and as a bridge treatment for lung transplant patients with moderate hemoptysis due to chronic inflammatory lung disease. Advanced imaging techniques, like MDCT angiography, enhance detection by providing more precise mapping of bronchial and systemic vascular anatomy sometimes missed by standard imaging, improving procedural safety. A pleural thickness >3 mm and enlarged extrapleural vessels suggest non-bronchial systemic artery bleeding. Predictive factors for recurrent hemoptysis post-BAE in idiopathic bronchiectasis include pseudomonas infection, massive sputum production, and aberrant bronchial arteries. Factors such as AV fistulas, systemic shunts, and underlying lung diseases also contribute to recurrence in non-specific cases. The 2022 CIRSE Standards of Practice have spurred advances in

microcatheter technology, enabling superselective coil embolizations in 98% of cases with lower risks of spinal cord infarction compared to agents like Gelfoam and NBCA. Early embolization reduces hospital stays and recurrence risks. Common embolic agents for BAE include NBCA, PVA, and coils, sometimes with Gelfoam. Recent studies suggest NBCA and coils outperform particles. Success rates vary based on hemoptysis presentation and vascular abnormalities. Embolic choice should prioritize patient safety and be tailored to individual clinical needs.

**TABLE OF CONTENTS/OUTLINE**

Introduction to BAE; Indications with Updates; Advancements in Techniques and Embolizations; Frontiers

## IREE-48 MIGRATION OF VASCULAR AND NON-VASCULAR STENTS: INCIDENCE, PRESENTATION, CONTRIBUTING FACTORS AND MANAGEMENT

**Awards**
**Certificate of Merit**

Dyda Dao, MD (*Abstract Co-Author*) Nothing to Disclose
Brian S. Funaki, MD (*Abstract Co-Author*) Consultant, Okami Medical;Advisory Board, Balt USA
Wojciech Cwikiel, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ramin Midia, MD (*Abstract Co-Author*) Nothing to Disclose
Mehran Midia, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Although not frequent, vascular and non-vascular stent migration can occur in IR practice and could be associated with significant morbidity and mortality. The incidence of stent migration is likely underreported. Clinically patient could be asymptomatic and in symptomatic patients' presentation largely depends on the stent location. Stent deployment is a dynamic process and there are many device, host and operator technique factor that could contribute to stent migration at time of deployment and thereafter. Management of stent migration ranges from close monitoring to interventional radiology management, open surgery and combination of the later. Interventional radiology management is the most commonly used method, with a high success rate. Interventional radiology techniques range from temporary anchoring (such as with balloons and snares), permanent anchoring (including with the use of overlapping or bridging stents), repositioning and retrieval of the migrated stent.

**TABLE OF CONTENTS/OUTLINE**

1. To review the incidence and clinical presentation of stent migration.2. To understand the contributing factors for the development of stent migration and discuss technical considerations for stent migration prevention.3. To highlight current techniques and strategies for managing migrated stents.

## IREE-5 REDEFINING VASCULAR PLUGS: RADIOLOGIST INTERPRETATION OF TECHNOLOGY AND TECHNIQUES FOR OPTIMAL EMBOLIZATION

Yasutoshi Ohta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Nishii, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation
Masaru Shiotani, RT (*Abstract Co-Author*) Nothing to Disclose
Yoshiaki Morita (*Abstract Co-Author*) Nothing to Disclose
Emi Tateishi (*Abstract Co-Author*) Nothing to Disclose
Teruhito Hayashi (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Hiroki Horinouchi (*Abstract Co-Author*) Nothing to Disclose
Midori Fukuyama, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuki Hara, RT (*Abstract Co-Author*) Nothing to Disclose
Akiyuki Kotoku, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The Vascular Plug (VP) is a cutting-edge embolization technology designed to precisely and effectively occlude a targeted vessel. The device efficiently occludes vessels with minimal impact on surrounding tissues by utilizing the body's natural processes that reduce blood flow and promote thrombus formation. Amplatzer Vascular Plugs (AVPs) are the traditional and most widely used devices. AVPs use a combination of density and radial force to induce thrombus formation, allowing for controlled and strategic embolization. This exhibit will focus on the important role of AVPs in treating aneurysms and parent vessel occlusions. It will detail their embolization techniques and how they differ from other embolic materials. It also aims to understand AVPs, evaluate their imaging properties and effects on blood flow reduction, explore their strategic use, and discuss evidence-based future directions in vascular embolization.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to Vascular Embolization - Overview of embolization principles - The advent and importance of vascular plugs2. Physiological Basis for Thrombosis in Embolization -Role of embolic density and radial force3. AVPs in Clinical Practice: Aneurysmal vs. Parent Vessel Embolization - Criteria for embolization strategy selection4. Evidence-Based Application of AVPs - Clinical applications: Visceral artery aneurysms, vascular malformations5. Challenges and Solutions in AVP's Embolization - Learning from complex cases and failed placements6. Advanced Embolization Techniques with AVPs - Plug anchor (stabilizer) technique - Coil-in-plug technique7. Future Directions in Vascular Embolization with VPs

## IREE-50 THE ART OF THE SPLEMBO: SPLENIC ARTERY EMBOLIZATION TIPS, TRICKS, AND CURRENT STANDARDS OF PRACTICE

**Awards**
**Cum Laude**

Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose
Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Exhibit viewers should be able to (A) understand some indications for traumatic and non-traumatic splenic embolization, (B) recognize key anatomy for splenic embolization on angiography, (C) appreciate various techniques available to perform splenic embolization and (D) understand how patients are managed post-procedurally/monitored for potential complications.

**TABLE OF CONTENTS/OUTLINE**

A. Indications for Splenic Embolization a. Traumatic Spleen Embolization i. Signs of Splenic Trauma and AAST Grades on Diagnostic Imaging (CT and angiography) ii. Splenic embolization versus splenectomy: Indications and long-term outcomes. iii. Prophylactic embolization b. Non-traumatic Spleen Embolization i. Immune thrombocytopenia ii. Splenic artery aneurysm iii. Splenomegaly and importance for chemotherapy iv. Cirrhosis v. Post-liver transplantation (splenic steal) B. Procedural anatomy: celiac and splenic artery anatomy visualized on angiography C. Approach to embolization a. Choice of embolic agent (coils, plugs, gelatin sponge, Onyx, glue) b. Traumatic embolization i. Vascular access points ii. Proximal versus Distal embolization: advantages/disadvantages of each approach iii. Important collaterals to assess and preserve c. Non-traumatic embolization i. Preparation for embolization, including diagnostic imaging, antibiotics, and vaccination practices ii. Lower and mid pole embolization targets iii. Controversies in target infarction rate D. Post-embolization Outcomes and Follow-up a. Major and minor complications and their radiologic findings i. Access site complication ii. Splenic necrosis iii. Infection b. Follow-up imaging and management guidelines i. Dependent on indication

## IREE-51 TINY SPARKS: EXPLORING ABLATION IN PEDIATRIC ONCOLOGY

Renata Nabeiro Dias Angelo, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rosseto Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Barbara d. Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio d. Meira, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Marcello Giovanni Messias Da Silva, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1- Understand the clinical indications and decision-making processes for pediatric ablation procedures.2- Explore the safety and efficacy of ablation technologies in pediatric applications.

**TABLE OF CONTENTS/OUTLINE**

1- IntroductionDiscuss the relevance of ablation therapy in pediatric care, highlighting the current need of adapting adult techniques for pediatric use.2- Indications for Pediatric AblationOverview of conditions in pediatric patients that may benefit from ablation, including both common and rare indications.3- Techniques and TechnologiesBrief description of the ablation methods used in pediatric cases, focusing on adaptations for smaller anatomies and lower tolerance levels.4- Cases Presentation of selected cases to illustrate successful outcomes and the critical thinking involved in treatment planning.5- Safety and Efficacy EvaluationAnalysis of safety measures, complication management, and efficacy assessments, according to established literature.6- Management and Follow-UpSuggestions on post-procedure care, emphasizing the unique aspects of pediatric patient management and long-term follow-up.7- ConclusionReinforce the importance of specialized training in pediatric ablation, and suggested directions for future research.

## IREE-52 SHAM PROCEDURES IN INTERVENTIONAL RADIOLOGY INVESTIGATIVE TRIALS: ESSENTIAL FOR RIGOROUS RESEARCH

Hyeon Yu, MD (*Abstract Co-Author*) Nothing to Disclose
Elaine M. Caoili, MD, MS (*Abstract Co-Author*) Steering Committee, ProKidney, LLC
Joseph M. Stavas, MD, MPH (*Presenter*) Employee, ProKidney;Speaker, ProKidney;Research Consultant, Excelerate Health Ventures

**TEACHING POINTS**

Sham procedures provide critical control in Interventional Radiology (IR) trials, minimizing bias and ensuring the true efficacy and safety of new treatments. This presentation explores the history, implementation, and challenges of sham procedures in IR research. We will review our experience with sham procedures in a novel autologous cell-based therapy investigative trial to treat chronic kidney disease and other blinding methods which require risk versus benefit assessment, consistency, and validation .

**TABLE OF CONTENTS/OUTLINE**

- The Importance of Sham Procedures
- Why they are necessary for unbiased results in IR trials.
- Examples where their absence has led to misleading findings.
- Examples of IR trials with sham procedures:
- Catheter-directed renal artery denervation for hypertension
- Vertebroplasty for osteoporosis fracture pain
- Prostatic artery embolization for benign prostatic hypertrophy
- Geniculate and shoulder artery embolization for pain
- Cell-based therapies for kidney disease
- Implementing Sham Procedures in IR
- Specific procedural and training methods to ensure blinding
- Ethical and regulatory considerations (regulatory agency guidance, Institutional Review Board approval)
- Challenges and Best Practices
- Addressing patient recruitment barriers
- Overcoming ethical barriers and concerns
- Strategies for maintaining consistency and minimizing unblinding
- Key point Emphasize the need for wider use of rigorous sham-controlled research methodologies within the IR community to drive innovation and ensure evidence-based treatments.

## IREE-53 INTERVENTIONAL RADIOLOGY IN THE MANAGEMENT OF TRANSPLANT-ASSOCIATED COMPLICATIONS

Sophie Chheang, MD (*Abstract Co-Author*) Medical Director, Agamon Technologies Limited
William Baker (*Abstract Co-Author*) Nothing to Disclose
Emily June Zolfaghari (*Abstract Co-Author*) Nothing to Disclose
Ryan Bitar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Recognize the common/basic surgical techniques and imaging appearances of allograft placement in transplant recipients
- Review critical post-transplant complications and their associated presentations on imaging.
- Discuss the role of interventional radiology in the management in such pathologies.

**TABLE OF CONTENTS/OUTLINE**

- Liver transplant
- Common transplant techniques
- Arterial complications
- Arterial stenosis
- Imaging: Ultrasound (US) and CT angiogram
- angioplasty/stenting +/- splenic artery embolization
- Biliary complications
- Leak
- Imaging: CT and HIDA
- Stenting and sclerotherapy
- anastomotic stricture:
- Imaging: MRCP
- Angioplasty/stenting
- Venous complications
- Deep venous thrombosis
- Imaging: CT and US
- thrombectomy
- IVC stenosis/occlusion
- Imaging: CT and US
- Angioplasty/stenting
- Intrahepatic and extrahepatic fluid collections
- Imaging: MRI and CT
- Drainage/aspiration
- Biopsy
- Specimen specifics
- Kidney transplant
- Common renal transplant techniques
- Arterial complications
- Renal arterial stenosis:
- Imaging: CT angiogram and US
- angioplasty/stenting
- Pseudoanuerysm/trauma
- Imaging: CT and US
- Intervention: embolization
- Venous complications
- Deep venous thrombosis
- Imaging: US
- Thrombectomy
- Urinary complications
- Ureteral stricture
- Imaging: CT and US
- angioplasty and nephroureterostomy placement
- Pyelonephritis
- Imaging: CT and US
- nephrostomy
- Perinephric collections
- Imaging: US and CT
- Drainage/aspiration
- Biopsy
- Specimen specifics

## IREE-54 EX-VIVO MODELS FOR IR PROCEDURAL TRAINING. TAKING SIMULATION TO NEW LEVELS

John A. Walker, MD, PhD (*Abstract Co-Author*) Speaker, Shionogi & Co, Ltd;Consultant, Shionogi & Co, Ltd
Rajeev Suri, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Carlos B. Ortiz, MD (*Abstract Co-Author*) Consultant, Argon Medical Devices, Inc
Marina Borrego, BS (*Abstract Co-Author*) Nothing to Disclose
Jorge E. Lopera, MD (*Presenter*) Shareholder, Tecnostent SA;Consultant, Merit Medical Systems, Inc;Research Grant, AngioDynamics, Inc

**TEACHING POINTS**

Simulation in IR is very limited due to the high cost of computer base simulators and the lack of realistic experience when using plastic and 3- D models.Ex-vivo organs are very inexpensive and offer an unique opportunity to develop several models to teach, train and do research in a low cost, safe and reproducible manner.We have successfully created several models using ex- vivo organs to teach and train on several basic and advanced IR techniques.The purpose of this exhibit is to teach other educational institutions how to start a simulation program using ex vivo organs.

**TABLE OF CONTENTS/OUTLINE**

How to get started: procuring the organs and the getting the basic materials.US guided kidney and liver biopsies Percutaneous Transhepatic Cholangiogram and cholecystostomy tube Models. PCN Double J ureteral stent placement and retrograde exchange Models. Portal vein and renal artery embolization models. Transjugular liver biopsy and TIPS placement- ICE guided model.

## IREE-55 RADIOEMBOLIZATION FOR LIVER CANCER : CONSIDERATION OF NON-HEPATIC ARTERY ORIGINATING FROM THE HEPATIC ARTERY

Hyo-Cheol Kim, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To ensure the safety and efficacy of radioembolization procedures, a thorough comprehension of hepatic artery anatomy is imperative. This is particularly crucial due to the potential for several non-hepatic arteries to arise from the hepatic artery, necessitating careful consideration to avoid their inadvertent treatment or to provide appropriate protection. Oversight or unintended treatment of non-hepatic arteries during radioembolization can result in a spectrum of adverse consequences, ranging from mild postembolization syndrome to severe gastrointestinal radiation ulceration. The primary objectives of this presentation are as follows: 1. Enumeration of non-hepatic arteries originating from the hepatic artery. 2. Acquisition of techniques for identifying and managing non-hepatic arteries before and during radioembolization. 3. Review of potential complications associated with the inadvertent treatment of these arteries.

**TABLE OF CONTENTS/OUTLINE**

1. Cystic artery, right gastric artery, accessory left gastric artery, hepatic falciform artery, left inferior phrenic artery, and supraduodenal artery. 2. Vascular anatomy visualization of non-hepatic arteries using CT/MR, DSA, and cone-beam CT. 3. Strategies for detecting non-hepatic arteries using cone-beam CT, planning angiography, and SPECT/CT. 4. Technical considerations including permanent embolization, temporary embolization, and bypass procedures. 5. Management of complications related to non-hepatic artery treatment, such as ischemic cholecystitis, radiation cholecystitis, radiation gastroduodenal ulceration, radiation dermatitis, and epigastric pain.

## IREE-56 INTRA-ARTERIAL TREATMENT FOR HEPATOCELLULAR CARCINOMAS : HOW TO MANAGE SHUNTING FROM THE ARTERY

Jin Woo Choi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

In the treatment of hepatocellular carcinomas, intra-arterial therapy such as chemoembolization and radioembolization is commonly used. However, operators may encounter shunts from the artery (such as arterioportal, arteriovenous, and arteriopulmonary shunts) that can hinder effective treatment. These shunts can be caused by various factors such as tumor invasion, previous percutaneous procedures, chronic inflammation, or congenital acquisition. If not properly occluded, embolic material can pass through the shunt and cause non-target embolization or serious complications. This exhibit aims to achieve three goals: (1) Review the radiologic appearance of arterioportal, arteriovenous, and arteriopulmonary shunts; (2) Learn how to manage these shunts with proper embolic materials; and (3) List the possible complications and their management.

**TABLE OF CONTENTS/OUTLINE**

1) List of shunts Arterioportal shunt (hepatic artery - portal vein), Arteriovenous shunt (hepatic artery - hepatic vein), Arteriopulmonary shunt (hepatic artery - pulmonary artery/vein), 2) Imaging findings on CT/MR and angiography according to the cause (tumorous vs non-tumorous condition) 3) Embolization strategy and materials for shunts 4) Complications related with non-target embolization and their management

## IREE-57 EMBOLIZATION WITH N-BUTYL CYANOACRYLATE : PROPERTIES, TECHNIQUE, PITFALLS, AND APPLICATIONS

Jin Woo Choi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

N-Butyl cyanoacrylate is a commonly used liquid embolic material for managing various medical conditions, such as vascular malformation, gastrointestinal bleeding, portal vein embolization, and tumor embolization. This material can be mixed with iodized oil to provide radiopacity and control the polymerization time. However, beginners may find it challenging to handle liquid embolic material compared to coils, plugs, and particles. The purpose of this exhibit is : (1) To describe the properties and mechanism of action of N-butyl cyanoacrylate. (2) To learn diverse injection techniques and potential pitfalls associated with its use. (3) To review various clinical indications and appropriate techniques for the use of N-butyl cyanoacrylate in interventional procedures.

**TABLE OF CONTENTS/OUTLINE**

1) N-butyl cyanoacrylate A. Chemical properties B. Effects on tissues C. Polymerization D. Mixture with iodized oil E. Mixture with iodized oil and alcohol 2) Injection technique and pitfalls A. flow-dependent injection B. pressure-dependent injection C. Balloon-occluded injection D. Potential pitfalls 3) Clinical indications A. Arteriovenous malformation B. Diverse bleeding embolization C. Vein embolization D. Tumor embolization E. Endoleak embolization F. Lymphatic embolization

## IREE-59 SUPERSELECTIVE RADIOEMBOLIZATION FOR HEPATOCELLULAR CARCINOMA : RADIATION SEGMENTECTOMY AND BEYOND

Hyo-Cheol Kim, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Radioembolization is an established treatment for unresectable hepatocellular carcinoma. Radioactive microspheres are preferentially deposited into the hypervascular tumor by siphoning effect so that injection of microspheres are commonly performed at the lobar artery level. However, superselective radioembolization is the best way to improve tumor response and to prevent potential complications. The purpose of this exhibit is : (1) To review the rationale of radiation segmentectomy. (2) To learn when superselective radioembolization is needed, (3) technical tips for superselective radioembolization.

**TABLE OF CONTENTS/OUTLINE**

1) Radiation segmentectomy : rationale and evidence 2) Dosimetry : Practical guide for dosimetry of superselective radioembolization3) When superselective radioembolization is needed A. small single tumor : radiation segmentectomyB. Large single tumor saddling on both lobesC. Small remnant liverD. Hepatic artery branching at acute angleE. Extrahepatic collateral artery supplying the tumor4) Technical consideration of superselective radioembolization A. Protection of distal normal liver by using balloon microcatheter and detachable coil B. Combination treatment of lobar and segmental arteryC. Combination treatment of 1st and 2nd week dosing of glass microsphere5) Follow-up imaging after superselective radioembolizationA. Early loss of arterial enhancement of the tumor B. Focal radiation necrosis mimicking new hypovascular tumor

## IREE-6 IMPORTANCE OF EYE PROTECTION DURING INTERVENTIONAL RADIOLOGY PROCEDURES

Yohei Inaba, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Saya Ono (*Abstract Co-Author*) Nothing to Disclose
Koichi Chida, PhD (*Abstract Co-Author*) Nothing to Disclose
Satoe Konta (*Abstract Co-Author*) Nothing to Disclose

Keisuke Yamamoto (*Abstract Co-Author*) Nothing to Disclose
Ryota Shindo (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-To understand the importance of eye protection by lead glasses during Interventional radiology (IR) procedures. -To discuss the radiation-shielding effects of over-glasses-type eyewear. -To compare the protection afforded by over-glasses-type and regular eyewear. -To encourage the user of prescription glasses to wear over-glasses-type eyewear. -To understand the importance of the combination use of radiation protection tools during IR procedures.

**TABLE OF CONTENTS/OUTLINE**

•Characteristics of over-glasses-type eyewear •Radiation protection effect of over-glasses-type eyewear in a phantom experiment •Covered area by lead glasses and recommendation for combination use of protection tools OUTLINE: In response to the new occupational eye lens dose limit, the use of radiation protection tools such as Pb eyewear is important in IR. Over-glasses-type eyewear has a large frame and lens to fit over prescription glasses. In recent years, 0.07 mm Pb eyewear has been used. It is more lightweight and comfortable than existing 0.75 mm one. The shielding effects of lead-equivalent glasses (over-glasses-type and regular) were evaluated by placing radiophotoluminescence dosimeters inside and outside the glasses, and on the surface of the eye. The over-glasses-type eyewear exhibited better protection than regular eyewear at the irradiation angles of clinical settings. According to our phantom study, 0.07 mm Pb over-glasses-type eyewear protected left eye effectively. However, the covered area of right eye was insufficient. Further improvements of its shape and combination use of radiation protection tools are needed.

## IREE-61 PARADIGM SHIFT FROM TREATMENT TO PREVENTION IN TYPE 2 ENDOLEAK POST ENDOVASCULAR AORTIC REPAIR: CURRENT EVIDENCE AND TECHNICAL TIPS

Masashi Tamura, MD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Manabu Misu (*Abstract Co-Author*) Nothing to Disclose
Shintaro Senda, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Endovascular aortic repair (EVAR) offers a minimally invasive solution for aortic aneurysms, yet introduces the unique complication called endoleaks (ELs). Type 2 (T2) ELs, characterized by low pressure, necessitate monitoring due to their potential to trigger or worsen type 1 ELs, leading to rupture. T2ELs are traditionally treated with endovascular embolization; however, this approach is frequently difficult and ineffective. Recently, preemptive branch embolization has surfaced as a promising alternative strategy. This exhibit aims to achieve three goals: (1) Reviewing the basics and recent topics of T2ELs; (2) Learning the latest evidence supporting the shift from treatment to prevention for T2ELs post EVAR; and (3) Exploring techniques of preemptive embolization to mitigate T2ELs.

**TABLE OF CONTENTS/OUTLINE**

(1) Introduction: Types of endoleaks, pathophysiology, and imaging evaluation of T2ELs. (2) Treatment of T2ELs: Indications, overview of interventional techniques, treatment limitations, and case presentation. (3) Transitioning from Treatment to Prevention: Rationale, indications, review of efficacy studies, ongoing research, and future directions. (4) Techniques for Preemptive Embolization: Procedural considerations, and data on catheter selection from our institution.

## IREE-62 CT-GUIDED CRYOABLATION FOR RENAL CELL CARCINOMA: PITFALLS, AND TIPS TO ENSURE ACCURACY AND SAFETY

**Awards**
**Cum Laude**

Nobuhiro Fujita, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Daisuke Okamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Kousei Ishigami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Keisuke Ishimatsu, MD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Makise (*Abstract Co-Author*) Nothing to Disclose
Kousuke Tabata (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Ushijima, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review the basics of CT-guided cryoablation and its indications for renal cell carcinoma.To learn the practice of CT-guided cryoablation for renal cell carcinoma and how to improve effective treatment.To learn about the potential complications of CT-guided cryoablation for renal cell carcinoma and how to prevent them.

**TABLE OF CONTENTS/OUTLINE**

A. Basics of CT-guided cryoablation. Principles of cryoablation Imaging modalities for targeting lesions and monitoring the treatment areaB. Indications for CT-guided cryoablation for renal cell carcinoma. Tumor size, Location, Single or multiple, Initial or secondary, Hereditary disease, Elderly patient, Patient with comorbiditiesC. Practice of CT-guided cryoablation for renal cell carcinoma. Anesthesia, Puncture under CT fluoroscopy, Positioning of the cryoprobes and monitoring of the treatment area by CT reconstruction imagingD. To ensure more effective cryoablation for renal cell carcinoma. Transarterial lipiodol marking before cryoablationE. Possible complications and how to prevent them. Hemorrhage, Renal dysfunction, Infection/abscess, Bowel injury, Ureteral injury, Pneumothroax, Abdominal pseudohernia, Dissemination, Hydrodissection for surrounding organs, Ureteral stenting to prevent ureteral injuryF. Percutaneous biopsy for histological diagnosis. Biopsy separate from cryoablationG. Pitfalls. Ice-ball crack during cryoablation, Mimicking of a recurrent lesion

## IREE-63 APPLICATIONS OF TRANSARTERIAL EMBOLIZATION IN MUSCULOSKELETAL PAIN MANAGEMENT

Stuart E. Braverman, MD (*Abstract Co-Author*) Nothing to Disclose
Robert G. Dionisio, MD (*Abstract Co-Author*) Nothing to Disclose
Kori A. Higashiya, MD (*Abstract Co-Author*) Nothing to Disclose
Chase Glenn, MD (*Abstract Co-Author*) Nothing to Disclose
Catherine Ho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review the efficacy and safety of Transarterial Embolization (TAE) in managing chronic musculoskeletal pain.

**TABLE OF CONTENTS/OUTLINE**

Background: Chronic musculoskeletal pain affects up to 30% of people worldwide, often necessitating interventions beyond NSAIDs and lifestyle modifications. Transarterial embolization (TAE) is a viable option for those with persistent, refractory pain despite pharmacologic therapy or are ineligible/averse to surgery.Pathophysiology/Technique: Angiogenesis, neurogenesis, and resulting inflammation underlie many MSK pain syndromes, such as osteoarthritis (OA). TAE targets these processes by selectively embolizing major arterial supplies, mitigating inflammation and pain.Application and Results:OA and OA related bone marrow lesions (knee, hands, shoulder, facet, and SI joints)Non Osteoarthritic Synovitis (Adhesive Capsulitis and Hip Synovitis)Tendonopathy/EnthesopathyOther (Chronic Myalgia and Fibroids)Conclusion: Multiple studies demonstrate TAE as a safe and effective way to manage chronic musculoskeletal pain. Further studies are warranted to elucidate long term efficacy and broaden our understanding of chronic MSK pain pathogenesis.

## IREE-64 STOP THE BLEEDING: THERE'S MORE THAN ONE WAY TO DO IT

Ryo Toya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideki Ishimaru (*Abstract Co-Author*) Nothing to Disclose
Tomoki Nakano, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Effective control of bleeding is crucial to prevent severe anemia or exsanguination. In various situations, interventional radiologists frequently manage hemostasis. The methods used to achieve bleeding control have their own advantages and disadvantages. In some cases, organ ischemia is acceptable to achieve hemostasis. The skills and equipment of interventional radiologists performing hemostatic techniques can vary, and there is no standard method for achieving hemostasis. Nevertheless, any available technique can be used to control bleeding if performed correctly. This educational exhibit illustrates the different treatment options for various bleeding scenarios, emphasizing how hemostasis can be achieved based on the skill level of each interventional radiologist.

**TABLE OF CONTENTS/OUTLINE**

Ischemic susceptibility of bleeding organs- Knowledge of embolic material properties: temporary / permanent- Tips for successful use of each embolic material- Hemostatic methods other than embolization: manual compression / stentgraft / thrombin- Contraindications in each situation

## IREE-65 LIVER VENOUS DEPRIVATION TO INDUCE LIVER HYPERTROPHY BEFORE MAJOR HEPATECTOMY: MATERIALS AND TECHNIQUES

Cristina Mosconi, MD (*Abstract Co-Author*) Nothing to Disclose
Lorenzo Braccischi, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vittoria Bazzocchi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Liver venous deprivation (LVD) is a safe and effective technique with low complications and rapid growth rates before major liver hepatectomy. The learning object of this educational are: to analyze different radiological interventional strategies to induce liver hypertrophy prior to surgery and explain how to perform LVD, focusing on different approaches and embolic materials, to understand the importance of maintaining a sufficient future liver remnant (FLR) volume for optimal liver function before surgery and to explain the techniques to calculate FLR.

**TABLE OF CONTENTS/OUTLINE**

Careful patient selection to assess FLR before surgery is a key factor for clinical outcomes to avoid post-hepatectomy liver failure (PHLF) and mortality. CT segmentation and (99m)Tc-mebrofenin-hepatobiliary scintigraphy (HBS) are valid alternatives for evaluating remnant percentage in order to plan the need for LVD. For portal embolization, access is usually transhepatic; several embolic materials have been used, including N-Butyl-Cyanoacrylate, Ethanol, PVA microparticles, Gelfoam Sponge, Coils and Plugs. Additional embolization of the hepatic vein allows significant hypertrophy, emphasizing the potential efficacy and safety of the combined approach in hepatic interventions. Access can be percutaneous trans-hepatic, jugular or femoral, and cyanoacrylate, plugs or coils are usually employed. Other techniques include radioembolization lobectomy with Yttrium-90 or Olmium-166.

## IREE-66 THE ENHANCED MYOMETRIAL VASCULARITY - IS IT AN AVM? REVIEWING DEFINITIONS, IMAGING FINDINGS, AND INTERVENTIONAL TREATMENT

Gustavo V. Andrade, MD (*Abstract Co-Author*) Nothing to Disclose
Francisco Donato JR, MD (*Abstract Co-Author*) Nothing to Disclose
Otavio Augusto Ferreira Dalla Pria, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Heming, MD (*Abstract Co-Author*) Nothing to Disclose
Camila Gadens Zamboni, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Arteriovenous malformations (AVMs) are congenital abnormalities that can affect any organ or tissue in the human body, with myriad presentations in radiological studies. True uterine AVM is extremely rare, with very few cases reported worldwide. Some acquired pathologies can lead to dilated and tangled vessels, with low-resistance turbulent high-flow, mimicking an AVM. Recently described, Enhanced Myometrial Vascularity (EMV) has imaging findings very similar to uterine AVM but is acquired and usually occurs in the context of a recent pregnancy or abortion. Nevertheless, correct diagnosis is crucial for appropriate treatment. This exhibit aims: 1. To review the literature concerning this entity, depicting clinical presentation; 2. To describe imaging findings that help to diagnose them among their differentials, focusing on the importance of the Radiologist; 3. To demonstrate over 15 cases of EMVs treated by catheter embolization, discuss findings and techniques, and focus on the role of the Interventional Radiologist; 4. To highlight essential teaching points to become familiar with the diagnosis and embolization treatment of EMVs.

**TABLE OF CONTENTS/OUTLINE**

1. Brief review of AVM and EMV concepts and radiological importance; 2. EMV definition, diagnostic criteria, and differentials among different radiologic imaging modalities; 3. Illustration of EMV cases treated by embolization, focusing on diagnosis and Interventional approach; 4. Conclusion and take-home messages, 5. References

## IREE-67 UNLOCKING INSIGHTS: THE ROLE OF FISTULOGRAPHY IN PERIPANCREATIC COLLECTIONS

Javiera Cornejo, MD (*Abstract Co-Author*) Nothing to Disclose
Trinidad Castro (*Abstract Co-Author*) Nothing to Disclose
Marcelo Castro, MD, MD (*Abstract Co-Author*) Nothing to Disclose

Maximiliano Klinkert (*Abstract Co-Author*) Nothing to Disclose
Diana Saavedra Bissett (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Acute necrotizing pancreatitis (ANP) affects 15% of cases and raise mortality to 30%, often requiring intensive care, readmissions, and invasive treatments.The management of complex fluid collections in ANP has evolved, with many medical centers adopting a "Step-up approach". This strategy begins with percutaneous drainage and minimally invasive techniques, succeeding approximately 50-60% of the time. This step can serve as both a definitive treatment or a bridge to more invasive procedures.Fistulization is a feared complication, being necrosis and infection a risk factor. Pancreatic cutaneous fistulas initially involves conservative measures, as many may spontaneously close. However, communication with surrounding structures as gastrointestinal tract, can lead to malnutrion, bleeding, and infections.While fistulography via CT is valuable for detecting postoperative pancreatic fistulas after pancreaticoduodenectomy, its efficacy for fistulas related to ANP during the percutaneous drainage stage is not well established. Nevertheless, this procedure aids in diagnosing and monitoring fistulas, providing crucial anatomical insights.This presentation aims to diagram the technique and showcase cases where CT fistulography is performed during percutaneous drainage of peripancreatic collections, enhancing the efficacy and safe of it for future studies.

**TABLE OF CONTENTS/OUTLINE**

1. Teaching points 2. Overview of Acute Pancreatitis - Role of Imaging3. Updates on Pancreatitis Necrosis Management: Step-Up Approach4. The Significance of Fistulography in Pancreatitis5. Case Review6. Conclusion and Future Directions in Imaging and Management of Peripancreatic collections 7. References

## IREE-68 PRECISION WITHOUT INCISION: EXPLORING ABLATION TECHNIQUES IN UTERINE FIBROID TREATMENT

Patricia Rosseto Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio d. Meira, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Barbara d. Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Renata Nabeiro Dias Angelo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcello Giovanni Messias Da Silva, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1- Discuss the different minimally invasive techniques available for treating uterine fibroids.2- Evaluate the effectiveness and safety profiles of each technique.3- Review patient selection criteria and outcomes for fibroid ablation.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction1a: Overview of uterine fibroids and the burden of disease.1b: Introduction to minimally-invasive ablation techniques as treatment options.2) Ablation Techniques2a: Exploration of MRgFUS, RFA, and other emerging ablation technologies.2b: Mechanism of action and important procedural details for each technique.3) Effectiveness and Safety3a: Explore effectiveness and safety data across different ablation methods.3b: Brief discussion of common and rare complications associated with each technique.4) Patient Selection4a: Criteria for selecting suitable candidates for minimally-invasive procedures.4b: Considerations based on fibroid size, location, and patient symptoms.5) Clinical Outcomes5a: Long-term outcomes and quality of life improvements post-ablation.6) Future Directions6a: Recent advancements and ongoing research in fibroid ablation.6b: Possible recommendations for patient selection.6c: Potential future technologies and their expected impact on treatment paradigms.7) Conclusion7a: Summary of current knowledge on fibroid ablation as a safe and effective treatment option.

## IREE-69 CENTRAL VENOUS ENDOVASCULAR RECONSTRUCTION FOR SVC OBSTRUCTION

Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose
LeAnn S. Stokes, MD (*Abstract Co-Author*) Nothing to Disclose
Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
William R. Winter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:1. To review the clinical indications of central venous endovascular reconstruction of the superior vena cava and brachiocephalic vein2. To demonstrate proper techniques for central venous endovascular reconstruction in cases of benign SVC syndrome3. To review complications of central venous endovascular reconstruction

**TABLE OF CONTENTS/OUTLINE**

1. Indications for central venous reconstructiona. Patients with symptoms (facial swelling, orthopnea) from SVC/central venous occlusion due to:i. Chronic indwelling pacemakers, hemodialysis catheters, central venous cathetersii. Benign tumors - thyroid goiteriii. Fibrosing mediastinitisiv. Sarcoidosisb. Prior to placement of central venous catheters/dialysis catheters in patients with chronic central venous occlusionc. Malignant causes of SVC syndrome refractory to tumor treatmenti. Bronchogenic carcinoma, lymphoma, sarcoma, metastatic disease, among others2. Approach to central venous reconstructiona. Venous access site selection - typically internal jugular or subclavian, possibly with femoral accessb. Venographyc. Wire and/or sharp recanalizationd. Balloon venoplasty and stent placement3. Complicationsa. Immediate/Short term:i. Localized pain, puncture site hematomaii. Arrhythmiaiii. Hemoptysis, hematemesisiv. Pulmonary edemav. Pulmonary embolismvi. Cardiac tamponade due to iatrogenic SVC perforationb. Intermediate/Long term:i. Restenosisii. Stent occlusioniii. SVC syndrome recurrence

## IREE-7 FROM SUBJECTIVE TO OBJECTIVE: REDEFINING CATHETER EMBOLIZATION SUCCESS WITH BLOOD FLOW VELOCITY VALIDATION

Masaru Shiotani, RT (*Abstract Co-Author*) Nothing to Disclose
Keizo Murakawa (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Akiyuki Kotoku, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroki Horinouchi (*Abstract Co-Author*) Nothing to Disclose

Teruhito Hayashi (*Abstract Co-Author*) Nothing to Disclose
Kazuki Hara, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Though the emergence of novel endovascular therapeutic devices like the Amplatzer Vascular Plug (AVP) and the Woven EndoBridge (WEB) has expanded our options for embolization procedures, we still rely on subjective analysis of angiography to determine completion, based on our experience. However, sometimes vessel flow recanalization occurs during follow-up, highlighting the need for a more precise, quantitative approach to angiography. In response, we developed a quantitative analysis method called mqDSA. In this presentation, we aim to compare the pros and cons of various methods, including MRI, ultrasound, and quantitative DSA. Our perspective underscores the necessity of adopting quantitative methodologies like mqDSA, which offer a more objective and reliable assessment, ultimately enhancing treatment outcomes and patient care.

**TABLE OF CONTENTS/OUTLINE**

1. Angiography (DSA) for Flow Velocity EvaluationPros: In-room feasibility and instant assessment and new quantitative method (mqDSA)Cons: Ionizing radiation exposure and contrast medium requirement.2. MRI-Based Flow Velocity EvaluationPros: Spatial resolution and non-invasiveness.Cons: Inaccessibility during procedures and susceptibility to artifacts.3. Ultrasound for Flow Velocity EvaluationPros: Portability and real-time measurement.Cons: Operator skill dependency and limited acoustic windows.4.Comparative Analysis of Flow Velocity Measurement TechniquesUsing graphical representations, we compare flow velocity measurement techniques (MRI, ultrasound, and angiography), showing their relationship to actual flow, for accuracy assessment.5.Clinical ApplicationsCase Studies: Practical implementations of mqDSA.

## IREE-70 UNDER PRESSURE: THE TOOLS AND TECHNIQUES TO A SUCCESSFUL ANGIOGRAPHY

Shane N. Newberger, MD (*Abstract Co-Author*) Nothing to Disclose
Arif Musa, MD, MS (*Abstract Co-Author*) Research Grant, Stryker Corporation;Contract, WebMD Health Corp (WebMD, Inc)
Ali N. Harb, MD (*Abstract Co-Author*) Nothing to Disclose
Brigitte Berryhill, DO (*Abstract Co-Author*) Nothing to Disclose
Shriya Veluri (*Abstract Co-Author*) Nothing to Disclose
Carson Middlebrook (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This exhibit aims to educate on mesenteric angiography in emergency settings. The focus of this exhibit will be an overview of the conventional and suture techniques to form a reverse curve for access into the mesenteric aortic branches to capture an angiogram. It will also include a background on mesenteric angiography, common curve catheters and their respective characteristics guiding selection, and a review of the mesenteric vasculature with examples of extravasation.

**TABLE OF CONTENTS/OUTLINE**

Background/Indications:The purpose of mesenteric angiography in diagnosing and treating active gastrointestinal (GI) bleeds with indications for performing angiography in such cases.Catheter Selection:Review of catheter properties that help guide selection for angiography. The catheters discussed: Cobra, Headhunter, Angle Taper, Simmons, and Mikaelsson.Techniques:Discussion of two mesenteric angiography techniques - conventional angiography technique over the aortic arch and the suture angiography technique. This will include step-by-step images for each technique and their advantages and disadvantages.Anatomy Overview:Presentation of angiogram cases on the Celiac, SMA, and IMA arteries and their branches with labeled anatomy and examples of extravasation. Additionally, a demonstration of a helpful tip to confirm proper catheter positioning before contrast injection will be provided.Conclusion:Participants will gain the necessary skills to select appropriate catheters for angiography, effectively use various mesenteric angiography techniques to form a reverse curve for obtaining quality and timely results, and develop a comprehensive understanding of mesenteric vascular anatomy.

## IREE-71 INTERVENTIONAL TREATMENT OF SYMPTOMATIC CHRONIC EXTRA-HEPATIC PORTAL VEIN OBSTRUCTION (EHPVO) IN NON CIRRHOTIC PATIENTS: TIPS AND TRICKS

**Awards**
**Certificate of Merit**

Alban L. Denys, MD (*Abstract Co-Author*) Consultant, BTG International LtdGrant, BTG International LtdConsultant, Terumo Corporation
IGNACIO ANDRES CANO, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To review the indications of interventional management of EHPVO.- To know the different steps and tips and tricks to perform a successful portal vein recanalization (PVR).- To review the results and complications that can occur during and after PVR.

**TABLE OF CONTENTS/OUTLINE**

EHPVO is a challenging condition frequently associated with portal prehepatic hypertension that can lead to variceal bleeding, portal biliopathy and ascites. In recent years, PVR alone or associated to TIPS has emerged as a promising treatment option for non cirrhotic patients with chronic EHPVO.Interventional treatment should be reserved to symptomatic patients, therefore a careful evaluation including gastroscopy for variceal staging, liver blood tests and an anatomical evaluation of the hepatic, portal, mesenteric and splenic veins which is usually performed by contrast enhanced CT with or without abdominal ultrasound and Doppler evaluation.PVR without TIPS is the preferred option when intrahepatic branches are patent (Marot classification 1 or 2). The access route to the portal system depends on the anatomical situation but is preferably done through the anterior sector oh the portal veins. TIPS is added to PVR only if the intrahepatic branches have a poor quality and if the portosystemic pressure gradient remains high after PVR.Direct access via the mesenteric or splenic vein is a problem solving when the liver access is failed or is not possible. Catheters, techniques and tips to recanalize the occluded atrophic portal vein will be discussed.In conclusion, PVR is a valuable option for patients with chronic PVT. Operators should be familiar with the indications, pre-procedural planning, and techniques for performing a successful PVR.

## IREE-72 "ICE, ICE BABY": REVIEW OF BEST PRACTICES OF CRYOABLATION FROM HEAD TO TOE

Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Andrew J. Marsala II, MD (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
William R. Winter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Meaghan Dendy, MD (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose

Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan D. Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To detail different cryotherapy techniques dependent on anatomy of interest 2. To explore the indications, contraindications, and potential complications of cryotherapy 3. To analyze the efficacy of cryotherapy versus alternative treatments

**TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Mechanism of action i. Cellular destruction via rapid freezing and thawing [1. Mechanical 2. Osmotic 3. Ischemic] b. Indications for cryotherapy i. Non-surgical candidate for local control of primary tumor or metastasis ii. Salvage therapy for locally recurrent disease iii. Palliative therapy c. Contraindications for cryotherapy i. Relative [1. Underlying coagulopathy 2. Bowel, vasculature, or other structures at high risk for non-target injury] ii. Absolute [1. Extensive local tumor volume] d. Alternative treatment approaches i. Radiofrequency ablation ii. Microwave ablation iii. Chemical ablation iv. Open surgical resection 2. Procedure a. Equipment i. 14g/17g cryoprobes ii. Biopsy supplies iii. Hydro-dissection supplies, if needed [1. 21g Chiba needle 2. Saline vs. contrast]) b. Pre-procedure i. Consent ii. Foley catheter or pyleoperfusion iii. Pre-operative embolization (if needed) iv. Preliminary CT v. Site identification and preparation c. Potential Sites i. Kidney ii. Lung iii. Bone iv. Soft Tissues (Desmoid, Endometrioma) v. Lymph Nodes vi. Adrenal Gland vii. Nerves d. Technique (site dependent) i. Freeze-thaw cycles ii. The "stick" technique iii. Track ablation e. Post-procedure i. Recovery ii. Infection prevention f. Complications i. Post-procedure bleeding ii. "Cryoshock" cytokine release iii. Pain and swelling iv. Incomplete therapy

## IREE-73 AN EX-VIVO TRAINING MODEL FOR KIDNEY EMBOLIZATION UTILIZING DIFFERENT EMBOLIC MATERIALS

Jorge E. Lopera, MD (*Abstract Co-Author*) Shareholder, Tecnostent SA;Consultant, Merit Medical Systems, Inc;Research Grant, AngioDynamics, Inc
John A. Walker, MD, PhD (*Abstract Co-Author*) Speaker, Shionogi & Co, Ltd;Consultant, Shionogi & Co, Ltd
Carlos B. Ortiz, MD (*Abstract Co-Author*) Consultant, Argon Medical Devices, Inc
Marina Borrego, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Discuss the benefits of simulation-based training. Discuss current training models available for kidney embolization. Describe a new teaching model for learning kidney embolization using different embolic materials.

**TABLE OF CONTENTS/OUTLINE**

Introduction. Discuss current embolization training models. Review a kidney embolization clinical case to compare training model similarities. Set-up for a newly developed ex vivo porcine kidney model. Review different embolic materials that can be used to teach kidney embolization utilizing the training model (Gelfoam, Glue, Microspheres , Obsidio, Coils). Conclusion: Incorporating simulation into medical training can provide an opportunity for additional hands-on training, without patient risk. This training model exposes operators to the techniques for kidney embolization using a variety of embolic materials.

## IREE-74 INTERVENTIONAL MANAGEMENT OF PULMONARY ARTERIOVENOUS MALFORMATIONS : TRICKS OF THE TRADE

**Awards**
**Magna Cum Laude**

Eric Therasse, MD (*Abstract Co-Author*) Research Consultant, SoundBite Medical Solutions
Pierre Perreault, MD (*Abstract Co-Author*) Consultant, Abbott Laboratories
Marie-France Giroux, MD (*Abstract Co-Author*) Stockholder, Abbott Laboratories
Louis Bouchard, MD (*Abstract Co-Author*) Nothing to Disclose
Gilles P. Soulez, MD, MSc (*Abstract Co-Author*) Speaker, Siemens AG;Research Grant, Siemens AG;Research Grant, Cook Group Incorporated;Advisory Board, Cook Group Incorporated;Patent agreement, Cook Group Incorporated;Research Grant, ViTAA Medical Solutions Inc;Advisory Board, ViTAA Medical Solutions Inc
Ricardo H. Do Amaral (*Abstract Co-Author*) Nothing to Disclose
Marin Halut, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Learn imaging findings of pulmonary arteriovenous malformations (PAVM) and present the PAVM classification based on angioarchitecture.Highlight the physiopathology of PAVM, the association with hereditary hemorrhagic telangiectasia and the need for screening.Recognize the indication for PAVM embolization.Learn how to embolize PAVM safely and prevent paradoxical embolization.Understand how to prevent and treat PAVM persistence after embolization.Assess the results of PAVM embolization on follow-up imaging and detect reperfusion.

**TABLE OF CONTENTS/OUTLINE**

PAVMs angioarchitecture and classification.PAVM and hereditary hemorrhagic telangiectasia.PAVM pathophysiology and associated complications.Clinical and imaging evaluation before PAVM treatment.Presentation of the relative role of the different imaging modalities chest X-Ray, echocardiography, chest CT, chest Angio-CT and DSA.Indications for PAVMs treatment.PAVM management in pregnant women.Embolization techniques:Presentation of the different embolization material and their use according to the PAVM angioarchitecture (simple PAVM, complex PAVM, and diffuse PAVM).Presentation of the material and techniques to prevent complication.Identification of the different types of PAVM persistence and how to treat them.The safe use of mechanical agent regarding the risk of paradoxical migration.Navigation techniques to access PAVMs safely and to prevent hemoptysis.Clinical and imaging follow-up protocol and criteria to assess outcome.

## IREE-75 CREATION OF A MULTIDISCIPLINARY CARE APPROACH FOR TREATMENT OF METASTATIC SPINAL TUMORS: A SINGLE-CENTER INSTITUTIONAL EXPERIENCE

Nima Kokabi, MD (*Abstract Co-Author*) Research support, Sirtex Medical Ltd;Consultant, Sirtex Medical Ltd;;
Nicole A. Keefe, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Gad, BSc, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Creation of a multidisciplinary care framework for patients with spinal tumor.Understanding how Interventional radiology fits into a multidisciplinary care framework for patients with spinal tumors.

**TABLE OF CONTENTS/OUTLINE**

Sixteen percent of all patients with metastatic cancer develop metastasis to the spine in their lifetime,which is often painful.Additionally, 1 out of 8 patients with spinal metastases develop pathologic vertebral compression fractures.While there are several effective therapies for metastatic bony spinal tumors, optimal care requires a multidisciplinary approach for individualized patient care. Interventional radiology plays an increasingly critical role in the management of patients with metastatic bony spinal tumors. At our institution, we have established a spine oncology Center of Excellence further supported with a Spine Oncology Tumor Program. A fellowship-trained spine oncology neurosurgeon leads the program and includes neurooncology, interventional radiology, radiation oncology, neuroradiology, pain anesthesia and medical oncology. The specialists meet twice monthly to discuss optimal treatment strategies. Management options may include biopsy, surgical resection, radiation treatment,chemotherapeutic agents, and interventional procedures such as include vertebral augmentation plus radiofrequency ablation (RFA). Spinal Tumor boards are not widely implemented across the country, and there are no set standards regarding which specialists are invited to be part of the spinal tumor board. This broad group of spine oncology specialists has proven to provide well-rounded streamlined care which fosters collaboration and interdisciplinary education.

## IREE-76 BENIGN THYROID NODULES: A COMPREHENSIVE ANALYSIS OF THERMAL ABLATION AS AN EFFECTIVE TREATMENT ALTERNATIVE

Rodrigo G. Garcia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Erivelto M. Volpi (*Abstract Co-Author*) Nothing to Disclose
Victor Arthur Ohannesian (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Antonio Rahal Junior (*Abstract Co-Author*) Nothing to Disclose
Luiz Nascimento (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Benign Thyroid Nodules and Symptoms: Benign thyroid nodules are common and can cause symptoms like dysphagia and dysphonia due to their size and location.- Autonomous Nodules: Some thyroid nodules exhibit autonomous behavior, producing excess thyroid hormone and resulting in hyperthyroidism.- Traditional Treatments vs Thermal Ablation (TA): Historically, thyroid nodules were managed with surgery or radioiodine therapy, often leading to gland removal and subsequent need for thyroid hormone replacement. TA techniques like radiofrequency ablation (RFA) or microwave ablation (MW) are emerging as minimally invasive alternatives that preserve gland function.- Advantages of Thermal Ablation (TA): TA offers benefits such as no visible scars, local anesthesia, sedation during the procedure, and quick recovery time, while maintaining hormonal function.- Efficacy of Thermal Ablation (TA): TA typically achieves a significant reduction in nodule volume, with a 50% volume reduction within 3 to 6 months and up to 90-95% reduction within 12 months. For autonomous nodules causing hyperthyroidism, thyroid-stimulating hormone (TSH) levels normalize within 60 days post-ablation.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction: Prevalence of Benign Thyroid Nodules Symptoms and Complications, Treatment Options: Surgery, Radioiodine Therapy, Thermal Ablation (TA).II. Methods: Use of Departmental Images, Extensive Bibliographic Review.III. Discussion: Presentation of Symptomatic Benign Thyroid Nodules and Traditional Treatment Approaches.IV. Conclusion: Recognition of TA as First-Line Treatment for Symptomatic Benign Thyroid Nodules.V. Limitations and Eligibility Factors for Thermal Ablation (TA).

## IREE-77 RENAL ABLATION COMPLICATIONS: WHAT TO EXPECT AND HOW TO HANDLE

Marcos R. Menezes, MD (*Abstract Co-Author*) Nothing to Disclose
Regis Otaviano Bezerra, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Guilherme L. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor Nascimento, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Amr Kalander, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Vivas Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Joao S. Pais, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A brief review of renal ablation techniques, indications and normal imaging evolution;To understand the incidence of the main complications, when to expect each type and how to handle each one.

**TABLE OF CONTENTS/OUTLINE**

Renal ablation has become a pivotal intervention in the management of renal masses, due to an escalating incidence of incidentally detected lesions, which account for approximately 67% of cases.Renal ablation offers numerous advantages, including reduced morbidity, enhanced parenchymal preservation and shorter hospital stays. The main therapeutic armamentarium encompass thermal ablation techniques such as Radiofrequency Ablation (RFA), Microwave Ablation (MWA), and Cryoablation (CRYO), without significant disparities in complication rates between them.Treatment assessment post-ablation involves meticulous evaluation of the ablation zone, characterized by a hypoattenuating area without enhancements, with a recommended margin of 5-10 mm to ensure complete lesion eradication. Complications, with an incidence of up to 12.9%, such as hemorrhage, hematuria, collecting system injury and pneumothorax, predominantly manifest as Clavien-Dindo grade I events.In conclusion, renal ablation is a cornerstone in renal oncology, representing a valuable therapeutic options, offering favorable outcomes with minimal morbidity. Understanding the nuances of treatment assessment, complication prediction, and management is imperative for optimizing patient care.

## IREE-78 CHOLANGIOSCOPY - WHEN IS IT TIME TO SCOPE THE BILIARY TREE?

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Kenechukwu Okoye, MEng, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Cholangioscopy allows for direct visualization of the biliary tree via the use of an endoscope during ERCP 2. Cholangioscopy is a safe and effective approach for the treatment and diagnosis of pancreaticobiliary disease, as well as for surgical planning in cases of cholangiosarcoma. 3. While regarded as safe, there are known risks. In addition to standard practices, there are strategies and technique that can be considered to minimize risk and maximize chances of success depending on the intervention. Alternative methods to cholangioscopy may be considered for each aforementioned indication, based on clinical factors.

**TABLE OF CONTENTS/OUTLINE**

1. Background: The varying indications for cholangioscopy - why perform one? When is it time to reach for one? a. Diagnosis of biliary pathology - typically following equivocal ERCP i. Radiolucent or otherwise unseen stones on cholangiography ii. Advanced biliary disease ie PSC making other

diagnostic procedures difficult iii. Concern for malignancy iv. Comparison to other diagnostic approaches, methods, indications, risk/benefit profile v. Decision algorithm(s) for diagnostic cholangioscopy b. Treatment of gallstones (eg electrohydraulic, laser lithotripsy) c. Deployment of stents d. Collecting biopsy e. Preoperative planning 2. Technical steps including patient preparation, details, equipment, 3. Case(s) review from The Ohio State University Wexner Medical CenterPatient safety, contraindications, pearls and pitfalls.

## IREE-8 DEVELOPING ARTERIAL EMBOLIZATION IN LOW-INCOME COUNTRIES: THE FAIREMBO PROJECT

**Awards**
**Certificate of Merit**

Julien Panneau (*Abstract Co-Author*) Nothing to Disclose
Pauline Brige (*Abstract Co-Author*) Nothing to Disclose
Vincent Vidal Sr, MD (*Abstract Co-Author*) Nothing to Disclose
MATHIEU DI BISCEGLIE (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Describe the main limitations to the development of interventional radiology in low-income countries. - Propose an embolization agent that is available, effective, and safe.- Promote the formation of interventional radiology teams.

### TABLE OF CONTENTS/OUTLINE

1. Main limitations to the development of interventional radiology in low-income countries.• Significant morbidity and mortality due to the lack of development of IR techniques in low-income countries• A lack of material resources in particular on embolic agents• A lack of interventional radiologists resources2. Suture as an available, effective and safe embolic agent• Suture fragment as torpedo for proximal embolization in a preclinical model• Suture-based microparticles for distal embolization in a preclinical model• Absorbable suture for transient embolization in postpartum preclinical model• Reported clinical cases of suture use as an embolic agent : renal pseudoaneurysm embolization and postpartum hemorrhage embolization3. Formation of interventional Radiology teams• On-site missions (Senegal, Ivory Coast, Cameroon) to train local radiologists and X-ray technicians: hands-on and clinical cases• Autonomous implementation and execution of IR procedures

## IREE-9 RADIOFREQUENCY ABLATION (RFA) AND ETHANOL ABLATION FOR BENIGN THYROID NODULES

Matthew Abad-Santos (*Abstract Co-Author*) Nothing to Disclose
Harneet Sangha (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiofrequency ablation (RFA) and ethanol ablation are two minimally invasive procedures that target benign nodules of the thyroid. Treatment is aimed at ablating abnormal cells via heat created by high frequency electric current in (RFA) and Alcohol injections result in dehydration and destruction of benign mass. The purpose of this exhibit is to provide a brief history and role of Thyroid Ablation (RFA) / alcohol injections for treatment of benign nodules by reviewing existing literature, while also using cases to emphasize the importance of (RFA) and alcohol ablation. Additionally, expressing the indications, contradictions and outcomes of (RFA) and alcohol ablation. Finally reviewing the preoperative and postoperative guidelines for patients undergoing (RFA).

### TABLE OF CONTENTS/OUTLINE

1. History of (RFA) and ethanol ablation and mechanism 2. Assessment of cases, including key management strategies and indications for ablation procedures and alcohol injections. 3. pre-procedural imaging and investigations, procedural techniques, outcomes, post-procedural follow-up, and complications. 4. Preoperative and postoperative guidelines as well as description of procedure. 5. Case based discussion and contraindications.

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# Abstract Archives of the RSNA, 2024

IREE-1

## VASCULAR AND LYMPHATIC COMPLICATIONS AFTER RENAL TRANSPLANT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan D. Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Baron, MD (*Abstract Co-Author*) Nothing to Disclose
William R. Winter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Shelby K. Frantz, MD (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:- To review anatomy of transplanted kidneys- To identify common vascular and lymphatic complications post renal transplant- To discuss minimally invasive treatment options to manage vascular and lymphatic complications after renal transplant

### TABLE OF CONTENTS/OUTLINE

1. Anatomy of Transplanted Kidneysa) Location (RLQ v LLQ)b) Arterial and Venous Anastomosisc) Other normal structures in the region2. Common Vascular Complications a) Renal Artery Stenosis/Thrombosis b) Renal Vein Thrombosisc) Renal vascular complications related to native vascular anatomyi. Aortaii. Common/External Iliac Arteryiii. Inferior Vena Cavaiv. Common/External Iliac Vein3. Vascular Complications After Transplant Biopsy a) Bleedingb) AVFc) Pseudoaneurysm4. Endovascular Management of Vascular Complicationsa) Angiography/Venographyi. Contrastii. CO2b) Invasive Pressure Measurementsc) Stent Placementd) Thrombectomy/Thrombolysise) Embolizationi. Coilsii. Liquid Embolicf) Surgical Alternatives5. Lymphatic Complicationsa) Lymphatic Leakb) Lymphocele Formation6. Treatment of Lymphatic Complicationsa) Lymphangiogram and Embolization

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# Abstract Archives of the RSNA, 2024

IREE-10

## ENDOVASCULAR MANAGEMENT OF AORTOENTERIC FISTULA: NAVIGATING CHALLENGES AND ADVANCEMENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Beatriz Garcia Martinez (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Sanz Bellon (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To provide an overview of the evolving role of endovascular interventions in the management of Aortoenteric Fistula, highlighting the advantages, challenges, and emerging trends in this minimally invasive approach through our experience and literature review.

### TABLE OF CONTENTS/OUTLINE

Classification of Aortoenteric Fistula.Primary aortoenteric fistulaClinical manifestation/Diagnosis Secondary aortoenteric fistula.True secondary aortoenteric fistula/Secondary paraprosthetic fistula./Clinical manifestation( DiagnosisTreatment.Surgical optionsPrimary fistulae/ Secondary fistulae Endovascular treatment optionsStent graft deployment/Embolization techniquesAdvantages and Challenges of Endovascular Treatment. AdvantagesAlternative treatment for high surgical risk patients./Rapid bleeding control in unstable patients./Advantages associated with an earlier patient recovery./Mitigation of Surgical Intervention in a Challenging Abdominal Environment.Challenges Sepsis./Recurrent bleeding./ Patient selection./Is it a definitive treatment or a bridge to surgery?/Is it a feasible treatment for recurrent fistula?Our experience.Case 1: Recurrent Fistula treated with endoprosthesis placement and latter embolization./Case 2: Recurrent Fistula treated with embolization of the fistula's path and embolization of the aneurysmal sac./Case 3: Aorto-Esophageal Fistula (AEF) selected for embolization treatment who died during the procedure./Case 4: First episode of True Secondary AEF. Treated with endoprosthesis placement in a patient with melena, hypotension, and anemia./Case 5: Recurrent fistula treated with endoprosthesis and proximal cuff. Conclusion

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# Abstract Archives of the RSNA, 2024

IREE-11

## STREAMLINED RESIN Y90 RADIATION SEGMENTECTOMY FOR SMALL HEPATOCELLULAR CARCINOMA (HCC): ONE & DONE TRIAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nima Kokabi, MD (*Abstract Co-Author*) Research support, Sirtex Medical Ltd;Consultant, Sirtex Medical Ltd;;
Michael Mohnasky (*Abstract Co-Author*) Nothing to Disclose
Haneyeh Shahbazian, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Gad, BSc, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1-In patients with small (<5cm) hepatocellular carcinoma (HCC) and no radiographically aggressive feature, undergoing radiation segmentectomy with Y90, hepatopulmonary shunt evaluation can be safely eliminated without any additional adverse events.2-In such patients it is safe to eliminate Tc99-MAA hepatopulmonary scan and LSF calculation from treatment planning and condense the Y90 planning and treatment into 1 day as opposed to traditional 2-day period.

### TABLE OF CONTENTS/OUTLINE

HCC is the 4th leading cause of cancer death worldwide. Conventionally, Y90 Transarterial Radioembolization (TARE) happens over 2 sessions. Mapping angiography and lung shunt calculation is the first session. The patient is then discharged home and returned approximately 2-3 weeks after for Y90 radioembolization. However, an increasing number of studies have shown that for small HCCs (<5 cm), and in the absence of macrovascular invasion and portosystemic shunt (TIPS), LSF is <10%.1,2Hence, based on typically administered activities and LSF, the projected dose to the lungs is significantly below the 30 Gy level, which is widely accepted as the dose to cause radiation-induced pneumonitis.3 Therefore, the LSF calculation can be safely omitted, which could, in turn, result in significant streamlining of Y90 TARE in patients with small HCC. This is particularly important to consider in patients who live in non-urban communities and commute long distances to undergo liver-directed therapy. The proposed exhibits highlight the safety and efficacy of streamlining the Y90 TARE procedure for patients with small HCC to a 1-day procedure.

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# Abstract Archives of the RSNA, 2024

IREE-12

## GASTROINTESTINAL VARICEAL BLEEDS: INTERVENTIONAL CONSIDERATIONS IN ACCESS AND TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kapil Wattamwar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recognize the portal-mesenteric venous system as a potential source of gastrointestinal bleeding. Illustrate case examples of varices in various locations along the gastrointestinal tract with multi-modality imaging. Highlight typical inflow and outflow vessels associated with varices in different locations. Discuss interventional approaches to access variceal bleeds based on their location as well as strategies for decompression and embolization. Review potential embolic agents for variceal bleeds and examine specific use cases based on anatomical and flow-related considerations.

### TABLE OF CONTENTS/OUTLINE

It is important to recognize that upper and lower gastrointestinal bleeds can arise from a portal-mesenteric venous source. 1. This exhibit will illustrate cases of variceal bleeds at several points along the gastrointestinal tract from the esophagus to the anus and highlight typical inflow and outflow vessels associated with each location. 2. Interventional techniques to treat such bleeds may involve various methods of decompression and/or embolization. 3. Approaches to access the portal-mesenteric venous system for intervention include through a TIPS, transvenous through a systemic outflow vein, transsplenic, transhepatic, transcaval and direct percutaneous puncture. 4. Factors such as the direction of flow, portosystemic pressure gradient and the impact of balloon occlusion on flow should be considered prior to embolization. 5. The choice of embolic should be tailored to the patient’s anatomy and flow dynamics. Embolic agents include coils, plugs, and liquid embolics such as n-Butyl cyanoacrylate, ethylene vinyl alcohol copolymer, and sodium tetradecyl sulfate sclerosant.

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# Abstract Archives of the RSNA, 2024

IREE-13

## IVC INTERVENTIONS: SEEING ALL THE INTERVENTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Carlos B. Ortiz, MD (*Abstract Co-Author*) Consultant, Argon Medical Devices, Inc
Arthur S. Joseph, DO (*Abstract Co-Author*) Nothing to Disclose
Andrew V. Chesley, MD (*Abstract Co-Author*) Nothing to Disclose
James J. Oh, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Inferior vena cava (IVC) angioplasty, thrombolysis, mechanical thrombectomy, and stenting are important treatment options to recanalize an occluded or thrombosed IVC. Preprocedural evaluation and follow up are essential for postprocedural management of patient undergoing IVC recanalization. Long term indwelling IVC filters pose a risk of caval thrombosis and removal should be considered when clinically appropriate. Transcaval interventions provide alternate access for difficult to reach anatomic areas.

### TABLE OF CONTENTS/OUTLINE

Introduction Pathogenesis of IVC occlusions in the setting of benign and malignant causes Imaging of IVC occlusion on US, CT, and diagnostic venogram, including review of collateral venous pathway formation Review of variant anatomy pertinent to IVC interventions. Current recanalization techniques employed in the treatment of IVC occlusions Use of transcaval access to perform lymph node biopsy and endoleak embolization Immediate complications and subsequent complications after IVC endovascular intervention Conclusion IVC and transcaval endovascular interventions are important therapies for a variety of pathologies. Knowledge of these advanced techniques is important for the interventionalist.

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# Abstract Archives of the RSNA, 2024

IREE-14

## A PRIMER ON APPROACHES FOR TRANSVENOUS BIOPSY OF INFERIOR VENA CAVA MASSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Victoria Kim, MD (*Abstract Co-Author*) Nothing to Disclose
David R. Berezovsky, DO (*Abstract Co-Author*) Nothing to Disclose
Ilya Livshits (*Abstract Co-Author*) Nothing to Disclose
Francis Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Camden MacDowell, MD,PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Inferior vena cava (IVC) masses often require a biopsy for a definitive diagnosis of the underlying pathology. IVC masses are often biopsied using a percutaneous approach. However, percutaneous biopsy is not always feasible, for example, when there is no safe biopsy trajectory due to surrounding structures or the patient's anatomy. In such situations, an endovascular approach is necessary. The purpose of this educational exhibit is to review endovascular biopsy approaches for IVC masses and address the following teaching points: 1. Review central venous anatomy and highlight CT/MRI/Fluoroscopy features of IVC masses. 2. Illustrate example indications for transvenous biopsy of IVC masses. 3. Detail transvenous biopsy of IVC masses using biopsy forceps under fluoroscopy. 4. Detail transvenous biopsy of IVC masses using a transjugular liver biopsy set under combined fluoroscopy and cone-beam CT guidance. 5. Detail alternative transvenous biopsy of IVC masses such as suction biopsy. 6. Discuss risks of transvenous biopsies, including bleeding and hematologic seeding.

### TABLE OF CONTENTS/OUTLINE

1. Central venous anatomy. 2. CT/MRI/Fluoroscopy findings of example IVC masses (e.g., leiomyosarcoma, Wilms tumor, adrenal cortical carcinomas). 3. Indication for transvenous biopsy of IVC masses. 4. Example case of transvenous biopsy with forceps. 5. Example case of transvenous biopsy with a modified transjugular liver biopsy set. 6. Alternative biopsy approach using transvenous suction biopsy. 7. Safety profile of transvenous biopsies and comparison with percutaneous approaches.

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# Abstract Archives of the RSNA, 2024

IREE-15

## ROLE OF INTERVENTIONAL RADIOLOGY IN ACUTE MESO-PORTAL VENOUS THROMBOSIS (MPVT): A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manoj K. Kathuria, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Rakesh K. Varma, MD, MBBS (*Abstract Co-Author*) Speaker, Becton, Dickinson and Company
Seung Kwon Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Anil K. Pillai, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Jayesh Soni, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmad Arar (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Recognize key imaging characteristics associated with acute MPVT on cross-sectional imaging to facilitate early diagnosis2) Understand the clinical indications necessitating acute MPVT interventions and the goals of treatment3) Familiarize with treatment algorithms and the tips and tricks used to manage acute MPVT

### TABLE OF CONTENTS/OUTLINE

1) Introduction and Clinical Impact2) Imaging findings of acute MPVT- Vascular: Absent flow on US and Doppler, filling defect, hyperdense clot, lack of portoportal collaterals- Non-Vascular: Hepatic necrosis, ascites, bowel wall thickening, lack of mural enhancement3) Indications for Endovascular Interventions:- Persistence of symptoms beyond 48-72 hours after anticoagulation initiation- Worsening symptoms- Extension of thrombus while on anticoagulation- Peritoneal signs on physical exam4) Comprehensive guide to endovascular techniques and algorithms for managing acute MPVT:- Systematic approach for treatment based on the location of the thrombus- Tips and tricksConclusion: Acute PV and SMV thrombosis pose risks of acute mesenteric ischemia or chronic portal hypertension. Endovascular interventions may be necessary for progression on anticoagulation or impending bowel infarction. Catheter Directed Thrombolysis is feasible but carries higher bleeding risks compared to anticoagulation alone. TIPS creation depends on post-intervention flow and PSG >10-12mmHg

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# Abstract Archives of the RSNA, 2024

IREE-16

## MULTIMODALITY IMAGING OF EMERGENT BILIARY DISORDERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Naciye Turan, MD (*Abstract Co-Author*) Nothing to Disclose
Joanna Kee-Sampson, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Menendez, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos I. Gonzalez Baerga, MD (*Abstract Co-Author*) Nothing to Disclose
Mayur K. Virarkar, MD (*Abstract Co-Author*) Nothing to Disclose
Sean Wehry (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Biliary emergencies present as a spectrum of pathologies, each with unique radiologic characteristics across various imaging modalities. Accurate imaging interpretation is critical for diagnosing these potentially life-threatening pathologies, underscoring the importance of radiologists' proficiency in identifying relevant imaging findings. It is also vital for radiologists to be familiar with image-guided interventions that can manage these emergencies. 1. Describe common pathologies that lead to emergent situations in various parts of the biliary system and discuss their clinical presentations and etiologies. 2. Recognize the imaging features across different imaging modalities for each emergent biliary condition. 3. Discuss image guided interventions that help bridge patients with various biliary emergencies to definitive treatment, or treat these pathologies.

### TABLE OF CONTENTS/OUTLINE

- Review of multimodality imaging findings: o Inflammatory: § Gallbladder: • Acute Cholecystitis o Calculous and acalculous • Gangrenous Cholecystitis • Hemorrhagic Cholecystitis § Bile Ducts: • Ascending cholangitis § Pancreas: • Acute Pancreatitis o Non-Inflammatory § Obstructive Jaundice • Choledocholithiasis • Mirizzi Syndrome • Malignancy § Bile Leak • Traumatic • Iatrogenic - Review of image guided interventions o Biliary diversion § Cholecystostomy § Percutaneous transhepatic biliary drainage o Biliary stents o Percutaneous management of cholelithiasis or choledocholithiasis

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# Abstract Archives of the RSNA, 2024

IREE-17

## NON-TRANSPLANT PEDIATRIC HEPATOBILIARY INTERVENTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Darshan Variyam, MD (*Abstract Co-Author*) Nothing to Disclose
Bartley Thornburg, MD (*Abstract Co-Author*) Nothing to Disclose
Shankar Rajeswaran, MD (*Abstract Co-Author*) Nothing to Disclose
Ahsun Riaz, MD (*Abstract Co-Author*) Consultant, Boston Scientific Corporation
Joe B. Baker, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Husnain, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Describe congenital/acquired disease processes in the pediatric liver related to the portal, parenchymal, biliary, and lymphatic systems. 2. Diagnosis of these disease processes using various imaging modalities. 3. Highlight the techniques employed by interventional radiologists to treat these various conditions.

### TABLE OF CONTENTS/OUTLINE

Portal Vein 1. Abernethy malformation a) Embryology b) Classification (anatomical variants) c) Clinical Presentation d) Diagnostic Imaging e) Treatment Options • Surgery (single session/staged closure) • Endovascular closure (single session/staged) • Combined surgical and endovascular closures2. Extrahepatic portal vein obstruction (EHPVO) a) Causes b) Clinical Presentation c) Diagnostic Imaging d) Treatment • Surgical Meso-Rex Shunt Creation • Endovascular options to treat malfunctioning shuntsParenchymal 1. Biopsies/Pressure Measurements a) Transjugular b) Percutaneous 2. Liver Tumors: Benign and Malignant a) Biopsies b) Hemangioma embolization c) RadioembolizationBiliary System1. Biliary Atresia a) Diagnostic Imaging b) Post-Kasai surveillance 2. Biliary Stricture a) Etiology b) Management • Percutaneous transhepatic cholangioplasty/stenting • Role of endoscopy 3. Biliary leak/biloma a) Etiology b) Management • Percutaneous drainage • Embolization of leaking duct 4. Stones/casts/debris a) Percutaneous endoscopic removal 5. Complications of biliary drainsLymphatic System 1. Protein-losing enteropathy (PLE) a) Pathophysiology of PLE in congenital heart disease patients b) Diagnostic Imaging c) Management • Percutaneous transhepatic lymphatic embolizationPeroral duodenal mucosal radiofrequency ablation

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# Abstract Archives of the RSNA, 2024

IREE-19

## A PRIMER ON RADIOGRAPHIC FEATURES AND MANAGEMENT OF ABERNETHY MALFORMATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Natalie Y. Ring, MD (*Abstract Co-Author*) Nothing to Disclose
Muhammad H. Malik, MD (*Abstract Co-Author*) Nothing to Disclose
Camden MacDowell, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Harjit Singh (*Abstract Co-Author*) Nothing to Disclose
Seulah Choi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Abernethy malformation is a congenital extrahepatic portosystemic shunt associated with numerous sequalae including hepatic encephalopathy, hepatic malignances, and hepatopulmonary syndrome. Early diagnosis via imaging is critical for subsequent management of the malformation and sequalae. The purpose of this educational exhibit is to review the anatomy and imaging features of Abernethy malformations and to address the following teaching points: 1. Review central venous anatomy and collateral circulation. 2. Review the anatomy of Abernethy Malformation and the known anatomic variants. • Type Ia, Ib, and II 3. Detail the clinical presentation and management strategies of four example Abernethy cases. 4. Discuss the role of Diagnostic and Interventional Radiology in diagnosis and management of patients with Abernethy malformations.

### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS/OUTLINE: I. Introduction and Anatomy of Abernethy Malformation A. Defining Abernethy Malformation and Its Prevalence B. The Anatomy of Type I and Type II Abernethy Malformations C. Understanding Physiology of Abernethy Malformation Variations and Associated Collateral Venous Drainage D. Investigating Implications of a Novel Abernethy Malformation Variant II. Case Studies (Examination of Type Ia case, Two Different Type II Cases, and Variant Type II Case) A. Clinical Presentation including Symptoms and Signs Associated with Abernethy Malformation B. Reviewing Surgical and Non-Surgical Approaches and Considerations Exploring Role of Interventional Radiology in both diagnosis and management

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# Abstract Archives of the RSNA, 2024

IREE-2

## SUPER-SELECTIVE SEGMENTAL ADRENAL VENOUS SAMPLING FOR PRIMARY ALDOSTERONISM: POSSIBILITIES AND LIMITATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Sota Oguro (*Abstract Co-Author*) Nothing to Disclose
Hiromitsu Tannai, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Adrenal venous sampling (AVS) is a diagnostic procedure for subtyping primary aldosteronism, which is a cause of secondary hypertension. Typically, blood is collected only from the main trunk of the adrenal vein. Segmental AVS, however, involves sampling blood from upstream tributaries using a microcatheter and can address certain diagnostic challenges. This presentation aims to: 1) Review the anatomy of the adrenal and surrounding venous structures, and identify diagnostic challenges associated with conventional AVS; 2) Describe the method of segmental AVS and provide examples where it is diagnostically beneficial; 3) Discuss techniques to manage challenging situations where achieving an accurate diagnosis remains difficult, even with segmental AVS.

### TABLE OF CONTENTS/OUTLINE

1. Adrenal and surrounding venous anatomy, conventional AVS; 2. Adrenal tributaries and the practice of segmental AVS; 3. Cases where segmental AVS is diagnostically useful: High aldosterone levels detectable only in adrenal tributaries from adrenal adenomas, Dilution effects due to extrarenal veins joining the adrenal vein, Co-existing cortisol-producing tumors, Bilateral aldosterone-producing adenomas, Ipsilateral multiple adrenal nodules; 4. Sampling from venous routes other than the adrenal veins and considerations for CT during adrenal arteriovenography.

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# Abstract Archives of the RSNA, 2024

IREE-20

## POST HISTOTRIPSY IMAGING FINDINGS: WHAT TO EXPECT AS IT BEGINS CLINICAL ADOPTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joan Vidal-Jove, MD,PhD (*Abstract Co-Author*) Research Consultant, HistoSonics, Inc
Timothy J. Ziemlewicz, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Research support, Johnson & Johnson;Consultant, HistoSonics, Inc;Shareholde, HistoSonics, Inc;
Mishal Mendiratta-Lala, MD (*Abstract Co-Author*) Nothing to Disclose
Xavier Serres (*Abstract Co-Author*) Nothing to Disclose
Fred T. Lee JR, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Patent agreement, Medtronic plc;Royalties, Medtronic plc;Board of Directors, HistoSonics, Inc;Stockholder, HistoSonics, Inc;Stockholder, Elucent Medical
Meghan G. Lubner, MD (*Abstract Co-Author*) Spouse, Consultant, Elephas Bio
Paul F. Laeseke, MD, PhD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, NeuWave Medical, Inc;Shareholder, HistoSonics, Inc;Consultant, HistoSonics, Inc;Research Grant, HistoSonics, Inc;Shareholder, Elucent Medical;Consultant, Elucent Medical;Shareholder, McGinley Orthopaedic Innovations, LLC
Allison B. Couillard, MD (*Abstract Co-Author*) Nothing to Disclose
Edwarda Golden, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Histotripsy is an emerging focal therapy for liver tumors that has a non-invasive, mechanical mechanism of action leading to unique imaging features.2. Histotripsy spares collagenous structures, which can lead to patent vessels and bile ducts within the treatment zone. These structures should not be confused for residual or recurrent tumor.3. Histotripsy treatments can be associated with a transient perfusion defect peripheral to the treatment site that undergoes reperfusion and can be confused for a larger than intended treatment.4. Histotripsy treatment zones involute rapidly compared with existing locoregional treatments, potentially allowing early identification of residual or recurrent tumor.

### TABLE OF CONTENTS/OUTLINE

Introduction to Histotripsy:• Mechanism of action• Clinical workflow• Trials performed to date from which these imaging findings are available. Expected Imaging Findings:• Recommended Imaging follow-up timeframe• Normal appearance of treatment zone post-histotripsy at various follow-up timepoints out to 2 years• Common variants of normal findings to not mistake as complication or incomplete treatment, including perfusion defects and patent vessels and bile ducts. Other findings:• Incomplete treatment appearance• Off-target effects

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# Abstract Archives of the RSNA, 2024

IREE-21

## DON’T MISS IT!: ARTERIAL FISTULA IN URINARY DIVERTED PATIENTS, FROM CT TO THE INTERVENTIONAL SUITE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz Garcia Martinez (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Revuelta Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Sutil (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand the pathophysiological mechanisms by which arteriourinary/arterioenteric fistulas develop and the risk factors for their formation. 2. Review the different forms of clinical presentation to know when to suspect them, the CT scan protocol and its findings. 3. Analyse the different forms of endovascular and surgical treatment.

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Pathophysiological mechanism of arteriourinary and arterioenteric fistulas. 3. Risk factors and clinical suspect: urinary diverted patients. The importance of clinical suspicion. 4. CT protocol and findings. 4.1. Other diagnostic tests: cystoscopy, pyelography. 5. The interventional suite: from CT findings to confirmation and treatment, a pictorial review. 6. Multidisciplinary management algorithm: analysis of endovascular and surgical management, as well as medical treatment. 7. Pictorial review of complications following interventional procedures, including diagnosis and management. 8. Conclusions. 9. Bibliography.

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# Abstract Archives of the RSNA, 2024

IREE-22

## ACUTE CHOLECYSTITIS; CURRENT DIAGNOSIS, MANAGEMENT, AND EMERGING ROLE OF INTERVENTIONAL RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Katsuhiro Kobayashi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1)Review current diagnosis of acute cholecystitis (AC) including imaging findings of AC. 2)Describe current management of AC according to Tokyo Guidelines 2018. 3)Discuss emerging role of interventional radiology in the management of AC.

### TABLE OF CONTENTS/OUTLINE

1) Overview of AC. 2) Pathophysiology of AC. 3) Anatomy and anatomical variants of the gallbladder. 4) Imaging findings of AC and its complications (emphysematous/gangrenous cholecystitis, pericholecystic abscess, gallbladder rupture, etc.). 5) Diagnosis of AC and its severity grading according to Tokyo Guidelines 2018. 6) Initial management of AC according to Tokyo Guidelines 2018. 7) Technique used for cholecystostomy tube placement. 8) Complications associated with cholecystostomy. 9) Emerging techniques used following cholecystostomy for non-surgical patients.

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# Abstract Archives of the RSNA, 2024

IREE-23

## PRE-CLINICAL INVESTIGATION OF HISTOTRIPSY FOR TARGETING PANCREATIC TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Warren Campbell, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Histotripsy offers advantages in both target precision with non-invasive options, but is limited by the tissue depth and gas obstructing ultrasound waves. In mice and pigs, preliminary studies indicate that tumors and be effectively targeted without damaging surrounding tissue, and can promote local tumor shrinkage with a systemic immune response. However, the technique requires further optimization to minimize risks off-target tissue damage. This technique may prove be a valuable non-invasive adjuvant therapy for patient with pancreatic cancer.

### TABLE OF CONTENTS/OUTLINE

1. The Histotripsy Technique A. Compare and contrast the ablation techniques targeting solid tumors using thermal stress. B. Review the limitations of thermal techniques such difficulty targeting tumors near sensitive structures, and inability to achieve uniform cell death. C. Discuss the mechanics of histotripsy and the equipment used to generate mechanical force to break cells apart with high-amplitude pulses. D. Explain why this technique may be beneficial in precise, rapid tissue ablation of pancreatic tumors.2. Clinical Findings supporting pancreatic tumor targeting A. Discuss literature on histotripsy for pancreatic cancer in mice and pig models. B. Discuss results showing efficacy in destroying Pan02 pancreatic tumors in an immunocompetent subcutaneous mouse model. C. Discuss porcine models ablating pancreatic tumors in a novel SCID-like pig D. Review results demonstrating histotripsy's ability to target and induce ablation within the pancreas of certain subjects and the limiting factors.3. Review the unique elements of histotripsy and why this technique may be beneficial in the patient population with pancreatic tumors.

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# Abstract Archives of the RSNA, 2024

IREE-25

## INTERCOSTAL INSIGHTS: INTERVENTIONAL RADIOLOGY'S ROLE IN MANAGING RIB RELATED COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jorge E. Lopera, MD (*Abstract Co-Author*) Shareholder, Tecnostent SA;Consultant, Merit Medical Systems, Inc;Research Grant, AngioDynamics, Inc
Andrew Ni (*Abstract Co-Author*) Nothing to Disclose
Kimberly D. Coffman, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review complications associated with interventional radiology procedures involving the ribs and adjacent structures. Review management and prevention strategies for rib complications

### TABLE OF CONTENTS/OUTLINE

IntroductionReviewing the anatomy of the ribsIntercostal artery and neurovascular bundleDiscussion of types of interventional radiology procedures that can lead to rib complicationsThoracentesisThoracostomyTransjugular liver biopsyHepatobiliary proceduresCommon types of complicationsHemothorax from intercostal artery injuryHematemesis Osteonecrosis of the ribRib fracturesComplications involving the ribs from interventional radiology procedures are poorly documented in existing literature. This presentation reviews common rib complications associated with IR procedures, focusing on key imaging findings and bringing awareness to these complications and management options.

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# Abstract Archives of the RSNA, 2024

IREE-26

## PREVENTION AND MANAGEMENT OF AIR EMBOLISM DURING IR PROCEDURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ghazwan M. Kroma, MD (*Abstract Co-Author*) Nothing to Disclose
Bernard Cheng, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Discuss pathophysiology, clinical diagnosis of intra-procedural air embolismReview best practices for prevention of air embolismDiscuss immediate steps following diagnosis of air embolism and definitive treatment including hyperbaric oxygen

### TABLE OF CONTENTS/OUTLINE

IntroductionPathogenesis of air embolism during lung biopsyTechniques to reduce air embolism development - Patient positioning, sampling technique, new devicesWhen to suspect an intra-procedural air embolism - Common symptoms and signsAir embolism treatment - immediate steps and treatment with hyperbaric oxygen including mechanism of action and discussion of efficacy

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# Abstract Archives of the RSNA, 2024

IREE-27

## WEDGED HEPATIC VENOUS PORTOGRAPHY FOR MESO-REX BYPASS PLANNING IN CHILDREN WITH EXTRA-HEPATIC PORTAL VEIN OBSTRUCTION: WHY AND HOW TO DO IT, WHAT ARE THE FINDINGS, AND DOES IT MATTER?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Dimitri A. Parra, MD, MMEd (*Abstract Co-Author*) Nothing to Disclose
Maria Gladkikh, MD,BSC (*Abstract Co-Author*) Nothing to Disclose
Afsaneh Amirabadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Victoria Vaughan (*Abstract Co-Author*) Nothing to Disclose
Maria F. Dien Esquivel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Learning Objectives: 1. Define the indications for wedged hepatic venous portography (WHVP) in children with extra hepatic portal vein obstruction. 2. Describe the WHPE technique.3. Illustrate the WHPE findings and their interpretation in the context of surgical planning.4. Correlate specific cases with clinical and surgical outcomes.

### TABLE OF CONTENTS/OUTLINE

• Introduction/Background• Learning Objectives• Normal Anatomy of the Intrahepatic Portal Venous System and Bertocchini Classification• Indications/Contraindications• Technique Description• Technical Tipso To improve the procedure planning and diagnostic accuracyo To obtain an adequate mapping of the patent intrahepatic portal system, by performing injections in different regions of the major hepatic veins .o To perform an adequate interpretation of findings and description of findings in the radiological report.• Illustrative Cases/Case Examples with surgical and clinical correlation.• Conclusions.

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# Abstract Archives of the RSNA, 2024

IREE-28

## NERVE BLOCKS: A PRIMER FOR INTERVENTIONAL RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Christina Boyd, MD (*Abstract Co-Author*) Nothing to Disclose
Kenneth N. Huynh, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the nerve distributions typically targeted for blockade and their relevant anatomy, from head to toe. 2. To review indications, techniques, technical considerations, pharmacology, and complications of nerve blocks. 3. To achieve a basic understanding of billing and coding for nerve block procedures.

### TABLE OF CONTENTS/OUTLINE

As the complexity of interventional radiology (IR) procedures increase, the need for adequate sedation and analgesia becomes more critical to ensure patient comfort and procedural success. Nerve blocks involve the injection of local anesthetic near targeted nerves to temporarily interrupt pain signals to the brain, offering regional pain relief that can be both diagnostic and therapeutic. These techniques are helpful in acute pain management, particularly peri-operative pain, chronic pain conditions including cancer-related pain. They have been shown to enhance quality of life, reduce opioid consumption, and facilitate earlier mobilization. Using these techniques, interventional radiologists can readily provide targeted analgesia, optimize therapeutic outcomes, and mitigate the need for general anesthesia in high-risk patients. This educational exhibit will (1) review commonly targeted nerves and distributions, and relevant anatomy including intercostal, pudendal nerves, erector spinae, transverse abdominis plane, stellate ganglion, celiac plexus, superior hypogastric plexus, and ganglion impar, (2) discuss techniques, technical considerations, and pharmacologic agents used for nerve blocks, as well as managing complications such as local anesthetic systemic toxicity (LAST), and (3) discuss basic billing and coding for nerve block procedures.

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# Abstract Archives of the RSNA, 2024

IREE-29

## NOT JUST TACE. USE OF TACE GUIDANCE SOFTWARE PRODUCED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Naoki Hosoda (*Abstract Co-Author*) Nothing to Disclose
Hirotoshi Murakami (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To learn about the IVR in the Gastrointestinal Tract. To learn about the TACE Guidance Software Produced. To learn about the gastrointestinal IVR using TACE Guidance. To learn about the Benefits of TACE Guidance.

### TABLE OF CONTENTS/OUTLINE

A. Gastrointestinal IVR and its Precaution B. TACE Guidance Software Produced C. About Appendiceal Bleeding CASE D. Benefits of TACE Guidance

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

IREE-3

## OVERVIEW OF PERCUTANEOUS TRANSHEPATIC BILIARY INTERVENTIONS: INDICATIONS AND BEST PRACTICES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Meaghan Dendy Case, MD (*Abstract Co-Author*) Nothing to Disclose
Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose
Tony Borgmann (*Abstract Co-Author*) Nothing to Disclose
William R. Winter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:1. To review normal and abnormal biliary tree anatomy2. To discuss types of biliary obstruction3. To provide an overview of percutaneous interventions for benign and malignant biliary pathology, including indications and best practices for each

### TABLE OF CONTENTS/OUTLINE

1. Normal and Abnormal Biliary Tree Anatomya. Normalb. Post Roux-en-Y Gastric Bypassc. Hepaticojejunostomyd. Situs Inversuse. Intestinal Malrotation2. Indicationsa. Obstructioni. Benign (stone, stricture, PSC, PBC)ii. Malignantiii. High vs Low Biliary Obstructioniv. Symptoms (pruritus, jaundice)b. Leakc. Infection3. Transhepatic Cholangiographya. Right vs Left-sided Accessb. Dilated vs Non-Dilated4. Transhepatic Biliary Drainagea. External vs Internal/External Drainb. Drain Upsizingc. Drain Externalization and Removal5. Potential Biliary Interventionsa. Cholangioplastyb. Stent (plastic, metal)c. Biopsy (brush, forceps, FNA)d. Cholangioscopye. Lithotripsyf. Ablationg. Rendezvous with ERCP

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# Abstract Archives of the RSNA, 2024

IREE-31

## IMAGING CHARACTERISTICS OF A NEWLY APPROVED NANOCOMPOSITE HYDROGEL BASED EMBOLIC AGENT WITH TANTALUM MICROPARTICLES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Johannes Du Pisanie, MD (*Abstract Co-Author*) Nothing to Disclose
Nima Kokabi, MD (*Abstract Co-Author*) Research support, Sirtex Medical Ltd;Consultant, Sirtex Medical Ltd;;
Andrew Caddell (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Introductions: A new conformable embolic (OBSIDIO Boston Scientific, Marlborough, MA), received 510(k) approval for the embolization of hypervascular tumors and peripheral blood vessel as of July 20221. This nanocomposite hydrogel based embolic agent with tantalum microparticles (NHTM) produces unique imaging characteristics as compared to preexisting commonly utilized embolics.Teaching points: To describe the imaging characteristics of NHTM on various imaging modalities.

### TABLE OF CONTENTS/OUTLINE

Angiographic Characteristics Dynamic Visualizations: NHTM is radio-opaque resulting in good visualization of the embolic during fluoroscopy and on radiographs2.CT Characteristics Reduced Streak Artifact: NHTM attenuates streak artifact compared to coil embolization. Contrast Differentiation: The K-edge of Tantalum is 67.4 keV, Iodine is 33.2 keV, Barium is 37.4 keV, Calcium is 4.0 keV, and Gadolinium 10.4 keV3. These differences may allow for differentiation on CT and dual energy CT based on Hounsfield unit density.MRI Characteristics Streak Artifact: NHTM does not produce streak artifact on MRI2. Variation Between Sequences: Based on the MRI properties of the hydrogel and the paramagnetic properties of tantalum sequence intensity is as follows. T2 High intensity. T1 Low
intensity.https://www.accessdata.fda.gov/cdrh_docs/pdf21/K213385.pdfdoi:10.1002/advs.202003327skuld.bmsc.washington.edu/scatter/AS_periodic.html

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# Abstract Archives of the RSNA, 2024

IREE-32

## SYNERGY OF CAR-T THERAPY WITH INTERVENTIONAL RADIOLOGY: HOW IR PROCEDURES CAN IMPROVE IMMUNOTHERAPY OUTCOMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Warren Campbell, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Interventional radiology has the capability to improve CAR-T therapy by improving efficacy and reducing systemic toxicity in treating solid tumors. Vascular therapy can administer localized delivery of CAR-T cells beyond the barriers of the tumor microenvironment or areas of poor vasculature.Priming tumors with ablation can improve antigen presentation to immune cells and degrade extracellular matrix barriers to immune infiltration.Interventional delivered adjuvant therapy may help T-cells function for longer durations. IR also has a role in continued surveillance of therapy and tumor monitoring. Collectively, the role of IR procedures should continue to be studied to improve solid tumor targeting with CAR-T therapy.

### TABLE OF CONTENTS/OUTLINE

1. review of T-cell therapy2. Locoregional therapies to deliver CAR-T therapy3. Evidence behind priming and adjuvant therapy of solid tumors in CAR-T therapy4. Role of IR in monitoring the efficacy of CAR-T therapy5. Conclusions

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# Abstract Archives of the RSNA, 2024

IREE-33

## MANAGEMENT OF COMPLICATIONS ASSOCIATED WITH TRANSJUGULAR INTRAHEPATIC PORTOSYSTEMIC SHUNT: TIPS FOR SUCCESSFUL TIPS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jamaal Benjamin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Girish Kumar, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel L. Rice, MD (*Abstract Co-Author*) Nothing to Disclose
Anil K. Pillai, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Rakesh K. Varma, MD, MBBS (*Abstract Co-Author*) Speaker, Becton, Dickinson and Company
Seth Toomay, MD (*Abstract Co-Author*) Nothing to Disclose
Husameddin El Khudari, MBChB (*Abstract Co-Author*) Nothing to Disclose
Ahmad Arar (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To recognize the potential technical complications related to TIPS creation, in a stepwise manner.2. To understand the causes of TIPS related complications and recognize the corresponding imaging findings.3. To learn how to prevent and address complications associated with TIPS, thereby enhancing patient safety and optimizing outcomes

### TABLE OF CONTENTS/OUTLINE

Outline: 1) Nonvascular and vascular complications prior to TIPS creation: Prevention is better than cure2) Handling Intraprocedural complications of TIPS- Nontarget TIPS insertion- Liver capsule Transgression3) TIPS device-related complications: Blame the fellow- Maldeployment- Migration- Biliary obstruction- Tipsitis4) TIPS malfunctioning: Early Occlusion, Stenosis, and Thrombosis5) Managing post-TIPS complications: Clearing the confusion- Acute Hepatic Encephalopathy- Spontaneous Shunts- Acute Hepatic Failure6) Variceal and arterial embolization in portal hypertension: Hemostasis beyond TIPS7) Miscellaneous Complications: Systemic and Radiation related

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# Abstract Archives of the RSNA, 2024

IREE-34

## MACHINE LEARNING (ML) VS CT/MRI-BASED VASCULAR MODEL FOR ASSESSING PORTAL HYPERTENSION: NON-INVASIVE ALTERNATIVE FOR PREDICTING HEPATIC VENOUS PRESSURE GRADIENT (HVPG)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Priya Mody, MD (*Abstract Co-Author*) Nothing to Disclose
Haneyeh Shahbazian, MD (*Abstract Co-Author*) Nothing to Disclose
Fahad S. Mohammed (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To educate radiologists on two non-invasive alternatives for predicting clinically significant portal hypertension (CSPH).

### TABLE OF CONTENTS/OUTLINE

IntroductionThe current gold standard for diagnosing clinically significant portal hypertension (CSPH) is the hepatic venous portal gradient (HVPG) procedure. Non-invasive models that predict CSPH would be a valuable tool for physicians assessing decompensation in patients with advanced chronic liver disease (ACLD). Two predictive models have recently been released to predict CSPH with either laboratory parameters using ML or imaging data from CT/MRI using a support vector machine. ML model• Readily Available Parameters- The 3P model uses platelet count, bilirubin, and international normalized ratio.• Online Tool- The study's online calculator calculates the probability of HPVG=10 and =16.• High AUC- When combined with liver stiffness measurement, the 3P model had an AUC of 0.858 for predicting portal pressure =10 mmHg, and the 5P model had an AUC of 0.901 for predicting portal pressure =16 mmHg.CT/MRI model• Usage of Imaging- The model utilizes geometric parameters extracted from segmented vessels within contrast-enhanced CT and MRIs to predict HPVG=10 using a support vector machine.• Detect Vasculature Changes: The model detects variations of the hepatic vascular systems (portal/hepatic vein) in CSPH, including reductions in mean whole-vessel volumes and length.• High AUC: The model had an AUC of 0.90 on the internal test set and 0.84-0.87 on external test sets.ConclusionsThe ML model predicts HPVG=10 and =16, while the CT/MRI model only predicts HPVG=10. Overall, both modalities are excellent non-invasive alternatives to HVPG procedures.

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# Abstract Archives of the RSNA, 2024

IREE-35

## CONTEMPORARY PRIMER ON THROMBECTOMY DEVICES IN THE MANAGEMENT OF LOWER EXTREMITY DVT: CURRENT STATE OF AFFAIRS AND EVOLVING APPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mensur Koso, MD (*Abstract Co-Author*) Nothing to Disclose
Gavin Wu, BA (*Abstract Co-Author*) Nothing to Disclose
Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Nojan Bajestani, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Deep vein thrombosis (DVT) has high morbidity and potential mortality that can lead to post-thrombotic syndrome in approximately 50% of patients, characterized by chronic pain, swelling, and walking difficulties. Catheter-directed interventional therapies such as percutaneous mechanical thrombectomy (PMT), catheter-directed thrombolysis (CDT), and pharmacomechanical CDT (PCDT), and others have been developed to alleviate symptoms, restore venous flow, and preserve valve function sooner and more effectively than conventional treatment. Appropriate device selection is paramount and depends on clinical context.After this exhibit, viewers will:1) Explore the clinical indications for thrombectomy and thrombolysis in DVT management2) Learn about all thrombolytic devices including aspiration, rotational, rheolytic, and ultrasound-assisted techniques3) Understand proper device selection and their advantages and disadvantages

### TABLE OF CONTENTS/OUTLINE

1) Introduction to DVT and Endovascular Management2) Overview of Thrombectomy Devices, including Mechanical, Aspiration, Rotational, Rheolytic, and Ultrasound-assisted techniques3) Mechanisms of Actions and Indications4) Guidelines for Device SelectionTechnique Benefits and Risks5) Evidence-Based Outcomes and recent national guidelines6) Case-based and Device-Specific Reviews7) Current Research and Future Directions8) Summary and Conclusions

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# Abstract Archives of the RSNA, 2024

IREE-36

## DISTAL TRANSRADIAL ACCESS FOR NON-CARDIAC INTERVENTIONS IN THE ERA OF MINIMALLY INVASIVE ENDOVASCULAR THERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Kondo Hiroshi (*Abstract Co-Author*) Nothing to Disclose
Yamamoto Masayoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Wada, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are the following.1. To describe recent advances of distal transradial access in non-cardiac interventions, including its indications, feasibility, and safety 2. To illustrate the basic anatomy and techniques of distal transradial access 3. To demonstrate practical interventional procedures and complications of distal transradial access through case-based review

### TABLE OF CONTENTS/OUTLINE

1. Indication and patient selection of distal transradial access for non-cardiac interventions 2. Anatomy of the radial artery and surrounding structures in the snuff box to explain the techniques of distal transradial access and complications associated with the puncture 3. Details of the procedure presented through case-based review: angiography suite settings, device selection, puncture of the distal radial artery, cannulation for the targeted arteries, and navigation of microcatheters 4. Complications associated with distal transradial artery access and how to handle them

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# Abstract Archives of the RSNA, 2024

IREE-37

## ALL YOU NEED TO KNOW ABOUT SELECTIVE ARTERIAL CALCIUM INJECTIONS AND VENOUS SAMPLING FOR PANCREATIC NEUROENDOCRINE TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nobuyuki Shiraga, MD (*Abstract Co-Author*) Nothing to Disclose
Masaaki Hori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fuyuki Washizuka (*Abstract Co-Author*) Nothing to Disclose
Masahiro Kobayashi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To understand the indications and objectives of selective arterial calcium injection (SACI) test for pancreatic neuroendocrine tumors (NETs).To review the anatomical vascular variations in pancreas.To understand how to perform SACI test including the appropriate injection sites according to patient's anatomical vascular variations and blood flow domination in pancreas.To learn how to interpret the sampling results for determining the localization of pancreatic NETs.

### TABLE OF CONTENTS/OUTLINE

A. Diagnosis and imaging findings of pancreatic NETs.B. How to perform SACI test including the injection sites, sampling sites, and the sampling times.C. Appropriate injection sites according to the types of blood flow domination.D. Evaluation of the sampling results with case presentations.

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# Abstract Archives of the RSNA, 2024

IREE-38

## BRONCHIAL ARTERY INFUSION CHEMOTHERAPY: TIPS AND TRICKS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Dayhane H. De Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Rayssa A. Melo, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz T. Siqueira, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Luiza Teixeira (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To discuss and illustrate a Bronchial artery infusion of chemotherapy for lymphangitic carcinomatosis, that to our knowledge has never been published.

### TABLE OF CONTENTS/OUTLINE

1 - To review the bibliography about Bronchial artery infusion of chemotherapy.2- To illustrate a case of pulmonary lymphangitic carcinomatosis, focusing on aspects related to imaging, procedures, treatments, and interventions.3 - Summary and take home messages.

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# Abstract Archives of the RSNA, 2024

IREE-39

## ABLATION OF OSSEOUS TUMORS: ESSENTIAL REVIEW OF NEURAL ANATOMY TO AVOID INJURY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jemianne Bautista, MD (*Abstract Co-Author*) Nothing to Disclose
Jea Ho S. Yu, BS (*Abstract Co-Author*) Nothing to Disclose
Anthony Zamary (*Abstract Co-Author*) Nothing to Disclose
Kevin Zhou (*Presenter*) Nothing to Disclose

### TEACHING POINTS

: Percutaneous ablation of osseous tumors followed by kyphoplasty/cementoplasty offers a targeted, minimally invasive option for patients with symptomatic disease and can be performed as an adjunct treatment to Surgery and Radiation. However, damage to critical neural anatomy represents a significant risk, and avoiding complications requires a detailed understanding of neural anatomy. This exhibit will provide:(1) Detailed review of neural anatomy relevant to the most common sites of osseous tumor ablation, including spinal, pelvic, and lower extremities. (2) Review of specific nerve function. (3) Cases highlighting successful navigation of complex neural pathways during ablation procedures. (4) Specific considerations for each ablation modality (RFA, cryoablation, thermoablation, etc.) including placement of ablation probes and the monitoring of heat spread or ice formation to prevent neural damage.

### TABLE OF CONTENTS/OUTLINE

(1) Overview of osseous tumors and indication for ablation therapy.(2) Neural anatomy associated with common sites of osseous tumor ablation.(3) Workup and procedural techniques to minimize the risk of neural injury.(4) High yield review of different ablation modalities (radiofrequency, cryoablation, microwave, and IRE) and their specific considerations regarding neural safety.(5) Case examples.

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# Abstract Archives of the RSNA, 2024

IREE-4

## PELVIC VENOUS REBUILDING: ILIOCAVAL RECONSTRUCTION TIPS, TRICKS AND CURRENT STANDARDS OF PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

LeAnn S. Stokes, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Tony Borgmann (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Exhibit viewers should be able to (A) understand indications and contraindications for iliocaval reconstruction, (B) review the imaging and anatomy to determine patient eligibility, (C) define the intervention techniques and equipment for iliocaval reconstruction, and (D) discuss short and long-term postoperative complications of the reconstruction

### TABLE OF CONTENTS/OUTLINE

A. Indications and contraindications for iliocaval reconstitution a. Indications for Reconstruction i. Venous occlusion in the setting of recurrent deep venous thrombosis ii. Post-thrombotic syndrome iii. Limitations in activities of daily living b. Contradictions i. Hypersensitive to stent compounds ii. Contraindication to anticoagulation (relative) c. Alternatives i. Conservative therapy B. Imaging and Anatomy a. Duplex ultrasonography b. CTV or MRV c. Venography C. Intervention techniques and equipment a. Equipment i. Access sheath, various guide catheters, and guidewires ii. Stents iii. Intravascular ultrasound b. Access and Positioning i. Vascular access points depend on the level and extent of occlusion/inflow - common femoral, popliteal, greater saphenous, internal jugular ii. Prone positioning to facilitate popliteal access iii. Supine positioning for more proximal access c. Recanalization i. Blunt ii. Sharp d. Reconstruction i. Indications of indwelling catheter-directed thrombolysis ii. Indications for thrombectomy iii. Stent choice, location, and measurements D. Complications and Post-Procedure Care a. Complications i. Access site hematoma ii. Stent migration iii. Stent thrombosis occlusion b. Post Procedure care i. Anticoagulation ii. Clinic and imaging follow-up recommendations

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# Abstract Archives of the RSNA, 2024

IREE-40

## MR-GUIDED CRYOABLATION OF PROSTATE CANCER BONE METASTASES: A COMPREHENSIVE GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Scott M. Thompson, MD, PhD (*Abstract Co-Author*) Research Consultant, Boston Scientific Corporation
Aiming Lu, PhD (*Abstract Co-Author*) Nothing to Disclose
Setayesh Sotoudehnia Korani, MD (*Abstract Co-Author*) Nothing to Disclose
Aliza Mushtaq, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Lance A. Mynderse, MD (*Abstract Co-Author*) Researcher, Koninklijke Philips NV;Equipment support, Koninklijke Philips NV;Investigator, Nanospectra Biosciences, Inc;Researcher, Nanospectra Biosciences, Inc
Daniel A. Adamo, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Ganjizadeh, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• The advantages of MR-guided cryoablation over CT-guided cryoablation in treating prostate cancer bone metastases• Effective patient selection and interpretation of MR and PET scans for accurate diagnosis and treatment planning• Optimal treatment planning and follow-up strategies for successful outcomes

### TABLE OF CONTENTS/OUTLINE

Introduction• Overview of MR-guided cryoablation: A minimally invasive, image-guided therapy for bone metastases• Advantages of MR guidance: Precision, safety, and efficacy in targeting bone metastasesPatient Selection and Imaging• Inclusion criteria for MR-guided cryoablation: Patient selection and evaluation• Role of PET/CT scans (11-C Choline and PSMA) in identifying metastatic sites• MR imaging characteristics of bone metastases: Visualization and interpretationTreatment Planning and Procedure• Procedure details: Utilization of 3-4 freeze/thaw cycles per session, with MRI and ultrasound assistance for needle placement• Importance of real-time monitoring of the ablation zone for complete treatmentFollow-up and Recurrence Management• Imaging schedule: Pre-operative planning and post-ablation follow-ups at 3, 6, and 12 months• Classification and management of recurrences:o In-field recurrences: Definition, examples, and treatment strategieso Out-of-field recurrences: Definition, instances, and treatment approaches

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# Abstract Archives of the RSNA, 2024

IREE-41

## THE SPECTRUM OF MOLECULAR IMAGING IN Y90 MICROSPHERE SELECTIVE INTERNAL RADIATION THERAPY (SIRT) FOR PRIMARY AND METASTATIC LIVER TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shima Tafreshi, MD (*Abstract Co-Author*) Nothing to Disclose
Mehdi Djekidel, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Weinstein, MD (*Abstract Co-Author*) Nothing to Disclose
Amna Aslam (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Pre Y90 selective internal radiation therapy (SIRT) abnormal biodistribution will determine adjustment in therapy delivery planning• High yield radiolabeling of Tc99m MAA for pretherapy mapping is also essential in avoiding confounding extrahepatic stomach and duodenal uptake due to free pertechnetate.• SPECT-CT is essential to map extrahepatic uptake• Gallbladder uptake of Y90 typically occurs due to either non-target embolization or reflux of the microspheres. • Close assessment of falciform ligament uptake is essential and requires expertise and the use of advanced SPECT-CT techniques. • Post-treatment assessment via SPECT-CT allows for early detection of gallbladder uptake which can lead to radiation-induced cholecystitis and allows for prompt management of such potential complications.• The application of dosimetry techniques pre and post SIRT is crucial in optimizing patient outcomes.

### TABLE OF CONTENTS/OUTLINE

Y90 SIRT has seen a huge increase in clinical utilization. Owing to numerous studies demonstrating outcome benefits for different indications it has gained in clinical acceptance and application. However, proper use requires expertise and a multilayered approach to patient selection and management. Molecular imaging plays an essential role in the overall successful delivery of this therapy. Optimized workflows and high-quality standards require expertise and knowledge of various aspects of the molecular imaging paradigm pre, during and post treatment. We offer to review the different aspects of molecular imaging involved in the care for Y90 liver SIRT patients including normal and abnormal biodistribution pre-, during and post-treatment, and dosimetry assessments.

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# Abstract Archives of the RSNA, 2024

IREE-42

## CYSTIC DUCT STENTING IN BENIGN DISEASE: AN OVERVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Patrick D. Sutphin, MD, PhD (*Abstract Co-Author*) Stockholder, Gilead Sciences, Inc;Stockholder, Editas Medicine;Stockholder, CRISPR Therapeutics AG;Stockholder, Intellia Therapeutics;Stockholder, Amwell;Stockholder, Teladoc Health Inc;Stockholder, Jazz Pharmaceuticals plc;Stockholder, ViewRay, Inc;Research funded, TriSalus Life Sciences
Kausthubh Hegde, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review indications and techniques of cystic duct stenting in benign gall bladder disease as an alternative to surgery
- Evaluating technical success and complications: efficacy and safety of the procedure and common complications
- Long-term outcomes of patients’ post-cystic duct stenting and feasibility of transitioning to surgery if the patient's condition improves

### TABLE OF CONTENTS/OUTLINE

- Introduction to cystic duct stenting:- Indication and patient selection criteria for choosing stenting over traditional surgical methods in benign gall-bladder disease- Techniques of stenting and devices used during the procedure- Protocols for pre- and post-procedure care
- Evaluating technical success: clinical outcomes from recent studies and case series
- Complications and management:- Review common and serious complications and how to prevent them- Strategies to manage complications and improve patient outcomes- Case studies (image-based) highlighting specific incidents
- Overview of follow-up protocols and long-term care with a focus on transitioning from stenting to surgery: criteria and case examples

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# Abstract Archives of the RSNA, 2024

IREE-43

## VISUAL GUIDE TO THE MEDICAL MANAGEMENT OF SITUS INVERSUS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Husameddin El Khudari, MBChB (*Abstract Co-Author*) Nothing to Disclose
Ahmed Abdelgawad (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1- describe be the situs inversus spectrum and its radiologic findings2- To identify the implication of the altered anatomy on performing interventional procedures3- To present a case-by-case review of the common interventional procedures performed on situs inversus patients

### TABLE OF CONTENTS/OUTLINE

Background: Situs solitus is the normal arrangement of the human viscera. Situs inversus is a rare genetic condition in which the organs of the chest and abdomen are positioned in a mirror image of normal human anatomy. The incidence of situs inversus totalis is approximately 1:10,000. Despite its rarity, these patient are still encountered in the IR world. Performing procedures on patients with situs inversus poses a unique challenge to interventionalist. Knowledge of the anatomical alterations and its implications on performing these interventions is very important for safe and successful performance of these procedures.Clinical Findings/Procedure Details:We present a case-by-case review of some of the common IR procedures performed on patients with situs inversus with special emphasis on technical aspects, tips and tricks to safely perform these procedures.We present the following cases:Angiogram and embolization in patient with GI bleeding
- Transarterial Chemoembolization/Y-90
- TIPS placement
- Gastrostomy placement
- Tunneled hemodialysis catheter placement
- Percutaneous transhepatic cholangiography
- IVC filter placementConclusion or Teaching Points: Situs inversus is a rare genetic condition that poses unique challenges to interventionalist. Understanding of the anatomic alteration and proper techniques is crucial to perform procedures safely and successfully on patient with situs inversus.

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# Abstract Archives of the RSNA, 2024

IREE-44

## LIVER HISTOTRIPSY: TIPS AND TRICKS FOR CLINICAL TREATMENT OF LIVER TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mishal Mendiratta-Lala, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanna Fox (*Abstract Co-Author*) Nothing to Disclose
Neehar Parikh, MD (*Abstract Co-Author*) Grant, Bayer AG;Consultant, Bayer AG;Grant, Boston Scientific Corporation;Grant, Exact Imaging Inc;Consultant, Exact Imaging Inc;Grant, Glycotest, Inc;Grant, Exelixis, Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Eli Lilly and Company;Advisory Board, Eisai Co, Ltd;Advisory Board, F. Hoffmann-La Roche Ltd;Advisory Board, FUJIFILM Holdings Corporation
Farah Jawad-Makki, MA (*Abstract Co-Author*) Nothing to Disclose
Elaine M. Caoili, MD, MS (*Abstract Co-Author*) Steering Committee, ProKidney, LLC
Nathan E. Loudon, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Oserowsky, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Navarro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Histotripsy is a new non-invasive locoregional therapy for liver tumors using mechanical cavitation for tissue destruction. 2. Histotripsy treatment configuration can be adapted per tumor, so that each ablation zone is unique per patient and per tumor, allowing for a personalized approach. 3. Histotripsy ablation spares collagenous structures, such as vessels and bile ducts, allowing for treatment of tumors that may otherwise be risky with invasive thermal ablation procedures. 4. There are restrictions to the application of histotripsy secondary to device limitations, the most critical being the inability to target tumors from an intercostal approach, which markedly limits clinical applicability of this technology. 5. Techniques such as pre-planning, patient positioning and coordination with anesthesiology can expand the scope of histotripsy by permitting treatment of lesions that would usually be precluded secondary to device limitations.

### TABLE OF CONTENTS/OUTLINE

Introduction to Histotripsy Technology Mechanism of action Introduction to the Clinical Workflow for Histotripsy Evaluation Patient referral process Selection process of appropriate candidates for treatment Tips and Tricks to expand the scope of histotripsy treatment Pre-treatment evaluation of liver tumors How to perform histotripsy via an intercostal approach Optimal patient positioning Coordination with anesthesiology team

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# Abstract Archives of the RSNA, 2024

IREE-45

## SECTORAL ECHOBRONCHOSCOPY DEMYSTIFIED. ESSENTIAL KNOWLEDGE FOR DOCTORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rodrigo Gobbo (*Abstract Co-Author*) Nothing to Disclose
Marcia Jacomelli (*Abstract Co-Author*) Nothing to Disclose
Victor Arthur Ohannesian (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Preparation involves smears and Reaction of Other Excluding Substances (ROSE), emphasizing initial cytopathological analysis for identifying lymphocytes and adjacent lesions. -ROSE crucial for mediastinal staging in lung neoplasia, guiding therapeutic decisions with minimal complications, but high sensitivity and cost.-Sectoral echobronchoscopy is clinically relevant for diagnosing peribronchial lesions and lymph nodes, staging pulmonary and extrathoracic neoplasms precisely.-Its established use ensures accuracy in diagnosing peritracheal lesions and staging, influencing therapeutic decisions in lung neoplasia management.-Despite its high cost, sectoral echobronchoscopy proves indispensable in coagulation disorders, hemodynamic instability, and ventilatory contraindications, ensuring precise staging and management.

### TABLE OF CONTENTS/OUTLINE

1.ANATOMY2.EQUIPMENT3.EXAM SYSTEMATIZATION4.MAIN INDICATIONS5.DIAGNOSTIC INCOME and SUMMARY OF EVIDENCE 6.CASES

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# Abstract Archives of the RSNA, 2024

IREE-47

## BREATHING NEW LIFE INTO BRONCHIAL ARTERY EMBOLIZATION (BAE): RECENT TECHNICAL AND CLINICAL OUTCOMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Clayton W. Commander, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Thomas Turner (*Abstract Co-Author*) Nothing to Disclose
Estefania Gonzales, BA, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Indications for BAE include hemoptysis causing airway or respiratory compromise, moderate hemoptysis with 3 episodes within a week each over 100 mL, increasing blood volumes from chronic bleeding or sudden bloody sputum, and as a bridge treatment for lung transplant patients with moderate hemoptysis due to chronic inflammatory lung disease. Advanced imaging techniques, like MDCT angiography, enhance detection by providing more precise mapping of bronchial and systemic vascular anatomy sometimes missed by standard imaging, improving procedural safety. A pleural thickness >3 mm and enlarged extrapleural vessels suggest non-bronchial systemic artery bleeding. Predictive factors for recurrent hemoptysis post-BAE in idiopathic bronchiectasis include pseudomonas infection, massive sputum production, and aberrant bronchial arteries. Factors such as AV fistulas, systemic shunts, and underlying lung diseases also contribute to recurrence in non-specific cases. The 2022 CIRSE Standards of Practice have spurred advances in microcatheter technology, enabling superselective coil embolizations in 98% of cases with lower risks of spinal cord infarction compared to agents like Gelfoam and NBCA. Early embolization reduces hospital stays and recurrence risks. Common embolic agents for BAE include NBCA, PVA, and coils, sometimes with Gelfoam. Recent studies suggest NBCA and coils outperform particles. Success rates vary based on hemoptysis presentation and vascular abnormalities. Embolic choice should prioritize patient safety and be tailored to individual clinical needs.

### TABLE OF CONTENTS/OUTLINE

Introduction to BAE; Indications with Updates; Advancements in Techniques and Embolizations; Frontiers

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# Abstract Archives of the RSNA, 2024

IREE-48

## MIGRATION OF VASCULAR AND NON-VASCULAR STENTS: INCIDENCE, PRESENTATION, CONTRIBUTING FACTORS AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Dyda Dao, MD (*Abstract Co-Author*) Nothing to Disclose
Brian S. Funaki, MD (*Abstract Co-Author*) Consultant, Okami Medical;Advisory Board, Balt USA
Wojciech Cwikiel, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ramin Midia, MD (*Abstract Co-Author*) Nothing to Disclose
Mehran Midia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Although not frequent, vascular and non-vascular stent migration can occur in IR practice and could be associated with significant morbidity and mortality. The incidence of stent migration is likely underreported. Clinically patient could be asymptomatic and in symptomatic patients' presentation largely depends on the stent location. Stent deployment is a dynamic process and there are many device, host and operator technique factor that could contribute to stent migration at time of deployment and thereafter. Management of stent migration ranges from close monitoring to interventional radiology management, open surgery and combination of the later. Interventional radiology management is the most commonly used method, with a high success rate. Interventional radiology techniques range from temporary anchoring (such as with balloons and snares), permanent anchoring (including with the use of overlapping or bridging stents), repositioning and retrieval of the migrated stent.

### TABLE OF CONTENTS/OUTLINE

1. To review the incidence and clinical presentation of stent migration.2. To understand the contributing factors for the development of stent migration and discuss technical considerations for stent migration prevention.3. To highlight current techniques and strategies for managing migrated stents.

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# Abstract Archives of the RSNA, 2024

IREE-5

## REDEFINING VASCULAR PLUGS: RADIOLOGIST INTERPRETATION OF TECHNOLOGY AND TECHNIQUES FOR OPTIMAL EMBOLIZATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yasutoshi Ohta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Nishii, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation
Masaru Shiotani, RT (*Abstract Co-Author*) Nothing to Disclose
Yoshiaki Morita (*Abstract Co-Author*) Nothing to Disclose
Emi Tateishi (*Abstract Co-Author*) Nothing to Disclose
Teruhito Hayashi (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Hiroki Horinouchi (*Abstract Co-Author*) Nothing to Disclose
Midori Fukuyama, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuki Hara, RT (*Abstract Co-Author*) Nothing to Disclose
Akiyuki Kotoku, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Vascular Plug (VP) is a cutting-edge embolization technology designed to precisely and effectively occlude a targeted vessel. The device efficiently occludes vessels with minimal impact on surrounding tissues by utilizing the body's natural processes that reduce blood flow and promote thrombus formation. Amplatzer Vascular Plugs (AVPs) are the traditional and most widely used devices. AVPs use a combination of density and radial force to induce thrombus formation, allowing for controlled and strategic embolization. This exhibit will focus on the important role of AVPs in treating aneurysms and parent vessel occlusions. It will detail their embolization techniques and how they differ from other embolic materials. It also aims to understand AVPs, evaluate their imaging properties and effects on blood flow reduction, explore their strategic use, and discuss evidence-based future directions in vascular embolization.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Vascular Embolization - Overview of embolization principles - The advent and importance of vascular plugs2. Physiological Basis for Thrombosis in Embolization -Role of embolic density and radial force3. AVPs in Clinical Practice: Aneurysmal vs. Parent Vessel Embolization - Criteria for embolization strategy selection4. Evidence-Based Application of AVPs - Clinical applications: Visceral artery aneurysms, vascular malformations5. Challenges and Solutions in AVP’s Embolization - Learning from complex cases and failed placements6. Advanced Embolization Techniques with AVPs - Plug anchor (stabilizer) technique - Coil-in-plug technique7. Future Directions in Vascular Embolization with VPs

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# Abstract Archives of the RSNA, 2024

IREE-50

## THE ART OF THE SPLEMBO: SPLENIC ARTERY EMBOLIZATION TIPS, TRICKS, AND CURRENT STANDARDS OF PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose
Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Exhibit viewers should be able to (A) understand some indications for traumatic and non-traumatic splenic embolization, (B) recognize key anatomy for splenic embolization on angiography, (C) appreciate various techniques available to perform splenic embolization and (D) understand how patients are managed post-procedurally/monitored for potential complications.

### TABLE OF CONTENTS/OUTLINE

A. Indications for Splenic Embolization a. Traumatic Spleen Embolization i. Signs of Splenic Trauma and AAST Grades on Diagnostic Imaging (CT and angiography) ii. Splenic embolization versus splenectomy: Indications and long-term outcomes. iii. Prophylactic embolization b. Non-traumatic Spleen Embolization i. Immune thrombocytopenia ii. Splenic artery aneurysm iii. Splenomegaly and importance for chemotherapy iv. Cirrhosis v. Post-liver transplantation (splenic steal) B. Procedural anatomy: celiac and splenic artery anatomy visualized on angiography C. Approach to embolization a. Choice of embolic agent (coils, plugs, gelatin sponge, Onyx, glue) b. Traumatic embolization i. Vascular access points ii. Proximal versus Distal embolization: advantages/disadvantages of each approach iii. Important collaterals to assess and preserve c. Non-traumatic embolization i. Preparation for embolization, including diagnostic imaging, antibiotics, and vaccination practices ii. Lower and mid pole embolization targets iii. Controversies in target infarction rate D. Post-embolization Outcomes and Follow-up a. Major and minor complications and their radiologic findings i. Access site complication ii. Splenic necrosis iii. Infection b. Follow-up imaging and management guidelines i. Dependent on indication

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# Abstract Archives of the RSNA, 2024

IREE-51

## TINY SPARKS: EXPLORING ABLATION IN PEDIATRIC ONCOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Renata Nabeiro Dias Angelo, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rosseto Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Barbara d. Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio d. Meira, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Marcello Giovanni Messias Da Silva, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1- Understand the clinical indications and decision-making processes for pediatric ablation procedures.2- Explore the safety and efficacy of ablation technologies in pediatric applications.

### TABLE OF CONTENTS/OUTLINE

1- IntroductionDiscuss the relevance of ablation therapy in pediatric care, highlighting the current need of adapting adult techniques for pediatric use.2- Indications for Pediatric AblationOverview of conditions in pediatric patients that may benefit from ablation, including both common and rare indications.3- Techniques and TechnologiesBrief description of the ablation methods used in pediatric cases, focusing on adaptations for smaller anatomies and lower tolerance levels.4- Cases Presentation of selected cases to illustrate successful outcomes and the critical thinking involved in treatment planning.5- Safety and Efficacy EvaluationAnalysis of safety measures, complication management, and efficacy assessments, according to established literature.6- Management and Follow-UpSuggestions on post-procedure care, emphasizing the unique aspects of pediatric patient management and long-term follow-up.7- ConclusionReinforce the importance of specialized training in pediatric ablation, and suggested directions for future research.

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# Abstract Archives of the RSNA, 2024

IREE-52

## SHAM PROCEDURES IN INTERVENTIONAL RADIOLOGY INVESTIGATIVE TRIALS: ESSENTIAL FOR RIGOROUS RESEARCH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hyeon Yu, MD (*Abstract Co-Author*) Nothing to Disclose
Elaine M. Caoili, MD, MS (*Abstract Co-Author*) Steering Committee, ProKidney, LLC
Joseph M. Stavas, MD, MPH (*Presenter*) Employee, ProKidney;Speaker, ProKidney;Research Consultant, Excelerate Health Ventures

### TEACHING POINTS

Sham procedures provide critical control in Interventional Radiology (IR) trials, minimizing bias and ensuring the true efficacy and safety of new treatments. This presentation explores the history, implementation, and challenges of sham procedures in IR research. We will review our experience with sham procedures in a novel autologous cell-based therapy investigative trial to treat chronic kidney disease and other blinding methods which require risk versus benefit assessment, consistency, and validation .

### TABLE OF CONTENTS/OUTLINE

- The Importance of Sham Procedures
- Why they are necessary for unbiased results in IR trials.
- Examples where their absence has led to misleading findings.
- Examples of IR trials with sham procedures:
- Catheter-directed renal artery denervation for hypertension
- Vertebroplasty for osteoporosis fracture pain
- Prostatic artery embolization for benign prostatic hypertrophy
- Geniculate and shoulder artery embolization for pain
- Cell-based therapies for kidney disease
- Implementing Sham Procedures in IR
- Specific procedural and training methods to ensure blinding
- Ethical and regulatory considerations (regulatory agency guidance, Institutional Review Board approval)
- Challenges and Best Practices
- Addressing patient recruitment barriers
- Overcoming ethical barriers and concerns
- Strategies for maintaining consistency and minimizing unblinding
- Key point Emphasize the need for wider use of rigorous sham-controlled research methodologies within the IR community to drive innovation and ensure evidence-based treatments.

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# Abstract Archives of the RSNA, 2024

IREE-53

## INTERVENTIONAL RADIOLOGY IN THE MANAGEMENT OF TRANSPLANT-ASSOCIATED COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sophie Chheang, MD (*Abstract Co-Author*) Medical Director, Agamon Technologies Limited
William Baker (*Abstract Co-Author*) Nothing to Disclose
Emily June Zolfaghari (*Abstract Co-Author*) Nothing to Disclose
Ryan Bitar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize the common/basic surgical techniques and imaging appearances of allograft placement in transplant recipients
- Review critical post-transplant complications and their associated presentations on imaging.
- Discuss the role of interventional radiology in the management in such pathologies.

### TABLE OF CONTENTS/OUTLINE

- Liver transplant
- Common transplant techniques
- Arterial complications
- Arterial stenosis
- Imaging: Ultrasound (US) and CT angiogram
- angioplasty/stenting +/- splenic artery embolization
- Biliary complications
- Leak
- Imaging: CT and HIDA
- Stenting and sclerotherapy
- anastomotic stricture:
- Imaging: MRCP
- Angioplasty/stenting
- Venous complications
- Deep venous thrombosis
- Imaging: CT and US
- thrombectomy
- IVC stenosis/occlusion
- Imaging: CT and US
- Angioplasty/stenting
- Intrahepatic and extrahepatic fluid collections
- Imaging: MRI and CT
- Drainage/aspiration
- Biopsy
- Specimen specifics
- Kidney transplant
- Common renal transplant techniques
- Arterial complications
- Renal arterial stenosis:
- Imaging: CT angiogram and US
- angioplasty/stenting
- Pseudoanuerysm/trauma
- Imaging: CT and US
- Intervention: embolization
- Venous complications
- Deep venous thrombosis
- Imaging: US
- Thrombectomy
- Urinary complications
- Ureteral stricture
- Imaging: CT and US
- angioplasty and nephroureterostomy placement
- Pyelonephritis
- Imaging: CT and US
- nephrostomy

- Perinephric collections
- Imaging: US and CT
- Drainage/aspiration
- Biopsy
- Specimen specifics

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# Abstract Archives of the RSNA, 2024

IREE-54

## EX-VIVO MODELS FOR IR PROCEDURAL TRAINING. TAKING SIMULATION TO NEW LEVELS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

John A. Walker, MD, PhD (*Abstract Co-Author*) Speaker, Shionogi & Co, Ltd;Consultant, Shionogi & Co, Ltd
Rajeev Suri, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Carlos B. Ortiz, MD (*Abstract Co-Author*) Consultant, Argon Medical Devices, Inc
Marina Borrego, BS (*Abstract Co-Author*) Nothing to Disclose
Jorge E. Lopera, MD (*Presenter*) Shareholder, Tecnostent SA;Consultant, Merit Medical Systems, Inc;Research Grant, AngioDynamics, Inc

### TEACHING POINTS

Simulation in IR is very limited due to the high cost of computer base simulators and the lack of realistic experience when using plastic and 3- D models.Ex-vivo organs are very inexpensive and offer an unique opportunity to develop several models to teach, train and do research in a low cost, safe and reproducible manner.We have successfully created several models using ex- vivo organs to teach and train on several basic and advanced IR techniques.The purpose of this exhibit is to teach other educational institutions how to start a simulation program using ex vivo organs.

### TABLE OF CONTENTS/OUTLINE

How to get started: procuring the organs and the getting the basic materials.US guided kidney and liver biopsies Percutaneous Transhepatic Cholangiogram and cholecystostomy tube Models. PCN Double J ureteral stent placement and retrograde exchange Models. Portal vein and renal artery embolization models. Transjugular liver biopsy and TIPS placement- ICE guided model.

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# Abstract Archives of the RSNA, 2024

IREE-55

## RADIOEMBOLIZATION FOR LIVER CANCER : CONSIDERATION OF NON-HEPATIC ARTERY ORIGINATING FROM THE HEPATIC ARTERY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hyo-Cheol Kim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To ensure the safety and efficacy of radioembolization procedures, a thorough comprehension of hepatic artery anatomy is imperative. This is particularly crucial due to the potential for several non-hepatic arteries to arise from the hepatic artery, necessitating careful consideration to avoid their inadvertent treatment or to provide appropriate protection. Oversight or unintended treatment of non-hepatic arteries during radioembolization can result in a spectrum of adverse consequences, ranging from mild postembolization syndrome to severe gastrointestinal radiation ulceration. The primary objectives of this presentation are as follows: 1. Enumeration of non-hepatic arteries originating from the hepatic artery. 2. Acquisition of techniques for identifying and managing non-hepatic arteries before and during radioembolization. 3. Review of potential complications associated with the inadvertent treatment of these arteries.

### TABLE OF CONTENTS/OUTLINE

1. Cystic artery, right gastric artery, accessory left gastric artery, hepatic falciform artery, left inferior phrenic artery, and supraduodenal artery. 2. Vascular anatomy visualization of non-hepatic arteries using CT/MR, DSA, and cone-beam CT. 3. Strategies for detecting non-hepatic arteries using cone-beam CT, planning angiography, and SPECT/CT. 4. Technical considerations including permanent embolization, temporary embolization, and bypass procedures. 5. Management of complications related to non-hepatic artery treatment, such as ischemic cholecystitis, radiation cholecystitis, radiation gastroduodenal ulceration, radiation dermatitis, and epigastric pain.

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# Abstract Archives of the RSNA, 2024

IREE-56

## INTRA-ARTERIAL TREATMENT FOR HEPATOCELLULAR CARCINOMAS : HOW TO MANAGE SHUNTING FROM THE ARTERY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jin Woo Choi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In the treatment of hepatocellular carcinomas, intra-arterial therapy such as chemoembolization and radioembolization is commonly used. However, operators may encounter shunts from the artery (such as arterioportal, arteriovenous, and arteriopulmonary shunts) that can hinder effective treatment. These shunts can be caused by various factors such as tumor invasion, previous percutaneous procedures, chronic inflammation, or congenital acquisition. If not properly occluded, embolic material can pass through the shunt and cause non-target embolization or serious complications. This exhibit aims to achieve three goals: (1) Review the radiologic appearance of arterioportal, arteriovenous, and arteriopulmonary shunts; (2) Learn how to manage these shunts with proper embolic materials; and (3) List the possible complications and their management.

### TABLE OF CONTENTS/OUTLINE

1) List of shunts Arterioportal shunt (hepatic artery - portal vein), Arteriovenous shunt (hepatic artery - hepatic vein), Arteriopulmonary shunt (hepatic artery - pulmonary artery/vein), 2) Imaging findings on CT/MR and angiography according to the cause (tumorous vs non-tumorous condition) 3) Embolization strategy and materials for shunts 4) Complications related with non-target embolization and their management

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# Abstract Archives of the RSNA, 2024

IREE-57

## EMBOLIZATION WITH N-BUTYL CYANOACRYLATE : PROPERTIES, TECHNIQUE, PITFALLS, AND APPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jin Woo Choi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

N-Butyl cyanoacrylate is a commonly used liquid embolic material for managing various medical conditions, such as vascular malformation, gastrointestinal bleeding, portal vein embolization, and tumor embolization. This material can be mixed with iodized oil to provide radiopacity and control the polymerization time. However, beginners may find it challenging to handle liquid embolic material compared to coils, plugs, and particles. The purpose of this exhibit is : (1) To describe the properties and mechanism of action of N-butyl cyanoacrylate. (2) To learn diverse injection techniques and potential pitfalls associated with its use. (3) To review various clinical indications and appropriate techniques for the use of N-butyl cyanoacrylate in interventional procedures.

### TABLE OF CONTENTS/OUTLINE

1) N-butyl cyanoacrylate A. Chemical properties B. Effects on tissues C. Polymerization D. Mixture with iodized oil E. Mixture with iodized oil and alcohol 2) Injection technique and pitfalls A. flow-dependent injection B. pressure-dependent injection C. Balloon-occluded injection D. Potential pitfalls 3) Clinical indications A. Arteriovenous malformation B. Diverse bleeding embolization C. Vein embolization D. Tumor embolization E. Endoleak embolization F. Lymphatic embolization

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# Abstract Archives of the RSNA, 2024

IREE-59

## SUPERSELECTIVE RADIOEMBOLIZATION FOR HEPATOCELLULAR CARCINOMA : RADIATION SEGMENTECTOMY AND BEYOND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hyo-Cheol Kim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radioembolization is an established treatment for unresectable hepatocellular carcinoma. Radioactive microspheres are preferentially deposited into the hypervascular tumor by siphoning effect so that injection of microspheres are commonly performed at the lobar artery level. However, superselective radioembolization is the best way to improve tumor response and to prevent potential complications. The purpose of this exhibit is : (1) To review the rationale of radiation segmentectomy. (2) To learn when superselective radioembolization is needed, (3) technical tips for superselective radioembolization.

### TABLE OF CONTENTS/OUTLINE

1) Radiation segmentectomy : rationale and evidence 2) Dosimetry : Practical guide for dosimetry of superselective radioembolization3) When superselective radioembolization is needed A. small single tumor : radiation segmentectomyB. Large single tumor saddling on both lobesC. Small remnant liverD. Hepatic artery branching at acute angleE. Extrahepatic collateral artery supplying the tumor4) Technical consideration of superselective radioembolization A. Protection of distal normal liver by using balloon microcatheter and detachable coil B. Combination treatment of lobar and segmental arteryC. Combination treatment of 1st and 2nd week dosing of glass microsphere5) Follow-up imaging after superselective radioembolizationA. Early loss of arterial enhancement of the tumor B. Focal radiation necrosis mimicking new hypovascular tumor

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# Abstract Archives of the RSNA, 2024

IREE-6

## IMPORTANCE OF EYE PROTECTION DURING INTERVENTIONAL RADIOLOGY PROCEDURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yohei Inaba, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Saya Ono (*Abstract Co-Author*) Nothing to Disclose
Koichi Chida, PhD (*Abstract Co-Author*) Nothing to Disclose
Satoe Konta (*Abstract Co-Author*) Nothing to Disclose
Keisuke Yamamoto (*Abstract Co-Author*) Nothing to Disclose
Ryota Shindo (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To understand the importance of eye protection by lead glasses during Interventional radiology (IR) procedures. -To discuss the radiation-shielding effects of over-glasses-type eyewear. -To compare the protection afforded by over-glasses-type and regular eyewear. -To encourage the user of prescription glasses to wear over-glasses-type eyewear. -To understand the importance of the combination use of radiation protection tools during IR procedures.

### TABLE OF CONTENTS/OUTLINE

•Characteristics of over-glasses-type eyewear •Radiation protection effect of over-glasses-type eyewear in a phantom experiment •Covered area by lead glasses and recommendation for combination use of protection tools OUTLINE: In response to the new occupational eye lens dose limit, the use of radiation protection tools such as Pb eyewear is important in IR. Over-glasses-type eyewear has a large frame and lens to fit over prescription glasses. In recent years, 0.07 mm Pb eyewear has been used. It is more lightweight and comfortable than existing 0.75 mm one. The shielding effects of lead-equivalent glasses (over-glasses-type and regular) were evaluated by placing radiophotoluminescence dosimeters inside and outside the glasses, and on the surface of the eye. The over-glasses-type eyewear exhibited better protection than regular eyewear at the irradiation angles of clinical settings. According to our phantom study, 0.07 mm Pb over-glasses-type eyewear protected left eye effectively. However, the covered area of right eye was insufficient. Further improvements of its shape and combination use of radiation protection tools are needed.

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# Abstract Archives of the RSNA, 2024

IREE-61

## PARADIGM SHIFT FROM TREATMENT TO PREVENTION IN TYPE 2 ENDOLEAK POST ENDOVASCULAR AORTIC REPAIR: CURRENT EVIDENCE AND TECHNICAL TIPS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Masashi Tamura, MD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Manabu Misu (*Abstract Co-Author*) Nothing to Disclose
Shintaro Senda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Endovascular aortic repair (EVAR) offers a minimally invasive solution for aortic aneurysms, yet introduces the unique complication called endoleaks (ELs). Type 2 (T2) ELs, characterized by low pressure, necessitate monitoring due to their potential to trigger or worsen type 1 ELs, leading to rupture. T2ELs are traditionally treated with endovascular embolization; however, this approach is frequently difficult and ineffective. Recently, preemptive branch embolization has surfaced as a promising alternative strategy. This exhibit aims to achieve three goals: (1) Reviewing the basics and recent topics of T2ELs; (2) Learning the latest evidence supporting the shift from treatment to prevention for T2ELs post EVAR; and (3) Exploring techniques of preemptive embolization to mitigate T2ELs.

### TABLE OF CONTENTS/OUTLINE

(1) Introduction: Types of endoleaks, pathophysiology, and imaging evaluation of T2ELs. (2) Treatment of T2ELs: Indications, overview of interventional techniques, treatment limitations, and case presentation. (3) Transitioning from Treatment to Prevention: Rationale, indications, review of efficacy studies, ongoing research, and future directions. (4) Techniques for Preemptive Embolization: Procedural considerations, and data on catheter selection from our institution.

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# Abstract Archives of the RSNA, 2024

IREE-62

## CT-GUIDED CRYOABLATION FOR RENAL CELL CARCINOMA: PITFALLS, AND TIPS TO ENSURE ACCURACY AND SAFETY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Nobuhiro Fujita, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Daisuke Okamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Kousei Ishigami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Keisuke Ishimatsu, MD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Makise (*Abstract Co-Author*) Nothing to Disclose
Kousuke Tabata (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Ushijima, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the basics of CT-guided cryoablation and its indications for renal cell carcinoma.To learn the practice of CT-guided cryoablation for renal cell carcinoma and how to improve effective treatment.To learn about the potential complications of CT-guided cryoablation for renal cell carcinoma and how to prevent them.

### TABLE OF CONTENTS/OUTLINE

A. Basics of CT-guided cryoablation. Principles of cryoablation Imaging modalities for targeting lesions and monitoring the treatment areaB. Indications for CT-guided cryoablation for renal cell carcinoma. Tumor size, Location, Single or multiple, Initial or secondary, Hereditary disease, Elderly patient, Patient with comorbiditiesC. Practice of CT-guided cryoablation for renal cell carcinoma. Anesthesia, Puncture under CT fluoroscopy, Positioning of the cryoprobes and monitoring of the treatment area by CT reconstruction imagingD. To ensure more effective cryoablation for renal cell carcinoma. Transarterial lipiodol marking before cryoablationE. Possible complications and how to prevent them. Hemorrhage, Renal dysfunction, Infection/abscess, Bowel injury, Ureteral injury, Pneumothroax, Abdominal pseudohernia, Dissemination, Hydrodissection for surrounding organs, Ureteral stenting to prevent ureteral injuryF. Percutaneous biopsy for histological diagnosis. Biopsy separate from cryoablationG. Pitfalls. Ice-ball crack during cryoablation, Mimicking of a recurrent lesion

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# Abstract Archives of the RSNA, 2024

IREE-63

## APPLICATIONS OF TRANSARTERIAL EMBOLIZATION IN MUSCULOSKELETAL PAIN MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Stuart E. Braverman, MD (*Abstract Co-Author*) Nothing to Disclose
Robert G. Dionisio, MD (*Abstract Co-Author*) Nothing to Disclose
Kori A. Higashiya, MD (*Abstract Co-Author*) Nothing to Disclose
Chase Glenn, MD (*Abstract Co-Author*) Nothing to Disclose
Catherine Ho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the efficacy and safety of Transarterial Embolization (TAE) in managing chronic musculoskeletal pain.

### TABLE OF CONTENTS/OUTLINE

Background: Chronic musculoskeletal pain affects up to 30% of people worldwide, often necessitating interventions beyond NSAIDs and lifestyle modifications. Transarterial embolization (TAE) is a viable option for those with persistent, refractory pain despite pharmacologic therapy or are ineligible/averse to surgery.Pathophysiology/Technique: Angiogenesis, neurogenesis, and resulting inflammation underlie many MSK pain syndromes, such as osteoarthritis (OA). TAE targets these processes by selectively embolizing major arterial supplies, mitigating inflammation and pain.Application and Results:OA and OA related bone marrow lesions (knee, hands, shoulder, facet, and SI joints)Non Osteoarthritic Synovitis (Adhesive Capsulitis and Hip Synovitis)Tendonopathy/EnthesopathyOther (Chronic Myalgia and Fibroids)Conclusion: Multiple studies demonstrate TAE as a safe and effective way to manage chronic musculoskeletal pain. Further studies are warranted to elucidate long term efficacy and broaden our understanding of chronic MSK pain pathogenesis.

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# Abstract Archives of the RSNA, 2024

IREE-64

## STOP THE BLEEDING: THERE'S MORE THAN ONE WAY TO DO IT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ryo Toya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideki Ishimaru (*Abstract Co-Author*) Nothing to Disclose
Tomoki Nakano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Effective control of bleeding is crucial to prevent severe anemia or exsanguination. In various situations, interventional radiologists frequently manage hemostasis. The methods used to achieve bleeding control have their own advantages and disadvantages. In some cases, organ ischemia is acceptable to achieve hemostasis. The skills and equipment of interventional radiologists performing hemostatic techniques can vary, and there is no standard method for achieving hemostasis. Nevertheless, any available technique can be used to control bleeding if performed correctly. This educational exhibit illustrates the different treatment options for various bleeding scenarios, emphasizing how hemostasis can be achieved based on the skill level of each interventional radiologist.

### TABLE OF CONTENTS/OUTLINE

Ischemic susceptibility of bleeding organs- Knowledge of embolic material properties: temporary / permanent- Tips for successful use of each embolic material- Hemostatic methods other than embolization: manual compression / stentgraft / thrombin- Contraindications in each situation

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# Abstract Archives of the RSNA, 2024

IREE-65

## LIVER VENOUS DEPRIVATION TO INDUCE LIVER HYPERTROPHY BEFORE MAJOR HEPATECTOMY: MATERIALS AND TECHNIQUES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Cristina Mosconi, MD (*Abstract Co-Author*) Nothing to Disclose
Lorenzo Braccischi, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vittoria Bazzocchi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Liver venous deprivation (LVD) is a safe and effective technique with low complications and rapid growth rates before major liver hepatectomy. The learning object of this educational are: to analyze different radiological interventional strategies to induce liver hypertrophy prior to surgery and explain how to perform LVD, focusing on different approaches and embolic materials, to understand the importance of maintaining a sufficient future liver remnant (FLR) volume for optimal liver function before surgery and to explain the techniques to calculate FLR.

### TABLE OF CONTENTS/OUTLINE

Careful patient selection to assess FLR before surgery is a key factor for clinical outcomes to avoid post-hepatectomy liver failure (PHLF) and mortality. CT segmentation and (99m)Tc-mebrofenin-hepatobiliary scintigraphy (HBS) are valid alternatives for evaluating remnant percentage in order to plan the need for LVD. For portal embolization, access is usually transhepatic; several embolic materials have been used, including N-Butyl-Cyanoacrylate, Ethanol, PVA microparticles, Gelfoam Sponge, Coils and Plugs. Additional embolization of the hepatic vein allows significant hypertrophy, emphasizing the potential efficacy and safety of the combined approach in hepatic interventions. Access can be percutaneous trans-hepatic, jugular or femoral, and cyanoacrylate, plugs or coils are usually employed. Other techniques include radioembolization lobectomy with Yttrium-90 or Olmium-166.

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# Abstract Archives of the RSNA, 2024

IREE-66

## THE ENHANCED MYOMETRIAL VASCULARITY - IS IT AN AVM? REVIEWING DEFINITIONS, IMAGING FINDINGS, AND INTERVENTIONAL TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gustavo V. Andrade, MD (*Abstract Co-Author*) Nothing to Disclose
Francisco Donato JR, MD (*Abstract Co-Author*) Nothing to Disclose
Otavio Augusto Ferreira Dalla Pria, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Heming, MD (*Abstract Co-Author*) Nothing to Disclose
Camila Gadens Zamboni, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Arteriovenous malformations (AVMs) are congenital abnormalities that can affect any organ or tissue in the human body, with myriad presentations in radiological studies. True uterine AVM is extremely rare, with very few cases reported worldwide. Some acquired pathologies can lead to dilated and tangled vessels, with low-resistance turbulent high-flow, mimicking an AVM. Recently described, Enhanced Myometrial Vascularity (EMV) has imaging findings very similar to uterine AVM but is acquired and usually occurs in the context of a recent pregnancy or abortion. Nevertheless, correct diagnosis is crucial for appropriate treatment. This exhibit aims: 1. To review the literature concerning this entity, depicting clinical presentation; 2. To describe imaging findings that help to diagnose them among their differentials, focusing on the importance of the Radiologist; 3. To demonstrate over 15 cases of EMVs treated by catheter embolization, discuss findings and techniques, and focus on the role of the Interventional Radiologist; 4. To highlight essential teaching points to become familiar with the diagnosis and embolization treatment of EMVs.

### TABLE OF CONTENTS/OUTLINE

1. Brief review of AVM and EMV concepts and radiological importance; 2. EMV definition, diagnostic criteria, and differentials among different radiologic imaging modalities; 3. Illustration of EMV cases treated by embolization, focusing on diagnosis and Interventional approach; 4. Conclusion and take-home messages, 5. References

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# Abstract Archives of the RSNA, 2024

IREE-67

## UNLOCKING INSIGHTS: THE ROLE OF FISTULOGRAPHY IN PERIPANCREATIC COLLECTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Javiera Cornejo, MD (*Abstract Co-Author*) Nothing to Disclose
Trinidad Castro (*Abstract Co-Author*) Nothing to Disclose
Marcelo Castro, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Maximiliano Klinkert (*Abstract Co-Author*) Nothing to Disclose
Diana Saavedra Bissett (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Acute necrotizing pancreatitis (ANP) affects 15% of cases and raise mortality to 30%, often requiring intensive care, readmissions, and invasive treatments.The management of complex fluid collections in ANP has evolved, with many medical centers adopting a "Step-up approach". This strategy begins with percutaneous drainage and minimally invasive techniques, succeeding approximately 50-60% of the time. This step can serve as both a definitive treatment or a bridge to more invasive procedures.Fistulization is a feared complication, being necrosis and infection a risk factor. Pancreatic cutaneous fistulas initially involves conservative measures, as many may spontaneously close. However, communication with surrounding structures as gastrointestinal tract, can lead to malnutrion, bleeding, and infections.While fistulography via CT is valuable for detecting postoperative pancreatic fistulas after pancreaticoduodenectomy, its efficacy for fistulas related to ANP during the percutaneous drainage stage is not well established. Nevertheless, this procedure aids in diagnosing and monitoring fistulas, providing crucial anatomical insights.This presentation aims to diagram the technique and showcase cases where CT fistulography is performed during percutaneous drainage of peripancreatic collections, enhancing the efficacy and safe of it for future studies.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

IREE-68

## PRECISION WITHOUT INCISION: EXPLORING ABLATION TECHNIQUES IN UTERINE FIBROID TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Patricia Rosseto Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio d. Meira, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Barbara d. Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Renata Nabeiro Dias Angelo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcello Giovanni Messias Da Silva, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1- Discuss the different minimally invasive techniques available for treating uterine fibroids.2- Evaluate the effectiveness and safety profiles of each technique.3- Review patient selection criteria and outcomes for fibroid ablation.

### TABLE OF CONTENTS/OUTLINE

1) Introduction1a: Overview of uterine fibroids and the burden of disease.1b: Introduction to minimally-invasive ablation techniques as treatment options.2) Ablation Techniques2a: Exploration of MRgFUS, RFA, and other emerging ablation technologies.2b: Mechanism of action and important procedural details for each technique.3) Effectiveness and Safety3a: Explore effectiveness and safety data across different ablation methods.3b: Brief discussion of common and rare complications associated with each technique.4) Patient Selection4a: Criteria for selecting suitable candidates for minimally-invasive procedures.4b: Considerations based on fibroid size, location, and patient symptoms.5) Clinical Outcomes5a: Long-term outcomes and quality of life improvements post-ablation.6) Future Directions6a: Recent advancements and ongoing research in fibroid ablation.6b: Possible recommendations for patient selection.6c: Potential future technologies and their expected impact on treatment paradigms.7) Conclusion7a: Summary of current knowledge on fibroid ablation as a safe and effective treatment option.

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# Abstract Archives of the RSNA, 2024

IREE-69

## CENTRAL VENOUS ENDOVASCULAR RECONSTRUCTION FOR SVC OBSTRUCTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose
LeAnn S. Stokes, MD (*Abstract Co-Author*) Nothing to Disclose
Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
William R. Winter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:1. To review the clinical indications of central venous endovascular reconstruction of the superior vena cava and brachiocephalic vein2. To demonstrate proper techniques for central venous endovascular reconstruction in cases of benign SVC syndrome3. To review complications of central venous endovascular reconstruction

### TABLE OF CONTENTS/OUTLINE

1. Indications for central venous reconstructiona. Patients with symptoms (facial swelling, orthopnea) from SVC/central venous occlusion due to:i. Chronic indwelling pacemakers, hemodialysis catheters, central venous cathetersii. Benign tumors - thyroid goiteriii. Fibrosing mediastinitisiv. Sarcoidosisb. Prior to placement of central venous catheters/dialysis catheters in patients with chronic central venous occlusionc. Malignant causes of SVC syndrome refractory to tumor treatmenti. Bronchogenic carcinoma, lymphoma, sarcoma, metastatic disease, among others2. Approach to central venous reconstructiona. Venous access site selection - typically internal jugular or subclavian, possibly with femoral accessb. Venographyc. Wire and/or sharp recanalizationd. Balloon venoplasty and stent placement3. Complicationsa. Immediate/Short term:i. Localized pain, puncture site hematomaii. Arrhythmiaiii. Hemoptysis, hematemesisiv. Pulmonary edemav. Pulmonary embolismvi. Cardiac tamponade due to iatrogenic SVC perforationb. Intermediate/Long term:i. Restenosisii. Stent occlusioniii. SVC syndrome recurrence

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# Abstract Archives of the RSNA, 2024

IREE-7

## FROM SUBJECTIVE TO OBJECTIVE: REDEFINING CATHETER EMBOLIZATION SUCCESS WITH BLOOD FLOW VELOCITY VALIDATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Masaru Shiotani, RT (*Abstract Co-Author*) Nothing to Disclose
Keizo Murakawa (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Akiyuki Kotoku, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroki Horinouchi (*Abstract Co-Author*) Nothing to Disclose
Teruhito Hayashi (*Abstract Co-Author*) Nothing to Disclose
Kazuki Hara, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Though the emergence of novel endovascular therapeutic devices like the Amplatzer Vascular Plug (AVP) and the Woven EndoBridge (WEB) has expanded our options for embolization procedures, we still rely on subjective analysis of angiography to determine completion, based on our experience. However, sometimes vessel flow recanalization occurs during follow-up, highlighting the need for a more precise, quantitative approach to angiography. In response, we developed a quantitative analysis method called mqDSA. In this presentation, we aim to compare the pros and cons of various methods, including MRI, ultrasound, and quantitative DSA. Our perspective underscores the necessity of adopting quantitative methodologies like mqDSA, which offer a more objective and reliable assessment, ultimately enhancing treatment outcomes and patient care.

### TABLE OF CONTENTS/OUTLINE

1. Angiography (DSA) for Flow Velocity EvaluationPros: In-room feasibility and instant assessment and new quantitative method (mqDSA)Cons: Ionizing radiation exposure and contrast medium requirement.2. MRI-Based Flow Velocity EvaluationPros: Spatial resolution and non-invasiveness.Cons: Inaccessibility during procedures and susceptibility to artifacts.3. Ultrasound for Flow Velocity EvaluationPros: Portability and real-time measurement.Cons: Operator skill dependency and limited acoustic windows.4.Comparative Analysis of Flow Velocity Measurement TechniquesUsing graphical representations, we compare flow velocity measurement techniques (MRI, ultrasound, and angiography), showing their relationship to actual flow, for accuracy assessment.5.Clinical ApplicationsCase Studies: Practical implementations of mqDSA.

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# Abstract Archives of the RSNA, 2024

IREE-70

## UNDER PRESSURE: THE TOOLS AND TECHNIQUES TO A SUCCESSFUL ANGIOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shane N. Newberger, MD (*Abstract Co-Author*) Nothing to Disclose
Arif Musa, MD, MS (*Abstract Co-Author*) Research Grant, Stryker Corporation;Contract, WebMD Health Corp (WebMD, Inc)
Ali N. Harb, MD (*Abstract Co-Author*) Nothing to Disclose
Brigitte Berryhill, DO (*Abstract Co-Author*) Nothing to Disclose
Shriya Veluri (*Abstract Co-Author*) Nothing to Disclose
Carson Middlebrook (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This exhibit aims to educate on mesenteric angiography in emergency settings. The focus of this exhibit will be an overview of the conventional and suture techniques to form a reverse curve for access into the mesenteric aortic branches to capture an angiogram. It will also include a background on mesenteric angiography, common curve catheters and their respective characteristics guiding selection, and a review of the mesenteric vasculature with examples of extravasation.

### TABLE OF CONTENTS/OUTLINE

Background/Indications:The purpose of mesenteric angiography in diagnosing and treating active gastrointestinal (GI) bleeds with indications for performing angiography in such cases.Catheter Selection:Review of catheter properties that help guide selection for angiography. The catheters discussed: Cobra, Headhunter, Angle Taper, Simmons, and Mikaelsson.Techniques:Discussion of two mesenteric angiography techniques - conventional angiography technique over the aortic arch and the suture angiography technique. This will include step-by-step images for each technique and their advantages and disadvantages.Anatomy Overview:Presentation of angiogram cases on the Celiac, SMA, and IMA arteries and their branches with labeled anatomy and examples of extravasation. Additionally, a demonstration of a helpful tip to confirm proper catheter positioning before contrast injection will be provided.Conclusion:Participants will gain the necessary skills to select appropriate catheters for angiography, effectively use various mesenteric angiography techniques to form a reverse curve for obtaining quality and timely results, and develop a comprehensive understanding of mesenteric vascular anatomy.

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# Abstract Archives of the RSNA, 2024

IREE-71

## INTERVENTIONAL TREATMENT OF SYMPTOMATIC CHRONIC EXTRA-HEPATIC PORTAL VEIN OBSTRUCTION (EHPVO) IN NON CIRRHOTIC PATIENTS: TIPS AND TRICKS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Alban L. Denys, MD (*Abstract Co-Author*) Consultant, BTG International LtdGrant, BTG International LtdConsultant, Terumo Corporation
IGNACIO ANDRES CANO, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To review the indications of interventional management of EHPVO.- To know the different steps and tips and tricks to perform a successful portal vein recanalization (PVR).- To review the results and complications that can occur during and after PVR.

### TABLE OF CONTENTS/OUTLINE

EHPVO is a challenging condition frequently associated with portal prehepatic hypertension that can lead to variceal bleeding, portal biliopathy and ascites. In recent years, PVR alone or associated to TIPS has emerged as a promising treatment option for non cirrhotic patients with chronic EHPVO.Interventional treatment should be reserved to symptomatic patients, therefore a careful evaluation including gastroscopy for variceal staging, liver blood tests and an anatomical evaluation of the hepatic, portal, mesenteric and splenic veins which is usually performed by contrast enhanced CT with or without abdominal ultrasound and Doppler evaluation.PVR without TIPS is the preferred option when intrahepatic branches are patent (Marot classification 1 or 2). The access route to the portal system depends on the anatomical situation but is preferably done through the anterior sector oh the portal veins. TIPS is added to PVR only if the intrahepatic branches have a poor quality and if the portosystemic pressure gradient remains high after PVR.Direct access via the mesenteric or splenic vein is a problem solving when the liver access is failed or is not possible. Catheters, techniques and tips to recanalize the occluded atrophic portal vein will be discussed.In conclusion, PVR is a valuable option for patients with chronic PVT. Operators should be familiar with the indications, pre-procedural planning, and techniques for performing a successful PVR.

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# Abstract Archives of the RSNA, 2024

IREE-72

## "ICE, ICE BABY": REVIEW OF BEST PRACTICES OF CRYOABLATION FROM HEAD TO TOE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lena Khanolkar (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Andrew J. Marsala II, MD (*Abstract Co-Author*) Nothing to Disclose
Reza Imani-Shikhabadi, MD, MS (*Abstract Co-Author*) Nothing to Disclose
William R. Winter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Meaghan Dendy, MD (*Abstract Co-Author*) Nothing to Disclose
Nate D. Kelm, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Voutsinas, MD (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Brian M. Fagel, MD (*Abstract Co-Author*) Nothing to Disclose
Demetrios Geanon, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan D. Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Abdalla, BS (*Abstract Co-Author*) Nothing to Disclose
Claire White-Dzuro (*Abstract Co-Author*) Nothing to Disclose
Atlee Witt (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is: 1. To detail different cryotherapy techniques dependent on anatomy of interest 2. To explore the indications, contraindications, and potential complications of cryotherapy 3. To analyze the efficacy of cryotherapy versus alternative treatments

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Mechanism of action i. Cellular destruction via rapid freezing and thawing [1. Mechanical 2. Osmotic 3. Ischemic] b. Indications for cryotherapy i. Non-surgical candidate for local control of primary tumor or metastasis ii. Salvage therapy for locally recurrent disease iii. Palliative therapy c. Contraindications for cryotherapy i. Relative [1. Underlying coagulopathy 2. Bowel, vasculature, or other structures at high risk for non-target injury] ii. Absolute [1. Extensive local tumor volume] d. Alternative treatment approaches i. Radiofrequency ablation ii. Microwave ablation iii. Chemical ablation iv. Open surgical resection 2. Procedure a. Equipment i. 14g/17g cryoprobes ii. Biopsy supplies iii. Hydro-dissection supplies, if needed [1. 21g Chiba needle 2. Saline vs. contrast]) b. Pre-procedure i. Consent ii. Foley catheter or pyleoperfusion iii. Pre-operative embolization (if needed) iv. Preliminary CT v. Site identification and preparation c. Potential Sites i. Kidney ii. Lung iii. Bone iv. Soft Tissues (Desmoid, Endometrioma) v. Lymph Nodes vi. Adrenal Gland vii. Nerves d. Technique (site dependent) i. Freeze-thaw cycles ii. The "stick" technique iii. Track ablation e. Post-procedure i. Recovery ii. Infection prevention f. Complications i. Post-procedure bleeding ii. "Cryoshock" cytokine release iii. Pain and swelling iv. Incomplete therapy

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# Abstract Archives of the RSNA, 2024

IREE-73

## AN EX-VIVO TRAINING MODEL FOR KIDNEY EMBOLIZATION UTILIZING DIFFERENT EMBOLIC MATERIALS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jorge E. Lopera, MD (*Abstract Co-Author*) Shareholder, Tecnostent SA;Consultant, Merit Medical Systems, Inc;Research Grant, AngioDynamics, Inc
John A. Walker, MD, PhD (*Abstract Co-Author*) Speaker, Shionogi & Co, Ltd;Consultant, Shionogi & Co, Ltd
Carlos B. Ortiz, MD (*Abstract Co-Author*) Consultant, Argon Medical Devices, Inc
Marina Borrego, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Discuss the benefits of simulation-based training. Discuss current training models available for kidney embolization. Describe a new teaching model for learning kidney embolization using different embolic materials.

### TABLE OF CONTENTS/OUTLINE

Introduction. Discuss current embolization training models. Review a kidney embolization clinical case to compare training model similarities. Set-up for a newly developed ex vivo porcine kidney model. Review different embolic materials that can be used to teach kidney embolization utilizing the training model (Gelfoam, Glue, Microspheres , Obsidio, Coils). Conclusion: Incorporating simulation into medical training can provide an opportunity for additional hands-on training, without patient risk. This training model exposes operators to the techniques for kidney embolization using a variety of embolic materials.

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# Abstract Archives of the RSNA, 2024

IREE-74

## INTERVENTIONAL MANAGEMENT OF PULMONARY ARTERIOVENOUS MALFORMATIONS : TRICKS OF THE TRADE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Eric Therasse, MD (*Abstract Co-Author*) Research Consultant, SoundBite Medical Solutions
Pierre Perreault, MD (*Abstract Co-Author*) Consultant, Abbott Laboratories
Marie-France Giroux, MD (*Abstract Co-Author*) Stockholder, Abbott Laboratories
Louis Bouchard, MD (*Abstract Co-Author*) Nothing to Disclose
Gilles P. Soulez, MD, MSc (*Abstract Co-Author*) Speaker, Siemens AG;Research Grant, Siemens AG;Research Grant, Cook Group Incorporated;Advisory Board, Cook Group Incorporated;Patent agreement, Cook Group Incorporated;Research Grant, ViTAA Medical Solutions Inc;Advisory Board, ViTAA Medical Solutions Inc
Ricardo H. Do Amaral (*Abstract Co-Author*) Nothing to Disclose
Marin Halut, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Learn imaging findings of pulmonary arteriovenous malformations (PAVM) and present the PAVM classification based on angioarchitecture.Highlight the physiopathology of PAVM, the association with hereditary hemorrhagic telangiectasia and the need for screening.Recognize the indication for PAVM embolization.Learn how to embolize PAVM safely and prevent paradoxical embolization.Understand how to prevent and treat PAVM persistence after embolization.Assess the results of PAVM embolization on follow-up imaging and detect reperfusion.

### TABLE OF CONTENTS/OUTLINE

PAVMs angioarchitecture and classification.PAVM and hereditary hemorrhagic telangiectasia.PAVM pathophysiology and associated complications.Clinical and imaging evaluation before PAVM treatment.Presentation of the relative role of the different imaging modalities chest X-Ray, echocardiography, chest CT, chest Angio-CT and DSA.Indications for PAVMs treatment.PAVM management in pregnant women.Embolization techniques:Presentation of the different embolization material and their use according to the PAVM angioarchitecture (simple PAVM, complex PAVM, and diffuse PAVM).Presentation of the material and techniques to prevent complication.Identification of the different types of PAVM persistence and how to treat them.The safe use of mechanical agent regarding the risk of paradoxical migration.Navigation techniques to access PAVMs safely and to prevent hemoptysis.Clinical and imaging follow-up protocol and criteria to assess outcome.

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# Abstract Archives of the RSNA, 2024

IREE-75

## CREATION OF A MULTIDISCIPLINARY CARE APPROACH FOR TREATMENT OF METASTATIC SPINAL TUMORS: A SINGLE-CENTER INSTITUTIONAL EXPERIENCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nima Kokabi, MD (*Abstract Co-Author*) Research support, Sirtex Medical Ltd;Consultant, Sirtex Medical Ltd;;
Nicole A. Keefe, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Gad, BSc, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Creation of a multidisciplinary care framework for patients with spinal tumor.Understanding how Interventional radiology fits into a multidisciplinary care framework for patients with spinal tumors.

### TABLE OF CONTENTS/OUTLINE

Sixteen percent of all patients with metastatic cancer develop metastasis to the spine in their lifetime,which is often painful.Additionally, 1 out of 8 patients with spinal metastases develop pathologic vertebral compression fractures.While there are several effective therapies for metastatic bony spinal tumors, optimal care requires a multidisciplinary approach for individualized patient care. Interventional radiology plays an increasingly critical role in the management of patients with metastatic bony spinal tumors. At our institution, we have established a spine oncology Center of Excellence further supported with a Spine Oncology Tumor Program. A fellowship-trained spine oncology neurosurgeon leads the program and includes neurooncology, interventional radiology, radiation oncology, neuroradiology, pain anesthesia and medical oncology. The specialists meet twice monthly to discuss optimal treatment strategies. Management options may include biopsy, surgical resection, radiation treatment,chemotherapeutic agents, and interventional procedures such as include vertebral augmentation plus radiofrequency ablation (RFA). Spinal Tumor boards are not widely implemented across the country, and there are no set standards regarding which specialists are invited to be part of the spinal tumor board. This broad group of spine oncology specialists has proven to provide well-rounded streamlined care which fosters collaboration and interdisciplinary education.

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IREE-76

## BENIGN THYROID NODULES: A COMPREHENSIVE ANALYSIS OF THERMAL ABLATION AS AN EFFECTIVE TREATMENT ALTERNATIVE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rodrigo G. Garcia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Erivelto M. Volpi (*Abstract Co-Author*) Nothing to Disclose
Victor Arthur Ohannesian (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Antonio Rahal Junior (*Abstract Co-Author*) Nothing to Disclose
Luiz Nascimento (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Benign Thyroid Nodules and Symptoms: Benign thyroid nodules are common and can cause symptoms like dysphagia and dysphonia due to their size and location.- Autonomous Nodules: Some thyroid nodules exhibit autonomous behavior, producing excess thyroid hormone and resulting in hyperthyroidism.- Traditional Treatments vs Thermal Ablation (TA): Historically, thyroid nodules were managed with surgery or radioiodine therapy, often leading to gland removal and subsequent need for thyroid hormone replacement. TA techniques like radiofrequency ablation (RFA) or microwave ablation (MW) are emerging as minimally invasive alternatives that preserve gland function.- Advantages of Thermal Ablation (TA): TA offers benefits such as no visible scars, local anesthesia, sedation during the procedure, and quick recovery time, while maintaining hormonal function.- Efficacy of Thermal Ablation (TA): TA typically achieves a significant reduction in nodule volume, with a 50% volume reduction within 3 to 6 months and up to 90-95% reduction within 12 months. For autonomous nodules causing hyperthyroidism, thyroid-stimulating hormone (TSH) levels normalize within 60 days post-ablation.

### TABLE OF CONTENTS/OUTLINE

I. Introduction: Prevalence of Benign Thyroid Nodules Symptoms and Complications, Treatment Options: Surgery, Radioiodine Therapy, Thermal Ablation (TA).II. Methods: Use of Departmental Images, Extensive Bibliographic Review.III. Discussion: Presentation of Symptomatic Benign Thyroid Nodules and Traditional Treatment Approaches.IV. Conclusion: Recognition of TA as First-Line Treatment for Symptomatic Benign Thyroid Nodules.V. Limitations and Eligibility Factors for Thermal Ablation (TA).

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# Abstract Archives of the RSNA, 2024

IREE-77

## RENAL ABLATION COMPLICATIONS: WHAT TO EXPECT AND HOW TO HANDLE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcos R. Menezes, MD (*Abstract Co-Author*) Nothing to Disclose
Regis Otaviano Bezerra, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Guilherme L. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor Nascimento, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Amr Kalander, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Vivas Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Joao S. Pais, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A brief review of renal ablation techniques, indications and normal imaging evolution;To understand the incidence of the main complications, when to expect each type and how to handle each one.

### TABLE OF CONTENTS/OUTLINE

Renal ablation has become a pivotal intervention in the management of renal masses, due to an escalating incidence of incidentally detected lesions, which account for approximately 67% of cases.Renal ablation offers numerous advantages, including reduced morbidity, enhanced parenchymal preservation and shorter hospital stays. The main therapeutic armamentarium encompass thermal ablation techniques such as Radiofrequency Ablation (RFA), Microwave Ablation (MWA), and Cryoablation (CRYO), without significant disparities in complication rates between them.Treatment assessment post-ablation involves meticulous evaluation of the ablation zone, characterized by a hypoattenuating area without enhancements, with a recommended margin of 5-10 mm to ensure complete lesion eradication. Complications, with an incidence of up to 12.9%, such as hemorrhage, hematuria, collecting system injury and pneumothorax, predominantly manifest as Clavien-Dindo grade I events.In conclusion, renal ablation is a cornerstone in renal oncology, representing a valuable therapeutic options, offering favorable outcomes with minimal morbidity. Understanding the nuances of treatment assessment, complication prediction, and management is imperative for optimizing patient care.

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# Abstract Archives of the RSNA, 2024

IREE-78

## CHOLANGIOSCOPY - WHEN IS IT TIME TO SCOPE THE BILIARY TREE?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Kenechukwu Okoye, MEng, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Cholangioscopy allows for direct visualization of the biliary tree via the use of an endoscope during ERCP 2. Cholangioscopy is a safe and effective approach for the treatment and diagnosis of pancreaticobiliary disease, as well as for surgical planning in cases of cholangiosarcoma. 3. While regarded as safe, there are known risks. In addition to standard practices, there are strategies and technique that can be considered to minimize risk and maximize chances of success depending on the intervention. Alternative methods to cholangioscopy may be considered for each aforementioned indication, based on clinical factors.

### TABLE OF CONTENTS/OUTLINE

1. Background: The varying indications for cholangioscopy - why perform one? When is it time to reach for one? a. Diagnosis of biliary pathology - typically following equivocal ERCP i. Radiolucent or otherwise unseen stones on cholangiography ii. Advanced biliary disease ie PSC making other diagnostic procedures difficult iii. Concern for malignancy iv. Comparison to other diagnostic approaches, methods, indications, risk/benefit profile v. Decision algorithm(s) for diagnostic cholangioscopy b. Treatment of gallstones (eg electrohydraulic, laser lithotripsy) c. Deployment of stents d. Collecting biopsy e. Preoperative planning 2. Technical steps including patient preparation, details, equipment, 3. Case(s) review from The Ohio State University Wexner Medical CenterPatient safety, contraindications, pearls and pitfalls.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

IREE-8

## DEVELOPING ARTERIAL EMBOLIZATION IN LOW-INCOME COUNTRIES: THE FAIREMBO PROJECT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Julien Panneau (*Abstract Co-Author*) Nothing to Disclose
Pauline Brige (*Abstract Co-Author*) Nothing to Disclose
Vincent Vidal Sr, MD (*Abstract Co-Author*) Nothing to Disclose
MATHIEU DI BISCEGLIE (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Describe the main limitations to the development of interventional radiology in low-income countries. - Propose an embolization agent that is available, effective, and safe.- Promote the formation of interventional radiology teams.

### TABLE OF CONTENTS/OUTLINE

1. Main limitations to the development of interventional radiology in low-income countries.• Significant morbidity and mortality due to the lack of development of IR techniques in low-income countries• A lack of material resources in particular on embolic agents• A lack of interventional radiologists resources2. Suture as an available, effective and safe embolic agent• Suture fragment as torpedo for proximal embolization in a preclinical model• Suture-based microparticles for distal embolization in a preclinical model• Absorbable suture for transient embolization in postpartum preclinical model• Reported clinical cases of suture use as an embolic agent : renal pseudoaneurysm embolization and postpartum hemorrhage embolization3. Formation of interventional Radiology teams• On-site missions (Senegal, Ivory Coast, Cameroon) to train local radiologists and X-ray technicians: hands-on and clinical cases• Autonomous implementation and execution of IR procedures

RSNA 2024
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# Abstract Archives of the RSNA, 2024

IREE-9

## RADIOFREQUENCY ABLATION (RFA) AND ETHANOL ABLATION FOR BENIGN THYROID NODULES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Matthew Abad-Santos (*Abstract Co-Author*) Nothing to Disclose
Harneet Sangha (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiofrequency ablation (RFA) and ethanol ablation are two minimally invasive procedures that target benign nodules of the thyroid. Treatment is aimed at ablating abnormal cells via heat created by high frequency electric current in (RFA) and Alcohol injections result in dehydration and destruction of benign mass. The purpose of this exhibit is to provide a brief history and role of Thyroid Ablation (RFA) / alcohol injections for treatment of benign nodules by reviewing existing literature, while also using cases to emphasize the importance of (RFA) and alcohol ablation. Additionally, expressing the indications, contradictions and outcomes of (RFA) and alcohol ablation. Finally reviewing the preoperative and postoperative guidelines for patients undergoing (RFA).

### TABLE OF CONTENTS/OUTLINE

1. History of (RFA) and ethanol ablation and mechanism 2. Assessment of cases, including key management strategies and indications for ablation procedures and alcohol injections. 3. pre-procedural imaging and investigations, procedural techniques, outcomes, post-procedural follow-up, and complications. 4. Preoperative and postoperative guidelines as well as description of procedure. 5. Case based discussion and contraindications.

# Abstract Archives of the RSNA, 2024

MKEE

**Musculoskeletal Imaging Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## MKEE-1 ADVANCED APPROACHES TO AN AGGRAVATING ARTHROPATHY: DIAGNOSING GOUT WITH US, DECT, AND MRI

Takeshi Fukuda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Helen Kwon (*Abstract Co-Author*) Nothing to Disclose
Alexander H. Dills, DO (*Abstract Co-Author*) Nothing to Disclose
Robert Freund, MD (*Abstract Co-Author*) Nothing to Disclose
Akira M. Murakami, MD (*Abstract Co-Author*) Nothing to Disclose
Daichi Hayashi, MD, PhD (*Abstract Co-Author*) Author with royalties, Wolters Kluwer nv
Megan Kenway, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1 - Review the pathophysiology of gout and the typical findings on planar imaging2 - Review the principles of DECT and mapping of monosodium urate (MSU) crystal deposits3 - Show the classic findings of gout on US, dual-energy CT (DECT), and MRI4 - Demonstrate common artifacts and mimics of gout on US, DECT, and MRI5 - Outline methods of reducing artifact and distinguishing gout from mimics on US, DECT, and MRI6 - Compare and contrast the utility of US, DECT, and MRI in detecting Gout

### TABLE OF CONTENTS/OUTLINE

- Epidemiology and history of gout, including typical presentation, diagnosis, and management- Classic examples of early and advanced gout on radiograph- Alternative imaging options, and the body regions they are the most useful in- Review of DECT physics and examples of the resultant MSU maps- Examples of typical findings of gout on DECT in soft-tissue windows and MSU maps- Examples of mild disease and atypical locations of gouty tophi- Overview of DECT artifacts that cause incorrect mapping of MSU deposits- Keratin in nailbeds and callous- Metal foreign bodies, implanted hardware, and external devices- Methods of reducing artifact and troubleshooting incorrect MSU mapping- Examples of typical findings of gout on US, nonspecific and specific- Artifacts and mimics of gout on US- Examples of typical findings of gout on MRI- Limits of MRI for evaluation of gout, and tools to increase specificity- Final comparison of DECT, US, and MRI, strengths, vs weaknesses

## MKEE-10 AGING AND INFLAMMATION: INSIGHTS INTO INFLAMMATORY MUSCULOSKELETAL DISEASES IN THE ELDERLY

Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Damaris V. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Herrera VI, MD, BA (*Abstract Co-Author*) Nothing to Disclose
VINICIUS R. BRAMBILLA, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia dos Reis Morimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The demographic shift towards an aging population presents novel healthcare challenges, notably in diagnosing and managing musculoskeletal conditions. Advanced age heightens susceptibility to various inflammatory musculoskeletal disorders, due to a chronic pro-inflammatory status and immune system dysregulation. Additionally, the elderly population are susceptible to adverse effects from polypharmacy, immunosuppressive responses, and drug-induced myopathies. Furthermore, tumors can predispose individuals to musculoskeletal inflammatory responses via the secretion of inflammatory cytokines and modulation of the immune system (paraneoplastic syndromes).The initial presentation of inflammatory conditions in elderly often presents lacking conventional radiological markers or prominent laboratory abnormalities. Discriminating between the insidious onset of inflammatory musculoskeletal disorders and degenerative changes poses a radiological challenge. Radiologists play a pivotal role in this scenario, serving as key contributors to the recognition of such conditions, thereby preventing irreversible disability and preserving the quality of life in the elderly population.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. The immune system of the elderly3. Multimodality imaging and approach4. Rheumatological Diseasesa) Rheumatoid Arthritisb) Enthesopathiesc) Rheumatica Polymyalgia5. Crystal Arthropathies a) Goutb) Calcium Pyrophosphate Deposition Disease 6. Inflammatory Myopathies a) Polymyositis and Dermatomyositis b) Inclusion Body Myositis 7. Paraneoplastic Syndromes a) Paraneoplastic Arthritis b) Hypertrophic Osteoarthropathy8. Miscellaneous 9. Conclusion

## MKEE-100 GLUTEAL CONTOUR IMPROVEMENTS FOR MUSCULOSKELETAL RADIOLOGY

**Awards**
**Certificate of Merit**

Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme B. Rocha, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:1. To review normal anatomy of the buttocks; 2. To discuss the possibilities of gluteal contour improvements, including lipoinjection and implantation; 3. To discuss some of the post treatment complications and their imaging correspondence

### TABLE OF CONTENTS/OUTLINE

Normal gluteal anatomyLipoinjectionGluteal implantationComplications of gluteal contouring surgical procedures, focusing on imaging findings

## MKEE-101 IMAGING OF KNEE ARTHROPLASTY: WHAT THE RADIOLOGIST NEEDS TO KNOW

**Awards**
**Certificate of Merit**

Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Dhilip Andrew, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Learn about different types of knee arthroplasties and arthroplasty implants used in routine practice.
- Gain knowledge of the pre-operative planning and measurements for knee arthroplasty including AI-generated automated limb angular and linear measurements.
- Improve knowledge and understanding about knee arthroplasty-related complications and their various imaging appearances.

### TABLE OF CONTENTS/OUTLINE

- Review relevant clinical anatomy, indications, surgical details of different types of arthroplasties.
- Discuss the role of multimodality imaging and role of validated AI-generated measurements for preoperative planning of knee arthroplasty and follow-up imaging for monitoring of complications.
- Case-based illustration of normal and abnormal findings on knee radiographs and cross-sectional images for monitoring such patients post-operatively.
- Normal appearances
- Common complications
- Implant specific complications.

## MKEE-102 THE ISSUE IS THE TISSUE: CT FINDINGS OVERLOOKED ON SOFT TISSUE WINDOWS IN LOWER EXTREMITY IMAGING

Cornelia B. Wenokor, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas Ardekani, DO (*Abstract Co-Author*) Nothing to Disclose
Justin Newman, DO (*Abstract Co-Author*) Nothing to Disclose
Garrett Yoon, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Reviewing commonly overlooked soft tissue pathology that can be clearly demonstrated with soft tissue window settings, particularly in cases of traumatic musculoskeletal injuries. 2. Illustrating and discussing the clinical significance of these findings; for instance, reporting tendon entrapment to aid in surgical planning. 3. Advocating for the use of CT imaging in making early time-sensitive findings on soft tissue windows, potentially avoiding the use of costly additional imaging modalities including MRI.

### TABLE OF CONTENTS/OUTLINE

1. Bone Marrow Pathology (Fracture, Marrow Infiltrative Disease). 2. Subcutaneous and Muscle Pathology (Compartment Syndrome, Morel-Lavallée Lesion, Muscle Tear, Hematoma, Thoracolumbar Fascia Tear, Accessory Soleus Muscle). 3. Ligament Pathology (Ligament Tears, Avulsion Injuries). 4. Meniscal and Knee Capsular Pathology. 5. Tendon Pathology (Entrapment, Rupture, Dislocation). 6. Nerve Pathology (Baxter's Neuropathy, Nerve Transection, Fibrolipomatous Hamartoma).

## MKEE-103 RECTUS FEMORIS: ANATOMY, PATTERNS OF INJURY AND IMAGING FEATURES

Brady K. Huang, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiane C. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Milanne Trottier, MD (*Abstract Co-Author*) Nothing to Disclose
Dyan V. Flores, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Rectus femoris injuries are common in many sports particularly soccer and rugby, and are the second or third most common thigh muscle strains after hamstring tears. Articles have described the complex anatomy and patterns of injury to various components of the rectus femoris, although lesser known entities like pseudodegloving and posterior fascia injuries have not been described.The objectives of this education exhibit are:1. Review the anatomy of the rectus femoris tendon muscle complex2. Describe and illustrate imaging features of injury to each component 3. Understand patterns of injury, implications to management and return to play

**TABLE OF CONTENTS/OUTLINE**

ANATOMYSITES OF INJURY AND IMAGING FEATURES Origin (bony and soft tissue avulsion) Direct head myofascialIndirect head myotendinous junction(feathery and bull's eye appearances)Muscle bellyIntramuscular degloving PseudodeglovingPosterior fasciaINJURY GRADING IMPLICATIONS TO RETURN TO PLAY

## MKEE-104 SCAPHOID FRACTURE: CLASSIFICATION, IMAGING, COMPLICATIONS AND TREATMENT

**Awards**
**Certificate of Merit**

Kawanpreet S. Rakhra, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Juvel Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Dyan V. Flores, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The scaphoid is the most commonly fractured carpal bone, typically following a fall on an outstretched hand in a young or middle-aged adult. Majority (65%) of scaphoid fractures involve the waist, with the next most common location (15%) being the proximal pole. The unique distal-to-proximal flow of the scaphoid's blood supply predisposes the larger proximal pole to complications to avascular necrosis. Other complications like delayed union or non-union can also occur. The radiologists plays an instrumental role in scaphoid fractures from diagnosis, detection of complications, to preoperative and postoperative assessment. The objectives of this educational exhibit are:1. To review scaphoid anatomy, particularly those unique to the bone (i.e., dual blood supply, lack of periosteum)2. To illustrate scaphoid fracture complications and their imaging appearances 3. To discuss treatment options and indications

**TABLE OF CONTENTS/OUTLINE**

SCAPHOID ANATOMY • Blood supply SCAPHOID FRACTURE • Mayo classification • Herbert and Fisher classification • ACR criteria for imaging of a scaphoid fracture • Complication: Malunion (delayed union and non-union) • Complication: Avascular necrosis • Complication: Scaphoid non-union advanced collapse • Imaging of complications TREATMENT • Management considerations for proximal versus distal scaphoid fracture • Casting versus internal fixation • Bone grafts: nonvascularized versus vascularized • Post-operative imaging evaluation OTHER TRAUMATIC CONDITIONS • Scapholunate instability • Other forms of carpal instability involving the scaphoid

## MKEE-105 WHAT'S IN A NAME? EPONYMOUS FRACTURES: IDENTIFICATION, SURGICAL IMPLICATIONS, AND HISTORICAL RELEVANCE

Parker Brown, MD (*Abstract Co-Author*) Nothing to Disclose
Anisha Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Jeremiah R. Long, MD (*Abstract Co-Author*) Nothing to Disclose
Paul Chroneos, MD (*Abstract Co-Author*) Nothing to Disclose
Logan Haug, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Demonstrate the named fractures and fracture-dislocation injuries of the upper and lower extremities. Differentiate similar fracture or fracture-dislocation patterns (Essex-Lopresti, Monteggia, and Galeazzi and Rolando, Bennett, and Pseudo-Bennett) and fractures occurring in close anatomic proximity such as at the 5th metatarsal base: stress fractures, Jones, and pseudo-Jones injuries. Emphasize injuries that can occur concurrently with eponymous fractures such as ACL and meniscal injury with Segond fractures. Highlight imaging findings (degree of displacement, articular surface involvement, articular step off, comminution, and degree of dislocation) relevant to clinical or orthopedic management and decision-making. Briefly note the historical individuals credited with the original descriptions of these fractures.

**TABLE OF CONTENTS/OUTLINE**

Upper Extremity: Thumb Base: Rolando, Bennett, Pseudo-Bennett Wrist: Barton, Colles, Hutchinson, and Smith Forearm: Essex-Lopresti, Galleazi, and Monteggia Shoulder: Hill-Sachs and Bankart. Lower Extremity: 5th Metatarsal Base: Stress, Jones, Pseudo-Jones (avulsion) Midfoot: Chopart, Lisfranc Talus: Cedell and Shepherd Ankle: Cotton, Dupuytren, Gosselin, Pilon, Tillaux, Maissoneuve Knee: Pelligrini-Stieda, Segond, Reverse Segond, Maissoneuve.

## MKEE-106 IMAGING PATTERNS OF SPONDYLODISCITIS: A PICTORIAL REVIEW

Trang T. Dam, MD,PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Spondylodiscitis is an infection involved disc-endplate complex, vertebral body, paravertebral tissue and epidural space. Diagnosis and treatment of spondylodiscitis can be delayed due to nonspecific signs and symptoms. 2. Magnetic resonance imaging (MRI), due to its high sensitivity and specificity, can help in early-phase detection, and differentiate between infectious spondylodiscitis versus inflammatory or degenerative spinal changes. 3. Computed tomography (CT) aids in evaluating bone erosions, calcifications, bone quality and CT-guided biopsy help to obtain causative organisms. 4. This exhibit describes the role of MRI and CT on the assessment of spondylodiscitis and other mimicking disorders in clinical practice

**TABLE OF CONTENTS/OUTLINE**

Spondylodiscitis: introduction.Pyogenic spondylodiscitis: typical and atypical imaging patterns. Tuberculosis spondylodiscitis: typical and atypical imaging patterns. Postoperative spondylodiscitis.Non-infectious spinal disorders mimicking infections: how MRI can help? Diagnostic work-up in suspicious spondylodiscitis.

## MKEE-107 DECIPHERING ORTHOPEDIC HIP HARDWARE IMAGING: HOW TO RECOGNIZE AND WHAT SURGEONS NEED TO KNOW

Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Ingrid D. Caridade, MD (*Abstract Co-Author*) Nothing to Disclose
Erica D. Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Maria Lobato Vaughan, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Lauar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Interpreting hip orthopedic materials through imaging methods can be challenging for the radiologist, as it is crucial knowledge due to its essential role in postoperative evaluation and diagnosing complications related to these devices. Plain radiographs are often the initial method of choice due to their availability, low cost, and ability to provide an overview of implant position, bone integrity, and joint alignment. However, other imaging methods such as computed tomography (CT) and magnetic resonance imaging (MRI) may be necessary for a more detailed assessment of the prosthesis-bone interface, surrounding soft tissues, and complications such as loosening, osteolysis, periprosthetic fractures, and infection. Ultrasonography also plays an important role in detecting peri-implant fluid collections and assessing adjacent soft tissues. The combination of these imaging methods allows for a comprehensive and accurate approach in interpreting hip orthopedic materials, assisting the medical team in making appropriate treatment decisions and improving patient outcomes post-surgery.

**TABLE OF CONTENTS/OUTLINE**

Through a pictorial essay, we will review the normal anatomy of the hip, indications for orthopedic materials, how to assess them through imaging methods, and what their main complications are.

## MKEE-108 MRI FINDINGS OF THE IDIOPATHIC INFLAMMATORY MYOPATHIES

Emad S. Allam, MD (*Abstract Co-Author*) Nothing to Disclose
Hongmin Xu, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Describe MRI findings of major subtypes of idiopathic inflammatory myopathies (IIM) and associated comorbidities.Clarify differentiating features among key IIM variants to enhance diagnosis confidence among radiologists.Highlight the connection between IIM and cancer, advocating for prompt cancer screening in IIM cases.

**TABLE OF CONTENTS/OUTLINE**

Exhibit major IIM cases including dermatomyositis, polymyositis, paraneoplastic fasciitis/myositis, and anti-synthetase syndrome myositis.Imaging features including the extent and pattern of muscle involvement and disease activity on MRI are described.Summary of differential diagnosis of the major subtypes of IIM. Highlights the importance of a comprehensive approach involving medical history, physical examination, laboratory testing, and advanced imaging techniques like MRI in differentiating between subtypes of myositis and guiding muscle biopsy.

## MKEE-109 A RADIOLOGICAL OVERVIEW OF SHOULDER ARTHROPLASTY. PRACTICAL KEYS IN THE ASSESSMENT OF SHOULDER REPLACEMENT

Rosa M. Lorente-Ramos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paz Azpeitia Hernandez (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia-Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Maria Martinez Gomiz (*Abstract Co-Author*) Nothing to Disclose
Carlos Oliva Fonte (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To know the different types of shoulder replacement. To review the role of imaging techniques (plain radiograph, CT, MRI, US, scintigraphy) in the evaluation of shoulder prostheses. To understand the usefulness and limitations of plain radiographs and CT in the evaluation of shoulder replacements, emphasizing useful parameters and illustrating image analysis and interpretation. To become familiar with normal and abnormal postoperative imaging findings and signs of complications

**TABLE OF CONTENTS/OUTLINE**

We review imaging of shoulder replacement, highlighting key concepts perceived as important variables by the surgeon and correlating images with clinical considerations and functional outcomes. We present: A review of types of replacement. Surgery aims. Imaging. Plain radiographs -Technique and views. Standard image acquisition: beam and anatomical landmarks -Parameters that should be evaluated: description of the components and alignment relative to normal anatomic alignment. Imaging. CT -Technique. -Parameters that should be evaluated. -Imaging of complications Early complications include instability or dislocation, hematoma, ulnar nerve dysfunction, deep infection, heterotopic ossification, and scapular spine fracture. Late complications include humeral and glenoid fractures, metaglene loosening, and scapular notching. Role of MRI, US and scintigraphy.

## MKEE-11 THE DIGITAL NERVE: MR AND US OF NORMAL ASPECT AND PATHOLOGIES

**Awards**
**Certificate of Merit**

Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda C. Bernal, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Understanding the anatomy of digital nerves in the upper limb;
- Navigating the anatomy of digital nerves in the lower limb;

- Correlating imaging findings with pathological changes in digital nerves;
- Analyzing ultrasonographic and magnetic resonance imaging findings across digital nerve pathologies.

**TABLE OF CONTENTS/OUTLINE**

Introduction:
- Anatomy of digital nerves
- Upper limb
- Lower limb
- Structure of the digital nerve
- Clinical presentationOverview of Magnetic Resonance Imaging (MRI) and Ultrasonography (US) in nerve evaluation:
- Normal imaging characteristics on MRI and US
- Techniques and protocols for digital nerves MRI
- US imaging techniques and considerations for digital nerve evaluationCase-based review:
- Traumatic lesions
- Inflammatory conditions
- Tumors
- Extrinsic compressionSummaryTake home messages

## MKEE-110 ELBOW IMAGING - HOW TO MASTER ITS COMPLEXITIES

Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Andreas Kunz, MD (*Abstract Co-Author*) Nothing to Disclose
Theresa Sophie Patzer, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Dislocations and fractures of the elbow joint are a common finding following trauma. At the same time, osseous lesions are often associated with injuries of the ligaments and tendons, in particular concerning the lateral and medial collateral ligament complex, as well as the distal insertion of the biceps tendon. Diagnostic work-up requires a profound understanding of anatomy, biomechanics and typical injury patterns. While conventional radiography oftentimes represents the primary imaging modality, additional cross-sectional examinations with high spatial resolution are often required in order to address the fracture pattern and associated soft tissue pathologies in detail.

**TABLE OF CONTENTS/OUTLINE**

1. Elbow joint anatomy a. Biomechanical properties b. Medial and lateral collateral ligament complex c. Muscles i. Extensors originating from lateral humeral epicondyle ii. Flexors originating from medial humeral epicondyle iii. Biceps tendon inserting at radial tuberosity d. Chiasma antebrachia 2. Imaging a. MRI with and without intravenous contrast enhancement b. Advantages of cone-beam CT over multidetector CT c. Postoperative Imaging 3. Pathologies a. Rupture of lateral collateral ligament complex b. Rupture of medial collateral ligament complex c. Lateral epicondylitis (tennis elbow) d. Medial epicondylitis (golfer's elbow) e. Rupture of the biceps tendon f. Osborne-Cotterill lesion 4. Discussion

## MKEE-111 WHAT A ZINGER! A GUIDE TO ULTRASOUND OF PERINEURIOMAS AND OTHER PERIPHERAL NERVE SHEATH TUMORS WITH MRI AND HISTOLOGIC CORRELATION

Preethi Kesavan, MD (*Abstract Co-Author*) Nothing to Disclose
Samer L. Soussahn, MD (*Abstract Co-Author*) Nothing to Disclose
Heidi Ehrich (*Abstract Co-Author*) Nothing to Disclose
Steven B. Soliman, DO (*Abstract Co-Author*) Consultant, General Electric Company;Speaker, General Electric Company
Gunjan B. Malhotra, MD (*Abstract Co-Author*) Nothing to Disclose
Erika Ysabelle E. Mojica, MD (*Abstract Co-Author*) Shareholder, Catalyst Pharmaceuticals
Molly Pantelic, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Emily Abraham, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Lamberg, MD (*Abstract Co-Author*) Nothing to Disclose
Joy Li, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Overview of perineuriomas and other peripheral nerve sheath tumors including histology/pathology and associated conditions2. Review of the sonographic findings characteristic of perineuriomas and other peripheral nerve sheath tumors with MRI and histologic correlation3. Differential diagnoses including malignancies, intraneural ganglia, and traumatic neuromas4. Ultrasound-guided biopsy technique

**TABLE OF CONTENTS/OUTLINE**

1. Introduction and overviewa) Types and nomenclatureb) Pathophysiologyc) Epidemiologyd) Histologic Findingse) Associated conditionsf) Clinical Findings2.Ultrasound evaluationa) Transducer selection and settingsb) Sonographic imaging technique and pearlsc) Characteristic sonographic findingsd) Differential diagnoses (including malignancies, intraneural ganglia, and traumatic neuromas) and ways to differentiate sonographically3. MRI evaluationa) MRI protocol and the use of intravenous gadolinium contrastb) Characteristic MRI featuresc) Examples of US/MRI correlation4.Ultrasound-guided biopsya) Technique detailsb) Procedure pearls and the use of local anesthetic versus sedation5.Summary

## MKEE-112 BEFORE AND AFTER: EVALUATING RESPONSE TO TREATMENT IN MULTIPLE MYELOMA - WHOLE BODY MR IMAGING AND PET/CT

Jesus D. Aquerreta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria J. Garcia-Velloso, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alberto Paternain, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Del Nido Recio (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Whole-body MR Imaging (WB-MRI) and FDG-PET/CT have a crucial role in the follow-up of Multiple Myeloma.• It is important to correlate the morphology of the lesions with diffusion-weighted imaging values (MRI) and with up-take values (FDG-PET/CT).• FDG-PET/CT is the gold standard for studying extramedullary disease, whereas WB-MRI has more sensitivity in depicting diffuse disease and non-secretor myeloma.

**TABLE OF CONTENTS/OUTLINE**

The Myeloma Response Assessment and Diagnosis System (MY-RADS) characterizes the disease state on MRI, at diagnosis and during follow-up. It is aimed to standardize reports and minimize variations. 5 Response Assessment Categories (RAC) have been described:• RAC 1 (Highly likely to be responding): previously evident lesion shows increase in ADC values from = 1400 to >1400 μm2/sec or = 40% increase in ADC from baseline.• RAC 2 (Likely to be responding): an increase in ADC from = 1000 to <1400, or >25% but <40% increase in ADC from baseline.• RAC 3: No observable change.• RAC 4 (Likely to be progressing): no change in size but increasing signal intensity with ADC values <1400.• RAC 5 (Highly likely to be progressing): new regions of hyperintensity with ADC values between 600-1000.On the other hand, the Italian myeloma criteria for PET use (IMPetUs) has standardized PET interpretation. FDG uptake is graded by the five-point scale of Deauville score (DS):1) No up-take is observed.2) Uptake = mediastinum.3) Uptake > mediastinum but = liver.4) Uptake moderately increased compared to the liver.5) Uptake markedly increased compared to the liver.Bone marrow non-focal uptake, focal bone lesions (site, number and uptake), paramedullary and extramedullary lesions are also studied.

## MKEE-113 MR NEUROGRAPHY OF THE OCCIPITAL NERVES - TECHNICAL CONSIDERATIONS AND INJURY PATTERNS

**Awards**
**Certificate of Merit**

Ek Tsoon Tan, PhD (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Medtronic Inc Research Grant, AMAG Pharmaceuticals
Lisa Gfrerer (*Abstract Co-Author*) Nothing to Disclose
Darryl B. Sneag, MD (*Abstract Co-Author*) Researcher, General Electric Company;Researcher, Siemens AG;Research support, AMAG Pharmaceuticals, Inc
Yen Po Lin, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Occipital neuralgia is a common pain syndrome that often occurs in combination with other headache disorders, such as migraines and tension headaches. An overlap in symptoms presents a diagnostic challenge for clinicians. Additionally, the small size and neighboring dermatomal territories of the occipital nerves often limit conventional MRI from accurately localizing pathology.• MR neurography (MRN) has not traditionally been used for occipital nerve evaluation. New technical advancements, including deep learning reconstruction techniques that enable higher spatial resolution, particularly for 3D isotropic sequences, now enable MRN as a modality to visualize these small nerves. • When performing MRN, it is crucial for the radiologist to be familiar with occipital nerve anatomy and technical considerations to optimize image quality.

**TABLE OF CONTENTS/OUTLINE**

• Background• Anatomy Overview o Greater, lesser and third occipital nerves• Technical Considerations o Magnet: high field strengtho RF Coils: conventional head and neck coil or newly-developed conformable neck coil o Protocol/Sequences & 7; Anatomical 2D sequences: proton density sequences& 7; MR neurography 2D sequences: T2 Dixon and T2 fat-saturated sequences& 7; MR neurography 3D sequences: double echo steady state& 7; Fat and vascular suppression techniques & 7; Deep learning reconstruction& 7; Zero-to-echo time (ZTE) sequences: for anatomical reference and rendering • Case exampleso Normal anatomy demonstration o Unilateral occipital neuropathy/ entrapmento Traumatic injuryo Iatrogenic injury/neuromao Treatment: decompression surgery, nerve block/injection, radiofrequency ablation

## MKEE-114 LEVEL UP BONE TUMOR DIAGNOSIS FOR RADIOLOGISTS: MALIGNANT TRANSFORMATION OF BONE WITH IMAGING-PATHOLOGY CORRELATION

Hyang-Sook Jeong (*Abstract Co-Author*) Nothing to Disclose
Jee-Young Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Seul Ki Lee, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Common bone lesions, initially benign or low-grade malignant, have the potential to transform into higher-grade of malignancies. 2. Although typical imaging features of common bone lesions are well-established, malignant transformation is rare and can be easily missed. Additionally, sampling errors during biopsies can lead to inaccurate diagnoses. 3. Benign bone tumors that can transform into malignancies include osteochondroma, enchondroma, fibrous dysplasia, and giant cell tumor of bone. Non-tumorous conditions that may undergo malignant transformation include Paget's disease of bone, bone infarction, chronic osteomyelitis, and bone that has received radiation therapy. 4. Low-grade malignancies that can progress to higher grades include low-grade central osteosarcoma, and atypical cartilaginous tumor/low-grade chondrosarcoma. 5. Early recognition of malignant transformation in bone lesions is crucial. Combining clinical presentation, imaging findings, and accurate pathology is essential for planning appropriate management strategies.

**TABLE OF CONTENTS/OUTLINE**

1. Typical Imaging Features of Common Bone Tumors 1-1. Bone Matrix: Osseous, Chondroid, and Fibrous 1-2. Benign vs. Malignant 2. Atypical Imaging Features and Diagnostic Challenges: Pearls and Pitfalls 2-1. Benign Bone Lesions Showing Malignant Transformation (Tumorous and Non-Tumorous Conditions) 2-2. Low-Grade Malignancies Progressing to Higher-Grades 3. The Importance of Precise Biopsy for Accurate Pathologic Diagnosis 4. Patients at Risk for Malignant Transformation of Bone Lesions 4-1. Impact of Prior treatment (Denosumab, Surgery, or Radiation) 4-2. Treatment Options: Timely Surgery vs. Watchful Follow-Up

## MKEE-115 APPLICATION OF 320-DETECTOR-ROW UPRIGHT CT IN ORTHOPEDIC AREAS

Orito Ikeda (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Abstract Co-Author*) Nothing to Disclose
Takeo Nagura (*Abstract Co-Author*) Nothing to Disclose
Mohammed Alshahri (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Minoru Yamada, RT (*Abstract Co-Author*) Nothing to Disclose
Yoichi Yokoyama, MD (*Abstract Co-Author*) Nothing to Disclose
Fumiko Yagi, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purposes of our exhibit are as follows: (1) To explain the development, background, and performance of 320-detector-row upright computed tomography (CT) for whole-body scans, (2) To describe the anatomical changes in each musculoskeletal structure due to differences in body position, that is, the direction of gravity, and (3) To illustrate the clinical applications and usefulness of upright CT in various orthopedic diseases with clinical case presentations.

**TABLE OF CONTENTS/OUTLINE**

(1) Development and advantages of upright CT with an area detector for whole-body scans (2) Performance of 320-detector-row upright CT: Physical characteristics, workflow improvement, safety, and remote operation during the infectious disease pandemic (3) Effects of gravity on the shoulder girdle, upper extremities, thorax, vertebrae, hip, knee, foot, and muscles in various parts of the body (4) Clinical applications of upright CT for various orthopedic diseases such as knee osteoarthritis, hip osteoarthritis, scoliosis/spinal deformity, lumbar spondylolisthesis, orbital wall fracture, and pectus excavatum (5) Upright 4D-CT (6) More accurate evaluation of seatbelt safety for autopilot driving with upright CT (7) Limitation (8) Conclusion

## MKEE-116 MSK TUBERCULOSIS (TB) MANIFESTATIONS

Marta A. Piorkowska, MBBS (*Abstract Co-Author*) Nothing to Disclose
Saad K. Chaudhry, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Usman Goga, MSc,MBBS (*Abstract Co-Author*) Nothing to Disclose
Susan Cross, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Krishanantham Ambalawaner, MBChB, BSc (*Abstract Co-Author*) Nothing to Disclose
Saigeet Eleti, FRCR, MBBChir (*Abstract Co-Author*) Nothing to Disclose
Sarah Hickman, MBBS (*Presenter*) Research collaboration, Vara;Research collaboration, ScreenPoint Medical BV;Research collaboration, Lunit Inc;Research collaboration, Kheiron Medical Technologies Ltd;Research collaboration, Alphabet Inc;Research collaboration, Volpara Health Technologies Limited

**TEACHING POINTS**

- MSK TB is rare (1-3% of cases of TB) and most commonly affects the spine (50%), followed by TB arthritis, and tenosynovitis is very rare. Concurrent intrathoracic TB occurs in ~ < 50% of cases. [Yukie Rodriguez-Takeuchi et al 2019, Pattamapaspong et al 2024, Burrill 2007]. -Symptom onset is insidious over weeks to months with progressive pain, night sweats, fatigue, weight loss and low grade fever. This leads to a significant delay in diagnosis (reportedly 3 -24 months).-Spinal involvement occurs via haematogenous spread usually infecting the anterior and central vertebral body. Infection can spread over multiple levels with sparing of the disc through subligamentous spread. With time, vertebral destruction and cold abscess formation may occur. -Disc involvement is usually late. Spread to paraspinal tissues may be in the form of a psoas abscess with calcification highly suggestive of TB. Epidural phlegmon can also extend to compress the spinal cord / cauda equina. -TB osteomyelitis is often misdiagnosed as multiple bone metastases. -TB Arthritis occurs from osteomyelitis or hematogenous spread and is typically a chronic granulomatous monoarthritis affecting weight bearing joints and typically demonstrates Phemister triad (juxta-articular osteoporosis, peripheral osseous erosion and gradual narrowing of the joint space).-TB Tenosynovitis occurs from hematogenous spread or extension from TB arthritis and most commonly occurs in the wrist and hand, usually involving the flexor tendon sheath.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction to MSK TB2) Spondylodiscitis 3) Psoas Abscess 4) Osteomyelitis 5) Septic arthritis 6) Synovitis 7) Tenosynovitis 8) Bursitis 9) Intramuscular / subcutaneous10) Conclusion

## MKEE-117 ON THE MOVE: DYNAMIC ULTRASOUND FOR THE ASSESSMENT OF LOWER EXTREMITY MUSCULOSKELETAL DISORDERS

**Awards**
**Certificate of Merit**

Steven B. Soliman, DO (*Abstract Co-Author*) Consultant, General Electric Company;Speaker, General Electric Company
Preethi Kesavan, MD (*Abstract Co-Author*) Nothing to Disclose
Gunjan B. Malhotra, MD (*Abstract Co-Author*) Nothing to Disclose
Molly Pantelic, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hannah Lamberg, MD (*Abstract Co-Author*) Nothing to Disclose
Joy Li, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Abraham, MD (*Abstract Co-Author*) Nothing to Disclose
Erika Ysabelle E. Mojica, MD (*Presenter*) Shareholder, Catalyst Pharmaceuticals

**TEACHING POINTS**

1. Ultrasound (US) is a valuable tool in assessing for musculoskeletal conditions due to the real-time assessment and isolation of specific pathologies using dynamic maneuvers.2. Dynamic musculoskeletal US should be considered for pathologic conditions that present with snapping, clicking, or pain with joint movement.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction of dynamic US for musculoskeletal pathologies, including its advantages, specific dynamic maneuvers, and additional considerations.2. Lower extremity pathologies assessed on dynamic US with accompanying cine clips, key static images, and teaching points on scanning technique, patient positioning, and sonographic findings. Selected pathologies include:a. Snapping iliopsoas tendonb. Meniscal extrusionc. Peroneal tendon subluxation/dislocation over the lateral malleolusd. Peroneal tendon intrasheath subluxation (types A and B)e. Achilles tendon tearsf. Morton neuroma and intermetatarsal bursitis3. Summarya. Review of teaching points

## MKEE-118 RADIAL WRIST PAIN - KEYS FOR THE GENERAL RADIOLOGIST

Noelia Arevalo (*Abstract Co-Author*) Nothing to Disclose
Joseba Mirena Zulueta Odriozola, MBBS (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel Angel Gomez Bermejo, MD (*Abstract Co-Author*) Nothing to Disclose
Abel Gonzalez Huete, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Upon reviewing this exhibit, the reader should:• Be familiar with the pathologies that can present with radial wrist pain. A brief overview will be provided detailing each pathology, including epidemiology and clinical presentation, essential for the differential diagnosis.• Be able to select the appropriate imaging modality in each case (plain film, ultrasound, CT, MRI) based on the patient's history, clinical context and symptoms, taking into account the utility and limitations of each modality.• Accurately describe the findings in studies performed on patients affected by the mentioned pathologies.•

Recognize the complications associated with each disease and their representation in imaging.• Understand the available therapeutic options, including interventions involving radiologists.

**TABLE OF CONTENTS/OUTLINE**

• Wrist anatomy• Differential diagnosis o Due to overuse:? De Quervain's stenosing tenosynovitis.? Proximal and distal intersection syndromes.o Acute traumatic origin:? Fracture of the distal end of the radius.? Carpal fractures: scaphoid, trapezius.? Fractures of the base of the first metacarpal: Bennett, Rolando and pseudo-Bennett.o Degenerative arthropathy:? Trapeziometacarpal osteoarthritis.? Trapezio-scapho-trapezoid osteoarthritis.? Radiocarpal osteoarthritis.o Nerve entrapment and injury:? Cheiralgia paresthetica - Wartenberg syndrome.? Post-traumatic neuroma.• Conclusions

## MKEE-119 PORTABLE LOW-FIELD MRI FOR IMPROVED MUSCULOSKELETAL DISORDERS DIAGNOSTICS - METHODS, CHALLENGES AND FUTURE POTENTIAL

Shira Nemirovsky-Rotman (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Medical imaging is a key component for diagnostics of musculoskeletal (MSK) conditions, currently considered a significant national public health issue - due to ageing population as well as prevalence of sport injuries. The growing need for accurate and fast examinations has resulted in a bottleneck in medical diagnostics and treatment. MRI exhibits superior soft-tissue contrast and resolution compared to other modalities; specifically, it is considered the gold-standard for diagnostics of a range of MSK injuries and disorders. Recently, research has focused on portable and low-field MRI scanners, which may be applied for various applications, including MSK. Low-field MRI provides invaluable opportunities for lower maintenance costs, as well as portable and accessible imaging; however, it produces images that suffer from reduced resolution and signal-to-noise ratios compared to their high-field counterparts. To address this issue, recent deep-learning-based methods have been applied to translate images acquired with low-field scanners to images with perceived high-field quality. Such methods show proof-of-concept in translating from low to high resolution; however, further research is needed to determine the diagnostic integrity of the obtained images for specific clinical applications.

**TABLE OF CONTENTS/OUTLINE**

1. Principles of AI-based algorithms for image translation from low- to high-field MRI scanners;2. The challenge of image registration and domain adaptation when training AI-based low-to-high-field translation algorithms;3. Clinical/diagnostic evaluation criteria vs. computer vision measures for assessment of reconstructed high-field images (as obtained from low-field).

## MKEE-12 GIANT CELL-RICH LESIONS OF BONE: BEYOND GIANT CELL TUMOR OF BONE

Xavier Sanjuan (*Abstract Co-Author*) Nothing to Disclose
Jose A. Narvaez, MD (*Abstract Co-Author*) Nothing to Disclose
Karen Perez Alfonso, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Carlos Sardinas (*Abstract Co-Author*) Nothing to Disclose
German G. Ratto, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Hernandez Ganan (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Giant cell-rich bone lesions comprize heterogeneous neoplastic and non-neoplastic disorders with diverse clinical, radiological and pathological presentations. They are characterized by the presence of conspicuous osteoclast-type giant cells as a component of the presenting entity. Giant cell tumor of bone is probably the best known of this group of lesions. The objectives of this review are: - To explain the molecular background in the formation of osteoclast-type giant cells (role of RANK ligand). - To analyze the radiological features of giant cell tumor of bone and post-treatment changes with denosumab. - To review the different tumors that can present giant cells, analyzing the relevant radiological features. - To review the molecular alterations that help to differentiate these entities, especially the H3.3 mutations.

**TABLE OF CONTENTS/OUTLINE**

- Cell biology in the formation of osteoclast-like giant cells. - Giant cell tumor of bone: imaging features, microscopic and molecular pathology features. - Imaging and pathologic features of GCTB after denosumab treatment. - Variants of GCTB: malignant GCTB, multicentric GCTB, metastatic GCTB. - Imaging and patholiogic features of other giant cell-rich lesions: o Aneurymal bone cyst (ABC) o Giant cell granuloma of the jaws (GCG). o Giant cell-rich osteosarcoma. o Giant Cell Reparative Granuloma (Solid ABC) o Benign fibrous histiocytoma of the bone (GCTB with regressive changes). o Non-ossifying fibroma of bone (NOF). o Chondroblastoma. o Chondromyxoid fibroma. o Brown tumor of hyperparathyroidism.

## MKEE-120 REVEALING RADIOGRAPHS: KEY REPORTS FOR THE ORTHOPEDIST IN FRACTURE MANAGEMENT

Sonia Carolina Hernandez Sanchez (*Abstract Co-Author*) Nothing to Disclose
Gustavo Rozo (*Abstract Co-Author*) Nothing to Disclose
Guillermo A. Granados Gonzalez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Recognize the different stages of bone healing, understand primary and secondary orthopedic management options.Identify complications such as non-union, pseudoarthrosis, and malunion.Accurate diagnosis and early intervention prevent long-term complications.Understand the process of bone transport and its clinical applications in correcting bone defects.Know what findings to include in radiological reports for effective decision-making.Recognize the importance of clear and concise communication in reports to ensure optimal patient care.

**TABLE OF CONTENTS/OUTLINE**

Table of Contents1. The Natural History of Fracture and Its Management - Orthopedic and Surgical Management of Fractures2. Alterations and Complications in Consolidation - Is pseudoarthrosis the same as non-union? - Types of non-union3. Functional Basis of External Fixation and Bone Transport4. Useful Reports for the Orthopedist5. Cases6. Teaching Points

## MKEE-121 ANALYSIS OF MUSCLE VIABILITY USING MAGNETIC RESONANCE IMAGING IN COMPARTMENT SYNDROME

Ana Belen Barba Arce, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Describe the study protocol using magnetic resonance imaging (MRI) in the assessment of compartment syndrome. 2. Determine the structural changes in the muscles affected by compartment syndrome, both acute and chronic. 3. Obtain objective and precise data on muscle viability that can help in treatment planning and patient follow-up. 4. Analyze the acute and chronic complications of this syndrome. 5. Perform a differential diagnosis with other entities.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Acute compartment syndrome. 2.1. Etiology. 2.2. Pathophysiology. 2.3. Clinical manifestations. 2.4. Diagnostic tests. 2.5. Treatment. 2.6. MRI study protocol. 2.6.1. Findings. 2.6.2. Muscle viability analysis. 3. Chronic compartment syndrome. 3.1. Chronic exertional compartment syndrome. 3.2. MRI study protocol. 3.2.1. Findings. 3.2.2. Muscle viability analysis. 4. Complications of compartment syndrome. 4.1. Infection. 4.2. Myonecrosis. 4.3. Calcifying myonecrosis. 4.4. Fibrous contractures. 4.5. Rhabdomyolysis. 5. Differential diagnosis. 6. Conclusions.

## MKEE-122 SQUEEZE THE DAY: AN IMAGING-BASED REVIEW OF DENERVATION SYNDROMES

Alejandra Cardona Del Valle, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Camareno-Soto, BSc (*Abstract Co-Author*) Nothing to Disclose
Carol Sanchez Santana (*Abstract Co-Author*) Nothing to Disclose
Kevin Hornedo, BS (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Trullenque, MD (*Abstract Co-Author*) Nothing to Disclose
Santiago A. Saldana Mendez, MD, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A. Review relevant anatomy, pathophysiology, and clinical presentation of Denervation Syndromes. B. Showcase the most common denervation syndromes and epidemiology. C. Discuss key imaging findings on Ultrasound (US) and Magnetic Resonance Images (MRI) for diagnosis. D. Examine the role of imaging in treatment planning.Denervation syndromes, resulting from diverse causes such as trauma, infection, tumors, or autoimmune disorders, frequently manifest as pain and weakness. While traditional diagnosis relied on clinical assessment and electromyography, MRI and ultrasound now play pivotal roles. These imaging modalities aid in identifying injury sites, duration of denervation, and underlying causes. This exhibit comprehensively reviews common denervation syndromes, showcasing MRI and ultrasound images to elucidate diagnosis and develop optimal treatment strategies.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction Objectives II. Anatomy and Pathophysiology III. Clinical Presentation IV. Showcase Common Denervation Syndromes A. Upper extremity 1. Subcapsular N. 2. Axillary N. 3. Radial N. 4. Median N. 5. Ulnar N. B. Lower extremity 1. Femoral N. 2. Obturator N. 3. Sciatic N. 4. Tibial 5. N. V. Diagnosis Key imaging findings on US and MRI evaluations VI. Treatment VII. Conclusion

## MKEE-123 DISCOID LATERAL MENISUCUS: HELPFUL FINDINGS IN X-RAY AND MAGNETIC RESONANCE IMAGING, AND NEW INSIGHTS ON SHAPE FEATURES OF BONE AND CARTILAGE

Keita Nagawa (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The major radiographical findings of discoid lateral meniscus (DLM) have been reported to be widening of the lateral joint line, cupping of the lateral tibial plateau, squaring of the lateral femoral condyle, widening of the tibial eminence, elevation of the fibular head, and condylar cutoff sign. To diagnose DLM on magnetic resonance imaging (MRI), several findings are important; the meniscal width is over 15 mm on the coronal slice. Continuity of the meniscus between the anterior and posterior horns on three or more 5-mm thick consecutive sagittal slices. In the recent studies, new insights for DLM concerning bone and cartilage morphology have been reported, including hypoplasia of the posterior lateral femoral condyle, and thin lateral tibial cartilage. In our analysis for DLM concerning the volume of subchondral bone and cartilage, the volume of lateral femoral epiphyseal bone and the cartilage volume of lateral tibial plateau were significantly smaller in the DLM group compared to the control group.

**TABLE OF CONTENTS/OUTLINE**

1. Basics of DLM2. Important X-ray findings for DLM3. To diagnose DLM with MRI4. New insights for DLM: bone and cartilage morphology5. Our findings for DLM: volume of subchondral bone and cartilage

## MKEE-124 VIRTUAL NON CALCIUM IMAGING IN CONTRAST ENHANCED DUAL-ENERGY CT IMPROVES DETECTION OF BONE METASTASES AND MAY ALSO REFLECT ACTIVITY OF BONE METASTASES

Shunsuke Itaya, RT (*Abstract Co-Author*) Nothing to Disclose
Yasuo Sakurai, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshihisa Kodama, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Hirotaka Nakashima, MSc, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Deep learning imaging reconstruction (DLIR) based virtual non-calcium (VNCa) images were created using a two-material decomposition process based on dual-energy CT acquisition with fast kV switching.2. The diagnostic performance of contrast-enhanced CT imaging and VNCa imaging was compared in 53 patients with clinically confirmed bone metastases.3. Three substance pairs were used for VNCa images in contrast-enhanced dual-energy CT: Iodine (Hydroxyapatite), Water (Hydroxyapatite), and Water (Calcium).4. Evaluation of metastatic bone tumors using VNCa imaging on contrast-enhanced dual-energy CT demonstrated superior diagnostic performance compared to conventional CT imaging.

**TABLE OF CONTENTS/OUTLINE**

Bone metastasis is a possible complication of all cancers and reduces the quality of life of patients. CT is difficult to diagnose osteoblastic bone metastases without destruction and is often missed. Virtual non calcium (VNCa) images are material-dense images obtained with dual-energy CT, which enhances the water component and removes the bone component. Using VNCa images in contrast-enhanced dual-energy CT may improve the identification of bone metastases and evaluate the activity of bone metastases by assessing the presence of contrast uptake. In this exhibition, we compared the diagnostic performance of bone metastases in contrast-enhanced dual-energy CT when evaluated with VNCa images plus bone and soft tissue conditions and when evaluated with bone and soft tissue conditions images only. The results showed that VNCa imaging had a higher discriminative ability for metastatic bone tumors. Furthermore, it was suggested that evaluating the activity of bone metastases is also feasible.

## MKEE-125 ALL THAT GLITTERS IS GOLD UNRAVELLING THE MAIN CONCEPTS OF THE CHRONIC RECURRENT MULTIFOCAL OSTEOMYELITIS IN WHOLE-BODY MAGNETIC RESONANCE IMAGING IN CHILDREN

Lislie G. Santin, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo B. Zukovski, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose

Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Anderson Phelipe Dias Sabry Azar, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Rocha, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Renan D. Lederer, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Viana Dos Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Chronic Recurrent Multifocal Osteomyelitis (CRMO) is an idiopathic inflammatory disorder of the bones, typically seen in children and adolescents. Whole-body magnetic resonance imaging (WB - MRI) is a very useful imaging tool in the detection and follow-up of such alterations. Therefore, the aim of this exhibit is to:Describe the main points related to the protocol of WB - MRI in children, including the particularities of the age group and the techniques used.Expose the main concepts of CRMO, including its pathophysiology and its main radiographic features.Demonstrate the main imaging findings of CRMO in WB-MRI and ways to identify such alterations in all sequences.Identify pitfalls and potential confounding imaging findings in WB-MRI.

**TABLE OF CONTENTS/OUTLINE**

Introduction: the importance of WB-MRI in the diagnosis and follow-up of CRMO.WB-MRI in childrenProtocolParticularities in childrenCRMODefinition and epidemiologyPathophysiologyMain radiographic featuresPitfalls in WB-MRINormal versus pathologic signal alterations.

## MKEE-126 DYNAMIC SPINE FLEXIBILITY EVALUATION WITH DYNAMIC DIGITAL RADIOGRAPHY FOR ADOLESCENT IDIOPATHIC SCOLIOSIS

Zhiwei Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Man Wang (*Abstract Co-Author*) Nothing to Disclose
Wu Liu (*Abstract Co-Author*) Nothing to Disclose
Shuo Ma (*Abstract Co-Author*) Nothing to Disclose
Zhe Zhao (*Abstract Co-Author*) Nothing to Disclose
Ruiyao Qin (*Abstract Co-Author*) Nothing to Disclose
Yun Wang (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To demonstrate a new way to evaluate spine flexibility with dynamic digital radiography.To design motion for supine bending, fulcrum bending and suspension, the general principle, and special points for each position. To suggest the exposure parameters and effect dose follow the ALARA principle. To show the case of each position movement, the trajectory and dynamic Cobb’s angle changes and stretch distance changes.

**TABLE OF CONTENTS/OUTLINE**

1. Background: -limits of static spine flexible evaluation - new technique of dynamic digital radiography (DDR) 2. Key aspects of DDR position acquisition: - Posture designing - Movement training 3. Exposure conditions for DDR: - Exposure parameters - Effective radiation dose 4. The dynamic changes of Cobb’s angle, spinal flexibility, and subject's stability during different DDR positions: - Cobb’s angle variations during different bending motion - Stretch distance changes during suspension motion

## MKEE-127 THE NEGLECTED HORNS: VARIANTS, PITFALLS AND PATHOLOGIES OF THE ANTERIOR HORNS OF THE MENISCI

**Awards**
**Certificate of Merit**

Michael Brown, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas S. Truong, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela J. Walsh, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The anterior horns of the menisci are less frequently considered than the body and posterior horns when assessing and studying meniscal appearance and pathology. The anterior horns of the medial and lateral menisci possess variant anatomy and at times may mimic pathologies. True tears and pathologic processes do occur in the anterior horn, and at times are subtle and may be overlooked. This educational exhibit is designed to demonstrate the traditional and variant anatomy of the medial and lateral menisci's anterior horns with examples of how to discern variant anatomy from pathology. The exhibit will also show examples of true pathology of the anterior horn, highlighting subtleties not to be overlooked.

**TABLE OF CONTENTS/OUTLINE**

Background Medial Meniscus Anatomy Variant Anatomy/Pathology mimics Far anterior insertion of the anterior horn Anterior meniscofemoral ligament of the medial meniscus Oblique meniscomeniscal ligament Lateral Meniscus Anatomy Variant Anatomy/Pathology mimics Striated/speckled appearance of the root attachment Mucoid degeneration of the anterior root/relationship to the ACL insertion Transverse ligament mimicking tear Pathology Meniscal contusions Tears Radial tears (more commonly seen at the lateral meniscus) Flap tears Complex tears Parameniscal cysts

## MKEE-128 BEND AND SNAP! DYNAMIC ULTRASOUND EVALUATION OF THE ELBOW AND SHOULDER

Erika Ysabelle E. Mojica, MD (*Abstract Co-Author*) Shareholder, Catalyst Pharmaceuticals
Emily Abraham, MD (*Abstract Co-Author*) Nothing to Disclose
Steven B. Soliman, DO (*Abstract Co-Author*) Consultant, General Electric Company;Speaker, General Electric Company
Gunjan B. Malhotra, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Lamberg, MD (*Abstract Co-Author*) Nothing to Disclose
Joy Li, MD (*Abstract Co-Author*) Nothing to Disclose
Preethi Kesavan, MD (*Abstract Co-Author*) Nothing to Disclose
Molly Pantelic, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Why dynamic ultrasound: indications, pearls, and pitfalls2. Dynamic pathologies of the elbow and shoulder: epidemiology, pathophysiology, and common clinical presentations3. Dynamic ultrasound evaluation of the elbow and shoulder, with a summary of key techniques, sonographic findings, and

MR anatomic correlation4. Treatment strategies for key elbow and shoulder pathologies

**TABLE OF CONTENTS/OUTLINE**

1. Introduction and overviewa. Why dynamic ultrasound: indications, pearls, and pitfallsb. Dynamic pathologies of the elbow and shoulderc. Epidemiologyd. Pathophysiologye. Common clinical presentations2. Dynamic ultrasound evaluation of the elbow and shouldera. Transducer selectionb. Key viewsc. Dynamic ultrasound techniques3. Dynamic ultrasound findings in key elbow and shoulder pathologies, with MR anatomic correlationa. Snapping triceps syndromeb. Elbow synovial fold syndromec. Biceps tendon tearsd. Subacromial impingemente. Acromioclavicular joint instabilityf. Rotator cuff tears4. Treatment strategies5. SummaryReferences:Cerezal L et al. Elbow Synovial Fold Syndrome. AJR Am J Roentgenol. 2013; 201(1):W88-96. https://doi.org/10.2214/AJR.12.8768.Jacobson J et al. Ulnar Nerve Dislocation and Snapping Triceps Syndrome: Diagnosis with Dynamic Sonography-Report of Three Cases. Radiology. 2001; 220(3):601-5. https://doi.org/10.1148/radiol.2202001723.Miller T et al. Ultrasound of the distal biceps brachii tendon using four approaches: reproducibility and reader preference. Skeletal Radiol. 2021; 50(5): 937-943. https://doi.org/10.1007/s00256-020-03637-z.

## MKEE-129 SPRINT TO DIAGNOSIS: UNRAVELING LOWER LIMB MUSCULOSKELETAL INJURIES IN RUNNERS

Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe C. Ferreira Dionisio, MD (*Abstract Co-Author*) Nothing to Disclose
Jose F. Neto, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Anatomy Understanding: Reviewing the anatomy of the structures of the lower limb to get a precise diagnosis.Early Recognition: Highlight the importance of prompt identification of lower limb musculoskeletal injuries in runners to prevent chronicity and optimize outcomes.Multimodal Imaging: Discuss the role of advanced imaging modalities such as MRI, CT, and ultrasound in providing detailed anatomical assessment and accurate diagnosis of soft tissue and bone injuries.Clinical Correlation: Emphasize the integration of imaging findings with clinical history and physical examination to enhance diagnostic precision.Injury Patterns: Explore common patterns of lower limb injuries encountered in runners, including stress fractures, muscle strains, tendinopathies, and ligamentous injuries, to aid radiologists in targeted evaluation.Conclusion: After this education exhibit you should be able to correctly diagnose the most prevalent injuries in runners.

**TABLE OF CONTENTS/OUTLINE**

I. IntroductionII. Anatomy reviewIII. Types of Bone Lower Limb Injuries in RunnersIV. Types of Muscle Lower Limb Injuries in RunnersV. Types of Tendon Lower Limb Injuries in RunnersVI. ConclusionVII. References

## MKEE-13 FIRM GRASP OF ANKLE INSTABILITY: UNDERSTANDING MRI FEATURES OF FAILURE MODES OF THE LATERAL ANKLE LIGAMENTS WITH SURGICAL AND FLUOROSCOPIC CORRELATION

Dhiren Shah, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Andrew Goldberg (*Abstract Co-Author*) Nothing to Disclose
Dimitri Amiras, MBBS, FRCR (*Abstract Co-Author*) Clinical Advisory Board, Medical iSight
Rikin Hargunani, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Jedrzej Krawczyk, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. How to image and identify the CFL, superior and inferior ATFL bundles on imaging2. Why these are important for management in suspected ankle instability.3. Injury to the lateral ligament complex involving the fibula / inferior ATFL can lead to subtalar joint instability4. This can be detected both during on-able fluoroscopy and intra-operatively and most importantly - correlated with MR appearances.

**TABLE OF CONTENTS/OUTLINE**

Lateral fibulotalocalcaneal ligament complex (LFTCL) is formed by the inferior fascicle of the anterior talofibular ligament (ATFL), connected with the calcaneofibular ligament (CFL) by arciform fibres ; it plays an important role in inversion injury prevention. This ligament complex is distinct from the superior fascicle of the ATFL - an intra-articular ligament unlikely to heal. An isolated repair of ATFL results in great outcomes if the complex is intact.In our exhibit, we outline:1. The anatomy and biomechanics of the lateral ligaments of the ankle.2. Injury mechanisms and related failure modes of the ligaments.3. MRI sequences used in our practice.4. Subsequent MRI appearances related to different failure models.5. Dynamic instability demonstrated by dynamic fluoroscopy.6. Correlation of example MRI cases with intra-operative videos.

## MKEE-130 OPERATIONALIZING CLINICAL KNEE MRI AT 7T: THE GOOD, THE BAD, AND THE UGLY

Aaron J. Wyse, MD (*Abstract Co-Author*) Nothing to Disclose
Michael G. Fox, MD (*Abstract Co-Author*) Royalties, RELX
Jeremiah R. Long, MD (*Abstract Co-Author*) Nothing to Disclose
David M. Melville, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan A. Flug, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
ANTHONY HANNON (*Abstract Co-Author*) Nothing to Disclose
Jason Tilque (*Abstract Co-Author*) Nothing to Disclose
Samuel J. Fahrenholtz, PhD (*Presenter*) Stockholder, Nano X Imaging

**TEACHING POINTS**

1) Though 7T represents a new technology with incredible capabilities, the current hardware and software requires intense optimization to reach an operational level of clinical abilities comparable with current 3T and 1.5T imaging. 7T clearance by the Food and Drug Administration is limited to knee and brain. 2) The primary advantage of 7T knee magnetic resonance imaging (MRI) is increased signal-to-noise ratio (SNR) which can be used for better resolution, less noise appearance, and/or faster imaging. 3) The primary disadvantages are heating and inhomogeneities in B0 and B1+. The inhomogeneities most significantly make chemical shift selective fat saturation fail, sometimes in the same anatomical regions across the acquisition planes. 4) Key technologies, e.g., deep learning reconstruction algorithms, are being deployed at 7T. MRI transmit and receive coil design is important. 5) The logistics of 7T are difficult. It is an expensive system with increased MR safety efforts and the possibility to induce bioeffects in patients.

**TABLE OF CONTENTS/OUTLINE**

1) Patient eligibility and safety at 7T; 2) Balancing SNR, acquisition time, and resolution; 3) Effects of B0 and B1+ inhomogeneities; 4) 3D MRI; 5) Deep learning reconstruction

## MKEE-131 HOW TO HAND-LE IT: DYNAMIC ULTRASOUND OF THE HAND AND WRIST

Preethi Kesavan, MD (*Abstract Co-Author*) Nothing to Disclose
Joy Li, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Abraham, MD (*Abstract Co-Author*) Nothing to Disclose
Steven B. Soliman, DO (*Abstract Co-Author*) Consultant, General Electric Company;Speaker, General Electric Company
Gunjan B. Malhotra, MD (*Abstract Co-Author*) Nothing to Disclose
Erika Ysabelle E. Mojica, MD (*Abstract Co-Author*) Shareholder, Catalyst Pharmaceuticals
Molly Pantelic, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hannah Lamberg, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Dynamic ultrasound of the hand and wrist is a valuable tool and can help answer clinical questions which are not well evaluated by CT or MR.2. Identification of abnormal movement of anatomic structures in relation to patient symptoms.

**TABLE OF CONTENTS/OUTLINE**

Introduction of dynamic ultrasound Advantages and challenges Upper extremity case examples with an explanation of scanning technique, pathology, and accompanying dynamic ultrasound cine clips and still images. Cases include 1. Intra-sheath subluxation of flexor digitorum tendons 2. De Quervain tenosynovitis and intra-sheath subluxation of abductor pollicus longus and extensor pollicus brevis 3. Extensor retinacular ligament injury/snapping of lateral band 4. Hardware/screws abutting flexor tendons and extensor compartments 5. Stenosing tenosynovitis 6. Stener lesion 7. Radial sagittal band tear with extensor tendon dislocation Summary/Key points

## MKEE-132 THE MANY FACES OF SOFT-TISSUE FIBROBLASTIC TUMORS

**Awards**
**Certificate of Merit**

Jesus D. Aquerreta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alberto Paternain, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Del Nido Recio (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Soft tissue tumors of fibrous origin are one of the most common tumors found in clinical practice.; They may have different biological behavior and imaging appearance, depending on the type. Some of these lesions may be reactive to a primary process, such as elastofibroma dorsi and myositis ossificans.; Tumors with high cellularity show higher signal on T2-weighted imaging (WI) and more enhancement, whereas tumors with dense internal collagen content show low signal intensity and less enhancement.

**TABLE OF CONTENTS/OUTLINE**

Fibroblastic and myofibroblastic tumors can be classified according to their biological behavior:
• **Benign lesions**:
○ Elastofibroma dorsi: it is located between the scapula and the posterior chest wall and it has heterogeneous appearance (fibrous and fatty tissue).
○ Myositis Ossificans: it shows a heterogeneous appearance on imaging and has calcified areas.
○ Fibromatosis Colli: it is found on the sternocleidomastoid muscle and it is secondary to trauma during childbirth.
○ Other lesions are: Nodular Fasciitis and Fibroma of the Tendon Sheath.
• **Intermediate lesions**: Palmar (Dupuytren) and Plantar (Ledderhose) Fibromatosis, Dermatofibrosarcoma, Solitary Fibrous Tumor.
• **Malignant lesions**:
○ Fibrosarcoma (not otherwise specified): it is hypointense on T1 WI and iso- to hyperintense on T2 WI, with peripheral enhancement.
○ Myxofibrosarcoma: it has a heterogeneous appearance with hyperintense foci on T2. Osseous involvement is frequent.
○ Sclerosing Epitheloid Fibrosarcoma: it produces cortical destruction and it shows variable signal intensity on T1 WI, with variable enhancement.
○ Other tumors are: Undifferentiated Pleomorphic Sarcoma or Low-grade Fibromyxoid Sarcoma.

## MKEE-133 ONCOLOGIC AND NON-ONCOLOGIC SKELETAL MUSCLE UPTAKE PATTERNS ON 18F FDG PET-CT: A CASE BASED MULTI-MODALITY PICTORIAL REVIEW WITH TEACHING PEARLS

Pokhraj P. Suthar, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Magill (*Abstract Co-Author*) Nothing to Disclose
Iryna Kostirko (*Abstract Co-Author*) Nothing to Disclose
Sumeet Virmani, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

F18 FDG PET-CT is a well-established imaging modality with applications in cancer staging, cardiology and neurology. Skeletal muscle FDG uptake seen on whole-body PET-CT may be physiologic or pathologic. Physiologic/normal FDG uptake in skeletal muscles is usually mild and homogeneous. This case-based pictorial review highlights the spectrum of physiologic and pathologic skeletal muscle uptake patterns on F-18 FDG PET-CT, some of which are very specific and virtually diagnostic. Our case-based pictorial review aims to review:1) Expected physiologic distribution and intensity of FDG uptake in skeletal muscles.2) Various physiologic variants (FDG injection in a postprandial state, use of insulin before FDG injection, vigorous muscle exercise, stress-induced muscle tension, spastic paresis, talking, chewing, clenching of fist, use of accessory muscles of respiration, use of crutches, altered biomechanics, etc.)3. Various non-oncologic pathologic patterns of skeletal muscle uptake (elastofibroma dorsi, post-vaccination, Baastrup's disease, hot spot sign in acetabular fossa etc.)4. Various focal and diffuse oncologic patterns of skeletal muscle uptake (leiomyosarcoma, rhabdomyosarcoma, lymphoma, metastasis)

**TABLE OF CONTENTS/OUTLINE**

Our case-based pictorial review of 20 interesting cases, highlights the spectrum of physiologic and pathologic skeletal muscle uptake patterns on F-18 FDG PET-CT, some of which are very specific and virtually diagnostic. Increased awareness of such patterns helps in avoiding misdiagnosis and unnecessary further interventions minimizing morbidity and mortality.

## MKEE-134 SPECTRUM OF UNDIFFERENTIATED SMALL ROUND CELL SARCOMAS— A RADIOLOGIC-PATHOLOGIC CORRELATION IN THE ERA OF WHO CLASSIFICATION 5TH EDITION (2020)

Ryo Kurokawa, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Mariko Kurokawa, MD (*Abstract Co-Author*) Nothing to Disclose

Yasunobu Takaki (*Abstract Co-Author*) Nothing to Disclose
Koichiro Mori (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Familiarize yourself with the new category, "undifferentiated small round cell sarcoma of bone and soft tissue," introduced in the WHO Classification of Tumors 5th edition (2020). • Recognize that these tumors primarily affect young individuals, exhibit high malignancy, and have a poor prognosis, emphasizing the importance of early and accurate diagnosis. • Understand the role of molecular genetic analysis in the accurate differential diagnosis of these tumors, as they often present with overlapping clinical and imaging features. • Learn to identify the characteristic imaging features of Ewing sarcoma and its related entities, which can help narrow down the differential diagnosi. • Keep in mind other small round cell tumors that should be considered in the differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Overview of the WHO Classification of Tumors 5th edition (2020) and the new category of "undifferentiated small round cell sarcoma of bone and soft tissue"
- Ewing sarcoma
- Clinical features, imaging findings, and pathological findings
- Treatment and imaging assessment after therapy
- New histological types such as Ewing like sarcoma
- Clinical features, imaging findings, and pathological findings
- Differentiation from Ewing sarcoma on imaging
- Differential diagnosis of small round cell tumors
- Malignant lymphoma, embryonal rhabdomyosarcoma, alveolar rhabdomyosarcoma, neuroblastoma, and desmoplastic small round cell tumor (DSRCT)
- Conclusion
- Significance of understanding the spectrum of undifferentiated small round cell sarcomas in the era of the WHO Classification 5th edition (2020)

## MKEE-135 UNLOCKING THE MYSTERIES OF PELVIC FLOOR DISORDERS: A UNIQUE PERSPECTIVE THROUGH MUSCULOSKELETAL ULTRASOUND

Pritika Panchal (*Abstract Co-Author*) Nothing to Disclose
Santosh Patil (*Abstract Co-Author*) Nothing to Disclose
S. Sindhura, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shah S Sameerkumar (*Abstract Co-Author*) Nothing to Disclose
Vijay Halagappanavar Vamadevappa (*Abstract Co-Author*) Nothing to Disclose
Y C. Manjunatha, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purposes of this exhibit are:- Highlight the role of musculoskeletal ultrasound, provide comprehensive overview of pelvic floor anatomy, common disorders, and the utility of musculoskeletal ultrasound in their evaluation. Demonstrate imaging techniques, discuss clinical applications and illustrate ultrasound findings in diagnosing and managing pelvic floor disorders. Highlight the advantages of musculoskeletal ultrasound over traditional imaging modalities. Emphasis on elastography and USG guided interventions.

**TABLE OF CONTENTS/OUTLINE**

Exhibit will be organized under the following headings: Introduction.
- Anatomy of pelvic floor.
- Indications of pelvic floor ultrasound.
- Equipment and technique.
- Common pelvic floor disorders
- Anterior compartment
- Stress urinary incompetence.
- Post sling surgery.
- Fowler syndrome- external urethral sphincter thickening.
- Pelvic organ prolapse.
- Cystocele.
- Central compartment
- Tricompartmental disease.
- Pneumovagina.
- Varicose veins.
- Angioneurotic edema.
- Barthrolin cyst.
- Sebaceous cyst
- Epidermoid.
- Posterior compartment
- Rectocele.
- Enterocele.
- Rectal intussusception.
- Rectoanal intussusception.
- Rectoenterocele.
- Anorectal dyssynergia.
- Fecal incontinence.
- Obstetric anal sphincter injury.
- Vulvar cellulitis.
- Male Pelvic Floor disorders
- Urinary incontinence.
- Peyronie’s disease.
- Painful pelvic floor disorders.
- Myofascial pain syndrome.
- Pudendal canal syndrome.
- Pyriformis syndrome.
- Rectus adductor symphysis syndrome.
- Athletic pubalgia.

- Lipedema.
- Ultrasound guided procedures.
- Elastography in pelvic floor disorders.
- Conclusion.

## MKEE-136 IMAGING OF THE PEDIATRIC ELBOW: AN OVERVIEW AND UPDATE

**Awards**
**Certificate of Merit**

Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor T. Paula, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Radiographic Evaluation of the Pediatric ElbowThe pediatric elbow presents unique challenges in radiographic assessment due to the ongoing development of ossification centers and growth plates. Key considerations include:Assessment of Growth Plates;Alignment and Joint Spaces;Ossification Centers (CRITOE);2. Trauma and Sports Related PainRecognize the main types of fractures that occur in the pediatric elbow, their most prevalent mechanism of injury, classification (when necessary), pitfalls in interpretation in different imaging methods, and the main complications.3. Non-Traumatic ConditionsAcquire understanding regarding the variances between the musculoskeletal systems of pediatric and adult patients. Explore the clinical and radiological manifestations of musculoskeletal disorders in children. To discuss the optimal imaging strategies for specific disease entities.

### TABLE OF CONTENTS/OUTLINE

1) RADIOGRAPHIC EVALUATION OF THE PEDIATRIC ELBOW2) TRAUMA AND SPORTS RELATED PAINACUTE TRAUMA:Fracture of the distal humeral epiphysis; Radial head dislocation; Supracondylar fracture; Lateral condyle fracture; Monteggia fracture-dislocation;Medial epicondyle fracture; Posterolateral elbow dislocation.OVERUSE INJURIESPanner's disease / Osteochondrosis of the capitellum; Osteochondral lesion (osteochondritis dissecans) in the capitellum; Osteochondral lesion (osteochondritis dissecans) in the trochlea; Traction apophysitis (medial epicondyle; olecranon)3) NON-TRAUMATIC CONDITIONS: Infection; Inflammatory (JIA); Tumors; Hemophilia

## MKEE-137 FIRE IN THE HOLE: REVIEW OF BLAST-RELATED HAND INJURIES

Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Kasha Chen (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Abstract Co-Author*) Nothing to Disclose
Cassidy Tung (*Abstract Co-Author*) Nothing to Disclose
Kenneth N. Huynh, DO (*Abstract Co-Author*) Nothing to Disclose
Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Erwin Ho (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the epidemiology of varying hand-blast injuries. 2. To discuss typical injury patterns of firework-related hand-blast injuries and highlight the key imaging findings with consideration of the hand anatomy and mechanism of injury. 3. To discuss corresponding injury complications and treatment options.

### TABLE OF CONTENTS/OUTLINE

Each year, roughly 3,000 hand-blast injuries occur in the United States and the incidence continues to rise. Such a trend is concerning because those affected are often young, with blast injuries causing soft tissue, neurovascular, bone, and joint damage that result in significant hand impairment and amputation. Only a few studies have specifically investigated firework-related injuries and have proposed injury mechanisms and severity classifications. The extensive nature of blast injuries combined with the increasing incidence underscores the urgent need for a better understanding of the mechanism of injury, pertinent radiologic findings, and treatment options. This exhibit will aim to (1) describe the growing public health issue of hand blast injuries, (2) review relevant anatomy of the hand, (3) discuss firework-related injury patterns with respect to the injury mechanism and anatomic considerations, and (4) illustrate our institution’s cases of hand blast injuries along a spectrum of severity with annotated radiographic images. An understanding of the typical injury pattern can help radiologists discern the often-complex radiographic appearance of blast injuries.

## MKEE-138 THUMBS UP FOR ULTRASOUND OF THE RADIAL WRIST

**Awards**
**Cum Laude**

Andrew J. Grainger, MD (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Lisa Billone, BSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. High resolution ultrasound can be used as a first line imaging modality for patients presenting with radial wrist pain, whether traumatic or non-traumatic in nature.2. The sonoanatomy of the radial wrist, including joints, ligaments, tendons, and nerves will be illustrated and described allowing participants to evaluate these structures in a protocol driven manner.3. The dynamic capabilities, superior spatial resolution, and direct patient interaction of ultrasound which provide unique advantages over MRI will be highlighted.4. Real case examples of pathologies causing radial wrist symptoms will be considered, including:a. Bone and joint disorders, such as synovitis, osteoarthritis, ligament injury, scaphoid fracturesb. Tendon pathologies, such as DeQuervain’s disease, intersection syndromes, tenosynovitis, partial and complete tears, post-operative complicationsc. Nerve disorders, such as

Wartenberg's syndrome, impingement, venipuncture injury, transectiond. Miscellaneous disorders, such as ganglion cysts, pseudoaneurysms, cystic adventitial disease

**TABLE OF CONTENTS/OUTLINE**

A. IntroductionB. Anatomy, ultrasound technique, pathology with case examples for thea. Bone and Joint i. Radiocarpal and midcarpal jointsii. Scapho-trapezium-trapezoid and 1st carpometacarpal jointsiii. Scapholunate ligamentiv. Scaphoid boneb. Tendon i. Abductor pollicis longus and extensor pollicis brevisii. Extensor carpi radialis longus and extensor carpi radialis brevisiii. Extensor pollicis longusiv. Flexor carpi radialisv. Flexor pollicis longusc. Nerve i. Superficial radial nerved. Miscellaneous i. Ganglion cystsii. Radial artery disordersiii. Accessory musclesC. Take home points

## MKEE-139 LUMBAR SPINE PARASPINAL MUSCLES ON MRI: ANATOMY, DERANGEMENTS, CONSENSUS RECOMMENDATIONS AND NEW HORIZONS

Robert D. Boutin, MD (*Abstract Co-Author*) Nothing to Disclose
Eddy Zandee van Rilland, MD (*Abstract Co-Author*) Nothing to Disclose
John Kleimeyer (*Abstract Co-Author*) Nothing to Disclose
Akshay Chaudhari, PhD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research Consultant, Subtle Medical, Inc
Jennifer A. Padwal, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Imaging evaluation of paraspinal muscles, particularly the multifidus which has been most thoroughly studied, requires an understanding of muscle anatomy and innervation that can help inform patterns of pathologic muscle changes. 2) Paraspinal muscle derangements have important implications for muscle function and low back pain in nonoperative, preoperative, and postoperative settings. 3) Current grading systems/methodologies for lumbar spine muscle measurements of cross-sectional area (CSA) and fatty infiltration (FI) are variable and generally qualitative. Automated AI techniques can be used for accurate, quantitative measurements of CSA and FI, facilitating longitudinal evaluation over time.

**TABLE OF CONTENTS/OUTLINE**

I. Paraspinal muscle anatomy: muscle composition, innervation, vascularity, attachments, and function. II. Review MRI findings of paraspinal muscle derangements based on physiological mechanism, including single or multilevel involvement, distribution, and time course. Discussion of the contribution of paraspinal muscle derangements to low back pain and decreased function. III. Current MRI methodologies of evaluating paraspinal muscle, including MRI-derived measurements of CSA and FI using chemical-shift MRI. Challenges of translating research into clinical practice and future directions, including potential added value of AI tools in the clinical setting and opportunistic implementation of International Society for the Study of the Lumbar Spine (ISSLS) consensus recommendations.

## MKEE-14 MUSCLING IN ON THE ACTION - ACCESSORY MUSCLES OF THE UPPER EXTREMITY

**Awards**
**Certificate of Merit**

Kathryn J. Stevens, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jennifer A. Padwal, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Multiple accessory muscles exist within the upper extremity, and have a widely varying prevalence 2) Accessory muscles are often overlooked but can have a significant clinical impact and present intraoperative challenges if not identified on preoperative imaging 3) Accessory muscles are best identified on MRI, particularly on T1 or PD-weighted images without fat suppression, where they can be confidently separated from the adjacent fat 4) Detailed knowledge of upper extremity muscle anatomy and awareness of these normal variants will help the practicing radiologist correctly identify these accessory muscles and become familiar with their contribution to upper extremity pathology

**TABLE OF CONTENTS/OUTLINE**

I) Accessory muscles of the shoulder/upper arm: case-based anatomic review and clinical impact II) Accessory muscles of the elbow/forearm: case-based anatomic review and clinical impact III) Accessory muscles of the wrist/hand: case-based anatomic review and clinical impact

## MKEE-140 TRAUMATIC AND SPORTS MUSCULAR INJURIES, WHAT TO LOOK FOR

Artur Da Rocha Correa Fernandes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marco Bianchi (*Abstract Co-Author*) Nothing to Disclose
Mauricio Ricardo Moreira da Silva Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Freitas (*Abstract Co-Author*) Nothing to Disclose
Jose Claudio N. Junqueira, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael B. Paschoalini, MSc (*Abstract Co-Author*) Nothing to Disclose
Pedro Henrique R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Henrique Pierro Carvalhinho (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Anatomy and BiomechanicsInjury mechanisms and patternsSpecific ConditionsInjury Grading

**TABLE OF CONTENTS/OUTLINE**

Muscles can be classified based on fiber orientation. In parallel muscles, fibers run parallel to the tendons, allowing larger ranges of excursion. Injuries typically affect the tendons and cause retraction. Pennate muscles, where fibers are oriented at an angle, generate greater force and are more susceptible to strains.Acute muscle injuries result from strain, contusion, laceration or compartment syndrome. The lower extremities are more frequently affected, especially the hamstring muscles, rectus femoris, and calf muscles. In the upper extremities, the most commonly injured are the rotator cuff and biceps brachii. Typically, the myotendinous junction is the most vulnerable. In older patients, the tendinous regions become the primary weak points. In skeletally immature patients, the apophysis is often affected, leading to apophysitis and avulsive fractures.DOMS is delayed muscular response to unaccustomed exertion, characterized, in MRI, by reversible enlargement and increased signal intensity in one or more muscles. Myositis ossificans is an abdormal response to trauma, resulting in nodular swelling, edema and peripheric calcifications.Various grading systems for muscle injury exist, primarily based on the type and size of lesion, the percentage of the cross-sectional area affected, and the presence of an intramuscular hematoma.

## MKEE-141 RISK VERSUS BENEFIT OF PERCUTANEOUS IMAGE-GUIDED BIOPSY FOR PERIPHERAL NERVE SHEATH TUMORS: UPDATED RECOMMENDATIONS FOR WHO, WHAT, WHEN AND HOW

Marco G. Aru, MD (*Abstract Co-Author*) Nothing to Disclose
Barry G. Hansford, MD (*Abstract Co-Author*) Nothing to Disclose
Kolade D. Odetoyinbo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

After viewing this exhibit the learner will be able to:- Understand general imaging characteristics of benign versus malignant nerve sheath tumors (PNSTs), as well as the limitations of imaging- Identify appropriate indications and pre-procedural work up for PNST biopsy based on lesion characteristics: benign, indeterminate, and malignant- Recognize "do not touch" PNSTs to avoid potentially deleterious consequences of biopsy-Describe techniques to optimize biopsy yield while maintaining patient comfort-List the frequency and types of postprocedural complications for image-guided biopsy of PNSTs-Be familiar with the diagnostic yield for different types of PNSTs-Triage non-diagnostic biopsies and repeat biopsy when warranted

**TABLE OF CONTENTS/OUTLINE**

-Introduction/Background-Brief case-based review of benign and malignant nerve sheath tumors including:--Clinical vignette--Multimodality key imaging features--Relevant histopathology- Clinical indications and preprocedural workup of PNSTs based on suspected type (benign, indeterminate, malignant)-Discussion of "do not touch" PNSTs-Techniques for PNST biopsy to maximize diagnostic yield and patient comfort-Post-procedural complications for PNST biopsies: benign, indeterminate, malignant-Literature review of expected diagnostic yield for PNST biopsies-Management of non-diagnostic biopsies-Summary

## MKEE-142 IF THE SHOE FITS, CALL IT: A LUMPY BUMPY CASE REVIEW OF BENIGN FOOT AND ANKLE SOFT TISSUE TUMORS AND MIMICS

Cornelia B. Wenokor, MD (*Abstract Co-Author*) Nothing to Disclose
Garrett Yoon, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Christopher Azzam, MD (*Abstract Co-Author*) Nothing to Disclose
Justin Newman, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Soft tissue tumors of the foot and ankle are rare, making diagnosis often difficult and delayed. Adding to this challenge is the multitude of tumor mimics, placing us in a diagnostic dilemma. Fortunately, the vast majority of these pathologies are benign. However, our ability to distinguish between them and generate a differential diagnosis is imperative for optimal management, directing treatment, and avoiding unnecessary interventions. We present common, as well as rare and interesting cases of benign foot and ankle soft tissue tumors and tumor mimics on imaging, including radiographs, CT, and MRI. We highlight demographics, etiology, salient characteristics, and important differential considerations. The selected cases encompass a wide range of tissue types, including fibrous, pericytic, vascular, adipocytic, fibrohistiocytic, and neural. This exhibit aims to facilitate accurate diagnosis of foot and ankle soft tissue tumors and tumor mimics, as well as raise awareness of several rare lumps and bumps.

**TABLE OF CONTENTS/OUTLINE**

IntroductionDesmoplastic fibroblastomaPlantar fibromatosis/Ledderhose diseaseGlomangiomatosisHemangiomaAngiofibrolipomaFibrolipomatous hamartomaTenosynovial giant cell tumorSchwannomaNeurofibromaTumor Mimics (calcific myonecrosis, tumoral calcinosis, posterior tibial neuritis, Morton's neuroma, Haglund's syndrome, saphenous vein thrombophlebitis, foreign body and pyogenic granuloma, ganglion cyst, heterotopic bone, keloid, Dupuytren's)Conclusion

## MKEE-143 POST-TRAUMATIC ENTITIES MIMICKING SOFT TISSUE AND BONE NEOPLASMS: WHAT THE RADIOLOGIST NEEDS TO KNOW

Barry G. Hansford, MD (*Abstract Co-Author*) Nothing to Disclose
Keshawn Pope, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

After viewing this exhibit, the learner will be able to: 1. List bone and soft tissue post-traumatic entities mimicking neoplastic disease 2. Identify entity specific multimodality key imaging features 3. Describe entity specific histories and clinical findings 4. Appreciate basic histopathology for select entities 5. Recognize post-traumatic "do not touch" lesions 6. Discuss entity specific treatment options/outcomes 7. Triage indeterminate entities necessitating image-guided biopsy

**TABLE OF CONTENTS/OUTLINE**

Introduction/background:• Pearls and pitfalls to distinguish between pathologic and bland fracturesCase-based review of post-traumatic entities mimicking neoplasm based on anatomic structures and type of trauma:• Osseous-Single traumatic episode: Healing fracture, apophyseal avulsion, subperiosteal hematoma, traumatic Schmorl's node, BPOP spectrum of lesions, etc.-Repetitive microtrauma: Stress fracture, enthesopathy, transient osteoporosis, subpubic cartilaginous cyst, hemophilia pseudotumor, intraosseous ganglion, osteochondrosis, etc. o Clinical vignette o Key imaging findings o Treatment options/outcomes• Soft tissues (muscle, fat, and fascial based): Morell Lavallee, myositis ossificans, chronic expanding hematoma, muscle herniation, adventitial bursa, torn tendon, nodular cystic fat necrosis, ganglion/cysts, etc. o Clinical vignette o Key imaging findings o Treatment options/outcomes• Neurovascular: Pseudoaneurysm, neuroma, and microgeodic disease o Clinical vignette o Key imaging findings o Treatment options/outcomes• Review of "do not touch" post-traumatic entities• Utilization of image-guided biopsy for indeterminate lesions Summary

## MKEE-144 STREAMLINING DUAL ENERGY CT MUSCULOSKELETAL PROTOCOLS IN A LARGE ACADEMIC CENTER: TIPS FROM THE GROUND UP

Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Peter H. Pham, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Anavim, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Anderanik Tomasian, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Golshan Momeni, MD (*Abstract Co-Author*) Nothing to Disclose
Jasmine Zhao, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Utilizing data from two energy spectra, dual energy CT (DECT) enables the detection and quantification of materials, which helps identify crystal arthropathy, bone marrow edema, tendon/ligament injuries, while also reducing metal artifacts in musculoskeletal imaging. 2. DECT findings often lead to significant changes in management, bolster diagnostic confidence, enhance incidental lesion characterization, and minimize the need for invasive interventions. 3. Despite its advantages, DECT adoption faces hurdles such as cost implications, data overload, and the need for additional education among clinicians and radiologists. 4. Stepwise implementation methods and education initiatives to increase familiarity with DECT are necessary to streamline its integration into routine practice.

**TABLE OF CONTENTS/OUTLINE**

1. Learning Objectives 2. Basic overview of DECT: Acquisition, Post-processing, and Interpretation 3. Applications of DECT in Musculoskeletal Imaging 4. Clinical Benefits of DECT Utilization 5. Impact of DECT on Clinical Management: Illustrated Though Emergency Department Cases 6. Barriers to DECT: Cost and Data Overload 7. Solutions and Steps to DECT implementation (3 Prong Approach) 8. Summary and Key Takeaways

## MKEE-145 CASE-BASED REVIEW OF ATYPICAL GOUT MIMICKERS USING DUAL-ENERGY CT IN THE EMERGENCY SETTING

Anderanik Tomasian, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Golshan Momeni, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Anavim, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Peter H. Pham, MD (*Abstract Co-Author*) Nothing to Disclose
Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Jasmine Zhao, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Despite its prevalence, diagnosing gout can be challenging due to its resemblance to other acute medical conditions. 2. Dual energy CT (DECT) utilizes attenuation data at two energy spectra to detect monosodium urate crystals, facilitating accurate gout diagnosis. 3. DECT offers practicality for emergency room settings, boasts high sensitivity and specificity, and expedites diagnosis, particularly in atypical cases or when traditional methods are inconclusive. 4. False positives, attributed to beam hardening and motion artifacts, are potential drawbacks. Additionally, false negatives may occur in the early stages of gout (<6 weeks). 5. DECT should be integrated into routine emergency imaging protocols to aid in diagnosing acute and challenging gout presentations, thereby guiding appropriate management.

**TABLE OF CONTENTS/OUTLINE**

1. Learning Objectives 2. Background: Clinical Presentation of Acute Gout 3. DECT Applications in Musculoskeletal Imaging 4. Utility of DECT for Gout in the Emergency Department: Advantages and Pitfalls 5. Ten Case-Based Examples of Atypical Gout Presentations 6. Summary and Key Takeaways

## MKEE-146 EXPLORATION OF BONE EDEMA: SPECTRAL ANALYSIS VIA DUAL-ENERGY COMPUTED TOMOGRAPHY FOR URGENT EVALUATION

Yeni Fernandez de Lara Barrera, MD (*Abstract Co-Author*) Nothing to Disclose
Estefania Murrieta Peralta, MD (*Abstract Co-Author*) Nothing to Disclose
Maria M. Salazar Osorio, MD (*Abstract Co-Author*) Nothing to Disclose
Karina I. Holguin Andrade, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Enhanced Characterization: Explore how the use of a bone edema map with dual-energy computed tomography (DECT) can improve fracture characterization, providing a more detailed and accurate assessment. 2. Identification of Hidden Fractures: 3. Reduced Diagnostic Time: Explain how DECT's ability to characterize fractures can decrease the time needed for diagnosing injuries, especially in emergency situations. 4. Differentiation between Acute and Chronic Fractures. 5. Utility of Bone Edema in DECT: Showcase the advantages of using bone edema as an indicator in DECT, such as its ability to detect fractures in early stages, precision in fracture localization, and its usefulness in treatment monitoring and surgical planning.

**TABLE OF CONTENTS/OUTLINE**

Background: Dual-energy computed tomography (DECT) is a sophisticated imaging technique that utilizes two distinct kilovoltages to assess X-ray absorption in tissues.Bone Marrow Edema: Bone marrow edema is a common feature in traumatic injuries and pathological conditions.Main Applications: Identification and diagnosis of fractures in the carpal and wrist bones.Compression vertebral fractures, distinguishing between acute and chronic fractures. Oncological evaluation.Hidden hip fractures and identification of periprosthetic fractures.Limitations and Pitfalls: Metallic Artifacts and Soft Tissue Limitations.Conclusion: Dual-energy computed tomography represents a significant advancement in the evaluation of bone marrow edema.

## MKEE-147 UPPER EXTREMITY NERVES AND THEIR BRANCHES - A MAGNETIC RESONANCE IMAGING AND SONOGRAPHIC ATLAS

Gregory S. Stacy, MD (*Abstract Co-Author*) Nothing to Disclose
Katie L. Nguyen, MD,BS (*Abstract Co-Author*) Nothing to Disclose
Braden Anderson, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

We have received growing numbers of requests to evaluate nerves of the upper extremity (e.g., in the setting of penetrating trauma) in order to assess the degree of nerve damage and potential for repair. These requests have included the major nerves as well as various cutaneous branches, which might not be as familiar to the radiologist. Dedicated ultrasound imaging has been particularly useful in the setting of ballistic fragments and orthopedic hardware. The purpose of this exhibit is to provide an atlas of upper extremity nerves using magnetic resonance images alongside corresponding sonographic images. Supplementary sonographic videos will be provided to aid in anatomic localization. We will review the origin of the major nerves (median, radial, ulnar, and musculocutaneous) at the distal brachial plexus, discuss their separate paths in the arm, and highlight several key and lesser-known branches along their respective courses. Discussion will feature key osseous, muscular, and vascular landmarks.

**TABLE OF CONTENTS/OUTLINE**

Introduction Ultrasound Technique Proximal Anatomy: Brachial Plexus Cords Median Nerve: Arm, Elbow, Forearm, and Wrist Anterior Interosseous Nerve Palmar Cutaneous Branch Ulnar Nerve: Arm, Elbow, Forearm, and Wrist Dorsal Cutaneous Branch Radial Nerve: Arm, Elbow, and Forearm Posterior Antebrachial Cutaneous Nerve Superficial Branch Deep Branch/Posterior Interosseous Nerve Musculocutaneous Nerve Lateral Antebrachial Cutaneous Nerve Medial Cutaneous Nerves Conclusion

## MKEE-148 MULTIMODALITY IMAGING EVALUATION OF MUSCULOSKELETAL MANIFESTATIONS IN RHEUMATOID ARTHRITIS: ADDRESSING RHEUMATOLOGISTS' NEEDS

Veronica Espinosa Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Axel A. Torres Monarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Bethsabel Rodriguez Encinas, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Eugenio Cosme, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Chapa-Ibarguengoitia, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Hernandez-Diaz (*Abstract Co-Author*) Nothing to Disclose

Lourdes M. Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Ana V. Meza Sanchez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To understand the pathophysiology of bone formation and resorption and its role in the pathophysiology of rheumatoid arthritis. To recognize the pathophysiology behind the imaging features in rheumatoid arthritis. To distinguish the primarily affected joints in rheumatoid arthritis and their main imaging features. To comprehend the indications and best acquisition protocols for rheumatoid arthritis in different imaging modalities. To understand the different scoring systems used to grade the disease.

**TABLE OF CONTENTS/OUTLINE**

Overview Definition and criteria according to ACR/EULAR 2010 Epidemiology Pathophysiology Bone cells. Bone formation and bone resorption processes. Rheumatoid arthritis pathophysiology Primarily affected joints. Imaging features Pathophysiology of imaging findings Plain radiograph Radiographic projections (Hand, foot, knee, ankle, spine) Findings Scoring systems CT Acquisition protocol Indications Findings Ultrasound Protocols Indications Findings Scoring systems MRI Acquisition protocol Indications Findings Scoring systems Test yourself! Summary (Take-home points).

## MKEE-149 REVOLUTIONIZING PREOPERATIVE PLANNING FOR MSK BONE TUMORS: INTEGRATING RADIOMICS AND 3D PRINTING FOR ENHANCED SURGICAL PRECISION

Matthias F. Froelich, MD (*Abstract Co-Author*) Consultant, Smart Reporting GmbH;Consultant, Guerbet SA
Lorenzo Muntaner, MD (*Abstract Co-Author*) Nothing to Disclose
Mara Villargordo Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Reda Britel, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Advancements in musculoskeletal oncology, incorporating 3D segmentation, radiomics, and printing, notably enhance surgical planning. 1-Segmentation in 3D involves the division of medical images into regions of interest, enabling precise manipulation and visualization of anatomical structures. 2-Radiomics, a rapidly evolving field, involves the extraction and analysis of quantitative features from medical images, offering valuable insights into tumor characteristics and behavior. 3-Additionally, 3D printing allows for the creation of physical models from medical imaging data, facilitating preoperative visualization and planning. Integration of these technologies improves surgical precision, reduces operative times, and enhances postoperative outcomes.However, challenges like specialized training persist. Future advancements promise further enhancements in musculoskeletal oncology surgical planning.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Clinical Characteristics and Surgical Considerations
- Principles of 3D Segmentation
- Applications of Radiomics in MSK Bone Tumors
- Applications of 3D Printing in Preoperative Planning
- Clinical and Economic Benefits of Implementing 3D Technologies
- Challenges and Limitations in Clinical Practice
- Future Perspectives and Technological Advances
- Conclusion

## MKEE-15 UNUSUAL AND CHALLENGING CT-GUIDED BONE BIOPSIES: NAVIGATING COMPLEX CASES WITH PRECISION AND INSIGHT

Mateus A. Hernandes, MD (*Abstract Co-Author*) Nothing to Disclose
Edgard E. Engel, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Papalexis (*Abstract Co-Author*) Nothing to Disclose
Giancarlo Facchini (*Abstract Co-Author*) Nothing to Disclose
Nelson F. Gava, MD (*Abstract Co-Author*) Nothing to Disclose
Marcello H. Nogueira-Barbosa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonor Savarese, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Bone biopsies are a critical element in the diagnostic pathway for various bone diseases, including primary bone tumors, metastatic conditions, infections, and other non-neoplastic disorders. In numerous instances, image-guided percutaneous biopsy is the preferred procedure due to its minimally invasive nature, high diagnostic yield, cost-effectiveness, and lower morbidity compared to surgical biopsy. Among image-guided techniques, computed tomography (CT) provides the benefit of superior spatial resolution and precise needle placement, thereby enhancing the success rate of the biopsy. Nevertheless, some skeletal sites can pose particular challenges, even with CT guidance, owing to anatomically intricate lesions, closeness to vital structures, lesions that are not visible on CT, or sclerotic lesions. Understanding the complexity of bone biopsies can represent an important resource for managing such cases effectively and safely.

**TABLE OF CONTENTS/OUTLINE**

Case-based review of various unusual and challenging cases of CT-guided bone biopsies, illustrating technical challenges, potential complications and practical strategies to increase the safety and diagnostic yield of the procedure.

## MKEE-150 POST HIP ARTHROSCOPY FINDINGS; WHAT THE RADIOLOGIST NEEDS TO KNOW

Peter J. Haar, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
William Whiteside, BS (*Abstract Co-Author*) Nothing to Disclose
Deividas Gustainis, MD (*Abstract Co-Author*) Nothing to Disclose
Brandon Tran (*Abstract Co-Author*) Nothing to Disclose
Rafael M. Jimenez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review normal and abnormal findings of MRIs status post hip arthroscopy.2. To review complications of the labrum after first hip arthroscopy. 3. To review complications and dehiscence of the capsule after arthroscopy. 4. To review techniques of capsulotomy and capsulorraphy and their MRI

appearance. 5. To review techniques of labral reconstruction vs labral repair and their MRI appearance. 6. To review additional extra-articular MRI findings that account for failed arthroplasty. 7. To review findings of the cartilage after hip arthroscopy.

**TABLE OF CONTENTS/OUTLINE**

1. Normal hip anatomy on CR and MRI2. Hip labral tears and their classification.3. Hip labral tears and their MRI appearance using the MAHORN classification. 4. Labral re tear status post labral repair. 5. Labral reconstruction and the concept of the "spacer" adjacent to the capsule. 6. Imaging after failed labral repair and reconstruction. 7. Cartilage imaging and MRI classification of cartilage injuries. 8. Cartilage injuries after arthroscopy including "carpet" lesion. 9. Capsular imaging. 10. Capsular dehiscence after arthroscopy.11. Types of capsulotomy and capsular repairs. 12 Other MRI findings for persistent pain after arthroscopy including medial stress fracture of the calcar.

## MKEE-151 GLENOHUMERAL ARTHROSIS: DOES YOUR REPORT TRULY ADDRESS THE SURGEON'S QUERIES?

Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda Yukari H. Takahashi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Shoulder osteoarthritis is an extremely important condition, especially in aging adults, which justifies its high and increasing prevalence. Furthermore, it has a strong correlation with chondral injuries, and it is the most frequent cause of disability in the USA as a consequence of decreased motion and pain. Secondary causes are more common, such as trauma or repeated microtrauma in throwing athletes, chondrolysis, avascular necrosis, inflammatory arthropathy, and joint instability. Management depends on various aspects, including symptoms, radiological findings, and staging. This study’s goal is to review the key points that the radiological report must address for surgical planning using examples from our service.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Objective
- Glenoid morphology alterations: deficiency of glenoid bone stock, glenoid version, and modified Walch classification
- Humeral head alterations: glenohumeral subluxation index and humeral head medialization
- Glenohumeral degenerative changes
- Conclusion
- References

## MKEE-152 BROKEN BONES IN LITTLE ONES: THE PLAYFUL PATH TO EVALUATING CHILDREN'S FRACTURES

Erica D. Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe C. Ferreira Dionisio, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda Yukari H. Takahashi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Fractures in children constitute a common entity in medical practice, especially for radiologists. However, this age group presents particularities compared to the adult population, such as in epidemiology, presentation, and classification. Therefore, understanding the development and maturation of the skeleton is necessary to comprehend the different types of pediatric fractures. Although the prognosis for most fractures is excellent, knowledge about children’s fractures and their accurate description is of utmost importance for therapeutic success. This study aims to provide a didactic review of the most prevalent pediatric fractures, correlate them with different imaging methods, and describe their main radiological findings and classifications.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Objective
- Review of normal pediatric skeleton development
- Cases of pediatric fractures in different joints and different imaging methods, detailing common radiological findings and classifications
- Conclusion
- References

## MKEE-153 STRUCTURED REPORTING FOR GLENOID-TRACK: ASSESSING SHOULDER STABILITY

Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Bianca Bianco, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Yuree M. Herenio SR, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The shoulder is the most frequently dislocated joint in the body, largely due to its extensive range of motion, which is unmatched in humans. Between 1% and 2% of people will endure a glenohumeral dislocation in their lifetime, with anterior dislocations comprising over 95% of these cases. Such dislocations often result from falls onto an extended arm or shoulder. A significant portion of those who suffer an initial anterior shoulder dislocation, specifically 20% to 48%, will face recurrences. This risk is especially high among younger individuals, where recurrence rates soar to 66% to 94% in those under 20 years old.

**TABLE OF CONTENTS/OUTLINE**

Introduction; Objective; Glenoid-Track: Assessing Shoulder Stability; Measurement Parameters; Discussion; Radiological Cases; Conclusion; References.

## MKEE-154 DECODING PATELLOFEMORAL INSTABILITY: A STRUCTURED REPORT APPROACH

Roberto Froeder Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Bianca Bianco, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Patellofemoral instability represents a significant clinical challenge, directly influencing knee functionality and patient well-being. This study addresses the four main etiological determinants of patellofemoral instability: the Caton-Deschamps index for the quantification of high patella, Dejour's classification of trochlear dysplasia, the measurement of the tibial tubercle-trochlear groove (TT-TG) length, and the analysis of patellar tilt. We employed advanced imaging methods to draw direct correlations between these anatomical variables and episodes of patellar instability, demonstrating the interrelationship of these factors in the pathogenesis of femoropatellar instability, as well as providing insights for the development of more effective interventions. This study highlights the importance of an in-depth assessment of anatomical factors in the clinical management of patellofemoral instability, proposing an integrative model for risk prediction and treatment personalization. The clinical relevance lies in improving therapeutic outcomes and reducing the recurrence of pathologies, reinforcing the need for precise and individualized surgical planning.

**TABLE OF CONTENTS/OUTLINE**

Introduction; Objective; Determinants of patellofemoral instability: the Caton-Deschamps index, Dejour's classification, measurement of the tibial tubercle-trochlear groove length and patellar tilt; Discussion; Radiological Cases; Conclusion; References.

## MKEE-155 A RADIOLOGICAL WALK THROUGH RHEUMATOID ARTHRITIS

Carlos Suevos, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Acosta Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Acosta Batlle, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the pathophysiology of rheumatoid arthritis.Explain the different articular and extra-articular radiological manifestations using illustrative cases.Review the usefulness of the different imaging techniques in this pathology: plain radiography, ultrasound, CT and MRI.Differential diagnoses of peripheral arthropathies.

**TABLE OF CONTENTS/OUTLINE**

Rheumatoid arthritis is a chronic autoimmune disease that mainly affects the musculoskeletal system and can become highly disabling during its evolution. Early diagnosis is essential to establish treatment in the initial stages of the disease, which can delay its progression and improve the life quality of these patients. For this, it is essential to know the articular and extra-articular radiological findings of this pathology and the utilities of the different imaging techniques for its diagnosis. In this exhibit we review the typical signs of rheumatoid arthritis with plain radiography, ultrasound, CT, and MRI and show the diagnostic imaging tips. Typically, this disease affects small joints with characteristic signs that allow to differentiate it from other peripheral arthropathies.

## MKEE-156 TUMOR TRAILS: NAVIGATING SOFT TISSUE LESIONS THROUGH STRUCTURED REPORTS

Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Janaina Moreira (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Froeder Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Bianca Bianco, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A medical report on soft tissue tumors must be clear, detailed, and comprehensive, ensuring a deep understanding of the case and enabling the medical community to assess and compare different therapeutic approaches. It is crucial to provide precise information about location, size, involvement of critical structures, and the presence of necrosis, as these characteristics are essential for determining prognosis and guiding clinical decisions. A well-crafted report significantly contributes to the advancement of medicine and the improvement of patient outcomes.

**TABLE OF CONTENTS/OUTLINE**

Introduction to Soft Tissue Tumor; Objectives; Location and Depth; Size of the Tumor; Involvement of Critical Structures; Presence of Necrosis; Diagnostic Methods; Radiological Cases; Conclusion; References.

## MKEE-157 BONE MARROW IMAGING: UNRAVELING VARIATIONS AND IDENTIFYING PATHOLOGIES

Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina D. Augusto, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Beatriz Benetti, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this study is to improve understanding of the different normal patterns of bone marrow conversion and reconversion, as well as pathological changes, using systematic analysis of the T1 signal to guide differentiation between the pathologies. Additionally, advanced MR techniques, including chemical shift imaging, diffusion-weighted imaging, dynamic contrast-enhanced MRI, and whole-body MRI, may be utilized in cases warranting further investigation, and will also be explored.

**TABLE OF CONTENTS/OUTLINE**

The most common MRI signal variations observed in adult patients' bone marrow encompass a spectrum ranging from normal variants to benign pathologies and malignancies. Understanding the normal appearance and the physiological (re)conversion pattern is crucial for identifying and categorizing these entities effectively. Typically, in benign variations, the signal intensity of the lumbar vertebral bodies on T1-weighted SE images should be higher than that of adjacent intervertebral discs. Similarly, the signal intensity of appendicular red marrow areas on T1-weighted SE images should be higher than that of adjacent muscles. A systematic approach to analyzing T1 signal intensity aids in classifying the most common alterations. However, attention should also be paid to additional signs, such as contralateral involvement, periosteal reaction, cortical extension, and post-contrast enhancement.

## MKEE-16 TIPS AND TRICKS TO IDENTIFY ENDOMETRIOSIS FOR MUSCULOSKELETAL RADIOLOGISTS: DIAGNOSTIC FEATURES AND RECOMMENDATIONS

Michael D. Ringler, MD (*Abstract Co-Author*) Nothing to Disclose
Myra K. Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Liina Poder, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Brian T. Welch, MD (*Abstract Co-Author*) Nothing to Disclose
Christin A. Tiegs-Heiden, MD (*Abstract Co-Author*) Nothing to Disclose
Priyanka Jha, MBBS (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Ceylan Colak, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Endometriosis is a common condition, affecting one in 10 premenopausal women, impacting approximately 200 million women globally. 2. Early diagnosis remains a challenge. The most common clinical presentation is pelvic pain, but patients may be asymptomatic or present with infertility. The average delay in diagnosis ranges from 4 to 11 years, and 65% of patients are initially misdiagnosed. 3. Contributing to the delay in diagnosis, patients may undergo multiple studies related to the musculoskeletal (MSK) system including lumbar, sacroiliac, pelvic and hip MRI studies. While endometriosis may involve nerves and soft tissues, MSK MRI protocols are not typically optimized for adequate mapping of disease in the pelvis, which may involve the bowel, bladder, ureters, and the diagnosis itself may not be established without a dedicated protocol. 4. Imaging studies, especially MRI, have a critical role in the noninvasive diagnosis of endometriosis. Endometriosis specific MRI protocols are important for the identification of disease as recommended by evidence-based consensus guidelines by the European Society of Urogenital Radiology and the Society of Abdominal Radiology Endometriosis disease-focused panel. In daily practice, it is important to recognize common MRI findings of endometriosis on MSK studies and to identify when to recommend a dedicated endometriosis imaging and gynecological evaluation.

**TABLE OF CONTENTS/OUTLINE**

1. Title 2. Disclosures 3. What is endometriosis? 4. Learning objectives 5. Common MR imaging findings of endometriosis 6. MRI protocol considerations 7. Treatment options 8. Case examples with imaging findings 9. Conclusion 10. References

## MKEE-17 KOOSH IT: USING GOLDEN-ANGLE RADIAL KOOSHBALL SAMPLING FOR 4D DYNAMIC MRI OF JOINTS

Joshua Auger (*Abstract Co-Author*) Nothing to Disclose
Sarah D. Bixby, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Simon K. Warfield, PhD (*Abstract Co-Author*) Nothing to Disclose
Jade Iwasaka-Neder, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Fatih Calakli (*Abstract Co-Author*) Nothing to Disclose
Musa Tunc Arslan (*Abstract Co-Author*) Nothing to Disclose
Giovani Schulte Farina, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Joints are moving structures by nature and motion abnormalities should be evaluated by assessing the full anatomy dynamically. Biomechanical parameters from static or quasi-static MRI scans are different from moving motion. - Most of the dynamic imaging techniques are 2D over time. - There is still a need for improved dynamic imaging with 4D (3D+time), submillimeter isotropic (<1mm3), relatively artifact-free, and contrast changeable to the different MSK tissues of interest to better characterize motion joint motion abnormalities. - Golden-angle radial kooshball sampling in combination with sliding window reconstruction can provide dynamic and motion-robust images of the joints during real-time motion in 4D using high-field 3T scanners. - The 4D dynamic radial kooshball technique can be implemented for different joints, such as ankles and knees. - Full anatomy of the joints can be visualized dynamically in the 3 planes throughout the maximum range of motion.

**TABLE OF CONTENTS/OUTLINE**

- Dynamic MRI Imaging in MSK: current techniques- K-space sampling - 3D golden-angle radial kooshball - Basis and concepts - Applications in dynamic imaging - Cartesian sampling- Reconstruction algorithms for dynamic imaging - Sliding window reconstruction- Patient preparation - Movement training and patient positioning- 4D dynamic imaging of joints - Knee - Ankle- Challenges and limitations - Potential clinical applications - Impingement phenomenon - Patellofemoral tracking - Hindfoot motion in tarsal coalition - Microinstability

## MKEE-18 BASIC AND ADVANCED WRIST MRI FOR EVALUATION OF TRIANGULAR FIBROCARTILAGE COMPLEX (TFCC) INJURY

Akimoto Nimura (*Abstract Co-Author*) Nothing to Disclose
Yoichi Yokoyama, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Masaki Matsusako, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Hashimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Yuko Tsujioka, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purposes of this exhibit are 1) To demonstrate the new anatomical findings of radioulnar ligaments. 2) To know basic 2D and 3D MR imaging findings of TFCC injuries. 3) To introduce the latest MR techniques for evaluation of TFCC including high-resolution images using deep learning reconstruction and CT-like images for bony structure.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction 2) Clinical aspects of TFCC injury 3) Latest anatomical knowledges of TFCC comparing with MRI 4) Pearls and pitfalls in wrist MR when evaluating TFCC injuries 5) Latest MR techniques for precise evaluation of TFCC i) High-resolution MRI with deep learning reconstruction ii) CT-like images

## MKEE-2 A RADIOLOGICAL GUIDE TO HAND INFLAMMATION: HANDY TIPS TO UNRAVEL DIAGNOSIS

**Awards**
**Certificate of Merit**

Firat Atak, MD (*Abstract Co-Author*) Nothing to Disclose
Ustun Aydingoz, MD (*Abstract Co-Author*) Nothing to Disclose
Sevtap Arslan (*Abstract Co-Author*) Nothing to Disclose

Adalet E. Yildiz, MD (*Abstract Co-Author*) Nothing to Disclose
Yasin Yarasir, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Inflammatory diseases of the hand are a diagnostic challenge both clinically and radiological. 2. Although many conditions do not have specific imaging findings, some clinical and radiological clues can help narrow down the differential considerations and reach the correct diagnosis. 3. Accurate diagnosis is critical to initiating appropriate treatment before inflammation causes long-term harm to the hand.

**TABLE OF CONTENTS/OUTLINE**

A. An overview of inflammatory hand conditions. B. Imaging modalities and protocols. C. The spectrum of hand inflammation - a. Autoimmune (rheumatoid arthritis, seronegative spondyloarthritis, systemic lupus erythematosus, scleroderma, polyarteritis nodosa); b. Depositional (gout, CPPD, ochronosis); c. Infectious (Whipple disease, Mycobacterial, septic arthritis, osteomyelitis, necrotizing fasciitis, paronychia, cellulitis); d. Traumatic/degenerative (De Quervain tenosynovitis, post-traumatic inflammation, erosive osteoarthritis); e. Miscellaneous (sarcoidosis, foreign body-related inflammation, complex regional pain syndrome) D. Summary chart. E. Conclusion.

## MKEE-20 SOFT TISSUE MASSES OF THE HAND AND FOOT: AN EDUCATIONAL REVIEW

Noelia Arevalo (*Abstract Co-Author*) Nothing to Disclose
Javier Blazquez Sanchez (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Acosta Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Santiago Resano Pardo SR (*Abstract Co-Author*) Nothing to Disclose
Maria D. Lopez Parra, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

In the evaluation of soft tissue lesions the goal of imaging ,is to confidently identify lesions that exhibit typical diagnostic imaging features and do not need further studies.When a solid soft tissue tumor is encountered and malignancy cannot be excluded, a histology study is mandatory.Although the imaging characteristics of several of the lesions discussed are non-specific,combining them with clinical features and lesion location allows the radiologist to suggest a specific type of tumor

**TABLE OF CONTENTS/OUTLINE**

Soft tissue tumors are frequently encountered in clinical practice.They include benign and malignant neoplasms, as well as pseudotumoural lesions.The differential diagnosis of soft tissue lesions can be narrowed significantly with the aid of imaging .Radiographs are critical in determining the presence or absence of mineralization and setting whether soft tissue mineralization are chondral or ossific in nature and to evaluate cortical involvement versus isolated soft tissue lesion in order to narrow the differential diagnosis.The US seems well suited for screening soft tissue masses, allowing us to differentiate cystic from solid nature of soft-tissue lesions.The cystic nature can be confirmed with sonography or MR imaging avoiding further studies.In non cystic lesion, the location and signal characteristics can suggest the diagnosis of some specific pathologies.Equally, and based on the presence or absence of mineralization, lesion density/signal intensity,and enhancement pattern synovial based lesions can be suggested. Finally,knowledge of the incidence of specific neoplasms of the foot and hand based on patient age aids radiologists in providing a limited differential diagnosis.

## MKEE-21 POSTOPERATIVE IMAGING OF THE PERIPHERAL NERVES: SURGERY AND IMAGING CONCEPTS

Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Eduarda C. Bernal, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Niels Vinicius Padua Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Kairos Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The aim of this exhibition is to: a) Review the main surgical procedures in peripheral nerves and postoperative imaging b) Highlight the most important topics for the surgeon c) Show illustrative and didactic cases from our service

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION a) Advances in peripheral nerve surgery b) Imaging modalities c) Surgical techniques and their indicationsIMAGING INTERPRETATION Main types of nerve injury and surgery, expected imaging findings and potential complications: 1) Neural compressive syndromes: 1a) Decompression: removal of factors leading to compression (e.g., carpal tunnel release surgery) 1b) Decompression with nerve transposition (e.g., ulnar nerve decompression) 1c) Neurectomy (nerve resection) (e.g., lateral femoral cutaneous nerve and interdigital nerve of the foot) 2) Neural tumors: tumors of neural sheath (schwannomas and neurofibromas). Procedures for each type of tumor vary, so it is important to distinguish when possible. Preoperative and postoperative imagins aspects 3) Traumatic nerve injury: 3a) Neurolysis: removal of adhesions surrounding the nerve 3b) Reconstruction of nerve continuity: excision of neuromas; neurorrhaphy or interposition of autologous nerve graft; other techniques including fibrin glue and nerve tubes 3c) Nerve transfer surgeryINTERACTIVE CASE-BASED DIDATICS a) Sample cases to illustrate and solidify the concepts, including pre and postoperative imaging b) Correlation with current literature dataCONCLUSION AND TAKE HOME MESSAGES Due to the advances in peripheral nerve surgery and increasing number of cases it has become essential for radiologists to be familiar with the main surgical techniques and postoperative imaging aspects

## MKEE-22 EXPLORING NON-TUMOROUS VASCULAR ABNORMALITIES IN MUSCULOSKELETAL IMAGING

**Awards**
**Certificate of Merit**

Gabriela Bailao, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose

Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Batista Rosa Pinto, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo de Tarso K. Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Non-tumorous vascular abnormalities in musculoskeletal present a diagnostic challenge, understanding these etiologies is crucial for an accurate diagnosis, especially because vascular abnormalities are often not the primary diagnostic consideration for clinicians, highlighting the role of radiologists in the diagnoses.Vascular abnormalities manifest through various symptoms such as pain, nodules, abnormal skin color and not rarely as incidental imaging findings, reflecting a wide array of pathologies.Multiple imaging methods can be used to provide precise localization and characterization of vascular abnormalities. Ultrasound offers real-time visualization and Doppler US exams provide valuable information about vascular flow. CT and MRI provide detailed anatomical information and the use of intravenous contrast in these methods improves the evaluation of vascular structures and the dynamics of blood flow. Conventional or minimally invasive angiography offers unparalleled visualization of vascular architecture.This presentation underscores the importance of a multidisciplinary approach in which radiologists collaborate to understand the complexities of non-tumorous vascular abnormalities in musculoskeletal imaging. By integrating clinical history, imaging findings, and radiological interpretation, we can optimize patient treatment and improve outcomes.

**TABLE OF CONTENTS/OUTLINE**

1. Overview epidemiology and clinical presentation2. The role of imaging2.1 Ultrasound2.2 MRI2.3 Angiography3. Non-tumor vascular pathologies:3.1 Traumatic and atraumatic thrombosis3.2 Ischemia3.3 Vasculitis3.4 Embolism3.5 Pseudoaneurysms3.6 Miscellaneous4. Flow chart

## MKEE-23 BEYOND THE MONITOR: EXPLORING 3D PRINTING IN RADIOLOGY

David R. Nascene, MD (*Abstract Co-Author*) Nothing to Disclose
Yu-Hui Huang, MD,MS (*Abstract Co-Author*) Nothing to Disclose
Ibrahim Abdalla, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Introduce the application of 3D printing in both clinical practice and educational contexts, highlighting its significance in enhancing understanding and treatment planning - Discuss commonly used techniques to create 3D models as well as their real life applications - Review a case involving a patient with recurrent left chest wall sarcoma, illustrating how 3D printing can be utilized to aid in understanding and managing complex clinical pathologies

**TABLE OF CONTENTS/OUTLINE**

- Introduction - 3D printing and use in clinical settings and education - Brief overview of relevant chest anatomy - Review the case of a patient with a recurrent left chest wall sarcoma- Methodology - Image selection and what to be mindful of - CT versus MRI, image thickness, and the use of contrast - Segmentation in Materialise Mimics and the best tools to get started - Region Grow, Split Mask, Multiple slice edit etc. - 3-Matic and the optimization of model characteristics - Sharing 3D Models using Sketchfab- Material Selection/Printing - Deciding between resin and filament prints - Overview of time and cost considerations- Conclusion

## MKEE-24 BONE LYMPHOMAS: A PICTORIAL ESSAY

Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Anderson Phelipe Dias Sabry Azar, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Morphological Variability: We explore diverse bone lymphoma manifestations via radiographic imaging, emphasizing lytic lesions, periosteal reactions, and soft tissue involvement to recognize these patterns for accurate diagnosis and management.Imaging Modalities: We discuss radiography, CT, MRI, PET and image-guided procedures for bone lymphoma assessment, providing an overview of their strengthsDifferential Diagnosis: There are diagnostic challenges due to overlapping features with other bone lesions. We review key differentiating factors aiding an accurate differentiation.

**TABLE OF CONTENTS/OUTLINE**

Introduction: Bone lymphomas pose diagnostic challenges due to diverse radiographic presentations. This essay aims to elucidate their morphology, imaging modalities, diagnosis, and clinical implications.Methods: Review imaging studies depicting bone lymphomas, analyzing radiography, CT, MRI, PET and image-guided procedures for morphological features and differential diagnosis.Objectives: elucidate the radiographic manifestations of the disease and facilitate accurate diagnosis. This includes enhancing understanding of various imaging modalities and their roles in assessment.Discussion: Bone lymphomas exhibit varied radiographic patterns. CT offers detailed anatomy assessment, MRI enhances soft tissue delineation, and PET aids staging. Differential diagnosis involves careful consideration of imaging findings and clinical context.Conclusion: Accurate diagnosis of bone lymphomas requires recognizing diverse radiographic presentations and leveraging multiple imaging modalities. Awareness of imaging pitfalls is crucial for optimal management.

## MKEE-25 BRACHIAL (COM)PLEXUS: AN EASY-GOING REVIEW OF ANATOMY AND PATHOLOGIES

Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Aureliano T. Brandao SR, DC, PhD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Izabel d. Karam, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia C. Zuffo (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo Campos Silva, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A) Identifying and understanding critical anatomical landmarks within MRI scans, such as the interscalene triangle, subclavian artery, and nerve roots from C5 to T1.B) Emphasize the importance of recognizing the normal appearances and variations of nerve paths to enhance diagnostic accuracy.C) Highlight the advantages of using high-resolution 3D imaging, DTI, and nerve-specific MRI sequences. Explain how these advanced techniques can reveal detailed nerve fiber integrity, crucial for diagnosing subtle neuropathies and planning surgical interventions.D) Discuss the key imaging signs of traumatic plexopathy, such as nerve discontinuity, hematoma, and pseudomeningocele formation. Train on differentiating between pre- and post-ganglionic injuries based on these imaging findings, and how they guide the prognosis and treatment strategies.E) How to identify nerve sheath tumors and differentiate them from other masses using MRI. Cover the imaging characteristics of benign versus malignant nerve tumors, and discuss how the localization, size, and effect on surrounding tissues can impact treatment options.F) The Role of Ultrasound in Real-time Diagnosis and Management.

**TABLE OF CONTENTS/OUTLINE**

A) Brachial plexus anatomy; B) MRI and ultrasound images; C) Pathologies; D) Future perspectives.

## MKEE-26 THE GREAT WALLS: ABDOMINAL, THORACIC, AND PARAVERTEBRAL - ANATOMY AND PATHOLOGICAL CONDITIONS

Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Niels Vinicius Padua Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Kairos Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Our educational exhibit aims to review the anatomy and pathological conditions of the abdominal wall, thoracic wall, and paravertebral region through the following points: Reviewing the normal anatomy and anatomical variants of these three regions; Discussing the differential diagnosis for lesions encountered at these sites; Proposing an algorithmic approach to identifying lesions and diffuse processes based on their imaging characteristics; Highlighting the role of imaging techniques in the diagnosis and management of lesions affecting the abdominal wall, chest wall, and paravertebral region.

**TABLE OF CONTENTS/OUTLINE**

1) Anatomy of abdominal and thoracic walls. 2) Pathologies of abdominal and thoracic walls and proposed algorithmic approach based on imaging characteristics: Hernias (primary, incisional); Mechanical friction (elastofibroma dorsi, snapping scapula syndrome), Muscle injurie; Anatomical variants (Poland syndrome); Mass-like lesions - Fat containing (lipoma, liposarcoma, lipohypertrophy, arteriovascular malformations), Fluid (haematoma, Morel-Lavallee, abscess, seroma, lymphatic malformation), Solid / soft tissue (endometriosis, desmoid tumor, sarcoma, metastasis, fibromatosis, foreign body granuloma). 3) Illustrative cases with multimodality imaging. 4) Paravertebral anatomy. 5) Pathologies of paravertebral region and proposed algorithmic approach based on imaging characteristics and anatomical location (epaxial and hypaxial). 6) Illustrative cases with multimodality imaging.

## MKEE-27 LIFE AND DEATH IN MUSCULOSKELETAL RADIOLOGY: ATYPICAL FACETS OF BONE INFARCTION AND NECROSIS

**Awards**
**Certificate of Merit**

Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Francisco Rocha (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas N. Silva, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Osteonecrosis refers to a broad concept of the consequences of blood supply impairment on bone tissues, widely debated and described through classic radiological features. However, the diagnosis challenge relays mainly on its atypical manifestations or associated complications, which include subtle initial imaging changes, unusual skeletal locations, paraneoplasic manifestations or post-procedure complications, such as radiotherapy, diathermy and bone marrow transplant. Additionally, overlapping imaging findings also pose further difficulties, such as osteomyelitis, bone tumors and metabolic bone disease. Traditional imaging protocols, as well as some emerging techniques, can provide detailed and qualitative information about the bone microstructure, perfusion and metabolic behavior. Those techniques include diffusion-weighted MR imaging (DWI) , dynamic contrast-enhanced MRI (DCE-MRI), Time-Resolved Imaging of Contrast Kinetics (TRICKS), dual-energy CT (DECT) and positron emission tomography (PET) imaging. Bone necrosis may present typical or atypical manifestations, due to its complex origins and multiple underlying mechanisms. Besides, other many other bone abnormalities might mimic atypical bone infarction conditions. Through the assistance of multimodality imaging protocols, the radiologist role relies on knowing when to suspect an atypical bone necrosis presentation, and which imaging technique should guide towards a correct diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction2. Etiology and Pathophysiology3. Imaging Patterns and Evolution4. Atypical Presentations 5. Bone Infarction-Like Diseases 6. Complications 7. Emerging techniques8. Conclusion

## MKEE-28 HOW TO CLASSIFY MUSCLE INJURIES: COMPARISON BETWEEN CLASSIFICATIONS BASED ON CASES

Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia C. Zuffo (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Camila De Paula Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo Campos Silva, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

A) Overview of Muscle Injury Classifications provide a comprehensive review of the various muscle injury classification systems discussed in the paper. Highlight the criteria used by each system to classify muscle injuries, including anatomical location, extent of tissue damage, and functional impairment.B) Comparing Classification Systems discuss the strengths and weaknesses of each classification system based on clinical cases. Analyze how each system performs in terms of diagnostic clarity, prognostic value, and treatment guidance. Encourage critical thinking about which system might be best suited for different types of injuries or clinical settings.C) Imaging Techniques for Muscle Injury Evaluation: detail the role of various imaging modalities like MRI, ultrasound, and CT in the assessment of muscle injuries. Explain how these techniques complement the classification systems by providing detailed visual evidence of muscle fiber disruption, hematoma formation, and other pathological changes within the injured muscle.D) Future Directions and Research Opportunities discuss the gaps in current muscle injury classification systems and areas for future research. Encourage exploration of how new imaging technologies or biomarkers could be integrated into existing frameworks to enhance diagnostic accuracy and predictive power.

**TABLE OF CONTENTS/OUTLINE**

A) Muscle injury classifications;B) MRI cases images;C) Comparison of the most commonly used classifications;D) Principles of treatment for muscle injuries according to classifications and discussions on return to sport;E) Future perspectives.

## MKEE-29 EXPLORING BONE METAPHYSEAL LESIONS: INSIGHTS ON IMAGING AND INTERPRETATION

Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia F. Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia Da Cruz Fagundes, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Bailao, MD (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The metaphysis is a crucial region of the bone that has a specific anatomy, cellularity, and vascularization, and for this reason, some lesions develop preferentially in this location. This region is also important as growth and development occur during childhood and adolescence. The metaphysis, being the most metabolically active portion of bone, hosts a wide variety of tumors, both benign and malignant that require early detection to prevent adverse effects. It is also prone to infectious conditions like osteomyelitis and metabolic disorders disrupting bone mineral metabolism, potentially leading to deformities. Common fractures in this region, resulting from trauma or mechanical stress, vary in severity and may affect the growth plate, posing risks to bone development. Understanding the diverse imaging patterns in injuries involving the metaphysis is crucial for accurate diagnosis and early recognition of potential complications. Radiography is typically the initial imaging method used, and when combined with magnetic resonance imaging or computed tomography, it enhances sensitivity and specificity in diagnosing and characterizing lesions. This work aims to outline various metaphyseal lesions of different origins, highlighting their distinctive anatomical, histological, and vascular features. Early and precise diagnosis is crucial for promptly initiating appropriate treatment, thereby maximizing patient outcomes.

**TABLE OF CONTENTS/OUTLINE**

1. Background 2. Anatomy and histology 3. Development bone 4. Metaphyseal lesions 4.1 Tumoral 4.2 Inflammatory and infectious 4.3 Mechanic/traumatic 4.4 Dysplasias/congenital changes 4.5 Metabolic 5. Imaging findings 6. Diagnostic approach

## MKEE-3 MR NEUROGRAPHY OF FINE-CALIBER NERVES: A CASE-BASED REVIEW

**Awards**
**Magna Cum Laude**

Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Lua Gulde (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Paulo Victor P. Helito, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Kairos Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Niels Vinicius Padua Carvalho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The analysis of fine-caliber peripheral nerves using imaging methods is a challenging task. However, recent advances enabled higher resolution, thinner sequences with multiplanar reformatting, making it feasible to evaluate these very thin nerves using MR neurography (MRN). Therefore, MRN has been used to: (1) exclude the diagnosis of peripheral neuropathy by displaying normal nerves and regional muscles; (2) confirm suspicion of peripheral neuropathy by directly showing the nerve abnormality or regional muscle denervation changes by depicting the lesions causing nerve entrapment or impingement; (3) assess the extent of the abnormality or the disease load; (4) detect incidental lesions in the region of interest that mimic neuropathy symptoms; (5) provide imaging guidance treatments.We aim to demonstrate through cases collect in our institution the evaluation of multiple neuropathies, reinforcing its role as an important tool to access the small caliber peripheral nerves.

**TABLE OF CONTENTS/OUTLINE**

(1) Peripheral nerves: concepts and anatomy, focusing on fine-caliber nerves; (2) Neuropathy: imaging findings and diagnostic challenges- Role of MRN; (3) Review through cases from our service, with literature review, including, but not limited to: (3.1) Intercostal neuropathy; (3.2) Long thoracic nerve; (3.3) Accessory nerve; (3.4) Suprascapular nerve; (3.5) Palmar cutaneous branch of the median nerve; (3.6) Medial cutaneous nerve of the forearm; (3.7) Digital nerve; (3.8) Genitofemoral nerve; (3.9) Superior gluteal nerve; (3.10) Obturator nerve; (3.11) Ilioinguinal nerve; (3.12) Medial plantar nerve...

## MKEE-30 PHOTON-COUNTING CT IN MSK - HOW I DO IT

Henner Huflage, MD (*Abstract Co-Author*) Nothing to Disclose
Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Andreas Kunz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Since the clinical emergence of the first photon-counting CT (PCCT) system in late 2021, investigations have shown advantages in all fields of radiology. Compared with standard energy-integrating detector CT, PCCT allows for superior dose efficiency in every examination. While this aspect by itself is groundbreaking, the advantages do not stop there: PCCT facilitates an unprecedented combination of ultra-high resolution imaging without dose penalty or field of view restrictions, elimination of electronic noise, and ubiquitous spectral information. Considering the high demands of orthopedic imaging for visualization of minuscule details while simultaneously covering large portions of skeletal and soft tissue anatomy, no subspecialty may benefit more from this novel detector technology than musculoskeletal radiology. This educational aims to provide a personal introduction to the cosmos of PCCT, explain its technical basics, and highlight the most promising applications for patient care, while also mentioning current limitations that need to be overcome in the future.

### TABLE OF CONTENTS/OUTLINE

1. Technical background 2. Radiation dose reduction 3. Spatial resolution improvement 4. Metal artifact reduction 5. Multi-energy and spectral imaging 6. Current technical limitations and outlook 7. Discussion

## MKEE-31 SCULPTING SUCCESS: VALUABLE INSIGHTS INTO BONE TUMOR SURGERY WITH 3D RECONSTRUCTION TECHNIQUES

Micaela Sturnigh, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Rosenvasser, MD (*Abstract Co-Author*) Nothing to Disclose
Javier M. Martinez Martinez, MD (*Abstract Co-Author*) Nothing to Disclose
Ignacio Ferrer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 3D Printing Process: To explore key stages, from image acquisition to bedside application.2. Selection of 3D Printing Technologies: To analyze the advantages and disadvantages of different 3D printing techniques and their specific applications in generating models for bone tumor resection.3. Preoperative Planning: to demonstrate how 3D printed models are used in preoperative planning to enhance surgical accuracy and efficiency. 4. Clinical Applications: Review clinical cases illustrating the use of 3D printed models in bone tumor resection and personalized implants.5. Visualization and Communication: To discuss how 3D printed models enhance communication among the surgical team and patients, to improve their understanding of the procedure.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to the 3D printing process in bone tumor resection.2. Key techniques and technologies used in 3D printing of models for orthopedic surgery.3. Highlighted clinical cases: examples of 3D printed model applications in preoperative planning and bone tumor resection.4. Practical considerations and challenges in implementing 3D printing in orthopedic clinical practice.5. Additional applications of 3D-printed models in orthopedics: patient education, interdisciplinary communication and surgical training.6. Conclusion: advancing excellence in bone tumor surgery.

## MKEE-32 ARE YOU READING IN A VACUUM OR COOKING WITH GAS? DIAGNOSTIC PITFALLS IN INTERPRETATION OF NONINFECTIOUS CAUSES OF GAS IN MUSCULOSKELETAL IMAGING

Tetyana A. Gorbachova, MD (*Abstract Co-Author*) Nothing to Disclose
Osama Syed, DO (*Abstract Co-Author*) Nothing to Disclose
Jacob T. Ramsey, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Describe physiologic conditions and noninfectious disorders of musculoskeletal system associated with presence of gas.2. Review differential diagnosis of intraarticular, juxta articular and intraosseous gas and associated common interpretational pitfalls in setting of trauma.3. Review common and uncommon etiologies of gas after joint replacement.

### TABLE OF CONTENTS/OUTLINE

1. Intra-articular gasa. Transient positional vacuum phenomenon: etiologyb. Trauma:i. Traumatic arthrotomyii. Closed injury: intraarticular vacuum phenomenon (VP) as an indicator of transient dislocation (adult hip)c. Iatrogenic: joint aspiration/injectiond. Degenerative: asymptomatic VP and symptomatic pneumatocyste. VP as a mimicker of internal derangement on MRI (knee, shoulder)2. Intra-osseous and juxta articular gasa. Acute fracturesi. Open fracturesii. Closed fractures in high energy traumaiii. Iatrogenic (local anesthesia during reduction)b. Insufficiency fractures (pelvis, spine)c. Chronic fracture with nonunion/ pseudoarthrosisd. Degenerative: periarticular pneumatocyst, soft tissue extension mimicking abscess3. Arthroplasty associated gasa. Intramedullary pneumatosis in early post operative period as a lesion mimickerb. Aseptic hydrogen pneumarthrosis as a sign of crevice corrosion

## MKEE-33 GENOMIC LANDSCAPE OF LEIOMYOSARCOMA: INSIGHT AND UPDATES FOR RADIOLOGISTS

Mohammad Saleh, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Francesco Alessandrino, MD (*Abstract Co-Author*) Nothing to Disclose
Ty K. Subhawong, MD (*Abstract Co-Author*) Research Consultant, Arog Pharmaceuticals, Inc;Stockholder, AbbVie Inc;Stockholder, AstraZeneca PLC;Stockholder, Johnson & Johnson;Stockholder, Pfizer Inc ;Stockholder, F. Hoffmann-La Roche Ltd;Stockholder, Teva Pharmaceutical Industries Ltd
Brandon Rose (*Abstract Co-Author*) Nothing to Disclose
Rosa P. Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Yu-Cherng C. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Jonczak (*Abstract Co-Author*) Nothing to Disclose
Winston Pearce (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Provide an overview of the genomic landscape of leiomyosarcoma (LMS) with focus on the mutations with imaging and therapeutic correlates.- Describe the different imaging techniques and the imaging features of different subtypes of LMS.- Identify the limitations of imaging and provide strategies for accurate imaging diagnosis of LMS

**TABLE OF CONTENTS/OUTLINE**

Overview of the LMS- Genomic landscape, incidence, epidemiology of LMS- Novelties of molecular and histopathologic classification of LMS- Principles of therapy and stagingImaging of LMS - Role of imaging in management of LMS and limitations of current imaging- Imaging features of early stage and advanced uterine and extrauterine (soft tissue) LMS, with imaging examples for each subtype, including examples of vascular, retroperitoneal, cutaneous, extremity LMS.- Strategies for accurate imaging diagnosis for every step of the natural history of LMS: at diagnosis, before and after treatment- Pitfalls of LMS imaging (Liposarcomas, uterine leiomyomas, vascular leiomyomas, other peripheral soft tissue sarcomas)Future directions- Radiomics and machine learning approaches to imaging of LMS- Advanced imaging techniques for diagnosis of LMS- Applications of circulating tumor DNA

## MKEE-34 CHECKMATE TO CHEST WALL TUMORS: A STRATEGIC APPROACH TO DIAGNOSIS

Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Macedo, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Chest wall tumors and tumor-like lesions are relatively rare, but understanding their diagnostic features is crucial. There exists a significant overlap in the presentation of different etiologies, with many non-specific features shared between benign and malignant tumors. Recognizing key imaging and clinical-epidemiological characteristics of the most common lesions is essential. Additionally, identifying findings that raise suspicion for malignancy is critical. This presentation will focus on multimodality essential features for differentiating benign and malignant lesions and, when possible, specific imaging features for determinante diagnosis. Relevant clinical and epidemiologic data will be highlighted. A brief review of a pertinent MRI protocol will also be included.

**TABLE OF CONTENTS/OUTLINE**

Introduction - Specific MRI protocol for chest wall lesionsCollection of cases, with a multimodality approach of the following lesions: Osteochondroma / Hemangioma / Elastofibroma Dorsi / Desmoid Tumor / Fibrous hamartoma of Infancy / Lipoma / Schwannoma / Ewing's Sarcoma / Chondrosarcoma / Myeloma / Metastasis / Brown Tumor / Leri Disease.

## MKEE-35 HIGH-RESOLUTION ULTRASOUND OF THE NAIL: CLINICAL AND PATHOLOGICAL CORRELATION

Tatiana Arroyave, MEd (*Abstract Co-Author*) Nothing to Disclose
Brian D. Norena Rengifo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Diseases in the nail may be an incidental finding or may manifest as a palpable or visible abnormality. Knowledge of the anatomy of the nail is crucial in the evaluation of tumor, inflammatory or traumatic lesions. High-resolution ultrasound is the image of choice for the characterization of superficial lesions in the nail. A meticulous technique is necessary to determine the type, composition and location of the lesion. Establishing a differential diagnosis is essential to offer adequate treatment.

**TABLE OF CONTENTS/OUTLINE**

This educational e-exhibit will review nail anatomy, ultrasound imaging findings, and differential diagnosis of nail unit lesions. An overview of the ultrasound technique for evaluating nail lesions will be provided and correlation with clinical and pathological images will be performed.

## MKEE-36 IMAGING INSIGHTS INTO EXERTIONAL COMPARTMENT SYNDROME AND ATHLETIC PERFORMANCE

**Awards**
**Certificate of Merit**

Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando O. Zorzenoni, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago A. Rizzetto, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Aurelio Soato Ratti, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Chronic Exertional Compartment Syndrome (CECS) is a prevalent yet frequently underdiagnosed condition, particularly among physically active individuals, posing substantial challenges and hindrances to performance. This review explores the multifaceted nature of CECS diagnosis and management, emphasizing the critical role of imaging techniques, notably MRI, in enhancing our understanding and approach to this condition. CECS diagnosis traditionally relied on invasive techniques like needle manometry, with its limitations and varying acceptance. However, advancements in imaging, especially MRI, offer non-invasive alternatives that present promising avenues for accurate diagnosis and improved patient outcomes. By examining the pathophysiology and anatomical considerations underlying CECS, clinicians gain valuable insights into its presentation and differential diagnosis. This study elucidates the diagnostic utility of imaging in CECS assessment, practical considerations and pitfalls associated with MRI interpretation, highlighting the importance of protocol standardization and clinician expertise. This article underscores the transformative impact of imaging, particularly MRI, in navigating the complexities of CECS diagnosis and management, aiming to empower healthcare professionals in optimizing patient care and facilitating a return to pain-free performance.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction; 2. Pathophysiology and Anatomy; 3. Symptoms and Clinical Scenario; 4. Classic Diagnostic Assessment 5. Non-Invasive Diagnostic Methods 6. MRI Expected Findings; 7. MRI Pitfalls; 8. Differential Diagnosis; 9. Treatment; 10. Conclusion

## MKEE-37 UNDERSTANDING EXTENSOR MECHANISM PATHOLOGIES AND THEIR POSTOPERATIVE APPEARANCES

Tony T. Wong, MD (*Abstract Co-Author*) Nothing to Disclose
Tina Roa, MD (*Abstract Co-Author*) Nothing to Disclose
Saheeb Ahmed, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Teaching Points 1. Understand the basic musculoskeletal anatomy of the knee through multiple imaging modalities (radiographs, CT, MRI), with a focus on the extensor mechanism. 2. Explore different pathologies of the extensor mechanism, their presentation, and their appearance under different imaging modalities. 3. Understand surgical variants used to treat extensor mechanism pathologies and the rationale behind their use. 4. Understand the expected postoperative appearance of extensor mechanism surgeries. 5. Recognize common postoperative complications.

**TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline 1. Normal Anatomy a. Radiographic features of the knee b. Cross sectional anatomy of the knee (CT and MRI), with a focus on the extensor mechanism (tendons, insertions, joints)2. Extensor mechanism pathology and related surgeriesa. Patellar instability i. MPFL reconstruction ii. Physeal sparing MPFL reconstruction iii. Lateral retinacular release iv. Tibial tuberosity transfer v. Roux-Goldthwait procedureb. Patellar abnormalities i. Patellofemoral cartilage repair ii. Bipartite patella resection iii. Patellar fracture repairc. Extensor mechanism tears i. Primary patellar and quadriceps tendon repair ii. Repair with augmentation: Achilles allograft reconstruction iii. Repair with augmentation: semitendinosus autograft reconstruction iv. Allograft patella extensor mechanism reconstruction3. Common postoperative complications

## MKEE-38 ULTRASOUND-GUIDED PERINEURAL INJECTIONS OF THE UPPER EXTREMITY FROM THE ARM TO THE WRIST

**Awards**
**Cum Laude**

Joseph C. Giaconi, MD (*Abstract Co-Author*) Nothing to Disclose
Nathaniel Mizraki, MD (*Abstract Co-Author*) Nothing to Disclose
George R. Matcuk JR, MD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Tanya L. Tivorsak, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Perineural injections in the upper extremity can be performed under ultrasound real-time guidance for therapeutic and diagnostic purposes. This exhibit will review the sonoanatomy of certain nerves in the upper extremity and topographic anatomy correlation with MRI. We will provide a guide for techniques and approaches for injecting specific nerves.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction and indications for perineural injections- diagnose and confirm specific neuropathy prior to nerve surgery, relieve nerve pain2. Procedure preparation- ultrasound transducers, needle size, amount of anesthetic or steroid/anesthetic mixture3. Anatomy and injection techniques of certain nerves including musculocutaneous nerve, radial nerve, medial dorsal cutaneous nerve, ulnar nerve, and median nerve4. Risks and side effects

## MKEE-39 DEEP UNDERSTANDING OF THE TIBIOFIBULAR SYNDESMOSIS: ANATOMY, BIOMECHANICS, IMAGING APPROACH AND POSTOPERATIVE EVALUATION

**Awards**
**Certificate of Merit**

Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia dos Reis Morimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Nacime Mansur (*Abstract Co-Author*) Nothing to Disclose
Gustavo O. Watanabe, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas N. Silva, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Tibiofibular syndesmotic injuries are challenging and often underestimated, especially mild or moderate cases. Proper diagnosis and treatment are essential to avoid long-term complication such as rotational instability and ankle osteoarthritis. The syndesmotic ligament injury and associated instability determine whether operative or non-operative treatment is needed. Imaging, like x-rays for initial assessment and weightbearing studies for dynamic insights, is crucial. MRI provides direct ligament visualization and detects associated injuries, despite limitations in evaluating ankle dynamics. In this context, knowledge of anatomy, biomechanics and injury mechanisms are essential in both diagnostic and therapeutic management. Emerging imaging techniques improves sensitivity, but they remain underutilized. Recognizing subtle imaging signs and comparing the affected side with the contralateral unaffected side can increase diagnostic accuracy. Postoperative imaging analysis is imperative when there is failure to achieve anatomical reduction, residual instability, or development of concomitant injuries. The radiologist should identify the surgical techniques, normal findings and abnormalities that may suggest complications, thus avoiding unnecessary procedures.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Tibiofibular syndesmosis anatomy 3. Biomechanics and trauma mechanism 4. Imaging diagnosis of tibiofibular syndesmosis injury a) Radiograph and Stress X-ray b) CT Scan c) Stress and weightbearing CT Scan d) MRI e) What to report in the preoperative exam? 5. Treatment and imaging evaluation a) Surgical techniques b) Complications c) What to report? 6.? ?Conclusion

## MKEE-4 VASCULAR VOYAGE: CHARTING VARIANT PATHWAYS IN MUSCULOSKELETAL IMAGING WITH CLINICAL AND SURGICAL IMPLICATIONS

**Awards**
**Certificate of Merit**

Sara Silberstein, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Tetyana A. Gorbachova, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei Tuluca (*Abstract Co-Author*) Nothing to Disclose
Maya Patel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To highlight different vascular variants encountered in common musculoskeletal studies- To review embryologic origin, prevalence, pertinent regional anatomy, and imaging of these vascular variants.- To describe the clinical significance and surgical implications of variant vascular anatomy with emphasis on risk of iatrogenic injury

### TABLE OF CONTENTS/OUTLINE

1. Persistent median artery: embryology/imaging/reported associations and complications - Bifid median nerve- Pronator syndrome - Carpal tunnel syndrome - Embolic digital ischemia 2. Corona mortis: embryology/classification/complications - Traumatic injury with superior pubic rami fractures - Iatrogenic injuries3. Persistent sciatic artery: embryology/classification/complications - Stenosis- Aneurysm- Imaging pitfalls - Surgical planning implications in revascularization procedures and renal transplant4. Aberrant anterior tibial artery: embryology/imaging/surgical significance - Total knee arthroplasty - High tibial osteotomy - PCL reconstruction- Posterior horn lateral meniscus repair 5. Dorsalis pedis artery: high take-off, oblique course - Aneurysm and pseudoaneurysm- Iatrogenic injury in fracture fixation and ankle arthroscopy - Fasciocutaneous flap reconstructions6. Summary table: key points

## MKEE-40 PEDIATRIC SACROILIAC JOINT: A PRATICAL GUIDEBOOK

Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Monteiro, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Rosenfeld, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this study is:• Review of sacroiliac joint development and anatomy through didactics illustrations.• Highlight and discuss specific findings of normal anatomy and variations in the sacroiliac joint in pediatric population.• Discuss and demonstrate the imaging findings of the wide range diseases that may affect children sacroiliac joint in a multimodality approach (CR, CT, MRI)• Enhancing understanding and diagnostic accuracy of the most common sacroiliac pathologies, as well as presenting other causes of low back pain in childhood

### TABLE OF CONTENTS/OUTLINE

• Introduction and overview of the normal development and anatomy of the sacroiliac joint• Demonstrate with didactic illustrations and cases the anatomical variations that the radiologist should be aware of.• Illustrate didactically the radiographic, CT and MRI findings of each sacroiliac joint disease in children, including:• Inflammatory arthropathies and Reactive Arthritis• Trauma and sports related injuries• Pyogenic, Tuberculous and Other Infections• Tumors that may involve the sacroiliac joint• Present differential diagnosis for low back pain in children, and propose a diagnostic algorithm, including which exams to be requested and according to the findings and clinical-laboratory correlation, narrow down the differential diagnosis• Summary

## MKEE-41 IMAGING EVALUATION OF SHOULDER ARTHROPLASTY: A COMPREHENSIVE EDUCATIONAL OVERVIEW

Lucas K. Miyahara, MD (*Abstract Co-Author*) Nothing to Disclose
Victor C. Mello (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this study is to: • Review the imaging and discuss the different types of shoulder arthroplasty with didactic and illustrative cases to consolidate the acquired knowledge. • Identify the typical visual outcome of various arthroplasty and pinpoint the primary issues and complications that may arise post-surgery, shared to all types and particularly those specific to each type of replacement procedure. • Suggest a report template that highlights the key relevant information for the orthopedic surgeon.

### TABLE OF CONTENTS/OUTLINE

Advancements in shoulder arthroplasty, along with varied surgical techniques and detailed anatomical studies, have significantly improved outcomes. Common motivations for shoulder arthroplasty include osteoarthritis, inflammatory arthritis, fractures, rotator cuff issues, and avascular necrosis. Recognizing key imaging indicators is essential for accurate diagnosis and determining the most suitable arthroplasty approach. Radiologists must not only understand the indications for each procedure but also be knowledgeable about potential complications. The presentation will include the following contents: - Introduction - Hemiarthroplasty - Anatomic total shoulder arthroplasty - Reverse total shoulder arthroplasty - Complications - Report template suggestion - Bibliographical references

## MKEE-42 REVIEWING BENIGN AND MALIGNANT PRIMARY BONE TUMORS: A RADIOLOGY-PATHOLOGY CORRELATION

Richard L. Barger JR, MD (*Abstract Co-Author*) Nothing to Disclose
Lesley Summerville, MD (*Abstract Co-Author*) Nothing to Disclose
Shaun H. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Vijaya K. Kosaraju, MD (*Abstract Co-Author*) Nothing to Disclose
Navid Faraji, MD (*Abstract Co-Author*) Nothing to Disclose
Nathan M. Amann, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the most common benign and malignant primary bone tumors including their risk factors and genetic markers- Understand imaging characteristics that can distinguish benign and malignant bone lesions- Understand the management of lesions discovered on imaging- Appreciate the histopathologic findings and how viewing the tumor at cellular level is reflected in radiologic imaging

**TABLE OF CONTENTS/OUTLINE**

Introduction to benign and malignant bone tumorsDefining benign vs. malignant primary bone lesionsSymptomatologyRelative incidenceHakim et al. 2015Incidence, risk factors and symptomatology of benign bone lesions including osteochondroma, giant cell tumor, osteoblastoma, and osteomaXu et al. 2023Incidence and risk factors stratified by age and gender for malignant bone tumors including osteosarcoma, chondrosarcoma, Ewing sarcoma, and chordomaImaging characteristics of bone tumors in generalBenign bone tumor characteristics Malignant bone tumor characteristicsManagement of discovered bone tumors Case review from our institutionPatient background and pertinent historyAnnotated imaging findingsAnnotated histopathologic findingsDiagnosis and reviewRisk factorsDiscussion of age distribution for specific tumorsGenetic markersProvided by the WHO 2020 Classification of Tumors of Bone (Choi et al. 2021)Typical imaging and histopathologic findingsConclusionSummarize imaging findings of benign and malignant lesionsSummarize histopathologic findings and how it is reflected in the imaging

## MKEE-43 CRACKS AND BREAKS: A RADIOLOGIST'S GUIDE TO FRACTURES

Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina D. Augusto, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Gustavo Junzi Konno, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

In this educational exhibit, our aim is to offer a thorough review of fractures, encompassing their terminology, classifications, complications, and specific characteristics related to various locations and skeletal maturation stages. A clear understanding and accurate reporting of these features are essential for enhancing clinical outcomes and minimizing complications.

**TABLE OF CONTENTS/OUTLINE**

Fractures are common events in the musculoskeletal radiology spectrum, demanding attention due to their clinical and functional implications. Understanding their complications is crucial for effective management and prevention of sequelae. Pediatric fractures possess unique characteristics, such as a greater potential for bone remodeling and anatomical peculiarities, necessitating a specific approach. Fracture classifications, such as Salter-Harris for epiphyseal fractures, and systems like AO/OTA, assist in standardizing assessment and selecting the most appropriate therapeutic approach, contributing to improved clinical outcomes. New technologies, like synthetic CT and dual-energy CT in conjunction with Deep Learning software, are revolutionizing musculoskeletal radiology, accelerating the identification of subtle fractures and underscoring the importance of continuous updating for musculoskeletal radiologists.

## MKEE-44 FROM BONES TO JOINTS: IMAGING INSIGHTS INTO MUSCULOSKELETAL SARCOIDOSIS

Lucas K. Miyahara, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas R. Medeiros (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Sarcoidosis is a multisystemic granulomatous disorder of unknown etiology, characterized by the accumulation of T lymphocytes and macrophages in affected organs. While it most commonly involves the lungs, lymph nodes, skin, and eyes, it may affect any organ, including the musculoskeletal system, with both symptomatic and asymptomatic manifestations. The purpose of this exhibit is: 1. To review sarcoidosis etiopathogenesis 2. To discuss how modern imaging techniques such as PET/CT help detect asymptomatic musculoskeletal sarcoidosis and are changing its relative prevalence 3. To analyze multimodality imaging findings of musculoskeletal sarcoidosis 4. To assess the differential diagnosis of musculoskeletal sarcoidosis

**TABLE OF CONTENTS/OUTLINE**

1. Acute sarcoid arthritis 2. Chronic sarcoid arthritis 3. Small bones sarcoidosis 4. Classic “lace-like” osteolysis pattern of small bones sarcoidosis 5. Large bones sarcoidosis 6. Spine sarcoidosis 7. Nodular muscular sarcoidosis 8. Nodular “dark star” pattern muscular sarcoidosis 9. Chronic muscular sarcoidosis 10. Subcutaneous sarcoidosis 11. Differential diagnosis of musculoskeletal sarcoidosis, such as metastasis, enchondroma, bone cyst, osteomyelitis 12. Multimodality evaluation of musculoskeletal sarcoidosis, including ultrasound, radiograph, computed tomography, magnetic resonance, and PET/CT

## MKEE-45 SYSTEMATIC APPROACH FOR DIFFERENTIATING LOCAL RECURRENCE OF MUSCULOSKELETAL (MSK) SARCOMA FROM POST-TREATMENT CHANGES WITH ADVANCED MRI TECHNIQUES - PICTOR ASSAY

Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre C. Valim, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Radiological surveillance assessments following musculoskeletal sarcoma surgery play a critical role in early detection of local recurrence. However, interpreting imaging can pose challenges, necessitating a systematic approach to accurately evaluate silent local recurrence. It is essential to understand the patient's clinical and surgical history and pretreatment images for differentiating recurrence from time-dependent posttreatment changes When conducting an examination, radiologists must determine which advanced MRI techniques (such as DIXON T1, STIR, DWI, DCE perfusion, and TIC curve analysis) should be employed to analyze both bone marrow and soft tissue. It is imperative to differentiate local recurrence from other time-dependent post-treatment changes, such as seroma, scarring, pseudotumor, radiation-induced marrow and soft tissue alterations, infection, neuropathy, and muscle atrophy, among others. For a more precise diagnosis, correlation of histopathological features with the radiological appearance of the tumor is essential. An understanding of the applicability and limitations of these techniques is necessary to ensure accurate diagnosis and potentially guide appropriate treatment for our patients.

**TABLE OF CONTENTS/OUTLINE**

Advanced MRI techniques and applicability in the early diagnosis of silent recurrence of MSK sarcoma and surveillance of these patients. Case discussion to illustrate false positive and false negative cases. Common pittfallsDifferential diagnosis. Utilization of 3D printing, virtual reality, and augmented reality

in diagnostic and therapeutic decision-making.

### MKEE-46 ZERO TE (OZTEO) MR BONE IMAGING: EXPECTED AND SURPRISING BENEFITS IN MUSCULOSKELETAL IMAGING

Andrew B. Ross, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Kenneth S. Lee, MD, MBA (*Abstract Co-Author*) Grant, NFL;Research support, Hologic, Inc;Royalties, RELX
Humberto G. Rosas, MD (*Abstract Co-Author*) Co-founder, AyrFlo;Stockholder, AyrFlo
Michael J. Tuite, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas C. Laucis, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Tan, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

Zero TE (oZTEo) is a new MR sequence designed for imaging cortical bone to create 'CT-like' images during MR exams. This 3-4 minute sequence can be easily added onto existing MR protocols. The oZTEo sequence enables visualization and characterization of structures and material that typically have extremely low signal on conventional MR sequences, including bone cortex, soft tissue calcification and ossification, and crystal deposition. During our institution's two years of using oZTEo in clinical practice, a surprising benefit of the sequence is its 3D isotropic acquisition which enables MPR reformatting and better assessment of anatomy, coalitions, and characterization of fractures on MR.

#### TABLE OF CONTENTS/OUTLINE

1. Brief overview of the physics of the Zero TE (oZTEo) sequence 2. Example cases of oZTEo enabling better characterization of osseous lesions, abnormalities, and pathologic fractures 3. Example cases of oZTEo enabling characterization of soft tissue calcification/ossification/crystal deposition 4. Example cases of oZTEo enabling better visualization of osseous anatomy including symptomatic coalitions 5. Overview of our institution's implementation of oZTEo with our MSK MR protocols by indication to most efficiently utilize the sequence

### MKEE-47 SACRAL MASSES: DISTINGUISHING CHORDOMAS FROM BENIGN NOTOCHORDAL TUMORS AND OTHER SACRAL TUMORS

Andrew E. Rosenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan Nixon, MD (*Abstract Co-Author*) Nothing to Disclose
Francis Hornicek, MD (*Abstract Co-Author*) Nothing to Disclose
Ty K. Subhawong, MD (*Abstract Co-Author*) Research Consultant, Arog Pharmaceuticals, Inc;Stockholder, AbbVie Inc;Stockholder, AstraZeneca PLC;Stockholder, Johnson & Johnson;Stockholder, Pfizer Inc ;Stockholder, F. Hoffmann-La Roche Ltd;Stockholder, Teva Pharmaceutical Industries Ltd
Fabiano N. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Brooke L. Sarna, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

The purpose of this exhibit is to highlight the importance of distinguishing benign from malignant sacral masses to enhance patient care and avoid unnecessary procedures. Particular focus is paid to chordomas and benign notochordal tumors (BNCTs), with an additional example of an intraosseous hemangioma (IH) which falls under the differential diagnosis of sacral masses. Upon completing this exhibit, the learner will be able to:1. Properly recognize and describe the typical MRI and CT features of chordomas and BNCTs, including features that distinguish the two.2. Properly recognize the typical histopathologic findings of chordomas and BNCTs and to synthesize them with what is seen macroscopically on MRI.3. Properly recognize intraosseous hemangiomas and their confounding imaging features in relation to chordomas and BNCTs as a differential diagnosis.

#### TABLE OF CONTENTS/OUTLINE

1. Introduction presenting sacral masses and their prevalence and morbidity. A differential diagnosis including both benign and malignant lesions will be provided.2. In particular, the distinguishing imaging features, pathologic correlates, and when available gross specimen and intra-operative photographs of chordomas, benign notochordal tumors, intraosseous hemangiomas, chondrosarcomas, giant cell tumors, and other less common sacral tumors will be provided.3. Objective information with subsequent discussion will be provided to help the general radiologist distinguish between these lesions and form a differential diagnosis.4. Conclusion.5. Bibliography.

### MKEE-48 STEPS TO RECOVERY: GUIDING THROUGH IMAGING OF THE POST-OPERATIVE KNEE

Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Ricardo Moreira da Silva Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

To demonstrate the most important aspects of the normal MRI anatomy of the knee joint.To explore diverse surgical interventions and treatments available for knee pathologies, including meniscus, ligaments, and cartilage, as well as understand their underlying mechanisms, indications, and potential complications.To identify the normal and abnormal post-treatment and post-operative MRI knee findings.To identify the critical aspects of post-operative knee imaging that must be detail in the report.

#### TABLE OF CONTENTS/OUTLINE

Introduction: the importance of the understanding of the main surgical interventions of knee pathologies.Normal knee anatomy and its variants.Surgical interventions of the knee meniscus, ligaments, and cartilage. Underlying mechanism; Indications; Potential complications; MRI imaging of normal and abnormal post-operative finding;Report essential information.Conclusion and take-home messages.

### MKEE-49 RENAL OSTEODYSTROPHY: A CONSTELLATION OF MUSKULOSKELETAL ABNORMALITIES

Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Gabriel Franchi De Santi, MD (*Abstract Co-Author*) Nothing to Disclose
Aluizio Barbosa De Carvalho (*Abstract Co-Author*) Nothing to Disclose
Mariana Barros Mendonca Figueiredo (*Abstract Co-Author*) Nothing to Disclose
Ana Lara Almeida Da Silva (*Abstract Co-Author*) Nothing to Disclose

CINTIA LEAL (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thayssa Leite, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie Basilio Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo de Tarso K. Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia E. Lobato, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Koody Andre Hassemi Kitawara (*Abstract Co-Author*) Nothing to Disclose
Karina Hayama, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To review pathophysiology and natural history of renal osteodystrophy. 2. To correlate their natural history with imaging findings in radiographies, CT and MRI. 3. To discuss epidemiology and risk factors of the of the main pathologies associated with renal osteodystrophy, correlating their findings in radiographies, CT and MRI.4. To emphasize the importance of early and accurate diagnosis, as well as present differential diagnoses of pathologies associated with renal osteodystrophy.

**TABLE OF CONTENTS/OUTLINE**

1- Pathophysiology of renal osteodystrophy2- Radiographic findings and possible differential diagnoses3- MRI and CT findings4- Brown tumors5- Soft tissue calcifications6- Vascular calcifications 7- Osteosclerosis 8- Osteomalacia 9- Osteoporosis

## MKEE-5 SYNDROMES-ASSOCIATED MUSCULOSKELETAL TUMORS

Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Jie C. Nguyen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Murat Alp Oztek, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Yaya (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Janos, MD (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Identify tumor syndromes associated with MSK neoplasmsReview the pathophysiology and clinical findings of discussed syndromes.Describe the imaging appearance of tumor syndromes associated tumors across multiple imaging modalities. Discuss the differential diagnoses for imaging findings of each tumor syndromes.

**TABLE OF CONTENTS/OUTLINE**

Bone tumors 1. Fibrous dysplasia ü McCune-Albright syndrome ü Mazabraud syndrome ü Epidermal nevus syndrome 2. Osteoma ü Gardner syndrome 3. Osteochondroma ü Multiple osteochondromas ü Metachondromatosis 4. Non-ossifying fibroma ü Neurofibromatosis type 1 ü Jaffe-Campacci syndrome 5. Chondroid tumor ü Multiple enchondromatosis (Ollier disease and Maffucci syndrome) ü Metachondromatosis 6. Osteosarcoma ü Li- Fraumeni syndrome ü Retinoblastoma ü Rothmund-Thompson syndrome type 2 ü Werner syndrome ü Bloom syndrome 7. Multiple myeloma ü POEMS syndrome Soft tissue tumors 1. Vascular tumor ü Maffucci syndrome ü Kasabach-Merritt syndrome ü Klippel-Trenaunay syndrome 2. Myxoma ü Mazabraud syndrome ü Carney complex 3. Xanthoma ü Familial hypercholesterolemia 4. Desmoid tumor ü Gardner syndrome 5. Peripheral nerve sheath tumor ü Neurofibromatosis type 1/2 ü Schwannomatosis ü Carney complex 6. Gastrointestinal stromal tumor ü Neurofibromatosis type 1 ü Familial GIST ü Carney-Stratakis 7. Rhabdomyosarcoma ü Neurofibromatosis ü Li-Fraumeni syndrome ü Beckwith-Wiedemann ü Costello syndrome ü Familial pleuropulmonary blastoma (DICER 1 syndrome) ü Gorlin syndrome/ nevoid basal cell carcinoma syndrome ü Rubinstein-Taybi syndrome 8. Leiomyosarcoma ü Hereditary leiomyomatosis and renal cancer (HLRCC) ü Rubinstein-Taybi

## MKEE-50 KNEE IMPLANTS: BREAKING IT DOWN

Janaina Moreira (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Gomes, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Froeder Oliveira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Knee replacements are devices used to replace damaged parts of the knee, usually in patients with severe arthritis or serious injuries. This summary focuses on the main angles, measurements and changes related to prostheses to guide radiologists in their reports. These are the main angles and measurements: The alfa angle, the gamma angle e femoral component alignment in the axial plane evaluate the relationship between the femur and the femoral component. On the other hand, the beta angle, the sigma angle and tibial component alignment in the axial plane evaluate the relationship between the tibia and the tibial component. As relevant changes we can highlight loosening: Indicated by changes in angles or increase in joint space. Radiolucent lines suggest this problem; polyethylene wear: evidenced by decreased joint space; infection: suspected by the presence of edema, increase in soft tissue or bone erosion.

**TABLE OF CONTENTS/OUTLINE**

Components of knee prostheses and their zones: it is essential to know what is being evaluated and how to describe the topography of the knee replacements. Main angles, measurements and variations of implant techniques: as important as knowing what to look for, is knowing where and how to look. Main complications: among them are osteolysis, loosening, cortical notching, periprosthetic fractures, infections and wear of the polyethylene component.

## MKEE-51 HALLUX VALGUS DEFORMITY: A COMPREHENSIVE AND ILLUSTRATED GUIDE FOR ITS RADIOGRAPHIC EVALUATION, SURGICAL TREATMENT OPTIONS, AND POTENTIAL COMPLICATIONS

**Awards**
**Certificate of Merit**

Ty K. Subhawong, MD (*Abstract Co-Author*) Research Consultant, Arog Pharmaceuticals, Inc;Stockholder, AbbVie Inc;Stockholder, AstraZeneca PLC;Stockholder, Johnson & Johnson;Stockholder, Pfizer Inc ;Stockholder, F. Hoffmann-La Roche Ltd;Stockholder, Teva Pharmaceutical Industries Ltd
Fabiano N. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan Nixon, MD (*Abstract Co-Author*) Nothing to Disclose
Brooke L. Sarna, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is to provide learners with a radiographic definition of hallux valgus. Illustrations of various possible measurements are included to aid learners in improving the accuracy of their reports. An explanation and illustration of various surgical corrective techniques is also provided to better aid learners in interpreting post-operative films. Upon completing this exhibit, the learner will be able to:1. Diagnose hallux valgus on radiographs.2. Provide various associated measurements to the orthopedic surgeon to better aid in management and operative planning.3. Properly recognize various common surgical corrective techniques in the post-operative imaging setting.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction presenting hallux valgus and its prevalence and morbidity. The radiographic definition and associated measurements on foot radiographs will be provided with corresponding illustrations.2. In-depth discussion outlining various common corrective surgical techniques, including Chevron osteotomy, Akin osteotomy, Scarf osteotomy, Weil osteotomy, and joint arthodeses (ex. Lapidus procedure) with accompanying illustrations and radiographic examples. Particular attention will be paid to post-operative imaging and evaluation of complications. When available, intra-operative photographic correlation will be provided.3. Examples of surgical complications and their radiographic and, when available, intra-operative correlation. Emphasis will be placed on how the general radiologist can recognize early and late complications.4. Conclusion.5. Bibliography.

## MKEE-52 DON'T FALL BEHIND: A REVIEW OF SACRAL FRACTURES AND LUMBOSACRAL DISSOCIATION INJURY PATTERNS

Jacob C. Mandell, MD (*Abstract Co-Author*) Author with royalties, Cambridge University Press
Bharti Khurana, MD, MBA (*Abstract Co-Author*) Consultant, General Electric Company;Editor, Wolters Kluwer nv;Author, Cambridge University Press;Consultant, ROKIT Healthcare, Inc
Yan Epelboym, MPH (*Abstract Co-Author*) Association of University Radiologists GE Radiology Research Academic Fellowship Boston Imaging Core Laboratory: Consultant
Phat Tan Nguyen, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Sacral fracture classifications and how the radiologist's interpretation impacts orthopedic management.2. Lumbosacral dissociation injury patterns and their pathophysiologic mechanism of action.3. Vascular injuries commonly associated with sacral fractures and lumbosacral dissociations.

**TABLE OF CONTENTS/OUTLINE**

• Bony and Ligamentous Pelvic Anatomy• Imaging Evaluation• Classification of Sacral Fractures• Lumbosacral Dissociation Injury Patterns• Associated Vascular Injuries• Conclusion / Teaching SummaryPrompt identification of sacral fractures and lumbosacral dissociation is critical to facilitate optimal evaluation and management of trauma patients. Sacral fractures may be associated with low-energy impact in demineralized individuals or with high-energy impact in the general population. Radiologists should be familiar with the classification of common and rare types of sacral fractures to facilitate optimal communication with the orthopedist. The most commonly used is the Denis classification system which categorizes fractures into three zones (Zones 1, 2, and 3) and four morphological subtypes (H, U, T, and ?). Anatomic separation of the pelvis from the spinal column, otherwise known as lumbosacral dissociation is a highly morbid and rare subtype of sacral fracture. Knowledge and identification of lumbosacral dissociation injury patterns and subtle associated injuries will facilitate appropriate orthopedic intervention. A review of commonly associated pelvic vascular injury is also critical to facilitate appropriate interventional and surgical management.

## MKEE-53 ARTICULAR AND PERIARTICULAR PATHOLOGY OF THE ADULT HIP: WHAT ARE THE STRENGTHS AND WEAKNESSES OF ULTRASOUND?

**Awards**
**Cum Laude**

Andrew J. Grainger, MD (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Robert S. Campbell, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Lisa Billone, BSc (*Abstract Co-Author*) Nothing to Disclose
Sarah Allred, BSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Utilized correctly, the resolution and dynamic abilities of ultrasound provide a useful diagnostic tool to assess the hip joint and adjacent structures.2. The strengths and limitations of ultrasound diagnosis will be highlighted, providing the participant with the knowledge of when ultrasound is best suited for assessment in the adult hip.3. Anatomy, technical considerations, optimal scanning techniques and pathologic examples will be reviewed for the structures indicated in the outline. Correlation with other modalities where appropriate.4. Pitfalls will be reviewed with the goal of minimizing diagnostic error.

**TABLE OF CONTENTS/OUTLINE**

> ANTERIOR HIP: anatomy, sonographic technique, pathologic exampleso Hip joint capsule joint distention; highlighting the importance of aspiration, demonstration of alternative windows o Acetabular Labrum Limited visualization with ultrasound - use secondary signs, include alternate imaging windowso Femoroacetabular Impingement (FAI): highlight causes dynamic U/S to assess for FAIo Iliopsoas Complex outline components, highlight dynamic U/S, tendinopathy, impingement, bursal distention effectso The Prosthetic Hip joint infection, ALVAL, impingement> POSTERIOR HIP: including anatomy, sonographic technique, pathologic exampleso Posterior joint capsuleo Ischiofemoral impingement highlight causes dynamic ultrasound to assess for IFI, impact on Sciatic Nerveo Short external rotators: tips to identify structures overlying the posterior joint, highlighting limitations of assessment due to depth> Summary of strengths and weaknesses

## MKEE-54 MUSCLE EDEMA: A REVIEW OF APPROACHES TO THE DIFFERENTIAL DIAGNOSES

Julia E. Castro Anaya, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Raimundo Gomes Do Rego Neto (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this study is:• Review the typical imaging findings of muscular edema on magnetic resonance imaging (MRI).• Characterize some of the main pathologies associated with muscular edema, understanding in this context their different physiopathologies.• Didactically propose a practical way to systematically approach various differential diagnoses in a didactic manner, considering the mechanism of edema, its distribution pattern, and enhancement after contrast administration.

**TABLE OF CONTENTS/OUTLINE**

• Characterizing muscular edema: normal appearance of musculature on magnetic resonance imaging and how to recognize characteristic findings of edema.Schematic drawing and sample cases• Physiopathology and mechanisms leading to muscular edema.Sample cases• Pattern of distribution of muscular edema according to the involvement of muscle groups.Sample cases• Characteristics after intravenous contrast administration.Sample cases• Flowchart with a targeted approach to the main differential diagnoses.Schematic drawing and table

## MKEE-55 ADD TO YOUR KNOWLEDGE: REVIEW OF THE NORMAL APPEARANCE AND TRAUMATIC INJURIES TO THE HIP ADDUCTOR MUSCULATURE

Chad Klochko, MD (*Abstract Co-Author*) Nothing to Disclose
Lisa Doan (*Abstract Co-Author*) Nothing to Disclose
Joseph G. Craig, MBChB (*Abstract Co-Author*) Nothing to Disclose
Brendan M. Franz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.) Overview of the normal adductor musculature of the hip on multiplanar MRI and ultrasound. 2.) Review of traumatic pathology involving the hip adductor musculature. 3.) Select additional pathologies of the medial hip musculature.

**TABLE OF CONTENTS/OUTLINE**

1.) Overview normal appearance of the adductor musculature of the hip on multiplanar MRI and ultrasound with review of associated muscle function. Including obturator Internus/Externus, Pectineus, Adductor Longus/Brevis, Adductor Magnus, Gracilis, Sartorius, Tensor fascia Lata, Iliopsoas, Vastus lateralis/medialis, and Gluteus Maximus. 2.) Review of traumatic pathology of the hip adductor musculature using both multiplanar MRI and ultrasound. Examples of muscle strain, partial thickness and full thickness tears involving the TFL, pectineus, obturator interns/externus, and adductor brevis. Avulsion injuries involving hamstring origins, adductor longus, and iliopsoas insertion. Isolated muscle atrophy. 3.) Example of additional pathologies affecting the adductor musculature including hematoma, abscess, and masses/neurofibromas. 4.) Conclusion

## MKEE-56 WELCOME TO THE JUNGLE: ANIMAL INSPIRED MUSCULOSKELETAL AND SPINE RADIOLOGY SIGNS

Jeremiah R. Long, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew P. Sill, MD (*Abstract Co-Author*) Nothing to Disclose
Logan Haug, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Radiological signs are important for radiologists and trainees to be familiar with because they can enhance recall of associated pathology and improve diagnostic accuracy. This exhibit will demonstrate the common and recognizable animal inspired musculoskeletal and spine imaging signs via a quiz-style, case-based approach and, when not pathognomonic, provide a differential highlighting the key imaging features supporting the correct diagnosis. For example, in the case of the gull-wing sign which is commonly associated with erosive osteoarthritis, we will highlight the clinical and radiologic features (distribution, joint space narrowing, and soft tissue changes) of other erosive arthritides in the differential such as psoriatic and rheumatoid arthritis.

**TABLE OF CONTENTS/OUTLINE**

A "sign" represents a recognizable and recurring radiological pattern suggestive of a certain disease or condition. Our presentation will highlight the key features of the musculoskeletal and spine radiological signs listed below: Extra-axial skeleton signs: 1. Pooping duck sign (triquetral fracture) 2. Anteater sign (calcaneonavicular coalition) 3. Gull wing sign (erosive osteoarthritis) 4. Rat bite erosion (gout) 5. Zebra stripe sign (transverse sclerotic lines in the long bones) 6. Swan neck deformity (autoimmune/inflammatory arthropathies) 7. Talar beak sign (tarsal coalition) 8. Fishtail deformity (elbow). Axial skeleton signs: 1. Winking owl sign (unilateral absent pedicle) 2. Scotty dog (normal anatomy) 3. Claw sign (degenerative disc disease) 4. Shark's fin sign (unilateral facet joint dislocation) 5. Fish vertebrae sign (osteoporosis).

## MKEE-57 REPORTING AND DATA SYSTEMS (RADS) IN MUSCULOSKELETAL (MSK) RADIOLOGY: EXPLAINED IN A SIMPLIFIED MANNER FOR PRACTICAL USAGE

Atul K. Taneja, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Angela He, BS, BA (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Learn the value of Reporting and Data Systems in radiology for patient care and multidisciplinary communications-management. 2. Gain knowledge of different RADS systems in musculoskeletal radiology with respect to tumors, infections, and neuropathy scoring. 3. Improve understanding of key points of each of the RADS systems with illustrative imaging examples.

**TABLE OF CONTENTS/OUTLINE**

1. Review of American College of Radiology (ACR) statements for RADS systems and their value in radiology with relevance to improving interdisciplinary communications and patient care. 2. Discussion of key points of different RADS systems while highlighting key advantages and pitfalls for each scoring system a. Musculoskeletal infection-RADS (MSKI-RADS) b. Bone-RADS c. Soft Tissue-RADS (ST-RADS) d. Osseous Tumor-RADS (OT-RADS) e. Neuropathy Score-RADS (NS-RADS) 3. Case-based illustration of imaging examples in quiz format to aid reader learning and understanding in different RADS systems.

## MKEE-58 MR IMAGING OF ACUTE COMPARTMENT SYNDROME THROUGHOUT THE BODY

Atul K. Taneja, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose

Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Angela He, BS, BA (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Learn about acute compartment syndrome and its presentation in various muscle groups of the body.2. Improve understanding of compartment syndrome imaging findings on MR imaging across various affected muscle groups with case-based illustrative imaging examples and gain knowledge of the consequences and complications of delayed or missed acute compartment syndrome diagnoses, especially in atypical cases

**TABLE OF CONTENTS/OUTLINE**

1. Review of acute compartment syndrome, its common clinical manifestations, and possible complications2. Discuss the current standards of diagnosing acute compartment syndrome, potential pitfalls of such methods, and the current role of imaging in diagnosing acute compartment syndrome3. Case-based illustration of imaging examples of acute compartment syndrome in various muscle groups to aid reader learning and prompt recognition of pertinent imaging findings; muscle groups to be covered: a. Legs b. Foot c. Thigh d. Paravertebral e. Forearm4. Case-based illustrations of chronic complications: a. Muscular atrophy b. Muscular fibrosis c. Tendinopathy d. Neuropathy

## MKEE-59 SCAPHOLUNATE INSTABILITY: A CLINICAL AND RADIOLOGICAL SYNOPSIS

Harikrishnan Nandakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Harlan M. Stock, MD (*Abstract Co-Author*) Nothing to Disclose
Sukrita Menon, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Understanding the normal scapho-luno-capitate alignment, scapholunate and capitolunate angles and normal carpal arcs. 2. Review the structure of scapholunate ligament (SLL). 3. Understanding the mechanism of SLL disruption, its clinical importance, and arthroscopic classification (Geissler). 4. Review the mechanism of scapholunate dissociation, perilunate, lunate and midcarpal dislocations (Mayfield classification) using multimodality imaging. 5. Understanding the sequelae of carpal injuries including Dorsal and Volar intercalated segment instabilities (DISI and VISI). 6. Scapholunate Advanced Collapse (SLAC) and Scaphoid Nonunion Advanced Collapse (SNAC) - Review the etiology, stages, and multimodality imaging findings. 7. Prognosis, staging and brief overview of treatment for SLL injuries (each stage)

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: Normal Scapholunate alignment, Normal intercarpal angles and carpal arcs. 2. Anatomy and function of SLL. 3. SLL injury: Etiology and arthroscopic classification. 4. Case based discussion - Mechanism, Ligament(s) affected, radiological features: a. Scapholunate dissociation. b. Perilunate dislocation. c. Midcarpal dislocation. d. Lunate dislocation. 5. SLAC: Etiology, mechanism, Watson staging system, radiological features. 6. SNAC: Etiology, mechanism, stages of osteoarthritis, radiological features. 7. DISI and VISI: Etiology, mechanism, and radiological features. 8. Prognostic factors and staging of SLL injuries (Garcia-Elias) and management

## MKEE-6 BIOMECHANICS, IMAGING AND DIFFERENTIAL DIAGNOSIS OF AVULSION FRACTURES: A PICTORIAL REVIEW

Elisabetta Ponte, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei Daniel Onuta, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Bernabeu Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Sebastian Paez Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Victoria Esteban Izquierdo, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Garces Marin, MD (*Abstract Co-Author*) Nothing to Disclose
Yolanda Herrero Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The aim of this report is to review the various ways in which avulsion fractures manifest in adult and pediatric population.To describe how avulsion fractures affect adjacent structures, and the best way to recognize them with their imaging characteristics at plain radiograph, computed tomography and resonance magnetic studies.To illustrate the main imaging features and to highlight associated injuries with-own experienced images.

**TABLE OF CONTENTS/OUTLINE**

Introduction, biomechanics, location and differential diagnosis.Avulsion fractures manifest when the tendon, ligament or joint capsule, becomes dislodged from the bone, typically resulting in the detachment of a cortical bone fragment.-Acute injuries demonstrate the presence of avulsed bone fragments.-Subacute/Chronic injuries exhibit more aggressive radiographic presentation due to repetitive trauma.The mechanism is determined when a structure that originates or is inserted into the bone exerts tension in the opposite direction to the bone, and this tension significantly exceeds the tensile strength of the bone.These fractures can occur in various anatomical locations and it is crucial to know their presentation well since complex injuries such as those that involve intra-articular extension or those that associate the presence of intra-articular loose bodies, delay in diagnosis can modify the prognosis and in case of subacute/chronic diseases, knowledge of them will help us not to confuse them with other pathologies.

## MKEE-60 ATHLETE'S HIP DISORDERS: BEYOND PUBALGIA

Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Viana Dos Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto P. Bambirra, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas O. Madeira, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Hip is one of the most complex articulations of the human body due its sophisticated biomechanics. Athletes test its capacity to the limit and some lesions are expected. However, hip disorders in athletes should not be misdiagnosed because most of them, if not treated correctly, can lead to movement limitation, decrease in quality of life and harm to professional athletes' career.The purpose of this exhibit is:
- Demonstrate a comprehensive understanding of the normal anatomy of the hip joint
- Explore the universe of hip pathologies beyond athlete's pubalgia, understanding its specific conditions and the difficulty to get the correct diagnosis
- Show how misdiagnosis and late treatment change prognosis, especially in professional athletes' career, even with small pathologies

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: a. Hip anatomy, biomechanics and its association with sports b. Epidemiology, clinical aspects and prognosis of athletes' hip disorders, especially in career lifetime and return to practice 2. Case-by-case review, discussion and interpretation of the main pathologies of athlete's hip in different imaging methods (x-ray, ultrasound, computed tomography and magnetic resonance imaging) and compartmentalization a. bone and joints b. cartilage c. myotendinous 3. Conclusion and "take-home messages"

## MKEE-61 GETTING IT RIGHT WHEN TAKING A STANCE: HOW TO DIFFERENTIATE INFECTIONS FROM SPINAL TUMORS

Lislie G. Santin, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Renan D. Lederer, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto P. Bambirra, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Examine the main differential diagnoses of infectious and tumorous lesions in the spine and paravertebral structures, and the benefits of MRI in studying them; Identify key MRI findings for infections vs. tumors in the spine; Develop a systematic MRI interpretation for accurate diagnosis of spine tumor vs. infectious lesions.

**TABLE OF CONTENTS/OUTLINE**

The variety of causes in spinal lesions poses a diagnostic challenge. Radiologists must distinguish between manifestations of infections and tumors in spine imaging. This study provides an overview of these conditions, presents relevant images, and outlines MRI evaluation strategies to differentiate between infectious and tumor-related findings.Patients with spinal lesions commonly exhibit nonspecific symptoms like back pain and neurological deficits. In these cases, careful radiological interpretation is crucial to differentiate between spine infections and tumors, with MRI being the preferred modality.In most infection cases, MRI typically reveals vertebral endplate destruction, disc and bone marrow signal abnormalities, and epidural or paravertebral abscesses. Among infectious causes, spondylodiscitis and tuberculosis are common. Neoplastic causes include primary tumors like osteosarcoma and Ewing's sarcoma, and metastatic diseases. Overall, radiologists need to understand the main tumor and infectious spine diagnoses, and employ a systematic MRI interpretation for accurate diagnosis.

## MKEE-62 TODAY'S PRACTICE, TOMORROW'S PATIENTS: GENETIC MUSCULOSKELETAL DISEASES WORTH OUR ATTENTION

Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Jie C. Nguyen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Sara Janos, MD (*Abstract Co-Author*) Nothing to Disclose
Murat Alp Oztek, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Yaya (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the pathophysiology and clinical findings of genetic musculoskeletal disorders Describe the typical musculoskeletal imaging findings of each genetic disorder Discuss the differential diagnosis and associated systemic imaging findings of each genetic disorder

**TABLE OF CONTENTS/OUTLINE**

Many genetic disorders involve the musculoskeletal (MSK) system and have typical imaging features, but radiologists have difficulty interpreting them due to their rarity. Therefore, it is important that radiologists be familiar with these genetic disorders and their typical imaging appearances to accurately aid in diagnosis and proper management. We will discuss different genetic disorders affecting the MSK system with their imaging appearances. We will explore imaging findings of each disorder and discuss how imaging aids in correct diagnosis. In this exhibit, weIn this exhibit, we will also review the clinical manifestations and associated systemic imaging findings. The focus of our work is the typical imaging appearance of: A to Z Achondroplasia Blount's disease Caudal regression syndrome Cleidocranial dysplasia Congenital insensitivity to pain and anhidrosis Congenital Tibial Hemimelia Diaphyseal dysplasia (Camurati-Engelmann disease) Fibrodysplasia ossificans progressiva Gaucher's disease Hereditary multiple osteochondromas Limb-girdle muscular dystrophy Madelung's deformities Mucolipidosis Mucopolysaccharidosis: Hurler syndrome (I), Hunter's syndrome (II), Morquio's syndrome (IV) Multiple epiphyseal dysplasias Nail patella syndrome Osteogenesis imperfecta Osteopetrosis Lipid granulomatosis Primary hypertrophic osteoarthropathy Proteus syndrome Syndactyly and polydactyly

## MKEE-63 HEREDITARY MULTIPLE EXOSTOSES: REVISITING AN OLD FRIEND

Sara Gomez Pena, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia Lon, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Lopez Herrero, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Crespo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Maria J. Moreno Casado (*Abstract Co-Author*) Nothing to Disclose
Alvaro Rueda-de-Eusebio, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review the clinical presentation and pathogenesis of Hereditary Multiple Exostoses (HME). - To describe the classic imaging findings of HME, specially conventional radiography and skeletal surveys for its diagnosis and follow-up. -To highlight the role of CT and MRI for the better characterization of lesions and complications. - To learn about the main complications and deformities associated with HME, with special focus on malignant transformation. It is important that radiologists know this disease and its follow-up protocol in order to identify cases with a high risk of malignant transformation.

**TABLE OF CONTENTS/OUTLINE**

Background: HME presents as multiple osteochondromas (OC) arising from metaphyses of long and flat bones. Clinical presentation: lesions may be asymptomatic, but they may also cause pain or other symptoms. Deformities and chondrosarcomatous transformation can also occur. Pathogenesis and histopathology Imaging Features: OC may vary in shape and distribution. Cases are usually studied and followed up with skeletal surveys. In some patients, MRI and CT are necessary to further characterize suspicious lesions. US is important in pediatric cases. Complications: --Osseous deformities In recent years, new classifications have been published, such as the Masada and Jo classification for forearm deformities or the Ahn classification for ankle deformities. Synostosis of kissing OC, fracture of an OC, other deformities, vascular and neural complcations and formation of bursas can also occur. --Malignant transformation is less frequent but is the most dangerous complication. Ų We will use representative images from the series of our Sarcoma Reference Center, with more than 35 cases.

## MKEE-64 PICTORIAL REVIEW OF CORRELATION BETWEEN MRI AND ARTHROSCOPIC FINDINGS OF KNEE JOINT

Han-Ying Lin, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. There exists a robust correlation between MRI and arthroscopic evaluations in diagnosing cruciate ligament pathology.2. There is suboptimal correlation observed for meniscal pathology, particularly for ramp lesion, which may present very subtle abnormalities on MRI.3. For cartilaginous pathology, a strong correlation exists between pre-operative MR and arthroscopy. However, the post-operative appearance of cartilage on MRI varies depending on the type of procedure performed and the duration of follow-up.4. For acute traumatic injuries involving the lateral collateral ligament and posterolateral corner, there exists a strong correlation. However, in cases of chronic injury, MRI findings may present subtle manifestations, posing challenges for accurate diagnosis, and reliance on physical examination and intraoperative observations becomes pivotal for accurate assessment and management. 5. There is strong correlation between MRI and arthroscopy for inflammatory process such as gout and pigmented villonodular synovitis (PVNS).

**TABLE OF CONTENTS/OUTLINE**

1. Correlation for ACL, cyclops lesion, and meniscal tear2. Correlation for PCL, LCL, posterolateral corner injury3. Cartilage pathology undergoing various types of procedures, with follow-up images4. Inflammatory condition: gouty arthritis, PVNS.

## MKEE-65 TUBERCULOSIS IN MOTION: A RADIOLOGICAL VIEW OF THE MUSCULOSKELETAL TISSUES

Alberto P. Bambirra, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo Henrique D. Toranzo, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Tuberculosis (TB) is a widespread public health problem. Musculoskeletal TB accounts for 25% of extrapulmonary cases and has a wide variety of imaging manifestations. Therefore, the aim of this exhibit is to:Present the main forms of musculoskeletal tuberculosis involvement.Review the main imaging findings from the different types of musculoskeletal TB, including both axial and extra-axial involvement.Demonstrate the main differential diagnoses of each type of musculoskeletal TB and ways to differentiate both conditions.

**TABLE OF CONTENTS/OUTLINE**

Introduction: the importance of identifying the main imaging findings from musculoskeletal TB.Main imaging findings from different types of musculoskeletal TB: Axial involvement: spondylodiscitis; tuberculous spinal meningitis; sacroiliac joints; the chest wall; Extra-axial involvement: peripheral arthritis; osteomyelitis; tenosynovitis and bursitis; myositis; Disseminated tuberculosis.Main differential diagnoses and their radiographic features: Infectious diseases ; Rheumatologic conditions ; Malignancy. Conclusion and take-home messages.

## MKEE-66 IMAGING OF MUSCULOSKELETAL INFECTIONS: KEY IMAGING FINDINGS AND DIFFERENTIAL DIAGNOSIS

Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren L. Pinto, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Imaging is crucial in identifying key findings of musculoskeletal infections, assessing their extension, complications, and facilitating differential diagnoses. The purpose of this exhibit is to: elucidate the role of imaging modalities in diagnosing musculoskeletal infections, highlight key imaging findings that distinguish various types and stages of infection and facilitate differential diagnosis by illustrating and comparing infectious processes with other non-infectious conditions.

**TABLE OF CONTENTS/OUTLINE**

Epidemiology and Classification of Infections: overview and categorization of musculoskeletal infections.Imaging Modalities: Advantages and Disadvantages. Comparative analysis of X-ray, ultrasound, CT, and MRI.Key Imaging Findings: features such as increased soft tissue, fluid collections, gas formation, periostitis, bone edema, intramedullary fat globules, bone destruction, sequestra, cloaca, and involucrum.Complications: issues including deep infection extension, collections, thrombophlebitis, delayed or nonunion in fractures, joint ankylosis, subchondral fractures, and osteonecrosis.Differential Diagnosis: differentiating musculoskeletal infections from inflammatory, microcrystalline diseases, traumatic, and neoplastic disorders.

## MKEE-67 SOLID STEPS: EXPLORING FOOT AND ANKLE INJURIES, A PICTORICAL REVIEW

Karina I. Holguin Andrade, MD (*Abstract Co-Author*) Nothing to Disclose
Yeni Fernandez de Lara Barrera, MD (*Abstract Co-Author*) Nothing to Disclose
Maria M. Salazar Osorio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To review the most frequent pathologies and their diagnosis using multiple imaging techniques.• To discuss the common and not so common presentations of foot and ankle pathologies through real cases.• Highlight the characteristic clinical signs of each type of injury

### TABLE OF CONTENTS/OUTLINE

IntroductionImaging techniques and their advantagesMain indicationsClinical findings and characteristic or unusual features of each presentation.Clinical casesConclusions

## MKEE-68 NO MORE PAIN: A GUIDE FOR LUMBAR SPINE TRANSFORAMINAL AND INTERLAMINAR PROCEDURES

Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Eduardo N. Kihara Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo P. Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Kairos Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Niels Vinicius Padua Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Enzo Calheiros, MD (*Abstract Co-Author*) Nothing to Disclose
Afranio D. Teixeira Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Hernane A. Holzmann, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This exhibit aims to: review intervention musculoskeletal procedures for low back pain relief in acute and outpatient settings, with emphasis on epidural injections; show a guide for patient interview; highlight the crucial aspects of pre-procedural planning; offer a step-by-step guide for performing both interlaminar and transforaminal lumbar spine infiltrations, discussing technique and possible challenges and complications; provide practical tips, tricks and self-assessment tools; discuss patient outcome and follow-up post procedure; briefly discuss other pain relief procedures in the lumbar spine, as well as future directions.

### TABLE OF CONTENTS/OUTLINE

Introduction to lumbar spine procedures in low back painBrief review of anatomy and physiopathology related to low back pain/Evidence-based discussion on indications and contraindication, emphasizing epidural infiltrations/Patient interview best practicesPre procedural planningPatient workup and expectations/Required imaging studies, procedure decision and planning/Preparation of materials, medications, contrast media, radiation dose discussionStep-by-step lumbar spine infiltration guide: interlaminar and transforaminal techniquesProcedure day preparation/Safety measures and sterile technique/Needle placement and localization, contrast and medication injectionPost procedure care/Case discussion and practical insights: cases of success, challenging cases, complications, tips and tricks and continuous medical education/Take-home points

## MKEE-69 DON'T FORGET POSTERIOR SHOULDER INSTABILITY, LEARN MORE ABOUT IT: MRI FINDINGS

Karly Cristhelly Garrido Estrella, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Eugenio Cosme, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Arizaga, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela L. Mendieta Rodriguez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To illustrate the relevant anatomy of the shoulder• To describe the biomechanism by which posterior shoulder instability occurs• To list the main etiologies of posterior shoulder instability• To review the role and importance of Magnetic Resonance Imaging (MRI) in the diagnosis of posterior instability• To explain step by step each of the associated lesions and their characteristics in the MRI showing images of the pathology.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Relevant shoulder anatomy3. Biomechanics of posterior shoulder instability4. Etiological factors5. MRI (Magnetic Resonance Imaging) diagnosis and importance of Magnetic Resonance Arthrography6. Associated lesions: Reverse Hill-Sachs injury (McLaughlin injury), reverse Bankart lesion, reverse Perthes lesion, POLPSA (posterior labrocapsular periosteal sleeve avulsion injury), posterior GLAD injury (glenolabral articular disruption), reverse HAGL lesion (reverse humeral avulsion of the glenohumeral ligament) or RHAGL injuries, Kim lesion, Bennett lesion.7. Conclusions8. References.

## MKEE-7 UNVEILING ASYMMETRY: DYNAMIC INTERSECTIONS AND FIBER ORIENTATION SHIFTS IN THE RADIOULNAR LIGAMENTS OF THE TRIANGULAR FIBROCARTILAGE COMPLEX

**Awards**
**Cum Laude**

Hiroshi Yoshioka, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Keiichi Akita, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Kurihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Abstract Co-Author*) Nothing to Disclose
Akimoto Nimura (*Abstract Co-Author*) Nothing to Disclose
Saya Horiuchi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Explore the nuanced anatomy of the radioulnar ligaments in the Triangular Fibrocartilage Complex (TFCC) through our study, which includes cadaver dissections, histology, and MRI findings. We will question the conventional notion of ligament symmetry, presenting variations in fiber orientation from their origin to insertion. Additionally, we'll examine how these ligaments cross, their importance for joint stability and motion, and present our new concept, supported by comprehensive evidence, potentially influencing clinical and radiological perspectives on the TFCC.

**TABLE OF CONTENTS/OUTLINE**

1) Reevaluating the conventional view of the radioulnar ligaments' symmetry in the TFCC. 2) Mapping the gradations in fiber orientation from the proximal ends to the distal attachments in the ligament's pathway. 3) Highlighting the complex interweaving of the radioulnar ligaments, potentially influencing joint stability and dexterity. 4) Considering the practical implications of these anatomical insights for improving clinical approaches and radiological evaluations of the TFCC.

## MKEE-70 HOLDING YOUR BACK: PARAVERTEBRAL LESIONS

Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Lucas K. Miyahara, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Kazunori Tsuji, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The paravertebral region is a complex anatomical structure located adjacent to the spine, providing it with stability, range of movement, vascular supply, containing the proximal portion of the nerves and the sympathetic chain/paravertebral ganglia. Paravertebral lesions can be tumoral or not, and may be primary, arising from any of the paravertebral components, or secondary, by invasion from adjacent structures or hematogenic/lymphatic dissemination. The purpose of this exhibit is to: 1. Review the paravertebral region, its anatomy, components, from the cervical to the sacral spine, and the relations between them. 2. Identify and classify the paravertebral lesions, illustrating the patterns of paravertebral lesions and the related etiology. 3. Highlight the main information that radiologists should include when reporting paravertebral lesions.

**TABLE OF CONTENTS/OUTLINE**

Introduction: General review of the normal paravertebral region and particularities from each segment (cervical, thoracic, lumbar and sacral). Differential diagnostic of paravertebral lesions and their general characteristics. Assessment of each imaging modality suitability in evaluating the paravertebral region. Tumoral lesions: Classifying the main groups of tumors, primary and secondary. Illustrating the tumoral lesions and their main imaging findings, and when adequate specific patterns of a tumor or a group. Non-tumoral lesions: Classifying the non-tumoral lesions by etiology. Illustrating their main imaging findings. Summary Table with the main lesions and their imaging aspects. Main information that should be included in the radiological report. Bibliographical references.

## MKEE-71 OSTEITIS FIBROSA CYSTICA: BONE INVOLVEMENT OF HYPERPARATHYROIDISM

Marcio A. Ishida, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz T. Nehme, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno B. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda T. Sato, MD (*Abstract Co-Author*) Nothing to Disclose
Raifran Neto (*Abstract Co-Author*) Nothing to Disclose
Andre Mannato, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Il Jun Yoo, MD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Silveira Moreira Novaes, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the different causes of hyperparathyroidismHighlight osseous involvement and its radiological findingsImprove the diagnostic approach by correlating multimodality imaging and clinical findings

**TABLE OF CONTENTS/OUTLINE**

Introduction Illustrate the relationship between osteitis fibrosa cystica and hyperparathyroidism Different causes of hyperparathyroidismReview its epidemiology and how to make the diagnosisMost affected bone locations and their radiological aspectsDifferential diagnosis with other osteolytic lesionsTreatmentTake home message

## MKEE-72 ADDUCTOR MUSCLE COMPLEX SPORT INJURIES. WHAT, HOW, WHY AND WHERE

**Awards**
**Magna Cum Laude**

Augusto Napoli, MD (*Abstract Co-Author*) Nothing to Disclose
Micaela A. Rabino, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ricardo H. Trueba, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro A. Mazza, MD (*Abstract Co-Author*) Nothing to Disclose
Cecilia M. Velez, MEd (*Abstract Co-Author*) Nothing to Disclose
Ricardo Cobenas, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Cedola, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo A. Eivers (*Abstract Co-Author*) Nothing to Disclose
Maria F. Neville, MEd (*Abstract Co-Author*) Nothing to Disclose

Tomas A. Pascual, MD (*Abstract Co-Author*) Nothing to Disclose
Agustin M. Marrero SR, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To know the anatomy, function, and biodynamic aspects of the adductor muscle complex. To recognize the spectrum of tearing of adductor muscles and tendons during sports practice analyzing their mechanism of injury. To evaluate the imaging methods in the different adductor lesions and to describe the precise location and characteristics. To describe ultrasound and magnetic resonance signs of these tears, emphasizing the prognostic criteria for recovery, return to play, and re-injury.

**TABLE OF CONTENTS/OUTLINE**

The adductor complex muscles consist of adductor longus, adductor brevis, adductor magnus, gracilis and pectineus muscles. Its main function is to bring the leg towards the midline of the body, and they also influence during high-speed directional changes. This muscle group is the second group most likely to be injured in sports with eccentric loads, particularly soccer. Adductor longus is the most superficial and originates from the anterior sector of the pubis and it inserts distally into the medial lip of the femur.The injuries of adductor muscle group were included in the category that causes of groin pain, being the adductor longus the most affected at the level of proximal insertion or at the myotendinous junction.Adductor longus proximal and central myotendinous junction injuries and proximal tendon injuries result in a large amount of time away from sports and a high risk of re-injury. Depending on its extent and location, we can estimate the evolution of injuries and the return to play.Adductor brevis and adductor magnus muscle injuries are less common than those of adductor longus. Adductor magnus, gracilis and pectineus muscle injuries are rare and uncommon.

## MKEE-73 *"BAD TO THE BONE"*: A GUIDE FOR THE CHALLENGING DIAGNOSIS OF CHRONIC NONBACTERIAL OSTEOMYELITIS

Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Barros Mendonca Figueiredo (*Abstract Co-Author*) Nothing to Disclose
CINTIA LEAL (*Abstract Co-Author*) Nothing to Disclose
Artur Da Rocha Correa Fernandes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Franchi De Santi, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie Basilio Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia dos Reis Morimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia E. Lobato, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Hayama, MD (*Abstract Co-Author*) Nothing to Disclose
Thayssa Leite, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:1. To review pathophysiology, epidemiology and natural history of Chronic Nonbacterial Osteomyelitis (CNO), emphasizing the key factors important for the radiologist to understand. 2. To correlate its natural history with imaging findings using a multimodal approach (including CR, CT, MRI and whole body exams). 3. To illustrate the presentations and specific findings of CNO and its differential diagnosis through didactic cases.

**TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline:1. Introduction and overview of Chronic Nonbacterial Osteomyelitis (CNO), including clinical assessment. 2. Didactic demonstration of radiograph, CT and MRI findings of the disease, along with the imaging protocol and the role of whole-body MRI in a multidisciplinary approach among imaging methods.3. Proposal of a guidebook for the main imaging findings and how to report them, aiding the pediatricians in determining the correct diagnosis and narrowing down the list of differential diagnosis. 4. Differential diagnosis, including bacterial osteomyelitis, juvenile idiopathic arthritis (JIA), Erdheim-Chester disease, bone tumors, hematologic malignancies, Paget's disease and Sweet syndrome. 5. Treatment and Prognosis. 6. Summary.

## MKEE-74 SAGITTAL SPINOPELVIC BALANCE: A COMPREHENSIVE REVIEW FOR PREOPERATIVE RADIOGRAPHIC ASSESSMENT

Michael Tay, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Garza-Gongora, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Roberts, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Alignment of the spine and pelvis in the sagittal plane has a significant impact on patient morbidity. Problems in alignment and balance lead to compensatory maneuvers, such as knee bending and cervical hyperlordosis, which have been shown to reduce quality of life. In the evaluation of an adult panoramic lateral radiograph of the spine, specific sagittal parameters should be reported, as these have clinical implications and direct surgical management. Examples of important parameters to report include: global lumbar lordosis (LL), pelvic incidence (PI), pelvic tilt (PT), PI-LL mismatch, and sagittal vertical axis (SVA).

**TABLE OF CONTENTS/OUTLINE**

Intro Upright poster maintenance. Regional shapes Segmental: Pelvic (Rigid), Lumbar (Flexible intercalary), Thoracic (Semirigid), Cervical (Flexible intercalary). Balancing: Spinopelvic haromony, suprajacent balancing, intersegmental balancing, global balancing. Surgical management and case review.

## MKEE-75 GET YOUR KICKS ON LUMBOSACRAL PLEXUS ROUTE 66: THE MAIN NERVE PATHS ON MRI

Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Lislie G. Santin, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo B. Zukovski, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Anderson Phelipe Dias Sabry Azar, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Viana Dos Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Rocha, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto P. Bambirra, MD (*Abstract Co-Author*) Nothing to Disclose

Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Morato Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Renan D. Lederer, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To demonstrate the normal MRI anatomy and the main pathologies involving the lumbosacral plexus;- To review and demonstrate the MRI protocols for better assessment of the lumbosacral plexus;- To understand the main function of each trunk and nerve, as well the clinical features of its involvement, correlating it to the image findings.

**TABLE OF CONTENTS/OUTLINE**

- Understanding the lumbosacral plexus anatomy and function is necessary to a precise diagnosis. Common causes of plexopathy are tumors, post-operative related pathologies, compressive syndromes, trauma, inflammatory and infectious diseases.- Review and demonstrate normal anatomy, anatomic variants and MRI protocols to assess the lumbosacral plexus; to describe the main pathologies involving the lumbosacral plexus. - Perform a literature review and pictorial essay.

## MKEE-76 DECODING THE ENIGMA: UNRAVELING MULTIMODALITY IMAGING ARTIFACTS IN MUSCOLOSKELETAL RADIOLOGY

Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Villela, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1) To recognize the most common artifacts in different image modalities (MRI, CT, ultrasonography and radiography). 2) To discuss the mechanisms for the formations of artifacts and how to reduce their occurrence. 3) To understand the consequences of misinterpreting artifacts as pathologies using real cases and how to overcome them.

**TABLE OF CONTENTS/OUTLINE**

1) Most common artifacts in musculoskeletal radiology: A) MRI: Magnetic susceptibility; Dielectric effect; Motion; Flow; Aliasing; Gibbs ringing effect; Zipper; Reconstruction; Signal loss; Lipid suppression; Dark shading; Cross-talk; Signal-to-noise ratio; Moiré fringes; Inhomogeneity. B) CT: Motion; Beam hardening; Photon starvation; Truncation; Metallic Materials; Tube arcing; Windmill; Cone beam effect. C) Ultrasonography: Focal Zone; Posterior Enhancement; Acoustic Shadowing; Reverberation; Mirror Image; Anisotropy; Refractile shadowing; Range Ambiguity. D) Radiography: Motion; Black lightning marks; Clear spots; Ghosting; Stitching; Dead pixels; Radiopaque external objects; Image compositing; Grid cut-off; Parallax effect; Midgray clipping; Backscatter.2) Mechanisms of artifacts formation on MRI, CT, ultrasonography and radiography.3) How to reduce the occurrence of artifacts in each modality.4) Consequences of misinterpreting artifacts as pathologies and how they were overcome using real cases.

## MKEE-77 OVERUSE INJURIES IN PEDIATRIC SPORTS MEDICINE: FROM COMMON TO RARE CASES

Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The participation of children and adolescents in sporting activities brings a series of physical and psychosocial benefits. Imbalances between training load and recovery, however, can make this interaction harmful, leading to cumulative microtrauma in bones, muscles, tendons and growth plates. With the popularity of youth sports programs, overuse injuries are increasingly common. The types and mechanisms of these lesions, as well as the peculiarities of the musculoskeletal system in the pediatric age group, are important information for the radiologist who works with young athletes. In this work, we propose to carry out a detailed review of overuse injuries, paying special attention to atypical presentations that have appeared in our service.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction. 2) Particularities of the musculoskeletal system in children, with focus on apophysis. 3) Imaging characteristics of overuse injuries, mechanisms of occurrence and associated sports. 4) Atypical presentations of overuse injuries and when to raise suspicion. 5) Challenges, pearls and pitfalls: normal anatomical variants and other mimics of lesions. 6) Take home messages.

## MKEE-78 CHORDOMAS: A COMPREHENSIVE OVERVIEW OF IMAGING FEATURES AND DIFFERENTIAL DIAGNOSIS

MAURICIO PEDREIRA (*Abstract Co-Author*) Nothing to Disclose
Marcio A. Ishida, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno B. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Silveira Moreira Novaes, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz T. Nehme, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Mannato, MD (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the imaging features of the chordoma and its epidemiology trough their respective topographies- Review the main differential diagnosis of chordomas

**TABLE OF CONTENTS/OUTLINE**

- Introduction:Main characteristics Imaging features- Specific Chordomas: Sacral chordoma Clival chordoma Vertebral chordoma- Differential diagnosis: Chodrosarcoma Metastasis Plasmacytoma Giant cell tumor Lymphoma Craniopharyngioma Invasive macroadenoma Spondylodiscitis- Conclusion

## MKEE-79 PRIMARY OSSEOUS TUMORS OF THE SPINE: TIPS FOR DIAGNOSIS

Oscar M. Navarro, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Emilio Inarejos Clemente, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Describe the use of conventional techniques and multiparametric MRI for diagnosis and follow-up in primary spinal tumors.Describe the most common benign and malignant primary osseous spinal tumors.Discuss the most common imaging findings of primary osseous spinal tumors with corresponding surgical and gross pathology findings. Interpret multiparametric MR imaging in patients with malignant unresectable tumors.

**TABLE OF CONTENTS/OUTLINE**

1. Clinical findings and demographics of benign and malignant primary spinal tumors.2. Benign tumors: Hemangioma, osteochondroma, osteoblastoma, osteoid osteoma, unicameral and aneurysmal bone cyst. Malignant tumors: Ewing sarcoma, osteosarcoma, chondrosarcoma, hemangioendothelioma, Langerhans cell histiocytosis.3. Imaging techniques in the study of spinal tumors, emphasizing on the role of multiparametric MRI and PET-MR for diagnosis and follow-up (DWI, perfusion, dynamic contrast studies, 3D volume reconstruction, 3D printing models).4. Imaging findings of spinal tumors, with illustrative examples with clinical, surgical and histopathological correlation.5. Use of functional MRI and nuclear medicine in treatment response assessment with illustrative examples.6. Imaging follow-up after tumor resection. Appropriate MR sequences for the evaluation of prostheses and metal artifacts.

## MKEE-8 ADVANCED MR IMAGING TECHNIQUES FOR THE ASSESSMENT OF METASTATIC BONE MARROW LESIONS: WHAT DOES THE RADIOLOGIST NEED TO KNOW?

Anwar R. Padhani, MBBS, FRCR (*Abstract Co-Author*) Advisory Board, Siemens AG;Speakers Bureau, Siemens AG;Advisory Board, Lucida Medical Ltd;Stockholder, Lucida Medical Ltd
Khaoula Bessame, MD, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Multiparametric Whole body MRI (WB-MRI) provides both morphological and functional (disease activity) information, with higher specificity and sensitivity for assessment of metastatic bone marrow disease (MBMD) compared with CT.- CT only provides morphological information (lytic, sclerotic or mixed MBMD).- Functional WB-MRI includes marrow fat fraction (F%) calculated using the Dixon sequence, high b-value DWI, and ADC images.- High specificity criteria for active MBMD using functional WB-MRI include (all must be present): morphological criteria (>5mm in size measured on F% image), high signal intensity on DWI (tumour: background SI ratio >4), ADC value 650-1300, and low F% (<20%).- False positives on high b-value DW images include fractures, infection, and treated tumor due to T2 shine-through.- Background dense sclerosis falsely elevates lesion F%.-Always correlate focal high b-value signal intensity bone marrow lesions with morphology, ADC and Dixon images.- WB-MRI protocol also incorporates STAR-VIBE, an artificial intelligence-generated adjunctive sequence providing CT-like images.-STAR-VIBE matches mineralization on CT, enabling assessment of bone integrity and fracture detection. Additionally, it can delineate fibrous tissue, such as joint capsules.

**TABLE OF CONTENTS/OUTLINE**

- Schematic approach for bone marrow assessment using functional WB-MRI.- Seven MBMD patterns and likely morphological and functional WB-MRI findings.- Algorithmic approach for MBMD.- Application of the algorithmic approach on 10 cases from our institution using a question and answer approach, with learning points from both clinical and radiological perspectives.- Disease mimics.- Take home messages.

## MKEE-80 OSTEOMALACIA: IMAGING FINDINGS AND DIFFERENTIAL DIAGNOSIS

Karina Hayama, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Franchi De Santi, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Thayssa Leite, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Barros Mendonca Figueiredo (*Abstract Co-Author*) Nothing to Disclose
CINTIA LEAL (*Abstract Co-Author*) Nothing to Disclose
Leticia E. Lobato, MD, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To Review the pathophysiology of osteomalacia.2. To Discuss the causes of osteomalacia and its differential diagnosis.3. To explore risk factors, epidemiology, clinical manifestations, and diagnostic methods.4. To discuss the most common imaging findings of osteomalacia, including Looser zones/pseudofractures, using a multimodal imaging approach.

**TABLE OF CONTENTS/OUTLINE**

1 - Osteomalacia: pathophysiology, causes , risk factors and epidemiology, clinical manifestations and diagnosis.2 - Looser zones/ pseudofractures3- Principle imaging findings of osteomalacia. 4- Differential diagnosis with other conditions involving the spine and pelvic, such as neoplasms, inflammatory arthropathies, degenerative changes, enteropathic arthropathies, among others.

## MKEE-81 IMAGING OF SPORTS-RELATED SOFT-TISSUE INJURIES IN THE HAND

Carmelo Messina, MD (*Abstract Co-Author*) Nothing to Disclose
Domenico Albano (*Abstract Co-Author*) Nothing to Disclose
Stefano Fusco, MD (*Abstract Co-Author*) Nothing to Disclose

Luca Maria Sconfienza, MD, PhD (*Abstract Co-Author*) Travel support, Bracco Group;Travel support, Esaote SpA;Speakers Bureau, Esaote SpA;Travel support, ABIOGEN PHARMA SpA;Speakers Bureau, P&R Holding;Speakers Bureau, Pfizer Inc ;Speaker, Novartis AG;Speaker, Merck KGaA;Speaker, MSDF
Francesca Serpi, MD (*Abstract Co-Author*) Nothing to Disclose
Salvatore Gitto, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Soft-tissue injuries of the thumb and fingers are frequently encountered in athletes and result from several mechanisms of trauma, which are often sports-specific. They include collateral ligament and palmar plate injuries, closed tendon tears, and tendon instability conditions resulting from pulley or sagittal band rupture.- The severity of hand soft-tissue injuries varies widely, requiring from conservative to surgical treatment. Timely diagnosis is crucial to offer optimal clinical management and avoid long-term complications and loss of function.- The role of imaging is to guide treatment by accurately identifying the type of lesion, its location and severity. Radiologists should be able to recognize a wide variety of sports-related hand injury patterns on radiographs, ultrasound, and MRI. All essential information should be reported to the orthopedic surgeon, including proper injury classification and associated findings, such as fractures and joint dislocation.

**TABLE OF CONTENTS/OUTLINE**

1. Collateral ligament and palmar plate injuries1.1. Ulnar collateral ligament of the thumb metacarpophalangeal joint1.2. Other collateral ligaments1.3. Palmar plate2. Closed tendon tears2.1. Lateral slips of the extensor tendon (Mallet finger)2.2. Central slip of the extensor tendon (Boutonniere deformity)2.3. Flexor digitorum profundus tendon (Jersey finger)3. Tendon instability3.1. Annular pulley rupture (Climber’s finger)3.2. Sagittal band rupture (Boxer’s knuckle)4. Implications for clinical management4.1. Essential information needed by the orthopedic surgeon4.2. Focus on injuries requiring surgery with surgical correlation

## MKEE-82 HOW TO BE A BLOODHOUND: A RADIOLOGIST'S GUIDE TO HEMATOLOGIC MALIGNANCIES

Da Eul Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Gong Yong Jin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Byeong-Kwon Shin, MD, BS (*Abstract Co-Author*) Nothing to Disclose
Jae Sung Yun (*Abstract Co-Author*) Nothing to Disclose
Eun Hae Park, MD (*Abstract Co-Author*) Nothing to Disclose
Min Jee Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Yeeun Lee, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

By this presentation, radiologists will explore key strategies for identifying and interpreting imaging findings associated with various hematologic malignancies. From recognizing subtle abnormalities to understanding the importance of specific imaging modalities, this presentation helps radiologists with the knowledge needed to effectively contribute to the diagnosis and management of these complex diseases.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to Hematologic Malignancies 2. Role of Radiologist in Hematologic Disease Diagnosis 3. Imaging Modalities for Hematologic Malignancies 4. Strategies for Bone Marrow Imaging 5. Recognizing Bone Marrow Abnormalities 6. Image findings : Pearl and Pitfalls 7. Advanced Imaging Techniques 8. Future Directions in Radiology for Hematologic Malignancies

## MKEE-83 HOW TO BONE UP ON POST-TREATMENT: IMAGING ASPECTS OF BONE TUMORS FOLLOWING TREATMENT

Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Leticia dos Reis Morimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique M. Lederman, MD (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
CARLA MACEDO (*Abstract Co-Author*) Nothing to Disclose
Artur Da Rocha Correa Fernandes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcelo d. Petrilli (*Abstract Co-Author*) Nothing to Disclose
CINTIA LEAL (*Abstract Co-Author*) Nothing to Disclose
Thayssa Leite, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is:1.To review indications and treatment options for benign and malignant bone tumors, considering patients’ clinical data and prognosis. 2.To illustrate, using didactic cases, the post-treatment imaging characteristics of a variety of bone tumors, including expected post-operative findings, post-chemotherapy and radiotherapy effects, as well as immediate and late complications seen in multimodality images (radiographs, CT scans and MRI). 3.To propose a structured reporting format containing essential information required by physicians for the follow-up care of these patients.

**TABLE OF CONTENTS/OUTLINE**

1.Introduction and contextualization of the multidisciplinary approach to post-treatment management of benign and malignant bone tumors. 2.Overview of treatment options for benign and locally aggressive tumors, as well as malignant lesions, such as aneurysmal bone cyst, giant cell tumor, Langerhans cell histiocytosis, Ewing sarcoma, osteosarcoma, chondroblastoma, bone metastasis and others. 3.Discussion and demonstration of expected imaging findings post-surgery and with other treatment modalities, using a multimodal approach (CR, US, CT and MRI). 4.Presentation of didactic cases illustrating the main possible complications of bone tumor treatment, including prosthesis-related complications, infection, tumor recurrence and adverse effects of chemotherapy and radiotherapy. 5.Proposal of a checklist for post-treatment tumor evaluation, outlining key findings that radiologists need to actively seach for during the follow-up of these oncologic patients. 6.Addressing potential prognosis. 7.Summary.

## MKEE-84 READING BETWEEN THE SIGNALS: WHO'S THE RED FLAG AND WHO'S THE GREEN FLAG IN SPINAL MARROW SIGNAL CHANGES

Gong Yong Jin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yeeun Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Eun Hae Park, MD (*Abstract Co-Author*) Nothing to Disclose
Da Eul Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Sung Yun (*Abstract Co-Author*) Nothing to Disclose
Min Jee Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Byeong-Kwon Shin, MD, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Bone Marrow signal change can be very tricky. This discussion illuminates the nuanced interpretation of spinal marrow signal changes, discerning between red flags indicating potential pathology and green flags representing benign findings. To facilitate interactive learning, the presentation includes carefully selected questions derived from images of diseases that often pose challenges in clinical practice. By comprehending the spectrum of signal alterations and their clinical implications, radiologists can significantly enhance their ability to contribute to precise diagnosis and effective patient management in spinal imaging

**TABLE OF CONTENTS/OUTLINE**

1. Introduction of spinal marrow signal 2. Understading MR sequence setting for spinal imaging(T1WI T2WI, T2 fat suppressed image, T1 contrast enhanced image, Coronal image)3. Green flags - Benign signal change(Hemangioma, Schmorl's node, Modic change (type 1 and type 2))4. Red flags - Pathologic marrow signal changes(Trauma, Infectious spondylitis, Malignancy (multiple myeloma and bone metastasis))

## MKEE-85 IMAGING ASSESSMENT OF RESPONSE IN SOFT TISSUE SARCOMA AFTER NEOADJUVANT RADIOTHERAPY

Ryan J. Avery, MD (*Abstract Co-Author*) Research Consultant, Konica Minolta, Inc
Sean Sachdev, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Hermida De Viveiros (*Abstract Co-Author*) Nothing to Disclose
Linda C. Kelahan, MD (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, MSc, PhD (*Abstract Co-Author*) Ther-AI LLC
Laetitia Perronne, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Gorkem Durak, MD (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Hatice Savas, MD (*Abstract Co-Author*) Nothing to Disclose
Seth Pollack, MD (*Abstract Co-Author*) Consultant, Bayer AG;Consultant, Deciphera Pharmaceuticals, LLC;Consultant, Apexigen Inc;Consultant, T-Knife, GmbH;Consultant, Aadi Bioscience, Inc;Consultant, Epizyme, Inc;Consultant, Obsidian;Consultant, Sensei;Consultant, SpringWorks Therapeutics, Inc
Meghana Karri (*Abstract Co-Author*) Nothing to Disclose
Ronen Sumagin (*Abstract Co-Author*) Nothing to Disclose
Amir Borhani, MD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Yuri Velichko, PhD (*Abstract Co-Author*) Nothing to Disclose
Tugce Agirlar Trabzonlu, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica L. Davis, MD (*Abstract Co-Author*) Research Consultant, Bayer AG;Research Consultant, Eli Lilly and Company
Mariam Goreish (*Abstract Co-Author*) Nothing to Disclose
Nicolo Gennaro, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Effective management of Soft Tissue Sarcoma (STS) relies on a robust multidisciplinary collaborative effort where state-of-the-art imaging plays a pivotal role in both the initial evaluation of the disease and in the estimation of preoperative tumor response.• Neoadjuvant radiotherapy (nRT) has emerged as an effective pre-surgical therapy, reducing local recurrence rates. It has a dual action: potential tumor shrinkage and reduction in viable tumor cells, both of which facilitate surgical intervention and enhance the local tumor control.• STS demonstrate varying responses to nRT, largely dependent on their histological subtypes. For example, myxoid liposarcomas typically exhibit significant shrinkage following nRT, whereas other subtypes like undifferentiated pleomorphic sarcomas often show a notable increase in tumor size due to treatment-related phenomena.

**TABLE OF CONTENTS/OUTLINE**

Introduction: Significance of Imaging in Preoperative Management of STS.Neoadjuvant Radiotherapy (nRT): Growing Role of nRT as Preoperative Treatment of STS.Pictorial Review of STS Response after nRT: -Impact of Histological Subtype on Response-Examples of Response:• Shrinkage (e.g., Myxoid Liposarcoma, Round Cell STS)• Increase in Size (e.g., Undifferentiated Pleomorphic Sarcoma) - Possible Causes (Necrosis, Hemorrhage)

## MKEE-86 PERIPHERAL INVOLVEMENT IN SPONDYLOARTHRITIS: A CASE-BASED REVIEW

Marco de Andrade Bianchi (*Abstract Co-Author*) Nothing to Disclose
Pedro Henrique R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Ricardo Moreira da Silva Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Henrique Pierro Carvalhinho (*Abstract Co-Author*) Nothing to Disclose
Artur Da Rocha Correa Fernandes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Breno Trindade (*Abstract Co-Author*) Nothing to Disclose
Jose Claudio N. Junqueira, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Freitas (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Spondyloarthritis are characterized mainly by inflammatory involvement of the spine and sacroiliac joints. However, peripheral musculoskeletal structures are also commonly affected in this group of diseases, either in conjunction with axial skeleton changes or independently, particularly in the early stages. Diagnosing spondyloarthropathies can be challenging and often occurs several years after symptom onset. Understanding the imaging aspects of peripheral musculoskeletal involvement in this disease group is crucial for accurate and early diagnosis, as well as for patient management, reducing the likelihood of potential complications. The purpose of this exhibit is: 1- To discuss relevant aspects of spondyloarthritis, focusing on magnetic resonance imaging findings. 2- To review the pathophysiology of spondyloarthritis and their correlation with musculoskeletal changes in imaging exams. 3- To demonstrate, through magnetic resonance imaging exams and illustrations, the main musculoskeletal alterations in the peripheral involvement of spondyloarthritis. 4- To discuss practical challenges and pitfalls in imaging assessment of spondyloarthritis.

**TABLE OF CONTENTS/OUTLINE**

1- General aspects of spondyloarthritis a. Epidemiology b. Pathophysiology c. Diagnostic criteria 2- Imaging findings in spondyloarthritis: a case-based review a. Axial skeleton b. Peripheral involvement 3- Practical challenges and pitfalls in imaging evaluation of spondyloarthritis 4- Final considerations 5- References

## MKEE-87 ADVANCES IN NAIL EVALUATION: USING ULTRASOUND AND MRI

**Awards**
**Certificate of Merit**

Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Jose De Arimateia Batista Araujo Filho (*Abstract Co-Author*) Nothing to Disclose
Luciana C. Zattar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The evaluation of nail disorders has traditionally relied on clinical examination and imaging techniques like X-ray. However, recent advances in medical technology have introduced the use of ultrasound (HFUS) and MRI for a more comprehensive assessment of nail conditions. This educational exhibit aims to explore the benefits and applications of these methods, providing valuable insights for radiologists and clinicians. And also to provide attendees with a comprehensive understanding of the role of HFUS and MRI in nail evaluation, equipping them with the knowledge and skills to effectively utilize these advanced imaging techniques in clinical practice, with:1.Overview of nail anatomy and common nail disorders2.Principles of HFUS and MRI in nail evaluation3.Comparative analysis of HFUS, MRI, and traditional imaging techniques4.Case studies demonstrating the diagnostic utility of HFUS and MRI5.Practical tips for optimizing imaging protocols and interpreting findings6.Future directions and emerging technologies

**TABLE OF CONTENTS/OUTLINE**

1.Introduction: Overview of nail anatomy2.Traditional Imaging Techniques: Role and Limitations of conventional imaging modalities3.Principles of HFUS and MRI in Nail Evaluation: Advantages4.Clinical Case Studies: Illustrative cases showcasing the diagnostic capabilities of HFUS and MRI5.Practical ConsiderationsImaging protocols and tips for accurate interpretation Pitfalls and challenges6.Future Perspectives- Emerging technologies/Potential advancements

## MKEE-88 OSTEOSARCOMA RECURRENCE: WHAT THE RADIOLOGIST NEEDS TO KNOW

Marco Bianchi (*Abstract Co-Author*) Nothing to Disclose
Carlos Henrique Pierro Carvalhinho (*Abstract Co-Author*) Nothing to Disclose
Pedro Henrique R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Breno Trindade (*Abstract Co-Author*) Nothing to Disclose
Mauricio Ricardo Moreira da Silva Filho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To promote early detection of osteosarcoma recurrence for an effective treatment. ? - To discuss the role of various imaging techniques (plain radiography, CT, MRI) in identifying recurrent osteosarcoma. ? - To identify key radiological signs of recurrence, such as new bone formation, soft tissue mass, and changes in the size or appearance of the original tumor. ? - To differentiate recurrent osteosarcoma from post-treatment changes and other conditions.- To discuss the role of biopsy and optimal biopsy techniques in ambiguous cases.- To emphasize the importance of an effective communication and a multidisciplinary approach involving radiologists, oncologists, and surgeons, for optimal patient management.

**TABLE OF CONTENTS/OUTLINE**

1. INTRODUCTION: A. A brief overview of osteosarcoma B. A brief overview of the imaging techniques and optimal imaging acquisition and post-processing parameters to detect recurrence. 2. RECOGNIZING SIGNS OF RECURRENCE: Overview of key radiological signs, including new bone formation, an enlarging soft tissue mass, and changes in the size or appearance of the original tumor.3. IDENTIFYING KEY FINDINGS AND DIFERENCIAL DIAGNOSIS: case studies and examples, with emphasis on what to report and what to recommend next to the clinician/ surgeon.4. CONCLUSION: Summary of key points. Future Directions.

## MKEE-89 SYSTEMATIC APPROACH IN THE DIAGNOSIS OF DESMOID-FIBROMATOSIS TUMOR OF EXTREMITIES WITH CONVENTIONAL AND ADVANCED MRI TECHNIQUES: TIPS AND TRICKS

Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre C. Valim, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Desmoid fibromatosis (DF) is a locally aggressive rare neoplasm, exhibiting a notable proclivity for recurrence, typically localized in the extremities. Classified as an "intermediate, locally aggressive" tumor, DF often presents diagnostic challenges and is prone to misidentification. It serves as a source of chronic pain, disability, and disfigurement. Given the rarity of this disease, arriving at a diagnosis necessitates a considerable diagnostic acumen. MRI stands as the preferred modality for imaging, thus mandating a systematic approach to effectively differentiate these tumors from malignant soft-tissue counterparts. The DF predisposes it to various complications, including compression and invasion of adjacent structures. Therefore, radiologists must remain cognizant of these potential complications to furnish accurate reports and promptly inform attending physicians for timely management. The propensity for false positive and false negative outcomes underscores the necessity for vigilance among those interpreting DF examinations, attributed to the tumor's high cellular density, as well as mucoid or cystic degeneration. An appreciation of both the capabilities and constraints of MRI techniques is imperative for achieving precise diagnoses and, subsequently, optimal treatment strategies for our patients.

**TABLE OF CONTENTS/OUTLINE**

The value of conventional and advanced MRI techniques (DIXON T1, T2*, SWI, DCEperfusion and TIC, DWI) in diagnosis and follow-up of DF. Case discussion to demonstrate the utility of distinguishing these tumors from: Lymphoma, Synoviosarcoma, Ewing sarcoma, High grade pleomorphic sarcoma, Fibrosarcoma, Giant cel Tumor. Common pittfalls.

## MKEE-9 WATER DENSITY VALUE EVALUATION METHOD BY MATERIAL DECOMPOSITION ANALYSIS USING DUAL ENERGY CT FOR VERTEBRAL COMPRESSION FRACTURES

Masanobu Nishi (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.Virtual non-calcium (VNCa) images are water density value images created by two-material decomposition process based on dual energy acquisition using a fast kV switching method.2.We devised a quantitative evaluation method for vertebral compression fractures using the characteristics of water density values of water and calcium or water and hydroxyapatite as the two materials.3.We verified the concordance rate between our quantitative

evaluation results and clinical results for 201 cases in which both DECT and MRI examinations were performed for suspected vertebral compression fractures.4.Given the high degree of agreement with clinical findings, we believe that this method can serve as a valuable diagnostic aid

**TABLE OF CONTENTS/OUTLINE**

Vertebral compression fractures affect the quality of daily life. Virtual non-Calcium images (VNCa) are derived from dual-energy CT and show water density values by separating water and bone components. In these images reveal edematous changes related to compression fracture. Previous studies have highlighted its diagnostic value. However, the subjective nature of visual evaluations poses challenges in accurate interpretation. To address this, we established a standard water density value and devised a quantitative method to measure deviations in water density for each vertebral body. In this exhibition, we detail the standard and evaluation values for quantitative assessment, along with the evaluation methodology. We then compared these quantitative evaluations with clinical findings, observing a high level of agreement. Our results suggest that this method can effectively aid in distinguishing such findings, enhancing clinical diagnostic accuracy.

## MKEE-90 NONTRAUMATIC SPINAL CORD COMPRESSION: ESSENTIAL INQUIRY QUESTIONS IN THE EMERGENCY SETTING

Jose A. Narvaez, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Hernandez Ganan (*Abstract Co-Author*) Nothing to Disclose
Juan Carlos Sardinas (*Abstract Co-Author*) Nothing to Disclose
Ricardo Jose Ponce Silva (*Abstract Co-Author*) Nothing to Disclose
German G. Ratto, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Janeth Gordillo Zabaleta, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- In a non-traumatic setting, acute myelopathy can be caused by compressive or non-compressive factors. These include extramedullary and intramedullary causes. Extramedullary causes can be degenerative (herniated disc), infectious (epidural abscess), vascular (malformations or epidural haematoma), and metastatic. - We would like to draw your attention to metastatic spinal cord compression (MSCC), which is defined as compression of the spinal cord and cauda equina by an extradural tumour mass. It is therefore important to understand and know the anatomy, pathophysiology and updated radiological protocols used to make an accurate diagnosis. The minimum radiological evidence of spinal cord compression is indentation of the theca at the level of the clinical features and displacement or encapsulation of the thecal sac surrounding the spinal cord or cauda equina by spinal epidural metastases (SEM) or locally advanced cancer. - These features are important in determining spinal instability. The Spine Instability Neoplastic Score (SINS) and the Epidural Spinal Cord Compression Scale, also known as the Bilsky Scale, are useful tools for predicting the need for urgent surgery. We will present many clinical cases using these scales.

**TABLE OF CONTENTS/OUTLINE**

- Definition of non-traumatic spinal cord compression (SCC) - Radiological anatomy of the spinal cord - Updated protocols for the emergency department - Imaging features on MR and CT - Causes of non-traumatic cord compression (Emphasis on extramedullary metastatic causes): Degenerative, infectious, and metastatic. - SINS and Bilsky classifications and their therapeutic implications: What should theradiologist know?

## MKEE-91 GRIP YOUR LEASH WELL: MUSCULOSKELETAL INJURIES TO THE DOG WALKERS

Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Akram Jawed (*Abstract Co-Author*) Nothing to Disclose
Vikas Gupta (*Abstract Co-Author*) Nothing to Disclose
Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Biswajit Borborah, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Dog walkers usually undergo multiple musculoskeletal injuries in the upper and lower limbs including the tendon, ligament other soft tissue injuries as well as bony injuries. Many of these injuries go un noticed as they may be trivial at the time of occurrence. However they present with greater disability in later stages. Early detection by clinical examination and proper imaging will lead to prevention of disabilities. Most of the dog walkers being elderly population, suffer from multiple injuries even with lesser trauma. Common injuries of the joints of the upper limb can be seen in a dog walker due to dog pulling behaviour. The mode of injury can be trips, falls or repetitive strain. Soft tissue sprains, strains and fractures of bones are commonly encountered with most commonly injured parts being fingers and rotator cuff.

**TABLE OF CONTENTS/OUTLINE**

Getting familiar with the common mechanisms of injury in dog walkers, both in upper and lower limbs. The hard yank of the leash can cause injuries of the hand that includes ulnar collateral ligament tear, injury to pulley mechanism, tendon tears and bony avulsions of small bones. The pull along the leash and rotation of the arm can lead to rotator cuff tear, medial and lateral epicondylitis.Pulling mechanism by heavy dogs can lead to imbalance in dog walkers and can lead to lower limb injuries including the internal derangement of knee joint and tear of medial and lateral supporting ligaments of the ankle.

## MKEE-92 SKIN CANVAS: PORTRAITS OF DIVERSITY

**Awards**
**Certificate of Merit**

Geovana Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo D. Chiovatto, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian Marques (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia D. Zavariz, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Moreli Antonine (*Abstract Co-Author*) Nothing to Disclose
Carolina Carotenuto Ramos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This study aims to characterize the anatomy of the skin and differentiate the main skin types, emphasizing their characteristics in relation to individual lifestyle habits. To achieve this, we analyze variations across different age groups and locations within the same individual, as well as contrasting the characteristics of skin more exposed to the sun with those less exposed, taking into account the use of sunscreen. Moreover, we explore the key findings on prevalent benign and malignant skin lesions, underscoring the critical role of high-frequency ultrasound and its features as vital tools for characterizing these lesions and identifying at-risk populations.This research contributes to a more comprehensive understanding of skin diversity in the population and

its relationship with environmental and behavioral factors, as well as helping to better understand the characteristic patterns of skin lesions, facilitating their ultrasound diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. Method, significance, and attributes of high-frequency ultrasound in assessing skin anatomy and its lesions. 2. Comparison between histological skin anatomy and the ultrasound features. 3. Various skin types present within a single individual. 4. Sonographic disparities between young skin and with high levels of elastosis due to age/sun exposure. 5. Discrimination of patterns of ultrasound findings between benign and malignant skin lesions 6. Application of Doppler while characterizing dermatological lesions.7. New technologies for dermatological diagnostics: elastography, Contrast-Enhanced Ultrasound (CEUS) and Artificial Intelligence.

## MKEE-93 IMAGING FINDINGS IN POSTOPERATIVE PATELLOFEMORAL INSTABILITY: USUAL FINDINGS AND COMPLICATIONS

Luiz T. Nehme, MD (*Abstract Co-Author*) Nothing to Disclose
Giovana G. Mesquita, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia Da Cruz Fagundes, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Silveira Moreira Novaes, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno C. Carneiro (*Abstract Co-Author*) Nothing to Disclose
Eduardo J. Bronzatto (*Abstract Co-Author*) Nothing to Disclose
Bruno B. Cardoso, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Patellofemoral instability is a multifactorial condition that is related to the presence of clinical and anatomical risk factors. The number of risk factors and the number of dislocation episodes, whether associated with osteochondral injuries or not, determine whether the treatment will be surgical or clinical. In case of surgical treatment, medial patellofemoral ligament reconstruction is the most frequently performed approach, either alone or in combination with other procedures. Malposition of the femoral tunnel, severe trochlear dysplasia, and patella fracture are the main causes of the need for surgical revision in medial patellofemoral ligament reconstruction. Tibial tuberosity osteotomy is frequently performed in conjunction with medial patellofemoral ligament reconstruction to correct an increased TTGT and/or patella alta. As this is a surgery with greater morbidity, it requires a longer return to weight-bearing and physical activity. Complications related to this procedure include fractures, deep vein thrombosis, and overcorrection. In addition, some particularities related to the treatment of pediatric patients should be considered in the surgical approach, such as the placement of the femoral tunnel below the growth plate in medial patellofemoral ligament reconstruction. Tibial tuberosity osteotomy is proscribed in children due to the high risk of growth arrest and/or recurvatum genu. Knowledge of the main surgical procedures and their most frequent complications is essential for correct imaging interpretation.

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Risk Factors and Treatments
- Surgical Procedures and Complications
- Conclusion

## MKEE-94 EXCAVATING BONY DISCOVERIES: A REVIEW OF INCIDENTAL OSSEOUS FINDINGS

Erwin Ho (*Abstract Co-Author*) Nothing to Disclose
Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Jasmine Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Kasha Chen (*Abstract Co-Author*) Nothing to Disclose
Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review clinical presentation, epidemiology, distribution, imaging appearance, and management of incidental benign osseous findings.

**TABLE OF CONTENTS/OUTLINE**

Incidental benign osseous findings are often discovered on non-musculoskeletal (MSK) examinations for non-musculoskeletal pathology. However, despite their benign nature, some osseous findings may change the entire clinical course and warrant additional imaging workup and sometimes even surgical intervention. This exhibit seeks to elucidate a broad range of incidental osseous findings in various imaging modalities, while clinicians work up other non-MSK issues, in a case-based fashion. This exhibit will present cases of incidental benign but clinically significant osseous findings and include avascular necrosis, insufficiency fracture, osteochondroma, fibrous dysplasia, enchondroma, brown tumors, and giant cell tumors. These diseases will be displayed with annotated images across multiple imaging modalities.

## MKEE-95 IMAGING THE BRACHIAL PLEXUS

Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Akram Jawed (*Abstract Co-Author*) Nothing to Disclose
Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Vikas Gupta (*Abstract Co-Author*) Nothing to Disclose
Arshpreet Kaur, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Brachial plexus is a complex network of nerves originating from the lower cervical and upper thoracic spinal cord segments. It consists of roots, trunks, divisions, cords, and terminal branches. Familiarize yourself with the spatial relationships and typical branching patterns. • MRI is the preferred modality due to its excellent soft tissue contrast and multiplanar capabilities. • Recognize normal anatomical variants like the presence of an accessory phrenic nerve, anomalous innervation patterns, or variable branching. Differentiate these from pathological findings like traumatic injuries (stretch, compression, laceration), neoplastic involvement (tumors like schwannomas, neurofibromas), inflammatory processes (brachial plexitis, e.g., Parsonage-Turner syndrome), and vascular abnormalities (e.g., thoracic outlet syndrome). • Determine the precise location and extent of pathology within the brachial plexus, whether it involves the roots, trunks, divisions, cords, or terminal branches. This localization is crucial for treatment planning. • Assess vascular structures adjacent to the brachial plexus, such as the subclavian artery and vein, for potential compression or displacement contributing to neurovascular conditions like thoracic outlet syndrome. • Utilize advanced imaging techniques such as MPR) and 3D

**TABLE OF CONTENTS/OUTLINE**

• Anatomy of brachial plexus • Appropriate MRI protocol • Normal variants of plexus which may mimic pathology • Traumatic, infective, inflammatory and neoplastic pathologies • Follow-up imaging post treatment

## MKEE-96 CHALLENGES AND IMPORTANCE OF DIAGNOSING FOREIGN BODIES IN MUSCULOSKELETAL RADIOLOGY

Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Bolsi, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Yago F. Carvalho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1- Types of Foreign Bodies and Their Insertion Contexts for each material.2- Imaging Methods for Detecting Foreign Bodies.3- Importance of Foreign Bodies Diagnosis.4- Radiological findings characteristic of each material.5 - What is the best imaging test to detect each exposed material.

**TABLE OF CONTENTS/OUTLINE**

1- Types of Foreign Bodies and their characteristics in imaging exams.2- Comparison of the different methods for detecting each type of foreign body, with their advantages, disadvantages and indications.3 - Illustrated teaching cases from our institution, showing different types of foreign bodies, using different diagnostic methods, in different contexts.3- Exhibition of simulated cases in phantoms with tissue density similar to human tissue, emphasizing surgical materials.4 - Exposure of the main risk factors for forgetting surgical material.

## MKEE-97 EXPLORING SOLID-CYSTIC BONE LESIONS: IMAGING ASPECTS

Luiz T. Nehme, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno C. Carneiro (*Abstract Co-Author*) Nothing to Disclose
Adriano Silveira Moreira Novaes, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno B. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo J. Bronzatto (*Abstract Co-Author*) Nothing to Disclose
Giovana G. Mesquita, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia Da Cruz Fagundes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Solid-cystic bone lesions comprise a heterogeneous group of pathologies that can be neoplastic or non-neoplastic, benign or malignant, primary or metastatic, and may exhibit aggressive or non-aggressive behavior.These lesions may pose diagnostic challenges due to their varied imaging appearances and clinical presentations. A radiological approach is established based on age, clinical presentation, location, and imaging characteristics to differentiate them.A common feature of many of these lesions is the presence of fluid-fluid levels, such as in aneurysmal bone cysts (ABC) and ABC-like changes, simple bone cysts, telangiectatic osteosarcoma, metastases, brown tumors, sacrococcygeal teratoma, and adamantinoma.ABC-like changes are associated with other neoplasia, especially giant cell tumor, chondroblastoma, osteoblastoma, non-ossifying fibroma, fibrous dysplasia, chondromyxoid fibroma and Langerhans cell histiocytosis.Other bone tumors may have a solid-cystic appearance on imaging, for instance lipomas and fibrous dysplasia with cystic degeneration, and aggressive neoplasia with extensive necrosis.Moreover, non-neoplastic disease may mimic a solid-cystic bone tumor, for example inflammatory arthropathy, infection, subperiosteal hematoma and hemophilic pseudotumor.Understanding the imaging aspects of solid-cystic bone lesions is crucial for accurate diagnosis and appropriate management.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction2. ABC3. ABC-like changes4. Simple bone cyst5. Telangiectatic osteosarcoma6. Metastases7. Sacrococcygeal teratoma8. Non-neoplastic pitfalls9. Conclusion

## MKEE-99 DON'T GET HUNG UP ON THE DISTAL BICEPS TENDON: A REVIEW DISTAL BICEP TENDON TEARS, NORMAL ANATOMY, US SCANNING TECHNIQUE, AND PATHOLOGY ON US AND MRI

Chad Klochko, MD (*Abstract Co-Author*) Nothing to Disclose
Zaid Mahdi, MD (*Abstract Co-Author*) Nothing to Disclose
Laurie A. Geiger, BS (*Abstract Co-Author*) Nothing to Disclose
Danishi Bedi (*Abstract Co-Author*) Nothing to Disclose
Prateek Chintalapati, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review of normal anatomy of the distal biceps tendon on US and MRI. 2. Technique for localizing and evaluating the tendon on ultrasound. 3. Post traumatic biceps imaging on US and MRI. 4. Pearls and pitfalls of distal bicep's imaging. Brief review of surgical treatment and post operative appearance on MRI and radiographs.

**TABLE OF CONTENTS/OUTLINE**

Brief review of normal anatomy of the distal biceps tendon - Technique for identifying the tendon on ultrasound. Normal appearance of the tendon on static and dynamic imaging. - Different US imaging approaches including the anterior, lateral, dorsal and medial approaches. - Brief review of normal anatomy on MRI involving the distal biceps tendon. Posttraumatic distal biceps imaging on ultrasound and MRI. - Review of common mechanisms of injury. - Static and dynamic US images of normal, partial thickness and full thickness hears of the distal biceps tendon. Correlative multiplanar MRI images of the distal biceps tendon. - Identification of the lacertus fibrosus in applicable cases Pearls and pitfalls of distal bicep's imaging. Brief review of surgical treatment and post operative appearance on MRI and radiographs. - Landmarks helpful in identifying the correct tendon and not adjacent structures - Useful physical findings - Common operative treatment - Post operative radiographic imaging appearance - MR example of post-operative retear of the distal biceps tendon. Conclusion/Summary

RSNA 2024
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# Abstract Archives of the RSNA, 2024

MKEE-1

## ADVANCED APPROACHES TO AN AGGRAVATING ARTHROPATHY: DIAGNOSING GOUT WITH US, DECT, AND MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Takeshi Fukuda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Helen Kwon (*Abstract Co-Author*) Nothing to Disclose
Alexander H. Dills, DO (*Abstract Co-Author*) Nothing to Disclose
Robert Freund, MD (*Abstract Co-Author*) Nothing to Disclose
Akira M. Murakami, MD (*Abstract Co-Author*) Nothing to Disclose
Daichi Hayashi, MD, PhD (*Abstract Co-Author*) Author with royalties, Wolters Kluwer nv
Megan Kenway, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1 - Review the pathophysiology of gout and the typical findings on planar imaging2 - Review the principles of DECT and mapping of monosodium urate (MSU) crystal deposits3 - Show the classic findings of gout on US, dual-energy CT (DECT), and MRI4 - Demonstrate common artifacts and mimics of gout on US, DECT, and MRI5 - Outline methods of reducing artifact and distinguishing gout from mimics on US, DECT, and MRI6 - Compare and contrast the utility of US, DECT, and MRI in detecting Gout

### TABLE OF CONTENTS/OUTLINE

- Epidemiology and history of gout, including typical presentation, diagnosis, and management- Classic examples of early and advanced gout on radiograph- Alternative imaging options, and the body regions they are the most useful in- Review of DECT physics and examples of the resultant MSU maps- Examples of typical findings of gout on DECT in soft-tissue windows and MSU maps- Examples of mild disease and atypical locations of gouty tophi- Overview of DECT artifacts that cause incorrect mapping of MSU deposits- Keratin in nailbeds and callous- Metal foreign bodies, implanted hardware, and external devices- Methods of reducing artifact and troubleshooting incorrect MSU mapping- Examples of typical findings of gout on US, nonspecific and specific- Artifacts and mimics of gout on US- Examples of typical findings of gout on MRI- Limits of MRI for evaluation of gout, and tools to increase specificity- Final comparison of DECT, US, and MRI, strengths, vs weaknesses

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# Abstract Archives of the RSNA, 2024

MKEE-10

## AGING AND INFLAMMATION: INSIGHTS INTO INFLAMMATORY MUSCULOSKELETAL DISEASES IN THE ELDERLY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Damaris V. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Herrera VI, MD, BA (*Abstract Co-Author*) Nothing to Disclose
VINICIUS R. BRAMBILLA, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia dos Reis Morimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The demographic shift towards an aging population presents novel healthcare challenges, notably in diagnosing and managing musculoskeletal conditions. Advanced age heightens susceptibility to various inflammatory musculoskeletal disorders, due to a chronic pro-inflammatory status and immune system dysregulation. Additionally, the elderly population are susceptible to adverse effects from polypharmacy, immunosuppressive responses, and drug-induced myopathies. Furthermore, tumors can predispose individuals to musculoskeletal inflammatory responses via the secretion of inflammatory cytokines and modulation of the immune system (paraneoplastic syndromes).The initial presentation of inflammatory conditions in elderly often presents lacking conventional radiological markers or prominent laboratory abnormalities. Discriminating between the insidious onset of inflammatory musculoskeletal disorders and degenerative changes poses a radiological challenge. Radiologists play a pivotal role in this scenario, serving as key contributors to the recognition of such conditions, thereby preventing irreversible disability and preserving the quality of life in the elderly population.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. The immune system of the elderly3. Multimodality imaging and approach4. Rheumatological Diseasesa) Rheumatoid Arthritisb) Enthesopathiesc) Rheumatica Polymyalgia5. Crystal Arthropathies a) Goutb) Calcium Pyrophosphate Deposition Disease 6. Inflammatory Myopathies a) Polymyositis and Dermatomyositis b) Inclusion Body Myositis 7. Paraneoplastic Syndromes a) Paraneoplastic Arthritis b) Hypertrophic Osteoarthropathy8. Miscellaneous 9. Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-100

## GLUTEAL CONTOUR IMPROVEMENTS FOR MUSCULOSKELETAL RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme B. Rocha, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:1. To review normal anatomy of the buttocks; 2. To discuss the possibilities of gluteal contour improvements, including lipoinjection and implantation; 3. To discuss some of the post treatment complications and their imaging correspondence

### TABLE OF CONTENTS/OUTLINE

Normal gluteal anatomyLipoinjectionGluteal implantationComplications of gluteal contouring surgical procedures, focusing on imaging findings

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

MKEE-101

## IMAGING OF KNEE ARTHROPLASTY: WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Dhilip Andrew, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Learn about different types of knee arthroplasties and arthroplasty implants used in routine practice.
- Gain knowledge of the pre-operative planning and measurements for knee arthroplasty including AI-generated automated limb angular and linear measurements.
- Improve knowledge and understanding about knee arthroplasty-related complications and their various imaging appearances.

### TABLE OF CONTENTS/OUTLINE

- Review relevant clinical anatomy, indications, surgical details of different types of arthroplasties.
- Discuss the role of multimodality imaging and role of validated AI-generated measurements for preoperative planning of knee arthroplasty and follow-up imaging for monitoring of complications.
- Case-based illustration of normal and abnormal findings on knee radiographs and cross-sectional images for monitoring such patients post-operatively.
- Normal appearances
- Common complications
- Implant specific complications.

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# Abstract Archives of the RSNA, 2024

MKEE-102

## THE ISSUE IS THE TISSUE: CT FINDINGS OVERLOOKED ON SOFT TISSUE WINDOWS IN LOWER EXTREMITY IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Cornelia B. Wenokor, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas Ardekani, DO (*Abstract Co-Author*) Nothing to Disclose
Justin Newman, DO (*Abstract Co-Author*) Nothing to Disclose
Garrett Yoon, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Reviewing commonly overlooked soft tissue pathology that can be clearly demonstrated with soft tissue window settings, particularly in cases of traumatic musculoskeletal injuries. 2. Illustrating and discussing the clinical significance of these findings; for instance, reporting tendon entrapment to aid in surgical planning. 3. Advocating for the use of CT imaging in making early time-sensitive findings on soft tissue windows, potentially avoiding the use of costly additional imaging modalities including MRI.

### TABLE OF CONTENTS/OUTLINE

1. Bone Marrow Pathology (Fracture, Marrow Infiltrative Disease). 2. Subcutaneous and Muscle Pathology (Compartment Syndrome, Morel-Lavallée Lesion, Muscle Tear, Hematoma, Thoracolumbar Fascia Tear, Accessory Soleus Muscle). 3. Ligament Pathology (Ligament Tears, Avulsion Injuries). 4. Meniscal and Knee Capsular Pathology. 5. Tendon Pathology (Entrapment, Rupture, Dislocation). 6. Nerve Pathology (Baxter's Neuropathy, Nerve Transection, Fibrolipomatous Hamartoma).

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# Abstract Archives of the RSNA, 2024

MKEE-103

## RECTUS FEMORIS: ANATOMY, PATTERNS OF INJURY AND IMAGING FEATURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Brady K. Huang, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiane C. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Milanne Trottier, MD (*Abstract Co-Author*) Nothing to Disclose
Dyan V. Flores, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Rectus femoris injuries are common in many sports particularly soccer and rugby, and are the second or third most common thigh muscle strains after hamstring tears. Articles have described the complex anatomy and patterns of injury to various components of the rectus femoris, although lesser known entities like pseudodegloving and posterior fascia injuries have not been described.The objectives of this education exhibit are:1. Review the anatomy of the rectus femoris tendon muscle complex2. Describe and illustrate imaging features of injury to each component 3. Understand patterns of injury, implications to management and return to play

### TABLE OF CONTENTS/OUTLINE

ANATOMYSITES OF INJURY AND IMAGING FEATURES Origin (bony and soft tissue avulsion) Direct head myofascialIndirect head myotendinous junction(feathery and bull’s eye appearances)Muscle bellyIntramuscular degloving PseudodeglovingPosterior fasciaINJURY GRADING IMPLICATIONS TO RETURN TO PLAY

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# Abstract Archives of the RSNA, 2024

MKEE-104

## SCAPHOID FRACTURE: CLASSIFICATION, IMAGING, COMPLICATIONS AND TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Kawanpreet S. Rakhra, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Juvel Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Dyan V. Flores, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The scaphoid is the most commonly fractured carpal bone, typically following a fall on an outstretched hand in a young or middle-aged adult. Majority (65%) of scaphoid fractures involve the waist, with the next most common location (15%) being the proximal pole. The unique distal-to-proximal flow of the scaphoid’s blood supply predisposes the larger proximal pole to complications to avascular necrosis. Other complications like delayed union or non-union can also occur. The radiologists plays an instrumental role in scaphoid fractures from diagnosis, detection of complications, to preoperative and postoperative assessment. The objectives of this educational exhibit are:1. To review scaphoid anatomy, particularly those unique to the bone (i.e., dual blood supply, lack of periosteum)2. To illustrate scaphoid fracture complications and their imaging appearances 3. To discuss treatment options and indications

### TABLE OF CONTENTS/OUTLINE

SCAPHOID ANATOMY • Blood supply SCAPHOID FRACTURE • Mayo classification • Herbert and Fisher classification • ACR criteria for imaging of a scaphoid fracture • Complication: Malunion (delayed union and non-union) • Complication: Avascular necrosis • Complication: Scaphoid non-union advanced collapse • Imaging of complications TREATMENT • Management considerations for proximal versus distal scaphoid fracture • Casting versus internal fixation • Bone grafts: nonvascularized versus vascularized • Post-operative imaging evaluation OTHER TRAUMATIC CONDITIONS • Scapholunate instability • Other forms of carpal instability involving the scaphoid

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# Abstract Archives of the RSNA, 2024

MKEE-105

## WHAT'S IN A NAME? EPONYMOUS FRACTURES: IDENTIFICATION, SURGICAL IMPLICATIONS, AND HISTORICAL RELEVANCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Parker Brown, MD (*Abstract Co-Author*) Nothing to Disclose
Anisha Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Jeremiah R. Long, MD (*Abstract Co-Author*) Nothing to Disclose
Paul Chroneos, MD (*Abstract Co-Author*) Nothing to Disclose
Logan Haug, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Demonstrate the named fractures and fracture-dislocation injuries of the upper and lower extremities. Differentiate similar fracture or fracture-dislocation patterns (Essex-Lopresti, Monteggia, and Galeazzi and Rolando, Bennett, and Pseudo-Bennett) and fractures occurring in close anatomic proximity such as at the 5th metatarsal base: stress fractures, Jones, and pseudo-Jones injuries. Emphasize injuries that can occur concurrently with eponymous fractures such as ACL and meniscal injury with Segond fractures. Highlight imaging findings (degree of displacement, articular surface involvement, articular step off, comminution, and degree of dislocation) relevant to clinical or orthopedic management and decision-making. Briefly note the historical individuals credited with the original descriptions of these fractures.

### TABLE OF CONTENTS/OUTLINE

Upper Extremity: Thumb Base: Rolando, Bennett, Pseudo-Bennett Wrist: Barton, Colles, Hutchinson, and Smith Forearm: Essex-Lopresti, Galleazi, and Monteggia Shoulder: Hill-Sachs and Bankart. Lower Extremity: 5th Metatarsal Base: Stress, Jones, Pseudo-Jones (avulsion) Midfoot: Chopart, Lisfranc Talus: Cedell and Shepherd Ankle: Cotton, Dupuytren, Gosselin, Pilon, Tillaux, Maissoneuve Knee: Pelligrini-Stieda, Segond, Reverse Segond, Maissoneuve.

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# Abstract Archives of the RSNA, 2024

MKEE-106

## IMAGING PATTERNS OF SPONDYLODISCITIS: A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Trang T. Dam, MD,PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Spondylodiscitis is an infection involved disc-endplate complex, vertebral body, paravertebral tissue and epidural space. Diagnosis and treatment of spondylodiscitis can be delayed due to nonspecific signs and symptoms. 2. Magnetic resonance imaging (MRI), due to its high sensitivity and specificity, can help in early-phase detection, and differentiate between infectious spondylodiscitis versus inflammatory or degenerative spinal changes. 3. Computed tomography (CT) aids in evaluating bone erosions, calcifications, bone quality and CT-guided biopsy help to obtain causative organisms. 4. This exhibit describes the role of MRI and CT on the assessment of spondylodiscitis and other mimicking disorders in clinical practice

### TABLE OF CONTENTS/OUTLINE

Spondylodiscitis: introduction.Pyogenic spondylodiscitis: typical and atypical imaging patterns. Tuberculosis spondylodiscitis: typical and atypical imaging patterns. Postoperative spondylodiscitis.Non-infectious spinal disorders mimicking infections: how MRI can help? Diagnostic work-up in suspicious spondylodiscitis.

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# Abstract Archives of the RSNA, 2024

MKEE-107

## DECIPHERING ORTHOPEDIC HIP HARDWARE IMAGING: HOW TO RECOGNIZE AND WHAT SURGEONS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Ingrid D. Caridade, MD (*Abstract Co-Author*) Nothing to Disclose
Erica D. Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Maria Lobato Vaughan, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Lauar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Interpreting hip orthopedic materials through imaging methods can be challenging for the radiologist, as it is crucial knowledge due to its essential role in postoperative evaluation and diagnosing complications related to these devices. Plain radiographs are often the initial method of choice due to their availability, low cost, and ability to provide an overview of implant position, bone integrity, and joint alignment. However, other imaging methods such as computed tomography (CT) and magnetic resonance imaging (MRI) may be necessary for a more detailed assessment of the prosthesis-bone interface, surrounding soft tissues, and complications such as loosening, osteolysis, periprosthetic fractures, and infection. Ultrasonography also plays an important role in detecting peri-implant fluid collections and assessing adjacent soft tissues. The combination of these imaging methods allows for a comprehensive and accurate approach in interpreting hip orthopedic materials, assisting the medical team in making appropriate treatment decisions and improving patient outcomes post-surgery.

### TABLE OF CONTENTS/OUTLINE

Through a pictorial essay, we will review the normal anatomy of the hip, indications for orthopedic materials, how to assess them through imaging methods, and what their main complications are.

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# Abstract Archives of the RSNA, 2024

MKEE-108

## MRI FINDINGS OF THE IDIOPATHIC INFLAMMATORY MYOPATHIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Emad S. Allam, MD (*Abstract Co-Author*) Nothing to Disclose
Hongmin Xu, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe MRI findings of major subtypes of idiopathic inflammatory myopathies (IIM) and associated comorbidities.Clarify differentiating features among key IIM variants to enhance diagnosis confidence among radiologists.Highlight the connection between IIM and cancer, advocating for prompt cancer screening in IIM cases.

### TABLE OF CONTENTS/OUTLINE

Exhibit major IIM cases including dermatomyositis, polymyositis, paraneoplastic fasciitis/myositis, and anti-synthetase syndrome myositis.Imaging features including the extent and pattern of muscle involvement and disease activity on MRI are described.Summary of differential diagnosis of the major subtypes of IIM. Highlights the importance of a comprehensive approach involving medical history, physical examination, laboratory testing, and advanced imaging techniques like MRI in differentiating between subtypes of myositis and guiding muscle biopsy.

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# Abstract Archives of the RSNA, 2024

MKEE-109

## A RADIOLOGICAL OVERVIEW OF SHOULDER ARTHROPLASTY. PRACTICAL KEYS IN THE ASSESSMENT OF SHOULDER REPLACEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rosa M. Lorente-Ramos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paz Azpeitia Hernandez (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia-Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Maria Martinez Gomiz (*Abstract Co-Author*) Nothing to Disclose
Carlos Oliva Fonte (*Abstract Co-Author*) Nothing to Disclose
Javier Azpeitia Arman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To know the different types of shoulder replacement. To review the role of imaging techniques (plain radiograph, CT, MRI, US, scintigraphy) in the evaluation of shoulder prostheses. To understand the usefulness and limitations of plain radiographs and CT in the evaluation of shoulder replacements, emphasizing useful parameters and illustrating image analysis and interpretation. To become familiar with normal and abnormal postoperative imaging findings and signs of complications

### TABLE OF CONTENTS/OUTLINE

We review imaging of shoulder replacement, highlighting key concepts perceived as important variables by the surgeon and correlating images with clinical considerations and functional outcomes. We present: A review of types of replacement. Surgery aims. Imaging. Plain radiographs -Technique and views. Standard image acquisition: beam and anatomical landmarks -Parameters that should be evaluated: description of the components and alignment relative to normal anatomic alignment. Imaging. CT -Technique. -Parameters that should be evaluated. -Imaging of complications Early complications include instability or dislocation, hematoma, ulnar nerve dysfunction, deep infection, heterotopic ossification, and scapular spine fracture. Late complications include humeral and glenoid fractures, metaglene loosening, and scapular notching. Role of MRI, US and scintigraphy.

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# Abstract Archives of the RSNA, 2024

MKEE-11

## THE DIGITAL NERVE: MR AND US OF NORMAL ASPECT AND PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda C. Bernal, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understanding the anatomy of digital nerves in the upper limb;
- Navigating the anatomy of digital nerves in the lower limb;
- Correlating imaging findings with pathological changes in digital nerves;
- Analyzing ultrasonographic and magnetic resonance imaging findings across digital nerve pathologies.

### TABLE OF CONTENTS/OUTLINE

Introduction:
- Anatomy of digital nerves
- Upper limb
- Lower limb
- Structure of the digital nerve
- Clinical presentationOverview of Magnetic Resonance Imaging (MRI) and Ultrasonography (US) in nerve evaluation:
- Normal imaging characteristics on MRI and US
- Techniques and protocols for digital nerves MRI
- US imaging techniques and considerations for digital nerve evaluationCase-based review:
- Traumatic lesions
- Inflammatory conditions
- Tumors
- Extrinsic compressionSummaryTake home messages

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# Abstract Archives of the RSNA, 2024

MKEE-110

## ELBOW IMAGING - HOW TO MASTER ITS COMPLEXITIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Andreas Kunz, MD (*Abstract Co-Author*) Nothing to Disclose
Theresa Sophie Patzer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Dislocations and fractures of the elbow joint are a common finding following trauma. At the same time, osseous lesions are often associated with injuries of the ligaments and tendons, in particular concerning the lateral and medial collateral ligament complex, as well as the distal insertion of the biceps tendon. Diagnostic work-up requires a profound understanding of anatomy, biomechanics and typical injury patterns. While conventional radiography oftentimes represents the primary imaging modality, additional cross-sectional examinations with high spatial resolution are often required in order to address the fracture pattern and associated soft tissue pathologies in detail.

### TABLE OF CONTENTS/OUTLINE

1. Elbow joint anatomy a. Biomechanical properties b. Medial and lateral collateral ligament complex c. Muscles i. Extensors originating from lateral humeral epicondyle ii. Flexors originating from medial humeral epicondyle iii. Biceps tendon inserting at radial tuberosity d. Chiasma antebrachia 2. Imaging a. MRI with and without intravenous contrast enhancement b. Advantages of cone-beam CT over multidetector CT c. Postoperative Imaging 3. Pathologies a. Rupture of lateral collateral ligament complex b. Rupture of medial collateral ligament complex c. Lateral epicondylitis (tennis elbow) d. Medial epicondylitis (golfer’s elbow) e. Rupture of the biceps tendon f. Osborne-Cotterill lesion 4. Discussion

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# Abstract Archives of the RSNA, 2024

MKEE-111

## WHAT A ZINGER! A GUIDE TO ULTRASOUND OF PERINEURIOMAS AND OTHER PERIPHERAL NERVE SHEATH TUMORS WITH MRI AND HISTOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Preethi Kesavan, MD (*Abstract Co-Author*) Nothing to Disclose
Samer L. Soussahn, MD (*Abstract Co-Author*) Nothing to Disclose
Heidi Ehrich (*Abstract Co-Author*) Nothing to Disclose
Steven B. Soliman, DO (*Abstract Co-Author*) Consultant, General Electric Company;Speaker, General Electric Company
Gunjan B. Malhotra, MD (*Abstract Co-Author*) Nothing to Disclose
Erika Ysabelle E. Mojica, MD (*Abstract Co-Author*) Shareholder, Catalyst Pharmaceuticals
Molly Pantelic, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Emily Abraham, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Lamberg, MD (*Abstract Co-Author*) Nothing to Disclose
Joy Li, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Overview of perineuriomas and other peripheral nerve sheath tumors including histology/pathology and associated conditions2. Review of the sonographic findings characteristic of perineuriomas and other peripheral nerve sheath tumors with MRI and histologic correlation3. Differential diagnoses including malignancies, intraneural ganglia, and traumatic neuromas4. Ultrasound-guided biopsy technique

### TABLE OF CONTENTS/OUTLINE

1. Introduction and overviewa) Types and nomenclatureb) Pathophysiologyc) Epidemiologyd) Histologic Findingse) Associated conditionsf) Clinical Findings2.Ultrasound evaluationa) Transducer selection and settingsb) Sonographic imaging technique and pearlsc) Characteristic sonographic findingsd) Differential diagnoses (including malignancies, intraneural ganglia, and traumatic neuromas) and ways to differentiate sonographically3. MRI evaluationa) MRI protocol and the use of intravenous gadolinium contrastb) Characteristic MRI featuresc) Examples of US/MRI correlation4.Ultrasound-guided biopsya) Technique detailsb) Procedure pearls and the use of local anesthetic versus sedation5.Summary

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# Abstract Archives of the RSNA, 2024

MKEE-112

## BEFORE AND AFTER: EVALUATING RESPONSE TO TREATMENT IN MULTIPLE MYELOMA - WHOLE BODY MR IMAGING AND PET/CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jesus D. Aquerreta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria J. Garcia-Velloso, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alberto Paternain, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Del Nido Recio (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Whole-body MR Imaging (WB-MRI) and FDG-PET/CT have a crucial role in the follow-up of Multiple Myeloma.• It is important to correlate the morphology of the lesions with diffusion-weighted imaging values (MRI) and with up-take values (FDG-PET/CT).• FDG-PET/CT is the gold standard for studying extramedullary disease, whereas WB-MRI has more sensitivity in depicting diffuse disease and non-secretor myeloma.

### TABLE OF CONTENTS/OUTLINE

The Myeloma Response Assessment and Diagnosis System (MY-RADS) characterizes the disease state on MRI, at diagnosis and during follow-up. It is aimed to standardize reports and minimize variations. 5 Response Assessment Categories (RAC) have been described:• RAC 1 (Highly likely to be responding): previously evident lesion shows increase in ADC values from = 1400 to >1400 μm2/sec or = 40% increase in ADC from baseline.• RAC 2 (Likely to be responding): an increase in ADC from = 1000 to <1400, or >25% but <40% increase in ADC from baseline.• RAC 3: No observable change.• RAC 4 (Likely to be progressing): no change in size but increasing signal intensity with ADC values <1400.• RAC 5 (Highly likely to be progressing): new regions of hyperintensity with ADC values between 600-1000.On the other hand, the Italian myeloma criteria for PET use (IMPetUs) has standardized PET interpretation. FDG uptake is graded by the five-point scale of Deauville score (DS):1) No up-take is observed.2) Uptake = mediastinum.3) Uptake > mediastinum but = liver.4) Uptake moderately increased compared to the liver.5) Uptake markedly increased compared to the liver.Bone marrow non-focal uptake, focal bone lesions (site, number and uptake), paramedullary and extramedullary lesions are also studied.

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MKEE-113

## MR NEUROGRAPHY OF THE OCCIPITAL NERVES - TECHNICAL CONSIDERATIONS AND INJURY PATTERNS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ek Tsoon Tan, PhD (*Abstract Co-Author*) Research Grant, General Electric Company Research Grant, Siemens AG Research Grant, Medtronic Inc Research Grant, AMAG Pharmaceuticals
Lisa Gfrerer (*Abstract Co-Author*) Nothing to Disclose
Darryl B. Sneag, MD (*Abstract Co-Author*) Researcher, General Electric Company;Researcher, Siemens AG;Research support, AMAG Pharmaceuticals, Inc
Yen Po Lin, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Occipital neuralgia is a common pain syndrome that often occurs in combination with other headache disorders, such as migraines and tension headaches. An overlap in symptoms presents a diagnostic challenge for clinicians. Additionally, the small size and neighboring dermatomal territories of the occipital nerves often limit conventional MRI from accurately localizing pathology.• MR neurography (MRN) has not traditionally been used for occipital nerve evaluation. New technical advancements, including deep learning reconstruction techniques that enable higher spatial resolution, particularly for 3D isotropic sequences, now enable MRN as a modality to visualize these small nerves. • When performing MRN, it is crucial for the radiologist to be familiar with occipital nerve anatomy and technical considerations to optimize image quality.

### TABLE OF CONTENTS/OUTLINE

• Background• Anatomy Overview o Greater, lesser and third occipital nerves• Technical Considerations o Magnet: high field strengtho RF Coils: conventional head and neck coil or newly-developed conformable neck coil o Protocol/Sequences & 7; Anatomical 2D sequences: proton density sequences& 7; MR neurography 2D sequences: T2 Dixon and T2 fat-saturated sequences& 7; MR neurography 3D sequences: double echo steady state& 7; Fat and vascular suppression techniques & 7; Deep learning reconstruction& 7; Zero-to-echo time (ZTE) sequences: for anatomical reference and rendering • Case exampleso Normal anatomy demonstration o Unilateral occipital neuropathy/ entrapmento Traumatic injuryo Iatrogenic injury/neuromao Treatment: decompression surgery, nerve block/injection, radiofrequency ablation

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# Abstract Archives of the RSNA, 2024

MKEE-114

## LEVEL UP BONE TUMOR DIAGNOSIS FOR RADIOLOGISTS: MALIGNANT TRANSFORMATION OF BONE WITH IMAGING-PATHOLOGY CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hyang-Sook Jeong (*Abstract Co-Author*) Nothing to Disclose
Jee-Young Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Seul Ki Lee, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Common bone lesions, initially benign or low-grade malignant, have the potential to transform into higher-grade of malignancies. 2. Although typical imaging features of common bone lesions are well-established, malignant transformation is rare and can be easily missed. Additionally, sampling errors during biopsies can lead to inaccurate diagnoses. 3. Benign bone tumors that can transform into malignancies include osteochondroma, enchondroma, fibrous dysplasia, and giant cell tumor of bone. Non-tumorous conditions that may undergo malignant transformation include Paget's disease of bone, bone infarction, chronic osteomyelitis, and bone that has received radiation therapy. 4. Low-grade malignancies that can progress to higher grades include low-grade central osteosarcoma, and atypical cartilaginous tumor/low-grade chondrosarcoma. 5. Early recognition of malignant transformation in bone lesions is crucial. Combining clinical presentation, imaging findings, and accurate pathology is essential for planning appropriate management strategies.

### TABLE OF CONTENTS/OUTLINE

1. Typical Imaging Features of Common Bone Tumors 1-1. Bone Matrix: Osseous, Chondroid, and Fibrous 1-2. Benign vs. Malignant 2. Atypical Imaging Features and Diagnostic Challenges: Pearls and Pitfalls 2-1. Benign Bone Lesions Showing Malignant Transformation (Tumorous and Non-Tumorous Conditions) 2-2. Low-Grade Malignancies Progressing to Higher-Grades 3. The Importance of Precise Biopsy for Accurate Pathologic Diagnosis 4. Patients at Risk for Malignant Transformation of Bone Lesions 4-1. Impact of Prior treatment (Denosumab, Surgery, or Radiation) 4-2. Treatment Options: Timely Surgery vs. Watchful Follow-Up

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# Abstract Archives of the RSNA, 2024

MKEE-115

## APPLICATION OF 320-DETECTOR-ROW UPRIGHT CT IN ORTHOPEDIC AREAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Orito Ikeda (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Abstract Co-Author*) Nothing to Disclose
Takeo Nagura (*Abstract Co-Author*) Nothing to Disclose
Mohammed Alshahri (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Minoru Yamada, RT (*Abstract Co-Author*) Nothing to Disclose
Yoichi Yokoyama, MD (*Abstract Co-Author*) Nothing to Disclose
Fumiko Yagi, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of our exhibit are as follows: (1) To explain the development, background, and performance of 320-detector-row upright computed tomography (CT) for whole-body scans, (2) To describe the anatomical changes in each musculoskeletal structure due to differences in body position, that is, the direction of gravity, and (3) To illustrate the clinical applications and usefulness of upright CT in various orthopedic diseases with clinical case presentations.

### TABLE OF CONTENTS/OUTLINE

(1) Development and advantages of upright CT with an area detector for whole-body scans (2) Performance of 320-detector-row upright CT: Physical characteristics, workflow improvement, safety, and remote operation during the infectious disease pandemic (3) Effects of gravity on the shoulder girdle, upper extremities, thorax, vertebrae, hip, knee, foot, and muscles in various parts of the body (4) Clinical applications of upright CT for various orthopedic diseases such as knee osteoarthritis, hip osteoarthritis, scoliosis/spinal deformity, lumbar spondylolisthesis, orbital wall fracture, and pectus excavatum (5) Upright 4D-CT (6) More accurate evaluation of seatbelt safety for autopilot driving with upright CT (7) Limitation (8) Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-116

## MSK TUBERCULOSIS (TB) MANIFESTATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marta A. Piorkowska, MBBS (*Abstract Co-Author*) Nothing to Disclose
Saad K. Chaudhry, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Usman Goga, MSc,MBBS (*Abstract Co-Author*) Nothing to Disclose
Susan Cross, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Krishanantham Ambalawaner, MBChB, BSc (*Abstract Co-Author*) Nothing to Disclose
Saigeet Eleti, FRCR, MBBChir (*Abstract Co-Author*) Nothing to Disclose
Sarah Hickman, MBBS (*Presenter*) Research collaboration, Vara;Research collaboration, ScreenPoint Medical BV;Research collaboration, Lunit Inc;Research collaboration, Kheiron Medical Technologies Ltd;Research collaboration, Alphabet Inc;Research collaboration, Volpara Health Technologies Limited

### TEACHING POINTS

- MSK TB is rare (1-3% of cases of TB) and most commonly affects the spine (50%), followed by TB arthritis, and tenosynovitis is very rare. Concurrent intrathoracic TB occurs in ~ < 50% of cases. [Yukie Rodriguez-Takeuchi et al 2019, Pattamapaspong et al 2024, Burrill 2007]. -Symptom onset is insidious over weeks to months with progressive pain, night sweats, fatigue, weight loss and low grade fever. This leads to a significant delay in diagnosis (reportedly 3 -24 months).-Spinal involvement occurs via haematogenous spread usually infecting the anterior and central vertebral body. Infection can spread over multiple levels with sparing of the disc through subligamentous spread. With time, vertebral destruction and cold abscess formation may occur. -Disc involvement is usually late. Spread to paraspinal tissues may be in the form of a psoas abscess with calcification highly suggestive of TB. Epidural phlegmon can also extend to compress the spinal cord / cauda equina. -TB osteomyelitis is often misdiagnosed as multiple bone metastases. -TB Arthritis occurs from osteomyelitis or hematogenous spread and is typically a chronic granulomatous monoarthritis affecting weight bearing joints and typically demonstrates Phemister triad (juxta-articular osteoporosis, peripheral osseous erosion and gradual narrowing of the joint space).-TB Tenosynovitis occurs from hematogenous spread or extension from TB arthritis and most commonly occurs in the wrist and hand, usually involving the flexor tendon sheath.

### TABLE OF CONTENTS/OUTLINE

1) Introduction to MSK TB2) Spondylodiscitis 3) Psoas Abscess 4) Osteomyelitis 5) Septic arthritis 6) Synovitis 7) Tenosynovitis 8) Bursitis 9) Intramuscular / subcutaneous10) Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-117

## ON THE MOVE: DYNAMIC ULTRASOUND FOR THE ASSESSMENT OF LOWER EXTREMITY MUSCULOSKELETAL DISORDERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Steven B. Soliman, DO (*Abstract Co-Author*) Consultant, General Electric Company;Speaker, General Electric Company
Preethi Kesavan, MD (*Abstract Co-Author*) Nothing to Disclose
Gunjan B. Malhotra, MD (*Abstract Co-Author*) Nothing to Disclose
Molly Pantelic, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hannah Lamberg, MD (*Abstract Co-Author*) Nothing to Disclose
Joy Li, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Abraham, MD (*Abstract Co-Author*) Nothing to Disclose
Erika Ysabelle E. Mojica, MD (*Presenter*) Shareholder, Catalyst Pharmaceuticals

### TEACHING POINTS

1. Ultrasound (US) is a valuable tool in assessing for musculoskeletal conditions due to the real-time assessment and isolation of specific pathologies using dynamic maneuvers.2. Dynamic musculoskeletal US should be considered for pathologic conditions that present with snapping, clicking, or pain with joint movement.

### TABLE OF CONTENTS/OUTLINE

1. Introduction of dynamic US for musculoskeletal pathologies, including its advantages, specific dynamic maneuvers, and additional considerations.2. Lower extremity pathologies assessed on dynamic US with accompanying cine clips, key static images, and teaching points on scanning technique, patient positioning, and sonographic findings. Selected pathologies include:a. Snapping iliopsoas tendonb. Meniscal extrusionc. Peroneal tendon subluxation/dislocation over the lateral malleolusd. Peroneal tendon intrasheath subluxation (types A and B)e. Achilles tendon tearsf. Morton neuroma and intermetatarsal bursitis3. Summarya. Review of teaching points

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# Abstract Archives of the RSNA, 2024

MKEE-118

## RADIAL WRIST PAIN - KEYS FOR THE GENERAL RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Noelia Arevalo (*Abstract Co-Author*) Nothing to Disclose
Joseba Mirena Zulueta Odriozola, MBBS (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel Angel Gomez Bermejo, MD (*Abstract Co-Author*) Nothing to Disclose
Abel Gonzalez Huete, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Upon reviewing this exhibit, the reader should:• Be familiar with the pathologies that can present with radial wrist pain. A brief overview will be provided detailing each pathology, including epidemiology and clinical presentation, essential for the differential diagnosis.• Be able to select the appropriate imaging modality in each case (plain film, ultrasound, CT, MRI) based on the patient's history, clinical context and symptoms, taking into account the utility and limitations of each modality.• Accurately describe the findings in studies performed on patients affected by the mentioned pathologies.• Recognize the complications associated with each disease and their representation in imaging.• Understand the available therapeutic options, including interventions involving radiologists.

### TABLE OF CONTENTS/OUTLINE

• Wrist anatomy• Differential diagnosis o Due to overuse:? De Quervain's stenosing tenosynovitis.? Proximal and distal intersection syndromes.o Acute traumatic origin:? Fracture of the distal end of the radius.? Carpal fractures: scaphoid, trapezius.? Fractures of the base of the first metacarpal: Bennett, Rolando and pseudo-Bennett.o Degenerative arthropathy:? Trapeziometacarpal osteoarthritis.? Trapezio-scapho-trapezoid osteoarthritis.? Radiocarpal osteoarthritis.o Nerve entrapment and injury:? Cheiralgia paresthetica - Wartenberg syndrome.? Post-traumatic neuroma.• Conclusions

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# Abstract Archives of the RSNA, 2024

MKEE-119

## PORTABLE LOW-FIELD MRI FOR IMPROVED MUSCULOSKELETAL DISORDERS DIAGNOSTICS - METHODS, CHALLENGES AND FUTURE POTENTIAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shira Nemirovsky-Rotman (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Medical imaging is a key component for diagnostics of musculoskeletal (MSK) conditions, currently considered a significant national public health issue - due to ageing population as well as prevalence of sport injuries. The growing need for accurate and fast examinations has resulted in a bottleneck in medical diagnostics and treatment. MRI exhibits superior soft-tissue contrast and resolution compared to other modalities; specifically, it is considered the gold-standard for diagnostics of a range of MSK injuries and disorders. Recently, research has focused on portable and low-field MRI scanners, which may be applied for various applications, including MSK. Low-field MRI provides invaluable opportunities for lower maintenance costs, as well as portable and accessible imaging; however, it produces images that suffer from reduced resolution and signal-to-noise ratios compared to their high-field counterparts. To address this issue, recent deep-learning-based methods have been applied to translate images acquired with low-field scanners to images with perceived high-field quality. Such methods show proof-of-concept in translating from low to high resolution; however, further research is needed to determine the diagnostic integrity of the obtained images for specific clinical applications.

### TABLE OF CONTENTS/OUTLINE

1. Principles of AI-based algorithms for image translation from low- to high-field MRI scanners;2. The challenge of image registration and domain adaptation when training AI-based low-to-high-field translation algorithms;3. Clinical/diagnostic evaluation criteria vs. computer vision measures for assessment of reconstructed high-field images (as obtained from low-field).

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# Abstract Archives of the RSNA, 2024

MKEE-12

## GIANT CELL-RICH LESIONS OF BONE: BEYOND GIANT CELL TUMOR OF BONE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Xavier Sanjuan (*Abstract Co-Author*) Nothing to Disclose
Jose A. Narvaez, MD (*Abstract Co-Author*) Nothing to Disclose
Karen Perez Alfonso, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Carlos Sardinas (*Abstract Co-Author*) Nothing to Disclose
German G. Ratto, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Hernandez Ganan (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Giant cell-rich bone lesions comprize heterogeneous neoplastic and non-neoplastic disorders with diverse clinical, radiological and pathological presentations. They are characterized by the presence of conspicuous osteoclast-type giant cells as a component of the presenting entity. Giant cell tumor of bone is probably the best known of this group of lesions. The objectives of this review are: - To explain the molecular background in the formation of osteoclast-type giant cells (role of RANK ligand). - To analyze the radiological features of giant cell tumor of bone and post-treatment changes with denosumab. - To review the different tumors that can present giant cells, analyzing the relevant radiological features. - To review the molecular alterations that help to differentiate these entities, especially the H3.3 mutations.

### TABLE OF CONTENTS/OUTLINE

- Cell biology in the formation of osteoclast-like giant cells. - Giant cell tumor of bone: imaging features, microscopic and molecular pathology features. - Imaging and pathologic features of GCTB after denosumab treatment. - Variants of GCTB: malignant GCTB, multicentric GCTB, metastatic GCTB. - Imaging and patholiogic features of other giant cell-rich lesions: o Aneurymal bone cyst (ABC) o Giant cell granuloma of the jaws (GCG). o Giant cell-rich osteosarcoma. o Giant Cell Reparative Granuloma (Solid ABC) o Benign fibrous histiocytoma of the bone (GCTB with regressive changes). o Non-ossifying fibroma of bone (NOF). o Chondroblastoma. o Chondromyxoid fibroma. o Brown tumor of hyperparathyroidism.

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# Abstract Archives of the RSNA, 2024

MKEE-120

## REVEALING RADIOGRAPHS: KEY REPORTS FOR THE ORTHOPEDIST IN FRACTURE MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sonia Carolina Hernandez Sanchez (*Abstract Co-Author*) Nothing to Disclose
Gustavo Rozo (*Abstract Co-Author*) Nothing to Disclose
Guillermo A. Granados Gonzalez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recognize the different stages of bone healing, understand primary and secondary orthopedic management options.Identify complications such as non-union, pseudoarthrosis, and malunion.Accurate diagnosis and early intervention prevent long-term complications.Understand the process of bone transport and its clinical applications in correcting bone defects.Know what findings to include in radiological reports for effective decision-making.Recognize the importance of clear and concise communication in reports to ensure optimal patient care.

### TABLE OF CONTENTS/OUTLINE

Table of Contents1. The Natural History of Fracture and Its Management - Orthopedic and Surgical Management of Fractures2. Alterations and Complications in Consolidation - Is pseudoarthrosis the same as non-union? - Types of non-union3. Functional Basis of External Fixation and Bone Transport4. Useful Reports for the Orthopedist5. Cases6. Teaching Points

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# Abstract Archives of the RSNA, 2024

MKEE-121

## ANALYSIS OF MUSCLE VIABILITY USING MAGNETIC RESONANCE IMAGING IN COMPARTMENT SYNDROME

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ana Belen Barba Arce, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Describe the study protocol using magnetic resonance imaging (MRI) in the assessment of compartment syndrome. 2. Determine the structural changes in the muscles affected by compartment syndrome, both acute and chronic. 3. Obtain objective and precise data on muscle viability that can help in treatment planning and patient follow-up. 4. Analyze the acute and chronic complications of this syndrome. 5. Perform a differential diagnosis with other entities.

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Acute compartment syndrome. 2.1. Etiology. 2.2. Pathophysiology. 2.3. Clinical manifestations. 2.4. Diagnostic tests. 2.5. Treatment. 2.6. MRI study protocol. 2.6.1. Findings. 2.6.2. Muscle viability analysis. 3. Chronic compartment syndrome. 3.1. Chronic exertional compartment syndrome. 3.2. MRI study protocol. 3.2.1. Findings. 3.2.2. Muscle viability analysis. 4. Complications of compartment syndrome. 4.1. Infection. 4.2. Myonecrosis. 4.3. Calcifying myonecrosis. 4.4. Fibrous contractures. 4.5. Rhabdomyolysis. 5. Differential diagnosis. 6. Conclusions.

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# Abstract Archives of the RSNA, 2024

MKEE-122

## SQUEEZE THE DAY: AN IMAGING-BASED REVIEW OF DENERVATION SYNDROMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alejandra Cardona Del Valle, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Camareno-Soto, BSc (*Abstract Co-Author*) Nothing to Disclose
Carol Sanchez Santana (*Abstract Co-Author*) Nothing to Disclose
Kevin Hornedo, BS (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Trullenque, MD (*Abstract Co-Author*) Nothing to Disclose
Santiago A. Saldana Mendez, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A. Review relevant anatomy, pathophysiology, and clinical presentation of Denervation Syndromes. B. Showcase the most common denervation syndromes and epidemiology. C. Discuss key imaging findings on Ultrasound (US) and Magnetic Resonance Images (MRI) for diagnosis. D. Examine the role of imaging in treatment planning.Denervation syndromes, resulting from diverse causes such as trauma, infection, tumors, or autoimmune disorders, frequently manifest as pain and weakness. While traditional diagnosis relied on clinical assessment and electromyography, MRI and ultrasound now play pivotal roles. These imaging modalities aid in identifying injury sites, duration of denervation, and underlying causes. This exhibit comprehensively reviews common denervation syndromes, showcasing MRI and ultrasound images to elucidate diagnosis and develop optimal treatment strategies.

### TABLE OF CONTENTS/OUTLINE

I. Introduction Objectives II. Anatomy and Pathophysiology III. Clinical Presentation IV. Showcase Common Denervation Syndromes A. Upper extremity 1. Subcapsular N. 2. Axillary N. 3. Radial N. 4. Median N. 5. Ulnar N. B. Lower extremity 1. Femoral N. 2. Obturator N. 3. Sciatic N. 4. Tibial 5. N. V. Diagnosis Key imaging findings on US and MRI evaluations VI. Treatment VII. Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-123

## DISCOID LATERAL MENISUCUS: HELPFUL FINDINGS IN X-RAY AND MAGNETIC RESONANCE IMAGING, AND NEW INSIGHTS ON SHAPE FEATURES OF BONE AND CARTILAGE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Keita Nagawa (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The major radiographical findings of discoid lateral meniscus (DLM) have been reported to be widening of the lateral joint line, cupping of the lateral tibial plateau, squaring of the lateral femoral condyle, widening of the tibial eminence, elevation of the fibular head, and condylar cutoff sign. To diagnose DLM on magnetic resonance imaging (MRI), several findings are important; the meniscal width is over 15 mm on the coronal slice. Continuity of the meniscus between the anterior and posterior horns on three or more 5-mm thick consecutive sagittal slices. In the recent studies, new insights for DLM concerning bone and cartilage morphology have been reported, including hypoplasia of the posterior lateral femoral condyle, and thin lateral tibial cartilage. In our analysis for DLM concerning the volume of subchondral bone and cartilage, the volume of lateral femoral epiphyseal bone and the cartilage volume of lateral tibial plateau were significantly smaller in the DLM group compared to the control group.

### TABLE OF CONTENTS/OUTLINE

1. Basics of DLM2. Important X-ray findings for DLM3. To diagnose DLM with MRI4. New insights for DLM: bone and cartilage morphology5. Our findings for DLM: volume of subchondral bone and cartilage

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# Abstract Archives of the RSNA, 2024

MKEE-124

## VIRTUAL NON CALCIUM IMAGING IN CONTRAST ENHANCED DUAL-ENERGY CT IMPROVES DETECTION OF BONE METASTASES AND MAY ALSO REFLECT ACTIVITY OF BONE METASTASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shunsuke Itaya, RT (*Abstract Co-Author*) Nothing to Disclose
Yasuo Sakurai, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshihisa Kodama, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Hirotaka Nakashima, MSc, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Deep learning imaging reconstruction (DLIR) based virtual non-calcium (VNCa) images were created using a two-material decomposition process based on dual-energy CT acquisition with fast kV switching.2. The diagnostic performance of contrast-enhanced CT imaging and VNCa imaging was compared in 53 patients with clinically confirmed bone metastases.3. Three substance pairs were used for VNCa images in contrast-enhanced dual-energy CT: Iodine (Hydroxyapatite), Water (Hydroxyapatite), and Water (Calcium).4. Evaluation of metastatic bone tumors using VNCa imaging on contrast-enhanced dual-energy CT demonstrated superior diagnostic performance compared to conventional CT imaging.

### TABLE OF CONTENTS/OUTLINE

Bone metastasis is a possible complication of all cancers and reduces the quality of life of patients. CT is difficult to diagnose osteoblastic bone metastases without destruction and is often missed. Virtual non calcium (VNCa) images are material-dense images obtained with dual-energy CT, which enhances the water component and removes the bone component. Using VNCa images in contrast-enhanced dual-energy CT may improve the identification of bone metastases and evaluate the activity of bone metastases by assessing the presence of contrast uptake. In this exhibition, we compared the diagnostic performance of bone metastases in contrast-enhanced dual-energy CT when evaluated with VNCa images plus bone and soft tissue conditions and when evaluated with bone and soft tissue conditions images only. The results showed that VNCa imaging had a higher discriminative ability for metastatic bone tumors. Furthermore, it was suggested that evaluating the activity of bone metastases is also feasible.

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# Abstract Archives of the RSNA, 2024

MKEE-125

## ALL THAT GLITTERS IS GOLD UNRAVELLING THE MAIN CONCEPTS OF THE CHRONIC RECURRENT MULTIFOCAL OSTEOMYELITIS IN WHOLE-BODY MAGNETIC RESONANCE IMAGING IN CHILDREN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lislie G. Santin, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo B. Zukovski, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Anderson Phelipe Dias Sabry Azar, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Rocha, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Renan D. Lederer, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Viana Dos Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Chronic Recurrent Multifocal Osteomyelitis (CRMO) is an idiopathic inflammatory disorder of the bones, typically seen in children and adolescents. Whole-body magnetic resonance imaging (WB - MRI) is a very useful imaging tool in the detection and follow-up of such alterations. Therefore, the aim of this exhibit is to:Describe the main points related to the protocol of WB - MRI in children, including the particularities of the age group and the techniques used.Expose the main concepts of CRMO, including its pathophysiology and its main radiographic features.Demonstrate the main imaging findings of CRMO in WB-MRI and ways to identify such alterations in all sequences.Identify pitfalls and potential confounding imaging findings in WB-MRI.

### TABLE OF CONTENTS/OUTLINE

Introduction: the importance of WB-MRI in the diagnosis and follow-up of CRMO.WB-MRI in childrenProtocolParticularities in childrenCRMODefinition and epidemiologyPathophysiologyMain radiographic featuresPitfalls in WB-MRINormal versus pathologic signal alterations.

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# Abstract Archives of the RSNA, 2024

MKEE-126

## DYNAMIC SPINE FLEXIBILITY EVALUATION WITH DYNAMIC DIGITAL RADIOGRAPHY FOR ADOLESCENT IDIOPATHIC SCOLIOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Zhiwei Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Man Wang (*Abstract Co-Author*) Nothing to Disclose
Wu Liu (*Abstract Co-Author*) Nothing to Disclose
Shuo Ma (*Abstract Co-Author*) Nothing to Disclose
Zhe Zhao (*Abstract Co-Author*) Nothing to Disclose
Ruiyao Qin (*Abstract Co-Author*) Nothing to Disclose
Yun Wang (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To demonstrate a new way to evaluate spine flexibility with dynamic digital radiography.To design motion for supine bending, fulcrum bending and suspension, the general principle, and special points for each position. To suggest the exposure parameters and effect dose follow the ALARA principle. To show the case of each position movement, the trajectory and dynamic Cobb’s angle changes and stretch distance changes.

### TABLE OF CONTENTS/OUTLINE

1. Background: -limits of static spine flexible evaluation - new technique of dynamic digital radiography (DDR) 2. Key aspects of DDR position acquisition: - Posture designing - Movement training 3. Exposure conditions for DDR: - Exposure parameters - Effective radiation dose 4. The dynamic changes of Cobb’s angle, spinal flexibility, and subject's stability during different DDR positions: - Cobb’s angle variations during different bending motion - Stretch distance changes during suspension motion

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# Abstract Archives of the RSNA, 2024

MKEE-127

## THE NEGLECTED HORNS: VARIANTS, PITFALLS AND PATHOLOGIES OF THE ANTERIOR HORNS OF THE MENISCI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Michael Brown, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas S. Truong, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela J. Walsh, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The anterior horns of the menisci are less frequently considered than the body and posterior horns when assessing and studying meniscal appearance and pathology. The anterior horns of the medial and lateral menisci possess variant anatomy and at times may mimic pathologies. True tears and pathologic processes do occur in the anterior horn, and at times are subtle and may be overlooked. This educational exhibit is designed to demonstrate the traditional and variant anatomy of the medial and lateral menisci's anterior horns with examples of how to discern variant anatomy from pathology. The exhibit will also show examples of true pathology of the anterior horn, highlighting subtleties not to be overlooked.

### TABLE OF CONTENTS/OUTLINE

Background Medial Meniscus Anatomy Variant Anatomy/Pathology mimics Far anterior insertion of the anterior horn Anterior meniscofemoral ligament of the medial meniscus Oblique meniscomeniscal ligament Lateral Meniscus Anatomy Variant Anatomy/Pathology mimics Striated/speckled appearance of the root attachment Mucoid degeneration of the anterior root/relationship to the ACL insertion Transverse ligament mimicking tear Pathology Meniscal contusions Tears Radial tears (more commonly seen at the lateral meniscus) Flap tears Complex tears Parameniscal cysts

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# Abstract Archives of the RSNA, 2024

MKEE-128

## BEND AND SNAP! DYNAMIC ULTRASOUND EVALUATION OF THE ELBOW AND SHOULDER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Erika Ysabelle E. Mojica, MD (*Abstract Co-Author*) Shareholder, Catalyst Pharmaceuticals
Emily Abraham, MD (*Abstract Co-Author*) Nothing to Disclose
Steven B. Soliman, DO (*Abstract Co-Author*) Consultant, General Electric Company;Speaker, General Electric Company
Gunjan B. Malhotra, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Lamberg, MD (*Abstract Co-Author*) Nothing to Disclose
Joy Li, MD (*Abstract Co-Author*) Nothing to Disclose
Preethi Kesavan, MD (*Abstract Co-Author*) Nothing to Disclose
Molly Pantelic, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Why dynamic ultrasound: indications, pearls, and pitfalls2. Dynamic pathologies of the elbow and shoulder: epidemiology, pathophysiology, and common clinical presentations3. Dynamic ultrasound evaluation of the elbow and shoulder, with a summary of key techniques, sonographic findings, and MR anatomic correlation4. Treatment strategies for key elbow and shoulder pathologies

### TABLE OF CONTENTS/OUTLINE

1. Introduction and overviewa. Why dynamic ultrasound: indications, pearls, and pitfallsb. Dynamic pathologies of the elbow and shoulderc. Epidemiologyd. Pathophysiologye. Common clinical presentations2. Dynamic ultrasound evaluation of the elbow and shouldera. Transducer selectionb. Key viewsc. Dynamic ultrasound techniques3. Dynamic ultrasound findings in key elbow and shoulder pathologies, with MR anatomic correlationa. Snapping triceps syndromeb. Elbow synovial fold syndromec. Biceps tendon tearsd. Subacromial impingemente. Acromioclavicular joint instabilityf. Rotator cuff tears4. Treatment strategies5. SummaryReferences:Cerezal L et al. Elbow Synovial Fold Syndrome. AJR Am J Roentgenol. 2013; 201(1):W88-96. https://doi.org/10.2214/AJR.12.8768.Jacobson J et al. Ulnar Nerve Dislocation and Snapping Triceps Syndrome: Diagnosis with Dynamic Sonography-Report of Three Cases. Radiology. 2001; 220(3):601-5. https://doi.org/10.1148/radiol.2202001723.Miller T et al. Ultrasound of the distal biceps brachii tendon using four approaches: reproducibility and reader preference. Skeletal Radiol. 2021; 50(5): 937-943. https://doi.org/10.1007/s00256-020-03637-z.

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# Abstract Archives of the RSNA, 2024

MKEE-129

## SPRINT TO DIAGNOSIS: UNRAVELING LOWER LIMB MUSCULOSKELETAL INJURIES IN RUNNERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe C. Ferreira Dionisio, MD (*Abstract Co-Author*) Nothing to Disclose
Jose F. Neto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Anatomy Understanding: Reviewing the anatomy of the structures of the lower limb to get a precise diagnosis.Early Recognition: Highlight the importance of prompt identification of lower limb musculoskeletal injuries in runners to prevent chronicity and optimize outcomes.Multimodal Imaging: Discuss the role of advanced imaging modalities such as MRI, CT, and ultrasound in providing detailed anatomical assessment and accurate diagnosis of soft tissue and bone injuries.Clinical Correlation: Emphasize the integration of imaging findings with clinical history and physical examination to enhance diagnostic precision.Injury Patterns: Explore common patterns of lower limb injuries encountered in runners, including stress fractures, muscle strains, tendinopathies, and ligamentous injuries, to aid radiologists in targeted evaluation.Conclusion: After this education exhibit you should be able to correctly diagnose the most prevalent injuries in runners.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

MKEE-13

## FIRM GRASP OF ANKLE INSTABILITY: UNDERSTANDING MRI FEATURES OF FAILURE MODES OF THE LATERAL ANKLE LIGAMENTS WITH SURGICAL AND FLUOROSCOPIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Dhiren Shah, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Andrew Goldberg (*Abstract Co-Author*) Nothing to Disclose
Dimitri Amiras, MBBS, FRCR (*Abstract Co-Author*) Clinical Advisory Board, Medical iSight
Rikin Hargunani, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Jedrzej Krawczyk, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. How to image and identify the CFL, superior and inferior ATFL bundles on imaging2. Why these are important for management in suspected ankle instability.3. Injury to the lateral ligament complex involving the fibula / inferior ATFL can lead to subtalar joint instability4. This can be detected both during on-able fluoroscopy and intra-operatively and most importantly - correlated with MR appearances.

### TABLE OF CONTENTS/OUTLINE

Lateral fibulotalocalcaneal ligament complex (LFTCL) is formed by the inferior fascicle of the anterior talofibular ligament (ATFL), connected with the calcaneofibular ligament (CFL) by arciform fibres ; it plays an important role in inversion injury prevention. This ligament complex is distinct from the superior fascicle of the ATFL - an intra-articular ligament unlikely to heal. An isolated repair of ATFL results in great outcomes if the complex is intact.In our exhibit, we outline:1. The anatomy and biomechanics of the lateral ligaments of the ankle.2. Injury mechanisms and related failure modes of the ligaments.3. MRI sequences used in our practice.4. Subsequent MRI appearances related to different failure models.5. Dynamic instability demonstrated by dynamic fluoroscopy.6. Correlation of example MRI cases with intra-operative videos.

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# Abstract Archives of the RSNA, 2024

MKEE-130

## OPERATIONALIZING CLINICAL KNEE MRI AT 7T: THE GOOD, THE BAD, AND THE UGLY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aaron J. Wyse, MD (*Abstract Co-Author*) Nothing to Disclose
Michael G. Fox, MD (*Abstract Co-Author*) Royalties, RELX
Jeremiah R. Long, MD (*Abstract Co-Author*) Nothing to Disclose
David M. Melville, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan A. Flug, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
ANTHONY HANNON (*Abstract Co-Author*) Nothing to Disclose
Jason Tilque (*Abstract Co-Author*) Nothing to Disclose
Samuel J. Fahrenholtz, PhD (*Presenter*) Stockholder, Nano X Imaging

### TEACHING POINTS

1) Though 7T represents a new technology with incredible capabilities, the current hardware and software requires intense optimization to reach an operational level of clinical abilities comparable with current 3T and 1.5T imaging. 7T clearance by the Food and Drug Administration is limited to knee and brain. 2) The primary advantage of 7T knee magnetic resonance imaging (MRI) is increased signal-to-noise ratio (SNR) which can be used for better resolution, less noise appearance, and/or faster imaging. 3) The primary disadvantages are heating and inhomogeneities in B0 and B1+. The inhomogeneities most significantly make chemical shift selective fat saturation fail, sometimes in the same anatomical regions across the acquisition planes. 4) Key technologies, e.g., deep learning reconstruction algorithms, are being deployed at 7T. MRI transmit and receive coil design is important. 5) The logistics of 7T are difficult. It is an expensive system with increased MR safety efforts and the possibility to induce bioeffects in patients.

### TABLE OF CONTENTS/OUTLINE

1) Patient eligibility and safety at 7T; 2) Balancing SNR, acquisition time, and resolution; 3) Effects of B0 and B1+ inhomogeneities; 4) 3D MRI; 5) Deep learning reconstruction

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# Abstract Archives of the RSNA, 2024

MKEE-131

## HOW TO HAND-LE IT: DYNAMIC ULTRASOUND OF THE HAND AND WRIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Preethi Kesavan, MD (*Abstract Co-Author*) Nothing to Disclose
Joy Li, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Abraham, MD (*Abstract Co-Author*) Nothing to Disclose
Steven B. Soliman, DO (*Abstract Co-Author*) Consultant, General Electric Company;Speaker, General Electric Company
Gunjan B. Malhotra, MD (*Abstract Co-Author*) Nothing to Disclose
Erika Ysabelle E. Mojica, MD (*Abstract Co-Author*) Shareholder, Catalyst Pharmaceuticals
Molly Pantelic, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hannah Lamberg, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Dynamic ultrasound of the hand and wrist is a valuable tool and can help answer clinical questions which are not well evaluated by CT or MR.2. Identification of abnormal movement of anatomic structures in relation to patient symptoms.

### TABLE OF CONTENTS/OUTLINE

Introduction of dynamic ultrasound Advantages and challenges Upper extremity case examples with an explanation of scanning technique, pathology, and accompanying dynamic ultrasound cine clips and still images. Cases include 1. Intra-sheath subluxation of flexor digitorum tendons 2. De Quervain tenosynovitis and intra-sheath subluxation of abductor pollicus longus and extensor pollicus brevis 3. Extensor retinacular ligament injury/snapping of lateral band 4. Hardware/screws abutting flexor tendons and extensor compartments 5. Stenosing tenosynovitis 6. Stener lesion 7. Radial sagittal band tear with extensor tendon dislocation Summary/Key points

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# Abstract Archives of the RSNA, 2024

MKEE-132

## THE MANY FACES OF SOFT-TISSUE FIBROBLASTIC TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Jesus D. Aquerreta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alberto Paternain, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Del Nido Recio (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Soft tissue tumors of fibrous origin are one of the most common tumors found in clinical practice.; They may have different biological behavior and imaging appearance, depending on the type. Some of these lesions may be reactive to a primary process, such as elastofibroma dorsi and myositis ossificans.; Tumors with high cellularity show higher signal on T2-weighted imaging (WI) and more enhancement, whereas tumors with dense internal collagen content show low signal intensity and less enhancement.

### TABLE OF CONTENTS/OUTLINE

Fibroblastic and myofibroblastic tumors can be classified according to their biological behavior:
• **Benign lesions**:
○ Elastofibroma dorsi: it is located between the scapula and the posterior chest wall and it has heterogeneous appearance (fibrous and fatty tissue).
○ Myositis Ossificans: it shows a heterogeneous appearance on imaging and has calcified areas.
○ Fibromatosis Colli: it is found on the sternocleidomastoid muscle and it is secondary to trauma during childbirth.
○ Other lesions are: Nodular Fasciitis and Fibroma of the Tendon Sheath.
• **Intermediate lesions**: Palmar (Dupuytren) and Plantar (Ledderhose) Fibromatosis, Dermatofibrosarcoma, Solitary Fibrous Tumor.
• **Malignant lesions**:
○ Fibrosarcoma (not otherwise specified): it is hypointense on T1 WI and iso- to hyperintense on T2 WI, with peripheral enhancement.
○ Myxofibrosarcoma: it has a heterogeneous appearance with hyperintense foci on T2. Osseous involvement is frequent.
○ Sclerosing Epitheloid Fibrosarcoma: it produces cortical destruction and it shows variable signal intensity on T1 WI, with variable enhancement.
○ Other tumors are: Undifferentiated Pleomorphic Sarcoma or Low-grade Fibromyxoid Sarcoma.

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# Abstract Archives of the RSNA, 2024

MKEE-133

## ONCOLOGIC AND NON-ONCOLOGIC SKELETAL MUSCLE UPTAKE PATTERNS ON 18F FDG PET-CT: A CASE BASED MULTI-MODALITY PICTORIAL REVIEW WITH TEACHING PEARLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pokhraj P. Suthar, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Magill (*Abstract Co-Author*) Nothing to Disclose
Iryna Kostirko (*Abstract Co-Author*) Nothing to Disclose
Sumeet Virmani, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

F18 FDG PET-CT is a well-established imaging modality with applications in cancer staging, cardiology and neurology. Skeletal muscle FDG uptake seen on whole-body PET-CT may be physiologic or pathologic. Physiologic/normal FDG uptake in skeletal muscles is usually mild and homogeneous. This case-based pictorial review highlights the spectrum of physiologic and pathologic skeletal muscle uptake patterns on F-18 FDG PET-CT, some of which are very specific and virtually diagnostic. Our case-based pictorial review aims to review:1) Expected physiologic distribution and intensity of FDG uptake in skeletal muscles.2) Various physiologic variants (FDG injection in a postprandial state, use of insulin before FDG injection, vigorous muscle exercise, stress-induced muscle tension, spastic paresis, talking, chewing, clenching of fist, use of accessory muscles of respiration, use of crutches, altered biomechanics, etc.)3. Various non-oncologic pathologic patterns of skeletal muscle uptake (elastofibroma dorsi, post-vaccination, Baastrup's disease, hot spot sign in acetabular fossa etc.)4. Various focal and diffuse oncologic patterns of skeletal muscle uptake (leiomyosarcoma, rhabdomyosarcoma, lymphoma, metastasis)

### TABLE OF CONTENTS/OUTLINE

Our case-based pictorial review of 20 interesting cases, highlights the spectrum of physiologic and pathologic skeletal muscle uptake patterns on F-18 FDG PET-CT, some of which are very specific and virtually diagnostic. Increased awareness of such patterns helps in avoiding misdiagnosis and unnecessary further interventions minimizing morbidity and mortality.

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# Abstract Archives of the RSNA, 2024

MKEE-134

## SPECTRUM OF UNDIFFERENTIATED SMALL ROUND CELL SARCOMAS— A RADIOLOGIC-PATHOLOGIC CORRELATION IN THE ERA OF WHO CLASSIFICATION 5TH EDITION (2020)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ryo Kurokawa, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Mariko Kurokawa, MD (*Abstract Co-Author*) Nothing to Disclose
Yasunobu Takaki (*Abstract Co-Author*) Nothing to Disclose
Koichiro Mori (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Familiarize yourself with the new category, "undifferentiated small round cell sarcoma of bone and soft tissue," introduced in the WHO Classification of Tumors 5th edition (2020). • Recognize that these tumors primarily affect young individuals, exhibit high malignancy, and have a poor prognosis, emphasizing the importance of early and accurate diagnosis. • Understand the role of molecular genetic analysis in the accurate differential diagnosis of these tumors, as they often present with overlapping clinical and imaging features. • Learn to identify the characteristic imaging features of Ewing sarcoma and its related entities, which can help narrow down the differential diagnosi. • Keep in mind other small round cell tumors that should be considered in the differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Overview of the WHO Classification of Tumors 5th edition (2020) and the new category of "undifferentiated small round cell sarcoma of bone and soft tissue"
- Ewing sarcoma
- Clinical features, imaging findings, and pathological findings
- Treatment and imaging assessment after therapy
- New histological types such as Ewing like sarcoma
- Clinical features, imaging findings, and pathological findings
- Differentiation from Ewing sarcoma on imaging
- Differential diagnosis of small round cell tumors
- Malignant lymphoma, embryonal rhabdomyosarcoma, alveolar rhabdomyosarcoma, neuroblastoma, and desmoplastic small round cell tumor (DSRCT)
- Conclusion
- Significance of understanding the spectrum of undifferentiated small round cell sarcomas in the era of the WHO Classification 5th edition (2020)

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# Abstract Archives of the RSNA, 2024

MKEE-135

## UNLOCKING THE MYSTERIES OF PELVIC FLOOR DISORDERS: A UNIQUE PERSPECTIVE THROUGH MUSCULOSKELETAL ULTRASOUND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pritika Panchal (*Abstract Co-Author*) Nothing to Disclose
Santosh Patil (*Abstract Co-Author*) Nothing to Disclose
S. Sindhura, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shah S Sameerkumar (*Abstract Co-Author*) Nothing to Disclose
Vijay Halagappanavar Vamadevappa (*Abstract Co-Author*) Nothing to Disclose
Y C. Manjunatha, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are:- Highlight the role of musculoskeletal ultrasound, provide comprehensive overview of pelvic floor anatomy, common disorders, and the utility of musculoskeletal ultrasound in their evaluation. Demonstrate imaging techniques, discuss clinical applications and illustrate ultrasound findings in diagnosing and managing pelvic floor disorders. Highlight the advantages of musculoskeletal ultrasound over traditional imaging modalities. Emphasis on elastography and USG guided interventions.

### TABLE OF CONTENTS/OUTLINE

Exhibit will be organized under the following headings: Introduction.
- Anatomy of pelvic floor.
- Indications of pelvic floor ultrasound.
- Equipment and technique.
- Common pelvic floor disorders
- Anterior compartment
- Stress urinary incompetence.
- Post sling surgery.
- Fowler syndrome- external urethral sphincter thickening.
- Pelvic organ prolapse.
- Cystocele.
- Central compartment
- Tricompartmental disease.
- Pneumovagina.
- Varicose veins.
- Angioneurotic edema.
- Barthrolin cyst.
- Sebaceous cyst
- Epidermoid.
- Posterior compartment
- Rectocele.
- Enterocele.
- Rectal intussusception.
- Rectoanal intussusception.
- Rectoenterocele.
- Anorectal dyssynergia.
- Fecal incontinence.
- Obstetric anal sphincter injury.
- Vulvar cellulitis.
- Male Pelvic Floor disorders
- Urinary incontinence.
- Peyronie’s disease.
- Painful pelvic floor disorders.
- Myofascial pain syndrome.
- Pudendal canal syndrome.
- Pyriformis syndrome.
- Rectus adductor symphysis syndrome.
- Athletic pubalgia.
- Lipedema.
- Ultrasound guided procedures.
- Elastography in pelvic floor disorders.
- Conclusion.

# Abstract Archives of the RSNA, 2024

MKEE-136

## IMAGING OF THE PEDIATRIC ELBOW: AN OVERVIEW AND UPDATE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor T. Paula, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Radiographic Evaluation of the Pediatric ElbowThe pediatric elbow presents unique challenges in radiographic assessment due to the ongoing development of ossification centers and growth plates. Key considerations include:Assessment of Growth Plates;Alignment and Joint Spaces;Ossification Centers (CRITOE);2. Trauma and Sports Related PainRecognize the main types of fractures that occur in the pediatric elbow, their most prevalent mechanism of injury, classification (when necessary), pitfalls in interpretation in different imaging methods, and the main complications.3. Non-Traumatic ConditionsAcquire understanding regarding the variances between the musculoskeletal systems of pediatric and adult patients. Explore the clinical and radiological manifestations of musculoskeletal disorders in children. To discuss the optimal imaging strategies for specific disease entities.

### TABLE OF CONTENTS/OUTLINE

1) RADIOGRAPHIC EVALUATION OF THE PEDIATRIC ELBOW2) TRAUMA AND SPORTS RELATED PAINACUTE TRAUMA:Fracture of the distal humeral epiphysis; Radial head dislocation; Supracondylar fracture; Lateral condyle fracture; Monteggia fracture-dislocation;Medial epicondyle fracture; Posterolateral elbow dislocation.OVERUSE INJURIESPanner's disease / Osteochondrosis of the capitellum; Osteochondral lesion (osteochondritis dissecans) in the capitellum; Osteochondral lesion (osteochondritis dissecans) in the trochlea; Traction apophysitis (medial epicondyle; olecranon)3) NON-TRAUMATIC CONDITIONS: Infection; Inflammatory (JIA); Tumors; Hemophilia

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# Abstract Archives of the RSNA, 2024

MKEE-137

## FIRE IN THE HOLE: REVIEW OF BLAST-RELATED HAND INJURIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Kasha Chen (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Abstract Co-Author*) Nothing to Disclose
Cassidy Tung (*Abstract Co-Author*) Nothing to Disclose
Kenneth N. Huynh, DO (*Abstract Co-Author*) Nothing to Disclose
Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Erwin Ho (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the epidemiology of varying hand-blast injuries. 2. To discuss typical injury patterns of firework-related hand-blast injuries and highlight the key imaging findings with consideration of the hand anatomy and mechanism of injury. 3. To discuss corresponding injury complications and treatment options.

### TABLE OF CONTENTS/OUTLINE

Each year, roughly 3,000 hand-blast injuries occur in the United States and the incidence continues to rise. Such a trend is concerning because those affected are often young, with blast injuries causing soft tissue, neurovascular, bone, and joint damage that result in significant hand impairment and amputation. Only a few studies have specifically investigated firework-related injuries and have proposed injury mechanisms and severity classifications. The extensive nature of blast injuries combined with the increasing incidence underscores the urgent need for a better understanding of the mechanism of injury, pertinent radiologic findings, and treatment options. This exhibit will aim to (1) describe the growing public health issue of hand blast injuries, (2) review relevant anatomy of the hand, (3) discuss firework-related injury patterns with respect to the injury mechanism and anatomic considerations, and (4) illustrate our institution’s cases of hand blast injuries along a spectrum of severity with annotated radiographic images. An understanding of the typical injury pattern can help radiologists discern the often-complex radiographic appearance of blast injuries.

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# Abstract Archives of the RSNA, 2024

MKEE-138

## THUMBS UP FOR ULTRASOUND OF THE RADIAL WRIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Andrew J. Grainger, MD (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Lisa Billone, BSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. High resolution ultrasound can be used as a first line imaging modality for patients presenting with radial wrist pain, whether traumatic or non-traumatic in nature.2. The sonoanatomy of the radial wrist, including joints, ligaments, tendons, and nerves will be illustrated and described allowing participants to evaluate these structures in a protocol driven manner.3. The dynamic capabilities, superior spatial resolution, and direct patient interaction of ultrasound which provide unique advantages over MRI will be highlighted.4. Real case examples of pathologies causing radial wrist symptoms will be considered, including:a. Bone and joint disorders, such as synovitis, osteoarthritis, ligament injury, scaphoid fracturesb. Tendon pathologies, such as DeQuervain’s disease, intersection syndromes, tenosynovitis, partial and complete tears, post-operative complicationsc. Nerve disorders, such as Wartenberg's syndrome, impingement, venipuncture injury, transectiond. Miscellaneous disorders, such as ganglion cysts, pseudoaneurysms, cystic adventitial disease

### TABLE OF CONTENTS/OUTLINE

A. IntroductionB. Anatomy, ultrasound technique, pathology with case examples for thea. Bone and Joint i. Radiocarpal and midcarpal jointsii. Scapho-trapezium-trapezoid and 1st carpometacarpal jointsiii. Scapholunate ligamentiv. Scaphoid boneb. Tendon i. Abductor pollicis longus and extensor pollicis brevisii. Extensor carpi radialis longus and extensor carpi radialis brevisiii. Extensor pollicis longusiv. Flexor carpi radialisv. Flexor pollicis longusc. Nerve i. Superficial radial nerved. Miscellaneous i. Ganglion cystsii. Radial artery disordersiii. Accessory musclesC. Take home points

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# Abstract Archives of the RSNA, 2024

MKEE-139

## LUMBAR SPINE PARASPINAL MUSCLES ON MRI: ANATOMY, DERANGEMENTS, CONSENSUS RECOMMENDATIONS AND NEW HORIZONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Robert D. Boutin, MD (*Abstract Co-Author*) Nothing to Disclose
Eddy Zandee van Rilland, MD (*Abstract Co-Author*) Nothing to Disclose
John Kleimeyer (*Abstract Co-Author*) Nothing to Disclose
Akshay Chaudhari, PhD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research Consultant, Subtle Medical, Inc
Jennifer A. Padwal, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Imaging evaluation of paraspinal muscles, particularly the multifidus which has been most thoroughly studied, requires an understanding of muscle anatomy and innervation that can help inform patterns of pathologic muscle changes. 2) Paraspinal muscle derangements have important implications for muscle function and low back pain in nonoperative, preoperative, and postoperative settings. 3) Current grading systems/methodologies for lumbar spine muscle measurements of cross-sectional area (CSA) and fatty infiltration (FI) are variable and generally qualitative. Automated AI techniques can be used for accurate, quantitative measurements of CSA and FI, facilitating longitudinal evaluation over time.

### TABLE OF CONTENTS/OUTLINE

I. Paraspinal muscle anatomy: muscle composition, innervation, vascularity, attachments, and function. II. Review MRI findings of paraspinal muscle derangements based on physiological mechanism, including single or multilevel involvement, distribution, and time course. Discussion of the contribution of paraspinal muscle derangements to low back pain and decreased function. III. Current MRI methodologies of evaluating paraspinal muscle, including MRI-derived measurements of CSA and FI using chemical-shift MRI. Challenges of translating research into clinical practice and future directions, including potential added value of AI tools in the clinical setting and opportunistic implementation of International Society for the Study of the Lumbar Spine (ISSLS) consensus recommendations.

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# Abstract Archives of the RSNA, 2024

MKEE-14

## MUSCLING IN ON THE ACTION - ACCESSORY MUSCLES OF THE UPPER EXTREMITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Kathryn J. Stevens, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jennifer A. Padwal, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Multiple accessory muscles exist within the upper extremity, and have a widely varying prevalence 2) Accessory muscles are often overlooked but can have a significant clinical impact and present intraoperative challenges if not identified on preoperative imaging 3) Accessory muscles are best identified on MRI, particularly on T1 or PD-weighted images without fat suppression, where they can be confidently separated from the adjacent fat 4) Detailed knowledge of upper extremity muscle anatomy and awareness of these normal variants will help the practicing radiologist correctly identify these accessory muscles and become familiar with their contribution to upper extremity pathology

### TABLE OF CONTENTS/OUTLINE

I) Accessory muscles of the shoulder/upper arm: case-based anatomic review and clinical impact II) Accessory muscles of the elbow/forearm: case-based anatomic review and clinical impact III) Accessory muscles of the wrist/hand: case-based anatomic review and clinical impact

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# Abstract Archives of the RSNA, 2024

MKEE-140

## TRAUMATIC AND SPORTS MUSCULAR INJURIES, WHAT TO LOOK FOR

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Artur Da Rocha Correa Fernandes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marco Bianchi (*Abstract Co-Author*) Nothing to Disclose
Mauricio Ricardo Moreira da Silva Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Freitas (*Abstract Co-Author*) Nothing to Disclose
Jose Claudio N. Junqueira, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael B. Paschoalini, MSc (*Abstract Co-Author*) Nothing to Disclose
Pedro Henrique R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Henrique Pierro Carvalhinho (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Anatomy and BiomechanicsInjury mechanisms and patternsSpecific ConditionsInjury Grading

### TABLE OF CONTENTS/OUTLINE

Muscles can be classified based on fiber orientation. In parallel muscles, fibers run parallel to the tendons, allowing larger ranges of excursion. Injuries typically affect the tendons and cause retraction. Pennate muscles, where fibers are oriented at an angle, generate greater force and are more susceptible to strains.Acute muscle injuries result from strain, contusion, laceration or compartment syndrome. The lower extremities are more frequently affected, especially the hamstring muscles, rectus femoris, and calf muscles. In the upper extremities, the most commonly injured are the rotator cuff and biceps brachii. Typically, the myotendinous junction is the most vulnerable. In older patients, the tendinous regions become the primary weak points. In skeletally immature patients, the apophysis is often affected, leading to apophysitis and avulsive fractures.DOMS is delayed muscular response to unaccustomed exertion, characterized, in MRI, by reversible enlargement and increased signal intensity in one or more muscles. Myositis ossificans is an abdormal response to trauma, resulting in nodular swelling, edema and peripheric calcifications.Various grading systems for muscle injury exist, primarily based on the type and size of lesion, the percentage of the cross-sectional area affected, and the presence of an intramuscular hematoma.

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# Abstract Archives of the RSNA, 2024

MKEE-141

## RISK VERSUS BENEFIT OF PERCUTANEOUS IMAGE-GUIDED BIOPSY FOR PERIPHERAL NERVE SHEATH TUMORS: UPDATED RECOMMENDATIONS FOR WHO, WHAT, WHEN AND HOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marco G. Aru, MD (*Abstract Co-Author*) Nothing to Disclose
Barry G. Hansford, MD (*Abstract Co-Author*) Nothing to Disclose
Kolade D. Odetoyinbo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After viewing this exhibit the learner will be able to:- Understand general imaging characteristics of benign versus malignant nerve sheath tumors (PNSTs), as well as the limitations of imaging- Identify appropriate indications and pre-procedural work up for PNST biopsy based on lesion characteristics: benign, indeterminate, and malignant- Recognize “do not touch” PNSTs to avoid potentially deleterious consequences of biopsy-Describe techniques to optimize biopsy yield while maintaining patient comfort-List the frequency and types of postprocedural complications for image-guided biopsy of PNSTs-Be familiar with the diagnostic yield for different types of PNSTs-Triage non-diagnostic biopsies and repeat biopsy when warranted

### TABLE OF CONTENTS/OUTLINE

-Introduction/Background-Brief case-based review of benign and malignant nerve sheath tumors including:--Clinical vignette--Multimodality key imaging features--Relevant histopathology- Clinical indications and preprocedural workup of PNSTs based on suspected type (benign, indeterminate, malignant)-Discussion of “do not touch” PNSTs-Techniques for PNST biopsy to maximize diagnostic yield and patient comfort-Post-procedural complications for PNST biopsies: benign, indeterminate, malignant-Literature review of expected diagnostic yield for PNST biopsies-Management of non-diagnostic biopsies-Summary

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# Abstract Archives of the RSNA, 2024

MKEE-142

## IF THE SHOE FITS, CALL IT: A LUMPY BUMPY CASE REVIEW OF BENIGN FOOT AND ANKLE SOFT TISSUE TUMORS AND MIMICS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Cornelia B. Wenokor, MD (*Abstract Co-Author*) Nothing to Disclose
Garrett Yoon, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Christopher Azzam, MD (*Abstract Co-Author*) Nothing to Disclose
Justin Newman, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Soft tissue tumors of the foot and ankle are rare, making diagnosis often difficult and delayed. Adding to this challenge is the multitude of tumor mimics, placing us in a diagnostic dilemma. Fortunately, the vast majority of these pathologies are benign. However, our ability to distinguish between them and generate a differential diagnosis is imperative for optimal management, directing treatment, and avoiding unnecessary interventions. We present common, as well as rare and interesting cases of benign foot and ankle soft tissue tumors and tumor mimics on imaging, including radiographs, CT, and MRI. We highlight demographics, etiology, salient characteristics, and important differential considerations. The selected cases encompass a wide range of tissue types, including fibrous, pericytic, vascular, adipocytic, fibrohistiocytic, and neural. This exhibit aims to facilitate accurate diagnosis of foot and ankle soft tissue tumors and tumor mimics, as well as raise awareness of several rare lumps and bumps.

### TABLE OF CONTENTS/OUTLINE

IntroductionDesmoplastic fibroblastomaPlantar fibromatosis/Ledderhose diseaseGlomangiomatosisHemangiomaAngiofibrolipomaFibrolipomatous hamartomaTenosynovial giant cell tumorSchwannomaNeurofibromaTumor Mimics (calcific myonecrosis, tumoral calcinosis, posterior tibial neuritis, Morton’s neuroma, Haglund’s syndrome, saphenous vein thrombophlebitis, foreign body and pyogenic granuloma, ganglion cyst, heterotopic bone, keloid, Dupuytren’s)Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-143

## POST-TRAUMATIC ENTITIES MIMICKING SOFT TISSUE AND BONE NEOPLASMS: WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Barry G. Hansford, MD (*Abstract Co-Author*) Nothing to Disclose
Keshawn Pope, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After viewing this exhibit, the learner will be able to: 1. List bone and soft tissue post-traumatic entities mimicking neoplastic disease 2. Identify entity specific multimodality key imaging features 3. Describe entity specific histories and clinical findings 4. Appreciate basic histopathology for select entities 5. Recognize post-traumatic “do not touch” lesions 6. Discuss entity specific treatment options/outcomes 7. Triage indeterminate entities necessitating image-guided biopsy

### TABLE OF CONTENTS/OUTLINE

Introduction/background:• Pearls and pitfalls to distinguish between pathologic and bland fracturesCase-based review of post-traumatic entities mimicking neoplasm based on anatomic structures and type of trauma:• Osseous-Single traumatic episode: Healing fracture, apophyseal avulsion, subperiosteal hematoma, traumatic Schmorl’s node, BPOP spectrum of lesions, etc.-Repetitive microtrauma: Stress fracture, enthesopathy, transient osteoporosis, subpubic cartilaginous cyst, hemophilia pseudotumor, intraosseous ganglion, osteochondrosis, etc. o Clinical vignette o Key imaging findings o Treatment options/outcomes• Soft tissues (muscle, fat, and fascial based): Morell Lavallee, myositis ossificans, chronic expanding hematoma, muscle herniation, adventitial bursa, torn tendon, nodular cystic fat necrosis, ganglion/cysts, etc. o Clinical vignette o Key imaging findings o Treatment options/outcomes• Neurovascular: Pseudoaneurysm, neuroma, and microgeodic disease o Clinical vignette o Key imaging findings o Treatment options/outcomes• Review of “do not touch” post-traumatic entities• Utilization of image-guided biopsy for indeterminate lesions Summary

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# Abstract Archives of the RSNA, 2024

MKEE-144

## STREAMLINING DUAL ENERGY CT MUSCULOSKELETAL PROTOCOLS IN A LARGE ACADEMIC CENTER: TIPS FROM THE GROUND UP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Peter H. Pham, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Anavim, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Anderanik Tomasian, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Golshan Momeni, MD (*Abstract Co-Author*) Nothing to Disclose
Jasmine Zhao, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Utilizing data from two energy spectra, dual energy CT (DECT) enables the detection and quantification of materials, which helps identify crystal arthropathy, bone marrow edema, tendon/ligament injuries, while also reducing metal artifacts in musculoskeletal imaging. 2. DECT findings often lead to significant changes in management, bolster diagnostic confidence, enhance incidental lesion characterization, and minimize the need for invasive interventions. 3. Despite its advantages, DECT adoption faces hurdles such as cost implications, data overload, and the need for additional education among clinicians and radiologists. 4. Stepwise implementation methods and education initiatives to increase familiarity with DECT are necessary to streamline its integration into routine practice.

### TABLE OF CONTENTS/OUTLINE

1. Learning Objectives 2. Basic overview of DECT: Acquisition, Post-processing, and Interpretation 3. Applications of DECT in Musculoskeletal Imaging 4. Clinical Benefits of DECT Utilization 5. Impact of DECT on Clinical Management: Illustrated Though Emergency Department Cases 6. Barriers to DECT: Cost and Data Overload 7. Solutions and Steps to DECT implementation (3 Prong Approach) 8. Summary and Key Takeaways

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# Abstract Archives of the RSNA, 2024

MKEE-145

## CASE-BASED REVIEW OF ATYPICAL GOUT MIMICKERS USING DUAL-ENERGY CT IN THE EMERGENCY SETTING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Anderanik Tomasian, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Golshan Momeni, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Anavim, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Peter H. Pham, MD (*Abstract Co-Author*) Nothing to Disclose
Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Jasmine Zhao, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Despite its prevalence, diagnosing gout can be challenging due to its resemblance to other acute medical conditions. 2. Dual energy CT (DECT) utilizes attenuation data at two energy spectra to detect monosodium urate crystals, facilitating accurate gout diagnosis. 3. DECT offers practicality for emergency room settings, boasts high sensitivity and specificity, and expedites diagnosis, particularly in atypical cases or when traditional methods are inconclusive. 4. False positives, attributed to beam hardening and motion artifacts, are potential drawbacks. Additionally, false negatives may occur in the early stages of gout (<6 weeks). 5. DECT should be integrated into routine emergency imaging protocols to aid in diagnosing acute and challenging gout presentations, thereby guiding appropriate management.

### TABLE OF CONTENTS/OUTLINE

1. Learning Objectives 2. Background: Clinical Presentation of Acute Gout 3. DECT Applications in Musculoskeletal Imaging 4. Utility of DECT for Gout in the Emergency Department: Advantages and Pitfalls 5. Ten Case-Based Examples of Atypical Gout Presentations 6. Summary and Key Takeaways

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# Abstract Archives of the RSNA, 2024

MKEE-146

## EXPLORATION OF BONE EDEMA: SPECTRAL ANALYSIS VIA DUAL-ENERGY COMPUTED TOMOGRAPHY FOR URGENT EVALUATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yeni Fernandez de Lara Barrera, MD (*Abstract Co-Author*) Nothing to Disclose
Estefania Murrieta Peralta, MD (*Abstract Co-Author*) Nothing to Disclose
Maria M. Salazar Osorio, MD (*Abstract Co-Author*) Nothing to Disclose
Karina I. Holguin Andrade, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Enhanced Characterization: Explore how the use of a bone edema map with dual-energy computed tomography (DECT) can improve fracture characterization, providing a more detailed and accurate assessment. 2. Identification of Hidden Fractures: 3. Reduced Diagnostic Time: Explain how DECT's ability to characterize fractures can decrease the time needed for diagnosing injuries, especially in emergency situations. 4. Differentiation between Acute and Chronic Fractures. 5. Utility of Bone Edema in DECT: Showcase the advantages of using bone edema as an indicator in DECT, such as its ability to detect fractures in early stages, precision in fracture localization, and its usefulness in treatment monitoring and surgical planning.

### TABLE OF CONTENTS/OUTLINE

Background: Dual-energy computed tomography (DECT) is a sophisticated imaging technique that utilizes two distinct kilovoltages to assess X-ray absorption in tissues.Bone Marrow Edema: Bone marrow edema is a common feature in traumatic injuries and pathological conditions.Main Applications: Identification and diagnosis of fractures in the carpal and wrist bones.Compression vertebral fractures, distinguishing between acute and chronic fractures. Oncological evaluation.Hidden hip fractures and identification of periprosthetic fractures.Limitations and Pitfalls: Metallic Artifacts and Soft Tissue Limitations.Conclusion: Dual-energy computed tomography represents a significant advancement in the evaluation of bone marrow edema.

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# Abstract Archives of the RSNA, 2024

MKEE-147

## UPPER EXTREMITY NERVES AND THEIR BRANCHES - A MAGNETIC RESONANCE IMAGING AND SONOGRAPHIC ATLAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gregory S. Stacy, MD (*Abstract Co-Author*) Nothing to Disclose
Katie L. Nguyen, MD,BS (*Abstract Co-Author*) Nothing to Disclose
Braden Anderson, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

We have received growing numbers of requests to evaluate nerves of the upper extremity (e.g., in the setting of penetrating trauma) in order to assess the degree of nerve damage and potential for repair. These requests have included the major nerves as well as various cutaneous branches, which might not be as familiar to the radiologist. Dedicated ultrasound imaging has been particularly useful in the setting of ballistic fragments and orthopedic hardware. The purpose of this exhibit is to provide an atlas of upper extremity nerves using magnetic resonance images alongside corresponding sonographic images. Supplementary sonographic videos will be provided to aid in anatomic localization. We will review the origin of the major nerves (median, radial, ulnar, and musculocutaneous) at the distal brachial plexus, discuss their separate paths in the arm, and highlight several key and lesser-known branches along their respective courses. Discussion will feature key osseous, muscular, and vascular landmarks.

### TABLE OF CONTENTS/OUTLINE

Introduction Ultrasound Technique Proximal Anatomy: Brachial Plexus Cords Median Nerve: Arm, Elbow, Forearm, and Wrist Anterior Interosseous Nerve Palmar Cutaneous Branch Ulnar Nerve: Arm, Elbow, Forearm, and Wrist Dorsal Cutaneous Branch Radial Nerve: Arm, Elbow, and Forearm Posterior Antebrachial Cutaneous Nerve Superficial Branch Deep Branch/Posterior Interosseous Nerve Musculocutaneous Nerve Lateral Antebrachial Cutaneous Nerve Medial Cutaneous Nerves Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-148

## MULTIMODALITY IMAGING EVALUATION OF MUSCULOSKELETAL MANIFESTATIONS IN RHEUMATOID ARTHRITIS: ADDRESSING RHEUMATOLOGISTS' NEEDS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Veronica Espinosa Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Axel A. Torres Monarrez, MD (*Abstract Co-Author*) Nothing to Disclose
Bethsabel Rodriguez Encinas, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Eugenio Cosme, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Chapa-Ibarguengoitia, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Hernandez-Diaz (*Abstract Co-Author*) Nothing to Disclose
Lourdes M. Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Ana V. Meza Sanchez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To understand the pathophysiology of bone formation and resorption and its role in the pathophysiology of rheumatoid arthritis. To recognize the pathophysiology behind the imaging features in rheumatoid arthritis. To distinguish the primarily affected joints in rheumatoid arthritis and their main imaging features. To comprehend the indications and best acquisition protocols for rheumatoid arthritis in different imaging modalities. To understand the different scoring systems used to grade the disease.

### TABLE OF CONTENTS/OUTLINE

Overview Definition and criteria according to ACR/EULAR 2010 Epidemiology Pathophysiology Bone cells. Bone formation and bone resorption processes. Rheumatoid arthritis pathophysiology Primarily affected joints. Imaging features Pathophysiology of imaging findings Plain radiograph Radiographic projections (Hand, foot, knee, ankle, spine) Findings Scoring systems CT Acquisition protocol Indications Findings Ultrasound Protocols Indications Findings Scoring systems MRI Acquisition protocol Indications Findings Scoring systems Test yourself! Summary (Take-home points).

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# Abstract Archives of the RSNA, 2024

MKEE-149

## REVOLUTIONIZING PREOPERATIVE PLANNING FOR MSK BONE TUMORS: INTEGRATING RADIOMICS AND 3D PRINTING FOR ENHANCED SURGICAL PRECISION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Matthias F. Froelich, MD (*Abstract Co-Author*) Consultant, Smart Reporting GmbH;Consultant, Guerbet SA
Lorenzo Muntaner, MD (*Abstract Co-Author*) Nothing to Disclose
Mara Villargordo Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Reda Britel, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Advancements in musculoskeletal oncology, incorporating 3D segmentation, radiomics, and printing, notably enhance surgical planning. 1-Segmentation in 3D involves the division of medical images into regions of interest, enabling precise manipulation and visualization of anatomical structures. 2-Radiomics, a rapidly evolving field, involves the extraction and analysis of quantitative features from medical images, offering valuable insights into tumor characteristics and behavior. 3-Additionally, 3D printing allows for the creation of physical models from medical imaging data, facilitating preoperative visualization and planning. Integration of these technologies improves surgical precision, reduces operative times, and enhances postoperative outcomes.However, challenges like specialized training persist. Future advancements promise further enhancements in musculoskeletal oncology surgical planning.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

MKEE-15

## UNUSUAL AND CHALLENGING CT-GUIDED BONE BIOPSIES: NAVIGATING COMPLEX CASES WITH PRECISION AND INSIGHT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mateus A. Hernandes, MD (*Abstract Co-Author*) Nothing to Disclose
Edgard E. Engel, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Papalexis (*Abstract Co-Author*) Nothing to Disclose
Giancarlo Facchini (*Abstract Co-Author*) Nothing to Disclose
Nelson F. Gava, MD (*Abstract Co-Author*) Nothing to Disclose
Marcello H. Nogueira-Barbosa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonor Savarese, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Bone biopsies are a critical element in the diagnostic pathway for various bone diseases, including primary bone tumors, metastatic conditions, infections, and other non-neoplastic disorders. In numerous instances, image-guided percutaneous biopsy is the preferred procedure due to its minimally invasive nature, high diagnostic yield, cost-effectiveness, and lower morbidity compared to surgical biopsy. Among image-guided techniques, computed tomography (CT) provides the benefit of superior spatial resolution and precise needle placement, thereby enhancing the success rate of the biopsy. Nevertheless, some skeletal sites can pose particular challenges, even with CT guidance, owing to anatomically intricate lesions, closeness to vital structures, lesions that are not visible on CT, or sclerotic lesions. Understanding the complexity of bone biopsies can represent an important resource for managing such cases effectively and safely.

### TABLE OF CONTENTS/OUTLINE

Case-based review of various unusual and challenging cases of CT-guided bone biopsies, illustrating technical challenges, potential complications and practical strategies to increase the safety and diagnostic yield of the procedure.

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# Abstract Archives of the RSNA, 2024

MKEE-150

## POST HIP ARTHROSCOPY FINDINGS; WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Peter J. Haar, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
William Whiteside, BS (*Abstract Co-Author*) Nothing to Disclose
Deividas Gustainis, MD (*Abstract Co-Author*) Nothing to Disclose
Brandon Tran (*Abstract Co-Author*) Nothing to Disclose
Rafael M. Jimenez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review normal and abnormal findings of MRIs status post hip arthroscopy.2. To review complications of the labrum after first hip arthroscopy. 3. To review complications and dehiscence of the capsule after arthroscopy. 4. To review techniques of capsulotomy and capsulorraphy and their MRI appearance. 5. To review techniques of labral reconstruction vs labral repair and their MRI appearance. 6. To review additional extra-articular MRI findings that account for failed arthroplasty. 7. To review findings of the cartilage after hip arthroscopy.

### TABLE OF CONTENTS/OUTLINE

1. Normal hip anatomy on CR and MRI2. Hip labral tears and their classification.3. Hip labral tears and their MRI appearance using the MAHORN classification. 4. Labral re tear status post labral repair. 5. Labral reconstruction and the concept of the "spacer" adjacent to the capsule. 6. Imaging after failed labral repair and reconstruction. 7. Cartilage imaging and MRI classification of cartilage injuries. 8. Cartilage injuries after arthroscopy including "carpet" lesion. 9. Capsular imaging. 10. Capsular dehiscence after arthroscopy.11. Types of capsulotomy and capsular repairs. 12 Other MRI findings for persistent pain after arthroscopy including medial stress fracture of the calcar.

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# Abstract Archives of the RSNA, 2024

MKEE-151

## GLENOHUMERAL ARTHROSIS: DOES YOUR REPORT TRULY ADDRESS THE SURGEON'S QUERIES?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda Yukari H. Takahashi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Shoulder osteoarthritis is an extremely important condition, especially in aging adults, which justifies its high and increasing prevalence. Furthermore, it has a strong correlation with chondral injuries, and it is the most frequent cause of disability in the USA as a consequence of decreased motion and pain. Secondary causes are more common, such as trauma or repeated microtrauma in throwing athletes, chondrolysis, avascular necrosis, inflammatory arthropathy, and joint instability. Management depends on various aspects, including symptoms, radiological findings, and staging. This study’s goal is to review the key points that the radiological report must address for surgical planning using examples from our service.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

MKEE-152

## BROKEN BONES IN LITTLE ONES: THE PLAYFUL PATH TO EVALUATING CHILDREN'S FRACTURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Erica D. Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe C. Ferreira Dionisio, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda Yukari H. Takahashi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Fractures in children constitute a common entity in medical practice, especially for radiologists. However, this age group presents particularities compared to the adult population, such as in epidemiology, presentation, and classification. Therefore, understanding the development and maturation of the skeleton is necessary to comprehend the different types of pediatric fractures. Although the prognosis for most fractures is excellent, knowledge about children’s fractures and their accurate description is of utmost importance for therapeutic success. This study aims to provide a didactic review of the most prevalent pediatric fractures, correlate them with different imaging methods, and describe their main radiological findings and classifications.

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Objective
- Review of normal pediatric skeleton development
- Cases of pediatric fractures in different joints and different imaging methods, detailing common radiological findings and classifications
- Conclusion
- References

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# Abstract Archives of the RSNA, 2024

MKEE-153

## STRUCTURED REPORTING FOR GLENOID-TRACK: ASSESSING SHOULDER STABILITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Bianca Bianco, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Yuree M. Herenio SR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The shoulder is the most frequently dislocated joint in the body, largely due to its extensive range of motion, which is unmatched in humans. Between 1% and 2% of people will endure a glenohumeral dislocation in their lifetime, with anterior dislocations comprising over 95% of these cases. Such dislocations often result from falls onto an extended arm or shoulder. A significant portion of those who suffer an initial anterior shoulder dislocation, specifically 20% to 48%, will face recurrences. This risk is especially high among younger individuals, where recurrence rates soar to 66% to 94% in those under 20 years old.

### TABLE OF CONTENTS/OUTLINE

Introduction; Objective; Glenoid-Track: Assessing Shoulder Stability; Measurement Parameters; Discussion; Radiological Cases; Conclusion; References.

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# Abstract Archives of the RSNA, 2024

MKEE-154

## DECODING PATELLOFEMORAL INSTABILITY: A STRUCTURED REPORT APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto Froeder Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Bianca Bianco, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Patellofemoral instability represents a significant clinical challenge, directly influencing knee functionality and patient well-being. This study addresses the four main etiological determinants of patellofemoral instability: the Caton-Deschamps index for the quantification of high patella, Dejour's classification of trochlear dysplasia, the measurement of the tibial tubercle-trochlear groove (TT-TG) length, and the analysis of patellar tilt. We employed advanced imaging methods to draw direct correlations between these anatomical variables and episodes of patellar instability, demonstrating the interrelationship of these factors in the pathogenesis of femoropatellar instability, as well as providing insights for the development of more effective interventions. This study highlights the importance of an in-depth assessment of anatomical factors in the clinical management of patellofemoral instability, proposing an integrative model for risk prediction and treatment personalization. The clinical relevance lies in improving therapeutic outcomes and reducing the recurrence of pathologies, reinforcing the need for precise and individualized surgical planning.

### TABLE OF CONTENTS/OUTLINE

Introduction; Objective; Determinants of patellofemoral instability: the Caton-Deschamps index, Dejour's classification, measurement of the tibial tubercle-trochlear groove length and patellar tilt; Discussion; Radiological Cases; Conclusion; References.

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# Abstract Archives of the RSNA, 2024

MKEE-155

## A RADIOLOGICAL WALK THROUGH RHEUMATOID ARTHRITIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carlos Suevos, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Acosta Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Acosta Batlle, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the pathophysiology of rheumatoid arthritis.Explain the different articular and extra-articular radiological manifestations using illustrative cases.Review the usefulness of the different imaging techniques in this pathology: plain radiography, ultrasound, CT and MRI.Differential diagnoses of peripheral arthropathies.

### TABLE OF CONTENTS/OUTLINE

Rheumatoid arthritis is a chronic autoimmune disease that mainly affects the musculoskeletal system and can become highly disabling during its evolution. Early diagnosis is essential to establish treatment in the initial stages of the disease, which can delay its progression and improve the life quality of these patients. For this, it is essential to know the articular and extra-articular radiological findings of this pathology and the utilities of the different imaging techniques for its diagnosis. In this exhibit we review the typical signs of rheumatoid arthritis with plain radiography, ultrasound, CT, and MRI and show the diagnostic imaging tips. Typically, this disease affects small joints with characteristic signs that allow to differentiate it from other peripheral arthropathies.

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# Abstract Archives of the RSNA, 2024

MKEE-156

## TUMOR TRAILS: NAVIGATING SOFT TISSUE LESIONS THROUGH STRUCTURED REPORTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Janaina Moreira (*Abstract Co-Author*) Nothing to Disclose
Diego A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Froeder Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Bianca Bianco, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A medical report on soft tissue tumors must be clear, detailed, and comprehensive, ensuring a deep understanding of the case and enabling the medical community to assess and compare different therapeutic approaches. It is crucial to provide precise information about location, size, involvement of critical structures, and the presence of necrosis, as these characteristics are essential for determining prognosis and guiding clinical decisions. A well-crafted report significantly contributes to the advancement of medicine and the improvement of patient outcomes.

### TABLE OF CONTENTS/OUTLINE

Introduction to Soft Tissue Tumor; Objectives; Location and Depth; Size of the Tumor; Involvement of Critical Structures; Presence of Necrosis; Diagnostic Methods; Radiological Cases; Conclusion; References.

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# Abstract Archives of the RSNA, 2024

MKEE-157

## BONE MARROW IMAGING: UNRAVELING VARIATIONS AND IDENTIFYING PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina D. Augusto, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Beatriz Benetti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this study is to improve understanding of the different normal patterns of bone marrow conversion and reconversion, as well as pathological changes, using systematic analysis of the T1 signal to guide differentiation between the pathologies. Additionally, advanced MR techniques, including chemical shift imaging, diffusion-weighted imaging, dynamic contrast-enhanced MRI, and whole-body MRI, may be utilized in cases warranting further investigation, and will also be explored.

### TABLE OF CONTENTS/OUTLINE

The most common MRI signal variations observed in adult patients' bone marrow encompass a spectrum ranging from normal variants to benign pathologies and malignancies. Understanding the normal appearance and the physiological (re)conversion pattern is crucial for identifying and categorizing these entities effectively. Typically, in benign variations, the signal intensity of the lumbar vertebral bodies on T1-weighted SE images should be higher than that of adjacent intervertebral discs. Similarly, the signal intensity of appendicular red marrow areas on T1-weighted SE images should be higher than that of adjacent muscles. A systematic approach to analyzing T1 signal intensity aids in classifying the most common alterations. However, attention should also be paid to additional signs, such as contralateral involvement, periosteal reaction, cortical extension, and post-contrast enhancement.

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# Abstract Archives of the RSNA, 2024

MKEE-16

## TIPS AND TRICKS TO IDENTIFY ENDOMETRIOSIS FOR MUSCULOSKELETAL RADIOLOGISTS: DIAGNOSTIC FEATURES AND RECOMMENDATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Michael D. Ringler, MD (*Abstract Co-Author*) Nothing to Disclose
Myra K. Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Liina Poder, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Brian T. Welch, MD (*Abstract Co-Author*) Nothing to Disclose
Christin A. Tiegs-Heiden, MD (*Abstract Co-Author*) Nothing to Disclose
Priyanka Jha, MBBS (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Ceylan Colak, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Endometriosis is a common condition, affecting one in 10 premenopausal women, impacting approximately 200 million women globally. 2. Early diagnosis remains a challenge. The most common clinical presentation is pelvic pain, but patients may be asymptomatic or present with infertility. The average delay in diagnosis ranges from 4 to 11 years, and 65% of patients are initially misdiagnosed. 3. Contributing to the delay in diagnosis, patients may undergo multiple studies related to the musculoskeletal (MSK) system including lumbar, sacroiliac, pelvic and hip MRI studies. While endometriosis may involve nerves and soft tissues, MSK MRI protocols are not typically optimized for adequate mapping of disease in the pelvis, which may involve the bowel, bladder, ureters, and the diagnosis itself may not be established without a dedicated protocol. 4. Imaging studies, especially MRI, have a critical role in the noninvasive diagnosis of endometriosis. Endometriosis specific MRI protocols are important for the identification of disease as recommended by evidence-based consensus guidelines by the European Society of Urogenital Radiology and the Society of Abdominal Radiology Endometriosis disease-focused panel. In daily practice, it is important to recognize common MRI findings of endometriosis on MSK studies and to identify when to recommend a dedicated endometriosis imaging and gynecological evaluation.

### TABLE OF CONTENTS/OUTLINE

1. Title 2. Disclosures 3. What is endometriosis? 4. Learning objectives 5. Common MR imaging findings of endometriosis 6. MRI protocol considerations 7. Treatment options 8. Case examples with imaging findings 9. Conclusion 10. References

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

MKEE-17

## KOOSH IT: USING GOLDEN-ANGLE RADIAL KOOSHBALL SAMPLING FOR 4D DYNAMIC MRI OF JOINTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joshua Auger (*Abstract Co-Author*) Nothing to Disclose
Sarah D. Bixby, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Simon K. Warfield, PhD (*Abstract Co-Author*) Nothing to Disclose
Jade Iwasaka-Neder, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Fatih Calakli (*Abstract Co-Author*) Nothing to Disclose
Musa Tunc Arslan (*Abstract Co-Author*) Nothing to Disclose
Giovani Schulte Farina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Joints are moving structures by nature and motion abnormalities should be evaluated by assessing the full anatomy dynamically. Biomechanical parameters from static or quasi-static MRI scans are different from moving motion. - Most of the dynamic imaging techniques are 2D over time. - There is still a need for improved dynamic imaging with 4D (3D+time), submillimeter isotropic (<1mm3), relatively artifact-free, and contrast changeable to the different MSK tissues of interest to better characterize motion joint motion abnormalities. - Golden-angle radial kooshball sampling in combination with sliding window reconstruction can provide dynamic and motion-robust images of the joints during real-time motion in 4D using high-field 3T scanners. - The 4D dynamic radial kooshball technique can be implemented for different joints, such as ankles and knees. - Full anatomy of the joints can be visualized dynamically in the 3 planes throughout the maximum range of motion.

### TABLE OF CONTENTS/OUTLINE

- Dynamic MRI Imaging in MSK: current techniques- K-space sampling - 3D golden-angle radial kooshball - Basis and concepts - Applications in dynamic imaging - Cartesian sampling- Reconstruction algorithms for dynamic imaging - Sliding window reconstruction- Patient preparation - Movement training and patient positioning- 4D dynamic imaging of joints - Knee - Ankle- Challenges and limitations - Potential clinical applications - Impingement phenomenon - Patellofemoral tracking - Hindfoot motion in tarsal coalition - Microinstability

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# Abstract Archives of the RSNA, 2024

MKEE-18

## BASIC AND ADVANCED WRIST MRI FOR EVALUATION OF TRIANGULAR FIBROCARTILAGE COMPLEX (TFCC) INJURY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Akimoto Nimura (*Abstract Co-Author*) Nothing to Disclose
Yoichi Yokoyama, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Masaki Matsusako, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Hashimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Yuko Tsujioka, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are 1) To demonstrate the new anatomical findings of radioulnar ligaments. 2) To know basic 2D and 3D MR imaging findings of TFCC injuries. 3) To introduce the latest MR techniques for evaluation of TFCC including high-resolution images using deep learning reconstruction and CT-like images for bony structure.

### TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Clinical aspects of TFCC injury 3) Latest anatomical knowledges of TFCC comparing with MRI 4) Pearls and pitfalls in wrist MR when evaluating TFCC injuries 5) Latest MR techniques for precise evaluation of TFCC i) High-resolution MRI with deep learning reconstruction ii) CT-like images

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# Abstract Archives of the RSNA, 2024

MKEE-2

## A RADIOLOGICAL GUIDE TO HAND INFLAMMATION: HANDY TIPS TO UNRAVEL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Firat Atak, MD (*Abstract Co-Author*) Nothing to Disclose
Ustun Aydingoz, MD (*Abstract Co-Author*) Nothing to Disclose
Sevtap Arslan (*Abstract Co-Author*) Nothing to Disclose
Adalet E. Yildiz, MD (*Abstract Co-Author*) Nothing to Disclose
Yasin Yarasir, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Inflammatory diseases of the hand are a diagnostic challenge both clinically and radiological. 2. Although many conditions do not have specific imaging findings, some clinical and radiological clues can help narrow down the differential considerations and reach the correct diagnosis. 3. Accurate diagnosis is critical to initiating appropriate treatment before inflammation causes long-term harm to the hand.

### TABLE OF CONTENTS/OUTLINE

A. An overview of inflammatory hand conditions. B. Imaging modalities and protocols. C. The spectrum of hand inflammation - a. Autoimmune (rheumatoid arthritis, seronegative spondyloarthritis, systemic lupus erythematosus, scleroderma, polyarteritis nodosa); b. Depositional (gout, CPPD, ochronosis); c. Infectious (Whipple disease, Mycobacterial, septic arthritis, osteomyelitis, necrotizing fasciitis, paronychia, cellulitis); d. Traumatic/degenerative (De Quervain tenosynovitis, post-traumatic inflammation, erosive osteoarthritis); e. Miscellaneous (sarcoidosis, foreign body-related inflammation, complex regional pain syndrome) D. Summary chart. E. Conclusion.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

MKEE-20

## SOFT TISSUE MASSES OF THE HAND AND FOOT: AN EDUCATIONAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Noelia Arevalo (*Abstract Co-Author*) Nothing to Disclose
Javier Blazquez Sanchez (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Acosta Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Santiago Resano Pardo SR (*Abstract Co-Author*) Nothing to Disclose
Maria D. Lopez Parra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In the evaluation of soft tissue lesions the goal of imaging ,is to confidently identify lesions that exhibit typical diagnostic imaging features and do not need further studies.When a solid soft tissue tumor is encountered and malignancy cannot be excluded, a histology study is mandatory.Although the imaging characteristics of several of the lesions discussed are non-specific,combining them with clinical features and lesion location allows the radiologist to suggest a specific type of tumor

### TABLE OF CONTENTS/OUTLINE

Soft tissue tumors are frequently encountered in clinical practice.They include benign and malignant neoplasms, as well as pseudotumoural lesions.The differential diagnosis of soft tissue lesions can be narrowed significantly with the aid of imaging .Radiographs are critical in determining the presence or absence of mineralization and setting whether soft tissue mineralization are chondral or ossific in nature and to evaluate cortical involvement versus isolated soft tissue lesion in order to narrow the differential diagnosis.The US seems well suited for screening soft tissue masses, allowing us to differentiate cystic from solid nature of soft-tissue lesions.The cystic nature can be confirmed with sonography or MR imaging avoiding further studies.In non cystic lesion, the location and signal characteristics can suggest the diagnosis of some specific pathologies.Equally, and based on the presence or absence of mineralization, lesion density/signal intensity,and enhancement pattern synovial based lesions can be suggested. Finally,knowledge of the incidence of specific neoplasms of the foot and hand based on patient age aids radiologists in providing a limited differential diagnosis.

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# Abstract Archives of the RSNA, 2024

MKEE-21

## POSTOPERATIVE IMAGING OF THE PERIPHERAL NERVES: SURGERY AND IMAGING CONCEPTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Eduarda C. Bernal, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Niels Vinicius Padua Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Kairos Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The aim of this exhibition is to: a) Review the main surgical procedures in peripheral nerves and postoperative imaging b) Highlight the most important topics for the surgeon c) Show illustrative and didactic cases from our service

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION a) Advances in peripheral nerve surgery b) Imaging modalities c) Surgical techniques and their indicationsIMAGING INTERPRETATION Main types of nerve injury and surgery, expected imaging findings and potential complications: 1) Neural compressive syndromes: 1a) Decompression: removal of factors leading to compression (e.g., carpal tunnel release surgery) 1b) Decompression with nerve transposition (e.g., ulnar nerve decompression) 1c) Neurectomy (nerve resection) (e.g., lateral femoral cutaneous nerve and interdigital nerve of the foot) 2) Neural tumors: tumors of neural sheath (schwannomas and neurofibromas). Procedures for each type of tumor vary, so it is important to distinguish when possible. Preoperative and postoperative imagins aspects 3) Traumatic nerve injury: 3a) Neurolysis: removal of adhesions surrounding the nerve 3b) Reconstruction of nerve continuity: excision of neuromas; neurorrhaphy or interposition of autologous nerve graft; other techniques including fibrin glue and nerve tubes 3c) Nerve transfer surgeryINTERACTIVE CASE-BASED DIDATICS a) Sample cases to illustrate and solidify the concepts, including pre and postoperative imaging b) Correlation with current literature dataCONCLUSION AND TAKE HOME MESSAGES Due to the advances in peripheral nerve surgery and increasing number of cases it has become essential for radiologists to be familiar with the main surgical techniques and postoperative imaging aspects

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# Abstract Archives of the RSNA, 2024

MKEE-22

## EXPLORING NON-TUMOROUS VASCULAR ABNORMALITIES IN MUSCULOSKELETAL IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Gabriela Bailao, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Batista Rosa Pinto, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo de Tarso K. Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Non-tumorous vascular abnormalities in musculoskeletal present a diagnostic challenge, understanding these etiologies is crucial for an accurate diagnosis, especially because vascular abnormalities are often not the primary diagnostic consideration for clinicians, highlighting the role of radiologists in the diagnoses.Vascular abnormalities manifest through various symptoms such as pain, nodules, abnormal skin color and not rarely as incidental imaging findings, reflecting a wide array of pathologies.Multiple imaging methods can be used to provide precise localization and characterization of vascular abnormalities. Ultrasound offers real-time visualization and Doppler US exams provide valuable information about vascular flow. CT and MRI provide detailed anatomical information and the use of intravenous contrast in these methods improves the evaluation of vascular structures and the dynamics of blood flow. Conventional or minimally invasive angiography offers unparalleled visualization of vascular architecture.This presentation underscores the importance of a multidisciplinary approach in which radiologists collaborate to understand the complexities of non-tumorous vascular abnormalities in musculoskeletal imaging. By integrating clinical history, imaging findings, and radiological interpretation, we can optimize patient treatment and improve outcomes.

### TABLE OF CONTENTS/OUTLINE

1. Overview epidemiology and clinical presentation2. The role of imaging2.1 Ultrasound2.2 MRI2.3 Angiography3. Non-tumor vascular pathologies:3.1 Traumatic and atraumatic thrombosis3.2 Ischemia3.3 Vasculitis3.4 Embolism3.5 Pseudoaneurysms3.6 Miscellaneous4. Flow chart

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# Abstract Archives of the RSNA, 2024

MKEE-23

## BEYOND THE MONITOR: EXPLORING 3D PRINTING IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David R. Nascene, MD (*Abstract Co-Author*) Nothing to Disclose
Yu-Hui Huang, MD,MS (*Abstract Co-Author*) Nothing to Disclose
Ibrahim Abdalla, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Introduce the application of 3D printing in both clinical practice and educational contexts, highlighting its significance in enhancing understanding and treatment planning - Discuss commonly used techniques to create 3D models as well as their real life applications - Review a case involving a patient with recurrent left chest wall sarcoma, illustrating how 3D printing can be utilized to aid in understanding and managing complex clinical pathologies

### TABLE OF CONTENTS/OUTLINE

- Introduction - 3D printing and use in clinical settings and education - Brief overview of relevant chest anatomy - Review the case of a patient with a recurrent left chest wall sarcoma- Methodology - Image selection and what to be mindful of - CT versus MRI, image thickness, and the use of contrast - Segmentation in Materialise Mimics and the best tools to get started - Region Grow, Split Mask, Multiple slice edit etc. - 3-Matic and the optimization of model characteristics - Sharing 3D Models using Sketchfab- Material Selection/Printing - Deciding between resin and filament prints - Overview of time and cost considerations- Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-24

## BONE LYMPHOMAS: A PICTORIAL ESSAY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Anderson Phelipe Dias Sabry Azar, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Morphological Variability: We explore diverse bone lymphoma manifestations via radiographic imaging, emphasizing lytic lesions, periosteal reactions, and soft tissue involvement to recognize these patterns for accurate diagnosis and management.Imaging Modalities: We discuss radiography, CT, MRI, PET and image-guided procedures for bone lymphoma assessment, providing an overview of their strengthsDifferential Diagnosis: There are diagnostic challenges due to overlapping features with other bone lesions. We review key differentiating factors aiding an accurate differentiation.

### TABLE OF CONTENTS/OUTLINE

Introduction: Bone lymphomas pose diagnostic challenges due to diverse radiographic presentations. This essay aims to elucidate their morphology, imaging modalities, diagnosis, and clinical implications.Methods: Review imaging studies depicting bone lymphomas, analyzing radiography, CT, MRI, PET and image-guided procedures for morphological features and differential diagnosis.Objectives: elucidate the radiographic manifestations of the disease and facilitate accurate diagnosis. This includes enhancing understanding of various imaging modalities and their roles in assessment.Discussion: Bone lymphomas exhibit varied radiographic patterns. CT offers detailed anatomy assessment, MRI enhances soft tissue delineation, and PET aids staging. Differential diagnosis involves careful consideration of imaging findings and clinical context.Conclusion: Accurate diagnosis of bone lymphomas requires recognizing diverse radiographic presentations and leveraging multiple imaging modalities. Awareness of imaging pitfalls is crucial for optimal management.

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# Abstract Archives of the RSNA, 2024

MKEE-25

## BRACHIAL (COM)PLEXUS: AN EASY-GOING REVIEW OF ANATOMY AND PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Aureliano T. Brandao SR, DC, PhD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Izabel d. Karam, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia C. Zuffo (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo Campos Silva, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A) Identifying and understanding critical anatomical landmarks within MRI scans, such as the interscalene triangle, subclavian artery, and nerve roots from C5 to T1.B) Emphasize the importance of recognizing the normal appearances and variations of nerve paths to enhance diagnostic accuracy.C) Highlight the advantages of using high-resolution 3D imaging, DTI, and nerve-specific MRI sequences. Explain how these advanced techniques can reveal detailed nerve fiber integrity, crucial for diagnosing subtle neuropathies and planning surgical interventions.D) Discuss the key imaging signs of traumatic plexopathy, such as nerve discontinuity, hematoma, and pseudomeningocele formation. Train on differentiating between pre- and post-ganglionic injuries based on these imaging findings, and how they guide the prognosis and treatment strategies.E) How to identify nerve sheath tumors and differentiate them from other masses using MRI. Cover the imaging characteristics of benign versus malignant nerve tumors, and discuss how the localization, size, and effect on surrounding tissues can impact treatment options.F) The Role of Ultrasound in Real-time Diagnosis and Management.

### TABLE OF CONTENTS/OUTLINE

A) Brachial plexus anatomy; B) MRI and ultrasound images; C) Pathologies; D) Future perspectives.

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# Abstract Archives of the RSNA, 2024

MKEE-26

## THE GREAT WALLS: ABDOMINAL, THORACIC, AND PARAVERTEBRAL - ANATOMY AND PATHOLOGICAL CONDITIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Niels Vinicius Padua Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Kairos Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Our educational exhibit aims to review the anatomy and pathological conditions of the abdominal wall, thoracic wall, and paravertebral region through the following points: Reviewing the normal anatomy and anatomical variants of these three regions; Discussing the differential diagnosis for lesions encountered at these sites; Proposing an algorithmic approach to identifying lesions and diffuse processes based on their imaging characteristics; Highlighting the role of imaging techniques in the diagnosis and management of lesions affecting the abdominal wall, chest wall, and paravertebral region.

### TABLE OF CONTENTS/OUTLINE

1) Anatomy of abdominal and thoracic walls. 2) Pathologies of abdominal and thoracic walls and proposed algorithmic approach based on imaging characteristics: Hernias (primary, incisional); Mechanical friction (elastofibroma dorsi, snapping scapula syndrome), Muscle injurie; Anatomical variants (Poland syndrome); Mass-like lesions - Fat containing (lipoma, liposarcoma, lipohypertrophy, arteriovascular malformations), Fluid (haematoma, Morel-Lavallee, abscess, seroma, lymphatic malformation), Solid / soft tissue (endometriosis, desmoid tumor, sarcoma, metastasis, fibromatosis, foreign body granuloma). 3) Illustrative cases with multimodality imaging. 4) Paravertebral anatomy. 5) Pathologies of paravertebral region and proposed algorithmic approach based on imaging characteristics and anatomical location (epaxial and hypaxial). 6) Illustrative cases with multimodality imaging.

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# Abstract Archives of the RSNA, 2024

MKEE-27

## LIFE AND DEATH IN MUSCULOSKELETAL RADIOLOGY: ATYPICAL FACETS OF BONE INFARCTION AND NECROSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Francisco Rocha (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas N. Silva, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Osteonecrosis refers to a broad concept of the consequences of blood supply impairment on bone tissues, widely debated and described through classic radiological features. However, the diagnosis challenge relays mainly on its atypical manifestations or associated complications, which include subtle initial imaging changes, unusual skeletal locations, paraneoplasic manifestations or post-procedure complications, such as radiotherapy, diathermy and bone marrow transplant. Additionally, overlapping imaging findings also pose further difficulties, such as osteomyelitis, bone tumors and metabolic bone disease. Traditional imaging protocols, as well as some emerging techniques, can provide detailed and qualitative information about the bone microstructure, perfusion and metabolic behavior. Those techniques include diffusion-weighted MR imaging (DWI) , dynamic contrast-enhanced MRI (DCE-MRI), Time-Resolved Imaging of Contrast Kinetics (TRICKS), dual-energy CT (DECT) and positron emission tomography (PET) imaging. Bone necrosis may present typical or atypical manifestations, due to its complex origins and multiple underlying mechanisms. Besides, other many other bone abnormalities might mimic atypical bone infarction conditions. Through the assistance of multimodality imaging protocols, the radiologist role relies on knowing when to suspect an atypical bone necrosis presentation, and which imaging technique should guide towards a correct diagnosis.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

MKEE-28

## HOW TO CLASSIFY MUSCLE INJURIES: COMPARISON BETWEEN CLASSIFICATIONS BASED ON CASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia C. Zuffo (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Camila De Paula Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo Campos Silva, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

A) Overview of Muscle Injury Classifications provide a comprehensive review of the various muscle injury classification systems discussed in the paper. Highlight the criteria used by each system to classify muscle injuries, including anatomical location, extent of tissue damage, and functional impairment.B) Comparing Classification Systems discuss the strengths and weaknesses of each classification system based on clinical cases. Analyze how each system performs in terms of diagnostic clarity, prognostic value, and treatment guidance. Encourage critical thinking about which system might be best suited for different types of injuries or clinical settings.C) Imaging Techniques for Muscle Injury Evaluation: detail the role of various imaging modalities like MRI, ultrasound, and CT in the assessment of muscle injuries. Explain how these techniques complement the classification systems by providing detailed visual evidence of muscle fiber disruption, hematoma formation, and other pathological changes within the injured muscle.D) Future Directions and Research Opportunities discuss the gaps in current muscle injury classification systems and areas for future research. Encourage exploration of how new imaging technologies or biomarkers could be integrated into existing frameworks to enhance diagnostic accuracy and predictive power.

### TABLE OF CONTENTS/OUTLINE

A) Muscle injury classifications;B) MRI cases images;C) Comparison of the most commonly used classifications;D) Principles of treatment for muscle injuries according to classifications and discussions on return to sport;E) Future perspectives.

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# Abstract Archives of the RSNA, 2024

MKEE-29

## EXPLORING BONE METAPHYSEAL LESIONS: INSIGHTS ON IMAGING AND INTERPRETATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia F. Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia Da Cruz Fagundes, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Bailao, MD (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The metaphysis is a crucial region of the bone that has a specific anatomy, cellularity, and vascularization, and for this reason, some lesions develop preferentially in this location. This region is also important as growth and development occur during childhood and adolescence. The metaphysis, being the most metabolically active portion of bone, hosts a wide variety of tumors, both benign and malignant that require early detection to prevent adverse effects. It is also prone to infectious conditions like osteomyelitis and metabolic disorders disrupting bone mineral metabolism, potentially leading to deformities. Common fractures in this region, resulting from trauma or mechanical stress, vary in severity and may affect the growth plate, posing risks to bone development. Understanding the diverse imaging patterns in injuries involving the metaphysis is crucial for accurate diagnosis and early recognition of potential complications. Radiography is typically the initial imaging method used, and when combined with magnetic resonance imaging or computed tomography, it enhances sensitivity and specificity in diagnosing and characterizing lesions. This work aims to outline various metaphyseal lesions of different origins, highlighting their distinctive anatomical, histological, and vascular features. Early and precise diagnosis is crucial for promptly initiating appropriate treatment, thereby maximizing patient outcomes.

### TABLE OF CONTENTS/OUTLINE

1. Background 2. Anatomy and histology 3. Development bone 4. Metaphyseal lesions 4.1 Tumoral 4.2 Inflammatory and infectious 4.3 Mechanic/traumatic 4.4 Dysplasias/congenital changes 4.5 Metabolic 5. Imaging findings 6. Diagnostic approach

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# Abstract Archives of the RSNA, 2024

MKEE-3

## MR NEUROGRAPHY OF FINE-CALIBER NERVES: A CASE-BASED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Lua Gulde (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Raul O. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo Bordalo-Rodrigues, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Paulo Victor P. Helito, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Kairos Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Niels Vinicius Padua Carvalho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The analysis of fine-caliber peripheral nerves using imaging methods is a challenging task. However, recent advances enabled higher resolution, thinner sequences with multiplanar reformatting, making it feasible to evaluate these very thin nerves using MR neurography (MRN). Therefore, MRN has been used to: (1) exclude the diagnosis of peripheral neuropathy by displaying normal nerves and regional muscles; (2) confirm suspicion of peripheral neuropathy by directly showing the nerve abnormality or regional muscle denervation changes by depicting the lesions causing nerve entrapment or impingement; (3) assess the extent of the abnormality or the disease load; (4) detect incidental lesions in the region of interest that mimic neuropathy symptoms; (5) provide imaging guidance treatments.We aim to demonstrate through cases collect in our institution the evaluation of multiple neuropathies, reinforcing its role as an important tool to access the small caliber peripheral nerves.

### TABLE OF CONTENTS/OUTLINE

(1) Peripheral nerves: concepts and anatomy, focusing on fine-caliber nerves; (2) Neuropathy: imaging findings and diagnostic challenges- Role of MRN; (3) Review through cases from our service, with literature review, including, but not limited to: (3.1) Intercostal neuropathy; (3.2) Long thoracic nerve; (3.3) Accessory nerve; (3.4) Suprascapular nerve; (3.5) Palmar cutaneous branch of the median nerve; (3.6) Medial cutaneous nerve of the forearm; (3.7) Digital nerve; (3.8) Genitofemoral nerve; (3.9) Superior gluteal nerve; (3.10) Obturator nerve; (3.11) Ilioinguinal nerve; (3.12) Medial plantar nerve...

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# Abstract Archives of the RSNA, 2024

MKEE-30

## PHOTON-COUNTING CT IN MSK - HOW I DO IT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Henner Huflage, MD (*Abstract Co-Author*) Nothing to Disclose
Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Andreas Kunz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Since the clinical emergence of the first photon-counting CT (PCCT) system in late 2021, investigations have shown advantages in all fields of radiology. Compared with standard energy-integrating detector CT, PCCT allows for superior dose efficiency in every examination. While this aspect by itself is groundbreaking, the advantages do not stop there: PCCT facilitates an unprecedented combination of ultra-high resolution imaging without dose penalty or field of view restrictions, elimination of electronic noise, and ubiquitous spectral information. Considering the high demands of orthopedic imaging for visualization of minuscule details while simultaneously covering large portions of skeletal and soft tissue anatomy, no subspecialty may benefit more from this novel detector technology than musculoskeletal radiology. This educational aims to provide a personal introduction to the cosmos of PCCT, explain its technical basics, and highlight the most promising applications for patient care, while also mentioning current limitations that need to be overcome in the future.

### TABLE OF CONTENTS/OUTLINE

1. Technical background 2. Radiation dose reduction 3. Spatial resolution improvement 4. Metal artifact reduction 5. Multi-energy and spectral imaging 6. Current technical limitations and outlook 7. Discussion

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# Abstract Archives of the RSNA, 2024

MKEE-31

## SCULPTING SUCCESS: VALUABLE INSIGHTS INTO BONE TUMOR SURGERY WITH 3D RECONSTRUCTION TECHNIQUES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Micaela Sturnigh, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Rosenvasser, MD (*Abstract Co-Author*) Nothing to Disclose
Javier M. Martinez Martinez, MD (*Abstract Co-Author*) Nothing to Disclose
Ignacio Ferrer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 3D Printing Process: To explore key stages, from image acquisition to bedside application.2. Selection of 3D Printing Technologies: To analyze the advantages and disadvantages of different 3D printing techniques and their specific applications in generating models for bone tumor resection.3. Preoperative Planning: to demonstrate how 3D printed models are used in preoperative planning to enhance surgical accuracy and efficiency. 4. Clinical Applications: Review clinical cases illustrating the use of 3D printed models in bone tumor resection and personalized implants.5. Visualization and Communication: To discuss how 3D printed models enhance communication among the surgical team and patients, to improve their understanding of the procedure.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to the 3D printing process in bone tumor resection.2. Key techniques and technologies used in 3D printing of models for orthopedic surgery.3. Highlighted clinical cases: examples of 3D printed model applications in preoperative planning and bone tumor resection.4. Practical considerations and challenges in implementing 3D printing in orthopedic clinical practice.5. Additional applications of 3D-printed models in orthopedics: patient education, interdisciplinary communication and surgical training.6. Conclusion: advancing excellence in bone tumor surgery.

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# Abstract Archives of the RSNA, 2024

MKEE-32

## ARE YOU READING IN A VACUUM OR COOKING WITH GAS? DIAGNOSTIC PITFALLS IN INTERPRETATION OF NONINFECTIOUS CAUSES OF GAS IN MUSCULOSKELETAL IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tetyana A. Gorbachova, MD (*Abstract Co-Author*) Nothing to Disclose
Osama Syed, DO (*Abstract Co-Author*) Nothing to Disclose
Jacob T. Ramsey, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Describe physiologic conditions and noninfectious disorders of musculoskeletal system associated with presence of gas.2. Review differential diagnosis of intraarticular, juxta articular and intraosseous gas and associated common interpretational pitfalls in setting of trauma.3. Review common and uncommon etiologies of gas after joint replacement.

### TABLE OF CONTENTS/OUTLINE

1. Intra-articular gasa. Transient positional vacuum phenomenon: etiologyb. Trauma:i. Traumatic arthrotomyii. Closed injury: intraarticular vacuum phenomenon (VP) as an indicator of transient dislocation (adult hip)c. Iatrogenic: joint aspiration/injectiond. Degenerative: asymptomatic VP and symptomatic pneumatocyste. VP as a mimicker of internal derangement on MRI (knee, shoulder)2. Intra-osseous and juxta articular gasa. Acute fracturesi. Open fracturesii. Closed fractures in high energy traumaiii. Iatrogenic (local anesthesia during reduction)b. Insufficiency fractures (pelvis, spine)c. Chronic fracture with nonunion/ pseudoarthrosisd. Degenerative: periarticular pneumatocyst, soft tissue extension mimicking abscess3. Arthroplasty associated gasa. Intramedullary pneumatosis in early post operative period as a lesion mimickerb. Aseptic hydrogen pneumarthrosis as a sign of crevice corrosion

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

MKEE-33

## GENOMIC LANDSCAPE OF LEIOMYOSARCOMA: INSIGHT AND UPDATES FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mohammad Saleh, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Francesco Alessandrino, MD (*Abstract Co-Author*) Nothing to Disclose
Ty K. Subhawong, MD (*Abstract Co-Author*) Research Consultant, Arog Pharmaceuticals, Inc;Stockholder, AbbVie Inc;Stockholder, AstraZeneca PLC;Stockholder, Johnson & Johnson;Stockholder, Pfizer Inc ;Stockholder, F. Hoffmann-La Roche Ltd;Stockholder, Teva Pharmaceutical Industries Ltd
Brandon Rose (*Abstract Co-Author*) Nothing to Disclose
Rosa P. Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Yu-Cherng C. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Jonczak (*Abstract Co-Author*) Nothing to Disclose
Winston Pearce (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Provide an overview of the genomic landscape of leiomyosarcoma (LMS) with focus on the mutations with imaging and therapeutic correlates.- Describe the different imaging techniques and the imaging features of different subtypes of LMS.- Identify the limitations of imaging and provide strategies for accurate imaging diagnosis of LMS

### TABLE OF CONTENTS/OUTLINE

Overview of the LMS- Genomic landscape, incidence, epidemiology of LMS- Novelties of molecular and histopathologic classification of LMS- Principles of therapy and stagingImaging of LMS - Role of imaging in management of LMS and limitations of current imaging- Imaging features of early stage and advanced uterine and extrauterine (soft tissue) LMS, with imaging examples for each subtype, including examples of vascular, retroperitoneal, cutaneous, extremity LMS.- Strategies for accurate imaging diagnosis for every step of the natural history of LMS: at diagnosis, before and after treatment- Pitfalls of LMS imaging (Liposarcomas, uterine leiomyomas, vascular leiomyomas, other peripheral soft tissue sarcomas)Future directions- Radiomics and machine learning approaches to imaging of LMS- Advanced imaging techniques for diagnosis of LMS- Applications of circulating tumor DNA

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# Abstract Archives of the RSNA, 2024

MKEE-34

## CHECKMATE TO CHEST WALL TUMORS: A STRATEGIC APPROACH TO DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Mecate Prada, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Nunes, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Macedo, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo M. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Lucas Da Silva Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Chest wall tumors and tumor-like lesions are relatively rare, but understanding their diagnostic features is crucial. There exists a significant overlap in the presentation of different etiologies, with many non-specific features shared between benign and malignant tumors. Recognizing key imaging and clinical-epidemiological characteristics of the most common lesions is essential. Additionally, identifying findings that raise suspicion for malignancy is critical. This presentation will focus on multimodality essential features for differentiating benign and malignant lesions and, when possible, specific imaging features for determinante diagnosis. Relevant clinical and epidemiologic data will be highlighted. A brief review of a pertinent MRI protocol will also be included.

### TABLE OF CONTENTS/OUTLINE

Introduction - Specific MRI protocol for chest wall lesionsCollection of cases, with a multimodality approach of the following lesions: Osteochondroma / Hemangioma / Elastofibroma Dorsi / Desmoid Tumor / Fibrous hamartoma of Infancy / Lipoma / Schwannoma / Ewing's Sarcoma / Chondrosarcoma / Myeloma / Metastasis / Brown Tumor / Leri Disease.

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# Abstract Archives of the RSNA, 2024

MKEE-35

## HIGH-RESOLUTION ULTRASOUND OF THE NAIL: CLINICAL AND PATHOLOGICAL CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatiana Arroyave, MEd (*Abstract Co-Author*) Nothing to Disclose
Brian D. Norena Rengifo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Diseases in the nail may be an incidental finding or may manifest as a palpable or visible abnormality. Knowledge of the anatomy of the nail is crucial in the evaluation of tumor, inflammatory or traumatic lesions. High-resolution ultrasound is the image of choice for the characterization of superficial lesions in the nail. A meticulous technique is necessary to determine the type, composition and location of the lesion. Establishing a differential diagnosis is essential to offer adequate treatment.

### TABLE OF CONTENTS/OUTLINE

This educational e-exhibit will review nail anatomy, ultrasound imaging findings, and differential diagnosis of nail unit lesions. An overview of the ultrasound technique for evaluating nail lesions will be provided and correlation with clinical and pathological images will be performed.

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# Abstract Archives of the RSNA, 2024

MKEE-36

## IMAGING INSIGHTS INTO EXERTIONAL COMPARTMENT SYNDROME AND ATHLETIC PERFORMANCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando O. Zorzenoni, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago A. Rizzetto, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Aurelio Soato Ratti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Chronic Exertional Compartment Syndrome (CECS) is a prevalent yet frequently underdiagnosed condition, particularly among physically active individuals, posing substantial challenges and hindrances to performance. This review explores the multifaceted nature of CECS diagnosis and management, emphasizing the critical role of imaging techniques, notably MRI, in enhancing our understanding and approach to this condition. CECS diagnosis traditionally relied on invasive techniques like needle manometry, with its limitations and varying acceptance. However, advancements in imaging, especially MRI, offer non-invasive alternatives that present promising avenues for accurate diagnosis and improved patient outcomes. By examining the pathophysiology and anatomical considerations underlying CECS, clinicians gain valuable insights into its presentation and differential diagnosis. This study elucidates the diagnostic utility of imaging in CECS assessment, practical considerations and pitfalls associated with MRI interpretation, highlighting the importance of protocol standardization and clinician expertise. This article underscores the transformative impact of imaging, particularly MRI, in navigating the complexities of CECS diagnosis and management, aiming to empower healthcare professionals in optimizing patient care and facilitating a return to pain-free performance.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

MKEE-37

## UNDERSTANDING EXTENSOR MECHANISM PATHOLOGIES AND THEIR POSTOPERATIVE APPEARANCES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tony T. Wong, MD (*Abstract Co-Author*) Nothing to Disclose
Tina Roa, MD (*Abstract Co-Author*) Nothing to Disclose
Saheeb Ahmed, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Teaching Points 1. Understand the basic musculoskeletal anatomy of the knee through multiple imaging modalities (radiographs, CT, MRI), with a focus on the extensor mechanism. 2. Explore different pathologies of the extensor mechanism, their presentation, and their appearance under different imaging modalities. 3. Understand surgical variants used to treat extensor mechanism pathologies and the rationale behind their use. 4. Understand the expected postoperative appearance of extensor mechanism surgeries. 5. Recognize common postoperative complications.

### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline 1. Normal Anatomy a. Radiographic features of the knee b. Cross sectional anatomy of the knee (CT and MRI), with a focus on the extensor mechanism (tendons, insertions, joints)2. Extensor mechanism pathology and related surgeriesa. Patellar instability i. MPFL reconstruction ii. Physeal sparing MPFL reconstruction iii. Lateral retinacular release iv. Tibial tuberosity transfer v. Roux-Goldthwait procedureb. Patellar abnormalities i. Patellofemoral cartilage repair ii. Bipartite patella resection iii. Patellar fracture repairc. Extensor mechanism tears i. Primary patellar and quadriceps tendon repair ii. Repair with augmentation: Achilles allograft reconstruction iii. Repair with augmentation: semitendinosus autograft reconstruction iv. Allograft patella extensor mechanism reconstruction3. Common postoperative complications

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# Abstract Archives of the RSNA, 2024

MKEE-38

## ULTRASOUND-GUIDED PERINEURAL INJECTIONS OF THE UPPER EXTREMITY FROM THE ARM TO THE WRIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Joseph C. Giaconi, MD (*Abstract Co-Author*) Nothing to Disclose
Nathaniel Mizraki, MD (*Abstract Co-Author*) Nothing to Disclose
George R. Matcuk JR, MD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
Tanya L. Tivorsak, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Perineural injections in the upper extremity can be performed under ultrasound real-time guidance for therapeutic and diagnostic purposes. This exhibit will review the sonoanatomy of certain nerves in the upper extremity and topographic anatomy correlation with MRI. We will provide a guide for techniques and approaches for injecting specific nerves.

### TABLE OF CONTENTS/OUTLINE

1. Introduction and indications for perineural injections- diagnose and confirm specific neuropathy prior to nerve surgery, relieve nerve pain2. Procedure preparation- ultrasound transducers, needle size, amount of anesthetic or steroid/anesthetic mixture3. Anatomy and injection techniques of certain nerves including musculocutaneous nerve, radial nerve, medial dorsal cutaneous nerve, ulnar nerve, and median nerve4. Risks and side effects

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# Abstract Archives of the RSNA, 2024

MKEE-39

## DEEP UNDERSTANDING OF THE TIBIOFIBULAR SYNDESMOSIS: ANATOMY, BIOMECHANICS, IMAGING APPROACH AND POSTOPERATIVE EVALUATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo A. Nico, MD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro H. Arruda, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela A. Da Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia dos Reis Morimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Nacime Mansur (*Abstract Co-Author*) Nothing to Disclose
Gustavo O. Watanabe, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas N. Silva, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Tibiofibular syndesmotic injuries are challenging and often underestimated, especially mild or moderate cases. Proper diagnosis and treatment are essential to avoid long-term complication such as rotational instability and ankle osteoarthritis. The syndesmotic ligament injury and associated instability determine whether operative or non-operative treatment is needed. Imaging, like x-rays for initial assessment and weightbearing studies for dynamic insights, is crucial. MRI provides direct ligament visualization and detects associated injuries, despite limitations in evaluating ankle dynamics. In this context, knowledge of anatomy, biomechanics and injury mechanisms are essential in both diagnostic and therapeutic management. Emerging imaging techniques improves sensitivity, but they remain underutilized. Recognizing subtle imaging signs and comparing the affected side with the contralateral unaffected side can increase diagnostic accuracy. Postoperative imaging analysis is imperative when there is failure to achieve anatomical reduction, residual instability, or development of concomitant injuries. The radiologist should identify the surgical techniques, normal findings and abnormalities that may suggest complications, thus avoiding unnecessary procedures.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Tibiofibular syndesmosis anatomy 3. Biomechanics and trauma mechanism 4. Imaging diagnosis of tibiofibular syndesmosis injury a) Radiograph and Stress X-ray b) CT Scan c) Stress and weightbearing CT Scan d) MRI e) What to report in the preoperative exam? 5. Treatment and imaging evaluation a) Surgical techniques b) Complications c) What to report? 6.? ?Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-4

## VASCULAR VOYAGE: CHARTING VARIANT PATHWAYS IN MUSCULOSKELETAL IMAGING WITH CLINICAL AND SURGICAL IMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Sara Silberstein, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Tetyana A. Gorbachova, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei Tuluca (*Abstract Co-Author*) Nothing to Disclose
Maya Patel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To highlight different vascular variants encountered in common musculoskeletal studies- To review embryologic origin, prevalence, pertinent regional anatomy, and imaging of these vascular variants.- To describe the clinical significance and surgical implications of variant vascular anatomy with emphasis on risk of iatrogenic injury

### TABLE OF CONTENTS/OUTLINE

1. Persistent median artery: embryology/imaging/reported associations and complications - Bifid median nerve- Pronator syndrome - Carpal tunnel syndrome - Embolic digital ischemia 2. Corona mortis: embryology/classification/complications - Traumatic injury with superior pubic rami fractures - Iatrogenic injuries3. Persistent sciatic artery: embryology/classification/complications - Stenosis- Aneurysm- Imaging pitfalls - Surgical planning implications in revascularization procedures and renal transplant4. Aberrant anterior tibial artery: embryology/imaging/surgical significance - Total knee arthroplasty - High tibial osteotomy - PCL reconstruction- Posterior horn lateral meniscus repair 5. Dorsalis pedis artery: high take-off, oblique course - Aneurysm and pseudoaneurysm- Iatrogenic injury in fracture fixation and ankle arthroscopy - Fasciocutaneous flap reconstructions6. Summary table: key points

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# Abstract Archives of the RSNA, 2024

MKEE-40

## PEDIATRIC SACROILIAC JOINT: A PRATICAL GUIDEBOOK

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Monteiro, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Rosenfeld, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this study is:• Review of sacroiliac joint development and anatomy through didactics illustrations.• Highlight and discuss specific findings of normal anatomy and variations in the sacroiliac joint in pediatric population.• Discuss and demonstrate the imaging findings of the wide range diseases that may affect children sacroiliac joint in a multimodality approach (CR, CT, MRI)• Enhancing understanding and diagnostic accuracy of the most common sacroiliac pathologies, as well as presenting other causes of low back pain in childhood

### TABLE OF CONTENTS/OUTLINE

• Introduction and overview of the normal development and anatomy of the sacroiliac joint• Demonstrate with didactic illustrations and cases the anatomical variations that the radiologist should be aware of.• Illustrate didactically the radiographic, CT and MRI findings of each sacroiliac joint disease in children, including:• Inflammatory arthropathies and Reactive Arthritis• Trauma and sports related injuries• Pyogenic, Tuberculous and Other Infections• Tumors that may involve the sacroiliac joint• Present differential diagnosis for low back pain in children, and propose a diagnostic algorithm, including which exams to be requested and according to the findings and clinical-laboratory correlation, narrow down the differential diagnosis• Summary

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# Abstract Archives of the RSNA, 2024

MKEE-41

## IMAGING EVALUATION OF SHOULDER ARTHROPLASTY: A COMPREHENSIVE EDUCATIONAL OVERVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lucas K. Miyahara, MD (*Abstract Co-Author*) Nothing to Disclose
Victor C. Mello (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this study is to: • Review the imaging and discuss the different types of shoulder arthroplasty with didactic and illustrative cases to consolidate the acquired knowledge. • Identify the typical visual outcome of various arthroplasty and pinpoint the primary issues and complications that may arise post-surgery, shared to all types and particularly those specific to each type of replacement procedure. • Suggest a report template that highlights the key relevant information for the orthopedic surgeon.

### TABLE OF CONTENTS/OUTLINE

Advancements in shoulder arthroplasty, along with varied surgical techniques and detailed anatomical studies, have significantly improved outcomes. Common motivations for shoulder arthroplasty include osteoarthritis, inflammatory arthritis, fractures, rotator cuff issues, and avascular necrosis. Recognizing key imaging indicators is essential for accurate diagnosis and determining the most suitable arthroplasty approach. Radiologists must not only understand the indications for each procedure but also be knowledgeable about potential complications. The presentation will include the following contents: - Introduction - Hemiarthroplasty - Anatomic total shoulder arthroplasty - Reverse total shoulder arthroplasty - Complications - Report template suggestion - Bibliographical references

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# Abstract Archives of the RSNA, 2024

MKEE-42

## REVIEWING BENIGN AND MALIGNANT PRIMARY BONE TUMORS: A RADIOLOGY-PATHOLOGY CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Richard L. Barger JR, MD (*Abstract Co-Author*) Nothing to Disclose
Lesley Summerville, MD (*Abstract Co-Author*) Nothing to Disclose
Shaun H. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Vijaya K. Kosaraju, MD (*Abstract Co-Author*) Nothing to Disclose
Navid Faraji, MD (*Abstract Co-Author*) Nothing to Disclose
Nathan M. Amann, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the most common benign and malignant primary bone tumors including their risk factors and genetic markers- Understand imaging characteristics that can distinguish benign and malignant bone lesions- Understand the management of lesions discovered on imaging- Appreciate the histopathologic findings and how viewing the tumor at cellular level is reflected in radiologic imaging

### TABLE OF CONTENTS/OUTLINE

Introduction to benign and malignant bone tumorsDefining benign vs. malignant primary bone lesionsSymptomatologyRelative incidenceHakim et al. 2015Incidence, risk factors and symptomatology of benign bone lesions including osteochondroma, giant cell tumor, osteoblastoma, and osteomaXu et al. 2023Incidence and risk factors stratified by age and gender for malignant bone tumors including osteosarcoma, chondrosarcoma, Ewing sarcoma, and chordomaImaging characteristics of bone tumors in generalBenign bone tumor characteristics Malignant bone tumor characteristicsManagement of discovered bone tumors Case review from our institutionPatient background and pertinent historyAnnotated imaging findingsAnnotated histopathologic findingsDiagnosis and reviewRisk factorsDiscussion of age distribution for specific tumorsGenetic markersProvided by the WHO 2020 Classification of Tumors of Bone (Choi et al. 2021)Typical imaging and histopathologic findingsConclusionSummarize imaging findings of benign and malignant lesionsSummarize histopathologic findings and how it is reflected in the imaging

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# Abstract Archives of the RSNA, 2024

MKEE-43

## CRACKS AND BREAKS: A RADIOLOGIST'S GUIDE TO FRACTURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina D. Augusto, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Gustavo Junzi Konno, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In this educational exhibit, our aim is to offer a thorough review of fractures, encompassing their terminology, classifications, complications, and specific characteristics related to various locations and skeletal maturation stages. A clear understanding and accurate reporting of these features are essential for enhancing clinical outcomes and minimizing complications.

### TABLE OF CONTENTS/OUTLINE

Fractures are common events in the musculoskeletal radiology spectrum, demanding attention due to their clinical and functional implications. Understanding their complications is crucial for effective management and prevention of sequelae. Pediatric fractures possess unique characteristics, such as a greater potential for bone remodeling and anatomical peculiarities, necessitating a specific approach. Fracture classifications, such as Salter-Harris for epiphyseal fractures, and systems like AO/OTA, assist in standardizing assessment and selecting the most appropriate therapeutic approach, contributing to improved clinical outcomes. New technologies, like synthetic CT and dual-energy CT in conjunction with Deep Learning software, are revolutionizing musculoskeletal radiology, accelerating the identification of subtle fractures and underscoring the importance of continuous updating for musculoskeletal radiologists.

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# Abstract Archives of the RSNA, 2024

MKEE-44

## FROM BONES TO JOINTS: IMAGING INSIGHTS INTO MUSCULOSKELETAL SARCOIDOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lucas K. Miyahara, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas R. Medeiros (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Sarcoidosis is a multisystemic granulomatous disorder of unknown etiology, characterized by the accumulation of T lymphocytes and macrophages in affected organs. While it most commonly involves the lungs, lymph nodes, skin, and eyes, it may affect any organ, including the musculoskeletal system, with both symptomatic and asymptomatic manifestations. The purpose of this exhibit is: 1. To review sarcoidosis etiopathogenesis 2. To discuss how modern imaging techniques such as PET/CT help detect asymptomatic musculoskeletal sarcoidosis and are changing its relative prevalence 3. To analyze multimodality imaging findings of musculoskeletal sarcoidosis 4. To assess the differential diagnosis of musculoskeletal sarcoidosis

### TABLE OF CONTENTS/OUTLINE

1. Acute sarcoid arthritis 2. Chronic sarcoid arthritis 3. Small bones sarcoidosis 4. Classic “lace-like” osteolysis pattern of small bones sarcoidosis 5. Large bones sarcoidosis 6. Spine sarcoidosis 7. Nodular muscular sarcoidosis 8. Nodular “dark star” pattern muscular sarcoidosis 9. Chronic muscular sarcoidosis 10. Subcutaneous sarcoidosis 11. Differential diagnosis of musculoskeletal sarcoidosis, such as metastasis, enchondroma, bone cyst, osteomyelitis 12. Multimodality evaluation of musculoskeletal sarcoidosis, including ultrasound, radiograph, computed tomography, magnetic resonance, and PET/CT

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

MKEE-45

## SYSTEMATIC APPROACH FOR DIFFERENTIATING LOCAL RECURRENCE OF MUSCULOSKELETAL (MSK) SARCOMA FROM POST-TREATMENT CHANGES WITH ADVANCED MRI TECHNIQUES - PICTOR ASSAY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre C. Valim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiological surveillance assessments following musculoskeletal sarcoma surgery play a critical role in early detection of local recurrence. However, interpreting imaging can pose challenges, necessitating a systematic approach to accurately evaluate silent local recurrence. It is essential to understand the patient's clinical and surgical history and pretreatment images for differentiating recurrence from time-dependent posttreatment changes When conducting an examination, radiologists must determine which advanced MRI techniques (such as DIXON T1, STIR, DWI, DCE perfusion, and TIC curve analysis) should be employed to analyze both bone marrow and soft tissue. It is imperative to differentiate local recurrence from other time-dependent post-treatment changes, such as seroma, scarring, pseudotumor, radiation-induced marrow and soft tissue alterations, infection, neuropathy, and muscle atrophy, among others. For a more precise diagnosis, correlation of histopathological features with the radiological appearance of the tumor is essential. An understanding of the applicability and limitations of these techniques is necessary to ensure accurate diagnosis and potentially guide appropriate treatment for our patients.

### TABLE OF CONTENTS/OUTLINE

Advanced MRI techniques and applicability in the early diagnosis of silent recurrence of MSK sarcoma and surveillance of these patients. Case discussion to illustrate false positive and false negative cases. Common pittfallsDifferential diagnosis. Utilization of 3D printing, virtual reality, and augmented reality in diagnostic and therapeutic decision-making.

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# Abstract Archives of the RSNA, 2024

MKEE-46

## ZERO TE (OZTEO) MR BONE IMAGING: EXPECTED AND SURPRISING BENEFITS IN MUSCULOSKELETAL IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andrew B. Ross, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Kenneth S. Lee, MD, MBA (*Abstract Co-Author*) Grant, NFL;Research support, Hologic, Inc;Royalties, RELX
Humberto G. Rosas, MD (*Abstract Co-Author*) Co-founder, AyrFlo;Stockholder, AyrFlo
Michael J. Tuite, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas C. Laucis, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Tan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Zero TE (oZTEo) is a new MR sequence designed for imaging cortical bone to create 'CT-like' images during MR exams. This 3-4 minute sequence can be easily added onto existing MR protocols. The oZTEo sequence enables visualization and characterization of structures and material that typically have extremely low signal on conventional MR sequences, including bone cortex, soft tissue calcification and ossification, and crystal deposition. During our institution's two years of using oZTEo in clinical practice, a surprising benefit of the sequence is its 3D isotropic acquisition which enables MPR reformatting and better assessment of anatomy, coalitions, and characterization of fractures on MR.

### TABLE OF CONTENTS/OUTLINE

1. Brief overview of the physics of the Zero TE (oZTEo) sequence 2. Example cases of oZTEo enabling better characterization of osseous lesions, abnormalities, and pathologic fractures 3. Example cases of oZTEo enabling characterization of soft tissue calcification/ossification/crystal deposition 4. Example cases of oZTEo enabling better visualization of osseous anatomy including symptomatic coalitions 5. Overview of our institution's implementation of oZTEo with our MSK MR protocols by indication to most efficiently utilize the sequence

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# Abstract Archives of the RSNA, 2024

MKEE-47

## SACRAL MASSES: DISTINGUISHING CHORDOMAS FROM BENIGN NOTOCHORDAL TUMORS AND OTHER SACRAL TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andrew E. Rosenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan Nixon, MD (*Abstract Co-Author*) Nothing to Disclose
Francis Hornicek, MD (*Abstract Co-Author*) Nothing to Disclose
Ty K. Subhawong, MD (*Abstract Co-Author*) Research Consultant, Arog Pharmaceuticals, Inc;Stockholder, AbbVie Inc;Stockholder, AstraZeneca PLC;Stockholder, Johnson & Johnson;Stockholder, Pfizer Inc ;Stockholder, F. Hoffmann-La Roche Ltd;Stockholder, Teva Pharmaceutical Industries Ltd
Fabiano N. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Brooke L. Sarna, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to highlight the importance of distinguishing benign from malignant sacral masses to enhance patient care and avoid unnecessary procedures. Particular focus is paid to chordomas and benign notochordal tumors (BNCTs), with an additional example of an intraosseous hemangioma (IH) which falls under the differential diagnosis of sacral masses. Upon completing this exhibit, the learner will be able to:1. Properly recognize and describe the typical MRI and CT features of chordomas and BNCTs, including features that distinguish the two.2. Properly recognize the typical histopathologic findings of chordomas and BNCTs and to synthesize them with what is seen macroscopically on MRI.3. Properly recognize intraosseous hemangiomas and their confounding imaging features in relation to chordomas and BNCTs as a differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction presenting sacral masses and their prevalence and morbidity. A differential diagnosis including both benign and malignant lesions will be provided.2. In particular, the distinguishing imaging features, pathologic correlates, and when available gross specimen and intra-operative photographs of chordomas, benign notochordal tumors, intraosseous hemangiomas, chondrosarcomas, giant cell tumors, and other less common sacral tumors will be provided.3. Objective information with subsequent discussion will be provided to help the general radiologist distinguish between these lesions and form a differential diagnosis.4. Conclusion.5. Bibliography.

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# Abstract Archives of the RSNA, 2024

MKEE-48

## STEPS TO RECOVERY: GUIDING THROUGH IMAGING OF THE POST-OPERATIVE KNEE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Ricardo Moreira da Silva Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To demonstrate the most important aspects of the normal MRI anatomy of the knee joint.To explore diverse surgical interventions and treatments available for knee pathologies, including meniscus, ligaments, and cartilage, as well as understand their underlying mechanisms, indications, and potential complications.To identify the normal and abnormal post-treatment and post-operative MRI knee findings.To identify the critical aspects of post-operative knee imaging that must be detail in the report.

### TABLE OF CONTENTS/OUTLINE

Introduction: the importance of the understanding of the main surgical interventions of knee pathologies.Normal knee anatomy and its variants.Surgical interventions of the knee meniscus, ligaments, and cartilage. Underlying mechanism; Indications; Potential complications; MRI imaging of normal and abnormal post-operative finding;Report essential information.Conclusion and take-home messages.

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# Abstract Archives of the RSNA, 2024

MKEE-49

## RENAL OSTEODYSTROPHY: A CONSTELLATION OF MUSKULOSKELETAL ABNORMALITIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Gabriel Franchi De Santi, MD (*Abstract Co-Author*) Nothing to Disclose
Aluizio Barbosa De Carvalho (*Abstract Co-Author*) Nothing to Disclose
Mariana Barros Mendonca Figueiredo (*Abstract Co-Author*) Nothing to Disclose
Ana Lara Almeida Da Silva (*Abstract Co-Author*) Nothing to Disclose
CINTIA LEAL (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thayssa Leite, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie Basilio Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo de Tarso K. Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia E. Lobato, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Koody Andre Hassemi Kitawara (*Abstract Co-Author*) Nothing to Disclose
Karina Hayama, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is: 1. To review pathophysiology and natural history of renal osteodystrophy. 2. To correlate their natural history with imaging findings in radiographies, CT and MRI. 3. To discuss epidemiology and risk factors of the of the main pathologies associated with renal osteodystrophy, correlating their findings in radiographies, CT and MRI.4. To emphasize the importance of early and accurate diagnosis, as well as present differential diagnoses of pathologies associated with renal osteodystrophy.

### TABLE OF CONTENTS/OUTLINE

1- Pathophysiology of renal osteodystrophy2- Radiographic findings and possible differential diagnoses3- MRI and CT findings4- Brown tumors5- Soft tissue calcifications6- Vascular calcifications 7- Osteosclerosis 8- Osteomalacia 9- Osteoporosis

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# Abstract Archives of the RSNA, 2024

MKEE-5

## SYNDROMES-ASSOCIATED MUSCULOSKELETAL TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Jie C. Nguyen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Murat Alp Oztek, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Yaya (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Janos, MD (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Identify tumor syndromes associated with MSK neoplasmsReview the pathophysiology and clinical findings of discussed syndromes.Describe the imaging appearance of tumor syndromes associated tumors across multiple imaging modalities. Discuss the differential diagnoses for imaging findings of each tumor syndromes.

### TABLE OF CONTENTS/OUTLINE

Bone tumors 1. Fibrous dysplasia ü McCune-Albright syndrome ü Mazabraud syndrome ü Epidermal nevus syndrome 2. Osteoma ü Gardner syndrome 3. Osteochondroma ü Multiple osteochondromas ü Metachondromatosis 4. Non-ossifying fibroma ü Neurofibromatosis type 1 ü Jaffe-Campacci syndrome 5. Chondroid tumor ü Multiple enchondromatosis (Ollier disease and Maffucci syndrome) ü Metachondromatosis 6. Osteosarcoma ü Li- Fraumeni syndrome ü Retinoblastoma ü Rothmund-Thompson syndrome type 2 ü Werner syndrome ü Bloom syndrome 7. Multiple myeloma ü POEMS syndrome Soft tissue tumors 1. Vascular tumor ü Maffucci syndrome ü Kasabach-Merritt syndrome ü Klippel-Trenaunay syndrome 2. Myxoma ü Mazabraud syndrome ü Carney complex 3. Xanthoma ü Familial hypercholesterolemia 4. Desmoid tumor ü Gardner syndrome 5. Peripheral nerve sheath tumor ü Neurofibromatosis type 1/2 ü Schwannomatosis ü Carney complex 6. Gastrointestinal stromal tumor ü Neurofibromatosis type 1 ü Familial GIST ü Carney-Stratakis 7. Rhabdomyosarcoma ü Neurofibromatosis ü Li-Fraumeni syndrome ü Beckwith-Wiedemann ü Costello syndrome ü Familial pleuropulmonary blastoma (DICER 1 syndrome) ü Gorlin syndrome/ nevoid basal cell carcinoma syndrome ü Rubinstein-Taybi syndrome 8. Leiomyosarcoma ü Hereditary leiomyomatosis and renal cancer (HLRCC) ü Rubinstein-Taybi

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# Abstract Archives of the RSNA, 2024

MKEE-50

## KNEE IMPLANTS: BREAKING IT DOWN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Janaina Moreira (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Gomes, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle B. Rumi, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Froeder Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Knee replacements are devices used to replace damaged parts of the knee, usually in patients with severe arthritis or serious injuries. This summary focuses on the main angles, measurements and changes related to prostheses to guide radiologists in their reports. These are the main angles and measurements: The alfa angle, the gamma angle e femoral component alignment in the axial plane evaluate the relationship between the femur and the femoral component. On the other hand, the beta angle, the sigma angle and tibial component alignment in the axial plane evaluate the relationship between the tibia and the tibial component. As relevant changes we can highlight loosening: Indicated by changes in angles or increase in joint space. Radiolucent lines suggest this problem; polyethylene wear: evidenced by decreased joint space; infection: suspected by the presence of edema, increase in soft tissue or bone erosion.

### TABLE OF CONTENTS/OUTLINE

Components of knee prostheses and their zones: it is essential to know what is being evaluated and how to describe the topography of the knee replacements. Main angles, measurements and variations of implant techniques: as important as knowing what to look for, is knowing where and how to look. Main complications: among them are osteolysis, loosening, cortical notching, periprosthetic fractures, infections and wear of the polyethylene component.

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# Abstract Archives of the RSNA, 2024

MKEE-51

## HALLUX VALGUS DEFORMITY: A COMPREHENSIVE AND ILLUSTRATED GUIDE FOR ITS RADIOGRAPHIC EVALUATION, SURGICAL TREATMENT OPTIONS, AND POTENTIAL COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ty K. Subhawong, MD (*Abstract Co-Author*) Research Consultant, Arog Pharmaceuticals, Inc;Stockholder, AbbVie Inc;Stockholder, AstraZeneca PLC;Stockholder, Johnson & Johnson;Stockholder, Pfizer Inc ;Stockholder, F. Hoffmann-La Roche Ltd;Stockholder, Teva Pharmaceutical Industries Ltd
Fabiano N. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan Nixon, MD (*Abstract Co-Author*) Nothing to Disclose
Brooke L. Sarna, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is to provide learners with a radiographic definition of hallux valgus. Illustrations of various possible measurements are included to aid learners in improving the accuracy of their reports. An explanation and illustration of various surgical corrective techniques is also provided to better aid learners in interpreting post-operative films. Upon completing this exhibit, the learner will be able to:1. Diagnose hallux valgus on radiographs.2. Provide various associated measurements to the orthopedic surgeon to better aid in management and operative planning.3. Properly recognize various common surgical corrective techniques in the post-operative imaging setting.

### TABLE OF CONTENTS/OUTLINE

1. Introduction presenting hallux valgus and its prevalence and morbidity. The radiographic definition and associated measurements on foot radiographs will be provided with corresponding illustrations.2. In-depth discussion outlining various common corrective surgical techniques, including Chevron osteotomy, Akin osteotomy, Scarf osteotomy, Weil osteotomy, and joint arthodeses (ex. Lapidus procedure) with accompanying illustrations and radiographic examples. Particular attention will be paid to post-operative imaging and evaluation of complications. When available, intra-operative photographic correlation will be provided.3. Examples of surgical complications and their radiographic and, when available, intra-operative correlation. Emphasis will be placed on how the general radiologist can recognize early and late complications.4. Conclusion.5. Bibliography.

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# Abstract Archives of the RSNA, 2024

MKEE-52

## DON’T FALL BEHIND: A REVIEW OF SACRAL FRACTURES AND LUMBOSACRAL DISSOCIATION INJURY PATTERNS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jacob C. Mandell, MD (*Abstract Co-Author*) Author with royalties, Cambridge University Press
Bharti Khurana, MD, MBA (*Abstract Co-Author*) Consultant, General Electric Company;Editor, Wolters Kluwer nv;Author, Cambridge University Press;Consultant, ROKIT Healthcare, Inc
Yan Epelboym, MPH (*Abstract Co-Author*) Association of University Radiologists GE Radiology Research Academic Fellowship Boston Imaging Core Laboratory: Consultant
Phat Tan Nguyen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Sacral fracture classifications and how the radiologist’s interpretation impacts orthopedic management.2. Lumbosacral dissociation injury patterns and their pathophysiologic mechanism of action.3. Vascular injuries commonly associated with sacral fractures and lumbosacral dissociations.

### TABLE OF CONTENTS/OUTLINE

• Bony and Ligamentous Pelvic Anatomy• Imaging Evaluation• Classification of Sacral Fractures• Lumbosacral Dissociation Injury Patterns• Associated Vascular Injuries• Conclusion / Teaching SummaryPrompt identification of sacral fractures and lumbosacral dissociation is critical to facilitate optimal evaluation and management of trauma patients. Sacral fractures may be associated with low-energy impact in demineralized individuals or with high-energy impact in the general population. Radiologists should be familiar with the classification of common and rare types of sacral fractures to facilitate optimal communication with the orthopedist. The most commonly used is the Denis classification system which categorizes fractures into three zones (Zones 1, 2, and 3) and four morphological subtypes (H, U, T, and ?). Anatomic separation of the pelvis from the spinal column, otherwise known as lumbosacral dissociation is a highly morbid and rare subtype of sacral fracture. Knowledge and identification of lumbosacral dissociation injury patterns and subtle associated injuries will facilitate appropriate orthopedic intervention. A review of commonly associated pelvic vascular injury is also critical to facilitate appropriate interventional and surgical management.

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# Abstract Archives of the RSNA, 2024

MKEE-53

## ARTICULAR AND PERIARTICULAR PATHOLOGY OF THE ADULT HIP: WHAT ARE THE STRENGTHS AND WEAKNESSES OF ULTRASOUND?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Andrew J. Grainger, MD (*Abstract Co-Author*) Speakers Bureau, General Electric Company
Robert S. Campbell, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Lisa Billone, BSc (*Abstract Co-Author*) Nothing to Disclose
Sarah Allred, BSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Utilized correctly, the resolution and dynamic abilities of ultrasound provide a useful diagnostic tool to assess the hip joint and adjacent structures.2. The strengths and limitations of ultrasound diagnosis will be highlighted, providing the participant with the knowledge of when ultrasound is best suited for assessment in the adult hip.3. Anatomy, technical considerations, optimal scanning techniques and pathologic examples will be reviewed for the structures indicated in the outline. Correlation with other modalities where appropriate.4. Pitfalls will be reviewed with the goal of minimizing diagnostic error.

### TABLE OF CONTENTS/OUTLINE

> ANTERIOR HIP: anatomy, sonographic technique, pathologic exampleso Hip joint capsule joint distention; highlighting the importance of aspiration, demonstration of alternative windows o Acetabular Labrum Limited visualization with ultrasound - use secondary signs, include alternate imaging windowso Femoroacetabular Impingement (FAI): highlight causes dynamic U/S to assess for FAIo Iliopsoas Complex outline components, highlight dynamic U/S, tendinopathy, impingement, bursal distention effectso The Prosthetic Hip joint infection, ALVAL, impingement> POSTERIOR HIP: including anatomy, sonographic technique, pathologic exampleso Posterior joint capsuleo Ischiofemoral impingement highlight causes dynamic ultrasound to assess for IFI, impact on Sciatic Nerveo Short external rotators: tips to identify structures overlying the posterior joint, highlighting limitations of assessment due to depth> Summary of strengths and weaknesses

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# Abstract Archives of the RSNA, 2024

MKEE-54

## MUSCLE EDEMA: A REVIEW OF APPROACHES TO THE DIFFERENTIAL DIAGNOSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Julia E. Castro Anaya, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Raimundo Gomes Do Rego Neto (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this study is:• Review the typical imaging findings of muscular edema on magnetic resonance imaging (MRI).• Characterize some of the main pathologies associated with muscular edema, understanding in this context their different physiopathologies.• Didactically propose a practical way to systematically approach various differential diagnoses in a didactic manner, considering the mechanism of edema, its distribution pattern, and enhancement after contrast administration.

### TABLE OF CONTENTS/OUTLINE

• Characterizing muscular edema: normal appearance of musculature on magnetic resonance imaging and how to recognize characteristic findings of edema.Schematic drawing and sample cases• Physiopathology and mechanisms leading to muscular edema.Sample cases• Pattern of distribution of muscular edema according to the involvement of muscle groups.Sample cases• Characteristics after intravenous contrast administration.Sample cases• Flowchart with a targeted approach to the main differential diagnoses.Schematic drawing and table

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MKEE-55

## ADD TO YOUR KNOWLEDGE: REVIEW OF THE NORMAL APPEARANCE AND TRAUMATIC INJURIES TO THE HIP ADDUCTOR MUSCULATURE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Chad Klochko, MD (*Abstract Co-Author*) Nothing to Disclose
Lisa Doan (*Abstract Co-Author*) Nothing to Disclose
Joseph G. Craig, MBChB (*Abstract Co-Author*) Nothing to Disclose
Brendan M. Franz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.) Overview of the normal adductor musculature of the hip on multiplanar MRI and ultrasound. 2.) Review of traumatic pathology involving the hip adductor musculature. 3.) Select additional pathologies of the medial hip musculature.

### TABLE OF CONTENTS/OUTLINE

1.) Overview normal appearance of the adductor musculature of the hip on multiplanar MRI and ultrasound with review of associated muscle function. Including obturator Internus/Externus, Pectineus, Adductor Longus/Brevis, Adductor Magnus, Gracilis, Sartorius, Tensor fascia Lata, Iliopsoas, Vastus lateralis/medialis, and Gluteus Maximus. 2.) Review of traumatic pathology of the hip adductor musculature using both multiplanar MRI and ultrasound. Examples of muscle strain, partial thickness and full thickness tears involving the TFL, pectineus, obturator interns/externus, and adductor brevis. Avulsion injuries involving hamstring origins, adductor longus, and iliopsoas insertion. Isolated muscle atrophy. 3.) Example of additional pathologies affecting the adductor musculature including hematoma, abscess, and masses/neurofibromas. 4.) Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-56

## WELCOME TO THE JUNGLE: ANIMAL INSPIRED MUSCULOSKELETAL AND SPINE RADIOLOGY SIGNS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jeremiah R. Long, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew P. Sill, MD (*Abstract Co-Author*) Nothing to Disclose
Logan Haug, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiological signs are important for radiologists and trainees to be familiar with because they can enhance recall of associated pathology and improve diagnostic accuracy. This exhibit will demonstrate the common and recognizable animal inspired musculoskeletal and spine imaging signs via a quiz-style, case-based approach and, when not pathognomonic, provide a differential highlighting the key imaging features supporting the correct diagnosis. For example, in the case of the gull-wing sign which is commonly associated with erosive osteoarthritis, we will highlight the clinical and radiologic features (distribution, joint space narrowing, and soft tissue changes) of other erosive arthritides in the differential such as psoriatic and rheumatoid arthritis.

### TABLE OF CONTENTS/OUTLINE

A “sign” represents a recognizable and recurring radiological pattern suggestive of a certain disease or condition. Our presentation will highlight the key features of the musculoskeletal and spine radiological signs listed below: Extra-axial skeleton signs: 1. Pooping duck sign (triquetral fracture) 2. Anteater sign (calcaneonavicular coalition) 3. Gull wing sign (erosive osteoarthritis) 4. Rat bite erosion (gout) 5. Zebra stripe sign (transverse sclerotic lines in the long bones) 6. Swan neck deformity (autoimmune/inflammatory arthropathies) 7. Talar beak sign (tarsal coalition) 8. Fishtail deformity (elbow). Axial skeleton signs: 1. Winking owl sign (unilateral absent pedicle) 2. Scotty dog (normal anatomy) 3. Claw sign (degenerative disc disease) 4. Shark’s fin sign (unilateral facet joint dislocation) 5. Fish vertebrae sign (osteoporosis).

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# Abstract Archives of the RSNA, 2024

MKEE-57

## REPORTING AND DATA SYSTEMS (RADS) IN MUSCULOSKELETAL (MSK) RADIOLOGY: EXPLAINED IN A SIMPLIFIED MANNER FOR PRACTICAL USAGE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Atul K. Taneja, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Angela He, BS, BA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Learn the value of Reporting and Data Systems in radiology for patient care and multidisciplinary communications-management. 2. Gain knowledge of different RADS systems in musculoskeletal radiology with respect to tumors, infections, and neuropathy scoring. 3. Improve understanding of key points of each of the RADS systems with illustrative imaging examples.

### TABLE OF CONTENTS/OUTLINE

1. Review of American College of Radiology (ACR) statements for RADS systems and their value in radiology with relevance to improving interdisciplinary communications and patient care. 2. Discussion of key points of different RADS systems while highlighting key advantages and pitfalls for each scoring system a. Musculoskeletal infection-RADS (MSKI-RADS) b. Bone-RADS c. Soft Tissue-RADS (ST-RADS) d. Osseous Tumor-RADS (OT-RADS) e. Neuropathy Score-RADS (NS-RADS) 3. Case-based illustration of imaging examples in quiz format to aid reader learning and understanding in different RADS systems.

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# Abstract Archives of the RSNA, 2024

MKEE-58

## MR IMAGING OF ACUTE COMPARTMENT SYNDROME THROUGHOUT THE BODY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Atul K. Taneja, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Alipio Ormond Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Angela He, BS, BA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Learn about acute compartment syndrome and its presentation in various muscle groups of the body.2. Improve understanding of compartment syndrome imaging findings on MR imaging across various affected muscle groups with case-based illustrative imaging examples and gain knowledge of the consequences and complications of delayed or missed acute compartment syndrome diagnoses, especially in atypical cases

### TABLE OF CONTENTS/OUTLINE

1. Review of acute compartment syndrome, its common clinical manifestations, and possible complications2. Discuss the current standards of diagnosing acute compartment syndrome, potential pitfalls of such methods, and the current role of imaging in diagnosing acute compartment syndrome3. Case-based illustration of imaging examples of acute compartment syndrome in various muscle groups to aid reader learning and prompt recognition of pertinent imaging findings; muscle groups to be covered: a. Legs b. Foot c. Thigh d. Paravertebral e. Forearm4. Case-based illustrations of chronic complications: a. Muscular atrophy b. Muscular fibrosis c. Tendinopathy d. Neuropathy

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# Abstract Archives of the RSNA, 2024

MKEE-59

## SCAPHOLUNATE INSTABILITY: A CLINICAL AND RADIOLOGICAL SYNOPSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Harikrishnan Nandakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Harlan M. Stock, MD (*Abstract Co-Author*) Nothing to Disclose
Sukrita Menon, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understanding the normal scapho-luno-capitate alignment, scapholunate and capitolunate angles and normal carpal arcs. 2. Review the structure of scapholunate ligament (SLL). 3. Understanding the mechanism of SLL disruption, its clinical importance, and arthroscopic classification (Geissler). 4. Review the mechanism of scapholunate dissociation, perilunate, lunate and midcarpal dislocations (Mayfield classification) using multimodality imaging. 5. Understanding the sequelae of carpal injuries including Dorsal and Volar intercalated segment instabilities (DISI and VISI). 6. Scapholunate Advanced Collapse (SLAC) and Scaphoid Nonunion Advanced Collapse (SNAC) - Review the etiology, stages, and multimodality imaging findings. 7. Prognosis, staging and brief overview of treatment for SLL injuries (each stage)

### TABLE OF CONTENTS/OUTLINE

1. Introduction: Normal Scapholunate alignment, Normal intercarpal angles and carpal arcs. 2. Anatomy and function of SLL. 3. SLL injury: Etiology and arthroscopic classification. 4. Case based discussion - Mechanism, Ligament(s) affected, radiological features: a. Scapholunate dissociation. b. Perilunate dislocation. c. Midcarpal dislocation. d. Lunate dislocation. 5. SLAC: Etiology, mechanism, Watson staging system, radiological features. 6. SNAC: Etiology, mechanism, stages of osteoarthritis, radiological features. 7. DISI and VISI: Etiology, mechanism, and radiological features. 8. Prognostic factors and staging of SLL injuries (Garcia-Elias) and management

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# Abstract Archives of the RSNA, 2024

MKEE-6

## BIOMECHANICS, IMAGING AND DIFFERENTIAL DIAGNOSIS OF AVULSION FRACTURES: A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elisabetta Ponte, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei Daniel Onuta, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Bernabeu Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Sebastian Paez Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Victoria Esteban Izquierdo, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Garces Marin, MD (*Abstract Co-Author*) Nothing to Disclose
Yolanda Herrero Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The aim of this report is to review the various ways in which avulsion fractures manifest in adult and pediatric population.To describe how avulsion fractures affect adjacent structures, and the best way to recognize them with their imaging characteristics at plain radiograph, computed tomography and resonance magnetic studies.To illustrate the main imaging features and to highlight associated injuries with-own experienced images.

### TABLE OF CONTENTS/OUTLINE

Introduction, biomechanics, location and differential diagnosis.Avulsion fractures manifest when the tendon, ligament or joint capsule, becomes dislodged from the bone, typically resulting in the detachment of a cortical bone fragment.-Acute injuries demonstrate the presence of avulsed bone fragments.-Subacute/Chronic injuries exhibit more aggressive radiographic presentation due to repetitive trauma.The mechanism is determined when a structure that originates or is inserted into the bone exerts tension in the opposite direction to the bone, and this tension significantly exceeds the tensile strength of the bone.These fractures can occur in various anatomical locations and it is crucial to know their presentation well since complex injuries such as those that involve intra-articular extension or those that associate the presence of intra-articular loose bodies, delay in diagnosis can modify the prognosis and in case of subacute/chronic diseases, knowledge of them will help us not to confuse them with other pathologies.

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# Abstract Archives of the RSNA, 2024

MKEE-60

## ATHLETE'S HIP DISORDERS: BEYOND PUBALGIA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Viana Dos Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto P. Bambirra, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas O. Madeira, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Hip is one of the most complex articulations of the human body due its sophisticated biomechanics. Athletes test its capacity to the limit and some lesions are expected. However, hip disorders in athletes should not be misdiagnosed because most of them, if not treated correctly, can lead to movement limitation, decrease in quality of life and harm to professional athletes' career.The purpose of this exhibit is:
- Demonstrate a comprehensive understanding of the normal anatomy of the hip joint
- Explore the universe of hip pathologies beyond athlete's pubalgia, understanding its specific conditions and the difficulty to get the correct diagnosis
- Show how misdiagnosis and late treatment change prognosis, especially in professional athletes' career, even with small pathologies

### TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Hip anatomy, biomechanics and its association with sports b. Epidemiology, clinical aspects and prognosis of athletes' hip disorders, especially in career lifetime and return to practice 2. Case-by-case review, discussion and interpretation of the main pathologies of athlete's hip in different imaging methods (x-ray, ultrasound, computed tomography and magnetic resonance imaging) and compartmentalization a. bone and joints b. cartilage c. myotendinous 3. Conclusion and "take-home messages"

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

MKEE-61

## GETTING IT RIGHT WHEN TAKING A STANCE: HOW TO DIFFERENTIATE INFECTIONS FROM SPINAL TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lislie G. Santin, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Renan D. Lederer, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto P. Bambirra, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Examine the main differential diagnoses of infectious and tumorous lesions in the spine and paravertebral structures, and the benefits of MRI in studying them; Identify key MRI findings for infections vs. tumors in the spine; Develop a systematic MRI interpretation for accurate diagnosis of spine tumor vs. infectious lesions.

### TABLE OF CONTENTS/OUTLINE

The variety of causes in spinal lesions poses a diagnostic challenge. Radiologists must distinguish between manifestations of infections and tumors in spine imaging. This study provides an overview of these conditions, presents relevant images, and outlines MRI evaluation strategies to differentiate between infectious and tumor-related findings.Patients with spinal lesions commonly exhibit nonspecific symptoms like back pain and neurological deficits. In these cases, careful radiological interpretation is crucial to differentiate between spine infections and tumors, with MRI being the preferred modality.In most infection cases, MRI typically reveals vertebral endplate destruction, disc and bone marrow signal abnormalities, and epidural or paravertebral abscesses. Among infectious causes, spondylodiscitis and tuberculosis are common. Neoplastic causes include primary tumors like osteosarcoma and Ewing's sarcoma, and metastatic diseases. Overall, radiologists need to understand the main tumor and infectious spine diagnoses, and employ a systematic MRI interpretation for accurate diagnosis.

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# Abstract Archives of the RSNA, 2024

MKEE-62

## TODAY'S PRACTICE, TOMORROW'S PATIENTS: GENETIC MUSCULOSKELETAL DISEASES WORTH OUR ATTENTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Ehsan Alipour, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Jie C. Nguyen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Sara Janos, MD (*Abstract Co-Author*) Nothing to Disclose
Murat Alp Oztek, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Yaya (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the pathophysiology and clinical findings of genetic musculoskeletal disorders Describe the typical musculoskeletal imaging findings of each genetic disorder Discuss the differential diagnosis and associated systemic imaging findings of each genetic disorder

### TABLE OF CONTENTS/OUTLINE

Many genetic disorders involve the musculoskeletal (MSK) system and have typical imaging features, but radiologists have difficulty interpreting them due to their rarity. Therefore, it is important that radiologists be familiar with these genetic disorders and their typical imaging appearances to accurately aid in diagnosis and proper management. We will discuss different genetic disorders affecting the MSK system with their imaging appearances. We will explore imaging findings of each disorder and discuss how imaging aids in correct diagnosis. In this exhibit, weIn this exhibit, we will also review the clinical manifestations and associated systemic imaging findings. The focus of our work is the typical imaging appearance of: A to Z Achondroplasia Blount’s disease Caudal regression syndrome Cleidocranial dysplasia Congenital insensitivity to pain and anhidrosis Congenital Tibial Hemimelia Diaphyseal dysplasia (Camurati-Engelmann disease) Fibrodysplasia ossificans progressiva Gaucher’s disease Hereditary multiple osteochondromas Limb-girdle muscular dystrophy Madelung's deformities Mucolipidosis Mucopolysaccharidosis: Hurler syndrome (I), Hunter’s syndrome (II), Morquio’s syndrome (IV) Multiple epiphyseal dysplasias Nail patella syndrome Osteogenesis imperfecta Osteopetrosis Lipid granulomatosis Primary hypertrophic osteoarthropathy Proteus syndrome Syndactyly and polydactyly

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# Abstract Archives of the RSNA, 2024

MKEE-63

## HEREDITARY MULTIPLE EXOSTOSES: REVISITING AN OLD FRIEND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sara Gomez Pena, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia Lon, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Lopez Herrero, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Crespo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria J. Moreno Casado (*Abstract Co-Author*) Nothing to Disclose
Alvaro Rueda-de-Eusebio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the clinical presentation and pathogenesis of Hereditary Multiple Exostoses (HME). - To describe the classic imaging findings of HME, specially conventional radiography and skeletal surveys for its diagnosis and follow-up. -To highlight the role of CT and MRI for the better characterization of lesions and complications. - To learn about the main complications and deformities associated with HME, with special focus on malignant transformation. It is important that radiologists know this disease and its follow-up protocol in order to identify cases with a high risk of malignant transformation.

### TABLE OF CONTENTS/OUTLINE

Background: HME presents as multiple osteochondromas (OC) arising from metaphyses of long and flat bones. Clinical presentation: lesions may be asymptomatic, but they may also cause pain or other symptoms. Deformities and chondrosarcomatous transformation can also occur. Pathogenesis and histopathology Imaging Features: OC may vary in shape and distribution. Cases are usually studied and followed up with skeletal surveys. In some patients, MRI and CT are necessary to further characterize suspicious lesions. US is important in pediatric cases. Complications: --Osseous deformities In recent years, new classifications have been published, such as the Masada and Jo classification for forearm deformities or the Ahn classification for ankle deformities. Synostosis of kissing OC, fracture of an OC, other deformities, vascular and neural complcations and formation of bursas can also occur. --Malignant transformation is less frequent but is the most dangerous complication. Ų We will use representative images from the series of our Sarcoma Reference Center, with more than 35 cases.

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# Abstract Archives of the RSNA, 2024

MKEE-64

## PICTORIAL REVIEW OF CORRELATION BETWEEN MRI AND ARTHROSCOPIC FINDINGS OF KNEE JOINT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Han-Ying Lin, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. There exists a robust correlation between MRI and arthroscopic evaluations in diagnosing cruciate ligament pathology.2. There is suboptimal correlation observed for meniscal pathology, particularly for ramp lesion, which may present very subtle abnormalities on MRI.3. For cartilaginous pathology, a strong correlation exists between pre-operative MR and arthroscopy. However, the post-operative appearance of cartilage on MRI varies depending on the type of procedure performed and the duration of follow-up.4. For acute traumatic injuries involving the lateral collateral ligament and posterolateral corner, there exists a strong correlation. However, in cases of chronic injury, MRI findings may present subtle manifestations, posing challenges for accurate diagnosis, and reliance on physical examination and intraoperative observations becomes pivotal for accurate assessment and management. 5. There is strong correlation between MRI and arthroscopy for inflammatory process such as gout and pigmented villonodular synovitis (PVNS).

### TABLE OF CONTENTS/OUTLINE

1. Correlation for ACL, cyclops lesion, and meniscal tear2. Correlation for PCL, LCL, posterolateral corner injury3. Cartilage pathology undergoing various types of procedures, with follow-up images4. Inflammatory condition: gouty arthritis, PVNS.

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# Abstract Archives of the RSNA, 2024

MKEE-65

## TUBERCULOSIS IN MOTION: A RADIOLOGICAL VIEW OF THE MUSCULOSKELETAL TISSUES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alberto P. Bambirra, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo Henrique D. Toranzo, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Tuberculosis (TB) is a widespread public health problem. Musculoskeletal TB accounts for 25% of extrapulmonary cases and has a wide variety of imaging manifestations. Therefore, the aim of this exhibit is to:Present the main forms of musculoskeletal tuberculosis involvement.Review the main imaging findings from the different types of musculoskeletal TB, including both axial and extra-axial involvement.Demonstrate the main differential diagnoses of each type of musculoskeletal TB and ways to differentiate both conditions.

### TABLE OF CONTENTS/OUTLINE

Introduction: the importance of identifying the main imaging findings from musculoskeletal TB.Main imaging findings from different types of musculoskeletal TB: Axial involvement: spondylodiscitis; tuberculous spinal meningitis; sacroiliac joints; the chest wall; Extra-axial involvement: peripheral arthritis; osteomyelitis; tenosynovitis and bursitis; myositis; Disseminated tuberculosis.Main differential diagnoses and their radiographic features: Infectious diseases ; Rheumatologic conditions ; Malignancy. Conclusion and take-home messages.

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# Abstract Archives of the RSNA, 2024

MKEE-66

## IMAGING OF MUSCULOSKELETAL INFECTIONS: KEY IMAGING FINDINGS AND DIFFERENTIAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren L. Pinto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Imaging is crucial in identifying key findings of musculoskeletal infections, assessing their extension, complications, and facilitating differential diagnoses. The purpose of this exhibit is to: elucidate the role of imaging modalities in diagnosing musculoskeletal infections, highlight key imaging findings that distinguish various types and stages of infection and facilitate differential diagnosis by illustrating and comparing infectious processes with other non-infectious conditions.

### TABLE OF CONTENTS/OUTLINE

Epidemiology and Classification of Infections: overview and categorization of musculoskeletal infections.Imaging Modalities: Advantages and Disadvantages. Comparative analysis of X-ray, ultrasound, CT, and MRI.Key Imaging Findings: features such as increased soft tissue, fluid collections, gas formation, periostitis, bone edema, intramedullary fat globules, bone destruction, sequestra, cloaca, and involucrum.Complications: issues including deep infection extension, collections, thrombophlebitis, delayed or nonunion in fractures, joint ankylosis, subchondral fractures, and osteonecrosis.Differential Diagnosis: differentiating musculoskeletal infections from inflammatory, microcrystalline diseases, traumatic, and neoplastic disorders.

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# Abstract Archives of the RSNA, 2024

MKEE-67

## SOLID STEPS: EXPLORING FOOT AND ANKLE INJURIES, A PICTORICAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karina I. Holguin Andrade, MD (*Abstract Co-Author*) Nothing to Disclose
Yeni Fernandez de Lara Barrera, MD (*Abstract Co-Author*) Nothing to Disclose
Maria M. Salazar Osorio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To review the most frequent pathologies and their diagnosis using multiple imaging techniques.• To discuss the common and not so common presentations of foot and ankle pathologies through real cases.• Highlight the characteristic clinical signs of each type of injury

### TABLE OF CONTENTS/OUTLINE

IntroductionImaging techniques and their advantagesMain indicationsClinical findings and characteristic or unusual features of each presentation.Clinical casesConclusions

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# Abstract Archives of the RSNA, 2024

MKEE-68

## NO MORE PAIN: A GUIDE FOR LUMBAR SPINE TRANSFORAMINAL AND INTERLAMINAR PROCEDURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Eduardo N. Kihara Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo P. Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Kairos Chi, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Niels Vinicius Padua Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Enzo Calheiros, MD (*Abstract Co-Author*) Nothing to Disclose
Afranio D. Teixeira Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Hernane A. Holzmann, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This exhibit aims to: review intervention musculoskeletal procedures for low back pain relief in acute and outpatient settings, with emphasis on epidural injections; show a guide for patient interview; highlight the crucial aspects of pre-procedural planning; offer a step-by-step guide for performing both interlaminar and transforaminal lumbar spine infiltrations, discussing technique and possible challenges and complications; provide practical tips, tricks and self-assessment tools; discuss patient outcome and follow-up post procedure; briefly discuss other pain relief procedures in the lumbar spine, as well as future directions.

### TABLE OF CONTENTS/OUTLINE

Introduction to lumbar spine procedures in low back painBrief review of anatomy and physiopathology related to low back pain/Evidence-based discussion on indications and contraindication, emphasizing epidural infiltrations/Patient interview best practicesPre procedural planningPatient workup and expectations/Required imaging studies, procedure decision and planning/Preparation of materials, medications, contrast media, radiation dose discussionStep-by-step lumbar spine infiltration guide: interlaminar and transforaminal techniquesProcedure day preparation/Safety measures and sterile technique/Needle placement and localization, contrast and medication injectionPost procedure care/Case discussion and practical insights: cases of success, challenging cases, complications, tips and tricks and continuous medical education/Take-home points

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# Abstract Archives of the RSNA, 2024

MKEE-69

## DON'T FORGET POSTERIOR SHOULDER INSTABILITY, LEARN MORE ABOUT IT: MRI FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karly Cristhelly Garrido Estrella, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Eugenio Cosme, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Arizaga, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela L. Mendieta Rodriguez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To illustrate the relevant anatomy of the shoulder• To describe the biomechanism by which posterior shoulder instability occurs• To list the main etiologies of posterior shoulder instability• To review the role and importance of Magnetic Resonance Imaging (MRI) in the diagnosis of posterior instability• To explain step by step each of the associated lesions and their characteristics in the MRI showing images of the pathology.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Relevant shoulder anatomy3. Biomechanics of posterior shoulder instability4. Etiological factors5. MRI (Magnetic Resonance Imaging) diagnosis and importance of Magnetic Resonance Arthrography6. Associated lesions: Reverse Hill-Sachs injury (McLaughlin injury), reverse Bankart lesion, reverse Perthes lesion, POLPSA (posterior labrocapsular periosteal sleeve avulsion injury), posterior GLAD injury (glenolabral articular disruption), reverse HAGL lesion (reverse humeral avulsion of the glenohumeral ligament) or RHAGL injuries, Kim lesion, Bennett lesion.7. Conclusions8. References.

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# Abstract Archives of the RSNA, 2024

MKEE-7

## UNVEILING ASYMMETRY: DYNAMIC INTERSECTIONS AND FIBER ORIENTATION SHIFTS IN THE RADIOULNAR LIGAMENTS OF THE TRIANGULAR FIBROCARTILAGE COMPLEX

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Hiroshi Yoshioka, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Keiichi Akita, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasuyuki Kurihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Abstract Co-Author*) Nothing to Disclose
Akimoto Nimura (*Abstract Co-Author*) Nothing to Disclose
Saya Horiuchi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Explore the nuanced anatomy of the radioulnar ligaments in the Triangular Fibrocartilage Complex (TFCC) through our study, which includes cadaver dissections, histology, and MRI findings. We will question the conventional notion of ligament symmetry, presenting variations in fiber orientation from their origin to insertion. Additionally, we'll examine how these ligaments cross, their importance for joint stability and motion, and present our new concept, supported by comprehensive evidence, potentially influencing clinical and radiological perspectives on the TFCC.

### TABLE OF CONTENTS/OUTLINE

1) Reevaluating the conventional view of the radioulnar ligaments' symmetry in the TFCC. 2) Mapping the gradations in fiber orientation from the proximal ends to the distal attachments in the ligament's pathway. 3) Highlighting the complex interweaving of the radioulnar ligaments, potentially influencing joint stability and dexterity. 4) Considering the practical implications of these anatomical insights for improving clinical approaches and radiological evaluations of the TFCC.

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# Abstract Archives of the RSNA, 2024

MKEE-70

## HOLDING YOUR BACK: PARAVERTEBRAL LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paola C. Kuenzer Goes, MD (*Abstract Co-Author*) Nothing to Disclose
Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Lucas K. Miyahara, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Kazunori Tsuji, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The paravertebral region is a complex anatomical structure located adjacent to the spine, providing it with stability, range of movement, vascular supply, containing the proximal portion of the nerves and the sympathetic chain/paravertebral ganglia. Paravertebral lesions can be tumoral or not, and may be primary, arising from any of the paravertebral components, or secondary, by invasion from adjacent structures or hematogenic/lymphatic dissemination. The purpose of this exhibit is to: 1. Review the paravertebral region, its anatomy, components, from the cervical to the sacral spine, and the relations between them. 2. Identify and classify the paravertebral lesions, illustrating the patterns of paravertebral lesions and the related etiology. 3. Highlight the main information that radiologists should include when reporting paravertebral lesions.

### TABLE OF CONTENTS/OUTLINE

Introduction: General review of the normal paravertebral region and particularities from each segment (cervical, thoracic, lumbar and sacral). Differential diagnostic of paravertebral lesions and their general characteristics. Assessment of each imaging modality suitability in evaluating the paravertebral region. Tumoral lesions: Classifying the main groups of tumors, primary and secondary. Illustrating the tumoral lesions and their main imaging findings, and when adequate specific patterns of a tumor or a group. Non-tumoral lesions: Classifying the non-tumoral lesions by etiology. Illustrating their main imaging findings. Summary Table with the main lesions and their imaging aspects. Main information that should be included in the radiological report. Bibliographical references.

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# Abstract Archives of the RSNA, 2024

MKEE-71

## OSTEITIS FIBROSA CYSTICA: BONE INVOLVEMENT OF HYPERPARATHYROIDISM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcio A. Ishida, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz T. Nehme, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno B. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda T. Sato, MD (*Abstract Co-Author*) Nothing to Disclose
Raifran Neto (*Abstract Co-Author*) Nothing to Disclose
Andre Mannato, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Il Jun Yoo, MD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Silveira Moreira Novaes, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the different causes of hyperparathyroidismHighlight osseous involvement and its radiological findingsImprove the diagnostic approach by correlating multimodality imaging and clinical findings

### TABLE OF CONTENTS/OUTLINE

Introduction Illustrate the relationship between osteitis fibrosa cystica and hyperparathyroidism Different causes of hyperparathyroidismReview its epidemiology and how to make the diagnosisMost affected bone locations and their radiological aspectsDifferential diagnosis with other osteolytic lesionsTreatmentTake home message

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# Abstract Archives of the RSNA, 2024

MKEE-72

## ADDUCTOR MUSCLE COMPLEX SPORT INJURIES. WHAT, HOW, WHY AND WHERE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Augusto Napoli, MD (*Abstract Co-Author*) Nothing to Disclose
Micaela A. Rabino, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ricardo H. Trueba, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro A. Mazza, MD (*Abstract Co-Author*) Nothing to Disclose
Cecilia M. Velez, MEd (*Abstract Co-Author*) Nothing to Disclose
Ricardo Cobenas, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Cedola, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo A. Eivers (*Abstract Co-Author*) Nothing to Disclose
Maria F. Neville, MEd (*Abstract Co-Author*) Nothing to Disclose
Tomas A. Pascual, MD (*Abstract Co-Author*) Nothing to Disclose
Agustin M. Marrero SR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To know the anatomy, function, and biodynamic aspects of the adductor muscle complex. To recognize the spectrum of tearing of adductor muscles and tendons during sports practice analyzing their mechanism of injury. To evaluate the imaging methods in the different adductor lesions and to describe the precise location and characteristics. To describe ultrasound and magnetic resonance signs of these tears, emphasizing the prognostic criteria for recovery, return to play, and re-injury.

### TABLE OF CONTENTS/OUTLINE

The adductor complex muscles consist of adductor longus, adductor brevis, adductor magnus, gracilis and pectineus muscles. Its main function is to bring the leg towards the midline of the body, and they also influence during high-speed directional changes. This muscle group is the second group most likely to be injured in sports with eccentric loads, particularly soccer. Adductor longus is the most superficial and originates from the anterior sector of the pubis and it inserts distally into the medial lip of the femur.The injuries of adductor muscle group were included in the category that causes of groin pain, being the adductor longus the most affected at the level of proximal insertion or at the myotendinous junction.Adductor longus proximal and central myotendinous junction injuries and proximal tendon injuries result in a large amount of time away from sports and a high risk of re-injury. Depending on its extent and location, we can estimate the evolution of injuries and the return to play.Adductor brevis and adductor magnus muscle injuries are less common than those of adductor longus. Adductor magnus, gracilis and pectineus muscle injuries are rare and uncommon.

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# Abstract Archives of the RSNA, 2024

MKEE-73

## *"BAD TO THE BONE"*: A GUIDE FOR THE CHALLENGING DIAGNOSIS OF CHRONIC NONBACTERIAL OSTEOMYELITIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Barros Mendonca Figueiredo (*Abstract Co-Author*) Nothing to Disclose
CINTIA LEAL (*Abstract Co-Author*) Nothing to Disclose
Artur Da Rocha Correa Fernandes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Franchi De Santi, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie Basilio Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia dos Reis Morimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia E. Lobato, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Hayama, MD (*Abstract Co-Author*) Nothing to Disclose
Thayssa Leite, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:1. To review pathophysiology, epidemiology and natural history of Chronic Nonbacterial Osteomyelitis (CNO), emphasizing the key factors important for the radiologist to understand. 2. To correlate its natural history with imaging findings using a multimodal approach (including CR, CT, MRI and whole body exams). 3. To illustrate the presentations and specific findings of CNO and its differential diagnosis through didactic cases.

### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline:1. Introduction and overview of Chronic Nonbacterial Osteomyelitis (CNO), including clinical assessment. 2. Didactic demonstration of radiograph, CT and MRI findings of the disease, along with the imaging protocol and the role of whole-body MRI in a multidisciplinary approach among imaging methods.3. Proposal of a guidebook for the main imaging findings and how to report them, aiding the pediatricians in determining the correct diagnosis and narrowing down the list of differential diagnosis. 4. Differential diagnosis, including bacterial osteomyelitis, juvenile idiopathic arthritis (JIA), Erdheim-Chester disease, bone tumors, hematologic malignancies, Paget's disease and Sweet syndrome. 5. Treatment and Prognosis. 6. Summary.

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# Abstract Archives of the RSNA, 2024

MKEE-74

## SAGITTAL SPINOPELVIC BALANCE: A COMPREHENSIVE REVIEW FOR PREOPERATIVE RADIOGRAPHIC ASSESSMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Michael Tay, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Garza-Gongora, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Roberts, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Alignment of the spine and pelvis in the sagittal plane has a significant impact on patient morbidity. Problems in alignment and balance lead to compensatory maneuvers, such as knee bending and cervical hyperlordosis, which have been shown to reduce quality of life. In the evaluation of an adult panoramic lateral radiograph of the spine, specific sagittal parameters should be reported, as these have clinical implications and direct surgical management. Examples of important parameters to report include: global lumbar lordosis (LL), pelvic incidence (PI), pelvic tilt (PT), PI-LL mismatch, and sagittal vertical axis (SVA).

### TABLE OF CONTENTS/OUTLINE

Intro Upright poster maintenance. Regional shapes Segmental: Pelvic (Rigid), Lumbar (Flexible intercalary), Thoracic (Semirigid), Cervical (Flexible intercalary). Balancing: Spinopelvic haromony, suprajacent balancing, intersegmental balancing, global balancing. Surgical management and case review.

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# Abstract Archives of the RSNA, 2024

MKEE-75

## GET YOUR KICKS ON LUMBOSACRAL PLEXUS ROUTE 66: THE MAIN NERVE PATHS ON MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Irline Cordeiro de Macedo Pontes, MD (*Abstract Co-Author*) Nothing to Disclose
Lislie G. Santin, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo B. Zukovski, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Anderson Phelipe Dias Sabry Azar, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Viana Dos Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique A. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Rocha, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto P. Bambirra, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Vasconcelos, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Nogueira, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Fujiki, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Morato Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Artemis D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Renan D. Lederer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To demonstrate the normal MRI anatomy and the main pathologies involving the lumbosacral plexus;- To review and demonstrate the MRI protocols for better assessment of the lumbosacral plexus;- To understand the main function of each trunk and nerve, as well the clinical features of its involvement, correlating it to the image findings.

### TABLE OF CONTENTS/OUTLINE

- Understanding the lumbosacral plexus anatomy and function is necessary to a precise diagnosis. Common causes of plexopathy are tumors, post-operative related pathologies, compressive syndromes, trauma, inflammatory and infectious diseases.- Review and demonstrate normal anatomy, anatomic variants and MRI protocols to assess the lumbosacral plexus; to describe the main pathologies involving the lumbosacral plexus. - Perform a literature review and pictorial essay.

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# Abstract Archives of the RSNA, 2024

MKEE-76

## DECODING THE ENIGMA: UNRAVELING MULTIMODALITY IMAGING ARTIFACTS IN MUSCOLOSKELETAL RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Carolina Villela, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is: 1) To recognize the most common artifacts in different image modalities (MRI, CT, ultrasonography and radiography). 2) To discuss the mechanisms for the formations of artifacts and how to reduce their occurrence. 3) To understand the consequences of misinterpreting artifacts as pathologies using real cases and how to overcome them.

### TABLE OF CONTENTS/OUTLINE

1) Most common artifacts in musculoskeletal radiology: A) MRI: Magnetic susceptibility; Dielectric effect; Motion; Flow; Aliasing; Gibbs ringing effect; Zipper; Reconstruction; Signal loss; Lipid suppression; Dark shading; Cross-talk; Signal-to-noise ratio; Moiré fringes; Inhomogeneity. B) CT: Motion; Beam hardening; Photon starvation; Truncation; Metallic Materials; Tube arcing; Windmill; Cone beam effect. C) Ultrasonography: Focal Zone; Posterior Enhancement; Acoustic Shadowing; Reverberation; Mirror Image; Anisotropy; Refractile shadowing; Range Ambiguity. D) Radiography: Motion; Black lightning marks; Clear spots; Ghosting; Stitching; Dead pixels; Radiopaque external objects; Image compositing; Grid cut-off; Parallax effect; Midgray clipping; Backscatter.2) Mechanisms of artifacts formation on MRI, CT, ultrasonography and radiography.3) How to reduce the occurrence of artifacts in each modality.4) Consequences of misinterpreting artifacts as pathologies and how they were overcome using real cases.

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# Abstract Archives of the RSNA, 2024

MKEE-77

## OVERUSE INJURIES IN PEDIATRIC SPORTS MEDICINE: FROM COMMON TO RARE CASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. Batista Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Thais S. Kuwazuru, MD (*Abstract Co-Author*) Nothing to Disclose
Denise T. Amaral (*Abstract Co-Author*) Nothing to Disclose
Eduardo L. Bizetto, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Viviane S. Yamachira (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The participation of children and adolescents in sporting activities brings a series of physical and psychosocial benefits. Imbalances between training load and recovery, however, can make this interaction harmful, leading to cumulative microtrauma in bones, muscles, tendons and growth plates. With the popularity of youth sports programs, overuse injuries are increasingly common. The types and mechanisms of these lesions, as well as the peculiarities of the musculoskeletal system in the pediatric age group, are important information for the radiologist who works with young athletes. In this work, we propose to carry out a detailed review of overuse injuries, paying special attention to atypical presentations that have appeared in our service.

### TABLE OF CONTENTS/OUTLINE

1) Introduction. 2) Particularities of the musculoskeletal system in children, with focus on apophysis. 3) Imaging characteristics of overuse injuries, mechanisms of occurrence and associated sports. 4) Atypical presentations of overuse injuries and when to raise suspicion. 5) Challenges, pearls and pitfalls: normal anatomical variants and other mimics of lesions. 6) Take home messages.

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# Abstract Archives of the RSNA, 2024

MKEE-78

## CHORDOMAS: A COMPREHENSIVE OVERVIEW OF IMAGING FEATURES AND DIFFERENTIAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

MAURICIO PEDREIRA (*Abstract Co-Author*) Nothing to Disclose
Marcio A. Ishida, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno B. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Silveira Moreira Novaes, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz T. Nehme, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Mannato, MD (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the imaging features of the chordoma and its epidemiology trough their respective topographies- Review the main differential diagnosis of chordomas

### TABLE OF CONTENTS/OUTLINE

- Introduction:Main characteristics Imaging features- Specific Chordomas: Sacral chordoma Clival chordoma Vertebral chordoma- Differential diagnosis: Chodrosarcoma Metastasis Plasmacytoma Giant cell tumor Lymphoma Craniopharyngioma Invasive macroadenoma Spondylodiscitis- Conclusion

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# Abstract Archives of the RSNA, 2024

MKEE-79

## PRIMARY OSSEOUS TUMORS OF THE SPINE: TIPS FOR DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Oscar M. Navarro, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Restrepo, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Emilio Inarejos Clemente, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe the use of conventional techniques and multiparametric MRI for diagnosis and follow-up in primary spinal tumors.Describe the most common benign and malignant primary osseous spinal tumors.Discuss the most common imaging findings of primary osseous spinal tumors with corresponding surgical and gross pathology findings. Interpret multiparametric MR imaging in patients with malignant unresectable tumors.

### TABLE OF CONTENTS/OUTLINE

1. Clinical findings and demographics of benign and malignant primary spinal tumors.2. Benign tumors: Hemangioma, osteochondroma, osteoblastoma, osteoid osteoma, unicameral and aneurysmal bone cyst. Malignant tumors: Ewing sarcoma, osteosarcoma, chondrosarcoma, hemangioendothelioma, Langerhans cell histiocytosis.3. Imaging techniques in the study of spinal tumors, emphasizing on the role of multiparametric MRI and PET-MR for diagnosis and follow-up (DWI, perfusion, dynamic contrast studies, 3D volume reconstruction, 3D printing models).4. Imaging findings of spinal tumors, with illustrative examples with clinical, surgical and histopathological correlation.5. Use of functional MRI and nuclear medicine in treatment response assessment with illustrative examples.6. Imaging follow-up after tumor resection. Appropriate MR sequences for the evaluation of prostheses and metal artifacts.

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# Abstract Archives of the RSNA, 2024

MKEE-8

## ADVANCED MR IMAGING TECHNIQUES FOR THE ASSESSMENT OF METASTATIC BONE MARROW LESIONS: WHAT DOES THE RADIOLOGIST NEED TO KNOW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Anwar R. Padhani, MBBS, FRCR (*Abstract Co-Author*) Advisory Board, Siemens AG;Speakers Bureau, Siemens AG;Advisory Board, Lucida Medical Ltd;Stockholder, Lucida Medical Ltd
Khaoula Bessame, MD, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Multiparametric Whole body MRI (WB-MRI) provides both morphological and functional (disease activity) information, with higher specificity and sensitivity for assessment of metastatic bone marrow disease (MBMD) compared with CT.- CT only provides morphological information (lytic, sclerotic or mixed MBMD).- Functional WB-MRI includes marrow fat fraction (F%) calculated using the Dixon sequence, high b-value DWI, and ADC images.- High specificity criteria for active MBMD using functional WB-MRI include (all must be present): morphological criteria (>5mm in size measured on F% image), high signal intensity on DWI (tumour: background SI ratio >4), ADC value 650-1300, and low F% (<20%).- False positives on high b-value DW images include fractures, infection, and treated tumor due to T2 shine-through.- Background dense sclerosis falsely elevates lesion F%.-Always correlate focal high b-value signal intensity bone marrow lesions with morphology, ADC and Dixon images.- WB-MRI protocol also incorporates STAR-VIBE, an artificial intelligence-generated adjunctive sequence providing CT-like images.-STAR-VIBE matches mineralization on CT, enabling assessment of bone integrity and fracture detection. Additionally, it can delineate fibrous tissue, such as joint capsules.

### TABLE OF CONTENTS/OUTLINE

- Schematic approach for bone marrow assessment using functional WB-MRI.- Seven MBMD patterns and likely morphological and functional WB-MRI findings.- Algorithmic approach for MBMD.- Application of the algorithmic approach on 10 cases from our institution using a question and answer approach, with learning points from both clinical and radiological perspectives.- Disease mimics.- Take home messages.

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# Abstract Archives of the RSNA, 2024

MKEE-80

## OSTEOMALACIA: IMAGING FINDINGS AND DIFFERENTIAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karina Hayama, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Franchi De Santi, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Thayssa Leite, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Barros Mendonca Figueiredo (*Abstract Co-Author*) Nothing to Disclose
CINTIA LEAL (*Abstract Co-Author*) Nothing to Disclose
Leticia E. Lobato, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To Review the pathophysiology of osteomalacia.2. To Discuss the causes of osteomalacia and its differential diagnosis.3. To explore risk factors, epidemiology, clinical manifestations, and diagnostic methods.4. To discuss the most common imaging findings of osteomalacia, including Looser zones/pseudofractures, using a multimodal imaging approach.

### TABLE OF CONTENTS/OUTLINE

1 - Osteomalacia: pathophysiology, causes , risk factors and epidemiology, clinical manifestations and diagnosis.2 - Looser zones/ pseudofractures3- Principle imaging findings of osteomalacia. 4- Differential diagnosis with other conditions involving the spine and pelvic, such as neoplasms, inflammatory arthropathies, degenerative changes, enteropathic arthropathies, among others.

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# Abstract Archives of the RSNA, 2024

MKEE-81

## IMAGING OF SPORTS-RELATED SOFT-TISSUE INJURIES IN THE HAND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carmelo Messina, MD (*Abstract Co-Author*) Nothing to Disclose
Domenico Albano (*Abstract Co-Author*) Nothing to Disclose
Stefano Fusco, MD (*Abstract Co-Author*) Nothing to Disclose
Luca Maria Sconfienza, MD, PhD (*Abstract Co-Author*) Travel support, Bracco Group;Travel support, Esaote SpA;Speakers Bureau, Esaote SpA;Travel support, ABIOGEN PHARMA SpA;Speakers Bureau, P&R Holding;Speakers Bureau, Pfizer Inc ;Speaker, Novartis AG;Speaker, Merck KGaA;Speaker, MSDF
Francesca Serpi, MD (*Abstract Co-Author*) Nothing to Disclose
Salvatore Gitto, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Soft-tissue injuries of the thumb and fingers are frequently encountered in athletes and result from several mechanisms of trauma, which are often sports-specific. They include collateral ligament and palmar plate injuries, closed tendon tears, and tendon instability conditions resulting from pulley or sagittal band rupture.- The severity of hand soft-tissue injuries varies widely, requiring from conservative to surgical treatment. Timely diagnosis is crucial to offer optimal clinical management and avoid long-term complications and loss of function.- The role of imaging is to guide treatment by accurately identifying the type of lesion, its location and severity. Radiologists should be able to recognize a wide variety of sports-related hand injury patterns on radiographs, ultrasound, and MRI. All essential information should be reported to the orthopedic surgeon, including proper injury classification and associated findings, such as fractures and joint dislocation.

### TABLE OF CONTENTS/OUTLINE

1. Collateral ligament and palmar plate injuries1.1. Ulnar collateral ligament of the thumb metacarpophalangeal joint1.2. Other collateral ligaments1.3. Palmar plate2. Closed tendon tears2.1. Lateral slips of the extensor tendon (Mallet finger)2.2. Central slip of the extensor tendon (Boutonniere deformity)2.3. Flexor digitorum profundus tendon (Jersey finger)3. Tendon instability3.1. Annular pulley rupture (Climber’s finger)3.2. Sagittal band rupture (Boxer’s knuckle)4. Implications for clinical management4.1. Essential information needed by the orthopedic surgeon4.2. Focus on injuries requiring surgery with surgical correlation

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# Abstract Archives of the RSNA, 2024

MKEE-82

## HOW TO BE A BLOODHOUND: A RADIOLOGIST'S GUIDE TO HEMATOLOGIC MALIGNANCIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Da Eul Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Gong Yong Jin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Byeong-Kwon Shin, MD, BS (*Abstract Co-Author*) Nothing to Disclose
Jae Sung Yun (*Abstract Co-Author*) Nothing to Disclose
Eun Hae Park, MD (*Abstract Co-Author*) Nothing to Disclose
Min Jee Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Yeeun Lee, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

By this presentation, radiologists will explore key strategies for identifying and interpreting imaging findings associated with various hematologic malignancies. From recognizing subtle abnormalities to understanding the importance of specific imaging modalities, this presentation helps radiologists with the knowledge needed to effectively contribute to the diagnosis and management of these complex diseases.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Hematologic Malignancies 2. Role of Radiologist in Hematologic Disease Diagnosis 3. Imaging Modalities for Hematologic Malignancies 4. Strategies for Bone Marrow Imaging 5. Recognizing Bone Marrow Abnormalities 6. Image findings : Pearl and Pitfalls 7. Advanced Imaging Techniques 8. Future Directions in Radiology for Hematologic Malignancies

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# Abstract Archives of the RSNA, 2024

MKEE-83

## HOW TO BONE UP ON POST-TREATMENT: IMAGING ASPECTS OF BONE TUMORS FOLLOWING TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daisy T. Kase (*Abstract Co-Author*) Nothing to Disclose
Leticia dos Reis Morimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Henrique M. Lederman, MD (*Abstract Co-Author*) Nothing to Disclose
Julio B. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
CARLA MACEDO (*Abstract Co-Author*) Nothing to Disclose
Artur Da Rocha Correa Fernandes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Andre Y. Aihara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcelo d. Petrilli (*Abstract Co-Author*) Nothing to Disclose
CINTIA LEAL (*Abstract Co-Author*) Nothing to Disclose
Thayssa Leite, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is:1.To review indications and treatment options for benign and malignant bone tumors, considering patients' clinical data and prognosis. 2.To illustrate, using didactic cases, the post-treatment imaging characteristics of a variety of bone tumors, including expected post-operative findings, post-chemotherapy and radiotherapy effects, as well as immediate and late complications seen in multimodality images (radiographs, CT scans and MRI). 3.To propose a structured reporting format containing essential information required by physicians for the follow-up care of these patients.

### TABLE OF CONTENTS/OUTLINE

1.Introduction and contextualization of the multidisciplinary approach to post-treatment management of benign and malignant bone tumors. 2.Overview of treatment options for benign and locally aggressive tumors, as well as malignant lesions, such as aneurysmal bone cyst, giant cell tumor, Langerhans cell histiocytosis, Ewing sarcoma, osteosarcoma, chondroblastoma, bone metastasis and others. 3.Discussion and demonstration of expected imaging findings post-surgery and with other treatment modalities, using a multimodal approach (CR, US, CT and MRI). 4.Presentation of didactic cases illustrating the main possible complications of bone tumor treatment, including prosthesis-related complications, infection, tumor recurrence and adverse effects of chemotherapy and radiotherapy. 5.Proposal of a checklist for post-treatment tumor evaluation, outlining key findings that radiologists need to actively seach for during the follow-up of these oncologic patients. 6.Addressing potential prognosis. 7.Summary.

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# Abstract Archives of the RSNA, 2024

MKEE-84

## READING BETWEEN THE SIGNALS: WHO'S THE RED FLAG AND WHO'S THE GREEN FLAG IN SPINAL MARROW SIGNAL CHANGES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gong Yong Jin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yeeun Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Eun Hae Park, MD (*Abstract Co-Author*) Nothing to Disclose
Da Eul Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Sung Yun (*Abstract Co-Author*) Nothing to Disclose
Min Jee Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Byeong-Kwon Shin, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Bone Marrow signal change can be very tricky. This discussion illuminates the nuanced interpretation of spinal marrow signal changes, discerning between red flags indicating potential pathology and green flags representing benign findings. To facilitate interactive learning, the presentation includes carefully selected questions derived from images of diseases that often pose challenges in clinical practice. By comprehending the spectrum of signal alterations and their clinical implications, radiologists can significantly enhance their ability to contribute to precise diagnosis and effective patient management in spinal imaging

### TABLE OF CONTENTS/OUTLINE

1. Introduction of spinal marrow signal 2. Understading MR sequence setting for spinal imaging(T1WI T2WI, T2 fat suppressed image, T1 contrast enhanced image, Coronal image)3. Green flags - Benign signal change(Hemangioma, Schmorl's node, Modic change (type 1 and type 2))4. Red flags - Pathologic marrow signal changes(Trauma, Infectious spondylitis, Malignancy (multiple myeloma and bone metastasis))

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# Abstract Archives of the RSNA, 2024

MKEE-85

## IMAGING ASSESSMENT OF RESPONSE IN SOFT TISSUE SARCOMA AFTER NEOADJUVANT RADIOTHERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ryan J. Avery, MD (*Abstract Co-Author*) Research Consultant, Konica Minolta, Inc
Sean Sachdev, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Hermida De Viveiros (*Abstract Co-Author*) Nothing to Disclose
Linda C. Kelahan, MD (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, MSc, PhD (*Abstract Co-Author*) Ther-AI LLC
Laetitia Perronne, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Gorkem Durak, MD (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Hatice Savas, MD (*Abstract Co-Author*) Nothing to Disclose
Seth Pollack, MD (*Abstract Co-Author*) Consultant, Bayer AG;Consultant, Deciphera Pharmaceuticals, LLC;Consultant, Apexigen Inc;Consultant, T-Knife, GmbH;Consultant, Aadi Bioscience, Inc;Consultant, Epizyme, Inc;Consultant, Obsidian;Consultant, Sensei;Consultant, SpringWorks Therapeutics, Inc
Meghana Karri (*Abstract Co-Author*) Nothing to Disclose
Ronen Sumagin (*Abstract Co-Author*) Nothing to Disclose
Amir Borhani, MD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Yuri Velichko, PhD (*Abstract Co-Author*) Nothing to Disclose
Tugce Agirlar Trabzonlu, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica L. Davis, MD (*Abstract Co-Author*) Research Consultant, Bayer AG;Research Consultant, Eli Lilly and Company
Mariam Goreish (*Abstract Co-Author*) Nothing to Disclose
Nicolo Gennaro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Effective management of Soft Tissue Sarcoma (STS) relies on a robust multidisciplinary collaborative effort where state-of-the-art imaging plays a pivotal role in both the initial evaluation of the disease and in the estimation of preoperative tumor response.• Neoadjuvant radiotherapy (nRT) has emerged as an effective pre-surgical therapy, reducing local recurrence rates. It has a dual action: potential tumor shrinkage and reduction in viable tumor cells, both of which facilitate surgical intervention and enhance the local tumor control.• STS demonstrate varying responses to nRT, largely dependent on their histological subtypes. For example, myxoid liposarcomas typically exhibit significant shrinkage following nRT, whereas other subtypes like undifferentiated pleomorphic sarcomas often show a notable increase in tumor size due to treatment-related phenomena.

### TABLE OF CONTENTS/OUTLINE

Introduction: Significance of Imaging in Preoperative Management of STS.Neoadjuvant Radiotherapy (nRT): Growing Role of nRT as Preoperative Treatment of STS.Pictorial Review of STS Response after nRT: -Impact of Histological Subtype on Response-Examples of Response:• Shrinkage (e.g., Myxoid Liposarcoma, Round Cell STS)• Increase in Size (e.g., Undifferentiated Pleomorphic Sarcoma) - Possible Causes (Necrosis, Hemorrhage)

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# Abstract Archives of the RSNA, 2024

MKEE-86

## PERIPHERAL INVOLVEMENT IN SPONDYLOARTHRITIS: A CASE-BASED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marco de Andrade Bianchi (*Abstract Co-Author*) Nothing to Disclose
Pedro Henrique R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Mauricio Ricardo Moreira da Silva Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Henrique Pierro Carvalhinho (*Abstract Co-Author*) Nothing to Disclose
Artur Da Rocha Correa Fernandes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Breno Trindade (*Abstract Co-Author*) Nothing to Disclose
Jose Claudio N. Junqueira, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Freitas (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Spondyloarthritis are characterized mainly by inflammatory involvement of the spine and sacroiliac joints. However, peripheral musculoskeletal structures are also commonly affected in this group of diseases, either in conjunction with axial skeleton changes or independently, particularly in the early stages. Diagnosing spondyloarthropathies can be challenging and often occurs several years after symptom onset. Understanding the imaging aspects of peripheral musculoskeletal involvement in this disease group is crucial for accurate and early diagnosis, as well as for patient management, reducing the likelihood of potential complications. The purpose of this exhibit is: 1- To discuss relevant aspects of spondyloarthritis, focusing on magnetic resonance imaging findings. 2- To review the pathophysiology of spondyloarthritis and their correlation with musculoskeletal changes in imaging exams. 3- To demonstrate, through magnetic resonance imaging exams and illustrations, the main musculoskeletal alterations in the peripheral involvement of spondyloarthritis. 4- To discuss practical challenges and pitfalls in imaging assessment of spondyloarthritis.

### TABLE OF CONTENTS/OUTLINE

1- General aspects of spondyloarthritis a. Epidemiology b. Pathophysiology c. Diagnostic criteria 2- Imaging findings in spondyloarthritis: a case-based review a. Axial skeleton b. Peripheral involvement 3- Practical challenges and pitfalls in imaging evaluation of spondyloarthritis 4- Final considerations 5- References

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MKEE-87

## ADVANCES IN NAIL EVALUATION: USING ULTRASOUND AND MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos Felippe D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Renata V. Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Jose De Arimateia Batista Araujo Filho (*Abstract Co-Author*) Nothing to Disclose
Luciana C. Zattar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The evaluation of nail disorders has traditionally relied on clinical examination and imaging techniques like X-ray. However, recent advances in medical technology have introduced the use of ultrasound (HFUS) and MRI for a more comprehensive assessment of nail conditions. This educational exhibit aims to explore the benefits and applications of these methods, providing valuable insights for radiologists and clinicians. And also to provide attendees with a comprehensive understanding of the role of HFUS and MRI in nail evaluation, equipping them with the knowledge and skills to effectively utilize these advanced imaging techniques in clinical practice, with:1.Overview of nail anatomy and common nail disorders2.Principles of HFUS and MRI in nail evaluation3.Comparative analysis of HFUS, MRI, and traditional imaging techniques4.Case studies demonstrating the diagnostic utility of HFUS and MRI5.Practical tips for optimizing imaging protocols and interpreting findings6.Future directions and emerging technologies

### TABLE OF CONTENTS/OUTLINE

1.Introduction: Overview of nail anatomy2.Traditional Imaging Techniques: Role and Limitations of conventional imaging modalities3.Principles of HFUS and MRI in Nail Evaluation: Advantages4.Clinical Case Studies: Illustrative cases showcasing the diagnostic capabilities of HFUS and MRI5.Practical ConsiderationsImaging protocols and tips for accurate interpretation Pitfalls and challenges6.Future Perspectives- Emerging technologies/Potential advancements

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# Abstract Archives of the RSNA, 2024

MKEE-88

## OSTEOSARCOMA RECURRENCE: WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marco Bianchi (*Abstract Co-Author*) Nothing to Disclose
Carlos Henrique Pierro Carvalhinho (*Abstract Co-Author*) Nothing to Disclose
Pedro Henrique R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Breno Trindade (*Abstract Co-Author*) Nothing to Disclose
Mauricio Ricardo Moreira da Silva Filho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To promote early detection of osteosarcoma recurrence for an effective treatment. ? - To discuss the role of various imaging techniques (plain radiography, CT, MRI) in identifying recurrent osteosarcoma. ? - To identify key radiological signs of recurrence, such as new bone formation, soft tissue mass, and changes in the size or appearance of the original tumor. ? - To differentiate recurrent osteosarcoma from post-treatment changes and other conditions.- To discuss the role of biopsy and optimal biopsy techniques in ambiguous cases.- To emphasize the importance of an effective communication and a multidisciplinary approach involving radiologists, oncologists, and surgeons, for optimal patient management.

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION: A. A brief overview of osteosarcoma B. A brief overview of the imaging techniques and optimal imaging acquisition and post-processing parameters to detect recurrence. 2. RECOGNIZING SIGNS OF RECURRENCE: Overview of key radiological signs, including new bone formation, an enlarging soft tissue mass, and changes in the size or appearance of the original tumor.3. IDENTIFYING KEY FINDINGS AND DIFERENCIAL DIAGNOSIS: case studies and examples, with emphasis on what to report and what to recommend next to the clinician/ surgeon.4. CONCLUSION: Summary of key points. Future Directions.

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MKEE-89

## SYSTEMATIC APPROACH IN THE DIAGNOSIS OF DESMOID-FIBROMATOSIS TUMOR OF EXTREMITIES WITH CONVENTIONAL AND ADVANCED MRI TECHNIQUES: TIPS AND TRICKS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre C. Valim, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Desmoid fibromatosis (DF) is a locally aggressive rare neoplasm, exhibiting a notable proclivity for recurrence, typically localized in the extremities. Classified as an "intermediate, locally aggressive" tumor, DF often presents diagnostic challenges and is prone to misidentification. It serves as a source of chronic pain, disability, and disfigurement. Given the rarity of this disease, arriving at a diagnosis necessitates a considerable diagnostic acumen. MRI stands as the preferred modality for imaging, thus mandating a systematic approach to effectively differentiate these tumors from malignant soft-tissue counterparts. The DF predisposes it to various complications, including compression and invasion of adjacent structures. Therefore, radiologists must remain cognizant of these potential complications to furnish accurate reports and promptly inform attending physicians for timely management. The propensity for false positive and false negative outcomes underscores the necessity for vigilance among those interpreting DF examinations, attributed to the tumor's high cellular density, as well as mucoid or cystic degeneration. An appreciation of both the capabilities and constraints of MRI techniques is imperative for achieving precise diagnoses and, subsequently, optimal treatment strategies for our patients.

### TABLE OF CONTENTS/OUTLINE

The value of conventional and advanced MRI techniques (DIXON T1, T2*, SWI, DCEperfusion and TIC, DWI) in diagnosis and follow-up of DF. Case discussion to demonstrate the utility of distinguishing these tumors from: Lymphoma, Synoviosarcoma, Ewing sarcoma, High grade pleomorphic sarcoma, Fibrosarcoma, Giant cel Tumor. Common pittfalls.

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# Abstract Archives of the RSNA, 2024

MKEE-9

## WATER DENSITY VALUE EVALUATION METHOD BY MATERIAL DECOMPOSITION ANALYSIS USING DUAL ENERGY CT FOR VERTEBRAL COMPRESSION FRACTURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Masanobu Nishi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.Virtual non-calcium (VNCa) images are water density value images created by two-material decomposition process based on dual energy acquisition using a fast kV switching method.2.We devised a quantitative evaluation method for vertebral compression fractures using the characteristics of water density values of water and calcium or water and hydroxyapatite as the two materials.3.We verified the concordance rate between our quantitative evaluation results and clinical results for 201 cases in which both DECT and MRI examinations were performed for suspected vertebral compression fractures.4.Given the high degree of agreement with clinical findings, we believe that this method can serve as a valuable diagnostic aid

### TABLE OF CONTENTS/OUTLINE

Vertebral compression fractures affect the quality of daily life. Virtual non-Calcium images (VNCa) are derived from dual-energy CT and show water density values by separating water and bone components. In these images reveal edematous changes related to compression fracture. Previous studies have highlighted its diagnostic value. However, the subjective nature of visual evaluations poses challenges in accurate interpretation. To address this, we established a standard water density value and devised a quantitative method to measure deviations in water density for each vertebral body. In this exhibition, we detail the standard and evaluation values for quantitative assessment, along with the evaluation methodology. We then compared these quantitative evaluations with clinical findings, observing a high level of agreement. Our results suggest that this method can effectively aid in distinguishing such findings, enhancing clinical diagnostic accuracy.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

MKEE-90

## NONTRAUMATIC SPINAL CORD COMPRESSION: ESSENTIAL INQUIRY QUESTIONS IN THE EMERGENCY SETTING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose A. Narvaez, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Hernandez Ganan (*Abstract Co-Author*) Nothing to Disclose
Juan Carlos Sardinas (*Abstract Co-Author*) Nothing to Disclose
Ricardo Jose Ponce Silva (*Abstract Co-Author*) Nothing to Disclose
German G. Ratto, MD (*Abstract Co-Author*) Nothing to Disclose
Karina Janeth Gordillo Zabaleta, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- In a non-traumatic setting, acute myelopathy can be caused by compressive or non-compressive factors. These include extramedullary and intramedullary causes. Extramedullary causes can be degenerative (herniated disc), infectious (epidural abscess), vascular (malformations or epidural haematoma), and metastatic. - We would like to draw your attention to metastatic spinal cord compression (MSCC), which is defined as compression of the spinal cord and cauda equina by an extradural tumour mass. It is therefore important to understand and know the anatomy, pathophysiology and updated radiological protocols used to make an accurate diagnosis. The minimum radiological evidence of spinal cord compression is indentation of the theca at the level of the clinical features and displacement or encapsulation of the thecal sac surrounding the spinal cord or cauda equina by spinal epidural metastases (SEM) or locally advanced cancer. - These features are important in determining spinal instability. The Spine Instability Neoplastic Score (SINS) and the Epidural Spinal Cord Compression Scale, also known as the Bilsky Scale, are useful tools for predicting the need for urgent surgery. We will present many clinical cases using these scales.

### TABLE OF CONTENTS/OUTLINE

- Definition of non-traumatic spinal cord compression (SCC) - Radiological anatomy of the spinal cord - Updated protocols for the emergency department - Imaging features on MR and CT - Causes of non-traumatic cord compression (Emphasis on extramedullary metastatic causes): Degenerative, infectious, and metastatic. - SINS and Bilsky classifications and their therapeutic implications: What should theradiologist know?

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# Abstract Archives of the RSNA, 2024

MKEE-91

## GRIP YOUR LEASH WELL: MUSCULOSKELETAL INJURIES TO THE DOG WALKERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Akram Jawed (*Abstract Co-Author*) Nothing to Disclose
Vikas Gupta (*Abstract Co-Author*) Nothing to Disclose
Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Biswajit Borborah, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Dog walkers usually undergo multiple musculoskeletal injuries in the upper and lower limbs including the tendon, ligament other soft tissue injuries as well as bony injuries. Many of these injuries go un noticed as they may be trivial at the time of occurrence. However they present with greater disability in later stages. Early detection by clinical examination and proper imaging will lead to prevention of disabilities. Most of the dog walkers being elderly population, suffer from multiple injuries even with lesser trauma. Common injuries of the joints of the upper limb can be seen in a dog walker due to dog pulling behaviour. The mode of injury can be trips, falls or repetitive strain. Soft tissue sprains, strains and fractures of bones are commonly encountered with most commonly injured parts being fingers and rotator cuff.

### TABLE OF CONTENTS/OUTLINE

Getting familiar with the common mechanisms of injury in dog walkers, both in upper and lower limbs. The hard yank of the leash can cause injuries of the hand that includes ulnar collateral ligament tear, injury to pulley mechanism, tendon tears and bony avulsions of small bones. The pull along the leash and rotation of the arm can lead to rotator cuff tear, medial and lateral epicondylitis.Pulling mechanism by heavy dogs can lead to imbalance in dog walkers and can lead to lower limb injuries including the internal derangement of knee joint and tear of medial and lateral supporting ligaments of the ankle.

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# Abstract Archives of the RSNA, 2024

MKEE-92

## SKIN CANVAS: PORTRAITS OF DIVERSITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Geovana Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo D. Chiovatto, MD (*Abstract Co-Author*) Nothing to Disclose
Vivian Marques (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia D. Zavariz, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Moreli Antonine (*Abstract Co-Author*) Nothing to Disclose
Carolina Carotenuto Ramos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This study aims to characterize the anatomy of the skin and differentiate the main skin types, emphasizing their characteristics in relation to individual lifestyle habits. To achieve this, we analyze variations across different age groups and locations within the same individual, as well as contrasting the characteristics of skin more exposed to the sun with those less exposed, taking into account the use of sunscreen. Moreover, we explore the key findings on prevalent benign and malignant skin lesions, underscoring the critical role of high-frequency ultrasound and its features as vital tools for characterizing these lesions and identifying at-risk populations.This research contributes to a more comprehensive understanding of skin diversity in the population and its relationship with environmental and behavioral factors, as well as helping to better understand the characteristic patterns of skin lesions, facilitating their ultrasound diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Method, significance, and attributes of high-frequency ultrasound in assessing skin anatomy and its lesions. 2. Comparison between histological skin anatomy and the ultrasound features. 3. Various skin types present within a single individual. 4. Sonographic disparities between young skin and with high levels of elastosis due to age/sun exposure. 5. Discrimination of patterns of ultrasound findings between benign and malignant skin lesions 6. Application of Doppler while characterizing dermatological lesions.7. New technologies for dermatological diagnostics: elastography, Contrast-Enhanced Ultrasound (CEUS) and Artificial Intelligence.

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# Abstract Archives of the RSNA, 2024

MKEE-93

## IMAGING FINDINGS IN POSTOPERATIVE PATELLOFEMORAL INSTABILITY: USUAL FINDINGS AND COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luiz T. Nehme, MD (*Abstract Co-Author*) Nothing to Disclose
Giovana G. Mesquita, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia Da Cruz Fagundes, MD (*Abstract Co-Author*) Nothing to Disclose
Adriano Silveira Moreira Novaes, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno C. Carneiro (*Abstract Co-Author*) Nothing to Disclose
Eduardo J. Bronzatto (*Abstract Co-Author*) Nothing to Disclose
Bruno B. Cardoso, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Patellofemoral instability is a multifactorial condition that is related to the presence of clinical and anatomical risk factors. The number of risk factors and the number of dislocation episodes, whether associated with osteochondral injuries or not, determine whether the treatment will be surgical or clinical. In case of surgical treatment, medial patellofemoral ligament reconstruction is the most frequently performed approach, either alone or in combination with other procedures. Malposition of the femoral tunnel, severe trochlear dysplasia, and patella fracture are the main causes of the need for surgical revision in medial patellofemoral ligament reconstruction. Tibial tuberosity osteotomy is frequently performed in conjunction with medial patellofemoral ligament reconstruction to correct an increased TTGT and/or patella alta. As this is a surgery with greater morbidity, it requires a longer return to weight-bearing and physical activity. Complications related to this procedure include fractures, deep vein thrombosis, and overcorrection. In addition, some particularities related to the treatment of pediatric patients should be considered in the surgical approach, such as the placement of the femoral tunnel below the growth plate in medial patellofemoral ligament reconstruction. Tibial tuberosity osteotomy is proscribed in children due to the high risk of growth arrest and/or recurvatum genu. Knowledge of the main surgical procedures and their most frequent complications is essential for correct imaging interpretation.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

MKEE-94

## EXCAVATING BONY DISCOVERIES: A REVIEW OF INCIDENTAL OSSEOUS FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Erwin Ho (*Abstract Co-Author*) Nothing to Disclose
Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Jasmine Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Kasha Chen (*Abstract Co-Author*) Nothing to Disclose
Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review clinical presentation, epidemiology, distribution, imaging appearance, and management of incidental benign osseous findings.

### TABLE OF CONTENTS/OUTLINE

Incidental benign osseous findings are often discovered on non-musculoskeletal (MSK) examinations for non-musculoskeletal pathology. However, despite their benign nature, some osseous findings may change the entire clinical course and warrant additional imaging workup and sometimes even surgical intervention. This exhibit seeks to elucidate a broad range of incidental osseous findings in various imaging modalities, while clinicians work up other non-MSK issues, in a case-based fashion. This exhibit will present cases of incidental benign but clinically significant osseous findings and include avascular necrosis, insufficiency fracture, osteochondroma, fibrous dysplasia, enchondroma, brown tumors, and giant cell tumors. These diseases will be displayed with annotated images across multiple imaging modalities.

# Abstract Archives of the RSNA, 2024

MKEE-95

## IMAGING THE BRACHIAL PLEXUS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Akram Jawed (*Abstract Co-Author*) Nothing to Disclose
Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Vikas Gupta (*Abstract Co-Author*) Nothing to Disclose
Arshpreet Kaur, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Brachial plexus is a complex network of nerves originating from the lower cervical and upper thoracic spinal cord segments. It consists of roots, trunks, divisions, cords, and terminal branches. Familiarize yourself with the spatial relationships and typical branching patterns. • MRI is the preferred modality due to its excellent soft tissue contrast and multiplanar capabilities. • Recognize normal anatomical variants like the presence of an accessory phrenic nerve, anomalous innervation patterns, or variable branching. Differentiate these from pathological findings like traumatic injuries (stretch, compression, laceration), neoplastic involvement (tumors like schwannomas, neurofibromas), inflammatory processes (brachial plexitis, e.g., Parsonage-Turner syndrome), and vascular abnormalities (e.g., thoracic outlet syndrome). • Determine the precise location and extent of pathology within the brachial plexus, whether it involves the roots, trunks, divisions, cords, or terminal branches. This localization is crucial for treatment planning. • Assess vascular structures adjacent to the brachial plexus, such as the subclavian artery and vein, for potential compression or displacement contributing to neurovascular conditions like thoracic outlet syndrome. • Utilize advanced imaging techniques such as MPR) and 3D

### TABLE OF CONTENTS/OUTLINE

• Anatomy of brachial plexus • Appropriate MRI protocol • Normal variants of plexus which may mimic pathology • Traumatic, infective, inflammatory and neoplastic pathologies • Follow-up imaging post treatment

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# Abstract Archives of the RSNA, 2024

MKEE-96

## CHALLENGES AND IMPORTANCE OF DIAGNOSING FOREIGN BODIES IN MUSCULOSKELETAL RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Bolsi, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Yago F. Carvalho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1- Types of Foreign Bodies and Their Insertion Contexts for each material.2- Imaging Methods for Detecting Foreign Bodies.3- Importance of Foreign Bodies Diagnosis.4- Radiological findings characteristic of each material.5 - What is the best imaging test to detect each exposed material.

### TABLE OF CONTENTS/OUTLINE

1- Types of Foreign Bodies and their characteristics in imaging exams.2- Comparison of the different methods for detecting each type of foreign body, with their advantages, disadvantages and indications.3 - Illustrated teaching cases from our institution, showing different types of foreign bodies, using different diagnostic methods, in different contexts.3- Exhibition of simulated cases in phantoms with tissue density similar to human tissue, emphasizing surgical materials.4 - Exposure of the main risk factors for forgetting surgical material.

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# Abstract Archives of the RSNA, 2024

MKEE-97

## EXPLORING SOLID-CYSTIC BONE LESIONS: IMAGING ASPECTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luiz T. Nehme, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno C. Carneiro (*Abstract Co-Author*) Nothing to Disclose
Adriano Silveira Moreira Novaes, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno B. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo J. Bronzatto (*Abstract Co-Author*) Nothing to Disclose
Giovana G. Mesquita, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia Da Cruz Fagundes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Solid-cystic bone lesions comprise a heterogeneous group of pathologies that can be neoplastic or non-neoplastic, benign or malignant, primary or metastatic, and may exhibit aggressive or non-aggressive behavior.These lesions may pose diagnostic challenges due to their varied imaging appearances and clinical presentations. A radiological approach is established based on age, clinical presentation, location, and imaging characteristics to differentiate them.A common feature of many of these lesions is the presence of fluid-fluid levels, such as in aneurysmal bone cysts (ABC) and ABC-like changes, simple bone cysts, telangiectatic osteosarcoma, metastases, brown tumors, sacrococcygeal teratoma, and adamantinoma.ABC-like changes are associated with other neoplasia, especially giant cell tumor, chondroblastoma, osteoblastoma, non-ossifying fibroma, fibrous dysplasia, chondromyxoid fibroma and Langerhans cell histiocytosis.Other bone tumors may have a solid-cystic appearance on imaging, for instance lipomas and fibrous dysplasia with cystic degeneration, and aggressive neoplasia with extensive necrosis.Moreover, non-neoplastic disease may mimic a solid-cystic bone tumor, for example inflammatory arthropathy, infection, subperiosteal hematoma and hemophilic pseudotumor.Understanding the imaging aspects of solid-cystic bone lesions is crucial for accurate diagnosis and appropriate management.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

MKEE-99

## DON’T GET HUNG UP ON THE DISTAL BICEPS TENDON: A REVIEW DISTAL BICEP TENDON TEARS, NORMAL ANATOMY, US SCANNING TECHNIQUE, AND PATHOLOGY ON US AND MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Chad Klochko, MD (*Abstract Co-Author*) Nothing to Disclose
Zaid Mahdi, MD (*Abstract Co-Author*) Nothing to Disclose
Laurie A. Geiger, BS (*Abstract Co-Author*) Nothing to Disclose
Danishi Bedi (*Abstract Co-Author*) Nothing to Disclose
Prateek Chintalapati, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review of normal anatomy of the distal biceps tendon on US and MRI. 2. Technique for localizing and evaluating the tendon on ultrasound. 3. Post traumatic biceps imaging on US and MRI. 4. Pearls and pitfalls of distal bicep’s imaging. Brief review of surgical treatment and post operative appearance on MRI and radiographs.

### TABLE OF CONTENTS/OUTLINE

Brief review of normal anatomy of the distal biceps tendon - Technique for identifying the tendon on ultrasound. Normal appearance of the tendon on static and dynamic imaging. - Different US imaging approaches including the anterior, lateral, dorsal and medial approaches. - Brief review of normal anatomy on MRI involving the distal biceps tendon. Posttraumatic distal biceps imaging on ultrasound and MRI. - Review of common mechanisms of injury. - Static and dynamic US images of normal, partial thickness and full thickness hears of the distal biceps tendon. Correlative multiplanar MRI images of the distal biceps tendon. - Identification of the lacertus fibrosus in applicable cases Pearls and pitfalls of distal bicep’s imaging. Brief review of surgical treatment and post operative appearance on MRI and radiographs. - Landmarks helpful in identifying the correct tendon and not adjacent structures - Useful physical findings - Common operative treatment - Post operative radiographic imaging appearance - MR example of post-operative retear of the distal biceps tendon. Conclusion/Summary

# Abstract Archives of the RSNA, 2024

MSEE

**Multisystem Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## MSEE-1 MULTISYSTEMIC IMAGING FINDINGS OF COCCIDIOIDOMYCOSIS

**Awards**
**Certificate of Merit**

Motoyo Yano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mark D. Sugi, MD (*Abstract Co-Author*) Consultant, Nextrast, Inc;Author with royalties, RELX
Clinton E. Jokerst, MD (*Abstract Co-Author*) Nothing to Disclose
Ichiro Ikuta, MD, MMedSc (*Abstract Co-Author*) Nothing to Disclose
Maria Zulfiqar, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Muhammad Naeem, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Logan Haug, MD (*Abstract Co-Author*) Nothing to Disclose
Akira Kawashima, MD (*Abstract Co-Author*) Nothing to Disclose
Jeremiah R. Long, MD (*Abstract Co-Author*) Nothing to Disclose
Harrison Lang, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. - Illustrate pathophysiology and mechanism of spread of Coccidioidomycosis. 2. -Provide multisystem case-based review of the imaging features of Coccidioidomycosis.

### TABLE OF CONTENTS/OUTLINE

• Coccidioidomycosis (aka “Valley Fever”) is a fungal infection found in dry desert soil. Symptomatic cases can range from mild pulmonary involvement to invasive multisystem infection particularly in the elderly and immunocompromised patients.• Intracranial findings: meningitis; hydrocephalus; vasculitis, arterial occlusion, cerebral infarction; focal parenchymal lesions, abscess, scattered T2 hyperintense white matter abnormalities.• Spinal findings: Discitis osteomyelitis +/- epidural abscess, spinal arachnoiditis, intramedullary edema/syrinx, intradural extramedullary lesions, syringomyelia/bulbia.• Chest: Acute: parenchymal ground glass or nodular consolidation +/- cavitation; intrathoracic adenopathy, pleural effusions, peribronchial thickening, miliary nodules; Chronic: residual nodule, chronic cavitation, and pneumonia, mycetoma, abscess, bronchopleural fistula• Abdomen and pelvis: Peritonitis (most common site in abdomen), hepatosplenic abscesses, lymphadenitis, pyelonephritis and renal mycetoma, prostatitis, epididymoorchitis, PID.• Musculoskeletal system Osteomyelitis, synovitis, soft tissue abscesses, cellulitis.Summary: Due to the potential multisystem involvement of Coccidioidomycosis, this exhibit is designed to help the radiologist identify spectrum of imaging features associated with each organ system, as well as provide examples where infection can mimic malignancy such as peritoneal carcinomatosis and osseous metastatic disease.

## MSEE-10 LADIES AND GENTLEMEN! WELCOME TO THE GREATEST SHOW ON EARTH - A GUIDE TO ENSURING THE CONTINUED HEALTH OF CIRCUS PERFORMERS

Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Oliveira Gatto, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Cinthia D. Ortega, MD,PhD (*Abstract Co-Author*) Speaker, Johnson & Johnson
Douglas da Cunha Khalil, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Imagine you have just been hired as the primary radiologist for a traveling circus. To succeed in your new role, you must familiarize yourself with several conditions that may become occupational hazards for your patients.This presentation will highlight the following main points: Recall common and uncommon diseases that are related to circus activities; Review the imaging patterns of different health issues; Imagine the diseases to be aware of when joining a traveling carnival; Discuss when the performer should be referred for a US, CT, or MRI scan.

### TABLE OF CONTENTS/OUTLINE

What are the conditions that may affect circus performers? Imagine what an occupational medicine physician would have to recognize, evaluate, and manage when deciding to join a traveling carnival.Various diseases and injuries can lead to a loss of productive work time among circus performers. Efficient use of diagnostic imaging can lead to proper diagnosis, quicker recovery rates, and, therefore, reduced lost work time for the troupe.Prepare to be amazed and dive into the magic of the circus. Before the curtain drops, the audience must understand the potential hazards that could lie in waiting for the troupe. This study presents a series of cases involving lesions and diseases that could create a stressful night for the circus ringmaster. But as any performer knows all too well, "the show must go on!".

## MSEE-11 VALUE OF RADIOLOGIC-PATHOLOGIC CORRELATION

Maria A. Manning, MD (*Abstract Co-Author*) Nothing to Disclose
Jamie Marko, MD (*Abstract Co-Author*) Nothing to Disclose
Perry J. Pickhardt, MD (*Abstract Co-Author*) Advisor, Bracco Group;Advisor, Zebra Medical Vision Ltd;Advisor, Nano X Imaging;
Myles T. Taffel, MD (*Abstract Co-Author*) Nothing to Disclose
Aaron M. Udager, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Meghan G. Lubner, MD (*Presenter*) Spouse, Consultant, Elephas Bio

### TEACHING POINTS

Clinical-radiologic-pathologic correlation is critical to understanding and characterizing disease.Understanding the pathologic features of disease informs radiologic appearance and may streamline differential diagnosis and improve diagnostic confidence.For trainees, robust grasp of radiologic-pathologic correlation may reduce the need for memorization and improve pattern recognition.As our understanding of molecular features of disease and our imaging technology continue to improve, we should pursue and embrace more advanced concepts of radiologic-pathologic correlation.

### TABLE OF CONTENTS/OUTLINE

Introduction/History/Definition of Radiologic-Pathologic CorrelationReview of Radiology as low power microscopy (identification of fat/lipid, calcification, fluid/mucin, blood/vascular, fibrous tissue, iron etc) and how this frames differential diagnosis.Discuss concepts around more advanced rad-path correlation including imaging features associated with advanced pathologic features and prognosisReview the importance of assessment of rad-path concordance after image guided procedures.Summary and future directions

## MSEE-12 PEUTZ-JEGHERS SYNDROME; GENOMICS, SURVEILLANCE, ONCOGENESIS AND IMAGING REVIEW OF ASSOCIATED PATHOLOGIES

Abdelrahman A. Abusaif, MBBCh (*Abstract Co-Author*) Nothing to Disclose
James M. Jing, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Introduce the genetic epidemiologic background of Peutz-Jeghers Syndrome (PJS). 2. Discuss the different common presentations diagnostic criteria of PJS. 3. Summarize the risk of different cancers in PJS patients, according to current literature. 4. Learn various imaging modalities for cancer screening in established PJS cases. 5. Illustrate cancers diagnosed by imaging in PJS. 6. Demonstrate the impact of imaging surveillance on patient outcomes.

### TABLE OF CONTENTS/OUTLINE

1) Introduction to PJS a) Incidence and etiology of PJS. b) Genetic error mode of inheritance. 2) Diagnosis of PJS a) Frequent presentations: i. Mucocutaneous pigmentation ii. Intussusception b) Diagnostic criteria: i. Indications of genetic testing ii. Indications suggested frequency of colonoscopy upper endoscopy 3) Prognosis cancer risk a) Overall cancer risk b) Strongly associated GIT pancreatic cancers c) Strongly associated Gynecologic cancers d) Lung cancer risk e) Other associated cancers 4) Imaging surveillance for cancers in PJS: a) Pancreatic CT / MRI examination b) Gastro-intestinal series. c) Pelvic / testicular Ultrasonography. d) Mammography and breast MRI 5) Examples of cancer cases diagnosed by imaging screening 6) Screening impact on patient outcome.

## MSEE-13 MASTOCYTOSIS: PATHOGENESIS, WHO CLASSIFICATION, IMAGING FEATURES WITH PATHOLOGIC CORRELATION

Mamie Gao, MD (*Abstract Co-Author*) Nothing to Disclose
Hagar S. Mahmoud, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review the pathology and clinical entities of mastocytosis. 2. Highlight the imaging features of mastocytosis in multiple organ systems including the lungs, lymph nodes, gastrointestinal tract, liver, kidneys, skin and musculoskeletal system 3. Discuss the potential mimics and pitfalls that may simulate the imaging features of mastocytosis.

### TABLE OF CONTENTS/OUTLINE

1-Mastocytosis pathology and pathophysiology: cutaneous mastocytosis, systemic mastocytosis (with or without cutaneous manifestations), and mast cell sarcoma. 2. Subtypes of systemic mastocytosis • indolent systemic mastocytosis (most common) • Smoldering systemic mastocytosis • Systemic mastocytosis with an associated hematological neoplasm • Aggressive systemic mastocytosis • Mast cell leukemia 2. Multisystem review of mastocytosis is a systemic disease that may affect any organ (lung, liver, spleen, musculoskeletal, gastrointestinal tract, kidneys, lymph nodes, and skin) 3. Imaging findings of mastocytosis on the US, MR, and CT is a pattern of diseases characterized by abnormal proliferation and infiltration of mast cells in different organs with inflammatory mediator release.

## MSEE-14 IMAGING AND UPDATES IN ROSAI-DORFMAN DISEASE

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo G. Marcelino, MD (*Abstract Co-Author*) Nothing to Disclose
Zubin Driver, MBBS (*Abstract Co-Author*) Nothing to Disclose
Amar Shah, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss recent updates in the pathogenesis and classification of Rosai-Dorfman Disease (RDD). 2. Describe the role of imaging and clinical and radiologic findings of RDD. 3. Review new treatment options and therapeutic response evaluation.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Review epidemiology and pathophysiology of Rosai-Dorfman Disease (RDD) 3. Newer Classification systems (2016 Working Group of Histiocytic Society Classification and 2022 WHO classification of hemolymphoid neoplasms) 4. Mixed histiocytosis: an overlap syndrome 5. Association with IgG4-related disease, autoimmune diseases, and neoplasia 6. Diagnosis of RDD 7. Role of Imaging 8. Review common and uncommon imaging presentations of RDD a. Lymphadenopathy b. Cutaneous Involvement c. Central nervous system involvement i. Brain (parenchymal and dural) ii. Spine d. Skeletal system (axial and appendicular skeleton) e. Abdomen and Pelvis i. Retroperitoneum 1. Renal, perirenal, and primary retroperitoneal ii. Organs 1. Pancreas, liver, and bowel iii. Peritoneum f. Intrathoracic Involvement. i. Cardiac, trachea, mediastinum g. Breast h. Head and Neck i. Orbit, paranasal sinuses, and thyroid 9. Prognosis 10. Molecular targets for treatment 11. Review treatment options and recent advances

## MSEE-15 FUNDAMENTALS OF GASTROINTESTINAL AND GENITOURINARY FLUOROSCOPY: A PRACTICAL GUIDE FOR BEGINNERS

Dennis M. Balfe, MD (*Abstract Co-Author*) Nothing to Disclose
Cary L. Siegel, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Grace G. Zhu, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley Eichar (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Fluoroscopic image acquisition and interpretation of conditions affecting the gastrointestinal and genitourinary systems remains a crucial skill set for the radiologist. However, advances in other technologies may make fluoroscopy less familiar to the practicing radiologist. The purpose of this exhibit is to: 1. Explain the principles of contrast agent mechanism and selection. 2. Describe the practical function of fluoroscopy cameras. 3. Display the basics of patient positioning and fluoroscopic image acquisition. 4. Provide principles and steps of the most common fluoroscopy studies.

**TABLE OF CONTENTS/OUTLINE**

1. Contrast agents: physics fundamentals, types of agents, specific indications, and contraindications. 2. Patient considerations: patient positioning, limited examinations, and fluoroscopic views. 3. Fluoroscopy camera standardized function: magnification, image acquisition, patient maneuvers, and collimation. 4. Principles of common fluoroscopy examinations: barium swallow/esophagram, upper GI, hysterosalpingogram, enemas, and cystography.

## MSEE-16 MULTIMODALITY IMAGING OF HEREDITARY CANCER SYNDROMES IN THE ABDOMEN

**Awards**
**Cum Laude**

Avinash Nehra, MD (*Abstract Co-Author*) Nothing to Disclose
Garima Suman, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Hereditary cancer syndromes account for 5-10% of all cancers. Imaging plays a vital role in diagnosis, screening, and surveillance of patients diagnosed or at risk for hereditary cancer syndromes. Radiologists may be able to suggest the diagnosis of underlying genetic disease, particularly in patients with multiple neoplasms at a young age. Basic knowledge of screening and surveillance guidelines and genetic mutations associated with cancer syndromes is essential for radiologists to provide optimal clinical care. In this exhibit, we will provide a comprehensive illustration of the abdominal manifestations of cancer syndromes relevant to day-to-day practice.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of abdominal manifestations of various hereditary cancer syndromes.2. Review epidemiology, genetics, current screening and surveillance guidelines, and how imaging plays a role.3. Describe imaging features of the following syndromes:- Lynch Syndrome- Familial Adenomatous Polyposis- Peutz Jeghers Syndrome- Multiple Endocrine Neoplasia Types 1 and 2- Von-Hipple Lindau Disease- Birt Hogg Dube syndrome - Hereditary Diffuse Gastric Cancer- Hereditary Pancreatic Ductal Adenocarcinoma- BRCA1 and 2 associated cancer syndromes- Tuberous Sclerosis- Cowden syndrome- Hereditary pancreatic ductal adenocarcinoma- Li Fraumeni syndrome- Hereditary paraganglioma-pheochromocytoma syndrome

## MSEE-17 TWIST AND SHOUT: INSIGHTS INTO ORGAN TORSION - A MULTISYSTEMIC IMAGING REVIEW

Elaine Yanata, MD (*Abstract Co-Author*) Nothing to Disclose
Laura M. Coura, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Docema, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Cinthia D. Ortega, MD,PhD (*Abstract Co-Author*) Speaker, Johnson & Johnson
Luiz Raphael P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Andre L. Bordini, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago M. Baraviera, MD (*Abstract Co-Author*) Nothing to Disclose
Walther Y. Ishikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Natalia K. Fujiwara, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Angelo Vasconcelos Sterchile, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Upon visiting this presentation, the viewer is expected to:- Understand the importance of organic torsion as medical emergencies and how imaging helps in the diagnosis.- Recognize imaging signs of torsions through the body.- Learn unusual torsion sites and imaging findings in different imaging modalities.- Detect imaging red flags of organic suffering and loss of viability.

**TABLE OF CONTENTS/OUTLINE**

This presentation contains a pictorial review of the torsion sites that can occur through the body, using different imaging methods, such as x-ray, ultrasound, computed tomography and magnetic resonance imaging. The usual radiological sign, the “whirlpool sign” which may be found in different scenarios, will be highlighted.The torsions included in this study are as follows:- Lung- Heart/inferior vena cava (herniation after traumatic pericardial

rupture)- Gastric volvulus- Sigmoid volvulus- Cecal volvulus- Petersen's hernia- Ovarian torsion- Testicular torsion- Isolated fallopian tube torsion- Testicular appendix torsion- And more...

## MSEE-18 WHEN TB STRIKES BELOW: UNVEILING THE ABDOMINAL MANIFESTATIONS OF TUBERCULOSIS

Marcella R. Prado, MD (*Abstract Co-Author*) Nothing to Disclose
ALEXANDRE BEZERRA (*Abstract Co-Author*) Nothing to Disclose
Mayra V. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Tiago Bertoncini, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To recognize the pathophysiology and contamination forms of tuberculosis.To learn about most abdominal radiological manifestations of tuberculosis, improving diagnostic performance.To discuss differential imaging diagnosis of TB, especially in immunosuppressed patients.

### TABLE OF CONTENTS/OUTLINE

Tuberculosis (TB) is an infectious, transmissible, chronic disease caused by Mycobacterium tuberculosis and a worldwide public health problem. Infection is secondary to inhaling suspended particles after forced breathing maneuvers, such as coughing. For this reason, lung infection is its most prevalent and best-known manifestation. However, other forms of dissemination are observed, resulting in nervous, musculoskeletal, and abdominal system involvement.Abdominal and other extrapulmonary TB manifestations correspond to 15-25% of cases, usually associated with immunosuppression, especially in individuals with HIV-acquired immunodeficiency syndrome. Imaging investigation is crucial since abdominal manifestations can result in extensive differential diagnosis. While findings are not pathognomonic, clinical-radiological correlation allows for the correct diagnosis and eventual complications, contributing to adequate treatment.A favorable clinical scenario, associated with knowledge of pathophysiology and familiarity with the multiple abdominal radiological manifestations of tuberculosis, contributes to the diagnosis, reducing morbidity and mortality and the social impact of the disease.

## MSEE-19 DIVING BENEATH THE SURFACE: UNVEILING CUTANEOUS TUMORS WITH ULTRA-HIGH-FREQUENCY AND DOPPLER ULTRASOUND IN DERMATOLOGY

Ivana Gibbons (*Abstract Co-Author*) Nothing to Disclose
Laura S. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Galupo (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Soraia Damiao, MD (*Abstract Co-Author*) Nothing to Disclose
Rubens Chojniak, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leticia Cavalcante (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To illustrate the ultra-high-frequency (UHF) ultrasound characteristics of the most common benign and malignant cutaneous lesions in B-mode and Doppler.- To demonstrate the association between the UHF ultrasound findings with the dermatoscopy and anatomopatologic results.

### TABLE OF CONTENTS/OUTLINE

Ultrasound has been a staple medical diagnostic tool for over half a century. In dermatology, its utilization is more recent, particularly with the advent of UHF ultrasound (> 15 MHz), enabling meticulous scrutiny of the skin and its appendages. Classically, UHF ultrasound is used to study changes in the hypoderma, as nodules and inflammatory processes. In cutaneous oncology, it can be used to identify and delimit the lesions, as well as assess the depth and invasion of neighboring structures by the tumor. In surgical planning, determining margins is of great importance and can avoid incomplete resections and unnecessary reinterventions. Ultrasound can also help in the differential diagnosis between benign and malignant cutaneous tumors, however it is essential that the radiologist learn to correlate ultrasound features with clinical / dermatoscopic evaluation as well as histological results.

## MSEE-2 GETTING THE MOST OUT OF MULTIDISCIPLINARY CASE CONFERENCE (MDC): THE RADIOLOGIST'S PERSPECTIVE FOR BEST PATIENT CARE

Zeyad Elias (*Abstract Co-Author*) Nothing to Disclose
Hayley Panet (*Abstract Co-Author*) Nothing to Disclose
Ania Z. Kielar, MD, FRCPC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Regardless of the type of MDC there are common themes that can help radiologists best prepare, in a time effective manner. This educational poster will address opportunities to improve efficiency, standardize MDC with an ultimate goal of improving patient management and outcomes.

### TABLE OF CONTENTS/OUTLINE

Considerations:1. Standardizing information presented to radiologists- Adequate history (AI may help to pull relevant information about diagnosis, prior patient therapies, and other intervention)- Knowing where to quickly find imaging if not on institutional PACS- Creating an environment of professionalism: encouraging physicians who submit patients for MDC to be present for their discussion or to send a delegate rather than delaying to another time- Use of standard template reporting by other radiologists to help those radiologists preparing MDC to find relevant information quickly 2. Ways to come to consensus at MDC on which guidelines to follow for each disease entity 3. Addressing volume of work for the radiologists a. What is a reasonable number of patients to review and discuss at MDC? i. Are all cases discussed relevant/necessary?b. Cost of increasing number of MDC if cannot accommodate patient volumes 4. Providing support to radiologists preparing MDC a. Options include time off the clinical schedule, or a lighter scheduleb. Including fellows in MDC preparation and presentationEquitably distributing MDC participation across the department

## MSEE-20 UNCOMMON FINDINGS INSICKLECELL ANEMIA: FROM HEAD TO TOE

**Awards**
**Certificate of Merit**

Lina M. Cadavid Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Gutierrez Marquez, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Agudelo, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Uribe Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Moreno Salinas, MD (*Abstract Co-Author*) Nothing to Disclose
Yeison Gomez (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Sickle cell anemia is an inherited disease caused by abnormal hemoglobin production that alters the shape of red blood cells and causes vascular occlusion, chronic hemolytic anemia, and infection. It can affect any part of the body with a variety of clinical and radiological manifestations. This scientific exposition will review the imaging manifestations of sickle cell anemia throughout the body in different imaging modalities, with emphasis on atypical presentations, including pediatric and adult patients. Recognizing the typical and atypical presentations of sickle cell anemia will allow a better approach to diagnosis and treatment of patients.

**TABLE OF CONTENTS/OUTLINE**

Review of the different radiological manifestations of sickle cell anemia throughout the body, highlighting rare findings. Examples based on cases (common and uncommon features) of sickle cell anemia throughout the body with different imaging modalities: Head and neck. Chest. Abdomen and pelvis. Musculoskeletal Multi-organic. Discussion with clinical cases and different imaging modalities used for diagnosis (US, CT, MRI), with their limitations and strengths.

## MSEE-21 BEYOND THE LUNG: RARE PRESENTATIONS OF EXTRAPULMONARY TUBERCULOSIS

Ricardo Uribe Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Gutierrez Marquez, MD (*Abstract Co-Author*) Nothing to Disclose
Jhonathan Reina Alzate, MD (*Abstract Co-Author*) Nothing to Disclose
Lina M. Cadavid Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Andres F. Latorre Pinto, MD (*Abstract Co-Author*) Nothing to Disclose
Duban Aristizabal Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Yeison Gomez (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Tuberculosis (TB) manifests across a wide spectrum of presentations. While the pulmonary system is the most commonly affected, TB can extend its reach to involve every organ system in the body. This results in a diverse array of imaging appearances, often resembling radiologic features of other conditions. This scientific exhibit will review rare extrapulmonary manifestations of TB throughout the body on different imaging modalities, with emphasis in atypical presentations including children and adult patients. Recognizing atypical presentations of TB will allow a better diagnostic approach and further treatment of patients in daily radiological practice given the high prevalence of the disease.

**TABLE OF CONTENTS/OUTLINE**

1) Review the different systems involved by the disease, highlighting atypical forms.2) Cased based examples of extrapulmonary TB infections in different organ systems and imaging modalities:· Genitourinary· Abdomen and pelvis· Bone · Head3) Discuss the relevance of each diagnostic modalities used in the approach of TB infection through the different case scenarios.

## MSEE-22 WBMRI IN MGUS: UNDERSTANDING THE "HIDDEN ENEMY"

Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor M. Sardenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre C. Valim, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

MGUS, a premalignant hematological condition prevalent in the elderly, carries a yearly progression rate to multiple myeloma (MM) of approximately 1%. It's imperative to explore potential related diseases stemming from MGUS and conduct investigations to exclude the presence of a malignant form. Rheumatologic diseases (RDs) influence the biology of MGUS, elevating the risk of progression to multiple myeloma (MM) or associated lymphoproliferative malignancies. WBMRI is a sensitive imaging modality that provide comprehensive coverage with high soft tissue contrast and spatial resolution in a condensed timeframe. It proves instrumental in the assessment of various multisystemic diseases and to detect and characterize multifocal or systemic conditions, both oncological and non-oncological. Achieving accurate diagnosis and effective surveillance demands a multidisciplinary approach, integrating radiological expertise to mitigate the risk of end-organ damage. As a cost-effective diagnostic imaging tool, WBMRI streamlines the process of diagnosis, therapeutic monitoring, and treatment decision-making, thereby enhancing patient care and outcomes.

**TABLE OF CONTENTS/OUTLINE**

Monoclonal Gammopathy of Undetermined Significance (MGUS): Clinical and Epidemiological Insights Diagnosis of MGUS Imaging Diagnosis: Whole-Body Diffusion-Weighted Magnetic Resonance Imaging Technique Exploration of Different Diseases Associated with MGUS, including: • Smoldering Myeloma • Multiple Myeloma • Non-Hodgkin Lymphomas • Waldenstrom Macroglobulinemia • Amyloid Light-chain and Amyloidosis • POEMS Syndrome (Osteosclerotic Myeloma) • Chronic Inflammatory Rheumatic Diseases

## MSEE-23 CLINICAL APPLICABILITY OF THE MASEI PROTOCOL DIFFERENTIAL DIAGNOSIS OF SPONDYLOARTHRITIS AND FIBROMYALGIA THROUGH ULTRASONOGRAPHY

Deise Vargas (*Abstract Co-Author*) Nothing to Disclose
Marco de Andrade Bianchi (*Abstract Co-Author*) Nothing to Disclose
Ricardo Amaro Noleto Araujo (*Abstract Co-Author*) Nothing to Disclose
Amanda Martins E. Ribeiro Dos Santos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Enthesitis, characterized as an essential pathogenic marker of spondyloarthritis, is often overlooked in clinical practice, resulting in missed opportunities for accurate diagnoses and effective disease activity assessments. This study examines the performance of the Madrid Sonography Enthesitis Index (MASEI) protocol in ultrasonographic evaluation of entheses, in which we will address:- Definition and clinical relevance of enthesitis in spondyloarthritis.- Importance of differential diagnosis between spondyloarthritis and fibromyalgia.- Demonstration of the use and interpretation of MASEI in clinical practice.

**TABLE OF CONTENTS/OUTLINE**

- Introduction: Contextualization of enthesitis and its underutilization.- Methodology: Study details and ultrasound techniques employed.- Data: Analysis- Comparison between patients with spondyloarthritis and fibromyalgia.- Conclusions and Clinical Implications- Discussion on the relevance of MASEI in improving diagnosis and clinical management.- Recommendations for Clinical Practice- How to effectively implement MASEI.This work emphasizes the need to incorporate MASEI into clinical practice to enhance the diagnosis and treatment of spondyloarthritis, avoiding misdiagnosis of fibromyalgia.

## MSEE-24 CONTRIBUTIONS TO ACCURATE DIAGNOSIS OF COMMON SKIN LESIONS IN DERMATOLOGICAL ULTRASOUND PRACTICE

Marco de Andrade Bianchi (*Abstract Co-Author*) Nothing to Disclose
Deise Vargas (*Abstract Co-Author*) Nothing to Disclose
Amanda Martins E. Ribeiro Dos Santos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- The combination of high-frequency ultrasound imaging and color Doppler allows for precise identification and study of skin lesions, including neoplasms, and tumor microcirculation.- High-frequency ultrasound imaging provides real-time, non-invasive, and detailed visualization of skin lesions directly on the patient's body.- This study aims to contribute to more accurate diagnoses in dermatology through the creation of a panel containing images of skin lesions and high-frequency ultrasound examination findings.- The panel serves as a valuable resource for physicians performing high-frequency dermatological ultrasound, facilitating lesion recognition and study.The purpose is to present a panel, which serves as consultation material, with images of the clinical and ultrasound presentation of the main most common dermatological lesions found in daily practice.

**TABLE OF CONTENTS/OUTLINE**

- Highlighting the importance of high-frequency ultrasound in enhancing skin lesion diagnosis and providing detailed, non-invasive imaging for more accurate diagnoses.- Descriptive study detailing the creation of a consultation panel for routine dermatological ultrasound in a private hospital.- Compilation of examination images, descriptions, and lesion photos to aid physicians in high-frequency dermatological ultrasound.- Creation of a panel for physicians to consult and study common skin lesions using high-frequency dermatological ultrasound.

## MSEE-25 BULLETS 101: WHAT THE RADIOLOGIST NEEDS TO KNOW

Shima Aran, MD (*Abstract Co-Author*) Nothing to Disclose
Larry A. Kramer, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Cotes, MD (*Abstract Co-Author*) Nothing to Disclose
Tiffany A. Kumala (*Abstract Co-Author*) Nothing to Disclose
Vidhyulatha Sanata, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Bullet injuries are prevalent in urban areas, particularly in regions with high rates of gun ownership, such as the United States. Imaging plays a crucial role in assessing the trajectory of the bullet and identifying internal organ injuries in the emergency setting. Generally, retained intact bullets or fragments are harmless unless they migrate, or their location causes internal damage. However, they pose a challenge for radiologists during MRI scans or when MRI clearance is required, especially if the bullet's history or composition hasn't been assessed previously. The goal of this presentation is to familiarize the radiologist with the most common types of guns and bullets, review different bullet compositions and how it affects our practice as radiologists in terms of artifacts and MRI clearance, and to describe the importance of a comprehensive assessment of bullet-related injuries, given the frequency of such incidents in communities with prevalent gun culture.

**TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline:
- Guns and Bullet types: Gun type: Handguns, Shotguns, Rifles. Bullet type: Round nose, ward cutter, semi-wad cutter, Full metal jacket, Hollow point. Composition of bullets: Lead, steel, copper, bullet core Jacket steel, nickel, or copper
- Bullet composition based on radiologic appearance: determining MRI clearance.
- Imaging Assessment: Acute and Chronic Injuries (Wound track, Internal injuries, Retained bullets, Anatomical Location)
- Imaging Artifacts and potential workarounds

## MSEE-26 CLINICAL ROLE OF PET/CT IN CAR T-CELL TREATMENT

**Awards**
**Certificate of Merit**

Carolina P. Abud, MD (*Abstract Co-Author*) Nothing to Disclose
Marina M. Costa (*Abstract Co-Author*) Nothing to Disclose
Leticia Rigo (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas J. Racy, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Uski, MD (*Abstract Co-Author*) Nothing to Disclose
Glaucia Oki, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Graziela C. Bernardo, MD (*Abstract Co-Author*) Nothing to Disclose
Evandro J. Bonetti, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

CAR T-cell therapy was initially developed for the treatment of refractory hematological malignancies. Currently, its indications are being expanded to include some types of solid tumors. The responses to this therapy have some particularities and knowing the expected evolution and correlation with the treatment chronogram is essential. The aim of this presentation is emphasize the role of imaging in this scenario (pre- and post-treatment), demonstrate the radiological findings that define evolutionary behavior, with a focus on FDG PET-CT, for the purpose of making unskilled radiologists more familiar with the therapy, to help them to identify the critical points.

**TABLE OF CONTENTS/OUTLINE**

Case-based didactic review of CAR T-cell therapy literature, with FDG PET-CT findings and others imaging methods, including the severe complications, and correlating on our service´s digital archive.

## MSEE-27 ABDOMINAL INVOLVEMENT IN LYMPHOMA: IMAGING FINDINGS BEYOND THE LYMPH NODE

Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Gomes SR, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Carolina De Moraes Sarmento (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

THE PURPOSE OF THIS EXHIBIT IS: 1. Review the most common sites of extranodal lymphoma, knowing that this entity has the potencial to affect any organ or tissue, in a variety of presentations that can mimic many other conditions.2. Recognize unusual and little-reported patterns of extranodal lymphoma through illustrative clinical cases (including CT, MRI and functional imaging methods).3. Highlight the role of the radiologist in decision-making in a multidisciplinary team.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 1.a Definitions, clinical, pathophysiological aspects 1.b CT and MRI protocols (Hints at evaluation of images; Potential "blind spots; Pearls and Pitfalls).2. Illustrative clinical cases: 2.a The main CT and MRI findings assessment of disease 2.b Atypical sites, clinical and imaging features 2.c Liver and Spleen 2.d Gastrointestinal tract 2.e Geniturinary tract 2.f Biliary tract 2.g Adrenal gland 2.h Peritoneum and Peritoneal Reflections 2.i Abdominal Wall3. Take-home messages 3.a Extranodal lymphoma can simulate other neoplasms or inflammatory conditions. 3.b Raising suspicion for this condition, especially in atypical epidemiological groups and in unexpected contexts, can make a difference in patient management, decision to biopsy, staging, or in detection of reccurrence and complications.

## MSEE-28 EXPECTED FINDINGS AND COMMON COMPLICATIONS OF COSMETIC PLASTIC SURGERY PROCEDURES: WHAT THE RADIOLOGIST NEEDS TO KNOW

Omar Andres Pantoja Burbano, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Ortiz, MD (*Abstract Co-Author*) Nothing to Disclose
Camilo A. Caicedo Montano, MD (*Abstract Co-Author*) Nothing to Disclose
Nicole Erazo Morera, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Aluja, MD, MEd (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review of the most common cosmetic plastic surgery procedures and their expected radiologic appearance. Identify abnormal findings and complications related to cosmetic plastic surgery procedures. Recognize the potential systemic complications and their radiologic features.

**TABLE OF CONTENTS/OUTLINE**

Introduction Common procedures: Facial (bichectomy, rhinoplasty, blepharoplasty, rhytidectomy, Dermal filler injections, Botox and hyaluronic acid), breast (augmentation, removal and mastopexy), abdominal (liposuction, belt lipectomy, abdominoplasty), Buttock augmentation, penile implants. Expected radiographic appearance and normal postoperative findings: what is normal and what is not. Complications: Acute: infection, collections, abscess, skin necrosis and fasciitis, lymphedema. Chronic: capsular contracture, breast or buttock prothesis rupture, iatrogenic allogenosis, gastrointestinal tract perforation, intra-abdominal injury, collections, fistula. Systemic complications: pulmonary embolism, pulmonary fat embolism, SDRA, deep vein thrombosis. Pitfalls Take home points.

## MSEE-29 BEYOND THE HORIZON: LANDSCAPE SIGNS IN RADIOLOGICAL IMAGING

Manolin Gomez Rivadeneira (*Abstract Co-Author*) Nothing to Disclose
Alejandra Cardona Del Valle, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Gonzalez, BS (*Abstract Co-Author*) Nothing to Disclose
Jose A. Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Discuss the most common radiological signs inspired by landscapes. -Explain the background, etiology, and radiological uses of each of the discussed signs. -Describe the signs through example cases and illustrations using various imaging modalities.

**TABLE OF CONTENTS/OUTLINE**

-I. Educational Objectives and Introduction- II. Discuss signs in the following categories: Urban, Rural, Marine and Snow land- III. Imaging examples- IV. Review importance in recognition- V. Self-assessment with multiple cases in quiz format- IX. ConclusionIn this comprehensive pictorial review, we will showcase a series of classic radiological signs inspired by different landscapes, such as rural, urban, marine, and snowland environments. These signs, visible across various imaging modalities, will be illustrated with example cases from our institution. Each sign will be presented alongside a public domain image or diagram of the object that inspired its name, allowing for easier association and recognition. Additionally, a concise explanation of the underlying pathology and pertinent information will be provided.-Urban Signs: Include the inverted Mercedes-Benz, racing car, flat tire, spoke wheel, steeple, lead pipe, tram track, and crazy paving signs.-Rural Signs: Include Mount Fuji, apple core, cotton wool, tulip bulb, and tree in bud signs.-Marine Signs: Include the whirlpool, bone island, seashore, sail, double bubble, triple bubble, and atoll signs.-Snowland Signs: Include snowman and snowstorm signs. By exploring these different landscape-themed signs, the pictorial review aims to enhance the recognition and understanding of various pathologies.

## MSEE-30 RADIOLOGIST GUIDE TO THE EVOLVING WORLD OF ECMOS

Scott A. Grumley, MD (*Abstract Co-Author*) Nothing to Disclose
Naga Sai Rasagna Mareddy, MBBS (*Abstract Co-Author*) Nothing to Disclose
Nina L. Terry, MD, JD (*Abstract Co-Author*) Stockholder, Johnson & Johnson;Spouse, Stockholder, Johnson & Johnson;Stockholder, Kimberly-Clark Corporation;Spouse, Stockholder, Kimberly-Clark Corporation;Stockholder, Microsoft Corporation;Spouse, Stockholder, Microsoft Corporation;Spouse, Stockholder, Amge
Satinder P. Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Ibrahim, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Understanding different ECMO configuration setups and their clinical context. • Learn to interpret evolving ECMO cannula configurations and underlying pathologies. • Appreciate the vital role of radiologists through accurate imaging interpretation and multidisciplinary collaboration.

**TABLE OF CONTENTS/OUTLINE**

• Introduction and Understanding ECMO setup: - Brief overview of ECMO and its significance in critical care. - Illustrative review of ECMO configurations in different clinical scenarios, explanation of VV, VA, and hybrid ECMO setups and potential complications and solutions. • Role of Radiologists in ECMO Care:

- Highlight the importance of accurate imaging interpretation in assessing cannula placement and complications. - Steps in obtaining optimal CTA images - Discuss collaborative approach between radiologists and multidisciplinary teams in ECMO patient management.

## MSEE-31 IMAGING OF DIABETIC COMPLICATIONS: FROM HEAD TO TOE

**Awards**
**Certificate of Merit**

Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Hirotaka Akita (*Abstract Co-Author*) Nothing to Disclose
Fumiko Yagi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) Understanding pathophysiology of diabetes mellitus(2) Understanding useful imaging findings in diabetes-related complications

### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. Pathophysiology of diabetes mellitusIII. Diabetes-related complicationsA. Head/neck- Hyperostosis Frontalis Interna- Stroke- Non-ketotic hyperglycemic hemichorea- Dementia- Malignant otitis externaB. Heart/vessel- Diabetic Cardiomyopathy- Coronary artery disease- Peripheral Artery DiseaseC. Breast - Diabetic mastopathyD. Gastrointestinal tract- Black esophagus (acute necrotizing esophagitis)- Fatty liver/subcapsular fatty infiltration- Emphysematous cholecystitis- Atrophic pancreas- Pancreatitis- Pneumatosis cystoides intestinalisE. Genitourinary system- Diabetic kidney disease- Renal abscess- Renal papillary necrosis- Medullary nephrocalcinosis- Xanthogranulomatous pyelonephritis- Emphysematous pyelonephritis/cystitisF. Reproductive organs- Calcification of the Vas Deferens- Vascular erectile dysfunction- Polycystic Ovary SyndromeG. Musculoskeletal system- Fournier's gangrene- Necrotizing fasciitis- Osteomyelitis- Spondylodiscitis- Diffuse idiopathic skeletal hyperostosis- Muscle Denervation- Insulin ball

## MSEE-32 MAXIMIZING THE POTENTIAL OF HIGH-FREQUENCY ULTRASOUND FOR SKIN FILLER IDENTIFICATION: FACTORS INFLUENCING PRODUCT EVALUATION AND DISTINCTION

Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle A. Zattar (*Abstract Co-Author*) Nothing to Disclose
Gladstone Faria (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Boggio (*Abstract Co-Author*) Nothing to Disclose
Natalia Venturelli (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana C. Zattar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Aesthetic procedures are increasingly being performed using injectable materials. In this context, the radiologist has been requested to recognize their usual aspects. To achieve accurate and timely detection and an appropriate approach for each case, High-frequency ultrasound (HFUS) is the most effective method. It is well established in the literature that ultrasound can identify the type of filler material injected, however, few studies address the aspects that can influence this identification. Correct knowledge of these aspects as well as the limitations of the devices should be known to the radiologist. This study aims to discuss and illustrate the factors that influence product evaluation and distinction.The purpose of this exhibit is:- To show and describe the main image patterns of cosmetic fillers that allow its identification (morphology, echogenicity, matrix, posterior artifacts), and teach how to report it;- To list, classify, and describe the different injectables and procedural aspects (dilution, rheology, manufacturer/trades, application site, injection technique, purpose, time of injection, and integration) and their influence on imaging;- To highlight the importance of different HFUS devices, transducers, and image settings in the product distinction;- To show and describe a practical chart that may help reach the correct product's approach in daily practice;

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION: why is it important?2. HOW TO IDENTIFICATE AND REPORT INJECTABLE MATERIALS3. WHICH FACTORS INFLUENCES?4. STEP-BY-STEP APPROACH5. WHAT SHOULD WE CARE ABOUT?5. CONCLUSION: new perspectives

## MSEE-33 ADENOID CYSTIC CARCINOMA: MULTIORGAN MANIFESTATIONS

**Awards**
**Certificate of Merit**

Komal B. Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MBBS, FRCR (*Abstract Co-Author*) Director, Grayscale Ltd;Co-owner, Grayscale Ltd;
Sireesha Yedururi, MBBS (*Abstract Co-Author*) Nothing to Disclose
Toma Omofoye, MD (*Abstract Co-Author*) Nothing to Disclose
Mylene T. Truong, MD (*Abstract Co-Author*) Nothing to Disclose
Girish S. Shroff, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Based on clinical/radiology experience at an international cancer referral center. Familiarize radiologists with: 1. Anatomic LocationsCommoner: salivary gland, nasal cavity, sinus, tongue, trachea/central bronchi Uncommon/Rare: breast, female reproductive tract, cervix, prostate, skin, etc 2. Varying use of multimodality imaging (CT, MRI, FDG PET/CT, ultrasound) according to location 3. Correlation of imaging with pathology, metastatic risk, clinical/surgical implications 4. Unique patterns of disease spread and of metastases

### TABLE OF CONTENTS/OUTLINE

Background/classification Epidemiologic Clinical Features Examples by anatomic site, diagnostic criteria, mimics and pitfalls Radpath correlations and site variable CT/MRI/PET correlation to histology subtypes/outcome Patterns of disease spread, perineural disease, metastases, growth rates Treatment surgical considerations

## MSEE-34 "TAKING A BITE OUT OF TEMPOROMANDIBULAR JOINT IMAGING" - ANATOMY, PATHOLOGY, AND INCIDENTAL FINDINGS

**Awards**
**Certificate of Merit**

Kathryn J. Stevens, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jennifer A. Padwal, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Review the basic anatomy of the temporomandibular joint including the articular disc and capsular attachments, surrounding muscles of mastication, condyle and adjacent temporal bone 2) Review normal position of articular disc, retrodiscal layers, and condylar head on both closed and open mouth views 3) Demonstrate different TMJ pathology including articular disc degeneration/perforation, disc displacement, joint effusions, and TMJ degenerative changes 4) Highlight potential "don't miss" incidental findings on CT and MR imaging of the TMJ

### TABLE OF CONTENTS/OUTLINE

I. Basic anatomic review of the temporomandibular joint and associated structures, including normal positioning on open-mouth and closed-mouth views II. Pathology of the temporomandibular joint III. Incidental temporomandibular joint findings on CT and MRI

## MSEE-35 PATHWAYS OF PERIL: RADIOLOGICAL INSIGHTS INTO MALIGNANT SUBPERITONEAL AND RETROPERITONEAL TUMORAL INFILTRATION

Venkata S. Katabathina, MD (*Abstract Co-Author*) Nothing to Disclose
Navya Dasyam, MD (*Abstract Co-Author*) Nothing to Disclose
Gayathri Devi Jalluri, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Anil K. Dasyam, MD (*Abstract Co-Author*) Nothing to Disclose
Renjie Chen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Peritoneal ligaments and mesenteries are best identified by the vessels running through them - Constituents of the different compartments of retroperitoneal spaces dictate the common pathology in these compartments - Subperitoneal spaces and retroperitoneal spaces are interconnected providing uninterrupted pathways for tumor spread -Retropreitoneal tumoral infiltration is often associated with significant constrictive effect

### TABLE OF CONTENTS/OUTLINE

- Embryological development of peritoneal and retroperitoneal spaces - Anatomy of retroperitoneal spaces and their components - Anatomy of peritoneal ligaments and mesenteries - Pathways of subperitoneal tumor infiltration in abdomen o Peritoneal ligaments o Omentum and Mesenteries - Pathways of subperitoneal tumor infiltration in pelvis o Peritoneal Ligaments o Mesenteries - Constricting effect of retroperitoneal tumor infiltration - clinical consequences and imaging clues - Communications between subperitoneal and retroperitineal spaces - clinical implications and imaging clues - Imaging mimics of malignant subperitoneal and retroperitoneal tumor infiltration - Summary

## MSEE-36 VASCULAR COMPRESSION SYNDROMES: A PICTORIAL OVERVIEW

Gavin Low, FRCR (*Abstract Co-Author*) Nothing to Disclose
Rishi P. Mathew, DMRD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Ryan K. Chee, MD (*Abstract Co-Author*) Nothing to Disclose
Mitchell Wilson, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Wendy Tu, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Ranjit Singh, MBBS, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Reshma Mary Koshy, MBChB, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This pictorial review aims to concisely summarise notable features identified in seven main vascular syndromes within the abdomen and pelvis using examples from different imaging modalities including ultrasound, fluoroscopy, CT and MRI. These relatively rare syndromes are often poorly understood and can be easily overlooked. They can be asymptomatic and identified incidentally or may manifest symptomatically.

### TABLE OF CONTENTS/OUTLINE

Table of contents • Median Arcuate Ligament Syndrome • Superior Mesenteric Artery Syndrome • Nutcracker Syndrome • May-Thurner Syndrome • Ureteropelvic Junction Obstruction • Retrocaval Ureter • Ovarian Vein Syndrome • Portal BiliopathyOutline This educational exhibit will primarily focus on the imaging features commonly encountered with the above entities. Information will be highlighted by providing case examples using a range of different imaging modalities. A brief overview on each syndrome demographics as well as potential treatment options will be explored. A table summarising the main key findings will also be provided to summarise the main imaging teaching points.

## MSEE-37 UNDERSTANDING DUAL-ENERGY CT. GETTING STARTED: ESSENTIALS IN TECHNICAL PRINCIPLES AND CLINICAL SCENARIOS

Augstin Z. Guzman Mercado, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Lucia Lopez Salazar, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daniel Soto Vargas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To overview the technical and physical principles behind Dual-Energy CT. - To summarize the various acquisition methods of Dual-Energy CT and the advantages and limitations of each approach. - To overview basic principles of how material decomposition images are generated. - To review material decomposition images commonly used in clinical practice. - To identify clinical settings where spectral reconstruction can increase the diagnostic sensitivity - To exemplify potential artifacts and pitfalls on spectral reconstructions.

### TABLE OF CONTENTS/OUTLINE

- Technical principles of Dual-Energy CT - Dual-Energy CT acquisition approaches - Understating material decomposition - Material decomposition images commonly used in clinical practice - Applicability of dual-energy CT in various clinical scenarios - Artifacts and Pitfalls - Advantages and limitations

## MSEE-38 MICROVASCULAR FLOW IMAGING IN SOLID TUMORS: A PRACTICAL APPROACH

Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana Cerri, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabriela R. Camerin, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Doppler US is a non-invasive and cost-effective imaging method useful for assessing vascularization patterns of organs and structures, including solid tumors. The most common modalities commercially available include spectral Doppler, color Doppler, and power Doppler.Microvascular flow imaging (MVFI) is a novel technique based on different filters from Doppler imaging, which excels in characterizing slow flow in small vessels, a challenge for conventional Doppler methods.MVFI applications in oncologic imaging are still evolving, with great potential in the diagnosis and follow-up of hepatobiliary, genitourinary, vascular, gastrointestinal, skin, and muscular tumors.This pictorial review aims to provide a practical overview of MVFI's main applications and limitations in oncologic imaging. It emphasizes key points and potential challenges for integrating MVFI into clinical practice.

### TABLE OF CONTENTS/OUTLINE

Background: perfusion imaging US techniques (advantages and disadvantages)- Doppler imaging- Contrast-enhanced US- Microvascular flow imagingPrinciples of MVFI - Recognizing microvascular patterns: a practical approachApplications of MVFI in oncologic imaging: a case-based review with multimodality imaging correlations- Skin- Thyroid- Lymph nodes- Liver- Kidney- Colon- Other tumorsClinical use: pearls and pitfallsSummary and take home messages

## MSEE-39 IMAGING IN SYSTEMIC SCLEROSIS (SCLERODERMA)

**Awards**
**Certificate of Merit**

David J. DiSantis, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Galib Mirza Nasirul Islam, MBBS (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Systemic sclerosis (Scleroderma) is a clinically heterogeneous disorder with protean manifestations, a chronic and frequently progressive course, and significant disability, disfigurement and mortality. Virtually every organ can be affected. This exhibit discusses scleroderma in detail and at the conclusion of the module, the learner should be able to:
- Familiarize with the pathogenesis and clinical features of scleroderma
- Understand the role imaging in the diagnosis and evaluation of scleroderma
- Discuss radiological findings seen in scleroderma
- Describe current treatment strategies, newer techniques as well as common confounding drug-induced manifestations

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Epidemiology
- Pathology and pathogenesis
- Disease classification
- Diagnosis and role of serum markers
- Mixed connective tissue disease (MCTD)
- Role of Imaging
- Manifestations of Scleroderma (reduced oral aperture, mucocutaneous telangiectasia, joint contractures, digital ischemic ulcers, cardiomyopathy, gastrointestinal hypomotility and bacterial overgrowth)
- Cutaneous Manifestations
- Respiratory involvement (interstitial lung disease and pulmonary arterial hypertension)
- Gastrointestinal Manifestations (upper tract, lower tract and anorectal)
- Renal involvement and scleroderma renal crisis
- Musculoskeletal Manifestations
- Cardiovascular involvement
- Urinary system Manifestations
- Nervous System Involvement
- Miscellaneous Features
- Cancer in Scleroderma
- Prognostic Factors
- Treatment Strategies
- Drug-induced manifestations

## MSEE-4 IMAGING FEATURES OF PERINEAL SUPPURATIONS

Marc Zins, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Delpla (*Abstract Co-Author*) Nothing to Disclose
Boulay-Coletta Isabelle, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Touloupas (*Abstract Co-Author*) Nothing to Disclose
Sophie Beranger Gibert (*Abstract Co-Author*) Nothing to Disclose
EMNA YOUNSI (*Abstract Co-Author*) Nothing to Disclose
Arnaud Pouvelle (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. Haouari I, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Perineal suppurations are pathological conditions with diverse clinical manifestations. They vary in severity and may be life-threatening. Regardless of the acute or chronic presentation, imaging plays a fundamental role in the initial assessment and post-treatment evaluation. CT scan is generally sufficient to establish the diagnosis of extensive perineal suppuration. MRI is necessary for assessment of fistula in-ano and for etiological assessment. Perineal suppurative lesions include abscesses, inflammatory masses, fistulous tracts, and fasciitis. Perineal suppuration may be of anorectal, cutaneous, genital, or urological origin. In the postoperative period of pelvic or perineal surgery, suppuration usually consists of infection of an implanted prosthetic material or anastomotic leakage. Imaging helps establishing the right diagnosis by showing specific or highly suggestive findings of some pathologies.

**TABLE OF CONTENTS/OUTLINE**

Overview of the male and female perineal anatomy. Discuss the indications and limitations of the different imaging modalities according to the acute or chronic nature of the clinical presentation and its severity. Discuss suppurative perineal conditions according to patient sex, clinical presentation, anatomical location and origin, and relation to the anal canal of the suppuration (communicating or not). Identify specific or highly suggestive imaging features of every etiology.

## MSEE-40 TIPS AND TRICKS IN ULTRASOUND EVALUATION OF ABDOMINAL HERNIAS

Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Catalina A. Carvajal Perrejinoski, MD (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Aragon, MD (*Abstract Co-Author*) Nothing to Disclose
Catalina Alarcon Del Campo, MD (*Abstract Co-Author*) Nothing to Disclose
Eugenio Zalaquett, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Profound comprehension of anatomical intricacies is indispensable in diagnosing and assessing abdominal wall hernias through ultrasound. A nuanced grasp of topographic anatomy proves invaluable in pinpointing the regions predisposed to herniation.2) Ultrasound stands unparalleled as the foremost imaging modality for scrutinizing abdominal hernias. Its unparalleled capacity for dynamic assessment, coupled with its adaptability to various patient positions, renders it peerless in this regard.3) Surgeons demand precise insights into the location, dimensions, and contents of hernial sacs. All this questions can be answered with an adequate ultrasound evaluation.

**TABLE OF CONTENTS/OUTLINE**

Abdominal wall anatomyUltrasound evaluationTips and TricksAnterior Abdominal Wall HerniasMidline herniaUmbilical herniaSpigelian herniaRichter herniaInguinal herniaFemoral herniaAmyand herniaGarengeot hernia

## MSEE-41 PIQUING YOUR INTEREST IN THE PECOMA FAMILY

**Awards**
**Certificate of Merit**

Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Grace G. Zhu, MD (*Abstract Co-Author*) Nothing to Disclose
Cary L. Siegel, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Rogers, MD (*Presenter*) Royalties, RELX

**TEACHING POINTS**

Teaching Points1) Clarify the pathologic and genetic characteristics of the tumors within the perivascular epithelioid cell tumor (PEComa) family, and their relationship to tuberous sclerosis complex2) Provide a multi-modality case-based review of the wide array of PEComas, geared toward radiologists concerned about potential malignancy or risk for complications

**TABLE OF CONTENTS/OUTLINE**

Outline1) Introduction/Backgrounda) Histology/Pathologyb) Tuberous Sclerosis Complex2) Pulmonarya) Lymphangioleiomyomatosisb) Primary pulmonary PEComa (Clear cell "sugar" tumor)3) Renala) Angiomyolipomab) Epithelioid variant angiomyolipomac) Monophasic/lipid poor angiomyolipoma versus capsular leiomyoma4) Uterine PEComaa) Benignb) Malignant5) Miscellaneous Sporadic PEComasa) Liverb) Retroperitoneumc) Pancreasd) Bowele) Soft tissuesf) Clear cell myomelanocytic tumor of the falciform ligament/ligamentum teres (CCMMT)6) Treatment considerations and follow-up

## MSEE-42 DECODING THE IMMUNOTHERAPY-RELATED ADVERSE EVENTS WITH IMAGING

**Awards**
**Cum Laude**

Roberto Garcia Figueiras, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joan C. Vilanova, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD, PhD (*Abstract Co-Author*) Speaker, General Electric Company
Sandra Baleato Gonzalez, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Cancer immunotherapies have revolutionized the therapeutic management of a wide number of malignancies. However, local, or systemic adverse events, so called immune- related adverse events (irAEs) are major complications. Radiologists play a fundamental role in the identification irAEs, both essential to be able to deliver the best care possible for the patient. This exhibit aims to: • Review the pathophysiology of irAES. • List the most common adverse effects, the incidence, and the median time to onset. • Recognize these findings on imaging to stablish a specific treatment.

**TABLE OF CONTENTS/OUTLINE**

1. Pathophysiological mechanisms of irAES. 2. Clinical significance and risk factors. 3. Timeline and Incidence, 4. Subtypes of irAES- The Essentials: colitis and pneumonitis.- The Killers: cardiac toxicities. - The Forgotten ones: vasculitis, polyarthritis, pneumatosis.- The Misreaded: acute kidney injury.- The Mimickers: sarcoid-like reaction, adrenalitis, and others. 5. Take home points. 6. Conclusions

## MSEE-43 THE CURRENT ROLE OF DERMATOLOGICAL ULTRASOUND IN CUTANEOUS NEOPLASM

Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana C. Zattar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

High frequency ultrasound (HFUS) is increasingly gaining more space in the evaluation of skin tumors due to its high anatomical definition and diagnostic accuracy. It allows in vivo analysis of primary lesion as well as locoregional staging, essential for a better surgical planning and important in the postoperative follow-up of the patients.This study aims to discuss and illustrate the radiologist's role in the evaluation of skin tumors with HFUS. The knowledge of tumors characteristics and specific imaging findings is essential for correct diagnosis and management of patients.The purpose of this exhibit is:- To describe a practical step by step approach of the skin tumors;- To show the main image patterns of the most common skin tumors and its subtypes;- To list, illustrate and describe characteristic imaging findings of rare skin tumors: dermatofibrosarcoma protuberans, cutaneous lymphoma, Kaposi sarcoma- To highlight the importance of HFUS in tumors diagnosis, staging and therapeutic planning;- To illustrate the use of HFUS in evaluation of therapeutic success, recurrence and complication;- To keep in mind important teaching points in skin tumors evaluation

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION: ultrasound, technique, tumorsDIAGNOSISCompositionLocalizationTREATMENTPre-treatment evaluationDuring treatment evaluationPost-treatment evaluationNEW PERSPECTIVESCONCLUSION

## MSEE-44 WHERE THERE IS SMOKE THERE IS FIRE: DIAGNOSTIC CLUES OF ABDOMINAL DISEASE

Aparecido N. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Heloise Miranda (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Batista Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Lhuanna Maria Barbosa Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Teaching points: The importance of imaging methods for diagnosis when an abdominaldisease is suspected is known. However we must be aware of radiologicalsigns that can predict diseases even in cases where there is no suspicion, oreven assist diagnostic suspicion when direct signs are hidden, either due totechnical or examiner limitations.The purpose of this exhibit is to: Highlight often overlooked but relevant indirect signs of abdominaldiseases observed on computed tomography (CT) and magneticresonance imaging (MRI).Explore the correlation between imaging findings and potentialunderlying etiologies, spanning inflammatory conditions, traumaticinjuries, neoplasms, vascular diseases, infectious diseases, and otherabdominal pathologies.Provide practical pearls and pitfalls by providing insights into interpretingradiologic manifestations, including identification of common reactivefindings encountered in abdominal imaging.Discuss the importance of incorporating clinical information, such as age,acuity of symptoms, clinical signs, and patient history, to refine thedifferential diagnosis.Propose appropriate follow-up strategies for further evaluation andmanagement of identified abdominal abnormalities.

**TABLE OF CONTENTS/OUTLINE**

2. Table of contents:Introduction;Paraneoplastic manifestations;Metabolic alterations;Vascular findings;Inflamatory and infeccious diseases;Take home messages

## MSEE-45 ADVANCEMENTS IN FISTULA IMAGING TECHNIQUES FOR ONCOLOGY: A COMPREHENSIVE REVIEW AND MULTIMODALITY CORRELATION

Sumeet Virmani, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Pokhraj P. Suthar, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren Arsenault, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Highlight the importance of integrating multiple imaging modalities such as CT, MRI, PET-CT, EUS, and MRF for a comprehensive assessment of oncological fistulas.• Emphasize the strengths of each modality in providing different aspects of information, such as anatomical detail, functional assessment, and tissue characterization.• Discuss the significance of advanced imaging techniques like diffusion-weighted MRI and dynamic contrast-enhanced MRI in improving sensitivity for detecting fistulas, especially those associated with tumor involvement. Illustrate how these techniques enhance diagnostic accuracy and aid in early detection and characterization.

**TABLE OF CONTENTS/OUTLINE**

Fistulas, abnormal connections between two epithelialized surfaces, present a challenging scenario in oncology due to their potential complications and impact on patient quality of life. This abstract reviews the evolving landscape of imaging modalities used for detecting and characterizing fistulas in oncological contexts. Recent advancements in imaging technology, including diffusion-weighted MRI, dynamic contrast-enhanced MRI, and positron emission tomography-computed tomography (PET-CT), offer enhanced sensitivity and specificity in identifying fistulas, particularly in the setting of tumor involvement. Moreover, emerging modalities like endoscopic ultrasound (EUS) and magnetic resonance fistulography (MRF) provide valuable insights into fistula anatomy and surrounding tissues, aiding in treatment planning and monitoring response to therapy.

## MSEE-46 LYMPHATICS FROM HEAD TO TOE: NON ENHANCED MR LYMPHOGRAPHY IS MORE THAN AN OPTION

Lionel Arrive, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Matthias Barral, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaa El Mouhadi, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Lymphatic anatomy is complex and challenging to explore. New imaging modalities improve understanding of many lymphatic disorders, but some of them are invasive-Non enhanced MR lymphography, a non invasive modality using heavily T2- weighted MRI sequences, has an excellent contrast and spatial resolution and can analyze both peripheral and central lymphatic system-Lymphatic disorders can be secondary to several conditions (surgery, radiation therapy) or can be congenital with localized or diffuse abnormaities. -Non contrast MR lymphography can be helpful for treatment planning and intervention procedures.

**TABLE OF CONTENTS/OUTLINE**

-Non contrast MR lymphography : technique and advantages -Anatomy and variants of the lymphatic system at non contrast MR lymphography - Lymphatic disorders from head to toe

## MSEE-47 TUBERCULOSIS: THE GREAT MIMICKER - A CASE-BASED REVIEW FROM HEAD TO TOE

**Awards**
**Certificate of Merit**

Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Horovitz (*Abstract Co-Author*) Nothing to Disclose
Paulo E. Catarina, MD (*Abstract Co-Author*) Nothing to Disclose
Joao V. Dutra Vieira, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Cerdeira Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago De Gaultier Paulo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Tuberculosis is a chronic granulomatous disease that can involve a spectrum of manifestations in multiple organs. Its clinical presentation can be nonspecific, and imaging exams are an auxiliary tool in the investigation. Diagnosis often becomes challenging as it can mimic various diseases, including malignancies. Therefore, it is crucial for radiologists to be familiar with the imaging spectra of tuberculosis in various organs and its differential diagnoses, in order to offer the best management for the patient. The purpose of this presentation is (1) to review the pathophysiology of tuberculosis, (2) to examine the imaging spectrum of tuberculosis through case-based studies, and (3) to discuss imaging features suggestive of extra-pulmonary tuberculosis and its differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Pathophysiology of tuberculosis 3. Cases presentations and differential diagnosis. 3.1. Head. 3.2. Neck. 3.3. Chest. 3.4. Cardiovascular. 3.5. Abdomen. 3.6. Urogenital. 3.7. Skeletal. 4. Summary. 5. Take Home Messages

## MSEE-48 WHOLE BODY MRI: IMAGING HEREDITARY SYNDROMES

Alexandre M. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Ralph R. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Regis Otaviano Bezerra, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pedro J. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio P. Pereira (*Abstract Co-Author*) Nothing to Disclose
Eduardo Freire, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe R. Ferreira (*Abstract Co-Author*) Nothing to Disclose
Sabrina M. Ando, MD (*Abstract Co-Author*) Nothing to Disclose
Paola Beninca, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

WB-MRI is a versatile method that can be applied in oncologic and non-oncologic scenarios, with specific protocol configurations. It is a useful test for detecting metastasis from various anatomic sites and a safe and recognized way to screen and monitor genetic and hereditary syndromes that can relate to cancer.The purpose of this exhibition is to:- Share our experience with diferent protocols of whole body resonance. - Review imaging findinds and pitfalls - A practical approach to interpreting these protocols systematizing the evaluation based on main imaging findings and clinical/laboratorial findings- Examples of neurofibromatosis, screening and monitoring of Li-Fraumeni syndrome and other conditions that can be monitored by WB-MRI.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction2) Cases/examples and teaching points of neurofibromatosis3) Examples of oncological follow up for Li-Fraumeni syndrome4) Cases/examples and teaching points of Li-Fraumeni screening5) Screening and follow up in patient whith RB1 gene mutation

## MSEE-49 IMPLEMENTATION AND ADDED VALUE OF PHOTON COUNTING CT IN YOUR ABDOMINAL IMAGING CLINICAL PRACTICE: A PRIMER ON APPLICATIONS, PROTOCOLS, AND WORKFLOW

Raja C. K. Subramaniam, PhD (*Abstract Co-Author*) Nothing to Disclose
Deborah Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Lewis, MD (*Abstract Co-Author*) Research Grant, Bayer AG
Karen A. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Eric J. Wilck, MD (*Abstract Co-Author*) Nothing to Disclose
Barak Friedman, MD (*Abstract Co-Author*) Nothing to Disclose
Neil M. Rofsky, MD (*Abstract Co-Author*) Advisory Board, Bracco Group;Advisory Board, General Electric Company;Advisory Board, Koninklijke Philips NV;Consultant, WebMD LLC
Bachir Taouli, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Bayer AG;Consultant, Guerbet SA;Research Grant, Regeneron Pharmaceuticals, Inc
Thomas P. O'Donnell (*Abstract Co-Author*) Researcher, Siemens AG
Vipashyana Jadav, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Provide an overview of the technical innovations provided by photon counting (PC)-CT 2. Discuss the patient selection and clinical applications 3. Review scanning protocols and image optimization 4. Provide tips and tricks to develop a high throughput PC-CT workflow in your practice

**TABLE OF CONTENTS/OUTLINE**

1. Background on technical development in PC-CT a. Detection of individual photons and measurement of a photon’s energy, while conventional CT measures aggregate photon energy deposition. b. Novel detector composition (cadmium telluride, cadmium zinc telluride, silicon) 2. Added benefits provided by PC-CT a. Energy discrimination and optimized spectral analysis b. Higher spatial resolution without the radiation dose penalty c. Improved contrast-to-noise ratio d. Use of reduced dose of iodinated contrast e. Lower radiation dose f. Artifact reduction 3. Clinical applications a. Mono-energy image reconstructions b. Virtual non-contrast images, iodine maps. c. Visceral organ lesion detection and characterization d. Artifact reduction in patients with metal prosthetic joints and implants. e. Opportunities for reduced dose imaging (i.e., pediatric patients) f. Future directions in quantitative imaging i). Material decomposition for renal stones and other stone diseases ii). Hepatic fat quantification 4. Development of a workflow in your practice a.

Development of a multidisciplinary PC-CT team comprised of physicists, technologists, and radiologists. b. Protocol optimization c. Patient selection d. Quality assurance

## MSEE-5 EXPLORING BOUNDARIES: IMAGING OF UNUSUAL PRESENTATIONS OF LYMPHOMA

Carolina Gutierrez Marquez, MD (*Abstract Co-Author*) Nothing to Disclose
Lina M. Cadavid Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana Bacca, MD (*Abstract Co-Author*) Nothing to Disclose
Duban Aristizabal Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel A. Correa Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Antonio Piedrahita Vallejo, MD (*Abstract Co-Author*) Nothing to Disclose
Yeison Gomez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Lymphoma has a wide spectrum of presentations and can involve every organ system in the body producing a variety of imaging appearances. Lymphoma is a common malignancy occurring at any age in life and presenting as imitator of other aggressive malignancies and benign conditions. This scientific exhibit will review the extranodal manifestations of lymphoma throughout the body on different imaging modalities emphasizing in atypical presentations including children and adult patients. Recognizing typical and atypical presentations of lymphoma will allow a better diagnostic approach and further treatment of patients in daily radiological practice.

### TABLE OF CONTENTS/OUTLINE

1) Review the classification of lymphoma: Hodgkin disease and non-Hodgkin lymphoma. Hodgkin disease usually present with nodal involvement. Therefore, this review will emphasize in extranodal presentations of non- Hodgkin lymphoma in different locations and highlight atypical forms. 2) Cased based examples of extranodal lymphomas in different organ systems and imaging modalities:• Head and spine• Intrathoracic disease, focused in parenchymal lung involvement• Abdomen and pelvis • Bone 3) Discuss, along with the clinical cases, the different imaging modalities used for diagnosis (US, CT, MRI, PET/CT), their limitation and strengths.

## MSEE-50 HEREDITARY TUMOR SYNDROMES ENCOUNTERED IN CARDIOTHORACIC IMAGING: MULTIMODALITY IMAGING REVIEW

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Charanjeet Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Gange JR, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc Stockholder, Bristol-Myers Squibb Company Research Consultant, Bayer AG Medical Advisory Board, AIxSCAN, Inc Shareholder, AIxSCAN, Inc
Tarek S. Elkady, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Derek Nitz, MD (*Abstract Co-Author*) Nothing to Disclose
Mamta Gupta (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Overview of common hereditary tumor syndromes encountered in cardiothoracic region. • Significance of multimodality imaging in the evaluation and management of genetic cancer syndromes. • Guidelines for imaging surveillance in individuals with known genetic cancer syndromes.

### TABLE OF CONTENTS/OUTLINE

IntroductionHereditary syndromes encountered in cardiothoracic imaging:NF1Tuberous sclerosisBirt-Hogg DubeCarneys complexLi-Fraumeni syndromeCHEK-2 mutations etc.Role of imaging in screening with a focus on whole body MRIRole of multimodality imaging in diagnosis, staging and follow-upCorrelation between imaging findings and genetic testingFuture directions in imaging and hereditary tumor research

## MSEE-51 COWDEN'S SYNDROME: MULTIMODALITY IMAGING REVIEW AND INSTITUTIONAL EXPERIENCE

Brian J. Di Giacinto, DO (*Abstract Co-Author*) Nothing to Disclose
Tasmia Amjad (*Abstract Co-Author*) Nothing to Disclose
Melanie D. Duhamel, DO (*Abstract Co-Author*) Nothing to Disclose
Laurel Chen, MEng (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. PTEN hamartoma syndromes (including Cowden's syndrome) are caused by pathologic mutations of the PTEN gene. CS patients develop numerous hamartomas throughout the breast, GI tract, uterus, and subcutaneous soft tissues.2. CS also increases risk of malignant neoplasms of the breast, thyroid, kidneys, colon, and likely uterus.3. Expert consensus guidelines suggest early surveillance with mammography, thyroid ultrasound, colonoscopy. However, evidence is insufficient to recommend regular pelvic ultrasound or full body MRI.4. First think benign hamartoma, but keep malignancy in mind.

### TABLE OF CONTENTS/OUTLINE

1. Brief discussion of epidemiology and clinical relevance of dropped gallstones.2. Discussion of the relevant anatomy and both expected and less common locations of dropped gallstone pathology.3. Examples of variable appearance of dropped gallstones across multiple modalities and changes that occur with time.4. Discussion of drop gallstone induced complications.5. Case based review of key learning points and potential pitfalls.

## MSEE-52 ROSAI DORFMAN DISEASE: THE GREAT MIMICKER

Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Koustav Ghosal, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• The diagnostic and staging evaluation of patients with newly diagnosed RDD should include an assessment of disease extent, as well as evaluation for conditions either known to be associated with RDD, particularly autoimmune disorders, or known to contain an RDD-like reactive component secondary to malignancies • Most patients with RDD present with bilateral, massive, and painless cervical lymphadenopathy with or without intermittent fevers, night sweats, and weight loss • Extranodal involvement has been reported in 43% of RDD cases. Multisystem involvement occurs in 19% of cases, and prognosis is correlated with the number of extranodal systems involved.

**TABLE OF CONTENTS/OUTLINE**

Introduction Nodal Disease Extranodal disease • Intracranial lesions • Sinonasal diseae • Orbital lesions • Thoracic lesions • Liver lesions • Renal lesions • Peritoneal lesions • Vasculitis • Lytic bone lesions • Soft tissue lesions Role of imaging Differential diagnosis Systemic involvement- Lymphoma, metastases, tuberculosis, Vastleman's disease, sarcoidosis Nasopharyngeal involvement- Juveile angiofibroma, lymphoma Osseous- Osteomyelitis, fibrous dysplasia, Ewings SOFT TISSUE - Soft-tissue sarcoma, desmoid tumor, Inflammatory pseudotumor VASCULITIS- Takayasu arteritis

## MSEE-53 IMAGING OF MUSCULOSKELETAL TOXICITIES DURING ANTICANCER TREATMENT IN THE ERA OF PRECISION MEDICINE

Marta Braschi Amirfarzan, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Rassi, MD (*Abstract Co-Author*) Nothing to Disclose
Lacey McIntosh, DO, MPH (*Abstract Co-Author*) Nothing to Disclose

**TEACHING POINTS**

Increasingly specific therapies in medicine are not without risk for complication.Radiologists reviewing follow-up therapy imaging should actively survey for therapy toxicities as the presence or absence of toxicity will influence a patient's treatment plan.

**TABLE OF CONTENTS/OUTLINE**

Review of the mechanism of action of the agents involved in musculoskeletal toxicities List of drug classes with examples of musculoskeletal side effects: Chemotherapy: Fluid retention from docetaxel, subtrochanteric femoral fracture from bisphosphonates Radiation Therapy Osteoporosis, Insufficiency Fractures, Osteonecrosis, Immune checkpoint inhibitors: Inflammatory Arthritis, Synovitis, Myositis, Sarcoid-like reaction Molecular Targeted therapies: Fluid retention from Imatinib Hormonal Treatment: osteoporosis from letrozole, osteonecrosis, fractures Cases Immune checkpoint inhibitors - inflammatory arthritis Aromatase inhibitors - osteoporosis Radiation therapy - fracture Bisphosphonates - fracture

## MSEE-54 LYMPHOMA: FROM HEAD TO TOES

Andres F. Caliz Cabrales, MD (*Abstract Co-Author*) Nothing to Disclose
Luz A. Unigarro, MD (*Abstract Co-Author*) Nothing to Disclose
Julian M. Gandur, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Blanco Rojas, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Natalia Venegas Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas H. Plata, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Describe the different types of lymphomas that may affect the body and their epidemiology.Exemplify imaging findings of different lymphomas in CNS, head and neck, thorax, abdomen and bone.Determine the usefulness of different imaging modalities in diagnosis of human body lymphomas.Compare and contrast imaging findings of different lymphomas in different įreas of the body.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction2. Epidemiology3. Central nervous system4. Head and neck5. Thorax6. Abdomen7. Musculoskeletal

## MSEE-55 MUCINOUS NEOPLASMS AND THE ROLE OF HIPEC

Ahmed M. Sobieh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Elhamy R. Heba, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Michael J. Nisiewicz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Pathogenesis of peritoneal mucinous neoplasms originates from rupture at the primary site, resulting in dissemination of malignant cells into the peritoneal cavity- HIPEC is one part of a multimodal treatment for peritoneal neoplasms. Goal of HIPEC is to treatment microscopic disease following surgical debulking/cytoreductive surgery- HIPEC is not a curative therapy, it is used for palliation and prolonged survival- Pseudomyxoma peritonei is classically defined as originating from appendiceal mucinous neoplasms. Currently, the term refers to mucinous peritoneal neoplasms originating from any abdominal or pelvic organ.

**TABLE OF CONTENTS/OUTLINE**

- Anatomy of the peritoneal cavity and pathways of disease migration- Review imaging features of various mucinous neoplasms of the abdomen and pelvis, with pathologic correlation- Definition of HIPEC, how HIPEC is performed, and its role in the treatment of mucinous neoplasms- Case review of various mucinous neoplasms, pre and post treatment

## MSEE-56 MEDICAL DEVICES IN THE ABDOMEN AND PELVIS- A PICTORIAL REVIEW FOR TRAINEES

Farah Rahman, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Siddiqui (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin Sellers, MD (*Abstract Co-Author*) Nothing to Disclose
Denton Connor, MD (*Abstract Co-Author*) Nothing to Disclose
Anugayathri Jawahar, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Comprehensive overview of various medical devices in the abdomen and pelvis and their imaging appearances on different modalities.The clinical indications of these medical devices, normal versus aberrant locations. Complications arising from aberrant locations.

**TABLE OF CONTENTS/OUTLINE**

Iatrogenically placed catheters, tubes, and devices to assist medical management in the abdomen and pelvis are common. New devices are coming to the market regularly, and radiologists need to know the imaging findings of these medical devices, understand the role of different devices in medical care, and differentiate between normal and appropriate positions. It is crucial to identify when these devices are outside their territory and recognize potential complications associated with them when in abnormal locations. This educational exhibit aims to provide a comprehensive overview of the radiographic appearances and clinical implications of short-term retrievable, long-term retrievable, and permanent devices within the abdomen and

pelvis.IntroductionDescribe the medical devices in relation to indication, expected position, abnormal location, and expected complication with the abnormal location. Short Term Retrievable Devices (Nasogastric Tubes, Biliary Stents, Capsule Endoscope, Intra-aortic Balloon Pump) Long Term Retrievable Devices (Gastric Lap Bands, Neurostimulator Device, Antibiotic Beads, Intrauterine Device, Vaginal Pessary, NuvaRing, IVC filter)Permanent/Non-Retrievable Devices (Vasectomy Clips, Penile Prosthesis types, Tubal Ligation Clips, Hernial Plug)Summary and take home points

## MSEE-57 FROM HEAD TO TOE: UNUSUAL LOCATIONS OF EXTRANODAL LYMPHOMAS

Yanet Y. Torres Maza (*Abstract Co-Author*) Nothing to Disclose
Alejandra M. Bonilla Ruiz I, BDS (*Abstract Co-Author*) Nothing to Disclose
Merecedes B. Mayta Jimenez, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa E. Velezmoro Diaz, MD (*Abstract Co-Author*) Nothing to Disclose
Lisett N. Cruzado-Quiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Marycarmen E. Flores Duenas, MD (*Abstract Co-Author*) Nothing to Disclose
Romy L. Ames Caro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Lymphoma is a neoplastic proliferation of lymphoid cells in lymph nodes and lymphatic tissues primarily, with bone marrow, spleen, and thymus involvement in many cases, but it can have an extranodal location, with or without nodalinvolvement.The extranodal engagement occurre more frequently for non-Hodgkin lymphomas (NHL, 25-40%) than for Hodgkin lymphomas (HL, 1%).The most common types of extranodal lymphomas (ENL) are diffuse large B-cell lymphoma (DLBCL) and Malt lymphoma.The gastrointestinal tract is affected in 43%, followed by head and neck with 14%, lung (2%), skin (7%), bone (5%), and brain (6-7%).On imagens one of the main characteristics is that the majority of these tumors show hyposignal in T2 sequences, enhancement on contrast and show marked restriction diffusion.Cross-sectional imaging (MRI and CT) are advised as techniques in the diagnosis, staging and follow-up, mainly in the diagnosis since many of these tumors are not surgical of first intention, therefore their recognition and accurate diagnosis make this pathology an important issue to take into account.

### TABLE OF CONTENTS/OUTLINE

Primary Thyroid Lymphoma, primary suprasellar Lymphoma, Primary uterine cervix lymphoma, Primary rectal lymphoma, Anal plasmablatic lymphoma, Primary bone lymphoma

## MSEE-58 DENGUE FEVER: A GUIDE FOR A MULTIMODAL APPROACH TO MULTISYSTEMIC COMPLICATIONS

Eduardo Gomes De Menezes JR, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Alves (*Abstract Co-Author*) Nothing to Disclose
Fernando Yamauchi (*Abstract Co-Author*) Nothing to Disclose
Carolina Carotenuto Ramos, MD (*Abstract Co-Author*) Nothing to Disclose
Helena A. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Dengue is the most important mosquito-borne viral disease in the world. The prevalence of the infection has increased dramatically in recent decades. The disease is now endemic in more than 100 countries worldwide.2. Dengue has a wide spectrum of clinical signs and symptoms, ranging from asymptomatic infection to severe, lethal manifestations. The early diagnosis of dengue can be established provisionally by clinical observation and readily available laboratory tests.3. According to the 2009 World Health Organization guidelines, patients are categorized as having the non-severe form (subdivided into those with warning signs and those without) or the severe form, according to clinical, laboratory and radiological criteria.4. Therefore, there is growing interest in the early identification of image characteristics related to disease with multisystemic representation, playing a highly relevant role in clinical management, through adequate identification, reporting and multimodality radiological characterization.

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION- OVERVIEW- PHYSIOPATHOLOGY- DIAGNOSIS - CLINICAL FORMS2. SYSTEMIC COMPLICATIONS AND REPORTING- ABDOMINAL- THORACIC - NEUROLOGYCAL - CARDIOVASCULAR- MUSCULOSKELETAL3. FRONT LINE APPROACH - ULTRASOUND- X-RAY4. GUIDED SYMPTOM APPROACH5. CONCLUSION

## MSEE-6 NOT ALL THAT IS STENOSED IS ATHEROSCLEROSED: THE VARIOUS FACES OF FIBROMUSCULAR DYSPLASIA AND ITS MIMICKERS

David M. Yousem, MD, MBA (*Abstract Co-Author*) Royalties, RELX;Speaker, MRI Online;Board Member, MRI Online;
Mohab Elnashar (*Abstract Co-Author*) Nothing to Disclose
Yasmin Aly (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understanding the pathogenesis and the histopathological characteristics of Fibromuscular Dysplasia (FMD). 2. Explore the diverse morphological presentations of FMD observed on angiograms, ranging from the common "string of beads" pattern to less familiar atypical forms such as carotid webs and artery dissections. 3. Understanding the clinical context surrounding FMD including patients' demographics and presenting symptoms. 4. Brief discussion on the differential diagnosis of FMD seen on angiographic imaging and how to differentiate them apart. 5. Illustrate the role of Radiology in treatment of FMD.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Definition. b. Epidemiology of FMD. c. The reason behind the growing interest in FMD. 2. Pathophysiology: a. The pathogenesis theorized leading to FMD. b. Histopathological classification of FMD. 3. Review of the different angiographic variants of FMD. 4. A case-based review: Providing sample scenarios illustrating the clinical findings and the angiographic findings of FMD. 5. Differential diagnosis of FMD on angiograms including, atherosclerosis, standing waves, segmental medial arteriolysis (SAM) and arterial tortuosity caused by multiple diseases to be discussed. 6. Summary and takeaway points.

## MSEE-60 POST-SURGICAL COMPLICATIONS: FLUOROSCOPIC FINDINGS OF PERFORATIONS, LEAKS, AND FISTULAS

Madeleine Nguyen (*Abstract Co-Author*) Nothing to Disclose
Alex Nguyen (*Abstract Co-Author*) Nothing to Disclose
Ryan Ko (*Abstract Co-Author*) Nothing to Disclose
Don N. Nguyen, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Although utilization numbers show fluoroscopy is not the cornerstone in diagnostic radiology with continued emphasis on cross sectional imaging, it is important to recognize its critical role particularly in the post-operative setting. The purpose of this educational exhibit is to familiarize radiologists with a series of cases highlighting fluoroscopic findings of worrisome complications following surgery. After review, the audience will be able to:1. Recognize different fluoroscopic studies and technique to help diagnose post-surgical complications2. Identify important fluoroscopic imaging findings that would prompt emergent intervention3. Discuss implications of different post-surgical complications on patient management, treatment and overall prognosis

**TABLE OF CONTENTS/OUTLINE**

I. Background on FluoroscopyII. Types of Fluoroscopic Studies (Indications, Oral Contrast Agents, Techniques)III. Cases of Post Surgical Complications:1. Boerhaave syndrome- Post operative nausea/vomiting (Esophagram)2. Gastrobronchial fistula- Esophagectomy with gastric pull through ('Tracheobronchogram')3. Gastric pouch leak- Roux en Y gastric bypass (Upper GI series)4. Feculent peritonitis- Partial colectomy for colonic neoplasm (Barium enema)5. Vesicovaginal fistula- Hysterectomy for cervical cancer (Cystogram)IV. Review of Fluoroscopic Findings (Perforations, Leaks and Fistulas)V. Patient Management/PrognosisVI. Clinical and Imaging Pearls

## MSEE-61 HYDATID DISEASE BEYOND HEPATIC INVOLVEMENT: A PICTORIAL REVIEW

**Awards**
**Certificate of Merit**

Ayse Ibis, MD (*Abstract Co-Author*) Nothing to Disclose
Mustafa Durmaz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the lifecycle and route of transmission for the causative agent (E. granularis) responsible for Hydatid disease and its epidemiology.Learn about the clinical signs and symptoms and how to confirm the diagnosisReview characteristic imaging findings at various parts of body with multimodality approach(US, CT and MRI) and staging.List possible differential diagnoses and how to approach to cystic lesions in atypical locationsLearn about the treatment options

**TABLE OF CONTENTS/OUTLINE**

Introduction to Hydatid DiseaseLife cycle of E. granulosus and TransmissionClinical Manifestations and DiagnosisInvolvement of Different Organs and Systems/Imaging FindingsTreatment

## MSEE-62 ESSENTIAL GUIDE FOR THE RADIOLOGIST IN IMAGES PREPARATION FOR SCIENTIFIC OR EDUCATION PRESENTATIONS

Orlando Catalano, MD (*Abstract Co-Author*) Nothing to Disclose
Vittoria Nunziata (*Abstract Co-Author*) Nothing to Disclose
Antonio Nunziata, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The most of the native images in Radiology are in DICOM format, not suitable for digital presentations and for rewiev articles. For this purpose they have to be converted in other formats. They have to have a suitable resolution, appropriated color codify, light compression and discreet evidence of the pathological focus. The purpose of the presentation is to give a guide to the Radiologist on how to prepare images and drawings for presentations on screen or on papery support.

**TABLE OF CONTENTS/OUTLINE**

The DICOM format represents the standard used by all the builders of Radiologic equipments. The DICOM files contains patient data, type of equipment, image parameters and finally the digital image, generally in Jpeg format, with a light level of compression. The DICOM files is not suitable for screen presentation softwares (PowerPoint or similars). The images extracted in the formats JPEG, PDF, PNG, GIF can be inserted, with a resolution at least of 150 dpi ( 300 dpi in 4K screens), with RGB color codify or in the greyscale. To be printed on papery supports (blackboard panel, rewiev articles, etc.), the images possibly have to be in TIFF format, resolution of at least of 400 dpi, CMYK color codify or in greyscale. The compression deteriorates in proportional way the image quality. The various digital images, the various color modes, the effects of compression on the image quality and a final toolkit for the optimal preparation of the images are illustrated in uploaded pdf.

## MSEE-63 EXPANDING THE DIFFERENTIAL FOR PELVIC MASSES: EXPLORING ATYPICAL PRESENTATIONS OF CLASSIC DIAGNOSES IN THE PELVIS

Ece I. Akduman, MD (*Abstract Co-Author*) Nothing to Disclose
Amirhossein Mohammadian Bajgiran, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Dilli (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The pelvis houses many structures including the rectum, bowel, bladder, reproductive organs, bone, soft tissue and lymphatics, from which myriad pathologies can arise. Pelvic masses presenting with atypical size, location, progression and arising structures can confuse the diagnosis for even the experienced radiologist. Careful comparison of key radiologic findings and diagnostic criteria between pelvic masses and their differentials is important for accurate reporting. Understanding of the pathologic basis behind pelvic masses can aid in the interpretation of their radiographic findings.

**TABLE OF CONTENTS/OUTLINE**

1. Extramedullary rectal plasma cell neoplasm a. Case study b. Diagnosis and key features c. Comparisons with bone-associated plasma cell neoplasm and DLBCL 2. Pelvic extra-adrenal myelolipoma a. Case study b. Diagnosis and key features c. Comparison with teratoma, liposarcoma and lipoma 3. Pelvic schwannoma a. Case study b. Diagnosis and key features c. Comparison with spindle cell sarcoma and GIST 4. Extra-uterine leiomyosarcoma a. Case study b. Diagnosis and key features c. Comparison with uterine leiomyosarcoma and parasitic fibroid 5. Periurethral leiomyoma a. Case study b. Diagnosis and key features c. Comparisons with uterine leiomyoma and urothelial carcinoma 6. Bladder small cell carcinoma a. Case study b. Diagnosis and key features c. Comparisons with urothelial carcinoma 7. Immature teratoma a. Case study (35 cm mass from pelvis to gallbladder fossa) b. Diagnosis and key features c. Comparisons with 30 cm mature teratoma and clear cell ovarian carcinoma 8. Rectal neuroendocrine carcinoma a. Case study b. Diagnosis and key features c. Comparisons with rectal NET and adenocarcinoma

## MSEE-64 TOWARD A CROSS-ORGAN AND COMPREHENSIVE UNDERSTANDING OF CARCINOSARCOMA OR SARCOMATOID CARCINOMA IN THE ABDOMEN AND PELVIS

(*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Tatsuya Suzuki (*Abstract Co-Author*) Nothing to Disclose
Hirotaka Akita (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maho Kurihara (*Abstract Co-Author*) Nothing to Disclose
Yuko Tsujioka, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Orito Ikeda (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Cancer cells originating from diverse organs, referred to as carcinosarcomas or sarcomatoid carcinomas, may be accompanied by sarcomas or sarcoma-like cells. These occurrences are uncommon, typically associated with an unfavorable prognosis, and often present challenges in terms of effective treatment. Additionally, the World Health Organization (WHO) classification is not unified for each organ. 2. In recent years, efforts have been made to identify shared characteristics among these tumors and investigate them in a cross-organ fashion. This implies that radiologists may be required to understand these tumors from a cross-sectional perspective in the future. 3. Here, we systematically compiled WHO classifications and clinical characteristics. We discussed a comprehensive, cross-sectional approach to imaging findings based on insights from our cases.

**TABLE OF CONTENTS/OUTLINE**

(1) Introduction (2) Female Genital Tumors (3) Urinary and Male Genital Tumors (4) Digestive System Tumors (5) Discussion (6) Summary (7) References

## MSEE-65 DEVELOPING PATIENT-SPECIFIC ORTHOPAEDIC AND SPINE ANATOMICAL MODELS AND OSTEOTOMY SURGICAL GUIDES FROM MEDICAL IMAGING AS AN IN-HOSPITAL CLINICAL 3D PRINTING SERVICE

**Awards**
**Cum Laude**

Mark B. Tan, MBBS, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Applications and value proposition of designing, developing and producing patient-specific 3D printed orthopaedic and spine anatomical models and osteotomy surgical guides via an in-hospital clinical 3D printing serviceImaging acquisition, segmentation and surgical guide design principles and considerations of these models and guidesCase examples

**TABLE OF CONTENTS/OUTLINE**

Applications of patient-specific 3D printed orthopaedic and spine anatomical models and osteotomy surgical guides.Value proposition of an in-hospital clinical 3D printing service for these devices.Image acquisition considerations for 3D printed orthopaedic and spine models and osteotomy surgical guides, i.e.CT: Utilisation of thin slices, contiguous slice intervalsMRI: Optimum sequence acquisition for modellingSegmentation considerations, i.e.Tumour segmentationCT-MRI-PET co-registrationSurgical guide design considerations, i.e.Design envelopes Fiducial and anchoring points, cutting slotsMaterial selection e.g. ability to be sterilised, stiffness, etc.These considerations are structured as case based teaching points, including the following casesCongenital - Foot Polydactyly supernumerary toe excision and 5th metatarsal osteotomy and bone graftingCongenital - Blount disease: Osteotomy with external fixation and gradual correctionPost traumatic - Distal Ulna post-traumatic deformity: Osteotomy and correctionPost-infection - Distal ankle deformity secondary to poliomyelitis: Osteotomy and realignment Spine - Atlantoaxial instability: C1-C2 instrumented fusionTumour (benign) - Humerus osteochondromaTumour (malignant) - Pelvic chordoma

## MSEE-66 ADPKD BEYOND KIDNEYS: THE ROLE OF DEEP LEARNING IN PRACTICAL IMPLEMENTATION OF EXTRARENAL MRI IMAGING BIOMARKERS

Hreedi Dev (*Abstract Co-Author*) Nothing to Disclose
Chenglin Zhu (*Abstract Co-Author*) Nothing to Disclose
Martin R. Prince, MD, PhD (*Abstract Co-Author*) Patent agreement, General Electric Company;
Zhongxiu Hu (*Abstract Co-Author*) Nothing to Disclose
Vahid Bazojoo, MD (*Abstract Co-Author*) Nothing to Disclose
Usama Sattar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Arman Sharbatdaran, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Autosomal Dominant Polycystic Kidney Disease (ADPKD) is a systemic disease primarily affecting kidneys and other organs requiring a comprehensive analysis when imaged by abdominal MRI or CT. MRI emerges as a transformative approach allowing for efficient and reproducible calculation of several clinically meaningful metrics assisting with currently limited treatment options due to incomplete evaluation of many imaging features.

**TABLE OF CONTENTS/OUTLINE**

Already well-known implemented imaging biomarkers: 1. ORGANS:I)Native kidneys- Height-adjusted Total kidney volume II) Liver-Volume III) Spleen - VolumeRecently developed imaging biomarkers and their role in clinical management. 1. ORGANS: I) Native kidneys: -Height adjusted Total kidney volume averaging 5 sequences on multiple scans -Exophytic simple renal cyst -Exophytic complex renal cysts -Complex renal cysts -Simple renal cysts -Transplant kidney volume II)Liver: -Fat fraction -Cyst Count -Cyst fraction (%) -Complex cystsIII) Pancreas: - Volume - Pancreatic cystsIV) Stomach: -Confinement by adjacent enlarged organsV) Gallbladder :- Bile accumulation rateVI) Seminal vesicles: - Volume (megavesicles)VII) Prostate: - Midline CystVIII) Bladder: - Volume - Urine output and ureteral jet effect2. VASCULAR STRUCTURESI) Aorta:- Volume - Aortic pulsatilityII) IVC Compression3. FLUID ACCUMULATIONSI) Pleural effusion: - volumeII) Pericardial effusion: - volumeIII) Ascites/free pelvic fluid: - volume4. BODY COMPOSITIONI) Visceral fat: - volumeII) Subcutaneous fat:- volumeIII) Paraspinal and abdominal wall muscle5. OTHERI) Nerve root sheath cysts

## MSEE-67 MAMMARY-TYPE MYOFIBROBLASTOMA: LOCATIONS AND IMAGING FEATURES WITH PATHOLOGIC CORRELATION

Ruifeng Guo (*Abstract Co-Author*) Nothing to Disclose
Ba D. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Steven Herber, MD, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To present the epidemiology, pathogenesis, clinical manifestations and differential diagnosis of mammary-type myofibroblastoma. 2. To show the different locations of mammary-type myofibroblastoma with its multi-modality imaging including radiography, ultrasound, CT, MR and PET/CT.

**TABLE OF CONTENTS/OUTLINE**

Mammary-type myofibroblastoma (MTMF) is a benign mesenchymal tumor initially reported by Wargotz et al. as a tumor in the breast of older men, also known as "benign spindle cell tumor of the breast", "spindle cell lipoma," "fibroma," "myogenic stromal tumor," or "solitary fibrous tumor" of the breast. It is theorized to arise from accessory breast tissue occurring along the embryonic milk-line from the axilla to the medial groin. Almost half of cases are found in the pelvis or inguinal region. About 25% of MTMF occur outside the embryonic milk-line, in the head and neck, abdomen, lower extremity, and to a lesser extend upper limb. The pathogenesis of mammary-type myofibroblastoma outside the embryonic milk-line distribution is still not totally elucidated. The exhibit presents the spectrum of MTMF features on ultrasound, CT, MR and PET/CT imaging and discusses their differential diagnosis based on early or advanced stages of the lesion. The exhibit also reviews the different sites of mammary-type myofibroblastoma such as pelvis, ischio-rectal region, back, retroperitoneum, inguina, thoracic wall, breast and lower extremity. An instance of recurrent tumor is also discussed and illustrated.

## MSEE-68 A DANGEROUS FRIENDLY FIRE: THE RADIOLOGICAL FEATURES OF IMMUNOTHERAPY-RELATED ADVERSE EFFECTS

**Awards**
**Certificate of Merit**

Helena A. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. dos Anjos, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Luciana Ramacho Rolim Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Gomes De Menezes JR, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Immunotherapy has revolutionized cancer management and diagnosis. Although the immune checkpoint inhibitors (ICIs) are successfully used to treat a wide variety of neoplasms, sometimes in advanced stages, they are related to patterns of disease progression and especially to negative effects or complications, named immune-related adverse events (irAEs).2. The immune-related adverse events (irAEs) should be graded according to their severity, requiring rapid recognition and management, given the spectrum of alterations, from indolent to potentially fatal. In this context, Diagnostic Imaging play a key role in front-line patient care.3. We proposed an approach based on questions and clinical cases to review the main concepts related to immunotherapy in a didactic and structured way, with a focus on clinical and radiological aspects of immune-related adverse events (irAEs).

**TABLE OF CONTENTS/OUTLINE**

1. Introduction- Key Concepts about Immunotherapy - The lexicon: ICIs and patterns of progression and response 2. Immune-related Adverse Events- Grading Severity Scale- Thoracic - Pneumonitis - Sarcoid-like reaction- Cardiovascular - Myocarditis - Vasculitis - Pericarditis- Gastrointestinal - Colitis - Gastroenteritis - Hepatitis - Pancreatitis - Cholangitis - Cholecystitis- Endocrine - Hypophysitis - Thyroiditis - Adrenalitis - Musculoskeletal - Arthritis (Inflammatory)- Central Nervous System - Encephalopathy 3. Conclusion

## MSEE-69 SPINE-TINGLING ENCOUNTERS WITH THE EXTRASPINAL KIND: INCIDENTAL FINDINGS ON LUMBAR SPINE MRI

Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Erwin Ho (*Abstract Co-Author*) Nothing to Disclose
Maryam Golshan Momeni, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Abstract Co-Author*) Nothing to Disclose
Cassidy Tung (*Abstract Co-Author*) Nothing to Disclose
Elliott Lebby, MD (*Abstract Co-Author*) Nothing to Disclose
Kasha Chen (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review the spectrum of incidental extraspinal findings on lumbar spine magnetic resonance imaging (MRI). To highlight imaging features of incidental extraspinal findings on lumbar spine MRI and review potential blind spots and pitfalls in commonly missed lesions.

**TABLE OF CONTENTS/OUTLINE**

MRI of the lumbar spine is commonly performed in routine evaluation for low back pain. Approximately 23% of American adults report they will seek diagnostic evaluation with MRI for this indication. MRI of the lumbar spine can reveal a range of incidental extraspinal findings within the organs in the field of view. Importantly, clinically significant extraspinal findings may be treatable and a systematic approach to diagnosis may reduce delay for treatment or unnecessary medical costs. This educational exhibit will: (1) review clinically significant incidental findings on magnetic resonance imaging (MRI) of the lumbar spine with illustrative cases within musculoskeletal, vascular, gastrointestinal, endocrine, and genitourinary systems, and (2) highlight imaging features and potential blind spots in the assessment of incidental pathologies including chest wall hematoma, lymphatic metastases, retroperitoneal hemorrhage, abdominal aortic aneurysms, gastrointestinal stromal tumor, cholelithiasis, choledocholithiasis, adrenal lesions, renal cell carcinoma, and ovarian cysts.

## MSEE-7 COWDEN SYNDROME: GENOMICS, ONCOGENESIS AND IMAGING REVIEW FOR ASSOCIATED PATHOLOGIES

Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Usama I. Salem, MBBCh, MD (*Abstract Co-Author*) Nothing to Disclose
Silvana C. Faria, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmed Taher, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review the genomics, oncogenesis and epidemiology of Cowden Syndrome (CS). 2. Outline the major and minor diagnostic criteria of CS. 3. Discuss the various tumor presentations of CS. 4. Illustrate the spectrum of associations and imaging features of associated benign lesions and malignancies. 4. Describe the current screening program for CS patients.

**TABLE OF CONTENTS/OUTLINE**

a. Epidemiology of CS i. Age/gender ii. Geographic distribution, populations at risk iii. Pattern of inheritance, discovery by Lloyd and Dennis in 1963 b. Pathophysiology of CS i. Genomics ii. Oncogenesis iii. Histopathology c. Surveillance imaging techniques d. Specific imaging examples of associated benign lesions and cancers that can be seen with surveillance i. Lhermitte-Duclos disease ii. Breast cancer/benign breast lesions iii. Thyroid carcinoma/benign thyroid growths iv. Endometrial cancer/uterine fibroid v. Colon cancer/polyps vi. Renal cell carcinoma vii. Melanoma/benign skin lesions e. Recommendations regarding management and genetic counseling

## MSEE-70 HOW ABOUT ACTINOMYCOSIS?

Roberto Fornell-Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Manex Lasa (*Abstract Co-Author*) Nothing to Disclose
Udane Oiartzabal, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Maria Asensi, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rodriguez Ripalda, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Jose Gomez Muga, MD (*Abstract Co-Author*) Nothing to Disclose
Leire Ormaetxe Albeniz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe the physiopathology and the radiological features of the major forms of systemic actinomycosis and their differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

Actinomyces is a gram-positive branching anaerobic bacteria that causes an indolent and recurrent suppurative infection. Although it predominantly affects the cervicofacial area, it can invade nearly any organ in the organism.Early treatment is crucial and typically results in a favourable prognosis. However, the locally invasive and disseminated forms may require aggressive surgical intervention. Therefore, early diagnosis is vital for successful management.Actinomycosis is a challenging diagnosis to be made based on radiological features, as its aggressive infiltrating behavior can mimic many other diseases, including both inflammatory and neoplastic lesions, requiring frequent histological confirmation.The three main characteristics that every radiologist must keep in mind in order to recognize this disease are its chronicity, its tendency to propagate across tissue planes conforming complex abscesses, and its typical initial response to antibiotic treatment followed by continuous relapses.In this review, we present a series of cases involving different forms of this condition, including cervicofacial, intestinal, gynaecological, genitourinary, thoracic, and central nervous system manifestations, summarizing the key imaging features and their differential diagnoses to aid in accurate identification and timely management of the disease.

## MSEE-71 VASCULAR ABNORMALITIES IN ATHLETES: STATE-OF-THE-ART MULTIMODALITY IMAGING

**Awards**
**Magna Cum Laude**

Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To discuss the vascular abnormalities that can be seen in athletes 2. To highlight the role of multimodality imaging in the evaluation of vascular abnormalities in athletes. 3. To discuss illustrate these vascular issues with case examples

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Vascular abnormalities in athletes- Etiology and pathophysiology 3. Risk factors- repetitive extremity movements, muscle hypertrophy, anatomic anomalies 4. Presentations- pain, swelling, ischemia 5. Imaging modalities- ultrasound, CT, MRI, angiography 6. Discussion (including sports and predisposing factors) and illustration of the following vascular abnormalities with case examples a) Thoracic outlet syndrome (baseball pitchers, tennis) - Paget Schroetter syndrome - Aneurysms/ stenosis of subclavian/ axillary arteries b) Quadrilateral space syndrome (baseball, volleyball) c) Palmar arch injury-Hypothenar hammer syndrome (cricket, baseball, handball) d) Digital ischemia (football, baseball) e) Arterial thromboembolism f) External iliac artery endofibrosis (cycling, long-distance running) g) External iliac artery dissection h) Adductor canal syndrome (running, skiing) i) Chronic exertional compartmental syndrome (long-distance running, rugby, tennis) j) Popliteal artery entrapment (basketball, football, rugby) k) Popliteal vein entrapment (football, rugby, soccer) l) Cystic adventitial necrosis m) Venous thromboembolism n) Venous insufficiency (distance running, cycling, tennis, weightlifting) o) Mesenteric ischemia p) GI bleed q) Coronary artery disease r) Pulmonary hypertension

## MSEE-72 LOOSE TRIGGER OR SAFETY ON: MRI AFTER BALLISTIC INJURY

Irfan Nazir Hassan, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sultan Bukhari (*Abstract Co-Author*) Nothing to Disclose
David Oommen (*Abstract Co-Author*) Nothing to Disclose
Esther A. Nimchinsky, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Giraldo Herrera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Civilian bullets fired in the US have distinct imaging appearances in human tissue, depending on their ferromagnetic and non-ferromagnetic metal alloy compositions. 2. Review of available imaging should be performed if there is a known history of gunshot injury. Allowing patients with deformed or destroyed bullets to pass beyond MR Zone 3 may be associated with a lower risk of adverse events than previously thought. 3. Tissue location of bullets, or acuity of the wound, does not appear to be associated with clinically significant displacement or rotation at 1.5 T. 4. MRI of non-ferromagnetic bullets within the study field of view is subject to minor local artifacts and can still be of diagnostic quality if planned appropriately, including the use of inversion recovery sequences.

### TABLE OF CONTENTS/OUTLINE

1. Background and Literature Review. 2. Level-1 Trauma Center Retrospective EMR Search. 3. Preliminary Case Series. 4. Suggested Clinical Approach.

## MSEE-73 IMAGING OF THE UMBILICUS: WHERE IS YOUR MOTHER?

**Awards**
**Certificate of Merit**

Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hirotaka Akita (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Fumiko Yagi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) Understanding embryonic development and anatomy of the umbilicus(2) Understanding useful radiological features of umbilical and periumbilical lesions

**TABLE OF CONTENTS/OUTLINE**

I. IntroductionII. Embryonic development of the umbilicusIII. Anatomy of the umbilicusIV. Umbilicus and umbilical lesionsA. Urachal remnant- Congenital urachal anomalies (patent urachus, urachal cyst, umbilical-urachal sinus, bladder diverticulum)- Complications of the urachal remnants (infection/inflammation and urachal carcinoma)B. Omphalomesenteric duct remnants- Omphalomesenteric duct anomalies (omphalomesenteric sinus, fistula, band, cyst, and Meckel's diverticulum)- Complications of Meckel's diverticulaC. Obliterated umbilical arteriesD. Obliterated umbilical veins- Right-sided round ligament of the liver- Abscess of the round ligament of the liverE. Recanalization of the paraumbilical veinsF. Umbilical ring lesions- Congenital hernia of the umbilical cord- Gastroschisis- Umbilical hernia- Endometriosis- Sister Mary Joseph's nodule- Atheroma G. Iatrogenic lesions- Port site hernia- Port-site seroma/abscesses- Central venous catheter misplacement- Umbilical venous catheterH. Others- Umbilical ring- Acupuncture needle- Adhesion after cesarean section

## MSEE-74 WORKLOAD ASSESSMENT OF SURGERY-ASSISTED SIMULATION USING VIRTUAL REALITY TECHNOLOGY: A WORKLOAD STUDY

Hirotaka Nakashima, MSc, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. 3D images can be observed from multiple directions in a virtual reality space, enabling a different kind of surgical simulation.2. A questionnaire survey using the NASA Task Load Index was conducted to investigate the workload of the new surgery-assisted simulation.3. The survey was administered to 15 subjects (7 orthopedic surgeons from the Spine Center and 8 thoracic surgeons).4. Compared to the conventional simulation method using monitors, the overall workload remained the same and resulted in improved work performance.

**TABLE OF CONTENTS/OUTLINE**

To ensure a smooth and safe surgery, it is crucial to have a thorough understanding of the location and arrangement of blood vessels and anatomical structures beforehand. While surgical simulations using 3D images have been developed, there are limitations in accurately reproducing the surgical field due to the use of 2D monitors for observation. In recent years, virtual reality (VR) technology has gained momentum in surgical simulations, enabling objects to be viewed from all angles within a virtual space, and providing an easier grasp of the positioning of structures. However, there are concerns about the potential for increased physician burden. To address this concern, we conducted an experiment comparing the workload of surgical simulations using VR technology to those using conventional 2D monitors, utilizing NASA's Task Load Index. The results revealed that surgical simulation using VR technology improved work performance without increasing physician workload compared to the conventional method. These findings suggest that VR technology has the potential to enhance surgical simulations and improve patient outcomes.

## MSEE-75 WE ARE GOING TO THE ZOO! YOU CAN COME TOO! MULTISYSTEM ANIMAL SIGNS

Jennifer S. Weaver, MD (*Abstract Co-Author*) Nothing to Disclose
Sherry S. Wang, MBBS, FRANZCR (*Abstract Co-Author*) Royalties, RELX
Jonathan Revels, DO (*Abstract Co-Author*) Nothing to Disclose
Sarah Bastawrous, DO (*Abstract Co-Author*) Nothing to Disclose
Saeed Elojeimy, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hayden Swartz, MD (*Abstract Co-Author*) Nothing to Disclose
Arafat Ali, DO (*Abstract Co-Author*) Nothing to Disclose
Shelby Stewart, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Identify animal signs applicable to adult and pediatric patients.2. Explain and illustrate the animal signs' associated diagnoses across multiple systems and modalities.

**TABLE OF CONTENTS/OUTLINE**

1. Big cats -Tiger -Eye of tiger sign of pantothenate kinase-associated neurodegeneration -Tiger stripe appearance in Lhermitte-Duclos -Feline esophagus 2. Aviary -Bird beak sign of achalasia -Hummingbird/penguin sign of midbrain atrophy -Gull wing appearance of erosive osteoarthritis -Winking owl sign of an absent pedicle -Pooping duck sign of triquetral fracture 3. Reptiles -Cobra head sign of ureterocele -Turtleback sign of schistosomiasis -Serpent sign of ruptured hydatid cyst 4. Butterfly garden -Butterfly glioma -Butterfly vertebra sign of sagittal cleft vertebra -Fracture with butterfly fragment -Caterpillar sign of pyloric stenosis -Cocoon of encapsulating peritoneal sclerosis 5. Animals from Africa -Elephant for the ivory phalanx of psoriatic arthritis and ivory vertebra sign of opacified vertebra -Zebra sign of osteogenesis imperfecta, spleen enhancement, remote cerebellar hemorrhage -Giraffe sign of Hashimoto thyroiditis -Camel sign of Dromedary hump -Anteater nose sign of calcaneonavicular coalition 6. Animals from Asia -Panda sign of Wilson disease -Racoon eyes of base of skull fractures 7. Animals from America -Bear's paw sign of xanthrogranulomatous pyelonephritis -Moose head of corpus callosal dysgenesis -Staghorn calculus of struvite calculi 8. Aquarium -Fish vertebra of osteoporosis -Fishtail pancreas of pancreas bifidum -Lobster claw of papillary necrosis -Manta ray of bladder exstrophy -Vertebral scalloping of abnormal bone and/or abnormal forces

## MSEE-76 ABDOMINAL MANIFESTATIONS OF EXTRANODAL LYMPHOMA: IMAGING SPECTRUM

Ernesto Garcia Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Ernesto Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Aleman Flores (*Abstract Co-Author*) Nothing to Disclose
Carlos Fernandez Cabrera (*Abstract Co-Author*) Nothing to Disclose
Alejandro Santana Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Rodriguez Fuentes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To describe the extranodal manifestations of lymphoma and the imaging findings. To illustrate the imaging spectrum of extranodal lymphoma.

**TABLE OF CONTENTS/OUTLINE**

Lymphoma has the potential to impact virtually every abdominal organ and tissue, resulting in a variety of imaging spectrums. Lymphoma usually presents with nodal disease, which includes the involvement of the lymph nodes, thymus, tonsils, and Waldeyer's ring. Involvement of other organs is considered extranodal disease, except for splenic involvement, which is considered nodal in Hodgkin Lymphoma (HL), and extranodal in Non-Hodgkin Lymphoma (NHL). Extranodal involvement indicates a worse prognosis and can simulate other diseases. Common locations of abdominal extranodal lymphoma include the spleen, liver, and gastrointestinal tract. Among them, primary extranodal lymphoma is very rare, with secondary involvement more frequently found with another primary neoplasm. In both cases, extranodal affectation is more common in NHL than in HL. Although the definitive diagnosis is with biopsy, imaging techniques have an important role in the management of extranodal lymphoma.

## MSEE-77 ONCOLOGICAL PITFALLS AND MIMICS IN THE ABDOMEN AND PELVIS

Matthew T.

Heller, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Nelly Tan, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Zulfiqar, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Cole P. Thompson, MD (*Abstract Co-Author*) Nothing to Disclose
Kristina Yancey, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicole Warrington, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Illustrate differences between a pitfall and a mimic in the setting of oncological imaging.Provide case-based review of various oncological pitfalls and mimics in the abdomen and pelvis.

**TABLE OF CONTENTS/OUTLINE**

Pitfalls • Spontaneous regression of primary malignancy HCC; Burnt out seminoma • Neoplasms resembling benign entities Cystic pancreatic NET, Cystic RCC, Mucinous GI malignancy, Adrenal mets from HCC or RCC, Pheochromocytomas. • Eye-catching benign pathology with superimposed malignancy Rectal hemangioma with superimposed malignant mass. • Peri-organ infiltration of malignancy resembling benign entities: Biliary lymphoma, linitis plastica, infiltrative TCC. • Progression of disease Growing teratoma syndrome; pseudoprogression in the setting of immunotherapy. • Prozone effect Choriocarcinoma • Concomitant complications: Ovarian torsion with adnexal tumors. Mimics • Benign tumors with aggressive appearing features Renal AML, uterine leiomyoma with IVC thrombus; endometriosis; Sternberg tumor; subserosal uterine adenomyomatous polyp. • Benign entities with malignant appearing enhancement patterns: Hepatic splenosis, splenic PSA.• Infection/inflammation looking like malignancy BCG prostatitis, XG cholecystitis, IgG4 pancreatitis, Actinomycosis, peritoneal TB or disseminated fungal infection.• Foreign body reactions Gossypiboma, gluteal silicone granulomatosis, mesh plug, bulking agents. • Anatomical structures mimicking masses Colonic diverticulosis, gastric fundal diverticulum, ectopic pancreatic rest, Meckel's diverticulum.

## MSEE-78 THE RADIOLOGICAL PALETTE OF ABDOMINAL LYMPHOMA

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Harshitha Shetty, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To describe the risk factors, etiopathogenesis, classification and staging of lymphoma. 2. To illustrate the salient imaging features and spectrum of appearances of lymphoma in the abdomen 3. To discuss the imaging features of extranodal lymphoma from other organ-specific neoplastic and inflammatory mimics.

**TABLE OF CONTENTS/OUTLINE**

1. Etiopathogenesis of lymphoma with risk factors for the various organ-specific lymphomas • Bacterial infection- H. pylori, Viral infection- EBV, HTLV, HIV • Immunosuppression- Post transplant lymphoproliferative disorder • Inflammatory diseases- Celiac disease, Atrophic gastritis 2. Classification - 2022 WHO classification of tumors of hematopoietic and lymphoid tissues based on the cell of origin (B cell, T cell, NK cells) and further categories. 3. Staging of lymphoma. 4. Imaging features of lymphoma in the abdomen • GI: Stomach, duodenum, ileum, appendix, colon • Hepatobiliary and pancreas • GU: Adrenal, renal/perirenal, ovarian and testicular • Splenic • Lymph nodal 5. Imaging mimics of lymphoma • Hepatic lymphoma- liver abscess, tubercular granuloma, metastatic liver lesion • Pancreatic lymphoma- pancreatic adenocarcinoma, autoimmune pancreatitis • Nodal lymphoma- disseminated tuberculosis, metastasis • Adrenal lymphoma- adrenal tuberculosis, histoplasmosis, adrenocortical carcinoma • Renal/perirenal lymphoma- IgG4-related retroperitoneal fibrosis, Erdheim-Chester disease, Rosai-Dorfman disease, retroperitoneal lymphatic malformation • Ovarian lymphoma- ovarian metastasis, malignant epithelial ovarian cancers 6. Discuss the treatment and post-treatment imaging appearances of lymphoma.

## MSEE-79 IDENTIFYING ADVERSE EFFECTS OF IMMUNOTHERAPY: KEY CONSIDERATIONS FOR RADIOLOGISTS

Alvaro Rueda-de-Eusebio, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Guerrero Martin (*Abstract Co-Author*) Nothing to Disclose
Maria del Carmen Polidura Aaruga, MBBCHIR (*Abstract Co-Author*) Nothing to Disclose
Natividad Gomez JR, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia Lon, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The use of immune mediated treatment of cancer is improving dramatically the patient's outcome and comfort, but it also carries new toxicity profiles. While standard antineoplastic therapy is associated with immunosuppression and infections, these new therapies induce overwhelming inflammation and autoimmunity. The vast majority of these adverse events can be classified as mild or moderate, but severe and life-threatening complications requiring ICU admission can also occur.A considerable part of adverse effects related to immunotherapy can be diagnosed by imaging methods. This situation makes the role of the radiologist key when it comes to optimizing treatment individually for each patient, taking into account the risks and benefits of the different therapies.This review will focus on the radiological approach to the new challenge that is to make an accurate and early diagnosis of these complications.

**TABLE OF CONTENTS/OUTLINE**

Understanding Immunotherapy: mechanism of action and types.Methods and backgroundResults and findingsRisk and protective factorsRespiratory tract toxicityCentral nervous system toxicityDigestive tract toxicityHepatobiliary toxicityRheumatological toxicityConclusionReferences

## MSEE-8 UNVEILING THE UNINTENDED AND BEYOND THE OBVIOUS: EXPLORING INCIDENTAL FINDINGS IN CT KUB EXCLUDING STONES

Pratik Mukherjee, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
WAKADE AKSHAY DIPAKRAO, FRCR, MMEd (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Non-urinary and Urinary pathologies excluding stones are commonly seen on CT KUB studies, some of which are potentially life threatening.2. It is essential for radiologists to look out beyond stones, both for the expected mimics and more importantly for the unexpected significant incidentals.3. Timely early workup and intervention in these subset of cases can potentially reduce mortality, morbidity and improve patient outcomes by changing the management.

**TABLE OF CONTENTS/OUTLINE**

Definition Computed tomography of kidneys, ureters and bladder (CT KUB) is a quick, non-invasive technique for diagnosis of urolithiasis. It is usually considered the initial imaging modality for suspected urolithiasis in an emergency setting.CT KUB is also advantageous to detect alternate cause of flank pain. Apart from calculi and mimics of urinary colic, often significant incidental significant findings affecting a wide range of organs is detected. It is interesting to note, that most of these findings are not clinically suspected at the time of presentation.Following are few of the examples of patients who presented with flank pain/renal colic but various other incidental findings are detected:Genito-urinary Renal Cell Carcinoma, Ovarian Dermoid cyst.Hepatobiliary Acute calculous cholecystitis, Multiple Hepatic abscesses, Cystic Pancreatic mass.Gastrointestinal Acute Appendicitis, Appendicular phlegmon, Appendix mucocele, Acute colonic diverticulitis, Intussusception, Sigmoid Carcinoma with hepatic metastasis.Vascular Aortic dissection, Aortic aneurysm.Musculoskeletal Multiple myeloma, Spondylodiscitis with psoas abscess.Miscellaneous Lymphoma, Retroperitoneal fibrosis.

## MSEE-81 AN AESTHETIC NIGHTMARE. THE US, CT, PET-CT, AND MRI DETECTION OF SILICONE OIL: WHAT THE RADIOLOGIST NEEDS TO KNOW

Guillermo P. Sangster, MD (*Abstract Co-Author*) Nothing to Disclose
Ximena L. Wortsman, MD (*Abstract Co-Author*) Speakers Bureau, AbbVie Inc;Royalties, Springer Nature
Carolina Andrea Mariluis (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Silicone oil is a non-FDA-approved permanent filler injected in many countries for cosmetic purposes. It presents a high rate of complications, and its detection should be familiar to any radiologist.- Ultrasound is the first-choice imaging technique due to its high sensitivity in distinguishing cosmetic fillers. Silicone oil presents as hyperechoic deposits that show a diffuse posterior acoustic reverberance, also known as a “snowstorm” artifact.- Magnetic resonance imaging (MRI) silicone oil-specific sequences can provide an accurate extent of the deposits.- The “Bright Multi-Bubble sign” identified in T2 and STIR sequences can be useful for diagnosis in cases of lack of silicone-specific sequences.- Radiologists have a critical role in diagnosing and characterizing this filler and its complications.

**TABLE OF CONTENTS/OUTLINE**

1. To Illustrate expected imaging findings and complications in patients receiving silicone oil injections.2. To depict common and uncommon imaging patterns in ultrasound (US), computed tomography (CT), PET-CT, and MRI exams.3. To discuss the most common differential diagnosis.4. Proposal of a new radiological sign for MRI exams: Bright Multi-Bubble sign.

## MSEE-82 EXPLORING LIPEDEMA ULTRASONOGRAPHIC FINDINGS AND CLINICAL IMPLICATIONS

Marco de Andrade Bianchi (*Abstract Co-Author*) Nothing to Disclose
Deise Vargas (*Abstract Co-Author*) Nothing to Disclose
Amanda Martins E. Ribeiro Dos Santos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Lipedema is a chronic condition characterized by the disproportionate accumulation of fat in the limbs, especially in women after puberty, with an estimated prevalence of 12.3% in the population of Brazilian women. Its clinical significance lies in the impact on the patient's quality of life due to symptoms. The purpose of this article is:- Definition and Clinical Relevance of Lipedema.- Demonstration of Lipedema Presentation on Ultrasound Image.- Presentation of the “Marbleized Pattern” in Morphological Evaluation via Ultrasound as an Auxiliary Diagnostic Criterion.

**TABLE OF CONTENTS/OUTLINE**

- Description of lipedema, a condition characterized by disproportionate fat accumulation, and its analysis by ultrasound.- Retrospective analysis of ultrasound exams to identify morphological differences in the hypodermis of patients with and without lipedema.- Identification of a specific morphological pattern, termed "marble pattern," in patients with lipedema during ultrasound exams.- Discussion on the utility of morphological evaluation of the hypodermis by ultrasound in the diagnosis and clinical management of lipedema.- Exploration of the clinical implications of identifying the “marble pattern” and recommendations for the diagnosis and treatment of lipedema based on ultrasound findings.In summary, the diagnosis of Lipedema through ultrasound is something recent, still frequently confused with more frequent conditions and this work brings the morphological assessment of the hypodermis through ultrasound as auxiliary diagnostic classifications and mapping of the disease.

## MSEE-83 EPITHELIOID HEMANGIOENDOTHELIOMA FROM HEAD TO TOE: A PRIMER FOR THE RADIOLOGIST

Gregory N. Emmanuel, MD (*Abstract Co-Author*) Nothing to Disclose
Jiyae Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Braschi Amirfarzan, MD (*Abstract Co-Author*) Nothing to Disclose
Jyothi Priya Jagannathan, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Thomas, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammad A. Nouh, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Variable clinical presentations of EHE based on the site of the primary tumor • Role of different imaging modalities to establish diagnosis, assess for metastatic lesions, guide biopsy and local therapy, and monitor treatment response therapy related toxicities. • Histopathologic features of EHE how it correlates with imaging findings. • Different treatment options including local and systemic therapy tailored to the clinical presentation.

**TABLE OF CONTENTS/OUTLINE**

• Definition and etiology of EHE • Clinical presentation based on tumor site. • Imaging features of EHE: Case-based approach o Hepatic EHE: Imaging features on Ultrasound, CT and MRI o Thoracic EHE: Different patterns of disease. o Osseous and soft tissue EHE o Other less common sites of disease o Role of Bone scintigraphy and PET/CT • Local and systemic treatment options. o Role of imaging to monitor treatment response and treatment related toxicity.

## MSEE-84 FROM BARNYARDS TO JUNGLES: INJURIES IN HUMAN-ANIMAL INTERACTIONS

Mihra S. Taljanovic, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Revels, DO (*Abstract Co-Author*) Nothing to Disclose
Erica M. Lanser, MD (*Abstract Co-Author*) Nothing to Disclose
Mariam Moshiri, MD (*Abstract Co-Author*) I am the Editor of RSNA Case Collection
Sherry S. Wang, MBBS, FRANZCR (*Abstract Co-Author*) Royalties, RELX
Robert O. Cone III, MD (*Abstract Co-Author*) Nothing to Disclose
Jamie M. Elifritz, BS, MD (*Abstract Co-Author*) Officer, Forensic Radiology Group;Partner, Forensic Radiology Group

Melissa M. Picard, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer S. Weaver, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Understand the ecology and context of animal vs human traumas; Describe common and unique injury mechanisms related to animal vs human traumas; Recognize radiological manifestations of these encounters; Describe the prognoses and treatment options of the associated injuries;

**TABLE OF CONTENTS/OUTLINE**

Introduction Throughout human history, human encounters with animals have often resulted in traumatic injuries. These incidents occur across various settings, including agricultural, wild, domestic, and recreational environments. In this exhibit, we explore the spectrum of traumatic injuries stemming from these encounters, including their mechanisms of injury and radiological manifestations, with a special focus on potential findings from post mortem CT examinations. Context Recreational (Rodeo, equestrian, circus, personal exotic animals); Agricultural/Farming (Cow/bulls, pigs, poultry, sheep); Domestic (Dogs, cats, pigs, reptiles); Wild (Bears, big game cats, deer, moose reptiles)Mechanisms of injury, radiological manifestations, prognoses, and treatments Osseous: Fractures, dislocations; Neurologic: Concussion, bleeding, and other Soft tissue: Amputation, ligament/tendon injury, bite, laceration, impalement/gouging, cellulitis/infection, predation;Conclusion

## MSEE-85 EXTRANODAL LYMPHOMA FROM HEAD TO TOE: A MULTISYSTEMIC IMAGING ATLAS

Claudia Ortega Mogilevich, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Pablo Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Munoz, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Weitz, MD (*Abstract Co-Author*) Nothing to Disclose
Matias F. Callejas, MD (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Felipe A. Sanchez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Approximately 30% of lymphomas arise from sites other than the lymph nodes. Extranodal involvement can occur in extensive nodal or multisystemic disease (secondary lymphoma) or in the absence of noticeable lymph node enlargement (primary lymphoma).
- Noninvasive imaging plays a crucial role in the diagnosis of extranodal lymphoma. Findings suggestive of extranodal disease can be identified on multiple modalities, including X-ray, CT, MR, and PET.
- Extranodal lymphoma can involve virtually any organ in the body and mimic various benign and malignant pathologies. Concomitant multiorgan involvement, splenomegaly, and lymphadenopathy identified on imaging is a key indication of the potential diagnosis.
- The majority of the cases are caused by non-Hodking lymphoma, and diffuse large B-cell lymphoma is the most common subvariant. The objective of this educational exhibit is to demonstrate the appearance of primary and secondary lymphoma across multiple organ systems and imaging modalities, with a focus on practical tips and differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

- Background
- Types of lymphoma
- Primary versus secondary lymphoma
- Imaging modalities: strengths and limitations
- Sites of involvement: a) CNS, b) Head and neck, c) Thoracic, d) Cardiac/pericardial, e) Gastrointestinal, f) Genitourinary, g) Solid abdominal organs, h) MSK
- Conclusion

## MSEE-86 ANGIOSARCOMA: IN SEARCH OF RADIOLOGICAL DIAGNOSTIC "CLUES" FOR A RARE TUMOR

Silvia Bague (*Abstract Co-Author*) Nothing to Disclose
Juan Carlos Pernas, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Oliva, MD (*Abstract Co-Author*) Nothing to Disclose
Xenia Codo, BDS (*Abstract Co-Author*) Nothing to Disclose
Jaume Llauger, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Martinez, MD (*Abstract Co-Author*) Nothing to Disclose
Diana Hernandez (*Abstract Co-Author*) Nothing to Disclose
Pompeu Pascual, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To expose the radiological findings of angiosarcoma on CT-scan and MRI in different organs and systems.- To review the histological and immunophenotypic characteristics of angiosarcoma.

**TABLE OF CONTENTS/OUTLINE**

- Introduction. Angiosarcoma is a rare malignant mesenchymal tumor with endothelial differentiation and very poor prognosis that may arise in different locations. The most common presentation is as cutaneous angiosarcoma, although it can also appear in soft tissue, bone, breast, and solid organs such as liver, spleen, ovary and heart. Hematogenous spread is the hallmark of this disease, with metastatic lesions appearing most frequently in lung, liver, and bone.- Diagnosis. The diagnosis of angiosarcoma is initially suspected based on imaging findings which must be confirmed by histological study. CT-scan and MRI are useful techniques both for diagnosis and for detecting complications such as spontaneous bleeding. In turn, the biopsy confirms the diagnosis and evaluates the tumor's aggressiveness.- Our experience. This study presents a comprehensive review of the radiological findings in a series of 74 angiosarcomas diagnosed at a single institution between 2000 and 2023, and the main histological and immunophenotypic features of these tumors.

## MSEE-87 ILLUMINATING THE FRAMEWORK: THE PHOTON-COUNTING-DETECTOR SCANNER'S REVOLUTION IN MUSCULOSKELETAL CT

Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Kishore Rajendran, PhD (*Abstract Co-Author*) Nothing to Disclose
Francis I. Baffour, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG

Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Nikkole Weber, ARRT, RT (*Abstract Co-Author*) Nothing to Disclose
Holly Kasten (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Describe features of Photon Counting Detector PCD technology that are beneficial for musculoskeletal (MSK) applications. Identify key elements of protocol development and optimization for PCD CT MSK imaging Demonstrate future advancements of MSK PCD-CT imaging

**TABLE OF CONTENTS/OUTLINE**

Review current state of the art in MSK CTSingle and dual energy, standard and ultra-high resolution (UHR), routine and low dose imagingDiscuss current limits in energy integrating detector (EID) CT for the following:EID high-resolution is not dose efficient, available only in extremities, and may not be useful for quantification tasksAt low doses, image noise is amplified resulting in suboptimal low-dose imagesLimited dual energy performance in large body regions, kernel and slice thickness limitationsLimited array of metal artifact reduction optionsBenefits of PCD-CTUHR imagingUHR imaging of extremitiesIncreased spatial resolution with superior trabecular definition. Potential for bone morphometric quantification tasksUHR imaging of large jointsUHR improves visualization of anatomic detailPotential for dose savingsIncreased dose efficiencySpectral capabilitiesMulti-threshold and virtual monoenergetic imaging for metal artifact reductionSingle source or dual-source material decomposition task with better contrast to noise ratio. Results in more accurate monosodium urate and bone edema characterization with fewer artifactsFuture advancements in MSK PCD imagingBone quantification (Bone density/strength) measurementsDual source acquisition mode for improved spectral separationImproved material decomposition for bone edema and gout

## MSEE-88 DENGUE FEVER: A MULTISYSTEM MULTIMODALITY IMAGING REVIEW

Davi D. Romao, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Ana I. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Delgado (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Enzo Calheiros, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Global incidence of dengue fever has grown dramatically, with an estimated 100-400 million infections occurring each year, primarily in tropical and subtropical areas.- Although most of the patients have no or mild symptoms, a change in the spectrum of clinical manifestations has been recently noted with some specific complications being recognized more frequently, specially related to endothelial dysfunction in diverse systems.- Imaging techniques including ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET) have yielded valuable insights into the pathophysiological mechanisms and associated complications of dengue fever.- This pictorial review aims to illustrate the diverse spectrum of imaging manifestations across different organ systems in dengue fever, highlighting the applications of imaging techniques in diagnosing complications and guiding therapeutic interventions.

**TABLE OF CONTENTS/OUTLINE**

1. Background- Epidemiology and pathogenesis- Clinical diagnosis: warning signs and severe dengue (hemorrhagic fever and shock syndrome)- Laboratory diagnosis2. Multimodality Imaging: applications, strengths, and limitations3. Neurological findings: encephalopathy, encephalitis, dengue-associated stroke and neuromuscular complications4. Thoracic findings: lungs, pleura, and heart5. Abdominal findings: gallbladder, liver, spleen, abdominal compartment syndrome 6. Other findings and clinical scenarios: viral arthritis, pregnancy, post-dengue syndrome7. Take home messages

## MSEE-9 THE HIDDEN CONNECTIONS: EXPLORING PARANEOPLASTIC SYNDROMES

Manex Lasa (*Abstract Co-Author*) Nothing to Disclose
Juan Jose Gomez Muga, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Diaz, MD (*Abstract Co-Author*) Nothing to Disclose
Leire Ormaetxe Albeniz, MD (*Abstract Co-Author*) Nothing to Disclose
Ainhoa Urrutia Ortiz De Salazar, MD (*Abstract Co-Author*) Nothing to Disclose
Udane Oiartzabal, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Cisneros Carpio, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rodriguez Ripalda, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To delineate the spectrum of imaging findings observed in various paraneoplastic syndromes and illustrate the clinical manifestations precipitated by these syndromes.

**TABLE OF CONTENTS/OUTLINE**

Paraneoplastic Syndromes (PNSs) compromise a constellation of disease manifestations arising from underlying neoplasms without direct tumor invasion. They lead to a range of symptoms affecting different organs or systems, complicating diagnosis and treatment.These manifestations, often mediated by cytokines, hormones, or immune reactions, include endocrine, neurological, rheumatological/dermatological, hematologic, and miscellaneous syndromes. Based on our clinical experience, we have encountered numerous paraneoplastic syndromes.This presentation utilizes radiological images sourced from our institution to elucidate the underlying radiographic findings defining these syndromes.Early identification is crucial for optimal management and patient prognosis. Radiologists must be familiar with common PNSs and their distinct imaging features to facilitate timely diagnosis and treatment.

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# Abstract Archives of the RSNA, 2024

MSEE-1

## MULTISYSTEMIC IMAGING FINDINGS OF COCCIDIOIDOMYCOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Motoyo Yano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mark D. Sugi, MD (*Abstract Co-Author*) Consultant, Nextrast, Inc;Author with royalties, RELX
Clinton E. Jokerst, MD (*Abstract Co-Author*) Nothing to Disclose
Ichiro Ikuta, MD, MMedSc (*Abstract Co-Author*) Nothing to Disclose
Maria Zulfiqar, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Muhammad Naeem, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Logan Haug, MD (*Abstract Co-Author*) Nothing to Disclose
Akira Kawashima, MD (*Abstract Co-Author*) Nothing to Disclose
Jeremiah R. Long, MD (*Abstract Co-Author*) Nothing to Disclose
Harrison Lang, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. - Illustrate pathophysiology and mechanism of spread of Coccidioidomycosis. 2. -Provide multisystem case-based review of the imaging features of Coccidioidomycosis.

### TABLE OF CONTENTS/OUTLINE

• Coccidioidomycosis (aka “Valley Fever”) is a fungal infection found in dry desert soil. Symptomatic cases can range from mild pulmonary involvement to invasive multisystem infection particularly in the elderly and immunocompromised patients.• Intracranial findings: meningitis; hydrocephalus; vasculitis, arterial occlusion, cerebral infarction; focal parenchymal lesions, abscess, scattered T2 hyperintense white matter abnormalities.• Spinal findings: Discitis osteomyelitis +/- epidural abscess, spinal arachnoiditis, intramedullary edema/syrinx, intradural extramedullary lesions, syringomyelia/bulbia.• Chest: Acute: parenchymal ground glass or nodular consolidation +/- cavitation; intrathoracic adenopathy, pleural effusions, peribronchial thickening, miliary nodules; Chronic: residual nodule, chronic cavitation, and pneumonia, mycetoma, abscess, bronchopleural fistula• Abdomen and pelvis: Peritonitis (most common site in abdomen), hepatosplenic abscesses, lymphadenitis, pyelonephritis and renal mycetoma, prostatitis, epididymoorchitis, PID.• Musculoskeletal system Osteomyelitis, synovitis, soft tissue abscesses, cellulitis.Summary: Due to the potential multisystem involvement of Coccidioidomycosis, this exhibit is designed to help the radiologist identify spectrum of imaging features associated with each organ system, as well as provide examples where infection can mimic malignancy such as peritoneal carcinomatosis and osseous metastatic disease.

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# Abstract Archives of the RSNA, 2024

MSEE-10

## LADIES AND GENTLEMEN! WELCOME TO THE GREATEST SHOW ON EARTH - A GUIDE TO ENSURING THE CONTINUED HEALTH OF CIRCUS PERFORMERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Oliveira Gatto, MD (*Abstract Co-Author*) Nothing to Disclose
Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Leao Edelmuth, MD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle Nakamura, MD (*Abstract Co-Author*) Nothing to Disclose
Cinthia D. Ortega, MD,PhD (*Abstract Co-Author*) Speaker, Johnson & Johnson
Douglas da Cunha Khalil, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Imagine you have just been hired as the primary radiologist for a traveling circus. To succeed in your new role, you must familiarize yourself with several conditions that may become occupational hazards for your patients.This presentation will highlight the following main points: Recall common and uncommon diseases that are related to circus activities; Review the imaging patterns of different health issues; Imagine the diseases to be aware of when joining a traveling carnival; Discuss when the performer should be referred for a US, CT, or MRI scan.

### TABLE OF CONTENTS/OUTLINE

What are the conditions that may affect circus performers? Imagine what an occupational medicine physician would have to recognize, evaluate, and manage when deciding to join a traveling carnival.Various diseases and injuries can lead to a loss of productive work time among circus performers. Efficient use of diagnostic imaging can lead to proper diagnosis, quicker recovery rates, and, therefore, reduced lost work time for the troupe.Prepare to be amazed and dive into the magic of the circus. Before the curtain drops, the audience must understand the potential hazards that could lie in waiting for the troupe. This study presents a series of cases involving lesions and diseases that could create a stressful night for the circus ringmaster. But as any performer knows all too well, "the show must go on!".

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# Abstract Archives of the RSNA, 2024

MSEE-11

## VALUE OF RADIOLOGIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria A. Manning, MD (*Abstract Co-Author*) Nothing to Disclose
Jamie Marko, MD (*Abstract Co-Author*) Nothing to Disclose
Perry J. Pickhardt, MD (*Abstract Co-Author*) Advisor, Bracco Group;Advisor, Zebra Medical Vision Ltd;Advisor, Nano X Imaging;
Myles T. Taffel, MD (*Abstract Co-Author*) Nothing to Disclose
Aaron M. Udager, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Meghan G. Lubner, MD (*Presenter*) Spouse, Consultant, Elephas Bio

### TEACHING POINTS

Clinical-radiologic-pathologic correlation is critical to understanding and characterizing disease.Understanding the pathologic features of disease informs radiologic appearance and may streamline differential diagnosis and improve diagnostic confidence.For trainees, robust grasp of radiologic-pathologic correlation may reduce the need for memorization and improve pattern recognition.As our understanding of molecular features of disease and our imaging technology continue to improve, we should pursue and embrace more advanced concepts of radiologic-pathologic correlation.

### TABLE OF CONTENTS/OUTLINE

Introduction/History/Definition of Radiologic-Pathologic CorrelationReview of Radiology as low power microscopy (identification of fat/lipid, calcification, fluid/mucin, blood/vascular, fibrous tissue, iron etc) and how this frames differential diagnosis.Discuss concepts around more advanced rad-path correlation including imaging features associated with advanced pathologic features and prognosisReview the importance of assessment of rad-path concordance after image guided procedures.Summary and future directions

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# Abstract Archives of the RSNA, 2024

MSEE-12

## PEUTZ-JEGHERS SYNDROME; GENOMICS, SURVEILLANCE, ONCOGENESIS AND IMAGING REVIEW OF ASSOCIATED PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Abdelrahman A. Abusaif, MBBCh (*Abstract Co-Author*) Nothing to Disclose
James M. Jing, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Introduce the genetic epidemiologic background of Peutz-Jeghers Syndrome (PJS). 2. Discuss the different common presentations diagnostic criteria of PJS. 3. Summarize the risk of different cancers in PJS patients, according to current literature. 4. Learn various imaging modalities for cancer screening in established PJS cases. 5. Illustrate cancers diagnosed by imaging in PJS. 6. Demonstrate the impact of imaging surveillance on patient outcomes.

### TABLE OF CONTENTS/OUTLINE

1) Introduction to PJS a) Incidence and etiology of PJS. b) Genetic error mode of inheritance. 2) Diagnosis of PJS a) Frequent presentations: i. Mucocutaneous pigmentation ii. Intussusception b) Diagnostic criteria: i. Indications of genetic testing ii. Indications suggested frequency of colonoscopy upper endoscopy 3) Prognosis cancer risk a) Overall cancer risk b) Strongly associated GIT pancreatic cancers c) Strongly associated Gynecologic cancers d) Lung cancer risk e) Other associated cancers 4) Imaging surveillance for cancers in PJS: a) Pancreatic CT / MRI examination b) Gastro-intestinal series. c) Pelvic / testicular Ultrasonography. d) Mammography and breast MRI 5) Examples of cancer cases diagnosed by imaging screening 6) Screening impact on patient outcome.

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# Abstract Archives of the RSNA, 2024

MSEE-13

## MASTOCYTOSIS: PATHOGENESIS, WHO CLASSIFICATION, IMAGING FEATURES WITH PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mamie Gao, MD (*Abstract Co-Author*) Nothing to Disclose
Hagar S. Mahmoud, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review the pathology and clinical entities of mastocytosis. 2. Highlight the imaging features of mastocytosis in multiple organ systems including the lungs, lymph nodes, gastrointestinal tract, liver, kidneys, skin and musculoskeletal system 3. Discuss the potential mimics and pitfalls that may simulate the imaging features of mastocytosis.

### TABLE OF CONTENTS/OUTLINE

1-Mastocytosis pathology and pathophysiology: cutaneous mastocytosis, systemic mastocytosis (with or without cutaneous manifestations), and mast cell sarcoma. 2. Subtypes of systemic mastocytosis • indolent systemic mastocytosis (most common) • Smoldering systemic mastocytosis • Systemic mastocytosis with an associated hematological neoplasm • Aggressive systemic mastocytosis • Mast cell leukemia 2. Multisystem review of mastocytosis is a systemic disease that may affect any organ (lung, liver, spleen, musculoskeletal, gastrointestinal tract, kidneys, lymph nodes, and skin) 3. Imaging findings of mastocytosis on the US, MR, and CT is a pattern of diseases characterized by abnormal proliferation and infiltration of mast cells in different organs with inflammatory mediator release.

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# Abstract Archives of the RSNA, 2024

MSEE-14

## IMAGING AND UPDATES IN ROSAI-DORFMAN DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo G. Marcelino, MD (*Abstract Co-Author*) Nothing to Disclose
Zubin Driver, MBBS (*Abstract Co-Author*) Nothing to Disclose
Amar Shah, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss recent updates in the pathogenesis and classification of Rosai-Dorfman Disease (RDD). 2. Describe the role of imaging and clinical and radiologic findings of RDD. 3. Review new treatment options and therapeutic response evaluation.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Review epidemiology and pathophysiology of Rosai-Dorfman Disease (RDD) 3. Newer Classification systems (2016 Working Group of Histiocytic Society Classification and 2022 WHO classification of hemolymphoid neoplasms) 4. Mixed histiocytosis: an overlap syndrome 5. Association with IgG4-related disease, autoimmune diseases, and neoplasia 6. Diagnosis of RDD 7. Role of Imaging 8. Review common and uncommon imaging presentations of RDD a. Lymphadenopathy b. Cutaneous Involvement c. Central nervous system involvement i. Brain (parenchymal and dural) ii. Spine d. Skeletal system (axial and appendicular skeleton) e. Abdomen and Pelvis i. Retroperitoneum 1. Renal, perirenal, and primary retroperitoneal ii. Organs 1. Pancreas, liver, and bowel iii. Peritoneum f. Intrathoracic Involvement. i. Cardiac, trachea, mediastinum g. Breast h. Head and Neck i. Orbit, paranasal sinuses, and thyroid 9. Prognosis 10. Molecular targets for treatment 11. Review treatment options and recent advances

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# Abstract Archives of the RSNA, 2024

MSEE-15

## FUNDAMENTALS OF GASTROINTESTINAL AND GENITOURINARY FLUOROSCOPY: A PRACTICAL GUIDE FOR BEGINNERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Dennis M. Balfe, MD (*Abstract Co-Author*) Nothing to Disclose
Cary L. Siegel, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Grace G. Zhu, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley Eichar (*Abstract Co-Author*) Nothing to Disclose
Mark J. Hoegger, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Fluoroscopic image acquisition and interpretation of conditions affecting the gastrointestinal and genitourinary systems remains a crucial skill set for the radiologist. However, advances in other technologies may make fluoroscopy less familiar to the practicing radiologist. The purpose of this exhibit is to: 1. Explain the principles of contrast agent mechanism and selection. 2. Describe the practical function of fluoroscopy cameras. 3. Display the basics of patient positioning and fluoroscopic image acquisition. 4. Provide principles and steps of the most common fluoroscopy studies.

### TABLE OF CONTENTS/OUTLINE

1. Contrast agents: physics fundamentals, types of agents, specific indications, and contraindications. 2. Patient considerations: patient positioning, limited examinations, and fluoroscopic views. 3. Fluoroscopy camera standardized function: magnification, image acquisition, patient maneuvers, and collimation. 4. Principles of common fluoroscopy examinations: barium swallow/esophagram, upper GI, hysterosalpingogram, enemas, and cystography.

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# Abstract Archives of the RSNA, 2024

MSEE-16

## MULTIMODALITY IMAGING OF HEREDITARY CANCER SYNDROMES IN THE ABDOMEN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Avinash Nehra, MD (*Abstract Co-Author*) Nothing to Disclose
Garima Suman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Hereditary cancer syndromes account for 5-10% of all cancers. Imaging plays a vital role in diagnosis, screening, and surveillance of patients diagnosed or at risk for hereditary cancer syndromes. Radiologists may be able to suggest the diagnosis of underlying genetic disease, particularly in patients with multiple neoplasms at a young age. Basic knowledge of screening and surveillance guidelines and genetic mutations associated with cancer syndromes is essential for radiologists to provide optimal clinical care. In this exhibit, we will provide a comprehensive illustration of the abdominal manifestations of cancer syndromes relevant to day-to-day practice.

### TABLE OF CONTENTS/OUTLINE

1. Overview of abdominal manifestations of various hereditary cancer syndromes.2. Review epidemiology, genetics, current screening and surveillance guidelines, and how imaging plays a role.3. Describe imaging features of the following syndromes:- Lynch Syndrome- Familial Adenomatous Polyposis- Peutz Jeghers Syndrome- Multiple Endocrine Neoplasia Types 1 and 2- Von-Hipple Lindau Disease- Birt Hogg Dube syndrome - Hereditary Diffuse Gastric Cancer- Hereditary Pancreatic Ductal Adenocarcinoma- BRCA1 and 2 associated cancer syndromes- Tuberous Sclerosis- Cowden syndrome- Hereditary pancreatic ductal adenocarcinoma- Li Fraumeni syndrome- Hereditary paraganglioma-pheochromocytoma syndrome

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# Abstract Archives of the RSNA, 2024

MSEE-17

## TWIST AND SHOUT: INSIGHTS INTO ORGAN TORSION - A MULTISYSTEMIC IMAGING REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elaine Yanata, MD (*Abstract Co-Author*) Nothing to Disclose
Laura M. Coura, MD (*Abstract Co-Author*) Nothing to Disclose
Rafael Docema, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio V. Sawamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Rodrigo C. Chate, MD (*Abstract Co-Author*) Nothing to Disclose
Cinthia D. Ortega, MD,PhD (*Abstract Co-Author*) Speaker, Johnson & Johnson
Luiz Raphael P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Andre L. Bordini, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago M. Baraviera, MD (*Abstract Co-Author*) Nothing to Disclose
Walther Y. Ishikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Daniel Pereira Lopes (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Natalia K. Fujiwara, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Angelo Vasconcelos Sterchile, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Upon visiting this presentation, the viewer is expected to:- Understand the importance of organic torsion as medical emergencies and how imaging helps in the diagnosis.- Recognize imaging signs of torsions through the body.- Learn unusual torsion sites and imaging findings in different imaging modalities.- Detect imaging red flags of organic suffering and loss of viability.

### TABLE OF CONTENTS/OUTLINE

This presentation contains a pictorial review of the torsion sites that can occur through the body, using different imaging methods, such as x-ray, ultrasound, computed tomography and magnetic resonance imaging. The usual radiological sign, the “whirlpool sign” which may be found in different scenarios, will be highlighted.The torsions included in this study are as follows:- Lung- Heart/inferior vena cava (herniation after traumatic pericardial rupture)- Gastric volvulus- Sigmoid volvulus- Cecal volvulus- Petersen’s hernia- Ovarian torsion- Testicular torsion- Isolated fallopian tube torsion- Testicular appendix torsion- And more...

# Abstract Archives of the RSNA, 2024

MSEE-18

## WHEN TB STRIKES BELOW: UNVEILING THE ABDOMINAL MANIFESTATIONS OF TUBERCULOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcella R. Prado, MD (*Abstract Co-Author*) Nothing to Disclose
ALEXANDRE BEZERRA (*Abstract Co-Author*) Nothing to Disclose
Mayra V. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Tiago Bertoncini, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To recognize the pathophysiology and contamination forms of tuberculosis.To learn about most abdominal radiological manifestations of tuberculosis, improving diagnostic performance.To discuss differential imaging diagnosis of TB, especially in immunosuppressed patients.

### TABLE OF CONTENTS/OUTLINE

Tuberculosis (TB) is an infectious, transmissible, chronic disease caused by Mycobacterium tuberculosis and a worldwide public health problem. Infection is secondary to inhaling suspended particles after forced breathing maneuvers, such as coughing. For this reason, lung infection is its most prevalent and best-known manifestation. However, other forms of dissemination are observed, resulting in nervous, musculoskeletal, and abdominal system involvement.Abdominal and other extrapulmonary TB manifestations correspond to 15-25% of cases, usually associated with immunosuppression, especially in individuals with HIV-acquired immunodeficiency syndrome. Imaging investigation is crucial since abdominal manifestations can result in extensive differential diagnosis. While findings are not pathognomonic, clinical-radiological correlation allows for the correct diagnosis and eventual complications, contributing to adequate treatment.A favorable clinical scenario, associated with knowledge of pathophysiology and familiarity with the multiple abdominal radiological manifestations of tuberculosis, contributes to the diagnosis, reducing morbidity and mortality and the social impact of the disease.

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# Abstract Archives of the RSNA, 2024

MSEE-19

## DIVING BENEATH THE SURFACE: UNVEILING CUTANEOUS TUMORS WITH ULTRA-HIGH-FREQUENCY AND DOPPLER ULTRASOUND IN DERMATOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ivana Gibbons (*Abstract Co-Author*) Nothing to Disclose
Laura S. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Galupo (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Soraia Damiao, MD (*Abstract Co-Author*) Nothing to Disclose
Rubens Chojniak, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leticia Cavalcante (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To illustrate the ultra-high-frequency (UHF) ultrasound characteristics of the most common benign and malignant cutaneous lesions in B-mode and Doppler.- To demonstrate the association between the UHF ultrasound findings with the dermatoscopy and anatomopatologic results.

### TABLE OF CONTENTS/OUTLINE

Ultrasound has been a staple medical diagnostic tool for over half a century. In dermatology, its utilization is more recent, particularly with the advent of UHF ultrasound (> 15 MHz), enabling meticulous scrutiny of the skin and its appendages. Classically, UHF ultrasound is used to study changes in the hypoderma, as nodules and inflammatory processes. In cutaneous oncology, it can be used to identify and delimit the lesions, as well as assess the depth and invasion of neighboring structures by the tumor. In surgical planning, determining margins is of great importance and can avoid incomplete resections and unnecessary reinterventions. Ultrasound can also help in the differential diagnosis between benign and malignant cutaneous tumors, however it is essential that the radiologist learn to correlate ultrasound features with clinical / dermatoscopic evaluation as well as histological results.

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# Abstract Archives of the RSNA, 2024

MSEE-2

## GETTING THE MOST OUT OF MULTIDISCIPLINARY CASE CONFERENCE (MDC): THE RADIOLOGIST'S PERSPECTIVE FOR BEST PATIENT CARE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Zeyad Elias (*Abstract Co-Author*) Nothing to Disclose
Hayley Panet (*Abstract Co-Author*) Nothing to Disclose
Ania Z. Kielar, MD, FRCPC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Regardless of the type of MDC there are common themes that can help radiologists best prepare, in a time effective manner. This educational poster will address opportunities to improve efficiency, standardize MDC with an ultimate goal of improving patient management and outcomes.

### TABLE OF CONTENTS/OUTLINE

Considerations:1. Standardizing information presented to radiologists- Adequate history (AI may help to pull relevant information about diagnosis, prior patient therapies, and other intervention)- Knowing where to quickly find imaging if not on institutional PACS- Creating an environment of professionalism: encouraging physicians who submit patients for MDC to be present for their discussion or to send a delegate rather than delaying to another time- Use of standard template reporting by other radiologists to help those radiologists preparing MDC to find relevant information quickly 2. Ways to come to consensus at MDC on which guidelines to follow for each disease entity 3. Addressing volume of work for the radiologists a. What is a reasonable number of patients to review and discuss at MDC? i. Are all cases discussed relevant/necessary?b. Cost of increasing number of MDC if cannot accommodate patient volumes 4. Providing support to radiologists preparing MDC a. Options include time off the clinical schedule, or a lighter scheduleb. Including fellows in MDC preparation and presentationEquitably distributing MDC participation across the department

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# Abstract Archives of the RSNA, 2024

MSEE-20

## UNCOMMON FINDINGS INSICKLECELL ANEMIA: FROM HEAD TO TOE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Lina M. Cadavid Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Gutierrez Marquez, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Agudelo, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Uribe Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Moreno Salinas, MD (*Abstract Co-Author*) Nothing to Disclose
Yeison Gomez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Sickle cell anemia is an inherited disease caused by abnormal hemoglobin production that alters the shape of red blood cells and causes vascular occlusion, chronic hemolytic anemia, and infection. It can affect any part of the body with a variety of clinical and radiological manifestations. This scientific exposition will review the imaging manifestations of sickle cell anemia throughout the body in different imaging modalities, with emphasis on atypical presentations, including pediatric and adult patients. Recognizing the typical and atypical presentations of sickle cell anemia will allow a better approach to diagnosis and treatment of patients.

### TABLE OF CONTENTS/OUTLINE

Review of the different radiological manifestations of sickle cell anemia throughout the body, highlighting rare findings. Examples based on cases (common and uncommon features) of sickle cell anemia throughout the body with different imaging modalities: Head and neck. Chest. Abdomen and pelvis. Musculoskeletal Multi-organic. Discussion with clinical cases and different imaging modalities used for diagnosis (US, CT, MRI), with their limitations and strengths.

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# Abstract Archives of the RSNA, 2024

MSEE-21

## BEYOND THE LUNG: RARE PRESENTATIONS OF EXTRAPULMONARY TUBERCULOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ricardo Uribe Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Gutierrez Marquez, MD (*Abstract Co-Author*) Nothing to Disclose
Jhonathan Reina Alzate, MD (*Abstract Co-Author*) Nothing to Disclose
Lina M. Cadavid Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Andres F. Latorre Pinto, MD (*Abstract Co-Author*) Nothing to Disclose
Duban Aristizabal Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Yeison Gomez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Tuberculosis (TB) manifests across a wide spectrum of presentations. While the pulmonary system is the most commonly affected, TB can extend its reach to involve every organ system in the body. This results in a diverse array of imaging appearances, often resembling radiologic features of other conditions. This scientific exhibit will review rare extrapulmonary manifestations of TB throughout the body on different imaging modalities, with emphasis in atypical presentations including children and adult patients. Recognizing atypical presentations of TB will allow a better diagnostic approach and further treatment of patients in daily radiological practice given the high prevalence of the disease.

### TABLE OF CONTENTS/OUTLINE

1) Review the different systems involved by the disease, highlighting atypical forms.2) Cased based examples of extrapulmonary TB infections in different organ systems and imaging modalities:· Genitourinary· Abdomen and pelvis· Bone · Head3) Discuss the relevance of each diagnostic modalities used in the approach of TB infection through the different case scenarios.

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# Abstract Archives of the RSNA, 2024

MSEE-22

## WBMRI IN MGUS: UNDERSTANDING THE "HIDDEN ENEMY"

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor M. Sardenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre C. Valim, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

MGUS, a premalignant hematological condition prevalent in the elderly, carries a yearly progression rate to multiple myeloma (MM) of approximately 1%. It's imperative to explore potential related diseases stemming from MGUS and conduct investigations to exclude the presence of a malignant form. Rheumatologic diseases (RDs) influence the biology of MGUS, elevating the risk of progression to multiple myeloma (MM) or associated lymphoproliferative malignancies. WBMRI is a sensitive imaging modality that provide comprehensive coverage with high soft tissue contrast and spatial resolution in a condensed timeframe. It proves instrumental in the assessment of various multisystemic diseases and to detect and characterize multifocal or systemic conditions, both oncological and non-oncological. Achieving accurate diagnosis and effective surveillance demands a multidisciplinary approach, integrating radiological expertise to mitigate the risk of end-organ damage. As a cost-effective diagnostic imaging tool, WBMRI streamlines the process of diagnosis, therapeutic monitoring, and treatment decision-making, thereby enhancing patient care and outcomes.

### TABLE OF CONTENTS/OUTLINE

Monoclonal Gammopathy of Undetermined Significance (MGUS): Clinical and Epidemiological Insights Diagnosis of MGUS Imaging Diagnosis: Whole-Body Diffusion-Weighted Magnetic Resonance Imaging Technique Exploration of Different Diseases Associated with MGUS, including: • Smoldering Myeloma • Multiple Myeloma • Non-Hodgkin Lymphomas • Waldenstrom Macroglobulinemia • Amyloid Light-chain and Amyloidosis • POEMS Syndrome (Osteosclerotic Myeloma) • Chronic Inflammatory Rheumatic Diseases

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# Abstract Archives of the RSNA, 2024

MSEE-23

## CLINICAL APPLICABILITY OF THE MASEI PROTOCOL DIFFERENTIAL DIAGNOSIS OF SPONDYLOARTHRITIS AND FIBROMYALGIA THROUGH ULTRASONOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Deise Vargas (*Abstract Co-Author*) Nothing to Disclose
Marco de Andrade Bianchi (*Abstract Co-Author*) Nothing to Disclose
Ricardo Amaro Noleto Araujo (*Abstract Co-Author*) Nothing to Disclose
Amanda Martins E. Ribeiro Dos Santos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Enthesitis, characterized as an essential pathogenic marker of spondyloarthritis, is often overlooked in clinical practice, resulting in missed opportunities for accurate diagnoses and effective disease activity assessments. This study examines the performance of the Madrid Sonography Enthesitis Index (MASEI) protocol in ultrasonographic evaluation of entheses, in which we will address:- Definition and clinical relevance of enthesitis in spondyloarthritis.- Importance of differential diagnosis between spondyloarthritis and fibromyalgia.- Demonstration of the use and interpretation of MASEI in clinical practice.

### TABLE OF CONTENTS/OUTLINE

- Introduction: Contextualization of enthesitis and its underutilization.- Methodology: Study details and ultrasound techniques employed.- Data: Analysis- Comparison between patients with spondyloarthritis and fibromyalgia.- Conclusions and Clinical Implications- Discussion on the relevance of MASEI in improving diagnosis and clinical management.- Recommendations for Clinical Practice- How to effectively implement MASEI.This work emphasizes the need to incorporate MASEI into clinical practice to enhance the diagnosis and treatment of spondyloarthritis, avoiding misdiagnosis of fibromyalgia.

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# Abstract Archives of the RSNA, 2024

MSEE-24

## CONTRIBUTIONS TO ACCURATE DIAGNOSIS OF COMMON SKIN LESIONS IN DERMATOLOGICAL ULTRASOUND PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marco de Andrade Bianchi (*Abstract Co-Author*) Nothing to Disclose
Deise Vargas (*Abstract Co-Author*) Nothing to Disclose
Amanda Martins E. Ribeiro Dos Santos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- The combination of high-frequency ultrasound imaging and color Doppler allows for precise identification and study of skin lesions, including neoplasms, and tumor microcirculation.- High-frequency ultrasound imaging provides real-time, non-invasive, and detailed visualization of skin lesions directly on the patient's body.- This study aims to contribute to more accurate diagnoses in dermatology through the creation of a panel containing images of skin lesions and high-frequency ultrasound examination findings.- The panel serves as a valuable resource for physicians performing high-frequency dermatological ultrasound, facilitating lesion recognition and study.The purpose is to present a panel, which serves as consultation material, with images of the clinical and ultrasound presentation of the main most common dermatological lesions found in daily practice.

### TABLE OF CONTENTS/OUTLINE

- Highlighting the importance of high-frequency ultrasound in enhancing skin lesion diagnosis and providing detailed, non-invasive imaging for more accurate diagnoses.- Descriptive study detailing the creation of a consultation panel for routine dermatological ultrasound in a private hospital.- Compilation of examination images, descriptions, and lesion photos to aid physicians in high-frequency dermatological ultrasound.- Creation of a panel for physicians to consult and study common skin lesions using high-frequency dermatological ultrasound.

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# Abstract Archives of the RSNA, 2024

MSEE-25

## BULLETS 101: WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shima Aran, MD (*Abstract Co-Author*) Nothing to Disclose
Larry A. Kramer, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Cotes, MD (*Abstract Co-Author*) Nothing to Disclose
Tiffany A. Kumala (*Abstract Co-Author*) Nothing to Disclose
Vidhyulatha Sanata, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Bullet injuries are prevalent in urban areas, particularly in regions with high rates of gun ownership, such as the United States. Imaging plays a crucial role in assessing the trajectory of the bullet and identifying internal organ injuries in the emergency setting. Generally, retained intact bullets or fragments are harmless unless they migrate, or their location causes internal damage. However, they pose a challenge for radiologists during MRI scans or when MRI clearance is required, especially if the bullet's history or composition hasn't been assessed previously. The goal of this presentation is to familiarize the radiologist with the most common types of guns and bullets, review different bullet compositions and how it affects our practice as radiologists in terms of artifacts and MRI clearance, and to describe the importance of a comprehensive assessment of bullet-related injuries, given the frequency of such incidents in communities with prevalent gun culture.

### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline:
- Guns and Bullet types: Gun type: Handguns, Shotguns, Rifles. Bullet type: Round nose, ward cutter, semi-wad cutter, Full metal jacket, Hollow point. Composition of bullets: Lead, steel, copper, bullet core Jacket steel, nickel, or copper
- Bullet composition based on radiologic appearance: determining MRI clearance.
- Imaging Assessment: Acute and Chronic Injuries (Wound track, Internal injuries, Retained bullets, Anatomical Location)
- Imaging Artifacts and potential workarounds

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

MSEE-26

## CLINICAL ROLE OF PET/CT IN CAR T-CELL TREATMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Carolina P. Abud, MD (*Abstract Co-Author*) Nothing to Disclose
Marina M. Costa (*Abstract Co-Author*) Nothing to Disclose
Leticia Rigo (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas J. Racy, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Uski, MD (*Abstract Co-Author*) Nothing to Disclose
Glaucia Oki, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Graziela C. Bernardo, MD (*Abstract Co-Author*) Nothing to Disclose
Evandro J. Bonetti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

CAR T-cell therapy was initially developed for the treatment of refractory hematological malignancies. Currently, its indications are being expanded to include some types of solid tumors. The responses to this therapy have some particularities and knowing the expected evolution and correlation with the treatment chronogram is essential. The aim of this presentation is emphasize the role of imaging in this scenario (pre- and post-treatment), demonstrate the radiological findings that define evolutionary behavior, with a focus on FDG PET-CT, for the purpose of making unskilled radiologists more familiar with the therapy, to help them to identify the critical points.

### TABLE OF CONTENTS/OUTLINE

Case-based didactic review of CAR T-cell therapy literature, with FDG PET-CT findings and others imaging methods, including the severe complications, and correlating on our service´s digital archive.

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# Abstract Archives of the RSNA, 2024

MSEE-27

## ABDOMINAL INVOLVEMENT IN LYMPHOMA: IMAGING FINDINGS BEYOND THE LYMPH NODE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Gomes SR, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Carolina De Moraes Sarmento (*Presenter*) Nothing to Disclose

### TEACHING POINTS

THE PURPOSE OF THIS EXHIBIT IS: 1. Review the most common sites of extranodal lymphoma, knowing that this entity has the potencial to affect any organ or tissue, in a variety of presentations that can mimic many other conditions.2. Recognize unusual and little-reported patterns of extranodal lymphoma through illustrative clinical cases (including CT, MRI and functional imaging methods).3. Highlight the role of the radiologist in decision-making in a multidisciplinary team.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 1.a Definitions, clinical, pathophysiological aspects 1.b CT and MRI protocols (Hints at evaluation of images; Potential "blind spots; Pearls and Pitfalls).2. Illustrative clinical cases: 2.a The main CT and MRI findings assessment of disease 2.b Atypical sites, clinical and imaging features 2.c Liver and Spleen 2.d Gastrointestinal tract 2.e Geniturinary tract 2.f Biliary tract 2.g Adrenal gland 2.h Peritoneum and Peritoneal Reflections 2.i Abdominal Wall3. Take-home messages 3.a Extranodal lymphoma can simulate other neoplasms or inflammatory conditions. 3.b Raising suspicion for this condition, especially in atypical epidemiological groups and in unexpected contexts, can make a difference in patient management, decision to biopsy, staging, or in detection of reccurrence and complications.

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# Abstract Archives of the RSNA, 2024

MSEE-28

## EXPECTED FINDINGS AND COMMON COMPLICATIONS OF COSMETIC PLASTIC SURGERY PROCEDURES: WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Omar Andres Pantoja Burbano, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas Ortiz, MD (*Abstract Co-Author*) Nothing to Disclose
Camilo A. Caicedo Montano, MD (*Abstract Co-Author*) Nothing to Disclose
Nicole Erazo Morera, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Aluja, MD, MEd (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review of the most common cosmetic plastic surgery procedures and their expected radiologic appearance. Identify abnormal findings and complications related to cosmetic plastic surgery procedures. Recognize the potential systemic complications and their radiologic features.

### TABLE OF CONTENTS/OUTLINE

Introduction Common procedures: Facial (bichectomy, rhinoplasty, blepharoplasty, rhytidectomy, Dermal filler injections, Botox and hyaluronic acid), breast (augmentation, removal and mastopexy), abdominal (liposuction, belt lipectomy, abdominoplasty), Buttock augmentation, penile implants. Expected radiographic appearance and normal postoperative findings: what is normal and what is not. Complications: Acute: infection, collections, abscess, skin necrosis and fasciitis, lymphedema. Chronic: capsular contracture, breast or buttock prothesis rupture, iatrogenic allogenosis, gastrointestinal tract perforation, intra-abdominal injury, collections, fistula. Systemic complications: pulmonary embolism, pulmonary fat embolism, SDRA, deep vein thrombosis. Pitfalls Take home points.

# Abstract Archives of the RSNA, 2024

MSEE-29

## BEYOND THE HORIZON: LANDSCAPE SIGNS IN RADIOLOGICAL IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manolin Gomez Rivadeneira (*Abstract Co-Author*) Nothing to Disclose
Alejandra Cardona Del Valle, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Gonzalez, BS (*Abstract Co-Author*) Nothing to Disclose
Jose A. Lara, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Discuss the most common radiological signs inspired by landscapes. -Explain the background, etiology, and radiological uses of each of the discussed signs. -Describe the signs through example cases and illustrations using various imaging modalities.

### TABLE OF CONTENTS/OUTLINE

-I. Educational Objectives and Introduction- II. Discuss signs in the following categories: Urban, Rural, Marine and Snow land- III. Imaging examples- IV. Review importance in recognition- V. Self-assessment with multiple cases in quiz format- IX. ConclusionIn this comprehensive pictorial review, we will showcase a series of classic radiological signs inspired by different landscapes, such as rural, urban, marine, and snowland environments. These signs, visible across various imaging modalities, will be illustrated with example cases from our institution. Each sign will be presented alongside a public domain image or diagram of the object that inspired its name, allowing for easier association and recognition. Additionally, a concise explanation of the underlying pathology and pertinent information will be provided.-Urban Signs: Include the inverted Mercedes-Benz, racing car, flat tire, spoke wheel, steeple, lead pipe, tram track, and crazy paving signs.-Rural Signs: Include Mount Fuji, apple core, cotton wool, tulip bulb, and tree in bud signs.-Marine Signs: Include the whirlpool, bone island, seashore, sail, double bubble, triple bubble, and atoll signs.-Snowland Signs: Include snowman and snowstorm signs. By exploring these different landscape-themed signs, the pictorial review aims to enhance the recognition and understanding of various pathologies.

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# Abstract Archives of the RSNA, 2024

MSEE-30

## RADIOLOGIST GUIDE TO THE EVOLVING WORLD OF ECMOS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Scott A. Grumley, MD (*Abstract Co-Author*) Nothing to Disclose
Naga Sai Rasagna Mareddy, MBBS (*Abstract Co-Author*) Nothing to Disclose
Nina L. Terry, MD, JD (*Abstract Co-Author*) Stockholder, Johnson & Johnson;Spouse, Stockholder, Johnson & Johnson;Stockholder, Kimberly-Clark Corporation;Spouse, Stockholder, Kimberly-Clark Corporation;Stockholder, Microsoft Corporation;Spouse, Stockholder, Microsoft Corporation;Spouse, Stockholder, Amge
Satinder P. Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Ibrahim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Understanding different ECMO configuration setups and their clinical context. • Learn to interpret evolving ECMO cannula configurations and underlying pathologies. • Appreciate the vital role of radiologists through accurate imaging interpretation and multidisciplinary collaboration.

### TABLE OF CONTENTS/OUTLINE

• Introduction and Understanding ECMO setup: - Brief overview of ECMO and its significance in critical care. - Illustrative review of ECMO configurations in different clinical scenarios, explanation of VV, VA, and hybrid ECMO setups and potential complications and solutions. • Role of Radiologists in ECMO Care: - Highlight the importance of accurate imaging interpretation in assessing cannula placement and complications. - Steps in obtaining optimal CTA images - Discuss collaborative approach between radiologists and multidisciplinary teams in ECMO patient management.

# Abstract Archives of the RSNA, 2024

MSEE-31

## IMAGING OF DIABETIC COMPLICATIONS: FROM HEAD TO TOE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Hirotaka Akita (*Abstract Co-Author*) Nothing to Disclose
Fumiko Yagi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) Understanding pathophysiology of diabetes mellitus(2) Understanding useful imaging findings in diabetes-related complications

### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. Pathophysiology of diabetes mellitusIII. Diabetes-related complicationsA. Head/neck- Hyperostosis Frontalis Interna- Stroke- Non-ketotic hyperglycemic hemichorea- Dementia- Malignant otitis externaB. Heart/vessel- Diabetic Cardiomyopathy- Coronary artery disease- Peripheral Artery DiseaseC. Breast - Diabetic mastopathyD. Gastrointestinal tract- Black esophagus (acute necrotizing esophagitis)- Fatty liver/subcapsular fatty infiltration- Emphysematous cholecystitis- Atrophic pancreas- Pancreatitis- Pneumatosis cystoides intestinalisE. Genitourinary system- Diabetic kidney disease- Renal abscess- Renal papillary necrosis- Medullary nephrocalcinosis- Xanthogranulomatous pyelonephritis- Emphysematous pyelonephritis/cystitisF. Reproductive organs- Calcification of the Vas Deferens- Vascular erectile dysfunction- Polycystic Ovary SyndromeG. Musculoskeletal system- Fournier’s gangrene- Necrotizing fasciitis- Osteomyelitis- Spondylodiscitis- Diffuse idiopathic skeletal hyperostosis- Muscle Denervation- Insulin ball

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# Abstract Archives of the RSNA, 2024

MSEE-32

## MAXIMIZING THE POTENTIAL OF HIGH-FREQUENCY ULTRASOUND FOR SKIN FILLER IDENTIFICATION: FACTORS INFLUENCING PRODUCT EVALUATION AND DISTINCTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabrielle A. Zattar (*Abstract Co-Author*) Nothing to Disclose
Gladstone Faria (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Boggio (*Abstract Co-Author*) Nothing to Disclose
Natalia Venturelli (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana C. Zattar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Aesthetic procedures are increasingly being performed using injectable materials. In this context, the radiologist has been requested to recognize their usual aspects. To achieve accurate and timely detection and an appropriate approach for each case, High-frequency ultrasound (HFUS) is the most effective method. It is well established in the literature that ultrasound can identify the type of filler material injected, however, few studies address the aspects that can influence this identification. Correct knowledge of these aspects as well as the limitations of the devices should be known to the radiologist. This study aims to discuss and illustrate the factors that influence product evaluation and distinction.The purpose of this exhibit is:- To show and describe the main image patterns of cosmetic fillers that allow its identification (morphology, echogenicity, matrix, posterior artifacts), and teach how to report it;- To list, classify, and describe the different injectables and procedural aspects (dilution, rheology, manufacturer/trades, application site, injection technique, purpose, time of injection, and integration) and their influence on imaging;- To highlight the importance of different HFUS devices, transducers, and image settings in the product distinction;- To show and describe a practical chart that may help reach the correct product’s approach in daily practice;

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION: why is it important?2. HOW TO IDENTIFICATE AND REPORT INJECTABLE MATERIALS3. WHICH FACTORS INFLUENCES?4. STEP-BY-STEP APPROACH5. WHAT SHOULD WE CARE ABOUT?5. CONCLUSION: new perspectives

# Abstract Archives of the RSNA, 2024

MSEE-33

## ADENOID CYSTIC CARCINOMA: MULTIORGAN MANIFESTATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Komal B. Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Ioannis Vlahos, MBBS, FRCR (*Abstract Co-Author*) Director, Grayscale Ltd;Co-owner, Grayscale Ltd;
Sireesha Yedururi, MBBS (*Abstract Co-Author*) Nothing to Disclose
Toma Omofoye, MD (*Abstract Co-Author*) Nothing to Disclose
Mylene T. Truong, MD (*Abstract Co-Author*) Nothing to Disclose
Girish S. Shroff, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Based on clinical/radiology experience at an international cancer referral center. Familiarize radiologists with: 1. Anatomic LocationsCommoner: salivary gland, nasal cavity, sinus, tongue, trachea/central bronchi Uncommon/Rare: breast, female reproductive tract, cervix, prostate, skin, etc 2. Varying use of multimodality imaging (CT, MRI, FDG PET/CT, ultrasound) according to location 3. Correlation of imaging with pathology, metastatic risk, clinical/surgical implications 4. Unique patterns of disease spread and of metastases

### TABLE OF CONTENTS/OUTLINE

Background/classification Epidemiologic Clinical Features Examples by anatomic site, diagnostic criteria, mimics and pitfalls Radpath correlations and site variable CT/MRI/PET correlation to histology subtypes/outcome Patterns of disease spread, perineural disease, metastases, growth rates Treatment surgical considerations

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# Abstract Archives of the RSNA, 2024

MSEE-34

## "TAKING A BITE OUT OF TEMPOROMANDIBULAR JOINT IMAGING" - ANATOMY, PATHOLOGY, AND INCIDENTAL FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Kathryn J. Stevens, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jennifer A. Padwal, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Review the basic anatomy of the temporomandibular joint including the articular disc and capsular attachments, surrounding muscles of mastication, condyle and adjacent temporal bone 2) Review normal position of articular disc, retrodiscal layers, and condylar head on both closed and open mouth views 3) Demonstrate different TMJ pathology including articular disc degeneration/perforation, disc displacement, joint effusions, and TMJ degenerative changes 4) Highlight potential "don't miss" incidental findings on CT and MR imaging of the TMJ

### TABLE OF CONTENTS/OUTLINE

I. Basic anatomic review of the temporomandibular joint and associated structures, including normal positioning on open-mouth and closed-mouth views II. Pathology of the temporomandibular joint III. Incidental temporomandibular joint findings on CT and MRI

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# Abstract Archives of the RSNA, 2024

MSEE-35

## PATHWAYS OF PERIL: RADIOLOGICAL INSIGHTS INTO MALIGNANT SUBPERITONEAL AND RETROPERITONEAL TUMORAL INFILTRATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Venkata S. Katabathina, MD (*Abstract Co-Author*) Nothing to Disclose
Navya Dasyam, MD (*Abstract Co-Author*) Nothing to Disclose
Gayathri Devi Jalluri, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Anil K. Dasyam, MD (*Abstract Co-Author*) Nothing to Disclose
Renjie Chen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Peritoneal ligaments and mesenteries are best identified by the vessels running through them - Constituents of the different compartments of retroperitoneal spaces dictate the common pathology in these compartments - Subperitoneal spaces and retroperitoneal spaces are interconnected providing uninterrupted pathways for tumor spread -Retropreitoneal tumoral infiltration is often associated with significant constrictive effect

### TABLE OF CONTENTS/OUTLINE

- Embryological development of peritoneal and retroperitoneal spaces - Anatomy of retroperitoneal spaces and their components - Anatomy of peritoneal ligaments and mesenteries - Pathways of subperitoneal tumor infiltration in abdomen o Peritoneal ligaments o Omentum and Mesenteries - Pathways of subperitoneal tumor infiltration in pelvis o Peritoneal Ligaments o Mesenteries - Constricting effect of retroperitoneal tumor infiltration - clinical consequences and imaging clues - Communications between subperitoneal and retroperitineal spaces - clinical implications and imaging clues - Imaging mimics of malignant subperitoneal and retroperitoneal tumor infiltration - Summary

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# Abstract Archives of the RSNA, 2024

MSEE-36

## VASCULAR COMPRESSION SYNDROMES: A PICTORIAL OVERVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gavin Low, FRCR (*Abstract Co-Author*) Nothing to Disclose
Rishi P. Mathew, DMRD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Ryan K. Chee, MD (*Abstract Co-Author*) Nothing to Disclose
Mitchell Wilson, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Wendy Tu, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Ranjit Singh, MBBS, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Reshma Mary Koshy, MBChB, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This pictorial review aims to concisely summarise notable features identified in seven main vascular syndromes within the abdomen and pelvis using examples from different imaging modalities including ultrasound, fluoroscopy, CT and MRI. These relatively rare syndromes are often poorly understood and can be easily overlooked. They can be asymptomatic and identified incidentally or may manifest symptomatically.

### TABLE OF CONTENTS/OUTLINE

Table of contents • Median Arcuate Ligament Syndrome • Superior Mesenteric Artery Syndrome • Nutcracker Syndrome • May-Thurner Syndrome • Ureteropelvic Junction Obstruction • Retrocaval Ureter • Ovarian Vein Syndrome • Portal BiliopathyOutline This educational exhibit will primarily focus on the imaging features commonly encountered with the above entities. Information will be highlighted by providing case examples using a range of different imaging modalities. A brief overview on each syndrome demographics as well as potential treatment options will be explored. A table summarising the main key findings will also be provided to summarise the main imaging teaching points.

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# Abstract Archives of the RSNA, 2024

MSEE-37

## UNDERSTANDING DUAL-ENERGY CT. GETTING STARTED: ESSENTIALS IN TECHNICAL PRINCIPLES AND CLINICAL SCENARIOS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Augstin Z. Guzman Mercado, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Lucia Lopez Salazar, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daniel Soto Vargas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To overview the technical and physical principles behind Dual-Energy CT. - To summarize the various acquisition methods of Dual-Energy CT and the advantages and limitations of each approach. - To overview basic principles of how material decomposition images are generated. - To review material decomposition images commonly used in clinical practice. - To identify clinical settings where spectral reconstruction can increase the diagnostic sensitivity - To exemplify potential artifacts and pitfalls on spectral reconstructions.

### TABLE OF CONTENTS/OUTLINE

- Technical principles of Dual-Energy CT - Dual-Energy CT acquisition approaches - Understating material decomposition - Material decomposition images commonly used in clinical practice - Applicability of dual-energy CT in various clinical scenarios - Artifacts and Pitfalls - Advantages and limitations

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# Abstract Archives of the RSNA, 2024

MSEE-38

## MICROVASCULAR FLOW IMAGING IN SOLID TUMORS: A PRACTICAL APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana Cerri, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabriela R. Camerin, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia A. Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Doppler US is a non-invasive and cost-effective imaging method useful for assessing vascularization patterns of organs and structures, including solid tumors. The most common modalities commercially available include spectral Doppler, color Doppler, and power Doppler.Microvascular flow imaging (MVFI) is a novel technique based on different filters from Doppler imaging, which excels in characterizing slow flow in small vessels, a challenge for conventional Doppler methods.MVFI applications in oncologic imaging are still evolving, with great potential in the diagnosis and follow-up of hepatobiliary, genitourinary, vascular, gastrointestinal, skin, and muscular tumors.This pictorial review aims to provide a practical overview of MVFI's main applications and limitations in oncologic imaging. It emphasizes key points and potential challenges for integrating MVFI into clinical practice.

### TABLE OF CONTENTS/OUTLINE

Background: perfusion imaging US techniques (advantages and disadvantages)- Doppler imaging- Contrast-enhanced US- Microvascular flow imagingPrinciples of MVFI - Recognizing microvascular patterns: a practical approachApplications of MVFI in oncologic imaging: a case-based review with multimodality imaging correlations- Skin- Thyroid- Lymph nodes- Liver- Kidney- Colon- Other tumorsClinical use: pearls and pitfallsSummary and take home messages

# Abstract Archives of the RSNA, 2024

MSEE-39

## IMAGING IN SYSTEMIC SCLEROSIS (SCLERODERMA)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

David J. DiSantis, MD (*Abstract Co-Author*) Nothing to Disclose
Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Galib Mirza Nasirul Islam, MBBS (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Systemic sclerosis (Scleroderma) is a clinically heterogeneous disorder with protean manifestations, a chronic and frequently progressive course, and significant disability, disfigurement and mortality. Virtually every organ can be affected. This exhibit discusses scleroderma in detail and at the conclusion of the module, the learner should be able to:
- Familiarize with the pathogenesis and clinical features of scleroderma
- Understand the role imaging in the diagnosis and evaluation of scleroderma
- Discuss radiological findings seen in scleroderma
- Describe current treatment strategies, newer techniques as well as common confounding drug-induced manifestations

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Epidemiology
- Pathology and pathogenesis
- Disease classification
- Diagnosis and role of serum markers
- Mixed connective tissue disease (MCTD)
- Role of Imaging
- Manifestations of Scleroderma (reduced oral aperture, mucocutaneous telangiectasia, joint contractures, digital ischemic ulcers, cardiomyopathy, gastrointestinal hypomotility and bacterial overgrowth)
- Cutaneous Manifestations
- Respiratory involvement (interstitial lung disease and pulmonary arterial hypertension)
- Gastrointestinal Manifestations (upper tract, lower tract and anorectal)
- Renal involvement and scleroderma renal crisis
- Musculoskeletal Manifestations
- Cardiovascular involvement
- Urinary system Manifestations
- Nervous System Involvement
- Miscellaneous Features
- Cancer in Scleroderma
- Prognostic Factors
- Treatment Strategies
- Drug-induced manifestations

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# Abstract Archives of the RSNA, 2024

MSEE-4

## IMAGING FEATURES OF PERINEAL SUPPURATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marc Zins, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Delpla (*Abstract Co-Author*) Nothing to Disclose
Boulay-Coletta Isabelle, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Touloupas (*Abstract Co-Author*) Nothing to Disclose
Sophie Beranger Gibert (*Abstract Co-Author*) Nothing to Disclose
EMNA YOUNSI (*Abstract Co-Author*) Nothing to Disclose
Arnaud Pouvelle (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. Haouari I, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Perineal suppurations are pathological conditions with diverse clinical manifestations. They vary in severity and may be life-threatening. Regardless of the acute or chronic presentation, imaging plays a fundamental role in the initial assessment and post-treatment evaluation. CT scan is generally sufficient to establish the diagnosis of extensive perineal suppuration. MRI is necessary for assessment of fistula in-ano and for etiological assessment. Perineal suppurative lesions include abscesses, inflammatory masses, fistulous tracts, and fasciitis. Perineal suppuration may be of anorectal, cutaneous, genital, or urological origin. In the postoperative period of pelvic or perineal surgery, suppuration usually consists of infection of an implanted prosthetic material or anastomotic leakage. Imaging helps establishing the right diagnosis by showing specific or highly suggestive findings of some pathologies.

### TABLE OF CONTENTS/OUTLINE

Overview of the male and female perineal anatomy. Discuss the indications and limitations of the different imaging modalities according to the acute or chronic nature of the clinical presentation and its severity. Discuss suppurative perineal conditions according to patient sex, clinical presentation, anatomical location and origin, and relation to the anal canal of the suppuration (communicating or not). Identify specific or highly suggestive imaging features of every etiology.

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# Abstract Archives of the RSNA, 2024

MSEE-40

## TIPS AND TRICKS IN ULTRASOUND EVALUATION OF ABDOMINAL HERNIAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Margarita V. Revzin, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Catalina A. Carvajal Perrejinoski, MD (*Abstract Co-Author*) Nothing to Disclose
Gonzalo Aragon, MD (*Abstract Co-Author*) Nothing to Disclose
Catalina Alarcon Del Campo, MD (*Abstract Co-Author*) Nothing to Disclose
Eugenio Zalaquett, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Profound comprehension of anatomical intricacies is indispensable in diagnosing and assessing abdominal wall hernias through ultrasound. A nuanced grasp of topographic anatomy proves invaluable in pinpointing the regions predisposed to herniation.2) Ultrasound stands unparalleled as the foremost imaging modality for scrutinizing abdominal hernias. Its unparalleled capacity for dynamic assessment, coupled with its adaptability to various patient positions, renders it peerless in this regard.3) Surgeons demand precise insights into the location, dimensions, and contents of hernial sacs. All this questions can be answered with an adequate ultrasound evaluation.

### TABLE OF CONTENTS/OUTLINE

Abdominal wall anatomyUltrasound evaluationTips and TricksAnterior Abdominal Wall HerniasMidline herniaUmbilical herniaSpigelian herniaRichter herniaInguinal herniaFemoral herniaAmyand herniaGarengeot hernia

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# Abstract Archives of the RSNA, 2024

MSEE-41

## PIQUING YOUR INTEREST IN THE PECOMA FAMILY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Grace G. Zhu, MD (*Abstract Co-Author*) Nothing to Disclose
Cary L. Siegel, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Rogers, MD (*Presenter*) Royalties, RELX

### TEACHING POINTS

Teaching Points1) Clarify the pathologic and genetic characteristics of the tumors within the perivascular epithelioid cell tumor (PEComa) family, and their relationship to tuberous sclerosis complex2) Provide a multi-modality case-based review of the wide array of PEComas, geared toward radiologists concerned about potential malignancy or risk for complications

### TABLE OF CONTENTS/OUTLINE

Outline1) Introduction/Backgrounda) Histology/Pathologyb) Tuberous Sclerosis Complex2) Pulmonarya) Lymphangioleiomyomatosisb) Primary pulmonary PEComa (Clear cell “sugar” tumor)3) Renala) Angiomyolipomab) Epithelioid variant angiomyolipomac) Monophasic/lipid poor angiomyolipoma versus capsular leiomyoma4) Uterine PEComaa) Benignb) Malignant5) Miscellaneous Sporadic PEComasa) Liverb) Retroperitoneumc) Pancreasd) Bowele) Soft tissuesf) Clear cell myomelanocytic tumor of the falciform ligament/ligamentum teres (CCMMT)6) Treatment considerations and follow-up

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# Abstract Archives of the RSNA, 2024

MSEE-42

## DECODING THE IMMUNOTHERAPY-RELATED ADVERSE EVENTS WITH IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Roberto Garcia Figueiras, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joan C. Vilanova, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Antonio Luna, MD, PhD (*Abstract Co-Author*) Speaker, General Electric Company
Sandra Baleato Gonzalez, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cancer immunotherapies have revolutionized the therapeutic management of a wide number of malignancies. However, local, or systemic adverse events, so called immune- related adverse events (irAEs) are major complications. Radiologists play a fundamental role in the identification irAEs, both essential to be able to deliver the best care possible for the patient. This exhibit aims to: • Review the pathophysiology of irAES. • List the most common adverse effects, the incidence, and the median time to onset. • Recognize these findings on imaging to stablish a specific treatment.

### TABLE OF CONTENTS/OUTLINE

1. Pathophysiological mechanisms of irAES. 2. Clinical significance and risk factors. 3. Timeline and Incidence, 4. Subtypes of irAES- The Essentials: colitis and pneumonitis.- The Killers: cardiac toxicities. - The Forgotten ones: vasculitis, polyarthritis, pneumatosis.- The Misreaded: acute kidney injury.- The Mimickers: sarcoid-like reaction, adrenalitis, and others. 5. Take home points. 6. Conclusions

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# Abstract Archives of the RSNA, 2024

MSEE-43

## THE CURRENT ROLE OF DERMATOLOGICAL ULTRASOUND IN CUTANEOUS NEOPLASM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Giovanni G. Cerri, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Natally Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana C. Zattar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

High frequency ultrasound (HFUS) is increasingly gaining more space in the evaluation of skin tumors due to its high anatomical definition and diagnostic accuracy. It allows in vivo analysis of primary lesion as well as locoregional staging, essential for a better surgical planning and important in the postoperative follow-up of the patients.This study aims to discuss and illustrate the radiologist's role in the evaluation of skin tumors with HFUS. The knowledge of tumors characteristics and specific imaging findings is essential for correct diagnosis and management of patients.The purpose of this exhibit is:- To describe a practical step by step approach of the skin tumors;- To show the main image patterns of the most common skin tumors and its subtypes;- To list, illustrate and describe characteristic imaging findings of rare skin tumors: dermatofibrosarcoma protuberans, cutaneous lymphoma, Kaposi sarcoma- To highlight the importance of HFUS in tumors diagnosis, staging and therapeutic planning;- To illustrate the use of HFUS in evaluation of therapeutic success, recurrence and complication;- To keep in mind important teaching points in skin tumors evaluation

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION: ultrasound, technique, tumorsDIAGNOSISCompositionLocalizationTREATMENTPre-treatment evaluationDuring treatment evaluationPost-treatment evaluationNEW PERSPECTIVESCONCLUSION

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# Abstract Archives of the RSNA, 2024

MSEE-44

## WHERE THERE IS SMOKE THERE IS FIRE: DIAGNOSTIC CLUES OF ABDOMINAL DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aparecido N. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Heloise Miranda (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Batista Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Lhuanna Maria Barbosa Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Teaching points: The importance of imaging methods for diagnosis when an abdominaldisease is suspected is known. However we must be aware of radiologicalsigns that can predict diseases even in cases where there is no suspicion, oreven assist diagnostic suspicion when direct signs are hidden, either due totechnical or examiner limitations.The purpose of this exhibit is to: Highlight often overlooked but relevant indirect signs of abdominaldiseases observed on computed tomography (CT) and magneticresonance imaging (MRI).Explore the correlation between imaging findings and potentialunderlying etiologies, spanning inflammatory conditions, traumaticinjuries, neoplasms, vascular diseases, infectious diseases, and otherabdominal pathologies.Provide practical pearls and pitfalls by providing insights into interpretingradiologic manifestations, including identification of common reactivefindings encountered in abdominal imaging.Discuss the importance of incorporating clinical information, such as age,acuity of symptoms, clinical signs, and patient history, to refine thedifferential diagnosis.Propose appropriate follow-up strategies for further evaluation andmanagement of identified abdominal abnormalities.

### TABLE OF CONTENTS/OUTLINE

2. Table of contents:Introduction;Paraneoplastic manifestations;Metabolic alterations;Vascular findings;Inflamatory and infeccious diseases;Take home messages

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# Abstract Archives of the RSNA, 2024

MSEE-45

## ADVANCEMENTS IN FISTULA IMAGING TECHNIQUES FOR ONCOLOGY: A COMPREHENSIVE REVIEW AND MULTIMODALITY CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sumeet Virmani, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Pokhraj P. Suthar, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren Arsenault, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Highlight the importance of integrating multiple imaging modalities such as CT, MRI, PET-CT, EUS, and MRF for a comprehensive assessment of oncological fistulas.• Emphasize the strengths of each modality in providing different aspects of information, such as anatomical detail, functional assessment, and tissue characterization.• Discuss the significance of advanced imaging techniques like diffusion-weighted MRI and dynamic contrast-enhanced MRI in improving sensitivity for detecting fistulas, especially those associated with tumor involvement. Illustrate how these techniques enhance diagnostic accuracy and aid in early detection and characterization.

### TABLE OF CONTENTS/OUTLINE

Fistulas, abnormal connections between two epithelialized surfaces, present a challenging scenario in oncology due to their potential complications and impact on patient quality of life. This abstract reviews the evolving landscape of imaging modalities used for detecting and characterizing fistulas in oncological contexts. Recent advancements in imaging technology, including diffusion-weighted MRI, dynamic contrast-enhanced MRI, and positron emission tomography-computed tomography (PET-CT), offer enhanced sensitivity and specificity in identifying fistulas, particularly in the setting of tumor involvement. Moreover, emerging modalities like endoscopic ultrasound (EUS) and magnetic resonance fistulography (MRF) provide valuable insights into fistula anatomy and surrounding tissues, aiding in treatment planning and monitoring response to therapy.

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# Abstract Archives of the RSNA, 2024

MSEE-46

## LYMPHATICS FROM HEAD TO TOE: NON ENHANCED MR LYMPHOGRAPHY IS MORE THAN AN OPTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lionel Arrive, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Matthias Barral, MD (*Abstract Co-Author*) Nothing to Disclose
Sanaa El Mouhadi, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Lymphatic anatomy is complex and challenging to explore. New imaging modalities improve understanding of many lymphatic disorders, but some of them are invasive-Non enhanced MR lymphography, a non invasive modality using heavily T2- weighted MRI sequences, has an excellent contrast and spatial resolution and can analyze both peripheral and central lymphatic system-Lymphatic disorders can be secondary to several conditions (surgery, radiation therapy) or can be congenital with localized or diffuse abnormaities. -Non contrast MR lymphography can be helpful for treatment planning and intervention procedures.

### TABLE OF CONTENTS/OUTLINE

-Non contrast MR lymphography : technique and advantages -Anatomy and variants of the lymphatic system at non contrast MR lymphography -Lymphatic disorders from head to toe

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# Abstract Archives of the RSNA, 2024

MSEE-47

## TUBERCULOSIS: THE GREAT MIMICKER - A CASE-BASED REVIEW FROM HEAD TO TOE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Eduardo Kaiser Ururahy Nunes Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Horovitz (*Abstract Co-Author*) Nothing to Disclose
Paulo E. Catarina, MD (*Abstract Co-Author*) Nothing to Disclose
Joao V. Dutra Vieira, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Cerdeira Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago De Gaultier Paulo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Tuberculosis is a chronic granulomatous disease that can involve a spectrum of manifestations in multiple organs. Its clinical presentation can be nonspecific, and imaging exams are an auxiliary tool in the investigation. Diagnosis often becomes challenging as it can mimic various diseases, including malignancies. Therefore, it is crucial for radiologists to be familiar with the imaging spectra of tuberculosis in various organs and its differential diagnoses, in order to offer the best management for the patient. The purpose of this presentation is (1) to review the pathophysiology of tuberculosis, (2) to examine the imaging spectrum of tuberculosis through case-based studies, and (3) to discuss imaging features suggestive of extra-pulmonary tuberculosis and its differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Pathophysiology of tuberculosis 3. Cases presentations and differential diagnosis. 3.1. Head. 3.2. Neck. 3.3. Chest. 3.4. Cardiovascular. 3.5. Abdomen. 3.6. Urogenital. 3.7. Skeletal. 4. Summary. 5. Take Home Messages

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# Abstract Archives of the RSNA, 2024

MSEE-48

## WHOLE BODY MRI: IMAGING HEREDITARY SYNDROMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alexandre M. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Ralph R. Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Regis Otaviano Bezerra, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pedro J. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio P. Pereira (*Abstract Co-Author*) Nothing to Disclose
Eduardo Freire, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe R. Ferreira (*Abstract Co-Author*) Nothing to Disclose
Sabrina M. Ando, MD (*Abstract Co-Author*) Nothing to Disclose
Paola Beninca, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

WB-MRI is a versatile method that can be applied in oncologic and non-oncologic scenarios, with specific protocol configurations. It is a useful test for detecting metastasis from various anatomic sites and a safe and recognized way to screen and monitor genetic and hereditary syndromes that can relate to cancer.The purpose of this exhibition is to:- Share our experience with diferent protocols of whole body resonance. - Review imaging findinds and pitfalls - A practical approach to interpreting these protocols systematizing the evaluation based on main imaging findings and clinical/laboratorial findings- Examples of neurofibromatosis, screening and monitoring of Li-Fraumeni syndrome and other conditions that can be monitored by WB-MRI.

### TABLE OF CONTENTS/OUTLINE

1) Introduction2) Cases/examples and teaching points of neurofibromatosis3) Examples of oncological follow up for Li-Fraumeni syndrome4) Cases/examples and teaching points of Li-Fraumeni screening5) Screening and follow up in patient whith RB1 gene mutation

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# Abstract Archives of the RSNA, 2024

MSEE-49

## IMPLEMENTATION AND ADDED VALUE OF PHOTON COUNTING CT IN YOUR ABDOMINAL IMAGING CLINICAL PRACTICE: A PRIMER ON APPLICATIONS, PROTOCOLS, AND WORKFLOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Raja C. K. Subramaniam, PhD (*Abstract Co-Author*) Nothing to Disclose
Deborah Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Lewis, MD (*Abstract Co-Author*) Research Grant, Bayer AG
Karen A. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Eric J. Wilck, MD (*Abstract Co-Author*) Nothing to Disclose
Barak Friedman, MD (*Abstract Co-Author*) Nothing to Disclose
Neil M. Rofsky, MD (*Abstract Co-Author*) Advisory Board, Bracco Group;Advisory Board, General Electric Company;Advisory Board, Koninklijke Philips NV;Consultant, WebMD LLC
Bachir Taouli, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Bayer AG;Consultant, Guerbet SA;Research Grant, Regeneron Pharmaceuticals, Inc
Thomas P. O'Donnell (*Abstract Co-Author*) Researcher, Siemens AG
Vipashyana Jadav, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Provide an overview of the technical innovations provided by photon counting (PC)-CT 2. Discuss the patient selection and clinical applications 3. Review scanning protocols and image optimization 4. Provide tips and tricks to develop a high throughput PC-CT workflow in your practice

### TABLE OF CONTENTS/OUTLINE

1. Background on technical development in PC-CT a. Detection of individual photons and measurement of a photon’s energy, while conventional CT measures aggregate photon energy deposition. b. Novel detector composition (cadmium telluride, cadmium zinc telluride, silicon) 2. Added benefits provided by PC-CT a. Energy discrimination and optimized spectral analysis b. Higher spatial resolution without the radiation dose penalty c. Improved contrast-to-noise ratio d. Use of reduced dose of iodinated contrast e. Lower radiation dose f. Artifact reduction 3. Clinical applications a. Mono-energy image reconstructions b. Virtual non-contrast images, iodine maps. c. Visceral organ lesion detection and characterization d. Artifact reduction in patients with metal prosthetic joints and implants. e. Opportunities for reduced dose imaging (i.e., pediatric patients) f. Future directions in quantitative imaging i). Material decomposition for renal stones and other stone diseases ii). Hepatic fat quantification 4. Development of a workflow in your practice a. Development of a multidisciplinary PC-CT team comprised of physicists, technologists, and radiologists. b. Protocol optimization c. Patient selection d. Quality assurance

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# Abstract Archives of the RSNA, 2024

MSEE-5

## EXPLORING BOUNDARIES: IMAGING OF UNUSUAL PRESENTATIONS OF LYMPHOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carolina Gutierrez Marquez, MD (*Abstract Co-Author*) Nothing to Disclose
Lina M. Cadavid Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Juliana Bacca, MD (*Abstract Co-Author*) Nothing to Disclose
Duban Aristizabal Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel A. Correa Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Antonio Piedrahita Vallejo, MD (*Abstract Co-Author*) Nothing to Disclose
Yeison Gomez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Lymphoma has a wide spectrum of presentations and can involve every organ system in the body producing a variety of imaging appearances. Lymphoma is a common malignancy occurring at any age in life and presenting as imitator of other aggressive malignancies and benign conditions. This scientific exhibit will review the extranodal manifestations of lymphoma throughout the body on different imaging modalities emphasizing in atypical presentations including children and adult patients. Recognizing typical and atypical presentations of lymphoma will allow a better diagnostic approach and further treatment of patients in daily radiological practice.

### TABLE OF CONTENTS/OUTLINE

1) Review the classification of lymphoma: Hodgkin disease and non-Hodgkin lymphoma. Hodgkin disease usually present with nodal involvement. Therefore, this review will emphasize in extranodal presentations of non- Hodgkin lymphoma in different locations and highlight atypical forms. 2) Cased based examples of extranodal lymphomas in different organ systems and imaging modalities:• Head and spine• Intrathoracic disease, focused in parenchymal lung involvement• Abdomen and pelvis • Bone 3) Discuss, along with the clinical cases, the different imaging modalities used for diagnosis (US, CT, MRI, PET/CT), their limitation and strengths.

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# Abstract Archives of the RSNA, 2024

MSEE-50

## HEREDITARY TUMOR SYNDROMES ENCOUNTERED IN CARDIOTHORACIC IMAGING: MULTIMODALITY IMAGING REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Charanjeet Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Gange JR, MD (*Abstract Co-Author*) Stockholder, Pfizer Inc Stockholder, Bristol-Myers Squibb Company Research Consultant, Bayer AG Medical Advisory Board, AIxSCAN, Inc Shareholder, AIxSCAN, Inc
Tarek S. Elkady, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Derek Nitz, MD (*Abstract Co-Author*) Nothing to Disclose
Mamta Gupta (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Overview of common hereditary tumor syndromes encountered in cardiothoracic region. • Significance of multimodality imaging in the evaluation and management of genetic cancer syndromes. • Guidelines for imaging surveillance in individuals with known genetic cancer syndromes.

### TABLE OF CONTENTS/OUTLINE

IntroductionHereditary syndromes encountered in cardiothoracic imaging:NF1Tuberous sclerosisBirt-Hogg DubeCarneys complexLi-Fraumeni syndromeCHEK-2 mutations etc.Role of imaging in screening with a focus on whole body MRIRole of multimodality imaging in diagnosis, staging and follow-upCorrelation between imaging findings and genetic testingFuture directions in imaging and hereditary tumor research

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# Abstract Archives of the RSNA, 2024

MSEE-51

## COWDEN'S SYNDROME: MULTIMODALITY IMAGING REVIEW AND INSTITUTIONAL EXPERIENCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Brian J. Di Giacinto, DO (*Abstract Co-Author*) Nothing to Disclose
Tasmia Amjad (*Abstract Co-Author*) Nothing to Disclose
Melanie D. Duhamel, DO (*Abstract Co-Author*) Nothing to Disclose
Laurel Chen, MEng (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. PTEN hamartoma syndromes (including Cowden's syndrome) are caused by pathologic mutations of the PTEN gene. CS patients develop numerous hamartomas throughout the breast, GI tract, uterus, and subcutaneous soft tissues.2. CS also increases risk of malignant neoplasms of the breast, thyroid, kidneys, colon, and likely uterus.3. Expert consensus guidelines suggest early surveillance with mammography, thyroid ultrasound, colonoscopy. However, evidence is insufficient to recommend regular pelvic ultrasound or full body MRI.4. First think benign hamartoma, but keep malignancy in mind.

### TABLE OF CONTENTS/OUTLINE

1. Brief discussion of epidemiology and clinical relevance of dropped gallstones.2. Discussion of the relevant anatomy and both expected and less common locations of dropped gallstone pathology.3. Examples of variable appearance of dropped gallstones across multiple modalities and changes that occur with time.4. Discussion of drop gallstone induced complications.5. Case based review of key learning points and potential pitfalls.

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# Abstract Archives of the RSNA, 2024

MSEE-52

## ROSAI DORFMAN DISEASE: THE GREAT MIMICKER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Babina Gosangi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Koustav Ghosal, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• The diagnostic and staging evaluation of patients with newly diagnosed RDD should include an assessment of disease extent, as well as evaluation for conditions either known to be associated with RDD, particularly autoimmune disorders, or known to contain an RDD-like reactive component secondary to malignancies • Most patients with RDD present with bilateral, massive, and painless cervical lymphadenopathy with or without intermittent fevers, night sweats, and weight loss • Extranodal involvement has been reported in 43% of RDD cases. Multisystem involvement occurs in 19% of cases, and prognosis is correlated with the number of extranodal systems involved.

### TABLE OF CONTENTS/OUTLINE

Introduction Nodal Disease Extranodal disease • Intracranial lesions • Sinonasal diseae • Orbital lesions • Thoracic lesions • Liver lesions • Renal lesions • Peritoneal lesions • Vasculitis • Lytic bone lesions • Soft tissue lesions Role of imaging Differential diagnosis Systemic involvement- Lymphoma, metastases, tuberculosis, Vastleman’s disease, sarcoidosis Nasopharyngeal involvement- Juveile angiofibroma, lymphoma Osseous- Osteomyelitis, fibrous dysplasia, Ewings SOFT TISSUE - Soft-tissue sarcoma, desmoid tumor, Inflammatory pseudotumor VASCULITIS- Takayasu arteritis

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# Abstract Archives of the RSNA, 2024

MSEE-53

## IMAGING OF MUSCULOSKELETAL TOXICITIES DURING ANTICANCER TREATMENT IN THE ERA OF PRECISION MEDICINE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marta Braschi Amirfarzan, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Rassi, MD (*Abstract Co-Author*) Nothing to Disclose
Lacey McIntosh, DO, MPH (*Abstract Co-Author*) Nothing to Disclose

### TEACHING POINTS

Increasingly specific therapies in medicine are not without risk for complication.Radiologists reviewing follow-up therapy imaging should actively survey for therapy toxicities as the presence or absence of toxicity will influence a patient’s treatment plan.

### TABLE OF CONTENTS/OUTLINE

Review of the mechanism of action of the agents involved in musculoskeletal toxicities List of drug classes with examples of musculoskeletal side effects: Chemotherapy: Fluid retention from docetaxel, subtrochanteric femoral fracture from bisphosphonates Radiation Therapy Osteoporosis, Insufficiency Fractures, Osteonecrosis, Immune checkpoint inhibitors: Inflammatory Arthritis, Synovitis, Myositis, Sarcoid-like reaction Molecular Targeted therapies: Fluid retention from Imatinib Hormonal Treatment: osteoporosis from letrozole, osteonecrosis, fractures Cases Immune checkpoint inhibitors - inflammatory arthritis Aromatase inhibitors - osteoporosis Radiation therapy - fracture Bisphosphonates - fracture

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MSEE-54

## LYMPHOMA: FROM HEAD TO TOES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andres F. Caliz Cabrales, MD (*Abstract Co-Author*) Nothing to Disclose
Luz A. Unigarro, MD (*Abstract Co-Author*) Nothing to Disclose
Julian M. Gandur, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Blanco Rojas, MD (*Abstract Co-Author*) Nothing to Disclose
Monica Natalia Venegas Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas H. Plata, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe the different types of lymphomas that may affect the body and their epidemiology.Exemplify imaging findings of different lymphomas in CNS, head and neck, thorax, abdomen and bone.Determine the usefulness of different imaging modalities in diagnosis of human body lymphomas.Compare and contrast imaging findings of different lymphomas in different ¡reas of the body.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Epidemiology3. Central nervous system4. Head and neck5. Thorax6. Abdomen7. Musculoskeletal

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MSEE-55

## MUCINOUS NEOPLASMS AND THE ROLE OF HIPEC

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ahmed M. Sobieh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Elhamy R. Heba, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Michael J. Nisiewicz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Pathogenesis of peritoneal mucinous neoplasms originates from rupture at the primary site, resulting in dissemination of malignant cells into the peritoneal cavity- HIPEC is one part of a multimodal treatment for peritoneal neoplasms. Goal of HIPEC is to treatment microscopic disease following surgical debulking/cytoreductive surgery- HIPEC is not a curative therapy, it is used for palliation and prolonged survival- Pseudomyxoma peritonei is classically defined as originating from appendiceal mucinous neoplasms. Currently, the term refers to mucinous peritoneal neoplasms originating from any abdominal or pelvic organ.

### TABLE OF CONTENTS/OUTLINE

- Anatomy of the peritoneal cavity and pathways of disease migration- Review imaging features of various mucinous neoplasms of the abdomen and pelvis, with pathologic correlation- Definition of HIPEC, how HIPEC is performed, and its role in the treatment of mucinous neoplasms- Case review of various mucinous neoplasms, pre and post treatment

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# Abstract Archives of the RSNA, 2024

MSEE-56

## MEDICAL DEVICES IN THE ABDOMEN AND PELVIS- A PICTORIAL REVIEW FOR TRAINEES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Farah Rahman, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Siddiqui (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin Sellers, MD (*Abstract Co-Author*) Nothing to Disclose
Denton Connor, MD (*Abstract Co-Author*) Nothing to Disclose
Anugayathri Jawahar, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Comprehensive overview of various medical devices in the abdomen and pelvis and their imaging appearances on different modalities.The clinical indications of these medical devices, normal versus aberrant locations. Complications arising from aberrant locations.

### TABLE OF CONTENTS/OUTLINE

Iatrogenically placed catheters, tubes, and devices to assist medical management in the abdomen and pelvis are common. New devices are coming to the market regularly, and radiologists need to know the imaging findings of these medical devices, understand the role of different devices in medical care, and differentiate between normal and appropriate positions. It is crucial to identify when these devices are outside their territory and recognize potential complications associated with them when in abnormal locations. This educational exhibit aims to provide a comprehensive overview of the radiographic appearances and clinical implications of short-term retrievable, long-term retrievable, and permanent devices within the abdomen and pelvis.IntroductionDescribe the medical devices in relation to indication, expected position, abnormal location, and expected complication with the abnormal location. Short Term Retrievable Devices (Nasogastric Tubes, Biliary Stents, Capsule Endoscope, Intra-aortic Balloon Pump) Long Term Retrievable Devices (Gastric Lap Bands, Neurostimulator Device, Antibiotic Beads, Intrauterine Device, Vaginal Pessary, NuvaRing, IVC filter)Permanent/Non-Retrievable Devices (Vasectomy Clips, Penile Prosthesis types, Tubal Ligation Clips, Hernial Plug)Summary and take home points

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# Abstract Archives of the RSNA, 2024

MSEE-57

## FROM HEAD TO TOE: UNUSUAL LOCATIONS OF EXTRANODAL LYMPHOMAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yanet Y. Torres Maza (*Abstract Co-Author*) Nothing to Disclose
Alejandra M. Bonilla Ruiz I, BDS (*Abstract Co-Author*) Nothing to Disclose
Merecedes B. Mayta Jimenez, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa E. Velezmoro Diaz, MD (*Abstract Co-Author*) Nothing to Disclose
Lisett N. Cruzado-Quiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Marycarmen E. Flores Duenas, MD (*Abstract Co-Author*) Nothing to Disclose
Romy L. Ames Caro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Lymphoma is a neoplastic proliferation of lymphoid cells in lymph nodes and lymphatic tissues primarily, with bone marrow, spleen, and thymus involvement in many cases, but it can have an extranodal location, with or without nodalinvolvement.The extranodal engagement occurre more frequently for non-Hodgkin lymphomas (NHL, 25-40%) than for Hodgkin lymphomas (HL, 1%).The most common types of extranodal lymphomas (ENL) are diffuse large B-cell lymphoma (DLBCL) and Malt lymphoma.The gastrointestinal tract is affected in 43%, followed by head and neck with 14%, lung (2%), skin (7%), bone (5%), and brain (6-7%).On imagens one of the main characteristics is that the majority of these tumors show hyposignal in T2 sequences, enhancement on contrast and show marked restriction diffusion.Cross-sectional imaging (MRI and CT) are advised as techniques in the diagnosis, staging and follow-up, mainly in the diagnosis since many of these tumors are not surgical of first intention, therefore their recognition and accurate diagnosis make this pathology an important issue to take into account.

### TABLE OF CONTENTS/OUTLINE

Primary Thyroid Lymphoma, primary suprasellar Lymphoma, Primary uterine cervix lymphoma, Primary rectal lymphoma, Anal plasmablatic lymphoma, Primary bone lymphoma

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# Abstract Archives of the RSNA, 2024

MSEE-58

## DENGUE FEVER: A GUIDE FOR A MULTIMODAL APPROACH TO MULTISYSTEMIC COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduardo Gomes De Menezes JR, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Alves (*Abstract Co-Author*) Nothing to Disclose
Fernando Yamauchi (*Abstract Co-Author*) Nothing to Disclose
Carolina Carotenuto Ramos, MD (*Abstract Co-Author*) Nothing to Disclose
Helena A. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Dengue is the most important mosquito-borne viral disease in the world. The prevalence of the infection has increased dramatically in recent decades. The disease is now endemic in more than 100 countries worldwide.2. Dengue has a wide spectrum of clinical signs and symptoms, ranging from asymptomatic infection to severe, lethal manifestations. The early diagnosis of dengue can be established provisionally by clinical observation and readily available laboratory tests.3. According to the 2009 World Health Organization guidelines, patients are categorized as having the non-severe form (subdivided into those with warning signs and those without) or the severe form, according to clinical, laboratory and radiological criteria.4. Therefore, there is growing interest in the early identification of image characteristics related to disease with multisystemic representation, playing a highly relevant role in clinical management, through adequate identification, reporting and multimodality radiological characterization.

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION- OVERVIEW- PHYSIOPATHOLOGY- DIAGNOSIS - CLINICAL FORMS2. SYSTEMIC COMPLICATIONS AND REPORTING- ABDOMINAL- THORACIC - NEUROLOGYCAL - CARDIOVASCULAR- MUSCULOSKELETAL3. FRONT LINE APPROACH - ULTRASOUND- X-RAY4. GUIDED SYMPTOM APPROACH5. CONCLUSION

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# Abstract Archives of the RSNA, 2024

MSEE-6

## NOT ALL THAT IS STENOSED IS ATHEROSCLEROSED: THE VARIOUS FACES OF FIBROMUSCULAR DYSPLASIA AND ITS MIMICKERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David M. Yousem, MD, MBA (*Abstract Co-Author*) Royalties, RELX;Speaker, MRI Online;Board Member, MRI Online;
Mohab Elnashar (*Abstract Co-Author*) Nothing to Disclose
Yasmin Aly (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understanding the pathogenesis and the histopathological characteristics of Fibromuscular Dysplasia (FMD). 2. Explore the diverse morphological presentations of FMD observed on angiograms, ranging from the common "string of beads" pattern to less familiar atypical forms such as carotid webs and artery dissections. 3. Understanding the clinical context surrounding FMD including patients' demographics and presenting symptoms. 4. Brief discussion on the differential diagnosis of FMD seen on angiographic imaging and how to differentiate them apart. 5. Illustrate the role of Radiology in treatment of FMD.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: a. Definition. b. Epidemiology of FMD. c. The reason behind the growing interest in FMD. 2. Pathophysiology: a. The pathogenesis theorized leading to FMD. b. Histopathological classification of FMD. 3. Review of the different angiographic variants of FMD. 4. A case-based review: Providing sample scenarios illustrating the clinical findings and the angiographic findings of FMD. 5. Differential diagnosis of FMD on angiograms including, atherosclerosis, standing waves, segmental medial arteriolysis (SAM) and arterial tortuosity caused by multiple diseases to be discussed. 6. Summary and takeaway points.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

MSEE-60

## POST-SURGICAL COMPLICATIONS: FLUOROSCOPIC FINDINGS OF PERFORATIONS, LEAKS, AND FISTULAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Madeleine Nguyen (*Abstract Co-Author*) Nothing to Disclose
Alex Nguyen (*Abstract Co-Author*) Nothing to Disclose
Ryan Ko (*Abstract Co-Author*) Nothing to Disclose
Don N. Nguyen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Although utilization numbers show fluoroscopy is not the cornerstone in diagnostic radiology with continued emphasis on cross sectional imaging, it is important to recognize its critical role particularly in the post-operative setting. The purpose of this educational exhibit is to familiarize radiologists with a series of cases highlighting fluoroscopic findings of worrisome complications following surgery. After review, the audience will be able to:1. Recognize different fluoroscopic studies and technique to help diagnose post-surgical complications2. Identify important fluoroscopic imaging findings that would prompt emergent intervention3. Discuss implications of different post-surgical complications on patient management, treatment and overall prognosis

### TABLE OF CONTENTS/OUTLINE

I. Background on FluoroscopyII. Types of Fluoroscopic Studies (Indications, Oral Contrast Agents, Techniques)III. Cases of Post Surgical Complications:1. Boerhaave syndrome- Post operative nausea/vomiting (Esophagram)2. Gastrobronchial fistula- Esophagectomy with gastric pull through ('Tracheobronchogram')3. Gastric pouch leak- Roux en Y gastric bypass (Upper GI series)4. Feculent peritonitis- Partial colectomy for colonic neoplasm (Barium enema)5. Vesicovaginal fistula- Hysterectomy for cervical cancer (Cystogram)IV. Review of Fluoroscopic Findings (Perforations, Leaks and Fistulas)V. Patient Management/PrognosisVI. Clinical and Imaging Pearls

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# Abstract Archives of the RSNA, 2024

MSEE-61

## HYDATID DISEASE BEYOND HEPATIC INVOLVEMENT: A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ayse Ibis, MD (*Abstract Co-Author*) Nothing to Disclose
Mustafa Durmaz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the lifecycle and route of transmission for the causative agent (E. granularis) responsible for Hydatid disease and its epidemiology.Learn about the clinical signs and symptoms and how to confirm the diagnosisReview characteristic imaging findings at various parts of body with multimodality approach(US, CT and MRI) and staging.List possible differential diagnoses and how to approach to cystic lesions in atypical locationsLearn about the treatment options

### TABLE OF CONTENTS/OUTLINE

Introduction to Hydatid DiseaseLife cycle of E. granulosus and TransmissionClinical Manifestations and DiagnosisInvolvement of Different Organs and Systems/Imaging FindingsTreatment

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# Abstract Archives of the RSNA, 2024

MSEE-62

## ESSENTIAL GUIDE FOR THE RADIOLOGIST IN IMAGES PREPARATION FOR SCIENTIFIC OR EDUCATION PRESENTATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Orlando Catalano, MD (*Abstract Co-Author*) Nothing to Disclose
Vittoria Nunziata (*Abstract Co-Author*) Nothing to Disclose
Antonio Nunziata, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The most of the native images in Radiology are in DICOM format, not suitable for digital presentations and for rewiev articles. For this purpose they have to be converted in other formats. They have to have a suitable resolution, appropriated color codify, light compression and discreet evidence of the pathological focus. The purpose of the presentation is to give a guide to the Radiologist on how to prepare images and drawings for presentations on screen or on papery support.

### TABLE OF CONTENTS/OUTLINE

The DICOM format represents the standard used by all the builders of Radiologic equipments. The DICOM files contains patient data, type of equipment, image parameters and finally the digital image, generally in Jpeg format, with a light level of compression. The DICOM files is not suitable for screen presentation softwares (PowerPoint or similars). The images extracted in the formats JPEG, PDF, PNG, GIF can be inserted, with a resolution at least of 150 dpi ( 300 dpi in 4K screens), with RGB color codify or in the greyscale. To be printed on papery supports (blackboard panel, rewiev articles, etc.), the images possibly have to be in TIFF format, resolution of at least of 400 dpi, CMYK color codify or in greyscale. The compression deteriorates in proportional way the image quality. The various digital images, the various color modes, the effects of compression on the image quality and a final toolkit for the optimal preparation of the images are illustrated in uploaded pdf.

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# Abstract Archives of the RSNA, 2024

MSEE-63

## EXPANDING THE DIFFERENTIAL FOR PELVIC MASSES: EXPLORING ATYPICAL PRESENTATIONS OF CLASSIC DIAGNOSES IN THE PELVIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ece I. Akduman, MD (*Abstract Co-Author*) Nothing to Disclose
Amirhossein Mohammadian Bajgiran, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Dilli (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The pelvis houses many structures including the rectum, bowel, bladder, reproductive organs, bone, soft tissue and lymphatics, from which myriad pathologies can arise. Pelvic masses presenting with atypical size, location, progression and arising structures can confuse the diagnosis for even the experienced radiologist. Careful comparison of key radiologic findings and diagnostic criteria between pelvic masses and their differentials is important for accurate reporting. Understanding of the pathologic basis behind pelvic masses can aid in the interpretation of their radiographic findings.

### TABLE OF CONTENTS/OUTLINE

1. Extramedullary rectal plasma cell neoplasm a. Case study b. Diagnosis and key features c. Comparisons with bone-associated plasma cell neoplasm and DLBCL 2. Pelvic extra-adrenal myelolipoma a. Case study b. Diagnosis and key features c. Comparison with teratoma, liposarcoma and lipoma 3. Pelvic schwannoma a. Case study b. Diagnosis and key features c. Comparison with spindle cell sarcoma and GIST 4. Extra-uterine leiomyosarcoma a. Case study b. Diagnosis and key features c. Comparison with uterine leiomyosarcoma and parasitic fibroid 5. Periurethral leiomyoma a. Case study b. Diagnosis and key features c. Comparisons with uterine leiomyoma and urothelial carcinoma 6. Bladder small cell carcinoma a. Case study b. Diagnosis and key features c. Comparisons with urothelial carcinoma 7. Immature teratoma a. Case study (35 cm mass from pelvis to gallbladder fossa) b. Diagnosis and key features c. Comparisons with 30 cm mature teratoma and clear cell ovarian carcinoma 8. Rectal neuroendocrine carcinoma a. Case study b. Diagnosis and key features c. Comparisons with rectal NET and adenocarcinoma

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# Abstract Archives of the RSNA, 2024

MSEE-64

## TOWARD A CROSS-ORGAN AND COMPREHENSIVE UNDERSTANDING OF CARCINOSARCOMA OR SARCOMATOID CARCINOMA IN THE ABDOMEN AND PELVIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Junya Tsuzaki (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Tatsuya Suzuki (*Abstract Co-Author*) Nothing to Disclose
Hirotaka Akita (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maho Kurihara (*Abstract Co-Author*) Nothing to Disclose
Yuko Tsujioka, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Orito Ikeda (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Cancer cells originating from diverse organs, referred to as carcinosarcomas or sarcomatoid carcinomas, may be accompanied by sarcomas or sarcoma-like cells. These occurrences are uncommon, typically associated with an unfavorable prognosis, and often present challenges in terms of effective treatment. Additionally, the World Health Organization (WHO) classification is not unified for each organ. 2. In recent years, efforts have been made to identify shared characteristics among these tumors and investigate them in a cross-organ fashion. This implies that radiologists may be required to understand these tumors from a cross-sectional perspective in the future. 3. Here, we systematically compiled WHO classifications and clinical characteristics. We discussed a comprehensive, cross-sectional approach to imaging findings based on insights from our cases.

### TABLE OF CONTENTS/OUTLINE

(1) Introduction (2) Female Genital Tumors (3) Urinary and Male Genital Tumors (4) Digestive System Tumors (5) Discussion (6) Summary (7) References

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# Abstract Archives of the RSNA, 2024

MSEE-65

## DEVELOPING PATIENT-SPECIFIC ORTHOPAEDIC AND SPINE ANATOMICAL MODELS AND OSTEOTOMY SURGICAL GUIDES FROM MEDICAL IMAGING AS AN IN-HOSPITAL CLINICAL 3D PRINTING SERVICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Mark B. Tan, MBBS, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Applications and value proposition of designing, developing and producing patient-specific 3D printed orthopaedic and spine anatomical models and osteotomy surgical guides via an in-hospital clinical 3D printing serviceImaging acquisition, segmentation and surgical guide design principles and considerations of these models and guidesCase examples

### TABLE OF CONTENTS/OUTLINE

Applications of patient-specific 3D printed orthopaedic and spine anatomical models and osteotomy surgical guides.Value proposition of an in-hospital clinical 3D printing service for these devices.Image acquisition considerations for 3D printed orthopaedic and spine models and osteotomy surgical guides, i.e.CT: Utilisation of thin slices, contiguous slice intervalsMRI: Optimum sequence acquisition for modellingSegmentation considerations, i.e.Tumour segmentationCT-MRI-PET co-registrationSurgical guide design considerations, i.e.Design envelopes Fiducial and anchoring points, cutting slotsMaterial selection e.g. ability to be sterilised, stiffness, etc.These considerations are structured as case based teaching points, including the following casesCongenital - Foot Polydactyly supernumerary toe excision and 5th metatarsal osteotomy and bone graftingCongenital - Blount disease: Osteotomy with external fixation and gradual correctionPost traumatic - Distal Ulna post-traumatic deformity: Osteotomy and correctionPost-infection - Distal ankle deformity secondary to poliomyelitis: Osteotomy and realignment Spine - Atlantoaxial instability: C1-C2 instrumented fusionTumour (benign) - Humerus osteochondromaTumour (malignant) - Pelvic chordoma

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# Abstract Archives of the RSNA, 2024

MSEE-66

## ADPKD BEYOND KIDNEYS: THE ROLE OF DEEP LEARNING IN PRACTICAL IMPLEMENTATION OF EXTRARENAL MRI IMAGING BIOMARKERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hreedi Dev (*Abstract Co-Author*) Nothing to Disclose
Chenglin Zhu (*Abstract Co-Author*) Nothing to Disclose
Martin R. Prince, MD, PhD (*Abstract Co-Author*) Patent agreement, General Electric Company;
Zhongxiu Hu (*Abstract Co-Author*) Nothing to Disclose
Vahid Bazojoo, MD (*Abstract Co-Author*) Nothing to Disclose
Usama Sattar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Arman Sharbatdaran, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Autosomal Dominant Polycystic Kidney Disease (ADPKD) is a systemic disease primarily affecting kidneys and other organs requiring a comprehensive analysis when imaged by abdominal MRI or CT. MRI emerges as a transformative approach allowing for efficient and reproducible calculation of several clinically meaningful metrics assisting with currently limited treatment options due to incomplete evaluation of many imaging features.

### TABLE OF CONTENTS/OUTLINE

Already well-known implemented imaging biomarkers: 1. ORGANS:I)Native kidneys- Height-adjusted Total kidney volume II) Liver-Volume III) Spleen - VolumeRecently developed imaging biomarkers and their role in clinical management. 1. ORGANS: I) Native kidneys: -Height adjusted Total kidney volume averaging 5 sequences on multiple scans -Exophytic simple renal cyst -Exophytic complex renal cysts -Complex renal cysts -Simple renal cysts - Transplant kidney volume II)Liver: -Fat fraction -Cyst Count -Cyst fraction (%) -Complex cystsIII) Pancreas: - Volume - Pancreatic cystsIV) Stomach: - Confinement by adjacent enlarged organsV) Gallbladder :- Bile accumulation rateVI) Seminal vesicles: - Volume (megavesicles)VII) Prostate: - Midline CystVIII) Bladder: - Volume - Urine output and ureteral jet effect2. VASCULAR STRUCTURESI) Aorta:- Volume - Aortic pulsatilityII) IVC Compression3. FLUID ACCUMULATIONSI) Pleural effusion: - volumeII) Pericardial effusion: - volumeIII) Ascites/free pelvic fluid: - volume4. BODY COMPOSITIONI) Visceral fat: - volumeII) Subcutaneous fat:- volumeIII) Paraspinal and abdominal wall muscle5. OTHERI) Nerve root sheath cysts

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# Abstract Archives of the RSNA, 2024

MSEE-67

## MAMMARY-TYPE MYOFIBROBLASTOMA: LOCATIONS AND IMAGING FEATURES WITH PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ruifeng Guo (*Abstract Co-Author*) Nothing to Disclose
Ba D. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Steven Herber, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To present the epidemiology, pathogenesis, clinical manifestations and differential diagnosis of mammary-type myofibroblastoma. 2. To show the different locations of mammary-type myofibroblastoma with its multi-modality imaging including radiography, ultrasound, CT, MR and PET/CT.

### TABLE OF CONTENTS/OUTLINE

Mammary-type myofibroblastoma (MTMF) is a benign mesenchymal tumor initially reported by Wargotz et al. as a tumor in the breast of older men, also known as “benign spindle cell tumor of the breast”, “spindle cell lipoma,” “fibroma,” “myogenic stromal tumor,” or “solitary fibrous tumor” of the breast. It is theorized to arise from accessory breast tissue occurring along the embryonic milk-line from the axilla to the medial groin. Almost half of cases are found in the pelvis or inguinal region. About 25% of MTMF occur outside the embryonic milk-line, in the head and neck, abdomen, lower extremity, and to a lesser extend upper limb. The pathogenesis of mammary-type myofibroblastoma outside the embryonic milk-line distribution is still not totally elucidated. The exhibit presents the spectrum of MTMF features on ultrasound, CT, MR and PET/CT imaging and discusses their differential diagnosis based on early or advanced stages of the lesion. The exhibit also reviews the different sites of mammary-type myofibroblastoma such as pelvis, ischio-rectal region, back, retroperitoneum, inguina, thoracic wall, breast and lower extremity. An instance of recurrent tumor is also discussed and illustrated.

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# Abstract Archives of the RSNA, 2024

MSEE-68

## A DANGEROUS FRIENDLY FIRE: THE RADIOLOGICAL FEATURES OF IMMUNOTHERAPY-RELATED ADVERSE EFFECTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Helena A. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Cassia T. Guimaraes, MD (*Abstract Co-Author*) Nothing to Disclose
Renata F. dos Anjos, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Luciana Ramacho Rolim Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Gomes De Menezes JR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Immunotherapy has revolutionized cancer management and diagnosis. Although the immune checkpoint inhibitors (ICIs) are successfully used to treat a wide variety of neoplasms, sometimes in advanced stages, they are related to patterns of disease progression and especially to negative effects or complications, named immune-related adverse events (irAEs).2. The immune-related adverse events (irAEs) should be graded according to their severity, requiring rapid recognition and management, given the spectrum of alterations, from indolent to potentially fatal. In this context, Diagnostic Imaging play a key role in front-line patient care.3. We proposed an approach based on questions and clinical cases to review the main concepts related to immunotherapy in a didactic and structured way, with a focus on clinical and radiological aspects of immune-related adverse events (irAEs).

### TABLE OF CONTENTS/OUTLINE

1. Introduction- Key Concepts about Immunotherapy - The lexicon: ICIs and patterns of progression and response 2. Immune-related Adverse Events- Grading Severity Scale- Thoracic - Pneumonitis - Sarcoid-like reaction- Cardiovascular - Myocarditis - Vasculitis - Pericarditis- Gastrointestinal - Colitis - Gastroenteritis - Hepatitis - Pancreatitis - Cholangitis - Cholecystitis- Endocrine - Hypophysitis - Thyroiditis - Adrenalitis - Musculoskeletal - Arthritis (Inflammatory)- Central Nervous System - Encephalopathy 3. Conclusion

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# Abstract Archives of the RSNA, 2024

MSEE-69

## SPINE-TINGLING ENCOUNTERS WITH THE EXTRASPINAL KIND: INCIDENTAL FINDINGS ON LUMBAR SPINE MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lawrence Wang, DO (*Abstract Co-Author*) Nothing to Disclose
Erwin Ho (*Abstract Co-Author*) Nothing to Disclose
Maryam Golshan Momeni, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Abstract Co-Author*) Nothing to Disclose
Cassidy Tung (*Abstract Co-Author*) Nothing to Disclose
Elliott Lebby, MD (*Abstract Co-Author*) Nothing to Disclose
Kasha Chen (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the spectrum of incidental extraspinal findings on lumbar spine magnetic resonance imaging (MRI). To highlight imaging features of incidental extraspinal findings on lumbar spine MRI and review potential blind spots and pitfalls in commonly missed lesions.

### TABLE OF CONTENTS/OUTLINE

MRI of the lumbar spine is commonly performed in routine evaluation for low back pain. Approximately 23% of American adults report they will seek diagnostic evaluation with MRI for this indication. MRI of the lumbar spine can reveal a range of incidental extraspinal findings within the organs in the field of view. Importantly, clinically significant extraspinal findings may be treatable and a systematic approach to diagnosis may reduce delay for treatment or unnecessary medical costs. This educational exhibit will: (1) review clinically significant incidental findings on magnetic resonance imaging (MRI) of the lumbar spine with illustrative cases within musculoskeletal, vascular, gastrointestinal, endocrine, and genitourinary systems, and (2) highlight imaging features and potential blind spots in the assessment of incidental pathologies including chest wall hematoma, lymphatic metastases, retroperitoneal hemorrhage, abdominal aortic aneurysms, gastrointestinal stromal tumor, cholelithiasis, choledocholithiasis, adrenal lesions, renal cell carcinoma, and ovarian cysts.

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# Abstract Archives of the RSNA, 2024

MSEE-7

## COWDEN SYNDROME: GENOMICS, ONCOGENESIS AND IMAGING REVIEW FOR ASSOCIATED PATHOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Akram M. Shaaban, MBBCh (*Abstract Co-Author*) Royalties, RELX
Usama I. Salem, MBBCh, MD (*Abstract Co-Author*) Nothing to Disclose
Silvana C. Faria, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmed Taher, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review the genomics, oncogenesis and epidemiology of Cowden Syndrome (CS). 2. Outline the major and minor diagnostic criteria of CS. 3. Discuss the various tumor presentations of CS. 4. Illustrate the spectrum of associations and imaging features of associated benign lesions and malignancies. 4. Describe the current screening program for CS patients.

### TABLE OF CONTENTS/OUTLINE

a. Epidemiology of CS i. Age/gender ii. Geographic distribution, populations at risk iii. Pattern of inheritance, discovery by Lloyd and Dennis in 1963 b. Pathophysiology of CS i. Genomics ii. Oncogenesis iii. Histopathology c. Surveillance imaging techniques d. Specific imaging examples of associated benign lesions and cancers that can be seen with surveillance i. Lhermitte-Duclos disease ii. Breast cancer/benign breast lesions iii. Thyroid carcinoma/benign thyroid growths iv. Endometrial cancer/uterine fibroid v. Colon cancer/polyps vi. Renal cell carcinoma vii. Melanoma/benign skin lesions e. Recommendations regarding management and genetic counseling

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# Abstract Archives of the RSNA, 2024

MSEE-70

## HOW ABOUT ACTINOMYCOSIS?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto Fornell-Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Manex Lasa (*Abstract Co-Author*) Nothing to Disclose
Udane Oiartzabal, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Maria Asensi, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rodriguez Ripalda, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Jose Gomez Muga, MD (*Abstract Co-Author*) Nothing to Disclose
Leire Ormaetxe Albeniz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe the physiopathology and the radiological features of the major forms of systemic actinomycosis and their differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

Actinomyces is a gram-positive branching anaerobic bacteria that causes an indolent and recurrent suppurative infection. Although it predominantly affects the cervicofacial area, it can invade nearly any organ in the organism.Early treatment is crucial and typically results in a favourable prognosis. However, the locally invasive and disseminated forms may require aggressive surgical intervention. Therefore, early diagnosis is vital for successful management.Actinomycosis is a challenging diagnosis to be made based on radiological features, as its aggressive infiltrating behavior can mimic many other diseases, including both inflammatory and neoplastic lesions, requiring frequent histological confirmation.The three main characteristics that every radiologist must keep in mind in order to recognize this disease are its chronicity, its tendency to propagate across tissue planes conforming complex abscesses, and its typical initial response to antibiotic treatment followed by continuous relapses.In this review, we present a series of cases involving different forms of this condition, including cervicofacial, intestinal, gynaecological, genitourinary, thoracic, and central nervous system manifestations, summarizing the key imaging features and their differential diagnoses to aid in accurate identification and timely management of the disease.

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# Abstract Archives of the RSNA, 2024

MSEE-71

## VASCULAR ABNORMALITIES IN ATHLETES: STATE-OF-THE-ART MULTIMODALITY IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To discuss the vascular abnormalities that can be seen in athletes 2. To highlight the role of multimodality imaging in the evaluation of vascular abnormalities in athletes. 3. To discuss illustrate these vascular issues with case examples

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Vascular abnormalities in athletes- Etiology and pathophysiology 3. Risk factors- repetitive extremity movements, muscle hypertrophy, anatomic anomalies 4. Presentations- pain, swelling, ischemia 5. Imaging modalities- ultrasound, CT, MRI, angiography 6. Discussion (including sports and predisposing factors) and illustration of the following vascular abnormalities with case examples a) Thoracic outlet syndrome (baseball pitchers, tennis) - Paget Schroetter syndrome - Aneurysms/ stenosis of subclavian/ axillary arteries b) Quadrilateral space syndrome (baseball, volleyball) c) Palmar arch injury-Hypothenar hammer syndrome (cricket, baseball, handball) d) Digital ischemia (football, baseball) e) Arterial thromboembolism f) External iliac artery endofibrosis (cycling, long-distance running) g) External iliac artery dissection h) Adductor canal syndrome (running, skiing) i) Chronic exertional compartmental syndrome (long-distance running, rugby, tennis) j) Popliteal artery entrapment (basketball, football, rugby) k) Popliteal vein entrapment (football, rugby, soccer) l) Cystic adventitial necrosis m) Venous thromboembolism n) Venous insufficiency (distance running, cycling, tennis, weightlifting) o) Mesenteric ischemia p) GI bleed q) Coronary artery disease r) Pulmonary hypertension

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# Abstract Archives of the RSNA, 2024

MSEE-72

## LOOSE TRIGGER OR SAFETY ON: MRI AFTER BALLISTIC INJURY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Irfan Nazir Hassan, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sultan Bukhari (*Abstract Co-Author*) Nothing to Disclose
David Oommen (*Abstract Co-Author*) Nothing to Disclose
Esther A. Nimchinsky, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Giraldo Herrera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Civilian bullets fired in the US have distinct imaging appearances in human tissue, depending on their ferromagnetic and non-ferromagnetic metal alloy compositions. 2. Review of available imaging should be performed if there is a known history of gunshot injury. Allowing patients with deformed or destroyed bullets to pass beyond MR Zone 3 may be associated with a lower risk of adverse events than previously thought. 3. Tissue location of bullets, or acuity of the wound, does not appear to be associated with clinically significant displacement or rotation at 1.5 T. 4. MRI of non-ferromagnetic bullets within the study field of view is subject to minor local artifacts and can still be of diagnostic quality if planned appropriately, including the use of inversion recovery sequences.

### TABLE OF CONTENTS/OUTLINE

1. Background and Literature Review. 2. Level-1 Trauma Center Retrospective EMR Search. 3. Preliminary Case Series. 4. Suggested Clinical Approach.

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# Abstract Archives of the RSNA, 2024

MSEE-73

## IMAGING OF THE UMBILICUS: WHERE IS YOUR MOTHER?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hirotaka Akita (*Abstract Co-Author*) Nothing to Disclose
Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Fumiko Yagi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) Understanding embryonic development and anatomy of the umbilicus(2) Understanding useful radiological features of umbilical and periumbilical lesions

### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. Embryonic development of the umbilicusIII. Anatomy of the umbilicusIV. Umbilicus and umbilical lesionsA. Urachal remnant- Congenital urachal anomalies (patent urachus, urachal cyst, umbilical-urachal sinus, bladder diverticulum)- Complications of the urachal remnants (infection/inflammation and urachal carcinoma)B. Omphalomesenteric duct remnants- Omphalomesenteric duct anomalies (omphalomesenteric sinus, fistula, band, cyst, and Meckel's diverticulum)- Complications of Meckel's diverticulaC. Obliterated umbilical arteriesD. Obliterated umbilical veins- Right-sided round ligament of the liver- Abscess of the round ligament of the liverE. Recanalization of the paraumbilical veinsF. Umbilical ring lesions- Congenital hernia of the umbilical cord- Gastroschisis- Umbilical hernia- Endometriosis- Sister Mary Joseph's nodule- Atheroma G. Iatrogenic lesions- Port site hernia- Port-site seroma/abscesses- Central venous catheter misplacement- Umbilical venous catheterH. Others- Umbilical ring- Acupuncture needle- Adhesion after cesarean section

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# Abstract Archives of the RSNA, 2024

MSEE-74

## WORKLOAD ASSESSMENT OF SURGERY-ASSISTED SIMULATION USING VIRTUAL REALITY TECHNOLOGY: A WORKLOAD STUDY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hirotaka Nakashima, MSc, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 3D images can be observed from multiple directions in a virtual reality space, enabling a different kind of surgical simulation.2. A questionnaire survey using the NASA Task Load Index was conducted to investigate the workload of the new surgery-assisted simulation.3. The survey was administered to 15 subjects (7 orthopedic surgeons from the Spine Center and 8 thoracic surgeons).4. Compared to the conventional simulation method using monitors, the overall workload remained the same and resulted in improved work performance.

### TABLE OF CONTENTS/OUTLINE

To ensure a smooth and safe surgery, it is crucial to have a thorough understanding of the location and arrangement of blood vessels and anatomical structures beforehand. While surgical simulations using 3D images have been developed, there are limitations in accurately reproducing the surgical field due to the use of 2D monitors for observation. In recent years, virtual reality (VR) technology has gained momentum in surgical simulations, enabling objects to be viewed from all angles within a virtual space, and providing an easier grasp of the positioning of structures. However, there are concerns about the potential for increased physician burden. To address this concern, we conducted an experiment comparing the workload of surgical simulations using VR technology to those using conventional 2D monitors, utilizing NASA's Task Load Index. The results revealed that surgical simulation using VR technology improved work performance without increasing physician workload compared to the conventional method. These findings suggest that VR technology has the potential to enhance surgical simulations and improve patient outcomes.

# Abstract Archives of the RSNA, 2024

MSEE-75

## WE ARE GOING TO THE ZOO! YOU CAN COME TOO! MULTISYSTEM ANIMAL SIGNS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jennifer S. Weaver, MD (*Abstract Co-Author*) Nothing to Disclose
Sherry S. Wang, MBBS, FRANZCR (*Abstract Co-Author*) Royalties, RELX
Jonathan Revels, DO (*Abstract Co-Author*) Nothing to Disclose
Sarah Bastawrous, DO (*Abstract Co-Author*) Nothing to Disclose
Saeed Elojeimy, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hayden Swartz, MD (*Abstract Co-Author*) Nothing to Disclose
Arafat Ali, DO (*Abstract Co-Author*) Nothing to Disclose
Shelby Stewart, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Identify animal signs applicable to adult and pediatric patients.2. Explain and illustrate the animal signs' associated diagnoses across multiple systems and modalities.

### TABLE OF CONTENTS/OUTLINE

1. Big cats -Tiger -Eye of tiger sign of pantothenate kinase-associated neurodegeneration -Tiger stripe appearance in Lhermitte-Duclos -Feline esophagus 2. Aviary -Bird beak sign of achalasia -Hummingbird/penguin sign of midbrain atrophy -Gull wing appearance of erosive osteoarthritis -Winking owl sign of an absent pedicle -Pooping duck sign of triquetral fracture 3. Reptiles -Cobra head sign of ureterocele -Turtleback sign of schistosomiasis -Serpent sign of ruptured hydatid cyst 4. Butterfly garden -Butterfly glioma -Butterfly vertebra sign of sagittal cleft vertebra -Fracture with butterfly fragment -Caterpillar sign of pyloric stenosis -Cocoon of encapsulating peritoneal sclerosis 5. Animals from Africa -Elephant for the ivory phalanx of psoriatic arthritis and ivory vertebra sign of opacified vertebra -Zebra sign of osteogenesis imperfecta, spleen enhancement, remote cerebellar hemorrhage -Giraffe sign of Hashimoto thyroiditis -Camel sign of Dromedary hump -Anteater nose sign of calcaneonavicular coalition 6. Animals from Asia -Panda sign of Wilson disease -Racoon eyes of base of skull fractures 7. Animals from America -Bear’s paw sign of xanthrogranulomatous pyelonephritis -Moose head of corpus callosal dysgenesis -Staghorn calculus of struvite calculi 8. Aquarium -Fish vertebra of osteoporosis -Fishtail pancreas of pancreas bifidum -Lobster claw of papillary necrosis -Manta ray of bladder exstrophy -Vertebral scalloping of abnormal bone and/or abnormal forces

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# Abstract Archives of the RSNA, 2024

MSEE-76

## ABDOMINAL MANIFESTATIONS OF EXTRANODAL LYMPHOMA: IMAGING SPECTRUM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ernesto Garcia Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Ernesto Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Aleman Flores (*Abstract Co-Author*) Nothing to Disclose
Carlos Fernandez Cabrera (*Abstract Co-Author*) Nothing to Disclose
Alejandro Santana Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Rodriguez Fuentes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To describe the extranodal manifestations of lymphoma and the imaging findings. To illustrate the imaging spectrum of extranodal lymphoma.

### TABLE OF CONTENTS/OUTLINE

Lymphoma has the potential to impact virtually every abdominal organ and tissue, resulting in a variety of imaging spectrums. Lymphoma usually presents with nodal disease, which includes the involvement of the lymph nodes, thymus, tonsils, and Waldeyer's ring. Involvement of other organs is considered extranodal disease, except for splenic involvement, which is considered nodal in Hodgkin Lymphoma (HL), and extranodal in Non-Hodgkin Lymphoma (NHL). Extranodal involvement indicates a worse prognosis and can simulate other diseases. Common locations of abdominal extranodal lymphoma include the spleen, liver, and gastrointestinal tract. Among them, primary extranodal lymphoma is very rare, with secondary involvement more frequently found with another primary neoplasm. In both cases, extranodal affectation is more common in NHL than in HL. Although the definitive diagnosis is with biopsy, imaging techniques have an important role in the management of extranodal lymphoma.

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# Abstract Archives of the RSNA, 2024

MSEE-77

## ONCOLOGICAL PITFALLS AND MIMICS IN THE ABDOMEN AND PELVIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Matthew T. Heller, MD (*Abstract Co-Author*) Nothing to Disclose
Anup S. Shetty, MD (*Abstract Co-Author*) Nothing to Disclose
Nelly Tan, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Zulfiqar, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Cole P. Thompson, MD (*Abstract Co-Author*) Nothing to Disclose
Kristina Yancey, MD (*Abstract Co-Author*) Nothing to Disclose
Khaled M. Elsayes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicole Warrington, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Illustrate differences between a pitfall and a mimic in the setting of oncological imaging.Provide case-based review of various oncological pitfalls and mimics in the abdomen and pelvis.

### TABLE OF CONTENTS/OUTLINE

Pitfalls • Spontaneous regression of primary malignancy HCC; Burnt out seminoma • Neoplasms resembling benign entities Cystic pancreatic NET, Cystic RCC, Mucinous GI malignancy, Adrenal mets from HCC or RCC, Pheochromocytomas. • Eye-catching benign pathology with superimposed malignancy Rectal hemangioma with superimposed malignant mass. • Peri-organ infiltration of malignancy resembling benign entities: Biliary lymphoma, linitis plastica, infiltrative TCC. • Progression of disease Growing teratoma syndrome; pseudoprogression in the setting of immunotherapy. • Prozone effect Choriocarcinoma • Concomitant complications: Ovarian torsion with adnexal tumors. Mimics • Benign tumors with aggressive appearing features Renal AML, uterine leiomyoma with IVC thrombus; endometriosis; Sternberg tumor; subserosal uterine adenomyomatous polyp. • Benign entities with malignant appearing enhancement patterns: Hepatic splenosis, splenic PSA.• Infection/inflammation looking like malignancy BCG prostatitis, XG cholecystitis, IgG4 pancreatitis, Actinomycosis, peritoneal TB or disseminated fungal infection.• Foreign body reactions Gossypiboma, gluteal silicone granulomatosis, mesh plug, bulking agents. • Anatomical structures mimicking masses Colonic diverticulosis, gastric fundal diverticulum, ectopic pancreatic rest, Meckel's diverticulum.

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# Abstract Archives of the RSNA, 2024

MSEE-78

## THE RADIOLOGICAL PALETTE OF ABDOMINAL LYMPHOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Harshitha Shetty, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To describe the risk factors, etiopathogenesis, classification and staging of lymphoma. 2. To illustrate the salient imaging features and spectrum of appearances of lymphoma in the abdomen 3. To discuss the imaging features of extranodal lymphoma from other organ-specific neoplastic and inflammatory mimics.

### TABLE OF CONTENTS/OUTLINE

1. Etiopathogenesis of lymphoma with risk factors for the various organ-specific lymphomas • Bacterial infection- H. pylori, Viral infection- EBV, HTLV, HIV • Immunosuppression- Post transplant lymphoproliferative disorder • Inflammatory diseases- Celiac disease, Atrophic gastritis 2. Classification - 2022 WHO classification of tumors of hematopoietic and lymphoid tissues based on the cell of origin (B cell, T cell, NK cells) and further categories. 3. Staging of lymphoma. 4. Imaging features of lymphoma in the abdomen • GI: Stomach, duodenum, ileum, appendix, colon • Hepatobiliary and pancreas • GU: Adrenal, renal/perirenal, ovarian and testicular • Splenic • Lymph nodal 5. Imaging mimics of lymphoma • Hepatic lymphoma- liver abscess, tubercular granuloma, metastatic liver lesion • Pancreatic lymphoma- pancreatic adenocarcinoma, autoimmune pancreatitis • Nodal lymphoma- disseminated tuberculosis, metastasis • Adrenal lymphoma- adrenal tuberculosis, histoplasmosis, adrenocortical carcinoma • Renal/perirenal lymphoma- IgG4-related retroperitoneal fibrosis, Erdheim-Chester disease, Rosai-Dorfman disease, retroperitoneal lymphatic malformation • Ovarian lymphoma- ovarian metastasis, malignant epithelial ovarian cancers 6. Discuss the treatment and post-treatment imaging appearances of lymphoma.

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# Abstract Archives of the RSNA, 2024

MSEE-79

## IDENTIFYING ADVERSE EFFECTS OF IMMUNOTHERAPY: KEY CONSIDERATIONS FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alvaro Rueda-de-Eusebio, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Guerrero Martin (*Abstract Co-Author*) Nothing to Disclose
Maria del Carmen Polidura Aaruga, MBBCHIR (*Abstract Co-Author*) Nothing to Disclose
Natividad Gomez JR, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia Lon, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The use of immune mediated treatment of cancer is improving dramatically the patient's outcome and comfort, but it also carries new toxicity profiles. While standard antineoplastic therapy is associated with immunosuppression and infections, these new therapies induce overwhelming inflammation and autoimmunity. The vast majority of these adverse events can be classified as mild or moderate, but severe and life-threatening complications requiring ICU admission can also occur.A considerable part of adverse effects related to immunotherapy can be diagnosed by imaging methods. This situation makes the role of the radiologist key when it comes to optimizing treatment individually for each patient, taking into account the risks and benefits of the different therapies.This review will focus on the radiological approach to the new challenge that is to make an accurate and early diagnosis of these complications.

### TABLE OF CONTENTS/OUTLINE

Understanding Immunotherapy: mechanism of action and types.Methods and backgroundResults and findingsRisk and protective factorsRespiratory tract toxicityCentral nervous system toxicityDigestive tract toxicityHepatobiliary toxicityRheumatological toxicityConclusionReferences

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# Abstract Archives of the RSNA, 2024

MSEE-8

## UNVEILING THE UNINTENDED AND BEYOND THE OBVIOUS: EXPLORING INCIDENTAL FINDINGS IN CT KUB EXCLUDING STONES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pratik Mukherjee, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
WAKADE AKSHAY DIPAKRAO, FRCR, MMEd (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Non-urinary and Urinary pathologies excluding stones are commonly seen on CT KUB studies, some of which are potentially life threatening.2. It is essential for radiologists to look out beyond stones, both for the expected mimics and more importantly for the unexpected significant incidentals.3. Timely early workup and intervention in these subset of cases can potentially reduce mortality, morbidity and improve patient outcomes by changing the management.

### TABLE OF CONTENTS/OUTLINE

Definition Computed tomography of kidneys, ureters and bladder (CT KUB) is a quick, non-invasive technique for diagnosis of urolithiasis. It is usually considered the initial imaging modality for suspected urolithiasis in an emergency setting.CT KUB is also advantageous to detect alternate cause of flank pain. Apart from calculi and mimics of urinary colic, often significant incidental significant findings affecting a wide range of organs is detected. It is interesting to note, that most of these findings are not clinically suspected at the time of presentation.Following are few of the examples of patients who presented with flank pain/renal colic but various other incidental findings are detected:Genito-urinary Renal Cell Carcinoma, Ovarian Dermoid cyst.Hepatobiliary Acute calculous cholecystitis, Multiple Hepatic abscesses, Cystic Pancreatic mass.Gastrointestinal Acute Appendicitis, Appendicular phlegmon, Appendix mucocele, Acute colonic diverticulitis, Intussusception, Sigmoid Carcinoma with hepatic metastasis.Vascular Aortic dissection, Aortic aneurysm.Musculoskeletal Multiple myeloma, Spondylodiscitis with psoas abscess.Miscellaneous Lymphoma, Retroperitoneal fibrosis.

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# Abstract Archives of the RSNA, 2024

MSEE-81

## AN AESTHETIC NIGHTMARE. THE US, CT, PET-CT, AND MRI DETECTION OF SILICONE OIL: WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Guillermo P. Sangster, MD (*Abstract Co-Author*) Nothing to Disclose
Ximena L. Wortsman, MD (*Abstract Co-Author*) Speakers Bureau, AbbVie Inc;Royalties, Springer Nature
Carolina Andrea Mariluis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Silicone oil is a non-FDA-approved permanent filler injected in many countries for cosmetic purposes. It presents a high rate of complications, and its detection should be familiar to any radiologist.- Ultrasound is the first-choice imaging technique due to its high sensitivity in distinguishing cosmetic fillers. Silicone oil presents as hyperechoic deposits that show a diffuse posterior acoustic reverberance, also known as a “snowstorm” artifact.- Magnetic resonance imaging (MRI) silicone oil-specific sequences can provide an accurate extent of the deposits.- The “Bright Multi-Bubble sign” identified in T2 and STIR sequences can be useful for diagnosis in cases of lack of silicone-specific sequences.- Radiologists have a critical role in diagnosing and characterizing this filler and its complications.

### TABLE OF CONTENTS/OUTLINE

1. To Illustrate expected imaging findings and complications in patients receiving silicone oil injections.2. To depict common and uncommon imaging patterns in ultrasound (US), computed tomography (CT), PET-CT, and MRI exams.3. To discuss the most common differential diagnosis.4. Proposal of a new radiological sign for MRI exams: Bright Multi-Bubble sign.

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# Abstract Archives of the RSNA, 2024

MSEE-82

## EXPLORING LIPEDEMA ULTRASONOGRAPHIC FINDINGS AND CLINICAL IMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marco de Andrade Bianchi (*Abstract Co-Author*) Nothing to Disclose
Deise Vargas (*Abstract Co-Author*) Nothing to Disclose
Amanda Martins E. Ribeiro Dos Santos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Lipedema is a chronic condition characterized by the disproportionate accumulation of fat in the limbs, especially in women after puberty, with an estimated prevalence of 12.3% in the population of Brazilian women. Its clinical significance lies in the impact on the patient's quality of life due to symptoms. The purpose of this article is:- Definition and Clinical Relevance of Lipedema.- Demonstration of Lipedema Presentation on Ultrasound Image.- Presentation of the “Marbleized Pattern” in Morphological Evaluation via Ultrasound as an Auxiliary Diagnostic Criterion.

### TABLE OF CONTENTS/OUTLINE

- Description of lipedema, a condition characterized by disproportionate fat accumulation, and its analysis by ultrasound.- Retrospective analysis of ultrasound exams to identify morphological differences in the hypodermis of patients with and without lipedema.- Identification of a specific morphological pattern, termed "marble pattern," in patients with lipedema during ultrasound exams.- Discussion on the utility of morphological evaluation of the hypodermis by ultrasound in the diagnosis and clinical management of lipedema.- Exploration of the clinical implications of identifying the “marble pattern” and recommendations for the diagnosis and treatment of lipedema based on ultrasound findings.In summary, the diagnosis of Lipedema through ultrasound is something recent, still frequently confused with more frequent conditions and this work brings the morphological assessment of the hypodermis through ultrasound as auxiliary diagnostic classifications and mapping of the disease.

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# Abstract Archives of the RSNA, 2024

MSEE-83

## EPITHELIOID HEMANGIOENDOTHELIOMA FROM HEAD TO TOE: A PRIMER FOR THE RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gregory N. Emmanuel, MD (*Abstract Co-Author*) Nothing to Disclose
Jiyae Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Braschi Amirfarzan, MD (*Abstract Co-Author*) Nothing to Disclose
Jyothi Priya Jagannathan, MD (*Abstract Co-Author*) Nothing to Disclose
Richard Thomas, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammad A. Nouh, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Variable clinical presentations of EHE based on the site of the primary tumor • Role of different imaging modalities to establish diagnosis, assess for metastatic lesions, guide biopsy and local therapy, and monitor treatment response therapy related toxicities. • Histopathologic features of EHE how it correlates with imaging findings. • Different treatment options including local and systemic therapy tailored to the clinical presentation.

### TABLE OF CONTENTS/OUTLINE

• Definition and etiology of EHE • Clinical presentation based on tumor site. • Imaging features of EHE: Case-based approach o Hepatic EHE: Imaging features on Ultrasound, CT and MRI o Thoracic EHE: Different patterns of disease. o Osseous and soft tissue EHE o Other less common sites of disease o Role of Bone scintigraphy and PET/CT • Local and systemic treatment options. o Role of imaging to monitor treatment response and treatment related toxicity.

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# Abstract Archives of the RSNA, 2024

MSEE-84

## FROM BARNYARDS TO JUNGLES: INJURIES IN HUMAN-ANIMAL INTERACTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mihra S. Taljanovic, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Revels, DO (*Abstract Co-Author*) Nothing to Disclose
Erica M. Lanser, MD (*Abstract Co-Author*) Nothing to Disclose
Mariam Moshiri, MD (*Abstract Co-Author*) I am the Editor of RSNA Case Collection
Sherry S. Wang, MBBS, FRANZCR (*Abstract Co-Author*) Royalties, RELX
Robert O. Cone III, MD (*Abstract Co-Author*) Nothing to Disclose
Jamie M. Elifritz, BS, MD (*Abstract Co-Author*) Officer, Forensic Radiology Group;Partner, Forensic Radiology Group
Melissa M. Picard, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer S. Weaver, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand the ecology and context of animal vs human traumas; Describe common and unique injury mechanisms related to animal vs human traumas; Recognize radiological manifestations of these encounters; Describe the prognoses and treatment options of the associated injuries;

### TABLE OF CONTENTS/OUTLINE

Introduction Throughout human history, human encounters with animals have often resulted in traumatic injuries. These incidents occur across various settings, including agricultural, wild, domestic, and recreational environments. In this exhibit, we explore the spectrum of traumatic injuries stemming from these encounters, including their mechanisms of injury and radiological manifestations, with a special focus on potential findings from post mortem CT examinations. Context Recreational (Rodeo, equestrian, circus, personal exotic animals); Agricultural/Farming (Cow/bulls, pigs, poultry, sheep); Domestic (Dogs, cats, pigs, reptiles); Wild (Bears, big game cats, deer, moose reptiles)Mechanisms of injury, radiological manifestations, prognoses, and treatments Osseous: Fractures, dislocations; Neurologic: Concussion, bleeding, and other Soft tissue: Amputation, ligament/tendon injury, bite, laceration, impalement/gouging, cellulitis/infection, predation;Conclusion

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# Abstract Archives of the RSNA, 2024

MSEE-85

## EXTRANODAL LYMPHOMA FROM HEAD TO TOE: A MULTISYSTEMIC IMAGING ATLAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Claudia Ortega Mogilevich, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Pablo Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Munoz, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Weitz, MD (*Abstract Co-Author*) Nothing to Disclose
Matias F. Callejas, MD (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Felipe A. Sanchez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Approximately 30% of lymphomas arise from sites other than the lymph nodes. Extranodal involvement can occur in extensive nodal or multisystemic disease (secondary lymphoma) or in the absence of noticeable lymph node enlargement (primary lymphoma).
- Noninvasive imaging plays a crucial role in the diagnosis of extranodal lymphoma. Findings suggestive of extranodal disease can be identified on multiple modalities, including X-ray, CT, MR, and PET.
- Extranodal lymphoma can involve virtually any organ in the body and mimic various benign and malignant pathologies. Concomitant multiorgan involvement, splenomegaly, and lymphadenopathy identified on imaging is a key indication of the potential diagnosis.
- The majority of the cases are caused by non-Hodking lymphoma, and diffuse large B-cell lymphoma is the most common subvariant. The objective of this educational exhibit is to demonstrate the appearance of primary and secondary lymphoma across multiple organ systems and imaging modalities, with a focus on practical tips and differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

- Background
- Types of lymphoma
- Primary versus secondary lymphoma
- Imaging modalities: strengths and limitations
- Sites of involvement: a) CNS, b) Head and neck, c) Thoracic, d) Cardiac/pericardial, e) Gastrointestinal, f) Genitourinary, g) Solid abdominal organs, h) MSK
- Conclusion

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# Abstract Archives of the RSNA, 2024

MSEE-86

## ANGIOSARCOMA: IN SEARCH OF RADIOLOGICAL DIAGNOSTIC "CLUES" FOR A RARE TUMOR

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Silvia Bague (*Abstract Co-Author*) Nothing to Disclose
Juan Carlos Pernas, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Oliva, MD (*Abstract Co-Author*) Nothing to Disclose
Xenia Codo, BDS (*Abstract Co-Author*) Nothing to Disclose
Jaume Llauger, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Martinez, MD (*Abstract Co-Author*) Nothing to Disclose
Diana Hernandez (*Abstract Co-Author*) Nothing to Disclose
Pompeu Pascual, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To expose the radiological findings of angiosarcoma on CT-scan and MRI in different organs and systems.- To review the histological and immunophenotypic characteristics of angiosarcoma.

### TABLE OF CONTENTS/OUTLINE

- Introduction. Angiosarcoma is a rare malignant mesenchymal tumor with endothelial differentiation and very poor prognosis that may arise in different locations. The most common presentation is as cutaneous angiosarcoma, although it can also appear in soft tissue, bone, breast, and solid organs such as liver, spleen, ovary and heart. Hematogenous spread is the hallmark of this disease, with metastatic lesions appearing most frequently in lung, liver, and bone.- Diagnosis. The diagnosis of angiosarcoma is initially suspected based on imaging findings which must be confirmed by histological study. CT-scan and MRI are useful techniques both for diagnosis and for detecting complications such as spontaneous bleeding. In turn, the biopsy confirms the diagnosis and evaluates the tumor's aggressiveness.- Our experience. This study presents a comprehensive review of the radiological findings in a series of 74 angiosarcomas diagnosed at a single institution between 2000 and 2023, and the main histological and immunophenotypic features of these tumors.

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# Abstract Archives of the RSNA, 2024

MSEE-87

## ILLUMINATING THE FRAMEWORK: THE PHOTON-COUNTING-DETECTOR SCANNER'S REVOLUTION IN MUSCULOSKELETAL CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Kishore Rajendran, PhD (*Abstract Co-Author*) Nothing to Disclose
Francis I. Baffour, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Nikkole Weber, ARRT, RT (*Abstract Co-Author*) Nothing to Disclose
Holly Kasten (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe features of Photon Counting Detector PCD technology that are beneficial for musculoskeletal (MSK) applications. Identify key elements of protocol development and optimization for PCD CT MSK imaging Demonstrate future advancements of MSK PCD-CT imaging

### TABLE OF CONTENTS/OUTLINE

Review current state of the art in MSK CTSingle and dual energy, standard and ultra-high resolution (UHR), routine and low dose imagingDiscuss current limits in energy integrating detector (EID) CT for the following:EID high-resolution is not dose efficient, available only in extremities, and may not be useful for quantification tasksAt low doses, image noise is amplified resulting in suboptimal low-dose imagesLimited dual energy performance in large body regions, kernel and slice thickness limitationsLimited array of metal artifact reduction optionsBenefits of PCD-CTUHR imagingUHR imaging of extremitiesIncreased spatial resolution with superior trabecular definition. Potential for bone morphometric quantification tasksUHR imaging of large jointsUHR improves visualization of anatomic detailPotential for dose savingsIncreased dose efficiencySpectral capabilitiesMulti-threshold and virtual monoenergetic imaging for metal artifact reductionSingle source or dual-source material decomposition task with better contrast to noise ratio. Results in more accurate monosodium urate and bone edema characterization with fewer artifactsFuture advancements in MSK PCD imagingBone quantification (Bone density/strength) measurementsDual source acquisition mode for improved spectral separationImproved material decomposition for bone edema and gout

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

MSEE-88

## DENGUE FEVER: A MULTISYSTEM MULTIMODALITY IMAGING REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Davi D. Romao, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Ana I. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Delgado (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Enzo Calheiros, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Global incidence of dengue fever has grown dramatically, with an estimated 100-400 million infections occurring each year, primarily in tropical and subtropical areas.- Although most of the patients have no or mild symptoms, a change in the spectrum of clinical manifestations has been recently noted with some specific complications being recognized more frequently, specially related to endothelial dysfunction in diverse systems.- Imaging techniques including ultrasound, computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET) have yielded valuable insights into the pathophysiological mechanisms and associated complications of dengue fever.- This pictorial review aims to illustrate the diverse spectrum of imaging manifestations across different organ systems in dengue fever, highlighting the applications of imaging techniques in diagnosing complications and guiding therapeutic interventions.

### TABLE OF CONTENTS/OUTLINE

1. Background- Epidemiology and pathogenesis- Clinical diagnosis: warning signs and severe dengue (hemorrhagic fever and shock syndrome)- Laboratory diagnosis2. Multimodality Imaging: applications, strengths, and limitations3. Neurological findings: encephalopathy, encephalitis, dengue-associated stroke and neuromuscular complications4. Thoracic findings: lungs, pleura, and heart5. Abdominal findings: gallbladder, liver, spleen, abdominal compartment syndrome 6. Other findings and clinical scenarios: viral arthritis, pregnancy, post-dengue syndrome7. Take home messages

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

MSEE-9

## THE HIDDEN CONNECTIONS: EXPLORING PARANEOPLASTIC SYNDROMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manex Lasa (*Abstract Co-Author*) Nothing to Disclose
Juan Jose Gomez Muga, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Diaz, MD (*Abstract Co-Author*) Nothing to Disclose
Leire Ormaetxe Albeniz, MD (*Abstract Co-Author*) Nothing to Disclose
Ainhoa Urrutia Ortiz De Salazar, MD (*Abstract Co-Author*) Nothing to Disclose
Udane Oiartzabal, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Cisneros Carpio, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Rodriguez Ripalda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To delineate the spectrum of imaging findings observed in various paraneoplastic syndromes and illustrate the clinical manifestations precipitated by these syndromes.

### TABLE OF CONTENTS/OUTLINE

Paraneoplastic Syndromes (PNSs) compromise a constellation of disease manifestations arising from underlying neoplasms without direct tumor invasion. They lead to a range of symptoms affecting different organs or systems, complicating diagnosis and treatment.These manifestations, often mediated by cytokines, hormones, or immune reactions, include endocrine, neurological, rheumatological/dermatological, hematologic, and miscellaneous syndromes. Based on our clinical experience, we have encountered numerous paraneoplastic syndromes.This presentation utilizes radiological images sourced from our institution to elucidate the underlying radiographic findings defining these syndromes.Early identification is crucial for optimal management and patient prognosis. Radiologists must be familiar with common PNSs and their distinct imaging features to facilitate timely diagnosis and treatment.

# Abstract Archives of the RSNA, 2024

NMMIEE

**Nuclear Medicine & Molecular Imaging Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## NMMIEE-1 BOMBARDMENT TO BEDSIDE: BEHIND THE SCENES OF NUCLEAR MEDICINE

Prem P. Batchala, MD (*Abstract Co-Author*) Nothing to Disclose
Wayne Dell, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

We recognize that there is limited exposure of radiology trainees to "behind the scenes" events during their 16 week exposure in Nuclear Medicine. However, understanding the events that lead to gamma and PET image production is critical in guiding patient preparation, as well as understanding technologist/patient/public safety, radiotracer biodistribution, and artifacts that influence interpretation. In this exhibit we attempt to highlight important practical steps involved in the most common nuclear medicine exams focused towards radiology trainees.

### TABLE OF CONTENTS/OUTLINE

1. Synthesis of most common radionuclides (99mTc, 18F) and radiopharmaceuticals including QA/QC procedures (e.g. Impurity testing)2. Radiopharmacy, Labeling methods (e.g. 99mTc labeling of RBCs, WBCs, sulfur colloid)3. Transport and receipt of radiopharmaceuticals4. Dose calibrator, radiopharmaceutical administration5. Area surveys, Waste disposal6. Camera (Gamma and PET) QC7. NRC guidelines, Authorized user, written directive

## NMMIEE-10 18F-FLUOROESTRADIOL (FES) PET IMAGING: INDICATIONS, IMAGING REVIEW AND IMPACT ON CLINICAL MANAGEMENT OF ESTROGEN RECEPTOR POSITIVE BREAST CANCER

Janice Thai, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel E. Grenier, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) To review indications and relative indications for 18F-Fluoroestradiol (FES) PET. 2) To demonstrate how FES PET is used to direct clinical management in patients with estrogen receptor (ER) positive breast cancer. 3) To review current limitations of FES PET.

### TABLE OF CONTENTS/OUTLINE

1) Indications for FES PET, including a) Official U.S. Food and Drug administration (FDA) approval, and b) Society of Nuclear Medicine and Molecular Imaging (SNMMI) appropriate use criteria. 2) Mechanism of action and normal biodistribution of FES. 3) Highlight clinical cases in which FES PET was used and how it impacted patient management, specifically: a) Diagnosing progression of metastatic disease in lieu of biopsy; b) Distinguishing between skeletal degenerative change and metastases; c) Diagnosing tumor recurrence that would not have otherwise been identified on diagnostic CT, F18-FDG PET or Tc-99m methylene diphosphonate (MDP) bone scan; and d) Differentiating between post treatment change and tumor recurrence.

## NMMIEE-11 REVISITING CLASSICAL NUCLEAR MEDICINE: THYROID AND SALIVARY GLAND SCINTIGRAPHY IN MODERN RADIOLOGY

Jun Isogai, MD (*Abstract Co-Author*) Nothing to Disclose
Kota Yokoyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Junichi Tsuchiya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kimiteru Ito, MD (*Abstract Co-Author*) Nothing to Disclose
Akira Toriihara (*Abstract Co-Author*) Nothing to Disclose
Ukihide Tateishi, PhD (*Abstract Co-Author*) Nothing to Disclose
Yusuke Kawasaki, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•Review the physiological basis and nuclear imaging techniques of thyroid and salivary glands.•Emphasize the relevance and utility of 99mTcO4- and 123I in the assessment of thyroid function and pathology.•Discuss the strategic role of nuclear medicine in managing thyroid conditions such as hyperthyroidism and differentiated thyroid cancer using 99mTcO4-, 123I, and 131I.•Highlight the application of 99mTcO4- in salivary gland imaging, particularly in the evaluation of Warthin's tumor, oncocytoma, and Sjögren's syndrome.•Explore future directions in nuclear imaging, focusing on the potential of PSMA PET and emerging tracers for enhancing diagnostic accuracy and therapeutic monitoring.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Thyroid and Salivary Gland Anatomy and Physiology2. Basics of Nuclear Medicine Techniques3. Detailed Review of Thyroid Scintigraphy•Thyroid Scintigraphy with 99mTcO4- and 123I•Applications in Differentiated Thyroid Cancer and Hyperthyroidism4. Salivary Gland

Scintigraphy•Diagnostic Uses in Sjögren's Syndrome and Salivary Gland Tumors5. Future Perspectives •Advancements in PSMA PET and the Development of Novel Tracers

## NMMIEE-12 TRANSARTERIAL RADIOEMBOLIZATION (TARE) OF YTTRIUM-90 IN PATIENTS WITH HEPATOCELLULAR CARCINOMA (HCC): EXPECTED AND UNEXPECTED IMAGING RESULTS THAT MUST BE RECOGNIZED BY THE RADIOLOGIST

Graziela C. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Helena N. Pedroso (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia P. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Heloise Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Lhuanna Maria Barbosa Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Rigo (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Camila P. Reifegerste, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Batista Rodrigues, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The objective of this exhibition is:Highlight radiological signs of response in patients with neoplasia after the use of yttrium-90 in different imaging modalities, including magnetic resonance imaging (MRI), computed tomography (CT) and PET-CT;Identify possible adverse effects of local therapy with TARE that are already known and associate them with the success or failure of this therapy;Understanding possible post-treatment changes is essential for correct radiological interpretations during the follow-up of patients undergoing TARE.Provide practical information and pitfalls in the interpretation of radiological manifestations, including radiopharmaceutical response time, differentiation between imaging findings directly related to neoplastic disease and secondary but expected manifestations.

### TABLE OF CONTENTS/OUTLINE

Hepatocellular carcinoma (HCC) is the most common primary liver cancer and the second most common cause of cancer mortality worldwide. This growing incidence has led to the evolution of treatment for HCC and several techniques have emerged, including everything from surgical resection to local ablation, transplantation, transcatheter arterial chemoembolization (TACE), TARE and systemic treatments, in order to reduce morbidity and mortality. Therefore, correct and individualized treatment planning is essential to obtain good results.Among the treatment options, TARE using yttrium-90, also called radioembolization or selective internal radiotherapy, has been gaining prominence and is based on a technique involving nuclear medicine and interventional radiology accepted for the treatment of HCC.

## NMMIEE-13 DON’T TREMBLE: USE OF PET MRI IN PARKINSON DISEASE AND ATYPICAL PARKINSONIAN SYNDROMES

Laura Y. Quiroz Rojas (*Abstract Co-Author*) Nothing to Disclose
Uvi Cancino Ramos, PhD,MD (*Abstract Co-Author*) Nothing to Disclose
Diana L. Perez Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
America Hernandez, MEd (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To describe abnormal MR imaging findings in atypical Parkinsonian syndromes- Identify normal FDG PET and DOPA PET findings in Parkinson disease < atypical Parkinsonian syndromes- To learn to identify relevant anatomical landmarks in the dopaminergic system

### TABLE OF CONTENTS/OUTLINE

•Introduction •Relevant anatomic < function in the dopaminergic system •Most common imaging patterns of Parkinson disease < atypical parkinsonian syndromes •High-field MRI < specialized sequences make it possible to define specific MRI signs for neurodegenerative disorders •Cases clinics representative •Conclusions •References

## NMMIEE-14 RADIOLABELED FIBROBLAST ACTIVATION PROTEIN INHIBITOR (FAPI) IN THE INTERSTITIAL LUNG DISEASES (ILD)

Narges Jokar (*Abstract Co-Author*) Nothing to Disclose
Esmail Jafari (*Abstract Co-Author*) Nothing to Disclose
Mehrzad Bahtouee (*Abstract Co-Author*) Nothing to Disclose
Majid Assadi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 68Ga-Fibroblast Activation Protein Inhibitor (FAPI) provides a readout to quantitatively measure the levels of activated fibroblasts in Interstitial Lung Diseases (ILD) with two common histological features, inflammation and fibrosis, regardless of their underlying causes. 2. GGO as a challenging finding on HRCT, raises questions about whether it represents inflammatory changes or interstitial fibrosis. 3. Distinguishing between inflammatory and fibrotic processes is crucial for treatment decisions, therapies focusing on inflammation may not work for patients with dominant fibrosis, while antifibrotic agents may be ineffective for patients with dominant inflammation. 4. FAP imaging is able to differentiate between regions of the lung with active fibrotic remodeling and those without fibrosis.5. The combination of 68Ga-FAPI PET/CT and HRCT yields an additive effect for evaluating ILD-related fibrosis and inflammatory processes over using either modality alone. 6. FAP-positive signals in the entire lung, suggesting different stages of fibrosis. Patients with many FAP-positive cells may be in active fibrosis, while those without may have stable fibrosis.

### TABLE OF CONTENTS/OUTLINE

1. FAPI imaging differentiates inflammatory changes and interstitial fibrosis2. Accurate and precise treatment approach for patients with dominant fibrosis using FAPI imaging3. Giving valuable insights into the complexities associated with ILD using FAPI imaging4. The different scenarios of either inflammation or active fibrosis based on FAPI imaging and HRCT.5. The potential diagnostic value of FAPI imaging in identifying tissue remodeling associated with chronic inflammations throughout the body.

## NMMIEE-15 FIBROBLAST ACTIVATION PROTEIN INHIBITOR (FAPI)- A NEW FRONTIER IN CARDIAC IMAGING

Narges Jokar (*Abstract Co-Author*) Nothing to Disclose
Esmail Jafari (*Abstract Co-Author*) Nothing to Disclose
Mohammadreza Pourbehi (*Abstract Co-Author*) Nothing to Disclose
Majid Assadi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

New FAP-targeting PET radiotracers that originally developed for oncologic imaging could serve as a noninvasive method for evaluating the active and fibrosis process process in the early days after myocardial infarction in a patient. Advantages are myocardial imaging with FAPI is Identification of early changes in fibroblast dynamics and profibrotic activity. Identification of subjects at elevated risk of heart failure Identification of patients who may benefit most from specific therapeutic interventions directed against adverse interstitial myocardial fibrosis. Differentiation between active and end-stage disease Monitoring of disease progression and treatment response Enhancing patient care and clinical outcomes Identifying active myofibroblasts would enhance comprehension of their presence in the injured myocardium. Assess the effectiveness of antifibrosis treatments. Offers indirect clues about the extent of fibrogenesis or collagen deposition. Potentially pinpointing a critical time window for preventing fibrosis. FAPI myocardial imaging should be aligned with the advancements in understanding cardiac fibrosis and the development of targeted antifibrotic interventions

**TABLE OF CONTENTS/OUTLINE**

1. Uptake distribution of 68Ga-FAPI-46 presumably representing worsening myocardial stiffness2. The FAPI tracer signal contribute to the development of interstitial fibrosis.3.FAPI imaging for assessing the active fibrosis process, which may persist as a chronic condition.4. Potential diagnostic value of FAPI imaging in identifying tissue remodeling throughout the body5. Dual tracers may improve the diagnostic accuracy for characterizing fibroinflammatory processes.

## NMMIEE-16 ENLIGHTENING RECTAL CANCER: [18F]FDG PET/MRI, A USEFUL TOOL FOR PRECISE STAGING

Diego Cecchin, MD (*Abstract Co-Author*) Nothing to Disclose
Carlo D'Alessandro, MD (*Abstract Co-Author*) Nothing to Disclose
Emilio Quaia, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Filippo Crimi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pietro Zucchetta (*Abstract Co-Author*) Nothing to Disclose
Gaya Spolverato (*Abstract Co-Author*) Nothing to Disclose
Giovanni Sussan, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Colorectal cancer, the most common gastrointestinal malignancy globally and the third leading cause of cancer-related death, includes rectal cancer, which comprises about one-third of cases. Guidelines recommend MRI for local staging and contrast-enhanced CT for detecting distant metastases. [18F] FDG PET/MRI appears to be a valuable tool for achieving highly precise diagnoses:
- It has been observed that the tumor response to pCRT often involves replacement of viable tumor tissue with fibrosis. Consequently, tumor understaging in this context may stem from the limitations of PET/CT to detect small clusters of residual disease. PET/MRI appears capable of accurately restaging patients following pCRT;
- [18F]FDG PET/MRI could increase the detection rate of potentially metastatic lymph nodes in rectal cancer patients;
- For M staging, [18F]FDG PET/MRI outperformed [18F]FDG PET/CT and CT in detecting metastases in solid organs, whereas it performed worse for lung metastases.

**TABLE OF CONTENTS/OUTLINE**

1) T-staging: the capability of [18F]FDG PET/MRI to precisely detect lesions remains intact even in the presence of local fibrosis; 2) N-staging: especially in cases of uncertainty, the combination of [18F]FDG PET/MRI detects hypermetabolic lymph nodes more effectively than MRI alone; 3) M-staging: [18F]PET/MRI provides high soft-tissue contrast, making it useful for examining solid organs such as the liver. Additionally, it can be utilized with specific MRI sequences, such as DWI, as needed.

## NMMIEE-17 CLINICAL EFFICACY AND PITFALLS OF DEEP LEARNING-BASED RECONSTRUCTION FOR PET IMAGING

Ryuji Akita, RT, MS (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Koumei Takauchi (*Abstract Co-Author*) Nothing to Disclose
Yuko Nakamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fuminari Tatsugami, MD (*Abstract Co-Author*) Nothing to Disclose
Mana Ishibashi (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Recently, Deep Learning-based Reconstruction (DLR) for PET imaging has been developed to provide higher signal-to-noise ratio (SNR) images. In the training process of the DLR, the DLR for PET iteratively optimizes filters of its deep convolutional neural network (DCNN) layers to minimize the differences between low-quality images (noisy image) and their paired high-quality images (targets), and the trained DLR can be applied to new data to output new high-quality images. Image quality was significantly improved with DLR-PET compared to conventional PET/CT images. The noise reduction and improved lesion-normal tissue contrast achieved with the DLR-PET may improve lesion detectability and allow more accurate prediction of treatment response. In addition, the PET image quality is maintained with shorter acquisition time or low doses. On the other hand, lesions that appear to have faint or mild FDG uptake on conventional reconstructed PET images may be false-positive due to overall increased uptake on the DLR-PET, so careful interpretation is required.

**TABLE OF CONTENTS/OUTLINE**

1. Principle of Deep Learning-based Reconstruction (DRL) for PET imaging 2. Results of our phantom study 3. Clinical case presentation 4. Pitfalls in interpretating the DLR images for PET 5. Future aspects of the DLR for PET imaging

## NMMIEE-18 FLUORESCENT INSIGHTS: A NUCLEAR MEDICINE GUIDE TO MUSCULOSKELETAL INFECTIONS

Harikrishnan Nandakumar, MD (*Abstract Co-Author*) Nothing to Disclose
David J. Lubin, MD (*Abstract Co-Author*) Nothing to Disclose
Sukrita Menon, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Understand the mechanism and common uses of conventional radionuclides utilized for musculoskeletal (MSK) scintigraphic imaging.2. Primary categories of adult MSK infections: Exploring various NM studies in each category which are helpful aids to conventional imaging.3. Review the radionuclide imaging algorithm to assess and choose the best modality optimized for each infection category.4. Explore the utility of hybrid NM techniques in differentiation infection from other pathology in the same region (prosthetic infection vs aseptic prosthetic loosening).5. Fundamental challenges and issues with conventional NM techniques such as false positives/negatives.6. Discuss upcoming developments (new radionuclides and techniques) and their potential role in revolutionizing current understanding of NM studies.

**TABLE OF CONTENTS/OUTLINE**

1.Conventional radionuclides and techniques in MSK scintigraphy: Mechanism and clinical indication (Bone Scintigraphy, Ga 67, Labelled leucocyte scintigraphy, In-111, F18-FDG, Ga 68). 2.Primary categories of adult MSK infectionsa. Peripheral Osteomyelitisb. Spondylodiscitisc. Prosthetic Joint Infection 3.Nuclear medicine imaging algorithm for study selection for adult MSK infections. 4.Hybrid NM techniques- SPECT/CT with 99mTc, Ga67, F18 FDG PET/CT, PET/MR 5. Fundamental diagnostic challenges with conventional scintigraphy.6. Future of NM in MSK infections - New techniques and radionuclides. a. Gallium-68-Citrate (68Ga) b. Tc labelled Interleukin-8 c. Sodium Fluoride (18F-NaF) d. Radiolabelled Antibiotics. Novel PET Tracers like 68Ga-NOTA-UBI, 18F-maltohexaose, nanopeptides etc.f. Dynamic whole-body multiparametric PET imaging.

## NMMIEE-19 LIVER METASTASES FROM UVEAL MELANOMA: MRI VERSUS FDG PET/CT

Ciara OBrien (*Abstract Co-Author*) Nothing to Disclose
Claudia Ortega Mogilevich, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Abstract Co-Author*) Nothing to Disclose
Aleena Malik, BSC (*Abstract Co-Author*) Nothing to Disclose
Zeyad Elias (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To demonstrate on a case-review basis, the role of MRI and FDG PET/CT in detection of uveal melanoma liver metastases.2. To review the classic imaging features of uveal melanoma metastases on MRI and demonstrate, through a case series, the variable degree of FDG uptake in this particular entity.3. Raise awareness among general radiologists that uveal melanoma liver metastases can exhibit low or variable radiotracer uptake in PET/CT scans, which may aid in avoiding false-negative restaging based solely on PET results.

**TABLE OF CONTENTS/OUTLINE**

1. Background demographics of mucosal versus non-mucosal melanomas.2. Description of diagnosis, natural history, and therapy options for uveal melanoma.3. Depict on a case-review series MRI features of liver metastases and their correlation with FDG PET/CT modality.4. Assessment of potential reasons for the variable degree of FDG uptake in this particular entity that behaves different than highly FDG avid mucosal melanomas.5. Conclusions

## NMMIEE-2 ALL THAT GLITTERS ISN'T GOLD: FALSE POSITIVES AT PSMA PET/CT

**Awards**
**Certificate of Merit**

Austin Pantel, MD (*Abstract Co-Author*) Institutional research support, Lantheus Holdings;Consultant, Blue Earth Diagnostics Ltd;Consultant, General Electric Company;Consultant, Lantheus Holdings
Mark Ehrhart, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Anderson, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Joseph Ahlander, PhD,DO (*Abstract Co-Author*) Nothing to Disclose
Ali Salehpoor, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Prostate-specific membrane antigen (PSMA) is a membrane protein that is over-expressed in high-risk prostate cancer. PSMA-targeted PET/CT is a valuable tool for detection, staging, and restaging of prostate cancer. However, many non-prostatic malignancies are known to express the PSMA receptor and thus may be seen on PSMA-targeted PET/CT. Knowledge of the biodistribution of PSMA-targeted radiopharmaceuticals and potential false positives is crucial in preventing misdiagnosis and unnecessary treatment. After reviewing this exhibit, radiologists will: 1) Understand normal biodistribution of PSMA as seen on PSMA-targeted PET/CT, 2) Identify causes of uptake that are not due to prostate cancer, and 3) Identify non-prostatic malignancies that express the PSMA receptor and which may have uptake on PSMA-targeted PET/CT.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Overview of the PSMA membrane protein b. Overview of PSMA-targeted PET/CT 2. Normal physiologic distribution seen on PSMA-targeted PET/CT a. Lacrimal, salivary glands b. Kidneys c. Liver d. Spleen e. Bowel f. Ganglia (such as celiac and stellate ganglia) g. Normal excretion in urine 3. False positives a. Granulomatous disease b. Bone pathology i. Paget's disease ii. Fibrous dysplasia iii. Healing fractures c. Benign soft tissue lesions i. Schwannoma ii. Meningioma iii. Hemangioma d. Malignant lesions i. Renal cell carcinoma ii. Lymphoma iii. Thyroid carcinoma iv. Multiple myeloma v. Neuroendocrine tumor vi. Gastrointestinal stromal tumor 4. Conclusion

## NMMIEE-20 MOST PROMISING "THE HOPEFUL EIGHT" RADIONUCLIDES FOR TARGETED ALPHA THERAPY: A BOOM TO THE FUTURE OF NUCLEAR MEDICINE

Johnny Yang, BS, BA (*Abstract Co-Author*) Nothing to Disclose
Nicholas Gatto, DO, MS (*Abstract Co-Author*) Nothing to Disclose
Lasya Daggumati (*Abstract Co-Author*) Nothing to Disclose
Vani Vijayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Marjorie Lam (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Abstract Co-Author*) Nothing to Disclose
John Hollis Tackett, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To outline the strengths weaknesses of the eight radionuclides with great potential for use in targeted alpha therapy.To describe potential clinical uses and applications for each of these radionuclides.

**TABLE OF CONTENTS/OUTLINE**

Visualization of radionuclide distribution on imaging and the irradiation of malignant cells are two of the primary goals of Nuclear Medicine. An advantageous method of treating malignancies is through targeted radionuclide therapy (TRT), as it delivers highly concentrated doses of radiation directly to tumor cells or to the surrounding microenvironment, while being a minimally invasive procedure. Targeted alpha therapy (TAT) is a form of TRT that focuses on alpha-emitting radionuclides. To provide the most efficacious treatment through TAT, the radionuclide decay pathway, particle emission range, relative biological effectiveness, and physical characteristics (half-life, method of production, radionuclidic purity, etc.) and biochemical characteristics (in-vivo stability, tissue targeting, toxicity, etc.) must be considered and optimized for the chosen radionuclide.Recently, studies have shown that there are eight alpha-emitting radionuclides with the most potential for use in targeted alpha therapy: actinium-225, astatine-211, bismuth-212, bismuth-213, lead-212, radium-223, terbium-149, and thorium-227. This exhibit will discuss these radionuclides in detail, exploring their potential applications in a clinical setting and the advantages and disadvantages for each.

## NMMIEE-21 [18F]FDOPA HYBRID PET/ MRI. AN EXPLORATION IN THE DIAGNOSIS OF TUMOR VIABILITY FROM TREATMENT-RELATED CHANGES IN BRAIN TUMOURS

Laura Rodriguez-Bel (*Abstract Co-Author*) Nothing to Disclose
Carles Majos (*Abstract Co-Author*) Nothing to Disclose
Karina Janeth Gordillo Zabaleta, MD (*Abstract Co-Author*) Nothing to Disclose
Albert Pons Escoda (*Abstract Co-Author*) Nothing to Disclose
Montserrat Cortes (*Abstract Co-Author*) Nothing to Disclose
Michal Pudis (*Abstract Co-Author*) Nothing to Disclose
Marina Suarez-Pinera (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• The assessment of treatment response in brain tumours and, more specifically, the differentiation between tumour recurrence and treatment related changes (TRC) remains a clinical and neuroimaging challenge. Main neuro-oncology societies (EANO, RANO, SNMMI, EANM) have recommended the use of MR and amino acid PET, both techniques, in this diagnosis. • The new generation of hybrid PET/MR scanners provides a multidisciplinary approach offering additional diagnostic information in a single scan. • The purpose of this exhibit is to evaluate the role of hybrid images in the differential diagnosis of tumour viability versus treatment-related changes.

**TABLE OF CONTENTS/OUTLINE**

1. A brief overview of the pathophysiological basis and analysis of [18F]FDOPA PET in brain tumours. 2. Conventional and advanced MRI sequences in neuro-oncology. 3. [18F]FDOPA PET/MRI images of cases from our department and correlation with histopathological findings. 4. Take-home messages.

## NMMIEE-22 FUNCTIONAL IMAGING PHENOTYPE-GENOTYPE CORRELATION IN PARAGANGLIOMA

**Awards**
**Certificate of Merit**

Clara Chen (*Abstract Co-Author*) Nothing to Disclose
Corina Millo, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Cahid Civelek, MD (*Abstract Co-Author*) Nothing to Disclose
Mayank Patel, MD (*Abstract Co-Author*) Stockholder, Alphatec Holdings, Inc;Stockholder, Oncolytics Biotech Inc;Stockholder, Meridian Bioscience Inc;Stockholder, Verve Therapeutics, Inc
Matthew Nazari, MD,BS (*Abstract Co-Author*) Nothing to Disclose
Sara Talvacchio (*Abstract Co-Author*) Nothing to Disclose
Alexander Ling, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Carrasquillo, MD (*Abstract Co-Author*) Nothing to Disclose
Karel Pacak, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Herscovitch, MD (*Abstract Co-Author*) Nothing to Disclose
Jaydira del Rivero (*Abstract Co-Author*) Nothing to Disclose
Frank I. Lin, MD (*Abstract Co-Author*) Nothing to Disclose
Kailah Charles (*Abstract Co-Author*) Nothing to Disclose
Tamara Prodanov (*Abstract Co-Author*) Nothing to Disclose
Abhishek Jha, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Paragangliomas (PGLs) are rare neuroendocrine tumors arising from chromaffin cells along with elevated catecholamines (epinephrine, norepinephrine, and dopamine) and/or their respective metabolites (metanephrine, normetanephrine, and methoxytyramine).2. PGLs are the most hereditary tumor among all endocrine and non-endocrine neoplasms and are currently divided into three clinically relevant genetic clusters (1[a,b], 2, and 3).3. Not only the clinical, biochemical, but functional (molecular) imaging phenotype is dependent upon genetic makeup of these tumors.4. There are 3 specific targets found in PGLs (somatostatin receptor, norepinephrine transporter, and L-type amino acid transporter).5. 68Ga-DOTATATE (targets somatostatin receptor) is the functional imaging phenotype in cluster 1a (SDHx-related) - primary or metastatic PGLs, metastatic sporadic, and head and neck PGLs.6. 18F-FDOPA (targets L-type amino acid transporter) is the functional imaging phenotype in cluster 1b, 2, and primary sporadic pheochromocytoma.7. Selection of targeted radiotherapy (177Lu-DOTATATE or 131I-MIBG) for metastatic patients depend upon uptake on 68Ga-DOTATATE and 123I-MIBG (targets norepinephrine transporter).

**TABLE OF CONTENTS/OUTLINE**

1. Definition and location of PGLs including rare locations.2. Genetic cluster classification. 3. Definition of theranostics and various theranostic targets in PGLs.4. Mechanism of action of radiopharmaceuticals.5. Demonstration of functional imaging phenotypes in various clusters and cohorts.6. Algorithm for identifying functional imaging phenotype when genotype is known.7. Application of functional imaging to select between targeted radiotherapies.

## NMMIEE-23 SARCOID-LIKE REACTIONS AFTER CANCER REMISSION: RADIOLOGY-PATHOLOGY CORRELATION

**Awards**
**Certificate of Merit**

Hina Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Igor Odintsov (*Abstract Co-Author*) Nothing to Disclose
Aparna Singh, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Sarcoid-like reactions, resembling malignancy, require histologic confirmation for accurate diagnosis in post-cancer patients. 2. Histological evaluation is crucial to differentiate sarcoid-like reactions from malignancy. 3. Awareness of these reactions is crucial to prevent misdiagnosis and unwarranted treatment interventions. 4. Utilization of FDG-PET/CT aids in the detection and monitoring of sarcoid-like reactions, guiding clinical management decisions effectively.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction A. Background on Sarcoid-like Reactions B. Importance of Accurate Diagnosis in Oncologic Patients II. Radiological-Pathological Correlation A. Imaging Features of Sarcoid-Like Reactions: PET/CT findings highlighting the challenges in diagnosing sarcoid-like reactions and the impact on treatment decisions. Characteristic imaging findings such as lymphadenopathy and pulmonary nodules distinguishing sarcoid-like reactions from malignancy. B. Sarcoid like reaction associated with various treatments such as immunotherapy, targeted therapy, and chemotherapy such as carboplatin. C. Importance of Histological Evaluation: Radiology pathology correlation in cases on sarcoidosis like reaction. D. Clinical Presentation and Diagnostic Challenges III. Conclusion A. Summary of Key Findings B. Recommendations for Clinical Practice C. Future Directions in Research

## NMMIEE-24 UNLOCKING ACCURACY: A COMPREHENSIVE GUIDE TO PRE-SCAN OPTIMIZATION FOR PET-CT

Yean P. Silva Hidalgo, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto P. Silva Hidalgo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Scanner components and their roles in image acquisitionKey factors influencing PET-CT imagePre-scan parameters to optimize PET-CT image qualityImage acquisition protocols and considerationsQuality control measures for PET-CT imaging

**TABLE OF CONTENTS/OUTLINE**

IntroductionPET-CT Scanner Components PET detector system: Scintillator crystals, photomultiplier tubes, and data acquisition electronics Computed tomography (CT) scanner Image reconstruction system: Algorithms for generating PET and CT imagesFactors Influencing PET-CT Image QualityPatient-related factors Physiological parameters, tracer uptake, and motion artifactsScanner-related factors Detector sensitivity, spatial resolution, and system noiseAcquisition-related factors Tracer dose, scan duration, and reconstruction parametersPre-Scan Modifications for Optimal Image QualityPatient preparation Dietary restrictions, hydration status, and bladder emptyingTracer administration Timing of injection, route of administration, and dosagePositioning and immobilization CT scan parametersImage Acquisition Protocols and ConsiderationsStandard PET-CT protocolsSpecialized protocolsQuality Control Measures for PET-CT ImagingPhantom studies Daily and weekly performance checks Standardized uptake value (SUV) normalization Quantitative analysis of tracer uptakeVisual assessment Image artifacts, noise levels, and overall image qualityConclusion Significance of pre-scan modifications for achieving high-quality PET-CT images Continuous advancements in PET-CT technology and image acquisition protocols

## NMMIEE-25 IMMUNOTHERAPY: A REVIEW OF IMMUNE POSITRON EMISSION TOMOGRAPHY RESPONSE CRITERIA

Loja L. Miriam SR, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To learn how immunotherapy works at the cellular level - To review the types of immune checkpoint inhibitors according to cancer type. - To describe the update of metabolic response criteria in immunotherapy. IPERCIST - To understand unusual metabolic response patterns in immunotherapy

**TABLE OF CONTENTS/OUTLINE**

- Immunotherapy. Introduction - immune checkpoint inhibitors - Approved ICIs according to cancer type - iPERCIST. Immune positron emission tomography Response Criteria - Unusual metabolic response patterns

## NMMIEE-26 PSMA (PROSTATE-NOT-SO-SPECIFIC MEMBRANE ANTIGEN) PET: A REVIEW OF BENIGN AND MALIGNANT INCIDENTAL FINDINGS

Vahid Yaghmai, MD, MS (*Abstract Co-Author*) Nothing to Disclose
James Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Rahmani, MD (*Abstract Co-Author*) Nothing to Disclose
Garrett G. Ward, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedeh Niloufar Rafiei Alavi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Define Prostate-Specific Membrane Antigen (PSMA) and its imaging role, emphasizing its association with prostate cancer and expression in other tissues.2) Discuss PSMA as a transmembrane protein with various cellular roles, highlighting its expression in both normal and neoplastic cells.3) Familiarize radiologists with the knowledge to identify common benign and malignant incidental findings on PSMA PET/CT.4) Introduce evidence-based methods to distinguish between incidental findings and true positive lesions in imaging.

**TABLE OF CONTENTS/OUTLINE**

1. Current Role of PSMA-PET/CT in the management of prostate cancer.2. Overview of the PSMA Protein, its structure, function, and clinical significance 3. Physiologic Uptake Patterns on PET/CT and identifying physiological versus pathological uptake.4. Common Benign Incidental Findings on PSMA-PET/CT 5. Common Non-Prostate Cancer Malignant Findings 6. Evidence-Based Identification Methods: Review the evidence supporting various approaches for accurately identifying incidental findings on PSMA-PET/CT

## NMMIEE-27 MECKEL'S: DELVING INTO THE DIAGNOSTICS OF THE DESOLATE DIVERTICULUM

Mark Ehrhart, MD (*Abstract Co-Author*) Nothing to Disclose
Shana Elman, MD,MA (*Abstract Co-Author*) Nothing to Disclose
R. Travis Clark, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Janos, MD (*Abstract Co-Author*) Nothing to Disclose
Aaron Gambrell, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Meckel's diverticulum is the most common congenital abnormality of the gastrointestinal tract, although only present in approximately 2% of the population. It is important to recognize the different clinical presentations and complications of this anomaly in order to expedite the diagnosis and

treatment for the patient. One of the common diagnostic imaging exams used in the work-up is the Tc-99m pertechnetate Meckel's scan, which will be highlighted in this exhibit, including how to improve the sensitivity of the exam and how to avoid falling for false positives and negatives. This exhibit will show examples of how other diagnostic tools can be used for identification and what tools can be used for troubleshooting to aid in diagnosis, as well as how similar clinical presentations can potentially distract a radiologist or clinical provider from a Meckel's diagnosis. At the end of this review the reader should be able to identify anatomy, recognize various clinical presentations, create a differential diagnosis and appropriately diagnose a Meckel's diverticulum.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Definition/ presentations b. Embryology c. Anatomy/ physiology 2. Imaging findings/ diagnostic troubleshooting a. Nuclear medicine b. Angiography c. CT d. Ultrasound 3. Complications a. GI hemorrhage b. SBO c. Intussusception d. Diverticulitis e. Perforation f. Neoplasm g. Umbilico-ileal fistula h. Hernia- Littre hernia 4. Management/ treatment a. Surgical options b. Prognosis/ outcomes 5. Differential Diagnosis a. IBD b. Ulcers c. Angiodysplasia d. Appendicitis e. Small bowel diverticulitis f. Intussusception look-alike: polyp or lymphoma g. Obstruction look-alike: adhesions or hernias 6. Conclusion

## NMMIEE-28 PRACTICAL INTERPRETATION OF BONE SCINTIGRAPHY: METASTASES, FRACTURES, AND BEYOND

**Awards**
**Certificate of Merit**

Felipe Martinez, MD (*Abstract Co-Author*) Nothing to Disclose
Ming Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Ba D. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Steve S. Huang, MD (*Abstract Co-Author*) Nothing to Disclose
Logan Haug, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To provide a brief overview of the protocols and relevant technical aspects of bone scintigraphy. To facilitate recognition of technical complications that can interfere with correct interpretation of bone scans. To provide a comprehensive list of "Aunt Minnies" that can be recognized on bone scan. To demonstrate characteristic scintigraphic features of benign and malignant bone lesions. To understand patterns of osseous radiotracer uptake and identify soft tissue findings that may contribute to accurate diagnosis of complex syndromes.

**TABLE OF CONTENTS/OUTLINE**

This exhibit has four main components: 1. Procedures/protocols of bone scintigraphy: planar, 3-phase, and SPECT/CT imaging 2. Demonstration of faulty acquisitions with inadequate/suboptimal imaging results: hot glove sign, free Tc-99m pertechnetate, incorrect photopeak, etc. 2. Characteristic and atypical features of metastasis (unifocal, multifocal, sarcomatoid features), fractures (insufficiency fractures, non-accidental trauma) and benign bone lesions (skull suture, enchondroma, infarct, osteoma/osteomatosis in Gardner's syndrome). 3. Scintigraphic osseous and soft tissue findings of metabolic diseases (renal osteodystrophy, brown tumors, calciphylaxis), iatrogenic findings (voriconazole, bisphosphonate, avastin), paraneoplastic syndromes (hypertrophic osteoarthropathy, tumor-induced osteomalacia), and multi-system syndromes (cleidocranial dysplasia, sacral agenesis, sickle cell disease, myelofibrosis, Erdheim-Chester disease, Asherson's syndrome, Mazabraud's syndrome, McCune-Albright syndrome, Mafucci syndrome, Ollier disease, and rhabdomyolysis).

## NMMIEE-29 RADIOPHARMACEUTICAL IMAGING IN THE MANAGEMENT OF CARDIAC SARCOIDOSIS AND AMYLOIDOSIS

Daniel Sehi (*Abstract Co-Author*) Nothing to Disclose
Farrokh Dehdashti, MD (*Abstract Co-Author*) Nothing to Disclose
Robert J. Gropler, MD (*Abstract Co-Author*) Grants, Bayer AG;Consultant, Biomedical Systems;Scientific Adivsor, Amgen Inc;Scientific Advisor, sanofi-aventis Group
Cylen Javidan, MD (*Abstract Co-Author*) Nothing to Disclose
Ashwin Singh S. Parihar, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Infiltrative cardiomyopathies involve deposition of abnormal substances within the myocardium leading to progressive deterioration of cardiac function and clinical symptoms of heart failure and arrhythmias. 2. Radiopharmaceutical imaging for cardiac amyloidosis and sarcoidosis provide a non-invasive assessment of disease state and in several cases obviate the requirement of an endomyocardial biopsy, helping directly initiate specific treatment. This exhibit provides a comprehensive overview of the clinical and imaging features of these diseases, including the impact of functional imaging in clinical management.

**TABLE OF CONTENTS/OUTLINE**

1. Common Clinical Presentations and diagnostic algorithms: a. Common clinical presentations. b. Initial diagnostic workup. c. Correlative imaging - Echocardiography, contrast-enhanced MRI. 2. Cardiac Sarcoidosis: a. Patient preparation for FDG PET. b. Imaging patterns on FDG PET and perfusion SPECT, underlying disease mechanisms, implications of imaging findings and imaging pitfalls. c. Clinical role in diagnosis, staging, response assessment and evaluation of suspected recurrence. d. Clinical management of Cardiac Sarcoidosis. 3. Cardiac Amyloidosis: a. Mechanism of radiotracers and Imaging techniques. b. Characteristic patterns on 99mTc-PYP planar and SPECT/CT imaging, including grading of uptake and imaging pitfalls. c. Performance of PYP imaging in specific clinical scenarios, including genetic mutations, type of amyloidosis, solitary cardiac amyloidosis without extra-cardiac involvement. d. Diagnostic accuracy of PYP imaging and its utility for initiating treatment. e. Clinical management of Cardiac Amyloidosis.

## NMMIEE-3 A NOVEL METHOD OF TRAINING TECHNOLOGISTS FOR DOSIMETRIC ANALYSIS SUPPORT IN A PRIVATE RADIOLOGY PRACTICE

Douglas A. Murrey JR, MD (*Abstract Co-Author*) Nothing to Disclose
Mitchell Kennedy (*Abstract Co-Author*) Nothing to Disclose
Michael Durka (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The use of customized dosimetric software streamlines radiologist workflows. 2. Establishing standardized training materials creates a framework for non-physicians to learn high-quality processing techniques. 3. Utilizing non-physicians is possible to relieve physician workload in processing Y90 Dosimetry

**TABLE OF CONTENTS/OUTLINE**

1. Background/Introduction: - Y90 Radioembolization: an overview of the treatment process 2. Problems with workflows and Y90 delivery in a radiology practice - Time intensive for physicians, etc. 3. Use of Non-Physicians in a Y90 workflow: - Nuclear Medicine and CT Technicians - Challenges and

Benefits. 4. Training Process. 5. Conclusions - Improved efficiency for physicians - Increased practicality of Y90 workflow, leading to increased ability to provide Y90 treatments in private radiology practices,

## NMMIEE-30 USEFULNESS OF PSMA PET/MRI IN TREATED PROSTATE CANCER PATIENTS, OUR INITIAL EXPERIENCE

David Durany Lara (*Abstract Co-Author*) Nothing to Disclose
Eugenia De Lama Salvador, MD (*Abstract Co-Author*) Nothing to Disclose
Eva Maria Merino Serra (*Abstract Co-Author*) Nothing to Disclose
Javier Robles Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Jose Martin-Marcuartu (*Abstract Co-Author*) Nothing to Disclose
Laura Chavarriaga, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of our presentation is to evaluate the performance and diagnostic accuracy of PSMA PET/MRI for the evaluation and detection of recurrent prostate cancer in patients treated with surgery or focal strategies, especially after Irreversible Electroporation (IRE) treatment.

### TABLE OF CONTENTS/OUTLINE

Focal therapy (FT) is an emerging treatment option for selected patients with localised prostate cancer (PCa). FT has the potential to achieve oncological control while preserving urinary, sexual and bowel function.IRE induces irreversible permeabilization of the cell membrane, resulting in loss of homeostasis and consequential cell death; with the advantage that preserves tissue structure of the prostate.In recent years, the clinical availability of integrated PET/MRI scanners has made it possible to explore the potential of multimodal, combined anatomical and functional imaging.PSMA PET/MRI has shown potential to use in the planification and early assessment before IRE treatment and follow-up of post-IRE patients and to identify lesions missed by mpMRI. Also, findings in PSMA PET/MRI has changed treatment indications (from focal treatment to systemic). Targeted therapies could be directed by PET/MRI with radiolabelled PSMA because of its ability to detect the most aggressive lesion.PET/MRI is an excellent synergistic imaging modality in the setting of biochemical PCa recurrence, as a tool to both characterize local disease within the prostate and evaluate for metastasis with a single examination.

## NMMIEE-31 BONE SCANS AND THE ORTHOPEDIC SURGERY PATIENT: WHAT RADIOLOGISTS AND CLINICIANS NEED TO KNOW

Brian Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa M. Zayas-Colon, MD (*Abstract Co-Author*) Nothing to Disclose
Tannaz Rajabi (*Abstract Co-Author*) Nothing to Disclose
Vaseem Chengazi, MD (*Abstract Co-Author*) Nothing to Disclose
Wei Li (*Abstract Co-Author*) Nothing to Disclose
John Cerne, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Interpreting bone scans of patients with orthopedic hardware is often a challenging topic for residents. We created this exhibit to teach: 1) key bone scan findings in relation to orthopedic hardware; 2) why these findings make sense. Clinicians want to know when there is orthopedic hardware loosening or osteomyelitis. Radiologists need to know that methyl diphosphonate (MDP) adsorbs in proportion to the rates of bone remodeling and that white blood cells (WBCs) migrate to areas of infection. By attaching a radiotracer to MDP or WBCs, a gamma camera can translate radioactivity to pixelation. Accordingly, focal uptake near hardware suggests stress fracture or hardware loosening in the context of remote surgery. Diffuse uptake with increased blood pool suggests hardware loosening vs infection, with the latter being more likely. Normal uptake in the setting of increased blood pool/perfusion suggests soft tissue inflammation vs degenerative arthritis. After reviewing this exhibit, the resident will understand why the imaging patterns make sense and how they can use this information to offer appropriately specific comments on pathology likelihood.

### TABLE OF CONTENTS/OUTLINE

(1) Bone Scans: how they work; what they can show (2) Orthopedic implants in different locations, and the sites of mechanical stress: hips; knees; ankles (3) Cemented vs Non-Cemented Appliances: implications for surgery; implications for imaging; pathophysiological basis (4) Tell Tale Patterns: focal uptake; diffuse uptake; normal uptake (5) Creating a Good Report: patient background; findings; impression (6) Review of Literature: hot off the press; sensitivity and specificity; what does the future hold?

## NMMIEE-32 CURRENT AND EMERGING ROLES OF PET/CT IN THE MANAGEMENT OF MULTIPLE MYELOMA

Asha Kandathil, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Heglin, DO, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Whole body FDG PET/CT is indicated in the evaluation of patients with suspected multiple myeloma, for evaluation of total metabolically active disease burden and detection of extramedullary disease. 2. Lab-based multiple myeloma staging methods such as Revised International Staging System (R-ISS) and the Durie-Salmon System show improved assessment of progression-free and overall survival when paired with metabolic activity (SUVmax) from FDG PET/CT scans. 3. The Italian Myeloma Criteria for PET Use (IMPeTUs) interpretation framework has shown accurate stratification of progression free and overall survival via the metabolic characterization of active lesions and may be used for both staging and treatment response assessment. 4. FDG PET/CT is the preferred modality for assessing response to multiple myeloma treatment. 5. Alternative PET agents have shown promising results for multiple myeloma characterization, such as 11C-methionine showing higher sensitivity and accuracy compared to FDG, Ga68-Pentixafor (CXCR4) staging patients higher than FDG, and Cu64-daratumumab showing higher sensitivity and accuracy compared to FDG.

### TABLE OF CONTENTS/OUTLINE

1. Multiple myeloma staging criteria - R-ISS, IMPeTUs, and Durie/Salmon. 2. FDG PET/CT for initial diagnosis, staging and prognostication of multiple myeloma. 3. FDG PET/CT for multiple myeloma treatment response. 4. Alternate PET targets: Ga68-CXCR4, 11C-methionine, 11C-choline

## NMMIEE-33 CHARACTERIZING MUSCLE FDG UPTAKE: AN INDICATOR FOR INFLAMMATORY DISEASES

**Awards**
**Certificate of Merit**

Ryogo Minamimoto, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

FDG uptake on PET/CT has been a valuable indicator in the diagnosis and management of inflammatory disease. This presentation explores the utility of muscle FDG uptake in differentiating between various inflammatory diseases (Dermatomyositis, Cancer-associated myositis, Sarcoidosis, Vascular disease, and Systematic inflammatory disease). Characterization of muscle FDG uptake patterns can enhance diagnostic accuracy, monitor disease progression, and optimize therapeutic interventions for patients with inflammatory diseases.

**TABLE OF CONTENTS/OUTLINE**

1. Dermatomyosis, 2. Cancer-associated myositis (rectal cancer), 3. Muscle involvement in Sarcoidosis, 4. Polyarteritis nodosa (PAN), 5 .Eosinophilic granulomatosis with polyangiitis (EPGA)

## NMMIEE-34 RADIONUCLIDE LYMPHOSCINTIGRAPHY: CASE BASED MULTIMODALITY PICTORIAL REVIEW WITH TEACHING PEARLS

Pokhraj P. Suthar, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Sumeet Virmani, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Evaluation and management of extremity edema, lymphatic malformations and leaks, and localization of sentinel lymph nodes for certain cancer patients is challenging for both the patient and the treating physician. Radionuclide lymphoscintigraphy can be effectively used to localize sentinel lymph nodes and prove and/or rule out lymphatic causes of swelling or leak. The purpose of this case-based pictorial exhibit is to highlight the imaging spectrum of various findings of radionuclide lymphoscintigraphy in patients with extremity edema, lymphatic malformations, and leaks, and localization of sentinel lymph nodes. Clinical and other multimodality imaging correlation is provided when available.

**TABLE OF CONTENTS/OUTLINE**

Our case-based multimodality pictorial review (15 cases) includes various patterns seen on both upper and lower-extremity radionuclide lymphangiograms. These include evaluating the number, course, symmetry, and intensity of lymphatic channels; timing related to visualization of draining regional nodes; the number of regional nodes visualized; dermal backflow and its severity; abnormal collaterals as suggested by visualization of popliteal and epitrochlear nodes; leaks and malformations; and protocol with helpful Tips and Pearls during the study. We also highlight its importance in anatomical localization and confirmation of lymphatic leaks and malformations and localizing sentinel lymph nodes in certain cancer patients. Multimodality correlation is provided where available.

## NMMIEE-35 UNDERSTANDING THE ROLE OF IMAGING BEFORE, DURING AND AFTER PSMA PROSTATE CANCER RADIOLIGAND THERAPY

Katelyn Niknam (*Abstract Co-Author*) Nothing to Disclose
Ida Sonni, MD (*Abstract Co-Author*) Nothing to Disclose
Mason Life (*Abstract Co-Author*) Nothing to Disclose
Gholam R. Berenji, MD, MSc (*Presenter*) Research Grant, Siemens AG;Research funded, General Electric Company;Research funded, Lantheus Holdings;Consultant, Canon Medical Systems Corporation

**TEACHING POINTS**

The prostate specific membrane antigen (PSMA) is a cell-surface glycoprotein over-expressed in most clinically significant PCa. PSMA is an ideal target for nuclear medicine theranostics applications in patients with prostate cancer (PCa), and has been widely used for the imaging (PSMA-PET) and therapy (PSMA-radioligand therapy - RLT) of patients with PCa. PSMA-RLT has emerged as a safe and effective treatment for advanced PCa. Imaging plays a crucial role throughout RLT treatment phases. Prior to PSMA-RLT it identifies those patients more likely to respond due to significant expression of the PSMA on their PCa cells. In addition to PSMA-PET, the natural pair for PSMA-RLT theranostics, FDG-PET can be useful in identifying PCa heterogeneity, that was suggested as a possible predictor of treatment response. Immediately after injection of the PSMA-RLT radiopharmaceutical and at subsequent intervals, a SPECT scan can be used to verify the distribution of the radiopharmaceutical in PCa foci, as well as quantify uptake to extrapolate dosimetric information. After completion of PSMA-RLT cycles, PSMA-PET is used to assess tumor response and monitor progression of disease.

**TABLE OF CONTENTS/OUTLINE**

• Introduction to Prostate Cancer Theranostics o Clinical indications o Radiopharmaceuticals o Future directions • PSMA PET/CT prior to PSMA-RLT o Patient eligibility o FDG-PET to assess tumor heterogeneity o Assessment of disease location and extent • Quantitative SPECT after PSMA-RLT o Distribution of PSMA-RLT o Quantification and dosimetry • PSMA PET/CT post-RLT Treatment response monitoring

## NMMIEE-36 TC99M DMSA RENAL CORTICAL SCINTIGRAPHY IN CHILDREN: BEYOND UTI

Marina Easty, FRCR (*Abstract Co-Author*) Nothing to Disclose
Lorenzo Biassoni, MBBS (*Abstract Co-Author*) Nothing to Disclose
Riwa Meshaka, MBChB (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Tc99m-DMSA renal cortical scintigraphy is the test of choice for renal parenchymal scarring following urinary tract infection in children at many centres globally, however its scope of use extends to numerous other indications [Vali et al., 2022]. High quality Tc99m-DMSA renal cortical scintigraphy +/- SPECT can • Characterise location and function of renal parenchyma in congenital anomalies • Evaluate upper and lower moiety differential function separately in duplex systems • Assess functioning renal parenchyma in renovascular hypertension before and after intervention.• Be used alongside low-dose CT to assess complex renal calculi and bilateral Wilms' tumours prior to urological surgery • Provide accurate parenchymal functional information in hydronephrosis, cystic disease, renal transplant, and following traumatic renal injury.

**TABLE OF CONTENTS/OUTLINE**

Role of Tc99m-DMSA scintigraphy, technical aspects, limitations, interpretation pearls and pitfalls, multimodality appearance and clinical correlation in: 1. Congenital renal anomalies: renal ectopia, fusion anomalies, duplex kidney. 2. Cystic renal disease and the nonfunctioning kidney. 3. Hydronephrosis before and after urology surgical intervention 4. Vascular disease including renovascular hypertension and renal vein thrombosis. 5. Complex renal calculi6. Renal parenchymal damage after trauma. 7. Wilms' tumour for nephron-sparing surgery. 8. Renal transplant

## NMMIEE-37 REDISCOVERING QUANTITATIVE LYMPHOSCINTIGRAPHY: AN APPROACH TO THE ASSESSMENT OF LYMPHEDEMA

Juliana Kim (*Abstract Co-Author*) Nothing to Disclose
Orhan K. Oz, MD,PhD (*Abstract Co-Author*) Nothing to Disclose

Jaewon Yang, PhD (*Abstract Co-Author*) Nothing to Disclose
Robert C. Sibley III, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Lymphoscintigraphy (LSG) is the oldest imaging method used to evaluate the lymphatic system. Despite the demonstrated utility of newer techniques including magnetic resonance (MR) lymphangiography, near-infrared imaging, and high-frequency ultrasound, LSG remains the gold standard in the evaluation of lymphedema due to its high sensitivity (96%) and specificity (100%)1. 2. The performance of LSG is highly dependent on the quality of the study protocol and the measurements used to evaluate patients with lymphedema. 3. In this educational exhibit, we provide an illustrated overview of lymphoscintigraphy protocols, reviewing types of radiotracers, exercise interventions, and quantitative measurements, including transport kinetics calculations, which can be used to improve the assessment of patients with primary and secondary lymphedema.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to lymphedema a. Epidemiology and disease burden b. Diagnosis c. Treatments 2. Comparison of lymphatic imaging methods used to evaluate lymphedema a. Advantages and disadvantages of quantitative lymphoscintigraphy b. MR lymphangiography, near-infrared imaging, and high-frequency ultrasound 3. Review of lymphoscintigraphy protocols a. Radiotracers used b. Exercise interventions c. Timing of imaging d. Quantitative measurements i. Lymph node uptake ii. Clearance rate constant iii. Quantitative asymmetry index iv. Blood appearance rate v. Contrast-to-noise ratio for dermal backflow 4. Challenges and Opportunities a. Clinical applications of quantitative lymphoscintigraphy b. Future directions

## NMMIEE-38 EXPANDING HORIZONS IN BRAIN IMAGING: THE INTEGRAL ROLE OF NUCLEAR MEDICINE AND MRI IN DIAGNOSING AND MANAGING NEUROLOGICAL DISORDERS

Ukihide Tateishi, PhD (*Abstract Co-Author*) Nothing to Disclose
Junichi Tsuchiya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akane Ozawa (*Abstract Co-Author*) Nothing to Disclose
Kimiteru Ito, MD (*Abstract Co-Author*) Nothing to Disclose
Jun Oyama (*Abstract Co-Author*) Nothing to Disclose
Tomoki Imokawa, MD (*Abstract Co-Author*) Nothing to Disclose
Kota Yokoyama, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Demonstrate the broad utility of brain perfusion and neuroreceptor SPECT, radionuclide cisternography, FDG, O-gas, amino acid, and Amyloid PET in diagnosing and managing cerebral diseases.2. Illustrate the complementary roles of these nuclear medicine techniques alongside MRI to provide a comprehensive understanding of cerebral pathologies, aiding in accurate diagnosis and effective treatment planning.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: Importance of Nuclear Medicine in Brain Imaging2. Cerebrovascular Diseases: Utilizing SPECT and PET for assessing cerebrovascular disorders, with a specific focus on their roles in pre-surgical evaluation.3. Epilepsy: Detection of epileptic foci using SPECT and PET to guide surgical and therapeutic interventions.4. Brain Tumors: Application of amino acid PET and FDG PET in differentiating tumor characteristics, crucial for diagnosis and management.5. Psychiatric Disorders: Exploration of cerebral perfusion patterns in psychiatric conditions, enhancing understanding and treatment approaches.6. Inflammatory and Infectious Diseases: PET and SPECT in the diagnosis and management of encephalitis and autoimmune disorders.7. Hydrocephalus and Duropathies: SPECT's role in diagnosing and differentiating cerebrospinal fluid dynamics and related pathologies.8. Neurodegenerative Diseases: Detailed discussion on the diagnostic processes for Alzheimer's disease and other dementias using MRI, SPECT, and PET to differentiate and decide on management strategies.9. Future Perspectives: Discussion on emerging tracers with limited evidence or clinical experience that may become significant in future neuroimaging practices.

## NMMIEE-39 POST-RADICAL PROSTATECTOMY BIOCHEMICAL RECURRENCE PSA, PSMA-PET, AND SALVATION RADIATION THERAPY INTERVAL ON HIGH RISK PATIENT ALL-CAUSE MORTALITY

Johnny Yang, BS, BA (*Abstract Co-Author*) Nothing to Disclose
Vani Vijayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Roux (*Abstract Co-Author*) Nothing to Disclose
Bryson Brister (*Abstract Co-Author*) Nothing to Disclose
John Hollis Tackett, BS (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Abstract Co-Author*) Nothing to Disclose
Marjorie Lam (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Discuss biochemical recurrence and treatment failure post-radical prostatectomy for prostate cancer.Assess all-cause mortality risk in salvage radiotherapy before and after PSA failure.Evaluate PSMA imaging intervals in patients with one high-risk factor (ie, pT3/4 or prostatectomy [p] Gleason score 8-10).Highlight the efficacy of 18F-DCFPyL-PET/CT over standard imaging.

**TABLE OF CONTENTS/OUTLINE**

Prostate-specific membrane antigen positron emission tomography, as compared with conventional imaging (bone scan, computed tomography, or magnetic resonance imaging), seems to improve detection of biochemical recurrence in patients with prostate-specific antigen failure (PSA> 0.20 ng/mL) after salvage radical prostatectomy (sRP) for prostate cancer. Its USDA approval was backed by findings from the phase III CONDOR trial, in which 63.9% of men with PSA failure with no definitive evidence of recurrence using standard imaging had a change in management based on the 18F-DCFPyL-PET/CT findings. Prior to sRT, physicians often order a PSMA-PET scan only after PSA > 0.20 ng/mL post-sRT. This timing is chosen because PSMA-PET scans demonstrate optimal sensitivity at PSA > 0.20 ng/mL and because many insurance companies only provide reimbursement if PSA levels exceed a predetermined threshold set by the insurance company. Delaying the initiation of sRP raises concerns for elevated all-cause mortality. To improve outcomes, PSMA-PET scans should be performed within 6 months of reaching PSA failure to prevent delayed treatment while still compliant with insurance policies. This study highlights the efficacy of 18F-DCFPyL-PET/CT in guiding treatment strategies for prostate cancer patients with PSA failure.

## NMMIEE-4 HOW TO REPORT PSMA PET/CT? A REVIEW OF AVAILABLE STANDARDIZED SCORING SYSTEMS

Maryam Rahmani, MD (*Abstract Co-Author*) Nothing to Disclose
Vahid Yaghmai, MD, MS (*Abstract Co-Author*) Nothing to Disclose
James Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Garrett G. Ward, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedeh Niloufar Rafiei Alavi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Explain why standardized reporting is crucial for optimal diagnostic accuracy in PSMA PET/CT2) Familiarize radiologists with all different tools for reporting PSMA-PET/CT results and identify the correct application for each of them3) Describe the two most commonly used PRIMARY score and PSMA-RADS score 4) Compare the performance of different tools for various indications of PSMA PET/CT

**TABLE OF CONTENTS/OUTLINE**

1) Overview of Standardized Reporting Tools for reporting PSMA PET/CT2) Provide a thorough description of the PRIMARY score, supplemented by relevant case examples.3) Explain the PSMA-RADS scoring system with case example studies. 3) Explain the RECIP 1.0, and PPP criteria for treatment response evaluation in PSMA PET/CT 4) A Comparative Review of Scoring Systems, discussing their advantages and disadvantages in different clinical scenarios.

## NMMIEE-40 CUTANEOUS MANIFESTATIONS OF NON-CUTANEOUS MALIGNANCIES ON PET-CT: A HEAD-TO-TOE PICTORIAL REVIEW

Douglas S. Katz, MD (*Abstract Co-Author*) Nothing to Disclose
Gregg Blumberg, DO (*Abstract Co-Author*) Nothing to Disclose
Luis G. Colon Flores, MD (*Abstract Co-Author*) Nothing to Disclose
Miltiadis Tembelis, MD (*Abstract Co-Author*) Nothing to Disclose
Aranz Khalilollahi (*Abstract Co-Author*) Nothing to Disclose
Armin Mahabadi (*Abstract Co-Author*) Nothing to Disclose
Anca-Oana Kranz (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

After this review, radiologists/those viewing this exhibit will be able to:• Review the cutaneous and subcutaneous (CSQ) metastatic disease patterns of different internal malignancies.• Understand what to look for in a patient's history.• Be aware of the newer therapies in CSQ and their effects on prognosis.Target audience: Medical students, radiology residents and fellows, and practicing radiologists.

**TABLE OF CONTENTS/OUTLINE**

• Introduction• Head and Neck Malignancies• Thoracic Malignancies• Hepatobiliary Gastrointestinal Malignancies• Genitourinary Malignancies• Lymphoma• Sarcoma• Summary• References

## NMMIEE-41 REVIEW OF BRAIN PET/MRI WITH A FOCUS ON THE APPLICATIONS OF JOINT-RECONSTRUCTION

**Awards**
**Cum Laude**

Matthew S. Breen, MD (*Abstract Co-Author*) Nothing to Disclose
Siddhant Dogra, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy M. Shepherd, MD, PhD (*Abstract Co-Author*) Co-founder, MICroStructure Imaging
Girish M. Fatterpekar, MBBS (*Abstract Co-Author*) Nothing to Disclose
James R. Loftus, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Joint reconstruction is an advanced technique which utilizes information from both the PET and MRI data to improve image reconstruction beyond simple image fusion 2. Advantages of joint reconstruction include superior delineation of activity in cortically-based radiotracers and improved detection of motion 3. Wide applications for joint reconstruction exist across a spectrum of brain PET/MRI techniques which may allow for higher quality image interpretation

**TABLE OF CONTENTS/OUTLINE**

1. Overview of Joint PET-MRI Reconstruction a. Description of technique - not just image fusion b. Advantages and pitfalls 2. Applications of Brain PET/MRI Using Joint Reconstruction a. FDG i. Neurodegenerative diseases ii. Epilepsy iii. Tumor progression versus post-treatment changes b. Amyloid-ligand c. Tau-ligand d. F-DOPA e. FET

## NMMIEE-42 GA68 PSMA PET AND MULTIPARAMETRIC MRI IN RECURRENT GLIOBLASTOMA MULTIFORME: CURRENT INSIGHTS AND FUTURE DIRECTIONS

Liang Wang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Qiubai Li, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Multimodal Imaging Benefits Highlight the advantages of Ga68 PSMA PET/CT and mpMRI. 2. Radiotracer Selection: Explore the specific roles of Ga68 PSMA in imaging recurrent GBM. 3. Clinical Applications: Illustrate how Ga68 PSMA PET/CT and mpMRI contribute to diagnosis, treatment planning, and monitoring, facilitating personalized therapeutic strategies. 4. Challenges and Future Directions: Address challenges related to standardization, biomarker validation, and the integration of advanced analytical techniques.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction A. Overview of Recurrent GBM B. Rationale for Integrating Ga68 PSMA PET/CT and mpMRI II. Multimodal Imaging Benefits A. Improved Soft Tissue Contrast B. Simultaneous Functional and Anatomical Information C. Potential for Quantitative Analysis III. Radiotracer Selection A. Ga68 PSMA PET for Assessing Tumor Metabolism B. Ga68 PSMA PET/CT and mpMRI for Evaluating Tumor Extent C. Ga68 PSMA PET/CT and mpMRI Markers for Identifying Treatment Resistance IV. Clinical Applications A. Accurate Diagnosis B. Guiding Therapeutic Interventions C. Predicting and Assessing Treatment Response V. Challenges and Future Directions A. Standardization of Imaging Protocols B. Validation of Biomarkers C. Integration of Advanced Analytical Techniques VI. Future Research Directions A. Protocol Optimization B. Conducting Validation Studies and Trials C. Tailoring Personalized Therapeutic Approaches VII. Conclusion A. Summary of Key Findings B. Implications for Clinical Practice C. Potential Enhancements in Patient Care

## NMMIEE-43 IS PSMA/PET REALLY PROSTATE SPECIFIC? AN UPDATE OF NON-PROSTATIC UPTAKE AND EMERGENT ROLE IN OTHER MALIGNANCIES

Patrick Veit-Haibach, MD (*Abstract Co-Author*) Grant, Siemens AG;Speaker, Siemens AG;Travel support, Siemens AG
Roshini Kulanthaivelu, MBBS (*Abstract Co-Author*) Nothing to Disclose

Ur Metser, MD, FRCPC (*Abstract Co-Author*) Consultant, POINT Biopharma Inc
Claudia Ortega Mogilevich, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Kohan, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review the physiological distribution of prostate-specific membrane antigen (PSMA), and potential pitfalls. 2. To present different benign processes showing PSMA uptake with demonstrative examples. 3. To describe malignancies other than prostate cancer that are associated with PSMA uptake, and to review the emerging potential role of PET on their diagnosis and treatment.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: - What is prostate-specific membrane antigen (PSMA)? 2. Physiological distribution of PSMA and potential pitfalls: Demonstrative cases.3. Benign processes demonstrating PSMA uptake, case-based series: - Benign tumors (E.g. meningioma, solitary fibrous tumor). - Infectious/inflammatory (E.g. pneumonia, proctitis). - Bone remodeling (E.g. fracture, Paget's disease). 4. Other malignancies showing PSMA uptake (E.g. hepatocellular carcinoma, cholangiocarcinoma, breast cancer, colorectal cancer, stomach signet ring carcinoma, adenoid cystic carcinoma, and other salivary gland tumors): - Mechanisms of PSMA uptake. - Updated evidence of PSMA/PET role on diagnosis and treatment.

## NMMIEE-44 ADVANCES IN RADIOPHARMACEUTICAL THERAPY IN NUCLEAR ONCOLOGY: EXPLORING ALPHA RPT OVER BETA RPT

Johnny Yang, BS, BA (*Abstract Co-Author*) Nothing to Disclose
Vani Vijayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
John Hollis Tackett, BS (*Abstract Co-Author*) Nothing to Disclose
Marjorie Lam (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Abstract Co-Author*) Nothing to Disclose
Nader Pahlevan, BA (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the fundamental principles of alpha and beta particles including emission properties of different radionuclides and their applications- Discuss differences in alpha and beta RPT and uses for individualized patient care- Highlight new advancements in RPT and potential side effects

**TABLE OF CONTENTS/OUTLINE**

Radionuclides have a wide variety of uses based on their physical characteristics. An important example is radiopharmaceutical therapy (RPT) which is when a radionuclide is used alone or ligated to a drug, protein, peptide, or monoclonal antibody for the destruction of undesirable cell lines. They are commonly used to treat hyperproliferative cancers and are especially useful in sites like bone and brain that are difficult to reach with conventional external radiotherapy due to the risk of damaging healthy cells. The radionuclides used are primarily beta-particle and alpha-particle emitters. Beta particles average a lower particle energy (PE) and linear energy transfer (LET) with a greater penetrance when compared to alpha particles that tend to have a higher PE and LET with a shorter range. Beta RPT has been available for many years, is very versatile, and is the current gold standard. Yet, new advancements are needed for more resilient cancerous pathologies. Using alpha particles could be an excellent novel therapy as recent clinical trials have shown it to be beneficial in patients where beta RPT has failed. However, some adverse effects have been observed. The approval of alpha particle therapy would broaden treatment options to allow for more individualized patient care.

## NMMIEE-5 FEASIBILITY OF PET ANGIOGRAPHY IN TAKAYASU AORTITIS: CAN IT BE AN ALTERNATIVE TO CT ANGIOGRAPHY?

Yoshifumi Nouno (*Abstract Co-Author*) Nothing to Disclose
Takuji Nanno (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Midori Fukuyama, MD (*Abstract Co-Author*) Nothing to Disclose
Keizo Murakawa (*Abstract Co-Author*) Nothing to Disclose
Emi Tateishi (*Abstract Co-Author*) Nothing to Disclose
Yusuke Terakawa, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

18F-FDG PET/CT effectively assesses active inflammatory lesions on the aortic wall in Takayasu arteritis (TAK). However, contrast-enhanced CT is still required to evaluate structural changes in the aorta, increasing radiation exposure and the risk of renal dysfunction. A digital PET/CT system equipped with Continuous Bed Motion (CBM) captures the ultra-early dynamic phase of 18F-FDG administration, enabling the acquisition of PET angiography (PET-angio). Previous reports of PET-angio indicated the usage of a higher dose of 18F-FDG than our standard dose of 2MBq/kg. In this study, we adjusted the speed of CBM and achieved PET-angio without increasing the dose of 18F-FDG. The neck-to-pelvis scan using CBM was initiated 20 seconds after injecting 18F-FDG diluted in 20 ml of 0.9% saline solution at a rate of 1 ml/s. Immediately after 18F-FDG administration, 20 ml of 0.9% saline solution was administered at the same rate of 1ml/s for flushing. The detection of radioactivity was insufficient for abdomen-to-pelvis with the fixed CBM speed of 22mm/s, resulting in unclear abdominal arteries. Adjusting the speed to 11mm/s at the level of the L3 vertebra enabled visualization of systemic arteries from the neck to the pelvis. Our combined approach of standard FDG PET/CT and the PET-angio offers clinical utility for monitoring arterial structural changes and active inflammation in TAK patients while minimizing radiation exposure and preventing contrast-induced nephropathy.

**TABLE OF CONTENTS/OUTLINE**

Fig. 1 Comprehensive evaluation in TAK: CTA and PETFig. 2 PET-angio protocol at our center.Fig. 3 Advantages of Adjusting CBM Speed on PET-angioFig. 4 Comparison between CTA and PET-angio.Fig. 5 Clinical benefits of PET-angio

## NMMIEE-6 PET/MRI IN MULTIPLE MYELOMA: POTENTIAL INDICATIONS, TIPS AND TRICKS

Montserrat Cortes (*Abstract Co-Author*) Nothing to Disclose
Jose A. Narvaez, MD (*Abstract Co-Author*) Nothing to Disclose
Karen Perez Alfonso, MD (*Abstract Co-Author*) Nothing to Disclose
Ivan Sanchez Rodriguez (*Abstract Co-Author*) Nothing to Disclose
Itziar Carro (*Abstract Co-Author*) Nothing to Disclose
Javier Hernandez Ganan (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The hybrid PET/MRI techniques combine the morphological information provided by MRI and the metabolic and functional data provided by 18FDG PET imaging. This makes it possible both to detect myeloma infiltration foci in the marrow and to assess prognosis and response to treatment. The objectives

of this review are: - To explain the PET/MRI technique and the protocol to be used. - To explore potential indications in clinical practice. - To assess the similarities and differences of ADC values and FDG uptakes (SUV).

**TABLE OF CONTENTS/OUTLINE**

- PET/MRI technique and protocol. - Diagnostic criteria for multiple myeloma: what the radiologist needs to know. - International Myeloma Working Group (IMWG) imaging recommendations: where would PET/MRI fit in? - Potential indications in clinical practice. - solitary bone plasmacitoma. - multiple myeloma with neurological symptoms or suspected spinal cord or radicular compression. - high-risk smoldering multiple myeloma. - Bone marrow imaging analysis: PET vs DWI sequences. - Tips and tricks for reporting a PET/MRI study.

## NMMIEE-7 STATE OF THE ART OF FUNCTIONAL IMAGING IN MULTIPLE MYELOMA:WB-MRI AND PET-CT

Claudio Cerchione (*Abstract Co-Author*) Nothing to Disclose
Danila Diano (*Abstract Co-Author*) Nothing to Disclose
Davide Bezzi (*Abstract Co-Author*) Nothing to Disclose
Andrea Prochowski Lamurri, MD (*Abstract Co-Author*) Nothing to Disclose
Arrigo Cattabriga (*Abstract Co-Author*) Nothing to Disclose
Alice Rossi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

According to international guidelines, patients with suspected myeloma should primarily undergo low-dose Whole Body Computed Tomography for diagnostic purposes.To optimize sensitivity and specificity and enable treatment response assessment, Whole Body Magnetic Resonance Imaging (WB-MRI) should include Diffusion Weighted Imaging with Apparent Diffusion Coefficient maps and T1-weighted Dixon sequences with bone marrow Fat Fraction quantification. At baseline WB-MRI shows greater sensitivity for the detecting focal lesions and diffuse bone marrow infiltration pattern than18F-fluorodeoxyglucose Positron Emission Tomography/Computed Tomography (PET-CT), which is considered of choice for evaluating response to treatment and minimal residual disease and imaging of extramedullary disease (EMD). Both WB-MRI and PET-CT findings have been associated with patient's prognosis. Due to tumor heterogeneity and new therapies, the most current research indicates that PET-CT and WB-MRI may play complimentary roles in providing distinct and complementary information.

**TABLE OF CONTENTS/OUTLINE**

1 Introduction. 2 Updated imaging technique standardization: Italian criteria for myeloma for PET-CT use (IMPeTUS Criteria) and WB-MRI Myeloma Response Assessment and Diagnosis System (MY-RADS) guidelines. 3 PET-CT and WB-MRI for staging of myeloma patients. 4 Emerging prognostic factors on PET-CT and WB-MRI. 5 PET-CT and WB-MRI for response assessment and minimal residual disease evaluation. 6 Future perspectives: new radiotracers for PET-CT and PET-MRI. 7 Conclusion. 8 References.

## NMMIEE-8 A GUIDE TO IMAGING BASED $^{177}$LU-PSMA-617 ELIGIBILITY CRITERIA: VISION VS THERAP

Sanaz Behnia, MD (*Abstract Co-Author*) Nothing to Disclose
Delphine L. Chen, MD (*Abstract Co-Author*) Grant, Telix Pharmaceuticals Limited;Speaker, Telix Pharmaceuticals Limited
Amir Iravani, MD (*Abstract Co-Author*) Nothing to Disclose
Alireza Ghodsi, MD (*Abstract Co-Author*) Nothing to Disclose
Ridvan A. Demirci, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Theranostics agents differ from conventional chemotherapy agents by allowing objective pre-treatment eligibility assessment.177Lu-PSMA-617 is an effective and safe treatment for metastatic castration resistant prostate cancer and has been on the focus of theranostics in recent years. Landmark clinical trials, VISON and TheraP, implemented different imaging-based inclusion criteria. Understanding the details of eligibility framework is essential for accurate patient selection. This exhibit aims to provide a guide to imaging-based eligibility criterion.

**TABLE OF CONTENTS/OUTLINE**

1. Understanding the trials: VISION vs TheraP a. VISION trial uses pre-treatment PSMA-PET along with contrast-enhanced CT while TheraP uses pre-treatment PSMA and FDG PET. b. Eligibility criteria set by TheraP led to higher screening failure compared to VISION trial (28% vs 12.6%). c. TheraP trial had higher PSA response rate compared to VISION trial (66% vs 46%). d. FGD-PET as an addition to the PSMA PET, may provide insights about the tumor biology by revealing tumoral heterogeneity. 2. Workflow of imaging-based VISION eligibility and case examples a. =1 PSMA positive lesion of any size in any organ AND b. No PSMA-negative lesions bigger than 2.5 cm in nodes, 1 cm in solid organs and 1 cm in soft tissue components of bone lesions. 3. Workflow of imaging-based TheraP eligibility and case examples a. At least one lesion with PSMA SUVmax =20 AND b. PSMA SUVmax = 10 in all measurable sites AND c. Absence of discordant findings between PSMA and FDG PET

## NMMIEE-9 LIVER LESIONS: THE NUCLEAR OPTION

Benjamin L. Viglianti, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel J. Wale, DO (*Abstract Co-Author*) Nothing to Disclose
Brett M. Arnkoff, MD (*Abstract Co-Author*) Nothing to Disclose
Miles Lewis (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. It is important for the radiologist to be familiar with the various appearances of liver lesions across common nuclear medicine exams.2. When certain hepatic lesions such as FNH and hemangiomas demonstrate atypical features on CT or MR, nuclear medicine studies can help to confirm the diagnosis.3. Newer PET agents including those targeting somatostatin receptors and PSMA have increased specificity in characterizing hepatic lesions, although there remain pitfalls.

**TABLE OF CONTENTS/OUTLINE**

I. IntroductionII. Gamma Agentsa. Tc99m sulfur colloidi. Focal nodular hyperplasiaii. Miscellaneousb. Tc99m labeled RBC’si. Hemangiomac. Hepatobiliary imagingd. Pseudo-lesionsi. SVC syndromeii. Budd Chiarie. Incidental uptake on other scans - liver lesion on bone scan, sestamibi, etc.III. PET agentsa. FDGi. Infectionii. Metastasesb. DOTATATEc. PSMAIV. Conclusion

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# Abstract Archives of the RSNA, 2024

NMMIEE-1

## BOMBARDMENT TO BEDSIDE: BEHIND THE SCENES OF NUCLEAR MEDICINE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Prem P. Batchala, MD (*Abstract Co-Author*) Nothing to Disclose
Wayne Dell, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

We recognize that there is limited exposure of radiology trainees to "behind the scenes" events during their 16 week exposure in Nuclear Medicine. However, understanding the events that lead to gamma and PET image production is critical in guiding patient preparation, as well as understanding technologist/patient/public safety, radiotracer biodistribution, and artifacts that influence interpretation. In this exhibit we attempt to highlight important practical steps involved in the most common nuclear medicine exams focused towards radiology trainees.

### TABLE OF CONTENTS/OUTLINE

1. Synthesis of most common radionuclides (99mTc, 18F) and radiopharmaceuticals including QA/QC procedures (e.g. Impurity testing)2. Radiopharmacy, Labeling methods (e.g. 99mTc labeling of RBCs, WBCs, sulfur colloid)3. Transport and receipt of radiopharmaceuticals4. Dose calibrator, radiopharmaceutical administration5. Area surveys, Waste disposal6. Camera (Gamma and PET) QC7. NRC guidelines, Authorized user, written directive

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

NMMIEE-10

## 18F-FLUOROESTRADIOL (FES) PET IMAGING: INDICATIONS, IMAGING REVIEW AND IMPACT ON CLINICAL MANAGEMENT OF ESTROGEN RECEPTOR POSITIVE BREAST CANCER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Janice Thai, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel E. Grenier, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) To review indications and relative indications for 18F-Fluoroestradiol (FES) PET. 2) To demonstrate how FES PET is used to direct clinical management in patients with estrogen receptor (ER) positive breast cancer. 3) To review current limitations of FES PET.

### TABLE OF CONTENTS/OUTLINE

1) Indications for FES PET, including a) Official U.S. Food and Drug administration (FDA) approval, and b) Society of Nuclear Medicine and Molecular Imaging (SNMMI) appropriate use criteria. 2) Mechanism of action and normal biodistribution of FES. 3) Highlight clinical cases in which FES PET was used and how it impacted patient management, specifically: a) Diagnosing progression of metastatic disease in lieu of biopsy; b) Distinguishing between skeletal degenerative change and metastases; c) Diagnosing tumor recurrence that would not have otherwise been identified on diagnostic CT, F18-FDG PET or Tc-99m methylene diphosphonate (MDP) bone scan; and d) Differentiating between post treatment change and tumor recurrence.

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# Abstract Archives of the RSNA, 2024

NMMIEE-11

## REVISITING CLASSICAL NUCLEAR MEDICINE: THYROID AND SALIVARY GLAND SCINTIGRAPHY IN MODERN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jun Isogai, MD (*Abstract Co-Author*) Nothing to Disclose
Kota Yokoyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Junichi Tsuchiya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kimiteru Ito, MD (*Abstract Co-Author*) Nothing to Disclose
Akira Toriihara (*Abstract Co-Author*) Nothing to Disclose
Ukihide Tateishi, PhD (*Abstract Co-Author*) Nothing to Disclose
Yusuke Kawasaki, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•Review the physiological basis and nuclear imaging techniques of thyroid and salivary glands.•Emphasize the relevance and utility of 99mTcO4- and 123I in the assessment of thyroid function and pathology.•Discuss the strategic role of nuclear medicine in managing thyroid conditions such as hyperthyroidism and differentiated thyroid cancer using 99mTcO4-, 123I, and 131I.•Highlight the application of 99mTcO4- in salivary gland imaging, particularly in the evaluation of Warthin's tumor, oncocytoma, and Sjögren's syndrome.•Explore future directions in nuclear imaging, focusing on the potential of PSMA PET and emerging tracers for enhancing diagnostic accuracy and therapeutic monitoring.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Thyroid and Salivary Gland Anatomy and Physiology2. Basics of Nuclear Medicine Techniques3. Detailed Review of Thyroid Scintigraphy•Thyroid Scintigraphy with 99mTcO4- and 123I•Applications in Differentiated Thyroid Cancer and Hyperthyroidism4. Salivary Gland Scintigraphy•Diagnostic Uses in Sjögren's Syndrome and Salivary Gland Tumors5. Future Perspectives •Advancements in PSMA PET and the Development of Novel Tracers

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# Abstract Archives of the RSNA, 2024

NMMIEE-12

## TRANSARTERIAL RADIOEMBOLIZATION (TARE) OF YTTRIUM-90 IN PATIENTS WITH HEPATOCELLULAR CARCINOMA (HCC): EXPECTED AND UNEXPECTED IMAGING RESULTS THAT MUST BE RECOGNIZED BY THE RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Graziela C. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Helena N. Pedroso (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia P. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Heloise Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Lhuanna Maria Barbosa Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Rigo (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Lewin, MD (*Abstract Co-Author*) Nothing to Disclose
Camila P. Reifegerste, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Batista Rodrigues, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The objective of this exhibition is:Highlight radiological signs of response in patients with neoplasia after the use of yttrium-90 in different imaging modalities, including magnetic resonance imaging (MRI), computed tomography (CT) and PET-CT;Identify possible adverse effects of local therapy with TARE that are already known and associate them with the success or failure of this therapy;Understanding possible post-treatment changes is essential for correct radiological interpretations during the follow-up of patients undergoing TARE.Provide practical information and pitfalls in the interpretation of radiological manifestations, including radiopharmaceutical response time, differentiation between imaging findings directly related to neoplastic disease and secondary but expected manifestations.

### TABLE OF CONTENTS/OUTLINE

Hepatocellular carcinoma (HCC) is the most common primary liver cancer and the second most common cause of cancer mortality worldwide. This growing incidence has led to the evolution of treatment for HCC and several techniques have emerged, including everything from surgical resection to local ablation, transplantation, transcatheter arterial chemoembolization (TACE), TARE and systemic treatments, in order to reduce morbidity and mortality. Therefore, correct and individualized treatment planning is essential to obtain good results.Among the treatment options, TARE using yttrium-90, also called radioembolization or selective internal radiotherapy, has been gaining prominence and is based on a technique involving nuclear medicine and interventional radiology accepted for the treatment of HCC.

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# Abstract Archives of the RSNA, 2024

NMMIEE-13

## DON’T TREMBLE: USE OF PET MRI IN PARKINSON DISEASE AND ATYPICAL PARKINSONIAN SYNDROMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura Y. Quiroz Rojas (*Abstract Co-Author*) Nothing to Disclose
Uvi Cancino Ramos, PhD,MD (*Abstract Co-Author*) Nothing to Disclose
Diana L. Perez Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
America Hernandez, MEd (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To describe abnormal MR imaging findings in atypical Parkinsonian syndromes- Identify normal FDG PET and DOPA PET findings in Parkinson disease < atypical Parkinsonian syndromes- To learn to identify relevant anatomical landmarks in the dopaminergic system

### TABLE OF CONTENTS/OUTLINE

•Introduction •Relevant anatomic < function in the dopaminergic system •Most common imaging patterns of Parkinson disease < atypical parkinsonian syndromes •High-field MRI < specialized sequences make it possible to define specific MRI signs for neurodegenerative disorders •Cases clinics representative •Conclusions •References

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# Abstract Archives of the RSNA, 2024

NMMIEE-14

## RADIOLABELED FIBROBLAST ACTIVATION PROTEIN INHIBITOR (FAPI) IN THE INTERSTITIAL LUNG DISEASES (ILD)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Narges Jokar (*Abstract Co-Author*) Nothing to Disclose
Esmail Jafari (*Abstract Co-Author*) Nothing to Disclose
Mehrzad Bahtouee (*Abstract Co-Author*) Nothing to Disclose
Majid Assadi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 68Ga-Fibroblast Activation Protein Inhibitor (FAPI) provides a readout to quantitatively measure the levels of activated fibroblasts in Interstitial Lung Diseases (ILD) with two common histological features, inflammation and fibrosis, regardless of their underlying causes. 2. GGO as a challenging finding on HRCT, raises questions about whether it represents inflammatory changes or interstitial fibrosis. 3. Distinguishing between inflammatory and fibrotic processes is crucial for treatment decisions, therapies focusing on inflammation may not work for patients with dominant fibrosis, while antifibrotic agents may be ineffective for patients with dominant inflammation. 4. FAP imaging is able to differentiate between regions of the lung with active fibrotic remodeling and those without fibrosis.5. The combination of 68Ga-FAPI PET/CT and HRCT yields an additive effect for evaluating ILD-related fibrosis and inflammatory processes over using either modality alone. 6. FAP-positive signals in the entire lung, suggesting different stages of fibrosis. Patients with many FAP-positive cells may be in active fibrosis, while those without may have stable fibrosis.

### TABLE OF CONTENTS/OUTLINE

1. FAPI imaging differentiates inflammatory changes and interstitial fibrosis2. Accurate and precise treatment approach for patients with dominant fibrosis using FAPI imaging3. Giving valuable insights into the complexities associated with ILD using FAPI imaging4. The different scenarios of either inflammation or active fibrosis based on FAPI imaging and HRCT.5. The potential diagnostic value of FAPI imaging in identifying tissue remodeling associated with chronic inflammations throughout the body.

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# Abstract Archives of the RSNA, 2024

NMMIEE-15

## FIBROBLAST ACTIVATION PROTEIN INHIBITOR (FAPI)- A NEW FRONTIER IN CARDIAC IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Narges Jokar (*Abstract Co-Author*) Nothing to Disclose
Esmail Jafari (*Abstract Co-Author*) Nothing to Disclose
Mohammadreza Pourbehi (*Abstract Co-Author*) Nothing to Disclose
Majid Assadi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

New FAP-targeting PET radiotracers that originally developed for oncologic imaging could serve as a noninvasive method for evaluating the active and fibrosis process process in the early days after myocardial infarction in a patient. Advantages are myocardial imaging with FAPI is Identification of early changes in fibroblast dynamics and profibrotic activity. Identification of subjects at elevated risk of heart failure Identification of patients who may benefit most from specific therapeutic interventions directed against adverse interstitial myocardial fibrosis. Differentiation between active and end-stage disease Monitoring of disease progression and treatment response Enhancing patient care and clinical outcomes Identifying active myofibroblasts would enhance comprehension of their presence in the injured myocardium. Assess the effectiveness of antifibrosis treatments. Offers indirect clues about the extent of fibrogenesis or collagen deposition. Potentially pinpointing a critical time window for preventing fibrosis. FAPI myocardial imaging should be aligned with the advancements in understanding cardiac fibrosis and the development of targeted antifibrotic interventions

### TABLE OF CONTENTS/OUTLINE

1. Uptake distribution of 68Ga-FAPI-46 presumably representing worsening myocardial stiffness2. The FAPI tracer signal contribute to the development of interstitial fibrosis.3.FAPI imaging for assessing the active fibrosis process, which may persist as a chronic condition.4. Potential diagnostic value of FAPI imaging in identifying tissue remodeling throughout the body5. Dual tracers may improve the diagnostic accuracy for characterizing fibroinflammatory processes.

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# Abstract Archives of the RSNA, 2024

NMMIEE-16

## ENLIGHTENING RECTAL CANCER: [18F]FDG PET/MRI, A USEFUL TOOL FOR PRECISE STAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Diego Cecchin, MD (*Abstract Co-Author*) Nothing to Disclose
Carlo D'Alessandro, MD (*Abstract Co-Author*) Nothing to Disclose
Emilio Quaia, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Filippo Crimi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pietro Zucchetta (*Abstract Co-Author*) Nothing to Disclose
Gaya Spolverato (*Abstract Co-Author*) Nothing to Disclose
Giovanni Sussan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Colorectal cancer, the most common gastrointestinal malignancy globally and the third leading cause of cancer-related death, includes rectal cancer, which comprises about one-third of cases. Guidelines recommend MRI for local staging and contrast-enhanced CT for detecting distant metastases. [18F] FDG PET/MRI appears to be a valuable tool for achieving highly precise diagnoses:
- It has been observed that the tumor response to pCRT often involves replacement of viable tumor tissue with fibrosis. Consequently, tumor understaging in this context may stem from the limitations of PET/CT to detect small clusters of residual disease. PET/MRI appears capable of accurately restaging patients following pCRT;
- [18F]FDG PET/MRI could increase the detection rate of potentially metastatic lymph nodes in rectal cancer patients;
- For M staging, [18F]FDG PET/MRI outperformed [18F]FDG PET/CT and CT in detecting metastases in solid organs, whereas it performed worse for lung metastases.

### TABLE OF CONTENTS/OUTLINE

1) T-staging: the capability of [18F]FDG PET/MRI to precisely detect lesions remains intact even in the presence of local fibrosis; 2) N-staging: especially in cases of uncertainty, the combination of [18F]FDG PET/MRI detects hypermetabolic lymph nodes more effectively than MRI alone; 3) M-staging: [18F]PET/MRI provides high soft-tissue contrast, making it useful for examining solid organs such as the liver. Additionally, it can be utilized with specific MRI sequences, such as DWI, as needed.

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# Abstract Archives of the RSNA, 2024

NMMIEE-17

## CLINICAL EFFICACY AND PITFALLS OF DEEP LEARNING-BASED RECONSTRUCTION FOR PET IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ryuji Akita, RT, MS (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Koumei Takauchi (*Abstract Co-Author*) Nothing to Disclose
Yuko Nakamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fuminari Tatsugami, MD (*Abstract Co-Author*) Nothing to Disclose
Mana Ishibashi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recently, Deep Learning-based Reconstruction (DLR) for PET imaging has been developed to provide higher signal-to-noise ratio (SNR) images. In the training process of the DLR, the DLR for PET iteratively optimizes filters of its deep convolutional neural network (DCNN) layers to minimize the differences between low-quality images (noisy image) and their paired high-quality images (targets), and the trained DLR can be applied to new data to output new high-quality images. Image quality was significantly improved with DLR-PET compared to conventional PET/CT images. The noise reduction and improved lesion-normal tissue contrast achieved with the DLR-PET may improve lesion detectability and allow more accurate prediction of treatment response. In addition, the PET image quality is maintained with shorter acquisition time or low doses. On the other hand, lesions that appear to have faint or mild FDG uptake on conventional reconstructed PET images may be false-positive due to overall increased uptake on the DLR-PET, so careful interpretation is required.

### TABLE OF CONTENTS/OUTLINE

1. Principle of Deep Learning-based Reconstruction (DRL) for PET imaging 2. Results of our phantom study 3. Clinical case presentation 4. Pitfalls in interpretating the DLR images for PET 5. Future aspects of the DLR for PET imaging

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# Abstract Archives of the RSNA, 2024

NMMIEE-18

## FLUORESCENT INSIGHTS: A NUCLEAR MEDICINE GUIDE TO MUSCULOSKELETAL INFECTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Harikrishnan Nandakumar, MD (*Abstract Co-Author*) Nothing to Disclose
David J. Lubin, MD (*Abstract Co-Author*) Nothing to Disclose
Sukrita Menon, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand the mechanism and common uses of conventional radionuclides utilized for musculoskeletal (MSK) scintigraphic imaging.2. Primary categories of adult MSK infections: Exploring various NM studies in each category which are helpful aids to conventional imaging.3. Review the radionuclide imaging algorithm to assess and choose the best modality optimized for each infection category.4. Explore the utility of hybrid NM techniques in differentiation infection from other pathology in the same region (prosthetic infection vs aseptic prosthetic loosening).5. Fundamental challenges and issues with conventional NM techniques such as false positives/negatives.6. Discuss upcoming developments (new radionuclides and techniques) and their potential role in revolutionizing current understanding of NM studies.

### TABLE OF CONTENTS/OUTLINE

1.Conventional radionuclides and techniques in MSK scintigraphy: Mechanism and clinical indication (Bone Scintigraphy, Ga 67, Labelled leucocyte scintigraphy, In-111, F18-FDG, Ga 68). 2.Primary categories of adult MSK infectionsa. Peripheral Osteomyelitisb. Spondylodiscitisc. Prosthetic Joint Infection 3.Nuclear medicine imaging algorithm for study selection for adult MSK infections. 4.Hybrid NM techniques- SPECT/CT with 99mTc, Ga67, F18 FDG PET/CT, PET/MR 5. Fundamental diagnostic challenges with conventional scintigraphy.6. Future of NM in MSK infections - New techniques and radionuclides. a. Gallium-68-Citrate (68Ga) b. Tc labelled Interleukin-8 c. Sodium Fluoride (18F-NaF) d. Radiolabelled Antibiotics. Novel PET Tracers like 68Ga-NOTA-UBI, 18F-maltohexaose, nanopeptides etc.f. Dynamic whole-body multiparametric PET imaging.

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# Abstract Archives of the RSNA, 2024

NMMIEE-19

## LIVER METASTASES FROM UVEAL MELANOMA: MRI VERSUS FDG PET/CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ciara OBrien (*Abstract Co-Author*) Nothing to Disclose
Claudia Ortega Mogilevich, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Abstract Co-Author*) Nothing to Disclose
Aleena Malik, BSC (*Abstract Co-Author*) Nothing to Disclose
Zeyad Elias (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To demonstrate on a case-review basis, the role of MRI and FDG PET/CT in detection of uveal melanoma liver metastases.2. To review the classic imaging features of uveal melanoma metastases on MRI and demonstrate, through a case series, the variable degree of FDG uptake in this particular entity.3. Raise awareness among general radiologists that uveal melanoma liver metastases can exhibit low or variable radiotracer uptake in PET/CT scans, which may aid in avoiding false-negative restaging based solely on PET results.

### TABLE OF CONTENTS/OUTLINE

1. Background demographics of mucosal versus non-mucosal melanomas.2. Description of diagnosis, natural history, and therapy options for uveal melanoma.3. Depict on a case-review series MRI features of liver metastases and their correlation with FDG PET/CT modality.4. Assessment of potential reasons for the variable degree of FDG uptake in this particular entity that behaves different than highly FDG avid mucosal melanomas.5. Conclusions

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# Abstract Archives of the RSNA, 2024

NMMIEE-2

## ALL THAT GLITTERS ISN'T GOLD: FALSE POSITIVES AT PSMA PET/CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Austin Pantel, MD (*Abstract Co-Author*) Institutional research support, Lantheus Holdings;Consultant, Blue Earth Diagnostics Ltd;Consultant, General Electric Company;Consultant, Lantheus Holdings
Mark Ehrhart, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Anderson, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Joseph Ahlander, PhD,DO (*Abstract Co-Author*) Nothing to Disclose
Ali Salehpoor, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Prostate-specific membrane antigen (PSMA) is a membrane protein that is over-expressed in high-risk prostate cancer. PSMA-targeted PET/CT is a valuable tool for detection, staging, and restaging of prostate cancer. However, many non-prostatic malignancies are known to express the PSMA receptor and thus may be seen on PSMA-targeted PET/CT. Knowledge of the biodistribution of PSMA-targeted radiopharmaceuticals and potential false positives is crucial in preventing misdiagnosis and unnecessary treatment. After reviewing this exhibit, radiologists will: 1) Understand normal biodistribution of PSMA as seen on PSMA-targeted PET/CT, 2) Identify causes of uptake that are not due to prostate cancer, and 3) Identify non-prostatic malignancies that express the PSMA receptor and which may have uptake on PSMA-targeted PET/CT.

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Overview of the PSMA membrane protein b. Overview of PSMA-targeted PET/CT 2. Normal physiologic distribution seen on PSMA-targeted PET/CT a. Lacrimal, salivary glands b. Kidneys c. Liver d. Spleen e. Bowel f. Ganglia (such as celiac and stellate ganglia) g. Normal excretion in urine 3. False positives a. Granulomatous disease b. Bone pathology i. Paget's disease ii. Fibrous dysplasia iii. Healing fractures c. Benign soft tissue lesions i. Schwannoma ii. Meningioma iii. Hemangioma d. Malignant lesions i. Renal cell carcinoma ii. Lymphoma iii. Thyroid carcinoma iv. Multiple myeloma v. Neuroendocrine tumor vi. Gastrointestinal stromal tumor 4. Conclusion

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# Abstract Archives of the RSNA, 2024

NMMIEE-20

## MOST PROMISING "THE HOPEFUL EIGHT" RADIONUCLIDES FOR TARGETED ALPHA THERAPY: A BOOM TO THE FUTURE OF NUCLEAR MEDICINE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Johnny Yang, BS, BA (*Abstract Co-Author*) Nothing to Disclose
Nicholas Gatto, DO, MS (*Abstract Co-Author*) Nothing to Disclose
Lasya Daggumati (*Abstract Co-Author*) Nothing to Disclose
Vani Vijayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Marjorie Lam (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Abstract Co-Author*) Nothing to Disclose
John Hollis Tackett, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To outline the strengths weaknesses of the eight radionuclides with great potential for use in targeted alpha therapy.To describe potential clinical uses and applications for each of these radionuclides.

### TABLE OF CONTENTS/OUTLINE

Visualization of radionuclide distribution on imaging and the irradiation of malignant cells are two of the primary goals of Nuclear Medicine. An advantageous method of treating malignancies is through targeted radionuclide therapy (TRT), as it delivers highly concentrated doses of radiation directly to tumor cells or to the surrounding microenvironment, while being a minimally invasive procedure. Targeted alpha therapy (TAT) is a form of TRT that focuses on alpha-emitting radionuclides. To provide the most efficacious treatment through TAT, the radionuclide decay pathway, particle emission range, relative biological effectiveness, and physical characteristics (half-life, method of production, radionuclidic purity, etc.) and biochemical characteristics (in-vivo stability, tissue targeting, toxicity, etc.) must be considered and optimized for the chosen radionuclide.Recently, studies have shown that there are eight alpha-emitting radionuclides with the most potential for use in targeted alpha therapy: actinium-225, astatine-211, bismuth-212, bismuth-213, lead-212, radium-223, terbium-149, and thorium-227. This exhibit will discuss these radionuclides in detail, exploring their potential applications in a clinical setting and the advantages and disadvantages for each.

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# Abstract Archives of the RSNA, 2024

NMMIEE-21

## [18F]FDOPA HYBRID PET/ MRI. AN EXPLORATION IN THE DIAGNOSIS OF TUMOR VIABILITY FROM TREATMENT-RELATED CHANGES IN BRAIN TUMOURS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura Rodriguez-Bel (*Abstract Co-Author*) Nothing to Disclose
Carles Majos (*Abstract Co-Author*) Nothing to Disclose
Karina Janeth Gordillo Zabaleta, MD (*Abstract Co-Author*) Nothing to Disclose
Albert Pons Escoda (*Abstract Co-Author*) Nothing to Disclose
Montserrat Cortes (*Abstract Co-Author*) Nothing to Disclose
Michal Pudis (*Abstract Co-Author*) Nothing to Disclose
Marina Suarez-Pinera (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• The assessment of treatment response in brain tumours and, more specifically, the differentiation between tumour recurrence and treatment related changes (TRC) remains a clinical and neuroimaging challenge. Main neuro-oncology societies (EANO, RANO, SNMMI, EANM) have recommended the use of MR and amino acid PET, both techniques, in this diagnosis. • The new generation of hybrid PET/MR scanners provides a multidisciplinary approach offering additional diagnostic information in a single scan. • The purpose of this exhibit is to evaluate the role of hybrid images in the differential diagnosis of tumour viability versus treatment-related changes.

### TABLE OF CONTENTS/OUTLINE

1. A brief overview of the pathophysiological basis and analysis of [18F]FDOPA PET in brain tumours. 2. Conventional and advanced MRI sequences in neuro-oncology. 3. [18F]FDOPA PET/MRI images of cases from our department and correlation with histopathological findings. 4. Take-home messages.

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# Abstract Archives of the RSNA, 2024

NMMIEE-22

## FUNCTIONAL IMAGING PHENOTYPE-GENOTYPE CORRELATION IN PARAGANGLIOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Clara Chen (*Abstract Co-Author*) Nothing to Disclose
Corina Millo, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Cahid Civelek, MD (*Abstract Co-Author*) Nothing to Disclose
Mayank Patel, MD (*Abstract Co-Author*) Stockholder, Alphatec Holdings, Inc;Stockholder, Oncolytics Biotech Inc;Stockholder, Meridian Bioscience Inc;Stockholder, Verve Therapeutics, Inc
Matthew Nazari, MD,BS (*Abstract Co-Author*) Nothing to Disclose
Sara Talvacchio (*Abstract Co-Author*) Nothing to Disclose
Alexander Ling, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Carrasquillo, MD (*Abstract Co-Author*) Nothing to Disclose
Karel Pacak, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Herscovitch, MD (*Abstract Co-Author*) Nothing to Disclose
Jaydira del Rivero (*Abstract Co-Author*) Nothing to Disclose
Frank I. Lin, MD (*Abstract Co-Author*) Nothing to Disclose
Kailah Charles (*Abstract Co-Author*) Nothing to Disclose
Tamara Prodanov (*Abstract Co-Author*) Nothing to Disclose
Abhishek Jha, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Paragangliomas (PGLs) are rare neuroendocrine tumors arising from chromaffin cells along with elevated catecholamines (epinephrine, norepinephrine, and dopamine) and/or their respective metabolites (metanephrine, normetanephrine, and methoxytyramine).2. PGLs are the most hereditary tumor among all endocrine and non-endocrine neoplasms and are currently divided into three clinically relevant genetic clusters (1[a,b], 2, and 3).3. Not only the clinical, biochemical, but functional (molecular) imaging phenotype is dependent upon genetic makeup of these tumors.4. There are 3 specific targets found in PGLs (somatostatin receptor, norepinephrine transporter, and L-type amino acid transporter).5. 68Ga-DOTATATE (targets somatostatin receptor) is the functional imaging phenotype in cluster 1a (SDHx-related) - primary or metastatic PGLs, metastatic sporadic, and head and neck PGLs.6. 18F-FDOPA (targets L-type amino acid transporter) is the functional imaging phenotype in cluster 1b, 2, and primary sporadic pheochromocytoma.7. Selection of targeted radiotherapy (177Lu-DOTATATE or 131I-MIBG) for metastatic patients depend upon uptake on 68Ga-DOTATATE and 123I-MIBG (targets norepinephrine transporter).

### TABLE OF CONTENTS/OUTLINE

1. Definition and location of PGLs including rare locations.2. Genetic cluster classification. 3. Definition of theranostics and various theranostic targets in PGLs.4. Mechanism of action of radiopharmaceuticals.5. Demonstration of functional imaging phenotypes in various clusters and cohorts.6. Algorithm for identifying functional imaging phenotype when genotype is known.7. Application of functional imaging to select between targeted radiotherapies.

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# Abstract Archives of the RSNA, 2024

NMMIEE-23

## SARCOID-LIKE REACTIONS AFTER CANCER REMISSION: RADIOLOGY-PATHOLOGY CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Hina Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Igor Odintsov (*Abstract Co-Author*) Nothing to Disclose
Aparna Singh, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Sarcoid-like reactions, resembling malignancy, require histologic confirmation for accurate diagnosis in post-cancer patients. 2. Histological evaluation is crucial to differentiate sarcoid-like reactions from malignancy. 3. Awareness of these reactions is crucial to prevent misdiagnosis and unwarranted treatment interventions. 4. Utilization of FDG-PET/CT aids in the detection and monitoring of sarcoid-like reactions, guiding clinical management decisions effectively.

### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Background on Sarcoid-like Reactions B. Importance of Accurate Diagnosis in Oncologic Patients II. Radiological-Pathological Correlation A. Imaging Features of Sarcoid-Like Reactions: PET/CT findings highlighting the challenges in diagnosing sarcoid-like reactions and the impact on treatment decisions. Characteristic imaging findings such as lymphadenopathy and pulmonary nodules distinguishing sarcoid-like reactions from malignancy. B. Sarcoid like reaction associated with various treatments such as immunotherapy, targeted therapy, and chemotherapy such as carboplatin. C. Importance of Histological Evaluation: Radiology pathology correlation in cases on sarcoidosis like reaction. D. Clinical Presentation and Diagnostic Challenges III. Conclusion A. Summary of Key Findings B. Recommendations for Clinical Practice C. Future Directions in Research

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# Abstract Archives of the RSNA, 2024

NMMIEE-24

## UNLOCKING ACCURACY: A COMPREHENSIVE GUIDE TO PRE-SCAN OPTIMIZATION FOR PET-CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yean P. Silva Hidalgo, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto P. Silva Hidalgo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Scanner components and their roles in image acquisitionKey factors influencing PET-CT imagePre-scan parameters to optimize PET-CT image qualityImage acquisition protocols and considerationsQuality control measures for PET-CT imaging

### TABLE OF CONTENTS/OUTLINE

IntroductionPET-CT Scanner Components PET detector system: Scintillator crystals, photomultiplier tubes, and data acquisition electronics Computed tomography (CT) scanner Image reconstruction system: Algorithms for generating PET and CT imagesFactors Influencing PET-CT Image QualityPatient-related factors Physiological parameters, tracer uptake, and motion artifactsScanner-related factors Detector sensitivity, spatial resolution, and system noiseAcquisition-related factors Tracer dose, scan duration, and reconstruction parametersPre-Scan Modifications for Optimal Image QualityPatient preparation Dietary restrictions, hydration status, and bladder emptyingTracer administration Timing of injection, route of administration, and dosagePositioning and immobilization CT scan parametersImage Acquisition Protocols and ConsiderationsStandard PET-CT protocolsSpecialized protocolsQuality Control Measures for PET-CT ImagingPhantom studies Daily and weekly performance checks Standardized uptake value (SUV) normalization Quantitative analysis of tracer uptakeVisual assessment Image artifacts, noise levels, and overall image qualityConclusion Significance of pre-scan modifications for achieving high-quality PET-CT images Continuous advancements in PET-CT technology and image acquisition protocols

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# Abstract Archives of the RSNA, 2024

NMMIEE-25

## IMMUNOTHERAPY: A REVIEW OF IMMUNE POSITRON EMISSION TOMOGRAPHY RESPONSE CRITERIA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Loja L. Miriam SR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To learn how immunotherapy works at the cellular level - To review the types of immune checkpoint inhibitors according to cancer type. - To describe the update of metabolic response criteria in immunotherapy. IPERCIST - To understand unusual metabolic response patterns in immunotherapy

### TABLE OF CONTENTS/OUTLINE

- Immunotherapy. Introduction - immune checkpoint inhibitors - Approved ICIs according to cancer type - iPERCIST. Immune positron emission tomography Response Criteria - Unusual metabolic response patterns

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# Abstract Archives of the RSNA, 2024

NMMIEE-26

## PSMA (PROSTATE-NOT-SO-SPECIFIC MEMBRANE ANTIGEN) PET: A REVIEW OF BENIGN AND MALIGNANT INCIDENTAL FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vahid Yaghmai, MD, MS (*Abstract Co-Author*) Nothing to Disclose
James Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Rahmani, MD (*Abstract Co-Author*) Nothing to Disclose
Garrett G. Ward, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedeh Niloufar Rafiei Alavi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Define Prostate-Specific Membrane Antigen (PSMA) and its imaging role, emphasizing its association with prostate cancer and expression in other tissues.2) Discuss PSMA as a transmembrane protein with various cellular roles, highlighting its expression in both normal and neoplastic cells.3) Familiarize radiologists with the knowledge to identify common benign and malignant incidental findings on PSMA PET/CT.4) Introduce evidence-based methods to distinguish between incidental findings and true positive lesions in imaging.

### TABLE OF CONTENTS/OUTLINE

1. Current Role of PSMA-PET/CT in the management of prostate cancer.2. Overview of the PSMA Protein, its structure, function, and clinical significance 3. Physiologic Uptake Patterns on PET/CT and identifying physiological versus pathological uptake.4. Common Benign Incidental Findings on PSMA-PET/CT 5. Common Non-Prostate Cancer Malignant Findings 6. Evidence-Based Identification Methods: Review the evidence supporting various approaches for accurately identifying incidental findings on PSMA-PET/CT

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# Abstract Archives of the RSNA, 2024

NMMIEE-27

## MECKEL'S: DELVING INTO THE DIAGNOSTICS OF THE DESOLATE DIVERTICULUM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mark Ehrhart, MD (*Abstract Co-Author*) Nothing to Disclose
Shana Elman, MD,MA (*Abstract Co-Author*) Nothing to Disclose
R. Travis Clark, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Janos, MD (*Abstract Co-Author*) Nothing to Disclose
Aaron Gambrell, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Meckel's diverticulum is the most common congenital abnormality of the gastrointestinal tract, although only present in approximately 2% of the population. It is important to recognize the different clinical presentations and complications of this anomaly in order to expedite the diagnosis and treatment for the patient. One of the common diagnostic imaging exams used in the work-up is the Tc-99m pertechnetate Meckel's scan, which will be highlighted in this exhibit, including how to improve the sensitivity of the exam and how to avoid falling for false positives and negatives. This exhibit will show examples of how other diagnostic tools can be used for identification and what tools can be used for troubleshooting to aid in diagnosis, as well as how similar clinical presentations can potentially distract a radiologist or clinical provider from a Meckel's diagnosis. At the end of this review the reader should be able to identify anatomy, recognize various clinical presentations, create a differential diagnosis and appropriately diagnose a Meckel's diverticulum.

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Definition/ presentations b. Embryology c. Anatomy/ physiology 2. Imaging findings/ diagnostic troubleshooting a. Nuclear medicine b. Angiography c. CT d. Ultrasound 3. Complications a. GI hemorrhage b. SBO c. Intussusception d. Diverticulitis e. Perforation f. Neoplasm g. Umbilico-ileal fistula h. Hernia- Littre hernia 4. Management/ treatment a. Surgical options b. Prognosis/ outcomes 5. Differential Diagnosis a. IBD b. Ulcers c. Angiodysplasia d. Appendicitis e. Small bowel diverticulitis f. Intussusception look-alike: polyp or lymphoma g. Obstruction look-alike: adhesions or hernias 6. Conclusion

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NMMIEE-28

## PRACTICAL INTERPRETATION OF BONE SCINTIGRAPHY: METASTASES, FRACTURES, AND BEYOND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Felipe Martinez, MD (*Abstract Co-Author*) Nothing to Disclose
Ming Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Ba D. Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Steve S. Huang, MD (*Abstract Co-Author*) Nothing to Disclose
Logan Haug, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To provide a brief overview of the protocols and relevant technical aspects of bone scintigraphy. To facilitate recognition of technical complications that can interfere with correct interpretation of bone scans. To provide a comprehensive list of “Aunt Minnies” that can be recognized on bone scan. To demonstrate characteristic scintigraphic features of benign and malignant bone lesions. To understand patterns of osseous radiotracer uptake and identify soft tissue findings that may contribute to accurate diagnosis of complex syndromes.

### TABLE OF CONTENTS/OUTLINE

This exhibit has four main components: 1. Procedures/protocols of bone scintigraphy: planar, 3-phase, and SPECT/CT imaging 2. Demonstration of faulty acquisitions with inadequate/suboptimal imaging results: hot glove sign, free Tc-99m pertechnetate, incorrect photopeak, etc. 2. Characteristic and atypical features of metastasis (unifocal, multifocal, sarcomatoid features), fractures (insufficiency fractures, non-accidental trauma) and benign bone lesions (skull suture, enchondroma, infarct, osteoma/osteomatosis in Gardner’s syndrome). 3. Scintigraphic osseous and soft tissue findings of metabolic diseases (renal osteodystrophy, brown tumors, calciphylaxis), iatrogenic findings (voriconazole, bisphosphonate, avastin), paraneoplastic syndromes (hypertrophic osteoarthropathy, tumor-induced osteomalacia), and multi-system syndromes (cleidocranial dysplasia, sacral agenesis, sickle cell disease, myelofibrosis, Erdheim-Chester disease, Asherson's syndrome, Mazabraud's syndrome, McCune-Albright syndrome, Mafucci syndrome, Ollier disease, and rhabdomyolysis).

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NMMIEE-29

## RADIOPHARMACEUTICAL IMAGING IN THE MANAGEMENT OF CARDIAC SARCOIDOSIS AND AMYLOIDOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Sehi (*Abstract Co-Author*) Nothing to Disclose
Farrokh Dehdashti, MD (*Abstract Co-Author*) Nothing to Disclose
Robert J. Gropler, MD (*Abstract Co-Author*) Grants, Bayer AG;Consultant, Biomedical Systems;Scientific Adivsor, Amgen Inc;Scientific Advisor, sanofi-aventis Group
Cylen Javidan, MD (*Abstract Co-Author*) Nothing to Disclose
Ashwin Singh S. Parihar, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Infiltrative cardiomyopathies involve deposition of abnormal substances within the myocardium leading to progressive deterioration of cardiac function and clinical symptoms of heart failure and arrhythmias. 2. Radiopharmaceutical imaging for cardiac amyloidosis and sarcoidosis provide a non-invasive assessment of disease state and in several cases obviate the requirement of an endomyocardial biopsy, helping directly initiate specific treatment. This exhibit provides a comprehensive overview of the clinical and imaging features of these diseases, including the impact of functional imaging in clinical management.

### TABLE OF CONTENTS/OUTLINE

1. Common Clinical Presentations and diagnostic algorithms: a. Common clinical presentations. b. Initial diagnostic workup. c. Correlative imaging - Echocardiography, contrast-enhanced MRI. 2. Cardiac Sarcoidosis: a. Patient preparation for FDG PET. b. Imaging patterns on FDG PET and perfusion SPECT, underlying disease mechanisms, implications of imaging findings and imaging pitfalls. c. Clinical role in diagnosis, staging, response assessment and evaluation of suspected recurrence. d. Clinical management of Cardiac Sarcoidosis. 3. Cardiac Amyloidosis: a. Mechanism of radiotracers and Imaging techniques. b. Characteristic patterns on 99mTc-PYP planar and SPECT/CT imaging, including grading of uptake and imaging pitfalls. c. Performance of PYP imaging in specific clinical scenarios, including genetic mutations, type of amyloidosis, solitary cardiac amyloidosis without extra-cardiac involvement. d. Diagnostic accuracy of PYP imaging and its utility for initiating treatment. e. Clinical management of Cardiac Amyloidosis.

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NMMIEE-3

## A NOVEL METHOD OF TRAINING TECHNOLOGISTS FOR DOSIMETRIC ANALYSIS SUPPORT IN A PRIVATE RADIOLOGY PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Douglas A. Murrey JR, MD (*Abstract Co-Author*) Nothing to Disclose
Mitchell Kennedy (*Abstract Co-Author*) Nothing to Disclose
Michael Durka (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The use of customized dosimetric software streamlines radiologist workflows. 2. Establishing standardized training materials creates a framework for non-physicians to learn high-quality processing techniques. 3. Utilizing non-physicians is possible to relieve physician workload in processing Y90 Dosimetry

### TABLE OF CONTENTS/OUTLINE

1. Background/Introduction: - Y90 Radioembolization: an overview of the treatment process 2. Problems with workflows and Y90 delivery in a radiology practice - Time intensive for physicians, etc. 3. Use of Non-Physicians in a Y90 workflow: - Nuclear Medicine and CT Technicians - Challenges and Benefits. 4. Training Process. 5. Conclusions - Improved efficiency for physicians - Increased practicality of Y90 workflow, leading to increased ability to provide Y90 treatments in private radiology practices,

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# Abstract Archives of the RSNA, 2024

NMMIEE-30

## USEFULNESS OF PSMA PET/MRI IN TREATED PROSTATE CANCER PATIENTS, OUR INITIAL EXPERIENCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David Durany Lara (*Abstract Co-Author*) Nothing to Disclose
Eugenia De Lama Salvador, MD (*Abstract Co-Author*) Nothing to Disclose
Eva Maria Merino Serra (*Abstract Co-Author*) Nothing to Disclose
Javier Robles Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Jose Martin-Marcuartu (*Abstract Co-Author*) Nothing to Disclose
Laura Chavarriaga, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of our presentation is to evaluate the performance and diagnostic accuracy of PSMA PET/MRI for the evaluation and detection of recurrent prostate cancer in patients treated with surgery or focal strategies, especially after Irreversible Electroporation (IRE) treatment.

### TABLE OF CONTENTS/OUTLINE

Focal therapy (FT) is an emerging treatment option for selected patients with localised prostate cancer (PCa). FT has the potential to achieve oncological control while preserving urinary, sexual and bowel function.IRE induces irreversible permeabilization of the cell membrane, resulting in loss of homeostasis and consequential cell death; with the advantage that preserves tissue structure of the prostate.In recent years, the clinical availability of integrated PET/MRI scanners has made it possible to explore the potential of multimodal, combined anatomical and functional imaging.PSMA PET/MRI has shown potential to use in the planification and early assessment before IRE treatment and follow-up of post-IRE patients and to identify lesions missed by mpMRI. Also, findings in PSMA PET/MRI has changed treatment indications (from focal treatment to systemic). Targeted therapies could be directed by PET/MRI with radiolabelled PSMA because of its ability to detect the most aggressive lesion.PET/MRI is an excellent synergistic imaging modality in the setting of biochemical PCa recurrence, as a tool to both characterize local disease within the prostate and evaluate for metastasis with a single examination.

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# Abstract Archives of the RSNA, 2024

NMMIEE-31

## BONE SCANS AND THE ORTHOPEDIC SURGERY PATIENT: WHAT RADIOLOGISTS AND CLINICIANS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Brian Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa M. Zayas-Colon, MD (*Abstract Co-Author*) Nothing to Disclose
Tannaz Rajabi (*Abstract Co-Author*) Nothing to Disclose
Vaseem Chengazi, MD (*Abstract Co-Author*) Nothing to Disclose
Wei Li (*Abstract Co-Author*) Nothing to Disclose
John Cerne, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Interpreting bone scans of patients with orthopedic hardware is often a challenging topic for residents. We created this exhibit to teach: 1) key bone scan findings in relation to orthopedic hardware; 2) why these findings make sense. Clinicians want to know when there is orthopedic hardware loosening or osteomyelitis. Radiologists need to know that methyl diphosphonate (MDP) adsorbs in proportion to the rates of bone remodeling and that white blood cells (WBCs) migrate to areas of infection. By attaching a radiotracer to MDP or WBCs, a gamma camera can translate radioactivity to pixelation. Accordingly, focal uptake near hardware suggests stress fracture or hardware loosening in the context of remote surgery. Diffuse uptake with increased blood pool suggests hardware loosening vs infection, with the latter being more likely. Normal uptake in the setting of increased blood pool/perfusion suggests soft tissue inflammation vs degenerative arthritis. After reviewing this exhibit, the resident will understand why the imaging patterns make sense and how they can use this information to offer appropriately specific comments on pathology likelihood.

### TABLE OF CONTENTS/OUTLINE

(1) Bone Scans: how they work; what they can show (2) Orthopedic implants in different locations, and the sites of mechanical stress: hips; knees; ankles (3) Cemented vs Non-Cemented Appliances: implications for surgery; implications for imaging; pathophysiological basis (4) Tell Tale Patterns: focal uptake; diffuse uptake; normal uptake (5) Creating a Good Report: patient background; findings; impression (6) Review of Literature: hot off the press; sensitivity and specificity; what does the future hold?

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# Abstract Archives of the RSNA, 2024

NMMIEE-32

## CURRENT AND EMERGING ROLES OF PET/CT IN THE MANAGEMENT OF MULTIPLE MYELOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Asha Kandathil, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Heglin, DO, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Whole body FDG PET/CT is indicated in the evaluation of patients with suspected multiple myeloma, for evaluation of total metabolically active disease burden and detection of extramedullary disease. 2. Lab-based multiple myeloma staging methods such as Revised International Staging System (R-ISS) and the Durie-Salmon System show improved assessment of progression-free and overall survival when paired with metabolic activity (SUVmax) from FDG PET/CT scans. 3. The Italian Myeloma Criteria for PET Use (IMPeTUs) interpretation framework has shown accurate stratification of progression free and overall survival via the metabolic characterization of active lesions and may be used for both staging and treatment response assessment. 4. FDG PET/CT is the preferred modality for assessing response to multiple myeloma treatment. 5. Alternative PET agents have shown promising results for multiple myeloma characterization, such as 11C-methionine showing higher sensitivity and accuracy compared to FDG, Ga68-Pentixafor (CXCR4) staging patients higher than FDG, and Cu64-daratumumab showing higher sensitivity and accuracy compared to FDG.

### TABLE OF CONTENTS/OUTLINE

1. Multiple myeloma staging criteria - R-ISS, IMPeTUs, and Durie/Salmon. 2. FDG PET/CT for initial diagnosis, staging and prognostication of multiple myeloma. 3. FDG PET/CT for multiple myeloma treatment response. 4. Alternate PET targets: Ga68-CXCR4, 11C-methionine, 11C-choline

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# Abstract Archives of the RSNA, 2024

NMMIEE-33

## CHARACTERIZING MUSCLE FDG UPTAKE: AN INDICATOR FOR INFLAMMATORY DISEASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ryogo Minamimoto, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

FDG uptake on PET/CT has been a valuable indicator in the diagnosis and management of inflammatory disease. This presentation explores the utility of muscle FDG uptake in differentiating between various inflammatory diseases (Dermatomyositis, Cancer-associated myositis, Sarcoidosis, Vascular disease, and Systematic inflammatory disease). Characterization of muscle FDG uptake patterns can enhance diagnostic accuracy, monitor disease progression, and optimize therapeutic interventions for patients with inflammatory diseases.

### TABLE OF CONTENTS/OUTLINE

1. Dermatomyosis, 2. Cancer-associated myositis (rectal cancer), 3. Muscle involvement in Sarcoidosis, 4. Polyarteritis nodosa (PAN), 5 .Eosinophilic granulomatosis with polyangiitis (EPGA)

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# Abstract Archives of the RSNA, 2024

NMMIEE-34

## RADIONUCLIDE LYMPHOSCINTIGRAPHY: CASE BASED MULTIMODALITY PICTORIAL REVIEW WITH TEACHING PEARLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pokhraj P. Suthar, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Sumeet Virmani, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Evaluation and management of extremity edema, lymphatic malformations and leaks, and localization of sentinel lymph nodes for certain cancer patients is challenging for both the patient and the treating physician. Radionuclide lymphoscintigraphy can be effectively used to localize sentinel lymph nodes and prove and/or rule out lymphatic causes of swelling or leak. The purpose of this case-based pictorial exhibit is to highlight the imaging spectrum of various findings of radionuclide lymphoscintigraphy in patients with extremity edema, lymphatic malformations, and leaks, and localization of sentinel lymph nodes. Clinical and other multimodality imaging correlation is provided when available.

### TABLE OF CONTENTS/OUTLINE

Our case-based multimodality pictorial review (15 cases) includes various patterns seen on both upper and lower-extremity radionuclide lymphangiograms. These include evaluating the number, course, symmetry, and intensity of lymphatic channels; timing related to visualization of draining regional nodes; the number of regional nodes visualized; dermal backflow and its severity; abnormal collaterals as suggested by visualization of popliteal and epitrochlear nodes; leaks and malformations; and protocol with helpful Tips and Pearls during the study. We also highlight its importance in anatomical localization and confirmation of lymphatic leaks and malformations and localizing sentinel lymph nodes in certain cancer patients. Multimodality correlation is provided where available.

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# Abstract Archives of the RSNA, 2024

NMMIEE-35

## UNDERSTANDING THE ROLE OF IMAGING BEFORE, DURING AND AFTER PSMA PROSTATE CANCER RADIOLIGAND THERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Katelyn Niknam (*Abstract Co-Author*) Nothing to Disclose
Ida Sonni, MD (*Abstract Co-Author*) Nothing to Disclose
Mason Life (*Abstract Co-Author*) Nothing to Disclose
Gholam R. Berenji, MD, MSc (*Presenter*) Research Grant, Siemens AG;Research funded, General Electric Company;Research funded, Lantheus Holdings;Consultant, Canon Medical Systems Corporation

### TEACHING POINTS

The prostate specific membrane antigen (PSMA) is a cell-surface glycoprotein over-expressed in most clinically significant PCa. PSMA is an ideal target for nuclear medicine theranostics applications in patients with prostate cancer (PCa), and has been widely used for the imaging (PSMA-PET) and therapy (PSMA-radioligand therapy - RLT) of patients with PCa. PSMA-RLT has emerged as a safe and effective treatment for advanced PCa. Imaging plays a crucial role throughout RLT treatment phases. Prior to PSMA-RLT it identifies those patients more likely to respond due to significant expression of the PSMA on their PCa cells. In addition to PSMA-PET, the natural pair for PSMA-RLT theranostics, FDG-PET can be useful in identifying PCa heterogeneity, that was suggested as a possible predictor of treatment response. Immediately after injection of the PSMA-RLT radiopharmaceutical and at subsequent intervals, a SPECT scan can be used to verify the distribution of the radiopharmaceutical in PCa foci, as well as quantify uptake to extrapolate dosimetric information. After completion of PSMA-RLT cycles, PSMA-PET is used to assess tumor response and monitor progression of disease.

### TABLE OF CONTENTS/OUTLINE

• Introduction to Prostate Cancer Theranostics o Clinical indications o Radiopharmaceuticals o Future directions • PSMA PET/CT prior to PSMA-RLT o Patient eligibility o FDG-PET to assess tumor heterogeneity o Assessment of disease location and extent • Quantitative SPECT after PSMA-RLT o Distribution of PSMA-RLT o Quantification and dosimetry • PSMA PET/CT post-RLT Treatment response monitoring

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# Abstract Archives of the RSNA, 2024

NMMIEE-36

## TC99M DMSA RENAL CORTICAL SCINTIGRAPHY IN CHILDREN: BEYOND UTI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marina Easty, FRCR (*Abstract Co-Author*) Nothing to Disclose
Lorenzo Biassoni, MBBS (*Abstract Co-Author*) Nothing to Disclose
Riwa Meshaka, MBChB (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Tc99m-DMSA renal cortical scintigraphy is the test of choice for renal parenchymal scarring following urinary tract infection in children at many centres globally, however its scope of use extends to numerous other indications [Vali et al., 2022]. High quality Tc99m-DMSA renal cortical scintigraphy +/- SPECT can • Characterise location and function of renal parenchyma in congenital anomalies • Evaluate upper and lower moiety differential function separately in duplex systems • Assess functioning renal parenchyma in renovascular hypertension before and after intervention.• Be used alongside low-dose CT to assess complex renal calculi and bilateral Wilms' tumours prior to urological surgery • Provide accurate parenchymal functional information in hydronephrosis, cystic disease, renal transplant, and following traumatic renal injury.

### TABLE OF CONTENTS/OUTLINE

Role of Tc99m-DMSA scintigraphy, technical aspects, limitations, interpretation pearls and pitfalls, multimodality appearance and clinical correlation in: 1. Congenital renal anomalies: renal ectopia, fusion anomalies, duplex kidney. 2. Cystic renal disease and the nonfunctioning kidney. 3. Hydronephrosis before and after urology surgical intervention 4. Vascular disease including renovascular hypertension and renal vein thrombosis. 5. Complex renal calculi6. Renal parenchymal damage after trauma. 7. Wilms' tumour for nephron-sparing surgery. 8. Renal transplant

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# Abstract Archives of the RSNA, 2024

NMMIEE-37

## REDISCOVERING QUANTITATIVE LYMPHOSCINTIGRAPHY: AN APPROACH TO THE ASSESSMENT OF LYMPHEDEMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Juliana Kim (*Abstract Co-Author*) Nothing to Disclose
Orhan K. Oz, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jaewon Yang, PhD (*Abstract Co-Author*) Nothing to Disclose
Robert C. Sibley III, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Lymphoscintigraphy (LSG) is the oldest imaging method used to evaluate the lymphatic system. Despite the demonstrated utility of newer techniques including magnetic resonance (MR) lymphangiography, near-infrared imaging, and high-frequency ultrasound, LSG remains the gold standard in the evaluation of lymphedema due to its high sensitivity (96%) and specificity (100%)1. 2. The performance of LSG is highly dependent on the quality of the study protocol and the measurements used to evaluate patients with lymphedema. 3. In this educational exhibit, we provide an illustrated overview of lymphoscintigraphy protocols, reviewing types of radiotracers, exercise interventions, and quantitative measurements, including transport kinetics calculations, which can be used to improve the assessment of patients with primary and secondary lymphedema.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to lymphedema a. Epidemiology and disease burden b. Diagnosis c. Treatments 2. Comparison of lymphatic imaging methods used to evaluate lymphedema a. Advantages and disadvantages of quantitative lymphoscintigraphy b. MR lymphangiography, near-infrared imaging, and high-frequency ultrasound 3. Review of lymphoscintigraphy protocols a. Radiotracers used b. Exercise interventions c. Timing of imaging d. Quantitative measurements i. Lymph node uptake ii. Clearance rate constant iii. Quantitative asymmetry index iv. Blood appearance rate v. Contrast-to-noise ratio for dermal backflow 4. Challenges and Opportunities a. Clinical applications of quantitative lymphoscintigraphy b. Future directions

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# Abstract Archives of the RSNA, 2024

NMMIEE-38

## EXPANDING HORIZONS IN BRAIN IMAGING: THE INTEGRAL ROLE OF NUCLEAR MEDICINE AND MRI IN DIAGNOSING AND MANAGING NEUROLOGICAL DISORDERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ukihide Tateishi, PhD (*Abstract Co-Author*) Nothing to Disclose
Junichi Tsuchiya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akane Ozawa (*Abstract Co-Author*) Nothing to Disclose
Kimiteru Ito, MD (*Abstract Co-Author*) Nothing to Disclose
Jun Oyama (*Abstract Co-Author*) Nothing to Disclose
Tomoki Imokawa, MD (*Abstract Co-Author*) Nothing to Disclose
Kota Yokoyama, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Demonstrate the broad utility of brain perfusion and neuroreceptor SPECT, radionuclide cisternography, FDG, O-gas, amino acid, and Amyloid PET in diagnosing and managing cerebral diseases.2. Illustrate the complementary roles of these nuclear medicine techniques alongside MRI to provide a comprehensive understanding of cerebral pathologies, aiding in accurate diagnosis and effective treatment planning.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: Importance of Nuclear Medicine in Brain Imaging2. Cerebrovascular Diseases: Utilizing SPECT and PET for assessing cerebrovascular disorders, with a specific focus on their roles in pre-surgical evaluation.3. Epilepsy: Detection of epileptic foci using SPECT and PET to guide surgical and therapeutic interventions.4. Brain Tumors: Application of amino acid PET and FDG PET in differentiating tumor characteristics, crucial for diagnosis and management.5. Psychiatric Disorders: Exploration of cerebral perfusion patterns in psychiatric conditions, enhancing understanding and treatment approaches.6. Inflammatory and Infectious Diseases: PET and SPECT in the diagnosis and management of encephalitis and autoimmune disorders.7. Hydrocephalus and Duropathies: SPECT's role in diagnosing and differentiating cerebrospinal fluid dynamics and related pathologies.8. Neurodegenerative Diseases: Detailed discussion on the diagnostic processes for Alzheimer's disease and other dementias using MRI, SPECT, and PET to differentiate and decide on management strategies.9. Future Perspectives: Discussion on emerging tracers with limited evidence or clinical experience that may become significant in future neuroimaging practices.

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# Abstract Archives of the RSNA, 2024

NMMIEE-39

## POST-RADICAL PROSTATECTOMY BIOCHEMICAL RECURRENCE PSA, PSMA-PET, AND SALVATION RADIATION THERAPY INTERVAL ON HIGH RISK PATIENT ALL-CAUSE MORTALITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Johnny Yang, BS, BA (*Abstract Co-Author*) Nothing to Disclose
Vani Vijayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Roux (*Abstract Co-Author*) Nothing to Disclose
Bryson Brister (*Abstract Co-Author*) Nothing to Disclose
John Hollis Tackett, BS (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Abstract Co-Author*) Nothing to Disclose
Marjorie Lam (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Discuss biochemical recurrence and treatment failure post-radical prostatectomy for prostate cancer.Assess all-cause mortality risk in salvage radiotherapy before and after PSA failure.Evaluate PSMA imaging intervals in patients with one high-risk factor (ie, pT3/4 or prostatectomy [p] Gleason score 8-10).Highlight the efficacy of 18F-DCFPyL-PET/CT over standard imaging.

### TABLE OF CONTENTS/OUTLINE

Prostate-specific membrane antigen positron emission tomography, as compared with conventional imaging (bone scan, computed tomography, or magnetic resonance imaging), seems to improve detection of biochemical recurrence in patients with prostate-specific antigen failure (PSA> 0.20 ng/mL) after salvage radical prostatectomy (sRP) for prostate cancer. Its USDA approval was backed by findings from the phase III CONDOR trial, in which 63.9% of men with PSA failure with no definitive evidence of recurrence using standard imaging had a change in management based on the 18F-DCFPyL-PET/CT findings. Prior to sRT, physicians often order a PSMA-PET scan only after PSA > 0.20 ng/mL post-sRT. This timing is chosen because PSMA-PET scans demonstrate optimal sensitivity at PSA > 0.20 ng/mL and because many insurance companies only provide reimbursement if PSA levels exceed a predetermined threshold set by the insurance company. Delaying the initiation of sRP raises concerns for elevated all-cause mortality. To improve outcomes, PSMA-PET scans should be performed within 6 months of reaching PSA failure to prevent delayed treatment while still compliant with insurance policies. This study highlights the efficacy of 18F-DCFPyL-PET/CT in guiding treatment strategies for prostate cancer patients with PSA failure.

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# Abstract Archives of the RSNA, 2024

NMMIEE-4

## HOW TO REPORT PSMA PET/CT? A REVIEW OF AVAILABLE STANDARDIZED SCORING SYSTEMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maryam Rahmani, MD (*Abstract Co-Author*) Nothing to Disclose
Vahid Yaghmai, MD, MS (*Abstract Co-Author*) Nothing to Disclose
James Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Garrett G. Ward, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedeh Niloufar Rafiei Alavi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Explain why standardized reporting is crucial for optimal diagnostic accuracy in PSMA PET/CT2) Familiarize radiologists with all different tools for reporting PSMA-PET/CT results and identify the correct application for each of them3) Describe the two most commonly used PRIMARY score and PSMA-RADS score 4) Compare the performance of different tools for various indications of PSMA PET/CT

### TABLE OF CONTENTS/OUTLINE

1) Overview of Standardized Reporting Tools for reporting PSMA PET/CT2) Provide a thorough description of the PRIMARY score, supplemented by relevant case examples.3) Explain the PSMA-RADS scoring system with case example studies. 3) Explain the RECIP 1.0, and PPP criteria for treatment response evaluation in PSMA PET/CT 4) A Comparative Review of Scoring Systems, discussing their advantages and disadvantages in different clinical scenarios.

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# Abstract Archives of the RSNA, 2024

NMMIEE-40

## CUTANEOUS MANIFESTATIONS OF NON-CUTANEOUS MALIGNANCIES ON PET-CT: A HEAD-TO-TOE PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Douglas S. Katz, MD (*Abstract Co-Author*) Nothing to Disclose
Gregg Blumberg, DO (*Abstract Co-Author*) Nothing to Disclose
Luis G. Colon Flores, MD (*Abstract Co-Author*) Nothing to Disclose
Miltiadis Tembelis, MD (*Abstract Co-Author*) Nothing to Disclose
Aranz Khalilollahi (*Abstract Co-Author*) Nothing to Disclose
Armin Mahabadi (*Abstract Co-Author*) Nothing to Disclose
Anca-Oana Kranz (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After this review, radiologists/those viewing this exhibit will be able to:• Review the cutaneous and subcutaneous (CSQ) metastatic disease patterns of different internal malignancies.• Understand what to look for in a patient's history.• Be aware of the newer therapies in CSQ and their effects on prognosis.Target audience: Medical students, radiology residents and fellows, and practicing radiologists.

### TABLE OF CONTENTS/OUTLINE

• Introduction• Head and Neck Malignancies• Thoracic Malignancies• Hepatobiliary Gastrointestinal Malignancies• Genitourinary Malignancies• Lymphoma• Sarcoma• Summary• References

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# Abstract Archives of the RSNA, 2024

NMMIEE-41

## REVIEW OF BRAIN PET/MRI WITH A FOCUS ON THE APPLICATIONS OF JOINT-RECONSTRUCTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Matthew S. Breen, MD (*Abstract Co-Author*) Nothing to Disclose
Siddhant Dogra, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy M. Shepherd, MD, PhD (*Abstract Co-Author*) Co-founder, MICroStructure Imaging
Girish M. Fatterpekar, MBBS (*Abstract Co-Author*) Nothing to Disclose
James R. Loftus, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Joint reconstruction is an advanced technique which utilizes information from both the PET and MRI data to improve image reconstruction beyond simple image fusion 2. Advantages of joint reconstruction include superior delineation of activity in cortically-based radiotracers and improved detection of motion 3. Wide applications for joint reconstruction exist across a spectrum of brain PET/MRI techniques which may allow for higher quality image interpretation

### TABLE OF CONTENTS/OUTLINE

1. Overview of Joint PET-MRI Reconstruction a. Description of technique - not just image fusion b. Advantages and pitfalls 2. Applications of Brain PET/MRI Using Joint Reconstruction a. FDG i. Neurodegenerative diseases ii. Epilepsy iii. Tumor progression versus post-treatment changes b. Amyloid-ligand c. Tau-ligand d. F-DOPA e. FET

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# Abstract Archives of the RSNA, 2024

NMMIEE-42

## GA68 PSMA PET AND MULTIPARAMETRIC MRI IN RECURRENT GLIOBLASTOMA MULTIFORME: CURRENT INSIGHTS AND FUTURE DIRECTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Liang Wang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Qiubai Li, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Multimodal Imaging Benefits Highlight the advantages of Ga68 PSMA PET/CT and mpMRI. 2. Radiotracer Selection: Explore the specific roles of Ga68 PSMA in imaging recurrent GBM. 3. Clinical Applications: Illustrate how Ga68 PSMA PET/CT and mpMRI contribute to diagnosis, treatment planning, and monitoring, facilitating personalized therapeutic strategies. 4. Challenges and Future Directions: Address challenges related to standardization, biomarker validation, and the integration of advanced analytical techniques.

### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Overview of Recurrent GBM B. Rationale for Integrating Ga68 PSMA PET/CT and mpMRI II. Multimodal Imaging Benefits A. Improved Soft Tissue Contrast B. Simultaneous Functional and Anatomical Information C. Potential for Quantitative Analysis III. Radiotracer Selection A. Ga68 PSMA PET for Assessing Tumor Metabolism B. Ga68 PSMA PET/CT and mpMRI for Evaluating Tumor Extent C. Ga68 PSMA PET/CT and mpMRI Markers for Identifying Treatment Resistance IV. Clinical Applications A. Accurate Diagnosis B. Guiding Therapeutic Interventions C. Predicting and Assessing Treatment Response V. Challenges and Future Directions A. Standardization of Imaging Protocols B. Validation of Biomarkers C. Integration of Advanced Analytical Techniques VI. Future Research Directions A. Protocol Optimization B. Conducting Validation Studies and Trials C. Tailoring Personalized Therapeutic Approaches VII. Conclusion A. Summary of Key Findings B. Implications for Clinical Practice C. Potential Enhancements in Patient Care

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# Abstract Archives of the RSNA, 2024

NMMIEE-43

## IS PSMA/PET REALLY PROSTATE SPECIFIC? AN UPDATE OF NON-PROSTATIC UPTAKE AND EMERGENT ROLE IN OTHER MALIGNANCIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Patrick Veit-Haibach, MD (*Abstract Co-Author*) Grant, Siemens AG;Speaker, Siemens AG;Travel support, Siemens AG
Roshini Kulanthaivelu, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ur Metser, MD, FRCPC (*Abstract Co-Author*) Consultant, POINT Biopharma Inc
Claudia Ortega Mogilevich, MD (*Abstract Co-Author*) Nothing to Disclose
Andres Kohan, MD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Murad, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the physiological distribution of prostate-specific membrane antigen (PSMA), and potential pitfalls. 2. To present different benign processes showing PSMA uptake with demonstrative examples. 3. To describe malignancies other than prostate cancer that are associated with PSMA uptake, and to review the emerging potential role of PET on their diagnosis and treatment.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: - What is prostate-specific membrane antigen (PSMA)? 2. Physiological distribution of PSMA and potential pitfalls: Demonstrative cases.3. Benign processes demonstrating PSMA uptake, case-based series: - Benign tumors (E.g. meningioma, solitary fibrous tumor). - Infectious/inflammatory (E.g. pneumonia, proctitis). - Bone remodeling (E.g. fracture, Paget’s disease). 4. Other malignancies showing PSMA uptake (E.g. hepatocellular carcinoma, cholangiocarcinoma, breast cancer, colorectal cancer, stomach signet ring carcinoma, adenoid cystic carcinoma, and other salivary gland tumors): - Mechanisms of PSMA uptake. - Updated evidence of PSMA/PET role on diagnosis and treatment.

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# Abstract Archives of the RSNA, 2024

NMMIEE-44

## ADVANCES IN RADIOPHARMACEUTICAL THERAPY IN NUCLEAR ONCOLOGY: EXPLORING ALPHA RPT OVER BETA RPT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Johnny Yang, BS, BA (*Abstract Co-Author*) Nothing to Disclose
Vani Vijayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
John Hollis Tackett, BS (*Abstract Co-Author*) Nothing to Disclose
Marjorie Lam (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Abstract Co-Author*) Nothing to Disclose
Nader Pahlevan, BA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the fundamental principles of alpha and beta particles including emission properties of different radionuclides and their applications- Discuss differences in alpha and beta RPT and uses for individualized patient care- Highlight new advancements in RPT and potential side effects

### TABLE OF CONTENTS/OUTLINE

Radionuclides have a wide variety of uses based on their physical characteristics. An important example is radiopharmaceutical therapy (RPT) which is when a radionuclide is used alone or ligated to a drug, protein, peptide, or monoclonal antibody for the destruction of undesirable cell lines. They are commonly used to treat hyperproliferative cancers and are especially useful in sites like bone and brain that are difficult to reach with conventional external radiotherapy due to the risk of damaging healthy cells. The radionuclides used are primarily beta-particle and alpha-particle emitters. Beta particles average a lower particle energy (PE) and linear energy transfer (LET) with a greater penetrance when compared to alpha particles that tend to have a higher PE and LET with a shorter range. Beta RPT has been available for many years, is very versatile, and is the current gold standard. Yet, new advancements are needed for more resilient cancerous pathologies. Using alpha particles could be an excellent novel therapy as recent clinical trials have shown it to be beneficial in patients where beta RPT has failed. However, some adverse effects have been observed. The approval of alpha particle therapy would broaden treatment options to allow for more individualized patient care.

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NMMIEE-5

## FEASIBILITY OF PET ANGIOGRAPHY IN TAKAYASU AORTITIS: CAN IT BE AN ALTERNATIVE TO CT ANGIOGRAPHY?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yoshifumi Nouno (*Abstract Co-Author*) Nothing to Disclose
Takuji Nanno (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Midori Fukuyama, MD (*Abstract Co-Author*) Nothing to Disclose
Keizo Murakawa (*Abstract Co-Author*) Nothing to Disclose
Emi Tateishi (*Abstract Co-Author*) Nothing to Disclose
Yusuke Terakawa, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

18F-FDG PET/CT effectively assesses active inflammatory lesions on the aortic wall in Takayasu arteritis (TAK). However, contrast-enhanced CT is still required to evaluate structural changes in the aorta, increasing radiation exposure and the risk of renal dysfunction. A digital PET/CT system equipped with Continuous Bed Motion (CBM) captures the ultra-early dynamic phase of 18F-FDG administration, enabling the acquisition of PET angiography (PET-angio). Previous reports of PET-angio indicated the usage of a higher dose of 18F-FDG than our standard dose of 2MBq/kg. In this study, we adjusted the speed of CBM and achieved PET-angio without increasing the dose of 18F-FDG. The neck-to-pelvis scan using CBM was initiated 20 seconds after injecting 18F-FDG diluted in 20 ml of 0.9% saline solution at a rate of 1 ml/s. Immediately after 18F-FDG administration, 20 ml of 0.9% saline solution was administered at the same rate of 1ml/s for flushing. The detection of radioactivity was insufficient for abdomen-to-pelvis with the fixed CBM speed of 22mm/s, resulting in unclear abdominal arteries. Adjusting the speed to 11mm/s at the level of the L3 vertebra enabled visualization of systemic arteries from the neck to the pelvis. Our combined approach of standard FDG PET/CT and the PET-angio offers clinical utility for monitoring arterial structural changes and active inflammation in TAK patients while minimizing radiation exposure and preventing contrast-induced nephropathy.

### TABLE OF CONTENTS/OUTLINE

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# Abstract Archives of the RSNA, 2024

NMMIEE-6

## PET/MRI IN MULTIPLE MYELOMA: POTENTIAL INDICATIONS, TIPS AND TRICKS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Montserrat Cortes (*Abstract Co-Author*) Nothing to Disclose
Jose A. Narvaez, MD (*Abstract Co-Author*) Nothing to Disclose
Karen Perez Alfonso, MD (*Abstract Co-Author*) Nothing to Disclose
Ivan Sanchez Rodriguez (*Abstract Co-Author*) Nothing to Disclose
Itziar Carro (*Abstract Co-Author*) Nothing to Disclose
Javier Hernandez Ganan (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The hybrid PET/MRI techniques combine the morphological information provided by MRI and the metabolic and functional data provided by 18FDG PET imaging. This makes it possible both to detect myeloma infiltration foci in the marrow and to assess prognosis and response to treatment. The objectives of this review are: - To explain the PET/MRI technique and the protocol to be used. - To explore potential indications in clinical practice. - To assess the similarities and differences of ADC values and FDG uptakes (SUV).

### TABLE OF CONTENTS/OUTLINE

- PET/MRI technique and protocol. - Diagnostic criteria for multiple myeloma: what the radiologist needs to know. - International Myeloma Working Group (IMWG) imaging recommendations: where would PET/MRI fit in? - Potential indications in clinical practice. - solitary bone plasmacitoma. - multiple myeloma with neurological symptoms or suspected spinal cord or radicular compression. - high-risk smoldering multiple myeloma. - Bone marrow imaging analysis: PET vs DWI sequences. - Tips and tricks for reporting a PET/MRI study.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

NMMIEE-7

## STATE OF THE ART OF FUNCTIONAL IMAGING IN MULTIPLE MYELOMA:WB-MRI AND PET-CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Claudio Cerchione (*Abstract Co-Author*) Nothing to Disclose
Danila Diano (*Abstract Co-Author*) Nothing to Disclose
Davide Bezzi (*Abstract Co-Author*) Nothing to Disclose
Andrea Prochowski Lamurri, MD (*Abstract Co-Author*) Nothing to Disclose
Arrigo Cattabriga (*Abstract Co-Author*) Nothing to Disclose
Alice Rossi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

According to international guidelines, patients with suspected myeloma should primarily undergo low-dose Whole Body Computed Tomography for diagnostic purposes.To optimize sensitivity and specificity and enable treatment response assessment, Whole Body Magnetic Resonance Imaging (WB-MRI) should include Diffusion Weighted Imaging with Apparent Diffusion Coefficient maps and T1-weighted Dixon sequences with bone marrow Fat Fraction quantification. At baseline WB-MRI shows greater sensitivity for the detecting focal lesions and diffuse bone marrow infiltration pattern than18F-fluorodeoxyglucose Positron Emission Tomography/Computed Tomography (PET-CT), which is considered of choice for evaluating response to treatment and minimal residual disease and imaging of extramedullary disease (EMD). Both WB-MRI and PET-CT findings have been associated with patient's prognosis. Due to tumor heterogeneity and new therapies, the most current research indicates that PET-CT and WB-MRI may play complimentary roles in providing distinct and complementary information.

### TABLE OF CONTENTS/OUTLINE

1 Introduction. 2 Updated imaging technique standardization: Italian criteria for myeloma for PET-CT use (IMPeTUS Criteria) and WB-MRI Myeloma Response Assessment and Diagnosis System (MY-RADS) guidelines. 3 PET-CT and WB-MRI for staging of myeloma patients. 4 Emerging prognostic factors on PET-CT and WB-MRI. 5 PET-CT and WB-MRI for response assessment and minimal residual disease evaluation. 6 Future perspectives: new radiotracers for PET-CT and PET-MRI. 7 Conclusion. 8 References.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

NMMIEE-8

## A GUIDE TO IMAGING BASED $^{177}$LU-PSMA-617 ELIGIBILITY CRITERIA: VISION VS THERAP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sanaz Behnia, MD (*Abstract Co-Author*) Nothing to Disclose
Delphine L. Chen, MD (*Abstract Co-Author*) Grant, Telix Pharmaceuticals Limited;Speaker, Telix Pharmaceuticals Limited
Amir Iravani, MD (*Abstract Co-Author*) Nothing to Disclose
Alireza Ghodsi, MD (*Abstract Co-Author*) Nothing to Disclose
Ridvan A. Demirci, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Theranostics agents differ from conventional chemotherapy agents by allowing objective pre-treatment eligibility assessment.177Lu-PSMA-617 is an effective and safe treatment for metastatic castration resistant prostate cancer and has been on the focus of theranostics in recent years. Landmark clinical trials, VISON and TheraP, implemented different imaging-based inclusion criteria. Understanding the details of eligibility framework is essential for accurate patient selection. This exhibit aims to provide a guide to imaging-based eligibility criterion.

### TABLE OF CONTENTS/OUTLINE

1. Understanding the trials: VISION vs TheraP a. VISION trial uses pre-treatment PSMA-PET along with contrast-enhanced CT while TheraP uses pre-treatment PSMA and FDG PET. b. Eligibility criteria set by TheraP led to higher screening failure compared to VISION trial (28% vs 12.6%). c. TheraP trial had higher PSA response rate compared to VISION trial (66% vs 46%). d. FGD-PET as an addition to the PSMA PET, may provide insights about the tumor biology by revealing tumoral heterogeneity. 2. Workflow of imaging-based VISION eligibility and case examples a. =1 PSMA positive lesion of any size in any organ AND b. No PSMA-negative lesions bigger than 2.5 cm in nodes, 1 cm in solid organs and 1 cm in soft tissue components of bone lesions. 3. Workflow of imaging-based TheraP eligibility and case examples a. At least one lesion with PSMA SUVmax =20 AND b. PSMA SUVmax = 10 in all measurable sites AND c. Absence of discordant findings between PSMA and FDG PET

RSNA 2024
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# Abstract Archives of the RSNA, 2024

NMMIEE-9

## LIVER LESIONS: THE NUCLEAR OPTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Benjamin L. Viglianti, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel J. Wale, DO (*Abstract Co-Author*) Nothing to Disclose
Brett M. Arnkoff, MD (*Abstract Co-Author*) Nothing to Disclose
Miles Lewis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. It is important for the radiologist to be familiar with the various appearances of liver lesions across common nuclear medicine exams.2. When certain hepatic lesions such as FNH and hemangiomas demonstrate atypical features on CT or MR, nuclear medicine studies can help to confirm the diagnosis.3. Newer PET agents including those targeting somatostatin receptors and PSMA have increased specificity in characterizing hepatic lesions, although there remain pitfalls.

### TABLE OF CONTENTS/OUTLINE

I. IntroductionII. Gamma Agentsa. Tc99m sulfur colloidi. Focal nodular hyperplasiaii. Miscellaneousb. Tc99m labeled RBC’si. Hemangiomac. Hepatobiliary imagingd. Pseudo-lesionsi. SVC syndromeii. Budd Chiarie. Incidental uptake on other scans - liver lesion on bone scan, sestamibi, etc.III. PET agentsa. FDGi. Infectionii. Metastasesb. DOTATATEc. PSMAIV. Conclusion

# Abstract Archives of the RSNA, 2024

NPMEE

## Noninterpretive Skills (Beyond Imaging) Education Exhibits

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

### NPMEE-1 WHO YOU GONNA CALL? GHOST (ARTIFACT) BUSTERS! REVIEWING THE ROLE OF MEDICAL PHYSICISTS IN OPTIMIZING RADIOLOGY DEPARTMENT FUNCTION AND IMAGING QUALITY

Anthony Roscoe, BSc, MSc (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Hartman, MD (*Abstract Co-Author*) Nothing to Disclose
Margaret E. Blackwood, MS (*Abstract Co-Author*) Nothing to Disclose
Nicholas Arconti, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

· Medical physicists play a critical role in ensuring departmental compliance with state and federal regulations, as well as maintaining accreditation· Physicists' expertise in image artifact troubleshooting and causative analysis serves to optimize quality assurance and improve patient outcomes· Constructing optimal imaging protocols requires medical physics expertise to ensure dose optimization· Collaboration between radiologists and medical physicists can inform departmental technology/device acquisition· As teachers, medical physicists can offer robust graduate and continuing medical education to trainee and attending radiologists

**TABLE OF CONTENTS/OUTLINE**

· An overview of our medical physicists' roles and responsibilities in maintaining departmental compliance with regulatory statutes and accreditation standards· Interesting cases within our department of imaging artifacts that were successfully diagnosed and resolved using medical physics expertise· A review of specific institutional imaging protocols (e.g. low-dose chest computed tomography) which depend on dose optimization· Several examples of recent instances of radiology-medical physics collaboration in deciding on optimal device and software acquisitions· An overview of our medical physicists' functioning as educators, including examples of radiation safety demonstrations and cases of directly educating patients with concerns about radiation exposure

### NPMEE-10 COUNTERING DEFICIT THINKING IN RADIOLOGY EDUCATION AND COMMUNITY OUTREACH USING ASSET-BASED APPROACHES

Maria D. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD (*Abstract Co-Author*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jade A. Anderson, MD (*Abstract Co-Author*) Nothing to Disclose
Natasha M. McFarlane, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• The radiology professional workforce has decreased representation of women and individuals from medically underserved groups.• Deficit-based thinking holds individual members of groups that are under-represented in medicine accountable for systemic inequities.• Implicit application of deficit thinking has continuous, negative effects on both trainees and the communities we serve.• Asset-based methods elevate the unique strengths of students and communities as resources to meet learning goals and health objectives.• Shifting to an asset-based approach is possible by intentionally integrating practical objectives into graduate medical education and community outreach.

**TABLE OF CONTENTS/OUTLINE**

A. Introductiona. Current Status of Workforce Diversity and Inclusion in Radiologyi. Radiology Professions Student Populationsb. Current Status of Imaging Disparitiesi. Populations with Decreased Access to Imaging TechnologiesB. Deficit Thinkinga. Definitionb. Common terms associated with deficit thinkingi. Medical Educationii. Community Outreachc. Outcomes associated with deficit thinkingi. Regular and normalized use of stigmatizing languageii. Impact on psychological well-beingiii. Continuation of healthcare disparitiesC. Asset-Based Approachesa. Definitionb. Potential benefits associated with asset-based approachesc. Reframing deficit narratives in medical education and community outreachd. Case examplesi. Radiology Educationii. Community Outreach

### NPMEE-11 FRAMEWORK FOR ENGAGING TRAINEES IN SUSTAINABILITY INITIATIVES USING A NATIONAL SURVEY

Charlotte J. Yong-Hing, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Sonali Sharma, BSc (*Abstract Co-Author*) Nothing to Disclose
Jimin Lee (*Abstract Co-Author*) Nothing to Disclose
Maura J. Brown, MD (*Abstract Co-Author*) Synthesis Health Inc - research collaboration, no financial relationship at this time ( Nov 2022).
Aleena Malik, BSC (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Importance of sustainability in radiology 2. Engaging trainees:- Highlight the significance of involving trainees in sustainability efforts from the beginning of their medical education.- Discuss the potential long-term impact of engaging trainees in sustainability initiatives on their future practice and leadership roles within healthcare organizations. 3. Assessing impact on trainees:- Explore current trainee attitudes and aspirations towards sustainability in radiology departments using national survey.- Describe methods for evaluating the effectiveness of sustainability initiatives on trainees' knowledge, skills, and attitudes.- Discuss the role of feedback mechanisms and continuous improvement processes in refining sustainability education and training programs for trainees.4. Integrating sustainability:- Explore strategies for incorporating sustainability principles into radiology curriculum and training programs based on a needs-assessment.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction- Significance of sustainability in radiology departments.II. Methods- Conducting a needs-based survey among radiology trainees. - Development of a sustainability framework.III. Trainee Engagement and Impact Evaluation- Educational workshops and hands-on training.- Evaluation of the impact on trainees' education and professional development.IV. Discussion- Benefits of integrating sustainability into radiology practice. - Implications for trainees and the broader healthcare system.V. Conclusion

## NPMEE-12 INTRODUCTION TO R FOR RADIOLOGISTS: APPLICATIONS IN RESEARCH, VISUALIZATION, AND PRACTICE MANAGEMENT

Ramtin Hajibeygi (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Kyle Tegtmeyer, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Coding and programming languages are an area with incredible potential value to radiologists across a range of domains, including research, statistics, image analysis and practice management. We seek to introduce radiologists to R, and provide a simple and easy to follow introduction to the R programming language. We review the process of setup and installation, options for integrated development environments (IDEs), and basics of the R language coding and syntax. We additionally seek to demonstrate relevant applications for radiologists, particularly those involved in research or academic endeavors, including statistical applications, data visualization, radiomics and machine learning. We also provide a range of applications relevant to non-academic radiologists, including statistics and modeling for practice management. Lastly, we provide a range of online resources for those interested in learning more above coding in R.

**TABLE OF CONTENTS/OUTLINE**

Topics covered include:- What is R? Introduction to the R programming language- How to download and install R- Review of available Integrated Development Environments (IDEs)- Basics of coding in R- Statistical applications for R- Data visualization with R- Radiomics applications in R- Machine Learning applications in R- Statistics and Data modeling applications for practice management and workflow optimization

## NPMEE-13 REVOLUTIONIZING RADIOLOGY EDUCATION: EXPLORING INNOVATIVE TEACHING METHODS

Omer A. Awan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Ozerk Turan (*Abstract Co-Author*) Nothing to Disclose
Izzet Altun, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1- Audience Response Systems (ARS): Utilize ARS to engage learners, assess real-time understanding, and enhance retention through interactive multiple-choice questions. 2- Flipped Classroom Techniques: Implement flipped classroom strategies to encourage independent learning and maximize in-class time for application and synthesis of concepts, simulating real-world diagnostic scenarios.3- Active Learning Strategies: Drawing anatomical structures and scrolling through diagnostic images to stimulate cognitive processing and enhance retention.4- Electronic Media: Videos, educational apps, QR codes, and social media platforms to retain knowledge, promote asynchronous learning, and engage learners outside the traditional classroom setting.

**TABLE OF CONTENTS/OUTLINE**

I. Introduction Technological advancements in radiology educationImportance of active learning approaches over traditional didactic methods II. Audience Response Systems (ARS) A. Definition B. Advantages and Challenges III. Flipped Classroom Techniques A. Concept and Implementation B. Application in Radiology Education C. Benefits and Challenges IV. Active Learning Strategies A. Drawing Anatomy B. Scrollable Images C. Application and Benefits V. Electronic Media A. Videos in Radiology Education B. Educational Apps C. QR Codes and Social Media Platforms VI. Discussion Optimizing use of innovative teaching methodsAddressing challenges and considerations for effective implementation VII. Conclusion

## NPMEE-14 SO YOU WANT TO START A NON-PROFIT: PRIVATE FOUNDATION VS. PUBLIC CHARITY - A GUIDE FOR THE RADIOLOGIST

Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Abstract Co-Author*) Nothing to Disclose
Samra Iftikhar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This primer will provide a practical overview of personal foundations and public charities, with a focus on the comparative advantages/disadvantages of each. We discuss additional strategies for each organizational style to reduce the radiologists overall tax burden. We hope this primer serves as both an introduction and inspiration for radiologists who may not have realized the incredible impact they may have via charitable work and help highlight avenues a radiologist may pursue to generate long-lasting, genuine change.Goals of Presentation:-Familiarize the radiologist with the basics of private charitable foundations and public charities (classical 501(c)3 certified non-profits)-Explore the rationale behind the creation of personal philanthropic organizations, contrasted with the drive behind most public charities-Learn about the potential tax benefits/pitfalls, regulatory oversight requirements, of both contrasting the benefits and risks and how they pertain to the radiologist

**TABLE OF CONTENTS/OUTLINE**

-Background:-Overview of the key features of private foundations and public charities-Highlight key differences between Private Foundations and Public Charities including:-Board Structure-Initial Requirements-Tax breaks and benefits-Direct contributions-Stock contributions-Real estate deductions-

Differences in regulatory oversight-Fund disbursement requirements-Contribution Strategy-Focus of organization and funding source:-Funding sources for private foundations vs. public charities-Grant disbursement to other non-profits vs. on the ground operations-Soft benefits of private foundations/public charities:-Networking-Personal fulfillment-Legacy

## NPMEE-15 PICTURE PERFECT PLANET: NAVIGATING RADIOLOGY'S ENVIRONMENTAL IMPACT AND POTENTIAL SOLUTIONS

Kasha Chen (*Abstract Co-Author*) Nothing to Disclose
Alvin Tran (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Abstract Co-Author*) Nothing to Disclose
Amir Imanzadeh, MD (*Abstract Co-Author*) Nothing to Disclose
Angellica Gordon, MD (*Abstract Co-Author*) Nothing to Disclose
Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Erwin Ho (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To present the environmental impact of radiology in terms of energy consumption, greenhouse gas emissions, and pollution.2. To discuss areas of opportunity and provide solutions on a system-wide, departmental, and individual level.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Energy Consumption in Radiology a. CTs and MRIs Energy Usage b. Strategies to Reduce Energy Consumption 3. Environmental Impacts of Radiology a. Cooling systems and Energy Needs b. Addressing Environmental Concerns 4. Artificial Intelligence a. Energy Demands of AI b. Optimization Strategies 5. Environmental Concerns with Gadolinium a. Public Health Implications b. Mitigation Techniques 6. Opportunities for Improvement a. System-wide, Departmental, and Individual Solutions 7. Conclusion

## NPMEE-16 A RESIDENT'S GUIDE TO PHYSICIAN REIMBURSEMENT

William Kirschner (*Abstract Co-Author*) Nothing to Disclose
Sophia R. O'Brien, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Richard Duszak JR, MD (*Abstract Co-Author*) Advisor, Ethos Medical, Inc;Shareholder, Ethos Medical, Inc
Frank J. Lexa, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Kari Williams, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The business of medical practice is not one of the six core competencies as defined by the Accreditation Council for Graduate Medical Education (ACGME) [1]. As a result, resident physicians may complete training without adequate knowledge of physician reimbursement and the business of medicine [1,2]. This presentation will provide a brief history of physician reimbursement, define the "Resource-based Relative Value Scale" payment system, translate the relative value unit into physician reimbursement and radiologist reimbursement and explain the physician reimbursement revenue cycle and how it applies to Radiologists.

### TABLE OF CONTENTS/OUTLINE

• Problem statement• Brief history of physician reimbursement o Usual, Customary, Reasonable rateo "Resource based relative value" (RBRVS) o Omnibus Reconciliation Act (1992)o Multiple Procedure Payment Reduction (2006)o Affordable Care Act (2010)• Resource based relative value, Relative value Unit, and Physician reimbursement o Definition and Division of the RVU. § Professional component, technical component, global payment• Conversion Factor• Geographic Practice cost index• Radiologist Reimbursement o Professional component of radiologist worko Technical component is absorbed by entity that owns capital, which may also be the physician.• Radiologist Reimbursement and Revenue Cycle o Define revenue cycle, preauthorization, and accounts receivable.o Explain the workflow from service performed to payment received.

## NPMEE-18 THE WORLD VS. THE MACHINE: BRINGING IMAGING AI TO GLOBAL HEALTH - GOOD ODDS OR BAD BETS?

Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Lina Karout, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Imaging access does not equal radiologists' availability in low-income countries (LIC). 2. Understand the landscape of currently available and approved AI applications in the context of thoracic imaging. 3. The differences in rigors of AI approval process in low- and high-income countries. 4. Possible impact of AI in global health in the context of medical imaging.

### TABLE OF CONTENTS/OUTLINE

1. Graphical summary of imaging access and radiologists' availability in the LIC. 2. Case-based illustration of available multi-vendor AI solutions and their applications in thoracic imaging. 3. Differences in how some AI tools are applied in developed and developing countries. 4. Using examples from our global imaging data from multiple countries to highlight the potentials and limitations of AI applications

## NPMEE-19 MONITORING OUR EYES: A LOOK AT COMPUTER VISION SYNDROME

Robert Hill, MD (*Abstract Co-Author*) Nothing to Disclose
Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Star Lopez (*Abstract Co-Author*) Nothing to Disclose
James Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Erwin Ho (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the pathophysiology, epidemiology, risk factors, and treatment modalities for computer vision syndrome.

**TABLE OF CONTENTS/OUTLINE**

Computer Vision Syndrome (CVS) is defined as a constellation of eye and vision symptoms that result from prolonged computer use. Symptoms include dry eyes, eye strain, headache, ocular redness, blurry vision, diplopia, and neck pain, arising due to maladaptive ocular surface, accommodative, and extraocular mechanisms. Many modalities of eye care can be employed to address CVS symptoms. Topical lubricative eyedrops and overnight ointments can rehydrate the ocular surface and create a protective evaporative barrier. Dietary supplements, namely omega-3s and blue light filtering glasses have been shown to improve clinical symptoms. Placement of occlusive punctal plugs preserves natural tears. Warm compresses via steam-chambered goggles or hot towel increase lipid layer thickness and tear film breakup time thereby improving symptoms. The ergonomic design of workstations can ease eye strain using warm, balanced lighting and appropriate monitor positioning. Finally, taking frequent and brief breaks away from screens, as outlined by the 20-20-20 rule, has been shown to improve symptoms without compromising one's duration of computer usage. A thorough understanding of the underlying causes, risk factors, and treatment options will empower radiologists to continue to work longer, more efficiently, and symptom free.

## NPMEE-2 MRI SUSTAINABILITY: UNLOCKING THE POWER OF HEAT RECOVERY IN RADIOLOGY

Daniel J. Margolis, MD (*Abstract Co-Author*) In-kind support, Siemens AG;Consultant, Promaxo, Inc
Akhil Soman (*Abstract Co-Author*) Nothing to Disclose
Filipp Alaverdyan (*Abstract Co-Author*) Nothing to Disclose
Daniel Audette (*Abstract Co-Author*) Nothing to Disclose
Lara Pes (*Abstract Co-Author*) Nothing to Disclose
Akua Amoah, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

MRI scanners play a crucial role in modern healthcare, but their operation consumes substantial energy and generates significant waste heat.To address this, a heat pump system is a potential solution to capture and repurpose MRI heat for sustainable energy utilization. Heat pumps efficiently transfer heat for heating and cooling functions depending on the direction of heat transfer.Embracing energy conservation in radiology departments holds promise for driving transformative change. Repurposed MRI heat offers a sustainable heating source and contributes to decarbonization efforts within healthcare facilities. Significant energy and heat savings are projected from the integration of heat pumps in the MRI exhaust system, with potentially millions of billions of BTU saved and up to 30% fossil fuel reduction.The question of how cost-effective this project will be cannot be overlooked. Incorporating a heat recovery system into a standard hospital building using a heat pump will cost hundreds of thousands to millions of dollars, but with eventual substantial annual savings.While this may be straightforward to apply for future MRI site designs, integration into existing MRI installation may be challenging and require additional investigation and costs, potentially taking the MRI offline for implementation.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of MRI waste heat 2. Heat pump energy recovery system 3. Potential Benefits 4. Cost Estimate 5. Pitfall

## NPMEE-20 ENHANCING RADIOLOGY PRACTICE THROUGH APPLICATIONS OF QUALITY IMPROVEMENT AND PALLIATIVE CARE IN PATIENT AND FAMILY CENTERED CARE

**Awards**
**Certificate of Merit**

Anna Luisa Kuhn, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paramesh Karandikar (*Abstract Co-Author*) Nothing to Disclose
Lyle Suh (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Understand Patient and Family-Centered Care (PFCC) principles.2. Understand the history, progress, and relevance of PFCC in radiology.3. Apply the concept of PFCC through practical models and strategies that prioritize quality care.Examples: Patient-oriented communication methods, safety and reporting protocols, cultural competency training, and interdisciplinary collaboration4. Understand PFCC in the context of palliative care in radiology.5. Understand applications of PFCC in the context of quality improvement (QI) initiatives.

**TABLE OF CONTENTS/OUTLINE**

1. Overview(a) Definition and Importance of Patient and Family Centered Care (PFCC); Review Core Principles of PFCC(b) History, Milestones, and Progress of PFCC in Radiology(c) Current challenges and opportunities for improvement2. The Relevance of PFCC in Radiology(a) Quality and value-based care(b) Patient outcomes, satisfaction, and experience(c) Communication3. Implementing PFCC in Radiology Practice(a) Building a culture and evidence-based processes(b) Overcoming Challenges and Barriers (Resistance to change, lack of resources, and competing priorities)4. PFCC and Palliative Care in Radiology Practice5. Quality Improvement for improving PFCC in Radiology6. Future Directions(a) PFCC in Practice, Research, and Training (e.g. Simulations)(b) Innovations and advancements6. Cases(a) Review scenario-based simulation illustrating successful implementation of PFCC in radiology and discuss outcomes and lessons learned

## NPMEE-21 WARREN BUFFET HAS ONE, WHY NOT YOU: THE LOGISTICS, BENEFITS, AND PITFALLS OF A PRIVATE FOUNDATION - AND WHY RADIOLOGISTS ARE WELL-POSITIONED TO START THEIR OWN

Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Ronald Gathagan, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Samra Iftikhar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

While classically associated with the ultrawealthy, the barrier for entry for creation of a personal charitable foundation is in fact much lower. Current suggested startup funding is between $250,000-$500,000, well within reach of the average practicing radiologist. We believe private foundations are a financial construct that all radiologists should be aware of as a vehicle for social impact and the construction of a meaningful legacy. This presentation will overview private foundations and aim to:-Familiarize the radiologist with the basics of personal/family run private foundations-Explore the rationale behind the creation of private philanthropic organizations-Learn about the potential tax benefits/pitfalls of this process-Increase understanding of the additional regulatory oversight that private foundations undergo-Highlight the reasons a radiologist could be interested in creating a personal foundation including and not limited to: addressing areas of personal/societal interest, global health causes, education, radiology research, etc.

**TABLE OF CONTENTS/OUTLINE**

-Background: Why chose a Private Foundation-Logistics in Setting up:-Certification Process-Initial Requirements-Contribution Strategy-Benefits:-Retention of control-Grant disbursement instead of building an on the ground operation-Networking and Investment-Traditional Focus (Disbursement of funding to various non-profit entities):-Additional Oversight:-Minimum yearly disbursement of funds-Additional investment income excise tax-Self-Dealing restrictions-Excess business holdings-Taxable expenditures-Gold Standard Examples:-Less Than Ideal Examples:

## NPMEE-22 UTILIZING THE SOCIAL ECOLOGICAL MODEL TO EXAMINE DEFICITS IN RECRUITMENT, PROMOTION, AND LEADERSHIP DEVELOPMENT OF WOMEN IN RADIOLOGY

Randy C. Miles, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Shiva Yagobian, BS (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD (*Abstract Co-Author*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Amy K. Patel, MD (*Abstract Co-Author*) Medical Advisor, Kheiron Medical Technologies Ltd;Consultant, Hologic, Inc
Franklin Iheanacho, BA (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

•Introduce the socioecological model (SEM) and its levels to explain individual-environment interactions •Examine barriers in recruitment, promotion, and leadership for women via SEM •Address the "leaky pipeline" in academic radiology for women at personal, interpersonal, institutional, community, and policy levels •Review literature on gender disparities in leadership

**TABLE OF CONTENTS/OUTLINE**

1. Socioecological Model (SEM) Introduction 1a. Outline SEM levels: intrapersonal, interpersonal, institutional, community, policy 1b. Explore women underrepresentation in radiology using SEM. 2. Positive Impact of a Diverse Workforce 3. Exploring the gender disparity at each SEM level 3a. Intrapersonal Level I. Recruitment II. Promotion II. Leadership 3b. Interpersonal Level I. Recruitment II. Promotion III. Leadership 3c. Institutional Level I. Recruitment II. Promotion III. Leadership 3d. Community/Policy Level I. Recruitment II. Promotion III. Leadership 4. Sealing the Leaky Pipeline

## NPMEE-23 AN ACADEMIC RADIOLOGIST'S ROADMAP TO SUCCESS: NAVIGATING THE WRITING PROCESS, JOURNALS, CONFERENCES, AND SOCIETY FELLOWSHIPS AND GRANTS

Maad Galal (*Abstract Co-Author*) Nothing to Disclose
Ahmed Kertam (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Quoc-Huy Ly (*Abstract Co-Author*) Nothing to Disclose
Carys Kenny-Howell (*Abstract Co-Author*) Nothing to Disclose
Jeffers Nguyen, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Because research is the currency in academia, it is imperative for aspiring academic radiologists to possess comprehensive skills and knowledge in conducting and disseminating research. However, navigating the layers of academic writing, project management, conference submissions, and journal publications can be overwhelming for novice academics.Through a systematic approach, this primer equips radiologists with the knowledge and skills necessary to excel in academic endeavors, providing guidance on literature review, data analysis, and project management. It also shares a roadmap of major conferences, journals, and grants in radiology and medicine, enhancing visibility within the academic community and facilitating effective dissemination of research findings.

**TABLE OF CONTENTS/OUTLINE**

- Skills, skills, skills: literature review, writing, citation, data analysis, and more- Lifecycle of academic projects: from conceptualization to publication-Road map of major U.S. and international conferences- Reviewer 2: Journals' impact factors, time to first decision, and acceptance rates- Academic societies' grants, fellowships, and awards

## NPMEE-24 AI X DEI: DEVELOPING A MEDICAL STUDENT CURRICULUM ON ARTIFICIAL INTELLIGENCE IN RADIOLOGY AND ITS IMPLICATIONS FOR HEALTH EQUITY

Alexander Lindqwister, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Christopher F. Beaulieu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Diamanto Rigas, MD (*Abstract Co-Author*) Nothing to Disclose
Zainub Dhanani (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Foundational Understanding in AI-Provide students with a broad foundation in AI technologies in radiology and potential impacts on diverse patient populations2. Bias Awareness and Mitigation-Equip students with the ability to identify and address bias in radiology AI applications, fosteringequitable diagnostic and treatment practices3. Cultural Humility-Emphasize importance of culturally humble AI development in radiology and its role in patient-centered and culturally sensitive care4. Policy and Governance in Radiology AI-Expose students to policy and governance aspects of healthcare AI in radiology, preparing them to advocate for ethical and equitable AI practices in radiology settings5. Emerging Technologies-Explore emerging AI technologies in radiology and implications for the future of radiology, empowering students to stay at the forefront of radiology innovation

**TABLE OF CONTENTS/OUTLINE**

Intro to AI: AI Terminology, Computational Basis of AI, Types of Data, Types of Algorithms/Models, AI for RadiologyAI Pitfalls and Risks: Limitations to AI/ML, Curse of Dimensionality, Validation for AI models, Bias in AI models, Health Equity Issues and Examples, Approaches to Mitigating BiasHuman and Machine Bias in AI Models: Data Curation/Sourcing Bias, Data Annotation and Visualization Bias, Training Dataset Bias, Model and Metric Bias, Inherited Bias, Cognitive Bias, Algorithm Deployment Bias, Evaluation Bias, Complacency in Automation Bias, Statistical Bias, Detection BiasBuilding AI Models: Determining your question, Dataset development, Dataset audits, Training/testing models, Understanding model outputs, Bias audits, Evaluating efficacy and accuracy, Legal Compliance

## NPMEE-25 BRAVING THE AI SURGE-EQUIPPING RADIOLOGY RESIDENCIES FOR TOMORROW'S CHALLENGES

Henrique M. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Amit Kumar (*Abstract Co-Author*) Nothing to Disclose
Swati Goyal (*Abstract Co-Author*) Nothing to Disclose

Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Vasantha Kumar Venugopal, MD (*Presenter*) Officer, CARPL.AI Inc

**TEACHING POINTS**

1. Deep dive into how AI is currently used in radiology, its capabilities, and its limitations, preparing residents for realistic applications and expectations.2. Emphasizing the importance of recognizing and mitigating biases in AI algorithms, and understanding the ethical implications of automated decision-making.3. Advocating for a balanced educational approach that combines AI tools with traditional hands-on learning to foster a comprehensive skill set.4. Highlighting the need for ongoing education in AI developments, ensuring that residents remain adept as technology evolves.5. Cultivating critical diagnostic skills that complement AI-driven data, ensuring residents can effectively interpret and question AI outputs.

**TABLE OF CONTENTS/OUTLINE**

Overview of AI technologies impacting radiology.Case studies of AI tools improving resident performance and engagementIdentifying and overcoming potential pitfalls such as over-reliance and diminished problem-solving skillsStrategies for teaching ethical considerations and algorithm transparencyEducational Strategies for AI Preparedness -Developing curricula that incorporate AI learning, including simulation-based training and AI-assisted diagnosticsThe role of mentorship and faculty development in an AI-enhanced educational environmentFuture Perspectives and Preparing for Change

## NPMEE-26 THINK LOCAL, ACT GLOBAL: INCORPORATING GLOBAL RADIOLOGY INTO YOUR PRACTICE

Karen Chetcuti, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
John Phalula, BMBS (*Abstract Co-Author*) Nothing to Disclose
Benjamin Brown, BS (*Abstract Co-Author*) Nothing to Disclose
Katrina A. McGinty, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

After reviewing this presentation, the learner will be able to1. Better understand and describe the disparity in radiology resources worldwide.2. Describe the pros and cons of different methods of involvement in global radiology.3. Understand the role of remote or hybrid involvement in radiology capacity building in low- and middle-income countries as a sustainable and effective means of improving radiology access4. Be prepared to take the next steps to sustainably and seamlessly incorporate global radiology into his/her/their practice

**TABLE OF CONTENTS/OUTLINE**

1. Overview of the need for global radiology2. Discussion of different approaches to global radiology, their strengths and challenges. This will include a discussion of equipment donation, in person visits and virtual support.3. Emphasize the importance of longitudinal projects and capacity building for improving radiology services worldwide.4. Describe hybrid or virtual approaches to global radiology, including current collaborations between an academic medical center in the Southeastern USA and a radiology program in Sub-Saharan Africa. Highlighted projects will include multidisciplinary tumor boards, peer learning conferences between the two residencies, lecture delivery and a supported hands on MRI curriculum. Discussion will focus on program building, program maintenance, measurements of success or failure and the importance of quantifying impact.5. Review topics covered and offer guidance for next steps to incorporate global radiology into one’s professional practice.

## NPMEE-27 METRICS AND INDICES AND SCAMS, OH MY: JOURNAL QUALITY CONSIDERATIONS FOR YOUR QUALITY RADIOLOGY MANUSCRIPT

Thea C. Moran, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. It's hard to efficiently select a journal for manuscript submission with the abundance of journal options in the current open-access landscape. Knowing how to efficiently find, and assess, journals for quality, chance of acceptance, and visibility benefits not just researchers, but patients and the public. 2. Journal metrics must be interpreted in terms of what they're supposed to indicate and their imperfections. 3. Many indices include radiology journals. Journals listed in multiple indices have better visibility but indices' inclusion criteria vary. 4. Megajournals are publishing options for radiology manuscripts; however, they're controversial. It's uncertain what their place will ultimately be in scientific publishing. 5. Predatory journals/publishers are best avoided. Well-known red flags exist. Publishing association directories list publishers who adhere to best practices.

**TABLE OF CONTENTS/OUTLINE**

1. Academic publishing overview. History, kinds of literature, who it affects and how. 2. Journal quality indicators a. Metrics What are they, their meaning(s)/weaknesses. b. Indices What are indices/databases, journal selection criteria, how they help visibility, PubMed/PubMedCentral/Medline, what indices list radiology journals 3. Predatory journals What are they, why are they a problem (for healthcare, authors, society), how to recognize and resources to help avoid 4. Megajournals What are they? Criteria? Controversies. Megajournals that have published radiology manuscripts 5. Personal and electronic means to form a list of potential journals - journal finders, scientific associations, mentors, peers, librarians, journals you review for. 6. Summation/take home points

## NPMEE-28 HOW TO BRING RADIATION SAFETY AND PHYSICS EDUCATION TO LIFE WITH A HANDS-ON FLUOROSCOPY TRAINING

Eduardo Thadeu De Oliveira Correia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
David W. Jordan, PhD (*Abstract Co-Author*) Nothing to Disclose
Lauren Fane, BEng (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Radiation protection and related physics can be taught interactively in an IR suite with simple supplies that medical physics departments have.2. A hands-on fluoroscopy training can demonstrate the distribution of scattered radiation, impact of equipment positioning, and effect of shielding.3. Radiation protection training early-on, before IR rotations can improve resident satisfaction, competence in protecting themselves and patients, and their physics and safety knowledge.

**TABLE OF CONTENTS/OUTLINE**

An interactive radiation protection training can be created with minimal supplies outside of an IR suite with a c-arm: area survey meter, RaySafe X2 with R/F sensor, lead aprons, and acrylic blocks to simulate patients.A hands-on fluoroscopy training can demonstrate radiation safety and physics concepts:1. Distribution of scattered radiation and variation based on size of body region / size of patient imaged and different orientations of the radiation source2. Patient distance from x-ray source impacts patient radiation dose, scatter, and image contrast, because the x-ray beam diverges.3. How much radiation is attenuated by shielding (lead aprons, barriers/boards/walls)This training improved residents' radiation safety knowledge and attitudes in a single-

institution, prospective study.1. Sustained increases in residents' confidence in protecting themselves and comfort in raising concerns to faculty2. Catered to a baseline deficit in concepts that are better demonstrated than discussed3. Increased radiation safety knowledge temporarily. More can be done during procedural rotations to reinforce safety practices and concepts

## NPMEE-29 TRAUMA-INFORMED CARE: SHAPING THE FUTURE OF RADIOLOGY PROCEDURES

**Awards**
**Certificate of Merit**

Janet E. Bailey, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Klein, MD (*Abstract Co-Author*) Nothing to Disclose
Angelica Alexopoulos (*Abstract Co-Author*) Nothing to Disclose
Sydney J. Torres, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the prevalence of trauma within the patient population and identify types of traumatic experiences patients may have faced.
- Recognize clinical warning signs that indicate a patient may have a history of trauma and identify potential triggers in radiology procedures.
- Explore a universal trauma-informed care approach and its general principles within healthcare, according to the Substance Abuse and Mental Health Services Administration (SAMHSA) and other expert recommendations.
- Provide an actionable framework applicable to clinical practice including before, during, and after procedures to increase patient comfort and patient-centered care within radiology.

### TABLE OF CONTENTS/OUTLINE

- Terminology: What is trauma and trauma-informed care?
- Clinical warning signs that a patient may have a history of trauma
- Potential triggers in radiology
- The Four R's: Definition of a trauma-informed approach
- The key principles of a trauma-informed approach
- A framework for best practices and recommendations to avoid retraumatization in radiology procedures
- Future areas to explore

## NPMEE-3 LLM HANDS-ON: GETTING START OF LLM PROGRAMMING IN PYTHON

Atsushi Teramoto, PhD (*Abstract Co-Author*) Nothing to Disclose
Kippei Isaji (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The emergence and advancement of large language models (LLMs) have made it possible to automate many tasks. These models are integrated into various services, and many users may already have experience interacting with them. However, opportunities to implement publicly available LLMs are limited. The purpose of this exhibit is to teach how to easily implement and fine-tune publicly available LLMs.

### TABLE OF CONTENTS/OUTLINE

Outline: The main teaching points of this exhibit are as follows: 1. LLMs pre-train on vast text data to gain general language knowledge. 2. In recent years, many LLMs have been developed. 3. LLMs have many potential applications in medical settings. TABLE OF CONTENTS: 1. What are LLMs? 2. Use Cases 3. Hands-on Session

## NPMEE-30 PATIENT-REPORTED OUTCOME MEASURES: WHAT THEY ARE, AND HOW THEY CAN BE USED TO IMPROVE PATIENT-CENTRED CARE IN RADIOLOGY

Andrea S. Doria, MD, PhD (*Abstract Co-Author*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)
Rakhshan Kamran (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Review the development, validation, and implementation of patient-reported outcome measures (PROMs), which should be the pillar of today's and tomorrow's radiological services to patients. 2) Explore benefits of PROMs to advance patient-centeredness of radiology, along with ethics and future directions.

### TABLE OF CONTENTS/OUTLINE

Radiology should be "patient-centered", but few initiatives exist assessing value creation and patient outcomes in radiology. PROMs can help advance patient-centeredness and value measurement in radiology. This presentation will cover how PROMs can be used in radiology. 1) Introduction to patient-reported outcome measures (PROMs). a) Overview, significance in radiology. b) Capturing patients' perspectives. c) Patient-centred care and demonstrating value of radiology. 2) Development of PROMs. a) Overview and examples of PROMs. b) Importance of patient involvement. 3) Validation of PROMs. a) Methods: validity, reliability, responsiveness. b) Overview of psychometrics. 4) Types of validity. a) Content, criterion, construct. b) Examples of validity assessment. 5) Implementation a) Strategies for PROM implementation. b) Discussion of challenges. 6) Benefits a) Improved communication, monitoring, patient-centred care. b) Research and quality improvement. 7) Case studies. a) Successful cases. b) Real-world experiences. 8) Ethical considerations. a) Confidentiality, consent, cultural sensitivity. b) Risks and limitations. 9) Future directions. a) Emerging trends, technology. b) Research areas, collaboration opportunities. 10) Conclusion a) Summary emphasizing PROMs' importance in improving patient-centred care and demonstrating value in radiology.

## NPMEE-32 ANATOMICALLY ACCURATE AND FLUOROSCOPICALLY VISIBLE 3D-PRINTED SPINAL MODEL FOR LUMBAR PUNCTURE SIMULATION AND TRAINEE EDUCATION

Mina Mousa, MD (*Abstract Co-Author*) Nothing to Disclose
Summer J. Decker, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Ford, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael Markovitz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Impact on Procedural Skills, Confidence and Error Reduction: Improve practical skills through hands-on experience with 3D-printed models to build confidence and reduce errors and complications. 2. Advancements in Simulation-Based Training: Learn about limitations of existing simulations and the need for more anatomically accurate, tactilely realistic, and fluoroscopically visible models. Highlight the design and composition of our 3D-printed lumbar spine model. 3. Standardization of Medical Education and Future Aims: Understand the potential benefits on medical trainee competence and patient safety. Establish a standardized training protocol for residents, fellows, and visiting students with the potential for broader applications in other medical fields and institutions.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction/Background • Need for hands-on medical training and role of 3D printing in addressing this gap; • Challenges and limitations of current training and simulation models; 2. Materials/Methods • Design and printing process of our 3D-printed model; • Material selection for realistic tactile feedback and fluoroscopic contrast visibility; • Implementation in training settings; 3. Results • Initial qualitative feedback; • Observations on usability and authenticity compared to traditional models; 4. Discussion • Impact on trainee competence and confidence; • Implications for patient safety and procedural success; • Considerations for further research and model refinement; 5. Conclusion: • Innovative aspects and potential benefits of the 3D model; • Future steps for controlled efficacy studies; • Potential adaptation for other procedures, medical fields and institutions

## NPMEE-33 BALANCING ACCESS AND ANXIETY: THE CHALLENGES AND OPPORTUNITIES OF IMMEDIATE RESULT RELEASE

Shoichi Maeda (*Abstract Co-Author*) Nothing to Disclose
Eri Ishikawa (*Abstract Co-Author*) Nothing to Disclose
Evgeny Pavlushkov, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jay Starkey, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- The 21st Century Cures Act requires immediate patient access to electronic health information, including radiology reports
- Radiologists must adapt to increased patient communication and shared decision-making
- Proactive guidance and clear reporting can ease patient anxiety about results
- Radiology practices should leverage technology to provide user-friendly patient resources
- Equitable access to health information remains a concern for older and low-income patients

**TABLE OF CONTENTS/OUTLINE**

I. Introduction• 21st Century Cures Act overview• Impact on radiologyII. Current State of Information Blocking in 2024• Implementation successes and challenges• Radiologist experiences and patient feedback• Evolving legal and regulatory landscapeIII. Benefits and Drawbacks of Immediate Result Access• Patient empowerment and shared decision-making• Potential for patient anxiety and confusion• Liability considerations for radiologistsIV. Best Practices for Patient-Centered Radiology• Proactive communication and expectation-setting• Clear, patient-friendly reporting style• Radiologist availability for direct patient questions• Leveraging AI tools for patient educationV. Ensuring Equitable Access• Challenges for older and low-tech-literacy patients• Socioeconomic barriers to portal use and internet access• Strategies for inclusivity and alternative communicationVI. Future Directions and Recommendations• Enhanced EHR interoperability and data sharing• Workflow changes to facilitate patient interaction• Payment models to support radiologist time spent on patient care• Ongoing patient outreach and educationVII. Conclusion

## NPMEE-34 A REVIEW OF THE MEDICAL USE OF ULTRASOUND IN SPACE

Abid Bashir (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To explore space medicine and use of ultrasound in spaceWhy do astronauts use ultrasound in space To diagnose and treatAstronauts training for use of ultrasoundLimitations of using ultrasound in spaceEquipment usedHow can we benefit from use of ultrasound in spaceUltrasound is a well proven diagnostic modality on earth and a versatile diagnostic imaging tool in space, why space applications.Space Applications terrestrial application development ultrasound applications in microgravity. French compact doppler system.

**TABLE OF CONTENTS/OUTLINE**

1. When was ultrasound first recognised as the main imaging tool in space. ?physiology of human body in space and the microgravity induced changes in physiology.2. What training is required to be competent3. What equipment is used4. What are the limitations5. Advanced Diagnostic Ultrasound in Microgravity6. Impact of space ultrasound on science and medicine6. ADUM Study advanced diagnostic ultrasound in microgravity7. WINFOCUS World Interactive Network Focused on Critical Ultrasound (WINFOCUS),NASA,s extreme environment Mission Operation (NEEMO)Future Applications

## NPMEE-35 ENHANCING SPACED REPETITION WITH LARGE LANGUAGE MODELS FOR RADIOLOGY EDUCATION: A PILOT STUDY TO EXPLORE ARTIFICIAL INTELLIGENCE (AI) CAPABILITY, PRACTICALITY AND INTEGRATION

Ryan J. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Long Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph Nenow, MD (*Abstract Co-Author*) Nothing to Disclose
Eric Li, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Spaced repetition systems have been acknowledged for improving knowledge retention, competency, and academic performance in medical education. Anki is a flashcard-based software platform, popular among medical trainees, that employs spaced repetition and active recall.-However, limitations exist in spaced repetition learning, including substantial time required for content creation, potential cognitive overload, and lack of customization. Large Language Models (LLMs) present a solution to these challenges by leveraging capabilities such as text summarization and structured data extraction to produce personalized educational content.-This pilot study evaluates the effectiveness of LLMs in enhancing Anki flashcard materials for radiology residents. We used a detailed scoring rubric, aligned with established content creation practices, to assess the ability of LLMs to generate relevant, useful educational materials within a spaced repetition framework.-Our findings explore the practicality and limitations of integrating LLMs into the educational workflows of radiology training, aiming to improve the accuracy, relevance, and customization of learning resources.

**TABLE OF CONTENTS/OUTLINE**

1. Generala. Existing workflows in medical/resident education2. Large Language Models (LLM)a. Third party LLMs (e.g. ChatGPT, Gemini, Llama)b. Role of LLM in medical education3. Pilot Studya. Intent/Designb. Methodologyc. Resultsd. Considerations (e.g. weighted scoring, pilot study scaling, rubric

standardization)4. Integration practicalitya. Conferences/lecturesb. Workstation learningc. Limitations and workarounds5. Implicationsa. Personalized learningb. Future Direction

## NPMEE-36 HARNESSING SOLAR ENERGY - SCIENCE OF LEARNING APPLIED TO RADIOLOGY

Joseph W. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine Copely, MD (*Abstract Co-Author*) Nothing to Disclose
Fara Y. Shikoh, MD (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Andres R. Ayoob, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Although physicians dedicate their lives to learning, most spend little, if any, time understanding the scientific underpinnings of the learning process.As a result, most often rely on personal experience, intuition, opinions, or the latest fad to inform how they learn, frequently leading to ineffective and inefficient practices as well as frustration. This may be particularly detrimental as an ever-expanding body of medical knowledge and rapidly-evolving technologies render the process of life-long learning a necessity for physicians.Fortunately, recent research into the psychological and physiological principles behind learning have led to a number of evidence-based principles proven to enhance the learning process. This has important implications for all - trainees preparing for licensure examination and independent medical practice, practicing radiologists keeping abreast of current knowledge and technologies, and those involved in design and delivery of continuing medical education activities.Understanding these evidence-based learning strategies and how to apply them to radiology education can facilitate knowledge acquisition, promote life-long learning skills, and improve patient outcomes.

### TABLE OF CONTENTS/OUTLINE

Review of how memory works (encoding, storage, and retrieval)Illustration of evidenced-based principles to improve recall: active learning, retrieval practice/testing effect, spaced learning, interleaving, deliberate practice, metacognition, feedback, and real-world applicationsDescription of practical tips to integrate these strategies into daily practice, from trainee education to continuing medical education

## NPMEE-37 ENSURING PATIENT SAFETY: A COMPREHENSIVE APPROACH TO RADIOLOGICAL ERRORS

**Awards**
**Certificate of Merit**

Shoichi Maeda (*Abstract Co-Author*) Nothing to Disclose
Eri Ishikawa (*Abstract Co-Author*) Nothing to Disclose
Evgeny Pavlushkov, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jay Starkey, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Teaching Points:
- Understand the ethical, legal, and safety implications of errors in radiology
- Learn best practices for responding to and mitigating errors
- Encourage a culture of transparency, accountability, and continuous improvement

### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline:
- Introduction
- Importance of addressing errors in radiology
- Types of errors (interpretation, missed findings, wrong studies, etc.)
- Ethical Considerations
- Duty to disclose errors to patients and referring physicians
- Balancing transparency with patient well-being
- Maintaining trust and integrity in the profession
- Legal Implications
- Potential malpractice liability
- Informed consent and patient communication
- Documentation and reporting requirements
- Patient Safety
- Impact of errors on patient outcomes
- Strategies for error prevention and mitigation
- Implementing safety protocols and checklists
- Responding to Errors
- Immediate actions (communicating with patients, referring physicians, and colleagues)
- Root cause analysis and system improvements
- Emotional support for healthcare professionals involved
- Quality Improvement Initiatives
- Encouraging a culture of safety and transparency
- Empowering radiologists and trainees to identify and report errors
- Collaborative efforts across specialties to enhance patient care
- Conclusion
- Summarize key points and best practices
- Emphasize the importance of a proactive, patient-centered approach to error management

## NPMEE-38 NEXT-GENERATION TB SCREENING: AI-DRIVEN ACTIVE CASE FINDING WITH PORTABLE CHEST RADIOGRAPHS - A RADIOLOGY REVOLUTION OR ROUTINE EVOLUTION?

Abhinav Jain, MD (*Abstract Co-Author*) Nothing to Disclose
Mehvash Haider (*Abstract Co-Author*) Nothing to Disclose
Amit Kumar (*Abstract Co-Author*) Nothing to Disclose
Vasantha Kumar Venugopal, MD (*Presenter*) Officer, CARPL.AI Inc

**TEACHING POINTS**

1. Studies show that AI algorithms can achieve sensitivity and specificity that meet or exceed WHO's Target Product Profile for TB triage tests, significantly outperforming human radiologists in settings with high TB burdens? 2. Portable chest radiographs combined with AI analysis enable rapid on-site TB screening reducing the delay from screening to diagnosis3. AI algorithms have been shown to reduce the number of Xpert tests required by 50% while maintaining a sensitivity above 90% 4. The STOP TB Partnership highlights AI-powered CAD's role across diverse settings, with case studies from India, Pakistan, Cambodia, Vietnam, Uganda, and Nigeria illustrating varied implementation challenges and successes.5. ACF Metrics Effective ACF is measured by specific metrics, e.g., in India: screening 10% of the population, testing 4.75% of those, diagnosing 5% of those tested, aiming for an NNS (Number Needed to Screen) below 1,538

**TABLE OF CONTENTS/OUTLINE**

Introduction to AI in TB Screening - Overview of the integration of AI with portable chest radiography in enhancing TB detection.Global Case Studies - Insights from Northeast Nigeria, implementations in Indonesia and India.Evaluation of AI in Screening Programs - Discussion on the evaluation of AI technologies in TB screening, including studies from the STOP TB Partnership and WHO guidelines on the use of AI in detecting TB from chest X-rays.Challenges and Ethical Considerations - Consideration of potential biases in AI algorithms, and the ethical implications of widespread AI deployment in healthcare.Conclusion Impact of AI-driven portable chest radiography in TB active case finding.

## NPMEE-39 THEORY OF CONSTRAINTS IN RADIOLOGY

Danilo Sirias (*Abstract Co-Author*) Nothing to Disclose
James V. Rawson, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

There are many approaches to process improvement. Common approaches used in Radiology include Lean and the Plan Do Study/Check Act cycle. The Theory of Constraints was described by Eli Goldratt in The Goal in 1984 taking an operations management approach to flow. The premise is that in any complex system, there are only a few rate limiting steps. Improvement efforts on a step, which is not rate limiting to the over flow in the organization, will increase throughput at that individual step. However, those gains will simple queue up at the constraint, so there will be no system level improvement in flow. A constraint can be a piece of equipment, personal or even a policy. For example, in Radiology, backlogs for outpatient appointments point to a constraint. A constraint is often an expensive, hard to duplicate resource. In the past in Radiology, this was often the equipment and could be approached by optimizing utilization of the equipment. In today’s world of radiology staff shortages, the staff may be the constraint. In this exhibit, we review how to optimize the constraint to improve throughput in Radiology.Teaching Points • In any complex system, there are only a few rate limiting steps/constraints. • An hour of time lost at a bottleneck is an hour lost for the system. • An hour saved at a non-bottle-neck does not improve throughput. • Buffers can be used to protect the constraint and increase utilization of the constraint (throughout).

**TABLE OF CONTENTS/OUTLINE**

I. Theory of Constraints defined II. Constraints and Rate Limiting Steps III. Five Focusing Steps IV. Improving Throughput V. Financial vs Flow Accounting VI. Next steps for Radiology

## NPMEE-4 TOWARDS GREENER IMAGING: EVALUATING SUSTAINABILITY IN TECHNOLOGY PROCUREMENT

Laura Mosteiro, MD (*Abstract Co-Author*) Nothing to Disclose
MARIA AMPARO VILLAVERDE GOMEZ, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Enjamio, PhD, MEng (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The modernisation of advanced technological equipment in our healthcare systems requires a holistic approach to procurement that takes into account the evolving challenges posed by climate change, together with technological advances and sustainability imperatives. In a public health service environment, technology procurement requires strategic planning that integrates service needs, clinical and organisational objectives, financial resources and sustainability criteria.This publication aims to critically assess the adequacy of equipment procurement criteria set out in national or regional plans, with a two-pronged approach:1. The breadth and depth of incorporation of renewal or endowment criteria associated with the life cycle of equipment, covering maintenance, operating and environmental costs. This includes the deliberate consideration of end-of-life disposal processes to mitigate environmental impact and advance sustainability goals.2. 2. The effectiveness of the implementation or subsequent monitoring of these criteria, ensuring compliance with established sustainability benchmarks and expectations, thereby promoting responsible financing.Ultimately, this study aims to provide insights into the strategic integration of objective sustainability criteria into technology procurement decisions.

**TABLE OF CONTENTS/OUTLINE**

1. Context and introduction2. Objectives3. Methodology 4. Results5. Discussion and conclusions

## NPMEE-40 ORGANIZATIONAL RESILIENCE IN RADIOLOGY

Omar Msto Hussain Nasser, MD (*Abstract Co-Author*) Nothing to Disclose
Bettina Siewert, MD (*Abstract Co-Author*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv
James V. Rawson, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Even before the COVID-19 pandemic there was much discussion about resilience. This was usually discussed in the content of burnout and focused on the resilience of the individual. More recent literature in radiology looks at the leadership and system drivers of burnout shifting some of the responsibility for burnout off of the individual. In the recent revision of the Malcolm Baldrige National Quality Award criteria, one of the frameshifts was to look for evidence of organizational resilience. We review the concepts of individual and organizational resilience and look at key performance indicators that Radiology practices can assess to identify opportunities to improve organizational resilience. Teaching points • In addition to individual resilience, organizations can be resilient. • Organizational resilience is not the sum of the resilience of the individuals in the organization. • Other organizational processes contribute to the ability to survive or even thrive/transform when faced with shock, disasters and crisis. • Key performance indicators/metrics with benchmarks and trends over time can be used by Radiology practices and hospitals to identify where there is opportunity to improve their organizational resilience.

**TABLE OF CONTENTS/OUTLINE**

I. Burnout and Moral Injury II. Individual Resilience III. Multifactorial approach to Burnout IV. Organizational Resilience V. Measure of Organizational resilience VI. Opportunities for Radiology

## NPMEE-41 COOKING UP ULTRASOUND PHANTOMS: A HOW-TO GUIDE

Logan M. Ryals, BS (*Abstract Co-Author*) Nothing to Disclose
Nader Pahlevan, BA (*Abstract Co-Author*) Nothing to Disclose
Thomas Powell (*Abstract Co-Author*) Nothing to Disclose
Charlotte Taylor, MD (*Abstract Co-Author*) Nothing to Disclose
Clinton Case (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Relay the importance of using US phantoms in teaching residents, medical students, and radiologists how to perform US-guided procedures.Provide step-by-step instructions for the creation of home-made US phantoms which may be used for demonstrations.

**TABLE OF CONTENTS/OUTLINE**

Ultrasound (US) is vital in diagnosing and treating disease, so providing quality US instruction to radiology residents to build proficiency and confidence in performing US-guided procedures is important. US phantoms are often employed to teach the basics of thyroid biopsy, breast biopsy, intravascular access, etc. Additionally, the use of US phantoms has enhanced student outreach, allowing for increased engagement within student-run interest groups. However, purchasing high quality US phantoms from a commercial vendor is often costly, and they must be replaced over time due to wear and tear. An alternative is to create "homemade" US phantoms using gelatin and other household materials. There is no standard recipe for creating homemade phantoms, and few step-by-step resources exist for radiology educators to create high-quality phantoms. Three types of phantoms will be discussed: a 3-layer amniocentesis/paracentesis abdominal phantom, a vessel phantom, and a breast biopsy phantom. A resource for creating breast biopsy and vascular access phantoms will be beneficial given that the ACGME will soon require breast biopsy and vascular access procedural competency for radiology residency graduation. In addition to providing instructions for creating US phantoms, demonstrations will be outlined, including probe placement, basics of scanning and probe types, US-guided fine needle aspiration, and student interest group activities.

## NPMEE-42 AN ULTRA SOUND IDEA: A SINGLE CENTER EXPERIENCE OF LONGITUDINAL, INTEGRATED POINT-OF-CARE ULTRASOUND CURRICULUM IN UNDERGRADUATE MEDICAL EDUCATION

Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Sohrab Kharabaf, BS (*Abstract Co-Author*) Nothing to Disclose
Monica Gerges (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Detail a single center longitudinal, integrated point-of-care ultrasound (POCUS) curriculum in undergraduate medical education, with sampled scanned cases and subjective feedback from student participants.Underscore benefits of such a curriculum, including health equity.

**TABLE OF CONTENTS/OUTLINE**

Our institution provides every medical student a handheld POCUS device, Butterfly iQ (made by Butterfly Network, Inc. based in Guilford, CT), which is used in concert with courses. Preclinical students complete biweekly teaching sessions and assessments that cover technical skills, clinical correlates, and image-guided procedures of all organ systems. Artificial intelligence-driven live teaching tools within Butterfly iQ guide students to obtain high quality scans. A supplementary ultrasound (US) scanning elective is also offered. Students on rotations complete select US views to demonstrate competence. Impact of this curricular program is gauged with subjective metrics. Many studies show that early exposure to POCUS training enhances anatomic knowledge and diagnostic skill. Data gathered by our institution reveals students felt more confident and demonstrated improved objective competence in obtaining US views after completing just one US elective session. Mastering such skills benefits a clinician's career, facilitating quicker, more accurate diagnoses. Handheld POCUS empowers students to improve health disparities. Our institution's novel approach to providing its medical students a longitudinal POCUS curriculum may serve as a best-practice guideline for other institutions seeking to enhance anatomic understanding, clinical skills, technological literacy, and health equity.

## NPMEE-43 CREATING AN INCLUSIVE IMAGING DEPARTMENT - SUPPORTING NEURODIVERGENT PATIENTS ON THE IMAGING JOURNEY

Magda Coetzee (*Abstract Co-Author*) Nothing to Disclose
Michelle Phillips (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Neurodiversity is an umbrella term for the different conditions that describe variations in the way human brains process information. The challenges faced by those with neurodiverse conditions can make attending imaging departments and undergoing examinations difficult. We have a duty of care to all patients; it is important to increase awareness of neurodiversity and offer practical advice to radiography professionals to improve their skills and offer an inclusive service.

**TABLE OF CONTENTS/OUTLINE**

The poster explains the challenges faced by neurodivergent patients - examples include executive function challenges, communication problems and issues with sensory overload. Further challenges are broken down by specific modality such as the intimate nature of mammography and the noise, confined space and necessary stillness of the Magnetic Resonance Imaging (MRI) scanner. This is followed by practical advice to ensure a better more understanding imaging service. Including - Working on the principle that everyone is to be treated with respect and no one is to be assumed to be unintelligent or incapable. Listen to your patients, use simple and direct language and give time for replies. Offer various methods of communication. Allow patients to see, touch and/or hear the equipment prior to their examination. The poster covers challenges adhering to the advice above but concludes with benefits of providing a service which is as accessible and smooth to as many as possible.

## NPMEE-44 ETHICS OF CARE IN RADIOLOGY: A PRIMER FOR EVERYDAY PRACTICE

Juliana M. Bueno, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Lin (*Abstract Co-Author*) Nothing to Disclose
Kaelin Cockrell, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

There is a misconception that medical ethics is less relevant to radiology due to the limited direct patient-physician interaction. However, radiologists face ethical dilemmas during their daily workflow, which are difficult to recognize as they involve technology, systems, and stakeholders beyond patients themselves. Lack of awareness of radiology specific ethical challenges is a barrier to quality clinical care. This exhibit illustrates radiology-specific ethical dilemmas through case-based examples to increase awareness and provide support to solving these everyday challenges.Teaching points: 1) Recognizing the key ethical principles that govern clinical care allows us to recognize situations at risk of ethical violation. 2) Awareness and knowledge of the

challenges that spring from each of the ethical principles is paramount. 3) The ethical challenges faced in diagnostic radiology are complex as they involve components of the system that are beyond the patients themselves. 4) A systematic approach to ethical problem-solving is necessary for the practice of radiology

**TABLE OF CONTENTS/OUTLINE**

1. Refresher on key clinical ethical principles: a) Beneficence b) Nonmaleficence c) Autonomy d) Justice 2. Commonly encountered clinical scenarios: a) Appropriate use of imaging and follow up. b) Communicating critical results. c) Immediate availability of reports to patients (21st Century Cures Act mandate). d) Deciding relevant incidental findings to report. e) Addressing diagnostic misses or misdiagnosis. f) Imaging in incarcerated and refugee populations. 3) Conclusions: a) Ethical problem-solving tools. b) Future directions when facing ethical dilemmas

## NPMEE-5 ENGAGING AND INSPIRING THE NEXT GENERATION OF RADIOLOGISTS

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Farbod Fazlollahi, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Setting Clear Expectations Articulate daily reciprocal expectations, including objectives and the student's role on the team. Example: Residents outline study types, software, and focus areas for the day.
- Explaining Diagnostic Reasoning and Processes Residents should verbalize their thought process and diagnostic reasoning as they navigate studies. Example: Explaining the choice of slices and views in a CT scan.
- Engaging and Assessing the Student Continuously ask students for their observations and reasoning to assess understanding and promote active learning. Example: "What do you see here? Why do you think that?"
- Providing Real-Time Feedback and Further Learning Offer immediate feedback and recommend resources for further learning based on daily performance. Example: Provide specific feedback and suggest relevant articles or modules.
- Challenging the Student to Predict and Interpret Encourage students to predict findings from clinical indications and interpret images independently. Example: Discuss expectations before revealing MRI results.

**TABLE OF CONTENTS/OUTLINE**

- Problem Statement
- The Need for Effective Engagement in Radiology Education
- Setting Clear Reciprocal Expectations
- Explaining Diagnostic Processes
- Engaging and Assessing the Student
- Challenging the Student to Interpret
- Summary and Wrap Up

## NPMEE-6 COMPASSIONATE COMMUNICATION: ELEVATING SKILLS FOR CONVEYING BAD NEWS IN BREAST IMAGING

**Awards**
**Certificate of Merit**

Janice Thai, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel E. Grenier, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Highlight the importance of training and education in delivering bad news in breast imaging. 2) Review step by step process for delivering bad news in breast imaging. 3) Review array of patient emotional responses, and tips for recognizing and responding empathically.

**TABLE OF CONTENTS/OUTLINE**

1) Emphasize the importance of delivering bad news effectively in medicine, within the context of a patient care model. 2) Define the breast radiologist's specific objectives in delivering bad news to patients. 3) Demonstrate a step-by-step process for delivering bad news. 4) Review spectrum of emotional responses to bad news so that the breast radiologist can be better prepared to respond and meet the patient where they are at. 5) Emphasize importance of patient diversity: cultural, socioeconomic, ethnic, and physical. 6) Highlight the importance of personal reflection in improving communication style, especially when starting out as a breast radiologist. 7) Provide specific case examples/scenarios to demonstrate the nuance and dynamism of delivering bad news to patients in breast imaging.

## NPMEE-7 RADIOLOGISTS FOR THE PUBLIC GOOD: A GUIDE TO NON-PROFIT ORGANIZATIONS IN RADIOLOGY AND HOW TO GET INVOLVED

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Abstract Co-Author*) Nothing to Disclose
Joseph Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Develop an understanding of the different types of non-profit work in radiology and available to radiologists• Understand the differing types of charitable/non-profit organizations in radiology, which can be grouped into four major areas: standalone charitable organizations, professional societies, charitable arms of for-profit organizations, and educational (e.g., Road2IR)• Foster an understanding of the various ways to get involved with charitable organizations within the field of radiology, at any level of time commitmentThere are several well-recognized and longstanding charitable organizations in medicine, such as Doctors without Borders, The Red Cross, and UNICEF. Non-profit/charitable work in radiology specifically is newer and has truly only accelerated over the past two decades. Digital imaging technology has fostered a revolution in imaging-related care and has offered novel means of broaden access. The possibilities for philanthropic work within our field are growing exponentially. The purpose of this overview is to raise awareness of, and provide opportunities for individuals who desire to become involved with non-profit work in the field of radiology.

**TABLE OF CONTENTS/OUTLINE**

-Background:-Standalone Charitable Organizations:-RAD-AID-Radiologists without Borders-UNITSUSA-Project CURE-Societal Charitable Arms:-RSNA, ASER, ARRS, etc-Charitable efforts of For Profit Organizations:-VRAD first read initiative-Educational:-Road2IR

## NPMEE-8 PRECISION PROTOTYPES: THE EVOLUTION OF PATIENT-SPECIFIC MODELS IN RADIOLOGY

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Farbod Fazlollahi, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Imaging Data Basics: CT and MRI imaging data is used to produce detailed anatomical cross-sections that are then processed by software to help distinguish different tissues.
- Conversion Process: 2D cross-sectional data is stacked to construct a 3D volume, then converted to a mesh structure for 3D printing, then divided into sections to be printed accurately one layer at a time
- Software Tools: A variety of commercially available software such as 3D Slicer, OsiriX, and Materialise Mimics are used for image processing, segmentation, and mesh generation.
- Clinical Applications: 3D printed models can be used to enhance preoperative planning, surgical navigation, and implant design, as well as for diagnosis, research and teaching. Important considerations for wider applicability in the clinical space include accuracy, quality assurance, and regulatory compliance.

**TABLE OF CONTENTS/OUTLINE**

- Problem Statement
- Introduction to CT and MRI Imaging Data
- Converting Imaging Data to 3D Printable Files
- Image Segmentation Techniques
- Software Tools for 3D Model Generation
- Clinical Applications of 3D Printing
- Quality Assurance and Regulatory Considerations
- Future Directions in 3D Printing
- Summary and Conclusion

## NPMEE-9 RADIOLOGY MYTH BUSTERS - FILTERING FACT FROM FICTION

**Awards**
**Cum Laude**

Lindsay S. DeWeese, PHD (*Abstract Co-Author*) Nothing to Disclose
Nadine Mallak, MD (*Abstract Co-Author*) Nothing to Disclose
Dennis Barbon, MD (*Abstract Co-Author*) Nothing to Disclose
Alice W. Fung, MD (*Abstract Co-Author*) Nothing to Disclose
Lindsay N. Douglas, PhD (*Abstract Co-Author*) Nothing to Disclose
Anna Mench (*Abstract Co-Author*) Nothing to Disclose
Catherine Meyer, PhD (*Abstract Co-Author*) Nothing to Disclose
Laszlo Szidonya, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review strongly held beliefs in Radiology, their origins, and supporting or disproving data.2. Present evidence-based, patient-friendly discussion points to better inform patients and non-radiology colleagues.

**TABLE OF CONTENTS/OUTLINE**

The discussion of each myth will include data from which the myth arose, data supporting a new perspective, and takeaways to help educate patients and non-radiologists.1. Myth #1: Effective dose is useful for individual patient dose and risk assessment.2. Myth #2: Ultrasound is the only safe imaging for pregnant patients.3. Myth #3: Imaging exams that utilize the lowest dose are always better.4. Myth #4: Patient shielding should be used whenever possible.5. Myth #5: Patients should always be isolated after radionuclide exams and therapies.6. Myth #6: Patients with renal dysfunction should avoid iodinated IV contrast or be given a lower dose of contrast.7. Myth #7: Iodine and shellfish allergies are contraindications to iodinated IV contrast administration.8. Myth #8: Spleen biopsy is contraindicated due to risk of bleeding.9. Myth #9: Gadolinium deposition is associated with long-term health problems.10. Myth #10: INR is always a useful assessment for bleeding risk.

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# Abstract Archives of the RSNA, 2024

NPMEE-1

## WHO YOU GONNA CALL? GHOST (ARTIFACT) BUSTERS! REVIEWING THE ROLE OF MEDICAL PHYSICISTS IN OPTIMIZING RADIOLOGY DEPARTMENT FUNCTION AND IMAGING QUALITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Anthony Roscoe, BSc, MSc (*Abstract Co-Author*) Nothing to Disclose
Matthew S. Hartman, MD (*Abstract Co-Author*) Nothing to Disclose
Margaret E. Blackwood, MS (*Abstract Co-Author*) Nothing to Disclose
Nicholas Arconti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

· Medical physicists play a critical role in ensuring departmental compliance with state and federal regulations, as well as maintaining accreditation· Physicists' expertise in image artifact troubleshooting and causative analysis serves to optimize quality assurance and improve patient outcomes· Constructing optimal imaging protocols requires medical physics expertise to ensure dose optimization· Collaboration between radiologists and medical physicists can inform departmental technology/device acquisition· As teachers, medical physicists can offer robust graduate and continuing medical education to trainee and attending radiologists

### TABLE OF CONTENTS/OUTLINE

· An overview of our medical physicists' roles and responsibilities in maintaining departmental compliance with regulatory statutes and accreditation standards· Interesting cases within our department of imaging artifacts that were successfully diagnosed and resolved using medical physics expertise· A review of specific institutional imaging protocols (e.g. low-dose chest computed tomography) which depend on dose optimization· Several examples of recent instances of radiology-medical physics collaboration in deciding on optimal device and software acquisitions· An overview of our medical physicists' functioning as educators, including examples of radiation safety demonstrations and cases of directly educating patients with concerns about radiation exposure

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# Abstract Archives of the RSNA, 2024

NPMEE-10

## COUNTERING DEFICIT THINKING IN RADIOLOGY EDUCATION AND COMMUNITY OUTREACH USING ASSET-BASED APPROACHES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria D. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD (*Abstract Co-Author*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jade A. Anderson, MD (*Abstract Co-Author*) Nothing to Disclose
Natasha M. McFarlane, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• The radiology professional workforce has decreased representation of women and individuals from medically underserved groups.• Deficit-based thinking holds individual members of groups that are under-represented in medicine accountable for systemic inequities.• Implicit application of deficit thinking has continuous, negative effects on both trainees and the communities we serve.• Asset-based methods elevate the unique strengths of students and communities as resources to meet learning goals and health objectives.• Shifting to an asset-based approach is possible by intentionally integrating practical objectives into graduate medical education and community outreach.

### TABLE OF CONTENTS/OUTLINE

A. Introductiona. Current Status of Workforce Diversity and Inclusion in Radiologyi. Radiology Professions Student Populationsb. Current Status of Imaging Disparitiesi. Populations with Decreased Access to Imaging TechnologiesB. Deficit Thinkinga. Definitionb. Common terms associated with deficit thinkingi. Medical Educationii. Community Outreachc. Outcomes associated with deficit thinkingi. Regular and normalized use of stigmatizing languageii. Impact on psychological well-beingiii. Continuation of healthcare disparitiesC. Asset-Based Approachesa. Definitionb. Potential benefits associated with asset-based approachesc. Reframing deficit narratives in medical education and community outreachd. Case examplesi. Radiology Educationii. Community Outreach

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# Abstract Archives of the RSNA, 2024

NPMEE-11

## FRAMEWORK FOR ENGAGING TRAINEES IN SUSTAINABILITY INITIATIVES USING A NATIONAL SURVEY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Charlotte J. Yong-Hing, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Sonali Sharma, BSc (*Abstract Co-Author*) Nothing to Disclose
Jimin Lee (*Abstract Co-Author*) Nothing to Disclose
Maura J. Brown, MD (*Abstract Co-Author*) Synthesis Health Inc - research collaboration, no financial relationship at this time ( Nov 2022).
Aleena Malik, BSC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Importance of sustainability in radiology 2. Engaging trainees:- Highlight the significance of involving trainees in sustainability efforts from the beginning of their medical education.- Discuss the potential long-term impact of engaging trainees in sustainability initiatives on their future practice and leadership roles within healthcare organizations. 3. Assessing impact on trainees:- Explore current trainee attitudes and aspirations towards sustainability in radiology departments using national survey.- Describe methods for evaluating the effectiveness of sustainability initiatives on trainees' knowledge, skills, and attitudes.- Discuss the role of feedback mechanisms and continuous improvement processes in refining sustainability education and training programs for trainees.4. Integrating sustainability:- Explore strategies for incorporating sustainability principles into radiology curriculum and training programs based on a needs-assessment.

### TABLE OF CONTENTS/OUTLINE

I. Introduction- Significance of sustainability in radiology departments.II. Methods- Conducting a needs-based survey among radiology trainees. - Development of a sustainability framework.III. Trainee Engagement and Impact Evaluation- Educational workshops and hands-on training.- Evaluation of the impact on trainees' education and professional development.IV. Discussion- Benefits of integrating sustainability into radiology practice. - Implications for trainees and the broader healthcare system.V. Conclusion

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NPMEE-12

## INTRODUCTION TO R FOR RADIOLOGISTS: APPLICATIONS IN RESEARCH, VISUALIZATION, AND PRACTICE MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ramtin Hajibeygi (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Kyle Tegtmeyer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Coding and programming languages are an area with incredible potential value to radiologists across a range of domains, including research, statistics, image analysis and practice management. We seek to introduce radiologists to R, and provide a simple and easy to follow introduction to the R programming language. We review the process of setup and installation, options for integrated development environments (IDEs), and basics of the R language coding and syntax. We additionally seek to demonstrate relevant applications for radiologists, particularly those involved in research or academic endeavors, including statistical applications, data visualization, radiomics and machine learning. We also provide a range of applications relevant to non-academic radiologists, including statistics and modeling for practice management. Lastly, we provide a range of online resources for those interested in learning more above coding in R.

### TABLE OF CONTENTS/OUTLINE

Topics covered include:- What is R? Introduction to the R programming language- How to download and install R- Review of available Integrated Development Environments (IDEs)- Basics of coding in R- Statistical applications for R- Data visualization with R- Radiomics applications in R- Machine Learning applications in R- Statistics and Data modeling applications for practice management and workflow optimization

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# Abstract Archives of the RSNA, 2024

NPMEE-13

## REVOLUTIONIZING RADIOLOGY EDUCATION: EXPLORING INNOVATIVE TEACHING METHODS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Omer A. Awan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Ozerk Turan (*Abstract Co-Author*) Nothing to Disclose
Izzet Altun, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1- Audience Response Systems (ARS): Utilize ARS to engage learners, assess real-time understanding, and enhance retention through interactive multiple-choice questions. 2- Flipped Classroom Techniques: Implement flipped classroom strategies to encourage independent learning and maximize in-class time for application and synthesis of concepts, simulating real-world diagnostic scenarios.3- Active Learning Strategies: Drawing anatomical structures and scrolling through diagnostic images to stimulate cognitive processing and enhance retention.4- Electronic Media: Videos, educational apps, QR codes, and social media platforms to retain knowledge, promote asynchronous learning, and engage learners outside the traditional classroom setting.

### TABLE OF CONTENTS/OUTLINE

I. Introduction Technological advancements in radiology educationImportance of active learning approaches over traditional didactic methods II. Audience Response Systems (ARS) A. Definition B. Advantages and Challenges III. Flipped Classroom Techniques A. Concept and Implementation B. Application in Radiology Education C. Benefits and Challenges IV. Active Learning Strategies A. Drawing Anatomy B. Scrollable Images C. Application and Benefits V. Electronic Media A. Videos in Radiology Education B. Educational Apps C. QR Codes and Social Media Platforms VI. Discussion Optimizing use of innovative teaching methodsAddressing challenges and considerations for effective implementation VII. Conclusion

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# Abstract Archives of the RSNA, 2024

NPMEE-14

## SO YOU WANT TO START A NON-PROFIT: PRIVATE FOUNDATION VS. PUBLIC CHARITY - A GUIDE FOR THE RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Abstract Co-Author*) Nothing to Disclose
Samra Iftikhar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This primer will provide a practical overview of personal foundations and public charities, with a focus on the comparative advantages/disadvantages of each. We discuss additional strategies for each organizational style to reduce the radiologists overall tax burden. We hope this primer serves as both an introduction and inspiration for radiologists who may not have realized the incredible impact they may have via charitable work and help highlight avenues a radiologist may pursue to generate long-lasting, genuine change.Goals of Presentation:-Familiarize the radiologist with the basics of private charitable foundations and public charities (classical 501(c)3 certified non-profits)-Explore the rationale behind the creation of personal philanthropic organizations, contrasted with the drive behind most public charities-Learn about the potential tax benefits/pitfalls, regulatory oversight requirements, of both contrasting the benefits and risks and how they pertain to the radiologist

### TABLE OF CONTENTS/OUTLINE

-Background:-Overview of the key features of private foundations and public charities-Highlight key differences between Private Foundations and Public Charities including:-Board Structure-Initial Requirements-Tax breaks and benefits-Direct contributions-Stock contributions-Real estate deductions-Differences in regulatory oversight-Fund disbursement requirements-Contribution Strategy-Focus of organization and funding source:-Funding sources for private foundations vs. public charities-Grant disbursement to other non-profits vs. on the ground operations-Soft benefits of private foundations/public charities:-Networking-Personal fulfillment-Legacy

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# Abstract Archives of the RSNA, 2024

NPMEE-15

## PICTURE PERFECT PLANET: NAVIGATING RADIOLOGY'S ENVIRONMENTAL IMPACT AND POTENTIAL SOLUTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kasha Chen (*Abstract Co-Author*) Nothing to Disclose
Alvin Tran (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Abstract Co-Author*) Nothing to Disclose
Amir Imanzadeh, MD (*Abstract Co-Author*) Nothing to Disclose
Angellica Gordon, MD (*Abstract Co-Author*) Nothing to Disclose
Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Erwin Ho (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To present the environmental impact of radiology in terms of energy consumption, greenhouse gas emissions, and pollution.2. To discuss areas of opportunity and provide solutions on a system-wide, departmental, and individual level.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Energy Consumption in Radiology a. CTs and MRIs Energy Usage b. Strategies to Reduce Energy Consumption 3. Environmental Impacts of Radiology a. Cooling systems and Energy Needs b. Addressing Environmental Concerns 4. Artificial Intelligence a. Energy Demands of AI b. Optimization Strategies 5. Environmental Concerns with Gadolinium a. Public Health Implications b. Mitigation Techniques 6. Opportunities for Improvement a. System-wide, Departmental, and Individual Solutions 7. Conclusion

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# Abstract Archives of the RSNA, 2024

NPMEE-16

## A RESIDENT'S GUIDE TO PHYSICIAN REIMBURSEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

William Kirschner (*Abstract Co-Author*) Nothing to Disclose
Sophia R. O'Brien, MD, MEd (*Abstract Co-Author*) Nothing to Disclose
Richard Duszak JR, MD (*Abstract Co-Author*) Advisor, Ethos Medical, Inc;Shareholder, Ethos Medical, Inc
Frank J. Lexa, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Kari Williams, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The business of medical practice is not one of the six core competencies as defined by the Accreditation Council for Graduate Medical Education (ACGME) [1]. As a result, resident physicians may complete training without adequate knowledge of physician reimbursement and the business of medicine [1,2]. This presentation will provide a brief history of physician reimbursement, define the "Resource-based Relative Value Scale" payment system, translate the relative value unit into physician reimbursement and radiologist reimbursement and explain the physician reimbursement revenue cycle and how it applies to Radiologists.

### TABLE OF CONTENTS/OUTLINE

• Problem statement• Brief history of physician reimbursement o Usual, Customary, Reasonable rateo "Resource based relative value" (RBRVS) o Omnibus Reconciliation Act (1992)o Multiple Procedure Payment Reduction (2006)o Affordable Care Act (2010)• Resource based relative value, Relative value Unit, and Physician reimbursement o Definition and Division of the RVU. § Professional component, technical component, global payment• Conversion Factor• Geographic Practice cost index• Radiologist Reimbursement o Professional component of radiologist worko Technical component is absorbed by entity that owns capital, which may also be the physician.• Radiologist Reimbursement and Revenue Cycle o Define revenue cycle, preauthorization, and accounts receivable.o Explain the workflow from service performed to payment received.

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# Abstract Archives of the RSNA, 2024

NPMEE-18

## THE WORLD VS. THE MACHINE: BRINGING IMAGING AI TO GLOBAL HEALTH - GOOD ODDS OR BAD BETS?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Lina Karout, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Imaging access does not equal radiologists' availability in low-income countries (LIC). 2. Understand the landscape of currently available and approved AI applications in the context of thoracic imaging. 3. The differences in rigors of AI approval process in low- and high-income countries. 4. Possible impact of AI in global health in the context of medical imaging.

### TABLE OF CONTENTS/OUTLINE

1. Graphical summary of imaging access and radiologists' availability in the LIC. 2. Case-based illustration of available multi-vendor AI solutions and their applications in thoracic imaging. 3. Differences in how some AI tools are applied in developed and developing countries. 4. Using examples from our global imaging data from multiple countries to highlight the potentials and limitations of AI applications

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# Abstract Archives of the RSNA, 2024

NPMEE-19

## MONITORING OUR EYES: A LOOK AT COMPUTER VISION SYNDROME

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Robert Hill, MD (*Abstract Co-Author*) Nothing to Disclose
Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Star Lopez (*Abstract Co-Author*) Nothing to Disclose
James Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Erwin Ho (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the pathophysiology, epidemiology, risk factors, and treatment modalities for computer vision syndrome.

### TABLE OF CONTENTS/OUTLINE

Computer Vision Syndrome (CVS) is defined as a constellation of eye and vision symptoms that result from prolonged computer use. Symptoms include dry eyes, eye strain, headache, ocular redness, blurry vision, diplopia, and neck pain, arising due to maladaptive ocular surface, accommodative, and extraocular mechanisms. Many modalities of eye care can be employed to address CVS symptoms. Topical lubricative eyedrops and overnight ointments can rehydrate the ocular surface and create a protective evaporative barrier. Dietary supplements, namely omega-3s and blue light filtering glasses have been shown to improve clinical symptoms. Placement of occlusive punctal plugs preserves natural tears. Warm compresses via steam-chambered goggles or hot towel increase lipid layer thickness and tear film breakup time thereby improving symptoms. The ergonomic design of workstations can ease eye strain using warm, balanced lighting and appropriate monitor positioning. Finally, taking frequent and brief breaks away from screens, as outlined by the 20-20-20 rule, has been shown to improve symptoms without compromising one’s duration of computer usage. A thorough understanding of the underlying causes, risk factors, and treatment options will empower radiologists to continue to work longer, more efficiently, and symptom free.

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# Abstract Archives of the RSNA, 2024

NPMEE-2

## MRI SUSTAINABILITY: UNLOCKING THE POWER OF HEAT RECOVERY IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel J. Margolis, MD (*Abstract Co-Author*) In-kind support, Siemens AG;Consultant, Promaxo, Inc
Akhil Soman (*Abstract Co-Author*) Nothing to Disclose
Filipp Alaverdyan (*Abstract Co-Author*) Nothing to Disclose
Daniel Audette (*Abstract Co-Author*) Nothing to Disclose
Lara Pes (*Abstract Co-Author*) Nothing to Disclose
Akua Amoah, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

MRI scanners play a crucial role in modern healthcare, but their operation consumes substantial energy and generates significant waste heat.To address this, a heat pump system is a potential solution to capture and repurpose MRI heat for sustainable energy utilization. Heat pumps efficiently transfer heat for heating and cooling functions depending on the direction of heat transfer.Embracing energy conservation in radiology departments holds promise for driving transformative change. Repurposed MRI heat offers a sustainable heating source and contributes to decarbonization efforts within healthcare facilities. Significant energy and heat savings are projected from the integration of heat pumps in the MRI exhaust system, with potentially millions of billions of BTU saved and up to 30% fossil fuel reduction.The question of how cost-effective this project will be cannot be overlooked. Incorporating a heat recovery system into a standard hospital building using a heat pump will cost hundreds of thousands to millions of dollars, but with eventual substantial annual savings.While this may be straightforward to apply for future MRI site designs, integration into existing MRI installation may be challenging and require additional investigation and costs, potentially taking the MRI offline for implementation.

### TABLE OF CONTENTS/OUTLINE

1. Overview of MRI waste heat 2. Heat pump energy recovery system 3. Potential Benefits 4. Cost Estimate 5. Pitfall

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# Abstract Archives of the RSNA, 2024

NPMEE-20

## ENHANCING RADIOLOGY PRACTICE THROUGH APPLICATIONS OF QUALITY IMPROVEMENT AND PALLIATIVE CARE IN PATIENT AND FAMILY CENTERED CARE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Anna Luisa Kuhn, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paramesh Karandikar (*Abstract Co-Author*) Nothing to Disclose
Lyle Suh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand Patient and Family-Centered Care (PFCC) principles.2. Understand the history, progress, and relevance of PFCC in radiology.3. Apply the concept of PFCC through practical models and strategies that prioritize quality care.Examples: Patient-oriented communication methods, safety and reporting protocols, cultural competency training, and interdisciplinary collaboration4. Understand PFCC in the context of palliative care in radiology.5. Understand applications of PFCC in the context of quality improvement (QI) initiatives.

### TABLE OF CONTENTS/OUTLINE

1. Overview(a) Definition and Importance of Patient and Family Centered Care (PFCC); Review Core Principles of PFCC(b) History, Milestones, and Progress of PFCC in Radiology(c) Current challenges and opportunities for improvement2. The Relevance of PFCC in Radiology(a) Quality and value-based care(b) Patient outcomes, satisfaction, and experience(c) Communication3. Implementing PFCC in Radiology Practice(a) Building a culture and evidence-based processes(b) Overcoming Challenges and Barriers (Resistance to change, lack of resources, and competing priorities)4. PFCC and Palliative Care in Radiology Practice5. Quality Improvement for improving PFCC in Radiology6. Future Directions(a) PFCC in Practice, Research, and Training (e.g. Simulations)(b) Innovations and advancements6. Cases(a) Review scenario-based simulation illustrating successful implementation of PFCC in radiology and discuss outcomes and lessons learned

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# Abstract Archives of the RSNA, 2024

NPMEE-21

## WARREN BUFFET HAS ONE, WHY NOT YOU: THE LOGISTICS, BENEFITS, AND PITFALLS OF A PRIVATE FOUNDATION - AND WHY RADIOLOGISTS ARE WELL-POSITIONED TO START THEIR OWN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Ronald Gathagan, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Samra Iftikhar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

While classically associated with the ultrawealthy, the barrier for entry for creation of a personal charitable foundation is in fact much lower. Current suggested startup funding is between $250,000-$500,000, well within reach of the average practicing radiologist. We believe private foundations are a financial construct that all radiologists should be aware of as a vehicle for social impact and the construction of a meaningful legacy. This presentation will overview private foundations and aim to:-Familiarize the radiologist with the basics of personal/family run private foundations-Explore the rationale behind the creation of private philanthropic organizations-Learn about the potential tax benefits/pitfalls of this process-Increase understanding of the additional regulatory oversight that private foundations undergo-Highlight the reasons a radiologist could be interested in creating a personal foundation including and not limited to: addressing areas of personal/societal interest, global health causes, education, radiology research, etc.

### TABLE OF CONTENTS/OUTLINE

-Background: Why chose a Private Foundation-Logistics in Setting up:-Certification Process-Initial Requirements-Contribution Strategy-Benefits:-Retention of control-Grant disbursement instead of building an on the ground operation-Networking and Investment-Traditional Focus (Disbursement of funding to various non-profit entities):-Additional Oversight:-Minimum yearly disbursement of funds-Additional investment income excise tax-Self-Dealing restrictions-Excess business holdings-Taxable expenditures-Gold Standard Examples:-Less Than Ideal Examples:

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# Abstract Archives of the RSNA, 2024

NPMEE-22

## UTILIZING THE SOCIAL ECOLOGICAL MODEL TO EXAMINE DEFICITS IN RECRUITMENT, PROMOTION, AND LEADERSHIP DEVELOPMENT OF WOMEN IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Randy C. Miles, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Shiva Yagobian, BS (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD (*Abstract Co-Author*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Amy K. Patel, MD (*Abstract Co-Author*) Medical Advisor, Kheiron Medical Technologies Ltd;Consultant, Hologic, Inc
Franklin Iheanacho, BA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

•Introduce the socioecological model (SEM) and its levels to explain individual-environment interactions •Examine barriers in recruitment, promotion, and leadership for women via SEM •Address the "leaky pipeline" in academic radiology for women at personal, interpersonal, institutional, community, and policy levels •Review literature on gender disparities in leadership

### TABLE OF CONTENTS/OUTLINE

1. Socioecological Model (SEM) Introduction 1a. Outline SEM levels: intrapersonal, interpersonal, institutional, community, policy 1b. Explore women underrepresentation in radiology using SEM. 2. Positive Impact of a Diverse Workforce 3. Exploring the gender disparity at each SEM level 3a. Intrapersonal Level I. Recruitment II. Promotion II. Leadership 3b. Interpersonal Level I. Recruitment II. Promotion III. Leadership 3c. Institutional Level I. Recruitment II. Promotion III. Leadership 3d. Community/Policy Level I. Recruitment II. Promotion III. Leadership 4. Sealing the Leaky Pipeline

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# Abstract Archives of the RSNA, 2024

NPMEE-23

## AN ACADEMIC RADIOLOGIST'S ROADMAP TO SUCCESS: NAVIGATING THE WRITING PROCESS, JOURNALS, CONFERENCES, AND SOCIETY FELLOWSHIPS AND GRANTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maad Galal (*Abstract Co-Author*) Nothing to Disclose
Ahmed Kertam (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Quoc-Huy Ly (*Abstract Co-Author*) Nothing to Disclose
Carys Kenny-Howell (*Abstract Co-Author*) Nothing to Disclose
Jeffers Nguyen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Because research is the currency in academia, it is imperative for aspiring academic radiologists to possess comprehensive skills and knowledge in conducting and disseminating research. However, navigating the layers of academic writing, project management, conference submissions, and journal publications can be overwhelming for novice academics.Through a systematic approach, this primer equips radiologists with the knowledge and skills necessary to excel in academic endeavors, providing guidance on literature review, data analysis, and project management. It also shares a roadmap of major conferences, journals, and grants in radiology and medicine, enhancing visibility within the academic community and facilitating effective dissemination of research findings.

### TABLE OF CONTENTS/OUTLINE

- Skills, skills, skills: literature review, writing, citation, data analysis, and more- Lifecycle of academic projects: from conceptualization to publication- Road map of major U.S. and international conferences- Reviewer 2: Journals' impact factors, time to first decision, and acceptance rates- Academic societies' grants, fellowships, and awards

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NPMEE-24

## AI X DEI: DEVELOPING A MEDICAL STUDENT CURRICULUM ON ARTIFICIAL INTELLIGENCE IN RADIOLOGY AND ITS IMPLICATIONS FOR HEALTH EQUITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alexander Lindqwister, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Christopher F. Beaulieu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Diamanto Rigas, MD (*Abstract Co-Author*) Nothing to Disclose
Zainub Dhanani (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Foundational Understanding in AI-Provide students with a broad foundation in AI technologies in radiology and potential impacts on diverse patient populations2. Bias Awareness and Mitigation-Equip students with the ability to identify and address bias in radiology AI applications, fosteringequitable diagnostic and treatment practices3. Cultural Humility-Emphasize importance of culturally humble AI development in radiology and its role in patient-centered and culturally sensitive care4. Policy and Governance in Radiology AI-Expose students to policy and governance aspects of healthcare AI in radiology, preparing them to advocate for ethical and equitable AI practices in radiology settings5. Emerging Technologies-Explore emerging AI technologies in radiology and implications for the future of radiology, empowering students to stay at the forefront of radiology innovation

### TABLE OF CONTENTS/OUTLINE

Intro to AI: AI Terminology, Computational Basis of AI, Types of Data, Types of Algorithms/Models, AI for RadiologyAI Pitfalls and Risks: Limitations to AI/ML, Curse of Dimensionality, Validation for AI models, Bias in AI models, Health Equity Issues and Examples, Approaches to Mitigating BiasHuman and Machine Bias in AI Models: Data Curation/Sourcing Bias, Data Annotation and Visualization Bias, Training Dataset Bias, Model and Metric Bias, Inherited Bias, Cognitive Bias, Algorithm Deployment Bias, Evaluation Bias, Complacency in Automation Bias, Statistical Bias, Detection BiasBuilding AI Models: Determining your question, Dataset development, Dataset audits, Training/testing models, Understanding model outputs, Bias audits, Evaluating efficacy and accuracy, Legal Compliance

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# Abstract Archives of the RSNA, 2024

NPMEE-25

## BRAVING THE AI SURGE-EQUIPPING RADIOLOGY RESIDENCIES FOR TOMORROW'S CHALLENGES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Henrique M. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Amit Kumar (*Abstract Co-Author*) Nothing to Disclose
Swati Goyal (*Abstract Co-Author*) Nothing to Disclose
Gilberto Szarf, MD, PhD (*Abstract Co-Author*) Speaker, F. Hoffmann-La Roche Ltd;Speaker, Amgen Inc;Speaker, Siemens AG
Vasantha Kumar Venugopal, MD (*Presenter*) Officer, CARPL.AI Inc

### TEACHING POINTS

1. Deep dive into how AI is currently used in radiology, its capabilities, and its limitations, preparing residents for realistic applications and expectations.2. Emphasizing the importance of recognizing and mitigating biases in AI algorithms, and understanding the ethical implications of automated decision-making.3. Advocating for a balanced educational approach that combines AI tools with traditional hands-on learning to foster a comprehensive skill set.4. Highlighting the need for ongoing education in AI developments, ensuring that residents remain adept as technology evolves.5. Cultivating critical diagnostic skills that complement AI-driven data, ensuring residents can effectively interpret and question AI outputs.

### TABLE OF CONTENTS/OUTLINE

Overview of AI technologies impacting radiology.Case studies of AI tools improving resident performance and engagementIdentifying and overcoming potential pitfalls such as over-reliance and diminished problem-solving skillsStrategies for teaching ethical considerations and algorithm transparencyEducational Strategies for AI Preparedness -Developing curricula that incorporate AI learning, including simulation-based training and AI-assisted diagnosticsThe role of mentorship and faculty development in an AI-enhanced educational environmentFuture Perspectives and Preparing for Change

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# Abstract Archives of the RSNA, 2024

NPMEE-26

## THINK LOCAL, ACT GLOBAL: INCORPORATING GLOBAL RADIOLOGY INTO YOUR PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karen Chetcuti, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
John Phalula, BMBS (*Abstract Co-Author*) Nothing to Disclose
Benjamin Brown, BS (*Abstract Co-Author*) Nothing to Disclose
Katrina A. McGinty, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After reviewing this presentation, the learner will be able to1. Better understand and describe the disparity in radiology resources worldwide.2. Describe the pros and cons of different methods of involvement in global radiology.3. Understand the role of remote or hybrid involvement in radiology capacity building in low- and middle-income countries as a sustainable and effective means of improving radiology access4. Be prepared to take the next steps to sustainably and seamlessly incorporate global radiology into his/her/their practice

### TABLE OF CONTENTS/OUTLINE

1. Overview of the need for global radiology2. Discussion of different approaches to global radiology, their strengths and challenges. This will include a discussion of equipment donation, in person visits and virtual support.3. Emphasize the importance of longitudinal projects and capacity building for improving radiology services worldwide.4. Describe hybrid or virtual approaches to global radiology, including current collaborations between an academic medical center in the Southeastern USA and a radiology program in Sub-Saharan Africa. Highlighted projects will include multidisciplinary tumor boards, peer learning conferences between the two residencies, lecture delivery and a supported hands on MRI curriculum. Discussion will focus on program building, program maintenance, measurements of success or failure and the importance of quantifying impact.5. Review topics covered and offer guidance for next steps to incorporate global radiology into one’s professional practice.

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# Abstract Archives of the RSNA, 2024

NPMEE-27

## METRICS AND INDICES AND SCAMS, OH MY: JOURNAL QUALITY CONSIDERATIONS FOR YOUR QUALITY RADIOLOGY MANUSCRIPT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thea C. Moran, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. It's hard to efficiently select a journal for manuscript submission with the abundance of journal options in the current open-access landscape. Knowing how to efficiently find, and assess, journals for quality, chance of acceptance, and visibility benefits not just researchers, but patients and the public. 2. Journal metrics must be interpreted in terms of what they're supposed to indicate and their imperfections. 3. Many indices include radiology journals. Journals listed in multiple indices have better visibility but indices' inclusion criteria vary. 4. Megajournals are publishing options for radiology manuscripts; however, they're controversial. It's uncertain what their place will ultimately be in scientific publishing. 5. Predatory journals/publishers are best avoided. Well-known red flags exist. Publishing association directories list publishers who adhere to best practices.

### TABLE OF CONTENTS/OUTLINE

1. Academic publishing overview. History, kinds of literature, who it affects and how. 2. Journal quality indicators a. Metrics What are they, their meaning(s)/weaknesses. b. Indices What are indices/databases, journal selection criteria, how they help visibility, PubMed/PubMedCentral/Medline, what indices list radiology journals 3. Predatory journals What are they, why are they a problem (for healthcare, authors, society), how to recognize and resources to help avoid 4. Megajournals What are they? Criteria? Controversies. Megajournals that have published radiology manuscripts 5. Personal and electronic means to form a list of potential journals - journal finders, scientific associations, mentors, peers, librarians, journals you review for. 6. Summation/take home points

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# Abstract Archives of the RSNA, 2024

NPMEE-28

## HOW TO BRING RADIATION SAFETY AND PHYSICS EDUCATION TO LIFE WITH A HANDS-ON FLUOROSCOPY TRAINING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduardo Thadeu De Oliveira Correia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo K. Bittencourt, MD, PhD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation
David W. Jordan, PhD (*Abstract Co-Author*) Nothing to Disclose
Lauren Fane, BEng (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Radiation protection and related physics can be taught interactively in an IR suite with simple supplies that medical physics departments have.2. A hands-on fluoroscopy training can demonstrate the distribution of scattered radiation, impact of equipment positioning, and effect of shielding.3. Radiation protection training early-on, before IR rotations can improve resident satisfaction, competence in protecting themselves and patients, and their physics and safety knowledge.

### TABLE OF CONTENTS/OUTLINE

An interactive radiation protection training can be created with minimal supplies outside of an IR suite with a c-arm: area survey meter, RaySafe X2 with R/F sensor, lead aprons, and acrylic blocks to simulate patients.A hands-on fluoroscopy training can demonstrate radiation safety and physics concepts:1. Distribution of scattered radiation and variation based on size of body region / size of patient imaged and different orientations of the radiation source2. Patient distance from x-ray source impacts patient radiation dose, scatter, and image contrast, because the x-ray beam diverges.3. How much radiation is attenuated by shielding (lead aprons, barriers/boards/walls)This training improved residents' radiation safety knowledge and attitudes in a single-institution, prospective study.1. Sustained increases in residents’ confidence in protecting themselves and comfort in raising concerns to faculty2. Catered to a baseline deficit in concepts that are better demonstrated than discussed3. Increased radiation safety knowledge temporarily. More can be done during procedural rotations to reinforce safety practices and concepts

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# Abstract Archives of the RSNA, 2024

NPMEE-29

## TRAUMA-INFORMED CARE: SHAPING THE FUTURE OF RADIOLOGY PROCEDURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Janet E. Bailey, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Klein, MD (*Abstract Co-Author*) Nothing to Disclose
Angelica Alexopoulos (*Abstract Co-Author*) Nothing to Disclose
Sydney J. Torres, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the prevalence of trauma within the patient population and identify types of traumatic experiences patients may have faced.
- Recognize clinical warning signs that indicate a patient may have a history of trauma and identify potential triggers in radiology procedures.
- Explore a universal trauma-informed care approach and its general principles within healthcare, according to the Substance Abuse and Mental Health Services Administration (SAMHSA) and other expert recommendations.
- Provide an actionable framework applicable to clinical practice including before, during, and after procedures to increase patient comfort and patient-centered care within radiology.

### TABLE OF CONTENTS/OUTLINE

- Terminology: What is trauma and trauma-informed care?
- Clinical warning signs that a patient may have a history of trauma
- Potential triggers in radiology
- The Four R's: Definition of a trauma-informed approach
- The key principles of a trauma-informed approach
- A framework for best practices and recommendations to avoid retraumatization in radiology procedures
- Future areas to explore

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# Abstract Archives of the RSNA, 2024

NPMEE-3

## LLM HANDS-ON: GETTING START OF LLM PROGRAMMING IN PYTHON

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Atsushi Teramoto, PhD (*Abstract Co-Author*) Nothing to Disclose
Kippei Isaji (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The emergence and advancement of large language models (LLMs) have made it possible to automate many tasks. These models are integrated into various services, and many users may already have experience interacting with them. However, opportunities to implement publicly available LLMs are limited. The purpose of this exhibit is to teach how to easily implement and fine-tune publicly available LLMs.

### TABLE OF CONTENTS/OUTLINE

Outline: The main teaching points of this exhibit are as follows: 1. LLMs pre-train on vast text data to gain general language knowledge. 2. In recent years, many LLMs have been developed. 3. LLMs have many potential applications in medical settings. TABLE OF CONTENTS: 1. What are LLMs? 2. Use Cases 3. Hands-on Session

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# Abstract Archives of the RSNA, 2024

NPMEE-30

## PATIENT-REPORTED OUTCOME MEASURES: WHAT THEY ARE, AND HOW THEY CAN BE USED TO IMPROVE PATIENT-CENTRED CARE IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andrea S. Doria, MD, PhD (*Abstract Co-Author*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)
Rakhshan Kamran (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Review the development, validation, and implementation of patient-reported outcome measures (PROMs), which should be the pillar of today’s and tomorrow’s radiological services to patients. 2) Explore benefits of PROMs to advance patient-centeredness of radiology, along with ethics and future directions.

### TABLE OF CONTENTS/OUTLINE

Radiology should be “patient-centered”, but few initiatives exist assessing value creation and patient outcomes in radiology. PROMs can help advance patient-centeredness and value measurement in radiology. This presentation will cover how PROMs can be used in radiology. 1) Introduction to patient-reported outcome measures (PROMs). a) Overview, significance in radiology. b) Capturing patients' perspectives. c) Patient-centred care and demonstrating value of radiology. 2) Development of PROMs. a) Overview and examples of PROMs. b) Importance of patient involvement. 3) Validation of PROMs. a) Methods: validity, reliability, responsiveness. b) Overview of psychometrics. 4) Types of validity. a) Content, criterion, construct. b) Examples of validity assessment. 5) Implementation a) Strategies for PROM implementation. b) Discussion of challenges. 6) Benefits a) Improved communication, monitoring, patient-centred care. b) Research and quality improvement. 7) Case studies. a) Successful cases. b) Real-world experiences. 8) Ethical considerations. a) Confidentiality, consent, cultural sensitivity. b) Risks and limitations. 9) Future directions. a) Emerging trends, technology. b) Research areas, collaboration opportunities. 10) Conclusion a) Summary emphasizing PROMs' importance in improving patient-centred care and demonstrating value in radiology.

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# Abstract Archives of the RSNA, 2024

NPMEE-32

## ANATOMICALLY ACCURATE AND FLUOROSCOPICALLY VISIBLE 3D-PRINTED SPINAL MODEL FOR LUMBAR PUNCTURE SIMULATION AND TRAINEE EDUCATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mina Mousa, MD (*Abstract Co-Author*) Nothing to Disclose
Summer J. Decker, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan M. Ford, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael Markovitz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Impact on Procedural Skills, Confidence and Error Reduction: Improve practical skills through hands-on experience with 3D-printed models to build confidence and reduce errors and complications. 2. Advancements in Simulation-Based Training: Learn about limitations of existing simulations and the need for more anatomically accurate, tactilely realistic, and fluoroscopically visible models. Highlight the design and composition of our 3D-printed lumbar spine model. 3. Standardization of Medical Education and Future Aims: Understand the potential benefits on medical trainee competence and patient safety. Establish a standardized training protocol for residents, fellows, and visiting students with the potential for broader applications in other medical fields and institutions.

### TABLE OF CONTENTS/OUTLINE

1. Introduction/Background • Need for hands-on medical training and role of 3D printing in addressing this gap; • Challenges and limitations of current training and simulation models; 2. Materials/Methods • Design and printing process of our 3D-printed model; • Material selection for realistic tactile feedback and fluoroscopic contrast visibility; • Implementation in training settings; 3. Results • Initial qualitative feedback; • Observations on usability and authenticity compared to traditional models; 4. Discussion • Impact on trainee competence and confidence; • Implications for patient safety and procedural success; • Considerations for further research and model refinement; 5. Conclusion: • Innovative aspects and potential benefits of the 3D model; • Future steps for controlled efficacy studies; • Potential adaptation for other procedures, medical fields and institutions

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# Abstract Archives of the RSNA, 2024

NPMEE-33

## BALANCING ACCESS AND ANXIETY: THE CHALLENGES AND OPPORTUNITIES OF IMMEDIATE RESULT RELEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shoichi Maeda (*Abstract Co-Author*) Nothing to Disclose
Eri Ishikawa (*Abstract Co-Author*) Nothing to Disclose
Evgeny Pavlushkov, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jay Starkey, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- The 21st Century Cures Act requires immediate patient access to electronic health information, including radiology reports
- Radiologists must adapt to increased patient communication and shared decision-making
- Proactive guidance and clear reporting can ease patient anxiety about results
- Radiology practices should leverage technology to provide user-friendly patient resources
- Equitable access to health information remains a concern for older and low-income patients

### TABLE OF CONTENTS/OUTLINE

I. Introduction• 21st Century Cures Act overview• Impact on radiologyII. Current State of Information Blocking in 2024• Implementation successes and challenges• Radiologist experiences and patient feedback• Evolving legal and regulatory landscapeIII. Benefits and Drawbacks of Immediate Result Access• Patient empowerment and shared decision-making• Potential for patient anxiety and confusion• Liability considerations for radiologistsIV. Best Practices for Patient-Centered Radiology• Proactive communication and expectation-setting• Clear, patient-friendly reporting style• Radiologist availability for direct patient questions• Leveraging AI tools for patient educationV. Ensuring Equitable Access• Challenges for older and low-tech-literacy patients• Socioeconomic barriers to portal use and internet access• Strategies for inclusivity and alternative communicationVI. Future Directions and Recommendations• Enhanced EHR interoperability and data sharing• Workflow changes to facilitate patient interaction• Payment models to support radiologist time spent on patient care• Ongoing patient outreach and educationVII. Conclusion

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# Abstract Archives of the RSNA, 2024

NPMEE-34

## A REVIEW OF THE MEDICAL USE OF ULTRASOUND IN SPACE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Abid Bashir (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To explore space medicine and use of ultrasound in spaceWhy do astronauts use ultrasound in space To diagnose and treatAstronauts training for use of ultrasoundLimitations of using ultrasound in spaceEquipment usedHow can we benefit from use of ultrasound in spaceUltrasound is a well proven diagnostic modality on earth and a versatile diagnostic imaging tool in space, why space applications.Space Applications terrestrial application development ultrasound applications in microgravity. French compact doppler system.

### TABLE OF CONTENTS/OUTLINE

1. When was ultrasound first recognised as the main imaging tool in space. ?physiology of human body in space and the microgravity induced changes in physiology.2. What training is required to be competent3. What equipment is used4. What are the limitations5. Advanced Diagnostic Ultrasound in Microgravity6. Impact of space ultrasound on science and medicine6. ADUM Study advanced diagnostic ultrasound in microgravity7. WINFOCUS World Interactive Network Focused on Critical Ultrasound (WINFOCUS),NASA,s extreme environment Mission Operation (NEEMO)Future Applications

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

NPMEE-35

## ENHANCING SPACED REPETITION WITH LARGE LANGUAGE MODELS FOR RADIOLOGY EDUCATION: A PILOT STUDY TO EXPLORE ARTIFICIAL INTELLIGENCE (AI) CAPABILITY, PRACTICALITY AND INTEGRATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ryan J. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Long Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph Nenow, MD (*Abstract Co-Author*) Nothing to Disclose
Eric Li, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Spaced repetition systems have been acknowledged for improving knowledge retention, competency, and academic performance in medical education. Anki is a flashcard-based software platform, popular among medical trainees, that employs spaced repetition and active recall.-However, limitations exist in spaced repetition learning, including substantial time required for content creation, potential cognitive overload, and lack of customization. Large Language Models (LLMs) present a solution to these challenges by leveraging capabilities such as text summarization and structured data extraction to produce personalized educational content.-This pilot study evaluates the effectiveness of LLMs in enhancing Anki flashcard materials for radiology residents. We used a detailed scoring rubric, aligned with established content creation practices, to assess the ability of LLMs to generate relevant, useful educational materials within a spaced repetition framework.-Our findings explore the practicality and limitations of integrating LLMs into the educational workflows of radiology training, aiming to improve the accuracy, relevance, and customization of learning resources.

### TABLE OF CONTENTS/OUTLINE

1. Generala. Existing workflows in medical/resident education2. Large Language Models (LLM)a. Third party LLMs (e.g. ChatGPT, Gemini, Llama)b. Role of LLM in medical education3. Pilot Studya. Intent/Designb. Methodologyc. Resultsd. Considerations (e.g. weighted scoring, pilot study scaling, rubric standardization)4. Integration practicalitya. Conferences/lecturesb. Workstation learningc. Limitations and workarounds5. Implicationsa. Personalized learningb. Future Direction

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# Abstract Archives of the RSNA, 2024

NPMEE-36

## HARNESSING SOLAR ENERGY - SCIENCE OF LEARNING APPLIED TO RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joseph W. Owen, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine Copely, MD (*Abstract Co-Author*) Nothing to Disclose
Fara Y. Shikoh, MD (*Abstract Co-Author*) Nothing to Disclose
James T. Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Andres R. Ayoob, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Although physicians dedicate their lives to learning, most spend little, if any, time understanding the scientific underpinnings of the learning process.As a result, most often rely on personal experience, intuition, opinions, or the latest fad to inform how they learn, frequently leading to ineffective and inefficient practices as well as frustration. This may be particularly detrimental as an ever-expanding body of medical knowledge and rapidly-evolving technologies render the process of life-long learning a necessity for physicians.Fortunately, recent research into the psychological and physiological principles behind learning have led to a number of evidence-based principles proven to enhance the learning process. This has important implications for all - trainees preparing for licensure examination and independent medical practice, practicing radiologists keeping abreast of current knowledge and technologies, and those involved in design and delivery of continuing medical education activities.Understanding these evidence-based learning strategies and how to apply them to radiology education can facilitate knowledge acquisition, promote life-long learning skills, and improve patient outcomes.

### TABLE OF CONTENTS/OUTLINE

Review of how memory works (encoding, storage, and retrieval)Illustration of evidenced-based principles to improve recall: active learning, retrieval practice/testing effect, spaced learning, interleaving, deliberate practice, metacognition, feedback, and real-world applicationsDescription of practical tips to integrate these strategies into daily practice, from trainee education to continuing medical education

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# Abstract Archives of the RSNA, 2024

NPMEE-37

## ENSURING PATIENT SAFETY: A COMPREHENSIVE APPROACH TO RADIOLOGICAL ERRORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Shoichi Maeda (*Abstract Co-Author*) Nothing to Disclose
Eri Ishikawa (*Abstract Co-Author*) Nothing to Disclose
Evgeny Pavlushkov, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jay Starkey, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Teaching Points:
- Understand the ethical, legal, and safety implications of errors in radiology
- Learn best practices for responding to and mitigating errors
- Encourage a culture of transparency, accountability, and continuous improvement

### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline:
- Introduction
- Importance of addressing errors in radiology
- Types of errors (interpretation, missed findings, wrong studies, etc.)
- Ethical Considerations
- Duty to disclose errors to patients and referring physicians
- Balancing transparency with patient well-being
- Maintaining trust and integrity in the profession
- Legal Implications
- Potential malpractice liability
- Informed consent and patient communication
- Documentation and reporting requirements
- Patient Safety
- Impact of errors on patient outcomes
- Strategies for error prevention and mitigation
- Implementing safety protocols and checklists
- Responding to Errors
- Immediate actions (communicating with patients, referring physicians, and colleagues)
- Root cause analysis and system improvements
- Emotional support for healthcare professionals involved
- Quality Improvement Initiatives
- Encouraging a culture of safety and transparency
- Empowering radiologists and trainees to identify and report errors
- Collaborative efforts across specialties to enhance patient care
- Conclusion
- Summarize key points and best practices
- Emphasize the importance of a proactive, patient-centered approach to error management

# Abstract Archives of the RSNA, 2024

NPMEE-38

## NEXT-GENERATION TB SCREENING: AI-DRIVEN ACTIVE CASE FINDING WITH PORTABLE CHEST RADIOGRAPHS - A RADIOLOGY REVOLUTION OR ROUTINE EVOLUTION?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Abhinav Jain, MD (*Abstract Co-Author*) Nothing to Disclose
Mehvash Haider (*Abstract Co-Author*) Nothing to Disclose
Amit Kumar (*Abstract Co-Author*) Nothing to Disclose
Vasantha Kumar Venugopal, MD (*Presenter*) Officer, CARPL.AI Inc

### TEACHING POINTS

1. Studies show that AI algorithms can achieve sensitivity and specificity that meet or exceed WHO's Target Product Profile for TB triage tests, significantly outperforming human radiologists in settings with high TB burdens? 2. Portable chest radiographs combined with AI analysis enable rapid on-site TB screening reducing the delay from screening to diagnosis3. AI algorithms have been shown to reduce the number of Xpert tests required by 50% while maintaining a sensitivity above 90% 4. The STOP TB Partnership highlights AI-powered CAD's role across diverse settings, with case studies from India, Pakistan, Cambodia, Vietnam, Uganda, and Nigeria illustrating varied implementation challenges and successes.5. ACF Metrics Effective ACF is measured by specific metrics, e.g., in India: screening 10% of the population, testing 4.75% of those, diagnosing 5% of those tested, aiming for an NNS (Number Needed to Screen) below 1,538

### TABLE OF CONTENTS/OUTLINE

Introduction to AI in TB Screening - Overview of the integration of AI with portable chest radiography in enhancing TB detection.Global Case Studies - Insights from Northeast Nigeria, implementations in Indonesia and India.Evaluation of AI in Screening Programs - Discussion on the evaluation of AI technologies in TB screening, including studies from the STOP TB Partnership and WHO guidelines on the use of AI in detecting TB from chest X-rays.Challenges and Ethical Considerations - Consideration of potential biases in AI algorithms, and the ethical implications of widespread AI deployment in healthcare.Conclusion Impact of AI-driven portable chest radiography in TB active case finding.

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# Abstract Archives of the RSNA, 2024

NPMEE-39

## THEORY OF CONSTRAINTS IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Danilo Sirias (*Abstract Co-Author*) Nothing to Disclose
James V. Rawson, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

There are many approaches to process improvement. Common approaches used in Radiology include Lean and the Plan Do Study/Check Act cycle. The Theory of Constraints was described by Eli Goldratt in The Goal in 1984 taking an operations management approach to flow. The premise is that in any complex system, there are only a few rate limiting steps. Improvement efforts on a step, which is not rate limiting to the over flow in the organization, will increase throughput at that individual step. However, those gains will simple queue up at the constraint, so there will be no system level improvement in flow. A constraint can be a piece of equipment, personal or even a policy. For example, in Radiology, backlogs for outpatient appointments point to a constraint. A constraint is often an expensive, hard to duplicate resource. In the past in Radiology, this was often the equipment and could be approached by optimizing utilization of the equipment. In today's world of radiology staff shortages, the staff may be the constraint. In this exhibit, we review how to optimize the constraint to improve throughput in Radiology.Teaching Points • In any complex system, there are only a few rate limiting steps/constraints. • An hour of time lost at a bottleneck is an hour lost for the system. • An hour saved at a non-bottle-neck does not improve throughput. • Buffers can be used to protect the constraint and increase utilization of the constraint (throughout).

### TABLE OF CONTENTS/OUTLINE

I. Theory of Constraints defined II. Constraints and Rate Limiting Steps III. Five Focusing Steps IV. Improving Throughput V. Financial vs Flow Accounting VI. Next steps for Radiology

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# Abstract Archives of the RSNA, 2024

NPMEE-4

## TOWARDS GREENER IMAGING: EVALUATING SUSTAINABILITY IN TECHNOLOGY PROCUREMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura Mosteiro, MD (*Abstract Co-Author*) Nothing to Disclose
MARIA AMPARO VILLAVERDE GOMEZ, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Enjamio, PhD, MEng (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The modernisation of advanced technological equipment in our healthcare systems requires a holistic approach to procurement that takes into account the evolving challenges posed by climate change, together with technological advances and sustainability imperatives. In a public health service environment, technology procurement requires strategic planning that integrates service needs, clinical and organisational objectives, financial resources and sustainability criteria.This publication aims to critically assess the adequacy of equipment procurement criteria set out in national or regional plans, with a two-pronged approach:1. The breadth and depth of incorporation of renewal or endowment criteria associated with the life cycle of equipment, covering maintenance, operating and environmental costs. This includes the deliberate consideration of end-of-life disposal processes to mitigate environmental impact and advance sustainability goals.2. 2. The effectiveness of the implementation or subsequent monitoring of these criteria, ensuring compliance with established sustainability benchmarks and expectations, thereby promoting responsible financing.Ultimately, this study aims to provide insights into the strategic integration of objective sustainability criteria into technology procurement decisions.

### TABLE OF CONTENTS/OUTLINE

1. Context and introduction2. Objectives3. Methodology 4. Results5. Discussion and conclusions

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# Abstract Archives of the RSNA, 2024

NPMEE-40

## ORGANIZATIONAL RESILIENCE IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Omar Msto Hussain Nasser, MD (*Abstract Co-Author*) Nothing to Disclose
Bettina Siewert, MD (*Abstract Co-Author*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv
James V. Rawson, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Even before the COVID-19 pandemic there was much discussion about resilience. This was usually discussed in the content of burnout and focused on the resilience of the individual. More recent literature in radiology looks at the leadership and system drivers of burnout shifting some of the responsibility for burnout off of the individual. In the recent revision of the Malcolm Baldrige National Quality Award criteria, one of the frameshifts was to look for evidence of organizational resilience. We review the concepts of individual and organizational resilience and look at key performance indicators that Radiology practices can assess to identify opportunities to improve organizational resilience. Teaching points • In addition to individual resilience, organizations can be resilient. • Organizational resilience is not the sum of the resilience of the individuals in the organization. • Other organizational processes contribute to the ability to survive or even thrive/transform when faced with shock, disasters and crisis. • Key performance indicators/metrics with benchmarks and trends over time can be used by Radiology practices and hospitals to identify where there is opportunity to improve their organizational resilience.

### TABLE OF CONTENTS/OUTLINE

I. Burnout and Moral Injury II. Individual Resilience III. Multifactorial approach to Burnout IV. Organizational Resilience V. Measure of Organizational resilience VI. Opportunities for Radiology

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# Abstract Archives of the RSNA, 2024

NPMEE-41

## COOKING UP ULTRASOUND PHANTOMS: A HOW-TO GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Logan M. Ryals, BS (*Abstract Co-Author*) Nothing to Disclose
Nader Pahlevan, BA (*Abstract Co-Author*) Nothing to Disclose
Thomas Powell (*Abstract Co-Author*) Nothing to Disclose
Charlotte Taylor, MD (*Abstract Co-Author*) Nothing to Disclose
Clinton Case (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Relay the importance of using US phantoms in teaching residents, medical students, and radiologists how to perform US-guided procedures.Provide step-by-step instructions for the creation of home-made US phantoms which may be used for demonstrations.

### TABLE OF CONTENTS/OUTLINE

Ultrasound (US) is vital in diagnosing and treating disease, so providing quality US instruction to radiology residents to build proficiency and confidence in performing US-guided procedures is important. US phantoms are often employed to teach the basics of thyroid biopsy, breast biopsy, intravascular access, etc. Additionally, the use of US phantoms has enhanced student outreach, allowing for increased engagement within student-run interest groups. However, purchasing high quality US phantoms from a commercial vendor is often costly, and they must be replaced over time due to wear and tear. An alternative is to create "homemade" US phantoms using gelatin and other household materials. There is no standard recipe for creating homemade phantoms, and few step-by-step resources exist for radiology educators to create high-quality phantoms. Three types of phantoms will be discussed: a 3-layer amniocentesis/paracentesis abdominal phantom, a vessel phantom, and a breast biopsy phantom. A resource for creating breast biopsy and vascular access phantoms will be beneficial given that the ACGME will soon require breast biopsy and vascular access procedural competency for radiology residency graduation. In addition to providing instructions for creating US phantoms, demonstrations will be outlined, including probe placement, basics of scanning and probe types, US-guided fine needle aspiration, and student interest group activities.

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# Abstract Archives of the RSNA, 2024

NPMEE-42

## AN ULTRA SOUND IDEA: A SINGLE CENTER EXPERIENCE OF LONGITUDINAL, INTEGRATED POINT-OF-CARE ULTRASOUND CURRICULUM IN UNDERGRADUATE MEDICAL EDUCATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roozbeh Houshyar, MD (*Abstract Co-Author*) Nothing to Disclose
Sohrab Kharabaf, BS (*Abstract Co-Author*) Nothing to Disclose
Monica Gerges (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Detail a single center longitudinal, integrated point-of-care ultrasound (POCUS) curriculum in undergraduate medical education, with sampled scanned cases and subjective feedback from student participants.Underscore benefits of such a curriculum, including health equity.

### TABLE OF CONTENTS/OUTLINE

Our institution provides every medical student a handheld POCUS device, Butterfly iQ (made by Butterfly Network, Inc. based in Guilford, CT), which is used in concert with courses. Preclinical students complete biweekly teaching sessions and assessments that cover technical skills, clinical correlates, and image-guided procedures of all organ systems. Artificial intelligence-driven live teaching tools within Butterfly iQ guide students to obtain high quality scans. A supplementary ultrasound (US) scanning elective is also offered. Students on rotations complete select US views to demonstrate competence. Impact of this curricular program is gauged with subjective metrics. Many studies show that early exposure to POCUS training enhances anatomic knowledge and diagnostic skill. Data gathered by our institution reveals students felt more confident and demonstrated improved objective competence in obtaining US views after completing just one US elective session. Mastering such skills benefits a clinician’s career, facilitating quicker, more accurate diagnoses. Handheld POCUS empowers students to improve health disparities. Our institution’s novel approach to providing its medical students a longitudinal POCUS curriculum may serve as a best-practice guideline for other institutions seeking to enhance anatomic understanding, clinical skills, technological literacy, and health equity.

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# Abstract Archives of the RSNA, 2024

NPMEE-43

## CREATING AN INCLUSIVE IMAGING DEPARTMENT - SUPPORTING NEURODIVERGENT PATIENTS ON THE IMAGING JOURNEY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Magda Coetzee (*Abstract Co-Author*) Nothing to Disclose
Michelle Phillips (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Neurodiversity is an umbrella term for the different conditions that describe variations in the way human brains process information. The challenges faced by those with neurodiverse conditions can make attending imaging departments and undergoing examinations difficult. We have a duty of care to all patients; it is important to increase awareness of neurodiversity and offer practical advice to radiography professionals to improve their skills and offer an inclusive service.

### TABLE OF CONTENTS/OUTLINE

The poster explains the challenges faced by neurodivergent patients - examples include executive function challenges, communication problems and issues with sensory overload. Further challenges are broken down by specific modality such as the intimate nature of mammography and the noise, confined space and necessary stillness of the Magnetic Resonance Imaging (MRI) scanner. This is followed by practical advice to ensure a better more understanding imaging service. Including - Working on the principle that everyone is to be treated with respect and no one is to be assumed to be unintelligent or incapable. Listen to your patients, use simple and direct language and give time for replies. Offer various methods of communication. Allow patients to see, touch and/or hear the equipment prior to their examination. The poster covers challenges adhering to the advice above but concludes with benefits of providing a service which is as accessible and smooth to as many as possible.

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# Abstract Archives of the RSNA, 2024

NPMEE-44

## ETHICS OF CARE IN RADIOLOGY: A PRIMER FOR EVERYDAY PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Juliana M. Bueno, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Lin (*Abstract Co-Author*) Nothing to Disclose
Kaelin Cockrell, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

There is a misconception that medical ethics is less relevant to radiology due to the limited direct patient-physician interaction. However, radiologists face ethical dilemmas during their daily workflow, which are difficult to recognize as they involve technology, systems, and stakeholders beyond patients themselves. Lack of awareness of radiology specific ethical challenges is a barrier to quality clinical care. This exhibit illustrates radiology-specific ethical dilemmas through case-based examples to increase awareness and provide support to solving these everyday challenges.Teaching points: 1) Recognizing the key ethical principles that govern clinical care allows us to recognize situations at risk of ethical violation. 2) Awareness and knowledge of the challenges that spring from each of the ethical principles is paramount. 3) The ethical challenges faced in diagnostic radiology are complex as they involve components of the system that are beyond the patients themselves. 4) A systematic approach to ethical problem-solving is necessary for the practice of radiology

### TABLE OF CONTENTS/OUTLINE

1. Refresher on key clinical ethical principles: a) Beneficence b) Nonmaleficence c) Autonomy d) Justice 2. Commonly encountered clinical scenarios: a) Appropriate use of imaging and follow up. b) Communicating critical results. c) Immediate availability of reports to patients (21st Century Cures Act mandate). d) Deciding relevant incidental findings to report. e) Addressing diagnostic misses or misdiagnosis. f) Imaging in incarcerated and refugee populations. 3) Conclusions: a) Ethical problem-solving tools. b) Future directions when facing ethical dilemmas

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# Abstract Archives of the RSNA, 2024

NPMEE-5

## ENGAGING AND INSPIRING THE NEXT GENERATION OF RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Farbod Fazlollahi, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Setting Clear Expectations Articulate daily reciprocal expectations, including objectives and the student's role on the team. Example: Residents outline study types, software, and focus areas for the day.
- Explaining Diagnostic Reasoning and Processes Residents should verbalize their thought process and diagnostic reasoning as they navigate studies. Example: Explaining the choice of slices and views in a CT scan.
- Engaging and Assessing the Student Continuously ask students for their observations and reasoning to assess understanding and promote active learning. Example: "What do you see here? Why do you think that?"
- Providing Real-Time Feedback and Further Learning Offer immediate feedback and recommend resources for further learning based on daily performance. Example: Provide specific feedback and suggest relevant articles or modules.
- Challenging the Student to Predict and Interpret Encourage students to predict findings from clinical indications and interpret images independently. Example: Discuss expectations before revealing MRI results.

### TABLE OF CONTENTS/OUTLINE



Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

NPMEE-6

## COMPASSIONATE COMMUNICATION: ELEVATING SKILLS FOR CONVEYING BAD NEWS IN BREAST IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Janice Thai, MD (*Abstract Co-Author*) Nothing to Disclose
Rachel E. Grenier, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Highlight the importance of training and education in delivering bad news in breast imaging. 2) Review step by step process for delivering bad news in breast imaging. 3) Review array of patient emotional responses, and tips for recognizing and responding empathically.

### TABLE OF CONTENTS/OUTLINE

1) Emphasize the importance of delivering bad news effectively in medicine, within the context of a patient care model. 2) Define the breast radiologist's specific objectives in delivering bad news to patients. 3) Demonstrate a step-by-step process for delivering bad news. 4) Review spectrum of emotional responses to bad news so that the breast radiologist can be better prepared to respond and meet the patient where they are at. 5) Emphasize importance of patient diversity: cultural, socioeconomic, ethnic, and physical. 6) Highlight the importance of personal reflection in improving communication style, especially when starting out as a breast radiologist. 7) Provide specific case examples/scenarios to demonstrate the nuance and dynamism of delivering bad news to patients in breast imaging.

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# Abstract Archives of the RSNA, 2024

NPMEE-7

## RADIOLOGISTS FOR THE PUBLIC GOOD: A GUIDE TO NON-PROFIT ORGANIZATIONS IN RADIOLOGY AND HOW TO GET INVOLVED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Cristina Fuss, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Merriam, DO (*Abstract Co-Author*) Nothing to Disclose
Joseph Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Develop an understanding of the different types of non-profit work in radiology and available to radiologists• Understand the differing types of charitable/non-profit organizations in radiology, which can be grouped into four major areas: standalone charitable organizations, professional societies, charitable arms of for-profit organizations, and educational (e.g., Road2IR)• Foster an understanding of the various ways to get involved with charitable organizations within the field of radiology, at any level of time commitmentThere are several well-recognized and longstanding charitable organizations in medicine, such as Doctors without Borders, The Red Cross, and UNICEF. Non-profit/charitable work in radiology specifically is newer and has truly only accelerated over the past two decades. Digital imaging technology has fostered a revolution in imaging-related care and has offered novel means of broaden access. The possibilities for philanthropic work within our field are growing exponentially. The purpose of this overview is to raise awareness of, and provide opportunities for individuals who desire to become involved with non-profit work in the field of radiology.

### TABLE OF CONTENTS/OUTLINE

-Background:-Standalone Charitable Organizations:-RAD-AID-Radiologists without Borders-UNITSUSA-Project CURE-Societal Charitable Arms:-RSNA, ASER, ARRS, etc-Charitable efforts of For Profit Organizations:-VRAD first read initiative-Educational:-Road2IR

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# Abstract Archives of the RSNA, 2024

NPMEE-8

## PRECISION PROTOTYPES: THE EVOLUTION OF PATIENT-SPECIFIC MODELS IN RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Farbod Fazlollahi, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Imaging Data Basics: CT and MRI imaging data is used to produce detailed anatomical cross-sections that are then processed by software to help distinguish different tissues.
- Conversion Process: 2D cross-sectional data is stacked to construct a 3D volume, then converted to a mesh structure for 3D printing, then divided into sections to be printed accurately one layer at a time
- Software Tools: A variety of commercially available software such as 3D Slicer, OsiriX, and Materialise Mimics are used for image processing, segmentation, and mesh generation.
- Clinical Applications: 3D printed models can be used to enhance preoperative planning, surgical navigation, and implant design, as well as for diagnosis, research and teaching. Important considerations for wider applicability in the clinical space include accuracy, quality assurance, and regulatory compliance.

### TABLE OF CONTENTS/OUTLINE

# Abstract Archives of the RSNA, 2024

NPMEE-9

## RADIOLOGY MYTH BUSTERS - FILTERING FACT FROM FICTION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Lindsay S. DeWeese, PHD (*Abstract Co-Author*) Nothing to Disclose
Nadine Mallak, MD (*Abstract Co-Author*) Nothing to Disclose
Dennis Barbon, MD (*Abstract Co-Author*) Nothing to Disclose
Alice W. Fung, MD (*Abstract Co-Author*) Nothing to Disclose
Lindsay N. Douglas, PhD (*Abstract Co-Author*) Nothing to Disclose
Anna Mench (*Abstract Co-Author*) Nothing to Disclose
Catherine Meyer, PhD (*Abstract Co-Author*) Nothing to Disclose
Laszlo Szidonya, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review strongly held beliefs in Radiology, their origins, and supporting or disproving data.2. Present evidence-based, patient-friendly discussion points to better inform patients and non-radiology colleagues.

### TABLE OF CONTENTS/OUTLINE

The discussion of each myth will include data from which the myth arose, data supporting a new perspective, and takeaways to help educate patients and non-radiologists.1. Myth #1: Effective dose is useful for individual patient dose and risk assessment.2. Myth #2: Ultrasound is the only safe imaging for pregnant patients.3. Myth #3: Imaging exams that utilize the lowest dose are always better.4. Myth #4: Patient shielding should be used whenever possible.5. Myth #5: Patients should always be isolated after radionuclide exams and therapies.6. Myth #6: Patients with renal dysfunction should avoid iodinated IV contrast or be given a lower dose of contrast.7. Myth #7: Iodine and shellfish allergies are contraindications to iodinated IV contrast administration.8. Myth #8: Spleen biopsy is contraindicated due to risk of bleeding.9. Myth #9: Gadolinium deposition is associated with long-term health problems.10. Myth #10: INR is always a useful assessment for bleeding risk.

# Abstract Archives of the RSNA, 2024

NREE

**Neuroradiology Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## NREE-1 OVERVIEW OF TEMPORAL LOBE PLUS EPILEPSY AND ANATOMIC SUBSTRATES: INSULA, THALAMUS, OLFACTORY, AND CINGULATE SYSTEMS

**Awards**
**Certificate of Merit**

Aline Herlopian (*Abstract Co-Author*) Nothing to Disclose
Chong Zhou, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Richard A. Bronen, MD (*Abstract Co-Author*) Nothing to Disclose
Justin Sindoni, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss temporal lobe plus epilepsy (TLE+) and its importance2. Review pertinent anatomy of TLE+ (e.g., connections to the insula, thalamus, olfactory, and cingulate)3. Review cases of pathologies of TLE+ structures involved in refractory epilepsyBackground: Temporal lobe epilepsy is the most common type of epilepsy and accounts for about half of all cases of focal epilepsy. Over the last few decades, it has been recognized that epilepsy may be the result of "network" changes in the brain rather than from a focal abnormality influencing an "epileptogenic zone." Temporal lobe plus epilepsy (TLE+) is a term coined to discuss the network of extratemporal structures involved in refractory temporal lobe epilepsy, including the insula, thalamus, olfactory connections, and cingulate. In this exhibit we will discuss the anatomy and connections of the structures involved in TLE+ in the context what is important for the radiologist to know and evaluate. We will review imaging of both normal anatomy and cases illustrating pathology in patients with TLE+. The ultimate goal is to assist the radiologist in providing optimal care in the diagnosis and successful treatment of epilepsy, particularly with helping targeting for recent therapies such and neuromodulation and laser ablation treatments.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Discussion of structures and connections of TLE+ (e.g. the insula, thalamus, olfactory connections, and cingulate)3. Imaging evaluation of normal TLE+ structures4. Case examples of pathology involving TLE+ structures5. Summarize TLE+ and future directions for the radiologist's role in the multidisciplinary approach to epilepsy treatment

## NREE-100 BEYOND THE OBVIOUS: UNRAVELING STROKE AND ITS IMPERSONATORS

Paulo C. Puac Polanco, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Torres, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Eduardo Portela de Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Santanu Chakraborty, FRCPC,MBBS (*Abstract Co-Author*) Nothing to Disclose
Nerses Nersesyan, MD (*Abstract Co-Author*) Nothing to Disclose
Azza Reda, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Lucia Brun, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To recognize and differentiate between cases of stroke and differential considerations based on imaging findings.- To recognize specific imaging patterns and signs associated to common and uncommon stroke mimics on imaging.- To understand the importance of accurate differentiation for timely and appropriate patient management.

### TABLE OF CONTENTS/OUTLINE

Mimics account for nearly half of all hospital admissions for suspected strokes. Stroke mimics may present as functional disorders or may be symptomatic of underlying neurological or medical conditions. A significant number of patients continue to receive thrombolysis unnecessarily, resulting in inherent risks and avoidable costs. Thus, accurate diagnosis is of utmost importance. A non-contrast CT scan alone is often insufficient for diagnosis, and multimodal CT or MRI scans are typically required.Imaging Pattern-Based Approach Through Cases:- Segmental gray and white matter: Stroke, Seizures, Migraine, HSV encephalitis, Venous thrombosis, TGA, Hypoglycemia, Tumor, MELAS- Cortical and deep gray matter: HII, Hepatic encephalopathy, CJD, Wernicke's encephalopathy.- Deep gray matter: Stroke, HII, CO poisoning, extrapontine myelinolysis, CJD, Nonketotic Hyperglycemia, Venous thrombosis, Wernicke's.- White matter: CADASIL, Susac's, demyelination, metronidazole and methotrexate toxicity, Heroin.- Watershed zones: Stroke, RCVS, PRES, Moya-Moya, Hyperperfusion syndrome.- Scattered Foci: Fat emboli, DAI Embolic infarcts, Mets.- Corpus Callosum: CLOCCs, Seizures, Marchiafava-Bignami. <!--EndFragment-->

## NREE-101 SPONTANEOUS INTRACRANIAL HYPOTENSION - AN EASY GUIDE

Beatriz Alba Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Juan V. Quintana Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Joseba Mirena Zulueta Odriozola, MBBS (*Abstract Co-Author*) Nothing to Disclose
Martiel M. Manrique Zegarra, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ines Pecharroman, PhD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

After reviewing this exhibit, the reader should: - Understand the pathophysiology of spontaneous intracranial hypotension and be able to explain and correlate it with the imaging findings. - Properly describe the findings in the studies performed to patients affected by this condition. - Learn the MRI sequences that are most useful for detecting the different findings leading to disease diagnosis and to identifying underlying causes, being aware of the differential diagnosis suggested by each of the described findings. - Be familiar with the complex diagnostic and therapeutic process of the disease: recognizing situations warranting a high clinical suspicion for this condition, determining appropriate screening tests, identifying circumstances in which invasive procedures are needed for further evaluation, and customizing treatment approaches for individual scenarios.

**TABLE OF CONTENTS/OUTLINE**

-Introduction - Clinical presentation - Differential diagnosis - Causes - Work-up algorithm - Diagnostic imaging : initial approach o Brain MRI o Spine MRI - Diagnostic imaging : investigating the etiology o CT-Myelography o Non invasive MR-Myelography o Fluoro-Myelography - Treatment o Conservative treatment o Targeted treatment - Conclusions

## NREE-102 PRIMARY CENTRAL NERVOUS SYSTEM LYMPHOMA: IMAGING AND FEATURES AND DIFFERENTIAL DIAGNOSIS

Diogo G. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Mori, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Imaging Modalities: Teach about the imaging modalities commonly used in diagnosing PCNSL.
- Typical Imaging Features: Highlight the typical imaging features of PCNSL on MRI and CT scans.
- Differential Diagnosis: Emphasize the importance of considering differential diagnoses when evaluating imaging findings suggestive of PCNSL in immunocompetent and immunocompromised patients.
- Key Differentiating Factors: Teach about the key differentiating factors between PCNSL and other brain lesions on imaging.
- Advanced Imaging Techniques: Introduce advanced imaging techniques such as diffusion-weighted imaging (DWI), perfusion-weighted imaging (PWI), and magnetic resonance spectroscopy (MRS), which may aid in differentiating PCNSL from other brain lesions based on specific metabolic and hemodynamic features.

**TABLE OF CONTENTS/OUTLINE**

Introduction to PCNSL: Definition and incidence and clinical presentation. Histophatological analysis: Overview of WHO classification diffuse large B-cell lymphoma (DLBCL) and other lymphoid neoplasms in the CNS. Role of Imaging in PCNSL Diagnosis: Importance of MRI in PCNSL diagnosis, clinical applicability and data provided by MRI. Imaging Features of PCNSL: Tumor metabolism, water molecule diffusion, cell density and blood-brain barrier permeability. Differential Diagnosis of PCNSL: Importance of distinguishing differential diagnoses, defining biopsy location. Atypical Forms of PCNSL: Extra-axial PCNSL, intravascular lymphoma, lymphomatosis Cerebri and skull lymphoma. Conclusion: Radiologist role is to contributed to the PCNSL diagnosis, treatment planning, and patient care.

## NREE-103 UNTANGLING THE LUMBOSACRAL PLEXUS MRI: SEARCH PATTERNS, PATHOLOGIES AND DIAGNOSTIC INSIGHTS

**Awards**
**Certificate of Merit**

Claudia F. Kirsch, MD (*Abstract Co-Author*) Consultant, Informa PLC;Royalties, Informa PLC
Jeffers Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Hamilton, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The lumbosacral plexus is a complex network of nerves formed by the ventral rami of the lumbar and sacral spine, with end branches innervating the pelvic sidewall and lower limbs. Despite its clinical significance, lumbosacral plexus MRI examinations are infrequently performed, and instances of imaged pathologies are even rarer. Consequently, radiologists may lack the exposure and expertise needed to effectively evaluate these examinations.Our objective is two-fold: 1) to delve into the anatomy and present cases illustrating key findings of lumbosacral plexus pathologies that we have drawn from the past 25 years at our academic tertiary center showcasing a wide range of etiologies, including neoplastic, infectious, inflammatory and traumatic causes; and 2) to highlight the key MRI sequences and demonstrate our search pattern while providing a step-by-step framework to assist in the interpretation of this uncommonly performed exam.

**TABLE OF CONTENTS/OUTLINE**

1.Review the anatomy of the lumbosacral plexus2.Identify the indications for MRI evaluation of the lumbosacral plexus in clinical practice3.Familiarize with the MRI techniques and sequences utilized for optimizing the imaging of the lumbosacral plexus4.Develop a systematic search pattern and highlight key elements that should be documented in every radiologist’s report5.Discuss and illustrate various pathologies affecting the lumbosacral plexus, including neoplastic, infectious/inflammatory, traumatic and degenerative etiologies

## NREE-104 IRON RIM LESIONS AND CENTRAL VEIN SIGN ON 3T SWI: WHAT RADIOLOGISTS SHOULD KNOW IN THE DIAGNOSIS OF MULTIPLE SCLEROSIS

Masayuki Maeda, MD (*Abstract Co-Author*) Nothing to Disclose
Seiya Kishi (*Abstract Co-Author*) Nothing to Disclose
Ryota Kogue, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fumine Tanaka (*Abstract Co-Author*) Nothing to Disclose
Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet

SA;
Maki Umino, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Iron rim lesions (IRLs) and central vein sign (CVS) on SWI have been reported to be useful for the diagnosis and monitoring of multiple sclerosis (MS). Here we demonstrate the importance of these findings regarding diagnosis and clinical relevance in MS patients. We aimed to1) Understand what IRLs indicate in MS pathology. 2) Learn about the pathology of CVS, which shows inflammation-dependent remodeling of blood vessel walls (lumen enlargement and collagen deposition). 3) Learn how specific IRLs and CVS are for MS lesions and what the differential diagnosis is. 4) Learn the relationship between IRLs and other MRI findings/clinical findings.

**TABLE OF CONTENTS/OUTLINE**

1. Pathology of IRLs: IRLs represent a rim of iron-laden macrophages/microglial cells at the lesion edge (i.e., chronic active lesion). 2. Diagnostic value of IRLs and CVS: IRLs are unique to MS except for Susac syndrome. CVS is unique to MS except for Behēet's disease. 3. IRLs and other MR findings: ring enhancement and hypointense ADC rim may predict progression from acute to IRL. 4. Combination of IRLs and CVS: a great impact on the prediction of clinically isolated syndrome patients' conversion to definite MS. 5. Clinical relevance of IRLs: IRLs may serve as a marker of persistent low-level inflammation in adjuvant therapy targeting insidious clinical decline.

## NREE-105 IDENTIFICATION AND CLINICAL SIGNIFICANCE OF PLAQUE ULCERATIONS

Luca Saba, MD (*Abstract Co-Author*) Nothing to Disclose
Brett Cucchiara (*Abstract Co-Author*) Nothing to Disclose
Jae W. Song, MD, MS (*Abstract Co-Author*) Nothing to Disclose
David Yang (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. We provide criteria for defining plaque ulcerations based on image modality.2. We correlate the anatomy of a plaque ulceration to its appearance on imaging and clarify the concept of an ulceration as a crater in plaque rather than an outpouching of the blood vessel wall.3. We describe the stages of how plaque develops and ulcerations form.4. We review the literature on the significance of plaque ulcerations and high risk with stroke and cardiac events.5. We provide examples of common image interpretation pitfalls that may mimic plaque ulcerations, including faint plaque calcifications, carotid webs, and intimal flaps from arterial dissections.

**TABLE OF CONTENTS/OUTLINE**

1. Identification of plaque ulceration. (a) Criteria for defining plaque ulceration in the vascular beds. (b) Classification of carotid artery ulceration types. (c) Anatomy of plaque ulceration and imaging appearances.2. Mechanism and pathophysiology of plaque ulceration.3. Clinical significance of plaque ulcerations in the aorta, coronary arteries, carotid arteries, and intracranial arteries. (a) Prevalence. (b) Histology. (c) Clinical associations with stroke or cardiac events. (d) Multimodality image examples on ultrasound/echocardiograms, CTAs, and MRAs.4. Image interpretation pitfalls of identifying plaque ulcerations. (a) Example of focal calcification. (b) Example of carotid web versus dissection

## NREE-106 SUMMER IS COMING - DECODING THE ARBOVIRUS IMPRINTS IN NEUROIMAGING

Tomas Freddi, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Celso Hygino, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To elucidate the neuroradiological manifestations of arbovirus infections, emphasizing characteristic imaging features across different modalities. To enhance understanding of the pathophysiological impact of arboviruses in the CNS, facilitating early diagnosis and effective intervention. To discuss the evolution of imaging in tracking the progression and support treatment response of arbovirus infections, highlighting their pivotal role in clinical decision-making.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of arboviruses, focusing on physiopathology and clinical findinds. 2. Epidemiology of arboviruses, focusing on those that frequently cause neurological manifestations 3. Discussion on the physiopathology of CNS invasion and typical progression. 4. Radiological signatures of dengue fever, West Nile virus, Chikungunya, Japanese Encephalitis, Saint Louis Encephalitis, and Zika, including cortical lesions, white matter changes, spinal cord findings, neural root involvement, and hemorrhagic presentations. 5. Associated complications: post Yellow-Fever Vaccination lesions, Guillain-Barré Syndrome. 6. Discuss the diagnosis challenges, using a combination of imaging features, clinical correlation, and laboratory confirmation. 7. Overview of current support treatments and prevention available for arbovirus infections and the role of neuroradiology in monitoring treatment efficacy and neurologic recovery. Implications of imaging findings on therapeutic decisions, particularly in severe cases requiring aggressive treatment. 8. Take-home messages: summary of the critical contributions of imaging to understanding, diagnosing, and managing arbovirus infections in the CNS.

## NREE-107 EPIDEMIC ECHOES OF THE TROPICAL TWISTER: NEURORADIOLOGICAL FEATURES OF CHIKUNGUNYA VIRUS

**Awards**
**Certificate of Merit**

Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Tomas Freddi, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Celso Hygino, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To illuminate the neuroradiological manifestations associated with Chikungunya virus (CHIKV) infections in adults, emphasizing specific imaging features that aid in diagnosis. To delineate the clinical relevance of these imaging findings, enhancing the understanding of CNS involvement. To advocate for integrating neuroradiological evidence with clinical diagnostics to optimize the prevention and management of CHIKV.

**TABLE OF CONTENTS/OUTLINE**

1.Brief overview of Chikungunya virus, including virology, transmission, and global epidemiology. 2.Discuss typical clinical presentations, focusing on neurological symptoms that prompt neuroradiological evaluation. 3.Comprehensive review of neuroradiological findings in CHIKV-infected patients, detailed descriptions of patterns observed in MRI and CT, including encephalitis, myelitis, and perinatal mother-to-child transmission. 4.Description of the spectrum of neurological complications associated with CHIKV, ranging from mild headache and vertigo to more severe complications like Guillain-Barré syndrome and acute disseminated encephalomyelitis. 5. Typical and atypical radiological features, such as meningeal enhancement, cerebral and spinal cord involvement, acute disseminated encephalomyelitis-like lesions, and Guillain-Barré syndrome. 6.Discussion on the role of imaging in differentiating CHIKV neurological manifestations from those caused by other arboviruses. 7.Prevention and discussion on the role of neuroradiology in monitoring treatment efficacy and neurological recovery. 8.Recap the significance of neuroradiological approaches in diagnosing and managing Chikungunya's neurological manifestations.

## NREE-108 OUTLINING THE SPINAL CORD: TOPOGRAPHIC APPROACH TO SPINAL CORD ABNORMALITIES

Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Celso Hygino, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To elucidate the benefits of topographic approach in imaging and classification of spinal cord lesions, enhancing diagnostic precision and therapeutic targeting.To showcase the integration of neuroimaging, clinical and laboratory data, with topographic lesions mapping to provide a comprehensive overview of lesion features. To better understand how topographic data can inform prognosis and guide rehabilitation strategies, improving outcomes.

**TABLE OF CONTENTS/OUTLINE**

1.Introduction to topographic approach of spinal cord lesions, emphasizing the value of detailed anatomical and functional mapping. 2.Classification system based on topographic data that categorizes injuries by segments of the spine, adjacent structures and specific neural elements affected. 3.Imaging the spinal lesions, including epidural abscess, lymphoma, angiomyolipoma, cytomegalovirus, syphilis, schistosomiasis, CIDP, melanoma, Guillain-Barré syndrome, post-vaccination myelitis, chemical radiculitis, sarcoidosis, subacute combined degeneration, copper deficiency, HIV, ADEM, NMOSD, tuberculosis, fungus, vasculitis, CLIPPERS, viral encephalitis, spinal cord ischemia, COVID myelitis. 6. Gadolinium enhancement patterns of the spinal cord diseases. 7.Examine how specific topographic features correlate with patient prognosis, potential for recovery and risk of complications. 8.Discuss how topographic information can guide surgical interventions, the choice of rehabilitation techniques, and the development of targeted therapies. 9. summary of the pivotal role that topographic mapping plays in transforming the landscape of spinal cord injury diagnosis and management.

## NREE-109 CHARACTERISTIC ANATOMIC LOCATION OF SYMMETRIC DWI HYPERINTENSE LESIONS: FROM INSIDE TO OUTSIDE

Kazufumi Kikuchi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Osamu Togao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kousei Ishigami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Koji Yamashita, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review what type of diseases could involve the inner or outer brain 2. To learn how DWI provides a greater contrast between lesions and surrounding normal structures than other sequences 3. To list differential diagnoses based on disease-specific location, shape, and clinical information

**TABLE OF CONTENTS/OUTLINE**

1) Innermost: Wernicke encephalopathy, osmotic demyelination, artery of Percheron infarction, and Leigh encephalopathy 2) Corpus callosum+ and Hippocampi: Cytotoxic lesions of the corpus callosum (CLOCCs), 5-FU induced encephalopathy, metronidazole-induced encephalopathy, autoimmune encephalitis, and human herpesvirus 6 (HHV-6) encephalitis 3) Pyramidal tracts, basal nuclei, and thalami CLCN2-related leukoencephalopathy, adrenomyeloneuropathy, hypomyelination of early myelinating structures (HEMS), vigabatrin-associated brain abnormalities, and hemolytic uremic syndrome 4) White matter Influenza encephalopathy, adrenoleukodystrophy, hereditary diffuse leukodystrophy with spheroids (HDLS), adult-onset autosomal dominant leukodystrophy, acute encephalopathy with biphasic seizures and late reduced diffusion (AESD), and neuronal intranuclear inclusion disease 5) Cortices and outside skull: Creutzfeldt-Jakob Disease, Gerstmann-Straussler-Scheinker disease, hypoxic-ischemic encephalopathy, and relapsing polychondritis

## NREE-11 ATYPICAL CEREBRAL VENOUS THROMBOSIS: 'THE EYES SEE WHAT THE MIND KNOWS' :EXPANDING THE PHENOTYPIC SPECTRUM OF CEREBRAL VENOUS THROMBOSIS

**Awards**
**Cum Laude**

Sabha Ahmed, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

I. llustrate the normal Intracranial Superficial andDeep Venous Anatomy.2. Illustrate the common findings of Cerebral Venous Sinus Thrombosis.3. Illustrate the tell tales of Cortical Vein Thrombosis.4. Illustrate with examples the rare phenotypic manifestations of atypical Cerebral Venous Thrombosis(CVT).5. Highlight the importance of ruling out atypical CVT in day-to-day reporting and avoid overcalling these manifestations as either Demyelinating or Neoplastic conditions.

**TABLE OF CONTENTS/OUTLINE**

Table of contentsOutline of normal intracranial superficial and deep venous systemOutline of the draining venous territories of the intracranial venous systemCommon imaging phenotypes of dural sinus , cortical and deep venous thrombosisCase based illustration of atypical cerebral venous thromboses - Schematic depiction of the the afflicted veinsHighlight the common misdiagnoses in day to day reporting of this condition

## NREE-110 THROUGH THE SKULL: EXPLORING TRANSCALVARIAL LESIONS

Andrea S. Costacurta, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose

Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo J. Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Rangel Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Virginia R. Simonini, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Da Silva, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adriana M. Melo, MBA, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Glenda Peres (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The intricate anatomical structures comprising the scalp, skull, and dura mater serve as potential loci for lesions capable of traversing multiple compartments. The purpose of this educational exhibit is to explore the various facets of transcalvarial lesions, including their clinical and imaging characteristics, in order to equip radiologists with the tools necessary to significantly narrow the spectrum of potential diagnoses.

**TABLE OF CONTENTS/OUTLINE**

1. Definition of a transcalvarial lesion.2. Overview of the anatomical structures that compose the scalp, cranial vault, and dura mater.3. Discussion of the main differential diagnosis: Meningioma, Lymphoma, Metastasis and Plasmacytoma.4. Patterns of calvarial invasion on CT.5. Miscellaneous: Demonstration of rare lesions that can manifest as transcalvarial masses: CNS Tuberculosis, Solitary Fibrous Tumor and Dermatofibrosarcoma Protuberans.

## NREE-111 PERIOPERATIVE AND POSTOPERATIVE COMPLICATIONS OF ENDOSCOPIC ENDONASAL APPROACH SURGERIES OF THE ANTERIOR SKULLBASE: A CASE-BASED REVIEW

**Awards**
**Certificate of Merit**

Marion A. Hughes, MD, JD (*Abstract Co-Author*) Nothing to Disclose
Barton F. Branstetter IV, MD (*Abstract Co-Author*) Nothing to Disclose
William E. Rothfus, MD (*Abstract Co-Author*) Nothing to Disclose
Katie S. Traylor, DO (*Abstract Co-Author*) Nothing to Disclose
Keerthi Arani, MD (*Abstract Co-Author*) Nothing to Disclose
Gloria Joo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The endoscopic endonasal approach (EEA) is a surgical technique that allows for direct access to a variety of tumors centered at the anterior skullbase. By operating through the nose and paranasal sinuses, EEA minimizes brain retraction, and manipulation of neurovascular structures that occur with transfacial and transcranial approaches.2. Knowledge of conventional pre-operative skullbase anatomy and typical postoperative appearance of nasoseptal flap reconstruction on CT and MRI is crucial to assess for possible complications of EEA.3. The most common type of complication is flap failure, which can manifest radiologically as CSF leak from flap migration/dehiscence, flap necrosis, and infection. Other less common complications involve injury to the internal carotid artery (ICA) and other adjacent skullbase structures. These complications can be evaluated with skullbase CT and MRI, cisternograms, and cerebral angiograms.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of the endoscopic endonasal approach: general technique and comparison of EEA to transfacial/transcranial approaches.2. Normal postoperative findings on CT and MRI: intact nasoseptal flap and fat graft.3. Postoperative Complications on Imaging A. Flap: flap migration with brain herniation, CSF leak, flap necrosis with infection. B. Vascular: ICA dissections, pseudoaneurysms, cavernous sinus thrombosis, air embolism to intracranial vessels.

## NREE-112 THE ART OF MISMATCH: A DIAGNOSTIC KEY IN CNS TUMOR IMAGING

Roy Riascos, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Torres, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Andres F. Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo C. Puac Polanco, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Maria Lucia Brun, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.To improve the ability to recognize and interpret various types of mismatches in CNS tumor imaging, leading to more accurate diagnoses. 2.To foster a deeper comprehension of the different scenarios where mismatch patterns can be valuable in the diagnostic process of CNS neoplasms. 3. To emphasize the importance of interdisciplinary collaboration in the initial approach of brain tumors and their evaluation after treatment.

**TABLE OF CONTENTS/OUTLINE**

In the realm of CNS neoplasm diagnosis, the emergence of mismatch scenarios offers a compelling dimension to the diagnostic process.The nuanced interplay between clinical presentations, diverse imaging modalities, and difficulties/limitations of imaging techniques unveils challenges for an accurate diagnosis where different types of mismatches can be found. The ability to recognize and interpret these deviations from the expected unlocks precision in diagnosing CNS neoplasms, ultimately leading to better patient care and outcomes.Outline: 1. Clinico-radiological mismatch: Pseudoprogression. Pseudo response. 2. Imaging-imaging mismatch: T2/FLAIR mismatch. Advanced-basic imaging mismatch. Mistmatch within imaging features. 3. Imaging-technique mismatch. 4. Imaging-surgical findings mismatch: Imaging. Conclusion: Understanding the pivotal role of mismatch scenarios in the diagnostic process of CNS neoplasms is key. We must emphasize the importance of interdisciplinary collaboration.

## NREE-113 MAPPING THE MAZE: NEUROIMAGING INSIGHTS INTO IMMUNOCOMPROMISED PATIENTS

**Awards**
**Certificate of Merit**

Faisal A. Alsugair, MD,FRCPC (*Abstract Co-Author*) Nothing to Disclose
Paulo C. Puac Polanco, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Azza Reda, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Immunocompromised patients represent a vulnerable group that can be affected by numerous neurological conditions.• The impairment of the body's immune system in this population can alter their ability to prevent diseases, particularly infections.• Other less common complications can be seen in immunocompromised patients, such as infection-induced neoplasms, paradoxical inflammatory reactions to treatment, or metabolic conditions. . There are several primary immune deficiencies and a wide number of secondary causes that include advanced age, metabolic conditions, infection (e.g., HIV), malnutrition, and chronic disorders such as diabetes and systemic lupus erythematosus

**TABLE OF CONTENTS/OUTLINE**

Approach for diagnosing Complications in Immunocompromised patientsA. Opportunistic infectionsB. Treatment-related complicationsC. NeoplasmsD. Miscellaneous A. Opportunistic infections- Toxoplasmosis- Fungal infections: Candida albicans, Cryptococcal meningoencephalitis, Cryptococcosis Gelatinous pseudocysts, choroid plexitis, Invasive fungal sinusitis- Viral infections: Ramsay-Hunt syndrome, herpes zoster virus, Herpes zoster ophthalmicus- Nocardia- CD8 encephalitis B. Treatment-related complications- PML- PML-IRIS C. Neoplasms- EBV-induced 1ry CNS Lymphoma - Miscellaneous- Vasculitis- Infarction

## NREE-114 CONTRAST-INDUCED ENCEPHALOPATHY: AN UNDERESTIMATED COMPLICATION AFTER ENDOVASCULAR PROCEDURES?

Salome Bosshart, MD (*Abstract Co-Author*) Nothing to Disclose
Rosario Pascarella, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Luisa Zedde, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalie Nierobisch (*Abstract Co-Author*) Nothing to Disclose
Nicolin Hainc (*Abstract Co-Author*) Nothing to Disclose
Alexander Stebner, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

I) Pathophysiology, epidemiology, and clinical presentation II) Typical radiographical signs of Contrast-Induced Encephalopathy (CIE) on CT and MRI. III) Distinguishing CIE from other differential diagnoses/frequent post-endovascular procedures complications.

**TABLE OF CONTENTS/OUTLINE**

What is CIE? It is a rare sporadic condition of neurotoxicity after intravascular administration of iodine contrast. It evolves rapidly and causes temporary neurological deficits/seizures shortly after contrast administration, sometimes within hours. Patients usually recover within days without residual findings on imaging, but cases of incomplete remission with permanent deficits and rarely death have been reported. It is assumed that the breakdown of the blood-brain barrier with contrast-leakage causes altered excitability and thus neuronal dysfunction. Typical imaging findings? Cortical and sulcal hyperdensities on CT not corresponding to blood but contrast agent and vasogenic edema resulting in mass effect. These findings typically resolve completely within hours to days on follow-up imaging. Pearls, pitfalls, and differential diagnoses: Is it blood or contrast? - Dual-Energy CT is a useful tool to differentiate iodine from blood! Is the swelling a sign of stroke progression? - Sometimes you will need CTA to exclude residual or recurrent vessel occlusions, or MRI to look for diffusion restriction in acute stroke patients and FLAIR/T1w/SWI for blood, as iodine contrast should not be visible on MRI! Am I missing something? - Time will tell: After excluding acute conditions like subarachnoid hemorrhage and acute ischemic stroke, CIE will resolve typically quickly with conservative supportive treatment.

## NREE-115 PICTORIAL REVIEW OF INTRAVENTRICULAR BRAIN TUMORS IN ADULTS AND CHILDREN - A PRIMER FOR RESIDENTS AND FELLOWS

Laiz Godoy, MD (*Abstract Co-Author*) Nothing to Disclose
Otavio Augusto Ferreira Dalla Pria, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Intraventricular brain tumors encompass myriad presentations in both clinical symptomology and radiological findings and frequently represent a challenge for the radiologist since multiple imaging features overlap among these tumors. Nevertheless, they account for a relevant incidence in our daily practice regardless of being an experienced neuroradiologist or a junior resident taking calls. Given their importance, a constant review of these entities is mandatory to succeed in general or neuroradiology. Moreover, this exhibit aims: 1. To review the literature concerning adult and children's intraventricular brain tumors; 2. To describe multi-modality imaging findings helpful in narrowing the differentials and relevant clinical presentations based on location, age, sex, etc. 3. To depict cases of typical and atypical supra and infratentorial intraventricular brain tumors in adults and children.

**TABLE OF CONTENTS/OUTLINE**

1. Concise exposition delineating the embryology, anatomical configuration, and physiological attributes pertinent to the ventricular system; 2. Illustration of diverse cases featuring intraventricular cerebral neoplasms, including but not limited to ependymoma, subependymoma, central neurocytoma, subependymal giant cell tumor, choroid plexus neoplasm, meningiomas, juxtaposed with a comprehensive examination of potential differentials such as colloid cysts, atypical teratoid/rhabdoid tumors, and other pathologies. Furthermore, incorporation of cases initially presumed to originate intrinsically but ultimately diagnosed within the extraventricular ambit due to semblant radiological manifestations; 3. Conclusion and take-home messages, 4. References

## NREE-116 UNRAVELING THE UNUSUAL: A CASE REVIEW OF UNIQUE TRIGGERS FOR TRANSIENT ISCHEMIC ATTACKS (TIAS)

Mansi N. Jantre III, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Transient Ischemic Attacks (TIAs) are often precipitated by conventional risk factors such as hypertension, diabetes, or hypercholesterolemia. However, there exists a subset of cases where atypical triggers play a significant role. This review examines the radiological features and diagnostic challenges associated with these unusual triggers for TIAs. Through a series of case studies and imaging modalities including CT, MRI, and angiography, we elucidate the role of radiology in understanding these atypical triggers is crucial for accurate diagnosis, timely intervention, and improved patient outcomes.

**TABLE OF CONTENTS/OUTLINE**

-Introduction - Case: Parapharyngeal abscess with secondary involvement of carotid sheath- Case; Stylocarotid syndrome in Eagles syndrome-Case: Subclavian steel syndrome-Case; ICA pseudoanuysm triggering TIA and Horners syndrome-Case; Floating unstable plaque in ICA

## NREE-117 WHEN TO WORRY ABOUT INTRACRANIAL CALCIFICATIONS: OVERVIEW ON CT

Guilherme C. Martins, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Calcifications within the brain parenchyma or vasculature are typical finding in all ages, present in the radiologist's daily routine. They can be age-related or pathological with a wide spectrum of presentations. Even with the introduction of Magnetic Resonance Imaging (MRI), non-contrast computerized tomography (NCCT) scan is the choice for detection and characterization. They can be classified into patterns with related terminology, ranging from dots, lines, stippled, blush, gyriform to conglomerates, as well as divided into pathological subtypes: vascular, genetic, infectious, inflammatory or neoplastic diseases. Pathological conditions can be linked to the radiological phenotype, taking into account anatomical location, distribution, dimensions and morphology, in association with clinical history and age. When identified in the appropriate clinical setting, the characteristic features allow the radiologist to facilitate the differential diagnosis and avoid practical errors.

### TABLE OF CONTENTS/OUTLINE

Optimizing the approach based on the radiological patterns, dividing them with related terminology and pathological subtypes thru a summary facilitates diagnosis, understanding and clinical management.

## NREE-118 DON'T BE VEIN: INTRACRANIAL VENOUS PATHOLOGY - A PRIMER FOR THE RADIOLOGIST

Ashok Srinivasan, MD (*Abstract Co-Author*) Nothing to Disclose
Grant E. MacKinnon, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understanding typical intracranial venous anatomy and common variants is essential to develop an effective search pattern and avoid misinterpretation, a common pitfall for the training radiologist.2. Recognizing patterns of venous thrombosis and hemorrhage will aid in rapid diagnosis and the potential need for additional imaging.3. Identifying venous malformations helps guide patient management and avoid unnecessary workup.

### TABLE OF CONTENTS/OUTLINE

I. Typical intracranial venous anatomy a) Unique features of intracranial veinsII. Common intracranial venous variants a) High riding jugular bulb b) Jugular diverticulum c) Jugular dehiscenceIII. Venous thrombosis a) Risk Factors b) Venous territories i) Dural venous sinus thrombosis ii) Deep venous thrombosis iii) Superficial venous thrombosis c) Imaging features signs d) Complications i) Infarction ii) Dural arteriovenous fistula e) Mimics i) Hypoplastic/stenotic transverse sinus ii) Arachnoid granulations iii) PolycythemiaIV. Venous hemorrhage a) Venous epidural hematoma i) Common subtypes (1) Anterior temporal (2) Vertex (3) Clival b) Germinal matrix hemorrhage i) Risk Factors ii) Grading c) Perimesencephalic (nonaneurysmal) subarachnoid hemorrhageV. Venous malformations a) Cavernous malformation b) Developmental venous anomaly c) Capillary telangiectasia d) Sinus pericranii

## NREE-119 BRAIN MRI PROTOCOLS: A USER GUIDE

Matthew F. Glasser, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Robert C. McKinstry III, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Arash Nazeri, MD (*Abstract Co-Author*) Nothing to Disclose
Michelle Wegscheid, MD,PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Brain MRI protocols can be overwhelming for trainees. A foundational understanding of the physical principles of brain MR sequences is important for effective clinical deployment and accurate diagnostic interpretation. Furthermore, understanding MR parameters as customizable variables will inform patient and pathology-specific protocol optimization. The purpose of this exhibit is to: 1) Discuss the basic physics principles underlying sources of tissue contrast and image quality. 2) Provide an overview of acquisition methods, pulse sequences, and acceleration techniques commonly used in brain MR protocols. 3) Illustrate clinical applications and limitations of MR parameters through case examples. 4) Detail an approach to optimizing MR protocols for patient needs and pathology-specific questions.

### TABLE OF CONTENTS/OUTLINE

Tissue contrast: i) Sources of contrast: T1, T2, T2*, ? (susceptibility), PD, fat/water content, magnetization transfer, motion, ii) Weighting vs. quantitative mapping, iii) Fat saturation methodsImage quality spatial resolution, SNR, CNR, image fidelity, artifactsImage acquisition methods: i) Read-out: cartesian vs. non-cartesian k-space sampling, 2D vs. 3D, EPI, ii) Common pulse sequences: spin echo, gradient echo, SSFP, inversion recovery, DWI, perfusion, BOLD, flow sensitive, iii) Acceleration techniques: multi-coil parallel imaging (GRAPPA/SENSE, CAIPIRINHA and wave-CAIPI), simultaneous multi-slice, k-t acceleration methods for dynamic imaging, compressed sensing, deep learning methods, geometry factor (g-factor), iv) Reduced FOV (e.g., ZOOMit)Hardware: magnetic field strength, radiofrequency coils, gradient strength and slew rate, b0 and b1 shimming

## NREE-120 HYPOPHYSITIS: RADIOLOGICAL FINDINGS AND CLINICAL CHARACTERISTICS

Alex Rovira-Canellas, MD (*Abstract Co-Author*) Scientific Advisory Board, Novartis AG;Speaker, Novartis AG;Scientific Advisory Board, Groupe Sanofi;Speaker, Groupe Sanofi;Scientific Advisory Board, SyntheticMR AB;Scientific Advisory Board, TensorMedical;Scientific Advisory Board, F. Hoffmann-La Roche Ltd
J. Carlos Tortajada Bustelo (*Abstract Co-Author*) Nothing to Disclose
Fidel Nunez (*Abstract Co-Author*) Nothing to Disclose
Betina Biagetti (*Abstract Co-Author*) Nothing to Disclose
Anna Casteras (*Abstract Co-Author*) Nothing to Disclose
Karelys Ng (*Abstract Co-Author*) Nothing to Disclose
Sahyly Siurana (*Abstract Co-Author*) Nothing to Disclose
Cristina Auger, MD (*Abstract Co-Author*) Nothing to Disclose
Esteban Cordero (*Abstract Co-Author*) Nothing to Disclose
Elena Martinez Saez (*Abstract Co-Author*) Nothing to Disclose
Silvana I. Sarria Estrada, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Hypophysitis is an inflammation of the pituitary gland and a rare cause of hypopituitarism. It can be primary (autoimmune or idiopathic) or secondary to sellar, suprasellar, and parasellar lesions, systemic diseases, or drugs. The most common primary hypophysitis is lymphocytic. Regardless of the etiology, patients with hypophysitis present symptoms and signs caused by inflammation that can lead to hypopituitarism with or without diabetes insipidus, and/or symptoms related to mass effect on the pituitary stalk, hypothalamus, or optic chiasm. The diagnosis relies on clinical, laboratory, and radiological findings. MRI with contrast is the preferred imaging modality, often necessitating follow-up studies to discern changes aiding in differentiation from pituitary adenomas. Treatment primarily entails hormonal replacement, with glucocorticoids reserved for cases presenting with compressive symptoms. Surgical intervention is seldom warranted.

**TABLE OF CONTENTS/OUTLINE**

1. Hypophysitis is recognized as a rare inflammatory condition affecting the pituitary gland.2. Lymphocytic hypophysitis is the most prevalent form of primary hypophysitis.3. Diagnosis of hypophysitis can be challenging, but MRI plays a crucial role in confirming the diagnosis and preventing misinterpretation that might lead to unnecessary surgical interventions.4. Treatment strategies primarily involve hormone replacement therapy and the use of high-dose glucocorticoids to alleviate mass effect and manage symptoms effectively.

## NREE-121 SUBTLE IMAGING FINDINGS LEADING TO NOT-SO SUBTLE PRESENTATIONS -PEARLS AND PITFALLS OF EASY-TO-MISS EPILEPTOGENIC ETIOLOGIES

Mehmet E. Adin, MD (*Abstract Co-Author*) Nothing to Disclose
Richard A. Bronen, MD (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Samra Iftikhar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Review the most common, uncommon, and easily missed causes of epilepsy.• Discuss types of seizures, MRI epilepsy protocol and sequences.• Describe the most important pearls, pitfalls, and causes of misses that the radiologist should know regarding each of the conditions described.

**TABLE OF CONTENTS/OUTLINE**

1. Prevalence and causes of epilepsy.2. Types of seizures: simple partial, complex partial, and generalized.3. Indications for imaging in adults and children with epilepsy.4. Imaging findings of the multiple etiologies with cases from our institution.5. Common misses and pitfalls.6. Pearls and systematic approach to increase the sensitivity of the radiologist to these conditions and improve detection of even the most subtle findings, including:a. Important information to review in the patient's chart.b. Useful imaging modalities including but not limited to MRI, CT, and nuclear medicine.c. MRI technique recommendations.d. Vital MRI sequences according to suspected etiology and patient's agee. Appropriate level and windowing.

## NREE-122 IMAGING PATTERNS OF SKULL BASE LESIONS ON CT/MR AND THEIR MIMICS: A SIMPLIFIED SYSTEMATIC APPROACH TO ANALYZE COMPLEX SKULL BASE LESIONS AND NARROW YOUR DIFFERENTIALS

Rita G. Bhatia, MD (*Abstract Co-Author*) Nothing to Disclose
Natalya Nagornaya, MD (*Abstract Co-Author*) Nothing to Disclose
Julieta Aristizabal Baron, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review pertinent anatomy of the skull base. 2. Provide a simple systematic approach and review the differential diagnosis of benign and malignant lesions of the skull base and common "pseudolesions" based on anatomic subdivisions, characteristic imaging features and patterns of growth allowing radiologists to narrow down the differential diagnosis. 3. Review specific roles and use of different imaging modalities for accurate diagnosis, localization, and staging when appropriate of most common skull base lesions.4. Highlight key points in the imaging findings that should be included in the radiology report as critical information for the pre-operative planning. 5. Highlight key imaging features of most common "pseudolesions" to help differentiate them from their potential pathologic mimics or "true lesions" and to avoid unnecessary biopsies and treatment.

**TABLE OF CONTENTS/OUTLINE**

1. Pseudolesions, normal variants, and developmental anomalies: fibrous dysplasia, arrested pneumatization of the sphenoid sinus, juvenile ossifying fibroma, aneurysmal bone cyst, petrous apex cephalocele, dermoid cyst, white epidermoid cyst, neuroenteric cyst and ecchordosis physaliphora. 2. Expansile benign skull lesions: lateral sphenoid meningocele, allergic fungal sinusitis, mucocele, and cholesterol granuloma. 3. Central skull base tumors: giant cell tumor, spindle cell hemangioma, clival chordoma, invasive pituitary adenoma, and plasmacytoma. 4. Petro-clival lesions: chordoma and chondrosarcoma. 5. Vascular lesion and mimics: petrous Internal carotid artery aneurysm, carotid canal sympathetic plexus schwannoma, and cavernous sinus capillary hemangioma.

## NREE-123 CENTRAL NERVOUS SYSTEM (CNS) COMPLICATIONS IN LEUKEMIA -A COMPREHENSIVE MRI APPROACH TO DIAGNOSIS AND MANAGEMENT

**Awards**
**Certificate of Merit**

Mariko Kurokawa, MD (*Abstract Co-Author*) Nothing to Disclose
Noriko Doki (*Abstract Co-Author*) Nothing to Disclose
Yasunobu Takaki (*Abstract Co-Author*) Nothing to Disclose
Koichiro Mori (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- CNS complications in leukemia are diverse and can significantly impact patient outcomes.
- MRI plays a crucial role in the early diagnosis and management of CNS lesions in leukemia patients.
- Recognizing characteristic MRI findings can help differentiate various CNS complications and guide appropriate treatment.

**TABLE OF CONTENTS/OUTLINE**

• Introduction
- Overview of CNS complications in leukemia

- Importance of MRI in diagnosis and management • Malignancy
- CNS infiltration and recurrence
- Post-transplant lymphoproliferative disorders • Infections
- Viral, bacterial, fungal and other infections • Cerebrovascular events
- Hemorrhage and thrombosis • Drug (and/or Radiotherapy)- related neurotoxicity
- Chemotherapy and radiotherapy-induced complications • Immune-mediated neurotoxicity
- CAR T-cell therapy and associated neurotoxicity syndromes • Conclusion
- Significance of a comprehensive MRI approach in leukemia patients

## NREE-124 METAL ARTIFACT REDUCTION IN CT ANGIOGRAPHY USING PHOTON-COUNTING DETECTOR CT

Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Kazuhisa Matsumoto (*Abstract Co-Author*) Nothing to Disclose
Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takatsune Kawaguchi, MD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nobuo Kitera, RT, MSc (*Abstract Co-Author*) Nothing to Disclose
Masahiro Nakashima, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Photon-counting detector (PCD) CT provides CT angiography (CTA) with higher spatial resolution and less noise than energy-integrating detector (EID) CT. Metals, such as clips, coils, stents, and liquid embolic materials, used during neurosurgery or endovascular surgery cause beam-hardening artifacts, which strongly degrade images. To settle this issue, we should optimize the reconstruction techniques including field-of-view (FOV), matrix size, kernel setting, use of iterative reconstruction (IR) and metal artifact reduction algorithms (MAR). PCD-CT also provides the retrospective use of virtual monoenergetic imaging. This presentation covers the advantages and pitfalls of PCD-CT over EID-CT, and discusses the causes and types of metal artifacts, and various reconstruction techniques. We also demonstrate latest advances in PCD-CT with case-based reviews.

### TABLE OF CONTENTS/OUTLINE

1. Principles and advantages of PCD-CT, and image quality of CTA using PCD-CT. 2. Overview of artifacts in general and explanation of the mechanisms and types of metal artifacts. 3. Reconstruction techniques to reduce metal artifacts. 4. Case-based review of cases in which reconstruction techniques to reduce metal artifacts were useful. 5. Discussion for utilities of PCD-CT for metal artifact reduction with advantages, disadvantages, and pitfalls.

## NREE-125 CLINICAL APPLICATIONS OF TECHNIQUES TO REDUCE GEOMETRIC DISTORTION AND SUSCEPTIBILITY ARTIFACT IN DIFFUSION-WEIGHTED MRI

**Awards**
**Certificate of Merit**

Shuichi Ito, MD (*Abstract Co-Author*) Nothing to Disclose
Azusa Ota (*Abstract Co-Author*) Nothing to Disclose
Hitomi Numamoto (*Abstract Co-Author*) Chairman, Canon Medical Systems Corporation
Yuichiro Monzen (*Abstract Co-Author*) Nothing to Disclose
Satoshi Ikeda (*Abstract Co-Author*) Nothing to Disclose
Yongping Ma (*Abstract Co-Author*) Nothing to Disclose
Shin Morooka (*Abstract Co-Author*) Nothing to Disclose
Satoshi Nakajima, MD (*Abstract Co-Author*) Nothing to Disclose
Sayo Otani, MD (*Abstract Co-Author*) Nothing to Disclose
Masaki Umehana, MD (*Abstract Co-Author*) Nothing to Disclose
Yasutaka Fushimi, MD (*Abstract Co-Author*) Nothing to Disclose
Koji Fujimoto, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Kanae K. Miyake, MD, PhD (*Abstract Co-Author*) Institutional research collaboration, Canon Medical Systems Corporation;
Yuji Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takayuki Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiko Sakata, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jumpei Fujimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Sachi Okuchi, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Diffusion-weighted imaging (DWI) is an essential MRI technique for assessing neurological disorders. Single-shot echo-planar imaging (SS-EPI) is the most widely used DWI technique; however, EPI-based DWI techniques are prone to susceptibility artifacts in areas of B0 field inhomogeneity. Therefore, many DWI techniques have been developed to overcome distortion caused by magnetic susceptibility. The aims of this presentation are (1) to introduce DWI techniques for distortion correction, (2) to realize the improvement of distortion in clinical cases, and (3) to discuss their clinical application. Furthermore, (4) techniques to reduce acquisition time, making these technologies more clinically useful, will also be presented.

### TABLE OF CONTENTS/OUTLINE

1. History and techniques of distortion correction in DWI.2. Clinical applications: We demonstrate examples of DWIs with distortion correction. The discussion will be categorized into the following two types of DWI techniques.(a) The methods to reduce distortions in EPI-based DWI, including Reverse encoding Distortion Correction (RDC) -DWI, etc. (b) The methods to reduce distortions using fast spin echo (FSE), including TGSE-BLADE DWI (2D turbo gradient- and spin-echo diffusion-weighted imaging with non-Cartesian BLADE trajectory), etc. 3. The techniques to reduce acquisition time for clinical applications: Specifically, they are parallel imaging, simultaneous multi-slice acceleration technique, and noise reduction technique. Noise reduction techniques include Deep Learning Reconstruction (DLR) techniques.

## NREE-126 TRACTOGRAPHY 101: A GUIDE TO SEGMENTATION

Karla D. Fuentes Badillo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Axon fibers, the fundamental components of neural communication, are classified into three main groups: commissural fibers, association fibers, and projection fibers. This classification is crucial for understanding the complex network of the brain. Projection fibers: white matter tracts that connect the cortex with other areas in the CNS. They may be efferent (motor) or afferent tracts (sensory), e.g., corticospinal tract, anterior thalamic radiations. Association fibers: connect different areas in the same hemisphere. There are two types of association fibers: long-range and U-fibers (short-range), e.g.,

arcuate fasciculus, inferior fronto-occipital fasciculi, cingulum (limbic system fibers), uncinate fasciculus. Commissural fibers: a type of white matter tract that crosses the midline, connecting the same cortical area in opposite hemispheres (right-left hemispheric connections), e.g., forceps minor and major. Three diffusion tensor imaging techniques in common use are the fractional anisotropy map, the principal diffusion direction map, and fiber-tracking maps. Axonal tracts are commonly mapped using a deterministic method called FACT (fiber assignment by continuous tracking). In this method, the user selects "seed voxels" in a particular area of the brain, and automated software computes fiber trajectories in and out of that area.

**TABLE OF CONTENTS/OUTLINE**

Introduction Basics Tractography Inferior Longitudinal Fasciculus (ILF) Inferior Fronto-Occipital Fasciculus (IFO) Arcuate Fasciculus (AF) Uncinate Fasciculus (UF) (forceps major, FMA) (forceps minor, FMI) Cingulum (CBT, CBD) Fornix (FX) Corticospinal Tract (CST) Anterior Thalamic Radiations (ATR) Conclusion

## NREE-127 MIND'S MAELSTROM: CURRENTS OF INTENSITY AND DENSITY SWIRLING THE INTRACRANIAL HEMORRHAGES ETIOLOGIES

Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To categorize the diverse etiologies of intracranial hemorrhage (ICH) and elucidate their radiological hallmarks.To explore the latest advancements in methodologies and imaging technologies for accurately pinpointing the causes of ICH.To highlight the critical role of radiological findings in guiding therapeutic strategies and prognostication for patients with ICH.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: an overview of intracranial hemorrhage. 2. Etiologies of Intracranial Hemorrhage: the prevalent and less common primary and secondary causes of ICH, such as hypertension, cerebral amyloid angiopathy, aneurysms, arteriovenous malformations, cavernous malformations, trauma, coagulopathies, tumors, vasculitis, and venous sinus thrombosis. 3. Radiological Identification of ICH Etiologies: the roles of CT, MRI, and digital subtraction angiography (DSA) in discerning the origin of the hemorrhage and the age of the clot. How imaging features, like the location and pattern of hemorrhage and associated findings, can indicate specific etiologies. ICH classification systems, including Fisher grading for subarachnoid hemorrhage, Zabramski classification for cavernous malformations, and Boston criteria for cerebral amyloid angiopathy. 4. Radiology-Guided Management and Therapeutic Approaches: how radiological findings, including the spot and swirl signs, influence active ICH management strategies, including surgical interventions. 5. Advancements in Imaging Techniques and Future Directions: recent technological innovations in radiology that improve the detection and characterization of ICH. 6. Take-home Messages.

## NREE-128 RADIOGRAPHIC INSIGHTS: SHAPING NUANCED ANATOMY - A JOURNEY THROUGH ORBITAL MYSTERIES & EYE DISEASE ENIGMAS

Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Anna P. Riello, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Bruna E. Gherardi, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The orbit is a sophisticated anatomical area encompassing vital structures such as the eye globe, optic nerve, and extraocular muscles. Thus, the precise interpretation of orbital imaging findings necessitates a comprehensive understanding of its complex anatomy and the interrelationships among these structures. The specific objectives are as follows: To delineate the orbital anatomy and highlight the critical anatomical relationships for clinical practice. To showcase the primary imaging findings associated with orbital disorders, tailored to the anatomical specifics of each compartment. To present the detailed orbital anatomy and its interconnected structure, ensuring accurate interpretation of imaging results.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of Imaging Modalities, Protocols, Pitfalls, Principles, and Techniques Specific to Orbital Imaging. 2. Bony Landmarks and Foramina Within the Orbit. 3. Anatomy and Functional Aspects of the Orbital Septum. 4. Detailed Examination of the Eye Globe: Anatomy, Function, and Imaging Assessments of Disorders. 5. The Optic Nerve and Sheath: Detailed MRI Characteristics and Associated Pathologies. 6. Diagnostic Imaging of Extraocular Muscles: Anatomy and Pathological Conditions. 7. Structural and Functional Analysis of Intraconal and Extraconal Spaces: Tools for Diagnostic Imaging of Related Disorders. 8. Assessment of the Nasolacrimal Apparatus. 9. Pathological Conditions Specific to Orbital Compartments: Infections, Tumors, and Inflammatory Diseases. 10. Clinical and Surgical Perspectives: Presentation and Management Strategies for Orbital Disorders, Including Surgical Techniques. 11. Take-Home Messages.

## NREE-129 CLOCK REWIND IN STROKE STRIDE: STRETCHING TIME'S BOUNDS IN BRAIN SALVAGE

Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Bezerra, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose

Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The primary objective of this abstract is to delve into the evolving landscape of stroke management, emphasizing the extended window for treatment beyond the traditionally accepted timeframe. It aims to shed light on the latest neuroradiological advancements and clinical trials that support this paradigm shift. Key objectives include: To analyze the impact of recent research on extending the treatment window for ischemic stroke, including the implications for radiological practices. To evaluate the role of conventional and advanced imaging techniques in identifying patients who can benefit from treatment in the extended window phase. To discuss integrating radiological innovations into clinical guidelines, focusing on time to treat and the potential for improved recovery rates.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: historical context of the "golden hour" in stroke treatment and its limitations. 2. Pivotal studies (ex: DAWN, DEFUSE 3) that challenge the traditional treatment window, extending the time frame for eligible thrombectomy patients. 3. "Brain window" vs. "time window" — how patient-specific factors influence treatment eligibility. 4. How MRI and CT perfusion techniques have become instrumental in identifying salvageable brain tissue beyond the conventional treatment window. 5. Radiological Innovations and Clinical Trials: Overview of ongoing clinical trials exploring the limits of stroke intervention timings, including thrombectomy and intravenous thrombolysis. 6. Future Directions: The potential for further expanding the treatment window with continuous advancements in the imaging diagnosis assessment. 7. Take-home messages.

## NREE-13 THE NOVEL DUAL INJECTION CONE BEAM CT FOR ASSESSMENT OF THE ANGIOARCHITECTURE OF INTRACRANIAL DURAL ARTERIOVENOUS FISTULAS

Yoichi Morofuji, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Understanding the complex dural arteriovenous fistula (dAVF) anatomy, especially in identifying the feeders and shunt patterns in relation to the affected sinus and cortical veins, is crucial for determining treatment approaches and predicting clinical outcomes and possible complications. We developed dual injection cone beam computed tomography (CBCT) that enabled the simultaneous identification of feeders, fistulous points, and drainers.

**TABLE OF CONTENTS/OUTLINE**

Our dual injection CBCT is a novel imaging modality for assessing the angioarchitecture of dAVFs. Although 3D-DSA reveals the morphological anatomy, all vessels are depicted uniformly, making it difficult to recognize feeders, fistulous points, and drainers. In contrast, in dual injection CBCT, the presence of diluted contrast media in the drainers and undiluted contrast medium in the feeders not only makes it easier to recognize the feeders and drainers but also enables detailed evaluation of the fistulous point. Identifying fistulous points and shunt patterns is crucial for determining the treatment approaches and avoiding possible complications. Cross-sectional imaging in dual injection CBCT can provide superior information on small arterial feeders and fistulous points compared to other modalities, such as 3D-DSA, CTA, and MRI, because the gradation of the contrast media in dual injection CBCT clearly demonstrates feeders and drainers. To the best of our knowledge, our dual injection CBCT is the first report to provide the images to distinguish the feeders, fistulous points, and drainers of shunt diseases simultaneously.

## NREE-130 RIVERS OF RISK: BRAIN HIGH-FLOW VASCULAR MALFORMATIONS THROUGH RADIOLOGIC RAPIDS

Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Bezerra, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To explore the intricate landscape of high-flow vascular malformations within the brain, emphasizing the crucial role of radiologic imaging in their diagnosis, classification, and treatment planning. To provide a detailed overview of the types and characteristics of high-flow vascular malformations in the brain. To highlight the advancements in imaging techniques that have transformed the detection, understanding, and intervention strategies for these conditions. To explore the multidisciplinary approach to managing high-flow vascular malformations, focusing on integrating radiologic findings into arteriographic therapeutic decisions.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction. 2. Classifying brain high-flow vascular malformations: arteriovenous malformations and cerebral proliferative angiopathy, their grading systems, risks, differentiation, and the implications for treatment. Overview of dural arteriovenous fistulas, including classification based on location, venous drainage patterns, and associated risks. Pial arteriovenous fistulae: epidemiology, radiographic features, complications, therapeutics, and prognosis. 3. Imaging: CT angiography, MRI angiography, 4D flow MRI, and digital subtraction angiography. 4. Challenges in imaging diagnosis: differentiating between various types of vascular malformations. The role of imaging in assessing the risks of bleeding and neurological deficits. 5. Treatment planning and radiologic guidance: endovascular treatment, surgery, and radiosurgery. 7. Clinical outcomes: the predictive value of imaging findings. 8. Take-home messages.

## NREE-132 MYSTERIES BENEATH THE MIND'S DOME: ILLUMINATING CONGENITAL MALFORMATIONS OF THE POSTERIOR FOSSA

**Awards**
**Cum Laude**

Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Celso Hygino, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose

Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The primary aim of this abstract is to dissect the intricate world of congenital malformations of the posterior fossa, emphasizing the groundbreaking role of radiological imaging in their diagnosis, classification, and management. This exploration intends to: Illuminate the diverse spectrum of congenital malformations within the posterior fossa, highlighting their clinical relevance and challenges in diagnosis. Detail the advancements in radiological techniques that have revolutionized the detection and understanding of these malformations. Foster a comprehensive approach to managing these conditions, leveraging imaging findings to guide therapeutic decisions and predict outcomes.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of the posterior fossa's anatomy and its critical role in neurological function. 2. Introduction to the complexity of congenital malformations in this region and their impact on patient morbidity and mortality. 3. Comparative analysis of CT, MRI, and ultrasonography in the context of prenatal and postnatal imaging. 4. MRI protocol. 5. Classification of common malformations, including Dandy-Walker malformation, Chiari malformations, and arachnoid cysts, along with rarer entities like rhombencephalosynapsis and pontocerebellar hypoplasia. 6. Embryological origins and potential genetic underpinnings of these conditions. 7. Exploration of how the extent and nature of malformations as seen on imaging correlate with neurological outcomes. 8. Potential areas for future research, like genetic markers and their imaging correlates. 9. Take-home messages.

## NREE-133 CAROTID WEB: IMAGING FEATURES AND ENDOVASCULAR MANAGEMENT

Yeray Aguilar Tejedor (*Abstract Co-Author*) Nothing to Disclose
Alejandro Santana Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Candelaria Linares Bello, MD (*Abstract Co-Author*) Nothing to Disclose
Ernesto Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Rodriguez Fuentes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To remember the craniocervical vascular anatomy. To describe the physiopathology of the carotid web and the different imaging findings. To explain the endovascular management in the treatment (stenting).

**TABLE OF CONTENTS/OUTLINE**

Carotid web is a rare and under-recognized cause of stroke, especially in young patients with a high recurrence rate. It presents as a linear membrane that extends from the posterior aspect of the carotid bulb or internal carotid artery into the lumen, and is considered an atypical form of fibromuscular dysplasia. This entity predisposes to thrombus formation due to blood stasis and platelet activation. A complete clinical history and physical examination are crucial for its diagnosis. Digital subtraction angiography is the gold standard diagnosis procedure. Endovascular procedures, such as stenting, plays an important role in its management.

## NREE-134 IMAGING REVIEW AND CLINICAL MANIFESTATIONS OF LACUNAR STROKE SYNDROMES

Maria Lucia Brun, MD (*Abstract Co-Author*) Nothing to Disclose
Thurl Cledera, MD (*Abstract Co-Author*) Nothing to Disclose
Stacey Danica L. Gosiaco, MD (*Abstract Co-Author*) Nothing to Disclose
Randall S. Teh, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin Ryan T. Yu, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Lacunar stroke syndromes represent a distinct subset of ischemic strokes, characterized by small subcortical infarcts resulting from occlusion of deep penetrating arteries. Difficulty may be encountered on imaging due to their small size unless there is a high index of suspicion. Correlation with the clinical presentation and imaging findings is paramount to diagnosis. The objectives of this exhibits are: 1) Understand the intricate relationship between neuroanatomy, vascular pathology, and clinical manifestations, 2) Recognize imaging features and patterns of lacunar stroke syndromes, 3) Develop a clinical approach to detecting infarct in acute brain imaging

**TABLE OF CONTENTS/OUTLINE**

IntroductionA. Definitions and NeuroanatomyB. Mechanism of Lacunar InfarctionC. Clinical PresentationD. Imaging ConsiderationClassic Lacunar SyndromesA. Pure Motor HemiparesisB. Ataxic HemiparesisC. Pure Sensory StrokeD. Sensorimotor StrokeE. Dysarthria-Clumsy Hand SyndromeAtypical Lacunar SyndromesA. Internuclear OpthalmoplegiaB. Isolated DysarthriaC. Hemichorac/HemiballismusD. Isolated Gaze PalsyE. Paramedian Thalamic SyndromeConclusion

## NREE-135 ALTERED VISUALIZATION OF DEEP MEDULLARY VEINS IN VARIOUS INTRACRANIAL DISORDERS: A STUDY OF SWI

**Awards**
**Certificate of Merit**

Eun Ja Lee, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To understand the physics of susceptibility-weighted MR imaging (SWI) and the venous anatomy on SWI.To investigate the fine anatomic structure of medullary veins of cerebral white matter on SWI.To describe various intracranial disorders in which the medullary veins play a major role in disease development.To assess the clinical significance of altered visualization of deep medullary veins in various intracranial disorders

**TABLE OF CONTENTS/OUTLINE**

1. General overview of SWI, including assessment of venous hemodynamics 2. Understanding the overall venous anatomy and anatomic structure of medullary veins in the cerebral hemisphere 3. Exploring the fine radiologic anatomy of the medullary veins using SWI. 4. Discussion of disorders related to altered visualization of deep medullary veins 1) changes of deep medullary veins in patients with acute and subacute ischemic stroke 2) changes of deep medullary veins in patients with moyamoya disease 3) changes of deep medullary veins in patients with cerebral venous sinus thrombosis - major

dural sinuses / cortical veins / deep veins4) changes of deep medullary veins in vascular anomaly or malformation - developmental venous anomaly / Sturge Weber syndrome / dural arteriovenous fistula 5) hemorrhagic disorders related to deep medullary veins - diffuse vascular injury due to trauma / deep medullary vein engorgement or thrombosis in neonates 6) changes of deep medullary veins in cerebral small vessel disease 7) changes of deep medullary veins in cognitive impairment 8) changes of deep medullary veins in patients with brain death 9) post-operative changes of deep medullary veins 10) others 5. Summary and conclusion

## NREE-136 LOOK TO THE BUBBLE - NEURORADIOLOGICAL ASPECTS OF INTRACRANIAL CYSTIC LESIONS

Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz R. Uchoa, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Freire, MD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Thiago B. Fernandes Feitosa, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Ramos, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cysts are often seen in brain imaging. Distinguishing between these cysts based solely on imaging findings can be difficult due to their varied presentations. A location-based approach and specific imaging features can help in making a more precise diagnosis.1) To review imaging findings of brain cystic lesions.2) Recognize the different types of brain cystic lesions, categorized on the basis of their causes and localization.3) A practical approach to interpreting these conditions systematizing the evaluation based on main neurologic imaging findings and clinical features.4) Formulate a differential diagnosis for a cystic-appearing lesion in the central nervous system, considering its location or site of origin and imaging features.

### TABLE OF CONTENTS/OUTLINE

1) Introduction.2) Localization of brain cystic lesions: Extra-axial x Intra-axial.3) Cystic lesions and other neurological imaging findings tips.4) Visual systematization of different types of cystic lesions.5) Main differential diagnosis for a cystic-appearing lesion.6) Take home messages.

## NREE-137 NEUROLOGICAL COMPLICATIONS OF VARICELLA ZOSTER VIRUS: COMPREHENSIVE UPDATE AND REVIEW OF CLINICAL AND IMAGING FEATURES

**Awards**
**Certificate of Merit**

Takashi Katsube (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshizako, MD (*Abstract Co-Author*) Nothing to Disclose
Yasushi Kaji, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Aiko Gobara, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Varicella zoster virus (VZV) infection causes several neurological complications, which can be severe because VZV reactivation is associated with a compromised immune system. Diagnosis of VZV is difficult in the absence of a characteristic rash, but is important because of the need for early antiviral therapy. MRI is a non-invasive diagnostic tool that can help reveal the neurological complications of VZV disease. Here, we review the neurological complications of VZV and discuss their diagnosis, differential diagnosis and validated imaging modalities.1. To provide a clinical and radiological review of the central nervous system (CNS) and peripheral nervous system (PNS) complications of VZV infection.2. To provide an anatomical and pathological review of the mechanisms by which CNS and PNS complications of VZV infection occur and spread, and to correlate these with imaging findings.3. To describe effective methods for the detection of neurological complications of VZV infection by imaging.

### TABLE OF CONTENTS/OUTLINE

A. Epidemiology and clinical features of neurological complications in VZVB. Radiological review of CNS and PNS complications of reactivated VZV and differential diagnosis of each 1. Meningoencephalitis 2. Cranial nerve palsies 3. Vasculopathy 4. Myelitis 5. Other neurological complications such as optic neuritis and perineuritisC. Effective Conventional MR imaging of brain, spinal cord, and peripheral nerve lesionsD. Advanced MR imaging methods for neurological complication detectionGd 3D-FLAIR, vessel wall imaging, 3D MR neurography

## NREE-138 NAVIGATING THE MAZE: MULTIMODAL IMAGING AND TECHNIQUES FOR DIAGNOSING ALZHEIMER'S DISEASE AND RELATED MEMORY DISORDERS

Akane Ozawa (*Abstract Co-Author*) Nothing to Disclose
Junichi Tsuchiya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ukihide Tateishi, PhD (*Abstract Co-Author*) Nothing to Disclose
Jun Oyama (*Abstract Co-Author*) Nothing to Disclose
Tomoki Imokawa, MD (*Abstract Co-Author*) Nothing to Disclose
Kota Yokoyama, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand imaging criteria for Alzheimer’s Disease using MRI, SPECT, and PET.2. Recognize differential diagnosis importance in memory disorders via case reviews.3.Learn to apply visual and statistical analysis tools for accurate clinical diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Imaging Techniques- Role of imaging in memory disorders, focusing on Alzheimer's Disease.- MRI: Identifying key and progressive AD signs.- PET/SPECT: Using metabolic, amyloid, and tau imaging for AD.- Statistical tools for objective assessment.2. Case Studies- Typical imaging features in advanced AD.- Early AD signs and nuclear medicine's role.- Differential diagnosis via MRI: Vascular dementia, Creutzfeldt-Jakob Disease, Neuronal Intranuclear Inclusion Disease, fragile X-associated tremor/ataxia syndrome, Hereditary diffuse leukoencephalopathy with spheroids, Cerebral Autosomal Dominant Arteriopathy with Subcortical Infarcts and Leukoencephalopathy, Primary progressive multiple sclerosis, HIV encephalopathies, delayed hypoxic

encephalopathies, Intravascular Large B cell Lymphoma, Neuropsychiatric SLE.- Differential diagnosis via nuclear medicine: Frontotemporal lobe dementia, Dementia with Lewy bodies, Corticobasal syndromes.3. Future DirectionsOverview of advanced imaging techniques in dementia research.

### NREE-139 JOURNEY INTO THE CRANIOVERTEBRAL JUNCTION: NAVIGATING THE CRANIOCERVICAL INSTABILITY WITH DYNAMIC CT AND MRI

Gaurav Pradhan (*Abstract Co-Author*) Nothing to Disclose
Jyoti Kumar, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammad Shoaib, MBBS,MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

1. Understanding CCI Dive into the clinical significance of craniocervical instability (CCI), exploring its impact on patient's lives and the urgency of early detection to mitigate adverse outcomes. 2. Technical Mastery Familiarise with the intricacies of dynamic MRI and CT imaging, uncovering tips and tricks to optimize image quality and overcome common challenges. 3. Quantitative Parameters Demystified Decode the significance of key quantitative parameters for CCI assessment, mastering measurement techniques and understanding their diagnostic and therapeutic implications. 4. Real-Life Application Embark on real-life adventures through case studies, and offer valuable insights for diagnosis and treatment.

#### TABLE OF CONTENTS/OUTLINE

I. Let's Get Started! A. What's the Big Deal with Craniocervical Instability (CCI)? B. Why Dynamic Imaging Holds the KeyII. Tech Talk: Getting the Perfect ShotProtocols for dynamic MRI and CT acquisition.III. Crunching Numbers: Your CCI Cheat Sheet A. Meet the Superheroes: Atlantodens Interval, Grab Oakes measurement, Clivoaxial angle, and More B. How These Numbers Solve Mysteries in CCIIV. Case Files: Stories from the Trenches From Ligamentous Laxity to the Perils of Compression: Real-Life CCI DramaV. Speak Radiology: From Reports to Conversations A. Putting Quantitative Parameters into Words That Make Sense B. Tips for Communicating Like a Pro with CliniciansVI. Tricky Trails: Avoiding Pitfalls in CCI Diagnosis A. Navigating the Treacherous Terrain of Inconclusive Measurements B. How to Stay on Course When the Diagnostic Maze Gets Tough

### NREE-14 STALKING THE PITUITARY: LESIONS GROWING ALONG THE PITUITARY STALK

Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Luana Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

- Recognize pituitary stalk thickening and expansive lesions that grow along the pituitary stalk- Review radiological findings of each pathology through a serie of cases- Narrow down diagnostic hypothesis by radiological findings, age and clinical information

#### TABLE OF CONTENTS/OUTLINE

- IntroductionOverview of sellar and parasellar anatomyPituitary stalk thickening and epidemiologyPituitary stalk expansive lesions and epidemiology- Imaging TechniqueBest image protocolsContrast media useMethod limitations- Image interpretationRadiological findings of pituitary stalk thickening and expansive lesions Associate radiological findings with patient’s background to narrow down differential diagnosis Describe MRI key features of each lesion

### NREE-140 TRANSVERSE RELAXATION RATE R2* IN NEUROIMAGING: POTENTIAL VALUE AND CLINICAL APPLICATIONS

Ayman Nada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahmoud Samir (*Abstract Co-Author*) Nothing to Disclose
Mostafa Amor (*Abstract Co-Author*) Nothing to Disclose
Josh Greaser (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. Allokka (*Abstract Co-Author*) Nothing to Disclose
Mark Doss (*Abstract Co-Author*) Nothing to Disclose
Yaseen Dhemesh (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

do an introduction to R2 star Imaging in Neuroradiologyexplain basic physics of R2 star Imagingdescribe Different Models of Data Analysisdescribe Different Packages for Data Analysis and Visualizationdescribe Challenges of Clinical Applicationdescribe Clinical Application in Neuroimaging

#### TABLE OF CONTENTS/OUTLINE

illustration about the concept of R2 starexplain basic physics of IVIM Imaging includingRadiofrequency Excitation and RelaxationT2 Relaxation and Decay R2 Valuesexplain the clinical Significance of R2 MRImention advantages and Challengesexplain 7T MRI and Enhanced R2 Imaging

### NREE-141 FOUND BY MORE THAN A STROKE OF LUCK: A REVIEW OF IMAGING MANIFESTATIONS AND RISK FACTORS FOR INCIDENTAL, PREVIOUSLY UNKNOWN CEREBRAL INFARCTS ON CT IMAGING

Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Abstract Co-Author*) Nothing to Disclose
Saeed Rahmani (*Abstract Co-Author*) Nothing to Disclose
Carys Kenny-Howell (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Presenter*) Nothing to Disclose

#### TEACHING POINTS

An estimated 9 to 13% of strokes are not diagnosed upon initial clinical presentation, with many infarcts detected as incidental chronic findings on CT head imaging later performed for unrelated purposes.-To understand the clinical implications and potential changes in management that an occur when previously unknown strokes are seen on brain imaging.-To become familiar with the radiographic manifestations and imaging findings of incidental prior strokes.-To recognize the risk factors for missed or delayed stroke diagnosis, including unusual clinical symptomatology and patient characteristics which place specific subgroups at increased risk

**TABLE OF CONTENTS/OUTLINE**

-Overview of the prevalence and clinical impact of missed or delayed diagnosis of stroke-Discuss the clinical implications of identifying previously unknown, even chronic strokes on primary and secondary prevention strategies to prevent stroke-related complications-CT head imaging features of incidental chronic stroke, including: infarct location (cortical vs subcortical), infarct size, vascular territory, and evolution in appearance over time-Recognizing stroke and non-stroke causes encephalomalacia (postsurgical changes, trauma, infection, congenital disorders, variant neurologic anatomy, and imaging artifact)-Identification of risk factors for missed or delayed stroke diagnosis (Non-traditional clinical signs and symptoms of stroke, Patient demographic factors, Hospital visit characteristics)

## NREE-142 BENEATH THE SURFACE: UNVEILING SPLIT CORD MALFORMATIONS THROUGH IMAGING

Surjith Vattoth, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Akram Alwarqi, MD (*Abstract Co-Author*) Nothing to Disclose
Asma Intakhab (*Abstract Co-Author*) Nothing to Disclose
Syed I. Alam, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Jouhar Jabeen Kolleri, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Syeda Shabistan Intekhab, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review embryonic pathogenesis of split cord malformation (SCM)2. Review types of SCM and their imaging features and clinical significance.3. Review associations of SCM and pertinent imaging findings

**TABLE OF CONTENTS/OUTLINE**

- Overview of SCM and clinical presentation
- Embryonic pathogenesis of SCM
- Types of SCM (Pang's classification) and imaging characteristicsa. Type 1b. Type 2
- Common associations of SCMa. Segmentation and fusion anomaliesb. Tethered cordc. Syringomyeliad. Scoliosis/Kyphoscoliosise. Meningomyelocelef. Spinal Lipoma
- Imaging recommendations, pearls and pitfalls

## NREE-143 THALAMIC INFARCTS: CLINICAL PRESENTATION WITH REVIEW OF ANATOMY AND VASCULAR SUPPLY OF RELEVANT THALAMIC NUCLEI

Rishi K. Gosalia, MD (*Abstract Co-Author*) Nothing to Disclose
Liam M. O'Neill, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Taggart, DO (*Abstract Co-Author*) Nothing to Disclose
Tamim Sultani, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Most common cause of unilateral thalamic infarcts is microvascular disease with less common causes to include large vessel arterial plaque disease and embolic infarcts. Microvascular disease related thalamic infarcts usually occur in the ventrolateral territory while large vessel plaque infarcts involve the posteromedial territories. Bilateral thalamic infarct etiology includes artery of Percheron occlusion, top of basilar artery occlusion and deep venous sinus thrombus.

**TABLE OF CONTENTS/OUTLINE**

The exhibit is formatted as 2 clinical cases. The first case is an 86-year-old female who presented with abnormal sensation in the corner of mouth and ipsilateral hand and foot found to have an acute infarct in the contralateral thalamus within the VPM/VPL nuclei consistent with Cheiro-Oral Pedal Syndrome. The second patient is a 47-year-old male who presented with numbness and pain in left forehead, maxilla, neck, chest and thigh with stabbing headache behind the eyes. This patient was also found to have an acute lacunar infarct within the VPL nucleus of the right thalamus and was diagnosed with thalamic pain syndrome. The affected thalamic nuclei in these cases are the ventral posteromedial (VPM) and ventral posterolateral nuclei (VPL). Infarcts in this region of the thalamus can present with myriad of symptoms including sensorimotor deficits with sudden onset and severe symptoms. Sensory loss and decreased levels of consciousness are also commonly seen in VPM/VPL thalamic nuclei infarcts. These regions of the thalamus are predominately supplied by paramedian or thalamic perforators from P1 and P2 segments of the PCA. The VPL nucleus is supplied by the posterior choroidal artery, a branch of the P2 segment PCA.

## NREE-15 THE MERGE OF BONES: DELVING INTO SYNOSTOSIS

Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Nunes (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Diego C. Fragoso (*Abstract Co-Author*) Nothing to Disclose
Carlos Jorge da Silva, PhD, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The development of the face and skull is orchestrated by a complex three-dimensional morphogenetic process involving hundreds of genes controlling a coordinated pattern of tissue proliferation, and differentiation from different embryological origins.Imaging characteristics allow differentiation between positional plagiocephaly and that resulting from craniosynostosis.Tomographic studies with 3D reconstruction are the gold standard for imaging in the diagnosis and classification of craniosynostoses for potential surgical planning, as they allow for great detail of the bone structure.MRI studies provide a better assessment of the brain parenchyma, especially in patients with syndromic craniosynostoses, where other findings may be present.In some cases, imaging markers allow for the diagnosis of a specific disease or at least a group of diseases.

**TABLE OF CONTENTS/OUTLINE**

IntroductionTo review (1) normal suture anatomy and (2) pattern of suture closureGenetic and Pathophysiological PerspectivesTo depict genetic and embryology of cranial suturesImagingTo discuss the main imaging modalities, including their strengths and weaknessTo guide radiologists in the differentiation between positional plagiocephaly from true synostosisTo demonstrate the imaging spectrum of craniosynostosis, involving single versus multiple suture fusionTo identify the main imaging markers that enable a confident diagnosis of a specific disease or a group of related diseasesTo highlight potential associated abnormalities

## NREE-16 COMPARATIVE EVALUATION OF HABENULAR VOLUME AND IRON CONTENT USING MANUAL AND NORMALIZED SEGMENTATION TECHNIQUES IN STAGE SEQUENCES

E. Mark Haacke, PhD (*Abstract Co-Author*) Research Grant, Biogen Idec Inc ;President, Magnetic Resonance Innovations, Inc
Lei Zhang (*Abstract Co-Author*) Nothing to Disclose
Yueluan Jiang (*Abstract Co-Author*) Nothing to Disclose
Bingyang Bian (*Abstract Co-Author*) Nothing to Disclose
Xingchen Pan (*Abstract Co-Author*) Nothing to Disclose
TAO LI (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Using different segmentation methods to study the intergroup differences in the volume and iron content of the habenula between patients with first episode depression (FED) and control group. All subjects underwent STAGE sequence magnetic resonance imaging (MRI). Volume measurement included two methods, the first involved manual segmentation using ITK-SNAP (Figure 1), and the second used a habenular brain template created from a high-resolution, high-contrast template comprised of a total of 990 brain scans, followed by post-processing with FSL software to obtain the volume of the habenula (Figure 2). Due to poor matching of QSM to the MNI 152 space, iron content was measured only through manually segmented brain templates in the QSM sequence.There were no differences in gender or age between patients with FED and the control group ($p > .05$) (Table 1). Using manual segmentation, there were no differences in volume or iron content of the bilateral habenula between FED patients and the control group ($p > .05$). However, standardized segmentation of the habenula showed intergroup differences, with a larger habenula volume in FED patients ($p < .05$). Furthermore, we compared the results of manual segmentation and standardized segmentation, finding intergroup differences in the right habenula ($p < .05$) (Table 2).The above results indicate that manual segmentation involves a certain level of subjectivity, while standardized segmentation is more sensitive in detecting intergroup differences. This suggests the need for applying more refined segmentation techniques in this field to achieve superior segmentation results in the future.

### TABLE OF CONTENTS/OUTLINE

ObjectiveMethods ResultsConclusion

## NREE-17 CONUS MEDULLARIS, FILUM TERMINALE AND CAUDA EQUINA: A POUTPORRI OF DIFFERENTIAL DIAGNOSES

Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Christiane M. Campos, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Abstract Co-Author*) Nothing to Disclose
Taisa Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Sameer P. Chandra, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Laura Petruz Piassa, MD (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To illustrate the anatomical landmarks of the conus medullaris, filum terminale and cauda equina.To show the spectrum of pathologies affecting these structures using a case-based approach.To review the various pathological processes and their imaging features, based on magnetic resonance imaging (MRI).Provide differential diagnosis of lesions according to congenital, inflammatory/ infectious/ demyelinating auto-immune, neoplastic and vascular etiologies.

### TABLE OF CONTENTS/OUTLINE

The conus medullaris represents the tapered terminus of the spinal cord, is a vital anatomical landmark in diagnostic radiology. The filum terminale is a small thin filament of connective tissue that extends inferiorly from the apex of the conus medullaris to the sacrum. Cauda equina is the collective term given to nerve roots distal to the conus medullaris, which occupy the lumbar cistern. A thorough grasp of its anatomy, common anatomical variations, and the diagnostic challenges associated with lesions in this area is crucial for radiologists. This pictorial essay provides a detailed review of the anatomy as well as the broad differential diagnosis of lesions located in these topographies. Differential diagnoses were addressed by etiology and divided into the following groups: congenital, vascular, inflammatory/ infectious, neoplastic and miscellaneous.MRI is the method of choice for evaluating these lesions, as it provides better tissue and contrast resolution in the analysis. The knowledge of the anatomy and imaging patterns of lesions located in these areas is crucial for radiologists to be able to narrow the differential diagnosis, guiding a more efficient therapeutic approach to patients.

## NREE-18 IMAGING FOLLOW-UP OF THE LONG-TERM THERAPEUTIC MECHANISM OF VERMICULITE NANOSHEETS ON ISCHEMIC STROKE

Feng Lishuai (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Intraventricular injected vermiculite (VMT) enter into brain parenchyma through damaged cerebrospinal fluid brain barrier.VMT were swallowed by microglia and then reduced the release of proinflammatory factor by microglia through regulating upstream signaling pathways.VMT also improved survival rate of neuron and the integrity of BBB after ischemic stroke, reduced the "no-reflow" after reperfusion.All these protective effects of VMT is demonstrated by MRI and ultrasound super-resolution imaging technology.

### TABLE OF CONTENTS/OUTLINE

Ischemic stroke is a common neurological disorder and a major cause of permanent disability in patients. So far, few therapeutic drugs that can treat neurological damage in stroke. Therefore, protecting nerves and promoting neural function recovery remain an urgent research area. In this study, we adopted the method of intraventricular injection of VMT nanosheets. By comparing the areas of abnormal diffusion weighted imaging (DWI) signals with VMT nanosheets entering the brain, and using techniques such as biological transmission electron microscopy and immunofluorescence, we elucidated the passive targeted delivery characteristics of VMT nanosheets at different time points after stroke. Furthermore, the multi-target protective effects and prognosis of VMT nanosheets on neurons, glial cells, and cerebral blood vessels after stroke were explored through motor and cognitive-behavioral studies, MRI, ultrasound super-resolution in vivo imaging techniques, and brain tissue samples validation. These results demonstrated the enormous potential of VMT nanosheets in the application of ischemic stroke.

## NREE-19 THESE GO TO ELEVEN: SERIOUS SPINAL TAP COMPLICATIONS YOU SHOULD KNOW ABOUT

**Awards**
**Certificate of Merit**

Alvaro Jose de la Iglesia Salas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This exhibit intends• To acquaint the reader with the most crucial intracranial and spinal complications after lumbar puncture (LP) through a series of cases in a multimodality fashion.• To discuss the significance of dura-arachnoid enhancement after LP.• To review the technique, risk factors, and contraindications for LP.The main teaching points are• LP is a generally safe diagnostic and therapeutic procedure.• The rate of severe complications is low, but radiologists may encounter some in their careers. Familiarization with these adverse effects will grant a timely and correct diagnosis.• Chief risk factors are traumatic or non-sterile technique, bleeding diathesis, raised intracranial pressure, and challenging anatomy.• CT and MRI should be scrutinized for signs of intracranial and spinal hemorrhage, cerebrospinal fluid leak, intracranial hypotension, herniation, and dural sinus thrombosis.• Meningitis, abscess, arachnoiditis, epidermoid cyst, and foreign body constitute more unusual sequelae to be mindful of.• Diffuse dura-arachnoid enhancement should likely not be a concern for delaying LP since it is not prevalent without intracranial hypotension, strongly advising to exclude other causes first when present.

### TABLE OF CONTENTS/OUTLINE

• Introduction: relevant anatomy, LP technique, general indications.• General contraindications and risk factors for complications following LP.• LP complications: spinal and intracranial hemorrhage, cerebrospinal fluid leak, intracranial hypotension, cerebral and cerebellar herniation, dural sinus thrombosis, arachnoiditis, meningeal infection, abscess, epidermoid cyst, foreign body.• Dura-arachnoid enhancement after LP.• Conclusion.

## NREE-2 SPETZLER MARTIN TAKE THE WHEEL! STEERING CLEAR FROM BRAIN TRAFFIC JAMS: AVM REVIEW

Amanda P. Marrero-Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Machicote, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Kevin Hornedo, BS (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandra Cardona Del Valle, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the grading of Arteriovenous Malformations (AVMs) as defined by the Spetzler-Martin classification. Provide anatomical diagrams of Grade I-V of AVMs. Contribute case examples with pathognomonic imaging findings of grade I-V AVMs on CT, MRI, and angiography studies. Define the possible complications of AVMs and their corresponding management. Provide a self-assessment tool for the classification of AVMs as defined by the Spetzler Martin classification.

### TABLE OF CONTENTS/OUTLINE

Educational Objectives Introduction. Arteriovenous Malformations (AVMs) Spetzler-Martin classification - Grade I-V Anatomical Diagrams, CT, MRI, and Angiography Imaging Findings and Treatment Options. Complications of AVMs. Self-assessment with multiple cases in quiz format. Conclusion. Brain AVMs are vascular lesions characterized by a connection between feeding arteries and a draining venous network without an intervening capillary bed. Clinically, AVMs can exhibit variable initial presentations and may result in serious outcomes such as intracranial hemorrhages, seizures, neurological deficits, and death. While diagnosis is made through different imaging modalities, management is mostly surgical. Thus, understanding AVM structure and location becomes relevant for planning appropriate interventions and anticipating potential complications. This exhibit will review the grading of AVMs as defined by the Spetzler-Martin classification using a pictorial depiction of lesions along with their appearance on various imaging modalities such as MRI, CT, and angiography. We will also discuss complications associated with AVMs, and address the role of radiology in guiding treatment decisions.

## NREE-20 CLINICAL NEUROIMAGING IMPLICATIONS OF 7-TESLA MRI

Brian P. Rigney, MD (*Abstract Co-Author*) Nothing to Disclose
Priti Balchandani, PhD (*Abstract Co-Author*) I am a named inventor on patents relating to magnetic resonance imaging (MRI) and RF pulse design. The patents have been licensed to GE Healthcare, Siemens AG, and Philips international. I receive royalty payments relating to these patents.I am a seed inv
Akbar Alipour, PhD (*Abstract Co-Author*) Nothing to Disclose
Hamza Chengazi, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley N. Delman, MD, MS (*Abstract Co-Author*) Consultant, Guerbet SA
Raj Shrivastava (*Abstract Co-Author*) Nothing to Disclose
Sema Yildiz (*Abstract Co-Author*) Nothing to Disclose
Sadaf Afif (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 7-Tesla MRI (7T) offers high spatial and contrast resolution with a superior signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) than conventional field strengths, enhancing clinical application by improving the detection and characterization of both normal and abnormal structures. This exhibit showcases clinical advantages of 7T. 2. High spatial and contrast resolution plays a role in imaging for trigeminal neuralgia, where 7T MRI has the potential to improve diagnosis associated with pathologies like masses, local vascular alterations, and microstructural changes. 3. The anatomy of the skull base poses a challenge for imaging of skull base tumors. 7T could play a crucial role in enhancing comprehensive preoperative tumor assessment, vital for precise surgical planning for achieving adequate tumor resection and minimizing morbidity. 4. 7T enhances noninvasive diagnosis of focal epileptogenic lesions and associated microstructural features with precise trigger point detection in patients with nondiagnostic conventional field studies which expedites targeted treatment planning. 5. The identification of cortical lesions, white matter plaques, and characterization of imaging biomarkers such as central vein sign in Multiple Sclerosis could be significantly enhanced by 7T, addressing challenges often seen with conventional MRI. 6. 7T may play a promising role in the diagnosis and follow-up of Alzheimer’s disease by better elucidating structural changes and accompanying pathologies such as cerebral microbleeds with superior resolution.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Trigeminal Neuralgia 3. Skull Base Tumors 4. Epilepsy 5. Multiple Sclerosis 6. Alzheimer's Disease

## NREE-21 TEMPORAL LOBE EPILEPSY WITH A FOCUS ON UNDERLYING ANATOMY: A PRIMER FOR THE RADIOLOGIST

**Awards**
**Certificate of Merit**

Justin Sindoni, MD (*Abstract Co-Author*) Nothing to Disclose
Richard A. Bronen, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Aline Herlopian (*Abstract Co-Author*) Nothing to Disclose
Chong Zhou, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review pertinent anatomy of the limbic system underlying temporal lobe epilepsy (ex. hippocampus, fornix, parahippocampal gyrus, cingulate).2. Review potential limbic anatomy variants that may be mistaken for pathology.3. Review cases of pathologies associated with temporal lobe epilepsy.Abstract: Temporal lobe epilepsy (TLE) is the most common type of epilepsy and accounts for about half of all cases of focal epilepsy. Diagnosis of epilepsy related radiological abnormalities often depends on identification of subtle imaging features involving the temporal lobe or limbic structures which can precipitate temporal lobe seizures. Accurate interpretation can be prone to error because unlike other neurological diseases such as tumors and demyelinating lesions, abnormalities in TLE may not involve significant MRI signal changes or distortion of brain anatomy. Additional normal individual differences in sulcal and gyral positioning and anatomy pose additional challenges. This exhibit will review normal anatomy, variant anatomy that may be confused with pathology, and pathologies that should be identified in the initial evaluation for TLE. We will review the concept of the limbic network and its functions and connections. Ultimately, this exhibit will serve as a primer for practicing radiologists in assessing complex and less recognized findings in medically refractory TLE.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction2. Background - Seizure workup with clinical context3. Normal anatomy of structures involved in temporal lobe epilepsy4. Examples of pathology involving limbic structures with clinical cases Summary of search pattern for TE seizure evaluation

## NREE-22 EXPLORING THE CEREBRAL AMYLOID ANGIOPATHY: WHAT THE RADIOLOGIST SHOULD KNOW?

Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Renata Bertanha, MD (*Abstract Co-Author*) Nothing to Disclose
Jairo Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana L. Arcanjo, MD (*Abstract Co-Author*) Nothing to Disclose
Vitoria L. Taumaturgo da Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Breno A. Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamim W. Handfas, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Campos Neto (*Abstract Co-Author*) Nothing to Disclose
Larissa Cavalcante Bomfim, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review important anatomic landmarks related to cerebral amyloid angiopathyTo review the imaging technique and protocols for the evaluation of cerebral amyloid angiopathyTo review the noninvasive clinical-radiological diagnostic criteria of cerebral amyloid angiopathy and CAA-related inflammationTo recognize the imaging features of cerebral amyloid angiopathy and CAA-related inflammation, and their correlation with diagnostic criteria.To discuss the use of the Amyloid-PET in the evaluation of the cerebral amyloid angiopathy

**TABLE OF CONTENTS/OUTLINE**

IntroductionAnatomic landmarks related to cerebral amyloid angiopathyImaging Technique and Protocols for the evaluation of cerebral amyloid angiopathyClinical-radiological diagnostic criteria of cerebral amyloid angiopathy and CAA-related inflammationImaging Features of Cerebral Amyloid Angiopathy and CAA-Related Inflammation and Diagnostic Criteria Correlation with Teaching CasesAmyloid-PET in the evaluation of the CAA with Teaching CasesTake Home MessagesReferences

## NREE-23 CEREBRAL VENOUS THROMBOSIS: UNRAVELING ITS EVOLUTION AND COMPLICATIONS

Alcino Alves Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Luis F. Godoy, MD (*Abstract Co-Author*) Stockholder, Johnson & Johnson;Stockholder, Illumina, Inc;Stockholder, UnitedHealth Group
Frederico Adolfo B. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana D. Hirata, MD (*Abstract Co-Author*) Nothing to Disclose
Breno A. Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio A. Dalpra, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Renata Bertanha, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos V. Camargo, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe B. Nascimento, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Benjamim W. Handfas, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa Cavalcante Bomfim, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review the anatomy of the cerebral venous system and its drainage territoriesTo review the imaging technique and protocols for the evaluation of Cerebral Venous Thrombosis To recognize the imaging features of cerebral venous thrombosis and its complicationsTo be familiarized with the evolution of cerebral venous thrombosis

**TABLE OF CONTENTS/OUTLINE**

IntroductionAnatomy of the Cerebral Venous System and its Drainage TerritoriesImaging Technique and Protocols for the Evaluation of Cerebral Venous Thrombosis and its ComplicationsImaging Features of Cerebral Venous Thrombosis with Teaching CasesCerebral Venous Thrombosis Evolution with Teaching CasesCerebral Venous Thrombosis Complications with Teaching CasesTake Home MessagesReferences

## NREE-24 ARTERIAL SPIN LABELING ASSESSMENT OF CEREBRAL ARTERIOVENOUS FISTULAE AND MALFORMATIONS

Noorbakhsh, MD,MPH (*Abstract Co-Author*) Nothing to Disclose
Divya S. Bolar, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Usha Trivedi, MD, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Arterial spin labeling (ASL) is a noninvasive MRI technique that magnetically labels blood for use as an endogenous tracer for to assess cerebral perfusion. ASL is exquisitely sensitive for detecting arteriovenous fistulae (AVF) and arteriovenous malformations (AVM) via arterialized signal in the venous system and/or nidus. ASL can identify subtle AV shunt lesions and provides valuable insight into the progression or resolution of these lesions on follow-up imaging. However, mimics of AV shunt lesions on ASL, such as jugular venous reflux and venous thrombosis, can confound interpretation and warrant additional imaging for confirmation. This educational exhibit showcases the utility of ASL for diagnosing and assessing AVF and AVM and provides examples of mimics of which the neuroradiologist should be aware.

**TABLE OF CONTENTS/OUTLINE**

1. Vascular Shunt Lesions - Review of arteriovenous malformations (AVM) and arteriovenous fistulae (AVF) 2. Current Methods of Assessing Shunt Lesions - Imaging methods to evaluate AVM and AVF 3. Discussion of Arterial Spin Labeling (ASL) - Review on acquisition and interpretation of ASL in the setting of AV shunting - Comparison of ASL with other techniques to assess shunt lesions 4. Cases of AVM with ASL - Examples of large and small AVMs 5. Cases of AVF with ASL - Examples of carotid cavernous fistula - Examples of dural arteriovenous fistula 6. ASL to Assess Follow up Studies - Progression and improvement of AVF and AVM on ASL 7. Pitfalls of ASL - Mimics of arterialized signal, including jugular venous reflux and venous sinus thrombosis 8. Summary of ASL and its utility for evaluating AVM and AVF

## NREE-25 5 STEPS ASSESSMENT OF ACUTE STROKE

Breno A. Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Luis F. Godoy, MD (*Abstract Co-Author*) Stockholder, Johnson & Johnson;Stockholder, Illumina, Inc;Stockholder, UnitedHealth Group
Victor Martinelli Preto, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Porto Cunha, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review the imaging technique and protocols for the initial evaluation of the acute strokeTo review the clinical presentation, and to recognize the relevant imaging features in the initial evaluation of the acute strokeTo demonstrate a structured, systematic, and concise five-step approach to the initial evaluation of the acute stroke.To improve the performance of the Radiologist in the acute stroke scenario.

**TABLE OF CONTENTS/OUTLINE**

IntroductionClinical Presentations and ScenariosImaging technique and protocols5 STEPS ASSESSMENT OF ACUTE STROKE: Relevant imaging features and tips with teaching cases of the initial evaluation of an acute stroke in a structured, systematic, and concise five-step approach.Take home messagesReferences

## NREE-26 MAPPING THE MEDULLA OBLONGATA - AN ANATOMY REVIEW AND STEP-BY-STEP PATHOLOGY APPROACH

Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Victor R. Marussi, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno S. Inada, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Christiane M. Campos, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the anatomy of the medulla oblongata, its specific structures, connections with other parts of the central nervous system, and main functions. Detail in step-by-step how and which weighted magnetic resonance imaging (MRI) sequences contribute to the identification of the main pathologies that affect the medulla oblongata. Demonstrate the importance of accurate diagnosis of bulbar pathologies for planning surgical and therapeutic interventions, and adequate monitoring of the disease in order to avoid further neurological damage.

**TABLE OF CONTENTS/OUTLINE**

The medulla oblongata is a small segment of the brain stem that contains structures fundamental to life, such as the vital autonomous cardiovascular and respiratory centers that control heart rate, blood pressure, and breathing. Although isolated bulbar injuries are rare, late diagnosis and inadequate treatment can lead to disability or death. In this context, magnetic resonance imaging (MRI) plays a central role in accurate and early diagnosis, and it is essential for radiologists to have in-depth knowledge and a focused look at image findings to identify anatomical structures, recognize pathological changes, differentiate similar conditions and correlate radiological findings with clinical symptoms. The step-by-step analysis of the medulla oblongata using magnetic resonance allows the optimization of analytical reasoning in the evaluation, helping to obtain a detailed understanding of the changes expected in each disease, contributing to an accurate diagnosis and, consequently, an adequate treatment that obtain the best clinical outcomes.

## NREE-27 TARGETED NEUROSURGICAL INTERVENTIONS: THE ROLE OF NEUROIMAGING IN LITT, DBS, AND HIFU

Evgeny Pavlushkov, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jay Starkey, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Explore new neurosurgical techniques and their applications
- Understand the role of neuroimaging in pre-and post-operative settings

- Discuss the anatomy and targets for LITT, DBS, and HIFU procedures
- Highlight the importance of neuroimaging in guiding and evaluating these treatments

**TABLE OF CONTENTS/OUTLINE**

- Introduction
- Laser Interstitial Thermal Therapy (LITT)
- Principles and mechanisms
- Indications and targeted pathologies
- Pre-operative imaging: planning and target identification
- Intra-operative imaging: real-time monitoring and guidance
- Post-operative imaging: assessing treatment response and complications
- Deep Brain Stimulation (DBS)
- Overview of DBS
- Targets for DBS:
- Ventral Intermediate Nucleus (VIM) for essential tremor
- Globus Pallidus internus (GPi) for dystonia and Parkinson's disease
- Subthalamic Nucleus (STN) for Parkinson's disease
- Pre-operative imaging: anatomical and functional mapping
- Intra-operative imaging: electrode placement and verification
- Post-operative imaging: evaluating lead position and stimulation effects
- High-Intensity Focused Ultrasound (HIFU)
- Principles and mechanisms of action
- Applications in neurosurgery, focusing on the VIM for essential tremor
- Pre-operative imaging: target localization and treatment planning
- Intra-operative imaging: real-time monitoring and guidance
- Post-operative imaging: assessing treatment efficacy
- Integration of Advanced Imaging Techniques
- The role of functional MRI, diffusion tensor imaging, and tractography
- Advances in intra-operative imaging: MRI-guided neurosurgery
- Future Directions and Challenges
- Emerging applications of LITT, DBS, and HIFU
- Potential limitations and risks
- Conclusion

## NREE-28 TEMPORAL LOBE ENCEPHALOCELES ASSOCIATED EPILEPSY - SUBTLE LESIONS YOU DO NOT WANT TO MISS

Richard A. Bronen, MD (*Abstract Co-Author*) Nothing to Disclose
Derek Nitz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Temporal Lobe Encephaloceles Associated Epilepsy - Subtle Lesions You Do Not Want to Miss Temporal Lobe Encephaloceles (TLenc) are herniations of brain parenchyma through dural defects in the middle cranial fossa and have been identified as a cause of medically refractory epilepsy. Identification of these lesions is imperative because surgical resection can be curative. However, there are challenges to the diagnosis of TLenc, which include lack of awareness of the lesion (particularly prior to 2015) and subtle findings on MR and CT imaging. TLenc are often small, isointense to brain tissue, and difficult to distinguish from normal TL undulations or adjacent subjacent extracranial tissue, particularly if thin high resolution imaging protocols are not utilized. At the conclusion of this exhibit, the learner will be able to do the following: Describe TLenc and their clinical significance. Will be aware of the current imaging protocol to optimize the detection of TLenc. Highlight key imaging features to identify TLenc. Identify typical and subtle cases of TLenc.

**TABLE OF CONTENTS/OUTLINE**

Background of TLenc: Define TLenc. Discuss clinical significance. Review current management of TLenc. Review pitfalls in the diagnosis of TLenc on imaging. Review recommended imaging protocol: Review HARNESS MRI imaging protocol. Discuss optimal sequences and view for identification of TLenc. Discuss key imaging features to identify TLenc. Review cases of typical and subtle TLenc.

## NREE-29 HAEMATOLYMPHOID TUMORS OF THE CENTRAL NERVOUS SYSTEM: A PERSPECTIVE BEYOND LYMPHOMA

Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Angelo C. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Giovanna S. Calfi, MD (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Lais Abduch, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Maia JR, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Review the subdivision of these tumors according to 2021 World Health Organization Classification of Tumours (WHO CNS5). ; Emphasize the main characteristics that distinguish primary and secondary lymphomas. ; Illustrate the different subtypes of histiocytic tumors and their radiological features.

**TABLE OF CONTENTS/OUTLINE**

● Introduction. ● Illustrate the origin of lymphocytic and histiocytic cells. ● Subdivision of these tumors according to 2021 World Health Organization Classification of Tumours (WHO CNS5). ● General considerations on lymphomas. ○ Diffuse primary lymphoma of large cells B.○ Secondary lymphoma. ○ Immunodeficiency-associated lymphoma.■ AIDS-related lymphoma.■ Post-transplant lymphoproliferative disorder (PTLD). ○ Intravascular large B-cell lymphoma (intravascular lymphomatosis). ○ Lymphomatoid granulomatosis. ● General considerations on histiocytic tumors. ● Langerhans cell histiocytosis.○ Langerhans cell histiocytosis.○ Hypothalamic-pituitary axis involvement.○ Neurodegenerative involvement. ● Non-Langerhans histiocytic tumors.○ Rosai-Dorfman disease.○ Erdheim-Chester disease.

## NREE-3 CONGENITAL CRANIOFACIAL ANOMALIES: A PICTORIAL REVIEW

Lauren J. Ehrlich, MD (*Abstract Co-Author*) Nothing to Disclose
Namita Bhagat, MD (*Abstract Co-Author*) Nothing to Disclose
Gaurav Cheraya, MD (*Abstract Co-Author*) Nothing to Disclose
Jordan Hughes, MD (*Abstract Co-Author*) Nothing to Disclose
Anisa A. Chowdhary, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Craniofacial malformations can be either isolated or part of a defined genetic syndrome. Early diagnosis of these malformations has vital clinical significance because some may present as acute emergencies in the postnatal period, whereas others may require long-term treatment. Some may also be associated with brain anomalies. The diagnostic value of three-dimensional reconstructed images by computed tomography (3D-CT) is particularly high in individuals with complex craniofacial deformities, and in patients with congenital malformations. 3D-CT imaging is the method of choice for understanding the pathologic morphology of the patients and in the preparation for craniofacial surgery.

### TABLE OF CONTENTS/OUTLINE

Introduction: Craniofacial malformation is one of the most commonly encountered birth defects in the prenatal and postnatal periods. Facial cleft cleft lip (CL) with or without cleft palate (CP), is the most common congenital craniofacial malformation. Craniofacial syndromes commonly associated with craniosynostis include Apert syndrome, Crouzon syndrome, and Pfeiffer syndrome, which are secondary to mutations of fibroblast growth factor receptor (FGFR). Purpose: The purpose of this study is to assess the clinical and CT imaging patterns of Craniofacial syndromes with correlating the abnormalities such as bone abnormalities of the face, cranium and the skull base.

## NREE-30 CHRONIC SUBDURAL HEMATOMA: ADVANCED IMAGING OF THE MEMBRANES AND THE ROLE OF MIDDLE MENINGEAL ARTERY EMBOLIZATION

Uttam Bodanapally, MBBS (*Abstract Co-Author*) Speakers Bureau, Siemens AG;Travel support, Siemens AG;Research support, Siemens AG
Dheeraj Gandhi, MBBS, MD (*Abstract Co-Author*) Research Grant, Stryker CorporationResearch Grant, Medtronic plc
Athanasios Pavlou, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Chronic subdural hematoma (cSDH) is a complex immunological and angiogenic process that is initiated by minor trauma to the dural membranes. Based on hematoma morphology, cSDHs are classified on unenhanced CT scans for triage and treatment. Certain hematoma morphologies benefit from membrane imaging by either contrast enhanced MRI or contrast enhanced dual energy CT (DECT) that provides valuable information to guide further management. With increasing accessibility and significant shorter scan time, DECT not only provides an excellent means for the depiction and grading of membranes, but also provides functional information by estimating the amount of iodine exudation through the immature capillaries present in the membranes. Conventional surgical management of cSDH can quickly decompress the hematoma but recurrence and complication rates are high. Middle meningeal artery embolization (MMAE) can restrict arterial supply to the membranes to induce necrosis, target neo-vasculature and the cycle of inflammation which are thought to be responsible for propagation and postoperative recurrence. In addition, MMAE can also be potentially used as a standalone method to induce resorption and resolution without surgical evacuation.

### TABLE OF CONTENTS/OUTLINE

Epidemiology and health care burden. Pathophysiology as it pertains to advanced imaging methods. Role of CT imaging with emphasis on dual energy techniques for membrane imaging. Use of advanced imaging to guide surgical management with or without adjunct middle meningeal artery embolization. Discussion of the utility of sole middle meningeal artery embolization. Future prospects in the diagnosis and treatment of chronic subdural hematomas

## NREE-31 JOIN THE BRIGHTER SIDE OF THE FORCE: HOW 7-TESLA MRI CAN HELP TO ASSESS CASES IN NEUROIMAGING

Lucas Roberto Lelis B. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Mika Shibuya, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Nunes (*Abstract Co-Author*) Nothing to Disclose
Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Bandeira, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Esmeraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paula Arantes (*Abstract Co-Author*) Nothing to Disclose
Thiago Matheus Santos Rios, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Overview clinical indications for 7-T MRI in neuroimaging, highlighting its superior detail over lower field MRIs.- Demonstrate the improved diagnostic capabilities of 7-T MRI for complex neurological conditions.- Address challenges in clinical application of 7-T MRI and propose solutions for integration into clinical practice.

### TABLE OF CONTENTS/OUTLINE

1. Introduction1.1. Evolution of MRI technology and introduction of 7-T MRI in neuroimaging.2. Additional benefits of 7-T MRI2.1. Brain tumors2.2. Radiotherapy planning2.3. Multiple sclerosis and demyelinating diseases2.4. Intracranial MRA and vessel imaging2.5. Movement disorders and deep brain stimulation2.6. Pituitary pathology2.7. Epilepsy focal lesions2.8. MR Spectroscopy for metabolic disorders3. Challenges and Solutions3.1. Technical, operational, and safety challenges of 7-T MRI and strategies for clinical adoption.4. Conclusions and Take Notes

## NREE-32 BEYOND THE BASICS OF PREOPERATIVE SPINE IMAGING: WHAT ARE THE FINDINGS THAT CHANGE MANAGEMENT?

Carol P. Geer, MD (*Abstract Co-Author*) Nothing to Disclose
Edwin A. Stevens, MD (*Abstract Co-Author*) Nothing to Disclose
Scott D. Wuertzer, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Caroline Wilson, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica Hinaman, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review cross-sectional spine imaging, highlighting the importance of CT for assessing fracture morphology and MRI for evaluating soft tissue injuries. 2. Describe additional, often overlooked, findings and anatomic considerations in the cervical, thoracic, and lumbar spine that affect patient management and should be included in all radiology reports. 3. Review these findings through a case-based approach with CT and MRI examples.

**TABLE OF CONTENTS/OUTLINE**

Review of Basics. Fracture morphology - value of CT. Soft tissue injury - value of MRI. Cervical Spine. Traumatic - Traumatic disc herniation. Extent of ligamentous injury. Integrity of the transverse ligament. Discoligamentous competency at C2/C3. Angulation of odontoid. Extent of fracture with underlying diffuse idiopathic skeletal hyperostosis or ankylosing spondylitis. Non-traumatic - Soft foraminal disc herniation or disc-osteophyte complex. Ossification of posterior longitudinal ligament. Alignment. Anatomic Consideration - location of vertebral artery position relative to C2 pars. Thoracic and Lumbar Spine. Traumatic - Traumatic disc herniation. Extent of ligamentous injury. Extent of fracture with underlying DISH or AS. Non-traumatic - Location of disc herniation. Etiology of post-surgical stenosis (recurrent disc, osteophyte, or scar). Prior decompressive surgery. Anatomic Consideration - location of iliac vein bifurcation complex to L4/L5 and L5/S1.

## NREE-33 UNRAVELING THE MIDLINE: SELLAR AND PARASELLAR LESIONS FROM A RADIOLOGIST'S PERSPECTIVE

Fernanda V. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Silveira, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

There is a myriad of sellar and parasellar lesions, and they are not uncommon. They are found especially in the pediatric population, accounting for approximately 10% of all pediatric intracranial tumors, and thus represent a routine diagnostic challenge for the radiologist. This educational exhibit aims to: review the normal anatomy and embryology of the midline of the brain, especially the pituitary gland, the suprasellar cistern and the hypothalamus; summarize the imaging characteristics of the sellar region on CT and MRI; review pituitary adenomas and their main mimicking entities, differential diagnoses and common pitfalls through a set of illustrative clinical cases.

**TABLE OF CONTENTS/OUTLINE**

(1) Introduction; (2) Anatomy and embryology of the brain midline (sella turcica and pituitary gland, parasellar region, suprasellar cistern and hypothalamus); (3) Case-based review of pituitary adenomas, and its main mimickers and differential diagnoses: pituitary carcinoma, granular cell tumor of the neurohypophysis, meningioma, pituitary metastasis, intrasellar plasmacytoma, pituitary apoplexy, aneurysms, pilocytic hypothalamic/chiasmatic astrocytoma, craniopharyngioma, sellar xanthogranuloma, hypothalamic hamartoma, clivus chordoma, sarcoidosis, surgical manipulation, carotid-cavernous fistula, epidermoid cyst; (4) Final remarks and take-home messages.

## NREE-34 IDENTIFYING AND CHARACTERIZING NON-STENOTIC POTENTIAL ARTERIOGENIC SOURCES OF EMBOLI IN PATIENTS WITH EMBOLIC STROKE OF UNDETERMINED SOURCE

Maoxue Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Niranjan Balu, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahmud Mossa-Basha, MD (*Abstract Co-Author*) Nothing to Disclose
Chun Yuan, PhD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;;
Ahmed Safwat, MD (*Abstract Co-Author*) Nothing to Disclose
Gador Canton (*Abstract Co-Author*) Nothing to Disclose
David Tirschwell, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Mona Kharaji, MD (*Abstract Co-Author*) Nothing to Disclose
Javid Azadbakht, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Embolic stroke of undetermined source (ESUS) is a diagnosis of exclusion and relies on luminal imaging to assess arteriogenic causes.• Growing evidence points towards non-stenotic atherosclerotic plaques as a potential stroke etiology.• Vessel wall imaging (VWI) can potentially detect these non-stenotic lesions better than luminal imaging.• Evaluating plaque features of vulnerability in VWI may better stratify risk for secondary stroke prevention.• If incorporated as part of standard-of-care in IS work-up, VWI can offer targets for more appropriate treatment in certain ESUS patients.• Optimizing VWI and stroke MRI protocols for time efficiency and image quality, while also engaging with ordering providers can lead to acceptance and understanding of the value of VWI in stroke work-up and secondary stroke prevention.

**TABLE OF CONTENTS/OUTLINE**

1. Etiologies of IS 2. Luminal imaging in IS2.1. Disadvantages of luminal imaging in evaluating small or outward remodeling plaques as potential arteriogenic causes of IS3. ESUS3.1. Definition3.2. Epidemiology and prognosis3.3. Traditional imaging and clinical evaluation paradigms4. Vessel wall imaging (VWI) in ESUS 4.1. Added value over luminal imaging4.2. Recommended protocols for efficiency and optimal image quality4.3. Identifying non-stenotic plaques (NSPs) upstream from the stroke territory4.4. VWI NSP mimics and imaging pitfalls4.5. Imaging features of high risk NSPs and their correlation with IS4.6. Incorporating carotid and intracranial VWI as part of standard-of-care in stroke work-up5. Technical and clinical challenges impeding the utility of VWI in ESUS 6. Future directions for addressing challenges for VWI implementation and interpretation

## NREE-35 ANATOMICAL VARIANTS OF INTRACRANIAL ARTERIES: WHAT THE YOUNG NEURORADIOLOGIST NEEDS TO KNOW

Bruno S. Inada, MD (*Abstract Co-Author*) Nothing to Disclose
Samir S. Omar, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Taisa Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Victor R. Marussi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Christiane M. Campos, MD,MD (*Abstract Co-Author*) Nothing to Disclose

Maria Laura Petruz Piassa, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Dias, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: Review of the main intracranial arterial anatomic variants; To categorize the variations based on embryology, morphology or topography; To establish correlations between computed tomography angiography (CTA) and/or magnetic resonance angiography (MRA) with digital subtraction angiography (DSA) in key cases, employing a didactic approach.

**TABLE OF CONTENTS/OUTLINE**

Introduction Summary of angiogenesis Examples of common and uncommon cases related to Variant Anatomy of Willis Circle and Other intracranial Vessels: 1. Arterial fenestration 2. Arterial duplication 3. Anterior cerebral artery variants 4. Middle cerebral artery variants 5. Posterior cerebral artery variants 6. Persistent carotid-basilar artery anastomosis 7. Normal variant arteries in the Skull Base Conclusion References

## NREE-36 CAROTID WEB: UNRAVELING A NON-INCIDENTAL FINDING

Alcino Alves Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Breno A. Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana L. Arcanjo, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Martinelli Preto, MD (*Abstract Co-Author*) Nothing to Disclose
Rafaela F. Palhares, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To review important anatomic landmarks of the carotid bulb and internal carotid artery. To review the imaging technique and protocols for the evaluation of carotid web and its complications.To recognize the imaging features of the carotid web and its atypical presentations, and to review the differential diagnosis, highlighting the key diagnostic features. To recognize the complications associated with the carotid web, particularly its relation to ischemic stroke and “cryptogenic” events.

**TABLE OF CONTENTS/OUTLINE**

Introduction Anatomic landmarks Imaging Technique and Protocols Typical and Atypical Imaging Features, Complications, and Evolution, with teaching cases Differential Diagnoses Take Home Messages References

## NREE-38 MYELIN OLIGODENDROCYTE GLYCOPROTEIN ANTIBODY-ASSOCIATED DISEASE(MOGAD): HOW TO RECOGNIZE NEUROIMAGING PATTERNS

**Awards**
**Certificate of Merit**

Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Tatiana Iutaka, BDS (*Abstract Co-Author*) Nothing to Disclose
Angelo C. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula A. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Carlos M. Maia JR (*Abstract Co-Author*) Nothing to Disclose
Tamara Hernandes Ricci, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia C. Santos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purposes of this exhibit are:- Review the main neuroimaging patterns of MOGAD through clinical cases.- Discuss and describe the imaging features at the heterogeneous phenotypes in MOGAD patients, focusing in MRI findings, such as optic neuritis, transverse myelitis, supratentorial and infratentorial involvement.

**TABLE OF CONTENTS/OUTLINE**

1. Imaging patterns of MOGAD disorder with epidemiological features in adult and pediatric population.- Neuroimaging patterns such as supratentorial and infratentorial involvement, optic neuritis and transverse myelitis. 2. Supratentorial and infratentorial most common imaging patterns in MOGAD patients illustrated by clinical cases.- Supratentorial involvement showed by clinical cases with heterogenous imaging patterns such as acute disseminated encephalomyelitis (ADEM), flair-hyperintense lesions in anti-MOG associated encephalitis with seizures (FLAMES) and other patterns.- Infratentorial involvement in MOGAD illustrated by a clinical case 3. The overlap of the imaging and neurological patterns of ADEM and FLAMES- Clinical case illustrating the alternance of ADEM and FLAMES imaging patterns 4. Transverse Myelitis in MOGAD patients.- Clinical cases showing the spinal cord involvement in MOGAD disease. 5. Optic neuritis imaging pattern in MOGAD- Imaging pattern of MOGAD optic neuritis and the differences of the optic nerve involvement in the most common differential diagnosis.

## NREE-39 NON-NEOPLASTIC INTRACRANIAL CYSTIC LESIONS: IMAGING FINDINGS AND PRACTICAL APPROACH OF THE DIFFERENTIAL DIAGNOSES

Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Scortegagna SR, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula A. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rafael M. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Larissa A. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana Iutaka, BDS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To suggest a diagnostic algorithm for non-neoplastic intracranial cystic lesions according to the predominant location.To review the broad differential diagnosis of non-neoplastic intracranial cystic lesions through clinical cases, discussing the clinical and imaging features.To emphasize the key imaging findings that are essential to the diagnosis

**TABLE OF CONTENTS/OUTLINE**

Introduction.Diagnostic algorithm for non-neoplastic intracranial cystic lesions according to the predominant location.Revision of the broad differential diagnosis through clinical cases, with a discussion of imaging and clinical features.- Extra-axial, off-midline cystic lesion: Arachnoid cyst; Choroidal fissure cyst; Epidermoid cyst; Neurocysticercosis.- Extra-axial, midline cystic lesion: Dermoid cyst; Nuroenteric cyst; Pineal gland cyst; Cavum septum pellucidum, cavum vergae and cavum interposed velum; Rathke's cleft cyst.- Intra-axial, parenchymal cystic lesion: Perivascular space; Neuroglial cyst; Hippocampal sulcus remnant; Porencephalic cyst; Neurocryptococcosis; Hydatidosis; Congenital CMV; Neurocysticercosis.- Intra-axial, ventricular cystic lesion: Colloid cyst; Ependymal cyst; Choroid plexus cyst; Neurocysticercosis.Table with the key imaging findings and typical location of each lesion.Conclusion

## NREE-4 BRAIN ASYMMETRIES: BETWEEN PHYSIOLOGICAL AND PATHOLOGICAL

Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Victor R. Marussi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Laura Petruz Piassa, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- The normal brain is not perfectly symmetrical.- Brain asymmetries are characterized by enlargement or atrophy of all or part of a cerebral hemisphere.- They can be physiological or non-physiological (congenital or acquired).

**TABLE OF CONTENTS/OUTLINE**

Brain asymmetry has been observed for over a century in humans in terms of structure, function, and behavior and is characterized by enlargement or atrophy of all or part of a cerebral hemisphere. They can be physiological or non-physiological (congenital or acquired). Physiological asymmetries reflect evolutionary, hereditary, developmental, experiential, and pathological factors. The specialization of the left hemisphere for language was one of the earliest observations of brain asymmetry. Among the most prominent observations of brain asymmetry are the right frontal and left occipital petalia (when one of the lobes protrudes towards the contralateral side, leaving impressions on the inner surface of the skull). Other common physiological asymmetries include gyral-sulcal patterns, distribution of grey and white matter and ventricular asymmetry. On the other hand, various diseases, whether congenital or acquired, present disproportion between one cerebral hemisphere or lobe and the other. A pratical approach to assessment, considering the dimensions of the affected hemisphere (enlarged or reduced), the size of the lateral ventricles on the diseased side, and the pattern of involvement between the cerebral lobes, can help narrow down the list of differential diagnoses.

## NREE-40 BOTTOMS UP: EXPLORING CAUDAL REGRESSION SYNDROME THROUGH RADIOLOGY

Vanessa C. Chacon, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz M. Navarro Estrada, MD (*Abstract Co-Author*) Nothing to Disclose
Berali Del Espiritu Santo Padilla, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Caudal Regression Syndrome (CRS) is a rare genetic disorder characterized by total or partial agenesis of the lower vertebral, sacral, and thoracolumbar spine.• The clinical presentation of CRS varies based on the extent of malformations, common features include a short intergluteal cleft, foot deformities, and lower extremity muscular atrophy. Neurological deficits correlate with the level of vertebral anomaly, while gastrointestinal and genitourinary abnormalities pose significant diagnostic challenges.• Antenatal ultrasound is sensitive for detecting hypoplasia of the lower extremities and sacral or lumbosacral agenesis.• Fetal MRI confirms the diagnosis and assesses the level of the terminal medullary cone. Postnatally, imaging modalities like ultrasonography, bone survey, CT scan, and MRI are utilized for confirmation and detailed assessment.• CRS is divided into two subgroups: Group 1, characterized by high agenesis with cord termination above the lower border of L1, while Group 2, features low agenesis below L1, and often presents a low-lying conus, predisposing to progressive neurological deterioration.• Additionally, Renhaw's classification categorizes sacral agenesis into four types, providing insights into the anatomical variations seen in CRS.

**TABLE OF CONTENTS/OUTLINE**

Epidemiology of CRSAssociations of CRSClinical Findings Relevant to RadiologistsRadiological Features on Antenatal UltrasoundRadiological Findings on MRIClassification of CRS on MRIInformation Clinicians Seek about CRS

## NREE-41 MASTERING NEUROVASCULAR DIAGNOSIS WITH BLACK BLOOD IMAGING

Elham Tavakkol, MD (*Abstract Co-Author*) Nothing to Disclose
Kamand Khalaj, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Konstanze Guggenberger, MD (*Abstract Co-Author*) Nothing to Disclose
Roy Riascos, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Javier M. Romero, MD (*Abstract Co-Author*) Stockholder, TMA Precision Medicine
Arash Kamali, MD (*Abstract Co-Author*) Nothing to Disclose
David E. Timaran Montenegro, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Demonstrate the role of black blood MR imaging (BB-MRI) in detecting and interpreting arterial wall diseases in intracranial vessels. • Depict the clinical applications and pitfalls of BB-MRI in neurovascular diagnosis. • Provide insights into the pathology beyond luminal abnormalities, enabling the differentiation of causes of stenosis, such as intracranial atherosclerotic disease, vasculitis, and reversible cerebral vasoconstriction syndrome, through

BB-MRI. • Highlight interpretive pitfalls, including artifacts from slow flow, enhancing veins mimicking arterial wall enhancement, and vasa vasorum enhancement mimicking vasculitis.

**TABLE OF CONTENTS/OUTLINE**

Atherosclerosis: Clear visualization of vessel walls and enabling precise assessment of atherosclerotic plaque morphology and burden. Vasculitis: concentric vessel wall thickening and enhancement. Notably, the "tram track sign," observed as a hyperintense line with hypointense rims, is a hallmark of vasculitic involvement. Dissection: intramural hematoma as a characteristic imaging finding in dissection, along with the eventual visualization of mural thrombus. Moyamoya Disease: Characteristic terminal intracranial internal carotid artery stenosis without enhancement. Intracranial Saccular Aneurysms: Stability of aneurysms can be predicted by absence of enhancement in the vessel wall. Vasospasm: Narrowing of vessel lumen without enhancement. Reversible Cerebral Vasoconstriction Syndrome (RCVS): Mild enhancement or no enhancement with thickened vessel walls. Giant Cell Arteritis: Helps in determining where to perform a biopsy on the temporal artery and predicting biopsy results.

## NREE-42 THE POSTOPERATIVE SELLA: WHAT IS THE RADIOLOGIST ROLE?

Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Postoperative evaluation of the sella turcica is a major challenge, even for experienced neuroradiologists. The objective of this presentation is to promote a review on the topic and propose solutions for the standardized evaluation of these exams, with the aim of increasing the precision and confidence of radiologists when faced with them.

**TABLE OF CONTENTS/OUTLINE**

- It is necessary to know the characteristics of pre-operative exams and how the surgical procedure was performed.- An examination with the appropriate technique must be performed, focusing on T2 and post-contrast T1-weighted sequences. Performing a dynamic sequence and post-contrast T1 3D fast spin echo sequences may be useful.- Careful evaluation of these studies should initially look for postoperative complications, such as bleeding, ischemia and CSF leak.- The assessment of residual lesion and progression must be carried out with caution, always using all available comparative exams, to identify slow growth.- Some post-treatment expected changes should also be observed, such as insinuation of the supra sellar cistern and herniation of the optic chiasm.

## NREE-43 CORTICAL BRAIN LESIONS: FACTS AND FEATURES

Alan I. Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Tamara Hernandes Ricci, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Tatiana Iutaka, BDS (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula A. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela C. Vasconcellos, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia C. Santos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Review the main imaging patterns of the differential diagnosis of cortical lesions - Discuss the essential imaging findings, such as leptomeningeal enhancement, cortical thickening, distribution features, and also the use of additional MRI sequences in the differential diagnosis of the cortical lesions- Illustrate the MRI imaging findings of each disorder through clinical cases, highlighting the key points, and discussing clinical and epidemiological features- Suggest a flowchart of the practical approach of cortical lesions

**TABLE OF CONTENTS/OUTLINE**

● The main imaging findings in the cortical lesions approach ● The use of additional MRI sequences ● Differential Diagnosis of Cortical Lesions○ Inflammatory Disorders: Multiple sclerosis; Myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD); Behçet disease Autoimmune encephalitis.○ Infectious Disorders: Tuberculosis; Syphilis; Herpes encephalitis; Creutzfeldt Jakob.○ Vascular Disorders: Infarction; Hypoxic ischemic brain injury.○ Neoplastic Disorders ○ Toxic and Metabolic Disorders: Wernicke's encephalopathy; Hyperammonemia; Hepatic encephalopathy; Marchiafava-Bignami; Osmotic demyelination syndrome; Wilson disease; Mitochondrial encephalomyopathy with lactic acidosis and stroke-like episodes (MELAS).○ Developmental Disorders: Focal cortical dysplasia; Heterotopia.○ Phakomatosis: Tuberous sclerosis; Sturge Weber.○ Neurodegenerative Disorders: Amyotrophic lateral sclerosis; Frontotemporal lobe dementia. ● Flowchart of the practical approach of cortical lesions

## NREE-44 HIDING IN THE CORNER: A SIMPLIFIED APPROACH TO CEREBELLOPONTINE ANGLE LESIONS

Joshua Russell (*Abstract Co-Author*) Nothing to Disclose
Madhurya Amirapu, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The CP angle is an anatomically complex region. It houses numerous structures such as cranial nerves (V, VI, VII), blood vessels, and cerebrospinal fluid spaces. Understanding the normal anatomy is crucial for interpreting abnormalities in this region. Involvement of the various structures here may have independent and/or overlapping symptoms. For example, extending a CP angle mass into the Dorello canal, a bony channel through which the abducens nerve travels from the prepontine cistern to the cavernous sinus, may present with lateral rectus muscle palsy. Cerebellopontine angle lesions can be divided into tumor and non-tumor lesions. The most common tumor lesions -Vestibular schwannoma (acoustic neuroma), Meningioma, Epidermoid Cyst, Arachnoid Cyst, Ependymoma, Lipoma, Dermoid, Primary malignancy (Lymphoma and Melanoma), Metastatic disease, Facial nerve and Vestibular nerve schwannomasThe most common non-tumor lesions -Aneurysm/Vertebrobasilar Dolichoectasia and Anterior Inferior Cerebellar Artery Loop.Cerebellopontine lesions typically demonstrate differentiating imaging characteristics, mostly evaluated on MRI and CT Brain.

**TABLE OF CONTENTS/OUTLINE**

Normal cerebellopontine angle anatomy including surrounding structures.Involvement of the various structures in this region and their possible clinical presentations (table and image examples).Common and few less common cerebellopontine angle lesions and epidemiological /syndromic correlation, if present (table/chart). Masses and their characteristic imaging features (images/case examples). Non tumor cerebellopontine lesions (table/image examples ). Radiologic pitfalls.Take home points/summary. References.

## NREE-45 REVIEW OF THE LILIEQUIST MEMBRANE AND ITS SIGNIFICANCE IN NEUROIMAGING

Julie B. Guerin, MD (*Abstract Co-Author*) Nothing to Disclose
John C. Benson, MD (*Abstract Co-Author*) Nothing to Disclose
Edward Ahn, MD (*Abstract Co-Author*) Nothing to Disclose
V. Michelle Silvera, MD (*Abstract Co-Author*) Nothing to Disclose
Norbert G. Campeau, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Hayden Swartz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The Liliequist membrane (LM) is an important landmark for both neuroradiologists and neurosurgeons to identify on preoperative and intraoperative examinations for CSF diversion, masses involving the floor of the third ventricle, and endoscopic third ventriculostomy (ETV) patency. 2. The LM is best visualized using MRI with thin-section, heavily T2-weighted imaging such as with balanced steady-state free procession (bSSFP) sequences such as FIESTA and CISS. Flow signal through ETV sites is best demonstrated using spin echo-based techniques such as T2 FSE, T2 SPACE or CUBE sequences.

**TABLE OF CONTENTS/OUTLINE**

1. Defining the LM and its anatomy: Illustrate the three main components of the LM and their anatomic relationships with adjacent suprasellar and hypothalamic structures. 2. History of the LM. 3. Imaging technique: Emphasize the importance of thin-section, heavily T2-weighted imaging for anatomic visualization of the LM, and FSE-based techniques for functional assessment of flow through an ETV. 4. Review a series of cases in which the LM is visualized before and/or after endoscopic third ventriculostomy. 5. Review a series of cases in which the LM is indirectly depicted by subarachnoid contrast, subarachnoid hemorrhage, or by mass effect secondary to lesions in the suprasellar or prepontine cisterns.

## NREE-46 VARYING SHADES OF EPIDERMOID TUMORS - THE BLACK, THE WHITE AND EVERYTHING IN BETWEEN

Rita G. Bhatia, MD (*Abstract Co-Author*) Nothing to Disclose
Natalya Nagornaya, MD (*Abstract Co-Author*) Nothing to Disclose
Gaurav M. Saigal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Hamilton Trinh, MD (*Abstract Co-Author*) Nothing to Disclose
Denver S. Pinto, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

At the end of this exhibit, the reader should be able to:1. Identify key imaging features of epidermoid tumors and its subtypes2. Differentiate epidermoid tumors from its differential diagnoses3. Understand the clinical presentation and symptoms associated with epidermoid tumors

**TABLE OF CONTENTS/OUTLINE**

Pathophysiology of epidermoids - Anatomy and patterns of growth of epidermoid cystsClinical PresentationCase discussion with imaging findings with a focus on MRI findings especiallya) Diffusion restrictionb) White Epidermoids, Dark epidermoids and varying patterns of intermediate signalc) Sites of epidermoid tumor,Sites of epidermoids:Intradural:a) Extraparenchymal: Cerebello-pontine angle, Suprasellar cistern, Middle cranial fossa, Anterior cranial fossa, Interhemispheric fissureb) Intraparenchymal: Temporal lobe, frontal lobec) Intraventricular: Fourth ventricle,Extradural: Intradiploic, Intraorbital,Extradural sites: Calvarium,,Differential diagnosis: 1. Arachnoid cyst (for the extra-axial type) 2. Dermoid cyst, Neurenteric cyst (for the midline location) 3. Cystic Schwannoma (for the cerebellopontine angle) 4. Craniopharyngioma (For the skull base location) 5. Developmental neuro-epithelial tumor (DNET) and Multi-nodular and vacuolating neuronal tumor (MVNT) --> for the intra-parenchymal location 6. Ependymoma, Subependymoma, Medulloblastoma (for the intraventricular location),,Complications: 1. Malignant degeneration 2. Chemical meningitis/ aseptic meningitis with and without hydrocephalus 3. Spontaneous hemorrhage,,Goals of treatment:

## NREE-47 SPECTRUM OF NEUROIMAGING FINDINGS IN CNS LYMPHOPROLIFERATIVE DISORDERS

**Awards**
**Cum Laude**

Bruno A. Telles, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Luis Novak Filho (*Abstract Co-Author*) Nothing to Disclose
Diego R. Lodi Lauriano, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Rudolfo Kleinubing Junior, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Ramina (*Abstract Co-Author*) Nothing to Disclose
Erasmo Barros Da Silva Junior (*Abstract Co-Author*) Nothing to Disclose
Leonardo Kami, MD (*Abstract Co-Author*) Nothing to Disclose
Joao V. de Oliveira Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela Santos Cavalcanti (*Abstract Co-Author*) Nothing to Disclose
James H. Yared, MD (*Abstract Co-Author*) Nothing to Disclose
Bernardo C. Teixeira, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Standard imaging signs of CNS lymphoproliferative disorders as revealed by MRI and CT. 2. Advanced imaging techniques such as MRI spectroscopy, diffusion-weighted imaging, and perfusion imaging are indispensable for distinguishing CNS lymphoproliferative disorders from other neurological disorders and assessing tumor aggressiveness. 3. These techniques provide intricate insights into the metabolic activity, cellular density, and vascularity of lesions, facilitating differentiation from other neurological pathologies and offering crucial information regarding tumor aggressiveness. 4. Accurate imaging interpretation informs treatment decisions and aids in monitoring therapeutic outcomes. 5. The precise interpretation of imaging findings serves as a cornerstone in guiding treatment strategies and monitoring therapeutic responses, highlighting the indispensable role of neuroradiologists in the comprehensive care of patients with CNS lymphoproliferative disorders.

**TABLE OF CONTENTS/OUTLINE**

1. Typical Presentation ○ Key Imaging Characteristics of CNS Lymphoma and Other Lymphoproliferative Disorders 2. Common Imaging Findings ○ Brain Manifestations of Lymphoma ○ Manifestations of Other Lymphoproliferative Disorders (*Intravascular Lymphoma, MALT Lymphoma of the Dura,*

*Lymphomatosis Cerebri*) 3. Atypical Presentations ○ Diverse Imaging Findings Across Unusual Sites: Eyes, Spinal Cord, Leptomeninges, Cerebellum/Brainstem, and Other Locations 4. Advanced Imaging Techniques ○ Application of MR Perfusion and MR Spectroscopy in Differential Diagnosis

## NREE-48 WRONG WHITE BRAIDS: UNRAVELING THE COMPLEXITY OF LEUKODYSTROPHIES FROM A RADIOLOGIST'S PERSPECTIVE

Juliana Duarte (*Abstract Co-Author*) Nothing to Disclose
JEAN LEVI RIBEIRO DE PAIVA (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz Borella (*Abstract Co-Author*) Nothing to Disclose
GABRIELLE BACCARIN (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Magnetic resonance imaging (MRI) plays a fundamental role in the diagnosis of leukodystrophies.Recognition of patterns on MRI includes differentiation between hypomyelinating and demyelinating patterns of white matter,distinguishing between diffuse and multifocal abnormalities,evaluating the predominant location of abnormalities,and identifying specific characteristics such as cystic degeneration of white matter,anterior temporal cysts,megalencephaly,increased perivascular spaces or small cysts,additional gray matter lesions,contrast enhancement,calcium deposits,microhemorrhages,spinal cord involvement,cranial nerves thickening and enhancement.Some spectroscopy findings may also suggest the diagnosis:in Canavan’s disease there is an increase in the NAA peak;a peak of alpha-glutamate concentrations (at 3.75 ppm) is observed in 18q Deletion Syndrome.MRI may lead to a specific diagnosis, suggest the appropriate genetic test to confirm the diagnosis,and have contributions in monitoring disease progression,and therapeutic responses.

### TABLE OF CONTENTS/OUTLINE

IntroductionCase-based review of leukodystrophies:Metachromatic leukodystrophyKrabbe diseaseX-linked adrenoleukodystrophyCanavan diseaseAlexander diseaseL-2-hydroxyglutarig acid uriaLeukoencephalopathy involving the brainstem and spinal cord with elevated lactate.Sjogren-Larsson syndromePropionic acidemia18q Deletion SyndromePOLR3B-related Hypomyelinating Leukodystrophy Adult-Onset Leukoencephalopathy with Axonal Spheroids and Pigmented GliaMegalencephalic leukoencephalopathy with subcortical cystsFinal remarks and take home messages

## NREE-49 HOW TO REPORT PITUITARY MACROADENOMAS

Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Importance of Structured Reporting- Emphasize the significance of a structured reporting format in providing comprehensive and consistent information to referring physicians and other healthcare providers. - Highlight how structured reports facilitate better understanding and interpretation of findings.2. Enhancing Communication - Encourage radiologists to use standardized terminology and formats to minimize ambiguity and misinterpretation of findings.3. Avoidance of Errors - Educate radiologists on errors in reporting pituitary macroadenomas, such as incomplete descriptions of tumor characteristics or failure to assess critical anatomical relationships.4. Clinical Decision Support - Highlight the role of structured reports in providing essential information for clinical decision-making, including tumor characteristics, proximity to critical structures, and potential treatment implications.

### TABLE OF CONTENTS/OUTLINE

1. Introduction- Overview of Pituitary Macroadenomas - Importance of Reporting and Diagnosis2. Characteristics of Pituitary Macroadenomas - Signal Intensity - Presence of Lobulation - Suprasellar Growth - Infrasellar Growth3. Relationship with Neighbor Structures - Optic Chiasm - Third Ventricle - Clivus - Sphenoid plane4. Remodeling of the Sellar Floor5. Type of Sphenoid Sinus Pneumatization6. Knosp Classification - Predicting Cavernous Sinus Invasion7. Presence and Importance of Onodi Cell8. Measure and Relevance of Intercarotid Distance9. Differential diagnosis - Red Flags that may point to other diagnosis10. Conclusion - Importance of Comprehensive and Structured Reporting - Clinical Implications

## NREE-5 INSIGHTS AND CONSIDERATIONS IN DEVELOPMENT AND PERFORMANCE EVALUATION OF GENERATIVE ADVERSARIAL NETWORKS (GANS): WHAT RADIOLOGISTS NEED TO KNOW

Kyung Mi Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Minjae Jang (*Abstract Co-Author*) Nothing to Disclose
Minjae Myung (*Abstract Co-Author*) Nothing to Disclose
Eui Jong Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Janghoon Oh (*Abstract Co-Author*) Nothing to Disclose
Hyug-Gi Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Jeong Taek Yoon, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Deep learning has advanced AI in medical imaging, leading to significant improvements but also creating challenges like the need for extensive training data and laborious labeling. Generative Adversarial Networks (GANs) generate synthetic images for data augmentation and simplify medical image processing, enhancing efficiency and enabling unsupervised anomaly detection, thus reducing reliance on labeled datasets. Our investigation into GANs in medical imaging addresses their varied architectures, the considerations for selecting appropriate GAN models, and the nuances of model training and performance evaluation. This presentation aims to provide radiologists who are new to GAN technology with a thorough understanding, guiding them through the practical application and evaluation of GANs in brain imaging with two illustrative examples. It offers a comprehensive exploration of the transformative potential of GANs in medical imaging research. Ultimately, this paper strives to equip radiologists with the knowledge to effectively utilize GANs, encouraging further research and application within the field.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. GAN architecture, hierarchy, and variants 3. Selecting the appropriate GAN for the research objectives 4. Input data training 5. Performance evaluation 6. Conclusion

## NREE-50 NOT EVERY DURAL BASE LESION REPRESENTS A MENINGIOMA: A PICTORIAL ESSAY ON SOLITARY FIBROUS TUMOR IN THE CENTRAL NERVOUS SYSTEM

Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Rangel Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. Quevedo (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This education exhibit provides an analysis of solitary fibrous tumors involving the central nervous system (SFT-CNS), which can often be misdiagnosed as meningiomas due to their rarity and similar imaging characteristics. Through the analysis of 8 consecutive cases treated in our hospital between 2014 and 2024, this exhibit aims to highlight the clinical, histopathological, and MRI characteristics of SFT-CNS. The purpose of this study are - To discuss the clinical and histopathological characteristics of SFT-CNS. - To demonstrate the main magnetic resonance imaging (MRI) findings in SFT-CNS. - To present 8 consecutive cases with histopathological confirmation treated in our hospital between 2014 and 2024. - To compare the imaging findings of differential diagnoses. - To enhance recognition of this uncommon pathology among radiologists.

### TABLE OF CONTENTS/OUTLINE

- Introduction - Clinical and Histopathological characteristics of SFT-CNS. - Main imagen features of SFT-CNS. - Compare the imaging findings of differential diagnoses, particularly with those of meningioma. - Cases of Patients with a Histopathological Diagnosis of SFT-CNS.

## NREE-51 FROM DAWSONS FINGERS TO CENTRAL VEIN SIGN: A RADIOLOGIST'S PRIMER TO CLINICALLY RELEVANT CONVENTIONAL AND EMERGING MRI BIOMARKERS IN MULTIPLE SCLEROSIS

**Awards**
**Certificate of Merit**

Suradech Suthiphosuwan, MD (*Abstract Co-Author*) Nothing to Disclose
Aditya Bharatha, MD (*Abstract Co-Author*) Nothing to Disclose
Yusuf Alibrahim, BMedSc, MD (*Abstract Co-Author*) Nothing to Disclose
Jiwon Oh, FRCPC,PhD (*Abstract Co-Author*) Nothing to Disclose
Timothy Reynold U. Lim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pathologic features of multiple sclerosis (MS) include perivenular demyelination, inflammation and neurodegeneration; active lesions predominate in relapsing-remitting, and smoldering lesions and neuroaxonal loss in progressive forms.Conventional MRI findings, while currently still the most used imaging biomarkers, lack pathologic specificity and only moderately correlate with disease activity and disability in MS.MRI biomarkers more specific to MS pathology are emerging; the two furthest along in clinical development are the central vein sign (CVS) and paramagnetic rim lesions (PRLs).CVS reflects perivenular demyelination and is highly specific and sensitive for distinguishing MS from mimics.PRLs represent lesions with chronic active inflammation along the lesion edge are also useful for diagnosis and prognosis across the entire MS spectrum.Other biomarkers such as brain and spinal cord volumetric measures, cortical lesions and leptomeningeal enhancement have also shown prognostic utility in MS.

### TABLE OF CONTENTS/OUTLINE

A. Pathologic basis of imaging biomarkers in MSa. MS involves both gray and white matterb. Perivenular inflammatory demyelinationc. Neurodegeneration in MSi. Neuroaxonal lossii. Chronic active "smoldering" lesionsB. Conventional MRI biomarkersa. T2/FLAIR lesionsi. 2017 McDonald Criteriaii. Prognostic utility of T2 lesion burdeniii. Optic nerve as 5th location for DISb. Gadolinium-enhancing lesionsc. T1 black holesC. Emerging MRI biomarkersa. CVSb. Chronic active lesionsi. PRLii. Slowly expanding lesionsc. Cortical lesionsd. Leptomeningeal enhancemente. Volumetric measuresi. Brain (global / regional) atrophyii. Spinal cord atrophy

## NREE-52 NEURO BEHçET'S SCAR TISSUE: UNVEILING THE MANIFESTATIONS ON THE CENTRAL NERVOUS SYSTEM

Lua P. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Zoraida Sachetto (*Abstract Co-Author*) Nothing to Disclose
Renan D. Turci, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are: Review and illustrate the pathogenesis, imaging findings of neurological involvement of Behēet' disease, the differential diagnoses, and their correlation with clinical findings. Describe through illustrative presentations the benefits of MRI imaging approach to the diagnosis of Neuro-Behēet. Present challenging cases, such as venodural fistula and dural venous thromboses and differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

Behēet pathogenesis and clinical findings. Imaging patterns on MR in different weighted sequences. Evaluation of complications such as venodural fistula and dural venous thromboses. Susceptibility weighted image (SWI)'s hole on detection of hemorrhagic findings in Neuro-Behēet.Imaging findings based on a pictorial review using representative cases from a Tertiary University Hospital database. A practical approach for better diagnostic accuracy and avoiding pitfalls. Final remarks.

## NREE-53 DECODING THE LOES SCORE: A STEP-BY-STEP REVIEW OF THE MRI SEVERITY SCORE FOR X-LINKED ADRENOLEUKODYSTROPHY

Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo V. Bahia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Clinical importance of the MRI severity score for X-linked adrenoleukodystrophy (X-ALD)Introduce Dr. Loes and the rationale behind the development of this scoring system; Explain what the score is and its significance in X-ALD evaluation; Highlight the score's role in evaluating disease severity, disease monitoring, prognosis and treatment decision-making.Score overview, components and methodologyDetail the specific MRI findings that contribute to the score through a structured reporting template elaborated by the authors; Describe how the MRI severity score is calculated and interpreted through a case-based approach, through cases from the author's institution; Discuss scoring thresholds.Review of the cerebral anatomy commonly affected by X-ALDReview neuroanatomic locations by correlating MRIs from clinical cases and didactic schemes elaborated by the authors.

### TABLE OF CONTENTS/OUTLINE

IntroductionBrief overview of X-ALD; Challenges in disease assessment.Overview of the MRI severity scoreDevelopment rationale: the importance of objective assessment; Evidence supporting its use; Role in treatment decision-making; Structured template for reporting.Components of the score and scoring methodology with anatomic correlationWhite matter involvement and focal atrophy; Corpus callosum involvement and atrophy; Optic pathway involvement; Auditory pathway involvement; Projection fibers involvement; Cerebellum involvement and atrophy; Basal ganglia involvement; Global atrophy, brainstem atrophy and methods for assessmentConclusionCalculation and practical considerations; Addressing challenges, limitations and areas for further developments; Key takeaways.

## NREE-54 IMAGING INSIGHTS ON CHILDHOOD STROKE - SHEDDING LIGHT ON A CHALLENGING CONDITION

Luiz Borella (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Costa Haiter, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Stroke in children raises concern to healthcare, due increasing incidence. The etiology is multifactorial, and this study emphasizes the main arterial etiologies of stroke, based on "The Childhood Arterial Ischemic Stroke Standardized Classification and Diagnostic Evaluation (CASCADE) criteria", searching for the best imaging findings, to assist accurate diagnoses. It subdivides into primary causes and secondary causes. Illustrated findings in original cases of "Moya-Moya" disease, carotid dissection in aortic/cervical arteriopathy, bacterial meningitis, viral infectious vasculitis (varicella zoster and COVID-19), occlusive vasculopathy due to Sickle Cell Disease and inflammatory vasculitis due to Behēet and Lupus are highlighted in the study, as well the main stroke mimics to keep in mind, especially hemiplegic migraine and posterior reversible encephalopathy syndrome (PRES). Ultimately, the study delves into the pitfalls, which must be considered to guarantee accurate diagnosis. The study seeks to improve diagnosis inchildren who can greatly benefit from an early diagnosis, allowing the expansion of future estudies and treatments, bringing greater quality of life to patients.

### TABLE OF CONTENTS/OUTLINE

- Introduction - Epidemiology of stroke in Children - The Childhood Arterial Ischemic Stroke Standardizes Classification and Diagnostic Evaluation(CASCADE) criteria Illustrated. - Main clinical manifestations - Diagnostic clues - Imaging investigation (cases and Imaging findings) in primary and secondary causes - Differential diagnoses and stroke mimics - Pitfalls

## NREE-55 EXPLORING NEURAL PATHWAYS - AI METHODS IN DIPY FOR ADVANCED NEUROANATOMICAL STUDIES

Serge Koudoro, MSc (*Abstract Co-Author*) Nothing to Disclose
Eleftherios Garyfallidis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

As datasets expand and analysis methodologies evolve, the demand for sophisticated computational resources and techniques intensifies. The Diffusion Imaging in Python (DIPY) community has cultivated a robust open source software ecosystem designed for the analysis of structural and diffusion MRI data. Throughout this exhibit, we will embark attendees on a journey to: A) Explore advanced AI tools within DIPY (Diffusion Imaging in Python) for MRI data analysis. B) Highlight key methodologies addressing common research challenges. C) Showcase innovative techniques like EVAC+ for brain extraction. D) Discuss the role of generative AI in segmentation enhancement. E) Introduce Patch2Self2 for denoising and its extensions. F) Survey distortion correction methods, including style transfer. G) Present statistical analysis capabilities and tract analytics in DIPY. H) Demonstrate Tractometry with Bundle Analytics 2.0 and BundleWarp. E) Present a novel method for direct data harmonization.

### TABLE OF CONTENTS/OUTLINE

This exhibit offers a hands-on exploration of a community-driven open-source ecosystem (DIPY), vital for analyzing structural and diffusion MRI data. Attendees will deepen their understanding of MR imaging, gain insights into MR imaging and stay updated on the latest advancements. Specific topics like brain extraction techniques, distortion correction methods, and data harmonization will be covered. A focus on tractometry will demonstrate to attendees how to enable detailed group comparisons and identification of statistically significant differences in tract properties between populations. We wrap up with reflections on advancements made and future directions in MRI data analysis.

## NREE-56 VASCULAR INTRACRANIAL EMERGENCIES OF CHILDHOOD

Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Delgado (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Enzo Calheiros, MD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Cesar Augusto P. Alves SR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This educational exhibition provides a comprehensive overview of the imaging evaluation of pediatric patients with vascular intracranial emergencies. Imaging patterns, differential diagnoses, and potential pitfalls in imaging interpretation will be addressed, as well as etiology categorization and classifications for the most common vascular emergencies, aiming at a broad review of the theme. The purpose of this exhibition is to: Provide an overview of the imaging evaluation of pediatric patients with vascular intracranial emergencies. Highlight specific imaging patterns and features that may suggest the etiology discussing differential diagnosis and potential pitfalls in imaging interpretation. Use case studies to illustrate radiological challenges and diagnostic considerations.

**TABLE OF CONTENTS/OUTLINE**

1 Clinical presentation and etiologyOverview of clinical presentation of pediatric intracranial vascular emergency divided by hemorrhagic, ischemic and thrombotic etiologies. 2 Ischemic Disorders: Inflammatory Arteriopathy Focal cerebral arteriopathy, Primary or Secondary vasculitis. 3 Ischemic Disorders: Non-Inflammatory Arteriopathy Dissection, Moyamoya patterns and Genetic etiologies. 4 Hemorrhagic disorders: Coagulation disorders and Germinal Matrix Hemorrhage. Aneurysm, Vein of galen aneurysmal malformation, Arteriovenous malformations, Germinal matrix hemorrhage, Cerebral proliferative angiopathy, Cavernous angiomas, Cerebrofacial arteriovenous metameric syndrome (CAMS), Dural arteriovenous fistula and Coagulation disorders 5 Cerebrovenous Thrombosis Cerebral Venous Sinus Thrombosis, Cortical Vein Thrombosis, Medullary Vein Thrombosis

## NREE-57 UNVEILING THE MYSTERIES OF THE PERIVASCULAR SPACES LESIONS

Thanh Binh Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Santanu Chakraborty, FRCPC,MBBS (*Abstract Co-Author*) Nothing to Disclose
Maria Lucia Brun, MD (*Abstract Co-Author*) Nothing to Disclose
Azza Reda, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Knowing the function and the role of the glymphatic system. • To discuss the normal anatomy of the perivascular spaces and variants.• To discuss the diverse types of causes and diseases affecting the perivascular spaces with highlight on the recently described and updated lesions.• To provide an approach describing lesions that mimics the perivascular spaces which will aid in appropriate management and guide in surgical intervention.

**TABLE OF CONTENTS/OUTLINE**

-Overview of the glymphatic system -Anatomy of the perivascular spaces and variants -Approach to diagnose neoplastic and non-neoplastic causes of dilated perivascular spacesA. Non enhancing causes.B. Enhancing causes. -Non enhancing causes• Small vessel diseases: cerebral amyloid angiopathy, CADASIL, hypertensive encephalopathy• Neurodegenerative: Parkinson disease, Alzheimer disease• Demyelination and Autoimmune disease: NMOSD, MS, SLE• Miscellaneous: Sener syndrome, mucopolysaccharidoses, traumatic brain injury -Enhancing causes• GFAP• Infection: Cryptococcus, PML-IRIS• Neoplastic: Intravascular lymphoma• Inflammatory: CLIPPERS, SLIPPERS, Intravascular Sarcoidosis -Diseases that mimics dilated perivascular spaces • Benign cysts: neuroglial cysts, arachnoid cysts, Neuroenteric cysts, choroidal cysts,• Vascular: Lacunar infarct, PVL in peds• Neoplastic: DENT, MVNT, low grade glioma (anterior temporal)• Infectious: Neurocysticercosis, Toxoplasmosis

## NREE-58 LOST IN THE LABYRINTH: REVIEW OF THE INNER EAR AND ITS CONGENITAL MALFORMATIONS

Andres F. Caliz Cabrales, MD (*Abstract Co-Author*) Nothing to Disclose
Julian M. Gandur, MD (*Abstract Co-Author*) Nothing to Disclose
Oreanna Quintero, MD (*Abstract Co-Author*) Nothing to Disclose
Jesus Eduardo Barreto Fernandez (*Abstract Co-Author*) Nothing to Disclose
Sara Gomez Milanes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This poster provides a review of the anatomy and embryology of the inner ear; this review aims to facilitate a better understanding of why congenital malformations occur and to aid in their identification. Additionally, each malformation will be reviewed, and an algorithm will be provided to assist in reaching a diagnosis easily. The poster also correlates these malformations with the most important syndromes associated with them, highlighting the importance of understanding genomics in the study of these malformations and their relationship with various genetic syndromes. The objective is to provide radiologists with a reference tool that simplifies the understanding of this topic, often considered a "labyrinth," and demystifies the inner ear by offering a clear and concise overview of its structure, embryonic development, and associated pathologies.

**TABLE OF CONTENTS/OUTLINE**

Objectives; Importance of timely identification of congenital malformations of the inner ear; Embryology; Anatomy; Congenital malformations of the inner ear and their classification systems; Concise review of each congenital malformation correlating them with their respective embryonic developmental failure and imaging cases. Including: Complete labyrinthine aplasia, Rudimentary otocyst, Cochlear aplasia, Common cavity, Cochlear hypoplasia, Incomplete partition, Enlarged vestibular aqueduct, Abnormalities in the bony canal and cochlear nerve; Diagnostic algorithm; Imaging cases resolved using the diagnostic algorithm; Link between inner ear development, brain, and body: Clues for many diagnoses; Gallery of normal images of the inner ear; Bibliography

## NREE-59 INSIGHTS FROM THE INSIDE: UPDATES ON TRANSCRANIAL ULTRASOUND IN GREY SCALE, DOPPLER, AND CONTRAST-ENHANCED TECHNIQUES

Eduardo D. Chiovatto, MD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Chiovatto, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Cavalanti, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Esmeraldo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Transcranial ultrasound has emerged as a valuable modality in neuroimaging due to its versatility, non-invasive nature, and low cost, offering real-time evaluation of cerebral hemodynamics and pathologies.The purpose of this exhibit is to review current applications and advancements in transcranial ultrasound techniques for adults with actual case examples, emphasizing the clinical significance of Grey Scale, Duplex Doppler, and Contrast-Enhanced modalities.

**TABLE OF CONTENTS/OUTLINE**

Introduction to Transcranial Ultrasound a. Anatomy and Approaches b. Overview of ultrasound techniques: Grey Scale, Duplex Doppler, and Contrast-Enhanced UltrasoundClinical Applications of Transcranial Ultrasound in Adults a. Detection and monitoring of vasospasm in subarachnoid hemorrhage b. Evaluating cerebral stenosis with Duplex Doppler c. Management of sickle cell disease via flow velocity assessments d. Identification and implications of internal carotid artery occlusion e. Diagnosing brain death f. Real-time monitoring of emboli g. Detecting vascular lesions amenable to interventional treatment h. Assessing reperfusion post-thrombolysis i. Role in diagnosing vertebrobasilar insufficiency j. Contribution to the diagnosis of Parkinson's disease k. Detection and follow-up of raised intracranial pressure l. Identification of right-left shunt m. Assessment of cerebrovascular reserve capacityResearch Frontiers in Transcranial Ultrasound a. Quantifying brain perfusion with contrast-enhanced ultrasoundConclusion a. Summarize the impact of transcranial ultrasound on radiological practice and its potential future applications

## NREE-6 DOWN THE PATH OF NEURONAL INJURY AND AXONAL DEGENERATION: PATHOLOGIC MECHANISMS AND IMAGING FINDINGS BEYOND WALLERIAN CHANGES

**Awards**
**Cum Laude**

Nancy Margarita Gutierrez Castaneda, MD (*Abstract Co-Author*) Nothing to Disclose
Michelle Y. Gonzalez Putoy SR, MD (*Abstract Co-Author*) Nothing to Disclose
Griselda T. Romero Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Zamora, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Angela M. Sosa, MD, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

After completing this exhibit, the viewer will be able to:Summarize the different types of axonal degeneration, including classic Wallerian degeneration versus non-Wallerian changes.Identify the main molecular mechanisms and pathways underlying axonal degeneration: NAD+ metabolism, mitochondrial dysfunction,and necroptosis.Describe axonal degeneration during aging and its critical role in the pathophysiology of neurodegenerative diseases,such as Alzheimer's disease,Parkinson's disease,amyotrophic lateral sclerosis.Recognize a spectrum of common and atypical imaging patterns of axonal degeneration utilizing a case-base approach.

**TABLE OF CONTENTS/OUTLINE**

1.overview of neuronal and axonal structure and function. 2.Types of neuronal degeneration.3.Cellular and molecular basis of axonal degeneration.4.Axonal degeneration in aging and neurodegenerative diseases.5. Case review including:a.Classic Wallerian degeneration along corticospinal tract(acute intramyelinic edema and chronic atrophic changes).b.Pontocerebellar axonal degeneration.c.Degeneration of cranial nerves.d.Cranial and caudal axonal degeneration in the spinal cord.e.Degeneration of mammillary bodies and fornix (e.g,temporal lobe, epilepsy/mesial temporal sclerosis).f. Optic nerve degeneration(e.g.,phthisis bulbi).g.Degeneration atrophy(e.g.,tongue[CNXII],masticador muscles[CNV],shoulder muscles[brachial plexus].hHypertrophic olivary degeneration.i.Neurodegenerative disease.

## NREE-60 PIECING TOGETHER THE PUZZLE OF NEUROTOXOPLASMOSIS: INSIGHTS FROM NEUROIMAGING

Fabiano Reis (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana T. Raeder, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Lua P. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Tiradentes (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review and illustrate the imaging findings of neurotoxoplasmosis, discuss the differential diagnoses, and correlate them with pathological images. Describe, through illustrative presentations, the benefits of the multimodality imaging approach for diagnosing neurotoxoplasmosis. Present challenging cases, such as differentiating between neurotoxoplasmosis, primary CNS lymphoma, and other opportunistic infections. Highlight radiological diagnostic pearls of neurotoxoplasmosis.

**TABLE OF CONTENTS/OUTLINE**

Neurotoxoplasmosis epidemiology and parasite life cycle. Imaging patterns on MR and CT. Susceptibility-weighted imaging (SWI) as an auxiliary tool for calcified lesions. Spectroscopy and perfusion as valuable tools for differential diagnosis. Imaging findings of post-treatment response. Differential diagnoses derived from a visual examination utilizing illustrative cases sourced from a database at a Tertiary University Hospital. Neurotoxoplasmosis imaging pearls. Final remarks.

## NREE-61 UNVEILING BRAIN METASTASIS RESPONSES TO IMMUNOTHERAPY: MRI INSIGHTS

Laura Oleaga, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nuria Bargallo, MD (*Abstract Co-Author*) Nothing to Disclose
Gary Amseian, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To illustrate the use of immune checkpoint inhibitors in treating brain metastases and the implications on MRI imaging.- To recognize both classical and novel immunotherapy-specific response patterns in brain MRI.- To highlight the importance of utilizing key radiological assessment criteria to standardize response evaluations and outline differences among them.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of immune checkpoint inhibitors in the management of brain metastases. 2. Imaging Patterns of Response. A. Classical response patterns: i. Complete response ii. Partial response iii. Stable disease iv. Progression of disease. B. Immunotherapy-specific patterns: i. Pseudoprogression ii. Hyperprogression iii. Durable response. 3. Assessment criteria to standardize response evaluation: A. Comparison of traditional vs Immunotherapy-

specific criteria. B. The significance of timing in distinguishing pseudoprogression and durable response. C. Addressing ambiguities in response criteria. D. Impact of clinical data on MRI assessment: neurological status, systemic therapy, and local treatments. 4. Spotting immune-related intra- and extracranial adverse events on imaging. 5. Brain MRI protocols and the potential of advanced techniques. 6. Conclusion

## NREE-62 CRACKING THE FETAL CENTRAL NERVOUS SYSTEM MRI: THE BIG PICTURE FOR RADIOLOGIST TRAINEES

Samuel Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Aura Maria M. Gonzalez Peralta, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Genier Fabian Castano Lizarazo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To assess the indications and techniques of neuro-fetal MRI in order to evaluate the main central nervous system anomalies.- To describe systematic evaluation of normal fetal central nervous system MRI. - To outline the main five fetal central nervous system pathologies as well as pearls and pitfalls that every radiologist must recognize.- To ilustrate through real-life cases assessment of fetal central nervous system pathologies at antenatal and postnatal follow-up MRI.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Central Nervous System fetal pathologies: epidemiology, indications, and MRI technique. 2. Evaluation of normal Central Nervous System fetal development at various gestational periods through MRI: A step-by-step guideline. 3. MRI assessment of the five main Central Nervous System fetal anomalies: pearls and pitfalls for radiologists trainees. 3a: Abnormal fetal Central Nervous System cortical layering, gyration, and sulcation. 3b: Fetal ventriculomegaly. 3c: Midline anomalies: holoprosencephaly, corpus callosum agenesis-dysgenesis. 3d: Posterior fossa anomalies. 3e: Spinal dysraphism. 4. Presentation of five captivating cases of cetal Central Nervous System pathologies antenatally diagnosed at a national perinatology ķnstitute with postnatal follow-up MRI. 5. Conclusions: what is the future of fetal Central Nervous System MRI?

## NREE-63 DIAGNOSTIC IMAGING OF PEDIATRIC SUPERFICIALLY/CORTICALLY-BASED BRAIN TUMORS: NAVIGATING COMMON AND COMPLEX CASES

Fabricio G. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Rosa Cerron Vela (*Abstract Co-Author*) Nothing to Disclose
Mario Mahecha, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1 Stress early and accurate diagnosis for better outcomes.2 Discuss challenges in diagnosing pediatric tumors like PXA and Ganglioglioma, focusing on their unique imaging features.3: Emphasize recognizing mimics like NCC and cortical tubers, detailing differentiation strategies with advanced MRI.4 Highlight MRI advancements for enhanced tumor visualization and diagnostic accuracy.5: Promote integrated diagnostic strategy, merging imaging, clinical assessment, and genetic profiling for precise and tailored diagnosis.

### TABLE OF CONTENTS/OUTLINE

Objective: Enhance diagnostic accuracy for pediatric brain tumors and mimics.OutlineIntroduction: Stress the importance of precise diagnosis in pediatric neuroimaging.Specific TumorsPXA Discuss MRI features to differentiate from high-grade gliomas.DNET Emphasize the "bubbly" appearance and its link to epilepsy.MVNT: Describe imaging characteristics that may appear aggressive.PLNTY Explain classification and MRI signals.DGONC Highlight difficulties in recognizing diffuse patterns.Ganglioglioma: Cover typical features including calcifications and cystic changes.DIG: Identify key diagnostic features like large cystic components and robust reaction.DLGNT: Discuss its presentation as diffuse leptomeningeal lesions, emphasizing diagnostic challenges.Cerebellar Hemangioblastomas Discuss association with VHL syndrome.Lhermitte Duclos Syndrome: Describe the "tiger-striped" MRI appearance and Cowden syndrome link.Tumor Mimics: Strategies for distinguishing mimics like neurocysticercosis and cortical tubers using advanced imaging.Cases: Present cases illustrating diagnostic challenges and typical scenarios.

## NREE-64 SPINAL CSF LEAKS: TYPICAL AND ATYPICAL APPEARANCES AT CT MYELOGRAPHY

**Awards**
**Magna Cum Laude**

Daniel J. Scoffings, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
David Butteriss (*Abstract Co-Author*) Nothing to Disclose
Neha Kallam, BSc, MBBS (*Abstract Co-Author*) Nothing to Disclose
Anoma Lalani Carlton Jones, MBBS, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After viewing this exhibit the learner will be to:1. Describe the different types of spinal CSF leak that lead to spontaneous intracranial hypotension.2. Recognise the most common appearances at CT myelography that occur in each type of spinal CSF leak.3. Evaluate some of the atypical imaging manifestations of spinal CSF leaks at CT myelography.

### TABLE OF CONTENTS/OUTLINE

OUTLINE: Spinal CSF leaks have gained increased recognition over the last decade with advances in myelography and scanning techniques, imaging resolution and scanner capabilities. Our understanding of the causative pathologies are ever evolving as new techniques come to light. Dynamic CT myelography is a useful tool for detection of such leaks provided that meticulous technique is utilized. This educational exhibit will review the range of pathologies that can be encountered in the adult and paediatric population with examples of all different types of leaks from ventral and dorsal dural tears, lateral leaks, CSF venous fistulas, with typical and more atypical appearances of each, as well some lesser known and recognized entities including loculated leaks and CSF venous malformations and genetic associations. CONTENTS (1) Classification of spontaneous spinal CSF leaks. (2) Types of dynamic CT myelography and when to use them. (a) Ultrafast dynamic. (b) Modified dynamic. (c) Lateral decubitus (3) Provocation maneuvers at CT myelography. (4) Appearances of spontaneous leak types at CT myelography. (a) Ventral (type 1) leaks. (b) Lateral (type 2) leaks. (c) CSF-venous fistulas. (5) Less common forms of spinal CSF leak. (a) CSF-venous malformation fistula. (b) Arachnoid ‘blebs’. (6) Pitfalls and mimics (7) The negative or equivocal CT myelogram.

## NREE-65 ‘FIND THE LEAK’: CURRENT CONCEPTS IN IMAGING AND INTERVENTIONS IN SPONTANEOUS INTRACRANIAL HYPOTENSION

Tony Rahul (*Abstract Co-Author*) Nothing to Disclose
Sai K. Deepalam JR, MD (*Abstract Co-Author*) Nothing to Disclose
Meghana Kancharla, MBBS (*Abstract Co-Author*) Nothing to Disclose

Shravan Reddy K, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shreyas Reddy K, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Spontaneous intracranial hypotension (SICH) is a clinical syndrome due to diminished intracranial pressure, leading to disruptions in the homeostasis among blood, cerebrospinal fluid (CSF), and cerebral parenchyma. • SICH stems from three primary causes: (1) CSF leak originating from a nerve root sleeve diverticulum; (2) CSF leak attributed to an osteophyte spur, and (3) CSF venous fistula (CVF). • A range of modalities is employed to assess the underlying condition, including computed tomographic (CT) myelography, dynamic CT myelography, digital subtraction myelography, magnetic resonance (MR) imaging, and MR myelography with intrathecal gadolinium. Selection among these modalities is contingent upon whether the leak is characterized as high or low flow. • A targeted epidural patch using autologous blood or fibrin glue is an effective intervention.

**TABLE OF CONTENTS/OUTLINE**

• Understanding the pathophysiology and clinical features of SICH. • Discuss in detail the brain and spine imaging findings of SICH, with emphasis on key findings. • Myelographic patterns of SCIH: Tips for identification. • Basics, step-by-step technical approach, and limitations of CT myelography, Dynamic CT myelography, Digital subtraction myelography and MR myelography. • Epidural blood patch: technique and limitations. • Diagnostic approach and management algorithm for SICH.

## NREE-66 THE DIFFERENT FACES OF FRONTOTEMPORAL DEMENTIA: CLINICAL, STRUCTURAL AND FUNCTIONAL CORRELATION

Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Angelo C. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Lais Abduch, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Carlos M. Maia JR (*Abstract Co-Author*) Nothing to Disclose
Giovanna S. Calfi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Review the definition and epidemiology of frontotemporal dementia (FTD) ; Emphasize the role of imaging studies in the investigation, follow-up and prognosis of FTD ; Illustrate the different variants of the FTD spectrum and their main radiological features

**TABLE OF CONTENTS/OUTLINE**

; Introduction: ; Definition and epidemiology of frontotemporal dementia ; Role of imaging studies in the context of FTD assessment ; Genetic components of FTD; ; Classification: ; Behavioral variant ; Language variants - Primary progressive aphasia ; Agrammatic variant ; Semantic variant ; Movement disorder's associated variants ; Progressive supranuclear palsy ; Corticobasal degeneration ; Amyotrophic lateral sclerosis; ; Perspectives; ; Take home messages; ; Conclusion

## NREE-67 CAROTID ARTERY DISEASES: WHAT SHOULD WE LOOK?

Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Delgado (*Abstract Co-Author*) Nothing to Disclose
Paula C. Pinho, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Patricia F. Vieira SR, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz R. Uchoa, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Danilo Giorgio O. Medrado, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago B. Fernandes Feitosa, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Through this pictorial essay will be made a review based on cases and original drawings about the pathologies of the carotid arteries. This will be addressed by typical imaging patterns to narrow down differential diagnoses. The purpose of this exhibition is to: - Review the anatomy of the carotid arteries; - Understand the advantages and limitations of the main imaging methods used to evaluate carotid pathologies; - Recognize the main imaging patterns of the most frequent carotid artery diseases.

**TABLE OF CONTENTS/OUTLINE**

ANATOMICAL CONCEPTS • Carotid arteries anatomy IMAGING ASSESSMENT METHODS • Ultrasound • Computerized Tomography • Magnetic Resonance Imaging CAROTID ARTERIES DISEASES • Imaging aspects of carotid pathologies • Teaching points to narrow down differential diagnoses INTERACTIVE CASE-BASED DIDACTICS • Sample cases to illustrate and solidify the concepts

## NREE-68 POSTOPERATIVE SPINAL IMAGING: KEEPING YOUR BEHIND OUT OF A BIND!

Ajay Malhotra, MD, MMM (*Abstract Co-Author*) Nothing to Disclose
Mihran A. Khdhir, MD (*Abstract Co-Author*) Nothing to Disclose
Dheeman Futela, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shadi Ebrahimian, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Accurate interpretation of post lumbar spinal surgery images is critical for radiologist. This educational exhibit focuses on the following topics:1. What are the imaging protocols used in post spinal surgery evaluation?We will explain different modalities including radiographs, CT, and MRI and the protocols used on each modality.2. How to evaluate post-operative radiographs?Different radiographic postsurgical complications will be explained including hardware fracture, loosening, et. 3. What is considered as normal postsurgical changes on CT/MRI?Expected postsurgical findings will be explained. 4. What are the early postsurgical complications on CT/MRI? Early complications including fluid collection, intraoperative vascular and neural injuries, hardware malpositioning, and possible intracranial hemorrhage will be shown. 5. What are the late complications?Late postsurgical changes such as infection, failed back surgery syndrome, pseudoarthrosis, and hardware failure will be discussed. 6. What are the challenges in evaluation of postsurgical CT and MRIs and what are the strategies to overcome those challenges?Streak artifacts related to the hardware is one of the most common limitations in evaluation of postoperative CT and MRI scans. The strategies in reducing these artifacts will be discussed.

**TABLE OF CONTENTS/OUTLINE**

1. Commonly used modalities and protocols in postoperative imaging.2. Expected findings and postsurgical complications on radiographs.3. Normal post-surgical CT/MRI findings.4. Early complications on CT/MRI.5. Late complications on CT/MRI.6. Challenges in evaluation of postsurgical CT/MRI images.7. Strategies to reduce hardware related artifacts.

## NREE-69 UNVEILING IMMUNE EFFECTOR CELL ASSOCIATED NEUROTOXICITY SYNDROME (ICANS): WHAT EVERY RADIOLOGIST SHOULD KNOW

Marta Calvo-Imirizaldu, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Manuel Rafael Lopez De La Torre Carretero (*Abstract Co-Author*) Nothing to Disclose
Pablo Del Nido Recio (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Mbongo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To understand some key clinical and radiological manifestations of Immune Effector Cell-Associated Neurotoxicity Syndrome (ICANS).To provide clues for identifying imaging patterns suggestive of ICANS for prompt diagnosis and intervention.

**TABLE OF CONTENTS/OUTLINE**

Chimeric antigen receptor (CAR) T cells targeting the CD19 cell surface glycoprotein have emerged as a highly effective immunologic therapy in patients with certain refractory hematologic malignancies. The engagement of these two cell receptors causes a systemic cytokine release, which can compromise the blood-brain barrier and cause an immune effector cell-associated neurotoxicity syndrome (ICANS).ICANS is a pattern of neurotoxicity observed in patients following CAR T-cell infusion with associated neurologic symptoms, such as headaches and confusion. Neuroimaging is frequently obtained in patients who present with acute neurologic changes after infusion. This pictorial review aims to summarize some of the neuroimaging findings in ICANS through illustrative cases from our institution.1. Brief overview of the fundamentals of CAR-T cell therapy and ICANS pathophysiology.2. Clinical presentation and grading severity of ICANS (ASTCT consensus).3. Neuroimaging findings. While typically yielding negative results, imaging is advised when encountering suspected ICANS cases. Such imaging is crucial for detecting brain oedema and other abnormalities including stroke, haemorrhage, leptomeningeal enhancement, and mass effect, among others. - CT and brain MRI imaging findings. - Main entities to be considered in the differential diagnosis of ICANS.- Other CNS complications following CAR-T cell therapy.

## NREE-7 CNS CAVERNOUS MALFORMATIONS IN CHILDREN, SPECTRUM OF DISEASE

**Awards**
**Certificate of Merit**

Paul J. Farnsworth, DO (*Abstract Co-Author*) Nothing to Disclose
Michael P. Oien, MD (*Abstract Co-Author*) Nothing to Disclose
Julie B. Guerin, MD (*Abstract Co-Author*) Nothing to Disclose
Carrie M. Carr, MD (*Abstract Co-Author*) Nothing to Disclose
Loryn Hovelson, ARRT (*Abstract Co-Author*) Nothing to Disclose
Norbert G. Campeau, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Jason T. Little, MD (*Abstract Co-Author*) Nothing to Disclose
Lynsey Ploenzke, BS (*Abstract Co-Author*) Nothing to Disclose
V. Michelle Silvera, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Cavernous malformations (CMs) are slow flow vascular malformations most commonly found in the brain and spinal cord. The clinical significance of CMs lies in their potential to cause various neurological symptoms and complications such as bleeding, seizures, neurological deficits, and headaches. Once a CM is diagnosed, the risk of bleeding needs to be addressed, the likelihood of which depends on factors such as location and the presence of certain genetic mutations in the patient. Diagnosing a CM on imaging can be challenging if atypical imaging features are present and when CMs are very large (giant) or infiltrative. Treatment options include observation with surveillance imaging, surgical resection, stereotactic radiosurgery, and laser interstitial thermal therapy (LITT). TEACHING POINTS:1. CMs can lead to a range of neurological symptoms and complications, such as bleeding, seizures, neurological deficits, and headaches. 2. Specific genetic mutations may result in Familial Cerebral Cavernous Malformation Syndrome (FCCM), increasing the likelihood in children of developing CMs throughout their lives. 3. CMs located in critical areas such as the brainstem are at higher risk to bleed, rebleed, and cause neurological deficits. 4. Giant and infiltrative CMs are often misdiagnosed and not considered in the list of potential diagnoses before surgery.

**TABLE OF CONTENTS/OUTLINE**

1. Define CMs and describe their typical imaging appearance. 2. Discuss atypical imaging features that complicate CM diagnosis. 3. Review FCCM and illustrate the three main types with case examples. 4. Review the imaging features of Giant CMs 5. Demonstrate the imaging features of Infiltrative CMs.

## NREE-70 CLINICAL APPLICATIONS OF PHOTON-COUNTING DETECTOR CT IN NEURORADIOLOGY

Francis I. Baffour, MD (*Abstract Co-Author*) Nothing to Disclose
Ajay A. Madhavan, MD (*Abstract Co-Author*) Nothing to Disclose
John I. Lane, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Norbert G. Campeau, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company

Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Vance Lehman, MD (*Abstract Co-Author*) Nothing to Disclose
Girish Bathla, MBBS (*Abstract Co-Author*) Nothing to Disclose
Paul J. Farnsworth, DO (*Abstract Co-Author*) Nothing to Disclose
Laurence J. Eckel, MD (*Abstract Co-Author*) Nothing to Disclose
John C. Benson, MD (*Abstract Co-Author*) Nothing to Disclose
Felix E. Diehn, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Photon-counting detector (PCD-) CT offers unique advantages over traditional energy-integrating detector (EID-) CT in neuroradiology. 2. The primary inherent benefit of PCD- over EID-CT is the ultra high spatial resolution, with slice thickness on the order of 0.2mm. 3. High yield diagnostic applications in neuroradiology include temporal bone CT, CT angiography (CTA) of the head and neck, CT venography (CTV) of the head, and CT myelography (CTM). 4. Other/emerging applications include head CT and face/sinus/orbit CT.

**TABLE OF CONTENTS/OUTLINE**

I. Brief review of relevant physics aspects of PCD-CT, compared to EID-CT. II. PCD-CT in temporal bone imaging a. Anatomy b. Case based pathology III. PCD-CTA a. Head CTA anatomy b. Distinguishing infundibula and aneurysms c. Evaluating aneurysms, both untreated and treated d. Assessing arterial stenoses e. Other (additional case based pathology) IV. PCD-CTV a. Anatomy b. Dural venous sinus thrombosis c. Idiopathic intracranial hypertension V. PCD-CTM a. Lateral decubitus imaging of CSF-venous fistulae b. Dynamic imaging of high-flow CSF leaks VI. Emerging applications (case based anatomy and pathology) a. Head CT b. Face/sinus/orbit CT

## NREE-71 THE NEW ERA OF GALLIUM-68 DOTATATE PET IMAGING TO EVALUATE INTRACRANIAL MENINGIOMAS: A PICTORIAL REVIEW

Nelson F. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Ottaiano, MD (*Abstract Co-Author*) Nothing to Disclose
Tomas Freddi, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Lucas De Araujo Rabelo (*Abstract Co-Author*) Nothing to Disclose
Marilia Assuncao Jorge (*Abstract Co-Author*) Nothing to Disclose
Ronaldo Belz (*Abstract Co-Author*) Nothing to Disclose
Efraim Ferreira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The main goal of this pictorial essay is:- To discuss the potential impacts of PET images using 68Gallium-DOTATATE as radiotracer on diagnostic confirmation and treatment management of meningiomas.- To demonstrate PET imaging follow-up for meningiomas that are unresectable, recurrent, incompletely resected, and/or higher-grade meningiomas, where radiation therapy (RT) may be preferred.- To describe and illustrate the radiological patterns of 68Gallium-DOTATATE PET images in posttreatment changes, as well as its correlation to other imaging modality, such as computed tomography (CT) and magnetic resonance imaging (MRI).

**TABLE OF CONTENTS/OUTLINE**

- Introduction- Imaging modalities- Pre-treatment imaging findings- Post-treatment follow-up findings- Practical tips and Pitfalls- Conclusion/Take home message

## NREE-72 ANTENATAL AND POSTNATAL IMAGING IN CONGENITAL POSTERIOR FOSSA ANOMALIES: PATTERN RECOGNITION AND DIAGNOSTIC APPROACH

**Awards**
**Certificate of Merit**

Elka Miller, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Neetika Gupta, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Pradeep Krishnan, MD (*Abstract Co-Author*) Nothing to Disclose
Shivaprakash B. Hiremath, DMRD, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review the anatomy and embryology of the posterior fossa on fetal and postnatal MRI. 2. To describe congenital anomalies of the posterior fossa with emphasis on non-cystic anomalies, describing their distinctive imaging features and accompanying effects on the cerebellum and the brainstem. 3. To advance understanding of non-cystic posterior fossa anomalies by highlighting specific imaging phenotypes and pattern-based approaches on antenatal and postnatal MRI.

**TABLE OF CONTENTS/OUTLINE**

1. Discuss various disease entities resulting in posterior fossa anomalies. 2. Identify salient imaging features of non-cystic posterior fossa disorders in the fetal and postnatal brain to reach a specific diagnosis. 3. Describe a systematic pattern-based imaging approach to help guide appropriate management and genetic evaluation.

## NREE-73 READ MY MIND: IMAGING CEREBRAL SMALL VESSEL DISEASE

Hediyeh Baradaran, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Bryan L. Bishop, MD (*Abstract Co-Author*) Nothing to Disclose
Keena Li (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. We will provide an overview of CSVD including criteria for diagnosis2. We will closely examine common imaging features of CSVD and their classification schemes and rating scales3. We will walk through imaging led examples and cases of CSVD to highlight key imaging features4. We will present data on the associations of each of these imaging findings to future stroke, cognitive impairment, and mortality.

**TABLE OF CONTENTS/OUTLINE**

1. Review of CSVD and diagnostic criteriaa. Epidemiology and risk factors2. Overview of common imaging features of CSVDa. White Matter Hyperintensitiesb. Covert Brain Infarctionsc. Cerebral Microbleedsd. Enlarged Perivascular Spaces3. White Matter Hyperintensitiesa. T2/FLAIR hyperintensity in periventricular/deep cerebral white matter, subcortical gray matter, BG, brainstemb. Various Established Imaging Scalesc. Imaging examples and casesd. Clinical associations with future stroke, dementia, mortality4. Covert Brain Infarctionsa. Imaging detected infarcts in asymptomatic patientsb. Covert brain infarction schema i. Specific examples of each classification ii. Lacunar, subcortical, corticalc. Clinical associations with future stroke, dementia, mortality5. Cerebral Microbleedsa. Small round or ovoid lesions (<10mm diameter) of marked hypo intensity with blooming on T2*b. MARS and BOMB criteriac. Imaging examples and casesd. Clinical associationsPerivascular spacesExtensions of extra cerebral fluid space covered by Pia mater surrounding cerebral vessels from brain surface into and through brain parenchymab. Potential classification schemasc. Imaging examples and casesd. Clinical associations7. Summary

## NREE-74 CAROTID PLAQUES RISK STRATIFICATION: THE APPLICABILITY AND LIMITATIONS OF THE PLAQUE-RADS

Francinne Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Gontijo, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Cleiton A. Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Arantes (*Abstract Co-Author*) Nothing to Disclose
Alcivan Morais Filho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Effective reporting of carotid plaque risk is no longer limited to stenosis measurement and is essential for communication prior treatment decisions. Critical characteristics of plaque, such as ulceration or irregularity, and internal hemorrhage are revealed by axial contrast imaging techniques. These characteristics add to a complete analysis of plaque instability and the risks of the following complications. Plaque-RADS (PR) aims to standardize radiologists, clinicians, and surgeons' communication about carotid plaques. In this system, plaques are divided into: normal vessel walls (PR1); plaques with Maximum Wall Thickness (MWT) <3 mm (PR2); MWT = 3 mm without complications (PR3); thick Fibrous Cap (FC) (3a), thin or invisible FC (3b), and healed ulcers (3c); complicated plaques (PR4) with ulcerations (4a), intraplaque hemorrhage (4b), or intraluminal thrombus (4c). PR has drawbacks, even with its advantages. It may misclassify the risk associated with these plaques since it assumes that those lacking a visible FC are thin-capped. The limitations of fibrous cap visibility make it difficult to classify Categories 3c and 4b, both of which show visible ulceration. The obligation to attribute a category, even under suspicion of limited evaluation, can also be detrimental. Although the system may need to address some of these limitations in order to increase its applicability, it is worthy in order to improve communication.

**TABLE OF CONTENTS/OUTLINE**

Presentation with Plaque-RADS and cases of limitations.

## NREE-75 THE WHOLE SPECTRUM OF MOYAMOYA DISEASE: FROM DIAGNOSIS TO POST-TREATMENT FOLLOW-UP

Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Moyamoya is a chronic occlusive, non-inflammatory and non-atherosclerotic cerebrovascular disorder, which affects mainly the intracranial portions of the distal internal carotid artery and the proximal anterior and middle cerebral arteries. The development of compensatory collateral circulation provides the angiographic appearance of a "puff of smoke", which translates to Moyamoya in Japanese and gives the disease its name. Radiological imaging plays a central role in the diagnosis of this disease and the recognition of resulting ischemic and hemorrhagic events. Our goal is to first review the imaging features of Moyamoya and then discuss the different surgical techniques developed to treat it, how to identify them on imaging studies, and what to expect from post-treatment imaging evaluation.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction. 2) Pathophysiological mechanism and anatomical correlation. 3) Angiographic classification of Moyamoya disease. 4) Vascular and parenchymal findings. 5) Surgical management: revascularization techniques and postoperative image characterization. 6) Assessment of pre- and post-treatment cerebral perfusion. 7) Challenges, pearls and pitfalls in differential diagnosis. 8) Future directions. 9) Take home messages.

## NREE-76 GENOMIC ROADMAP OF ASTROCYTIC TUMORS: NAVIGATING THROUGH MOLECULAR HIGHWAY

Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Thiago B. Fernandes Feitosa, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Delgado (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This pictorial essay explores the 2021 WHO classification of astrocytic tumors, with a particular focus on the integration of molecular and genetic profiling, which now plays a pivotal role in the categorization of these neoplasms.Through a series of illustrative clinical cases, accompanied by insightful diagrams and educational illustrations, the key objectives of this review are to explain the updated classification, showcase practical applications in clinical settings,

discuss important molecular markers, provide insights on neuroimaging interpretation, address challenges in adopting the new system, review prognostic implications, and explore future trends.

**TABLE OF CONTENTS/OUTLINE**

2021 WHO classification for astrocytic tumors- Explaining the Updated Classification- Importance of molecular and genetic profiling in tumor categorization Important Genes and Molecular profiles - Discussion on key markers and their significance in differentiating astrocytic tumor subtypes Illustrative Cases - Presentation of select cases to demonstrate practical applications - Use of diagrams and illustrations to enhance understanding- Highlighting the use of molecular and genetic markers in diagnosis, prognostication, and therapy Exploring Future Trends - Anticipation of evolving trends in neuro-oncology - Discussion on how advancements in molecular genetics may impact future updates to tumor classification

## NREE-77 ASSESSMENT OF TREATMENT RESPONSE IN ADULT GLIOMAS: A PRIMER FOR RADIOLOGISTS

Bruna G. Dutra (*Abstract Co-Author*) Nothing to Disclose
Raquel A. Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Luis F. Godoy, MD (*Abstract Co-Author*) Stockholder, Johnson & Johnson;Stockholder, Illumina, Inc;Stockholder, UnitedHealth Group
Heitor C. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Oertel D'Amico, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Understanding the relevance of establishing criteria for defining treatment response status in patients with glioma.Brief history of the RANO criteria and it’s previous versions.Understanding the importance of updated criteria (RANO 2.0 from 2023), with a focus on the limitations of previous versions.Becoming familiar with how to apply the RANO 2.0 criteria in practice.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTIONResponse Assessment in Neuro-Oncology (RANO) overview.GENERAL RECOMMENDATIONS IN RANO 2.0Intended use for RANO 2.0:Patient population and tumor types.Imaging protocol definition, including choice of modality and recommended study parameters.DISEASE ASSESSMENT RECOMMENDATIONS IN RANO 2.0Method of measurement: two-dimensional and volumetric assessment.Definition of measurable and nonmeasurable disease.Definition of target and nontarget lesions.ASSESSMENT OF TREATMENT RESPONSE STATUS IN RANO 2.0Selection of baseline study for comparison.Criteria for definition of treatment response status as complete response, partial response, stable disease and progressive disease.Definition and use of “sum of bideminsional products”.Illustrative cases focusing on practical application of RANO 2.0 criteria.Special considerations:Pseudoprogression and confirmatory scans (which settings require confirmatory imaging and appropriate confirmation timing).Pseudoresponse (associated tumor and treatment).Nonenhancing glioblastoma IDH-wildtype.FUTERE PERSPECTIVESBT-RADS:Overview of intended use.Limitations.Advanced imaging:Current uses for advanced imaging in the setting of adult glioma.Trends in the literature for validation in treatment response assessment.

## NREE-78 STARING INTO THE BRAINS ABYSS: NAVIGATING THROUGH CORTICAL MALFORMATIONS

Kevin Kurt Mac Allister (*Abstract Co-Author*) Nothing to Disclose
Cristina H. Besada SR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Federico M. Olivera Plata, MEd (*Abstract Co-Author*) Nothing to Disclose
Manuel S. Perez Akly, MD (*Abstract Co-Author*) Nothing to Disclose
Stefania Solanot, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Cortical malformations must be ruled out in essentially every pediatric patient with developmental delay or epilepsy.MRI is certainly recommended as the most important imaging method in the evaluation of MCD, thanks to its optimal delineation of grey and white matter structures.Neuroimaging plays a crucial role in the prenatal and postnatal diagnosis of malformations of cortical development, since pathological tissue is not always available except for surgeries or autopsies. Radiologically, cortical malformations exhibit distinct imaging features such as abnormal cortical lamination, dysplastic gyri, and heterotopias.CT misses the abnormality in more than 30% of cases.Radiologists should also obtain detailed information from the referring clinicians regarding the size of the head, possible syndromic clinical features, epilepsy semiology, and EEG findings (particularly, location of origin of spikes) before reporting the examination

**TABLE OF CONTENTS/OUTLINE**

Role of imaging in the diagnosis of malformation of cortical development Normal cortex developmentClassification according to the affected stage of normal cortex development Description of the most important disorders and radiological findingsConclusion References

## NREE-79 GLAND FINALE: POST-OPERATIVE PITUITARY INSIGHTS

Rebeca O. Francelino, MD (*Abstract Co-Author*) Nothing to Disclose
THARYN Goncalves FRANCO DE GODOY (*Abstract Co-Author*) Nothing to Disclose
Raquel A. Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Arantes (*Abstract Co-Author*) Nothing to Disclose
Guilherme Almeida (*Abstract Co-Author*) Nothing to Disclose
Taisa M. Guarilha, MD (*Abstract Co-Author*) Nothing to Disclose
Luis Antonio Tobaru Tibana, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas G. Braga, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

In this presentation, we delve into the critical aspects of post-operative image acquisition protocols, focusing on timing and sequences essential for optimal imaging outcomes. Additionally, we explore the typical postoperative changes that occur following pituitary surgery. These changes encompass various factors, including anatomical distortions, the utilization of common surgical materials, the presence of hematic residues, gas foci, and local artifacts. Moreover, we emphasize the importance of recognizing specific imaging changes indicative of residual lesions and complications. Understanding and identifying these changes are paramount in postoperative imaging, as they provide valuable insights into the patient's recovery process and are crucial for prompt intervention and management.

**TABLE OF CONTENTS/OUTLINE**

1. Contemporary Protocol for Pituitary Assessment. 2. Routes of Intervention in Pituitary Lesions: highlight transsphenoidal route particularities and other main intervention routes. 3. Primary Surgical Inclusion Materials and MRI Characteristics: describe MRI characteristics of surgical materials and common imaging artifacts. 4. Common Changes After Surgical Removal of Pituitary Adenomas. 5. Notable Complications: discuss regional hemorrhage,

cerebrospinal fluid leakage, ischemia, among others. 6. Characterizing Residual Pituitary Adenoma Lesions on MRI: focus on distinct gadolinium enhancements for identifying residual lesions. 7. Current Protocol for Postoperative Pituitary Adenoma Surveillance via MRI. 8. Main Items in the Imaging Report: highlight essential components for clinical and imaging follow-up alterations.

## NREE-80 ACUTE SPINAL TRAUMA MRI: A PRACTICAL GUIDE FOR BEGINNERS

David Castanedo SR, MD (*Abstract Co-Author*) Nothing to Disclose
Aranzazu Sanchez Gabin, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Revuelta Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandra Somoano Marfull (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Sutil (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To know the basic spinal Magnetic Resonace Imaging (MRI) protocol in the traumatic context.- To identify the potential injuries that can occur in spinal trauma, both at the spinal cord and extramedullary area.- To know the Schaeffer and Basic classifications to assess the severity of spinal injuries

### TABLE OF CONTENTS/OUTLINE

A) Imaging techniques in spinal traumaB) Main MRI protocol and special sequences (in case of lesion at the craniocervical junction, lesion in the dura mater of the thecal sac, vertebral arteries, radicular lesion or spinal cord infarction)C) Types of injuries- Ligamentary lesions (anterior and posterior longitudinal ligament, ligamentum flavum, supra and interspinous ligaments)- Disc damage and acute herniations- Vascular injuries- Extramedullary haemorrhage- Cord damage: cord edema, haemorrhage, spinal cord section. Schaeffer and Basic classifications.

## NREE-82 FROM PIXELS TO PRACTICE: IMPACTFUL NEUROIMAGING ADVANCES IN THE CLINICAL MANAGEMENT OF CEREBRAL AMYLOID ANGIOPATHY

**Awards**
**Certificate of Merit**

Eduardo D. Valadares, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Clara Zanon Zotin (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cerebral Amyloid Angiopathy (CAA) is a the second most prevalent form of cerebral small vessel disease, with devastating clinical consequences.The pattern of distribution of MRI-visible lesions aids in the distinction between CAA and other prevalent forms of sporadic cerebral small vessel diseases, such as hypertensive arteriolosclerosis.The Boston Criteria v2.0 offers high positive predictive value for the diagnosis of CAA. Edinburgh Criteria is useful in the characterization of CAA-related ICH in CT studies. Hemorrhagic markers, especially cortical superficial siderosis, more strongly predict the risk of first-ever or recurrent intracerebral hemorrhage, compared to non-hemorrhagic markers, which are more strongly associated with cognitive impairment, but are often outperformed by advanced techniques, such as diffusion-based markers.

### TABLE OF CONTENTS/OUTLINE

• Introduction: Pathophysiology, clinical spectrum, and classification of CAA.• Neuroimaging features: Hemorrhagic (cerebral microbleeds, cortical superficial siderosis, intracerebral hemorrhage, intragyral hemorrhages, convexity subarachnoid hemorrhage) and Non-hemorrhagic (perivascular spaces in the centrum semi-ovale, cortical cerebral microinfarcts, white matter hyperintensities in a multifocal subcortical pattern• Diagnostic value: Boston criteria (versions 1.0, 1.5, and 2.0) and Edinburgh criteria • Prognostic value: Risk of first-ever and recurrent intracerebral hemorrhage; Risk of transient focal neurological episodes; Risk of cognitive decline• Impact of neuroimaging markers of CAA in clinical management of patients with stroke.• CAA diagnosis in the era of anti-amyloid treatmento Risk of ARIA

## NREE-83 SMALL HEADS BIG TROUBLES NEONTAL CEREBRAL HYPOXIC-ISCHEMIC INJURY

Paola A. Lara Rodezno, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The assessment of the radiological signs in hypoxia in the full-term neonate are characteristic and different from older children; on the other hand, the alterations in premature neonates are different from those in full-term neonates. Assessment of signs of hypoxic damage on neonatal brain imaging requires attention to a number of specific signs. It is important for the radiologist to know the normal findings according to the gestational age of the neonate and to differentiate between severe or total hypoxia, prolonged or partial and mixed hypoxia. Brain MRI was evaluated in premature and term infants looking for 4 interrelated fundamental signs grouped under the term "1-2-3-4 sign" with findings of total severe hypoxia such as: increase in signal intensity of the basal ganglia and thalamus in T1W, posterior arm sign absent in full-term neonate, signs of diffusion hypoxia; signs of prolonged hypoxia such as hyperintensity of the cerebral cortex on T1W.

### TABLE OF CONTENTS/OUTLINE

The most frequent finding was hyperintensity of the basal nuclei, followed by hyperintensity of the gyri and lamellar cortical necrosis.

## NREE-84 A 360 DEGREE REVIEW OF THE POWER OF LOW INTENSITY FOCUSED ULTRASOUND (LIFUS) IN MANAGEMENT OF BRAIN TUMORS

Jody L. Tanabe, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha Pisani Petrucci, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nolan Dang (*Abstract Co-Author*) Nothing to Disclose
Natalie Serkova, PhD, MBA (*Abstract Co-Author*) Nothing to Disclose
Parisa Khoshpouri, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understanding LIFUS Mechanisms Explore the fundamental mechanisms underlying Low Intensity Focused Ultrasound (LIFUS) and its unique features in affecting the blood brain barrier. 2. Explaining the Safety Profiles: Evaluate the safety profile of LIFUS in diagnosis and management of brain tumors facilitating drug delivery, emphasizing key considerations for clinical implementation. 3. Clinical Application and Ongoing Trials: Discuss the current clinical

applications of LIFUS in approaching brain lesions and highlight ongoing trials investigating its efficacy, aiming to delineate its potential role as a therapeutic modality in combination with oncologic treatments.

**TABLE OF CONTENTS/OUTLINE**

• Introduction to LIFUS and its Mechanism of Action: Briefly introduce the concept of Low Intensity Focused Ultrasound (LIFUS) and the underlying mechanism of LIFUS, focusing on how it interacts with neural tissue and disrupts the BBB. its potential applications in neuroradiology and targeting brain tumors. • Safety Profile: Highlight the safety considerations associated with LIFUS, including its non-invasive nature, potential side effects, and current safety protocols. • Ongoing Clinical Trials: Provide an overview of ongoing clinical trials investigating the use of LIFUS in various neurological conditions, including the objectives, methodologies, and preliminary findings. • Conclusion: Summarize the potential of LIFUS as a promising tool in neuroradiology and neuromodulation, highlighting its role in advancing the field and addressing unmet clinical needs.

## NREE-85 AN EDUCATIONAL EXHIBIT OF THE DIFFERENT IMAGING CHARACTERISTICS OF HR- VWI MRI AND MRA ON PATIENTS WITH CONFIRMED INFECTIOUS VASCULITIS

Javier M. Romero, MD (*Abstract Co-Author*) Stockholder, TMA Precision Medicine
Suely F. Ferraciolli, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Odette Ganem (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

HR- VWI has been recently utilized as an excellent sequence to detect inflammation of the intracranial circulation when vasculitis is suspected. Although imaging characteristics have been well defined in patients with primary central nervous system vasculitis, infectious or secondary vasculitis has been less well described. Many Infectious etiologies may result in vasculitis, including viral, bacterial, or fungal etiologies.In this pictorial review, we would like to highlight the local changes on the vascular wall and the predominant vascular territories compromised in infectious diseases viewed on High-resolution vessel wall imaging (HR-VWI) MRI and magnetic resonance angiography (MRA).

**TABLE OF CONTENTS/OUTLINE**

- Introduction- Clinical presentation of Infectious Vasculitis: Viral, Bacterial, and Fungal - Radiographic characteristics of infectious vasculitis on MRA and HR VWI MRI - Differential Diagnosis with other causes of CNS Vasculitis (with schematic drawing)- Conclusion

## NREE-86 EX VIVO HIGH-RESOLUTION CAROTID PLAQUE MRI WITH EMPHASIS OF QUANTITATIVE SUSCEPTIBILITY MAPPING: IMMUNOHISTOPATHOLOGICAL CORRELATION

Ryo Toya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomoki Nakano, MD (*Abstract Co-Author*) Nothing to Disclose
Ayano Ishiyama, MD (*Abstract Co-Author*) Nothing to Disclose
Hideki Ishimaru (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Many studies using in vivo carotid plaque MRI have highlighted its usefulness in the detection of clinically unstable plaques. However, in vivo MRI is often plagued by motion artifacts, such as carotid artery pulsation, and offers lower spatial resolution than microscopic histopathology specimens. Consequently, accurately assessing signals related to different components within carotid plaques can be difficult. Ex vivo MRI presents advantages such as eliminating motion artifacts and providing higher-resolution images that can be accurately correlated with histopathology. Quantitative susceptibility mapping (QSM), a recently developed technique for measuring tissue susceptibility, is expected to characterize the carotid plaque composition. In this presentation, we provide new insights from ex vivo high-resolution carotid plaque MRI, including QSM, and identify discrepancies with previous in vivo imaging results while also raising important issues that require further attention.

**TABLE OF CONTENTS/OUTLINE**

-Immunostaining is useful for diagnosing carotid plaque components -Can intraplaque hemorrhage and lipid-containing components be distinguished? -Is it the only calcification that shows a low signal in all imaging sequences? -Is it practically possible to diagnose fibrous cap? -What signals do the fibrous component and loose matrix exhibit? -Key challenges to be solved.

## NREE-87 DIAGNOSTIC ACCURACY OF CONTRAST ENHANCED FLUID-ATTENUATED INVERSION RECOVERY (CE-FLAIR) MRI IN DIAGNOSIS OF INFECTIOUS MENINGITIS TAKING CSF ANALYSIS AS GOLD STANDARD”

Urooj Kanwal, DMRD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shaista Shoukat, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sumera Shahbaz, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sumaira Roohi, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Meningitis, an inflammation of the meninges, can be caused by various infectious agents. Early and accurate diagnosis is vital for effective treatment. Cerebrospinal fluid (CSF) analysis is the standard method, but Contrast Enhanced Fluid-Attenuated Inversion Recovery (CE-FLAIR) MRI shows potential for improved visualization of meningeal inflammation. However, its diagnostic accuracy compared to CSF analysis needs clarification. This study aims to address this gap.

**TABLE OF CONTENTS/OUTLINE**

STUDY DESIGN Cross-Sectional Descriptive Study RESULTSThe mean age was calculated to be 35.4 + 14.7 years with 145 male participants (51.60%) and 136 female participants (48.40%).The diagnostic accuracy of CE-FLAIR MRI was further delineated in Figure No. 5. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated as 96.05%, 92.23%, 94.71%, and 94.06%, respectively. The overall diagnostic accuracy of CE-FLAIR MRI was determined to be 94.51%. CONCLUSION This study provides valuable insights into the diagnostic accuracy of contrast enhanced fluid-attenuated inversion recovery (CE-FLAIR) MRI in meningitis diagnosis. The results underscore the potential of CE-FLAIR MRI as a noninvasive tool with comparable diagnostic accuracy to the gold standard cerebrospinal fluid (CSF) analysis.

## NREE-88 CLINICAL SIGNIFICANCE OF OUTER CONTOUR ASSESSMENT OF INTRACRANIAL VESSELS USING 3D HEAVILY T2 WEIGHTED MR CISTERNOGRAPHY

Hideki Ishimaru (*Abstract Co-Author*) Nothing to Disclose
Tomoki Nakano, MD (*Abstract Co-Author*) Nothing to Disclose
Ryo Toya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Chika Somagawa, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

3DMR cisternography is a high spatial resolution image with heavy T2 contrast (cerebrospinal fluid is visualized as a high signal and the other as a low signal). Imaging methods based on fast spin echo and fast gradient echo are mainly used and are effective in the diagnosis of cerebrospinal fluid leaks, hydrocephalus, and the relationship between tumors and normal structures. This method can also be used to evaluate intracranial vascular contours and can be applied to a variety of vascular diseases. The purpose of this exhibit is to provide clinical applications of 3D MR cisternography in various intracranial vascular diseases, with an emphasis on the outer contour assessment of intracranial vessels.

**TABLE OF CONTENTS/OUTLINE**

Sequence for 3D MR cisternography-Imaging parameters and image contrast-Case based presentation-A. Arterial contours (arterial course in acute arterial occlusion, evaluation of outer diameter of occluded blood vessels in moyamoya disease, aplastic/twig-like MCA)-B. Venous contours (involvement in neurovascular compression, draining veins in dural arteriovenous fistula)-C. Estimation of vascular wall pathology by comparison with TOF (atherosclerotic plaque, arterial dissection, cerebral vasospasm, etc)-D. Location of cerebral aneurysm (distal dural ring and paraclinoid aneurysm)-E. Others-F. Limitations and Pitfalls-

## NREE-89 DON'T GET LOST, USE THE BONE. A COMPREHENSIVE GUIDE OF THE ANTERIOR CONDYLAR CONFLUENCE ANATOMY USING CONE-BEAM CT

**Awards**
**Certificate of Merit**

Orlando M. Diaz, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando Ahumada (*Abstract Co-Author*) Nothing to Disclose
Kristina Ramirez Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Valeria Ortega, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Review the anatomy of the anterior condylar confluence and the related network of vein structures. 2) Describe the cone-beam CT utility in arteriovenous fistulas at the anterior condylar confluence and adjacent bone structures.3) Recognize the landmarks and identify differences between the arteriovenous fistulas of the anterior, posterior, and lateral condylar veins.

**TABLE OF CONTENTS/OUTLINE**

1) Cone-beam CT: Importance in describing bone anatomya) Previous literature utilization of cone-beam CTb) Cone-beam CT's role in understanding the anterior condylar confluence and adjacent venous structures2) Posterior fossa venous drainage overview3) Anterior condylar confluence anatomy 4) Anatomy review with cone beam CT: Structures related to the anterior condylar confluence5) How to identify anterior condylar vein6) Anterior condylar vein arteriovenous fistulasa) Case 1b) Case 27) How to identify posterior condylar vein8) Posterior condylar vein arteriovenous fistulasa) Case 3b) Case 49) How to identify lateral condylar vein10) Lateral condylar vein arteriovenous fistulasa) Case 3b) Case 411) Conclusion

## NREE-9 MANAGEMENT OF INTRACRANIAL METASTASES: WHAT THE RADIOLOGIST NEEDS TO KNOW

Miral D. Jhaveri, MD, MBA (*Abstract Co-Author*) Royalties, RELX
Surjith Vattoth, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Santhosh Gaddikeri, MD (*Abstract Co-Author*) Nothing to Disclose
Ken Tatebe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shehbaz M. Ansari, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Brian Mu, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Review imaging findings associated with intracranial metastases, with an emphasis on features that are germane to management decisions.2. Discuss the major modalities for treatment of intracranial metastases including radiation therapies, systemic treatments (chemotherapy immunotherapy), and surgical approaches with a focus on clinical issues relevant to an interpreting radiologist.3. Review post-treatment imaging of intracranial metastases and the major complications associated with each treatment modality.4. Role of advanced imaging to differentiate residual/recurrent metastasis vs treatment related changes.

**TABLE OF CONTENTS/OUTLINE**

Significant advancements have been made in the diagnosis and treatment of intracranial metastases, improving outcomes but complicating their clinical landscape and evaluation on imaging. To generate cogent reporting, radiologists should understand the clinical implications of different imaging characteristics of metastatic lesions and have basic familiarity with when and how major treatment modalities are used. The exhibit focuses on the routine neuroimaging task of evaluating intracranial metastases both before and after treatment. The role of advanced imaging techniques beyond conventional MRI is discussed, particularly in the differentiation of true residual or recurrent metastastic disease from pseudoprogression or radiation necrosis. Additionally, a wide range of complications including postoperative, parenchymal and vascular post-radiation, and chemotherapy and immunotherapy related complications are also reviewed.

## NREE-91 POST-THROMBECTOMY IMAGING FINDINGS: WHAT THE GENERAL RADIOLOGIST NEEDS TO KNOW

**Awards**
**Magna Cum Laude**

Ranliang Hu, MD (*Abstract Co-Author*) Stockholder, Moderna, Inc;Stockholder, Pfizer Inc
Dan I. Cohen-Addad, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander D. Bode, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Nance, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Saumya Gurbani, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Describe the clinical indications for mechanical thrombectomy and the TICI classification scale for assessing reperfusion after thrombectomy.2. Illustrate normal imaging findings and complications following mechanical thrombectomy, including a review of the clinical relevance of these findings.3. Discuss the use of different modalities to differentiate blood products from contrast staining, including dual energy CT and MRI.

**TABLE OF CONTENTS/OUTLINE**

Mechanical thrombectomy is an effective intervention for ischemic stroke and relies on multimodal imaging for post-procedure follow-up. With increasing prevalence, the general radiologist should be familiar with the spectrum of post-thrombectomy imaging. In this article, we describe expected and unexpected imaging findings via a case review of patients who underwent mechanical thrombectomy for ischemic stroke.- Clinical guidelines for mechanical thrombectomy and TICI classification of reperfusion.- Review expected post-thrombectomy findings: clot resolution, contrast staining, subarachnoid hemorrhage.- Review unexpected imaging findings and their clinical relevance, including: residual clot, re-occlusion, access site dissection and pseudoaneurysm, vasospasm, hemorrhagic conversion, contrast-induced neurotoxicity.- Discuss use of dual energy CT and MRI to differentiate hemorrhage from contrast staining

## NREE-92 JOURNEY TO THE CENTER OF THE HEAD - IMAGING REVIEW OF CAVERNOUS SINUS TUMORAL LESIONS

**Awards**
**Certificate of Merit**

Marta Calvo-Imirizaldu, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Manuel Rafael Lopez De La Torre Carretero (*Abstract Co-Author*) Nothing to Disclose
Elida Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo D. Dominguez, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Miguel Escudero-Fernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Reyes M. Garcia-Eulate (*Abstract Co-Author*) Nothing to Disclose
Carmen Mbongo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• To evaluate the different tumoral entities that can involve the cavernous sinuses (CS), including intrinsic and extrinsic lesions.• To describe perineural paths and anatomic relationships, such as the skull-base foramina, that are important in secondary invasion of the CS.

**TABLE OF CONTENTS/OUTLINE**

Many crucial vascular and nervous structures converge in the CS, including the internal carotid artery -ICA- and the cranial nerves III, IV, V1, V2 and VI. The CS can be damaged by tumoral lesions of distinct origins.Neoplasms can primarily arise within the CS, secondarily invade it from adjacent structures, by perineural spread through skull base foramina or by metastatic disease.• Intrinsic tumors include:- Meningioma: it produces luminal narrowing of the ICA and shows homogeneous enhancement after contrast administration.- Cavernous Hemangioma: it does not produce luminal narrowing of the ICA.- Schwannoma: it shows heterogeneous enhancement, and cystic or hemorrhagic areas can be observed.- Plexiform Neurofibroma: the target sign is a typical finding of these tumors.- Other tumors: Solitary Fibrous Tumor and Melanoma.• Extrinsic tumors can be classified according to their location:- Sellar and suprasellar region: Pituitary macroadenoma invades the CS when it contacts more than 67% of the diameter of the ICA. A Craniopharyngioma can show cystic and calcified areas in children.- Oral / Maxillary region: Nasopharyngeal Carcinoma, Juvenile Nasopharyngeal Angiofibroma, Adenoid Cystic Carcinoma, Rhabdomyosarcoma, Esthesioneuroblastoma.- Bone malignancies: Chordoma, Chondrosarcoma, Osteosarcoma.- Systemic malignancies: Lymphoma, Multiple Myeloma and Metastases.

## NREE-93 BRIDGING THE GAP: LIFE-SIZE 3D PRINTED PEDIATRIC TO ADULT NEUROVASCULAR AND CRANIAL ANATOMY

Jonathan M. Morris, MD (*Abstract Co-Author*) Consultant, Medtronic plc;Speaker, Medtronic plc;Consultant, Merit Medical Systems, Inc;Speaker, Merit Medical Systems, Inc;Consultant, Landauer Inc;Speaker, Johnson & Johnson
David F. Black, MD (*Abstract Co-Author*) Nothing to Disclose
Hayden Swartz, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Pediatric neurovascular anatomy is a series of small and complex arteries and veins overlapping critical neuroanatomic structures. Foundational knowledge begins in medical school with adult cadaveric dissections, two-dimensional (2D) medical illustrations, and progresses through cross sectional imaging and angiographic evaluation during training. 2. Current resources provide limited conceptual models of the small and complex pediatric neurovascular and neuroanatomic relationships. 3. Cadaveric dissections provide valuable understanding, however, are destructive and not widely available due to ethical factors, limited autopsy exposure, and rarity of pathology. 4. By combining coregistered computed tomography (CT), CT angiography, and gadolinium bolus magnetic resonance venogram with three-dimensional (3D) computer aided design software, 3D printing pioneers a practical solution to teach age-dependent, patient-specific, life-size neurovascular anatomy and the overlying cranial vault in normal patients ages 0-18. 5. 3D printed models offer several advantages including an ethical nondestructive means to acquire, manufacture, and teach neurovascular anatomy, including haptic perception, unattainable by current resources, critical for radiology trainees.

**TABLE OF CONTENTS/OUTLINE**

1. Background of pediatric neurovascular anatomy. 2. Current state of educational tools and gap. 3. Benefits of patient and age specific 3D printed models from imaging. 4. Future directions of 3D neurovascular education.

## NREE-94 JOURNEY TO THE CENTER OF THE HEAD - IMAGING REVIEW OF CAVERNOUS SINUS NON-TUMORAL LESIONS

Jose Miguel Escudero-Fernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Elida Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo D. Dominguez, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Calvo-Imirizaldu, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Reyes M. Garcia-Eulate (*Abstract Co-Author*) Nothing to Disclose
Carmen Mbongo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; To evaluate the different non-tumoral entities that can invade the cavernous sinuses (CS).; To learn the most important imaging features of each lesion and how to make an adequate differential diagnosis with neoplastic etiologies.; To describe anatomic relationships, such as the skull-base foramina, that are important in secondary invasion of the CS.

**TABLE OF CONTENTS/OUTLINE**

Unlike neoplasms, non-tumoral lesions tend to show low signal on T2-weighted imaging. They can be classified according to their etiology:; Vascular etiologies: Carotid-cavernous fistula, Internal carotid artery Aneurysm and CS thrombosis. They all produce similar clinical features; the CS syndrome (exophthalmos, ophthalmoplegia, chemosis, etc). Digital subtraction angiography plays a dual role in their diagnosis and management.; Infectious

etiologies: Fungal sinusitis produces narrowing and thrombosis of the internal carotid artery and the CS, with infarction of paranasal and nasal tissues (producing the typical "black turbinate sign"). Tuberculous pachymeningitis manifests as nodular and enhancing lesions.; Inflammatory etiologies: include Granulomatosis with Polyangiitis, Tolosa-Hunt Syndrome, Sarcoidosis and IgG4 Disease. Granulomatosis with polyangiitis affects paranasal sinus, nasal cavities and orbits and may produce hypertrophic pachymeningitis with CS involvement, ICA stenosis and vasculitis. Tolosa-Hunt syndrome is a diagnosis of exclusion and involves the CS region, the superior orbital fissure and the orbital apex of the same side.; Miscellaneous: Arachnoid, Epidermoid, Dermoid Cysts and Pseudocysts. Epidermoid cysts do not enhance and show diffusion restriction.

## NREE-95 DEFINING THE CENTRAL ROLE OF RADIOLOGY FOR SAFE AND EFFECTIVE ANTI-AMYLOID THERAPY IN EARLY ALZHEIMER'S DISEASE

Joseph M. Mettenburg, MD (*Abstract Co-Author*) Nothing to Disclose
Riddhi Patira (*Abstract Co-Author*) Nothing to Disclose
Saurab Faruque, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Anti-amyloid (AA) monoclonal antibodies rapidly emerged as an approved treatment for Alzheimer's disease (AD) dementia. Efficacious and safe treatment requires robust clinical data to accurately classify patients at initiation and to monitor throughout treatment. Radiologists directly contribute to this process through acquisition and interpretation of baseline and serial screening MRI and careful collection of cerebrospinal fluid (CSF) samples. This educational exhibit aims to prepare radiologists for their central role in AA therapy programs.The educational objectives of this exhibit are to understand:- Factors affecting CSF AD biomarker analysis and the recommended pre-analytical protocol for mitigating variability- Conditions and imaging features that exclude patients from AA therapy, and radiographic pitfalls and mimics- The role of MRI parameters in serial amyloid-related imaging abnormality (ARIA) assessment- Imaging characteristics of ARIA-H (hemorrhage) and ARIA-E (edema)- Monitoring timelines for ARIA, and circumstances and recommendations for adjustments to monitoring and treatment

### TABLE OF CONTENTS/OUTLINE

1. AD pathophysiology therapeutic targets2. The radiologist’s role in treatment initiationa. Baseline MRI-detectable exclusionary conditions criteria, and their imaging characteristics mimicsb. Rationale recommendations for standardized CSF sample collection3. The radiologist’s role in monitoring managementa. Overview of ARIA-H ARIA-Eb. Considerations for selecting MRI sequence type field strengthc. Recommended monitoring protocol timelined. Evaluating ARIA radiographic severitye. Adjustments to monitoring therapy after detection of ARIA

## NREE-96 MRI “ARTIFACTS” WITH CLINICAL RELEVANCE IN STROKE EVALUATION

Richard Wang (*Abstract Co-Author*) Nothing to Disclose
Meisam Hoseinyazdi (*Abstract Co-Author*) Nothing to Disclose
Vivek Yedavalli, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Dhairya Lakhani, MD (*Abstract Co-Author*) Nothing to Disclose
Minsoo Kim (*Abstract Co-Author*) Nothing to Disclose
Kevin Chen, BA (*Abstract Co-Author*) Nothing to Disclose
Cynthia M. Greene, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To review the physical origins of MRI signs including Fluid Attenuated Inversion Recovery (FLAIR) Hyperintense Vessel Sign (HVS), Susceptibility Weighted Imaging (SWI) Brush Sign (BS) and the Arterial Spin Labeling (ASL) Arterial Transit Artifact (ATA). -Then describe the imaging features of these artifacts in MRI. -We will then review the associations of these findings with acute stroke.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. The FLAIR hyperintense vessel sign (HVS).a, The physics of hyperintense vessels on FLAIR.b, Imaging appearance. c, Clinical Associations - scoring FHV ASPECT.3. SWI brush sign (BS)a, The origin of the brush sign on SWI.b, Imaging appearance. c, Clinical associations.4. ASL arterial transit artifact (ATA)a, The origin of the arterial transit artifact. b, Imaging appearance.c, Clinical associations.

## NREE-97 FUNCTIONAL MRI TECHNIQUES TO DETECT, UNDERSTAND, AND PROGNOSTICATE DISORDERS OF CONSCIOUSNESS

David Fischer (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Ware, MD (*Abstract Co-Author*) Nothing to Disclose
Azfar Basunia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Disorders of consciousness (DoC) are believed to occur due to disruption of key awareness and arousal brain networks. Conventional clinical assessments have major limitations and suffer high misdiagnosis rates, posing challenges to decision making over the withdrawal of life-sustaining care. In this exhibit, we aim to:1. Highlight limitations of current clinical assessments and conventional imaging in neuroprognostication.2. Illustrate fMRI techniques to detect and differentiate between levels of consciousness and prognosticate on future recovery.3. Review current society guidelines and possible implementation strategies.

### TABLE OF CONTENTS/OUTLINE

1. Overview of disorders and levels of consciousness.2. Current clinical assessments and conventional imaging techniques (CT, MRI) a. Limitations in accurate DoC detection and neuroprognostication b. Need for novel techniques based on the neurobiology of coma.3. Functional MRI (fMRI) for understanding and prognosticating on DoC and detecting covert consciousness such as covert cortical processing and cognitive motor dissociation a. Task-based fMRI b. Stimulus-based fMRI c. Resting-state fMRI - (i) Functional network integrity for neuroprognostication (ii) Frequency domain analysis (iii) Emerging techniques such as dynamic functional connectivity.4. Practical considerations for fMRI implementation a. Acquisition and pre-processing strategies, including novel techniques to improve patient-level reliability b. Post-processing approaches and interpretation c. Considerations for scanning critically ill patients (safety, sedation, etc).5. Current society guidelines and expert consensus on DoC neuroprognostication with fMRI.

## NREE-98 INTRACRANIAL VESSEL WALL MRI: WHAT YOUR LUMEN IS NOT TELLING YOU

Keena Li (*Abstract Co-Author*) Nothing to Disclose
Hediyeh Baradaran, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Bryan L. Bishop, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. We will provide an overview of what VWI entails and which patient populations are most likely to benefit from this type of advanced imaging. 2. We will provide an in-depth review of imaging techniques and protocols for high quality VWI in a timely manner which can be easily transitioned to clinical practice. 3. We will provide a clear, stepwise approach for interpreting vessel wall MR. 4. We will review specific scenarios in which VWI is a useful tool and adjunct to standard imaging.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction and overview of what vessel wall imaging means and who may benefit from this technique. a. Allows visualization of vessel wall rather than lumen alone. b. Differentiating etiologies of intracranial luminal stenosis. c. Identifying source of symptomatic disease which does not result in luminal stenosis and is not detected on standard imaging. 2. Imaging protocol for VWI. a. Review of various imaging techniques and protocols for VWI. b. Practical information on specific sequences and timing. 3. Stepwise approach to interpreting VWI in the clinical setting. a. Identify vessel narrowing on TOF MRA. b. Classify pattern of narrowing. c. Evaluate T2 weighted sequence. d. Evaluated for presence of and pattern of enhancement. 4. Scenarios in which VWI is a useful adjunct to standard neuro imaging. a. Non-stenosing Atherosclerotic Plaque i. Vessel wall enhancement, remodeling, plaque thickness and surface irregularity, intraplaque hemorrhage. b. CNS Vasculitis i. Concentric wall thickening and enhancement which persist over multiple examinations. c. Moyamoya i. VWI can be helpful to differentiate MMD, A-MMS, and V-MMS. d. CAA (A Beta Angiitis) i. Wall inflammation can be seen in inflammatory CAA.

## NREE-99 CURRENT STATUS OF GLYMPHATIC IMAGING: PERSPECTIVES AS OF 2024

Toshiki Nakane (*Abstract Co-Author*) Nothing to Disclose
Hisashi Kawai (*Abstract Co-Author*) Nothing to Disclose
Rintaro Ito, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Shinji Naganawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rei Nakamichi (*Abstract Co-Author*) Nothing to Disclose
Toshiaki Taoka, MD, PhD (*Presenter*) Research Grant, Canon Medical Systems Corporation

**TEACHING POINTS**

Since its introduction in 2012, the glymphatic system hypothesis has gained attention through animal studies showing its role in conditions like Alzheimer’s disease, Parkinson’s disease, stroke or head trauma. Human evaluation remains challenging due to the unavailability of fluorescent tracers and the unapproved use of intrathecal gadolinium-based contrast agents (GBCA). As an alternative, the Diffusion Tensor Image Analysis aLong the Perivascular Space (DTI-ALPS) method has gained traction for its noninvasive nature and simple interpretability through the ALPS-index. However, recent critiques question its reliability due to sensitivity to imaging conditions and issues like fiber crossing. This exhibit will introduce the concept of glymphatic system, detail the DTI-ALPS method along with its limitations, and explore additional non-invasive techniques such as choroid plexus volume, perivascular space volume assessment, and evaluations of blood-brain barrier or venous wall permeability using GBCA, offering a comprehensive overview of current methodologies for glymphatic system evaluation.

**TABLE OF CONTENTS/OUTLINE**

1. Overview of the Glymphatic System- Introduction to the Glymphatic System Hypothesis- Importance of the Glymphatic System in Neurological Diseases2. Detailed Analysis of the DTI-ALPS Method-Description of the DTI-ALPS Technique and the ALPS Index-Limitations and Critiques of the DTI-ALPS Method3. Other Non-Invasive Assessment Techniques for Glymphatic System-Non-Contrast Techniques (e.g., choroid plexus volume assessment)-Contrast-Enhanced Techniques (e.g., evaluation of blood-brain barrier)

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# Abstract Archives of the RSNA, 2024

NREE-1

## OVERVIEW OF TEMPORAL LOBE PLUS EPILEPSY AND ANATOMIC SUBSTRATES: INSULA, THALAMUS, OLFACTORY, AND CINGULATE SYSTEMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Aline Herlopian (*Abstract Co-Author*) Nothing to Disclose
Chong Zhou, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Richard A. Bronen, MD (*Abstract Co-Author*) Nothing to Disclose
Justin Sindoni, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss temporal lobe plus epilepsy (TLE+) and its importance2. Review pertinent anatomy of TLE+ (e.g., connections to the insula, thalamus, olfactory, and cingulate)3. Review cases of pathologies of TLE+ structures involved in refractory epilepsyBackground: Temporal lobe epilepsy is the most common type of epilepsy and accounts for about half of all cases of focal epilepsy. Over the last few decades, it has been recognized that epilepsy may be the result of “network” changes in the brain rather than from a focal abnormality influencing an “epileptogenic zone.” Temporal lobe plus epilepsy (TLE+) is a term coined to discuss the network of extratemporal structures involved in refractory temporal lobe epilepsy, including the insula, thalamus, olfactory connections, and cingulate. In this exhibit we will discuss the anatomy and connections of the structures involved in TLE+ in the context what is important for the radiologist to know and evaluate. We will review imaging of both normal anatomy and cases illustrating pathology in patients with TLE+. The ultimate goal is to assist the radiologist in providing optimal care in the diagnosis and successful treatment of epilepsy, particularly with helping targeting for recent therapies such and neuromodulation and laser ablation treatments.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Discussion of structures and connections of TLE+ (e.g. the insula, thalamus, olfactory connections, and cingulate)3. Imaging evaluation of normal TLE+ structures4. Case examples of pathology involving TLE+ structures5. Summarize TLE+ and future directions for the radiologist’s role in the multidisciplinary approach to epilepsy treatment

RSNA 2024
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# Abstract Archives of the RSNA, 2024

NREE-100

## BEYOND THE OBVIOUS: UNRAVELING STROKE AND ITS IMPERSONATORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Paulo C. Puac Polanco, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Torres, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Eduardo Portela de Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Santanu Chakraborty, FRCPC,MBBS (*Abstract Co-Author*) Nothing to Disclose
Nerses Nersesyan, MD (*Abstract Co-Author*) Nothing to Disclose
Azza Reda, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Lucia Brun, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To recognize and differentiate between cases of stroke and differential considerations based on imaging findings.- To recognize specific imaging patterns and signs associated to common and uncommon stroke mimics on imaging.- To understand the importance of accurate differentiation for timely and appropriate patient management.

### TABLE OF CONTENTS/OUTLINE

Mimics account for nearly half of all hospital admissions for suspected strokes. Stroke mimics may present as functional disorders or may be symptomatic of underlying neurological or medical conditions. A significant number of patients continue to receive thrombolysis unnecessarily, resulting in inherent risks and avoidable costs. Thus, accurate diagnosis is of utmost importance. A non-contrast CT scan alone is often insufficient for diagnosis, and multimodal CT or MRI scans are typically required.Imaging Pattern-Based Approach Through Cases:- Segmental gray and white matter: Stroke, Seizures, Migraine, HSV encephalitis, Venous thrombosis, TGA, Hypoglycemia, Tumor, MELAS- Cortical and deep gray matter: HII, Hepatic encephalopathy, CJD, Wernicke's encephalopathy.- Deep gray matter: Stroke, HII, CO poisoning, extrapontine myelinolysis, CJD, Nonketotic Hyperglycemia, Venous thrombosis, Wernicke's.- White matter: CADASIL, Susac's, demyelination, metronidazole and methotrexate toxicity, Heroin.- Watershed zones: Stroke, RCVS, PRES, Moya-Moya, Hyperperfusion syndrome.- Scattered Foci: Fat emboli, DAI Embolic infarcts, Mets.- Corpus Callosum: CLOCCs, Seizures, Marchiafava-Bignami. <!--EndFragment-->

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# Abstract Archives of the RSNA, 2024

NREE-101

## SPONTANEOUS INTRACRANIAL HYPOTENSION - AN EASY GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Beatriz Alba Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Juan V. Quintana Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Joseba Mirena Zulueta Odriozola, MBBS (*Abstract Co-Author*) Nothing to Disclose
Martiel M. Manrique Zegarra, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Ines Pecharroman, PhD (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After reviewing this exhibit, the reader should: - Understand the pathophysiology of spontaneous intracranial hypotension and be able to explain and correlate it with the imaging findings. - Properly describe the findings in the studies performed to patients affected by this condition. - Learn the MRI sequences that are most useful for detecting the different findings leading to disease diagnosis and to identifying underlying causes, being aware of the differential diagnosis suggested by each of the described findings. - Be familiar with the complex diagnostic and therapeutic process of the disease: recognizing situations warranting a high clinical suspicion for this condition, determining appropriate screening tests, identifying circumstances in which invasive procedures are needed for further evaluation, and customizing treatment approaches for individual scenarios.

### TABLE OF CONTENTS/OUTLINE

-Introduction - Clinical presentation - Differential diagnosis - Causes - Work-up algorithm - Diagnostic imaging : initial approach o Brain MRI o Spine MRI - Diagnostic imaging : investigating the etiology o CT-Myelography o Non invasive MR-Myelography o Fluoro-Myelography - Treatment o Conservative treatment o Targeted treatment - Conclusions

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# Abstract Archives of the RSNA, 2024

NREE-102

## PRIMARY CENTRAL NERVOUS SYSTEM LYMPHOMA: IMAGING AND FEATURES AND DIFFERENTIAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Diogo G. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Mori, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Imaging Modalities: Teach about the imaging modalities commonly used in diagnosing PCNSL.
- Typical Imaging Features: Highlight the typical imaging features of PCNSL on MRI and CT scans.
- Differential Diagnosis: Emphasize the importance of considering differential diagnoses when evaluating imaging findings suggestive of PCNSL in immunocompetent and immunocompromised patients.
- Key Differentiating Factors: Teach about the key differentiating factors between PCNSL and other brain lesions on imaging.
- Advanced Imaging Techniques: Introduce advanced imaging techniques such as diffusion-weighted imaging (DWI), perfusion-weighted imaging (PWI), and magnetic resonance spectroscopy (MRS), which may aid in differentiating PCNSL from other brain lesions based on specific metabolic and hemodynamic features.

### TABLE OF CONTENTS/OUTLINE

Introduction to PCNSL: Definition and incidence and clinical presentation. Histophatological analysis: Overview of WHO classification diffuse large B-cell lymphoma (DLBCL) and other lymphoid neoplasms in the CNS. Role of Imaging in PCNSL Diagnosis: Importance of MRI in PCNSL diagnosis, clinical applicability and data provided by MRI. Imaging Features of PCNSL: Tumor metabolism, water molecule diffusion, cell density and blood-brain barrier permeability. Differential Diagnosis of PCNSL: Importance of distinguishing differential diagnoses, defining biopsy location. Atypical Forms of PCNSL: Extra-axial PCNSL, intravascular lymphoma, lymphomatosis Cerebri and skull lymphoma. Conclusion: Radiologist role is to contributed to the PCNSL diagnosis, treatment planning, and patient care.

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# Abstract Archives of the RSNA, 2024

NREE-103

## UNTANGLING THE LUMBOSACRAL PLEXUS MRI: SEARCH PATTERNS, PATHOLOGIES AND DIAGNOSTIC INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Claudia F. Kirsch, MD (*Abstract Co-Author*) Consultant, Informa PLC;Royalties, Informa PLC
Jeffers Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher J. Hamilton, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The lumbosacral plexus is a complex network of nerves formed by the ventral rami of the lumbar and sacral spine, with end branches innervating the pelvic sidewall and lower limbs. Despite its clinical significance, lumbosacral plexus MRI examinations are infrequently performed, and instances of imaged pathologies are even rarer. Consequently, radiologists may lack the exposure and expertise needed to effectively evaluate these examinations.Our objective is two-fold: 1) to delve into the anatomy and present cases illustrating key findings of lumbosacral plexus pathologies that we have drawn from the past 25 years at our academic tertiary center showcasing a wide range of etiologies, including neoplastic, infectious, inflammatory and traumatic causes; and 2) to highlight the key MRI sequences and demonstrate our search pattern while providing a step-by-step framework to assist in the interpretation of this uncommonly performed exam.

### TABLE OF CONTENTS/OUTLINE

1.Review the anatomy of the lumbosacral plexus2.Identify the indications for MRI evaluation of the lumbosacral plexus in clinical practice3.Familiarize with the MRI techniques and sequences utilized for optimizing the imaging of the lumbosacral plexus4.Develop a systematic search pattern and highlight key elements that should be documented in every radiologist’s report5.Discuss and illustrate various pathologies affecting the lumbosacral plexus, including neoplastic, infectious/inflammatory, traumatic and degenerative etiologies

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# Abstract Archives of the RSNA, 2024

NREE-104

## IRON RIM LESIONS AND CENTRAL VEIN SIGN ON 3T SWI: WHAT RADIOLOGISTS SHOULD KNOW IN THE DIAGNOSIS OF MULTIPLE SCLEROSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Masayuki Maeda, MD (*Abstract Co-Author*) Nothing to Disclose
Seiya Kishi (*Abstract Co-Author*) Nothing to Disclose
Ryota Kogue, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fumine Tanaka (*Abstract Co-Author*) Nothing to Disclose
Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Maki Umino, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Iron rim lesions (IRLs) and central vein sign (CVS) on SWI have been reported to be useful for the diagnosis and monitoring of multiple sclerosis (MS). Here we demonstrate the importance of these findings regarding diagnosis and clinical relevance in MS patients. We aimed to1) Understand what IRLs indicate in MS pathology. 2) Learn about the pathology of CVS, which shows inflammation-dependent remodeling of blood vessel walls (lumen enlargement and collagen deposition). 3) Learn how specific IRLs and CVS are for MS lesions and what the differential diagnosis is. 4) Learn the relationship between IRLs and other MRI findings/clinical findings.

### TABLE OF CONTENTS/OUTLINE

1. Pathology of IRLs: IRLs represent a rim of iron-laden macrophages/microglial cells at the lesion edge (i.e., chronic active lesion). 2. Diagnostic value of IRLs and CVS: IRLs are unique to MS except for Susac syndrome. CVS is unique to MS except for Behēet's disease. 3. IRLs and other MR findings: ring enhancement and hypointense ADC rim may predict progression from acute to IRL. 4. Combination of IRLs and CVS: a great impact on the prediction of clinically isolated syndrome patients' conversion to definite MS. 5. Clinical relevance of IRLs: IRLs may serve as a marker of persistent low-level inflammation in adjuvant therapy targeting insidious clinical decline.

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# Abstract Archives of the RSNA, 2024

NREE-105

## IDENTIFICATION AND CLINICAL SIGNIFICANCE OF PLAQUE ULCERATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luca Saba, MD (*Abstract Co-Author*) Nothing to Disclose
Brett Cucchiara (*Abstract Co-Author*) Nothing to Disclose
Jae W. Song, MD, MS (*Abstract Co-Author*) Nothing to Disclose
David Yang (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. We provide criteria for defining plaque ulcerations based on image modality.2. We correlate the anatomy of a plaque ulceration to its appearance on imaging and clarify the concept of an ulceration as a crater in plaque rather than an outpouching of the blood vessel wall.3. We describe the stages of how plaque develops and ulcerations form.4. We review the literature on the significance of plaque ulcerations and high risk with stroke and cardiac events.5. We provide examples of common image interpretation pitfalls that may mimic plaque ulcerations, including faint plaque calcifications, carotid webs, and intimal flaps from arterial dissections.

### TABLE OF CONTENTS/OUTLINE

1. Identification of plaque ulceration. (a) Criteria for defining plaque ulceration in the vascular beds. (b) Classification of carotid artery ulceration types. (c) Anatomy of plaque ulceration and imaging appearances.2. Mechanism and pathophysiology of plaque ulceration.3. Clinical significance of plaque ulcerations in the aorta, coronary arteries, carotid arteries, and intracranial arteries. (a) Prevalence. (b) Histology. (c) Clinical associations with stroke or cardiac events. (d) Multimodality image examples on ultrasound/echocardiograms, CTAs, and MRAs.4. Image interpretation pitfalls of identifying plaque ulcerations. (a) Example of focal calcification. (b) Example of carotid web versus dissection

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# Abstract Archives of the RSNA, 2024

NREE-106

## SUMMER IS COMING - DECODING THE ARBOVIRUS IMPRINTS IN NEUROIMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tomas Freddi, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Celso Hygino, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To elucidate the neuroradiological manifestations of arbovirus infections, emphasizing characteristic imaging features across different modalities. To enhance understanding of the pathophysiological impact of arboviruses in the CNS, facilitating early diagnosis and effective intervention. To discuss the evolution of imaging in tracking the progression and support treatment response of arbovirus infections, highlighting their pivotal role in clinical decision-making.

### TABLE OF CONTENTS/OUTLINE

1. Overview of arboviruses, focusing on physiopathology and clinical findinds. 2. Epidemiology of arboviruses, focusing on those that frequently cause neurological manifestations 3. Discussion on the physiopathology of CNS invasion and typical progression. 4. Radiological signatures of dengue fever, West Nile virus, Chikungunya, Japanese Encephalitis, Saint Louis Encephalitis, and Zika, including cortical lesions, white matter changes, spinal cord findings, neural root involvement, and hemorrhagic presentations. 5. Associated complications: post Yellow-Fever Vaccination lesions, Guillain-Barré Syndrome. 6. Discuss the diagnosis challenges, using a combination of imaging features, clinical correlation, and laboratory confirmation. 7. Overview of current support treatments and prevention available for arbovirus infections and the role of neuroradiology in monitoring treatment efficacy and neurologic recovery. Implications of imaging findings on therapeutic decisions, particularly in severe cases requiring aggressive treatment. 8. Take-home messages: summary of the critical contributions of imaging to understanding, diagnosing, and managing arbovirus infections in the CNS.

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# Abstract Archives of the RSNA, 2024

NREE-107

## EPIDEMIC ECHOES OF THE TROPICAL TWISTER: NEURORADIOLOGICAL FEATURES OF CHIKUNGUNYA VIRUS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Tomas Freddi, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Celso Hygino, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To illuminate the neuroradiological manifestations associated with Chikungunya virus (CHIKV) infections in adults, emphasizing specific imaging features that aid in diagnosis. To delineate the clinical relevance of these imaging findings, enhancing the understanding of CNS involvement. To advocate for integrating neuroradiological evidence with clinical diagnostics to optimize the prevention and management of CHIKV.

### TABLE OF CONTENTS/OUTLINE

1.Brief overview of Chikungunya virus, including virology, transmission, and global epidemiology. 2.Discuss typical clinical presentations, focusing on neurological symptoms that prompt neuroradiological evaluation. 3.Comprehensive review of neuroradiological findings in CHIKV-infected patients, detailed descriptions of patterns observed in MRI and CT, including encephalitis, myelitis, and perinatal mother-to-child transmission. 4.Description of the spectrum of neurological complications associated with CHIKV, ranging from mild headache and vertigo to more severe complications like Guillain-Barré syndrome and acute disseminated encephalomyelitis. 5. Typical and atypical radiological features, such as meningeal enhancement, cerebral and spinal cord involvement, acute disseminated encephalomyelitis-like lesions, and Guillain-Barré syndrome. 6.Discussion on the role of imaging in differentiating CHIKV neurological manifestations from those caused by other arboviruses. 7.Prevention and discussion on the role of neuroradiology in monitoring treatment efficacy and neurological recovery. 8.Recap the significance of neuroradiological approaches in diagnosing and managing Chikungunya's neurological manifestations.

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# Abstract Archives of the RSNA, 2024

NREE-108

## OUTLINING THE SPINAL CORD: TOPOGRAPHIC APPROACH TO SPINAL CORD ABNORMALITIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Diogo G. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Celso Hygino, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To elucidate the benefits of topographic approach in imaging and classification of spinal cord lesions, enhancing diagnostic precision and therapeutic targeting.To showcase the integration of neuroimaging, clinical and laboratory data, with topographic lesions mapping to provide a comprehensive overview of lesion features. To better understand how topographic data can inform prognosis and guide rehabilitation strategies, improving outcomes.

### TABLE OF CONTENTS/OUTLINE

1.Introduction to topographic approach of spinal cord lesions, emphasizing the value of detailed anatomical and functional mapping. 2.Classification system based on topographic data that categorizes injuries by segments of the spine, adjacent structures and specific neural elements affected. 3.Imaging the spinal lesions, including epidural abscess, lymphoma, angiomyolipoma, cytomegalovirus, syphilis, schistosomiasis, CIDP, melanoma, Guillain-Barré syndrome, post-vaccination myelitis, chemical radiculitis, sarcoidosis, subacute combined degeneration, copper deficiency, HIV, ADEM, NMOSD, tuberculosis, fungus, vasculitis, CLIPPERS, viral encephalitis, spinal cord ischemia, COVID myelitis. 6. Gadolinium enhancement patterns of the spinal cord diseases. 7.Examine how specific topographic features correlate with patient prognosis, potential for recovery and risk of complications. 8.Discuss how topographic information can guide surgical interventions, the choice of rehabilitation techniques, and the development of targeted therapies. 9. summary of the pivotal role that topographic mapping plays in transforming the landscape of spinal cord injury diagnosis and management.

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# Abstract Archives of the RSNA, 2024

NREE-109

## CHARACTERISTIC ANATOMIC LOCATION OF SYMMETRIC DWI HYPERINTENSE LESIONS: FROM INSIDE TO OUTSIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kazufumi Kikuchi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Osamu Togao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kousei Ishigami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Koji Yamashita, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review what type of diseases could involve the inner or outer brain 2. To learn how DWI provides a greater contrast between lesions and surrounding normal structures than other sequences 3. To list differential diagnoses based on disease-specific location, shape, and clinical information

### TABLE OF CONTENTS/OUTLINE

1) Innermost: Wernicke encephalopathy, osmotic demyelination, artery of Percheron infarction, and Leigh encephalopathy 2) Corpus callosum+ and Hippocampi: Cytotoxic lesions of the corpus callosum (CLOCCs), 5-FU induced encephalopathy, metronidazole-induced encephalopathy, autoimmune encephalitis, and human herpesvirus 6 (HHV-6) encephalitis 3) Pyramidal tracts, basal nuclei, and thalami CLCN2-related leukoencephalopathy, adrenomyeloneuropathy, hypomyelination of early myelinating structures (HEMS), vigabatrin-associated brain abnormalities, and hemolytic uremic syndrome 4) White matter Influenza encephalopathy, adrenoleukodystrophy, hereditary diffuse leukodystrophy with spheroids (HDLS), adult-onset autosomal dominant leukodystrophy, acute encephalopathy with biphasic seizures and late reduced diffusion (AESD), and neuronal intranuclear inclusion disease 5) Cortices and outside skull: Creutzfeldt-Jakob Disease, Gerstmann-Straussler-Scheinker disease, hypoxic-ischemic encephalopathy, and relapsing polychondritis

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# Abstract Archives of the RSNA, 2024

NREE-11

## ATYPICAL CEREBRAL VENOUS THROMBOSIS: 'THE EYES SEE WHAT THE MIND KNOWS' :EXPANDING THE PHENOTYPIC SPECTRUM OF CEREBRAL VENOUS THROMBOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Sabha Ahmed, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

I. llustrate the normal Intracranial Superficial andDeep Venous Anatomy.2. Illustrate the common findings of Cerebral Venous Sinus Thrombosis.3. Illustrate the tell tales of Cortical Vein Thrombosis.4. Illustrate with examples the rare phenotypic manifestations of atypical Cerebral Venous Thrombosis(CVT).5. Highlight the importance of ruling out atypical CVT in day-to-day reporting and avoid overcalling these manifestations as either Demyelinating or Neoplastic conditions.

### TABLE OF CONTENTS/OUTLINE

Table of contentsOutline of normal intracranial superficial and deep venous systemOutline of the draining venous territories of the intracranial venous systemCommon imaging phenotypes of dural sinus , cortical and deep venous thrombosisCase based illustration of atypical cerebral venous thromboses - Schematic depiction of the the afflicted veinsHighlight the common misdiagnoses in day to day reporting of this condition

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# Abstract Archives of the RSNA, 2024

NREE-110

## THROUGH THE SKULL: EXPLORING TRANSCALVARIAL LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andrea S. Costacurta, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo J. Medeiros, MD (*Abstract Co-Author*) Nothing to Disclose
Rangel Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Virginia R. Simonini, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Da Silva, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adriana M. Melo, MBA, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Glenda Peres (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The intricate anatomical structures comprising the scalp, skull, and dura mater serve as potential loci for lesions capable of traversing multiple compartments. The purpose of this educational exhibit is to explore the various facets of transcalvarial lesions, including their clinical and imaging characteristics, in order to equip radiologists with the tools necessary to significantly narrow the spectrum of potential diagnoses.

### TABLE OF CONTENTS/OUTLINE

1. Definition of a transcalvarial lesion.2. Overview of the anatomical structures that compose the scalp, cranial vault, and dura mater.3. Discussion of the main differential diagnosis: Meningioma, Lymphoma, Metastasis and Plasmacytoma.4. Patterns of calvarial invasion on CT.5. Miscellaneous: Demonstration of rare lesions that can manifest as transcalvarial masses: CNS Tuberculosis, Solitary Fibrous Tumor and Dermatofibrosarcoma Protuberans.

# Abstract Archives of the RSNA, 2024

NREE-111

## PERIOPERATIVE AND POSTOPERATIVE COMPLICATIONS OF ENDOSCOPIC ENDONASAL APPROACH SURGERIES OF THE ANTERIOR SKULLBASE: A CASE-BASED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Marion A. Hughes, MD, JD (*Abstract Co-Author*) Nothing to Disclose
Barton F. Branstetter IV, MD (*Abstract Co-Author*) Nothing to Disclose
William E. Rothfus, MD (*Abstract Co-Author*) Nothing to Disclose
Katie S. Traylor, DO (*Abstract Co-Author*) Nothing to Disclose
Keerthi Arani, MD (*Abstract Co-Author*) Nothing to Disclose
Gloria Joo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The endoscopic endonasal approach (EEA) is a surgical technique that allows for direct access to a variety of tumors centered at the anterior skullbase. By operating through the nose and paranasal sinuses, EEA minimizes brain retraction, and manipulation of neurovascular structures that occur with transfacial and transcranial approaches.2. Knowledge of conventional pre-operative skullbase anatomy and typical postoperative appearance of nasoseptal flap reconstruction on CT and MRI is crucial to assess for possible complications of EEA.3. The most common type of complication is flap failure, which can manifest radiologically as CSF leak from flap migration/dehiscence, flap necrosis, and infection. Other less common complications involve injury to the internal carotid artery (ICA) and other adjacent skullbase structures. These complications can be evaluated with skullbase CT and MRI, cisternograms, and cerebral angiograms.

### TABLE OF CONTENTS/OUTLINE

1. Overview of the endoscopic endonasal approach: general technique and comparison of EEA to transfacial/transcranial approaches.2. Normal postoperative findings on CT and MRI: intact nasoseptal flap and fat graft.3. Postoperative Complications on Imaging A. Flap: flap migration with brain herniation, CSF leak, flap necrosis with infection. B. Vascular: ICA dissections, pseudoaneurysms, cavernous sinus thrombosis, air embolism to intracranial vessels.

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# Abstract Archives of the RSNA, 2024

NREE-112

## THE ART OF MISMATCH: A DIAGNOSTIC KEY IN CNS TUMOR IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roy Riascos, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Carlos H. Torres, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Andres F. Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo C. Puac Polanco, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Maria Lucia Brun, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.To improve the ability to recognize and interpret various types of mismatches in CNS tumor imaging, leading to more accurate diagnoses. 2.To foster a deeper comprehension of the different scenarios where mismatch patterns can be valuable in the diagnostic process of CNS neoplasms. 3. To emphasize the importance of interdisciplinary collaboration in the initial approach of brain tumors and their evaluation after treatment.

### TABLE OF CONTENTS/OUTLINE

In the realm of CNS neoplasm diagnosis, the emergence of mismatch scenarios offers a compelling dimension to the diagnostic process.The nuanced interplay between clinical presentations, diverse imaging modalities, and difficulties/limitations of imaging techniques unveils challenges for an accurate diagnosis where different types of mismatches can be found. The ability to recognize and interpret these deviations from the expected unlocks precision in diagnosing CNS neoplasms, ultimately leading to better patient care and outcomes.Outline: 1. Clinico-radiological mismatch: Pseudoprogression. Pseudo response. 2. Imaging-imaging mismatch: T2/FLAIR mismatch. Advanced-basic imaging mismatch. Mistmatch within imaging features. 3. Imaging-technique mismatch. 4. Imaging-surgical findings mismatch: Imaging. Conclusion: Understanding the pivotal role of mismatch scenarios in the diagnostic process of CNS neoplasms is key. We must emphasize the importance of interdisciplinary collaboration.

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# Abstract Archives of the RSNA, 2024

NREE-113

## MAPPING THE MAZE: NEUROIMAGING INSIGHTS INTO IMMUNOCOMPROMISED PATIENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Faisal A. Alsugair, MD,FRCPC (*Abstract Co-Author*) Nothing to Disclose
Paulo C. Puac Polanco, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Azza Reda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Immunocompromised patients represent a vulnerable group that can be affected by numerous neurological conditions.• The impairment of the body's immune system in this population can alter their ability to prevent diseases, particularly infections.• Other less common complications can be seen in immunocompromised patients, such as infection-induced neoplasms, paradoxical inflammatory reactions to treatment, or metabolic conditions. . There are several primary immune deficiencies and a wide number of secondary causes that include advanced age, metabolic conditions, infection (e.g., HIV), malnutrition, and chronic disorders such as diabetes and systemic lupus erythematosus

### TABLE OF CONTENTS/OUTLINE

Approach for diagnosing Complications in Immunocompromised patientsA. Opportunistic infectionsB. Treatment-related complicationsC. NeoplasmsD. Miscellaneous A. Opportunistic infections- Toxoplasmosis- Fungal infections: Candida albicans, Cryptococcal meningoencephalitis, Cryptococcosis Gelatinous pseudocysts, choroid plexitis, Invasive fungal sinusitis- Viral infections: Ramsay-Hunt syndrome, herpes zoster virus, Herpes zoster ophthalmicus- Nocardia- CD8 encephalitis B. Treatment-related complications- PML- PML-IRIS C. Neoplasms- EBV-induced 1ry CNS Lymphoma - Miscellaneous- Vasculitis- Infarction

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# Abstract Archives of the RSNA, 2024

NREE-114

## CONTRAST-INDUCED ENCEPHALOPATHY: AN UNDERESTIMATED COMPLICATION AFTER ENDOVASCULAR PROCEDURES?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Salome Bosshart, MD (*Abstract Co-Author*) Nothing to Disclose
Rosario Pascarella, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Luisa Zedde, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalie Nierobisch (*Abstract Co-Author*) Nothing to Disclose
Nicolin Hainc (*Abstract Co-Author*) Nothing to Disclose
Alexander Stebner, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

I) Pathophysiology, epidemiology, and clinical presentation II) Typical radiographical signs of Contrast-Induced Encephalopathy (CIE) on CT and MRI. III) Distinguishing CIE from other differential diagnoses/frequent post-endovascular procedures complications.

### TABLE OF CONTENTS/OUTLINE

What is CIE? It is a rare sporadic condition of neurotoxicity after intravascular administration of iodine contrast. It evolves rapidly and causes temporary neurological deficits/seizures shortly after contrast administration, sometimes within hours. Patients usually recover within days without residual findings on imaging, but cases of incomplete remission with permanent deficits and rarely death have been reported. It is assumed that the breakdown of the blood-brain barrier with contrast-leakage causes altered excitability and thus neuronal dysfunction. Typical imaging findings? Cortical and sulcal hyperdensities on CT not corresponding to blood but contrast agent and vasogenic edema resulting in mass effect. These findings typically resolve completely within hours to days on follow-up imaging. Pearls, pitfalls, and differential diagnoses: Is it blood or contrast? - Dual-Energy CT is a useful tool to differentiate iodine from blood! Is the swelling a sign of stroke progression? - Sometimes you will need CTA to exclude residual or recurrent vessel occlusions, or MRI to look for diffusion restriction in acute stroke patients and FLAIR/T1w/SWI for blood, as iodine contrast should not be visible on MRI! Am I missing something? - Time will tell: After excluding acute conditions like subarachnoid hemorrhage and acute ischemic stroke, CIE will resolve typically quickly with conservative supportive treatment.

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# Abstract Archives of the RSNA, 2024

NREE-115

## PICTORIAL REVIEW OF INTRAVENTRICULAR BRAIN TUMORS IN ADULTS AND CHILDREN - A PRIMER FOR RESIDENTS AND FELLOWS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laiz Godoy, MD (*Abstract Co-Author*) Nothing to Disclose
Otavio Augusto Ferreira Dalla Pria, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Intraventricular brain tumors encompass myriad presentations in both clinical symptomology and radiological findings and frequently represent a challenge for the radiologist since multiple imaging features overlap among these tumors. Nevertheless, they account for a relevant incidence in our daily practice regardless of being an experienced neuroradiologist or a junior resident taking calls. Given their importance, a constant review of these entities is mandatory to succeed in general or neuroradiology. Moreover, this exhibit aims: 1. To review the literature concerning adult and children's intraventricular brain tumors; 2. To describe multi-modality imaging findings helpful in narrowing the differentials and relevant clinical presentations based on location, age, sex, etc. 3. To depict cases of typical and atypical supra and infratentorial intraventricular brain tumors in adults and children.

### TABLE OF CONTENTS/OUTLINE

1. Concise exposition delineating the embryology, anatomical configuration, and physiological attributes pertinent to the ventricular system; 2. Illustration of diverse cases featuring intraventricular cerebral neoplasms, including but not limited to ependymoma, subependymoma, central neurocytoma, subependymal giant cell tumor, choroid plexus neoplasm, meningiomas, juxtaposed with a comprehensive examination of potential differentials such as colloid cysts, atypical teratoid/rhabdoid tumors, and other pathologies. Furthermore, incorporation of cases initially presumed to originate intrinsically but ultimately diagnosed within the extraventricular ambit due to semblant radiological manifestations; 3. Conclusion and take-home messages, 4. References

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# Abstract Archives of the RSNA, 2024

NREE-116

## UNRAVELING THE UNUSUAL: A CASE REVIEW OF UNIQUE TRIGGERS FOR TRANSIENT ISCHEMIC ATTACKS (TIAS)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mansi N. Jantre III, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Transient Ischemic Attacks (TIAs) are often precipitated by conventional risk factors such as hypertension, diabetes, or hypercholesterolemia. However, there exists a subset of cases where atypical triggers play a significant role. This review examines the radiological features and diagnostic challenges associated with these unusual triggers for TIAs. Through a series of case studies and imaging modalities including CT, MRI, and angiography, we elucidate the role of radiology in understanding these atypical triggers is crucial for accurate diagnosis, timely intervention, and improved patient outcomes.

### TABLE OF CONTENTS/OUTLINE

-Introduction - Case: Parapharyngeal abscess with secondary involvement of carotid sheath- Case; Stylocarotid syndrome in Eagles syndrome-Case: Subclavian steel syndrome-Case; ICA pseudoanuysm triggering TIA and Horners syndrome-Case; Floating unstable plaque in ICA

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# Abstract Archives of the RSNA, 2024

NREE-117

## WHEN TO WORRY ABOUT INTRACRANIAL CALCIFICATIONS: OVERVIEW ON CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Guilherme C. Martins, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Calcifications within the brain parenchyma or vasculature are typical finding in all ages, present in the radiologist's daily routine. They can be age-related or pathological with a wide spectrum of presentations. Even with the introduction of Magnetic Resonance Imaging (MRI), non-contrast computerized tomography (NCCT) scan is the choice for detection and characterization. They can be classified into patterns with related terminology, ranging from dots, lines, stippled, blush, gyriform to conglomerates, as well as divided into pathological subtypes: vascular, genetic, infectious, inflammatory or neoplastic diseases. Pathological conditions can be linked to the radiological phenotype, taking into account anatomical location, distribution, dimensions and morphology, in association with clinical history and age. When identified in the appropriate clinical setting, the characteristic features allow the radiologist to facilitate the differential diagnosis and avoid practical errors.

### TABLE OF CONTENTS/OUTLINE

Optimizing the approach based on the radiological patterns, dividing them with related terminology and pathological subtypes thru a summary facilitates diagnosis, understanding and clinical management.

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# Abstract Archives of the RSNA, 2024

NREE-118

## DON'T BE VEIN: INTRACRANIAL VENOUS PATHOLOGY - A PRIMER FOR THE RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ashok Srinivasan, MD (*Abstract Co-Author*) Nothing to Disclose
Grant E. MacKinnon, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understanding typical intracranial venous anatomy and common variants is essential to develop an effective search pattern and avoid misinterpretation, a common pitfall for the training radiologist.2. Recognizing patterns of venous thrombosis and hemorrhage will aid in rapid diagnosis and the potential need for additional imaging.3. Identifying venous malformations helps guide patient management and avoid unnecessary workup.

### TABLE OF CONTENTS/OUTLINE

I. Typical intracranial venous anatomy a) Unique features of intracranial veinsII. Common intracranial venous variants a) High riding jugular bulb b) Jugular diverticulum c) Jugular dehiscenceIII. Venous thrombosis a) Risk Factors b) Venous territories i) Dural venous sinus thrombosis ii) Deep venous thrombosis iii) Superficial venous thrombosis c) Imaging features signs d) Complications i) Infarction ii) Dural arteriovenous fistula e) Mimics i) Hypoplastic/stenotic transverse sinus ii) Arachnoid granulations iii) PolycythemiaIV. Venous hemorrhage a) Venous epidural hematoma i) Common subtypes (1) Anterior temporal (2) Vertex (3) Clival b) Germinal matrix hemorrhage i) Risk Factors ii) Grading c) Perimesencephalic (nonaneurysmal) subarachnoid hemorrhageV. Venous malformations a) Cavernous malformation b) Developmental venous anomaly c) Capillary telangiectasia d) Sinus pericranii

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# Abstract Archives of the RSNA, 2024

NREE-119

## BRAIN MRI PROTOCOLS: A USER GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Matthew F. Glasser, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Robert C. McKinstry III, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Arash Nazeri, MD (*Abstract Co-Author*) Nothing to Disclose
Michelle Wegscheid, MD,PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Brain MRI protocols can be overwhelming for trainees. A foundational understanding of the physical principles of brain MR sequences is important for effective clinical deployment and accurate diagnostic interpretation. Furthermore, understanding MR parameters as customizable variables will inform patient and pathology-specific protocol optimization. The purpose of this exhibit is to: 1) Discuss the basic physics principles underlying sources of tissue contrast and image quality. 2) Provide an overview of acquisition methods, pulse sequences, and acceleration techniques commonly used in brain MR protocols. 3) Illustrate clinical applications and limitations of MR parameters through case examples. 4) Detail an approach to optimizing MR protocols for patient needs and pathology-specific questions.

### TABLE OF CONTENTS/OUTLINE

Tissue contrast: i) Sources of contrast: T1, T2, T2*, ? (susceptibility), PD, fat/water content, magnetization transfer, motion, ii) Weighting vs. quantitative mapping, iii) Fat saturation methodsImage quality spatial resolution, SNR, CNR, image fidelity, artifactsImage acquisition methods: i) Read-out: cartesian vs. non-cartesian k-space sampling, 2D vs. 3D, EPI, ii) Common pulse sequences: spin echo, gradient echo, SSFP, inversion recovery, DWI, perfusion, BOLD, flow sensitive, iii) Acceleration techniques: multi-coil parallel imaging (GRAPPA/SENSE, CAIPIRINHA and wave-CAIPI), simultaneous multi-slice, k-t acceleration methods for dynamic imaging, compressed sensing, deep learning methods, geometry factor (g-factor), iv) Reduced FOV (e.g., ZOOMit)Hardware: magnetic field strength, radiofrequency coils, gradient strength and slew rate, b0 and b1 shimming

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# Abstract Archives of the RSNA, 2024

NREE-120

## HYPOPHYSITIS: RADIOLOGICAL FINDINGS AND CLINICAL CHARACTERISTICS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alex Rovira-Canellas, MD (*Abstract Co-Author*) Scientific Advisory Board, Novartis AG;Speaker, Novartis AG;Scientific Advisory Board, Groupe Sanofi;Speaker, Groupe Sanofi;Scientific Advisory Board, SyntheticMR AB;Scientific Advisory Board, TensorMedical;Scientific Advisory Board, F. Hoffmann-La Roche Ltd
J. Carlos Tortajada Bustelo (*Abstract Co-Author*) Nothing to Disclose
Fidel Nunez (*Abstract Co-Author*) Nothing to Disclose
Betina Biagetti (*Abstract Co-Author*) Nothing to Disclose
Anna Casteras (*Abstract Co-Author*) Nothing to Disclose
Karelys Ng (*Abstract Co-Author*) Nothing to Disclose
Sahyly Siurana (*Abstract Co-Author*) Nothing to Disclose
Cristina Auger, MD (*Abstract Co-Author*) Nothing to Disclose
Esteban Cordero (*Abstract Co-Author*) Nothing to Disclose
Elena Martinez Saez (*Abstract Co-Author*) Nothing to Disclose
Silvana I. Sarria Estrada, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Hypophysitis is an inflammation of the pituitary gland and a rare cause of hypopituitarism. It can be primary (autoimmune or idiopathic) or secondary to sellar, suprasellar, and parasellar lesions, systemic diseases, or drugs. The most common primary hypophysitis is lymphocytic. Regardless of the etiology, patients with hypophysitis present symptoms and signs caused by inflammation that can lead to hypopituitarism with or without diabetes insipidus, and/or symptoms related to mass effect on the pituitary stalk, hypothalamus, or optic chiasm. The diagnosis relies on clinical, laboratory, and radiological findings. MRI with contrast is the preferred imaging modality, often necessitating follow-up studies to discern changes aiding in differentiation from pituitary adenomas. Treatment primarily entails hormonal replacement, with glucocorticoids reserved for cases presenting with compressive symptoms. Surgical intervention is seldom warranted.

### TABLE OF CONTENTS/OUTLINE

1. Hypophysitis is recognized as a rare inflammatory condition affecting the pituitary gland.2. Lymphocytic hypophysitis is the most prevalent form of primary hypophysitis.3. Diagnosis of hypophysitis can be challenging, but MRI plays a crucial role in confirming the diagnosis and preventing misinterpretation that might lead to unnecessary surgical interventions.4. Treatment strategies primarily involve hormone replacement therapy and the use of high-dose glucocorticoids to alleviate mass effect and manage symptoms effectively.

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# Abstract Archives of the RSNA, 2024

NREE-121

## SUBTLE IMAGING FINDINGS LEADING TO NOT-SO SUBTLE PRESENTATIONS -PEARLS AND PITFALLS OF EASY-TO-MISS EPILEPTOGENIC ETIOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mehmet E. Adin, MD (*Abstract Co-Author*) Nothing to Disclose
Richard A. Bronen, MD (*Abstract Co-Author*) Nothing to Disclose
Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Samra Iftikhar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Review the most common, uncommon, and easily missed causes of epilepsy.• Discuss types of seizures, MRI epilepsy protocol and sequences.• Describe the most important pearls, pitfalls, and causes of misses that the radiologist should know regarding each of the conditions described.

### TABLE OF CONTENTS/OUTLINE

1. Prevalence and causes of epilepsy.2. Types of seizures: simple partial, complex partial, and generalized.3. Indications for imaging in adults and children with epilepsy.4. Imaging findings of the multiple etiologies with cases from our institution.5. Common misses and pitfalls.6. Pearls and systematic approach to increase the sensitivity of the radiologist to these conditions and improve detection of even the most subtle findings, including:a. Important information to review in the patient’s chart.b. Useful imaging modalities including but not limited to MRI, CT, and nuclear medicine.c. MRI technique recommendations.d. Vital MRI sequences according to suspected etiology and patient’s agee. Appropriate level and windowing.

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# Abstract Archives of the RSNA, 2024

NREE-122

## IMAGING PATTERNS OF SKULL BASE LESIONS ON CT/MR AND THEIR MIMICS: A SIMPLIFIED SYSTEMATIC APPROACH TO ANALYZE COMPLEX SKULL BASE LESIONS AND NARROW YOUR DIFFERENTIALS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rita G. Bhatia, MD (*Abstract Co-Author*) Nothing to Disclose
Natalya Nagornaya, MD (*Abstract Co-Author*) Nothing to Disclose
Julieta Aristizabal Baron, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review pertinent anatomy of the skull base. 2. Provide a simple systematic approach and review the differential diagnosis of benign and malignant lesions of the skull base and common "pseudolesions" based on anatomic subdivisions, characteristic imaging features and patterns of growth allowing radiologists to narrow down the differential diagnosis. 3. Review specific roles and use of different imaging modalities for accurate diagnosis, localization, and staging when appropriate of most common skull base lesions.4. Highlight key points in the imaging findings that should be included in the radiology report as critical information for the pre-operative planning. 5. Highlight key imaging features of most common "pseudolesions" to help differentiate them from their potential pathologic mimics or "true lesions" and to avoid unnecessary biopsies and treatment.

### TABLE OF CONTENTS/OUTLINE

1. Pseudolesions, normal variants, and developmental anomalies: fibrous dysplasia, arrested pneumatization of the sphenoid sinus, juvenile ossifying fibroma, aneurysmal bone cyst, petrous apex cephalocele, dermoid cyst, white epidermoid cyst, neuroenteric cyst and ecchordosis physaliphora. 2. Expansile benign skull lesions: lateral sphenoid meningocele, allergic fungal sinusitis, mucocele, and cholesterol granuloma. 3. Central skull base tumors: giant cell tumor, spindle cell hemangioma, clival chordoma, invasive pituitary adenoma, and plasmacytoma. 4. Petro-clival lesions: chordoma and chondrosarcoma. 5. Vascular lesion and mimics: petrous Internal carotid artery aneurysm, carotid canal sympathetic plexus schwannoma, and cavernous sinus capillary hemangioma.

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# Abstract Archives of the RSNA, 2024

NREE-123

## CENTRAL NERVOUS SYSTEM (CNS) COMPLICATIONS IN LEUKEMIA -A COMPREHENSIVE MRI APPROACH TO DIAGNOSIS AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Mariko Kurokawa, MD (*Abstract Co-Author*) Nothing to Disclose
Noriko Doki (*Abstract Co-Author*) Nothing to Disclose
Yasunobu Takaki (*Abstract Co-Author*) Nothing to Disclose
Koichiro Mori (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- CNS complications in leukemia are diverse and can significantly impact patient outcomes.
- MRI plays a crucial role in the early diagnosis and management of CNS lesions in leukemia patients.
- Recognizing characteristic MRI findings can help differentiate various CNS complications and guide appropriate treatment.

### TABLE OF CONTENTS/OUTLINE

• Introduction
- Overview of CNS complications in leukemia
- Importance of MRI in diagnosis and management • Malignancy
- CNS infiltration and recurrence
- Post-transplant lymphoproliferative disorders • Infections
- Viral, bacterial, fungal and other infections • Cerebrovascular events
- Hemorrhage and thrombosis • Drug (and/or Radiotherapy)- related neurotoxicity
- Chemotherapy and radiotherapy-induced complications • Immune-mediated neurotoxicity
- CAR T-cell therapy and associated neurotoxicity syndromes • Conclusion
- Significance of a comprehensive MRI approach in leukemia patients

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# Abstract Archives of the RSNA, 2024

NREE-124

## METAL ARTIFACT REDUCTION IN CT ANGIOGRAPHY USING PHOTON-COUNTING DETECTOR CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Kazuhisa Matsumoto (*Abstract Co-Author*) Nothing to Disclose
Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takatsune Kawaguchi, MD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nobuo Kitera, RT, MSc (*Abstract Co-Author*) Nothing to Disclose
Masahiro Nakashima, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Photon-counting detector (PCD) CT provides CT angiography (CTA) with higher spatial resolution and less noise than energy-integrating detector (EID) CT. Metals, such as clips, coils, stents, and liquid embolic materials, used during neurosurgery or endovascular surgery cause beam-hardening artifacts, which strongly degrade images. To settle this issue, we should optimize the reconstruction techniques including field-of-view (FOV), matrix size, kernel setting, use of iterative reconstruction (IR) and metal artifact reduction algorithms (MAR). PCD-CT also provides the retrospective use of virtual monoenergetic imaging. This presentation covers the advantages and pitfalls of PCD-CT over EID-CT, and discusses the causes and types of metal artifacts, and various reconstruction techniques. We also demonstrate latest advances in PCD-CT with case-based reviews.

### TABLE OF CONTENTS/OUTLINE

1. Principles and advantages of PCD-CT, and image quality of CTA using PCD-CT. 2. Overview of artifacts in general and explanation of the mechanisms and types of metal artifacts. 3. Reconstruction techniques to reduce metal artifacts. 4. Case-based review of cases in which reconstruction techniques to reduce metal artifacts were useful. 5. Discussion for utilities of PCD-CT for metal artifact reduction with advantages, disadvantages, and pitfalls.

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# Abstract Archives of the RSNA, 2024

NREE-125

## CLINICAL APPLICATIONS OF TECHNIQUES TO REDUCE GEOMETRIC DISTORTION AND SUSCEPTIBILITY ARTIFACT IN DIFFUSION-WEIGHTED MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Shuichi Ito, MD (*Abstract Co-Author*) Nothing to Disclose
Azusa Ota (*Abstract Co-Author*) Nothing to Disclose
Hitomi Numamoto (*Abstract Co-Author*) Chairman, Canon Medical Systems Corporation
Yuichiro Monzen (*Abstract Co-Author*) Nothing to Disclose
Satoshi Ikeda (*Abstract Co-Author*) Nothing to Disclose
Yongping Ma (*Abstract Co-Author*) Nothing to Disclose
Shin Morooka (*Abstract Co-Author*) Nothing to Disclose
Satoshi Nakajima, MD (*Abstract Co-Author*) Nothing to Disclose
Sayo Otani, MD (*Abstract Co-Author*) Nothing to Disclose
Masaki Umehana, MD (*Abstract Co-Author*) Nothing to Disclose
Yasutaka Fushimi, MD (*Abstract Co-Author*) Nothing to Disclose
Koji Fujimoto, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Kanae K. Miyake, MD, PhD (*Abstract Co-Author*) Institutional research collaboration, Canon Medical Systems Corporation;
Yuji Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takayuki Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiko Sakata, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jumpei Fujimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Sachi Okuchi, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Diffusion-weighted imaging (DWI) is an essential MRI technique for assessing neurological disorders. Single-shot echo-planar imaging (SS-EPI) is the most widely used DWI technique; however, EPI-based DWI techniques are prone to susceptibility artifacts in areas of B0 field inhomogeneity. Therefore, many DWI techniques have been developed to overcome distortion caused by magnetic susceptibility. The aims of this presentation are (1) to introduce DWI techniques for distortion correction, (2) to realize the improvement of distortion in clinical cases, and (3) to discuss their clinical application. Furthermore, (4) techniques to reduce acquisition time, making these technologies more clinically useful, will also be presented.

### TABLE OF CONTENTS/OUTLINE

1. History and techniques of distortion correction in DWI.2. Clinical applications: We demonstrate examples of DWIs with distortion correction. The discussion will be categorized into the following two types of DWI techniques.(a) The methods to reduce distortions in EPI-based DWI, including Reverse encoding Distortion Correction (RDC) -DWI, etc. (b) The methods to reduce distortions using fast spin echo (FSE), including TGSE-BLADE DWI (2D turbo gradient- and spin-echo diffusion-weighted imaging with non-Cartesian BLADE trajectory), etc. 3. The techniques to reduce acquisition time for clinical applications: Specifically, they are parallel imaging, simultaneous multi-slice acceleration technique, and noise reduction technique. Noise reduction techniques include Deep Learning Reconstruction (DLR) techniques.

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# Abstract Archives of the RSNA, 2024

NREE-126

## TRACTOGRAPHY 101: A GUIDE TO SEGMENTATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karla D. Fuentes Badillo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Axon fibers, the fundamental components of neural communication, are classified into three main groups: commissural fibers, association fibers, and projection fibers. This classification is crucial for understanding the complex network of the brain. Projection fibers: white matter tracts that connect the cortex with other areas in the CNS. They may be efferent (motor) or afferent tracts (sensory), e.g., corticospinal tract, anterior thalamic radiations. Association fibers: connect different areas in the same hemisphere. There are two types of association fibers: long-range and U-fibers (short-range), e.g., arcuate fasciculus, inferior fronto-occipital fasciculi, cingulum (limbic system fibers), uncinate fasciculus. Commissural fibers: a type of white matter tract that crosses the midline, connecting the same cortical area in opposite hemispheres (right-left hemispheric connections), e.g., forceps minor and major. Three diffusion tensor imaging techniques in common use are the fractional anisotropy map, the principal diffusion direction map, and fiber-tracking maps. Axonal tracts are commonly mapped using a deterministic method called FACT (fiber assignment by continuous tracking). In this method, the user selects "seed voxels" in a particular area of the brain, and automated software computes fiber trajectories in and out of that area.

### TABLE OF CONTENTS/OUTLINE

Introduction Basics Tractography Inferior Longitudinal Fasciculus (ILF) Inferior Fronto-Occipital Fasciculus (IFO) Arcuate Fasciculus (AF) Uncinate Fasciculus (UF) (forceps major, FMA) (forceps minor, FMI) Cingulum (CBT, CBD) Fornix (FX) Corticospinal Tract (CST) Anterior Thalamic Radiations (ATR) Conclusion

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# Abstract Archives of the RSNA, 2024

NREE-127

## MIND'S MAELSTROM: CURRENTS OF INTENSITY AND DENSITY SWIRLING THE INTRACRANIAL HEMORRHAGES ETIOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To categorize the diverse etiologies of intracranial hemorrhage (ICH) and elucidate their radiological hallmarks.To explore the latest advancements in methodologies and imaging technologies for accurately pinpointing the causes of ICH.To highlight the critical role of radiological findings in guiding therapeutic strategies and prognostication for patients with ICH.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: an overview of intracranial hemorrhage. 2. Etiologies of Intracranial Hemorrhage: the prevalent and less common primary and secondary causes of ICH, such as hypertension, cerebral amyloid angiopathy, aneurysms, arteriovenous malformations, cavernous malformations, trauma, coagulopathies, tumors, vasculitis, and venous sinus thrombosis. 3. Radiological Identification of ICH Etiologies: the roles of CT, MRI, and digital subtraction angiography (DSA) in discerning the origin of the hemorrhage and the age of the clot. How imaging features, like the location and pattern of hemorrhage and associated findings, can indicate specific etiologies. ICH classification systems, including Fisher grading for subarachnoid hemorrhage, Zabramski classification for cavernous malformations, and Boston criteria for cerebral amyloid angiopathy. 4. Radiology-Guided Management and Therapeutic Approaches: how radiological findings, including the spot and swirl signs, influence active ICH management strategies, including surgical interventions. 5. Advancements in Imaging Techniques and Future Directions: recent technological innovations in radiology that improve the detection and characterization of ICH. 6. Take-home Messages.

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# Abstract Archives of the RSNA, 2024

NREE-128

## RADIOGRAPHIC INSIGHTS: SHAPING NUANCED ANATOMY - A JOURNEY THROUGH ORBITAL MYSTERIES & EYE DISEASE ENIGMAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Anna P. Riello, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Bruna E. Gherardi, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The orbit is a sophisticated anatomical area encompassing vital structures such as the eye globe, optic nerve, and extraocular muscles. Thus, the precise interpretation of orbital imaging findings necessitates a comprehensive understanding of its complex anatomy and the interrelationships among these structures. The specific objectives are as follows: To delineate the orbital anatomy and highlight the critical anatomical relationships for clinical practice. To showcase the primary imaging findings associated with orbital disorders, tailored to the anatomical specifics of each compartment. To present the detailed orbital anatomy and its interconnected structure, ensuring accurate interpretation of imaging results.

### TABLE OF CONTENTS/OUTLINE

1. Overview of Imaging Modalities, Protocols, Pitfalls, Principles, and Techniques Specific to Orbital Imaging. 2. Bony Landmarks and Foramina Within the Orbit. 3. Anatomy and Functional Aspects of the Orbital Septum. 4. Detailed Examination of the Eye Globe: Anatomy, Function, and Imaging Assessments of Disorders. 5. The Optic Nerve and Sheath: Detailed MRI Characteristics and Associated Pathologies. 6. Diagnostic Imaging of Extraocular Muscles: Anatomy and Pathological Conditions. 7. Structural and Functional Analysis of Intraconal and Extraconal Spaces: Tools for Diagnostic Imaging of Related Disorders. 8. Assessment of the Nasolacrimal Apparatus. 9. Pathological Conditions Specific to Orbital Compartments: Infections, Tumors, and Inflammatory Diseases. 10. Clinical and Surgical Perspectives: Presentation and Management Strategies for Orbital Disorders, Including Surgical Techniques. 11. Take-Home Messages.

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# Abstract Archives of the RSNA, 2024

NREE-129

## CLOCK REWIND IN STROKE STRIDE: STRETCHING TIME'S BOUNDS IN BRAIN SALVAGE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Bezerra, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The primary objective of this abstract is to delve into the evolving landscape of stroke management, emphasizing the extended window for treatment beyond the traditionally accepted timeframe. It aims to shed light on the latest neuroradiological advancements and clinical trials that support this paradigm shift. Key objectives include: To analyze the impact of recent research on extending the treatment window for ischemic stroke, including the implications for radiological practices. To evaluate the role of conventional and advanced imaging techniques in identifying patients who can benefit from treatment in the extended window phase. To discuss integrating radiological innovations into clinical guidelines, focusing on time to treat and the potential for improved recovery rates.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: historical context of the "golden hour" in stroke treatment and its limitations. 2. Pivotal studies (ex: DAWN, DEFUSE 3) that challenge the traditional treatment window, extending the time frame for eligible thrombectomy patients. 3. "Brain window" vs. "time window" — how patient-specific factors influence treatment eligibility. 4. How MRI and CT perfusion techniques have become instrumental in identifying salvageable brain tissue beyond the conventional treatment window. 5. Radiological Innovations and Clinical Trials: Overview of ongoing clinical trials exploring the limits of stroke intervention timings, including thrombectomy and intravenous thrombolysis. 6. Future Directions: The potential for further expanding the treatment window with continuous advancements in the imaging diagnosis assessment. 7. Take-home messages.

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# Abstract Archives of the RSNA, 2024

NREE-13

## THE NOVEL DUAL INJECTION CONE BEAM CT FOR ASSESSMENT OF THE ANGIOARCHITECTURE OF INTRACRANIAL DURAL ARTERIOVENOUS FISTULAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yoichi Morofuji, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understanding the complex dural arteriovenous fistula (dAVF) anatomy, especially in identifying the feeders and shunt patterns in relation to the affected sinus and cortical veins, is crucial for determining treatment approaches and predicting clinical outcomes and possible complications. We developed dual injection cone beam computed tomography (CBCT) that enabled the simultaneous identification of feeders, fistulous points, and drainers.

### TABLE OF CONTENTS/OUTLINE

Our dual injection CBCT is a novel imaging modality for assessing the angioarchitecture of dAVFs. Although 3D-DSA reveals the morphological anatomy, all vessels are depicted uniformly, making it difficult to recognize feeders, fistulous points, and drainers. In contrast, in dual injection CBCT, the presence of diluted contrast media in the drainers and undiluted contrast medium in the feeders not only makes it easier to recognize the feeders and drainers but also enables detailed evaluation of the fistulous point. Identifying fistulous points and shunt patterns is crucial for determining the treatment approaches and avoiding possible complications. Cross-sectional imaging in dual injection CBCT can provide superior information on small arterial feeders and fistulous points compared to other modalities, such as 3D-DSA, CTA, and MRI, because the gradation of the contrast media in dual injection CBCT clearly demonstrates feeders and drainers. To the best of our knowledge, our dual injection CBCT is the first report to provide the images to distinguish the feeders, fistulous points, and drainers of shunt diseases simultaneously.

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# Abstract Archives of the RSNA, 2024

NREE-130

## RIVERS OF RISK: BRAIN HIGH-FLOW VASCULAR MALFORMATIONS THROUGH RADIOLOGIC RAPIDS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Raquel Bezerra, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To explore the intricate landscape of high-flow vascular malformations within the brain, emphasizing the crucial role of radiologic imaging in their diagnosis, classification, and treatment planning. To provide a detailed overview of the types and characteristics of high-flow vascular malformations in the brain. To highlight the advancements in imaging techniques that have transformed the detection, understanding, and intervention strategies for these conditions. To explore the multidisciplinary approach to managing high-flow vascular malformations, focusing on integrating radiologic findings into arteriographic therapeutic decisions.

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 2. Classifying brain high-flow vascular malformations: arteriovenous malformations and cerebral proliferative angiopathy, their grading systems, risks, differentiation, and the implications for treatment. Overview of dural arteriovenous fistulas, including classification based on location, venous drainage patterns, and associated risks. Pial arteriovenous fistulae: epidemiology, radiographic features, complications, therapeutics, and prognosis. 3. Imaging: CT angiography, MRI angiography, 4D flow MRI, and digital subtraction angiography. 4. Challenges in imaging diagnosis: differentiating between various types of vascular malformations. The role of imaging in assessing the risks of bleeding and neurological deficits. 5. Treatment planning and radiologic guidance: endovascular treatment, surgery, and radiosurgery. 7. Clinical outcomes: the predictive value of imaging findings. 8. Take-home messages.

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# Abstract Archives of the RSNA, 2024

NREE-132

## MYSTERIES BENEATH THE MIND'S DOME: ILLUMINATING CONGENITAL MALFORMATIONS OF THE POSTERIOR FOSSA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Roberto Q. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Heber Colares Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Hernandes Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Celso Hygino, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vitor A. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Ribas, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro N. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Laura C. Magalhaes, MD (*Abstract Co-Author*) Nothing to Disclose
Elissandra M. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Tasso d. Rego (*Abstract Co-Author*) Nothing to Disclose
Maysa R. Oliveira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The primary aim of this abstract is to dissect the intricate world of congenital malformations of the posterior fossa, emphasizing the groundbreaking role of radiological imaging in their diagnosis, classification, and management. This exploration intends to: Illuminate the diverse spectrum of congenital malformations within the posterior fossa, highlighting their clinical relevance and challenges in diagnosis. Detail the advancements in radiological techniques that have revolutionized the detection and understanding of these malformations. Foster a comprehensive approach to managing these conditions, leveraging imaging findings to guide therapeutic decisions and predict outcomes.

### TABLE OF CONTENTS/OUTLINE

1. Overview of the posterior fossa's anatomy and its critical role in neurological function. 2. Introduction to the complexity of congenital malformations in this region and their impact on patient morbidity and mortality. 3. Comparative analysis of CT, MRI, and ultrasonography in the context of prenatal and postnatal imaging. 4. MRI protocol. 5. Classification of common malformations, including Dandy-Walker malformation, Chiari malformations, and arachnoid cysts, along with rarer entities like rhombencephalosynapsis and pontocerebellar hypoplasia. 6. Embryological origins and potential genetic underpinnings of these conditions. 7. Exploration of how the extent and nature of malformations as seen on imaging correlate with neurological outcomes. 8. Potential areas for future research, like genetic markers and their imaging correlates. 9. Take-home messages.

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# Abstract Archives of the RSNA, 2024

NREE-133

## CAROTID WEB: IMAGING FEATURES AND ENDOVASCULAR MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yeray Aguilar Tejedor (*Abstract Co-Author*) Nothing to Disclose
Alejandro Santana Hernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Candelaria Linares Bello, MD (*Abstract Co-Author*) Nothing to Disclose
Ernesto Santana, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Rodriguez Fuentes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To remember the craniocervical vascular anatomy. To describe the physiopathology of the carotid web and the different imaging findings. To explain the endovascular management in the treatment (stenting).

### TABLE OF CONTENTS/OUTLINE

Carotid web is a rare and under-recognized cause of stroke, especially in young patients with a high recurrence rate. It presents as a linear membrane that extends from the posterior aspect of the carotid bulb or internal carotid artery into the lumen, and is considered an atypical form of fibromuscular dysplasia. This entity predisposes to thrombus formation due to blood stasis and platelet activation. A complete clinical history and physical examination are crucial for its diagnosis. Digital subtraction angiography is the gold standard diagnosis procedure. Endovascular procedures, such as stenting, plays an important role in its management.

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# Abstract Archives of the RSNA, 2024

NREE-134

## IMAGING REVIEW AND CLINICAL MANIFESTATIONS OF LACUNAR STROKE SYNDROMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria Lucia Brun, MD (*Abstract Co-Author*) Nothing to Disclose
Thurl Cledera, MD (*Abstract Co-Author*) Nothing to Disclose
Stacey Danica L. Gosiaco, MD (*Abstract Co-Author*) Nothing to Disclose
Randall S. Teh, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin Ryan T. Yu, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Lacunar stroke syndromes represent a distinct subset of ischemic strokes, characterized by small subcortical infarcts resulting from occlusion of deep penetrating arteries. Difficulty may be encountered on imaging due to their small size unless there is a high index of suspicion. Correlation with the clinical presentation and imaging findings is paramount to diagnosis. The objectives of this exhibits are: 1) Understand the intricate relationship between neuroanatomy, vascular pathology, and clinical manifestations, 2) Recognize imaging features and patterns of lacunar stroke syndromes, 3) Develop a clinical approach to detecting infarct in acute brain imaging

### TABLE OF CONTENTS/OUTLINE

IntroductionA. Definitions and NeuroanatomyB. Mechanism of Lacunar InfarctionC. Clinical PresentationD. Imaging ConsiderationClassic Lacunar SyndromesA. Pure Motor HemiparesisB. Ataxic HemiparesisC. Pure Sensory StrokeD. Sensorimotor StrokeE. Dysarthria-Clumsy Hand SyndromeAtypical Lacunar SyndromesA. Internuclear OpthalmoplegiaB. Isolated DysarthriaC. Hemichorac/HemiballismusD. Isolated Gaze PalsyE. Paramedian Thalamic SyndromeConclusion

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# Abstract Archives of the RSNA, 2024

NREE-135

## ALTERED VISUALIZATION OF DEEP MEDULLARY VEINS IN VARIOUS INTRACRANIAL DISORDERS: A STUDY OF SWI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Eun Ja Lee, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To understand the physics of susceptibility-weighted MR imaging (SWI) and the venous anatomy on SWI.To investigate the fine anatomic structure of medullary veins of cerebral white matter on SWI.To describe various intracranial disorders in which the medullary veins play a major role in disease development.To assess the clinical significance of altered visualization of deep medullary veins in various intracranial disorders

### TABLE OF CONTENTS/OUTLINE

1. General overview of SWI, including assessment of venous hemodynamics 2. Understanding the overall venous anatomy and anatomic structure of medullary veins in the cerebral hemisphere 3. Exploring the fine radiologic anatomy of the medullary veins using SWI. 4. Discussion of disorders related to altered visualization of deep medullary veins 1) changes of deep medullary veins in patients with acute and subacute ischemic stroke 2) changes of deep medullary veins in patients with moyamoya disease 3) changes of deep medullary veins in patients with cerebral venous sinus thrombosis - major dural sinuses / cortical veins / deep veins4) changes of deep medullary veins in vascular anomaly or malformation - developmental venous anomaly / Sturge Weber syndrome / dural arteriovenous fistula 5) hemorrhagic disorders related to deep medullary veins - diffuse vascular injury due to trauma / deep medullary vein engorgement or thrombosis in neonates 6) changes of deep medullary veins in cerebral small vessel disease 7) changes of deep medullary veins in cognitive impairment 8) changes of deep medullary veins in patients with brain death 9) post-operative changes of deep medullary veins 10) others 5. Summary and conclusion

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# Abstract Archives of the RSNA, 2024

NREE-136

## LOOK TO THE BUBBLE - NEURORADIOLOGICAL ASPECTS OF INTRACRANIAL CYSTIC LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz R. Uchoa, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Freire, MD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Thiago B. Fernandes Feitosa, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Ramos, MD (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cysts are often seen in brain imaging. Distinguishing between these cysts based solely on imaging findings can be difficult due to their varied presentations. A location-based approach and specific imaging features can help in making a more precise diagnosis.1) To review imaging findings of brain cystic lesions.2) Recognize the different types of brain cystic lesions, categorized on the basis of their causes and localization.3) A practical approach to interpreting these conditions systematizing the evaluation based on main neurologic imaging findings and clinical features.4) Formulate a differential diagnosis for a cystic-appearing lesion in the central nervous system, considering its location or site of origin and imaging features.

### TABLE OF CONTENTS/OUTLINE

1) Introduction.2) Localization of brain cystic lesions: Extra-axial x Intra-axial.3) Cystic lesions and other neurological imaging findings tips.4) Visual systematization of different types of cystic lesions.5) Main differential diagnosis for a cystic-appearing lesion.6) Take home messages.

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# Abstract Archives of the RSNA, 2024

NREE-137

## NEUROLOGICAL COMPLICATIONS OF VARICELLA ZOSTER VIRUS: COMPREHENSIVE UPDATE AND REVIEW OF CLINICAL AND IMAGING FEATURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Takashi Katsube (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshizako, MD (*Abstract Co-Author*) Nothing to Disclose
Yasushi Kaji, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Aiko Gobara, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Varicella zoster virus (VZV) infection causes several neurological complications, which can be severe because VZV reactivation is associated with a compromised immune system. Diagnosis of VZV is difficult in the absence of a characteristic rash, but is important because of the need for early antiviral therapy. MRI is a non-invasive diagnostic tool that can help reveal the neurological complications of VZV disease. Here, we review the neurological complications of VZV and discuss their diagnosis, differential diagnosis and validated imaging modalities.1. To provide a clinical and radiological review of the central nervous system (CNS) and peripheral nervous system (PNS) complications of VZV infection.2. To provide an anatomical and pathological review of the mechanisms by which CNS and PNS complications of VZV infection occur and spread, and to correlate these with imaging findings.3. To describe effective methods for the detection of neurological complications of VZV infection by imaging.

### TABLE OF CONTENTS/OUTLINE

A. Epidemiology and clinical features of neurological complications in VZVB. Radiological review of CNS and PNS complications of reactivated VZV and differential diagnosis of each 1. Meningoencephalitis 2. Cranial nerve palsies 3. Vasculopathy 4. Myelitis 5. Other neurological complications such as optic neuritis and perineuritisC. Effective Conventional MR imaging of brain, spinal cord, and peripheral nerve lesionsD. Advanced MR imaging methods for neurological complication detectionGd 3D-FLAIR, vessel wall imaging, 3D MR neurography

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# Abstract Archives of the RSNA, 2024

NREE-138

## NAVIGATING THE MAZE: MULTIMODAL IMAGING AND TECHNIQUES FOR DIAGNOSING ALZHEIMER'S DISEASE AND RELATED MEMORY DISORDERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Akane Ozawa (*Abstract Co-Author*) Nothing to Disclose
Junichi Tsuchiya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ukihide Tateishi, PhD (*Abstract Co-Author*) Nothing to Disclose
Jun Oyama (*Abstract Co-Author*) Nothing to Disclose
Tomoki Imokawa, MD (*Abstract Co-Author*) Nothing to Disclose
Kota Yokoyama, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand imaging criteria for Alzheimer’s Disease using MRI, SPECT, and PET.2. Recognize differential diagnosis importance in memory disorders via case reviews.3.Learn to apply visual and statistical analysis tools for accurate clinical diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Imaging Techniques- Role of imaging in memory disorders, focusing on Alzheimer's Disease.- MRI: Identifying key and progressive AD signs.- PET/SPECT: Using metabolic, amyloid, and tau imaging for AD.- Statistical tools for objective assessment.2. Case Studies- Typical imaging features in advanced AD.- Early AD signs and nuclear medicine's role.- Differential diagnosis via MRI: Vascular dementia, Creutzfeldt-Jakob Disease, Neuronal Intranuclear Inclusion Disease, fragile X-associated tremor/ataxia syndrome, Hereditary diffuse leukoencephalopathy with spheroids, Cerebral Autosomal Dominant Arteriopathy with Subcortical Infarcts and Leukoencephalopathy, Primary progressive multiple sclerosis, HIV encephalopathies, delayed hypoxic encephalopathies, Intravascular Large B cell Lymphoma, Neuropsychiatric SLE.- Differential diagnosis via nuclear medicine: Frontotemporal lobe dementia, Dementia with Lewy bodies, Corticobasal syndromes.3. Future DirectionsOverview of advanced imaging techniques in dementia research.

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# Abstract Archives of the RSNA, 2024

NREE-139

## JOURNEY INTO THE CRANIOVERTEBRAL JUNCTION: NAVIGATING THE CRANIOCERVICAL INSTABILITY WITH DYNAMIC CT AND MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gaurav Pradhan (*Abstract Co-Author*) Nothing to Disclose
Jyoti Kumar, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammad Shoaib, MBBS,MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understanding CCI Dive into the clinical significance of craniocervical instability (CCI), exploring its impact on patient's lives and the urgency of early detection to mitigate adverse outcomes. 2. Technical Mastery Familiarise with the intricacies of dynamic MRI and CT imaging, uncovering tips and tricks to optimize image quality and overcome common challenges. 3. Quantitative Parameters Demystified Decode the significance of key quantitative parameters for CCI assessment, mastering measurement techniques and understanding their diagnostic and therapeutic implications. 4. Real-Life Application Embark on real-life adventures through case studies, and offer valuable insights for diagnosis and treatment.

### TABLE OF CONTENTS/OUTLINE

I. Let's Get Started! A. What's the Big Deal with Craniocervical Instability (CCI)? B. Why Dynamic Imaging Holds the KeyII. Tech Talk: Getting the Perfect ShotProtocols for dynamic MRI and CT acquisition.III. Crunching Numbers: Your CCI Cheat Sheet A. Meet the Superheroes: Atlantodens Interval, Grab Oakes measurement, Clivoaxial angle, and More B. How These Numbers Solve Mysteries in CCIIV. Case Files: Stories from the Trenches From Ligamentous Laxity to the Perils of Compression: Real-Life CCI DramaV. Speak Radiology: From Reports to Conversations A. Putting Quantitative Parameters into Words That Make Sense B. Tips for Communicating Like a Pro with CliniciansVI. Tricky Trails: Avoiding Pitfalls in CCI Diagnosis A. Navigating the Treacherous Terrain of Inconclusive Measurements B. How to Stay on Course When the Diagnostic Maze Gets Tough

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# Abstract Archives of the RSNA, 2024

NREE-14

## STALKING THE PITUITARY: LESIONS GROWING ALONG THE PITUITARY STALK

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Luana Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize pituitary stalk thickening and expansive lesions that grow along the pituitary stalk- Review radiological findings of each pathology through a serie of cases- Narrow down diagnostic hypothesis by radiological findings, age and clinical information

### TABLE OF CONTENTS/OUTLINE

- IntroductionOverview of sellar and parasellar anatomyPituitary stalk thickening and epidemiologyPituitary stalk expansive lesions and epidemiology- Imaging TechniqueBest image protocolsContrast media useMethod limitations- Image interpretationRadiological findings of pituitary stalk thickening and expansive lesions Associate radiological findings with patient’s background to narrow down differential diagnosis Describe MRI key features of each lesion

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# Abstract Archives of the RSNA, 2024

NREE-140

## TRANSVERSE RELAXATION RATE R2* IN NEUROIMAGING: POTENTIAL VALUE AND CLINICAL APPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ayman Nada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahmoud Samir (*Abstract Co-Author*) Nothing to Disclose
Mostafa Amor (*Abstract Co-Author*) Nothing to Disclose
Josh Greaser (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. Allokka (*Abstract Co-Author*) Nothing to Disclose
Mark Doss (*Abstract Co-Author*) Nothing to Disclose
Yaseen Dhemesh (*Presenter*) Nothing to Disclose

### TEACHING POINTS

do an introduction to R2 star Imaging in Neuroradiologyexplain basic physics of R2 star Imagingdescribe Different Models of Data Analysisdescribe Different Packages for Data Analysis and Visualizationdescribe Challenges of Clinical Applicationdescribe Clinical Application in Neuroimaging

### TABLE OF CONTENTS/OUTLINE

illustration about the concept of R2 starexplain basic physics of IVIM Imaging includingRadiofrequency Excitation and RelaxationT2 Relaxation and Decay R2 Valuesexplain the clinical Significance of R2 MRImention advantages and Challengesexplain 7T MRI and Enhanced R2 Imaging

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# Abstract Archives of the RSNA, 2024

NREE-141

## FOUND BY MORE THAN A STROKE OF LUCK: A REVIEW OF IMAGING MANIFESTATIONS AND RISK FACTORS FOR INCIDENTAL, PREVIOUSLY UNKNOWN CEREBRAL INFARCTS ON CT IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Long H. Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Kuehne, MD (*Abstract Co-Author*) Nothing to Disclose
Saeed Rahmani (*Abstract Co-Author*) Nothing to Disclose
Carys Kenny-Howell (*Abstract Co-Author*) Nothing to Disclose
Danling Chen, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

An estimated 9 to 13% of strokes are not diagnosed upon initial clinical presentation, with many infarcts detected as incidental chronic findings on CT head imaging later performed for unrelated purposes.-To understand the clinical implications and potential changes in management that an occur when previously unknown strokes are seen on brain imaging.-To become familiar with the radiographic manifestations and imaging findings of incidental prior strokes.-To recognize the risk factors for missed or delayed stroke diagnosis, including unusual clinical symptomatology and patient characteristics which place specific subgroups at increased risk

### TABLE OF CONTENTS/OUTLINE

-Overview of the prevalence and clinical impact of missed or delayed diagnosis of stroke-Discuss the clinical implications of identifying previously unknown, even chronic strokes on primary and secondary prevention strategies to prevent stroke-related complications-CT head imaging features of incidental chronic stroke, including: infarct location (cortical vs subcortical), infarct size, vascular territory, and evolution in appearance over time-Recognizing stroke and non-stroke causes encephalomalacia (postsurgical changes, trauma, infection, congenital disorders, variant neurologic anatomy, and imaging artifact)-Identification of risk factors for missed or delayed stroke diagnosis (Non-traditional clinical signs and symptoms of stroke, Patient demographic factors, Hospital visit characteristics)

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# Abstract Archives of the RSNA, 2024

NREE-142

## BENEATH THE SURFACE: UNVEILING SPLIT CORD MALFORMATIONS THROUGH IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Surjith Vattoth, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Akram Alwarqi, MD (*Abstract Co-Author*) Nothing to Disclose
Asma Intakhab (*Abstract Co-Author*) Nothing to Disclose
Syed I. Alam, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Jouhar Jabeen Kolleri, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Syeda Shabistan Intekhab, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review embryonic pathogenesis of split cord malformation (SCM)2. Review types of SCM and their imaging features and clinical significance.3. Review associations of SCM and pertinent imaging findings

### TABLE OF CONTENTS/OUTLINE

- Overview of SCM and clinical presentation
- Embryonic pathogenesis of SCM
- Types of SCM (Pang’s classification) and imaging characteristicsa. Type 1b. Type 2
- Common associations of SCMa. Segmentation and fusion anomaliesb. Tethered cordc. Syringomyeliad. Scoliosis/Kyphoscoliosise. Meningomyelocelef. Spinal Lipoma
- Imaging recommendations, pearls and pitfalls

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# Abstract Archives of the RSNA, 2024

NREE-143

## THALAMIC INFARCTS: CLINICAL PRESENTATION WITH REVIEW OF ANATOMY AND VASCULAR SUPPLY OF RELEVANT THALAMIC NUCLEI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rishi K. Gosalia, MD (*Abstract Co-Author*) Nothing to Disclose
Liam M. O'Neill, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Taggart, DO (*Abstract Co-Author*) Nothing to Disclose
Tamim Sultani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Most common cause of unilateral thalamic infarcts is microvascular disease with less common causes to include large vessel arterial plaque disease and embolic infarcts. Microvascular disease related thalamic infarcts usually occur in the ventrolateral territory while large vessel plaque infarcts involve the posteromedial territories. Bilateral thalamic infarct etiology includes artery of Percheron occlusion, top of basilar artery occlusion and deep venous sinus thrombus.

### TABLE OF CONTENTS/OUTLINE

The exhibit is formatted as 2 clinical cases. The first case is an 86-year-old female who presented with abnormal sensation in the corner of mouth and ipsilateral hand and foot found to have an acute infarct in the contralateral thalamus within the VPM/VPL nuclei consistent with Cheiro-Oral Pedal Syndrome. The second patient is a 47-year-old male who presented with numbness and pain in left forehead, maxilla, neck, chest and thigh with stabbing headache behind the eyes. This patient was also found to have an acute lacunar infarct within the VPL nucleus of the right thalamus and was diagnosed with thalamic pain syndrome. The affected thalamic nuclei in these cases are the ventral posteromedial (VPM) and ventral posterolateral nuclei (VPL). Infarcts in this region of the thalamus can present with myriad of symptoms including sensorimotor deficits with sudden onset and severe symptoms. Sensory loss and decreased levels of consciousness are also commonly seen in VPM/VPL thalamic nuclei infarcts. These regions of the thalamus are predominately supplied by paramedian or thalamic perforators from P1 and P2 segments of the PCA. The VPL nucleus is supplied by the posterior choroidal artery, a branch of the P2 segment PCA.

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# Abstract Archives of the RSNA, 2024

NREE-15

## THE MERGE OF BONES: DELVING INTO SYNOSTOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Nunes (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Diego C. Fragoso (*Abstract Co-Author*) Nothing to Disclose
Carlos Jorge da Silva, PhD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The development of the face and skull is orchestrated by a complex three-dimensional morphogenetic process involving hundreds of genes controlling a coordinated pattern of tissue proliferation, and differentiation from different embryological origins.Imaging characteristics allow differentiation between positional plagiocephaly and that resulting from craniosynostosis.Tomographic studies with 3D reconstruction are the gold standard for imaging in the diagnosis and classification of craniosynostoses for potential surgical planning, as they allow for great detail of the bone structure.MRI studies provide a better assessment of the brain parenchyma, especially in patients with syndromic craniosynostoses, where other findings may be present.In some cases, imaging markers allow for the diagnosis of a specific disease or at least a group of diseases.

### TABLE OF CONTENTS/OUTLINE

IntroductionTo review (1) normal suture anatomy and (2) pattern of suture closureGenetic and Pathophysiological PerspectivesTo depict genetic and embryology of cranial suturesImagingTo discuss the main imaging modalities, including their strengths and weaknessTo guide radiologists in the differentiation between positional plagiocephaly from true synostosisTo demonstrate the imaging spectrum of craniosynostosis, involving single versus multiple suture fusionTo identify the main imaging markers that enable a confident diagnosis of a specific disease or a group of related diseasesTo highlight potential associated abnormalities

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NREE-16

## COMPARATIVE EVALUATION OF HABENULAR VOLUME AND IRON CONTENT USING MANUAL AND NORMALIZED SEGMENTATION TECHNIQUES IN STAGE SEQUENCES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

E. Mark Haacke, PhD (*Abstract Co-Author*) Research Grant, Biogen Idec Inc ;President, Magnetic Resonance Innovations, Inc
Lei Zhang (*Abstract Co-Author*) Nothing to Disclose
Yueluan Jiang (*Abstract Co-Author*) Nothing to Disclose
Bingyang Bian (*Abstract Co-Author*) Nothing to Disclose
Xingchen Pan (*Abstract Co-Author*) Nothing to Disclose
TAO LI (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Using different segmentation methods to study the intergroup differences in the volume and iron content of the habenula between patients with first episode depression (FED) and control group. All subjects underwent STAGE sequence magnetic resonance imaging (MRI). Volume measurement included two methods, the first involved manual segmentation using ITK-SNAP (Figure 1), and the second used a habenular brain template created from a high-resolution, high-contrast template comprised of a total of 990 brain scans, followed by post-processing with FSL software to obtain the volume of the habenula (Figure 2). Due to poor matching of QSM to the MNI 152 space, iron content was measured only through manually segmented brain templates in the QSM sequence.There were no differences in gender or age between patients with FED and the control group ($p > .05$) (Table 1). Using manual segmentation, there were no differences in volume or iron content of the bilateral habenula between FED patients and the control group ($p > .05$). However, standardized segmentation of the habenula showed intergroup differences, with a larger habenula volume in FED patients ($p < .05$). Furthermore, we compared the results of manual segmentation and standardized segmentation, finding intergroup differences in the right habenula ($p < .05$) (Table 2).The above results indicate that manual segmentation involves a certain level of subjectivity, while standardized segmentation is more sensitive in detecting intergroup differences. This suggests the need for applying more refined segmentation techniques in this field to achieve superior segmentation results in the future.

### TABLE OF CONTENTS/OUTLINE

ObjectiveMethods ResultsConclusion

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# Abstract Archives of the RSNA, 2024

NREE-17

## CONUS MEDULLARIS, FILUM TERMINALE AND CAUDA EQUINA: A POUTPORRI OF DIFFERENTIAL DIAGNOSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Christiane M. Campos, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Abstract Co-Author*) Nothing to Disclose
Taisa Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Sameer P. Chandra, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Laura Petruz Piassa, MD (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To illustrate the anatomical landmarks of the conus medullaris, filum terminale and cauda equina.To show the spectrum of pathologies affecting these structures using a case-based approach.To review the various pathological processes and their imaging features, based on magnetic resonance imaging (MRI).Provide differential diagnosis of lesions according to congenital, inflammatory/ infectious/ demyelinating auto-immune, neoplastic and vascular etiologies.

### TABLE OF CONTENTS/OUTLINE

The conus medullaris represents the tapered terminus of the spinal cord, is a vital anatomical landmark in diagnostic radiology. The filum terminale is a small thin filament of connective tissue that extends inferiorly from the apex of the conus medullaris to the sacrum. Cauda equina is the collective term given to nerve roots distal to the conus medullaris, which occupy the lumbar cistern. A thorough grasp of its anatomy, common anatomical variations, and the diagnostic challenges associated with lesions in this area is crucial for radiologists. This pictorial essay provides a detailed review of the anatomy as well as the broad differential diagnosis of lesions located in these topographies. Differential diagnoses were addressed by etiology and divided into the following groups: congenital, vascular, inflammatory/ infectious, neoplastic and miscellaneous.MRI is the method of choice for evaluating these lesions, as it provides better tissue and contrast resolution in the analysis. The knowledge of the anatomy and imaging patterns of lesions located in these areas is crucial for radiologists to be able to narrow the differential diagnosis, guiding a more efficient therapeutic approach to patients.

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# Abstract Archives of the RSNA, 2024

NREE-18

## IMAGING FOLLOW-UP OF THE LONG-TERM THERAPEUTIC MECHANISM OF VERMICULITE NANOSHEETS ON ISCHEMIC STROKE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Feng Lishuai (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Intraventricular injected vermiculite (VMT) enter into brain parenchyma through damaged cerebrospinal fluid brain barrier.VMT were swallowed by microglia and then reduced the release of proinflammatory factor by microglia through regulating upstream signaling pathways.VMT also improved survival rate of neuron and the integrity of BBB after ischemic stroke, reduced the "no-reflow" after reperfusion.All these protective effects of VMT is demonstrated by MRI and ultrasound super-resolution imaging technology.

### TABLE OF CONTENTS/OUTLINE

Ischemic stroke is a common neurological disorder and a major cause of permanent disability in patients. So far, few therapeutic drugs that can treat neurological damage in stroke. Therefore, protecting nerves and promoting neural function recovery remain an urgent research area. In this study, we adopted the method of intraventricular injection of VMT nanosheets. By comparing the areas of abnormal diffusion weighted imaging (DWI) signals with VMT nanosheets entering the brain, and using techniques such as biological transmission electron microscopy and immunofluorescence, we elucidated the passive targeted delivery characteristics of VMT nanosheets at different time points after stroke. Furthermore, the multi-target protective effects and prognosis of VMT nanosheets on neurons, glial cells, and cerebral blood vessels after stroke were explored through motor and cognitive-behavioral studies, MRI, ultrasound super-resolution in vivo imaging techniques, and brain tissue samples validation. These results demonstrated the enormous potential of VMT nanosheets in the application of ischemic stroke.

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# Abstract Archives of the RSNA, 2024

NREE-19

## THESE GO TO ELEVEN: SERIOUS SPINAL TAP COMPLICATIONS YOU SHOULD KNOW ABOUT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Alvaro Jose de la Iglesia Salas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This exhibit intends• To acquaint the reader with the most crucial intracranial and spinal complications after lumbar puncture (LP) through a series of cases in a multimodality fashion.• To discuss the significance of dura-arachnoid enhancement after LP.• To review the technique, risk factors, and contraindications for LP.The main teaching points are• LP is a generally safe diagnostic and therapeutic procedure.• The rate of severe complications is low, but radiologists may encounter some in their careers. Familiarization with these adverse effects will grant a timely and correct diagnosis.• Chief risk factors are traumatic or non-sterile technique, bleeding diathesis, raised intracranial pressure, and challenging anatomy.• CT and MRI should be scrutinized for signs of intracranial and spinal hemorrhage, cerebrospinal fluid leak, intracranial hypotension, herniation, and dural sinus thrombosis.• Meningitis, abscess, arachnoiditis, epidermoid cyst, and foreign body constitute more unusual sequelae to be mindful of.• Diffuse dura-arachnoid enhancement should likely not be a concern for delaying LP since it is not prevalent without intracranial hypotension, strongly advising to exclude other causes first when present.

### TABLE OF CONTENTS/OUTLINE

• Introduction: relevant anatomy, LP technique, general indications.• General contraindications and risk factors for complications following LP.• LP complications: spinal and intracranial hemorrhage, cerebrospinal fluid leak, intracranial hypotension, cerebral and cerebellar herniation, dural sinus thrombosis, arachnoiditis, meningeal infection, abscess, epidermoid cyst, foreign body.• Dura-arachnoid enhancement after LP.• Conclusion.

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# Abstract Archives of the RSNA, 2024

NREE-2

## SPETZLER MARTIN TAKE THE WHEEL! STEERING CLEAR FROM BRAIN TRAFFIC JAMS: AVM REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Amanda P. Marrero-Gonzalez, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Machicote, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Kevin Hornedo, BS (*Abstract Co-Author*) Nothing to Disclose
Claudia Muns, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandra Cardona Del Valle, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the grading of Arteriovenous Malformations (AVMs) as defined by the Spetzler-Martin classification. Provide anatomical diagrams of Grade I-V of AVMs. Contribute case examples with pathognomonic imaging findings of grade I-V AVMs on CT, MRI, and angiography studies. Define the possible complications of AVMs and their corresponding management. Provide a self-assessment tool for the classification of AVMs as defined by the Spetzler Martin classification.

### TABLE OF CONTENTS/OUTLINE

Educational Objectives Introduction. Arteriovenous Malformations (AVMs) Spetzler-Martin classification - Grade I-V Anatomical Diagrams, CT, MRI, and Angiography Imaging Findings and Treatment Options. Complications of AVMs. Self-assessment with multiple cases in quiz format. Conclusion. Brain AVMs are vascular lesions characterized by a connection between feeding arteries and a draining venous network without an intervening capillary bed. Clinically, AVMs can exhibit variable initial presentations and may result in serious outcomes such as intracranial hemorrhages, seizures, neurological deficits, and death. While diagnosis is made through different imaging modalities, management is mostly surgical. Thus, understanding AVM structure and location becomes relevant for planning appropriate interventions and anticipating potential complications. This exhibit will review the grading of AVMs as defined by the Spetzler-Martin classification using a pictorial depiction of lesions along with their appearance on various imaging modalities such as MRI, CT, and angiography. We will also discuss complications associated with AVMs, and address the role of radiology in guiding treatment decisions.

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# Abstract Archives of the RSNA, 2024

NREE-20

## CLINICAL NEUROIMAGING IMPLICATIONS OF 7-TESLA MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Brian P. Rigney, MD (*Abstract Co-Author*) Nothing to Disclose
Priti Balchandani, PhD (*Abstract Co-Author*) I am a named inventor on patents relating to magnetic resonance imaging (MRI) and RF pulse design. The patents have been licensed to GE Healthcare, Siemens AG, and Philips international. I receive royalty payments relating to these patents.I am a seed inv
Akbar Alipour, PhD (*Abstract Co-Author*) Nothing to Disclose
Hamza Chengazi, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley N. Delman, MD, MS (*Abstract Co-Author*) Consultant, Guerbet SA
Raj Shrivastava (*Abstract Co-Author*) Nothing to Disclose
Sema Yildiz (*Abstract Co-Author*) Nothing to Disclose
Sadaf Afif (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. 7-Tesla MRI (7T) offers high spatial and contrast resolution with a superior signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) than conventional field strengths, enhancing clinical application by improving the detection and characterization of both normal and abnormal structures. This exhibit showcases clinical advantages of 7T. 2. High spatial and contrast resolution plays a role in imaging for trigeminal neuralgia, where 7T MRI has the potential to improve diagnosis associated with pathologies like masses, local vascular alterations, and microstructural changes. 3. The anatomy of the skull base poses a challenge for imaging of skull base tumors. 7T could play a crucial role in enhancing comprehensive preoperative tumor assessment, vital for precise surgical planning for achieving adequate tumor resection and minimizing morbidity. 4. 7T enhances noninvasive diagnosis of focal epileptogenic lesions and associated microstructural features with precise trigger point detection in patients with nondiagnostic conventional field studies which expedites targeted treatment planning. 5. The identification of cortical lesions, white matter plaques, and characterization of imaging biomarkers such as central vein sign in Multiple Sclerosis could be significantly enhanced by 7T, addressing challenges often seen with conventional MRI. 6. 7T may play a promising role in the diagnosis and follow-up of Alzheimer’s disease by better elucidating structural changes and accompanying pathologies such as cerebral microbleeds with superior resolution.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Trigeminal Neuralgia 3. Skull Base Tumors 4. Epilepsy 5. Multiple Sclerosis 6. Alzheimer’s Disease

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# Abstract Archives of the RSNA, 2024

NREE-21

## TEMPORAL LOBE EPILEPSY WITH A FOCUS ON UNDERLYING ANATOMY: A PRIMER FOR THE RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Justin Sindoni, MD (*Abstract Co-Author*) Nothing to Disclose
Richard A. Bronen, MD (*Abstract Co-Author*) Nothing to Disclose
Irene Dixe de Oliveira Santo, MD (*Abstract Co-Author*) Nothing to Disclose
Aline Herlopian (*Abstract Co-Author*) Nothing to Disclose
Chong Zhou, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review pertinent anatomy of the limbic system underlying temporal lobe epilepsy (ex. hippocampus, fornix, parahippocampal gyrus, cingulate).2. Review potential limbic anatomy variants that may be mistaken for pathology.3. Review cases of pathologies associated with temporal lobe epilepsy.Abstract: Temporal lobe epilepsy (TLE) is the most common type of epilepsy and accounts for about half of all cases of focal epilepsy. Diagnosis of epilepsy related radiological abnormalities often depends on identification of subtle imaging features involving the temporal lobe or limbic structures which can precipitate temporal lobe seizures. Accurate interpretation can be prone to error because unlike other neurological diseases such as tumors and demyelinating lesions, abnormalities in TLE may not involve significant MRI signal changes or distortion of brain anatomy. Additional normal individual differences in sulcal and gyral positioning and anatomy pose additional challenges. This exhibit will review normal anatomy, variant anatomy that may be confused with pathology, and pathologies that should be identified in the initial evaluation for TLE. We will review the concept of the limbic network and its functions and connections. Ultimately, this exhibit will serve as a primer for practicing radiologists in assessing complex and less recognized findings in medically refractory TLE.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. Background - Seizure workup with clinical context3. Normal anatomy of structures involved in temporal lobe epilepsy4. Examples of pathology involving limbic structures with clinical cases Summary of search pattern for TE seizure evaluation

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# Abstract Archives of the RSNA, 2024

NREE-22

## EXPLORING THE CEREBRAL AMYLOID ANGIOPATHY: WHAT THE RADIOLOGIST SHOULD KNOW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Renata Bertanha, MD (*Abstract Co-Author*) Nothing to Disclose
Jairo Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana L. Arcanjo, MD (*Abstract Co-Author*) Nothing to Disclose
Vitoria L. Taumaturgo da Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Breno A. Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamim W. Handfas, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Campos Neto (*Abstract Co-Author*) Nothing to Disclose
Larissa Cavalcante Bomfim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review important anatomic landmarks related to cerebral amyloid angiopathyTo review the imaging technique and protocols for the evaluation of cerebral amyloid angiopathyTo review the noninvasive clinical-radiological diagnostic criteria of cerebral amyloid angiopathy and CAA-related inflammationTo recognize the imaging features of cerebral amyloid angiopathy and CAA-related inflammation, and their correlation with diagnostic criteria.To discuss the use of the Amyloid-PET in the evaluation of the cerebral amyloid angiopathy

### TABLE OF CONTENTS/OUTLINE

IntroductionAnatomic landmarks related to cerebral amyloid angiopathyImaging Technique and Protocols for the evaluation of cerebral amyloid angiopathyClinical-radiological diagnostic criteria of cerebral amyloid angiopathy and CAA-related inflammationImaging Features of Cerebral Amyloid Angiopathy and CAA-Related Inflammation and Diagnostic Criteria Correlation with Teaching CasesAmyloid-PET in the evaluation of the CAA with Teaching CasesTake Home MessagesReferences

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# Abstract Archives of the RSNA, 2024

NREE-23

## CEREBRAL VENOUS THROMBOSIS: UNRAVELING ITS EVOLUTION AND COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alcino Alves Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Luis F. Godoy, MD (*Abstract Co-Author*) Stockholder, Johnson & Johnson;Stockholder, Illumina, Inc;Stockholder, UnitedHealth Group
Frederico Adolfo B. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana D. Hirata, MD (*Abstract Co-Author*) Nothing to Disclose
Breno A. Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio A. Dalpra, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Renata Bertanha, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos V. Camargo, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe B. Nascimento, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Benjamim W. Handfas, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa Cavalcante Bomfim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the anatomy of the cerebral venous system and its drainage territoriesTo review the imaging technique and protocols for the evaluation of Cerebral Venous Thrombosis To recognize the imaging features of cerebral venous thrombosis and its complicationsTo be familiarized with the evolution of cerebral venous thrombosis

### TABLE OF CONTENTS/OUTLINE

IntroductionAnatomy of the Cerebral Venous System and its Drainage TerritoriesImaging Technique and Protocols for the Evaluation of Cerebral Venous Thrombosis and its ComplicationsImaging Features of Cerebral Venous Thrombosis with Teaching CasesCerebral Venous Thrombosis Evolution with Teaching CasesCerebral Venous Thrombosis Complications with Teaching CasesTake Home MessagesReferences

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# Abstract Archives of the RSNA, 2024

NREE-24

## ARTERIAL SPIN LABELING ASSESSMENT OF CEREBRAL ARTERIOVENOUS FISTULAE AND MALFORMATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Abraham Noorbakhsh, MD,MPH (*Abstract Co-Author*) Nothing to Disclose
Divya S. Bolar, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Usha Trivedi, MD, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Arterial spin labeling (ASL) is a noninvasive MRI technique that magnetically labels blood for use as an endogenous tracer for to assess cerebral perfusion. ASL is exquisitely sensitive for detecting arteriovenous fistulae (AVF) and arteriovenous malformations (AVM) via arterialized signal in the venous system and/or nidus. ASL can identify subtle AV shunt lesions and provides valuable insight into the progression or resolution of these lesions on follow-up imaging. However, mimics of AV shunt lesions on ASL, such as jugular venous reflux and venous thrombosis, can confound interpretation and warrant additional imaging for confirmation. This educational exhibit showcases the utility of ASL for diagnosing and assessing AVF and AVM and provides examples of mimics of which the neuroradiologist should be aware.

### TABLE OF CONTENTS/OUTLINE

1. Vascular Shunt Lesions - Review of arteriovenous malformations (AVM) and arteriovenous fistulae (AVF) 2. Current Methods of Assessing Shunt Lesions - Imaging methods to evaluate AVM and AVF 3. Discussion of Arterial Spin Labeling (ASL) - Review on acquisition and interpretation of ASL in the setting of AV shunting - Comparison of ASL with other techniques to assess shunt lesions 4. Cases of AVM with ASL - Examples of large and small AVMs 5. Cases of AVF with ASL - Examples of carotid cavernous fistula - Examples of dural arteriovenous fistula 6. ASL to Assess Follow up Studies - Progression and improvement of AVF and AVM on ASL 7. Pitfalls of ASL - Mimics of arterialized signal, including jugular venous reflux and venous sinus thrombosis 8. Summary of ASL and its utility for evaluating AVM and AVF

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# Abstract Archives of the RSNA, 2024

NREE-25

## 5 STEPS ASSESSMENT OF ACUTE STROKE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Breno A. Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Luis F. Godoy, MD (*Abstract Co-Author*) Stockholder, Johnson & Johnson;Stockholder, Illumina, Inc;Stockholder, UnitedHealth Group
Victor Martinelli Preto, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Porto Cunha, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review the imaging technique and protocols for the initial evaluation of the acute strokeTo review the clinical presentation, and to recognize the relevant imaging features in the initial evaluation of the acute strokeTo demonstrate a structured, systematic, and concise five-step approach to the initial evaluation of the acute stroke.To improve the performance of the Radiologist in the acute stroke scenario.

### TABLE OF CONTENTS/OUTLINE

IntroductionClinical Presentations and ScenariosImaging technique and protocols5 STEPS ASSESSMENT OF ACUTE STROKE: Relevant imaging features and tips with teaching cases of the initial evaluation of an acute stroke in a structured, systematic, and concise five-step approach.Take home messagesReferences

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# Abstract Archives of the RSNA, 2024

NREE-26

## MAPPING THE MEDULLA OBLONGATA - AN ANATOMY REVIEW AND STEP-BY-STEP PATHOLOGY APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Victor R. Marussi, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno S. Inada, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Christiane M. Campos, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the anatomy of the medulla oblongata, its specific structures, connections with other parts of the central nervous system, and main functions. Detail in step-by-step how and which weighted magnetic resonance imaging (MRI) sequences contribute to the identification of the main pathologies that affect the medulla oblongata. Demonstrate the importance of accurate diagnosis of bulbar pathologies for planning surgical and therapeutic interventions, and adequate monitoring of the disease in order to avoid further neurological damage.

### TABLE OF CONTENTS/OUTLINE

The medulla oblongata is a small segment of the brain stem that contains structures fundamental to life, such as the vital autonomous cardiovascular and respiratory centers that control heart rate, blood pressure, and breathing. Although isolated bulbar injuries are rare, late diagnosis and inadequate treatment can lead to disability or death. In this context, magnetic resonance imaging (MRI) plays a central role in accurate and early diagnosis, and it is essential for radiologists to have in-depth knowledge and a focused look at image findings to identify anatomical structures, recognize pathological changes, differentiate similar conditions and correlate radiological findings with clinical symptoms. The step-by-step analysis of the medulla oblongata using magnetic resonance allows the optimization of analytical reasoning in the evaluation, helping to obtain a detailed understanding of the changes expected in each disease, contributing to an accurate diagnosis and, consequently, an adequate treatment that obtain the best clinical outcomes.

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NREE-27

## TARGETED NEUROSURGICAL INTERVENTIONS: THE ROLE OF NEUROIMAGING IN LITT, DBS, AND HIFU

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Evgeny Pavlushkov, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jay Starkey, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Explore new neurosurgical techniques and their applications
- Understand the role of neuroimaging in pre-and post-operative settings
- Discuss the anatomy and targets for LITT, DBS, and HIFU procedures
- Highlight the importance of neuroimaging in guiding and evaluating these treatments

### TABLE OF CONTENTS/OUTLINE

- Introduction
- Laser Interstitial Thermal Therapy (LITT)
- Principles and mechanisms
- Indications and targeted pathologies
- Pre-operative imaging: planning and target identification
- Intra-operative imaging: real-time monitoring and guidance
- Post-operative imaging: assessing treatment response and complications
- Deep Brain Stimulation (DBS)
- Overview of DBS
- Targets for DBS:
- Ventral Intermediate Nucleus (VIM) for essential tremor
- Globus Pallidus internus (GPi) for dystonia and Parkinson's disease
- Subthalamic Nucleus (STN) for Parkinson's disease
- Pre-operative imaging: anatomical and functional mapping
- Intra-operative imaging: electrode placement and verification
- Post-operative imaging: evaluating lead position and stimulation effects
- High-Intensity Focused Ultrasound (HIFU)
- Principles and mechanisms of action
- Applications in neurosurgery, focusing on the VIM for essential tremor
- Pre-operative imaging: target localization and treatment planning
- Intra-operative imaging: real-time monitoring and guidance
- Post-operative imaging: assessing treatment efficacy
- Integration of Advanced Imaging Techniques
- The role of functional MRI, diffusion tensor imaging, and tractography
- Advances in intra-operative imaging: MRI-guided neurosurgery
- Future Directions and Challenges
- Emerging applications of LITT, DBS, and HIFU
- Potential limitations and risks
- Conclusion

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# Abstract Archives of the RSNA, 2024

NREE-28

## TEMPORAL LOBE ENCEPHALOCELES ASSOCIATED EPILEPSY - SUBTLE LESIONS YOU DO NOT WANT TO MISS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Richard A. Bronen, MD (*Abstract Co-Author*) Nothing to Disclose
Derek Nitz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Temporal Lobe Encephaloceles Associated Epilepsy - Subtle Lesions You Do Not Want to Miss Temporal Lobe Encephaloceles (TLenc) are herniations of brain parenchyma through dural defects in the middle cranial fossa and have been identified as a cause of medically refractory epilepsy. Identification of these lesions is imperative because surgical resection can be curative. However, there are challenges to the diagnosis of TLenc, which include lack of awareness of the lesion (particularly prior to 2015) and subtle findings on MR and CT imaging. TLenc are often small, isointense to brain tissue, and difficult to distinguish from normal TL undulations or adjacent subjacent extracranial tissue, particularly if thin high resolution imaging protocols are not utilized. At the conclusion of this exhibit, the learner will be able to do the following: Describe TLenc and their clinical significance. Will be aware of the current imaging protocol to optimize the detection of TLenc. Highlight key imaging features to identify TLenc. Identify typical and subtle cases of TLenc.

### TABLE OF CONTENTS/OUTLINE

Background of TLenc: Define TLenc. Discuss clinical significance. Review current management of TLenc. Review pitfalls in the diagnosis of TLenc on imaging. Review recommended imaging protocol: Review HARNESS MRI imaging protocol. Discuss optimal sequences and view for identification of TLenc. Discuss key imaging features to identify TLenc. Review cases of typical and subtle TLenc.

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NREE-29

## HAEMATOLYMPHOID TUMORS OF THE CENTRAL NERVOUS SYSTEM: A PERSPECTIVE BEYOND LYMPHOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Angelo C. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Giovanna S. Calfi, MD (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Lais Abduch, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Maia JR, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Review the subdivision of these tumors according to 2021 World Health Organization Classification of Tumours (WHO CNS5). ; Emphasize the main characteristics that distinguish primary and secondary lymphomas. ; Illustrate the different subtypes of histiocytic tumors and their radiological features.

### TABLE OF CONTENTS/OUTLINE

● Introduction. ● Illustrate the origin of lymphocytic and histiocytic cells. ● Subdivision of these tumors according to 2021 World Health Organization Classification of Tumours (WHO CNS5). ● General considerations on lymphomas. ○ Diffuse primary lymphoma of large cells B.○ Secondary lymphoma. ○ Immunodeficiency-associated lymphoma.■ AIDS-related lymphoma.■ Post-transplant lymphoproliferative disorder (PTLD). ○ Intravascular large B-cell lymphoma (intravascular lymphomatosis). ○ Lymphomatoid granulomatosis. ● General considerations on histiocytic tumors. ● Langerhans cell histiocytosis.○ Langerhans cell histiocytosis.○ Hypothalamic-pituitary axis involvement.○ Neurodegenerative involvement. ● Non-Langerhans histiocytic tumors.○ Rosai-Dorfman disease.○ Erdheim-Chester disease.

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# Abstract Archives of the RSNA, 2024

NREE-3

## CONGENITAL CRANIOFACIAL ANOMALIES: A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lauren J. Ehrlich, MD (*Abstract Co-Author*) Nothing to Disclose
Namita Bhagat, MD (*Abstract Co-Author*) Nothing to Disclose
Gaurav Cheraya, MD (*Abstract Co-Author*) Nothing to Disclose
Jordan Hughes, MD (*Abstract Co-Author*) Nothing to Disclose
Anisa A. Chowdhary, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Craniofacial malformations can be either isolated or part of a defined genetic syndrome. Early diagnosis of these malformations has vital clinical significance because some may present as acute emergencies in the postnatal period, whereas others may require long-term treatment. Some may also be associated with brain anomalies. The diagnostic value of three-dimensional reconstructed images by computed tomography (3D-CT) is particularly high in individuals with complex craniofacial deformities, and in patients with congenital malformations. 3D-CT imaging is the method of choice for understanding the pathologic morphology of the patients and in the preparation for craniofacial surgery.

### TABLE OF CONTENTS/OUTLINE

Introduction: Craniofacial malformation is one of the most commonly encountered birth defects in the prenatal and postnatal periods. Facial cleft cleft lip (CL) with or without cleft palate (CP), is the most common congenital craniofacial malformation. Craniofacial syndromes commonly associated with craniosynostis include Apert syndrome, Crouzon syndrome, and Pfeiffer syndrome, which are secondary to mutations of fibroblast growth factor receptor (FGFR). Purpose: The purpose of this study is to assess the clinical and CT imaging patterns of Craniofacial syndromes with correlating the abnormalities such as bone abnormalities of the face, cranium and the skull base.

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# Abstract Archives of the RSNA, 2024

NREE-30

## CHRONIC SUBDURAL HEMATOMA: ADVANCED IMAGING OF THE MEMBRANES AND THE ROLE OF MIDDLE MENINGEAL ARTERY EMBOLIZATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Uttam Bodanapally, MBBS (*Abstract Co-Author*) Speakers Bureau, Siemens AG;Travel support, Siemens AG;Research support, Siemens AG
Dheeraj Gandhi, MBBS, MD (*Abstract Co-Author*) Research Grant, Stryker CorporationResearch Grant, Medtronic plc
Athanasios Pavlou, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Chronic subdural hematoma (cSDH) is a complex immunological and angiogenic process that is initiated by minor trauma to the dural membranes. Based on hematoma morphology, cSDHs are classified on unenhanced CT scans for triage and treatment. Certain hematoma morphologies benefit from membrane imaging by either contrast enhanced MRI or contrast enhanced dual energy CT (DECT) that provides valuable information to guide further management. With increasing accessibility and significant shorter scan time, DECT not only provides an excellent means for the depiction and grading of membranes, but also provides functional information by estimating the amount of iodine exudation through the immature capillaries present in the membranes. Conventional surgical management of cSDH can quickly decompress the hematoma but recurrence and complication rates are high. Middle meningeal artery embolization (MMAE) can restrict arterial supply to the membranes to induce necrosis, target neo-vasculature and the cycle of inflammation which are thought to be responsible for propagation and postoperative recurrence. In addition, MMAE can also be potentially used as a standalone method to induce resorption and resolution without surgical evacuation.

### TABLE OF CONTENTS/OUTLINE

Epidemiology and health care burden. Pathophysiology as it pertains to advanced imaging methods. Role of CT imaging with emphasis on dual energy techniques for membrane imaging. Use of advanced imaging to guide surgical management with or without adjunct middle meningeal artery embolization. Discussion of the utility of sole middle meningeal artery embolization. Future prospects in the diagnosis and treatment of chronic subdural hematomas

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# Abstract Archives of the RSNA, 2024

NREE-31

## JOIN THE BRIGHTER SIDE OF THE FORCE: HOW 7-TESLA MRI CAN HELP TO ASSESS CASES IN NEUROIMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lucas Roberto Lelis B. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Mika Shibuya, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas M. Nunes (*Abstract Co-Author*) Nothing to Disclose
Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela A. Bandeira, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Esmeraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paula Arantes (*Abstract Co-Author*) Nothing to Disclose
Thiago Matheus Santos Rios, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Overview clinical indications for 7-T MRI in neuroimaging, highlighting its superior detail over lower field MRIs.- Demonstrate the improved diagnostic capabilities of 7-T MRI for complex neurological conditions.- Address challenges in clinical application of 7-T MRI and propose solutions for integration into clinical practice.

### TABLE OF CONTENTS/OUTLINE

1. Introduction1.1. Evolution of MRI technology and introduction of 7-T MRI in neuroimaging.2. Additional benefits of 7-T MRI2.1. Brain tumors2.2. Radiotherapy planning2.3. Multiple sclerosis and demyelinating diseases2.4. Intracranial MRA and vessel imaging2.5. Movement disorders and deep brain stimulation2.6. Pituitary pathology2.7. Epilepsy focal lesions2.8. MR Spectroscopy for metabolic disorders3. Challenges and Solutions3.1. Technical, operational, and safety challenges of 7-T MRI and strategies for clinical adoption.4. Conclusions and Take Notes

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# Abstract Archives of the RSNA, 2024

NREE-32

## BEYOND THE BASICS OF PREOPERATIVE SPINE IMAGING: WHAT ARE THE FINDINGS THAT CHANGE MANAGEMENT?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carol P. Geer, MD (*Abstract Co-Author*) Nothing to Disclose
Edwin A. Stevens, MD (*Abstract Co-Author*) Nothing to Disclose
Scott D. Wuertzer, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Caroline Wilson, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica Hinaman, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review cross-sectional spine imaging, highlighting the importance of CT for assessing fracture morphology and MRI for evaluating soft tissue injuries. 2. Describe additional, often overlooked, findings and anatomic considerations in the cervical, thoracic, and lumbar spine that affect patient management and should be included in all radiology reports. 3. Review these findings through a case-based approach with CT and MRI examples.

### TABLE OF CONTENTS/OUTLINE

Review of Basics. Fracture morphology - value of CT. Soft tissue injury - value of MRI. Cervical Spine. Traumatic - Traumatic disc herniation. Extent of ligamentous injury. Integrity of the transverse ligament. Discoligamentous competency at C2/C3. Angulation of odontoid. Extent of fracture with underlying diffuse idiopathic skeletal hyperostosis or ankylosing spondylitis. Non-traumatic - Soft foraminal disc herniation or disc-osteophyte complex. Ossification of posterior longitudinal ligament. Alignment. Anatomic Consideration - location of vertebral artery position relative to C2 pars. Thoracic and Lumbar Spine. Traumatic - Traumatic disc herniation. Extent of ligamentous injury. Extent of fracture with underlying DISH or AS. Non-traumatic - Location of disc herniation. Etiology of post-surgical stenosis (recurrent disc, osteophyte, or scar). Prior decompressive surgery. Anatomic Consideration - location of iliac vein bifurcation complex to L4/L5 and L5/S1.

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# Abstract Archives of the RSNA, 2024

NREE-33

## UNRAVELING THE MIDLINE: SELLAR AND PARASELLAR LESIONS FROM A RADIOLOGIST'S PERSPECTIVE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fernanda V. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Silveira, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

There is a myriad of sellar and parasellar lesions, and they are not uncommon. They are found especially in the pediatric population, accounting for approximately 10% of all pediatric intracranial tumors, and thus represent a routine diagnostic challenge for the radiologist. This educational exhibit aims to: review the normal anatomy and embryology of the midline of the brain, especially the pituitary gland, the suprasellar cistern and the hypothalamus; summarize the imaging characteristics of the sellar region on CT and MRI; review pituitary adenomas and their main mimicking entities, differential diagnoses and common pitfalls through a set of illustrative clinical cases.

### TABLE OF CONTENTS/OUTLINE

(1) Introduction; (2) Anatomy and embryology of the brain midline (sella turcica and pituitary gland, parasellar region, suprasellar cistern and hypothalamus); (3) Case-based review of pituitary adenomas, and its main mimickers and differential diagnoses: pituitary carcinoma, granular cell tumor of the neurohypophysis, meningioma, pituitary metastasis, intrasellar plasmacytoma, pituitary apoplexy, aneurysms, pilocytic hypothalamic/chiasmatic astrocytoma, craniopharyngioma, sellar xanthogranuloma, hypothalamic hamartoma, clivus chordoma, sarcoidosis, surgical manipulation, carotid-cavernous fistula, epidermoid cyst; (4) Final remarks and take-home messages.

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# Abstract Archives of the RSNA, 2024

NREE-34

## IDENTIFYING AND CHARACTERIZING NON-STENOTIC POTENTIAL ARTERIOGENIC SOURCES OF EMBOLI IN PATIENTS WITH EMBOLIC STROKE OF UNDETERMINED SOURCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maoxue Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Niranjan Balu, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahmud Mossa-Basha, MD (*Abstract Co-Author*) Nothing to Disclose
Chun Yuan, PhD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;;
Ahmed Safwat, MD (*Abstract Co-Author*) Nothing to Disclose
Gador Canton (*Abstract Co-Author*) Nothing to Disclose
David Tirschwell, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Mona Kharaji, MD (*Abstract Co-Author*) Nothing to Disclose
Javid Azadbakht, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Embolic stroke of undetermined source (ESUS) is a diagnosis of exclusion and relies on luminal imaging to assess arteriogenic causes.• Growing evidence points towards non-stenotic atherosclerotic plaques as a potential stroke etiology.• Vessel wall imaging (VWI) can potentially detect these non-stenotic lesions better than luminal imaging.• Evaluating plaque features of vulnerability in VWI may better stratify risk for secondary stroke prevention.• If incorporated as part of standard-of-care in IS work-up, VWI can offer targets for more appropriate treatment in certain ESUS patients.• Optimizing VWI and stroke MRI protocols for time efficiency and image quality, while also engaging with ordering providers can lead to acceptance and understanding of the value of VWI in stroke work-up and secondary stroke prevention.

### TABLE OF CONTENTS/OUTLINE

1. Etiologies of IS 2. Luminal imaging in IS2.1. Disadvantages of luminal imaging in evaluating small or outward remodeling plaques as potential arteriogenic causes of IS3. ESUS3.1. Definition3.2. Epidemiology and prognosis3.3. Traditional imaging and clinical evaluation paradigms4. Vessel wall imaging (VWI) in ESUS 4.1. Added value over luminal imaging4.2. Recommended protocols for efficiency and optimal image quality4.3. Identifying non-stenotic plaques (NSPs) upstream from the stroke territory4.4. VWI NSP mimics and imaging pitfalls4.5. Imaging features of high risk NSPs and their correlation with IS4.6. Incorporating carotid and intracranial VWI as part of standard-of-care in stroke work-up5. Technical and clinical challenges impeding the utility of VWI in ESUS 6. Future directions for addressing challenges for VWI implementation and interpretation

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# Abstract Archives of the RSNA, 2024

NREE-35

## ANATOMICAL VARIANTS OF INTRACRANIAL ARTERIES: WHAT THE YOUNG NEURORADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bruno S. Inada, MD (*Abstract Co-Author*) Nothing to Disclose
Samir S. Omar, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Taisa Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Victor R. Marussi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Christiane M. Campos, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Maria Laura Petruz Piassa, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Dias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is: Review of the main intracranial arterial anatomic variants; To categorize the variations based on embryology, morphology or topography; To establish correlations between computed tomography angiography (CTA) and/or magnetic resonance angiography (MRA) with digital subtraction angiography (DSA) in key cases, employing a didactic approach.

### TABLE OF CONTENTS/OUTLINE

Introduction Summary of angiogenesis Examples of common and uncommon cases related to Variant Anatomy of Willis Circle and Other intracranial Vessels: 1. Arterial fenestration 2. Arterial duplication 3. Anterior cerebral artery variants 4. Middle cerebral artery variants 5. Posterior cerebral artery variants 6. Persistent carotid-basilar artery anastomosis 7. Normal variant arteries in the Skull Base Conclusion References

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# Abstract Archives of the RSNA, 2024

NREE-36

## CAROTID WEB: UNRAVELING A NON-INCIDENTAL FINDING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alcino Alves Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Breno A. Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Rogerio Iquizli, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana L. Arcanjo, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Martinelli Preto, MD (*Abstract Co-Author*) Nothing to Disclose
Rafaela F. Palhares, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To review important anatomic landmarks of the carotid bulb and internal carotid artery. To review the imaging technique and protocols for the evaluation of carotid web and its complications.To recognize the imaging features of the carotid web and its atypical presentations, and to review the differential diagnosis, highlighting the key diagnostic features. To recognize the complications associated with the carotid web, particularly its relation to ischemic stroke and “cryptogenic” events.

### TABLE OF CONTENTS/OUTLINE

Introduction Anatomic landmarks Imaging Technique and Protocols Typical and Atypical Imaging Features, Complications, and Evolution, with teaching cases Differential Diagnoses Take Home Messages References

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# Abstract Archives of the RSNA, 2024

NREE-38

## MYELIN OLIGODENDROCYTE GLYCOPROTEIN ANTIBODY-ASSOCIATED DISEASE(MOGAD): HOW TO RECOGNIZE NEUROIMAGING PATTERNS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Tatiana Iutaka, BDS (*Abstract Co-Author*) Nothing to Disclose
Angelo C. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula A. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Carlos M. Maia JR (*Abstract Co-Author*) Nothing to Disclose
Tamara Hernandes Ricci, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia C. Santos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are:- Review the main neuroimaging patterns of MOGAD through clinical cases.- Discuss and describe the imaging features at the heterogeneous phenotypes in MOGAD patients, focusing in MRI findings, such as optic neuritis, transverse myelitis, supratentorial and infratentorial involvement.

### TABLE OF CONTENTS/OUTLINE

1. Imaging patterns of MOGAD disorder with epidemiological features in adult and pediatric population.- Neuroimaging patterns such as supratentorial and infratentorial involvement, optic neuritis and transverse myelitis. 2. Supratentorial and infratentorial most common imaging patterns in MOGAD patients illustrated by clinical cases.- Supratentorial involvement showed by clinical cases with heterogenous imaging patterns such as acute disseminated encephalomyelitis (ADEM), flair-hyperintense lesions in anti-MOG associated encephalitis with seizures (FLAMES) and other patterns.- Infratentorial involvement in MOGAD illustrated by a clinical case 3. The overlap of the imaging and neurological patterns of ADEM and FLAMES- Clinical case illustrating the alternance of ADEM and FLAMES imaging patterns 4. Transverse Myelitis in MOGAD patients.- Clinical cases showing the spinal cord involvement in MOGAD disease. 5. Optic neuritis imaging pattern in MOGAD- Imaging pattern of MOGAD optic neuritis and the differences of the optic nerve involvement in the most common differential diagnosis.

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# Abstract Archives of the RSNA, 2024

NREE-39

## NON-NEOPLASTIC INTRACRANIAL CYSTIC LESIONS: IMAGING FINDINGS AND PRACTICAL APPROACH OF THE DIFFERENTIAL DIAGNOSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Scortegagna SR, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula A. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rafael M. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Larissa A. Martins, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana Iutaka, BDS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To suggest a diagnostic algorithm for non-neoplastic intracranial cystic lesions according to the predominant location.To review the broad differential diagnosis of non-neoplastic intracranial cystic lesions through clinical cases, discussing the clinical and imaging features.To emphasize the key imaging findings that are essential to the diagnosis

### TABLE OF CONTENTS/OUTLINE

Introduction.Diagnostic algorithm for non-neoplastic intracranial cystic lesions according to the predominant location.Revision of the broad differential diagnosis through clinical cases, with a discussion of imaging and clinical features.- Extra-axial, off-midline cystic lesion: Arachnoid cyst; Choroidal fissure cyst; Epidermoid cyst; Neurocysticercosis.- Extra-axial, midline cystic lesion: Dermoid cyst; Nuroenteric cyst; Pineal gland cyst; Cavum septum pellucidum, cavum vergae and cavum interposed velum; Rathke’s cleft cyst.- Intra-axial, parenchymal cystic lesion: Perivascular space; Neuroglial cyst; Hippocampal sulcus remnant; Porencephalic cyst; Neurocryptococcosis; Hydatidosis; Congenital CMV; Neurocysticercosis.- Intra-axial, ventricular cystic lesion: Colloid cyst; Ependymal cyst; Choroid plexus cyst; Neurocysticercosis.Table with the key imaging findings and typical location of each lesion.Conclusion

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# Abstract Archives of the RSNA, 2024

NREE-4

## BRAIN ASYMMETRIES: BETWEEN PHYSIOLOGICAL AND PATHOLOGICAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Victor R. Marussi, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda B. Assuncao, MD (*Abstract Co-Author*) Nothing to Disclose
Carolinny Cruvinel Maia, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Laura Petruz Piassa, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Odilo M. Queiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Diego Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Sabrina Medeiros Olimpio, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- The normal brain is not perfectly symmetrical.- Brain asymmetries are characterized by enlargement or atrophy of all or part of a cerebral hemisphere.- They can be physiological or non-physiological (congenital or acquired).

### TABLE OF CONTENTS/OUTLINE

Brain asymmetry has been observed for over a century in humans in terms of structure, function, and behavior and is characterized by enlargement or atrophy of all or part of a cerebral hemisphere. They can be physiological or non-physiological (congenital or acquired). Physiological asymmetries reflect evolutionary, hereditary, developmental, experiential, and pathological factors. The specialization of the left hemisphere for language was one of the earliest observations of brain asymmetry. Among the most prominent observations of brain asymmetry are the right frontal and left occipital petalia (when one of the lobes protrudes towards the contralateral side, leaving impressions on the inner surface of the skull). Other common physiological asymmetries include gyral-sulcal patterns, distribution of grey and white matter and ventricular asymmetry. On the other hand, various diseases, whether congenital or acquired, present disproportion between one cerebral hemisphere or lobe and the other. A pratical approach to assessment, considering the dimensions of the affected hemisphere (enlarged or reduced), the size of the lateral ventricles on the diseased side, and the pattern of involvement between the cerebral lobes, can help narrow down the list of differential diagnoses.

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# Abstract Archives of the RSNA, 2024

NREE-40

## BOTTOMS UP: EXPLORING CAUDAL REGRESSION SYNDROME THROUGH RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vanessa C. Chacon, MD (*Abstract Co-Author*) Nothing to Disclose
Beatriz M. Navarro Estrada, MD (*Abstract Co-Author*) Nothing to Disclose
Berali Del Espiritu Santo Padilla, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Caudal Regression Syndrome (CRS) is a rare genetic disorder characterized by total or partial agenesis of the lower vertebral, sacral, and thoracolumbar spine.• The clinical presentation of CRS varies based on the extent of malformations, common features include a short intergluteal cleft, foot deformities, and lower extremity muscular atrophy. Neurological deficits correlate with the level of vertebral anomaly, while gastrointestinal and genitourinary abnormalities pose significant diagnostic challenges.• Antenatal ultrasound is sensitive for detecting hypoplasia of the lower extremities and sacral or lumbosacral agenesis.• Fetal MRI confirms the diagnosis and assesses the level of the terminal medullary cone. Postnatally, imaging modalities like ultrasonography, bone survey, CT scan, and MRI are utilized for confirmation and detailed assessment.• CRS is divided into two subgroups: Group 1, characterized by high agenesis with cord termination above the lower border of L1, while Group 2, features low agenesis below L1, and often presents a low-lying conus, predisposing to progressive neurological deterioration.• Additionally, Renhaw's classification categorizes sacral agenesis into four types, providing insights into the anatomical variations seen in CRS.

### TABLE OF CONTENTS/OUTLINE

Epidemiology of CRSAssociations of CRSClinical Findings Relevant to RadiologistsRadiological Features on Antenatal UltrasoundRadiological Findings on MRIClassification of CRS on MRIInformation Clinicians Seek about CRS

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# Abstract Archives of the RSNA, 2024

NREE-41

## MASTERING NEUROVASCULAR DIAGNOSIS WITH BLACK BLOOD IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elham Tavakkol, MD (*Abstract Co-Author*) Nothing to Disclose
Kamand Khalaj, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Konstanze Guggenberger, MD (*Abstract Co-Author*) Nothing to Disclose
Roy Riascos, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Javier M. Romero, MD (*Abstract Co-Author*) Stockholder, TMA Precision Medicine
Arash Kamali, MD (*Abstract Co-Author*) Nothing to Disclose
David E. Timaran Montenegro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Demonstrate the role of black blood MR imaging (BB-MRI) in detecting and interpreting arterial wall diseases in intracranial vessels. • Depict the clinical applications and pitfalls of BB-MRI in neurovascular diagnosis. • Provide insights into the pathology beyond luminal abnormalities, enabling the differentiation of causes of stenosis, such as intracranial atherosclerotic disease, vasculitis, and reversible cerebral vasoconstriction syndrome, through BB-MRI. • Highlight interpretive pitfalls, including artifacts from slow flow, enhancing veins mimicking arterial wall enhancement, and vasa vasorum enhancement mimicking vasculitis.

### TABLE OF CONTENTS/OUTLINE

Atherosclerosis: Clear visualization of vessel walls and enabling precise assessment of atherosclerotic plaque morphology and burden. Vasculitis: concentric vessel wall thickening and enhancement. Notably, the "tram track sign," observed as a hyperintense line with hypointense rims, is a hallmark of vasculitic involvement. Dissection: intramural hematoma as a characteristic imaging finding in dissection, along with the eventual visualization of mural thrombus. Moyamoya Disease: Characteristic terminal intracranial internal carotid artery stenosis without enhancement. Intracranial Saccular Aneurysms: Stability of aneurysms can be predicted by absence of enhancement in the vessel wall. Vasospasm: Narrowing of vessel lumen without enhancement. Reversible Cerebral Vasoconstriction Syndrome (RCVS): Mild enhancement or no enhancement with thickened vessel walls. Giant Cell Arteritis: Helps in determining where to perform a biopsy on the temporal artery and predicting biopsy results.

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# Abstract Archives of the RSNA, 2024

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## THE POSTOPERATIVE SELLA: WHAT IS THE RADIOLOGIST ROLE?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Postoperative evaluation of the sella turcica is a major challenge, even for experienced neuroradiologists. The objective of this presentation is to promote a review on the topic and propose solutions for the standardized evaluation of these exams, with the aim of increasing the precision and confidence of radiologists when faced with them.

### TABLE OF CONTENTS/OUTLINE

- It is necessary to know the characteristics of pre-operative exams and how the surgical procedure was performed.- An examination with the appropriate technique must be performed, focusing on T2 and post-contrast T1-weighted sequences. Performing a dynamic sequence and post-contrast T1 3D fast spin echo sequences may be useful.- Careful evaluation of these studies should initially look for postoperative complications, such as bleeding, ischemia and CSF leak.- The assessment of residual lesion and progression must be carried out with caution, always using all available comparative exams, to identify slow growth.- Some post-treatment expected changes should also be observed, such as insinuation of the supra sellar cistern and herniation of the optic chiasm.

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# Abstract Archives of the RSNA, 2024

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## CORTICAL BRAIN LESIONS: FACTS AND FEATURES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alan I. Araujo, MD (*Abstract Co-Author*) Nothing to Disclose
Tamara Hernandes Ricci, MD (*Abstract Co-Author*) Nothing to Disclose
Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Tatiana Iutaka, BDS (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula A. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela C. Vasconcellos, MD (*Abstract Co-Author*) Nothing to Disclose
Nathalia C. Santos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review the main imaging patterns of the differential diagnosis of cortical lesions - Discuss the essential imaging findings, such as leptomeningeal enhancement, cortical thickening, distribution features, and also the use of additional MRI sequences in the differential diagnosis of the cortical lesions- Illustrate the MRI imaging findings of each disorder through clinical cases, highlighting the key points, and discussing clinical and epidemiological features- Suggest a flowchart of the practical approach of cortical lesions

### TABLE OF CONTENTS/OUTLINE

● The main imaging findings in the cortical lesions approach ● The use of additional MRI sequences ● Differential Diagnosis of Cortical Lesions○ Inflammatory Disorders: Multiple sclerosis; Myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD); Behçet disease Autoimmune encephalitis.○ Infectious Disorders: Tuberculosis; Syphilis; Herpes encephalitis; Creutzfeldt Jakob.○ Vascular Disorders: Infarction; Hypoxic ischemic brain injury.○ Neoplastic Disorders ○ Toxic and Metabolic Disorders: Wernicke's encephalopathy; Hyperammonemia; Hepatic encephalopathy; Marchiafava-Bignami; Osmotic demyelination syndrome; Wilson disease; Mitochondrial encephalomyopathy with lactic acidosis and stroke-like episodes (MELAS).○ Developmental Disorders: Focal cortical dysplasia; Heterotopia.○ Phakomatosis: Tuberous sclerosis; Sturge Weber.○ Neurodegenerative Disorders: Amyotrophic lateral sclerosis; Frontotemporal lobe dementia. ● Flowchart of the practical approach of cortical lesions

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## HIDING IN THE CORNER: A SIMPLIFIED APPROACH TO CEREBELLOPONTINE ANGLE LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joshua Russell (*Abstract Co-Author*) Nothing to Disclose
Madhurya Amirapu, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The CP angle is an anatomically complex region. It houses numerous structures such as cranial nerves (V, VI, VII), blood vessels, and cerebrospinal fluid spaces. Understanding the normal anatomy is crucial for interpreting abnormalities in this region. Involvement of the various structures here may have independent and/or overlapping symptoms. For example, extending a CP angle mass into the Dorello canal, a bony channel through which the abducens nerve travels from the prepontine cistern to the cavernous sinus, may present with lateral rectus muscle palsy. Cerebellopontine angle lesions can be divided into tumor and non-tumor lesions. The most common tumor lesions -Vestibular schwannoma (acoustic neuroma), Meningioma, Epidermoid Cyst, Arachnoid Cyst, Ependymoma, Lipoma, Dermoid, Primary malignancy (Lymphoma and Melanoma), Metastatic disease, Facial nerve and Vestibular nerve schwannomasThe most common non-tumor lesions -Aneurysm/Vertebrobasilar Dolichoectasia and Anterior Inferior Cerebellar Artery Loop.Cerebellopontine lesions typically demonstrate differentiating imaging characteristics, mostly evaluated on MRI and CT Brain.

### TABLE OF CONTENTS/OUTLINE

Normal cerebellopontine angle anatomy including surrounding structures.Involvement of the various structures in this region and their possible clinical presentations (table and image examples).Common and few less common cerebellopontine angle lesions and epidemiological /syndromic correlation, if present (table/chart). Masses and their characteristic imaging features (images/case examples). Non tumor cerebellopontine lesions (table/image examples ). Radiologic pitfalls.Take home points/summary. References.

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# Abstract Archives of the RSNA, 2024

NREE-45

## REVIEW OF THE LILIEQUIST MEMBRANE AND ITS SIGNIFICANCE IN NEUROIMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Julie B. Guerin, MD (*Abstract Co-Author*) Nothing to Disclose
John C. Benson, MD (*Abstract Co-Author*) Nothing to Disclose
Edward Ahn, MD (*Abstract Co-Author*) Nothing to Disclose
V. Michelle Silvera, MD (*Abstract Co-Author*) Nothing to Disclose
Norbert G. Campeau, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Hayden Swartz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The Liliequist membrane (LM) is an important landmark for both neuroradiologists and neurosurgeons to identify on preoperative and intraoperative examinations for CSF diversion, masses involving the floor of the third ventricle, and endoscopic third ventriculostomy (ETV) patency. 2. The LM is best visualized using MRI with thin-section, heavily T2-weighted imaging such as with balanced steady-state free procession (bSSFP) sequences such as FIESTA and CISS. Flow signal through ETV sites is best demonstrated using spin echo-based techniques such as T2 FSE, T2 SPACE or CUBE sequences.

### TABLE OF CONTENTS/OUTLINE

1. Defining the LM and its anatomy: Illustrate the three main components of the LM and their anatomic relationships with adjacent suprasellar and hypothalamic structures. 2. History of the LM. 3. Imaging technique: Emphasize the importance of thin-section, heavily T2-weighted imaging for anatomic visualization of the LM, and FSE-based techniques for functional assessment of flow through an ETV. 4. Review a series of cases in which the LM is visualized before and/or after endoscopic third ventriculostomy. 5. Review a series of cases in which the LM is indirectly depicted by subarachnoid contrast, subarachnoid hemorrhage, or by mass effect secondary to lesions in the suprasellar or prepontine cisterns.

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# Abstract Archives of the RSNA, 2024

NREE-46

## VARYING SHADES OF EPIDERMOID TUMORS - THE BLACK, THE WHITE AND EVERYTHING IN BETWEEN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rita G. Bhatia, MD (*Abstract Co-Author*) Nothing to Disclose
Natalya Nagornaya, MD (*Abstract Co-Author*) Nothing to Disclose
Gaurav M. Saigal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Hamilton Trinh, MD (*Abstract Co-Author*) Nothing to Disclose
Denver S. Pinto, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

At the end of this exhibit, the reader should be able to:1. Identify key imaging features of epidermoid tumors and its subtypes2. Differentiate epidermoid tumors from its differential diagnoses3. Understand the clinical presentation and symptoms associated with epidermoid tumors

### TABLE OF CONTENTS/OUTLINE

Pathophysiology of epidermoids - Anatomy and patterns of growth of epidermoid cystsClinical PresentationCase discussion with imaging findings with a focus on MRI findings especiallya) Diffusion restrictionb) White Epidermoids, Dark epidermoids and varying patterns of intermediate signalc) Sites of epidermoid tumor,Sites of epidermoids:Intradural:a) Extraparenchymal: Cerebello-pontine angle, Suprasellar cistern, Middle cranial fossa, Anterior cranial fossa, Interhemispheric fissureb) Intraparenchymal: Temporal lobe, frontal lobec) Intraventricular: Fourth ventricle,Extradural: Intradiploic, Intraorbital,Extradural sites: Calvarium,,Differential diagnosis: 1. Arachnoid cyst (for the extra-axial type) 2. Dermoid cyst, Neurenteric cyst (for the midline location) 3. Cystic Schwannoma (for the cerebellopontine angle) 4. Craniopharyngioma (For the skull base location) 5. Developmental neuro-epithelial tumor (DNET) and Multi-nodular and vacuolating neuronal tumor (MVNT) --> for the intra-parenchymal location 6. Ependymoma, Subependymoma, Medulloblastoma (for the intraventricular location),,Complications: 1. Malignant degeneration 2. Chemical meningitis/ aseptic meningitis with and without hydrocephalus 3. Spontaneous hemorrhage,,Goals of treatment:

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# Abstract Archives of the RSNA, 2024

NREE-47

## SPECTRUM OF NEUROIMAGING FINDINGS IN CNS LYMPHOPROLIFERATIVE DISORDERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Bruno A. Telles, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Luis Novak Filho (*Abstract Co-Author*) Nothing to Disclose
Diego R. Lodi Lauriano, MD (*Abstract Co-Author*) Nothing to Disclose
Joao Rudolfo Kleinubing Junior, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Ramina (*Abstract Co-Author*) Nothing to Disclose
Erasmo Barros Da Silva Junior (*Abstract Co-Author*) Nothing to Disclose
Leonardo Kami, MD (*Abstract Co-Author*) Nothing to Disclose
Joao V. de Oliveira Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela Santos Cavalcanti (*Abstract Co-Author*) Nothing to Disclose
James H. Yared, MD (*Abstract Co-Author*) Nothing to Disclose
Bernardo C. Teixeira, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Standard imaging signs of CNS lymphoproliferative disorders as revealed by MRI and CT. 2. Advanced imaging techniques such as MRI spectroscopy, diffusion-weighted imaging, and perfusion imaging are indispensable for distinguishing CNS lymphoproliferative disorders from other neurological disorders and assessing tumor aggressiveness. 3. These techniques provide intricate insights into the metabolic activity, cellular density, and vascularity of lesions, facilitating differentiation from other neurological pathologies and offering crucial information regarding tumor aggressiveness. 4. Accurate imaging interpretation informs treatment decisions and aids in monitoring therapeutic outcomes. 5. The precise interpretation of imaging findings serves as a cornerstone in guiding treatment strategies and monitoring therapeutic responses, highlighting the indispensable role of neuroradiologists in the comprehensive care of patients with CNS lymphoproliferative disorders.

### TABLE OF CONTENTS/OUTLINE

1. Typical Presentation ○ Key Imaging Characteristics of CNS Lymphoma and Other Lymphoproliferative Disorders 2. Common Imaging Findings ○ Brain Manifestations of Lymphoma ○ Manifestations of Other Lymphoproliferative Disorders (*Intravascular Lymphoma, MALT Lymphoma of the Dura, Lymphomatosis Cerebri*) 3. Atypical Presentations ○ Diverse Imaging Findings Across Unusual Sites: Eyes, Spinal Cord, Leptomeninges, Cerebellum/Brainstem, and Other Locations 4. Advanced Imaging Techniques ○ Application of MR Perfusion and MR Spectroscopy in Differential Diagnosis

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# Abstract Archives of the RSNA, 2024

NREE-48

## WRONG WHITE BRAIDS: UNRAVELING THE COMPLEXITY OF LEUKODYSTROPHIES FROM A RADIOLOGIST'S PERSPECTIVE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Juliana Duarte (*Abstract Co-Author*) Nothing to Disclose
JEAN LEVI RIBEIRO DE PAIVA (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz Borella (*Abstract Co-Author*) Nothing to Disclose
GABRIELLE BACCARIN (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Magnetic resonance imaging (MRI) plays a fundamental role in the diagnosis of leukodystrophies.Recognition of patterns on MRI includes differentiation between hypomyelinating and demyelinating patterns of white matter,distinguishing between diffuse and multifocal abnormalities,evaluating the predominant location of abnormalities,and identifying specific characteristics such as cystic degeneration of white matter,anterior temporal cysts,megalencephaly,increased perivascular spaces or small cysts,additional gray matter lesions,contrast enhancement,calcium deposits,microhemorrhages,spinal cord involvement,cranial nerves thickening and enhancement.Some spectroscopy findings may also suggest the diagnosis:in Canavan’s disease there is an increase in the NAA peak;a peak of alpha-glutamate concentrations (at 3.75 ppm) is observed in 18q Deletion Syndrome.MRI may lead to a specific diagnosis, suggest the appropriate genetic test to confirm the diagnosis,and have contributions in monitoring disease progression,and therapeutic responses.

### TABLE OF CONTENTS/OUTLINE

IntroductionCase-based review of leukodystrophies:Metachromatic leukodystrophyKrabbe diseaseX-linked adrenoleukodystrophyCanavan diseaseAlexander diseaseL-2-hydroxyglutarig acid uriaLeukoencephalopathy involving the brainstem and spinal cord with elevated lactate.Sjogren-Larsson syndromePropionic acidemia18q Deletion SyndromePOLR3B-related Hypomyelinating Leukodystrophy Adult-Onset Leukoencephalopathy with Axonal Spheroids and Pigmented GliaMegalencephalic leukoencephalopathy with subcortical cystsFinal remarks and take home messages

# Abstract Archives of the RSNA, 2024

NREE-49

## HOW TO REPORT PITUITARY MACROADENOMAS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Importance of Structured Reporting- Emphasize the significance of a structured reporting format in providing comprehensive and consistent information to referring physicians and other healthcare providers. - Highlight how structured reports facilitate better understanding and interpretation of findings.2. Enhancing Communication - Encourage radiologists to use standardized terminology and formats to minimize ambiguity and misinterpretation of findings.3. Avoidance of Errors - Educate radiologists on errors in reporting pituitary macroadenomas, such as incomplete descriptions of tumor characteristics or failure to assess critical anatomical relationships.4. Clinical Decision Support - Highlight the role of structured reports in providing essential information for clinical decision-making, including tumor characteristics, proximity to critical structures, and potential treatment implications.

### TABLE OF CONTENTS/OUTLINE

1. Introduction- Overview of Pituitary Macroadenomas - Importance of Reporting and Diagnosis2. Characteristics of Pituitary Macroadenomas - Signal Intensity - Presence of Lobulation - Suprasellar Growth - Infrasellar Growth3. Relationship with Neighbor Structures - Optic Chiasm - Third Ventricle - Clivus - Sphenoid plane4. Remodeling of the Sellar Floor5. Type of Sphenoid Sinus Pneumatization6. Knosp Classification - Predicting Cavernous Sinus Invasion7. Presence and Importance of Onodi Cell8. Measure and Relevance of Intercarotid Distance9. Differential diagnosis - Red Flags that may point to other diagnosis10. Conclusion - Importance of Comprehensive and Structured Reporting - Clinical Implications

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# Abstract Archives of the RSNA, 2024

NREE-5

## INSIGHTS AND CONSIDERATIONS IN DEVELOPMENT AND PERFORMANCE EVALUATION OF GENERATIVE ADVERSARIAL NETWORKS (GANS): WHAT RADIOLOGISTS NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kyung Mi Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Minjae Jang (*Abstract Co-Author*) Nothing to Disclose
Minjae Myung (*Abstract Co-Author*) Nothing to Disclose
Eui Jong Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Janghoon Oh (*Abstract Co-Author*) Nothing to Disclose
Hyug-Gi Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Jeong Taek Yoon, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Deep learning has advanced AI in medical imaging, leading to significant improvements but also creating challenges like the need for extensive training data and laborious labeling. Generative Adversarial Networks (GANs) generate synthetic images for data augmentation and simplify medical image processing, enhancing efficiency and enabling unsupervised anomaly detection, thus reducing reliance on labeled datasets. Our investigation into GANs in medical imaging addresses their varied architectures, the considerations for selecting appropriate GAN models, and the nuances of model training and performance evaluation. This presentation aims to provide radiologists who are new to GAN technology with a thorough understanding, guiding them through the practical application and evaluation of GANs in brain imaging with two illustrative examples. It offers a comprehensive exploration of the transformative potential of GANs in medical imaging research. Ultimately, this paper strives to equip radiologists with the knowledge to effectively utilize GANs, encouraging further research and application within the field.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. GAN architecture, hierarchy, and variants 3. Selecting the appropriate GAN for the research objectives 4. Input data training 5. Performance evaluation 6. Conclusion

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# Abstract Archives of the RSNA, 2024

NREE-50

## NOT EVERY DURAL BASE LESION REPRESENTS A MENINGIOMA: A PICTORIAL ESSAY ON SOLITARY FIBROUS TUMOR IN THE CENTRAL NERVOUS SYSTEM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Rangel Costa, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. Quevedo (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This education exhibit provides an analysis of solitary fibrous tumors involving the central nervous system (SFT-CNS), which can often be misdiagnosed as meningiomas due to their rarity and similar imaging characteristics. Through the analysis of 8 consecutive cases treated in our hospital between 2014 and 2024, this exhibit aims to highlight the clinical, histopathological, and MRI characteristics of SFT-CNS. The purpose of this study are - To discuss the clinical and histopathological characteristics of SFT-CNS. - To demonstrate the main magnetic resonance imaging (MRI) findings in SFT-CNS. - To present 8 consecutive cases with histopathological confirmation treated in our hospital between 2014 and 2024. - To compare the imaging findings of differential diagnoses. - To enhance recognition of this uncommon pathology among radiologists.

### TABLE OF CONTENTS/OUTLINE

- Introduction - Clinical and Histopathological characteristics of SFT-CNS. - Main imagen features of SFT-CNS. - Compare the imaging findings of differential diagnoses, particularly with those of meningioma. - Cases of Patients with a Histopathological Diagnosis of SFT-CNS.

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# Abstract Archives of the RSNA, 2024

NREE-51

## FROM DAWSONS FINGERS TO CENTRAL VEIN SIGN: A RADIOLOGIST'S PRIMER TO CLINICALLY RELEVANT CONVENTIONAL AND EMERGING MRI BIOMARKERS IN MULTIPLE SCLEROSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Suradech Suthiphosuwan, MD (*Abstract Co-Author*) Nothing to Disclose
Aditya Bharatha, MD (*Abstract Co-Author*) Nothing to Disclose
Yusuf Alibrahim, BMedSc, MD (*Abstract Co-Author*) Nothing to Disclose
Jiwon Oh, FRCPC,PhD (*Abstract Co-Author*) Nothing to Disclose
Timothy Reynold U. Lim, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pathologic features of multiple sclerosis (MS) include perivenular demyelination, inflammation and neurodegeneration; active lesions predominate in relapsing-remitting, and smoldering lesions and neuroaxonal loss in progressive forms.Conventional MRI findings, while currently still the most used imaging biomarkers, lack pathologic specificity and only moderately correlate with disease activity and disability in MS.MRI biomarkers more specific to MS pathology are emerging; the two furthest along in clinical development are the central vein sign (CVS) and paramagnetic rim lesions (PRLs).CVS reflects perivenular demyelination and is highly specific and sensitive for distinguishing MS from mimics.PRLs represent lesions with chronic active inflammation along the lesion edge are also useful for diagnosis and prognosis across the entire MS spectrum.Other biomarkers such as brain and spinal cord volumetric measures, cortical lesions and leptomeningeal enhancement have also shown prognostic utility in MS.

### TABLE OF CONTENTS/OUTLINE

A. Pathologic basis of imaging biomarkers in MSa. MS involves both gray and white matterb. Perivenular inflammatory demyelinationc. Neurodegeneration in MSi. Neuroaxonal lossii. Chronic active "smoldering" lesionsB. Conventional MRI biomarkersa. T2/FLAIR lesionsi. 2017 McDonald Criteriaii. Prognostic utility of T2 lesion burdeniii. Optic nerve as 5th location for DISb. Gadolinium-enhancing lesionsc. T1 black holesC. Emerging MRI biomarkersa. CVSb. Chronic active lesionsi. PRLii. Slowly expanding lesionsc. Cortical lesionsd. Leptomeningeal enhancemente. Volumetric measuresi. Brain (global / regional) atrophyii. Spinal cord atrophy

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# Abstract Archives of the RSNA, 2024

NREE-52

## NEURO BEHçET'S SCAR TISSUE: UNVEILING THE MANIFESTATIONS ON THE CENTRAL NERVOUS SYSTEM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lua P. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Zoraida Sachetto (*Abstract Co-Author*) Nothing to Disclose
Renan D. Turci, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are: Review and illustrate the pathogenesis, imaging findings of neurological involvement of Behēet' disease, the differential diagnoses, and their correlation with clinical findings. Describe through illustrative presentations the benefits of MRI imaging approach to the diagnosis of Neuro-Behēet. Present challenging cases, such as venodural fistula and dural venous thromboses and differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

Behēet pathogenesis and clinical findings. Imaging patterns on MR in different weighted sequences. Evaluation of complications such as venodural fistula and dural venous thromboses. Susceptibility weighted image (SWI)'s hole on detection of hemorrhagic findings in Neuro-Behēet.Imaging findings based on a pictorial review using representative cases from a Tertiary University Hospital database. A practical approach for better diagnostic accuracy and avoiding pitfalls. Final remarks.

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# Abstract Archives of the RSNA, 2024

NREE-53

## DECODING THE LOES SCORE: A STEP-BY-STEP REVIEW OF THE MRI SEVERITY SCORE FOR X-LINKED ADRENOLEUKODYSTROPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Clara Fiorot, MD (*Abstract Co-Author*) Nothing to Disclose
Angelo D. Correa, MD (*Abstract Co-Author*) Nothing to Disclose
Paulo V. Bahia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ferdinand D. Cabrera Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro A. Gama Carpentieri Primo, MD (*Abstract Co-Author*) Nothing to Disclose
Nina Ventura, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. Quevedo (*Abstract Co-Author*) Nothing to Disclose
Paula Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza Ambrozino, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Nahoum, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Clinical importance of the MRI severity score for X-linked adrenoleukodystrophy (X-ALD)Introduce Dr. Loes and the rationale behind the development of this scoring system; Explain what the score is and its significance in X-ALD evaluation; Highlight the score's role in evaluating disease severity, disease monitoring, prognosis and treatment decision-making.Score overview, components and methodologyDetail the specific MRI findings that contribute to the score through a structured reporting template elaborated by the authors; Describe how the MRI severity score is calculated and interpreted through a case-based approach, through cases from the author's institution; Discuss scoring thresholds.Review of the cerebral anatomy commonly affected by X-ALDReview neuroanatomic locations by correlating MRIs from clinical cases and didactic schemes elaborated by the authors.

### TABLE OF CONTENTS/OUTLINE

IntroductionBrief overview of X-ALD; Challenges in disease assessment.Overview of the MRI severity scoreDevelopment rationale: the importance of objective assessment; Evidence supporting its use; Role in treatment decision-making; Structured template for reporting.Components of the score and scoring methodology with anatomic correlationWhite matter involvement and focal atrophy; Corpus callosum involvement and atrophy; Optic pathway involvement; Auditory pathway involvement; Projection fibers involvement; Cerebellum involvement and atrophy; Basal ganglia involvement; Global atrophy, brainstem atrophy and methods for assessmentConclusionCalculation and practical considerations; Addressing challenges, limitations and areas for further developments; Key takeaways.

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# Abstract Archives of the RSNA, 2024

NREE-54

## IMAGING INSIGHTS ON CHILDHOOD STROKE - SHEDDING LIGHT ON A CHALLENGING CONDITION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luiz Borella (*Abstract Co-Author*) Nothing to Disclose
Fabiano Reis (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Costa Haiter, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Stroke in children raises concern to healthcare, due increasing incidence. The etiology is multifactorial, and this study emphasizes the main arterial etiologies of stroke, based on "The Childhood Arterial Ischemic Stroke Standardized Classification and Diagnostic Evaluation (CASCADE) criteria", searching for the best imaging findings, to assist accurate diagnoses. It subdivides into primary causes and secondary causes. Illustrated findings in original cases of "Moya-Moya" disease, carotid dissection in aortic/cervical arteriopathy, bacterial meningitis, viral infectious vasculitis (varicella zoster and COVID-19), occlusive vasculopathy due to Sickle Cell Disease and inflammatory vasculitis due to Behēet and Lupus are highlighted in the study, as well the main stroke mimics to keep in mind, especially hemiplegic migraine and posterior reversible encephalopathy syndrome (PRES). Ultimately, the study delves into the pitfalls, which must be considered to guarantee accurate diagnosis. The study seeks to improve diagnosis inchildren who can greatly benefit from an early diagnosis, allowing the expansion of future estudies and treatments, bringing greater quality of life to patients.

### TABLE OF CONTENTS/OUTLINE

- Introduction - Epidemiology of stroke in Children - The Childhood Arterial Ischemic Stroke Standardizes Classification and Diagnostic Evaluation(CASCADE) criteria Illustrated. - Main clinical manifestations - Diagnostic clues - Imaging investigation (cases and Imaging findings) in primary and secondary causes - Differential diagnoses and stroke mimics - Pitfalls

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# Abstract Archives of the RSNA, 2024

NREE-55

## EXPLORING NEURAL PATHWAYS - AI METHODS IN DIPY FOR ADVANCED NEUROANATOMICAL STUDIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Serge Koudoro, MSc (*Abstract Co-Author*) Nothing to Disclose
Eleftherios Garyfallidis (*Presenter*) Nothing to Disclose

### TEACHING POINTS

As datasets expand and analysis methodologies evolve, the demand for sophisticated computational resources and techniques intensifies. The Diffusion Imaging in Python (DIPY) community has cultivated a robust open source software ecosystem designed for the analysis of structural and diffusion MRI data. Throughout this exhibit, we will embark attendees on a journey to: A) Explore advanced AI tools within DIPY (Diffusion Imaging in Python) for MRI data analysis. B) Highlight key methodologies addressing common research challenges. C) Showcase innovative techniques like EVAC+ for brain extraction. D) Discuss the role of generative AI in segmentation enhancement. E) Introduce Patch2Self2 for denoising and its extensions. F) Survey distortion correction methods, including style transfer. G) Present statistical analysis capabilities and tract analytics in DIPY. H) Demonstrate Tractometry with Bundle Analytics 2.0 and BundleWarp. E) Present a novel method for direct data harmonization.

### TABLE OF CONTENTS/OUTLINE

This exhibit offers a hands-on exploration of a community-driven open-source ecosystem (DIPY), vital for analyzing structural and diffusion MRI data. Attendees will deepen their understanding of MR imaging, gain insights into MR imaging and stay updated on the latest advancements. Specific topics like brain extraction techniques, distortion correction methods, and data harmonization will be covered. A focus on tractometry will demonstrate to attendees how to enable detailed group comparisons and identification of statistically significant differences in tract properties between populations. We wrap up with reflections on advancements made and future directions in MRI data analysis.

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# Abstract Archives of the RSNA, 2024

NREE-56

## VASCULAR INTRACRANIAL EMERGENCIES OF CHILDHOOD

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Delgado (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Enzo Calheiros, MD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Cesar Augusto P. Alves SR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This educational exhibition provides a comprehensive overview of the imaging evaluation of pediatric patients with vascular intracranial emergencies. Imaging patterns, differential diagnoses, and potential pitfalls in imaging interpretation will be addressed, as well as etiology categorization and classifications for the most common vascular emergencies, aiming at a broad review of the theme. The purpose of this exhibition is to: Provide an overview of the imaging evaluation of pediatric patients with vascular intracranial emergencies. Highlight specific imaging patterns and features that may suggest the etiology discussing differential diagnosis and potential pitfalls in imaging interpretation. Use case studies to illustrate radiological challenges and diagnostic considerations.

### TABLE OF CONTENTS/OUTLINE

1 Clinical presentation and etiologyOverview of clinical presentation of pediatric intracranial vascular emergency divided by hemorrhagic, ischemic and thrombotic etiologies. 2 Ischemic Disorders: Inflammatory Arteriopathy Focal cerebral arteriopathy, Primary or Secondary vasculitis. 3 Ischemic Disorders: Non-Inflammatory Arteriopathy Dissection, Moyamoya patterns and Genetic etiologies. 4 Hemorrhagic disorders: Coagulation disorders and Germinal Matrix Hemorrhage. Aneurysm, Vein of galen aneurysmal malformation, Arteriovenous malformations, Germinal matrix hemorrhage, Cerebral proliferative angiopathy, Cavernous angiomas, Cerebrofacial arteriovenous metameric syndrome (CAMS), Dural arteriovenous fistula and Coagulation disorders 5 Cerebrovenous Thrombosis Cerebral Venous Sinus Thrombosis, Cortical Vein Thrombosis, Medullary Vein Thrombosis

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# Abstract Archives of the RSNA, 2024

NREE-57

## UNVEILING THE MYSTERIES OF THE PERIVASCULAR SPACES LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thanh Binh Nguyen, MD (*Abstract Co-Author*) Nothing to Disclose
Santanu Chakraborty, FRCPC,MBBS (*Abstract Co-Author*) Nothing to Disclose
Maria Lucia Brun, MD (*Abstract Co-Author*) Nothing to Disclose
Azza Reda, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Knowing the function and the role of the glymphatic system. • To discuss the normal anatomy of the perivascular spaces and variants.• To discuss the diverse types of causes and diseases affecting the perivascular spaces with highlight on the recently described and updated lesions.• To provide an approach describing lesions that mimics the perivascular spaces which will aid in appropriate management and guide in surgical intervention.

### TABLE OF CONTENTS/OUTLINE

-Overview of the glymphatic system -Anatomy of the perivascular spaces and variants -Approach to diagnose neoplastic and non-neoplastic causes of dilated perivascular spacesA. Non enhancing causes.B. Enhancing causes. -Non enhancing causes• Small vessel diseases: cerebral amyloid angiopathy, CADASIL, hypertensive encephalopathy• Neurodegenerative: Parkinson disease, Alzheimer disease• Demyelination and Autoimmune disease: NMOSD, MS, SLE• Miscellaneous: Sener syndrome, mucopolysaccharidoses, traumatic brain injury -Enhancing causes• GFAP• Infection: Cryptococcus, PML-IRIS• Neoplastic: Intravascular lymphoma• Inflammatory: CLIPPERS, SLIPPERS, Intravascular Sarcoidosis -Diseases that mimics dilated perivascular spaces • Benign cysts: neuroglial cysts, arachnoid cysts, Neuroenteric cysts, choroidal cysts,• Vascular: Lacunar infarct, PVL in peds• Neoplastic: DENT, MVNT, low grade glioma (anterior temporal)• Infectious: Neurocysticercosis, Toxoplasmosis

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# Abstract Archives of the RSNA, 2024

NREE-58

## LOST IN THE LABYRINTH: REVIEW OF THE INNER EAR AND ITS CONGENITAL MALFORMATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andres F. Caliz Cabrales, MD (*Abstract Co-Author*) Nothing to Disclose
Julian M. Gandur, MD (*Abstract Co-Author*) Nothing to Disclose
Oreanna Quintero, MD (*Abstract Co-Author*) Nothing to Disclose
Jesus Eduardo Barreto Fernandez (*Abstract Co-Author*) Nothing to Disclose
Sara Gomez Milanes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This poster provides a review of the anatomy and embryology of the inner ear; this review aims to facilitate a better understanding of why congenital malformations occur and to aid in their identification. Additionally, each malformation will be reviewed, and an algorithm will be provided to assist in reaching a diagnosis easily. The poster also correlates these malformations with the most important syndromes associated with them, highlighting the importance of understanding genomics in the study of these malformations and their relationship with various genetic syndromes. The objective is to provide radiologists with a reference tool that simplifies the understanding of this topic, often considered a "labyrinth," and demystifies the inner ear by offering a clear and concise overview of its structure, embryonic development, and associated pathologies.

### TABLE OF CONTENTS/OUTLINE

Objectives; Importance of timely identification of congenital malformations of the inner ear; Embryology; Anatomy; Congenital malformations of the inner ear and their classification systems; Concise review of each congenital malformation correlating them with their respective embryonic developmental failure and imaging cases. Including: Complete labyrinthine aplasia, Rudimentary otocyst, Cochlear aplasia, Common cavity, Cochlear hypoplasia, Incomplete partition, Enlarged vestibular aqueduct, Abnormalities in the bony canal and cochlear nerve; Diagnostic algorithm; Imaging cases resolved using the diagnostic algorithm; Link between inner ear development, brain, and body: Clues for many diagnoses; Gallery of normal images of the inner ear; Bibliography

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# Abstract Archives of the RSNA, 2024

NREE-59

## INSIGHTS FROM THE INSIDE: UPDATES ON TRANSCRANIAL ULTRASOUND IN GREY SCALE, DOPPLER, AND CONTRAST-ENHANCED TECHNIQUES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eduardo D. Chiovatto, MD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Chiovatto, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Brunetto, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paulo Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Cavalanti, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Esmeraldo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Transcranial ultrasound has emerged as a valuable modality in neuroimaging due to its versatility, non-invasive nature, and low cost, offering real-time evaluation of cerebral hemodynamics and pathologies.The purpose of this exhibit is to review current applications and advancements in transcranial ultrasound techniques for adults with actual case examples, emphasizing the clinical significance of Grey Scale, Duplex Doppler, and Contrast-Enhanced modalities.

### TABLE OF CONTENTS/OUTLINE

Introduction to Transcranial Ultrasound a. Anatomy and Approaches b. Overview of ultrasound techniques: Grey Scale, Duplex Doppler, and Contrast-Enhanced UltrasoundClinical Applications of Transcranial Ultrasound in Adults a. Detection and monitoring of vasospasm in subarachnoid hemorrhage b. Evaluating cerebral stenosis with Duplex Doppler c. Management of sickle cell disease via flow velocity assessments d. Identification and implications of internal carotid artery occlusion e. Diagnosing brain death f. Real-time monitoring of emboli g. Detecting vascular lesions amenable to interventional treatment h. Assessing reperfusion post-thrombolysis i. Role in diagnosing vertebrobasilar insufficiency j. Contribution to the diagnosis of Parkinson’s disease k. Detection and follow-up of raised intracranial pressure l. Identification of right-left shunt m. Assessment of cerebrovascular reserve capacityResearch Frontiers in Transcranial Ultrasound a. Quantifying brain perfusion with contrast-enhanced ultrasoundConclusion a. Summarize the impact of transcranial ultrasound on radiological practice and its potential future applications

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# Abstract Archives of the RSNA, 2024

NREE-6

## DOWN THE PATH OF NEURONAL INJURY AND AXONAL DEGENERATION: PATHOLOGIC MECHANISMS AND IMAGING FINDINGS BEYOND WALLERIAN CHANGES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Nancy Margarita Gutierrez Castaneda, MD (*Abstract Co-Author*) Nothing to Disclose
Michelle Y. Gonzalez Putoy SR, MD (*Abstract Co-Author*) Nothing to Disclose
Griselda T. Romero Sanchez, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Zamora, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Angela M. Sosa, MD, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After completing this exhibit, the viewer will be able to:Summarize the different types of axonal degeneration, including classic Wallerian degeneration versus non-Wallerian changes.Identify the main molecular mechanisms and pathways underlying axonal degeneration: NAD+ metabolism, mitochondrial dysfunction,and necroptosis.Describe axonal degeneration during aging and its critical role in the pathophysiology of neurodegenerative diseases,such as Alzheimer's disease,Parkinson's disease,amyotrophic lateral sclerosis.Recognize a spectrum of common and atypical imaging patterns of axonal degeneration utilizing a case-base approach.

### TABLE OF CONTENTS/OUTLINE

1.overview of neuronal and axonal structure and function. 2.Types of neuronal degeneration.3.Cellular and molecular basis of axonal degeneration.4.Axonal degeneration in aging and neurodegenerative diseases.5. Case review including:a.Classic Wallerian degeneration along corticospinal tract(acute intramyelinic edema and chronic atrophic changes).b.Pontocerebellar axonal degeneration.c.Degeneration of cranial nerves.d.Cranial and caudal axonal degeneration in the spinal cord.e.Degeneration of mammillary bodies and fornix (e.g,temporal lobe, epilepsy/mesial temporal sclerosis).f. Optic nerve degeneration(e.g.,phthisis bulbi).g.Degeneration atrophy(e.g.,tongue[CNXII],masticador muscles[CNV],shoulder muscles[brachial plexus].hHypertrophic olivary degeneration.i.Neurodegenerative disease.

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# Abstract Archives of the RSNA, 2024

NREE-60

## PIECING TOGETHER THE PUZZLE OF NEUROTOXOPLASMOSIS: INSIGHTS FROM NEUROIMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fabiano Reis (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana T. Raeder, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Yamada, MD (*Abstract Co-Author*) Nothing to Disclose
Lua P. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Tiradentes (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review and illustrate the imaging findings of neurotoxoplasmosis, discuss the differential diagnoses, and correlate them with pathological images. Describe, through illustrative presentations, the benefits of the multimodality imaging approach for diagnosing neurotoxoplasmosis. Present challenging cases, such as differentiating between neurotoxoplasmosis, primary CNS lymphoma, and other opportunistic infections. Highlight radiological diagnostic pearls of neurotoxoplasmosis.

### TABLE OF CONTENTS/OUTLINE

Neurotoxoplasmosis epidemiology and parasite life cycle. Imaging patterns on MR and CT. Susceptibility-weighted imaging (SWI) as an auxiliary tool for calcified lesions. Spectroscopy and perfusion as valuable tools for differential diagnosis. Imaging findings of post-treatment response. Differential diagnoses derived from a visual examination utilizing illustrative cases sourced from a database at a Tertiary University Hospital. Neurotoxoplasmosis imaging pearls. Final remarks.

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# Abstract Archives of the RSNA, 2024

NREE-61

## UNVEILING BRAIN METASTASIS RESPONSES TO IMMUNOTHERAPY: MRI INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura Oleaga, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nuria Bargallo, MD (*Abstract Co-Author*) Nothing to Disclose
Gary Amseian, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To illustrate the use of immune checkpoint inhibitors in treating brain metastases and the implications on MRI imaging.- To recognize both classical and novel immunotherapy-specific response patterns in brain MRI.- To highlight the importance of utilizing key radiological assessment criteria to standardize response evaluations and outline differences among them.

### TABLE OF CONTENTS/OUTLINE

1. Overview of immune checkpoint inhibitors in the management of brain metastases. 2. Imaging Patterns of Response. A. Classical response patterns: i. Complete response ii. Partial response iii. Stable disease iv. Progression of disease. B. Immunotherapy-specific patterns: i. Pseudoprogression ii. Hyperprogression iii. Durable response. 3. Assessment criteria to standardize response evaluation: A. Comparison of traditional vs Immunotherapy-specific criteria. B. The significance of timing in distinguishing pseudoprogression and durable response. C. Addressing ambiguities in response criteria. D. Impact of clinical data on MRI assessment: neurological status, systemic therapy, and local treatments. 4. Spotting immune-related intra- and extracranial adverse events on imaging. 5. Brain MRI protocols and the potential of advanced techniques. 6. Conclusion

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# Abstract Archives of the RSNA, 2024

NREE-62

## CRACKING THE FETAL CENTRAL NERVOUS SYSTEM MRI: THE BIG PICTURE FOR RADIOLOGIST TRAINEES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Samuel Castillo, MD (*Abstract Co-Author*) Nothing to Disclose
Aura Maria M. Gonzalez Peralta, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Genier Fabian Castano Lizarazo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To assess the indications and techniques of neuro-fetal MRI in order to evaluate the main central nervous system anomalies.- To describe systematic evaluation of normal fetal central nervous system MRI. - To outline the main five fetal central nervous system pathologies as well as pearls and pitfalls that every radiologist must recognize.- To ilustrate through real-life cases assessment of fetal central nervous system pathologies at antenatal and postnatal follow-up MRI.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Central Nervous System fetal pathologies: epidemiology, indications, and MRI technique. 2. Evaluation of normal Central Nervous System fetal development at various gestational periods through MRI: A step-by-step guideline. 3. MRI assessment of the five main Central Nervous System fetal anomalies: pearls and pitfalls for radiologists trainees. 3a: Abnormal fetal Central Nervous System cortical layering, gyration, and sulcation. 3b: Fetal ventriculomegaly. 3c: Midline anomalies: holoprosencephaly, corpus callosum agenesis-dysgenesis. 3d: Posterior fossa anomalies. 3e: Spinal dysraphism. 4. Presentation of five captivating cases of cetal Central Nervous System pathologies antenatally diagnosed at a national perinatology ķnstitute with postnatal follow-up MRI. 5. Conclusions: what is the future of fetal Central Nervous System MRI?

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# Abstract Archives of the RSNA, 2024

NREE-63

## DIAGNOSTIC IMAGING OF PEDIATRIC SUPERFICIALLY/CORTICALLY-BASED BRAIN TUMORS: NAVIGATING COMMON AND COMPLEX CASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fabricio G. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Rosa Cerron Vela (*Abstract Co-Author*) Nothing to Disclose
Mario Mahecha, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1 Stress early and accurate diagnosis for better outcomes.2 Discuss challenges in diagnosing pediatric tumors like PXA and Ganglioglioma, focusing on their unique imaging features.3: Emphasize recognizing mimics like NCC and cortical tubers, detailing differentiation strategies with advanced MRI.4 Highlight MRI advancements for enhanced tumor visualization and diagnostic accuracy.5: Promote integrated diagnostic strategy, merging imaging, clinical assessment, and genetic profiling for precise and tailored diagnosis.

### TABLE OF CONTENTS/OUTLINE

Objective: Enhance diagnostic accuracy for pediatric brain tumors and mimics.OutlineIntroduction: Stress the importance of precise diagnosis in pediatric neuroimaging.Specific TumorsPXA Discuss MRI features to differentiate from high-grade gliomas.DNET Emphasize the "bubbly" appearance and its link to epilepsy.MVNT: Describe imaging characteristics that may appear aggressive.PLNTY Explain classification and MRI signals.DGONC Highlight difficulties in recognizing diffuse patterns.Ganglioglioma: Cover typical features including calcifications and cystic changes.DIG: Identify key diagnostic features like large cystic components and robust reaction.DLGNT: Discuss its presentation as diffuse leptomeningeal lesions, emphasizing diagnostic challenges.Cerebellar Hemangioblastomas Discuss association with VHL syndrome.Lhermitte Duclos Syndrome: Describe the "tiger-striped" MRI appearance and Cowden syndrome link.Tumor Mimics: Strategies for distinguishing mimics like neurocysticercosis and cortical tubers using advanced imaging.Cases: Present cases illustrating diagnostic challenges and typical scenarios.

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# Abstract Archives of the RSNA, 2024

NREE-64

## SPINAL CSF LEAKS: TYPICAL AND ATYPICAL APPEARANCES AT CT MYELOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Daniel J. Scoffings, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
David Butteriss (*Abstract Co-Author*) Nothing to Disclose
Neha Kallam, BSc, MBBS (*Abstract Co-Author*) Nothing to Disclose
Anoma Lalani Carlton Jones, MBBS, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After viewing this exhibit the learner will be to:1. Describe the different types of spinal CSF leak that lead to spontaneous intracranial hypotension.2. Recognise the most common appearances at CT myelography that occur in each type of spinal CSF leak.3. Evaluate some of the atypical imaging manifestations of spinal CSF leaks at CT myelography.

### TABLE OF CONTENTS/OUTLINE

OUTLINE: Spinal CSF leaks have gained increased recognition over the last decade with advances in myelography and scanning techniques, imaging resolution and scanner capabilities. Our understanding of the causative pathologies are ever evolving as new techniques come to light. Dynamic CT myelography is a useful tool for detection of such leaks provided that meticulous technique is utilized. This educational exhibit will review the range of pathologies that can be encountered in the adult and paediatric population with examples of all different types of leaks from ventral and dorsal dural tears, lateral leaks, CSF venous fistulas, with typical and more atypical appearances of each, as well some lesser known and recognized entities including loculated leaks and CSF venous malformations and genetic associations. CONTENTS (1) Classification of spontaneous spinal CSF leaks. (2) Types of dynamic CT myelography and when to use them. (a) Ultrafast dynamic. (b) Modified dynamic. (c) Lateral decubitus (3) Provocation maneuvers at CT myelography. (4) Appearances of spontaneous leak types at CT myelography. (a) Ventral (type 1) leaks. (b) Lateral (type 2) leaks. (c) CSF-venous fistulas. (5) Less common forms of spinal CSF leak. (a) CSF-venous malformation fistula. (b) Arachnoid ‘blebs’. (6) Pitfalls and mimics (7) The negative or equivocal CT myelogram.

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# Abstract Archives of the RSNA, 2024

NREE-65

## 'FIND THE LEAK': CURRENT CONCEPTS IN IMAGING AND INTERVENTIONS IN SPONTANEOUS INTRACRANIAL HYPOTENSION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tony Rahul (*Abstract Co-Author*) Nothing to Disclose
Sai K. Deepalam JR, MD (*Abstract Co-Author*) Nothing to Disclose
Meghana Kancharla, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shravan Reddy K, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shreyas Reddy K, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Spontaneous intracranial hypotension (SICH) is a clinical syndrome due to diminished intracranial pressure, leading to disruptions in the homeostasis among blood, cerebrospinal fluid (CSF), and cerebral parenchyma. • SICH stems from three primary causes: (1) CSF leak originating from a nerve root sleeve diverticulum; (2) CSF leak attributed to an osteophyte spur, and (3) CSF venous fistula (CVF). • A range of modalities is employed to assess the underlying condition, including computed tomographic (CT) myelography, dynamic CT myelography, digital subtraction myelography, magnetic resonance (MR) imaging, and MR myelography with intrathecal gadolinium. Selection among these modalities is contingent upon whether the leak is characterized as high or low flow. • A targeted epidural patch using autologous blood or fibrin glue is an effective intervention.

### TABLE OF CONTENTS/OUTLINE

• Understanding the pathophysiology and clinical features of SICH. • Discuss in detail the brain and spine imaging findings of SICH, with emphasis on key findings. • Myelographic patterns of SCIH: Tips for identification. • Basics, step-by-step technical approach, and limitations of CT myelography, Dynamic CT myelography, Digital subtraction myelography and MR myelography. • Epidural blood patch: technique and limitations. • Diagnostic approach and management algorithm for SICH.

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# Abstract Archives of the RSNA, 2024

NREE-66

## THE DIFFERENT FACES OF FRONTOTEMPORAL DEMENTIA: CLINICAL, STRUCTURAL AND FUNCTIONAL CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Renato Hoffmann Nunes, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Angelo C. Duarte, MD (*Abstract Co-Author*) Nothing to Disclose
Helen Ribeiro De Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe T. Pacheco, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Antonio J. Da Rocha, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heytor Jose De Oliveira Cabral, MD (*Abstract Co-Author*) Nothing to Disclose
Manoel Barbosa, MD (*Abstract Co-Author*) Nothing to Disclose
Lais Abduch, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Coutinho, MD (*Abstract Co-Author*) Nothing to Disclose
Lazaro F. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Luiz P. Scoppetta, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Carlos M. Maia JR (*Abstract Co-Author*) Nothing to Disclose
Giovanna S. Calfi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Review the definition and epidemiology of frontotemporal dementia (FTD) ; Emphasize the role of imaging studies in the investigation, follow-up and prognosis of FTD ; Illustrate the different variants of the FTD spectrum and their main radiological features

### TABLE OF CONTENTS/OUTLINE

; Introduction: ; Definition and epidemiology of frontotemporal dementia ; Role of imaging studies in the context of FTD assessment ; Genetic components of FTD; ; Classification: ; Behavioral variant ; Language variants - Primary progressive aphasia ; Agrammatic variant ; Semantic variant ; Movement disorder’s associated variants ; Progressive supranuclear palsy ; Corticobasal degeneration ; Amyotrophic lateral sclerosis; ; Perspectives; ; Take home messages; ; Conclusion

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# Abstract Archives of the RSNA, 2024

NREE-67

## CAROTID ARTERY DISEASES: WHAT SHOULD WE LOOK?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Delgado (*Abstract Co-Author*) Nothing to Disclose
Paula C. Pinho, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Patricia F. Vieira SR, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz R. Uchoa, MD (*Abstract Co-Author*) Nothing to Disclose
Vinicius T. Goncalves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Danilo Giorgio O. Medrado, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago B. Fernandes Feitosa, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Through this pictorial essay will be made a review based on cases and original drawings about the pathologies of the carotid arteries. This will be addressed by typical imaging patterns to narrow down differential diagnoses. The purpose of this exhibition is to: - Review the anatomy of the carotid arteries; - Understand the advantages and limitations of the main imaging methods used to evaluate carotid pathologies; - Recognize the main imaging patterns of the most frequent carotid artery diseases.

### TABLE OF CONTENTS/OUTLINE

ANATOMICAL CONCEPTS • Carotid arteries anatomy IMAGING ASSESSMENT METHODS • Ultrasound • Computerized Tomography • Magnetic Resonance Imaging CAROTID ARTERIES DISEASES • Imaging aspects of carotid pathologies • Teaching points to narrow down differential diagnoses INTERACTIVE CASE-BASED DIDACTICS • Sample cases to illustrate and solidify the concepts

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# Abstract Archives of the RSNA, 2024

NREE-68

## POSTOPERATIVE SPINAL IMAGING: KEEPING YOUR BEHIND OUT OF A BIND!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ajay Malhotra, MD, MMM (*Abstract Co-Author*) Nothing to Disclose
Mihran A. Khdhir, MD (*Abstract Co-Author*) Nothing to Disclose
Dheeman Futela, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shadi Ebrahimian, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Accurate interpretation of post lumbar spinal surgery images is critical for radiologist. This educational exhibit focuses on the following topics:1. What are the imaging protocols used in post spinal surgery evaluation?We will explain different modalities including radiographs, CT, and MRI and the protocols used on each modality.2. How to evaluate post-operative radiographs?Different radiographic postsurgical complications will be explained including hardware fracture, loosening, et. 3. What is considered as normal postsurgical changes on CT/MRI?Expected postsurgical findings will be explained. 4. What are the early postsurgical complications on CT/MRI? Early complications including fluid collection, intraoperative vascular and neural injuries, hardware malpositioning, and possible intracranial hemorrhage will be shown. 5. What are the late complications?Late postsurgical changes such as infection, failed back surgery syndrome, pseudoarthrosis, and hardware failure will be discussed. 6. What are the challenges in evaluation of postsurgical CT and MRIs and what are the strategies to overcome those challenges?Streak artifacts related to the hardware is one of the most common limitations in evaluation of postoperative CT and MRI scans. The strategies in reducing these artifacts will be discussed.

### TABLE OF CONTENTS/OUTLINE

1. Commonly used modalities and protocols in postoperative imaging.2. Expected findings and postsurgical complications on radiographs.3. Normal post-surgical CT/MRI findings.4. Early complications on CT/MRI.5. Late complications on CT/MRI.6. Challenges in evaluation of postsurgical CT/MRI images.7. Strategies to reduce hardware related artifacts.

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# Abstract Archives of the RSNA, 2024

NREE-69

## UNVEILING IMMUNE EFFECTOR CELL ASSOCIATED NEUROTOXICITY SYNDROME (ICANS): WHAT EVERY RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marta Calvo-Imirizaldu, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Manuel Rafael Lopez De La Torre Carretero (*Abstract Co-Author*) Nothing to Disclose
Pablo Del Nido Recio (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Carmen Mbongo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To understand some key clinical and radiological manifestations of Immune Effector Cell-Associated Neurotoxicity Syndrome (ICANS).To provide clues for identifying imaging patterns suggestive of ICANS for prompt diagnosis and intervention.

### TABLE OF CONTENTS/OUTLINE

Chimeric antigen receptor (CAR) T cells targeting the CD19 cell surface glycoprotein have emerged as a highly effective immunologic therapy in patients with certain refractory hematologic malignancies. The engagement of these two cell receptors causes a systemic cytokine release, which can compromise the blood-brain barrier and cause an immune effector cell-associated neurotoxicity syndrome (ICANS).ICANS is a pattern of neurotoxicity observed in patients following CAR T-cell infusion with associated neurologic symptoms, such as headaches and confusion. Neuroimaging is frequently obtained in patients who present with acute neurologic changes after infusion. This pictorial review aims to summarize some of the neuroimaging findings in ICANS through illustrative cases from our institution.1. Brief overview of the fundamentals of CAR-T cell therapy and ICANS pathophysiology.2. Clinical presentation and grading severity of ICANS (ASTCT consensus).3. Neuroimaging findings. While typically yielding negative results, imaging is advised when encountering suspected ICANS cases. Such imaging is crucial for detecting brain oedema and other abnormalities including stroke, haemorrhage, leptomeningeal enhancement, and mass effect, among others. - CT and brain MRI imaging findings. - Main entities to be considered in the differential diagnosis of ICANS.- Other CNS complications following CAR-T cell therapy.

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# Abstract Archives of the RSNA, 2024

NREE-7

## CNS CAVERNOUS MALFORMATIONS IN CHILDREN, SPECTRUM OF DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Paul J. Farnsworth, DO (*Abstract Co-Author*) Nothing to Disclose
Michael P. Oien, MD (*Abstract Co-Author*) Nothing to Disclose
Julie B. Guerin, MD (*Abstract Co-Author*) Nothing to Disclose
Carrie M. Carr, MD (*Abstract Co-Author*) Nothing to Disclose
Loryn Hovelson, ARRT (*Abstract Co-Author*) Nothing to Disclose
Norbert G. Campeau, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Jason T. Little, MD (*Abstract Co-Author*) Nothing to Disclose
Lynsey Ploenzke, BS (*Abstract Co-Author*) Nothing to Disclose
V. Michelle Silvera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cavernous malformations (CMs) are slow flow vascular malformations most commonly found in the brain and spinal cord. The clinical significance of CMs lies in their potential to cause various neurological symptoms and complications such as bleeding, seizures, neurological deficits, and headaches. Once a CM is diagnosed, the risk of bleeding needs to be addressed, the likelihood of which depends on factors such as location and the presence of certain genetic mutations in the patient. Diagnosing a CM on imaging can be challenging if atypical imaging features are present and when CMs are very large (giant) or infiltrative. Treatment options include observation with surveillance imaging, surgical resection, stereotactic radiosurgery, and laser interstitial thermal therapy (LITT). TEACHING POINTS:1. CMs can lead to a range of neurological symptoms and complications, such as bleeding, seizures, neurological deficits, and headaches. 2. Specific genetic mutations may result in Familial Cerebral Cavernous Malformation Syndrome (FCCM), increasing the likelihood in children of developing CMs throughout their lives. 3. CMs located in critical areas such as the brainstem are at higher risk to bleed, rebleed, and cause neurological deficits. 4. Giant and infiltrative CMs are often misdiagnosed and not considered in the list of potential diagnoses before surgery.

### TABLE OF CONTENTS/OUTLINE

1. Define CMs and describe their typical imaging appearance. 2. Discuss atypical imaging features that complicate CM diagnosis. 3. Review FCCM and illustrate the three main types with case examples. 4. Review the imaging features of Giant CMs 5. Demonstrate the imaging features of Infiltrative CMs.

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## CLINICAL APPLICATIONS OF PHOTON-COUNTING DETECTOR CT IN NEURORADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Francis I. Baffour, MD (*Abstract Co-Author*) Nothing to Disclose
Ajay A. Madhavan, MD (*Abstract Co-Author*) Nothing to Disclose
John I. Lane, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Norbert G. Campeau, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Vance Lehman, MD (*Abstract Co-Author*) Nothing to Disclose
Girish Bathla, MBBS (*Abstract Co-Author*) Nothing to Disclose
Paul J. Farnsworth, DO (*Abstract Co-Author*) Nothing to Disclose
Laurence J. Eckel, MD (*Abstract Co-Author*) Nothing to Disclose
John C. Benson, MD (*Abstract Co-Author*) Nothing to Disclose
Felix E. Diehn, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Photon-counting detector (PCD-) CT offers unique advantages over traditional energy-integrating detector (EID-) CT in neuroradiology. 2. The primary inherent benefit of PCD- over EID-CT is the ultra high spatial resolution, with slice thickness on the order of 0.2mm. 3. High yield diagnostic applications in neuroradiology include temporal bone CT, CT angiography (CTA) of the head and neck, CT venography (CTV) of the head, and CT myelography (CTM). 4. Other/emerging applications include head CT and face/sinus/orbit CT.

### TABLE OF CONTENTS/OUTLINE

I. Brief review of relevant physics aspects of PCD-CT, compared to EID-CT. II. PCD-CT in temporal bone imaging a. Anatomy b. Case based pathology III. PCD-CTA a. Head CTA anatomy b. Distinguishing infundibula and aneurysms c. Evaluating aneurysms, both untreated and treated d. Assessing arterial stenoses e. Other (additional case based pathology) IV. PCD-CTV a. Anatomy b. Dural venous sinus thrombosis c. Idiopathic intracranial hypertension V. PCD-CTM a. Lateral decubitus imaging of CSF-venous fistulae b. Dynamic imaging of high-flow CSF leaks VI. Emerging applications (case based anatomy and pathology) a. Head CT b. Face/sinus/orbit CT

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# Abstract Archives of the RSNA, 2024

NREE-71

## THE NEW ERA OF GALLIUM-68 DOTATATE PET IMAGING TO EVALUATE INTRACRANIAL MENINGIOMAS: A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nelson F. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Ottaiano, MD (*Abstract Co-Author*) Nothing to Disclose
Tomas Freddi, MD (*Abstract Co-Author*) Nothing to Disclose
Larissa Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Lucas De Araujo Rabelo (*Abstract Co-Author*) Nothing to Disclose
Marilia Assuncao Jorge (*Abstract Co-Author*) Nothing to Disclose
Ronaldo Belz (*Abstract Co-Author*) Nothing to Disclose
Efraim Ferreira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The main goal of this pictorial essay is:- To discuss the potential impacts of PET images using 68Gallium-DOTATATE as radiotracer on diagnostic confirmation and treatment management of meningiomas.- To demonstrate PET imaging follow-up for meningiomas that are unresectable, recurrent, incompletely resected, and/or higher-grade meningiomas, where radiation therapy (RT) may be preferred.- To describe and illustrate the radiological patterns of 68Gallium-DOTATATE PET images in posttreatment changes, as well as its correlation to other imaging modality, such as computed tomography (CT) and magnetic resonance imaging (MRI).

### TABLE OF CONTENTS/OUTLINE

- Introduction- Imaging modalities- Pre-treatment imaging findings- Post-treatment follow-up findings- Practical tips and Pitfalls- Conclusion/Take home message

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# Abstract Archives of the RSNA, 2024

NREE-72

## ANTENATAL AND POSTNATAL IMAGING IN CONGENITAL POSTERIOR FOSSA ANOMALIES: PATTERN RECOGNITION AND DIAGNOSTIC APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Elka Miller, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Neetika Gupta, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Pradeep Krishnan, MD (*Abstract Co-Author*) Nothing to Disclose
Shivaprakash B. Hiremath, DMRD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the anatomy and embryology of the posterior fossa on fetal and postnatal MRI. 2. To describe congenital anomalies of the posterior fossa with emphasis on non-cystic anomalies, describing their distinctive imaging features and accompanying effects on the cerebellum and the brainstem. 3. To advance understanding of non-cystic posterior fossa anomalies by highlighting specific imaging phenotypes and pattern-based approaches on antenatal and postnatal MRI.

### TABLE OF CONTENTS/OUTLINE

1. Discuss various disease entities resulting in posterior fossa anomalies. 2. Identify salient imaging features of non-cystic posterior fossa disorders in the fetal and postnatal brain to reach a specific diagnosis. 3. Describe a systematic pattern-based imaging approach to help guide appropriate management and genetic evaluation.

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# Abstract Archives of the RSNA, 2024

NREE-73

## READ MY MIND: IMAGING CEREBRAL SMALL VESSEL DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hediyeh Baradaran, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Bryan L. Bishop, MD (*Abstract Co-Author*) Nothing to Disclose
Keena Li (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. We will provide an overview of CSVD including criteria for diagnosis2. We will closely examine common imaging features of CSVD and their classification schemes and rating scales3. We will walk through imaging led examples and cases of CSVD to highlight key imaging features4. We will present data on the associations of each of these imaging findings to future stroke, cognitive impairment, and mortality.

### TABLE OF CONTENTS/OUTLINE

1. Review of CSVD and diagnostic criteriaa. Epidemiology and risk factors2. Overview of common imaging features of CSVDa. White Matter Hyperintensitiesb. Covert Brain Infarctionsc. Cerebral Microbleedsd. Enlarged Perivascular Spaces3. White Matter Hyperintensitiesa. T2/FLAIR hyperintensity in periventricular/deep cerebral white matter, subcortical gray matter, BG, brainstemb. Various Established Imaging Scalesc. Imaging examples and casesd. Clinical associations with future stroke, dementia, mortality4. Covert Brain Infarctionsa. Imaging detected infarcts in asymptomatic patientsb. Covert brain infarction schema i. Specific examples of each classification ii. Lacunar, subcortical, corticalc. Clinical associations with future stroke, dementia, mortality5. Cerebral Microbleedsa. Small round or ovoid lesions (<10mm diameter) of marked hypo intensity with blooming on T2*b. MARS and BOMB criteriac. Imaging examples and casesd. Clinical associationsPerivascular spacesExtensions of extra cerebral fluid space covered by Pia mater surrounding cerebral vessels from brain surface into and through brain parenchymab. Potential classification schemasc. Imaging examples and casesd. Clinical associations7. Summary

RSNA 2024
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# Abstract Archives of the RSNA, 2024

NREE-74

## CAROTID PLAQUES RISK STRATIFICATION: THE APPLICABILITY AND LIMITATIONS OF THE PLAQUE-RADS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Francinne Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Gontijo, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Cleiton A. Freitas, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Arantes (*Abstract Co-Author*) Nothing to Disclose
Alcivan Morais Filho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Effective reporting of carotid plaque risk is no longer limited to stenosis measurement and is essential for communication prior treatment decisions. Critical characteristics of plaque, such as ulceration or irregularity, and internal hemorrhage are revealed by axial contrast imaging techniques. These characteristics add to a complete analysis of plaque instability and the risks of the following complications. Plaque-RADS (PR) aims to standardize radiologists, clinicians, and surgeons' communication about carotid plaques. In this system, plaques are divided into: normal vessel walls (PR1); plaques with Maximum Wall Thickness (MWT) <3 mm (PR2); MWT = 3 mm without complications (PR3); thick Fibrous Cap (FC) (3a), thin or invisible FC (3b), and healed ulcers (3c); complicated plaques (PR4) with ulcerations (4a), intraplaque hemorrhage (4b), or intraluminal thrombus (4c). PR has drawbacks, even with its advantages. It may misclassify the risk associated with these plaques since it assumes that those lacking a visible FC are thin-capped. The limitations of fibrous cap visibility make it difficult to classify Categories 3c and 4b, both of which show visible ulceration. The obligation to attribute a category, even under suspicion of limited evaluation, can also be detrimental. Although the system may need to address some of these limitations in order to increase its applicability, it is worthy in order to improve communication.

### TABLE OF CONTENTS/OUTLINE

Presentation with Plaque-RADS and cases of limitations.

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# Abstract Archives of the RSNA, 2024

NREE-75

## THE WHOLE SPECTRUM OF MOYAMOYA DISEASE: FROM DIAGNOSIS TO POST-TREATMENT FOLLOW-UP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel L. Cardoso, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Moyamoya is a chronic occlusive, non-inflammatory and non-atherosclerotic cerebrovascular disorder, which affects mainly the intracranial portions of the distal internal carotid artery and the proximal anterior and middle cerebral arteries. The development of compensatory collateral circulation provides the angiographic appearance of a "puff of smoke", which translates to Moyamoya in Japanese and gives the disease its name. Radiological imaging plays a central role in the diagnosis of this disease and the recognition of resulting ischemic and hemorrhagic events. Our goal is to first review the imaging features of Moyamoya and then discuss the different surgical techniques developed to treat it, how to identify them on imaging studies, and what to expect from post-treatment imaging evaluation.

### TABLE OF CONTENTS/OUTLINE

1) Introduction. 2) Pathophysiological mechanism and anatomical correlation. 3) Angiographic classification of Moyamoya disease. 4) Vascular and parenchymal findings. 5) Surgical management: revascularization techniques and postoperative image characterization. 6) Assessment of pre- and post-treatment cerebral perfusion. 7) Challenges, pearls and pitfalls in differential diagnosis. 8) Future directions. 9) Take home messages.

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# Abstract Archives of the RSNA, 2024

NREE-76

## GENOMIC ROADMAP OF ASTROCYTIC TUMORS: NAVIGATING THROUGH MOLECULAR HIGHWAY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria Martin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcos F. Docema, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jorge T. Takahashi, MD (*Abstract Co-Author*) Nothing to Disclose
Camila T. Amancio (*Abstract Co-Author*) Nothing to Disclose
Claudia D. Leite, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hae W. Lee, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Thiago B. Fernandes Feitosa, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Delgado (*Abstract Co-Author*) Nothing to Disclose
Isabela D. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Jose Pinheiro Lopes, MD (*Abstract Co-Author*) Nothing to Disclose
Julia M. Brunelli, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This pictorial essay explores the 2021 WHO classification of astrocytic tumors, with a particular focus on the integration of molecular and genetic profiling, which now plays a pivotal role in the categorization of these neoplasms.Through a series of illustrative clinical cases, accompanied by insightful diagrams and educational illustrations, the key objectives of this review are to explain the updated classification, showcase practical applications in clinical settings, discuss important molecular markers, provide insights on neuroimaging interpretation, address challenges in adopting the new system, review prognostic implications, and explore future trends.

### TABLE OF CONTENTS/OUTLINE

2021 WHO classification for astrocytic tumors- Explaining the Updated Classification- Importance of molecular and genetic profiling in tumor categorization Important Genes and Molecular profiles - Discussion on key markers and their significance in differentiating astrocytic tumor subtypes Illustrative Cases - Presentation of select cases to demonstrate practical applications - Use of diagrams and illustrations to enhance understanding- Highlighting the use of molecular and genetic markers in diagnosis, prognostication, and therapy Exploring Future Trends - Anticipation of evolving trends in neuro-oncology - Discussion on how advancements in molecular genetics may impact future updates to tumor classification

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# Abstract Archives of the RSNA, 2024

NREE-77

## ASSESSMENT OF TREATMENT RESPONSE IN ADULT GLIOMAS: A PRIMER FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bruna G. Dutra (*Abstract Co-Author*) Nothing to Disclose
Raquel A. Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Luis F. Godoy, MD (*Abstract Co-Author*) Stockholder, Johnson & Johnson;Stockholder, Illumina, Inc;Stockholder, UnitedHealth Group
Heitor C. Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Murilo Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Oertel D'Amico, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understanding the relevance of establishing criteria for defining treatment response status in patients with glioma.Brief history of the RANO criteria and it’s previous versions.Understanding the importance of updated criteria (RANO 2.0 from 2023), with a focus on the limitations of previous versions.Becoming familiar with how to apply the RANO 2.0 criteria in practice.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTIONResponse Assessment in Neuro-Oncology (RANO) overview.GENERAL RECOMMENDATIONS IN RANO 2.0Intended use for RANO 2.0:Patient population and tumor types.Imaging protocol definition, including choice of modality and recommended study parameters.DISEASE ASSESSMENT RECOMMENDATIONS IN RANO 2.0Method of measurement: two-dimensional and volumetric assessment.Definition of measurable and nonmeasurable disease.Definition of target and nontarget lesions.ASSESSMENT OF TREATMENT RESPONSE STATUS IN RANO 2.0Selection of baseline study for comparison.Criteria for definition of treatment response status as complete response, partial response, stable disease and progressive disease.Definition and use of “sum of bideminsional products”.Illustrative cases focusing on practical application of RANO 2.0 criteria.Special considerations:Pseudoprogression and confirmatory scans (which settings require confirmatory imaging and appropriate confirmation timing).Pseudoresponse (associated tumor and treatment).Nonenhancing glioblastoma IDH-wildtype.FUTERE PERSPECTIVESBT-RADS:Overview of intended use.Limitations.Advanced imaging:Current uses for advanced imaging in the setting of adult glioma.Trends in the literature for validation in treatment response assessment.

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# Abstract Archives of the RSNA, 2024

NREE-78

## STARING INTO THE BRAINS ABYSS: NAVIGATING THROUGH CORTICAL MALFORMATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kevin Kurt Mac Allister (*Abstract Co-Author*) Nothing to Disclose
Cristina H. Besada SR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Federico M. Olivera Plata, MEd (*Abstract Co-Author*) Nothing to Disclose
Manuel S. Perez Akly, MD (*Abstract Co-Author*) Nothing to Disclose
Stefania Solanot, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cortical malformations must be ruled out in essentially every pediatric patient with developmental delay or epilepsy.MRI is certainly recommended as the most important imaging method in the evaluation of MCD, thanks to its optimal delineation of grey and white matter structures.Neuroimaging plays a crucial role in the prenatal and postnatal diagnosis of malformations of cortical development, since pathological tissue is not always available except for surgeries or autopsies. Radiologically, cortical malformations exhibit distinct imaging features such as abnormal cortical lamination, dysplastic gyri, and heterotopias.CT misses the abnormality in more than 30% of cases.Radiologists should also obtain detailed information from the referring clinicians regarding the size of the head, possible syndromic clinical features, epilepsy semiology, and EEG findings (particularly, location of origin of spikes) before reporting the examination

### TABLE OF CONTENTS/OUTLINE

Role of imaging in the diagnosis of malformation of cortical development Normal cortex developmentClassification according to the affected stage of normal cortex development Description of the most important disorders and radiological findingsConclusion References

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# Abstract Archives of the RSNA, 2024

NREE-79

## GLAND FINALE: POST-OPERATIVE PITUITARY INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rebeca O. Francelino, MD (*Abstract Co-Author*) Nothing to Disclose
THARYN Goncalves FRANCO DE GODOY (*Abstract Co-Author*) Nothing to Disclose
Raquel A. Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Arantes (*Abstract Co-Author*) Nothing to Disclose
Guilherme Almeida (*Abstract Co-Author*) Nothing to Disclose
Taisa M. Guarilha, MD (*Abstract Co-Author*) Nothing to Disclose
Luis Antonio Tobaru Tibana, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas G. Braga, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In this presentation, we delve into the critical aspects of post-operative image acquisition protocols, focusing on timing and sequences essential for optimal imaging outcomes. Additionally, we explore the typical postoperative changes that occur following pituitary surgery. These changes encompass various factors, including anatomical distortions, the utilization of common surgical materials, the presence of hematic residues, gas foci, and local artifacts. Moreover, we emphasize the importance of recognizing specific imaging changes indicative of residual lesions and complications. Understanding and identifying these changes are paramount in postoperative imaging, as they provide valuable insights into the patient's recovery process and are crucial for prompt intervention and management.

### TABLE OF CONTENTS/OUTLINE

1. Contemporary Protocol for Pituitary Assessment. 2. Routes of Intervention in Pituitary Lesions: highlight transsphenoidal route particularities and other main intervention routes. 3. Primary Surgical Inclusion Materials and MRI Characteristics: describe MRI characteristics of surgical materials and common imaging artifacts. 4. Common Changes After Surgical Removal of Pituitary Adenomas. 5. Notable Complications: discuss regional hemorrhage, cerebrospinal fluid leakage, ischemia, among others. 6. Characterizing Residual Pituitary Adenoma Lesions on MRI: focus on distinct gadolinium enhancements for identifying residual lesions. 7. Current Protocol for Postoperative Pituitary Adenoma Surveillance via MRI. 8. Main Items in the Imaging Report: highlight essential components for clinical and imaging follow-up alterations.

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# Abstract Archives of the RSNA, 2024

NREE-80

## ACUTE SPINAL TRAUMA MRI: A PRACTICAL GUIDE FOR BEGINNERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David Castanedo SR, MD (*Abstract Co-Author*) Nothing to Disclose
Aranzazu Sanchez Gabin, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Revuelta Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandra Somoano Marfull (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Sutil (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To know the basic spinal Magnetic Resonace Imaging (MRI) protocol in the traumatic context.- To identify the potential injuries that can occur in spinal trauma, both at the spinal cord and extramedullary area.- To know the Schaeffer and Basic classifications to assess the severity of spinal injuries

### TABLE OF CONTENTS/OUTLINE

A) Imaging techniques in spinal traumaB) Main MRI protocol and special sequences (in case of lesion at the craniocervical junction, lesion in the dura mater of the thecal sac, vertebral arteries, radicular lesion or spinal cord infarction)C) Types of injuries- Ligamentary lesions (anterior and posterior longitudinal ligament, ligamentum flavum, supra and interspinous ligaments)- Disc damage and acute herniations- Vascular injuries- Extramedullary haemorrhage- Cord damage: cord edema, haemorrhage, spinal cord section. Schaeffer and Basic classifications.

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# Abstract Archives of the RSNA, 2024

NREE-82

## FROM PIXELS TO PRACTICE: IMPACTFUL NEUROIMAGING ADVANCES IN THE CLINICAL MANAGEMENT OF CEREBRAL AMYLOID ANGIOPATHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Eduardo D. Valadares, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Clara Zanon Zotin (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Cerebral Amyloid Angiopathy (CAA) is a the second most prevalent form of cerebral small vessel disease, with devastating clinical consequences.The pattern of distribution of MRI-visible lesions aids in the distinction between CAA and other prevalent forms of sporadic cerebral small vessel diseases, such as hypertensive arteriolosclerosis.The Boston Criteria v2.0 offers high positive predictive value for the diagnosis of CAA. Edinburgh Criteria is useful in the characterization of CAA-related ICH in CT studies. Hemorrhagic markers, especially cortical superficial siderosis, more strongly predict the risk of first-ever or recurrent intracerebral hemorrhage, compared to non-hemorrhagic markers, which are more strongly associated with cognitive impairment, but are often outperformed by advanced techniques, such as diffusion-based markers.

### TABLE OF CONTENTS/OUTLINE

• Introduction: Pathophysiology, clinical spectrum, and classification of CAA.• Neuroimaging features: Hemorrhagic (cerebral microbleeds, cortical superficial siderosis, intracerebral hemorrhage, intragyral hemorrhages, convexity subarachnoid hemorrhage) and Non-hemorrhagic (perivascular spaces in the centrum semi-ovale, cortical cerebral microinfarcts, white matter hyperintensities in a multifocal subcortical pattern• Diagnostic value: Boston criteria (versions 1.0, 1.5, and 2.0) and Edinburgh criteria • Prognostic value: Risk of first-ever and recurrent intracerebral hemorrhage; Risk of transient focal neurological episodes; Risk of cognitive decline• Impact of neuroimaging markers of CAA in clinical management of patients with stroke.• CAA diagnosis in the era of anti-amyloid treatmento Risk of ARIA

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# Abstract Archives of the RSNA, 2024

NREE-83

## SMALL HEADS BIG TROUBLES NEONTAL CEREBRAL HYPOXIC-ISCHEMIC INJURY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Paola A. Lara Rodezno, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The assessment of the radiological signs in hypoxia in the full-term neonate are characteristic and different from older children; on the other hand, the alterations in premature neonates are different from those in full-term neonates. Assessment of signs of hypoxic damage on neonatal brain imaging requires attention to a number of specific signs. It is important for the radiologist to know the normal findings according to the gestational age of the neonate and to differentiate between severe or total hypoxia, prolonged or partial and mixed hypoxia. Brain MRI was evaluated in premature and term infants looking for 4 interrelated fundamental signs grouped under the term "1-2-3-4 sign" with findings of total severe hypoxia such as: increase in signal intensity of the basal ganglia and thalamus in T1W, posterior arm sign absent in full-term neonate, signs of diffusion hypoxia; signs of prolonged hypoxia such as hyperintensity of the cerebral cortex on T1W.

### TABLE OF CONTENTS/OUTLINE

The most frequent finding was hyperintensity of the basal nuclei, followed by hyperintensity of the gyri and lamellar cortical necrosis.

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# Abstract Archives of the RSNA, 2024

NREE-84

## A 360 DEGREE REVIEW OF THE POWER OF LOW INTENSITY FOCUSED ULTRASOUND (LIFUS) IN MANAGEMENT OF BRAIN TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jody L. Tanabe, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha Pisani Petrucci, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nolan Dang (*Abstract Co-Author*) Nothing to Disclose
Natalie Serkova, PhD, MBA (*Abstract Co-Author*) Nothing to Disclose
Parisa Khoshpouri, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understanding LIFUS Mechanisms Explore the fundamental mechanisms underlying Low Intensity Focused Ultrasound (LIFUS) and its unique features in affecting the blood brain barrier. 2. Explaining the Safety Profiles: Evaluate the safety profile of LIFUS in diagnosis and management of brain tumors facilitating drug delivery, emphasizing key considerations for clinical implementation. 3. Clinical Application and Ongoing Trials: Discuss the current clinical applications of LIFUS in approaching brain lesions and highlight ongoing trials investigating its efficacy, aiming to delineate its potential role as a therapeutic modality in combination with oncologic treatments.

### TABLE OF CONTENTS/OUTLINE

• Introduction to LIFUS and its Mechanism of Action: Briefly introduce the concept of Low Intensity Focused Ultrasound (LIFUS) and the underlying mechanism of LIFUS, focusing on how it interacts with neural tissue and disrupts the BBB. its potential applications in neuroradiology and targeting brain tumors. • Safety Profile: Highlight the safety considerations associated with LIFUS, including its non-invasive nature, potential side effects, and current safety protocols. • Ongoing Clinical Trials: Provide an overview of ongoing clinical trials investigating the use of LIFUS in various neurological conditions, including the objectives, methodologies, and preliminary findings. • Conclusion: Summarize the potential of LIFUS as a promising tool in neuroradiology and neuromodulation, highlighting its role in advancing the field and addressing unmet clinical needs.

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# Abstract Archives of the RSNA, 2024

NREE-85

## AN EDUCATIONAL EXHIBIT OF THE DIFFERENT IMAGING CHARACTERISTICS OF HR- VWI MRI AND MRA ON PATIENTS WITH CONFIRMED INFECTIOUS VASCULITIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Javier M. Romero, MD (*Abstract Co-Author*) Stockholder, TMA Precision Medicine
Suely F. Ferraciolli, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Odette Ganem (*Presenter*) Nothing to Disclose

### TEACHING POINTS

HR- VWI has been recently utilized as an excellent sequence to detect inflammation of the intracranial circulation when vasculitis is suspected. Although imaging characteristics have been well defined in patients with primary central nervous system vasculitis, infectious or secondary vasculitis has been less well described. Many Infectious etiologies may result in vasculitis, including viral, bacterial, or fungal etiologies.In this pictorial review, we would like to highlight the local changes on the vascular wall and the predominant vascular territories compromised in infectious diseases viewed on High-resolution vessel wall imaging (HR-VWI) MRI and magnetic resonance angiography (MRA).

### TABLE OF CONTENTS/OUTLINE

- Introduction- Clinical presentation of Infectious Vasculitis: Viral, Bacterial, and Fungal - Radiographic characteristics of infectious vasculitis on MRA and HR VWI MRI - Differential Diagnosis with other causes of CNS Vasculitis (with schematic drawing)- Conclusion

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# Abstract Archives of the RSNA, 2024

NREE-86

## EX VIVO HIGH-RESOLUTION CAROTID PLAQUE MRI WITH EMPHASIS OF QUANTITATIVE SUSCEPTIBILITY MAPPING: IMMUNOHISTOPATHOLOGICAL CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ryo Toya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomoki Nakano, MD (*Abstract Co-Author*) Nothing to Disclose
Ayano Ishiyama, MD (*Abstract Co-Author*) Nothing to Disclose
Hideki Ishimaru (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Many studies using in vivo carotid plaque MRI have highlighted its usefulness in the detection of clinically unstable plaques. However, in vivo MRI is often plagued by motion artifacts, such as carotid artery pulsation, and offers lower spatial resolution than microscopic histopathology specimens. Consequently, accurately assessing signals related to different components within carotid plaques can be difficult. Ex vivo MRI presents advantages such as eliminating motion artifacts and providing higher-resolution images that can be accurately correlated with histopathology. Quantitative susceptibility mapping (QSM), a recently developed technique for measuring tissue susceptibility, is expected to characterize the carotid plaque composition. In this presentation, we provide new insights from ex vivo high-resolution carotid plaque MRI, including QSM, and identify discrepancies with previous in vivo imaging results while also raising important issues that require further attention.

### TABLE OF CONTENTS/OUTLINE

-Immunostaining is useful for diagnosing carotid plaque components -Can intraplaque hemorrhage and lipid-containing components be distinguished? -Is it the only calcification that shows a low signal in all imaging sequences? -Is it practically possible to diagnose fibrous cap? -What signals do the fibrous component and loose matrix exhibit? -Key challenges to be solved.

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NREE-87

## DIAGNOSTIC ACCURACY OF CONTRAST ENHANCED FLUID-ATTENUATED INVERSION RECOVERY (CE-FLAIR) MRI IN DIAGNOSIS OF INFECTIOUS MENINGITIS TAKING CSF ANALYSIS AS GOLD STANDARD”

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Urooj Kanwal, DMRD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shaista Shoukat, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sumera Shahbaz, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sumaira Roohi, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Meningitis, an inflammation of the meninges, can be caused by various infectious agents. Early and accurate diagnosis is vital for effective treatment. Cerebrospinal fluid (CSF) analysis is the standard method, but Contrast Enhanced Fluid-Attenuated Inversion Recovery (CE-FLAIR) MRI shows potential for improved visualization of meningeal inflammation. However, its diagnostic accuracy compared to CSF analysis needs clarification. This study aims to address this gap.

### TABLE OF CONTENTS/OUTLINE

STUDY DESIGN Cross-Sectional Descriptive Study RESULTSThe mean age was calculated to be 35.4 + 14.7 years with 145 male participants (51.60%) and 136 female participants (48.40%).The diagnostic accuracy of CE-FLAIR MRI was further delineated in Figure No. 5. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated as 96.05%, 92.23%, 94.71%, and 94.06%, respectively. The overall diagnostic accuracy of CE-FLAIR MRI was determined to be 94.51%. CONCLUSION This study provides valuable insights into the diagnostic accuracy of contrast enhanced fluid-attenuated inversion recovery (CE-FLAIR) MRI in meningitis diagnosis. The results underscore the potential of CE-FLAIR MRI as a noninvasive tool with comparable diagnostic accuracy to the gold standard cerebrospinal fluid (CSF) analysis.

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# Abstract Archives of the RSNA, 2024

NREE-88

## CLINICAL SIGNIFICANCE OF OUTER CONTOUR ASSESSMENT OF INTRACRANIAL VESSELS USING 3D HEAVILY T2 WEIGHTED MR CISTERNOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hideki Ishimaru (*Abstract Co-Author*) Nothing to Disclose
Tomoki Nakano, MD (*Abstract Co-Author*) Nothing to Disclose
Ryo Toya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Chika Somagawa, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

3DMR cisternography is a high spatial resolution image with heavy T2 contrast (cerebrospinal fluid is visualized as a high signal and the other as a low signal). Imaging methods based on fast spin echo and fast gradient echo are mainly used and are effective in the diagnosis of cerebrospinal fluid leaks, hydrocephalus, and the relationship between tumors and normal structures. This method can also be used to evaluate intracranial vascular contours and can be applied to a variety of vascular diseases. The purpose of this exhibit is to provide clinical applications of 3D MR cisternography in various intracranial vascular diseases, with an emphasis on the outer contour assessment of intracranial vessels.

### TABLE OF CONTENTS/OUTLINE

Sequence for 3D MR cisternography-Imaging parameters and image contrast-Case based presentation-A. Arterial contours (arterial course in acute arterial occlusion, evaluation of outer diameter of occluded blood vessels in moyamoya disease, aplastic/twig-like MCA)-B. Venous contours (involvement in neurovascular compression, draining veins in dural arteriovenous fistula)-C. Estimation of vascular wall pathology by comparison with TOF (atherosclerotic plaque, arterial dissection, cerebral vasospasm, etc)-D. Location of cerebral aneurysm (distal dural ring and paraclinoid aneurysm)-E. Others-F. Limitations and Pitfalls-

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# Abstract Archives of the RSNA, 2024

NREE-89

## DON'T GET LOST, USE THE BONE. A COMPREHENSIVE GUIDE OF THE ANTERIOR CONDYLAR CONFLUENCE ANATOMY USING CONE-BEAM CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Orlando M. Diaz, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando Ahumada (*Abstract Co-Author*) Nothing to Disclose
Kristina Ramirez Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Valeria Ortega, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Review the anatomy of the anterior condylar confluence and the related network of vein structures. 2) Describe the cone-beam CT utility in arteriovenous fistulas at the anterior condylar confluence and adjacent bone structures.3) Recognize the landmarks and identify differences between the arteriovenous fistulas of the anterior, posterior, and lateral condylar veins.

### TABLE OF CONTENTS/OUTLINE

1) Cone-beam CT: Importance in describing bone anatomya) Previous literature utilization of cone-beam CTb) Cone-beam CT's role in understanding the anterior condylar confluence and adjacent venous structures2) Posterior fossa venous drainage overview3) Anterior condylar confluence anatomy 4) Anatomy review with cone beam CT: Structures related to the anterior condylar confluence5) How to identify anterior condylar vein6) Anterior condylar vein arteriovenous fistulasa) Case 1b) Case 27) How to identify posterior condylar vein8) Posterior condylar vein arteriovenous fistulasa) Case 3b) Case 49) How to identify lateral condylar vein10) Lateral condylar vein arteriovenous fistulasa) Case 3b) Case 411) Conclusion

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# Abstract Archives of the RSNA, 2024

NREE-9

## MANAGEMENT OF INTRACRANIAL METASTASES: WHAT THE RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Miral D. Jhaveri, MD, MBA (*Abstract Co-Author*) Royalties, RELX
Surjith Vattoth, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Santhosh Gaddikeri, MD (*Abstract Co-Author*) Nothing to Disclose
Ken Tatebe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shehbaz M. Ansari, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Brian Mu, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Review imaging findings associated with intracranial metastases, with an emphasis on features that are germane to management decisions.2. Discuss the major modalities for treatment of intracranial metastases including radiation therapies, systemic treatments (chemotherapy immunotherapy), and surgical approaches with a focus on clinical issues relevant to an interpreting radiologist.3. Review post-treatment imaging of intracranial metastases and the major complications associated with each treatment modality.4. Role of advanced imaging to differentiate residual/recurrent metastasis vs treatment related changes.

### TABLE OF CONTENTS/OUTLINE

Significant advancements have been made in the diagnosis and treatment of intracranial metastases, improving outcomes but complicating their clinical landscape and evaluation on imaging. To generate cogent reporting, radiologists should understand the clinical implications of different imaging characteristics of metastatic lesions and have basic familiarity with when and how major treatment modalities are used. The exhibit focuses on the routine neuroimaging task of evaluating intracranial metastases both before and after treatment. The role of advanced imaging techniques beyond conventional MRI is discussed, particularly in the differentiation of true residual or recurrent metastastic disease from pseudoprogression or radiation necrosis. Additionally, a wide range of complications including postoperative, parenchymal and vascular post-radiation, and chemotherapy and immunotherapy related complications are also reviewed.

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# Abstract Archives of the RSNA, 2024

NREE-91

## POST-THROMBECTOMY IMAGING FINDINGS: WHAT THE GENERAL RADIOLOGIST NEEDS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Ranliang Hu, MD (*Abstract Co-Author*) Stockholder, Moderna, Inc;Stockholder, Pfizer Inc
Dan I. Cohen-Addad, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander D. Bode, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Nance, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Saumya Gurbani, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Describe the clinical indications for mechanical thrombectomy and the TICI classification scale for assessing reperfusion after thrombectomy.2. Illustrate normal imaging findings and complications following mechanical thrombectomy, including a review of the clinical relevance of these findings.3. Discuss the use of different modalities to differentiate blood products from contrast staining, including dual energy CT and MRI.

### TABLE OF CONTENTS/OUTLINE

Mechanical thrombectomy is an effective intervention for ischemic stroke and relies on multimodal imaging for post-procedure follow-up. With increasing prevalence, the general radiologist should be familiar with the spectrum of post-thrombectomy imaging. In this article, we describe expected and unexpected imaging findings via a case review of patients who underwent mechanical thrombectomy for ischemic stroke.- Clinical guidelines for mechanical thrombectomy and TICI classification of reperfusion.- Review expected post-thrombectomy findings: clot resolution, contrast staining, subarachnoid hemorrhage.- Review unexpected imaging findings and their clinical relevance, including: residual clot, re-occlusion, access site dissection and pseudoaneurysm, vasospasm, hemorrhagic conversion, contrast-induced neurotoxicity.- Discuss use of dual energy CT and MRI to differentiate hemorrhage from contrast staining

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# Abstract Archives of the RSNA, 2024

NREE-92

## JOURNEY TO THE CENTER OF THE HEAD - IMAGING REVIEW OF CAVERNOUS SINUS TUMORAL LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Marta Calvo-Imirizaldu, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Manuel Rafael Lopez De La Torre Carretero (*Abstract Co-Author*) Nothing to Disclose
Elida Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo D. Dominguez, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Miguel Escudero-Fernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Reyes M. Garcia-Eulate (*Abstract Co-Author*) Nothing to Disclose
Carmen Mbongo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To evaluate the different tumoral entities that can involve the cavernous sinuses (CS), including intrinsic and extrinsic lesions.• To describe perineural paths and anatomic relationships, such as the skull-base foramina, that are important in secondary invasion of the CS.

### TABLE OF CONTENTS/OUTLINE

Many crucial vascular and nervous structures converge in the CS, including the internal carotid artery -ICA- and the cranial nerves III, IV, V1, V2 and VI. The CS can be damaged by tumoral lesions of distinct origins.Neoplasms can primarily arise within the CS, secondarily invade it from adjacent structures, by perineural spread through skull base foramina or by metastatic disease.• Intrinsic tumors include:- Meningioma: it produces luminal narrowing of the ICA and shows homogeneous enhancement after contrast administration.- Cavernous Hemangioma: it does not produce luminal narrowing of the ICA.- Schwannoma: it shows heterogeneous enhancement, and cystic or hemorrhagic areas can be observed.- Plexiform Neurofibroma: the target sign is a typical finding of these tumors.- Other tumors: Solitary Fibrous Tumor and Melanoma.• Extrinsic tumors can be classified according to their location:- Sellar and suprasellar region: Pituitary macroadenoma invades the CS when it contacts more than 67% of the diameter of the ICA. A Craniopharyngioma can show cystic and calcified areas in children.- Oral / Maxillary region: Nasopharyngeal Carcinoma, Juvenile Nasopharyngeal Angiofibroma, Adenoid Cystic Carcinoma, Rhabdomyosarcoma, Esthesioneuroblastoma.- Bone malignancies: Chordoma, Chondrosarcoma, Osteosarcoma.- Systemic malignancies: Lymphoma, Multiple Myeloma and Metastases.

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# Abstract Archives of the RSNA, 2024

NREE-93

## BRIDGING THE GAP: LIFE-SIZE 3D PRINTED PEDIATRIC TO ADULT NEUROVASCULAR AND CRANIAL ANATOMY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jonathan M. Morris, MD (*Abstract Co-Author*) Consultant, Medtronic plc;Speaker, Medtronic plc;Consultant, Merit Medical Systems, Inc;Speaker, Merit Medical Systems, Inc;Consultant, Landauer Inc;Speaker, Johnson & Johnson
David F. Black, MD (*Abstract Co-Author*) Nothing to Disclose
Hayden Swartz, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Pediatric neurovascular anatomy is a series of small and complex arteries and veins overlapping critical neuroanatomic structures. Foundational knowledge begins in medical school with adult cadaveric dissections, two-dimensional (2D) medical illustrations, and progresses through cross sectional imaging and angiographic evaluation during training. 2. Current resources provide limited conceptual models of the small and complex pediatric neurovascular and neuroanatomic relationships. 3. Cadaveric dissections provide valuable understanding, however, are destructive and not widely available due to ethical factors, limited autopsy exposure, and rarity of pathology. 4. By combining coregistered computed tomography (CT), CT angiography, and gadolinium bolus magnetic resonance venogram with three-dimensional (3D) computer aided design software, 3D printing pioneers a practical solution to teach age-dependent, patient-specific, life-size neurovascular anatomy and the overlying cranial vault in normal patients ages 0-18. 5. 3D printed models offer several advantages including an ethical nondestructive means to acquire, manufacture, and teach neurovascular anatomy, including haptic perception, unattainable by current resources, critical for radiology trainees.

### TABLE OF CONTENTS/OUTLINE

1. Background of pediatric neurovascular anatomy. 2. Current state of educational tools and gap. 3. Benefits of patient and age specific 3D printed models from imaging. 4. Future directions of 3D neurovascular education.

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# Abstract Archives of the RSNA, 2024

NREE-94

## JOURNEY TO THE CENTER OF THE HEAD - IMAGING REVIEW OF CAVERNOUS SINUS NON-TUMORAL LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jose Miguel Escudero-Fernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Elida Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo D. Dominguez, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Calvo-Imirizaldu, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Reyes M. Garcia-Eulate (*Abstract Co-Author*) Nothing to Disclose
Carmen Mbongo, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; To evaluate the different non-tumoral entities that can invade the cavernous sinuses (CS).; To learn the most important imaging features of each lesion and how to make an adequate differential diagnosis with neoplastic etiologies.; To describe anatomic relationships, such as the skull-base foramina, that are important in secondary invasion of the CS.

### TABLE OF CONTENTS/OUTLINE

Unlike neoplasms, non-tumoral lesions tend to show low signal on T2-weighted imaging. They can be classified according to their etiology:; Vascular etiologies: Carotid-cavernous fistula, Internal carotid artery Aneurysm and CS thrombosis. They all produce similar clinical features; the CS syndrome (exophthalmos, ophthalmoplegia, chemosis, etc). Digital subtraction angiography plays a dual role in their diagnosis and management.; Infectious etiologies: Fungal sinusitis produces narrowing and thrombosis of the internal carotid artery and the CS, with infarction of paranasal and nasal tissues (producing the typical "black turbinate sign"). Tuberculous pachymeningitis manifests as nodular and enhancing lesions.; Inflammatory etiologies: include Granulomatosis with Polyangiitis, Tolosa-Hunt Syndrome, Sarcoidosis and IgG4 Disease. Granulomatosis with polyangiitis affects paranasal sinus, nasal cavities and orbits and may produce hypertrophic pachymeningitis with CS involvement, ICA stenosis and vasculitis. Tolosa-Hunt syndrome is a diagnosis of exclusion and involves the CS region, the superior orbital fissure and the orbital apex of the same side.; Miscellaneous: Arachnoid, Epidermoid, Dermoid Cysts and Pseudocysts. Epidermoid cysts do not enhance and show diffusion restriction.

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# Abstract Archives of the RSNA, 2024

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## DEFINING THE CENTRAL ROLE OF RADIOLOGY FOR SAFE AND EFFECTIVE ANTI-AMYLOID THERAPY IN EARLY ALZHEIMER'S DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joseph M. Mettenburg, MD (*Abstract Co-Author*) Nothing to Disclose
Riddhi Patira (*Abstract Co-Author*) Nothing to Disclose
Saurab Faruque, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Anti-amyloid (AA) monoclonal antibodies rapidly emerged as an approved treatment for Alzheimer's disease (AD) dementia. Efficacious and safe treatment requires robust clinical data to accurately classify patients at initiation and to monitor throughout treatment. Radiologists directly contribute to this process through acquisition and interpretation of baseline and serial screening MRI and careful collection of cerebrospinal fluid (CSF) samples. This educational exhibit aims to prepare radiologists for their central role in AA therapy programs.The educational objectives of this exhibit are to understand:- Factors affecting CSF AD biomarker analysis and the recommended pre-analytical protocol for mitigating variability- Conditions and imaging features that exclude patients from AA therapy, and radiographic pitfalls and mimics- The role of MRI parameters in serial amyloid-related imaging abnormality (ARIA) assessment- Imaging characteristics of ARIA-H (hemorrhage) and ARIA-E (edema)- Monitoring timelines for ARIA, and circumstances and recommendations for adjustments to monitoring and treatment

### TABLE OF CONTENTS/OUTLINE

1. AD pathophysiology therapeutic targets2. The radiologist’s role in treatment initiationa. Baseline MRI-detectable exclusionary conditions criteria, and their imaging characteristics mimicsb. Rationale recommendations for standardized CSF sample collection3. The radiologist’s role in monitoring managementa. Overview of ARIA-H ARIA-Eb. Considerations for selecting MRI sequence type field strengthc. Recommended monitoring protocol timelined. Evaluating ARIA radiographic severitye. Adjustments to monitoring therapy after detection of ARIA

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# Abstract Archives of the RSNA, 2024

NREE-96

## MRI "ARTIFACTS" WITH CLINICAL RELEVANCE IN STROKE EVALUATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Richard Wang (*Abstract Co-Author*) Nothing to Disclose
Meisam Hoseinyazdi (*Abstract Co-Author*) Nothing to Disclose
Vivek Yedavalli, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Dhairya Lakhani, MD (*Abstract Co-Author*) Nothing to Disclose
Minsoo Kim (*Abstract Co-Author*) Nothing to Disclose
Kevin Chen, BA (*Abstract Co-Author*) Nothing to Disclose
Cynthia M. Greene, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To review the physical origins of MRI signs including Fluid Attenuated Inversion Recovery (FLAIR) Hyperintense Vessel Sign (HVS), Susceptibility Weighted Imaging (SWI) Brush Sign (BS) and the Arterial Spin Labeling (ASL) Arterial Transit Artifact (ATA). -Then describe the imaging features of these artifacts in MRI. -We will then review the associations of these findings with acute stroke.

### TABLE OF CONTENTS/OUTLINE

1. Introduction2. The FLAIR hyperintense vessel sign (HVS).a, The physics of hyperintense vessels on FLAIR.b, Imaging appearance. c, Clinical Associations - scoring FHV ASPECT.3. SWI brush sign (BS)a, The origin of the brush sign on SWI.b, Imaging appearance. c, Clinical associations.4. ASL arterial transit artifact (ATA)a, The origin of the arterial transit artifact. b, Imaging appearance.c, Clinical associations.

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# Abstract Archives of the RSNA, 2024

NREE-97

## FUNCTIONAL MRI TECHNIQUES TO DETECT, UNDERSTAND, AND PROGNOSTICATE DISORDERS OF CONSCIOUSNESS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David Fischer (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Ware, MD (*Abstract Co-Author*) Nothing to Disclose
Azfar Basunia, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Disorders of consciousness (DoC) are believed to occur due to disruption of key awareness and arousal brain networks. Conventional clinical assessments have major limitations and suffer high misdiagnosis rates, posing challenges to decision making over the withdrawal of life-sustaining care. In this exhibit, we aim to:1. Highlight limitations of current clinical assessments and conventional imaging in neuroprognostication.2. Illustrate fMRI techniques to detect and differentiate between levels of consciousness and prognosticate on future recovery.3. Review current society guidelines and possible implementation strategies.

### TABLE OF CONTENTS/OUTLINE

1. Overview of disorders and levels of consciousness.2. Current clinical assessments and conventional imaging techniques (CT, MRI) a. Limitations in accurate DoC detection and neuroprognostication b. Need for novel techniques based on the neurobiology of coma.3. Functional MRI (fMRI) for understanding and prognosticating on DoC and detecting covert consciousness such as covert cortical processing and cognitive motor dissociation a. Task-based fMRI b. Stimulus-based fMRI c. Resting-state fMRI - (i) Functional network integrity for neuroprognostication (ii) Frequency domain analysis (iii) Emerging techniques such as dynamic functional connectivity.4. Practical considerations for fMRI implementation a. Acquisition and pre-processing strategies, including novel techniques to improve patient-level reliability b. Post-processing approaches and interpretation c. Considerations for scanning critically ill patients (safety, sedation, etc).5. Current society guidelines and expert consensus on DoC neuroprognostication with fMRI.

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# Abstract Archives of the RSNA, 2024

NREE-98

## INTRACRANIAL VESSEL WALL MRI: WHAT YOUR LUMEN IS NOT TELLING YOU

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Keena Li (*Abstract Co-Author*) Nothing to Disclose
Hediyeh Baradaran, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Bryan L. Bishop, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. We will provide an overview of what VWI entails and which patient populations are most likely to benefit from this type of advanced imaging. 2. We will provide an in-depth review of imaging techniques and protocols for high quality VWI in a timely manner which can be easily transitioned to clinical practice. 3. We will provide a clear, stepwise approach for interpreting vessel wall MR. 4. We will review specific scenarios in which VWI is a useful tool and adjunct to standard imaging.

### TABLE OF CONTENTS/OUTLINE

1. Introduction and overview of what vessel wall imaging means and who may benefit from this technique. a. Allows visualization of vessel wall rather than lumen alone. b. Differentiating etiologies of intracranial luminal stenosis. c. Identifying source of symptomatic disease which does not result in luminal stenosis and is not detected on standard imaging. 2. Imaging protocol for VWI. a. Review of various imaging techniques and protocols for VWI. b. Practical information on specific sequences and timing. 3. Stepwise approach to interpreting VWI in the clinical setting. a. Identify vessel narrowing on TOF MRA. b. Classify pattern of narrowing. c. Evaluate T2 weighted sequence. d. Evaluated for presence of and pattern of enhancement. 4. Scenarios in which VWI is a useful adjunct to standard neuro imaging. a. Non-stenosing Atherosclerotic Plaque i. Vessel wall enhancement, remodeling, plaque thickness and surface irregularity, intraplaque hemorrhage. b. CNS Vasculitis i. Concentric wall thickening and enhancement which persist over multiple examinations. c. Moyamoya i. VWI can be helpful to differentiate MMD, A-MMS, and V-MMS. d. CAA (A Beta Angiitis) i. Wall inflammation can be seen in inflammatory CAA.

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# Abstract Archives of the RSNA, 2024

NREE-99

## CURRENT STATUS OF GLYMPHATIC IMAGING: PERSPECTIVES AS OF 2024

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Toshiki Nakane (*Abstract Co-Author*) Nothing to Disclose
Hisashi Kawai (*Abstract Co-Author*) Nothing to Disclose
Rintaro Ito, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Shinji Naganawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rei Nakamichi (*Abstract Co-Author*) Nothing to Disclose
Toshiaki Taoka, MD, PhD (*Presenter*) Research Grant, Canon Medical Systems Corporation

### TEACHING POINTS

Since its introduction in 2012, the glymphatic system hypothesis has gained attention through animal studies showing its role in conditions like Alzheimer's disease, Parkinson's disease, stroke or head trauma. Human evaluation remains challenging due to the unavailability of fluorescent tracers and the unapproved use of intrathecal gadolinium-based contrast agents (GBCA). As an alternative, the Diffusion Tensor Image Analysis aLong the Perivascular Space (DTI-ALPS) method has gained traction for its noninvasive nature and simple interpretability through the ALPS-index. However, recent critiques question its reliability due to sensitivity to imaging conditions and issues like fiber crossing. This exhibit will introduce the concept of glymphatic system, detail the DTI-ALPS method along with its limitations, and explore additional non-invasive techniques such as choroid plexus volume, perivascular space volume assessment, and evaluations of blood-brain barrier or venous wall permeability using GBCA, offering a comprehensive overview of current methodologies for glymphatic system evaluation.

### TABLE OF CONTENTS/OUTLINE

1. Overview of the Glymphatic System- Introduction to the Glymphatic System Hypothesis- Importance of the Glymphatic System in Neurological Diseases2. Detailed Analysis of the DTI-ALPS Method-Description of the DTI-ALPS Technique and the ALPS Index-Limitations and Critiques of the DTI-ALPS Method3. Other Non-Invasive Assessment Techniques for Glymphatic System-Non-Contrast Techniques (e.g., choroid plexus volume assessment)-Contrast-Enhanced Techniques (e.g., evaluation of blood-brain barrier)

# Abstract Archives of the RSNA, 2024

OBEE

**OB/Gynecology Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## OBEE-1 ULTRASOUND ASSESSMENT OF GRAVID CERVIX: A PRIMER FOR RADIOLOGISTS

Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Matheus Santos Rios, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana Cerri, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Abstract Co-Author*) Nothing to Disclose
Sergio Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Enzo Calheiros, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Preterm birth (PTM) continues to stand as the foremost cause of perinatal morbidity and mortality globally, with a reduced cervical length (CL) representing a clinical marker classically associated with an increased risk of preterm delivery.- Ultrasound (US) is the primary imaging method for evaluating the gravid cervix in patients at high risk for PTB (including asymptomatic women) or those exhibiting signs of preterm labor.- CL measured by US is a very useful screening test that has been associated with better prediction of PTB than previously available tests.- This pictorial review aims to illustrate key concepts in the clinical use of US as a screening tool for PTB, focusing on the evaluation of CL. Based on a step-by-step approach, we propose a systematization of this examination tailored for clinical radiologists.

### TABLE OF CONTENTS/OUTLINE

1. Background: Preterm birth- Risk factors- Screening and prevention2. Anatomy of uterine cervix and changes during pregnancy3. US-based screening strategies for preterm birth- Cervical length- Other US findings (funneling, amniotic fluid sludge, etc)4. US techniques: - Transabdominal - Translabial - Transvaginal - 3D Imaging - Elastography5. ACR Appropriateness Criteria: a step-by-step approach6. Management of short cervix: what to know and what to look for7. Summary and take-home messages

## OBEE-10 ENDOMETRIOSIS OF THE ADNEXA ON MRI: AN IN-DEPTH REVIEW BEYOND THE ENDOMETRIOMA

Anuradha S. Shenoy-Bhangle, MD (*Abstract Co-Author*) Nothing to Disclose
Haatal B. Macer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) A thorough understanding of adnexal anatomy is crucial to describing sites of DE for surgeons2) DE of the broad ligament manifests as T2 hypointense nodular implants contiguous with adjacent DE, in isolation or endometrioma of the broad ligament. Lateral pelvic extension may involve the pelvic nerves3) DE of the fallopian tube manifests as salpingitis, serosal/subserosal implants with tethering and hydrosalpinx, mucosal/luminal implants with hematosalpinx, or T2 hypointense thickening at a salpingectomy site4) Don't forget paratubal cysts as a potential site of endometriosis5) Ovarian endometriosis includes superficial implants, serosal disease and endometrioma6) Round ligament DE manifests as thickening, nodularity deviation and/or shortening, most commonly involving the intrapelvic portion near the uterus

### TABLE OF CONTENTS/OUTLINE

1) Adnexal Anatomy on MR: Broad Ligament, Round Ligament, Fallopian Tubes, Ovaries, Uterine Artery, Ovarian Artery, Lateral Pelvic Nerves2) Manifestations of endometriosis in the BL on MR with case examples and implications on neural involvement: Nodular implants contiguous with adjacent DE, Nodular implants in isolation, endometrioma of the broad ligament3) Manifestations of endometriosis of the FT on MR: Salpingitis, Serosal/Subserosal implants, Mucosal/Luminal Implants, Tubal Stump Implant4) Paratubal Endometriosis: Atypical site of DE, identification of cysts on MR and importance of pre-operative reporting for optimal DE excision5) Manifestations of endometriosis of the Ovaries on MR with case examples: Superficial implants, Serosal disease, Endometrioma6) Endometriosis of the RL: Normal anatomy, intra/extra pelvic involvement,7) Conclusion

## OBEE-11 ADNEXAL TORSION: DO YOU HAVE AN MRI AVAILABLE? IF YES, USE IT NO MATTER WHAT TIME IT IS

Arnaldo Scardapane (*Abstract Co-Author*) Nothing to Disclose
Luca Leo (*Abstract Co-Author*) Nothing to Disclose
Giuseppe V. Sturda (*Abstract Co-Author*) Nothing to Disclose
Roberta Montefrancesco (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review CT and MR imaging of adnexal torsion with pathologic correlation. 2. To propose an optimized MRI protocol (as brief and diagnostic as possible) for the gynecological emergencies that are simple to perform. 3. To emphasize the validity of using DWI sequences to identify ovarian viability.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: pathophysiology of adnexal torsion. 2. Presentation of "confusing-doubtful" clinical manifestations in Emergency Department. 3. What to do when ultrasound and CT are not enough? MRI: to whom, how and what time. 4. CT and MRI features with pathological correlations of ovarian necrosis due to delayed diagnoses. 5. Clinical cases in which the timely use of MR imaging leads to an early diagnosis preserving the ovary.

## OBEE-12 CLINICAL IMPLEMENTATION OF SOCIETY OF RADIOLOGISTS IN ULTRASOUND CONSENSUS PANEL GUIDELINES FOR DETECTING ENDOMETRIOSIS ON ROUTINE PELVIC US: CHALLENGES, OPPORTUNITIES AND STRATEGIES FOR SUCCESS

Liina Poder, MD (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Scott W. Young, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Luyao Shen, MD (*Abstract Co-Author*) Nothing to Disclose
Myra K. Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Priyanka Jha, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Endometriosis a prevalent disorder affecting approximately 10% of premenopausal patients.2. Chronic pelvic pain and infertility are the most common presenting symptoms3. Despite the high prevalence, endometriosis is frequently under recognized on imaging and patients face significant diagnostic delays of over 7-10 years4. Ultrasound is the most commonly performed imaging study for female pelvic symptoms and hence provides an opportunity for detecting endometriosis on routine pelvic imaging5. Simple maneuvers such as sliding sign and wide field of view imaging can help detect endometriosis on ultrasound6. Direct and indirect ultrasound features can be assessed, stratifying the risk for endometriosis based on the presence of these features.7. Further management and guidance for MRI can be provided based on the APU scores.

**TABLE OF CONTENTS/OUTLINE**

1. Background information on prevalence of endometriosis2. Understand reasons for diagnostic delays of 7-10 years3. Update on clinical society guidelines for endometriosis imaging4. Necessity for screening for endometriosis on routine pelvic ultrasound5. Identify screening population6. Definition of augmented ultrasound7. Learn the necessary maneuvers to adopt the protocol into clinical practice8. How to perform a sliding sign- demonstration using static and cine images9. Demonstrate wide field of view imaging on static and cine images10. Show common imaging features of endometriosis on routine pelvic ultrasound11. Imaging examples of cases detected on routine pelvic ultrasound, followed by advanced endometriosis imaging (both US or MRI) and finally surgical correlation will be presented.

## OBEE-13 ADVANCED OVARIAN NEOPLASIA: DEFINITION OF AFFECTED ANATOMICAL SITES AND THE IMPACT OF TARGETED REPORT ON SURGICAL APPROACH

Lhuanna Maria Barbosa Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia P. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina P. Abud, MD (*Abstract Co-Author*) Nothing to Disclose
Marina M. Costa (*Abstract Co-Author*) Nothing to Disclose
Maria Helena N. Pedroso (*Abstract Co-Author*) Nothing to Disclose
Ana Claudia V. Uski SR, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Heloise Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Batista Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Reviewing the potential anatomical sites involved in ovarian neoplasms following a standardized lexicon for radiological reporting proposed by the Society of Abdominal Radiology and the European Society of Urogenital Radiology Female Pelvic Imaging Working Group (SAR/ESUR lexicon) for CT and MRI studies. Demonstrating the particularities of each method (CT, MRI, and PET-FDG) and their main limitations in this context. Showing the importance of targeted reports in accurately defining anatomical sites for optimal surgical management.

**TABLE OF CONTENTS/OUTLINE**

Many patients with ovarian cancer present with advanced-stage disease at the time of diagnosis. In this scenario, standard treatment includes a combination of cytoreductive surgery and chemotherapy. It is unquestionable that the treatment goal should be the complete resection of all visible and palpable tumors, with imaging methods essential for determining tumor extent and guiding surgical decision-making. Targeted reports, with a systematic evaluation of 45 anatomical sites potentially involved in ovarian neoplasms, should be accurately reported and properly topographed. Additionally, recognizing radiological criteria predictive of optimal or suboptimal cytoreduction should be extensively acknowledged by radiologists to assist and guide gynecologic oncologic surgeons in decision-making.

## OBEE-15 IMAGING APPROACH FOR VULVAR DISEASES: WHAT EVERY RADIOLOGIST SHOULD KNOW

Maria N. Napoli, MD (*Abstract Co-Author*) Nothing to Disclose
Teresa A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia E. Gimenez, MS (*Abstract Co-Author*) Nothing to Disclose
Leonela Panaccio (*Abstract Co-Author*) Nothing to Disclose
MARIA BELEN DASS CORREA (*Abstract Co-Author*) Nothing to Disclose
Felicitas Aguirre (*Abstract Co-Author*) Nothing to Disclose
Paula Hernandez Garrigo (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Ultrasound serves as the primary diagnostic method for the initial assessmentof vulvar lesions. Nevertheless, MRI stands out as the preeminent imaging modality for comprehensive evaluation of both the anatomical structure and pathological features of the area.; Vulvar lesions encompass a diverse array of medical conditions affecting the female lower genital tract, ranging from benign to malignant diseases.; Benign lesions usually manifest as simple cystic or solid lesions.; Malignant diseases typically manifest as sizable, compact masses infiltrating the vaginal and perineal regions.; Enhanced comprehension of the normal anatomical structures combined with refined MRI imaging techniques facilitates more precise evaluation of these conditions, mitigating the need for unwarranted interventions and facilitating surgical planning where necessary.

**TABLE OF CONTENTS/OUTLINE**

; Review of vulvar anatomy.; Assessment of the utility of magnetic resonance imaging across various vulvar pathologies and its impact on adjacent organ involvement.; Establishment of an anatomical and imaging correlation to elucidate diverse vulvar pathologies.; Comparative analysis employing algorithms to delineate the radiological features observed in magnetic resonance imaging across different pathologies.

## OBEE-16 EARLY AND DELAYED POST-CESAREAN COMPLICATIONS: AN IMAGING REVIEW

Ananya Panda, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Amr M. Elmahdy, MBChB (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Zacharias, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To discuss role of imaging in distinguishing the expected postoperative findings following cesarean delivery from those that require attention/ treatment. 2. To discuss imaging of acute complications following cesarean delivery. 3. To describe radiological findings of chronic complications following cesarean delivery.

**TABLE OF CONTENTS/OUTLINE**

IntroductionEpidemiologyCesarean delivery techniqueNormal post-operative imaging findingsAcute ComplicationsHematoma:Bladder Flap HematomaSubfascial HematomaRectus Sheath HematomaDehiscence/Rupture:DehiscenceRuptureRetained products of conceptionVascular Delayed ComplicationsScar nicheCesarean scar pregnancyPlacenta accreta spectrumAbdominal wall endometriosisMalpositioned intrauterine deviceAbdominal adhesions

## OBEE-17 DIAGNOSTIC DILEMMAS IN ENDOMETRIOSIS: RADIOLOGICAL SOLUTIONS

Samruddhi V. Jain JR, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Kuldip S. Mann, MD (*Abstract Co-Author*) Nothing to Disclose
Charanjeet Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmet Y. Yitik, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua R. Russell, DO (*Abstract Co-Author*) Nothing to Disclose
Mili Rohilla, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Recognizing diverse clinical presentations and complications of endometriosis.-Identifying radiological appearances on various imaging modalities.-Appreciating diagnostic challenges and nuances in endometriosis assessment.

**TABLE OF CONTENTS/OUTLINE**

Outline/Table of Contents:I. Introduction to EndometriosisA. Significance and prevalenceB. Clinical clues and risk factorsII. Clinical Staging and Diagnostic ChallengesA. Current staging methods and limitationsB. Diagnostic clues and unusual manifestationsIII. Radiological ManifestationsA. Imaging modalities and their sensitivityB. Diagnostic clues on CT, MRI, and ultrasoundIV. Complications and Associated FindingsA. Malignant transformation and secondary infectionsB. Rupture of endometrioma and associated complicationsV. Conclusion and Clinical ImplicationsA. Role of imaging in early diagnosis and managementB. Importance of radiologists' familiarity with endometriosis presentations

## OBEE-18 INTRAUTERINE DEVICES REVISITED: A COMPREHENSIVE LOOK AT COMPLICATIONS

Erika Suenaga, MD (*Abstract Co-Author*) Nothing to Disclose
Paula de Lima Regio, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Passos Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Yoshimura (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Claudia C. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Dubinco, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Francisco Neto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcelo R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta Linhares, MD (*Abstract Co-Author*) Nothing to Disclose
Eliane E. Dutenhefner, MD, BDS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Intrauterine devices (IUDs) exert a contraceptive effect when placed inside the uterus and represent one of the most widely used contraceptive methods worldwide. Evaluation begins before device placement to assess any factors that may impair insertion. Improper placement can result in pelvic pain, abnormal bleeding, infections, and ectopic pregnancy. Increasingly, IUD placement is guided by ultrasound to minimize complications.This presentation aims to outline radiological signs of IUD expulsion, with an emphasis on distinguishing between partial and complete expulsion. It covers the identification of radiographic evidence of IUD perforation, including visualization of the device outside the uterine cavity, displacement into adjacent organs, and migration. Associated complications are identified using imaging modalities such as ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). The discussion includes key elements of a comprehensive radiology report, including a detailed description of findings, location and extent of abnormalities, and relevant differential diagnoses, which aid in decision-making for removal and treatment.

**TABLE OF CONTENTS/OUTLINE**

Case-based didactic review of intrauterine devices complications in different imaging modalities (ultrasound, CT scan and MRI) based on our service's digital archive and correlated with a comprehensive literature review.

### OBEE-19 DUCTUS VENOSUS AGENESIS IN FETUSES: A CASE SERIES ANALYSIS OF ULTRASOUND FINDINGS AND ASSOCIATION PATTERNS

Adinaryana Makam, MD (*Abstract Co-Author*) Nothing to Disclose
Urvi Ahlawat, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This study examines 27 fetuses diagnosed with Ductus Venosus (DV) agenesis via prenatal ultrasound, identifying association patterns with other prenatal ultrasound findings.

**TABLE OF CONTENTS/OUTLINE**

Background: This retrospective case series investigates 27 fetuses diagnosed with DV agenesis via prenatal ultrasound, analyzing maternal age, gestational age, DV agenesis types, associated anomalies, and intrahepatic portal vein system status. Results: Descriptive statistics revealed a mean maternal age of 25.96 years (range: 21-44) and a mean gestational age of 21.67 weeks. DV agenesis types included Type 1 (10 cases), Type 2 (12 cases), and Type 3A (5 cases). Association patterns indicated cardiac, genitourinary, and musculoskeletal anomalies such as Cardiomegaly, Ventricular Septal Defect, Aberrant Right Subclavian Artery, Echogenic Focus in the Left Ventricle, Renal Pelvis Dilatation, Multicystic Dysplastic Kidney, Right Crossed Fused Ectopic Kidney, Clitoromegaly, Frontal Scalloping, Spinal Dysraphism, Congenital Talipes Equinovarus, Single Umbilical Artery, Increased Nuchal Translucency, Sylvian Fissure Delayed for Gestational Age, with notable correlations between maternal age and cardiac/genitourinary anomalies ($r = 0.27$, $p < 0.05$; $r = 0.22$, $p < 0.05$, respectively). Chi-square tests revealed type-specific associations: Type 1 with cardiac anomalies ($p < 0.05$), Type 2 with genitourinary anomalies ($p < 0.05$), and Type 3A with musculoskeletal anomalies ($p < 0.05$). The study underscores the subtype-specific implications of DV agenesis on fetal development, emphasizing the importance of prenatal ultrasound in early detection and informed prenatal care.

### OBEE-2 A REVIEW OF THE MRI FEATURES OF ENDOMETRIOSIS: WHAT SHOULD BE PAID ATTENTION TO DURING THE REPORTING PROCESS?

Mehmet Simsar, MD (*Abstract Co-Author*) Nothing to Disclose
Hilal Sahin, MD (*Abstract Co-Author*) Nothing to Disclose
Yesim Y. Yuruk, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Provides a comprehensive overview of the symptoms and the possible formation mechanisms of endometriosis • Describes MRI features of endometriosis • Reviews the revised American Society for Reproductive Medicine (rASRM) classification and ENZIAN classification and their contents used in mapping of endometriosis • Demonstrates the common and rare presentations of endometriosis using case-based examples, highlighting distinctive clinical and MRI features that can aid in the best diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Table of Contents 1. Terminology and etiology of endometriosis 2. A practical approach to endometriosis subtypes 3. Specific MRI features of endometriosis subtypes 4. Overview of revised American Society for Reproductive Medicine (rASRM) classification and ENZIAN classification 5. Case-based reviews of endometriosis subtypes Outlines • Knowledge of endometriosis subtypes is essential for diagnosing and localizing pathologies. • Understanding the key MRI features and common/rare locations of endometriosis is the first step in generating a diagnosis and mapping the disease for appropriate treatment. • Obtaining relevant clinical history and recognizing specific imaging appearances can help provide the best diagnosis.

### OBEE-21 ENDOMETRIOSIS: BE READY, IDENTIFY EMERGENCY, HANDLE URGENCY

Izabela P. Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Alice Cristina C. Brandao Salomao, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Brunna C. Oliveira, MD, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Endometriosis is a chronic disease characterized by the ectopic implantation of an endometrium-like tissue, containing glands and stroma, outside the uterus, and can significantly impact a woman's quality of life, manifesting in pelvic pain, infertility, and psychosocial challenges. Despite its chronicity, endometriosis can present acutely, either exacerbating an existing condition or as a primary cause, prompting patients to seek emergency medical attention, sometimes before a formal diagnosis is established.This educational exhibit aims to spotlight presentations of endometriosis commonly overlooked or misinterpreted in emergency settings, using case studies where it led to urgent situations. Emphasizing the crucial need for timely recognition, delayed diagnosis hinders prompt intervention and treatment, and may increase the likelihood of recurrent symptoms or complications.

**TABLE OF CONTENTS/OUTLINE**

Didactic cases demonstrating various emergency and urgent presentations of endometriosis using different imaging modalities such as ultrasound, computed tomography, and magnetic resonance imaging, including:Bowel obstructionUterine and vaginal vault ruptureInfection of endometriomasEctopic pregnancyHemorrhagic acute abdomenUrinary tract obstructionCatamenial pneumothorax

### OBEE-23 SERUM BIOMARKERS IN GYNECOLOGIC CONDITIONS: A RADIOLOGIST'S GUIDE TO NAVIGATE THE ALPHABET SOUP

**Awards**
**Certificate of Merit**

Sarah Taylor (*Abstract Co-Author*) Nothing to Disclose
Biatta Sholosh, MD (*Abstract Co-Author*) Nothing to Disclose
Esther Elishaev, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandro Furlan, MD, MMM (*Abstract Co-Author*) Royalties, RELX;Research support, Endra, Inc;Consultant, Bracco Group
Gayathri Devi Jalluri, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Ekta Maheshwari, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. A number of malignant and benign gynecological entities are associated with elevation of serum biomarkers. The various tumor markers differ in their usefulness for screening, diagnosis, prognosis, assessing therapeutic response, and detecting recurrence. 2. Awareness of these associations and characteristic imaging patterns is integral to Radiology practice for optimal diagnosis, facilitating recommendations for ancillary imaging and work up.

**TABLE OF CONTENTS/OUTLINE**

Some important gynecologic biomarkers are: CA-125, b-HCG, Alpha-fetoprotein (AFP), Inhibin, Estradiol, Carcinoembryonic antigen, Müllerian inhibiting substance, CA 19-9, Lactate Dehydrogenase. Since pathologic diagnosis of malignancies may be difficult without laparotomy, tumor markers in addition to diagnostic imaging are useful in preoperative evaluation. An ideal marker should be highly specific and sensitive, however due to false positives and elevated indices seen in multiple benign entities, imaging plays a crucial role in guiding appropriate patient management. Multimodal approach including the evaluation of serum biomarkers combined with imaging, seems to be the best strategy for characterization, identification of recurrence, and monitoring response to treatment in female cancer patients. Tumor markers also demonstrate physiological variation with age and menopausal status as well as benign neoplasms and inflammatory conditions. This knowledge is critical to avoid overreporting of malignancy.

## OBEE-24 UNUSUAL IMAGING PRESENTATIONS OF ENDOMETRIOSIS

Rita Maria Lahoud, MD (*Abstract Co-Author*) Nothing to Disclose
Megan Kenway, MD (*Abstract Co-Author*) Nothing to Disclose
Dinushi S. Perera, MD (*Abstract Co-Author*) Nothing to Disclose
Rosaura Suazo Aguero, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Endometriosis is defined as the presence of endometrial glands in locations outside the uterus. It is a common condition that occurs in 6-10% of all reproductive woman.The most common peritoneal sites of involvement are the ovaries, uterine ligaments, cut-de-sac, and pelvic peritoneum reflected over the uterus, fallopian tubes, rectosigmoid and bladder. The most common complaints associated with endometriosis are dysmenorrhea and pelvic pain; although some patients often present without pain and only with complaints of infertility, or there is an incidental finding of an ovarian mass on imaging. However, some of these incidental findings are uncommon, prompting to a malignancy workup. While recognizing the hallmarks and typical imaging patterns of endometriosis is basic, acknowledging unusual presentations awards every radiologist the extra mile. At the end of this review we will be able to understand uncommon imaging appearances of endometriosis. To analyze the correlation between imaging features and histopathological findings. To contrast the optimal use of conventional imaging for malignancy mimickers in endometriosis.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction on Endometriosis and its manifestations 2. Description on usual and unusual imaging appearances of endometriosis 4. Case examples5. Conclusion

## OBEE-25 NOT ALL PELVIC PAIN STEMS FROM ENDOMETRIOSIS: VENOUS-ORIGIN PAIN IS ALSO A SIGNIFICANT REALITY!

**Awards**
**Certificate of Merit**

Fanilda Barros (*Abstract Co-Author*) Nothing to Disclose
Isabela Tavares (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Manuella Barreto Silva (*Abstract Co-Author*) Nothing to Disclose
JOANA STORINO (*Abstract Co-Author*) Nothing to Disclose
NATHALIA CARDOSO (*Abstract Co-Author*) Nothing to Disclose
FRANCINE FREITAS FERNANDES (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Pelvic venous insufficiency is a major cause of chronic pelvic pain in women of reproductive age, accounting for 16-31% of cases.Ultrasound examination is the primary diagnostic tool, offering excellent visualization of pelvic veins. Proper identification of external and internal iliac veins, and gonadal plexuses is crucial. Transvaginal ultrasound with color Doppler provides high-resolution images of pelvic veins, facilitating detection of flow direction changes. Evaluation includes grayscale assessment for thrombus and post-thrombotic fibrocicatricial changes and color/spectral Doppler study for flow pattern and reflux detection. Transvaginal ultrasound with color Doppler plays a vital role in pelvic vein assessment across gynecological and vascular contexts.

**TABLE OF CONTENTS/OUTLINE**

1) Ultrasound assessment based on current literature for investigating pelvic varicose veins. 2) Exploring pelvic venous anatomy with transvaginal ultrasound 3) Pathophysiology of pelvic venous disorders: Why hemodynamics is so crucial? 4) Technical considerations for ultrasound examination. 5) Clinical Cases: interpretation of ultrasound findings and differential diagnoses. 6) Reporting: What information should the radiologist provide to gynecologists and vascular surgeons? 7) Future perspectives

## OBEE-26 UNVEILING ENDOMETRIOSIS INVOLVING THE LATERAL PELVIC COMPARTMENT: A RADIOLOGICAL INSIGHT

**Awards**
**Magna Cum Laude**

Ingrid Ferreira (*Abstract Co-Author*) Nothing to Disclose
Luciana G. Matteoni-Athayde, MD (*Abstract Co-Author*) Nothing to Disclose
Karina d. Giassi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Brunna C. Oliveira, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Alice Cristina C. Brandao Salomao, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
CICILIA F. PONTES FERNANDEZ, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Recognizing the imaging characteristics of lateral pelvic compartment endometriosis on TVS and MRI.Understanding the clinical presentation and implications of lateral pelvic compartment endometriosis.Identifying challenges in diagnosing lateral pelvic compartment endometriosis and strategies to overcome them.Integrating radiological findings with clinical and surgical approaches for optimal patient management.

**TABLE OF CONTENTS/OUTLINE**

IntroductionEndometriosis involving the Lateral Pelvic Compartment overviewBrief anatomy reviewImaging TechniquesRoles of TVS and MRI in detectionRadiological FeaturesPresentation variancesDifferential diagnosisCase StudiesImaging evidence examplesManagement StrategiesImpact of diagnosis on treatment Surgical treatment approachesConclusionRadiology's roleEmerging technologies

## OBEE-27 WHAT EVERY RADIOLOGIST SHOULD KNOW ABOUT HYSTEROSALPINGOGRAPHY

Paula E. Hernandez Quiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Tania D. Grimaldo Galeana, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Alonzo Correa I, MD (*Abstract Co-Author*) Nothing to Disclose
Lourdes M. Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Eunice L. Urbina Marure, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To teach hysterosalpingography technique, indications, contraindications and complications.To provide cases-based review of common findings in hysterosalpingography.To describe clinical scenarios in which hysterosalpingography provides information about diagnoses and its comparison with other diagnostic imaging methods.Review patient history, clinical presentetation and findings in hysterosalpingography.

**TABLE OF CONTENTS/OUTLINE**

Generalities characteristics of hysterosalpingography.Techinque, indications, contraindications, complications of histerosalpingography.Cases based review of the common and uncommon findings in histerosalpingography: clinical scenarios, complementary studies and diferent diagnoses.Summary: pearls.

## OBEE-28 MASTERING PELVIC ULTRASOUND: PRACTICAL TIPS FOR EFFECTIVE IMAGING

**Awards**
**Certificate of Merit**

Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rachel Brito, MD (*Abstract Co-Author*) Nothing to Disclose
PENELOPE ANDRADE (*Abstract Co-Author*) Nothing to Disclose
Luciana G. Matteoni-Athayde, MD (*Abstract Co-Author*) Nothing to Disclose
Brunna C. Oliveira, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
CICILIA F. PONTES FERNANDEZ, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Transvaginal ultrasound (TVUS) is frequently utilized for screening or monitoring gynecological pathologies throughout reproductive and postmenopausal years.Despite advancements in diagnostic accuracy for detecting small endometriosis lesions via TVUS, incomplete evaluations are still common due to technical challenges, sometimes related to patient anatomy.Discussion of techniques, adjustments, and maneuvers can mitigate technical limitations, leading to more precise diagnoses.

**TABLE OF CONTENTS/OUTLINE**

Explanation of optimal ultrasound imaging formation concepts (e.g., focus, transducer positioning, insonation angle, contrast).Review of pelvic anatomy via sonography.Overview of common technical challenges in pelvic ultrasound, including:Poor definition of contours and uterine cavity (e.g., midverted or excessively bulky uteri).Difficulty detecting/evaluating lesions too close to the transducer.Organs or lesions situated too far from the transducer (e.g., upper pelvis with a narrow field of view via vaginal route).Patients unable to undergo TVUS (e.g., virgins, individuals with vaginismus).Identification of the origin of adnexal lesions.Challenges in visualizing the ovaries.Definition of pelvic spaces.Presentation of clinical cases via ultrasound images and illustrations, accompanied by suggestions for improving image quality and resolving technical difficulties. These solutions are categorized into:Dynamic maneuvers.Technical tips and device adjustments.Optimization of transducers.Utilization of different sonographic approaches.Application of specific anatomical knowledge.Summary of key concepts in each section.

## OBEE-29 'P TO F' OF ENZIAN, AN APPROACH TO MAGNETIC RESONANCE IMAGING EVALUATION FOR ENDOMETRIOSIS: A PICTORICAL REVIEW

Araceli Yameli V. Serrato SR, PhD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Hernandez Olivera, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Magnetic resonance imaging and ultrasound have been used as the staging method for endometriosis. The gold standard diagnosis for endometriosis was histopathological characterization obtained by laparoscopy, however, due to limited access to specialized surgeons and costs, laparoscopic diagnosis has been reserved for specific cases. The current role of MRI is very important, so an optimal categorization system should be able to forecast pain and fertility, describe the extent of the disease (based on anatomical features), and give patients reliable information. In this work we will exemplify the use of the #ENZIAN classification used in our workplace because it has allowed better characterization of lesions (mapping) and post-treatment surveillance imaging.

**TABLE OF CONTENTS/OUTLINE**

1. MRI protocol: Key sequences, Tips for optimization. 2. #ENZIAN classification, imaging features on MRI: evaluation of the peritoneum, ovaries, tubes, Deep endometriosis findings (recto-vaginal space, vagina, retrocervical area, sacrouterine and cardinal ligaments, rectum, adenomyosis and extragenital locations with examples from each category. 3. Differential diagnosis mimics. 4. Clinical cases and reports. 5. Post-treatment Surveillance imaging: Post-surgical appearance and local recurrence. 6. Conclusion.

## OBEE-3 EXPLORING THE CURVES OF THE UTERUS - A DETAILED LOOK AT ISTHMIC LESIONS ON MRI

Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea L. Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna G. Busoletto Tripode SR, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucas R. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa Bretas (*Abstract Co-Author*) Nothing to Disclose
Marilia A. Tavares, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the anatomy of the uterus, with an emphasis on the location and structure of the uterine isthmus.Explore the different lesions that can affect the uterine isthmus.Discuss the radiological findings and clinical context associated with each type of isthmic lesion.

**TABLE OF CONTENTS/OUTLINE**

The uterine isthmus, as the narrowest portion of the uterus, plays a crucial role in female reproductive health and can be the site of origin of various gynecological pathologies. Isthmic uterine lesions constitute a complex category of abnormalities affecting tissue in this region. Due to their strategic location, these lesions may manifest a variety of symptoms, presenting diagnostic challenges.Diagnosis is typically made through imaging exams such as ultrasound or magnetic resonance imaging, with appropriate management depending on accurate identification of the lesion type and assessment of factors such as size, location, and risk of malignancy.This study aims to review a wide range of isthmic lesions, including isthmoceles, fibroids, ectopic pregnancies in cesarean scars, endometriosis, adenomyosis, adenomyoma, hematomas, anomalous vessels post-curettage, intrauterine device insertion in isthmocele, implantation of trophoblastic tissue in cesarean scar, and polyps, as well as addressing imaging diagnostic methods and available treatment options.By providing a comprehensive and up-to-date overview of this topic, this work aims to contribute to a better understanding and management of isthmic uterine lesions in radiological clinical practice.

## OBEE-30 DIAGNOSING INTRACRANIAL MASSES AND THEIR MIMICS IN-UTERO

**Awards**
**Certificate of Merit**

Elka Miller, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Patrick Shannon (*Abstract Co-Author*) Nothing to Disclose
Suzanne Laughlin, MD (*Abstract Co-Author*) Nothing to Disclose
Pradeep Krishnan, MD (*Abstract Co-Author*) Nothing to Disclose
Susan I. Blaser, MD (*Abstract Co-Author*) Nothing to Disclose
Neetika Gupta, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To explore the spectrum of antenatal identified brain tumors and their association with genetic syndromes.To describe the common and rare neuroimaging manifestations of congenital brain tumors on fetal and postnatal imaging.To discuss the significance of advanced imaging techniques and imaging protocols in diagnosing and prognosticating the congenital brain tumors.

**TABLE OF CONTENTS/OUTLINE**

1. Congenital brain tumors are typically occurring during late fetal and early postnatal stages, often incidentally through antenatal imaging or based on clinical symptoms postnatally.2. Despite their rarity, congenital brain tumors are increasingly recognized in-utero due to advancements in imaging techniques and enhanced surveillance during pregnancy and infancy.3. Understanding associated tumor predisposition syndromes and specific genetic rearrangements is crucial for elucidating tumor etiology and guiding optimal management approaches.4. Regardless of tumor type or grade, congenital brain tumors uniformly present poor prognoses, attributed to unique metabolic and genetic pathways, prevalent embryonal histology, and rapid growth rates.

## OBEE-31 LEARN BEFORE YOU SLING OFF: THE ROLE OF TRANSLABIAL ULTRASOUND IN PRE- AND POSTOPERATIVE MESH ASSESSMENT

Brunna C. Oliveira, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
CICILIA F. PONTES FERNANDEZ, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda Pipitone, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Women commonly suffer from pelvic floor disorders such as urinary incontinence and pelvic organ prolapse, often associated with pregnancy, menopause, and obesity.Synthetic midurethral slings are a widely used surgical option for management of stress urinary incontinence, and can be transobturator or retropubic.While midurethral slings have excellent outcomes in terms of urinary continence and overall psychosocial well-being, complications like urinary retention, infection, vaginal erosion, and chronic pain may occur.Translabial ultrasound is a powerful tool for assessing synthetic slings both before and after surgery, predicting outcomes and identifying complications.This presentation aims to acquaint radiologists with the necessary skills for incorporating translabial ultrasound into routine sling evaluation.

**TABLE OF CONTENTS/OUTLINE**

Introduction to Translabial Ultrasound (TLUS), highlighting its advantages over conventional imaging modalities for evaluating pelvic floor disorders in both pre- and postoperative settings.Technical Considerations in TLUS Imaging: patient preparation and equipment setup; scanning technique and patient positioning. Role of TLUS in Sling Evaluation, including: crucial preoperative data to report; identifying sling type, quantity, position, and orientation at rest and during Valsalva maneuver; assessing sling integrity, clinical efficacy, and primary complications; most prevalent associated genital abnormalities; post-sling pelvic pain assessment; measurement and distance analysis. Illustrative case studies demonstrating TLUS's clinical effectiveness in sling assessment. Future Directions and Considerations

## OBEE-32 3D AND 4D HYSTEROSALPINGO CONTRAST SONOGRAPHY (HYCOSY): ADVANCED TUBAL PATENCY ASSESSMENT

Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lorena Luryann Cartaxo Silva (*Abstract Co-Author*) Nothing to Disclose
Manuella Barreto Silva (*Abstract Co-Author*) Nothing to Disclose
Eduardo Schor (*Abstract Co-Author*) Nothing to Disclose
FRANCINE FREITAS FERNANDES (*Abstract Co-Author*) Nothing to Disclose
Paulo S. Cossi (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

More than 50 million women suffer from infertility worldwide, among whom 30% have pathology associated with the fallopian tubes. In this context, the assessment of tubal patency is vital. HyCoSy, utilizing second-generation microbubble contrast-enhanced ultrasound (CEUS), has emerged as a preferred initial imaging modality in Europe and Asia, offering comparable efficacy to traditional methods like hysterosalpingography (HSG). Its advantages include avoidance of ionizing radiation to the pelvis, iodine allergy concerns and reduced discomfort during the exam. The ability to assess ovarian and intrauterine lesions simultaneously, has high sensitivity and specificity to diagnose others infertility-related pathologies, being considered an important

diagnostic method for assessing fertility in the "one-stop shop". A dedicated ultrasound software facilitates its performance by showing the morphology and path of the fallopian tube, the speed and volume of contrast extravasation, and its characteristics around the ovaries.

**TABLE OF CONTENTS/OUTLINE**

1) Review of the current literature for the investigation of fallopian tubes 2) Pathophysiology of tubal dysfunctions 3) Technical considerations about HyCoSy 4) Interpretation and critical analysis of sonographic findings 5) Report: What information should the radiologist provide to gynecologists and fertility specialists? 6) Future perspective

## OBEE-34 ROLE OF MRI IN DIAGNOSING COMMON PLACENTAL PATHOLOGIES; A PICTORIAL REVIEW AND UPDATES FROM RECENT LITERATURE

Hina Arif Tiwari, MD (*Abstract Co-Author*) Nothing to Disclose
Fatima M. Al-Khafaji, MBChB (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Abnormal placentation disease has become more frequent secondary to increased rate of cesarean sections. Ultrasonography is the first imaging modality performed, but MRI remains of superior value in accurate differentiation of abnormal placentation. 2. Detailed MRI reports are of great value in describing abnormal placentation by improving the maternal outcome and involving multidisciplinary team, when needed. 3. Gradient-echo sequence provides better delineation of the placental contour and interface with the myometrium, but only the spin echo sequences provide information on signal heterogeneity and intra-placental bands. 4. The maternal surface of the placenta contains cotyledons, which are placental outpouchings surrounded by MRI T2 dark clefts and septa, these must be differentiated from placental invasion of the myometrium. 5. So far there are no reported fetal acoustic safety issues in pelvic MRI examinations performed in 30 minutes or less in magnet strength of 1.5 Tesla. 6. Although gadolinium-based MRI examination differentiates myometrium from placenta, the half-life of gadolinium in fetuses is unknown. Contrast MRI is suggested in fetal demise or in patient's willing to terminate the pregnancy.

**TABLE OF CONTENTS/OUTLINE**

1. Embryogenesis of normal placenta and pathogenesis of abnormal placentation. 2. Placental anatomy; role of MRI. 3. Abbreviated MRI protocol in placental imaging with review of recent updates. 4. Spectrum of common placental pathologies with corresponding MRI findings, including: a. Placenta accreta. b. Placenta increta. c. Placenta percreta. d. Placenta previa. e. Placental abruption. 5. Review of latest literature updates on common placental pathologies.

## OBEE-35 PELVIC ENDOMETRIOSIS: WHAT YOUR MRI REPORT CAN'T MISS

Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Heitor Passeri, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Carolina De Moraes Sarmento (*Abstract Co-Author*) Nothing to Disclose
Fernando D. Tamamoto SR, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio E. Silva JR, BDS (*Abstract Co-Author*) Nothing to Disclose
Ana P. Bavaresco, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Beraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Cleo F. Souza, BMedSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Endometriosis is a chronic inflammatory disease highly undiagnosed, with an incidence estimated in up to 15% of women of reproductive age. Definition: presence of endometrial tissue outside the endometrial cavity. Among the related symptoms are dyspareunia, pelvic pain, and infertility. Despite its high prevalence, the radiology signs and findings of pelvic endometriosis may not be so widespread, and the diagnosis through magnetic resonance remains a challenge for many radiologists. The purpose of this exhibit is:Review the role of MRI in the diagnosis and accurate staging of pelvic endometriosis;Propose a sequence of relevant points to analyze when examining a pelvic MRI and why they are relevant;Set a list of information the radiological report must give and how they help to module and settle the better surgical approach.

**TABLE OF CONTENTS/OUTLINE**

IntroductionEpidemiology and pathophysiology DiagnosisBlind spot endometrioid lesionsPelvic compartments - the “must have” informationAnterior compartmentMiddle compartmentPosterior compartmentCases examples with the correlation between the radiology report and the specific surgery approach;Discussion and take-home messages.

## OBEE-36 THE VISUAL JOURNEY OF ASSISTED REPRODUCTION: IMAGING INSIGHTS

Gabriela Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Cinthia C. Barbisan, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriella D. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Paulo Silva Junior (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The increased accessibility of assisted reproduction techniques has generated a greater number of ultrasound examinations as well as a greater number of associated complications. Within this context, it is crucial for the ultrasonographer to have knowledge about normal anatomy of the female pelvis and the normal alterations related to treatment, as well as possible complications. Transvaginal ultrasound not only allows for the assessment of ovarian reserve but also strict monitoring of adnexal changes to determine the optimal time for ovarian puncture. It also provides evaluation of uterine morphology, fallopian tubes, and endometrial characteristics, which are crucial for effective treatment. The dynamic evaluation provides data on pelvic organ mobility or the presence of adhesions. Doppler not only enables vascular assessment but also ensures safer puncture procedures by detecting important vessels in the traject. Thus, when the examiner is familiar with the most common findings and the detailed patient history, ultrasound examination allows differentiation of expected alterations, such as post-puncture hemorrhagic cysts, from potentially serious complications, such as ovarian hyperstimulation syndrome, ovarian torsion, infected collections, and ectopic pregnancy. Finally, although some alterations may be rare, timely diagnosis leads to better clinical outcomes with a higher success rate of the procedure.

**TABLE OF CONTENTS/OUTLINE**

The aim of this study is to synthesize the most relevant ultrasonographic information, in correlation with other imaging methods, so that the physician can perform assisted reproduction with higher chances of success and fewer complications.

## OBEE-37 WHAT YOU MUST KNOW ABOUT THE PLACENTA AND UMBILICAL CORD

**Awards**
**Certificate of Merit**

Leonardo F. Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Alice Cristina C. Brandao Salomao, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Ines Novis (*Abstract Co-Author*) Nothing to Disclose
Patricia P. Cardia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Caroline L. Ghezzi (*Abstract Co-Author*) Nothing to Disclose
Patricia Leal, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe normal placental imaging findings, variations from the norm, and morphological anomalies.Outline the protocol and main sequences utilized in magnetic resonance imaging (MRI) for optimal placental imaging.Establish correlations between ultrasound and MRI findings

### TABLE OF CONTENTS/OUTLINE

IntroductionDefine normal variationsEpidemiology and risk factors.Imaging featuresOutline predominant imaging features observed in normal variants.Elaborate on the imaging findings related to morphological anomalies of the placenta and umbilical cord.ConclusionDiscuss the role of ultrasound and MRI in identifying normal findings and variants, as well as in identifying morphological anomalies associated with adverse pregnancy outcomes.

## OBEE-38 BENIGN UTERINE PATHOLOGY ON MAGNETIC RESONANCE IMAGING (MRI) - A PRACTICAL GUIDE FOCUSED ON ESSENTIAL INFORMATION FOR AN ASSERTIVE REPORT

Gabriel L. Beraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando D. Tamamoto SR, MD (*Abstract Co-Author*) Nothing to Disclose
Ana I. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Cleo F. Souza, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Antonio E. Silva JR, BDS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The main clinical indications for performing an MRI of the pelvis are leiomyomatosis, endometriosis, uterine adenomyosis, ovarian cysts/lesions, pelvic pain, abnormal uterine bleeding, and postoperative evaluation; New pathological classifications for these pathologies may cause difficulties in interpreting and describing these findings to meet this new demand; The purpose of this exhibit is: Facilitate the diagnosis and description of benign uterine pathology on MRI simply and practically through flowcharts and graphic schemes, based on the most recent literature.

### TABLE OF CONTENTS/OUTLINE

A review of information and new relevant classifications for a complete radiological report on the clinical management of the main non-endometriosis benign uterine pathologies, divided into the following categories: o uterine anatomy and positioning, including measurement parameters; o myometrium: myoma, myometrial cysts, adenomyosis, ACUM, isthmocele; o endometrium: endometrial polyp, intrauterine contraceptives (types, correct position, and endoceptive migration criteria); o uterine cervix: cervical polyp, cysts and cervicitis; o parameters: pelvic varicose veins/pelvic congestion syndrome.Discussion and take-home messages.

## OBEE-39 EXPLORING UNKNOWN TERRITORIES BY SONOGRAPHY: ATYPICAL LOCATIONS OF DEEP ENDOMETRIOSIS

Karina d. Giassi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana G. Matteoni-Athayde, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rachel Brito, MD (*Abstract Co-Author*) Nothing to Disclose
Brunna C. Oliveira, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
PENELOPE ANDRADE (*Abstract Co-Author*) Nothing to Disclose
CICILIA F. PONTES FERNANDEZ, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Deep endometriosis (DE) frequently involves the torus, posterior cul-de-sac, uterosacral ligaments, and rectum.Diagnosing DE in less common areas poses significant challenges, particularly for less experienced radiologists.Understanding the anatomy, embryology, and pathophysiology is vital for grasping DE's spread within the abdominal cavity.To review clinical presentations and ultrasonographic findings of DE, with a focus on practical tips for detecting the condition in atypical abdominal locations.Accurate recognition of uncommon sites of DE aids in complete disease mapping, leading to improved surgical planning and outcomes.

### TABLE OF CONTENTS/OUTLINE

Introduction: Provides an overview of deep endometriosis, highlighting its typical locations and the importance of recognizing atypical manifestations for effective diagnosis and management.Pelvic Anatomy: Reviews key concepts necessary to understand the anatomical distribution of DE, including peritoneal folds, the dissemination of peritoneal fluid from the pelvic cavity, and the embryology of the Nuck canal.Clinical Cases: Discusses symptoms, imaging interpretations, and detection tips through clinical cases in unusual locations such as:High Sigmoid Small IntestineCecum Terminal IleumVermiform AppendixBladder (Vesical Trigone, Peripheral Portions)Ureter (High Location in the Pelvis)Parametrium (Anterior Infiltration)Paracolic GutterHepatorenal SpaceDiaphragmAbdominal Wall (Umbilical Scar, Parietal Peritoneum)Pelvic WallDifferential Diagnoses: Explores differential diagnoses such as desmoid tumor, peritoneal implants metastasis, and carcinoid tumor.

## OBEE-4 RADIOMIC TUMOR PROFILING FOR PROGNOSTICATION AND TAILORING OF TREATMENT IN UTERINE CERVICAL CANCER - A LITERATURE REVIEW

Ingfrid H. Haldorsen, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kristine E. Fasmer, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Agnes J. Eide, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To provide an overview of published work on radiomic tumor profiling for prognostication in cervical cancer2. To highlight the potential role of radiomics for risk stratification and tailoring of treatment in cervical cancer 3. To discuss present methodological challenges in radiomic tumor profiling and future directions 4. To encourage future research and discussion on how to translate advanced radiomic profiling to better cancer care

**TABLE OF CONTENTS/OUTLINE**

1. Introduction1.1. Radiomics definition 1.2. Steps in radiomic workflow1.3. Application of radiomic profiling in cancer research2. Overview of published work on radiomics in uterine cervical cancer2.1. Methodological assessment of radiomics studies2.2. Radiomic signatures related to tumor prognostic factors2.3. Radiomic modelling for prediction of survival and recurrence 3. The potential of radiomics 3.1. Noninvasive assessment of risk profiles3.2. Personalizing treatment algorithms 3.3. Prediction of treatment response and clinical outcome4. The challenges of radiomics4.1. Sources of bias related to study design and analysis 4.2. Imaging and segmentation challenges 4.3. Need for validation4.4. Need for prospective studies and testing in clinical settings 4.5. Data sharing and open-source reporting 5. Bridging the gap between radiomics and cancer care 5.1. Proposed solutions and future directions

## OBEE-40 HYSTEROSALPINGOGRAPHY: GO BACK TO BASICS. A PICTORIAL REVIEW

Jorge Arturo Martinez Conejo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Hysterosalpingography is a study available in most hospital centers. It is a low-cost study that, despite advances in imaging, is still useful in the diagnosis of infertility. The main uses are the evaluation of the endometrial cavity and fallopian tubes. This pictorial review This pictorial review aims to show the technique that must be performed as well as the pathologies that we can find during the studies.

**TABLE OF CONTENTS/OUTLINE**

IntroductionHow to do it? (Technique)Assesments of the uterus (Position)Fallopian tubes permeabilityTube patologyEmbriologyUterine malformationsFilling defects (Endometrial patology)Additional findings

## OBEE-41 BREAKING BAD NEWS IN OBSTETRIC ULTRASOUND: COMUNNICATION SKILLS FOR RADIOLOGISTS

Thiago Matheus Santos Rios, MD (*Abstract Co-Author*) Nothing to Disclose
MARCOS VINICIUS BROGIN (*Abstract Co-Author*) Nothing to Disclose
Sergio Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Enzo Calheiros, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana Cerri, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. DISCUSS COMMUNICATION SKILLS IN OBSTETRIC ULTRASOUND, INCLUDING PATIENT EXPECTATIONS AND OUTCOMES 2. SUMMARIZE OBSTETRIC EMERGENCIES AND COMPLICATIONS 3. PRESENT SPIKES PROTOCOL APPLIED TO SONOGRAPHERS 4. ELABORATE ABOUT RESIDENT EDUCATION IN OBSTETRIC ULTRASOUND: 5. HIGHLIGHT CHALLENGING SCENARIOS IN OBSTETRIC ULTRASOUND WITH A CASE-REVIEW APPROACH

**TABLE OF CONTENTS/OUTLINE**

Introduction Overview of the importance of effective communication in obstetric ultrasound. Communication Skills in Obstetric Ultrasound Importance of clear and empathetic communication. Impact of poor communication on patient outcomes. Obstetric Emergencies and Complications Diagnosis and management of high-risk pregnancies. Identification of placental abnormalities and fetal anomalies. Application of SPIKES Protocol Overview of the SPIKES protocol. Adaptation of SPIKES for obstetric ultrasound scenarios. Resident Education Integration of communication skills training into the OBGYN ultrasound curriculum. Role of mentorship, simulation, and feedback in resident education. Challenging Scenarios Case studies of fetal demise, congenital malformations, ectopic pregnancies, and molar pregnancies. Strategies for effective communication and support in challenging obstetric ultrasound cases.

## OBEE-42 MULTIMODALITY IMAGING OF C-SECTION SCAR ENDOMETRIOSIS

Daniel Kowal, MD (*Abstract Co-Author*) Speaker, Samsung Electronics Co, Ltd
Camilla Ramezanzadeh, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Endometriosis can spread to multiple locations through surgical intervention and iatrogenic transport, with the anterior abdominal/pelvic wall the most common location of occurrence. The incidence of C-section scar endometriosis is approximately 0.8%.• Understand that not all patients will be symptomatic, and these lesions can therefore be discovered incidentally, usually on computed tomography. Symptomatic patients can have constant or recurrent cyclical pain related to hormonal impact.• Image findings of C-section scar endometriosis on different imaging modalities can vary due to hormonal influence depending on the patient’s phase of menstrual cycle.• Mimicking lesions and differential diagnoses must be excluded, including keloids, scar granulomas, and metastases.

**TABLE OF CONTENTS/OUTLINE**

• Introduction - Review endometriosis population at risk.• Pathophysiology and clinical presentation of C-section scar endometriosis.• Sample multimodality imaging examples demonstrating the varying imaging appearance of scar endometriosis and unique location of seeding throughout the abdominal and pelvic wall.• Mimicking lesions and pitfalls to consider.• Appropriate diagnostic workup and management.

## OBEE-43 EMERGENCY DISORDERS IN PREGNANCY: STRATEGIES FOR MATERNAL CARE

Takahito Nakajima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tsukasa Saida, MD (*Abstract Co-Author*) Nothing to Disclose
Toshitaka Ishiguro, MD (*Abstract Co-Author*) Nothing to Disclose
Sodai Hoshiai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toyomi Satoh, MD (*Abstract Co-Author*) Nothing to Disclose

Masafumi Sakai, MD (*Abstract Co-Author*) Nothing to Disclose
Taishi Amano, MD (*Abstract Co-Author*) Nothing to Disclose
Miki Yoshida, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Pregnant women present to the emergency department with various conditions. Radiologists collaborate with obstetricians to select appropriate imaging modalities and make accurate diagnoses based on the situation. This exhibit will discuss emergency conditions related to pregnancy as well as non-pregnancy-related emergencies common in pregnant women, covering imaging findings, examination strategies, and treatment approaches for these situations. The teaching points of this exhibition are as follows. 1. Criteria for selecting imaging tests and contrast agents based on symptoms in pregnant women presenting to the emergency department 2. Presentation of key imaging findings contributing to the diagnosis of various emergencies during pregnancy, along with subsequent treatment

**TABLE OF CONTENTS/OUTLINE**

A. Characteristics of pregnant women B. Indications for imaging modalities and contrast agent use considering pregnancy C. Imaging features, examination strategies, and treatment of emergency conditions related to pregnancy D. Imaging characteristics, examination strategies, and treatment of emergency conditions commonly observed in pregnant women but unrelated to pregnancy

## OBEE-44 AN EDUCATIONAL OVERVIEW OF THE TYPICAL AND ATYPICAL MANIFESTATIONS OF ENDOMETRIOSIS

Dalia Kazzaz, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Ioanna Papadopoulou, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Catriona L. Davies, MBBS (*Abstract Co-Author*) Nothing to Disclose
Julia C. Hillier, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Christopher Page, MBBCh, BSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Give a brief overview of the disease process. Describe classic MRI features of endometriosis from uncomplicated to deep infiltrating endometriosis (DIE) within the pelvis. Describe key review areas when assessing the pelvis for endometriosis and DIE. Suggest a structured radiology report that aims to maintain clarity and also highlight the pertinent findings to the gynaecology team. Outline some common pitfalls when assessing the female pelvis with MR for patients with endometriosis. Showcase some uncommon sites of endometriosis that should be considered when evaluating patients. Provide some correlating surgical images to help understand and consolidate the disease process.

**TABLE OF CONTENTS/OUTLINE**

Using our database we will illustrate the various spectrum of features in endometriosis. We will begin with the common MRI findings with some key tips and pitfalls in interpreting the female pelvis. We will showcase some cases of classic deep infiltrating endometriosis. Finally we will demonstrate examples of uncommon extra-pelvic depositions in cases of umbilical, diaphragmatic, neural and subcutaneous endometriosis. Throughout we will provide some real case images of the corresponding surgical findings. We will also suggest a structured report template following the ENZIAN surgical classification to ensure radiology reports are succinct and clear when dealing with the most complex cases.

## OBEE-45 A LAPAROSCOPIC LOOK AT TORSION: UNDERSTANDING ADNEXAL AND LEIOMYOMA TORSION THROUGH ANIMATION

**Awards**
**Certificate of Merit**

Toru Honda, MD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Hori, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Kengo Kiso, MD (*Abstract Co-Author*) Nothing to Disclose
Shohei Matsumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Hiromitsu Onishi, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company
Takahiro Tsuboyama, MD (*Abstract Co-Author*) Nothing to Disclose
Mitsuaki Tatsumi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takashi Ota, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideyuki Fukui, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Adnexal torsion occurs when an adnexa becomes twisted around the tissue supporting it, leading to stromal edema, hemorrhagic infarction, and necrosis of the adnexal structures with consequent outcomes. This painful condition is a medical emergency that can result in losing an adnexa if not treated quickly. CT and MRI are valuable for diagnosing adnexal and leiomyoma torsion, and some characteristic findings have been reported. However, radiologists have limited opportunities to study adnexal and leiomyoma torsion surgery. This presentation aims to show how adnexal and leiomyoma torsion image findings appear during laparoscopic animation.

**TABLE OF CONTENTS/OUTLINE**

A) "Imaging Features of Adnexal and Leiomyoma Torsion"
- Adnexal and leiomyoma torsion can be diagnosed using CT and MRI imaging, which can reveal the following features:
- Hemorrhagic infarction
- Twisted pedicle
- Twisted vascular pedicle: flow void
- "Lack of enhancement" sign
- Deviation of uterus
- Dark fan sign
- Rim enhancement B) "Pelvic Organ Anatomy in Laparoscopic Animation"
- Laparoscopic animation can provide a detailed view of the anatomy of the organs in the pelvis, including the adnexa, uterus, fallopian tubes, and surrounding structures. C) "Relationship between Imaging Findings and Laparoscopic Animation in Adnexal Torsion"
- Adnexal torsion can occur in various structures in the pelvis, including the ovary, paraovarian cyst, and fallopian tube, as well as leiomyoma in the uterus. Laparoscopic animation can show the following conditions:
- Massive ovarian edema
- Ovarian mature cystic teratoma
- Ovarian fibroma

- Ovarian mucinous cystadenoma
- Paraovarian cyst
- Isolated fallopian tube torsion
- Fallopian tube teratoma
- Leiomyoma

## OBEE-46 IMAGING OF ENDOMETRIAL STROMAL TUMORS: KEYS TO DIAGNOSIS

**Awards**
**Certificate of Merit**

Yu Zou (*Abstract Co-Author*) Nothing to Disclose
Le Wang (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) A well-margined T2 high-signal tumor occurring in the uterus should prompt suspicion of endometrial stromal tumor (EST). 2) The presence of a "worm-like" or "nodular" appearance, margins or internal T2 low-signal bands, and significant high signal on DWI should raise strong suspicion for ESTs. Furthermore, the tumor grows into the uterine cavity and may exhibit the “valve opening sign”, which is a key point of differentiation from cell-rich fibroids or FH-deficient fibroids. 3) EST is a rare condition with atypical clinical presentations, often leading to misdiagnosis as benign uterine tumors on imaging studies, such as uterine fibroids, adenomyomas, and endometrial polyps. According to the site of tumor occurrence and imaging manifestations, EST is summarized into five major categories: "mass-like type", " adenomyosis-type",”endometrial-type" , "external-type" and "cystic-type", in order to improve the radiologist understanding of this disease.

### TABLE OF CONTENTS/OUTLINE

1) To provide an up-to-date overview of the classification, incidence, clinical presentation, and current status of diagnostic imaging in endometrial stromal tumors (EST). 2) Elucidate the scanning equipment, sequences, and parameters utilized for magnetic resonance examination of EST. 3) Categorize the pathological and imaging manifestations of EST, with particular emphasis on the various imaging types observed in low-grade endometrial stromal sarcoma (LG-ESS), which exhibits the highest incidence rate. 4) Explore treatment options, prognosis assessment, recurrence patterns, and metastatic potential in EST. 5) Conclude with a summary encompassing key information regarding EST.

## OBEE-47 BEYOND O-RADS 4 AND 5 : A MULTIMODALITY APPROACH TO CHARACTERIZING BORDERLINE AND MALIGNANT OVARIAN NEOPLASM SUBTYPES

Daniel Kowal, MD (*Abstract Co-Author*) Speaker, Samsung Electronics Co, Ltd
Nilisha Regmi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Ovarian-Adnexal Reporting and Data System (O-RADS) for ultrasound (US) and magnetic resonance imaging (MRI) has significantly improved the consistency of interpretations and risk stratification for ovarian masses. The O-RADS system aids in distinguishing between benign and worrisome characteristics, guiding the need for further workup and more aggressive management strategies. Despite its effectiveness, O-RADS does not specifically characterize subtypes of borderline and malignant tumors. Identifying distinguishing imaging features of different ovarian tumoral subtypes can aid in preoperative planning, guide the radiologist’s search pattern, and potentially influence patient management.This exhibit highlights characteristic features of high-risk ovarian lesions that are typically categorized as O-RADS 4 or 5. A multimodality approach is reviewed, including computed tomography (CT), US, and MRI.We delve into the unique imaging features of various ovarian tumor types, including borderline and malignant epithelial (serous, mucinous, endometrioid, clear cell) and malignant germ cell and sex-cord stromal tumors. We discuss pitfalls to avoid such as the importance of proper CT windowing in identifying calcified peritoneal implants and address mimicking ‘chameleon lesions’ with overlapping features such as borderline mucinous tumors, endometriomas and fluid-predominant dermoid cysts.

### TABLE OF CONTENTS/OUTLINE

•Classification and characterization of different borderline and malignant lesion (from pathologically proven sample cases) •Rare Tumors (e.g., Krukenberg tumor, lymphoma, collision tumors) •Pitfalls •Summary •Reference

## OBEE-48 PEERING INTO THE PELVIS - A DEEP DIVE INTO ENDOMETRIOSIS WITH ULTRASOUND AND MRI

Madhura A. Desai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Victoria Barbee, MD (*Abstract Co-Author*) Nothing to Disclose
Kelly L. Cox, DO (*Abstract Co-Author*) Nothing to Disclose
Sadhna Nandwana, MD (*Abstract Co-Author*) Nothing to Disclose
Neema J. Patel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review/recognize the endometriosis phenotypes and ultrasound (US) and magnetic resonance imaging (MRI) findings, especially those of deep infiltrating endometriosis (DIE) phenotype. Review the essential endometriosis MRI pelvis protocol sequences and key sequences for detection of endometriosis and DIE. Review pelvic anatomy to understand common sites of DIE and enhance detection.

### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Endometriosis phenotypes 1. Superficial Peritoneal 2. Ovarian Endometrioma 3. Deep Infiltrating Endometriosis (DIE) II. Diagnostic tools A. Imaging - Protocols and Techniques/Sequences to Diagnose Detect 1. US 2. MRI B. Laparoscopy III. Review of Pelvic Anatomy and Compartments with Endometriosis Cases A. Anterior 1. Bladder, Urethra, Ureter 2. Round Ligament 3. Spaces/planes: prevesical space, vesicouterine pouch, and vesicovaginal septum B. Middle 1. Reproductive Organs - Vagina, Uterus, Ovaries, and Fallopian Tubes 2. Spaces/planes: Broad ligament and meso-ovarium C. Posterior 1. Rectum/rectosigmoid colon 2. Uterosacral ligaments 3. Spaces/planes: rectouterine pouch, retrocervical space, and rectovaginal septum D. Additional Sites 1. Pelvic floor 2. Abdominal wall IV. Conclusions A. DIE is the most severe phenotype of endometriosis, invading the peritoneum or adjacent structures and distorting pelvic anatomy. B. US has a role in screening for endometriosis with dynamic maneuvers and better accessibility and affordability, but MRI is key to diagnose, manage, and reduce treatment delays for conservative therapies and prior to laparoscopy with high quality, multiplanar, small field-of-view, non-fat suppressed T2-weighted sequence.

## OBEE-49 A PICTURE IS WORTH THOUSAND WORDS, BUT OPTIMIZED IMAGING IS PRICELESS: EXPERT GUIDANCE ON HOW TO FINE TUNE YOUR US IMAGES FOR O-RADS US ASSESSMENT

**Awards**
**Magna Cum Laude**

Krupa K. Patel-Lippmann, MD (*Abstract Co-Author*) Nothing to Disclose
Maitray D. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Loretta M. Strachowski, MD (*Abstract Co-Author*) Royalties, RELX;Speaker, World Class CME
Myra K. Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Sadowski, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine E. Maturen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Catherine R. Phillips, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Use the highest frequency transducer that allows adequate depth penetration to achieve optimum visualization. Adjust focal zone, gain and field-of-view settings to optimize resolution.2. Transvaginal scanning improves imaging due to closer proximity to the ovary, increasing resolution and avoiding bowel gas; but a transabdominal approach may be the best option when ovaries are anteriorly or superiorly positioned and when transvaginal is not feasible.3. Orthogonal cine clips through the entirety of a lesion are invaluable when unable to personally scan. These clips enable evaluation of the character and number of internal components which may not be captured on static images.4. For Doppler assessment, the color box should target the region of interest to improve sensitivity and minimize artifacts. Spectral Doppler can be helpful to differentiate true vascular flow from Doppler artifact.5. Special sonographic techniques can be valuable for adnexal lesion characterization. The sliding maneuver can help to clarify lesion origin; decubitus positioning enables assessment of the mobility of cyst contents.

### TABLE OF CONTENTS/OUTLINE

1. Outline of images needed for assessment of ovarian and adnexal lesions, with focus on technical parameters and methods for optimization with illustrative examples. 2. Image-rich example cases featuring proper technique and image interpretation pitfalls due to suboptimal technique.3. Review of color and spectral Doppler technique and methods for optimization including how color flow affects the O-RADS US score in certain scenarios.

## OBEE-5 MURPHY'S LAW: WHAT CAN GO WRONG IN GYNECOLOGICAL AND OBSTETRIC PROCEDURES? A PICTORIAL ESSAY ON CASES

Leandro A. Mattos Sr, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcus V. Nascimento, MD (*Abstract Co-Author*) Fellow, Hospital Israelita Albert Einstein
Maria Luiza Lacerda Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana C. Pasquini Raiza, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are:- Create a multimodality-based didactic review of the main topics of complications at gynecological and obstetric procedures.- Construct a practice guide with schematic figures explaining the gynecological and obstetric procedures.- Present a didactic categorization of the following topics: myomectomy, assisted reproduction, curettage, hysterectomy, and cesarean section.- Illustrate those conditions based on cases from our radiology group.

### TABLE OF CONTENTS/OUTLINE

In this exhibit, we will discuss the principles of complications during gynecological and obstetric procedures and focus on their imaging features using a multimodality approach.INTRODUCTION- Epidemiology Imaging role based on current guidelinesCASE-BASED REVIEW- MyomectomyAbscess- Assisted reproductionOvarian hyperstimulation syndrome- CurettagePerforation- HysterectomyGonadal vein thrombosis- Cesarean sectionUreteral injury with vesicouterine fistula

## OBEE-50 ENDOMETRIOSIS: A JOURNEY FROM INFERTILITY TO FERTILITY

Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Liina Poder, MD (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Madison M. Breiland, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela I. Causa Andrieu, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) 10-15% of reproductive-age patients have endometriosis, and 30-50% are associated with infertility.Endometriosis degree may not correlate with infertility degree. Early discussion about goals of care (pain relief versus fertility) is essential.Ovarian factor: US and antimullerian hormone levels are good markers. Antral follicle count in US reflects ovarian reserve. It's best done between days 2-5 of the menstrual cycle, counting follicles between 2-10 mm in each ovary. Endometriomas can affect follicle and oocyte recovery.Tubal factor: Hysterosalpingogram evaluates tubal patency using various imaging methods and contrast agents. It's done between days 5-11 of the menstrual cycle. Both fallopian tubes and intraperitoneal spill should be visible.Uterine factor: Adenomyosis can cause infertility by affecting implantation. Mullerian malformations may coexist with endometriosis.(2) The treatment should be personalized: expectant management, surgical removal of implants, ovulation induction, or IVF.(3) Although endometriosis usually regresses during pregnancy, complications may rarely occur: spontaneous hemoperitoneum, enlargement/abscess/rupture of ovarian endometriomas, tethering/rupture of adhesions, bowel perforation, ureteral rupture, and uterine rupture. (4) The dysfunctional uterine changes could predispose to complications: preterm birth, placenta previa, stillbirth, post-partum hemorrhage, and fetal malpresentation.

### TABLE OF CONTENTS/OUTLINE

- Endometriosis and Infertility: Diagnosis
- Endometriosis and Infertility: Treatment
- Endometriosis and Fertility: Pregnancy complications
- Endometriosis and Fertility: Peripartum complications

## OBEE-51 IUD LOCATION: ARE WE SPEAKING THE SAME LANGUAGE?

Jessica J. Koster, MD (*Abstract Co-Author*) Nothing to Disclose
Meredith Gray (*Abstract Co-Author*) Nothing to Disclose
Kelli J. Andresen, MD (*Abstract Co-Author*) Nothing to Disclose
Valerie French (*Abstract Co-Author*) Nothing to Disclose
Jill A. Jones, MD, RVT (*Presenter*) Research Consultant, Corcept Therapeutics Inc

**TEACHING POINTS**

There are numerous terms used to describe variant locations of intrauterine devices (IUDs), such as displaced, low-lying, malpositioned, or partial expulsion. However, these terms are vague and frequently misinterpreted by providers, and may lead patients to infer there is risk of personal harm or that the IUD is not adequate contraception. Current consensus guidelines from the American College of Obstetricians and Gynecologists (ACOG) state the greatest risk of unwanted pregnancy may be the unnecessary removal of a nonfundal IUD. The ACOG recommends counseling patients, whether symptomatic or asymptomatic, prior to removal of the IUD. Many providers now advocate for IUDs to be left in place if located above the internal os. For this reason, radiology reports should use clear and consistent terminology to describe IUD position and avoid terms that may raise suspicion for patient injury. We support using a simple lexicon to describe the location of IUDs on ultrasound reports, which is widely understood by OB/Gyn providers and aligns with current gynecologic literature.

**TABLE OF CONTENTS/OUTLINE**

1. Provide an overview of IUD contraception, including trends in use, efficacy, and risks/side effects 2. OB/Gyn colleagues provide a clinical perspective to IUD management, including a review of current ACOG consensus guidelines for management of nonfundal IUDs 3. Introduce standard lexicon to describe IUD location, with illustrations, ultrasound cases, and sample reports

## OBEE-52 FETAL MR IMAGING OF OBSTRUCTIVE HYDROCEPHALUS: PICTORIAL REVIEW OF AETIOLOGIES

Andrea Righini (*Abstract Co-Author*) Nothing to Disclose
Giana Izzo (*Abstract Co-Author*) Nothing to Disclose
Francesco Pacchiano (*Abstract Co-Author*) Nothing to Disclose
Chiara Doneda (*Abstract Co-Author*) Nothing to Disclose
Cecilia Parazzini (*Abstract Co-Author*) Nothing to Disclose
Filippo Arrigoni (*Abstract Co-Author*) Nothing to Disclose
Mario Tortora, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Fetal ventriculomegaly can be broadly classified as obstructive or non-obstructive. Several pathologies and malformations can lead to obstructive ventriculomegaly by interrupting CSF normal flow. Identifying these entities can facilitate diagnosis and clarify the mechanisms underlying ventriculomegaly as well as optimize prognostic and therapeutic management. Incorporating visual representations of etiologic pictures is beneficial for both novice and experienced radiologists specializing in fetal imaging.

**TABLE OF CONTENTS/OUTLINE**

Ventriculomegaly is the most commonly depicted abnormality of the fetal CNS at prenatal imaging. This finding is nonspecific, with a rate of associated malformations ranging from 10% to 50%. The understanding of causal factors at prenatal stage may be a challenge and is further confounded by the lack of histopathological data. Response to treatment and prognostication are not clearly defined. Early and accurate diagnosis at prenatal MRI is therefore essential, allowing improved prenatal counselling and facilitating appropriate referral. We retrospectively reviewed our Fetal MRI database (4568 exams). We included 201 cases of obstructive hydrocephalus according strict inclusion criteria: isolated aqueduct stenosis (36.3%); hemorrhagic events leading to secondary aqueduct obstruction (30.3%); rhombencephalosynapsis (7.5%); dural sinus malformation (6%); midline cysts (5.4%); diencephalic-mesencephalic junction (DMJ) dysplasia (3.5%); infective based lesions (3%); tumor/hematoma (2.5%); Chiari 1 (1.5%); Walker-Warburg disease (1%); miscellanea (3%). We discuss MR features providing clinical and postnatal MRI or histopathology correlation.

## OBEE-53 THE ROLE OF THE RADIOLOGIST IN THE EVALUATION OF UTERINE ADENOMYOSIS

Ana Belen Barba Arce, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Explain what adenomyosis consists of: etiopathogenesis, clinical manifestations, risk factors, and treatment. 2. Review normal uterine anatomy. 3. Present the diagnostic methods used to detect adenomyosis, focusing on its evaluation through magnetic resonance imaging (MRI). 4. Show the different manifestations of adenomyosis and their characteristics as seen on MRI. 5. Describe possible pitfalls and the differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. What is adenomyosis?. 2. Etiopathogenesis. 3. Incidence. 4. Clinical manifestations. 5. Risk factor's. 6. Diagnostic tests. 7. Treatment. 8. MRI study protocol. 8.1. Previous recommendations. 8.2. Sequences. 9. Anatomical review. 10. Classification of adenomyosis by MRI. 11. Characteristic findings of adenomyosis by MRI. 11.1. Diffuse adenomyosis. 11.2. Focal adenomyosis. 12. Pitfalls. 12.1. Physiologic changes in the uterine body during the menstrual cycle. 12.2. Uterine contractions. 12.3. Postmenopausal uteruses and in women using contraceptive drugs. 13. Differential diagnosis. 13.1. Leiomyoma. 13.2. Endometriosis. 13.3. Accessory cavitated uterine mass. 13.4. Myometrial invasion by endometrial cancer. 13.5. Low-grade endometrial stroma sarcoma. 13.6. Maligned adenomiosis. 14. Conclusions.

## OBEE-54 ULTRASOUND APPROACH TO ADENOMYOSIS, THE FIRST AND BIGGEST STEP IN DIAGNOSIS

Rodrigo Arrieta Darras, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-Identify the normal ultrasound findings of the uterus and the main characteristics and classification of adenomyosis.-Illustrate the featured ultrasound signs and imaging data in the diagnosis of adenomyosis.

**TABLE OF CONTENTS/OUTLINE**

-Normal ultrasound findings of the uterus.-Some facts of adenomyosis: -History -The introduction of ultrasound as a diagnostic modality of this disease. -Using different modalities of ultrasound-Video clips and the importance of making them.

## OBEE-55 TUMOR-LIKE CONDITIONS AND PSEUDOTUMORAL LESIONS IN THE FEMALE PELVIS: IMAGING FEATURES, DIFFERENTIAL DIAGNOSIS, AND THERAPEUTIC STRATEGY

Masafumi Harada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kenji Matsuzaki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mayumi Takeuchi, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Nonneoplastic conditions may present tumor-like manifestations in the uterus and adnexa, and normal organs may undergo dynamic changes with physiological conditions or hormonal stimulation appearing as pseudotumoral "Don't Touch" lesions. They are common in young women, occasionally with hormonal activity, and are often associated with pregnancy. Accurate diagnosis is important for the appropriate management to avoid excess surgical procedures and to preserve fertility and function. A wide spectrum of clinical and imaging features, and therapeutic strategies are reviewed. 2. To demonstrate look-alike tumors and tumor-like lesions on imaging, and to describe the clues to the differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1. Physiological changes of normal organs: age, menstrual cycle, pregnancy, medication 2. Ovarian histological anatomy w/ hormonal synthesis 3-a. Pathogenesis of tumor-like lesions related to hormonal excess: gonadotropins, estrogen, androgen 3-b. Clinical features of functioning lesions: direct and indirect signs 4-a. Non-neoplastic ovarian cysts, 4-b. Enlarged ovaries w/ stromal proliferation or edema, 4-c. Pregnancy-related ovarian lesions 5-a. Non-neoplastic uterine lesions: Myometrial, Pregnancy-related, C-section scar-related 6. Endometriosis and related lesions 7. PID and related lesions 8. Advanced MR techniques: 3D-T2WI, DWI (computed /reduced FOV), SWI, DCE-MRI, MR Spectroscopy 9. Treatment options: Conservative, Minimal invasive, Fertility /function preserving

## OBEE-56 DIAGNOSTIC AND MANAGEMENT IMPLICATIONS OF 2023 FIGO STAGING FOR ENDOMETRIAL CANCER: A PRIMER FOR RADIOLOGISTS

**Awards**
**Certificate of Merit**

Alejandra Esparza Young (*Abstract Co-Author*) Nothing to Disclose
Philip T. Valente, MD (*Abstract Co-Author*) Nothing to Disclose
Paulina Ramirez (*Abstract Co-Author*) Nothing to Disclose
Edward Kost (*Abstract Co-Author*) Nothing to Disclose
Georgia McCann (*Abstract Co-Author*) Nothing to Disclose
Srinivasa R. Prasad, MD (*Abstract Co-Author*) Nothing to Disclose
Venkata S. Katabathina, MD (*Abstract Co-Author*) Nothing to Disclose
Sriram Jaganathan, MD (*Abstract Co-Author*) Nothing to Disclose
Alexsandra M. Ramirez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Familiarize the audience with 2023 updates of the FIGO Endometrial Cancer (EC) Staging System Review new molecular classifications, pathologic advances, natural history novel therapies Describe the imaging findings adapted to updated 2023 FIGO staging system with emphasis on potential diagnostic management implications Discuss novel treatments role of imaging in assessing treatment efficacy

**TABLE OF CONTENTS/OUTLINE**

Introduction Review newly proposed 2023 FIGO Endometrial cancer staging system Pathology, genetics molecular biology Grading: Grades 1-3 Histology: Aggressive Non-aggressive; Endometrioid, Serous, clear cell, undifferentiated, carcinosarcoma mixed Lymphovascular space invasion Molecular classification: POLEmut (good prognosis), Mismatch repair deficient, No specific molecular profile p53abn (worse prognosis) Role of sentinel lymph node biopsy Imaging techniques: US, CT, MRI PET/CT MRI role in preoperative assessment: Tailor presurgical treatment, risk stratification management Effect of FIGO staging on imaging recommendations: CT vs. MRI vs. PET/CT Diagnostic and management implications MRI Role: Myometrial or cervical stromal invasion? •Uterine body, serosal, adnexal, or parametrial involvement? Pelvic, periaortic lymphadenopathy? •Distant metastases?•Treatment complications? •Recurrent disease? Role of imaging in fertility preservation strategies Novel treatments role of imaging in assessing treatment efficacy ConclusionAdvances in understanding pathology molecular classifications of EC led to 2023 FIGO staging system. MRI helps in preop assessment, risk stratification selection of most appropriate initial therapy.

## OBEE-57 THE UPDATED 2023 STAGING OF ENDOMETRIAL CANCER. TIPS FOR MRI INTERPRETATION

Alfonso Iglesias, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Learn about the current modifications in the new FIGO 2023 endometrial cancer staging Recognize the differences from the previous staging system Know the major changes in the revised FIGO 2023 endometrial cancer staging that affect MR imaging interpretation

**TABLE OF CONTENTS/OUTLINE**

Explain the new FIGO 2023 staging for endometrial cancer that includes the various histological types, tumor patterns, and molecular classification because they affect prognosis and enable a more appropriate treatment planning Description of the changes incorporated in the new FIGO 2023 with emphasis on the modifications that have occurred with respect to the FIGO 2009 staging Show MRI findings in different stages of endometrial cancer and their correlation with the updated FIGO 2023 staging and its pathological correlation and to identify those MRI findings that condition the management of patients with endometrial carcinoma

## OBEE-58 FETAL MRI: ABDOMINAL CYSTIC LESIONS

Javier Carrascoso Arranz (*Abstract Co-Author*) Nothing to Disclose
Alejandro Diaz Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Vicente Martinez de Vega, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucia Sanabria, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Lopez Alcolea, MD (*Abstract Co-Author*) Nothing to Disclose
David Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel R. Recio Rodriguez, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

· MRI is a complementary tool to ultrasound that helps characterize lesions and assess the degree of extension.· Ovarian cysts are very common cystic lesions in female fetuses and often bleed.· Gradient echo sequences in phase and opposed phase can detect the presence of fat in teratomas.· Diffusion sequence allows us to calculate the ADC of teratomas; immature teratomas present lower ADC values than mature ones due to increased cellularity.

**TABLE OF CONTENTS/OUTLINE**

Prenatal diagnosis of abdominal cystic lesions by ultrasound is quite common. Fetal MRI, with its multiplanar capacity and greater tissue characterization, aids in diagnosing these lesions and better assessing their extension.Cystic lesions are classified into gastrointestinal (intestinal duplication cysts, meconium pseudocysts, lymphatic malformations, hepatic and biliary cystic lesions, splenic cysts, and intestinal dilatations), genitourinary (ovarian cysts, hydrometrocolpos, urogenital sinus, cloacal malformation, renal and adrenal cystic lesions), cystic teratomas, and lesions associated with the Currarino triad.Characteristic radiological findings of these lesions are described, as well as the different MRI sequences useful for diagnosis.

## OBEE-59 FETAL MRI: MIDLINE ANOMALIES AND CORTICAL DEVELOPMENT MALFORMATIONS

Paula Molina Vigara, MD (*Abstract Co-Author*) Nothing to Disclose
Vicente Martinez de Vega, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia Lopez Alcolea, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Diaz Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
David Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Sanabria, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel R. Recio Rodriguez, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Fetal MRI:• Has high sensitivity in detecting midline anomalies,• Detects anomalies associated with dysgenesis of the corpus callosum followed by cortical malformations and posterior fossa anomalies.• Identifies all forms of holoprosencephaly.• Is the technique of choice for cortical development malformations, lacking the limitations of ultrasound.

**TABLE OF CONTENTS/OUTLINE**

Different midline anomalies are described, including dysgenesis of the corpus callosum, alobar, semilobar, or lobar holoprosencephaly, septo-optic dysplasia, lipoma of the corpus callosum, interhemispheric cysts and absence of the cavum pellucidum. The characteristic radiological findings of each pathology and the most frequent associated genetic alterations are shown.Cerebral cortical development is divided into three processes: cell proliferation (2nd to 4th month), neuronal migration (3rd/4th month to week 24), and cortical organization (week 22 to 2 years of age). The classification proposed by Barkovich in 2012 is reviewed, showing radiological findings and the main associated genetic alterations in:• Proliferative disorders: Decreased proliferation (microlissencephaly), increased proliferation (hemimegalencephaly), and abnormal proliferation (cortical dysplasia or cortical hamartomas of tuberous sclerosis).• Migration disorders: Decreased migration (classical lissencephaly), increased migration (congenital muscular dystrophy), ectopic migration (heterotopias).• Cortical organization disorders: Polymicrogyria and schizencephaly (closed-lip type I, open-lip type II).

## OBEE-6 FROM TWISTS TO INFECTIONS: A TUBE PICTORIAL ESSAY BEYOND YOUTUBE

Luciana C. Pasquini Raiza, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro A. Mattos Sr, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcus V. Nascimento, MD (*Abstract Co-Author*) Fellow, Hospital Israelita Albert Einstein
Roberta Linhares, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purposes of this exhibit are:- Create a multimodality-based didactic review of the main topics of the study of the uterine tube with multiple imaging methods.- Construct a practice guide with schematic figures explaining the main complications of the uterine tube.- Suggest a didactic categorization of the following topics: fertility study, acute emergency complication, neoplasm with tubal involvement, infectious complication, and obstetric complication.- Illustrate those conditions based on cases from our radiology group.

**TABLE OF CONTENTS/OUTLINE**

In this exhibit, we will discuss the principles of complications during gynecological and obstetric procedures and focus on their imaging features using a multimodality approach.INTRODUCTION - Review the main conditions related to uterine tube.- Describe the imaging protocols.CASE-BASED REVIEW- Fertility studyhysterosalpingographymagnetic resonance hysterosalpingography- Acute emergency complicationtubal torsion- Tumor with tubal involvementendometrioid carcinomatubal adenomatoid tumor- Infectious complicationInfectious complication- Obstetric complicationEctopic pregnancyHeterotopic pregnancy

## OBEE-60 ULTRASOUND OF THE POST PROCEDURE UTERUS: CHRONIC FINDINGS WITH CORRELATIVE IMAGING

Shuchi K. Rodgers, MD (*Abstract Co-Author*) Royalties, RELX
Mindy M. Horrow, MD (*Presenter*) Spouse, Employee, Bristol-Myers Squibb Company

**TEACHING POINTS**

1. The configuration of an anteverted and retroflexed uterus is rare other than related to adhesions from Cesarean section and may cause sub-optimal transvaginal imaging 2. Clinical complications related to the Cesarean section scar include dysfunctional bleeding, ectopic pregnancy and IUD malposition 3. Residual functional endometrial tissue after endometrial ablation can lead to cornual hematosalpinx, hematometra and adenomyosis 4. Post ablation tubal sterilization syndrome may occur after ablation in patients with prior tubal ligation when egress of blood from residual endometrium is obstructed in antegrade and retrograde directions, leading to cyclic pelvic pain despite amenorrhea

**TABLE OF CONTENTS/OUTLINE**

A. C-section- changes in uterus 1. Position 2. Scar a. Appearance of scar(s) b. Appearance of niche/isthmocele i. Measurement ii. SIS 3. Complications of the uterine scar a. Dysfunctional bleeding b. Ectopic pregnancy c. IUD malposition 4. Complications of the abdominal wall scar a. Endometrial implants b. Hernia c. Bowel obstruction B. Endometrial Ablation a. Background b. Normal appearance c. Complications i. Symptomatic obstructed menses ii. Hematometra 1. Central 2. Cornual iii. Adenomyosis iv. Post ablation tubal sterilization syndrome v. Other considerations (pregnancy, malignancy) C. Fibroid Treatments a. Myomectomy b. Uterine artery embolization D. Other a. Synechiae b. Vascular complications: AVM, PSA c. Retained devices related to uterine procedures d. Obstructed uterus

## OBEE-61 ACUTE GYNECOLOGICAL PAIN AND ITS RADIOLOGICAL FINDINGS BY TC

Pascual Adrian Gonzalvo Gomez (*Abstract Co-Author*) Nothing to Disclose
Samuel Roldan Minana (*Abstract Co-Author*) Nothing to Disclose
Elena Pascual Perez, MD (*Abstract Co-Author*) Nothing to Disclose

Elena Sierra, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Rozas (*Abstract Co-Author*) Nothing to Disclose
Myriam Segarra Hernandez (*Abstract Co-Author*) Nothing to Disclose
Paloma Briceno Torralba, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Accurate evaluation of acute gynecological pathology presenting with acute pain through CT is challenging due to different gynecological conditions.- Emergency radiology in the rigorous diagnosis of urgent gynecological pathology as well as in guiding therapeutic planning is crucial due to a high morbimortality.

**TABLE OF CONTENTS/OUTLINE**

Acute gynecological pain represents a significant clinical challenge, with various forms of clinical presentation that can range from benign ailments to potentially life-threatening conditions. In this context, computed tomography (CT) has emerged as an essential tool for the fast and accurate evaluation of these conditions due to its capacity to generate detailed images rapidly. However, despite the latest advances in CT image resolution, the female pelvic region remains a tackled area to characterize and poses a challenge even for the most experienced radiologists.This review aims to explore, by different examples, the role of CT in the initial evaluation of emergent gynecological pathologies, such as ruptured ectopic pregnancy or sepsis due to pelvic inflammatory disease, often requiring immediate treatment through radiological intervention or surgery. It will also focus on other gynecological manifestations that necessitate precise differential diagnosis from other commonly occurring intra-abdominal processes due to their urgent nature.

## OBEE-62 LOOK CAREFULLY: IT'S NOT AN OVARIAN LESION!

Jorge Elias JR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vitor V. Ricci (*Abstract Co-Author*) Nothing to Disclose
Carlos M. Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Cecilia V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Pereira (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Gouvea, MD (*Abstract Co-Author*) Nothing to Disclose
Arthur Ogata, MD (*Abstract Co-Author*) Nothing to Disclose
Thalyne Lima (*Abstract Co-Author*) Nothing to Disclose
Valdair F. Muglia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Helena Kaca Do Carmo (*Abstract Co-Author*) Nothing to Disclose
Pamela Grazielle Correa De Oliveira (*Abstract Co-Author*) Nothing to Disclose
Guilherme N. Alves, MD, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The adnexal and paraovarian regions can harbor various pathologies, ranging from infectious to neoplastic conditions. It's crucial for radiologists to accurately characterize and diagnose these lesions, although extraovarian findings are often overlooked due to the higher frequency of ovarian involvement. This presents a diagnostic challenge. This review aims to discuss the most common paraovarian conditions and their identification on Magnetic Resonance Imaging (MRI), Computed Tomography (CT), and Ultrasound images, with an emphasis on distinguishing them from ovarian lesions. While many findings are benign and similar to adnexal lesions, leiomyomatosis, and endometriosis affecting atypical sites like the broad ligament should be noted. Fluid-filled lesions such as hydrosalpinx, hematosalpinx, paraovarian cysts, and peritoneal inclusion cysts are also noteworthy. Malignant lesions are typically secondary, often originating from the pelvis and abdomen, although primary neoplasms can occur, posing challenges in diagnosis. Schwannomas and neurofibromas along pelvic nerves are potential findings. In fertile patients, ectopic pregnancy should be considered as a differential diagnosis for paraovarian masses. Given that accurate diagnosis can expedite treatment, recognizing and confidently reporting prevalent extraovarian lesions is paramount.

**TABLE OF CONTENTS/OUTLINE**

- Detailed anatomy of the adnexal region with imaging correlation; - The list of differentials, including the most common paraovarian lesions;- How to identify classic findings of extraovarian origin and how to confidently differentiate them from ovarian ones.

## OBEE-63 PICTORIAL REVIEW OF BILATERAL ADNEXAL LESIONS

Jean p. Akakpo Sr, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Olivier Lucidarme, MD, PhD (*Abstract Co-Author*) Speaker, Bracco Group;Speaker, F. Hoffmann-La Roche Ltd;Expert Witness, Bayer AG
Natalia H. Concatto, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmina Badachi, MD (*Abstract Co-Author*) Nothing to Disclose
Catherine Uzan (*Abstract Co-Author*) Nothing to Disclose
Salma Ayadi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Explore the spectrum of bilateral adnexal lesions.• Highlight the diagnostic nuances and imaging characteristics of common and uncommon entities, also benign and malignant.• Present a selection of cases to illustrate.

**TABLE OF CONTENTS/OUTLINE**

Bilateral adnexal lesions pose a diagnostic challenge in clinical practice, necessitating a multidisciplinary approach for accurate assessment and management. These lesions, affecting structures such as the ovaries, fallopian tubes, and surrounding tissues, stem from diverse etiologies, including inflammatory, infectious, neoplastic, and functional causes.The first step when bilateral adnexal lesions are found is to exclude infection (ie: tubo-ovarian abscesses), endometriomas and functional affections such as: polycystic ovary syndrome, hyperthecosis and ovarian hyperstimulation syndrome.When organic bilateral adnexial tumors are diagnosed, the radiologist should describe and stratify the risk of malignancy of each tumor according to the Ovarian-Adnexal Reporting and Data System (O-RADS). However, the O-RADS does not include any observations when lesions are bilateral. We often encounter bilateral lesions, sometimes with divergent O-RADS categories, which may or may not be of the same etiology. Certain pathologies, such as serous carcinoma, mature teratoma, and metastasis, exhibit a propensity for bilateral involvement. Knowledge of these entities and their differential diagnoses is imperative for enriching diagnostic reports alongside O-RADS categorization.This pictorial review aims at aiding radiologists in identifying and interpreting imaging findings associated with bilateral adnexal lesions.

## OBEE-64 WORKING IN CONCERT: RADIOLOGY, PATHOLOGY, AND GYNECOLOGY ONCOLOGY APPLICATIONS OF THE 2023 FIGO UPDATES IN ENDOMETRIAL CANCER STAGING

Jamie McDowell (*Abstract Co-Author*) Nothing to Disclose
David Bass, MD (*Abstract Co-Author*) Nothing to Disclose

Denes Szekeres, BS (*Abstract Co-Author*) Nothing to Disclose
Wei Li (*Abstract Co-Author*) Nothing to Disclose
Tannaz Rajabi (*Abstract Co-Author*) Nothing to Disclose
Ashlee Smith (*Abstract Co-Author*) Nothing to Disclose
Akshya Gupta, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The FIGO classification for endometrial cancer was recently updated, with key differences in staging that are important for radiologists to be aware of. 2. Radiologic/pathologic correlation for endometrial cancer, including different histologic subtypes and molecular classifications, will be provided. The associated clinical implications and management recommendations will be highlighted in a case-based format.

**TABLE OF CONTENTS/OUTLINE**

1. Introduce endometrial cancer demographics, clinical presentation, and initial work-up 2. Review of the updated 2023 FIGO endometrial cancer staging system with emphasis on changes from the prior system3. Case based discussion of patients with different stages of endometrial cancer, with multimodality radiologic findings and associated pathologic correlation. Specific concepts that will be addressed include: a. Non-aggressive and aggressive histologic subtypes b. Importance of myometrial and lymphovascular space invasion c. Review of molecular classification of endometrial tumors and updated prognostic and staging implications d. Key radiologic and pathologic features that impact clinical management and treatment options 4. Pitfalls of the new staging system and current gaps in the literature

## OBEE-65 BEYOND THE SURFACE: ENHANCING DIAGNOSTIC ACCURACY WITH MULTIPLANAR RECONSTRUCTION IN SALINE INFUSION SONOHYSTEROGRAPHY

**Awards**
**Certificate of Merit**

Veronica Espinosa Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo A. Cervantes Flores, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela Briones, MD (*Abstract Co-Author*) Nothing to Disclose
Montserrat M. Cuadra, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Provide the learners with information about the procedure, materials, and techniques involved in sonohysterography, describing each step in a systematic manner. 2. Discover the potential of multiplanar reconstructive ultrasound images for detection of uterine pathologies, offering exceptional insights into anatomical structures and spatial relationships. 3. Explore the different imaging techniques available in uterine and endometrial pathologies, analyzing their respective advantages and limitations. 4. Describe the main abnormalities that we can diagnose with sonohysterography, identifying and interpreting these findings with precision and expertise. 5. Communicate and navigate the complexities of image interpretation in sonohysterography.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to Sonohysterography: a. Evolution and advancements in gynecologic ultrasound techniques. b. Advantages of saline-infused sonohysterography and comparing different imaging techniques. 2. Fundamentals of Hysterosonography Technique: a. Patient preparation and positioning for hysterosonography. b. Materials. c. Imaging protocol and step-by-step instructions. 3. Normal sonographic anatomy of the uterine cavity 4. Clinical Applications and Utility of Hysterosonography a. Congenital uterine malformations b. Endometrial polyps c. Endometrial hyperplasia d. Leiomyomas e. Uterine adhesion bands 5. Diagnostic Pitfalls and Challenges in Image Interpretation

## OBEE-66 LOOKING INTO PLACENTA ACCRETA SPECTRUM WITH MRI:RADIOLOGIC-PATHOLOGIC CORRELATION

Lia A. Moulopoulos, MD (*Abstract Co-Author*) Nothing to Disclose
Anastasia Konstantinidou (*Abstract Co-Author*) Nothing to Disclose
Marianna Konidari, MD (*Abstract Co-Author*) Nothing to Disclose
Charis Bourgioti, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Placenta accreta spectrum (PAS) is considered an iatrogenic disease and it may be associated with major ante- and postpartum complications for both mother and fetus, especially if not diagnosed prenatally. • Traditionally used terminology of placenta accreta, increta, and percreta is under debate and the so-called percreta cases are attributed to uterine dehiscence and adhesions between uterine serosa and posterior bladder wall. • Standardization and update of clinical, pathologic and imaging criteria for PAS diagnosis and grading is pivotal for improvement in diagnosis and treatment of PAS. • Familiarity with the main MRI findings of PAS and deeper understanding of the clinical relevance of each sign through pathologic correlation, will help radiologists provide more accurate diagnoses, optimizing patient care.

**TABLE OF CONTENTS/OUTLINE**

• Introduction to PAS: Definitions, epidemiology, predisposing factors, common clinical findings, and appropriate diagnostic imaging modalities. • Current challenges in understanding the pathophysiology of PAS and debate on its clinical and histopathological confirmation. • Prenatal use of MRI in PAS diagnosis and management: A routine or an adjunct assessment tool? • Normal placenta pathology and correlation with MRI anatomy. • MRI protocols for PAS evaluation: Conventional protocols and implementation of advanced functional techniques • MRI description, pathophysiological and rad-path correlation of MRI signs of PAS according to SAR/ESUR joint consensus guidelines. Is it possible to discriminate between uterine dehiscence and PAS myoinvasion? • Follow-up MRI in patients with uterine sparing management for PAS. What to expect.

## OBEE-67 FINDING YOUR NICHE: IMAGING FINDINGS ALONG THE SPECTRUM OF CESAREAN SECTION SCAR COMPROMISE AND OTHER POST-CESAREAN COMPLICATIONS

Erin N. Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Ishwarya Sivakumar (*Abstract Co-Author*) Nothing to Disclose
Julia Fisher, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Cesarean Section (CS) is increasingly common. Surgical techniques vary and include classic transverse, fundal and midline vertical incisions.2. The spectrum of cesarean scar compromise includes uterine niche, uterine window, uterine dehiscence, and uterine rupture. Each entity has its own imaging features and clinical implications.3. MRI is the imaging modality of choice to evaluate cesarean scar compromise given field of view, tissue resolution and clear delineation of uterine layers.4. Key features of CS scar defects that should be reported include maximum myometrial thickness and proximity of the abnormal myometrium to the urinary bladder.5. Additional complications of CS can occur concomitantly including infection, hematoma, adhesive disease, placenta accreta spectrum and CS ectopic pregnancy.

**TABLE OF CONTENTS/OUTLINE**

1. Background including rates of Cesarean Section (CS). 2. Surgical technique: Classic, fundal and midline vertical incision3. Uterine Scar physiology, uterine anatomy, and normal appearance of the nulliparous and post-CS uterus 4. Protocol recommendations for MR evaluation of the post-CS uterus. 5. Spectrum of cesarean section scar compromise including: uterine niche. uterine window, uterine dehiscence, and uterine rupture6. What the surgeon needs to know: descriptors and features to report that may aid in operative planning7. Additional complications of CS including infection, endometritis, surgical site abscess, post operative hematoma, adhesive disease, CS ectopic, and placenta accreta spectrum. 8. Conclusion

## OBEE-68 EMPOWERING DIAGNOSIS: THE RADIOLOGIST'S KEY ROLE IN PRIMARY AMENORRHEA MANAGEMENT

Maria N. Napoli, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Chacon, MD (*Abstract Co-Author*) Nothing to Disclose
Martina Aineseder, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin Kurt Mac Allister (*Abstract Co-Author*) Nothing to Disclose
Ayelen Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Florencia Trila, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Radiology should be the first referral department as imaging plays a key role.Ultrasound is the first line investigation while Magnetic resonance imaging is important for accurate diagnosis and surgical planning.The kidneys should be assesed at all times in mullerian duct anomalies given the high frecuency of anomalies (30%)The Herlyn-Werner-Wunderlich syndrome (HWWS) usually presents as a triad: didelphys uterus, low genital obstruction and unilateral renal anomaly.Hypothalamic-pituitary axis alterations may be suspected due to findings on ultrasound such as an infantile uterus or the absence of secondary sexual characteristics.

**TABLE OF CONTENTS/OUTLINE**

Primary amenorrhea is defined as the absence of menarche at age 16 years with normal growth and development of secondary sexual characteristics, or at age 14 years in the absence of normal growth or development of secondary sexual characteristics. Its incidence is approximately 3,000 per 100,000 individuals, mainly due to hypothalamic amenorrhea. The menstrual cycle depends on the proper functioning of the hypothalamic-pituitary-ovarian axis and its target organs that constitute the outflow tract (uterus and vagina). Any alteration in these structures can trigger amenorrhea.The management of a patient with primary amenorrhea requires an interdisciplinary approach and the radiologist plays a key role since up to approximately 67% of the diagnoses are made by means of an imaging study.In order to organize the etiologies in a logical and educational way it is proposed to divide the causes into three levels. Level 1: Outlet tract. Level 2: Gonadal. Level 3: Diencephalon.

## OBEE-69 FEMALE GENITAL TRACT CONGENITAL ANOMALY SPECTRUM: THE ROLE OF IMAGING IN CLASSIFICATION, SURGICAL PLANNING, AND MULTIDISCIPLINARY CARE

**Awards**
**Cum Laude**

Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marjan Attaran (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Myra K. Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Mary C. Costello, DO (*Abstract Co-Author*) Nothing to Disclose
Priyanka Jha, MBBS (*Abstract Co-Author*) Nothing to Disclose
Cara King (*Abstract Co-Author*) Nothing to Disclose
Swati V. Putcha, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Female genital tract congenital anomalies (FGTCAs) impact up to 7% of those assigned female at birth and up to 25% of women with infertility or history of miscarriage. 2. FGTCAs are often associated with renal, vascular or bony anomalies due to complex embryologic interplay. 3. FGTCAs impact patients throughout their lifetime. Counseling and treatment must consider future phases of life. 4. Multidisciplinary care centers offer patients a comprehensive approach to medical management optimization and surgical correction tailored to a patient’s desires. 5. Transvaginal ultrasound is first-line imaging modality for FGTCA, but may not be possible in those with vaginal agenesis or younger patients. MRI is second-line non-invasive imaging modality for diagnosis, identification of associated anomalies, concurrent pathologies, treatment planning, and identification of innate and post-surgical complications. 6. MRI protocol tailored for FGTCA evaluation is necessary to aid in accurate classification and surgical planning.

**TABLE OF CONTENTS/OUTLINE**

1. Title 2. Disclosures 3. Learning objectives 4. Female genital tract congenital anomaly background information and embryology 5. MRI protocol and report considerations 6. Case examples with imaging and management / surgical planning information (septate spectrum longitudinal transverse; rudimentary horn spectrum including communicating, non-communicating and ACUM; agenesis cases including MRKH, cervical and vaginal agenesis, AIS; complex anomalies, associated anomalies including GU, vascular and osseous). 7. Conclusion 8. References

## OBEE-7 UNLOCKING MYSTERIES: EARLY AND LATE GROWTH ONSET DIAGNOSIS AND MANAGEMENT

Sergio Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Sousa Santana De Paula (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana Cerri, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To discuss the diagnosis and management of early and late onset growth restriction, highlighting: The importance of early detection and understanding the distinction between small for gestational age (SGA) and fetal growth restriction (FGR) is paramount for fetal health. Ultrasound assessment that

encompasses essential parameters, timing, and frequency of surveillance, guided by ISUOG criteria for interpreting fetal growth charts. Management strategies in fetal care based on the severity of SGA/FGR and gestational age, considering optimal timing and mode of delivery. Future directions: Ongoing research in the field of SGA and FGR.

**TABLE OF CONTENTS/OUTLINE**

1. IntroductionOverview of Growth Restriction (GR) in PregnancyImportance of Early Detection and Management 2. Understanding Growth Restriction Definition and Classification of Growth Restriction Pathophysiology of Early and Late Onset Growth Restriction Risk Factors and Contributing Factors 3. Ultrasound Evaluation of Growth Restriction Role of Ultrasound in Prenatal Assessment Measurement Parameters for Fetal Growth Assessment 4. Early Onset Growth Restriction: Diagnosis and Management Clinical Features and Diagnostic Criteria Ultrasound Findings and Biometric Parameters Antenatal Surveillance Strategies Interventional Strategies and Management Approaches 5. Late Onset Growth Restriction: Diagnosis and Management Clinical Characteristics and Diagnostic Challenges Ultrasound Markers and Predictive Models Therapeutic Interventions and Management Strategies 6. Role of Advanced Ultrasound Imaging Techniques 7. Future Directions and Research Opportunities 8. Conclusion

## OBEE-70 CLEARING THE HURDLES TO PERFECT PICTURES: OPTIMIZING THE MRI PELVIS PROTOCOL FOR O-RADS

Andrea G. Rockall, FRCR, MRCP (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Sadowski, MD (*Abstract Co-Author*) Nothing to Disclose
Nancy Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Reinhold, MD, MSc (*Abstract Co-Author*) Research Grant, Imagia Cybernetics Inc
Isabelle Thomassin-Naggara, MD (*Abstract Co-Author*) Researcher, General Electric Company;Research funded, General Electric Company;Researcher, Canon Medical Systems Corporation;Research funded, Canon Medical Systems Corporation;Research funded, Hologic, Inc;Research funded, Siemens AG;Research funded, Guerbet SA
Stephanie Nougaret, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Krupa K. Patel-Lippmann, MD (*Abstract Co-Author*) Nothing to Disclose
Angela Tong, MD (*Presenter*) Equipment support, Siemens AG

**TEACHING POINTS**

1. Acquiring T2WI and Post-contrast T1WI with 3mm slice thickness is important to ensure visualization of small papillary projections.2. In/opposed phase images in addition to fat suppressed images are essential as dermoids may only contain microscopic fat.3. The high b value in the DWI acquisition must be at least 1000s/mm2 to ensure sufficient signal loss from fluid in cysts.4. Parallel imaging and multi band techniques can decrease acquisition time for DWI.5. Employ left/right phase encoding and anterior saturation bands on T2WI to decrease motion artifact.6. Time intensity curves can risk stratify lesions into O-RADS MRI 3, 4, and 5, while visual inspection single phase post contrast sequence can only stratify between O-RADS 4 and 5 with decreased positive predictive value.7. ROIs for time intensity curves must be placed on enhancing adnexal solid tissue and the outer myometrium for proper risk stratification.

**TABLE OF CONTENTS/OUTLINE**

1. Review the minimum requirements for MRI sequences and optimal imaging planes needed for using the O-RADS MRI risk score.2. Image rich case based review of pitfalls and importance of optimization of each sequence.3. Details on how to perform time intensity curve analysis properly.

## OBEE-9 NEXT-GENERATION DIAGNOSTICS: UNVEILING THE POWER OF $^{23}$NA-MRI IMAGING IN THE FIELD OF GYNECOLOGY

Toyomi Satoh, MD (*Abstract Co-Author*) Nothing to Disclose
Toshitaka Ishiguro, MD (*Abstract Co-Author*) Nothing to Disclose
Miki Yoshida, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takahito Nakajima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sodai Hoshiai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masashi Shindo, RT (*Abstract Co-Author*) Nothing to Disclose
Taishi Amano, MD (*Abstract Co-Author*) Nothing to Disclose
Masafumi Sakai, MD (*Abstract Co-Author*) Nothing to Disclose
Saki Shibuki (*Abstract Co-Author*) Nothing to Disclose
Tsukasa Saida, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The regulation of sodium (Na+) ion influx into cells is crucially maintained by Na+ channels, Na+/H+ and Na+/Ca2+ exchangers, while Na+ ion efflux is facilitated by Na+/K+-ATPase, ensuring a significant transmembrane Na+ ion gradient. When this regulatory system is compromised, it leads to disruptions in the intracellular sodium concentration, fostering cancer metastasis by enabling cellular invasion and migration. Furthermore, Na+ ion accumulation around cancer cells, often a result of inflammation, enhances tumor immunogenicity. Consequently, alterations in Na+ ion levels could serve as vital biomarkers for the diagnosis and prognosis of tumors. 23Na-MRI stands out by providing insights into changes in Na+ ion concentration within tumors and provides biochemical information that reflects cell viability, structural integrity, and energy metabolism. This technology has proven its efficacy in detecting early molecular-level therapeutic responses before any morphological changes become apparent. In this exhibition, we delve into the basic principles of 23Na-MRI technology and explore its potential for clinical application as a non-invasive diagnostic tool, specifically in the field of gynecology.The teaching points of this exhibit are: 1. The basic principles of 23Na-MRI technology.2. The potential of 23Na-MRI for clinical application as a non-invasive diagnostic tool, specifically in the field of gynecology.

**TABLE OF CONTENTS/OUTLINE**

A. The basic principles of 23Na-MRI technology and its limitations.B. Actual 23Na-MRI images of various gynecological conditions including benign and malignant, along with interpretations of their findings.

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# Abstract Archives of the RSNA, 2024

OBEE-1

## ULTRASOUND ASSESSMENT OF GRAVID CERVIX: A PRIMER FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Matheus Santos Rios, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana Cerri, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cesar Gabriel Rocha Da Costa Paloschi, MD (*Abstract Co-Author*) Nothing to Disclose
Sergio Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Enzo Calheiros, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Preterm birth (PTM) continues to stand as the foremost cause of perinatal morbidity and mortality globally, with a reduced cervical length (CL) representing a clinical marker classically associated with an increased risk of preterm delivery.- Ultrasound (US) is the primary imaging method for evaluating the gravid cervix in patients at high risk for PTB (including asymptomatic women) or those exhibiting signs of preterm labor.- CL measured by US is a very useful screening test that has been associated with better prediction of PTB than previously available tests.- This pictorial review aims to illustrate key concepts in the clinical use of US as a screening tool for PTB, focusing on the evaluation of CL. Based on a step-by-step approach, we propose a systematization of this examination tailored for clinical radiologists.

### TABLE OF CONTENTS/OUTLINE

1. Background: Preterm birth- Risk factors- Screening and prevention2. Anatomy of uterine cervix and changes during pregnancy3. US-based screening strategies for preterm birth- Cervical length- Other US findings (funneling, amniotic fluid sludge, etc)4. US techniques: - Transabdominal - Translabial - Transvaginal - 3D Imaging - Elastography5. ACR Appropriateness Criteria: a step-by-step approach6. Management of short cervix: what to know and what to look for7. Summary and take-home messages

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# Abstract Archives of the RSNA, 2024

OBEE-10

## ENDOMETRIOSIS OF THE ADNEXA ON MRI: AN IN-DEPTH REVIEW BEYOND THE ENDOMETRIOMA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Anuradha S. Shenoy-Bhangle, MD (*Abstract Co-Author*) Nothing to Disclose
Haatal B. Macer, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) A thorough understanding of adnexal anatomy is crucial to describing sites of DE for surgeons2) DE of the broad ligament manifests as T2 hypointense nodular implants contiguous with adjacent DE, in isolation or endometrioma of the broad ligament. Lateral pelvic extension may involve the pelvic nerves3) DE of the fallopian tube manifests as salpingitis, serosal/subserosal implants with tethering and hydrosalpinx, mucosal/luminal implants with hematosalpinx, or T2 hypointense thickening at a salpingectomy site4) Don't forget paratubal cysts as a potential site of endometriosis5) Ovarian endometriosis includes superficial implants, serosal disease and endometrioma6) Round ligament DE manifests as thickening, nodularity deviation and/or shortening, most commonly involving the intrapelvic portion near the uterus

### TABLE OF CONTENTS/OUTLINE

1) Adnexal Anatomy on MR: Broad Ligament, Round Ligament, Fallopian Tubes, Ovaries, Uterine Artery, Ovarian Artery, Lateral Pelvic Nerves2) Manifestations of endometriosis in the BL on MR with case examples and implications on neural involvement: Nodular implants contiguous with adjacent DE, Nodular implants in isolation, endometrioma of the broad ligament3) Manifestations of endometriosis of the FT on MR: Salpingitis, Serosal/Subserosal implants, Mucosal/Luminal Implants, Tubal Stump Implant4) Paratubal Endometriosis: Atypical site of DE, identification of cysts on MR and importance of pre-operative reporting for optimal DE excision5) Manifestations of endometriosis of the Ovaries on MR with case examples: Superficial implants, Serosal disease, Endometrioma6) Endometriosis of the RL: Normal anatomy, intra/extra pelvic involvement,7) Conclusion

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# Abstract Archives of the RSNA, 2024

OBEE-11

## ADNEXAL TORSION: DO YOU HAVE AN MRI AVAILABLE? IF YES, USE IT NO MATTER WHAT TIME IT IS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Arnaldo Scardapane (*Abstract Co-Author*) Nothing to Disclose
Luca Leo (*Abstract Co-Author*) Nothing to Disclose
Giuseppe V. Sturda (*Abstract Co-Author*) Nothing to Disclose
Roberta Montefrancesco (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review CT and MR imaging of adnexal torsion with pathologic correlation. 2. To propose an optimized MRI protocol (as brief and diagnostic as possible) for the gynecological emergencies that are simple to perform. 3. To emphasize the validity of using DWI sequences to identify ovarian viability.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: pathophysiology of adnexal torsion. 2. Presentation of “confusing-doubtful” clinical manifestations in Emergency Department. 3. What to do when ultrasound and CT are not enough? MRI: to whom, how and what time. 4. CT and MRI features with pathological correlations of ovarian necrosis due to delayed diagnoses. 5. Clinical cases in which the timely use of MR imaging leads to an early diagnosis preserving the ovary.

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# Abstract Archives of the RSNA, 2024

OBEE-12

## CLINICAL IMPLEMENTATION OF SOCIETY OF RADIOLOGISTS IN ULTRASOUND CONSENSUS PANEL GUIDELINES FOR DETECTING ENDOMETRIOSIS ON ROUTINE PELVIC US: CHALLENGES, OPPORTUNITIES AND STRATEGIES FOR SUCCESS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Liina Poder, MD (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Scott W. Young, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Luyao Shen, MD (*Abstract Co-Author*) Nothing to Disclose
Myra K. Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Priyanka Jha, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Endometriosis a prevalent disorder affecting approximately 10% of premenopausal patients.2. Chronic pelvic pain and infertility are the most common presenting symptoms3. Despite the high prevalence, endometriosis is frequently under recognized on imaging and patients face significant diagnostic delays of over 7-10 years4. Ultrasound is the most commonly performed imaging study for female pelvic symptoms and hence provides an opportunity for detecting endometriosis on routine pelvic imaging5. Simple maneuvers such as sliding sign and wide field of view imaging can help detect endometriosis on ultrasound6. Direct and indirect ultrasound features can be assessed, stratifying the risk for endometriosis based on the presence of these features.7. Further management and guidance for MRI can be provided based on the APU scores.

### TABLE OF CONTENTS/OUTLINE

1. Background information on prevalence of endometriosis2. Understand reasons for diagnostic delays of 7-10 years3. Update on clinical society guidelines for endometriosis imaging4. Necessity for screening for endometriosis on routine pelvic ultrasound5. Identify screening population6. Definition of augmented ultrasound7. Learn the necessary maneuvers to adopt the protocol into clinical practice8. How to perform a sliding sign- demonstration using static and cine images9. Demonstrate wide field of view imaging on static and cine images10. Show common imaging features of endometriosis on routine pelvic ultrasound11. Imaging examples of cases detected on routine pelvic ultrasound, followed by advanced endometriosis imaging (both US or MRI) and finally surgical correlation will be presented.

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# Abstract Archives of the RSNA, 2024

OBEE-13

## ADVANCED OVARIAN NEOPLASIA: DEFINITION OF AFFECTED ANATOMICAL SITES AND THE IMPACT OF TARGETED REPORT ON SURGICAL APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lhuanna Maria Barbosa Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmin Fernandes De Aquino, MD (*Abstract Co-Author*) Nothing to Disclose
Marilia P. Ferreira, MD (*Abstract Co-Author*) Nothing to Disclose
Marnya Wellysa Leite Tavares, MD (*Abstract Co-Author*) Nothing to Disclose
Kamila S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina P. Abud, MD (*Abstract Co-Author*) Nothing to Disclose
Marina M. Costa (*Abstract Co-Author*) Nothing to Disclose
Maria Helena N. Pedroso (*Abstract Co-Author*) Nothing to Disclose
Ana Claudia V. Uski SR, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Ezir Lima Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Heloise Miranda, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Batista Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Eduarda Bezerra Cirne, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Reviewing the potential anatomical sites involved in ovarian neoplasms following a standardized lexicon for radiological reporting proposed by the Society of Abdominal Radiology and the European Society of Urogenital Radiology Female Pelvic Imaging Working Group (SAR/ESUR lexicon) for CT and MRI studies. Demonstrating the particularities of each method (CT, MRI, and PET-FDG) and their main limitations in this context. Showing the importance of targeted reports in accurately defining anatomical sites for optimal surgical management.

### TABLE OF CONTENTS/OUTLINE

Many patients with ovarian cancer present with advanced-stage disease at the time of diagnosis. In this scenario, standard treatment includes a combination of cytoreductive surgery and chemotherapy. It is unquestionable that the treatment goal should be the complete resection of all visible and palpable tumors, with imaging methods essential for determining tumor extent and guiding surgical decision-making. Targeted reports, with a systematic evaluation of 45 anatomical sites potentially involved in ovarian neoplasms, should be accurately reported and properly topographed. Additionally, recognizing radiological criteria predictive of optimal or suboptimal cytoreduction should be extensively acknowledged by radiologists to assist and guide gynecologic oncologic surgeons in decision-making.

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# Abstract Archives of the RSNA, 2024

OBEE-15

## IMAGING APPROACH FOR VULVAR DISEASES: WHAT EVERY RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria N. Napoli, MD (*Abstract Co-Author*) Nothing to Disclose
Teresa A. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia E. Gimenez, MS (*Abstract Co-Author*) Nothing to Disclose
Leonela Panaccio (*Abstract Co-Author*) Nothing to Disclose
MARIA BELEN DASS CORREA (*Abstract Co-Author*) Nothing to Disclose
Felicitas Aguirre (*Abstract Co-Author*) Nothing to Disclose
Paula Hernandez Garrigo (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Ultrasound serves as the primary diagnostic method for the initial assessmentof vulvar lesions. Nevertheless, MRI stands out as the preeminent imaging modality for comprehensive evaluation of both the anatomical structure and pathological features of the area.; Vulvar lesions encompass a diverse array of medical conditions affecting the female lower genital tract, ranging from benign to malignant diseases.; Benign lesions usually manifest as simple cystic or solid lesions.; Malignant diseases typically manifest as sizable, compact masses infiltrating the vaginal and perineal regions.; Enhanced comprehension of the normal anatomical structures combined with refined MRI imaging techniques facilitates more precise evaluation of these conditions, mitigating the need for unwarranted interventions and facilitating surgical planning where necessary.

### TABLE OF CONTENTS/OUTLINE

; Review of vulvar anatomy.; Assessment of the utility of magnetic resonance imaging across various vulvar pathologies and its impact on adjacent organ involvement.; Establishment of an anatomical and imaging correlation to elucidate diverse vulvar pathologies.; Comparative analysis employing algorithms to delineate the radiological features observed in magnetic resonance imaging across different pathologies.

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# Abstract Archives of the RSNA, 2024

OBEE-16

## EARLY AND DELAYED POST-CESAREAN COMPLICATIONS: AN IMAGING REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ananya Panda, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Amr M. Elmahdy, MBChB (*Abstract Co-Author*) Nothing to Disclose
Yashant Aswani, MD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Zacharias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To discuss role of imaging in distinguishing the expected postoperative findings following cesarean delivery from those that require attention/ treatment. 2. To discuss imaging of acute complications following cesarean delivery. 3. To describe radiological findings of chronic complications following cesarean delivery.

### TABLE OF CONTENTS/OUTLINE

IntroductionEpidemiologyCesarean delivery techniqueNormal post-operative imaging findingsAcute ComplicationsHematoma:Bladder Flap HematomaSubfascial HematomaRectus Sheath HematomaDehiscence/Rupture:DehiscenceRuptureRetained products of conceptionVascular Delayed ComplicationsScar nicheCesarean scar pregnancyPlacenta accreta spectrumAbdominal wall endometriosisMalpositioned intrauterine deviceAbdominal adhesions

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# Abstract Archives of the RSNA, 2024

OBEE-17

## DIAGNOSTIC DILEMMAS IN ENDOMETRIOSIS: RADIOLOGICAL SOLUTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Samruddhi V. Jain JR, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Kuldip S. Mann, MD (*Abstract Co-Author*) Nothing to Disclose
Charanjeet Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmet Y. Yitik, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua R. Russell, DO (*Abstract Co-Author*) Nothing to Disclose
Mili Rohilla, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Recognizing diverse clinical presentations and complications of endometriosis.-Identifying radiological appearances on various imaging modalities.-Appreciating diagnostic challenges and nuances in endometriosis assessment.

### TABLE OF CONTENTS/OUTLINE

Outline/Table of Contents:I. Introduction to EndometriosisA. Significance and prevalenceB. Clinical clues and risk factorsII. Clinical Staging and Diagnostic ChallengesA. Current staging methods and limitationsB. Diagnostic clues and unusual manifestationsIII. Radiological ManifestationsA. Imaging modalities and their sensitivityB. Diagnostic clues on CT, MRI, and ultrasoundIV. Complications and Associated FindingsA. Malignant transformation and secondary infectionsB. Rupture of endometrioma and associated complicationsV. Conclusion and Clinical ImplicationsA. Role of imaging in early diagnosis and managementB. Importance of radiologists' familiarity with endometriosis presentations

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# Abstract Archives of the RSNA, 2024

OBEE-18

## INTRAUTERINE DEVICES REVISITED: A COMPREHENSIVE LOOK AT COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Erika Suenaga, MD (*Abstract Co-Author*) Nothing to Disclose
Paula de Lima Regio, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Passos Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Yoshimura (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Margrit Muller, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Claudia C. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Andre Dubinco, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme Swerts Pereira (*Abstract Co-Author*) Nothing to Disclose
Lara Quiche, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Francisco Neto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcelo R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta Linhares, MD (*Abstract Co-Author*) Nothing to Disclose
Eliane E. Dutenhefner, MD, BDS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Intrauterine devices (IUDs) exert a contraceptive effect when placed inside the uterus and represent one of the most widely used contraceptive methods worldwide. Evaluation begins before device placement to assess any factors that may impair insertion. Improper placement can result in pelvic pain, abnormal bleeding, infections, and ectopic pregnancy. Increasingly, IUD placement is guided by ultrasound to minimize complications.This presentation aims to outline radiological signs of IUD expulsion, with an emphasis on distinguishing between partial and complete expulsion. It covers the identification of radiographic evidence of IUD perforation, including visualization of the device outside the uterine cavity, displacement into adjacent organs, and migration. Associated complications are identified using imaging modalities such as ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). The discussion includes key elements of a comprehensive radiology report, including a detailed description of findings, location and extent of abnormalities, and relevant differential diagnoses, which aid in decision-making for removal and treatment.

### TABLE OF CONTENTS/OUTLINE

Case-based didactic review of intrauterine devices complications in different imaging modalities (ultrasound, CT scan and MRI) based on our service's digital archive and correlated with a comprehensive literature review.

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# Abstract Archives of the RSNA, 2024

OBEE-19

## DUCTUS VENOSUS AGENESIS IN FETUSES: A CASE SERIES ANALYSIS OF ULTRASOUND FINDINGS AND ASSOCIATION PATTERNS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Adinaryana Makam, MD (*Abstract Co-Author*) Nothing to Disclose
Urvi Ahlawat, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This study examines 27 fetuses diagnosed with Ductus Venosus (DV) agenesis via prenatal ultrasound, identifying association patterns with other prenatal ultrasound findings.

### TABLE OF CONTENTS/OUTLINE

Background: This retrospective case series investigates 27 fetuses diagnosed with DV agenesis via prenatal ultrasound, analyzing maternal age, gestational age, DV agenesis types, associated anomalies, and intrahepatic portal vein system status. Results: Descriptive statistics revealed a mean maternal age of 25.96 years (range: 21-44) and a mean gestational age of 21.67 weeks. DV agenesis types included Type 1 (10 cases), Type 2 (12 cases), and Type 3A (5 cases). Association patterns indicated cardiac, genitourinary, and musculoskeletal anomalies such as Cardiomegaly, Ventricular Septal Defect, Aberrant Right Subclavian Artery, Echogenic Focus in the Left Ventricle, Renal Pelvis Dilatation, Multicystic Dysplastic Kidney, Right Crossed Fused Ectopic Kidney, Clitoromegaly, Frontal Scalloping, Spinal Dysraphism, Congenital Talipes Equinovarus, Single Umbilical Artery, Increased Nuchal Translucency, Sylvian Fissure Delayed for Gestational Age, with notable correlations between maternal age and cardiac/genitourinary anomalies ($r = 0.27$, $p < 0.05$; $r = 0.22$, $p < 0.05$, respectively). Chi-square tests revealed type-specific associations: Type 1 with cardiac anomalies ($p < 0.05$), Type 2 with genitourinary anomalies ($p < 0.05$), and Type 3A with musculoskeletal anomalies ($p < 0.05$). The study underscores the subtype-specific implications of DV agenesis on fetal development, emphasizing the importance of prenatal ultrasound in early detection and informed prenatal care.

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# Abstract Archives of the RSNA, 2024

OBEE-2

## A REVIEW OF THE MRI FEATURES OF ENDOMETRIOSIS: WHAT SHOULD BE PAID ATTENTION TO DURING THE REPORTING PROCESS?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mehmet Simsar, MD (*Abstract Co-Author*) Nothing to Disclose
Hilal Sahin, MD (*Abstract Co-Author*) Nothing to Disclose
Yesim Y. Yuruk, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Provides a comprehensive overview of the symptoms and the possible formation mechanisms of endometriosis • Describes MRI features of endometriosis • Reviews the revised American Society for Reproductive Medicine (rASRM) classification and ENZIAN classification and their contents used in mapping of endometriosis • Demonstrates the common and rare presentations of endometriosis using case-based examples, highlighting distinctive clinical and MRI features that can aid in the best diagnosis.

### TABLE OF CONTENTS/OUTLINE

Table of Contents 1. Terminology and etiology of endometriosis 2. A practical approach to endometriosis subtypes 3. Specific MRI features of endometriosis subtypes 4. Overview of revised American Society for Reproductive Medicine (rASRM) classification and ENZIAN classification 5. Case-based reviews of endometriosis subtypes Outlines • Knowledge of endometriosis subtypes is essential for diagnosing and localizing pathologies. • Understanding the key MRI features and common/rare locations of endometriosis is the first step in generating a diagnosis and mapping the disease for appropriate treatment. • Obtaining relevant clinical history and recognizing specific imaging appearances can help provide the best diagnosis.

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# Abstract Archives of the RSNA, 2024

OBEE-21

## ENDOMETRIOSIS: BE READY, IDENTIFY EMERGENCY, HANDLE URGENCY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Izabela P. Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Alice Cristina C. Brandao Salomao, MD (*Abstract Co-Author*) Nothing to Disclose
Lavinia Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Brunna C. Oliveira, MD, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Endometriosis is a chronic disease characterized by the ectopic implantation of an endometrium-like tissue, containing glands and stroma, outside the uterus, and can significantly impact a woman's quality of life, manifesting in pelvic pain, infertility, and psychosocial challenges. Despite its chronicity, endometriosis can present acutely, either exacerbating an existing condition or as a primary cause, prompting patients to seek emergency medical attention, sometimes before a formal diagnosis is established.This educational exhibit aims to spotlight presentations of endometriosis commonly overlooked or misinterpreted in emergency settings, using case studies where it led to urgent situations. Emphasizing the crucial need for timely recognition, delayed diagnosis hinders prompt intervention and treatment, and may increase the likelihood of recurrent symptoms or complications.

### TABLE OF CONTENTS/OUTLINE

Didactic cases demonstrating various emergency and urgent presentations of endometriosis using different imaging modalities such as ultrasound, computed tomography, and magnetic resonance imaging, including:Bowel obstructionUterine and vaginal vault ruptureInfection of endometriomasEctopic pregnancyHemorrhagic acute abdomenUrinary tract obstructionCatamenial pneumothorax

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# Abstract Archives of the RSNA, 2024

OBEE-23

## SERUM BIOMARKERS IN GYNECOLOGIC CONDITIONS: A RADIOLOGIST'S GUIDE TO NAVIGATE THE ALPHABET SOUP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Sarah Taylor (*Abstract Co-Author*) Nothing to Disclose
Biatta Sholosh, MD (*Abstract Co-Author*) Nothing to Disclose
Esther Elishaev, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandro Furlan, MD, MMM (*Abstract Co-Author*) Royalties, RELX;Research support, Endra, Inc;Consultant, Bracco Group
Gayathri Devi Jalluri, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Ekta Maheshwari, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. A number of malignant and benign gynecological entities are associated with elevation of serum biomarkers. The various tumor markers differ in their usefulness for screening, diagnosis, prognosis, assessing therapeutic response, and detecting recurrence. 2. Awareness of these associations and characteristic imaging patterns is integral to Radiology practice for optimal diagnosis, facilitating recommendations for ancillary imaging and work up.

### TABLE OF CONTENTS/OUTLINE

Some important gynecologic biomarkers are: CA-125, b-HCG, Alpha-fetoprotein (AFP), Inhibin, Estradiol, Carcinoembryonic antigen, Müllerian inhibiting substance, CA 19-9, Lactate Dehydrogenase. Since pathologic diagnosis of malignancies may be difficult without laparotomy, tumor markers in addition to diagnostic imaging are useful in preoperative evaluation. An ideal marker should be highly specific and sensitive, however due to false positives and elevated indices seen in multiple benign entities, imaging plays a crucial role in guiding appropriate patient management. Multimodal approach including the evaluation of serum biomarkers combined with imaging, seems to be the best strategy for characterization, identification of recurrence, and monitoring response to treatment in female cancer patients. Tumor markers also demonstrate physiological variation with age and menopausal status as well as benign neoplasms and inflammatory conditions. This knowledge is critical to avoid overreporting of malignancy.

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# Abstract Archives of the RSNA, 2024

OBEE-24

## UNUSUAL IMAGING PRESENTATIONS OF ENDOMETRIOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rita Maria Lahoud, MD (*Abstract Co-Author*) Nothing to Disclose
Megan Kenway, MD (*Abstract Co-Author*) Nothing to Disclose
Dinushi S. Perera, MD (*Abstract Co-Author*) Nothing to Disclose
Rosaura Suazo Aguero, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Endometriosis is defined as the presence of endometrial glands in locations outside the uterus. It is a common condition that occurs in 6-10% of all reproductive woman.The most common peritoneal sites of involvement are the ovaries, uterine ligaments, cut-de-sac, and pelvic peritoneum reflected over the uterus, fallopian tubes, rectosigmoid and bladder. The most common complaints associated with endometriosis are dysmenorrhea and pelvic pain; although some patients often present without pain and only with complaints of infertility, or there is an incidental finding of an ovarian mass on imaging. However, some of these incidental findings are uncommon, prompting to a malignancy workup. While recognizing the hallmarks and typical imaging patterns of endometriosis is basic, acknowledging unusual presentations awards every radiologist the extra mile. At the end of this review we will be able to understand uncommon imaging appearances of endometriosis. To analyze the correlation between imaging features and histopathological findings. To contrast the optimal use of conventional imaging for malignancy mimickers in endometriosis.

### TABLE OF CONTENTS/OUTLINE

1. Introduction on Endometriosis and its manifestations 2. Description on usual and unusual imaging appearances of endometriosis 4. Case examples5. Conclusion

# Abstract Archives of the RSNA, 2024

OBEE-25

## NOT ALL PELVIC PAIN STEMS FROM ENDOMETRIOSIS: VENOUS-ORIGIN PAIN IS ALSO A SIGNIFICANT REALITY!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Fanilda Barros (*Abstract Co-Author*) Nothing to Disclose
Isabela Tavares (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Manuella Barreto Silva (*Abstract Co-Author*) Nothing to Disclose
JOANA STORINO (*Abstract Co-Author*) Nothing to Disclose
NATHALIA CARDOSO (*Abstract Co-Author*) Nothing to Disclose
FRANCINE FREITAS FERNANDES (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pelvic venous insufficiency is a major cause of chronic pelvic pain in women of reproductive age, accounting for 16-31% of cases.Ultrasound examination is the primary diagnostic tool, offering excellent visualization of pelvic veins. Proper identification of external and internal iliac veins, and gonadal plexuses is crucial. Transvaginal ultrasound with color Doppler provides high-resolution images of pelvic veins, facilitating detection of flow direction changes. Evaluation includes grayscale assessment for thrombus and post-thrombotic fibrocicatricial changes and color/spectral Doppler study for flow pattern and reflux detection. Transvaginal ultrasound with color Doppler plays a vital role in pelvic vein assessment across gynecological and vascular contexts.

### TABLE OF CONTENTS/OUTLINE

1) Ultrasound assessment based on current literature for investigating pelvic varicose veins. 2) Exploring pelvic venous anatomy with transvaginal ultrasound 3) Pathophysiology of pelvic venous disorders: Why hemodynamics is so crucial? 4) Technical considerations for ultrasound examination. 5) Clinical Cases: interpretation of ultrasound findings and differential diagnoses. 6) Reporting: What information should the radiologist provide to gynecologists and vascular surgeons? 7) Future perspectives

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# Abstract Archives of the RSNA, 2024

OBEE-26

## UNVEILING ENDOMETRIOSIS INVOLVING THE LATERAL PELVIC COMPARTMENT: A RADIOLOGICAL INSIGHT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Ingrid Ferreira (*Abstract Co-Author*) Nothing to Disclose
Luciana G. Matteoni-Athayde, MD (*Abstract Co-Author*) Nothing to Disclose
Karina d. Giassi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Brunna C. Oliveira, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Alice Cristina C. Brandao Salomao, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
CICILIA F. PONTES FERNANDEZ, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recognizing the imaging characteristics of lateral pelvic compartment endometriosis on TVS and MRI.Understanding the clinical presentation and implications of lateral pelvic compartment endometriosis.Identifying challenges in diagnosing lateral pelvic compartment endometriosis and strategies to overcome them.Integrating radiological findings with clinical and surgical approaches for optimal patient management.

### TABLE OF CONTENTS/OUTLINE

IntroductionEndometriosis involving the Lateral Pelvic Compartment overviewBrief anatomy reviewImaging TechniquesRoles of TVS and MRI in detectionRadiological FeaturesPresentation variancesDifferential diagnosisCase StudiesImaging evidence examplesManagement StrategiesImpact of diagnosis on treatment Surgical treatment approachesConclusionRadiology's roleEmerging technologies

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# Abstract Archives of the RSNA, 2024

OBEE-27

## WHAT EVERY RADIOLOGIST SHOULD KNOW ABOUT HYSTEROSALPINGOGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Paula E. Hernandez Quiroz, MD (*Abstract Co-Author*) Nothing to Disclose
Tania D. Grimaldo Galeana, MD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Alonzo Correa I, MD (*Abstract Co-Author*) Nothing to Disclose
Lourdes M. Avila, MD (*Abstract Co-Author*) Nothing to Disclose
Eunice L. Urbina Marure, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To teach hysterosalpingography technique, indications, contraindications and complications.To provide cases-based review of common findings in hysterosalpingography.To describe clinical scenarios in which hysterosalpingography provides information about diagnoses and its comparison with other diagnostic imaging methods.Review patient history, clinical presentetation and findings in hysterosalpingography.

### TABLE OF CONTENTS/OUTLINE

Generalities characteristics of hysterosalpingography.Techinque, indications, contraindications, complications of histerosalpingography.Cases based review of the common and uncommon findings in histerosalpingography: clinical scenarios, complementary studies and diferent diagnoses.Summary: pearls.

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# Abstract Archives of the RSNA, 2024

OBEE-28

## MASTERING PELVIC ULTRASOUND: PRACTICAL TIPS FOR EFFECTIVE IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rachel Brito, MD (*Abstract Co-Author*) Nothing to Disclose
PENELOPE ANDRADE (*Abstract Co-Author*) Nothing to Disclose
Luciana G. Matteoni-Athayde, MD (*Abstract Co-Author*) Nothing to Disclose
Brunna C. Oliveira, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
CICILIA F. PONTES FERNANDEZ, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Transvaginal ultrasound (TVUS) is frequently utilized for screening or monitoring gynecological pathologies throughout reproductive and postmenopausal years.Despite advancements in diagnostic accuracy for detecting small endometriosis lesions via TVUS, incomplete evaluations are still common due to technical challenges, sometimes related to patient anatomy.Discussion of techniques, adjustments, and maneuvers can mitigate technical limitations, leading to more precise diagnoses.

### TABLE OF CONTENTS/OUTLINE

Explanation of optimal ultrasound imaging formation concepts (e.g., focus, transducer positioning, insonation angle, contrast).Review of pelvic anatomy via sonography.Overview of common technical challenges in pelvic ultrasound, including:Poor definition of contours and uterine cavity (e.g., midverted or excessively bulky uteri).Difficulty detecting/evaluating lesions too close to the transducer.Organs or lesions situated too far from the transducer (e.g., upper pelvis with a narrow field of view via vaginal route).Patients unable to undergo TVUS (e.g., virgins, individuals with vaginismus).Identification of the origin of adnexal lesions.Challenges in visualizing the ovaries.Definition of pelvic spaces.Presentation of clinical cases via ultrasound images and illustrations, accompanied by suggestions for improving image quality and resolving technical difficulties. These solutions are categorized into:Dynamic maneuvers.Technical tips and device adjustments.Optimization of transducers.Utilization of different sonographic approaches.Application of specific anatomical knowledge.Summary of key concepts in each section.

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# Abstract Archives of the RSNA, 2024

OBEE-29

## 'P TO F' OF ENZIAN, AN APPROACH TO MAGNETIC RESONANCE IMAGING EVALUATION FOR ENDOMETRIOSIS: A PICTORICAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Araceli Yameli V. Serrato SR, PhD (*Abstract Co-Author*) Nothing to Disclose
Vanessa Hernandez Olivera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Magnetic resonance imaging and ultrasound have been used as the staging method for endometriosis. The gold standard diagnosis for endometriosis was histopathological characterization obtained by laparoscopy, however, due to limited access to specialized surgeons and costs, laparoscopic diagnosis has been reserved for specific cases. The current role of MRI is very important, so an optimal categorization system should be able to forecast pain and fertility, describe the extent of the disease (based on anatomical features), and give patients reliable information. In this work we will exemplify the use of the #ENZIAN classification used in our workplace because it has allowed better characterization of lesions (mapping) and post-treatment surveillance imaging.

### TABLE OF CONTENTS/OUTLINE

1. MRI protocol: Key sequences, Tips for optimization. 2. #ENZIAN classification, imaging features on MRI: evaluation of the peritoneum, ovaries, tubes, Deep endometriosis findings (recto-vaginal space, vagina, retrocervical area, sacrouterine and cardinal ligaments, rectum, adenomyosis and extragenital locations with examples from each category. 3. Differential diagnosis mimics. 4. Clinical cases and reports. 5. Post-treatment Surveillance imaging: Post-surgical appearance and local recurrence. 6. Conclusion.

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# Abstract Archives of the RSNA, 2024

OBEE-3

## EXPLORING THE CURVES OF THE UTERUS - A DETAILED LOOK AT ISTHMIC LESIONS ON MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ulysses S. Torres, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo O. Pacheco, MSc, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea L. Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna G. Busoletto Tripode SR, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe D'Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucas R. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa Bretas (*Abstract Co-Author*) Nothing to Disclose
Marilia A. Tavares, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the anatomy of the uterus, with an emphasis on the location and structure of the uterine isthmus.Explore the different lesions that can affect the uterine isthmus.Discuss the radiological findings and clinical context associated with each type of isthmic lesion.

### TABLE OF CONTENTS/OUTLINE

The uterine isthmus, as the narrowest portion of the uterus, plays a crucial role in female reproductive health and can be the site of origin of various gynecological pathologies. Isthmic uterine lesions constitute a complex category of abnormalities affecting tissue in this region. Due to their strategic location, these lesions may manifest a variety of symptoms, presenting diagnostic challenges.Diagnosis is typically made through imaging exams such as ultrasound or magnetic resonance imaging, with appropriate management depending on accurate identification of the lesion type and assessment of factors such as size, location, and risk of malignancy.This study aims to review a wide range of isthmic lesions, including isthmoceles, fibroids, ectopic pregnancies in cesarean scars, endometriosis, adenomyosis, adenomyoma, hematomas, anomalous vessels post-curettage, intrauterine device insertion in isthmocele, implantation of trophoblastic tissue in cesarean scar, and polyps, as well as addressing imaging diagnostic methods and available treatment options.By providing a comprehensive and up-to-date overview of this topic, this work aims to contribute to a better understanding and management of isthmic uterine lesions in radiological clinical practice.

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# Abstract Archives of the RSNA, 2024

OBEE-30

## DIAGNOSING INTRACRANIAL MASSES AND THEIR MIMICS IN-UTERO

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Elka Miller, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Patrick Shannon (*Abstract Co-Author*) Nothing to Disclose
Suzanne Laughlin, MD (*Abstract Co-Author*) Nothing to Disclose
Pradeep Krishnan, MD (*Abstract Co-Author*) Nothing to Disclose
Susan I. Blaser, MD (*Abstract Co-Author*) Nothing to Disclose
Neetika Gupta, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To explore the spectrum of antenatal identified brain tumors and their association with genetic syndromes.To describe the common and rare neuroimaging manifestations of congenital brain tumors on fetal and postnatal imaging.To discuss the significance of advanced imaging techniques and imaging protocols in diagnosing and prognosticating the congenital brain tumors.

### TABLE OF CONTENTS/OUTLINE

1. Congenital brain tumors are typically occurring during late fetal and early postnatal stages, often incidentally through antenatal imaging or based on clinical symptoms postnatally.2. Despite their rarity, congenital brain tumors are increasingly recognized in-utero due to advancements in imaging techniques and enhanced surveillance during pregnancy and infancy.3. Understanding associated tumor predisposition syndromes and specific genetic rearrangements is crucial for elucidating tumor etiology and guiding optimal management approaches.4. Regardless of tumor type or grade, congenital brain tumors uniformly present poor prognoses, attributed to unique metabolic and genetic pathways, prevalent embryonal histology, and rapid growth rates.

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# Abstract Archives of the RSNA, 2024

OBEE-31

## LEARN BEFORE YOU SLING OFF: THE ROLE OF TRANSLABIAL ULTRASOUND IN PRE- AND POSTOPERATIVE MESH ASSESSMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Brunna C. Oliveira, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
CICILIA F. PONTES FERNANDEZ, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda Pipitone, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Women commonly suffer from pelvic floor disorders such as urinary incontinence and pelvic organ prolapse, often associated with pregnancy, menopause, and obesity.Synthetic midurethral slings are a widely used surgical option for management of stress urinary incontinence, and can be transobturator or retropubic.While midurethral slings have excellent outcomes in terms of urinary continence and overall psychosocial well-being, complications like urinary retention, infection, vaginal erosion, and chronic pain may occur.Translabial ultrasound is a powerful tool for assessing synthetic slings both before and after surgery, predicting outcomes and identifying complications.This presentation aims to acquaint radiologists with the necessary skills for incorporating translabial ultrasound into routine sling evaluation.

### TABLE OF CONTENTS/OUTLINE

Introduction to Translabial Ultrasound (TLUS), highlighting its advantages over conventional imaging modalities for evaluating pelvic floor disorders in both pre- and postoperative settings.Technical Considerations in TLUS Imaging: patient preparation and equipment setup; scanning technique and patient positioning. Role of TLUS in Sling Evaluation, including: crucial preoperative data to report; identifying sling type, quantity, position, and orientation at rest and during Valsalva maneuver; assessing sling integrity, clinical efficacy, and primary complications; most prevalent associated genital abnormalities; post-sling pelvic pain assessment; measurement and distance analysis. Illustrative case studies demonstrating TLUS's clinical effectiveness in sling assessment. Future Directions and Considerations

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# Abstract Archives of the RSNA, 2024

OBEE-32

## 3D AND 4D HYSTEROSALPINGO CONTRAST SONOGRAPHY (HYCOSY): ADVANCED TUBAL PATENCY ASSESSMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lorena Luryann Cartaxo Silva (*Abstract Co-Author*) Nothing to Disclose
Manuella Barreto Silva (*Abstract Co-Author*) Nothing to Disclose
Eduardo Schor (*Abstract Co-Author*) Nothing to Disclose
FRANCINE FREITAS FERNANDES (*Abstract Co-Author*) Nothing to Disclose
Paulo S. Cossi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

More than 50 million women suffer from infertility worldwide, among whom 30% have pathology associated with the fallopian tubes. In this context, the assessment of tubal patency is vital. HyCoSy, utilizing second-generation microbubble contrast-enhanced ultrasound (CEUS), has emerged as a preferred initial imaging modality in Europe and Asia, offering comparable efficacy to traditional methods like hysterosalpingography (HSG). Its advantages include avoidance of ionizing radiation to the pelvis, iodine allergy concerns and reduced discomfort during the exam. The ability to assess ovarian and intrauterine lesions simultaneously, has high sensitivity and specificity to diagnose others infertility-related pathologies, being considered an important diagnostic method for assessing fertility in the "one-stop shop". A dedicated ultrasound software facilitates its performance by showing the morphology and path of the fallopian tube, the speed and volume of contrast extravasation, and its characteristics around the ovaries.

### TABLE OF CONTENTS/OUTLINE

1) Review of the current literature for the investigation of fallopian tubes 2) Pathophysiology of tubal dysfunctions 3) Technical considerations about HyCoSy 4) Interpretation and critical analysis of sonographic findings 5) Report: What information should the radiologist provide to gynecologists and fertility specialists? 6) Future perspective

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# Abstract Archives of the RSNA, 2024

OBEE-34

## ROLE OF MRI IN DIAGNOSING COMMON PLACENTAL PATHOLOGIES; A PICTORIAL REVIEW AND UPDATES FROM RECENT LITERATURE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hina Arif Tiwari, MD (*Abstract Co-Author*) Nothing to Disclose
Fatima M. Al-Khafaji, MBChB (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Abnormal placentation disease has become more frequent secondary to increased rate of cesarean sections. Ultrasonography is the first imaging modality performed, but MRI remains of superior value in accurate differentiation of abnormal placentation. 2. Detailed MRI reports are of great value in describing abnormal placentation by improving the maternal outcome and involving multidisciplinary team, when needed. 3. Gradient-echo sequence provides better delineation of the placental contour and interface with the myometrium, but only the spin echo sequences provide information on signal heterogeneity and intra-placental bands. 4. The maternal surface of the placenta contains cotyledons, which are placental outpouchings surrounded by MRI T2 dark clefts and septa, these must be differentiated from placental invasion of the myometrium. 5. So far there are no reported fetal acoustic safety issues in pelvic MRI examinations performed in 30 minutes or less in magnet strength of 1.5 Tesla. 6. Although gadolinium-based MRI examination differentiates myometrium from placenta, the half-life of gadolinium in fetuses is unknown. Contrast MRI is suggested in fetal demise or in patient's willing to terminate the pregnancy.

### TABLE OF CONTENTS/OUTLINE

1. Embryogenesis of normal placenta and pathogenesis of abnormal placentation. 2. Placental anatomy; role of MRI. 3. Abbreviated MRI protocol in placental imaging with review of recent updates. 4. Spectrum of common placental pathologies with corresponding MRI findings, including: a. Placenta accreta. b. Placenta increta. c. Placenta percreta. d. Placenta previa. e. Placental abruption. 5. Review of latest literature updates on common placental pathologies.

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# Abstract Archives of the RSNA, 2024

OBEE-35

## PELVIC ENDOMETRIOSIS: WHAT YOUR MRI REPORT CAN'T MISS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Heitor Passeri, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Carolina De Moraes Sarmento (*Abstract Co-Author*) Nothing to Disclose
Fernando D. Tamamoto SR, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio E. Silva JR, BDS (*Abstract Co-Author*) Nothing to Disclose
Ana P. Bavaresco, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Beraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Cleo F. Souza, BMedSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Endometriosis is a chronic inflammatory disease highly undiagnosed, with an incidence estimated in up to 15% of women of reproductive age. Definition: presence of endometrial tissue outside the endometrial cavity. Among the related symptoms are dyspareunia, pelvic pain, and infertility. Despite its high prevalence, the radiology signs and findings of pelvic endometriosis may not be so widespread, and the diagnosis through magnetic resonance remains a challenge for many radiologists. The purpose of this exhibit is:Review the role of MRI in the diagnosis and accurate staging of pelvic endometriosis;Propose a sequence of relevant points to analyze when examining a pelvic MRI and why they are relevant;Set a list of information the radiological report must give and how they help to module and settle the better surgical approach.

### TABLE OF CONTENTS/OUTLINE

IntroductionEpidemiology and pathophysiology DiagnosisBlind spot endometrioid lesionsPelvic compartments - the “must have” informationAnterior compartmentMiddle compartmentPosterior compartmentCases examples with the correlation between the radiology report and the specific surgery approach;Discussion and take-home messages.

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# Abstract Archives of the RSNA, 2024

OBEE-36

## THE VISUAL JOURNEY OF ASSISTED REPRODUCTION: IMAGING INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gabriela Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Cinthia C. Barbisan, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriella D. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Marcela C. Lauar, MD (*Abstract Co-Author*) Nothing to Disclose
Isabela Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Paulo Silva Junior (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The increased accessibility of assisted reproduction techniques has generated a greater number of ultrasound examinations as well as a greater number of associated complications. Within this context, it is crucial for the ultrasonographer to have knowledge about normal anatomy of the female pelvis and the normal alterations related to treatment, as well as possible complications. Transvaginal ultrasound not only allows for the assessment of ovarian reserve but also strict monitoring of adnexal changes to determine the optimal time for ovarian puncture. It also provides evaluation of uterine morphology, fallopian tubes, and endometrial characteristics, which are crucial for effective treatment. The dynamic evaluation provides data on pelvic organ mobility or the presence of adhesions. Doppler not only enables vascular assessment but also ensures safer puncture procedures by detecting important vessels in the traject. Thus, when the examiner is familiar with the most common findings and the detailed patient history, ultrasound examination allows differentiation of expected alterations, such as post-puncture hemorrhagic cysts, from potentially serious complications, such as ovarian hyperstimulation syndrome, ovarian torsion, infected collections, and ectopic pregnancy. Finally, although some alterations may be rare, timely diagnosis leads to better clinical outcomes with a higher success rate of the procedure.

### TABLE OF CONTENTS/OUTLINE

The aim of this study is to synthesize the most relevant ultrasonographic information, in correlation with other imaging methods, so that the physician can perform assisted reproduction with higher chances of success and fewer complications.

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# Abstract Archives of the RSNA, 2024

OBEE-37

## WHAT YOU MUST KNOW ABOUT THE PLACENTA AND UMBILICAL CORD

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Leonardo F. Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Alice Cristina C. Brandao Salomao, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Ines Novis (*Abstract Co-Author*) Nothing to Disclose
Patricia P. Cardia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Caroline L. Ghezzi (*Abstract Co-Author*) Nothing to Disclose
Patricia Leal, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe normal placental imaging findings, variations from the norm, and morphological anomalies.Outline the protocol and main sequences utilized in magnetic resonance imaging (MRI) for optimal placental imaging.Establish correlations between ultrasound and MRI findings

### TABLE OF CONTENTS/OUTLINE

IntroductionDefine normal variationsEpidemiology and risk factors.Imaging featuresOutline predominant imaging features observed in normal variants.Elaborate on the imaging findings related to morphological anomalies of the placenta and umbilical cord.ConclusionDiscuss the role of ultrasound and MRI in identifying normal findings and variants, as well as in identifying morphological anomalies associated with adverse pregnancy outcomes.

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# Abstract Archives of the RSNA, 2024

OBEE-38

## BENIGN UTERINE PATHOLOGY ON MAGNETIC RESONANCE IMAGING (MRI) - A PRACTICAL GUIDE FOCUSED ON ESSENTIAL INFORMATION FOR AN ASSERTIVE REPORT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gabriel L. Beraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo P. Polizio, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando D. Tamamoto SR, MD (*Abstract Co-Author*) Nothing to Disclose
Ana I. Oliveira (*Abstract Co-Author*) Nothing to Disclose
Yuri C. Neves, PhD (*Abstract Co-Author*) Nothing to Disclose
Cleo F. Souza, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Antonio E. Silva JR, BDS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The main clinical indications for performing an MRI of the pelvis are leiomyomatosis, endometriosis, uterine adenomyosis, ovarian cysts/lesions, pelvic pain, abnormal uterine bleeding, and postoperative evaluation; New pathological classifications for these pathologies may cause difficulties in interpreting and describing these findings to meet this new demand; The purpose of this exhibit is: Facilitate the diagnosis and description of benign uterine pathology on MRI simply and practically through flowcharts and graphic schemes, based on the most recent literature.

### TABLE OF CONTENTS/OUTLINE

A review of information and new relevant classifications for a complete radiological report on the clinical management of the main non-endometriosis benign uterine pathologies, divided into the following categories: o uterine anatomy and positioning, including measurement parameters; o myometrium: myoma, myometrial cysts, adenomyosis, ACUM, isthmocele; o endometrium: endometrial polyp, intrauterine contraceptives (types, correct position, and endoceptive migration criteria); o uterine cervix: cervical polyp, cysts and cervicitis; o parameters: pelvic varicose veins/pelvic congestion syndrome.Discussion and take-home messages.

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# Abstract Archives of the RSNA, 2024

OBEE-39

## EXPLORING UNKNOWN TERRITORIES BY SONOGRAPHY: ATYPICAL LOCATIONS OF DEEP ENDOMETRIOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karina d. Giassi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana G. Matteoni-Athayde, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rachel Brito, MD (*Abstract Co-Author*) Nothing to Disclose
Brunna C. Oliveira, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
PENELOPE ANDRADE (*Abstract Co-Author*) Nothing to Disclose
CICILIA F. PONTES FERNANDEZ, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Deep endometriosis (DE) frequently involves the torus, posterior cul-de-sac, uterosacral ligaments, and rectum.Diagnosing DE in less common areas poses significant challenges, particularly for less experienced radiologists.Understanding the anatomy, embryology, and pathophysiology is vital for grasping DE's spread within the abdominal cavity.To review clinical presentations and ultrasonographic findings of DE, with a focus on practical tips for detecting the condition in atypical abdominal locations.Accurate recognition of uncommon sites of DE aids in complete disease mapping, leading to improved surgical planning and outcomes.

### TABLE OF CONTENTS/OUTLINE

Introduction: Provides an overview of deep endometriosis, highlighting its typical locations and the importance of recognizing atypical manifestations for effective diagnosis and management.Pelvic Anatomy: Reviews key concepts necessary to understand the anatomical distribution of DE, including peritoneal folds, the dissemination of peritoneal fluid from the pelvic cavity, and the embryology of the Nuck canal.Clinical Cases: Discusses symptoms, imaging interpretations, and detection tips through clinical cases in unusual locations such as:High Sigmoid Small IntestineCecum Terminal IleumVermiform AppendixBladder (Vesical Trigone, Peripheral Portions)Ureter (High Location in the Pelvis)Parametrium (Anterior Infiltration)Paracolic GutterHepatorenal SpaceDiaphragmAbdominal Wall (Umbilical Scar, Parietal Peritoneum)Pelvic WallDifferential Diagnoses: Explores differential diagnoses such as desmoid tumor, peritoneal implants metastasis, and carcinoid tumor.

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# Abstract Archives of the RSNA, 2024

OBEE-4

## RADIOMIC TUMOR PROFILING FOR PROGNOSTICATION AND TAILORING OF TREATMENT IN UTERINE CERVICAL CANCER - A LITERATURE REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ingfrid H. Haldorsen, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kristine E. Fasmer, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Agnes J. Eide, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To provide an overview of published work on radiomic tumor profiling for prognostication in cervical cancer2. To highlight the potential role of radiomics for risk stratification and tailoring of treatment in cervical cancer 3. To discuss present methodological challenges in radiomic tumor profiling and future directions 4. To encourage future research and discussion on how to translate advanced radiomic profiling to better cancer care

### TABLE OF CONTENTS/OUTLINE

1. Introduction1.1. Radiomics definition 1.2. Steps in radiomic workflow1.3. Application of radiomic profiling in cancer research2. Overview of published work on radiomics in uterine cervical cancer2.1. Methodological assessment of radiomics studies2.2. Radiomic signatures related to tumor prognostic factors2.3. Radiomic modelling for prediction of survival and recurrence 3. The potential of radiomics 3.1. Noninvasive assessment of risk profiles3.2. Personalizing treatment algorithms 3.3. Prediction of treatment response and clinical outcome4. The challenges of radiomics4.1. Sources of bias related to study design and analysis 4.2. Imaging and segmentation challenges 4.3. Need for validation4.4. Need for prospective studies and testing in clinical settings 4.5. Data sharing and open-source reporting 5. Bridging the gap between radiomics and cancer care 5.1. Proposed solutions and future directions

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# Abstract Archives of the RSNA, 2024

OBEE-40

## HYSTEROSALPINGOGRAPHY: GO BACK TO BASICS. A PICTORIAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jorge Arturo Martinez Conejo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Hysterosalpingography is a study available in most hospital centers. It is a low-cost study that, despite advances in imaging, is still useful in the diagnosis of infertility. The main uses are the evaluation of the endometrial cavity and fallopian tubes. This pictorial review This pictorial review aims to show the technique that must be performed as well as the pathologies that we can find during the studies.

### TABLE OF CONTENTS/OUTLINE

IntroductionHow to do it? (Technique)Assesments of the uterus (Position)Fallopian tubes permeabilityTube patologyEmbriologyUterine malformationsFilling defects (Endometrial patology)Additional findings

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# Abstract Archives of the RSNA, 2024

OBEE-41

## BREAKING BAD NEWS IN OBSTETRIC ULTRASOUND: COMUNNICATION SKILLS FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thiago Matheus Santos Rios, MD (*Abstract Co-Author*) Nothing to Disclose
MARCOS VINICIUS BROGIN (*Abstract Co-Author*) Nothing to Disclose
Sergio Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Enzo Calheiros, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana Cerri, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. DISCUSS COMMUNICATION SKILLS IN OBSTETRIC ULTRASOUND, INCLUDING PATIENT EXPECTATIONS AND OUTCOMES 2. SUMMARIZE OBSTETRIC EMERGENCIES AND COMPLICATIONS 3. PRESENT SPIKES PROTOCOL APPLIED TO SONOGRAPHERS 4. ELABORATE ABOUT RESIDENT EDUCATION IN OBSTETRIC ULTRASOUND: 5. HIGHLIGHT CHALLENGING SCENARIOS IN OBSTETRIC ULTRASOUND WITH A CASE-REVIEW APPROACH

### TABLE OF CONTENTS/OUTLINE

Introduction Overview of the importance of effective communication in obstetric ultrasound. Communication Skills in Obstetric Ultrasound Importance of clear and empathetic communication. Impact of poor communication on patient outcomes. Obstetric Emergencies and Complications Diagnosis and management of high-risk pregnancies. Identification of placental abnormalities and fetal anomalies. Application of SPIKES Protocol Overview of the SPIKES protocol. Adaptation of SPIKES for obstetric ultrasound scenarios. Resident Education Integration of communication skills training into the OBGYN ultrasound curriculum. Role of mentorship, simulation, and feedback in resident education. Challenging Scenarios Case studies of fetal demise, congenital malformations, ectopic pregnancies, and molar pregnancies. Strategies for effective communication and support in challenging obstetric ultrasound cases.

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# Abstract Archives of the RSNA, 2024

OBEE-42

## MULTIMODALITY IMAGING OF C-SECTION SCAR ENDOMETRIOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Kowal, MD (*Abstract Co-Author*) Speaker, Samsung Electronics Co, Ltd
Camilla Ramezanzadeh, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Endometriosis can spread to multiple locations through surgical intervention and iatrogenic transport, with the anterior abdominal/pelvic wall the most common location of occurrence. The incidence of C-section scar endometriosis is approximately 0.8%.• Understand that not all patients will be symptomatic, and these lesions can therefore be discovered incidentally, usually on computed tomography. Symptomatic patients can have constant or recurrent cyclical pain related to hormonal impact.• Image findings of C-section scar endometriosis on different imaging modalities can vary due to hormonal influence depending on the patient's phase of menstrual cycle.• Mimicking lesions and differential diagnoses must be excluded, including keloids, scar granulomas, and metastases.

### TABLE OF CONTENTS/OUTLINE

• Introduction - Review endometriosis population at risk.• Pathophysiology and clinical presentation of C-section scar endometriosis.• Sample multimodality imaging examples demonstrating the varying imaging appearance of scar endometriosis and unique location of seeding throughout the abdominal and pelvic wall.• Mimicking lesions and pitfalls to consider.• Appropriate diagnostic workup and management.

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# Abstract Archives of the RSNA, 2024

OBEE-43

## EMERGENCY DISORDERS IN PREGNANCY: STRATEGIES FOR MATERNAL CARE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Takahito Nakajima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tsukasa Saida, MD (*Abstract Co-Author*) Nothing to Disclose
Toshitaka Ishiguro, MD (*Abstract Co-Author*) Nothing to Disclose
Sodai Hoshiai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toyomi Satoh, MD (*Abstract Co-Author*) Nothing to Disclose
Masafumi Sakai, MD (*Abstract Co-Author*) Nothing to Disclose
Taishi Amano, MD (*Abstract Co-Author*) Nothing to Disclose
Miki Yoshida, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Pregnant women present to the emergency department with various conditions. Radiologists collaborate with obstetricians to select appropriate imaging modalities and make accurate diagnoses based on the situation. This exhibit will discuss emergency conditions related to pregnancy as well as non-pregnancy-related emergencies common in pregnant women, covering imaging findings, examination strategies, and treatment approaches for these situations. The teaching points of this exhibition are as follows. 1. Criteria for selecting imaging tests and contrast agents based on symptoms in pregnant women presenting to the emergency department 2. Presentation of key imaging findings contributing to the diagnosis of various emergencies during pregnancy, along with subsequent treatment

### TABLE OF CONTENTS/OUTLINE

A. Characteristics of pregnant women B. Indications for imaging modalities and contrast agent use considering pregnancy C. Imaging features, examination strategies, and treatment of emergency conditions related to pregnancy D. Imaging characteristics, examination strategies, and treatment of emergency conditions commonly observed in pregnant women but unrelated to pregnancy

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# Abstract Archives of the RSNA, 2024

OBEE-44

## AN EDUCATIONAL OVERVIEW OF THE TYPICAL AND ATYPICAL MANIFESTATIONS OF ENDOMETRIOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Dalia Kazzaz, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Ioanna Papadopoulou, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Catriona L. Davies, MBBS (*Abstract Co-Author*) Nothing to Disclose
Julia C. Hillier, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Christopher Page, MBBCh, BSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Give a brief overview of the disease process. Describe classic MRI features of endometriosis from uncomplicated to deep infiltrating endometriosis (DIE) within the pelvis. Describe key review areas when assessing the pelvis for endometriosis and DIE. Suggest a structured radiology report that aims to maintain clarity and also highlight the pertinent findings to the gynaecology team. Outline some common pitfalls when assessing the female pelvis with MR for patients with endometriosis. Showcase some uncommon sites of endometriosis that should be considered when evaluating patients. Provide some correlating surgical images to help understand and consolidate the disease process.

### TABLE OF CONTENTS/OUTLINE

Using our database we will illustrate the various spectrum of features in endometriosis. We will begin with the common MRI findings with some key tips and pitfalls in interpreting the female pelvis. We will showcase some cases of classic deep infiltrating endometriosis. Finally we will demonstrate examples of uncommon extra-pelvic depositions in cases of umbilical, diaphragmatic, neural and subcutaneous endometriosis. Throughout we will provide some real case images of the corresponding surgical findings. We will also suggest a structured report template following the ENZIAN surgical classification to ensure radiology reports are succinct and clear when dealing with the most complex cases.

# Abstract Archives of the RSNA, 2024

OBEE-45

## A LAPAROSCOPIC LOOK AT TORSION: UNDERSTANDING ADNEXAL AND LEIOMYOMA TORSION THROUGH ANIMATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Toru Honda, MD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Hori, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Kengo Kiso, MD (*Abstract Co-Author*) Nothing to Disclose
Shohei Matsumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Hiromitsu Onishi, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company
Takahiro Tsuboyama, MD (*Abstract Co-Author*) Nothing to Disclose
Mitsuaki Tatsumi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takashi Ota, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideyuki Fukui, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Adnexal torsion occurs when an adnexa becomes twisted around the tissue supporting it, leading to stromal edema, hemorrhagic infarction, and necrosis of the adnexal structures with consequent outcomes. This painful condition is a medical emergency that can result in losing an adnexa if not treated quickly. CT and MRI are valuable for diagnosing adnexal and leiomyoma torsion, and some characteristic findings have been reported. However, radiologists have limited opportunities to study adnexal and leiomyoma torsion surgery. This presentation aims to show how adnexal and leiomyoma torsion image findings appear during laparoscopic animation.

### TABLE OF CONTENTS/OUTLINE

A) "Imaging Features of Adnexal and Leiomyoma Torsion"
- Adnexal and leiomyoma torsion can be diagnosed using CT and MRI imaging, which can reveal the following features:
- Hemorrhagic infarction
- Twisted pedicle
- Twisted vascular pedicle: flow void
- "Lack of enhancement" sign
- Deviation of uterus
- Dark fan sign
- Rim enhancement B) "Pelvic Organ Anatomy in Laparoscopic Animation"
- Laparoscopic animation can provide a detailed view of the anatomy of the organs in the pelvis, including the adnexa, uterus, fallopian tubes, and surrounding structures. C) "Relationship between Imaging Findings and Laparoscopic Animation in Adnexal Torsion"
- Adnexal torsion can occur in various structures in the pelvis, including the ovary, paraovarian cyst, and fallopian tube, as well as leiomyoma in the uterus. Laparoscopic animation can show the following conditions:
- Massive ovarian edema
- Ovarian mature cystic teratoma
- Ovarian fibroma
- Ovarian mucinous cystadenoma
- Paraovarian cyst
- Isolated fallopian tube torsion
- Fallopian tube teratoma
- Leiomyoma

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# Abstract Archives of the RSNA, 2024

OBEE-46

## IMAGING OF ENDOMETRIAL STROMAL TUMORS: KEYS TO DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Yu Zou (*Abstract Co-Author*) Nothing to Disclose
Le Wang (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) A well-margined T2 high-signal tumor occurring in the uterus should prompt suspicion of endometrial stromal tumor (EST). 2) The presence of a "worm-like" or "nodular" appearance, margins or internal T2 low-signal bands, and significant high signal on DWI should raise strong suspicion for ESTs. Furthermore, the tumor grows into the uterine cavity and may exhibit the “valve opening sign”, which is a key point of differentiation from cell-rich fibroids or FH-deficient fibroids. 3) EST is a rare condition with atypical clinical presentations, often leading to misdiagnosis as benign uterine tumors on imaging studies, such as uterine fibroids, adenomyomas, and endometrial polyps. According to the site of tumor occurrence and imaging manifestations, EST is summarized into five major categories: "mass-like type", " adenomyosis-type",”endometrial-type" , "external-type" and "cystic-type", in order to improve the radiologist understanding of this disease.

### TABLE OF CONTENTS/OUTLINE

1) To provide an up-to-date overview of the classification, incidence, clinical presentation, and current status of diagnostic imaging in endometrial stromal tumors (EST). 2) Elucidate the scanning equipment, sequences, and parameters utilized for magnetic resonance examination of EST. 3) Categorize the pathological and imaging manifestations of EST, with particular emphasis on the various imaging types observed in low-grade endometrial stromal sarcoma (LG-ESS), which exhibits the highest incidence rate. 4) Explore treatment options, prognosis assessment, recurrence patterns, and metastatic potential in EST. 5) Conclude with a summary encompassing key information regarding EST.

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# Abstract Archives of the RSNA, 2024

OBEE-47

## BEYOND O-RADS 4 AND 5 : A MULTIMODALITY APPROACH TO CHARACTERIZING BORDERLINE AND MALIGNANT OVARIAN NEOPLASM SUBTYPES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Kowal, MD (*Abstract Co-Author*) Speaker, Samsung Electronics Co, Ltd
Nilisha Regmi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Ovarian-Adnexal Reporting and Data System (O-RADS) for ultrasound (US) and magnetic resonance imaging (MRI) has significantly improved the consistency of interpretations and risk stratification for ovarian masses. The O-RADS system aids in distinguishing between benign and worrisome characteristics, guiding the need for further workup and more aggressive management strategies. Despite its effectiveness, O-RADS does not specifically characterize subtypes of borderline and malignant tumors. Identifying distinguishing imaging features of different ovarian tumoral subtypes can aid in preoperative planning, guide the radiologist's search pattern, and potentially influence patient management.This exhibit highlights characteristic features of high-risk ovarian lesions that are typically categorized as O-RADS 4 or 5. A multimodality approach is reviewed, including computed tomography (CT), US, and MRI.We delve into the unique imaging features of various ovarian tumor types, including borderline and malignant epithelial (serous, mucinous, endometrioid, clear cell) and malignant germ cell and sex-cord stromal tumors. We discuss pitfalls to avoid such as the importance of proper CT windowing in identifying calcified peritoneal implants and address mimicking 'chameleon lesions' with overlapping features such as borderline mucinous tumors, endometriomas and fluid-predominant dermoid cysts.

### TABLE OF CONTENTS/OUTLINE

•Classification and characterization of different borderline and malignant lesion (from pathologically proven sample cases) •Rare Tumors (e.g., Krukenberg tumor, lymphoma, collision tumors) •Pitfalls •Summary •Reference

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

OBEE-48

## PEERING INTO THE PELVIS - A DEEP DIVE INTO ENDOMETRIOSIS WITH ULTRASOUND AND MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Madhura A. Desai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Victoria Barbee, MD (*Abstract Co-Author*) Nothing to Disclose
Kelly L. Cox, DO (*Abstract Co-Author*) Nothing to Disclose
Sadhna Nandwana, MD (*Abstract Co-Author*) Nothing to Disclose
Neema J. Patel, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review/recognize the endometriosis phenotypes and ultrasound (US) and magnetic resonance imaging (MRI) findings, especially those of deep infiltrating endometriosis (DIE) phenotype. Review the essential endometriosis MRI pelvis protocol sequences and key sequences for detection of endometriosis and DIE. Review pelvic anatomy to understand common sites of DIE and enhance detection.

### TABLE OF CONTENTS/OUTLINE

I. Introduction A. Endometriosis phenotypes 1. Superficial Peritoneal 2. Ovarian Endometrioma 3. Deep Infiltrating Endometriosis (DIE) II. Diagnostic tools A. Imaging - Protocols and Techniques/Sequences to Diagnose Detect 1. US 2. MRI B. Laparoscopy III. Review of Pelvic Anatomy and Compartments with Endometriosis Cases A. Anterior 1. Bladder, Urethra, Ureter 2. Round Ligament 3. Spaces/planes: prevesical space, vesicouterine pouch, and vesicovaginal septum B. Middle 1. Reproductive Organs - Vagina, Uterus, Ovaries, and Fallopian Tubes 2. Spaces/planes: Broad ligament and meso-ovarium C. Posterior 1. Rectum/rectosigmoid colon 2. Uterosacral ligaments 3. Spaces/planes: rectouterine pouch, retrocervical space, and rectovaginal septum D. Additional Sites 1. Pelvic floor 2. Abdominal wall IV. Conclusions A. DIE is the most severe phenotype of endometriosis, invading the peritoneum or adjacent structures and distorting pelvic anatomy. B. US has a role in screening for endometriosis with dynamic maneuvers and better accessibility and affordability, but MRI is key to diagnose, manage, and reduce treatment delays for conservative therapies and prior to laparoscopy with high quality, multiplanar, small field-of-view, non-fat suppressed T2-weighted sequence.

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# Abstract Archives of the RSNA, 2024

OBEE-49

## A PICTURE IS WORTH THOUSAND WORDS, BUT OPTIMIZED IMAGING IS PRICELESS: EXPERT GUIDANCE ON HOW TO FINE TUNE YOUR US IMAGES FOR O-RADS US ASSESSMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Krupa K. Patel-Lippmann, MD (*Abstract Co-Author*) Nothing to Disclose
Maitray D. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Loretta M. Strachowski, MD (*Abstract Co-Author*) Royalties, RELX;Speaker, World Class CME
Myra K. Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Sadowski, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine E. Maturen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Catherine R. Phillips, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Use the highest frequency transducer that allows adequate depth penetration to achieve optimum visualization. Adjust focal zone, gain and field-of-view settings to optimize resolution.2. Transvaginal scanning improves imaging due to closer proximity to the ovary, increasing resolution and avoiding bowel gas; but a transabdominal approach may be the best option when ovaries are anteriorly or superiorly positioned and when transvaginal is not feasible.3. Orthogonal cine clips through the entirety of a lesion are invaluable when unable to personally scan. These clips enable evaluation of the character and number of internal components which may not be captured on static images.4. For Doppler assessment, the color box should target the region of interest to improve sensitivity and minimize artifacts. Spectral Doppler can be helpful to differentiate true vascular flow from Doppler artifact.5. Special sonographic techniques can be valuable for adnexal lesion characterization. The sliding maneuver can help to clarify lesion origin; decubitus positioning enables assessment of the mobility of cyst contents.

### TABLE OF CONTENTS/OUTLINE

1. Outline of images needed for assessment of ovarian and adnexal lesions, with focus on technical parameters and methods for optimization with illustrative examples. 2. Image-rich example cases featuring proper technique and image interpretation pitfalls due to suboptimal technique.3. Review of color and spectral Doppler technique and methods for optimization including how color flow affects the O-RADS US score in certain scenarios.

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# Abstract Archives of the RSNA, 2024

OBEE-5

## MURPHY'S LAW: WHAT CAN GO WRONG IN GYNECOLOGICAL AND OBSTETRIC PROCEDURES? A PICTORIAL ESSAY ON CASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leandro A. Mattos Sr, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcus V. Nascimento, MD (*Abstract Co-Author*) Fellow, Hospital Israelita Albert Einstein
Maria Luiza Lacerda Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Luciana C. Pasquini Raiza, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are:- Create a multimodality-based didactic review of the main topics of complications at gynecological and obstetric procedures.- Construct a practice guide with schematic figures explaining the gynecological and obstetric procedures.- Present a didactic categorization of the following topics: myomectomy, assisted reproduction, curettage, hysterectomy, and cesarean section.- Illustrate those conditions based on cases from our radiology group.

### TABLE OF CONTENTS/OUTLINE

In this exhibit, we will discuss the principles of complications during gynecological and obstetric procedures and focus on their imaging features using a multimodality approach.INTRODUCTION- Epidemiology Imaging role based on current guidelinesCASE-BASED REVIEW- MyomectomyAbscess- Assisted reproductionOvarian hyperstimulation syndrome- CurettagePerforation- HysterectomyGonadal vein thrombosis- Cesarean sectionUreteral injury with vesicouterine fistula

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# Abstract Archives of the RSNA, 2024

OBEE-50

## ENDOMETRIOSIS: A JOURNEY FROM INFERTILITY TO FERTILITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Liina Poder, MD (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Madison M. Breiland, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela I. Causa Andrieu, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) 10-15% of reproductive-age patients have endometriosis, and 30-50% are associated with infertility.Endometriosis degree may not correlate with infertility degree. Early discussion about goals of care (pain relief versus fertility) is essential.Ovarian factor: US and antimullerian hormone levels are good markers. Antral follicle count in US reflects ovarian reserve. It's best done between days 2-5 of the menstrual cycle, counting follicles between 2-10 mm in each ovary. Endometriomas can affect follicle and oocyte recovery.Tubal factor: Hysterosalpingogram evaluates tubal patency using various imaging methods and contrast agents. It's done between days 5-11 of the menstrual cycle. Both fallopian tubes and intraperitoneal spill should be visible.Uterine factor: Adenomyosis can cause infertility by affecting implantation. Mullerian malformations may coexist with endometriosis.(2) The treatment should be personalized: expectant management, surgical removal of implants, ovulation induction, or IVF.(3) Although endometriosis usually regresses during pregnancy, complications may rarely occur: spontaneous hemoperitoneum, enlargement/abscess/rupture of ovarian endometriomas, tethering/rupture of adhesions, bowel perforation, ureteral rupture, and uterine rupture. (4) The dysfunctional uterine changes could predispose to complications: preterm birth, placenta previa, stillbirth, post-partum hemorrhage, and fetal malpresentation.

### TABLE OF CONTENTS/OUTLINE

- Endometriosis and Infertility: Diagnosis
- Endometriosis and Infertility: Treatment
- Endometriosis and Fertility: Pregnancy complications
- Endometriosis and Fertility: Peripartum complications

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OBEE-51

## IUD LOCATION: ARE WE SPEAKING THE SAME LANGUAGE?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jessica J. Koster, MD (*Abstract Co-Author*) Nothing to Disclose
Meredith Gray (*Abstract Co-Author*) Nothing to Disclose
Kelli J. Andresen, MD (*Abstract Co-Author*) Nothing to Disclose
Valerie French (*Abstract Co-Author*) Nothing to Disclose
Jill A. Jones, MD, RVT (*Presenter*) Research Consultant, Corcept Therapeutics Inc

### TEACHING POINTS

There are numerous terms used to describe variant locations of intrauterine devices (IUDs), such as displaced, low-lying, malpositioned, or partial expulsion. However, these terms are vague and frequently misinterpreted by providers, and may lead patients to infer there is risk of personal harm or that the IUD is not adequate contraception. Current consensus guidelines from the American College of Obstetricians and Gynecologists (ACOG) state the greatest risk of unwanted pregnancy may be the unnecessary removal of a nonfundal IUD. The ACOG recommends counseling patients, whether symptomatic or asymptomatic, prior to removal of the IUD. Many providers now advocate for IUDs to be left in place if located above the internal os. For this reason, radiology reports should use clear and consistent terminology to describe IUD position and avoid terms that may raise suspicion for patient injury. We support using a simple lexicon to describe the location of IUDs on ultrasound reports, which is widely understood by OB/Gyn providers and aligns with current gynecologic literature.

### TABLE OF CONTENTS/OUTLINE

1. Provide an overview of IUD contraception, including trends in use, efficacy, and risks/side effects 2. OB/Gyn colleagues provide a clinical perspective to IUD management, including a review of current ACOG consensus guidelines for management of nonfundal IUDs 3. Introduce standard lexicon to describe IUD location, with illustrations, ultrasound cases, and sample reports

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# Abstract Archives of the RSNA, 2024

OBEE-52

## FETAL MR IMAGING OF OBSTRUCTIVE HYDROCEPHALUS: PICTORIAL REVIEW OF AETIOLOGIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andrea Righini (*Abstract Co-Author*) Nothing to Disclose
Giana Izzo (*Abstract Co-Author*) Nothing to Disclose
Francesco Pacchiano (*Abstract Co-Author*) Nothing to Disclose
Chiara Doneda (*Abstract Co-Author*) Nothing to Disclose
Cecilia Parazzini (*Abstract Co-Author*) Nothing to Disclose
Filippo Arrigoni (*Abstract Co-Author*) Nothing to Disclose
Mario Tortora, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Fetal ventriculomegaly can be broadly classified as obstructive or non-obstructive. Several pathologies and malformations can lead to obstructive ventriculomegaly by interrupting CSF normal flow. Identifying these entities can facilitate diagnosis and clarify the mechanisms underlying ventriculomegaly as well as optimize prognostic and therapeutic management. Incorporating visual representations of etiologic pictures is beneficial for both novice and experienced radiologists specializing in fetal imaging.

### TABLE OF CONTENTS/OUTLINE

Ventriculomegaly is the most commonly depicted abnormality of the fetal CNS at prenatal imaging. This finding is nonspecific, with a rate of associated malformations ranging from 10% to 50%. The understanding of causal factors at prenatal stage may be a challenge and is further confounded by the lack of histopathological data. Response to treatment and prognostication are not clearly defined. Early and accurate diagnosis at prenatal MRI is therefore essential, allowing improved prenatal counselling and facilitating appropriate referral. We retrospectively reviewed our Fetal MRI database (4568 exams). We included 201 cases of obstructive hydrocephalus according strict inclusion criteria: isolated aqueduct stenosis (36.3%); hemorrhagic events leading to secondary aqueduct obstruction (30.3%); rhombencephalosynapsis (7.5%); dural sinus malformation (6%); midline cysts (5.4%); diencephalic-mesencephalic junction (DMJ) dysplasia (3.5%); infective based lesions (3%); tumor/hematoma (2.5%); Chiari 1 (1.5%); Walker-Warburg disease (1%); miscellanea (3%). We discuss MR features providing clinical and postnatal MRI or histopathology correlation.

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# Abstract Archives of the RSNA, 2024

OBEE-53

## THE ROLE OF THE RADIOLOGIST IN THE EVALUATION OF UTERINE ADENOMYOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ana Belen Barba Arce, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Explain what adenomyosis consists of: etiopathogenesis, clinical manifestations, risk factors, and treatment. 2. Review normal uterine anatomy. 3. Present the diagnostic methods used to detect adenomyosis, focusing on its evaluation through magnetic resonance imaging (MRI). 4. Show the different manifestations of adenomyosis and their characteristics as seen on MRI. 5. Describe possible pitfalls and the differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. What is adenomyosis?. 2. Etiopathogenesis. 3. Incidence. 4. Clinical manifestations. 5. Risk factor's. 6. Diagnostic tests. 7. Treatment. 8. MRI study protocol. 8.1. Previous recommendations. 8.2. Sequences. 9. Anatomical review. 10. Classification of adenomyosis by MRI. 11. Characteristic findings of adenomyosis by MRI. 11.1. Diffuse adenomyosis. 11.2. Focal adenomyosis. 12. Pitfalls. 12.1. Physiologic changes in the uterine body during the menstrual cycle. 12.2. Uterine contractions. 12.3. Postmenopausal uteruses and in women using contraceptive drugs. 13. Differential diagnosis. 13.1. Leiomyoma. 13.2. Endometriosis. 13.3. Accessory cavitated uterine mass. 13.4. Myometrial invasion by endometrial cancer. 13.5. Low-grade endometrial stroma sarcoma. 13.6. Maligned adenomiosis. 14. Conclusions.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

OBEE-54

## ULTRASOUND APPROACH TO ADENOMYOSIS, THE FIRST AND BIGGEST STEP IN DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Rodrigo Arrieta Darras, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-Identify the normal ultrasound findings of the uterus and the main characteristics and classification of adenomyosis.-Illustrate the featured ultrasound signs and imaging data in the diagnosis of adenomyosis.

### TABLE OF CONTENTS/OUTLINE

-Normal ultrasound findings of the uterus.-Some facts of adenomyosis: -History -The introduction of ultrasound as a diagnostic modality of this disease. -Using different modalities of ultrasound-Video clips and the importance of making them.

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# Abstract Archives of the RSNA, 2024

OBEE-55

## TUMOR-LIKE CONDITIONS AND PSEUDOTUMORAL LESIONS IN THE FEMALE PELVIS: IMAGING FEATURES, DIFFERENTIAL DIAGNOSIS, AND THERAPEUTIC STRATEGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Masafumi Harada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kenji Matsuzaki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mayumi Takeuchi, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Nonneoplastic conditions may present tumor-like manifestations in the uterus and adnexa, and normal organs may undergo dynamic changes with physiological conditions or hormonal stimulation appearing as pseudotumoral “Don’t Touch” lesions. They are common in young women, occasionally with hormonal activity, and are often associated with pregnancy. Accurate diagnosis is important for the appropriate management to avoid excess surgical procedures and to preserve fertility and function. A wide spectrum of clinical and imaging features, and therapeutic strategies are reviewed. 2. To demonstrate look-alike tumors and tumor-like lesions on imaging, and to describe the clues to the differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

1. Physiological changes of normal organs: age, menstrual cycle, pregnancy, medication 2. Ovarian histological anatomy w/ hormonal synthesis 3-a. Pathogenesis of tumor-like lesions related to hormonal excess: gonadotropins, estrogen, androgen 3-b. Clinical features of functioning lesions: direct and indirect signs 4-a. Non-neoplastic ovarian cysts, 4-b. Enlarged ovaries w/ stromal proliferation or edema, 4-c. Pregnancy-related ovarian lesions 5-a. Non-neoplastic uterine lesions: Myometrial, Pregnancy-related, C-section scar-related 6. Endometriosis and related lesions 7. PID and related lesions 8. Advanced MR techniques: 3D-T2WI, DWI (computed /reduced FOV), SWI, DCE-MRI, MR Spectroscopy 9. Treatment options: Conservative, Minimal invasive, Fertility /function preserving

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# Abstract Archives of the RSNA, 2024

OBEE-56

## DIAGNOSTIC AND MANAGEMENT IMPLICATIONS OF 2023 FIGO STAGING FOR ENDOMETRIAL CANCER: A PRIMER FOR RADIOLOGISTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Alejandra Esparza Young (*Abstract Co-Author*) Nothing to Disclose
Philip T. Valente, MD (*Abstract Co-Author*) Nothing to Disclose
Paulina Ramirez (*Abstract Co-Author*) Nothing to Disclose
Edward Kost (*Abstract Co-Author*) Nothing to Disclose
Georgia McCann (*Abstract Co-Author*) Nothing to Disclose
Srinivasa R. Prasad, MD (*Abstract Co-Author*) Nothing to Disclose
Venkata S. Katabathina, MD (*Abstract Co-Author*) Nothing to Disclose
Sriram Jaganathan, MD (*Abstract Co-Author*) Nothing to Disclose
Alexsandra M. Ramirez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Familiarize the audience with 2023 updates of the FIGO Endometrial Cancer (EC) Staging System Review new molecular classifications, pathologic advances, natural history novel therapies Describe the imaging findings adapted to updated 2023 FIGO staging system with emphasis on potential diagnostic management implications Discuss novel treatments role of imaging in assessing treatment efficacy

### TABLE OF CONTENTS/OUTLINE

Introduction Review newly proposed 2023 FIGO Endometrial cancer staging system Pathology, genetics molecular biology Grading: Grades 1-3 Histology: Aggressive Non-aggressive; Endometrioid, Serous, clear cell, undifferentiated, carcinosarcoma mixed Lymphovascular space invasion Molecular classification: POLEmut (good prognosis), Mismatch repair deficient, No specific molecular profile p53abn (worse prognosis) Role of sentinel lymph node biopsy Imaging techniques: US, CT, MRI PET/CT MRI role in preoperative assessment: Tailor presurgical treatment, risk stratification management Effect of FIGO staging on imaging recommendations: CT vs. MRI vs. PET/CT Diagnostic and management implications MRI Role: Myometrial or cervical stromal invasion? •Uterine body, serosal, adnexal, or parametrial involvement? Pelvic, periaortic lymphadenopathy? •Distant metastases?•Treatment complications? •Recurrent disease? Role of imaging in fertility preservation strategies Novel treatments role of imaging in assessing treatment efficacy ConclusionAdvances in understanding pathology molecular classifications of EC led to 2023 FIGO staging system. MRI helps in preop assessment, risk stratification selection of most appropriate initial therapy.

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# Abstract Archives of the RSNA, 2024

OBEE-57

## THE UPDATED 2023 STAGING OF ENDOMETRIAL CANCER. TIPS FOR MRI INTERPRETATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alfonso Iglesias, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Learn about the current modifications in the new FIGO 2023 endometrial cancer staging Recognize the differences from the previous staging system Know the major changes in the revised FIGO 2023 endometrial cancer staging that affect MR imaging interpretation

### TABLE OF CONTENTS/OUTLINE

Explain the new FIGO 2023 staging for endometrial cancer that includes the various histological types, tumor patterns, and molecular classification because they affect prognosis and enable a more appropriate treatment planning Description of the changes incorporated in the new FIGO 2023 with emphasis on the modifications that have occurred with respect to the FIGO 2009 staging Show MRI findings in different stages of endometrial cancer and their correlation with the updated FIGO 2023 staging and its pathological correlation and to identify those MRI findings that condition the management of patients with endometrial carcinoma

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# Abstract Archives of the RSNA, 2024

OBEE-58

## FETAL MRI: ABDOMINAL CYSTIC LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Javier Carrascoso Arranz (*Abstract Co-Author*) Nothing to Disclose
Alejandro Diaz Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Vicente Martinez de Vega, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucia Sanabria, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Lopez Alcolea, MD (*Abstract Co-Author*) Nothing to Disclose
David Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel R. Recio Rodriguez, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

· MRI is a complementary tool to ultrasound that helps characterize lesions and assess the degree of extension.· Ovarian cysts are very common cystic lesions in female fetuses and often bleed.· Gradient echo sequences in phase and opposed phase can detect the presence of fat in teratomas.· Diffusion sequence allows us to calculate the ADC of teratomas; immature teratomas present lower ADC values than mature ones due to increased cellularity.

### TABLE OF CONTENTS/OUTLINE

Prenatal diagnosis of abdominal cystic lesions by ultrasound is quite common. Fetal MRI, with its multiplanar capacity and greater tissue characterization, aids in diagnosing these lesions and better assessing their extension.Cystic lesions are classified into gastrointestinal (intestinal duplication cysts, meconium pseudocysts, lymphatic malformations, hepatic and biliary cystic lesions, splenic cysts, and intestinal dilatations), genitourinary (ovarian cysts, hydrometrocolpos, urogenital sinus, cloacal malformation, renal and adrenal cystic lesions), cystic teratomas, and lesions associated with the Currarino triad.Characteristic radiological findings of these lesions are described, as well as the different MRI sequences useful for diagnosis.

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# Abstract Archives of the RSNA, 2024

OBEE-59

## FETAL MRI: MIDLINE ANOMALIES AND CORTICAL DEVELOPMENT MALFORMATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Paula Molina Vigara, MD (*Abstract Co-Author*) Nothing to Disclose
Vicente Martinez de Vega, PhD (*Abstract Co-Author*) Nothing to Disclose
Julia Lopez Alcolea, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Diaz Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
David Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Sanabria, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel R. Recio Rodriguez, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Fetal MRI:• Has high sensitivity in detecting midline anomalies,• Detects anomalies associated with dysgenesis of the corpus callosum followed by cortical malformations and posterior fossa anomalies.• Identifies all forms of holoprosencephaly.• Is the technique of choice for cortical development malformations, lacking the limitations of ultrasound.

### TABLE OF CONTENTS/OUTLINE

Different midline anomalies are described, including dysgenesis of the corpus callosum, alobar, semilobar, or lobar holoprosencephaly, septo-optic dysplasia, lipoma of the corpus callosum, interhemispheric cysts and absence of the cavum pellucidum. The characteristic radiological findings of each pathology and the most frequent associated genetic alterations are shown.Cerebral cortical development is divided into three processes: cell proliferation (2nd to 4th month), neuronal migration (3rd/4th month to week 24), and cortical organization (week 22 to 2 years of age). The classification proposed by Barkovich in 2012 is reviewed, showing radiological findings and the main associated genetic alterations in:• Proliferative disorders: Decreased proliferation (microlissencephaly), increased proliferation (hemimegalencephaly), and abnormal proliferation (cortical dysplasia or cortical hamartomas of tuberous sclerosis).• Migration disorders: Decreased migration (classical lissencephaly), increased migration (congenital muscular dystrophy), ectopic migration (heterotopias).• Cortical organization disorders: Polymicrogyria and schizencephaly (closed-lip type I, open-lip type II).

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# Abstract Archives of the RSNA, 2024

OBEE-6

## FROM TWISTS TO INFECTIONS: A TUBE PICTORIAL ESSAY BEYOND YOUTUBE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luciana C. Pasquini Raiza, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro A. Mattos Sr, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marcus V. Nascimento, MD (*Abstract Co-Author*) Fellow, Hospital Israelita Albert Einstein
Roberta Linhares, MD (*Abstract Co-Author*) Nothing to Disclose
Ronaldo H. Baroni, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernando M. Coelho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are:- Create a multimodality-based didactic review of the main topics of the study of the uterine tube with multiple imaging methods.- Construct a practice guide with schematic figures explaining the main complications of the uterine tube.- Suggest a didactic categorization of the following topics: fertility study, acute emergency complication, neoplasm with tubal involvement, infectious complication, and obstetric complication.- Illustrate those conditions based on cases from our radiology group.

### TABLE OF CONTENTS/OUTLINE

In this exhibit, we will discuss the principles of complications during gynecological and obstetric procedures and focus on their imaging features using a multimodality approach.INTRODUCTION - Review the main conditions related to uterine tube.- Describe the imaging protocols.CASE-BASED REVIEW- Fertility studyhysterosalpingographymagnetic resonance hysterosalpingography- Acute emergency complicationtubal torsion- Tumor with tubal involvementendometrioid carcinomatubal adenomatoid tumor- Infectious complicationInfectious complication- Obstetric complicationEctopic pregnancyHeterotopic pregnancy

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# Abstract Archives of the RSNA, 2024

OBEE-60

## ULTRASOUND OF THE POST PROCEDURE UTERUS: CHRONIC FINDINGS WITH CORRELATIVE IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shuchi K. Rodgers, MD (*Abstract Co-Author*) Royalties, RELX
Mindy M. Horrow, MD (*Presenter*) Spouse, Employee, Bristol-Myers Squibb Company

### TEACHING POINTS

1. The configuration of an anteverted and retroflexed uterus is rare other than related to adhesions from Cesarean section and may cause sub-optimal transvaginal imaging 2. Clinical complications related to the Cesarean section scar include dysfunctional bleeding, ectopic pregnancy and IUD malposition 3. Residual functional endometrial tissue after endometrial ablation can lead to cornual hematosalpinx, hematometra and adenomyosis 4. Post ablation tubal sterilization syndrome may occur after ablation in patients with prior tubal ligation when egress of blood from residual endometrium is obstructed in antegrade and retrograde directions, leading to cyclic pelvic pain despite amenorrhea

### TABLE OF CONTENTS/OUTLINE

A. C-section- changes in uterus 1. Position 2. Scar a. Appearance of scar(s) b. Appearance of niche/isthmocele i. Measurement ii. SIS 3. Complications of the uterine scar a. Dysfunctional bleeding b. Ectopic pregnancy c. IUD malposition 4. Complications of the abdominal wall scar a. Endometrial implants b. Hernia c. Bowel obstruction B. Endometrial Ablation a. Background b. Normal appearance c. Complications i. Symptomatic obstructed menses ii. Hematometra 1. Central 2. Cornual iii. Adenomyosis iv. Post ablation tubal sterilization syndrome v. Other considerations (pregnancy, malignancy) C. Fibroid Treatments a. Myomectomy b. Uterine artery embolization D. Other a. Synechiae b. Vascular complications: AVM, PSA c. Retained devices related to uterine procedures d. Obstructed uterus

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# Abstract Archives of the RSNA, 2024

OBEE-61

## ACUTE GYNECOLOGICAL PAIN AND ITS RADIOLOGICAL FINDINGS BY TC

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pascual Adrian Gonzalvo Gomez (*Abstract Co-Author*) Nothing to Disclose
Samuel Roldan Minana (*Abstract Co-Author*) Nothing to Disclose
Elena Pascual Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Sierra, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Rozas (*Abstract Co-Author*) Nothing to Disclose
Myriam Segarra Hernandez (*Abstract Co-Author*) Nothing to Disclose
Paloma Briceno Torralba, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Accurate evaluation of acute gynecological pathology presenting with acute pain through CT is challenging due to different gynecological conditions.- Emergency radiology in the rigorous diagnosis of urgent gynecological pathology as well as in guiding therapeutic planning is crucial due to a high morbimortality.

### TABLE OF CONTENTS/OUTLINE

Acute gynecological pain represents a significant clinical challenge, with various forms of clinical presentation that can range from benign ailments to potentially life-threatening conditions. In this context, computed tomography (CT) has emerged as an essential tool for the fast and accurate evaluation of these conditions due to its capacity to generate detailed images rapidly. However, despite the latest advances in CT image resolution, the female pelvic region remains a tackled area to characterize and poses a challenge even for the most experienced radiologists.This review aims to explore, by different examples, the role of CT in the initial evaluation of emergent gynecological pathologies, such as ruptured ectopic pregnancy or sepsis due to pelvic inflammatory disease, often requiring immediate treatment through radiological intervention or surgery. It will also focus on other gynecological manifestations that necessitate precise differential diagnosis from other commonly occurring intra-abdominal processes due to their urgent nature.

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# Abstract Archives of the RSNA, 2024

OBEE-62

## LOOK CAREFULLY: IT'S NOT AN OVARIAN LESION!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jorge Elias JR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vitor V. Ricci (*Abstract Co-Author*) Nothing to Disclose
Carlos M. Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Cecilia V. Torres, MD (*Abstract Co-Author*) Nothing to Disclose
Caio Pereira (*Abstract Co-Author*) Nothing to Disclose
Gabriel L. Gouvea, MD (*Abstract Co-Author*) Nothing to Disclose
Arthur Ogata, MD (*Abstract Co-Author*) Nothing to Disclose
Thalyne Lima (*Abstract Co-Author*) Nothing to Disclose
Valdair F. Muglia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Leticia Helena Kaca Do Carmo (*Abstract Co-Author*) Nothing to Disclose
Pamela Grazielle Correa De Oliveira (*Abstract Co-Author*) Nothing to Disclose
Guilherme N. Alves, MD, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The adnexal and paraovarian regions can harbor various pathologies, ranging from infectious to neoplastic conditions. It's crucial for radiologists to accurately characterize and diagnose these lesions, although extraovarian findings are often overlooked due to the higher frequency of ovarian involvement. This presents a diagnostic challenge. This review aims to discuss the most common paraovarian conditions and their identification on Magnetic Resonance Imaging (MRI), Computed Tomography (CT), and Ultrasound images, with an emphasis on distinguishing them from ovarian lesions. While many findings are benign and similar to adnexal lesions, leiomyomatosis, and endometriosis affecting atypical sites like the broad ligament should be noted. Fluid-filled lesions such as hydrosalpinx, hematosalpinx, paraovarian cysts, and peritoneal inclusion cysts are also noteworthy. Malignant lesions are typically secondary, often originating from the pelvis and abdomen, although primary neoplasms can occur, posing challenges in diagnosis. Schwannomas and neurofibromas along pelvic nerves are potential findings. In fertile patients, ectopic pregnancy should be considered as a differential diagnosis for paraovarian masses. Given that accurate diagnosis can expedite treatment, recognizing and confidently reporting prevalent extraovarian lesions is paramount.

### TABLE OF CONTENTS/OUTLINE

- Detailed anatomy of the adnexal region with imaging correlation; - The list of differentials, including the most common paraovarian lesions;- How to identify classic findings of extraovarian origin and how to confidently differentiate them from ovarian ones.

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# Abstract Archives of the RSNA, 2024

OBEE-63

## PICTORIAL REVIEW OF BILATERAL ADNEXAL LESIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jean p. Akakpo Sr, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Olivier Lucidarme, MD, PhD (*Abstract Co-Author*) Speaker, Bracco Group;Speaker, F. Hoffmann-La Roche Ltd;Expert Witness, Bayer AG
Natalia H. Concatto, MD (*Abstract Co-Author*) Nothing to Disclose
Yasmina Badachi, MD (*Abstract Co-Author*) Nothing to Disclose
Catherine Uzan (*Abstract Co-Author*) Nothing to Disclose
Salma Ayadi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Explore the spectrum of bilateral adnexal lesions.• Highlight the diagnostic nuances and imaging characteristics of common and uncommon entities, also benign and malignant.• Present a selection of cases to illustrate.

### TABLE OF CONTENTS/OUTLINE

Bilateral adnexal lesions pose a diagnostic challenge in clinical practice, necessitating a multidisciplinary approach for accurate assessment and management. These lesions, affecting structures such as the ovaries, fallopian tubes, and surrounding tissues, stem from diverse etiologies, including inflammatory, infectious, neoplastic, and functional causes.The first step when bilateral adnexal lesions are found is to exclude infection (ie: tubo-ovarian abscesses), endometriomas and functional affections such as: polycystic ovary syndrome, hyperthecosis and ovarian hyperstimulation syndrome.When organic bilateral adnexial tumors are diagnosed, the radiologist should describe and stratify the risk of malignancy of each tumor according to the Ovarian-Adnexal Reporting and Data System (O-RADS). However, the O-RADS does not include any observations when lesions are bilateral. We often encounter bilateral lesions, sometimes with divergent O-RADS categories, which may or may not be of the same etiology. Certain pathologies, such as serous carcinoma, mature teratoma, and metastasis, exhibit a propensity for bilateral involvement. Knowledge of these entities and their differential diagnoses is imperative for enriching diagnostic reports alongside O-RADS categorization.This pictorial review aims at aiding radiologists in identifying and interpreting imaging findings associated with bilateral adnexal lesions.

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# Abstract Archives of the RSNA, 2024

OBEE-64

## WORKING IN CONCERT: RADIOLOGY, PATHOLOGY, AND GYNECOLOGY ONCOLOGY APPLICATIONS OF THE 2023 FIGO UPDATES IN ENDOMETRIAL CANCER STAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jamie McDowell (*Abstract Co-Author*) Nothing to Disclose
David Bass, MD (*Abstract Co-Author*) Nothing to Disclose
Denes Szekeres, BS (*Abstract Co-Author*) Nothing to Disclose
Wei Li (*Abstract Co-Author*) Nothing to Disclose
Tannaz Rajabi (*Abstract Co-Author*) Nothing to Disclose
Ashlee Smith (*Abstract Co-Author*) Nothing to Disclose
Akshya Gupta, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The FIGO classification for endometrial cancer was recently updated, with key differences in staging that are important for radiologists to be aware of. 2. Radiologic/pathologic correlation for endometrial cancer, including different histologic subtypes and molecular classifications, will be provided. The associated clinical implications and management recommendations will be highlighted in a case-based format.

### TABLE OF CONTENTS/OUTLINE

1. Introduce endometrial cancer demographics, clinical presentation, and initial work-up 2. Review of the updated 2023 FIGO endometrial cancer staging system with emphasis on changes from the prior system3. Case based discussion of patients with different stages of endometrial cancer, with multimodality radiologic findings and associated pathologic correlation. Specific concepts that will be addressed include: a. Non-aggressive and aggressive histologic subtypes b. Importance of myometrial and lymphovascular space invasion c. Review of molecular classification of endometrial tumors and updated prognostic and staging implications d. Key radiologic and pathologic features that impact clinical management and treatment options 4. Pitfalls of the new staging system and current gaps in the literature

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# Abstract Archives of the RSNA, 2024

OBEE-65

## BEYOND THE SURFACE: ENHANCING DIAGNOSTIC ACCURACY WITH MULTIPLANAR RECONSTRUCTION IN SALINE INFUSION SONOHYSTEROGRAPHY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Veronica Espinosa Cruz, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo A. Cervantes Flores, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela Briones, MD (*Abstract Co-Author*) Nothing to Disclose
Montserrat M. Cuadra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Provide the learners with information about the procedure, materials, and techniques involved in sonohysterography, describing each step in a systematic manner. 2. Discover the potential of multiplanar reconstructive ultrasound images for detection of uterine pathologies, offering exceptional insights into anatomical structures and spatial relationships. 3. Explore the different imaging techniques available in uterine and endometrial pathologies, analyzing their respective advantages and limitations. 4. Describe the main abnormalities that we can diagnose with sonohysterography, identifying and interpreting these findings with precision and expertise. 5. Communicate and navigate the complexities of image interpretation in sonohysterography.

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Sonohysterography: a. Evolution and advancements in gynecologic ultrasound techniques. b. Advantages of saline-infused sonohysterography and comparing different imaging techniques. 2. Fundamentals of Hysterosonography Technique: a. Patient preparation and positioning for hysterosonography. b. Materials. c. Imaging protocol and step-by-step instructions. 3. Normal sonographic anatomy of the uterine cavity 4. Clinical Applications and Utility of Hysterosonography a. Congenital uterine malformations b. Endometrial polyps c. Endometrial hyperplasia d. Leiomyomas e. Uterine adhesion bands 5. Diagnostic Pitfalls and Challenges in Image Interpretation

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# Abstract Archives of the RSNA, 2024

OBEE-66

## LOOKING INTO PLACENTA ACCRETA SPECTRUM WITH MRI:RADIOLOGIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lia A. Moulopoulos, MD (*Abstract Co-Author*) Nothing to Disclose
Anastasia Konstantinidou (*Abstract Co-Author*) Nothing to Disclose
Marianna Konidari, MD (*Abstract Co-Author*) Nothing to Disclose
Charis Bourgioti, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Placenta accreta spectrum (PAS) is considered an iatrogenic disease and it may be associated with major ante- and postpartum complications for both mother and fetus, especially if not diagnosed prenatally. • Traditionally used terminology of placenta accreta, increta, and percreta is under debate and the so-called percreta cases are attributed to uterine dehiscence and adhesions between uterine serosa and posterior bladder wall. • Standardization and update of clinical, pathologic and imaging criteria for PAS diagnosis and grading is pivotal for improvement in diagnosis and treatment of PAS. • Familiarity with the main MRI findings of PAS and deeper understanding of the clinical relevance of each sign through pathologic correlation, will help radiologists provide more accurate diagnoses, optimizing patient care.

### TABLE OF CONTENTS/OUTLINE

• Introduction to PAS: Definitions, epidemiology, predisposing factors, common clinical findings, and appropriate diagnostic imaging modalities. • Current challenges in understanding the pathophysiology of PAS and debate on its clinical and histopathological confirmation. • Prenatal use of MRI in PAS diagnosis and management: A routine or an adjunct assessment tool? • Normal placenta pathology and correlation with MRI anatomy. • MRI protocols for PAS evaluation: Conventional protocols and implementation of advanced functional techniques • MRI description, pathophysiological and rad-path correlation of MRI signs of PAS according to SAR/ESUR joint consensus guidelines. Is it possible to discriminate between uterine dehiscence and PAS myoinvasion? • Follow-up MRI in patients with uterine sparing management for PAS. What to expect.

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# Abstract Archives of the RSNA, 2024

OBEE-67

## FINDING YOUR NICHE: IMAGING FINDINGS ALONG THE SPECTRUM OF CESAREAN SECTION SCAR COMPROMISE AND OTHER POST-CESAREAN COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Erin N. Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Ishwarya Sivakumar (*Abstract Co-Author*) Nothing to Disclose
Julia Fisher, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Cesarean Section (CS) is increasingly common. Surgical techniques vary and include classic transverse, fundal and midline vertical incisions.2. The spectrum of cesarean scar compromise includes uterine niche, uterine window, uterine dehiscence, and uterine rupture. Each entity has its own imaging features and clinical implications.3. MRI is the imaging modality of choice to evaluate cesarean scar compromise given field of view, tissue resolution and clear delineation of uterine layers.4. Key features of CS scar defects that should be reported include maximum myometrial thickness and proximity of the abnormal myometrium to the urinary bladder.5. Additional complications of CS can occur concomitantly including infection, hematoma, adhesive disease, placenta accreta spectrum and CS ectopic pregnancy.

### TABLE OF CONTENTS/OUTLINE

1. Background including rates of Cesarean Section (CS). 2. Surgical technique: Classic, fundal and midline vertical incision3. Uterine Scar physiology, uterine anatomy, and normal appearance of the nulliparous and post-CS uterus 4. Protocol recommendations for MR evaluation of the post-CS uterus. 5. Spectrum of cesarean section scar compromise including: uterine niche. uterine window, uterine dehiscence, and uterine rupture6. What the surgeon needs to know: descriptors and features to report that may aid in operative planning7. Additional complications of CS including infection, endometritis, surgical site abscess, post operative hematoma, adhesive disease, CS ectopic, and placenta accreta spectrum. 8. Conclusion

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# Abstract Archives of the RSNA, 2024

OBEE-68

## EMPOWERING DIAGNOSIS: THE RADIOLOGIST'S KEY ROLE IN PRIMARY AMENORRHEA MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Maria N. Napoli, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Chacon, MD (*Abstract Co-Author*) Nothing to Disclose
Martina Aineseder, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin Kurt Mac Allister (*Abstract Co-Author*) Nothing to Disclose
Ayelen Leao, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Florencia Trila, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Radiology should be the first referral department as imaging plays a key role.Ultrasound is the first line investigation while Magnetic resonance imaging is important for accurate diagnosis and surgical planning.The kidneys should be assesed at all times in mullerian duct anomalies given the high frecuency of anomalies (30%)The Herlyn-Werner-Wunderlich syndrome (HWWS) usually presents as a triad: didelphys uterus, low genital obstruction and unilateral renal anomaly.Hypothalamic-pituitary axis alterations may be suspected due to findings on ultrasound such as an infantile uterus or the absence of secondary sexual characteristics.

### TABLE OF CONTENTS/OUTLINE

Primary amenorrhea is defined as the absence of menarche at age 16 years with normal growth and development of secondary sexual characteristics, or at age 14 years in the absence of normal growth or development of secondary sexual characteristics. Its incidence is approximately 3,000 per 100,000 individuals, mainly due to hypothalamic amenorrhea. The menstrual cycle depends on the proper functioning of the hypothalamic-pituitary-ovarian axis and its target organs that constitute the outflow tract (uterus and vagina). Any alteration in these structures can trigger amenorrhea.The management of a patient with primary amenorrhea requires an interdisciplinary approach and the radiologist plays a key role since up to approximately 67% of the diagnoses are made by means of an imaging study.In order to organize the etiologies in a logical and educational way it is proposed to divide the causes into three levels. Level 1: Outlet tract. Level 2: Gonadal. Level 3: Diencephalon.

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# Abstract Archives of the RSNA, 2024

OBEE-69

## FEMALE GENITAL TRACT CONGENITAL ANOMALY SPECTRUM: THE ROLE OF IMAGING IN CLASSIFICATION, SURGICAL PLANNING, AND MULTIDISCIPLINARY CARE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Luciana P. Chamie, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marjan Attaran (*Abstract Co-Author*) Nothing to Disclose
Wendaline M. VanBuren, MD (*Abstract Co-Author*) Nothing to Disclose
Myra K. Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Mary C. Costello, DO (*Abstract Co-Author*) Nothing to Disclose
Priyanka Jha, MBBS (*Abstract Co-Author*) Nothing to Disclose
Cara King (*Abstract Co-Author*) Nothing to Disclose
Swati V. Putcha, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Female genital tract congenital anomalies (FGTCAs) impact up to 7% of those assigned female at birth and up to 25% of women with infertility or history of miscarriage. 2. FGTCAs are often associated with renal, vascular or bony anomalies due to complex embryologic interplay. 3. FGTCAs impact patients throughout their lifetime. Counseling and treatment must consider future phases of life. 4. Multidisciplinary care centers offer patients a comprehensive approach to medical management optimization and surgical correction tailored to a patient's desires. 5. Transvaginal ultrasound is first-line imaging modality for FGTCA, but may not be possible in those with vaginal agenesis or younger patients. MRI is second-line non-invasive imaging modality for diagnosis, identification of associated anomalies, concurrent pathologies, treatment planning, and identification of innate and post-surgical complications. 6. MRI protocol tailored for FGTCA evaluation is necessary to aid in accurate classification and surgical planning.

### TABLE OF CONTENTS/OUTLINE

1. Title 2. Disclosures 3. Learning objectives 4. Female genital tract congenital anomaly background information and embryology 5. MRI protocol and report considerations 6. Case examples with imaging and management / surgical planning information (septate spectrum longitudinal transverse; rudimentary horn spectrum including communicating, non-communicating and ACUM; agenesis cases including MRKH, cervical and vaginal agenesis, AIS; complex anomalies, associated anomalies including GU, vascular and osseous). 7. Conclusion 8. References

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# Abstract Archives of the RSNA, 2024

OBEE-7

## UNLOCKING MYSTERIES: EARLY AND LATE GROWTH ONSET DIAGNOSIS AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sergio Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Sousa Santana De Paula (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Regiany Alessandra Garcia Jureidini (*Abstract Co-Author*) Nothing to Disclose
Dario Nascimento Ferreira Alves, MD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Vitoria Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Mayumi Takamune, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana Cerri, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ramon Borge Rizzi, MD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Rosolen Iunes, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To discuss the diagnosis and management of early and late onset growth restriction, highlighting: The importance of early detection and understanding the distinction between small for gestational age (SGA) and fetal growth restriction (FGR) is paramount for fetal health. Ultrasound assessment that encompasses essential parameters, timing, and frequency of surveillance, guided by ISUOG criteria for interpreting fetal growth charts. Management strategies in fetal care based on the severity of SGA/FGR and gestational age, considering optimal timing and mode of delivery. Future directions: Ongoing research in the field of SGA and FGR.

### TABLE OF CONTENTS/OUTLINE

1. IntroductionOverview of Growth Restriction (GR) in PregnancyImportance of Early Detection and Management 2. Understanding Growth Restriction Definition and Classification of Growth Restriction Pathophysiology of Early and Late Onset Growth Restriction Risk Factors and Contributing Factors 3. Ultrasound Evaluation of Growth Restriction Role of Ultrasound in Prenatal Assessment Measurement Parameters for Fetal Growth Assessment 4. Early Onset Growth Restriction: Diagnosis and Management Clinical Features and Diagnostic Criteria Ultrasound Findings and Biometric Parameters Antenatal Surveillance Strategies Interventional Strategies and Management Approaches 5. Late Onset Growth Restriction: Diagnosis and Management Clinical Characteristics and Diagnostic Challenges Ultrasound Markers and Predictive Models Therapeutic Interventions and Management Strategies 6. Role of Advanced Ultrasound Imaging Techniques 7. Future Directions and Research Opportunities 8. Conclusion

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# Abstract Archives of the RSNA, 2024

OBEE-70

## CLEARING THE HURDLES TO PERFECT PICTURES: OPTIMIZING THE MRI PELVIS PROTOCOL FOR O-RADS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andrea G. Rockall, FRCR, MRCP (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Sadowski, MD (*Abstract Co-Author*) Nothing to Disclose
Nancy Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Reinhold, MD, MSc (*Abstract Co-Author*) Research Grant, Imagia Cybernetics Inc
Isabelle Thomassin-Naggara, MD (*Abstract Co-Author*) Researcher, General Electric Company;Research funded, General Electric Company;Researcher, Canon Medical Systems Corporation;Research funded, Canon Medical Systems Corporation;Research funded, Hologic, Inc;Research funded, Siemens AG;Research funded, Guerbet SA
Stephanie Nougaret, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Krupa K. Patel-Lippmann, MD (*Abstract Co-Author*) Nothing to Disclose
Angela Tong, MD (*Presenter*) Equipment support, Siemens AG

### TEACHING POINTS

1. Acquiring T2WI and Post-contrast T1WI with 3mm slice thickness is important to ensure visualization of small papillary projections.2. In/opposed phase images in addition to fat suppressed images are essential as dermoids may only contain microscopic fat.3. The high b value in the DWI acquisition must be at least 1000s/mm2 to ensure sufficient signal loss from fluid in cysts.4. Parallel imaging and multi band techniques can decrease acquisition time for DWI.5. Employ left/right phase encoding and anterior saturation bands on T2WI to decrease motion artifact.6. Time intensity curves can risk stratify lesions into O-RADS MRI 3, 4, and 5, while visual inspection single phase post contrast sequence can only stratify between O-RADS 4 and 5 with decreased positive predictive value.7. ROIs for time intensity curves must be placed on enhancing adnexal solid tissue and the outer myometrium for proper risk stratification.

### TABLE OF CONTENTS/OUTLINE

1. Review the minimum requirements for MRI sequences and optimal imaging planes needed for using the O-RADS MRI risk score.2. Image rich case based review of pitfalls and importance of optimization of each sequence.3. Details on how to perform time intensity curve analysis properly.

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# Abstract Archives of the RSNA, 2024

OBEE-9

## NEXT-GENERATION DIAGNOSTICS: UNVEILING THE POWER OF $^{23}$NA-MRI IMAGING IN THE FIELD OF GYNECOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Toyomi Satoh, MD (*Abstract Co-Author*) Nothing to Disclose
Toshitaka Ishiguro, MD (*Abstract Co-Author*) Nothing to Disclose
Miki Yoshida, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takahito Nakajima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sodai Hoshiai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masashi Shindo, RT (*Abstract Co-Author*) Nothing to Disclose
Taishi Amano, MD (*Abstract Co-Author*) Nothing to Disclose
Masafumi Sakai, MD (*Abstract Co-Author*) Nothing to Disclose
Saki Shibuki (*Abstract Co-Author*) Nothing to Disclose
Tsukasa Saida, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The regulation of sodium (Na+) ion influx into cells is crucially maintained by Na+ channels, Na+/H+ and Na+/Ca2+ exchangers, while Na+ ion efflux is facilitated by Na+/K+-ATPase, ensuring a significant transmembrane Na+ ion gradient. When this regulatory system is compromised, it leads to disruptions in the intracellular sodium concentration, fostering cancer metastasis by enabling cellular invasion and migration. Furthermore, Na+ ion accumulation around cancer cells, often a result of inflammation, enhances tumor immunogenicity. Consequently, alterations in Na+ ion levels could serve as vital biomarkers for the diagnosis and prognosis of tumors. 23Na-MRI stands out by providing insights into changes in Na+ ion concentration within tumors and provides biochemical information that reflects cell viability, structural integrity, and energy metabolism. This technology has proven its efficacy in detecting early molecular-level therapeutic responses before any morphological changes become apparent. In this exhibition, we delve into the basic principles of 23Na-MRI technology and explore its potential for clinical application as a non-invasive diagnostic tool, specifically in the field of gynecology.The teaching points of this exhibit are: 1. The basic principles of 23Na-MRI technology.2. The potential of 23Na-MRI for clinical application as a non-invasive diagnostic tool, specifically in the field of gynecology.

### TABLE OF CONTENTS/OUTLINE

A. The basic principles of 23Na-MRI technology and its limitations.B. Actual 23Na-MRI images of various gynecological conditions including benign and malignant, along with interpretations of their findings.

# Abstract Archives of the RSNA, 2024

PDEE

**Pediatric Imaging Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## PDEE-1 RAPID MRI FOR PEDIATRIC ACUTE ABDOMINOPELVIC PAIN IN THE EMERGENCY DEPARTMENT: A REVIEW OF IMAGING TECHNIQUE, IMPLEMENTATION, AND DIAGNOSES

**Awards**
**Certificate of Merit**

Rama S. Ayyala, MD (*Abstract Co-Author*) Nothing to Disclose
Gary R. Schooler, MD (*Abstract Co-Author*) Nothing to Disclose
Cara E. Morin, PhD (*Abstract Co-Author*) Nothing to Disclose
Justine M. Kemp, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine N. Epstein, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After reviewing this education exhibit, the learner will have an improved understanding of:1- How to implement a rapid MRI protocol for acute abdominopelvic pain in pediatric patients2- Benefits and limitations of rapid MRI in comparison to other imaging modalities in the emergent setting3- Most common etiologies of pediatric abdominopelvic pain encountered in the emergency department

### TABLE OF CONTENTS/OUTLINE

1- Background, including indications and protocol for emergent rapid MRI:a. Review of MRI sequence options, suggested protocol, and strategies for successful service line implementationb. Review advantages and limitations of rapid MRI, including scenarios where other modalities such as ultrasound and CT provide necessary alternative or supplemental informationc.c. Presentation of clinical and imaging algorithms for acute abdominopelvic pain in pediatric patients incorporating rapid MRI2- Case based approach of emergent pediatric diagnoses, including:a. Acute appendicitis (uncomplicated and complicated), ovarian torsion, tubo-ovarian abscess, pyelonephritis, omental infarction, pancreatitis, colitis, and abdominopelvic massesb. Imaging mimics and potential pitfalls3- Summary: Take home points

## PDEE-10 PEDIATRIC BRAIN TUMORS: A GENETIC AND IMAGING SYNOPSIS

Vivek B. Pai, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias W. Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Manohar M. Shroff, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Aaditeya Jhaveri, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The 2021 WHO CNS tumor classification has undergone changes in terms of nomenclature with introduction of new tumor entities. 2. Tumors are increasingly defined by the its genetics, rather than imaging features alone. 3. Understanding the genetic landscape is essential in predicting tumor behavior, especially with the advent of improved chemotherapy.

### TABLE OF CONTENTS/OUTLINE

• Review the 2021 WHO classification of CNS tumors• Discuss genetic pathways of pediatric CNS tumors• Describe imaging features of pediatric CNS tumors with emphasis on the recently added/updated tumors, including, but not limited to:A. High Grade Gliomas: Diffuse midline glioma H3 K27-altered, diffuse hemispheric glioma H3 G34-mutant, Diffuse pediatric-type high-grade glioma H3-wildtype/ IDH-wildtype, Infant-type hemispheric glioma. B. Low-grade diffuse gliomas: Diffuse astrocytoma, MYB or MYBL1-altered, Polymorphous low-grade neuroepithelial tumor of the young, Diffuse low-grade glioma MAPK pathway altered. C. Circumscribed astrocytic gliomas: High-grade astrocytoma with piloid features, Astroblastoma MN1 -altered D. Glioneuronal and neuronal tumours: Diffuse glioneuronal tumor with oligodendroglioma-like features and nuclear clusters, Myxoid glioneuronal tumor, Multinodular and vacuolating neuronal tumor, Diffuse leptomeningeal glioneuronal tumor E. Embryonal tumours: Medulloblastoma, Atypical teratoid/ rhabdoid tumour F. Ependymal tumours: Supratentorial and posterior fossa Ependymomas

## PDEE-12 A MULTIFACETED THREAT: CNS AND SPINE MANIFESTATIONS IN PEDIATRIC LEUKEMIA

Kathleen Schenker, MD (*Abstract Co-Author*) Nothing to Disclose
Ashrith Kandula (*Presenter*) Nothing to Disclose

### TEACHING POINTS

· Pediatric leukemia can involve the central nervous system (CNS) and spine through direct infiltration, opportunistic infections, and treatment-related complications.· Recognizing the diverse CNS and spine manifestations is crucial for prompt diagnosis and effective management.· This presentation will

equip radiologists with the imaging features of these complications.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: Epidemiology and Significance of CNS/Spine Involvement in Pediatric Leukemia2. Direct Infiltration by Leukemic Cells2.1 Chloroma (Granulocytic Sarcoma)2.2 Orbital Leukemic Infiltrate3. Infectious Complications3.1 Invasive Aspergillosis 3.2 Rhizomucor Pusillis Infection 3.3 Rothia Meningitis 3.4 Invasive Fungal Sinusitis4. Treatment-Related Toxicities4.1 Methotrexate Neurotoxicity 4.2 Posterior Reversible Encephalopathy Syndrome (PRES) 4.3 Mineralizing Vasculopathy5. Vascular Complications5.1 Blastic Hyperleukocytosis 5.2 Septic Emboli 5.3 Venous Sinus Thrombosis 5.4 Thromboembolic Strokes 5.5 Retinal Hemorrhages6. Long-Term Sequelae6.1 Radiation-Induced NeoplasmsResults: We will present a series of cases highlighting the imaging features and clinical course of each entity. The discussion will emphasize the importance of a multidisciplinary approach, including clinical presentation, laboratory findings, and neuroimaging, for accurate diagnosis and timely intervention.Conclusion: CNS and spine involvement represent a complex challenge in pediatric leukemia. Recognizing the diverse etiologies and their characteristic imaging patterns is crucial for prompt diagnosis and effective management, ultimately improving patient outcomes.

## PDEE-13 BE PREPARED: IT'S NOT BECAUSE IT'S RARE THAT IT WON'T HAPPEN! WHAT THE RADIOLOGIST NEEDS TO KNOW ABOUT SPONTANEOUS BILIARY PERFORATIONS IN CHILDREN

Lisa Suzuki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Silvia Maria S. Rocha (*Abstract Co-Author*) Nothing to Disclose
Jorge Mesquita, MD (*Abstract Co-Author*) Nothing to Disclose
Luisa L. Faria, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Alves (*Abstract Co-Author*) Nothing to Disclose
Elisa M. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Alves Tavares, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Spontaneous biliary perforations (SBP) are rare but an important cause of surgical jaundice in pediatrics and one of the most common causes of acute abdomen in children, most often diagnosed at the stage of biliary peritonitis. They are known to affect the extra hepatic biliary tree and occasionally, the intrahepatic ducts. This is one of the most common cause of surgical solution jaundice in neonates. And most cases present between the 2nd and 6th weeks of life, more seen under 4years of age. Preoperative diagnosis is very challenging for the radiologist and surgeon, and that is why they need to be aware of SBP as a differential diagnosis of acute abdomen in childhood, because an early diagnosis and efficient surgical management can improve the prognosis and also save the child's life. Most children who present with SBP in infancy are typically previously healthy infants with unremarkable birth and perinatal histories. The actual etiopathogenesis is unknown. Congenital weakness of the common hepatic duct, trauma, choledochal cyst, viral infection, acalculous cholecystitis are all believed to be involved, among other causes. The presenting symptoms are usually benign and non-specific, unless there is a superimposed bacterial peritonitis. However, over a period of hours, days or even weeks, the patients might gradually develop a progressively abdominal distension, jaundice, peritonitis, septicemia, and symptoms of biliary tract disease.

**TABLE OF CONTENTS/OUTLINE**

General aspects of Spontaneous Biliary Perforations- Etiology- Prognosis- Imaging Diagnosis Summary

## PDEE-14 ENDOBRONCHIAL LESIONS IN THE CHILDREN: RADIOLOGIC-BRONCHOSCOPIC-PATHOLOGIC CORRELATION

David M. Biko, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Hansel J. Otero, MD (*Abstract Co-Author*) Nothing to Disclose
Jordan B. Rapp, MD (*Abstract Co-Author*) Nothing to Disclose
Aoife Corcoran (*Abstract Co-Author*) Nothing to Disclose
Ammie M. White, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph Piccione (*Abstract Co-Author*) Nothing to Disclose
Ankita Chauhan, MD, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Illustrate the imaging spectrum of endobronchial pathologic entities in children 2. Discuss benign and malignant lesions and identify imaging features that can help differentiate them 3. Understand the radiologist’s role in recognizing endobronchial pathology to aid appropriate treatment

**TABLE OF CONTENTS/OUTLINE**

Goals and objectives Background • Endobronchial lesions are sporadic in children• Endobronchial obstruction often presents with wheezing, persistent cough, recurrent fever, and hemoptysis• Obstructive symptoms occur when the mass occludes more than half the airway lumen and result in respiratory distress• Because these lesions are rare and symptoms are nonspecific, these entities are often initially misdiagnosed as asthma or pneumoniaPathologic entities • Foreign body, mucus impaction, mucoepidermoid carcinoma, inflammatory myofibroblastic tumor, carcinoid, laryngotracheal papillomatosis, mycobacterium avium-intracellulare granuloma, pyogenic granulomaImaging and Bronchoscopic Findings• Infants may present with segmental hyperinflation or persistent lobar consolidation on chest radiograph• CT findings may have specific imaging features or may need further assessment with bronchoscopy• Bronchoscopic assessment and excision/biopsy remain primary diagnostic and interventional toolsPathologic CorrelationSummary • Knowledge of characteristic imaging features aids the radiologist in making the correct diagnosis and prevents treatment delays

## PDEE-15 NONE, ONE, TWO OR THREE BALLS? SCAN, COLOR AND GO FOR IT!

Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

* Sonography serves as an optimal and often sole modality for imaging scrotal disorders in children. It boasts high accuracy, widespread availability in most institutions, safety, and does not necessitate sedation. * It is imperative to consider clinical symptoms during the examination, such as non-palpable testicles or the presence of one or multiple palpable nodules. * Achieving an accurate diagnosis hinges on distinguishing between painful and non-painful pathologies of the scrotum and inguinal region.

**TABLE OF CONTENTS/OUTLINE**

* Review of Sonographic Techniques: Gray-Scale and Doppler Appearance of the Pediatric Scrotum * Systematic Approach to Sonographic Imaging * Cases of Scrotal Disorders in Children: Cryptorchidism and Testicular Ectopia, Different Types of Hydrocele, Hydatid Torsion, Hyperplasia of the Rete

Testis, Splenogonadal Fusion, Polyorchidism, Meconium Peritonitis, and Testicular Neoplasms * Imaging Modalities: Gray-Scale and Doppler Ultrasound

## PDEE-16 ANOMALOUS PANCREATICOBILIARY JUNCTION ON MRCP ASSOCIATED WITH CHOLEDOCHAL CYSTS: SPECTRUM OF IMAGING FINDINGS IN CHILDREN

Abhay S. Srinivasan, MD (*Abstract Co-Author*) Nothing to Disclose
Michael R. Acord, MD (*Abstract Co-Author*) Nothing to Disclose
Rebecca Dennis, DO (*Abstract Co-Author*) Nothing to Disclose
Youck Jen Siu Navarro, MD (*Abstract Co-Author*) Nothing to Disclose
Sudha A. Anupindi, MD (*Abstract Co-Author*) Nothing to Disclose
Shyam Sunder B. Venkatakrishna, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ankita Chauhan, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In anomalous pancreaticobiliary junction (APBJ), the pancreatic and bile ducts join outside the duodenal wall to form a long common channel. APBJ is associated with raised amylase and lipase levels in the duct fluid. Obstructive cholangiopathy is a common cause of cholestatic jaundice in infants with APBJ, as it is found in patients with choledochal cysts, particularly Todani types I and IV. In older children with APBJ, the symptoms are related to cholangitis and pancreatitis. Relatively long common channel is a major risk factor for the development of cholangiocarcinoma in adulthood, so timely excision reduces morbidity and mortality. Teaching Points 1. Understand the pathophysiology behind pancreaticobiliary junction anomalies. 2. Learn the classification of junctional anomalies in children. 3. Illustrate the imaging spectrum of anomalous pancreaticobiliary junction in children with choledochal cysts. 4. Learn how to measure the length of the common channel.

### TABLE OF CONTENTS/OUTLINE

-Background information on APBJ and imaging findings on Magnetic Resonance Cholangiopancreatography (MRCP). -Normal pancreaticobiliary ductal anatomy -Pancreaticobiliary maljunction (definition, pathophysiology, demographics) -Correlation with endoscopic retrograde cholangiopancreatography (ERCP) and with surgical findings -Choledochal cyst (Todani classification) and APBJ in choledochal cysts with exemplary cases - Recommended treatment guidelines and role of surveillance imaging - Summary

## PDEE-17 IT' S A DSD! - KEEP CALM, DON'T PANIC AND FOLLOW THE TRACK

Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatiana M. Fazecas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Disorders of sexual differentiation often induce anxiety among both the infant's family and the attending physicians tasked with evaluating infants presenting with genital abnormalities. It is imperative for radiologists to possess a thorough understanding of the DSD classification system. In cases involving newborns with ambiguous genitalia, pediatric radiologists are frequently consulted to conduct ultrasonography (US) examinations aimed at addressing various anatomical inquiries. Employing a systematic approach to initial sonographic imaging enables comprehensive assessment of critical genitourinary structures, pivotal for guiding diagnostic and clinical interventions. An organized ultrasonographic (US) methodology is indispensable for evaluating several structures, including those originating from the Müllerian ducts (uterus and upper vagina), discerning the type of gonad (testes, ovaries, ovotestes, or streak gonads), assessing the distal vagina, and examining the adrenal glands.

### TABLE OF CONTENTS/OUTLINE

1) DSD Classification System 2) Systematic Approach to Initial Sonographic Imaging 3) Different Cases of DSD: DDS 46 XX (CAH, testicular); DDS 46 XY (ovotestis, gonadal dysgenesis, androgen insensitivity); Ovotestis DDS 4) Imaging Modalities: Abdominal and Pelvic Ultrasound; Transperineal Ultrasound; Genitography

## PDEE-19 TINY TITANS : EYE-VENTURES IN PAEDIATRIC ULTRASOUND

Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Ayushi Gupta, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Paediatric ocular ultrasound(US) plays a pivotal role in assessing eye health by focusing on anatomy, imaging techniques, and distinguishing between normal and abnormal conditions.US aids in differential diagnosis by assessing lesion morphology, distinguishing between solid and cystic masses, and detecting features such as calcifications, hemorrhage, retinal/choroid detachments, or foreign bodies. Color Doppler US proves useful in suspected cases of vascular, inflammatory, or neoplastic lesions.Congenital and acquired ocular conditions can be accurately diagnosed through US, spanning from irregular globe size to atypical morphological features. US reveals distinctive echoes for pathologies within the vitreous, such as hemorrhage or infection, and delineates detachment types like retinal detachment or choroid detachment with characteristic lines. It also identifies posterior wall masses, primarily retinoblastoma.Paediatric ocular US is a non-invasive adjunct to clinical assessment, especially in cases where traditional visualization methods are compromised.

### TABLE OF CONTENTS/OUTLINE

Learning normal anatomy of the paediatric globe and protocol based US to distinguish between normal and abnormal conditions.To review the congenital and acquired ocular pathology in the paediatric age group and to explain its most characteristic US findings.Distinguishing solid and cystic masses, and features such as calcifications, haemorrhage, retinal/choroid detachments, or foreign bodies.Distinguishing different kinds of haemorrhages involving eye.

## PDEE-2 THE CHALLENGING ULTRASONOGRAPHIC FINDINGS OF NEONATAL AND PEDIATRIC COW'S MILK PROTEIN ALLERGY (CMPA)

Yoshino Tamaki Sameshima, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
MARCIA W. MATSUOKA, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Romano, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Inflammatory and infectious intestinal diseases lead to a thickening of the intestinal wall, which can be detected using gray-scale ultrasound.- Color Doppler ultrasound can detect increases in vascular flow in the intestinal wall if there is active inflammation.- Intestinal pneumatosis is a potentially serious condition in neonatal and pediatric settings and may be associated with hepatic portal venous gas.- Although these findings are non-specific, they may be an expression of CMPA and should always be evaluated in the clinical context, particularly in the context of cow's milk protein exposure.

**TABLE OF CONTENTS/OUTLINE**

- Providing a multimodality-based didactic review of the main topics of cow's milk protein allergy (CMPA) including: pathophysiology, diagnostic evaluation, clinical presentations and ultrasonographic findings.- Preparation of a practical guide on how to perform an evaluation, in which the patterns of the structures and their clinical relevance are presented and discussed.- Correlating the findings with the differential diagnosis in the context of the emergency department.Outline: Ultrasonography can be routinely used to diagnose and monitor changes associated with CMPA. The increasing incidence of pediatric cases of CMPA in our Institution prompted us to present this work, to raise awareness of the various sonographic presentations, from the simplest to the most complex, emphasizing the systematic evaluation of the abdomen with special attention to the intestinal loops.

## PDEE-20 FROM PIROUETTES TO PATHOLOGIES: RECOGNIZING COMMON FOOT AND ANKLE INJURIES AMONG YOUNG FEMALE BALLET DANCERS

Sarah D. Bixby, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Jade Iwasaka-Neder, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Megan Kenway, MD (*Abstract Co-Author*) Nothing to Disclose
Nikhil Gupta, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Robert Freund, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Review relevant anatomy of the foot, ankle, and distal lower leg.; Review common imaging modalities used to assess traumatic injuries of young ballet dancers.; Demonstrate common injury patterns in the foot, ankle, and lower leg along with their mechanism of injury, including both acute and chronic conditions related to excessive turnout and dancing en pointe.; Understand the mechanism of the injury and management options that enable return to dance.

**TABLE OF CONTENTS/OUTLINE**

- Normal Anatomy
- Labeled Diagram of relevant normal foot/ankle anatomy
- Common static ballet positions and dynamic ballet movements and associated patterns of injury
- Impact of turnout and en pointe on the dancer's foot
- Imaging modalities and common imaging indications
- Plain Radiographs, Computed Tomography, Magnetic Resonance Imaging.
- Fractures
- Dancer's Fracture (5th metatarsal)
- Midfoot Fractures including the "Nutcracker" fracture
- Distal Phalanx Fractures
- Ligamentous Injuries
- Deltoid Ligament
- Anterior Talofibular Ligament
- Lisfranc Ligament
- Tibiofibular Ligament
- Impingement Syndromes
- Anterior Ankle Impingement
- Posterior Ankle Impingement "Dancer's Heel"
- Tendon Abnormalities
- Flexor Hallucis Longus Tendon Tenosynovitis "Dancer's Tendinitis"
- Posterior Tibialis/Plantaris strain/tear
- Achilles Tendon strain/tear
- Peroneus Brevis/Longus strain/tear
- Stress Reactions
- Metatarsals
- First MTP Sesamoid
- Midfoot (Cuboid, Navicular)
- Tibia/Fibula
- Other/Misc.
- Plantar Fasciitis
- Morton Neuroma
- Hallux Valgus
- "Spotty Bone Marrow" (SBM) pattern in tarsal bones

## PDEE-21 EXPLORING FETAL CERVICAL MASSES: UNDERSTANDING INTERPRETATIONS AND PROGNOSTIC INSIGHTS

Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Ultrasound serves as the main screening modality for cervical masses. MRI complements ultrasound by confirming diagnosis and assessing prognosis. Virtual navigation, US and MRI reconstruction may helps in postnatal surgical planning. The primary masses encountered in the fetus include lymphatic malformation, goiter, cervical teratoma, brachial cysts and hemangioma. The main differential diagnosis are meningocele and occipital encephalocele.

**TABLE OF CONTENTS/OUTLINE**

1) Fetal Cervical Pathologies a. Benign and Malignant Masses b. Lymphatic System Malformations c. Primary Sites 2) MRI and Ultrasound Findings a. Main Features b. Differential Diagnoses c. Pitfalls 3) Application of Virtual Navigation in Diagnosis and Prognosis 4) Prognostic Indicators of the Pathologies

## PDEE-22 CONGENITAL NEUROBLASTOMA: A PATHOLOGY TO BE REMEMBERED

Yoshino Tamaki Sameshima, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
MARCIA W. MATSUOKA, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Merigue, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Demonstrate through ultrasonographic exams the regression of congenital neuroblastoma cases in the adrenal glands, as well as secondary hepatic metastasis to congenital neuroblastoma- Show ultrasonographic images of possible differential diagnoses of this pathology (adrenal hemorrhage, pulmonary sequestration, and congenital adrenal hyperplasia)-Demonstrate the importance of routine evaluation not only of the adrenal gland but also the adrenal fossa for early detection of possible lesions.

**TABLE OF CONTENTS/OUTLINE**

INTRODUCTION- Epidemiology- Anatomy- Ultrasonographic techniqueCASE-BASED REVIEW- Congenital neuroblastoma cases with spontaneous involution- Differential diagnosesFINAL CONSIDERATIONSREFERENCES

## PDEE-23 EMPOWERING PEDIATRICS: LEVERAGING WHOLE-BODY DIFFUSION-WEIGHTED MAGNETIC RESONANCE IMAGING FOR VULNERABLE POPULATIONS

Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor M. Sardenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre C. Valim, MD (*Abstract Co-Author*) Nothing to Disclose
Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernanda P. Philadelpho, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Whole-Body Diffusion-Weighted Magnetic Resonance Imaging (WB-DW-MRI) represents a sensitive imaging modality devoid of ionizing radiation, capable of providing comprehensive whole-body coverage with superior soft tissue contrast and spatial resolution within a condensed timeframe. WB-DW-MRI proves invaluable in assessing various disease processes affecting the vulnerable pediatric population, encompassing cancer diagnosis and staging, disseminated infections, metabolic and idiopathic disorders, systemic rheumatologic conditions, congenital anomalies, inherited diseases, immunodeficiency disorders, and tumor predisposition syndromes. WB-DW-MRI is adept at detecting and characterizing multifocal or systemic diseases, particularly aiding in the diagnosis of challenging conditions where consensus among a multidisciplinary team of healthcare professionals may be lacking. It serves as a cost-effective diagnostic imaging method facilitating accurate diagnosis, therapeutic monitoring, and informed treatment decisions. This is particularly pertinent in the context of the vulnerable pediatric population, effectively minimizing unnecessary procedures.It is imperative to employ the optimal protocol for each disease to ensure accurate diagnosis and differential diagnosis.

**TABLE OF CONTENTS/OUTLINE**

Imaging Diagnosis in Underserved Areas of Brazil;Whole-Body Diffusion-Weighted Magnetic Resonance Imaging Technique;Diagnosis of Challenging Diseases • Inflammatory (Chronic Nonbacterial Osteomyelitis, Juvenile Idiopathic Arthritis, Polyarteritis Nodosa) • Idiopathic (Sarcoidosis, Rosai-Dorfman) • Metabolic (Hypovitaminosis - Scurvy, Alimentary Selectivity Autism)

## PDEE-24 UNDERSTANDING FACIAL CLEFTS

Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Lisa Suzuki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Maira Sarpi, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta C. Andrade, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The aim of this study is to revisit the classification system of craniofacial clefts proposed by Tessier in 1976. Until then, there had been a variety of nomenclatures, and some authors had attempted to standardize them. Tessier's classification is considered the main reference because of its simplicity and applicability.Although this classification system is based on clinical and surgical observation, many of the features can be explained by embryological and anatomical factors. The most accepted theory relates to disturbances in the formation or fusion of facial processes, but the molecular mechanism is partly understood.The Tessier classification involves numbering the facial clefts from 0 to 14 based on their location in two areas: the orbit/eyelid and the jaw/lips.They can also occur in combination and skeletal and soft tissue clefts do not necessarily coincide.Radiologists should be able to recognize these facial deformities and their associated findings to improve the diagnosis and surgical decision making. knowledge of this system will then allow for consistent professional communication. This manuscript outlines the Tessier classification using imaging examples to illustrate this system and to contribute to its memorability due to the rarity of some findings.

**TABLE OF CONTENTS/OUTLINE**

1. Embryological theory and anatomy 2. Tessier classification 3. CT imaging examples and main descriptors 4. Related findings

## PDEE-25 UNVEILING DEVELOPMENTAL ENIGMAS: IMAGING EMBRYOLOGIC VARIANTS AND ANOMALIES IN THE SELLAR AND SUPRASELLAR REGION

Deepali Bhalla (*Abstract Co-Author*) Nothing to Disclose
Rajan P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Rohan Samant, MBA (*Abstract Co-Author*) Nothing to Disclose
Manav Bhalla, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The sellar and suprasellar region is a complex anatomical space harboring critical structures vital for endocrine regulation. Embryonic development plays a pivotal role in shaping the intricate anatomy of this region. Understanding the embryologic variants and anomalies of this region is paramount for accurate diagnosis and management. Variations in the development of Rathke's pouch, the infundibulum, and adjacent structures during embryogenesis can lead to a spectrum of anomalies, ranging from benign variations to clinically significant pathologies. Imaging serves as indispensable tools for the evaluation of these anomalies, in particular, detailed visualization of the pituitary gland, hypothalamus, optic chiasm, and surrounding structures, facilitating precise anatomical delineation and pathological characterization.

**TABLE OF CONTENTS/OUTLINE**

I. Importance of understanding embryologic variants and anomalies in the sellar and suprasellar region. II. Embryologic Basis of Sellar and Suprasellar Anomalies - Developmental origins of key structures: Rathke's pouch and infundibulum; Embryonic structures in the sellar and suprasellar region; Variations and anomalies arising from embryologic development III. Clinical Significance of Sellar and Suprasellar Anomalies -Effects on endocrine regulation and neurovascular function; Clinical presentation and diagnostic challenges IV. Imaging Modalities for Evaluation - Role of MRI in anatomical characterization; Utilization of CT; Advanced MRI techniques V. Diagnostic Challenges and Considerations - Pitfalls and limitations of imaging modalities; Importance of integrating clinical and radiological findings

## PDEE-27 IMAGING APPEARANCE OF CSF SHUNTS AND THEIR COMPLICATIONS

Shehanaz K. Ellika, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew Koh, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah Mohajeri Moghaddam, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Pranay Rao, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• A wide variety of treatment options exist for both temporary and permanent CSF diversion. • CSF shunt catheters are composed of several components including a proximal catheter, reservoir, valve, and distal catheter. • Shunt malfunction can be categorized by early and late complications. • Imaging plays an important role in assessment of shunt malfunction. • Comparison with prior imaging clinical history is key. • Ventricular shunting can result in brain calavarial changes which are also well evaluated on imaging studies.

**TABLE OF CONTENTS/OUTLINE**

• CSF Diversion o Temporary measures o Permanent measures • Shunt components • Imaging of CSF shunts • Shunt complications o Early: Tip misplacement, tip migration, infection, shunt disconnection, etc. o Late: Fracture, pseudocyst, shunt calcification, shunt erosion, over drainage, etc. • Brain calvarial changes related to ventricular shunting

## PDEE-28 ORBITAL MANIFESTATIONS OF SYNDROMIC DISEASES

Karen Moeller, MD (*Abstract Co-Author*) Nothing to Disclose
Livja Mertiri (*Abstract Co-Author*) Nothing to Disclose
Thierry Huisman, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Huy D. Tran, MD (*Abstract Co-Author*) Nothing to Disclose
Rajan P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Oswaldo Guevara Tirado, MD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- List rare syndromic disorders that may affect the orbit.- Outline a systemic approach for evaluating the orbits and surrounding structures to assist in the identification of rare syndromic diseases.- Illustrate and describe the unique optic imaging features of rare syndromic diseases.

**TABLE OF CONTENTS/OUTLINE**

Rare syndromic diseases can be particularly difficult to diagnose, especially when they present with a wide variety of symptoms and clinical findings. However, imaging of the orbit and the surrounding structures can significantly aid in narrowing down the differential diagnoses. Adopting a systematic approach when evaluating the eye involves assessing the globe, optic nerve, extraocular muscles, vascular structures, and the intracranial, maxillofacial, and temporal bone regions. Subsequent visualization of anomalies such as size discrepancies, hemorrhages, and other defects can be crucial in arriving at the correct diagnosis and improving patient care.1. Introduction Objectives2. Epidemiology3. Systemic approach for orbit evaluation among rare neurological diseases4. Case examples of syndromic diseases and their manifestations· CHARGE Syndrome· Tuberous Sclerosis· Leptin Deficient Lipodystrophy Syndrome· Norrie Disease· Septo-Optic Dysplasia· Neurofibromatosis Type 1· Kearns-Sayre Syndrome· Congenital Cranial Dysinnervation Disorders (CCDD)· Sturge-Weber Syndrome· Von-Hippel Lindau· Blue Rubber Bleb Nevus Syndrome· Terson Syndrome· PHACES Syndrome· Parry-Romberg Syndrome· Goldenhar Syndrome· Encephalocraniocutaneous Lipomatosis· Walker-Warburg Syndrome5. Conclusion

## PDEE-29 WHAT IS THIS UNEXPECTED LUMP? IMAGING EVALUATION OF LUMPS AND BUMPS IN THE PEDIATRIC PATIENT

Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
MARCIA W. MATSUOKA, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Yoshino Tamaki Sameshima, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review common lumps and bumps in children and suggest a practical initial sonographic approach. Emphasize ultrasound (US) imaging as a safe and commonly used method for evaluating these lesions, often the first diagnostic study requested. Recommend optimal imaging techniques, such as using high-frequency linear transducers for superficial lesions and lower-frequency probes for deeper structures. Emphasize the importance of Doppler imaging for a comprehensive evaluation of soft tissue masses, confirming the vascular, cystic, or solid nature of a mass and aiding in further characterization.Recognize the limitations of ultrasound and acknowledge that in some cases, further evaluation with MRI or CT, biopsy, or surgical excision may be required for an accurate diagnosis.

**TABLE OF CONTENTS/OUTLINE**

This educational exhibit describes the sonographic imaging appearance of the most common lumps and bumps at a tertiary hospital in Sćo Paulo. We divided them into categories:CONGENITAL (branchial cleft cyst, thyroglossal duct cyst, undescended testis; VASCULAR ANOMALIES (vascular tumors (e.g. hemangioma); Vascular malformations (e.g. lymphatic malformations); INFECTION (abscess, retained foreign body; myiasis; TRAUMATIC INJURY (hematoma and muscle injury; subgaleal hematoma; fibromatosis colli; fracture; subcutaneous fat necrosis of the newborn; LYMPH NODES (reactive lymphadenopathy; Bacille Calmette-Guérin (BCG) lymphadenitis; Malignant lymphadenopathy (lymphoma); BREAST LUMP (physiologic neonatal breast enlargement; Gynecomastia; SKIN AND SOFT TISSUE (epidermoid Cyst; Lipoma; Baker's Cyst; HERNIAS (Hernia of the Nuck Canal; Umbilical Hernia; Inguinal Hernia).

## PDEE-3 PEDIATRIC RHABDOMYOSARCOMA FROM HEAD TO TOE: A COMPREHENSIVE ANALYSIS OF IMAGING FINDINGS

Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
Suheyla P. Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshino Tamaki Sameshima, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Romano, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Rhabdomyosarcoma is a malignant tumor with morphology resembling skeletal muscle cells.- Imaging findings are nonspecific and indistinguishable from other sarcomas. The tumor’s anatomic location and demographic data of the patient are more useful for narrowing the differential diagnosis.- Up to 20% of patients with rhabdomyosarcomas present with metastases at the time of diagnosis (typically in the lungs and bone marrow).

**TABLE OF CONTENTS/OUTLINE**

Table of contents:- Establishing the importance and effectiveness of accurate evaluation of rhabdomyosarcoma.- Review imaging findings across various examination modalities (MRI, CT, US, PET-CT) for different anatomical systems (head and neck, abdomen and musculoskeletal).- Creation of a practical guide for conducting an evaluation, including the necessary variables for follow-up.- Illustrating these conditions based on cases from our radiology group.Outline: Imaging modalities have played a decisive role in the localization of rhabdomyosarcomas. Assessing the local extent of the tumor is an essential aspect of radiological evaluation and has a direct impact on treatment. Detecting invasion of adjacent structures, considering the involvement of critical anatomical structures, and metastatic spread are fundamental to staging the disease and determining appropriate treatment strategies, be it surgical resection, radiotherapy, or a combination of these procedures.The correlation between radiological findings and histopathological characteristics is a noteworthy aspect of our discussion. Understanding how imaging features align with underlying pathology can help refine diagnostic criteria and predict tumor behavior.

## PDEE-30 FOLLOW THE PATH: A SYSTEMATIC APPROACH TO THE LINEAR AND RETICULAR PATTERN ON CHEST COMPUTED TOMOGRAPHY IN PEDIATRIC PATIENTS

Luisa L. Faria, MD (*Abstract Co-Author*) Nothing to Disclose
Deborah Y. Otto (*Abstract Co-Author*) Nothing to Disclose
Lisa Suzuki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodolfo Lourenco (*Abstract Co-Author*) Nothing to Disclose
Amanda Alves Tavares, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Linear and reticular opacities constitute a radiological pattern of lung involvement that represents thickening of the pulmonary interstitium by fluid, fibrosis or infiltration by cells or other material, presenting a broad differential diagnosis. The objective of this work is to present a systematic approach for interpreting the linear and reticular pattern in chest computed tomography specifically in pediatric patients, bringing to light important, and often not well-known, differential diagnoses in this age group. The approach to learning through radiological patterns brings advantages to learning, improving diagnostic skills and expanding knowledge.This presentation aims to:(1) review the linear and reticular patterns of abnormality on chest computed tomography;(2) present a case-based and systematic approach to the linear and reticular pattern on chest computed tomography in pediatric patients.

**TABLE OF CONTENTS/OUTLINE**

- Introduction- Anatomy of the secondary lobule.- Basic chest computed tomography patterns.- Case-based and systematic approach to the linear and reticular pattern (interlobular septal thickening, centrilobular peribronchovascular interstitial thickening, peribronchovascular interstitial thickening, intralobular interstitial thickening, fissure thickening, subpleural lines)

## PDEE-31 METÁSTASIS DE RETINOBLASTOMA: MÁS ALLÁ DE LO CONVENCIONAL

Karina Marisol Gress Motiel, MD (*Abstract Co-Author*) Nothing to Disclose
Maryury Fabiola Pineda Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Diana N. Nunez Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Vilma J. Varela George SR, MEd (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.- Pediatric intraocular malignancies have retinoblastoma as the most common cause. The cause is loss of function of the RB1 tumor suppressor gene, although some tumors result from amplification of the MYCN oncogene with normal RB1 genes.2.- 1 in every 16,000 births has retinoblastoma. There are no known geographic, racial or sexual preferences. Heritable retinoblastoma is diagnosed at midlife at 12 months and non-heritable disease at 24 months. 3.-Preoperative evaluation of retinoblastoma relies on magnetic resonance imaging. In addition to evaluate of tumor invasion of the ON, choroid, and sclera, all of which are high-risk features for systemic dissemination.4.- Trilateral retinoblastoma refers to the presence of intracranial tumor histologically similar to retinoblastoma in the pineal gland or suprasellar cistern in addition to bilateral ocular involvement.5.-Extraocular extension of retinoblastoma is an important risk factor for the development of distant metastases in the non-central nervous system, as it allows the tumor to access vascular and lymphatic channels .

**TABLE OF CONTENTS/OUTLINE**

1.Radiological anatomy2.Retinoblastoma generalities3.Retinoblastoma disemination pathwaysa) Intracraneal spaceb)Trilateral retinoblastomac)Tetralateral retinoblastomad)lymphatic routese)Hematogenous via4.Factors that increase the risk of progression5.Unusual Cancer Spread6.Estadification system

## PDEE-32

Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshino Tamaki Sameshima, MD (*Abstract Co-Author*) Nothing to Disclose

## HOW CAN WE HELP IN THE MANAGEMENT OF PRECOCIOUS PUBERTY? CLINICAL APPROACH AND THE ROLE OF IMAGING - A GUIDE FOR THE RADIOLOGIST

Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
Yago F. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Bolsi, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This article aims to: 1 - Review the definition of precocious puberty, its clinical and laboratory findings, as well as aspects related to the treatment and follow-up of patients. 2 - Demonstrate the role of radiological exams such as hand and wrist x-ray, pelvic ultrasound and pituitary MRI in the diagnosis and follow-up of the disease, showing several cases of precocious puberty, correlating the different imaging methods used for diagnosis.

**TABLE OF CONTENTS/OUTLINE**

1 - To provide a complete review o precocious puberty, starting with its definition, its clinical and laboratory findings, showing the way to correctly identify and diagnose the disease and its subtypes, as well as the hormonal profiles that can be identified in its various spectrums and the main types of treatment currently available. 2 - Discuss the main radiological exams used for diagnosis and follow-up, including hand and wrist x-ray for estimating bone age, showing how the exam is performed and interpreted, what should be assessed for the calculation, as well as the main classification methods (Greulich-Pyle and Tanner-Whitehouse) and also show new techniques. 3 - Demonstrate the importance of pelvic ultrasound in the assessment of patients with suspected precocious puberty, reviewing the main changes related to hormonal stimulation and how this affects the female sex organs and pituitary MRI in the evaluation of central origin precocious puberty.

## PDEE-33 3D IMAGING IN MüLLERIAN DUCT ANOMALIES: WHAT THE SURGEON WANTS TO KNOW

Sunit Davda, MBBS, MRCP (*Abstract Co-Author*) Nothing to Disclose
Amanda R. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Kantheera Leesmidt, MD (*Abstract Co-Author*) Nothing to Disclose
Jesse L. Courtier, MD (*Abstract Co-Author*) Founder, Sira Medical, Inc;Consultant, Sira Medical, Inc
Sloane Berger-Chen (*Abstract Co-Author*) Nothing to Disclose
Jocelyn Cheng, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Müllerian duct anomalies (MDA) have important implications on the reproductive health of female children. MDAs are frequently associated with other congenital anomalies of the cervix, vagina, or urinary tract, and are a common cause of infertility and pregnancy loss after adolescence. The purpose of this educational exhibit is to: (1) Review the embryology, classification, imaging features of Müllerian duct anomalies (2) Review the indications and techniques for surgical management of Müllerian duct anomalies in pediatric patients (3) Provide specific cases and clinical courses of patients with specific Müllerian duct anomalies (4) Allow learners to test their knowledge with a quiz.

**TABLE OF CONTENTS/OUTLINE**

Using original images and figures from our institution, this exhibit will review the role of MRI in detecting, classifying and guiding surgical management of Müllerian duct anomalies in children. (1) Introduction: Review the embryology, classification, imaging features and treatment options of Müllerian duct anomalies (2) Indications/contraindications to surgical management of Müllerian duct anomalies (3) Procedure and techniques for surgical management of Müllerian duct anomalies (4) Case review of patients with specific Müllerian duct anomalies (5) Allow learners to test their knowledge with a quiz.

## PDEE-34 IMAGING OF THE NEONATAL BRAIN: HYPOXIC ISCHEMIC ENCEPHALOPATHY AND BEYOND

Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Vivek B. Pai, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. MRI is a key step in the evaluation of neonatal encephalopathy 2. MR imaging of the neonatal brain relies on optimized protocols and neonate-specific MR hardware 3. A myriad of etiologies cause bilateral brain injury in neonates, clinically and radiologically mimicking Hypoxic Ischemic Encephalopathy (HIE) 4. Having a pattern-based approach is crucial in narrowing down a diagnosis

**TABLE OF CONTENTS/OUTLINE**

1. Review imaging protocols for assessment of the neonatal brain 2. Discuss the pathophysiology and imaging patterns of neonatal HIE 3. Detailed review of other causes of neonatal encephalopathy: A. Metabolic etiologies: • Molybdenum Cofactor, Sulphite Oxidase Deficiency • Urea Cycle disorder: OTC deficiency, Citrullinemia • Organic Acidopathies: Maple Syrup Urine Disease, Non-ketotic hyperglycinemia, Isovaleric aciduria, Methylmalonic acidemia • Hypernatremia • Hypoglycemia • Mitochondrial Encephalopathy: Leigh's Disease, MELAS• Peroxisomal disorders: Zellweger's Syndrome B. Infections: • TORCH • Viral: Herpes Simplex Virus Encephalitis, Parechoviral infection • Bacterial: Group B streptococcal Septicemia, Bacillus cereus. E. Coli meningitis • Fungal: Candidiasis C. Arterial and Venous Ischemia D. Malformations: Hemimegalencephaly E. Others: Abusive Head Injury

## PDEE-35 LUNG TRANSPLANT IN CHILDREN: OUR RADIOLOGICAL EXPERIENCE AND APPROACH

German Ramos Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Lopez Coello, MD (*Abstract Co-Author*) Nothing to Disclose
Luis Riera Soler, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Riaza Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. del Carpio Bellido Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Gonzalo Carballes, BMBCh (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Espinal Colominas, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Fernando Casanova Barba, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Generalities in children lung transplantation Principal causes and epidemiologyMethodsFollow-upHow CT results can substantially impact the patient's management and treatment.Normal findings in CT scanDescribe main radiological findings of short and long-term complications

**TABLE OF CONTENTS/OUTLINE**

Introductions in pediatric lung transplantation, overview, materials and methods and importance of study.Our results: Normal findings that include those related to the bronchial and vascular anastomoses. The most frequent parenchymal complications following lung transplantation including differents types of infections and acute or chronic rejection (bronchiolitis obliterans). Postoperative vascular complication that required CT angiography for diagnosis (Bleeding from the surgical bed).The most frequent posttransplantation airway complications include dehiscence as an early complication and stenosis as a long term problem. CT is useful when bronchopleural fistula is suspected.The protocol/checklist we use in our center and propose to optimal evaluate after a lung transplant in childrenConclusions:Importance of CT scan examination after lung transplantation in children for follow-up and the assessment of airway and parenchymal complications. To know the most common findings after lung transplantation and to recognize signs of complications, especially in their early stages.Importance of the role that the radiologists play to preserve the graft and ensure accurate assessment.

## PDEE-36 UNDERSTANDING PEDIATRIC NEUROINFLAMMATION: WHAT SPARKS THE FIRE?

Manohar M. Shroff, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Vivek B. Pai, MBBS, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Pediatric neuroinflammation (PN) is an expanding group of disorders presenting with symptoms ranging from mild to severe neuropsychiatric manifestations with variable levels of consciousness. 2. PN has gained traction in recent literature because of the improved understanding of pathologic / genetic triggers and ensuring inflammatory cascades, thereby enhancing therapeutic options. 3. Knowledge of the pathophysiology of these disorders forms the fundamental basis of understanding the pattern of brain injury detected on imaging. 4. Imaging findings may often be non-specific, to begin with, however, lesions may evolve within a few hours to days. A high index of suspicion, in an appropriate clinical setting is imperative to initiate prompt institution of anti-inflammatory and neuroprotective treatment measures.

**TABLE OF CONTENTS/OUTLINE**

1. Revisit key concepts of adaptive and innate immunity 2. Discuss the role of Microglia 3. Review the physiology of the blood barrier and demystify the concept of its immune privilege 4. Discuss the pathophysiology and imaging appearances of specific neuroinflammatory entities in pediatric patients: • Multiple Sclerosis • Neuromyelitis optica spectrum disorder (NMOSD) • Myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) • Rasmussen's encephalitis • Anti-NMDAR encephalitis • Opsoclonus-myoclonus ataxia syndrome (OMAS) • Acute necrotizing encephalopathy • Hemophagocytic Lymphohistiocytosis (HLH) • Langerhans cell histiocytosis • Interferonopathies / Aicardi- Goutičres syndrome

## PDEE-37 NEUROIMAGING OF PEDIATRIC CNS TUMORS IN TUMOR PREDISPOSITION SYNDROMES

Karuna V. Shekdar, MD (*Abstract Co-Author*) Nothing to Disclose
Aashim Bhatia, MS (*Abstract Co-Author*) Consultant, Guerbet SA
Mariam S. Aboian, MD, PhD (*Abstract Co-Author*) Researcher, Blue Earth Diagnostics Ltd;Researcher, Fusion Pharmaceuticals;Research collaboration, Pro Medicus Limited
Austin Moats, MD (*Abstract Co-Author*) Nothing to Disclose
Raisa Amiruddin, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Several tumor predisposition syndromes (TPS) have been described in association with common childhood CNS tumors such as medulloblastoma, Atypical Teratoid Rhabdoid Tumor, retinoblastoma, choroid plexus carcinoma etc., It is important to recognize TPS as they directly impact treatment and outcome in affected patients, and surveillance imaging in unaffected patients. We aim to illustrate neuroimaging findings in common as well as some newly described TPS presenting in childhood and the common genes/genetic pathways affected. The educational exhibit will provide trainees and practicing radiologists information on CNS tumors and TPS needed to participate in brain tumor board discussions.

**TABLE OF CONTENTS/OUTLINE**

The vast array of TPS can be an intimidating topic. Although there is overlap with TPS of CNS tumors in adults, we will describe neuroimaging entities associated with common pediatric CNS tumors. (A) Common TPS: - NF1 - NF2 - Tuberous sclerosis - Li Fraumeni - Gorlin syndrome - Rhabdoid tumor predisposition syndrome - Von Hippel Lindau - Ataxia Telangiectasia - Cowden/PTEN hamartoma tumor syndrome - DICER1 syndrome - Brain tumor polyposis syndrome 2 - RB1 - Lynch syndrome - Noonan syndrome - Constitutional Mismatch Repair Deficiency - Hereditary paraganglioma-pheochromocytoma syndrome (B) Other TPS: - Shelterin complex gene POT1 - MEN1 - Familial melanoma astrocytoma syndrome - BAP1 tumor predisposition syndrome - SMARCE1

## PDEE-38 PEDIATRIC ABDOMINAL RADIOGRAPHS -- WHEN TO WORRY

Akosua Sintim-Damoa, MD (*Abstract Co-Author*) Nothing to Disclose
Edward Harpstead (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Common exam in pediatric setting- Indications include abdominal distention, abdominal pain, nausea, and vomiting· Findings are frequently normal or nonspecific, however certain findings should cause concern and warrant further evaluation

**TABLE OF CONTENTS/OUTLINE**

Abnormal Findings on Abdominal Radiographs Misplaced Air - Pneumoperitoneum, common signs- Pneumatosis Intestinalis, primary and secondary- Pneumobilia- Portal Venous Gas- Gas in Foreign Body Dilated Bowel- Proximal bowel obstruction- Distal bowel obstruction- Paucity of bowel gas- Centralized bowel loops Calcifications- Meconium Peritonitis- Intraluminal- Neonatal Ovarian Torsion- Teratoma- Malignancy Mass Effect- Intussusception- Malignancy- Pseudocyst Osseous Abnormalities

## PDEE-39 PEDIATRIC PANCREATIC IMAGING: NAVIGATING COMPLEX LANDSCAPES

**Awards**
**Cum Laude**

Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Describe the conventional and novel imaging modalities used in the diagnosis and management of pancreatic lesions in children. Illustrate the imaging features of the most common pancreatic diseases in children including congenital, inflammatory, traumatic and neoplastic lesions. Discuss pattern-based approach for diagnosing pediatric pancreatic diseases.

**TABLE OF CONTENTS/OUTLINE**

Pancreatic embryology, normal anatomy and anatomical variants. Imaging modalities: Conventional (US-CT-MRI-MRCP-Nuclear medicine-Interventional radiology- Endoscopic US) Novel (Contrast enhanced US-Elastography (US and MR)-Dual energy CT-Photon counting CT-New radiotracers-radiomics, radiogenomics, artificial intelligence and machine learning. Special consideration about children with pancreatic diseases: Patients with pancreatic endocrine and exocrine insufficiencies (fasting duration- renal function)-Radiation and contrast precautions. Pancreatic diseases in children: Congenital (e.g. pancreatic divsium and annular pancreas), hereditary (e.g. cystic fibrosis and hemochromatosis), pancreatitis (acute-recurrent acute-chronic-others: autoimmune, drug-induced- dialysis related), traumatic and neoplastic (PRIMARY: SPEN, Pancreatoblastoma, Adenocarcinoma, NET and Lymphoma/ METASTASIS: Local extension from retroperitoneal rhabdomyosarcoma and neuroblastoma or Distant metastases). Pattern-based approach for pancreatic diseases in children. Diagnostic pitfalls and mimics of different pancreatic lesions Post-surgical imaging of the pancreas: Types of pancreatic surgeries and techniques- Expected post-operative findings- Post-operative complications imaging features.

## PDEE-4 IMAGING EVALUATION OF PEDIATRIC POSTERIOR FOSSA TUMORS - PEARLS AND PITFALLS

Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Knowledge of the updated WHO classification of tumors of the central nervous system facilitates pathologic and radiologic categorization of posterior fossa tumors 2. A fundamental understanding of key tumorigenesis pathways aids in multidisciplinary patient management discussion 3. Appropriate use and understanding of available MRI sequences in tumor work-up can narrow the differential diagnosis of posterior fossa tumors

**TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Overview of WHO classification of tumors of CNSb. MRI protocolc. Tumors - classic features, differential diagnosis, tumor genetics, pearls, pitfallsi. Pilocytic astrocytomaii. Ependymomaiii. Medulloblastomaiv. Diffuse midline gliomav. Atypical teratoid rhabdoid tumor vi. Embryonal tumor with multilayered rosettesvii. High-grade glioma - including diffuse pediatric-type, infant-typeviii. Choroid plexus tumord. Other less common posterior fossa tumors to recognize i. Pilomyxoid astrocytoma ii. Rosette-forming glioneuronal tumor iii. Lhermitte-Duclos iv. Diffuse leptomeningeal glioneuronal tumor v. Ganglioglioma vi. Hemangioblastoma vii. Schwannoma e. Cheat sheets - differentiating tumors based on T2 appearance, presence of restricted diffusion, calcification, hemorrhage, growth pattern, enhancement pattern 2. Conclusion

## PDEE-40 PEDIATRIC MENISCAL RETEARS: WHAT WE MISS AND WHAT THE SURGEON NEEDS TO KNOW FROM THE MRI

Pritish Bawa, MD (*Abstract Co-Author*) Nothing to Disclose
Indranil V. Kushare, MD (*Abstract Co-Author*) Nothing to Disclose
Lorece A. Harris (*Abstract Co-Author*) Nothing to Disclose
Megan May, MD (*Abstract Co-Author*) Nothing to Disclose
Livja Mertiri (*Abstract Co-Author*) Nothing to Disclose
Jason Amaral (*Abstract Co-Author*) Nothing to Disclose
J. H. Kan, MD (*Abstract Co-Author*) Nothing to Disclose
Oladipupo Fagbongbe (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Understand unique pediatric meniscal pathology after primary repair, and the surgeon’s approach to treatment when there is a retear. This includes but is not limited to retears of a treated lateral discoid meniscus and retears that occur in the setting of multi-ligamentous injury in children. 2. Learn how to use arthroscopic report and MRI findings to differentiate normal post-operative meniscal change from meniscal retears

**TABLE OF CONTENTS/OUTLINE**

1. Surgical approaches to meniscal repaira. Primary repair, including coverage of meniscal root repairs and menisco-capsular repairsb. Saucerization technique for discoid meniscus 2. Diagnostic search pattern for identification of a meniscal retear. A step-by-step approach a. How to read arthroscopic report: a radiologist’s perspective b. Primary repairs: how to interpret fluid or contrast interposition at primary repair site - is this a retear or normal post-op meniscus? c. Saucerization/reshaping: knowing surgeon’s objectives to help identify superimposed tearing after saucerization d. Radiologist search pattern approach to meniscus characterization of retears when there are changes related to both meniscal primary repair and saucerization 3. MR imaging gallery after meniscal repair with emphasis on great calls and humble retear misses with arthroscopic correlation with pediatric orthopaedic surgeon’s perspectives. How we can do better as radiologists? a. Complete discoid meniscus with meniscal retear after saucerization and primary repair (Case 1) b. Incomplete discoid meniscus with meniscal retear after saucerization and primary repair (Case 2) c. Meniscal retears with displacement d. Meniscal retears in setting of multi-ligamentous injury

## PDEE-41 IMAGING ASSESSMENT OF THE POST-SURGICAL TETHERED CORD, RELEVANT FINDINGS ON MRI

Valeria Morales, MD (*Abstract Co-Author*) Nothing to Disclose
Yady V. Hurtado Burbano, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Identify the general characteristics and types of dysraphisms and post-surgical tethered cord. • Illustrate the featured imaging data of the post-surgical tethered cord and the additional related and unrelated findings.

**TABLE OF CONTENTS/OUTLINE**

• An overview of dysraphisms. • Myelomeningocele, an open spinal dysraphism.• Post-surgical tethered cord. o Imaging clues to aid the diagnosis. o Classification. • Additional related and unrelated findings.

## PDEE-42 BUILDING BRIDGES: RADIOLOGICAL PERSPECTIVES ON COMMISSURAL PLAQUE

Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Rossi, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula A. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Nevena Fileva (*Abstract Co-Author*) Nothing to Disclose
Rita de Cassia M. Pincerato, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Clara Zanon Zotin (*Abstract Co-Author*) Nothing to Disclose
Aline Halla, MD (*Abstract Co-Author*) Nothing to Disclose
Saymon Dants Barbosa Oliveira (*Abstract Co-Author*) Nothing to Disclose
Mika Shibuya, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo D. Valadares, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Understand the Anatomy and Embryology of Commisural Plaque Show a protocol for evaluating commisural malformationsReview the malformations and syndromes related to Commisural PlaqueTips for evaluating fetal MRI in cases of commisural malformations

**TABLE OF CONTENTS/OUTLINE**

Anatomy and EmbryologyMRI protocol to access commissural anomaliesSpectrum of commissural abnormalitiesComplete Agenesis, Partial Agenesis, Dysgenesis, Hypoplasia, Abnormal ThickeningAnterior commissure developmental anomaly and related structuresCorpus callosum developmental anomaly and related structuresPosterior comissure developmental anomaly and related structuresDevelopment of other important related structuresAssociated intracranial anomalies in corpus callosum agenesisInterhemispheric cystNeuronal migration disordersAgenesis of inferior vermisEncephaloceleLipoma of interhemispheric fissureSyndromes Commonly Associated With Commissural AnomaliesAicardi syndromeChiari II malformationDandy Walker ContinuumShapiro SyndromePallister-KillianWalker-Warburg syndromeSepto-optic syndromeTurner syndromeNoonanMoebius syndromeJoubert syndrome HoloprosencephalyOthers SyndromesFetal MRIClinical implications of commissural anomaliesTakehome messages

## PDEE-43 LOST AND FOUND: US REVELATIONS IN THE EMPTY SCROTUM AND GROIN LUMPS. A GUIDE FOR THE RESIDENT

Manuela Laguna Kirof, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia B. Pugliese SR (*Abstract Co-Author*) Nothing to Disclose
Diana M. Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Bautista Rolla, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Pablo Tobon, MD (*Abstract Co-Author*) Nothing to Disclose
Maria E. Orozco, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The widespread use of ultrasound (US) has led to increased detection of scrotal pathology, primarily involving extratesticular alterations originating in the tunica vaginalis. The tunica vaginalis should close during embryonic development. Anomalous closure is associated with persistent processus vaginalis, hydrocele of the spermatic cord, and inguinoscrotal hernia.US facilitates the diagnosis of persistence, associated alterations, and complications. Additionally, it plays a crucial role in conservative management (follow-up) and aids in determining the need for urgent surgery.Teaching Points:Understand the anatomy of the inguinal canal and its embryology, particularly in relation to the process of testicular descent.Recognize some of the most common pathologies that can occur in the inguinal canal in pediatrics.Review practical aspects of performing ultrasound of the inguinal canal.Summarize the different ultrasound patterns observed in testicles located within the inguinal canal and those that remain undescended.Identify the different types of hydrocele in pediatrics.

**TABLE OF CONTENTS/OUTLINE**

Anatomy and embryology.Imaging description of different cases of common pathologies in the inguinal region in pediatrics.Tips and differential diagnoses.Conclusions.

## PDEE-44 SEE IT, KNOW IT, TREAT IT: IMAGING SPECTRUM OF ADNEXAL PATHOLOGIES IN THE PEDIATRIC AGE GROUP

Anand Dorai Raju, MD (*Abstract Co-Author*) Nothing to Disclose
Asif Jamal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Preet K. Sandhu, MD (*Abstract Co-Author*) Nothing to Disclose
Chinky Patel, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Adnexal pathology is frequently encountered in the pediatric age group.2. The diagnosis can be delayed or missed as younger patients often present with non-specific symptoms of abdominal pain mimicking other acute abdominal processes or due to a low index of suspicion.3. Various adnexal masses can be encountered including cysts, neoplasms, surgical emergencies, and pelvic infections.4. Ultrasound is the primary imaging modality with CT or MRI indicated for further characterization in some clinical scenarios.5. Clinical correlation with the imaging findings directs diagnosis and subsequent management of these patients.6. The radiologist should know the spectrum of adnexal disease processes that can affect the pediatric age group and their imaging appearance.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: prevalence of adnexal pathologies in the pediatric age group, spectrum of adnexal disease, and the importance of imaging.2. Imaging modalities utilized for diagnosing adnexal pathologies.3. Importance of correlating imaging findings with the clinical presentation.4. Examples of various adnexal pathologies at our institution.

## PDEE-45 CRANIAL ULTRASOUND IN PAEDIATRIC EMERGENCIES: EXPLORING THE BRAIN IN REAL TIME

Marta Pelaz Esteban (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Sutil (*Abstract Co-Author*) Nothing to Disclose
Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose

Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- To review the indications for transfontanelar ultrasound, especially in the emergency setting.- To review the CUS technique (including technical parameters, standardized planes?)- To know the main pathologic findings that are relevant for emergency management.

**TABLE OF CONTENTS/OUTLINE**

Transfontanelar ultrasound is a fast, readily available test lack of ionizing radiation. It is suitable for the neonatal period and very useful as long as the anterior fontanel remains open. However, it is a test with some limitations, such as being highly operator-dependent. This may give rise to doubts in the radiologist inexperienced in the technique. A) CUS indications in the emergency settingB) CUS techinque- Technical parameters (probes, frecuency, depth, focus?)- Standard coronal and sagittal planes- Other accesses (mastoid, sphenoid fontanelle?)- Doppler ultrasoundC) Normal variants of the brain ultrasound appearanceD) Main pathologic findings- Hemorraghe (germinal matrix hemorraghe, intra and extraaxial hemorrage)- Hypoxic ischemic events (periventricular leukomalacia, hypoxic-ischaemic encephalopathy of the term neonate, arterial infarction, sinus thrombosis)- Hydrocephalus- Neonatal brain infections

## PDEE-46 THINK OUTSIDE THE GRAY: THE COMMON, THE UNCOMMON AND THE RARE PEDIATRIC EXTRA-AXIAL TUMORS OF BRAIN

Manish Bajaj, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Adam Goldman-Yassen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
John V. Dennison, MD (*Abstract Co-Author*) Nothing to Disclose
Vidya Sankar Viswanathan, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Discuss the different types of extra-axial brain tumors in pediatric patients and its classification, highlight the histological characteristics and typical locations of each tumor type2. Describe the imaging characteristics of each tumor type on various modalities such as MRI, CT, and sometimes PET scans.3. Identify common tumors or lesions that may mimic the appearance of atypical extra-axial brain tumors in pediatric patients4. Explore the role of advanced imaging techniques such as diffusion-weighted imaging (DWI), perfusion-weighted imaging (PWI) in characterizing these tumors.5. Discuss the management approach for various types of tumors

**TABLE OF CONTENTS/OUTLINE**

1. Introduction to Atypical Extra-Axial Brain Tumors in Pediatrics. -Typical locations and demographics. -Classification based on histological features. -Current challenges in Diagnosis.2Advanced Imaging Techniques. -DWI and its applications. -PWI for assessing tumor vascularity. 3.Imaging Characteristics. -Solitary Fibrous Tumor. -Occipital Schwannoma. -Intracranial Chondroma. -Atypical Teratoid/Rhabdoid Tumor. -Posterior fossa medulloblastoma. 4.Differential Diagnosis and Classic Mimics. -Common differential diagnoses. -Imaging features that help differentiate tumors from mimics. 5.Management Strategies. -Surgical considerations. -Adjuvant therapies. -Long-term follow-up recommendations. 6.Solve the case. -Example case to solve. -Discussion of diagnosis and management

## PDEE-47 SPECTRUM OF PEDIATRIC ABNORMALITIES OF THE BILIARY TRACT

Pallavi Sagar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Katherine Nimkin, MD (*Abstract Co-Author*) Nothing to Disclose
Neha Udayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Teresa Victoria, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hajer Jarraya (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Pediatric biliary tract abnormalities include congenital anomalies such as anatomic anomalies, various cholestatic processes, congenital cystic and non-cystic anomalies and non-congenital anomalies such as neoplastic, inflammatory or infectious disorders. 2. Differential diagnoses of cystic congenital anomalies include cystic biliary atresia, fibrocystic liver diseases which designate a group of disorders affecting biliary tree and encompasses congenital hepatic fibrosis, Caroli disease and choledochal cysts. 3. The differential diagnoses of non-cystic congenital anomalies include biliary atresia and Alagille syndrome. 4. Spectrum of biliary atresia depends on the anatomic level of obstruction, four different types are described. Most common cases are perinatal. 5. Most common cases of biliary atresia are non-syndromic. Syndromic biliary atresia which occurs in 10%, can be associated with various congenital anomalies such as polysplenia, asplenia, heterotaxy syndrome, intestinal malrotation and interrupted IVC. 6. Congenital abnormalities of the gallbladder include agenesis and hypoplasia but also variations in position of the gallbladder, its shape, number and structure.

**TABLE OF CONTENTS/OUTLINE**

1) Epidemiology and classification of congenital and non-congenital biliary anomalies 2) Imaging Findings a) Biliary anomalies in the prenatal period b) Cystic biliary anomalies in neonates, infants, children and adolescentsc) Non cystic biliary anomalies in neonates, infants, children and adolescents3) Associated abnormalities in syndromic biliary tract congenital abnormalities 4) Algorithm of differential diagnosis based on level of biliary tree involvement

## PDEE-48 SONOGRAPHIC DEPICTION OF A DEFECT IN THE WALL OF THE INTESTINE IN NEONATES AND YOUNG CHILDREN WITH INTESTINAL PERFORATION

Alan Daneman, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Faingold, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Rutten, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamin Traubici, BSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To illustrate a group of neonates and young children with a variety of causes of intestinal perforation in whom the defect in the intestinal wall was correctly recognized preoperatively on sonography (US) as this has not been previously recognized in this age group.To emphasize that intestinal perforation in neonates and young children does not always lead to the presence of free gas on plain radiographs or US.To emphasize other US features, such as echogenic ascites and focal fluid collections, as important US signs of perforation in this age group.

**TABLE OF CONTENTS/OUTLINE**

We illustrate four neonates or young children in whom the intestinal defect due to perforation was depicted on US and correctly recognized on preoperative US.Plain abdominal X-Rays (AXR) showed abdominal distension, a paucity of bowel gas, and absence of free gas in three.In the fourth, the AXR, showed diffuse distension of bowel with a large amount of gas and a moderate amount of free gas.On US, there was no evidence of free gas in one, a tiny amount of free gas in two, and a moderate amount of free gas in one.On US, there were moderate to large amounts of echogenic ascites in all four.On US, a focal defect at the site of intestinal perforation was depicted and was recognized by the fellow or US technologist performing the examination in all four.The intestinal defect was proven at surgery in all four.These four cases illustrate the ability of US to depict the defect in the intestinal wall in neonates and young children with intestinal perforation. It is essential for US technologists and radiologists to search for such defects on US, especially in those cases with no evidence of free gas on AXR or US, and in the presence of echogenic ascites.

## PDEE-49 FETAL STROKE PRECEDES CORTICAL DYSPLASIA: MRI DEMONSTRATION

Ignacio Delgado, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Nerea Maiz (*Abstract Co-Author*) Nothing to Disclose
Angel Sanchez-Montanez, MD (*Abstract Co-Author*) Nothing to Disclose
Carlota Rodo (*Abstract Co-Author*) Nothing to Disclose
Elida Vazquez (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To understand that fetal brain hypoxia-ischemia can cause more classically recognized patterns of abnormal neuronal migration and organization2. To recognize the evolving appearance of fetal cerebral hypoxic-ischemic lesions, which also can lead to lesions such as polymicrogyria, schizencephaly or focal cortical dysplasia3. To show in an educational format demonstrative selected cases seen in our tertiary center with evidence that hypoxia in the developing fetal brain may also lead to anomalies that suggest a more classic teratogenic effect.

**TABLE OF CONTENTS/OUTLINE**

Fetal stroke usually leads to loss of brain tissue or atrophy (porencephaly, encephalomalacia). Schizencephaly, distinguished from porencephaly by the presence of gray matter heterotopias lining the cleft, is assumed to result from an early vascular-disruptive process before migration. Both conditions can be caused by COL4A1-COL4A2 mutations. Most authors also suggest that many cases of polymicrogyria result from ischemia, cases related to carbon monoxide inhalation or twins with fetal demise have been reported.Authors show here several relevant cases with evidence that hypoxia occurring early in the developing fetal brain has the potential to lead not only to the more commonly accepted disruptive-type defects but also to patterns of anomalies that suggest a more classic teratogenic effect, such as schizencephaly, polymicrogyria or both together. Moreover, these cases also show by fetal MR imaging the follow-up demonstration intrauterus about the evolving nature of cerebral infarction or germinal matrix hemorrhage leading to cortical gyration anomalies. In most of these cases, we will show the postnatal MR imaging correlation.

## PDEE-5 IMAGING EVALUATION OF PEDIATRIC PINEAL REGION LESIONS - PEARLS AND PITFALLS

Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Knowledge of the updated WHO classification of tumors of the central nervous system facilitates pathologic and radiologic categorization of pineal region tumors 2. A fundamental understanding of key tumorigenesis pathways aids in multidisciplinary patient management discussion 3. Appropriate use and understanding of available MRI sequences in tumor work-up can narrow the differential diagnosis of pineal region tumors

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Overview of the WHO classification of tumors of the central nervous system 3. MRI protocol for tumor work-up 4. Non-neoplastic lesions a. Pineal cyst b. Calcification c. Cavum velum interpositum 4. Arachnoid cyst 5. Vein of Galen malformation 5. Pineal region tumors a. Pineocytoma b. Pineal parenchymal tumor of intermediate differentiation c. Pineoblastoma d. Papillary tumor of pineal region e. Germinoma - bifocal, trifocal f. Low-grade glioma 6 Cheat sheets - differentiating tumors based on T2 appearance, presence of restricted diffusion, calcification, hemorrhage, growth pattern, enhancement pattern 7. Conclusion

## PDEE-50 CEREBELLAR HYPOPLASIA: A ROAD MAP TO FETAL MRI EVALUATION AND DIFFERENTIAL DIAGNOSIS

Roberto Bastos, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago De Gaultier Paulo, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Cerdeira Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Oliveira-Szejnfeld, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Silva (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Learn the correct protocol for proper measurement and evaluation of the cerebellum using screening ultrasound. Identify the morphological aspects of the cerebellum in fetal magnetic resonance imaging, as well as the principal associated congenital anomalies. Understand the stages of cerebellar development and common anomalies that can occur. Acknowledge the importance of fetal MRI in diagnosing cerebellar hypoplasias.

**TABLE OF CONTENTS/OUTLINE**

The purpose of this presentation is to demonstrate the main congenital anomalies associated with cerebellar hypoplasia using fetal MRI. We will start by briefly discussing the epidemiology, causes, prognosis, and screening ultrasonography findings. Furthermore, we will review the available literature on the normal aspects of the brainstem and cerebellum. Then, we will provide examples of each case with the MRI findings that helped in the diagnosis and correlate them with genetic markers. Finally, we will propose a flowchart of the main cerebellar hypoplasias.

## PDEE-51 PEDIATRIC NECK ULTRASOUND: A PRACTICAL GUIDANCE FOR RADIOLOGY RESIDENTS BASED ON CLINICAL CASES

Laura Alonso, MD (*Abstract Co-Author*) Nothing to Disclose
Mabel Garcia-Hidalgo Alonso, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto Ramirez Garcia-Mina, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-To provide a practical guide on how to do a proper pediatric neck ultrasound.-To review the most frequent pediatric neck pathology in an organized way.-To demonstrate a pertinent differential diagnosis according to the age of the patient, and location of the lesion.-To emphasize the ultrasound characteristics of the different pathology and its correlation with MR imaging through a series of representative cases within our hospital setting.-To highlight warning signs that require further evaluation of proper management.

**TABLE OF CONTENTS/OUTLINE**

1) Background. Radiologic evaluation with high-frequency ultrasonography (US) is essential for the diagnosis of neck lumps in the pediatric population.2) Ultrasound anatomy and systematic.3) Thyroidal pathology. Thyroid nodules, from benign (adenomatoid/colloid nodule, hemorrhagic thyroid cyst) to malignant (thyroid papillary carcinoma). Autoimmune pathology.4) Cystic lesions. Thyroglossal duct cyst, branchial cleft cyst (cranial fasciitis as a first branchial cleft cyst mimicker), dermoid and epidermoid cyst.5) Lymphadenopathies. Cervical adenitis and complicated adenitis (non-tuberculous mycobacteria adenitis, complicated lymphadenopathy with abscess formation).6) Hemangioma and vascular malformations (venous, lymphatic, and arteriovenous malformations).7) Ectopic thymus.8) Fibromatosis colli.9) Leukemia and lymphoma.10) Rhabdomyosarcoma.11) Salivary glands. Obstructive sialadenitis. Neonatal suppurative sialadenitis. Acute parotitis. Ranula. Pleomorphic adenoma.12) Conclusion.

## PDEE-52 PLAYGROUND INJURIES: WHEN IT'S NOT ALL FUN AND GAMES

**Awards**
**Magna Cum Laude**

Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jennifer Stimec, MD (*Abstract Co-Author*) Nothing to Disclose
Manuela Perez Matta, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan K. Campbell, MD (*Abstract Co-Author*) Nothing to Disclose
Trent Mizzi (*Abstract Co-Author*) Nothing to Disclose
Mary-Louise C. Greer, MBBS (*Abstract Co-Author*) Research Grant, AbbVie Inc
Caroline Rutten, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Raise awareness and increase recognition of playground-related injury patterns in children, with particular emphasis on those associated with different types of playground equipment - Describe the timing, frequency and age distribution of imaged playground injuries - Discuss the distribution of fractures across body parts with different playground equipment - Illustrate common and less common injury patterns

**TABLE OF CONTENTS/OUTLINE**

- Background - Learning objectives - When do playground injuries occur? - What playground equipment? - What location of injuries? - Normal bone development and healing patterns - Differing fracture patterns based on location and mechanism:
- Salter-Harris classification
- Elbow fractures
- Forearm fractures
- Clavicle and shoulder fractures
- Trampoline fractures
- Toddler fractures
- Ankle and feet fractures
- Rib and sternum fractures - Head and spine trauma - Abdominal trauma - Would you fall for these pitfalls?

## PDEE-53 PEDIATRIC TRANSTHORACIC ECHOCARDIOGRAPHY (TTE): A PRIMER FOR THE CONGENITAL CARDIAC RADIOLOGIST

Haytham Ibrahim (*Abstract Co-Author*) Nothing to Disclose
Saad Saeed (*Abstract Co-Author*) Nothing to Disclose
Abdusamea G. Shabani, MBBCh, FRCR (*Abstract Co-Author*) Nothing to Disclose
Gurdeep S. Mann, MBChB,FRCR (*Abstract Co-Author*) Nothing to Disclose
Hesham Al-Saloos (*Abstract Co-Author*) Nothing to Disclose
Diana Bernal Quintero (*Abstract Co-Author*) Nothing to Disclose
Mehak Un Nisa P. Raja, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Decipher comprehensive anatomic data acquired by TTE?Understand the qualitative and quantitative evaluation of cardiovascular physiology and function by TTE through standard modalities such as M-mode, Color mapping, Pulsed wave and Continuous wave Doppler interrogation?Interpret standard quantification tools in TTE (i.e distances, areas, volumes, mass, blood flow velocities, tissue velocities, time intervals, peak gradients and mean gradients)?Familiarize with TTE appearances of valvular heart diseases and pre and post-op TTE assessment of the commonest pediatric CHD lesions ?

**TABLE OF CONTENTS/OUTLINE**

Anatomy: The standard echocardiographic views (tips and tricks)?Physics Principles of US and Doppler?TTE modalities (made-easy):?Motion mode, ?Color mapping, ?Pulsed wave (PW), Doppler ?Continuous Wave (CW) Doppler ?Standard quantification tools ?Pathology- Valvular heart diseases ?Pathology- Congenital heart diseases (pre and post-op imaging): ?ASD, VSD?, TOF, TGA

## PDEE-54 A NEW PERSPECTIVE OF PEDIATRIC RHEUMATOLOGIC DISORDERS: AUTOINFLAMMATORY-AUTOIMMUNE CONTINUUM

Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Gen Nishimura (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsuhiko Handa, MD (*Abstract Co-Author*) Nothing to Disclose
Orito Ikeda (*Abstract Co-Author*) Nothing to Disclose
Tatsuo Kono, MD (*Abstract Co-Author*) Nothing to Disclose
Yuko Tsujioka, MD,PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Autoimmune diseases are a diverse group of disorders caused by dysregulation of acquired immunity with loss of immune tolerance to self-tissues and autoantibodies, which commonly manifest as a multisystem disorder and has been a major issue in rheumatology. Autoinflammatory diseases are caused by dysregulation of innate immunity with pathogen-independent cytokine-induced inflammation and absence of autoantibodies, which were initially thought to be a group of rare hereditary periodic fever syndromes, e.g., cryopyrin-associated periodic syndrome. However, the concept of autoinflammatory diseases has recently expanded to a broader group of disorders with chronic inflammation, e.g., systemic juvenile idiopathic arthritis. Studies of cytokine signature have revealed the importance of innate immunity in autoimmune diseases, and thus anti-cytokine therapy is used for affected individuals. Given these advancements, it is proposed that autoinflammatory and autoimmune diseases are not separate conditions but autoinflammatory-autoimmune continuum. Based on the new perspective, we show the imaging spectrum of pediatric multisystem disorders, mainly focusing on rheumatological disorders. We highlight imaging similarities between autoimmune and autoinflammatory disorders, which support the hypothesis of autoinflammatory-autoimmune continuum.

**TABLE OF CONTENTS/OUTLINE**

Introduction (the perspective of autoinflammatory-autoimmune continuum) - Monogenic autoinflammatory diseases - Polygenic autoinflammatory diseases - Intermediate diseases - Polygenic autoimmune diseases - Pathology bridging the autoimmune and autoinflammatory diseases including interferonopathy

## PDEE-55 BEYOND MILK FOR HEALTHY BONES: PEDIATRIC METABOLIC BONE DISEASES

Jorge Delgado, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammad Jalloul, MD (*Abstract Co-Author*) Nothing to Disclose
John D. Karp, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Hamza Alizai, MD (*Abstract Co-Author*) Nothing to Disclose
Mostafa Alnoury, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Recognize Common Culprits Identify prevalent pediatric metabolic bone diseases like rickets, hypophosphatasia, osteogenesis imperfecta, and Ehlers-Danlos syndrome.
- Image Interpretation for Differentiation Understand characteristic imaging findings on radiographs, CT scans, and MRI scans to differentiate these diseases.
- Modality Selection Made Easy Grasp the strengths and applications of radiography, CT, MRI, and bone scintigraphy for optimal evaluation of each condition.

**TABLE OF CONTENTS/OUTLINE**

Pediatric Metabolic Bone Diseases (PMBDs) disrupt the processes for building and maintaining strong functional bones. Early diagnosis and proper management of PMBDs are crucial to prevent complications like fractures, bone deformities, and growth impairment. Specific Diseases and their Imaging Signatures A. Rickets and Osteomalacia B. Mineralization Disorders: • Hypophosphatemic Rickets • Hereditary Hyperphosphatasia (juvenile Paget disease) C. Bone Density Abnormalities: • Osteoporosis • Osteopetrosis D. Collagen Disorders Affecting Bone: • Osteogenesis Imperfecta • Ehlers-Danlos Syndrome • Marfan syndrome E. Other PMBDs • McCune-Albright Syndrome • Renal Osteodystrophy

## PDEE-56 GUT CHECK ON PEDIATRIC ENTERIC CONTRAST: ARE YOU POSITIVE, NEGATIVE, OR NEUTRAL?

**Awards**
**Certificate of Merit**

Mitchell A. Chess, MD (*Abstract Co-Author*) Nothing to Disclose
Apeksha Chaturvedi, MD (*Abstract Co-Author*) Nothing to Disclose
Nina B. Klionsky, MD (*Abstract Co-Author*) Nothing to Disclose
Steve Stephen, BS, MBA (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Enteric contrast agents may enhance the visibility and diagnostic certainty of intestinal and peritoneal findings in pediatric CT imaging. Despite these advantages, their need is debated. Key considerations for using enteric contrast in pediatric body imaging include: • Caution with using positive enteric contrast in patients with gastrointestinal (GI) mucosal or intramural bleeds, as it may obscure the source of bleeding and vascular malformations • Enteric contrast can enhance distinction between serosal tumors and gut lumen when the source of GI bleed is extraluminal • Neutral enteric contrast can improve bowel wall enhancement • Improved scanner technology with ability to perform multiplanar reconstructions reduce reliance on enteric contrast for diagnostic clarity • Emergency department patient throughput and safety considerations (e.g., extended exposure to transmissible diseases including COVID and RSV)

**TABLE OF CONTENTS/OUTLINE**

• Review common enteric contrast agents, emphasizing indications, risks, and other considerations unique to children • Summarize arguments for and against the use of enteric contrast, including perceived benefits, risks to patients, increased radiation dose, and logistical challenges • Discuss weight-based enteric contrast dose and administration protocols in children • Present pediatric imaging findings on a case-based template alongside a discussion of whether enteric contrast would be appropriate in similar cases • Highlight the potential for novel enteric contrast agents still in development, including dark enteric contrast agents and high-Z contrast agents

## PDEE-57 CATHETERS, TUBES AND OTHER MEDICAL DEVICES IN PEDIATRICS: MALPOSITION AND COMPLICATIONS ARISING FROM THEIR USE

Pablo Castanon Remy (*Abstract Co-Author*) Nothing to Disclose
Beatriz Espejo Garcia (*Abstract Co-Author*) Nothing to Disclose
Maria I. Martinez-Leon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Jose Garcia Munoz (*Abstract Co-Author*) Nothing to Disclose
Andrea Gallego Gomez (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Assessment through various imaging tests, primarily utilize simple radiography to assess the status and placement of different medical devices in pediatric patients.• Understand the importance of early detection by the radiologist of potential complications that may arise from their use, primarily mechanical complications, caused by improper placement of these devices.• Interpret different clinical cases of pediatric patients.

**TABLE OF CONTENTS/OUTLINE**

In this presentation, we will conduct a systematic review of the types of medical devices used in pediatrics, considering that they are more common in patients admitted to pediatric ICU and neonatology. These devices are essential for managing pediatric patients in intensive care; therefore, understanding them in pediatric patients and learning to assess their correct localization is fundamental in the work of a radiologist. Early detection of possible complications secondary to their use is also crucial.It is often challenging to interpret. Therefore, it is essential to know which devices to look for in each case, their appropriate location, and how to interpret data suggestive of possible complications.Subsequently, we will present a series of tables explaining the appropriate indications, route, and location of devices in imaging tests suitable for their study, followed by a series of cases of pediatric patients with these complications. The devices that can be evaluated with images in this presentation include: Nasogastric tube, endotracheal tube, chest drainage tube, umbilical venous catheter, umbilical arterial catheter, epicutaneous catheter, central venous catheter, ventriculoperitoneal shunt and others less commonly used devices.

## PDEE-58 WHAT THE RADIOLOGY RESIDENT NEEDS TO KNOW ABOUT PEDIATRIC MODIFIED BARIUM SWALLOW

**Awards**
**Certificate of Merit**

Bindu Setty, MD (*Abstract Co-Author*) Nothing to Disclose
Kerry Pearl (*Abstract Co-Author*) Nothing to Disclose
Jessica Pisegna (*Abstract Co-Author*) Nothing to Disclose
Ilse Castro-Aragon, MD (*Abstract Co-Author*) Nothing to Disclose
Ali A. Elzieny (*Abstract Co-Author*) Nothing to Disclose
Pooja Sikka, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Provide an overview on the speech language pathologist (SLP) assessment of the indications, preparation, and terminology for a pediatric modified barium swallow (pMBS) study.2. Highlight imaging abnormalities detected on a pMBS study.3. Correlate pMBS radiologic findings with their etiologies and management.4. Discuss how a pediatric swallow evaluation differs from that of adults.

**TABLE OF CONTENTS/OUTLINE**

1. SLP clinical feeding evaluation and indications for a pMBS study.2. Brief overview of the normal peripheral and central mechanisms of swallowing, including the sequential phases, supportive anatomy, and pediatric neuroanatomic correlates.3. SLP pMBS examination with a description of the setup and rationale for utilizing different types of positioning, equipment, bolus consistencies (thicker vs. thinner), delivery methods, and timed fatigue testing to assess form and function.4. Definitions of specific SLP pMBS terminology, such as oral aversion, pharyngeal residue, swallowing delay, and reduced esophageal clearance.5. Imaging findings in pMBS penetration, aspiration, nasopharyngeal reflux, laryngomalacia, etc.6. Causes and pathophysiology of abnormalities detected on a pMBS study.7. Findings on brain MRI in patients who would need a pMBS study.8. Management options for a failed pMBS study.9. How a pediatric MBS study differs from an adult MBS study in terms of clinical evaluation, grading of findings, and intervention.10. Summary highlighting the applications of a pMBS study for radiology residents.

## PDEE-59 PEARLS AND PITFALLS IN PEDIATRIC NEUROVASCULAR RADIOLOGY: A TRAINEE'S AFTER-HOURS GUIDE

Kathleen Schenker, MD (*Abstract Co-Author*) Nothing to Disclose
Ashrith Kandula (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Master the Fundamentals: Grasp the cerebrovascular anatomy of the brain and spinal cord in children to understand blood flow patterns and interpret neuroimaging.
- Recognize Early Signs: Identify the classic presentation of congestive heart failure in neonates with Vein of Galen Malformation (VGAM) and its characteristic imaging findings.
- Sharpen Stroke Diagnosis: Broaden your understanding of pediatric stroke symptoms in septic embolism. Utilize CTA and MRA to identify characteristic features and differentiate from other etiologies.
- Unveil Behēet's Disease: Recognize the multifocal vascular involvement (venous thrombosis and arterial stenoses) seen on angiography in Behēet's disease.
- Think Collateral Flow: Suspect moyamoya syndrome in children with progressive ischemic symptoms or headaches,
- MRI Venography is Key: Importance of MRV for accurate and timely diagnosis of Venous Sinus Thrombosis (VST) in children, which can mimic other stroke etiologies.
- Thunderclap Headache: Consider RCVS in adolescents with normal initial MRI.

**TABLE OF CONTENTS/OUTLINE**

Pearls for Initial Assessment:
- Key historical details and presenting signs/symptoms specific to pediatric patients.
- Tailoring imaging protocols to minimize radiation exposure.
- Pitfalls to Avoid:
- Misinterpreting normal variants for pathology.
- Missing subtle findings due to limited experience.
- Ordering unnecessary imaging studies.
- Case-Based Learning:
- Common pediatric neurovascular emergencies will be presented in a concise case format.
- Each case will highlight key imaging findings, differential diagnoses, and pearls for interpretation.
- Pitfalls specific to each case will be emphasized to guide trainees in avoiding misdiagnosis.

## PDEE-6 IMAGING EVALUATION OF PEDIATRIC SELLA/SUPRASELLAR LESIONS: PEARLS AND PITFALLS

Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Knowledge of the updated WHO classification of tumors of the central nervous system facilitates pathologic and radiologic categorization of sella/suprasellar region tumors 2. A fundamental understanding of key tumorigenesis pathways aids in multidisciplinary patient management discussion 3. Appropriate use and understanding of available MRI sequences in tumor work-up can narrow the differential diagnosis of sella/suprasellar tumors

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Overview of the WHO classification of tumors of the central nervous system 3. MRI protocol for tumor work-up 4. Pseudotumors - classic features, differential diagnosis, pearls, pitfalls a. Pars intermedius cyst b. Rathke cleft cyst c. Arachnoid cyst d. Epidermoid cyst e. Dermoid cyst f. Suprasellar lipoma 5. Sella/suprasellar tumors - classic features, differential diagnosis, pearls, pitfalls a. Pilocytic astrocytoma b. Pilomyxoid astrocytoma c. Craniopharyngioma d. Hypothalamic hamartoma e. Germinoma f. Pituitary macroadenoma 6. Cheat sheets - differentiating tumors based on T2 appearance, presence of restricted diffusion, calcification, hemorrhage, growth pattern, enhancement pattern 7. Conclusion

## PDEE-60 ROLE OF INTERVENTIONAL RADIOLOGY IN DIAGNOSIS OF EXTRA HEPATIC BILIARY ATRESIA (EHBA)

Kushaljit S. Sodhi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Anmol Bhatia, MD (*Abstract Co-Author*) Nothing to Disclose
Ravi Kanojia, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sadhna Lal (*Abstract Co-Author*) Nothing to Disclose
Akshay K. Saxena, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Importance of early diagnosis of EHBA, Classification of EHBA, Technique of ultrasound guided Percutaneous Transhepatic Cholecysto Cholangiography (PTCC), Review of published literature regarding advantages and safety of the PTCC, Technique of ultrasound guided liver biopsy, Benefit of combined ultrasound guided PTCC and liver biopsy

**TABLE OF CONTENTS/OUTLINE**

Definition and types of EHBA, Clinical presentation, differential diagnosis and urgency in clinching early diagnosis of EHBA, Brief summary of diagnostic ultrasonography features of EHBA, Emphasizing status of intra operative cholangiography (IOC) as the gold standard and highlighting the risk of negative laparotomy, Technique of ultrasound guided PTCC, Illustrative cases comparing PTCC and IOC from the authors' institute, Advantages, pitfalls and complications of PTCC, Use of combined ultrasound guided PTCC and liver biopsy for establishing the diagnosis of EHBA

## PDEE-61 FETAL MRI PICKING UP THE TORCH AGAIN! - UPDATE ON PRENATAL INFECTIONS OF THE CENTRAL NERVOUS SYSTEM

**Awards**
**Certificate of Merit**

Ignacio Delgado, MD (*Abstract Co-Author*) Nothing to Disclose
Elida Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Sanchez-Montanez, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

; Prenatal central nervous system (CNS) infections remain an important cause of acute and long-term neurological morbidity.; Fetal MRI is the best modality for demonstrating the expressions of the inflammatory response to infection in the brain in fetuses and neonates.; Prompt brain imaging diagnosis facilitates immediate therapy and early recognition of complications.

**TABLE OF CONTENTS/OUTLINE**

Early diagnosis of CNS infections in fetuses is best performed with US, whereas MRI is the best diagnostic study for determining areas of involvement in the brain and spine and for improving the ability to narrow the differential diagnosis. Diffusion-weighted imaging identifies cytotoxic edema and abscesses.Prenatal CNS infections are included in the STORCH acronym (syphilis, toxoplasmosis, rubella, CMV, HIV and herpes simplex), also Zika virus or Parvovirus B19. Early infections affect organogenesis, while later infections lead to brain destruction.; CMV is the most common agent. Early infections may result in malformations within the lissencephaly-pachygyria spectrum, and cerebellar hypoplasia and periventricular calcifications, while infections acquired later produce diffuse polymicrogyria, or white matter injury.; Herpes simplex virus (type 2) is a major cause of neonatal encephalitis. Neuroimaging reflects leptomeningeal inflammation and diffuse parenchymal involvement, ranging from vasogenic to cytotoxic edema, with diffusion restriction and necrosis, evolving to cystic encephalomalacia or dystrophic calcification.; Zika virus prenatal infection can lead to microcephaly, cerebral calcification, cortical malformation, ventriculomegaly and corpus callosum hypoplasia.

## PDEE-62 PEDIATRIC EWING SARCOMA: THE RADIOLOGIST'S GUIDE TO UPDATES IN TUMOR CLASSIFICATION, STAGING, PROGNOSTICATION AND SURVEILLANCE

**Awards**
**Certificate of Merit**

Apeksha Chaturvedi, MD (*Abstract Co-Author*) Nothing to Disclose
Sheela B. Garudaiyengar, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Philip J. Katzman, MD (*Abstract Co-Author*) Nothing to Disclose
Hunter R. Carlock, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. WHO 2020 has introduced a new category of "undifferentiated round cell sarcomas of the bone and soft tissue" including Ewing sarcoma and Ewing-like sarcoma entities.2. Clinical, epidemiologic, immunohistochemical, genetic, and imaging characteristics help distinguish individual tumor subtypes within this broad category.3. With advances in FDG-PET CT/MR, bone marrow biopsy is no longer universally recommended for tumor staging.4. Whole Body MR is increasingly used for tumor staging and surveillance.5. Tumor prognostication is hinged on both pretreatment factors and response to therapy, with presence of metastases at diagnosis the most important prognostic factor.6. Key imaging findings impact clinical decision making and surgical approach.

**TABLE OF CONTENTS/OUTLINE**

1. Background information2. New WHO 2020 classification of Ewing sarcoma and its relevance to radiologists3. Clinical, epidemiologic, immunohistochemical, and molecular genetic features of Ewing sarcoma relative to Ewing-like sarcoma entities4. Multimodal imaging appearances of

Ewing sarcoma and Ewing-like sarcoma entities5. Updated MR imaging protocols, with a focus on diffusion-weighted and whole-body MR6. Evolving staging/surveillance recommendations7. Revised report templates incorporating prognostic variables (localized versus metastatic disease; proximal/distal tumors; extraskeletal/skeletal Ewing sarcoma; tumor size; pathologic fracture+/-; residual viable tumor after chemotherapy or local control surgery+/-)8. Conclusions

## PDEE-63 IF A PICTURE IS WORTH A THOUSAND WORDS THEN WHAT ABOUT A NUMBER? PEDIATRIC IBD IMAGING-BASED INDICES IN CLINICAL PRACTICE

**Awards**
**Certificate of Merit**

Ruth Cytter-Kuint, MD (*Abstract Co-Author*) Nothing to Disclose
Denise A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Li-Tal Pratt, MD (*Abstract Co-Author*) Nothing to Disclose
Ailish Coblentz, MD (*Abstract Co-Author*) Nothing to Disclose
Ronit Precel, MD (*Abstract Co-Author*) Nothing to Disclose
Gili Focht, MSc, MBA (*Abstract Co-Author*) Nothing to Disclose
Mary-Louise C. Greer, MBBS (*Presenter*) Research Grant, AbbVie Inc

### TEACHING POINTS

1. To understand the role of imaging biomarkers in inflammatory bowel disease (IBD); 2. To be familiar with pediatric and adult-derived MRI and ultrasound-based indices; 3. To calculate pediatric MRI- and ultrasound- based indices for inclusion in diagnostic imaging reports; and 4. To consider future applications of imaging-based indices in pediatric IBD.

### TABLE OF CONTENTS/OUTLINE

1. Background Explain the evolution of biomarkers in IBD from clinical and endoscopic scores to imaging-based indices, gauging disease activity, severity and treatment response, guiding drug development, with potential for prognostication. 2. Imaging-based Indices: Describe specific indices using MR enterography (MRE), pelvic MRI (PMR) and bowel ultrasound, quantifying disease activity, severity and treatment response, highlighting new MRI-based indices developed in pediatric cohorts. 3. Pediatric Imaging-based Indices (a) Pediatric Inflammatory Crohn's MRE Index - PICMI, (b) Pediatric MRI-Based Perianal Crohn Disease index - PEMPAC and (c) Pediatric ultrasound-based scores - SPAUSS and PCD-US Define index components, methodology for score calculation and cut-off values for remission, active inflammation and response as relevant. Provide examples illustrating scores and reporting templates. 4. Future Directions: Consider current and emerging roles of imaging biomarkers including use of Artificial Intelligence/Deep Learning, integration with texture analysis, and exploration of unmet needs such as quantification of intestinal fibrosis. 5. Practice Cases: Interactive exercise trialing score calculations on MRE, PMR and ultrasound.

## PDEE-64 ALTERNATIVE ACCESS SITES FOR PEDIATRIC ARTERIAL INTERVENTIONS - THINK BEYOND THE FEMORAL

**Awards**
**Cum Laude**

Joao G. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Elaine Y. Kan, MBChB (*Abstract Co-Author*) Nothing to Disclose
Moritz Wildgruber, MD, PhD (*Abstract Co-Author*) Consultant, Sirtex Medical Ltd;Consultant, iThera Medical GmbH;Consultant, Bayer AG
Stephanie Franchi-Abella, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Chen (*Abstract Co-Author*) Nothing to Disclose
Dimitri A. Parra, MD, MMEd (*Abstract Co-Author*) Nothing to Disclose
Kin Fen Kevin Fung, MBBS, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Obtaining arterial access is the one of the most challenging aspects for pediatric arterial interventions, especially in neonates and young infants.- Due to larger sheath-to-vessel ratio, the risk of thrombo-occlusive complication is higher in young children. Strategies to prevent complications include limb warming, ultrasound guided access, low-profile hydrophilic sheath and heparinization.- Common femoral artery access remains the standard for interventions in children. Alternative access sites include axillary, brachial, radial, carotid, and umbilical arteries and umbilical vein in neonates.- Upper extremity access sites should be considered in children with significant aorta caliber differences such as in hepatic hemangioma, and aortoiliac occlusive conditions such as mid-aortic syndrome. Other advantages include ease of catheterisation and passage of interventional devices into visceral arteries with acute downward angulation- Carotid access is not commonly used but can be an alternative in infants requiring complex cardiac or neurovascular interventions.- Umbilical artery can be used in neonates up to 1 week of age. Umbilical vein is an alternative if there is a patent ductus arteriosus or foramen ovale, which can act as a conduit between the arterial and venous systems. Advantages include ability to use larger sheaths and prevention of access-related complications in the extremities.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Technique for arterial access in children 3. Strategies to prevent access-related complications 4. Standard and alternative arterial access sites: Advantages and potential issues 5. Illustrative cases 6. Management of complications 7. Conclusions

## PDEE-65 PEDIATRIC GENITOURINARY RADIONUCLIDE SCINTIGRAPHY WITH INTERESTING ANATOMIC CASE CORRELATION

Michael A. Steiner, MD (*Abstract Co-Author*) Nothing to Disclose
John Hollis Tackett, BS (*Abstract Co-Author*) Nothing to Disclose
Marjorie Lam (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Abstract Co-Author*) Nothing to Disclose
Vani Vijayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Johnny Yang, BS, BA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review anatomy and physiology of MAG3 renal scans - Correlate with other imaging for common and uncommon pediatric genitourinary pathology.- Discuss complementary role of MAG3 renal scans for diagnostic purposes

### TABLE OF CONTENTS/OUTLINE

Technetium-99m (Tc-99m) scintigraphy, using tracers such as mercaptoacetyltriglycine (MAG3), dimercaptosuccinic acid (DMSA), and diethylenetriaminepentaacetic acid (DTPA) offers excellent anatomical and physiological details. Tc-99m MAG3 is considered one of the best methods for

assessing renal function owing to favorable qualities in energy and dosimetry. DTPA adds glomerular filtration rate assessment, and DMSA provides information for differentiating pyelonephritis versus scarring in the presence of vesicoureteral reflux and multiple episodes of urinary tract infection. Thus, pediatric genitourinary imaging commonly utilizes technetium scintigraphy. Through a case series, this exhibit will include cases of collecting system dilatation and other GU pathology due to various obstructive and nonobstructive pathology where MAG3 imaging proved useful in diagnosis and/or clinical management. Illustrative cases are reviewed with ultrasound and CT correlation.

## PDEE-66 INNER EAR ANOMALIES IN CONGENITAL HEARING LOSS, STEP BY STEP APPROACH FOR NOVICE

**Awards**
**Certificate of Merit**

Moegamad A. Ederies, MBBCh, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jehan Al-Rayahi, MD (*Abstract Co-Author*) Nothing to Disclose
Alaa O. Koko, MD, BMBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

General objective Step by step approach to identify inner ear abnormalities in congenital hearing loss.Detailed Objectives: 1- To define the concept of congenital hearing loss and the variable classification approach 2-To determine the optimum CT MRI planes (and MRI sequences ) 3-To review the inner ear components imaged in CT MRI 4-To clarify in detail the abnormal morphology of cochlea, vestibule , semicircular canals, and IAM in congenital hearing loss.5- To review images of real cases.

### TABLE OF CONTENTS/OUTLINE

Definition and classification of Congenital hearing loss.The applied CT MRI protocols.The anatomy of inner ear structure's. Simple approach to identify inner ear abnormality.Detailed abnormal morphology of cochlea ,vestibule ,semicircular canals and IAM.

## PDEE-67 BENIGN AND MALIGNANT PEDIATRIC LIVER MASSES: RADIOLOGIC-PATHOLOGIC UPDATE FROM THE PEDIATRIC LIRADS WORKING GROUP

**Awards**
**Certificate of Merit**

Ellen M. Chung, MD (*Abstract Co-Author*) Nothing to Disclose
Adina L. Alazraki, MD (*Abstract Co-Author*) Nothing to Disclose
Esther Ro, MD (*Abstract Co-Author*) Nothing to Disclose
Cara E. Morin, PhD (*Abstract Co-Author*) Nothing to Disclose
Mitchell Rees, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Berklite (*Abstract Co-Author*) Nothing to Disclose
Geetika Khanna, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Alex Towbin, MD (*Abstract Co-Author*) Author, RELX;Consultant, Anderson Publishing, Ltd;Advisory Board, KLAS Enterprises LLC;Travel support, Merative LP
Gary R. Schooler, MD (*Abstract Co-Author*) Nothing to Disclose
Amy B. Kolbe, MD (*Abstract Co-Author*) Nothing to Disclose
Judy H. Squires, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth R. Tang, MD (*Abstract Co-Author*) Nothing to Disclose
Ali B. Syed, MD (*Abstract Co-Author*) Research Consultant, IBM Corporation
Michael R. Acord, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Many classification schemes and management recommendations for benign and malignant liver masses in children have evolved over the last 15 years.2. There are characteristic pathologic findings that may affect the imaging appearance of these tumors in children.3. Contrast enhanced ultrasound and use of hepatobiliary contrast agents are becoming standard of care for imaging liver masses in children.

### TABLE OF CONTENTS/OUTLINE

• Introduction: General discussion of updates in the imaging of benign and malignant pediatric liver tumors. Review of the Los Angeles liver tumor symposium consensus classification of tumor histopathology • Specific Pathologies: Each section will discuss clinical, imaging, and pathologic features, differential diagnoses, and management recommendations. o Infantile and congenital hemangiomas. Updates: ISSVA nomenclature and classification. o Mesenchymal hamartoma. o Focal nodular hyperplasia. Updates: FNH-like lesions o Hepatocellular adenoma. Updates: Subtypes and associations o Hepatoblastoma. Updates: LIRADS imaging recommendations, PRETEXT staging for risk stratification, treatment strategies, and prognosis. Discussion of hepatocellular neoplasm NOS. o Hepatocellular carcinoma. Updates: LIRADS, imaging recommendations, predisposition, available screening recommendations, and prognosis. o Fibrolamellar hepatocellular carcinoma. o Undifferentiated embryonal sarcoma.

## PDEE-68 IMAGING OF HEARING LOSS IN PEDIATRIC POPULATION

Vijay S. Pande, MD (*Abstract Co-Author*) Nothing to Disclose
Pratit Pokharel, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Approximate prevalence of hearing loss is between 2 to 3 per 1000 babies, while by the age of 12 years approximately 20% of children have detectable hearing loss either in one or both ears. Congenital hearing loss is often sensorineural and associated with genetic conditions or isolated inner ear malformations. While in older children conductive hearing loss is common. Early detection and treatment are important to prevent significant language disability. High resolution CT and MR imaging plays crucial role in demonstrating the inner ear anatomy and pathologies. Imaging has also established pivotal role in selecting patients for cochlear implantation.We wish to make the residents and radiologist in practice aware of the imaging anatomy of temporal bone and imaging features in commonly encountered conditions.

### TABLE OF CONTENTS/OUTLINE

Technical considerations in CT, MRI, for imaging in pediatric hearing loss. Pertinent imaging anatomy in evaluation of hearing loss. Imaging features of congenital and acquired external and middle ear pathologies. Imaging features of congenital and acquired inner ear pathologies.

## PDEE-69 UNPEELING SUBPIAL HEMORRHAGES IN NEONATES: ANATOMY, IMAGING AND CLINICAL INSIGHTS

Saul Rodriguez (*Abstract Co-Author*) Nothing to Disclose
Natally AlArab, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Yutaka Sato, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lillian M. Lai, MD (*Abstract Co-Author*) Nothing to Disclose
T. Shawn Sato, MD (*Presenter*) Research Grant, Bracco Group

### TEACHING POINTS

Subpial hemorrhages (SPH) are an often under-recognized and misdiagnosed type of intracranial hemorrhage, most commonly seen in neonates and young infants. Although the etiology remains elusive, SPH are known to be associated with various conditions including but not limited to the birth trauma, neonatal hypoxic brain injury, abusive head trauma and hydrocephalus shunting. SPH are located superficial to the cortex, in the potential space between the glia limitans and the pia matter. On MR imaging, SPH are localized to the brain surface and the subjacent cortex can show diffusion restriction. Accurate diagnosis holds significant clinical implications given the potential parenchymal damage associated with SPH. We present the pertinent anatomy, proposed pathophysiology and imaging features crucial for accurate diagnosis of SPH.

### TABLE OF CONTENTS/OUTLINE

- Review pertinent anatomy and pathophysiology and understand the unique imaging features and clinical significance of SPH.- Become familiar with the typical imaging features of SPH and learn to differentiate it from subarachnoid and subdural hemorrhages.- Review cases of subpial hemorrhage to familiarize and aid in recognizing this frequently misdiagnosed entity.

## PDEE-7 IMAGING EVALUATION OF PEDIATRIC SUPRATENTORIAL TUMORS: PEARLS AND PITFALLS

Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Knowledge of the updated WHO classification of tumors of the central nervous system facilitates pathologic and radiologic categorization of supratentorial tumors 2. A fundamental understanding of key tumorigenesis pathways aids in multidisciplinary patient management discussion 3. Appropriate use and understanding of available MRI sequences in tumor work-up can narrow the differential diagnosis of supratentorial tumors

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Overview of the WHO classification of tumors of the central nervous system 3. MRI protocol for tumor work-up 4. Tumors - classic features, differential diagnosis, tumor genetics, pearls, pitfalls a. High-grade glioma: i. Diffuse hemispheric glioma: H3 G34 mutant ii. Diffuse pediatric-type glioma: H3 WT, IDH WT iii.Diffuse infant-type hemispheric glioma: NTRK, ROS1, ALK, MET b. Pilocytic astrocytoma c. Subependymal giant cell astrocytoma d. Ependymoma: ZFTA fusion positive, YAP1 fusion positive e. Choroid plexus tumor: Choroid plexus papilloma, atypical choroid plexus papilloma, choroid plexus carcinoma f. Embryonal tumor with multilayered rosettes g. Atypical teratoid rhabdoid tumor h. Seizure-related tumors: i. Pilomyxoid xanthoastrocytoma ii. Ganglioglioma iii. Dysembryoplastic neuroepithelial tumor i. Other less common supratentorial tumors to recognize i. Desmoplastic infantile astrocytoma/Desmoplastic infantile ganglioglioma ii. Multinodular and vacuolating neuronal tumor iii. Meningioma iv. Solitary fibrous tumor of dura v. Metastasis 5. Cheat sheets - differentiating tumors based on T2 appearance, presence of restricted diffusion, calcification, hemorrhage, growth pattern, enhancement pattern 6. Conclusion

## PDEE-70 WHAT DO I DO WITH IT? UPDATE ON PEDIATRIC THYROID NODULE ASSESSMENT AND MANAGEMENT

Jesse L. Courtier, MD (*Abstract Co-Author*) Founder, Sira Medical, Inc;Consultant, Sira Medical, Inc
Sunit Davda, MBBS, MRCP (*Abstract Co-Author*) Nothing to Disclose
Amanda R. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Kalpana Manral, MD (*Abstract Co-Author*) Nothing to Disclose
Rachelle Durand, DO (*Abstract Co-Author*) Nothing to Disclose
Kantheera Leesmidt, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Thyroid nodules in the pediatric population exhibit a lower incidence rate of 0.5% to 1.6%, yet the malignancy rate is 25% to 30% which is higher compared to adults.2. Pediatric thyroid cancer has a greater risk of metastasis to lungs and lymph nodes with more likely extrathyroidal growth and recurrence. However, their prognosis is favorable.3. ATA and ACR-TIRADS are the two most common ultrasound-based risk stratification systems for description of thyroid nodules and stratify the risk characteristics in adults, however, the diagnostic performance when applying to the pediatric population has been less reported.4. Utilizing thyroid ultrasound reference standards tailored for adults in pediatric populations may offer advantages, although they may not always be accurate. ATA, ACR-TIRADS, and EU-TIRADS have moderate diagnostic performance in pediatric thyroid nodule patients.5. US features of microcalcifications, ill-defined margins, size > 3.5 cm, and abnormal lymph nodes increase sensitivity and specificity for malignancy in pediatric population.6. Performing biopsies on nodules categorized as the highest risk and smaller than 1 cm could improve diagnostic accuracy.

### TABLE OF CONTENTS/OUTLINE

1. Review features of common pediatric benign and malignant thyroid lesions.2. Illustrate potential pitfalls and mimics of thyroid masses.3. Evaluate the strengths and weaknesses of various adult thyroid nodule scoring criteria as they apply to pediatrics.4. Review management of pediatric thyroid nodules.5. Test understanding with a short quiz.

## PDEE-71 VARIOUS ASPECTS AND MIMICKERS OF IMAGING FINDINGS OF ACUTE ENCEPHALOPATHY WITH BIPHASIC SEIZURES AND LATE REDUCED DIFFUSION (AESD)

Harushi Mori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiro Nakamata, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

AESD is one of the most common acute encephalopathies in infants and young children in East Asia. Clinically, it develops as febrile status epilepticus and often shows no abnormal findings on diffusion-weighted image(DWI) or T2-weighted images taken on the first or second day of onset; therefore, distinguishing it from febrile seizures in the early stages of the disease is challenging. However, magnetic resonance spectroscopy (MRS) and arterial spin labeling (ASL) may exhibit characteristic abnormalities, even in the early stages of the disease. Unlike febrile seizures, AESD has a high rate of sequelae, exceeding 60%, and early therapeutic intervention improves neurological prognosis; thus, early diagnosis is important. Therefore, radiologists should be

familiar with the typical patterns, variants, and mimickers of AESD. The purpose of this exhibit is:1. To explain the disease concept and pathogenesis of AESD2. To discuss the clinical course and imaging findings of AESD3. To discuss the excitotoxity encephalopathy spectrum4. To discuss the mimickers of AESD

**TABLE OF CONTENTS/OUTLINE**

•Disease concept and pathogenesis of AESD.•Clinical aspects of AESD•Typical imaging findings ?DWI ?ASL ?MRS •Other imaging findings •Spectrum of encephalopathy with excitotoxicity (e.g. hemiconvulsion-hemiplegia/hemiconvulsion-hemiplegia-epilepsy syndrome, clinically mild infantile encephalopathy associated with excitotoxicity, infantile traumatic brain injury with a biphasic clinical course and late reduced diffusion) •Imaging mimickers (e.g. hemorrhagic shock and encephalopathy syndrome, meningitis, posterior reversible encephalopathy syndrome)

## PDEE-72 DECODING THE PUZZLE: A MULTIMODAL APPROACH TO PEDIATRIC NON-TRAUMATIC HEAD AND NECK EMERGENCIES

Kathleen Schenker, MD (*Abstract Co-Author*) Nothing to Disclose
Ashrith Kandula (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Unravel the diverse causes of pediatric non-traumatic head and neck emergencies.• Master the art of differential diagnosis using a multimodal imaging approach.• Gain insight into the unique imaging characteristics of frequently encountered emergencies.

**TABLE OF CONTENTS/OUTLINE**

- Introduction:
- Challenges in diagnosing pediatric non-traumatic head and neck emergencies.
- Unveiling the Culprit:
- Plain radiography: Unveiling the bony clues.
- Ultrasound: A bedside warrior for rapid evaluation.
- CT: Delineating intricate anatomy and complications.
- MRI: Unveiling soft tissue involvement.
- Decoding the Images:
- Infectious emergencies:
- Lemierre syndrome: Painting the jugular vein red.
- Gradenigo syndrome: Facial pain whispers of a cranial nerve dilemma.
- Cavernous sinus thrombosis: When the crossroads of blood flow become inflamed.
- Epiglottitis: The cherry red flag of a life-threatening airway obstruction.
- Branchial cleft cyst and lymphangioma: When remnants of development turn troublesome.
- Atypical mycobacterial infection: The sly infectious invader.
- Mastoiditis with intracranial complications: Balancing hearing with brain health.
- Sinusitis with intracranial complications (Pott's puffy tumor): When a sinus infection breaches its boundaries.
- Skull base osteomyelitis: A bone infection with a cranial address.
- Non-infectious emergencies:
- Labyrinthitis: The inner ear's dance gone wrong.
- Orbital pseudotumor: Inflammation masquerading as a mass.
- Juvenile angiofibroma: An aggressive vascular anomaly.
- Orbital varix: Bulging eye caused by a dilated vein.
- Mimics:
- Langerhans cell histiocytosis (LCH) vs. infectious processes.
- Discitis/osteomyelitis vs. infectious complications.

## PDEE-73 UNVEILING IMAGING INSIGHTS INTO CHILDHOOD INTERSTITIAL LUNG DISEASES (CHILDS): A COMPREHENSIVE REVIEW OF CLINICAL AND RADIOLOGICAL PROFILES

**Awards**
**Certificate of Merit**

Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Tatsuo Kono, MD (*Abstract Co-Author*) Nothing to Disclose
Gen Nishimura (*Abstract Co-Author*) Nothing to Disclose
Yuko Tsujioka, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Eugene Nishi, MD (*Abstract Co-Author*) Nothing to Disclose
Kunihiko Shimizu (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Orito Ikeda (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Childhood interstitial lung diseases (chILDs) are individually rare, but overall, many affected children seek medical services. Since chILDs, particularly of the infantile-onset, were poorly understood for a long time, many cases remained undiagnosed as "unexplained" ILDs. However, the new chILD classification (2007) for children under 2 years, and the expanded classification (2015) for children ages 2-18 years provided a more comprehensive picture of chILDs. The genetic and histological background of chILDs has been revealed as well. Radiologists should be aware of the disease classification, pathophysiology, and relevant imaging findings of chILDs. Accurate diagnosis will lead to further elucidation and development of efficient medical interventions for this group of disorders. TEACHING POINTS 1. Based on the current classification of chILDs, their pathophysiology and imaging findings will be presented, highlighting imaging findings that may enable us to make definitive diagnoses. 2. The spectrum of chILDs overlaps with that of adult ILDs; however, we should be aware of distinctive clinical and imaging characteristics in chILDs and the presence of infant-specific chILDs.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction2) Disorders of infancy (diffuse developmental abnormalities/alveolar growth abnormalities/surfactant dysfunction and related abnormalities/specific conditions of poorly defined etiology/miscellaneous monogenic chILDs)3) Disorders not specific to infancy and childhood (disorders of normal host/disorders related to systemic diseases/disorders of the immunocompromised host/disorders masquerading as interstitial lung disease)4) Discussion

## PDEE-74 UPDATE ON US SCREENING FOR DEVELOPMENTAL DYSPLASIA OF THE HIP (DDH): WHY, HOW AND WHEN?

Placzek (*Abstract Co-Author*) Nothing to Disclose
Hakan Omeroglu (*Abstract Co-Author*) Nothing to Disclose
Ustun Aydingoz, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Casini (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Chlapoutakis, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• To demonstrate why and how hip ultrasound has largely replaced clinical examination and radiography, as the screening method of choice for the early detection of developmental dysplasia of the hip in neonates and infants. • To justify the selection of Graf's technique over the other sonographic techniques, as the "one-stop-shop" for the diagnosis and monitoring of treatment of developmental dysplasia of the hip. • To present the evidence which proves that universal sonographic screening is preferred over selective screening. • To present Graf's technique main examination steps, including baby positioning, quality evaluation, morphological classification, and final typing. • To demonstrate the main treatment principles according to the Graf's hip type. • To comment on the main reasons for underperformance and practically demonstrate the main sources of erroneous practice and confusion. • To emphasize the importance of structured training as a requisite for the "lege artis" performance of the technique.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Screening methods for developmental dysplasia of the hip 3. Sonographic techniques 4. Why Graf's technique 5. Universal vs. selective screening with Graf's technique 6. Presentation of Graf's technique examination steps 7. Common errors and how to avoid them. 8. Treatment guidance / monitoring of treatment 9. Structured training 10. Conclusions

## PDEE-75 UNRAVELING CHALLENGES: IMAGING DIAGNOSIS OF PEDIATRIC SOLID PERITONEAL TUMORS

Salma Moalla, MD (*Abstract Co-Author*) Nothing to Disclose
Manel Mestiri, MD (*Abstract Co-Author*) Nothing to Disclose
Corinne Balleyguier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Remy Barbe, MD (*Abstract Co-Author*) Nothing to Disclose
Yassamin Benhayoun Sadafyine (*Abstract Co-Author*) Nothing to Disclose
El Mehdi Mniai, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Peritoneal neoplasms are a group of tumors that arise within the peritoneum space but outside the major organs. Diagnosis of these tumors is often challenging for radiologists and consists of several steps, including determining the tumor's location within the peritoneum, often by excluding involvement of adjacent abdominal structures, and identifying distinctive imaging features. The diagnostic spectrum for rare solid peritoneal masses in children is broad, and includes rhabdomyosarcomas, desmoid tumors, teratomas, and inflammatory myofibroblastic tumors... Ultrasound serves as the frontline imaging modality for initial assessment thanks to its accessibility and lack of ionizing radiation. Computed Tomography (CT) offers superior visualization and aids in lesion detection, localization, and distant staging, especially when malignancy is suspected. Magnetic Resonance Imaging (MRI) provides excellent soft tissue contrast and is valuable for diagnosis and surveillance, particularly with diffusion-weighted sequences for detecting subtle peritoneal lesions. A methodical approach to diagnosing solid peritoneal masses in pediatric patients is essential. This approach involves integrating clinical data with imaging findings while taking into account age-related differences and the rarity of such tumors in children. Despite the major contribution of imaging, biopsy is still often warranted for histological confirmation.

**TABLE OF CONTENTS/OUTLINE**

1) Introduction and Objectives 2) Imaging signs of localization 3) Contribution of imaging modalities 4) Illustration of some rare solid peritoneal tumors in pediatrics 5) Take home messages 6) References

## PDEE-76 IMAGING OF MYXOID-CONTAINING TUMORS IN CHILDREN AND ADOLESCENTS

Oscar M. Navarro, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea S. Doria, MD, PhD (*Abstract Co-Author*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)
Afsaneh Amirabadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Magdalena P. Reyes Recasens, MD (*Abstract Co-Author*) Nothing to Disclose
Jesus A. Arenos-Abril, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. List the most common myxoid-containing tumors involving the pediatric and adolescent age group. 2. Discuss the role of different imaging modalities used in the work-up of these lesions and describe the main imaging findings, emphasizing MRI features. 3. Recognize the characteristic MRI signal of the myxoid matrix to facilitate the differential diagnosis of soft tissue tumors.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. MRI characteristics including diffusion weighted-imaging features of myxoid-containing lesions. 3. Histological types involving the pediatric and adolescent age group: a. Myxoid liposarcoma b. Primitive myxoid mesenchymal tumor of infancy (PMMTI) c. Low-grade myxoid fibrosarcoma d. Chondromyxoid fibroma e. NTRK-rearranged spindle cell neoplasm f. Extraskeletal myxoid chondrosarcoma 4. Take home points 5. References

## PDEE-77 TUBE FOR THOUGHT: IMAGING OF COMPLICATIONS ASSOCIATED WITH GASTROSTOMY AND GASTROJEJUNOSTOMY TUBES

Eugene G. Sheffield, MD (*Abstract Co-Author*) Nothing to Disclose
Asif Jamal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Preet K. Sandhu, MD (*Abstract Co-Author*) Nothing to Disclose
Chinky Patel, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Percutaneous feeding tubes such as gastrostomy and gastrojejunostomy tubes are widely used in the pediatric age group requiring long-term nutritional support. 2. Several complications are associated with the feeding tube apparatus such as abnormal placement, malpositioning, malfunction, and other uncommon complications. 3. Fluoroscopy is the initial modality of choice to evaluate for feeding tube complications using water soluble, non-ionic iodinated contrast agents. Ultrasound and CT are complementary in some cases. 4. A scout radiograph of the abdomen is often obtained prior to fluoroscopic evaluation to look for obvious malpositioning of the percutaneous feeding apparatus followed by fluoroscopy in the posteroanterior and right

lateral positions to look for contrast opacifying the stomach and jejunum depending on the type of feeding tube, and to assess the position of the apparatus. 6. It is often challenging to identify feeding tube related complications on fluoroscopy and a high index of suspicion is required based on the clinical scenario. 7. The role of the radiologist is to be aware of percutaneous feeding tube related complications and to identify them in a timely manner for optimal patient care.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: use and importance of percutaneous gastrostomy and gastrojejunostomy tubes in the pediatric age group.2. Highlight various types of complications associated with feeding tube placement.3. Approach to evaluating these complications with an emphasis on imaging findings on fluoroscopy.4. Examples of feeding tube-related complications at our facility.

## PDEE-78 THE CHALLENGE OF UNDERSTANDING THE AIRWAY OBSTRUCTION IN FETUS: AN APPROACH TO EMBRIOLOGY, IMAGING ASPECTS AND PATOLOGY

Antonio S. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda D. Braojos Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Marcus Otavio Silva de Campos Meneses, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz Rodrigues Santos, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Fetal magnetic resonance imaging (MRI) is the modality of choice for evaluation of congenital airway pathologies, which present a diagnostic challenge when assessed by ultrasound. The radiologist should be also accustomed with the embryology and normal anatomy of the airway and have a checklist to identify all structures every time is reading a fetal MRI. Identification of congenital airway anomalies become a crucial topic, as managing these pathologies may require interventions at the time of delivery or even during intrauterine life, posing a significant challenge for the perinatal care team due to the complexities of these pathologies and the risk of fetal demise.This pictorial essay will provide a detailed review of normal airway imaging findings in fetal MRI and their correlation with pathological findings, including some postnatal correlation cases.The objectives of this pictorial essay are:1 - To demonstrate the normal anatomy of the airway on fetal MRI; 2 - To present the primary congenital diseases involving the larynx and trachea; 3 - To identify the key radiological features of tracheal atresia, tracheal agenesis, and bronchial atresia;

**TABLE OF CONTENTS/OUTLINE**

1-Normal embryology of the airway; 2-Anatomy and anatomical relationships of the fetal airway; 3-Tracheal agenesis; 4-Tracheal atresia, stenosis or web; 5- Laryngeal stenosis, atresia or web; 6- Bronchial Atresia 7- Correlation between fetal MRI findings and postnatal outcomes;

## PDEE-79 IMAGING OF PEDIATRIC THYROID REVISITED

Oscar M. Navarro, MD (*Abstract Co-Author*) Nothing to Disclose
Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Maria Pont, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Lucia Riaza Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To describe key imaging features and discuss practical tips that can help the radiologist narrow the differential diagnosis of pediatric thyroid disorders2. To explain the use of new imaging technologies in pediatric thyroid evaluation3. To discuss the utility of Kwak TI-RADS, ACR-TIRADS, ATA and structured report system in the evaluation of pediatric thyroid disorders

**TABLE OF CONTENTS/OUTLINE**

1. US technique2. Normal anatomy, normal variants and pitfalls (cricoid cartilage, pyramidal lobe, intrathyroid thymus)3. Congenital thyroid abnormalities3.1. Congenital hypothyroidysm- Thyroid dysgenesis (agenesis, hemiagenesis, ectopia, hypoplasia)- Thyroid dyshormonogenesis3.2. Thyroglossal duct cyst4. Diffuse thyroid diseases4.1. Chronic lymphocytic thyroiditis (Hashimoto disease)4.2. Diffuse hyperplasia (Graves disease)4.3. Nodular hyperplasia4.5. Non-autoimmune thyroiditis (suppurative, granulomatous, subacute non-suppurative thyroiditis (De Quervain)4.6. Diffuse sclerosing variant of papillary carcinoma5. Focal thyroid lesions5.1. Benign lesions (colloid follicles/cysts, true epithelial-lined cysts, hyperplastic nodules with cystic degeneration, follicular adenoma)5.2. Thyroid cancer (papillary, follicular and medullary carcinoma)5.3. Predisposing factors for pediatric thyroid cancer including genetic disorders such as RET, DICER1 or PTEN gene mutations6. Utility and reproducibility of Kwak TI-RADS, ACR-TIRADS, ATA and structured report in the evaluation of pediatric thyroid lesions7. Evaluation of lymphadenopathy8. Newer techniques (elastography, superb microvascular imaging, contrast-enhanced US, radiomics/radiogenomics, AI)9. Conclusions

## PDEE-8 FLUOROSCOPIC IMAGING IN TRACHEOESOPHAGEAL FISTULA REPAIR: MASTERING THE TECHNIQUE TO MINIMIZE COMPLICATIONS

Kari L. Hayes (*Abstract Co-Author*) Nothing to Disclose
Chelsea S. Life, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Understand the pathology and subtypes of tracheoesophageal fistula (TEF)- Recognize imaging appearance of TEF, so as to not delay diagnosis- Review the potential complications of surgical correction of TEF and how would they be recognized on imaging- A model protocol for a pediatric post-operative esophagram will be provided- Pearls and pitfalls of pediatric esophagrams

**TABLE OF CONTENTS/OUTLINE**

- Title slide- TEF: Pathology- TEF: Subtypes- Diagnosing TEF: Pathway and Typical Imaging Appearance- Management of TEF- Potential Complications of Surgical Correction of TEF- Fluoroscopic Post-operative Evaluation: Appropriate Technique and Protocol- Pearls and Pitfalls of Fluoroscopic Esophagrams- Cases/Examples illustrating the aforementioned teaching points

## PDEE-80 SUSTAINING THE FUTURE OF PEDIATRIC RADIOLOGY

Hansel J. Otero, MD (*Abstract Co-Author*) Nothing to Disclose
Sweta Parmar (*Abstract Co-Author*) Nothing to Disclose
Johnny McLaughlin (*Abstract Co-Author*) Nothing to Disclose
Alexandra Sharashidze (*Abstract Co-Author*) Nothing to Disclose
Karen I. Ramirez Suarez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understand the environmental implications of radiology practices, including waste generation and energy consumption, prompting a commitment to sustainability.
- Provide specific examples of interventions that are cost-saving and friendlier to the environment adapted to pediatric radiology practices.
- Examine the cost and environmental impact of changes in equipment energy efficiency, reduction of single use items, and the adoption of multipatient contrast vials.

### TABLE OF CONTENTS/OUTLINE

- Introduction:
- Radiology environmental impact
- Environmental responsibility and vulnerability
- Principles for radiology sustainability and decarbonization
- First steps towards a more sustainable pediatric radiology department:
- Assembling the team
- Focus on cost-saving strategies
- Improving equipment energy efficiency and decreasing energy use
- Workstation power consumption
- Getting rid of single-use supplies and items
- Iodinated contrast vials
- Additional Projects
- Future directions
- Evaluation of climate-aware metrics tools for radiology departments
- Sustainability action plan

## PDEE-81 IMAGING SPECTRUM OF PEDIATRIC PANCREATIC ABNORMALITIES

Luis F. Goncalves, MD, MSc (*Abstract Co-Author*) Speaker, Koninklijke Philips NV;;
Susan M. Hamman, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Zulfiqar, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Asmaa Aamir, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The pancreas can be involved in a wide array of congenital and acquired conditions in the pediatric population. The purpose of this exhibit is: 1. To become familiar with the spectrum of pancreatic disorders in children. 2. Review a multimodality approach and technical considerations for the diagnosis of pancreatic pathology. 3. To illustrate the imaging features of common and uncommon pancreatic disorders in pediatric patients.

### TABLE OF CONTENTS/OUTLINE

Imaging approach to pancreatic lesions. Normal appearance of the pancreas on different imaging modalities. Congenital pancreatic anomalies: pancreas divisum, annular pancreas, ectopic pancreas, pancreatic hypoplasia, abnormal pancreaticobiliary junction. Congenital disorders with pancreatic insufficiency: cystic fibrosis, Schwachman- Diamond syndrome, hereditary pancreatitis, other genetic risk factors. Pancreatitis: acute, chronic, autoimmune. Pancreatic trauma: blunt trauma, penetrating trauma, nonaccidental trauma. Pancreatic infection. Cystic lesions of pancreas: congenital cyst, pseudocyst, von Hippel- Lindau syndrome, autosomal dominant polycystic kidney disease, cystic pancreatic neoplasms. Solid pancreatic tumors: Pancreatoblastoma, solid pseudopapillary neoplasm, neuroendocrine tumor, acinar cell carcinoma, adenocarcinoma, non-epithelial tumors including lymphoma, inflammatory myofibroblastic tumor, invading tumors, metastatic disease. Other pancreatic lesions: intrapancreatic accessory spleen, vascular lesions. Summary.

## PDEE-82 DON'T STICK YOUR NECK OUT: DISSECTING THE SPECTRUM OF PEDIATRIC NECK EMERGENCIES

Ajay Malhotra, MD, MMM (*Abstract Co-Author*) Nothing to Disclose
Shadi Ebrahimian, MD (*Abstract Co-Author*) Nothing to Disclose
Dheeman Futela, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mihir Khunte (*Abstract Co-Author*) Nothing to Disclose
Rahul Jayaram, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Accurate imaging is crucial for diagnosing and managing non-traumatic pediatric head and neck emergencies. The appropriate imaging modality, such as ultrasound, CT, or MRI, varies depending on the particular condition. These conditions include orbital and sinus emergencies, deep neck emergencies, ear emergencies, or airway emergencies. Choosing the proper imaging is critical for determining the most suitable treatment approach and distinguishing between cases requiring immediate intervention and those that can be addressed with medical therapy. Familiarity with the clinical features of pediatric emergencies and collaboration with clinicians can ultimately improve diagnostic precision and treatment effectiveness.

### TABLE OF CONTENTS/OUTLINE

1. Introduction-Importance of imaging in pediatric emergencies-Overview of common head and neck emergencies2. Choosing the Appropriate Imaging Modality-Ultrasound: Safe, cost-effective, but limited depth and operator dependent.-CT: Rapid, detailed bone imaging, but radiation exposure and contrast risks.-MRI: Radiation-free, superior soft tissue contrast, but longer scan times.3. Specific Conditions and Imaging Guidelines-Orbital Emergencies: Identifying cellulitis and abscesses· Sinus / Nasal Emergencies: Complications of sinusitis-Ear Emergencies: Diagnosing otitis and mastoiditis-Airway Emergencies: Recognizing epiglottitis and croup-Neck Emergencies: Recognizing infection, foreign body, vascular emergencies, congenital anomalies4. Case Studies-Application of skills discussed toward patient cases5. Conclusion-Summary of key points-Importance of clinical picture and collaboration when interpreting imaging

## PDEE-83 "TUMMIES" FOR "DUMMIES": NAVIGATING PEDIATRIC ABDOMINAL X-RAYS

Thierry Huisman, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nadia F. Mahmood, MD (*Abstract Co-Author*) Nothing to Disclose
Oswaldo Guevara Tirado, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Lina Kim (*Abstract Co-Author*) Nothing to Disclose
Ricardo Torres, BS (*Abstract Co-Author*) Nothing to Disclose
Karla Santiago-Soltero, BS (*Abstract Co-Author*) Nothing to Disclose
Danet Lugo (*Abstract Co-Author*) Nothing to Disclose
Laura Santiago Caobi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Explore the prevalence and significance of pediatric abdominal pain and the diagnostic role of abdominal x-rays.- Outline a systematic approach to interpreting pediatric abdominal X-rays to improve diagnostic precision and patient outcomes.- Illustrate common pathologies identified in pediatric abdominal x-rays with case examples and address their diagnostic challenges.- Discuss common pitfalls and limitations of pediatric abdominal x-rays.

### TABLE OF CONTENTS/OUTLINE

Pediatric abdominal pain is one of the most common encounters in medical practice, often requiring prompt and accurate evaluation. Optimal use of abdominal x-rays in the pediatric population requires a proper technical assessment, recognition of pathological signs, and knowledge of common pitfalls and limitations. Adopting a systematic approach when reviewing abdominal x-rays entails a careful evaluation of gas patterns, extraluminal air, abdominal masses, calcifications, the peritoneal cavity, and surrounding osseous structures. Maintaining such a structure is key to enhancing diagnostic accuracy and improving patient outcomes.1. Introduction Objectives. 2. Epidemiology 3. How to approach a Pediatric Abdominal X-Rays 4. Common Encounters Stratified 5. Common Pitfalls Limitations 6. Case Examples 7. Conclusion

## PDEE-84 CHILDHOOD ILD (CHILD) PART II: LUNG DISEASE NOT SPECIFIC TO INFANCY - IMAGING FINDINGS AND HISTOPATHOLOGIC CORRELATION

**Awards**
**Certificate of Merit**

Ammie M. White, MD (*Abstract Co-Author*) Nothing to Disclose
Mariangeles Medina Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Luis O. Tierradentro-Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Jenny Pogoriler, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Santiago Martinez-Correa, MD (*Abstract Co-Author*) Nothing to Disclose
David M. Biko, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Hansel J. Otero, MD (*Abstract Co-Author*) Nothing to Disclose
John P. Lichtenberger III, MD (*Abstract Co-Author*) Nothing to Disclose
Ankita Chauhan, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Karen I. Ramirez Suarez, MD (*Abstract Co-Author*) Nothing to Disclose
Jordan B. Rapp, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Overview the current understanding of pediatric interstitial lung diseases, from early childhood to adolescent years 2. Describe the distinctive imaging features and patterns associated with these conditions, emphasizing key CT findings 3. Correlate imaging findings with corresponding pathologic characteristics, highlighting the relationship between radiologic appearance and underlying pathophysiologic processes

### TABLE OF CONTENTS/OUTLINE

- Introduction: The role of imaging in the evaluation and management of chILD in children and adolescents Importance of a multidisciplinary approach- Diagnostic approach depending on clinical presentation and background- Imaging modalities and protocols- Describe characteristic imaging findings of pediatric diffuse lung disease related to:- Connective tissue disease or immune mediated e.g. sJIA, Systemic Sclerosis, SLE, MCTD, Sarcoidosis- Alveolar Hemorrhage e.g. Capillaritis, GPA, BMPR2 - Enviromental or drug related e.g. Hypersensitivity Pneumonitis, Eosinophilic PNA, Pleuroparenchymal fibroelastosis- Bronchiolitis Obliterans e.g. post-infection, post-transplant- Pulmonary Alveolar Proteinosis- Unclassified conditions e.g. Other cystic and fibrotic lung diseases- Differential Diagnosis: Considerations and potential mimics- Conclusion: Take-home points and future directions in imaging and management of pediatric diffuse lung disease

## PDEE-9 BRAIN MALFORMATION IN THE GENOMIC ERA, WHAT THE RADIOLOGIST NEED TO KNOW

Osamah A. Alwalid, MMed (*Abstract Co-Author*) Nothing to Disclose
Marwa Al-Subhi, MD (*Abstract Co-Author*) Nothing to Disclose
Jehan Al-Rayahi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To understand the role of radiology in the evaluation of brain malformation.- To understand basic genetic principles and lingo related to CNS malformation.- To learn the different genetic techniques utilized in the evaluation of patient with brain malformation. - To understand the genetic landscape of common brain malformation and the radiology phenpotype correlation.

### TABLE OF CONTENTS/OUTLINE

Introduction Genetic Principles and Techniques: - - Cytogenetic testing - - Narrow gene testing - - Next generation sequencing Brain malformation and their genetic landscape: - - Holoprosencephaly - - Malformation of cortical development - -Tubulopathies - - Ciliopathies o Joubert o Others related disorders Conclusion

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# Abstract Archives of the RSNA, 2024

PDEE-1

## RAPID MRI FOR PEDIATRIC ACUTE ABDOMINOPELVIC PAIN IN THE EMERGENCY DEPARTMENT: A REVIEW OF IMAGING TECHNIQUE, IMPLEMENTATION, AND DIAGNOSES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Rama S. Ayyala, MD (*Abstract Co-Author*) Nothing to Disclose
Gary R. Schooler, MD (*Abstract Co-Author*) Nothing to Disclose
Cara E. Morin, PhD (*Abstract Co-Author*) Nothing to Disclose
Justine M. Kemp, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine N. Epstein, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

After reviewing this education exhibit, the learner will have an improved understanding of:1- How to implement a rapid MRI protocol for acute abdominopelvic pain in pediatric patients2- Benefits and limitations of rapid MRI in comparison to other imaging modalities in the emergent setting3- Most common etiologies of pediatric abdominopelvic pain encountered in the emergency department

### TABLE OF CONTENTS/OUTLINE

1- Background, including indications and protocol for emergent rapid MRI:a. Review of MRI sequence options, suggested protocol, and strategies for successful service line implementationb. Review advantages and limitations of rapid MRI, including scenarios where other modalities such as ultrasound and CT provide necessary alternative or supplemental informationc.c. Presentation of clinical and imaging algorithms for acute abdominopelvic pain in pediatric patients incorporating rapid MRI2- Case based approach of emergent pediatric diagnoses, including:a. Acute appendicitis (uncomplicated and complicated), ovarian torsion, tubo-ovarian abscess, pyelonephritis, omental infarction, pancreatitis, colitis, and abdominopelvic massesb. Imaging mimics and potential pitfalls3- Summary: Take home points

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# Abstract Archives of the RSNA, 2024

PDEE-10

## PEDIATRIC BRAIN TUMORS: A GENETIC AND IMAGING SYNOPSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vivek B. Pai, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias W. Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Manohar M. Shroff, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Aaditeya Jhaveri, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The 2021 WHO CNS tumor classification has undergone changes in terms of nomenclature with introduction of new tumor entities. 2. Tumors are increasingly defined by the its genetics, rather than imaging features alone. 3. Understanding the genetic landscape is essential in predicting tumor behavior, especially with the advent of improved chemotherapy.

### TABLE OF CONTENTS/OUTLINE

• Review the 2021 WHO classification of CNS tumors• Discuss genetic pathways of pediatric CNS tumors• Describe imaging features of pediatric CNS tumors with emphasis on the recently added/updated tumors, including, but not limited to:A. High Grade Gliomas: Diffuse midline glioma H3 K27-altered, diffuse hemispheric glioma H3 G34-mutant, Diffuse pediatric-type high-grade glioma H3-wildtype/ IDH-wildtype, Infant-type hemispheric glioma. B. Low-grade diffuse gliomas: Diffuse astrocytoma, MYB or MYBL1-altered, Polymorphous low-grade neuroepithelial tumor of the young, Diffuse low-grade glioma MAPK pathway altered. C. Circumscribed astrocytic gliomas: High-grade astrocytoma with piloid features, Astroblastoma MN1 -altered D. Glioneuronal and neuronal tumours: Diffuse glioneuronal tumor with oligodendroglioma-like features and nuclear clusters, Myxoid glioneuronal tumor, Multinodular and vacuolating neuronal tumor, Diffuse leptomeningeal glioneuronal tumor E. Embryonal tumours: Medulloblastoma, Atypical teratoid/ rhabdoid tumour F. Ependymal tumours: Supratentorial and posterior fossa Ependymomas

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# Abstract Archives of the RSNA, 2024

PDEE-12

## A MULTIFACETED THREAT: CNS AND SPINE MANIFESTATIONS IN PEDIATRIC LEUKEMIA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kathleen Schenker, MD (*Abstract Co-Author*) Nothing to Disclose
Ashrith Kandula (*Presenter*) Nothing to Disclose

### TEACHING POINTS

· Pediatric leukemia can involve the central nervous system (CNS) and spine through direct infiltration, opportunistic infections, and treatment-related complications.· Recognizing the diverse CNS and spine manifestations is crucial for prompt diagnosis and effective management.· This presentation will equip radiologists with the imaging features of these complications.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: Epidemiology and Significance of CNS/Spine Involvement in Pediatric Leukemia2. Direct Infiltration by Leukemic Cells2.1 Chloroma (Granulocytic Sarcoma)2.2 Orbital Leukemic Infiltrate3. Infectious Complications3.1 Invasive Aspergillosis 3.2 Rhizomucor Pusillis Infection 3.3 Rothia Meningitis 3.4 Invasive Fungal Sinusitis4. Treatment-Related Toxicities4.1 Methotrexate Neurotoxicity 4.2 Posterior Reversible Encephalopathy Syndrome (PRES) 4.3 Mineralizing Vasculopathy5. Vascular Complications5.1 Blastic Hyperleukocytosis 5.2 Septic Emboli 5.3 Venous Sinus Thrombosis 5.4 Thromboembolic Strokes 5.5 Retinal Hemorrhages6. Long-Term Sequelae6.1 Radiation-Induced NeoplasmsResults: We will present a series of cases highlighting the imaging features and clinical course of each entity. The discussion will emphasize the importance of a multidisciplinary approach, including clinical presentation, laboratory findings, and neuroimaging, for accurate diagnosis and timely intervention.Conclusion: CNS and spine involvement represent a complex challenge in pediatric leukemia. Recognizing the diverse etiologies and their characteristic imaging patterns is crucial for prompt diagnosis and effective management, ultimately improving patient outcomes.

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# Abstract Archives of the RSNA, 2024

PDEE-13

## BE PREPARED: IT'S NOT BECAUSE IT'S RARE THAT IT WON'T HAPPEN! WHAT THE RADIOLOGIST NEEDS TO KNOW ABOUT SPONTANEOUS BILIARY PERFORATIONS IN CHILDREN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lisa Suzuki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Silvia Maria S. Rocha (*Abstract Co-Author*) Nothing to Disclose
Jorge Mesquita, MD (*Abstract Co-Author*) Nothing to Disclose
Luisa L. Faria, MD (*Abstract Co-Author*) Nothing to Disclose
Livia Alves (*Abstract Co-Author*) Nothing to Disclose
Elisa M. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Alves Tavares, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Spontaneous biliary perforations (SBP) are rare but an important cause of surgical jaundice in pediatrics and one of the most common causes of acute abdomen in children, most often diagnosed at the stage of biliary peritonitis. They are known to affect the extra hepatic biliary tree and occasionally, the intrahepatic ducts. This is one of the most common cause of surgical solution jaundice in neonates. And most cases present between the 2nd and 6th weeks of life, more seen under 4years of age. Preoperative diagnosis is very challenging for the radiologist and surgeon, and that is why they need to be aware of SBP as a differential diagnosis of acute abdomen in childhood, because an early diagnosis and efficient surgical management can improve the prognosis and also save the child's life. Most children who present with SBP in infancy are typically previously healthy infants with unremarkable birth and perinatal histories. The actual etiopathogenesis is unknown. Congenital weakness of the common hepatic duct, trauma, choledochal cyst, viral infection, acalculous cholecystitis are all believed to be involved, among other causes. The presenting symptoms are usually benign and non-specific, unless there is a superimposed bacterial peritonitis. However, over a period of hours, days or even weeks, the patients might gradually develop a progressively abdominal distension, jaundice, peritonitis, septicemia, and symptoms of biliary tract disease.

### TABLE OF CONTENTS/OUTLINE

General aspects of Spontaneous Biliary Perforations- Etiology- Prognosis- Imaging Diagnosis Summary

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PDEE-14

## ENDOBRONCHIAL LESIONS IN THE CHILDREN: RADIOLOGIC-BRONCHOSCOPIC-PATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

David M. Biko, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Hansel J. Otero, MD (*Abstract Co-Author*) Nothing to Disclose
Jordan B. Rapp, MD (*Abstract Co-Author*) Nothing to Disclose
Aoife Corcoran (*Abstract Co-Author*) Nothing to Disclose
Ammie M. White, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph Piccione (*Abstract Co-Author*) Nothing to Disclose
Ankita Chauhan, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Illustrate the imaging spectrum of endobronchial pathologic entities in children 2. Discuss benign and malignant lesions and identify imaging features that can help differentiate them 3. Understand the radiologist’s role in recognizing endobronchial pathology to aid appropriate treatment

### TABLE OF CONTENTS/OUTLINE

Goals and objectives Background • Endobronchial lesions are sporadic in children• Endobronchial obstruction often presents with wheezing, persistent cough, recurrent fever, and hemoptysis• Obstructive symptoms occur when the mass occludes more than half the airway lumen and result in respiratory distress• Because these lesions are rare and symptoms are nonspecific, these entities are often initially misdiagnosed as asthma or pneumoniaPathologic entities • Foreign body, mucus impaction, mucoepidermoid carcinoma, inflammatory myofibroblastic tumor, carcinoid, laryngotracheal papillomatosis, mycobacterium avium-intracellulare granuloma, pyogenic granulomaImaging and Bronchoscopic Findings• Infants may present with segmental hyperinflation or persistent lobar consolidation on chest radiograph• CT findings may have specific imaging features or may need further assessment with bronchoscopy• Bronchoscopic assessment and excision/biopsy remain primary diagnostic and interventional toolsPathologic CorrelationSummary • Knowledge of characteristic imaging features aids the radiologist in making the correct diagnosis and prevents treatment delays

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# Abstract Archives of the RSNA, 2024

PDEE-15

## NONE, ONE, TWO OR THREE BALLS? SCAN, COLOR AND GO FOR IT!

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

* Sonography serves as an optimal and often sole modality for imaging scrotal disorders in children. It boasts high accuracy, widespread availability in most institutions, safety, and does not necessitate sedation. * It is imperative to consider clinical symptoms during the examination, such as non-palpable testicles or the presence of one or multiple palpable nodules. * Achieving an accurate diagnosis hinges on distinguishing between painful and non-painful pathologies of the scrotum and inguinal region.

### TABLE OF CONTENTS/OUTLINE

* Review of Sonographic Techniques: Gray-Scale and Doppler Appearance of the Pediatric Scrotum * Systematic Approach to Sonographic Imaging * Cases of Scrotal Disorders in Children: Cryptorchidism and Testicular Ectopia, Different Types of Hydrocele, Hydatid Torsion, Hyperplasia of the Rete Testis, Splenogonadal Fusion, Polyorchidism, Meconium Peritonitis, and Testicular Neoplasms * Imaging Modalities: Gray-Scale and Doppler Ultrasound

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# Abstract Archives of the RSNA, 2024

PDEE-16

## ANOMALOUS PANCREATICOBILIARY JUNCTION ON MRCP ASSOCIATED WITH CHOLEDOCHAL CYSTS: SPECTRUM OF IMAGING FINDINGS IN CHILDREN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Abhay S. Srinivasan, MD (*Abstract Co-Author*) Nothing to Disclose
Michael R. Acord, MD (*Abstract Co-Author*) Nothing to Disclose
Rebecca Dennis, DO (*Abstract Co-Author*) Nothing to Disclose
Youck Jen Siu Navarro, MD (*Abstract Co-Author*) Nothing to Disclose
Sudha A. Anupindi, MD (*Abstract Co-Author*) Nothing to Disclose
Shyam Sunder B. Venkatakrishna, MBBS (*Abstract Co-Author*) Nothing to Disclose
Ankita Chauhan, MD, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In anomalous pancreaticobiliary junction (APBJ), the pancreatic and bile ducts join outside the duodenal wall to form a long common channel. APBJ is associated with raised amylase and lipase levels in the duct fluid. Obstructive cholangiopathy is a common cause of cholestatic jaundice in infants with APBJ, as it is found in patients with choledochal cysts, particularly Todani types I and IV. In older children with APBJ, the symptoms are related to cholangitis and pancreatitis. Relatively long common channel is a major risk factor for the development of cholangiocarcinoma in adulthood, so timely excision reduces morbidity and mortality. Teaching Points 1. Understand the pathophysiology behind pancreaticobiliary junction anomalies. 2. Learn the classification of junctional anomalies in children. 3. Illustrate the imaging spectrum of anomalous pancreaticobiliary junction in children with choledochal cysts. 4. Learn how to measure the length of the common channel.

### TABLE OF CONTENTS/OUTLINE

-Background information on APBJ and imaging findings on Magnetic Resonance Cholangiopancreatography (MRCP). -Normal pancreaticobiliary ductal anatomy -Pancreaticobiliary maljunction (definition, pathophysiology, demographics) -Correlation with endoscopic retrograde cholangiopancreatography (ERCP) and with surgical findings -Choledochal cyst (Todani classification) and APBJ in choledochal cysts with exemplary cases - Recommended treatment guidelines and role of surveillance imaging - Summary

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PDEE-17

## IT’ S A DSD! - KEEP CALM, DON’T PANIC AND FOLLOW THE TRACK

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatiana M. Fazecas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Disorders of sexual differentiation often induce anxiety among both the infant’s family and the attending physicians tasked with evaluating infants presenting with genital abnormalities. It is imperative for radiologists to possess a thorough understanding of the DSD classification system. In cases involving newborns with ambiguous genitalia, pediatric radiologists are frequently consulted to conduct ultrasonography (US) examinations aimed at addressing various anatomical inquiries. Employing a systematic approach to initial sonographic imaging enables comprehensive assessment of critical genitourinary structures, pivotal for guiding diagnostic and clinical interventions. An organized ultrasonographic (US) methodology is indispensable for evaluating several structures, including those originating from the Müllerian ducts (uterus and upper vagina), discerning the type of gonad (testes, ovaries, ovotestes, or streak gonads), assessing the distal vagina, and examining the adrenal glands.

### TABLE OF CONTENTS/OUTLINE

1) DSD Classification System 2) Systematic Approach to Initial Sonographic Imaging 3) Different Cases of DSD: DDS 46 XX (CAH, testicular); DDS 46 XY (ovotestis, gonadal dysgenesis, androgen insensitivity); Ovotestis DDS 4) Imaging Modalities: Abdominal and Pelvic Ultrasound; Transperineal Ultrasound; Genitography

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# Abstract Archives of the RSNA, 2024

PDEE-19

## TINY TITANS : EYE-VENTURES IN PAEDIATRIC ULTRASOUND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Bharat Aggarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Amit K. Sahu, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Ayushi Gupta, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Paediatric ocular ultrasound(US) plays a pivotal role in assessing eye health by focusing on anatomy, imaging techniques, and distinguishing between normal and abnormal conditions.US aids in differential diagnosis by assessing lesion morphology, distinguishing between solid and cystic masses, and detecting features such as calcifications, hemorrhage, retinal/choroid detachments, or foreign bodies. Color Doppler US proves useful in suspected cases of vascular, inflammatory, or neoplastic lesions.Congenital and acquired ocular conditions can be accurately diagnosed through US, spanning from irregular globe size to atypical morphological features. US reveals distinctive echoes for pathologies within the vitreous, such as hemorrhage or infection, and delineates detachment types like retinal detachment or choroid detachment with characteristic lines. It also identifies posterior wall masses, primarily retinoblastoma.Paediatric ocular US is a non-invasive adjunct to clinical assessment, especially in cases where traditional visualization methods are compromised.

### TABLE OF CONTENTS/OUTLINE

Learning normal anatomy of the paediatric globe and protocol based US to distinguish between normal and abnormal conditions.To review the congenital and acquired ocular pathology in the paediatric age group and to explain its most characteristic US findings.Distinguishing solid and cystic masses, and features such as calcifications, haemorrhage, retinal/choroid detachments, or foreign bodies.Distinguishing different kinds of haemorrhages involving eye.

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# Abstract Archives of the RSNA, 2024

PDEE-2

## THE CHALLENGING ULTRASONOGRAPHIC FINDINGS OF NEONATAL AND PEDIATRIC COW'S MILK PROTEIN ALLERGY (CMPA)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yoshino Tamaki Sameshima, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
MARCIA W. MATSUOKA, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Romano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Inflammatory and infectious intestinal diseases lead to a thickening of the intestinal wall, which can be detected using gray-scale ultrasound.- Color Doppler ultrasound can detect increases in vascular flow in the intestinal wall if there is active inflammation.- Intestinal pneumatosis is a potentially serious condition in neonatal and pediatric settings and may be associated with hepatic portal venous gas.- Although these findings are non-specific, they may be an expression of CMPA and should always be evaluated in the clinical context, particularly in the context of cow’s milk protein exposure.

### TABLE OF CONTENTS/OUTLINE

- Providing a multimodality-based didactic review of the main topics of cow’s milk protein allergy (CMPA) including: pathophysiology, diagnostic evaluation, clinical presentations and ultrasonographic findings.- Preparation of a practical guide on how to perform an evaluation, in which the patterns of the structures and their clinical relevance are presented and discussed.- Correlating the findings with the differential diagnosis in the context of the emergency department.Outline: Ultrasonography can be routinely used to diagnose and monitor changes associated with CMPA. The increasing incidence of pediatric cases of CMPA in our Institution prompted us to present this work, to raise awareness of the various sonographic presentations, from the simplest to the most complex, emphasizing the systematic evaluation of the abdomen with special attention to the intestinal loops.

# Abstract Archives of the RSNA, 2024

PDEE-20

## FROM PIROUETTES TO PATHOLOGIES: RECOGNIZING COMMON FOOT AND ANKLE INJURIES AMONG YOUNG FEMALE BALLET DANCERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sarah D. Bixby, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Jade Iwasaka-Neder, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Megan Kenway, MD (*Abstract Co-Author*) Nothing to Disclose
Nikhil Gupta, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Robert Freund, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Review relevant anatomy of the foot, ankle, and distal lower leg.; Review common imaging modalities used to assess traumatic injuries of young ballet dancers.; Demonstrate common injury patterns in the foot, ankle, and lower leg along with their mechanism of injury, including both acute and chronic conditions related to excessive turnout and dancing en pointe.; Understand the mechanism of the injury and management options that enable return to dance.

### TABLE OF CONTENTS/OUTLINE

- Normal Anatomy
- Labeled Diagram of relevant normal foot/ankle anatomy
- Common static ballet positions and dynamic ballet movements and associated patterns of injury
- Impact of turnout and en pointe on the dancer's foot
- Imaging modalities and common imaging indications
- Plain Radiographs, Computed Tomography, Magnetic Resonance Imaging.
- Fractures
- Dancer's Fracture (5th metatarsal)
- Midfoot Fractures including the "Nutcracker" fracture
- Distal Phalanx Fractures
- Ligamentous Injuries
- Deltoid Ligament
- Anterior Talofibular Ligament
- Lisfranc Ligament
- Tibiofibular Ligament
- Impingement Syndromes
- Anterior Ankle Impingement
- Posterior Ankle Impingement "Dancer's Heel"
- Tendon Abnormalities
- Flexor Hallucis Longus Tendon Tenosynovitis "Dancer's Tendinitis"
- Posterior Tibialis/Plantaris strain/tear
- Achilles Tendon strain/tear
- Peroneus Brevis/Longus strain/tear
- Stress Reactions
- Metatarsals
- First MTP Sesamoid
- Midfoot (Cuboid, Navicular)
- Tibia/Fibula
- Other/Misc.
- Plantar Fasciitis
- Morton Neuroma
- Hallux Valgus
- "Spotty Bone Marrow" (SBM) pattern in tarsal bones

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# Abstract Archives of the RSNA, 2024

PDEE-21

## EXPLORING FETAL CERVICAL MASSES: UNDERSTANDING INTERPRETATIONS AND PROGNOSTIC INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Ultrasound serves as the main screening modality for cervical masses. MRI complements ultrasound by confirming diagnosis and assessing prognosis. Virtual navigation, US and MRI reconstruction may helps in postnatal surgical planning. The primary masses encountered in the fetus include lymphatic malformation, goiter, cervical teratoma, brachial cysts and hemangioma. The main differential diagnosis are meningocele and occipital encephalocele.

### TABLE OF CONTENTS/OUTLINE

1) Fetal Cervical Pathologies a. Benign and Malignant Masses b. Lymphatic System Malformations c. Primary Sites 2) MRI and Ultrasound Findings a. Main Features b. Differential Diagnoses c. Pitfalls 3) Application of Virtual Navigation in Diagnosis and Prognosis 4) Prognostic Indicators of the Pathologies

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# Abstract Archives of the RSNA, 2024

PDEE-22

## CONGENITAL NEUROBLASTOMA: A PATHOLOGY TO BE REMEMBERED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yoshino Tamaki Sameshima, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
MARCIA W. MATSUOKA, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriela Merigue, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Demonstrate through ultrasonographic exams the regression of congenital neuroblastoma cases in the adrenal glands, as well as secondary hepatic metastasis to congenital neuroblastoma- Show ultrasonographic images of possible differential diagnoses of this pathology (adrenal hemorrhage, pulmonary sequestration, and congenital adrenal hyperplasia)-Demonstrate the importance of routine evaluation not only of the adrenal gland but also the adrenal fossa for early detection of possible lesions.

### TABLE OF CONTENTS/OUTLINE

INTRODUCTION- Epidemiology- Anatomy- Ultrasonographic techniqueCASE-BASED REVIEW- Congenital neuroblastoma cases with spontaneous involution- Differential diagnosesFINAL CONSIDERATIONSREFERENCES

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# Abstract Archives of the RSNA, 2024

PDEE-23

## EMPOWERING PEDIATRICS: LEVERAGING WHOLE-BODY DIFFUSION-WEIGHTED MAGNETIC RESONANCE IMAGING FOR VULNERABLE POPULATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor M. Sardenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre C. Valim, MD (*Abstract Co-Author*) Nothing to Disclose
Clarissa C. Moraes Do Carmo, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carolina A. Almeida, MD (*Abstract Co-Author*) Nothing to Disclose
Flavia M. Costa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fernanda P. Philadelpho, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Whole-Body Diffusion-Weighted Magnetic Resonance Imaging (WB-DW-MRI) represents a sensitive imaging modality devoid of ionizing radiation, capable of providing comprehensive whole-body coverage with superior soft tissue contrast and spatial resolution within a condensed timeframe. WB-DW-MRI proves invaluable in assessing various disease processes affecting the vulnerable pediatric population, encompassing cancer diagnosis and staging, disseminated infections, metabolic and idiopathic disorders, systemic rheumatologic conditions, congenital anomalies, inherited diseases, immunodeficiency disorders, and tumor predisposition syndromes. WB-DW-MRI is adept at detecting and characterizing multifocal or systemic diseases, particularly aiding in the diagnosis of challenging conditions where consensus among a multidisciplinary team of healthcare professionals may be lacking. It serves as a cost-effective diagnostic imaging method facilitating accurate diagnosis, therapeutic monitoring, and informed treatment decisions. This is particularly pertinent in the context of the vulnerable pediatric population, effectively minimizing unnecessary procedures.It is imperative to employ the optimal protocol for each disease to ensure accurate diagnosis and differential diagnosis.

### TABLE OF CONTENTS/OUTLINE

Imaging Diagnosis in Underserved Areas of Brazil;Whole-Body Diffusion-Weighted Magnetic Resonance Imaging Technique;Diagnosis of Challenging Diseases • Inflammatory (Chronic Nonbacterial Osteomyelitis, Juvenile Idiopathic Arthritis, Polyarteritis Nodosa) • Idiopathic (Sarcoidosis, Rosai-Dorfman) • Metabolic (Hypovitaminosis - Scurvy, Alimentary Selectivity Autism)

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PDEE-24

## UNDERSTANDING FACIAL CLEFTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eloisa M. Gebrim, MD (*Abstract Co-Author*) Nothing to Disclose
Raphael M. Reali, MD (*Abstract Co-Author*) Nothing to Disclose
Marcio Ricardo T. Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Soraia A. Souza, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Lisa Suzuki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Maira Sarpi, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta C. Andrade, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The aim of this study is to revisit the classification system of craniofacial clefts proposed by Tessier in 1976. Until then, there had been a variety of nomenclatures, and some authors had attempted to standardize them. Tessier's classification is considered the main reference because of its simplicity and applicability.Although this classification system is based on clinical and surgical observation, many of the features can be explained by embryological and anatomical factors. The most accepted theory relates to disturbances in the formation or fusion of facial processes, but the molecular mechanism is partly understood.The Tessier classification involves numbering the facial clefts from 0 to 14 based on their location in two areas: the orbit/eyelid and the jaw/lips.They can also occur in combination and skeletal and soft tissue clefts do not necessarily coincide.Radiologists should be able to recognize these facial deformities and their associated findings to improve the diagnosis and surgical decision making. knowledge of this system will then allow for consistent professional communication. This manuscript outlines the Tessier classification using imaging examples to illustrate this system and to contribute to its memorability due to the rarity of some findings.

### TABLE OF CONTENTS/OUTLINE

1. Embryological theory and anatomy 2. Tessier classification 3. CT imaging examples and main descriptors 4. Related findings

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# Abstract Archives of the RSNA, 2024

PDEE-25

## UNVEILING DEVELOPMENTAL ENIGMAS: IMAGING EMBRYOLOGIC VARIANTS AND ANOMALIES IN THE SELLAR AND SUPRASELLAR REGION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Deepali Bhalla (*Abstract Co-Author*) Nothing to Disclose
Rajan P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Rohan Samant, MBA (*Abstract Co-Author*) Nothing to Disclose
Manav Bhalla, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The sellar and suprasellar region is a complex anatomical space harboring critical structures vital for endocrine regulation. Embryonic development plays a pivotal role in shaping the intricate anatomy of this region. Understanding the embryologic variants and anomalies of this region is paramount for accurate diagnosis and management. Variations in the development of Rathke's pouch, the infundibulum, and adjacent structures during embryogenesis can lead to a spectrum of anomalies, ranging from benign variations to clinically significant pathologies. Imaging serves as indispensable tools for the evaluation of these anomalies, in particular, detailed visualization of the pituitary gland, hypothalamus, optic chiasm, and surrounding structures, facilitating precise anatomical delineation and pathological characterization.

### TABLE OF CONTENTS/OUTLINE

I. Importance of understanding embryologic variants and anomalies in the sellar and suprasellar region. II. Embryologic Basis of Sellar and Suprasellar Anomalies - Developmental origins of key structures: Rathke's pouch and infundibulum; Embryonic structures in the sellar and suprasellar region; Variations and anomalies arising from embryologic development III. Clinical Significance of Sellar and Suprasellar Anomalies -Effects on endocrine regulation and neurovascular function; Clinical presentation and diagnostic challenges IV. Imaging Modalities for Evaluation - Role of MRI in anatomical characterization; Utilization of CT; Advanced MRI techniques V. Diagnostic Challenges and Considerations - Pitfalls and limitations of imaging modalities; Importance of integrating clinical and radiological findings

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# Abstract Archives of the RSNA, 2024

PDEE-27

## IMAGING APPEARANCE OF CSF SHUNTS AND THEIR COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Shehanaz K. Ellika, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew Koh, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah Mohajeri Moghaddam, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Pranay Rao, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• A wide variety of treatment options exist for both temporary and permanent CSF diversion. • CSF shunt catheters are composed of several components including a proximal catheter, reservoir, valve, and distal catheter. • Shunt malfunction can be categorized by early and late complications. • Imaging plays an important role in assessment of shunt malfunction. • Comparison with prior imaging clinical history is key. • Ventricular shunting can result in brain calavarial changes which are also well evaluated on imaging studies.

### TABLE OF CONTENTS/OUTLINE

• CSF Diversion o Temporary measures o Permanent measures • Shunt components • Imaging of CSF shunts • Shunt complications o Early: Tip misplacement, tip migration, infection, shunt disconnection, etc. o Late: Fracture, pseudocyst, shunt calcification, shunt erosion, over drainage, etc. • Brain calvarial changes related to ventricular shunting

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# Abstract Archives of the RSNA, 2024

PDEE-28

## ORBITAL MANIFESTATIONS OF SYNDROMIC DISEASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karen Moeller, MD (*Abstract Co-Author*) Nothing to Disclose
Livja Mertiri (*Abstract Co-Author*) Nothing to Disclose
Thierry Huisman, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Huy D. Tran, MD (*Abstract Co-Author*) Nothing to Disclose
Rajan P. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Oswaldo Guevara Tirado, MD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- List rare syndromic disorders that may affect the orbit.- Outline a systemic approach for evaluating the orbits and surrounding structures to assist in the identification of rare syndromic diseases.- Illustrate and describe the unique optic imaging features of rare syndromic diseases.

### TABLE OF CONTENTS/OUTLINE

Rare syndromic diseases can be particularly difficult to diagnose, especially when they present with a wide variety of symptoms and clinical findings. However, imaging of the orbit and the surrounding structures can significantly aid in narrowing down the differential diagnoses. Adopting a systematic approach when evaluating the eye involves assessing the globe, optic nerve, extraocular muscles, vascular structures, and the intracranial, maxillofacial, and temporal bone regions. Subsequent visualization of anomalies such as size discrepancies, hemorrhages, and other defects can be crucial in arriving at the correct diagnosis and improving patient care.1. Introduction Objectives2. Epidemiology3. Systemic approach for orbit evaluation among rare neurological diseases4. Case examples of syndromic diseases and their manifestations· CHARGE Syndrome· Tuberous Sclerosis· Leptin Deficient Lipodystrophy Syndrome· Norrie Disease· Septo-Optic Dysplasia· Neurofibromatosis Type 1· Kearns-Sayre Syndrome· Congenital Cranial Dysinnervation Disorders (CCDD)· Sturge-Weber Syndrome· Von-Hippel Lindau· Blue Rubber Bleb Nevus Syndrome· Terson Syndrome· PHACES Syndrome· Parry-Romberg Syndrome· Goldenhar Syndrome· Encephalocraniocutaneous Lipomatosis· Walker-Warburg Syndrome5. Conclusion

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# Abstract Archives of the RSNA, 2024

PDEE-29

## WHAT IS THIS UNEXPECTED LUMP? IMAGING EVALUATION OF LUMPS AND BUMPS IN THE PEDIATRIC PATIENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia T. Lima (*Abstract Co-Author*) Nothing to Disclose
MARCIA W. MATSUOKA, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Yoshino Tamaki Sameshima, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review common lumps and bumps in children and suggest a practical initial sonographic approach. Emphasize ultrasound (US) imaging as a safe and commonly used method for evaluating these lesions, often the first diagnostic study requested. Recommend optimal imaging techniques, such as using high-frequency linear transducers for superficial lesions and lower-frequency probes for deeper structures. Emphasize the importance of Doppler imaging for a comprehensive evaluation of soft tissue masses, confirming the vascular, cystic, or solid nature of a mass and aiding in further characterization.Recognize the limitations of ultrasound and acknowledge that in some cases, further evaluation with MRI or CT, biopsy, or surgical excision may be required for an accurate diagnosis.

### TABLE OF CONTENTS/OUTLINE

This educational exhibit describes the sonographic imaging appearance of the most common lumps and bumps at a tertiary hospital in Sćo Paulo. We divided them into categories:CONGENITAL (branchial cleft cyst, thyroglossal duct cyst, undescended testis; VASCULAR ANOMALIES (vascular tumors (e.g. hemangioma); Vascular malformations (e.g. lymphatic malformations); INFECTION (abscess, retained foreign body; myiasis; TRAUMATIC INJURY (hematoma and muscle injury; subgaleal hematoma; fibromatosis colli; fracture; subcutaneous fat necrosis of the newborn; LYMPH NODES (reactive lymphadenopathy; Bacille Calmette-Guérin (BCG) lymphadenitis; Malignant lymphadenopathy (lymphoma); BREAST LUMP (physiologic neonatal breast enlargement; Gynecomastia; SKIN AND SOFT TISSUE (epidermoid Cyst; Lipoma; Baker's Cyst; HERNIAS (Hernia of the Nuck Canal; Umbilical Hernia; Inguinal Hernia).

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# Abstract Archives of the RSNA, 2024

PDEE-3

## PEDIATRIC RHABDOMYOSARCOMA FROM HEAD TO TOE: A COMPREHENSIVE ANALYSIS OF IMAGING FINDINGS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
Suheyla P. Ribeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina R. Soares, MD (*Abstract Co-Author*) Nothing to Disclose
Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshino Tamaki Sameshima, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor C. Romano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Rhabdomyosarcoma is a malignant tumor with morphology resembling skeletal muscle cells.- Imaging findings are nonspecific and indistinguishable from other sarcomas. The tumor’s anatomic location and demographic data of the patient are more useful for narrowing the differential diagnosis.- Up to 20% of patients with rhabdomyosarcomas present with metastases at the time of diagnosis (typically in the lungs and bone marrow).

### TABLE OF CONTENTS/OUTLINE

Table of contents:- Establishing the importance and effectiveness of accurate evaluation of rhabdomyosarcoma.- Review imaging findings across various examination modalities (MRI, CT, US, PET-CT) for different anatomical systems (head and neck, abdomen and musculoskeletal).- Creation of a practical guide for conducting an evaluation, including the necessary variables for follow-up.- Illustrating these conditions based on cases from our radiology group.Outline: Imaging modalities have played a decisive role in the localization of rhabdomyosarcomas. Assessing the local extent of the tumor is an essential aspect of radiological evaluation and has a direct impact on treatment. Detecting invasion of adjacent structures, considering the involvement of critical anatomical structures, and metastatic spread are fundamental to staging the disease and determining appropriate treatment strategies, be it surgical resection, radiotherapy, or a combination of these procedures.The correlation between radiological findings and histopathological characteristics is a noteworthy aspect of our discussion. Understanding how imaging features align with underlying pathology can help refine diagnostic criteria and predict tumor behavior.

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# Abstract Archives of the RSNA, 2024

PDEE-30

## FOLLOW THE PATH: A SYSTEMATIC APPROACH TO THE LINEAR AND RETICULAR PATTERN ON CHEST COMPUTED TOMOGRAPHY IN PEDIATRIC PATIENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luisa L. Faria, MD (*Abstract Co-Author*) Nothing to Disclose
Deborah Y. Otto (*Abstract Co-Author*) Nothing to Disclose
Lisa Suzuki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodolfo Lourenco (*Abstract Co-Author*) Nothing to Disclose
Amanda Alves Tavares, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Linear and reticular opacities constitute a radiological pattern of lung involvement that represents thickening of the pulmonary interstitium by fluid, fibrosis or infiltration by cells or other material, presenting a broad differential diagnosis. The objective of this work is to present a systematic approach for interpreting the linear and reticular pattern in chest computed tomography specifically in pediatric patients, bringing to light important, and often not well-known, differential diagnoses in this age group. The approach to learning through radiological patterns brings advantages to learning, improving diagnostic skills and expanding knowledge.This presentation aims to:(1) review the linear and reticular patterns of abnormality on chest computed tomography;(2) present a case-based and systematic approach to the linear and reticular pattern on chest computed tomography in pediatric patients.

### TABLE OF CONTENTS/OUTLINE

- Introduction- Anatomy of the secondary lobule.- Basic chest computed tomography patterns.- Case-based and systematic approach to the linear and reticular pattern (interlobular septal thickening, centrilobular peribronchovascular interstitial thickening, peribronchovascular interstitial thickening, intralobular interstitial thickening, fissure thickening, subpleural lines)

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# Abstract Archives of the RSNA, 2024

PDEE-31

## METÁSTASIS DE RETINOBLASTOMA: MÁS ALLÁ DE LO CONVENCIONAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karina Marisol Gress Motiel, MD (*Abstract Co-Author*) Nothing to Disclose
Maryury Fabiola Pineda Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Diana N. Nunez Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Vilma J. Varela George SR, MEd (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.- Pediatric intraocular malignancies have retinoblastoma as the most common cause. The cause is loss of function of the RB1 tumor suppressor gene, although some tumors result from amplification of the MYCN oncogene with normal RB1 genes.2.- 1 in every 16,000 births has retinoblastoma. There are no known geographic, racial or sexual preferences. Heritable retinoblastoma is diagnosed at midlife at 12 months and non-heritable disease at 24 months. 3.-Preoperative evaluation of retinoblastoma relies on magnetic resonance imaging. In addition to evaluate of tumor invasion of the ON, choroid, and sclera, all of which are high-risk features for systemic dissemination.4.- Trilateral retinoblastoma refers to the presence of intracranial tumor histologically similar to retinoblastoma in the pineal gland or suprasellar cistern in addition to bilateral ocular involvement.5.-Extraocular extension of retinoblastoma is an important risk factor for the development of distant metastases in the non-central nervous system, as it allows the tumor to access vascular and lymphatic channels .

### TABLE OF CONTENTS/OUTLINE

1.Radiological anatomy2.Retinoblastoma generalities3.Retinoblastoma disemination pathwaysa) Intracraneal spaceb)Trilateral retinoblastomac)Tetralateral retinoblastomad)lymphatic routese)Hematogenous via4.Factors that increase the risk of progression5.Unusual Cancer Spread6.Estadification system

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# Abstract Archives of the RSNA, 2024

PDEE-32

## HOW CAN WE HELP IN THE MANAGEMENT OF PRECOCIOUS PUBERTY? CLINICAL APPROACH AND THE ROLE OF IMAGING - A GUIDE FOR THE RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Paulo Eduardo Daruge Grando, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshino Tamaki Sameshima, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
Yago F. Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eduardo Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda G. Bolsi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This article aims to: 1 - Review the definition of precocious puberty, its clinical and laboratory findings, as well as aspects related to the treatment and follow-up of patients. 2 - Demonstrate the role of radiological exams such as hand and wrist x-ray, pelvic ultrasound and pituitary MRI in the diagnosis and follow-up of the disease, showing several cases of precocious puberty, correlating the different imaging methods used for diagnosis.

### TABLE OF CONTENTS/OUTLINE

1 - To provide a complete review o precocious puberty, starting with its definition, its clinical and laboratory findings, showing the way to correctly identify and diagnose the disease and its subtypes, as well as the hormonal profiles that can be identified in its various spectrums and the main types of treatment currently available. 2 - Discuss the main radiological exams used for diagnosis and follow-up, including hand and wrist x-ray for estimating bone age, showing how the exam is performed and interpreted, what should be assessed for the calculation, as well as the main classification methods (Greulich-Pyle and Tanner-Whitehouse) and also show new techniques. 3 - Demonstrate the importance of pelvic ultrasound in the assessment of patients with suspected precocious puberty, reviewing the main changes related to hormonal stimulation and how this affects the female sex organs and pituitary MRI in the evaluation of central origin precocious puberty.

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# Abstract Archives of the RSNA, 2024

PDEE-33

## 3D IMAGING IN MüLLERIAN DUCT ANOMALIES: WHAT THE SURGEON WANTS TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sunit Davda, MBBS, MRCP (*Abstract Co-Author*) Nothing to Disclose
Amanda R. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Kantheera Leesmidt, MD (*Abstract Co-Author*) Nothing to Disclose
Jesse L. Courtier, MD (*Abstract Co-Author*) Founder, Sira Medical, Inc;Consultant, Sira Medical, Inc
Sloane Berger-Chen (*Abstract Co-Author*) Nothing to Disclose
Jocelyn Cheng, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Müllerian duct anomalies (MDA) have important implications on the reproductive health of female children. MDAs are frequently associated with other congenital anomalies of the cervix, vagina, or urinary tract, and are a common cause of infertility and pregnancy loss after adolescence. The purpose of this educational exhibit is to: (1) Review the embryology, classification, imaging features of Müllerian duct anomalies (2) Review the indications and techniques for surgical management of Müllerian duct anomalies in pediatric patients (3) Provide specific cases and clinical courses of patients with specific Müllerian duct anomalies (4) Allow learners to test their knowledge with a quiz.

### TABLE OF CONTENTS/OUTLINE

Using original images and figures from our institution, this exhibit will review the role of MRI in detecting, classifying and guiding surgical management of Müllerian duct anomalies in children. (1) Introduction: Review the embryology, classification, imaging features and treatment options of Müllerian duct anomalies (2) Indications/contraindications to surgical management of Müllerian duct anomalies (3) Procedure and techniques for surgical management of Müllerian duct anomalies (4) Case review of patients with specific Müllerian duct anomalies (5) Allow learners to test their knowledge with a quiz.

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# Abstract Archives of the RSNA, 2024

PDEE-34

## IMAGING OF THE NEONATAL BRAIN: HYPOXIC ISCHEMIC ENCEPHALOPATHY AND BEYOND

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Vivek B. Pai, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. MRI is a key step in the evaluation of neonatal encephalopathy 2. MR imaging of the neonatal brain relies on optimized protocols and neonate-specific MR hardware 3. A myriad of etiologies cause bilateral brain injury in neonates, clinically and radiologically mimicking Hypoxic Ischemic Encephalopathy (HIE) 4. Having a pattern-based approach is crucial in narrowing down a diagnosis

### TABLE OF CONTENTS/OUTLINE

1. Review imaging protocols for assessment of the neonatal brain 2. Discuss the pathophysiology and imaging patterns of neonatal HIE 3. Detailed review of other causes of neonatal encephalopathy: A. Metabolic etiologies: • Molybdenum Cofactor, Sulphite Oxidase Deficiency • Urea Cycle disorder: OTC deficiency, Citrullinemia • Organic Acidopathies: Maple Syrup Urine Disease, Non-ketotic hyperglycinemia, Isovaleric aciduria, Methylmalonic acidemia • Hypernatremia • Hypoglycemia • Mitochondrial Encephalopathy: Leigh's Disease, MELAS• Peroxisomal disorders: Zellweger's Syndrome B. Infections: • TORCH • Viral: Herpes Simplex Virus Encephalitis, Parechoviral infection • Bacterial: Group B streptococcal Septicemia, Bacillus cereus. E. Coli meningitis • Fungal: Candidiasis C. Arterial and Venous Ischemia D. Malformations: Hemimegalencephaly E. Others: Abusive Head Injury

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# Abstract Archives of the RSNA, 2024

PDEE-35

## LUNG TRANSPLANT IN CHILDREN: OUR RADIOLOGICAL EXPERIENCE AND APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

German Ramos Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Lopez Coello, MD (*Abstract Co-Author*) Nothing to Disclose
Luis Riera Soler, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Riaza Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Luis A. del Carpio Bellido Vargas, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Gonzalo Carballes, BMBCh (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Espinal Colominas, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Fernando Casanova Barba, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Generalities in children lung transplantation Principal causes and epidemiologyMethodsFollow-upHow CT results can substantially impact the patient's management and treatment.Normal findings in CT scanDescribe main radiological findings of short and long-term complications

### TABLE OF CONTENTS/OUTLINE

Introductions in pediatric lung transplantation, overview, materials and methods and importance of study.Our results: Normal findings that include those related to the bronchial and vascular anastomoses. The most frequent parenchymal complications following lung transplantation including differents types of infections and acute or chronic rejection (bronchiolitis obliterans). Postoperative vascular complication that required CT angiography for diagnosis (Bleeding from the surgical bed).The most frequent posttransplantation airway complications include dehiscence as an early complication and stenosis as a long term problem. CT is useful when bronchopleural fistula is suspected.The protocol/checklist we use in our center and propose to optimal evaluate after a lung transplant in childrenConclusions:Importance of CT scan examination after lung transplantation in children for follow-up and the assessment of airway and parenchymal complications. To know the most common findings after lung transplantation and to recognize signs of complications, especially in their early stages.Importance of the role that the radiologists play to preserve the graft and ensure accurate assessment.

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# Abstract Archives of the RSNA, 2024

PDEE-36

## UNDERSTANDING PEDIATRIC NEUROINFLAMMATION: WHAT SPARKS THE FIRE?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manohar M. Shroff, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Vivek B. Pai, MBBS, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Pediatric neuroinflammation (PN) is an expanding group of disorders presenting with symptoms ranging from mild to severe neuropsychiatric manifestations with variable levels of consciousness. 2. PN has gained traction in recent literature because of the improved understanding of pathologic / genetic triggers and ensuring inflammatory cascades, thereby enhancing therapeutic options. 3. Knowledge of the pathophysiology of these disorders forms the fundamental basis of understanding the pattern of brain injury detected on imaging. 4. Imaging findings may often be non-specific, to begin with, however, lesions may evolve within a few hours to days. A high index of suspicion, in an appropriate clinical setting is imperative to initiate prompt institution of anti-inflammatory and neuroprotective treatment measures.

### TABLE OF CONTENTS/OUTLINE

1. Revisit key concepts of adaptive and innate immunity 2. Discuss the role of Microglia 3. Review the physiology of the blood barrier and demystify the concept of its immune privilege 4. Discuss the pathophysiology and imaging appearances of specific neuroinflammatory entities in pediatric patients: • Multiple Sclerosis • Neuromyelitis optica spectrum disorder (NMOSD) • Myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) • Rasmussen's encephalitis • Anti-NMDAR encephalitis • Opsoclonus-myoclonus ataxia syndrome (OMAS) • Acute necrotizing encephalopathy • Hemophagocytic Lymphohistiocytosis (HLH) • Langerhans cell histiocytosis • Interferonopathies / Aicardi- Goutičres syndrome

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# Abstract Archives of the RSNA, 2024

PDEE-37

## NEUROIMAGING OF PEDIATRIC CNS TUMORS IN TUMOR PREDISPOSITION SYNDROMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Karuna V. Shekdar, MD (*Abstract Co-Author*) Nothing to Disclose
Aashim Bhatia, MS (*Abstract Co-Author*) Consultant, Guerbet SA
Mariam S. Aboian, MD, PhD (*Abstract Co-Author*) Researcher, Blue Earth Diagnostics Ltd;Researcher, Fusion Pharmaceuticals;Research collaboration, Pro Medicus Limited
Austin Moats, MD (*Abstract Co-Author*) Nothing to Disclose
Raisa Amiruddin, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Several tumor predisposition syndromes (TPS) have been described in association with common childhood CNS tumors such as medulloblastoma, Atypical Teratoid Rhabdoid Tumor, retinoblastoma, choroid plexus carcinoma etc., It is important to recognize TPS as they directly impact treatment and outcome in affected patients, and surveillance imaging in unaffected patients. We aim to illustrate neuroimaging findings in common as well as some newly described TPS presenting in childhood and the common genes/genetic pathways affected. The educational exhibit will provide trainees and practicing radiologists information on CNS tumors and TPS needed to participate in brain tumor board discussions.

### TABLE OF CONTENTS/OUTLINE

The vast array of TPS can be an intimidating topic. Although there is overlap with TPS of CNS tumors in adults, we will describe neuroimaging entities associated with common pediatric CNS tumors. (A) Common TPS: - NF1 - NF2 - Tuberous sclerosis - Li Fraumeni - Gorlin syndrome - Rhabdoid tumor predisposition syndrome - Von Hippel Lindau - Ataxia Telangiectasia - Cowden/PTEN hamartoma tumor syndrome - DICER1 syndrome - Brain tumor polyposis syndrome 2 - RB1 - Lynch syndrome - Noonan syndrome - Constitutional Mismatch Repair Deficiency - Hereditary paraganglioma-pheochromocytoma syndrome (B) Other TPS: - Shelterin complex gene POT1 - MEN1 - Familial melanoma astrocytoma syndrome - BAP1 tumor predisposition syndrome - SMARCE1

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# Abstract Archives of the RSNA, 2024

PDEE-38

## PEDIATRIC ABDOMINAL RADIOGRAPHS -- WHEN TO WORRY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Akosua Sintim-Damoa, MD (*Abstract Co-Author*) Nothing to Disclose
Edward Harpstead (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Common exam in pediatric setting- Indications include abdominal distention, abdominal pain, nausea, and vomiting· Findings are frequently normal or nonspecific, however certain findings should cause concern and warrant further evaluation

### TABLE OF CONTENTS/OUTLINE

Abnormal Findings on Abdominal Radiographs Misplaced Air - Pneumoperitoneum, common signs- Pneumatosis Intestinalis, primary and secondary- Pneumobilia- Portal Venous Gas- Gas in Foreign Body Dilated Bowel- Proximal bowel obstruction- Distal bowel obstruction- Paucity of bowel gas- Centralized bowel loops Calcifications- Meconium Peritonitis- Intraluminal- Neonatal Ovarian Torsion- Teratoma- Malignancy Mass Effect- Intussusception- Malignancy- Pseudocyst Osseous Abnormalities

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# Abstract Archives of the RSNA, 2024

PDEE-39

## PEDIATRIC PANCREATIC IMAGING: NAVIGATING COMPLEX LANDSCAPES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Describe the conventional and novel imaging modalities used in the diagnosis and management of pancreatic lesions in children. Illustrate the imaging features of the most common pancreatic diseases in children including congenital, inflammatory, traumatic and neoplastic lesions. Discuss pattern-based approach for diagnosing pediatric pancreatic diseases.

### TABLE OF CONTENTS/OUTLINE

Pancreatic embryology, normal anatomy and anatomical variants. Imaging modalities: Conventional (US-CT-MRI-MRCP-Nuclear medicine-Interventional radiology- Endoscopic US) Novel (Contrast enhanced US-Elastography (US and MR)-Dual energy CT-Photon counting CT-New radiotracers-radiomics, radiogenomics, artificial intelligence and machine learning. Special consideration about children with pancreatic diseases: Patients with pancreatic endocrine and exocrine insufficiencies (fasting duration- renal function)-Radiation and contrast precautions. Pancreatic diseases in children: Congenital (e.g. pancreatic divsium and annular pancreas), hereditary (e.g. cystic fibrosis and hemochromatosis), pancreatitis (acute-recurrent acute-chronic-others: autoimmune, drug-induced- dialysis related), traumatic and neoplastic (PRIMARY: SPEN, Pancreatoblastoma, Adenocarcinoma, NET and Lymphoma/ METASTASIS: Local extension from retroperitoneal rhabdomyosarcoma and neuroblastoma or Distant metastases). Pattern-based approach for pancreatic diseases in children. Diagnostic pitfalls and mimics of different pancreatic lesions Post-surgical imaging of the pancreas: Types of pancreatic surgeries and techniques- Expected post-operative findings- Post-operative complications imaging features.

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# Abstract Archives of the RSNA, 2024

PDEE-4

## IMAGING EVALUATION OF PEDIATRIC POSTERIOR FOSSA TUMORS - PEARLS AND PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Knowledge of the updated WHO classification of tumors of the central nervous system facilitates pathologic and radiologic categorization of posterior fossa tumors 2. A fundamental understanding of key tumorigenesis pathways aids in multidisciplinary patient management discussion 3. Appropriate use and understanding of available MRI sequences in tumor work-up can narrow the differential diagnosis of posterior fossa tumors

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Overview of WHO classification of tumors of CNSb. MRI protocolc. Tumors - classic features, differential diagnosis, tumor genetics, pearls, pitfallsi. Pilocytic astrocytomaii. Ependymomaiii. Medulloblastomaiv. Diffuse midline gliomav. Atypical teratoid rhabdoid tumor vi. Embryonal tumor with multilayered rosettesvii. High-grade glioma - including diffuse pediatric-type, infant-typeviii. Choroid plexus tumord. Other less common posterior fossa tumors to recognize i. Pilomyxoid astrocytoma ii. Rosette-forming glioneuronal tumor iii. Lhermitte-Duclos iv. Diffuse leptomeningeal glioneuronal tumor v. Ganglioglioma vi. Hemangioblastoma vii. Schwannoma e. Cheat sheets - differentiating tumors based on T2 appearance, presence of restricted diffusion, calcification, hemorrhage, growth pattern, enhancement pattern 2. Conclusion

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# Abstract Archives of the RSNA, 2024

PDEE-40

## PEDIATRIC MENISCAL RETEARS: WHAT WE MISS AND WHAT THE SURGEON NEEDS TO KNOW FROM THE MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pritish Bawa, MD (*Abstract Co-Author*) Nothing to Disclose
Indranil V. Kushare, MD (*Abstract Co-Author*) Nothing to Disclose
Lorece A. Harris (*Abstract Co-Author*) Nothing to Disclose
Megan May, MD (*Abstract Co-Author*) Nothing to Disclose
Livja Mertiri (*Abstract Co-Author*) Nothing to Disclose
Jason Amaral (*Abstract Co-Author*) Nothing to Disclose
J. H. Kan, MD (*Abstract Co-Author*) Nothing to Disclose
Oladipupo Fagbongbe (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand unique pediatric meniscal pathology after primary repair, and the surgeon’s approach to treatment when there is a retear. This includes but is not limited to retears of a treated lateral discoid meniscus and retears that occur in the setting of multi-ligamentous injury in children. 2. Learn how to use arthroscopic report and MRI findings to differentiate normal post-operative meniscal change from meniscal retears

### TABLE OF CONTENTS/OUTLINE

1. Surgical approaches to meniscal repaira. Primary repair, including coverage of meniscal root repairs and menisco-capsular repairsb. Saucerization technique for discoid meniscus 2. Diagnostic search pattern for identification of a meniscal retear. A step-by-step approach a. How to read arthroscopic report: a radiologist’s perspective b. Primary repairs: how to interpret fluid or contrast interposition at primary repair site - is this a retear or normal post-op meniscus? c. Saucerization/reshaping: knowing surgeon’s objectives to help identify superimposed tearing after saucerization d. Radiologist search pattern approach to meniscus characterization of retears when there are changes related to both meniscal primary repair and saucerization 3. MR imaging gallery after meniscal repair with emphasis on great calls and humble retear misses with arthroscopic correlation with pediatric orthopaedic surgeon’s perspectives. How we can do better as radiologists? a. Complete discoid meniscus with meniscal retear after saucerization and primary repair (Case 1) b. Incomplete discoid meniscus with meniscal retear after saucerization and primary repair (Case 2) c. Meniscal retears with displacement d. Meniscal retears in setting of multi-ligamentous injury

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# Abstract Archives of the RSNA, 2024

PDEE-41

## IMAGING ASSESSMENT OF THE POST-SURGICAL TETHERED CORD, RELEVANT FINDINGS ON MRI

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Valeria Morales, MD (*Abstract Co-Author*) Nothing to Disclose
Yady V. Hurtado Burbano, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Identify the general characteristics and types of dysraphisms and post-surgical tethered cord. • Illustrate the featured imaging data of the post-surgical tethered cord and the additional related and unrelated findings.

### TABLE OF CONTENTS/OUTLINE

• An overview of dysraphisms. • Myelomeningocele, an open spinal dysraphism.• Post-surgical tethered cord. o Imaging clues to aid the diagnosis. o Classification. • Additional related and unrelated findings.

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# Abstract Archives of the RSNA, 2024

PDEE-42

## BUILDING BRIDGES: RADIOLOGICAL PERSPECTIVES ON COMMISSURAL PLAQUE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Leandro T. Lucato, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Rossi, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Paula A. Fonseca, MD (*Abstract Co-Author*) Nothing to Disclose
Nevena Fileva (*Abstract Co-Author*) Nothing to Disclose
Rita de Cassia M. Pincerato, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Clara Zanon Zotin (*Abstract Co-Author*) Nothing to Disclose
Aline Halla, MD (*Abstract Co-Author*) Nothing to Disclose
Saymon Dants Barbosa Oliveira (*Abstract Co-Author*) Nothing to Disclose
Mika Shibuya, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo D. Valadares, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understand the Anatomy and Embryology of Commisural Plaque Show a protocol for evaluating commisural malformationsReview the malformations and syndromes related to Commisural PlaqueTips for evaluating fetal MRI in cases of commisural malformations

### TABLE OF CONTENTS/OUTLINE

Anatomy and EmbryologyMRI protocol to access commissural anomaliesSpectrum of commissural abnormalitiesComplete Agenesis, Partial Agenesis, Dysgenesis, Hypoplasia, Abnormal ThickeningAnterior commissure developmental anomaly and related structuresCorpus callosum developmental anomaly and related structuresPosterior comissure developmental anomaly and related structuresDevelopment of other important related structuresAssociated intracranial anomalies in corpus callosum agenesisInterhemispheric cystNeuronal migration disordersAgenesis of inferior vermisEncephaloceleLipoma of interhemispheric fissureSyndromes Commonly Associated With Commissural AnomaliesAicardi syndromeChiari II malformationDandy Walker ContinuumShapiro SyndromePallister-KillianWalker-Warburg syndromeSepto-optic syndromeTurner syndromeNoonanMoebius syndromeJoubert syndrome HoloprosencephalyOthers SyndromesFetal MRIClinical implications of commissural anomaliesTakehome messages

RSNA 2024
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# Abstract Archives of the RSNA, 2024

PDEE-43

## LOST AND FOUND: US REVELATIONS IN THE EMPTY SCROTUM AND GROIN LUMPS. A GUIDE FOR THE RESIDENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manuela Laguna Kirof, MD (*Abstract Co-Author*) Nothing to Disclose
Natalia B. Pugliese SR (*Abstract Co-Author*) Nothing to Disclose
Diana M. Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Bautista Rolla, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Pablo Tobon, MD (*Abstract Co-Author*) Nothing to Disclose
Maria E. Orozco, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The widespread use of ultrasound (US) has led to increased detection of scrotal pathology, primarily involving extratesticular alterations originating in the tunica vaginalis. The tunica vaginalis should close during embryonic development. Anomalous closure is associated with persistent processus vaginalis, hydrocele of the spermatic cord, and inguinoscrotal hernia.US facilitates the diagnosis of persistence, associated alterations, and complications. Additionally, it plays a crucial role in conservative management (follow-up) and aids in determining the need for urgent surgery.Teaching Points:Understand the anatomy of the inguinal canal and its embryology, particularly in relation to the process of testicular descent.Recognize some of the most common pathologies that can occur in the inguinal canal in pediatrics.Review practical aspects of performing ultrasound of the inguinal canal.Summarize the different ultrasound patterns observed in testicles located within the inguinal canal and those that remain undescended.Identify the different types of hydrocele in pediatrics.

### TABLE OF CONTENTS/OUTLINE

Anatomy and embryology.Imaging description of different cases of common pathologies in the inguinal region in pediatrics.Tips and differential diagnoses.Conclusions.

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# Abstract Archives of the RSNA, 2024

PDEE-44

## SEE IT, KNOW IT, TREAT IT: IMAGING SPECTRUM OF ADNEXAL PATHOLOGIES IN THE PEDIATRIC AGE GROUP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Anand Dorai Raju, MD (*Abstract Co-Author*) Nothing to Disclose
Asif Jamal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Preet K. Sandhu, MD (*Abstract Co-Author*) Nothing to Disclose
Chinky Patel, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Adnexal pathology is frequently encountered in the pediatric age group.2. The diagnosis can be delayed or missed as younger patients often present with non-specific symptoms of abdominal pain mimicking other acute abdominal processes or due to a low index of suspicion.3. Various adnexal masses can be encountered including cysts, neoplasms, surgical emergencies, and pelvic infections.4. Ultrasound is the primary imaging modality with CT or MRI indicated for further characterization in some clinical scenarios.5. Clinical correlation with the imaging findings directs diagnosis and subsequent management of these patients.6. The radiologist should know the spectrum of adnexal disease processes that can affect the pediatric age group and their imaging appearance.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: prevalence of adnexal pathologies in the pediatric age group, spectrum of adnexal disease, and the importance of imaging.2. Imaging modalities utilized for diagnosing adnexal pathologies.3. Importance of correlating imaging findings with the clinical presentation.4. Examples of various adnexal pathologies at our institution.

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# Abstract Archives of the RSNA, 2024

PDEE-45

## CRANIAL ULTRASOUND IN PAEDIATRIC EMERGENCIES: EXPLORING THE BRAIN IN REAL TIME

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marta Pelaz Esteban (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Barrios Lopez, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Sutil (*Abstract Co-Author*) Nothing to Disclose
Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To review the indications for transfontanelar ultrasound, especially in the emergency setting.- To review the CUS technique (including technical parameters, standardized planes?)- To know the main pathologic findings that are relevant for emergency management.

### TABLE OF CONTENTS/OUTLINE

Transfontanelar ultrasound is a fast, readily available test lack of ionizing radiation. It is suitable for the neonatal period and very useful as long as the anterior fontanel remains open. However, it is a test with some limitations, such as being highly operator-dependent. This may give rise to doubts in the radiologist inexperienced in the technique. A) CUS indications in the emergency settingB) CUS techinque- Technical parameters (probes, frecuency, depth, focus?)- Standard coronal and sagittal planes- Other accesses (mastoid, sphenoid fontanelle?)- Doppler ultrasoundC) Normal variants of the brain ultrasound appearanceD) Main pathologic findings- Hemorraghe (germinal matrix hemorraghe, intra and extraaxial hemorrage)- Hypoxic ischemic events (periventricular leukomalacia, hypoxic-ischaemic encephalopathy of the term neonate, arterial infarction, sinus thrombosis)- Hydrocephalus- Neonatal brain infections

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# Abstract Archives of the RSNA, 2024

PDEE-46

## THINK OUTSIDE THE GRAY: THE COMMON, THE UNCOMMON AND THE RARE PEDIATRIC EXTRA-AXIAL TUMORS OF BRAIN

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Manish Bajaj, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Adam Goldman-Yassen, MD, MS (*Abstract Co-Author*) Nothing to Disclose
John V. Dennison, MD (*Abstract Co-Author*) Nothing to Disclose
Vidya Sankar Viswanathan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Discuss the different types of extra-axial brain tumors in pediatric patients and its classification, highlight the histological characteristics and typical locations of each tumor type2. Describe the imaging characteristics of each tumor type on various modalities such as MRI, CT, and sometimes PET scans.3. Identify common tumors or lesions that may mimic the appearance of atypical extra-axial brain tumors in pediatric patients4. Explore the role of advanced imaging techniques such as diffusion-weighted imaging (DWI), perfusion-weighted imaging (PWI) in characterizing these tumors.5. Discuss the management approach for various types of tumors

### TABLE OF CONTENTS/OUTLINE

1. Introduction to Atypical Extra-Axial Brain Tumors in Pediatrics. -Typical locations and demographics. -Classification based on histological features. -Current challenges in Diagnosis.2Advanced Imaging Techniques. -DWI and its applications. -PWI for assessing tumor vascularity. 3.Imaging Characteristics. -Solitary Fibrous Tumor. -Occipital Schwannoma. -Intracranial Chondroma. -Atypical Teratoid/Rhabdoid Tumor. -Posterior fossa medulloblastoma. 4.Differential Diagnosis and Classic Mimics. -Common differential diagnoses. -Imaging features that help differentiate tumors from mimics. 5.Management Strategies. -Surgical considerations. -Adjuvant therapies. -Long-term follow-up recommendations. 6.Solve the case. -Example case to solve. -Discussion of diagnosis and management

# Abstract Archives of the RSNA, 2024

PDEE-47

## SPECTRUM OF PEDIATRIC ABNORMALITIES OF THE BILIARY TRACT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pallavi Sagar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Katherine Nimkin, MD (*Abstract Co-Author*) Nothing to Disclose
Neha Udayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Teresa Victoria, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hajer Jarraya (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Pediatric biliary tract abnormalities include congenital anomalies such as anatomic anomalies, various cholestatic processes, congenital cystic and non-cystic anomalies and non-congenital anomalies such as neoplastic, inflammatory or infectious disorders. 2. Differential diagnoses of cystic congenital anomalies include cystic biliary atresia, fibrocystic liver diseases which designate a group of disorders affecting biliary tree and encompasses congenital hepatic fibrosis, Caroli disease and choledochal cysts. 3. The differential diagnoses of non-cystic congenital anomalies include biliary atresia and Alagille syndrome. 4. Spectrum of biliary atresia depends on the anatomic level of obstruction, four different types are described. Most common cases are perinatal. 5. Most common cases of biliary atresia are non-syndromic. Syndromic biliary atresia which occurs in 10%, can be associated with various congenital anomalies such as polysplenia, asplenia, heterotaxy syndrome, intestinal malrotation and interrupted IVC. 6. Congenital abnormalities of the gallbladder include agenesis and hypoplasia but also variations in position of the gallbladder, its shape, number and structure.

### TABLE OF CONTENTS/OUTLINE

1) Epidemiology and classification of congenital and non-congenital biliary anomalies 2) Imaging Findings a) Biliary anomalies in the prenatal period b) Cystic biliary anomalies in neonates, infants, children and adolescentsc) Non cystic biliary anomalies in neonates, infants, children and adolescents3) Associated abnormalities in syndromic biliary tract congenital abnormalities 4) Algorithm of differential diagnosis based on level of biliary tree involvement

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

PDEE-48

## SONOGRAPHIC DEPICTION OF A DEFECT IN THE WALL OF THE INTESTINE IN NEONATES AND YOUNG CHILDREN WITH INTESTINAL PERFORATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Alan Daneman, MD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Faingold, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Rutten, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamin Traubici, BSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To illustrate a group of neonates and young children with a variety of causes of intestinal perforation in whom the defect in the intestinal wall was correctly recognized preoperatively on sonography (US) as this has not been previously recognized in this age group.To emphasize that intestinal perforation in neonates and young children does not always lead to the presence of free gas on plain radiographs or US.To emphasize other US features, such as echogenic ascites and focal fluid collections, as important US signs of perforation in this age group.

### TABLE OF CONTENTS/OUTLINE

We illustrate four neonates or young children in whom the intestinal defect due to perforation was depicted on US and correctly recognized on preoperative US.Plain abdominal X-Rays (AXR) showed abdominal distension, a paucity of bowel gas, and absence of free gas in three.In the fourth, the AXR, showed diffuse distension of bowel with a large amount of gas and a moderate amount of free gas.On US, there was no evidence of free gas in one, a tiny amount of free gas in two, and a moderate amount of free gas in one.On US, there were moderate to large amounts of echogenic ascites in all four.On US, a focal defect at the site of intestinal perforation was depicted and was recognized by the fellow or US technologist performing the examination in all four.The intestinal defect was proven at surgery in all four.These four cases illustrate the ability of US to depict the defect in the intestinal wall in neonates and young children with intestinal perforation. It is essential for US technologists and radiologists to search for such defects on US, especially in those cases with no evidence of free gas on AXR or US, and in the presence of echogenic ascites.

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# Abstract Archives of the RSNA, 2024

PDEE-49

## FETAL STROKE PRECEDES CORTICAL DYSPLASIA: MRI DEMONSTRATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ignacio Delgado, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Nerea Maiz (*Abstract Co-Author*) Nothing to Disclose
Angel Sanchez-Montanez, MD (*Abstract Co-Author*) Nothing to Disclose
Carlota Rodo (*Abstract Co-Author*) Nothing to Disclose
Elida Vazquez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand that fetal brain hypoxia-ischemia can cause more classically recognized patterns of abnormal neuronal migration and organization2. To recognize the evolving appearance of fetal cerebral hypoxic-ischemic lesions, which also can lead to lesions such as polymicrogyria, schizencephaly or focal cortical dysplasia3. To show in an educational format demonstrative selected cases seen in our tertiary center with evidence that hypoxia in the developing fetal brain may also lead to anomalies that suggest a more classic teratogenic effect.

### TABLE OF CONTENTS/OUTLINE

Fetal stroke usually leads to loss of brain tissue or atrophy (porencephaly, encephalomalacia). Schizencephaly, distinguished from porencephaly by the presence of gray matter heterotopias lining the cleft, is assumed to result from an early vascular-disruptive process before migration. Both conditions can be caused by COL4A1-COL4A2 mutations. Most authors also suggest that many cases of polymicrogyria result from ischemia, cases related to carbon monoxide inhalation or twins with fetal demise have been reported.Authors show here several relevant cases with evidence that hypoxia occurring early in the developing fetal brain has the potential to lead not only to the more commonly accepted disruptive-type defects but also to patterns of anomalies that suggest a more classic teratogenic effect, such as schizencephaly, polymicrogyria or both together. Moreover, these cases also show by fetal MR imaging the follow-up demonstration intrauterus about the evolving nature of cerebral infarction or germinal matrix hemorrhage leading to cortical gyration anomalies. In most of these cases, we will show the postnatal MR imaging correlation.

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# Abstract Archives of the RSNA, 2024

PDEE-5

## IMAGING EVALUATION OF PEDIATRIC PINEAL REGION LESIONS - PEARLS AND PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Knowledge of the updated WHO classification of tumors of the central nervous system facilitates pathologic and radiologic categorization of pineal region tumors 2. A fundamental understanding of key tumorigenesis pathways aids in multidisciplinary patient management discussion 3. Appropriate use and understanding of available MRI sequences in tumor work-up can narrow the differential diagnosis of pineal region tumors

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Overview of the WHO classification of tumors of the central nervous system 3. MRI protocol for tumor work-up 4. Non-neoplastic lesions a. Pineal cyst b. Calcification c. Cavum velum interpositum 4. Arachnoid cyst 5. Vein of Galen malformation 5. Pineal region tumors a. Pineocytoma b. Pineal parenchymal tumor of intermediate differentiation c. Pineoblastoma d. Papillary tumor of pineal region e. Germinoma - bifocal, trifocal f. Low-grade glioma 6 Cheat sheets - differentiating tumors based on T2 appearance, presence of restricted diffusion, calcification, hemorrhage, growth pattern, enhancement pattern 7. Conclusion

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# Abstract Archives of the RSNA, 2024

PDEE-50

## CEREBELLAR HYPOPLASIA: A ROAD MAP TO FETAL MRI EVALUATION AND DIFFERENTIAL DIAGNOSIS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Roberto Bastos, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago De Gaultier Paulo, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Cerdeira Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Oliveira-Szejnfeld, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Silva (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Learn the correct protocol for proper measurement and evaluation of the cerebellum using screening ultrasound. Identify the morphological aspects of the cerebellum in fetal magnetic resonance imaging, as well as the principal associated congenital anomalies. Understand the stages of cerebellar development and common anomalies that can occur. Acknowledge the importance of fetal MRI in diagnosing cerebellar hypoplasias.

### TABLE OF CONTENTS/OUTLINE

The purpose of this presentation is to demonstrate the main congenital anomalies associated with cerebellar hypoplasia using fetal MRI. We will start by briefly discussing the epidemiology, causes, prognosis, and screening ultrasonography findings. Furthermore, we will review the available literature on the normal aspects of the brainstem and cerebellum. Then, we will provide examples of each case with the MRI findings that helped in the diagnosis and correlate them with genetic markers. Finally, we will propose a flowchart of the main cerebellar hypoplasias.

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# Abstract Archives of the RSNA, 2024

PDEE-51

## PEDIATRIC NECK ULTRASOUND: A PRACTICAL GUIDANCE FOR RADIOLOGY RESIDENTS BASED ON CLINICAL CASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Laura Alonso, MD (*Abstract Co-Author*) Nothing to Disclose
Mabel Garcia-Hidalgo Alonso, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Alberto Ramirez Garcia-Mina, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To provide a practical guide on how to do a proper pediatric neck ultrasound.-To review the most frequent pediatric neck pathology in an organized way.-To demonstrate a pertinent differential diagnosis according to the age of the patient, and location of the lesion.-To emphasize the ultrasound characteristics of the different pathology and its correlation with MR imaging through a series of representative cases within our hospital setting.-To highlight warning signs that require further evaluation of proper management.

### TABLE OF CONTENTS/OUTLINE

1) Background. Radiologic evaluation with high-frequency ultrasonography (US) is essential for the diagnosis of neck lumps in the pediatric population.2) Ultrasound anatomy and systematic.3) Thyroidal pathology. Thyroid nodules, from benign (adenomatoid/colloid nodule, hemorrhagic thyroid cyst) to malignant (thyroid papillary carcinoma). Autoimmune pathology.4) Cystic lesions. Thyroglossal duct cyst, branchial cleft cyst (cranial fasciitis as a first branchial cleft cyst mimicker), dermoid and epidermoid cyst.5) Lymphadenopathies. Cervical adenitis and complicated adenitis (non-tuberculous mycobacteria adenitis, complicated lymphadenopathy with abscess formation).6) Hemangioma and vascular malformations (venous, lymphatic, and arteriovenous malformations).7) Ectopic thymus.8) Fibromatosis colli.9) Leukemia and lymphoma.10) Rhabdomyosarcoma.11) Salivary glands. Obstructive sialadenitis. Neonatal suppurative sialadenitis. Acute parotitis. Ranula. Pleomorphic adenoma.12) Conclusion.

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# Abstract Archives of the RSNA, 2024

PDEE-52

## PLAYGROUND INJURIES: WHEN IT'S NOT ALL FUN AND GAMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Magna Cum Laude**

Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jennifer Stimec, MD (*Abstract Co-Author*) Nothing to Disclose
Manuela Perez Matta, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan K. Campbell, MD (*Abstract Co-Author*) Nothing to Disclose
Trent Mizzi (*Abstract Co-Author*) Nothing to Disclose
Mary-Louise C. Greer, MBBS (*Abstract Co-Author*) Research Grant, AbbVie Inc
Caroline Rutten, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Raise awareness and increase recognition of playground-related injury patterns in children, with particular emphasis on those associated with different types of playground equipment - Describe the timing, frequency and age distribution of imaged playground injuries - Discuss the distribution of fractures across body parts with different playground equipment - Illustrate common and less common injury patterns

### TABLE OF CONTENTS/OUTLINE

- Background - Learning objectives - When do playground injuries occur? - What playground equipment? - What location of injuries? - Normal bone development and healing patterns - Differing fracture patterns based on location and mechanism:
- Salter-Harris classification
- Elbow fractures
- Forearm fractures
- Clavicle and shoulder fractures
- Trampoline fractures
- Toddler fractures
- Ankle and feet fractures
- Rib and sternum fractures - Head and spine trauma - Abdominal trauma - Would you fall for these pitfalls?

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# Abstract Archives of the RSNA, 2024

PDEE-53

## PEDIATRIC TRANSTHORACIC ECHOCARDIOGRAPHY (TTE): A PRIMER FOR THE CONGENITAL CARDIAC RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Haytham Ibrahim (*Abstract Co-Author*) Nothing to Disclose
Saad Saeed (*Abstract Co-Author*) Nothing to Disclose
Abdusamea G. Shabani, MBBCh, FRCR (*Abstract Co-Author*) Nothing to Disclose
Gurdeep S. Mann, MBChB,FRCR (*Abstract Co-Author*) Nothing to Disclose
Hesham Al-Saloos (*Abstract Co-Author*) Nothing to Disclose
Diana Bernal Quintero (*Abstract Co-Author*) Nothing to Disclose
Mehak Un Nisa P. Raja, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Decipher comprehensive anatomic data acquired by TTE?Understand the qualitative and quantitative evaluation of cardiovascular physiology and function by TTE through standard modalities such as M-mode, Color mapping, Pulsed wave and Continuous wave Doppler interrogation?Interpret standard quantification tools in TTE (i.e distances, areas, volumes, mass, blood flow velocities, tissue velocities, time intervals, peak gradients and mean gradients)?Familiarize with TTE appearances of valvular heart diseases and pre and post-op TTE assessment of the commonest pediatric CHD lesions ?

### TABLE OF CONTENTS/OUTLINE

Anatomy: The standard echocardiographic views (tips and tricks)?Physics Principles of US and Doppler?TTE modalities (made-easy):?Motion mode, ?Color mapping, ?Pulsed wave (PW), Doppler ?Continuous Wave (CW) Doppler ?Standard quantification tools ?Pathology- Valvular heart diseases ?Pathology- Congenital heart diseases (pre and post-op imaging): ?ASD, VSD?, TOF, TGA

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# Abstract Archives of the RSNA, 2024

PDEE-54

## A NEW PERSPECTIVE OF PEDIATRIC RHEUMATOLOGIC DISORDERS: AUTOINFLAMMATORY-AUTOIMMUNE CONTINUUM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Gen Nishimura (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsuhiko Handa, MD (*Abstract Co-Author*) Nothing to Disclose
Orito Ikeda (*Abstract Co-Author*) Nothing to Disclose
Tatsuo Kono, MD (*Abstract Co-Author*) Nothing to Disclose
Yuko Tsujioka, MD,PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Autoimmune diseases are a diverse group of disorders caused by dysregulation of acquired immunity with loss of immune tolerance to self-tissues and autoantibodies, which commonly manifest as a multisystem disorder and has been a major issue in rheumatology. Autoinflammatory diseases are caused by dysregulation of innate immunity with pathogen-independent cytokine-induced inflammation and absence of autoantibodies, which were initially thought to be a group of rare hereditary periodic fever syndromes, e.g., cryopyrin-associated periodic syndrome. However, the concept of autoinflammatory diseases has recently expanded to a broader group of disorders with chronic inflammation, e.g., systemic juvenile idiopathic arthritis. Studies of cytokine signature have revealed the importance of innate immunity in autoimmune diseases, and thus anti-cytokine therapy is used for affected individuals. Given these advancements, it is proposed that autoinflammatory and autoimmune diseases are not separate conditions but autoinflammatory-autoimmune continuum. Based on the new perspective, we show the imaging spectrum of pediatric multisystem disorders, mainly focusing on rheumatological disorders. We highlight imaging similarities between autoimmune and autoinflammatory disorders, which support the hypothesis of autoinflammatory-autoimmune continuum.

### TABLE OF CONTENTS/OUTLINE

Introduction (the perspective of autoinflammatory-autoimmune continuum) - Monogenic autoinflammatory diseases - Polygenic autoinflammatory diseases - Intermediate diseases - Polygenic autoimmune diseases - Pathology bridging the autoimmune and autoinflammatory diseases including interferonopathy

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PDEE-55

## BEYOND MILK FOR HEALTHY BONES: PEDIATRIC METABOLIC BONE DISEASES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jorge Delgado, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammad Jalloul, MD (*Abstract Co-Author*) Nothing to Disclose
John D. Karp, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Hamza Alizai, MD (*Abstract Co-Author*) Nothing to Disclose
Mostafa Alnoury, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Recognize Common Culprits Identify prevalent pediatric metabolic bone diseases like rickets, hypophosphatasia, osteogenesis imperfecta, and Ehlers-Danlos syndrome.
- Image Interpretation for Differentiation Understand characteristic imaging findings on radiographs, CT scans, and MRI scans to differentiate these diseases.
- Modality Selection Made Easy Grasp the strengths and applications of radiography, CT, MRI, and bone scintigraphy for optimal evaluation of each condition.

### TABLE OF CONTENTS/OUTLINE

Pediatric Metabolic Bone Diseases (PMBDs) disrupt the processes for building and maintaining strong functional bones. Early diagnosis and proper management of PMBDs are crucial to prevent complications like fractures, bone deformities, and growth impairment. Specific Diseases and their Imaging Signatures A. Rickets and Osteomalacia B. Mineralization Disorders: • Hypophosphatemic Rickets • Hereditary Hyperphosphatasia (juvenile Paget disease) C. Bone Density Abnormalities: • Osteoporosis • Osteopetrosis D. Collagen Disorders Affecting Bone: • Osteogenesis Imperfecta • Ehlers-Danlos Syndrome • Marfan syndrome E. Other PMBDs • McCune-Albright Syndrome • Renal Osteodystrophy

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PDEE-56

## GUT CHECK ON PEDIATRIC ENTERIC CONTRAST: ARE YOU POSITIVE, NEGATIVE, OR NEUTRAL?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Mitchell A. Chess, MD (*Abstract Co-Author*) Nothing to Disclose
Apeksha Chaturvedi, MD (*Abstract Co-Author*) Nothing to Disclose
Nina B. Klionsky, MD (*Abstract Co-Author*) Nothing to Disclose
Steve Stephen, BS, MBA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Enteric contrast agents may enhance the visibility and diagnostic certainty of intestinal and peritoneal findings in pediatric CT imaging. Despite these advantages, their need is debated. Key considerations for using enteric contrast in pediatric body imaging include: • Caution with using positive enteric contrast in patients with gastrointestinal (GI) mucosal or intramural bleeds, as it may obscure the source of bleeding and vascular malformations • Enteric contrast can enhance distinction between serosal tumors and gut lumen when the source of GI bleed is extraluminal • Neutral enteric contrast can improve bowel wall enhancement • Improved scanner technology with ability to perform multiplanar reconstructions reduce reliance on enteric contrast for diagnostic clarity • Emergency department patient throughput and safety considerations (e.g., extended exposure to transmissible diseases including COVID and RSV)

### TABLE OF CONTENTS/OUTLINE

• Review common enteric contrast agents, emphasizing indications, risks, and other considerations unique to children • Summarize arguments for and against the use of enteric contrast, including perceived benefits, risks to patients, increased radiation dose, and logistical challenges • Discuss weight-based enteric contrast dose and administration protocols in children • Present pediatric imaging findings on a case-based template alongside a discussion of whether enteric contrast would be appropriate in similar cases • Highlight the potential for novel enteric contrast agents still in development, including dark enteric contrast agents and high-Z contrast agents

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# Abstract Archives of the RSNA, 2024

PDEE-57

## CATHETERS, TUBES AND OTHER MEDICAL DEVICES IN PEDIATRICS: MALPOSITION AND COMPLICATIONS ARISING FROM THEIR USE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Pablo Castanon Remy (*Abstract Co-Author*) Nothing to Disclose
Beatriz Espejo Garcia (*Abstract Co-Author*) Nothing to Disclose
Maria I. Martinez-Leon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Jose Garcia Munoz (*Abstract Co-Author*) Nothing to Disclose
Andrea Gallego Gomez (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Assessment through various imaging tests, primarily utilize simple radiography to assess the status and placement of different medical devices in pediatric patients.• Understand the importance of early detection by the radiologist of potential complications that may arise from their use, primarily mechanical complications, caused by improper placement of these devices.• Interpret different clinical cases of pediatric patients.

### TABLE OF CONTENTS/OUTLINE

In this presentation, we will conduct a systematic review of the types of medical devices used in pediatrics, considering that they are more common in patients admitted to pediatric ICU and neonatology. These devices are essential for managing pediatric patients in intensive care; therefore, understanding them in pediatric patients and learning to assess their correct localization is fundamental in the work of a radiologist. Early detection of possible complications secondary to their use is also crucial.It is often challenging to interpret. Therefore, it is essential to know which devices to look for in each case, their appropriate location, and how to interpret data suggestive of possible complications.Subsequently, we will present a series of tables explaining the appropriate indications, route, and location of devices in imaging tests suitable for their study, followed by a series of cases of pediatric patients with these complications. The devices that can be evaluated with images in this presentation include: Nasogastric tube, endotracheal tube, chest drainage tube, umbilical venous catheter, umbilical arterial catheter, epicutaneous catheter, central venous catheter, ventriculoperitoneal shunt and others less commonly used devices.

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# Abstract Archives of the RSNA, 2024

PDEE-58

## WHAT THE RADIOLOGY RESIDENT NEEDS TO KNOW ABOUT PEDIATRIC MODIFIED BARIUM SWALLOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Bindu Setty, MD (*Abstract Co-Author*) Nothing to Disclose
Kerry Pearl (*Abstract Co-Author*) Nothing to Disclose
Jessica Pisegna (*Abstract Co-Author*) Nothing to Disclose
Ilse Castro-Aragon, MD (*Abstract Co-Author*) Nothing to Disclose
Ali A. Elzieny (*Abstract Co-Author*) Nothing to Disclose
Pooja Sikka, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Provide an overview on the speech language pathologist (SLP) assessment of the indications, preparation, and terminology for a pediatric modified barium swallow (pMBS) study.2. Highlight imaging abnormalities detected on a pMBS study.3. Correlate pMBS radiologic findings with their etiologies and management.4. Discuss how a pediatric swallow evaluation differs from that of adults.

### TABLE OF CONTENTS/OUTLINE

1. SLP clinical feeding evaluation and indications for a pMBS study.2. Brief overview of the normal peripheral and central mechanisms of swallowing, including the sequential phases, supportive anatomy, and pediatric neuroanatomic correlates.3. SLP pMBS examination with a description of the setup and rationale for utilizing different types of positioning, equipment, bolus consistencies (thicker vs. thinner), delivery methods, and timed fatigue testing to assess form and function.4. Definitions of specific SLP pMBS terminology, such as oral aversion, pharyngeal residue, swallowing delay, and reduced esophageal clearance.5. Imaging findings in pMBS penetration, aspiration, nasopharyngeal reflux, laryngomalacia, etc.6. Causes and pathophysiology of abnormalities detected on a pMBS study.7. Findings on brain MRI in patients who would need a pMBS study.8. Management options for a failed pMBS study.9. How a pediatric MBS study differs from an adult MBS study in terms of clinical evaluation, grading of findings, and intervention.10. Summary highlighting the applications of a pMBS study for radiology residents.

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# Abstract Archives of the RSNA, 2024

PDEE-59

## PEARLS AND PITFALLS IN PEDIATRIC NEUROVASCULAR RADIOLOGY: A TRAINEE'S AFTER-HOURS GUIDE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kathleen Schenker, MD (*Abstract Co-Author*) Nothing to Disclose
Ashrith Kandula (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Master the Fundamentals: Grasp the cerebrovascular anatomy of the brain and spinal cord in children to understand blood flow patterns and interpret neuroimaging.
- Recognize Early Signs: Identify the classic presentation of congestive heart failure in neonates with Vein of Galen Malformation (VGAM) and its characteristic imaging findings.
- Sharpen Stroke Diagnosis: Broaden your understanding of pediatric stroke symptoms in septic embolism. Utilize CTA and MRA to identify characteristic features and differentiate from other etiologies.
- Unveil Behēet's Disease: Recognize the multifocal vascular involvement (venous thrombosis and arterial stenoses) seen on angiography in Behēet's disease.
- Think Collateral Flow: Suspect moyamoya syndrome in children with progressive ischemic symptoms or headaches,
- MRI Venography is Key: Importance of MRV for accurate and timely diagnosis of Venous Sinus Thrombosis (VST) in children, which can mimic other stroke etiologies.
- Thunderclap Headache: Consider RCVS in adolescents with normal initial MRI.

### TABLE OF CONTENTS/OUTLINE

Pearls for Initial Assessment:
- Key historical details and presenting signs/symptoms specific to pediatric patients.
- Tailoring imaging protocols to minimize radiation exposure.
- Pitfalls to Avoid:
- Misinterpreting normal variants for pathology.
- Missing subtle findings due to limited experience.
- Ordering unnecessary imaging studies.
- Case-Based Learning:
- Common pediatric neurovascular emergencies will be presented in a concise case format.
- Each case will highlight key imaging findings, differential diagnoses, and pearls for interpretation.
- Pitfalls specific to each case will be emphasized to guide trainees in avoiding misdiagnosis.

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# Abstract Archives of the RSNA, 2024

PDEE-6

## IMAGING EVALUATION OF PEDIATRIC SELLA/SUPRASELLAR LESIONS: PEARLS AND PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Knowledge of the updated WHO classification of tumors of the central nervous system facilitates pathologic and radiologic categorization of sella/suprasellar region tumors 2. A fundamental understanding of key tumorigenesis pathways aids in multidisciplinary patient management discussion 3. Appropriate use and understanding of available MRI sequences in tumor work-up can narrow the differential diagnosis of sella/suprasellar tumors

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Overview of the WHO classification of tumors of the central nervous system 3. MRI protocol for tumor work-up 4. Pseudotumors - classic features, differential diagnosis, pearls, pitfalls a. Pars intermedius cyst b. Rathke cleft cyst c. Arachnoid cyst d. Epidermoid cyst e. Dermoid cyst f. Suprasellar lipoma 5. Sella/suprasellar tumors - classic features, differential diagnosis, pearls, pitfalls a. Pilocytic astrocytoma b. Pilomyxoid astrocytoma c. Craniopharyngioma d. Hypothalamic hamartoma e. Germinoma f. Pituitary macroadenoma 6. Cheat sheets - differentiating tumors based on T2 appearance, presence of restricted diffusion, calcification, hemorrhage, growth pattern, enhancement pattern 7. Conclusion

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# Abstract Archives of the RSNA, 2024

PDEE-60

## ROLE OF INTERVENTIONAL RADIOLOGY IN DIAGNOSIS OF EXTRA HEPATIC BILIARY ATRESIA (EHBA)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kushaljit S. Sodhi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Anmol Bhatia, MD (*Abstract Co-Author*) Nothing to Disclose
Ravi Kanojia, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sadhna Lal (*Abstract Co-Author*) Nothing to Disclose
Akshay K. Saxena, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Importance of early diagnosis of EHBA, Classification of EHBA, Technique of ultrasound guided Percutaneous Transhepatic Cholecysto Cholangiography (PTCC), Review of published literature regarding advantages and safety of the PTCC, Technique of ultrasound guided liver biopsy, Benefit of combined ultrasound guided PTCC and liver biopsy

### TABLE OF CONTENTS/OUTLINE

Definition and types of EHBA, Clinical presentation, differential diagnosis and urgency in clinching early diagnosis of EHBA, Brief summary of diagnostic ultrasonography features of EHBA, Emphasizing status of intra operative cholangiography (IOC) as the gold standard and highlighting the risk of negative laparotomy, Technique of ultrasound guided PTCC, Illustrative cases comparing PTCC and IOC from the authors' institute, Advantages, pitfalls and complications of PTCC, Use of combined ultrasound guided PTCC and liver biopsy for establishing the diagnosis of EHBA

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# Abstract Archives of the RSNA, 2024

PDEE-61

## FETAL MRI PICKING UP THE TORCH AGAIN! - UPDATE ON PRENATAL INFECTIONS OF THE CENTRAL NERVOUS SYSTEM

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ignacio Delgado, MD (*Abstract Co-Author*) Nothing to Disclose
Elida Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Sanchez-Montanez, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos Jimenez Vazquez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

; Prenatal central nervous system (CNS) infections remain an important cause of acute and long-term neurological morbidity.; Fetal MRI is the best modality for demonstrating the expressions of the inflammatory response to infection in the brain in fetuses and neonates.; Prompt brain imaging diagnosis facilitates immediate therapy and early recognition of complications.

### TABLE OF CONTENTS/OUTLINE

Early diagnosis of CNS infections in fetuses is best performed with US, whereas MRI is the best diagnostic study for determining areas of involvement in the brain and spine and for improving the ability to narrow the differential diagnosis. Diffusion-weighted imaging identifies cytotoxic edema and abscesses.Prenatal CNS infections are included in the STORCH acronym (syphilis, toxoplasmosis, rubella, CMV, HIV and herpes simplex), also Zika virus or Parvovirus B19. Early infections affect organogenesis, while later infections lead to brain destruction.; CMV is the most common agent. Early infections may result in malformations within the lissencephaly-pachygyria spectrum, and cerebellar hypoplasia and periventricular calcifications, while infections acquired later produce diffuse polymicrogyria, or white matter injury.; Herpes simplex virus (type 2) is a major cause of neonatal encephalitis. Neuroimaging reflects leptomeningeal inflammation and diffuse parenchymal involvement, ranging from vasogenic to cytotoxic edema, with diffusion restriction and necrosis, evolving to cystic encephalomalacia or dystrophic calcification.; Zika virus prenatal infection can lead to microcephaly, cerebral calcification, cortical malformation, ventriculomegaly and corpus callosum hypoplasia.

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# Abstract Archives of the RSNA, 2024

PDEE-62

## PEDIATRIC EWING SARCOMA: THE RADIOLOGIST'S GUIDE TO UPDATES IN TUMOR CLASSIFICATION, STAGING, PROGNOSTICATION AND SURVEILLANCE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Apeksha Chaturvedi, MD (*Abstract Co-Author*) Nothing to Disclose
Sheela B. Garudaiyengar, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Philip J. Katzman, MD (*Abstract Co-Author*) Nothing to Disclose
Hunter R. Carlock, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. WHO 2020 has introduced a new category of "undifferentiated round cell sarcomas of the bone and soft tissue" including Ewing sarcoma and Ewing-like sarcoma entities.2. Clinical, epidemiologic, immunohistochemical, genetic, and imaging characteristics help distinguish individual tumor subtypes within this broad category.3. With advances in FDG-PET CT/MR, bone marrow biopsy is no longer universally recommended for tumor staging.4. Whole Body MR is increasingly used for tumor staging and surveillance.5. Tumor prognostication is hinged on both pretreatment factors and response to therapy, with presence of metastases at diagnosis the most important prognostic factor.6. Key imaging findings impact clinical decision making and surgical approach.

### TABLE OF CONTENTS/OUTLINE

1. Background information2. New WHO 2020 classification of Ewing sarcoma and its relevance to radiologists3. Clinical, epidemiologic, immunohistochemical, and molecular genetic features of Ewing sarcoma relative to Ewing-like sarcoma entities4. Multimodal imaging appearances of Ewing sarcoma and Ewing-like sarcoma entities5. Updated MR imaging protocols, with a focus on diffusion-weighted and whole-body MR6. Evolving staging/surveillance recommendations7. Revised report templates incorporating prognostic variables (localized versus metastatic disease; proximal/distal tumors; extraskeletal/skeletal Ewing sarcoma; tumor size; pathologic fracture+/-; residual viable tumor after chemotherapy or local control surgery+/-)8. Conclusions

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# Abstract Archives of the RSNA, 2024

PDEE-63

## IF A PICTURE IS WORTH A THOUSAND WORDS THEN WHAT ABOUT A NUMBER? PEDIATRIC IBD IMAGING-BASED INDICES IN CLINICAL PRACTICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ruth Cytter-Kuint, MD (*Abstract Co-Author*) Nothing to Disclose
Denise A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Li-Tal Pratt, MD (*Abstract Co-Author*) Nothing to Disclose
Ailish Coblentz, MD (*Abstract Co-Author*) Nothing to Disclose
Ronit Precel, MD (*Abstract Co-Author*) Nothing to Disclose
Gili Focht, MSc, MBA (*Abstract Co-Author*) Nothing to Disclose
Mary-Louise C. Greer, MBBS (*Presenter*) Research Grant, AbbVie Inc

### TEACHING POINTS

1. To understand the role of imaging biomarkers in inflammatory bowel disease (IBD); 2. To be familiar with pediatric and adult-derived MRI and ultrasound-based indices; 3. To calculate pediatric MRI- and ultrasound- based indices for inclusion in diagnostic imaging reports; and 4. To consider future applications of imaging-based indices in pediatric IBD.

### TABLE OF CONTENTS/OUTLINE

1. Background Explain the evolution of biomarkers in IBD from clinical and endoscopic scores to imaging-based indices, gauging disease activity, severity and treatment response, guiding drug development, with potential for prognostication. 2. Imaging-based Indices: Describe specific indices using MR enterography (MRE), pelvic MRI (PMR) and bowel ultrasound, quantifying disease activity, severity and treatment response, highlighting new MRI-based indices developed in pediatric cohorts. 3. Pediatric Imaging-based Indices (a) Pediatric Inflammatory Crohn's MRE Index - PICMI, (b) Pediatric MRI-Based Perianal Crohn Disease index - PEMPAC and (c) Pediatric ultrasound-based scores - SPAUSS and PCD-US Define index components, methodology for score calculation and cut-off values for remission, active inflammation and response as relevant. Provide examples illustrating scores and reporting templates. 4. Future Directions: Consider current and emerging roles of imaging biomarkers including use of Artificial Intelligence/Deep Learning, integration with texture analysis, and exploration of unmet needs such as quantification of intestinal fibrosis. 5. Practice Cases: Interactive exercise trialing score calculations on MRE, PMR and ultrasound.

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# Abstract Archives of the RSNA, 2024

PDEE-64

## ALTERNATIVE ACCESS SITES FOR PEDIATRIC ARTERIAL INTERVENTIONS - THINK BEYOND THE FEMORAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Joao G. Amaral, MD (*Abstract Co-Author*) Nothing to Disclose
Elaine Y. Kan, MBChB (*Abstract Co-Author*) Nothing to Disclose
Moritz Wildgruber, MD, PhD (*Abstract Co-Author*) Consultant, Sirtex Medical Ltd;Consultant, iThera Medical GmbH;Consultant, Bayer AG
Stephanie Franchi-Abella, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Chen (*Abstract Co-Author*) Nothing to Disclose
Dimitri A. Parra, MD, MMEd (*Abstract Co-Author*) Nothing to Disclose
Kin Fen Kevin Fung, MBBS, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Obtaining arterial access is the one of the most challenging aspects for pediatric arterial interventions, especially in neonates and young infants.- Due to larger sheath-to-vessel ratio, the risk of thrombo-occlusive complication is higher in young children. Strategies to prevent complications include limb warming, ultrasound guided access, low-profile hydrophilic sheath and heparinization.- Common femoral artery access remains the standard for interventions in children. Alternative access sites include axillary, brachial, radial, carotid, and umbilical arteries and umbilical vein in neonates.- Upper extremity access sites should be considered in children with significant aorta caliber differences such as in hepatic hemangioma, and aortoiliac occlusive conditions such as mid-aortic syndrome. Other advantages include ease of catheterisation and passage of interventional devices into visceral arteries with acute downward angulation- Carotid access is not commonly used but can be an alternative in infants requiring complex cardiac or neurovascular interventions.- Umbilical artery can be used in neonates up to 1 week of age. Umbilical vein is an alternative if there is a patent ductus arteriosus or foramen ovale, which can act as a conduit between the arterial and venous systems. Advantages include ability to use larger sheaths and prevention of access-related complications in the extremities.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Technique for arterial access in children 3. Strategies to prevent access-related complications 4. Standard and alternative arterial access sites: Advantages and potential issues 5. Illustrative cases 6. Management of complications 7. Conclusions

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# Abstract Archives of the RSNA, 2024

PDEE-65

## PEDIATRIC GENITOURINARY RADIONUCLIDE SCINTIGRAPHY WITH INTERESTING ANATOMIC CASE CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Michael A. Steiner, MD (*Abstract Co-Author*) Nothing to Disclose
John Hollis Tackett, BS (*Abstract Co-Author*) Nothing to Disclose
Marjorie Lam (*Abstract Co-Author*) Nothing to Disclose
Chanukya Cherukuri (*Abstract Co-Author*) Nothing to Disclose
Vani Vijayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Johnny Yang, BS, BA (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Review anatomy and physiology of MAG3 renal scans - Correlate with other imaging for common and uncommon pediatric genitourinary pathology.- Discuss complementary role of MAG3 renal scans for diagnostic purposes

### TABLE OF CONTENTS/OUTLINE

Technetium-99m (Tc-99m) scintigraphy, using tracers such as mercaptoacetyltriglycine (MAG3), dimercaptosuccinic acid (DMSA), and diethylenetriaminepentaacetic acid (DTPA) offers excellent anatomical and physiological details. Tc-99m MAG3 is considered one of the best methods for assessing renal function owing to favorable qualities in energy and dosimetry. DTPA adds glomerular filtration rate assessment, and DMSA provides information for differentiating pyelonephritis versus scarring in the presence of vesicoureteral reflux and multiple episodes of urinary tract infection. Thus, pediatric genitourinary imaging commonly utilizes technetium scintigraphy. Through a case series, this exhibit will include cases of collecting system dilatation and other GU pathology due to various obstructive and nonobstructive pathology where MAG3 imaging proved useful in diagnosis and/or clinical management. Illustrative cases are reviewed with ultrasound and CT correlation.

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# Abstract Archives of the RSNA, 2024

PDEE-66

## INNER EAR ANOMALIES IN CONGENITAL HEARING LOSS, STEP BY STEP APPROACH FOR NOVICE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Moegamad A. Ederies, MBBCh, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jehan Al-Rayahi, MD (*Abstract Co-Author*) Nothing to Disclose
Alaa O. Koko, MD, BMBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

General objective Step by step approach to identify inner ear abnormalities in congenital hearing loss.Detailed Objectives: 1- To define the concept of congenital hearing loss and the variable classification approach 2-To determine the optimum CT MRI planes (and MRI sequences ) 3-To review the inner ear components imaged in CT MRI 4-To clarify in detail the abnormal morphology of cochlea, vestibule , semicircular canals, and IAM in congenital hearing loss.5- To review images of real cases.

### TABLE OF CONTENTS/OUTLINE

Definition and classification of Congenital hearing loss.The applied CT MRI protocols.The anatomy of inner ear structure's. Simple approach to identify inner ear abnormality.Detailed abnormal morphology of cochlea ,vestibule ,semicircular canals and IAM.

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# Abstract Archives of the RSNA, 2024

PDEE-67

## BENIGN AND MALIGNANT PEDIATRIC LIVER MASSES: RADIOLOGIC-PATHOLOGIC UPDATE FROM THE PEDIATRIC LIRADS WORKING GROUP

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ellen M. Chung, MD (*Abstract Co-Author*) Nothing to Disclose
Adina L. Alazraki, MD (*Abstract Co-Author*) Nothing to Disclose
Esther Ro, MD (*Abstract Co-Author*) Nothing to Disclose
Cara E. Morin, PhD (*Abstract Co-Author*) Nothing to Disclose
Mitchell Rees, MD (*Abstract Co-Author*) Nothing to Disclose
Lara Berklite (*Abstract Co-Author*) Nothing to Disclose
Geetika Khanna, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Alex Towbin, MD (*Abstract Co-Author*) Author, RELX;Consultant, Anderson Publishing, Ltd;Advisory Board, KLAS Enterprises LLC;Travel support, Merative LP
Gary R. Schooler, MD (*Abstract Co-Author*) Nothing to Disclose
Amy B. Kolbe, MD (*Abstract Co-Author*) Nothing to Disclose
Judy H. Squires, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth R. Tang, MD (*Abstract Co-Author*) Nothing to Disclose
Ali B. Syed, MD (*Abstract Co-Author*) Research Consultant, IBM Corporation
Michael R. Acord, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Many classification schemes and management recommendations for benign and malignant liver masses in children have evolved over the last 15 years.2. There are characteristic pathologic findings that may affect the imaging appearance of these tumors in children.3. Contrast enhanced ultrasound and use of hepatobiliary contrast agents are becoming standard of care for imaging liver masses in children.

### TABLE OF CONTENTS/OUTLINE

• Introduction: General discussion of updates in the imaging of benign and malignant pediatric liver tumors. Review of the Los Angeles liver tumor symposium consensus classification of tumor histopathology • Specific Pathologies: Each section will discuss clinical, imaging, and pathologic features, differential diagnoses, and management recommendations. o Infantile and congenital hemangiomas. Updates: ISSVA nomenclature and classification. o Mesenchymal hamartoma. o Focal nodular hyperplasia. Updates: FNH-like lesions o Hepatocellular adenoma. Updates: Subtypes and associations o Hepatoblastoma. Updates: LIRADS imaging recommendations, PRETEXT staging for risk stratification, treatment strategies, and prognosis. Discussion of hepatocellular neoplasm NOS. o Hepatocellular carcinoma. Updates: LIRADS, imaging recommendations, predisposition, available screening recommendations, and prognosis. o Fibrolamellar hepatocellular carcinoma. o Undifferentiated embryonal sarcoma.

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# Abstract Archives of the RSNA, 2024

PDEE-68

## IMAGING OF HEARING LOSS IN PEDIATRIC POPULATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Vijay S. Pande, MD (*Abstract Co-Author*) Nothing to Disclose
Pratit Pokharel, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Approximate prevalence of hearing loss is between 2 to 3 per 1000 babies, while by the age of 12 years approximately 20% of children have detectable hearing loss either in one or both ears. Congenital hearing loss is often sensorineural and associated with genetic conditions or isolated inner ear malformations. While in older children conductive hearing loss is common. Early detection and treatment are important to prevent significant language disability. High resolution CT and MR imaging plays crucial role in demonstrating the inner ear anatomy and pathologies. Imaging has also established pivotal role in selecting patients for cochlear implantation.We wish to make the residents and radiologist in practice aware of the imaging anatomy of temporal bone and imaging features in commonly encountered conditions.

### TABLE OF CONTENTS/OUTLINE

Technical considerations in CT, MRI, for imaging in pediatric hearing loss. Pertinent imaging anatomy in evaluation of hearing loss. Imaging features of congenital and acquired external and middle ear pathologies. Imaging features of congenital and acquired inner ear pathologies.

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# Abstract Archives of the RSNA, 2024

PDEE-69

## UNPEELING SUBPIAL HEMORRHAGES IN NEONATES: ANATOMY, IMAGING AND CLINICAL INSIGHTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Saul Rodriguez (*Abstract Co-Author*) Nothing to Disclose
Natally AlArab, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Yutaka Sato, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lillian M. Lai, MD (*Abstract Co-Author*) Nothing to Disclose
T. Shawn Sato, MD (*Presenter*) Research Grant, Bracco Group

### TEACHING POINTS

Subpial hemorrhages (SPH) are an often under-recognized and misdiagnosed type of intracranial hemorrhage, most commonly seen in neonates and young infants. Although the etiology remains elusive, SPH are known to be associated with various conditions including but not limited to the birth trauma, neonatal hypoxic brain injury, abusive head trauma and hydrocephalus shunting. SPH are located superficial to the cortex, in the potential space between the glia limitans and the pia matter. On MR imaging, SPH are localized to the brain surface and the subjacent cortex can show diffusion restriction. Accurate diagnosis holds significant clinical implications given the potential parenchymal damage associated with SPH. We present the pertinent anatomy, proposed pathophysiology and imaging features crucial for accurate diagnosis of SPH.

### TABLE OF CONTENTS/OUTLINE

- Review pertinent anatomy and pathophysiology and understand the unique imaging features and clinical significance of SPH.- Become familiar with the typical imaging features of SPH and learn to differentiate it from subarachnoid and subdural hemorrhages.- Review cases of subpial hemorrhage to familiarize and aid in recognizing this frequently misdiagnosed entity.

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# Abstract Archives of the RSNA, 2024

PDEE-7

## IMAGING EVALUATION OF PEDIATRIC SUPRATENTORIAL TUMORS: PEARLS AND PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Helen M. Branson, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Knowledge of the updated WHO classification of tumors of the central nervous system facilitates pathologic and radiologic categorization of supratentorial tumors 2. A fundamental understanding of key tumorigenesis pathways aids in multidisciplinary patient management discussion 3. Appropriate use and understanding of available MRI sequences in tumor work-up can narrow the differential diagnosis of supratentorial tumors

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Overview of the WHO classification of tumors of the central nervous system 3. MRI protocol for tumor work-up 4. Tumors - classic features, differential diagnosis, tumor genetics, pearls, pitfalls a. High-grade glioma: i. Diffuse hemispheric glioma: H3 G34 mutant ii. Diffuse pediatric-type glioma: H3 WT, IDH WT iii.Diffuse infant-type hemispheric glioma: NTRK, ROS1, ALK, MET b. Pilocytic astrocytoma c. Subependymal giant cell astrocytoma d. Ependymoma: ZFTA fusion positive, YAP1 fusion positive e. Choroid plexus tumor: Choroid plexus papilloma, atypical choroid plexus papilloma, choroid plexus carcinoma f. Embryonal tumor with multilayered rosettes g. Atypical teratoid rhabdoid tumor h. Seizure-related tumors: i. Pilomyxoid xanthoastrocytoma ii. Ganglioglioma iii. Dysembryoplastic neuroepithelial tumor i. Other less common supratentorial tumors to recognize i. Desmoplastic infantile astrocytoma/Desmoplastic infantile ganglioglioma ii. Multinodular and vacuolating neuronal tumor iii. Meningioma iv. Solitary fibrous tumor of dura v. Metastasis 5. Cheat sheets - differentiating tumors based on T2 appearance, presence of restricted diffusion, calcification, hemorrhage, growth pattern, enhancement pattern 6. Conclusion

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# Abstract Archives of the RSNA, 2024

PDEE-70

## WHAT DO I DO WITH IT? UPDATE ON PEDIATRIC THYROID NODULE ASSESSMENT AND MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Jesse L. Courtier, MD (*Abstract Co-Author*) Founder, Sira Medical, Inc;Consultant, Sira Medical, Inc
Sunit Davda, MBBS, MRCP (*Abstract Co-Author*) Nothing to Disclose
Amanda R. Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Kalpana Manral, MD (*Abstract Co-Author*) Nothing to Disclose
Rachelle Durand, DO (*Abstract Co-Author*) Nothing to Disclose
Kantheera Leesmidt, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Thyroid nodules in the pediatric population exhibit a lower incidence rate of 0.5% to 1.6%, yet the malignancy rate is 25% to 30% which is higher compared to adults.2. Pediatric thyroid cancer has a greater risk of metastasis to lungs and lymph nodes with more likely extrathyroidal growth and recurrence. However, their prognosis is favorable.3. ATA and ACR-TIRADS are the two most common ultrasound-based risk stratification systems for description of thyroid nodules and stratify the risk characteristics in adults, however, the diagnostic performance when applying to the pediatric population has been less reported.4. Utilizing thyroid ultrasound reference standards tailored for adults in pediatric populations may offer advantages, although they may not always be accurate. ATA, ACR-TIRADS, and EU-TIRADS have moderate diagnostic performance in pediatric thyroid nodule patients.5. US features of microcalcifications, ill-defined margins, size > 3.5 cm, and abnormal lymph nodes increase sensitivity and specificity for malignancy in pediatric population.6. Performing biopsies on nodules categorized as the highest risk and smaller than 1 cm could improve diagnostic accuracy.

### TABLE OF CONTENTS/OUTLINE

1. Review features of common pediatric benign and malignant thyroid lesions.2. Illustrate potential pitfalls and mimics of thyroid masses.3. Evaluate the strengths and weaknesses of various adult thyroid nodule scoring criteria as they apply to pediatrics.4. Review management of pediatric thyroid nodules.5. Test understanding with a short quiz.

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# Abstract Archives of the RSNA, 2024

PDEE-71

## VARIOUS ASPECTS AND MIMICKERS OF IMAGING FINDINGS OF ACUTE ENCEPHALOPATHY WITH BIPHASIC SEIZURES AND LATE REDUCED DIFFUSION (AESD)

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Harushi Mori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiro Nakamata, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

AESD is one of the most common acute encephalopathies in infants and young children in East Asia. Clinically, it develops as febrile status epilepticus and often shows no abnormal findings on diffusion-weighted image(DWI) or T2-weighted images taken on the first or second day of onset; therefore, distinguishing it from febrile seizures in the early stages of the disease is challenging. However, magnetic resonance spectroscopy (MRS) and arterial spin labeling (ASL) may exhibit characteristic abnormalities, even in the early stages of the disease. Unlike febrile seizures, AESD has a high rate of sequelae, exceeding 60%, and early therapeutic intervention improves neurological prognosis; thus, early diagnosis is important. Therefore, radiologists should be familiar with the typical patterns, variants, and mimickers of AESD. The purpose of this exhibit is:1. To explain the disease concept and pathogenesis of AESD2. To discuss the clinical course and imaging findings of AESD3. To discuss the excitotoxity encephalopathy spectrum4. To discuss the mimickers of AESD

### TABLE OF CONTENTS/OUTLINE

•Disease concept and pathogenesis of AESD.•Clinical aspects of AESD•Typical imaging findings ?DWI ?ASL ?MRS •Other imaging findings •Spectrum of encephalopathy with excitotoxicity (e.g. hemiconvulsion-hemiplegia/hemiconvulsion-hemiplegia-epilepsy syndrome, clinically mild infantile encephalopathy associated with excitotoxicity, infantile traumatic brain injury with a biphasic clinical course and late reduced diffusion) •Imaging mimickers (e.g. hemorrhagic shock and encephalopathy syndrome, meningitis, posterior reversible encephalopathy syndrome)

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# Abstract Archives of the RSNA, 2024

PDEE-72

## DECODING THE PUZZLE: A MULTIMODAL APPROACH TO PEDIATRIC NON-TRAUMATIC HEAD AND NECK EMERGENCIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kathleen Schenker, MD (*Abstract Co-Author*) Nothing to Disclose
Ashrith Kandula (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Unravel the diverse causes of pediatric non-traumatic head and neck emergencies.• Master the art of differential diagnosis using a multimodal imaging approach.• Gain insight into the unique imaging characteristics of frequently encountered emergencies.

### TABLE OF CONTENTS/OUTLINE

- Introduction:
- Challenges in diagnosing pediatric non-traumatic head and neck emergencies.
- Unveiling the Culprit:
- Plain radiography: Unveiling the bony clues.
- Ultrasound: A bedside warrior for rapid evaluation.
- CT: Delineating intricate anatomy and complications.
- MRI: Unveiling soft tissue involvement.
- Decoding the Images:
- Infectious emergencies:
- Lemierre syndrome: Painting the jugular vein red.
- Gradenigo syndrome: Facial pain whispers of a cranial nerve dilemma.
- Cavernous sinus thrombosis: When the crossroads of blood flow become inflamed.
- Epiglottitis: The cherry red flag of a life-threatening airway obstruction.
- Branchial cleft cyst and lymphangioma: When remnants of development turn troublesome.
- Atypical mycobacterial infection: The sly infectious invader.
- Mastoiditis with intracranial complications: Balancing hearing with brain health.
- Sinusitis with intracranial complications (Pott's puffy tumor): When a sinus infection breaches its boundaries.
- Skull base osteomyelitis: A bone infection with a cranial address.
- Non-infectious emergencies:
- Labyrinthitis: The inner ear's dance gone wrong.
- Orbital pseudotumor: Inflammation masquerading as a mass.
- Juvenile angiofibroma: An aggressive vascular anomaly.
- Orbital varix: Bulging eye caused by a dilated vein.
- Mimics:
- Langerhans cell histiocytosis (LCH) vs. infectious processes.
- Discitis/osteomyelitis vs. infectious complications.

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# Abstract Archives of the RSNA, 2024

PDEE-73

## UNVEILING IMAGING INSIGHTS INTO CHILDHOOD INTERSTITIAL LUNG DISEASES (CHILDS): A COMPREHENSIVE REVIEW OF CLINICAL AND RADIOLOGICAL PROFILES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Masahiro Jinzaki, MD, PhD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation;Support, General Electric Company
Tatsuo Kono, MD (*Abstract Co-Author*) Nothing to Disclose
Gen Nishimura (*Abstract Co-Author*) Nothing to Disclose
Yuko Tsujioka, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Eugene Nishi, MD (*Abstract Co-Author*) Nothing to Disclose
Kunihiko Shimizu (*Abstract Co-Author*) Nothing to Disclose
Taiki Nozaki, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshitake Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Orito Ikeda (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Childhood interstitial lung diseases (chILDs) are individually rare, but overall, many affected children seek medical services. Since chILDs, particularly of the infantile-onset, were poorly understood for a long time, many cases remained undiagnosed as "unexplained" ILDs. However, the new chILD classification (2007) for children under 2 years, and the expanded classification (2015) for children ages 2-18 years provided a more comprehensive picture of chILDs. The genetic and histological background of chILDs has been revealed as well. Radiologists should be aware of the disease classification, pathophysiology, and relevant imaging findings of chILDs. Accurate diagnosis will lead to further elucidation and development of efficient medical interventions for this group of disorders. TEACHING POINTS 1. Based on the current classification of chILDs, their pathophysiology and imaging findings will be presented, highlighting imaging findings that may enable us to make definitive diagnoses. 2. The spectrum of chILDs overlaps with that of adult ILDs; however, we should be aware of distinctive clinical and imaging characteristics in chILDs and the presence of infant-specific chILDs.

### TABLE OF CONTENTS/OUTLINE

1) Introduction2) Disorders of infancy (diffuse developmental abnormalities/alveolar growth abnormalities/surfactant dysfunction and related abnormalities/specific conditions of poorly defined etiology/miscellaneous monogenic chILDs)3) Disorders not specific to infancy and childhood (disorders of normal host/disorders related to systemic diseases/disorders of the immunocompromised host/disorders masquerading as interstitial lung disease)4) Discussion

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# Abstract Archives of the RSNA, 2024

PDEE-74

## UPDATE ON US SCREENING FOR DEVELOPMENTAL DYSPLASIA OF THE HIP (DDH): WHY, HOW AND WHEN?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Richard Placzek (*Abstract Co-Author*) Nothing to Disclose
Hakan Omeroglu (*Abstract Co-Author*) Nothing to Disclose
Ustun Aydingoz, MD (*Abstract Co-Author*) Nothing to Disclose
Carolina Casini (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Chlapoutakis, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To demonstrate why and how hip ultrasound has largely replaced clinical examination and radiography, as the screening method of choice for the early detection of developmental dysplasia of the hip in neonates and infants. • To justify the selection of Graf's technique over the other sonographic techniques, as the "one-stop-shop" for the diagnosis and monitoring of treatment of developmental dysplasia of the hip. • To present the evidence which proves that universal sonographic screening is preferred over selective screening. • To present Graf's technique main examination steps, including baby positioning, quality evaluation, morphological classification, and final typing. • To demonstrate the main treatment principles according to the Graf's hip type. • To comment on the main reasons for underperformance and practically demonstrate the main sources of erroneous practice and confusion. • To emphasize the importance of structured training as a requisite for the "lege artis" performance of the technique.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Screening methods for developmental dysplasia of the hip 3. Sonographic techniques 4. Why Graf's technique 5. Universal vs. selective screening with Graf's technique 6. Presentation of Graf's technique examination steps 7. Common errors and how to avoid them. 8. Treatment guidance / monitoring of treatment 9. Structured training 10. Conclusions

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# Abstract Archives of the RSNA, 2024

PDEE-75

## UNRAVELING CHALLENGES: IMAGING DIAGNOSIS OF PEDIATRIC SOLID PERITONEAL TUMORS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Salma Moalla, MD (*Abstract Co-Author*) Nothing to Disclose
Manel Mestiri, MD (*Abstract Co-Author*) Nothing to Disclose
Corinne Balleyguier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Remy Barbe, MD (*Abstract Co-Author*) Nothing to Disclose
Yassamin Benhayoun Sadafyine (*Abstract Co-Author*) Nothing to Disclose
El Mehdi Mniai, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Peritoneal neoplasms are a group of tumors that arise within the peritoneum space but outside the major organs. Diagnosis of these tumors is often challenging for radiologists and consists of several steps, including determining the tumor's location within the peritoneum, often by excluding involvement of adjacent abdominal structures, and identifying distinctive imaging features. The diagnostic spectrum for rare solid peritoneal masses in children is broad, and includes rhabdomyosarcomas, desmoid tumors, teratomas, and inflammatory myofibroblastic tumors... Ultrasound serves as the frontline imaging modality for initial assessment thanks to its accessibility and lack of ionizing radiation. Computed Tomography (CT) offers superior visualization and aids in lesion detection, localization, and distant staging, especially when malignancy is suspected. Magnetic Resonance Imaging (MRI) provides excellent soft tissue contrast and is valuable for diagnosis and surveillance, particularly with diffusion-weighted sequences for detecting subtle peritoneal lesions. A methodical approach to diagnosing solid peritoneal masses in pediatric patients is essential. This approach involves integrating clinical data with imaging findings while taking into account age-related differences and the rarity of such tumors in children. Despite the major contribution of imaging, biopsy is still often warranted for histological confirmation.

### TABLE OF CONTENTS/OUTLINE

1) Introduction and Objectives 2) Imaging signs of localization 3) Contribution of imaging modalities 4) Illustration of some rare solid peritoneal tumors in pediatrics 5) Take home messages 6) References

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# Abstract Archives of the RSNA, 2024

PDEE-76

## IMAGING OF MYXOID-CONTAINING TUMORS IN CHILDREN AND ADOLESCENTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Oscar M. Navarro, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea S. Doria, MD, PhD (*Abstract Co-Author*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)
Afsaneh Amirabadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Magdalena P. Reyes Recasens, MD (*Abstract Co-Author*) Nothing to Disclose
Jesus A. Arenos-Abril, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. List the most common myxoid-containing tumors involving the pediatric and adolescent age group. 2. Discuss the role of different imaging modalities used in the work-up of these lesions and describe the main imaging findings, emphasizing MRI features. 3. Recognize the characteristic MRI signal of the myxoid matrix to facilitate the differential diagnosis of soft tissue tumors.

### TABLE OF CONTENTS/OUTLINE

1. Introduction 2. MRI characteristics including diffusion weighted-imaging features of myxoid-containing lesions. 3. Histological types involving the pediatric and adolescent age group: a. Myxoid liposarcoma b. Primitive myxoid mesenchymal tumor of infancy (PMMTI) c. Low-grade myxoid fibrosarcoma d. Chondromyxoid fibroma e. NTRK-rearranged spindle cell neoplasm f. Extraskeletal myxoid chondrosarcoma 4. Take home points 5. References

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# Abstract Archives of the RSNA, 2024

PDEE-77

## TUBE FOR THOUGHT: IMAGING OF COMPLICATIONS ASSOCIATED WITH GASTROSTOMY AND GASTROJEJUNOSTOMY TUBES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Eugene G. Sheffield, MD (*Abstract Co-Author*) Nothing to Disclose
Asif Jamal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Preet K. Sandhu, MD (*Abstract Co-Author*) Nothing to Disclose
Chinky Patel, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Percutaneous feeding tubes such as gastrostomy and gastrojejunostomy tubes are widely used in the pediatric age group requiring long-term nutritional support. 2. Several complications are associated with the feeding tube apparatus such as abnormal placement, malpositioning, malfunction, and other uncommon complications. 3. Fluoroscopy is the initial modality of choice to evaluate for feeding tube complications using water soluble, non-ionic iodinated contrast agents. Ultrasound and CT are complementary in some cases. 4. A scout radiograph of the abdomen is often obtained prior to fluoroscopic evaluation to look for obvious malpositioning of the percutaneous feeding apparatus followed by fluoroscopy in the posteroanterior and right lateral positions to look for contrast opacifying the stomach and jejunum depending on the type of feeding tube, and to assess the position of the apparatus. 6. It is often challenging to identify feeding tube related complications on fluoroscopy and a high index of suspicion is required based on the clinical scenario. 7. The role of the radiologist is to be aware of percutaneous feeding tube related complications and to identify them in a timely manner for optimal patient care.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: use and importance of percutaneous gastrostomy and gastrojejunostomy tubes in the pediatric age group.2. Highlight various types of complications associated with feeding tube placement.3. Approach to evaluating these complications with an emphasis on imaging findings on fluoroscopy.4. Examples of feeding tube-related complications at our facility.

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# Abstract Archives of the RSNA, 2024

PDEE-78

## THE CHALLENGE OF UNDERSTANDING THE AIRWAY OBSTRUCTION IN FETUS: AN APPROACH TO EMBRIOLOGY, IMAGING ASPECTS AND PATOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Antonio S. Souza, MD (*Abstract Co-Author*) Nothing to Disclose
Pedro Daltro, MD (*Abstract Co-Author*) Nothing to Disclose
Fernanda D. Braojos Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Heron Werner JR, MD (*Abstract Co-Author*) Nothing to Disclose
Marcus Otavio Silva de Campos Meneses, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana M. Fazecas, MD (*Abstract Co-Author*) Nothing to Disclose
Luiz Rodrigues Santos, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Fetal magnetic resonance imaging (MRI) is the modality of choice for evaluation of congenital airway pathologies, which present a diagnostic challenge when assessed by ultrasound. The radiologist should be also accustomed with the embryology and normal anatomy of the airway and have a checklist to identify all structures every time is reading a fetal MRI. Identification of congenital airway anomalies become a crucial topic, as managing these pathologies may require interventions at the time of delivery or even during intrauterine life, posing a significant challenge for the perinatal care team due to the complexities of these pathologies and the risk of fetal demise.This pictorial essay will provide a detailed review of normal airway imaging findings in fetal MRI and their correlation with pathological findings, including some postnatal correlation cases.The objectives of this pictorial essay are:1 - To demonstrate the normal anatomy of the airway on fetal MRI; 2 - To present the primary congenital diseases involving the larynx and trachea; 3 - To identify the key radiological features of tracheal atresia, tracheal agenesis, and bronchial atresia;

### TABLE OF CONTENTS/OUTLINE

1-Normal embryology of the airway; 2-Anatomy and anatomical relationships of the fetal airway; 3-Tracheal agenesis; 4-Tracheal atresia, stenosis or web; 5- Laryngeal stenosis, atresia or web; 6- Bronchial Atresia 7- Correlation between fetal MRI findings and postnatal outcomes;

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# Abstract Archives of the RSNA, 2024

PDEE-79

## IMAGING OF PEDIATRIC THYROID REVISITED

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Oscar M. Navarro, MD (*Abstract Co-Author*) Nothing to Disclose
Emilio Inarejos Clemente, MD (*Abstract Co-Author*) Nothing to Disclose
Eman E. Marie, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Maria Pont, MD (*Abstract Co-Author*) Nothing to Disclose
Samantha K. Gerrie, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Lucia Riaza Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Navallas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To describe key imaging features and discuss practical tips that can help the radiologist narrow the differential diagnosis of pediatric thyroid disorders2. To explain the use of new imaging technologies in pediatric thyroid evaluation3. To discuss the utility of Kwak TI-RADS, ACR-TIRADS, ATA and structured report system in the evaluation of pediatric thyroid disorders

### TABLE OF CONTENTS/OUTLINE

1. US technique2. Normal anatomy, normal variants and pitfalls (cricoid cartilage, pyramidal lobe, intrathyroid thymus)3. Congenital thyroid abnormalities3.1. Congenital hypothyroidysm- Thyroid dysgenesis (agenesis, hemiagenesis, ectopia, hypoplasia)- Thyroid dyshormonogenesis3.2. Thyroglossal duct cyst4. Diffuse thyroid diseases4.1. Chronic lymphocytic thyroiditis (Hashimoto disease)4.2. Diffuse hyperplasia (Graves disease)4.3. Nodular hyperplasia4.5. Non-autoimmune thyroiditis (suppurative, granulomatous, subacute non-suppurative thyroiditis (De Quervain)4.6. Diffuse sclerosing variant of papillary carcinoma5. Focal thyroid lesions5.1. Benign lesions (colloid follicles/cysts, true epithelial-lined cysts, hyperplastic nodules with cystic degeneration, follicular adenoma)5.2. Thyroid cancer (papillary, follicular and medullary carcinoma)5.3. Predisposing factors for pediatric thyroid cancer including genetic disorders such as RET, DICER1 or PTEN gene mutations6. Utility and reproducibility of Kwak TI-RADS, ACR-TIRADS, ATA and structured report in the evaluation of pediatric thyroid lesions7. Evaluation of lymphadenopathy8. Newer techniques (elastography, superb microvascular imaging, contrast-enhanced US, radiomics/radiogenomics, AI)9. Conclusions

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# Abstract Archives of the RSNA, 2024

PDEE-8

## FLUOROSCOPIC IMAGING IN TRACHEOESOPHAGEAL FISTULA REPAIR: MASTERING THE TECHNIQUE TO MINIMIZE COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kari L. Hayes (*Abstract Co-Author*) Nothing to Disclose
Chelsea S. Life, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understand the pathology and subtypes of tracheoesophageal fistula (TEF)- Recognize imaging appearance of TEF, so as to not delay diagnosis- Review the potential complications of surgical correction of TEF and how would they be recognized on imaging- A model protocol for a pediatric post-operative esophagram will be provided- Pearls and pitfalls of pediatric esophagrams

### TABLE OF CONTENTS/OUTLINE

- Title slide- TEF: Pathology- TEF: Subtypes- Diagnosing TEF: Pathway and Typical Imaging Appearance- Management of TEF- Potential Complications of Surgical Correction of TEF- Fluoroscopic Post-operative Evaluation: Appropriate Technique and Protocol- Pearls and Pitfalls of Fluoroscopic Esophagrams- Cases/Examples illustrating the aforementioned teaching points

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# Abstract Archives of the RSNA, 2024

PDEE-80

## SUSTAINING THE FUTURE OF PEDIATRIC RADIOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hansel J. Otero, MD (*Abstract Co-Author*) Nothing to Disclose
Sweta Parmar (*Abstract Co-Author*) Nothing to Disclose
Johnny McLaughlin (*Abstract Co-Author*) Nothing to Disclose
Alexandra Sharashidze (*Abstract Co-Author*) Nothing to Disclose
Karen I. Ramirez Suarez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Understand the environmental implications of radiology practices, including waste generation and energy consumption, prompting a commitment to sustainability.
- Provide specific examples of interventions that are cost-saving and friendlier to the environment adapted to pediatric radiology practices.
- Examine the cost and environmental impact of changes in equipment energy efficiency, reduction of single use items, and the adoption of multipatient contrast vials.

### TABLE OF CONTENTS/OUTLINE



Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

PDEE-81

## IMAGING SPECTRUM OF PEDIATRIC PANCREATIC ABNORMALITIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luis F. Goncalves, MD, MSc (*Abstract Co-Author*) Speaker, Koninklijke Philips NV;;
Susan M. Hamman, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Zulfiqar, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Asmaa Aamir, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The pancreas can be involved in a wide array of congenital and acquired conditions in the pediatric population. The purpose of this exhibit is: 1. To become familiar with the spectrum of pancreatic disorders in children. 2. Review a multimodality approach and technical considerations for the diagnosis of pancreatic pathology. 3. To illustrate the imaging features of common and uncommon pancreatic disorders in pediatric patients.

### TABLE OF CONTENTS/OUTLINE

Imaging approach to pancreatic lesions. Normal appearance of the pancreas on different imaging modalities. Congenital pancreatic anomalies: pancreas divisum, annular pancreas, ectopic pancreas, pancreatic hypoplasia, abnormal pancreaticobiliary junction. Congenital disorders with pancreatic insufficiency: cystic fibrosis, Schwachman- Diamond syndrome, hereditary pancreatitis, other genetic risk factors. Pancreatitis: acute, chronic, autoimmune. Pancreatic trauma: blunt trauma, penetrating trauma, nonaccidental trauma. Pancreatic infection. Cystic lesions of pancreas: congenital cyst, pseudocyst, von Hippel- Lindau syndrome, autosomal dominant polycystic kidney disease, cystic pancreatic neoplasms. Solid pancreatic tumors: Pancreatoblastoma, solid pseudopapillary neoplasm, neuroendocrine tumor, acinar cell carcinoma, adenocarcinoma, non-epithelial tumors including lymphoma, inflammatory myofibroblastic tumor, invading tumors, metastatic disease. Other pancreatic lesions: intrapancreatic accessory spleen, vascular lesions. Summary.

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# Abstract Archives of the RSNA, 2024

PDEE-82

## DON'T STICK YOUR NECK OUT: DISSECTING THE SPECTRUM OF PEDIATRIC NECK EMERGENCIES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ajay Malhotra, MD, MMM (*Abstract Co-Author*) Nothing to Disclose
Shadi Ebrahimian, MD (*Abstract Co-Author*) Nothing to Disclose
Dheeman Futela, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mihir Khunte (*Abstract Co-Author*) Nothing to Disclose
Rahul Jayaram, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Accurate imaging is crucial for diagnosing and managing non-traumatic pediatric head and neck emergencies. The appropriate imaging modality, such as ultrasound, CT, or MRI, varies depending on the particular condition. These conditions include orbital and sinus emergencies, deep neck emergencies, ear emergencies, or airway emergencies. Choosing the proper imaging is critical for determining the most suitable treatment approach and distinguishing between cases requiring immediate intervention and those that can be addressed with medical therapy. Familiarity with the clinical features of pediatric emergencies and collaboration with clinicians can ultimately improve diagnostic precision and treatment effectiveness.

### TABLE OF CONTENTS/OUTLINE

1. Introduction-Importance of imaging in pediatric emergencies-Overview of common head and neck emergencies2. Choosing the Appropriate Imaging Modality-Ultrasound: Safe, cost-effective, but limited depth and operator dependent.-CT: Rapid, detailed bone imaging, but radiation exposure and contrast risks.-MRI: Radiation-free, superior soft tissue contrast, but longer scan times.3. Specific Conditions and Imaging Guidelines-Orbital Emergencies: Identifying cellulitis and abscesses· Sinus / Nasal Emergencies: Complications of sinusitis-Ear Emergencies: Diagnosing otitis and mastoiditis-Airway Emergencies: Recognizing epiglottitis and croup-Neck Emergencies: Recognizing infection, foreign body, vascular emergencies, congenital anomalies4. Case Studies-Application of skills discussed toward patient cases5. Conclusion-Summary of key points-Importance of clinical picture and collaboration when interpreting imaging

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# Abstract Archives of the RSNA, 2024

PDEE-83

## "TUMMIES" FOR "DUMMIES": NAVIGATING PEDIATRIC ABDOMINAL X-RAYS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thierry Huisman, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nadia F. Mahmood, MD (*Abstract Co-Author*) Nothing to Disclose
Oswaldo Guevara Tirado, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Lina Kim (*Abstract Co-Author*) Nothing to Disclose
Ricardo Torres, BS (*Abstract Co-Author*) Nothing to Disclose
Karla Santiago-Soltero, BS (*Abstract Co-Author*) Nothing to Disclose
Danet Lugo (*Abstract Co-Author*) Nothing to Disclose
Laura Santiago Caobi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Explore the prevalence and significance of pediatric abdominal pain and the diagnostic role of abdominal x-rays.- Outline a systematic approach to interpreting pediatric abdominal X-rays to improve diagnostic precision and patient outcomes.- Illustrate common pathologies identified in pediatric abdominal x-rays with case examples and address their diagnostic challenges.- Discuss common pitfalls and limitations of pediatric abdominal x-rays.

### TABLE OF CONTENTS/OUTLINE

Pediatric abdominal pain is one of the most common encounters in medical practice, often requiring prompt and accurate evaluation. Optimal use of abdominal x-rays in the pediatric population requires a proper technical assessment, recognition of pathological signs, and knowledge of common pitfalls and limitations. Adopting a systematic approach when reviewing abdominal x-rays entails a careful evaluation of gas patterns, extraluminal air, abdominal masses, calcifications, the peritoneal cavity, and surrounding osseous structures. Maintaining such a structure is key to enhancing diagnostic accuracy and improving patient outcomes.1. Introduction Objectives. 2. Epidemiology 3. How to approach a Pediatric Abdominal X-Rays 4. Common Encounters Stratified 5. Common Pitfalls Limitations 6. Case Examples 7. Conclusion

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# Abstract Archives of the RSNA, 2024

PDEE-84

## CHILDHOOD ILD (CHILD) PART II: LUNG DISEASE NOT SPECIFIC TO INFANCY - IMAGING FINDINGS AND HISTOPATHOLOGIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Ammie M. White, MD (*Abstract Co-Author*) Nothing to Disclose
Mariangeles Medina Perez, MD (*Abstract Co-Author*) Nothing to Disclose
Luis O. Tierradentro-Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Jenny Pogoriler, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Santiago Martinez-Correa, MD (*Abstract Co-Author*) Nothing to Disclose
David M. Biko, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Hansel J. Otero, MD (*Abstract Co-Author*) Nothing to Disclose
John P. Lichtenberger III, MD (*Abstract Co-Author*) Nothing to Disclose
Ankita Chauhan, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Karen I. Ramirez Suarez, MD (*Abstract Co-Author*) Nothing to Disclose
Jordan B. Rapp, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Overview the current understanding of pediatric interstitial lung diseases, from early childhood to adolescent years 2. Describe the distinctive imaging features and patterns associated with these conditions, emphasizing key CT findings 3. Correlate imaging findings with corresponding pathologic characteristics, highlighting the relationship between radiologic appearance and underlying pathophysiologic processes

### TABLE OF CONTENTS/OUTLINE

- Introduction: The role of imaging in the evaluation and management of chILD in children and adolescents Importance of a multidisciplinary approach- Diagnostic approach depending on clinical presentation and background- Imaging modalities and protocols- Describe characteristic imaging findings of pediatric diffuse lung disease related to:- Connective tissue disease or immune mediated e.g. sJIA, Systemic Sclerosis, SLE, MCTD, Sarcoidosis- Alveolar Hemorrhage e.g. Capillaritis, GPA, BMPR2 - Enviromental or drug related e.g. Hypersensitivity Pneumonitis, Eosinophilic PNA, Pleuroparenchymal fibroelastosis- Bronchiolitis Obliterans e.g. post-infection, post-transplant- Pulmonary Alveolar Proteinosis- Unclassified conditions e.g. Other cystic and fibrotic lung diseases- Differential Diagnosis: Considerations and potential mimics- Conclusion: Take-home points and future directions in imaging and management of pediatric diffuse lung disease

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PDEE-9

## BRAIN MALFORMATION IN THE GENOMIC ERA, WHAT THE RADIOLOGIST NEED TO KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Osamah A. Alwalid, MMed (*Abstract Co-Author*) Nothing to Disclose
Marwa Al-Subhi, MD (*Abstract Co-Author*) Nothing to Disclose
Jehan Al-Rayahi, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- To understand the role of radiology in the evaluation of brain malformation.- To understand basic genetic principles and lingo related to CNS malformation.- To learn the different genetic techniques utilized in the evaluation of patient with brain malformation. - To understand the genetic landscape of common brain malformation and the radiology phenpotype correlation.

### TABLE OF CONTENTS/OUTLINE

Introduction Genetic Principles and Techniques: - - Cytogenetic testing - - Narrow gene testing - - Next generation sequencing Brain malformation and their genetic landscape: - - Holoprosencephaly - - Malformation of cortical development - -Tubulopathies - - Ciliopathies o Joubert o Others related disorders Conclusion

# Abstract Archives of the RSNA, 2024

PHEE

**Physics Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## PHEE-1 NOVEL NOISE EVALUATION METHODS THAT BEYOND THE LIMITS OF NOISE SD(STANDARD DEVIATION) AND NPS(NOISE POWER SPECTRUM) - A NOISE EVALUATION METHOD APPLICABLE TO CLINICAL IMAGES

Sunao Mizumura (*Abstract Co-Author*) Nothing to Disclose
Masahiro Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Fuyuki Washizuka (*Abstract Co-Author*) Nothing to Disclose
Nobuyuki Shiraga, MD (*Abstract Co-Author*) Nothing to Disclose
Masaaki Hori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideharu Nakao (*Abstract Co-Author*) Nothing to Disclose
MASAYA NISHIWAKI (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Kobayashi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To understand the issues with noise evaluation using Noise Standard Deviation (Noise SD) and Noise Power Spectrum (NPS). To explore apparent noise, a novel approach that addresses the shortcomings of conventional noise evaluation methods. To recognize the advantages of evaluating noise in clinical imaging. To identify the limitations of apparent noise and strategies to overcome them.

### TABLE OF CONTENTS/OUTLINE

A. Limitations of Noise Standard Deviation (SD) : A Simple Measurement Method that Does Not Account for Frequency Information B. Challenges of Noise Power Spectrum (NPS) : Complicated Analysis and Difficulties in Clinical Imaging Applications C. Advantages of Apparent Noise Evaluation D. Application of Apparent Noise Evaluation in Clinical Imaging E. Overcoming the Limitations of Noise SD and NPS with Apparent Noise Evaluation

## PHEE-10 GENERAL RADIOGRAPHY ARTIFACTS: A VISUAL REVIEW

Beth A. Schueler, PhD (*Abstract Co-Author*) Nothing to Disclose
Jill M. Lucas, ARRT, BS (*Abstract Co-Author*) Nothing to Disclose
Zaiyang Long, PhD (*Abstract Co-Author*) Nothing to Disclose
Lindsay Ranschau, BS, ARRT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Identify radiographic image artifacts participants will learn how to recognize the appearance of image artifacts that may obscure pathology. Investigate the cause of artifacts learners will study potential sources of common artifacts. Implement artifact resolution methods participants will be equipped with practical techniques to minimize artifact occurrence, prompting the production of high-quality radiographic images.

### TABLE OF CONTENTS/OUTLINE

Radiographic artifacts can cause obscured or undiagnostic images, possibly requiring repeat imaging and radiographic room downtime. Our team has gathered image artifacts in many different types of equipment configurations and clinical scenarios. We will describe the investigation and diagnosis of artifact causes as well as resolution methods. Sharing this information with imaging technologists and radiologists will empower them to be able to minimize artifact occurrence and optimize image quality, facilitating accurate diagnosis and clinical decision-making. The following types of artifacts will be reviewed:system hardware-related, system software-related, patient-related, technologist-related, environment-related.

## PHEE-11 BEYOND THE BASICS. MRI GADOLINIUM BASED CONTRASTS AGENTS: UPDATES AND GUIDELINES REVIEW

**Awards**
**Certificate of Merit**

Karly Cristhelly Garrido Estrella, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Arizaga, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela L. Mendieta Rodriguez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To describe the classification of contrast agents in Magnetic resonance imaging based on the type and biodistribution.• To explain the main characteristics of Gadolinium.• To review Gadolinium-based contrast agents (GBCAs), describing their generalities and classifications.• To list the early and late adverse reactions GBCAs and explain Gadolinium deposition disease/symptoms associated with Gadolinium exposure, based on the different

guidelines of the American College of Radiology (ACR) and European Society of Radiology (ESUR).• To define nephrogenic systemic fibrosis.• To review current recommendations according to ACR and ESUR guidelines on risk assessment, pregnancy, breastfeeding and waiting time between examinations.• To summarize information about the development of new GBCAs.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction.2. Contrast agents in Magnetic Resonance Imaging.3. Gadolinium features.4. Gadolinium-Based Contrast Agents (GBCAs): Generalities, classifications, adverse reactions and risk factors, Gadolinium deposition disease (GDD)/symptoms associated with Gadolinium exposure (SAGE), Nephrogenyc systemic fibrosis (NSF), pregnancy and lactation, update and guidelines: risk assessment recommendations, waiting times between examinations recommendations.5. What's new? Contrast agents in development.6. Conclusions.7. References.

## PHEE-12 DOSE REDUCTION IN INTERVENTIONAL CT PROCEDURES BY OPTIMIZING HELICAL SCAN PARAMETERS

**Awards**
**Cum Laude**

Keith B. Quencer, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew B. O'Brien, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan R. Foster, MD (*Abstract Co-Author*) Royalties, RELX;Consultant, RELX
Lindsay S. DeWeese, PHD (*Abstract Co-Author*) Nothing to Disclose
Lindsay N. Douglas, PhD (*Abstract Co-Author*) Nothing to Disclose
Isaac J. Bailey, MS (*Abstract Co-Author*) Nothing to Disclose
Rachel Malinowski (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Define common CT procedures, workflow, and different scan mode options for procedures. 2) Discuss image quality requirements for diagnostic versus CT procedures. 3) Review protocol parameters relevant to dose optimization including automatic tube current and iterative reconstruction settings. 4) Identify strategies for CT dose optimization in CT procedures. 5) Understand that adjustments can be made to the helical portion of the procedure to significantly reduce patient dose.

**TABLE OF CONTENTS/OUTLINE**

1) CT Procedures a) Common types of CT procedures 2) Scan mode options a) Workflow of procedures b) Helical versus CT scanner interventional scan modes Takeaway 1-2: Knowledge of scan mode options and parameters for common CT procedures is imperative for knowing where optimization is viable. 3) Protocol parameters to be adjusted to optimize the helical scan used in procedures a) Image quality requirements for diagnostic versus CT procedures b) Automatic tube current modulation image quality reference setting c) Iterative reconstruction Takeaway: Parameter adjustments are used to optimize procedure protocols based on image quality requirements. 4) Prior studies that have had success in CT dose optimization 5) Targeting the helical scan success at a single institution and future work a) Adjusting DRI and iDose4 resulted in 30-40% dose reduction b) Utilize what was learned to optimize pediatric procedures Takeaway: Results from a single institution demonstrate the feasibility of optimizing CT procedures.

## PHEE-14 DIXON METHOD AND IN-PHASE/OPPOSED-PHASE IMAGING: CLINICAL UTILITY AND PITFALLS

Aoi Uchida, MD (*Abstract Co-Author*) Nothing to Disclose
Masako Tokuhashi, MD (*Abstract Co-Author*) Nothing to Disclose
Juri Miyaji, MD (*Abstract Co-Author*) Nothing to Disclose
Takashi Katayama, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

In this presentation, our aim is to review the clinical utility and pitfalls of the different types of Dixon methods and in-phase (IP) and opposed-phase (OP) imaging in MRI. The Dixon method and IP/OP MR imaging are routinely used in various fields. Currently, several techniques with different characteristics are used, and there is no one perfect method that is suitable for all purposes. It is important for radiologists to be aware of the characteristics of the different types of Dixon methods, as improper interpretation of the Dixon method can lead to misdiagnosis. However, many radiologists find it difficult to understand the principles of MRI and also to understand how the principles of different techniques affect clinical practice. Simplified explanations or explanations for commercial purposes are provided to doctors, but they may not be sufficient to solve clinical problems. We have made efforts to provide explanations that are easy to understand for radiologists, without sacrificing accuracy, by referring to many clinical cases.

**TABLE OF CONTENTS/OUTLINE**

Introduction/ About chemical shift/ IP/OP imaging/ Minimal basics of the Dixon method/ Advantages of the Dixon method 1. Uniform and selective fat suppression 2. Four (+ 1) kinds of images obtained from one scan 3. Quantification of fat and R2* values / Pitfalls 1. Underestimation of both fat and iron deposition (IP/OP imaging) 2. Swapping artifact (Dixon method) 3. Effect of an incomplete signal model (GRE conventional Dixon method) 4. Reversed echo time order (IP/OP imaging) 5. OP signal drop in the TSE Dixon method (TSE Dixon method using acquired data for OP image) 6. IP/OP images in the modified Dixon method / Conclusions

## PHEE-15 FLUOROSCOPIC COLPOCYSTODEFECOGRAPHY: TIPS FOR SUCCESSFUL TECHNIQUE AND RELEVANT INTERPRETATION

EMNA YOUNSI (*Abstract Co-Author*) Nothing to Disclose
Marc Zins, MD (*Abstract Co-Author*) Nothing to Disclose
Boulay-Coletta Isabelle, MD (*Abstract Co-Author*) Nothing to Disclose
Sophie Anglaret, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. Haouari I, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Pelvic floor dysfunction constitutes a major public health issue. - Fluoroscopic defecography is considered as the best imaging study to explore obstructed defecation. When rectal opacification is combined with vaginal, bladder and small bowel opacification, the examination is called colpocystodefecography (CCD). - Like dynamic pelvic MR, CCD is very useful for identifying different pelvic floor disorders (rectal and pelvic organ prolapses, anismus, descending perineum syndrome?) and the interplay of the different compartments. - Although CCD does not allow pelvic floor muscles study, it provides optimal functional evaluation during defecation reproducing natural conditions for normal defecation (sitting position, soft stool consistency?). For this reason, dynamic pelvic MR and CCD should be considered as complementary examinations, particularly when MR is not conclusive (no rectal emptying obtained). - Good technique is necessary to unmask all the abnormalities presented by the patient, and methodical interpretation in line with the latest recommendations is mandatory to communicate the result of the examination to the prescribing physician in the right terminology and with the right anomalies quantification.

**TABLE OF CONTENTS/OUTLINE**

- Describe the appropriate technique for the realization of the CCD according to the latest recommendations., with tips on how to overcome technical limitations and reduce radiation exposure. - Define the various pelvic floor disorders using pathological CCD exams examples. - Propose a synthetic reporting template using the consensual terminology.

## PHEE-16 EXPLORING UNCHARTED FRONTIERS: ADVANCING BEYOND DIFFUSION TENSOR IMAGING

Robert C. McKinstry III, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joshua S. Shimony, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tammie S. Benzinger, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company;Investigator, Eli Lilly and Company;Investigator, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Research Grant, Siemens AG;Consultant, ADM Diagnostics, LLC;Speakers Bureau, Biogen Idec Inc;Advisory Board, Biogen Idec Inc
Ali Y. Mian, MD (*Abstract Co-Author*) Nothing to Disclose
Zhongwei Zhang, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Diffusion tensor imaging (DTI) has firmly established as a cornerstone in clinic, offering unparalleled insights into brain microstructure. Traditionally employed for acute infarction assessment, it now finds common use in brain tumor treatment planning (tractography), evaluating transient metabolic failure during seizures, and assessing perivascular spaces and glymphatic clearance. The purposes of this Education Exhibit are 1. To offer a comprehensive and visually engaging overview of DTI, enabling readers to develop an intuitive understanding of DTI physics and to recognize its strengths and limitations. 2. Discuss the DTI fundamentals and recent advances towards bolstering the quality, speed, and reliability of data acquisition. 3. Graphically illustrate the underlying principles behind the transformation from directional diffusion data to the tensor matrix. 4. Discuss both qualitative and quantitative DTI measures, along with underlying biophysical mechanisms. 5. Review recent advances beyond traditional DTI, such as DTI-ALPS, FWE-DTI, IVIM-DTI, TBSS, and NODDI, etc.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction; 2. Why is a tensor needed in DTI? 3. DTI Data Acquisition: Echo Planar Imaging and its variants; 4. DTI Data Acquisition: Practical considerations; 5. Diffusion modeling and diffusion tensor Processing; 6. From directional diffusion data to tensor matrix; 7. Understanding the eigenvalues and the eigenvectors; 8. Diffusion Tensor Ellipsoid; 9. The basis of anisotropic water diffusion in the nervous system; 10. Qualitative Measures; 11. Quantitative DTI Measures; 12. Tensor Shape Classification; 13. Principal Diffusion Direction Map; 14. Fiber Tracking; 15. Beyond traditional DTI.

## PHEE-17 HOW CAN WE USE EFFECTIVE ATOMIC NUMBER INFORMATION GENERATED BY PHOTON-COUNTING COMPUTED TOMOGRAPHY? - A PROPOSAL FOR APPLICATION TO DENTAL FORENSICS -

Hiroaki Hayashi, PhD (*Abstract Co-Author*) Research collaboration, Meditec Japan Co., Ltd;Research collaboration, JOB Corporation
Yusuke Morimitsu (*Abstract Co-Author*) Nothing to Disclose
Noriaki Akagi, RT (*Abstract Co-Author*) Nothing to Disclose
Natsumi Kimoto (*Abstract Co-Author*) I am an employee of JOB CORPORATION.
Rina Nishigami (*Abstract Co-Author*) Nothing to Disclose
Chihiro Kurose (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Iguchi, MD (*Abstract Co-Author*) Personal fee, Guerbet SA
Tatsuya Maeda (*Abstract Co-Author*) Research collaboration, Meditec Japan Co., Ltd
Daiki Kobayashi, BS (*Abstract Co-Author*) Nothing to Disclose
Shunsuke Okada (*Abstract Co-Author*) Nothing to Disclose
Takashi Asahara (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Effective atomic number (Zeff) images can be calculated using photon-counting CT and dual-energy CT.2. The Zeff value of artificial dental materials can be used for dental forensics, because the value is a consistent physical indicator for dental materials and can be obtained with various imaging systems such as photon-counting CT, dual-energy CT and scanogram systems using a photon-counting detector.

**TABLE OF CONTENTS/OUTLINE**

1. Forensic dentistry often confirms the identities of unidentified persons by comparing postmortem dental information with the antemortem treatment history. Zeff values of artificial dental materials provided by photon-counting CT (PC-CT) can improve identification accuracy. 2. Explanation of our algorithm for deriving Zeff images using PC-CT. 3. Accuracy evaluation of Zeff images from a multi-energy CT phantom consisting of known atomic number materials. 4. Phantom experiments using artificial dental materials. The atomic number for each artificial dental material was the same value regardless of the imaging systems, and even when the material was embedded in the dental head phantom, it indicated a consistent value. 5. We proposed a procedure for identifying unidentified persons using dental information for dental forensics. By combining quantitative analysis and qualitative analysis using PC-CT, the identification accuracy of undefined persons can be improved.

## PHEE-18 PHOTON-COUNTING-DETECTOR (STANDARD- AND ULTRA-HIGH-RESOLUTION) VS. ENERGY-INTEGRATING-DETECTOR CT: A PRACTICAL GUIDE TO SELECTING THE RIGHT TECHNOLOGY

Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Nikkole Weber, ARRT, RT (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Katlyn Patzner (*Abstract Co-Author*) Nothing to Disclose
Jennifer Jones (*Abstract Co-Author*) Nothing to Disclose
Michael R. Bruesewitz, RT (*Abstract Co-Author*) Nothing to Disclose
Felix E. Diehn, MD (*Abstract Co-Author*) Nothing to Disclose
Kelly K. Horst, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Joseph R. Swicklik, RT, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Photon-counting-detector (PCD) CT offers many advantages over energy-integrating-detector (EID) CT. However, access to PCD-CT is typically limited. Many CT practices face challenges in determining which exams should be performed using PCD-CT. Priority should be given to exams that would benefit patients the most. 2. PCD-CT provides clear benefits for exams requiring high spatial resolution, ultra-low radiation doses, or simultaneous high-resolution/high speed/spectral imaging 3. PCD-CT has not shown clear benefits in exams that only require smooth kernel reconstruction for soft tissue (e.g., routine abdomen and brain) and quantitative spectral imaging. 4. In PCD-CT, the ultra-high-resolution (UHR) mode is usually preferred, but it has limitations in tube capacity and scan speed compared to the standard-resolution (SR) mode.

**TABLE OF CONTENTS/OUTLINE**

1. Background: PCD-CT vs. EID-CT 2. Describe the challenges in choosing between scanners and techniques on PCD-CT: a. UHR vs. SR b. Threshold vs. spectral images c. With or without Sn filter d. Flash mode vs. regular mode e. Metal artifact reduction (MAR) software vs. virtual monochromatic images (VMI) 3. Provide a practical guide on how to choose the right scanner and techniques: a. Compare image quality of PCD-CT (SR and UHR) and EID-CT in phantom scans b. List exam types and provide examples where PCD-CT has or hasn't shown clear benefits over EID-CT c. Describe pros and cons of SR and UHR modes on PCD-CT d. Compare options for MAR: high-energy VMI vs. MAR software vs. threshold high images

## PHEE-19 THE IMPORTANCE OF ACQUIRED RESOLUTION IN THE AGE OF AI RECONSTRUCTIONS

Scott Robertson, PhD (*Abstract Co-Author*) Nothing to Disclose
Dorothy A. Lowell, MD (*Abstract Co-Author*) Nothing to Disclose
Alex K. Smith, PhD, MS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Novel Artificial Intelligence (AI)-assisted reconstructions are becoming more prevalent in all areas of radiology. While these reconstruction algorithms offer several major advantages compared with conventional reconstructions, such as improved image sharpness, higher signal-to-noise ratio (SNR), and overall better image quality, the connection between the acquired resolution and the resulting image resolution has become less apparent. In particular, the improved SNR provided by these AI reconstructions can be leveraged to reduce acquisition time (through reduced averages, increased readout bandwidth, etc.), while still delivering improved image quality. This may lead a naḭve observer to reduce the acquisition resolution in an attempt to further reduce acquisition time. In this exhibit, we will review the connection between acquired, and final (interpolated) image resolution, focusing on how the DL reconstruction enhances the acquired resolution, as well as how reducing the acquisition resolution will negatively impact the final images. Potential pitfalls of reducing acquisition resolution will be demonstrated, and we will show an example of how reducing the acquisition resolution can acquire a BI-RADS non-compliant exam.

**TABLE OF CONTENTS/OUTLINE**

1. Key components of a DL-based reconstruction algorithm, 2. How DL can enhance a conventional acquisition, 3. Comparison of conventional reconstruction to DL-based reconstruction, 4. The effect of reducing acquisition resolution on conventional and DL-based reconstructions, 5. Alternative methods to reduce acquisition time in the age of DL-based reconstructions, 6. Summary

## PHEE-2 DEEP LEARNING FOR SUPER-RESOLUTION IN SCENARIOS WITH INSUFFICIENT PAIRED DATA IN MEDICAL IMAGING

Yuichiro Hayashi, PhD (*Abstract Co-Author*) Nothing to Disclose
Kensaku Mori, PhD (*Abstract Co-Author*) Research Grant, Cybernet Systems Co, Ltd;Intellectual Property, Cybernet Systems Co, Ltd;Research Grant, J Morita Corporation;Intellectual Property, J Morita Corporation;Developer, J Morita Corporation
Masahiro Oda, PhD (*Abstract Co-Author*) Nothing to Disclose
YUNHENG WU (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purposes of our exhibit are:1. To understand the concept of super-resolution (SR).2. To realize generative adversarial network which is a common deep learning model for SR.3. To recognize the challenges of insufficient paired data in performing SR on medical images.4. To learn about some deep-learning methods that overcome the challenge in medical image SR.5. To discuss the potential for future advancements in medical image SR with insufficient paired data.

**TABLE OF CONTENTS/OUTLINE**

Deep Learning-Based Super-Resolution (SR) and Its Applications in Medical Imaging- Introduce what deep learning-based super-Resolution is.- Explain how SR technology is applied to medical images.Deep Learning Model for SR- Introduce what GAN is.- Explain why GAN can be used in SR.Challenge of Insufficient Paired Data- Explain why sufficient paired data is lacking in medical imaging.- Describe the impact of insufficient paired data on deep learning models.Methods for Overcoming Insufficient Paired Data in Medical Image- Data augmentation and paired data creation method through downsampling for SR model training.• Increasing sample diversity through methods such as rotation and flipping.• Creating training data pairs by downsampling HR (High Resolution) images to obtain LR (Low Resolution) images.- Precise registration and coarse-to-fine cascade training method for SR model training.• Improving the quality of training data by improving HR-LR image registration.• Coars-to-fine Cascade training method to gradually enhancing image details while reducing artifacts.Future Prospects and Discussion- Discuss artifacts generated by GAN in medical images.- Explore potential methods to minimize the generation of artifacts.

## PHEE-20 RE-EXPLAINING SOFT TISSUE CONTRAST ON MRI: TISSUE PROPERTY FILTERS

**Awards**
**Certificate of Merit**

Daniel Cornfeld, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The Bloch equations are useful for plotting tissue signal as a function of time for a given pulse sequence but are limited for comparing the signal between tissues. Consequently, many radiologists have limited knowledge of how contrast is generated and disease is detected by the standard pulse sequences used in clinical practice. Through interactive plots and didactic text the exhibit will introduce the concept of tissue property filters as a way understanding what makes tissues and disease bright or dark on images. We explain T1, T2, and PD weighting both quantitatively and qualitatively. The filters are then used to explain how sequence parameters are chosen to optimise contrast between normal tissues and also between normal tissues and disease. Finally, we explain how these concepts are used to design sequences highly sensitive to disease and to understand the limitations of these sequences.

**TABLE OF CONTENTS/OUTLINE**

A. Introduction to tissue property filters B. Explanation of Fast Spin Echo T1, T2, and PD C. Grey matter vs White matter - Contrast in Brain imaging D. Ligaments, Tendons, Fat, and Muscle - Contrast in MSK Imaging E. Quantification of T1, T2, and PD weighting F. Inversion Recovery: Why T2-STIR and T2-FLAIR work G. Inversion Recovery T1: Why T1-FLAIR and MP-RAGE work H. Future applications: Imaging white matter and fascia

## PHEE-21 ULTRASOUND SPATIAL COMPOUNDING AND HARMONIC IMAGING: WHAT ARE THEY AND HOW DO THEY CHANGE THE IMAGE?

Mark D. Sugi, MD (*Abstract Co-Author*) Consultant, Nextrast, Inc;Author with royalties, RELX
Cameron Adler, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel J. Fahrenholtz, PhD (*Abstract Co-Author*) Stockholder, Nano X Imaging
Cole P. Thompson, MD (*Abstract Co-Author*) Nothing to Disclose
Khushnood Hamdani (*Abstract Co-Author*) Nothing to Disclose
William F. Sensakovic, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Understand how harmonic and spatial compound imaging work 2. Learn how harmonic and spatial compound imaging impact image quality3. Determine where harmonic and spatial compound imaging can improve clinical imaging

**TABLE OF CONTENTS/OUTLINE**

1. How does harmonic imaging work?1a. Physics and knobology for harmonic imaging1b. What are the advantages/disadvantages of harmonic imaging?2. How does spatial compound imaging work? 2a. Physics and knobology for harmonic imaging 2b. What are the advantages/disadvantages of compound imaging?3. Can we combine spatial compound imaging and harmonic imaging?3a. What are the advantages/disadvantages of combining? 4. Guidance on clinical usage of harmonic and compound imaging

## PHEE-22 THE USE OF DIAGNOSTIC CT AND MR IN TREATMENT PLANNING FOR TRANS-ARTERIAL RADIOEMBOLIZATION OF HEPATOCELLULAR CARCINOMA--WHAT MEDICAL PHYSICISTS SHOULD KNOW

Huimin Wu, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhihua Qi, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To understand the roles of diagnostic CT and MR in the dosimetry guided treatment planning process for trans-arterial radioembolization of hepatocellular carcinoma (HCC); 2. To recognize the constituent series or sequences of a diagnostic CT and MR liver study based on their purposes and appearance; 3. To properly select the series or sequence to fuse with the non-diagnostic CT (as part of MAA mapping SPECT-CT) in the subsequent treatment planning process

**TABLE OF CONTENTS/OUTLINE**

1. Brief overview of trans-arterial radioembolization of HCC; 2. The value of diagnostic images in treatment planning for trans-arterial radioembolization of HCC; 3. Brief overview of liver's segmental anatomy; 4. Brief overview of liver's vascular anatomy including hepatic arteries, portal veins, and hepatic veins; 5. Typical diagnostic CT liver protocols (a). Different phases of CT scans (b). Key anatomy identified on CT images (c). Appearance and possible artifacts; 6. Typical diagnostic MR liver protocols (focusing on purpose, appearance and possible artifacts for each type of sequences) (a). T2 weighted sequence (b). T1 weighted sequence (c). DIXON sequence (d). Diffusion weighted imaging sequence (e). Other advanced sequences; 7. Rationale for choosing the best series for treatment planning (a). Clinical consideration (b). Image CNR consideration (c). Artifact consideration (d). Image registration consideration.

## PHEE-23 FACTORS AFFECTING CONTRAST ENHANCEMENT IN COMPUTED TOMOGRAPHY IMAGING

**Awards**
**Certificate of Merit**

Giuseppe V. Toia, MD, MS (*Abstract Co-Author*) Research Consultant, General Electric Company;Research Grant, General Electric Company
Sean Rose, PhD (*Abstract Co-Author*) Research Grant, medInt Holdings, LLC;
Kelsey Schluter, BS (*Abstract Co-Author*) Nothing to Disclose
Timothy P. Szczykutowicz, PhD (*Abstract Co-Author*) Consultant, Aidoc Medical Ltd;Consultant, Flowhow.ai;Consultant, medInt Holdings, LLC;Consultant, Alara, Inc;Consultant, AstoCT, Inc;Research Grant, General Electric Company;Research Grant, Canon Medical Systems Corporation
Carrie Bartels, RT (*Abstract Co-Author*) Nothing to Disclose
Rachel Bladorn, BS, RT (*Abstract Co-Author*) Nothing to Disclose
Zahra Alyani Nezhad, BSc, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

(1) Improper contrast enhancement is a leading motivator for repeated CT examinations. (2) Many interacting factors influence contrast enhancement including physics-based, patient-related and contrast protocol-related. (3) Three physics (beam energy, beam hardening, scan duration), two patient (blood volume, cardiac output), and five contrast prescriptions (contrast volume, injection rate, iodine concentration, scan delay, saline flush) related factors will be quantitatively described giving the reader the ability to quantify the change in contrast enhancement when performing CT protocol optimization to achieve optimal contrast enhancement.

**TABLE OF CONTENTS/OUTLINE**

This education exhibit will provide a survey of how iodinated contrast agent is required for specific CT indications. Then, ten different factors affecting CT enhancement will be described and placed into categories of: physics, patient, or contrast prescription. We will then present a categorization which places each factor into a scalar category (i.e., the factor scales CT number enhancement but doesn't change the form of the enhancement curve in time) and a temporal category (i.e., the factor changes the temporal dynamics of the contrast enhancement curve). When possible, we will present a quantitative model explaining the impact of the factor on CT number enhancement. The interaction between factors will also be described. Lastly, we will present case examples demonstrating the factors described in this exhibit.

## PHEE-24 EXPLANATION OF NON-PHYSICAL VALUES ON SPECTRAL MATERIAL DENSITY MAPS IN CT

**Awards**
**Cum Laude**

Giuseppe V. Toia, MD, MS (*Abstract Co-Author*) Research Consultant, General Electric Company;Research Grant, General Electric Company
Timothy P. Szczykutowicz, PhD (*Abstract Co-Author*) Consultant, Aidoc Medical Ltd;Consultant, Flowhow.ai;Consultant, medInt Holdings, LLC;Consultant, Alara, Inc;Consultant, AstoCT, Inc;Research Grant, General Electric Company;Research Grant, Canon Medical Systems Corporation
Aria Salyapongse, BS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Readers of this exhibit will come away understanding: (1) why non-iodine containing tissues (e.g., bone) may have positive iodine (water) material density map values, (2) why a radiologist may see negative material density values, (3) how the choice of bases affects the predicted iodine density in an iodine (water) map for an iodine-containing tissue, and (4) the conditions for material basis choices yielding accurate iodine density values.

**TABLE OF CONTENTS/OUTLINE**

We will begin with a review of basic physics of material decomposition based on Alvarez and Macovski's 1976 work describing how any tissue can be described as a photoelectric and Compton scattering basis. We will then describe how the photoelectric and Compton basis can be extended to material basis pairs to characterize tissue in terms of material basis (i.e., iodine and water). Then we will explain the well-known problem of calcium in iodine (water) images. Then, we will present an explanation of why a radiologist might observe a negative value on a material density map. Next, we will describe how basis pair choice affects the measured iodine in an iodine-containing voxel with different background materials. Finally, we will conclude with a description of the conditions necessary for accurate iodine density based on the choice of basis materials.

## PHEE-25 HOW CAN WE MEASURE BIOLOGICAL VISCOSITY NON-INVASIVELY USING MRI?

Yuki Kanazawa, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiro Haga, PhD (*Abstract Co-Author*) Nothing to Disclose
Mitsuharu Miyoshi (*Abstract Co-Author*) Employee, General Electric Company
Hiroaki Hayashi, PhD (*Abstract Co-Author*) Research collaboration, Meditec Japan Co., Ltd;Research collaboration, JOB Corporation
Masafumi Harada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tosiaki Miyati, PhD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mayuka Seguchi (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. The viscosity measurement in vivo should be quantitively derived using DWI.2. The higher the viscosity according to material density, the lower the ADC.3. The viscosity depends on both concentration and temperature.4. Conversion of the ADC of biological tissue into viscosity using the DWI-viscosity function, utilizing the linear relationship between ADC and viscosity corresponding to the Stokes-Einstein equation.5. The DWI-viscosity measurement method we developed could be applied to patients with atherosclerotic plaque non-invasively, e.g., undergoing preoperative evaluation for carotid endarterectomy (CEA) or carotid artery stenting (CAS).

**TABLE OF CONTENTS/OUTLINE**

• The Stokes-Einstein equation shows the linear relationship between the diffusion coefficient and viscosity. However, experimentally measuring the viscosity of living cells non-invasively is challenging.• Polymers with viscosity that mimic substances that make up living cells, for example, glycerin solutions.• The DWI viscosity function was determined from the two phantom experiments using glycerin solutions.• The slopes of the linear regression curves in the relationship between ADC and viscosity, that is, the DWI-viscosity function, decreased at elevated temperatures with a significant correlation (All, $R2 > 0.98$).• When comparing DWI viscosity with pathological findings for atherosclerotic plaques, a significant difference was observed between patients with and without symptoms ($P < 0.001$) and hemorrhage findings ($P < 0.05$).

## PHEE-26 ARTIFICIAL INTELLIGENCE: WHAT EVERY RADIOLOGIST SHOULD KNOW

Abhishek Mishra, DO (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Understand the intersection of artificial intelligence and radiology, exploring what exactly defines "artificial intelligence".2) Explore the foundational principles behind the integration of AI in radiology.3) Survey the diverse applications of AI in radiology, from image interpretation and diagnosis, to workflow optimization and more.4) Examine the AI techniques utilized in radiology, such as deep learning, convolutional neural networks, and natural language processing, elucidating their roles in medical images and reports.

**TABLE OF CONTENTS/OUTLINE**

- Introduction to AI in Radiology:
- Define artificial intelligence and its relevance in the field of radiology.
- Discuss the technological advancements that have facilitated the integration of AI into radiology, such as improvements in computational power, availability of large datasets, and development of advanced algorithms.
- Overview of Different Application of AI in Radiology
- Image Interpretation: (1) Computer-Aided Detection (2) Automated Detection (3) Image Segmentation (4) Quantitative Analysis
- Decision Support: (1) Diagnostic Assistance (2) Treatment Planning (3) Risk Stratification
- Workflow Optimization: (1) Prioritization (2) Resource Allocation (3) Automation of Repetitive Tasks (4) Integration with clinical data
- Dictation: (1) Natural Language Processing (2) Contextual Assistance (3) Quality Assurance (4) Automated Reporting
- Review of Key AI Techniques (and examples in current practice)
- Machine learning
- Convolutional neural networks
- Deep Learning
- Natural Language Processing
- Computer Vision
- Knowledge Representation and Reasoning

## PHEE-27 INSIGHTS INTO MSK DECT: ILLUMINATING THE SHADOWS

Elena Canales Lachen (*Abstract Co-Author*) Nothing to Disclose
Jose Acosta Batlle, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Suevos, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Arevalo (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose

Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel Angel Gomez Bermejo, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Develop the potential Spectral CT imaging has in both traumatic and non-traumatic musculoskeletal diseases through a case-based approach.- Explore different Spectral CT maps applied to a varied spectrum of musculoskeletal disorders with a special focus on Virtual Non-Calcium reconstructions correlated with conventional X-rays and MRI scans.- Propose a practical step-by-step post-processing method to display Spectral CT data and optimize color-coded reconstruction maps.- Standardize a basic lexicon to describe findings and avoid pitfalls when reading musculoskeletal Spectral CT scans.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction. 1.1 DECT Imaging Principles. 1.2 DECT Reconstructions Workflow.2. MSK Spectral CT Case-based Approach Learning. 2.1 Traumatic Pathology: 2.1.1. Vertebral fractures. 2.1.2. Scaphoid fractures. 2.1.3. Trochanteric BME. 2.2 Non-traumatic Pathology: 2.2.1. Arthropathies: Gout, CPPD, HAAD. 2.2.2. Bone infection: osteomyelitis. 2.2.3. Bone Metastasis. 2.2.4. Vanishing bone metastasis. 2.2.5. Foreign modeling agent reactions (FMAR).3. Conclusion

## PHEE-28 PHOTON COUNTING CT - WHAT DO WE KNOW AND WHAT CAN WE EXPECT?

Srujana Ganti, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Bimal Mayur Kumar Vora (*Abstract Co-Author*) Nothing to Disclose
Parag R. Salkade, FRCR,MMed (*Abstract Co-Author*) Nothing to Disclose
Steven B. Wong, MD, MBChB (*Abstract Co-Author*) Nothing to Disclose
Stefanie Lee, MBBS (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1.Explain the technology underpinning Photon Counting CT and discuss the differences between Photon Counting CT and current available CT technology. 2. Discuss the advantages and clinical applications of Photon Counting CT 3.Discuss the potential challenges and considerations that Radiology departments need to take into account before obtaining a Photon Counting CT scanner.

**TABLE OF CONTENTS/OUTLINE**

Photon counting CT is one of the latest developments in CT scanner technology and holds significant promise, in areas of superior image quality and radiation dose reduction. This poster will aim to give an overview of this novel technology and what can be expected, in terms of clinical applications, benefits and potential challenges. The timeline of CT scanner technology development, culminating in the creation of the latest, photon counting CT scanner will be discussed.The poster will also elucidate the fundamental differences between photon counting CT and existing CT technology, such as dual energy CT. Clinical applications and advantages over conventional CT scanning technology will be presented. The poster also aims to discuss some of the potential problems and challenges that Radiology departments may face if they were to obtain this scanner, such as cost and infrastructure considerations.

## PHEE-29 REGULATORY SCIENCE CHALLENGES AND GAPS AT THE FDA FOR RADIOLOGY AI DEVICES

Frank W. Samuelson, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Petrick, PhD (*Abstract Co-Author*) Nothing to Disclose
Aldo Badano, PhD (*Abstract Co-Author*) Research Grant, Barco nv
Kenny H. Cha, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexej Gossmann (*Abstract Co-Author*) Nothing to Disclose
Ravi K. Samala, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Regulatory science is the science of developing tools, methods, and data, including computational approaches, to stimulate innovation and facilitate the scientific regulatory evaluation of medical products. Increased attention and investment in radiology artificial intelligence (AI) enabled software as medical devices (AI-SaMDs) over the last decade has recently led to an exponential increase in AI-enabled devices authorized by the FDA. However, there are inconsistencies between performance results reported in the academic literature and the number and type of devices authorized for clinical use in the US. In this exhibit, we discuss issues related to regulatory science, in (a) data, (b) AI development and (c) AI performance assessment. We provide a comprehensive view of these regulatory science challenges and gaps and describe related Regulatory Science Tools (RSTs) made publicly available to reduce risk of AI development and facilitate consistent and rigorous evaluation.

**TABLE OF CONTENTS/OUTLINE**

Challenges in radiology AI regulatory science are key factors limiting the advancement, development, and deployment of AI-SaMDs. The outline of this presentation is as follows: (1) Addressing patient data access, augmentation approaches using synthetic data, generative AI, and other in silico approaches. (2) Assessing the limitations in AI development including bias, subgroup analysis, continual learning, and post-market monitoring. (3) Developing evaluation methods for novel devices including metric selection, LLM-based devices, and triage, notification and rule-out devices. (4) Deliver resources to support device innovation and patient access to new technologies by use of FDA's RSTs.

## PHEE-3 VISUALIZATION AND PROTECTION OF RADIATION FOR EYE LENS EXPOSED BY SINGLE WEARABLE DOSIMETER

Masaki Fujisawa (*Abstract Co-Author*) Nothing to Disclose
Ryota Shindo (*Abstract Co-Author*) Nothing to Disclose
Koichi Chida, PhD (*Abstract Co-Author*) Nothing to Disclose
Yohei Inaba, PhD, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

-To understand the importance of visualizing and monitoring the radiation dose for eye lenses by wearable radio-photoluminescence (RPL) glass dosimeter. -To understand the need for managing the occupational dose to reduce radiation exposure for eye lenses in radiology exams. -To understand the importance of protecting medical staffs or caregivers attending to patients from radiation.

**TABLE OF CONTENTS/OUTLINE**

TABLE OF CONTENTS In this study, we utilized radio-photoluminescence (RPL) silver-activated phosphate glasses as the lens body of over-glass eyewear. The wearable RPL dosimeter developed successfully exhibited RPL emission in proportion to the X-ray irradiation dose. Moreover, we demonstrated the feasibility of the developed dosimeter for visualization and protection at the same time. OUTLINE Growing interest is being paid for local radiation exposure on the human eye triggered by the recommendation given by International Commission on Radiological Protection (ICRP). The risk of cataracts

should be more strictly controlled and managed under the new regulation, effective in Japan in April 2021. Optical observation of the phosphate-glass lens for the wearable device successfully exhibited RPL emission after X-ray irradiation in different schemes, including clinical conditions. To evaluate the radiation shielding functions of the developed wearable RPL dosimeter, commercially available RPL dosimeters were placed in front and backward of the RPL lens during the irradiation. Results suggested that the developed wearable device has the potential to accomplish convenient dosimetry for local radiation exposure for human eyes as well as radiation protection functions in a single wearable device.

## PHEE-4 HOW IMAGE GENERATION AI AND MULTIMODAL AI WORK AND THEIR APPLICATIONS IN CAD

Hirotsugu Takabatake, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Masaki Mori, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Natori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kensaku Mori, PhD (*Abstract Co-Author*) Research Grant, Cybernet Systems Co, Ltd;Intellectual Property, Cybernet Systems Co, Ltd;Research Grant, J Morita Corporation;Intellectual Property, J Morita Corporation;Developer, J Morita Corporation
Masahiro Oda, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of our exhibit are:1. To confirm what are the differences between previous and recent image generation AIs (VAE, GAN vs Diffusion Model (DM))2. To learn applications of DM-based image generation AI in CAD3. To learn what is multimodal AI4. To learn applications of multimodal AI in CAD

### TABLE OF CONTENTS/OUTLINE

Image generation AI- What is image generation AI- Introductions of image generation models: VAE, GAN, Diffusion Model (DM)- Advantages and drawbacks of models- How DM generates imagesApplications of DM-based image generation AIs in CAD- Image generation: Generate variations of tumor images to improve the performance of CAD systems- Segmentation: Segmentation of organ and tumor regions from various medical images- Image translation: Convert image modalities from CT to MR, MR to CT, between MR images of different weighting conditionsMultimodal AI- What is Multimodal AI- Multimodal AIs and their mechanisms: DALL-E 2, Stable Diffusion- How do large multimodal datasets contribute to building multimodal AIApplication of Multimodal AI in CAD- Image explanation generation: Generate texts explaining findings in medical images- Anonymization: Automatically anonymize medical image and text

## PHEE-5 DREAMS AND REALITY IN PHOTON COUNTING CT: CURRENT CAPABILITY OF THE PHOTON COUNTING CT AND FUTURE PROSPECTS

**Awards**
**Certificate of Merit**

Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Shota Kondo (*Abstract Co-Author*) Nothing to Disclose
Wataru Fukumoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toru Higaki, PhD (*Abstract Co-Author*) Nothing to Disclose
Fuminari Tatsugami, MD (*Abstract Co-Author*) Nothing to Disclose
Yuko Nakamura, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Photon counting detector CT (PCD CT) is becoming popular worldwide, and CT vendors other than Siemens Healthineers, which was the first to launch a commercial scanner, are also developing PCDCT. PCDCT is superior to conventional CT in spatial- and low-contrast resolution and is expected to reduce radiation dose. However, there is a limit to the improvement of spatial- and low contrast resolution, and radiation dose cannot be reduced without limitation. Spectral imaging also has various limitations at present. This educational exhibit will outline the current technical capabilities of PCD CT and discuss how we might utilize PCD CT in clinical practice.

### TABLE OF CONTENTS/OUTLINE

1. Current technical issues of PCD CT 1) Charge sharing, 2) K-escape, 3) Compton scatter, 4) Pulse pile-up2. To what extent can PCD CT improve spatial resolution? - limitation factors for spatial resolution3. To what extent can low contrast resolution be improved by PCD CT?4. Current radiation dose reduction in PCD CT5. When will the K-edge imaging be realized?6. Do the detector materials affect the diagnostic capability of PCD CT?7. Which areas of clinical practice will be advanced by introduction of the PCD CT?

## PHEE-6 HOW DO WE DETERMINE THE WATER VOLUME IN THE CENTRAL NERVOUS SYSTEM?

Masafumi Harada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuki Kanazawa, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiro Haga, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryuji Oshiro (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. T2 signal decay multi-component model: the amplitude of each structural water needs to be determined using a curve fitting.2. The electronic microscope image of myelinated axons can be divided into three water pools: myelin sheath (My), axon (Ax), and intra/extracellular fluid (IE).3. T2 values of each component: My < Ax < IE.4. T2 distribution with different peaks for myelin water and other water components.5. Myelin water fraction (MWF) values have some variations in response to B0 inhomogeneity and multi-echo dataset.

### TABLE OF CONTENTS/OUTLINE

• MWF is calculated using some MR signal models for the central nervous system (CNS), which consists of three structural water pools (myelin sheath, axon, and IE).• Convert process of multi-component water phantom derived from electron microscopic analysis: Machine learning is instrumental.• The data acquisition using MR simulator: Setting pulse sequence and imaging parameters.• The fitting algorithm for the T2 signal decay multi-component model: Each amplitude is derived from the fraction of the divided regions.• Applying numerical MWF phantom for multicomponent CNS relaxometry: Comparison of MWF derived from different imaging parameters and B0 inhomogeneity datasets.

## PHEE-7 THE RADIOLOGY RESIDENT'S GUIDE TO BRAIN MRI: CORE PRINCIPLES OF PHYSICS AND SEQUENCES

Carla Vert Soler, MD (*Abstract Co-Author*) Nothing to Disclose
Sara L. Castaner, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Carlos Ordonez (*Abstract Co-Author*) Nothing to Disclose
MARIDELMA VILLANUEVA (*Abstract Co-Author*) Nothing to Disclose

Malgorzata Stachno (*Abstract Co-Author*) Nothing to Disclose
Electra Hernandez (*Abstract Co-Author*) Nothing to Disclose
Anna Oliva (*Abstract Co-Author*) Nothing to Disclose
Paloma Puyalto, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Nuria Faure, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanni Mattiello, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Interpreting magnetic resonance imaging requires a basic knowledge of its physical principles, familiarity with the sequences, and understanding their individual significance in the main protocols used in brain studies.This educational review aims to provide a clear, concise, and understandable insight into the physical principles of MRI and the sequences used in the evaluation of the central nervous system (CNS) and their applications in assessing the major brain disorders.Multiple sequences, distinguished by the use of different pulses and gradients, yield information on the nature and behavior of various CNS structures and lesions, enabling a wide range of specific studies (brain tumors, epilepsy, demyelinating diseases, strokes, and cognitive disorders).A solid yet simplified understanding of MRI's physical principles and employed sequences can assist residents in their rotation and enhance their interpretation skills to approach the major CNS conditions.

**TABLE OF CONTENTS/OUTLINE**

Basic principles of MRI physics and sequences: the proton and the magnetic field;what happens in the MRI scanner;what is T1 and T2 relaxation;what is an MRI sequence.Main MRI sequences and their applications in CNS imaging: T1WI, T2WI, DWI, magnetic susceptibility sequences, angiographic and flow imaging, perfusion imaging, spectroscopy, functional MRI and MRI tractography.

## PHEE-8 LOW-DOSE IMAGING USING ULTRA-HIGH RESOLUTION MODE AND ADDED BEAM FILTRATION IN PHOTON-COUNTING-DETECTOR CT

Felix E. Diehn, MD (*Abstract Co-Author*) Nothing to Disclose
Julie B. Guerin, MD (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joseph R. Swicklik, RT, BS (*Abstract Co-Author*) Nothing to Disclose
Zhongxing Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Kelly K. Horst, MD (*Abstract Co-Author*) Nothing to Disclose
Michael R. Bruesewitz, RT (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Teaching points: 1. PCD-CT improves radiation dose efficiency over EID-CT because of improved photon-energy weighting, increased geometrical efficiency, reduced electronic noise, and small detector effect. 2. Ultra-high-resolution (UHR) acquisition mode on PCD-CT provides a better spatial resolution-noise tradeoff. 3. Added beam filtration such as tin (Sn) filter can further improve radiation dose efficiency in PCD-CT, like in EID-CT 4. Combining UHR and added Sn filter on PCD-CT can achieve ultra-low-dose imaging capability (as low as that in a chest x-ray exam) for some unenhanced CT exams.

**TABLE OF CONTENTS/OUTLINE**

Table of Contents/Outline: 1. Explain the four fundamental physical factors why PCD-CT has a better radiation dose efficiency over EID-CT a. Equal or optimal photon energy weighting b. elimination of septae between detector pixels c. reduced electronic noise d. small detector effect 2. In a phantom experiment, compare image quality and radiation dose efficiency between PCD-CT and EID-CT for multiple settings: a. Standard resolution (SR) vs. UHR mode b. 120 kV vs. 100 kV with Sn filter (100Sn) c. Multiple radiation dose levels d. Multiple reconstruction kernels 3. Demonstrate the feasibility of ultra-low-dose imaging in some un-enhanced patient exams on PCD-CT using both UHR mode and added Sn filter. Radiation dose in some of these exams can approach that in a chest x-ray, i.e., 0.1 mSv. a. Sinus b. Pediatric cystic fibrosis c. Lung cancer screening

## PHEE-9 ADVANCED BODY MRI SEQUENCES AND TECHNIQUES

Lauren F. Alexander, MD (*Abstract Co-Author*) Spouse, Stockholder, Abbott Laboratories;Spouse, Stockholder, AbbVie Inc;Spouse, Stockholder, General Electric Company;Spouse, Stockholder, Myriad Genetics, Inc
Candice W. Bolan, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Agely, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Bowman, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shengzhen Tao (*Abstract Co-Author*) Nothing to Disclose
Jordan LeGout, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review various forms of accelerated image acquisition. Discuss different methods for improving image quality. Address abdominopelvic applications of deep learning. Learn with real clinical applications and case examples

**TABLE OF CONTENTS/OUTLINE**

1. Introduction a. Discuss vendors and proprietary sequence naming b. Stress importance of innovation and constant improvement for high quality body MRI 2. Sequences and techniques with physics explanations and example applications A. Keyhole Imaging i. HCC screening ii. To counter transient tachypnea with Eovist B. Compressed Sensing i. Breath-hold MRCP ii. Urography C. Radial acquisition a. Motion resistant T2b. High-resolution post contrast imaging D. Radial + Compressed Sensing i. Free breathing post contrast imaging ii. Dynamic contrast enhancement (prostate) E. Motion corrected subtraction F. Simultaneous Multi-Slice i. Acceleration ii. Increased NEX for same time G. Zoomed Diffusion i. Advantages over standard diffusion ii. Prostate, kidney, pancreas H. Readout Segmented Diffusion i. Reduction of susceptibility artifact ii. Rectal, prostate I. Deep Learning i. Advantages, disadvantages ii. Large FOV spin echo iii. Small FOV spin echo iv. Single shot spin echo 3. Miscellaneous Quality Improvement i. Microenema ii. FOV control iii. Secretin for duodenal masses iv. Saturation bands v. Dark oral contrast 4. Conclusion and References

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# Abstract Archives of the RSNA, 2024

PHEE-1

## NOVEL NOISE EVALUATION METHODS THAT BEYOND THE LIMITS OF NOISE SD(STANDARD DEVIATION) AND NPS(NOISE POWER SPECTRUM) - A NOISE EVALUATION METHOD APPLICABLE TO CLINICAL IMAGES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Sunao Mizumura (*Abstract Co-Author*) Nothing to Disclose
Masahiro Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Fuyuki Washizuka (*Abstract Co-Author*) Nothing to Disclose
Nobuyuki Shiraga, MD (*Abstract Co-Author*) Nothing to Disclose
Masaaki Hori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideharu Nakao (*Abstract Co-Author*) Nothing to Disclose
MASAYA NISHIWAKI (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Kobayashi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To understand the issues with noise evaluation using Noise Standard Deviation (Noise SD) and Noise Power Spectrum (NPS). To explore apparent noise, a novel approach that addresses the shortcomings of conventional noise evaluation methods. To recognize the advantages of evaluating noise in clinical imaging. To identify the limitations of apparent noise and strategies to overcome them.

### TABLE OF CONTENTS/OUTLINE

A. Limitations of Noise Standard Deviation (SD) : A Simple Measurement Method that Does Not Account for Frequency Information B. Challenges of Noise Power Spectrum (NPS) : Complicated Analysis and Difficulties in Clinical Imaging Applications C. Advantages of Apparent Noise Evaluation D. Application of Apparent Noise Evaluation in Clinical Imaging E. Overcoming the Limitations of Noise SD and NPS with Apparent Noise Evaluation

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

PHEE-10

## GENERAL RADIOGRAPHY ARTIFACTS: A VISUAL REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Beth A. Schueler, PhD (*Abstract Co-Author*) Nothing to Disclose
Jill M. Lucas, ARRT, BS (*Abstract Co-Author*) Nothing to Disclose
Zaiyang Long, PhD (*Abstract Co-Author*) Nothing to Disclose
Lindsay Ranschau, BS, ARRT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Identify radiographic image artifacts participants will learn how to recognize the appearance of image artifacts that may obscure pathology. Investigate the cause of artifacts learners will study potential sources of common artifacts. Implement artifact resolution methods participants will be equipped with practical techniques to minimize artifact occurrence, prompting the production of high-quality radiographic images.

### TABLE OF CONTENTS/OUTLINE

Radiographic artifacts can cause obscured or undiagnostic images, possibly requiring repeat imaging and radiographic room downtime. Our team has gathered image artifacts in many different types of equipment configurations and clinical scenarios. We will describe the investigation and diagnosis of artifact causes as well as resolution methods. Sharing this information with imaging technologists and radiologists will empower them to be able to minimize artifact occurrence and optimize image quality, facilitating accurate diagnosis and clinical decision-making. The following types of artifacts will be reviewed:system hardware-related, system software-related, patient-related, technologist-related, environment-related.

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# Abstract Archives of the RSNA, 2024

PHEE-11

## BEYOND THE BASICS. MRI GADOLINIUM BASED CONTRASTS AGENTS: UPDATES AND GUIDELINES REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Karly Cristhelly Garrido Estrella, MD (*Abstract Co-Author*) Nothing to Disclose
Ana C. Gandara, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Arizaga, MD (*Abstract Co-Author*) Nothing to Disclose
Pamela L. Mendieta Rodriguez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To describe the classification of contrast agents in Magnetic resonance imaging based on the type and biodistribution.• To explain the main characteristics of Gadolinium.• To review Gadolinium-based contrast agents (GBCAs), describing their generalities and classifications.• To list the early and late adverse reactions GBCAs and explain Gadolinium deposition disease/symptoms associated with Gadolinium exposure, based on the different guidelines of the American College of Radiology (ACR) and European Society of Radiology (ESUR).• To define nephrogenic systemic fibrosis.• To review current recommendations according to ACR and ESUR guidelines on risk assessment, pregnancy, breastfeeding and waiting time between examinations.• To summarize information about the development of new GBCAs.

### TABLE OF CONTENTS/OUTLINE

1. Introduction.2. Contrast agents in Magnetic Resonance Imaging.3. Gadolinium features.4. Gadolinium-Based Contrast Agents (GBCAs): Generalities, classifications, adverse reactions and risk factors, Gadolinium deposition disease (GDD)/symptoms associated with Gadolinium exposure (SAGE), Nephrogenyc systemic fibrosis (NSF), pregnancy and lactation, update and guidelines: risk assessment recommendations, waiting times between examinations recommendations.5. What’s new? Contrast agents in development.6. Conclusions.7. References.

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# Abstract Archives of the RSNA, 2024

PHEE-12

## DOSE REDUCTION IN INTERVENTIONAL CT PROCEDURES BY OPTIMIZING HELICAL SCAN PARAMETERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Keith B. Quencer, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew B. O'Brien, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan R. Foster, MD (*Abstract Co-Author*) Royalties, RELX;Consultant, RELX
Lindsay S. DeWeese, PHD (*Abstract Co-Author*) Nothing to Disclose
Lindsay N. Douglas, PhD (*Abstract Co-Author*) Nothing to Disclose
Isaac J. Bailey, MS (*Abstract Co-Author*) Nothing to Disclose
Rachel Malinowski (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Define common CT procedures, workflow, and different scan mode options for procedures. 2) Discuss image quality requirements for diagnostic versus CT procedures. 3) Review protocol parameters relevant to dose optimization including automatic tube current and iterative reconstruction settings. 4) Identify strategies for CT dose optimization in CT procedures. 5) Understand that adjustments can be made to the helical portion of the procedure to significantly reduce patient dose.

### TABLE OF CONTENTS/OUTLINE

1) CT Procedures a) Common types of CT procedures 2) Scan mode options a) Workflow of procedures b) Helical versus CT scanner interventional scan modes Takeaway 1-2: Knowledge of scan mode options and parameters for common CT procedures is imperative for knowing where optimization is viable. 3) Protocol parameters to be adjusted to optimize the helical scan used in procedures a) Image quality requirements for diagnostic versus CT procedures b) Automatic tube current modulation image quality reference setting c) Iterative reconstruction Takeaway: Parameter adjustments are used to optimize procedure protocols based on image quality requirements. 4) Prior studies that have had success in CT dose optimization 5) Targeting the helical scan success at a single institution and future work a) Adjusting DRI and iDose4 resulted in 30-40% dose reduction b) Utilize what was learned to optimize pediatric procedures Takeaway: Results from a single institution demonstrate the feasibility of optimizing CT procedures.

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# Abstract Archives of the RSNA, 2024

PHEE-14

## DIXON METHOD AND IN-PHASE/OPPOSED-PHASE IMAGING: CLINICAL UTILITY AND PITFALLS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Aoi Uchida, MD (*Abstract Co-Author*) Nothing to Disclose
Masako Tokuhashi, MD (*Abstract Co-Author*) Nothing to Disclose
Juri Miyaji, MD (*Abstract Co-Author*) Nothing to Disclose
Takashi Katayama, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

In this presentation, our aim is to review the clinical utility and pitfalls of the different types of Dixon methods and in-phase (IP) and opposed-phase (OP) imaging in MRI. The Dixon method and IP/OP MR imaging are routinely used in various fields. Currently, several techniques with different characteristics are used, and there is no one perfect method that is suitable for all purposes. It is important for radiologists to be aware of the characteristics of the different types of Dixon methods, as improper interpretation of the Dixon method can lead to misdiagnosis. However, many radiologists find it difficult to understand the principles of MRI and also to understand how the principles of different techniques affect clinical practice. Simplified explanations or explanations for commercial purposes are provided to doctors, but they may not be sufficient to solve clinical problems. We have made efforts to provide explanations that are easy to understand for radiologists, without sacrificing accuracy, by referring to many clinical cases.

### TABLE OF CONTENTS/OUTLINE

Introduction/ About chemical shift/ IP/OP imaging/ Minimal basics of the Dixon method/ Advantages of the Dixon method 1. Uniform and selective fat suppression 2. Four (+ 1) kinds of images obtained from one scan 3. Quantification of fat and R2* values / Pitfalls 1. Underestimation of both fat and iron deposition (IP/OP imaging) 2. Swapping artifact (Dixon method) 3. Effect of an incomplete signal model (GRE conventional Dixon method) 4. Reversed echo time order (IP/OP imaging) 5. OP signal drop in the TSE Dixon method (TSE Dixon method using acquired data for OP image) 6. IP/OP images in the modified Dixon method / Conclusions

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# Abstract Archives of the RSNA, 2024

PHEE-15

## FLUOROSCOPIC COLPOCYSTODEFECOGRAPHY: TIPS FOR SUCCESSFUL TECHNIQUE AND RELEVANT INTERPRETATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

EMNA YOUNSI (*Abstract Co-Author*) Nothing to Disclose
Marc Zins, MD (*Abstract Co-Author*) Nothing to Disclose
Boulay-Coletta Isabelle, MD (*Abstract Co-Author*) Nothing to Disclose
Sophie Anglaret, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed A. Haouari I, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Pelvic floor dysfunction constitutes a major public health issue. - Fluoroscopic defecography is considered as the best imaging study to explore obstructed defecation. When rectal opacification is combined with vaginal, bladder and small bowel opacification, the examination is called colpocystodefecography (CCD). - Like dynamic pelvic MR, CCD is very useful for identifying different pelvic floor disorders (rectal and pelvic organ prolapses, anismus, descending perineum syndrome?) and the interplay of the different compartments. - Although CCD does not allow pelvic floor muscles study, it provides optimal functional evaluation during defecation reproducing natural conditions for normal defecation (sitting position, soft stool consistency?). For this reason, dynamic pelvic MR and CCD should be considered as complementary examinations, particularly when MR is not conclusive (no rectal emptying obtained). - Good technique is necessary to unmask all the abnormalities presented by the patient, and methodical interpretation in line with the latest recommendations is mandatory to communicate the result of the examination to the prescribing physician in the right terminology and with the right anomalies quantification.

### TABLE OF CONTENTS/OUTLINE

- Describe the appropriate technique for the realization of the CCD according to the latest recommendations., with tips on how to overcome technical limitations and reduce radiation exposure. - Define the various pelvic floor disorders using pathological CCD exams examples. - Propose a synthetic reporting template using the consensual terminology.

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# Abstract Archives of the RSNA, 2024

PHEE-16

## EXPLORING UNCHARTED FRONTIERS: ADVANCING BEYOND DIFFUSION TENSOR IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Robert C. McKinstry III, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joshua S. Shimony, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tammie S. Benzinger, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company;Investigator, Eli Lilly and Company;Investigator, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Research Grant, Siemens AG;Consultant, ADM Diagnostics, LLC;Speakers Bureau, Biogen Idec Inc;Advisory Board, Biogen Idec Inc
Ali Y. Mian, MD (*Abstract Co-Author*) Nothing to Disclose
Zhongwei Zhang, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Diffusion tensor imaging (DTI) has firmly established as a cornerstone in clinic, offering unparalleled insights into brain microstructure. Traditionally employed for acute infarction assessment, it now finds common use in brain tumor treatment planning (tractography), evaluating transient metabolic failure during seizures, and assessing perivascular spaces and glymphatic clearance. The purposes of this Education Exhibit are 1. To offer a comprehensive and visually engaging overview of DTI, enabling readers to develop an intuitive understanding of DTI physics and to recognize its strengths and limitations. 2. Discuss the DTI fundamentals and recent advances towards bolstering the quality, speed, and reliability of data acquisition. 3. Graphically illustrate the underlying principles behind the transformation from directional diffusion data to the tensor matrix. 4. Discuss both qualitative and quantitative DTI measures, along with underlying biophysical mechanisms. 5. Review recent advances beyond traditional DTI, such as DTI-ALPS, FWE-DTI, IVIM-DTI, TBSS, and NODDI, etc.

### TABLE OF CONTENTS/OUTLINE

1. Introduction; 2. Why is a tensor needed in DTI? 3. DTI Data Acquisition: Echo Planar Imaging and its variants; 4. DTI Data Acquisition: Practical considerations; 5. Diffusion modeling and diffusion tensor Processing; 6. From directional diffusion data to tensor matrix; 7. Understanding the eigenvalues and the eigenvectors; 8. Diffusion Tensor Ellipsoid; 9. The basis of anisotropic water diffusion in the nervous system; 10. Qualitative Measures; 11. Quantitative DTI Measures; 12. Tensor Shape Classification; 13. Principal Diffusion Direction Map; 14. Fiber Tracking; 15. Beyond traditional DTI.

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# Abstract Archives of the RSNA, 2024

PHEE-17

## HOW CAN WE USE EFFECTIVE ATOMIC NUMBER INFORMATION GENERATED BY PHOTON-COUNTING COMPUTED TOMOGRAPHY? - A PROPOSAL FOR APPLICATION TO DENTAL FORENSICS -

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hiroaki Hayashi, PhD (*Abstract Co-Author*) Research collaboration, Meditec Japan Co., Ltd;Research collaboration, JOB Corporation
Yusuke Morimitsu (*Abstract Co-Author*) Nothing to Disclose
Noriaki Akagi, RT (*Abstract Co-Author*) Nothing to Disclose
Natsumi Kimoto (*Abstract Co-Author*) I am an employee of JOB CORPORATION.
Rina Nishigami (*Abstract Co-Author*) Nothing to Disclose
Chihiro Kurose (*Abstract Co-Author*) Nothing to Disclose
Toshihiro Iguchi, MD (*Abstract Co-Author*) Personal fee, Guerbet SA
Tatsuya Maeda (*Abstract Co-Author*) Research collaboration, Meditec Japan Co., Ltd
Daiki Kobayashi, BS (*Abstract Co-Author*) Nothing to Disclose
Shunsuke Okada (*Abstract Co-Author*) Nothing to Disclose
Takashi Asahara (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Effective atomic number (Zeff) images can be calculated using photon-counting CT and dual-energy CT.2. The Zeff value of artificial dental materials can be used for dental forensics, because the value is a consistent physical indicator for dental materials and can be obtained with various imaging systems such as photon-counting CT, dual-energy CT and scanogram systems using a photon-counting detector.

### TABLE OF CONTENTS/OUTLINE

1. Forensic dentistry often confirms the identities of unidentified persons by comparing postmortem dental information with the antemortem treatment history. Zeff values of artificial dental materials provided by photon-counting CT (PC-CT) can improve identification accuracy. 2. Explanation of our algorithm for deriving Zeff images using PC-CT. 3. Accuracy evaluation of Zeff images from a multi-energy CT phantom consisting of known atomic number materials. 4. Phantom experiments using artificial dental materials. The atomic number for each artificial dental material was the same value regardless of the imaging systems, and even when the material was embedded in the dental head phantom, it indicated a consistent value. 5. We proposed a procedure for identifying unidentified persons using dental information for dental forensics. By combining quantitative analysis and qualitative analysis using PC-CT, the identification accuracy of undefined persons can be improved.

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# Abstract Archives of the RSNA, 2024

PHEE-18

## PHOTON-COUNTING-DETECTOR (STANDARD- AND ULTRA-HIGH-RESOLUTION) VS. ENERGY-INTEGRATING-DETECTOR CT: A PRACTICAL GUIDE TO SELECTING THE RIGHT TECHNOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Nikkole Weber, ARRT, RT (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Katlyn Patzner (*Abstract Co-Author*) Nothing to Disclose
Jennifer Jones (*Abstract Co-Author*) Nothing to Disclose
Michael R. Bruesewitz, RT (*Abstract Co-Author*) Nothing to Disclose
Felix E. Diehn, MD (*Abstract Co-Author*) Nothing to Disclose
Kelly K. Horst, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Joseph R. Swicklik, RT, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Photon-counting-detector (PCD) CT offers many advantages over energy-integrating-detector (EID) CT. However, access to PCD-CT is typically limited. Many CT practices face challenges in determining which exams should be performed using PCD-CT. Priority should be given to exams that would benefit patients the most. 2. PCD-CT provides clear benefits for exams requiring high spatial resolution, ultra-low radiation doses, or simultaneous high-resolution/high speed/spectral imaging 3. PCD-CT has not shown clear benefits in exams that only require smooth kernel reconstruction for soft tissue (e.g., routine abdomen and brain) and quantitative spectral imaging. 4. In PCD-CT, the ultra-high-resolution (UHR) mode is usually preferred, but it has limitations in tube capacity and scan speed compared to the standard-resolution (SR) mode.

### TABLE OF CONTENTS/OUTLINE

1. Background: PCD-CT vs. EID-CT 2. Describe the challenges in choosing between scanners and techniques on PCD-CT: a. UHR vs. SR b. Threshold vs. spectral images c. With or without Sn filter d. Flash mode vs. regular mode e. Metal artifact reduction (MAR) software vs. virtual monochromatic images (VMI) 3. Provide a practical guide on how to choose the right scanner and techniques: a. Compare image quality of PCD-CT (SR and UHR) and EID-CT in phantom scans b. List exam types and provide examples where PCD-CT has or hasn’t shown clear benefits over EID-CT c. Describe pros and cons of SR and UHR modes on PCD-CT d. Compare options for MAR: high-energy VMI vs. MAR software vs. threshold high images

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# Abstract Archives of the RSNA, 2024

PHEE-19

## THE IMPORTANCE OF ACQUIRED RESOLUTION IN THE AGE OF AI RECONSTRUCTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Scott Robertson, PhD (*Abstract Co-Author*) Nothing to Disclose
Dorothy A. Lowell, MD (*Abstract Co-Author*) Nothing to Disclose
Alex K. Smith, PhD, MS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Novel Artificial Intelligence (AI)-assisted reconstructions are becoming more prevalent in all areas of radiology. While these reconstruction algorithms offer several major advantages compared with conventional reconstructions, such as improved image sharpness, higher signal-to-noise ratio (SNR), and overall better image quality, the connection between the acquired resolution and the resulting image resolution has become less apparent. In particular, the improved SNR provided by these AI reconstructions can be leveraged to reduce acquisition time (through reduced averages, increased readout bandwidth, etc.), while still delivering improved image quality. This may lead a naļve observer to reduce the acquisition resolution in an attempt to further reduce acquisition time. In this exhibit, we will review the connection between acquired, and final (interpolated) image resolution, focusing on how the DL reconstruction enhances the acquired resolution, as well as how reducing the acquisition resolution will negatively impact the final images. Potential pitfalls of reducing acquisition resolution will be demonstrated, and we will show an example of how reducing the acquisition resolution can acquire a BI-RADS non-compliant exam.

### TABLE OF CONTENTS/OUTLINE

1. Key components of a DL-based reconstruction algorithm, 2. How DL can enhance a conventional acquisition, 3. Comparison of conventional reconstruction to DL-based reconstruction, 4. The effect of reducing acquisition resolution on conventional and DL-based reconstructions, 5. Alternative methods to reduce acquisition time in the age of DL-based reconstructions, 6. Summary

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# Abstract Archives of the RSNA, 2024

PHEE-2

## DEEP LEARNING FOR SUPER-RESOLUTION IN SCENARIOS WITH INSUFFICIENT PAIRED DATA IN MEDICAL IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yuichiro Hayashi, PhD (*Abstract Co-Author*) Nothing to Disclose
Kensaku Mori, PhD (*Abstract Co-Author*) Research Grant, Cybernet Systems Co, Ltd;Intellectual Property, Cybernet Systems Co, Ltd;Research Grant, J Morita Corporation;Intellectual Property, J Morita Corporation;Developer, J Morita Corporation
Masahiro Oda, PhD (*Abstract Co-Author*) Nothing to Disclose
YUNHENG WU (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of our exhibit are:1. To understand the concept of super-resolution (SR).2. To realize generative adversarial network which is a common deep learning model for SR.3. To recognize the challenges of insufficient paired data in performing SR on medical images.4. To learn about some deep-learning methods that overcome the challenge in medical image SR.5. To discuss the potential for future advancements in medical image SR with insufficient paired data.

### TABLE OF CONTENTS/OUTLINE

Deep Learning-Based Super-Resolution (SR) and Its Applications in Medical Imaging- Introduce what deep learning-based super-Resolution is.- Explain how SR technology is applied to medical images.Deep Learning Model for SR- Introduce what GAN is.- Explain why GAN can be used in SR.Challenge of Insufficient Paired Data- Explain why sufficient paired data is lacking in medical imaging.- Describe the impact of insufficient paired data on deep learning models.Methods for Overcoming Insufficient Paired Data in Medical Image- Data augmentation and paired data creation method through downsampling for SR model training.• Increasing sample diversity through methods such as rotation and flipping.• Creating training data pairs by downsampling HR (High Resolution) images to obtain LR (Low Resolution) images.- Precise registration and coarse-to-fine cascade training method for SR model training.• Improving the quality of training data by improving HR-LR image registration.• Coars-to-fine Cascade training method to gradually enhancing image details while reducing artifacts.Future Prospects and Discussion- Discuss artifacts generated by GAN in medical images.- Explore potential methods to minimize the generation of artifacts.

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# Abstract Archives of the RSNA, 2024

PHEE-20

## RE-EXPLAINING SOFT TISSUE CONTRAST ON MRI: TISSUE PROPERTY FILTERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Daniel Cornfeld, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The Bloch equations are useful for plotting tissue signal as a function of time for a given pulse sequence but are limited for comparing the signal between tissues. Consequently, many radiologists have limited knowledge of how contrast is generated and disease is detected by the standard pulse sequences used in clinical practice. Through interactive plots and didactic text the exhibit will introduce the concept of tissue property filters as a way understanding what makes tissues and disease bright or dark on images. We explain T1, T2, and PD weighting both quantitatively and qualitatively. The filters are then used to explain how sequence parameters are chosen to optimise contrast between normal tissues and also between normal tissues and disease. Finally, we explain how these concepts are used to design sequences highly sensitive to disease and to understand the limitations of these sequences.

### TABLE OF CONTENTS/OUTLINE

A. Introduction to tissue property filters B. Explanation of Fast Spin Echo T1, T2, and PD C. Grey matter vs White matter - Contrast in Brain imaging D. Ligaments, Tendons, Fat, and Muscle - Contrast in MSK Imaging E. Quantification of T1, T2, and PD weighting F. Inversion Recovery: Why T2-STIR and T2-FLAIR work G. Inversion Recovery T1: Why T1-FLAIR and MP-RAGE work H. Future applications: Imaging white matter and fascia

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# Abstract Archives of the RSNA, 2024

PHEE-21

## ULTRASOUND SPATIAL COMPOUNDING AND HARMONIC IMAGING: WHAT ARE THEY AND HOW DO THEY CHANGE THE IMAGE?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mark D. Sugi, MD (*Abstract Co-Author*) Consultant, Nextrast, Inc;Author with royalties, RELX
Cameron Adler, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel J. Fahrenholtz, PhD (*Abstract Co-Author*) Stockholder, Nano X Imaging
Cole P. Thompson, MD (*Abstract Co-Author*) Nothing to Disclose
Khushnood Hamdani (*Abstract Co-Author*) Nothing to Disclose
William F. Sensakovic, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Understand how harmonic and spatial compound imaging work 2. Learn how harmonic and spatial compound imaging impact image quality3. Determine where harmonic and spatial compound imaging can improve clinical imaging

### TABLE OF CONTENTS/OUTLINE

1. How does harmonic imaging work?1a. Physics and knobology for harmonic imaging1b. What are the advantages/disadvantages of harmonic imaging?2. How does spatial compound imaging work? 2a. Physics and knobology for harmonic imaging 2b. What are the advantages/disadvantages of compound imaging?3. Can we combine spatial compound imaging and harmonic imaging?3a. What are the advantages/disadvantages of combining? 4. Guidance on clinical usage of harmonic and compound imaging

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# Abstract Archives of the RSNA, 2024

PHEE-22

## THE USE OF DIAGNOSTIC CT AND MR IN TREATMENT PLANNING FOR TRANS-ARTERIAL RADIOEMBOLIZATION OF HEPATOCELLULAR CARCINOMA--WHAT MEDICAL PHYSICISTS SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Huimin Wu, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhihua Qi, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand the roles of diagnostic CT and MR in the dosimetry guided treatment planning process for trans-arterial radioembolization of hepatocellular carcinoma (HCC); 2. To recognize the constituent series or sequences of a diagnostic CT and MR liver study based on their purposes and appearance; 3. To properly select the series or sequence to fuse with the non-diagnostic CT (as part of MAA mapping SPECT-CT) in the subsequent treatment planning process

### TABLE OF CONTENTS/OUTLINE

1. Brief overview of trans-arterial radioembolization of HCC; 2. The value of diagnostic images in treatment planning for trans-arterial radioembolization of HCC; 3. Brief overview of liver's segmental anatomy; 4. Brief overview of liver's vascular anatomy including hepatic arteries, portal veins, and hepatic veins; 5. Typical diagnostic CT liver protocols (a). Different phases of CT scans (b). Key anatomy identified on CT images (c). Appearance and possible artifacts; 6. Typical diagnostic MR liver protocols (focusing on purpose, appearance and possible artifacts for each type of sequences) (a). T2 weighted sequence (b). T1 weighted sequence (c). DIXON sequence (d). Diffusion weighted imaging sequence (e). Other advanced sequences; 7. Rationale for choosing the best series for treatment planning (a). Clinical consideration (b). Image CNR consideration (c). Artifact consideration (d). Image registration consideration.

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# Abstract Archives of the RSNA, 2024

PHEE-23

## FACTORS AFFECTING CONTRAST ENHANCEMENT IN COMPUTED TOMOGRAPHY IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Giuseppe V. Toia, MD, MS (*Abstract Co-Author*) Research Consultant, General Electric Company;Research Grant, General Electric Company
Sean Rose, PhD (*Abstract Co-Author*) Research Grant, medInt Holdings, LLC;
Kelsey Schluter, BS (*Abstract Co-Author*) Nothing to Disclose
Timothy P. Szczykutowicz, PhD (*Abstract Co-Author*) Consultant, Aidoc Medical Ltd;Consultant, Flowhow.ai;Consultant, medInt Holdings, LLC;Consultant, Alara, Inc;Consultant, AstoCT, Inc;Research Grant, General Electric Company;Research Grant, Canon Medical Systems Corporation
Carrie Bartels, RT (*Abstract Co-Author*) Nothing to Disclose
Rachel Bladorn, BS, RT (*Abstract Co-Author*) Nothing to Disclose
Zahra Alyani Nezhad, BSc, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

(1) Improper contrast enhancement is a leading motivator for repeated CT examinations. (2) Many interacting factors influence contrast enhancement including physics-based, patient-related and contrast protocol-related. (3) Three physics (beam energy, beam hardening, scan duration), two patient (blood volume, cardiac output), and five contrast prescriptions (contrast volume, injection rate, iodine concentration, scan delay, saline flush) related factors will be quantitatively described giving the reader the ability to quantify the change in contrast enhancement when performing CT protocol optimization to achieve optimal contrast enhancement.

### TABLE OF CONTENTS/OUTLINE

This education exhibit will provide a survey of how iodinated contrast agent is required for specific CT indications. Then, ten different factors affecting CT enhancement will be described and placed into categories of: physics, patient, or contrast prescription. We will then present a categorization which places each factor into a scalar category (i.e., the factor scales CT number enhancement but doesn’t change the form of the enhancement curve in time) and a temporal category (i.e., the factor changes the temporal dynamics of the contrast enhancement curve). When possible, we will present a quantitative model explaining the impact of the factor on CT number enhancement. The interaction between factors will also be described. Lastly, we will present case examples demonstrating the factors described in this exhibit.

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# Abstract Archives of the RSNA, 2024

PHEE-24

## EXPLANATION OF NON-PHYSICAL VALUES ON SPECTRAL MATERIAL DENSITY MAPS IN CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Giuseppe V. Toia, MD, MS (*Abstract Co-Author*) Research Consultant, General Electric Company;Research Grant, General Electric Company
Timothy P. Szczykutowicz, PhD (*Abstract Co-Author*) Consultant, Aidoc Medical Ltd;Consultant, Flowhow.ai;Consultant, medInt Holdings, LLC;Consultant, Alara, Inc;Consultant, AstoCT, Inc;Research Grant, General Electric Company;Research Grant, Canon Medical Systems Corporation
Aria Salyapongse, BS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Readers of this exhibit will come away understanding: (1) why non-iodine containing tissues (e.g., bone) may have positive iodine (water) material density map values, (2) why a radiologist may see negative material density values, (3) how the choice of bases affects the predicted iodine density in an iodine (water) map for an iodine-containing tissue, and (4) the conditions for material basis choices yielding accurate iodine density values.

### TABLE OF CONTENTS/OUTLINE

We will begin with a review of basic physics of material decomposition based on Alvarez and Macovski's 1976 work describing how any tissue can be described as a photoelectric and Compton scattering basis. We will then describe how the photoelectric and Compton basis can be extended to material basis pairs to characterize tissue in terms of material basis (i.e., iodine and water). Then we will explain the well-known problem of calcium in iodine (water) images. Then, we will present an explanation of why a radiologist might observe a negative value on a material density map. Next, we will describe how basis pair choice affects the measured iodine in an iodine-containing voxel with different background materials. Finally, we will conclude with a description of the conditions necessary for accurate iodine density based on the choice of basis materials.

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# Abstract Archives of the RSNA, 2024

PHEE-25

## HOW CAN WE MEASURE BIOLOGICAL VISCOSITY NON-INVASIVELY USING MRI?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yuki Kanazawa, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiro Haga, PhD (*Abstract Co-Author*) Nothing to Disclose
Mitsuharu Miyoshi (*Abstract Co-Author*) Employee, General Electric Company
Hiroaki Hayashi, PhD (*Abstract Co-Author*) Research collaboration, Meditec Japan Co., Ltd;Research collaboration, JOB Corporation
Masafumi Harada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tosiaki Miyati, PhD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mayuka Seguchi (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. The viscosity measurement in vivo should be quantitively derived using DWI.2. The higher the viscosity according to material density, the lower the ADC.3. The viscosity depends on both concentration and temperature.4. Conversion of the ADC of biological tissue into viscosity using the DWI-viscosity function, utilizing the linear relationship between ADC and viscosity corresponding to the Stokes-Einstein equation.5. The DWI-viscosity measurement method we developed could be applied to patients with atherosclerotic plaque non-invasively, e.g., undergoing preoperative evaluation for carotid endarterectomy (CEA) or carotid artery stenting (CAS).

### TABLE OF CONTENTS/OUTLINE

• The Stokes-Einstein equation shows the linear relationship between the diffusion coefficient and viscosity. However, experimentally measuring the viscosity of living cells non-invasively is challenging.• Polymers with viscosity that mimic substances that make up living cells, for example, glycerin solutions.• The DWI viscosity function was determined from the two phantom experiments using glycerin solutions.• The slopes of the linear regression curves in the relationship between ADC and viscosity, that is, the DWI-viscosity function, decreased at elevated temperatures with a significant correlation (All, $R2 > 0.98$).• When comparing DWI viscosity with pathological findings for atherosclerotic plaques, a significant difference was observed between patients with and without symptoms ($P < 0.001$) and hemorrhage findings ($P < 0.05$).

# Abstract Archives of the RSNA, 2024

PHEE-26

## ARTIFICIAL INTELLIGENCE: WHAT EVERY RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Abhishek Mishra, DO (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Understand the intersection of artificial intelligence and radiology, exploring what exactly defines "artificial intelligence".2) Explore the foundational principles behind the integration of AI in radiology.3) Survey the diverse applications of AI in radiology, from image interpretation and diagnosis, to workflow optimization and more.4) Examine the AI techniques utilized in radiology, such as deep learning, convolutional neural networks, and natural language processing, elucidating their roles in medical images and reports.

### TABLE OF CONTENTS/OUTLINE

- Introduction to AI in Radiology:
- Define artificial intelligence and its relevance in the field of radiology.
- Discuss the technological advancements that have facilitated the integration of AI into radiology, such as improvements in computational power, availability of large datasets, and development of advanced algorithms.
- Overview of Different Application of AI in Radiology
- Image Interpretation: (1) Computer-Aided Detection (2) Automated Detection (3) Image Segmentation (4) Quantitative Analysis
- Decision Support: (1) Diagnostic Assistance (2) Treatment Planning (3) Risk Stratification
- Workflow Optimization: (1) Prioritization (2) Resource Allocation (3) Automation of Repetitive Tasks (4) Integration with clinical data
- Dictation: (1) Natural Language Processing (2) Contextual Assistance (3) Quality Assurance (4) Automated Reporting
- Review of Key AI Techniques (and examples in current practice)
- Machine learning
- Convolutional neural networks
- Deep Learning
- Natural Language Processing
- Computer Vision
- Knowledge Representation and Reasoning

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# Abstract Archives of the RSNA, 2024

PHEE-27

## INSIGHTS INTO MSK DECT: ILLUMINATING THE SHADOWS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Elena Canales Lachen (*Abstract Co-Author*) Nothing to Disclose
Jose Acosta Batlle, MD (*Abstract Co-Author*) Nothing to Disclose
Carlos Suevos, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Martinez De Vega, MD (*Abstract Co-Author*) Nothing to Disclose
Noelia Arevalo (*Abstract Co-Author*) Nothing to Disclose
Noelia Bravo Alcobendas, MD (*Abstract Co-Author*) Nothing to Disclose
Ana M. Vera-Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel Angel Gomez Bermejo, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Fernandez-Rodriguez, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Develop the potential Spectral CT imaging has in both traumatic and non-traumatic musculoskeletal diseases through a case-based approach.- Explore different Spectral CT maps applied to a varied spectrum of musculoskeletal disorders with a special focus on Virtual Non-Calcium reconstructions correlated with conventional X-rays and MRI scans.- Propose a practical step-by-step post-processing method to display Spectral CT data and optimize color-coded reconstruction maps.- Standardize a basic lexicon to describe findings and avoid pitfalls when reading musculoskeletal Spectral CT scans.

### TABLE OF CONTENTS/OUTLINE

1. Introduction. 1.1 DECT Imaging Principles. 1.2 DECT Reconstructions Workflow.2. MSK Spectral CT Case-based Approach Learning. 2.1 Traumatic Pathology: 2.1.1. Vertebral fractures. 2.1.2. Scaphoid fractures. 2.1.3. Trochanteric BME. 2.2 Non-traumatic Pathology: 2.2.1. Arthropathies: Gout, CPPD, HAAD. 2.2.2. Bone infection: osteomyelitis. 2.2.3. Bone Metastasis. 2.2.4. Vanishing bone metastasis. 2.2.5. Foreign modeling agent reactions (FMAR).3. Conclusion

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# Abstract Archives of the RSNA, 2024

PHEE-28

## PHOTON COUNTING CT - WHAT DO WE KNOW AND WHAT CAN WE EXPECT?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Srujana Ganti, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Bimal Mayur Kumar Vora (*Abstract Co-Author*) Nothing to Disclose
Parag R. Salkade, FRCR,MMed (*Abstract Co-Author*) Nothing to Disclose
Steven B. Wong, MD, MBChB (*Abstract Co-Author*) Nothing to Disclose
Stefanie Lee, MBBS (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1.Explain the technology underpinning Photon Counting CT and discuss the differences between Photon Counting CT and current available CT technology. 2. Discuss the advantages and clinical applications of Photon Counting CT 3.Discuss the potential challenges and considerations that Radiology departments need to take into account before obtaining a Photon Counting CT scanner.

### TABLE OF CONTENTS/OUTLINE

Photon counting CT is one of the latest developments in CT scanner technology and holds significant promise, in areas of superior image quality and radiation dose reduction. This poster will aim to give an overview of this novel technology and what can be expected, in terms of clinical applications, benefits and potential challenges. The timeline of CT scanner technology development, culminating in the creation of the latest, photon counting CT scanner will be discussed.The poster will also elucidate the fundamental differences between photon counting CT and existing CT technology, such as dual energy CT. Clinical applications and advantages over conventional CT scanning technology will be presented. The poster also aims to discuss some of the potential problems and challenges that Radiology departments may face if they were to obtain this scanner, such as cost and infrastructure considerations.

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# Abstract Archives of the RSNA, 2024

PHEE-29

## REGULATORY SCIENCE CHALLENGES AND GAPS AT THE FDA FOR RADIOLOGY AI DEVICES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Frank W. Samuelson, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicholas Petrick, PhD (*Abstract Co-Author*) Nothing to Disclose
Aldo Badano, PhD (*Abstract Co-Author*) Research Grant, Barco nv
Kenny H. Cha, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexej Gossmann (*Abstract Co-Author*) Nothing to Disclose
Ravi K. Samala, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Regulatory science is the science of developing tools, methods, and data, including computational approaches, to stimulate innovation and facilitate the scientific regulatory evaluation of medical products. Increased attention and investment in radiology artificial intelligence (AI) enabled software as medical devices (AI-SaMDs) over the last decade has recently led to an exponential increase in AI-enabled devices authorized by the FDA. However, there are inconsistencies between performance results reported in the academic literature and the number and type of devices authorized for clinical use in the US. In this exhibit, we discuss issues related to regulatory science, in (a) data, (b) AI development and (c) AI performance assessment. We provide a comprehensive view of these regulatory science challenges and gaps and describe related Regulatory Science Tools (RSTs) made publicly available to reduce risk of AI development and facilitate consistent and rigorous evaluation.

### TABLE OF CONTENTS/OUTLINE

Challenges in radiology AI regulatory science are key factors limiting the advancement, development, and deployment of AI-SaMDs. The outline of this presentation is as follows: (1) Addressing patient data access, augmentation approaches using synthetic data, generative AI, and other in silico approaches. (2) Assessing the limitations in AI development including bias, subgroup analysis, continual learning, and post-market monitoring. (3) Developing evaluation methods for novel devices including metric selection, LLM-based devices, and triage, notification and rule-out devices. (4) Deliver resources to support device innovation and patient access to new technologies by use of FDA's RSTs.

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# Abstract Archives of the RSNA, 2024

PHEE-3

## VISUALIZATION AND PROTECTION OF RADIATION FOR EYE LENS EXPOSED BY SINGLE WEARABLE DOSIMETER

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Masaki Fujisawa (*Abstract Co-Author*) Nothing to Disclose
Ryota Shindo (*Abstract Co-Author*) Nothing to Disclose
Koichi Chida, PhD (*Abstract Co-Author*) Nothing to Disclose
Yohei Inaba, PhD, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

-To understand the importance of visualizing and monitoring the radiation dose for eye lenses by wearable radio-photoluminescence (RPL) glass dosimeter. -To understand the need for managing the occupational dose to reduce radiation exposure for eye lenses in radiology exams. -To understand the importance of protecting medical staffs or caregivers attending to patients from radiation.

### TABLE OF CONTENTS/OUTLINE

TABLE OF CONTENTS In this study, we utilized radio-photoluminescence (RPL) silver-activated phosphate glasses as the lens body of over-glass eyewear. The wearable RPL dosimeter developed successfully exhibited RPL emission in proportion to the X-ray irradiation dose. Moreover, we demonstrated the feasibility of the developed dosimeter for visualization and protection at the same time. OUTLINE Growing interest is being paid for local radiation exposure on the human eye triggered by the recommendation given by International Commission on Radiological Protection (ICRP). The risk of cataracts should be more strictly controlled and managed under the new regulation, effective in Japan in April 2021. Optical observation of the phosphate-glass lens for the wearable device successfully exhibited RPL emission after X-ray irradiation in different schemes, including clinical conditions. To evaluate the radiation shielding functions of the developed wearable RPL dosimeter, commercially available RPL dosimeters were placed in front and backward of the RPL lens during the irradiation. Results suggested that the developed wearable device has the potential to accomplish convenient dosimetry for local radiation exposure for human eyes as well as radiation protection functions in a single wearable device.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

PHEE-4

## HOW IMAGE GENERATION AI AND MULTIMODAL AI WORK AND THEIR APPLICATIONS IN CAD

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hirotsugu Takabatake, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Masaki Mori, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Natori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kensaku Mori, PhD (*Abstract Co-Author*) Research Grant, Cybernet Systems Co, Ltd;Intellectual Property, Cybernet Systems Co, Ltd;Research Grant, J Morita Corporation;Intellectual Property, J Morita Corporation;Developer, J Morita Corporation
Masahiro Oda, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of our exhibit are:1. To confirm what are the differences between previous and recent image generation AIs (VAE, GAN vs Diffusion Model (DM))2. To learn applications of DM-based image generation AI in CAD3. To learn what is multimodal AI4. To learn applications of multimodal AI in CAD

### TABLE OF CONTENTS/OUTLINE

Image generation AI- What is image generation AI- Introductions of image generation models: VAE, GAN, Diffusion Model (DM)- Advantages and drawbacks of models- How DM generates imagesApplications of DM-based image generation AIs in CAD- Image generation: Generate variations of tumor images to improve the performance of CAD systems- Segmentation: Segmentation of organ and tumor regions from various medical images- Image translation: Convert image modalities from CT to MR, MR to CT, between MR images of different weighting conditionsMultimodal AI- What is Multimodal AI- Multimodal AIs and their mechanisms: DALL-E 2, Stable Diffusion- How do large multimodal datasets contribute to building multimodal AIApplication of Multimodal AI in CAD- Image explanation generation: Generate texts explaining findings in medical images- Anonymization: Automatically anonymize medical image and text

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# Abstract Archives of the RSNA, 2024

PHEE-5

## DREAMS AND REALITY IN PHOTON COUNTING CT: CURRENT CAPABILITY OF THE PHOTON COUNTING CT AND FUTURE PROSPECTS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Shota Kondo (*Abstract Co-Author*) Nothing to Disclose
Wataru Fukumoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toru Higaki, PhD (*Abstract Co-Author*) Nothing to Disclose
Fuminari Tatsugami, MD (*Abstract Co-Author*) Nothing to Disclose
Yuko Nakamura, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Photon counting detector CT (PCD CT) is becoming popular worldwide, and CT vendors other than Siemens Healthineers, which was the first to launch a commercial scanner, are also developing PCDCT. PCDCT is superior to conventional CT in spatial- and low-contrast resolution and is expected to reduce radiation dose. However, there is a limit to the improvement of spatial- and low contrast resolution, and radiation dose cannot be reduced without limitation. Spectral imaging also has various limitations at present. This educational exhibit will outline the current technical capabilities of PCD CT and discuss how we might utilize PCD CT in clinical practice.

### TABLE OF CONTENTS/OUTLINE

1. Current technical issues of PCD CT 1) Charge sharing, 2) K-escape, 3) Compton scatter, 4) Pulse pile-up2. To what extent can PCD CT improve spatial resolution? - limitation factors for spatial resolution3. To what extent can low contrast resolution be improved by PCD CT?4. Current radiation dose reduction in PCD CT5. When will the K-edge imaging be realized?6. Do the detector materials affect the diagnostic capability of PCD CT?7. Which areas of clinical practice will be advanced by introduction of the PCD CT?

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# Abstract Archives of the RSNA, 2024

PHEE-6

## HOW DO WE DETERMINE THE WATER VOLUME IN THE CENTRAL NERVOUS SYSTEM?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Masafumi Harada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuki Kanazawa, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiro Haga, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryuji Oshiro (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. T2 signal decay multi-component model: the amplitude of each structural water needs to be determined using a curve fitting.2. The electronic microscope image of myelinated axons can be divided into three water pools: myelin sheath (My), axon (Ax), and intra/extracellular fluid (IE).3. T2 values of each component: My < Ax < IE.4. T2 distribution with different peaks for myelin water and other water components.5. Myelin water fraction (MWF) values have some variations in response to B0 inhomogeneity and multi-echo dataset.

### TABLE OF CONTENTS/OUTLINE

• MWF is calculated using some MR signal models for the central nervous system (CNS), which consists of three structural water pools (myelin sheath, axon, and IE).• Convert process of multi-component water phantom derived from electron microscopic analysis: Machine learning is instrumental.• The data acquisition using MR simulator: Setting pulse sequence and imaging parameters.• The fitting algorithm for the T2 signal decay multi-component model: Each amplitude is derived from the fraction of the divided regions.• Applying numerical MWF phantom for multicomponent CNS relaxometry: Comparison of MWF derived from different imaging parameters and B0 inhomogeneity datasets.

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# Abstract Archives of the RSNA, 2024

PHEE-7

## THE RADIOLOGY RESIDENT'S GUIDE TO BRAIN MRI: CORE PRINCIPLES OF PHYSICS AND SEQUENCES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Carla Vert Soler, MD (*Abstract Co-Author*) Nothing to Disclose
Sara L. Castaner, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Carlos Ordonez (*Abstract Co-Author*) Nothing to Disclose
MARIDELMA VILLANUEVA (*Abstract Co-Author*) Nothing to Disclose
Malgorzata Stachno (*Abstract Co-Author*) Nothing to Disclose
Electra Hernandez (*Abstract Co-Author*) Nothing to Disclose
Anna Oliva (*Abstract Co-Author*) Nothing to Disclose
Paloma Puyalto, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Nuria Faure, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanni Mattiello, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Interpreting magnetic resonance imaging requires a basic knowledge of its physical principles, familiarity with the sequences, and understanding their individual significance in the main protocols used in brain studies.This educational review aims to provide a clear, concise, and understandable insight into the physical principles of MRI and the sequences used in the evaluation of the central nervous system (CNS) and their applications in assessing the major brain disorders.Multiple sequences, distinguished by the use of different pulses and gradients, yield information on the nature and behavior of various CNS structures and lesions, enabling a wide range of specific studies (brain tumors, epilepsy, demyelinating diseases, strokes, and cognitive disorders).A solid yet simplified understanding of MRI's physical principles and employed sequences can assist residents in their rotation and enhance their interpretation skills to approach the major CNS conditions.

### TABLE OF CONTENTS/OUTLINE

Basic principles of MRI physics and sequences: the proton and the magnetic field;what happens in the MRI scanner;what is T1 and T2 relaxation;what is an MRI sequence.Main MRI sequences and their applications in CNS imaging: T1WI, T2WI, DWI, magnetic susceptibility sequences, angiographic and flow imaging, perfusion imaging, spectroscopy, functional MRI and MRI tractography.

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# Abstract Archives of the RSNA, 2024

PHEE-8

## LOW-DOSE IMAGING USING ULTRA-HIGH RESOLUTION MODE AND ADDED BEAM FILTRATION IN PHOTON- COUNTING-DETECTOR CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Felix E. Diehn, MD (*Abstract Co-Author*) Nothing to Disclose
Julie B. Guerin, MD (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joseph R. Swicklik, RT, BS (*Abstract Co-Author*) Nothing to Disclose
Zhongxing Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Kelly K. Horst, MD (*Abstract Co-Author*) Nothing to Disclose
Michael R. Bruesewitz, RT (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Teaching points: 1. PCD-CT improves radiation dose efficiency over EID-CT because of improved photon-energy weighting, increased geometrical efficiency, reduced electronic noise, and small detector effect. 2. Ultra-high-resolution (UHR) acquisition mode on PCD-CT provides a better spatial resolution-noise tradeoff. 3. Added beam filtration such as tin (Sn) filter can further improve radiation dose efficiency in PCD-CT, like in EID-CT 4. Combining UHR and added Sn filter on PCD-CT can achieve ultra-low-dose imaging capability (as low as that in a chest x-ray exam) for some unenhanced CT exams.

### TABLE OF CONTENTS/OUTLINE

Table of Contents/Outline: 1. Explain the four fundamental physical factors why PCD-CT has a better radiation dose efficiency over EID-CT a. Equal or optimal photon energy weighting b. elimination of septae between detector pixels c. reduced electronic noise d. small detector effect 2. In a phantom experiment, compare image quality and radiation dose efficiency between PCD-CT and EID-CT for multiple settings: a. Standard resolution (SR) vs. UHR mode b. 120 kV vs. 100 kV with Sn filter (100Sn) c. Multiple radiation dose levels d. Multiple reconstruction kernels 3. Demonstrate the feasibility of ultra-low-dose imaging in some un-enhanced patient exams on PCD-CT using both UHR mode and added Sn filter. Radiation dose in some of these exams can approach that in a chest x-ray, i.e., 0.1 mSv. a. Sinus b. Pediatric cystic fibrosis c. Lung cancer screening

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# Abstract Archives of the RSNA, 2024

PHEE-9

## ADVANCED BODY MRI SEQUENCES AND TECHNIQUES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lauren F. Alexander, MD (*Abstract Co-Author*) Spouse, Stockholder, Abbott Laboratories;Spouse, Stockholder, AbbVie Inc;Spouse, Stockholder, General Electric Company;Spouse, Stockholder, Myriad Genetics, Inc
Candice W. Bolan, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Agely, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Bowman, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shengzhen Tao (*Abstract Co-Author*) Nothing to Disclose
Jordan LeGout, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review various forms of accelerated image acquisition. Discuss different methods for improving image quality. Address abdominopelvic applications of deep learning. Learn with real clinical applications and case examples

### TABLE OF CONTENTS/OUTLINE

1. Introduction a. Discuss vendors and proprietary sequence naming b. Stress importance of innovation and constant improvement for high quality body MRI 2. Sequences and techniques with physics explanations and example applications A. Keyhole Imaging i. HCC screening ii. To counter transient tachypnea with Eovist B. Compressed Sensing i. Breath-hold MRCP ii. Urography C. Radial acquisition a. Motion resistant T2b. High-resolution post contrast imaging D. Radial + Compressed Sensing i. Free breathing post contrast imaging ii. Dynamic contrast enhancement (prostate) E. Motion corrected subtraction F. Simultaneous Multi-Slice i. Acceleration ii. Increased NEX for same time G. Zoomed Diffusion i. Advantages over standard diffusion ii. Prostate, kidney, pancreas H. Readout Segmented Diffusion i. Reduction of susceptibility artifact ii. Rectal, prostate I. Deep Learning i. Advantages, disadvantages ii. Large FOV spin echo iii. Small FOV spin echo iv. Single shot spin echo 3. Miscellaneous Quality Improvement i. Microenema ii. FOV control iii. Secretin for duodenal masses iv. Saturation bands v. Dark oral contrast 4. Conclusion and References

# Abstract Archives of the RSNA, 2024

ROEE

## Radiation Oncology Education Exhibits

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

### ROEE-1 NAVIGATING THE MAZE: EVALUATING IMAGING FEATURES POST CHEMORADIATION IN GLIOBLASTOMA MULTIFORME

Thomaz R. Mostardeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Mike Dohopolski, MD (*Abstract Co-Author*) Nothing to Disclose
Fabricio S. Feltrin, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza G. Schmitt, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Glioblastoma multiforme (GBM) is the most common primary brain malignancy in adults. Treatment involves maximal surgical resection followed by adjuvant chemoradiation. Stereotactic Ablative Radiotherapy (SABR) is a new, evolving paradigm, in the adjuvant management of newly diagnosed GBM. Post-treatment imaging features include: tumoral pseudo-progression, progression outside the radiation field, progression inside the radiation field, complete resolution, partial response, and treatment-induced changesTumoral pseudo-progression in GBM poses challenges on follow-up imaging, often mimicking solid tumor enhancement. It's more common with SABR.Perfusion and diffusion-weighted imaging are crucial in distinguishing pseudo-progression from recurrence. GBM recurrence typically exhibits high perfusion (highly vascular nature) and restricted diffusion (ADC values lower than 1300 x 10-6 mm2/s), while pseudo-progression shows lower perfusion and higher ADC values. Tumoral morphological features (e.g., increased infiltration) tend to represent tumor growth, while a well-defined margin is more common in pseudo-progression. Early recognition and differentiation of imaging features are essential for timely intervention in patients with incomplete response/recurrence.

**TABLE OF CONTENTS/OUTLINE**

1- Introduction 2- Radiation Therapy in Glioblastoma Multiforme 3- Monitoring treatment response after chemoradiation 4- Neuroimaging findings after chemoradiation: 4.1) Tumoral pseudo-progression; 4.2) Progression outside the radiation field; 4.3) Progression inside the radiation field; 4.4) Complete resolution; 4.5) Partial response; 4.6) Treatment-induced changes. 5- Summary

### ROEE-2 PRE-TREATMENT AND POST-TREATMENT IMAGING OF LARYNX CARCINOMA: RADIOLOGIC AND LARYNGOSCOPIC CORRELATION

Philip R. Chapman, MD (*Abstract Co-Author*) Nothing to Disclose
Edina C. Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Zack Nigogosyan, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Describe the work-up and staging for larynx carcinoma 2. Explore laryngoscopic and radiographic imaging (ex. CT, PET) correlation in larynx carcinoma 3. Discuss how laryngoscopic and radiographic findings affect the work-up and management of larynx carcinoma 4. Understand imaging considerations for treatment planning and delivery of radiation therapy for larynx carcinoma 5. At the completion of this course, the participant will be able to: •Understand the role of laryngoscopy and radiologic imaging in the work-up and staging for localized larynx carcinoma •Determine situations in which findings on laryngoscopy and imaging may provide complementary information in affecting target delineation and subsequent radiation treatment •Understand imaging features post-treatment since it can be difficult to differentiate post-treatment changes from residual tumor or recurrent tumor •Understand common surveillance imaging techniques used to monitor treatment side effects

**TABLE OF CONTENTS/OUTLINE**

1. Introduction 2. Work-up for larynx carcinoma 3. Clinical examination, laryngoscopic and radiographic findings correlation in relation to management 4. Radiation treatment planning considerations in larynx carcinoma 5. Imaging with laryngoscopic correlation of larynx cancer after treatment 6. Methods of monitoring treatment response with clinical examination, CT neck and PET/CT 7. Common surveillance imaging techniques (ex. carotid ultrasound, CT chest) used to monitor treatment side effects 8. Summary

### ROEE-3 MUSCULOSKELETAL COMPLICATIONS OF RADIATION THERAPY AND IMMUNOTHERAPY

**Awards**
**Certificate of Merit**

Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Soltanolkotabi, MD (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie K. Schaub, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Haseli, MD (*Abstract Co-Author*) Nothing to Disclose

Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Gita Y. Karande, MMEd, FRCR (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Identify the role of imaging in evaluation of post-therapeutic complications affecting musculoskeletal (MSK) system in the cases of radiation therapy and immunotherapy· Describe the MSK complications in response to immunotherapy· Discuss post-radiation imaging findings

**TABLE OF CONTENTS/OUTLINE**

Musculoskeletal complications can occur as a result of exposure to bone and soft tissues surrounding the radiation area. It can manifest acutely during radiotherapy or afterward. These include alteration in bone density, pathologic fractures, osteonecrosis, or late post-radiation induced neoplasms. Immunotherapy is another revolutionary approach to cancer treatment with novel mechanism of action with T-cell and immune activation against cancer cells. Immune-mediated adverse effects affecting the muscles, bones, joints, and connective tissue lead to different patterns of findings on imaging. We aim to assess the post-immunotherapy and post-radiation imaging findings that affect the musculoskeletal system:§ Post- immunotherapy:· Arthritis/polyarthritis· Tenosynovitis· Myositis/necrotizing myositis· Fasciitis· Enthesopathy· Rhabdomyolysis· Chondrocalcinosis· Fracture (osteoporotic)· Osteitis§ Post-radiation changes:ü Bone and joints:· Osteonecrosis· Pathologic fracture· Radiation-induced neoplasms: osteochondroma, sarcoma· Osteopenia· Increased bone density· Sacroiliac joint abnormalities (widening, irregularity)· Radiation-induced osteochondroma· Bone marrow reconversion· Bone marrow osteitis· Growth impairment and physeal injuryü Soft tissue:· Soft tissue fibrosis· Myositis· Recall myositis· Lymphedema· Dystrophic soft tissue calcification· Secondary sarcoma

## ROEE-4 IMAGING FOR PANCREAS RADIATION PLANNING

Yulia Romalis, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

To elucidate which radiographic features are important in radiation therapy treatment planning and how these finding influence management.

**TABLE OF CONTENTS/OUTLINE**

Understand the CT Protocol for Pancreas Cancer?Define the resectability criteria for pancreas cancer?Identify resectable, borderline, and unresectable pancreas lesions on CT and MR imaging?Understand the generic process of pancreas cancer radiation volumes, dosing, and importance of accurate GTV delineation for dose escalation particularly in unresectable cases

## ROEE-5 RADIATION-INDUCED IMAGING CHANGES OF THORACOLUMBAR SPINE: WHAT RADIOLOGISTS NEED TO KNOW?

Mengya Sun (*Abstract Co-Author*) Nothing to Disclose
Guanglei Tang, MBBS (*Abstract Co-Author*) Nothing to Disclose
Yang Peng (*Abstract Co-Author*) Nothing to Disclose
Chang Li (*Abstract Co-Author*) Nothing to Disclose
Jian Guan, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review the pathological changes and imaging appearance of thoracolumbar spine after radiotherapy; 2. To know special imaging appearance of thoracolumbar spine after radiotherapy; 3. To realize the relationship between involved extent of spine after radiotherapy and radiation disease; 4. To learn diagnosis and differential diagnosis for radiotherapy related complications by imaging appearance of thoracolumbar spine

**TABLE OF CONTENTS/OUTLINE**

1. Pathological changes and routine imaging appearance: (1) Pathological changes of thoracolumbar spine after radiotherapy; (2) CT and MRI appearance of thoracolumbar spine after radiotherapy during different periods 2. Special imaging appearance: (1) Imaging appearance of thoracolumbar spine after radiotherapy for different tumors (thoracic tumor, abdominal tumor and pelvic tumor); (2) Imaging appearance of thoracolumbar spine after special radiotherapy (radioactive stent, radio- active particles, et al); 3. Relationship between involved extent of spine after radiotherapy and radiation disease: (1) Assistance for diagnosis of recent radiation diseases; (2) Assistance for diagnosis of long-term complications; (3) Assistance for differential diagnosis of radiation diseases; (4) Assistance for therapeutic evaluation (such as ovarian suspension, tumor metastasis or recurrence, et al)

## ROEE-6 QA ASPECTS OF MRI FOR STEREOTACTIC RADIOSURGERY

Joshua P. Yung, PhD (*Abstract Co-Author*) Nothing to Disclose
R. Jason Stafford, PhD (*Abstract Co-Author*) Nothing to Disclose
Tina Briere, PHD (*Abstract Co-Author*) Nothing to Disclose
Chris M. Walker, PhD (*Presenter*) Researcher, Siemens AG

**TEACHING POINTS**

1. Understand the physical principles behind geometric distortions in MRI and how to reduce them. 2. Appreciate the rigorous quality assurance needed to reliable generate images with geometric fidelity sufficient for radiosurgery. 3. Know how to evaluate an imaging study to ensure it is of sufficient accuracy to be utilized for treatment planning.

**TABLE OF CONTENTS/OUTLINE**

1. An overview of stereotactic radiosurgery in focused on the brain. 2. A description of the physical processes that lead to geometric distortion in MRI images. 3. System quality control measures to ensure geometric accuracy. 4. Protocol design characteristics to ensure geometric accuracy. 5. Case studies and experience sharing from our institutions brain radiosurgery practice.

## ROEE-7 RADIATION PNEUMONITIS IN LOCALLY ADVANCED NON-SMALL CELL LUNG CANCER PATIENTS WITH ARTIFICIAL-INTELLIGENCE SCREENED INTERSTITIAL LUNG DISEASE

Chris McIntosh (*Abstract Co-Author*) Nothing to Disclose
Andrea Bezjak, MD (*Abstract Co-Author*) Nothing to Disclose
Sonja Kandel, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Hope (*Abstract Co-Author*) Nothing to Disclose
Hannah Bacon (*Abstract Co-Author*) Nothing to Disclose
Patrik Rogalla, MD, MBA (*Presenter*) Institutional Research Grant, Canon Medical Systems Corporation;Institutional Research Grant, KA Imaging

## TEACHING POINTS

• Interstitial lung disease (ILD) complicates cancer treatment • ILD increases lung cancer risk • AI can identify patients with ILD from planning CTs (in-house development) • Patients with AI-screened ILD have stronger correlations between dosimetric parameters and the development of Grade =2 and Grade =3 radiation pneumonitis • Screening for ILD helps consider the application of different dose constraints in lung cancer patients to mitigate the increased risk of severe toxicity

## TABLE OF CONTENTS/OUTLINE

1. Background and clinical importance 2. Study population (n=498), demographics 3. Results AI screening for ILD and cancer treatment 4. Incidence of radiation pneumonitis 5. Lessons learned

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

ROEE-1

## NAVIGATING THE MAZE: EVALUATING IMAGING FEATURES POST CHEMORADIATION IN GLIOBLASTOMA MULTIFORME

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thomaz R. Mostardeiro, MD (*Abstract Co-Author*) Nothing to Disclose
Mike Dohopolski, MD (*Abstract Co-Author*) Nothing to Disclose
Fabricio S. Feltrin, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza G. Schmitt, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Glioblastoma multiforme (GBM) is the most common primary brain malignancy in adults. Treatment involves maximal surgical resection followed by adjuvant chemoradiation. Stereotactic Ablative Radiotherapy (SABR) is a new, evolving paradigm, in the adjuvant management of newly diagnosed GBM. Post-treatment imaging features include: tumoral pseudo-progression, progression outside the radiation field, progression inside the radiation field, complete resolution, partial response, and treatment-induced changesTumoral pseudo-progression in GBM poses challenges on follow-up imaging, often mimicking solid tumor enhancement. It's more common with SABR.Perfusion and diffusion-weighted imaging are crucial in distinguishing pseudo-progression from recurrence. GBM recurrence typically exhibits high perfusion (highly vascular nature) and restricted diffusion (ADC values lower than 1300 x 10-6 mm2/s), while pseudo-progression shows lower perfusion and higher ADC values. Tumoral morphological features (e.g., increased infiltration) tend to represent tumor growth, while a well-defined margin is more common in pseudo-progression. Early recognition and differentiation of imaging features are essential for timely intervention in patients with incomplete response/recurrence.

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# Abstract Archives of the RSNA, 2024

ROEE-2

## PRE-TREATMENT AND POST-TREATMENT IMAGING OF LARYNX CARCINOMA: RADIOLOGIC AND LARYNGOSCOPIC CORRELATION

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Philip R. Chapman, MD (*Abstract Co-Author*) Nothing to Disclose
Edina C. Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Zack Nigogosyan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Describe the work-up and staging for larynx carcinoma 2. Explore laryngoscopic and radiographic imaging (ex. CT, PET) correlation in larynx carcinoma 3. Discuss how laryngoscopic and radiographic findings affect the work-up and management of larynx carcinoma 4. Understand imaging considerations for treatment planning and delivery of radiation therapy for larynx carcinoma 5. At the completion of this course, the participant will be able to: •Understand the role of laryngoscopy and radiologic imaging in the work-up and staging for localized larynx carcinoma •Determine situations in which findings on laryngoscopy and imaging may provide complementary information in affecting target delineation and subsequent radiation treatment •Understand imaging features post-treatment since it can be difficult to differentiate post-treatment changes from residual tumor or recurrent tumor •Understand common surveillance imaging techniques used to monitor treatment side effects

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# Abstract Archives of the RSNA, 2024

ROEE-3

## MUSCULOSKELETAL COMPLICATIONS OF RADIATION THERAPY AND IMMUNOTHERAPY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Bahar Mansoori, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Soltanolkotabi, MD (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie K. Schaub, MD (*Abstract Co-Author*) Nothing to Disclose
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Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Gita Y. Karande, MMEd, FRCR (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Identify the role of imaging in evaluation of post-therapeutic complications affecting musculoskeletal (MSK) system in the cases of radiation therapy and immunotherapy· Describe the MSK complications in response to immunotherapy· Discuss post-radiation imaging findings

### TABLE OF CONTENTS/OUTLINE

Musculoskeletal complications can occur as a result of exposure to bone and soft tissues surrounding the radiation area. It can manifest acutely during radiotherapy or afterward. These include alteration in bone density, pathologic fractures, osteonecrosis, or late post-radiation induced neoplasms. Immunotherapy is another revolutionary approach to cancer treatment with novel mechanism of action with T-cell and immune activation against cancer cells. Immune-mediated adverse effects affecting the muscles, bones, joints, and connective tissue lead to different patterns of findings on imaging. We aim to assess the post-immunotherapy and post-radiation imaging findings that affect the musculoskeletal system:§ Post- immunotherapy:· Arthritis/polyarthritis· Tenosynovitis· Myositis/necrotizing myositis· Fasciitis· Enthesopathy· Rhabdomyolysis· Chondrocalcinosis· Fracture (osteoporotic)· Osteitis§ Post-radiation changes:ü Bone and joints:· Osteonecrosis· Pathologic fracture· Radiation-induced neoplasms: osteochondroma, sarcoma· Osteopenia· Increased bone density· Sacroiliac joint abnormalities (widening, irregularity)· Radiation-induced osteochondroma· Bone marrow reconversion· Bone marrow osteitis· Growth impairment and physeal injuryü Soft tissue:· Soft tissue fibrosis· Myositis· Recall myositis· Lymphedema· Dystrophic soft tissue calcification· Secondary sarcoma

# Abstract Archives of the RSNA, 2024

ROEE-4

## IMAGING FOR PANCREAS RADIATION PLANNING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yulia Romalis, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

To elucidate which radiographic features are important in radiation therapy treatment planning and how these finding influence management.

### TABLE OF CONTENTS/OUTLINE

Understand the CT Protocol for Pancreas Cancer?Define the resectability criteria for pancreas cancer?Identify resectable, borderline, and unresectable pancreas lesions on CT and MR imaging?Understand the generic process of pancreas cancer radiation volumes, dosing, and importance of accurate GTV delineation for dose escalation particularly in unresectable cases

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# Abstract Archives of the RSNA, 2024

ROEE-5

## RADIATION-INDUCED IMAGING CHANGES OF THORACOLUMBAR SPINE: WHAT RADIOLOGISTS NEED TO KNOW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Mengya Sun (*Abstract Co-Author*) Nothing to Disclose
Guanglei Tang, MBBS (*Abstract Co-Author*) Nothing to Disclose
Yang Peng (*Abstract Co-Author*) Nothing to Disclose
Chang Li (*Abstract Co-Author*) Nothing to Disclose
Jian Guan, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the pathological changes and imaging appearance of thoracolumbar spine after radiotherapy; 2. To know special imaging appearance of thoracolumbar spine after radiotherapy; 3. To realize the relationship between involved extent of spine after radiotherapy and radiation disease; 4. To learn diagnosis and differential diagnosis for radiotherapy related complications by imaging appearance of thoracolumbar spine

### TABLE OF CONTENTS/OUTLINE

1. Pathological changes and routine imaging appearance: (1) Pathological changes of thoracolumbar spine after radiotherapy; (2) CT and MRI appearance of thoracolumbar spine after radiotherapy during different periods 2. Special imaging appearance: (1) Imaging appearance of thoracolumbar spine after radiotherapy for different tumors (thoracic tumor, abdominal tumor and pelvic tumor); (2) Imaging appearance of thoracolumbar spine after special radiotherapy (radioactive stent, radio- active particles, et al); 3. Relationship between involved extent of spine after radiotherapy and radiation disease: (1) Assistance for diagnosis of recent radiation diseases; (2) Assistance for diagnosis of long-term complications; (3) Assistance for differential diagnosis of radiation diseases; (4) Assistance for therapeutic evaluation (such as ovarian suspension, tumor metastasis or recurrence, et al)

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

ROEE-6

## QA ASPECTS OF MRI FOR STEREOTACTIC RADIOSURGERY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Joshua P. Yung, PhD (*Abstract Co-Author*) Nothing to Disclose
R. Jason Stafford, PhD (*Abstract Co-Author*) Nothing to Disclose
Tina Briere, PHD (*Abstract Co-Author*) Nothing to Disclose
Chris M. Walker, PhD (*Presenter*) Researcher, Siemens AG

### TEACHING POINTS

1. Understand the physical principles behind geometric distortions in MRI and how to reduce them. 2. Appreciate the rigorous quality assurance needed to reliable generate images with geometric fidelity sufficient for radiosurgery. 3. Know how to evaluate an imaging study to ensure it is of sufficient accuracy to be utilized for treatment planning.

### TABLE OF CONTENTS/OUTLINE

1. An overview of stereotactic radiosurgery in focused on the brain. 2. A description of the physical processes that lead to geometric distortion in MRI images. 3. System quality control measures to ensure geometric accuracy. 4. Protocol design characteristics to ensure geometric accuracy. 5. Case studies and experience sharing from our institutions brain radiosurgery practice.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

ROEE-7

## RADIATION PNEUMONITIS IN LOCALLY ADVANCED NON-SMALL CELL LUNG CANCER PATIENTS WITH ARTIFICIAL-INTELLIGENCE SCREENED INTERSTITIAL LUNG DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Chris McIntosh (*Abstract Co-Author*) Nothing to Disclose
Andrea Bezjak, MD (*Abstract Co-Author*) Nothing to Disclose
Sonja Kandel, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Hope (*Abstract Co-Author*) Nothing to Disclose
Hannah Bacon (*Abstract Co-Author*) Nothing to Disclose
Patrik Rogalla, MD, MBA (*Presenter*) Institutional Research Grant, Canon Medical Systems Corporation;Institutional Research Grant, KA Imaging

### TEACHING POINTS

• Interstitial lung disease (ILD) complicates cancer treatment • ILD increases lung cancer risk • AI can identify patients with ILD from planning CTs (in-house development) • Patients with AI-screened ILD have stronger correlations between dosimetric parameters and the development of Grade =2 and Grade =3 radiation pneumonitis • Screening for ILD helps consider the application of different dose constraints in lung cancer patients to mitigate the increased risk of severe toxicity

### TABLE OF CONTENTS/OUTLINE

1. Background and clinical importance 2. Study population (n=498), demographics 3. Results AI screening for ILD and cancer treatment 4. Incidence of radiation pneumonitis 5. Lessons learned

# Abstract Archives of the RSNA, 2024

VAEE

**Vascular Imaging Education Exhibits**

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Sub-Events**

## VAEE-10 THE LAW OF THE STRONGEST: VASCULAR COMPRESSIVE SYNDROMES

Yolanda Herrero Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Calero Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei Daniel Onuta, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Sebastian Paez Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Victoria Esteban Izquierdo, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Garces Marin, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Lopez Beneyto, MD (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Cecilia Ruiz de Castaneda (*Abstract Co-Author*) Nothing to Disclose
Elisabetta Ponte, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Define vascular compression syndromes and explain their significance.List common vascular compression syndromes (like Thoracic Outlet Syndrome, Nutcracker Syndrome, etc.), detailing the neurovascular structures involved in each syndrome.Discuss typical clinical manifestations that correlate with each affected structure, enhancing clinical relevance.Emphasize the role of CT imaging in the diagnosis of these syndromes, providing examples of key CT features for different syndromes.Use images to illustrate typical radiological signs that aid in the diagnosis.Include brief case studies where specific CT features led to a diagnosis.Encourage vigilance and thorough assessment using CT imaging for patients presenting with symptoms suggestive of vascular compression.

### TABLE OF CONTENTS/OUTLINE

IntroductionDefinition of vascular compression SyndromesOverview of vascular compression SyndromesDefinition and general pathophysiologyExamples of common SyndromesAffected neurovascular structuresDetailed list of neurovascular structures commonly entrappedCorrelation with anatomical locationsClinical manifestationsSymptoms associated with each SyndromeHow these symptoms correlate with the entrapped structuresRole of CT Imaging in diagnosisAdvantages of using CT imagingComparison with other diagnostic modalitiesSpecific CT findings for each SyndromeVisual aids: Diagrams and images demonstrating typical featuresManagement and Treatment OverviewGeneral treatment approachesImportance of early diagnosis and interventionConclusion

## VAEE-11 RADIOLOGISTS TOOLKIT: MULTIMODAL ASSESEMENT AND TREATMENT OF RENAL VASCULATURE PAHOLOGY

Luis Enrique Nunez Castellanos (*Abstract Co-Author*) Nothing to Disclose
Augstin Z. Guzman Mercado, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Describe normal renal vasculature anatomy, common variants and its clinical significance.• Understand normal nephrogram on contrast enhanced CT, radiologic signs translating on pathologic entities.• Learn the main findings on the multiple imaging methods including ultrasound, CEUS, CT, MR, Gammagram and Angiography.• Describe epidemiology, pathogenesis, etiology main imaging features, the main vascular pathologies• Understand the current role of the radiologist in the diagnosis and treatment of renal vascular pathologies.

### TABLE OF CONTENTS/OUTLINE

• Anatomy: normal anatomy, anatomical variants,• Multimodal approach: Ultrasound, Doppler, CEUS, computed tomography• Epidemiology, pathogenesis, etiology, main imaging features and treatment of vascular pathology.• Venous pathology: thrombosis, tumor thrombosis, compression syndromes.• Arterial pathology: fibromuscular dysplasia, stenosis, occlusion, pseudoaneurysm, arteriovenous fistula, active bleeding.• Endovascular treatment: Dianostic angiography, stenosis angioplasty, pseudoaneurysm / arteriovenous fistula embolization, active bleeding embolization.

## VAEE-12 VENOUS ANEURYSMS

**Awards**
**Certificate of Merit**

Prabhakar Rajiah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Craig M. Johnson, DO (*Abstract Co-Author*) Nothing to Disclose

Sudhakar K. Venkatesh, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Safa Hoodeshenas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1)To highlight the clinical significance of venous aneurysms with focus on their potential complications.2)To discuss the role of multimodality imaging in the evaluation of venous aneurysms3)To illustrate various types of venous aneurysms with case examples4)To describe the interventional management of venous aneurysms

**TABLE OF CONTENTS/OUTLINE**

1) Definition2) Classification of venous aneurysms3) Pathophysiology and risk factors4) Complications- thrombosis, infection, rupture, and pulmonary embolism5) Role of Imaging- Ultrasound, CT, MRI, Nuclear medicine, venography (CTV, MRV, DSA)6) Interventional management of venous aneurysms- Indications, types7) Pictorial review of venous aneurysms• Abdominal veins: Splenic, Portal, Superior Mesenteric, Hepatic Veins, Inferior Vena Cava, Iliac Veins• Thoracic veins: Pulmonary Veins, Superior Vena Cava, Azygos vein, brachiocephalic vein, Chest wall veins (embryonic and dorsal scapular veins)• Upper and lower extremities: Superficial and Deep, Popliteal Vein, Subclavian Vein, Perforator Veins• Cerebral, Head and Neck Veins- Internal Jugular Vein, Calcarine, Vein of Galen

## VAEE-13 UNVEILING ABDOMINAL VASCULAR COMPRESSION SYNDROMES: WHAT THE RADIOLOGIST NEEDS TO KNOW?

Natalia H. Concatto, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Freitas (*Abstract Co-Author*) Nothing to Disclose
Henrique M. Guerra, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- Abdominal vascular compression syndromes comprise a diverse group of conditions characterized by either the compression of a vascular structure or an anatomical structure being compressed by a vessel.- Computed tomography is integral to the diagnostic process, providing crucial imaging data that aids radiologists in identifying these syndromes.- However, it is important to note that imaging findings associated with vascular compression can frequently appear in asymptomatic individuals, raising concerns about potential overdiagnosis.- Therefore, a comprehensive diagnostic approach, incorporating clinical symptoms and additional testing, is essential to ensure accurate diagnosis and appropriate management of vascular compression syndromes.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction:- Definition and scope of vascular compression syndromes- Importance of computed tomography (CT) in the diagnostic.2. Radiological Considerations of each syndrome- Key imaging findings for each syndrome- Role of CT imaging in detailed anatomical assessment.3. Clinical Approach- Common symptoms and clinical manifestations- Importance of correlating imaging findings with clinical symptoms and additional diagnostic tests.4. Conclusion- Future directions in imaging techniques and clinical management of vascular compression syndromes.

## VAEE-14 UNTANGLE THE YARN BALL: A WALKTHROUGH MAJOR VASCULAR MALFORMATIONS

Hermes Vinicius Pedrini Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Andre P. Romualdo (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the 2018 ISSVA Classification of Vascular Anomalies.Review CT and MR imaging protocol for vascular analysis.Review the imaging characteristics of common vascular anomalies.Propose an algorithmic imaging evaluation of vascular malformations.Expose illustrative cases of vascular malformations and their clinical correlations.

**TABLE OF CONTENTS/OUTLINE**

2018 ISSVA Classification of Vascular Anomalies: - Vascular tumors. - Vascular malformations: Simple; Combined; Vascular anomalies of major named vessels; Vascular anomalies associated with others anomalies. - Unclassified anomalies. Explanation and exemplification of non-central nervous system vascular malformations. Subdivision of vascular malformations into high-flow and low-flow and their imaging characteristics. CT and MR protocols and reconstruction techniques, systematically mentioned in the interpretation of our cases. Imaging findings of vascular malformations across modalities (computerized tomography, magnetic resonance imaging, ultrasound and Doppler). Correlation beetween imaging and clinical signs of non-central nervous system vascular malformations. Practical information for effective reporting and necessary information for intervention planning.

## VAEE-15 PRECISION IN RECONSTRUCTIVE SURGERY: CHARTING PERFORATOR ARTERIES WITH CT

**Awards**
**Certificate of Merit**

Pablo Sanz Bellon (*Abstract Co-Author*) Nothing to Disclose
Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Beatriz Garcia Martinez (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To understand the concept of perforator and its use in flaps (angiosome model). 2. To review the imaging protocols for CT of perforator arteries for preoperative planning of the most commonly used flaps. 3. To show the MIP (Maximum Intensity Projection), MPR (Multiplanar Reformation) and VR (Volume Rendering) image reconstructions for each flap. 4. To specify how to communicate the relevant information to the surgeon in the image reconstructions and radiology report.

**TABLE OF CONTENTS/OUTLINE**

1. Introduction: 1.1 Angiosome. 1.2 Characteristics of perforator arteries and the "ideal" one. 2. General CT technical parameters for image acquisition and specific protocols for each flap. 3. Most commonly used flaps: anatomy, general considerations, reconstructions and radiological report. 3.1. Deep

Inferior Epigastric Perforator (DIEP) flap. 3.2. Thoracodorsal Artery Perforator (TAP) flap. 3.3. Anterolateral thigh (ALT) flap. 3.4. Superior gluteal artery perforator (SGAP) flap. 3.5. Peroneal artery flap and musculocutaneous flaps of the lower limbs. 4. Conclusions. 5. Bibliography.

## VAEE-16 ULTRASOUND FEATURES OF ARTERIOVENOUS FISTULA

Ana Gomes, MD (*Abstract Co-Author*) Nothing to Disclose
Caio P. Martinel, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Lucas S. Galvao I, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Froeder Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Janaina Moreira (*Abstract Co-Author*) Nothing to Disclose
Marcos Antonio Tebet Filho (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The rising occurrence of end-stage renal disease and its impact on healthcare have spurred increased attention to vascular access provision. Hemodialysis vascular access is the predominant method for renal replacement therapy, primarily achieved through arteriovenous fistula creation.An arteriovenous fistula is established by connecting a native artery to a vein, with the goal of providing long-term access for hemodialysis in individuals with end-stage renal disease until they can undergo a kidney transplant. Typically conducted in the upper extremities, preferably the non-dominant arm, the most common connections are made between the radial artery and the cephalic vein.When conducted with meticulous methodology, ultrasound assessment of AV access enables thorough evaluation from its inception to potential complications, like failure of maturation, stenotic vascular lesions, thrombosis, hematoma, aneurysms or pseudoaneurysms, and infection.

### TABLE OF CONTENTS/OUTLINE

- Review expected ultrasound findings expected for a patent arteriovenous fistula for hemodialysis.- Evaluate the most common complications and their presentation on ultrasound.

## VAEE-18 CT ASSESSMENT OF ENDOLEAKS AFTER ENDOVASCULAR AORTIC ANEURYSM REPAIR: AN UPDATED REVIEW

Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Vieira, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Azambuja, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recognize the imaging anatomy of the abdominal aorta (AA) and its main branches. Understand the primary concepts related to the clinical and surgical management of abdominal aortic aneurysm (AAA). Familiarize with the main aspects of the pre- and post-operative imaging evaluation of AAA. Recognize endovascular aneurysm repair (EVAR) complications, with focus on endoleaks. Comprehend the key principles and potential applications of artificial intelligence (AI) for prediction and detection of complications after EVAR, including endoleak.

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION: AA and its branches anatomy and relationship with other abdominal structures. AAA imaging patterns on Computed Tomography Angiography (CTA). AAA criteria to intervene and how to proceed (open surgery x EVAR). How to evaluate and follow the patient after surgery. EVAR complications. 2. DIAGNOSIS AND IMAGING FINDINGS: Endoleak - What are the mechanisms? How to identify How to proceed? 3. FUTURE PERSPECTIVES: ARTIFICIAL INTELLIGENCE: AI for diagnosing and predicting EVAR complications. 4. SUMMARY AND SYSTEMATIC APPROACH. 5. TAKE HOME MESSAGES.

## VAEE-19 IMAGING FINDINGS OF INFLAMMATORY AND INFECTIOUS CONDITIONS OF THE AORTA

Thiago Vieira, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Pasquali (*Abstract Co-Author*) Nothing to Disclose
Davi D. Romao, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre M. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Azambuja, MD (*Abstract Co-Author*) Nothing to Disclose
Luana Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Paola Beninca, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Aorta can be affected by inflammatory and infectious conditions.Radiologists play a crucial role in early recognition and prompt treatment, which are essential to prevent complications and improve patient outcomes.Distinguishing between these affections solely by image finginds can be difficult because aortitis imaging can vary depending on the underlying cause and the specific type of aortitis. The purpose of this exibition is to:- Recognize the various diseases and pathogens involved in aortitis.- Review imaging findinds of aortitis (inflamatory and infectious).- How to differentiate different diseases involving the aorta by image.

### TABLE OF CONTENTS/OUTLINE

1) Introduction2) Types of aortitis and their different examples3) Large, medium and small vessel vasculites4) Other conditious and infections conditions that affects the aorta5) Infectious conditions of the aorta

## VAEE-2 PORTAL VEIN FLOW AND HEPATIC TRANSPLANT: UNDERSTANDING REGENERATION MECHANISMS AND HOW TO CALCULATE IT - A TUTORIAL

Nicolas Bastidas (*Abstract Co-Author*) Nothing to Disclose
Estefan Ramos Isaza, MD (*Abstract Co-Author*) Nothing to Disclose
John A. Betancourt, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Fernanda Gomez (*Abstract Co-Author*) Nothing to Disclose
Pedro Rey (*Abstract Co-Author*) Nothing to Disclose
Sergio Andres Vergara Cardenas, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Understanding the Pitfalls and Physical Principles of Doppler Analysis.Evaluating Spectral Parameters During Pre- and Post-hepatic Transplantation.Explaining the Importance of Portal Vein Flow Calculation During Pre- and Post-Hepatic Transplantation.Making Reproducible Measurement of Portal Vein Flow Step by Step.

**TABLE OF CONTENTS/OUTLINE**

Doppler Principles and PitfallsFundamentals of Regeneration in Hepatic TransplantationSpectral Doppler ParametersCalculation of Portal Vein FlowKey PointsPortal Doppler is indicated in the perioperative evaluation of liver transplant patients. The assessment of portal vein volume flow (PVF) is used to define the feasibility of the intervention, the need for additional procedures to correct portal flow and to determine prognosis. This work provides an educational approach, showing how to perform PVF measurement by Doppler analysis, evaluating the necessary aspects to make its calculation reproducible, as well as its relationship with parenchymal regeneration when compared with volumetric data obtained by other diagnostic images.

## VAEE-20 INFERIOR VENA CAVA ANOMALIES: GIVING DIRECTIONS

Lucia A. Chagas, MD (*Abstract Co-Author*) Nothing to Disclose
Bernardo S. Oliveira, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Sartim, MD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Giunchetti Strabelli, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purpose of this exhibit is: 1. To review usual and unusual cases of anomalies of the inferior vena cava (IVC). 2. To correlate important findings with the anatomy, embryology, and pathophysiology, focusing on their clinical-radiological correlations. 3. To discuss image findings according to subgroups and classifications, in order to enhance surgeons and radiologists' skills. 4. To highlight their characteristics in order to radiologists with these conditions, preventing unfavorable patient outcome. 5. To review CT and MRI protocols in the evaluation of patients with IVC anomalies.

**TABLE OF CONTENTS/OUTLINE**

1. Applied embryology and anatomy of the IVC. 2. CT and MRI protocols in the evaluation of patients with suspected IVC anomalies. 3. Applications: a case-based review: (a) congenital absence (b) hypoplasia (c) Pre-renal: azygos continuation of IVC (d) Renal: retroaortic left renal vein, circumaortic venous collar (e) Post-renal: transposition or left-sided IVC, duplication of IVC, retrocaval or circumcaval ureter, absent infrarenal inferior vena cava, marsupial cava or preaortic iliac confluence (f) Miscellaneous and other findings 4. Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics. 5. Future directions 6. Summary and take-home messages.

## VAEE-21 'IT WAS NOT JUST A PLAQUE!'. UNVEILING THE ENIGMA OF NON-ATHEROSCLEROTIC ARTERIAL DISORDERS

Andre P. Romualdo (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Hermes Vinicius Pedrini Pereira, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Review the histopathologic characteristics of nonatherosclerotic arterial diseases. Review CT and MR imaging protocols for vessel analysis. Expose illustrative cases of nonatherosclerotic arterial conditions and its clinical correlations. Define differential diagnosis according to imaging pattern and vascular distribution. Tips on how to identify minimal and initial findings before clinical manifestations.

**TABLE OF CONTENTS/OUTLINE**

Concepts of arterial wall histology and pathophysiology of inflammatory and noninflammatory arterial nonatherosclerotic diseases. Correlation between Imaging patterns and histological sub-types of arterial diseases. CT and MR protocols and reconstruction techniques, systematically mentioned in the interpretation of our cases. Imaging aspects of acute vascular events, from large to small sizes artery branches. Evolution of the vascular involvement, from minimal wall irregularities to dissections, aneurysm formation and occlusive arterial events. Other arterial wall abnormalities that may have clinical repercussions (compressive syndromes). Correlation between Imaging and clinical signs. Risk factors and pre-existing conditions that can help us think about nonatherosclerotic arterial diseases. Practical information for effective reporting and necessary information for intervention planning, including the critical imaging findings that needs immediate intervention.

## VAEE-22 TO ENDOLEAKS AND BEYOND: A PICTORIAL REVIEW OF ENDOVASCULAR ANEURYSM REPAIR IMAGING AND ITS COMPLICATIONS

Yukiyoshi Kimura, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Garrido Urincho, MD (*Abstract Co-Author*) Nothing to Disclose
Genier Fabian Castano Lizarazo, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana J. Ludena Camacho I, MD (*Abstract Co-Author*) Nothing to Disclose
Aura Maria M. Gonzalez Peralta, MD, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• To understand preprocedural imaging evaluation to produce detailed and clinically useful imaging reports that assist interventionalists in the appropriate patient selection to achieve successful EVAR.• To review the abdominal aortic aneurysm imaging characteristics that must be accurately described for endovascular aortic aneurysm repair planning.• To describe the CT imaging findings of EVAR complications and the key features for the diagnosis.• To analyze therapeutic approaches considering and review various current secondary reintervention approaches that are usually employed for treatment.• To discuss surveillance recommendations after EVAR for timely detecting and evaluating the most common complications, considering evidence-based guidelines that provide a background to facilitate safe, cost-effective, and clinically relevant imaging.

**TABLE OF CONTENTS/OUTLINE**

• Introduction• Vascular Anatomy• Pretreatment Imaging Assessment. What to report?• CT angiography technique• EVAR complication classification• a. Endograft device-related complications• b. Systemic complication• Surveillance Considerations• Take home points• Conclusion

## VAEE-23 OPTIMIZING VESSEL WALL IMAGING FOR CEREBROVASCULAR ASSESSMENT AND INTEGRATING IT INTO STROKE WORKUP STANDARDS OF CARE

Gador Canton (*Abstract Co-Author*) Nothing to Disclose
Maoxue Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Mona Kharaji, MD (*Abstract Co-Author*) Nothing to Disclose
Mahmud Mossa-Basha, MD (*Abstract Co-Author*) Nothing to Disclose
Niranjan Balu, PhD (*Abstract Co-Author*) Nothing to Disclose
Chun Yuan, PhD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;;
David Tirschwell, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Ahmed Safwat, MD (*Abstract Co-Author*) Nothing to Disclose
Javid Azadbakht, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Conventional luminal imaging may fail to fully characterize vessel wall pathologies, leading to difficulties in distinguishing between various causes of cerebrovascular diseases.• Vessel wall imaging (VWI) enables direct visualization of vessel wall, aiding in distinguishing different causes of cerebrovascular diseases that need different prognostic and management considerations.• For capturing small intracranial artery lesions high spatial resolution and blood suppression techniques are crucial, but they prolong the acquisition time. Acceleration techniques have been developed for both pre-reconstruction (mostly based on parallel imaging) and post-reconstruction (mostly exploiting AI techniques) stages.• Refining VWI protocols in stroke patients to achieve faster acquisitions and higher-quality images can foster the adoption and recognition of the value of VWI in stroke work-up and secondary stroke prevention.

### TABLE OF CONTENTS/OUTLINE

1. Protocol optimization for VWI1.1. Technical optimizations for imaging acceleration of vessel wall MRI protocols1.1.1. AI reconstructions1.1.2. CAIPI1.1.3. CS1.2. Blood suppression approaches1.2.1. DANTE1.2.2. MSDE1.2.3. 3D VRFA TSE1.3. Carotid and intracranial VWI protocols1.4. Multi-contrast protocols2. Findings on standard of care VWI for stroke workup2.1. Differentiating various arterial diseases leading to stroke2.2. Characterizing atherosclerotic plaques and discussing features of vulnerability2.3. Detecting arteriogenic sources of emboli in cases of cryptogenic stroke2.4. Discussing clinical pitfalls and technical difficulties of VWI in stroke patients

## VAEE-24 BEYOND COLOR: SUPPLEMENTING DIAGNOSTIC EVALUATION IN DOPPLER ULTRASOUND WITH B-FLOW IMAGING

Ricardo Lange Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Cavalanti, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando L. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Peter C. Francolin (*Abstract Co-Author*) Nothing to Disclose
Lucas G. Annechini, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Esmeraldo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

B-Flow is a type of technology in ultrasound that allows the visualization of blood flow by representing echoes in shades of gray that vary according to reflector speed and dynamics. B-Flow complements the capabilities of traditional Doppler imaging, offering several significant enhancements: Higher frame rate and improved spatial resolution compared to color flow; Reduced dependency on the angle of scanning; Avoids vessel wall overlap, with no overlay techniques.The purpose of this exhibit is to review current clinical applications of B-flow imaging and explore how it can supplement Doppler evaluations, enhancing diagnostic certainty. B-flow imaging facilitates the visualization of specific pathological conditions and provides a practical method for capturing illustrative images that are beneficial for radiologists and referring physicians to understand the examination.

### TABLE OF CONTENTS/OUTLINE

Introduction a. Overview of coded excitation technology b. Advantages and tradeoffs in ultrasound imaging Clinical Applications a. Evaluation of hepatic vasculature b. Visualization of intratumoral vessels c. Renal blood flow and kidney transplant assessment d. Utilization in perinatology and fetal echocardiography e. Imaging of artery stenosis and plaque morphology f. Diagnosis of arterial dissection and fibromuscular dysplasia g. Assessment of arteriovenous fistulas h. Investigation of venous thrombosis (acute and chronic) i. Evaluation of peripheral arterial disease and bypass surgery outcomes Discussion of current evidence and its limitations a. Review of evidence quality and limitations in B-Flow studies Future Perspectives a. Potential applications and areas for further investigation

## VAEE-25 NON-TRAUMATIC CTA IMAGING OF THE UPPER EXTREMITY

Kevin R. Kalisz, MD (*Abstract Co-Author*) Reviewer, Oakstone Publishing, LLC;Consultant, VoxelMetrix, LLC
Julia M. Asmar, MD (*Abstract Co-Author*) Nothing to Disclose
Lynne M. Hurwitz Koweek, MD (*Abstract Co-Author*) Departmental Research Grant, Siemens AG;Departmental Research Grant, HeartFlow, Inc;Departmental Research Grant, Verily Lifesciences LLC
Jennifer L. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Cheng, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Computed Tomographic Angiography (CTA) of the upper extremity can provide non-invasive assessment of non-traumatic pathologies, including embolic disease, vasculitis, and post surgical assessment of arteriovenous fistula (AVF) and arteriovenous graft (AVG) complications. Knowledge of both the conventional and variant anatomy and spectrum of disease by the radiologist is important for communication with referring services. Teaching points include a review of conventional and variant anatomy with emphasis on the utilization of 3D reformats and curved planar reconstruction (CPR), imaging protocols, and review of spectrum of pathologies.

### TABLE OF CONTENTS/OUTLINE

1. Review imaging protocols and tailoring them to the clinical scenario2. Emphasize the conventional arterial anatomy of the upper extremity along with common variant anatomy3. Illustrate the clinical scenarios that can result in arterial stenosis and/or occlusion including infection and vasculitis4. Compare and contrast the spectrum of expected appearances of AVFs and AVGs versus complications in the post-surgical state

## VAEE-26 DEEP LEARNING: IMAGING CHARACTERISTICS OF DEEP VENOUS THROMBOSIS AND ASSOCIATED BENIGN CONDITIONS

Steven Sauk,
MD (*Abstract Co-Author*) Consultant, Becton, Dickinson and Company
Demetrios A. Raptis, MD (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Bhalla, MD (*Abstract Co-Author*) Advisory Board, Precisa Gravimetrics AG
Daniel R. Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Joaquin Martinez Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher O'Sullivan, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. Pathophysiology of thrombus formation 2. Clinical importance and diagnostic challenges 3. Imaging characteristics of acute and chronic venous thrombosis on ultrasound (US), computed tomography (CT), and magnetic resonance (MR) imaging 4. Diseases associated with thrombosis 5. Complications 6. Role of interventional radiology in management

**TABLE OF CONTENTS/OUTLINE**

I. Mechanism of clot formation II. Risk factors III. Imaging characteristics and differentiation of benign from malignant thrombus and mimics a. US b. CT c. MR d. Venography IV. Benign diseases a. Head and neck i. Acute jugular thrombosis ii. Lemierre syndrome b. Chest i. Thoracic outlet syndrome ii. Central venous thrombosis c. Abdomen and pelvis i. Budd-Chiari ii. Duodeno-caval fistula iii. Portomesenteric venous thrombus iv. Mondor disease v. Inflammatory/infectious-associated thrombophlebitis vi. Ovarian vein thrombus vii. May-Thurner syndrome viii. Iliocaval thrombosis d. Extremities i. Deep venous thrombosis ii. Superficial thrombosis and thrombophlebitis V. Complications a. Acute i. Pulmonary and septic emboli/infarcts ii. Phlegmasia cerulea dolens iii. Acute mesenteric venous ischemia b. Chronic i. Chronic mesenteric ischemia ii. Portal biliopathy iii. Post-thrombotic syndrome VI. Role of interventional radiology in management a. General algorithms and strategy i. Conservative management options ii. Percutaneous intervention options 1. Thrombectomy tools and stents a. Splanchnic system b. Lower extremities

## VAEE-27 CT ANGIOGRAPHY OF THE LOWER EXTREMITY ARTERIES: AN ILLUSTRATED GUIDE TO ANATOMY, PATHOLOGY, NORMAL AND ABNORMAL POST-OPERATIVE IMAGING

Panos K. Prassopoulos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vasileios Rafailidis, MD (*Abstract Co-Author*) Nothing to Disclose
Sasan Partovi, MD (*Abstract Co-Author*) Nothing to Disclose
Alba R. Pugliesi, MD (*Abstract Co-Author*) Nothing to Disclose
Elisavet Psoma (*Abstract Co-Author*) Nothing to Disclose
Angeliki Papachristodoulou, MD, MSc (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To familiarize with normal lower extremity arterial anatomy, significant anatomic variations and collateral circulation in patients with steno-occlusive disease. 2. Specific patterns and anatomic distribution of steno-occlusive disease will be associated with underlying pathology. 3. To show educational cases of the spectrum of atherosclerotic disease, with emphasis on CT angiography, including thrombotic embolic disease. Rare non-atherosclerotic entities will also be presented, such as mid-aortic syndrome, small aorta syndrome, popliteal artery entrapment and aortitis.4. To present post-treatment complications in the peri-procedural and long-term period. 5. To underline the role of contrast-enhanced ultrasound by correlation to CTA in selected cases.

**TABLE OF CONTENTS/OUTLINE**

1. Lower extremity arterial anatomy a. Normal pattern terminology b. Variations c. Systemic-systemic systemic-visceral collaterals 2. Disease categories a. Atherosclerosis b. Patterns and pathology of steno-occlusive disease c. Inflammatory d. Congenital e. Functional 3. Normal post-operative imaging a. Endarterectomy b. Stenting: iliac, femoral, popliteal c. Bypass grafting: various anatomic types 4. Post-treatment complications a. Stent: neointimal hyperplasia, restenosis, thrombosis, fracture, displacement, endoleak b. Bypass grafting: thrombosis, infection c. Trauma: pseudoaneurysm, hemorrhage, arteriovenous fistula d. Correlation of CEUS with CTA

## VAEE-28 EXPLORING THE UNIVERSE OF THROMBI: A RADIOLOGIST'S PERSPECTIVE

Martin M. Pesce, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro J. Pacini (*Abstract Co-Author*) Nothing to Disclose
Rodrigo S. Loto, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

• Pathophysiology of Thrombosis. • Imaging Modalities for Thrombi Detection. • Differentiating Thrombi from Other Conditions. Radiologic clues. • Protocoling is crucial for correct diagnosis. Artifacts and potential pitfalls. • Show the main imaging findings through different case examples of our institution.

**TABLE OF CONTENTS/OUTLINE**

Thrombosis occurs when there is a disruption in the balance between thrombogenic factors and protective mechanisms. In recent years, research in thromboembolic diseases has been inundated with new observations, making it worthwhile to strive for the evaluation of thrombotic mechanisms in individuals suffering from or predisposed to thromboembolic diseases. Table of contents: • Introduction. General concepts. • Thrombogenesis. • Composition, location, and types of thrombi. • Thromboinflammation. Thrombus age? • CT protocols technique: Possible scenarios. • Thrombosis and infections. What do we know beyond covid? • Malignant/benign tumors. Thrombosis and cancer. Micro and macrovascular invasion. Complications: thrombotic and nonthrombotic embolism (pulmonary tumor thrombotic microangiopathy). • Thrombosis in unusual sites. • Collateral circulation: a practical review. • Take-home points.

## VAEE-29 VARICOCELE: ULTRASOUND FEATURES AND EMBOLISATION. UPDATE FOR RADIOLOGIST

**Awards**
**Certificate of Merit**

Nicolas Rodriguez Ramirez, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Pastorin (*Abstract Co-Author*) Nothing to Disclose
Elena Romero (*Abstract Co-Author*) Nothing to Disclose
Xiaqun Xu (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Lorena Melian Iribar, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Become familiar with the correct performance of ultrasound examination of varicocele.2) Learn the typical sonographic findings. 3) Recognize the ultrasound appearance of the normal and pathological pampiniform plexus of veins. 4) Learn the recommendations for the performance of varicocele embolization.

**TABLE OF CONTENTS/OUTLINE**

Varicoceles are relatively common in asymptomatic men and even more prevalent in subfertile/infertile men or chronic scrotal discomfort, being the most common cause of potentially correctable male infertility. Ultrasound (US) is the preferred method for evaluation and a standardized protocol should be followed. A grey-scale and color Doppler examination should be performed bilaterally, with spectral Doppler analysis. Most investigators recommend examining the patient in both supine and erect positions, as well as during Valsalva. Testicular volume correlates with testicular function in infertile patients and those with varicocele, making it important to measure. It is important to measure the largest dilated vein and document the patient's position and sampling site, regardless of its location. Venous reflux causes testicular damage, which can be reversed by eliminating reflux. Spectral Doppler analysis measures reflux duration, which is essential. Regarding the treatment, percutaneous embolization is a highly effective and minimally invasive procedure that successfully treats lesions such as varicoceles.

## VAEE-3 FOUR-DIMENSIONAL (4D) FLOW MR IN VASCULAR DISEASE

Albert Hsiao, MD, PhD (*Abstract Co-Author*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging
Brian Pogatchnik, MD (*Abstract Co-Author*) Nothing to Disclose
Liliana Ma, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Rita Maria Lahoud, MD (*Abstract Co-Author*) Nothing to Disclose
Melina Hosseiny, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

4D Flow: Tailoring Acquisition for Vascular DiseaseWhat is 4D Flow?Acquisition parameters: FOV, Resolution, Velocity encoding speedPost-processing and phase-error correctionHemodynamic measurements: flow and pressurea)Pressure from modified Bernoulli equation to assess arterial stenosisb)Flow to assess shunt severityc)Flow to assess severity of venous stenosisd)Conservation of mass / flowCase examples:1) Applications in Arterial diseases:-Coarctation-Aortic dissection-Vasculitis-Aneurysm2) Applications in Vascular Malformations:-Case examples in extremity and neurovascular AVMs-Bulk flow decreases following successful therapy, whether interventional embolization or radiotherapy3)Applications in Abdominopelvic Venous Disease:-Pelvic congestion-May-Thurner-Nutcracker-POTS and Ehlers-Danlos

**TABLE OF CONTENTS/OUTLINE**

Outline:1. Introduction to 4D Flow and Clinical Applications in Vascular Disease2. Assessing hemodynamic significance: stenoses and shunts3. Vascular malformations: high flow, low flow and hemodynamic changes with therapy4. Hemodynamics of aortic dissection: tears and fenestrations5. Pelvic congestion and venous disease

## VAEE-30 VASCULITIS VENTURES: A RADIOLOGIST'S JOURNEY THROUGH LARGE VESSEL INFLAMMATION PATTERNS

Simona Manole, MD (*Abstract Co-Author*) Nothing to Disclose
Ioana Popescu, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

This presentation aims to:- Sensitize radiologists to vasculitides and the dynamic nature of studying these intricate conditions.- Outline the classification and characteristics of vasculitides, with a dedicated focus on large vessel vasculitis.- Underscore the key imaging features of large vessel vasculitis, predominantly through illustrative CTA case studies.- Explore the diagnostic challenges, including the identification of complications and even differentiation from mimicking entities.- Highlight the pivotal role of the radiologist within the multidisciplinary team in the diagnosis and management of vasculitides.

**TABLE OF CONTENTS/OUTLINE**

1. Prepare Your Backpacks! - Introduction to vasculitis2. Choosing the Route - Anatomy of the main vessels and their branches3. Finding Your Way in the Dark(room) - Vascular imaging techniques and features 4. Learning the Language - The Revised International Chapel Hill Consensus Conference nomenclature of vasculitides5. Hop On and Let’s Go! - Example cases of primary large vessel vasculitides6. Still on the Road - Example cases of secondary large vessel vasculitides7. Let’s take a Detour! - Example cases of pulmonary large vessel vasculitides8. Navigating Obstacles - Complications of vasculitides9. Avoiding Wrong Turns - Differential diagnosis and mimickers of vasculitis10. It’s Better with Friends - Multidisciplinary approach to vasculitis management11. A Journey to Remember! - Take home messages

## VAEE-31 DOPPLER ULTRASOUND OF THE TEMPORAL ARTERY, PICTORIAL ESSAY OF CASES THAT THE RADIOLOGIST SHOULD KNOW

Marcelo R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Yoshimura (*Abstract Co-Author*) Nothing to Disclose
Antonella Folchini (*Abstract Co-Author*) Nothing to Disclose
Marcio Gulinelli, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Ventura, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Alexandre Kanas, MD (*Abstract Co-Author*) Nothing to Disclose
Victor A. Jabour, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Passos Braga, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

The purposes of this exhibit are:1. Importance of learning the anatomy of the temporal artery and its branches.2. Understand the ultrasound technique to better perform the exam.3. Understand the different types of temporal artery aneurysm and their different findings in B mode and color.4. Know the ultrasound manifestation of temporal arteritis and the expected pattern after effective clinical treatment.

**TABLE OF CONTENTS/OUTLINE**

1. Anatomy of the temporal artery and its branches.2. Ultrasound technique used to evaluate the temporal artery, the main adjustments, parameters and what should be analyzed.3. Illustrate with case reports from our department the main pathologies:- Pseudoaneurysm- Fusiform aneurysm- Saccular aneurysm- Temporal arteritis

## VAEE-4 NEW HORIZON OF CT IMAGE PROCESSING: INNOVATIVE DOSE REDUCING CTA SUBTRACTION TECHNIQUE

Katsumi Tsujioka, RT (*Abstract Co-Author*) Researcher, Canon Medical Systems Corporation
Emi Tomita (*Abstract Co-Author*) Nothing to Disclose
Takeo Uetsuki, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Nobuaki Idobata (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Subtraction Computed Tomography Angiography (CTA) can accurately evaluate the vascular lumen in cases of high calcification, however, to perform the subtraction technique it is necessary to obtain non-contrast images as a mask in addition to the contrast enhanced images. Using recently developed image positioning technique in helical imaging, we propose a CTA subtraction that does not require the non-contrast mask images.

**TABLE OF CONTENTS/OUTLINE**

[1] We propose a method to obtain non-contrast enhanced axial Images during positioning imaging and to omit the additional non-contrast imaging. [2] Subtraction CTA is a method in which only blood vessels are extracted by subtracting non-contrast images from CTA images. It is effective for the assessment of the vascular lumen, however, in addition to the CTA image, a non-contrast image mask must be acquired for the subtraction process, which increases the radiation exposure. [3] Non-contrast axial images can be obtained using low-dose helical positioning with an additive filter. [4] After obtaining CTA images, the positioning images and CTA images are reconstructed under the same conditions. The subtraction with non-rigid positioning is performed using a 3D workstation. [5] The subtraction CTA using positioning images and CTA images, does not require the additional exposure for mask image acquisition, but still facilitates observation and evaluation of the vessel lumen.

## VAEE-5 WISDOM OF EVALUATING ENDOLEAK WITH 4D CT -HOW TO RELIABLY ACQUIRE IMAGES WITH LOW RADIATION DOSE AND SHORT SCANNING TIME-

Takashi Nishiyama (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

It is possible to differentiate the type of Endoleak using 4D CT However, there are issues with the extension of scanning time and the tradeoff relationship between radiation dose and number of frames. This time, we have developed imaging method that reduces radiation dose by 40% and increases the number of frames by 2.25 times compared to conventional methods.

**TABLE OF CONTENTS/OUTLINE**

We have developed method for differentiating Endoleak types using 4D CT, which reduces the radiation dose by 40% and increases the number of frames by 2.25 times compared to conventional methods. When it is difficult to maintain body position and hold breath for long time, it is necessary to accurately predict the time from just before contrast to the peak of CTA to minimize the scanning time. Therefore, we used Test Bolus Tracking, which allows us to start scanning at optimal timing. Furthermore, to obtain a high number of frames while reducing the radiation dose, we generated 120 bpm pulse generated from a simulated ECG and performed intermittent scanning As a result, we observed retrograde blood flow from the distal inferior mesenteric artery to the proximal inferior mesenteric artery at low radiation dose and short scanning time and could diagnose type II Endoleak. This method is effective in reducing scanning time, decreasing radiation dose, and increasing the number of frames, which are the issues of 4D CT.

## VAEE-6 VASCULAR ABNORMALITIES OF HAND AND WRIST- STATE-OF-THE ART MULTIMODALITY IMAGING

**Awards**
**Cum Laude**

Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1. To review the vascular anatomy and pathologies of the hand and wrist 2. To discuss the state-of-the-art imaging modalities in the evaluation of these vascular abnormalities 3. To illustrate the imaging appearances of various vascular abnormalities of hand and wrist

**TABLE OF CONTENTS/OUTLINE**

1. INTRODUCTION 2. VASCULAR ANATOMY OF THE HAND AND WRIST- including superficial and deep palmar arches, metacarpal and digital arteries 3. IMAGING MODALITIES- Ultrasound, doppler, CT, MRI, DSA 4. CT TECHNIQUES- CT Angiography (CTA), Multiphasic acquisitions, Dynamic CTA, multienergy CT, High-resolution photon counting CT 5. MRI TECHNIQUES- Standard MRI, Conventional MRA, 3D T1w acquisitions, Time-resolved MRA, Non contrast MRI techniques - e.g. NATIVE 6. STANDARD CT AND MRI PROTOCOL 7. REVIEW AND ILLUSTRATION OF THE FOLLOWING VASCULAR ABNORMALITIES WITH CASE EXAMPLES a) a. Anatomical variations- Persistent median artery, arch variations; a. Trauma/Iatrogenic; b. Occupational- Hypothenar hammer syndrome, Hand arm vibration syndrome; c. Thromboembolus; d. Thromboangiitis obliterans, Raynaud disease; e. Vasoocclusive disease (including paraneoplastic syndrome); f. Frostbite; g. Intra-arterial drug injection/drugs/chemicals; h. Vasculitis/Autoimmune/rheumatic diseases; i. Infections ; j. Aneurysms/ Pseudoaneurysms; k. Vascular malformations- Arterial, venous, lymphatic; l. Vascular tumors- Pyogenic granuloma, spindle cell hemangioma, intravascular endothelial cell hyperplasia; m. Perivascular tumors- Glomus tumor, myopericytoma; n. Extrinsic compression by tumors; o. Hand transplant workup 8. PITFALLS 9. MISSES

## VAEE-7 OMC! OH, MY COATED ANEURYSM: A MULTIMODALITY IMAGING GUIDE OF MYCOTIC ANEURYSMS FROM HEAD TO TOE

Daniel Kowal, MD (*Abstract Co-Author*) Speaker, Samsung Electronics Co, Ltd
Mansha A. Khubchandani, MD (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

Mycotic aneurysms represent a rare yet perilous vascular condition, impacting the aorta and visceral, peripheral and cerebral arteries. They stem from the dilation and deterioration of the arterial wall triggered by bloodstream infection or septic embolization, often from infective endocarditis. Early detection and swift intervention are paramount for mitigating mortality. However, diagnosis can be hindered by nonspecific presenting symptoms, often resulting in advanced-stage diagnosis or delayed complications like rupture or fistula formation. While clinical factors and biomarkers may heighten suspicion, they

lack specificity in diagnosis. Advanced imaging modalities like CT angiography and MRI have superseded conventional angiography as minimally invasive tools for both detecting suspected cases and characterizing confirmed cases, aiding in vascular mapping and treatment planning. Imaging findings include lobulated pseudoaneurysm, irregular wall, aneurysmal thrombosis and perianeurysmal gas, edema, abscess, soft tissue mass and lymphadenopathy. Familiarity with these imaging appearances can guide appropriate management, which typically entails a combination of antibiotic therapy, surgical debridement, revascularization, or endovascular procedures based on individual patient characteristics. This educational exhibit endeavors to immerse radiologists in a captivating cinematic journey throughout the body while highlighting the intricacies of mycotic aneurysms.

**TABLE OF CONTENTS/OUTLINE**

Introduction Pathogenesis Clinical features and complications Multimodality imaging examples of mycotic aneurysms spanning from head to toe Management Summary Limitation References

## VAEE-8 BEYOND ANEURYSMS: ANATOMY, EMBRYOLOGY AND PATHOLOGIES OF THE ABDOMINAL AORTA WITH IMPLICATIONS FOR MODERN ENDOVASCULAR MANAGEMENT

**Awards**
**Certificate of Merit**

Richard D. White, MBChB, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

1) Highlight the embryological development of the abdominal aorta, with schematic illustrations. 2) Discuss anatomy and key anatomical variants of the abdominal aorta, with case examples. 3) Illustrate a broad spectrum of a pathologies of the abdominal aorta, with clinical correlation and discussion of the implications for modern endovascular management

**TABLE OF CONTENTS/OUTLINE**

1) Embryology. 2) Anatomy and variants. 3) Pathologies. a. Aneurysm. b. Acute aortic syndromes. c. Fistulas. d. Mid-aortic syndrome. e. Ischemia. f. Inflammatory / infective. g. Trauma. h. Iatrogenic. i. Post-surgical / endovascular appearances. j. Miscellaneous.

## VAEE-9 THE RESIDENT'S GUIDE TO ACUTE VASCULAR IMAGING: AN ABC APPROACH

Richard D. White, MBChB, FRCR (*Presenter*) Nothing to Disclose

**TEACHING POINTS**

- By taking an ABC approach, highlight a range of acute vascular pathologies that residents might encounter, with pearls, pitfalls and clinical relevance.

**TABLE OF CONTENTS/OUTLINE**

1. Aneurysm 2. Bleeding 3. CTA protocols 4. Dissection 5. Embolism 6. Fistula 7. Gating 8. Hematoma 9. IVC 10. Jugular (and other neck findings) 11. Kidney and other solid organ injury 12. Line misplacement 13. Mesenteric 14. Non-contrast 15. Organ infarction 16. Pseudoaneurysm 17. Query dissection? 18. Rupture 19. SVC 20. Thoracic aortic injury 21. Ulceration 22. Vasculitis 23. White limb 24. X-ray artefacts: mimics of pathology on CT 25. Y-grafts and other post-surgical findings 26. Zebra spleen

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# Abstract Archives of the RSNA, 2024

VAEE-10

## THE LAW OF THE STRONGEST: VASCULAR COMPRESSIVE SYNDROMES

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yolanda Herrero Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Calero Ortega, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei Daniel Onuta, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Sebastian Paez Alvarez, MD (*Abstract Co-Author*) Nothing to Disclose
Victoria Esteban Izquierdo, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Tejedor Toquero, MD (*Abstract Co-Author*) Nothing to Disclose
Pablo Garces Marin, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Lopez Beneyto, MD (*Abstract Co-Author*) Nothing to Disclose
Jaime Lopez Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Cecilia Ruiz de Castaneda (*Abstract Co-Author*) Nothing to Disclose
Elisabetta Ponte, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Define vascular compression syndromes and explain their significance.List common vascular compression syndromes (like Thoracic Outlet Syndrome, Nutcracker Syndrome, etc.), detailing the neurovascular structures involved in each syndrome.Discuss typical clinical manifestations that correlate with each affected structure, enhancing clinical relevance.Emphasize the role of CT imaging in the diagnosis of these syndromes, providing examples of key CT features for different syndromes.Use images to illustrate typical radiological signs that aid in the diagnosis.Include brief case studies where specific CT features led to a diagnosis.Encourage vigilance and thorough assessment using CT imaging for patients presenting with symptoms suggestive of vascular compression.

### TABLE OF CONTENTS/OUTLINE

IntroductionDefinition of vascular compression SyndromesOverview of vascular compression SyndromesDefinition and general pathophysiologyExamples of common SyndromesAffected neurovascular structuresDetailed list of neurovascular structures commonly entrappedCorrelation with anatomical locationsClinical manifestationsSymptoms associated with each SyndromeHow these symptoms correlate with the entrapped structuresRole of CT Imaging in diagnosisAdvantages of using CT imagingComparison with other diagnostic modalitiesSpecific CT findings for each SyndromeVisual aids: Diagrams and images demonstrating typical featuresManagement and Treatment OverviewGeneral treatment approachesImportance of early diagnosis and interventionConclusion

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# Abstract Archives of the RSNA, 2024

VAEE-11

## RADIOLOGISTS TOOLKIT: MULTIMODAL ASSESEMENT AND TREATMENT OF RENAL VASCULATURE PAHOLOGY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Luis Enrique Nunez Castellanos (*Abstract Co-Author*) Nothing to Disclose
Augstin Z. Guzman Mercado, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Describe normal renal vasculature anatomy, common variants and its clinical significance.• Understand normal nephrogram on contrast enhanced CT, radiologic signs translating on pathologic entities.• Learn the main findings on the multiple imaging methods including ultrasound, CEUS, CT, MR, Gammagram and Angiography.• Describe epidemiology, pathogenesis, etiology main imaging features, the main vascular pathologies• Understand the current role of the radiologist in the diagnosis and treatment of renal vascular pathologies.

### TABLE OF CONTENTS/OUTLINE

• Anatomy: normal anatomy, anatomical variants,• Multimodal approach: Ultrasound, Doppler, CEUS, computed tomography• Epidemiology, pathogenesis, etiology, main imaging features and treatment of vascular pathology.• Venous pathology: thrombosis, tumor thrombosis, compression syndromes.• Arterial pathology: fibromuscular dysplasia, stenosis, occlusion, pseudoaneurysm, arteriovenous fistula, active bleeding.• Endovascular treatment: Dianostic angiography, stenosis angioplasty, pseudoaneurysm / arteriovenous fistula embolization, active bleeding embolization.

# Abstract Archives of the RSNA, 2024

VAEE-12

## VENOUS ANEURYSMS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Prabhakar Rajiah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Craig M. Johnson, DO (*Abstract Co-Author*) Nothing to Disclose
Sudhakar K. Venkatesh, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Safa Hoodeshenas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1)To highlight the clinical significance of venous aneurysms with focus on their potential complications.2)To discuss the role of multimodality imaging in the evaluation of venous aneurysms3)To illustrate various types of venous aneurysms with case examples4)To describe the interventional management of venous aneurysms

### TABLE OF CONTENTS/OUTLINE

1) Definition2) Classification of venous aneurysms3) Pathophysiology and risk factors4) Complications- thrombosis, infection, rupture, and pulmonary embolism5) Role of Imaging- Ultrasound, CT, MRI, Nuclear medicine, venography (CTV, MRV, DSA)6) Interventional management of venous aneurysms- Indications, types7) Pictorial review of venous aneurysms• Abdominal veins: Splenic, Portal, Superior Mesenteric, Hepatic Veins, Inferior Vena Cava, Iliac Veins• Thoracic veins: Pulmonary Veins, Superior Vena Cava, Azygos vein, brachiocephalic vein, Chest wall veins (embryonic and dorsal scapular veins)• Upper and lower extremities: Superficial and Deep, Popliteal Vein, Subclavian Vein, Perforator Veins• Cerebral, Head and Neck Veins- Internal Jugular Vein, Calcarine, Vein of Galen

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

VAEE-13

## UNVEILING ABDOMINAL VASCULAR COMPRESSION SYNDROMES: WHAT THE RADIOLOGIST NEEDS TO KNOW?

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Natalia H. Concatto, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Freitas (*Abstract Co-Author*) Nothing to Disclose
Henrique M. Guerra, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- Abdominal vascular compression syndromes comprise a diverse group of conditions characterized by either the compression of a vascular structure or an anatomical structure being compressed by a vessel.- Computed tomography is integral to the diagnostic process, providing crucial imaging data that aids radiologists in identifying these syndromes.- However, it is important to note that imaging findings associated with vascular compression can frequently appear in asymptomatic individuals, raising concerns about potential overdiagnosis.- Therefore, a comprehensive diagnostic approach, incorporating clinical symptoms and additional testing, is essential to ensure accurate diagnosis and appropriate management of vascular compression syndromes.

### TABLE OF CONTENTS/OUTLINE

1. Introduction:- Definition and scope of vascular compression syndromes- Importance of computed tomography (CT) in the diagnostic.2. Radiological Considerations of each syndrome- Key imaging findings for each syndrome- Role of CT imaging in detailed anatomical assessment.3. Clinical Approach- Common symptoms and clinical manifestations- Importance of correlating imaging findings with clinical symptoms and additional diagnostic tests.4. Conclusion- Future directions in imaging techniques and clinical management of vascular compression syndromes.

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# Abstract Archives of the RSNA, 2024

VAEE-14

## UNTANGLE THE YARN BALL: A WALKTHROUGH MAJOR VASCULAR MALFORMATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Hermes Vinicius Pedrini Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Andre P. Romualdo (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the 2018 ISSVA Classification of Vascular Anomalies.Review CT and MR imaging protocol for vascular analysis.Review the imaging characteristics of common vascular anomalies.Propose an algorithmic imaging evaluation of vascular malformations.Expose illustrative cases of vascular malformations and their clinical correlations.

### TABLE OF CONTENTS/OUTLINE

2018 ISSVA Classification of Vascular Anomalies: - Vascular tumors. - Vascular malformations: Simple; Combined; Vascular anomalies of major named vessels; Vascular anomalies associated with others anomalies. - Unclassified anomalies. Explanation and exemplification of non-central nervous system vascular malformations. Subdivision of vascular malformations into high-flow and low-flow and their imaging characteristics. CT and MR protocols and reconstruction techniques, systematically mentioned in the interpretation of our cases. Imaging findings of vascular malformations across modalities (computerized tomography, magnetic resonance imaging, ultrasound and Doppler). Correlation beetween imaging and clinical signs of non-central nervous system vascular malformations. Practical information for effective reporting and necessary information for intervention planning.

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# Abstract Archives of the RSNA, 2024

VAEE-15

## PRECISION IN RECONSTRUCTIVE SURGERY: CHARTING PERFORATOR ARTERIES WITH CT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Pablo Sanz Bellon (*Abstract Co-Author*) Nothing to Disclose
Maria J. Galante I, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Berasategui Criado, MD (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Abstract Co-Author*) Nothing to Disclose
Elena Julian Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Celia Cantolla Nates (*Abstract Co-Author*) Nothing to Disclose
Beatriz Garcia Martinez (*Abstract Co-Author*) Nothing to Disclose
Marina Arroyo Olmedo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To understand the concept of perforator and its use in flaps (angiosome model). 2. To review the imaging protocols for CT of perforator arteries for preoperative planning of the most commonly used flaps. 3. To show the MIP (Maximum Intensity Projection), MPR (Multiplanar Reformation) and VR (Volume Rendering) image reconstructions for each flap. 4. To specify how to communicate the relevant information to the surgeon in the image reconstructions and radiology report.

### TABLE OF CONTENTS/OUTLINE

1. Introduction: 1.1 Angiosome. 1.2 Characteristics of perforator arteries and the "ideal" one. 2. General CT technical parameters for image acquisition and specific protocols for each flap. 3. Most commonly used flaps: anatomy, general considerations, reconstructions and radiological report. 3.1. Deep Inferior Epigastric Perforator (DIEP) flap. 3.2. Thoracodorsal Artery Perforator (TAP) flap. 3.3. Anterolateral thigh (ALT) flap. 3.4. Superior gluteal artery perforator (SGAP) flap. 3.5. Peroneal artery flap and musculocutaneous flaps of the lower limbs. 4. Conclusions. 5. Bibliography.

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# Abstract Archives of the RSNA, 2024

VAEE-16

## ULTRASOUND FEATURES OF ARTERIOVENOUS FISTULA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ana Gomes, MD (*Abstract Co-Author*) Nothing to Disclose
Caio P. Martinel, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Lucas S. Galvao I, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Froeder Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Janaina Moreira (*Abstract Co-Author*) Nothing to Disclose
Marcos Antonio Tebet Filho (*Abstract Co-Author*) Nothing to Disclose
Luana Paschoal, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The rising occurrence of end-stage renal disease and its impact on healthcare have spurred increased attention to vascular access provision. Hemodialysis vascular access is the predominant method for renal replacement therapy, primarily achieved through arteriovenous fistula creation.An arteriovenous fistula is established by connecting a native artery to a vein, with the goal of providing long-term access for hemodialysis in individuals with end-stage renal disease until they can undergo a kidney transplant. Typically conducted in the upper extremities, preferably the non-dominant arm, the most common connections are made between the radial artery and the cephalic vein.When conducted with meticulous methodology, ultrasound assessment of AV access enables thorough evaluation from its inception to potential complications, like failure of maturation, stenotic vascular lesions, thrombosis, hematoma, aneurysms or pseudoaneurysms, and infection.

### TABLE OF CONTENTS/OUTLINE

- Review expected ultrasound findings expected for a patent arteriovenous fistula for hemodialysis.- Evaluate the most common complications and their presentation on ultrasound.

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# Abstract Archives of the RSNA, 2024

VAEE-18

## CT ASSESSMENT OF ENDOLEAKS AFTER ENDOVASCULAR AORTIC ANEURYSM REPAIR: AN UPDATED REVIEW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Fabiana Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago Vieira, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose de Arimateia B. Araujo Filho, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roddie Moraes Neto, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Azambuja, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel L. Cardoso, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Recognize the imaging anatomy of the abdominal aorta (AA) and its main branches. Understand the primary concepts related to the clinical and surgical management of abdominal aortic aneurysm (AAA). Familiarize with the main aspects of the pre- and post-operative imaging evaluation of AAA. Recognize endovascular aneurysm repair (EVAR) complications, with focus on endoleaks. Comprehend the key principles and potential applications of artificial intelligence (AI) for prediction and detection of complications after EVAR, including endoleak.

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION: AA and its branches anatomy and relationship with other abdominal structures. AAA imaging patterns on Computed Tomography Angiography (CTA). AAA criteria to intervene and how to proceed (open surgery x EVAR). How to evaluate and follow the patient after surgery. EVAR complications. 2. DIAGNOSIS AND IMAGING FINDINGS: Endoleak - What are the mechanisms? How to identify How to proceed? 3. FUTURE PERSPECTIVES: ARTIFICIAL INTELLIGENCE: AI for diagnosing and predicting EVAR complications. 4. SUMMARY AND SYSTEMATIC APPROACH. 5. TAKE HOME MESSAGES.

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# Abstract Archives of the RSNA, 2024

VAEE-19

## IMAGING FINDINGS OF INFLAMMATORY AND INFECTIOUS CONDITIONS OF THE AORTA

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Thiago Vieira, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Publio C. Viana, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre Pasquali (*Abstract Co-Author*) Nothing to Disclose
Davi D. Romao, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor D. Bichuette, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre M. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Azambuja, MD (*Abstract Co-Author*) Nothing to Disclose
Luana Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Paola Beninca, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Aorta can be affected by inflammatory and infectious conditions.Radiologists play a crucial role in early recognition and prompt treatment, which are essential to prevent complications and improve patient outcomes.Distinguishing between these affections solely by image finginds can be difficult because aortitis imaging can vary depending on the underlying cause and the specific type of aortitis. The purpose of this exibition is to:- Recognize the various diseases and pathogens involved in aortitis.- Review imaging findinds of aortitis (inflamatory and infectious).- How to differentiate different diseases involving the aorta by image.

### TABLE OF CONTENTS/OUTLINE

1) Introduction2) Types of aortitis and their different examples3) Large, medium and small vessel vasculites4) Other conditious and infections conditions that affects the aorta5) Infectious conditions of the aorta

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# Abstract Archives of the RSNA, 2024

VAEE-2

## PORTAL VEIN FLOW AND HEPATIC TRANSPLANT: UNDERSTANDING REGENERATION MECHANISMS AND HOW TO CALCULATE IT - A TUTORIAL

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Nicolas Bastidas (*Abstract Co-Author*) Nothing to Disclose
Estefan Ramos Isaza, MD (*Abstract Co-Author*) Nothing to Disclose
John A. Betancourt, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Fernanda Gomez (*Abstract Co-Author*) Nothing to Disclose
Pedro Rey (*Abstract Co-Author*) Nothing to Disclose
Sergio Andres Vergara Cardenas, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Understanding the Pitfalls and Physical Principles of Doppler Analysis.Evaluating Spectral Parameters During Pre- and Post-hepatic Transplantation.Explaining the Importance of Portal Vein Flow Calculation During Pre- and Post-Hepatic Transplantation.Making Reproducible Measurement of Portal Vein Flow Step by Step.

### TABLE OF CONTENTS/OUTLINE

Doppler Principles and PitfallsFundamentals of Regeneration in Hepatic TransplantationSpectral Doppler ParametersCalculation of Portal Vein FlowKey PointsPortal Doppler is indicated in the perioperative evaluation of liver transplant patients. The assessment of portal vein volume flow (PVF) is used to define the feasibility of the intervention, the need for additional procedures to correct portal flow and to determine prognosis. This work provides an educational approach, showing how to perform PVF measurement by Doppler analysis, evaluating the necessary aspects to make its calculation reproducible, as well as its relationship with parenchymal regeneration when compared with volumetric data obtained by other diagnostic images.

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# Abstract Archives of the RSNA, 2024

VAEE-20

## INFERIOR VENA CAVA ANOMALIES: GIVING DIRECTIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Lucia A. Chagas, MD (*Abstract Co-Author*) Nothing to Disclose
Bernardo S. Oliveira, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Ricardo D. Sartim, MD (*Abstract Co-Author*) Nothing to Disclose
Renato D. Teixeira, MD (*Abstract Co-Author*) Nothing to Disclose
Luciana P. Baptista, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Giunchetti Strabelli, MD (*Abstract Co-Author*) Nothing to Disclose
Lucas d. Gomes de Farias, MD, PhD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purpose of this exhibit is: 1. To review usual and unusual cases of anomalies of the inferior vena cava (IVC). 2. To correlate important findings with the anatomy, embryology, and pathophysiology, focusing on their clinical-radiological correlations. 3. To discuss image findings according to subgroups and classifications, in order to enhance surgeons and radiologists' skills. 4. To highlight their characteristics in order to radiologists with these conditions, preventing unfavorable patient outcome. 5. To review CT and MRI protocols in the evaluation of patients with IVC anomalies.

### TABLE OF CONTENTS/OUTLINE

1. Applied embryology and anatomy of the IVC. 2. CT and MRI protocols in the evaluation of patients with suspected IVC anomalies. 3. Applications: a case-based review: (a) congenital absence (b) hypoplasia (c) Pre-renal: azygos continuation of IVC (d) Renal: retroaortic left renal vein, circumaortic venous collar (e) Post-renal: transposition or left-sided IVC, duplication of IVC, retrocaval or circumcaval ureter, absent infrarenal inferior vena cava, marsupial cava or preaortic iliac confluence (f) Miscellaneous and other findings 4. Sample cases of pearls, pitfalls, diagnostic difficulties, and mimics. 5. Future directions 6. Summary and take-home messages.

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# Abstract Archives of the RSNA, 2024

VAEE-21

## 'IT WAS NOT JUST A PLAQUE!'. UNVEILING THE ENIGMA OF NON-ATHEROSCLEROTIC ARTERIAL DISORDERS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Andre P. Romualdo (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Albuquerque, MD (*Abstract Co-Author*) Nothing to Disclose
Bruna Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Hermes Vinicius Pedrini Pereira, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Review the histopathologic characteristics of nonatherosclerotic arterial diseases. Review CT and MR imaging protocols for vessel analysis. Expose illustrative cases of nonatherosclerotic arterial conditions and its clinical correlations. Define differential diagnosis according to imaging pattern and vascular distribution. Tips on how to identify minimal and initial findings before clinical manifestations.

### TABLE OF CONTENTS/OUTLINE

Concepts of arterial wall histology and pathophysiology of inflammatory and noninflammatory arterial nonatherosclerotic diseases. Correlation between Imaging patterns and histological sub-types of arterial diseases. CT and MR protocols and reconstruction techniques, systematically mentioned in the interpretation of our cases. Imaging aspects of acute vascular events, from large to small sizes artery branches. Evolution of the vascular involvement, from minimal wall irregularities to dissections, aneurysm formation and occlusive arterial events. Other arterial wall abnormalities that may have clinical repercussions (compressive syndromes). Correlation between Imaging and clinical signs. Risk factors and pre-existing conditions that can help us think about nonatherosclerotic arterial diseases. Practical information for effective reporting and necessary information for intervention planning, including the critical imaging findings that needs immediate intervention.

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# Abstract Archives of the RSNA, 2024

VAEE-22

## TO ENDOLEAKS AND BEYOND: A PICTORIAL REVIEW OF ENDOVASCULAR ANEURYSM REPAIR IMAGING AND ITS COMPLICATIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Yukiyoshi Kimura, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Garrido Urincho, MD (*Abstract Co-Author*) Nothing to Disclose
Genier Fabian Castano Lizarazo, MD (*Abstract Co-Author*) Nothing to Disclose
Tatiana J. Ludena Camacho I, MD (*Abstract Co-Author*) Nothing to Disclose
Aura Maria M. Gonzalez Peralta, MD, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• To understand preprocedural imaging evaluation to produce detailed and clinically useful imaging reports that assist interventionalists in the appropriate patient selection to achieve successful EVAR.• To review the abdominal aortic aneurysm imaging characteristics that must be accurately described for endovascular aortic aneurysm repair planning.• To describe the CT imaging findings of EVAR complications and the key features for the diagnosis.• To analyze therapeutic approaches considering and review various current secondary reintervention approaches that are usually employed for treatment.• To discuss surveillance recommendations after EVAR for timely detecting and evaluating the most common complications, considering evidence-based guidelines that provide a background to facilitate safe, cost-effective, and clinically relevant imaging.

### TABLE OF CONTENTS/OUTLINE

• Introduction• Vascular Anatomy• Pretreatment Imaging Assessment. What to report?• CT angiography technique• EVAR complication classification• a. Endograft device-related complications• b. Systemic complication• Surveillance Considerations• Take home points• Conclusion

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# Abstract Archives of the RSNA, 2024

VAEE-23

## OPTIMIZING VESSEL WALL IMAGING FOR CEREBROVASCULAR ASSESSMENT AND INTEGRATING IT INTO STROKE WORKUP STANDARDS OF CARE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Gador Canton (*Abstract Co-Author*) Nothing to Disclose
Maoxue Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Mona Kharaji, MD (*Abstract Co-Author*) Nothing to Disclose
Mahmud Mossa-Basha, MD (*Abstract Co-Author*) Nothing to Disclose
Niranjan Balu, PhD (*Abstract Co-Author*) Nothing to Disclose
Chun Yuan, PhD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;;
David Tirschwell, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Ahmed Safwat, MD (*Abstract Co-Author*) Nothing to Disclose
Javid Azadbakht, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Conventional luminal imaging may fail to fully characterize vessel wall pathologies, leading to difficulties in distinguishing between various causes of cerebrovascular diseases.• Vessel wall imaging (VWI) enables direct visualization of vessel wall, aiding in distinguishing different causes of cerebrovascular diseases that need different prognostic and management considerations.• For capturing small intracranial artery lesions high spatial resolution and blood suppression techniques are crucial, but they prolong the acquisition time. Acceleration techniques have been developed for both pre-reconstruction (mostly based on parallel imaging) and post-reconstruction (mostly exploiting AI techniques) stages.• Refining VWI protocols in stroke patients to achieve faster acquisitions and higher-quality images can foster the adoption and recognition of the value of VWI in stroke work-up and secondary stroke prevention.

### TABLE OF CONTENTS/OUTLINE

1. Protocol optimization for VWI1.1. Technical optimizations for imaging acceleration of vessel wall MRI protocols1.1.1. AI reconstructions1.1.2. CAIPI1.1.3. CS1.2. Blood suppression approaches1.2.1. DANTE1.2.2. MSDE1.2.3. 3D VRFA TSE1.3. Carotid and intracranial VWI protocols1.4. Multi-contrast protocols2. Findings on standard of care VWI for stroke workup2.1. Differentiating various arterial diseases leading to stroke2.2. Characterizing atherosclerotic plaques and discussing features of vulnerability2.3. Detecting arteriogenic sources of emboli in cases of cryptogenic stroke2.4. Discussing clinical pitfalls and technical difficulties of VWI in stroke patients

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# Abstract Archives of the RSNA, 2024

VAEE-24

## BEYOND COLOR: SUPPLEMENTING DIAGNOSTIC EVALUATION IN DOPPLER ULTRASOUND WITH B-FLOW IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Ricardo Lange Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Cavalanti, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando L. Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Peter C. Francolin (*Abstract Co-Author*) Nothing to Disclose
Lucas G. Annechini, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus Tonholo Ikedo, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Esmeraldo, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

B-Flow is a type of technology in ultrasound that allows the visualization of blood flow by representing echoes in shades of gray that vary according to reflector speed and dynamics. B-Flow complements the capabilities of traditional Doppler imaging, offering several significant enhancements: Higher frame rate and improved spatial resolution compared to color flow; Reduced dependency on the angle of scanning; Avoids vessel wall overlap, with no overlay techniques.The purpose of this exhibit is to review current clinical applications of B-flow imaging and explore how it can supplement Doppler evaluations, enhancing diagnostic certainty. B-flow imaging facilitates the visualization of specific pathological conditions and provides a practical method for capturing illustrative images that are beneficial for radiologists and referring physicians to understand the examination.

### TABLE OF CONTENTS/OUTLINE

Introduction a. Overview of coded excitation technology b. Advantages and tradeoffs in ultrasound imaging Clinical Applications a. Evaluation of hepatic vasculature b. Visualization of intratumoral vessels c. Renal blood flow and kidney transplant assessment d. Utilization in perinatology and fetal echocardiography e. Imaging of artery stenosis and plaque morphology f. Diagnosis of arterial dissection and fibromuscular dysplasia g. Assessment of arteriovenous fistulas h. Investigation of venous thrombosis (acute and chronic) i. Evaluation of peripheral arterial disease and bypass surgery outcomes Discussion of current evidence and its limitations a. Review of evidence quality and limitations in B-Flow studies Future Perspectives a. Potential applications and areas for further investigation

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# Abstract Archives of the RSNA, 2024

VAEE-25

## NON-TRAUMATIC CTA IMAGING OF THE UPPER EXTREMITY

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Kevin R. Kalisz, MD (*Abstract Co-Author*) Reviewer, Oakstone Publishing, LLC;Consultant, VoxelMetrix, LLC
Julia M. Asmar, MD (*Abstract Co-Author*) Nothing to Disclose
Lynne M. Hurwitz Koweek, MD (*Abstract Co-Author*) Departmental Research Grant, Siemens AG;Departmental Research Grant, HeartFlow, Inc;Departmental Research Grant, Verily Lifesciences LLC
Jennifer L. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Katherine A. Cheng, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Computed Tomographic Angiography (CTA) of the upper extremity can provide non-invasive assessment of non-traumatic pathologies, including embolic disease, vasculitis, and post surgical assessment of arteriovenous fistula (AVF) and arteriovenous graft (AVG) complications. Knowledge of both the conventional and variant anatomy and spectrum of disease by the radiologist is important for communication with referring services. Teaching points include a review of conventional and variant anatomy with emphasis on the utilization of 3D reformats and curved planar reconstruction (CPR), imaging protocols, and review of spectrum of pathologies.

### TABLE OF CONTENTS/OUTLINE

1. Review imaging protocols and tailoring them to the clinical scenario2. Emphasize the conventional arterial anatomy of the upper extremity along with common variant anatomy3. Illustrate the clinical scenarios that can result in arterial stenosis and/or occlusion including infection and vasculitis4. Compare and contrast the spectrum of expected appearances of AVFs and AVGs versus complications in the post-surgical state

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# Abstract Archives of the RSNA, 2024

VAEE-26

## DEEP LEARNING: IMAGING CHARACTERISTICS OF DEEP VENOUS THROMBOSIS AND ASSOCIATED BENIGN CONDITIONS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Steven Sauk, MD (*Abstract Co-Author*) Consultant, Becton, Dickinson and Company
Demetrios A. Raptis, MD (*Abstract Co-Author*) Nothing to Disclose
Malak Itani, MD (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Bhalla, MD (*Abstract Co-Author*) Advisory Board, Precisa Gravimetrics AG
Daniel R. Ludwig, MD (*Abstract Co-Author*) Nothing to Disclose
Joaquin Martinez Pereira, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher O'Sullivan, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. Pathophysiology of thrombus formation 2. Clinical importance and diagnostic challenges 3. Imaging characteristics of acute and chronic venous thrombosis on ultrasound (US), computed tomography (CT), and magnetic resonance (MR) imaging 4. Diseases associated with thrombosis 5. Complications 6. Role of interventional radiology in management

### TABLE OF CONTENTS/OUTLINE

I. Mechanism of clot formation II. Risk factors III. Imaging characteristics and differentiation of benign from malignant thrombus and mimics a. US b. CT c. MR d. Venography IV. Benign diseases a. Head and neck i. Acute jugular thrombosis ii. Lemierre syndrome b. Chest i. Thoracic outlet syndrome ii. Central venous thrombosis c. Abdomen and pelvis i. Budd-Chiari ii. Duodeno-caval fistula iii. Portomesenteric venous thrombus iv. Mondor disease v. Inflammatory/infectious-associated thrombophlebitis vi. Ovarian vein thrombus vii. May-Thurner syndrome viii. Iliocaval thrombosis d. Extremities i. Deep venous thrombosis ii. Superficial thrombosis and thrombophlebitis V. Complications a. Acute i. Pulmonary and septic emboli/infarcts ii. Phlegmasia cerulea dolens iii. Acute mesenteric venous ischemia b. Chronic i. Chronic mesenteric ischemia ii. Portal biliopathy iii. Post-thrombotic syndrome VI. Role of interventional radiology in management a. General algorithms and strategy i. Conservative management options ii. Percutaneous intervention options 1. Thrombectomy tools and stents a. Splanchnic system b. Lower extremities

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# Abstract Archives of the RSNA, 2024

VAEE-27

## CT ANGIOGRAPHY OF THE LOWER EXTREMITY ARTERIES: AN ILLUSTRATED GUIDE TO ANATOMY, PATHOLOGY, NORMAL AND ABNORMAL POST-OPERATIVE IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Panos K. Prassopoulos, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vasileios Rafailidis, MD (*Abstract Co-Author*) Nothing to Disclose
Sasan Partovi, MD (*Abstract Co-Author*) Nothing to Disclose
Alba R. Pugliesi, MD (*Abstract Co-Author*) Nothing to Disclose
Elisavet Psoma (*Abstract Co-Author*) Nothing to Disclose
Angeliki Papachristodoulou, MD, MSc (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To familiarize with normal lower extremity arterial anatomy, significant anatomic variations and collateral circulation in patients with steno-occlusive disease. 2. Specific patterns and anatomic distribution of steno-occlusive disease will be associated with underlying pathology. 3. To show educational cases of the spectrum of atherosclerotic disease, with emphasis on CT angiography, including thrombotic embolic disease. Rare non-atherosclerotic entities will also be presented, such as mid-aortic syndrome, small aorta syndrome, popliteal artery entrapment and aortitis.4. To present post-treatment complications in the peri-procedural and long-term period. 5. To underline the role of contrast-enhanced ultrasound by correlation to CTA in selected cases.

### TABLE OF CONTENTS/OUTLINE

1. Lower extremity arterial anatomy a. Normal pattern terminology b. Variations c. Systemic-systemic systemic-visceral collaterals 2. Disease categories a. Atherosclerosis b. Patterns and pathology of steno-occlusive disease c. Inflammatory d. Congenital e. Functional 3. Normal post-operative imaging a. Endarterectomy b. Stenting: iliac, femoral, popliteal c. Bypass grafting: various anatomic types 4. Post-treatment complications a. Stent: neointimal hyperplasia, restenosis, thrombosis, fracture, displacement, endoleak b. Bypass grafting: thrombosis, infection c. Trauma: pseudoaneurysm, hemorrhage, arteriovenous fistula d. Correlation of CEUS with CTA

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# Abstract Archives of the RSNA, 2024

VAEE-28

## EXPLORING THE UNIVERSE OF THROMBI: A RADIOLOGIST'S PERSPECTIVE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Martin M. Pesce, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro J. Pacini (*Abstract Co-Author*) Nothing to Disclose
Rodrigo S. Loto, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

• Pathophysiology of Thrombosis. • Imaging Modalities for Thrombi Detection. • Differentiating Thrombi from Other Conditions. Radiologic clues. • Protocoling is crucial for correct diagnosis. Artifacts and potential pitfalls. • Show the main imaging findings through different case examples of our institution.

### TABLE OF CONTENTS/OUTLINE

Thrombosis occurs when there is a disruption in the balance between thrombogenic factors and protective mechanisms. In recent years, research in thromboembolic diseases has been inundated with new observations, making it worthwhile to strive for the evaluation of thrombotic mechanisms in individuals suffering from or predisposed to thromboembolic diseases. Table of contents: • Introduction. General concepts. • Thrombogenesis. • Composition, location, and types of thrombi. • Thromboinflammation. Thrombus age? • CT protocols technique: Possible scenarios. • Thrombosis and infections. What do we know beyond covid? • Malignant/benign tumors. Thrombosis and cancer. Micro and macrovascular invasion. Complications: thrombotic and nonthrombotic embolism (pulmonary tumor thrombotic microangiopathy). • Thrombosis in unusual sites. • Collateral circulation: a practical review. • Take-home points.

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# Abstract Archives of the RSNA, 2024

VAEE-29

## VARICOCELE: ULTRASOUND FEATURES AND EMBOLISATION. UPDATE FOR RADIOLOGIST

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Nicolas Rodriguez Ramirez, MD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Pastorin (*Abstract Co-Author*) Nothing to Disclose
Elena Romero (*Abstract Co-Author*) Nothing to Disclose
Xiaqun Xu (*Abstract Co-Author*) Nothing to Disclose
Itxaso Galan-Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Lorena Melian Iribar, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Ines Rubio Aguilera, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Become familiar with the correct performance of ultrasound examination of varicocele.2) Learn the typical sonographic findings. 3) Recognize the ultrasound appearance of the normal and pathological pampiniform plexus of veins. 4) Learn the recommendations for the performance of varicocele embolization.

### TABLE OF CONTENTS/OUTLINE

Varicoceles are relatively common in asymptomatic men and even more prevalent in subfertile/infertile men or chronic scrotal discomfort, being the most common cause of potentially correctable male infertility. Ultrasound (US) is the preferred method for evaluation and a standardized protocol should be followed. A grey-scale and color Doppler examination should be performed bilaterally, with spectral Doppler analysis. Most investigators recommend examining the patient in both supine and erect positions, as well as during Valsalva. Testicular volume correlates with testicular function in infertile patients and those with varicocele, making it important to measure. It is important to measure the largest dilated vein and document the patient's position and sampling site, regardless of its location. Venous reflux causes testicular damage, which can be reversed by eliminating reflux. Spectral Doppler analysis measures reflux duration, which is essential. Regarding the treatment, percutaneous embolization is a highly effective and minimally invasive procedure that successfully treats lesions such as varicoceles.

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# Abstract Archives of the RSNA, 2024

VAEE-3

## FOUR-DIMENSIONAL (4D) FLOW MR IN VASCULAR DISEASE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Albert Hsiao, MD, PhD (*Abstract Co-Author*) Co-founder, Arterys Inc;Shareholder, Arterys Inc;Co-founder, Vektor.AI;Shareholder, Vektor.AI;Research Grant, Bayer AG;Research Grant, General Electric Company;Research Grant, KA Imaging
Brian Pogatchnik, MD (*Abstract Co-Author*) Nothing to Disclose
Liliana Ma, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Rita Maria Lahoud, MD (*Abstract Co-Author*) Nothing to Disclose
Melina Hosseiny, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

4D Flow: Tailoring Acquisition for Vascular DiseaseWhat is 4D Flow?Acquisition parameters: FOV, Resolution, Velocity encoding speedPost-processing and phase-error correctionHemodynamic measurements: flow and pressurea)Pressure from modified Bernoulli equation to assess arterial stenosisb)Flow to assess shunt severityc)Flow to assess severity of venous stenosisd)Conservation of mass / flowCase examples:1) Applications in Arterial diseases:-Coarctation-Aortic dissection-Vasculitis-Aneurysm2) Applications in Vascular Malformations:-Case examples in extremity and neurovascular AVMs-Bulk flow decreases following successful therapy, whether interventional embolization or radiotherapy3)Applications in Abdominopelvic Venous Disease:-Pelvic congestion-May-Thurner-Nutcracker-POTS and Ehlers-Danlos

### TABLE OF CONTENTS/OUTLINE

Outline:1. Introduction to 4D Flow and Clinical Applications in Vascular Disease2. Assessing hemodynamic significance: stenoses and shunts3. Vascular malformations: high flow, low flow and hemodynamic changes with therapy4. Hemodynamics of aortic dissection: tears and fenestrations5. Pelvic congestion and venous disease

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# Abstract Archives of the RSNA, 2024

VAEE-30

## VASCULITIS VENTURES: A RADIOLOGIST'S JOURNEY THROUGH LARGE VESSEL INFLAMMATION PATTERNS

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Simona Manole, MD (*Abstract Co-Author*) Nothing to Disclose
Ioana Popescu, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

This presentation aims to:- Sensitize radiologists to vasculitides and the dynamic nature of studying these intricate conditions.- Outline the classification and characteristics of vasculitides, with a dedicated focus on large vessel vasculitis.- Underscore the key imaging features of large vessel vasculitis, predominantly through illustrative CTA case studies.- Explore the diagnostic challenges, including the identification of complications and even differentiation from mimicking entities.- Highlight the pivotal role of the radiologist within the multidisciplinary team in the diagnosis and management of vasculitides.

### TABLE OF CONTENTS/OUTLINE

1. Prepare Your Backpacks! - Introduction to vasculitis2. Choosing the Route - Anatomy of the main vessels and their branches3. Finding Your Way in the Dark(room) - Vascular imaging techniques and features 4. Learning the Language - The Revised International Chapel Hill Consensus Conference nomenclature of vasculitides5. Hop On and Let’s Go! - Example cases of primary large vessel vasculitides6. Still on the Road - Example cases of secondary large vessel vasculitides7. Let’s take a Detour! - Example cases of pulmonary large vessel vasculitides8. Navigating Obstacles - Complications of vasculitides9. Avoiding Wrong Turns - Differential diagnosis and mimickers of vasculitis10. It’s Better with Friends - Multidisciplinary approach to vasculitis management11. A Journey to Remember! - Take home messages

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VAEE-31

## DOPPLER ULTRASOUND OF THE TEMPORAL ARTERY, PICTORIAL ESSAY OF CASES THAT THE RADIOLOGIST SHOULD KNOW

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Marcelo R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Yoshimura (*Abstract Co-Author*) Nothing to Disclose
Antonella Folchini (*Abstract Co-Author*) Nothing to Disclose
Marcio Gulinelli, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Carlos A. Ventura, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Alexandre Kanas, MD (*Abstract Co-Author*) Nothing to Disclose
Victor A. Jabour, MD (*Abstract Co-Author*) Nothing to Disclose
Matheus M. Marcelino Dias, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Passos Braga, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

The purposes of this exhibit are:1. Importance of learning the anatomy of the temporal artery and its branches.2. Understand the ultrasound technique to better perform the exam.3. Understand the different types of temporal artery aneurysm and their different findings in B mode and color.4. Know the ultrasound manifestation of temporal arteritis and the expected pattern after effective clinical treatment.

### TABLE OF CONTENTS/OUTLINE

1. Anatomy of the temporal artery and its branches.2. Ultrasound technique used to evaluate the temporal artery, the main adjustments, parameters and what should be analyzed.3. Illustrate with case reports from our department the main pathologies:- Pseudoaneurysm- Fusiform aneurysm- Saccular aneurysm- Temporal arteritis

RSNA 2024
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# Abstract Archives of the RSNA, 2024

VAEE-4

## NEW HORIZON OF CT IMAGE PROCESSING: INNOVATIVE DOSE REDUCING CTA SUBTRACTION TECHNIQUE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Katsumi Tsujioka, RT (*Abstract Co-Author*) Researcher, Canon Medical Systems Corporation
Emi Tomita (*Abstract Co-Author*) Nothing to Disclose
Takeo Uetsuki, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Nobuaki Idobata (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Subtraction Computed Tomography Angiography (CTA) can accurately evaluate the vascular lumen in cases of high calcification, however, to perform the subtraction technique it is necessary to obtain non-contrast images as a mask in addition to the contrast enhanced images. Using recently developed image positioning technique in helical imaging, we propose a CTA subtraction that does not require the non-contrast mask images.

### TABLE OF CONTENTS/OUTLINE

[1] We propose a method to obtain non-contrast enhanced axial Images during positioning imaging and to omit the additional non-contrast imaging. [2] Subtraction CTA is a method in which only blood vessels are extracted by subtracting non-contrast images from CTA images. It is effective for the assessment of the vascular lumen, however, in addition to the CTA image, a non-contrast image mask must be acquired for the subtraction process, which increases the radiation exposure. [3] Non-contrast axial images can be obtained using low-dose helical positioning with an additive filter. [4] After obtaining CTA images, the positioning images and CTA images are reconstructed under the same conditions. The subtraction with non-rigid positioning is performed using a 3D workstation. [5] The subtraction CTA using positioning images and CTA images, does not require the additional exposure for mask image acquisition, but still facilitates observation and evaluation of the vessel lumen.

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# Abstract Archives of the RSNA, 2024

VAEE-5

## WISDOM OF EVALUATING ENDOLEAK WITH 4D CT -HOW TO RELIABLY ACQUIRE IMAGES WITH LOW RADIATION DOSE AND SHORT SCANNING TIME-

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Takashi Nishiyama (*Presenter*) Nothing to Disclose

### TEACHING POINTS

It is possible to differentiate the type of Endoleak using 4D CT However, there are issues with the extension of scanning time and the tradeoff relationship between radiation dose and number of frames. This time, we have developed imaging method that reduces radiation dose by 40% and increases the number of frames by 2.25 times compared to conventional methods.

### TABLE OF CONTENTS/OUTLINE

We have developed method for differentiating Endoleak types using 4D CT, which reduces the radiation dose by 40% and increases the number of frames by 2.25 times compared to conventional methods. When it is difficult to maintain body position and hold breath for long time, it is necessary to accurately predict the time from just before contrast to the peak of CTA to minimize the scanning time. Therefore, we used Test Bolus Tracking, which allows us to start scanning at optimal timing. Furthermore, to obtain a high number of frames while reducing the radiation dose, we generated 120 bpm pulse generated from a simulated ECG and performed intermittent scanning As a result, we observed retrograde blood flow from the distal inferior mesenteric artery to the proximal inferior mesenteric artery at low radiation dose and short scanning time and could diagnose type II Endoleak. This method is effective in reducing scanning time, decreasing radiation dose, and increasing the number of frames, which are the issues of 4D CT.

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# Abstract Archives of the RSNA, 2024

VAEE-6

## VASCULAR ABNORMALITIES OF HAND AND WRIST- STATE-OF-THE ART MULTIMODALITY IMAGING

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Cum Laude**

Prabhakar Rajiah, MD, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1. To review the vascular anatomy and pathologies of the hand and wrist 2. To discuss the state-of-the-art imaging modalities in the evaluation of these vascular abnormalities 3. To illustrate the imaging appearances of various vascular abnormalities of hand and wrist

### TABLE OF CONTENTS/OUTLINE

1. INTRODUCTION 2. VASCULAR ANATOMY OF THE HAND AND WRIST- including superficial and deep palmar arches, metacarpal and digital arteries 3. IMAGING MODALITIES- Ultrasound, doppler, CT, MRI, DSA 4. CT TECHNIQUES- CT Angiography (CTA), Multiphasic acquisitions, Dynamic CTA, multienergy CT, High-resolution photon counting CT 5. MRI TECHNIQUES- Standard MRI, Conventional MRA, 3D T1w acquisitions, Time-resolved MRA, Non contrast MRI techniques - e.g. NATIVE 6. STANDARD CT AND MRI PROTOCOL 7. REVIEW AND ILLUSTRATION OF THE FOLLOWING VASCULAR ABNORMALITIES WITH CASE EXAMPLES a) a. Anatomical variations- Persistent median artery, arch variations; a. Trauma/Iatrogenic; b. Occupational- Hypothenar hammer syndrome, Hand arm vibration syndrome; c. Thromboembolus; d. Thromboangiitis obliterans, Raynaud disease; e. Vasoocclusive disease (including paraneoplastic syndrome); f. Frostbite; g. Intra-arterial drug injection/drugs/chemicals; h. Vasculitis/Autoimmune/rheumatic diseases; i. Infections ; j. Aneurysms/ Pseudoaneurysms; k. Vascular malformations- Arterial, venous, lymphatic; l. Vascular tumors- Pyogenic granuloma, spindle cell hemangioma, intravascular endothelial cell hyperplasia; m. Perivascular tumors- Glomus tumor, myopericytoma; n. Extrinsic compression by tumors; o. Hand transplant workup 8. PITFALLS 9. MISSES

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# Abstract Archives of the RSNA, 2024

VAEE-7

## OMC! OH, MY COATED ANEURYSM: A MULTIMODALITY IMAGING GUIDE OF MYCOTIC ANEURYSMS FROM HEAD TO TOE

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Daniel Kowal, MD (*Abstract Co-Author*) Speaker, Samsung Electronics Co, Ltd
Mansha A. Khubchandani, MD (*Presenter*) Nothing to Disclose

### TEACHING POINTS

Mycotic aneurysms represent a rare yet perilous vascular condition, impacting the aorta and visceral, peripheral and cerebral arteries. They stem from the dilation and deterioration of the arterial wall triggered by bloodstream infection or septic embolization, often from infective endocarditis. Early detection and swift intervention are paramount for mitigating mortality. However, diagnosis can be hindered by nonspecific presenting symptoms, often resulting in advanced-stage diagnosis or delayed complications like rupture or fistula formation. While clinical factors and biomarkers may heighten suspicion, they lack specificity in diagnosis. Advanced imaging modalities like CT angiography and MRI have superseded conventional angiography as minimally invasive tools for both detecting suspected cases and characterizing confirmed cases, aiding in vascular mapping and treatment planning. Imaging findings include lobulated pseudoaneurysm, irregular wall, aneurysmal thrombosis and perianeurysmal gas, edema, abscess, soft tissue mass and lymphadenopathy. Familiarity with these imaging appearances can guide appropriate management, which typically entails a combination of antibiotic therapy, surgical debridement, revascularization, or endovascular procedures based on individual patient characteristics. This educational exhibit endeavors to immerse radiologists in a captivating cinematic journey throughout the body while highlighting the intricacies of mycotic aneurysms.

### TABLE OF CONTENTS/OUTLINE

Introduction Pathogenesis Clinical features and complications Multimodality imaging examples of mycotic aneurysms spanning from head to toe Management Summary Limitation References

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# Abstract Archives of the RSNA, 2024

VAEE-8

## BEYOND ANEURYSMS: ANATOMY, EMBRYOLOGY AND PATHOLOGIES OF THE ABDOMINAL AORTA WITH IMPLICATIONS FOR MODERN ENDOVASCULAR MANAGEMENT

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

**Awards**
**Certificate of Merit**

Richard D. White, MBChB, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

1) Highlight the embryological development of the abdominal aorta, with schematic illustrations. 2) Discuss anatomy and key anatomical variants of the abdominal aorta, with case examples. 3) Illustrate a broad spectrum of a pathologies of the abdominal aorta, with clinical correlation and discussion of the implications for modern endovascular management

### TABLE OF CONTENTS/OUTLINE

1) Embryology. 2) Anatomy and variants. 3) Pathologies. a. Aneurysm. b. Acute aortic syndromes. c. Fistulas. d. Mid-aortic syndrome. e. Ischemia. f. Inflammatory / infective. g. Trauma. h. Iatrogenic. i. Post-surgical / endovascular appearances. j. Miscellaneous.

Printed on: 05/28/25

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# Abstract Archives of the RSNA, 2024

VAEE-9

## THE RESIDENT'S GUIDE TO ACUTE VASCULAR IMAGING: AN ABC APPROACH

Sunday, Dec. 1 9:00AM - 6:00PM Room: LEARNING CENTER

Richard D. White, MBChB, FRCR (*Presenter*) Nothing to Disclose

### TEACHING POINTS

- By taking an ABC approach, highlight a range of acute vascular pathologies that residents might encounter, with pearls, pitfalls and clinical relevance.

### TABLE OF CONTENTS/OUTLINE

1. Aneurysm 2. Bleeding 3. CTA protocols 4. Dissection 5. Embolism 6. Fistula 7. Gating 8. Hematoma 9. IVC 10. Jugular (and other neck findings) 11. Kidney and other solid organ injury 12. Line misplacement 13. Mesenteric 14. Non-contrast 15. Organ infarction 16. Pseudoaneurysm 17. Query dissection? 18. Rupture 19. SVC 20. Thoracic aortic injury 21. Ulceration 22. Vasculitis 23. White limb 24. X-ray artefacts: mimics of pathology on CT 25. Y-grafts and other post-surgical findings 26. Zebra spleen

# Abstract Archives of the RSNA, 2024

M2-SPBR

**Breast Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPBR-1 PRECISION ENHANCEMENT IN ULTRASOUND-BASED BREAST CANCER DETECTION: A CLINICAL VALIDATION STUDY OF VIS-BUS TECHNOLOGY

Hyuksool Kwon (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the diagnostic performance of Vis-BUS, powered by Barreleye Inc., a state-of-the-art AI-driven ultrasound tool designed to accurately distinguish between benign and malignant breast lesions. The study aims to validate the effectiveness of Vis-BUS, with a focus on improving diagnostic accuracy in breast cancer screening and identifying factors that affect performance.

### METHODS AND MATERIALS

Vis-BUS comprises two components: Lesion detection AI and Lesion analysis AI. The Lesion detection AI employs a b-mode image to identifies the location of the lesion. The neural networks are trained with 19k breast b-mode images using stochastic gradient descent method. The dataset consisted of 258 breast ultrasound examinations categorized by Vis-BUS into benign and malignant findings. The diagnostic accuracy was evaluated using the Area Under the Receiver Operating Characteristic (AUROC) and the Area Under the Precision-Recall Curve (AUPRC). Logistic regression analyzed factors associated with diagnostic discrepancies, specifically examining lesion size, calcification presence, and BI-RADS categories.

### RESULTS

Participants in the study had an average age of 48.2 years (SD = 11.0), and the average lesion size was 1.72 cm (SD = 1.40). Vis-BUS exhibited high diagnostic accuracy, as evidenced by an AUROC of 0.964 and an AUPRC of 0.967. Analysis of 33 misdiagnosed cases (12.79% error rate) revealed significant factors contributing to diagnostic errors. Lesion size showed a statistically significant influence, with an Odds Ratio (OR) of 1.79 (95% CI: 1.11 to 2.87; p=0.016), indicating increased misclassification risks with smaller lesions. The absence of calcification significantly affected outcomes, with an OR of 3.625 (95% CI: 1.23 to 10.69; p=0.020). Lower BI-RADS categories also correlated with increased diagnostic errors, with an OR of 1.42 (95% CI: 1.15 to 1.76; p=0.001). Interestingly, breast density was not a significant factor, highlighting the software's effectiveness across various breast types.

### CONCLUSION

The study confirms that Vis-BUS is a robust tool for breast cancer screening, capable of distinguishing between benign and malignant lesions with high accuracy. The identified predictive factors for misclassification provide targeted areas for further software refinement, especially in improving sensitivity towards benign conditions.

### CLINICAL RELEVANCE/APPLICATION

Vis-BUS's ability to deliver high accuracy in breast cancer detection is critical for clinical settings, where early and accurate diagnosis is paramount. Integrating Vis-BUS into routine screening practices can significantly enhance diagnostic accuracy, reduce misdiagnosis rates, and ensure timely and appropriate patient management.

## M2-SPBR-10 A MULTIMODAL DEEP LEARNING MODEL BASED ON PET/CT IMAGES AND ASSOCIATED REPORTS FOR BREAST CANCER SURVIVAL PREDICTION AND ANALYSIS

Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Luyi Han (*Abstract Co-Author*) Nothing to Disclose
Yuan Gao, MS (*Abstract Co-Author*) Nothing to Disclose
Tianyu Zhang (*Abstract Co-Author*) Nothing to Disclose
Tao Tan (*Abstract Co-Author*) Nothing to Disclose
Xin Wang, MS (*Abstract Co-Author*) Nothing to Disclose
Chunyao Lu (*Abstract Co-Author*) Nothing to Disclose
Xinglong Liang (*Presenter*) Nothing to Disclose

### PURPOSE

To predict 5-year survival and risk scores for breast cancer patients using PET/CT images and accompanying reports.

### METHODS AND MATERIALS

In total 795 paired cases of PET/CT scans and reports of breast cancer patients at in-house medical center were retrospectively collected from 2008 to 2020 with 85% cases allocated for training (using 5-fold cross-validation) and 15% for testing. The multimodal model comprises two branches: one utilizing a pre-trained natural language processing model for report feature extraction and another based on convolutional neural network for image feature extraction. Pseudo masks of PET/CT scans generated using our trained tumor segmentation model were also utilized as inputs for the image input branch. The extracted features were fed into a Multi-Layer Perceptron to predict 5-year survival (alive or not) and into an attention-based multiple-instance learning model to predict risk scores. Performance was evaluated using the area under the receiver operating characteristic curve (AUC), accuracy, and the concordance index (C-index), hazard ratio (HR).

### RESULTS

The performance of the model using both images and reports was significantly better than each system individually in a single-modal setting for 5-year survival (AUC-Multimodal = 0.847, Accuracy=0.850, 95% CI [0.783,0.908]; AUC-Image=0.746, P<0.0001, Accuracy=0.758 95% CI [0.683 ,0.825]; AUC-Report=0.788, P<0.0001, Accuracy=0. 800 95% CI [0.716,0.867]) and for survival analysis (C-index-Multimodal=0.717 95% CI [0.649, 0.773], HR=2.78 95% CI [1.55,5.00]; C-index- Image=0.656 95% CI [0.583, 0.726], HR=1.72 95% CI [0.99,2.99]; C-index-Report=0.694 95% CI [0.623, 0.758], HR=7.41 95% CI [3.82,14.34]).

### CONCLUSION

Combining PET/CT images and associated reports in a deep learning based multi-modal prediction model improves prediction of breast cancer survival over the use of either modality alone.

### CLINICAL RELEVANCE/APPLICATION

This multi-modal approach may serve as a new avenue for breast cancer prognostication, and a blueprint for prognostication in other diseases. It can potentially be extended to include all types of information in the electronic medical record. By extracting different types of relevant information for clinical decision making it may support individualized treatment and care for breast cancer patients.

## M2-SPBR-11 V-NET DEEP LEARNING SEGMENTATION OF BREAST LESIONS ON 3T DCE-MR IMAGES

Nicolo Cardobi, MD (*Abstract Co-Author*) Nothing to Disclose
Stefania Montemezzi, MD (*Abstract Co-Author*) Nothing to Disclose
Pier Giorgio Esposito (*Abstract Co-Author*) Nothing to Disclose
Carlo Cavedon, DPhil (*Abstract Co-Author*) Nothing to Disclose
Marina Fedon Vocaturo (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Cardano (*Abstract Co-Author*) Nothing to Disclose
Luisa Altabella (*Presenter*) Nothing to Disclose

### PURPOSE

In medical imaging, lesion segmentation is a crucial step for monitoring tumor progression and/or extracting radiomic features to characterize lesions. Traditionally, this task relies on time consuming manual input, affected by operator variability and impacting subsequent analysis. Automated approaches aim to mitigate this variability. This study focuses on developing an automated deep learning (DL) segmentation model for malignant breast lesion segmentations on DCE-MRI based on V-Net architecture.

### METHODS AND MATERIALS

A retrospective study involved 131 women who underwent DCE-MRI before neoadjuvant chemotherapy (NAC) between January 2016 and November 2021 on a 3T MRI scanner. Manual segmentation of the second subtracted post-contrast image was used to train a V-Net algorithm. A two-stage approach was employed, consisting in a first model to segment the whole breast and a second model to segment lesions within the breast ROI. More precisely, in the first step, raw breast segmentations, with ample borders, were used to train an initial V-Net architecture to obtain a breast mask prediction, producing a model that effectively restricts the area for further lesion detection. Then images were divided into smaller 3D patches to capture fine-grained features. V-Net model was applied to the non-empty tiles of the breast image to identify lesion. A final fine tuning on the lesion patch was performed to set the threshold and reduce false positives. Several parameters in terms of percentage of background patches used and binarization threshold were evaluated to obtain the best performing model.

### RESULTS

Using 100% background patches and 0.6 threshold yields the best performance, with fewer outliers and higher overall accuracy, with a median 0.9998 (IQR: 0.9995-0.9999) both for train an test. This results in a median Dice score of 0.77 (IQR 0.66-0.83) for the training set and 0.71 (IQR 0.51-0.82) for the test set comparing human and automated segmentation tasks. Furthermore, automatic segmentation was approximately 5 times faster than manual segmentation.

### CONCLUSION

Preference was shown for utilizing all image information (100% background) and employing a higher threshold to reduce false positives. Despite satisfactory results, improvements are possible through dataset augmentation, architectural modifications, and hardware upgrades.

### CLINICAL RELEVANCE/APPLICATION

The proposed automated segmentation achieved its primary goal of reducing human operator variability and providing a time-efficient segmentation. While reducing operator variability and providing efficient segmentation, human supervision is still necessary to address false positives and fine-tune thresholds.

## M2-SPBR-2 FULLY AUTOMATED INTERPRETATION OF ABBREVIATED BREAST MRI BY MACHINE LEARNING

Christiane K. Kuhl, MD, PhD (*Abstract Co-Author*) Advisory Board, Guerbet SA;Speaker, Bracco Group;Speaker, Bayer AG
Gustav Mueller-Franzes, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Truhn, MD (*Abstract Co-Author*) Research Consultant, Aristra Medical
Maike Bode, MD (*Abstract Co-Author*) Nothing to Disclose
Debora Jutz (*Presenter*) Nothing to Disclose

### PURPOSE

Abbreviated breast MRI (AB-MRI) is increasingly used for screening of breast cancer. Artificial Intelligence (AI) models for the detection of breast cancer in AB-MRI can potentially support radiologists. Here, we compare an AI model working on the full diagnostic MRI protocol (FDP) vs. an AI model working on the AB-MRI protocol (AP).

**METHODS AND MATERIALS**

In a retrospective study on 7,835 patients, who received breast MRI examinations between 2010 and 2017, two neural network architectures (ResNet18 and ResNet50) were trained both on the full diagnostic protocol and on the abbreviated protocol. Receiver operator characteristics, sensitivities and specificities were compared using five-fold cross validation.

**RESULTS**

The ResNet18 network trained on the FDP achieved an AUC of 0.911±0.007, while the same neural network trained on the AP had an AUC of 0.905±0.002. Sensitivity and specificity were 0.825±0.043 and 0.857±0.027 for the neural network trained on the FDP, and 0.793±0.034 and 0.876±0.035 for the neural network trained on the AP. The ResNet50 network achieved AUCs of 0.904±0.004 and 0.911±0.004 trained on the FDP and the AP respectively. Sensitivity and specificity were 0.823±0.049 and 0.849±0.036 for the neural network trained on the FDP, and 0.791±0.027 and 0.891±0.011 for the neural network trained on the AP.

**CONCLUSION**

Neural networks trained on the AP achieve accuracies comparable to networks trained on the FDP, thus questioning the need for the FDP when using AI models.

**CLINICAL RELEVANCE/APPLICATION**

The abbreviated protocol could be used to increase throughput of examinations in the screening setting. In line with existing literature on human reader studies we did not find evidence that the FDP is superior to the AP when using AI models.

## M2-SPBR-3 INTEGRATION OF MULTI-INFORMATION FROM TIME-INTENSITY CURVE AND BI-RADS SCORE IN A DEEP LEARNING MODEL FOR DISCRIMINATION OF BENIGN AND MALIGNANT BREAST LESIONS USING DCE-MRI

Yanfen Cui (*Abstract Co-Author*) Nothing to Disclose
Zaiyi Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Yanting Liang (*Abstract Co-Author*) Nothing to Disclose
Chu Han (*Abstract Co-Author*) Nothing to Disclose
Chinting Wong (*Abstract Co-Author*) Nothing to Disclose
Zhenwei Shi, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a deep learning model on DCE-MRI scans for discrimination of benign and malignant breast lesions.

**METHODS AND MATERIALS**

A retrospective analysis was conducted on multi-phase DCE-MRI scans obtained from over 2805 patients between January 2010 and July 2023 from three different hospitals. The deep learning (DL) framework employed a Vision Transformer architecture and consisted of two stages: transfer learning using an in-house pre-trained MRI foundation model and fine-tuning. In the pre-training stage, a contrastive learning algorithm (MoCoV3) was applied to 14,070 MRI scans. The fine-tuning process incorporated multi-phase of DCE-MRI scans to mimic the time-intensity curve (TIC) and integrate diagnostic BI-RADS scores, with the aim of minimizing the risk of false-positive results. A Breast tumor Benign and Malignant (B2M) score was generated by the deep learning model and its performance was evaluated using metrics such as the area under the receiver operating characteristic curve (AUC), accuracy, sensitivity, and specificity. To enhance interpretability, the Grad-CAM method was employed to visualize the attention heatmap of the deep learning model.

**RESULTS**

The training dataset consisted of 1705 patients with 1806 lesions (median age, 46.5 years [IQR, 31.2-68.4 years]) from center A, while the two external test datasets included over 315 patients with 336 lesions and 785 patients with 902 lesions (median age, 44.6 years [IQR, 39.5-77.2 years]). The B2M score exhibited significant association with discrimination of benign and malignant breast tumors, with odds ratio of 4.12 [95% CI: 3.57,4.75]; P < .001. The final model demonstrated excellent performance in the internal validation dataset (AUC, 0.95) and the external test datasets (AUC range, 0.92-0.96). The accuracy and sensitivity were 0.89 and 0.92 in test dataset 1, and 0.83 and 0.92 in test dataset 2, respectively.

**CONCLUSION**

This study developed a prediction model that combined multi-information from DCE-MRI scans and integrated BI-RADS scores showed excellent performance for discriminating benign and malignant breast lesions.

**CLINICAL RELEVANCE/APPLICATION**

The developed predictive model enables a comprehensive assessment of breast lesions, aiding in accurate diagnosis and treatment planning for breast cancer patients.

## M2-SPBR-4 SUPER-RESOLUTION ULTRASOUND RADIOMICS TO PREDICT POSTOPERATIVE UPSTAGING OF DUCTAL CARCINOMA IN SITU

Jianhua Zhou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Liang Yang (*Presenter*) Nothing to Disclose

**PURPOSE**

We aimed to develop a model for predicting the postoperative upstaging of DCIS based on super resolution (SR) ultrasound images.

**METHODS AND MATERIALS**

In this multicenter retrospective study, patients with biopsy-proven DCIS underwent ultrasound examination were included from 4 independent centers between January 2015 and June 2023 (center 1, training and validation set; center 2, 3 and 4, external test set). We used a super-resolution reconstruction algorithm to enhance the resolution of original high resolution (HR) ultrasound images and obtain SR images. The selected HR radiomics features and SR radiomics features were combined with clinical features to construct the HR fusion model and SR fusion model, respectively. The diagnostic performance of the models and radiologists were then evaluated using area under receiver operating characteristic curve (AUC) and decision curve analysis.

**RESULTS**

A total of 681 women (median age, 47 years; interquartile range, 42-54) with 681 biopsy-proven DCIS lesions were included, with 106 lesions in validation set and 153 lesions in external test set. The SR Fusion model achieved an AUC of 0.819 (0.732-0.890) in the validation set and 0.800 (95% CI 0.728-0.860) in the external test set, outperforming radiologists (AUC = 0.62, 95% CI 0.58-0.65; P < 0.001), clinical model (AUC = 0.682, 95% CI 0.602-0.755; P = 0.016) and HR Fusion model (AUC = 0.724, 95% CI 0.646-0.793; P = 0.034) in the external test set.

**CONCLUSION**

The SR Fusion model integrating SR features and clinical features can effectively predict the postoperative upstaging of DCIS.

**CLINICAL RELEVANCE/APPLICATION**

The radiomics model can effectively predict the upstaging of DCIS and the super-resolution images can improve the performance of radiomics model compared to the original ultrasound images.

## M2-SPBR-6 ASSESSMENT OF BREAST POSITIONING IN DIGITAL MAMMOGRAPHY: PERFORMANCE OF AN ARTIFICIAL INTELLIGENT QUALITY CONTROL SYSTEM AND AGREEMENT WITH RADIOGRAPHERS

Huizhi Cao (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to assess breast positioning in digital mammography using an artificial intelligent quality control system (AIQCS) and determine the agreement between the AI system and radiographers.

**METHODS AND MATERIALS**

Breast positioning assessment was conducted using an AI system (Edison, GE Healthcare) and by four radiographers on 223 examinations of women. Nine image quality criteria were employed for craniocaudal and mediolateral-oblique views, covering various aspects of breast positioning. The area under the receiver operating characteristic curve (AUC) was calculated to predict poor imaging quality by the AI system based on criteria such as incomplete gland, incomplete pectoralis muscle, and exposure. Intraclass correlation and Cohen's kappa coefficient (?) were used to evaluate correlation and agreement between radiographers and AI.

**RESULTS**

The AUC for poor imaging quality prediction by the AI system ranged from 0.903 to 0.982, with an overall accuracy of 0.958. Intraclass correlation for the pectoral nipple line between radiographers and AI was >0.80. Substantial to almost perfect agreement (? >0.85) was observed between radiographers and AI for the nipple in profile criterion. Agreement varied from slight to moderate (? = 0.40-0.65) for other criteria, with higher agreement observed between pairs of radiographers (mean ? = 0.70) than between radiographers and AI (mean ? = 0.61).

**CONCLUSION**

AI shows promise in evaluating breast position criteria in mammography, reducing subjectivity. However, varying agreement between radiographers and AI was observed.

**CLINICAL RELEVANCE/APPLICATION**

Accurate breast positioning with AI systems is crucial for quality control in mammography, ultimately contributing to optimal image quality and improved diagnostic accuracy.

## M2-SPBR-7 A MULTIPARAMETRIC MRI-BASED RADIOMIC MODEL FOR STRATIFYING POSTOPERATIVE RECURRENCE IN LUMINAL B BREAST CANCER

Sicong Huang (*Abstract Co-Author*) Nothing to Disclose
Maosheng Xu, MD (*Abstract Co-Author*) Nothing to Disclose
Ruixin Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop an MRI-based radiomics model to assess the likelihood of recurrence in Luminal B breast cancer.

**METHODS AND MATERIALS**

The study analyzed medical images and clinical data from 244 patients with Luminal B breast cancer. Of 244 patients, 35 had experienced recurrence and 209 had not. The patients were randomly divided into the training set (51.5 ± 12.5 years old; n = 171) and the test set (51.7 ± 11.3 years old; n = 73) in a ratio of 7:3. The study employed univariate and multivariate Cox regression along with the least absolute shrinkage and selection operator (LASSO) regression methods to select radiomic features and calculate a risk score. A combined model was constructed by integrating the risk score with the clinical and pathological characteristics.

**RESULTS**

The study identified two radiomic features (GLSZM and GLRLM) from DCE-MRI were used to calculate a risk score. The AUCs were 0.860 and 0.868 in the training set, and 0.816 and 0.714 in the testing set for 3- and 5-year recurrence risk, respectively. The combined model incorporating the risk score, pN, and endocrine therapy showed improved predictive power, with AUCs of 0.857 and 0.912 in the training set and 0.943 and 0.945 in the testing set for 3- and 5-year recurrence risk, respectively. The calibration curve of the combined model showed good consistency between predicted and measured values.

**CONCLUSION**

Our study developed an MRI-based radiomic model that integrates clinical and radiomic features to assess the likelihood of recurrence in Luminal B breast cancer. The model shows promise for improving clinical risk stratification and treatment decision-making.

**CLINICAL RELEVANCE/APPLICATION**

This study developed a predictive model for the recurrence of Luminal B breast cancer based on DCE-MRI radiomic features. Due to the importance of proper diagnosis and evaluation in treating Luminal B breast cancer, the algorithm proposed herein may offer a high degree of clinical utility in guiding personalized treatment.

## M2-SPBR-8 ASSESSING MAMMOGRAPHY POSITIONING QUALITY AND VARIABILITY BETWEEN AND WITHIN BREAST SCREENING PROGRAMS DURING THE COVID-19 PANDEMIC: A MULTICENTRE STUDY USING A.I. TO EVALUATE POPULATION-LEVEL UNMET MAMMOGRAPHY POSITIONING CRITERIA

Jean M. Seely, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Sylvia H. Heywang-Kobrunner, MD (*Abstract Co-Author*) Nothing to Disclose
Mohamed Abdolell, MSc, BSc (*Abstract Co-Author*) Founder and CEO, Densitas Inc
Georgia G. Spear, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company;Scientific Advisory Board, Hologic, Inc
Nisha Sharma, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Sian E. Iles, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer I. Payne, PhD (*Abstract Co-Author*) Nothing to Disclose
Toni W. Vomweg (*Abstract Co-Author*) Nothing to Disclose
Laurie R. Margolies, MD (*Presenter*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical

### PURPOSE

This multicentre study aimed to evaluate the impact of COVID-19-related safety measures, such as the use of personal protective equipment (PPE) and service suspensions, on mammography positioning quality and its variability across breast screening programs (BSPs) in North America and Europe. The study sought to determine whether these pandemic-induced operational changes influenced the consistency of mammographic imaging quality between and within BSPs.

### METHODS AND MATERIALS

A total of 249,817 screening mammograms from seven BSPs, collected between December 1, 2019, and February 28, 2021, were included. Relative variability of unmet positioning criteria rates was assessed using the Coefficient of Variation (CV) between and within BSPs and MUs in that period. Unmet positioning criteria rates pre-post first onset of COVID-19 were assessed on a subset of 50,000 mammograms obtained during the 10 weeks preceding March 15, 2019, and the 10 weeks following the resumption of services post the first COVID-19 wave. Mammography positioning and compression criteria were assessed for all mammograms using AI algorithms (Densitas intelliMammo® ), and included 19 image-level criteria and an overall (PGMI=Perfect/Good/Moderate/Inadequate) study-level score. Ethics approvals were obtained from all participating BSPs.

### RESULTS

There were no statistically significant changes in the unmet positioning criteria rates before and after the initial COVID-19 wave across the BSPs (all p-values > 0.05), indicating that pre-pandemic quality levels were maintained. However, the study highlighted significant variability in unmet positioning criteria both between and within BSPs; the CV ranged from 9.51% for under/over compression to 60.25% for inadequate (PGMI=I) quality studies, with overall median variability across BSPs noted at 83.46%.

### CONCLUSION

The findings demonstrate that despite the disruptions caused by the COVID-19 pandemic, that would have included PPE use and other safety protocols, mammography positioning quality within the BSPs remained consistent with pre-pandemic levels.Limitations: Technologist experience, training protocols, and patient-specific characteristics, which could influence the observed variability, were not available for analysis.

### CLINICAL RELEVANCE/APPLICATION

The observed variability in error rates of images accepted for interpretation both between and within BSPs underscores the challenges in achieving uniform standards of mammographic quality across different operational environments. The results highlight the need for continued and perhaps increased attention to mammographic image quality as the study suggests that too many exams with unmet positioning criteria may be being accepted for interpretation.

## M2-SPBR-9 POST-MARKET SURVEILLANCE OF AI IN A BREAST CANCER SCREENING SETTING

Adnan Taib (*Abstract Co-Author*) Nothing to Disclose
Yan Chen, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Artificial intelligence (AI) models are likely to be updated whilst already embedded into screening workflows. Testing these new models through traditional research methods may be too slow in determining if these new models are safe to the public. We outline a method of rapidly evaluating different versions of the same AI model using the same Personal Performance in Mammographic Screening (PERFORMS) external quality assurance (EQA) scheme used to test humans.

### METHODS AND MATERIALS

In this study, ten PERFORMS test sets including 1200 breasts sourced from multiple centres in the United Kingdom National Health Service breast cancer screening programme were evaluated by three consecutive versions of the same commercially available AI algorithm between 2022-2024. Version (V) 1 was the earliest version of the AI, whilst V3 was the most recent. Test sets contained a mixture of challenging cases including interval cancers specially selected by an expert panel of radiologists. Each breast was considered separately. For pathologically proven malignancies a lesion level analysis was conducted, where the location of marked regions of interest were considered for AI. The highest score was recorded per lesion. For non-malignant breasts, a breast level analysis was conducted, where the highest score per breast was recorded. Sensitivity and specificity were calculated for AI. The study was powered to detect a medium-sized effect (odds ratio, 3.5 or 0.29) for sensitivity.

### RESULTS

Three versions of the same AI model were monitored using a test set comprising of 882 non-malignant breasts and 328 malignant lesions. When using the developer's suggested recall score threshold, the sensitivities for AI V1, V2 and V3 were 87%, 89% and 83% respectively. AI V3 exhibited significant variation in its sensitivity when compared to V2 (OR 0.60, p=.027). When comparing specificity at the same threshold, no difference was observed between V1 (87%), V2 (88%) and V3 (90%), p=.18.

### CONCLUSION

Reliability testing of updated AI models already integrated into clinical practice is of paramount importance to detect for performance drift during updates and to assist in the recalibration of AI recall thresholds.

## CLINICAL RELEVANCE/APPLICATION

Rapidly testing newer versions of the same AI model on the same homogenous EQA test sets may enable the detection of subtle changes in performance. Such methods could inform a novel framework used in the post-market surveillance of AI models.
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# Abstract Archives of the RSNA, 2024

M2-SPCA

**Cardiac Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPCA-1 SYNTHETIC EXTRACELLULAR VOLUME FRACTION DERIVED USING DEEP LEARNING WITH A CONVOLUTIONAL NEURAL NETWORK

Yusuke Kobayashi (*Abstract Co-Author*) Nothing to Disclose
Takuya Matsuda (*Abstract Co-Author*) Nothing to Disclose
Wataru Toshimori (*Abstract Co-Author*) Nothing to Disclose
Teruhito Kido, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuki Tanabe (*Abstract Co-Author*) Nothing to Disclose
Takaaki Hosokawa (*Abstract Co-Author*) Nothing to Disclose
Kazuki Yoshida, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The extracellular volume fraction obtained using cardiac computed tomography (CT)-extracellular volume fraction (CT-ECV) was used to assess myocardial fibrosis. However, laboratory blood hematocrit (Hct) measurements are also required. We hypothesized that the application of deep learning (DL) with a convolutional neural network (CNN) can predict Hct from calcium score images and calculate ECVDL without requiring a blood sampling.

### METHODS AND MATERIALS

We enrolled 270 patients who underwent cardiac CT and laboratory blood hematocrit examinations on the same day. We cropped five axial calcium score images (five-slice gaps) from the bronchial bifurcation level. Among them, 216 (864 axial images), 54 (216 axial images), and 40 patients (200 axial images) were assigned to the training dataset for DL model development, validation, and testing, respectively. Furthermore, in the test dataset, we evaluated ECV estimation using HctDL. The original ECV was calculated by blood sampling Hct using dedicated software. ECVDL was calculated using the HctDL. The correlations between Hct and HctDL, original ECV, and ECVDL were assessed using Spearman's rank correlation test and a Bland-Altman analysis.

### RESULTS

No significant difference was found between Hct and HctDL at the patient level (35.5 ± 4.0% vs. 36.2 ± 2.9%, respectively, $p = 0.26$). HctDL and Hct levels were moderately correlated ($r = 0.65$, $p < 0.01$). Bland-Altman analysis showed slight bias (-0.681%) between HctDL and Hct with 95% limits of agreement of -6.6 and 5.3. There was no significant difference between ECV and ECVDL at the patient level (28.6%, 26.6-32.9% vs. 28.2%, 25.8-33.3 %, respectively; $p = 0.36$). ECVDL and original ECV were strongly correlated ($r = 0.99$, $p < 0.001$). The Bland-Altman analysis showed slight bias (0.227%) between ECVDL and the original ECV with 95% limits of agreement of -2.78 and 3.24 at the patient level.

### CONCLUSION

A reliable ECV estimation can be achieved using calcium score images and DL with a CNN. The ECVDL values calculated from HctDL showed excellent agreement with the original ECV, indicating the robustness of the ECV estimation without the need for blood sampling.

### CLINICAL RELEVANCE/APPLICATION

Hct derived from calcium score images using DL with a CNN enables the accurate quantification of the myocardial extracellular volume fraction by cardiac CT without the need for blood sampling. Overcoming blood sampling limitations could expand the usefulness of CT-ECV for myocardial tissue characterizations.

## M2-SPCA-10 AI-ENABLED CARDIAC CHAMBERS VOLUMETRY IN CORONARY ARTERY CALCIUM (CAC) SCANS (AI-CAC) SIGNIFICANTLY IMPROVES ON AGATSTON CAC SCORE FOR PREDICTING ALL CARDIOVASCULAR EVENTS: THE MULTI-ETHNIC STUDY OF ATHEROSCLEROSIS

David F. Yankelevitz, MD (*Abstract Co-Author*) Consultant, Accumetra LLC;Stockholder, Accumetra LLC;Medical Advisory Board, Carestream Health, Inc;Royalties, General Electric Company;Consultant, AstraZeneca PLC;Consultant, Pfizer Inc;Consultant, F. Hoffmann-La Roche Ltd
Sabee Y. Molloi, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Tom Atlas, MD (*Abstract Co-Author*) Nothing to Disclose
Chenyu Zhang (*Abstract Co-Author*) Nothing to Disclose
Kyle Atlas (*Abstract Co-Author*) Nothing to Disclose
Jagat Narula, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Claudia I. Henschke, MD,PhD (*Abstract Co-Author*) Advisory Board, LungLifeAI, Inc;Board Member, Early Diagnosis and Treatment Research Foundation Inc
Michael V. McConnell, MD (*Abstract Co-Author*) Research support, General Electric Company
Nathan Wong, PhD (*Abstract Co-Author*) Nothing to Disclose

Zahi A. Fayad, PhD (*Abstract Co-Author*) Nothing to Disclose
Anthony P. Reeves, PhD (*Abstract Co-Author*) Stockholder, VisionGate, Inc;Patent agreement, General Electric Company;President, D4vision, Inc
Matthew J. Budoff, MD (*Abstract Co-Author*) Nothing to Disclose
David J. Maron, MD (*Abstract Co-Author*) Nothing to Disclose
Morteza Naghavi (*Presenter*) Nothing to Disclose

**PURPOSE**

Coronary artery calcium (CAC) scans contain valuable information beyond the Agatston Score which is currently reported for predicting coronary heart disease (CHD) only. We examined whether new artificial intelligence (AI) algorithms applied to CAC scans may provide significant improvement in prediction of all cardiovascular disease (CVD) events in addition to CHD, including heart failure, atrial fibrillation, stroke, resuscitated cardiac arrest, and all CVD-related deaths.

**METHODS AND MATERIALS**

We applied AI-enabled automated cardiac chambers volumetry and automated calcified plaque characterization to CAC scans (AI-CAC) of 5830 individuals (52.2% women, age 61.7±10.2 years) without known CVD that were previously obtained for CAC scoring at the baseline examination of the Multi-Ethnic Study of Atherosclerosis (MESA). We used 15-year outcomes data and assessed discrimination using the time-dependent area under the curve (AUC) for AI-CAC versus the Agatston Score.

**RESULTS**

During 15 years of follow-up, 1773 CVD events accrued. The AUC at 1-, 5-, 10-, and 15-year follow up for AI-CAC vs Agatston Score was (0.784 vs 0.701), (0.771 vs. 0.709), (0.789 vs.0.712) and (0.816 vs. 0.729) ($p<0.0001$ for all), respectively. The category-free Net Reclassification Index of AI-CAC vs. Agatston Score at 1-, 5-, 10-, and 15-year follow up was 0.31, 0.24, 0.29 and 0.29 ($p<.0001$ for all), respectively. AI-CAC plaque characteristics including number, location, and density of plaque plus number of vessels significantly improved NRI for CAC 1-100 cohort vs. Agatston Score (0.342).

**CONCLUSION**

In this multi-ethnic longitudinal population study, AI-CAC significantly and consistently improved the prediction of all CVD events over 15 years compared with the Agatston score.

**CLINICAL RELEVANCE/APPLICATION**

Opportunistic screening of enlarged cardiac chambers in non-contrast CT scans enables detection of asymptomatic patients at high risk for CVD.

## M2-SPCA-3 PRECISION OF AUTOMATED CARDIAC CHAMBERS AND GREAT VESSEL VOLUME SEGMENTATION IN DIFFICULT CASES USING AN OPEN SOURCE FULL BODY SEGMENTATION MODEL

Matthias S. May, MD (*Abstract Co-Author*) Speakers Bureau, Siemens AG
Leonard Stepansky (*Abstract Co-Author*) Nothing to Disclose
Lisa Sommerfeld (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the precision of automated cardiac and great vessel segmentation using the 'Total Segmentator' (TS) by Wasserthal et al. in patients with structural abnormalities.

**METHODS AND MATERIALS**

The study involved 89 CT scans, including a control group of clinical routine cases and 13 balanced study groups representing various structural abnormalities (Chest wall deformities, hypertrophic cardiomyopathies (HCM), aortic, mitral or tricuspid valve replacement, left ventricular assist devices (LVAD), newborns (under age one), preschool children (age one to four), elementary school children (age five to nine), secondary school children (age ten to sixteen), adults with transposition of the great arteries (TGA), situs inversus or Fontan circulation). Imaging was retrospectively chosen from multiple CT scanners from the years 2012 to 2024, utilizing soft tissue kernel and intravenous contrast agents. Automated segmentation of six mediastinal structures (left and right atrium and ventricle, aorta, pulmonary artery) was followed by manual corrections. Statistical analysis with the dice coefficient and surface dice ensued.

**RESULTS**

The model performed well (dice=0.9) on clinical routine cases. It did not perform significantly (pgt0.05) inferior on patients with chest wall deformities (dice=0.87), HCMs (dice=0.88), aortic (dice=0.87), mitral (dice=0.88) and tricuspid valve replacements (dice=0.88). LVADs were segmented adequate (dice=0.87), except for the left heart (atrium surface dice=0.2, ventricle dice=0.69). In children below one year of age, the TS didn't reliably detect the structures (dice=0.23). The precision increased with age. Only the great arteries were segmented inferior in patients between 10 and 16 years (total dice=0.88, aorta surface dice=0.51, pulmonary surface dice=0.37). In adults with congenital heart disease the algorithm performed inferior than on the clinical routine collective with a dice of 0.46 in patients with TGA, 0.38 in patients with a situs inversus and 0.43 in patients with Fontan circulation.

**CONCLUSION**

The algorithm provides dependable results for segmentation in clinical routine patients, patients with chest wall deformities, HCM and replaced heart valves. In patients with a LVAD only the segmentation of the left heart is inconsistent. Patients aged 0 to 9 need manual segmentation. Adolescents between 10 and 16 years of age had good results of the heart chambers, but the great arteries were limited. In adults with congenital heart disease the algorithm does not perform adequate.

**CLINICAL RELEVANCE/APPLICATION**

These findings indicate that in clinical practice, full body algorithms are sufficient for most heart measurements, but corrections are required for certain pathologies and age groups.

## M2-SPCA-5 OPTIMIZING AI THRESHOLDS FOR THE DETECTION OF ACTIONABLE CORONARY ARTERY CALCIUM IN CHEST CT IMAGING: A VALIDATION STUDY AGAINST HUMAN SCORING

Travis Browning, MD (*Abstract Co-Author*) Consultant, Change Healthcare
Maya Wiessman (*Abstract Co-Author*) Nothing to Disclose
Suhny Abbara, MD (*Abstract Co-Author*) Royalties, RELX
Arzu Canan, MD (*Abstract Co-Author*) Nothing to Disclose
Parag Joshi (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Peshock, MD (*Abstract Co-Author*) Stockholder, General Electric Company;Researcher, Siemens AG;Researcher, Aidoc Medical

Wyatt Miller (*Abstract Co-Author*) Nothing to Disclose
Ann Marie Navar (*Abstract Co-Author*) Nothing to Disclose
Fernando U. Kay, MD, PhD (*Presenter*) Research Grant, Edwards Lifesciences Corporation

**PURPOSE**

We implemented an AI software to quantify coronary artery calcium volume (AI-CACvol) in chest CT scans at UT Southwestern in September 2022. Our goal was to retrospectively establish optimal detection thresholds for actionable CAC and validate their performance in a post-implementation population. AI results were compared against qualitative human CAC scoring (H-CACqual).

**METHODS AND MATERIALS**

Eligible patients had undergone a non-contrast chest CT and a cardiac CT with Agatston CAC scoring (CACscore, standard of reference). CACvol was calculated using commercially available AI software (AI Rad Companion, Siemens), and H-CACqual involved subjective CAC scoring by a board-certified radiologist following 2016 SCCT/STR guidelines.

**RESULTS**

The derivation cohort included 333 patients (59% female, median age 62 years, range 28-92 years). Median AI-CACvol was 21.0 $mm^3$ (IQR: 193.0 $mm^3$); median CACscore was 30.7 AU (IQR: 250.0 AU). The Pearson's correlation coefficient for log-transformed AI-CACvol and CACscore was 0.91 (95% CI: 0.88-0.92). H-CACqual showed significant association with CACscore, Spearman's correlation coefficient 0.90 (95% CI: 0.88-0.92). ROC curve analysis for detecting CACscore = 100 AU showed an AUC of 0.97 for AI-CACvol vs. 0.92 for H-CACqual ($p < 0.001$). Optimal thresholds were 70.1 $mm^3$ for AI-CACvol and "moderate" or greater for H-CACqual. In the prospective cohort of 39 patients (75% female, median age 67 years, range 46-80 years), median CACscore was 43 AU (IQR: 215 AU). Using the optimized threshold, AI-CACvol achieved 100% sensitivity and 88% specificity for detecting higher-risk patients, compared with 71% sensitivity and 100% specificity for H-CACqual.

**CONCLUSION**

AI-CACvol correlates strongly with the Agatston method and could be a precise, accessible metric for opportunistic cardiovascular risk screening.

**CLINICAL RELEVANCE/APPLICATION**

AI-CACvol is offering high-performance thresholds that might inform future automated best practice alerts.

## M2-SPCA-7 DEEP LEARNING FOR CORONARY ARTERY CENTERLINE EXTRACTION FROM CORONARY CT ANGIOGRAPHY

Antonio Esposito, MD (*Abstract Co-Author*) Support, Bracco Group;Speakers Bureau, Bayer AG
Alberto Colombo (*Abstract Co-Author*) Nothing to Disclose
Davide Vignale (*Abstract Co-Author*) Nothing to Disclose
Anna Palmisano, MD (*Abstract Co-Author*) Nothing to Disclose
Francesco Pisu (*Presenter*) Nothing to Disclose

**PURPOSE**

Coronary Computed Tomography angiography (CCTA) represents the non-invasive imaging of choice for the assessment of coronary artery disease (CAD). Multi-planar reconstructions of vessels by means of centerlines enable stenosis detection and plaque identification and are needed to extract radiomic features for research. However, manual delineation is unfeasible and commercially available tools are not suitable for research due to several limitations: inaccurate tracing of centerlines, particularly near bifurcations; frequent errors in mapping the lumen centerline requiring manual edits; and a lack of automated batch processing capabilities. Aim of the present study is to develop a fully-automated deep-learning (DL) based method to accurately extract topology-preserving coronary centerlines from CCTA images.

**METHODS AND MATERIALS**

A 2D U-Net model was trained to segment the coronary lumen. For each anatomical axis, the network predicted the likelihood of each voxel belonging to the lumen, followed by a majority voting retaining voxels selected by at least two views. Lumen meshes were extracted via marching cubes and clipped at the ostia. Centerline extraction involved tracing the paths of steepest descent of the eikonal solution solved on the embedded Voronoi diagram. Performance were evaluated based on overlap with manual annotations through Intersection over Union (IoU), F1-score, total overlap (OV) and average distance (AD). The model was trained on 64 CCTA - 40 from the public ASOCA dataset and 24 from our institution - and evaluated on 20 unseen cases presenting different CAD severity scores. CCTA were acquired using multi-vendor scanners with prospective and retrospective ECG gating and reconstructed at end-diastolic, end-systolic and in 10% increments. In-plane resolution was 0.3-0.4 mm and slice thickness was 0.3-0.62 mm.

**RESULTS**

The method showed high accuracy in segmentation and centerline extraction. Class-specific mean IoU was 76%±3 and F1-score was 0.87±0.02. Mean centerline OV was 92%±0.09, with AD of 0.48mm±0.06 from the reference, which was close to the mean voxel size. It was also computationally efficient, with the entire pipeline processing an exam in approximately 50 seconds.

**CONCLUSION**

This study confirms the effectiveness of a DL-based method for automated centerline extraction from CCTA. The approach extracts highly accurate centerlines in a short time, making it suitable for clinical workflows, large-scale studies and precise segmental analysis of periluminal tissue.

**CLINICAL RELEVANCE/APPLICATION**

The proposed pipeline supports rapid and accurate coronary centerline extraction, thus potentially speeding up stenosis and plaque characterization, crucial for timely and effective patient care in cardiology.

## M2-SPCA-8 REAL-WORLD CLINICAL DEPLOYMENT AND VALIDATION OF MACHINE-LEARNING ALGORITHM FOR CORONARY ARTERY CALCIUM SCORING ON LUNG CANCER SCREENING LOW DOSE CT EXAMS: INITIAL INSIGHTS

Leslie Ciancibello, RT (*Abstract Co-Author*) Nothing to Disclose
Cody R. Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Robert C. Gilkeson, MD (*Abstract Co-Author*) Research Consultant, Riverain Technologies, LLC;Research support, Koninklijke Philips NV;Research support, Siemens AG;Research support, General Electric Company;Consultant, HeartFlow, Inc
Syed Muhammad Awais Bukhari, MD (*Abstract Co-Author*) Nothing to Disclose
Joshua Hunter, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate, in a real-world clinical setting, the accuracy of a machine learning algorithm (MLA) in coronary artery calcium (CAC) scoring on lung cancer screening (LCS) low-dose CT (LDCT) chest exams and the potential to replace dedicated CAC scoring exams.

**METHODS AND MATERIALS**

49 patients (55% female, 61 ± 6 y/o) were identified who underwent ECG-gated cardiac CT (CCT) for CAC scoring and LCS LDCT on the same day since real-world deployment of a MLA (Bunkerhill Inc., CAC Version 1.3.0) that computes CAC score on LDCT. To further evaluate reliability of the MLA's scoring, manual scoring on LDCT was also performed. Agatston CAC scores and resultant risk category were recorded for all three methods. Performance metrics of LDCT-derived scores were calculated with the CCT-derived score as ground truth. Mean difference in scores and agreement on risk category were evaluated with Bland-Altman analysis and Cohen's kappa, respectively.Dose length product (DLP) was recorded for radiation analysis. A cardiothoracic radiologist performed a subjective visual analysis to determine the preferred calcium score between CCT and LDCT exam for all patients.

**RESULTS**

On LDCT, the MLA achieved accuracy, sensitivity and specificity of .94, .95 and .91, respectively, for detection of CAC. The MLA's risk category matched CCT's in 78% of exams and differed by one in the rest, signifying excellent agreement (Kappa = 0.84). Bland-Altman analysis revealed a mean difference of 4.1 in CAC score (p = 0.85; Wilcoxon matched pairs test). Separately, MLA and manual scoring of LDCT agreed on risk category in 76% of exams and differed by one in the rest, signifying excellent agreement (Kappa = 0.83). Average DLP (mGy·cm) was 72.7 ± 15.8 in CCT and 125.0 ± 24.2 in LDCT, demonstrative of potential to reduce radiation exposure by 35% if LDCT CAC score is used. Radiologist's subjective preference for CAC score by exam type was CCT in 35%, LDCT in 16%, and no preference in 49% of cases.

**CONCLUSION**

In real-world clinical use, the MLA demonstrated excellent accuracy in computing and risk stratifying CAC from LCS LDCT exams. Cases of clinically relevant differences in CAC score highlight how radiologists must serve as gatekeepers of AI; for example, noting possible sources of MLA errors to infer inaccuracies in automated CAC scores. The reliability of MLA-assisted CAC scoring on LDCT shows that ECG-gated CCT may be unnecessary in most patients undergoing LCS, which could potentially reduce radiation by 35% in a population vulnerable to radiation's harms.

**CLINICAL RELEVANCE/APPLICATION**

MLA tools for CAC scoring on LDCT exams in real-world clinical practice are reasonably accurate and, in the future, can potentially replace dedicated CAC scoring exams to reduce radiation exposure in most patients undergoing LCS.

## M2-SPCA-9 IMPROVING THE QUALITY OF ENERGY-INTEGRATING CARDIAC CT WITH HIGH RESOLUTION RECONSTRUCTION AND AI-DENOISING TO APPROACH STATE-OF-THE-ART PHOTON COUNTING DETECTOR CT

Jeffrey Marsh JR, BS (*Abstract Co-Author*) Nothing to Disclose
Shaojie Chang, PhD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Kevin J. Treb, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Recent introduction of photon counting detector CT (PCD-CT) has shown high-resolution (HR) and improved quantitative accuracy in coronary CT angiography (cCTA). However, the limited number of PCD-CT scanners constrains its impact as 99% of CT scanners are based on energy-integrating detectors (EID). This study aims to improve the image quality of EID-CT in cCTA, leveraging HR reconstruction and AI denoising techniques to approach the performance of state-of-the-art PCD-CT.

**METHODS AND MATERIALS**

Ten cCTA patients were scanned on EID-CT scanners (Force, Siemens) and two sets of images were reconstructed: routine images (Bv40 kernel), and sharp images (Bv59 kernel). Iterative reconstruction (IR) at strengths 1 and 4 were applied. A U-Net architecture convolutional neural network (CNN) was developed and trained for denoising. Briefly, thicker slice (3 mm) images with lower noise were reconstructed, serving as the label. A noise map was generated by subtracting the IR4 and IR1 reconstructions of thin slice (0.6 mm), which were then added to the labels to create noisy input to the network. Standard data augmentation techniques were applied and mean square error served as the loss function. The trained model was tested on an independent patient cohort of 5 cCTA cases, each of whom had undergone both EID-CT and PCD-CT (NAEOTOM Alpha, Siemens) scans on the same day. EID-CT images reconstructed with Bv59 and 0.6 mm slice thickness were processed through the trained model. The AI output ("sharp-denoised" EID-CT image) was compared to both routine EID-CT (Bv40) and HR PCD-CT images (Bv60 with 0.2 mm slice thickness).

**RESULTS**

AI output images demonstrated an 80% average reduction in noise compared to the input images. Difference images between AI inputs and outputs showed noise without any observable edge structures, confirming that the spatial resolution of the input images was maintained. Compared to the routine EID-CT (Bv40), AI output images showed substantial improvement in spatial resolution without increasing image noise. The AI output images more closely matched the quality of PCD-CT images in terms of spatial resolution and noise, particularly in resolving small coronary calcifications and small branches of coronary arteries not visible with routine EID-CT.

**CONCLUSION**

With sharper reconstructions and AI denoising, the quality of cardiac CT images from EID-CT can be enhanced, approaching the performance of state-of-the-art PCD-CT.

**CLINICAL RELEVANCE/APPLICATION**

Improving the quality of readily available EID-CT with AI may be a cost-effective and accessible alternative to purchasing a PCD-CT to improve cardiac CT image quality, which has a potential for widespread impact given the large installed base of EID-CT.

# Abstract Archives of the RSNA, 2024

M2-SPCH

**Chest Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPCH-1 INTERCOSTAL MUSCLE VOLUME MEASURED BY DEEP-LEARNING BASED AUTOMATIC SEGMENTATION IN CHRONIC INTERSTITIAL PNEUMONIA: ASSOCIATION WITH DEGREE OF RESTRICTIVE AND DIFFUSING IMPAIRMENT AND PULMONARY FIBROSIS EXTENT

Yasutaka Nakano, MD, PhD (*Abstract Co-Author*) Speaker, Boehringer Ingelheim GmbH;Speaker, GlaxoSmithKline plc;Speaker, AstraZeneca PLC;Speaker, Olympus Corporation
Yuto Masaki (*Abstract Co-Author*) Nothing to Disclose
Yoshito Otake (*Abstract Co-Author*) Nothing to Disclose
Yoko Murakami, MD (*Abstract Co-Author*) Nothing to Disclose
Yukihiro Nagatani, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Nakagawa (*Abstract Co-Author*) Nothing to Disclose
Yoko Hirayama, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshinobu Sato, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshiyuki Watanabe, MD, PhD (*Abstract Co-Author*) Research Grant, Sumitomo Dainippon Pharma Co, Ltd;Research Grant, Canon Medical Systems Corporation
Kenta Tanimura, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To segmentate intercostal muscle by using deep-learning (DL)-based automatic segmentation on computed tomography (CT) and evaluate the association between volume or density of intercostal muscles with respiratory dysfunction as well as the degree of pulmonary fibrosis and breathlessness in chronic interstitial pneumonia (IP)

### METHODS AND MATERIALS

DL-based automated intercostal muscle segmentation algorithm was applied on unenhanced chest CT in 36 patients with chronic IP, which consists in 10 idiopathic pulmonary fibrosis, 17 connective tissue disease-related IP and 9 IP with other etiology. Volumes of 1st to 7th bilateral intercostal muscles (VICM), lean VICM and mean CT density (MCTD) of ICM were measured. The associations of the 3 measured values with pulmonary function test parameters as well as the ratio of honeycomb area to the total lung fields (%HA) quantified as the extent of pulmonary fibrosis were examined with Spearman's rank correlation coefficients. The 3 measured values were also compared between 2 sub-groups classified according to the presence of IPF or that of strong breathlessness based on modified medical research council dyspnea scale (mMRC) using the Mann-Whitney U tests.

### RESULTS

%FVC of the included IP patients ranged from 35 to 129 (81.8±22.3). Measured VCIM varied from 98.3 to 344.1 mm3 (223±60 mm3). In addition to positive association with height and body weight, lean VCIM correlated positively with %FVC (r=0.385, p=0.021) and %DLco (r=0.443, p=0.008), and negatively with %HA (r=-0.512, p=0.002). VCIM tended to be lower in 7 strong breathless IP patients (182±56 mm3) with mMRC of 2 to 4 as compared with 29 weak breathless IP patients with mMRC of 0 to 1 (233±57 mm3) (p=0.063). MCTD of CIM in 26 non-IPF patients (3.3±12.0 HU) was lower than that in 10 IPF patients (-7.4±13.7 HU) (p=0.020).

### CONCLUSION

Despite small amount in the measurement, lean VCIM quantified with DL-based automatic segmentation demonstrated to decrease as the restrictive or diffusing impairment got prominent or the pulmonary fibrosis got enlarged. Moreover, the decrease in measured VCIM was implied in association with exacerbation of the breathlessness.

### CLINICAL RELEVANCE/APPLICATION

DL-based automatic VCIM measurement can be sensitive to temporal change in VCIM and useful for the objective evaluation of therapeutic effect by respiratory rehabilitation in chronic IP patients.

## M2-SPCH-2 QUANTITATIVE EVALUATION OF DISEASE SEVERITY OF CONNECTIVE TISSUE DISEASE ASSOCIATED INTERSTITIAL LUNG DISEASE USING LOW-DOSE PHOTON COUNTING CT

Zhoumeng Ying (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Lan Song, MD (*Abstract Co-Author*) Nothing to Disclose
Yang Yu, MENG (*Abstract Co-Author*) Employee, Siemens AG
Zhenchen Zhu, MD, MEng (*Presenter*) Nothing to Disclose

### PURPOSE

Patients with connective tissue disease (CTD)-associated interstitial lung disease (CTD-ILD) usually require long-term follow-up of high-resolution CT examination and are thus at increased risk of radiation exposure. The goal of the study is to assess whether the Sn-filtered low-dose photon-counting detector (PCD) CT (PCD-LDCT) can quantify the severity of CTD-ILD.

### METHODS AND MATERIALS

Patients were prospectively recruited from a CTD-ILD cohort between November 2023 and April 2024. Patients received standard-dose PCD-CT (PCD-SDCT) followed by PCD-LDCT on the same day. CT images of 1mm slice thickness were constructed with Bl60 and Qr56 kernel. Total visual extent (TVE) was rated manually on Bl60 PCD-SDCT images. CTD-ILD was classified into extensive and limited group using combined forced vital capacity (FVC)% predicted and TVE. The normal lung volume percentage (NL%: -700~-950 HU), ILD volume% (ILD%: -200~-700 HU) and mean lung density (MLD) were individually calculated by CT Pulmo 3D from Qr56 images and compared between the radiation protocols using paired student t-test. Receiver operating characteristic (ROC) analysis and Pearson correlation analysis were performed with PCD-LDCT-derived parameters.

### RESULTS

Twenty-six patients (mean 57 ± 10 years old; 18 females) were included. The effective dose of PCD-LDCT was nearly 7 times lower than PCD-SDCT (0.33 vs. 2.30 mSv). TVE rated by 2 radiologists reached substantial agreement (weighted ? = 0.81). Lower NL% (83.8% vs. 75.0%, P = 0.006), higher ILD% (11.4% vs. 19.4%, P = 0.004) and higher MLD (-817 HU vs. -766 HU, P = 0.002) were found in extensive CTD-ILD compared with limited group. NL% had significant moderate correlation with FVC% predicted (r = 0.43, P = 0.03) and strong correlation with DLCO% predicted (r = 0.70, P < 0.001). ROC analysis indicated ILD% (AUC = 0.846, cutoff = 17.9, sensitivity = 63.3%, specificity = 93.3%), NL% (AUC = 0.827, cutoff = 78.9, sensitivity = 72.7%, specificity = 93.3%) and MLD (AUC = 0.833, cutoff = -803, sensitivity = 81.8%, specificity = 80.0%) had good performance for extensive CTD-ILD discrimination. The PCD-LDCT quantitative parameters reached comparable results to that of PCD-SDCT for ILD% (mean absolute difference, MAD = 0.76%, P = 0.07) and MLD (MAD = 4 HU, P = 0.343), except for NL% (MAD = 2.1%, P < 0.001).

### CONCLUSION

Our results highlight the potential of PCD-LDCT in quantitative evaluation of CTD-ILD severity while significantly reducing radiation exposure for patients.

### CLINICAL RELEVANCE/APPLICATION

Our study proposes an easy approach to quantify CTD-ILD severity using PCD-LDCT and demonstrated their correlation with pulmonary function test. Besides, the result of our study brings promise to those patients who are at increased risk of radiation exposure.

## M2-SPCH-3 PUSHING THE LIMIT OF SPATIAL RESOLUTION IN PHOTON-COUNTING-DETECTOR CT FOR IMAGING INTERSTITIAL LUNG DISEASE USING A DEDICATED HIGH-RESOLUTION CONVOLUTIONAL NEURAL NETWORK

Chi Wan Koo, MD (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Patricia J. Mergo, MD (*Abstract Co-Author*) Nothing to Disclose
Prabhakar Rajiah, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Alex K. Bratt, MD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Zhongxing Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To clinically evaluate an ultra-high-resolution convolutional neural network (UHR-CNN) developed to reduce noise and achieve the highest spatial resolution on photon-counting-detector (PCD) CT for interstitial lung disease (ILD).

### METHODS AND MATERIALS

A PCD-CT (Alpha, Siemens) scanned 50 patients with suspected ILD using the UHR mode (120x0.2 mm). Three methods were used to reconstruct the images: (1) Clinical standard of care: medium sharp kernel (Qr56) with iterative reconstruction (IR) and a pixel size of 0.41 mm (410-mm FOV and 1024 matrix), (2) sharpest quantitative kernel (Qr89) with IR and 0.15 mm pixel size (150-mm FOV and 1024 matrix), (3) Qr89 with UHR-CNN, 0.15 mm pixel size (150-mm FOV and 1024 matrix). Three thoracic radiologists evaluated these reconstruction methods for each case in a randomized, blinded fashion. Radiologists rated the likelihood of each of five imaging findings: reticulation, ground-glass opacities (GGO), mosaic pattern, traction bronchiectasis, honeycombing, lower lobe predominance, peripheral lung predominance, and probability of usual interstitial pneumonia (UIP) (5-point scale: 1=very low probability, 2=low probability, 3=indeterminate, 4=high probability, 5=very high probability). Magnitude score (the absolute difference of confidence scores from 3 [equivocal]) was used for analysis (higher scores indicated greater confidence). Radiologists also rated subjective image quality in terms of noise, artifacts (1-4, 4= excellent), spatial resolution, and overall image quality (1-5, 5=excellent).

### RESULTS

Qr89-HR-CNN had the highest overall diagnostic image quality among the 3 reconstructions: 4.68 vs 3.95 (Qr89-IR) vs 3.97 (Qr56-IR), p<0.001. The magnitude scores in Qr89-HR-CNN were significantly higher than Qr56-IR for imaging findings of reticulation (1.56 vs 1.37; p <0.001), GGO (1.67 vs 1.55; p <0.001), mosaic pattern (1.43 vs 1.37, p<0.05), traction bronchiectasis (1.75 vs 1.57, p<0.001), peripheral lung predominance (1.61 vs 1.57, p<0.05). No significant difference was found for honeycombing, lower lung predominance and diagnosis of UIP (p>0.05).

### CONCLUSION

The sharpest quantitative reconstruction available on the PCD-CT (0.15 mm) with the proposed UHR-CNN denoising method improved the overall diagnostic image quality and reader confidence for presence or absence of imaging findings of reticulation, GGO, mosaic pattern, traction bronchiectasis, and peripheral lung predominance in patients with suspected ILD.

### CLINICAL RELEVANCE/APPLICATION

The highest spatial resolution achievable with PCD-CT is not currently utilized clinically. Our proposed UHR-CNN decreased noise at increased resolution, which is likely beneficial in the diagnosis of interstitial lung disease.

## M2-SPCH-4 DEFINING QUANTITATIVE RISK THRESHOLDS FOR INTERSTITIAL LUNG ABNORMALITIES (ILA) AND THEIR PROGNOSTIC ASSOCIATIONS IN ASIAN HEALTH SCREENING POPULATIONS

Kyubin Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Seungbaek Hong, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jong Eun Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Jiyun Ok (*Abstract Co-Author*) Nothing to Disclose
Yeon Joo Jeong, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study is to define quantitative risk thresholds for ILAs with correlation to long-term prognostic outcomes using deep learning-based ILA quantification at CT scans of an Asian health screening population.

**METHODS AND MATERIALS**

This retrospective study included participants aged 50 years or older who underwent chest CT scans at two health screening centers over a 7-year period (2007-2013). ILA status was classified as none, equivocal ILA, and ILA (either nonfibrotic or fibrotic), assessed visually. The extent of ILA was quantitatively assessed using a deep learning-based approach for ILA quantification. Multivariable Cox proportional hazards models were utilized to evaluate the association between the extent of ILA and the hazards of disease-related adverse events (lung cancer development, interstitial lung disease development, and disease-specific mortality) and all-cause mortality.

**RESULTS**

A total of 2427 participants were included in this study. ILAs were visually identified in the CT scans of 55 individuals (2%), and equivocal ILAs were observed in 63 individuals (3%). The mean extent of ILA, as measured by the quantitative system, was 3.3% for the ILA group and 0.5% for the equivocal ILA group. When dividing the groups by setting thresholds of 0-1%, 1-3%, 3-5%, and 5% or more according to ILA extent, the groups with 5% or more ILA and 3-5% ILA were independently associated with disease-related adverse events (HR, 28.2; 95% CI: 8.2, 96.6; P < .001, and HR, 5.8; 95% CI: 1.7, 20.0; P = 0.005, respectively) and all-cause mortality (HR, 5.2; 95% CI: 1.6, 16.9; P = 0.005, and HR, 5.4; 95% CI: 2.3, 12.7; P < .001, respectively) compared with those having no ILA.

**CONCLUSION**

The threshold for ILA extent associated with long-term prognostic outcomes, determined by deep learning-based ILA quantification, was evaluated to be 3% or more of the total lung volume.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning-based ILA quantification can be used to evaluate long-term prognostic outcomes in health screening populations.

## M2-SPCH-6 THE CAPABILITY OF DEEP-RADIOMICS TO PREDICT PATHOLOGICAL RESPONSE TO NEOADJUVANT IMMUNOCHEMOTHERAPY IN NON-SMALL CELL LUNG CANCER: A RETROSPECTIVE MULTICENTER STUDY

Guoliang Shao (*Abstract Co-Author*) Nothing to Disclose
Xiaoyun Liang (*Abstract Co-Author*) Nothing to Disclose
Yuanxin Ye (*Abstract Co-Author*) Nothing to Disclose
Yuchi Tian (*Presenter*) Nothing to Disclose

**PURPOSE**

To establish a predictive model that combines radiomics, deep learning and clinical features for predicting the pathological complete response (pCR) of non-small cell lung cancer (NSCLC) patients after neoadjuvant immunochemotherapy (NIT).

**METHODS AND MATERIALS**

We retrospectively collected patients from three centers, of which center 1 was split into training and internal testing cohorts in a 7:3 ratio, and centers 2 and 3 were combined into an external testing cohort. In this study, tumor segmentation was performed on chest CT images before (pre-NIT) and after (post-NIT) neoadjuvant therapy. Radiomics features were extracted using Pyradiomics to build pre-NIT and post-NIT feature groups. And delta 1, 2, and 3 feature groups were built based on three delta radiomics formulas. For deep learning (DL) features, a pretrained 3D Restnet-18 was used to extract features from the post-NIT images, and the outputs of 512 neurons from the last fully connected layer of the network were used as DL features to build DL feature group. The most meaningful features were selected using the mRMR and LASSO. A logistic regression classifier was then applied to create a classification model to predict the pathological response (pCR or non-pCR). We refer to the probability predicted from radiomics features as the Rad-scores, and from DL features as the Deep-scores. Finally, Rad-scores, Deep-scores, and meaningful clinical features were used to build a combined model and plot a nomogram. The model was validated in the internal and external testing cohorts. The ROC and DCA curves were employed to evaluate model performance.

**RESULTS**

A total of 178 patients were enrolled in the current study. In conventional radiomics, the efficacy of post-NIT model was better than the pre-NIT, with AUCs of 0.825(training) and 0.832(testing), respectively. In delta radiomics model, delta1 had best efficacy, with the AUC of 0.942 and 0.810, respectively. Subsequently, the post-NIT and delta1 features were further constructed as the combined model 1 with AUCs of 0.939 and 0.849, respectively. The AUCs of the DL model were 0.832 and 0.818, respectively. Only iRECIST clinical factor (p = 0.007) was combined with the radiomics and the DL features to establish the combined model 2, which achieved the best performance among all the models, with AUCs of 0.955, 0.882, and 0.839 for the training, internal and external testing cohorts, respectively.

**CONCLUSION**

Our results demonstrated that combination of three dimensional features can provide complementary information to predict pCR more accurately.

**CLINICAL RELEVANCE/APPLICATION**

Deep-radiomics model provides a noninvasive promising way to predict pCR to NIT in NSCLC patients, and facilitates personalized clinical decision making.

## M2-SPCH-7 ROLE OF PRONE CT IN ASSESSING INTERSTITIAL LUNG ABNORMALITIES

David A. Lynch, MBBCh (*Abstract Co-Author*) Research Consultant, CALYX Inc;Research Consultant, Boehringer Ingelheim GmbH;Research Consultant, Veracyte, Inc;Research Consultant, DAIICHI SANKYO Group;Research Consultant, AstraZeneca PLC;Consultant, Polarean, Inc;Consultant, Bristol Myers Squibb Company
Soon Ho Yoon, MD (*Abstract Co-Author*) Officer, MEDICALIP
Kum Ju Chae, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan H. Chung, MD (*Abstract Co-Author*) Speaker, Veracyte, Inc;Consultant, Veracyte, Inc;Consultant, Boehringer Ingelheim GmbH;Speaker, Boehringer Ingelheim GmbH;Consultant, F. Hoffmann-La Roche Ltd;Speaker, F. Hoffmann-La Roche Ltd
Jong Eun Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Masahiro Yanagawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jiyoung Song, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

We aimed to evaluate whether supine chest CT alone suffices for diagnosing interstitial lung abnormality (ILA), thereby reducing prone chest CT.

**METHODS AND MATERIALS**

We retrospectively identified patients who underwent prone chest CT from January 2021 to July 2023 within one month after supine chest CT due to suspected ILA to constitute 69 age, sex-matched subjects (23 each of normal, non-fibrotic ILA, and fibrotic ILA). Five multi-national thoracic radiologists independently rated ILA suspicion scores on a 5-point scale on supine CT images (session 1). For suspected ILA cases, fibrosis scores (1 to 5-point) and ILA extent (1-100%) were rated. After a one-month washout, matched supine-prone CT images were provided (session 2). We compared the area under the receiver operating characteristic curves (AUCs) of ILA suspicion scores across ILA types and sessions. We classified each reader's ILA suspicion and fibrosis scores into four diagnostic groups (normal, non-fibrotic ILA, indeterminate-type ILA, fibrotic ILA) and evaluated interrater agreement using Fleiss' kappa and Gwet's AC 1: ILA suspicion scores of 1-2, normal; 3-5, positive ILA; fibrosis scores of 1-2, non-fibrotic ILA; 3, indeterminate-type ILA; 4-5, fibrotic ILA. For ILA extent, we evaluated the Pearson correlation coefficients and the differences between sessions within readers using a linear mixed model.

**RESULTS**

For non-fibrotic ILA, the pooled AUC of the five readers significantly increased from session 1 to session 2 (0.76 to 0.92, P<0.001), while no significant differences were observed for fibrotic ILA (0.94 and 0.99, P=0.06). The interrater agreement significantly increased from session 1 to session 2 for non-fibrotic ILA (Fleiss' kappa from 0.25 to 0.51, P=0.004; Gwet's AC1 from 0.44 to 0.65, P=0.004), while there was no significant difference for fibrotic ILA (Fleiss' kappa 0.63 and 0.72, P=0.082; Gwet's AC1 0.70 and 0.80, P=0.064 in session 1 and 2). Regarding extent, fibrotic ILA showed higher intra-reader correlation coefficients (0.74) compared to non-fibrotic ILA (0.44). Mean ILA extent decreased in non-fibrotic ILA (6.7% to 5.2%, P<0.001) and fibrotic ILA (10.0% to 8.0%, P<0.001) from session 1 to 2.

**CONCLUSION**

For fibrotic ILA, diagnostic accuracy and inter-reader agreement were substantial with supine CT alone while non-fibrotic ILA benefited by adding prone CT. However, sole supine CT interpretation led to overestimating ILA extent by 1-2% regardless of ILA types.

**CLINICAL RELEVANCE/APPLICATION**

By demonstrating that supine CT alone accurately diagnoses fibrotic ILA, our study supports omitting prone CT in cases of fibrotic ILA, thereby streamlining the diagnostic process, reducing patient discomfort, radiation exposure, and costs.

## M2-SPCH-8 QUANTIFICATION AND ANALYSIS USING ARTIFICIAL INTELLIGENCE OF THE LUNG IN PATIENTS WITH IDIOPATIC PULMUNARY FIBROSIS TRATED WITH NINTEDANIB AND CORRELATION WITH DLCO% AND FVC%

Francesco Turco (*Abstract Co-Author*) Nothing to Disclose
Francesco Manti (*Abstract Co-Author*) Nothing to Disclose
Anna Ferrarelli (*Abstract Co-Author*) Nothing to Disclose
Domenico Barresi (*Abstract Co-Author*) Nothing to Disclose
Domenico Lagana (*Abstract Co-Author*) Nothing to Disclose
Alessia Mondelli, MD (*Abstract Co-Author*) Nothing to Disclose
Corrado Pelaia (*Abstract Co-Author*) Nothing to Disclose
Caterina Battaglia, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

High-resolution computed tomography has allowed over the years the diagnosis and follow-up of interstitial pulmonary diseases, in particular idiopathic pulmonary fibrosis. In recent years, the need for quantitative data has given rise to new Score to predict the prognosis of patients suffering from this disease and also the arise of new dedicated software from Artificial intelligence. The goal of the study was to evaluate in our pool of patient how the application of a quantitative score and analysis using AI software applied to CT images can predict the effectiveness of the drug Nintedanib compared to Esbriet both used for years to stop the progression of the disease

**METHODS AND MATERIALS**

We retrospectively enrolled 74 patients diagnosed with IPF from 2018 to 2023 before and one year after starting therapy with Esbriet or Nintedanib. We applied on CT images a radiological visual score to evaluate the percentage of parenchyma preserved based on a score ranging from 0 to 5 points assigned to the upper and lower lobes bilaterally reaching a scale of values from 0 to 20. Then, we analyzed the same TC scans using 3D slicer tools for the segmentation and the analysis of the lung. In addition, we correlated the value of the score to values of DLCO (Alveolar-capillary diffusion Carbon Monoxide) and FVC (Forced vital capacity).

**RESULTS**

74 patients were divided into two groups and for each we calculated the CT score as well as the FVC and DLCO. 75% were men with average age of 73 ± 7 years. The CT score ranged from 19 to 0 with an average of 6 ± 4 in both groups. We found a not statistically significant difference in terms of DLCO, FVC, radiological visual score and AI analysis to one year in patients on Nintedabib therapy indicating disease stability (DLCO p= 0.7917, Score p = 0.7941, FVC p = 0.4133). On the contrary we found a statistically significant difference to one year in patients on Esbriet therapy indicating a worsening of the radiological picture and DLCO (DLCO p=0.0225, SCORE p=0.005) no difference was found in terms of FVC (p=0.0883). Another important result obtained with the use of AI tools were that the in patients treated with Esbriet had more infiltrates that the group treated with Nintedanib at one year control (P= 0.0429)

**CONCLUSION**

In our results we found that, in patients treated with Nintedanib, the values of DLCO, FVC and radiological scores remain stable one year after the start of treatment, and also the volume and the infiltrates calculated with AI, meanwhile in patients treated with Esbriet there is a deterioration in DLCO values and radiological score, and an increase of infiltrated, but a stability for FVC values.

**CLINICAL RELEVANCE/APPLICATION**

application in the current clinical and radiological practice

## M2-SPCH-9 CT FINDINGS OF ANTI-MELANOMA DIFFERENTIATION ASSOCIATED GENE 5 ANTIBODY POSITIVE DERMATOMYOSITIS ASSOCIATED INTERSTITIAL LUNG DISEASE: CORRELATION BETWEEN SHORT-TERM

## INTERVAL CHANGES AND PROGNOSIS

Takatoshi Aoki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshiya Tanaka, MD (*Abstract Co-Author*) Nothing to Disclose
Yo Todoroki (*Abstract Co-Author*) Nothing to Disclose
Midori Ueno, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Anti-melanoma differentiation associated gene 5 antibody positive dermatomyositis (anti-MDA5-DM) associated interstitial lung disease (ILD) often show rapidly progressive course and resistance to treatment, but the clinical presentation and prognosis are varied. Although the CT findings of anti-MDA5-DM associated ILD were sporadically reported, to our knowledge, the relationship between short-term interval changes and prognosis has not been fully evaluated. This study aimed to evaluate the impact of the CT findings, including the short-term interval changes, on the prognosis in anti-MDA5-DM associated ILD patients.

### METHODS AND MATERIALS

A total of 24 anti-MDA5-DM associated ILD patients were included in this study. All 24 patients underwent follow-up CT scans an average of 24.5 days (range: 12-35 days) after baseline CT. Two thoracic radiologists assessed the CT findings at baseline CT before treatment for: consolidation, ground-glass opacities (GGO), reticulation, honeycomb, volume loss, perilobular opacities, crazy paving appearance, location and distribution, and the short-term interval changes of CT findings for: enlargement of consolidation/GGO/perilobular opacities, increased attenuation of GGO, progression of fibrosis, and whole lung abnormality changes (enlarge/stable/diminish). Kaplan-Meyer methods and log-rank test were used to identify the association between CT findings and death.

### RESULTS

Six patients died, and the mean time from baseline CT to death was 72.5 days (range: 28-124). Kaplan-Meyer methods and log-rank test revealed a higher mortality risk in cases with craniocaudal random distribution on baseline CT, progression of fibrosis and enlargement of total abnormal findings on short-term follow-up CT ($p=0.004$, 0.014, 0.020, respectively).

### CONCLUSION

In addition to craniocaudal random distribution at baseline, progression of fibrosis and enlargement of whole lung abnormality in short-term interval were the signs of poor prognosis of anti-MDA5-DM associated ILD patients.

### CLINICAL RELEVANCE/APPLICATION

Short-term interval changes of chest CT findings closely correlates with prognosis of anti-MDA5-DM associated ILD patients. Progression of fibrosis and enlargement of whole lung abnormality in short-term interval after baseline CT would require therapeutic changes.

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# Abstract Archives of the RSNA, 2024

M2-SPER

**Emergency Radiology Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPER-1 OPTIMIZING EMERGENCY CARE: THE ROLE OF MULTI-ALGORITHM AI IN REDUCING IMAGING WAIT TIMES FOR CRITICAL CONDITIONS

Joseph H. Yacoub, MD, MD (*Abstract Co-Author*) Stockholder, NVIDIA Corporation
Pranay Krishnan, MD (*Abstract Co-Author*) Nothing to Disclose
Ross W. Filice, MD (*Abstract Co-Author*) Advisor, BunkerHill Health, Inc;Shareholder, BunkerHill Health, Inc;Speaker, General Electric Company;Speaker, Koios Medical;Researcher, Koios Medical
Luke Stoltzfus, BS (*Presenter*) Nothing to Disclose

### PURPOSE

This study evaluates the efficacy of a multi-algorithm artificial intelligence (AI) platform in the emergency department (ED) for prioritizing imaging interpretation of patients with suspected critical conditions.

### METHODS AND MATERIALS

From November 2023 to March 2024, data was gathered from ED CTs processed by the AI platform in a major health system. The AI system issued prioritization notifications to radiologists for AI positive (AI+) findings in cases of suspected CT head angiography brain aneurysms (BA), non-contrast CT head intracranial hemorrhages (ICH), pulmonary angiography and contrast chest CT pulmonary embolisms (PE and iPE, respectively), and all vessel occlusions (all_VO). AI+ results were also displayed on the radiologist worklists. Median imaging interpretation wait times for AI-flagged cases (AI+) were compared to those not flagged by the AI (AI-). Imaging interpretation wait time is defined as the total time from scan acquisition to beginning of report dictation by the radiologist.

### RESULTS

A total of 43,977 ED cases were collected (BA 7.3%, ICH 48.1%, IPE 25.1%, PE 14.1%, all_VO 5.4%). AI+ cases were 3.52% (1,547/42,430) of the ED cases. The median wait time for all AI+ cases (ICH, BA, PE, IPE, and all_VO) was 14.3 minutes (IQR: 26.5 minutes) compared to 18.0 minutes (IQR: 32.6 minutes) for the AI negative cases. The observed median wait time reduction for all ED cases was statistically significant (Mood's test p-value <0.05) at a 20.6% reduction (3.7 minutes). The largest median wait time reduction observed was for BA cases at 26.9% reduction (4.1 minutes) and the smallest median wait time reduction was for all_VO cases at 6.7% (0.9 minutes).

### CONCLUSION

The implementation of a multi-algorithm AI significantly enhanced the prioritization process of ED cases for a range of critical conditions, particularly in brain aneurysm cases. This AI system significantly reduced imaging wait times for suspected positive cases, demonstrating its potential to streamline emergency care.

### CLINICAL RELEVANCE/APPLICATION

The decrease in imaging wait times for AI-flagged cases indicates that AI can significantly enhance the efficiency of emergency departments by prioritizing positive cases and accelerating the diagnosis, which may improve high acuity patient outcomes.

## M2-SPER-2 PERFORMANCE AND RELIABILITY OF AN ARTIFICIAL INTELLIGENCE ALGORITHM FOR THE AUTOMATED DETECTION OF INCIDENTAL ABDOMINAL AORTIC ANEURYSM

Mark J. Krycia, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph J. Cavallo, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Jerome H. Avondo, PhD (*Abstract Co-Author*) Employee, Aidoc Ltd
Danling Chen, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Abdominal aortic aneurysm (AAA) is a frequently encountered incidental finding on CT imaging performed in the acute care setting, with an estimated prevalence of 1.3 to 12.5% in the general population. Artificial intelligence (AI) algorithms have been developed to automatically measure maximal aortic lumen size with the goal of improving AAA detection and streamlining radiology workflow. However, few studies have evaluated the performance of these tools in a large clinical setting. To this purpose, we conducted a retrospective study evaluating the accuracy of an AI algorithm for the screening and triage of incidental AAA on non-optimized CT imaging.

## METHODS AND MATERIALS

A retrospective study was performed on CT examinations (inclusive of contrast enhanced and noncontrast protocols) of the abdomen and pelvis performed in the emergency setting of a tertiary academic center from July 31-December 31, 2020, and January 1-May 10, 2021. CT exam images were processed by an FDA-cleared AI algorithm, while a natural language processing program (NLP) was used to analyze the associated radiology report. Exams which were positive for the presence of AAA on imaging by AI processing, but negative by NLP analysis of their corresponding report, were designated as potential discrepancies, and independently reviewed by an ED radiologist.

## RESULTS

In total, 4,023 abdominal and pelvic CT examinations were analyzed. 3,955 (98.3%) cases were negative for presence of AAA by NLP assessment of their respective report, with 16 of these cases flagged by the AI algorithm as discrepancies potentially positive for AAA. 31% (n=5/16) of the discrepant cases were determined by secondary review to be truly positive for previously undocumented AAA. A greater number of AAA were detected with AI versus with imaging interpretation by radiologists alone demonstrating an enhanced detection rate of 7.4% (5/(4,023-3,955) = 5/68). When analyzing discrepant cases that were ultimately deemed negative for AAA on secondary review (69%, n=11), it was noted that AI overestimation of abdominal aortic diameter was often related to obliquity of the aortic lumen in the axial plane. When axial CT images were subsequently reformatted in multiplanar reconstruction to account for aortic tortuosity, accurate measurements were obtained.

## CONCLUSION

Artificial intelligence algorithms demonstrate the potential to improve detection rates of incidental abdominal aortic aneurysms on CT imaging.

## CLINICAL RELEVANCE/APPLICATION

Abdominal aortic aneurysm can pose life-threatening consequences in the event of rupture. Accurate detection of incidental AAA, particularly in high throughput workflows such as the emergency department, is essential for guiding surveillance strategies and management.

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# Abstract Archives of the RSNA, 2024

M2-SPGI

**Gastrointestinal Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPGI-1 AUTOMATED HEPATIC STEATOSIS QUANTIFICATION IN PATIENTS WITH CHRONIC LIVER DISEASE ON CT: VOLUME OF INTEREST-BASED ATTENUATION MEASUREMENT

Seo Yeon Youn, MD (*Abstract Co-Author*) Nothing to Disclose
Yu Ri Shin (*Abstract Co-Author*) Nothing to Disclose
Sung Eun Rha, MD (*Abstract Co-Author*) Nothing to Disclose
Soon Nam Oh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joon-Il Choi, MD, PhD (*Abstract Co-Author*) Research Grant, Guerbet SA;Research Grant, Samsung Electronics Co, Ltd
Hokun Kim, MD (*Abstract Co-Author*) Research Grant, TAEJOON Pharmaceutical Co, Ltd
Bohyun Kim, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The validity of an automated quantification of hepatic steatosis on computed tomography (CT) has been demonstrated in a screening cohort and in a healthy population, but not in a cohort of patients with known chronic liver disease (CLD). We investigated the feasibility of a CT-based automated hepatic steatosis quantification in patients with CLD on noncontrast CT images using magnetic resonance spectroscopy proton density fat fraction (MRS-PDFF) as a reference standard.

### METHODS AND MATERIALS

This retrospective study included patients with CLD who underwent liver CT including noncontrast images and liver MRI with MRS-PDFF within a 6-month period from Oct 2023 to Mar 2024. A commercially available CT-based liver fat assessment program (ClariHepato, Clarip Inc.) used automated volume of interest (VOI) to quantify the liver attenuation (density_L), the attenuation difference between the liver and spleen (diff_LS), the attenuation ratio of the liver and spleen (ratio_LS), and CT-derived fat fraction (CDFF). Averaged attenuation values (density_ROI) were obtained within three manually drawn regions of interest (ROIs) in the liver. Agreement between density_ROI and density_L was evaluated using intraclass correlation coefficient (ICC) and Bland-Altman analysis. Pearson's correlation analysis was performed for all subjects and a subgroup of patients with liver cirrhosis (LC), comparing MRS-PDFF with the following parameters: CDFF, density_L, diff_LS, and ratio_LS.

### RESULTS

: A total of 68 patients (mean age, 62.0±11.2 years, 42 men) with 101 pairs of CT and MRI were included. Of them, 33 patients had LC. Technical failure occurred in 2 cases (2.0%). Good agreement was observed between density_L and density_ROI with an ICC of 0.869 (95% confidence interval 0.812-0.910). All CT parameters showed a significant correlation with MRS-PDFF (ps<0.001), with correlation coefficients for CDFF, density_L, diff_LS, ratio_LS, and density_ROI of 0.572, -0.519, -0.523, -0.503, and -0.567, respectively. In patients with LC, a significant correlation was likewise found (ps<0.001), with correlation coefficients for CDFF, density_L, diff_LS, ratio_LS, and density_ROI of 0.654, -0.622, -0.636, -0.755, and -0.627, respectively.

### CONCLUSION

CT-based automated steatosis quantification using VOI showed significant correlations with manual ROI-based attenuation and MRS-PDFF values in patient with CLD, regardless of the presence of LC.

### CLINICAL RELEVANCE/APPLICATION

CT-based automated steatosis quantification is a feasible method for hepatic steatosis evaluation in patients with chronic liver disease.

## M2-SPGI-12 INTEGRATED CLINICAL AND CONTRAST-ENHANCED CT PARAMETERS FOR PREDICTING THERAPEUTIC RESPONSE IN COLORECTAL CANCER LIVER METASTASIS TREATED WITH CHEMOTHERAPY AND BEVACIZUMAB

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Long Yuan (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to investigate the predictive value of clinical and pre- and post-treatment contrast-enhanced computed tomography (CT) parameters for the early therapeutic response of colorectal liver metastasis (CRLM) treated with chemotherapy and bevacizumab.

### METHODS AND MATERIALS

A retrospective analysis was conducted on patients with CRLM who received first-line chemotherapy combined with bevacizumab treatment in our hospital from January 2018 to January 2023, including clinical and contrast-enhanced CT images. The morphological features of CRLM after four treatment cycles

were assessed using contrast-enhanced CT images. CT values at baseline and after four treatment cycles in different phases (PS, AP, VP, and DP), and density change values (?CT values) before and after treatment were calculated. According to RECIST 1.1, CRLM after 12 treatment cycles was categorized into responsive (PR, SD, and CR) and non-responsive groups (PD). Differences between the two groups were searched for using the T-test, Mann-Whitney U, or chi-square test, and diagnostic performances of the different variables were evaluated using the receiver operating characteristic (ROC) curve.

**RESULTS**

Forty-six patients (mean age: 58±11.37 years) with 121 CRLM (83 and 38 in the responsive and non-responsive groups) were included. RAS mutant-type CRLM was more prevalent in the responsive group than in the wild-type group, with a significant difference (P<0.001). CRLM with a lobulated shape and heterogeneous texture after four treatment cycles showed a poorer treatment response than those with a round shape and homogeneous texture, with a significant difference (P<0.05). Additionally, CT values of AP-pre, VP-pre, DP-pre, VP-post, and ?AP were higher in the responsive group than in the non-responsive group. The combined use of clinical and contrast-enhanced CT parameters demonstrated better efficacy (AUC >0.7) than single parameters. Parameters such as RAS, texture-post, and AP-pre combined showed higher predictive efficacy. Conclusion: The combination of clinical parameters and contrast-enhanced CT parameters before and after treatment can effectively predict the early therapeutic response in patients with CRLM.

**CONCLUSION**

The combination of clinical parameters and contrast-enhanced CT parameters before and after treatment can effectively predict the early therapeutic response in patients with CRLM.

**CLINICAL RELEVANCE/APPLICATION**

The findings underscore the utility of integrated parameters in facilitating the early detection of liver metastases with a more favorable treatment response. These results lay the groundwork for devising personalized treatment strategies in clinical settings and highlight their promising clinical relevance.

## M2-SPGI-13 DYNAMIC CHANGES IN IVIM PARAMETERS AND LIVER PATHOLOGICAL CHARACTERISTICS DURING LIVER REGENERATION IN METABOLIC DYSFUNCTION-ASSOCIATED STEATOTIC LIVER DISEASE (MASLD): AN EXPERIMENTAL STUDY

Wen Shen, MD (*Abstract Co-Author*) Nothing to Disclose
Shuangshuang Xie (*Abstract Co-Author*) Nothing to Disclose
Caixin Qiu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Hepatic steatosis will affect the regenerative capacity of the liver, and MASLD patients have a high complication rate and mortality after partial hepatectomy (PH) [1-3]. The mechanism of liver regeneration after hepatectomy in patients with MASLD is unclear. We aimed to explore the pathological changes that occur during regeneration of the residual liver after PH in rats with MASLD and to determine the value of using voxel-incoherent motion (IVIM) to monitor liver regeneration.

**METHODS AND MATERIALS**

Seventy male Sprague-Dawley rats were randomly divided into two groups: 1) Control group: underwent 70% PH (n=35); 2) MASLD group: underwent 70% PH after a high-fat diet for 10 weeks (n=35); Five rats from each group were randomly selected for IVIM longitudinal follow-up scans at baseline, postoperative day 1, day 2, day 3, day 5, day 7, and day 14. And then sacrificed for pathological analysis. Liver parenchyma D, D*, PF were measured, and hepatocyte KI-67 proliferation index, cell size, and cell hypertrophy rate were calculated. Two-way analysis of variance was used to compare differences in MR imaging parameters between the MASLD group and the control group. One-way analysis of variance was used to compare differences in MR imaging parameters at different time points among the control group and MASLD group. Pearson correlation analysis was used to assess the correlation between MR parameters and pathological indicators. A significance level of P<0.05 was considered statistically significant.

**RESULTS**

Compared to the control group, the trend of changes in D, D*, and PF values in the MASLD group was generally consistent (see Fig.1 for details). Compared to the control group, the MASLD group exhibited lower levels of KI-67 proliferation on post-PH days 1, and 2 (all P < 0.05), with peak levels observed on days 3, followed by a gradual decline (P > 0.05). Additionally, the hepatocytes in the MASLD group were overall larger than those in the control group (all P < 0.05). Both groups showed a trend of increased hepatocyte size followed by a decrease postoperatively, with the maximum hepatocyte size observed on day 2 in the MASLD group and on day 1 in the control group (Fig.2). D* value had a good negative correlation with hepatocyte size and KI-67 (r=-0.799, -0.815, respectively) (table 1).

**CONCLUSION**

The regeneration mechanism in MASLD liver following PH parallels that of a normal liver, involving hepatocyte hypertrophy and proliferation. However, MASLD liver regeneration is hindered. IVIM can reflect the pathological changes of liver regeneration after PH and can be used as a tool to monitor liver regeneration in MASLD.

**CLINICAL RELEVANCE/APPLICATION**

IVIM can serve as a non-invasive imaging technique to monitor liver regeneration in MASLD.

## M2-SPGI-3 INTRACELLULAR ENHANCED TECHNIQUE FOR GADOXETIC ACID-ENHANCED HEPATOBILIARY-PHASE MAGNETIC RESONANCE IMAGES: UTILITY FOR EVALUATING HEPATIC FUNCTION

Takashi Nishihara (*Abstract Co-Author*) Employee, FUJIFILM Holdings Corporation
Shintaro Morishita (*Abstract Co-Author*) Nothing to Disclose
Hirokazu Asaka (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Yukiko Honda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shota Kondo (*Abstract Co-Author*) Nothing to Disclose
Masahiro Takizawa, PhD (*Abstract Co-Author*) Employee, FUJIFILM Holdings Corporation
Toru Shirai (*Abstract Co-Author*) Nothing to Disclose
DARA LOPES DIAS FONSECA (*Abstract Co-Author*) Nothing to Disclose
Toru Higaki, PhD (*Abstract Co-Author*) Nothing to Disclose
Keigo Narita (*Abstract Co-Author*) Nothing to Disclose
Shogo Maeda, MD (*Abstract Co-Author*) Nothing to Disclose
Motoshi Fujimori (*Abstract Co-Author*) Employee, FUJIFILM Holdings Corporation
Yoko Ohara (*Abstract Co-Author*) Employee, FUJIFILM Holdings Corporation

Ryo Higashino (*Abstract Co-Author*) Nothing to Disclose
Yuko Nakamura, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Hepatic parenchymal enhancement on gadoxetic acid-enhanced hepatobiliary phase (HBP) magnetic resonance images decreases as the hepatic function decreases. However, simple signal measurements on HBP images may be affected not only by hepatocyte specific- but also by extracellular space enhancement. This results in the inaccurate estimation of liver function. To improve hepatocyte-specific gadoxetic acid enhancement, we developed an intracellular enhancement (ICE) technique that suppresses signals from the extracellular space using a motion-sensitized driven equilibrium pulse. To investigate the utility of this technique for the evaluation of hepatic function we compared HBP images acquired with and without our ICE technique.

**METHODS AND MATERIALS**

We subjected 67 patients with suspected neoplastic hepatic lesions to gadoxetic acid-enhanced HBP imaging with and without ICE (i+HBP, i-HBP). The images were acquired 20 min after the injection of gadoxetic acid. A radiologist calculated the liver-spleen ratio (LSC) [LSC = region of interest (ROI)LIVER/ROIS], where ROILIVER is the mean signal intensity (SI) of the hepatic parenchyma and ROIS the mean SI of the spleen. To explore factors related to outcomes (Child-Pugh classification), we performed uni- and multivariate logistic regression analysis. Receiver operating analysis (ROC) was used to evaluate the diagnostic performance of LSC on i+HBP and i-HBP (i+LSC and i-LSC) to differentiate between Child-Pugh class A and B.

**RESULTS**

Of the 67 patients, 57 patients were in Child-Pugh class A and 10 patients were in class B. Univariate logistic analysis identified both i+LSC ($p < 0.01$) and i-LSC ($p = 0.03$) as significant factors in determining the Child-Pugh classification. Multivariate logistic analysis identified i+LSC but not i-LSC as a significant factor for the Child-Pugh classification ($p < 0.01$ vs $p = 0.49$). For the differentiation between Child-Pugh A and B, the value of i+LSC [area under the curve (AUC) 0.81; cutoff 2.12, sensitivity 80.0%, specificity 66.7%] was higher than of i-LSC (AUC 0.68; cutoff 1.12, sensitivity 40.0%, specificity 96.3%).

**CONCLUSION**

On gadoxetic acid-enhanced MRI scans acquired in the HBP, hepatic function can be estimated accurately with our ICE technique.

**CLINICAL RELEVANCE/APPLICATION**

Hepatocyte-specific enhancement with our ICE technique may be an imaging biomarker for the evaluation of hepatic function.

## M2-SPGI-4 INTEGRATED CLINICAL AND CONTRAST-ENHANCED CT PARAMETERS FOR PREDICTING THERAPEUTIC RESPONSE IN COLORECTAL CANCER LIVER METASTASIS TREATED WITH CHEMOTHERAPY AND BEVACIZUMAB

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Long Yuan (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to investigate the predictive value of clinical and pre- and post-treatment contrast-enhanced computed tomography (CT) parameters for the early therapeutic response of colorectal liver metastasis (CRLM) treated with chemotherapy and bevacizumab.

**METHODS AND MATERIALS**

A retrospective analysis was conducted on patients with CRLM who received first-line chemotherapy combined with bevacizumab treatment in our hospital from January 2018 to January 2023, including clinical and contrast-enhanced CT images. The morphological features of CRLM after four treatment cycles were assessed using contrast-enhanced CT images. CT values at baseline and after four treatment cycles in different phases (PS, AP, VP, and DP), and density change values (?CT values) before and after treatment were calculated. According to RECIST 1.1, CRLM after 12 treatment cycles was categorized into responsive (PR, SD, and CR) and non-responsive groups (PD). Differences between the two groups were searched for using the T-test, Mann-Whitney U, or chi-square test, and diagnostic performances of the different variables were evaluated using the receiver operating characteristic (ROC) curve.

**RESULTS**

Forty-six patients (mean age: 58±11.37 years) with 121 CRLM (83 and 38 in the responsive and non-responsive groups) were included. RAS mutant-type CRLM was more prevalent in the responsive group than in the wild-type group, with a significant difference ($P<0.001$). CRLM with a lobulated shape and heterogeneous texture after four treatment cycles showed a poorer treatment response than those with a round shape and homogeneous texture, with a significant difference ($P<0.05$). Additionally, CT values of AP-pre, VP-pre, DP-pre, VP-post, and ?AP were higher in the responsive group than in the non-responsive group. The combined use of clinical and contrast-enhanced CT parameters demonstrated better efficacy (AUC >0.7) than single parameters. Parameters such as RAS, texture-post, and AP-pre combined showed higher predictive efficacy. Conclusion: The combination of clinical parameters and contrast-enhanced CT parameters before and after treatment can effectively predict the early therapeutic response in patients with CRLM.

**CONCLUSION**

The combination of clinical parameters and contrast-enhanced CT parameters before and after treatment can effectively predict the early therapeutic response in patients with CRLM.

**CLINICAL RELEVANCE/APPLICATION**

The findings underscore the utility of integrated parameters in facilitating the early detection of liver metastases with a more favorable treatment response. These results lay the groundwork for devising personalized treatment strategies in clinical settings and highlight their promising clinical relevance.

## M2-SPGI-5 PREDICTIONS OF LIVER FUNCTIONAL RESERVE USING IODINE-UPTAKE PARAMETERS AND HEPATOSPLENIC VOLUMETRIC INDICES FROM MULTIPHASE HEPATIC CT: COMPARISONS WITH INDOCYANINE GREEN RETENSION TEST AND 99MTC-GSA SCINTIGRAPHY

Yasunori Nagayama, MD (*Abstract Co-Author*) Nothing to Disclose
Toshinori Hirai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Nakaura, MD (*Abstract Co-Author*) Nothing to Disclose
Masafumi Kidoh, MD, PhD (*Abstract Co-Author*) Endowed Chair, Koninklijke Philips NV
Narumi Taguchi (*Abstract Co-Author*) Nothing to Disclose
Masamichi Hokamura (*Abstract Co-Author*) Nothing to Disclose
SOICHIRO ISHIUCHI (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Ryuya Yoshida (*Abstract Co-Author*) Nothing to Disclose
Shinya Shiraishi (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Yokota (*Abstract Co-Author*) Nothing to Disclose
Takumi Osaki (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate whether extracellular volume fraction (ECV), iodine washout rate (IWR), and hepatosplenic volume indices on multiphase hepatic CT allow estimation of liver functional reserve measured with the indocyanine-green retention test (ICG-R15) and identification of patients with contraindications to major hepatectomy (ICG-R15=20%) compared to technetium-99m galactosyl human serum albumin (99mTc-GSA) scintigraphy.

**METHODS AND MATERIALS**

This retrospective study included 118 patients (84 men, mean age 69.4±11.3 years) who underwent ICG-R15 test, 99mTc-GSA scintigraphy, and multiphase hepatic CT including early portal venous phase (PVP) and 3-min delayed phase (DP) for the planning of hepatectomy. Hepatic ECV, IWR, and liver and spleen volumes normalized by body surface area (LV/BSA and SpV/BSA, respectively) were quantified with multiphase CT. For 99mTc-GSA, the hepatic uptake ratio at 15 minutes (HH15) and the receptor index (LHL15) were quantified. Associations between imaging parameters and ICG-R15 were evaluated using Spearman's correlation coefficient. Parameters were compared between patients with and without contraindications to major hepatectomy (ICG-R15=20% [n=22] and <20% [n=96], respectively). Diagnostic performance for identifying patients with ICG-R15=20% was evaluated using areas under the receiver operating characteristic curves (AUC). Multivariable logistic regression was used to identify independent CT predictors for ICG-R15>20%, and combined performance was determined.

**RESULTS**

IWR, LV/BSA, and LHL15 were lower, while ECV, SpV/BSA, and HH15 were higher in patients with ICG-R15=20% than in those with ICG-R15<20% (all p<0.001). ICG-R15 showed moderate correlations with IWR (r=-0.523) and LHL15 (r=-0.504), but weak or very weak correlations with ECV (r=0.355), LV/BSA (r=-0.123), SpV/BSA (r=0.248), and HH15 (r=0.385). AUCs of ECV, IWR, LV/BSA, SpV/BSA, HH15, and LHL15 for predicting ICG-R15=20% were 0.719, 0.845, 0.653, 0.694, 0.844, and 0.878, respectively. IWR, SpV/BSA, and LV/BSA were identified as independent CT predictors, with a combined AUC of 0.924.

**CONCLUSION**

IWR from multiphase hepatic CT provided better prediction of liver functional reserve compared to ECV and hepatosplenic volume indices. Combined IWR, liver, and spleen volume indices may be used as substitutes for 99mTc-GSA scintigraphy in identifying patients with contraindications to major hepatectomy.

**CLINICAL RELEVANCE/APPLICATION**

Multiphase hepatic CT for hepatic tumor assessments could enable estimation of hepatic functional reserves by quantifying IWR and hepatosplenic volume, potentially serving as simple, cost-effective, and reliable imaging approach to optimize treatment planning.

## M2-SPGI-6 QUANTITATIVE ASSESSMENT OF THE MICROSTRUCTURE AROUND THE RECTAL CANCER TO PREDICT N STAGE BY INTRAVOXLE INCOHERENT MOTION DIFFUSION WEIGHED MAGNETIC RESONANCE IMAGING

Anna Mou (*Presenter*) Nothing to Disclose

**PURPOSE**

The study is to determine whether the microstructural features around the tumor could predict lymph node(LN) staging in patients with rectal cancer by intravoxle incoherent motion diffusion-weighed magnetic resonance imaging(IVIM).

**METHODS AND MATERIALS**

74 patients with pathologically proven rectal adenocarcinoma underwent routine rectal MRI and IVIM(b values=0,20,50,100,200,400,600,800,1000,2000s/mm2) sequences were included. 45 patients had no lymph node metastasis(N0), 29 patients had positive lymph node metastasis(N+). ROIs were placed adjacent to (MAT,with 5mm of the outline of the largest cross-section of tumor) and distant from (MDT,at least 10mm from the tumor) the tumor to measure the IVIM parameters to predict LN. Unpaired t test and receiver operating characteristic (ROC) curve analysis were analyzed.

**RESULTS**

The positive lymph node(N+) demonstrated higher f values in MAT(0.331±0.110 vs 0,431±0.153, p=0.004) and higher D values in MDT(4.017 ±4.763 vs 8.351±1.348(10-3·mm2/s,p=0.003) than lymph node(N-). f values in MAT and D values in MDT had good diagnostic efficiency to predict N+ (AUC= 0.693,0.709,P=0.005,0.003).

**CONCLUSION**

f values in MAT and D values could noninvasive predict N stage in patients with rectal cancer based on IVIM.

**CLINICAL RELEVANCE/APPLICATION**

The microstructural features around the tumor could predict lymph node in patients with rectal cancer based on IVIM.

## M2-SPGI-7 DETECTION OF INFLAMMATORY BOWEL DISEASES IN MRE IMAGES WITH SPATIALLY CONTEXT-AWARE YOLOV4

Seohyun Lee (*Abstract Co-Author*) Nothing to Disclose
Joonseok Lim, MD (*Abstract Co-Author*) Nothing to Disclose
Nieun Seo, MD (*Abstract Co-Author*) Nothing to Disclose
Hansang Lee, PhD (*Abstract Co-Author*) Nothing to Disclose
Helen Hong, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Utilizing deep learning to detect inflammatory sites in single 2D slice images of magnetic resonance enterography (MRE) from patients with inflammatory bowel disease, e.g. Crohn’s disease, has limitations due to the lack of spatial context information, which can lead to numerous false positive detections. To improve the precision of inflammation detection, we propose a spatially context-aware YOLOv4 method that incorporate spatial context information with spatially-stacked multi-channel images.

## METHODS AND MATERIALS

The dataset consists of MRE images from 222 patients collected between March 2016 and December 2018. Initially, we utilized three-slice sequences of {m-s,m,m+s}-th slices mapped to three channels to incorporate spatial contextual information across slices, where s={1,2,3,4,5} refers to the distance between slices to control the spatial context. Subsequently, the YOLOv4 model based on the Darknet-53 framework was fine-tuned to detect inflammation from multi-channel images. Model training and evaluation were conducted in the Google Colab environment using Python and Darknet framework.

## RESULTS

The experimental results demonstrated that the proposed method significantly improves the consistency of inflammatory disease detection across multiple slices while reducing false positives compared to traditional single-slice detection methods. The baseline method employing single-slice imaging showed inconsistency in detection and higher rates of false positives. Conversely, the proposed method, utilizing the three-channel images, achieved higher consistency and precision in detecting inflammatory areas, as evidenced by the quantitative evaluations using mean Average Precision and recall scores. Additionally, the detection performance improved the most when the spatial context distance s was set to 1.

## CONCLUSION

Our method confirmed that leveraging spatial information from consecutive slices in MRE images through YOLOv4 significantly improves the accuracy and consistency of detecting inflammatory disease sites. By integrating a broader contextual understanding of the disease's manifestation across adjacent slices, our proposed method effectively addresses the variability and detection challenges posed by single-slice approaches. (This research was supported by a grant of the Korea Health Technology RD Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health Welfare, Republic of Korea (grant number : HI22C1496))

## CLINICAL RELEVANCE/APPLICATION

By improving inflammation detection with high accuracy and reduced false positives, the proposed method can be used to automatically estimate the activity of inflammatory bowel diseases.

# M2-SPGI-9 EARLY EXPLORATORY ANALYSIS OF IMAGE QUALITY AND DOSE SAVINGS IN DOUBLE LOW-DOSE ABDOMINAL CT FOR SUSPECTED ACUTE APPENDICITIS

Hokun Kim, MD (*Abstract Co-Author*) Research Grant, TAEJOON Pharmaceutical Co, Ltd
Seo Yeon Youn, MD (*Abstract Co-Author*) Nothing to Disclose
Soon Nam Oh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bohyun Kim, MD (*Presenter*) Nothing to Disclose

## PURPOSE

In CT, lower kVp increases the attenuation of iodine, allowing for reduced contrast media (CM) doses. However, a standardized low-dose CM protocol for low-kVp abdominopelvic CT is lacking. Institutions, including ours, performed these scans using either standard dose CM (approximately 0.521 g I/kg) suited for 120 kVp (single low-dose CT, SLCT) or anecdotal reduced doses. Lowering both kVp and CM dose (double low-dose CT, DLCT) could benefit young adults suspected of acute appendicitis. We present an early exploratory analysis of image quality and dose savings from an ongoing prospective single arm study aiming to establish a tailored DLCT protocol (NCT05878665).

## METHODS AND MATERIALS

From Dec 2023 to Feb 2024, patients aged 18-44 years with BMI < 30 kg/m2 and clinical suspicion of acute appendicitis were enrolled. They underwent DLCT with a CM dose reduction targeted at 10% per 10 kVp decrease from the 0.521g I/kg and 120 kVp. Image quality, dose reduction, and positive predictive value (PPV) for appendicitis were compared between DLCT and SLCT. All images were acquired using a 128-slice CT scanner with automatic exposure control, automatic kV selection, and iterative reconstruction. For the statistical analysis, t-test and Mann-Whitney test were used with P values < 0.05 indicate significance.

## RESULTS

The DLCT group included 52 patients (age, 33.5 ± 7 years; 30 females), and SLCT group included 53 patients (age, 33.3 ± 6.5 years, 35 females) retrospectively collected from Nov 2023 to Dec 2023, with no enrollment period overlap. The BMI, body weight, effective diameters, and number of CT scans under 80kVp were comparable between groups (Ps = 0.06). While image noise levels were comparable, the SNR and CNR measured from the solid organs, portal vein, and psoas muscle were all significantly higher in SLCT group (Ps = 0.001). Subjective assessments of noise score was comparable in groups (P = 0.52), but organ enhancement and diagnostic image quality scored higher in SLCT (Ps < 0.001). Appendiceal visibility, diagnostic confidence, and PPV for diagnosing appendicitis (70% [7/10 cases] vs. 80% [8/10 cases]) were comparable (Ps = 0.62). The dose of the CM (0.383 ± 0.048 gI /kg vs. 0.589 ± 0.085 gI/kg) and effective dose (3.8 ± 1.9 mSv vs. 5.0 ± 2.3 mSv) was reduced by 35% and 22% in DLCT, respectively, compared to SLCT.

## CONCLUSION

DLCT reduced the iodide dose and effective dose by 35% and 22% compared to SLCT, while showing comparable appendiceal visibility, diagnostic confidence, and PPV for appendicitis despite lower SNR and CNR. Thus, the suggested DLCT protocol may be a feasible option for young adults with suspected acute appendicitis.

## CLINICAL RELEVANCE/APPLICATION

The DLCT protocol, reducing CM dose by 10% for every 10 kVp decrease, is viable for suspected acute appendicitis.

# Abstract Archives of the RSNA, 2024

M2-SPGU

**Genitourinary Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPGU-1 CLINICAL VALIDATION OF DEEP LEARNING-EMPOWERED PRE-OPERATIVE AUXILIARY PLANNING SYSTEM FOR KIDNEY CANCER: A MULTICENTER STUDY

Fule Wu (*Abstract Co-Author*) Employee, Infervision
Shaokang Wang (*Abstract Co-Author*) Nothing to Disclose
Bing Zhong (*Abstract Co-Author*) Nothing to Disclose
Gongcheng Wang (*Abstract Co-Author*) Nothing to Disclose
Chen Xia (*Abstract Co-Author*) Nothing to Disclose
Ji Qi (*Abstract Co-Author*) Nothing to Disclose
Dawei Wang, PhD (*Presenter*) Employee, Infervision

### PURPOSE

Since the segmentation performance determines the three-dimensional reconstruction accuracy, in turn, affects the precision of surgery planning, we explore the reliability of deep learning (DL)-based pre-operative auxiliary planning system in aiding renal cancer surgery planning by examining its segmentation performance on renal lesions and vessels.

### METHODS AND MATERIALS

One hundred and eighty pre-operative abdominal contrast-enhanced CT examinations (slice thickness < 2mm) were retrospectively collected from patients who underwent renal cancer surgery in 8 medical centers. Two experienced surgeons established the gold standard annotations of renal lesions, kidneys, renal vessels, and other urological organs via consensus. Eligible samples for each segmentation task were included for validation. The DL-based pre-operative auxiliary planning system for kidney cancer (InferOperate Urology Planning, Infervision) which generates the three-dimensional reconstruction of renal structures based on automated structural segmentations was employed and validated in this study. The DICE index was calculated to evaluate the performance of segmentation algorithms underlying the auxiliary surgery planning system.

### RESULTS

The DICE index of the validated DL system reached 0.963 (95%: 0.964,0.962), 0.880 (95%CI: 0.885, 0.876), 0.860 (95%CI: 0.866, 0.855), and 0.909 (95%CI: 0.899, 0.920) for segmentations of kidney, renal artery, renal vein, and renal lesions, respectively. Subgroup analyses for CT manufacturers, slice thickness, reconstruction kernels, and tube voltages showed no significant difference, indicating the robustness of the underlying algorithms. Besides, the DICE indexes for segmenting adrenal glands and ureters were 0.816 (95%CI: 0.804, 0.828), and 0.757 (95%CI: 0.746, 0.763), respectively.

### CONCLUSION

The employed auxiliary planning system demonstrates robust performance in the segmentation of renal lesions, vessels, kidneys, and other urological organs and tissues, guaranteeing the accuracy of the 3D reconstruction and favoring precise renal cancer surgery planning.

### CLINICAL RELEVANCE/APPLICATION

Compared with 2D images, 3D reconstruction results can more accurately present the anatomical structure of the kidney, show the relationship between lesions and their adjacency, and assist in precise surgical implementation. The system validated in this study can efficiently and automatically complete the three-dimensional reconstruction of kidney lesions and anatomical structures and allow the surgical resection simulation based on 3D results, effectively assisting preoperative planning, and helping achieve precise surgery.

## M2-SPGU-2 BIPARAMETRIC PROSTATE MRI WITH SUPER-RESOLUTION DEEP LEARNING RECONSTRUCTION: COMPARISON WITH CONVENTIONAL RECONSTRUCTION TECHNIQUE

Hiromitsu Onishi, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company
Mitsuaki Tatsumi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takashi Ota, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuichi Yamashita (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Toru Honda, MD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Hori, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Yoshimori Kassai, MS (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hideyuki Fukui, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kengo Kiso, MD (*Abstract Co-Author*) Nothing to Disclose
Shohei Matsumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Kaketaka Koki, MD (*Abstract Co-Author*) Nothing to Disclose

Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Super-resolution deep learning reconstruction (SR-DLR) can simultaneously reduce image noise and improve spatial resolution. The purpose of this study was to compare image quality and diagnostic performance between biparametric prostate MRI with and without SR-DLR.

**METHODS AND MATERIALS**

This retrospective study included 38 patients who underwent prostate MRI including T2-weighted imaging (T2WI) and diffusion-weighted imaging (DWI) using a 3-Tesla scanner, followed by prostatectomy or MR/US fusion-guided prostate biopsy. T2WI and DWI were reconstructed using both conventional reconstruction and SR-DLR. The signal-to-noise ratio (SNR) of the prostate was measured as a quantitative analysis. Two radiologists independently evaluated the image quality of T2WI and DWI in terms of visibility of prostate anatomy, image noise, sharpness (T2WI), distortion (DWI), and overall image quality using a 5-point rating scale. They also assessed the likelihood of the presence of prostate cancer using PI-RADS version 2.1. Diagnostic performance was compared between two image sets (conventional T2WI+DWI and SR-DLR T2WI+DWI) using the jackknife free-response receiver operating characteristic (JAFROC) analysis.

**RESULTS**

The SNR of SR-DLR images was significantly higher than that of conventional images for both T2WI and DWI ($P < .001$). Mean visual scores of SR-DLR images were significantly higher than those of conventional images for both readers for all assessments ($P < .05$). The JAFROC1 figure of merit of SR-DLR images for prostate cancer detection was higher than that of conventional images for both readers, although the differences were not statistically significant (0.85 vs. 0.78, $P = 0.19$, and 0.70 vs. 0.69, $P = 0.86$, respectively).

**CONCLUSION**

SR-DLR resulted in higher image quality in prostate MRI compared to the conventional reconstruction technique. Diagnostic performance tended to be higher in SR-DLR images, although no significant differences were observed.

**CLINICAL RELEVANCE/APPLICATION**

SR-DLR can significantly improve the image quality of biparametric MRI by reducing noise and increasing spatial resolution. Some prostate cancers could only be detected by SR-DLR images, which may have the potential to improve the diagnostic performance.

## M2-SPGU-3 COMPARISON BETWEEN CONVENTIONAL CYSTOURETHROGRAPHY AND MRI WITH VOIDING MR-CYSTOURETHROGRAPHY IN THE EVALUATION OF MALE ANTERIOR URETHRAL STRICTURES

Marco Di Girolamo, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the accuracy of conventional retrograde and voiding cystourethrography and MRI together with voiding MR-cystourethrography in the evaluation of male urethral strictures.

**METHODS AND MATERIALS**

We evaluated 39 male patients with anterior urethral strictures diagnosed with urine flow velocity recording and conventional retrograde and voiding cystourethrography. All these patients underwent MRI and voiding MR-cystourethrography using a 1.5T superconductive magnet. The patients had urine-filled bladders and high-resolution sagittal TSE T2-weighted scans were performed (TR:6250ms; TE:90ms;sl.thick.:3mm; acq.time:3'38"). Voiding MR-cystourethrography was performed with T1-weighted spoiled 3D gradient-echo acquisitions on sagittal plane (TR:12ms; TE:2,7ms; flip-angle:40°; sl.thickness: 2mm; acq.time:12s) after the filling of bladder lumen with contrast-material-enhanced urine obtainded by the i.v administration 20 mg of furosemide followed by ¾ of the normal dose of a paramagnetic contrast agent (Magnevist, Bayer Pharma, Germany). After micturition high-resolution coronal TSE T2-weighted scans were performed at the level of the stenosis. Two radiologists in consensus evaluated the morphology and length of the urethral stenosis with the two modalities and with MRI the entity and the site of spongio-fibrosis was assessed.

**RESULTS**

6 patients were not able to perform voiding MR-cystourethrography. In 33 patients evaluated with two imaging modalities 42 urethral strictures were detected. The measurement of the stenosis length was equal or superior with voiding MR cystourethrography and the analysis of 3D sagittal scans allowed a better evaluation of the morphology of the urethral strictures in comparison with conventional cystourethrography. 32 strictures with Spongio-fibrosis were found (76%). The site of spongio-fibrosis was always assessed with MRI (dorsal, ventral, dorsal and ventral and circular fibrosis).

**CONCLUSION**

MRI with voiding MR-cystourethrography shows the morphology and the length of the urethral strictures better than conventional cystourethrography and allows the detection and site of spongio-fibrosis, avoiding radiation exposure to the gonads and urinary catheterization.

**CLINICAL RELEVANCE/APPLICATION**

MRI could be proposed as all-in-one technique for the evaluation of urethral stenosis, allowing their detection and length assessment and determining the presence and site of spongiofibrosis.

## M2-SPGU-4 CARDIOVASCULAR RISK AND METABOLIC SYNDROME IN MILD AUTONOMOUS CORTISOL SECRETION (MACS) PATIENTS: A COMPARATIVE STUDY WITH PRIMARY ALDOSTERONISM (PA)

Emilio Quaia, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Francesco Bigolin, MD (*Abstract Co-Author*) Nothing to Disclose
Filippo Crimi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlo D'Alessandro, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanni Sussan, MD (*Abstract Co-Author*) Nothing to Disclose
Elvis Vassallo, MD (*Abstract Co-Author*) Nothing to Disclose
Chiara Zerbato (*Presenter*) Nothing to Disclose

**PURPOSE**

The incidence of incidentalomas has increased tenfold over the past two decades. Primary aldosteronism (PA) and Mild autonomous cortisol secretion (MACS), previously referred to as subclinical Cushing’s syndrome, are common hormonal abnormalities in benign adrenal tumors. The aim of the study

was to analyze the CT body composition parameters of patients with MACS and PA and to compare them to evaluate which population shows a higher cardiovascular risk and metabolic syndrome.

**METHODS AND MATERIALS**

We retrospectively included 90 patients, of whom 36 were diagnosed with PA and 54 with MACS. CT scans were performed at the diagnosis of PA and MACS.We evaluated total body circumferences and body surface, total fat area, visceral and parietal areas, visceral-total and visceral-parietal ratios, the area of muscular mass and the total body composition.Additionally, were also collected the attenuation value of the liver, spleen and cortical bone of the 3rd lumbar vertebra.Measurements were performed at the 3rd lumbar spine level with a semi-automated quantification by ImageJ, an open-source image processing program derived from NIH Image for the Macintosh platform. Using this program, we could adjust the image thresholds to obtain specific elements for our study.The data between the two cohorts were compared using Mann-Whitney or Student's t test, as appropriate.

**RESULTS**

The ratio visceral/total is significantly higher in MACS patients compared to PA (median 0,49, IQR 0,39-0,59 vs median 0,17, IQR 0,11-0,26; p<0,0001).The ratio visceral/parietal was different in the two cohorts, with a trend toward significance (median 0,94, IQR 0,64-1,46 vs median 0,79, IQR 0,71-0,86; p=0,060).Additionally, there was a higher visceral fat mass, which is more prominently represented in absolute terms in patients with MACS compared to those with PA (median 174cm2, IQR 114-279 vs median 133cm2, IQR 59-211 p< 0.03). Moreover, there was a significant reduction of the attenuation value of 3rd lumbar vertebra in MACS patients compared to those with PA (median 106HU, IQR 85-140 vs median 171HU, IQR 133-209; p<0,0001).Moreover, there was a reduction of the muscle mass in patients with MACS compared to those with PA (median 121cm2, IQR 99-151 vs median 288cm2, IQR 263-318; p<0,0001).

**CONCLUSION**

MACS patients have greater reduction in muscle mass and bone mass than PA patients, in addition they have greater fat mass.

**CLINICAL RELEVANCE/APPLICATION**

MACS patients have a higher cardiovascular risk and metabolic syndrome as PA patients, although guidelines do not recommend any specific medical or surgical treatment for these patients.

## M2-SPGU-6 COMPARING PSMA PET/CT AND MULTIPARAMETRIC MPMRI FOR SELECTING ELIGIBILITY FOR FOCAL THERAPY IN PROSTATE CANCER

Vahid Yaghmai, MD, MS (*Abstract Co-Author*) Nothing to Disclose
James Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Rahmani, MD (*Abstract Co-Author*) Nothing to Disclose
Garrett G. Ward, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedeh Niloufar Rafiei Alavi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Current guidelines recommend focal therapy for prostate cancer patients with unifocal, unilateral lesions and no extra-prostatic disease. This study aimed to compare the diagnostic accuracy of 18F-PSMA-PET/CT and multiparametric mpMRI in identifying bilateral or multifocal unilateral disease from unifocal hemi-lateral involvement of the prostate.

**METHODS AND MATERIALS**

We reviewed records for 140 prostate cancer patients using 18F-PSMA-PET/CT and mpMRI. Lesion lateralization was categorized as bilateral or unilateral. Unilateral involvement was further classified as unifocal if it involved adjacent sextants and multifocal if distant sextants (e.g., base and apex) were involved. Diagnostic accuracy and agreement were assessed using Cohen's kappa and ROC curve analyses.

**RESULTS**

36/140 (25.7%) of the patients had multifocal disease. Detection rates were 53.8% for both modalities, 19.4% only by PSMA PET/CT, and 2.7% only by mpMRI. 22.2%. of cases were missed by both modalities. The agreement on multifocal versus unifocal disease detection was moderate (kappa=0.549). 18F-PSMA-PET/CT showed higher sensitivity (72.9% [55.8-86.2]), specificity (88% [79.7-94.7]), PPV (75% [61.1-85.1]), and NPV (87.7% [80.6-92.4]) than mpMRI, which had a sensitivity of 63.6% [45.1-79.6], specificity of 82.2% [79.7-94.7], PPV of 58.3% [45.3-70.3], and NPV of 85.2% [78.4-90.1]. ROC analysis confirmed superior diagnostic accuracy of 18F-PSMA-PET/CT (AUC = 0.813 [0.720-0.906]) compared to mpMRI (AUC = 0.718 [0.610-0.826]).

**CONCLUSION**

18F-PSMA-PET/CT demonstrates superior accuracy in identifying multifocal versus unifocal disease, suggesting its preference in evaluating prostate cancer patients for focal therapy eligibility.

**CLINICAL RELEVANCE/APPLICATION**

18F-PSMA-PET/CT is recommended over mpMRI for assessing eligibility for focal therapy in prostate cancer due to its higher diagnostic precision.

## M2-SPGU-7 COMPARING IMAGE QUALITY CATEGORIZATION USING PI-QUAL VERSIONS 1 AND 2

Dimitri A. Kessler, PhD (*Abstract Co-Author*) GlaxoSmithKline, Funding of PhD Studentship
Iztok Caglic, MD (*Abstract Co-Author*) Nothing to Disclose
Tristan Barrett, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Kang-Lung Lee, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The diagnostic efficacy of prostate MRI for detecting lesions in prostate cancer is heavily reliant on image quality. Prostate Imaging Quality (PI-QUAL) seeks to standardize this evaluation and has recently been updated to version 2 in April 2024. This study aims to assess inter-reader agreement for PI-QUAL v1 and v2 scores from prostate multiparametric MRI (mpMRI) scans.

**METHODS AND MATERIALS**

Conducted retrospectively at an academic medical center, this study analyzed 350 mpMRI scans performed in biopsy-naļve patients using five different MR systems (1.5T or 3T) between 2018 and 2022. Two expert uroradiologists with 15 and 7 years of experience, respectively and independently evaluated mpMRI quality using PI-QUAL v1 and v2 guidelines. PI-QUAL v1 scores (out of 5) were grouped into inadequate (1-2), acceptable (3), or optimal quality (4-5). Additionally, following the v2 system, biparametric MRI categorization (v2 bpMRI) using T2WI and DWI was computed alongside

mpMRI categorization (v2 mpMRI). Inter-reader agreement was assessed using Cohen's weighted kappa. A chi-square test was employed to ascertain whether significant differences exist among quality scores from different criteria, with a significance level (a) set at 0.05.

**RESULTS**

Substantial inter-reader agreement was observed for the overall PI-QUAL v1 score (? = 0.64) and moderate agreement for v2 mpMRI (? = 0.54) and v2 bpMRI scores (? = 0.57). Predominant quality levels shifted from optimal in v1 (65%) to acceptable in v2 mpMRI categorization (55%) ($p < 0.001$). With the application of v2, the addition of DCE increased the proportion of cases of at least adequate quality from 30% (bpMRI) to 64% (mpMRI) ($p < 0.001$). Inter-reader agreements on individual sequences were similar between v1 and v2 on T2WI (? = 0.46 and 0.49 for v1 and v2, respectively), DWI (? = 0.66 and 0.70, respectively), and DCE (? = 0.71 and 0.61, respectively).

**CONCLUSION**

This study demonstrates substantial agreement for PI-QUAL v1 and moderate agreement for v2 mpMRI and v2 bpMRI scores. A notable shift from optimal to acceptable quality levels was observed from v1 to v2 mpMRI categorization. Furthermore, a significant shift occurred from inadequate to acceptable categorization between v2 bpMRI and v2 mpMRI. Inter-reader agreements on individual sequences remained comparable between the versions.

**CLINICAL RELEVANCE/APPLICATION**

PI-QUAL v2 enhances image quality evaluation for both bpMRI and mpMRI. Shifting from inadequate to acceptable, between v2 bpMRI and v2 mpMRI, confirms the role of DCE as an image quality “safety net”. Understanding inter-reader agreement between PI-QUAL versions 1 and 2 is crucial for ensuring reliable interpretation of prostate MRI findings, thereby improving diagnostic workflows in clinical practice.

## M2-SPGU-8 COMPARATIVE STUDY ON THE DIAGNOSTIC VALUE OF DIRECT LYMPHANGIOGRAPHY AND CT LYMPHANGIOGRAPHY IN PRIMARY CHYLURIA

Qi Hao (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the diagnostic value of direct lymphangiography (DLG) and CT lymphangiography (CTL) in primary chyluria.

**METHODS AND MATERIALS**

Thirty-seven patients diagnosed as primary chyluria were recruited in this retrospective study. All patients were examined by DLG and CTL. All images were reviewed by 2 radiologists separately and reached decisions by consensus.For DLG and CTL, the indexs were?Lymphatic morphology and lymphatic reflux of bilateral iliac lymphatic, lumbar trunk and thoracic duct; ?Distribution of abnormal lymphatic vessels in the urinary system,thorax and abdomen.The results of CTL and DLG were statistically analyzed. The Mcnemar test in the paired ?2 test was used to analyze indexs of CTL compared with DLG, and the difference was statistically significant at P& 4;0.05, and the Kappa test was also used to evaluate the concordance between the two methods of CTL and DLG for the diagnosis of primary chyluria.

**RESULTS**

The difference between CTL and DLG for showing contralateral iliac, contralateral lumbar trunk and bronchial mediastinal trunk lymphatic reflux was statistically significant ($P < 0.05$),and the detection rate of CTL was higher than that of DLG.CTL and DLG were highly consistent in showing ipsilateral and contralateral renal lymphatic reflux (Kappa > 0.800),CTL (34/37) had a higher detection rate for renal lymphatic reflux than DLG (30/37),and CTL could further reveal the distribution of abnormal lymphatic vessels in the kidney and perirenal area. The difference between DLG and CTL for showing lymphatic reflux in the cervical trunk and subclavian trunk was statistically significant ($P < 0.05$),and the detection rate of CTL was lower than that of DLG.

**CONCLUSION**

CTL can show the distribution, extent and severity of abnormal dilated lymphatic vessels in primary chyluria, it is especially valuable for the assessment of renal lymphatic reflux,the distribution of abnormal lymphatic vessels in the perinephric region, contralateral iliac and lumbar trunk lymphatic reflux. And DLG is more advantageous for showing thoracic duct dysfunction and terminal lymphatic reflux. The detection rate of DLG for primary chyluria was 81.1%, and the combined application of DLG and CTL was able to improve the detection rate to 91.9%.

**CLINICAL RELEVANCE/APPLICATION**

The DLG and CTL complement each other, this can provide an important imaging basis for the diagnosis and preoperative evaluation of primary chyluria.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

M2-SPHN

**Head & Neck Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPHN-3 SUBTRACTION IODINE MAPS COMBINED WITH DEEP LEARNING RECONSTRUCTION FOR EVALUATION OF TEMPORAL BONE TUMORS

Jian Wang (*Abstract Co-Author*) Nothing to Disclose
Zhe Zhang (*Abstract Co-Author*) Nothing to Disclose
Yu Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Min Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Jiajing Tong (*Abstract Co-Author*) Nothing to Disclose
Tong Su, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the capability of subtraction iodine maps (SIM) combined with deep learning reconstruction (DLR) to evaluate temporal bone tumors, compared with conventional temporal bone enhanced CT images.

### METHODS AND MATERIALS

This prospective study continuously recruited twenty-one patients with temporal bone tumors who underwent temporal bone enhanced CT scans. All acquisitions were performed with a 320 row-detector CT scanner (Aquilion ONE Genesis Edition). Pre-contrast and enhanced images were both reconstructed using HIR (Adaptive Iterative Dose Reduction [AIDR] 3D) and DLR (Advanced Intelligent Clear-IQ Engine [AiCE]). Afterward, these two groups of images processed with a dedicated software (SURESubtraction) to generate SIM images. Therefore, three groups of images were produced for analysis: Enhanced-HIR, SIM-HIR, SIM-DLR. Qualitative parameters, including overall image quality, confidence index of lesion detection, ability of lesion contour visualization, and temporal bone involvement display ability, were rated by two radiologists independently according to a five-point scale. Quantitative parameters, including contrast-to-noise ratio (CNR) between the temporal bone tumor and muscle, were computed and compared.

### RESULTS

For overall image quality, SIM-HIR was equivalent to Enhanced-HIR, and SIM-DLR was superior to SIM-HIR (all $p<0.05$). For ability of lesion contour visualization, the three groups had comparable scores, with the SIM-DLR being the highest. For ability of lesion contour visualization and temporal bone involvement display, SIM-HIR was superior to Enhanced-HIR (all $p<0.05$). And SIM-DLR was equivalent to SIM-HIR with higher scores. For qualitative evaluation, two raters showed good agreement, with kappa values of 0.707. For quantitative evaluation, the CNR of SIM-HIR was equivalent to that of Enhanced-HIR ($7.59\pm4.07$ vs $8.13\pm4.68$, $p=0.58$). And the CNR of SIM-DLR was significantly higher than that of SIM-HIR ($11.67\pm6.34$ vs $7.59\pm4.07$, $p<0.001$).

### CONCLUSION

Compared with conventional enhanced CT, subtraction iodine maps combined with deep learning reconstruction can improve the image quality of CT images of temporal bone tumor. With equivalent capability to detect temporal bone lesions, SIM-DLR can notably enhance the visualization of lesion contour and bone involvement.

### CLINICAL RELEVANCE/APPLICATION

SIM-DLR can enhance the visualization of the extent of tumor invasion in the temporal bone, facilitating the formulation of surgical strategies.

## M2-SPHN-4 INFLUENCE OF IMAGING PARAMETERS ON COCHLEA DUCT LENGTH AND OPERATIVE PLANING DECISIONS IN MULTISLICE CT

Philipp Feldle, MD (*Abstract Co-Author*) Nothing to Disclose
Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Henner Huflage, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In CI surgery, precise Cochlear Duct Length (CDL) measurement is pivotal for individualized electrode carrier selection and postoperative anatomical fitting. The detail in preoperative temporal bone CT scans significantly impacts CDL measurement and CI electrode contact determination. This study aims to assess how radiation dose and reconstruction field of view (FOV) in multi-slice CT affect preoperative CDL measurement and electrode contact determination.

## METHODS AND MATERIALS

20 human petrous bone specimens were examined with multislice spiral CT with three radiation doses (CTDIvol 40, 20, 10 mGy). Each data set was reconstructed with three different FOV settings (250, 125, 50 mm). Preoperative measurement of the CDL was performed with an otological planning software. Ultra high-resolution images with outmaxed radiation dose (CTDIvol 250 mGy) served as a reference standard.

## RESULTS

Regardless of FOV reconstructions and cross all tested scan modes, including high, standard, and low dose there were no significant differences compared to the reference scans (all $p>0.05$) regarding cochlear duct length measurement and angular insertion depth. Preoperative simulation of the hearing frequency distribution showed no dependency on radiation dose or field of view (all $p>0.05$).

## CONCLUSION

For pre-operative evaluation of cochlear implant surgery in multi slice CT a significant reduction in radiation dose is feasible. Planning parameters do not benefit from reduced pixel size by dedicated small field of views.

## CLINICAL RELEVANCE/APPLICATION

Pre-operative evaluation for cochlear implant surgery is feasible with substantially reduced radiation dose and does not benefit by reduced pixel size.

# Abstract Archives of the RSNA, 2024

M2-SPIN

**Imaging Informatics Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPIN-1 GENERATION OF LOW KEV MONOCHROMATIC LIKE IMAGE FROM SINGLE ENERGY CT USING DEEP LEARNING BASED TRANSFORMATION

Bipul Das, PhD (*Abstract Co-Author*) Nothing to Disclose
Risa Shigemasa (*Abstract Co-Author*) Nothing to Disclose
Kok Yen Tham (*Abstract Co-Author*) Nothing to Disclose
Utkarsh Agrawal (*Abstract Co-Author*) Nothing to Disclose
Rajesh Langoju (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Imai, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Monochromatic images play a crucial role in Dual Energy CT (DECT), where lower keV images offer enhanced contrast detectability. However, single energy CT (SECT) lacks the ability to generate these Monochromatic lower keV images. We propose a deep learning algorithm to generate lower keV images from single energy CT scans across various contrast phases and organs in body imaging. Our AI-based framework learns the attenuation transformation from a given kVp image to the desired low keV target image. Notably, the generated images exhibit higher contrast without additional artifacts compared to those acquired at the target energy (kVp/keV). This work holds promise for improving diagnostic accuracy and enhancing clinical workflows in body oncology and vascular studies.

### METHODS AND MATERIALS

We propose a supervised learning with a cyclic consistency check for high kVp to low keV target image transformation. Since SECT does not have the corresponding image, 70 keV (as comparable to 120 kVp [1,2]) and 50 keV monochromatic image pairs generated from GE HealthCare Gemstone Spectral Imaging (GSI), fast kV switching dual energy acquisition on Revolution and Revolution Apex CT systems are used in the supervised training. A cyclic consistency is used in the network to avoid degenerate solution arising from possible many-to-many mapping due to the attenuation properties of tissues across different energies between the input-target pairs. The cyclic part of the network generates the reverse transform from 50 keV to 70 keV image. MAE loss is used in the network balanced between the forward-reverse transformation. The proposed network is trained on more than 40000 of monochromatic image pairs acquired at different contrast levels, including arterial, portal/venous, and delayed cases. Inferencing is done on monochromatic images for quantitative evaluation and on single energy images for qualitative assessment.

### RESULTS

Fig. 2 shows comparison with prediction output from 70 keV portal abdomen images and true 50 keV and shows low deviation in the error map in range [-25,25]. While a sample 50keV image generated from a SECT 120 kVp image is illustrated in Fig. 3.

### CONCLUSION

We demonstrate a deep learning-based Monochromatic low keV image generation from single energy scan for improved contrast visibility across different contrast phases and evaluation across 70keV and single energy images.

### CLINICAL RELEVANCE/APPLICATION

A low keV image along with the primary standard single kVp image is helpful in oncology studies for vasculature analysis in contrast scans. Similar to GSI systems, this methodology opens the option of low keV like image along with primary image in single energy CT systems.

## M2-SPIN-2 DEVELOPING IMPROVED METRICS FOR DESCRIBING BRAIN INVOLVEMENT IN SYMPTOMS AFTER MILD TRAUMATIC BRAIN INJURY

Travis H. Snyder, DO (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Lewine, PhD (*Abstract Co-Author*) Nothing to Disclose
Jose Martinez (*Abstract Co-Author*) Nothing to Disclose
Tzvi Crystal (*Abstract Co-Author*) Nothing to Disclose
Priya Santhanam, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexeis Ong (*Abstract Co-Author*) Nothing to Disclose
Cheryl E. Vanier, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Relate laterality analysis approaches to functional models of brain hemispheric involvement in symptomatology after mild traumatic brain injury (mTBI). We approached this question using simulations based on parameters from empirical data.

### METHODS AND MATERIALS

The correlation between right and left side volumes for the primary motor cortex (PMC; NeuroQuant 3.0) was estimated from MRI-based volumetrics (n=520) mTBI patients. A subset (n=53) with neuropsychological testing were used to estimate empirical correlations between right and left PMC volumes and Beck Anxiety Index (BAI) score. Using the observed correlations, datasets with right and left PMC volume and BAI scores were simulated based on three known and one novel model of lateral brain influence on symptoms (Models A-D). Laterality metrics included separate analysis of right and left regions, a laterality index (LI=Right-Left)/(Right+Left), a different LI based on principal components (PC) analysis, and an asymmetry index (|LI-Median(LI)|. Simulated datasets with sample size of 100 were used to relate BAI to volume and laterality metrics in simple linear regressions, with subsequent Benjamini-Hochberg p-value adjustment.

### RESULTS

For Model A, where symptoms correlated only with right PMC volume, BAI unsurprisingly had relationships with right PMC volume (100% of simulations) and asymmetry index (3%); 56% of simulations incorrectly related BAI to left PMC volume and only 2% related BAI to the traditional LI. In 13% of simulations, BAI was related to the PC-based LI. Metrics performed as anticipated in Model B, where PMC had no lateralization relative to BAI. The same was true for Model C, where right and left PMC made partially overlapping contributions to BAI; however, the PC-based laterality inconsistently indicated laterality in some simulations (17%). Based on the novel Model D (BAI and side-independent asymmetry of PMC right and left sides were related), as expected, the anxiety related to the asymmetry index (100%), but not PMC volumes (2%-3%) nor the PC-based laterality (3%); however, LI did not behave as expected in Model D (51%).

### CONCLUSION

The most frequently used strategies for examining lateralization are analyzing right and left sides separately or the use of laterality indices. These results suggest both strategies can be misleading when trying to determine the underlying structure of lateralization in the brain relative to symptoms. Side-independent asymmetry deserves more study, as it was observed only when an appropriate metric was incorporated into the analysis.

### CLINICAL RELEVANCE/APPLICATION

Novel metrics of hemispheric brain laterality show promise in accurately reflecting the underlying brain involvement in mTBI symptoms.

## M2-SPIN-3 EYESEE: REAL RADIOLOGY ROOM EXPERIENCE WITH EYE TRACKING AND DEEP LEARNING

Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, MSc, PhD (*Abstract Co-Author*) Ther-AI LLC
Gorkem Durak, MD (*Abstract Co-Author*) Nothing to Disclose
Alpay Medetalibeyoglu (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Krupinski, PhD (*Abstract Co-Author*) Nothing to Disclose
Drew A. Torigian, MD, MA (*Abstract Co-Author*) Co-founder, Quantitative Radiology Solutions LLC
Jayaram K. Udupa, PhD (*Abstract Co-Author*) Co-founder, Quantitative Radiology Solutions, LLC
Elif Keles, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bin Wang, BEng (*Presenter*) Nothing to Disclose

### PURPOSE

To record the eye movements of radiologists with eye-tracking technology in real radiology room experience with PACS system, allowing full functionality of real-time decision support system by going beyond lab experiments and test deep learning frameworks to assist auto-segmentation of organs and tumors.

### METHODS AND MATERIALS

We developed a new eye-tracking-based medical viewer system with automatic diagnostic capabilities supported by deep learning. The EyeSee allows us to capture the eye gaze data of radiologists during scan reading and input it into the trained deep learning algorithms. For diagnostic enhancement, EyeSee automatically crops the images into patches and extracts the deep image features of each patch. Meanwhile, we apply the proposed time-aggregation method to calculate each patch's eye gaze time duration feature. Then, EyeSee combines two features to conduct medical image classification or segmentation. EyeSee supports both 2D and 3D scans (ultrasound, X-ray, CT, PET, MRI, etc.). For demonstration purposes, a public Chest X-ray dataset with eye gaze was used in the experiments, which included 1083 cases with three different labels (Normal, Congestive Heart Failure, and Pneumonia). We also used CT, MRI, and X-Ray for real-time segmentation purposes.

### RESULTS

We employed 10-fold cross-validation to validate our diagnostic results in X-Ray disease classification, achieving an accuracy of 83.18% with an inference time of just 0.353 seconds per patient. This demonstrates that our method not only boosts diagnostic accuracy but also minimizes time consumption, enhancing the efficiency of integrating eye tracking into diagnostic readings. Furthermore, we evaluated various deep learning algorithms and found that graph neural networks outperform both convolutional neural networks and transformer-based models in this application. Our segmentation strategy is based on a combination of gaze prompts with SAM for real-time segmentation of objects; videos are attached for visual examples.

### CONCLUSION

In this study, we built the EyeSee system, which integrates eye-tracking technology into real-time medical image analysis in real radiology room settings. By utilizing the expert knowledge hidden in the eye gaze collected, our system enhances diagnostic accuracy with impressive efficiency. The strong application of eye tracking shows the combination of human and deep learning strengths.

### CLINICAL RELEVANCE/APPLICATION

There is an unmet need for decision-support systems in radiology rooms. Deep learning methods may fall short in many cases where radiologists' gaze patterns can fill this gap. EyeSee improves computer-aided diagnostic systems and helps with radiologists' busy work pace.

## M2-SPIN-4 MRI INTENSITY STANDARDIZATION VIA PROTOTYPE LEARNING FOR IMPROVED ONCOLOGICAL ANALYSIS OF HETEROGENOUS DATASETS

Amir Borhani, MD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Linda C. Kelahan, MD (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, MSc, PhD (*Abstract Co-Author*) Ther-AI LLC
Seth Pollack, MD (*Abstract Co-Author*) Consultant, Bayer AG;Consultant, Deciphera Pharmaceuticals, LLC;Consultant, Apexigen Inc;Consultant, T-Knife, GmbH;Consultant, Aadi Bioscience, Inc;Consultant, Epizyme, Inc;Consultant, Obsidian;Consultant, Sensei;Consultant, SpringWorks Therapeutics, Inc
Laetitia Perronne, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Gorkem Durak, MD (*Abstract Co-Author*) Nothing to Disclose

Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Sean Sachdev, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolo Gennaro, MD (*Abstract Co-Author*) Nothing to Disclose
Tugce Agirlar Trabzonlu, MD (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan J. Avery, MD (*Abstract Co-Author*) Research Consultant, Konica Minolta, Inc
Hatice Savas, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Velichko, PhD (*Abstract Co-Author*) Nothing to Disclose
Pedro Hermida De Viveiros (*Abstract Co-Author*) Nothing to Disclose
Xin Zhu (*Abstract Co-Author*) Nothing to Disclose
Mariam Goreish (*Abstract Co-Author*) Nothing to Disclose
Meghana Karri (*Presenter*) Nothing to Disclose

**PURPOSE**

Oncological MRI datasets exhibit significant heterogeneity due to variations in scanners, imaging protocols, and imaging of different anatomical regions. This limits the use of raw MRI scans for quantitative analysis and AI research. We propose a novel, prototype-learning-based approach to address MRI intensity standardization for such heterogeneous datasets.

**METHODS AND MATERIALS**

This study proposes a novel MRI intensity standardization model based on prototype learning. First, we use unsupervised clustering techniques to identify natural groups within the images by analyzing voxel-wise intensity metrics computed from raw MRI scans. These clusters are expected to group images from similar anatomical regions and acquired with similar protocols. Prototype learning selects a representative scan ("prototype") within each cluster. Cluster-specific intensity standardization (e.g., Nyul) is then applied, utilizing the corresponding prototype as the reference instead of a single image representing the entire dataset. We evaluate our method on brain, musculoskeletal, and abdominopelvic MRI datasets using cross-correlation (CC), mutual information (MI), and mean structure similarity (MSSIM).

**RESULTS**

The prototype learning approach achieved high efficacy in producing uniform intensity distributions across different anatomical regions, markedly improving upon traditional methods. For example, in the musculoskeletal MRI dataset, we observed enhancements of 4.9% in CC, 11% in MI, and 15% in MSSIM. For abdominopelvic MRI dataset, the increments were 0.4% in CC, 0.9% in MI, and 17% in MSSIM, indicating substantial enhancement in image quality and diagnostic reliability across varied anatomical regions. In MRI brain dataset, both CC and MSSIM showed similar improvements, with an increase of 0.66% in MSSIM. This likely be due to the inherently homogeneous nature of brain dataset compared to other datasets.

**CONCLUSION**

This study proposes methods that identify sources of heterogeneity within the MRI datasets and then apply intensity standardization within each group, providing scalable and efficient alternatives to conventional methods. By eliminating the need for labeled data, these techniques become more generalized across different anatomical regions and conditions, thus improving the robustness and reliability of quantitative MRI analyses.

**CLINICAL RELEVANCE/APPLICATION**

Standardized MRI data facilitates diverse oncological applications, including quantitative imaging and AI, potentially leading to improved cancer detection, staging, and diagnosis.

## M2-SPIN-5 LABEL-FREE LIVER TUMOR SEGMENTATION FOR AI DEVELOPMENT AND VALIDATION

Xiaoxi Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Qixin Hu (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To relieve the need for time-consuming per-voxel annotation, we investigate whether training on synthetic tumors in abdominal CT scans can enable AI models to detect and segment real tumors in the liver.

**METHODS AND MATERIALS**

The Liver Tumor Segmentation Benchmark (LiTS) was used in this study. We followed the official split of LiTS using 5-fold cross-validation. The volume of liver tumors ranges from 38mm^3 to 349 cm^3, and the types of liver lesions include HCC and secondary liver tumors and metastasis derived from colorectal, breast, and lung cancer. For comparison, a dataset of 116 CT scans with healthy livers was assembled from CHAOS (20 CT scans), BTCV (47 CT scans), Pancreas-CT (38 CT scans), and health subjects in LiTS (11 CT scans). We then generated tumors in these scans on the fly, resulting in enormous image-label pairs of synthetic tumors for training the AI model. We designed a modeling-based method to synthesize liver tumors, consisting of shape generation and texture generation. First, we applied ellipse generation, elastic deformation, and mask blur to customize the shape. Second, we applied salt-noise generation, gaussian filter, scaling, and clipping to generate a texture mask, which was then subtracted by the original intensity of the healthy liver. We also considered the mass effect and cirrhosis in the healthy part of the liver. For quality assessment, we developed Visual Turing Test on synthetic vs. liver tumors (illustrated in Figure A). DSC and NSD scores were used to quantify segmentation performance, and Sensitivity was used to quantify small tumor detection (volume < 125mm^3) performance.

**RESULTS**

Medical professionals with 6-year and 35-year experience obtained an accuracy of 26.5% and 71.0% in distinguishing synthetic tumors from real ones in CT scans. AI trained with synthetic tumors could achieve a sensitivity of 61.8% in detecting small tumors. AI can also segment liver tumors with a DSC and NSD score of 59.8% and 61.3%. In contrast, AI trained with per-voxel annotations held a sensitivity of 52.0%, with a DSC and NSD score of 57.5% and 58.0%.

**CONCLUSION**

AI algorithms can segment liver cancer at high sensitivity, DSC, and NSD without manual annotation by radiologists. AI trained with synthetic lesions performed similarly to that trained with 100 per-voxel annotated CTs of liver cancer (which took months to create).

**CLINICAL RELEVANCE/APPLICATION**

Tumor synthesis showed promise to help AI algorithms segment and detect liver cancer in CT scans by creating sufficiently diverse training examples. Tumor synthesis also enabled us to conduct larger studies to rigorously examine AI performance in detecting liver cancer of different locations, sizes,

shapes, textures, and stages, which are not limited to a fixed finite-size test set.

## M2-SPIN-6 VALIDATION OF AN ARTIFICIAL INTELLIGENCE ALGORITHM FOR EARLY PANCREATIC CANCER DETECTION

Cindy Neuzillet (*Abstract Co-Author*) Nothing to Disclose
Mostafa El Hajjam, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Alexandre Bone (*Abstract Co-Author*) Employee, Guerbet SA
Clement Abi Nader (*Abstract Co-Author*) Nothing to Disclose
Abed Rhmari Tlemcani, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Pancreatic cancer (PC) has a poor prognosis, largely due to late diagnosis in 80% of patients, limiting therapeutic options. Late diagnosis results from the lack of specific early symptoms and screening methods. PC screening could detect early cases, enabling timely surgery and improving patient survival rates. However, the sensitivity of current imaging modalities prevents the development of PC screening approaches. Therefore, the goal of this work is to evaluate an artificial intelligence (AI) algorithm to detect Stage IA PC on portal venous phase CT scans.

### METHODS AND MATERIALS

An AI algorithm for PC detection on portal CT scans was trained on a private cohort of 2134 patients (Abi Nader et al., Invest Radiol, 2023). The algorithm was re-calibrated on an external test set of 882 patients (429 PC, 453 controls) and reached a 90% sensitivity and a 90% specificity. This algorithm was evaluated on an external cohort of 28 pre-operative CT scans of patients from the Ambroise Paré hospital who underwent PC resection. Patients were diagnosed at stage IA (T1, N0, M0). A radiologist with more than 25 years of experience reviewed both the portal and arterial CT scans of the patients for PC identification. The sensitivity of the algorithm, the radiologist, and a combination of both the algorithm and the radiologist were computed with respect to the histopathological gold-standard. Bootstrapping was performed to compare the sensitivity distributions of the different approaches.

### RESULTS

Lesions were small (mean ± sd lesion diameter: 16.5 ± 3.7 mm), resectable with 60% classified R0 after surgery (healthy margin > 1mm) according to NCCN guidelines and 57% lesions were isodense on the portal CT scan. The sensitivity of the algorithm, radiologist and combination of both were, 85.7%, [71.4, 96.4] (median [95% CI]), 89.2% [78.5, 100] and 92.8% [82.1, 100], respectively. Associated p-values were 0.65, 0.27 and 0.53 for the comparisons between algorithm/radiologist, algorithm/combination and radiologist/combination, respectively.

### CONCLUSION

The algorithm showed promise for detecting small and resectable PC using solely portal venous scans. The difference between the algorithm and an experienced radiologist which used both the portal and arterial phases was not statistically significant. The combination of both the AI algorithm and the expert radiologist showed a high sensitivity on this early-stage cohort. The addition of an AI system within the radiologist workflow could be clinically relevant for incidental early-stage PC detection, especially for non-expert radiologists.

### CLINICAL RELEVANCE/APPLICATION

This pilot study suggests that our AI algorithm could be a valuable tool for detecting early PC, motivating further validation on larger cohorts.

## M2-SPIN-7 MAKING YOUR FIRST CHOICE: TO ADDRESS COLD START PROBLEM IN MEDICAL ACTIVE LEARNING

Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Liangyu Chen (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to reduce the manual annotation workload for radiologists in developing large, annotated datasets and advancing high-performance AI algorithms for computer-aided diagnosis.

### METHODS AND MATERIALS

We employed three medical imaging datasets: Cohort 1 (107,180 histopathological images of colorectal cancer tissue), Cohort 2 (58,850 CT scans of various abdominal organs), and Cohort 3 (17,092 microscopic images of peripheral blood cells). Each dataset was divided into an 85% training set and a 15% test set. To determine which data points should be annotated first by expert radiologists, we examined two data sampling strategies: active sampling and random sampling. Active sampling involved selecting data points based on their typicality and diversity, determined by entropy in AI predictions and similarity to already annotated data. We introduced a novel querying strategy named HaCon (Hard-to-Contrast), which involves feature extraction through contrastive learning, cluster assignment using K-means for label diversity, and selection of hard-to-contrast data points. In contrast, random sampling involved non-selective data point annotation. AI diagnostic performance was measured using the Area Under the ROC Curve (AUC) scores.

### RESULTS

Active sampling significantly outperformed random sampling, with AUC improvements of 1.8% on Cohort 1, 2.6% on Cohort 2, and 5.2% on Cohort 3. In summary, our active sampling can reduce annotation costs by over 60% while maintaining high-performance AI algorithms.

### CONCLUSION

Data are not created equal; intelligently selecting critical data points (i.e., typical and diverse) to be annotated first can substantially reduce labeling efforts for clinicians, and these data are more crucial for the development of high-performance AI algorithms. AI performance can be improved through the active learning process, wherein we identify the algorithm's failures and successes, pinpoint the most important data points, provide manual annotations for them, and retrain the algorithms.

### CLINICAL RELEVANCE/APPLICATION

The study supports the application of active learning in medical imaging, which minimizes radiologists' annotation efforts by focusing on areas where AI is less accurate. Our approach facilitated the creation of a comprehensive dataset of 9,262 fully annotated CT scans, cutting annotation efforts by 60% and maintaining high diagnostic accuracy in computer-aided diagnosis.

## M2-SPIN-8 MACHINE LEARNING AND CT RADIOMICS TO PREDICT DISEASE PROGRESSION AND TREATMENT RESPONSE TO 1ST-LINE PEMBROLIZUMAB MONOTHERAPY IN ADVANCED NON SMALL CELL LUNG CANCER (NSCLC)

Ren Yuan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Barbara Melosky (*Abstract Co-Author*) Nothing to Disclose
Calum MacAulay, PhD (*Abstract Co-Author*) Nothing to Disclose
Cheryl Ho (*Abstract Co-Author*) Nothing to Disclose
Jessica Li, MD (*Abstract Co-Author*) Nothing to Disclose
Qian Ye (*Abstract Co-Author*) Nothing to Disclose
Stephen Lam, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Ian Janzen, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

The 5-year survival rate of lung cancer (LC) is among the lowest for cancer survival largely due to majority diagnosed at late or advanced stages. Immunotherapy has fulfilled their promise for LC treatment. Health Canada approved single agent pembrolizumab (Pem) in the first line setting for stage IIIB/IV NSCLC with PD-L1=50%, no EGFR/ALK aberrations. In this cohort, despite 45% of patients would benefit the best from single agent Pem, the other 55% do not respond and may require an alternative first line regimen. The clinical dilemma is that are no consensus clinicopathological features that can be used to distinguish the two subgroups. We propose a Machine Learning (ML) model using pre-treatment CT radiomic features can predict treatment response to pembrolizumab in this high PD-L1 cohort.

### METHODS AND MATERIALS

Two retrospective cohorts of patients with stage IIIB/IV NSCLC, PD-L1=50%, with no EGFR/ALK mutations were studied, including a training set (Tr-set: N=97, 56F:41M, 73±6yo) and an external validation set (X-set: N=17, 9F:8M, 65±10yo). All patients had CT scans at baseline and additional follow-up (FU) CTs 9-12 weeks after receiving Pem. Response was determined using RECIST v1.1: "Disease Control" (DC) vs "Progressive Disease" (PD) (Tr-set: 60 DC vs. 37 PD; X-set: 9 DC vs. 8 PD). An in-house radiomic feature extraction pipeline was used to extract 2D radiomic texture and intensity features of lung lesions. A five-fold cross-validated Logistic Regression (LR) model was developed to classify DC vs. PD, and the best-fit LR was used to calculate the predicted "risk of PD" for each patient and to separate patients into "high-" vs. "low-risk of PD" groups by comparing their calculated "risk-of-PD" of the best-fit LR model. Three prediction models were trained on discrete feature sets: patient demographics and clinical features alone, baseline CT radiomic features alone, and the combination of both.

### RESULTS

ROC analysis indicates excellent performance in discriminating DC vs. PD of the best-fit LR model that incorporates a combination of baseline CT radiomics and clinical description features in both training and external validation cohorts (Tr-set: AUC=0.91±0.06; X-set: AUC=0.88, CI 95%: 0.72-0.99). The Kaplan-Meier plots showed that the "predicted high-risk of PD" group had worse OS compared to the "predicted low-risk of PD" group (in X-set, log rank $p<0.01$).

### CONCLUSION

The preliminary data showed that a ML model that integrates both clinical descriptors and CT radiomics can identify NSCLC patients who are likely to develop progressive disease while receiving upfront Pem monotherapy.

### CLINICAL RELEVANCE/APPLICATION

This ML model has a potential to assist decision-making for the optimal first line treatment in advanced NSCLC patients with PD-L1=50%.

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# Abstract Archives of the RSNA, 2024

M2-SPIR

**Interventional Radiology Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPIR-1 CLINICAL APPLICATION OF DEEP LEARNING-BASED TECHNIQUES FOR RADIATION DOSE REDUCTION IN CT-GUIDED LUNG BIOPSIES

Hai-Feng Duan, MMed (*Abstract Co-Author*) Nothing to Disclose
Long Xu (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the clinical application value of different noise indices (NI) for radiation dose reduction in CT-guided percutaneous lung puncture biopsy (PTNB) based on deep learning image reconstruction (DLIR) technique.

### METHODS AND MATERIALS

Thirty-two patients with PTNB were selected, and three sets of images were obtained after adjusting the puncture needle using a small range (40 mm), 100 KV, automatic tube current modulation (ATCM), and NI 15, 30, and 45 scans sequentially. Group A was scanned with NI 15, with 50% weight of adaptive statistical iterative reconstruction-V, and the DLIR-H reconstructed images with NI 30 and 45 were in group B and C respectively. The CT and SD values of paraspinal muscles, subcutaneous fat, and arterial vessels were measured at the center of the puncture point and its upper and lower 10-mm levels, respectively, and the signal-to-noise ratio (SNR) and the contrast-to-noise ratio (CNR) were calculated. Then the images were subjectively scored by two physicians while comparing the radiation dose (ED) among the three groups.

### RESULTS

By subjective evaluation, the image quality of group A, B, and C all meet clinical requirements for puncturing. The SD and SNR values of group B images were better than those of groups A and C. The SD and SNR at muscle and fat of group A and group B were significantly different, and the difference also existed in group B and group C ($P < 0.05$); the differences of the SD and SNR values of the images of groups A and C at paraspinal muscle and subcutaneous fat were not statistically significant. The differences in effective radiation dose (ED) among the three groups were all statistically significant ($P < 0.05$). Compared with Group A, the ED in Group B and C were reduced by 82.86% and 93.90% respectively; the ED in Group C was reduced by 64.44% compared with that in Group B.

### CONCLUSION

Increasing the noise index combined with the DLIR technique can significantly reduce the patient radiation dose during CT-guided PTNB.

### CLINICAL RELEVANCE/APPLICATION

The use of a low-dose CT scanning protocol combined with deep learning reconstruction (DLIR) reconstruction techniques can improve image quality and thus significantly reduce the dose of reduced radiation in CT-guided percutaneous lung puncture biopsy (PTNB).

## M2-SPIR-2 ULTRA-LOW RADIATION DOSE SCANNING COMBINED WITH DEEP LEARNING RECONSTRUCTION ALGORITHM IN CT-GUIDED LUNG ASPIRATION BIOPSY

Hai-Feng Duan, MMed (*Abstract Co-Author*) Nothing to Disclose
Long Xu (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the feasibility and clinical value of ultra-low radiation dose scanning combined with deep learning reconstruction (DLIR) algorithm in CT-guided lung puncture biopsy (PTNB).

### METHODS AND MATERIALS

According to the different scanning protocols, 60 patients with lung puncture biopsy were divided into conventional dose group (Group A) and ultra-low dose group (Group B).Group A was 100KV, noise (NI) was 15, Group B NI was 45, and the rest of the scanning parameters were the same. The first and last whole-lung scans in the conventional dose group were scanned using the conditions of groups A and B, respectively, for evaluating the image quality improvement potential of the deep learning reconstruction algorithm (DLR).The first whole-lung scan was reconstructed using filtered back projection (FBP) and adaptive statistical iterative reconstruction-V (50%-ASIR-V) with weights of 50%, and the last whole-lung scan was reconstructed using three intensities of the deep learning reconstruction algorithm (DLIR-L, DLIR-M, DLIR-H) reconstructed images. The CT and SD values of paraspinal muscles, subcutaneous fat, and aortic vessels were measured, the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. The baseline characteristics of the patients, total radiation dose during puncture, pathologic positivity rate and complication rate were compared between groups A and B.

### RESULTS

The differences in CT values at muscle, subcutaneous fat and aortic vessels in the reconstructed images under the five different conditions were not statistically significant (P>0.05), but the differences in SD, SNR and CNR values were statistically significant, and two-by-two comparative analyses between the groups showed that there were no statistically significant differences between the DLIR-H images and the 50% ASIR-V images in muscle, fat, vascular SD and SNR (both P> 0.05); the differences in CNR values between FBP vs DLIR-H and DLIR-L vs DLIR-H groups were statistically significant (both P < 0.05). Compared with group A, the total radiation dose of group B was reduced by about 93.6%, and the image quality of both groups could meet the needs of clinical puncture, and the differences in baseline characteristics, pathologic positivity rate, and complication rate of patients in the two groups were not statistically significant (P all > 0.05).

### CONCLUSION

Ultra-low-dose CT scanning combined with DLIR reconstruction can significantly reduce image noise and improve image quality without affecting the safety of puncture and the pathologic positive rate.

### CLINICAL RELEVANCE/APPLICATION

Ultra-low radiation dose scanning combined with deep learning reconstruction algorithms can reduce the radiation dose to the patient.

## M2-SPIR-3 DIAGNOSTIC PERFORMANCE OF AI BASED DE-NOISING ALGORITHM FOR LOW RADIATION DOSE CT GUIDED BIOPSIES AND COMPARISON WITH ITERATIVE RECONSTRUCTION TECHNIQUES

SUYASH KULKARNI (*Abstract Co-Author*) Nothing to Disclose
Aniruddha Nene (*Abstract Co-Author*) Nothing to Disclose
Akshay D. Baheti, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Nitin S. Shetty, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Amit J. Choudhari, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Girish Chinnaswamy, MD (*Abstract Co-Author*) Nothing to Disclose
Vasundhara Smriti, MD (*Presenter*) Nothing to Disclose

### PURPOSE

CT radiation is a potential concern for radiation induced carcinogenesis. Iterative reconstruction techniques (IR) reduce the image noise and enables dose reduction, compared to conventional filtered back projection (FBP). However, IR is vendor specific, requires raw data, is computationally intense and only available in latest scanners. The study aimed to assess the image quality of a vendor neutral, AI based de-noising algorithm for CT guided biopsies and compare with IR.

### METHODS AND MATERIALS

We evaluated consecutive (January 1st, 2022 - September 1st, 2023) patients who underwent CT guided biopsies in an IRB-approved, HIPPA compliant, retrospective study. CT guided biopsy protocols are performed in 3 phases; planning, targeting and post procedure. Planning phase are diagnostic scans, performed at standard dose (100%) {SDp}. as targeting phase focuses on needle guidance, lower doses were selected, at 70%, 50% 33% reduced mA (kVp constant). Low dose targeting {LDt} phase was reconstructed with AI based de-noising algorithm (PixelShine®, AlgoMedica, CA, USA) (PS), FBP IR. Two readers (20 4 years of experience) subjectively evaluated the noise, edge sharpness, artifacts and overall diagnostic quality of the images, on 5-point Likert scale. Objective measurements for Hounsfield Units (HU), standard deviation of HU values, SNR CNR were calculated. Statistical analysis was performed to obtain p-values, paired T test, Wilcoxon Signed-Rank test.

### RESULTS

Out of 660 CT guided biopsies, 85 cases were identified with SDp LDt phases, 53 cases were performed on 128 slice scanners with IR (Incisive CT, Philips Healthcare) (35 cases with SDp + 50% LDt, 18 cases with SDp + 33% LDt) and 32 cases on 16 slice scanners with no IR (Sensation CT, Siemens Healthineers) (SDp + upto 50% LDt). Subjective assessment showed lower image noise in LDt-PS compared to LDt-FBP at both 50% and 33% low dose, whereas LDt-PS was almost equivalent to LDt-IR at 50% dose and slightly better at 33% dose. Similar edge sharpness was seen in LDt-PS and SDp-IR, artifacts were less on LDt-PS, with overall score of LDt-PS higher than SDp-IR. Image noise at 33% with LDt-PS was similar to SDp (12.3±3.2, 10.3±3.5) and lowered by 58% compared to LDt-FBP, and higher CNR and SNR than LDt-IR.

### CONCLUSION

Low dose (50% 33%) CT images processed with AI based de-noising algorithm showed lower image noise and artifacts compared to FBP, as well as IR post-processing. Furthermore, this vendor neutral algorithm showed similar image quality as vendor specific IR.

### CLINICAL RELEVANCE/APPLICATION

Vendor neutral AI based de-noising algorithm have the potential to lower CT radiation dose by 33% and provides similar image quality as IR and for the older CT machines this provides a viable option for drastic reduction in dose.

## M2-SPIR-4 FEASIBILITY OF MRI GUIDED IN-BORE BIOPSIES AT 0.55T

Hero K. Hussain, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Nicole Seiberlich, PhD (*Abstract Co-Author*) Royalties, Siemens AG;Research support, Siemens AG
Elaine M. Caoili, MD, MS (*Abstract Co-Author*) Steering Committee, ProKidney, LLC
Vikas Gulani, MD, PhD (*Abstract Co-Author*) Research support, Siemens AG;Consulting, Cook Group Incorporated
Yun Jiang, PhD (*Abstract Co-Author*) Nothing to Disclose
Shane A. Wells, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson
Tejinder Kaur, MD, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate feasibility of lesion identification and in-bore MRI-guided prostate biopsies using a large-bore 0.55T scanner.

### METHODS AND MATERIALS

9 participants with a mean age of 67 ± 7.3 years prospectively participated in this IRB-approved study between May 2023 and March 2024. 8 participants underwent in-bore MRI-guided prostate biopsy at 0.55T MRI scanner(Magnetom Free.Max,Siemens Healthineers, Erlangen,Germany). 1 participant was unable to undergo the procedure due to chronic contractures. Imaging protocol included axial T2wTSE (pre-biopsy), single shot T2wTSE (HASTE) and balanced steady-state free precession (bSSFP) sequences used intraprocedurally. Four biopsies were carried out using a transrectal approach, employing a robot-controlled manipulator and intrarectal directing device (Soteria Medical, Arnhem, Netherlands). Participants who did not have a rectum underwent

percutaneous targeting via transgluteal route. 2-3 cores were obtained in each case. Lesion sizes, cancer detection rates, positive percentage volume, disease grade change, duration to first core, and the overall procedure were reported.

**RESULTS**

9 lesions (size 1.8 ± 0.9 cm) were biopsied. Lesions positive for malignancy showed one Grade Group 1 (GG 1) cancer, four GG 2 cancers, one GG 3 cancer, and one GG 5 cancer. Two lesions turned out to be benign. Two participants had Gleason score (GS) upgraded, one had a marked increase in the positive percentage volume of core from 5 % to 80%, and four had a new cancer diagnosis. One new cancer was identified in a patient with left hip arthroplasty ipsilateral to the prosthesis, due to improved susceptibility artifact at lower field. Average time for procedure and time to first core in transrectal approach was 1 hour 14 minutes and 33 minutes respectively. For percutaneous route average time for procedure was 1 hour 10 minutes and time to first core was 54 minutes.

**CONCLUSION**

The work shows that lesion identification and accurate targeting is possible in suspicious prostate cancers at low performance gradient 0.55T MRI. Both procedures currently take approximately 75 minutes, though time to first core is faster for the percutaneous route. Increased experience with the procedure/imaging is expected to decrease required times.

**CLINICAL RELEVANCE/APPLICATION**

MRI-guided interventions using lower-field 0.55T systems have the potential for accurate lesion identification and targeting. This capability can help alleviate undue pressure on higher-field scanners in terms of patient load. Additionally, it offers added benefits for patients with hip implants.

## M2-SPIR-5 NEXT-GENERATION SEQUENCING ANALYSIS OF IMAGE-GUIDED BIOPSY SAMPLES IN EARLY-STAGE NON-SMALL CELL LUNG CANCER: A REAL-WORLD FEASIBILITY STUDY

David F. Yankelevitz, MD (*Abstract Co-Author*) Consultant, Accumetra LLC;Stockholder, Accumetra LLC;Medical Advisory Board, Carestream Health, Inc;Royalties, General Electric Company;Consultant, AstraZeneca PLC;Consultant, Pfizer Inc;Consultant, F. Hoffmann-La Roche Ltd
Arel Golombeck, MD (*Abstract Co-Author*) Nothing to Disclose
Rowena Yip, PhD, MPH (*Abstract Co-Author*) Nothing to Disclose
Claudia I. Henschke, MD,PhD (*Abstract Co-Author*) Advisory Board, LungLifeAI, Inc;Board Member, Early Diagnosis and Treatment Research Foundation Inc
Louis Gros, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Next-generation sequencing (NGS) of tumor cell-derived DNA/RNA is crucial for early-stage Non-Small Cell Lung Cancer (NSCLC) care. This study examines NGS success rates, i.e., the feasibility of DNA and RNA sequencing, and the quality of DNA sequencing on early-stage NSCLC biopsies.

**METHODS AND MATERIALS**

We analyzed data from a multi-institutional study focusing on stage I NSCLC treatments. We included patients with NGS-tested biopsies of =30 mm nodules confirmed as stage I NSCLC by surgery. Our assessment covered biopsy types, NGS success rates (DNA and RNA sequencing feasibility and quality), tumor cellularity, radiological characteristics, and patient outcomes. Biopsy methods consisted of CT-guided fine needle aspiration biopsy (FNAB), CT-guided core needle biopsy (CNB) and endobronchial ultrasound-guided transbronchial fine needle aspiration (EBUS-TBNA). DNA sequencing meeting quality standards was assessed based on required coverage criteria. NGS assays' detection limits for genomic alterations vary and low tumor cell content can yield false negatives. We utilized the Sema4 assay (Stamford, CT), targeting 161 genes with a minimum sequencing depth of 200x and computed descriptive statistics.

**RESULTS**

77 patients were included (39 females), mostly white (57%) and smokers (75%), median age 68.6. Nodule types: 60 solid, 11 part-solid, 6 non-solid. Mean diameter: 19.6 mm, solid component: 13.6 mm. Biopsy methods: 57/77 FNAB, 12/77 CNB, and 8/77 EBUS-TBNA. No post-biopsy complications occurred. DNA sequencing was successful in 75 of 77 biopsies (97.4%). In 2 patients, tumor cellularity was too low. Quality standards were met in 88% of biopsies, with no significant differences among methods. Biopsies not meeting standards came from nodules with smaller solid components (8.4mm vs. 14.2mm, Welch Two Sample t-test p: 0.0481) and more part-solid/nonsolid nodules (44.4% vs. 19.1%). Tumor cellularity was lower in these samples (25.7% vs. 46.0%, Wilcoxon rank sum test, p=0.0443). RNA sequencing was feasible in 51/77 (66.2%), notably lower in samples from FNABs (59.6%) compared to CNBs (91.7%) and EBUS-TBNAs (75%) (Pearson's Chi-squared test, p=0.04). Nodule size was lower in the non-analyzable samples but not significantly, as was tumor cellularity (35.9% vs. 47.9%, p=0.053). Nodule consistency was comparable.

**CONCLUSION**

DNA sequencing succeeded in 97.4% of biopsies of nodules = 30 mm. Nodule solid component size and tumor cellularity correlated with DNA sequencing quality. RNA-based NGS feasibility was lower, especially in FNAB samples.

**CLINICAL RELEVANCE/APPLICATION**

NGS is feasible on small lung tumor biopsies with a high success rate. Quality depends on both the size of the solid component of the nodule and the tumor cellularity in the sample.

## M2-SPIR-6 CLINICAL FEASIBILITY OF AN INSTRUMENT-CONTROLLING MASTER-SLAVE CT FLUOROSCOPY-GUIDED INTERVENTIONAL ROBOT FOR PERCUTANEOUS PUNCTURE

Wenge Xing (*Abstract Co-Author*) Nothing to Disclose
Zhi Guo, MD (*Abstract Co-Author*) Nothing to Disclose
Yong Li (*Abstract Co-Author*) Nothing to Disclose
Xueling Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Nan Wang (*Abstract Co-Author*) Nothing to Disclose
Bin Xiong (*Abstract Co-Author*) Nothing to Disclose
Haipeng Yu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This work aims to introduce a novel master-slave interventional surgical robotic system using CT fluoroscopy guidance. The manipulator and end-effector of this system can be deployed in separate room to overcome the limitation of radiation dose to radiologists that existing in traditional CT-guided puncture approach. This system integrates fluoroscopy imaging and master-slave control technologies to enhance procedural feasibility and patient safety.

### METHODS AND MATERIALS

A prospective study was conducted on 83 participants (Age: 62.1±10.6yrs, F: 39, M: 44) for lung and liver percutaneous puncture surgery utilizing the robotic system. The primary aim was the one-time puncture success rate, the secondary aims included the number of needle adjustments, the time taken for successful puncture and the entire procedure, and user evaluation of device performance. Additionally, the radiation dose for the whole surgical procedure (including radiation dose in pre-operation scan, intra-operation and post-operation scan) was recorded and the safety of the system was evaluated.

### RESULTS

78 patients of Per Protocol Set were statistic evaluated. The system achieved a one-attempt puncture success rate of 96.2% among 78 participants. The average number of needle adjustments per procedure was 1.1. The mean time for a successful puncture was 1.61 minutes. Approximately 100% of clinicians rated the system's functionality, stability, and portability as "satisfactory". Regarding safety, 12.3% of participants experienced puncture-related complications (including pneumothorax, hemoptysis and bleeding), with no device defects occurring during the clinical trial. Moreover, the average effective radiation dose for the whole surgical procedure was 5.35 mSv under the usual CT dose for the thoracic-abdominal regions (6.1-7.7 mSv).

### CONCLUSION

This study demonstrates the feasibility and safety of the novel robotic system for percutaneous lung puncture. This system achieved a puncture time of less than 2 minutes and favorable clinician ratings, thereby highlighting its potential for widespread clinical adoption.

### CLINICAL RELEVANCE/APPLICATION

Traditional CT-guided percutaneous puncture techniques and existing navigation systems suffered from repeated radiation exposure, procedural complications, and the lack of real-time imaging. The master-slave interventional robot enhances one-time puncture success rate and safety to patients, significantly reducing puncture time, and is endorsed by clinicians for broader clinical application.

## M2-SPIR-7 COMPARATIVE RANDOMIZED CLINICAL TRIAL OF A MASTER-SLAVE INTERVENTIONAL ROBOT FOR ABDOMINAL PERCUTANEOUS PUNCTURE

Wenge Xing (*Abstract Co-Author*) Nothing to Disclose
Lu Zhang (*Abstract Co-Author*) Nothing to Disclose
Nan Wang (*Abstract Co-Author*) Nothing to Disclose
Jianjun Li (*Abstract Co-Author*) Nothing to Disclose
Bin Xiong (*Abstract Co-Author*) Nothing to Disclose
Yinzhang Lv (*Abstract Co-Author*) Nothing to Disclose
Zi Wang, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

CT-guided percutaneous puncture is critical for diagnosing and treating abdominal malignancies. To improve clinical outcomes and avoid radiation to radiologists, a novel CT fluoroscopy image guided master-slave robotic system was developed, the manipulator and end-effector of this system can be deployed in separate room. This study aims to validate the feasibility and safety of the developed system of abdominal percutaneous punctures against traditional CT-guided techniques.

### METHODS AND MATERIALS

We conducted a prospective, randomized, controlled trial involving patients undergoing abdominal percutaneous puncture. 30 patients (M: 15, F: 15; mean lesion size 7.04cm) were enrolled in this study. 15 participants (mean lesion size 7.39cm) were divided in the study group. 15 participants (mean lesion size 6.71cm) experienced the conventional CT-guided freehand puncture to serve as the control group. The primary endpoint was the one-time puncture success rate. Secondary endpoints included patient radiation dose of whole procedure, total procedure time and complication rate. The procedure time analysis of each step (including preoperative planning, sterilization and anesthesia, preparation, puncture and target confirmation) was also evaluated.

### RESULTS

29 patients (M: 14, F: 15) of Per Protocol Set were statistically analyzed. The study group demonstrated a 100% (14/14) one-time puncture success rate compared to 40% (6/15) in the control group, with a statistically significant difference ($p<0.01$). The trial group also showed superiority in secondary endpoints, notably reduced puncture time (median 0.56min vs 2.05min, $p<0.01$), and less radiation dose (median 5.19mSv vs 17.49mSv, $p<0.001$) than the control group. These results indicate the enhanced feasibility and safety to patient of the robotic system. The median of total procedure time was 14.84 minutes vs 9.02 minutes with the procedure time analysis shown in Figure 1. No complication was observed in both groups.

### CONCLUSION

The developed system significantly improves the success rate of abdominal percutaneous punctures and reduces the puncture time and radiation dose, as well as eliminates all radiation to radiologists, demonstrating superior efficiency and safety compared to traditional CT-guided methods. Its successful application in abdominal punctures highlights the potential for broader clinical adoption, enhancing procedural outcomes and patient care.

### CLINICAL RELEVANCE/APPLICATION

The new interventional robot boosts surgical feasibility in abdominal puncture over traditional methods. These findings suggest the system's potential for widespread clinical adoption and mark a significant advancement in the minimally invasive treatment of abdominal malignancies.

## M2-SPIR-9 THE EFFECTS OF OPERATOR SPECIALTY ON DIAGNOSTIC YIELD AND BLEEDING COMPLICATIONS FOR PERCUTANEOUS RENAL PARENCHYMAL BIOPSY

Atul B. Shinagare, MD (*Abstract Co-Author*) Consultant, VirtualScopics, Inc;Consultant, Imaging Endpoints
Daniel I. Glazer, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew P. Schenker, MD (*Abstract Co-Author*) Nothing to Disclose
Agatha Stanek, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the safety and efficacy of percutaneous renal parenchymal biopsy and compare outcomes when performed by radiologists and nephrologists

## METHODS AND MATERIALS

This IRB-approved single institution retrospective cohort study included all patients undergoing percutaneous renal parenchymal biopsies performed by radiologists (1/1/22-12/31/23) and nephrologists (1/1/22-12/31/22). Basic demographic data (age, sex, weight), guidance modality, needle gauge, biopsy technique, number of core samples, adverse events, and number of glomeruli obtained were all collected from the electronic health record. Biopsies of both native and transplant kidneys were included. Procedures performed by radiologists utilized 18-gauge side cutting needles and co-axial technique and procedures performed by nephrologists utilized 16-gauge side cutting needles and non-coaxial technique. Adverse events were graded according to SIR criteria. Categorical variables were compared with a Fisher exact test and continuous variables were compared with a t-test.

## RESULTS

A total of 324 biopsies were performed during the study period, 124 by radiologists (16 transplant, 108 native) and 200 by nephrologists (79 transplant, 121 native). Mean patient age was similar (53.1 years vs 55.5 years, $p=0.21$) with patient weight greater for biopsies performed by radiologists (92.8 kg vs 76.03 kg, $p<0.001$). Diagnostic rate was 100% [124/124] for radiologists and 98.5% [197/200] for nephrologists ($p=0.29$). Number of core samples (2.6 vs 2.0; $p<0.001$) and glomeruli obtained per procedure (36.9 vs 31.0; $p<0.001$) were higher for biopsies performed by radiologists. Bleeding events were more common following biopsies performed by nephrologists (55/200, 27.5%) compared to biopsies performed by radiologists (4/124, 3.2%) ($p<0.001$), although almost all were minor. Two major bleeding events occurred. One major bleeding event was a radiologist performed biopsy of a native kidney that requiring overnight observation but no intervention. The other major bleeding event was a nephrologist performed native kidney biopsy that resulted in hypotension due to active arterial bleeding and required urgent transarterial embolization.

## CONCLUSION

Percutaneous renal parenchymal biopsies performed by radiologists resulted in fewer bleeding events and had similar diagnostic yield compared to procedures performed by nephrologists despite the greater average weight of patients biopsied by radiologists.

## CLINICAL RELEVANCE/APPLICATION

Kidney parenchymal biopsies should be performed with 18-gauge needles and coaxial technique as this has equivalent diagnostic yield to larger core needle samples with fewer adverse events.

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# Abstract Archives of the RSNA, 2024

M2-SPMK

**Musculoskeletal Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPMK-1 REFORMULATING IMAGE TRANSITION AS IMAGE SELF-INPAINTING: SYNTHESIZING HIGH-FIDELITY MRI IMAGES

Enhao Gong, PhD (*Abstract Co-Author*) Employee, Subtle Medical, Inc;Stockholder, Subtle Medical, Inc
Long Wang (*Abstract Co-Author*) Nothing to Disclose
Lei Xiang, MS (*Abstract Co-Author*) Nothing to Disclose
Zhihao Zhang (*Presenter*) Nothing to Disclose

### PURPOSE

Synthesizing required sequences from the acquired ones of MRI protocol can make the entire process more efficient. We developed an inpainting-based deep learning (DL) network (IBSNet) for MRI sequence high-fidelity synthesis and assessed its image quality.

### METHODS AND MATERIALS

Ten clinical knee MRI cases from multiple institutions and scanners were retrospectively identified with sagittal T2 FS sequence as the source and sagittal PD sequence as the target. A total of 3200 slices were used for training and 800 slices were used for testing. We ingeniously reformulated the problem of image transition as a self-restoration task, wherein during training, random rectangular regions of arbitrary sizes were cropped from the target image as missing patches, which were then filled with content from the corresponding regions of the source image to construct the source image. We generated over ten thousand source-target image pairs and trained a DL model to learn the nonlinear mapping between them. During inference, the source image was directly utilized as input, with missing patches set to areas equal to their own size. To assess the image quality, the SNR and CNR on four pathological tissues, i.e, muscle, cartilage, fluid, and menisci were calculated for both synthetic images and SOC images. Additionally, the Signal-to-Noise Ratio (PSNR) and Structural Similarity (SSIM) were used to measure the similarity between the synthetic images and SOC images. Wilcoxon signed-rank tests was utilized for intergroup comparisons. $p<0.05$ indicated a statistically significant difference. Additionally, we performed ablation experiments to compare our method quantitatively and qualitatively with other state-of-the-art DL methods.

### RESULTS

The median SNR of all tissues of synthetic sequences were higher than that of SOC sequences (muscle:137.06 vs. 49.47, cartilage:126.14 vs. 41.68, fluid: 361.39 vs. 128.57, menisci: 30.07 vs. 11.24), $p<0.05$. The median CNR of cartilage-to-fluid, fluid-to-menisci, and menisci-to-cartilage of synthetic sequences were 0.34, 12.01, and 0.08, respectively equal to or higher on that of SOC sequences (0.32, 11.44, 0.08), with no statistically significant difference. Synthetic sequences exhibited excellent similarity to SOC sequences, with a PSNR of 31.81±1.91db and SSIM of 99.76±0.03. Compared to five other DL methods, ours outperformed them by 1.88 to 3.94 in PSNR and exhibiting more realistic visual results.

### CONCLUSION

MRI synthesized by the inpainting-based method exhibit higher image quality and visual fidelity compared to SOC images.

### CLINICAL RELEVANCE/APPLICATION

Our inpainting-based method has the ability to synthesize high-fidelity target MRI sequences, reducing the scanning time and improving patient experience.

## M2-SPMK-2 DEEP LEARNING MODELS FOR LUMBAR SPINAL STENOSIS ON MRI: COMPARISON WITH GENERAL RADIOLOGISTS AND ORTHOPEDISTS

Andrew Makmur, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Cheng, MBBS (*Abstract Co-Author*) Nothing to Disclose
Jiong Hao J. Tan, MBBS (*Abstract Co-Author*) Nothing to Disclose
Zongchen Li, MD (*Abstract Co-Author*) Nothing to Disclose
CHANGSHUO LIU (*Abstract Co-Author*) Nothing to Disclose
Alvin Ng Hong Zhi (*Abstract Co-Author*) Nothing to Disclose
James Hallinan, MBChB (*Abstract Co-Author*) Nothing to Disclose
Weizhong Jonathan Sng, MBBS (*Abstract Co-Author*) Nothing to Disclose
You Jun Lee, FRCR, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

To develop deep learning models to automate detection and stenosis classification on lumbar spine MRI, and evaluate performance compared to General Radiologists and Orthopedists.

### METHODS AND MATERIALS

Lumbar spine MRI studies from Sep 2015 to Sep 2019 were obtained retrospectively. Exclusion criteria were spinal instrumentation, suboptimal image quality, post-gadolinium studies, and severe scoliosis. Axial T2w and sagittal T1w images were used. Studies were split into training, validation and test sets. A local external test set of 100 studies was available. Training data were labelled by 4 Radiologists using predefined gradings (normal, mild, moderate, severe) for the central canal, lateral recesses and neural foramina. A 2-component model using convolutional neural networks (CNN) for region of interest (ROI) detection and classification, and a transformer model utilizing a CNN to extract latent features first and a transformer architecture for ROI detection and classification were developed. Consensus labelling by 2 Musculoskeletal Radiologists (10 and 12 years of experience) served as the reference standard. Test sets were separately labelled by 8 participants (2 General Radiologists, 2 Radiology Trainees, 2 Orthopedic Surgeons, and 2 Orthopedic Trainees). Detection recall (%), interrater agreement (Gwet ?), sensitivity, and specificity were evaluated for the models and participants.

### RESULTS

Overall, 564 MRI lumbar spine studies were included (mean age ± SD, 52 ± 19; 302 women), with 464 used for training (74%), validation (8%), and 100 (18%) for the internal test set. Both models showed high recall values for all ROIs in both test sets (central canal >99%; lateral recess 95-98%; neural foramina 94-95%; p<0.001), similar to the participants. Dichotomous classification (normal/mild vs moderate/severe) by the CNN model, transformer model and participants showed respective ? values for central canal 0.99, 0.99, 0.97-0.98, lateral recess 0.98, 0.94, 0.81-0.94, and neural foramina 0.98, 0.95, 0.91-0.95 on internal testing (p<0.001); for central canal 0.99, 0.97, 0.92-0.97, lateral recess 0.97, 0.90, 0.61-0.91, and neural foramina 0.99, 0.94, 0.87-0.93 on external testing (p<0.001).

### CONCLUSION

Compared to a range of clinicians, the CNN model showed superior performance and the transformer model showed similar to superior performance for classification of central canal, lateral recess and neural foraminal stenosis.

### CLINICAL RELEVANCE/APPLICATION

These models could assist radiologists in lumbar spine MRI assessment, improving efficiency through semi-automated reporting and providing guidance to radiologists in-training. In the clinic, the model predictions could assist orthopedists in surgical planning and patient education.

## M2-SPMK-4 AUTONOMOUS MEASUREMENT OF ANATOMIC MALROTATION OF EXTREMITIES ON CT IMAGING IN PEDIATRICS

Heidi Kecskemethy, MS (*Abstract Co-Author*) Nothing to Disclose
Md Sanzid Bin Hossain (*Abstract Co-Author*) Nothing to Disclose
Patrick Yang (*Abstract Co-Author*) Nothing to Disclose
Chandra Teja Tiriveedhi (*Abstract Co-Author*) Nothing to Disclose
Lena Naffaa (*Abstract Co-Author*) Nothing to Disclose
Samir Fouissi (*Abstract Co-Author*) Nothing to Disclose
Monica Epelman, MD (*Abstract Co-Author*) Nothing to Disclose
Dexter Hadley (*Abstract Co-Author*) Nothing to Disclose
Jaiminkumar Ashokbhai Bhoi (*Abstract Co-Author*) Nothing to Disclose
Harry Lee (*Abstract Co-Author*) Nothing to Disclose
Andrew Sanford (*Presenter*) Nothing to Disclose

### PURPOSE

Malrotation of lower extremities manifests as in/out-toeing that requires meticulous CT evaluation of torsional angles for corrective surgical planning in patients 8 years and older. Manual measurement of these angles is both tedious and labor-intensive and requires training by an expert radiologist to perform accurately. We develop novel artificial intelligence/machine learning (AI/ML) models to automate accurate measurement of these torsional angles on CT in a pediatric clinical population.

### METHODS AND MATERIALS

We analyzed two dimensional DICOM images from CT scans acquired from patients seen by Nemours Radiology from 2019 to 2022. To make precise angular measurements, we selected the correct DICOM slice for each of up to 8 angles at the femur and tibia that maximizes specific landmark anatomy per clinical guidelines. To develop our algorithm, we focused on only the proximal femur at the hip using femoral head and neck as anatomical landmarks. To identify these landmarks, we leveraged “template matching” which depends on a set of rigid visual patterns to discriminate the femoral head from neck, ResNet50 which is classic pretrained deep learning model for classification using bounding boxes, and the pretrained state-of-the art “Segment Anything Model” (SAM) for most precise auto-segmentation of the femoral structures. We then leveraged OpenCV methods to calculate precise angles about the segmented landmarks.

### RESULTS

We downloaded 141,805 DICOM files from 190 pediatric patients (41% male; average age = 12.7y [2y-22y]). We made 956 annotations of up to 8 angles on 167 patients. We developed a custom SAM-Med2D instance fine-tuned on 2D medical images to generate auto-segment masks for a ResNet50 classifier that discriminates anatomic landmarks. Our novel SAM-Med2D-Resnet50 model could both learn to identify the optimal slice that maximizes the surface area of anatomical landmarks and accurately measure the angle at the selected slice. Initial validation in 22 patients shows accurate performance for both slice selection and angle measurement when landmarks were distinct.

### CONCLUSION

We developed state-of-the art AI/ML to jointly identify the correct slice of the CT that maximized femoral head and neck anatomical landmarks on CT and curate the angle between them as precisely as the gold standard human expert measurements in most cases.

### CLINICAL RELEVANCE/APPLICATION

Integrating precise AI/ML algorithms into radiology workflows may optimize orthopedic surgical planning, enhance diagnostic precision, and streamline decision-making for pediatric patients to impact their entire lives. Ongoing work will model all 8 angles of the lower extremities and special cases to allow for fully autonomous assessment of malrotation of clinical patients on CT.

## M2-SPMK-6 POTENTIAL OF ENHANCING GPT-4 IN MRI REPORT SUMMARIZATION WITH VISUAL CONTENTS: A QUANTITATIVE ANALYSIS

Kang Wang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Yang Yang, PhD (*Abstract Co-Author*) Nothing to Disclose
Jin Liu (*Abstract Co-Author*) Nothing to Disclose
Zheren Zhu, MSc (*Presenter*) Nothing to Disclose

## PURPOSE

The advancements in large language models (LLM) have shown great promise in radiological text generation. Recently, multimodal LLMs, especially those incorporating image inputs, emerged and offered great potential beyond language-only systems. In this study, we want to evaluate whether and how the quality of related supplementary visual contents can enhance GPT's performance in radiology through MRI report summarization from finding to impression.

## METHODS AND MATERIALS

We acquired 20 de-identified clinical sagittal MSK MRI studies carried out on a 0.55T low-field (LF) scanner (Siemens Free.Max, UCSF Health) from 19 patients. All these studies include image series using 4- or 5-times-repeated scanning. Radiology reports were used as text contents, where the 'Finding' and 'Impression' parts were used for summarization and the ground-truth outputs. One middle slice of an image series was selected as related supplementary visual content for each study, considering the maximum images the GPT model can take and the centered region of interest in MSK studies. We used the single repetitions and the averages of multi-repeated images as low signal-to-noise ratio (SNR) and high-SNR pairs. We evaluated the three approaches: text only, text plus the low-SNR (noisy) image, and text plus the high-SNR (clean) image as contents fed to the LLM to generate the impressions. We utilized OpenAI's GPT-4 vision (gpt-4-turbo-2024-04-09) API and modified the concept of few-shot prompt engineering by contextually supplying 50 impression text examples from 50 unseen reports. Our prompts were structured by following best practices. We set 'Impression:' as an initiation and the temperature parameter to 0.1 to help focus the model's response. Machine translation metrics Rouge-1, Rouge-L, and BLEU were employed to evaluate word overlap, common subsequence, and quality of short sequences.

## RESULTS

Applying an additional clean image (Rouge-L 32.1, 95% CI: 26.9, 37.4) significantly outperformed (paired t-test, $p=0.05$) the addition of a noisy image (Rouge-L 27.8, 95% CI: 25.2-30.4) in generating sequences close to those of radiologists. It also surpassed text-only inputs (Rouge-L 29.4, 95% CI: 26.2-32.6), though not significantly ($p=0.22$).

## CONCLUSION

This study shows that the quality of visual content is crucial for aiding LLMs in radiological text generation, as high-quality content showed the potential to enhance GPT in MRI report summarization, while low-quality visuals hindered performance.

## CLINICAL RELEVANCE/APPLICATION

Incorporating visual data into LLMs has the potential to better streamline radiologists' workflows, leading to more efficient and accurate radiology report generation.

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# Abstract Archives of the RSNA, 2024

M2-SPMS

**Multisystem Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPMS-1 ACUTE EFFECTS OF SMOKING AND VAPING ON MARKERS OF VASCULAR FUNCTION VIA QUANTITATIVE MRI, AN EXPANDED COHORT

Christiana Cottrell (*Abstract Co-Author*) Nothing to Disclose
Felix W. Wehrli, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael Langham (*Abstract Co-Author*) Nothing to Disclose
Rasleen Grewal (*Abstract Co-Author*) Nothing to Disclose
Marianne Nabbout, MD, BS (*Presenter*) Nothing to Disclose

### PURPOSE

This work aims to evaluate the acute effects of tobacco smoking, nicotinized- and non-nicotinized e-cigarette vaping challenges on vascular function in healthy smokers and vapers via quantitative MRI. Pre-inhalation challenge markers are compared to baseline data from non-smokers/non-vapers.

### METHODS AND MATERIALS

Participants undergo three study visits involving two suites of MRI scans separated by inhalation challenges: (1) tobacco cigarette smoke, (2) nicotinized e-cigarette aerosol, (3) non-nicotinized e-cigarette aerosol. Thirty-one healthy smokers and vapers (17 males), ages 21-49 years, have been studied to date. Twenty-two participants completed all three visits, eight participants completed one visit, and one participant completed two visits. Ten non-smokers/non-vapers (two males), ages 21-33 years, also underwent a baseline scan protocol only. Most elements of the protocol have been described in previous literature published by our laboratory. In brief, a cuff occlusion was applied at the proximal thigh to assess flow-mediated dilation (FMD). Following deflation, femoral artery flow velocity and venous oxygen saturation (SvO2) were quantified. Aortic arch pulse wave velocity was evaluated with complex difference signals from velocity-encoded projections. Phase-contrast MR at the superior sagittal sinus (SSS) during a breath-hold challenge yielded a measure of cerebrovascular reactivity. Cerebral metabolic rate of oxygen was derived from the SSS flow velocity and SvO2. Finally, neurovascular compliance of the brain's arterial tree was measured from time-resolved carotid flow rates. Pre- versus post-inhalation markers from each of the three interventions were then compared using unpaired t-tests.

### RESULTS

The study is ongoing and double-blinded. Therefore, data from all three interventions were combined. Following inhalation there were significant decreases in the superficial femoral artery baseline velocity and time of forward flow, suggesting impaired vascular reactivity (both $p<0.05$). At the femoral vein, baseline SvO2 was reduced ($p = 0.01$). The comparison of biomarkers from smokers/vapers pre-inhalation to non-smokers/non-vapers (no inhalation) showed NVC was greater (+37%; $p<0.005$) and FMD lower (-42%; $p<0.05$) in smokers/vapers.

### CONCLUSION

This MRI protocol was able to detect acute effects of smoking and vaping on markers of vascular function.

### CLINICAL RELEVANCE/APPLICATION

The data highlight the deleterious effects of smoking and vaping.

## M2-SPMS-2 XENON-129 MRI PULMONARY GAS EXCHANGE IN LONG COVID IS ASSOCIATED WITH COGNITIVE FUNCTION AND BRAIN MRI

Tara Lanning (*Abstract Co-Author*) Nothing to Disclose
Eric Bruening (*Abstract Co-Author*) Nothing to Disclose
Marrissa McIntosh, PhD (*Abstract Co-Author*) Nothing to Disclose
Conner Wharff (*Abstract Co-Author*) Nothing to Disclose
Alejandro Comellas, MD (*Abstract Co-Author*) Nothing to Disclose
Natally AlArab, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Karin Hoth (*Abstract Co-Author*) Nothing to Disclose
Eric A. Hoffman, PhD (*Abstract Co-Author*) Founder, VIDA Diagnostics, Inc;Shareholder, VIDA Diagnostics, Inc;Advisory Board, Siemens AG
Sean B. Fain, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Consultant, Marvel Medtech, LLC;Research Consultant, Regeneron Pharmaceuticals, Inc;Research Consultant, Groupe Sanofi
Andrew Hahn (*Abstract Co-Author*) Nothing to Disclose
Jonathan Percy (*Abstract Co-Author*) Nothing to Disclose
Carinda Linkenmeyer (*Abstract Co-Author*) Nothing to Disclose
Keegan Staab, BS (*Presenter*) Nothing to Disclose

## PURPOSE

Assess associations between pulmonary MRI gas exchange, structural and functional brain MRI, and cognition in long COVID patients.

## METHODS AND MATERIALS

Subjects with persistent dyspnea and/or fatigue following the resolution of acute COVID-19 infection (long COVID) were recruited from a post-COVID-19 clinic. Hyperpolarized 129Xe pulmonary MRI, structural and functional brain MRI, pulmonary function (forced expiratory volume in 1 second [FEV1]) and cognitive tests were acquired at the same study visit. Images of pulmonary gas exchange were obtained spectroscopically using a 1-point Dixon technique to estimate the xenon uptake in alveolar-capillary membrane (mem:gas) and red blood cell (RBC:gas) compartments and gas transfer ratio (RBC:mem). 3D MPRAGE anatomical and T1 weighted ASL functional brain MRI were processed using BRAINSAutoWorkup to quantify cerebral gray (GM) and white matter (WM) volumes and cerebral blood flow (CBF). Perceived cognitive difficulties were measured using Patient-Reported Outcomes Measurement Information System (PROMIS Cognitive Function) and objective cognitive performance was assessed using National Institute of Health Toolbox V3 Cognition Battery with normatively adjust t-scores grouped as follows: total cognition composite (TCC), executive function (EF), processing speed (PS), memory (Mem) and language (Lang). Univariate relationships were evaluated using Spearman correlations.

## RESULTS

11 subjects (10 female, age=52±12 yrs. [min-max=28-63], BMI=30±8 kg/m3 [min-max=21-42]) approximately 31 months from acute infection (min-max=24-40 months) were evaluated. Subjects self-reported cognitive difficulties (PROMIS mean t-score=34.4); cognitive performance was within normal limits (TCC mean t-score=55.5). Pulmonary-cognition relationships were observed for EF with RBC:mem (?=0.76, p=0.02) and RBC:gas (?=0.60, p=0.05). Percent predicted FEV1 was not significantly related to cognition, but trended toward a relationship with PS (?=0.54, p=0.08). Pulmonary-brain MRI relationships were observed for RBC:mem with cerebral WM (?=0.65, p=0.04), frontal lobe GM (?=0.66, p=0.04), parietal lobe WM (?=0.77, p=0.01), parietal lobe WM (?=0.71, p=0.02) volumes, and CBF (?=-0.74, p=0.04). RBC:gas was also correlated with CBF (?=-0.79, p=0.02).

## CONCLUSION

In long COVID, lower pulmonary gas exchange may be associated with cognitive dysfunction, as well as lower GM and WM volumes and higher CBF.

## CLINICAL RELEVANCE/APPLICATION

Gas exchange abnormalities sensitively detected using 129Xe MRI may help identify long COVID patients who require additional treatment or long-term management.

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# Abstract Archives of the RSNA, 2024

M2-SPNMMI

**Nuclear Medicine & Molecular Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPNMMI-1 WHITE MATTER CHANGES ON FDG PET AFTER CAR T-CELL THERAPY

Mary Ellen I. Koran, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Steven Bishay (*Abstract Co-Author*) Nothing to Disclose
Monica Nable (*Abstract Co-Author*) Nothing to Disclose
Natalie Jones (*Abstract Co-Author*) Nothing to Disclose
Trent Schwartz (*Abstract Co-Author*) Nothing to Disclose
Gary T. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
David Smith (*Abstract Co-Author*) Nothing to Disclose
Bennett A. Landman, PhD (*Abstract Co-Author*) Nothing to Disclose
Oliver S. Zhao (*Abstract Co-Author*) Nothing to Disclose
Timothy Hohman (*Abstract Co-Author*) Nothing to Disclose
T. Bryan Jackson (*Abstract Co-Author*) Nothing to Disclose
Sydney Nelson (*Presenter*) Nothing to Disclose

### PURPOSE

Chimeric Antigen Receptor (CAR) T-cell therapy represents a novel and effective method of treating many malignancies. In CAR T-cell therapy, normal T-lymphocytes are removed from the body, re-engineered to attack specific cancer cells, and returned to the patient. Though CAR T-cell therapy has improved survival in hematologic malignancies, it is associated with neurotoxicities in up to 70% of patients as measured by immune cell-associated neurotoxicity scores (ICANS). We do not yet know what areas of the brain are most susceptible. 2-[18F]-fluoro-2-deoxy-glucose (FDG) PET represents a noninvasive method of assessing early changes in neuronal and synaptic function. Here, we evaluate the changes in FDG PET of the brain before and after CAR T-cell treatment.

### METHODS AND MATERIALS

22 patients treated with CAR T-cell therapy who had a pre-treatment and post-treatment FDG PET scan were identified through the Institution's Cancer Center's Cancer registry. Standardized uptake value ratio (SUVR) was calculated, and each FDG PET image was co-registered and nonlinearly warped to a standardized coordinate system. Voxel-wise linear mixed-effect models were used to assess for changes in SUVR after CAR T-cell therapy. A conservative two-sided voxel-level threshold of $p<0.001$ uncorrected and gaussian random field theory for cluster correction with a family-wise error rate (FWER) of $pFWER < .05$ was used.

### RESULTS

Compared to baseline, multiple large clusters met conservative significance thresholds with decreases in glucose metabolism following CAR T-cell therapy. These included large regions in the frontal and temporal lobes and in the white matter, throughout nearly the entire corpus collosum and part of the occipital tract ($pFWER=<0.001$). 14 of these patients had at least one ICANS =1 indicating neurological symptoms after treatment with dis-orientation and word finding difficulty symptoms present in 5 of these patients. Analyses stratifying and covarying by ICANS are ongoing.

### CONCLUSION

This is the first study to evaluate the effects of CAR T-cell therapy on the brain using FDG PET, a highly sensitive biomarker of neuronal health. Consistent with multiple published MR studies, the white matter appears particularly vulnerable to the effects of CAR T-cell therapy. Though the neurotoxic effects from CAR T-cell therapy can vary widely, many of our patients had word-finding difficulty which has also been previously associated with white matter changes.

### CLINICAL RELEVANCE/APPLICATION

This is the first study to evaluate which regions of the brain are most susceptible to the effects of CAR T-cell therapy using images of the brain extracted from routine whole body FDG PET.

## M2-SPNMMI-2 UV-LIGHT ANTIBACTERIAL PHOTODYNAMIC THERAPY THROUGH ELECTROMAGNETIC TRACKING TECHNOLOGY IN PROSTHETIC JOINT INFECTIONS

Anthony O. Osifuye, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Periprosthetic joint infection (PJI) is associated with high patient morbidity. Despite improvements in infection prevention, diagnostic approaches, surgical and antimicrobial treatment, more individuals are being diagnosed with PJIs each year. Antimicrobial photodynamic therapy (aPDT), an emerging clinical

application of theranostics, is specifically designed to identify and destroy microorganisms causing local infection. APDT uses multi-functional molecules called photosensitizers (PSs), which can be excited by light of a specific wavelength to transfer energy to surrounding oxygen and produce reactive oxygen species (ROS), which in turn damage and/or eradicate the bacteria. Several metal-based photosensitizers conjugated with radioisotopes used in PET and SPECT nuclear imaging preclinical research studies demonstrate differentiation between sterile inflammation and infection. Consequently, PJIs can be identified and therapeutic effects monitored in real time. Using emerging next-generation electromagnetic tracking technology to access difficult-to-reach areas of the body circumvents limitations associated with UV/visible light, which has a limited penetration depth in biological tissues (< 3 mm). The hypothesis is decreased bacterial presence in a prosthetic joint space model through use of UV-light photodynamic therapy through electromagnetic tracking technology.

## METHODS AND MATERIALS

A model is developed to mimic prosthetic joint infection by introducing manufacturer-cultured bacterial strains into the prosthetic joint space. To track and treat the infection, Radwave's GPS electromagnetic tracking technology is used along with ultraviolet type-C diode application. Furthermore, counter-on-chip bacterial cultures are employed for precise quantification and analysis of bacterial cells.

## RESULTS

Results in process

## CONCLUSION

Based on the findings of this study, the goal is to show a reduction in treated bacterial cultures measured with counter-on-chip technology and a decrease in standard value units in the region of interest on SPECT and PET scans. This will enable quantification analysis of bacterial cell destruction using UV-light photodynamic therapy facilitated by electromagnetic tracking technology.

## CLINICAL RELEVANCE/APPLICATION

This underexplored alternative therapy has the potential to serve a critical role in PJI treatment.

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# Abstract Archives of the RSNA, 2024

M2-SPNPM

**Noninterpretive Skills (Beyond Imaging) Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPNPM-1 PROGRAM SIGNAL UTILIZATION AND IMPACT ON RADIOLOGY RESIDENCY MATCH: SURVEY OF APPLICANTS

Jeffery Hogg, MD (*Abstract Co-Author*) Nothing to Disclose
Francis Deng, MD (*Abstract Co-Author*) Nothing to Disclose
Arun Murugesan, MD (*Abstract Co-Author*) Nothing to Disclose
Mahla Radmard, MD (*Abstract Co-Author*) Nothing to Disclose
Sahil Patel, MD (*Abstract Co-Author*) Nothing to Disclose
David M. Yousem, MD, MBA (*Abstract Co-Author*) Royalties, RELX;Speaker, MRI Online;Board Member, MRI Online;
Muhammad H. Malik, MD (*Abstract Co-Author*) Nothing to Disclose
Dhairya Lakhani, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Despite an incremental increase in residency slots, the surge in DR residency applicants has intensified the competitiveness of the radiology match. In response to these challenges, compounded by the shift to virtual interviewing, the NRMP introduced the signaling system in 2022. This system is designed to aid applicants in effectively conveying their program preferences, thereby enhancing the likelihood of securing interview invitations from desired programs. This study evaluates the effectiveness of the ERAS signaling system for DR candidates.

### METHODS AND MATERIALS

This survey-based study was approved by our Institutional Review Board and conducted after the Match results of March 2024 using the Qualtrics Research Suite. The survey targeted 728 radiology residency applicants registered with TheRadRoom platform, achieving a completion rate of 75% (n=202). We collected detailed demographic data, information on applications and interview invitations both with and without the use of program signals, and respondents' strategic use of signals. Statistical analyses were performed using IBM SPSS, focusing on interview conversion rates for different signal categories and stratifications. independent samples t-tests were conducted for two-group comparisons and one-way ANOVA was used for multiple group comparisons. chi-square test was utilized for categorical data analysis.

### RESULTS

202 applicants completed the survey. 176 (87.1%) were first-time applicants. 98.5% utilized the ERAS signaling system. Programs targeted with signals showed significantly higher interview invitation rates compared to those not targeted. The interview conversion rate for programs targeted with gold signals was 59.8% (±27.4%) and 51.8% (±31.3%) for silver signals. In contrast, the interview conversion rate for programs that did not receive any signals was significantly lower, at 8.5% (±8.5%). Furthermore, 76% (n=146 out of 192 respondents) endorsed continued use of signaling for future DR match cycles

### CONCLUSION

The ERAS signaling system is perceived to be a beneficial tool in the radiology residency application process, enabling applicants to better convey their program preferences and increasing their chances of securing interviews. Future cycles may benefit from refining this system to accommodate the growing competitiveness of the match process

### CLINICAL RELEVANCE/APPLICATION

The ERAS signaling system enhances diagnostic radiology residency applicants' ability to secure interviews at preferred programs, addressing the increased competition in the match process. Its strategic use and potential refinement could improve match outcomes, benefiting applicants and programs alike

## M2-SPNPM-2 ENHANCING EARLY RADIOLOGY EDUCATION AND INTEREST THROUGH RESIDENT-LED WORKSHOPS

Latifa L. Sanhaji, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Quach, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In many medical schools, radiology is introduced late, typically during clinical years, often leading students to struggle with image interpretation and not grasp its relevance early in their training. This delay can affect their performance in clinical rotations and standardized tests like USMLE Steps 1 and 2CK, which include many image-based questions. Recognizing the growing interest among students in radiology as a potential specialty, we started targeted, resident-led workshops aligned with preclinical modules to bridge this gap early in their educational journey.

## METHODS AND MATERIALS

We enlisted volunteer radiology residents to conduct monthly, high-yield lectures aligned with preclinical organ modules. Over two years (2022-2024), 152 students participated in 10 comprehensive sessions. The curriculum was designed around popular STEP review resources, emphasizing case-based scenarios that contrast normal and pathological images. Each lecture featured 3-5 questions to measure understanding and track progress, with added queries about confidence in image interpretation and interest in radiology careers to better gauge effectiveness of the workshops in those domains.

## RESULTS

The workshops led to substantial improvements in various categories: 1. Scores on pre- and post-tests improved markedly from 64% to 82%. 2. Confidence in interpreting radiological images increased by 50%, with average scores rising from below four to six out of ten. 3. 88% of survey respondents found the lectures beneficial for future scenarios in clinical rotations. 4. Notably, 83% of survey respondents reported a heightened interest in pursuing radiology residencies (DR/IR).

## CONCLUSION

Developing a coherent preclinical radiology curriculum can be challenging but rewarding. Our workshops, integrated with the institutional curriculum and supported by the Radiology Interest Group, significantly boosted student engagement and preparedness for clinical roles and exams. This proactive approach not only aids in mastering the imaging sections of standardized tests and better preparing students for interpreting images during clinicals, but also fosters early interest in radiology, positioning students better for residency applications.

## CLINICAL RELEVANCE/APPLICATION

NA

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# Abstract Archives of the RSNA, 2024

M2-SPNR

**Neuroradiology Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPNR-1 ASSESSING THE VISIBILITY OF NIGROSOME-1 IN LOWER RESOLUTION MCTFI QSM IMAGING: IMPLICATIONS FOR PARKINSON'S DISEASE AND DEMENTIA WITH LEWY BODIES

Salil Soman, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Bulent Aslan, MD (*Abstract Co-Author*) Nothing to Disclose
Youssef Masmoudi, MD (*Abstract Co-Author*) Nothing to Disclose
Yi Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Yan Wen, PhD (*Abstract Co-Author*) Nothing to Disclose
Pascal Spincemaille, PhD (*Abstract Co-Author*) Nothing to Disclose
Shreyas Balaji (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to identify the presence of Nigrosome-1 (N1) in mcTFI QSM images. N1 is a dopamine rich region of the substantia nigra (SN) which contains the largest portion of neurons affected in Parkinson's disease (PD). During Dementia with Lewy Bodies (DLB) and PD, iron is deposited in N1, leading to loss of visibility of N1. Previous studies have shown that N1 has a strong negative predictive value (close to 100%) for PD., and that N1 is visible in QSM images with a minimum voxel resolution of 0.6 x0.67x1.34mm. Our work aims to confirm the visibility of N1 on QSM images with a lower voxel resolution of 0.8x1x2mm.

### METHODS AND MATERIALS

A total of 29 mcTFI QSM images were collected with a 3T MRI scanner on healthy patients with no known diagnosis of DLB or PD. These images were reviewed to confirm the presence or absence of N1, specifically through the presence of the "Swallow Tail Sign" (STS) that has been shown to indicate the presence of N1. Two images were excluded due to artifacts, resulting in a total count of 27 subjects. Images where more than half of the reviewers agreed that N1 was present, and images where all reviewers agreed that N1 was present were counted.

### RESULTS

In all 27 subjects, the SN was visible bilaterally. Out of the 27 cases, in 8 cases all reviewers agreed the STS was visible, in 2 cases a majority agreed the STS was visible, and in 9 cases at least 1 reviewer stated that STS was visible. This corresponded to 29.6% of cases where all reviewers agreed N1 was present, 37.0% of cases where more than half suggested N1 was present, and 70.3% of cases where at least 1 reviewer stated that N1 was present. In addition, in 3 cases where the STS was present, it was only present unilaterally.

### CONCLUSION

In select scans, N1 appears to be visible on mcTFI QSM images with a resolution of 0.8x1x2mm. Future work is necessary to examine why N1 is more visible on some QSM images than others at this resolution, as well as quantification of the size/presence of N1.

### CLINICAL RELEVANCE/APPLICATION

The appearance of N1 at a lower resolution potentially indicates the usefulness of N1 imaging through mcTFI QSM imaging in MRI scanners that are more widely available. Based on previous research, given the near 100% negative predictive value for PD of the STS, this may allow PD to be ruled out in a wider range of clinical settings. However, absence of the STS in a scan at this resolution cannot confirm PD.

## M2-SPNR-10 GENETIC MECHANISMS UNDERLYING GRAY MATTER ATROPHY IN PARKINSON'S DISEASE:A TRANSCRIPTOME AND NEUROIMAGING STUDY

Xiangminh Fang, MD (*Abstract Co-Author*) Nothing to Disclose
Ji Yi (*Presenter*) Nothing to Disclose

### PURPOSE

Extensive research has shown prominent gray matter atrophy (GMA) in patients with Parkinson's disease (PD), yet its genetic mechanisms are largely unknown. The purpose of our study was to explore the genetic mechanisms underlying GMV alterations in PD.

### METHODS AND MATERIALS

To achieve this goal, we first conducted a neuroimaging meta-analysis as well as a VBM study in an independent dataset to investigate GMV changes. We carried out the meta-analysis and recruited 48 PD patients and 26 healthy controls (HC) to acquire magnetic resonance images using a 3.0T MRI scanner (Magnetom 3T Siemens, Prisma, Germany). Furthermore, we combined the AHBA to perform a transcriptome-neuroimaging spatial association analysis to

identify genes whose expression levels were related to gray matter atrophy in PD. Finally, an array of post hoc analyses were conducted to investigate the functional features of the identified genes.

**RESULTS**

Following the extensive literature review and selection process, 1,831 PD patients and 1,378 HC from 44 studies were included, with prominent gray matter atrophy in PD patients ($p < 0.05$, FWE corrected). Our data showed that PD patients consistently showed significant gray matter atrophy in the superior temporal gyrus. Furthermore, a spatial correlation study between the transcriptome data and neuroimaging indicated that these gray matter reductions were spatially related to the expression of 1952 overlap genes. In addition, the genes were exclusively expressed in the brain tissue, specifically among dopamine receptor cells, throughout almost the entire developmental stage. Likewise, these genes showed the potential for creating a PPI network supported by 16 putative hub genes of functional significance. In addition, we delineated the spatial temporal expression trajectory of three hub genes with the highest degree values (i.e., CTNNB1, MAPK3, and CALM3). We discovered that the genes were correlated with an array of behavioral terms, including vision motion, spatial cognition, execution, and intensity emotion, by correlating gene expression with behavioral domains using BrainMap along with behavioral domains including early visual, motion, and regulation via Neurosynth.

**CONCLUSION**

Overall, our findings indicate that gray matter atrophy in PD could potentially be a consequence of intricate interactions between a complex set of genes, confirming the polygenic nature of this neurological condition.

**CLINICAL RELEVANCE/APPLICATION**

Our findings may not only offer unique insight into the genetic mechanisms of gray matter atrophy in PD but also inform novel treatment approaches targeting the molecular substrates underlying brain morphological abnormalities.

## M2-SPNR-12 INTEGRATED EVALUATION OF NIGROSOME 1 SIGN, NEUROMELANIN-SENSITIVE MR AND IRON DEPOSITION

Satoshi Nakajima, MD (*Abstract Co-Author*) Nothing to Disclose
Nobukatsu Sawamoto (*Abstract Co-Author*) Nothing to Disclose
Shuichi Ito, MD (*Abstract Co-Author*) Nothing to Disclose
Masaki Umehana, MD (*Abstract Co-Author*) Nothing to Disclose
Sachi Okuchi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sayo Otani, MD (*Abstract Co-Author*) Nothing to Disclose
Satoshi Ikeda (*Abstract Co-Author*) Nothing to Disclose
Sean Sethi (*Abstract Co-Author*) Nothing to Disclose
Shin Morooka (*Abstract Co-Author*) Nothing to Disclose
Akihiko Sakata, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yongping Ma (*Abstract Co-Author*) Nothing to Disclose
Yuta Terada (*Abstract Co-Author*) Nothing to Disclose
Yuji Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jumpei Fujimoto, MD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Shima (*Abstract Co-Author*) Nothing to Disclose
Kiarash Ghassaban (*Abstract Co-Author*) Nothing to Disclose
Yasutaka Fushimi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Although the deformation of the substantia nigra pars compacta (SNpc) (i.e. loss of swallow tail sign), signal loss on neuromelanin-sensitive MRI, and iron deposition in the deep gray matter (DGM) structures are important findings in Parkinson's disease (PD), an integrated analysis including these biomarkers has not been performed well. The aim of this study was to differentiate between PD and healthy controls by using integrated analysis of PD-specific MR findings.

**METHODS AND MATERIALS**

Patients with PD and healthy controls were recruited between August 2022 and December 2023. All subjects gave written consent to this prospective study. All subjects underwent 3T MRI (MAGNETOM Skyra, Siemens Healthineers) including a magnetization transfer contrast (MTC) and a double flip angle multi-echo protocol as part of Strategically Acquired Gradient Echo (STAGE) (SpinTech Inc., Bingham Farms, MI, USA). The data analysis included detecting the presence of Nigrosom-1 (N1) sign in the SNpc, signal intensity and volume of neuromelanin (NM) content and iron quantification through quantitative susceptibility mapping (QSM) in DGM including caudate nucleus (CN), globus pallidus (GP), putamen (Pt), thalamus (TH), pulvinar thalamus (Pul), substantia nigra (SN), red nucleus (RN), and dentate nucleus (DN). The 3D regions of interest were manually demarcated on QSM maps. Mean susceptibility values from global analysis (i.e. from the whole structure) as well as regional high iron analysis (extracted from thresholding susceptibility values higher than the upper 95% prediction intervals at a given age) were extracted for each individual structure. Univariate and multivariate analyses were performed using these parameters.

**RESULTS**

Nineteen patients with PD (68.0 ± 8.0 years, 10 males, Hoehn and Yahr scale 1 (n=1), 2 (n=13), 3 (n=4), 4 (n=1)) and 21 healthy controls (68.3 ± 8.6 years, 12 males) were enrolled. Discriminating PD from controls was successful using each method: N1 sign ($P<0.001$), NM volume($P<0.001$), susceptibility values of global analysis (CN, $P<0.001$; Pt, $P<0.001$; Pul, $P=0.006$), regional analysis (Pt, $P<0.001$; Pul, $P=0.009$, TH, $P=0.008$). Stepwise logistic regression analyses were performed and the best model was created using N1 sign, NM volume, Pt, RN and TH (area under the curve of 0.99).

**CONCLUSION**

Integrated analysis of PD specific MR findings including N1 sign, NM volume, and iron content in the DGM structures robustly discriminates between PD and healthy controls.

**CLINICAL RELEVANCE/APPLICATION**

Integrated analysis of N1 sign, NM volume, and QSM is clinically feasible and has diagnostic potential in the evaluation of PD. Our results show NM volume decrease potentially precedes iron increase in the nigral regions of early PD patients.

## M2-SPNR-14 ALTERED NEUROVASCULAR COUPLING IN CHILDREN WITH SPASTIC CEREBRAL PALSY

Heng Liu, PhD (*Abstract Co-Author*) Nothing to Disclose
Ying Peng (*Abstract Co-Author*) Nothing to Disclose
Chunfeng Zhao (*Abstract Co-Author*) Nothing to Disclose
Dan Luo (*Abstract Co-Author*) Nothing to Disclose
Haoyue Yu (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to investigate the possible neurovascular decoupling (NVC) and its clinical implications in childhood spastic CP using resting-state functional magnetic resonance imaging (rs-fMRI) and arterial spin labeling (ASL).

**METHODS AND MATERIALS**

Spastic CP patients and healthy participants underwent rs-fMRI and ASL to calculate regional homogeneity (ReHo), fractional amplitude of low-frequency fluctuation (fALFF) and cerebral blood flow (CBF), respectively. Two types of NVC metrics (CBF/ ReHo, CBF/fALFF) were compared between spastic CP and healthy controls (HCs), and the inner association between altered NVC metrics and clinical variables in spastic CP group was further analyzed.

**RESULTS**

The study included 20 children with spastic CP and 22 sex- and age-matched HCs. Compared to HCs, among regional level (all PGRF<0.05), spastic CP showed significantly higher CBF/ReHo coupling in left fusiform, right lingual, bilateral thalamus, left calcarine, left caudate, and increased CBF/fALFF coupling in left lingual, left middle temporal, right middle occipital, bilateral caudate, left angular, left middle cingulum. Furthermore, increased CBF/fALFF coupling was found in the left middle temporal, left angular and negatively correlated with the Communication Function Classification System level of spastic CP.

**CONCLUSION**

Children with spastic CP present altered NVC, associated with Communication Function level. The study shed a new insight into the pathophysiology of spastic CP.

**CLINICAL RELEVANCE/APPLICATION**

Spastic CP has been showed perfusion and neural activity alteration; however, the coupling changes is still unknown. Rs-fMRI study provides neuroimaging evidence of neuronal injury and cerebral perfusion changes in CP. However, these studies on CP mainly used a single imaging modality, and this method cannot comprehensively reflect the altered regional CBF and neuronal activity caused by CP. In contrast, NVC combined with rs-fMRI and ASL can comprehensively reflect the relationship between neural activity changes and regional CBF. However, it is presently unclear how the balance between cerebral perfusion and neural activity changes in spastic CP. Thus, we sought to explore relationships between perfusion and neural activity organization on regional basis and to determine how proxies of NVC change during the pathophysiology of spastic CP.

## M2-SPNR-16 VULNERABILITY OF NEUROMELANIN IN SUBSTANTIA NIGRA IN HEALTHY CONTROLS AND EARLY-STAGE PARKINSON'S DISEASE: LEFT HEMISPHERIC AND SENSORIMOTOR PREDOMINANCE

Na Wang (*Abstract Co-Author*) Nothing to Disclose
Pu-Yeh Wu (*Abstract Co-Author*) Nothing to Disclose
Liqin Yang (*Abstract Co-Author*) Nothing to Disclose
Yuxin Li (*Abstract Co-Author*) Nothing to Disclose
Xueling Liu, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the hemispheric and spatial asymmetries of neuromoelanin in substantial nigra in healthy controls (HCs) and early-stage Parkinson's Disease (EPD) patients by setMag images reconstructed from quantitative susceptibility mapping (QSM).

**METHODS AND MATERIALS**

We recruited right-handed 57 EPD and 34 HC aged over 50 years. Quantitative susceptibility mapping were acquired, from which short-echo-time magnitude (setMag) images and study-specific neuromelanin-sensitive template was generated. Then neuromelanin contrast ratio (CR) were calculated in the sensorimotor, associative and limbic subregions of substantia nigra pars compacta (SNc). We analysed hemispheric and spatial asymmetry of the CR in HC and EPD groups using two-way ANOVA, respectively. An unpaired-t test was used to compare the group differences in neuromelanin CRs. Receiver operating characteristic (ROC) curves were performed for the diagnosis of EPD in different hemispheres and locations of SNc, and Delong test was used to assess the discriminative diagnostic efficacy for EPD.

**RESULTS**

There were significant hemisphere × location interactions in HC [$F(1, 66) = 21.630$, $p < 0.001$] and EPD [$F(1.758, 98.435) = 24.613$, $p < 0.001$] groups. According to the simple effect analysis, neuromelanin CR of the left hemisphere was lower than that of the right hemisphere only in the sensorimotor territory of SNc, but no hemispheric difference was found in associative or limbic territory in both HC and EPD groups. Meanwhile, in the left hemisphere, the CR value of SNc was found lowest in sensorimotor territory of SNc in both HC and EPD groups. The area of under curves (AUCs) of the neuromelanin CR between the HC and EPD subjects in different hemispheres and locations were from 0.705 to 0.869, and Delong test showed the highest discrimination value was found in the left sensorimotor territory of SNc.

**CONCLUSION**

This template-based neuromelanin measurement detects the left sensorimotor territory of SNc as the predominant vulnerable region for neuromelanin degeneration inn both HC and EPD.

**CLINICAL RELEVANCE/APPLICATION**

This finding suggests that the left sensorimotor territory of SNc maybe the first neuromelanin degeneration area in both HC and EPD subjects, focusing on this specific region may enhance early detection for PD and potentially guiding targeted therapeutic interventions.

## M2-SPNR-18 NEUROIMAGING EVIDENCE OF GLYMPHATIC SYSTEM DYSFUNCTION IN PARKINSON'S DISEASE WITH SLEEP DISORDERS

Zhuofeng Liang (*Abstract Co-Author*) Nothing to Disclose
Wen Zhibo, BA (*Abstract Co-Author*) Nothing to Disclose
Xinzi Liu (*Abstract Co-Author*) Nothing to Disclose
Yongzhou Xu (*Abstract Co-Author*) Nothing to Disclose
Ni Zeng (*Abstract Co-Author*) Nothing to Disclose
Xinran Yan (*Abstract Co-Author*) Nothing to Disclose
Anyi Lin (*Abstract Co-Author*) Nothing to Disclose
Jingyue Xue (*Presenter*) Nothing to Disclose

### PURPOSE

In Parkinson's disease (PD), the glymphatic system, responsible for clearing a-synuclein, may be linked to sleep disorders. We're exploring this association using a noninvasive and visualized technique, called diffusion tensor image analysis along the perivascular space (DTI-ALPS) to compare glymphatic activity in PD patients with sleep disorders (PD-s) ,without sleep disorders (PD-ns) and healthy controls (HC). We aim to explore whether early sleep intervention can benefit those at high risk for PD, whether improving sleep in PD patients can alleviate motor symptoms and enhance quality of life.

### METHODS AND MATERIALS

This study prospectively enrolled 104 PD patients and 28 HC from March 2023 to March 2024. PD patients were categorized into two groups based on the Pittsburgh sleep quality index (PSQI): PD-s group (n = 58) and PD-ns group (n =46). DTI sequence was acquired. Image processing and index calculation were conducted using the FSL platform. An in-house bash script integarating FSL and MRtrix3 commands was developed for image preprocessing, generating FA and DTI-ALPS images. After co-registeration with standard templates, specific brain regions were identified using the marker atlas and the ALPS-index was calculated based on these regions showing in Fig. 1.

### RESULTS

Table 1 and Table 2 present the basic characteristics of three groups, including the ALPS index. Fig. 2 illustrates significant differences in the ALPS index across three groups ($P < 0.05$). Post-hoc tests revealed a higher ALPS index in the HC group compared to the PD-s ($P = 0.001$) and a high ALPS index in the PD-ns group compared to the PD-s group ($P = 0.040$). The correlations between the ALPS index and these clinical features with significant differences in two PD groups were showed in Fig. 3.

### CONCLUSION

We employed a non-invasive approach to unveil glymphatic system dysfunction in PD patients. The ALPS index emerges as a pivotal marker of cerebral glymphatic system alterations, particularly in PD patients with sleep disorders, suggesting that targeting sleep disorders could be a novel intervention strategy. Moreover, we propose the ALPS index as a valuable follow-up indicator. Our DTI-ALPS pipeline, which yields rapid and stable results, holds promise for future clinical applications.

### CLINICAL RELEVANCE/APPLICATION

We propose a new framework regarding 'a-syn-glymphatic system-sleep disorder-motor disturbance-PD', which may enhance our understanding of the pathophysiology of PD. We think DTI-ALPS-index is a follow-up indicator and an assessment after interventions.

## M2-SPNR-4 EFFECTS OF PERIPHERAL ACTH LEVELS ON BRAIN NETWORK TOPOLOGY IN PATIENTS WITH MAJOR DISORDER DEPRESSION

Yanwei Miao (*Abstract Co-Author*) Nothing to Disclose
Chun Yang (*Abstract Co-Author*) Nothing to Disclose
Shiyun Tian, MD (*Presenter*) Nothing to Disclose

### PURPOSE

A subgroup of major depressive disorder (MDD) is associated with elevated hypothalamic-pituitary-adrenal (HPA) axis hormone levels. In this study, we aimed to explore the differences in resting-state brain network topology in depressed patients with different ACTH levels, and to evaluate their relationship with peripheral blood ACTH levels to understand the neuroendocrine axis mechanism of hormone-related depression.

### METHODS AND MATERIALS

This study collected resting-state functional magnetic resonance imaging (fMRI) data and peripheral blood hypothalamic-pituitary-adrenal (HPA) axis-related hormones (adrenocorticotropic hormone; ACTH, cortisol; CORT) from N=49 patients with depression, further stratified into high ACTH cases (High ACTH MDD; >65 pg/mL; N=20) and normal ACTH cases (Normal ACTH MDD; 7 pg/mL 65 pg/mL; N=29). Additionally, fMRI scans were conducted on N=21 healthy control(HC) subjects. In this analysis, topological global and local metrics were used to identify indices that differed between MDD and HC, and the correlation between different brain network metrics and ACTH was analyzed.

### RESULTS

1. The outcomes of the global network indicators reveal a substantial reduction in the AUC of Cp ($t=-2.729, P=0.008$) and Eloc ($t=-2.744, P=0.008$) AUC values for all MDD patients when compared to HCs (Fig. 1A, B). Similarly, the AUC values for Cp ($t=-2.637$, $p=0.012$) and Eloc ($t=-2.834$, $p=0.007$) in High-ACTH MDD exhibit a significant decrease compared to HC (Fig. 1C, D). 2. The local indicators demonstrate that the nodal Eloc of all MDD compared to HC in the cingulo-opercular network right temporal lobe has increased ($pBonferroni=0.00014$). For Normal-ACTH MDD compared to HC, the nodal Eloc in the cingulo-opercular network has increased (right temporal lobe, $pBonferroni = 0.00001$), while for High-ACTH MDD compared to HC, the nodal Cp of the cingulo-opercular network has decreased (left ventral frontal cortex, $pBonferroni = 0.00002$) (Fig. 1E). 3. Correlation analysis was conducted between meaningful network node indices and ACTH, with age and gender as covariates. The partial correlation analysis showed a significant correlation with the node Cp vFC.L ($p=0.030$, $r=-0.317$) and node Eloc ($p=0.676$, $r=-0.063$) (Fig. 1F).

### CONCLUSION

The ACTH level in patients with depression is related to the topological structure of the brain network. As the ACTH level increases, the functional separation disorder in the cognitive control processing system area becomes more serious.

### CLINICAL RELEVANCE/APPLICATION

The brain topology of patients with depression at different levels of the HPA axis is different, which is related to the pathogenesis of neuroendocrine-related depression and has guiding significance for subsequent treatment.

## M2-SPNR-5 EVALUATION OF CORRELATIONS BETWEEN TRACE ELEMENTS AND SPINOCEREBELLAR ATAXIA TYPE 3: A MULTI-ELEMENTAL ANALYSIS

Lihua Deng (*Abstract Co-Author*) Nothing to Disclose
Chen Liu (*Presenter*) Nothing to Disclose

### PURPOSE

Spinocerebellar ataxia type 3 (SCA3), a neurodegenerative disorder resulting from excess CAG repeats in the ATXN3 gene, leads to progressive cerebellar ataxia and other symptoms. The results of previous studies suggest that trace element dysregulation can contribute to neurodegenerative disorder

onset.Here, we explored the relationships of trace element dysregulation with CAG repeat length in the ATXN3 gene, as well as structural and functional connectivity in the brain,and reveals the extent and location of trace element-induced neurodegeneration in the brains of patients with SCA3.

**METHODS AND MATERIALS**

We enrolled 45 patients with genetically confirmed SCA3 and 44 healthy controls (HCs), assessing them with inductively coupled plasma mass spectrometry to measure blood levels of essential trace elements. Neuroimaging assessments included high-resolution Diffusion Tensor Imaging (DTI) and resting-state functional MRI (rs-fMRI) to evaluate brain structural integrity and functional connectivity. Statistical analysis correlated trace element levels with imaging findings and clinical data.

**RESULTS**

We found that the blood concentrations of lithium (Li), selenium (Se), and copper (Cu) were significantly lower in patients with SCA3 than in HCs; there were negative correlations of Li and Se levels with CAG repeat length, especially in the manifest subgroup. Through DTI combined with rs-fMRI, we revealed that Li levels were negatively correlated with fractional anisotropy in the bilateral superior longitudinal fasciculus(SLF), and positively correlated with bidirectional causal connectivity between the right inferior parietal lobule (IPL) and left cerebellum for SCA3 patients.The tractography map traced from the SLF showed reduced structural connectivity of nerve fibre paths in patients with SCA3(mostly distributed in the cerebellar, brainstem, and thalamus),and reduced dorsal premotor cortex (PMd)/IPL and cerebellum functional connectivity in patients with SCA3.

**CONCLUSION**

The study confirmed that trace element dysregulation is significantly associated with genes, clinical manifestation and neurodegenerative changes in SCA3. The findings suggest that specific trace elements might play roles in disease progression and could potentially serve as biomarkers for SCA3 severity and progression.

**CLINICAL RELEVANCE/APPLICATION**

Understanding the relationship between trace elements and SCA3 pathophysiology not only provides insights into the underlying mechanisms of the disease but also opens potential therapeutic avenues. Modulating levels of specific trace elements such as lithium might offer novel approaches to mitigating clinical symptoms and neurodegenerative progression in SCA3.

## M2-SPNR-7 GLYMPHATIC SYSTEM DYSFUNCTION AND RISK OF CLINICAL MILESTONES IN PATIENTS WITH PARKINSON'S DISEASE

Minming Zhang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Cheng Zhou (*Presenter*) Nothing to Disclose

**PURPOSE**

Glymphatic dysfunction may play a significant role in the development and progression of neurodegenerative diseases. We aimed to evaluate the association between glymphatic dysfunction and the risk of malignant event/clinical milestones in Parkinson's disease (PD).

**METHODS AND MATERIALS**

This retrospective cohort study was conducted at the Second Affiliated Hospital of Zhejiang University. Baseline data were collected from August, 2014, to December, 2020. A convenience sample of 236 patients with PD was recruited by the movement disorder specialists, and need routine visits to the hospital's movement disorder clinic. Diffusion Tensor Imaging analysis along the perivascular space (DTI-ALPS) index was calculated as an approximate measure of glymphatic function. The primary outcomes were four clinical milestones including recurrent falls, wheelchair dependence, dementia, and placement in residential or nursing home care. First, the associations of DTI-ALPS with the risk of clinical milestones were examined using multivariate Cox proportional hazards regression models. Second, logistic regression was repeated using clinical variables and DTI-ALPS index individually and in combination with the two to explore the ability to distinguish patients who reached clinical milestones within a five-year period.

**RESULTS**

A total of 175 PD patients (age 59.7 ± 9.6, 42% female) with baseline DTI-ALPS index and follow-up clinical assessments were included. A lower DTI-ALPS was independently associated with increased risk of recurrent falls (HR 0.09; 95% CI 0.02-0.41; P = .002), wheelchair dependence (HR 0.05; 95% CI 0.01-0.39; P = .004), and dementia (HR 0.04; 95% CI 0.00-0.74; P = .030). Additionally, in 103 patients (age 60.7 ± 8.9, 42% female) monitored over 5-years, logistic regression model combining clinical variables and DTI-ALPS index showed better performance for predicting recurrent falls within 5 years than model using clinical variables or DTI-ALPS index alone (AUC, 0.82 vs. 0.72, and 0.82 vs. 0.72; P = .040 and .020, respectively).

**CONCLUSION**

Glymphatic dysfunction, as measured by the DTI-ALPS index, was associated with increased risk of clinical milestones in patients with PD. This finding implies that therapy targeting glymphatic system may serve as a viable strategy for slowing down the progression of PD.

**CLINICAL RELEVANCE/APPLICATION**

These findings suggest that therapeutic strategies targeting the glymphatic system could potentially improve outcomes for patients with Parkinson disease.

# Abstract Archives of the RSNA, 2024

M2-SPPD

**Pediatric Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPPD-2 FETAL BODY COMPOSITION REFERENCE CHARTS AND SEXUAL DIMORPHISM USING MAGNETIC RESONANCE IMAGING

Liat Ben-Sira, MD (*Abstract Co-Author*) Nothing to Disclose
Dafna Ben Bashat, PhD (*Abstract Co-Author*) Nothing to Disclose
Leo Joskowicz, PhD (*Abstract Co-Author*) Officer, HighRAD Ltd
Karina K. Haratz, MD,MSc (*Abstract Co-Author*) Nothing to Disclose
Liran Hiersch (*Abstract Co-Author*) Nothing to Disclose
Bella Specktor Fadida (*Abstract Co-Author*) Nothing to Disclose
Tamir Graziani, MD (*Abstract Co-Author*) Nothing to Disclose
Sharon Vanetik Klein (*Abstract Co-Author*) Nothing to Disclose
Bar Neeman (*Abstract Co-Author*) Nothing to Disclose
Netanell Avisdris (*Abstract Co-Author*) Nothing to Disclose
Jayan Khawaja, MD (*Abstract Co-Author*) Nothing to Disclose
Bossmat Yehuda (*Abstract Co-Author*) Nothing to Disclose
Yair Wexler (*Abstract Co-Author*) Nothing to Disclose
Jacky Herzlich (*Abstract Co-Author*) Nothing to Disclose
Aviad Rabinowich, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The American Academy of Pediatrics (AAP) advises that the nutrition of preterm infants should target a body composition similar to that of a fetus in utero. Still, reference charts for intrauterine body composition are missing. Moreover, data on sexual differences in intrauterine body composition during pregnancy are limited. Additionally, conditions such as fetal growth restriction and gestational diabetes can alter fetal body composition, suggesting the need for charts for risk stratification. The purpose of this study was to create reference charts for intrauterine body composition from 30 to 36+6 weeks post-conception and evaluate differences between sexes.

### METHODS AND MATERIALS

In this single-center retrospective study, data from 225 normal developing fetuses acquired at 3T magnetic resonance imaging (MRI) scans, including True Fast Imaging with Steady State Free Precession (TruFISP) and T1-weighted 2-point Dixon sequences covering the entire fetus, were included. Deep Convolutional Neural Networks were utilized to segment the fetal body and subcutaneous adipose tissue automatically. The fetus's body mass (BM), fat signal fraction (FSF), fat mass (FM), FM percentage (FM%), fat-free mass (FFM), and FFM percentage (FFM%) were calculated. Using the Generalized Additive Models for Location, Scale, and Shape (GAMLSS) method, reference charts were created, and sexual dimorphism was examined using analysis of covariance (ANCOVA). A P-value below 0.05 is deemed significant.

### RESULTS

Throughout late gestation, there was an increase in BM, FSF, FM, FM%, and FFM, while the FFM% decreased. Reference charts and gestational age and sex-specific percentiles are provided. Males exhibited significantly higher BM, FFM, and FFM% and lower FSF and FM% ($P<0.001$) compared with females, with no significant difference in FM between sexes ($P=0.126$).

### CONCLUSION

MRI-derived intrauterine body composition growth charts are valuable for tracking growth in preterm infants, adhering to the AAP guidelines, and risk stratification in pregnancies complicated with fetal malnutrition. This study demonstrated that sexual differences in body composition are already present in the intrauterine phase.

### CLINICAL RELEVANCE/APPLICATION

MRI-based fetal body composition reference charts may be used to monitor preterm infant growth.

## M2-SPPD-3 PREDICTING PERINATAL OUTCOMES OF FETAL GROWTH RESTRICTION COMPLICATED PREGNANCIES WITH MULTI-MODALITY FETAL SONOGRAPHIC AND MRI APPROACH

Daphna Link, PhD (*Abstract Co-Author*) Nothing to Disclose
Liat Ben-Sira, MD (*Abstract Co-Author*) Nothing to Disclose
Dafna Ben Bashat, PhD (*Abstract Co-Author*) Nothing to Disclose
Leo Joskowicz, PhD (*Abstract Co-Author*) Officer, HighRAD Ltd
Karina K. Haratz, MD,MSc (*Abstract Co-Author*) Nothing to Disclose

Ayala Zilberman (*Abstract Co-Author*) Nothing to Disclose
Liran Hiersch (*Abstract Co-Author*) Nothing to Disclose
Bella Specktor Fadida (*Abstract Co-Author*) Nothing to Disclose
Tamir Graziani, MD (*Abstract Co-Author*) Nothing to Disclose
Sharon Vanetik Klein (*Abstract Co-Author*) Nothing to Disclose
Bar Neeman (*Abstract Co-Author*) Nothing to Disclose
Dana Schonberger (*Abstract Co-Author*) Nothing to Disclose
Netanell Avisdris (*Abstract Co-Author*) Nothing to Disclose
Jayan Khawaja, MD (*Abstract Co-Author*) Nothing to Disclose
Bossmat Yehuda (*Abstract Co-Author*) Nothing to Disclose
Jacky Herzlich (*Abstract Co-Author*) Nothing to Disclose
Aviad Rabinowich, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Predict perinatal outcomes of fetal growth restriction (FGR)-complicated pregnancies using multi-modality multi-parametric data including fetal MRI, US, and clinical data with supervised machine learning (ML).

**METHODS AND MATERIALS**

Participants with FGR-complicated and appropriate for gestational age (AGA) pregnancies were prospectively recruited and followed until the infant was discharged. Two primary outcomes were recorded - intervention due to non-reassuring fetal status (NRFS) and a composite of adverse neonatal outcomes (CANO), which included any of the following: necrotizing enterocolitis, intraventricular hemorrhage, respiratory interventions, =10 days in the neonatal intensive care unit or >7 days for complete enteral nutrition. Participants underwent fetal MRI and US within a 7-day interval. MRI scans were acquired with 3T scanners employing True Fast Imaging with Steady State Free Precession (TruFISP) and T1-weighted 2-point Dixon covering the entire womb. The fetal body, subcutaneous adipose tissue, and placenta were automatically segmented from MRI using Deep Convolutional Neural Networks. Nine supervised ML classifiers were evaluated using 3-fold cross-validation to predict primary outcomes, and key predictive features were computed using the Shapley Additive Explanation tool. We further compared the multi-modality approach with the US-only approach (routine fetal biometrics and Doppler studies).

**RESULTS**

46 participants with FGR-complicated pregnancies and 26 participants with AGA pregnancies were enrolled. An eXtreme Gradient Boosting (XGBosst) with a logistic objective yielded the best results for predicting CANO, resulting in an area under the receiver operating characteristics curve (AUC-ROC) of 0.87, accuracy of 0.87, and F1-score of 0.69. Key predictive features included placental volume, MRI-estimated fetal weight, fat mass, and abdominal circumference. The US-alone approach reached an AUC-ROC of 0.76, accuracy of 0.83, and F1-score of 0.5 using the same algorithm. A support vector machine (SVM) with a linear kernel model yielded the best results for predicting interventions for NRFS with an AUC-ROC of 0.9, accuracy of 0.87, and F1-score of 0.53, with similar results using the sonographic-alone approach.

**CONCLUSION**

Multi-modality approach coupled with supervised ML algorithms may improve adverse neonatal prognostication of FGR-complicated pregnancies. However, predictions for interventions due to NRFS were less effective across both models.

**CLINICAL RELEVANCE/APPLICATION**

Employing multi-modal data can potentially enhance the prediction of adverse neonatal outcomes in pregnancies complicated by FGR.
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# Abstract Archives of the RSNA, 2024

M2-SPPH

**Physics Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPPH-1 OPTIMIZATION OF PHOTON COUNTING CT FOR CARDIAC IMAGING IN PATIENTS WITH LEFT VENTRICULAR ASSIST DEVICES; AN IN-DEPTH ASSESSMENT OF METAL ARTIFACTS

Lilian Henriksson (*Abstract Co-Author*) Nothing to Disclose
Tino Ebbers, PhD (*Abstract Co-Author*) Nothing to Disclose
Marten Sandstedt, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Linus Ohlsson, MD (*Abstract Co-Author*) Nothing to Disclose
Anders Persson, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bente Konst (*Presenter*) Nothing to Disclose

### PURPOSE

Photon counting CT (PCCT) holds promise for mitigating metal artifacts and can produce virtual mono-energetic images, while maintaining temporal resolution, making it a valuable tool for characterizing the heart. This study aimed to evaluate and optimize PCCT for cardiac imaging in patients during LVAD therapy by conducting an in-depth objective assessment of metal artifacts and visual grading.

### METHODS AND MATERIALS

Various scan and reconstruction settings were tested on a phantom and further evaluated on a patient acquisition to identify the optimal protocol settings. The phantom comprised an empty thoracic cavity, supplemented with heart and lungs from a cadaver lamb. The heart was implanted with an LVAD and iodine contrast. Scans were performed on a PCCT. Metal artifacts were assessed by three objective methods: HU/SD measurements (DiffHU , SDARTIFACT), Fourier analysis (AmplitudeLowFreq) and depicted LVAD volume in the images (BloomVol). 6 radiologists graded metal artifacts and the diagnostic interpretability in the LVAD lumen, cardiac tissue, lung tissue, and spinal cord using a 5-point rating scale. Regression and correlation analysis were conducted to determine the assessment method most closely associated with acquisition and reconstruction parameters, and the objective method demonstrating the highest correlation with visual grading

### RESULTS

Imaging the lamb heart with 90 kVp results in more streaks and areas with loss of information than imaging with 120/140 kVp. Due to blooming artifact, the LVAD volume varied from 42.3 to 92.7 cm3. This variation is dependent on factors in descending order of impact: kVp, kernel, keV, and iMAR. The qualitative assessment showed that radiologists found images acquired at 120 kVp and IQ 80, reconstructed with110 keV, kernel Qr40 and iMAR preset pacemaker to have fewest metal artifacts. For diagnostic interpretability of cardiac tissue T3D and kernel Bv56 are preferred.

### CONCLUSION

In our study, we identified acquisition and reconstructions parameters that produced image quality preferred by the radiologist, while minimizing metal artifacts. The volume of LVAD to measure blooming was shown to be the best objective method to assess metal artifacts, while the Fourier method for assessing streak artifacts was also shown to be effective. Overall, PCCT has the potential to revolutionize the evaluation of patients with left ventricular assist devices by offering improved image quality and thereby augmented device assessment.

### CLINICAL RELEVANCE/APPLICATION

Left ventricular assist devices (LVADs) of today are placed above the diaphragm which increases CT artifacts on the heart. Photon counting CT (PCCT) is shown to reduce metal artifacts and an optimal protocol may enable a wider use of PCCT during the therapy.

## M2-SPPH-10 VISUAL DISCRIMINATION OF IODINATED- AND GADOLINATED- CONTRAST AGENTS USING PROTOTYPE PHOTON COUNTING DETECTOR CT

Toshinori Hirai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshinori Funama, PhD (*Abstract Co-Author*) Nothing to Disclose
Shinichi Kojima (*Abstract Co-Author*) Employee, FUJIFILM Holdings Corporation
Kazuma Yokoi (*Abstract Co-Author*) Employee, FUJIFILM Holdings Corporation
Isao Takahashi, PhD (*Abstract Co-Author*) Employee, FUJIFILM Holdings Corporation
Seitaro Oda, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Photon counting detector CT (PCD-CT) uses energy-resolving detectors that can simultaneously sample the energy spectrum at multiple regions. This allows a higher spectral resolution, enabling the identification of material-specific spectral characteristics, such as the K-edge signature of the contrast agent. This study aimed to investigate the visual discrimination ability of iodinated- and gadolinated- contrast agents in prototype PCD-CT.

### METHODS AND MATERIALS

Phantom containing tubes with water, five different gadolinated contrast concentrations (0.39-3.15 mgGd/mL), and two different iodinated contrast concentrations (1.5 and 3.0 mgI/mL) was used. The phantom was scanned 10 times each using the tube voltage at 120 kVp and three types of milliampere-seconds (105mAs, 150mAs, 300mAs) with the prototype PCD-CT developed by FUJIFILM Healthcare Corporation. Iodine-gadolinium discrimination color images (red for iodine, green for gadolinium) for each scan were generated. Two radiologists rated their confidence in visual discrimination of iodine and gadolinium in the color images using a 4-point scale (0, not distinguishable - 3, definitely distinguishable). We compared the visual confidence scores for each tube current setting.

### RESULTS

Iodine and gadolinium can be distinguished by using the spectral information, while lower concentrations of both iodine and gadolinium resulted in lower visual confidence scores. For visual identification of gadolinium below 2.36mgGd/mL, the lower the tube current setting, the lower the visual confidence score. For visual identification of iodine at 3.0 mgI/mL, visual confidence scores were significantly lower at lower tube current settings. At 1.5 mgI/mL, there was no significant difference in visual confidence scores depending on tube current. Regarding visual scores, there was excellent interobserver agreement (kappa, 0.85; 95% confidence interval: 0.80, 0.90).

### CONCLUSION

Iodinated- and gadolinated-contrast agents can be visually discriminated by using the prototype PCD-CT, and observers' confidence tended to decrease, especially at low concentrations and at low tube current settings. Visual observation of material decomposition images can require appropriate imaging settings depending on the concentration of the target materials.

### CLINICAL RELEVANCE/APPLICATION

Sufficient visual discrimination can be possible in material decomposition images using PCD-CT under appropriate imaging settings.

## M2-SPPH-11 UTILIZING MATERIAL DECOMPOSITION TECHNOLOGY BASED ON DUAL-ENERGY CT FOR STRATIFICATION OF LIVER IRON DEPOSITS IN THALASSEMIA PATIENTS

Lina Li (*Abstract Co-Author*) Nothing to Disclose
Peng Peng, MD (*Abstract Co-Author*) Nothing to Disclose
Minggui Wei (*Presenter*) Nothing to Disclose

### PURPOSE

This study investigated the utility of dual-energy CT (DECT) using a material decomposition (MD) algorithm to quantify hepatic iron deposition. The objective was to determine an optimal DECT-derived virtual iron concentration (VIC) threshold that stratifies hepatic iron levels, with MRI T2* serving as the reference standard.

### METHODS AND MATERIALS

125 thalassemia patients who underwent both DECT and MRI scans. VIC measurements were derived from iron (water) and iron (Fat) material images reconstructed using the MD algorithm. Five regions of interest (ROIs) were defined on the largest cross-sectional area of the liver parenchyma in VIC [iron (water)], VIC [iron (Fat)], and T2* (MRI) images, with two on the left lobe and three on the right. The average of these ROIs represented the final VIC and T2* values. Spearman statistics evaluated the correlation between VIC values and T2*. Patients were categorized into four groups based on MRI T2* grading: none (T2* > 6.3 ms, grade 0), mild (T2*, 2.7-6.3 ms, grade 1), moderate (T2*, 1.4-2.7 ms, grade 2), and severe (T2* < 1.4 ms, grade 3). Receiver operating characteristic (ROC) curves were generated to assess the diagnostic accuracy of VIC [iron (water)] and VIC [iron (Fat)] for detecting liver iron deposition, with area under the curve (AUC) calculated. Optimal Youden index-based cutoff points for VIC [iron (water)] and VIC [iron (Fat)] were determined to diagnose hepatic iron deposition and to differentiate between severity grades.

### RESULTS

VIC [iron (water)] demonstrated a strong negative correlation with T2* (r = -0.937), with AUCs of 0.964, 0.977, and 0.973 for identifying mild, moderate, and severe hepatic iron deposition, respectively. Cutoff values for VIC [iron (water)] were 3.04 for diagnosing grade 1 or higher (sensitivity 84.3%, specificity 100%), 3.93 for grades 2 or 3 (sensitivity 93.1%, specificity 96.4%), and 6.24 for grade 3 (sensitivity 96.3%, specificity 94.3%). Similarly, VIC [iron (Fat)] correlated strongly negatively with T2* (r = -0.938, 95% CI: -0.957 to -0.910), with AUCs of 0.964, 0.973, and 0.970 for the respective grades. Cutoffs for VIC [iron (Fat)] were 12.032 for grade 1 or higher (sensitivity 84.3%, specificity 100%), 13.116 for grades 2 or 3 (sensitivity 91.4%, specificity 94.6%), and 15.326 for grade 3 (sensitivity 93.6%, specificity 95.4%).

### CONCLUSION

DECT employing the MD algorithm effectively correlated with T2* MRI, enabling accurate quantification and grading of liver iron concentrations in thalassemia patients.

### CLINICAL RELEVANCE/APPLICATION

Implementing DECT for quantitative analysis of hepatic iron deposition enhanced detection efficacy, providing a reliable and convenient diagnostic tool for assessing hepatic iron levels.

## M2-SPPH-2 A COMPARATIVE ANALYSIS OF A PHOTON-COUNTING CT SYSTEM AND PREMIUM DUAL-ENERGY CT PLATFORMS: A PHANTOM STUDY

Steven A. Rothenberg, MD (*Abstract Co-Author*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC
Abheek Raviprasad, MD (*Abstract Co-Author*) Nothing to Disclose
Hakki S. Sagdic, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew D. Smith, MD, PhD (*Abstract Co-Author*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms
Robert C. Boggs, PhD (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Presenter*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc

### PURPOSE

Variations in spectral CT systems may lead to significant differences in image quality and radiation dose. The purpose of this study was to evaluate the performance of a clinical photon counting CT (PCCT) platform and various premium dual-energy CT (DECT) scanners using a multi-energy CT phantom.

### METHODS AND MATERIALS

The multi-energy CT phantom (Model 1472, Gammex Inc.) with 26 different inserts was initially scanned at standard dose (16 mGy), low dose (8 mGy) and extra-low dose (4 mGy) settings with a clinical PCCT system (NAEOTOM Alpha, Siemens Healthineers). For comparison, a fast-kVp-switching DECT (Discovery 750 HD, GE Medical Systems) and a dual-source DECT (Somatom FORCE, Siemens Healthineers) were also utilized to scan the phantom. Similar acquisition parameters were used for the different scanners. Quantitative accuracy of attenuation, measured in Hounsfield Units (HU), and noise, measured as the standard deviation of HU, were assessed by drawing circular regions of interest placed in the center of the insert rods. The center was determined when the four localization markers were present in the images. Mean signal-to noise ratio (SNR) and contrast-to-noise ratio (CNR) values were calculated and compared for acquisitions at the same dose or those at different doses. The Friedman test with Dunnett's multiple comparisons test was used to assess differences between related samples.

### RESULTS

The highest mean SNR and CNR values for the PCCT were 7.85 and 4.65, respectively, which were significantly better than those of the other scanners ($p<0.0001$). The extra-low dose scan of the PCCT demonstrated a better SNR value overall compared to the standard and low dose scans of the fast-kVp-switching DECT scanner ($p<0.05$) and had similar results with the standard and low dose scans of the dual-source DECT scanner. Mean SNR values were progressively increased with the dosage and best SNR yielded at the standard dose. The SNR values for all three doses differed significantly from each other ($p<0.05$). The best mean CNR was achieved at the standard dose, which was not statistically significant compared to the mean CNR of the low dose but was statistically different compared to the extra-low dose ($p<0.05$). Mean HU values were not significantly different between the scanners.

### CONCLUSION

PCCT enables high-quality exams even at extra-low dose CT scanning settings. When using equivalent doses, the PCCT significantly enhances overall image quality, or permits radiation dose reduction in comparison to the latest-generation DECT scanners.

### CLINICAL RELEVANCE/APPLICATION

PCCT scanners provide better overall image quality and contrast compared to DECT scanners, potentially enabling a superior diagnostic assessment at a lower radiation dose to the patient.

## M2-SPPH-6 A NOVEL UCP-1 QUANTITATIVEMETHOD: EXPLORATORY ON THE SPECTRAL CT MATERIAL DECOMPOSITION TECHNIQUE OF THE IDENTIFICATION OF ANIMAL ADIPOSE TISSUE TYPES

Bo Duan (*Abstract Co-Author*) Nothing to Disclose
Yan Gao (*Abstract Co-Author*) Nothing to Disclose
Huarui Zhang (*Abstract Co-Author*) Nothing to Disclose
Lu Wang (*Abstract Co-Author*) Nothing to Disclose
Hao Zhi (*Abstract Co-Author*) Nothing to Disclose
Ailian Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Qinhe Zhang (*Abstract Co-Author*) Nothing to Disclose
Zhenyu Jiang (*Abstract Co-Author*) Nothing to Disclose
Runyu Miao (*Abstract Co-Author*) Nothing to Disclose
Qingyu Ji (*Presenter*) Nothing to Disclose

### PURPOSE

To explore and validate the feasibility of quantitative measurement of Uncoupling Protein 1 (UCP-1) in rat brown adipose tissue and white adipose tissue using spectral CT substance separation technique.

### METHODS AND MATERIALS

In this study, we performed spectral CT scanning on 81 SD rats (2 months old) at room temperature for quantitative measurement of UCP-1 in brown and white adipose tissue. We obtained the UCP-1 virtual values of brown adipose tissue located in the interscapular region (BAT), subcutaneous white adipose tissue in the abdomen (WAT- subcutaneous), and abdominal visceral white adipose tissue (WAT-visceral) for the UCP-1 using self-prepared UCP-1 (Fat) matrix pairs. T-test and one-way ANOVA were applied to compare the difference in UCP-1 content in the adipose tissue of the three sites (including BAT, WAT-subcutaneous, and WAT-visceral), and $p<0.001$ was considered statistically significant.

### RESULTS

T-test showed that the difference in UCP-1 values between BAT and WAT-subcutaneous were statistically significant ($p<0.001$), and the values in the two groups of BAT and WAT-visceral were also statistically significance ($p<0.001$). However, p was 0.0018 between WAT-subcutaneous and WAT-visceral ($p>0.001$). The mean±standard of UCP-1 of BAT, WAT-subcutaneous, and WAT-visceral were: 1028.9±98.1, 135.9±13.7 and -50.7±9.4, One-ANOVA test showed there was statistically significance ($F=231.098$, $p=0.000$).

### CONCLUSION

The feasibility of the spectral CT technique in quantifying the difference in UCP-1 content between brown and white adipose tissue in rats was successfully validated in this study. It provided important methods to explore novel clinical diagnoses and therapeutic strategies in lipid metabolic diseases.

### CLINICAL RELEVANCE/APPLICATION

UCP-1 is a protein found in mitochondria, mainly distributed in the mitochondria of brown adipose tissue. It plays a significant role in the regulation of energy metabolism and thermogenesis. UCP-1 can actively promote the metabolism and burning of fatty acids to produce ATP for cellular use in energy metabolism and antioxidant activity. The mechanism helps to prevent the growth and spread of tumor cells. The UCP-1 in brown adipose tissue assists reduce oxidative stress and keeps cells from oxygen radical damage to prevent the risk of tumor. Therefore it is important to conduct a quantitative study on UCP-1 in tumor prevention and therapy. This validation study will advance the development of non-invasive diagnostic techniques by measuring UCP-1 in brown adipose tissue and white adipose tissue of experimental rats, which will make it possible to quantify UCP-1 in vivo by spectral CT substance separation techniques.

## M2-SPPH-8 ENHANCING METAL OBJECT IMAGING: EXPLORING THE POTENTIAL OF SPECTRAL PHOTON-COUNTING CT

Ting Y. Tao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adrian A. Sanchez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Christopher D. Abraham, MD (*Abstract Co-Author*) Nothing to Disclose
Krystle Barhaghi, MD (*Abstract Co-Author*) Nothing to Disclose
Yao Hao, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhongwei Zhang, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

In clinical settings, the population of patients with metal objects is steadily increasing. These objects range from biomedical implants for organ support, body function monitoring, and targeted medication delivery, to foreign bodies resulting from trauma. The appearance of metal artifacts manifests as prominent bright and dark streaks across the reconstructed images, thereby compromising the image quality. Despite advances in metal artifact reduction techniques, CT scans still struggle to accurately assess tissues neighboring metal objects. In this study, we aimed to investigate the potential of virtual monoenergetic imaging via photon-counting CT (PCD-CT) to improve the imaging of metal objects through phantom studies.

**METHODS AND MATERIALS**

Spectrum estimation: to model the photons that remain detectable post-attenuation through various metallic materials, including C (Z=6), Mg (Z=12), Al (Z=13), Ti (Z=22), Fe (Z=26), Co (Z=27), Ni (Z=28), and Pb(Z=82).Phantom Study: A torso phantom (icotec Medical Inc.) with 4 types of spine configurations was used: I) normal/native spine without hardware insert; II) Titanium screw and rod spine insert; III) hybrid spine insert with CFR-PEEK screw and Titanium tulip head; and IV) CFR-PEEK spine insert with CFR-PEEK screw and rod. Each respective insert was scanned using Siemens NAEOTOM Alpha PCD-CT. Monoenergetic keV image reconstruction at variable levels was applied. The phantom was also scanned using both kV and MV CBCT for comparison purposes.

**RESULTS**

Spectrum estimation study not only illustrate the differential attenuation of low-energy and high-energy photons compared to the original x-ray spectrum but also delineate the crucial keV threshold necessary for monogenic keV image reconstruction. Lower-energy photons experience more significant attenuation, causing a shift in the original photon-energy spectrum towards higher energies. Additionally, higher Z elements correspond to higher keV thresholds.The phantom study showed that increasing the keV level reduces metal artifacts, albeit at the cost of lower tissue contrast. The optimized keV should ideally surpass, yet remain proximal to, the detectable keV threshold for optimal image quality.

**CONCLUSION**

By reconstructing images at specific energy levels, PCD-CT offers a unique approach to imaging, particularly advantageous for patients with metal objects within the body, where traditional CT imaging often faces challenges such as beam hardening artifacts and reduced image quality.

**CLINICAL RELEVANCE/APPLICATION**

PCD-CT improves imaging with metallic objects through monoenergetic image reconstruction, rendering it an appealing choice for clinical settings aiming to enhance image quality in cases involving metallic objects.

## M2-SPPH-9 LIVER FAT QUANTIFICATION WITH SILICON-BASED PHOTON-COUNTING CT: AN IN-SILICO IMAGING STUDY

Ehsan Samei, PHD (*Abstract Co-Author*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc
Zhye Yin (*Abstract Co-Author*) Employee, General Electric Company
Paul Segars (*Abstract Co-Author*) Nothing to Disclose
Mridul Bhattarai, MS (*Abstract Co-Author*) Nothing to Disclose
Ehsan Abadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Fredrik Gronberg (*Abstract Co-Author*) Employee, General Electric Company
Raj Kumar Panta, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the clinical utility of silicon-based photon-counting CT (Si-PCCT) to quantify liver fat content (LFC) on material-decomposed images.

**METHODS AND MATERIALS**

Si-PCCT is a new PCCT technology with multiple prototype systems currently available for investigation but not ready for clinical application. To evaluate such eventual utility, we developed a simulator of the system and benchmarked against the prototype. The simulator was used to image a computational Gammex phantom (in-plane dimension of 40cm x 30cm) and XCAT virtual human phantoms (VHPs) with different levels of LFC (1-100%) using a standard abdominal CT protocol. Spectral sinograms were processed using a maximum-likelihood based material decomposition technique. The estimated LFCs in the reconstructed material-decomposed images were compared against the digitally defined ground-truth values.

**RESULTS**

A linear relationship (R2 = 0.987) was observed between the estimated LFC and the ground-truth LFC on both the Gammex phantom and VHP datasets. Statistical analysis indicated statistical similarity in the LFC quantification accuracy between the Gammex phantom and the VHPs (p-value = 0.674). The root mean square error for both datasets was 3.65%. The Bland-Altman plot showed an excellent agreement between the estimated and the ground-truth LFC, with lower discrepancy (< ± 2%) at higher LFC and higher discrepancy (< ± 6 to 8%) at lower LFC.

**CONCLUSION**

Si-PCCT offers accurate fat quantification across a wide range of LFC as evidenced by in-silico evaluation conducted on both a geometrical and anthropomorphic phantom.

**CLINICAL RELEVANCE/APPLICATION**

The study highlights the potential of Si-PCCT to accurately quantify LFC in individuals with fatty liver disease. This technique has important clinical implications in liver fat assessment, offering promising prospects for opportunistic screening in clinical settings.

# Abstract Archives of the RSNA, 2024

M2-SPVA

**Vascular Imaging Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-SPVA-1 DEVELOPMENT AND CLINICAL APPLICATION OF KEY TECHNOLOGIES FOR RECOGNIZING AND DIAGNOSING LOWER EXTREMITY ARTERIAL CTA IMAGING USING ARTIFICIAL INTELLIGENCE

Qingyu Ji (*Abstract Co-Author*) Nothing to Disclose
Hao Zhi (*Abstract Co-Author*) Nothing to Disclose
Jiahuan Xu (*Abstract Co-Author*) Nothing to Disclose
Bo Duan (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the accuracy of artificial intelligence (AI) -based diagnostic system in the analysis of lower extremity arterial stenosis and plaque, and to explore its clinical application value in the diagnosis and treatment of lower extremity arterial diseases.

### METHODS AND MATERIALS

A total of 180 patients who underwent CT angiography (CTA) of lower extremity arteries and digital subtraction angiography (DSA) of lower extremity arteries were retrospectively collected. The DSA results were used as the gold standard to evaluate the accuracy of lower extremity artery CTA and artificial intelligence in the diagnosis of lower extremity artery stenosis, and the segmentation analysis was performed, with the results of lower extremity artery CTA as the gold standard. The accuracy of artificial intelligence in the diagnosis of lower extremity arterial plaque attributes was evaluated, and its specificity, sensitivity and accuracy were calculated. The ROC curve was drawn to evaluate the efficiency of the artificial intelligence diagnosis system. At the same time, the report release time and non-AI post-processing were compared.

### RESULTS

Finally, 4180 vessels and 6270 vessel segments were analyzed in this study. The accuracy, sensitivity and specificity of artificial intelligence in the diagnosis of calcified plaque and non-calcified plaque were 92.76% and 93.88%, 73.93% and 74.37%, 94.15% and 97.55%, respectively. The accuracy, sensitivity and specificity of artificial intelligence in the diagnosis of significant stenosis of cranial and carotid arteries were 92.64%, 78.46% and 94.67%, respectively. Compared with conventional non-artificial intelligence post-processing, the time of vascular report production was saved by 29.0±4.5 minutes after AI-assisted diagnosis.

### CONCLUSION

The CTA system based on artificial intelligence is reliable in the diagnosis of lower extremity arterial plaque characteristics and vascular stenosis, which significantly improves the work efficiency of radiologists.

### CLINICAL RELEVANCE/APPLICATION

Artificial intelligence (AI) is highly accurate and efficient in analyzing lower extremity arterial narrowing and plaque formation, aiding in the early detection and precise diagnosis of peripheral artery disease (PAD). This technology can streamline the workflow of healthcare professionals, leading to faster assessments and improved treatment planning for patients. AI also assists in risk prediction and personalized care strategies for better patient outcomes. Overall, AI plays a significant role in enhancing the diagnosis, management, and outcomes of PAD patients.

## M2-SPVA-2 CT IMAGING USING VARIABLE HELICAL PITCH (VHP) SCANNING FOR LOWER EXTREMITY ARTERIAL DISEASE (LEAD): REDUCED CONTRAST MEDIUM DOSE, IMPROVED IMAGE QUALITY AND DIAGNOSTIC ACCURACY

Wanli Yang (*Abstract Co-Author*) Nothing to Disclose
Bei Bei DU (*Abstract Co-Author*) Nothing to Disclose
Yadi Yang (*Abstract Co-Author*) Nothing to Disclose
Xin Li (*Abstract Co-Author*) Nothing to Disclose
Xiaoshi Li (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the clinical value of VHP in lower extremity CTA scanning for LEAD patients.

### METHODS AND MATERIALS

Eighty Patients with suspected LEAD underwent lower extremity CTA were prospectively enrolled between October 2022 and October 2023. Patients were divided evenly into two groups: VHP group (n=40) and conventional group (n=40). In the VHP group, test bolus injection method was used to obtain the variable helical pitch. The scanning range was divided into two parts, above the knee and below the knee. Two helical pitches can be determined based on

the time to peak of contrast arrival at the knee joint and the scanning range of the two parts. The contrast medium (CM) volume for the VHP group was 15 mL (test bolus) + subsequent CTA examination (scan time * injection rate 4 mL/s). The conventional group uses bolus tracking and scans are conducted with a standard pitch of 0.828. If the arteries below the knee joint level are not clearly displayed, an additional small range re-scan is performed, ranging from the toes to the lower edge of the knee joint. The CM volume of conventional group was determined according to the body weight (=60 kg, 80 mL; 60-90 kg, 100 mL; >90 kg, 120 mL). The standard deviation (SD), signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR) were calculated. The subjective image quality was independently evaluated by two radiologists. Radiation dose and CM volume were also recorded. The diagnostic accuracy was calculated.

**RESULTS**

The signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) on small distal lower extremity vessels in the VHP group, such as the anterior tibial artery and dorsalis pedis artery, were superior to the conventional group (all $p<0.05$). The subjective image quality score in the VHP group was better than the conventional group ($p<0.05$). There was no statistically significant difference in radiation dose between the two groups (VHP: 1.67 ± 0.64 mSv, conventional group: 1.65 ± 0.39 mSv, $p=0.87$). The CM volume in the VHP group (64.55 ± 11.87 mL) was lower than the conventional group (89.63 ± 10.03 mL), with a decrease of approximately 33.0%. VHP group had higher sensitivity (100% vs. 87.5%) and accuracy (100% vs. 97.35%) than the conventional group.

**CONCLUSION**

In lower extremity arterial CTA scans, the use of VHP technology can significantly reduce the CM dose, improve subjective image quality, and enhance the objective image quality of distal small vessels.

**CLINICAL RELEVANCE/APPLICATION**

It has the potential to replace conventional scans in clinical practice and become the standard technique for lower extremity arterial CT scans.

## M2-SPVA-3 DESCENDING THORACIC AORTIC ELONGATION PREDICTS TYPE B AORTIC DISSECTION IN MARFAN SYNDROME

Nicholas S. Burris, MD (*Abstract Co-Author*) Royalties, ImBio, LLC
Heather A. Knauer, PhD (*Abstract Co-Author*) Nothing to Disclose
Prabhvir S. Marway, BA, MBBChir (*Abstract Co-Author*) Nothing to Disclose
Nic Tjahjadi (*Abstract Co-Author*) Nothing to Disclose
Himanshu J. Patel, MD (*Abstract Co-Author*) Research Consultant, W. L. Gore & Associates, IncResearch Consultant, Medtronic plcResearch Consultant, Terumo CorporationResearch Consultant, Edwards Lifesciences Corporation
Carlos Alberto Campello Jorge, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Marfan syndrome (MFS) patients are at high risk of type B dissection (TBAD) after prophylactic repair of the root/ascending aorta, commonly occurring at normal or mildly dilated diameters. Alternative anatomic predictors such as arch angle acuity, increased descending thoracic aortic length and tortuosity have been suggested as potential biomarkers, but longitudinal data to corroborate their prognostic value is sparse. The purpose of this study was to evaluate changes in aortic geometric features in MFS patients -beyond diameter measurements- in an attempt to identify novel predictors of TBAD development.

**METHODS AND MATERIALS**

In this single-center, retrospective study, computed tomography angiography scans from adult MFS patients (2004-2023) without prior descending thoracic aortic repair were included, with a minimal inter-scan interval of 2 years. Aortic diameter at multiple standard levels, centerline length (left subclavian to celiac artery) and tortuosity index (centerline length/linear height) were measured in descending thoracic aorta and were normalized by the time interval (per year). Arch angle was measured between the apex of the arch and the ascending and descending aorta at the level of the main pulmonary artery. Aortic growth rate was assessed by vascular deformation mapping technique, a validated 3-dimensional image analysis technique for aortic growth measurement.

**RESULTS**

Of the 105 patients included, the majority (63.8%) were male, 70.5% with prior ascending root replacement, a mean age of 40 ± 15 years, and an imaging interval of 6.1 ± 3.6 years. During imaging surveillance, 12 (11.4%) patients developed acute TBAD. There were increased rates of female sex, dural ectasia, warfarin usage, and mechanical aortic valve replacement in the TBAD group. Patients with TBAD had significantly larger diameters at follow-up CTs, higher elongation rate (2.4 vs. 0.5 mm/y; $p < 0.001$), and increasing acuity of arch angle over follow-up (-5.2° vs. +2.1°, $p = 0.03$). Multivariable logistic regression revealed an increased risk of TBAD with a higher elongation rate (OR 2.16, 95% CI 1.28-3.65; $p=0.004$) and aortic growth rate (OR 9.78, 95% CI 1.11-86.08; $p = 0.04$), but not with age, female sex, and pre-dissection proximal descending aortic diameter.

**CONCLUSION**

Descending aortic elongation rate independently predicts the development of type B dissection in MFS, whereas diameter, age, and sex do not. These findings suggest that centerline-derived elongation rate is a valuable parameter to be considered in the risk-stratification of MFS patients.

**CLINICAL RELEVANCE/APPLICATION**

Monitoring aortic elongation presents as a key instrument in the surveillance of MFS patients and may help identify patients at high risk for TBAD.

# Abstract Archives of the RSNA, 2024

M5A-SPBR

**Breast Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPBR-1 MULTIPARAMETRIC MRI MODEL WITH DYNAMIC CONTRAST-ENHANCED AND APPARENT DIFFUSION COEFFICIENT ENABLES ACCURATE PREDICTION OF BENIGN AND MALIGNANT BREAST LESIONS

Huanhuan Liu (*Abstract Co-Author*) Nothing to Disclose
Ran Luo, MD (*Abstract Co-Author*) Nothing to Disclose
Lijun Wang (*Abstract Co-Author*) Nothing to Disclose
Dengbin Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Yanhong Chen (*Presenter*) Nothing to Disclose

### PURPOSE

The study aims to investigate the value of a convolutional neural network (CNN) based on multiparametric magnetic resonance imaging in predicting malignancy of breast lesions.

### METHODS AND MATERIALS

We developed a CNN model based on the dynamic contrast-enhanced imaging (DCE) and Diffusion-Weighted Imaging(DWI) with apparent diffusion coefficient(ADC) mapping to characterize breast lesions. Between November 2018 and October 2019, 556 lesions (307 malignant, 249 benign) in 556 patients were pooled in the training/ validation set. Lesions were semi-automatically segmented by two breast radiologists using ITK-SNAP software. The standard of reference was histologic consequences. Algorithm performance was evaluated in an independent testing set of 243 lesions in 243 patients using weighted sums of the area under the curve (AUC) scores.

### RESULTS

In the Testing set, the model of DCE-ADC achieved the highest diagnostic efficiency with an area under the receiver operating characteristic (ROC) curve(AUC) of 0.889 and the accuracy, sensitivity, and specificity were 82.5%, 80.7% and 84.1%, respectively, surpassing the other models including DCE-DWI-ADC, DCE-DWI, and other single-parameter model.

### CONCLUSION

Multiparametric MRI using DCE-MRI and DWI-ADC maintains high sensitivity, improves specificity, and maximizes diagnostic accuracy, which can prevent unnecessary breast biopsy.

### CLINICAL RELEVANCE/APPLICATION

Multiparametric MRI model enables accurate prediction of benign and malignant breast lesions guiding clinical decision-making.

## M5A-SPBR-10 COMPARISON OF THE RISK SCORE FOR CANCER DETECTION ON SCREENING MAMMOGRAMS GIVEN BY AN AI ALGORITHM AND THE RADIOLOGISTS

Solveig S. Hofvind (*Abstract Co-Author*) Nothing to Disclose
Jonas Gjesvik (*Abstract Co-Author*) Nothing to Disclose
Tone Hovda, PhD, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To explore association of an artificial intelligence (AI) algorithm's risk score for cancer detection and the radiologists' interpretation scores in a population-based mammographic screening program using independent double reading and consensus.

### METHODS AND MATERIALS

The study sample included 602,134 screening mammography examinations performed 2004-2018, including 3439 screen-detected breast cancer cases, all independently read by two radiologists and assigned a score on a scale 1-5 (1: normal/benign, 2: probably benign, 3: intermediate suspicious, 4: probably malignant, 5: malignant). All examinations were analyzed by a commercially available AI-algorithm, scoring each examination on a continuous scale from 0.0-1.0, with 1.0 representing highest likelihood of cancer. We defined score sum as the sum of interpretation scores by both radiologists, ranging from 3 (score 1+2) to 10 (score 5+5), sums 8-10 were collapsed into one category. We analyzed algorithm sensitivity and association with score sum at three different thresholds: At T1, the 3.0% highest AI-scores were considered positive (corresponding to the actual recall rate in the study population). At T2, the 8.7% highest AI-scores were considered positive (corresponding to the actual consensus rate), and at T3, the 50% highest AI-scores were considered positive. We performed descriptive analyses and one-way ANOVA for trend, $p<0.05$ statistically significant.

### RESULTS

AI scored 83.3% (2864/3439) of the screen-detected cancers positive at T1, ranging from 57.4% (264/460, score sum 3) to 98.9% (717/725, score sum 8-10). At T2, AI scored 93.5% (3216/3439) of the cancers positive, range 82.2% (378/460, score sum 3) to 99.9% (724/725, score sum 8-10). At T3, AI scored 99.7% (3427/3439) of the cancers positive, ranging from 98.9% (455/460, score sum 3) to 100.0% (725/725, score sum 8-10). P<0.01 for trend for sum of scores for T1, T2 and T3.

### CONCLUSION

We observed a statistically significant positive association between AI risk score and radiologists' interpretation scores.

### CLINICAL RELEVANCE/APPLICATION

Agreement between AI risk score and radiologists' interpretation scores indicates that it is safe to further test AI as a stand-alone reader in prospective studies; however, screen-detected cancers with less suspicious characteristics remain a challenge to both AI and radiologists.

## M5A-SPBR-2 AUTOMATED IDENTIFICATION OF CHALLENGING MAMMOGRAPHIC CASES USING ARTIFICIAL INTELLIGENCE: A NOVEL APPROACH FOR EDUCATIONAL TEST SET CURATION

Mary T. Rickard, MBBS, FRANZCR (*Abstract Co-Author*) Nothing to Disclose
Ziba Gandomkar (*Abstract Co-Author*) Nothing to Disclose
Patrick C. Brennan, BS, PhD (*Abstract Co-Author*) Director, DetectED-X
Moayyad E. Suleiman, PhD (*Presenter*) CTO, DetectED-X

### PURPOSE

Traditional methods of assessing the interpretative difficulty of mammographic cases for educational purposes may not always accurately reflect their true difficulty. To address this, we propose a novel approach utilizing artificial intelligence (AI) to classify normal mammograms as either easy or challenging. This would facilitate the rapid identification of difficult cases within large archives of mammographic images to streamline educational test set curation process.

### METHODS AND MATERIALS

A dataset of 441 cancer-free screening mammograms, confirmed through a two-year follow-up, was utilized. Each mammogram was independently assessed by numerous radiologists or trainees. Regions of interest (ROIs) containing false positives (FPs) were identified and categorized as challenging-to-interpret if marked by over 10% of interpreters; otherwise, they were deemed easy-to-interpret. Concurrently, three publicly available AI-based models were employed to generate ROIs. These outputs were then used as input to train and validate an EfficientNet B3 model, aimed at distinguishing between challenging and easy-to-interpret FP ROIs. Performance was evaluated using ten-fold cross-validation.

### RESULTS

Among 11,410 FPs annotated by readers, 1,142 were identified as challenging-to-interpret. Combining outputs from the AI-based models yielded 14,112 ROIs, effectively encompassing 99.56% of radiologists'-identified challenging FPs and 98.00% of easy-to-interpret FPs. The cross-validated EfficientNet model achieved an area under the receiver operating characteristics curve (AUC) of 0.85 (95% CI: 0.84-0.86) for identifying challenging-to-interpret FP ROIs.

### CONCLUSION

Our study demonstrates that combining AI-generated ROIs with a finely tuned EfficientNet model can accurately predict challenging-to-interpret normal mammograms. This approach has the potential to streamline the curation of educational test sets and guide AI development towards cases where it is most beneficial.

### CLINICAL RELEVANCE/APPLICATION

The findings highlight the potential of AI in rapidly identifying difficult cases within large archives of mammographic images. This has implications for improving the quality and relevance of educational materials for radiologists and trainees, thereby enhancing their diagnostic skills and proficiency.

## M5A-SPBR-3 DUAL-DOMAIN MTANN FOR VIRTUAL HIGH-DOSE IMAGING IN DIGITAL BREAST TOMOSYNTHESIS (DBT)

ZHIPENG DENG (*Abstract Co-Author*) Nothing to Disclose
Kenji Suzuki, PhD (*Abstract Co-Author*) Nothing to Disclose
Ze Jin, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Digital breast tomosynthesis (DBT) is an advanced imaging technique that enhances early breast cancer detection by providing three-dimensional (3D) representations. Although DBT increases diagnostic precision, it exposes patients to a higher radiation dose compared with traditional 2D mammography. With the goal of substantial reduction in the radiation exposure in DBT, we developed a novel dual-domain radiation dose reduction technology that involves denoising in both raw projection and reconstructed domains.

### METHODS AND MATERIALS

Our dual-domain massive-training artificial neural network (MTANN) approach consists of applying 2D-MTANN to raw DBT projections, followed by a reconstruction process, and then utilizing a 3D-MTANN on reconstructed slices. During training, our MTANN learned the relationship between low-dose (LD) images and high-dose (HD) images. In the testing phase, this approach was able to convert LD raw projections into virtual high-dose (VHD) reconstructed slices, which significantly reduced noise and artifacts while preserving image quality. VHD images retained fine details, such as microcalcifications (MCs), which are vital for accurate breast cancer diagnosis.

### RESULTS

Our dual-domain radiation dose reduction technology was capable of converting LD images into VHD images, the image quality of which was similar to real HD images. To assess the effectiveness of dose reduction, we evaluated the image quality by measuring the contrast-to-noise ratio (CNR). Our method achieved the highest CNR among all methods with statistically significant differences (paired t-test: $P < 0.05$). Small MCs, measuring approximately 0.45 mm and 0.3 mm, lost the contrast to various extents in the output images from BM3D, K-SVD, RED-CNN, DnCNN, and DnGAN, unlike our method which effectively preserved the contrast.

### CONCLUSION

We developed a dual-domain radiation dose reduction technology based on MTANN, which converts LD DBT images into VHD DBT images, equivalent to full-dose DBT images, as evaluated in 51 non-training clinical cases. We showed that the integration of denoising in both the raw projection domain and the reconstructed domain of DBT images was effective, with each compensating for the other. This novel technology effectively reduced noise in half-dose images while preserving calcifications and breast tissue structures.

### CLINICAL RELEVANCE/APPLICATION

Our method was able to reduce radiation dose to patients by generating virtual high-dose images from low-dose input images.

## M5A-SPBR-4 FORECAST OF GENETIC ASSESSMENTS FOR TUMOR RESPONSE TO CHEMOTHERAPY ONLY WITH PRETHERAPEUTIC BREAST MRI BY MEANS OF RADIOGENOMIC IMAGING BIOMARKER SCHEME

Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ze Jin, PhD (*Abstract Co-Author*) Nothing to Disclose
Taiguang Yuan (*Abstract Co-Author*) Nothing to Disclose
Yukiko Tokuda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasuto Naoi, MD,PhD (*Abstract Co-Author*) Research Grant, Sysmex CorporationSpeaker, Sysmex Corporation
Kenji Suzuki, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Genetic assessment is frequently used to predict chemotherapy responses and the recurrence risk for breast cancer patients. However, the genetic test is costly, invasive, and not feasible for every patient. Our study aims to develop a non-invasive scheme that uses only pretherapeutic MRI to predict the genetic assessments for tumor response to chemotherapy (immune-related 23-gene signature: IRSN-23) and risk of cancer recurrence (95-gene classifier: 95-GC). This was achieved by integrating machine-learning techniques with an optimal biomarker selection method.

### METHODS AND MATERIALS

Our database contained 118 breast MRI studies from 118 patients, all of which had IRSN-23 results; 76 patients of which had 95-GC results. The proposed scheme encompasses a systematic three-step process: feature extraction from a segmented tumors in pretherapeutic MR images, discovering imaging biomarkers by our original biomarker selection method under the maximal area-under-the-curve (MaxAUC) criterion, and prediction of genetic assessment with the imaging biomarkers. Our MaxAUC biomarker selection method was applied to 318 features to discover the most effective imaging biomarkers for forecasting genetic assessments. A prediction model was established with a support vector machine classifier with the most effective combination of imaging biomarkers. The comparative study evaluated the proposed method's performance against the latest state-of-the-art (SOTA) deep-learning models, including ResNet, DenseNet, and the Vision Transformer (ViT) models.

### RESULTS

In five-fold cross-validation tests, our proposed scheme achieved AUC values of 0.93 and 0.95 in predicting genetic test results of 95-GC and IRSN-23, respectively, which significantly outperformed 0.77 and 0.62 ($P << 0.05$), respectively, by the best-performing SOTA model.

### CONCLUSION

Our results demonstrated that our proposed scheme forecasted the genetic assessments for the risks of recurrence (by 95-GC) and responses to chemotherapy (by IRSN-23) for breast cancer accurately only with pretherapeutic MRI before chemotherapy.

### CLINICAL RELEVANCE/APPLICATION

Our scheme is able to forecast recurrence risks and tumor responses to chemotherapy for breast cancer solely from pretherapeutic MRI data before the commencement of chemotherapy, which offers novel personalized and non-invasive diagnosis in breast cancer treatment.

## M5A-SPBR-5 COMPREHENSIVE SUPPORT FOR BREAST MAMMOGRAM INTERPRETATION: EVALUATION OF A MULTI-INSTANT MULTI-MODAL AI SYSTEM SUPPORTING INTERPRETIVE AND NONINTERPRETIVE FUNCTIONS

Svati S. Long, MD (*Abstract Co-Author*) Nothing to Disclose
Pierre Fillard, PhD (*Abstract Co-Author*) Employee, Therapixel SA;Stockholder, Therapixel SA
Pauline Germaine, DO (*Abstract Co-Author*) Nothing to Disclose
Caroline Sclafert (*Abstract Co-Author*) Nothing to Disclose
Thomas Bertinotti (*Abstract Co-Author*) Nothing to Disclose
Serena Pacile, PhD (*Presenter*) Employee, Therapixel SA

### PURPOSE

Artificial intelligence (AI) has been proven to hold promising potential for revolutionizing breast cancer screening, offering advanced capabilities to enhance diagnostic accuracy and efficiency. In this study, we aimed to evaluate the impact of a multi-modal multi-instant AI-based system on the diagnostic performance of radiologists in interpreting mammograms.

### METHODS AND MATERIALS

We designed a multi-reader multi-case study taking into account the evaluation of both interpretive and non-interpretive tasks. The overall diagnostic performance was compared between the unaided versus aided reading condition using the Area Under the Receiver Operator Characteristic (AUC). Intra-class correlation coefficient (ICC), Fleiss Kappa and accuracy were used to analyze agreement and performance on non-interpretive tasks. Reading time and perceived fatigue were used as comprehensive metrics to assess the efficiency of readers.

### RESULTS

The average diagnostic performance significantly increased by 7.4% [95% CI: 4.5% - 10%] with the concurrent assistance of the AI system with a p-value<0.001. All readers experienced an augmented AUC with AI support, with improvements ranging from 0.02 to 0.18. On average, readers found 8% more cancers in assisted reading condition compared to the unassisted reading conditions. The intra-class correlation coefficient, used to quantify the agreement between readers when interpreting a case, went from 0.6 [95% CI: 0.55 - 0.65] in unassisted condition to 0.74 [95% CI: 0.70 - 0.78] for readings done with the concurrent assistance of AI. An overall decrease of 24% in reading time and a markedly reduced perceived fatigue were also found.

**CONCLUSION**

The incorporation of this AI system, capable of handling multiple image type, prior mammograms, and multiple outputs, notably improved the diagnostic proficiency of radiologists in identifying breast cancer when analyzing both DBT and 2D mammography images together, while also reducing the time required for combined interpretive and non-interpretive tasks.

**CLINICAL RELEVANCE/APPLICATION**

The application of such AI-based system could offer a comprehensive solution to support breast cancer screening practice and improve its effectiveness.

## M5A-SPBR-6 ARTIFICIAL INTELLIGENCE (AI)-BASED MAMMOGRAPHY SCORES FOR PREDICTING LYMPH NODE METASTASIS IN EARLY-STAGE BREAST CANCER

Jalim Koo (*Abstract Co-Author*) Nothing to Disclose
Na Lae Eun, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to develop and validate nomograms based on an Artificial Intelligence (AI)-based scores for mammography, combined with clinicopathologic features, to predict lymph node (LN) metastasis in early-stage breast cancer.

**METHODS AND MATERIALS**

A retrospective cohort of patients with clinical T1 or T2 and N0 breast cancers who underwent definitive breast and axillary surgery between January 2013 and December 2015 was included. Patients were randomly allocated into traning and validation sets (7:3 ratio). Clinicopathologic features and the AI score for mammography (Lunit Insight MMG) were analyzed using logistic regression to develop nomograms for LN metastasis prediction. The area under the receiver operating characteristic curve (AUC) was used to evaluate nomogram performance.

**RESULTS**

A total of 516 women were included (mean age ± standard deviation, 50 years ± 10.5). Multivariable analysis identified the AI score for mammography, lymphovascular invasion, HER2-positive status, and total mastectomy surgery type as significantly associated with LN metastasis (all $P < .05$). The developed prediction model achieved an AUC of 0.750 in the training set and 0.773 in the validation set for predicting LN metastasis, respectively.

**CONCLUSION**

The AI score for mammography, in combination with lymphovascular invasion, HER2-positive status, and total mastectomy surgery type, demonstrates significant utility in predicting LN metastasis in early-stage breast cancer.

**CLINICAL RELEVANCE/APPLICATION**

The integration of AI-based scores for mammography, alongside traditional clinicopathologic factors, may offer a valuable tool for predicting LN metastasis in early-stage breast cancer.

## M5A-SPBR-7 FEATURE ANALYSIS OF SCREENING DETECTED CANCER AND MISSED CANCER OF ARTIFICIAL INTELLIGENCE-BASED COMPUTER-ASSISTED DIAGNOSIS (AI-CAD) ON AI-STREAM STUDY

Jin Kyung An, MD (*Abstract Co-Author*) Nothing to Disclose
Nami Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyunghee Ko, MD (*Abstract Co-Author*) Nothing to Disclose
Jung Kyu Ryu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yeong Mi Park, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yun Woo Chang, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This presentation aims to investigate the characteristics of screening-detected cancer and missed cancer by applying AI-CAD to the prospective, multicenter study populations of the AI-STREAM study.

**METHODS AND MATERIALS**

From 2021.02 to 2022.12., 24,545 cases of 24,543 participants enrolled in the AI-STREAM study were analyzed as AI-CAD (Lunit INSIGHT mammography). Positive AI results were defined as scores > 10%. Negative AI results were observed in 23,010 cases, while positive results were found in 1,535 cases. Breast density, provided by AI-CAD, was recorded in four groups. A total of 131 cases of screening-detected cancer were diagnosed based on pathological diagnosis within 6 months, with AI-CAD detecting 118 cases. Breasts were subdivided into nine groups (10-99, 10 units each) based on their abnormality scores, and positive predictive value (PPV) was calculated for each subgroup. AI-abnormal scores were compared to mammographic and pathological findings.

**RESULTS**

The overall PPV of AI-CAD was 7.69. The PPVs ranged from 0.8% to 6.3% in groups 1 to 6 and increased sequentially from groups 7 to 9, reaching 19.6%, 31.7%, and 74.4, respectively. The median AI scores of malignant in fatty breasts [median, 98.8] appeared higher than those in dense breasts (88.4). In mammography findings of malignancy, the highest AI score was for mass with microcalcification (96.4), and the lowest was for asymmetry (58.6). When comparing pathological findings, the median AI score was higher in IDC (90.6) than in DCIS (75.6). The AI score was lower in malignant tumors<1 cm, those without LN metastasis, and those classified as Luminal A type ($p < 0.05$). 13 cases of AI-CAD missed cancer included DCIS (n=5), IDC (n=7), and medullary cancer (n=1). The size ranged from 0.7 to 8cm, and all of which were classified as luminal A. Mammography of missed cancer predominantly showed dense breasts (n=10) compared to fatty breasts (n=3), including asymmetry (n=5), mass (n=4), distortion(n=1), and microcalcification (n=1). None of the mass with microcalcification. Two cases exhibited negative mammographic features and dense breasts.

**CONCLUSION**

AI-CAD demonstrates significant promise in detecting breast cancer within screening populations, with AI abnormal scores showing an acceptable correlation with pathologic and mammographic features. Understanding the characteristics of AI-CAD detected or missed cancers could aid in the application of AI-CAD systems.

### CLINICAL RELEVANCE/APPLICATION

1. The overall PPV of AI-CAD was 7.69, falling within the recommended PPV1 range of 3-8%. 2. The PPV of AI-CAD increased sequentially, depending on the abnormal score. 3. AI-CAD demonstrated acceptable performance and correlation with pathological and mammographic features.

## M5A-SPBR-8 EXTERNAL MULTI-CENTER MULTI-MANUFACTURER VALIDATION OF A MAMMOGRAPHY-BASED AI SCORE TO SELECT PATIENTS FOR SUPPLEMENTAL BREAST CANCER SCREENING

Fredrik Strand, MD, PhD (*Abstract Co-Author*) Speaker, Lunit Inc
Klara Solander (*Abstract Co-Author*) Nothing to Disclose
Haiko Schurz, BSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Kevin Smith, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Davida Astrom (*Abstract Co-Author*) Nothing to Disclose
Moein Sorkhei (*Abstract Co-Author*) Nothing to Disclose
Yue Liu (*Abstract Co-Author*) Nothing to Disclose
Fernando Cossio Ramirez, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

AISmartDensity is an AI-based score for selecting women for supplemental screening. It integrates risk, masking, and cancer signs, which also takes as input the score of one commercial AI CADe system. It has been validated in a single-center setting with AI CADe from Lunit and Hologic images. This retrospective study extended the evaluation to images from GE, Phillips, and Siemens.

### METHODS AND MATERIALS

We used a subset of the VAIB dataset which was created by sampling 5763 four-view FFDM examinations of women from 3 regions in Sweden during 2014-2019. Weighted random sampling ensured representivity for equipment manufacturer, patient age, and density. Cancer or healthy status was confirmed within 3 years of the exam. We included exams between 60 days and 3 years before diagnosis to avoid screen-detected cancer. Exams diagnosed within 2 months to 2 years were considered Interval Cancers (IC), and within 2 to 3 years, Next Round Detected Cancer (NRDC). The healthy and NRDC exams were upsampled to resemble a real-world incidence of 0.2% IC and 0.5% NRDC.The AUC, sensitivity, and PPV were measured for the exams belonging to the top 8% AISmartDensity scores.

### RESULTS

The AUC of AISmartDensity was for GE (n=161641): 0.62 (95%CI=[0.60, 0.63]), for Phillips (n=161641): 0.73 (95%CI=[0.71, 0.74]) and for Siemens (n=57553): 0.74 ( 95%CI=[0.68,0.80]) with p-value < 0.001 for each comparison. The sensitivity, for the top 8% of scores, showed that for GE 22% of cancers were included, for Philips 25% and for Siemens 30%.

### CONCLUSION

AISmartDensity generalised well to images acquired with Philips and Siemens equipment but not GE. This highlights the importance of validating on images from the same manufacturer as the algorithm will be applied to before clinical implementation. The overall results were lower than the ones previously reported on Hologic images.

### CLINICAL RELEVANCE/APPLICATION

Selecting patients for further work-up based on the scores created by AISmartDensity proved to reduce the number of IC and NRDC by detecting up to 32% more cancers than standard double reading screening.

## M5A-SPBR-9 AN AI-GUIDED REVIEW PROCESS LOWERS RECALL RATES WHILE MAINTAINING CANCER DETECTION RATES

Benjamin Reece (*Abstract Co-Author*) Employee, RadNet, Inc
A. Gregory Sorensen, MD (*Abstract Co-Author*) Employee, RadNet, Inc;Board member, IMRIS Inc;Board member, Siemens AG;Board member, DFB Healthcare Acquisitions Corp;Board member, inviCRO, LLC;;;;
Jacqueline S. Holt, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan Haslam, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Jiye G. Kim, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Leeann Louis, BS, PhD (*Presenter*) Researcher, RadNet, Inc

### PURPOSE

Optimal mammography screening maintains adequately high cancer detection rates (CDR) while keeping recall rates (RR) low. We tested the hypothesis that an AI-guided review process could be used to lower recalls, the most common harm of screening, while maintaining high cancer detection rates by performing an additional review on a subset of exams where cancer likelihood is very low, but the patient was recalled by the interpreting radiologist.

### METHODS AND MATERIALS

An FDA-cleared CADe/x device was run on all eligible screening mammograms (N=292,692) at 3 outpatient screening mammography practices (including 64, 2, and 17 facilities that performed 180,529 screens, 12,889 screens and 99,274 screens at Practices 1, 2, and 3 respectively) from 07/2022-10/2023. Starting 03/2023 for Practices 1 and 2, and 04/2023 for Practice 3, a recall-focused AI-guided review process (AIRP) was implemented, where exams in the least suspicious 75% of AI scores recalled by the interpreting radiologist underwent a second review by an expert breast imaging specialist. The second reviewer decided whether to consult with the interpreting radiologist to reconsider their recall decision. To determine whether implementing AIRP lowered RR without negatively impacting CDR, we measured RR and CDR before and after the process was implemented and compared them using a Chi-squared test. In addition, to determine whether the impact of AIRP varied by radiologist's baseline RR, we plotted each radiologist's change in RR with AIRP as a function of their RR without AIRP and fit an ordinary least squares regression.

### RESULTS

Recall rates dropped significantly with AIRP for Practice 1 (from 12.0% to 10.4%, $p < 0.01$) and 3 (from 9.9% to 9.1%, $p < 0.01$) but not for Practice 2 (10.4% to 10.5%, $p = 0.84$), likely due to the low number of screens performed there. The cancer detection rate did not change significantly at any practice as a result of AIRP ($p > 0.05$). The change in RR with AIRP was significantly and negatively correlated with RR without AIRP ($p = 0.001$), meaning radiologists who had higher RR without AIRP had the biggest drop in RR with AIRP.

### CONCLUSION

Use of an AI-guided review process successfully lowered RR at 2 out of 3 outpatient screening mammography practices without compromising CDRs. This was driven primarily by a decrease in the RR of radiologists whose average RR was higher during baseline, indicating the process was most effective for

the radiologists who needed it the most.

**CLINICAL RELEVANCE/APPLICATION**

An AI-guided review process has the potential to lower RR without compromising CDR, reducing the most common harm identified by the USPSTF associated with screening mammography.

# Abstract Archives of the RSNA, 2024

M5A-SPCA

**Cardiac Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPCA-1 AUTOMATED LEFT VENTRICULAR VOLUMETRY USING ARTIFICIAL INTELLIGENCE IN CORONARY CALCIUM SCANS (AI-CAC) PREDICTS HEART FAILURE COMPARABLY TO CARDIAC MRI AND OUTPERFORMS NT-PROBNP: THE MULTI-ETHNIC STUDY OF ATHEROSCLEROSIS (MESA)

Anthony P. Reeves, PhD (*Abstract Co-Author*) Stockholder, VisionGate, Inc;Patent agreement, General Electric Company;President, D4vision, Inc
Claudia I. Henschke, MD,PhD (*Abstract Co-Author*) Advisory Board, LungLifeAI, Inc;Board Member, Early Diagnosis and Treatment Research Foundation Inc
David F. Yankelevitz, MD (*Abstract Co-Author*) Consultant, Accumetra LLC;Stockholder, Accumetra LLC;Medical Advisory Board, Carestream Health, Inc;Royalties, General Electric Company;Consultant, AstraZeneca PLC;Consultant, Pfizer Inc;Consultant, F. Hoffmann-La Roche Ltd
Dong Li (*Abstract Co-Author*) Nothing to Disclose
Tom Atlas, MD (*Abstract Co-Author*) Nothing to Disclose
Chenyu Zhang (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Budoff, MD (*Abstract Co-Author*) Nothing to Disclose
Nathan Wong, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyle Atlas (*Abstract Co-Author*) Nothing to Disclose
Morteza Naghavi (*Presenter*) Nothing to Disclose

### PURPOSE

Artificial intelligence-powered coronary artery calcium scan (AI-CAC) provides more actionable information than currently reported. In this study we compared left ventricular (LV) volume measured by AI-CAC versus cardiac magnetic resonance imaging (CMR) and NT-proBNP for predicting heart failure (HF). Additionally, we compared AI-CAC vs. NT-proBNP for detection of left ventricular hypertrophy (LVH) defined by CMR.

### METHODS AND MATERIALS

We used 15-year outcomes data for incident heart failure (HF) from 3078 asymptomatic MESA participants (52.3% women, age 62.2±10.3 years) who underwent both CAC scans and CMR at the baseline examination. Data on CMR semi-manual LV volume, NT-proBNP, and Agatston CAC score were obtained from MESA. Discrimination was assessed using the time-dependent area under the curve (AUC) for incident HF.

### RESULTS

Over 15 years of follow up, 133 cases of HF were diagnosed. The AUC for AI-CAC (0.789) and CMR (0.793) were not significantly different (p=0.67) but were significantly higher than NT-proBNP (0.719) and Agatston score (0.664) (p<.0001) for prediction of incident HF. AI-CAC and CMR significantly improved the continuous Net Reclassification Index of NT-proBNP (0.37) and Agatston score (0.45) for HF prediction (p<0.001 for all). The AUC for AI-CAC vs. NT-proBNP for LVH was 0.871 vs. 0.600 for males and 0.854 vs. 0.600 for females.

### CONCLUSION

In MESA, AI-CAC automated LV volumetry and CMR semi-automated LV volumetry equally predicted incident HF over 15 years and outperformed NT-proBNP. AI-CAC significantly outperformed NT-proBNP for detection of LVH. Both AI-CAC and CMR significantly improved on NT-proBNP and Agatston CAC score for predicting incident HF.

### CLINICAL RELEVANCE/APPLICATION

Radiologists and cardiologists are currently unable to detect enlarged cardiac chambers in non-contrast chest CT scans without the AI, therefore these patients go undetected and untreated. Opportunistic screening of enlarged cardiac chambers in non-contrast CT scans enables detection of asymptomatic patients at high risk for HF.

## M5A-SPCA-10 EVALUATION OF AN ARTIFICIAL INTELLIGENCE-BASED AUTOMATIC POSITIONING METHOD FOR SETTING THE RANGE OF CORONARY CT ANGIOGRAPHY: A RETROSPECTIVE STUDY

Kai Zhao, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate and compare the performance of the conventional manual positioning method and the artificial intelligence (AI)-based automatic positioning method in setting the range of coronary CT angiography (CCTA).

### METHODS AND MATERIALS

In this retrospective study, 52 patients who underwent CCTA were included and analyzed. All patients underwent a localization scan before the CCTA scan to determine the appropriate scan range. The scan range for CCTA was then determined using the conventional manual positioning method, based on analyzing anterior-posterior (AP) scout images derived from the localization scan. The artificial intelligence automatic positioning method was retrospectively used to calculate the range for CCTA scan based on AP scout images. The actual location and range of the coronary arteries were retrospectively determined by examining CCTA axial images. The performance of conventional manual positioning and AI-based automatic positioning in setting the range of coronary artery scanning were compared using the actual location and range of the coronary arteries as the reference standard.

### RESULTS

The scan length determined by AI-based automatic positioning was significantly shorter than that determined by manual positioning (123.85±10.85 mm vs. 148.46±11.40, $p < 0.00$). Moreover, the actual position and range of the coronary artery were both within the scan length range determined by AI automatic positioning and manual positioning for all included patients. The AI-based automatic positioning method showed significantly lower absolute error compared to the conventional manual method for both superior (29.34±8.60 mm vs. 36.96±9.11 mm, $p < 0.001$) and inferior boundaries (12.98±7.98mm vs. 29.91±10.72mm, $p < 0.001$) of coronary arteries. Mean absolute and relative measurement errors with AI were also significantly lower than those with manual positioning for determining CCTA scan range (42.26±9.68 mm vs. 66.87±11.88 mm; 52.63%±14.18% vs. 83.33% ±19.19%; all p <0 .001).

### CONCLUSION

The AI-based automatic positioning method is superior to the conventional manual positioning method for setting the scan range in CCTA.

### CLINICAL RELEVANCE/APPLICATION

AI-based scan range determination in CCTA can provide improved accuracy, reduced radiation dose, and optimized scanning workflow.

## M5A-SPCA-2 CORONARY ARTERY CALCIUM SCANS POWERED BY ARTIFICIAL INTELLIGENCE (AI-CAC) PREDICTS ATRIAL FIBRILLATION AND STROKE COMPARABLY TO CARDIAC MAGNETIC RESONANCE IMAGING: THE MULTI-ETHNIC STUDY OF ATHEROSCLEROSIS (MESA)

Claudia I. Henschke, MD,PhD (*Abstract Co-Author*) Advisory Board, LungLifeAI, Inc;Board Member, Early Diagnosis and Treatment Research Foundation Inc
Nathan Wong, PhD (*Abstract Co-Author*) Nothing to Disclose
David F. Yankelevitz, MD (*Abstract Co-Author*) Consultant, Accumetra LLC;Stockholder, Accumetra LLC;Medical Advisory Board, Carestream Health, Inc;Royalties, General Electric Company;Consultant, AstraZeneca PLC;Consultant, Pfizer Inc;Consultant, F. Hoffmann-La Roche Ltd
Anthony P. Reeves, PhD (*Abstract Co-Author*) Stockholder, VisionGate, Inc;Patent agreement, General Electric Company;President, D4vision, Inc
Tom Atlas, MD (*Abstract Co-Author*) Nothing to Disclose
Chenyu Zhang (*Abstract Co-Author*) Nothing to Disclose
Kyle Atlas (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Budoff, MD (*Abstract Co-Author*) Nothing to Disclose
Morteza Naghavi (*Presenter*) Nothing to Disclose

### PURPOSE

AI-CAC provides more actionable information than the Agatston coronary artery calcium (CAC) score. We have recently shown in the Multi-Ethnic Study of Atherosclerosis (MESA) that AI-CAC automated left atrial (LA) volumetry enabled prediction of atrial fibrillation (AF) as early as one year. In this study we evaluated the performance of AI-CAC LA volumetry versus LA measured by human experts using cardiac magnetic resonance imaging (CMRI) for predicting AF and stroke, and compared them with CHARGE-AF risk score, Agatston score, and NT-proBNP.

### METHODS AND MATERIALS

We used 15-year outcomes data from 3552 asymptomatic individuals (52.2% women, age 61.7±10.2 years) who underwent both CAC scans and CMRI in the MESA baseline examination. CMRI LA volume was previously measured by human experts. Data on BNP, CHARGE-AF risk score and the Agatston score were obtained from MESA. Discrimination was assessed using the time-dependent area under the curve (AUC).

### RESULTS

Over 15 years follow-up, 562 cases of AF and 140 cases of stroke accrued. The AUC for AI-CAC versus CMRI for AF and stroke were not significantly different (0.802 vs. 0.798 and 0.762 vs. 0.751 respectively, $p=0.60$). AI-CAC significantly improved the continuous Net Reclassification Index (NRI) for prediction of AF and stroke when added to CHARGE-AF risk score (0.28, 0.21), NT-proBNP (0.43, 0.37), and Agatston score (0.69, 0.41) respectively (p for all<0.0001).

### CONCLUSION

AI-CAC automated LA volumetry and CMRI LA volume measured by human experts similarly predicted incident AF and stroke over 15 years. Further studies to investigate the clinical utility of AI-CAC for AF and stroke prediction are warranted.

### CLINICAL RELEVANCE/APPLICATION

Opportunistic screening of enlarged cardiac chambers in non-contrast CT scans enables detection of asymptomatic patients at high risk for AF and stroke.

## M5A-SPCA-3 AI-ENABLED AUTOMATED BONE MINERAL DENSITY MEASUREMENT IN CORONARY ARTERY CALCIUM SCANS (AUTOBMD) IS ASSOCIATED WITH HIGH CORONARY ARTERY CALCIUM SCORE INDEPENDENTLY OF CONVENTIONAL RISK FACTORS: MULTI-ETHNIC STUDY OF ATHEROSCLEROSIS (MESA)

David F. Yankelevitz, MD (*Abstract Co-Author*) Consultant, Accumetra LLC;Stockholder, Accumetra LLC;Medical Advisory Board, Carestream Health, Inc;Royalties, General Electric Company;Consultant, AstraZeneca PLC;Consultant, Pfizer Inc;Consultant, F. Hoffmann-La Roche Ltd
Anthony P. Reeves, PhD (*Abstract Co-Author*) Stockholder, VisionGate, Inc;Patent agreement, General Electric Company;President, D4vision, Inc
Tom Atlas, MD (*Abstract Co-Author*) Nothing to Disclose
Chenyu Zhang (*Abstract Co-Author*) Nothing to Disclose
Kyle Atlas (*Abstract Co-Author*) Nothing to Disclose
Matthew J. Budoff, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia I. Henschke, MD,PhD (*Abstract Co-Author*) Advisory Board, LungLifeAI, Inc;Board Member, Early Diagnosis and Treatment Research Foundation Inc
Morteza Naghavi (*Presenter*) Nothing to Disclose

**PURPOSE**

The association between low bone mineral density (BMD) and coronary artery calcium (CAC) has been reported before using manual measurement of thoracic BMD. Such manual measurements are time-consuming and subject to operator errors. We therefore used an AI-enabled BMD measurement tool to explore the relationship between CAC and BMD independent of traditional risk factors.

**METHODS AND MATERIALS**

The validation of AutoBMDTM (HeartLung.AI, Houston TX) has been reported previously. We applied AutoBMD to CAC scans of 6043 individuals (53.3% female, age 61.9±10.2 years) from the baseline examination (2000-2002) of MESA. Thoracic BMD was measured in T7-T9 vertebrae. Osteoporosis was defined as a T-Score below -2.5. Cox proportional hazards regression was used to calculate hazard ratios (HR) per unit change for 10-year coronary heart disease (CHD) prediction.

**RESULTS**

Average BMD in men and women were 164.4 ± 45.1 and 163.1 ± 50.0 g/cm3 respectively (P=0.3467). Average CAC score for men and women were 223.4±544.0 and 76.2± 241.3 cm3 respectively (P<0.0001). A total of 1672 cases were classified as osteoporotic, which included 986 (58.0%) men and 714 (42.0%) women. After adjusting for age, gender and conventional CVD risk factors, average CAC score in osteoporotic cases versus normal BMD was 170.1 ± 531.1 vs. 130.4+272.8 respectively (P = 0.004). Decreased BMD was associated with CHD independently of CAC and CVD risk factors (HR=0.997, p=0.0143).

**CONCLUSION**

Low BMD and high CAC are associated independently of age, gender, and traditional risk factors of cardiovascular diseases.

**CLINICAL RELEVANCE/APPLICATION**

Further studies are warranted to evaluate the potential added value of automated BMD to CAC for prediction of adverse events.

## M5A-SPCA-5 APPLICATION OF ONE-BEAT ACQUISITION WITH MOTION CORRECTION ALGORITHM (SSF1) IN CORONARY ARTERY CT ANGIOGRAPHY OF PATIENTS WITH ATRIAL FIBRILLATION: EVALUATION OF CORONARY ARTERY USING ARTIFICIAL INTELLIGENCE ASSISTED DIAGNOSTIC SYSTEM

Shumeng Zhu (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the impact of one-beat acquisition with motion correction algorithm (SSF1) on image quality of coronary CT angiography (CCTA) in patients with atrial fibrillation, and its diagnostic efficiency using an artificial intelligence aided diagnosis system (AI-ADS).

**METHODS AND MATERIALS**

A total of 91 consecutive patients with atrial fibrillation (56 males, 67.32±11.45y), who underwent one-beat CCTA were analyzed. Images were reconstructed with SSF1. The subjective and objective image quality of the coronary arteries were evaluated. Using the invasive coronary catheter angiography as the gold standard, the diagnostic efficacy of AI-ADS and AI-ADS + radiologist for stenoses above moderate and severe degrees were calculated.

**RESULTS**

Effective radiation dose was 2.54±0.86 mSv. The average CT values of all major coronary arteries and branches were greater than 400HU. The two radiologists rated vessels as good or above 96.70% (350/364) and 96.15% (352/364), respectively, and the diagnosable rate reached 100% (subjective score =3 points). The diagnostic efficacy of AI-ADS vs. AI-ADS + radiologist for above moderate stenoses: diagnostic accuracy (85.71% vs 91.21%), sensitivity (90.91% vs 98.70%), and specificity (57.14% vs 50.00%) on patient level; (84.07% vs 86.54%), (74.22% vs 84.78%), and specificity (89.41% vs 87.61%) on vascular level; (90.99% vs 93.11%), (67.14% vs 79.05%) and (95.49% vs 95.84%) on segment level. For above severe stenoses: diagnostic accuracy (60.44% vs 69.23%), sensitivity (55.93% vs 83.05%), and specificity (68.75% vs 43.75%) on patient level; (80.84% vs 84.62%), (43.21% vs 66.67%), and (91.17% vs 89.75%) on vessel level; (91.94% vs 94.91%), (34.21% vs 64.91%) and (97.36% vs 96.96%) on segment level.

**CONCLUSION**

One-beat acquisition with SSF1 can obtain high-quality coronary images in patients with atrial fibrillation. AI-ADS can automatically distinguish coronary images with different stenosis degrees, but the sensitivity of AI-ADS is low, especially for the diagnosis of severe stenosis. AI-ADS + radiologist can improve the diagnostic efficiency.

**CLINICAL RELEVANCE/APPLICATION**

One-beat acquisition with SSF1 can obtain high-quality coronary images in patients with atrial fibrillation. AI-ADS can automatically distinguish coronary images with different stenosis degrees, and AI-ADS + radiologist can improve the diagnostic efficiency.

## M5A-SPCA-6 DIRECT ESTIMATION OF CARDIAC EJECTION FRACTION WITHOUT LEFT VENTRICULAR CONTOUR TRACING USING DEEP LEARNING

Tim Leiner, MD, PhD (*Abstract Co-Author*) Research support, Pie Medical Imaging BV;Advisory Board, Cart-Tech BV;Advisory Board, AI4MedImaging;Advisor, Quantib BV;Consultant, Guerbet SA
Jacinta Browne, PhD (*Abstract Co-Author*) Nothing to Disclose
Enas Ahmed (*Abstract Co-Author*) Nothing to Disclose
Tzu Cheng Chao (*Abstract Co-Author*) Nothing to Disclose
Nichol He, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study was to train a deep learning model to predict normal or abnormal LVEF from end-diastolic (EDV) and end-systolic (ESV) cardiac MR volumes.

**METHODS AND MATERIALS**

MR cine images from 373 patients were used to train several ResNet model variations. LVEF was calculated from EDV and ESV segmentations by expert radiologists. Sample size was expanded through augmentations and fed into ResNet models as EDV/ESV pairs. A 3-bin output model was trained to

predict overt cardiac dysfunction (LVEF < 40%), mild systolic LV dysfunction (LVEF between 40-50%), and normal (LVEF > 50%). A 4-bin output model was trained to detect hyperdynamic LV function (LVEF > 65%) as well. To balance input data, 400 volumes per bin and 250 volumes per bin were used to train the 3-output model and 4-output model respectively. Testing was performed on remaining volumes, and confusion-matrix metrics were calculated. ResNet models were built using MONAI's library.

**RESULTS**

Of the ResNet variations tested, a simple 4-layer ResNet with in-plane sizes (16, 32, 64, 128) was found to have the best performance on both 3-output and 4-output configurations. Processing time was 0.62 s/sample. The 3-output model demonstrated greater classification performance (F1: 0.73, 0.60, 0.90, AUC: 0.88, 0.86, 086). Other variations on the ResNet architecture were tested as well, such as integrating multi-layer perceptron's to encode EDV/ESV separately and utilizing autoencoders to encode input volumes. However, neither method provided any improvements to predictive power.

**CONCLUSION**

A simple ResNet architecture enables high accuracy classification of LVEF into categories of overt dysfunction, mild dysfunction and normal systolic LV function in < 1 second without the need for human expert or AI-based LV contouring.

**CLINICAL RELEVANCE/APPLICATION**

Left ventricular ejection fraction (LVEF) serves as a fundamental measure of cardiac function. However, quantitative measurement of LVEF requires human-supervised segmentation while qualitative measurements are subjective1. While recent literature focuses on cardiac segmentation2,3, qualitative LVEF prediction is simpler and more efficient for clinical application.

## M5A-SPCA-7 ARTIFICIAL INTELLIGENCE BASED CORONARY ARTERY CALCIUM SCORING REDUCES TIME TO INTERPRETATION AND MAINTAINS EXPERT-LEVEL ACCURACY

Ismail M. Kabakus, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
James Munford (*Abstract Co-Author*) Nothing to Disclose
Sameer Abrol, MD (*Abstract Co-Author*) Nothing to Disclose
Jordan H. Chamberlin, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Coronary artery calcium (CAC) score is an important metric for cardiac risk stratification; However, manual segmentation is notably time consuming and tedious to perform. Artificial intelligence (AI) has been suggested as a possible solution, but successful implementation requires demonstration of both expert level accuracy and improved efficiency.

**METHODS AND MATERIALS**

148 patients who underwent routine low dose gated non-contrast cardiac computed tomography ("Calcium scoring protocol") were retrospectively identified and prospectively evaluated. Two raters performed a timed assessment with both manual (expert alone) and semi-automatic (manual review and as-needed modification of AI segmentation) quantification of CAC in addition to a fully automatic and previously validated deep learning CAC quantification (AI-RAD Companion, Siemens Healthineers). Metrics of inter-rater reliability, accuracy, and efficiency were calculated. Assessment of change in the multi-ethnic study of atherosclerosis (MESA) score was also performed with the different CAC scores.

**RESULTS**

AI-Expert inter-rater reliability for CAC score was considered excellent; Two-way ICC = 0.951 (0.933 - 0.964). AI was significantly faster to measure CAC score alone than with manual or with semiautomatic scoring (15 ± 2s vs 38 ± 13s vs 45 ± 24s, P < 0.001 for both comparisons) across all brackets of CAC severity. Semiautomatic (AI + Expert review) demonstrated a significant reduction in time for patients with at least mild calcium burden. (Pmild = 0.004, Pmoderate = 0.001, Psevere < 0.001). Regarding MESA scores, the mean bias for the whole cohort was 2.1 ± 12.1%, and 95% of the differences in percentiles between AI and expert score fell within ± 10% of the gold standard.

**CONCLUSION**

A deep learning algorithm to perform CAC scoring demonstrated inter-expert reliability of results and was significantly faster than manual segmentation, especially for patients with higher burden of CAC.

**CLINICAL RELEVANCE/APPLICATION**

AI can help expedite calculation of clinically meaningful risk statistics and reduce burden of post-processing on cardiac imagers.

## M5A-SPCA-8 CLINICAL UTILITY OF FRACTIONAL FLOW RESERVE-COMPUTED TOMOGRAPHY (FFR-CT) FOR PATIENT WITH SUSPECTED VASOSPASTIC ANGINA: PRELIMINARY REPORT

Si-Hyuck Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Ki Yeol Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eun Ju Chun, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Dowon Yoon, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Vasospastic angina (VA) is diffuse or segmental coronary spasm of coronary arteries, one of the causes of myocardial infarction with nonobstructive coronary artery but requires invasive coronary angiography with ergonovine provocation tests (ICA-EPT). Recently, fractional flow reserve computed tomography (FFR-CT) has been shown to have good performance in detecting lesion-specific ischemia noninvasively. Therefore, we aimed to determine whether changes in FFR-CT values during the cardiac cycle have diagnostic utility in patients with suspected VA.

**METHODS AND MATERIALS**

Among patients who presented to the emergency department with acute chest pain and underwent coronary CT angiography (CCTA) for excluding obstructive stenosis, 58 patients (56±11 years, 53.4% male) with VA confirmed by ICA-EPT were retrospectively collected. In all patients, FFR values were obtained from systolic and diastolic images on retrospective ECG-gating CCTA using a commercially available automated program (HeartMedi+; AI Medic Inc., Korea). We evaluated the change of FFR value of three coronary arteries during systolic and diastolic phases as follows: 1) fixed ischemia (FFR = 0.75 on both phases), 2) Spastic ischemia (FFR = 0.75 on any phase), 3) No ischemia (FFR > 0.75 on both phases). In addition, we compared the location of ischemic coronary arteries between FFR-CT and spastic arteries by ICA-EPT.

**RESULTS**

A total of 162 vessels of FFR-CT from 58 patients with VA were analyzed and matched with ICA-EPT. On the analysis of the changes of FFR values, 10 vessels (6.2%) showed fixed ischemia and 29 vessels (21.0%) showed spastic ischemia in 27 patients (45.6%) with VA. Of 39 vessels showing fixed or spastic ischemia on FFR-CT, 25 vessels (64.1%) form 16 patients with VA were well matched to vessels causing vasospastic angina on ICA-EPT.

**CONCLUSION**

FFR-CT may be helpful for diagnosing the VA when considering the changes of FFR values during cardiac cycle.

**CLINICAL RELEVANCE/APPLICATION**

FFR-CT, which can noninvasively detect lesion-specific ischemia, may be used for dynamic ischemic change when considering the changes of FFR values during cardiac cycle, therefore, it may be helpful for diagnosing the VA.

## M5A-SPCA-9 EFFECT OF INCREASED SPATIAL RESOLUTION OF PHOTON-COUNTING DETECTOR CORONARY COMPUTED TOMOGRAPHY ANGIOGRAPHIES ON ARTIFICIAL INTELLIGENCE BASED CAD-RADS ASSESSMENT

Moritz Halfmann, MD (*Abstract Co-Author*) Nothing to Disclose
Tilman S. Emrich, MD (*Abstract Co-Author*) Speaker, Siemens AG;Travel support, Siemens AG;Advisory Board, Siemens AG
Philipp Locherer (*Abstract Co-Author*) Nothing to Disclose
Anton Kilburg (*Presenter*) Nothing to Disclose

**PURPOSE**

Recent studies have shown that an increased in-plane resolution of coronary computed tomography angiographies (CCTA) provided by a photon-counting detector (PCD) CT can significantly influence the classification of patients within the Coronary Artery Disease Reporting and Data System (CAD-RADS). However, the higher resolution typically comes with an increase in image noise and little is known whether fully automatic reporting tools can equally benefit from the increased resolution as a human reader can. Thus, the purpose of this study was to compare CAD-RADS classification between a commercially available automatic classification tool and cardiovascular radiologists as a reference standard.

**METHODS AND MATERIALS**

A total of 26 patients with coronary artery disease who underwent PCD-CCTA with an acquired in-plane resolution of 0.11 mm were retrospectively identified. Curved multiplanar reconstructions consisting of 9 images per main coronary artery (right coronary artery, left anterior descending and left circumflex) were reconstructed from reconstructions with 0.2 mm and 0.6 mm slice thicknesses and sent to an artificial intelligence (AI) based, CE-marked CAD-RADS classification tool (CorEx, Spimed AI). As a reference standard, two specifically trained radiologists, who were blinded to each other's results, assessed the CCTA images at both slice thicknesses according to CAD-RADS. Differences were assessed on a per-patient basis by Wilcoxon signed rank tests.

**RESULTS**

Prior to final analysis, 4/26 (15.4%) patients with stair-step artifacts had to be excluded due to erroneous processing in the AI-tool. From the remaining 22 patients, the higher spatial resolution led to significantly lower median CAD-RADS scores per patient (2 [IQR, 1-5] vs. 3 [IQR, 1-5], P=.015), with a reclassification of 7/22 (32 %) patients to a lower score. There was no evidence of a difference in median CAD-RADS scores compared to the expert reference (3 [IQR, 1-5] vs. 2 [IQR, 2-3], P=0.061 for 0.6 mm slice thickness reconstructions and 2 [IQR, 1-5] vs. 2 [IQR, 1-3], P=.081 for 0.2 mm slice thickness reconstructions, respectively).

**CONCLUSION**

Fully automated, artificial intelligence aided assessment of coronary artery computed tomography angiographies significantly improves with increasing spatial resolution, leading to reclassification of one third of patients into lower disease categories according to the Coronary Artery Disease Reporting and Data System.

**CLINICAL RELEVANCE/APPLICATION**

Existing AI-based tools for automated assessment of CAD-RADS categories be used on increased spatial resolution PCD-CCTA.

# Abstract Archives of the RSNA, 2024

M5A-SPCH

**Chest Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPCH-1 ENHANCING RADIOLOGICAL ASSESSMENT OF DUST DISEASES: EVALUATING THE IMPACT OF ONLINE SELF-ASSESSMENT EDUCATIONAL MODULES AND FEEDBACK INTERVENTIONS

Patrick C. Brennan, BS, PhD (*Abstract Co-Author*) Director, DetectED-X
Ziba Gandomkar (*Abstract Co-Author*) Nothing to Disclose
Moayyad E. Suleiman, PhD (*Presenter*) CTO, DetectED-X

### PURPOSE

This study evaluates the efficacy of online self-assessment test sets and feedback interventions in enhancing radiological skills for dust diseases in chest X-ray and lung CT cases.

### METHODS AND MATERIALS

In this longitudinal study, 11 radiologists and trainees participated. Baseline and post-intervention performance (measured by sensitivity, specificity, and Cohen's Kappa) were evaluated using curated test sets for CT images and chest X-rays with similar difficulty. Additional educational cases were provided in two self-assessment test sets, allowing immediate feedback and comparison to ground truth. In the interventions, they received feedback on 45 CT cases and 90 chest X-rays, covering a total of 47 dust disease cases. Paired Wilcoxon signed rank tests evaluated significant improvements in performance metrics between baseline and final test sets, with further exploration of associations between performance improvement and participant characteristics using the Kruskal-Wallis test.

### RESULTS

Results showed significant improvements in Kappa values post-intervention for CT ($p=.03$), and a marginal improvement in chest X-ray specificity ($p=.07$). Participant characteristics such as familiarity with the B Reader Self-Study Syllabus ($p=.04$) and B-reader certification status ($p=.03$) significantly influenced performance improvement in CT. In chest X-ray, specialty interest in lung diseases ($p=.006$) and workload (<20 vs =20 cases per week; $p=.023$) were associated with higher specificity improvement. For CT feature assessment, a substantial increase in agreement between observers was observed for "Diffuse well-rounded opacities" ($p=.02$), "Grading of diffuse well-rounded opacities" ($p=.047$), and "Identifying the type of predominant parenchymal abnormality" ($p=.02$). For chest x-ray, significant improvement was observed in assessing the presence of interstitial lung disease ($p=.014$).

### CONCLUSION

Self-guided educational interventions with feedback mechanism effectively enhance radiological assessment skills for dust diseases. Participant characteristics such as familiarity with study materials and certification status could play role in in the degree of improvement.

### CLINICAL RELEVANCE/APPLICATION

Online self-assessment enhances radiologists' dust disease diagnosis skills on chest X-ray and lung CT. For CT, familiarity with ILO classification boosts post-intervention improvement in performance.

## M5A-SPCH-2 PRELIMINARY CLINICAL EVALUATION OF LUNG ADENOCARCINOMAS USING A CADMIUM ZINC TELLURIDE-BASED PHOTON-COUNTING DETECTOR COMPUTED TOMOGRAPHY

Tatsushi Kobayashi, MD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation
Keiichi Nomura, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroki Taguchi (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Tetsruro Taki (*Abstract Co-Author*) Nothing to Disclose
Masashi Wakabayashi (*Abstract Co-Author*) Nothing to Disclose
Eisuke Goto (*Abstract Co-Author*) Nothing to Disclose
Keiju Aokage, MD, PhD (*Abstract Co-Author*) Research Grant, Konica Minolta Group
Joji Samejima (*Abstract Co-Author*) Nothing to Disclose
Yoshihisa Muramatsu, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Hirofumi Kuno, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideki Furuya (*Abstract Co-Author*) Nothing to Disclose
Tomoaki Sasaki, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to evaluate image quality and diagnostic confidence in lung adenocarcinomas using a cadmium zinc telluride (CZT)-based photon-counting detector computed tomography (PCD-CT).

**METHODS AND MATERIALS**

This prospective study was approved by our institutional review board, and informed consent was obtained from all participants. Twenty-five patients were examined using a CZT-based PCD-CT (TSX-501R, Canon Medical Systems, Otawara, Japan). Eighteen of them (median age 74.5 years, IQR 65-77 years; 13 men; total twenty lesions) were suspected or confirmed as adenocarcinoma in situ, minimally invasive adenocarcinoma, or invasive adenocarcinoma. Two different collimation mode images with adaptive iterative dose reduction 3D (AIDR 3D) were reconstructed; 512 x 512 matrix named as normal resolution (NR) mode, 1024 x 1024 matrix named as super high resolution (SHR) mode. Furthermore, deep learning reconstruction (DLR) was added for SHR mode instead of using AIDR 3D. For qualitative image analysis by the two readers, kappa coefficients of the image findings for lung adenocarcinomas, 5-point Likert scales for image quality, and diagnostic confidence were evaluated. For quantitative image analysis, signal-to-noise ratio (SNR) and tilts of the air abronchiologram after the correction were compared.

**RESULTS**

There were 3 pure ground glass nodules, 10 part-solid nodules, and 7 solid nodules. For qualitative analysis, there were good interobserver agreements in the most features (kappa coefficients > 0.6). Compared to the NR, the SHR with AIDR 3D had significantly higher diagnostic confidence for almost all imaging findings ($P < 0.01$), but significantly lower image noise ($P < 0.01$). In addition, SHR with DLR showed significantly higher image quality and diagnostic confidence than SHR with AIDR 3D. For quantitative analysis, SNR, the minimum and maximum tilts of air bronchiolograms were significantly difference among the three groups ($P = 0.024$, $P < 0.001$, and $P < 0.001$, respectively [Friedman tests]).

**CONCLUSION**

SHR modes showed improved diagnostic confidence for most imaging findings of lung adenocarcinomas. Furthermore, DLR added further improvement of diagnostic confidence and significant reduction of image noise.

**CLINICAL RELEVANCE/APPLICATION**

SHR with DLR can depict the details of lung adenocarcinomas with higher diagnostic confidence with significant reduction of image noise.

## M5A-SPCH-3 PREDICTING HIGH-GRADE PATTERN IN IASLC GRADING SYSTEM OF LUNG ADENOCARCINOMA USING $^{18}$F-FDG PET/CT IMAGING COMBINED WITH CLINICAL FEATURES: A NOMOGRAM APPROACH

Jinju Sun (*Abstract Co-Author*) Nothing to Disclose
Shuangqi Fu (*Presenter*) Nothing to Disclose

**PURPOSE**

The new International Association for the Study of Lung Cancer (IASLC) grading system for invasive lung adenocarcinoma has demonstrated significant prognostic efficacy, benefiting many patients with adjuvant chemotherapy.We aimed to develop a nomogram that integrates PET/CT imaging and clinical features for preoperative prediction of IASLC grading.

**METHODS AND MATERIALS**

This study included 1327 lung adenocarcinoma patients who underwent preoperative 18F-FDG PET/CT and were confirmed by surgical pathology,with retrospective analysis conducted on their images and clinical data.Univariate and multivariate analyses identified independent clinical and imaging variables.Finally,a predictive model and a nomogram were established using multivariable logistic regression analysis.Model performance was evaluated using receiver operating characteristic (ROC) curves and accuracy assessments. Decision curve analysis (DCA) and calibration curves assessed clinical utility.

**RESULTS**

In the training cohort, the PET/CT imaging-clinical combined model effectively predicted patients with high-grade pattern(AUC=0.837),outperforming the PET(AUC=0.789, DeLong, $p<0.05$) or CT (AUC=0.780, DeLong, $p<0.05$) models.Similar superiority was observed in the test cohort (AUC = 0.834),with improved performance over standalone PET (AUC = 0.780, DeLong test, $p < 0.05$) and CT (AUC = 0.767, DeLong test, $p < 0.05$) models.Good calibration and decision curve analysis demonstrated the clinical usefulness of the nomogram.

**CONCLUSION**

The 18F-FDG PET/CT imaging-clinical combined model is effective in predicting high-grade patterns in patients.The derived nomogram aids in identifying patients who would benefit from adjuvant therapy.

**CLINICAL RELEVANCE/APPLICATION**

Utilizing 18F-FDG PET/CT imaging combined with clinical features provides a robust predictive tool for high-grade patterns in lung adenocarcinoma,which helps predict patient prognosis and select individuals to benefit from adjuvant treatment.

## M5A-SPCH-4 BLIND SPOTS FOR RADIOLOGISTS AND LUNG-RADS: ANALYSIS OF CTS OF PATIENTS WHO DIED OF LUNG CANCER DESPITE LUNG CANCER SCREENING

James Brown (*Abstract Co-Author*) Nothing to Disclose
Alexander Beagle (*Abstract Co-Author*) Nothing to Disclose
Masha Bondarenko (*Abstract Co-Author*) Nothing to Disclose
Maya Vella, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Ho Sohn, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hannah Ahn, MD (*Abstract Co-Author*) Nothing to Disclose
Sayedomid Ebrahimzadeh, MD (*Abstract Co-Author*) Nothing to Disclose
Tician Schnitzler, MD (*Abstract Co-Author*) Nothing to Disclose
Adam Yala, PhD (*Abstract Co-Author*) Nothing to Disclose
Ashita Tanwar (*Presenter*) Nothing to Disclose

**PURPOSE**

Lung cancer screening is associated with 20% reduction in lung cancer mortality, but an unanswered question is why many still die of lung cancer despite adherence to screening. Improved understanding of such cases can elucidate potential gaps in screening practices at the individual radiologist and/or the Lung-RADS guideline level.

**METHODS AND MATERIALS**

We retrospectively reviewed National Lung Screening Trial (NLST) data to identify participants who died of lung cancer within 7 years of their first CT, determined by the study's end-point verification process, and whose first CT did not raise suspicion for lung cancer ("negative"). For CTs that had nodule(s) visible in negative scans which eventually became suspicious for lung cancer (determined by a thoracic radiologist), 4 board-certified, thoracic fellowship trained, radiologists individually determined if the nodule was suspicious in the negative scan based on Lung-RADS v2022; for cases with disagreement, adjudication was performed by group consensus discussion.

**RESULTS**

Of NLST's 26,722 patients who received annual CTs, 173 died of lung cancer from 2002-2009 and did not have cancer identified on the baseline CT. We excluded 25 for missing scans, 28 for cancer between screening CTs, and 29 who had 3 negative screens and died more than 2 years after their final screen; 91 NLST participants met inclusion criteria. Upon the radiologists' review and discussion of the cases: 22 (24%) had "missed," retrospectively visible nodules rated Lung-RADS v2022 3/4 (on negative screens) that developed into lung cancer. 18 (20%) had retrospectively visible nodules (on negative screens) that did not meet Lung-RADS criteria ("not callable") and later developed into cancer. 48 (53%) had no nodule visible in retrospect or aggressive cancers that appeared between the 1 year screening interval, and 3 (3.3%) cases were uncategorized due to group disagreement. 45% of missed nodules were peribronchovascular, 14% were juxtapleural, and 18% were obscured by abnormality and many had spiculated morphology. 10 (56%) of not callable nodules were small (<6mm), 6 (33%) were obscured by abnormality, and 4 (22%) were subsolid.

**CONCLUSION**

Commonly "missed" nodules were often juxtapleural, peribronchovascular, or obscured by abnormality, but often with spiculated morphology. Nodules "not callable" as suspicious by Lung-RADS v2022 were often small (<6mm), obscured by abnormality, or subsolid.

**CLINICAL RELEVANCE/APPLICATION**

Retrospective review of lung nodules in screening associated with lung cancer death revealed blind spots for radiologists and/or guidelines, illustrating ways to elevate individual radiologists' diagnostic accuracy and providing valuable data for Lung-RADS improvement.

## M5A-SPCH-6 VOLUMETRIC BODY COMPOSITION METRICS EXTRACTED FROM PET/CT PREDICT CLINICAL OUTCOMES IN NON-SMALL CELL LUNG CANCER PATIENTS

Govind Mattay, MD, MBA (*Presenter*) Nothing to Disclose

**PURPOSE**

Determine whether whole body volumetric body composition metrics extracted from PET/CT predict progression free survival (PFS) and overall survival (OS) in Non-Small Cell Lung Cancer (NSCLC) patients.

**METHODS AND MATERIALS**

206 patients (median age 65 years; 116 females and 90 males) with treatment-naive lung adenocarcinoma (T1-T4, N0-N3, M0-M1) were included in this retrospective analysis. PFS and OS were defined as time from initial pathologic diagnosis to progression and death respectively. Body composition metrics from T1 to the hips were extracted from initial staging FDG PET/CT through automated volumetric CT segmentation (Voronoi Health Analytics Inc). Extracted metrics included total volume, % total body composition, and Hounsfield unit density of different anatomical compartments (adipose tissue, skeletal muscle, bones, and visceral organs). The optimal cutoff value for each metric to predict survival was calculated via biomarker threshold optimization. A Cox proportional hazards univariate regression model was used to determine which variables predicted survival in all patients and males and females separately, with hazard ratios (HR) > 1 indicating a negative impact on survival. The Benjamini-Hochberg procedure was used to control for false discovery rate.

**RESULTS**

Body composition metrics had different effects on PFS and OS. Increased fractional intramuscular fat was associated with worse OS (HR=2.39, p=0.03). Increased fractional subcutaneous fat was associated with worse PFS (HR=1.83,p=0.02), an effect driven by the female sex (female HR=2.10, p=0.01; male HR =2.09, p=0.11). Increased fat attenuation across most compartments were associated with worse PFS and OS. Although higher iliopsoas volume was associated with better PFS in all patients (HR=0.54, p=0.048), total body skeletal muscle had no effect (HR=0.81,p=0.14). Increased trabecular bone density was associated with better OS (HR=0.42, p=0.03). Although increased abdominal aortic calcifications were associated with worse OS in all patients (HR=2.68, p=0.03), cardiac calcifications had no effect (HR=0.65, p=0.06).

**CONCLUSION**

Several body composition metrics were significant predictors of survival in treatment-naive NSCLC patients, however metrics had different effects on PFS and OS and between men and women.

**CLINICAL RELEVANCE/APPLICATION**

Volumetric body composition metrics extracted from PET/CT can aid in prognostication in NSCLC patients. These biomarkers may be useful to tailor lifestyle modifications that improve overall survival and potentially alter tumor biology.

## M5A-SPCH-7 PREDICTION OF SHORT-TERM PULMONARY COMPLICATIONS FOLLOWING LOBECTOMY OR SUB-LOBECTOMY FOR LUNG CANCER USING PREOPERATIVE CHEST QUANTITATIVE COMPUTED TOMOGRAPHY

Wanyi Zheng (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the value of the predicted postoperative pulmonary function values derived from preoperative chest quantitative computed tomography (QCT) in predicting short-term pulmonary complications (PC) after lobectomy or sub-lobectomy for lung cancer.

**METHODS AND MATERIALS**

Seventy-nine consecutive patients with lung cancer who underwent thoracoscopic lobectomy or sub-lobectomy were enrolled in the study. A chest CT scan and pulmonary function test (PFT) were performed one week before the surgery. Patients were divided into PC+ group (n=16) and PC- group (n= 63) according to the one-week hospitalization. The total functional lung volume (TFLV) and the resection functional lung volume (RFLV) were calculated by QCT method. The predicted postoperative pulmonary function indexes, including preoperative total lung capacity (TLC), forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), and diffusion capacity for carbon monoxide (DLCO), were calculated using the QCT method and the anatomical segmentation (AS) method. PC-related factors were screened by univariable analysis to construct clinical, clinical-PFT, clinical-AS, and clinical-

QCT models. A combined model was constructed using all PC-related parameters. Multivariable logistic regression was used to find independent predictors of PC. Receiver operating characteristic (ROC) analysis was conducted to evaluate the predictive performance.

**RESULTS**

Age, removed number of lung segments, RFLV, RFLV/TFLV in the PC+ group were higher than those in the PC- group (P<0.05); FEV1, FVCQCT, FEV1QCT, FVCAS, and FEV1AS in PC+ group were lower than those in PC- group (P <0.05). FEV1QCT (OR: 0.043, P=0.001) and FVCAS (OR: 12.314, P = 0.048) were independent predictors. Comparison of the areas under the curve: Clinical-QCT (0.851) > Clinical-AS (0.823) > Clinical-PFT (0.803) > Clinical (0.718) model. When all PC-related factors were combined, the area under the curve (AUC) of combined model was the highest of 0.871, with a sensitivity of 75% and a specificity of 88.5% under the optimal cut-off value.

**CONCLUSION**

FEV1QCT is an independent predictor of short-term PC after lung lobectomy or sub-lobectomy, and QCT-based model had high predictive performance.

**CLINICAL RELEVANCE/APPLICATION**

Chest QCT provides quantitative parameters to predict postoperative early complications, providing valuable insights for treatment selection and prognosis assessment.

## M5A-SPCH-8 VALUE OF THE PREDICTED POSTOPERATIVE PULMONARY FUNCTION VALUES CALCULATED FROM PREOPERATIVE CHEST QUANTITATIVE COMPUTED TOMOGRAPHY IN PREDICTING SHORT-TERM PULMONARY COMPLICATIONS AFTER LOBECTOMY OR SUB-LOBECTOMY FOR LUNG CANCER

Wanyi Zheng (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the value of the predicted postoperative pulmonary function values derived from preoperative chest quantitative computed tomography (QCT) in predicting short-term pulmonary complications (PC) after lobectomy or sub-lobectomy for lung cancer.

**METHODS AND MATERIALS**

Seventy-nine consecutive patients with lung cancer who underwent thoracoscopic lobectomy or sub-lobectomy were enrolled in the study. A chest CT scan and pulmonary function test (PFT) were performed one week before the surgery. Patients were divided into PC+ group (n=16) and PC- group (n= 63) according to the one-week hospitalization. The total functional lung volume (TFLV) and the resection functional lung volume (RFLV) were calculated by QCT. Furthermore, the predicted postoperative pulmonary function indexes, including preoperative total lung capacity (TLC), forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), and diffusion capacity for carbon monoxide (DLCO), were calculated using the QCT method and the anatomical segmentation (AS) method. Univariable analysis was used to screen PC-related parameters which were utilized to construct clinical, clinical-PFT, clinical-AS, and clinical-QCT models. Multivariable logistic regression was used to find independent predictors of PC. Receiver operating characteristic (ROC) analysis was conducted to evaluate the predictive performance.

**RESULTS**

Age, removed number of lung segments, RFLV, RFLV/TFLV in the PC+ group were higher than those in the PC- group (P<0.05); FEV1, FVCQCT, FEV1QCT, FVCAS, and FEV1AS in PC+ group were lower than those in PC- group (P <0.05). FEV1QCT (OR: 0.043, P=0.001) and FVCAS (OR:12.314, P=0.048) were independent predictors. Comparison of the area under the curve: Clinical-QCT (0.851) > Clinical-AS (0.823) > Clinical-PFT (0.803) > Clinical (0.718) model. The sensitivity and specificity of the Clinical-QCT model under the optimal cutoff were 75% and 83.6%, respectively.

**CONCLUSION**

FEV1QCT is an independent predictor of short-term PC after lung lobectomy or sub-lobectomy. The Clinical-QCT model had higher predicting performance than the Clinical-AS and the Clinical-PFT models.

**CLINICAL RELEVANCE/APPLICATION**

Chest QCT provides quantitative parameters to predict postoperative early complications, which can be very important for the selection of treatment strategy and prognosis assessment.

## M5A-SPCH-9 COMPARATIVE ANALYSIS OF SHORT-TERM EFFICACY OF CT-GUIDED PERCUTANEOUS AND NAVIGATION BRONCHOSCOPY-GUIDED ABLATION FOR LUNG CANCER

Weiqing Huang (*Abstract Co-Author*) Nothing to Disclose
Yingying Chen (*Abstract Co-Author*) Nothing to Disclose
Yun Liu (*Abstract Co-Author*) Nothing to Disclose
Chen Huai, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the safety and short-term effect of local control of CT-guided percutaneous ablation and navigation bronchoscopy-guided ablation in the treatment of lung cancer.

**METHODS AND MATERIALS**

A retrospective study was conducted on 65 patients with lung cancer who underwent CT-guided percutaneous ablation and navigation bronchoscopy-guided ablation in our hospital from 2016 to 2023. The percutaneous ablation group comprised 31 patients, while the bronchoscopic ablation group had 34 patients. The basic information, therapeutic information and postoperative follow-up information were collected for the two groups. The local control rate was assessed by analyzing post-operative CT results, and postoperative complications were compared to evaluate the safety. We used SPSS 26.0 for statistical analysis.

**RESULTS**

The results indicate that there was no statistically significant difference in gender, age, tumor origin, tumor size and composition, tumor location, and the distance from the parietal pleura between the two groups (p>0.05). There was also no significant difference in the size of the ablation zone of one month and three months post-procedure,as well as in 3-month complete ablation rate (p>0.05). In terms of complications, the percutaneous ablation group had a higher incidence of pneumothorax (35.5% vs 0.0%, p<0.001) and pleural effusion (25.8% vs 2.9%, p<0.05) as compared to the bronchoscopic ablation group. Nevertheless, the two groups had no significant difference in the incidence rates of post-operative complications such as fever, hemoptysis, and chest pain (all p>0.05).

## CONCLUSION

Based on the current results, percutaneous ablation and bronchoscopic ablation are similar in early local control of lung cancer, while bronchoscopic ablation has a lower complication rate of pneumothorax and pleural effusion.

## CLINICAL RELEVANCE/APPLICATION

The results have important clinical implications as they highlight the need for careful consideration of the potential risks associated with each ablation technique. By understanding the advantages and disadvantages of each ablation technique, clinicians can tailor the treatment approach to individual patients. These findings could assist in clinical decision-making and personalized treatment planning for lung cancer patients, ultimately leading to improved outcomes and quality of life.

# Abstract Archives of the RSNA, 2024

M5A-SPER

**Emergency Radiology Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPER-1 A DEEP LEARNING PIPELINE FOR BULLET FRAGMENT DETECTION IN GUNSHOT WOUND PATIENTS FOR AN ENHANCED RADIOLOGICAL ASSESSMENT IN EMERGENCY CARE

Rasleen Grewal (*Abstract Co-Author*) Nothing to Disclose
Jeremy W. Cannon, MD,MS (*Abstract Co-Author*) Nothing to Disclose
Kristen Chreiman (*Abstract Co-Author*) Nothing to Disclose
Enrie Gan (*Abstract Co-Author*) Nothing to Disclose
Yi-An Hsieh (*Abstract Co-Author*) Nothing to Disclose
Winnie Xu (*Abstract Co-Author*) Nothing to Disclose
Elena G. Taratuta, MD (*Abstract Co-Author*) Nothing to Disclose
Chamith Rajapakse, PhD (*Abstract Co-Author*) Nothing to Disclose
Min-Keun (Kevin) Song (*Abstract Co-Author*) Nothing to Disclose
Christiana Cottrell (*Abstract Co-Author*) Nothing to Disclose
Rashad Madi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Gun violence is a public health issue in the US, with over 48,000 deaths per year from related injuries. For patients with gunshot wounds (GSW), CT scans are crucial for identifying injuries sustained from ballistic trauma, including organ injuries, hemorrhage, penetrating fractures, and retained bullet fragments. However, a rapid assessment of multiple GSWs in emergency settings is clinically difficult and risks treatment delays and complications. This work aims to build and assess the capabilities of machine learning pipelines to identify bullet fragments in CT scans quickly, accurately, and precisely for initial emergency care.

### METHODS AND MATERIALS

Using CT scout view images and manual annotations from 1335 patients treated for GSW injuries at an urban Level 1 trauma center from 2019 to 2022, three pipelines built upon pre-existing architectures were trained for bullet detection and segmentation. Pipeline 1 employed a Mask R-CNN model trained on bullet fragment annotations to detect and segment bullet fragments. Pipeline 2 employed a Mask R-CNN model trained on high-density annotations to detect high-density ROIs and then classify and segment bullet fragments. Pipeline 3 used a Faster R-CNN model to detect high-density ROIs, two ResNet50 models to classify images as coronal or sagittal and determine if they contain the patient's head, three ResNet50 models to classify ROIs as bullet fragments, and an FCN model for segmentation.

### RESULTS

Pipeline 3 identified the most bullet fragments at 89-91% prediction intersection of bullet annotations across varying non-maximum suppression intersection over union thresholds (76-79% for pipeline 1, 62-66% for pipeline 2), yielded 88-91% accuracy in ROI classification (63%-71% for pipeline 1, 48-59% for pipeline 2), and also provided the greatest overlap of predicted masks and annotations with a Dice coefficient of 0.488 (0.336 for pipeline 1, 0.247 for pipeline 2). Intermediate models in pipeline 3 classified images as coronal vs sagittal with 98.8% accuracy and containing the head or not with 99.3% accuracy.

### CONCLUSION

Our study demonstrates the potential of deep learning pipelines in rapidly and accurately identifying bullet fragments in CT scans of patients with GSW. Further fine-tuning could enhance bullet fragment detection, potentially matching the performance of radiologists and facilitating the calculation of additional metrics, such as bullet movement over time, to improve clinical decision-making and expedite treatment in emergency settings.

### CLINICAL RELEVANCE/APPLICATION

Deep learning pipelines help clinicians quickly and accurately identify bullet fragments in CT scans of patients with GSW, potentially enhancing treatment efficacy and expediting care in emergency settings.

## M5A-SPER-2 LATENT DIFFUSION MODEL APPROACH FOR DETECTION OF PANCREATIC ABNORMALITIES IN ABDOMINAL CT OF EMERGENCY PATIENTS

Jingyo Jeong (*Abstract Co-Author*) Nothing to Disclose
Jhii Hyun Ahn, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop and to validate a latent diffusion model able to detect pancreatic abnormalities at CT

## METHODS AND MATERIALS

To generate normal abdominal CT images using latent diffusion model, we retrospectively collected contrast-enhanced abdominal CT images obtained from 368 patients (mean age, 53 years ± 12 [SD], 177 women) with a normal pancreas who visited the emergency room. For testing, we used contrast-enhanced abdominal CT images obtained from 8 patients (mean age, 51 years ± 14 [SD], 3 women) with pancreatic abnormality who visited the emergency room. We applied a window level setting (width=350, level=50) before using abdominal CT images for learning to remove unnecessary organs and improve contrast. The proposed latent diffusion model for anomaly detection only trains normal data. The input data converts into Encoded Latent Z using the encoder of a pre-trained Variational Autoencoder (VAE). Noise is added to generate Noised Latent Z through the diffusion process. A Denoising U-Net produces Denoised Latent Z, and the decoder of VAE generates normal images. For the quantitative evaluation of the anomaly detection algorithm, an anomaly map was generated by comparing the differences between the original abdominal CT images of patients with pancreatic diseases and the generated images. The anomaly map was used to classify the images into normal and abnormal class. The proposed algorithm performance was evaluated on a slice-by-slice basis for true positives, true negatives, false positives, and false negatives. In addition, the metrics such as accuracy, sensitivity, specificity, and AUC (area under the receiver operating characteristic curve) were computed using established formulas.

## RESULTS

In the test set, there were 2 chronic pancreatitis, 2 acute pancreatitis, 1 accessory spleen in pancreas tail, 1 pancreas serous cystadenoma, 1 pancreatic duct dilatation, and 1 traumatic transection of pancreas. The latent diffusion model achieved 87.8% accuracy, 95.4% sensitivity, 87.2% specificity and 0.916 AUC for detecting pancreatic abnormalities.

## CONCLUSION

Deep learning model based on latent diffusion model, a generative approach designed to transform images with pancreatic diseases similar to normal data, can accurately detect pancreatic abnormalities on abdominal CT.

## CLINICAL RELEVANCE/APPLICATION

If this proposed model is implemented in the emergency room, it can accelerate the diagnostic process for pancreatic abnormalities and increase diagnostic accuracy, resulting in appropriate treatment and improved prognosis for patients.

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# Abstract Archives of the RSNA, 2024

M5A-SPGI

**Gastrointestinal Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPGI-10 DIAGNOSTIC PERFORMANCE OF DUAL ENERGY CT ANGIOGRAPHY (DECTA) FOR GASTROINTESTINAL BLEEDING (GIB)

Sung Yoon Park, MD (*Abstract Co-Author*) Nothing to Disclose
Dushyant Sahani, MD (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV;Advisory Board, Canon Medical Systems Corporation;Advisory Board, General Electric Company;
Sarabjeet Singh, MD, MBA (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Toshiba Corporation;Research Grant, General Electric Company;Research Grant, Koninklijke Philips NV
Karthika Devi D S, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

Gastrointestinal bleeding (GIB) is a potential life-threatening condition and accurate detection of the cause is crucial for timely management. The purpose of the study was to assess the role of DECTA in the evaluation of potential causes of GIB.

### METHODS AND MATERIALS

In an IRB-approved retrospective study (January 2023 - December 2023), 1744 consecutive DECTA exams for suspected GIB. DECTA were evaluated. CTA were performed on fast kV switching (Revolution Apex, GE) Dual source (Definition Force, Siemens). Images were acquired with NC, Art late venous phase after iodinated CM (Omnipaque 350 GE) at 3-5.5 cc/s. Images were reconstructed as axial, coronal, sagittal, MIPS (coronal) and MD-iodine. Two readers (30 15 years of experience) independently evaluated for active GIB or potential source of bleeding. Subjective image assessment was graded on 5-point Likert scale for image quality diagnostic confidence. MD-I images were evaluated after the initial assessment for the findings and readers confidence.

### RESULTS

A total of 59/1744 (3.3%) exams were rated CT positive for active GIB or potential source of bleeding. Active bleed as qualified by contrast extravasation was detected in 25/59 (42.3%) exams. Additional diagnostic/interventional procedures were performed in 17/25 (68%) patients. GIB sites were detected in stomach (n=5), duodenum (n=4), jejunal (n=3) colon (ascending n=1, transverse n=3, sigmoid n=3), rectal (n=2) and omental (n=1) region. In 34 patients with no active bleed on CTA, potential bleeding source was identified in 25 (73.5%). MDI images helped improve diagnostic confidence for detection in 39.5 % cases. In cases with reference standard verification (n=32) the calculated sensitivity and specificity for DECTA were 80.0% 81.8 % respectively.

### CONCLUSION

CTA is frequently ordered exam in patients with suspected GIB with overall low yield (3.3%) for positive findings. DECTA helps in accurate detection of active bleeding as well as in identifying a potential source of bleeding.

### CLINICAL RELEVANCE/APPLICATION

Imaging with dual-energy CT angiography helps fast accurate diagnosis of gastrointestinal bleeding and can show precise location or source, thereby guiding next steps in clinical management.

## M5A-SPGI-2 QUANTITATIVE ANALYSIS OF THE STAGING OFHEPATIC FIBROSIS INANIMALS USING SPECTRALCT MATERIAL DECOMPOSITION: FOCUSING ON THE EFFECT OF HYDROGEN PEROXIDE

Bo Duan (*Abstract Co-Author*) Nothing to Disclose
Qingyu Ji (*Abstract Co-Author*) Nothing to Disclose
Yan Gao (*Abstract Co-Author*) Nothing to Disclose
Hongliang Li (*Abstract Co-Author*) Nothing to Disclose
Runyu Miao (*Abstract Co-Author*) Nothing to Disclose
Lu Wang (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study was to explore the clinical value of hydrogen peroxide in the staging of hepatic fibrosis (HF) by means of spectral CT material decomposition technique.

**METHODS AND MATERIALS**

Twenty-five healthy New Zealand white rabbits were randomly divided into control group (n = 5) and experimental group (n = 20). The experimental group was injected with 10% carbon tetrachloride olive oil solution to establish the model of liver fibrosis. At 5, 7, 9 and 11weeks, 5 rabbits in the experimental group and 1 rabbit in the control group were randomly selected to undergo spectral CT unenhanced scan and arterial phase enhanced scan (80kVp-140kVp, 405 mA). All images were transferred into the AW 4.7 workstation and image post-processing was performed using the GSI Viewer software, and images containing only hydrogen peroxide were generated by the spectral CT material decomposition technique. Regions of interest (ROI) was placed on the lesion images, and to avoid individual differences, the same size ROI was placed within the aorta at the same level in order to calculate the normalized hydrogen peroxide concentration (NHPC). Liver tissue samples from all experimental rabbits were collected to assess the staging of HF using pathologic tests. The NHPC and the pathological staging of the liver were used as the evaluation indexes, and statistics were analyzed by analysis of variance (ANOVA) to compare the differences between groups, with $P < 0.05$ indicating a statistically significant difference.

**RESULTS**

To compare the difference of NHPC in arterial phase between the staging of HF, ANOVA was used in this study, and the results showed that NHPC in each fibrosis stage was F0 (0.89±0.07), F1 (0.99±0.08), F2 (0.96±0.15), F3 (1.08±0.50), and F4 (1.11±0.71), and the difference between the groups was statistically significant ($F=3.269$, $P<0.05$). The diagnostic efficacy of NHPC in differentiating the staging of HF in the arterial phase was well demonstrated, with an area under the curve of 0.082, $p<0.05$, and a 95% confidence interval of (0.676-0.998).

**CONCLUSION**

NHPC of liver at spectral CT material decomposition showed correlation with the stages of HF and has a good diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative measurement of hydrogen peroxide concentration using spectral CT material decomposition provides a noninvasive method for clinical diagnosis of HF stages compared with liver histopathological examination.

## M5A-SPGI-3 QUANTITATIVE ASSESSMENT OF SPLENIC HEMODYNAMICS BY LOW-DOSE MULTI-PARAMETER CT FOR PREDICTING HIGH-RISK ESOPHAGEAL VARICES IN CIRRHOSIS

Cheng Yan (*Abstract Co-Author*) Nothing to Disclose
Liqin Zhao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the value of splenic hemodynamic parameters from low-dose one-stop dual-energy and perfusion CT (LD-DEPCT) in non-invasively predicting high-risk esophageal varices (HREV) in cirrhotic patients.

**METHODS AND MATERIALS**

We retrospectively analyzed cirrhotic patients diagnosed with esophageal varices (EV) through clinical, laboratory, imaging, and endoscopic examinations from January 2019 to December 2023 in two hospitals. All patients underwent LD-DEPCT to acquire splenic iodine concentration and perfusion parameters. Radiation dose was recorded. Patients were classified into non-HREV and HREV groups based on endoscopy. Imaging parameter differences between groups were evaluated through independent sample t-tests and Mann-Whitney U tests. Predictive accuracy was determined by analyzing receiver operating characteristic curves and calculating the area under the curve (AUC) values. $P < 0.05$ was considered statistically significant.

**RESULTS**

The 89 patients were divided into the non-HREV (n=33) and the HREV groups (n=56). The total radiation dose was 20.66 ± 4.07 mSv. There were significant differences in portal iodine concentration (PIC), blood flow (BF), permeability surface (PS), spleen volume (V-S), total iodine concentration (TIC), and total blood volume of the spleen (BV-S). TIC showed the highest predictive efficacy (AUC=0.87), with 91.07% sensitivity and 81.82% specificity at a cutoff of 1283.41 mg.

**CONCLUSION**

Splenic hemodynamic parameters obtained from LD-DEPCT can non-invasively and accurately assess the hemodynamic status of the spleen in cirrhotic patients with EV and predict the occurrence of HREV.

**CLINICAL RELEVANCE/APPLICATION**

CT multi-parameter obtained using low-dose one-stop dual-energy and perfusion CT present significant clinical application value in noninvasively evaluate HREV.

## M5A-SPGI-7 IDENTIFICATION OF BENIGN OR MALIGNANT LIVER MASSES USING CORRECTED EFFECTIVE ATOMIC NUMBER

Mitsunari Maruyama (*Presenter*) Nothing to Disclose

**PURPOSE**

To examine whether hepatic hemangiomas and malignant liver masses (hepatocellular carcinomas/liver metastases) can be differentiated using corrected effective atomic numbers on plain CT images.

**METHODS AND MATERIALS**

Plain and contrast-enhanced Dual-energy CT was performed on 96 patients (132 liver masses) using the 256-row CT (Revolution Apex Elite, GE HealthCare, Waukesha, WI, USA) ) from October 2023 to March 2024. There were 49 hepatic hemangiomas (Hemangioma), 43 hepatocellular carcinomas (HCC), and 40 liver metastases (Meta). Of the 40 Meta, 17 were colon cancer metastases and 23 were pancreatic cancer metastases. AW Server3.2 Ext. 4.9 was used to establish and measure a 10 mm diameter region of interest (ROI) in the tumor on the plain CT images. The ROI was set in the area where there was no degeneration, referring to contrast-enhanced CT. Corrected effective atomic numbers (Zeff) were calculated from the actual measurement Zeff and the Liver fat value (%) on plain CT images using the following formula: Corrected Zeff=[Actual measurement Zeff - 6.27*Liver fat value (%)/100] / [1-Liver fat value (%)/100]. Mean Corrected Zeff was compared among the Hemangioma, HCC, and Meta groups.

**RESULTS**

The Mean Corrected Zeff was as follows: Hemangioma,7.618±0.114; HCC,7.771±0.123; Meta, 7.756±0.204. There was a significant difference between Corrected Zeff (Hemangioma vs. HCC, $p< 0.001$; Hemangioma vs. Meta, $p< 0.001$; Tukey's multiple comparison test). There was no significant difference

between HCC and Meta. When malignant liver mass was defined as HCC/meta, the corrected Zeff > 7.666 differentiated malignant liver mass and Hemangioma with a sensitivity of 80.7% and specificity of 71.4% (AUC = 0.771, p = 0.042).

## CONCLUSION

Corrected effective atomic numbers > 7.666 on plain CT could distinguish malignant liver masses (hepatocellular carcinomas/liver metastases) and hepatic hemangiomas with a sensitivity of 80.7% and specificity of 71.4% (AUC = 0.771, p = 0.042).

## CLINICAL RELEVANCE/APPLICATION

Corrected effective atomic numbers (Zeff) were calculated from the actual measurement Zeff and the Liver fat value (%) on plain CT using the following formula: Corrected Zeff=[Actual measurement Zeff - 6.27*Liver fat value (%)/100] / [1-Liver fat value (%)/100]. Corrected effective atomic numbers > 7.666 could distinguish malignant liver masses (hepatocellular carcinomas/liver metastases) and hepatic hemangiomas with a sensitivity of 80.7% and specificity of 71.4% (AUC = 0.771, p = 0.042).

# Abstract Archives of the RSNA, 2024

M5A-SPGU

**Genitourinary Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPGU-1 COULD CT RADIOMIC ANALYSIS OF BENIGN ADRENAL INCIDENTALOMAS SUGGEST THE NEED FOR FURTHER ENDOCRINOLOGICAL EVALUATION?

Cristina Campi, PhD (*Abstract Co-Author*) Nothing to Disclose
Emilio Quaia, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Alessia Pepe, MD (*Abstract Co-Author*) Nothing to Disclose
Filippo Crimi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
GIULIO CABRELLE (*Abstract Co-Author*) Nothing to Disclose
Filippo Ceccato (*Abstract Co-Author*) Nothing to Disclose
Irene Tizianel (*Abstract Co-Author*) Nothing to Disclose
Alessandro Toniolo, MD (*Presenter*) Nothing to Disclose

### PURPOSE

We studied the application of CT texture analysis in adrenal incidentalomas with baseline characteristics of benignity highly suggestive for adenoma to find whether there is a correlation between the extracted features and the secretory and clinical data. Patients with non-functioning adrenal adenomas normally do not require any intervention, otherwise those with hormonal hypersecretion are worthy to be further clinically investigated, even if it does not cause any symptoms. This study utilizes CT and a radiomic-based machine-learning approach to predict mild autonomous cortisol secretion by adrenal incidentalomas.

### METHODS AND MATERIALS

A total of 206 patients (mean age 65.9 years; 113 female) between 2005 and 2020 affected by adrenal incidentaloma were retrospectively enrolled. On the basis of the biochemical and endocrinological evaluation the patients were divided into those with Non-Functioning Adrenal Adenomas (NFAI, n=115), and with Mild Autonomous Cortisol Secretion (MACS, n=91). After a resampling of all CT images, the adenomas were delineated using LifeX in the unenhanced phase and 136 texture parameters were extracted for each volume of interest (VOI). Highly correlated features were removed, and the entire group was then randomly divided in a training cohort of 143 patients and in a validation cohort of 63. Random Forest was used both in the training and validation cohorts to test the accuracy of CT textural features and cortisol-related comorbidities in identifying MACS patients.

### RESULTS

Twelve parameters were retained in the Random Forest radiomic model, that showed a 100% sensitivity and specificity in the training cohort. In the validation cohort, high specificity (81%) and positive predictive value (74%) were achieved by the model, however the sensitivity (39%) and negative predictive value (50%) obtained were relatively low. Noteworthy, if the data about presence or absence of comorbidities linked to cortisol hypersecretion, such as hypertension, diabetes, dyslipidemia and osteoporosis, were added in the model, the results did not differ, confirming a 100% sensitivity and specificity in the training cohort and an 81% specificity and a 39% sensitivity in the validation group.

### CONCLUSION

Radiomic analysis of adrenal incidentalomas with characteristics highly suggestive of benignity, in unenhanced CT scans, could screen with a good specificity those patients who will need a further endocrinological evaluation for mild autonomous cortisol secretion, regardless of the clinical information about the cortisol-related comorbidities.

### CLINICAL RELEVANCE/APPLICATION

Radiomic analysis performed at unenhanced CT scans could predict mild autonomous cortisol secretion by adrenal incidentalomas with a benign aspect.

## M5A-SPGU-2 CYSTITIS GLANDULARIS: MR IMAGING CHARACTERISTICS IN 27 PATIENTS

Haiyi Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Mengqiu Cui (*Abstract Co-Author*) Nothing to Disclose
Bai Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Honghao Xu (*Abstract Co-Author*) Nothing to Disclose
Liu Haili (*Abstract Co-Author*) Nothing to Disclose
Chen Yijian (*Abstract Co-Author*) Nothing to Disclose
Yuanhao Ma (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the diagnostic characteristics of Cystitis Glandularis (CG) using magnetic resonance imaging (MRI).

### METHODS AND MATERIALS

A retrospective consecutive study was conducted on patients who underwent bladder MRI examination at the First Medical Center of Chinese PLA General Hospital between January 2019 and November 2023, who also underwent pathological biopsy within one month. Image analysis was jointly conducted by two radiologists with 20 and 15 years of experience in imaging diagnosis of urologic diseases, respectively.

### RESULTS

A total of 27 patients were included in the study (median age 47 years, 24 males) (Table 1). CG lesions are commonly located in the bladder trigone area (18/27); in terms of morphology, they can be categorized as focal thickening (17/27), nodular (8/27), and diffuse thickening of the entire bladder (2/27). On T2-weighted imaging (T2WI), (15/17) patients appeared as slightly hyperintense thickened inner layer (comparing to obturator internus), and there was a higher signal in the central thickened inner layer, resembling a "sandwich sign" (Figure 1), and (6/8) patients presented with slightly hyperintense nodules. (19/27) patients showed slightly hypointense on T1-weighted imaging (T1WI) (lesion signal slightly lower than obturator internus signal), and lesions on DWI were mainly high (5/27) and slightly high signal (21/27), with an average ADC value of 2.171 ± 0.052 × 10-3mm2/s. Among the 23 patients who underwent dynamic contrast-enhanced scanning, (18/23) lesions showed mild enhancement in the arterial phase (average 1.7 times comparing to unenhanced phase), and the degree of enhancement gradually increased in the venous and delayed phases (average 2.2 and 2.3 times compared to the unenhanced phase, respectively), showing a "progressive" enhancement pattern (Figure 2).

### CONCLUSION

On MRI, the majority of CG manifest as focal thickening or nodules in the bladder trigone area, showing slightly hyperintense on T2WI, slightly hypointense on T1WI, a “progressive” enhancement pattern, without significant restriction on DWI. Focal thickening lesions may exhibit a special “sandwich sign”.

### CLINICAL RELEVANCE/APPLICATION

To clarify the MRI diagnostic features of Cystitis Glandularis.

## M5A-SPGU-3 CT TEXTURE ANALYSIS TO PREDICT RESPONSE TO EDP-M CHEMOTHERAPY IN PATIENTS WITH ADRENOCORTICAL CARCINOMA

Filippo Crimi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Francesca Turatto, MD (*Abstract Co-Author*) Nothing to Disclose
Maurizio Iacobone (*Abstract Co-Author*) Nothing to Disclose
Irene Tizianel (*Abstract Co-Author*) Nothing to Disclose
Giovanni Sussan, MD (*Abstract Co-Author*) Nothing to Disclose
Filippo Ceccato (*Abstract Co-Author*) Nothing to Disclose
Emilio Quaia, MD (*Abstract Co-Author*) Speakers Bureau, Bracco Group
Cristina Campi, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlo D'Alessandro, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Adrenocortical carcinoma (ACC) is a rare and highly aggressive malignancy, which typically has a poor prognosis. Locally advanced and metastatic ACC represent respectively 18%-26% and 21%-46% of ACC at diagnosis, and these patients usually undergo chemotherapy with etoposide, doxorubicin, cisplatin and mitotane (EDP-M). The value of image-based texture features as a powerful method to assist clinical management in cancer patients has been established recently. We aimed to analyze the association between response to EDP-M treatment and textural features in patients with locally advanced or metastatic ACC.

### METHODS AND MATERIALS

17 patients who underwent adequate pretreatment and post-treatment CT images were included. Response to treatment was assessed by using RECIST 1.1, Choi and volumetric criteria. A literature-based comprehensive approach, used as our gold standard, allowed us to binary classify responders and non-responders. Texture features were obtained from the largest tumoral lesion of each patient using LifeX freeware, and we compared the two groups to highlight features with significant differences. With the parameters selected, ROC curves were drawn to evaluate the accuracy in detecting responders to EDP-M therapy.

### RESULTS

The long-run high grey level emphasis (LRHGLE_GLRLM) and the intensity-histogram kurtosis features showed good ability to discriminate responders and non-responders (AUC of 0.8; 95%CI 0.55-1.0; 95%CI 0.55-1.0), with higher accuracy if considered together (AUC of 0.9; 95%CI 0.724-1.0).

### CONCLUSION

Texture parameters from routinely performed CT images could be used as an independent imaging tool for predicting response to chemotherapy with EDP-M regimen. We also conjecture that coarser and more heterogeneous texture features could represent more favorable behavior in these patients. However, further research is needed.

### CLINICAL RELEVANCE/APPLICATION

Radiomic features obtained from the texture analysis of primitive or metastatic lesions in CT performed routinely, may predict response to therapy with EDP -M in patients with advanced and/or metastatic adrenocortical carcinoma.If validated by further studies, this information could be used as an independent parameter to predict response to chemotherapy in patients with adrenocortical carcinoma.

## M5A-SPGU-4 CORRELATION OF PROSTATE WHOLE GLAND AND ZONAL VOLUMES AND RISK OF TRANSITION ZONE PROSTATE CANCER

Gu Mu Yang Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Jiahui Zhang (*Abstract Co-Author*) Nothing to Disclose
Erjia Guo, MS, BA (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaoxiao Zhang (*Abstract Co-Author*) Nothing to Disclose
Hao Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Xin Bai III, MD (*Abstract Co-Author*) Nothing to Disclose
Li Chen (*Abstract Co-Author*) Nothing to Disclose
Qianyu Peng (*Abstract Co-Author*) Nothing to Disclose
Lili Xu (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the role of prostate whole gland volume (Vwg) and zonal volumes in prostate cancer pathogenesis by analyzing their correlation with transition zone clinically significant prostate cancer (csPCa).

**METHODS AND MATERIALS**

Patients who underwent prostate biopsy, radical prostatectomy, or follow-up diagnosed benign disease at our institution between January 2019 and December 2022 were retrospectively enrolled. A previously developed prostate zonal segmentation model was utilized to segment prostate zonal glands and calculate the Vwg, transition zone volume, and peripheral zone volume. Prostate zonal volumes and clinical risk factors were subjected to univariate analysis and multivariate analysis, with subgroup analyses based on significant clinical variables. Prostate volume was also evaluated concerning cancer aggressiveness. Receiver operating characteristic (ROC) curves were generated to evaluate and compare the diagnostic performance for csPCa.

**RESULTS**

The study included 821 patients (median age: 65 [59-71] years), with 120 diagnosed with csPCa. Univariate followed by multivariate analysis identified age, prostate-specific antigen (PSA), Prostate Imaging-Reporting and Data System (PI-RADS) score, and Vwg as independent csPCa risk factors (OR: 1.065, 1.088, 2.380, and 0.942, respectively, all $P < 0.05$). Subgroup analysis showed that in patients with different PI-RADS categories, PSA levels, and age groups, the non-csPCa group consistently exhibited significantly higher Vwg compared to the csPCa group, except those under 55 years. No statistical significance was noted between patients with different cancer aggressiveness. Diagnostic performance analysis revealed that incorporating Vwg into the model with age, PSA, and PI-RADS significantly improved diagnostic efficacy (area under the ROC curve: 0.909 vs 0.635—0.810, all $P < 0.05$).

**CONCLUSION**

Prostate whole gland volume is an important protective factor for transition zone csPCa but was not correlated with cancer aggressiveness. Integrating prostate whole gland volume with clinical factors enhances diagnostic accuracy for transition zone csPCa.

**CLINICAL RELEVANCE/APPLICATION**

This study underscores the significance of prostate whole gland volume in the pathogenesis of transition zone csPCa, which could improve diagnostic accuracy and inform decision-making in prostate cancer management.

## M5A-SPGU-5 COMPARISON OF MRI-DIRECTED TRANSRECTAL ULTRASOUND (TRUS)-GUIDED VERSUS MRI-DIRECTED TRANSPERINEAL (TP)-GUIDED FUSION PROSTATE BIOPSY FOR DIAGNOSIS OF PROSTATE CANCER: A PRAGMATIC RANDOMIZED CONTROL TRIAL

Nicola Schieda, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare any prostate cancer (PCa) and clinically significant (CS)-PCa detection rates for TP-guided and TRUS-guided fusion prostate biopsy.

**METHODS AND MATERIALS**

This IRB approved study is a pragmatic randomized control trial which was conducted at a single tertiary-care referral center for PCa from October 2022 to May 2024 (Trial# NCT03936127). Patients with abnormal (=1 lesion, PI-RADS score =3) prostate MRI performed within 6-months of planned targeted prostate biopsy were recruited. Men were randomized to undergo either TP-guided or TRUS-guided targeted fusion biopsy. Patients and biopsy-operators were unblinded to allocation. PCa and CS-PCa diagnosis by lesion was retrieved from histopathology reports and compared overall and stratified by PI-RADS, lesion location and clinical indication using mixed-effect logistic regression modelling. Procedure-related pain score (1-10) and complications (infection, sepsis, bleeding) were also compared.

**RESULTS**

Preliminary data analysis included 182 patients (45%; 81/182 TRUS, 55%; 101/182 TP) with 250 lesions. There were 73% (183/250) peripheral zone (PZ) and 27% (67/250) transition zone (TZ) lesions and 10% (24/250) lesions located at the prostate base, 32% (80/250) at the prostate apex and the remaining 58% (146/250) lesions encompassing the mid-gland. Overall, any-PCa and CS-PCa cancer detection were: 64% (52/81) TRUS and 76% (77/101) TP ($p=.08$) and 46% (37/81) TRUS and 53% (54/101) TP ($p=0.30$). There was no difference in CS-PCa stratified by PI-RADS score comparing TRUS and TP biopsy ($p>0.05$). In the TZ, for TRUS: 45% (14/31) any-PCa and 10% (3/31) CS-PCa; and, for TP: 53% (19/36) any-PCa and 28% (10/36) CS-PCa. Comparing biopsy techniques for the prostate base, for TRUS: 45% (5/11) any-PCa and 36% (4/11) CS-PCa; and, for TP 72% (13/18) any-PCa and 13% (1/8) CS-PCa. For the prostate apex, for TRUS: 71% (30/42) any-PCa and 52% (14/27) CS-PCa; and, for TP: 70% (38/54) any-PCa and 57% (17/30) CS-PCa. No difference was noted comparing TRUS to TP for any lesion location ($p>0.05$). Mean pain scores were: 3±2 (IQR 1-4) TRUS versus 3±2 (IQR 2-5), $p=0.20$. There was one case of urinary retention, 1 urinary tract infection and 1 case of urosepsis in the TRUS group only.

**CONCLUSION**

This pragmatic RCT shows no difference in any-PCa and clinically significant PCa diagnosis comparing TP-guided and TRUS-guided targeted prostate biopsy overall, stratified by PI-RADS score and lesion location.

**CLINICAL RELEVANCE/APPLICATION**

There is no difference in prostate cancer detection comparing TRUS and TP guided fusion biopsy.

## M5A-SPGU-6 CT-BASED RADIOMICS ANALYSIS CAN DIFFERENTIATE ADRENAL PHEOCHROMOCYTOMAS FROM ADENOMAS WITH HIGH ACCURACY: RESULTS IN 170 MASSES

William W. Mayo-Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Oleg S. Pianykh, PhD (*Abstract Co-Author*) Nothing to Disclose
Justine A. Barletta, MD (*Abstract Co-Author*) Nothing to Disclose
Jay B. Patel, PhD (*Abstract Co-Author*) Nothing to Disclose
Borna E. Dabiri, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrew Sharp, MS (*Abstract Co-Author*) Nothing to Disclose
Melissa Viator, BS, MS (*Abstract Co-Author*) Nothing to Disclose
Christopher Bridge, DPhil (*Abstract Co-Author*) Institutional support, NVIDIA Corporation;Institutional support, General Electric Company;Institutional support, Nuance Communications, Inc
Daniel I. Glazer, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To identify optimal CT-based radiomics features that can differentiate adrenal pheochromocytomas from adenomas

**METHODS AND MATERIALS**

An institutional pathology database was queried to retrospectively identify unique patients with pathologically proven adrenal pheochromocytomas from 5/1/05-5/1/23. In addition to tissue confirmation of pheochromocytoma, patients needed to have a contrast-enhanced abdominal CT with an adrenal mass available in the electronic health record (n=95). The adrenal glands were segmented using a previously validated machine learning algorithm. To serve as a comparison, 75 adrenal adenomas were identified from a previously reported and segmented dataset of 991 consecutive portal venous phase CT examinations. Pheochromocytoma segmentations were reviewed and corrected if needed by a board-certified abdominal radiologist with 9 years post-fellowship experience. The final dataset consisted of 170 adrenal masses (95 pheochromocytomas and 75 incidental nodules) with 136 used in the development set and 34 in the test set. Following confirmation of accurate segmentation, 457 different radiomics features were evaluated and used to create a Boolean rule model. Performance of the Boolean rule model was cross-validated and reported using F1 score on the test set.

**RESULTS**

The study cohort included 65 males and 105 females with mean age 61 years. The Boolean rule-learning model determined that the single feature most predictive of pheochromocytoma was maximum pixel attenuation of > 137 HU, producing an F1 score of 0.85. For a two-feature model, adding grey scale non-uniformity of > 30 to the model achieved an F1 score of 0.94 (Figure). Increasing the model to three features produced only a minor increase in F1 score (0.97).

**CONCLUSION**

A two-feature machine learning model utilizing maximum pixel attenuation > 137 HU and non-grey scale uniformity > 30 is highly predictive of adrenal pheochromocytoma.

**CLINICAL RELEVANCE/APPLICATION**

Identifying adrenal lesions that require further management is challenging as etiologies other than adenomas are uncommon. CT-based radiomics may add value by diagnosing a nodule as a pheochromocytoma based on hyperenhancement and heterogeneity without additional testing.

## M5A-SPGU-7 CT UROGRAPHY FOR HEMATURIA: IMPACTS OF RISK-STRATIFICATION

Jody Riherd, MD (*Abstract Co-Author*) Nothing to Disclose
Ian P. Rumball, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

While recent guidelines support risk-stratified evaluation for hematuria, discrepancies remain between exact criteria for imaging use and selection, and engrained utilization patterns may lead to excess use of CT Urography (CTU) despite potential for adverse effects and poor diagnostic performance in certain populations. We investigated the prevalence of benign and malignant causes of hematuria found on CTU in patients of varying pre-test risk, evaluated diagnostic performance of CTU for urologic malignancy, and identified adherence to recent diagnostic guidelines.

**METHODS AND MATERIALS**

969 consecutive patients who underwent primary CTU for hematuria at a rural academic medical center between 1/1/2021 - 7/31/2023 were included. Cases were divided into microscopic and gross hematuria, and risk-stratified according to the 2020 American Urologic Association (AUA) and 2023 Dutch Association of Urology guidelines. CTU, cystoscopy, and pathology reports were reviewed to assess prevalence of benign and malignant hematuria etiologies on CTU and diagnostic performance of CTU for urologic malignancy.

**RESULTS**

658 cases (68%) had a potential cause for hematuria found on CTU, of which 466 (48%) were suggestive of benign hematuria etiologies and 192 (20%) were suggestive of malignant hematuria. When compared to cases in which AUA did not recommend CTU, the cohort of AUA-concordant CTUs (N=917) had improved CTU detection of all hematuria causes (70% vs 35%; $p<0.001$) and suspected malignancies (21% vs 3.8%; $p=0.003$). Similar trends were found for the Dutch criteria (N=687, 75% vs 50%; $p<0.001$, 23% vs 11%; $p<0.001$). For urologic malignancy, CTU had a diagnostic yield of 11.2% and a false referral rate of 1.5%. 94.6% of CTUs ordered were in concordance with AUA guidelines, compared to 70.1% for the Dutch guidelines.

**CONCLUSION**

Application of risk-stratifying guidelines improved the performance of CTU for detecting urologic abnormalities and malignancies that cause hematuria. Imaging obtained according to the 2020 AUA criteria detected malignancy at a comparable rate compared with the 2023 Dutch criteria (21% vs 23%), with a lower rate of suspected malignancy among cases where CTU was not suggested (3.8% vs 11%) at the expense of 230 more recommended studies. Our study displayed a strong diagnostic yield of CTU for urologic malignancy, perhaps related to high guideline adherence.

**CLINICAL RELEVANCE/APPLICATION**

Application of the 2020 AUA and 2023 Dutch criteria can improve diagnostic performance of CTU, though increased imaging utilization or a higher rate of missed malignancy, respectively, are trade-offs when comparing the two.

## M5A-SPGU-9 COMPREHENSIVE EVALUATION OF DEEP LEARNING RECONSTRUCTION IN ULTRA-LOW-DOSE CT FOR UROLITHIASIS: ASSESSING IMAGE QUALITY AND LESION DETECTION IN PHANTOM AND CLINICAL SCENARIOS

Min Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Lili Xu (*Abstract Co-Author*) Nothing to Disclose
Hao Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Xin Bai III, MD (*Abstract Co-Author*) Nothing to Disclose
Gu Mu Yang Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaoxiao Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the efficacy of the Advanced Intelligent Clear-IQ Engine (AICE), a deep learning reconstruction algorithm, in enhancing image quality and lesion detection in ultra-low-dose-CT (ULDCT) for urolithiasis, comparing with various reconstruction algorithms across phantom and clinical images

## METHODS AND MATERIALS

A phantom containing high-contrast and low-contrast objects of 2 mm, 5 mm, and 8 mm sizes underwent scanning at low-dose and ultra-low dose radiation levels. Low-dose images were reconstructed with the Adaptive Iterative Dose Reduction 3D algorithm (LD-AIDR), while ultra-low-dose images were reconstructed using different methods including filtered back projection (ULD-FBP), Adaptive Iterative Dose Reduction 3D (ULD-AIDR), Forward-projected model-based Iterative Reconstruction SoluTion (ULD-FIRST), AICE (ULD-AICE), and sharp AICE (ULD-AICEs). Quantitative metrics such as noise power spectrum (NPS), task transfer function (TTF), and detectability were assessed. Clinical patients with suspected urolithiasis underwent LDCT and ULDCT, with images reconstructed similarly to the phantom. Radiation dose, stone characteristics, lesion detection and subjective image quality were evaluated.

## RESULTS

In phantom images, ULD-AICEs exhibited superior detectability of high-contrast and low-contrast objects across all sizes compared to LD-AIDR images and other ULD methods ($P < 0.01$). ULD-AICEs demonstrated significantly higher TTF10%, and TTF 50% for high-contrast objects, as well as higher TTF10% for low-contrast objects compared to LD-AIDR ($P < 0.01$). ULD-AICEs also showed significantly lower NPS than LD-AIDR. In clinical patients, the average effective radiation dose of ULDCT was significantly lower than that of LDCT ($1.34 \pm 0.37$ vs. $6.33 \pm 0.98$ mSv, $p < 0.01$). LD-AIDR detected 129 urinary stones and ULD-AICEs detected 123 out of 129 stones, achieving the highest detection rate of 95.34% compared to other reconstruction methods. Stone characteristics in ULD-AICEs were comparable to LD-AIDR. Moreover, ULD-AICEs exhibited the highest lesion detection rate (92.2%, 60/64) among all reconstructions, according to LD-AIDR, which serves as the gold standard. The ULD-AICEs demonstrated superior image quality with the lowest noise and highest SNR, except in fat, and achieved the highest average subjective score.

## CONCLUSION

The AICEs reconstruction algorithm demonstrates promise in optimizing ULDCT for urolithiasis, offering superior lesion detection and image quality enhancement across phantom and clinical studies.

## CLINICAL RELEVANCE/APPLICATION

AICE emerges as a preferred reconstruction algorithm for ULDCT in urolithiasis, potentially enhancing diagnostic accuracy and patient care in urological imaging.

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# Abstract Archives of the RSNA, 2024

M5A-SPHN

**Head & Neck Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPHN-2 EVALUATION OF FACIAL NERVE IMAGING USING CRANI IN PAROTID GLAND PATHOLOGIES: A PRELIMINARY EXPERIENCE

Ullas V. Acharya, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Uday D. Patil, MD (*Abstract Co-Author*) Research Consultant, General Electric Company
Georgina George, MD, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

The intracranial portions of cranial nerves are visualized using heavily T2-weighted 3D imaging; however, visualizing the extracranial portions of these nerves remains difficult due to their small diameters, tortuous courses, susceptibility artifacts, blood vessels, all of which can confound nerve visualization. Post-contrast 3D CRANI adequately suppresses signals from surrounding blood vessels and fat, enabling better visualization of extra foraminal cranial nerves. In this study, 3D CRANI was tested in its clinical application to view the extra-foraminal facial nerve and its branches, particularly in relation to parotid gland pathologies.

### METHODS AND MATERIALS

A post-contrast CRANI sequence was acquired in a 3T system scanner (Philips, Ingenia) with a 32-ch head coil to evaluate the extraforaminal course of the facial nerve in a total of 10 cases, 8 associated with parotid lesions, 1 with lymphomatous involvement of the nerve, and 1 with facial neuritis. The nerve was visualized and evaluated with multiplanar reformations and maximum intensity projections of post-gadolinium CRANI images with a thickness of 5mm and an overlapping slice gap of -0.5mm. Three radiologists—one with three years of experience, one with thirteen years as a neuroradiologist, and one with over thirty years as a senior radiologist—reviewed the pictures and reached a consensus.

### RESULTS

The extraforaminal segment of the facial nerve was well visualized in all cases up to its bifurcation, demonstrating its relationship with the parotid lesion. In a case of lymphoma, the extent of the lymphomatous involvement of the extraforaminal portions of both facial nerves was well visualized, which was seen as focal, segmental thickening as compared to diffuse, uniform thickening of the nerve seen in a case of facial neuritis, i.e. Bell's palsy. The visualization and tracing of distal branches of the facial nerve after its bifurcation in relation to the lesion were, however, poor.

### CONCLUSION

This study illustrated the ability of this unique MR neurography sequence to create nerve-selective imaging and detail the relationship of the facial nerve in parotid pathologies within clinically reasonable acquisition times.

### CLINICAL RELEVANCE/APPLICATION

Understanding the facial nerve and its relationship to a parotid gland lesion can allow surgeons to make better preoperative assessments. This enables surgeons to choose and perform extracapsular parotid dissections over superficial parotidectomies, significantly enhancing facial nerve preservation and function in selected cases. Although this is an early study demonstrating the effectiveness of this unique MR sequence, it is certain to spark interest in analyzing other cranial nerve courses and pathologies.

## M5A-SPHN-3 THE VALUE OF SYNTHETIC MRI IN DISCRIMINATING METASTATIC AND NON-METASTATIC LYMPH NODES IN HNSCC, COMPARED WITH DWI AND MULTI-RADIOLOGISTS

Fan Yang (*Abstract Co-Author*) Nothing to Disclose
Meng Lin (*Abstract Co-Author*) Nothing to Disclose
Xiaoduo Yu (*Abstract Co-Author*) Nothing to Disclose
Haoran Wei (*Presenter*) Nothing to Disclose

### PURPOSE

To explore whether the histogram parameters of synthetic MRI (SyMRI) are useful in differentiating metastatic from benign cervical lymph nodes in patients with HNSCC.

### METHODS AND MATERIALS

A total of 46 HNSCC patients with 149 pathologically confirmed lymph nodes (LNs) (metastatic LNs: 58, non-metastatic LNs: 91) were included in the study. The histogram parameters derived from SyMRI, ADC values, and short and long diameters for each LN were obtained. The LNs were randomly divided into a training set and an independent validation set by a ratio of 7:3. Significantly different parameters between metastatic and non-metastatic

LNs were selected in the training set, and logistic regression analysis was adopted to construct different models. ROC analysis and AUC were performed to assess the diagnostic performance of different models and multi-radiologists. The DeLong test was used to determine the best diagnostic model.

**RESULTS**

The AUCs of the three models were 0.806 (SyMRI_model), 0.783 (DWI), and 0.878 (Combined_model) in the validation set. The Combined_model (SyMRI+ADCvalue+size) had the highest diagnostic potency in differentiating metastatic LNs from non-metastatic LNs in both training and validation sets, with an accuracy of 0.875 and 0.867 in the two sets. The diagnostic performance of Combined_model was superior to multi-radiologists not only in all LNs but also in the cohort of sub-centimeter LNs.

**CONCLUSION**

SyMRI-derived histogram parameters manifested satisfactory diagnostic performance for the discrimination of cervical LNs in HNSCC.

**CLINICAL RELEVANCE/APPLICATION**

HNSCC is common malignancy worldwide, with up to 80% of patients having cervical (LNM) at the time of diagnosis. The presence of LNM serves as a significant adverse prognostic factor, contributing to disease progression, diminished long-term survival rates, and therapeutic complexities.Within a single acquisition, SyMRI generates multiple parameter maps, quantitative T1, T2, and PD values could be biomarkers that reflect the intrinsic magnetic properties of the tissue, establishing a relationship between MRI images and microstructural features.In the study, we observed notable differences in several histogram parameters obtained from SyMRI between metastatic and non-metastatic LNs in HNSCC. The Combined_model achieved high AUC. In addition, our model demonstrated superior diagnostic performance compared to the subjective analysis of multi-radiologists, especially in the sub-centimeter groups.

## M5A-SPHN-5 BASELINE VIRTUAL MR ELASTOGRAPHY AND RADIOLOGICAL DEPTH OF INVASION IN THE PREDICTION DISEASE-PROGRESSION IN NASOPHARYNGEAL CARCINOMA

Meng Lin (*Abstract Co-Author*) Nothing to Disclose
Xiaoduo Yu (*Abstract Co-Author*) Nothing to Disclose
Yueluan Jiang (*Abstract Co-Author*) Nothing to Disclose
Hongmei Zhang (*Abstract Co-Author*) Nothing to Disclose
Haoran Wei (*Abstract Co-Author*) Nothing to Disclose
Fan Yang (*Presenter*) Nothing to Disclose

**PURPOSE**

Nasopharyngeal carcinoma (NPC) is an aggressive head and neck cancer. Concurrent chemoradiotherapy is the mainstay of treatment for NPC. However, appropriately 10-30% of NPC patients would suffer treatment failure. Virtual MR elastography (vMRE) could be used to obtain tissue elasticity value. However, those studies are lacking in the head and neck field. NPC with high T stage have poorer prognosis than those with low T stage. Whether the radiological depth of invasion (rDOI), a quantitative factor, could serve as a prognostic factor in NPC has not been exploited. Therefore, based on the concept of quantitative and objective assessment, we explored the prognostic value of vMRE and rDOI in predicting disease progression in NPC.

**METHODS AND MATERIALS**

This study prospectively included 45 NPC patients. The mean and median value of shift ADC (sADC) at b value of 200/1000 and 200/1500 were obtained based on the largest slice of tumor. Besides, we measured the rDOI in both axial and coronal positions. At the axial CET1WI, a reference line connecting the front of lateral nasopharyngeal wall (or the front of tumor when it not extent beyond lateral nasopharyngeal wall) and the center of posterior nasopharyngeal wall on the largest slice of tumor was firstly drew. The length of inward invasion of the tumor perpendicular to the reference line was defined as axial rDOI (rDOI_aT1WI). At the coronal CET1WI, a reference line connecting the vertices of the pterygoid process on both sides was firstly drew. The distance of upward invasion of tumors perpendicular to the reference line was defined as coronal rDOI (rDOI_cT1WI). The X-tile software was used to obtain the optimal cut-off value and to categorize patients into low-risk (both < cut-off value) and high-risk groups (the rest). The clinical outcome is progression-free survival (PFS). All statistical analysis was conducted using R. Univariate and multivariate Cox analysis were used to construct models. The nomogram and calibration curves were plotted. The C-index was calculated.

**RESULTS**

18/45 (40.0%) patients were diagnosed with disease progression and the median follow-up duration was 56.5 (22.5, 58.2) months. Several parameters were significantly correlated with PFS and sADCmean (200/1000) and rDOI were the independent predictors. After multivariate analysis, sADCmean and rDOI were selected to construct vMRE+rDOI model. The C-index of vMRE+rDOI model were 0.753, which was significantly higher than TNM model (0.556). The nomogram, calibration curves and Kaplan-Meier curve were attached.

**CONCLUSION**

Our study is the first to find that sADC of vMRE and rDOI could predict disease progression in NPC.

**CLINICAL RELEVANCE/APPLICATION**

Patients with high sADCmean and high-risk rDOI need aggressive treatment and close follow-up.

# Abstract Archives of the RSNA, 2024

M5A-SPIN

**Imaging Informatics Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPIN-1 SARCOPENIA DIAGNOSIS IN OPPORTUNISTIC CHEST CT SCREENING AMONG THE KOREAN POPULATION: ESTABLISHING THRESHOLDS AND CLINICAL APPLICATIONS

Jong H. Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Changmin Park (*Abstract Co-Author*) Nothing to Disclose
Sihwan Kim, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate optimal thresholds for skeletal muscle area (SMA) on different vertebra locations from 12th thoracic (T12) vertebra level to 2nd lumbar (L2) vertebra level using Korean population data; beyond the body composition assessment on 3rd lumber vertebra (L3) level.

### METHODS AND MATERIALS

The patients are consisted of 354 male (54.8%) and 291 female (45.2%). Average age of total patients (n = 645) is 63.7 yrs (64.3 for male and 63.1 for female). The sarcopenia is defined by the sex-specific L3 SMA threshold referenced as 117.04cm2 for male and 71.39cm2 for female. Based on the criteria, sarcopenia patients of the study were 72 (20.3%) for male and 22 (7.5%) for female. The vertebra body was localized by YOLO detection model and SMA value was calculated using automatic body composition analysis software (ClariMetabo, ClariPi, Seoul, Republic of Korea). For vertebra localization model, 120 contrast-enhanced abdominal CT scan data was used and it was augmented to 480 cases using CT contrast agent removing algorithm for mixing the synthetic non-contrast CT images. To find an optimal threshold, a receiver operating characteristic (ROC) curve analysis, sensitivity, specificity, and the area under ROC (AUROC) were calculated to evaluate diagnosis agreement at suggesting SMA thresholds.

### RESULTS

The optimal SMA threshold for sarcopenia detection at T12, L1, L2 vertebra levels were 91.5 cm2, 98.0 cm2, 113.8 cm2 in male, and 56.9 cm2, 62.4 cm2, 67.5 cm2 in female. The sensitivity for detecting sarcopenia using optimal SMA threshold at T12, L1, L2 vertebra levels were 0.79, 0.88 and 0.98 for male, and their specificity were 0.82, 0.82 and 0.55 for female, respectively. The AUROC for SMA threshold of each vertebra level (T12, L1 and L2) was 0.85, 0.90 and 0.90 for male, and 0.55, 0.57 and 0.66 for female. Through our study, it is possible to have an opportunistic screening for diagnosing sarcopenia on different CT scan protocols, not limited to the abdominal CT assessment using the L3 vertebra. To the best of our knowledge, this is the only reference standards using Korean population data to diagnose sarcopenia on different levels of the vertebra.

### CONCLUSION

We suggested cut-off values of SMA for substitutable vertebra bodies (e.g. L2, L1, T12) replacing the L3 level assessment when diagnosing sarcopenia. We hope the opportunistic screening chance to diagnose sarcopenia on different CT scan protocols be accomplished, and thresholds be applicated as more practical standards in Asia.

### CLINICAL RELEVANCE/APPLICATION

In CT-based sarcopenia diagnosis, a SMA measured at the L3 vertebra level is traditionally referenced using abdominal CT, but it is important to find alternative diagnosis criteria within a chest CT for a more universal diagnosis in terms of opportunistic screening.

## M5A-SPIN-2 AUTOMATED QUANTITATIVE ANALYSIS OF CARDIAC MR SHORT-AXIS CINE IMAGES IN THE NAKO HEALTH STUDY: SEGMENTATION PIPELINE AND QUALITY CONTROL

Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Peter M. Full, BSC (*Abstract Co-Author*) Nothing to Disclose
Manuel Hein (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Jeanette Schulz-Menger, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher L. Schlett, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Maximilian Russe, MD (*Abstract Co-Author*) Nothing to Disclose
Fabian Isensee, MSc (*Abstract Co-Author*) Nothing to Disclose
Christopher Schuppert, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop an automated segmentation pipeline for short-axis cardiac magnetic resonance (CMR) cine images from the prospective multi-center NAKO Health Study and to perform an in-depth quality control of image and segmentation quality.

### METHODS AND MATERIALS

A deep learning algorithm based on the nnU-Net architecture was trained for semantic segmentation on an independent dataset of expert-annotated short-axis CMR cine images including standard contours for both ventricles. The trained model was applied to CMR data from the NAKO Health Study baseline cohort, comprising 29,491 examinations from individual participants. The model inference was used to calculate ventricular volumes at all time points and to subsequently determine parameters of left and right ventricular (LV, RV) morphofunction, including volumes at end-diastole and end-systole (EDV, ESV), and myocardial mass (LVM). A visual quality control for image and segmentation quality included cases exhibiting (1) outliers in standard morphofunctional parameters, (2) outliers in the difference between left and right ventricular stroke volumes, or (3) outliers in timepoint differences between EDV and ESV. Additionally, cases exhibiting (4) abnormal LV time-volume curves were considered. The ratings employed a five-point Likert scale with values ranging from 5 (good) and 4 (acceptable) to 3 (moderate), 2 (poor), and 1 (non-diagnostic).

### RESULTS

All 29,491 CMR examinations were processed. The outlier analysis identified 5,180 cases (17.6% of the total), of which 1,936 (6.6%) received a moderate or lower rating for image or segmentation quality. The majority of these cases were associated with outliers in morphofunctional parameters and abnormal time-volume curves. After excluding these cases, the mean values calculated from the automated segmentations for LVEDV, LVESV, and LVM were 141.5 ml, 52.3 ml, and 113.3 g, respectively. The excluded cases showed significantly higher means by 4.6 ml (3.3%) for LVEDV, 13.8 ml (26.4%) for LVESV, and 8.1 g (7.2%) for LVM compared to the included cases (all $p<0.001$).

### CONCLUSION

The presented pipeline enabled the automated segmentation of a large CMR dataset. It also served to facilitate quality control by identifying examinations with suboptimal image or segmentation quality, allowing subsequent quantitative analyses to be conducted with a reduced risk of introducing bias.

### CLINICAL RELEVANCE/APPLICATION

An accurately performing segmentation pipeline for short-axis CMR cine images is the gateway to any large-scale quantitative analyses of such datasets. Findings from the NAKO Health Study based on this dataset may provide new insights into cardiovascular risk factors and (sub)clinical disease.

## M5A-SPIN-3 MANUAL VERSUS AI-ASSISTED RECIST-BASED MEASUREMENT OF LYMPH NODE METASTASIS: A COMPARATIVE ANALYSIS OF MEASUREMENT VARIABILITY AND TIME

Chikako Tanaka (*Abstract Co-Author*) Nothing to Disclose
Motoo Nomura, MD (*Abstract Co-Author*) Nothing to Disclose
Ryo Sakamoto, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Shigemi Matsumoto (*Abstract Co-Author*) Nothing to Disclose
Koji Fujimoto, MD, PhD (*Presenter*) Research Grant, Canon Medical Systems Corporation

### PURPOSE

In oncology clinical trials, tumor lesion assessment based on RECIST criteria is required, which places a great burden on radiologists or clinicians to accurately measure the size of targeted lesions while understanding the tumor morphology. Recently, AI-assisted measurement became possible for this task. We tested its effectiveness using cases with lymph node metastasis.

### METHODS AND MATERIALS

Metastatic lymph nodes reported in radiology reports for clinical trials in 2011-2023 were randomly included in this retrospective study. Sixteen lesions with well-defined margins in ten cases were eligible for evaluation. Two board-certified radiologists (DrA and DrB) independently measured these metastatic lymph nodes, using both manual (M) and AI-assisted (A) methods. One of them performed measurements twice. The coefficient of variation (CV) for the measured diameter and the measurement time were compared between the 1st and the 2nd measurement of one radiologist to evaluate intra-reader variability both for M (M1DrA vs M2DrA) and A (A1DrA vs A2DrA). Similarly, inter-reader variability was evaluated both for M (M1DrA vs M1DrB) and A (A1DrA vs A1DrB). Times required for the measurement were compared between M of DrA and DrB, A of DrA and DrB, M and A of DrA, and M and A of DrB. Statistical analyses were performed using Wilcoxon signed-rank tests. P-values after Bonferroni correction ($p < 0.05/4 = 0.0125$) were considered to indicate statistically significant differences.

### RESULTS

Sixteen lesions ranged 12-30 mm in the longest diameter in the short axis. Intra-reader CV of AI-assisted measurement was smaller than that of M, but the difference was not significant ($p=0.018$). Inter-reader CV of AI-assisted measurement was smaller than that of M, but the difference was not significant ($p=0.403$). There were no significant differences between intra-reader CV and inter-reader CV ($p=0.396$ for M, $p=0.092$ for A). Measurement times for AI-assisted measurement was shorter than that of M ($p=0.004$ for DrA, $p=0.0006$ for DrB). Measurement times by DrA was significantly longer than that by DrB ($p=0.000$ for M, $p=0.001$ for A).

### CONCLUSION

The required time for the measurement of metastatic lymph nodes were significantly reduced by the AI-assisted measurement compared with manual measurement.

### CLINICAL RELEVANCE/APPLICATION

An AI-assisted measurement for the metastatic lymph nodes for clinical trials may reduce the burden of radiologists.

## M5A-SPIN-4 CT SCAN COMPOSITE SCORE CAN IDENTIFY GLIOBLASTOMA PATIENTS WITH WORSE OUTCOMES

Shama Jaswal, MBBS (*Abstract Co-Author*) Nothing to Disclose
Yifei Xu (*Abstract Co-Author*) Nothing to Disclose
Vincent Chow (*Abstract Co-Author*) Nothing to Disclose
Muhammad Naeem, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Norman Atagu, MD,BSC (*Abstract Co-Author*) Nothing to Disclose
Mirza Faisal Beg (*Abstract Co-Author*) Nothing to Disclose
Michael Chicoine (*Abstract Co-Author*) Nothing to Disclose
Sonika Dahiya, MD (*Abstract Co-Author*) Nothing to Disclose
Cyrus Raji, MD, PhD (*Abstract Co-Author*) Consultant, Brainreader ApS;Consultant, Neuroevolution, LLC;Consultant, Apollo Health
Joseph E. Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Karteek Popuri (*Abstract Co-Author*) Nothing to Disclose
Olesya Mironchuk, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Hosseinzadeh Kassani (*Abstract Co-Author*) Nothing to Disclose

David H. Ballard, MD (*Abstract Co-Author*) Nothing to Disclose
Da Ma (*Abstract Co-Author*) Nothing to Disclose

**PURPOSE**

Obesity is a risk factor for many cancer types including glioblastoma multiforme (GBM). Body mass index alone is an insufficient indicator of health risks associated with obesity. We used CT body composition analyses to construct a sex-specific composite score that would optimally predict overall survival in GBM.

**METHODS AND MATERIALS**

Using a retrospective institutional cohort, we performed single slice (L3) and volumetric (L1-L5) automated body segmentation analyses on abdominal and pelvic computed tomography (CT) scans performed within 1 month of diagnosis of GBM. Multivariable Cox proportional hazards models were then used to identify variables that were independently associated with GBM overall survival. Lastly, a learning-tree algorithm was implemented to identify the relative importance of body composition metrics using a XGBoost-powered learning model. These weights were used to create sex-specific composite CT scan scores of protective and predisposing factor with relation to GBM survival. A log-rank pairwise t-test was used to compared GBM survival across patient groups stratified based on these CT composite scores.

**RESULTS**

Higher relative inter/intramuscular adipose tissue volume (HR(95%CI):1.9(1.01-3.06), p=0.02), visceral adipose tissue volume (HR(95%CI):2.1(1.04-4.1), p=0.04) and aortic calcification volume (HR(95%CI):2.6(1.2-5.5), p<0.001) were associated with lower GBM overall survival, while higher subcutaneous adipose tissue volume (HR(95%CI):0.4(0.2-0.8), p=0.02), iliopsoas muscle volume (HR(95%CI):0.4(0.2-0.9), p<0.001), and trabecular bone density (HR(95%CI):0.4(0.1-0.8), p=0.003) were predictive of higher GBM OS (p-value of all tests <0.05). Using quartiles of the CT scan composite predisposing and protective scores, we were able to stratify male and female participants with significantly different outcomes with regards to GBM OS (Figure). Male and female participants with higher burden of predisposing factors had significantly lower chances of survival compared to those with lower cumulative burden of these factors (Figure, p-value Q4 vs. Q1 males< 0.01 and 0.001 in females).

**CONCLUSION**

Using automated body segmentation analysis and through an XGboost-powered learning algorithm, we optimized a CT scan composite score that was able to stratify GBM patients with worse overall survival.

**CLINICAL RELEVANCE/APPLICATION**

Metabolism measured with abdominal body composition provides an actionable advancement toward precision medicine in GBM management, as life-style and dietary regimens have the ability to alter body composition and metabolism and potentially GBM tumor biology.

## M5A-SPIN-5 DIFFERENTIATE ADRENAL LIPID-POOR ADENOMA FROM NODULAR HYPERPLASIA WITH CT QUANTITATIVE PARAMETERS: A FEASIBILITY STUDY

Hao Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Gu Mu Yang Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Lili Xu (*Abstract Co-Author*) Nothing to Disclose
Li Chen (*Abstract Co-Author*) Nothing to Disclose
Erjia Guo, MS, BA (*Abstract Co-Author*) Nothing to Disclose
Jiahui Zhang (*Abstract Co-Author*) Nothing to Disclose
Xiaoxiao Zhang (*Abstract Co-Author*) Nothing to Disclose
Qianyu Peng (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Xin Bai III, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to explore the potential of CT quantitative parameters in differentiating adrenal lipid-poor adenoma (LPA) from nodular hyperplasia and evaluate diagnostic performance.

**METHODS AND MATERIALS**

Retrospective analysis was conducted on patients with LPA or nodular hyperplasia who underwent unenhanced and contrast-enhanced CT before adrenalectomy. Regions of interest were created to allow determination of each lesion's unenhanced (CTpre), portal-venous phase attenuation (CTp), and the portal-venous phase attenuation of the abdominal aorta. We subsequently calculated absolute enhancement (a lesion’s portal-venous phase attenuation minus unenhanced attenuation [in HUs]), relative enhancement (absolute enhancement divided by unenhanced attenuation), and the relative enhancement ratio ([absolute enhancement divided by abdominal aorta’s portal-venous phase attenuation] ×100%). We also measured lesion size and recorded lesion number. Volume was assessed by ITK-snap software and the ratio of lesion volume to ipsilateral adrenal volume (volume ratio) was determined. Intergroup differences were analyzed using Student’s t-test and chi-squared test. Binary and multivariate logistic regression models were developed, and receiver operating characteristic (ROC) curves were constructed to determine the area under the ROC curve (AUC), sensitivity, and specificity. The model’s performance was then compared against radiologists’ subjective assessments, and the inter- and intra-reader agreement values among radiologists were calculated.

**RESULTS**

The study enrolled 128 patients with pathologically confirmed LPA (n=83) and nodular hyperplasia (n=45). Portal-venous phase attenuation, volume ratio, and lesion number were independent predictors of LPA. The AUC for the multivariate logistic regression model incorporating CTp, volume ratio, and lesion number was 0.835 (95% CI, 0.764-0.907; with a sensitivity of 73.5% and specificity of 80%). The radiologists’ diagnostic specificity and accuracy appeared to be inferior to the model. The inter-reader agreement among radiologists ranged from 0.082 to 0.535, and the intra-reader agreement values of two radiologists were 0.734 and 0.583, respectively.

**CONCLUSION**

The portal-venous phase CT demonstrated significant potential in distinguishing LPA from nodular hyperplasia. The model integrating CTp, volume ratio, and lesion number exhibited superior diagnostic performance compared to radiologists in terms of variability and reproducibility.

**CLINICAL RELEVANCE/APPLICATION**

The proposed model based on CT quantitative parameters of the portal-venous phase can guide clinical treatment decisions and prevent unnecessary surgery in patients with nodular hyperplasia.

## M5A-SPIN-6 TOTALSEGMENTATOR V2 - BETTER, FASTER, AND MORE SUSTAINABLE

Daniel T. Boll, MD (*Abstract Co-Author*) Nothing to Disclose
Joshy Cyriac (*Abstract Co-Author*) Nothing to Disclose
Shan Yang, MSc (*Abstract Co-Author*) Nothing to Disclose
Michael Bach (*Abstract Co-Author*) Nothing to Disclose
Daniel Hinck (*Abstract Co-Author*) Nothing to Disclose
Elmar M. Merkle, MD (*Abstract Co-Author*) Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Guerbet SA;
Tobias Heye, MD (*Abstract Co-Author*) Nothing to Disclose
Maurice Pradella, MD (*Abstract Co-Author*) Nothing to Disclose
Hanns-Christian Breit, MD (*Abstract Co-Author*) Nothing to Disclose
Manfred T. Meyer (*Abstract Co-Author*) Nothing to Disclose
Martin Segeroth, MD, BSc (*Abstract Co-Author*) Nothing to Disclose
Lorraine Abel, MD (*Abstract Co-Author*) Nothing to Disclose
Jakob Wasserthal (*Presenter*) Nothing to Disclose

### PURPOSE

We introduce TotalSegmentator v2, an enhanced version of the CT image segmentation tool TotalSegmentator, designed to improve segmentation accuracy even on difficult cases, support a wider range of anatomical structures, run faster, and require less memory. These improvements enable even more large-scale radiology studies and sophisticated development of radiology deep learning algorithms.

### METHODS AND MATERIALS

The version 2 segments 137 classes, including 33 new anatomical structures compared to version 1 (supra-aortic vessels, appendicular bones, tissue types, thyroid, sternum, costal cartilages, pulmonary veins, superior vena cava, spinal cord, kidney cysts, vertebrae body). It uses a larger and more diverse training set of 1559 CT scans (v1: 1204 CT scans), with a focus on complex pathological cases (e.g. hemorrhage or ascites) and cases where TotalSegmentator v1 failed. The segmentation framework now relies on the newly released nnU-Net segmentation algorithms v2 with improved runtime. Performance was validated using a test set of 89 CT scans including various pathologies (test set 1). To demonstrate the improved accuracy on pathological cases, we additionally evaluated the segmentation performance on abdominal organs affected by hemorrhage or ascites (11 CT scans) (test set 2).

### RESULTS

TotalSegmentator v2 demonstrated robust segmentation on test set 1 with a Normalized Surface Distance (NSD) across all structures of 0.929 [CI 0.903 - 0.950] at 3mm resolution and 0.962 [CI 0.941 - 0.977] at 1.5mm resolution. Improvements were noted in abdominal organ segmentation among pathological cases (test set 2), with a NSD of 0.949 [CI: 0.916 - 0.980], surpassing TotalSegmentator v1 (0.931 [CI 0.879 - 0.973], p=0.416) and significantly outperforming a model trained on the open BTCV dataset (0.767 [CI 0.698 - 0.826], p=0.003). Compared to TotalSegmentator v1 runtime is up to 5x faster when running on GPU (v2: 44 s; v1 233 s) and 32x faster when running on CPU (v2: 49 s; v1 1560 s) while reducing memory consumption by 40%. This results in lower energy consumption and higher sustainability.

### CONCLUSION

TotalSegmentator v2 substantially enhances the utility and scalability of automated anatomical segmentation in CT imaging. It is (1) publicly available; (2) easy to use; and (3) works robustly amongst various clinical settings.

### CLINICAL RELEVANCE/APPLICATION

With its higher accuracy and faster runtime, TotalSegmentator v2 enables more precise and extensive segmentations of anatomical structures. This advancement supports a broader range of clinical and research applications, potentially improving diagnostic accuracy and therapeutic planning in diverse patient populations.

## M5A-SPIN-8 AUTOMATED SEGMENTATION AND QUANTIFICATION OF ADIPOSE TISSUE AND BONE MARROW ON WHOLE-BODY DIXON MRI USING CROSS-MODALITY TRANSFER LEARNING

Ge Hu (*Abstract Co-Author*) Nothing to Disclose
Huadan Xue, MD (*Abstract Co-Author*) Nothing to Disclose
Da-Ming Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Jiao Li, MS,MS (*Abstract Co-Author*) Nothing to Disclose
Shengqian Huang (*Presenter*) Nothing to Disclose

### PURPOSE

1) To develop a deep learning-based method for automated segmentation and quantification of adipose tissue (AT) and bone marrow (BM) on whole-body Dixon MRI images. 2) To evaluate a cross-modality transfer learning strategy via CT-to-Dixon MRI image synthesis for improving the performance of this segmentation task.

### METHODS AND MATERIALS

The real Dixon MRI dataset consisted of whole-body T1-weighted Dixon MRI scans in 26 patients. Subcutaneous AT (SAT), visceral AT (VAT), mediastinal AT (MAT), vertebral body BM, pelvic bone BM, and femur BM were manually annotated on fat-only images (553-688 slices per case). 20 cases were used for 5-fold cross-validation and 6 cases were used for testing. Extra 6 cases with MRI scans and 500 cases with labeled CT data from the TotalSegmentator dataset were collected for training a generative adversarial network (CycleGAN). CT-to-Dixon MRI conversion was achieved by introducing AT and BM reconstruction loss in CycleGAN. 3D nnU-Net was pre-trained on pseudo Dixon MRI dataset and fine-tuned on real Dixon MRI dataset. The predicted BM was used for localization to automatically determine the volumes of fat in different parts, the fat areas at each vertebral level, and the BM fat fraction (FF). The segmentation performance was evaluated using Dice similarity coefficient (DSC), and the quantitative results were assessed using Pearson correlation coefficient (r), intraclass correlation coefficient (ICC), and mean relative error (MRE).

### RESULTS

DSC are presented in order of SAT, VAT, MAT, vertebral body BM, pelvic bone BM, and femur BM. In cross-validation, DSC using the transfer learning strategy were 0.982, 0.980, 0.940, 0.890, 0.911, and 0.961, respectively, outperforming the model trained from scratch ($p < 0.05$, paired t-test). When training with 25% samples, the strategy achieved comparable performance to training with all samples for AT segmentation (mean DSC: 0.962 vs. 0.964). Notably, the pre-trained model itself enabled zero-shot segmentation of AT (DSC: 0.943, 0.924, 0.851). The predicted volumes of SAT/VAT/MAT, AT volumes in chest/abdomen/pelvis/thighs, AT areas at L3 level, and BMFF showed excellent consistency with the ground truth ($r > 0.98$, ICC > 0.97,

MRE < 5%). The model also demonstrated good segmentation (DSC: 0.987, 0.981, 0.942, 0.897, 0.911, 0.966) and quantification performance (r > 0.98, ICC > 0.97, MRE < 3%) on the test set.

**CONCLUSION**

Deep learning model can efficiently segment whole-body AT and BM, enabling precise quantification of fat in different body parts. The cross-modality transfer learning strategy enhances the segmentation performance.

**CLINICAL RELEVANCE/APPLICATION**

This method enables automated fat quantification, which can be applied in clinical assessments and scientific studies.

# Abstract Archives of the RSNA, 2024

M5A-SPIR

**Interventional Radiology Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPIR-1 PREDICTORS OF DIAGNOSTIC SUCCESS IN PERCUTANEOUS BIOPSIES OF BONE LESIONS

Rush H. Chewning, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmad I. Alomari, MD (*Abstract Co-Author*) Nothing to Disclose
Gulraiz A. Chaudry, MBChB (*Abstract Co-Author*) Nothing to Disclose
Raja Shaikh, MD (*Abstract Co-Author*) Nothing to Disclose
Usama Anwar, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the procedural and lesion-specific predictors that influence the diagnostic success of percutaneous biopsies for bone lesions.

### METHODS AND MATERIALS

This retrospective study evaluated 287 patients who underwent 313 image-guided PCNBs for bone lesions in interventional radiology at a tertiary care pediatric hospital, from February 2009 to September 2023. Procedural details like biopsy core numbers, needle specifications, and guidance methods were recorded alongside pre-procedural imaging (CT, MRI, radiographs, PET scans) data. Bivariate and multivariate analyses were performed using LOGISTIC and HPLOGISTIC procedures in SAS/STAT® 14.1.

### RESULTS

Of the 313 biopsies, 306 had sufficient data to analyze. In this subset, the average age was 11.6 years ± 4.5 (163 male). Of the 306 biopsies, 208 (68%) were diagnostic while 100 (32%) were non-diagnostic. The most common needles used were 14 and 16-gauge (76%). Single Predictor Models: Important predictors of the odds of diagnostic success included extracting = 5 cores (OR = 2.78, 95% CI: 1.69-4.57, P < 0.001), diffuse lesions (OR = 2.55, 95% CI: 1.14-5.69, P = 0.022), and the presence of a soft tissue component (OR = 2.79, 95% CI: 1.39-5.62, P = 0.004). Positive PET avidity increased the odds compared to presumed or known negative avidity (OR = 3.45, 95% CI: 1.30-9.14, P = 0.013). Larger lesion volumes increased the odds with an estimate on the log(volume) scale of 0.194 (95% CI: 0.097-0.290, P < 0.001). Multiple Predictor Model: The multivariable analysis of 306 procedures identified an optimal model with moderate accuracy (AUC = 0.71) using three predictors: number of cores = 5 (OR = 1.82, 95% CI: 1.06-3.15, P = 0.031), lesion volume (estimate = 0.156, 95% CI: 0.052-0.261, P = 0.003), and clinical suspicion (P = 0.053). For clinical suspicion, the OR for secondary vs recurrent lesion was 10.80 (95% CI: 1.54-75.68, P = 0.017), and for secondary vs primary lesion was 6.94 (95% CI: 1.61-33.33, P = 0.009).

### CONCLUSION

The study demonstrates that the number of extracted cores and specific lesion characteristics significantly influence the diagnostic success of image-guided PCNBs for bone lesions.

### CLINICAL RELEVANCE/APPLICATION

Based on the three-predictor model, the extracted number of cores and assessment of specific lesion characteristics can be optimized to increase the diagnostic yield of PCNBs for bone lesions.

## M5A-SPIR-2 SAFETY AND EFFICACY OF IMAGE GUIDED BONE BIOPSIES: INSIGHTS GAINED FROM THE REGISTRY OF THE GERMAN SOCIETY FOR INTERVENTIONAL RADIOLOGY AND MINIMALLY INVASIVE THERAPY (DEGIR) 2018-2023

Sebastian Zensen, MD (*Abstract Co-Author*) Nothing to Disclose
Johannes Haubold, MD (*Abstract Co-Author*) Speaker, Siemens AG
Michael Forsting, MD (*Abstract Co-Author*) Nothing to Disclose
Aleksandar Milosevic, MD (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In bone lesions, a histopathological analysis is essential prior to any further therapeutic approach. Here, percutaneous image guided biopsies have gradually replaced open biopsies because of their high diagnostic yield and low complication rate. However, improved diagnostic possibilities, most notably in the field of molecular diagnosis, have increased the demand considerably. Hence, historical data on these procedures have to be considered as outdated. The aim of the present evaluation was to use data from the prospectively managed multinational registry of the German Society for Interventional Radiology and Minimally Invasive Therapy (DeGIR, Deutsche Gesellschaft für Interventionelle Radiologie und minimal-invasive Therapie) to investigate procedural details, success and complication rate of percutaneous image guided bone biopsies.

### METHODS AND MATERIALS

During a five-year timespan from 2018 until 2022, 17,397 biopsies from 214 centers were analyzed (median patient age: 64 years, IQR 51-75 years; female: 52%, 9,046/17,397). Technical success was defined as the visually successful placement of the biopsy needle in the target lesion. Based on the recommendations of the Society of Interventional Radiology (SIR), complications were subsumed as minor (Grade A B) or major (C-F). Explorative data analysis was performed.

### RESULTS

Around one third of biopsies were performed as outpatient procedures (34%, 5,924/17,397). Most interventions were performed using local anesthesia only (86.6% (15,072/17,397). In most cases, CT-guidance was used (68.7%,11,952/17,397), followed by ultrasound (18.5%, 3214/17,397), fluoroscopy (12.1%, 2,099/17,397), MRI (0.6%, 121/17,397), and combined approaches (e.g., ultrasound + CT) in 0.7% (140/17,397).A technically successful biopsy was possible in 98.9% (17,201/17,397). In 11,073 cases with an available histopathological report, the biopsy sample was histologically representative in 93.2% (10,316/11,073). The reported complication rate was 0.62% (108/17,397) and only 23.1% (25/108) were considered as major complications according to the SIR classification.

### CONCLUSION

Percutaneous image guided bone biopsies are safe procedures with a low complication and a high technical success rate.

### CLINICAL RELEVANCE/APPLICATION

As percutaneous image guided bone biopsies have a low complication rate, it might be possible to perform this intervention mainly as an outpatient procedure.

## M5A-SPIR-3 TRANSVASCULAR TARGETED BIOPSIES WITH ANGIO CT IN HYBRID MODE

Philipp M. Paprottka (*Abstract Co-Author*) Nothing to Disclose
Tobias Geith (*Abstract Co-Author*) Nothing to Disclose
Jonathan Nadjiri, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study evaluated the feasibility and safety of transvascular targeted biopsies (TTB), a novel technique utilizing conventional endovascular biopsy sets guided by angio-CT. The primary goal was to enable precise tissue sampling, particularly in cases where percutaneous access was either unattainable or contraindicated.

### METHODS AND MATERIALS

The study spanned from 2021 to 2023 and included cases involving targeted biopsies of paravascular structures using conventional transvascular biopsy sets. These cases necessitated a non-percutaneous approach due to either infeasibility or contraindication resulting from coagulopathy. The procedures were conducted in an angio-CT hybrid suite. Initially, a contrast-enhanced or native CT scan was performed for pre-procedural planning. Post-processing techniques were employed to identify target locations, and this information was seamlessly integrated into fluoroscopy images. Fluoroscopy guided the placement of conventional transjugular biopsy sets, while CT-fluoroscopy was employed when necessary to precisely position the needle within the suspected lesion. Adverse events were monitored for a follow-up period of 7 days as an indicator of safety, with success inferred from pathology reports containing representative results.

### RESULTS

Transvascular targeted biopsies were successfully performed in six patients. Among these cases, two involved biopsies of tumours adhering to the outside of the superior vena cava with severe upper inflow congestion. Additionally, one paracaval lymph node near the inferior vena cava was biopsied. Other successful TTB procedures included biopsies of a circumscriptive liver metastasis, a transplanted and a non-transplanted kidney with kidney failure. Notably, no adverse events were reported, and the technical success rate, as confirmed by pathology reports, was 100%.

### CONCLUSION

Transvascular targeted biopsies conducted within an angio-CT environment utilizing conventional biopsy sets are feasible and helpful, achieving a seemingly high technical success rate with high safety.

### CLINICAL RELEVANCE/APPLICATION

Transvascular targeted biopsies (TTB) offer a breakthrough in tissue sampling, especially in cases where percutaneous access is challenging or contraindicated. This novel technique, utilizing conventional endovascular biopsy sets guided by angio-CT, enables precise sampling of paravascular structures, broadening diagnostic possibilities in complex clinical scenarios. With a 100% technical success rate and no reported adverse events, TTB demonstrates promising feasibility and safety, potentially transforming diagnostic approaches and guiding tailored treatment strategies for patients facing challenging biopsy scenarios.

## M5A-SPIR-4 NOVEL ENDOBILIARY RADIOFREQUENCY ABLATION SYSTEM USING STENT-BASED ELECTRODE IN THE PORCINE MODEL: A PRELIMINARY FEASIBILITY STUDY

Jung-Hoon Park, PhD (*Abstract Co-Author*) Nothing to Disclose
Yubeen Park (*Abstract Co-Author*) Nothing to Disclose
Dong-Sung Won, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Endobiliary radiofrequency ablation (RFA) has been developed as a promising palliative therapy to improve stent patency and patient survival in the malignant biliary obstruction (MBO). However, conventional catheter-based electrodes may be limited by insufficient tumor ablation due to inadequate contact with the tortuous bile duct wall. This study aimed to investigate the feasibility and possibility of the stent-based electrode (SBE)-RFA system in the porcine common bile duct (CBD).

### METHODS AND MATERIALS

An endobiliary RFA system composed of bipolar SBE with two electrodes using braided nitinol wires and a customized RFA generator with a polarity-switching system. Ex-vivo studies utilizing porcine livers were conducted to evaluate ablation area under various protocols, manipulating output power and ablation times as independent variables. Subsequently, endobiliary RFA was performed in nine male porcine using a protocol selected based on ex-vivo findings. Pre- and post-procedural evaluations, including cholangiography, endoscopy, and histological analysis were performed.

**RESULTS**

The SBE custom RFA generator exhibited accurate temperature feedback and power output, demonstrating high reproducibility. The ablation zone in pig liver was confirmed to increase as both power and time were increased. In the porcine CBD, endobiliary RFA was technically successful without ductal perforation, and led to luminal narrowing proportional to both output power and ablation time. The degree of mucosal damage, including hemorrhagic erosion and erythema, was increased with higher RFA-related parameters in the endoscopic examination. Histological examination demonstrated enhanced ablation area and circumferential shape with increased inflammatory cell infiltration, cellular necrosis, and heat shock proteins proportional to the ablation protocol.

**CONCLUSION**

This study demonstrates the technical feasibility and efficacy of endobiliary RFA utilizing a novel bipolar SBE-RFA system. Enhanced and uniformed ablation ranges were observed in the porcine CBD, suggesting its potential as a palliative therapeutic option for unresectable MBO.

**CLINICAL RELEVANCE/APPLICATION**

The SBE-RFA system represents a significant advancement in the management of MBO with uniform ablation zone and provides a minimally invasive alternative to improve survival in ineligible surgical patients.

## M5A-SPIR-5 INTERVENTIONAL MICRODEVICE IMPLANTATION AND RETRIEVAL FOR IN-VIVO DRUG RESPONSE ASSESSMENTS: PRECLINICAL SAFETY AND FEASIBILITY IN A RABBIT VX-2 SOFT TISSUE SARCOMA MODEL

Yan Epelboym, MPH (*Abstract Co-Author*) Association of University Radiologists GE Radiology Research Academic Fellowship Boston Imaging Core Laboratory: Consultant
Sajan Panikkanvalappil (*Abstract Co-Author*) Nothing to Disclose
Guigen Liu (*Abstract Co-Author*) Nothing to Disclose
Ezra Burch, MD (*Abstract Co-Author*) Nothing to Disclose
Oliver Jonas (*Abstract Co-Author*) Nothing to Disclose
Christine Dominas (*Abstract Co-Author*) Nothing to Disclose
Grace Foley (*Abstract Co-Author*) Nothing to Disclose
Sebastian Ahn (*Abstract Co-Author*) Nothing to Disclose
Nobuhiko Hata, PhD (*Abstract Co-Author*) Research Grant, Canon USA Inc;Research Grant, Koh Young Technology Inc;Research Consultant, AZE, Ltd;Research Consultant, Harmonus, Ltd;Stockholder, Harmonus, Ltd
Sharath Bhagavatula, MD (*Abstract Co-Author*) Nothing to Disclose
Courtney Marlin (*Abstract Co-Author*) Nothing to Disclose
Stuart G. Silverman, MD (*Abstract Co-Author*) Nothing to Disclose
Zuzana Tatarova (*Abstract Co-Author*) Nothing to Disclose
Juraj Jakubik (*Abstract Co-Author*) Nothing to Disclose
Destiny Matthew (*Abstract Co-Author*) Nothing to Disclose
Ryan Reichert (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the safety and feasibility of an interventional technique for placement and retrieval of a novel, implantable microdevice (IMD) in a rabbit VX-2 tumor model, with the overall goal of enabling rapid drug response assessments in solid tumors.

**METHODS AND MATERIALS**

IMDs are miniaturized devices that fit inside the tip of a percutaneous needle and contain multiple individual wells, each containing microdoses of drugs that diffuse locally into surrounding tumor tissue. This study utilized a rabbit hindlimb VX-2 tumor model with similar risk and technical complexity of a human soft tissue sarcoma. Under conscious sedation and using US guidance, 4-5 IMDs were placed into eight rabbit tumors. Each IMD released microdoses of fluorescent drugs (Doxorubicin, Topotecan, Sunitinib) into 18 spatially distinct microscopic tissue regions over a 1-day period. Under fluoroscopic guidance, a custom over-the-wire biopsy procedure was used to extract the IMD along with surrounding tumor tissue for drug-response analysis. Procedural adverse events were evaluated. The number of IMDs and drug release sites retrieved with sufficient intact tissue (at least 300um) per tumor were quantified using gross pathology and fluorescence imaging.

**RESULTS**

An average of 4.5 ± 0.5 IMDs were implanted containing 81.0 ± 9.0 drug release sites per tumor. Mean implantation procedure duration was 25.5 ± 2.5 minutes and retrieval procedure duration was 46.0 ± 0.5 minutes. No clinically significant complications were observed, including bleeding, infection, or inability to remove the IMD. The retrieval success rate, defined as retrieval of drug-containing tumor tissue, was 68.25% (57-76%), with an average of 55.25 ± 5.3 discrete drug sites retrieved per tumor.

**CONCLUSION**

This animal study supports that interventional IMD placement and retrieval in a superficial soft tissue tumor is safe and feasible. These findings suggest that translation to first-in-human trials in similar locations could be considered in the future.

**CLINICAL RELEVANCE/APPLICATION**

Percutaneous image-guided IMDs analyze drug effects of numerous individual cancer treatments simultaneously in-vivo and have the potential to personalize drug optimization and advance drug development. The ability to perform IMD implantation and retrieval without surgery may substantially expand patient eligibility and IMD utilization in cancer trials.

## M5A-SPIR-6 ASSESSING ABDOMINAL AORTIC ANEURYSM GROWTH BY USING RADIOMICS OF PERIVASCULAR ADIPOSE TISSUE AFTER ENDOVASCULAR REPAIR

Jin Chen (*Abstract Co-Author*) Nothing to Disclose
Zhe Zhang (*Abstract Co-Author*) Nothing to Disclose
Shenbo Zhang (*Abstract Co-Author*) Nothing to Disclose
Zhiwei Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Ge Hu (*Abstract Co-Author*) Nothing to Disclose
Rui Lv (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the relationship between radiomic features of perivascular adipose tissue (PVAT) and abdominal aortic aneurysm (AAA) growth after endovascular aneurysm repair (EVAR).

**METHODS AND MATERIALS**

Patients with sub-renal AAA who underwent regular follow-up after EVAR from March 2014 to March 2024 were retrospectively collected. Two radiologists segmented the aneurysm and PVAT. By calculating the aneurysm volume from two follow-up CT scans, patients were divided into growing and non-growing groups. 107 radiomic features were automatically extracted from the PVAT region. Univariable and multivariable logistic regression was performed to analyze radiomic features and clinical characteristics. The performance of the integrated clinico-radiological model was compared with models using only radiomic features or clinical characteristics separately.

**RESULTS**

A total of 79 patients (68±9 years, 89% men) were enrolled in this study, 19 of whom had an growing aneurysm. Compared to the stable group, PVAT of growing AAA showed higher surface area to volume ratio (non-growing vs. growing, 0.63 vs. 0.70, P=0.04), and a trend of low dependence and high dispersion manifested by texture features (P<0.05). The area under the curve (AUC) of the integrated clinico-radiological model was 0.78 (95% CI 0.65-0.91), with a specificity of 87%. The integrated model outperformed models using only radiomic or clinical features separately(0.78 vs. 0.69 vs. 0.69).

**CONCLUSION**

Higher surface area to volume ratio and more heterogeneous texture presentation of PVAT were associated with aneurysm dilation after EVAR. Radiomic features of PVAT have the potential to predict AAA progression.

**CLINICAL RELEVANCE/APPLICATION**

Radiomic features of perivascular adipose tissue are associated with abdominal aortic aneurysm progression and can be an independent risk factor for aneurysm dilatation to assist clinicians in postoperative patient surveillance and management.

## M5A-SPIR-7 CT THERMOGRAPHY CAN PREDICT THE CHANGE IN TEMPERATURE DISTRIBUTION INSIDE ICE-BALL DURING CRYOABLATION?- VERIFICATION WITH PHANTOM EXPERIMENT

Hajime Sakuma, MD, PhD (*Abstract Co-Author*) Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;Research Grant, Guerbet SA;
Katsutoshi Nakamori, RT (*Abstract Co-Author*) Nothing to Disclose
Yuki Omori (*Abstract Co-Author*) Nothing to Disclose
Hikari Fukui (*Abstract Co-Author*) Nothing to Disclose
Masashi Fujimori, MD,PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Cryoablation (CA) has become a widely used thermal treatment for tumors since the advent of argon (Ar) gas-based system. Reported tumor lethal zone is <-40°C and a margin of >6 mm is recommended. However, the ambient temperature around the tumor and Ar gas pressure during CA may affect the ice ball size and the temperature distribution inside the ice ball. This phantom study assessed the effects of ambient temperature and Ar gas pressure on the temperature distribution of the ice ball and verified the feasibility of computed tomography (CT) thermography.

**METHODS AND MATERIALS**

A 500ml of 5% agarose gel phantom was prepared using saline solution with embedding a multi-polar fine thermocouple and a cryoprobe. The phantom was settled in a thermostatic chamber placed in a CT. The chamber temperature was set at 24°C (low; LT) and 37°C (high; HT). Freezing was performed for 15 minutes, and the phantom temperature was recorded every 5 second. The entire phantom was scanned with CT just before and 15 minutes after starting freezing. The experiment was triplicated at different Ar gas pressure of 26.2~27.5MPa. The curvilinear temperature changes in the ice ball were modeled by the least-squares method. The distances from the cryoprobe to 0 and -40°C were estimated and compared for different chamber temperatures and gas pressures. Spherical regions of interest with a diameter of 2 mm were set at 2 mm intervals outward from the cryoprobe and CT values were measured before and 15 minutes after freezing, and the correlation between the change in CT values and the estimated temperatures was evaluated.

**RESULTS**

The mean central temperature significantly decreased in LT than HT (-64.2? v.s. -57.0?, P=0.01). The mean radius of the ice ball (18.5 mm v.s. 16.2 mm, p=0.002) and % of area <40? in ice ball (38.5% v.s. 35.2%, P=0.04) increased significantly in LT than HT. No significant difference was found in the size of area with 0?~-40? (LT: 11.4 mm v.s. HT: 10.5 mm, P=0.07). Single regression analysis showed that as Ar gas pressure at the start of freezing decreased, % of area <40? decreased regardless of the ambient temperature (coefficient of determination, R2=0.79). At lower temperatures, the decrease in CT values of ice ball tended to be greater compared to pre-freeze CT values, but the correlation was poor (R2=0.33).

**CONCLUSION**

The central temperature of the ice ball was lower and the overall ice ball size and % of area <40°C are larger in lower ambient temperature, but % of area <40°C became smaller as Ar gas pressure decreased, regardless of the ambient temperature. However, this temperature distribution was difficult to estimate from the CT images obtained during CA.

**CLINICAL RELEVANCE/APPLICATION**

Since CT thermography is diffiult, a larger margin should be secured under lower Ar gas pressure setting.

## M5A-SPIR-8 SPECTRUM AND GENOTYPE-PHENOTYPE CORRELATIONS OF EXTRACRANIAL VASCULAR ANOMALIES DRIVEN BY RAS/MAPK VARIANTS

Walter A. Wohlgemuth (*Abstract Co-Author*) Nothing to Disclose
Jens Ricke, MD, PhD (*Abstract Co-Author*) Research Grant, Sirtex Medical Ltd;Research Grant, Bayer AG;Research Grant, Terumo Corporation;Research Grant, Boston Scientific Corporation
Wibke Uller, MD (*Abstract Co-Author*) Nothing to Disclose
Moritz Wildgruber, MD, PhD (*Abstract Co-Author*) Consultant, Sirtex Medical Ltd;Consultant, iThera Medical GmbH;Consultant, Bayer AG
Max Seidensticker (*Abstract Co-Author*) Grant, Sirtex Medical Ltd;Speaker, Sirtex Medical Ltd;Grant, Bayer AG;Speaker, Bayer AG;Speaker, Siemens AG;Speaker, Cook Group Incorporated;Speaker, Boston Scientific Corporation;Speaker, LIAM GmbH;
Vanessa F. Schmidt, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

We aimed to correlate alterations in the rat sarcoma virus (RAS)/mitogen-activated protein kinase pathway in vascular anomalies to the clinical phenotype for improved patient and treatment stratification.

**METHODS AND MATERIALS**

This retrospective multicenter cohort study included 29 patients with extracranial vascular anomalies containing mosaic pathogenic variants (PVs) in genes of the RAS/mitogen-activated protein kinase pathway. Tissue samples were collected during invasive treatment or clinically indicated biopsies. PVs were detected by the targeted sequencing of panels of genes known to be associated with vascular anomalies, performed using DNA from affected tissue. Subgroup analyses were performed according to the affected genes with regard to phenotypic characteristics in a descriptive manner.

**RESULTS**

Twenty-five vascular malformations, 3 vascular tumors, and 1 patient with both a vascular malformation and vascular tumor presented the following distribution of PVs in genes: Kirsten rat sarcoma viral oncogene (n=10), neuroblastoma ras viral oncogene homolog (n=1), Harvey rat sarcoma viral oncogene homolog (n=5), V-Raf murine sarcoma viral oncogene homolog B (n=8), and mitogen-activated protein kinase kinase 1 (n=5). Patients with RAS PVs had advanced disease stages according to the Schobinger classification (stage 3-4: RAS, 9/13 versus non-RAS, 3/11) and more frequent progression after treatment (RAS, 10/13 versus non-RAS, 2/11). Lesions with Kirsten rat sarcoma viral oncogene PVs infiltrated more tissue layers compared with the other PVs including other RAS PVs (multiple tissue layers: Kirsten rat sarcoma viral oncogene, 8/10 versus other PVs, 6/19).

**CONCLUSION**

This comparison of patients with various PVs in genes of the RAS/MAPK pathway provides potential associations with certain morphological and clinical phenotypes.

**CLINICAL RELEVANCE/APPLICATION**

RAS variants were associated with more aggressive phenotypes, generating preliminary data and hypothesis for future larger studies.

## M5A-SPIR-9 LIVER TUMOR RABBITS MODEL BUILD WITH A NEWLY DEVELOPED $VX_2$ RABBIT CARCINOMA CELL LINE

Shenbo Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the application of a newly established transplantable VX2 rabbit carcinoma cell line in building rabbit models of liver cancer.

**METHODS AND MATERIALS**

The Institute of Basic Medical Sciences of the Chinese Academy of Medical Sciences provided the cell line. The cell line originated from the VX2 tumor strain and has cultured 21 generations. A total of 2 ×108 VX2 cells <and> conventional VX2 tumor strains were injected into the hind limb muscle of 2 healthy New Zealand white rabbits respectively. Two weeks later the VX2 tumor was harvested and transplanted into the liver of 15 healthy Newzeland white rabbits (10 cell-line-derived tumors and 5 tumor-strain-derived tumors). To evaluate tumor growth, all of the rabbits underwent CT scanning 2 weeks after transplantation. The rabbits were sacrificed 3 weeks after transplantation to harvest the tumor for pathological examination (hematoxylin-eosin staining).

**RESULTS**

The tumor grew in both VX2-cell-line-injected <and> VX2-tumor-strains-injected rabbits. Tumor growth was observed in five of ten that underwent cell-line-derived tumor transplantation, <and> three of five rabbits that underwent tumor-strain-derived tumor transplantation. Pathological examination demonstrated similar microscopic construction between tumor-strain-derived tumors <and> cell-line-derived tumors.

**CONCLUSION**

This newly developed VX2 rabbit carcinoma cell line can generate tumors in healthy Newzeland White rabbits. The generated tumor has similar pathological characters under hematoxylin-eosin staining with conventional tumor-strains-derived tumors.

**CLINICAL RELEVANCE/APPLICATION**

This newly developed VX2 rabbit carcinoma cell line is promising to replace the conventional tumor strain in building rabbit models of liver cancer.

# Abstract Archives of the RSNA, 2024

M5A-SPMK

**Musculoskeletal Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPMK-1 A Conditional GAN Approach for Artifact Removal: Preserving Pathological Patterns in Dual-energy CT Imaging

Ashok Kambaluru (*Abstract Co-Author*) Nothing to Disclose
Chankue Park, MD (*Abstract Co-Author*) Nothing to Disclose
Siyeoul Lee (*Abstract Co-Author*) Nothing to Disclose
Seonho Kim (*Abstract Co-Author*) Nothing to Disclose
Minwoo Kim (*Abstract Co-Author*) Nothing to Disclose
Dongeon Lee (*Abstract Co-Author*) Nothing to Disclose
Chunsu Park, MS, BA (*Presenter*) Nothing to Disclose

### PURPOSE

Artifacts in dual-energy CT (DECT) can obscure or simulate the pathological edema patterns, leading to incorrect interpretations if not properly recognized. Although conventional deep neural networks have been employed to eliminate artifacts in DECT, there is a risk of unintentionally changing the appearance of edema patterns because of the similarity to artifacts. We developed a novel framework to enhance networks maintaining bone structure integrity while selectively removing artifacts and ensuring that the generated images retain crucial patterns for disease diagnosis.

### METHODS AND MATERIALS

This retrospective study was approved by the institutional review board and the need for informed consent was waived. We collected DECT (80 and 140 kVp, Revolution CT; GEHealthcare) and corresponding MRI images from 70 patients meeting the conditions for accurate annotation and data integrity. Regions of interest were annotated, extracted, and resized to (256 × 256). We used 2,901 slices (n = 56, mean age: 57 ± 11years; 30 female) and 731 slices (n = 14, mean age: 63 ± 12years; 8 female), for training and testing, respectively. Our network's architecture comprises multiple neural networks that are strategically interconnected, enabling artifact removal to access a diverse set of artifact-corrupted bone images. This configuration directs the model to proficiently distinguish between artifacts and pathological edema patterns, facilitating effective isolation.

### RESULTS

We evaluated the efficacy of our proposed method by comparing it to various attribute-editing image reconstruction methods such as FaderNet, StarGAN, and CycleGAN. Our model, CAPTURE-GAN, demonstrated superior effectiveness in clearing a variety of artifact patterns (87.7%) while retaining edema characteristics (80.3%). At the same time, CAPTURE-GAN maintained the integrity of tissue structure and texture, crucial for identifying diseases. These results are supported by quantitative evaluation findings with high PSNR (39.52) and SSIM (0.986).

### CONCLUSION

Our study presents a new solution aimed at improving the interpretation of DECT images by preserving critical edema patterns while removing artifacts. This approach utilizes a classifier and masks during the training process, offering a simple yet impactful method for maintaining essential information about edema, which is vital and must not be compromised. Remarkably, our model outperforms existing networks in preserving edema features while effectively eliminating artifacts.

### CLINICAL RELEVANCE/APPLICATION

Our innovative artifact removal can enhance the diagnostic accuracy of medical professionals with limited experience in DECT, especially by minimizing misinterpretations of normal patterns as abnormal findings.

## M5A-SPMK-2 DEEP LEARNING MODEL DEVELOPMENT FOR SCREENING JOINT INFLAMMATION IN HAND RADIOGRAPH OF RHEUMATOID ARTHRITIS PATIENTS

Keum San Chun, PhD (*Abstract Co-Author*) Nothing to Disclose
Hyemin Park (*Abstract Co-Author*) Nothing to Disclose
Sungwon Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Joon-Yong Jung, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seung Eun Lee, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Ultrasound is the standard imaging modality to evaluate the inflammatory changes in hand joints of rheumatoid arthritis (RA) patients. However, it is operator-dependent and takes a long time to examine. In this study, we developed the deep learning (DL) model to automatically detect the joint location and inflammation in the hand radiographs of RA patients.

## METHODS AND MATERIALS

The two-step model consisted of a joint localization model (model 1) and an inflammation detection model (model 2). Two datasets of the anteroposterior (AP) view plain radiographs of both hands from two institutions (D1, n=330; D2, n=289) were used for model development. In model 1, D1 and D2 were used as training and test sets, respectively. DeepLabCuts algorithm was implemented to localize each hand and wrist joint as a radiocarpal, ulnocarpal, CMC, MCP, PIP, and DIP joint. The mean squared error (MSE) was calculated for model 1 evaluation. In model 2, D2 included the RA patients satisfying the ACR/EULAR RA classification criteria with the result of ultrasound exam of hand joints. Radiographs with severe joint deformity and artifact were excluded. Each hand and wrist joint were labeled positive or negative on plain radiographs based on the result of the ultrasound exam. A positive label was assigned in two conditions: 1) both synovitis and increased effusion were observed, 2) either synovitis or increased effusion was present in the ultrasound image accompanied by the steroid injection. We grouped 36 joints on both hands and wrists into three categories based on their anatomical shapes. Each joint group was assigned an instance of model 2, a pre-trained ResNet50. The input images were pre-processed using contrast limited adaptive histogram equalization (CLAHE) and resized into 224-by-224 image prior to getting input to model 2. The classification performance for each group was reported separately with the precision, recall, and F1 score.

## RESULTS

In model 1, the test error of all joint was 3.06 ± 0.30 pixels and MSE was 0.098. In model 2, 418 finger joints (n=4,984), 152 radiocarpal joint (n=302) and 133 ulnocarpal joints (n=300) were labelled as positive after the curation of D2. The precision, recall, and F1 scores were in 65%, 88%, 75% in finger joint, 71%, 97%, 82% in radiocarpal joint, and 47%, 91%, 62% in ulnocarpal joint, respectively.

## CONCLUSION

Our developed DL model for joint localization and inflammation detection demonstrated high recall values, indicating its feasibility in identifying the disease affected joints and screening target joints for ultrasound examination in RA patients.

## CLINICAL RELEVANCE/APPLICATION

We can screen the inflammatory change on the hand radiograph with the DL model assistance and offer the information about target joint for ultrasound examination.

# M5A-SPMK-4 BENCHMARKABLE EXTERNAL VALIDATION FOR SEQUENTIAL ADOPTION OF AN AI SOLUTION AT FOUR HOSPITALS IN VESTRE-VIKEN HOSPITAL TRUST (VV), NORWAY

Jonas Vardal, MD (*Abstract Co-Author*) Nothing to Disclose
Ramprabananth Sivanandan, MD, MBBS (*Presenter*) Nothing to Disclose

## PURPOSE

Being the first to implement a commercially CE approved AI solution in a clinical workflow setting in Norway, a benchmarkable external validation was conducted in one of the hospitals to evaluate a bone fracture algorithm. Subsequent mini validations were carried out on other hospitals within VV to ensure consistency and reliability across multiple locations.

## METHODS AND MATERIALS

This AI algorithm was used to detect fractures on X-rays with patient history of recent trauma. Validation occurred in three phases involving 1,601 examinations (fig.1). Phase 1, a double-blinded retrospective study was conducted over a seven-month period that included 634 examinations with a balanced distribution of positive and negative cases among different age groups, and fracture locations (fig.2). Additional findings included various fracture types and related findings such as casts, prostheses, effusions, or bone lesions. Phase 2 was also a retrospective double-blinded study over a two-week period with 465 examinations. Phase 3 was a prospective study allowing radiologist access to AI results, covering 504 examinations over another two-week period. Validation was conducted by three board-certified radiologists and two radiology residents, with ground truth established via radiologist reports, relevant CT and MRI related to the history. Mini validations at other hospitals were based on Phase 2, with outcomes compared to benchmarked results.

## RESULTS

In Phase 1, AI detection accuracy was 91.3%, compared to 95.2% for radiologists' reports. Phase 3 showed an increase in sensitivity from 93% to 98% with AI assistance, although specificity marginally decreased from 99.3% to 98.8%. Mini validation results across hospitals showed slight variations but remained consistent with benchmarked outcomes (fig.3).

## CONCLUSION

The study effectively mitigated bias related to fracture location in Phase 1 and assessed real-world applicability in Phase 2 through mini validations at other hospitals. Phase 3 evaluated the enhanced diagnostic outcomes with AI assistance. Overall, the AI application demonstrated good accuracy, slightly lower than that of radiologists but significantly improved sensitivity and accuracy with AI support.

## CLINICAL RELEVANCE/APPLICATION

The multiphasic external validation helped in secure and successful adoption of this AI algorithm and sequential implementation across multiple hospitals at VV through mini validation. Also, incorporation of this AI algorithm enhanced the diagnostic process in clinical settings.

# Abstract Archives of the RSNA, 2024

M5A-SPMS

**Multisystem Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPMS-1 PREDICTION OF METASTATIC AND NON-METASTATIC PELVIC AND RETROPERITONEAL LYMPH NODES BASED ON RADIOMICS ON CT IMAGES

Yaofeng Zhang (*Abstract Co-Author*) Nothing to Disclose
Kexin Wang (*Abstract Co-Author*) Nothing to Disclose
Xiaodong Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Jinpeng Li (*Presenter*) Nothing to Disclose

### PURPOSE

To establish a model by radiomics to predict pelvic and retroperitoneal metastatic/non-metastatic lymph nodes in patients with malignant tumors.

### METHODS AND MATERIALS

A total of 215 preoperative abdominal and pelvic enhanced CT scans of the patients who underwent lymph node related pathological examinations at our center and were confirmed to have pelvic and retroperitoneal lymph node metastases were retrospective collected to construct the model. Another 38 preoperative enhanced CT scans of the patients under the same conditions (different time periods) were retrospective collected as hold-out test set, and the two datasets were mutually exclusive. The ground truth was determined after a doctor marked metastatic/non-metastatic lymph nodes according to the the region and size of the metastatic/non-metastatic lymph nodes in the corresponding pathological report and CT image features, and examined by another doctor. Using CT portal vein phase thin-layer images as input, a predictive model was established using radiomics and deep learning radiomics. AUC was used to evaluate the classification performance of each combination method in the test set of the model construction data and hold-out test set. Four combination methods, radiomics and deep learning radiomics, were selected with the highest AUC in the test set and hold-out test set, respectively. The model performance was evaluated by sensitivity, specificity, accuracy, PPV, NPV, and AUCs of ROC curves in the test set of the model construction data and hold-out test set. Comparing the AUCs of radiomics models with different combinations by Delong test.

### RESULTS

For the test set of model construction data, the sensitivity, specificity, accuracy, PPV, NPV, and AUC of the four different combinations of radiomics models were the highest at 0.818 (0.746,0.890), 0.910 (0.847,0.974), 0.830 (0.828,0.831), 0.908 (0.843,0.973), 0.767 (0.678,0.857), and 0.899 (0.856,0.942). For the hold-out test set, the sensitivity, specificity, accuracy, PPV, NPV, and AUC of the four different combinations of omics models were the highest at 0.828 (0.736,0.921), 0.907 (0.830,0.985), 0.856 (0.854,0.858), 0.906 (0.827,0.984), 0.814 (0.714,0.913), and 0.885 (0.823,0.946). There was no statistically significant difference in AUCs among the four different combinations of radiomics models in the test set for model construction data or hold-out test set.

### CONCLUSION

Based on radiomics, it is great to predict pelvic and retroperitoneal lymph node metastasis or non-metastasis in patients with malignant tumors.

### CLINICAL RELEVANCE/APPLICATION

Radiomics and deep learning radiomics models were developed to predict pelvic and retroperitoneal metastatic/non-metastatic lymph nodes in patients with malignant tumors.

## M5A-SPMS-2 MRI-BASED PREDICTION OF TOTAL AND REGIONAL BRAIN VOLUME LOSS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS, INDEPENDENT OF THE VISCERAL FAT DISTRIBUTION

Nasrin Akbari (*Abstract Co-Author*) Nothing to Disclose
Saqib Basar (*Abstract Co-Author*) Nothing to Disclose
Arun Rajendran (*Abstract Co-Author*) Nothing to Disclose
Madhurima Datta (*Abstract Co-Author*) Nothing to Disclose
Yosef G. Chodakiewitz, MD (*Abstract Co-Author*) Nothing to Disclose
Sam Hashemi, MSc (*Abstract Co-Author*) Nothing to Disclose
Thanh Duc Nguyen (*Abstract Co-Author*) Nothing to Disclose
Saurabh Garg (*Abstract Co-Author*) Nothing to Disclose
Ahmed Gouda, MSc (*Abstract Co-Author*) Nothing to Disclose
Soojin Lee (*Presenter*) Nothing to Disclose

## PURPOSE

This study aims to investigate the link between Type 2 Diabetes Mellitus (T2DM) and brain volume, while controlling for age, gender, and visceral fat distribution.

## METHODS AND MATERIALS

The study analyzed whole-body MRIs (WB-MRI) acquired at 1.5 T from 341 patients with T2DM and compared with 338 non-diabetics matching for age, gender and visceral fat distribution. Brain volumes were segmented into 96 regions using FastSurfer, with normalization by intracranial volume. Visceral fat (vfat) volume was segmented using 3D nnU-Net model. T-tests were used to compare mean total brain volumes, including gray and white matter zones, lobes (frontal, temporal, parietal, and occipital), and Alzheimer's prone regions (i.e., hippocampus, posterior cingulate, and precuneus).

## RESULTS

No statistically significant differences were observed in the mean ages of the T2DM group (63.03 ± 10.82) and the normal group (mean age 62.86 ± 10.64).The mean BMI and vfat distributions were 29.84 kg/m2 and 4835.38 ml in the T2DM group as compared to 29.80 kg/m2 and 4831.20 ml in the non-diabetic group. T2DM was associated with lower total brain volume ($p = 0.024$) and white matter volume ($p = 0.007$). There were no statistically significant reductions in gray matter ($p = 0.062$) or hippocampal volume ($p = 0.290$) within the T2DM group. T2DM-related white matter loss was most pronounced in the occipital lobe ($p = 0.034$). While lower volumes were also observed in the frontal lobe ($p = 0.066$), left caudate ($p = 0.059$) and right caudate ($p = 0.069$) regions, the results did not reach statistical significance.

## CONCLUSION

Lower total brain and white matter volumes suggest a structural impact of the metabolic disorder on the brain. These findings suggest a direct association between T2DM and brain morphology, suggesting potential pathways through which T2DM may contribute to neurological changes. Interestingly, T2DM has shown to be a risk factor for Lewy body and Parkinson's disease dementia, which has been associated with an abnormal appearance of the occipito-parietal region on brain MRIs.

## CLINICAL RELEVANCE/APPLICATION

This study uncovers a significant link between T2DM and reduced brain volume, particularly in white matter, independent of obesity. These findings emphasize the structural impact of diabetes on the brain, which may explain the cognitive decline seen in T2DM patients.

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# Abstract Archives of the RSNA, 2024

M5A-SPNMMI

**Nuclear Medicine & Molecular Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPNMMI-1 ASSOCIATION BETWEEN PRETREATMENT C-11 METHIONINE PET METRICS, HISTOLOGY, AND PROGNOSIS IN 125 NEWLY DIAGNOSED ADULT-TYPE DIFFUSE GLIOMA PATIENTS BASED ON THE WHO 2021 CLASSIFICATION

Atsushi Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Michinobu Nagao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shuji Sakai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Koichiro Kaneko, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To clarify the relationships between 11C-methionine (MET) positron emission tomography (PET) metrics and the histology, genetics, and prognosis of adult-type diffuse glioma (ADG) based on the World Health Organization (WHO) 2021 classification.

### METHODS AND MATERIALS

A total of 125 newly diagnosed ADG patients were enrolled. We compared the maximum standardized uptake value (SUVmax), tumor-to-normal ratio (TNR), metabolic tumor volume (MTV), and total lesion methionine uptake (TLMU) to the histology and genetics of the ADG patients. We also evaluated the prognoses of the 93 surgically treated patients.

### RESULTS

The isocitrate dehydrogenase (IDH) wild (w) ADG patients showed significantly higher MET-PET metrics ($p<0.05$ for all parameters), significantly shorter overall survival (OS) and progression-free survival (PFS) ($p<0.0001$ for both) than those of the IDH mutant (m) ADG patients. Among the parameters, the TNR showed the highest area under the curve (0.77) (0.63-0.74) for differentiating these patient groups. In the IDHm ADG group, the SUVmax, MTV, and TLMU values were significantly higher in IDHm grade (G) 4 astrocytoma patients than IDHm G2/3 astrocytoma patients ($p<0.05$ for all), but not than G2-3 oligodendroglioma patients. The PFS was significantly shorter in the G4 astrocytoma patients versus the G2/3 astrocytoma and G3 oligodendroglioma patients ($p<0.05$ for both). The SUVmax and TNR values were significantly higher in recurrent patients than non-recurrent patients ($p<0.01$ for both), but no significant differences were found in MTV or TLMU values.

### CONCLUSION

MET-PET metrics well reflect the histological subtype, WHO grade and prognosis of ADG based on the 2021 WHO classification, with the exception of oligodendroglial tumors. Volumetric parameters were not significantly associated with recurrence, unlike the SUVmax and TNR.

### CLINICAL RELEVANCE/APPLICATION

1) MET-PET metrics well reflect the histological subtype of ADG based on the new WHO 2021 classification, but oligodendroglial tumors shows high MET-PET metrics regardless of their favorable prognosis.2) TNR is the best parameter for distinguish IDH wild ADGs from IDH mutant ADGs.3) Preoperative TNR and SUVmax values are significantly associated with prognosis.of ADG patients. However, volumetric parameters such as MTV and TLMU are not associated with prognosis unlike those of FDG-PET in other malignancies.

## M5A-SPNMMI-2 EXTRACELLULAR VOLUME FRACTION (ECV) VALUE IN LUNG CANCER CALCULATED FROM PHOTON-COUNTING DETECTOR CT: CORRELATION OF ECV VALUES WITH [18-F] FAPI-PET/CT AND [18-F] FDG-PET/CT UPTAKE VALUES

Ryo Ogawa, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Shuhei Doi, MD (*Abstract Co-Author*) Nothing to Disclose
Yukiko Tokuda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasushi Shintani, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Keisuke Ninomiya (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazuki Yamagata, MD (*Abstract Co-Author*) Nothing to Disclose
Mitsuaki Tatsumi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akinori Hata, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuriko Yoshida (*Abstract Co-Author*) Nothing to Disclose
Daiki Nishigaki, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Yanagawa, MD, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

[18-F]-labeled fibroblast activation protein inhibitor (FAPI)-PET/CT can visualize cancer stroma such as cancer-associated fibroblasts (CAF). Comprehensive spectral data using photon-counting detector (PCD)-CT may provide more accurate extracellular volume fraction (ECV) value associated with CAF. The aim of this study was to compare ECV values on PCD-CT between uptake values on [18-F] FAPI-PET/CT and [18-F] FDG (fluorodeoxyglucose)-PET/CT.

## METHODS AND MATERIALS

13 nodules with 12 lung cancer patients (5 women) were scanned by PCD-CT. Unenhanced and enhanced CT (3-minute-delayed scan) images were obtained with 1 mm slice thickness using a reconstruction kernel (Qr40) and quantum iterative reconstruction level 4 (QIR4). The dose of contrast material (300mgI) per patient was decided on the basis of 2 ml per weight. Two different ECV values (ECV-a and ECV-b) were calculated from CT values (Hounsfield Units, HU) and iodine density (mg/cc) respectively. Formulas using hematocrit values (Hct) of each patient were as follows: 1) ECV-a (%) = (100-Hct) x [enhancement value in cancer (HU)] / [enhancement value in blood pool (HU)]; and 2) ECV-b (%) = (100-Hct) x [Iodine density in cancer (mg/cc)] / [Iodine density in blood pool (mg/cc)]. In [18-F] FAPI-PET/CT and [18-F] FDG (fluorodeoxyglucose)-PET/CT close to the imaging date of PCD-CT, each uptake value was measured at a location corresponding to the ECV measurement part. Correlation between each ECV value and each uptake value were evaluated using regression analysis. P values < 0.05 were considered significant.

## RESULTS

Size of nodules (8 part-solid and 5 solid) showed 23.0mm±10.2mm (mean ± standard deviation [SD]). ECV-a was 32.5±56.4% (mean ± SD) and ECV-b was 41.3±9.64% (mean ± SD). FAPI uptake showed 5.16±4.63 (mean ± SD) and FDG uptake showed 5.57±5.30 (mean ± SD). There was a significant correlation between ECV-b (y) and FAPI uptake (x) (correlation coefficient r, 0.56; regression equation, y=35.284 +1.159x; and p=0.048), but no correlation between ECV-a (y) and FAPI uptake (x) (correlation coefficient r, 0.09; regression equation, y=26.386 +1.187x; and p=0.75). Neither ECV-a nor ECV-b had a significant correlation with FDG uptake (correlation coefficient r, 0.20 and 0.41; p=0.578 and p=0.238, respectively).

## CONCLUSION

ECV-b value calculated from iodine density on PCD-CT significantly had a positive correlation with FAPI uptake, but not with FDG uptake.

## CLINICAL RELEVANCE/APPLICATION

ECV value with use of PCD-CT shows a positive correlation with FAPI uptake, it can be used as a biomarker to visualize CAF and may be useful in predicting lung cancer prognosis and treatment resistance.

# Abstract Archives of the RSNA, 2024

M5A-SPNPM

**Noninterpretive Skills (Beyond Imaging) Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPNPM-1 FEASIBILITY STUDY OF A VIRTUAL REALITY BREAST BIOPSY SIMULATION

Stefanie B. Zalasin, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie A. Woodard, DO (*Abstract Co-Author*) Investigator, Bracco Group Institutional research support, Bracco Group
Ceren Yalniz, MD (*Abstract Co-Author*) Nothing to Disclose
Yufeng Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Kathryn W. Zamora, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Kyle Kleiman (*Presenter*) Nothing to Disclose

### PURPOSE

To assess feasibility of a novel virtual reality breast biopsy simulation trainer.

### METHODS AND MATERIALS

This was a HIPAA-compliant, IRB-approved prospective feasibility study. The participants were three fellowship-trained breast radiologists with varying years of experience. Participants received an introduction to the virtual reality (VR) breast biopsy simulation and brief training session, describing how to enter the simulation and navigate controls. The participants were then instructed to perform as many breast biopsies as possible within a 15-minute period. One biopsy cycle consisted of entering the breast with the biopsy needle, taking a biopsy sample, and removing the needle. Time to successfully biopsy the mass was recorded by the VR program, and this data was recorded to assess improvement from start to finish of the simulation. A post-procedure survey was administered to all participants immediately after completion of the simulation. Qualitative open-ended subjective feedback was also obtained via Qualtrics.

### RESULTS

All three breast radiologists completed the simulation. There were no complications from the procedure, including no motion sickness or fatigue resulting in simulation termination. Results of data obtained from the simulation showed decreased time to successful biopsy (slope = -19.23) with each subsequent trial for each of the three participant breast radiologists. A decreased time to biopsy was associated with a higher cumulative number of successful biopsies ($p=0.0037$). A higher number of cumulative successful biopsies was associated with decreased number of body entries ($p=0.0332$) and biopsy fires ($p=0.0221$) before a successful tissue sample. Mean responses for Likert scale survey results were overall high. The radiologists found the simulator to be engaging (4.67/5.00 ± 0.47), realistic (2.67/3.00 ± 0.47) and would recommend the simulation to other healthcare professionals (2.67/3.00 ± 0.47). The radiologists participating in the trial also provided overall favorable subjective feedback.

### CONCLUSION

This study presents a novel approach for ultrasound-guided breast biopsy training with a VR simulation that showed to be successfully capable of recording time-to-completion of each biopsy attempt. Future studies will be directed towards assessing the utility of the simulation in improving trainee skills.

### CLINICAL RELEVANCE/APPLICATION

Ultrasound-guided breast biopsies are the most frequently performed image-guided breast procedures, but learners may lack volume. Virtual reality is an emerging technology, allowing learners to have flexibility in learning, life-like interactive experiences, and measurable feedback.

## M5A-SPNPM-2 ENVIRONMENTAL SUSTAINABILITY IN RADIOLOGY: EXCESS IMAGING UTILIZATION ATTRIBUTED TO POOR AIR QUALITY

Omar Taboun (*Abstract Co-Author*) Nothing to Disclose
Anish Kirpalani, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Hayley Panet (*Abstract Co-Author*) Nothing to Disclose
Maura J. Brown, MD (*Abstract Co-Author*) Synthesis Health Inc - research collaboration, no financial relationship at this time ( Nov 2022).
Kate Hanneman, MD, MPH (*Presenter*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc

### PURPOSE

There is growing recognition of the negative global impact of climate change on human health, including poor air quality related to pollution and wildfires. Climate disruptions are also associated with increased emergency department visits. However, there is currently no data on the association between environmental exposures and radiology volumes. The purpose of this study was to determine short-term associations of ambient air quality with emergency medical imaging utilization.

### METHODS AND MATERIALS

Daily imaging utilization counts from four emergency departments were retrospectively evaluated and linked to daily environmental data from the same geographic area over a 10-year period (2013-2022). Air quality health index (AQHI) was calculated based on daily direct measurement concentrations of ground-level ozone, nitrogen dioxide and fine particulate matter (PM2.5). A time-stratified case-crossover design was employed. Statistical analysis included conditional Poisson regression models to evaluate short-term associations of daily variations in ambient AQHI with daily emergency department imaging utilization for up to 7 days preceding imaging (lag 0-7). The moving average of mean daily AQHI was calculated to account for lagged exposure effects.

### RESULTS

Between 2013-2022, 1,666,420 imaging tests were performed with mean ambient daily AQHI of 2.8±0.7. Mean AQHI was associated with total imaging utilization at lags 0, 1, 2, 3, 4 and 5, with highest effect at lag 1 (day after exposure), gradually diminishing in magnitude and significance thereafter. A rise of 1 unit in the 3-day moving average of AQHI (representing the average exposure of air quality over the current and previous 2 days) was associated with an overall imaging utilization increase of 2.9% (IRR 1.029; 95% CI 1.025, 1.033). Poor air quality, defined using a previously established high health risk AQHI cut point (maximum AQHI =7), was associated with overall imaging utilization increase of 4.1% (IRR 1.041; 95% CI 1.033, 1.050) compared to low health risk air quality (AQHI <4) as the reference category. When stratified by imaging modality, worse AQHI was associated with increased x-ray, CT, and ultrasound imaging utilization but not MRI.

### CONCLUSION

Poor air quality is associated with increased emergency department medical imaging utilization. Individual daily effects are modest, however the cumulative impact of poor air quality on imaging utilization is substantial.

### CLINICAL RELEVANCE/APPLICATION

These results are timely given poor air quality associated with recent increases in the frequency and severity of wildfires and can be used to inform adaptation strategies to prepare for surges in imaging utilization.

## M5A-SPNPM-3 CREATING A GREENER OUTPATIENT MRI FACILITY: ENHANCING SUSTAINABILITY AND ENERGY EFFICIENCY THROUGH FAST IMAGING TECHNIQUES

Vibhas Deshpande, PhD (*Abstract Co-Author*) Researcher, Siemens AG
Susie Y. Huang, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Sean A. Woolen, MD, MS (*Abstract Co-Author*) Research Grant, Siemens AG;Investigator, Siemens AG
Amy Becker (*Abstract Co-Author*) Nothing to Disclose
Wei-Ching Lo (*Abstract Co-Author*) Employee, Siemens AG
Pan Su (*Abstract Co-Author*) Nothing to Disclose
Azadeh Tabari, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Energy consumption during active MRI scanning varies between scanners, pulse sequences and protocol. The goal of this study was to investigate the impact of MRI acquisition time reduction on energy efficiency, cost, and carbon savings through implementing fast MRI techniques for three commonly performed neurological, body, and musculoskeletal MRI exams. We hypothesized that accelerating MRI acquisition would reduce the energy consumption, electricity cost, and associated greenhouse gas emissions of MR scanning commensurately.

### METHODS AND MATERIALS

Net scan times (i.e., acquisition time = active mode - exam preparation time) were acquired for pituitary, lumbar spine (L-spine) and prostate MRI examinations on 4 identical outpatient 70-cm-bore 3T scanners (MAGNETOM Vida; Siemens Healthineers, Forchheim, Germany) at established outpatient imaging facilities during pre-implementation (3/1/2019-3/1/2020) and our new sustainable outpatient imaging facility during post-implementation periods (3/1/2022-3/1/2023) (Table 1). Power measurement logs were extracted for these protocols. Per-examination energy consumption, cost (estimated at $0.252/kWh in Massachusetts), and carbon savings were calculated retrospectively.

### RESULTS

The median net scan times for pituitary, L-spine and prostate protocols were 24.3, 25.3 and 29.8 min, respectively, during the pre-implementation period. During the post-implementation period, the net scan times were reduced by 20% for pituitary, 62% for L-spine and 48% for prostate protocols (19.5, 9.6 and 15.5 min, respectively). The per-examination energy consumption for pituitary, L-spine and prostate protocols using accelerated MRI sequences during net scan time were reduced by 3.69, 8.36 and 12.59 kWh (Fig. 1), respectively, translating to a potential cost savings of $0.95 (26%), $2.1 (62%), $3.17 (54%), and carbon savings of 0.003 (24%), 0.006 (59%) and 0.009 (53%) MTCO2eq per-MRI examination.

### CONCLUSION

The implementation of fast pituitary, L-spine and prostate MRI sequences significantly reduced the acquisition times for these three commonly performed neurological, body, and musculoskeletal MRI protocols. The results indicate that higher energy efficiency may be attained by shortening net scan times, with substantial concomitant carbon- and cost-saving potential.

### CLINICAL RELEVANCE/APPLICATION

Shortening MR examinations reduces energy expenditure during active scanning and achieves greater energy efficiency, as exemplified through three commonly performed MRI exams (pituitary, lumbar spine, prostate). The amount of carbon- and cost-savings that can be achieved through this approach is synergistic with improved patient care.

# Abstract Archives of the RSNA, 2024

M5A-SPNR

**Neuroradiology Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPNR-10 ASSOCIATIONS OF TENSOR-BASED BRAIN MORPHOMETRY WITH AUTOPSY CONFIRMED LIMBIC AGE-RELATED TDP-43 PATHOLOGY (LATE)

Konstantinos Arfanakis, PhD (*Abstract Co-Author*) Nothing to Disclose
David A. Bennett, MD (*Abstract Co-Author*) Nothing to Disclose
Abdur Raquib Ridwan, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahir Tazwar, BS (*Abstract Co-Author*) Nothing to Disclose
Julie A. Schneider, MD (*Abstract Co-Author*) Nothing to Disclose
Arnold M. Evia JR, PhD (*Abstract Co-Author*) Nothing to Disclose
Rasheed Abid, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

Limbic-predominant age-related TDP-43 encephalopathy neuropathological change (LATE-NC) is common in older adults and has been associated with substantial cognitive impairment. However, the association of LATE-NC with brain morphometry has not been thoroughly investigated. In this work, we examined the association of LATE-NC with brain morphometric anomalies using tensor-based morphometry (TBM) in a large community cohort of older adults that came to autopsy (N=897).

### METHODS AND MATERIALS

Cerebral hemispheres were acquired from 897 deceased older adults participating in Rush Memory and Aging Project, Religious Orders Study, Minority Aging Research Study, and Clinical Core. Hemispheres were imaged ex-vivo on 3T MRI scanners using 2D spin-echo sequence (voxel size=0.6×0.6×1.5mm3), which was followed by detailed neuropathologic examination. The participant scans were non-linearly registered to an ex-vivo template, and the resulting deformation fields were used to calculate the logarithm of the Jacobian determinant in each voxel (LogJ maps).Voxelwise linear regression was used to test the association between deformations shown in the LogJ maps and LATE-NC stages, controlling for other age-related neuropathologies (Alzheimer's disease, Lewy bodies, arteriolosclerosis, atherosclerosis, cerebral amyloid angiopathy, gross and microscopic infarcts), age at death, sex, education, postmortem intervals, and scanners. To identify the earliest LATE-NC stage exhibiting morphometric abnormalities, LogJ values were compared between LATE-NC stages 1-5 and stage 0. Statistical significance was set at $p<0.05$.

### RESULTS

Voxelwise analysis revealed an independent association of LATE-NC with significantly lower volume in both gray and white matter regions within the temporal and frontal lobes and basal ganglia ($p<0.05$), including amygdala, hippocampus, entorhinal, parahippocampal, temporal pole, inferior temporal, middle temporal, fusiform, medial orbitofrontal, lateral orbitofrontal, insula, accumbens, and putamen cortices. Groupwise comparison of LogJ values revealed significant morphometric anomalies in small temporal lobe areas in stages 1-2, more temporal lobe as well as basal ganglia tissue in stage 3, and finally also included frontal lobe areas in stages 4-5.

### CONCLUSION

The present study showed a spatial pattern of morphometric abnormality that is consistent with the known pathological distribution of LATE-NC. The anomalies were detected as early as LATE-NC stage 1, suggesting that MRI is sensitive to the early stages of the disease.

### CLINICAL RELEVANCE/APPLICATION

This pattern may potentially be used in the development of a marker of LATE-NC, which currently can only be definitively diagnosed at autopsy.

## M5A-SPNR-11 TRACKING DISABILITY IN MULTIPLE SCLEROSIS USING DIFFUSION MRI

Els Fieremans, PhD (*Abstract Co-Author*) Scientific Advisory Board, Microstructure Imaging, Inc;Stockholder, Microstructure Imaging, Inc;Royalties, General Electric Company
Timothy M. Shepherd, MD, PhD (*Abstract Co-Author*) Co-founder, MICroStructure Imaging
Ilya Kister (*Abstract Co-Author*) Nothing to Disclose
Santiago Coelho, PhD (*Abstract Co-Author*) Nothing to Disclose
Nalini Jeet (*Abstract Co-Author*) Nothing to Disclose
Dmitry S. Novikov, PhD (*Abstract Co-Author*) Scientific Advisor, Microstructure Imaging, Inc;Stockholder, Microstructure Imaging, Inc
Benjamin Ades-Aron, PhD (*Abstract Co-Author*) Stockholder, Microstructure Imaging Inc
Valentin N. Stepanov, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study investigates microstructural changes in the normal appearing white matter (NAWM) of Multiple Sclerosis (MS) patients over time using clinically feasible diffusion tensor imaging (DTI) and diffusion kurtosis imaging (DKI). By comparing the diffusion metrics against commonly used clinical markers such as volumetrics and lesion load (LL), we aim to demonstrate their superior sensitivity in detecting subtle changes associated with disease progression in MS.

**METHODS AND MATERIALS**

This IRB-approved prospective study longitudinally monitored 36 MS patients (23 females; mean age 52 ± 11.5 years; median EDSS 4.5 ± 2.5) over an average period of 467 days (±102 days). MRI conducted using 3T Siemens Prisma and included multi-shell diffusion MRI (dMRI), with acquisition time 10 min, from which DTI and DKI metrics were extracted. WM regions of interest (ROI) were obtained using the JHU atlas. T1w MPRAGE and T2w FLAIR were used to quantify volumes of cortical gray matter (GM), basal nuclei, thalami, corpus callosum, overall WM, and lesions as well as LL using Freesurfer and Samseg. Symbol Digit Modalities Test (SDMT) was measured to evaluate cognitive decline. For all metrics, we derived changes between two timepoints, and used Spearman rank tests to assess correlations between changes in imaging markers and SDMT, adjusted for age at disease onset, with correlation coefficients (?) reported and significance set at $p < 0.05$.

**RESULTS**

Longitudinally, significant correlations were observed between changes in SDMT and dMRI metrics: Mean and Radial Diffusivities in the anterior corona radiata demonstrated negative correlations (? = -0.43, -0.40 respectively). Fractional Anisotropy in the superior longitudinal fasciculus (SLF) showed a positive correlation (? = 0.43). Additionally, Mean Kurtosis in overall WM and Radial Kurtosis in the posterior thalamic radiation and SLF correlated positively (? = 0.44, 0.58, and 0.55 respectively). In contrast, no significant correlations were found between changes in SDMT and the volumes of interest in GM or WM, or LL. The exclusion of lesions from the ROIs did not substantially alter these results, indicating that the observed correlations are primarily driven by subtle global changes in the NAWM rather than localized lesion effects.

**CONCLUSION**

Diffusion MRI (DTI and DKI) of the NAWM is sensitive to changes associated with cognitive decline in MS over time, unlike structural MRI. This study highlights the potential of dMRI as a clinically feasible method offering new insights for monitoring disease progression in MS patients.

**CLINICAL RELEVANCE/APPLICATION**

These findings highlight the potential of dMRI to enhance monitoring accuracy of MS progression in clinical settings and to inform future therapeutic strategies.

## M5A-SPNR-12 INVESTIGATING OXYGEN METABOLISM ABNORMALITIES IN PARKINSON DISEASE

Junghun Cho, PhD (*Abstract Co-Author*) Nothing to Disclose
Arpita Misra (*Presenter*) Nothing to Disclose

**PURPOSE**

Although Parkinson's disease (PD) is the second most common neurodegenerative disorder, no cure currently exists. This is partly due to the lack of sensitive biomarkers capable of detecting disease-related changes, which hinders the development of effective treatment. In this study, we introduce oxygen extraction fraction (OEF) as a novel biomarker for investigating metabolic abnormalities in PD. OEF, the ratio of oxygen tissue extracts from the blood, directly quantifies tissue viability and functionality. We investigate the differences in OEF between PD patients and healthy controls (HC), and the relationship of OEF with iron accumulation in PD.

**METHODS AND MATERIALS**

A routine multi-echo gradient echo (mGRE) data was acquired from 25 PD patients and 22 HC. OEF was calculated by using a novel integrative model of quantitative susceptibility mapping (QSM) and quantitative blood oxygen level-dependent imaging (qBOLD), termed QQ (QSM+qBOLD=QQ). Iron accumulation was measured by another parameter from QQ, non-blood tissue susceptibility (?n ). Multivariate regression analysis was used to compare OEF and ?n between PD and HC, to access relationship between OEF and ?n , and between OEF and Mini-Mental-State-Examination (MMSE).

**RESULTS**

In cortical and basal ganglia regions, OEF and ?n were significantly higher ($p<0.05$) in PD compared to HC. In PD, OEF was associated with ?n and MMSE. These results are consistent with literature expectations and suggest iron accumulation in PD brains and its compensatory increase in oxygen metabolism.

**CONCLUSION**

QQ-based OEF can be a meaningful biomarker to investigate metabolic abnormalities and their association with disease severality and progression in PD.

**CLINICAL RELEVANCE/APPLICATION**

A novel OEF mapping technique, QQ, utilizes a single routine MRI sequence without the need for impractical gas inhalation procedures to obtain OEF. Hence, QQ-based OEF may be readily applied in clinical settings to study the causes and disease progression of PD.

## M5A-SPNR-13 DIAGNOSTIC PERFORMANCE OF PETRA-MRA IN THE FOLLOW-UP OF INTRACRANIAL ANEURYSMS AFTER CLIPPING

Sang Hyun Suh, MD (*Abstract Co-Author*) Nothing to Disclose
Hee Sang Oh (*Presenter*) Nothing to Disclose

**PURPOSE**

While follow-up assessment of clipped aneurysms (CAs) using magnetic resonance angiography (MRA) can be challenging due to susceptibility artifacts, a novel MRA sequence, Pointwise Encoding Time Reduction with Radial Acquisition (PETRA) subtraction-based MRA, has been developed to reduce these artifacts. We aimed to validate the diagnostic performance of PETRA-MRA by comparing it with digital subtraction angiography (DSA) as a reference for follow-up of CAs using 3T MR scanner.

**METHODS AND MATERIALS**

Patients with clipping who underwent both PETRA-MRA and DSA between September 2019 and December 2021 were retrospectively included. Two neuroradiologists independently reviewed with the reconstructed images of PETRA-MRA to assess the visibility of the arteries around the clips and aneurysm recurrence or remnant of CA using a 3-point scale. The diagnostic accuracy of PETRA-MRA was evaluated in comparison to DSA.

### RESULTS

The study included 34 patients (28 females, mean age 59 ± 9.6 years) with 48 CAs. PETRA-MRA allowed visualization of the parent vessels around the clips in 98% of cases, compared to 39% with time-of-flight (TOF) MRA ($p < 0.0001$). DSA confirmed 14 (29.2%) residual or recurrent aneurysms. PETRA-MRA demonstrated high accuracy, specificity, positive predictive value, and negative predictive value of 99.2%, 100%, 100%, and 97.8%, respectively, while the sensitivity was 66.7%.

### CONCLUSION

This retrospective study demonstrates that PETRA-MRA provides excellent visibility of adjacent vessels near clips and has a high diagnostic accuracy in detecting aneurysm remnants or recurrences in CAs. Further prospective studies are warranted to establish its utility as a reliable alternative for follow-up after clipping.

### CLINICAL RELEVANCE/APPLICATION

Ultra short echo time MRA(PETRA-MRA) was useful in the follow-up of both coiled and clipped aneurysm by reducing metal artifacts. However, previous studies for clipped aneurysms showed the preliminary result without evaluating diagnostic performance using DSA as a reference.In this study, PETRA-MRA had an excellent diagnostic performance in clipped aneurysms. By confirming the diagnostic performance of PETRA-MRA, further studies in a prospective large cohort study are needed, which will strengthen PETRA-MRA as a reliable alternative to other imaging modalities for the follow-up after clipping.

## M5A-SPNR-14 ASSESSING THE CENTRAL VEIN SIGN IN MULTIPLE SCLEROSIS USING CONTRAST-ENHANCED SEGMENTED 3D-FLAIR* ON A 1.5 T SYSTEM: A PROSPECTIVE OBSERVATIONAL STUDY

Ayse Altintas (*Abstract Co-Author*) Nothing to Disclose
Ali Yusuf Oner, MD (*Abstract Co-Author*) Nothing to Disclose
Hande Ozen Atalay, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmet Peker (*Abstract Co-Author*) Nothing to Disclose
Yunus Emre Senturk, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Central vein sign (CVS) in 3D FLAIR* imaging is becoming acknowledged as a successful technique for differentiating demyelinating plaque in multiple sclerosis (MS) from other types of white matter signal abnormalities when the early diagnosis is challenging with conventional MR imaging. The majority of current literature utilizes high magnetic field strengths in CVS assessment, such as 3T and 7T. Our objective is to assess the efficacy of CVS 3D-FLAIR* in 1.5 T systems enhanced with intravenous gadolinium-based contrast media (GBCA) and compare it with the CVS performance of GBCA-enhanced 3T FLAIR* imaging.

### METHODS AND MATERIALS

This is a prospective observational study in a single center from February 2022 to February 2023. 3D-FLAIR* was created with a 75% signal contribution from the segmented 3D EPI-T2* and a 25% signal contribution from the 3D-FLAIR imaging with an isotropic resolution of 0.8 mm. Overall, 41 GBCA-enhanced 1.5T 3D-FLAIR* and 28 GBCA-enhanced 3T 3D-FLAIR* were acquired from the participants with established MS diagnosis. First, the eligibility of each demyelinating lesion was determined based on the NAIMS-CVS criteria and assigned with number by the central rater (Y.E.S). Then the enumerated CVS-eligible lesions were classified as CVS+ or CVS- by the central rater and co-rater (A.P). Consequently, select-6* and percentage-based methods were utilized to assess the CVS efficacy in all patients.

### RESULTS

Overall, 895 lesions were eligible by the central rater based on NAIMS CVS criteria. 341 (59.7%) CVS+ lesions in GBCA-enhanced 1.5T and 226 (69.7%) CVS+ lesions in GBCA-enhanced 3T were identified. 39 of 41 participants in GBCA-enhanced 1.5T FLAIR* and 27 of 28 participants in GBCA-enhanced 3T FLAIR* met the select-6* requirements. Inter-rater and intra-rater reliability for GBCA-enhanced FLAIR* in 1.5T system are substantial (ICC1:0.79 and ICC2: 0.78 respectively). For the percentage-based system, GBCA-enhanced FLAIR* revealed a mean of 63% ± 14.8 in 1.5T systems and 72% ± 13.4 in 3T systems per participant ($p=0.015$).

### CONCLUSION

GBCA-enhanced 3D FLAIR* in 1.5T systems, albeit underperformed to 3T systems, was also efficient in the detection of CVS status considering the pre-determined threshold of the current literature for MS diagnosis.

### CLINICAL RELEVANCE/APPLICATION

With this proven diagnostic efficacy in detecting CVS, 1.5T scanners can be used to reinforce the present armada of higher-field MR scanners, in serving and reaching out to a wider number of MS patients worldwide.

## M5A-SPNR-15 VISCERAL FAT ACCUMULATION MEDIATES THE ASSOCIATIONBETWEEN HIPPOCAMPAL ATROPHY AND COGNITIVEANDEMOTIONAL IMPAIRMENTS IN MIDDLE-AGED NAFLD PATIENTS

Kuanghui Xu (*Abstract Co-Author*) Nothing to Disclose
Yihan Jin (*Abstract Co-Author*) Nothing to Disclose
Ruoyu Tang (*Abstract Co-Author*) Nothing to Disclose
Jie Li I, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaofei Chen (*Abstract Co-Author*) Nothing to Disclose
Liqiang Wu (*Abstract Co-Author*) Nothing to Disclose
Yuchi Tian (*Presenter*) Nothing to Disclose

### PURPOSE

Non-alcoholic fatty liver disease (NAFLD) is the most common chronic liver disease and is thought to be significantly associated with brain health, particularly in terms of cognitive impairment and mood disorders. However, the neuroanatomical basis of NAFLD and how brain morphology affects cognitive and emotional function remain unclear. This study aims to analyze the changes of brain structure and its relationship with cognitive function in patients with NAFLD using voxel-based morphometry (VBM).

### METHODS AND MATERIALS

Seventy-four patients with NAFLD and sixty-two healthy controls matched for sex, age, and years of education were recruited. All participants underwent high-resolution 3D-T1WI MRI scans to obtain whole-brain structural images. The difference of gray matter volume (GMV) between the two groups was

compared by voxel-based morphometry. Partial correlation analysis and mediation effect analysis were further used to assess the relationship between GMV values in abnormal regions and cognitive function, mood symptoms, and clinical indicators in NAFLD patients.

**RESULTS**

People with NAFLD exhibit impaired cognitive function, anxiety and depression. Compared to healthy controls, NAFLD patients showed reduced GMV in the bilateral hippocampus, the left parahippocampal gyrus, the right fusiform gyrus, the left middle temporal gyrus, the right supplementary motor area (SMA), and the right cerebellar hemisphere. In patients with NAFLD, GMV values in the right hippocampus and left parahippocampal gyrus were positively correlated with DST scores, while GMV values in the right fusiform gyrus were negatively correlated with waist-to-hip ratio. Medial analysis revealed that the relationship between GMV values in the right hippocampus and cognitive function and negative emotions was entirely mediated by liver fat content.

**CONCLUSION**

Patients with NAFLD exhibit atrophy in brain regions associated with reward circuits and sensorimotor networks. Among them, atrophy of the medial temporal lobe is associated with cognitive impairment, anxiety and depression, which is exacerbated by the accumulation of visceral fat.

**CLINICAL RELEVANCE/APPLICATION**

This study emphasizes the clinical significance of changes in specific brain regions in patients with non-alcoholic fatty liver disease (NAFLD), such as atrophy in the bilateral hippocampus and the left parahippocampal gyrus, linking these alterations to cognitive impairments and mood disorders, and indicates that controlling visceral fat accumulation can improve cognitive and emotional symptoms.

## M5A-SPNR-16 DYNAMIC DIGITAL RADIOGRAPHY: A NOVEL IMAGING TECHNIQUE TO INVESTIGATE PATIENTS WITH CERVICAL PAIN

Paolo F. Felisaz, MD (*Abstract Co-Author*) Nothing to Disclose
Giancarlo Oliva (*Abstract Co-Author*) Nothing to Disclose
Maurizio Ce, MD,BA (*Abstract Co-Author*) Nothing to Disclose
Laura Macri (*Abstract Co-Author*) Nothing to Disclose
Francesca Lucrezia Rabaiotti (*Abstract Co-Author*) Nothing to Disclose
Tatiana Lisnic (*Abstract Co-Author*) Nothing to Disclose
Michaela Cellina (*Presenter*) Nothing to Disclose

**PURPOSE**

Dynamic Digital Radiology (DDR) is a new imaging technique that allows, through pulsated X-Ray emission, the acquisition of high-resolution sequential imaging to assess the movement of different anatomical structures.Our aim was to assess the added value of cervical DDR (CDDR) in patients complaining cervical pain.

**METHODS AND MATERIALS**

We prospectively included patients evaluated by our Neurosurgeons for long-term cervical pain, poorly responsive to conservative treatments, who previously underwent MRI. Patients were carefully instructed on how to perform consecutive movement of cervical spine flexion and extension and tried the movement many times.CCDR acquisition parameters were as follows: MRI consisted of a standard acquisition protocol including sagittal T1-, T2 weighted and STIR sequences, and axial T2-weighted sequences. DDR acquisition parameters were: 70 Kv, 100 mA, 15 fps, esposure time: 5msec, acquisition time: 10 sec. Image analysis was performed by two experienced neuroradiologist and one neurosurgeon in consensus. Image analysis included on MRI: spondylarthrosis signs (osteophytes, vertebral plates sclerosis), spondylolisthesis, reduction of the intervertebral space, and signs of disc degeneration. On CDDR: spondylarthrosis signs, the range of the flexion and the extension movements (subjectively classified in normal or reduced), spondylolisthesis, reduction of the intervertebral space, presence of "stiff" disc, defined as a disk maintaining the same thickness during the whole dynamic cycle. The patients' management (surgical versus conservative) was established by two experience neurosurgeons in consensus.Radiation exposure was assessed by our physician as Dose area product (DAP).

**RESULTS**

20 patients (12 male; mean age 45 years) were enrolled.CDDR showed a reduced range of the cervical movements in 19/20 patients (95%). CDDR was comparable to MRI in assessing the presence of spondylarthrosis signs (present on both examinations in 20/20 cases)Signs of disc degeneration on MRI corresponded to reduction of the reduction of the intervertebral spaces high on DDR in 20/20 patients (100%). CDDR showed spondylolisthesis in 20/20 (100%) patients, whereas MRI missed listhesis in 5/20 patients (25%). CDDR highlighted the presence of stiff disc in 18 (90%) patients. CCDR findings changed the patients' management compared with what established with the sole MRI in 4/20 patients (20%).Mean DAP was 69 dGycm2.

**CONCLUSION**

CDDR allows an optimal evaluation of spondylarthrosis and adds functional information about the range of movement excursion and about the presence of stiff discs.

**CLINICAL RELEVANCE/APPLICATION**

DDR provide additional information useful for the management of patients complaining long-term cervical pain.

## M5A-SPNR-18 DYSREGULATED FUNCTIONAL NETWORK INTERACTIONS IN THE BRAIN OF DEPRESSION: FROM THE PERSPECTIVE OF THE TRIPLE-NETWORK MODEL

Manxi Xu (*Presenter*) Nothing to Disclose

**PURPOSE**

Major Depressive Disorder (MDD) has a high incidence and disability rate, imposing a significant economic burden on families and society. However, the etiology remains unclear, and objective diagnostic markers are lacking. Studies have shown alterations in functional connectivity within three interrelated neurocognitive networks: the Default Mode Network (DMN), Salience Network (SN), and Executive Control Network (ECN), which play a crucial role in MDD onset, symptoms, and response to antidepressant treatment . We hypothesize the presence of static and dynamic abnormal connectivity patterns in these core networks of MDD patients. To test this, we employ static functional network connectivity (FNC) analysis, dynamic functional network connectivity (dFNC), the network interaction index (NII), and the dynamic functional network connectivity (dNII) to investigate interactions among DMN, SN, and ECN, proposing reliable indicators.

**METHODS AND MATERIALS**

This study included 112 MDD patients diagnosed according to DSM-5 criteria and 49 healthy controls (HC). All participants underwent independent component analysis, and NII and FNC were computed based on the identified independent components. dFNC was derived using the sliding window

method, followed by K-means clustering of windowed dFNC. Mean dynamic network interaction index (mdNII) and the variance of dynamic network interaction index (vardNII) were calculated.

**RESULTS**

The results of static functional network connectivity show that compared to HC, NII of MDD patients significantly increase (T=-2.24; P=0.03). Further research find that the abnormality of NII in MDD patients is caused by a decrease in SN-DMN connectivity (T=2.19; P=0.03); The results of dynamic functional network connectivity show that after controlling for confounding factors, mdNII of the MDD patient group significantly increase compared to the control group (T=-3.68, P<0.001). Further research find that the abnormality of mdNII in MDD patients is caused by differences in SN-DMN connectivity (reduction), and this change is not affected by the clustering form.

**CONCLUSION**

MDD patients have abnormal network functional interactions that can be captured by static and dynamic NII indicators. The abnormal network interactions are mainly caused by reduced SN-DMN connectivity. This deepens our understanding of the abnormal activity of the three networks in MDD patients, helps to reveal the pathogenesis of MDD, and provides ideas for its intervention.

**CLINICAL RELEVANCE/APPLICATION**

This study reveals altered brain network connectivity in MDD patients, suggesting that measures like the Network Interaction Index (NII) could improve diagnosis and inform personalized treatments.

## M5A-SPNR-19 RADIOMIC PROFILING OF ANEURYSMAL BLEBS IS INFLUENCED BY HEMODYNAMICS AND MECHANICAL STRESS

Andres Gudino (*Abstract Co-Author*) Nothing to Disclose
Edgar Samaniego (*Abstract Co-Author*) Nothing to Disclose
Elena Sagues (*Abstract Co-Author*) Nothing to Disclose
Navami Shenoy (*Abstract Co-Author*) Nothing to Disclose
Arshaq Saleem (*Abstract Co-Author*) Nothing to Disclose
Daniela Molina (*Abstract Co-Author*) Nothing to Disclose
Sebastian Sanchez (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Jaramillo (*Abstract Co-Author*) Nothing to Disclose
Carlos Dier, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The presence of blebs increases the likelihood of aneurysms rupture. Radiomic profiling (RP) can provide information about signal intensity (SI) distribution within the aneurysm's wall. However, the specific radiomics features (RFs) of different compartments within the aneurysm, such as the bleb and the body sac, have yet to be studied. We analyzed the inter-relationship between RP of aneurysmal blebs and computational fluid dynamics (CFD) alongside finite element analysis (FEA).

**METHODS AND MATERIALS**

One hundred fourteen aneurysms were imaged from May 2019 to December 2022 with 3T-MRI. Blebs were adjudicated as focal outpouchings within the body of the aneurysms on 3-dimensional rotational angiography (3DRA). 3D Slicer was used to generate 3D models of the aneurysm's bodies and blebs. RFs were independently extracted from both the body and bleb in T1+Gadolinium (GD) MRI sequences. CFD and FEA were employed to calculate Wall Shear Stress (WSS) and Wall Tension (WT), respectively. Univariate regression models were utilized to compare the blebs and bodies of each aneurysm. Spearman's correlation analyses were conducted to assess the relationships between the blebs' RP and the metrics of WSS and WT.

**RESULTS**

Eighteen aneurysms with blebs (16%, 18/114), were identified. 56% (55/93) of the RFs showed significant differences between the blebs and the bodies of the same aneurysms. Among these RFs, 28% (5/18) were classified as first-order, while 68% (50/75) were second-order features. A total of forty-one strong or moderate correlations were identified between either WSS or WT and the RP of the blebs. Specifically, 11% (6/55) of the RFs correlated with Time-Averaged WSS, 33% (18/55) with WSS Gradient, 27% (15/55) with the Oscillatory Shear Index (OSI), and 3.6% (2/55) with WT. Blebs exhibited different SI distributions among voxels and texture patterns compared to the sacs of the aneurysm bodies. In addition, there was a notable association between the variation in texture within the blebs and low WSS alongside high OSI.

**CONCLUSION**

Blebs exhibit unique RP compared to aneurysm body sacs. The heterogeneity of the bleb's wall may be caused by distinct mechanical load and hemodynamics, as demonstrated by the co-localization with low WSS.

**CLINICAL RELEVANCE/APPLICATION**

Radiomic profiling can help identify regions of high rupture risk within the aneurysm wall.

## M5A-SPNR-4 AUTOMATED DIAGNOSIS OF IDIOPATHIC NORMAL PRESSURE HYDROCEPHALUS USING SINGLE 3D T1-WEIGHTED MRI SCAN: A HYBRID DEEP LEARNING-MACHINE LEARNING APPROACH

Seung Hyun Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Seungjun Lee, BS (*Abstract Co-Author*) Nothing to Disclose
Chong Hyun Suh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Suyoung Yun, MD (*Abstract Co-Author*) Nothing to Disclose
Wooseok Jung, MSc (*Abstract Co-Author*) Nothing to Disclose
Saehyun Kim (*Presenter*) Nothing to Disclose

**PURPOSE**

Idiopathic normal pressure hydrocephalus (iNPH), a treatable form of dementia, often remains undiagnosed due to its similarity to neurodegenerative conditions such as Alzheimer's disease (AD) and Parkinson's disease (PD). This study aimed to develop and validate automated algorithms for diagnosing iNPH using only a single 3D T1-weighted MRI scan, facilitating early detection and treatment.

**METHODS AND MATERIALS**

This multicenter study included training and external testing datasets with subjects categorized as iNPH, AD, PD, and healthy controls (HC). All participants underwent 3D T1-weighted MRI scans from various scanners. We developed a hybrid deep learning-machine learning model: 3D Swin Transformer with additional MRI postprocessing stages for measuring iNPH biomarkers (see figure: disproportionately enlarged subarachnoid space

hydrocephalus [DESH] indices including Sylvian fissure enlargement and high-convexity tightness, callosal angle, Evans' index, and normalized lateral ventricle volume) from T1-weighted MRI scans, followed by XGBoost using these features for iNPH classification. The performance of the biomarker measurement and iNPH classification was evaluated using the area under the receiver operating characteristic curve (AUC) and the intraclass correlation coefficient (ICC).

**RESULTS**

The training dataset of 452 patients (200 men, 252 women; age 73.2 ± 6.5 years) included 111 iNPH (24.6%), 101 AD (22.3%), 103 PD (22.8%), and 137 HC (30.3%). The external testing dataset of 110 patients (48 men, 62 women; age 72.4 ± 7.7 years) had 28 (25.5%) iNPH, 28 (25.5%) AD, 26 PD (23.6%), and 28 HC (25.5%). The model achieved excellent performance both in biomarker measurement (AUC: 0.956 for DESH, 0.830 for sylvian fissure enlargement, 0.956 for high-convexity tightness; ICC: 0.824 for callosal angle, 0.924 for Evans index) and iNPH classification (AUC: 0.983 for cross-validation, 0.936 for external testing), surpassing previous works lacking external validation. In addition, the performance remained high (AUC: 0.988 for cross-validation, 0.938 for external testing) even using manually labeled features for iNPH classification, indicating the robustness of the model.

**CONCLUSION**

The proposed method effectively utilizes clinically interpretable biomarkers from a single MRI scan to diagnose iNPH, demonstrating both interpretability and robust diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

The proposed method could facilitate widespread iNPH screening from routinely acquired T1-weighted MRI scans, enabling timely diagnosis and treatment of iNPH.

## M5A-SPNR-6 INCREASED DETECTION OF CEREBRAL MICROBLEEDS WITH VENOUS ASSOCIATION IN CEREBRAL AMYLOID ANGIOPATHY AT HIGH-RESOLUTION 7T-MRI

Daniele Botta (*Abstract Co-Author*) Nothing to Disclose
Frederic Assal, MD (*Abstract Co-Author*) Nothing to Disclose
Frederic Grouiller (*Abstract Co-Author*) Nothing to Disclose
Karl-Olof Lovblad, MD (*Abstract Co-Author*) Nothing to Disclose
Felix Kurz (*Presenter*) Nothing to Disclose

**PURPOSE**

Cerebral microbleeds (MBs) are key indicators in neurovascular conditions, particularly cerebral amyloid angiopathy (CAA), within the broader category of cerebral small vessel disease. Despite their prevalence, MB pathophysiology still remains unclear, however, recent evidence based on MR images with 350µmx350µm in-plane resolution suggests an association between some MBs and adjacent small venous structures, typically missed on conventional MRI. Using highresolution ultra-high-field MRI, the objective was to assess the MB vascular environment in patients with probable CAA.

**METHODS AND MATERIALS**

We included n=5 patients with probable CAA according to the updated Boston Criteria 2.0 (3 men, 2 women) in this observational study, who were examined with a susceptibility-weighted imaging (SWI) sequence (150µmx150µm in-plane resolution, TE: 15ms, TR: 25ms, acquisition time: 6:34min) at a 7-Tesla MRI scanner (Siemens Magnetom Terra.X). Two expert readers reviewed images to find and quantify lobar MBs, and to assess their association with the venous topography.

**RESULTS**

Average patient age was 72.2 ± 8.9 years with 9.4 ± 4.6 MBs per patient (total number of MBs: 47). For each patient, 60.09% ± 12.12% of MBs had a direct spatial connection to a small venous structure. The presence of MBs with a venous association was highly correlated with the overall number of MBs per patient (r2=0.98, p=0.005), while there was a negativecorrelation of MBs with a venous association and patient age (r=-0.95, p=0.010).

**CONCLUSION**

Compared with a previous study at lower resolution that found that only a small number (14%) of MBs had a venous association, our findings suggest a significantly higher number of MBs with a relation to adjacent venous structures in patients with CAA. These insights point towards a potential venous role in the pathogenesis of CAA and MB formation, especially in younger patients. Further research with expanded cohorts and pathological confirmation is needed to substantiate these observations and clarify the mechanisms involved.

**CLINICAL RELEVANCE/APPLICATION**

The clinical relevance of this study lies in its potential to enhance our understanding of the pathophysiology of cerebral microbleeds, particularly in the context of cerebral amyloid angiopathy. By elucidating the association between MBs and adjacent small venous structures, the study provides insights into potential mechanisms underlying MB formation. Understanding the vascular environment surrounding MBs could have implications for diagnosis, prognosis, and treatment. For instance, if venous involvement is indeed found to play a significant role in MB formation, it may lead to the development of novel imaging biomarkers for early detection and monitoring of CAA-related pathology.

## M5A-SPNR-7 ULTRA-HIGH RESOLUTION PHOTON-COUNTING CT ANGIOGRAPHY FOR NEUROVASCULAR IMAGING - IMAGE QUALITY ASSESSMENT USING DEDICATED RECONSTRUCTION KERNELS AND QUANTUM ITERATIVE RECONSTRUCTION

Maria G. Matheus, MD (*Abstract Co-Author*) Nothing to Disclose
Milad Yazdani, MD (*Abstract Co-Author*) Nothing to Disclose
Sameer Tipnis, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Vittoria Spampinato, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Bayer AG
Justin Chetta, MD (*Abstract Co-Author*) Nothing to Disclose
Adrienn Toth, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the image quality of ultra-high resolution (UHR) photon-counting CT (PCCT) angiography using a wide range of dedicated vascular kernels and all strength levels of quantum iterative reconstruction (QIR) in a cohort of patients with intracranial saccular aneurysms.

**METHODS AND MATERIALS**

18 patients with intracranial saccular aneurysms, who had previously undergone conventional EID-CT, were prospectively enrolled. CT angiograms of the head and neck were acquired on a clinical dual-source PCCT (NAEOTOM Alpha, Siemens, Germany) in UHR mode. Two image sets were generated: the

first included images reconstructed with a variety of dedicated vascular kernels (Hv36, Hv48, Hv56, Hv64, Hv72, Hv80) and QIR-1. After a preliminary qualitative analysis by two experienced neuroradiologists, the Hv64 kernel was selected for the second set of images, assessing all strength levels of QIR (0-4). The quantitative image quality of both image sets was evaluated. Signal, noise, signal-to-noise (SNR), and contrast-to-noise (CNR) were measured by manually placing regions of interest (ROIs) on each reconstruction at 12 standard anatomical locations (grouped as "Extracranial vessels", "Large intracranial vessels", and "Small intracranial vessels). Sharpness was measured by placing line profiles perpendicular to the vessel's borders to detect attenuation values using a dedicated workstation (ImageJ, version 1.53). Vessel sharpness was defined as the maximum per-pixel change in signal intensity.

**RESULTS**

The use of sharper reconstruction kernels resulted in increased image noise and decreased SNR and CNR. However, vessel sharpness increased more than twofold from Hv36 to Hv80 at each evaluated location. The greatest difference was measured in the small intracranial arteries (from 113.91 ± 28.16 to 308.04 ± 88.25, p <.001) By reducing image noise, the higher QIR levels improved quantitative image quality. While SNR and CNR increased by a factor of 2.62 and 3.42, small intracranial vessel sharpness increased by 12.51% from QIR-0 to QIR-4.

**CONCLUSION**

A combination of sharp dedicated kernels and high QIR levels enabled the improved visualization of intracranial vessels. The optimized reconstruction parameters delivered improved vessel sharpness, at the small intracranial locations in particular, showing promising results for neurovascular imaging considering the typical location of intracranial saccular aneurysms. In the following steps, a qualitative assessment of image quality will be conducted to further analyze the impact of reconstruction kernel and QIR adjustments on overall image quality.

**CLINICAL RELEVANCE/APPLICATION**

Our results provide meaningful data for protocol optimization on photon-counting-CT for neurovascular imaging.

## M5A-SPNR-9 0.55T IMAGING OF PATIENTS WITH SPINAL HARDWARE: DIAGNOSTIC FEASIBILITY AND METAL ARTIFACT COMPARISON TO 1.5/3T MRI

Francisco F. Rivas Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Vikas Gulani, MD, PhD (*Abstract Co-Author*) Research support, Siemens AG;Consulting, Cook Group Incorporated
Jayapalli R. Bapuraj, MD (*Abstract Co-Author*) Nothing to Disclose
Nicole Seiberlich, PhD (*Abstract Co-Author*) Royalties, Siemens AG;Research support, Siemens AG
Shruti Mishra, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Masotti (*Abstract Co-Author*) Nothing to Disclose
Lauren Kelsey, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Expected reduced susceptibility artifacts may improve spinal implant evaluation at 0.55T compared to 1.5/3T. The aim of this study is to assess inter-reader agreement of imaging findings and compare readers' assessment of image quality (IQ) and the appearance of metal artifact (MA) in patients with spinal implants between 0.55T and 1.5/3T MRI.

**METHODS AND MATERIALS**

In this IRB-approved retrospective study, patients imaged on the Siemens Healthineers Magnetom Free.Max 0.55T (n=42; 19M, 23F; avg. age 55 yrs.) with spinal hardware in situ (n=11 cervical, n=6 thoracic, n=21 lumbar, n=3 sacral, n=1 total; median hardware levels=2) between 12/2021-3/2024 were included. Of these, 19 patients had an exam at high-field (HF) (n=18, 1.5T; n=1, 3T) with the same hardware in situ. All exams were anonymized and scored independently by three board-certified neuroradiologists (R1-3). Readers selected diagnoses/imaging findings from a pick-list for all 61 exams. For the 19 paired exams, paired sequences were rated using a 4-point Likert scale for IQ and MA (1=non-diagnostic/severe artifacts, 4=excellent/minimal artifacts). Wilcoxon signed-rank tests were applied to determine sequence-wise differences between 0.55T and HF ratings for IQ and MA. Raw agreement and Cohen's kappa were applied to assess diagnostic agreement independently for each field-strength cohort.

**RESULTS**

In both 0.55T and HF, raw agreement for the following findings ranged between 81-95%: cord signal abnormality, suspicion for osteomyelitis/discitis, suspicion for osseous metastatic disease, and compression fracture. Agreement on post-operative fluid collection and spinal canal stenosis was 64.3% and 66.7% at 0.55T, and 78.9% and 52.6% at HF, respectively. Agreement on neural foraminal stenosis was lowest in both cohorts, 47.6% at 0.55T and 36.8% at HF. No sequence at 0.55T was rated statistically significantly inferior to HF in either IQ or MA. Statistically significant results where a sequence was rated higher at 0.55T compared to HF were as follows for IQ: sagittal T1w TSE (R1: p=0.03) and as follows for MA: axial T1w TSE (R1: p=0.01; R2: p=0.02), sagittal T1w TSE (R1: p=0.01), axial T2w TSE (R1: p=0.01), sagittal T1w TSE Dixon in-phase post-contrast (R2: p=0.04), sagittal T2w STIR (R2: p=0.01).

**CONCLUSION**

Imaging patients with spinal hardware at 0.55T results in comparable inter-reader agreement for clinically relevant findings/diagnoses compared to 1.5/3T. The evaluated routine sequences were rated as having equivalent or improved IQ and MA compared to HF by three neuroradiologists.

**CLINICAL RELEVANCE/APPLICATION**

Post-operative spinal hardware imaging and diagnostic evaluation may be comparably or superiorly performed at 0.55T when compared to conventional 1.5/3T field strengths.

# Abstract Archives of the RSNA, 2024

M5A-SPOB

**OB/Gynecology Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPOB-1 DIAGNOSTIC ACCURACY OF CONTRAST ENHANCED ULTRASOUND QUANTITATIVE PARAMETERS VIS-A-VIS DYNAMIC MAGNETIC RESONANCE IMAGING PARAMETERS FOR CHARACTERIZATION OF SONOGRAPHICALLY COMPLEX ADNEXAL MASSES: A PILOT STUDY

Hemal Grover, MD (*Abstract Co-Author*) Nothing to Disclose
Sayantan Patra, MD (*Abstract Co-Author*) Nothing to Disclose
Geetika Khanna, MD (*Abstract Co-Author*) Nothing to Disclose
Shabnam B. Grover, MD, DMRD (*Presenter*) Nothing to Disclose

### PURPOSE

Contrast enhanced ultrasound (CEUS) using second generation microbubble contrast, eliminated in expired air, has not yet been extensively explored for evaluation of adnexal masses. Therefore, aim of this study was to compare diagnostic accuracy of CEUS Quantitative Parameters vis-ą-vis Dynamic MRI (DyMRI) parameters for characterization of complex adnexal masses.

### METHODS AND MATERIALS

This was a retrospective analysis of an IRB approved study comprising 30 patients with 32 complex adnexal masses who underwent both CEUS DyMRI, prior to surgical resection. Histopathology results were considered as gold standard. CEUS was performed by standard technique on Siemens equipment using Sonovue® second generation ultrasound contrast. Video clips were acquired for at least 90 seconds post contrast. Equipment in-built Contrast Dynamics software spontaneously generated quantitative parameters, namely: Time to peak,Tp; Peak enhancement,Pe; Mean transit time,MTT; Area Under the Curve,AUC also provided time intensity curve (TIC). DyMRI was performed on Phillips 3T MRI equipment as per standard protocol for adnexal masses. TIC for DyMRI, were generated from in-built software type II type III curves were considered malignant. Additionally, ROC curve analysis was done for both modalities to obtain discriminant cut off values. Subsequently, diagnostic accuracy of each technique, for benign versus malignant characterization, was calculated based on the best discerning parameters. Sensitivity, specificity, PPV, NPV diagnostic accuracy were calculated based on histopathology results.

### RESULTS

Histopathology revealed 20 adnexal masses as malignant 12 benign. For CEUS, best determinant parameters were found to be AUC followed by PE MTT. For DyMRI, the same were wash-in rates, wash-out rates AUC. Sensitivity, specificity, positive negative predictive values for CEUS were 90%, 75%, 83.3% 81.8%; for DyMRI it was 90%, 91.67%, 94.74% 84.62%. Diagnostic accuracy of CEUS DyMRI were 84.38% 90.63% respectively. (Composite figure combining imaging statistics, submitted)

### CONCLUSION

CEUS shows comparable diagnostic accuracy to DyMRI, a vital component of adnexal MRI evaluation. The major advantages of CEUS are two fold. First being lower cost, which is almost a fifth of DyMRI. Secondly, since Sonovue is excreted through lungs, it can be safely used in patients with renal compromise, who cannot undergo Gadolinium MRI.

### CLINICAL RELEVANCE/APPLICATION

Significantly lower cost safety in patients with renal compromise favor further exploration wider clinical application of CEUS, especially in low resource settings, lacking MRI facilities.

## M5A-SPOB-3 VALUE OF VIRTUAL MAGNETIC RESONANCE ELASTOGRAPHY IN THICK PLACENTA

Jiejun Cheng (*Abstract Co-Author*) Nothing to Disclose
Jialu Xu (*Presenter*) Nothing to Disclose

### PURPOSE

We aimed to explore the value of diffusion weighted imaging (DWI)- based virtual magnetic resonance elastography (vMRE) in predicting preterm birth of pregnancies with thick placenta.

### METHODS AND MATERIALS

Twenty-five preterm birth of pregnancies with thick placenta(TP) and normal birth of pregnancies with thick placenta were included in this prospective study. Diffusion-weighted imaging (b-value of 50 ,200and 800 s/mm2 ) were performed on all pregnant women using a 1.5 T magnetic resonance

imaging (MRI)scanner. DWI-based vMRE parameter [the stiffness value (μdiff)], and apparent diffusion coefficient (ADC) were calculated and compared between groups. The predictive effciency was compared by the logistic regression analysis and receiver operating characteristic curve analysis.

**RESULTS**

The average thickness of placenta was 49.320±8.568mm in pregnancies without preterm birth versus 58.741±9.010mm in pregnancies with preterm birth. ADC of placenta was lower in pregnancies with preterm birth than without preterm birth(1.570±0.269×10-3 mm2 /s versus 1.768±0.174×10-3 mm2 /s, p=0.034); But the μdiff value increased in pregnancies with preterm birth than without preterm birth(5.571±0.563 kpa versus4.825±0.528kpa, p=0.007). The placental stiffness was predictive risk factor for preterm birth in pregnancies with TP.The area under AUC was 0.851.

**CONCLUSION**

vMRE quantifies placenta elastography in TP pregnancies. Placental vMRE might be a vital non-invasive supplement for predicting preterm birth in pregnancies with thick placenta.

**CLINICAL RELEVANCE/APPLICATION**

Placental vMRE might be a useful tool to assess placental function and a vital non-invasive supplement for predicting preterm birth in pregnancies with thick placenta.

## M5A-SPOB-4 LESION-BASED EVALUATION OF AN ECHOGENIC COMPONENT-BASED AI/CADX MODEL FOR THE CLASSIFICATION OF MALIGNANT AND BENIGN ADNEXAL LESIONS WITH ULTRASOUND IMAGING

Ernst Lengyel (*Abstract Co-Author*) Nothing to Disclose
Maryellen L. Giger, PhD (*Abstract Co-Author*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC
Hui Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Jacques S. Abramowicz, MD (*Abstract Co-Author*) Author with royalties, Wolters Kluwer nv;Medical Advisory Board, Samsung Electronics Co, Ltd
Roni Yoeli-Bik, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan Longman (*Abstract Co-Author*) Nothing to Disclose
Heather Whitney, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Due to their heterogeneous nature, up to one-third of adnexal lesions assessed by qualitative ultrasound-based risk models are classified as indeterminate. Artificial intelligence/ computer-aided diagnosis (AI/CADx) tools that provide an automatic, quantitative assessment might improve the ability to reliably classify benign and malignant lesions. We previously developed an AI/CADx pipeline for automatic segmentation and echogenic component-based radiomic feature extraction of adnexal lesions on ultrasound merged with manual solid elements detection with high performance (AUC = 0.91 [0.83, 0.98]). The goal of this study was to evaluate the lesion-by-lesion likelihood of malignancy using AI/CADx at a target operating point along withthe Assessment of Different NEoplasias in the adneXa (ADNEX) model for reference.

**METHODS AND MATERIALS**

A retrospective dataset of sonographic images of adnexal lesions (1 per case, no markups; cancer prevalence 27.9%) had been collected and split into training/validation (95 lesions; 70%) and independent test sets (41 lesions; 30%). In the test set, we evaluated the sensitivity, specificity, PPV, and NPV at target 95% sensitivity (established from the training set) via a posteriori bootstrapping of the likelihood of malignancy 200 times. We also compared the AI/CADx lesion-by-lesion likelihood of malignancy with the ADNEX performance at 10% cut-off.

**RESULTS**

For the AI/CADx model at target 95% sensitivity, the sensitivity, specificity, PPV, and NPV were 0.99 [0.87, 1.00], 0.71 [0.54, 0.83], 0.58 [0.48, 0.71], and 0.41 [0.35, 0.45], respectively. All malignant and 22/29 benign lesions were correctly classified by both the AI/CADx and ADNEX models. Both models incorrectly classified three benign lesions as malignant (a teratoma, a cystadenofibroma, and a fibroma). The AI/CADx model incorrectly classified three additional benign lesions (two cystadenofibromas and teratoma); the ADNEX model incorrectly classified one additional benign lesion (an infarcted benign cyst with torsion).

**CONCLUSION**

Lesion-based analysis of a novel AI/CADx pipeline designed to classify adnexal lesions on ultrasound as malignant or benign showed comparable classification to the ADNEX model with the additional benefit of an automated pipeline. All malignant cases were correctly classified by both models. Three unique false positive results by AI/CADx indicate the potential for additional development particularly for cystadenofibromas and teratomas.

**CLINICAL RELEVANCE/APPLICATION**

An AI/CADx-based pipeline for automatic segmentation and classification of malignant and benign adnexal lesions on ultrasound has the potential to reduce diagnostic variability and improve the decision-making process.

# Abstract Archives of the RSNA, 2024

M5A-SPPD

**Pediatric Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPPD-1 MATERNAL TOBACCO SMOKING ASSOCIATED WITH PLACENTA VOLUMES DIFFERENCES AND ALTERED TEXTURE FEATURES

Rupa Radhakrishnan, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Ramana V. Vishnubhotla, PhD (*Abstract Co-Author*) Nothing to Disclose
Ashok Panigrahy, MD (*Abstract Co-Author*) Nothing to Disclose
Senthilkumar Sadhasivam (*Abstract Co-Author*) Nothing to Disclose
Jonathan Class, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The placenta plays an important role in fetal development and neuroprotection. In a previous study, we showed that prenatal opioid exposure and smoking was associated with increased placental volumes. This study aims to assess morphological abnormalities in the placenta using placental texture analysis in pregnant women with substance exposure and smoking, compared to control pregnant women.

### METHODS AND MATERIALS

This was a prospective IRB approved study that recruited pregnant women with prenatal opioid and other substance exposure and nonsubstance using controls. Two-dimensional (2D) MR images of the placenta were acquired using a Half-Fourier Single-shot Turbo spin-Echo (HASTE) sequence. Placenta region of interest masks were manually segmented. Labeled images were run through a radiomics pipeline with 2D resampled data. Second order statistical features based on gray level co-occurrence matrix, gray level run length matrix, and gray level size zone matrix were assessed. Comparisons were made for those with prenatal opioid and tobacco exposure and placenta size using a robust linear regression while accounting for demographic variables (infant sex, race, maternal age, gestational age, maternal body mass index) and placenta volume.

### RESULTS

There were 43 pregnant mothers, including 23 with opioid use, 17 with tobacco use and 20 controls without opioid or tobacco use. Average gestational age was (M=34.3, SD=3.2) in the opioid group (M=34.1, SD=3.3) in the tobacco group, and (M=33.7, SD=3.2) in controls. Tobacco smoking was significantly associated with larger placenta volumes (p=0.008), as well as differences in contrast (p=0.02), difference average (measure of overall homogeneity; p=0.01), inverse difference (measure of local homogeneity; p=0.04), and zone percentage (measure of coarseness; p=0.03). Opioid exposure alone was not associated with placental textural feature differences.

### CONCLUSION

We identified maternal smoking to be associated specific differences in placenta texture features on placental MRI compared to non-smoking controls.

### CLINICAL RELEVANCE/APPLICATION

The results of this study suggest the impact of maternal smoking on placental volume and its texture. Alterations in placental texture have been reported in fetuses with growth restriction. Future steps would be to understand how placenta texture features may predict fetal and infant growth and development in pregnancies with prenatal substance exposure.

## M5A-SPPD-2 EXTERNAL VALIDATION OF THE ARTIFICIAL INTELLIGENCE-BASED ALGORITHM FOR SCREENING OF ILEOCOLIC INTUSSUSCEPTION USING PEDIATRIC ABDOMINAL RADIOGRAPHS: A MULTICENTER RETROSPECTIVE STUDY

Eun-Kyung Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Pyeong Hwa Kim (*Abstract Co-Author*) Nothing to Disclose
Sungwon Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Kyunghwa Han, PhD (*Abstract Co-Author*) Nothing to Disclose
Hee Mang Yoon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Haesung Yoon, MD, PhD (*Abstract Co-Author*) Research Grant, Bracco Group
Hyun Joo Shin, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To upgrade and validate the artificial intelligence (AI) algorithm for screening ileocolic intussusception on pediatric abdominal radiographs using multicenter data.

## METHODS AND MATERIALS

Pediatric patients (= 5 years old) who visited the emergency department and underwent both abdominal radiographs and ultrasonography on the same date for the evaluation of ileocolic intussusception from March 2012 to February 2022 at Hospital A, from March 2020 to February 2022 at Hospital B, and from March 2016 to February 2022 at Hospital C were included retrospectively. Patients were categorized into control and intussusception groups based on the ultrasound (US) results. The AI algorithm was retrained using additional data from Hospital A, utilizing the You-Only-Look-Once (YOLO)-v4-p5 model. For external validation, data from Hospitals B and C were utilized. Two radiologists assessed the presence of intussusception using abdominal radiographs, and the diagnostic performance was compared with the upgraded AI model using logistic regression with a generalized estimating equation.

## RESULTS

Abdominal radiographs from a total of 431 patients, including 143 patients with intussusception at Hospital A, were used to develop the upgraded algorithm. For external validation, 68 patients (M:F = 42:26, mean age 1.6 ± 1.5 years) with 19 cases of intussusception from Hospital B, and 90 patients (M:F = 47:43, mean age 1.5 ± 1.3 years) with 30 cases of intussusception from Hospital C were included. When comparing the diagnostic performances of radiologists with that of the AI algorithm, the sensitivity (75.5% vs. 44.9%, p<0.001), accuracy (82.3% vs. 74.7%, p=0.029), and negative predictive value (NPV) (88.6% vs. 78.1%, p<0.001) were significantly higher in AI compared to the radiologists overall. However, there were no statistically significant differences in specificity (85.3% vs. 88.1%, p=0.479) and positive predictive value (PPV) (69.8% vs. 62.9%, p=0.311).

## CONCLUSION

This multicenter external validation study demonstrates the potential use of AI as a screening tool for ileocolic intussusception on pediatric abdominal radiographs. Presenting an applicable way to use AI in pediatric abdominal emergency cases is clinically significant, and demonstrating external validation results is necessary to ensure safety and assess its potential for real-world implementation.

## CLINICAL RELEVANCE/APPLICATION

Intussusception is one of the important emergent abdominal diseases of young infants, needing immediate treatment. We wanted to know whether AI could help to detect children who need further evaluation and to focus external validation of the AI algorithm on abdominal radiographs using multicenter data.

# M5A-SPPD-3 A NEW FRONTIER: PEDIATRIC APENDIC RADS AND ITS IMPACT ON PEDIATRIC APPENDICITIS DIAGNOSIS

Yoshino Tamaki Sameshima, MD (*Abstract Co-Author*) Nothing to Disclose
Cesar Passos Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel J. Neto (*Abstract Co-Author*) Nothing to Disclose
Marcos R. Queiroz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Marcelo R. Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Fabiana Gual, MD (*Abstract Co-Author*) Nothing to Disclose
MARCIA W. MATSUOKA, MD (*Abstract Co-Author*) Nothing to Disclose
Victor A. Jabour, MD (*Abstract Co-Author*) Nothing to Disclose
Hugo Franco, MD (*Presenter*) Nothing to Disclose

## PURPOSE

- Ultrasonography plays a crucial role in evaluating suspected cases, providing varied assessments of appendicitis likelihood, especially in children, since ultrasound is a diagnostic method free from ionizing radiation, low cost, quick to access, and with real-time evaluation.- This study introduces PEDIATRIC APENDIC-RADS to standardize ultrasound reporting for acute appendicitis among the pediatric age group, aiming to improve objective descriptions of direct and indirect signs, stratifying the risk for acute inflammatory process of the cecal appendix with a final numerical classification, assisting clinicians and pediatricians in the management and follow-up of suspected patients, especially in doubtful cases.

## METHODS AND MATERIALS

- This study examines retrospectively consecutive patients of age from 0 to 16 years old undergoing abdominal ultrasound for acute appendicitis, with main outcome being histopathological confirmation post-surgery.- Imaging results were categorized into five PEDIATRIC APENDIC-RADS groups at the moment of examination.- Statistical analysis includes descriptive stats, chi-square, Fisher's exact, likelihood ratio tests, ROC curve, and calibration belt construction.

## RESULTS

- A total of 356 patients were assessed for suspected acute appendicitis using ultrasonography.- Of the diagnosed patients, 67% were male, primarily exhibiting symptoms such as nausea and/or vomiting (81%), right iliac fossa pain (57%), and sudden decompression in the right iliac fossa (43%).- Stratification into PEDIATRIC APENDIC-RADS categories revealed a significant variation in the incidence of acute appendicitis, with incidence rates of 19% for category 0 (unvisualized appendix) and 4.8%, 9.5%, 4.8%, and 62% for categories 1 through 4, respectively (p<0.001).

## CONCLUSION

- The PEDIATRIC APENDIC-RADS showed excellent discriminative ability, as evidenced by an AURTOC of 0.950 (95% CI, 0.899-1).- Model calibration was deemed adequate.- PEDIATRIC APENDIC-RADS categorization shows excellent performance in standardizing ultrasound-derived acute appendicitis probability, potentially enhancing physician communication and patient management standardization.

## CLINICAL RELEVANCE/APPLICATION

- In daily practice, clinicians and pediatricians can use PEDIATRIC APENDIC-RADS to quickly assess ultrasound findings, categorize patients into risk groups, and make informed decisions about further management, all while minimizing radiation exposure and improving patient care.

# Abstract Archives of the RSNA, 2024

M5A-SPPH

**Physics Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPPH-1 A SIZE- AND DOSE-INDEPENDENT DEEP LEARNING APPROACH TO MULTI-MATERIAL DECOMPOSITION IN PHOTON-COUNTING CT

Jayasai R. Rajagopal, PHD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth C. Jones, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Ehsan Abadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Paul Segars (*Abstract Co-Author*) Nothing to Disclose
Ehsan Samei, PHD (*Abstract Co-Author*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc
Saikiran Rapaka, PhD (*Abstract Co-Author*) Employee, Siemens AG
Pooyan Sahbaee, PhD (*Presenter*) Employee, Siemens AG

### PURPOSE

To develop a deep learning-based method for decomposing materials such as calcium, iodine, and gadolinium in spectral CT which is robust across various sizes and doses

### METHODS AND MATERIALS

A clinical photon-counting CT system (NAEOTOM Alpha, Siemens Healthineers) was simulated using the DukeSim platform (Duke University). Images were generated from two different datasets: cylindrical phantoms (12 phantoms; 20-42 cm diameter) and anthropomorphic abdominal phantoms (58 phantoms; XCAT, Duke University). Both datasets included clinically-relevant contrast agents (iodine (0-7 mg/mL), gadolinium (0-5 mg/mL)) and biological materials (soft tissue, calcium). Acquisition was simulated at 120 kV using 20-65 keV energy thresholds and at multiple size dependent dose levels for each phantom to create variable image quality across the dataset. The model was trained in two phases using a U-Net architecture: an initial feature detection of material per voxel followed by an estimate of iodine or gadolinium concentration. Models were trained with hybrid data containing cylindrical phantoms and a variable number (0-8) of XCAT phantoms. Model performance was evaluated by classification accuracy for the feature network and root-mean-squared error (RMSE) for the material concentration network.

### RESULTS

The model demonstrated high classification accuracy (92% iodine, 86% gadolinium, 95% calcium) and material concentration RMSE (0.57 mg/mL iodine, 0.39 mg/mL gadolinium) compared to ground truth values. Model performance increased when including a greater number of anthropomorphic models in the training dataset (53% with 0 XCATs to 91% with 8 XCATs). Material classification and concentration accuracy remained consistent across phantom size and dose conditions.

### CONCLUSION

A deep learning based approach to material decomposition trained using a hybrid dataset was able to accurately quantify iodine and gadolinium in the simulated images. The performance of the algorithm was maintained in conditions of low image quality. Future work will apply this algorithm to clinical data.

### CLINICAL RELEVANCE/APPLICATION

This robust material decomposition technique could potentially enhance the clinical viability of characterizing materials in spectral CT, independent of patient size and radiation dose.

## M5A-SPPH-10 A COMPARISON OF IMAGE NOISE AND TEXTURE IN CONTRAST-ENHANCED ABDOMINAL CT BETWEEN DEEP LEARNING IMAGE RECONSTRUCTION (DLIR) AND ADAPTIVE STATISTICAL ITERATIVE RECONSTRUCTION-V (ASIR-V)

Jianxin Guo (*Abstract Co-Author*) Nothing to Disclose
Jianying Li, PhD (*Abstract Co-Author*) Employee, General Electric Company
Le Cao (*Presenter*) Nothing to Disclose

### PURPOSE

To compare image noise and texture in contrast-enhanced abdominal CT between deep learning image reconstruction (DLIR) and adaptive statistical iterative reconstruction-V (ASIR-V).

**METHODS AND MATERIALS**

Contrast-enhanced abdominal CT images of 40 patients with hepatic lesions were retrospectively analyzed. Images in the portal phase were reconstructed at 1.25mm slice thickness using the 10, 30%, 50%, 70% and 90% ASIR-V and DLIR at low (DLIR-L), medium (DLIR-M) and high (DLIR-H) settings. CT number and standard deviation (SD) of the hepatic parenchyma, spleen, and paravertebral muscle were measured. The CT number skewness on liver parenchyma, spleen and paravertebral muscle were calculated to reflect image texture. Noise texture was also evaluated using a five-point discrete visual scale: 5, no pixilation or blotchy appearance; 4, minor pixilation or blotchy appearance not affecting diagnostic confidence; 3, moderate pixilation or blotchy appearance mildly limiting diagnostic confidence; 2, elevated pixilation or blotchy appearance reducing diagnostic confidence; and 1, major pixilation or blotchy appearance with poor diagnostic confidence. The measurements among the two algorithms were analyzed using SPSS22.0, with $P<0.05$ indicating statistically significant difference.

**RESULTS**

For both reconstruction algorithms, image noise in hepatic parenchyma, spleen, and paravertebral muscle decreased with the increase of reconstruction strength. The CT number skewness of ASIR-V increased with reconstruction percentage, but the CT number skewness of DLIR remained constant or decreased with the increase of reconstruction strength, and was lower than ASIR-V images. The 70% and 90% ASIR-V images appeared “too smooth” and “speckled”. DLIR had higher subjective scores and DLIR-H was rated the highest.

**CONCLUSION**

DLIR can effectively reduce image noise without changing image noise texture and does not appear too smooth with higher reconstruction strength.

**CLINICAL RELEVANCE/APPLICATION**

To compare image noise and texture in contrast-enhanced abdominal CT between deep learning image reconstruction (DLIR) and adaptive statistical iterative reconstruction-V (ASIR-V).

## M5A-SPPH-12 APPLICATION OF MODIFIED POSITIONING TO REDUCE BEAM HARDENING ARTIFACTS IN NECK CT IMAGING FOR THYROID EVALUATION

Huijuan Huang (*Abstract Co-Author*) Nothing to Disclose
Wencong Yang (*Abstract Co-Author*) Nothing to Disclose
Dongyi Chen (*Abstract Co-Author*) Nothing to Disclose
Furong Luo (*Abstract Co-Author*) Nothing to Disclose
Huijun Xiao (*Abstract Co-Author*) Nothing to Disclose
Weihua Lin (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the feasibility of a modified positioning (MP) in reducing beam hardening artifacts for thyroid evaluation in neck CT imaging.

**METHODS AND MATERIALS**

This prospective study enrolled 153 patients who were suspected of thyroid diseases and needed contrast-enhanced neck CT imaging, randomized into the MP group (n=70) and the conventional position group (CP, n=83). An auxiliary postural support device was used in the modified position group to ensure the patient's head was tilted back, shoulders sunk, and neck protruded during scanning, and no auxiliary postural device was used in the conventional position group, with all other scanning parameters being the same. Objective image quality was assessed by comparing the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) in both the heaviest and minimal artifact areas of the thyroid with two sides, along with the artifact-involved area percentage and artifact index between the two groups. Additionally, subjective image quality evaluations regarding the thyroid and the whole neck were performed independently by a junior and a senior radiologist using a 5-scale method.

**RESULTS**

The MP images had lower artifact-involved area percentages (left 0% vs. 43.8%, right 0% vs. 40.7%, both $P<0.001$), and higher SNR and CNR (left thyroid: SNR 16.83 vs. 7.1, CNR 11.02 vs. 7.33; right thyroid: SNR 16.7 vs. 6.9, CNR 12 vs. 6.7, all $P<0.001$) than the CP group. The artifact index was also significantly lower in the MP group for both sides (left 6.7 vs. 12.7, right 7.03 vs. 11.7, $P=0.015$). MP images had higher scores than the CP group on both thyroid (score>3 points: 62/70[88.6%] vs. 33/83[39.8%] for reader 1, 62/70[88.6%] vs. 32/83[38.6%] for reader 2, both $P < 0.05$) and neck (score>3 points: 54/70[77.2%] vs. 38/83[45.8%] for reader 1, 58/70[82.8%] vs. 46/83[55.4%] for reader 2, both $P< 0.05$) evaluation.

**CONCLUSION**

The modified positioning reduces photon starvation and beam hardening artifacts in lower neck CT imaging, and improves the display of thyroid.

**CLINICAL RELEVANCE/APPLICATION**

The imaging quality of thyroid in neck CT scanning is often interfered with beam-hardening artifacts resulting from adjacent anatomies. This study found a modified position could reduce artifacts and improve image quality in neck CT imaging, which has important clinical applications in the diagnosis of thyroid diseases.

## M5A-SPPH-3 SPECTRAL POST-PROCESSING (SPP) IN CLINICAL PHOTON-COUNTING CT (PCCT): IMAGE QUALITY COMPARISON OF POST-PROCESSED SPECTRAL IMAGES WITH DIRECT RECONSTRUCTIONS FROM SCANNER CONSOLE

Richard W. Ahn, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Liqiang Ren, PhD (*Abstract Co-Author*) Nothing to Disclose
Lakshmi Ananthakrishnan, MD (*Abstract Co-Author*) Nothing to Disclose
Xinhui Duan, PhD (*Abstract Co-Author*) Nothing to Disclose
Kristina Hallam (*Abstract Co-Author*) Employee, Siemens AG
Areej Aljabal, PhD (*Abstract Co-Author*) Nothing to Disclose
Afrouz Ataei, PhD (*Abstract Co-Author*) Nothing to Disclose
Xunbo Xu, ARRT (*Presenter*) Nothing to Disclose

**PURPOSE**

The first-generation commercial photon-counting CT <NAEOTOM Alpha, Siemens> uses a spectral post-processing <SPP> file format to store spectral data and retrospectively generate spectral images. The purpose of this phantom and patient study is to compare attenuation <HU> and noise on spectral reconstructions created from the SPP file to reconstructions generated at scanner console.

**METHODS AND MATERIALS**

The ACR CT accreditation phantom was scanned using 120 kV, 125 mAs, pitch 0.8, collimation 144x0.4mm and CTDIvol 12 mGy. Two sets of spectral images were generated from ACR phantom study on scanner console and at a thin client workstation using the SPP file <image thickness 1, 3 and 5 mm, kernel Qr44, virtual monoenergetic images of 50, 60, 70 ,100, 140 keV, IMD and virtual unenhanced <VNC> images>. Five ROI of the same size were placed on polyethylene, acrylic, bone, air and water rods. For patient study, three patients, who underwent abdomen and pelvis with IV contrast exams, were picked, representing three sizes: medium <M: BMI 21.8kg/m2>, large <L: BMI 29.3kg/m2>, and extra-large <XL: BMI: 34.7kg/m2>. All the three exams were performed on the same scanner as the phantom study with protocol settings: 120 kVp, IQ level 147, collimation 144x0.4mm and pitch 0.8. Radiation dose levels <CTDIvol> were M: 5.5mGy, L: 10.7mGy, XL: 12.1mGy. The images were generated from the scanner console and syngo.via including iodine density map <IMD>, virtual monoenergetic image <60keV> with a reconstruction kernel Qr44 and 5 mm thickness. Six circular ROI were placed on different anatomical areas, including aorta, liver, spleen, kidney, muscle, and subcutaneous/intraperitoneal fat. Analysis was performed to evaluate the difference in HU and SD at each ROI location.

**RESULTS**

For the phantom study, CT number differences in all the images were less than 1.0 HU, with exceptions including [-1.8, -0.8] HU <min, max> for bone at 50 keV and [-10.6, 9.7] HU for air and bone in IMD. A noise comparison revealed SPP-generated images with a higher noise level at 5 mm slice thickness. The noise differences translated to a CNR difference of [-0.09, 0.14]. For patient studies, there is no significant difference <p<0.05> on HU and noise level between images generated from scanner console and syngo.via.

**CONCLUSION**

For reconstructions created from an SPP file versus the scanner console, a slight difference in noise was noted in a phantom, but no significant difference in HU and noise level in patients.

**CLINICAL RELEVANCE/APPLICATION**

SPP files may be used to archive spectral information if certain spectral reconstructions are not imminently required for clinical reading. Spectral results can be generated from an SPP file with a similar image quality as the scanner.

## M5A-SPPH-4 IMAGE QUALITY AND LESION DETECTABILITY OF DOUBLE LOW-DOSE CT USING DEEP LEARNING-BASED IMAGE RECONSTRUCTION ALGORITHM

Hyojeong Lee (*Abstract Co-Author*) Nothing to Disclose
Jeong Kyong Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Yewon Lim, MD (*Abstract Co-Author*) Nothing to Disclose
Jin Sil Kim, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study assessed whether image quality and detectability of focal liver lesions in double low-dose hepatic multiphase CT(DLDCT), aimed at reducing both radiation and iodine levels by approximately 30% using a vendor-agnostic deep learning model(DLM), are comparable to those obtained from standard-dose CT(SDCT) using hybrid iterative reconstruction.

**METHODS AND MATERIALS**

We evaluated CT images from 73 patients who underwent hepatic multiphase CT with a dual-source scanner for low-radiation-dose CT and low-concentration iodine contrast between June and October 2023 and had a prior SDCT within the past year. Two radiologists graded overall image quality, perceived artificial enhancement, and liver contour sharpness on arterial and portal phase images using a 5-point scale for qualitative analysis. For quantitative image quality analysis, measurements included image noise, signal-to-noise ratio, and contrast-to-noise ratio within the liver. Lesion conspicuity and detection were analyzed using generalized estimating equation analysis and the jackknife free-response receiver operating characteristic figures-of-merit(FOM), respectively.

**RESULTS**

DLDCT significantly reduced the effective dose(10.3±6.0mSv vs. 16.4±7.1mSv) and iodine concentration(270mgI/mL vs. 350mgI/mL) compared to SDCT (P<0.001). The mean overall quality scores for arterial and portal phase images were significantly higher for DLDCT using DLM than for SDCT(arterial phase: 4.93±0.24 vs. 4.77±0.45, P<0.001; portal phase: 4.92±0.26 vs. 4.83±0.38, P<0.001). DLDCT demonstrated significantly better quantitative outcomes for liver lesion contrast-to-noise ratio(P<0.05). Lesion detectability was significantly higher in DLDCT images using DLM compared to SDCT images (0.978 vs. 0.917, respectively; P=0.0018).

**CONCLUSION**

DLDCT using DLM can provide better conspicuity and image quality than SDCT using lower radiation and contrast media concentration.

**CLINICAL RELEVANCE/APPLICATION**

Reducing the radiation dose and iodine concentration in liver dynamic CT imaging can lessen the patient burden associated with CT follow-up and be considered possible for CT surveillance of chronic liver disease.

## M5A-SPPH-5 THE ENIGMA OF AIR BUBBLE ARTIFACTS IN CT IMAGING:CAUSES AND IDENTIFICATION

Yini Chen (*Abstract Co-Author*) Nothing to Disclose
Bo Sun (*Abstract Co-Author*) Nothing to Disclose
Renwang Pu JR, MBBCh, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Yiwei Qi (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to elucidate the imaging features and formation mechanism of the infrequent CT air bubble artifacts.

**METHODS AND MATERIALS**

A retrospective analysis was conducted on 113 head CT cases. A meticulous comparative assessment was eventually completed on 7 cases.All imaging procedures were performed using a GE Discovery HD750 CT scanner.The parameters : a tube voltage of 120kVp, tube current of 200mA, slice thickness of 5.0mm, slice interval of 2.0mm, rotation time of 0.8S, and a gantry tilt angle of 0°.During the Imaging evaluation, the window level was set at 40 HU, while the window width varied from 20,40,60,80,100,150, to 300HU, respectively, encompassing the semioval center level and lateral ventricular level, with scores assigned based on a four-point Likert scale. The attenuation range, distribution and morphology of Air Bubble Artifacts were recorded.To

further investigate the distribution of artifact throughout the entire brain, MATLAB 2022a was employed. To interpret the resulting map, a grayscale inversion was applied,yielding a volumetric attenuation distribution map. Three phantoms filled with purified water, tube cooling oil and air were selected to investigate the causes of the artifact.

**RESULTS**

1.The optimal window width for effectively displaying these artifacts was determined to be 60 HU.2.The CT values for air bubble artifact ranged from 8.00 to 19.89 HU, with a mean value of approximately 11.81±4.09HU and a range of attenuation variability from 28.00% to 68.28%.3. The distribution of air bubble artifact across 16 specific regions within two levels in the 7 cases was randomly shown.4.The images of air bubble artifact were irregular, and the patchy configuration(80.77%,42/52)of hypoattenuations were the most common morphology.5.The volume attenuation distribution maps revealed CT value attenuation in both the gray and white matter regions of the entire brain.6.The average difference value between air and cooling oil was 839.43 HU.

**CONCLUSION**

The Air bubble artifact is a visible density reduction area(patchy configuration or band-like of hypoattenuation)under the condition of narrow window width of CT images when an excessive number of air bubbles in the CT tube cooling oil randomly appear along the X-ray path together with cooling oil circulation. The appearance, location and number of air bubble artifacts are random, with the hypoattenuation having a heterogeneous distribution and measuring less than 20HU.

**CLINICAL RELEVANCE/APPLICATION**

If a patchy or band-like hypoattenuation is observed in a head CT scan, which is inconsistent with clinical manifestations, the possibility of air bubble artifact should be considered. Regular CT quality control is essential to ensure accurate imaging diagnosis.

## M5A-SPPH-6 CLINICAL VALUE OF THE WHOLE HEART MOTION CORRECTION ALGORITHM IN CTA EXAMINATION OF THE CORONARY COMBINED THORACO-ABDOMINAL AORTA IN PATIENTS WITH TYPE A AORTIC DISSECTION PRESENTING PERICARDIAL EFFUSION

Suping Chen (*Abstract Co-Author*) Nothing to Disclose
Naiming Wu (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the impact of the whole-heart motion correction algorithm (SSF2) on image quality and AI measurements in patients with type A aortic dissection presenting pericardial effusion (PE).

**METHODS AND MATERIALS**

Coronary combined thoraco-abdominal aortic CTA data from 25 patients with type A aortic dissection presenting PE were retrospectively included, and images were processed using the standard algorithm (STD), the coronary motion correction algorithm (SSF1), and SSF2. Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of the true lumen of the aorta (TL), left circumflex branch (LCX), left anterior descending branch (LAD), and right coronary artery (RCA) were collected. Subjective image evaluation of aortic and coronary arteries was performed using a 5-point scale. Fractional flow reserve derived by CT (FFR-CT), stenosis, and transluminal attenuation gradient (TAG) were automatically generated by commercial coronary analysis software.

**RESULTS**

The mean heart rate was 81.86±15.22 bpm, and the mean thickness of PE was 18.01±5.65 mm. The SNR of the TL and LAD was the highest on the SSF2 images, followed by SSF1, and the lowest on the STD images (all $p<0.05$). The CNR values of TL, LCX, LAD, and RCA were ranked: SSF2 > SSF1 > STD (all $P<0.05$). The subjective score on aorta was not statistically different among the three groups of images, and that on coronary arteries was highest for SSF2 images [5(4,5)], second for SSF1 images [4(3,4)], and the lowest for STD [3(2,4)], with $P<0.05$. The analyzability of FFR-CT for the STD, SSF1, and SSF2 images was 21/25 (84%), 22/25 (88%), and 23/25 (92%). For all three coronary arteries, there were no statistically significant differences in FFR-CT values, stenosis, or TAG (all $P > 0.05$).

**CONCLUSION**

For CTA in type A aortic dissection with pericardial effusion, SSF2 improves true-false lumen contrast, reduces coronary motion artifacts, and improves coronary artery visualization without interfering with automatic measurements by the AI software.

**CLINICAL RELEVANCE/APPLICATION**

Pericardial effusion is a risk factor for coronary stenosis in type A aortic dissection; however, the presence of pericardial effusion affects the visualization of the coronary arteries on CTA images. SSF2 improves the true-false lumen contrast of the aorta and improves the display of coronary arteries, showing high clinical application value.

## M5A-SPPH-7 SHARPNESS EVALUATION OF CHEST MULTI PLANAR RECONSTRUCTION IMAGES WITH NORMAL AND SUPER HIGH-RESOLUTION MODE OF CZT-BASED PHOTON-COUNTING DETECTOR CT

Keisuke Fujii, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsushi Kobayashi, MD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation
Hiroki Taguchi (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yoshihisa Muramatsu, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Tomoaki Sasaki, MD (*Abstract Co-Author*) Nothing to Disclose
Keiichi Nomura, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

CZT-based Photon-counting detector (PCD) CT scanner has normal-resolution (NR) and super-high-resolution (SHR) modes. It is clinically important to evaluate how much not only axial SHR images, but also coronal and sagittal SHR images have higher sharpness than those with the NR mode. Thus, the aim of this study is to compare sharpness of multi planar SHR images with the CZT-based PCD-CT scanner with that of the NR images.

**METHODS AND MATERIALS**

A standard adult male thoracic phantom (LSCT-001, Kyoto Kagaku, Japan) with spherical nodules enclosed in lung fields at lung apex, tracheal bifurcation, and lung base was scanned with a CZT-based PCD-CT (TSX-501R, Canon Medical Systems, Japan). The scanning conditions were tube voltage of 120 kVp, tube current of 250 mA, rotation time of 0.5 s, and pitch factor of 0.8. The axial, coronal, sagittal NR and SHR images were reconstructed with adaptive iterative dose reduction three-dimensional (AIDR3D) algorithm of the standard strength at 200 mm field of view. The reconstruction conditions for NR images were slice thickness of 0.6 mm, reconstruction kernel of soft tissue (FC13) and lung (FC51), and matrix size of 512. The reconstruction conditions for SHR images were slice thickness of 0.2 mm, reconstruction kernel of soft tissue (FC13) and lung (FC54), and matrix size of

1024. We evaluated sharpness of each image using the analysis method devised by Imai et al. First, 180- or 360-line segments centered on a 10 mm diameter nodule (?270 HU) of each image were set in the radial direction at a central angle interval of 1°, and the edge profiles were obtained by calculating the average CT values of the pixels located at the same distance from the center of the nodule. Next, we modeled the edge profiles using stochastic differential equations, and derived a formula for the edge profile as a solution to the equation. The differential profile was obtained by subtracting the two adjacent mean CT values in the edge profile. The ratio between contrast obtained from the estimated edge profiles and maximum values of the differential profiles was defined as the sharpness index.

**RESULTS**

The sharpness of axial, coronal and sagittal SHR images for soft tissue kernel was approximately 1.4, 1.6 and 1.4 times higher than the NR images, respectively. The sharpness of axial, coronal and sagittal SHR images for lung kernel was approximately 1.5, 1.7 and 1.4 times higher than the NR images, respectively.

**CONCLUSION**

The multi planar SHR images with a CZT-based PCD-CT scanner were found to have approximately 1.5 times higher sharpness than the NR images.

**CLINICAL RELEVANCE/APPLICATION**

This study highlights the advantages of using the SHR mode with a CZT-based PCD-CT scanner for evaluating the microstructure of lung nodules in thoracic imaging.

## M5A-SPPH-9 IMPROVING CLARITY AND DIAGNOSTIC CONFIDENCE OF CORONARY STENT IN CORONARY CT ANGIOGRAPHY FOR PATIENT WITH HIGH HEART RATES USING A SECOND-GENERATION WHOLE- HEART MOTION CORRECTION ALGORITHM (SSF2)

Jianying Li, PhD (*Abstract Co-Author*) Employee, General Electric Company
Jianxin Guo (*Abstract Co-Author*) Nothing to Disclose
Tingting Qu (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the effect of a whole- heart motion correction algorithm (SSF2) on image quality and diagnostic confidence of coronary stent in coronary CT angiography (CCTA) for patients with high heart rates.

**METHODS AND MATERIALS**

Seventeen patients (with 22 stents) with high heart rates (88.79±11.40 bpm, 76-112 bpm) underwent CCTA. Images were reconstructed using standard algorithm without motion correction (STD), with the first-generation snapshot freeze (SSF1) and SSF2 motion correction. Subjective scoring (5-point method) and objective evaluation of stents were performed. Subjective evaluation included the severity of stent motion artifacts, clarity of stent display, and diagnostic confidence within the stent. Objective evaluation included CT and SD values of the fat outside the stent with the most severe stent artifacts, in-stent lumen diameter, external stent diameter and severity of blooming artifact (blooming artifact = (external stent diameter - in-stent lumen diameter)/external stent diameter * 100).

**RESULTS**

SSF2 had significantly smaller motion artifacts (0.36±0.58) and higher stent clarity scores (4.05±0.58) compared to STD (1.86±1.04, 2.77±0.92) and SSF1 (1.23±0.69, 3.23±0.61). The diagnostic confidence score of SSF2 was significantly higher than that of STD, but compatible to SSF1 ($P>0.05$). There was a statistically significant difference in fat CT and SD values among the three groups (all $P<0.05$), with SSF2 having the lowest values STD the highest. The stent reconstructed with STD had the smallest in-stent lumen diameter and the largest blooming artifact (all $P<0.05$), but no difference between SSF1 and SSF2 in these two values.

**CONCLUSION**

The application of SSF2 in CCTA significantly reduces the motion artifacts of coronary stents for patients with high heart rates compared to STD and SSF1, resulting in better display of the coronary arteries inside the stents and improved diagnostic confidence.

**CLINICAL RELEVANCE/APPLICATION**

SSF2 technology can make coronary stent display clearer and improve diagnostic confidence, making it a highly recommended coronary reconstruction technique.

# Abstract Archives of the RSNA, 2024

M5A-SPVA

**Vascular Imaging Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-SPVA-1 ASSOCIATION STUDY ON ABDOMINAL AORTIC HEMODYNAMIC PARAMETERS BASED ON 4D-FLOW MRI WITH RENAL FUNCTION IN CHRONIC KIDNEY DISEASE

Qinling Zong (*Abstract Co-Author*) Nothing to Disclose
Jiule Ding (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the correlation between renal function and abdominal aortic hemodynamic parameters based on 4D-Flow MRI in patients with chronic kidney disease (CKD).

### METHODS AND MATERIALS

A prospective study was conducted on 73 patients diagnosed with CKD between March 2021 and May 2023, as well as 13 volunteers without kidney injury. According to the estimated glomerular filtration rate (eGFR), the subjects were divided into CKD1-3 group (n = 34), CKD4-5 group (n = 39), and control group (n = 13). All subjects underwent 4D-Flow MRI examination of the abdominal aorta, measuring pulse wave velocity (PWV), and peak velocity and maximum wall shear stress (WSS) at the proximal plane (Plane_1) and the higher renal artery opening plane (Plane_2) of abdominal aorta. The differences in 4D-Flow MRI hemodynamic parameters among the three groups were compared. The correlation between 4D-Flow MRI hemodynamic parameters and eGFR and the independent influencing factors that affect eGFR was analyzed.

### RESULTS

There were significant differences in abdominal aortic PWV and maximal WSS of Plane_1 and Plane_2 among the three groups (all $P<0.05$). Abdominal aortic PWV was mildly negatively correlated with eGFR (?=-0.298, P=0.005). There was a mild positive correlation between maximal WSS of Plane_1 and Plane_2 with eGFR (?=0.394, $P<0.001$; ?=0.293, P=0.006). Abdominal aortic PWV and maximal WSS of Plane_1 were independent influencing factors of eGFR (all $P<0.05$).

### CONCLUSION

There is an independent correlation between renal function and abdominal aortic hemodynamic parameters based on 4D-Flow MRI in patients with CKD, and reduced abdominal aortic compliance is an important influencing factor in the progression of CKD.

### CLINICAL RELEVANCE/APPLICATION

1. It is feasible to apply 4D-Flow MRI for quantitative evaluation of abdominal aortic compliance in patients with CKD. 2. There is an independent correlation between renal function and abdominal aortic hemodynamic parameters based on 4D-Flow MRI in patients with CKD, and reduced abdominal aortic compliance is an important influencing factor in the progression of CKD.

## M5A-SPVA-3 NON-CONTRAST ENHANCED MR-ANGIOGRAPHY OF THE ABDOMINAL ARTERIES: INTRAINDIVIDUAL COMPARISON OF RELAXATION-ENHANCED ANGIOGRAPHY WITHOUT CONTRAST AND TRIGGERING (REACT) AND 4D CONTRAST-ENHANCED MR-ANGIOGRAPHY

Kenan Kaya, MD (*Abstract Co-Author*) Nothing to Disclose
Roman J. Gertz, MD (*Abstract Co-Author*) Institutional research contract, Koninklijke Philips NV
Philip S. Rauen, MD (*Abstract Co-Author*) Nothing to Disclose
Kilian Weiss, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Lukas Goertz (*Abstract Co-Author*) Nothing to Disclose
David C. Maintz, MD (*Abstract Co-Author*) Nothing to Disclose
Thorsten Persigehl, MD (*Abstract Co-Author*) Nothing to Disclose
Lenhard Pennig, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Institutional Grant, Koninklijke Philips NV
Jan Paul Janssen, MD (*Abstract Co-Author*) Nothing to Disclose
Carsten H. Gietzen, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study was to evaluate a novel 3D isotropic flow-independent non-contrast-enhanced magnetic resonance angiography (non-CE-MRA) sequence (Relaxation-Enhanced Angiography without Contrast and Triggering (REACT)) for imaging of the abdominal arteries by comparing image quality and the assessment of vessel stenosis to 4D contrast-enhanced MRA (4D CE-MRA).

## METHODS AND MATERIALS

Thirty patients (mean age 35.7 ± 16.8 years; 20 females) referred for abdominal vessel imaging using a standardized protocol at 3 T were included in this retrospective, single center study. The protocol comprised both 4D CE-MRA and REACT (navigator-triggering, Compressed SENSE factor 10 for acceleration of data acquisition, nominal scan time 02:54 min, and reconstructed voxel size 0.78 x 0.78 x 0.85 mm3) sequences. Two radiologists independently evaluated abdominal arteries for the presence of stenosis, vascular variants, and other vascular findings (e.g., dissection). The subjective image quality of arteries was assessed using a 4-point Likert scale (1 = non-diagnostic, 4 = excellent). Vessels were classified based on size: (1) abdominal aorta (supra- and infrarenal segments), (2) large arteries (celiac trunk, superior mesenteric artery, renal arteries), (3) medium arteries (splenic artery, common and proper hepatic artery), and (4) small arteries (gastric arteries, hepatic arteries, inferior mesenteric artery).

## RESULTS

REACT had a total acquisition time of 5:36 ± 00:40 minutes while 4D CE-MRA showed an acquisition time (including the native scan and bolus tracking sequence) of 3:45 ± 00:59 minutes ($p < .001$). Considering 4D CE-MRA as the reference standard, REACT achieved a sensitivity of 87.5% and specificity of 100% for relevant (= 50%) stenosis, while detecting 89.3% of variants and 100% of other findings. While 4D CE-MRA yielded higher values for large arteries (4D CE-MRA: 3.61 ± 0.61, REACT: 3.35 ± 0.72; $p < .001$), vessel quality was comparable between both sequences for the aorta (4D CE-MRA: 3.94 ± 0.24, REACT: 3.88 ± 0.44; $p = .044$), medium (4D CE-MRA: 2.93 ± 0.96, REACT: 2.77 ± 0.90; $p = .028$), and small arteries (4D CE-MRA: 2.15 ± 0.85, REACT: 2.04 ± 0.86; $p = .032$).

## CONCLUSION

In a short scan time of about 5 min, REACT provides good diagnostic performance for the detection of relevant stenoses, variants, and other findings of the abdominal arteries while yielding to 4D CE-MRA comparable image quality.

## CLINICAL RELEVANCE/APPLICATION

The findings of this study highlight the potential of REACT for vessel imaging without gadolinium contrast and may expand its use for imaging of the abdominal vasculature.

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# Abstract Archives of the RSNA, 2024

M5B-SPBR

**Breast Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPBR-1 IMPROVING THE PERFORMANCE OF AI-BASED SYSTEMS FOR BREAST CANCER DETECTION USING SELF-SUPERVISED-LEARNING TECHNIQUES

Svati S. Long, MD (*Abstract Co-Author*) Nothing to Disclose
Pierre Fillard, PhD (*Abstract Co-Author*) Employee, Therapixel SA;Stockholder, Therapixel SA
Stanislas Chambon (*Abstract Co-Author*) Nothing to Disclose
Yaroslav Nikulin (*Abstract Co-Author*) Nothing to Disclose
Serena Pacile, PhD (*Presenter*) Employee, Therapixel SA

### PURPOSE

The aim of this work is to highlight the benefits of using a self-supervised-learning (SSL) technique over a standard supervised learning (SL) technique to pre-train the backbone of a Deep Neural Network (DNN) that detects cancer in 2D and 3D mammography images.

### METHODS AND MATERIALS

The algorithm used in this work is based on MammoScreen3 software (by Therapixel) . It uses an ensemble of DNNs to detect malignant lesions on both DBT and FFDM images and to predict for each detection a malignancy score. Each DNN exhibits the same structure. It builds upon a backbone that plays the role of the feature extractor and 2 heads that play the roles of predictors. One head predicts the lesions localizations and one head predicts their malignancy scores. The backbone is, preliminary pre-trained to perform an auxiliary task, a crucial and necessary way to ensure good final performances of the algorithm. Then, the entire DNN (backbone and predictors) is fine-tuned with SL.This work compares two versions of the algorithm, hereafter referred to as MS_SL and MS_SSL, for which the backbones are either pre-trained with SL or with SSL. To obtain MS_SL, the backbones are pre-trained with SL to predict for a given patch its label: healthy tissue or different types of lesions.. To obtain MS_SSL, the backbone is pre-trained with the SSL technique MoCo on roughly 4 millions unlabeled 2D and 3D images.MS_SSL is compared against MS_SL and GMIC, used as a state-of-the-art reference, on a test set composed of 27,336 FFDM Hologic images (1,413 malignant images, 25,923 benign images). The performances are given in terms of AUC-ROC / Image. The statistical gains in AUC are estimated with Delong’s method. The Precision-Recall curves (with their corresponding AP: AveragePrecision / image) are also plotted and compared.

### RESULTS

MS_SSL exhibits an AUC of 0.9255 (0.9173 0.9337), while MS_SL has an AUC of 0.9215 (0.9133 0.9298) and GMIC an AUC of 0.8710 (0.8606 0.8814). MS_SSL outperforms both MS_SL with a gain in AUC of 0.0040 (0.0005 0.0074) $p = 0.0119$ and GMIC with a gain in AUC of 0.0545 (0.0453 0.0637) $p < 0.0001$. The superiority of MS_SSL can also be observed in terms of AP with a gain of +18% and 2% compared to GMIC and MS_SL respectively.

### CONCLUSION

Pre-training the backbone of a DNN with SSL leads to slightly better test performances than with SL with the extra benefit of requiring no labeled data. It opens new perspectives for the development of DNNs algorithms for breast cancer screening.

### CLINICAL RELEVANCE/APPLICATION

Data scarcity and labeling cost of mammography images prevents the training of large DNN with SL. SSL offers promising perspectives to cope with these constraints and to enhance DNN’s performances.

## M5B-SPBR-10 AN AI-DRIVEN SAFEGUARD REVIEW PROCESS HELPS DETECT AGGRESSIVE BREAST CANCERS

Jacqueline S. Holt, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan Haslam, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Mireille P. Aujero, MD (*Abstract Co-Author*) Nothing to Disclose
Jiye G. Kim, PhD (*Presenter*) Employee, RadNet, Inc

### PURPOSE

With considerable variability in radiologist performance interpreting screening mammograms, one approach to reduce missed cancers is a safeguard review process where AI identifies exams at risk of potential missed cancers, triggering review by a second, experienced breast imager. Here, we sought to test whether cancers detected through this process include aggressive cancers that would particularly benefit from immediate intervention for better prognosis.

**METHODS AND MATERIALS**

An AI-driven safeguard review process was implemented prospectively in a community practice from July 2021 - June 2022. A custom-built AI algorithm was used to flag the most suspicious screening DBT exams that had not been recalled by the initial interpreting radiologist. An expert breast imaging specialist performed a second, safeguard review of each of the flagged exams, and consulted with the initial interpreting radiologist for discordant interpretations. Cancers detected during this period were followed up for pathology, nodal status, cancer size, hormonal status, and cancer stage. Cancers were deemed aggressive if an invasive cancer had lymph node involvement, had triple-negative status, or was stage IIA or greater. Patient demographics (e.g., age and race/ethnicity) were also collected.

**RESULTS**

Out of a total of 40,532 screening exams during this period, 2,296 were flagged by the AI for a safeguard review. The safeguard reviewer identified 130 of these exams with potential misses, resulting in the detection of 41 cancers. These additional 41 cancers were found on top of the 219 cancers detected without the safeguard process. 43.9% of the additional cancers caught were from patients with dense breasts, 75.6% were invasive, 9.8% were triple-negative, and 12.2% were stage IIA or greater. Together, 22.0% of these cancers were deemed aggressive, compared to 19.2% of the cancers caught without the safeguard process. The cancers detected through the AI-driven safeguard process were from patients with similar demographics (age, race, and ethnicity) to those whose cancers detected without the safeguard process.

**CONCLUSION**

The AI-driven safeguard review process resulted in the detection of more breast cancers that would have otherwise been missed. These cancers consisted of mostly invasive cancers with a substantial proportion being aggressive cancers. This result suggests that a combination of modern deep learning AI plus targeted safeguard review is practical and provides significant improvement in detecting important cancers in a community practice.

**CLINICAL RELEVANCE/APPLICATION**

An AI-driven safeguard process can reduce missed cancers, a substantial proportion of which are aggressive cancers that require early detection and treatment for improved prognosis.

## M5B-SPBR-4 AUTOMATED MACHINE-LEARNING-BASED UNENHANCED RADIOMICS FOR IDENTIFICATION OF HER2-LOW BREAST CANCERS USING DIFFUSION-WEIGHTED IMAGING

Chunmei Li, MD (*Abstract Co-Author*) Nothing to Disclose
Min Chen, PhD (*Abstract Co-Author*) Nothing to Disclose
Xue Li (*Presenter*) Nothing to Disclose

**PURPOSE**

Developing new antibody-drug conjugates requires precise identification of human epidermal growth factor receptor 2 (HER2)-low breast cancers. This study aims to investigate the potential application of an automated machine learning model in developing unenhanced apparent diffusion coefficient (ADC)-based radiomics for distinguishing between HER2-zero and HER2-low/ positive breast cancers, as well as HER2-zero and HER2-low breast cancers.

**METHODS AND MATERIALS**

This study enrolled 169 patients with invasive breast cancer (27 HER2-zero, 96 HER2-low, and 46 HER2-positive). A total of 1200 radiomics features and 11 clinicopathologic features were extracted from each lesion. PyCaret was used to construct an automated machine learning pipeline for two binary classifications: HER2-zero versus HER2-low and HER2-zero versus HER2-low/ positive breast cancers. The performance of 13 machine learning models, based on the training cohort, was compared using AUC to obtain the optimal model. The optimal model was subsequently validated using an internal validation cohort. Students' t-tests, Mann-Whitney U tests or Chi-Square tests were used. The performance of the best model was evaluated through accuracy, AUC, sensitivity, positive predictive value, and F1 score.

**RESULTS**

For HER2-zero versus HER2-low breast cancers, the Gradient Boosting Classifier exhibited superior classification performance for the radiomics model, achieving an AUC of 0.75 in the validation cohort. The Random Forest Classifier (RF) demonstrated the best performance for the clinical-radiomics model with an AUC of 0.79 in the validation cohort. For HER2-zero versus HER2-low/ positive breast cancers, the RF was the optimal choice for both the radiomics and the radiomics-clinicopathologic models, each achieving an AUC of 0.82 in the validation cohort.

**CONCLUSION**

In conclusion, non-invasive prediction of HER2 expression status is challenging for radiologists. However, automated machine learning methods based on unenhanced radiomics have demonstrated promising outcomes. This approach facilitates the automated execution of machine learning workflows, saving time for radiologists and thereby enabling more efficient treatment guidance for patients with HER2-low breast cancer.

**CLINICAL RELEVANCE/APPLICATION**

The application of automated machine learning with ADC-based radiomics for the identification of HER2-low breast cancers is both feasible and advantageous.

## M5B-SPBR-6 PATIENT PERCEPTION OF ARTIFICIAL INTELLIGENCE USE IN INTERPRETATION OF SCREENING MAMMOGRAMS: A SURVEY STUDY

Emily E. Knippa, MD (*Abstract Co-Author*) Nothing to Disclose
Basak E. Dogan, MD (*Abstract Co-Author*) Research Grant, Seno Medical Instruments, Inc;Research Grant, MedCognetics, Inc
Yin Xi, PhD (*Abstract Co-Author*) Nothing to Disclose
Berat Bersu Ozcan, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess patient perceptions of the use of artificial intelligence (AI) in the interpretation of screening mammograms.

**METHODS AND MATERIALS**

In a prospective, IRB approved trial, all patients undergoing screening in our institution between 02.01.2023-08.01.2023 were offered a 29-question survey to assess their perception of AI use in their screening mammography interpretation. Age, race, education and income level, history of personal/family of breast cancer and prior breast biopsy were collected. Univariate and multivariate logistic regression was used to identify the independent factors associated with patients' acceptance of AI use.

**RESULTS**

Of 518 patients, most patients were between the ages of 50-79 (65.5%), at least college graduates (67.0%), and Non-Hispanic White [50.6% (NHW),18.1% Non-Hispanic Black (NHB), 13.3% Hispanic, 8.9% Asian, 9.1% multiracial or missing]. Patient-reported knowledge of AI was none or minimal in 76.4%. Most (74.1%) preferred to be consented to before AI is used. Stand-alone use was accepted by 4.4%. After an AI-interpreted abnormal screening, 91.3% requested radiologist review before scheduling a follow-up exam, compared to 64.7% of radiologist recall reviews by AI ($p<0.001$). In cases of discrepancy between AI and radiologist, higher rate of patients would undergo diagnostic for radiologist recalls compared to AI recalls (59.3% vs 52.5%, $p=0.03$). The majority held the vendor, hospital, and the radiologist accountable for AI diagnostic errors (57.7% for false negatives, 53.7% for false positives). At least moderate concern about loss of personal interaction, transparency, proof of technology, loss of privacy and bias was expressed by, 76.6%, 74.2%, 73.0%, 65.1% and 63.2% respectively. Higher education was associated with higher acceptance [OR (95%CI; 2.05(1.31-3.20, $p=0.002$). Concerns about data privacy and bias were higher among Hispanic [OR(95%CI); 2.41(0.99-5.89, $p=0.05$), 3.32(1.15-9.61, $p=0.005$), respectively] and NHB [OR(95%CI); 2.87(1.25-6.58, $p=0.03$), 4.31(1.50-12.39, $p=0.005$) NHW patients.

**CONCLUSION**

Patients support AI use as a second reader of screening mammograms, despite concerns about loss of personal interaction, privacy, transparency, and bias. Education level is significantly associated with AI acceptance. Accountability for AI-related diagnostic errors remains unclear.

**CLINICAL RELEVANCE/APPLICATION**

The safe and effective implementation of AI should include patient input to facilitate informed decision-making.

## M5B-SPBR-7 VARIATIONAL MODE DECOMPOSITION-AIDED DEEP LEARNING FRAMEWORK FOR IMPROVING CLASSIFICATION OF BREAST LESIONS IN ULTRASOUND IMAGES

Mostafa Fatemi, PhD, PhD (*Abstract Co-Author*) Nothing to Disclose
Azra Alizad, MD (*Abstract Co-Author*) Nothing to Disclose
Manali Saini, MEng, PhD (*Abstract Co-Author*) Nothing to Disclose
Sara Hassanzadeh, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine the performance of a novel variational mode decomposition-assisted deep learning framework in differentiating malignant from benign breast masses.

**METHODS AND MATERIALS**

In our proposed framework, breast ultrasound images were first decomposed by using two-dimensional variational mode decomposition (2D-VMD) for extracting low level features of lesions. The decomposed images were given as inputs along with the original images to the proposed low-complex deep learning classification model comprising depth-wise separable convolutional layers with mixed pooling, squeeze and excite block. The proposed deep learning framework was applied on two public data, UDIAT and BUSI as well as in our in-clinic data set. The in-clinic study included 655 female patient volunteers. The study was HIPAA compliant and approved by our Institutional Review Board. Signed informed consent was obtained from each enrolled patient.

**RESULTS**

The results of our study demonstrated robust performance of the proposed framework across three datasets— two public datasets and an in-clinic breast dataset —with accuracies of 98%, 93%, and 89% and specificity of 100, 93, 94 %, respectively. Further analysis of the proposed network without using 2D-VMD indicated a decrease of 5% in the classification accuracy. Further, the low complex architecture of the model reduced time to diagnose malignancy to about 2ms per image, five times faster than the conventional methods.

**CONCLUSION**

Our results indicates that the addition of 2D-VMD can significantly improve the overall classification accuracy by capturing the lesion-specific boundary features in the decomposed modes, which further boosts the performance of deep learning model. The proposed framework exhibits high classification performance and computational efficiency, which are crucial for timely diagnosis of malignancy and reducing the need for unnecessary benign biopsies. Thereby, the proposed framework is feasible for use in real-time diagnostic applications.

**CLINICAL RELEVANCE/APPLICATION**

The proposed deep learning method improves breast lesion classification with low computational complexity, aiding faster decision-making in clinical settings that could lead to better patient outcome.

## M5B-SPBR-8 IMPACT OF NEW TECHNOLOGIES ON A BREAST CANCER SCREENING PROGRAM

Marina Alvarez Benito, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jose Luis Raya Povedano, MD (*Abstract Co-Author*) Nothing to Disclose
Esperanza Elias Cabot (*Abstract Co-Author*) Nothing to Disclose
Sara Romero Martin (*Abstract Co-Author*) Nothing to Disclose
Eduardo Gutierrez Dorta, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To analyze the impact of digital breast tomosynthesis (DBT) and artificial intelligence (AI) on the detection rate, recall rate, and workload of a population-based breast cancer screening program. The reference technique was the standard double reading strategy with digital mammography (DM).

**METHODS AND MATERIALS**

A total of 23,996 consecutive screening studies classified into four groups were retrospectively analyzed: DM group (5,045 DM studies conducted between March 2020 and March 2021), DBT group (6,953 DBT studies conducted between March 2020 and March 2021), DM+AI group (5,049 DM studies conducted between March 2021 and March 2022), and DBT+AI group (6,949 DBT studies conducted between March 2021 and March 2022). The studies performed between March 2021 and March 2022 were processed by an AI system that assigned each study a score (0 - 100) and risk category (low, intermediate, high) based on the probability of malignancy. Ten specialized radiologists independently performed double reading without consensus, determining whether patients should be referred to a reference unit or scheduled for follow-up at two years. In cases assessed by AI, the radiologists had access to the information provided by the system during the reading process.Recall and detection rates were obtained for the different reading strategies: double reading DM (standard strategy), double reading DBT, single reading and double reading DM+AI, and single reading and double reading DBT+AI. The strategies were compared using the chi-square test.

## RESULTS

Compared to double reading DM, single reading DM+AI increased the detection rate by 1.6‰ (7.3‰ vs 5.7‰, p=0.325), with a 2.1% decrease in the recall rate (4.1% vs 6.2%, p<0.001) and a 50% decrease in reading volume. Double reading DM+AI increased the detection rate by 2.4‰ (8.1‰ vs 5.7‰; p=0.151), with a 0.5% increase in the recall rate (6.7% vs 6.2%) and the same reading volume. Compared to double reading DM, single reading DBT+AI increased the detection rate by 2.8‰ (8.5‰ vs 5.7‰; p=0.082), with a 2.7% decrease in the recall rate (3.5% vs 6.2%, p<0.001) and a 50% decrease in reading volume. Double reading DBT+AI increased detection rate by 3.9‰ (9.6 vs 5.7‰; p=0.018), with a 0.4% decrease in the recall rate (5.8 vs 6.2; p=0.301) and the same reading volume.

## CONCLUSION

The single DBT-AI-supported reading strategy achieved better detection rates compared to single or double DM reading with and without AI support and compared to single or double DBT reading. The double DBT-AI-supported reading strategy had the highest detection rate but increased the recall rate and doubled the workload.

## CLINICAL RELEVANCE/APPLICATION

AI-supported single or double DBT readings significantly improved detection and recall rates compared to double DM readings.

# M5B-SPBR-9 PREDICTING FIVE-YEAR POST-TREATMENT BREAST CANCER RECURRENCE USING MULTI-TIME-POINT MAMMOGRAMS AND MEDICAL REPORTS

Carla Sitges, MD (*Abstract Co-Author*) Nothing to Disclose
Xin Wang, MS (*Abstract Co-Author*) Nothing to Disclose
Xinglong Liang (*Abstract Co-Author*) Nothing to Disclose
Tao Tan (*Abstract Co-Author*) Nothing to Disclose
Tianyu Zhang (*Abstract Co-Author*) Nothing to Disclose
Luyi Han (*Abstract Co-Author*) Nothing to Disclose
Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Yuan Gao, MS (*Abstract Co-Author*) Nothing to Disclose
Chunyao Lu (*Presenter*) Nothing to Disclose

## PURPOSE

Predicting the risk of breast cancer recurrence after treatment remains challenging. Current follow-up is mostly one-size-fits-all surveillance using Mammography or DBT. This appears insufficient as many recurrences are still diagnosed as interval cancers. This study aims to develop a deep-learning model based on the clinical characteristics of the cancer and the provided therapy, enriched with multi-time-point pretreatment mammograms to predict the recurrence of breast cancer after initial therapy.

## METHODS AND MATERIALS

We retrospectively collected data on 3188 breast cancer patients from our institution presenting between January 1, 2004, and December 31, 2020. 401 of these patients (12.6%) presented with local breast cancer recurrence during surveillance. Relevant preoperative information was extracted from medical reports, encompassing demographic, clinical, radiologic, pathology, and treatment data. Additionally, 18079 multi-time-point digital screening mammograms obtained before the therapy of the first cancer were collected and we integrated them synergistically into our model. The dataset was split into training (2550 patients), validation (319 patients), and test (319 patients) cohorts. We compared our approach with commonly used machine learning methods relying on clinical data only and image-based deep learning models. Prediction performance was assessed based on the area under the receiver operating characteristic curve (AUC).

## RESULTS

Our hybrid model achieved an AUC of 0.738 (95% CI: 0.702, 0.753), which was significantly better than the AUCs of 0.690 (95% CI: 0.686, 0.710) for a common machine learning model using only clinical factors and 0.618 (95% CI: 0.607, 0.633) for an imaging only based DL model, improving accuracy by 0.048 (95% CI: 0.016, 0.064, p<0.01) and 0.120 (95% CI: 0.024, 0.134, p<0.01) respectively.

## CONCLUSION

Combining pretreatment mammograms from multiple time points with detailed medical reports significantly enhances the accuracy of predicting breast cancer recurrence following conventional therapy.

## CLINICAL RELEVANCE/APPLICATION

This study highlights the benefits of integrating comprehensive clinical data and sequential mammograms into predictive models to increase the precision of predicting breast cancer recurrence. This could be used for selecting specific follow-up schedules for breast cancer patients.

# Abstract Archives of the RSNA, 2024

M5B-SPCA

**Cardiac Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPCA-1 CARDIAC MAGNETIC RESONANCE LONG-TERM FOLLOW-UP ANALYSIS OF CARDIAC AND VALVULAR FUNCTION IN ADULTS WITH SURGICALLY CORRECTED TRANSPOSITION OF THE GREAT VESSELS

Gerhard B. Adam, MD (*Abstract Co-Author*) Nothing to Disclose
Gunnar K. Lund, MD (*Abstract Co-Author*) Nothing to Disclose
Kersten Peldschus, MD (*Abstract Co-Author*) Nothing to Disclose
Jochen Herrmann, MD (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV;Speaker, Koninklijke Philips NV;Research Grant, Schallware GmbH;Speaker, Schallware GmbH
Carsten Rickers (*Abstract Co-Author*) Nothing to Disclose
Enver G. Tahir, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Hancken-Pauschinger (*Abstract Co-Author*) Nothing to Disclose
Jennifer Erley, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To analyze the long-term influence of a surgically corrected dextro-transposition of the great vessels (D-TGA) on left and right ventricular (LV, RV), as well as valvular function compared to healthy controls, as well as to assess the impact of pulmonary artery valve re-surgery.

### METHODS AND MATERIALS

In this retrospective single-center study, 42 adults with D-TGA who underwent arterial switch operation (ASO) during childhood received a follow-up cardiac magnetic resonance imaging (CMR) exam (3T, Ingenia, Philips) between 2021 and 2023 (49% female, age 33 ±10), more than 20 years after the initial surgery. LV and RV volumes (indexed to body surface area), ejection fraction (EF), and global longitudinal strain (GLS) of the LV (Feature Tracking, Cvi42, Circle Vascular Imaging) were analyzed. Results were compared with a healthy control group (n=15, 47% female, age 55.7 ± 12.4) Patients with re-surgery (of the pulmonary artery or aorta) were compared with patients without re-surgery. Generalized linear models (including age, sex, body surface area) and Mann-Whitney U test were applied.

### RESULTS

D-TGA patients who underwent ASO showed a significantly impaired LV GLS (-14.0% ± 6.2 vs. -17.3% ± 2.4, $p<0.049$). At the same time, LV EF (62% ± 5) was not significantly different to controls ($p=0.630$). Radial and circumferential strain, as well as RV volumes and EF were also not different between D-TGA patients and controls. 12/42 D-TGA patients underwent re-surgery of the pulmonary arteries or pulmonary valve, the most frequent was pulmonary-conduit after over 20 years after the first surgery. Patients with re-surgery of the pulmonary artery or valve showed a significantly higher maximum flow velocity (TP Vmax) ($p=0.042$) and a significantly lower stroke volume (TP SV) above the pulmonary valve ($p=0.034$) in the follow-up CMR exam.

### CONCLUSION

D-TGA patients who underwent ASO show a reduced LV GLS compared to healthy controls despite normal EF after a follow-up of over 20 years, as subtle sign of decreased LV contractility. D-TGA patients with re-surgery of the pulmonary artery showed a flow acceleration and a reduced stroke volume above the pulmonary valve, indicating truncus pulmonalis valve stenosis.

### CLINICAL RELEVANCE/APPLICATION

Reduced GLS could serve as a potential indicator of subtle left ventricular dysfunction in adult D-TGA patients. D-TGA patients with re-surgery of the pulmonary artery exhibit signs of pulmonary valve stenosis and potentially adverse RV remodeling, which should be closely integrated into clinical follow-ups.

## M5B-SPCA-10 DIFFERENCES IN PULMONARY TRANSIT TIME AND PULMONARY VASCULAR VOLUME BETWEEN SYSTEMIC AMYLOIDOSIS PATIENTS WITH AND WITHOUT CARDIAC INVOLVEMENT

Sharmila Dorbala, MPH (*Abstract Co-Author*) Research Grant, Pfizer Inc;Research Grant, General Electric Company;Research Grant, Attralus;Research Grant, Koninklijke Philips NV;Consultant Pfizer Inc ;Consultant, General Electric Company;Consultant, Johnson & Johnson;Speaker, Ionetix
Sarah Cuddy, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Raymond Y. Kwong (*Abstract Co-Author*) Nothing to Disclose
Rodney H. Falk, MD (*Abstract Co-Author*) Nothing to Disclose
Raul San Jose Estepar, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael Jerosch-Herold, PhD (*Abstract Co-Author*) Nothing to Disclose
Olivier Clerc (*Abstract Co-Author*) Nothing to Disclose
Sumit Gupta, MBBS, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Systemic light chain (AL) amyloidosis causes deposition of amyloid fibrils in various organs including the heart and lungs. Pulmonary transit time (PTT) and pulmonary vascular volume (PVV) are physiological parameters reflecting cardiopulmonary hemodynamics which are shown to predict adverse cardiovascular outcomes independently. This study explores PTT and PVV differences between AL amyloidosis with and without cardiac involvement.

### METHODS AND MATERIALS

A retrospective single center cross-sectional cohort study analyzed subjects with biopsy-proven AL amyloidosis grouped into 3: 1) recently diagnosed AL amyloidosis with cardiac involvement (AL-CMP; n=58), 2) AL amyloidosis treated with cardiac involvement (AL-CMP-rem; n=24), and 3) recently diagnosed AL amyloidosis without cardiac involvement (AL-non-CMP; n=17). Evaluation included serum biomarkers and cardiac magnetic resonance. PTT was calculated from rest perfusion images utilizing regions of interest placed within the basal right and left ventricular blood pool. PTT was normalized for heart rate (PTTn). PVVi was estimated as PTT(s) × cardiac output (ml/s) indexed to body surface area. One-way ANOVA was used to compare groups. The Pearson correlation coefficient was used to assess relationships.

### RESULTS

Patients in the 3 groups (AL-CMP; AL-CMP-rem; AL-non-CMP) were comparable based on age [62.8(7.8); 63.5(7.0); 58.1(8.8)] and gender (male, 53.4%; 50%; 70.6%). PTTn was longer ($p<0.001$) in AL-CMP group [14.3 (5.0)] compared to both AL-CMP-rem [11.4(5.8)] and AL-non-CMP [8.9(3.5)] groups. PVVi was higher ($p<0.001$) in AL-CMP group [29.0(24.1 - 36.7) mL/ m2] compared to both AL-CMP-remission [24.6 (19.2 - 31.5) mL/ m2] and AL-non-CMP [19.7 (15.2 - 26.3)] groups. PTTn and PVVi correlated with left ventricular mass index (0.44; 0.50) and left atrial area index (0.35; 0.46); and negatively correlated with LVEF (-0.51; -0.36) and RVEF (-0.43; -0.31). PTTn and PVVi correlated with Global ECV fraction(0.47; 0.39), which represents expansion of extracellular space and iECV (0.50;0.51), a measure of total amyloid burden. Native T1, T2, ECV and iECV ($p<0.05$)were higher in subjects with cardiac involvement compared to those without cardiac involvement and were similar between the AL-CMP and AL-CMP-rem groups.

### CONCLUSION

PTT and PVV are higher in AL-CMP compared to AL-CMP-rem group despite similar ventricular ejection fractions, suggesting that differences may be due to factors related to pulmonary circulation.

### CLINICAL RELEVANCE/APPLICATION

PTT and PVV may be useful biomarkers in systemic amyloidosis patients and provide additional information about cardiopulmonary hemodynamics when combined with currently used biomarkers that evaluate cardiac structure and function.

## M5B-SPCA-2 HIGH RESOLUTION MODIFIED DIXON DUAL PHASE STEADY STATE ANGIOGRAPHY WITH SYSTOLIC AND DIASTOLIC PHASE IN PEDIATRIC PATIENTS WITH COMPLEX CONGENITAL HEART DISEASE

Christoph Katemann (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Alexander Isaak, MD (*Abstract Co-Author*) Nothing to Disclose
Shuo Zhang, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Christopher Hart (*Abstract Co-Author*) Nothing to Disclose
Lucia Danny Beissel, MD (*Presenter*) Nothing to Disclose

### PURPOSE

3D magnetic resonance angiography (MRA) is crucial for diagnostic evaluation and interventional planning in pediatric patients with complex congenital heart disease (CDH). The aim of this study is to evaluate the impact of a 3D modified Dixon (mDixon) dual phase steady state MRA on the diagnostic assessment in patients with complex CDH.

### METHODS AND MATERIALS

In this prospective study from July 2023 to April 2024, patients with various types of complex CDH (e.g. Tetralogy of Fallot, hypoplastic left heart syndrome and atrioventricular septal defect) underwent clinically indicated cardiovascular magnetic resonance (CMR) at 3 Tesla. A free breathing 3D mDixon steady state MRA with respiratory navigator gating was used for diastolic and systolic imaging in one single acquisition. Optimal trigger delay for systolic imaging was obtained from 4-chamber cine views. Trigger delay for diastolic imaging was set to end diastole. Vessel diameter (main pulmonary artery, left pulmonary artery, right pulmonary artery, aortic isthmus, aorta ascendens, aorta descendens) and image quality in different venous und arterial vessels (5=excellent to 1=non-diagnostic) were assessed in each phase. For statistical analysis paired t-test and Wilcoxon test were used, as appropriate.

### RESULTS

36 pediatric patients were included (7.9±7.4 years). Vessel diameter were significantly greater in systole than in diastole (e.g. main pulmonary artery 25.1±6.8mm vs. 20.4±6.2mm; P=0.00009). Especially due to flow artifacts in systole, image quality was better in diastole than in systole for main pulmonary artery and aorta (e.g. main pulmonary artery 4.5 [interquartile range 3-5,] vs. 3 [interquartile range, 2-4.25]; P=0.01). There was no difference in image quality between systole and diastole in the pulmonary veins or arteries, coronaries, superior and inferior vena cava and in supraaortic vessels. Primarily due to arrhythmia and high pulse rate, there was a non-diagnostic image quality in two patients in the diastolic phase whereas good image quality could be achieved in systolic phase which is less susceptible to heart rate changes.

### CONCLUSION

In pediatric patients with complex congenital heart disease, 3D mDixon dual phase steady state MRA offers additional diagnostic value and at the same time does not extend acquisition times. The additional systolic image could allow a more precise pre-procedural sizing of implants by avoiding an underestimation of diameters and can have diagnostic implications as they are more robust even in arrhythmic patients.

### CLINICAL RELEVANCE/APPLICATION

The additional systolic phase means an improvement of steady state MRA, especially in cases of arrythmia or high heart rate, and allows more precise pre-procedural sizing of implants.

## M5B-SPCA-3 PREDICTING CORONARY CALCIUM SCORE FROM CHEST X-RAYS USING AI

Bruno A. Rocha, MD (*Abstract Co-Author*) Nothing to Disclose
Igor R. Oliveira, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and evaluate the accuracy of an artificial intelligence tool based on Convolutional Neural Networks (CNNs) for predicting the coronary calcium score (Agatston score) from chest X-rays. The goal is to provide an accessible alternative for cardiovascular risk stratification.

**METHODS AND MATERIALS**

This retrospective study analyzed radiological reports of patients who underwent coronary calcium score CT scans, alongside chest radiographs conducted within one year of the CT study. The dataset included 10,000 patients, all anonymized to protect confidentiality. The training data was divided into a training set (70%), a validation set (10%), and a test set (20%). Exclusion criteria included patients with coronary stents or revascularization. Chest X-ray images were preprocessed using the "torch-xray-vision" library, focusing on the heart and aortic region. Patients were categorized into two groups based on their CACS: zero and non-zero. A convolutional neural network (CNN) was trained using Python 3.11 and the TensorFlow library with VGG-19 architecture, to classify individuals into these categories using chest X-rays as input. Performance was evaluated using the area under the receiver operating characteristic curve (AUC), confusion matrix, sensitivity, and specificity.

**RESULTS**

The VGG-19 model with segmented images focusing on the "0 and greater than 0" CACS categories achieved an AUC of 0.75, with a sensitivity of 71,6% and a specificity of 62,3%, positive predictive value of 65,5% and negative predictive value of 68,7%. This indicates a significant ability to differentiate between patients with varying levels of coronary artery calcification and accurately identify those with and without elevated CACS. Factors contributing to this performance include image segmentation, focusing on calcification detection.

**CONCLUSION**

The study successfully developed a machine learning tool capable of predicting the coronary calcium score with accuracy. This tool provides a viable means for early detection of cardiovascular risks, offering significant utility in clinical decision-making.

**CLINICAL RELEVANCE/APPLICATION**

The tool aims to optimize resources by screening large populations, identifying individuals who could benefit from further cardiovascular risk stratification with standard cardiac CT scans. This enhances public health outcomes by providing a scalable solution, particularly for settings with limited diagnostic resources.

## M5B-SPCA-4 DIAGNOSTIC ACCURACY OF ARTIFICIAL-INTELLIGENCE BASED CAD-RADS EVALUATION IN ASYMPTOMATIC MALE ATHLETES

Ilias Tsiflikas, MD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Gassenmaier, MD (*Abstract Co-Author*) Nothing to Disclose
Jan M. Brendel (*Abstract Co-Author*) Nothing to Disclose
Florian Hagen, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Krumm, MD (*Abstract Co-Author*) Speakers Bureau, Siemens AG
Moritz T. Winkelmann, MD (*Abstract Co-Author*) Nothing to Disclose
Simon Greulich (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, MBA (*Abstract Co-Author*) Advisory Panel, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Advisory Panel, Bayer AG;Speakers Bureau, Bayer AG;Research Grant, Bayer AG
Christof Burgstahler (*Abstract Co-Author*) Nothing to Disclose
Thomas Kuestner, DIPLENG (*Abstract Co-Author*) Nothing to Disclose
Jean-Francois Paul, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jens Kubler, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate deep-learning based assessment of coronary stenosis in an asymptomatic low-risk cohort of athletes.

**METHODS AND MATERIALS**

The artificial intelligence (AI)-based model was applied to an in-house prospectively recruited cohort of asymptomatic male marathon runners who underwent coronary computed tomography angiography (CCTA). CCTA stenosis quantification was performed with AI-models (CorEx, Spimed-AI) and compared with visual quantitative assessment using the Coronary Artery Disease-Reporting and Data System 2.0 (CAD-RADS).

**RESULTS**

94 male patients with a mean age of 53 ± 7 years were evaluated. Coronary artery disease (CAD, i.e. =1% stenosis, CAD-RADS 1 or higher) was present in 34/94 (36%) patients, significant CAD (i.e. >50% stenosis, CAD-RADS 3 or higher) was present in 3/94 patients (3%) after visual analysis. AI-based evaluation detected CAD in 53/94 patients (56%) with 91.2% sensitivity, 63.3% specificity, 58.5% positive predictive value, 92.7% negative predictive value and 73.4% diagnostic accuracy. AI-based evaluation detected significant CAD in 12/94 (13%) patients with 100% sensitivity, 90.1% specificity, 25.0% positive predictive value, 100% negative predictive value and 90.4% diagnostic accuracy.

**CONCLUSION**

AI-based CAD assessment of significant stenosis (CAD-RADS 3 or higher) indicates high diagnostic accuracy in a low-risk population.

**CLINICAL RELEVANCE/APPLICATION**

AI-based quantification of coronary artery stenosis to accelerate workflow.

## M5B-SPCA-5 LEFT VENTRICULAR ABNORMALITY DETECTION USING AI-MEASURED CARDIO-THORACIC RATIO ON CHEST RADIOGRAPHS

Dongmyung Shin, PhD (*Abstract Co-Author*) Researcher, RadiSen Co, Ltd
Joshua Ra (*Abstract Co-Author*) Nothing to Disclose
Heejun Shin, BS (*Abstract Co-Author*) Nothing to Disclose
Minkyung Lee (*Presenter*) Nothing to Disclose

**PURPOSE**

To present an AI model measuring cardiothoracic ratio (CTR) on chest x-ray radiographs (CXRs) and examine the correlation between CTR and echocardiographic diagnoses of severe left ventricular hypertrophy (SLVH) and dilated left ventricle (DLV).

**METHODS AND MATERIALS**

[Data] 71,589 CXRs of 24,689 patients were used in our study (CheXchoNet). The data was approved by the IRB and is publicly available. Patients underwent echocardiograms within one year of their X-ray scans, which diagnosed them with either SLVH or DLV. We constructed a composite binary label based on the presence of either condition (9,861/61,728 composite positive/negative). We used commercially available AI software to measure CTRs on individual CXRs. [Analysis] We first examined the histograms of CTR values according to the composite labels to check whether there was a significant difference between the two groups using a t-test. Then, we calculated sensitivity, specificity, area under the curve (AUC), and the Youden index with ground truth to the composite labels by changing the threshold of CTR for binary classification. Finally, we developed a classification AI model (multilayer perceptron with two fully connected layers) that takes a CTR value, age, and sex of a patient as inputs and predicts a binary composite label. We used 80% of CXRs for training and the remaining data for evaluation. We repeated the AUC and Youden index calculations.

**RESULTS**

The average CTR value was significantly higher in composite SLVH/DLV positive patients compared to negative patients (mean ± std: 0.56 ± 0.07 for positive; 0.51 ± 0.07 for negatives; p-value < 0.001). The binary classification of the composite label showed an AUC of 0.69, and the Youden index of 0.30 was maximized when CTR > 0.53, reporting a sensitivity of 0.70 and specificity of 0.60. When sex, age, and CTR were used as inputs in the classification AI model, an AUC was 0.71, and the Youden index was 0.32, with a sensitivity of 0.74 and specificity of 0.58. When CTR values were not included as inputs, the AUC dropped significantly to 0.54, implying the importance of CTR measurements for accurate prediction of composite SLVH/DLV labels.

**CONCLUSION**

We propose an AI model that provides automated measurements of CTR on chest radiographs and shows its potential to predict the echocardiographic diagnoses of left ventricular structural abnormalities.

**CLINICAL RELEVANCE/APPLICATION**

Automated and precise measurement of CTR using AI models can assist radiologists in the identification of cardiomegaly on chest radiographs. This may facilitate clinical decision-making to pursue confirmatory imaging with echocardiography for earlier recognition of left ventricular hypertrophy and dilation.

## M5B-SPCA-6 ASSESSMENT OF EARLY RIGHT VENTRICULAR DYSFUNCTION IN PULMONARY HYPERTENSION PATIENTS USING CARDIOVASCULAR MAGNETIC RESONANCE FEATURE TRACKING TECHNIQUE

Jianxiu Lian (*Abstract Co-Author*) Nothing to Disclose
Jian-Xing Qiu, MD (*Abstract Co-Author*) Nothing to Disclose
Jia Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the feasibility of CMR-FT technology for quantitatively assessing the myocardial strain of the RV in PH patients.

**METHODS AND MATERIALS**

22 PH patients (PH group, 9 males, mean age: 22?92years) and 20 healthy controls (Control group, 9 males, mean age: 19?73years) who all underwent CMR were retrospectively enrolled. All participants underwent 3.0T CMR examination (Ingenia CX, Philips Healthcare, the Netherlands) with a 32-channel abdominal coil. The sequence of b-SSFP cines were performed for CMR-FT assessment. Scan parameters were as follows: TR=45.6 ms , TE=1.4 ms , field of view (FOV)=340×340 mm , slice thickness=8 mm, voxel size=1.6×1.6×8 mm3.CMR-FT technique was used to measure 3D basal, mid-cavity, apical and global myocardium longitudinal strain (LS), circumferential strain (CS) and radial strain (RS) of RV with CVI 42.0 software. The software automatically detected the endocardial contours of RV during both the diastolic and systolic phases. Subsequently, the epicardial contours of RV were manually drawn and adjustments were made to ensure accurate delineation layer by layer. The SPSS26.0 software was used to obtain statistical results about the differences between the two groups' myocardial strain parameters of RV using Student's t-test or Mann-Whitney U test. Receiver operating characteristic (ROC) analysis was performed to assess the clinical utility of all strain parameters and calculate the cut-off value. Statistical significance was set at $P < 0.05$.

**RESULTS**

RSGlobal,CSGlobal,LSGlobal,RSBasal,RSMid,CSMid,CSApical,LSMid and LSApical were significantly changed in the PH group compared with the controls (all P< 0 .05). ROC curve analysis was performed for strain parameters between the PH group and control group when obvious deference existed. RSGlobal,CSGlobal,LSGlobal,RSBasal,RSMid,CSMid,CSApical,LSMidand LSApical were predictors for PH patients,while LSApical showed the best performance (Cut-off value=-15.15%, AUC=0.92, Sensitivity=0.773, Specificity=0.95).

**CONCLUSION**

RV myocardial strain parameters especially LSApical were feasible to reflect the progression of PH patients and have the potential to be the predictors for early detection of RV dysfunction in PH patients .

**CLINICAL RELEVANCE/APPLICATION**

RV myocardial strain parameters attained from CMR-FT technology were feasible to reflect the progression of PH patients and had the potential to early detect RV dysfunction in PH patients, and could help clinician make an accurate diagnose and timely treatment to improve patients' long-term outcome.

## M5B-SPCA-7 LIPOMATOUS HYPERTROPHY OF THE INTERATRIAL SEPTUM (LHIS) IN DIFFERENT SUBPOPULATIONS: A POTENTIAL NOVEL EPICARDIAL ADIPOSE TISSUE BIOMARKER?

Gudrun Feuchtner, MD (*Abstract Co-Author*) Nothing to Disclose
Gerlig Widmann, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Pietro Giacomo Lacaita, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Epicardial adipose tissue (EAT) is a novel biomarker for cardiovascular risk stratification. Lipomatous hypertrophy of the interatrial septum (LHIS) is a distinct compartment of the EAT. While its association with obesity is known, no texture analysis has been performed yet among different subpopulations.Therefore, the purpose of our study was to quantify LHIS texture by computed tomography (CT) in different subpopulations, and to evaluate its association with cardiovascular risk factors (CVRF).

### METHODS AND MATERIALS

5466 patients (age, 59.7+/-11.4;41.4% females) undergoing coronary CT angiography (CTA) for clinical indications were recruited retrospectively and screened for LHIS.LHIS-density (HU), coronary stenosis severity (CAD-RADS), coronary artery calcium (CAC) score, and high-risk plaque (HRP) were quantified by CTA.The major cardiovascular risk factors and comorbidities were collected.

### RESULTS

324 patients had LHIS. LHIS-density was lower in obese (BMI>30kg/m2)(20.4 vs 13.6HU;p=0.02) BMI was inversely correlated with LHIS density (HU) (BetaR -0.031;95%CI:-0.054- -0.008;p=0.007). Multivariate regression model showed an association of both BMI and LHIS-density (HU) with COPD, while BMI was less strongly (OR:0.94:95%CI: 0.896-0.985;p=0.01) than LHIS-density (HU)(OR:1.01; 95%CI:1.005-1.025,p=0.003) associated. After adjusting for age and CAC score, BMI was no longer significant significance (OR:0.95;95%CI:0.907-1.004);p=0.072) only LHIS -density (HU) (OR:1.02;95% CI:1.005-1.026, p=0.005) remained associated. BMI was not associated with LHIS (OR:1.0,p=0.681), only age and COP (OR 1.02 and OR 9.13, both p<0.001). 151(72.6%) of 208 patients with COPD had LHIS, which is markedly higher than in the literature. LHIS density in COPD patients was higher (-10.93HU vs -21.1HU;p<0.001). CAC and coronary stenosis severity (CAD-RADS and >50% stenosis) were not different (p=0.106;p=0.156 and p=0.350). High-risk plaques were observed more frequently in COPD patients with severe GOLD stages >= 2 (32.3% vs 20.1%;p=0.044).

### CONCLUSION

LHIS texture is distinct in different subpopulations: In obese, LHIS density is lower. In COPD patients LHIS tissue density is higher, suggestive for higher brown fat component. Coronary stenosis severity and calcium were not different, HRP were more frequent in severe COPD.

### CLINICAL RELEVANCE/APPLICATION

LHIS is a distinct compartment of the EAT, with a different texture among different subpopulations.

## M5B-SPCA-8 PRELIMINARY STUDY ON THE ASSESSMENT OF RIGHT VENTRICULAR SYSTOLIC FUNCTION AND ITS CORRELATION WITH CLINICAL INDICES IN PATIENTS WITH STABLE COPD USING CARDIAC MAGNETIC RESONANCE

Jianlin Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Hao Woo (*Abstract Co-Author*) Nothing to Disclose
Dong Yang, BMedSc, MMEd (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the value of cardiac magnetic resonance (CMR) in evaluating right ventricular systolic function in patients with stable chronic obstructive pulmonary disease (COPD) and its correlation with relevant clinical indexes.

### METHODS AND MATERIALS

From April 2015 to February 2021, 35 patients with stable COPD diagnosed in the respiratory department of Zhongshan Hospital affiliated with Dalian University were enrolled. These patients were divided into a cardiac decompensation group (15 cases) and a compensation group (20 cases) based on a 6-minute walking test. Within one week, all participants underwent pulmonary function tests (FEV1/FVC), measurement of CMR right ventricular ejection fraction (RVEF), cardiac index (RVCI), right ventricular median transverse diameter change fraction (RVFMDC), brain natriuretic peptide levels, COPD assessment test (CAT), and other clinical indexes.

### RESULTS

No significant differences were observed in age, sex, or blood pressure between the cardiac function compensation and decompensation groups ($P > 0.05$). Significant differences were found in RVEF (51.50±2.34% vs 49.11±3.36%), RVCI (1.91±0.21 ml/min/m2 vs 1.28±0.19 ml/min/m2), and RVFMDC (32.28±7.43% vs 25.56±2.22%) between the two groups ($P < 0.05$). There were no significant differences in other indexes of right ventricular systolic function ($P > 0.05$). A negative correlation was noted between RVCI and CAT score ($r = -0.656$, $P < 0.001$), RVEF and CAT score ($r = -0.538$, $P < 0.001$), RVEF and NT-proBNP ($r = -0.394$, $P = 0.019$), and between RVFMDC and both CAT score ($r = -0.655$, $P < 0.001$) and NT-proBNP ($r = -0.317$, $P = 0.05$).

### CONCLUSION

CMR can reliably evaluate the changes and degree of right ventricular systolic function in patients with stable COPD, which is helpful for early clinical evaluation and diagnosis.

### CLINICAL RELEVANCE/APPLICATION

The results of this study indicate that using 1.5T MRI equipment for CMR technology is a feasible and effective method to quantitatively evaluate the right ventricular systolic function of patients with stable chronic obstructive pulmonary disease (COPD). Additionally, it confirms that the COPD assessment test (CAT) score and brain natriuretic peptide levels are important factors affecting right ventricular systolic function.These findings can provide an important reference basis for the formulation of clinical treatment plans and efficacy evaluation in such patients.

## M5B-SPCA-9 SYSTEMIC RIGHT VENTRICLE TORSION IN CONGENITALLY CORRECTED AND COMPLETE TRANSPOSITION OF THE GREAT ARTERIES USING MOTION TRACKING ANALYSIS OF CARDIAC CINE MAGNETIC RESONANCE

Kei Inai (*Abstract Co-Author*) Nothing to Disclose
Shuji Sakai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seiko Shimizu (*Abstract Co-Author*) Nothing to Disclose
Yurie Shirai (*Abstract Co-Author*) Nothing to Disclose
Michinobu Nagao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiro Inoue, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In congenitally corrected transposition of great arteries (cTGA) and complete transposition of great arteries(TGA), the anatomic right ventricle (RV) can be carrying the systemic circulation. The dysfunction of anatomic RV corresponding to the systemic circulation and tricuspid valve regurgitation influences the prognosis of patients. No good kinetic parameter has been found to identify patients who survive to old age in a non-repair, so called natural course in cTGA. We hypothesize that the appearance of right ventricular torsion associated with right ventricular remodeling of the systemic circulation underlies the maintenance of pump function.

## METHODS AND MATERIALS

We analyzed 50 patients with cTGA and TGA who underwent cardiac cine magnetic resonance image retrospectively. We calculated the time-torsion curve all around in each segments using short-axis cine images of the basal to apex of the systemic right or left ventricle(LV) and the motion tracking method. The torsion (degrees/cm) in each segments during ventricular contraction was extracted and compared to the left ventricular torsion of the systemic RV or LV with cTGA and TGA and 20 healthy controls.

## RESULTS

The torsion was significantly decreased in the following order: control, systemic LV, and RV(1.93±0.46 degree/cm vs. 1.17±0.47 degree/cm vs. 0.93±0.62 degree/cm, $p<0.05$). In the systemic RV of cTGA, the torsion in the natural course (n=13) was significantly higher than that after repair (1.39±0.64 degree/cm vs 0.57±0.29 degree/cm, $p<0.05$). The torsion of cTGA in the natural course was comparable to that of systemic LV group, suggesting maintenance of pump function in the RV. On the other hand, the decreased torsion of cTGA that requires repair suggested that it was difficult to maintain pump function.

## CONCLUSION

The presence of torsion preserved in the Systemic RV suggests remodeling of the Systemic RV and may contribute to the maintenance of pump function in the natural course of cTGA.

## CLINICAL RELEVANCE/APPLICATION

In the natural course of cTGA, the torsion appeared to be equally present in the RV as in the LV, suggesting that RV torsion may be a useful indicator for prognosis of cTGA and for determining repair procedures.

# Abstract Archives of the RSNA, 2024

M5B-SPCH

**Chest Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPCH-1 PROGNOSTIC VARIABILITY IN PATHOLOGIC T3 NON-SMALL CELL LUNG CANCER WITH SEPARATE NODULES: THE IMPACT OF SEPARATE NODULE CHARACTERISTICS ON SURVIVAL OUTCOMES

Joon Beom Seo, MD, PhD (*Abstract Co-Author*) Stockholder, Promedius Inc;Stockholder, Coreline Soft, Co Ltd;Stockholder, Anymedi Inc
Sang Min Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Jooae Choe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Eun Jin Chae, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sohee Park, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Patients with T3 non-small cell lung cancer (NSCLC) with separate nodules (SNs) have been reported to have better prognosis than those with other T3 descriptor-tumors. However, significant heterogeneity might exist in patients with pathologic T3-SNs but there have been limited attempts to identify prognostic subgroup in pT3-SN tumors based on imaging and pathological features of SNs.

### METHODS AND MATERIALS

This retrospective study included patients with pT2b-pT3 NSCLC who underwent lobectomy/pneumonectomy between 2010 and 2021. Imaging and pathological features of primary tumors and their SN(s) were recorded. Recurrence-free survival (RFS) and overall survival (OS) were evaluated using Cox proportional hazards model.

### RESULTS

The patients (1107 patients) included in the study had pT2b (498 patients), pT3 without SN (468 patients), and pT3 with SN (141 patients) tumors. Subsolid SN was an independent favorable prognostic factor for both RFS (hazard ratio [HR]: 0.26; P = .001) and OS (HR, 0.11; P < .001). Moreover, SN numbers was a significant prognostic factor for RFS (HR, 0.11; P < .001). In patients with pT3-solid SN tumors, a distance of > 3 cm from the primary tumor (HR, 1.92; P = .04) was the only prognostic factor for shorter OS. Moreover, pT3-subsolid SN and pT2b tumors were associated with comparable RFS and OS; whereas pT3-solid SN and other T3 descriptor-tumors were associated with comparable RFS and OS (log-rank, P > .999 for all).

### CONCLUSION

Patients with surgically resected pT3-SN NSCLC showed different prognosis according to the presence of GGO components of SNs. Prognosis of pT3 tumors with subsolid SNs was comparable to that of pT2b but the prognosis of pT3 tumors with solid SNs were comparable to other T3 descriptors.

### CLINICAL RELEVANCE/APPLICATION

Although previous studies have shown that SN could potentially offer a significantly better prognosis among patients with pT3, there is significant heterogeneity among patients with pT3-SN and subcategorizing these patients based on CT characteristics of the SN revealed subgroups with different outcomes. Furthermore, CT characteristics of SN emerged as a significant prognostic factor in patients with pT3-SN.

## M5B-SPCH-2 PREDICTING SPREAD THROUGH AIR SPACES STATUS OF LUNG ADENOCARCINOMA WITH “ONE-STOP” CHEST SPECTRAL AND PERFUSION IMAGING CT

Junli Tao (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the spectral and perfusion computed tomography (CT) findings of lung adenocarcinoma with spread through air spaces (STAS) positive or negative, compare the accuracy of spectral and perfusion in predicting STAS status, and explore whether the combined modle can improve the prediction efficiency of STAS status.

### METHODS AND MATERIALS

Patients who underwent “one-stop” chest spectral and perfusion CT were prospectively enrolled from June 2022 to February 2024. A total of 187 patients with STAS + (n = 62) and STAS - (n = 125) were included. Differences in CT imaging characteristics between STAS + and STAS - were compared. Spectral parameters (CT40keV, C T70keV, CT100keV, iodine concentration [IC], water concentration [WC], and effective atomic number [Zeff]) of the lesions in the arterial and venous phases were measured. The perfusion parameters, including blood volume (BV), blood flow (BF), mean transit time (MTT), and time to peak (TTP), were measured simultaneously. The differences in the spectral and perfusion parameters between the groups were examined. Receiver operating characteristic (ROC) curves were calculate and compare the area under the curve (AUC) in both groups.

**RESULTS**

Patients with STAS + or STAS - had different maximum diameter, nodule type, shape, and lymph node metastasis (P = 0.001, 0.001, 0.001, and 0.013, respectively). In the arterial and venous phases, the values of spectral parameters (CT40keV, CT70keV, IC, and Zeff) were greater in the STAS + group than the STAS - (P < 0.05). Similarly, the values of the perfusion parameters (BV, BF, MTT) were greater in the STAS + group than STAS - group (P < 0.01), while the TTP was longer than that in the STAS + group (P < 0.01). The AUC of the arterial and venous phases was 0.83 (95% [CI]: 0.72-0.86) and 0.84 (95% [CI]: 0.73-0.88), respectively. There was no significant difference between them(P > 0.05). When combined the spectral parameters, the AUC was lower than perfusion parameters. For the spectral parameters, the AUC was 0.86 (95% [CI]: 0.76-0.90). For the perfusion parameters, the AUC was 0.90 (95% CI: 0.83-0.95). Finally, Combining spectral and perfusion parameters, the AUC of the combined model was 0.96 (95% CI: 0.88-0.99), which was higher than all other models.

**CONCLUSION**

Spectral and perfusion CT both have the capability to differentiate lung adenocarcinoma STAS status. Compared to spectral, perfusion CT imaging has higher diagnostic efficiency in distinguishing STAS status. Combining spectral and perfusion, the combined model was superior than the other models.

**CLINICAL RELEVANCE/APPLICATION**

"One-stop" chest spectral and perfusion CT imaging can predict the lung adenocarcinoma STAS status noninvasively and preoperatively, which is helpful to optimize clinical treatment plan.

## M5B-SPCH-3 PREDICT TUMOR SPREAD THROUGH AIR SPACES IN PERIPHERAL STAGE I LUNG ADENOCARCINOMA USING A VISION TRANSFORMER MODEL

Xiaofeng Li (*Presenter*) Nothing to Disclose

**PURPOSE**

Preoperative assessment of tumor spread through air spaces (STAS) is crucial for surgical planning in early-stage lung cancer. The Vision Transformer (ViT)-based deep learning (DL) models outperformed other traditional neural networks but the value of predicting STAS in peripheral stage I lung adenocarcinoma is unclear. This study aims to develop a 3D ViT model based on enhanced CT images of the tumor and 3mm peritumoral to predict STAS in peripheral stage I lung adenocarcinoma.

**METHODS AND MATERIALS**

We retrospective analysis the preoperative CT data from patients diagnosed with lung tumors from January 2022 to December 2023, with additional data collected from another hospital serving as an external validation set. Inclusion criteria were: 1) Clinical stages T1-T2aN0M0 as defined by the 8th AJCC staging system; 2) The peripheral lesion located in the outer two-thirds of the lung field on chest CT axial images, with the tumor's center within this region; 3) Postoperative pathological diagnosis confirmed as adenocarcinoma. Exclusion criteria included: 1) Preoperative CT diagnosis or postoperative pathological diagnosis of double primary or multiple primary (>2) lung cancers; 2) Preoperative anticancer treatments such as radiotherapy, chemotherapy, immunotherapy, or targeted therapy. A senior radiologist independently delineated the region of interest (ROI) around the lung cancer tumors using the 'Grow From Seeds' feature in 3D-slicer software, performing an external expansion of 3mm on the delineated tumor areas. The CT images were then cropped to a size of 64x64x64 pixels around the tumor. The 3D Vit algorithm was employed to train the model, which was also validated on an independent external dataset. Model evaluation metrics included AUC, Accuracy, F1-Score, Precision, and Recall.

**RESULTS**

The training set included 208 patients (median age, 62 years; male: female 55%: 45%), with 45 (21.63%) cases positive for STAS. Comparisons between centers showed no significant statistical difference in clinical and pathological variables (P > 0.05). The DL model using the 3D Vit algorithm demonstrated performance metrics of AUC, Accuracy, Precision, and Recall in the training set and external validation set as follows: 0.9757, 0.9901, 1, 0.9514; and 0.7766, 0.8415, 0.6932, 0.7, respectively. The confusion matrix also confirmed the model's robust diagnostic efficacy.

**CONCLUSION**

The 3D Vit model based on the tumor and 3mm peritumoral exhibits significant predictive capability for STAS in peripheral stage I lung adenocarcinoma.

**CLINICAL RELEVANCE/APPLICATION**

Preoperative predict STAS in peripheral stage I lung adenocarcinoma is crucial for the thoracic surgeon to choose the surgical approach. DL models based on the 3D VIT can improve the performance.

## M5B-SPCH-4 ADVANCING EGFR MUTATION SUBTYPES PREDICTION IN NSCLC BY COMBINING 3D PRETRAINED CONVNEXT, RADIOMICS, AND CLINICAL FEATURES

Fang Zhou, MD (*Abstract Co-Author*) Nothing to Disclose
Chantao Huang (*Abstract Co-Author*) Nothing to Disclose
Zhixuan Song (*Abstract Co-Author*) Nothing to Disclose
Peng Hao (*Presenter*) Nothing to Disclose

**PURPOSE**

The aim of this study was to develop a novel approach for predicting the expression status of Epidermal Growth Factor Receptor (EGFR) and its subtypes in patients with Non-Small Cell Lung Cancer (NSCLC) by utilizing a Three-Dimensional Convolutional Neural Network model called ConvNeXt, along with radiomics features and clinical features.

**METHODS AND MATERIALS**

This retrospective study included a total of 732 NSCLC patients with available CT imaging and EGFR expression data. The regions of interest (ROI) were manually segmented and clinical pathological characteristics were collected. Radiological and deep learning features were extracted. These cases were randomly divided into training, validation and testing sets. Feature selection was performed and XGBoost was used to create individual and combined models to predict the presence of EGFR and subtype mutations. The effectiveness of the models was evaluated using ROC curves and PRC curves.

**RESULTS**

Seven models were established based on deep learning features, radiomic features, clinical data and their combinations. In terms of predicting EGFR mutations, compared with other prediction models, the ModelCNN-radiomic-clinical model showed the best performance with an AUC of 0.801. When distinguishing between EGFR subtypes ex19del and L858R, the ModelCNN-radiomic model had the highest AUC value of 0.775.

### CONCLUSION

Both deep learning models and models based on radiomic features can provide highly accurate non-invasive predictions of EGFR status and its subtypes. The fusion model has the potential to enhance the non-invasive methods for predicting EGFR mutations and subtypes, providing a more reliable prediction method.

### CLINICAL RELEVANCE/APPLICATION

This study's fusion model combining 3D-CNN ConvNeXt, radiomics, and clinical features offers a more accurate and non-invasive method for predicting EGFR mutations and subtypes in NSCLC patients, thereby potentially improving personalized treatment strategies.

## M5B-SPCH-5 CT-BASED VISION TRANSFORMER PREDICTS OUTCOMES IN PATIENTS WITH NON-SMALL CELL LUNG CANCER RECEIVING IMMUNOTHERAPY

Ting Xu (*Abstract Co-Author*) Nothing to Disclose
Shuxing Wang (*Abstract Co-Author*) Nothing to Disclose
Xiaowen Liu (*Abstract Co-Author*) Nothing to Disclose
Jingshan Gong, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop and validate multimodal deep learning model on the basis of CT-based Vision Transformer (ViT) to predict outcomes in patients with non-small cell lung cancer (NSCLC) receiving immunotherapy.

### METHODS AND MATERIALS

This retrospective study enrolled 329 patients with advanced NSCLC receiving immunotherapy at two centers from October 2019 to October 2023. Patients from center 1 (n=210) were used as the training set, and the external test set included the 119 patients from center 2. ViT was implemented to extract deep learning features of NSCLCs from preoperative chest CT images and generate immunotherapy response deep learning score (irDLS). Patients were stratified into high-irDLS and low-irDLS groups based on optimal cut-off value of irDLS in training set. Cox proportional hazards regression model was used to assess the correlation between variables and progression-free survival (PFS) and overall survival (OS), calculating hazard ratio (HR) and 95% confidence intervals (CIs). Kaplan-Meier method was employed to plot PFS and OS curves, with Log-rank test used for intergroup comparisons.

### RESULTS

The HR of irDLS was 0.699 (95% CI: 0.496, 0.984; P=0.003) for PFS, and 0.608 (95% CI: 0.371, 0.994; p=0.045), respectively. It could predict 1-, 3- and 5-year DFS with an area under the receiver operating characteristic curve (AUC) of 0.748, 0.725 and 0.726, and 1-, 3- and 5-year OS with AUC of 0.770, 0.773 and 0.764 in the external test set, respectively. When irDLS combining with PLR, clinical stage and bone metastasis, the multimodal model predicted 1, 3, and 5-year PFS with AUC of 0.775, 0.812, and 0.841 in the external test set, respectively.

### CONCLUSION

The radiomics signature derived from preoperative CT using ViT could non-invasively predict outcomes in patients with NSCLC receiving immunotherapy. The multimodal model integrating radiomics signature and clinical data was able to predict survival of patients with NSCLC receiving immunotherapy with high performance, which could provide decision-making support for selecting suitable patients receiving immunotherapy.

### CLINICAL RELEVANCE/APPLICATION

In this bi-center study, the multimodal model integrating immunotherapy response deep learning score, derived from preoperation CT images through Vision Transformer, and clinical data could obtain high predictive performance for outcomes in patients with NSCLCs receiving immunotherapy. The radiomics signature showed the potential to be a surrogate imaging biomarker for selection of patients who would be benefit for immunotherapy noninvasively.

## M5B-SPCH-6 ASSESSING THE EFFICIENCY OF ELIGIBILITY CRITERIA FOR LOW-DOSE COMPUTED TOMOGRAPHY LUNG SCREENING IN CHINA ACCORDING TO CURRENT GUIDELINES

Ning Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Yanyan Tang (*Presenter*) Nothing to Disclose

### PURPOSE

The efficiency of the LCS for each guideline criterion was expressed as the efficiency ratio (ER). The inclusion rates, eligibility rates, LC detection rates, and ER based on the different eligibility criteria of the four guidelines were comparatively analyzed. The four guidelines were as follows: China guideline for the screening and early detection of lung cancer (CGSL), National Comprehensive Cancer Network (NCCN), the United States Preventive Services Task Force (USPSTF) , and International Early Lung Cancer Action Program (I-ELCAP).

### METHODS AND MATERIALS

Between 2005 and 2022, 31,394 asymptomatic individuals were screened using low-dose computed tomography (LDCT) at our institution. Demographic data and relevant LC risk factors were collected. The efficiency of the LCS for each guideline criterion was expressed as the efficiency ratio (ER). The inclusion rates, eligibility rates, LC detection rates, and ER based on the different eligibility criteria of the four guidelines were comparatively analyzed. The four guidelines were as follows: China guideline for the screening and early detection of lung cancer (CGSL), National Comprehensive Cancer Network (NCCN), the United States Preventive Services Task Force (USPSTF) , and International Early Lung Cancer Action Program (I-ELCAP).

### RESULTS

Of 31,394 participants, 298 (155 women, 143 men) were diagnosed with LC. For CGSL, NCCN, USPSTF, and I-ELCAP guidelines, the eligibility rates for guidelines were 13.92%, 6.97%, 6.81%, 53.46%, ERe for eligibility criteria were 1.46%, 1.64%, 1.51%, and 1.13%, respectively, and for the inclusion rates, they were 19.0%, 9.5%, 9.3%, and 73.0%, respectively. LCs which meet the screening criteria of CGSL, NCCN, USPSTF, and I-ELCAP guidelines were 29.2%, 16.4%, 14.8%, and 86.6%, respectively. The age and smoking criteria for CGSL were stricter, hence resulting in lower rates of LC meeting the screening criteria.The CGSL, NCCN, and USPSTF guidelines showed the highest underdiagnosis in the 45-50 age group (17.4%), while the I-ELCAP guideline displayed the highest missed diagnosis rate (3.0%) in the 35-39 age group. Males and females significantly differed in eligibility based on the criteria of the four guidelines (P<0.001).

### CONCLUSION

The I-ELCAP guideline has the highest eligibility rate for both males and females. but its actual efficiency ratio for those deemed eligible by the guideline was the lowest. Whereas the NCCN guideline has the highest ERe value for those deemed eligible by the guideline.

### CLINICAL RELEVANCE/APPLICATION

These findings provide valuable insights for improving LCS guidelines in the Chinese population.

## M5B-SPCH-7 EVALUATION FOR OSTEOPOROSIS ON LOW-DOSE CHEST CT (LDCT) OBTAINED FOR LUNG CANCER SCREENING: A RETROSPECTIVE STUDY OF 784 PATIENTS

Cihan Duran, MD (*Abstract Co-Author*) Nothing to Disclose
Migena Gjoni (*Abstract Co-Author*) Nothing to Disclose
Muhammad O. Awiwi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate for osteoporosis in asymptomatic patients presenting for lung cancer screening.

### METHODS AND MATERIALS

A retrospective review of 784 patients with low-dose CT (LDCT) was performed. Patients with a dual-energy X-ray absorptiometry (DEXA) scan performed within 4 months of the LDCT were selected. Vertebral trabecular bone attenuation was measured between T7-L1. T-scores were recorded from DEXA scans (a T-score of =-2.5 was considered diagnostic of osteoporosis; and a T-score between -1.0 and -2.4 was considered osteopenia). FRAX scores were calculated. Thoracic vertebral compression fractures were recorded.

### RESULTS

93% of patients were female. Osteoporosis was present in 31% of the patients and 52% had osteopenia. Receiver operator curve (ROC) analysis was performed and an AUC value of 0.748 (95% CI: 0.701-0.795) was obtained for diagnosing osteoporosis using CT-trabecular bone attenuation. A median trabecular bone attenuation cutoff value of <130 HU yielded a sensitivity of 92% and a specificity of 22%; whereas a cutoff value of <70 HU yielded a sensitivity of 23% and a specificity of 95% for diagnosing osteoporosis. A cutoff value of <130 HU identified 89% of patients for whom osteoporosis treatment was indicated based on their FRAX scores. A sub-analysis was performed on individuals between 50-64 years of age (who are younger than the recommended age for routine DEXA screening) and 23% (44/192) of whom had osteoporosis, and 8% (16/192) had vertebral compression fractures.

### CONCLUSION

Low vertebral trabecular bone attenuation calculated from lung cancer screening LDCT is suggestive of osteoporosis. Sensitivities and specificities were calculated at various cutoff values.

### CLINICAL RELEVANCE/APPLICATION

Low vertebral trabecular bone attenuation values calculated on lung cancer screening LDCT may be used to recommend further evaluation with DEXA scan. LDCT evaluation for osteoporosis is particularly important for individuals younger than the current recommended DEXA screening age of 65 years.

## M5B-SPCH-9 LONG TERM OUTCOMES OF A MULTIDISCIPLINARY LUNG CANCER LOW DOSE CT SCREENING PROGRAM FROM A LARGE CANADIAN COMMUNITY HOSPITAL CENTER

Anna Bendzsak (*Abstract Co-Author*) Nothing to Disclose
Kassandra Bisson (*Abstract Co-Author*) Nothing to Disclose
Garima Sharma (*Abstract Co-Author*) Nothing to Disclose
Daniel Levay (*Abstract Co-Author*) Nothing to Disclose
Brandon Sheffield (*Abstract Co-Author*) Nothing to Disclose
Parneet Cheema (*Abstract Co-Author*) Nothing to Disclose
Kashif Irshad (*Abstract Co-Author*) Nothing to Disclose
Marc G. Ossip, MD, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

To report results of 8 years of lung cancer screening in a large Canadian community hospital. William Osler Health System (WOHS) High Risk Lung Cancer Screening Program was established in 2012 and is the longest running multidisciplinary lung cancer screening program in Canada outside of a research or pilot study.

### METHODS AND MATERIALS

Retrospective review of patients who had lung cancer screening in the WOHS High Risk Lung Cancer Screening Program between February 2012 to December 2019 with follow-up until April 2023. Eligibility for screening was age 55-77, minimum 30-pack-year smoker, no prior lung cancer, no CT scan within 12 months of initial Low Dose Computed Tomography (LDCT) and former smokers must have quit within 15 years.

### RESULTS

During the 8 years, 5460 patients were enrolled, with an average of 683 new patients per year (27% annual growth rate). Median age at entry was 63 and 61% were males. The retention rate was 74%. A total of 14,048 LDCT were completed, of which 88.6% were reported with recommendations for routine follow up, 11.4% for shorter term follow up, and 2% leading to biopsy. Biopsy was performed on 5.3% of patients (n=287), either CT guided +/- endobronchial ultrasound / mediastinoscopy (EBUS/med) in 3.8%, and EBUS/med alone in 1.4%. The pneumothorax rate per CT biopsy was 41%, and the chest tube rate 14%. Of the 225 CT guided biopsies, 52.4% were malignant, 11.6% atypical/suspicious for cancer, 21.8% benign, and 4.2% non-diagnostic. Of the 118 malignant cases, 50% were non-small cell lung cancer (NSCLC) adenocarcinoma, 28% NSCLC squamous cell, 11% NSCLC not otherwise specified, 3% large cell neuroendocrine, 4% small cell lung cancer, 2% carcinoid and 1% metastatic non lung cancer. In patients with atypical / suspicious CT biopsy pathology results, 69.2% had a subsequent malignancy diagnosis, and of those with non-diagnostic or benign CT biopsy pathology results, 38.7% and 23.4% had a subsequent malignancy diagnosis, respectively. Surgical resections were performed on 198 patients (3.6%). Overall surgical malignancy rate was 88.8%, if presurgical biopsy was performed 93.4% and if not performed 76.0%. The cancer detection rate was 4.2% (lung cancer 4.0%, n=221), with a prevalence of 40%. The average lung cancer size was 2.3 cm and 26% were lymph node positive. The clinical or surgical stage of lung cancers detected was primarily early stage: stage I (62.0%), II (11.3%), III (16.7%) and IV (10%).

### CONCLUSION

Eight years of lung cancer screening in a community hospital detected a high rate of cancers, primarily early stage, with a low rate of lung biopsies required.

## CLINICAL RELEVANCE/APPLICATION

Lung cancer screening in a community hospital is feasible and can result in similar lung cancer detection rates and stage shift as reported in the literature.
Printed on: 05/28/25

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

M5B-SPER

**Emergency Radiology Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPER-1 NEW PHOTO-REALISTIC ILLUMINATION TECHNIQUE APPLIED TO NAKED-EYE AUTO-STEREOSCOPIC DISPLAYS FOR 3D POSTMORTEM CT IMAGES OF SKULL FRACTURES

Wataru Fukumoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Keigo Chosa (*Abstract Co-Author*) Nothing to Disclose
Shintaro Morishita (*Abstract Co-Author*) Nothing to Disclose
Toru Higaki, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Haruka Higashibori (*Presenter*) Nothing to Disclose

### PURPOSE

Post-mortem CT (PMCT) is a supplementary diagnostic modality in forensics; it facilitates detecting bone fractures. In forensics, not only bone fractures but also the power and direction of the applied external force must be assessed to determine the cause of death. Although the three dimensional (3D) CT image is one of the most interpretable presentation format, current standard displays are 2D modalities and the true depth and direction information which is the essence of 3D is still lacking. We developed a photo-realistic illumination (PRI) technique that simulates the interaction of photons with the scanned object. It yields photo-realistic images on naked-eye auto-stereoscopic (NEAS) displays. We compared it with the conventional volume rendering (VR) technique applied to 3D-PMCT images of skull fractures.

### METHODS AND MATERIALS

We enrolled 16 cadavers with skull fractures (11 males, 5 females; 9 traffic accident, 4 falls, 3 drifting in the sea) who had undergone autopsy and PMCT studies between 2019 and 2023 at our center for cause-of-death investigations. The scans were performed on a 16-row multi-detector CT scanner (Aquilion Lightning; Canon Medical Systems). The 3D-PMCT images with the PRI technique applied to NEAS display and the conventional VR technique were reconstructed from axial CT images of 0.5-mm slice thickness with soft kernel. A forensic radiologist, a forensic pathologist, and a medical student assigned a confidence score ranging from 1 (poor) to 5 (excellent) in their assessment of the image quality with respect to the detection of skull fractures and the estimation of the external force. Image-quality differences between the scans obtained with the two techniques were analyzed with the two-sided Wilcoxon signed-rank test.

### RESULTS

The mean image-quality scores regarding both the detection of skull fractures and the estimation of the external force were 3.6 (SD 1.0) for the PRI technique on the NEAS display; they were 2.7 (SD 0.9) and 2.6 (SD 0.7), respectively, for the VR technique (both $p<0.01$).

### CONCLUSION

For the assessment of skull fractures in cadavers, our new PRI technique applied on NEAS displays of 3D-PMCT images was superior to the conventional VR technique.

### CLINICAL RELEVANCE/APPLICATION

As our new PRI technique applied to NEAS displays facilitates the assessment of skull fractures and the estimation of the external force, it may be useful for pre-autopsy forensic pathology examinations.

# Abstract Archives of the RSNA, 2024

M5B-SPGI

**Gastrointestinal Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPGI-11 DECODING GASTRIC TUMOR HETEROGENEITY: A RADIOMICS APPROACH TO DISTINGUISH GASTRIC CANCER VARIANTS

LI YANG (*Abstract Co-Author*) Nothing to Disclose
Jia-Liang Ren, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaoxiao He (*Presenter*) Nothing to Disclose

### PURPOSE

To establish diagnostic models for differentiating gastric neuroendocrine carcinoma (g-NEC) and gastric mixed adeno-neuroendocrine carcinoma (g-MANEC) from gastric adenocarcinoma (g-ADC) based on traditional contrast enhanced CT imaging features and radiomics features.

### METHODS AND MATERIALS

A retrospective collection of 90 patients with g-(MA)NEC (g-MANEC and g-NEC), confirmed by surgical pathology and without pre-surgical anti-tumor treatment, was conducted. These patients were matched 1:1 by pathological T-stage with 90 patients diagnosed with g-ADC post-operatively. Traditional contrast enhanced CT imaging features were analyzed using univariable and multivariable logistic regression. Tumor segmentation was performed using Slicer software, and radiomics features were extracted using the PyRadiomics platform. Feature selection was conducted through univariable analysis, correlation analysis, LASSO, and multivariable stepwise logistic regression to establish a radiomics model and calculate the Radiomics score (Rad-score). The independent predictors from the clinical model and Rad-score were integrated to create a combined model. The diagnostic performance of the models was assessed and compared using ROC curves and DeLong's test. The models' diagnostic efficacy was further validated in subgroup of g-NEC vs. g-ADC and g-MANEC vs. g-ADC cases.

### RESULTS

The tumor necrosis and lymph node metastasis were identified as independent predictors for differentiating g-(MA)NEC from g-ADC ($P < 0.05$). The clinical model demonstrating AUCs of 0.700 in the training cohort and 0.667 in the validation cohort. From 1502 extracted radiomic features, five were retained to establish the radiomics model, which showed AUCs of 0.809 in the training cohort and 0.802 in the validation cohort. The combined model yielded AUCs of 0.853 and 0.812 in the training and validation cohort and significantly outperformed the clinical model in both cohorts ($P < 0.05$). Subgroup analysis revealed that the combined model exhibited acceptable performance in differentiating g-NEC from g-ADC and g-MANEC from g-ADC, with AUCs of 0.887 and 0.823 in the training cohort and 0.852 and 0.762 in the validation cohort.

### CONCLUSION

Combined model based on traditional CT imaging and radiomic features provide a non-invasive and effective preoperative diagnostic method for differentiating g-(MA)NEC from g-ADC.

### CLINICAL RELEVANCE/APPLICATION

The biological behaviors of g-(MA)NEC and g-ADC are different, with the former characterized by higher aggressiveness and poorer prognosis. This distinction is also reflected in their treatment approaches, where first-line pharmacological therapies and surgical techniques vary between the two.

## M5B-SPGI-12 ABDOMINAL CONTRAST-ENHANCED CT RADIOMICS INPREDICTING SECONDARY IMATINIB RESISTANCE IN HIGH-RISK GASTROINTESTINAL STROMAL TUMORS

LI YANG (*Abstract Co-Author*) Nothing to Disclose
Jia-Liang Ren, MD (*Abstract Co-Author*) Nothing to Disclose
Qing Hao (*Presenter*) Nothing to Disclose

### PURPOSE

This study evaluated the potential of radiomics from contrast-enhanced abdominal CT to predict secondary resistance to adjuvant imatinib therapy in high-risk gastrointestinal stromal tumors (GISTs).

### METHODS AND MATERIALS

Clinical data from high-risk GIST patients who underwent imatinib adjuvant therapy and monitored post-operatively were analyzed. Ninety-two patients, including 19 resistant cases at Center 1, were divided into training (n=64) and internal validation (n=28) sets at a 7:3 ratio. An additional 12 patients including 2 resistant cases from Center 2, were included as external validation set. Clinical attributes and conventional CT imaging findings were documented. A clinical model was developed using univariate and multivariate logistic regression. Radiomics features were extracted from 3D segmented

tumors on thin-layer venous phase image by using PyRadiomics platform. After correlation analysis and recursive feature elimination, radiomics models employing logistic regression, support vector machines, random forests, and decision trees, were constructed. The most effective model based on predictive performance was select, generating a rad-score. A combination model integrating independent predictors from both the clinical model and the rad-score was developed. The predictive performance of the three models was evaluated using ROC curves and the DeLong test.

**RESULTS**

Significant predictors of imatinib resistance included blurred margins and blood supply/dilated draining vessels ($P < 0.05$). The clinical model demonstrated AUCs of 0.874 (95% CI, 0.762-0.985) and 0.803 (95% CI, 0.608-0.998) in training and internal validation sets, respectively. Following feature selection, the best-performing radiomics model utilized a decision tree with three features, achieving AUCs of 0.882 in the training set and 0.864 in the internal validation set. The combination model had AUCs of 0.963 (95% CI, 0.925-1.000) and 0.939 (95% CI, 0.861-1.000) in the training and internal validation sets, respectively. The combination model demonstrated superior accuracy and specificity with values of 0.917,0.900.

**CONCLUSION**

The combination model, incorporating conventional imaging characteristics and radiomics features from contrast-enhanced abdominal CT, robustly predicts imatinib resistance post-surgery in GIST patients.

**CLINICAL RELEVANCE/APPLICATION**

Approximately 50% of GIST patients develop secondary resistance to imatinib within 2 years, leading to treatment failure and poor prognosis. The proposed model offers an innovative strategy for early and precise detection of potential resistance in high-risk GIST patients, enhancing follow-up management strategies.

## M5B-SPGI-2 QUANTITATIVE MULTIPARAMETRIC VOLUMETRIC PREDICTION OF REBLEEDING AFTER ESOPHAGEAL VARICEAL LIGATION IN CIRRHOSIS BY SPECTRAL COMPUTED TOMOGRAPHY

Guo Yu (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the clinical value of energy-spectral CT multiparametric volumetric quantification in predicting the risk of rebleeding within 1 year after endoscopic lancing of esophageal varices (EVL) in patients with ruptured esophageal variceal hemorrhage (EVB) in cirrhosis.

**METHODS AND MATERIALS**

Thirty-five patients who were first ligated for ruptured esophageal variceal hemorrhage due to cirrhosis were collected and underwent portal vein energetic CT, and the patients were followed up for 1 year, and were divided into a no-rebleeding group and a rebleeding group on the basis of whether or not they had rebleeding within 1 year of the endoscopic ligation treatment. The hepatic VACR post-processing software was used to automatically extract the liver in the portal vein stage to realize the extraction of the whole liver, and then the liver was automatically divided into the left and right lobes by using the automatic segmentation of the liver based on the portal vein, and the volume measurements and VR reconstruction were carried out for the whole liver and the different lobes of the liver. The liver volume, portal and arterial effective atomic number, iodine (water) concentration, water (iodine) concentration, standardized iodine concentration, and single-energy CT value of 40-140 keV were measured for the whole liver and different liver lobes. Standardized iodine concentrations were calculated for each energy spectrum parameter. The correlation between energy-spectrum CT multiparameter volumetric quantification and rebleeding in cirrhotic EVB patients undergoing EVL within 1 year was analyzed.

**RESULTS**

There were statistically significant differences between IC, WC, whole liver Zeff, whole liver Zeff in portal phase, whole liver Zeff in arterial phase, and aortic IC, and the AUC values of the area under the curve of the working characteristics (ROC) of the subjects were 0.835, 0.804, 0.735, 0.788, and 0.761. Construction of a rebleed occurring within 1 year after endoscopic treatment of gastroesophageal varices in cirrhotic liver Nomogram column-line graph prediction model with an AUC of 0.866 [95% CI (0.740,0.992)].

**CONCLUSION**

The risk of postoperative rebleeding in patients with cirrhotic EVB can be effectively predicted based on the energy spectrum parameters before endoscopic treatment, which is important for guiding clinical treatment.

**CLINICAL RELEVANCE/APPLICATION**

Spectral CT has good predictive properties and can be used as a risk assessment tool for clinical rebleeding of ruptured esophagogastric fundal varices.

# Abstract Archives of the RSNA, 2024

M5B-SPGU

**Genitourinary Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPGU-1 DIAGNOSTIC ACCURACY AND INTER-READER AGREEMENT OF NAC-VIRADS SCORING SYSTEM: A PROSPECTIVE VALIDATION STUDY

Martina Pecoraro, MD (*Abstract Co-Author*) Nothing to Disclose
Valeria Panebianco, MD (*Abstract Co-Author*) Nothing to Disclose
Emanuele Messina, MD (*Abstract Co-Author*) Nothing to Disclose
Francesca Mezzapesa (*Abstract Co-Author*) Nothing to Disclose
Ludovica Laschena, MD (*Abstract Co-Author*) Nothing to Disclose
Ailin Dehghanpour, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Recently a novel scoring system nac-VIRADS (Neoadjuvant Chemotherapy VI-RADS) was proposed to assess radiological response based on MRI after chemotherapy in patients with MIBC (muscle-invasive bladder cancer).The aim of this study is to determine the diagnostic accuracy of nac-VIRADS in predicting response to systematic therapy in patients with MIBC, validating this innovative score and evaluating inter-reader agreement.

### METHODS AND MATERIALS

This prospective study included patients with non-metastatic MIBC who underwent trans-urethral resection of bladder tumor (TURBT) and/or repeated TUR, followed by neoadjuvant chemotherapy (NAC), radical cystectomy (RC), and extended pelvic lymph node dissection. Patients underwent pre- and post-treatment multiparametric MRI. Radiological response was evaluated by two experienced urogenital radiologists using nac-VIRADS scoring system. The reference standard was based on histopathologic reports and tumor regression grades from RC. Nac-VIRADS performance was assessed by means of ROC analysis, according to both readers' assessments, deriving sensitivity, specificity, PPV, NPV, and accuracy. Interreader agreement was determined with Cohen's k statistics. Univariable and multivariable analyses were implemented.

### RESULTS

55 patients were included. n=13 were classified as nac-VIRADS 1-2, n=14 as nac-VIRADS 3, n=22 as nac-VIRADS 4, and n=6 as nac-VIRADS 5. Overall, there was agreement between nac-VIRADS scoring and radical cystectomy pathology report and tumor regression grade, except for two cases scored as nac-VIRADS 3 with ypT3aN1 and TRG-3 pathology findings. Diagnostic performance showed a range of 90%-94% sensitivity, 86%-90% specificity, 87%-92% positive predictive value (PPV), and 89%-92% negative predictive value (NPV). AUC was 0.84 (95% CI: 0.80-0.88) for the more experienced reader. Inter-reader agreement was almost perfect (K = 0.88). Hematuria correlated with disease progression.

### CONCLUSION

Nac-VIRADS scoring system offers a reliable and reproducible approach, employing a clear algorithm, to assess the response to systemic therapy in patients with MIBC. Its implementation has the potential to significantly influence therapeutic decision-making and enhance overall patient survival.

### CLINICAL RELEVANCE/APPLICATION

The radiological restaging of patients with MIBC undergoing neoadjuvant therapy offers the opportunity to radically change patient management, improving and refining therapeutic decisions, increasing the percentage of patients who can benefit from non-radical treatments, avoiding radical cystectomy, and enhancing patient quality of life.

## M5B-SPGU-2 DEVELOPMENT AND VALIDATION OF AN INTEGRATIVE DEEP LEARNING MODEL FOR PREDICTING HRR GENE MUTATION AND RESPONSE TO TARGETED THERAPY IN METASTATIC CASTRATION-RESISTANT PROSTATE CANCER: A MULTICENTER STUDY

Xiang Liu (*Presenter*) Nothing to Disclose

### PURPOSE

To develop and validate an integrative deep learning model for predicting homologous recombination repair (HRR) gene mutations and the response to targeted poly (ADP-ribose) polymerase inhibitor (PARPi) treatment in patients with metastatic castration-resistant prostate cancer (mCRPC).

### METHODS AND MATERIALS

In this multicenter study, 210 patients with mCRPC were included between September 2018 and November 2023. Among them, 118 patients from Center 1 were assigned into the training cohort and 92 patients into the validation cohort. All patients underwent HRR gene sequencing, multiparametric prostate MRI and biopsy histology. An integrative model was constructed using a deep learning model (ResNet-50) based on multiparametric MRI features and

histologic features to predict HRR gene mutation. The predictive performance was assessed using the ROC curve analysis. Additionally, 78 mCRPC patients from Center 2 who have received PARPi targeted therapy were included to assess the performance of the established integrative model in predicting the response to the targeted therapy. Radiographic progression-free survival (rPFS) was used as the endpoint and Kaplan-Meier analysis was used for further assessment of predictive efficacy for PARPi treatment.

**RESULTS**

An integrative model consisted of multiparametric MRI and histologic features was established for predicting HRR gene mutation. This integrative model achieved an AUC of 0.84 and 0.79, sensitivity of 0.86 and 0.82, and specificity of 0.80 and 0.75 in the training and validation cohorts, respectively. Kaplan-Meier analysis showed that the integrative model was associated with the rPFS in response to PARPi treatment (log-rank $P < 0.05$).

**CONCLUSION**

The integrative model based on prostate MRI and histologic features can be helpful for predicting HRR gene mutation and PARPi therapy response in patients with mCRPC.

**CLINICAL RELEVANCE/APPLICATION**

A multimodal integration model consisted of multiparametric MRI and biopsy histology can assist in predicting HRR gene status and the therapy response when HRR sequencing is not available due to the lack of facility or limited tissue sample.

## M5B-SPGU-3 DIAGNOSTIC PERFORMANCE OF THE CLEAR CELL LIKELIHOOD SCORE INTEGRATED WITH CYSTIC DEGENERATION AND NECROSIS FOR IDENTIFYING CLEAR CELL RENAL CELL CARCINOMA IN CT1 SOLID RENAL MASSES ON IMAGING

Yuwei Hao (*Abstract Co-Author*) Nothing to Disclose
Mengqiu Cui (*Abstract Co-Author*) Nothing to Disclose
Haiyi Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Shaopeng Zhou, MD (*Abstract Co-Author*) Nothing to Disclose
Yuanhao Ma (*Abstract Co-Author*) Nothing to Disclose
Huiping Guo (*Abstract Co-Author*) Nothing to Disclose
Bai Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Xueyi Ning (*Abstract Co-Author*) Nothing to Disclose
Honghao Xu (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic value of clear cell likelihood score(ccLS) integrated with cystic degeneration and necrosis in clear cell carcinoma (ccRCC) in cT1 solid renal masses(SRMs).

**METHODS AND MATERIALS**

This retrospective study consecutively included 299 patients (203 males, 96 females; mean age, 54±13years) who underwent MRI from our hospital between January 2022 and November 2023, showing a total of 305 renal masses with pathologically confirmed cT1 SRMs. Five abdominal radiologists were trained in the ccLS algorithm and the assessment of cystic degeneration and necrosis, two radiologists scored independently all cT1 SRMs using ccLS v2.0 and ccLS integrated with cystic degeneration and necrosis (cn-ccLS, if the lesion has cystic degeneration or necrosis, the score is increased by one on the basis of ccLS, and the original ccLS 5 score remains unchanged) respectively, with disagreements resolved through consultation. Random-effects logistic regression modeling was used to evaluate the diagnostic performance of ccLS v2.0 and cn-ccLS for ccRCC, and the area under curve (AUC) of ccLS and cn-ccls were compared using the DeLong's test. Three other radiologists scored independently 100 cT1 SRMs from January 2022 to December 2022. The interobserver agreement of the ccLS score was evaluated using the Weighted Kappa test, and differences in the weighted Kappa coefficients was compared using the Gwet consistency coefficient.

**RESULTS**

The sample included 229 ccRCCs, 76 other renal masses. The mean size of all lesions was 3.4±1.2cm. In cT1 SRMs, the pooled sensitivity, specificity, accuracy of ccLS v2.0 for diagnosing ccRCC were 74%, 88%, 53%, as compared with 94%, 82%, 91% with cn-ccLS, respectively. The AUC of cn-ccLS was significantly higher than that of ccLS v2.0 for diagnosis of ccRCC (0.88 vs 0.81; $P<0.001$). In cT1a SRMs, the pooled sensitivity, specificity, accuracy of ccLS v2.0 for diagnosing ccRCC were 73%, 86%, 53%, as compared with 90%, 78%, 87% with cn-ccLS, respectively. The AUC did not differ significantly between cn-ccLS and ccLS v2.0 (0.84 vs 0.80; $P>0.05$). In cT1b SRMs, the pooled sensitivity, specificity, accuracy of ccLS v2.0 for diagnosing ccRCC were 75%, 94%, 80%, as compared with 98%, 94%, 98% with cn-ccLS, respectively. The AUC of cn-ccLS was significantly higher than that of ccLS v2.0 for diagnosis of ccRCC (0.96 vs 0.85; $P<0.001$). Interobserver agreement of cn-ccLS was significantly higher than that of ccLS v2.0 (0.74 vs 0.66; $P<0.001$).

**CONCLUSION**

Incorporating cystic degeneration and necrosis significantly enhances the diagnostic performance of the ccLS v2.0 system for ccRCC in cT1 SRMs, particularly in cT1b SRMs.

**CLINICAL RELEVANCE/APPLICATION**

Assist radiologusts in daily diagnosis work.

## M5B-SPGU-5 DEEP LEARNING FOR DISTINGUISHING PROSTATE CANCER AND BENIGN DISEASE OF PATIENTS WITH GRAY-ZONE PROSTATE-SPECIFIC ANTIGEN LEVELS AND PI-RADS 3 LESIONS

Li Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

When the PSA level of PI-RADS 3 patients is also in the" gray area" of 4-10 ng/ml, it will be more difficult to differentiate the nature of the disease before operation. In this study, we analyzed the imaging features of patients with PI-RADS and PSA in the"double gray area" and their efficacy in differentiating benign from malignant disease using deep learning(DL) approaches with conventional neural networks.

**METHODS AND MATERIALS**

In all, 274 patients (184 non-PCa and 90 PCa) with the PSA level in the" gray area" (4-10 ng/ml) of PI-RADS 3 scores patients that underwent mpMRI were included in this retrospective study. Among the 274 patients, 280 lesions (>50 mm3) were extracted (184 non-PCa and 96 PCa). MpMRI exams were prospectively reported using PI-RADS V2.1 by two experienced radiologists. The proposed DL framework is illustrated in Figure 1. We developed a

framework using DenseNet 121 as the backbone. The 280 lesions were randomly divided with a 8:2 ratio into training and test sets. Data on the clinical risk factors related to PCa with PI-RADS and PSA in the"double gray area" were collected for all patients (table 1). Lesion volumes of interest (VOI) from T2-weighted imaging (T2WI) and apparent diffusion coefficient (ADC) imaging were annotated by two radiologists. We used AUCs with 95% CIs to assess the performance on the test set and clinical model for the diagnosis of PCa with PI-RADS and PSA in the"double gray area". The difference in AUCs between the models were tested for statistical significance using DeLong's test.

**RESULTS**

The univariate logistic regression analysis suggested that among clinical factors, patient age, prostate volume, tPSA, PSAD were significant factors for predicting PCa in patients with the"double gray area"(table 1). The multiple logistic analysis showed that the PSAD and prostate volume were important factors that could be used as independent predictors. The outcomes of the univariate and multiple logistic regression analyses are presented in table 2. The AUC, sensitivity, and specificity of the clinical model were 0.688(0.604-0.773), 0.642 (0.524-0.716), and 0.746 (0.655-0.841), respectively. The DL model based on case level yielded an AUC, sensitivity, and specificity of 0.872(0.818-0.926), 0.85 (0.74-0.95) and 0.87 (0.76-0.94) for identification of PCa with PI-RADS and PSA in the"double gray area" in the test data set, significantly improving performance over the clinical model (figure 2).

**CONCLUSION**

DL, is an effective and non-invasive method for predicting PCa with PI-RADS and PSA in the"double gray area". Thus can provide clinicians a more accurate quantitative tool than the PI-RADS for clinical decision making.

**CLINICAL RELEVANCE/APPLICATION**

deep learning predicting PCa with PI-RADS and PSA in the"double gray area"

## M5B-SPGU-7 DEEP LEARNING AND RADIOMICS-BASED DETECTION OF FOCAL ABNORMALITIES IN ADRENAL GLANDS

Xiaodong Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Yaofeng Zhang (*Abstract Co-Author*) Nothing to Disclose
Yuanchong Chen, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To set up a 3D V-Net-based segmentation model of adrenal lesions, a 3D ResNet-based classification model, radiomics-based models as well as the volumetric reference interval (VRI) for detecting abnormalities in adrenal glands.

**METHODS AND MATERIALS**

Different detecting methods included are 3D ResNet-based classification model, 3D V-Net-based lesion segmentation model, radiomics-based classification model (standard radiomics and deep learning-based radiomics), and the reference interval of adrenal volume. A total of 1086 CT image series with focal adrenal lesions were retrospectively collected, annotated, and used for the training of the adrenal lesion segmentation model. Another group of 3861 image series with bilateral normal adrenal glands along with the aforementioned dataset were used for the training of the 3D ResNet-based classification model and radiomics-based models. The VRIs are set as [1288.18, 4166.55] mm3 and [1457.80, 4941.88] mm3 for right and left adrenal gland. With the use of different thresholds of the largest diameter of the adrenal lesion, the other cohort consisting of 699 patients with pathologically confirmed adrenal lesions (external validation dataset 1) was included for validation of the detection performance of various methods in pre-surgical cases. Another consecutive cohort of patients with a history of malignancy (N = 479) was used for validation in the screening population (external validation dataset 2). The diagnosis of adrenal abnormalities from radiology reports of the external validation cases were compared with these detection methods.

**RESULTS**

At the threshold of 10 mm, the 3D ResNet-based model, the 3D V-Net-based lesion segmentation model, the standard radiomics-based model, the deep learning-based-radiomics-based model, and the VRI showed varied sensitivities (91.3%, 99.0%, 86.0%, 74.3%, and 78.1%) and accuracies (92.3%, 98.4%, 87.5%, 80.1%, and 84.7%) in external validation dataset 1. Different sensitivities (58.3%, 69.4%, 65.7%, 41.7%, and 40.7%) and accuracies (86.8%, 92.8%, 82.9%, 82.6%, and 88.8%) were showed in external validation dataset 2. The lesion segmentation model had the best performance among all other methods ($P < 0.05$), without significant difference compared to radiology reports ($P = 0.090$ and $P = 0.505$ for external validation datasets 1 and 2) while others do ($P < 0.05$).

**CONCLUSION**

The 3D V-Net-based segmentation model of adrenal lesions has the best performance in detecting abnormal adrenal glands in both pre-surgical and screening cases.

**CLINICAL RELEVANCE/APPLICATION**

A 3D V-Net-based segmentation model of adrenal lesions can be used for the detection of abnormalities of adrenal glands, with higher performance compared to other models, in various clinical scenarios.

## M5B-SPGU-9 DEVELOPMENT OF LEXICON TERMS FOR STRATIFICATION OF PI-RADSV2 3+1 LESIONS: MULTI-READER EXPERIENCE AND COMPLEMENTARY UTILITY OF AI

David Bonekamp, MD (*Abstract Co-Author*) Speaker, Bayer AG
Thomas Hielscher (*Abstract Co-Author*) Nothing to Disclose
Nils Netzer (*Abstract Co-Author*) Nothing to Disclose
Philip A. Glemser, MD (*Abstract Co-Author*) Nothing to Disclose
Markus Hohenfellner, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter W. Schlemmer, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG
Markus Wilhelm, MD (*Abstract Co-Author*) Nothing to Disclose
Albrecht Stenzinger (*Abstract Co-Author*) Nothing to Disclose
Christian Ziener (*Abstract Co-Author*) Nothing to Disclose
Viktoria Schutz (*Abstract Co-Author*) Nothing to Disclose
Magdalena Goertz (*Abstract Co-Author*) Nothing to Disclose
Patrick Asbach, MD (*Presenter*) Institutional research support, Siemens AG;Institutional research support, Canon Medical Systems Corporation;Speaker, b.e.imaging GmbH;Travel support, b.e.imaging GmbH

## PURPOSE

Focally DCE enhancing peripheral zone PI-RADS 3 lesions are upgraded to PI-RADS 4 (PI-RADS 3+1) based on PI-RADS v2.1 and remain challenging even for experienced readers. Thus, better mpMRI based stratification is needed for the decision biopsy or follow-up. We aimed to risk-stratify PI-RADS 3+1 lesions by definition of a new expert-based lexicon of terms, to investigate the usability of the lexicon by application by 2 additional experienced prostate readers, and to evaluate the contribution of deep learning models.

## METHODS AND MATERIALS

86 MR lesions clinically assessed as PI-RADS 3+1 in 75 patients and 83 examinations were retrospectively evaluated in consensus by two expert uroradiologists by application of a newly created feature catalogue. The same lesions were then re-evaluated by two additional experienced prostate radiologists with inter-reader agreement assessed using ICCs. The catalogue included sequence-specific (T2w, DWI and DCE) and inter-sequence correlative items, in total 14 categories, and 59 individual lexicon phrases/terms within the categories. Value of lexicon items for sPC prediction was assessed utilizing the expert read and extended TRUS/MRI biopsy histopathological correlation, utilizing L1-penalized logistic regression models. Bi- and multiparametric deep learning models for automated lesion segmentation were evaluated in conjunction with feature items in combined models.

## RESULTS

Expert consensus read established an upper threshold for sensitivity and specificity in lesional assessment. Independent application of the lexicon terms by the readers confirmed utility of the terms for single-readers. In univariate analysis the feature "T2w configuration: irregular/microlobulated/spiculated" showed statistical significance (OR 9.2; adj. p-value: 0.016) and strongest sPC correlation. Solely feature-based models did not benefit from integrating DCE features. In contrast, multiparametric AI models (AI-driven or AI-enhanced) did benefit from DCE consideration.

## CONCLUSION

A new feature lexicon demonstrated utility for risk-stratification of clinical PI-RADS 3+1 lesions. DCE imaging seems more beneficial for AI compared to readers.

## CLINICAL RELEVANCE/APPLICATION

Lexicon of terms with and without AI demonstrated potential to risk-stratify PI-RADS 3+1 lesions.

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# Abstract Archives of the RSNA, 2024

M5B-SPHN

**Head & Neck Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPHN-3 THE CASCADE ARTIFICIAL INTELLIGENT FRAMEWORK OF SEGMENTATION-DISCRIMINATION APPROACH FOR AUTOMATIC ALL-IN-ONE DIAGNOSIS OF OSSICULAR CHAIN DEFORMITY AT CT

Xinyi Meng (*Abstract Co-Author*) Nothing to Disclose
Liangliang Shang (*Abstract Co-Author*) Nothing to Disclose
GAO YANJUN (*Abstract Co-Author*) Nothing to Disclose
Liuxu Jin (*Abstract Co-Author*) Nothing to Disclose
Yishan Li (*Abstract Co-Author*) Nothing to Disclose
Xiaoyue Zhang (*Abstract Co-Author*) Nothing to Disclose
Rui Wang (*Presenter*) Nothing to Disclose

### PURPOSE

Diagnosing ossicular chain deformity (OCD) in radiology not only consumes time and effort but also carries a risk of misdiagnosis. Advanced artificial intelligence (AI)-assisted diagnostic technology has the potential to enhance the performance of radiologists in diagnosing OCD. This study aimed to develop and validate a cascading AI framework that employs a segmentation-discrimination strategy for the automatic detection of various OCD in CT scans.

### METHODS AND MATERIALS

In this retrospective analysis, our method utilized the nnU-Net framework for the automatic segmentation of auditory ossicles, alongside machine learning (ML) models to detect abnormalities in patients' auditory ossicles. We assessed and compared the efficacy of our selected ML approach in identifying OCD patients against deep learning networks (such as Res-Net and Dense-Net) and the volume-threshold algorithm, using area under the curve, sensitivity, specificity, and accuracy to evaluate the models' discriminative performance at the ossicular level. Additionally, to gauge the overall effectiveness at the patient level, we calculated and compared sensitivity, specificity, and accuracy across various models.

### RESULTS

A total of 1858 temporal bone CT images were divided into the training set (n = 1302) and the test set (n = 556); The final diagnosis (OCD-positive or OCD-negative) was determined by an experienced senior radiologist. In terms of ML, the logistic regression (LR) model outperformed others in the discrimination of abnormal malleus (accuracy was 0.903), while the random forest (RF) model excelled in distinguishing between abnormal incus (accuracy was 0.853) and stapes (accuracy was 0.863). Consequently, our segmentation-discrimination approach involved the LR model being selected for distinguishing abnormal malleus and the RF model for discerning abnormal incus and stapes as the optimal models for auditory ossicles discrimination. At the patient level, our method achieved a diagnostic accuracy of 0.874, while Res-Net, Dense-Net, and volume-threshold achieved accuracies of 0.849,0.827, and 0.766, respectively.

### CONCLUSION

The method of the cascaded AI framework based on segmentation-discrimination strategy demonstrates high performance in identifying patients with various types of OCD in CT scans.

### CLINICAL RELEVANCE/APPLICATION

Firstly, our research offers radiologists guidance for diagnosing OCD, aiding early treatment and improving patient well-being. Furthermore, our method reduces diagnostic errors, enhances proficiency, and fills gaps in AI diagnosis of small organs like the temporal bone. Finally, we're also developing an AI-assisted platform for automated diagnosis of temporal bone diseases.

## M5B-SPHN-4 DEEP LEARNING RECONSTRUCTION OF DIFFUSION-WEIGHTED MRI ENABLES SHORTER EXAMINATION TIMES WHILE MAINTAINING IMAGE QUALITY IN HEAD AND NECK IMAGING

Elisabeth Weiland (*Abstract Co-Author*) Employee, Siemens AG
Sebastian Werner, MD (*Abstract Co-Author*) Nothing to Disclose
Saif Afat, MD (*Abstract Co-Author*) Nothing to Disclose
Andreas Brendlin, MD (*Abstract Co-Author*) Nothing to Disclose
Vitali Koch, MD (*Abstract Co-Author*) Nothing to Disclose
Omar Darwish (*Abstract Co-Author*) Nothing to Disclose
Thomas Benkert (*Abstract Co-Author*) Employee, Siemens AG
Judith Herrmann, MD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Gassenmaier, MD (*Abstract Co-Author*) Nothing to Disclose

Jan M. Brendel (*Abstract Co-Author*) Nothing to Disclose
Haidara Al Mansour, MD, MEng (*Presenter*) Nothing to Disclose

**PURPOSE**

Diffusion weighted imaging of the head and neck region is instrumental for a wide range of clinical applications; however, it could be challenging due to high degree of artifacts and reduced image quality. Deep learning reconstruction may enhance image quality of head and neck DWI. The purpose of this study is to investigate the performance of an accelerated and deep learning reconstructed diffusion- weighted imaging (DWIDL) of the head and neck in terms of image quality and diagnostic confidence.

**METHODS AND MATERIALS**

This is a retrospective study of patients who underwent clinically indicated head and neck diffusion-weighted imaging of the head and neck at 1.5T and 3T from August 2023 to January 2024 at a tertiary care center. Imaging was performed at a low b-value (0 or 50 sec/mm2) and a high b-value (800 sec/mm2) and apparent diffusion coefficient (ADC) maps were computed. After acquiring the standard single shot EPI DWI sequences, the identical raw MR dataset underwent retrospective undersampling. This process entailed reconstructing a reduced number of signal averages using a novel DL based reconstruction algorithm (DWIDL) resulting in accelerated datasets.

**RESULTS**

A total of 30 patients (mean age, 55 ± 19 years; range, 24- 84; 18 men) with various pathologies were included. Scan time was reduced by 68% at 1.5 Tesla and up to 55% at 3 Tesla. All readers observed no discernible difference between DWI and DWIDL concerning image quality parameters or diagnostic confidence in both low and high b-value images, as well as the ADC (all $P > 0.05$).

**CONCLUSION**

Deep learning reconstruction of diffusion-weighted MRI of the head and neck imaging is feasible, enabling a significant reduction in examination time without compromising image quality or diagnostic confidence. This technique paves the way for an accelerated and diagnostic DWI of the head and neck.

**CLINICAL RELEVANCE/APPLICATION**

This technique paves the way for an accelerated and diagnostic DWI of the head and neck.

## M5B-SPHN-5 GROUND TRUTH ADEQUACY IN RADIOMICS AND ARTIFICIAL INTELLIGENCE STUDIES OF LYMPH NODE CLASSIFICATION IN HEAD AND NECK CANCER: A SYSTEMATIC REVIEW AND META-ANALYSIS

Anjali Patel (*Abstract Co-Author*) Nothing to Disclose
Seyedeh Mehrsa Sadat Razavi (*Abstract Co-Author*) Nothing to Disclose
Hakki S. Sagdic, MD (*Abstract Co-Author*) Nothing to Disclose
Aysha Dogan (*Abstract Co-Author*) Nothing to Disclose
Evelyn Y. Anthony, MD (*Abstract Co-Author*) Nothing to Disclose
Jay Talati, BS (*Abstract Co-Author*) Nothing to Disclose
Alexandria Iakovidis (*Abstract Co-Author*) Nothing to Disclose
MD MAHFUZ AL HASAN (*Abstract Co-Author*) Nothing to Disclose
Navid Asadi (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Abheek Raviprasad, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph Zhou (*Abstract Co-Author*) Nothing to Disclose
Saba Ghazimoghadam (*Abstract Co-Author*) Nothing to Disclose
Antika Roy, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Radiomics and artificial intelligence (AI) studies report promising results for lymph node classification in head and neck cancer. However, the reliability and generalizability of these studies is contingent on the quality of the ground truth (GT) data utilized to train these algorithms and robustness of the methodology used to ensure proper radiological-pathologic correlation. In this study, we performed a comprehensive evaluation of existing studies focusing on GT, evaluating the methodology, adequacy, and potential gaps.

**METHODS AND MATERIALS**

We conducted a systematic search on Embase and PubMed using PRISMA standard from 2013 to 2023. The search included papers using different machine learning/AI and radiomic-based algorithms to classify LN metastases in head and neck cancer on CT or MRI imaging. The study excluded studies that performed only lymph node segmentation, studies using ultrasound, or studies that analyzed the PET (metabolic) part only without radiomic or AI(ML/DL) model analysis on CT or MRI. We extracted ground truth related information into different columns focusing on information on nodal levels evaluated, number of experts involved, primary tumor site, node size, classification type, GT used (biopsy, surgical specimens, or other), methodology for image path correlation, and model analysis.

**RESULTS**

Between 2013 and 2023, a total of 1337 records were identified from PubMed and Embase. After application of our inclusion/exclusion criteria, 60 studies were included for analysis. We categorized 6 types of ground truth from these studies. 79% of the selected studies classified the lymph nodes as malignant vs benign. Most studies used some histopathological results as a standard for GT masks for LN classification. However, our meta-analysis identified only 13 papers out of 60 that provided any details on radiological-pathological correlation of individual lymph nodes. The expertise of the evaluators varied, and 14 papers did not mention the experience level of the experts. None of the studies specifically discussed how radiologically normal but pathologically abnormal nodes with early metastasis were correlated.

**CONCLUSION**

Many studies either lack or provide insufficient information on ground truth determination and radiologic-pathologic correlation. Given that that GT information is central to the validity of the algorithms, we recommend that more emphasis be placed on the adequacy of GT and methodology for radiologic-pathologic correlation in future studies and guidelines for algorithm development.

**CLINICAL RELEVANCE/APPLICATION**

This study reveals a significant gap that can prevent generalizability and successful future translation of AI algorithms used for evaluation of cervical lymph nodes in clinical practice.

# Abstract Archives of the RSNA, 2024

M5B-SPIN

**Imaging Informatics Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPIN-1 LIFESPAN TRAJECTORIES FOR PANCREAS VOLUME AND FAT FROM THE GENERAL POPULATION: REFERENCE VALUES FROM OVER 66.000 INDIVIDUALS

Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Christopher L. Schlett, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Reisert (*Abstract Co-Author*) Nothing to Disclose
Vineet K. Raghu, PhD (*Abstract Co-Author*) Nothing to Disclose
Zeynep Berkarda, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias Jung, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Assessment of imaging-based pancreatic phenotypes such as volume and fatty infiltration may help to improve personalized prevention and prognostication in patients with metabolic disease. With advances in artificial intelligence, fully automated approaches to quantify pancreatic phenotypes from cross-sectional imaging studies have become feasible; however, reference values from the general population are still missing. In this study, we used an automated deep learning pipeline to estimate pancreatic volume and fat from magnetic resonance imaging (MRI) to calculate reference curves similar to growth charts known from pediatric care.

### METHODS AND MATERIALS

We used pooled MRI data from two large observational cohort studies: the UK Biobank (UKBB) and the German National Cohort (NAKO). The only input to the deep learning pipeline was a T1w dual-echo Dixon MRI scan; the output was 1) pancreas volume (ml) and 2) the pancreatic fat fraction (PFF; %). Based on these outputs, sex-stratified changes in pancreas volume and PFF were calculated across age groups. In addition, normative reference curves adjusted for age, sex, and height were generated for both measures.

### RESULTS

The final cohort comprised 66,666 individuals from the general population (mean age: 57.7±12.9 years; mean BMI: 26.2±4.5 kg/m2; 48.3 % female). Mean pancreatic volume and PFF was 73.9±23.6 ml and 19.2±9.1 % in males and 54.6±19.9 ml and 14.1±7.9 % in females, respectively. Pancreas volume showed a slight increase until the 6th age decade followed by a slow decline in both sexes. In contrast, PFF steadily increased for both sexes throughout the lifespan. For both measures, the variability was higher in males vs. females.

### CONCLUSION

This study provides MRI-derived age, sex and height adjusted normative curves for pancreas volume and PFF from a large general population. These curves may provide the basis to establish reference values and track typical and atypical changes of pancreatic phenotypes throughout the lifespan with the potential to identify individuals at risk similar to growth charts in pediatric care. As automated assessment of imaging-derived pancreatic phenotypes are increasingly accessible, this could be used for opportunistic risk estimation from routine MRI to improve personalized prevention and lifestyle interventions.

### CLINICAL RELEVANCE/APPLICATION

Fully automated imaging-based assessment of pancreatic phenotypes during routine MR imaging may provide clinicians with a tool to opportunistically identify high-risk individuals beyond currently established approaches with the potential to improve personalized prevention and decision-making without additional testing.

## M5B-SPIN-2 END-TO-END AI SEGMENTATION OF KIDNEY AND LESIONS: A DUAL-MODEL APPROACH FOR ENHANCED CT IMAGING

Nalan Karunanayake, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The main objective of this study is to develop a deep learning model for precise 3D segmentation of kidneys and renal lesions from CT scans.

### METHODS AND MATERIALS

The developed model provides an end-to-end segmentation solution across two phases. Initially, a transformer-based approach delineates kidney organs and lesions, enhancing spatial awareness. Subsequently, a deep convolutional neural network with cross-layer connections performs advanced feature abstraction, optimizing the network by improving feature propagation and depth effectiveness. This study employed two renal CT datasets in the nephrogenic phase: a public dataset with 489 scans (mean age 59.33 ± 14.39, 306 males, 182 females, 1 transgender) and a proprietary dataset with 617 scans (mean age 56.71 ± 11.18, 428 males, 189 females). Training was conducted on 389 scans from the public dataset, with internal validation on 100 scans and external validation on all 617 scans from the private dataset. Lesion sizes were categorized as small (=4 cm), medium (>4 cm to =7 cm), and large (>7 cm) for detailed performance evaluation.

### RESULTS

The initial segmentation of kidney organ achieved a compelling Dice score of 0.966 ± 0.067 and Predictive Volume Error (PVE) of 0.027 ± 0.062. In detailed lesion analysis, Dice scores for small, medium, and large lesions on the internal validation dataset were 0.896 ± 0.162, 0.897 ± 0.062, and 0.928 ± 0.156, respectively, with corresponding PVEs of 0.059 ± 0.144, 0.054 ± 0.063, and 0.045 ± 0.132. External validation further confirmed the model's effectiveness, achieving Dice scores of 0.768 ± 0.0247, 0.885 ± 0.112, and 0.917 ± 0.071 for small, medium, and large lesions, respectively, with respective PVEs of 0.172 ± 0.235, 0.071 ± 0.099, and 0.051 ± 0.067.

### CONCLUSION

The dual-phase AI model accurately segments renal lesions of varying sizes and demonstrates robust performance on unseen CT data, matching human expert precision. Its integration into clinical workflows could enhance diagnostic accuracy, especially for small or indistinct lesions, positioning it as a valuable tool in radiology.

### CLINICAL RELEVANCE/APPLICATION

The AI model's precise segmentation of kidney lesions boosts diagnostic accuracy. Its robust performance on new data indicates readiness for clinical use, potentially accelerating diagnosis and guiding clinical decisions. This marks a significant step forward in renal tumor imaging.

## M5B-SPIN-3 PANCREAS VOLUME PREDICTS MAJOR ADVERSE CARDIOVASCULAR EVENTS AND MORTALITY IN THE GENERAL POPULATION: INSIGHTS FROM THE UK BIOBANK

Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Maximilian Russe, MD (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Vineet K. Raghu, PhD (*Abstract Co-Author*) Nothing to Disclose
Zeynep Berkarda, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Reisert (*Abstract Co-Author*) Nothing to Disclose
Matthias Jung, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The pancreas plays a crucial role in the pathogenesis of cardiometabolic diseases. Pancreas volume may serve as a measure to estimate pancreas function and to identify individuals at increased risk of cardiometabolic disease and mortality. Here, we used a deep learning model to automatically quantify pancreatic volume from MRI and investigated the association with major adverse cardiovascular events (MACE) and mortality in the general population.

### METHODS AND MATERIALS

This study used a large population cohort from the UK Biobank (UKBB). The only input to the deep learning model was a T1-weighted dual-echo Dixon MRI; the output was an estimate of pancreas volume in ml. The primary outcome was MACE, the secondary outcome all-cause mortality. Cumulative incidence and Kaplan-Meier survival curves were calculated (volume categories <10%; 10-90%; >90%) to investigate time to MACE and mortality, respectively. The association between pancreas volume and MACE/mortality was assessed via multivariable Cox regression analyses.

### RESULTS

Among 36,317 UKBB participants (mean age 65.1±7.8 years, 51.7% female), 2.7% [969/36,317] MACE and 1.7% [633/36,317] deaths of all cause occurred over a median follow-up of 4.8 years. Cumulative incidence and Kaplan Meier survival curves showed a higher rate of MACE and mortality for individuals with the lowest (<10%) pancreas volume. Cox regression revealed an association between pancreas volume and MACE (HR (per SD), 0.92 [95% CI, 0.85-0.99]; p=0.02) as well as mortality (HR, 0.80 [95% CI, 0.74-0.87]; p<0.001). This association remained significant after adjustment for demographics (age, sex, BMI, race) and cardiometabolic risk factors (hypertension, smoking, diabetes, lipid panel, history of cancer) (MACE; HR (per SD), 0.88 [95% CI, 0.81-0.96]; p=0.005 and mortality; HR (per SD), 0.81 [95% CI, 0.73-0.89]; p<0.001).

### CONCLUSION

MRI-derived pancreas volume is an independent predictor for MACE and all-cause mortality in the general population beyond traditional clinical risk factors.

### CLINICAL RELEVANCE/APPLICATION

Opportunistic quantification of pancreas volume from medical imaging studies may help to identify individuals at increased risk of MACE and all-cause mortality with the potential to improve personalized prevention and prognostication.

## M5B-SPIN-4 PANCREAS SUB-REGION SEGMENTATION ON CT

Abhinav Suri, BA, MPH (*Abstract Co-Author*) Nothing to Disclose
Tejas Sudharshan Mathai, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Summers, MD, PhD (*Abstract Co-Author*) Royalties,iCAD, Inc;Royalties, Koninklijke Philips NV;Royalties, ScanMed, LLC;Royalties, Ping An Insurance (Group) Company of China, Ltd;Royalties, Translation Holdings;Research support, Ping An Insurance (Group) Company of China, Ltd
Brandon R. Khoury, MD (*Abstract Co-Author*) Nothing to Disclose
Yan Zhuang, PhD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

CT imaging contains useful biomarkers for detecting pancreatic pathologies. However, current approaches provide whole-organ biomarkers rather than region-specific biomarkers, which are critical to predicting disease severity such as pancreatic adenocarcinomas. The purpose of this study is to develop a

deep learning-based 3D tool to segment pancreatic sub-regions (the head, body, and tail) on CT volumes.

**METHODS AND MATERIALS**

This retrospective study used the large publicly available TotalSegmentator dataset, which contains 1228 unique CT volumes. 595 volumes were excluded because part or all of the pancreas was not included, resulting in a total number of 633 CT volumes in the final dataset. We randomly split the dataset into training (n=507) and testing (n=126) subsets. To minimize annotation burden, two graders labeled three pancreatic landmarks (i.e., the centroid of the head, body, and tail) for all 633 volumes and also created full annotations for the head, body and tail for 50 out of 126 volumes in the testing set. These sub-regional annotations were evenly verified by two radiologists (an attending w/30 yrs experience and a resident) and used for evaluation.A modified nnUNet-based model was trained to predict the head, body, and tail centroid landmarks. Given the full pancreas segmentation (which is easily obtained from prior algorithms with high accuracy), the predicted centroid landmarks assign each voxel in the pancreas mask to a subregion label based on which centroid it was closest to. The segmentation results were evaluated against the ground truth masks using the Dice similarity coefficient (DSC) and Normalized Surface Distance (NSD).

**RESULTS**

The mean +/- std dev of DSC (%) and NSD (%) for the head, body, and tail were 90.6+/-4.5 and 94.2+/-4.7, 83.1+/-6.9 and 86.9+/-6.0, and 85.6+/-8.3 and 90.2+/-7.4, respectively.

**CONCLUSION**

The proposed method accurately segmented three pancreatic sub-regions (head, body, and tail) in a large publicly available CT dataset.

**CLINICAL RELEVANCE/APPLICATION**

This tool can extract imaging biomarkers for each pancreatic sub-region and facilitate the assessment of regional pancreatic pathologies for clinical correlation with disease status, such as diabetes, pancreatitis, and pancreatic cancer.

## M5B-SPIN-5 FACTORS IMPACTING AI-BASED CORONARY ARTERY CALCIFICATION SCORING IN NON-GATED LOW-DOSE CHEST CT: A COMPARISON TO MANUAL SCORING IN ECG-GATED CARDIAC CT

Jong H. Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Eun-Ah Park, MD (*Abstract Co-Author*) Nothing to Disclose
Baren Jeong (*Abstract Co-Author*) Nothing to Disclose
Changmin Park (*Abstract Co-Author*) Nothing to Disclose
Sihwan Kim, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate influential factors on the agreement between manual coronary artery calcification scoring (CACS) in ECG-gated cardiac CT and AI-based automated CACS in non-gated low dose chest CT using multi-vendor dataset.

**METHODS AND MATERIALS**

The study retrospectively analyzed 1083 and 851 patients from the two different CACS CT protocols with multi-vendor CT dataset. Manual CACS in ECG-gated cardiac CT was set as the reference standard using commercial semi-automatic CACS program. AI-based automated CACS was performed in different CACS CT protocols using a dedicated AI software. A Pearson coefficient (r) and coefficient of determination (r2) were calculated for demonstrating a linear correlation and its explainability between manual CACS and fully automated AI-CACS. The detection performance of AI-CACS was evaluated by accuracy, sensitivity, and specificity. The reliability of AI-CACS for cardiovascular disease severity categorization was assessed using linearly weighted kappa (?) statistics. The agreement between manual CACS for ECG-gated cardiac CT and AI-CACS for two different CACS CT protocols were evaluated with intraclass correlation coefficient (ICC).

**RESULTS**

Pearson coefficient (?) was less than one for both ECG-gated cardiac CT and non-gated low dose chest CT. Coefficient of determination (R2) was at the estimated level of 0.98 and 0.92 for each CT protocol. While the AI-CACS in ECG-gated cardiac CT was almost perfect (at least 99.3%), the AI-CACS in non-gated low dose chest CT yield scores of 86.4-100%, 74.0-100%, and 76.7-100% for accuracy, sensitivity, and specificity, respectively. The ? for CVD risk categorization was 0.91-0.96 for ECG-gated and 0.68-0.9 for non-gated low dose chest CT. The ICC between manual CACS and AI-CACS for each CT protocol were 0.988 [95%CI 0.985-0.991] and 0.959 [95%CI 0.945-0.968], respectively. Among the CVD risk categories, minimal- to low-risk range (1=CAC<10) showed largest errors.

**CONCLUSION**

Image distortion by unwanted motion blurring and quantum noises from reduced radiation dose were the main factors for subtle CACS discrepancy. Nevertheless, AI-based CACS in low dose chest CT shows promising reliability in risk management of future cardiovascular event; One thing should be cautious is the underestimation of CAC score compared to that of ECG-gated cardiac CT.

**CLINICAL RELEVANCE/APPLICATION**

The CACS remains limited to manual or semi-automatic measurements in ECG-gated cardiac CT, which takes a large amount of human labor and time. What factors influence a clinical usage of the automated AI-CACS in non-gated low dose chest CT compared to the manual CACS in ECG-gated cardiac CT? In this paper, we aim to analyze the findings regarding this matter.

## M5B-SPIN-6 A DUAL-ENERGY CT-BASED NOMOGRAM FOR IDENTIFYING AXILLARY LYMPH NODE WITH MACROMETASTASES IN CLINICAL T1/2N0 INVASIVE BREAST CANCER

Suping Chen (*Abstract Co-Author*) Nothing to Disclose
Lin Lin, MBBS (*Abstract Co-Author*) Nothing to Disclose
Fang Zeng, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a prediction model based on spectral CT to evaluate axillary lymph node (ALN) with macrometastases in clinical T1/2N0 invasive breast cancer.

**METHODS AND MATERIALS**

A total of 217 clinical T1/2N0 invasive breast cancer patients who underwent spectral CT scans were retrospectively enrolled and categorized into a training cohort (n = 151) and validation cohort (n = 66). These patients were classified into ALN non- macrometastases (stage pN0 or pN0[i+] or pN1mi) and ALN macrometastases (stage pN1-3) subgroups. The morphologic criteria and quantitative spectral CT parameters of the most suspicious ALN were

measured and compared. Least absolute shrinkage and selection operator (Lasso) was used to screen predictive indicators to build a logistic model. The receiver operating characteristic (ROC) curve and decision curve analysis (DCA) were used to evaluate the models.

**RESULTS**

The combined arterial-venous phase spectral CT model yielded the best diagnostic performance in discrimination of ALN non-macrometastases and ALN macrometastases with the highest AUC (0.963 in the training cohort and 0.945 in validation cohorts). Among single phase spectral CT models, the venous phase spectral CT model showed the best performance (AUC = 0.960 in the training cohort and 0.940 in validation cohorts). There was no significant difference in AUCs among the three models (DeLong test, P > 0.05 for each comparison).

**CONCLUSION**

A Lasso-logistic model that combined morphologic features and quantitative spectral CT parameters based on single phase contrast enhanced spectral imaging potentially be used as a non-invasive tool for individual preoperative prediction of ALN status in clinical T1/2N0 invasive breast cancers.

**CLINICAL RELEVANCE/APPLICATION**

The prediction model has a favorable discriminating ability between patients with ALN non-macrometastases (stage pN0 or pN0[i+] or pN1mi) and patients with ALN macrometastases (stage pN1-3), showing potential for serving as a non-invasive imaging biomarker to predict ALN status and develop individualized treatment strategies.

## M5B-SPIN-7 DEEP LEARNING-BASED FULLY AUTOMATED DETECTION AND SEGMENTATION OF PELVIC LYMPH NODES ON DIFFUSION-WEIGHTED IMAGES FOR PROSTATE CANCER: A MULTICENTER STUDY

Xiaoying Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Kexin Wang (*Abstract Co-Author*) Nothing to Disclose
Wenpeng Huang (*Abstract Co-Author*) Nothing to Disclose
Zhaonan Sun (*Presenter*) Nothing to Disclose

**PURPOSE**

Accurate identification and evaluation of lymph nodes (LNs) in prostate cancer (PCa) patients is crucial for effective staging but can be time-consuming. We utilized a 3D V-Net model to improve the efficiency and accuracy of LN detection and segmentation.

**METHODS AND MATERIALS**

Utilizing pelvic diffusion-weighted imaging (DWI) scans, the 3D V-Net framework underwent training on a dataset comprising data from a hospital with 1,151 patients, encompassing 32,507 annotated LNs, following data augmentation procedures. Subsequently, external validation was conducted on data from 401 patients across three additional hospitals, encompassing 7,707 LNs. The segmentation performance was evaluated using the Dice similarity coefficient (DSC). The comparison between automated and manual segmentation regarding the short diameter and volume of LNs was conducted using Bland-Altman plots and correlation analysis. The performance for suspicious metastatic LN detection (short diameter > 8 mm) was evaluated using sensitivity, positive predictive value (PPV), and per-patient false-positive rate (FP/vol) at the LN level and sensitivity, specificity, and PPV at the patient level.

**RESULTS**

In the external validation test dataset, the model achieved a DSC of 0.77-0.82 for all, suspicious, and largest LNs. The model achieved a sensitivity, PPV, and FP/vol of 60.1% (95% confidence interval (CI), 57.6%-62.6%), 79.2% (95% CI, 76.6%-81.5%), and 0.56 at the LN level, respectively. At the patient level, the model achieved a sensitivity, specificity, and PPV of 81.1% (95% CI, 76.5%-85.0%), 75.6% (95% CI, 65.1%-83.8%), and 93.2% (95% CI, 89.7%-95.6%), respectively. The model achieved a strong correlation and good consistency between the short diameter and volume of the automatically segmented and manually annotated LNs.

**CONCLUSION**

This 3D V-Net model can segment LNs effectively based on pelvic DWI images for PCa and holds great potential for facilitating N-staging in clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

This study showcases the clinical potential of a 3D V-Net model in accurately segmenting LNs in patients with PCa, offering promising prospects for enhancing N-staging in clinical settings.

## M5B-SPIN-8 THE ARTIFICIAL INTELLIGENCE MODEL AUTOMATICALLY QUANTIFIES MULTIPLE MYELOMA LESIONS ON WHOLE-BODY LOW-DOSE CT SCANS

Xiaoying Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Zhaonan Sun (*Abstract Co-Author*) Nothing to Disclose
Wenpeng Huang (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to assess the feasibility of utilizing deep learning technology for the automatic detection of osteolytic lesions in multiple myeloma (MM) on Whole Body Low Dose CT (WBLDCT) scans.

**METHODS AND MATERIALS**

WBLDCT images were retrospectively collected from inpatients at Peking University First Hospital between June 2020 and July 2023. Exclusion criteria encompassed postoperative bone quality, poor image quality, and the presence of other bone tumor lesions. The dataset comprised 106 image sets, including 34 MM patients with 9638 osteolytic lesions and 75 non-MM patients without osteolytic lesions. Data were divided into training (n=84), tuning (n=11), and testing (n=11) sets at an 8:1:1 ratio. Following preprocessing, a 3D V-Net deep learning network was employed for whole-body bone structure segmentation, followed by a 2D U-Net deep learning network for osteolytic lesion segmentation. Evaluation metrics included Dice similarity coefficient (DSC), Jaccard index (JACRD), volume similarity (VS), Hausdorff distance (HD), and average distance (AD), with lesions smaller than 5 mm filtered out at the lesion level.

**RESULTS**

In the testing set, 397 osteolytic lesions were manually annotated by physicians. The model detected 169 lesions accurately, missed 228 lesions, and identified 794 additional lesions, yielding a sensitivity of 42.5% and a positive predictive value of 17.5%. The overall segmentation results were DICE=0.31±0.13, JACRD=0.19±0.09, VS=0.74±0.13, HD=141.3±40.7mm, and AD=13.0±4.39mm. Bland-Altman analysis demonstrated high

consistency between the model-predicted and physician-annotated volumes, long diameters, mid diameters, and short diameters, with most data points falling within the 95% confidence interval.

## CONCLUSION

Deep learning technology holds promise for detecting osteolytic lesions in MM on WBLDCT scans, though further improvement in accuracy is warranted.

## CLINICAL RELEVANCE/APPLICATION

The model shows promise in facilitating the quantitative assessment of tumor burden in multiple myeloma.

# Abstract Archives of the RSNA, 2024

M5B-SPIR

**Interventional Radiology Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPIR-2 POTENTIAL TIME SAVINGS IN INTERVENTIONAL RADIOLOGY FROM USING CHATGPT FOR DOCUMENTATION AND ADMINISTRATION

Philipe S. Breiding, MD (*Abstract Co-Author*) Nothing to Disclose
Matthew McMurray, MD (*Abstract Co-Author*) Nothing to Disclose
Claus Beisbart (*Abstract Co-Author*) Nothing to Disclose
Gerd Noeldge, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jan Felix Senge (*Abstract Co-Author*) Nothing to Disclose
Fabian Haupt (*Abstract Co-Author*) Nothing to Disclose
Frank Mosler, MD (*Abstract Co-Author*) Nothing to Disclose
Keivan Daneshvar Ghorbani, MD (*Abstract Co-Author*) Nothing to Disclose
Alois Komarek, MD (*Abstract Co-Author*) Nothing to Disclose
Wolfram Bosbach, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The future demand for interventional radiology services is predicted to grow substantially. Administration and documentation consume a substantial amount of working time already and can be expected to increase equally. This study tested the possibility of the large language model ChatGPT to perform those tasks.

### METHODS AND MATERIALS

The reporting template of the Radiological Society of North America (RSNA) for peripherally inserted central catheters (PICC) was iterated in three predefined cases. ChatGPT had to produce appropriate reports in text. ChatGPT output was assessed by radiologist by score card, as well as by a Python code calculating similarities between output texts.

### RESULTS

Overall, reception of the score card assessment was positive. Participating radiologists expect potential time savings for clinical operations from large language models.

### CONCLUSION

In the future, large language models might well find their way into clinical application. Our study has been able to highlight potential productivity improvements which would appeal to patients, doctors, and hospital administrators.

### CLINICAL RELEVANCE/APPLICATION

Time savings on documentation / administration are highly welcome. Large language models might provide those. Freed time could be spend on increased doctor-patient interaction.

## M5B-SPIR-3 AUTOMATIC AUGMENTED REALITY OVERLAY OF CT WITHOUT FIDUCIALS USING SKIN TRACKING WITH A SMARTPHONE

Bradford J. Wood, MD (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;Researcher, Koninklijke Philips NV;Intellectual property, Koninklijke Philips NV;Equipment Support, Koninklijke Philips NV;Researcher, Celsion Corporation;Research Grant, Celsion Corporation;Researcher, BTG International Ltd;Intellectual property, BTG International Ltd;Researcher, Boston Scientific Corporation;Research Grant, Boston Scientific Corporation;Intellectual property, Boston Scientific Corporation;Researcher, Siemens AG;Equipment Support, Siemens AG;Researcher, Sarasota Interventional Radiology;Researcher, NVIDIA Corporation;Research Grant, NVIDIA Corporation;Equipment support, AngioDynamics, Inc;Equipment support, Profound Medical Inc;Researcher, Canon Medical Systems Corporation;License agreement, Canon Medical Systems Corporation;Researcher, AstraZeneca PLC;Researcher, Exact Imaging Inc
Ming Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Sheng Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicole Varble (*Abstract Co-Author*) Nothing to Disclose
Tabea Borde, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Laetitia Saccenti, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Augmented reality (AR) can enhance standard visualizations by overlaying internal 3D images or objects onto external surfaces through goggles or smartphones. An overlay of CT imaging is possible on a body for percutaneous applications. One of the main limitations has been the necessity to include fiducials in the pre-procedural imaging, to assure correct registration of the AR objects to the real body. To overcome this limitation, we evaluated the use of a skin tracking tool, to recognize and track physical objects in the real environment and compared it to conventional registration using fiducial

### METHODS AND MATERIALS

An AR smartphone application was developed using Unity and Vuforia SDK platforms. For skin tracking registration, a CT scan of a torso phantom was acquired, and its surface model was generated. The AR app detected and tracked the skin of phantom according to its surface model. For conventional fiducial registration, an image reference box with embedded radio opaque fiducials was placed on the torso phantom and was included in the preoperative CT scan. The AR app then tracked the phantom by tracking this reference box. Accuracy of the overlay using skin tracking registration was assessed and compared to conventional registration by measuring the gap distance between 7 skin marks on the physical body and the AR model, on scaled pictures (ImageJ). Pictures were taken at different distances from the skin (10cm, 30cm) and different angles (0°, 45°, 90°)

### RESULTS

Using skin tracking registration, the median accuracy from 30 measurements was 1.75mm [IQR 0.73-3.18mm]. There was no difference of accuracy according to the distance of the smartphone (at 10cm: 2.30 [IQR 1.50-3.15mm], at 30cm: 1.10mm [IQR 0.30-5.65mm], p=0.18), neither according to the angle of the smartphone (0°: 2.45mm [IQR 1.40-3.80mm], 45°: 1.05mm [IQR 0.63-2.03mm], 90°: 5.05mm [IQR 2.83-7.28mm], p=0.1). Skin tracking registration matches conventional registration accuracy (3.2mm, [IQR1.3-4.6mm], p=0.07). Using conventional registration, there was no difference according to the distance or angle of the smartphone, but there was a difference according to skin mark location, with greater error the further away from fiducial marker. Surface tracking has the advantage over conventional registration of not losing accuracy with distance from fiducial to phantom

### CONCLUSION

Automatic registration using a skin tracking tool has an accuracy of 1.75mm on a torso phantom, which is as accurate as conventional registration with fiducial

### CLINICAL RELEVANCE/APPLICATION

Skin tracking on a smartphone can be used to recognize and track a body for augmented reality applications. This overlay technique is accurate while it is no longer necessary to perform pre-procedural imaging to include fiducial.

## M5B-SPIR-4 INTERPRETABLE MACHINE LEARNING FOR MANAGEMENT OF ABDOMINAL AND PELVIC INJURIES CAUSED BY BLUNT TRAUMA: A PROOF-OF-CONCEPT STUDY WITH THE TRAUMA QUALITY IMPROVEMENT PROGRAM REGISTRY

Arrix Ryce, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To demonstrate interpretable machine learning’s capacity to support comparisons of therapeutic strategies for blunt abdominal and pelvic traumas.

### METHODS AND MATERIALS

Patients 18 years and older with abdominal and pelvic injuries registered via the Trauma Quality Improvement Program (2007-19) were identified and grouped by management strategy initiated within 24 hours of presentation: non-operative management (NOM), embolization, or surgery. Given a management strategy and set of clinical characteristics, gradient boosting classifiers predicted in-hospital mortality. Each classifier’s performance was described via area under the receiving operating characteristic curve (AUC) and F1 score. Characteristics with the greatest contributions to predicted mortality were identified via mean absolute SHAP value. The top 5 contributors to predicted mortality were compared visually across management strategies via SHAP partial dependence plots.

### RESULTS

Classifiers of in-hospital mortality were associated with AUC's from 0.73 to 0.85 and F1 scores from 0.74 to 0.92. The 5 characteristics with the highest mean absolute SHAP values and, thus, greatest impact on predictions were GCS score, body temperature, blood oxygen saturation, respiratory rate (RR), and pulse. These did not vary across management strategies.Across all management strategies, GCS scores’ contributions to predicted mortality were lower among patients with scores = 7 than those with scores < 7. Blood oxygen saturation’s contributions decreased monotonically with increasing oxygen saturation. RR’s contributions decreased with RR < 20 breaths/min but increased with RR > 20 breaths/min.Body temperature’s contributions decreased with temperatures < 37 C and increased with those >37 C among NOM and surgery patients but decreased monotonically with increasing body temperature among embolization patients. Pulse’s contributions decreased with pulses < 80 beats/min and increased with pulses > 80 beats/min among NOM patients, decreased with pulses < 100 beats/min and increased with pulses > 100 beats/min among surgery patients. However, no clear trend between pulse and predicted mortality was visualized among embolization patients.

### CONCLUSION

In-hospital mortality can be predicted with fidelity from clinical characteristics available upon hospital arrival. Additionally, SHAP values can facilitate global, visual comparisons of risk.

### CLINICAL RELEVANCE/APPLICATION

This study demonstrates a novel approach to interpretable machine learning in trauma care that can support real-time patient selection by interventional radiologists. Risk profiles with greater specificity and clinical utility may be ascertained in future work by evaluating SHAP interaction effects.

## M5B-SPIR-5 UNVEILING THE IMMUNOMODULATORY EFFECTS OF TRANSARTERIAL CHEMOEMBOLIZATION: INSIGHTS INTO LOCAL T CELL INFILTRATION IN HEPATOCELLULAR CARCINOMA

Bernhard Gebauer, MD (*Abstract Co-Author*) Speaker, PAREXEL International Corporation;Speaker, Becton, Dickinson and Company;Speaker, Sirtex Medical Ltd;Speaker, Abbott Laboratories;Speaker, Cook Group Incorporated;Speaker, AngioDynamics, Inc;Speaker, PharmCept;Speaker, ewimed GmbH;Speaker, Novartis AG;Speaker, F. Hoffmann-La Roche Ltd;Speaker, Merck & Co, Inc;Speaker, ICON plc;Speaker, Ipsen SA;Speaker, Bayer AG;Speaker, Pfizer Inc;Speaker, Guerbet SA;Speaker, Terumo Corporation
Ornela Sulejmani (*Abstract Co-Author*) Nothing to Disclose
Lynn J. Savic, MD (*Abstract Co-Author*) Research Grant, Guerbet SA
Yubei he (*Abstract Co-Author*) Nothing to Disclose
Robin Schmidt (*Abstract Co-Author*) Nothing to Disclose

Emine Yaren Yilmaz Ince, MD (*Abstract Co-Author*) Nothing to Disclose
Luisa Heidemann (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate local immunomodulatory effects of conventional transarterial chemoembolization (cTACE) in patients with hepatocellular carcinoma (HCC).

**METHODS AND MATERIALS**

This interim analysis of a prospective study included 66 patients with unresectable HCC undergoing ablation alone using interstitial brachytherapy (iBT) or cTACE followed by iBT (10/20-08/23). IRB approval and informed consent were obtained. Biopsies were acquired prior to iBT under CT-guidance from treatment-naļve HCC (iBT group) or 24h after cTACE (cTACE/iBT group), respectively. Biopsies were stained for CD8+ T cells using immunohistochemistry. Following whole slide scanning, the entire sample on the digitalized slides was quantitatively assessed using QuPath software and a machine-learning based approach to distinguish tumor cells, hepatocytes, CD8+ T cells, and stroma. CD8+ T-cell infiltration was quantified in percentage of all counted cells and compared between untreated and post-cTACE HCC. Biopsies were then categorized as low (= median) or high (> median) immune response to evaluate associations with overall survival (OS) and tumor response assessed on MRI at 8 weeks according to mRECIST. Statistics included unpaired t-test, Kaplan-Meier, and Log Rank test.

**RESULTS**

This interim analysis included 31 untreated and 35 post-cTACE biopsies. CD8+ T-cell infiltration was similar in treatment-naļve (mean 3.532±2.734%) and post-cTACE (3.158±2.881%, p=0.592) biopsies. The median percentage of tumor-infiltrating CD8+ T-cells was 2.569%. Patients with high (>2.569%) immune response following cTACE exhibited better OS than those classified low T-cell infiltration (p=0.813), although median OS was not reached. Untreated HCC yielded slightly longer survival with low (median 749 days) compared to high immune response (709 days, p=0.95). Responders (n=50) showed more T-cell infiltration (3.192±2.612%, p=0.934) compared to non-responders (n=11; 3.118±3.075 %, p=0.335) but a low odds ratio of 0.487 for having a low (= median) immune infiltration.

**CONCLUSION**

These preliminary findings show comparable CD8+ T-cell infiltration in HCC biopsies before and after cTACE. T cell counts were generally low indicating a rather immunologically cold tumor microenvironment. Results from further characterizations of T cell sub-populations and functions are still pending. Patients with high post-cTACE immune response showed slightly improved survival, and responders tended to have higher T-cell infiltration, suggesting a potential link between intratumoral T cell response and treatment efficacy.

**CLINICAL RELEVANCE/APPLICATION**

Understanding the role of T-cell infiltration in HCC and changes induced by cTACE may aid prognosis and treatment decisions in HCC patients.

## M5B-SPIR-6 FEASIBILITY AND SAFETY OF TEGUS TELEPROCTORING OF MECHANICAL THROMBECTOMIES PERFORMED BY GENERAL INTERVENTIONAL RADIOLOGISTS IN A NON-COMPREHENSIVE STROKE CENTER

Francesco Diana, MD (*Abstract Co-Author*) Nothing to Disclose
Manuel Requena (*Abstract Co-Author*) Nothing to Disclose
Jordi Villalba, MD (*Abstract Co-Author*) Nothing to Disclose
Leandro Fernandez Cabrera (*Abstract Co-Author*) Nothing to Disclose
David Hernandez-Morales (*Abstract Co-Author*) Nothing to Disclose
Marta De Dios Lascuevas, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Tomasello (*Abstract Co-Author*) Nothing to Disclose
Maria Lourdes Diaz, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Mechanical thrombectomy (MT) is usulally performed in comprehensive stroke centers by experienced neurointerventional radiologists. However, logistical and geographic limitations often hinder access to rapid MT, especially in remote areas.The purpose of this presentarion is to explore the use of remote teleproctoring to support MT conducted by general interventional radiologists (IR) at thrombectomy capable centers, compared to on-site proctoring outcomes.

**METHODS AND MATERIALS**

The Arnau de Vilanova Hospital in Spain, serving 500,000 people over 12,000 km2, used to transfer stroke patients requiring MT to a comprehensive stroke center 160 km away. To overcome COVID-19 mobility restrictions, the Tegus Teleproctoring System was installed. From April 2021 to May 2023, general IR conducted MT either with on-site proctor supervision or teleproctoring support. We aim to compare clinical outcome of patients receiving MT according to proctoring method.

**RESULTS**

During the study, 51 MTs were performed: 17 with TEGUS teleproctoring and 34 with on-site proctoring. Both groups had similar baseline characteristics, except for NIHSS scores (Tegus 9 (IQR 6- 20) v/s 18 (IQR 12-22), p: 0,034). No significant differences were found in door-to-revascularization time (82 (SD 28.2) v/s 84 (SD 26.4) min, p: 0.895). The final mTICI distribution and 90-day mRS scores were comparable. There were no reports of symptomatic intracranial hemorrhage in either group.

**CONCLUSION**

This study shows the feasibility of remote teleproctoring during emergent cases of MT in a remote hospital.

**CLINICAL RELEVANCE/APPLICATION**

Teleproctoring tools may help to improve initial learning curves of interventional radiologists with limited experience in MT, and lower the territorial inequity associated to MT.

## M5B-SPIR-9 UNRAVELING SHIFTS IN PRO- AND ANTI-INFLAMMATORY CYTOKINE PATTERNS AFTER CONVENTIONAL TRANSARTERIAL CHEMOEMBOLIZATION FOR HEPATOCELLULAR CARCINOMA

Ornela Sulejmani (*Abstract Co-Author*) Nothing to Disclose
Andreas Wilhelm (*Abstract Co-Author*) Nothing to Disclose
Lynn J. Savic, MD (*Abstract Co-Author*) Research Grant, Guerbet SA
Luisa Heidemann (*Abstract Co-Author*) Nothing to Disclose
Robin Schmidt (*Abstract Co-Author*) Nothing to Disclose

Bernhard Gebauer, MD (*Abstract Co-Author*) Speaker, PAREXEL International Corporation;Speaker, Becton, Dickinson and Company;Speaker, Sirtex Medical Ltd;Speaker, Abbott Laboratories;Speaker, Cook Group Incorporated;Speaker, AngioDynamics, Inc;Speaker, PharmCept;Speaker, ewimed GmbH;Speaker, Novartis AG;Speaker, F. Hoffmann-La Roche Ltd;Speaker, Merck & Co, Inc;Speaker, ICON plc;Speaker, Ipsen SA;Speaker, Bayer AG;Speaker, Pfizer Inc;Speaker, Guerbet SA;Speaker, Terumo Corporation
Emine Yaren Yilmaz Ince, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The Emerald-1 trial sought to exploit the immunomodulatory benefits of transarterial chemoembolization (TACE) combined with immunotherapies in hepatocellular carcinoma (HCC). To better understand potential synergistic mechanisms and predict tumor response, this study analyzed cytokine levels longitudinally before and after conventional (c)TACE.

**METHODS AND MATERIALS**

This subgroup analysis of a prospective study included 23 patients with unresectable HCC undergoing cTACE followed by ablation using interstitial high dose-rate brachytherapy after 24h (02/22-05/23). IRB approval and informed consent were obtained. Serum samples were collected from peripheral blood 1 day before and after cTACE. Samples were analyzed using Mesoscale discovery validated V-Plex assays for proinflammatory (interferon-gamma (IFN-?), interleukin (IL)-1ß, -2, -6, -8, -17A, monocyte chemoattractant protein (MCP)-1, macrophage inflammatory protein (MIP)-1a, tumor necrosis factor (TNF)-a), anti-inflammatory (IL-4, -5, -10, -13), and pro-angiogenic factors (vascular endothelial (VEGF)-A and basic fibroblast growth factor (bFGF)). Additionally, tumor response at 8 weeks was assessed using mRECIST. Statistics included Wilcoxon- and Mann-Whitney test.

**RESULTS**

The cohort comprised 22 men and 1 woman (73.2±8.7 years), with 20 patients classified as Child-Pugh A and 3 as B, 10 as Barcelona Clinic Liver Cancer stage A and 13 with B, and a mean tumor size of 51.3±24.1 cm. All anti-inflammatory cytokines had decreased after cTACE compared to baseline, with IL-5 ($p=0.0006$) and IL-4 ($p=0.0019$) reaching statistical significance. However, also IFN-? ($p<0.0001$), IL-2 ($p=0.5202$), IL-8 ($p=0.0049$), IL-17 ($p=0.0049$), TNF-a ($p=0.0003$), MIP-1a ($p<0.0001$), and MCP-1 ($p=0.0003$) decreased, while only IL-1ß ($p=0.3333$) and IL-6 ($p = 0.0043$) increased following cTACE. Stratification by mRECIST (available in n=22) revealed higher baseline MCP-1 levels ($p = 0.1537$) in responders (n=15) and elevated bFGF levels ($p=0.0449$) in non-responders (n=6) post-cTACE, respectively.

**CONCLUSION**

Our study revealed significant cytokine changes post-cTACE for HCC, including decreases in anti-inflammatory and some pro-inflammatory cytokines. Notably, IL-1ß and IL-6 increased, suggesting an acute inflammatory reaction to treatment. These findings highlight the intricate immunological responses to cTACE and their potential impact on treatment outcomes.

**CLINICAL RELEVANCE/APPLICATION**

Understanding cTACE-induced immunological effects in HCC can help tailor treatment strategies and predict outcomes. Humoral factors, alongside cellular immune responses, could serve as prognostic markers, but further longitudinal research is needed to understand the underlying mechanisms.

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# Abstract Archives of the RSNA, 2024

M5B-SPMK

**Musculoskeletal Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPMK-1 FOUR-DIMENSIONAL COMPUTED TOMOGRAPHY-DERIVED INTEROSSEOUS PROXIMITIES DURING FOREARM PRONOSUPINATION

Kristin D. Zhao, MA (*Abstract Co-Author*) Nothing to Disclose
Sanjeev Kakar, MD (*Abstract Co-Author*) Nothing to Disclose
Thor Andreassen (*Abstract Co-Author*) Nothing to Disclose
Andrew Thoreson (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Cesar Lopez (*Abstract Co-Author*) Nothing to Disclose
Taylor Trentadue, BS (*Presenter*) Nothing to Disclose

### PURPOSE

The distal radioulnar joint (DRUJ) transmits load through the wrist and facilitates forearm pronosupination (PS). Limited osseous congruency of the radius and ulna contributes to intrinsic DRUJ instability, with volar-dorsal translation occurring during PS. Dynamic imaging-derived biomarkers may improve DRUJ instability diagnosis. 4DCT (3DCT + time) captures wrist mechanics during functional tasks. We seek to relate DRUJ interosseous proximities to PS angle using statistical parametric mapping (SPM), which quantifies variability in spatiotemporal data. We hypothesized that PS angle influences DRUJ proximity, particularly along the volar-dorsal axis of the sigmoid notch.

### METHODS AND MATERIALS

Following IRB approval and written consent, 4DCT data during PS were collected in 12 female participants with unilateral DRUJ injury (median (IQR) age: 28 (24-46) years). Participants moved in a motion-guiding device at 70 bpm (pronation to supination) while 4DCT volumes were captured using a commercial dual-source photon-counting detector CT (NAEOTOM Alpha, Siemens; temporal resolution: 66 ms). A total of 725 CT volumes were collected over all 4DCT acquisitions. The radius and ulna were segmented from static CT using semi-automated pipelines. Static-to-dynamic bone registration was performed using custom algorithms; 686 (95%) volumes were free from motion artifact and included. A multi-domain statistical shape model was used to generate a canonical DRUJ. Participant meshes were morphed to the canonical DRUJ using a generalized regression neural network. PS angle was calculated as the finite helical axis. The relationship between PS angle and interosseous proximities was analyzed with an SPM general linear model. The test statistic, SPM{t}, was calculated on the sigmoid notch. The critical threshold (t*), which a% of smooth random proximity maps would traverse, was used for hypothesis testing (a=0.05, 0.01, 0.001, 0.0001 in sensitivity analyses).

### RESULTS

As hypothesized, there was a significant relationship between PS angle and DRUJ sigmoid notch proximities, particularly along the volar-dorsal axis. Vertex-specific coefficients ß quantify that 10° increased pronation is associated with a ß [range: -0.18 - 0.30] mm change in proximity.

### CONCLUSION

Increased pronation is associated with increased volar and decreased dorsal sigmoid notch proximities. This demonstrates a novel application of SPM to 4DCT data, allowing quantitative spatial analysis of articular surface interactions during motion.

### CLINICAL RELEVANCE/APPLICATION

4DCT is an emerging technique to quantify and localize changes in wrist mechanics during functional tasks. SPM can be applied to paired datasets to determine regions demonstrating injury-related patterns.

## M5B-SPMK-2 THE APPLICATION OF CONTRAST-ENHANCED MAGNETIC RESONANCE NEUROGRAPHY IN DIAGNOSIS AND GRADING OF CARPAL TUNNEL SYNDROME

Wenjun Wu (*Abstract Co-Author*) Nothing to Disclose
Youzhi Wang (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the diagnostic accuracy and grading value of carpal tunnel syndrome (CTS) with contrast-enhanced magnetic resonance neurography (ceMRN).

### METHODS AND MATERIALS

Thirty-one patients with confirmed carpal tunnel syndrome (CTS) and 30 healthy controls were prospectively collected, and evaluated using ceMRN to record the information below the median nerve: nerve width, nerve-to-muscle T2 signal intensity (nT2), which are identified as CTS patients, also need to

measure the length, area of nerve entrapment, negative enhancement (percentage reduction of nerve signal at entrapment compared to higher signal from adjacent nerve) and ceMRN nerve entrapment grade of CTS patients. Clinical data were retrospectively extracted from the medical records of patients diagnosed with CTS (Boston carpal tunnel questionnaire, symptoms and signs, and clinical severity grading).

**RESULTS**

Compared with clinical evaluation, ceMRN had a sensitivity of 0.97 and specificity of 0.90 in detecting nerve entrapment. When distinguished according to clinical severity levels, the sensitivities were 0.63, 0.5, and 0.56 for I, II, and III injuries, and the specificities were 0.83, 0.59, and 0.86, respectively. The areas under the curve for predicting CTS using nerve width and nT2 were 0.89 and 0.87 ($p<0.05$), respectively, and the AUC for predicting CTS using the above two parameters combined was 0.94. In the ceMRN nerve entrapment grading, there were significant differences in nerve length, area of nerve entrapment, negative enhancement, and nT2 ($p<0.05$). There was a positive correlation between clinical severity and ceMRN nerve entrapment grading (correlation coefficient = 0.64; $p<0.0001$).

**CONCLUSION**

Contrast-enhanced MRN of the median nerve in the wrist can improve the diagnostic efficacy of CTS and has great potential for grading patient severity.

**CLINICAL RELEVANCE/APPLICATION**

The ceMRN significantly improves the visualization of peripheral nerves and pathology in the wrist and palm by robustly suppressing the signals of fat, bone marrow, and especially vessels in patients, which can significantly improve readers' confidence in identifying nerves, and improve the detection of lesions.

## M5B-SPMK-3 PRELIMINARY EXPERIENCE WITH NEW TRACTION DEVICE ON NON-ARTHROGRAPHIC WRIST MRI

David Yeung (*Abstract Co-Author*) Nothing to Disclose
James F. Griffith, MD (*Abstract Co-Author*) Nothing to Disclose
Miaoru Zhang, MMEd (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the distraction effect and wearability of a new wrist traction device in healthy subjects during wrist MRI examinations.

**METHODS AND MATERIALS**

17 healthy subjects (11 males, 6 females; mean age 29 years, range 24-43 years) underwent wrist MRI (Philips Ingenia Elition X 3.0T MRI system) between November 2023 and April 2024. A new traction device was applied to the wrists during MR examination. All subjects first completed the wrist MRI without traction and then with traction, lying supine with the examined wrist and traction device at the side (Fig. 1).A 10-point analog scale pain-severity questionnaire was completed by each subject within 15 minutes of MRI completion (1). Joint space width and articular cartilage visibility at five radiocarpal and intercarpal joints were evaluated on proton-density weighted fat-suppressed coronal images before and after traction. Joint space width was defined as the minimal distance between opposing cortical bone surfaces (2,3). Articular cartilage visibility was graded as poor (<25%), moderate (25-75%), or good (>75%) visibility depending on the percentage visibility of articular cartilage (4).

**RESULTS**

12 (71%) of 17 subjects had no pain during or after the MRI with traction, while 5 (29%) subjects had a slight increase of wrist pain with traction (mean 2 points, range 1-4 points). Joint space width of the radioscaphoid, radiolunate, scaphocapitate and lunocapitate joints was increased after traction (all p values = 0.001), with an average increase of 0.74 mm (Fig. 2, Table.1). Articular cartilage visibility was improved at the radiolunate and lunocapitate joints (p values < 0.05). More than half of radiolunate, scaphocapitate and lunocapitate joints were graded as 'good' visibility after traction (Table 2).

**CONCLUSION**

This new traction device can effectively distract the wrist joints, improving cartilage surface visibility in all subjects with a minimal increase in discomfort in about one-third of subjects.

**CLINICAL RELEVANCE/APPLICATION**

Wrist MRI with traction, using the standard weight and pulley system, has high accuracy for detecting intrinsic ligaments and other injuries, though it is limited by the cumbersome traction method. With this new traction device, patients can lie comfortably in a supine position with the wrist examined by the side. This new device provides good wrist joint distraction and cartilage visibility, which may reduce the need for wrist arthrography.

## M5B-SPMK-4 MUSCULOSKELETAL IMAGING COMPLICATIONS OF RECREATIONALLY INJECTED XYLAZINE

Amber C. Simmons, MD (*Abstract Co-Author*) Nothing to Disclose
Noah Wasserman, MD (*Abstract Co-Author*) Nothing to Disclose
Alvaro Ordonez, MD (*Abstract Co-Author*) Nothing to Disclose
Nogah Shabshin, MD (*Abstract Co-Author*) Consultant, Active Implants;Consultant, CartiHeal Ltd;Consultant, Nanox;Consultant, Greenbone;
John D. Karp, MBBCh (*Presenter*) Nothing to Disclose

**PURPOSE**

Xylazine is an increasingly misused non-opioid sedative that is often recreationally injected with Fentanyl for enhanced effects. Xylazine is now found as an adulterant in >90% of illegal drug samples tested in Philadelphia and has been detected in samples nationwide. Xylazine causes vasoconstriction of peripheral blood vessels and decreased skin perfusion, causing tissue necrosis and impaired wound healing. Despite the surge in xylazine use, there is limited information regarding the associated soft tissue and bone complications on imaging. Therefore, we provide the first imaging evaluation of Xylazine-related musculoskeletal (MSK) complications.

**METHODS AND MATERIALS**

An IRB-approved retrospective analysis was conducted in a multicenter institution in Philadelphia, PA. Adult patients were identified through Nuance mPower and included if injected xylazine was documented (self-reported and/or positive drug test) and had received MSK imaging. Demographics, clinical and imaging characteristics were evaluated and correlated with inflammatory and microbiological results.

**RESULTS**

A total of 44 patients were included with a median age of 38 years (range 29-52), 27% female and 91% Caucasian. The site of injection-related MSK complications was predominantly in the lower extremities (52%), followed by upper extremities (48%), and the neck (7%). All patients had extensive open wounds. Imaging included radiographs (89%), CT (70%), ultrasound (23%), and MRI (20%). Radiographic and CT findings included soft-tissue obliteration and marginal undulations, exposed fascia and muscles, and extensive periosteal reaction along the involved bone. Despite the similarity to

osteomyelitis (OM) and the severity of the wounds, acute and chronic OM were confirmed with multimodality imaging in 20% and 9% of the cases, respectively. One pathological fracture on acute OM was noted. In 7% of cases, findings were indeterminate for OM. Additional imaging features included abscess formation (19%) and subcutaneous emphysema (11%). A lack of a robust systemic inflammatory response was also observed (mean white blood cell count = 8.4 ± 4.9 103 cells/uL). Positive blood cultures were reported in only 18% of cases.

**CONCLUSION**

The increased recreational use of injected xylazine is leading to a rise in severe MSK complications observed on imaging. Our analysis showed that the severity of wounds was not commensurate with the degree of bone involvement and systemic inflammatory response.

**CLINICAL RELEVANCE/APPLICATION**

The emerging xylazine abuse as an illicit substance is associated with severe MSK complications. Detailed characterization of the imaging findings observed in this population can guide radiologists to optimize resources and improve patient care.

## M5B-SPMK-5 ASSOCIATIONS OF THREE MAGNETIC RESONANCE IMAGING CLASSIFICATIONS WITH TREATMENT OPTIONS FOR PATIENTS WITH LATERAL EPICONDYLITIS: SURGICAL OR CONSERVATIVE TREATMENT

Huili Zhan, MMed (*Abstract Co-Author*) Nothing to Disclose
Ping Wang (*Abstract Co-Author*) Nothing to Disclose
Heng Zhang (*Abstract Co-Author*) Nothing to Disclose
Qian Zhanhua (*Abstract Co-Author*) Nothing to Disclose
Bai Rongjie (*Abstract Co-Author*) Nothing to Disclose
Ye Wei (*Abstract Co-Author*) Nothing to Disclose
Jianing Cui (*Presenter*) Nothing to Disclose

**PURPOSE**

The study aimed to analyze the magnetic resonance imaging (MRI) features of patients with lateral epicondylitis (LE) who underwent conservative or surgical treatment and to evaluate the significance of MRI characteristics in deciding treatment management. Furthermore, three MRI-based LE classifications were introduced to investigate the best classification that can be used to refine predictive models for surgical treatment.

**METHODS AND MATERIALS**

374 LE patients comprised the operative(n = 261) and non-operative (n = 113) groups. All patients received conservative treatment for at least 6 months. If elbow pain persisted or elbow movement was limited, conservative treatment had failed, and surgery was required. The covariance of parameters was checked using Spearman's correlation analysis, and variables with correlation coefficients greater than 0.7 were excluded. The predictors of surgical treatment were analyzed using the logistic regression method. Furthermore, based on previous studies, we selected three MRI classifications to classify the pathologies of the origin of ECT. Specific details of the three MRI classifications are summarized. Finally, four models were developed. Model 1 included all meaningful parameters in the multivariate analysis, and models 2 to 4 were model 1 plus MRI classifications 1 to 3, respectively. The Net Reclassification Improvement (NRI) index was employed to evaluate the enhanced prediction capabilities of models 2 to 4 relative to model 1 regarding patient management strategies. Of the whole samples, 70% were randomly chosen to train the models, while 30% were applied for the test.

**RESULTS**

There were significant differences in age, CET tear size, LCL complex, synovial plica(SP), muscle edema, and ulnar nerve. The factors of sex, CET tear size, LCL complex, SP, muscle edema, and ulnar nerve were correlated with surgical treatment. The AUC of predicted probabilities for model 1 in the training and testing sets were 0.824 and 0.728. In the test set, the NRI values for Models 2 to 4 were 4.2, 1.3, and 11.8, respectively; however, only Model 4 achieved significance with a P-value of 0.012.

**CONCLUSION**

The severity of the LE was greater in the surgical group. The combination of MRI and baseline characteristics can assist doctors in making prompt decisions regarding surgical treatment for patients. MRI classification 3, which further categorizes tendinopathy into subtypes, enhances the accuracy of traditional predictive models.

**CLINICAL RELEVANCE/APPLICATION**

MRI classification of subdivided tendinopathy improves the ability of the conventional model to assess which LE patients require surgical treatment.

## M5B-SPMK-6 THE RADIOHUMERAL SYNOVIAL PLICA: ANATOMY, HISTOLOGY, AND IMPLICATIONS FOR CHRONIC LATERAL EPICONDYLITIS

Huili Zhan, MMed (*Abstract Co-Author*) Nothing to Disclose
Ping Wang (*Abstract Co-Author*) Nothing to Disclose
Qian Zhanhua (*Abstract Co-Author*) Nothing to Disclose
Bai Rongjie (*Abstract Co-Author*) Nothing to Disclose
Ye Wei (*Abstract Co-Author*) Nothing to Disclose
Heng Zhang (*Abstract Co-Author*) Nothing to Disclose
Jianing Cui (*Presenter*) Nothing to Disclose

**PURPOSE**

Our study aimed to elucidate the relationship between synovial plica (SP) and the surrounding ligaments and tendons through the cadaveric section, histological assessment, magnetic resonance imaging (MRI), and MR angiography of elbow specimens. We then evaluated the relationship between SP and clinical symptoms as well as MRI features in patients with chronic lateral epicondylitis (LE).

**METHODS AND MATERIALS**

MRI was performed on 8 cadaveric elbows specimens. The MRI findings were compared with those in anatomic sections and histologic preparations. In addition, 99 patients with chronic LE who underwent preoperative elbow MRI and arthroscopic surgery were included and divided into 77 patients with SP and 22 without SP. The differences in clinical and MRI features between the two groups were compared. The clinical variables included age, affected side, pain duration, and elbow function. Elbow function was evaluated preoperatively and at 3-week, 6-week, and 3-month postoperatively using the visual analogue scale (VAS) score, DASH score, and range of motion. The MRI variables included common extensor tendon (CET), lateral collateral ligament(LCL) complex, muscle edema, ulnar neuropathy, and bone changes.

## RESULTS

The SPs were histologically divided into two categories: one with synovial epithelium externally and fibrous, fat, and vascular tissue internally, and the other solely composed of fibrous tissue. The SP was a thickening of the synovium proximal to the annular ligament (AL) that extends into the joint cavity, then moves to the radial collateral ligament, and finally attaches to the lateral epicondyle along with the CET. The SP, ligament, and tendon blend without distinct boundaries. Furthermore, in the study of patients with chronic LE, we found that the SP group had higher preoperative and 3-week postoperative VAS scores and more severe CET and LCL complex abnormalities (Table 1-2). Postoperative VAS scores decreased in both groups. However, at 3-month postoperative, the VAS score continued to show a decreasing trend in the SP group ($P < 0.001$), whereas there was no significant decrease in the without SP group.

## CONCLUSION

The SP is distinct from the AL but closely correlates with the LCL complex and CET enthesis at the lateral epicondyle. Patients with SP have more severe pain scores, LCL complex and CET abnormalities, and longer postoperative recovery times.

## CLINICAL RELEVANCE/APPLICATION

A comprehensive study of anatomy, histology, and the impact of SP on chronic LE patients could improve diagnostic accuracy, and refine therapeutic strategies.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

M5B-SPMS

**Multisystem Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPMS-1 IMPACT OF SPLEEN VOLUME AND ITS DYNAMIC CHANGE IN THE CONTEXT OF NHL TREATED WITH CHIMERIC ANTIGEN RECEPTOR T-CELL THERAPY

Jens Ricke, MD, PhD (*Abstract Co-Author*) Research Grant, Sirtex Medical Ltd;Research Grant, Bayer AG;Research Grant, Terumo Corporation;Research Grant, Boston Scientific Corporation
Peter Bartenstein (*Abstract Co-Author*) Nothing to Disclose
Viktoria Blumenberg (*Abstract Co-Author*) Nothing to Disclose
Wolfgang G. Kunz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Marion Subklewe (*Abstract Co-Author*) Nothing to Disclose
Michael Winkelmann, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Chimeric antigen receptor T-cell therapy (CART) targeting the CD19 antigen is a powerful treatment option for later line treatment of relapsed or refractory (r/r) lymphoma. The spleen, as part of the lymphatic system, is often involved in immune response processes that could also play a role in CART efficacy. In this study, we investigate the impact of spleen volume (SV) and its dynamic change between baseline (BL) and early follow-up imaging on progression-free survival (PFS) and overall survival (OS) in the context of CART.

### METHODS AND MATERIALS

Patients with available BL and 30-days follow-up (FU1) computed tomography (CT) or 18-F fluorodeoxyglucose positron emission tomography ([18F]-FDG PET)/CT scan before CART were included. The spleen was 3D-segmented on all scans and spleen volume change (SVC) was calculated as a percentage of BL to FU1. Treatment response, overall response rate (ORR) and PFS were determined based on Lugano criteria. Mann-Whitney U test was used to test significance between responders and non-responders and between spleen involvement at BL (SIBL) and non-SIBL. Log-rank (Mantel-Cox) tests were performed to assess the significance of survival.

### RESULTS

68 out of 78 patients met the inclusion criteria. The median SV at BL was 244.5 cm3 and the median SVCBL to FU1 was -8.85 cm3. Patients of the responder group showed a significant decrease of SVCBL to FU1 compared to the non-responding group ($p = 0.001$) and patients with SIBL showed a small, but not significant difference to patients with non-SIBL ($p = 0.056$). In survival analysis, there was a significant difference between the groups in both OS ($p = 0.040$) and PFS ($p = 0.008$) for SVCBL to FU1. No significant differences were seen in SVBL and SIBL for both OS (SVBL: $p = 0.342$; SIBL: $p = 0.418$) and PFS (SVBL: $p = 0.376$; SIBL: $p = 0.577$). A subgroup survival analysis for SVCBL to FU1 in combination with SIBL showed a significant difference for PFS ($p = 0.049$) and no significant difference for OS ($p = 0.175$).

### CONCLUSION

This study demonstrated that the change in SV between baseline and 30-day follow-up (SVCBL to FU1) is associated with PFS and OS both for patients with and without involvement of the spleen and should be explored as a potential novel biomarker for survival prediction in the context of CART treated lymphoma patients.

### CLINICAL RELEVANCE/APPLICATION

Understanding the immunologic processes and involvement of the lymphatic system may be helpful in the clinical management of lymphoma patients undergoing CART.

## M5B-SPMS-2 DEEP LEARNING AUTOMATION OF SPLEEN SEGMENTATION FOR ASSESSING SPLENOMEGALY IN MYELOFIBROSIS: A REPRODUCIBLE APPROACH TO EVALUATE DISEASE PROGRESSION VERSUS RESPONSE

Vahid Bazojoo, MD (*Abstract Co-Author*) Nothing to Disclose
Hreedi Dev (*Abstract Co-Author*) Nothing to Disclose
Chenglin Zhu (*Abstract Co-Author*) Nothing to Disclose
Zhongxiu Hu (*Abstract Co-Author*) Nothing to Disclose
Martin R. Prince, MD, PhD (*Abstract Co-Author*) Patent agreement, General Electric Company;
Usama Sattar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Arman Sharbatdaran, MD (*Presenter*) Nothing to Disclose

## PURPOSE

Myelofibrosis induces splenomegaly through extra-medullary hematopoiesis. Spleen size is an increasingly important biomarker for myelofibrosis progression. This study assesses the reproducibility and accuracy of spleen volume measurements using ellipsoidal estimation, manual contouring, and model-assisted deep learning contouring.

## METHODS AND MATERIALS

In this retrospective cohort study, spleen volume measurement approaches were analyzed in 20 myelofibrosis patients using axial T1-weighted, axial T2-weighted, and coronal T2-weighted MRI imaging. Three different measurement approaches—ellipsoidal estimation (length × width × thickness × p/6), manual contouring, and model-assisted contouring—were performed by 5 experts. The model was a 3D NNU-net model trained with Axial T1, Axial T2, Coronal T2 and SSFP images from 413 subjects labeled by experts then observed and checked by board certified radiologist with 30 years' experience in abdominal MRI. We compared these methods to identify the most reproducible approach for using spleen volume as a biomarker in assessing myelofibrosis progression.

## RESULTS

Internal/external validation of the 3D nnU-net model showed a Dice of 97% compared to radiologist ground truth. Model-assisted contouring had the lowest coefficient of variation for spleen volume among the 5 expert observers, 0.37 % (± 0.84) compared to manual contouring, 3.6% (±1.7) (p=0.004) and ellipsoidal estimation (a commonly used method) from 3 measurements 16.3% (±6.7) (p=0.008). Further reduction in coefficient of variation down to 0.32% (±0.59) was achieved by averaging model-assisted segmentations across Axial T2-weighted, Axial T1-weighted, and Coronal T2-weighted MRI sequence (p=0.006).

## CONCLUSION

Utilizing a model-assisted deep learning approach substantially enhances reproducibility, reducing observer variation in measuring splenomegaly in myelofibrosis patients.

## CLINICAL RELEVANCE/APPLICATION

Spleen volume reduction (SVR) percentage is an important biomarker in evaluating myelofibrosis disease progression versus response. Additionally, SVR percentage is used as a crucial biomarker in most clinical trials assessing drug treatment efficacy in myelofibrosis. Thus, improving the accuracy and reproducibility of spleen volume measurements is critical for reliable clinical outcomes and therapeutic decision-making. Improving reproducibility decreases the time interval required to detect a meaningful change in spleen volume allowing for more frequent monitoring of patient response to treatment and earlier detection of treatment failures.

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# Abstract Archives of the RSNA, 2024

M5B-SPNMMI

**Nuclear Medicine & Molecular Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPNMMI-1 DOUBLE-NETWORK MAGNETIC HYDROGEL WITH INDIRECT THERMO-SENSITIVE PHASE TRANSITION FOR "OFF-ON" CHEMOEMBOLIZATION THERAPY OF HEPATOCELLULAR CARCINOMA BASED ON MAGNETIC RESONANCE NAVIGATION

Longlong Wang (*Abstract Co-Author*) Nothing to Disclose
Lei Li (*Abstract Co-Author*) Nothing to Disclose
Na Li (*Abstract Co-Author*) Nothing to Disclose
Jingwen Ma (*Presenter*) Nothing to Disclose

### PURPOSE

Transcatheter arterial chemoembolization (TACE) has become the standard of treatment for patients suffering hepatic cancer in middle/advanced stage or no surgical resection indication. Although TACE is safe, over- and off-targeted embolization must face with. Therefore, we hypothesized the efficacy of HCC embolization could be improved by achieving precise targeting of embolic agents in vivo and "off-on" embolization.

### METHODS AND MATERIALS

Magnetic dual network hydrogel based on hyaluronic acid-dopamine (HA-DA) and alginate (ALG)-Ca2+ was constructed and three components were added including thermo-sensitive liposomes (HFP@Lip) loading with hyaluronidase (HAase) and magneto-thermal FeCo magnetic nanoparticles (NPs), Doxorubicin (DOX) and iodohexanol for digital subtraction angiography (DSA), namely HFP@LipDI/HAALG. Its gelation time and rheological properties was measured. Precise internal localization of the embolic hydrogel achieved by MRN technology; HAase was triggered releasing by alternating magnetic field (AMF) heating. The internal location of hydrogel, blocking and recanalization of bloodstream could be visualized by MRI and DSA.

### RESULTS

FeCo NPs (~11 nm) were successfully prepared; HFP@LipDI/HAALG were constructed; gelation time was adjusted by altering ratio of HRP and H2O2 and control gelation time ranging 300-400 s to ensure sufficient time for MRN; it was tested that optimum gelation time achieved when the final concentration of HA-DA, ALG, HRP and H2O2 were 2 wt%, 5 wt%, 0.05 mg·mL-1 and 0.01 mmol·mL-1 respectively. HFP@LipI/HAALG was prepared by adding 20 wt% of iodohexanol, and which successfully degrading after heating within AMF. Noteworthy, FeCo NPs not only provide magnetic property essential in MRN and contrast agents in MRI, but also act as heating source to trigger HAase release in AMF. Carotid arteries were imaged using 3D-TOF sequences in MRI, and after injection of gadodiamide vessels were observed more clearly. Inserting microcatheters in carotid artery, and HFP@LipI/HAALG were injected to block blood supply of carotid artery. An AMF coil has been made. Temperature of HFP@LipI/HAALG containing 2.5 mg·mL-1 of FeCo could be effortlessly rise by 15.4°C within 30 s under the magnetic field condition of 33 KA·m-1, 115 kHz.

### CONCLUSION

The embolic agent can be precisely localized in vivo, internal degradation through extracorporeal manipulation to successfully realizing the "off-on" embolization.

### CLINICAL RELEVANCE/APPLICATION

The construction of the hydrogel embolic agent provides new technologies for improving over- and off-targeted embolization in TACE treatment of hepatic cancer, and provides the possibility to improve the prognosis and life quality of patients receiving TACE.

## M5B-SPNMMI-2 TREM-1 PET FOR THE CHARACTERIZATION OF MYELOID INFLAMMATION AFTER TBI IN MICE

Aisling Chaney, PhD (*Abstract Co-Author*) Nothing to Disclose
John G. Cooper, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Central nervous system (CNS)-infiltrating myeloid cells, namely monocytes and macrophages, have been implicated in the pathogenesis of secondary immune injury after traumatic brain injury (TBI). Importantly, the location and temporal dynamics of myeloid cells have the potential to serve as a clinically meaningful biomarker of secondary injury after TBI. Herein, we describe the successful use of a novel positron emission tomography (PET) imaging tracer for triggering receptor expressed on myeloid cells-1 (TREM1) to specifically image whole-body proinflammatory peripheral myeloid cell responses after TBI in mice. To determine the relationship between peripheral and central inflammation, we also directly compare TREM1-PET with PET imaging of translocator protein 18 kDa (TSPO) a widely used approach for measuring neuroinflammation.

## METHODS AND MATERIALS

Mild TBI was induced in C57BL/6 mice using a weight drop model. TSPO-PET using [18F]DPA-714 was performed at 9 days post-injury (DPI). [64Cu]TREM1-mAb-PET was performed in a subgroup of the same cohort of mice at 10 DPI. This time-point was chosen to maximize the specificity for infiltrating monocytes and activated microglia. Regions of interest were defined by semi-automated fitting of skull CT to a 3D brain atlas (Fig. 1C). Following TREM1-PET, mice were sacrificed, and tissues harvested for biodistribution (BioD) analysis.

## RESULTS

TSPO-PET demonstrated significantly increased signal in whole brains of TBI compared to sham mice ($p=0.002$, Fig. 1A). Cortical TSPO signal trended higher but was not significant ($p=0.08$). TREM1-PET demonstrated significantly increased signal in both whole brain and cortex ($p=0.03$-$0.04$, Fig. 1B). Ex vivo BioD demonstrated significantly increased [64Cu]TREM1-mAb signal in the bone marrow of TBI mice (vs. shams) indicating expansion of peripheral proinflammatory myeloid cells following injury (Fig. 1D).

## CONCLUSION

We demonstrate the ability of TREM1-PET to detect both brain and whole-body innate inflammation after TBI in mice and demonstrate the feasibility of this approach. Differing signals in the cortex suggest that these tracers are detecting separate aspects of the inflammatory response. Additional PET experiments to characterize the spatiotemporal dynamics of myeloid inflammation after TBI are ongoing.

## CLINICAL RELEVANCE/APPLICATION

TBI affects more than 2.5 million US residents every year, at a cost of over $40.6 billion. There is an urgent unmet clinical need to better understand the processes involved in TBI, with the long-term goal of improving diagnosis and treatment of this devastating disorder. The present work investigates a novel PET imaging biomarker (TREM1) to characterize the myeloid component of neuroinflammation.

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# Abstract Archives of the RSNA, 2024

M5B-SPNPM

**Noninterpretive Skills (Beyond Imaging) Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPNPM-1 ENERGY SAVING STRATEGY USING OPTIMAL TUBE VOLTAGE AND TUBE CURRENT IN ABDOMINAL CT - PHANTOM STUDY

Chang Hee Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jeong Woo Kim, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study was aimed to investigative optimal tube voltage and tube current considering energy as well as radiation dose and image quality for abdominal CT using phantom.

### METHODS AND MATERIALS

A customized anthropomorphic phantom (PH-5, Kyoto Kagaku) was scanned at 20 different protocols combining 4 tube voltages (80, 100, 120, and 135 kVp) and 5 tube currents (100, 200, 300, 400, and 500 mA) using a 320-row multidetector CT scanner. In each protocol, energy consumption was measured using an energy consumption measurement sensor, and dose length products (DLPs) were recorded. The phantom contains 8 focal liver lesions (FLLs) (4 hypoattenuating nodules and 4 hyperattenuating nodules). In quantitative analysis, noise was measured by drawing regions-of-interest (ROIs) in the subcutaneous fat layer and paraspinal muscle in the phantom. Additionally, to calculate the contrast-to-noise (CNR) of the FLLs, attenuations of the FLLs and adjacent liver parenchyma were measured by drawing ROIs. The CNRs were calculated by using the following equation: CNR = | ROIL - ROIf |/SDnoise, where ROIL is the mean attenuation of liver parenchyma, ROIf is the mean attenuation of FLL, and SDnoise is the mean image noise. All measurements were repeated five times, and the average value was used. The CNRs of FLLs in different protocols were compared using the Wilcoxon signed-rank test.

### RESULTS

Energy consumption was lower for 100 kVp/300 mA (9.64 Wh), 100 kVp/200 mA (6.82 Wh), and 100 kVp/100 mA (4.4 Wh) than for 80 kVp/400 mA (10.27 Wh) and 80 kVp/500 mA (12.65 Wh). DLP for 100 kVp/200 mA (219.4 mGy·cm) and 100 kVp/100 mA (109.7 mGy·cm) was lower than 80 kVp/500 mA (239.7 mGy·cm), but 100 kVp/300 mA (329 mGy·cm) was higher than 80 kVp/500 mA. The image noise was lower at 100 kVp/100 mA than 80 kVp/50 mA, but not statistically significant (7.20 ± 0.20 vs. 7.39 ± 0.20, p = 0.132), whereas 100 kVp/200 mA was significantly lower than 80 kVp/50 mA (6.15 ± 0.21 vs. 7.39 ± 0.20, p = 0.002). The CNR for 8 FLLs was significantly lower for 100 kVp/100 mA than 80 kVp/500 mA (4.63 ± 2.59 vs. 5.64 ± 3.29, p = 0.018), but 100 kVp/200 mA did not show a statistically significant difference from 80 kVp/500 mA (5.47 ± 3.17 vs. 5.64 ± 3.29, p = 0.208).

### CONCLUSION

Compared to the protocol using 80 kVp and 500 mA, the protocol using 100 kVp and 200 mA had lower DLP and noise, and nearly 50% lower energy consumption without compromising CNR of FLLs.

### CLINICAL RELEVANCE/APPLICATION

Low tube voltage and high tube current have been reported to increase the CNR of hepatic hypervascular tumor while reducing patient radiation dose. Considering energy consumption, the combination of moderate tube voltage and moderate tube current may be a candidate for an energy saving strategy while reducing radiation dose and image noise and without compromising CNR.

## M5B-SPNPM-2 THE IMPACT OF COOLING SYSTEMS ON THE OVERALL ENERGY USE OF MRI SYSTEMS

Christopher P. Hess, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company; Consultant, Siemens AG; DSMB, Focused Ultrasound Foundation; DSMB, uniQure Biopharma; DSMB, Asklepios BioPharmaceutical; Medical Advisory Board, Kheiron Medical Technologies
Alastair J. Martin, PhD (*Abstract Co-Author*) Research Grant, MRI Interventions, Inc
Amy Becker (*Abstract Co-Author*) Nothing to Disclose
Soeren Gruebel (*Abstract Co-Author*) Nothing to Disclose
Vibhas Deshpande, PhD (*Abstract Co-Author*) Researcher, Siemens AG
Sean A. Woolen, MD, MS (*Presenter*) Research Grant, Siemens AG;Investigator, Siemens AG

### PURPOSE

The healthcare sector significantly impacts the climate crisis, with over half of its carbon footprint stemming from energy use. MRI systems are major energy consumers in the hospital with little known about the energy needed to cool these devices. Our study focuses on evaluating the energy contributions and patterns of dedicated MRI cooling systems.

## METHODS AND MATERIALS

An energy meter (Siemens SEM3) was installed at an outpatient facility where 0.55T (Siemens Magnetom Free.Max) and 3T (Siemens Magnetom Vida) MRI systems were in operation. Current transformers were placed separately on the power distribution units for each of the MRIs and on the chiller units that were providing cooling for the MRI systems. Power data was extracted with a Desigo platform. The chillers were both Filtrine systems and dedicated solely to their MRI. Power draw from each system was continuously monitored with 10s temporal resolution for the period of 1 week. Average power consumption for both the MRI and chillers were evaluated during periods of scanning and idle time. Total energy use of each system over a week was measured. Data were summarized with descriptive statistics and 95% CIs.

## RESULTS

During overnight idle periods, the MRIs exhibited an average power draw of 9.25±0.03 kW (0.55T) and 11.22±0.03 kW (3T). Correspondingly, the chillers used 5.54±6.59 kW (0.55T) and 6.77±7.81 kW (3T). The chillers consistently maintained a characteristic power draw during idle periods, but increased activity during scanning periods due to heightened cooling demands, shifting to shorter cycles and a constant higher power mode. Overall, chillers accounted for 57% of the energy use for the 0.55T and 50% for the 3T MRI systems. Notably, during idle periods, these percentages increased to 60% for both MRI models. Over the course of the week, the MRI systems consumed an average of 239±15 kWh (0.55T) and 399±43 kWh (3T), while the chillers consumed 138±5 kWh (0.55T) and 198±14 kWh (3T). Under constant idle conditions, projected daily energy usage was 222 kWh (0.55T) and 269 kWh (3T) for the MRIs and 125 kWh (0.55T) and 162 kWh (3T) for the chillers. The additional energy associated with scanning was only 17 kWh (0.55T) and 130 kWh (3T) for MRI, and 13 kWh (0.55T) and 36 kWh (3T) for chillers.

## CONCLUSION

Our findings indicate that MRI chillers are responsible for 50-60% of total MRI system energy use, with small additional energy consumed during actual scanning compared to idle periods.

## CLINICAL RELEVANCE/APPLICATION

This study underscores the critical need for strategies that minimize idle energy consumption in cooling systems, enhancing energy efficiency in healthcare. Implementing such energy-efficient practices could significantly lower the carbon footprint of medical imaging facilities.

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# Abstract Archives of the RSNA, 2024

M5B-SPNR

**Neuroradiology Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPNR-1 OPTIMIZING ECHO TIME PARAMETERS IN POINT-RESOLVED SPECTROSCOPY FOR ENHANCED CYSTATHIONINE DETECTION IN GLIOMA PATIENTS: A VALIDATION STUDY

Min Zhou (*Abstract Co-Author*) Nothing to Disclose
Ziqiao Lei, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jie Zhao (*Abstract Co-Author*) Nothing to Disclose
Zhuang Nie (*Presenter*) Nothing to Disclose

### PURPOSE

To optimize the echo time (TE) of point-resolved spectroscopy (PRESS) for cystathionine detection in gliomas, and evaluate the diagnostic accuracy of PRESS for 1p/19q-codeletion identification.

### METHODS AND MATERIALS

The TE of PRESS was optimized with numerical and phantom analysis to better resolve cystathionine from the overlapping aspartate multiplets. The optimized and 97 ms TE PRESS were then applied to 84 prospectively-enrolled patients suspected of glioma or glioma recurrence to examine the influence of aspartate on cystathionine quantification, and diagnostic performance for 1p/19q-codeleted gliomas.

### RESULTS

The TE of PRESS was optimized as (TE1, TE2) = (17 ms, 28 ms). The spectral pattern of cystathionine and aspartate were consistent between calculation and phantom. The mean concentrations of cystathionine in vivo fitting without aspartate were significantly higher than those fitting with full basis-set for 97 ms TE PRESS (1.97 ± 2.01 mM vs. 1.55 ± 1.95 mM, $p < 0.01$), but not significantly different for 45 ms method (0.801 ± 1.217 mM and 0.796 ± 1.217 mM, $p = 0.494$). The cystathionine concentrations of 45 ms approach was better correlated with those of edited-MRS than 97 ms counterparts ($r = 0.68$ vs. 0.49, both $p < 0.01$). The sensitivity and specificity for discriminating 1p/19q-codeleted gliomas were 66.7% and 73.7% for 45 ms method, and 44.4% and 52.5% for 97 ms method, respectively.

### CONCLUSION

The 45 ms TE PRESS yielded more precise cystathionine estimates than the 97 ms method.

### CLINICAL RELEVANCE/APPLICATION

The cystathionine-optimized TE = 45 ms PRESS sequence provides more precise cystathionine measurements, and is anticipated to facilitate noninvasive diagnosis of 1p/19q-codeleted gliomas, and the dynamic monitoring of tumor progression, treatment response, or recurrence in those patients.

## M5B-SPNR-10 CORRELATION BETWEEN GLYMPHATIC SYSTEM FUNCTION AND SEGMENTAL ABNORMALITIES OF WHITE MATTER MICROSTRUCTURE IN MAJOR DEPRESSION DISORDER PATIENTS

Shiyun Tian, MD (*Abstract Co-Author*) Nothing to Disclose
Yan Wei Miao (*Abstract Co-Author*) Nothing to Disclose
Chun Yang (*Presenter*) Nothing to Disclose

### PURPOSE

We aimed to investigate glymphatic system function in major depression disorder (MDD) by performing diffusion tensor imaging analysis along the perivascular space (DTI-ALPS) and to evaluate its association with cerebral white matter abnormalities and neuropsychological scale scores.

### METHODS AND MATERIALS

The preprocessing of 3D-T1WI images was performed using FSL software. Automated Fiber Quantification (AFQ) technology can automatically identify the main 20 fiber bundles in the entire brain. The method for DTI-ALPS calculation is summarized in Fig. 1. Finally, the DTI-ALPS was calculated using the following formula: DTI-ALPS = mean (Dxproj, Dxassoc)/ mean (Dyproj, Dzassoc). We use the average value of two neuro-radiologists for subsequent statistical analysis. SPSS Statistics V26.0. was used to analyze the demographic characteristics (including age, gender, and years of education), HAMD, HAMA, and MoCA. Partial correlation analyses were done to investigate the relationship between DTI-ALPS, AFQ and neuropsychological assessment results, after adjusting age, gender, and years of education.

### RESULTS

Figure 2 summarizes the inclusion process. For the results of mean diffusion differences in tract level, MDD group showed significantly increased AD value (Table 2). For diffusion differences in point-wise level, significant alterations were mainly observed in MD , AD and RD, details were shown in Figure 3 (FWE correction, $p<0.05$). Interobserver agreement was excellent for the ALPS index (ICC, 0.844, 95% CI: 0.750, 0.905). The averaged DTI-ALPS values according to the participant groups were summarized in Table 3 and Figure 4. Partial correlation analysis was conducted mean diffusion differences in tract level of AFQ analysis (Figure 5). For diffusion differences in point-wise level of AFQ analysis, MD value of CB_L were found negatively correlated with DTI-ALPS index (Figure 6). Results for the associations between DTI-ALPS and HAMD Scale, HAMA Scale, and cognitive test results were summarized in Table 4.

### CONCLUSION

In conclusion, we found that the DTI-ALPS index of MDD patients was decreased, which may indicate impaired glymphatic system function. The DTI-ALPS index was associated with retardation and decreased cognitive ability. Our study also revealed associations between impaired DTI-ALPS and white matter microstructural abnormalities. It may be a promising biomarker for the glymphatic system in MDD.

### CLINICAL RELEVANCE/APPLICATION

In this study, we found brain glymphatic activity reduction and white matter damage in patients with MDD. Moreover, impairment of glymphatic function as reflected by DTI-ALPS index was related to white matter damage, retardation, and cognitive impairment in MDD patients. ADDIN EN.REFLIST

## M5B-SPNR-11 IMAGE QUALITY ASSESSMENT AND WHITE MATTER HYPERINTENSITY QUANTIFICATION IN TWO ACCELERATED HIGH-RESOLUTION 3D FLAIR TECHNIQUES: WAVE-CAIPI AND DEEP LEARNING-BASED SPACE

Yangsean P. Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ha-Kyung Jung, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the image quality obtained using two accelerated high-resolution 3D FLAIR techniques for the brain—deep learning-reconstruction SPACE (DL-SPACE) and wave-CAIPI FLAIR.

### METHODS AND MATERIALS

A total of 123 participants underwent DL-SPACE and wave-CAIPI FLAIR imaging of the brain were retrospectively reviewed. In a qualitative analysis, two radiologists rated the quality of each image, including the overall image quality, artifacts, sharpness, fine-structure conspicuity, and lesion conspicuity based on Likert scales. In a quantitative analysis, the signal-to-noise ratio (SNR) for the normal-appearing white matter (NAWM) and lesion and the contrast-to-noise ratio (CNR) for a lesion were calculated and compared. Moreover, the volumes of white matter hyperintensities (WMHs) obtained with the two techniques were automatically quantified and compared.

### RESULTS

The DL-SPACE FLAIR technique demonstrated a significantly higher fine-structure conspicuity ($P < 0.001$), lower degree of artifacts ($P < 0.001$), and higher overall image quality ($P = 0.001$). The mean SNR values were significantly higher with the DL-SPACE FLAIR technique (NAWM, 43.95 vs. 31.6; lesion, 31.35 vs. 21.28; all, $P < 0.001$). Additionally, the mean CNR of the WMH was significantly higher with the DL-SPACE FLAIR technique (11.34 vs. 8.22; $P < 0.001$). The periventricular and deep WMH volumes were significantly larger with the DL-SPACE FLAIR technique ($1.91 \pm 4.69$ vs. $1.54 \pm 4.18$; $P < 0.001$ and $0.26 \pm 0.42$ vs. $0.23 \pm 0.38$; $P = 0.002$, respectively).

### CONCLUSION

The DL-SPACE FLAIR technique produced images with superior quality, SNR, and CNR compared to the wave-CAIPI FLAIR technique with the same acquisition time.

### CLINICAL RELEVANCE/APPLICATION

DL-SPACE FLAIR is an accelerated MR technique that provides superior FLAIR image quality of the brain than wave-CAIPI technique in a clinically feasible scan time.

## M5B-SPNR-12 IMPACT OF METHOTREXATE THERAPY ON BRAIN METABOLISM IN PEDIATRIC AND YOUNG ADOLESCENT CANCER SURVIVORS: AN 18F-FDG PET/MRI STUDY

K. Elizabeth Hawk, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lucia Baratto, MD (*Abstract Co-Author*) Nothing to Disclose
Hyun Gi Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heike E. Daldrup-Link, MD (*Abstract Co-Author*) Managing director, Monasteria Press LLC Research Grant, MegaPro Inc
Tie Liang, PhD (*Abstract Co-Author*) Nothing to Disclose
Zahra Shokri Varniab, MD (*Presenter*) Nothing to Disclose

### PURPOSE

High-dose Methotrexate (HDMTX) chemotherapy has been linked to microglia activation and subsequent oligodendrocyte depletion in pre-clinical studies. However, it is not known if 18F-FDG PET imaging can detect the different phases of brain inflammation and brain damage after HDMTX. To close this gap, we evaluated the brain metabolism of pediatric cancer survivors on [18F] FDG PET/MRI before and after completion of HDMTX therapy. We hypothesized that HDMTX would leads to increased brain metabolism on short term and decreased brain metabolism long term follow up studies.

### METHODS AND MATERIALS

In an IRB approved, retrospective study, we enrolled 19 pediatric patients and young adults (three female and 17 males; age 17.9±4.32 years), with lymphoma (n=13) or osteosarcoma (n=6), who had undergone [18F] FDG PET/MRI at baseline and after completion of HDMTX (>1000 mg/m2). The post-treatment scan was conducted =3 months after the end of HDMTX therapy (group 1, n=12 patients) or more than 3 month after the end of chemotherapy (group 2, n=7 patients). The mean and maximum standardized uptake value (SUVmean and SUVmax) was measured in eleven different brain regions in each patient using PMOD software. Within each group, SUV data of the same region before and after chemotherapy was compared with the Wilcoxon Matched-Pairs Signed-Rank Test.

### RESULTS

Compared to baseline scans, we found increased cortical 18F-FDG signal on short term follow up PET scans, but not long-term follow-up PET scans. In group 1, SUVmean and SUVmax of the entire cortex was significantly increased post treatment (7.40±1.58 and 13.66±3.48) compared to baseline values

(5.29±1.73 and 9.68±3.63, respectively, p<0.001). In group 2, SUVmean and SUVmax of the entire cortex was not significantly different post treatment (5.99±1.39 and 11.06±2.93) compared to baseline values (6.09±1.71 and 11.51±3.50; p=0.1).

**CONCLUSION**

[18F] FDG PET/MRI demonstrated significantly increased cortical metabolism on short term follow up scans after HDMTX, which might indicate microglia activation. By contrast, [18F] FDG PET/MRI scans more than 3 months after end of therapy demonstrated recovered brain metabolism or decreased brain metabolism.

**CLINICAL RELEVANCE/APPLICATION**

Non-invasively identifying brain inflammation with 18F-FDG PET/MRI after HDMTX therapy could enable patient stratification for targeted anti-inflammatory interventions, potentially improving long-term neurological outcomes.

## M5B-SPNR-13 SIMULTANEOUS MULTIPARAMETRIC ESTIMATION OF ARTERIOVENOUS MALFORMATIONS HEMODYNAMICS USING MR FINGERPRINTING ASL (MRF-ASL)

Judy Huang, MD (*Abstract Co-Author*) Nothing to Disclose
Dengrong Jiang (*Abstract Co-Author*) Nothing to Disclose
Dhairya Lakhani, MD (*Abstract Co-Author*) Nothing to Disclose
Wen Shi (*Abstract Co-Author*) Nothing to Disclose
Vivek Yedavalli, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hanzhang Lu, PhD (*Abstract Co-Author*) Nothing to Disclose
Risheng Xu (*Abstract Co-Author*) Nothing to Disclose
Zhiyi Hu (*Presenter*) Nothing to Disclose

**PURPOSE**

Arteriovenous malformations (AVM) are a congenital vascular disease characterized by the direct connection between arteries and veins without a capillary bed. The resulting shunts within the AVM niduses disrupt normal hemodynamics, leading to complications such as hemorrhage or stroke. MR fingerprinting arterial spin labeling (MRF-ASL) enables simultaneous assessment of multiple parameters, including cerebral blood flow (CBF), arterial cerebral blood volume (aCBV), and bolus arrival time (BAT). This study aims to 1) evaluate the effectiveness of MRF-ASL in assessing AVM hemodynamics and 2) compare its sensitivity for AVM detection with CBF measured on single delay pseudo-continuous ASL (pCASL) as graded by the reference standard Spetzler Martin (SM) criteria on digital subtraction angiography (DSA).

**METHODS AND MATERIALS**

Patients with DSA-confirmed AVM were included in this IRB-approved study with SM grades assessed. Derived MRF-ASL parametric maps included: CBF1-compartment, CBF2-compartment, aCBV, BAT, and T1. Single delay 2D pCASL CBF was also acquired for the comparison of AVM detection and characterization. MRF-ASL and pCASL were each acquired within 5 minutes. To quantify MRF-ASL and pCASL parameters, regions-of-interest (ROIs) of AVM nidus and contralateral non-affected tissue were manually drawn based on T2-weighted images. Paired t-test was used to compare the MRF-ASL parameters within the AVM nidus and the same spatial location in the contralateral non-affected side. Associations between SM grades and MRF-ASL parametric values in AVM nidus were evaluated using linear regression.

**RESULTS**

7 AVM patients (5F, age 44.9±13.8 years) were studied. ROI analysis showed that the AVM nidus region had higher CBF1-compartment (P<.0001), CBF2-compartment (P<.0001), aCBV (P=.008), and shorter BAT (P=.005) than the contralateral non-affected side. In contrast, no significant difference in pCASL CBF was found (P=.57). The MRF-ASL aCBV was significantly associated with SM grade (P = .02). No association was found for CBF1-compartment (P=.44), CBF2-compartment (P=.16), or BAT (P=.30).

**CONCLUSION**

MRF-ASL exhibited superior sensitivity in detecting the AVM lesion compared to single delay pCASL. Within the AVM nidus region, we observed elevated CBF1-compartment, CBF2-compartment, aCBV, and shorter BAT values compared to contralateral normal tissue in the same patients. The aCBV values within the nidus were significantly associated with SM grade. In summary, our findings suggest that MRF-ASL holds promise as a useful tool for AVM assessment.

**CLINICAL RELEVANCE/APPLICATION**

Our preliminary analysis demonstrates that the 5-minute multi-parametric MRF-ASL acquisition is a promising technique for AVM detection and characterization.

## M5B-SPNR-14 USE OF MRI IN THE PREDICTION OF DEEP TMS RESPONSE IN OCD

Omer Uysal (*Abstract Co-Author*) Nothing to Disclose
Muhammed Taha Esmeray (*Abstract Co-Author*) Nothing to Disclose
Reyhan Ilhan (*Abstract Co-Author*) Nothing to Disclose
Mehmet Kemal Arikan (*Abstract Co-Author*) Nothing to Disclose
Oznur Kalaba (*Abstract Co-Author*) Nothing to Disclose
Murat Asik (*Presenter*) Nothing to Disclose

**PURPOSE**

Brain morphological biomarkers could contribute to understanding the treatment response in patients with obsessive compulsive disorder (OCD). The present study aims to investigate whether patients responsive to deep Transcranial Magnetic Stimulation (TMS) differ from non-responsive individuals in terms of brain morphology.

**METHODS AND MATERIALS**

This retrospective study included thirty-three OCD patients (14 female and 19 male) aged at 18 - 60 (mean ± SD = 34.52 ± 12.97 years). Based on the 50% reduction in Yale-Brown Obsessive Compulsive Scale (Y-BOCS) scores after treatment, patients were grouped as responders (n=22) and non-responders (n=11). MR imaging in the OCD and control groups was performed by using a 3T MR Scanner.180 sections high-resolution T1-weighted images (magnetization-prepared rapid gradient-echo) were obtained in axial and sagittal planes.The images of all subjects were uploaded to VolBrain which is a fully automatic pipeline for volumetric brain analysis and able to provide accurate volumetric information and segmentation analysis.Brain structure, thickness and general brain measurements were compared among responders, non-responders, and healthy controls. Brain structure and cortical thickness were compared via multivariate analysis of variance by taking gender as fixed factor and age as covariate. The significance level was set at <0.05 for all comparisons.

**RESULTS**

OCD patients who respond to deep TMS treatment had decreased volume in bilateral frontal pole, right basal forebrain, right anterior orbital gyrus, right medial orbital gyrus compared to non-responders and healthy controls. As specific to difference between responders and non-responders, pairwise comparison revealed that there is a statistically significant difference in volumes of bilateral and total frontal pole, total and right basal forebrain, anterior orbital gyrus, and medial orbital gyrus. Responders had decreased volume in comparison to both non-responders and healthy controls.MANOVA indicated there was a statistically significant effect of diagnostic groups on cortical thickness of the entire brain ($p < .0001$) and statistically significant effect of diagnostic groups on overall brain morphology, i.e, white matter and gray matter ( $p < .045$ ).

**CONCLUSION**

Our findings reveal a substantial association between a reduction in anterior orbital gyrus, medial orbital gyrus, frontal pole and, basal forebrain volume and response to deep TMS treatment. Decreased volume in these regions could be the morphological predictor of response to deep TMS in OCD treatment.

**CLINICAL RELEVANCE/APPLICATION**

In brain volumetric MRI examination in patients with OCD, segmentation and volume changes in certain regions support the clinical findings.

## M5B-SPNR-16 A SYSTEMATIC REVIEW OF FUNCTIONAL MRI TRACTOGRAPHY IN GLIOMAS AND PREDICTING OUTCOMES USING ARTIFICIAL INTELLIGENCE

Joe Davids (*Abstract Co-Author*) Nothing to Disclose
Samiullah Dost, MD (*Abstract Co-Author*) Nothing to Disclose
Nishika Bhatt (*Abstract Co-Author*) Nothing to Disclose
Sanchit Aapan (*Abstract Co-Author*) Nothing to Disclose
Nazir Sirajudeen (*Abstract Co-Author*) Nothing to Disclose
Mohammed Blaaza, BSC,MBBS (*Presenter*) Nothing to Disclose

**PURPOSE**

The aim of this investigation is to undertake an assessment of the application of artificial intelligence (AI) in prognosticating outcomes for glioma patients within the framework of functional magnetic resonance imaging (fMRI) and tractography. These imaging modalities are remarkable for visualising tracts, and gliomas, and their relationship, however, are seldom used in daily diagnostics. Early detection and diagnosis are paramount, and the integration of AI methodologies with anatomical marking holds significant promise in mitigating long-term malignant sequelae.

**METHODS AND MATERIALS**

A systematic search was conducted across PubMed, Ovid MEDLINE, and Web of Science databases. The search query comprised key terms such as "Glioma," "fMRI," "Artificial Intelligence," and "Tractography." A meta-analysis was conducted to quantitatively amalgamate data from various studies. The analyses were completed in line with the PRISMA systematic review guidelines.

**RESULTS**

The search strategy identified 23 relevant papers. After excluding duplicates and ineligible studies, five studies were suitable for meta-analysis, with a total enrolment of 280 patients. The investigation underscored the role of artificial intelligence in prognosticating symptoms based on fMRI and tractography data. Notably, machine learning-based prognostication of motor function exhibited a high sensitivity (0.74) specificity (0.75), and accuracy (0.74), while prediction of aphasia demonstrated a sensitivity of 0.75, specificity of 0.85, and accuracy of 0.81. Furthermore, deep learning models revealed an augmentation in tracked diffusion streamlines by 13% for high-grade gliomas and 9.25% for low-grade gliomas.

**CONCLUSION**

AI methodologies have emerged as highly promising tools in forecasting the occurrence, timing, and severity of symptoms among glioma patients based on fMRI and tractography data. Such insights hold considerable potential to inform clinical decision-making and surgical planning. However, the validation of these preliminary findings warrants further trials and studies to enhance their robustness and reliability.

**CLINICAL RELEVANCE/APPLICATION**

This review aims to provide a comprehensive and reliable summary of the role of artificial intelligence in symptom detection of glioma patients. This summary offers insights into treatment effectiveness, guiding evidence-based decision-making, and ultimately improving patient outcomes.

## M5B-SPNR-17 STRATEGIES FOR PREVENTING BRAIN MRI IMAGE DEGRADATION FOLLOWING FERUMOXYTOL INJECTION AND DETERMINING THE OPTIMAL TIME INTERVAL BETWEEN FERUMOXYTOL ADMINISTRATION AND IMAGING

Thomas J. O'Neill, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah Farooq (*Abstract Co-Author*) Nothing to Disclose
Usman A. Dar, MD (*Abstract Co-Author*) Nothing to Disclose
Seunghong Rhee, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Ferumoxytol, an FDA-approved agent for treating iron deficiency anemia in adults with chronic kidney disease (CKD), is also widely used off-label as a magnetic resonance imaging (MRI) contrast agent. Despite its benefits, the potential for Ferumoxytol to cause unintended degradation of Brain MRI images, particularly in SWI (Susceptibility Weighted Imaging) and GRE (Gradient Recalled Echo) sequences, has been insufficiently addressed. This study aims to investigate the extent of image degradation associated with Ferumoxytol and to establish an optimal time interval between Ferumoxytol administration and MRI to minimize such effects.

**METHODS AND MATERIALS**

This study included 43 patients who received Ferumoxytol and underwent Brain MRI within a 3-month period. We examined the impact of Ferumoxytol on MRI images, focusing on unintended T1 sequence enhancement and degradation of image quality in SWI or GRE sequences. We also measured the time interval between Ferumoxytol administration and MRI scanning. Additional factors considered included the patient's history of dialysis (peritoneal or hemodialysis) and whether the glomerular filtration rate (GFR) was below 60 ml/min at the time of Ferumoxytol administration and imaging.

**RESULTS**

Unintended T1 enhancement was observed in 67.5% of cases, while 62.5% demonstrated image degradation in SWI/GRE sequences. The average time interval between Ferumoxytol administration and Brain MRI was 6.625 days. Among the patients, 70% (no = 28) had a GFR above 60 ml/min, and 10%

had undergone dialysis (no =4). Binary logistic regression analysis revealed a significant correlation between the time interval from Ferumoxytol administration to the observed effects on T1 enhancement and SWI/GRE sequences ($p = 0.007$ for T1 enhancement and $p = 0.008$ for SWI/GRE degradation), while no correlation was found between dialysis or GFR and image quality. A cutoff time interval of 6.5 days yielded an 80% sensitivity and 96% specificity for T1 enhancement effects, whereas a cutoff of 5.5 days provided a 93% sensitivity and 40% specificity for SWI/GRE effects.

**CONCLUSION**

Independent of dialysis status or GFR, a time interval of more than 5 to 6 days between Ferumoxytol administration and Brain MRI is recommended to mitigate image degradation. The study's limitations include a relatively small patient cohort, which restricts the robustness of correlations between dialysis and/or GFR and image degradation.

**CLINICAL RELEVANCE/APPLICATION**

Improving the quality of Brain MRI scans when Ferumoxytol is used as a hematopoietic agent in chronic kidney disease population by identifying a safe window between Ferumoxytol administration and MRI imaging, especially in SWI and GRE sequences.

## M5B-SPNR-19 SUSCEPTIBILITY VALIDATION WITH IRON CONCENTRATION AND TEMPLATE-BASED MULTICHANNEL SPATIAL NORMALIZATION PRECISION FOR OLDER ADULT BRAIN QSM

Md Tahmid Yasar, BSc (*Abstract Co-Author*) Nothing to Disclose
Arnold M. Evia JR, PhD (*Abstract Co-Author*) Nothing to Disclose
Yingjuan Wu, MS,BEng (*Abstract Co-Author*) Nothing to Disclose
Mohammad Rakeen Niaz (*Abstract Co-Author*) Nothing to Disclose
Shengwei Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Abdur Raquib Ridwan, PhD (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Arfanakis, PhD (*Abstract Co-Author*) Nothing to Disclose
Rasheed Abid, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Quantitative susceptibility mapping (QSM) is pivotal for studying iron and calcium homeostasis in brain and age-related pathologies. The newly developed MIITRA-QSM template fills the crucial need for high-resolution QSM imaging of the older adult brain. This work aims to: a) evaluate the average susceptibility of the MIITRA-QSM template against actual iron content in targeted brain regions of older adults, and b) conduct a template-based, multichannel evaluation to assess representativeness and precision in spatial normalization across subjects.

**METHODS AND MATERIALS**

In this study, MIITRA-QSM was first investigated for its correlation with iron concentration, and subsequently, it was compared with two other publicly available templates (HybraPD and MuSus-100), with susceptibility values normalized between 0 and 10000. First, the mean of iron concentration of 308 subjects with non-demented were evaluated for both hemispheres in the inferior-temporal, anterior-cingulate, and middle-frontal cortex. Linear regression was used to investigate the correlation between the median susceptibility of the MIITRA-QSM template with iron concentration in the six selected regions. Next, 3D T1-weighted MPRAGE and multi-echo 3D GRE data from 100 non-demented older adults (aged 67.8-97.2 years) were used for all the templates. Five registration pipelines were used: single-channel registration of susceptibility maps to QSM templates; multichannel registration of T1-weighted images and susceptibility maps to T1-weighted and QSM templates (at 25%, 50%, and 75% weights); and single-channel registration of T1-weighted images to T1-weighted templates. Average log-Jacobian maps of deformations were generated for each participant. Finally, inter-subject pairwise normalized cross-correlation of magnetic susceptibility maps (4950 pairs) was calculated for each registration approach.

**RESULTS**

Regression analysis yielded robust results with an R2 value of 0.892 and a p-value of 0.00453, indicating significant correlation among iron concentration and template susceptibility. Registration to MIITRA-QSM resulted in less deformation compared to other templates across all pipelines. Furthermore, pairwise normalized cross-correlation demonstrated the highest spatial matching for MIITRA-QSM.

**CONCLUSION**

The study underscores that susceptibility in MIITRA-QSM strongly correlates with iron concentrations in targeted regions. Additionally, the MIITRA atlas proved to be highly representative of the older adult brain, demonstrating the highest spatial matching during single-channel susceptibility registration.

**CLINICAL RELEVANCE/APPLICATION**

QSM templates offer insights into age-related changes in brain iron levels.

## M5B-SPNR-2 IMPROVING MICROSTRUCTURE QUANTIFICATION USING SELF-SUPERVISED AND PHYSICS-INFORMED DEEP LEARNING

Qiyuan Tian (*Abstract Co-Author*) Nothing to Disclose
Jialan Zheng (*Abstract Co-Author*) Nothing to Disclose
Ziyu Li (*Abstract Co-Author*) Nothing to Disclose
Yi Jing (*Abstract Co-Author*) Nothing to Disclose
Zihan Li (*Abstract Co-Author*) Nothing to Disclose
Enhao Gong, PhD (*Presenter*) Employee, Subtle Medical, Inc;Stockholder, Subtle Medical, Inc

**PURPOSE**

Diffusion MRI is an important tool for mapping brain tissue microstructure non-invasively. The microstructure properties quantified by diffusion models are critical biomarkers for accurate diagnosis. However, the accurate estimation of diffusion model parameters suffers from intrinsic low-SNR of DWIs. Recently a self-supervised and physics-informed framework for diffusion model optimization entitled DIMOND has been proposed and validated on healthy subjects. This study aims to evaluate DIMOND's efficacy and robustness for diffusion tensor fitting among subjects with anomalies.

**METHODS AND MATERIALS**

This study involved pre-processed diffusion data (18×b=0, 90×b=1000 s/mm2, 1.25 mm iso.) of six subjects with anomalies from Human Connectome Project (HCP). A subset containing the first two b=0 and 15 b=1000 s/mm2 image volumes was extracted for each subject to simulate a clinical acquisition scheme. The anomalies include posterior midline arachnoid cyst, right parietal lobe cyst, right dorsal benign cyst, right lateral ventricle cyst, right frontal white matter atypicality and posterior right cerebellum lesion. The anomalies were labeled manually in reference fractional anisotropy (FA) and axial diffusivity (AD) maps.The training of DIMOND includes three steps: 1) mapping noisy input diffusion data to diffusion model parameter values using NN, 2) modeling diffusion signals by passing NN predictions to forward diffusion models, and 3) optimizing NN's parameter by minimizing the difference between the acquired signals and synthesized signals from step 2. In this study, NN is consisted of one layer of 3×3×3 convolution layers

followed by six fully connected layers. For each subject, reference tensor model parameters were derived from all available diffusion data using ordinary least square regression (OLS) of FSL. DIMOND was trained and applied to the subset of each subject's data and compared with OLS results.

**RESULTS**

Cysts and tumors are distinguishable from the surrounding tissues under both methods. However, DIMOND exhibited denoising effect which enhanced the visibility of anomalies. Quantitatively, DIMOND predicted FA and AD maps with lower MAEs, both throughout the entire brain and in the regions with anomalies.

**CONCLUSION**

DIMOND can recover microstructures accurately and reliably for both normal and abnormal tissues, and outperforms the conventional method.

**CLINICAL RELEVANCE/APPLICATION**

DIMOND's superior performance render it a potential next-generation tool for quantifying microstructural properties in clinical settings, aiding diagnosis and enhancing the AI-based automated diagnostic methods.

## M5B-SPNR-3 ACCELERATED MOTION CORRECTION WITH DEEP LEARNING FOR FUNCTIONAL MRI - A POTENTIAL FOR REAL-TIME FMRI PROCESSING FOR FASTER CLINICAL ASSESSMENT

Saurabh Jain (*Abstract Co-Author*) Nothing to Disclose
Janova Anbarasi (*Abstract Co-Author*) Nothing to Disclose
Akshay Kumaar M (*Abstract Co-Author*) Nothing to Disclose
Sachin Patalasingh (*Abstract Co-Author*) Nothing to Disclose
Shamanth Hampali (*Abstract Co-Author*) Nothing to Disclose
Rimjhim Agrawal, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

While functional MRI (fMRI) offers valuable insights into brain functions, its resolution is lower than that of other techniques making it susceptible to the artefacts caused by head motions, impacting its reliability and interpretability of analyses. Motion correction is a standardised procedure to minimise distortions and inaccuracies caused by movement. However, traditional methods are less efficient and computationally expensive. To address this limitation, we present a novel deep learning framework specially designed for fast and effective motion correction of fMRI.

**METHODS AND MATERIALS**

This study analysed fMRI (N=151) sourced from multiple datasets including the Human Connectome Project, OpenNeuro, and privately acquired datasets. Preprocessing involved slice-time correction and extraction of middle slices from all planes into 2D moving images, each paired with reference volume of the respective subject. A Multi-Head Convolutional Neural Network was trained to predict the 12 affine parameters, utilising the reference and moving images. A subject-level 5-fold cross-validation was employed, with Mean Absolute Error (MAE) to train the framework.

**RESULTS**

We evaluated the network's performance on all 5 evaluation folds using various metrics. It achieved the best results in fold 3, with MAE of 0.03 and a runtime of 0.5, 0.02 seconds on CPU and GPU respectively. The framework was tested for generalizability on unseen data (hold out set, N=17), where the MAE was ~0.06. Further evaluation was done by realigning fMRI data with predicted motion parameters which resulted in significant accuracy improvement, leading to MAE ~0.01, when compared to AFNI with an impressive reduction by 82% in computation.

**CONCLUSION**

In summary, our study utilised diverse fMRI datasets and neural network architectures to predict parameters for motion correction. The model exhibited robust performance leading to efficiency on both CPU and GPU compared to conventional methods which could take hours. This could potentially enable real-time motion correction during scan acquisition. The results solidify the potential of the deep learning framework to significantly improve the reliability and interpretability of fMRI analysis across various datasets and settings.

**CLINICAL RELEVANCE/APPLICATION**

This study highlights the potential for real-time fMRI processing and augmenting quicker decisions in clinical settings like surgeries, neuromodulation, and neurofeedback analysis. This will also ensure results with higher reliability with a lower turnaround time making it apt for diagnosis and prognostic assistance to medical practitioners. This would significantly impact improved patient outcomes by reducing the overall burden by making the process more efficient.

## M5B-SPNR-7 IS IT POSSIBLE TO USE LOW-DOSE DEEP LEARNING IMAGE RECONSTRUCTION ALGORITHM FOR BRAIN CT PERFUSION EXAMINATION ON CT ROUTINELY?

Songwei Yue (*Abstract Co-Author*) Nothing to Disclose
Yuhan Zhou, MD (*Abstract Co-Author*) Nothing to Disclose
Zhihao Wang (*Abstract Co-Author*) Nothing to Disclose
Limin Lei (*Presenter*) Nothing to Disclose

**PURPOSE**

Evaluate the performance of deep learning image reconstruction (DLIR) algorithm combined with low-dose protocol in whole brain CT perfusion (CTP) examination.

**METHODS AND MATERIALS**

Retrospective collection involving 112 patients subjected to three CTP dose-modulation scanning protocols (1: 80 kV 150mA, 2: 80 kV and 100mA, 3: 70 kV 150mA). CTP datasets were reconstructed using FBP, ASIR-V40%, 80%, and DLIR L, M, H levels for protocol 1(Group A-F), ASIR-V80% and DLIR-H for protocol 2(Group G, H) and 3(Group I, J). CT values, image noise, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) of each group were compared. Perfusion parameters were evaluated (CBF, CBV, Tmax, MTT, and TTP) according to Abels' scoring system, and compared.

**RESULTS**

The radiation doses of the CTP in protocols 1-3 were 5.70mSv, 3.81mSv, 3.83 mSv, respectively. Within protocols 1, Group F had the highest SNR and CNR. Groups F, E, and C generated higher subjective scores. The perfusion parameters were not changing.Within protocols 2 and 3, the DLIR-H images showed lower SD values than ASIR-V80%, with higher SNR, CNR and subjective scores ($P<0.05$ for Group G vs. H, Group I vs. J).The objective and subjective image quality of DLIR-H images in protocols 2 and 3 were comparable to those of the ASIR-V80% group in protocols 1 ($P>0.05$ for Group C vs.

H vs. J). Groups I and J showed significant differences in perfusion parameters compared to other groups, especially in decreased MTT and increased CBF values in the white matter region. The perfusion parameters were not changing in group G, H.

**CONCLUSION**

Low current with the DLIR-H improves image quality without compromising perfusion parameter accuracy. However, reducing tube voltage to 70kV lowers accuracy, especially for MTT and CBF.

**CLINICAL RELEVANCE/APPLICATION**

TrueFidelity images with reduced tube current holds the potential to design CT acquisition protocols at reduced radiation dose levels without sacrificing image quality, which is particularly attractive in repeat examinations.

## M5B-SPNR-9 EFFECTIVE GLIOBLASTOMA SEGMENTATION THROUGH TRACTOGRAPHY

Shamanth Hampali (*Abstract Co-Author*) Nothing to Disclose
Bhagyasree Kanuparthi (*Abstract Co-Author*) Nothing to Disclose
Akshay Kumaar M (*Abstract Co-Author*) Nothing to Disclose
Aryan Raj Tiwary (*Abstract Co-Author*) Nothing to Disclose
Rimjhim Agrawal, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Traditional imaging techniques for Glioblastoma segmentation rely on multiple structural modalities, often failing to capture the intricate microstructural details necessary for precise delineation of tumor boundaries. This study leverages the unique capabilities of diffusion MRI (dMRI) to track water molecule diffusion, offering a detailed view of white matter tissue connectivity. By employing tractography, we aim to enhance the segmentation accuracy of brain tumour, by evaluating the integrating of white matter structure.

**METHODS AND MATERIALS**

In this study, we propose using dmri image for tractography based segmentation of tumor. Probabilistic tractography was applied to 10 clinical cases (single-shell DWI) of brain tumors, adjusting seed cutoff values to generate scalar map of white matter connectivity. Voxels were scored based on the streamline's seed-cutoff value, with higher scores indicating healthier tissue. T1-weighted imaging combined with CSF segmentation refined these maps, focusing analysis on disrupted white matter tracts. The manually delineated contrast-enhancing tumor regions on preoperative T1 images by two independent expert clinicians served as a standard for evaluating the tractography-based tumor delineation.

**RESULTS**

Initial results show that variable seed cutoff values in tractography effectively isolated areas with reduced or absent white matter connectivity, aligning well with tumor locations. Comparisons between algorithm-based tumor delineation and manual delineations revealed high sensitivity (80%) and specificity (90%), confirming the method's accuracy.

**CONCLUSION**

Integrating variable seed cutoff values in probabilistic tractography offers a promising approach for enhancing tumor boundary delineation in neurosurgical planning. This technique improves the precision of interventions by accurately identifying tumor-affected white matter pathways, potentially leading to better surgical outcomes and patient prognosis.

**CLINICAL RELEVANCE/APPLICATION**

Accurately demarcating tumors supports precise surgical resections and radiation therapy planning, minimizing damage to healthy brain tissue and enhancing overall treatment efficacy. Reduces scan time since multiple structural modalities are not required.

# Abstract Archives of the RSNA, 2024

M5B-SPOB

**OB/Gynecology Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPOB-1 DEEP LEARNING NETWORK BASED ON PET/CT PRIMARY AND METASTATIC LESIONS: PREDICTING PLATINUM RESISTANCE IN OVARIAN CANCER

Wei Qian (*Abstract Co-Author*) Nothing to Disclose
Shouliang Qi (*Abstract Co-Author*) Nothing to Disclose
Beibei Li (*Abstract Co-Author*) Nothing to Disclose
Haoming Zhuang (*Abstract Co-Author*) Nothing to Disclose
Huiwen Luo (*Abstract Co-Author*) Nothing to Disclose
Dianning He, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Clinicians currently use genetic testing to determine platinum drug resistance, but neglect the important information provided by tumor imaging. Given the diverse, specific and heterogeneous nature of ovarian cancer, the present study uses a method of fusing images of primary tumor foci with locoregionally coded metastases to accurately identify whether a patient with high-grade serous ovarian cancer (HGSOC) are resistant to platinum-based drugs.

### METHODS AND MATERIALS

A total of 291 patients with HGSOC, including 97 platinum-resistant and 194 platinum-sensitive patients, are used in this study. Tumors are labeled by a gynecologist with 5 years of experience. In this study, we apply a deep learning model to enhance the traditional platinum resistance prediction method, while using radiomics tools for analysis. In the data pre-processing stage, we accurately localize and encode metastatic foci information, combined with the original lesion image information as the network input. Subsequently, an end-to-end dense convolutional neural network (Densenet) is constructed utilising the squeeze-excitation (SE) module and spatial pyramid pooling (SPP).

### RESULTS

In this study, the accuracy of the Densenet model was 70.7% when fusing primary lesion computed tomography (CT) images, positron emission tomography (PET) images, and metastatic lesion CT images. When primary lesion CT images, PET images, and metastatic lesion PET images were fused, the accuracy based on the Densenet model was 61.5%. However, when only primary lesion CT and PET images were fused, the accuracy based on the Densenet model was 59.9%.

### CONCLUSION

The experimental results demonstrate that the diversity and heterogeneity of metastatic tumors provide a wealth of information, and the fusion of these metastatic data enables the model to capture tumor characteristics in a more comprehensive manner. The proposed deep learning framework, which combines images of the primary lesion with information from metastases, demonstrates superior performance in predicting platinum resistance in patients. This framework has the potential to assist gynecologists in making more appropriate treatment decisions.

### CLINICAL RELEVANCE/APPLICATION

This study makes a significant contribution to the field of medical imaging research by providing insights into the prognostic prediction of platinum resistance. This is of significant clinical value in the development of individualized treatment regimens for each patient.

## M5B-SPOB-2 MULTI-CLASS DEEP LEARNING CLASSIFICATION OF ADNEXAL MASSES ON PELVIC MRI

Theresa Mokry (*Abstract Co-Author*) Research agreement, Bayer AG
Christa Flechtenmacher (*Abstract Co-Author*) Nothing to Disclose
Oliver Zivanovic (*Abstract Co-Author*) Nothing to Disclose
Hans-Ulrich Kauczor, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Speakers Bureau, AstraZeneca PLC;Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Merck & Co, Inc
Nils Netzer (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter W. Schlemmer, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG
Thomas Hielscher (*Abstract Co-Author*) Nothing to Disclose
Lisa Katharina Nees (*Abstract Co-Author*) Nothing to Disclose
David Bonekamp, MD (*Presenter*) Speaker, Bayer AG

### PURPOSE

To train a deep convolutional neural network for segmentation and classification of adnexal masses into multiple histopathological entities.

## METHODS AND MATERIALS

141 women (median age 51 years (IQR 38-60)) underwent multiparametric MRI after diagnosis of an indeterminate adnexal mass on transvaginal ultrasound. Axial T2w (used as reference for elastic co-registration and resampling), T1w, T1w fat-saturated, T1w post-contrast, DWI and ADC map calculated from b=0 and b=2000 s/mm2 were used for further analysis. MRI was interpreted by an expert radiologist (Rad) in pelvic MRI who assigned O-RADS category and manually segmented ovaries on all modalities. All patients underwent surgery and histopathology served as gold standard, borderline histopathology was considered as malignant. nnUnet was trained in 5-fold crossvalidation using 23 different histopathological labels. Validation performance with prediction probabilities for each class was recorded and presence of the correct class within the top-1 to top-5 predictions evaluated. While prediction utilized all 23 classes, histopathological subtypes were aggregated for subanalyses.

## RESULTS

The dataset included annotations of 237 adnexal sites. CNN did not detect adnexal mass or tissue in 25 sites (1 malignant, 1 ovarian carcinoma, 17 benign, 1 Brenner tumor, 1 borderline, 2 cystadenofibroma, 1 dermoid, 1 fibroma). The remaining 212 sites included N(Top-1-true positives (TP)/sensitivity/specificity/cluster-adjusted AUC of CNN classification): 50 ovarian carcinomas (40/0.8/0.91/0.91), 3 ovarian metastases (0/0/1.00/0.62), 18 dermoid cysts (14/0.78/0.97/0.94), 23 endometrioma (18/0.78/0.97/0.93), 39 physiologic ovaries (21/0.54/0.91/0.75) , 34 cystadenoma (5/0.24/0.91/0.71). For 8 borderline, 4 corpus luteum cysts, 5 fibroms, 1 fibroplastic tissue, 5 follicles and 1 struma ovarii there were no TP classifications. Overall accuracy was 0.54. Top 2|3|5 TP/sensitivity/specificity was 42/0.84/0.86|44/0.88/0.81|46/0.92/0.74 for ovarian carcinoma, 19/0.83/0.92|21/0.91/0.90|21/0.91/0.85 for endometrioma and 14/0.78/0.91|16/0.89/0.88|16/0.89/0.83 for dermoid.

## CONCLUSION

23-class deep learning using 6 modality mpMRI data achieved best classification performance for ovarian carcinoma, dermoid and endometrioma. Considering the top-5 probable predictions, 92% of ovarian carcinoma is detected, still at specificity of 0.74, with 80% of ovarian carcinomas being correctly classified against the other entities utilizing the top classification.

## CLINICAL RELEVANCE/APPLICATION

Deep learning demonstrates potential for stratification of adnexal masses on multiparametric MRI into multiple histopathological classes.

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# Abstract Archives of the RSNA, 2024

M5B-SPPD

**Pediatric Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPPD-1 IMPACT OF A FREE-BREATHING ABDOMINAL MAGNETIC RESONANCE IMAGING PROTOCOL ON PEDIATRIC RADIOLOGY WORKFLOW

Sebastian Gallo-Bernal, MD (*Abstract Co-Author*) Nothing to Disclose
Michael S. Gee, MD, PhD (*Abstract Co-Author*) Researcher, General Electric Company Researcher, Siemens AG Researcher, Motilent LLC
Suely F. Ferraciolli, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Valeria Pena-Trujillo, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Describe the experience of an academic referral center implementing a free-breathing (FB) abdominal MRI protocol on pediatric patients

### METHODS AND MATERIALS

In this retrospective study, an imaging database of a tertiary academic pediatric center was queried to identify all pediatric patients 0-17 years of age who underwent a clinically indicated abdominal MRI in a 3T scanner (Prisma, Siemens Healthcare) using a FB MRI protocol including a combination of navigator-triggered, radial non-Cartesian and motion robust sequences over a 3 year period. Collected data included patient sociodemographic and clinical characteristics as well as exam-related factors. Indications were classified into four different groups for analysis (non-syndromic oncologic, hereditary cancer syndromes, congenital/other genetic conditions, and non-oncologic abdominal symptoms). Exams performed with or without sedation, as well as those performed with or without intravenous contrast, were compared to evaluate the total scan time in each group based on DICOM sequence time stamps.

### RESULTS

66 cases were analyzed; mean age at imaging was 5.35±3.1 years old. 44 cases (66.7%) were female, 12 cases had MRI without anesthesia (18.2%), and 5 (7.6%) out of 66 were performed without contrast. Overall scanning time was 42.85±7.97 minutes. The most common indication was hereditary cancer syndromes (69.7%), followed by non-syndromic oncologic (25.8%). When comparing patients with anesthesia vs. non-anesthesia, there was no statistically significant difference in terms of the scanning time (42.52±8.23 minutes vs. 44.33±6.74 minutes; p=0.4), gender (females 71.1% vs. 70.0%; p=0.9) nor age (5.28±3.0 vs. 5.67±3.5 p=0.7). Likewise, when comparing patients with MRIs with contrast vs. non-contrast, there was no difference in scanning time (43.05±7.7 minutes vs. 40.40±11.6 minutes; p=0.6).

### CONCLUSION

Implementation of a pediatric FB abdominal MRI protocol in clinical practice showed no significant difference in scan time whether patients were scanned awake or with sedation, making it a valuable and consistent standardized imaging tool for a wide range of challenging patients, including neonates, child life specialists assisted, and anesthetized patients.

### CLINICAL RELEVANCE/APPLICATION

Respiratory motion artifacts are particularly challenging in pediatric abdominal MRI. This is especially relevant in some patients who may be unable to follow breathing instructions due to their young age, sedation, or developmental delays.? Recent advances in MR pulse sequences, such as non-Cartesian radial k-space sampling techniques or navigator-triggered T1-weighted Dixon, have led to improved image quality and decreased motion artifacts during free-breathing abdominal MRI.

## M5B-SPPD-2 THE EFFECT OF BREATH CONTROL ON THE EVALUATION OF HEPATIC SHEAR WAVE ELASTICITY AND DISPERSION IN PEDIATRIC PATIENTS

Chanyoung Rhee, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to assess the impact of breath control on the reliability and accuracy of 2D Shear Wave Elastography (SWE) and Shear Wave Dispersion (SWD) in diagnosing pediatric liver disease, focusing on the optimization of elastography protocols.

### METHODS AND MATERIALS

The study cohort comprised 225 pediatric patients who underwent 2D-SWE and SWD assessments between September 2021 and February 2023, with ultrasound evaluations performed in both gentle free-breath and breath-hold states. Within this group, 30 patients also underwent MR elastography and were subjected to a second ultrasound examination by two radiologists, spaced one week apart. The study assessed correlations between breathing

conditions, compared the Area Under the Curve (AUC) with MRE as the reference standard, and conducted subgroup analyses to evaluate inter-rater agreement and test-retest reliability.

**RESULTS**

Liver stiffness (LS) and liver dispersion (LD) in free-breath and breath-hold states showed a marginally significant difference (5.31 ± 1.28 vs. 5.09 ± 1.27 kPa, p = .08; 12.17 ± 2.04 vs. 11.75 ± 2.01 m/s/kHz, p = .04), with high correlations between each breathing condition (LS, r = .69, P < .001; LD, r = .64, P < .001). The AUC for LS showed no significant difference between free-breath (0.67) and breath-hold (0.71) (p = .175). Inter-rater agreement revealed ICCs of 0.83 (free-breath) and 0.94 (breath-hold) for LS, and 0.70 (free-breath) and 0.85 (breath-hold) for LD, all significant (P < .001). Test-retest reliability for LS was 0.88 in both conditions, while for LD, it was 0.70 in free-breath and 0.74 in breath-hold, all significant (P < .001), underscoring higher but not substantial reliability in breath-hold conditions.

**CONCLUSION**

While maintaining breath-hold during ultrasound elastography slightly increases reliability, the minimal difference from results measured in free-breath conditions renders the latter acceptable, particularly when a breath-hold proves to be difficult.

**CLINICAL RELEVANCE/APPLICATION**

In pediatric patients, where breath control is relatively challenging, breath-holding is not essential for reliably measuring 2D-SWE and SWD.

## M5B-SPPD-3 HIGHER AGE, LOW HOUSEHOLD INCOME, NON-TEACHING HOSPITAL STATUS, AND MIDWEST LOCATION PREDICT INCREASED CT OVER ULTRASOUND UTILIZATION IN CHILDREN WITH APPENDICITIS

Cory Pfeifer, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Samuel Byrne (*Presenter*) Nothing to Disclose

**PURPOSE**

Ultrasound is the first line modality in the radiologic approach to pediatric appendicitis. Ultrasound localization of the appendix requires practice and experience given the propensity for regional bowel gas and dependence on depth of this small structure. Lack of ability to obtain a diagnosis exposes the child to increased cost and radiation associated with CT. This study examines factors associated with increased CT utilization and thus decreased compliance with the ACR Appropriateness Criteria in the United States.

**METHODS AND MATERIALS**

This study utilizes data from the Nationwide Emergency Department Sample. All 2019 emergency department encounters with a diagnosis code for appendicitis (K35.80) and a CPT code for either abdominal ultrasound or CT were assessed. Differential utilization for each modality was evaluated with respect to sex, race, median household income, primary payer, trauma center status, teaching hospital status, and hospital region.

**RESULTS**

291,588 encounters met criteria for the study. Average age for patients receiving CT was 13.91 vs. 10.78 for ultrasound (p<0.001). 33.39% of patients with annual household income below $48,000 received CT vs. 16.68% ultrasound. For annual household income over $82,000, CT utilization was 20.00% vs. 30.60% ultrasound. 38.28% of patients at non-trauma centers were exposed to CT vs. 18.02% US. At level 1 trauma centers, this was reversed at 7.98% CT and 30.47% CT. 40.39% of patients at metropolitan non-teaching centers received CT vs. 14.61% ultrasound. At metropolitan teaching hospitals, this was reversed at 19.55% CT and 27.21% ultrasound. In non-metropolitan hospitals, the rates were 53.05% CT and 10.08% ultrasound. CT utilization was greatest in the Midwest (38.46%) followed by South (31.43%), Northeast (19.48%), and West (17.95%). Ultrasound utilization was 37.01% in the Northeast, 21.69% in the West, 18.91% in the Midwest, and 18.56% in the South. Total ED expense was $15,521 for encounters in which CT was ordered compared to $9,708 in which US was ordered (p<0.001).

**CONCLUSION**

Multiple social determinants of health contribute to increased radiation and cost associated with CT when pediatric appendicitis is suspected in the emergency department.

**CLINICAL RELEVANCE/APPLICATION**

Acute appendicitis is one of the most common abdominal surgical emergencies in children. The use of imaging is a mainstay in diagnosing appendicitis. Because children are more sensitive to CT radiation than adults, it is important to minimize the use of CT when possible.

## M5B-SPPD-4 INFLAMMATORY BOWEL DISEASE AND SACROILIITIS: HOW STRONG IS THIS LIAISON IN PEDIATRIC PATIENTS?

Francesco Causin, MD (*Abstract Co-Author*) Nothing to Disclose
Giulia Fichera, MD (*Abstract Co-Author*) Nothing to Disclose
Chiara Giraudo, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Alice Miotto (*Abstract Co-Author*) Nothing to Disclose
Monica Zuliani, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Pilati, MD (*Abstract Co-Author*) Nothing to Disclose
Nicole Zizzari, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the occurrence of sacroiliitis in children undergoing abdominal MR for suspected or proven inflammatory bowel disease (IBD).

**METHODS AND MATERIALS**

The electronic database of our tertiary center was searched for children and adolescents (<21 years old) undergoing an abdominal MR for IBD with at least a fluid-sensitive fat-sat and a T1w sequence including the sacroiliac joint in the protocol. For each patient, the sacroiliac joint was subdivided in four quadrants on each side (upper iliac, upper sacral, lower iliac, lower sacral). Then the presence of bone marrow edema (BME), fatty bone marrow replacement, enthesitis, erosions, capsulitis, and ankylosis was assessed. The occurrence of BME, joint effusion, synovitis in the hip was also investigated. The presence of anatomical variants was recorded. If available, follow-ups up to two years were assessed. Descriptive statistics were performed.

**RESULTS**

130 patients (58 female; 17±4 years-old) matched the inclusion criteria. 102 patients were diagnosed with IBD (93 Crohn's, 9 ulcerative colitis), 18 had an indeterminate colitis, and 9 no signs of IBD. Only 3 patients had areas of BME at diagnosis (2.3%), 2 of them affected by Crohn's and 1 without signs of IBD. Therefore, the overall prevalence of BME in IBD at diagnosis was 2%. Only 1 of these 3 patients underwent 2 follow-ups and the BME persisted. Overall, 74 patients underwent a second follow-up and 41 also a third one. At diagnosis, one patient had one single area of BME in the left upper sacrum

which persisted in all 3 MR scans, one had areas of BME in the left upper iliac bone and one in the sacrum and upper and lower iliac bone. During the second MR one patient demonstrated one area of BME in the left upper sacrum which persisted also at the third scan. No other acute or chronic inflammatory changes were detected in the sacroiliac joints nor in the hips. Four patients had a transitional vertebra (two Castellvi type 3a, one type 2b, and one type 2a) without nearby areas of BME.

**CONCLUSION**

Only around 2% of patients with IBD have BME in the sacroiliac joint without any additional sign of inflammation.

**CLINICAL RELEVANCE/APPLICATION**

The occurrence of sacroiliitis seems to be low in pediatric patients with IBD nevertheless when it occurs it tends to persist therefore it should not be overlooked and properly treated.

# Abstract Archives of the RSNA, 2024

M5B-SPPH

**Physics Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPPH-1 HEAD-TO-HEAD COMPARISON OF PERIVASCULAR FAT ATTENUATION INDEX IN NON-CONTRAST CARDIAC CT AND CORONARY CTA

Yuji Matsuzaki, RT (*Abstract Co-Author*) Nothing to Disclose
Shun Okuyama, RT (*Abstract Co-Author*) Nothing to Disclose
Rina Sakai (*Abstract Co-Author*) Nothing to Disclose
Yasutoshi Ohta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Nishii, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Keizo Murakawa (*Abstract Co-Author*) Nothing to Disclose
Masaki Sakurai (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Saito, RT (*Abstract Co-Author*) Nothing to Disclose
Hayaki Fujii, RT (*Presenter*) Nothing to Disclose

### PURPOSE

Coronary perivascular fat attenuation index (FAI) from coronary CT angiography (CCTA) imaging is a potential biomarker. Beam hardening from vessel luminal contrast can affect plaque measurements in CT, but its impact on FAI has not been well evaluated. This study examines the influence of contrast on FAI by measuring it in both contrast-enhanced and non-contrast phases within the same CCTA examination.

### METHODS AND MATERIALS

We retrospectively reviewed 88 patients who underwent CCTA for stable chest pain between June 2023 and April 2024. Coronary calcium scoring at 120 kV was followed by CCTA at 100 kV. Cases with extensive calcifications and motion artifacts were excluded due to poor image quality. We collected calcium scores, CAD-RADS classification, heart rate during imaging, and results from additional tests for coronary artery disease with ischemia. Deep learning image reconstruction was used to obtain 0.625mm images in both contrast-enhanced and non-contrast phases. FAI was measured in the right coronary artery from 1 cm distal to its ostium, extending 4 cm. CT values of the right coronary artery lumen in the same region were also measured. We analyzed the correlation between contrast-enhanced and non-contrast FAI using a Bland-Altman plot and performed multivariate analysis to identify factors affecting the difference. Multivariate logistic regression assessed the factors contributing to ischemic coronary artery disease.

### RESULTS

In total, 62 cases were analyzed, 24 of whom were female. The median age was 65 years (IQR 54-74), and the median heart rate was 60 bpm (IQR 56-63). The CAD-RADS scores were: 44 cases with a score below 3, 22 with a score of 3 or above and 14 with coronary artery disease with ischemia. The non-contrast FAI (median -76.0 HU) and contrast-enhanced FAI (median -80.5 HU) were positively correlated ($R = 0.77$, $p < .001$). However, the contrast-enhanced FAI was significantly lower than the non-contrast FAI by -4.7 HU (95% CI, -6.1 to -3.4). Factors affecting this difference included the CT value of the right coronary artery lumen (Stdß = -0.30, $p = .01$) and heart rate during imaging (Stdß = -0.34, $p = .005$). FAI was not significantly related to coronary artery disease with ischemia; only CAD-RADS = 3 showed significance.

### CONCLUSION

FAI in CCTA is significantly lower than non-contrast FAI due to contrast effects in the lumen.

### CLINICAL RELEVANCE/APPLICATION

While FAI in CCTA is a promising imaging biomarker, it's susceptible to variations due to beam hardening from contrast-enhanced RCA lumen. Accurate interpretation and diagnosis require consideration of these factors in the clinical application of FAI in CCTA.

## M5B-SPPH-10 HIGH-FIDELITY CT PHANTOMS FOR ULTRA-HIGH-RESOLUTION IMAGING

Jessica Im, BEng (*Abstract Co-Author*) Nothing to Disclose
Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Austin Zhuang (*Abstract Co-Author*) Nothing to Disclose
Michael Geagan (*Abstract Co-Author*) Nothing to Disclose
Ryan Fair, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Ultra-high-resolution (UHR) computed tomography (CT) imaging has become an essential part of clinical routines, driven by the recent introduction of photon-counting CT (PCCT). The increased resolution offers numerous clinical applications, especially in cardiovascular and chest imaging. For evaluating these novel applications, it is necessary to fabricate lifelike phantoms that incorporate UHR features. In this study, we introduce a novel 3D printing technique to generate lifelike UHR phantoms using stereolithography (SLA) printing technology.

**METHODS AND MATERIALS**

Building on our previous 3D printing technology, PixelPrint, designed for fused deposition modeling (FDM), we have developed a novel solution utilizing SLA printing for creating UHR phantoms. An input image, such as a digital phantom or patient data, is converted on a voxel-by-voxel basis into printer instructions by determining the required ratios of polymerized to unpolymerized material for each specific Hounsfield unit (HU). To evaluate the UHR capabilities, a digital version of a Siemens star was used as the input. The phantoms were fabricated using photosensitive resin in an ultra-high resolution 3D printer (microArch S240, Boston Micro Fabrication). The printing parameters were set to a pixel size of 10 µm and a layer thickness of 40 µm. For characterization, the phantoms were scanned using a dual-source PCCT scanner (NAEOTOM Alpha, Siemens Healthineers) with a tube voltage of 120 kVp and an exposure of 1000 mAs. Images were reconstructed in UHR mode with a matrix size of 1024x1024, field of view of 60 mm, and slice thickness of 1 mm. Feature size was evaluated using angular integration profiles at various axial distances from the center of the star.

**RESULTS**

Based on the angular integrals taken, the mean width of spokes measured on the star were as small as 0.16 mm. Feature sizes were still within the standard deviation compared to expected values down to 0.11 mm. Dynamic range of the phantoms was between 115 HU for completely unpolymerized voxels and 220 HU for completely polymerized voxels. A quasi-continuous contrast gradient between these two extrema was also attained in other UHR phantoms.

**CONCLUSION**

The introduced UHR version of PixelPrint, utilizing SLA printing, enables the creation of phantoms with fine features while also accommodating low contrast scenarios, such as in liver and lung imaging. Future studies will be necessary to evaluate the image quality of patient-based phantoms fabricated with this technology.

**CLINICAL RELEVANCE/APPLICATION**

The introduction of high-performance CT phantoms facilitates the evaluation of novel technologies, such as PCCT and AI reconstruction. This advancement helps streamline clinical translation and ultimately enhances patient care.

## M5B-SPPH-2 ASSESSMENT OF LOW CONTRAST DETECTABILITY VIA AN IN-SILICO IMAGING TRIAL COMPARING DEEP LEARNING RECONSTRUCTION TO CONVENTIONAL RECONSTRUCTION ALGORITHMS

Kirsten Lee Boedeker, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Ilmar Hein, PhD (*Abstract Co-Author*) Nothing to Disclose
Akira Nishikori, MS (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Dylan Mather (*Abstract Co-Author*) Nothing to Disclose
Daniel W. Shin, MS, BS (*Presenter*) Employee, Canon Medical Systems Corporation

**PURPOSE**

Deep learning reconstruction (DLR) algorithms are trained on anatomical images and designed to reduce noise while preserving signal. This study aims to assess the low contrast detectability (LCD) of simulated, controlled test objects in a patient dataset for a prototype DLR vs conventional reconstruction algorithms.

**METHODS AND MATERIALS**

An analytic forward projection model based on the specifications of a wide volume CT scanner (Canon Medical Systems, Aquilion ONE PRISM, Otawara, Japan), including detector, source, and geometry, was used for simulation.. The sinogram of low contrast rods, 5mm in diameter and 35HU in contrast, were simulated and inserted into an existing patient sinogram. A total of 512 test objects were placed into a relatively homogeneous region of the liver across 16 slices of 0.5mm nominal thickness. Simulated dose levels were varied using a noise addition tool. The sinograms were reconstructed with a prototype DLR, Hybrid Iterative Reconstruction (HIR), and Filtered Backprojection (FBP) with a body kernel. Low contrast detectability was evaluated using a non-prewhitening model observer, and the standard error of the estimated detectability value was calculated using a bootstrapping method.

**RESULTS**

At 18.8mGy, DLR had 33% higher detectability (d') compared to HIR and 109% higher detectability compared to FBP. Similarly, at 9.4mGy, DLR showed 24% higher detectability compared to HIR and 131% higher detectability compared to FBP. The p-values for all the comparisons were well below 0.01.

**CONCLUSION**

This in-silico imaging study illustrates significantly improved LCD with DLR compared to conventional reconstruction methods.

**CLINICAL RELEVANCE/APPLICATION**

The improved LCD with DLR demonstrated in Silico provides evidence DLR is likely to increase diagnostic confidence and facilitate dose optimization in acquired patient data.

## M5B-SPPH-3 CHARACTERIZATION OF LUNG LESIONS WITH HYBRID LIFELIKE PHANTOMS IN LOW-DOSE PHOTON-COUNTING DETECTOR CT

Zhou Yu, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Leonid Roshkovan, MD (*Abstract Co-Author*) Nothing to Disclose
Shobhit Sharma, PhD (*Abstract Co-Author*) Nothing to Disclose
Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Richard Thompson, PhD (*Abstract Co-Author*) Employee, Canon Medical Research, USA
Steven Ross, PhD (*Abstract Co-Author*) Nothing to Disclose
Kai Mei, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate and compare the low-dose performance of photon-counting detector CT (PCDCT) for characterization of lung lesions using a hybrid 3D-printed lifelike phantom.

**METHODS AND MATERIALS**

A hybrid 3D-printed lung phantom (PixelPrint) was created from ultra-high-resolution patient CT images and 3 distinct computational lung lesion models. The lesions were modeled at different sizes (diameter = 13, 17, 27 mm) and levels of spiculations (high, medium, and low). The phantom was placed within the multi-energy CT phantom (Gammex, Sun Nuclear) to simulate a realistic patient size, and scanned using both a conventional energy-integrating detector CT (EIDCT) and a prototype CZT-based PCDCT. The scan protocol (120 kVp; large FOV; small focal spot; CTDIvol of 20.4, 9.8, 4.9, 2.4, and 1.6 mGy; 0.6 pitch (detailed)) was closely matched between the systems. All scans were reconstructed at native resolutions (pixel size/slice thickness of 0.5/0.5 mm for EIDCT and 0.25/0.2 mm for PCDCT) using lung kernel (FC52) and standard strength of iterative denoising. Images were registered to the original patient image dataset (ground truth) used for generating the phantom, using rigid transformations (SimpleITK). Following registration to the original dataset used to generate the phantom, images were resampled using an isotropic voxel size of 0.5 mm. For analysis, ROIs bounding lesions were estimated, and root mean squared error (RMSE) and structural similarity index (SSIM) were computed on all images with respect to the ground truth.

**RESULTS**

Compared to EIDCT, PCDCT was more effective at characterizing lesions, especially at lower doses where PCDCT images were visually sharper without blurring of edges and distortions in lesion shape. For both scanners, RMSE increased and SSIM decreased with reduced dose, with PCDCT performance better than EIDCT at all doses. For PCDCT, relative improvements (mean±SD) over EIDCT for all exposures were found to be 4.9±3.5% and 8.3±4.1% for RMSE and SSIM, respectively, with highest improvements of 7.5% and 11.9% for RMSE and SSIM at lowest dose (1.6 mGy).

**CONCLUSION**

A hybrid lifelike phantom with computational lesions was used to assess the performance of EIDCT and PCDCT for low-dose lung imaging. As indicated by the higher SSIM and lower RMSE compared to EIDCT at all doses, PCDCT images are superior for characterizing lung lesions, especially at lower radiation doses.

**CLINICAL RELEVANCE/APPLICATION**

Accurate visual characterization of morphological and texture features of lesions while reducing patient dose is clinically important for monitoring the severity and progression of lung cancer.

## M5B-SPPH-4 REALISTIC 3D-PRINTED HIGH-RESOLUTION CT PHANTOMS FEATURING COMPUTATIONAL LUNG LESIONS FOR PHOTON-COUNTING COMPUTED TOMOGRAPHY

Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Richard Thompson, PhD (*Abstract Co-Author*) Employee, Canon Medical Research, USA
Steven Ross, PhD (*Abstract Co-Author*) Nothing to Disclose
Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Zhou Yu, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Leonid Roshkovan, MD (*Abstract Co-Author*) Nothing to Disclose
Shobhit Sharma, PhD (*Abstract Co-Author*) Nothing to Disclose
Kai Mei, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To create a realistic high-resolution 3D-printed lung phantom for characterizing lung lesions using the PixelPrint technology to evaluate photon-counting computed tomography (PCCT).

**METHODS AND MATERIALS**

For this study, 3 computational lung lesions, characterized by distinct features and levels of spiculation (A: highly spiculated, B: moderately spiculated, and C: minimally spiculated), were used. The lesions were scaled (1x-4x) to obtain target sizes of 11-45, 7-30, and 5-20 mm for lesions A, B, and C, respectively. All lesions were 3D-printed as a single phantom at -50 HU attenuation within -700 HU background. To simulate realistic patient sizes, the phantom was inserted in outer ring of Gammex phantom and scanned on a prototype CZT-based PCCT using 120 kVp Large FOV, and S focal spot (0.4x0.5 mm) at 5 dose levels (CTDIvol: 1.6-20 mGy). All scans were reconstructed in ultra high-resolution (UHR) mode (pixel size/slice thickness: 0.25/0.2 mm), using a lung kernel (FC52) and iterative denoising. To assess the phantom for evaluating PCCT, an example radiomics task involving comparison of features amongst doses was selected. For this task, radiomics features were extracted using PyRadiomics from HU-threshold lesion masks and compared against features extracted from largest lesion size at highest dose.

**RESULTS**

All lesions were effectively visualized, with UHR images allowing for distinguishing specific features of each lesion type. Differences in lesions at native sizes (1x) were most difficult to evaluate due to blurring of their characteristic spiculations. For radiomics, variations in dose were found to be inconsequential for relatively larger lesions but caused degradation of accuracy for smaller lesions. For example, volumetric size had errors <1% across all doses for largest lesions (4x) which increased to >6% for smaller lesions (2x) at doses <5 mGy. Similarly, fluctuating errors were observed for smallest (1x) lesions, with errors as high as 15%, making radiomics estimation challenging.

**CONCLUSION**

The study demonstrates that computational lung lesions can be incorporated into PixelPrint phantoms, facilitating the evaluation PCCT UHR imaging. Availability of such phantoms would enable accurate and customized evaluations of this technology by providing access to high-resolution ground-truth information.

**CLINICAL RELEVANCE/APPLICATION**

New medical imaging technologies require task-specific evaluations for effective translation to clinical use. Availability of a high-resolution lung phantom with access to ground-truth would allow for evaluation of PCCT UHR imaging for tasks involving detection and classification of lung nodules.

## M5B-SPPH-5 ASSESSING THE IMPACT OF BREATH HOLDING AND ARM POSITIONING ON 3D CAMERA IMAGING IN CT CHEST EXAMINATIONS

Xinhui Duan, PhD (*Abstract Co-Author*) Nothing to Disclose
Kristina Hallam (*Abstract Co-Author*) Employee, Siemens AG
Suhny Abbara, MD (*Abstract Co-Author*) Royalties, RELX
Lakshmi Ananthakrishnan, MD (*Abstract Co-Author*) Nothing to Disclose
Yin Xi, PhD (*Abstract Co-Author*) Nothing to Disclose
Liqiang Ren, PhD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey B. Guild, PhD (*Abstract Co-Author*) Nothing to Disclose
Afrouz Ataei, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The study aims to assess the influence of breath holding and arm positioning (up/down) on the performance of 3D camera imaging in CT chest examinations.

**METHODS AND MATERIALS**

Authorized by the Institutional Review Board (IRB), 17 patients who underwent chest CT scans were recruited in this study. For each patient, the 3D camera-recommended table height was recorded for three different positions: arms down with no breath holding (G1), arms down with breath holding (G2), and arms up with breath holding (G3). Patients underwent manual positioning by trained radiographers, and the ordered studies performed per standard of care. The recommended table height by the 3D camera for chest scans was compared between G1 and G2 (assessing breath holding) and G2 and G3 (assessing arm position) using Bland-Altman plots. Patient positioning accuracy was quantified through the calculation of the vertical centroid to isocenter (VCI) value, delineating the distance between the gantry isocenter and the patient centroid y-coordinate. Comparison of VCI values (G1 vs. G2; G2 vs. G3) were conducted using Box-and-Whisker plots and Wilcoxon signed-rank-test.

**RESULTS**

The median difference between recommended table heights is -2.9 mm (95% limits-of-agreements (LOAs): [-12.4, 6.7 mm]) for G1 and G2 scans (G1-G2), and -1.7 mm (95% LOAs: [-16.8, 13.4 mm]) for G2 and G3 scans (G2-G3). The median theoretical VCI values, calculated based on the recommend table heights for G1 and G2 scans were -6.4 mm [-8.3, -0.1 mm] and -5.2 mm [-7.1, 1.3 mm] (p=0.055) from gantry isocenter. The median VCI values for G2 and G3 scans were -5.2 mm [-7.1, 1.3 mm] and -2.3 mm [-6.7, 6.3 mm] (p=0.629).

**CONCLUSION**

Breath-holding and arm position (up/down) did not significantly change the 3D camera-recommended table height for our cohort of patients undergoing chest CTs, and all three different positions achieved accurate patient positioning with median differences between patient centroid and gantry isocenter less than 7mm.

**CLINICAL RELEVANCE/APPLICATION**

Accurate patient positioning can be achieved regardless of the status of breath holding and arms position.

## M5B-SPPH-6 IMPROVEMENT OF IMAGE QUALITY IN CT IMAGES USING STOCHASTIC RESONANCE - DUALITY OF IMAGE NOISE IN CT IMAGES

Kengo Igarashi (*Presenter*) Nothing to Disclose

**PURPOSE**

Image noise in Computed Tomography (CT) images is one of the major factors degrading the image quality. Thus, many studies of noise reduction techniques have been conducted. On the contrary, the phenomenon that disproves such traditional thought for noise has been discovered in recent years and is called "stochastic resonance". It is well known that the phenomenon appears by adding noise to non-liner system such as threshold detector and provides the improvement of the system response. We have set out on the following two subjects of study; 1. Verification of stochastic resonance on CT images 2. Effect of stochastic resonance on high and low intensity signals in noise added CT images

**METHODS AND MATERIALS**

We designed the brain phantom that simulates CT imaging findings of acute cerebral infarction. The CT images of the phantom were acquired with a Multi Detector row CT scanner. Two kinds of Gaussian noise were added to the CT images: white Gaussian noise and band limited noise in spatial frequency domain which was generated by passing white Gaussian noise through a band-pass filter (the range of bandwidth from 0.0083 to 0.83 cycle/mm). After adding these noises, the CT images were transformed to 8 bits gray scale images using windowing process which is one of the thresholding techniques window level = 50 HU, window width = 30 HU).

**RESULTS**

The brain sulci and cerebral edema in CT phantom images were employed as the high- and low-intensity signals, respectively. To evaluate the contrast resolution of CT images, the contrast-to-noise ratio (CNR) for each signal was measured. For subjective recognition, when optimal intensity of noise was added, image signals in the noise-added CT images with windowing process can be detected easily. This result indicated that stochastic resonance is induced by adding noises. For quantitative evaluation, regardless of the kind of noise, CNR for the brain sulcus took the maximum value at the added noise intensity of 10 HU, whereas CNR for the cerebral edema decreased as the added noise intensity increased. However, the sharpness of the edema contour was improved by the stochastic synchronization which is one of the stochastic resonances. The results were almost consistent with subjective recognition of these CT images. Thus, appearance of stochastic resonance on CT images was verified quantitatively and found to improve signal detectability.

**CONCLUSION**

Stochastic resonance can be expected to yield the improvement of signal detectability in CT images.

**CLINICAL RELEVANCE/APPLICATION**

It is suggested that the detectability of low-contrast lesions, such as acute cerebral infarction, can be improved by stochastic resonance.

## M5B-SPPH-7 PERFORMANCE EVALUATION OF HIGH-RESOLUTION TYPE DEEP LEARNING RECONSTRUCTION (SPATIAL RESOLUTION, SLICE THICKNESS AND PEAK CT VALUE)

Katsumi Tsujioka, RT (*Presenter*) Researcher, Canon Medical Systems Corporation

**PURPOSE**

In recent years, the deep learning reconstruction (DLR) has emerged as an image reconstruction method that utilizes AI in X-ray CT. However, those were noise reduction type DLRs. The precise IQ engine (PIQE) was developed as a new DLR for high-resolution AI reconstruction. In this report, we present the results of an experiment to improve the spatial resolution in the X-Y plane and Z-axis direction for high-resolution DLR reconstruction.

**METHODS AND MATERIALS**

Two CT machines were used in our study. The conventional CT is Aquilion ONE (Canon Medical Systems, Japan). Conventional reconstruction and PIQE reconstruction were performed on this CT. The other is the Aquilion Precision (Canon Medical Systems, Japan), an ultra-high-resolution CT. A spiral metal wire phantom made of metal wire with a diameter of 0.1 mm was used in the experiment. The MTF in the X-Y plane, the effective slice thickness in the Z-axis direction, and the peak CT value of metal wire were evaluated.

**RESULTS**

As the results of the experiments, the MTF of conventional CT image reconstructed using PIQE was improved compared to conventional image reconstruction, but was slightly inferior to ultra-high-resolution CT. The effective slice thickness was 0.63mm for conventional CT, 0.453mm for PIQE conventional CT, and 0.378mm for ultra-high-resolution CT. The peak CT value was 579.2HU for conventional CT, 893.1HU for PIQE conventional CT, and 1540.0HU for ultra-high-resolution CT.

**CONCLUSION**

Our experiments revealed that high resolution type DLR reconstruction (PIQE) works not only in the X-Y plane but also in the Z-axis direction. It had higher spatial resolution and thinner slice thickness compared to conventional CT. Furthermore, reducing the voxel size had the effect of increasing the CT value of the phantom. It is noteworthy that these phenomena were achieved with DLR without changing the hardware of conventional CT equipment.

**CLINICAL RELEVANCE/APPLICATION**

The increase in peak CT value due to PIQE means that the ability to visualize small blood vessels has improved. In addition, it was found that the spatial resolution improved by PIQE means that even conventional CT equipment has a spatial resolution close to that of ultra-high-resolution CT.

## M5B-SPPH-8 MODEL OBSERVER TASK-BASED ASSESSMENT OF CT METAL ARTIFACT REDUCTION ALGORITHMS: FEASIBILITY STUDY ON HIP ARTHROPLASTY PHANTOM

Brian R. Herts, MD (*Abstract Co-Author*) Grant, Siemens AG
Nancy A. Obuchowski, PhD, MS (*Abstract Co-Author*) Research Consultant, Siemens AG;Research Consultant, IBM Corporation;Research Consultant, Elucid Bioimaging Inc;Research Consultant, Takeda Pharmaceutical Company Limited
Grant Fong, MS (*Abstract Co-Author*) Research Grant, Siemens Healthineers
Wadih Karim, RT (*Abstract Co-Author*) Nothing to Disclose
Steven Izen, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrew Primak, PhD (*Abstract Co-Author*) Employee, Siemens AG
Naveen Subhas, MD, MPH (*Presenter*) Research support, Siemens AG

**PURPOSE**

Recently published USFDA framework for task-based assessment of CT metal artifact reduction (MAR) algorithms using channelized Hotelling observers (CHO) was performed in a mathematical phantom. This method provided a standardizable approach but has not been validated in a physical phantom. The present study investigates the feasibility of assessing lesion detectability using CHO in a hip arthroplasty phantom and compares the performance to that of human observers.

**METHODS AND MATERIALS**

A phantom simulating a human pelvis was designed with rotatable hip inserts containing cobalt-chromium spheres connected to titanium rods surrounded by 16 unique spherical lesions embedded in bone and soft tissue. This phantom was scanned 100 times on a CT (Somatom Force, Siemens Healthineers) at standard-dose and half-dose protocols (140 kVp, 300 and 150 quality reference mAs) with inserts rotated in four orientations to provide lesion present/absent pairings for CHO lesion detectability (d') calculations. d' was optimized by testing different channel selections (Gabor and Laguerre-Gauss) and image transformation techniques on images reconstructed with and without iterative MAR (iMAR, Siemens Healthineers) at both dose protocols. Differences in d' were assessed using linear regression and compared to previously published human observer detectability and confidence scores using Spearman's correlation.

**RESULTS**

Accurate CHO d' required image masking and thresholding to isolate lesion signal and minimize background differences. d' measurements using Laguerre-Gauss channels were less sensitive to artifacts and therefore selected for testing. Pooling across all lesions, d' of half-dose iMAR images were significantly greater than standard-dose filtered back projection images ($p=0.010$) and not significantly different from standard-dose iMAR images ($p=0.358$). d' results showed a significant, positive correlation with human observer detectability ($?=0.723$, $p<0.001$) and confidence scores ($?=0.727$, $p<0.001$).

**CONCLUSION**

Using CHO for lesion detectability assessment of CT MAR algorithms is feasible and correlates well with human observers but requires appropriate channel selection and artifact reduction techniques.

**CLINICAL RELEVANCE/APPLICATION**

The use of model observers for task-based evaluations can provide a objective assessment of how well MARs perform in clinical scenarios.

## M5B-SPPH-9 IMPACT OF DEEP LEARNING IMAGE RECONSTRUCTION ALGORITHM ON IMAGE QUALITY AND LUNG FUNCTION MEASUREMENTS IN LOW-DOSE CHEST CT IMAGING FOR DIAGNOSING CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Suping Chen (*Abstract Co-Author*) Nothing to Disclose
Yuanfen Liu (*Abstract Co-Author*) Nothing to Disclose
Wanyi Zheng (*Abstract Co-Author*) Nothing to Disclose
Ye Xiongxin (*Abstract Co-Author*) Nothing to Disclose
Borong Tang (*Abstract Co-Author*) Nothing to Disclose
Xiaoyong Zhang (*Abstract Co-Author*) Nothing to Disclose
Liwei Xue, BS (*Presenter*) Nothing to Disclose

## PURPOSE

To explore the Impact of deep learning image reconstruction algorithm on image quality and lung function measurements in low-dose chest CT imaging for diagnosing chronic obstructive pulmonary disease (COPD).

## METHODS AND MATERIALS

We prospectively collected 38 suspected COPD patients who underwent low-dose biphasic chest CT scans. The CT data were reconstructed by four algorithms: filtered back projection (FBP), adaptive statistical iterative reconstruction-Veo with weights of 40% and 80% (ASIR-V40%, ASIR-V80%), and high-level deep learning image reconstruction (DLIR-H). We collected and compared the objective image quality parameters (SD, signal-to-noise ratio [SNR] and contrast-to-noise ratio [CNR]), the parameters related to the emphysema and the small airways on the three-grouped CT images. The differences in CT quantitative parameters on different algorithm-reconstructed images were analyzed using the Friedman test.

## RESULTS

Our study included 28 (73.7%) COPD patients. The DLP was 71.80±30.34 mGy*cm. Comparison in the percentage of voxel volume with CT values below -950 HU on the inspiratory phase (LAAisp-950%): FBP > ASIR-V40% >ASIR-V80% > DLIR-H ($P < 0.05$), while there was no statistical difference in comparisons of other emphysema-related parameters ($P < 0.05$). For all small airway-related quantifications including lumen area, wall area, and wall thickness on upper-right, lower-right, and lower-left bronchia showed no statistical difference among the four grouped images (all $P > 0.05$). Muscle SD was significantly different on the images of the four groups and was lowest on DLIR-H images (FBP > ASIR-V40% >ASIR-V80% > DLIR-H , $P < 0.05$); in the main bronchial SNR and CNR comparisons, (DLIR-H > ASIR-V80% >ASIR-V40% > FBP, $P < 0.05$ for both).

## CONCLUSION

In low-dose chest CT imaging, the deep learning image reconstruction algorithm improves image quality and reduces LAAisp-950% measurements without affecting small airway measurements.

## CLINICAL RELEVANCE/APPLICATION

In COPD diagnosis, deep learning image reconstruction algorithms improve low-dose chest CT image quality and have high clinical value.

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# Abstract Archives of the RSNA, 2024

M5B-SPRO

**Radiation Oncology Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPRO-1 DUAL-ENERGY CT PARAMETERS AND QUANTITATIVE ASSESSMENT OF EXTRACELLULAR VOLUME FRACTION IN GRADING INVASIVE PULMONARY ADENOCARCINOMA

Yinghui Ge (*Abstract Co-Author*) Nothing to Disclose
Xiaojing Kan (*Abstract Co-Author*) Nothing to Disclose
Bin Nan (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the value of various Dual-Energy Computed Tomography (DECT) parameters and Extracellular Volume Fraction (ECV) in grading the differentiation of invasive pulmonary adenocarcinoma.

### METHODS AND MATERIALS

A retrospective collection of invasive pulmonary adenocarcinoma patients who underwent preoperative DECT enhancement scans at our institution from June 2018 to December 2023 was conducted. Based on pathological results, patients were divided into a moderate/high differentiation group (21 cases) and a low differentiation group (19 cases). Measurements of lesion iodine concentration and effective atomic number during arterial and venous phases, as well as ECV, normalized iodine concentration, and normalized effective atomic number, were taken. The ?2 test was used to analyze categorical parameter differences between the two groups, including patient gender, lesion location, and mediastinal lymph node metastasis presence. An independent sample t-test compared differences in patient age, BMI, hematocrit, maximum lesion diameter, micropapillary structure proportion, and various imaging quantitative parameters across phases. Receiver Operating Characteristic (ROC) curves evaluated statistically significant parameters for distinguishing adenocarcinoma differentiation grades.

### RESULTS

The arterial phase ECV, arterial phase normalized effective atomic number, and venous phase ECV, iodine concentration, normalized iodine concentration, and normalized effective atomic number were significantly higher in the moderate/high differentiation group than in the low differentiation group ($t=2.166\sim4.195$, $P<0.05$). The lesion diameter and micropapillary structure content were smaller in the moderate/high differentiation group, with significant differences ($P<0.05$). ROC curve analysis of arterial phase ECV, arterial phase normalized effective atomic number, and venous phase ECV, iodine concentration, normalized iodine concentration, and normalized effective atomic number yielded AUCs of 0.714, 0.662, 0.820, 0.749, 0.807, 0.799, respectively, with venous phase ECV diagnosis having the highest AUC, sensitivity, and specificity of 76.2% and 78.9%, respectively.

### CONCLUSION

DECT parameters can provide additional information for preoperative assessment of pulmonary adenocarcinoma differentiation, offering significant clinical value, with venous phase ECV demonstrating the highest diagnostic efficacy.

### CLINICAL RELEVANCE/APPLICATION

The potential for ECV to contribute to more accurate tumor differentiation and patient management is cautiously optimistic, pending further validation from broader studies.

# Abstract Archives of the RSNA, 2024

M5B-SPVA

**Vascular Imaging Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-SPVA-1 DYNAMIC RADIAL MR IMAGING FOR ENDOLEAK SURVEILLANCE AFTER ENDOVASCULAR REPAIR OF ABDOMINAL AORTIC ANEURYSMS WITH INCONCLUSIVE CT ANGIOGRAPHY: A PROSPECTIVE STUDY

Sven S. Walter, MD (*Abstract Co-Author*) Nothing to Disclose
Gerd Groezinger (*Abstract Co-Author*) Nothing to Disclose
Haidara Al Mansour, MD, MEng (*Presenter*) Nothing to Disclose

### PURPOSE

To assess free-breathing, dynamic radial magnetic resonance angiography (MRA) for detecting endoleaks post-endovascular aortic repair (EVAR) in cases with inconclusive computed tomography angiography (CTA).

### METHODS AND MATERIALS

This prospective single-center study included participants who underwent dynamic radial MRI (Golden-angle RAdial Sparse Parallel-Volumetric interpolated breath-hold, GRASP-VIBE) after inconclusive multiphasic CT for the presence of endoleaks during the follow-up of EVAR-treated abdominal aortic aneurysms. CT and MRI datasets were independently assessed by two radiologists for image quality, diagnostic confidence, and the presence/type of endoleak. Statistical analyses included interrater and intermethod agreement, and diagnostic performance (sensitivity, specificity, area under the curve (AUC)).

### RESULTS

A total of 17 participants (mean age, 70±9 years; 13 males) were included. Subjective image analysis demonstrated good image quality and interrater agreement (k=0.6) for both modalities, while diagnostic confidence was significantly higher in MRA (P=.03). There was significantly improved accuracy for detecting type II endoleaks on MRA (AUC 0.97 [95% CI:0.87, 1.0]) compared to CTA (AUC 0.66 [95% CI:0.41, 0.91]; P=.03). Although MRA demonstrated higher values for sensitivity, specificity, AUC, and interrater agreement, none of the other types nor the overall detection rate for endoleaks showed difference in the diagnostic performance over CT (p=0.12). CTA and MRA revealed slight to moderate intermethod concordance in endoleak detection (k=0.3 - 0.64).

### CONCLUSION

The GRASP-VIBE MRA characterized by high spatial and temporal resolution, demonstrates clinical feasibility with good image quality and superior diagnostic confidence. It notably enhances diagnostic performance in detecting and classifying endoleaks, particularly type II, compared to traditional multiphase CTA with inconclusive findings.

### CLINICAL RELEVANCE/APPLICATION

Enhanced surveillance for endoleaks post-EVAR could be attained through the utilization of radial MR imaging. This method not only enhances endoleak detection but also enables precise classification of endoleak types, thereby impacting clinical management strategies.

## M5B-SPVA-2 PREVALENCE OF UNRUPTURED INTRACRANIAL ANEURYSMS IN HEALTHY VIETNAMESE COMMUNITY:AN ANALYSIS BASED ON BRAIN EXAMINATION BY 3-TESLA MR-ANGIOGRAPHY

Quoc-Anh Nguyen-Duong, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study was to assess the detection rate, imaging features, and some risk factors of unruptured intracranial aneurysms (UIA) using 3 Tesla MRI and MR angiography (MRA).

### METHODS AND MATERIALS

A brain examination using 3 Tesla MRI/ MRA was scanned in 2962 healthy adults 18 years or older (mean age [± SD] 53.9 ± 12.1 years; 48.7% women) in the South of Vietnam between March 2021 and June 2023. Exclusion criteria were saccular aneurysm type protrusions with a maximum diameter < 1.5 mm and non-diagnostic imaging in cases of suspected aneurysms. The cases with a confirmed aneurysm diagnosis were analyzed in the aneurysm group. PHASES Score and the relationship between aneurysm occurrence and risk factors (age, sex, smoking history, alcohol use, hypertension, hyperlipidemia, medical symptom of headache, familial medical history of stroke, unruptured intracranial aneurysm) were investigated by the authors.

## RESULTS

276 aneurysms were confirmed in 237 individuals (detection rate 8%). Aneurysm incidence trended upward with increasing age. The average age in the aneurysm group was 56,9±11,3. The detection rate for women was significantly higher than for men (p < 0.001). The highest detection rate was 32.9% for people in their 50s. Of the patients with aneurysms, 33 (13.9%) had multiple cerebral aneurysms. By location, the internal carotid artery (ICA) was the most common aneurysm position, with 233 (85.6%) occurrences. Within the ICA, following the Boulithier classification, C1- C5 was the site of 56 aneurysms (20.6%); C6, 165 (60.6%); and C7, 12 (4.4%). Regarding aneurysm size, 2.0-2.9 mm was the most common size range, with 96 occurrences (35.3%), followed by 3.0-3.9 mm (24.3%). The largest aneurysm was 40 mm. The PHASES score was = 2 in 83.1% of the cases. Multivariate logistic regression analysis showed that familial medical history of UIA (p = 0.039, OR 1.91, 95% CI 1.02- 3.57), age (p < 0.001, OR 2.3, 95% CI 1.3-4.1), and female sex (p < 0.001, OR1.74, 95% CI 1.32-2.28), were statistically significant risk factors for aneurysm occurrence, whereas alcohol use was not a significant risk factor (p = 0,012, OR 0,7, Cl 95%: 0,53 - 0,92).

## CONCLUSION

The aneurysm detection rate was high in this study. Familial medical history of UIA, female sex, and older age were associated with an increased aneurysm detection rate, whereas alcohol use was not associated with an increased detection rate.

## CLINICAL RELEVANCE/APPLICATION

This retrospective analysis supports the necessity to screen and manage cerebral aneurysms in the community by utilizing 3 Tesla MRI imaging.

# M5B-SPVA-3 EVALUATION OF 4D FLOW MRI TO THE HEMODYNAMIC CHANGES OF THE CAROTID ARTERIES IN PATIENTS WITH HYPERLIPIDEMIA

Shuangqi Fu (*Abstract Co-Author*) Nothing to Disclose
Yang Li (*Abstract Co-Author*) Nothing to Disclose
Xiang Yong (*Abstract Co-Author*) Nothing to Disclose
Weiling Wang (*Presenter*) Nothing to Disclose

## PURPOSE

To obtain various hemodynamic parameters of carotid artery in patients with hyperlipidemia through 4D Flow MRI technology, and to explore the correlation between blood lipids and hemodynamic parameters.

## METHODS AND MATERIALS

This study prospectively enrolled 109 participants (46 females, 63 males, mean age 37 years) under 55 years of age. According to the serum triacylglycerol (TAG) value on the day of examination or within three days, they were further divided into normal group,elevated group and severely elevated group,normal group and elevated group according to serum total cholesterol (TC) value, and normal group and high-risk group according to serum high-density lipoprotein (HLD) value.All subjects underwent 4D Flow MR examination of the neck, and the total volume, peak blood flow velocity, mean axial Wall Shear Stress(WSS), mean circumferential WSS, WWSmax and WWSmean of bilateral common carotid artery (CCA) and internal carotid artery (ICC) were obtained by CVI post-processing software.The test for between-group differences was performed using Man-Whitney-Turst and Kruskal-Wallisha-Turst..A multiple linear regression model was established to evaluate the effects of age, sex, TG, TC and HLD on hemodynamic parameters.

## RESULTS

There were significant differences in WWSmax between the TAG-severely elevated group with the TAG-elevated group (p=0.00059) and the TAG-normal group (p=0.00000) (P<0.001), but there was no statistically significant difference between the TAG-elevated group and TAG-normal group (P=0.94).There were significant differences in WWSmean between the TAG-severely elevated group with the TAG-elevated group (p=0.0027) and the TAG-normal group (p=0.00033) (P<0.05), but there was no significant difference between the TAG-elevated group and the TAG-normal group (P=0.88).There were significant differences in WWSmax between the abnormal HDL group and the normal group (P=0.023) and between the abnormal TC group and the normal group (P=0.036), and there was no significant difference in WWSmean between the abnormal TC group and the normal group (P=0.039), but there was no significant difference between the abnormal HDL group and the normal group (P=0.13).There were no statistically significant differences in the remaining hemodynamic parameters.The TAG mixed model (F=10.025, p<0.001; F=3.881, p=0.011302) could significantly predict WWSmax and WWSmean.

## CONCLUSION

Abnormal changes in the three blood lipid indexes (TG,TC,HDL) can cause an increase in Wall Shear Stress, especially when TAG is severely elevated.

## CLINICAL RELEVANCE/APPLICATION

By measuring the changes of carotid artery 4D Flow MRI blood flow parameters, it can guide the clinical treatment control range of patients with hyperlipidemia.

# Abstract Archives of the RSNA, 2024

R2-SPBR

**Breast Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPBR-1 PREDICTORS OF LOCAL RECURRENCE IN EARLY-STAGE BREAST CANCER: PREOPERATIVE IMAGING AND CLINICOPATHOLOGIC FACTORS FOLLOWING ABBREVIATED BREAST MRI

Eun Ju Son, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Na Lae Eun, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to investigate preoperative MRI and clinicopathologic features associated with local-regional recurrence (LRR) in early-stage breast cancer patients who underwent postoperative abbreviated MRI following breast and axillary surgery.

### METHODS AND MATERIALS

A retrospective analysis was conducted on 1170 patients (mean age, 54.2 years; range, 24-90 years) with stage I or II breast cancer between January 2013 and December 2017. Patients underwent preoperative MRI, surgery, and postoperative abbreviated MRI. Preoperative imaging features, including the Breast Imaging Reporting and Data System (BI-RADS) lexicon of mammographic density and MRI, and clinicopathologic characteristics were analyzed using logistic regression to identify factors independently associated with LRR at abbreviated breast MRI screening.

### RESULTS

Among the patients, 57 (4.9%) experienced LRR at a median follow-up of 77.8 months. In multivariable analysis, dense breast tissue on mammography (OR = 4.208; 95% CI: 0.998, 17.748; P = 0.05), absence of heterogeneous enhancement on preoperative MRI (OR = 0.403; 95% CI: 0.192, 0.846; P = 0.016), high nuclear grade (OR = 2.104; 95% CI: 1.079, 4.106; P = 0.03), and presence of lymphovascular invasion (OR = 2.021; 95% CI: 1.076, 3.798; P = 0.03) were significantly associated with LRR at abbreviated breast MRI screening.

### CONCLUSION

Dense breast tissue, absence of heterogeneous enhancement on preoperative MRI, high nuclear grade, and presence of lymphovascular invasion are associated with increased risk of LRR in early-stage breast cancer patients undergoing postoperative abbreviated MRI surveillance.

### CLINICAL RELEVANCE/APPLICATION

Incorporating dense breast tissue, absence of heterogeneous enhancement on preoperative MRI, high nuclear grade, and presence of lymphovascular invasion into clinical practice may aid in tailoring follow-up strategies for early-stage breast cancer patients undergoing postoperative abbreviated MRI surveillance.

## R2-SPBR-10 PATIENT PERCEPTION OF ARTIFICIAL INTELLIGENCE IN BREAST IMAGING

Laurie R. Margolies, MD (*Abstract Co-Author*) Stock options, Nuevozen Corporation Medical Advisory Board, Screenpoint Medical
Nikki Mehran, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah Ameri, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Artificial intelligence (AI) has the potential to improve diagnostic accuracy and efficiency in breast imaging. Though radiologists appreciate the benefits and limitations of AI, little information exists regarding patients' receptiveness and understanding of the use of AI in their individual breast imaging analysis. The goal of the study is to investigate patients' preferences about and perceptions of AI and its role in breast imaging interpretation.

### METHODS AND MATERIALS

Surveys were distributed to all patients presenting for imaging or biopsies within the breast radiology department at six facilities within an urban hospital system between September 2023 and March 2024 to evaluate their subjective understanding of AI, their perception of its use in ultrasound and mammography, and their potential concerns or interest in incorporating AI into their imaging analysis and reporting. Data was analyzed using Pearson's Chi squared test and $p<0.05$.

### RESULTS

Among 130 survey respondents, 66 (48%) supported the use of AI in breast radiology if they benefited from an earlier and more accurate diagnosis, which was independent of age, sex, race/ethnicity, level of education, and subjective understanding of AI. The majority of patients (64%) would feel more comfortable with doctors using AI, if they better understood how AI was used to create a diagnosis. The most frequently cited concern about the use of AI in breast radiology was loss of the relationship between patient and doctor (43%), followed by concern of doctors losing their skills (28%) and AI making

too many mistakes (23%). A minority of patients (16%) would want AI to be used in their imaging analysis if an additional cost was required for its use. There was no correlation between using social media platforms or technological applications for healthcare information and support of AI in breast imaging (p = 0.9). A majority of patients (60%) would like their study primarily read by a physician with a second physician consulted for questions, rather than AI. This was not correlated with having a personal or familial history of breast cancer (p=0.7) or every having had a biopsy (p=0.8).

**CONCLUSION**

Patients have variable understanding, perceptions and preferences regarding the use of AI in breast imaging. Educational measures to increase transparency and improve patients' understanding of AI in radiology can suggest a synergistic relationship between AI and providers as well as increase patient trust in their personal healthcare experience.

**CLINICAL RELEVANCE/APPLICATION**

Patients have variable understanding, perceptions and preferences regarding the use of AI in breast imaging. Increased communication and education about AI may help improve patient comfort with this increasingly prevalent diagnostic aid.

## R2-SPBR-3 MOBILE SCREENING MAMMOGRAPHY AT A MAJOR COMPREHENSIVE CANCER CENTER: HOW THE COVID-19 PANDEMIC AFFECTED COMPLIANCE WITH IMAGING FOLLOW-UP AFTER ABNORMAL SCREENING MAMMOGRAM

Jia Sun (*Abstract Co-Author*) Nothing to Disclose
Elliana Young (*Abstract Co-Author*) Nothing to Disclose
Ethan O. Cohen, MD (*Abstract Co-Author*) Spouse, Consultant, Boehringer Ingelheim GmbH;Spouse, Consultant, Novo Nordisk AS;Spouse, Consultant, Eli Lilly and Company
Gary J. Whitman, MD (*Abstract Co-Author*) Consultant, Siemens AG;Editor, Wolters Kluwer nv
Charisma DeSai, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Our mobile screening mammography program serves mostly underserved, uninsured patients (insured patients are occasionally imaged), and covid-19 forced a temporary shutdown of this program during 2020. The study goal was to determine how covid-19 affected compliance with follow-up after an abnormal screening mammogram.

**METHODS AND MATERIALS**

We retrospectively reviewed all screening mammograms (mobile and non-mobile) from the following time periods: Pre-pandemic (01/01/17-03/06/20), covid shutdown (03/07/20-07/07/20, when our mobile mammography program was inoperative), subacute pandemic (07/08/20-12/31/20), and chronic pandemic (01/01/21-12/31/22). Demographics and imaging follow-up data were recorded. Statistical analysis included Fisher's Exact and the Kruskall-Wallis tests.

**RESULTS**

The underserved mobile screening mammography population was predominantly Hispanic (81.6-93.2% across time periods), uninsured (100% across time periods), and resided in postal codes below the U.S. national median income (59.3-60% across time periods). The reverse was true for insured mobile screening mammography patients and non-mobile screening mammography patients (all $p<0.001$). Compliance with follow-up after an abnormal screening mammogram was 87.8-90% across all time periods for non-mobile screening mammography patients, while the compliance rates for the underserved and insured mobile screening patients were 76.2% and 67.2%, 59.7% and 30%, 53.7% and 42.9% during the pre-pandemic, subacute pandemic, and chronic pandemic time periods, respectively (all overall $p<0.001$). Median screening to diagnostic interval for non-mobile screening patients was 19, 12, and 11 days during the pre-pandemic, subacute pandemic, and chronic pandemic time periods, respectively ($p<0.001$). In comparison, the median screening to diagnostic interval for the underserved and insured mobile screening patients were 41 and 29 days, 57 and 40 days, 49 and 19 days during the pre-pandemic, subacute pandemic, and chronic pandemic time periods, respectively (all overall $p<0.001$).

**CONCLUSION**

Compared with before the covid-19 pandemic, our mobile screening mammography program's underserved population, which is predominantly Hispanic, uninsured, and of lower income, has had reduced compliance with follow-up after an abnormal screening mammogram. By the end of 2022, the screening to diagnostic interval remained worse than pre-pandemic levels.

**CLINICAL RELEVANCE/APPLICATION**

Our underserved mobile screening mammography population has been negatively impacted by the covid-19 pandemic. Additional efforts to improve follow-up after an abnormal screening mammogram are needed.

## R2-SPBR-4 ABBREVIATED MRI PROTOCOLS IN HIGH RISK BREAST SCREENING PROGRAMMES: ARE WE READY TO GO?

Linda Metaxa, MD (*Abstract Co-Author*) Nothing to Disclose
Shefali Dani (*Abstract Co-Author*) Nothing to Disclose
Nithya Vidyaprakash, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Vasiliki Papalouka, MBBS, MSc (*Abstract Co-Author*) Nothing to Disclose
Sookyeen Lee, MBChB (*Abstract Co-Author*) Nothing to Disclose
Tamara Suaris, MBBS, FRCR (*Presenter*) Nothing to Disclose

**PURPOSE**

Abbreviated MRI protocols ( AbbMRI) aim to provide a cost-effective study without compromising diagnostic accuracy. We aim to assess the diagnostic performance of AbbMRI in high-risk breast cancer screening.

**METHODS AND MATERIALS**

Four experienced breast radiologists retrospectively reviewed the AbbMRI protocol in 236 MRI breast studies performed for very high-risk women between January 2018 - 2020. The protocol consisted of six sequences: pre-contrast T1W, T2W axial, two dynamic postcontrast, subtracted axial sequences and MIP reconstruction. Readers were blinded to history, and patient outcomes. Prior MRI imaging was reviewed when available in AbbMRI format. Results were compared with existing reports of the full protocol (19 sequences). The studies were double read both in the AbbMRI and full protocol and in cases of discrepancies, a 3rd read followed. Descriptive Statistics, sensitivity, specificity, and predictive values were calculated and compared.

**RESULTS**

From the 236 MRI studies, four invasive malignancies and one B3 lesion (radial scar) were identified. The average time to read the AbbMRI was 69 seconds (range: 28 to 240 seconds; 95% CI: 63, 74 seconds). The inter-rater rate (IRR) between the readers in Abb MRI was 90.7%, while between the abbreviated and full protocol reading was 94.3%. The recall rate for AbbMRI was 5.1%, and 6.1% for full protocol (p=0.9). Sensitivity achieved by AbbMRI (100%) was equal to the full protocol (no cancers were missed). NPV were high for both reading sessions (100%). There was no statistically significant difference between the specificity of the abbreviated MRI (95.7%) and the full protocol (95.5%) (p=0.9, a=0.05), as well as the PPV (16.7 vs 16, p>0.05).

**CONCLUSION**

Abbreviated MRI is feasible in screening MRI of high risk patients, with sensitivity and cancer detection rate comparable to the full MRI protocol. Abbreviated breast MRI can be considered as a safe alternative to conventional MR studies in UK very high-risk screening programme , reducing MR waiting times/backlog. Limitations: This is a small retrospective study with only 4 cancers identified in our study sample.

**CLINICAL RELEVANCE/APPLICATION**

The use of AbbMRI protocols appear to have potential in High risk screening programmes, helping to improve MRI efficiency, reduce radiology reading time without compromising recall rates and cancer detection rates.

## R2-SPBR-6 SOCIOECONOMIC DEMOGRAPHICS OF BREAST IMAGING PATIENTS STRATIFIED BY EXAMINATION DAY AND START TIME

Habib Tannir, MS (*Abstract Co-Author*) Nothing to Disclose
Olga Lukyanchenko (*Abstract Co-Author*) Nothing to Disclose
Elaine Hwang (*Abstract Co-Author*) Nothing to Disclose
Jia Sun (*Abstract Co-Author*) Nothing to Disclose
Taylor Stutz (*Abstract Co-Author*) Nothing to Disclose
Ethan O. Cohen, MD (*Presenter*) Spouse, Consultant, Boehringer Ingelheim GmbH;Spouse, Consultant, Novo Nordisk AS;Spouse, Consultant, Eli Lilly and Company

**PURPOSE**

With ongoing concerns over the disparities in access to breast imaging, we compared breast imaging patient demographics based on their imaging appointment time and day.

**METHODS AND MATERIALS**

Screening mammography, diagnostic mammography, breast ultrasound, and breast MRI patients during 01/01/2016-01/30/2022 were retrospectively reviewed. Patient race, ethnicity, age, insurance status, and income were assessed.

**RESULTS**

304,029 examinations were included. Appointments for Asians, African Americans, younger patients, and patients with wealthier zip codes were more common on Fridays and Saturdays than Monday-Thursdays (all p<0.001; Asians: 9.5% and 13.5% of Friday and Saturday appointments versus 7.7-8.6% for Monday-Thursdays, African Americans: 15.2% and 21.9% of Friday and Saturday appointments versus 13.1-13.9% for Monday-Thursdays, median age: 57 and 54 years for Friday and Saturday appointments versus 58-59 years for Monday-Thursdays, wealthier zip codes: 56.9% and 68.2% of Friday and Saturday appointments versus 55.0-56.9% for Monday-Thursdays) and more common in the late afternoon and evening than other times of day (all p<0.001; Asians: 10.2% and 11.2% of late afternoon and evening appointments versus 8.3-8.5% for other times, African Americans: 14.7% and 15.2% of late afternoon and evening appointments versus 13.5-14.3% for other times, median age: 57 and 52 years for late afternoon and evening appointments versus 58 years for other times, wealthier zip codes: 59.7% and 57.0% of late afternoon and evening appointments versus 54.7-56.2% for other times). Similar trends were not seen for Hispanics. Self-pay patient appointments were more common on Saturdays and in the evening (2.0% of Saturday appointments versus 1.7% for Monday-Fridays, p<0.001; 3.1% of evening appointments versus 1.6-1.9% for other times, p=0.001).

**CONCLUSION**

Breast Imaging patient demographics differ based on appointment day and examination time. Asian, African American, younger, and wealthier patients were more commonly scheduled later in the day and on Fridays or Saturdays. Self-pay patients were more commonly scheduled in the evening or on Saturdays.

**CLINICAL RELEVANCE/APPLICATION**

Greater availability of Friday, Saturday, and later afternoon-evening appointments could improve disparities in access to breast imaging services.

## R2-SPBR-7 EARLY PREDICTION OF NEOADJUVANT CHEMOTHERAPY RESPONSE: A COMPREHENSIVE RADIOMICS ANALYSIS OF TUMOR AND BREAST TISSUE

Haoxin Zheng (*Abstract Co-Author*) Nothing to Disclose
Kyunghyun Sung, PhD (*Abstract Co-Author*) Nothing to Disclose
Ran Yan (*Presenter*) Nothing to Disclose

**PURPOSE**

Accurate prediction of neoadjuvant chemotherapy (NAC) response in breast cancer is pivotal for optimizing treatment plans and surgical approaches. This study aims to evaluate the predictive potential of combining radiomics features from tumor, peritumoral region, and background parenchymal enhancement (BPE) with clinical data for early complete response prediction following NAC.

**METHODS AND MATERIALS**

A total of 191 patients from ten clinical trial sites in the BMMR2 challenge data as a subset of the ACRIN6698 trial were included in this study. Each patient included DCE MRIs before (T0) and at an early stage (T1) of NAC. The peritumor region is segmented outward from the tumor for 8mm. The fibroglandular tissue is segmented by a previously developed neural network to extract BPE radiomics. Radiomics features were extracted from the tumor, peritumoral region, and BPE across three DCE image phases (pre-contrast, early post-contrast, and late post-contrast). Features of time points T0, T1, and delta radiomics features reflecting dynamic changes between T0 and T1 were included.We pruned features for redundancy using the variance inflation factor (VIF) and the correlation matrix and eliminated low-performing features via logistic regression. Our final selection of radiomics features was refined using the lasso model. Prediction models were developed using multivariable logistic regression, SVM, and XGBoost based on different combinations of

radiomics features with clinical features. The AUC, specific sensitivity, and specificity values at the Youden index were used to evaluate the performance of prediction models.

**RESULTS**

Data were divided into training (117) and testing (74) datasets. The tumor region alone exhibited the highest performance (AUC [95% CI]: 0.780 [0.729-0.831], sensitivity: 92.2%, specificity: 51.5%) among single region models, with further enhancement upon incorporating BPE radiomics (AUC [95% CI]: 0.806 [0.711-0.923], sensitivity: 81.6%, specificity: 70.7%). However, combining all three regions did not yield superior predictive power (AUC [95% CI]: 0.720 [0.651-0.793], sensitivity: 65.3%, specificity: 72.7%). Notably, the combination of tumor and BPE radiomics excelled in predicting response in hormone receptor-positive subtypes and high-grade tumors.

**CONCLUSION**

Integrating tumor radiomics with clinical data from DCE-MRI enables robust early prediction of NAC response in breast cancer. The addition of BPE radiomics further refines prediction accuracy.

**CLINICAL RELEVANCE/APPLICATION**

The inclusion of BPE radiomics features augments the efficacy of early NAC response prediction, suggesting its potential to reflect underlying cancer pathophysiological responses to treatment.

## R2-SPBR-8 INTRA- AND PERITUMORAL RADIOMICS BASED ON MULTIPARAMETRIC MRI FOR PREOPERATIVE PREDICTION OF AXILLARY LYMPH NODE BURDEN AND DISEASE-FREE SURVIVAL IN INVASIVE BREAST CANCER

Tingting Liu (*Abstract Co-Author*) Nothing to Disclose
Yanni Jiang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jialu Lin (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and validate a radiomics signature based on intratumoral and peritumoral multiparametric MRI for preoperative prediction of axillary lymph node (ALN) burden and assessment of individualized disease-free survival (DFS) in invasive breast cancer.

**METHODS AND MATERIALS**

A total of 410 patients with pathologically confirmed invasive breast cancer (training dataset: n = 287; validation dataset: n = 123) from January 2018 and December 2019 who underwent breast MRI before treatment were retrospectively recruited. Pathological axillary lymph node metastases =3 or >3 were used to differentiate between low and high ALN burden groups. Based on five distinct MRI sequences, including T2 turbo inversion recovery magnitude (TIRM) of the fat compression sequence, diffusion-weighted imaging (DWI), apparent diffusion coefficient (ADC) map, and the second and fourth phases of dynamic contrast-enhanced (DCE) MRI, radiomics features related to ALN burden were selected in three specific regions (intratumor, peritumour, and intratumour + peritumour). Subsequently, the Support Vector Machine (SVM) was utilized to construct the three radiomics models and calculate the radiomics signature (Radscore) for each region. Univariate and multivariate logistic regression analyses were applied to identify clinical features associated with ALN burden, which were then incorporated into the radiomics nomogram. Kaplan-Meier survival curves based on the radiomics and nomogram models were used to estimate DFS.

**RESULTS**

All three Radscores showed good performance for ALN burden prediction, with the combined regional Radscore (Com-Radscore) performing the best, yielding AUCs of 0.909 in the training dataset and 0.808 in the validation dataset. The established radiomics nomogram, incorporating the combined radiomics features and MRI-reported peritumoral edema and lesion enhancement pattern, demonstrated satisfactory calibration and discrimination in both the training and validation datasets, with AUCs of 0.907 (95% CI: 0.873-0.942) and 0.832 (95% CI: 0.759-0.906), respectively. DFS was significantly shorter in the higher-risk groups defined by the combined radiomics model and nomogram (both $p < .05$). Higher Com-Radscore was independently associated with worse DFS in the entire cohort ($p < .05$).

**CONCLUSION**

The combined regional radiomics model and radiomics nomogram based on multiparametric MRI provided satisfactory preoperative prediction of ALN burden and DFS in patients with invasive breast cancer.

**CLINICAL RELEVANCE/APPLICATION**

The new model aids in providing opportunities for precision axillary management and subsequent follow-up by effectively predicting preoperative ALN burden and prognosis among patients with invasive breast cancer.

## R2-SPBR-9 A NOMOGRAM BASED ON APPARENT DIFFUSION COEFFICIENT DERIVED FROM DIFFUSION-WEIGHTED IMAGING (DWI) FOR PREDICTING AXILLARY LYMPH NODE METASTASIS IN BREAST CANCER

Huifang Chen (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study was to construct a nomogram based on apparent diffusion coefficient (ADC) to accurately preoperative evaluate ALN metastasis before treatment and the ALN metastasis after neoadjuvant chemotherapy (NAC) and avoid unnecessary axillary surgery in patients with breast cancer.

**METHODS AND MATERIALS**

In this retrospective cohort study, we conducted an analysis of 778 breast cancer patients from two hospitals. These patients were enrolled from the training cohort (427 patients) and the external validation cohort 1 (351 patients). Uni- and multivariable logistic regression was performed to identify independent predictors of ALN metastasis. The nomogram was constructed based on the significant factors associated with ALN metastasis before treatment (task 1) and ALN metastasis after NAC (task 2), respectively. Model performance was assessed by area under the curve (AUC), accuracy, sensitivity, and specificity. The clinical benefit of these models was revealed by decision curve analysis (DCA). The predictive performance was validated using external validation cohort.

**RESULTS**

The ADC values for ALN metastasis before treatment and ALN metastasis after NAC were significantly lower than that for ALN non-metastasis before treatment and ALN non-metastasis after NAC between the two cohorts (all $P < 0.05$). The nomogram model combined ADC value and clinical data exhibited the best performance. The nomogram demonstrated satisfactory predictive performance in the training cohort (task 1: AUC 0.879, task 2: AUC 0.761), and external validation cohort 1 (task 1: AUC 0.837, task 2: AUC 0.805).

## CONCLUSION

The nomogram, a noninvasive, preoperative prediction tool that incorporates a combination of ADC and clinical data, showed favorable predictive efficacy for the status of ALN metastasis before treatment and ALN metastasis after NAC. Validation of the external cohort achieved good predictive performance. Therefore, the nomogram potential to serve as a noninvasive approach to assist personalized treatment decisions, guide ALN management, avoiding unnecessary ALND.

## CLINICAL RELEVANCE/APPLICATION

ADC is a non-invasive, acceptable, and widely used in clinical MRIs screening method. The nomogram based on ADC to differentiate ALN metastasis before treatment and the ALN metastasis after NAC, and help to avoid unnecessary axillary surgery.

# Abstract Archives of the RSNA, 2024

R2-SPCA

**Cardiac Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPCA-1 A CARDIAC MAGNETIC RESONANCE 4D FLOW STUDY ON MITRAL ANNULOPLASTY (MAP): IMPACT ON LEFT VENTRICULAR FLOW DYNAMICS AND FUNCTIONAL CORRELATIONS WITH DIFFERENT TYPES OF DEVICES

Letizia Ruoli, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate functional and fluidodynamic modifications after MAP with different types of annuloplasty prosthetics using 4D-flow techniques and analysis of left atrial strain in CMR.

### METHODS AND MATERIALS

We enrolled 12 patients treated with MAP - 6 with a semi-rigid ring with an open anterior segment and 6 with a flexible band - and had them undergo CMR at least 12 months after the procedure. The protocol included cineMR and 4D-Flow sequences covering the entire heart. We quantified Total Flow Volume (TFV), Peak Velocity (Vmax), and Wall Shear Stress (WSS) with their respective locations. We analyzed left atrial volumes and strain obtaining Reservoir, Conduit, and Booster-Pump values. We ultimately compared patients with 30 healthy controls matched for age and sex, including 10 with 4D-flow sequences

### RESULTS

Patients who underwent MAP had lower ejection fraction (49.3±4.2% vs. 62.34±6.3%; $p < 0.001$), reduced TFV (52.3±7.8ml vs. 69.6±9.7; $p = 0.014$), and higher WSS (0.7±0.2Pa vs. 0.4±0.2Pa; $p < 0.001$) compared to controls; the WSS appeared also higher in the first group (semi-rigid ring) compared to the flexible band. As per the vortex flow patterns analysis, both interventricular and beneath the mitral valve during the whole cardiac cycle, there were no significant changes among the two different groups of MAP compared with controls.MAP patients also exhibited decreased Reservoir (20.6±20.1% vs. 22.9±2.5%; $p = 0.033$), lower Conduit (9.1±3.48% vs. 12.7±1.8%; $p = 0.005$), and increased Booster Pump strain (12.4±1.8% vs. 8.9±2.3%; $p = 0.001$) compared to controls. The time since the intervention inversely correlated with trans-mitral TVF (r: -0.95; $p = 0.041$) but did not affect valvular WSS. In MAP patients, left atrial Booster Pump strain inversely correlated with transvalvular Vmax (r: -0.95; $p = 0.046$).

### CONCLUSION

Patients who underwent MAP showed a decrease in TFV and an increase in transvalvular WSS with the highest values found along the prosthetic edge due to an increase in annular rigidity, especially in the semi-rigid ring compared to the flexible ring. However, the flow patterns remained similar to the control group, indicating a good resolution post-procedure for both prosthetics. Ultimately, the left atrium appears to compensate functionally by increasing active contraction after MAP, showing higher values of booster pump strain.

### CLINICAL RELEVANCE/APPLICATION

We aim to provide new parameters for post-MAP functional assessment to improve patient selection and personalize prosthetic type for each patient, aiming for an increasingly personalized approach.

## R2-SPCA-10 DENOISE TO VISUALIZE: ENHANCING 3D IMAGING OF THE MITRAL VALVE IN CARDIAC CT WITH A DEEP LEARNING-BASED POST HOC DENOISING METHOD

Keizo Murakawa (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Saito, RT (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Kensuke Umehara, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomoro Morikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Nishii, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation
Junko Ota, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroki Nakajima, RT (*Abstract Co-Author*) Nothing to Disclose
Yasutoshi Ohta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuji Matsuzaki, RT (*Abstract Co-Author*) Nothing to Disclose
Takuma Kobayashi, MS (*Abstract Co-Author*) Nothing to Disclose
Shun Okuyama, RT (*Presenter*) Nothing to Disclose

### PURPOSE

Cardiac CT has significant potential for accurate 3D imaging of complex mitral valve (MV) anatomy before valve repair surgery. However, evaluating the thin and floppy MV in 3D volume-rendered (3DVR) images is challenging. We hypothesized that a deep-learning (DL) based post-processing denoising technique could improve image quality, contributing to the creation of more diagnostic 3DVR images without projection data.

### METHODS AND MATERIALS

We retrospectively reviewed 50 cardiac CTs from 2023 patients with severe mitral regurgitation preparing for MV repair. We use a dual-source CT scanner to scan all heart phases through contrast bolus tracking in the left atrium (LA). A radiologist chose the stationary MV phase during systole for further evaluation. Iterative reconstruction was used to obtain original images. And the images denoised using a post hoc method using the residual dense network. In image analysis, we compared the original image with the denoised image. We measured CT values and standard deviations in the LA cavity using circular ROIs and the MV leaflet using linear ROIs. We created 3DVR images using a 3D workstation, adjusting to the surgeon's view and blood chamber transparency to display LA walls and valve leaflets. CT values for LA and leaflet were thresholded at the 75th percentile using opacity curves. We used a 10-point scoring system to evaluate images for LA cavity transparency and MV leaflet depiction. We evaluated diagnostic confidence for prolapse leaflets using eight-valve leaflet segments: A1-3, P1-3, AC, and PC. Image noise and qualitative scores were compared with the Wilcoxon sign-rank test between original and denoised images. Surgical outcomes were used as a reference to assess the diagnostic ability of 3DVR images via ROC curves with generalized estimating equations.

### RESULTS

In 50 cases (median age 64 [IQR 55-74] years, 20 female, average heart rate at scan 67±2 bpm), the denoising method resulted in a significant reduction in image noise, from 28 [21-30] HU to 16 [13-17] HU ($P < .001$). The 3DVR image evaluation showed improved uniformity in LA cavity transparency (from 4.5 [3-6] to 9 [7.8-9.3]) and significantly enhanced depiction of valve leaflets (from 8 [6-8.3] to 9 [8-10]) ($P < .001$ for all). The area under the curve for the ROC showed a substantial increase with denoised images (0.940, 95% CI 0.906-0.976) compared to the original (0.906, 95% CI 0.868-0.945) ($P = .009$).

### CONCLUSION

DL-based post hoc denoising significantly improves 3DVR imaging and its diagnostic performance of the MV in cardiac CT.

### CLINICAL RELEVANCE/APPLICATION

Advanced 3D Cardiac CT imaging can improve surgical outcomes and patient satisfaction by aiding surgeons in planning repair procedures and helping patients understand their condition.

## R2-SPCA-2 PHOTON-COUNTING DETECTOR COMPUTED TOMOGRAPHY QUANTIFICATION OF WHOLE-BODY EXTRACELLULAR VOLUME TO ASSESS FLUID VOLUME STATUS

Pal Maurovich Horvat, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Martin Ugander, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nora M. Kerkovits (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a method and healthy normal values for quantification of whole body extracellular volume (ECV) using photon-counting computed tomography (PCCT).

### METHODS AND MATERIALS

Consecutive healthy subjects provided written informed consent and underwent PCCT (Naeotom Alpha, Siemens) urography as part of their evaluation as potential living kidney donors. ECV (ml) was calculated as ECV = ([I]CA x VCA - IMbladder) x (1-hematocrit) / [I]blood, incorporating known injected iodinated contrast concentration ([I]CA, mg/ml) and volume (VCA, ml), measured blood iodine concentration ([I]blood, mg/ml), and urinary bladder total excreted iodine mass (IMbladder, mg) quantified on iodine maps with a region of interest in the inferior vena cava and regions of interest in all images covering the whole urinary bladder acquired at one time point 6-10 minutes after intravenous iodinated contrast administration (iomeprol or iopromide, 300±26 mg/kg injected iodine dose), and hematocrit measured from venous blood sampling.

### RESULTS

In healthy subjects (n=51, age 47±9 years, 55% female, body mass index 26.9±5.3 kg/m2) unindexed whole body ECV was greater in males compared to females (9.7±2.0 vs 7.8±1.6 L, $p<0.001$), but did not differ when indexed to body weight (112±14 vs 112±18 ml/kg, $p=0.91$, combined normal range 112±15, 95% limits 82-142 ml/kg), and was independent of age ($p=0.83$), contrast agent type ($p=0.79$), and scan delay time after contrast injection ($p=0.29$).

### CONCLUSION

Iodine mapping with PCCT is an effective and robust method for measuring whole body ECV, enabling the objective quantification of fluid volume status, and normal values are presented.

### CLINICAL RELEVANCE/APPLICATION

Single timepoint late phase post-contrast PCCT iodine mapping as part of routine CT urography can quantify whole body extracellular fluid volume for applications in conditions characterized by volume overload such as heart failure or chronic kidney disease. This simple and novel method holds promise as an objective measure of fluid volume status for diagnosis, risk stratification, and assessing and managing therapy response.

## R2-SPCA-3 CARDIAC PSEUDOANEURYSMS: CLINICAL PATTERNS AND PREDICTORS OF OUTCOMES

Mangun Randhawa, MD (*Abstract Co-Author*) Nothing to Disclose
Sandeep S. Hedgire, MD (*Abstract Co-Author*) Nothing to Disclose
Vinit Baliyan, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Andre Lupp Mota, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Brian B. Ghoshhajra, MD, MBA (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Consultant, Siemens AG
Amine El Kandoussi (*Abstract Co-Author*) Nothing to Disclose
Azin Ghamari (*Presenter*) Nothing to Disclose

**PURPOSE**

Cardiac pseudoaneurysms (PSA), characterized by a contained rupture and covered by pericardium, thrombus, or scar, pose significant diagnostic and management challenges due to their high risk of fatal rupture. This study, leveraging the diagnostic strengths of CT imaging, expands the examination of PSAs beyond the ventricular subtypes commonly resulting from myocardial infarction to include various locations and etiologies. It aims to identify clinical profiles, imaging characteristics, and patterns that may predict patient outcomes.

**METHODS AND MATERIALS**

This IRB-approved, retrospective study analyzed cardiac PSA imaging characteristics (location, size, multiplicity) from cardiothoracic CTs performed between April 2014 and April 2024. Data on demographics, comorbidities, risk factors, major adverse cardiac events (MACE), and surgical intervention were extracted from electronic health records. Statistical analysis was performed using JASP (an open-source statistical software).

**RESULTS**

This study included 82 patients (mean age 59.5 years, 57 males) with 96 PSAs. The most common etiologies were infection (80.5%), myocardial infarction (12.2%), and iatrogenic causes (7.3%). The most prevalent location was the aortic valve (56.2%), with an average size of 3.21 ± 2.69 cm.Complications included new heart block (54.8%), valvular dysfunction (51.2%), and heart failure (36.5%). Surgical intervention occurred in 54.5% of cases, with a mean time to intervention of 70 ± 178.53 days from diagnosis. Follow-up until the date of the last recorded encounter revealed MACE in 47.6% of patients, primarily from cardiovascular death (12.2%) and stroke (10.4%).Logistic regression revealed that predictors of MACE included age ($p=0.024$), smoking ($p=0.016$), and prior infective endocarditis ($p=0.037$). Predictors of surgical intervention were age ($p=0.007$), hypertension ($p=0.019$), alcohol intake ($p=0.039$), intravenous drug use ($p=0.005$), and new heart block ($p=0.041$).

**CONCLUSION**

Age, smoking status, prior infective endocarditis, hypertension, alcohol intake, intravenous drug use, and new heart block significantly predict MACE and surgical outcomes in PSA patients.

**CLINICAL RELEVANCE/APPLICATION**

This study enhances the understanding of cardiac pseudoaneurysms by detailing their diverse etiologies and locations, aiding in more accurate prognosis assessments.

## R2-SPCA-4 EVALUATING THE STATUS OF CARDIAC IMAGING TRAINING IN RADIOLOGY RESIDENCY PROGRAMS IN THE UNITED STATES

Diana Litmanovich, MD (*Abstract Co-Author*) Nothing to Disclose
Tami J. Bang, MD (*Abstract Co-Author*) Nothing to Disclose
Aurelija Liubauske (*Abstract Co-Author*) Nothing to Disclose
Ivan Diogo Queiros, MD,MMed (*Abstract Co-Author*) Nothing to Disclose
Ronald L. Eisenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer M. Cutts, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Revels, DO (*Abstract Co-Author*) Nothing to Disclose
Yuval Liberman, MD, MMedSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Cardiac imaging holds significant importance in contemporary diagnostic radiology and constitutes a portion of the Radiology Core examination. Consequently, ensuring comprehensive training in this domain is imperative for radiology residency programs. This study aims to assess the present status of cardiac imaging training across radiology residency programs in the United States.

**METHODS AND MATERIALS**

Utilizing the Research Electronic Data Capture (REDCap) platform, survey questionnaires were distributed to heads of cardiac/cardiothoracic sections in all eligible US radiology residency programs.

**RESULTS**

Out of 163 questionnaires dispatched, 70 responses were received, with a completion rate of 82.9%. The findings revealed that 85.9% of programs offered a dedicated cardiac imaging rotation, with 58.8% spanning four weeks, primarily conducted in a single block. Moreover, 31.4% of programs provided an extended cardiac experience ranging from 6 to 12 weeks. A designated individual responsible for cardiac imaging was reported by 90.7% of programs, with 68.5% being radiologists and 22.2% representing combined radiologist and cardiologist roles. Regarding reporting responsibilities, 40.7% assigned cardiac CT interpretations to radiologists alone, while 59.3% involved combined radiologist and cardiologist assessments. For cardiac MRI studies, 69.0% shared reporting duties, either through alternate coverage days or with radiologists focusing on non-cardiac findings. Furthermore, 65.5% of programs conducted over six cardiac case conferences annually, and 75.9% offered more than six cardiac lectures. Among the surveyed programs, 65.6% provided cardiothoracic fellowships, with 87.2% allocating over three months to cardiac imaging training. However, only 18.6% offered dedicated cardiovascular fellowships.

**CONCLUSION**

This study provides valuable insights into the current landscape of cardiac imaging education and practice within radiology residency programs. These findings can inform professional societies in developing guidelines to establish a more standardized and comprehensive approach to cardiac imaging education.

**CLINICAL RELEVANCE/APPLICATION**

Assess the present status of cardiac imaging training across radiology residency programs in the United States.

## R2-SPCA-5 INCIDENCE OF DEVICE-RELATED THROMBOSIS FOLLOWING LEFT ATRIAL APPENDAGE OCCLUSION: A SYSTEMATIC REVIEW AND META-ANALYSIS

Wei Li (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Mehrad Rokni, MD (*Abstract Co-Author*) Nothing to Disclose
Tannaz Rajabi (*Abstract Co-Author*) Nothing to Disclose
Seyedali Nabipoorashrafi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Device-related thrombus (DRT) is one of the most important complications of left atrial appendage occlusion (LAAO). However, existing literature on the incidence and timing of DRT post-LAAO contains mixed findings, and there are currently no standardized timelines for follow-up imaging to ensure prompt detection of DRT. This study conducted a meta-analysis to calculate the incidence of DRT at various time points post-LAAO to aid in understanding the over-time trend of DRT incidence.

**METHODS AND MATERIALS**

The PubMed, Cochrane Library, and Embase databases were searched from inception to May 2023 for articles that reported on DRT following LAAO. References were then hand-searched according to PRISMA-P (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols) to identify studies meeting the following inclusion criteria: clinical trials or observational studies that include at least 20 patients who received an LAAO device, and which specify the follow-up imaging protocol and time of DRT diagnosis. The data were collected and stratified into six timepoints based on the time to diagnosis from procedure via TEE or CTA: 30, 45, 60, 90, 180, and more than 180 days (the longest follow-up reported). Statistical analysis was subsequently performed using a random effects model to calculate the cumulative DRT incidence with 95% confidence intervals (CI) at each timepoint.

**RESULTS**

2181 records were obtained from the initial database search. After review, 97 relevant articles were identified with a total DRT incidence of 706/33,245 (2.12%). The mean cumulative incidence at day 30 was 0.83% (15/996, CI: 0.23% - 2.98%, I2 = 0.00%); day 45 was 1.24% (156/10,909, CI: 0.90% - 1.70%, I2 = 37.30%); day 60 was 1.91% (25/1,347, CI: 1.10% - 3.29%, I2 = 34.10%); day 90 was 2.14% (120/4,559, CI: 1.41% - 3.25%, I2 = 36.90%); day 180 was 2.06 (159/8,088, CI: 1.45% - 2.92%, I2 = 62.50%); and day >180 was 2.9% (231/7,346, CI: 2.07% - 4.06%, I2 = 70.60%).

**CONCLUSION**

Our results reveal the incidence of DRT over time following LAAO. The trend of cumulative incidence changes was not uniform across different time points. The cumulative incidence rises rapidly within the first 90 days, then plateaus by 180 days post LAAO, increasing marginally thereafter. This pattern underscores the need for vigilant monitoring during the early post-procedural period. At the same time, it demonstrates that additional follow-up imaging is required beyond this time period.

**CLINICAL RELEVANCE/APPLICATION**

Our results show the incidence of DRT over time post LAAO. Understanding how the incidence of DRT changes over time will help guide post-LAAO follow-up protocols, enhance the safety of LAAO devices, and potentially improve patient outcomes.

## R2-SPCA-6 THE INVESTIGATION OF LEFT ATRIAL STRAIN ANALYSIS USING CARDIAC COMPUTED TOMOGRAPHY IMAGING IN PATIENTS WITH ATRIAL FIBRILLATION

Takuya Matsuda (*Abstract Co-Author*) Nothing to Disclose
Yusuke Kobayashi (*Abstract Co-Author*) Nothing to Disclose
Teruhito Kido, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
SHUN SAWADA (*Abstract Co-Author*) Nothing to Disclose
Yuki Tanabe (*Abstract Co-Author*) Nothing to Disclose
Tomoro Morikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Suekuni (*Presenter*) Nothing to Disclose

**PURPOSE**

Atrial fibrillation (AF) is one of the most frequent tachyarrhythmias, and it increases the risk of intracardiac thrombus causing cerebral infarction and other embolisms. Catheter ablation (CA) is currently used as a treatment for AF, but the relatively high recurrence rate after treatment is an issue. Previous studies have reported that left atrial strain could have evaluated for LA function than conventional morphological indices such as left atrial volume index (LAVI). This study aimed to examine the feasibility of CT-derived LA strain (CT-LAS) analysis for LA function assessment in patients with AF.

**METHODS AND MATERIALS**

A total of 406 patients with AF (paroxysmal AF, 56%; persistent AF, 43%), who underwent cardiac CT to acquire the navigation data for CA, were included. CT-LAS was calculated by dividing the difference between the maximum and the minimum circumference by the minimum, and the average values of two and four chamber view were used. The maximum and minimum LA volume index (LAVImax and LAVImin) were also calculated with CT. The correlations between CT-LAS and both LAVIs were assessed by Spearman's rank correlation coefficient. Additionally, The correlations between CT-LAS and the types of AF(paroxysmal or persistent) were assessed by Mann-Whitney U test.

**RESULTS**

There were significant correlations between CT-LAS and LAVImax (r: 0.45, p <0.0001) or LAVImin (r: 0.68, p <0.0001). CT-LAS in patients with paroxysmal and persistent AF were 20.6 (14.8-25.9) % and 8.5 (7.0-11.2) %. LAVImax in patients with paroxysmal and persistent AF was 49.5 (41.5-60.3) and 63.7 (545.0-77.6) mL/m2. LAVImin in patients with paroxysmal and persistent AF was 28.9 (22.3-36.8) and 52.2 (41.5-67.0) mL/m2. There were significant differences in CT-LAS, LAVImax and LAVImin between patients with paroxysmal and persistent AF (p <0.0001 in each).

**CONCLUSION**

CT-LAS analysis is feasible for LA function assessment in patients with AF.

**CLINICAL RELEVANCE/APPLICATION**

CT-LAS is as useful as or more than conventional morphologic indices in assessing LA function in patients with AF. CT-LAS can provide an incremental value of LA function to cardiac CT imaging that is performed as a navigation tool for catheter ablation.

## R2-SPCA-7 LEFT ATRIAL VOLUME INDEX DERIVED FROM COMPUTED TOMOGRAPHY CAN BE A POWERFUL PREDICTOR OF ATRIAL FIBRILLATION RECURRENCE AFTER INITIAL CATHETER ABLATION

SHUN SAWADA (*Abstract Co-Author*) Nothing to Disclose
Takuya Matsuda (*Abstract Co-Author*) Nothing to Disclose
Teruhito Kido, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Suekuni (*Abstract Co-Author*) Nothing to Disclose
Yuki Tanabe (*Abstract Co-Author*) Nothing to Disclose
Tomoro Morikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Yusuke Kobayashi (*Presenter*) Nothing to Disclose

### PURPOSE

Catheter ablation (CA) for atrial fibrillation (AF) has been established, but the recurrence is still common. Left atrial volume index derived from echocardiography (US-LAVI) is one of powerful predictors for AF recurrence, but several challenges exist in US-LAVI analysis due to deep attenuation, limited acoustic window, and so on. The aim of this study was to propose LAVI derived from computed tomography (CT-LAVI) as an alternative parameter to US-LAVI and to determine the relationship between CT-LAVI and AF recurrence after initial CA.

### METHODS AND MATERIALS

This retrospective study included 304 patients who underwent cardiac CT and echocardiography before the initial CA for AF. CT- and US-LAVI were defined as the maximum LA volume divided by the body surface area. The correlation between CT-LAVI and US-LAVI was evaluated by Spearman's rank correlation coefficient and Bland-Altman analysis. CT-LAVI and US-LAVI were compared by Wilcoxon signed-rank test. Cox proportional hazard model was used to calculate hazard ratios (HR) of predictors for AF recurrence. AF recurrence curves were constructed by Kaplan-Meier method.

### RESULTS

Of 304 patients, 275 patients (paroxysmal AF, 51%; persistent AF, 49%) were enrolled excluding 1 patient for poor contrast enhancement in cardiac CT and 28 patients for poor LA visualization in echocardiography. CT-LAVI was significantly correlated with US-LAVI ($r=0.74$, $p <0.001$). Bland-Altman analysis revealed that the mean difference with 95 % confidence interval (CI) between CT-LAVI and US-LAVI were 24.1 (95%CI, 22.6 to 25.7) ml/m2, and the proportional bias was observed. The median CT-LAVI was 58.5 (46.7-72.5) ml/m2, which was significantly greater than that of US-LAVI [34.2 (26.7-43.1) ml/m2] ($p <0.001$). After a median-follow-up of 19 (9-36) months, 92 of 275 patients (33%) had AF recurrence. In a univariable Cox regression analysis, AF phenotype, US-LAVI above the mean (36.7 ml/m2), and CT-LAVI above the mean (60.9 ml/m2) were associated with AF recurrence. In a multivariable Cox regression analysis, AF phenotype (HR, 2.3 [95%CI, 1.4-3.7]; $p =0.0009$) and CT-LAVI (HR, 1.8 [95%CI, 1.1-3.0]; $p =0.031$) were identified as independent predictors, but US-LAVI was not. At Kaplan-Meier analysis, AF recurrence frequency after 5 years was significantly higher in patients with CT-LAVI above the mean than that in patients with CT-LAVI below the mean (65% vs. 43%, $p =0.001$).

### CONCLUSION

CT-LAVI was an independent predictor for AF recurrence after CA superior to US-LAVI.

### CLINICAL RELEVANCE/APPLICATION

Cardiac CT is feasible not only for preoperative-navigation image of CA, but also for LA function assessment and postoperative AF recurrence prediction.

## R2-SPCA-8 RELIABILITY OF POST-CONTRAST DL-BASED HIGHLY-ACCELERATED CARDIAC CINE MRI FOR THE ASSESSMENT OF VENTRICULAR FUNCTION

Tsuyoshi Sugawara (*Abstract Co-Author*) Nothing to Disclose
Kunihiro Yoshioka, MD (*Abstract Co-Author*) Nothing to Disclose
Makoto Orii (*Presenter*) Nothing to Disclose

### PURPOSE

The total exam time can be reduced if high-quality 2D cine images can be collected post-contrast to minimize non-scanning time prior to late gadolinium enhancement imaging. This study aimed to assess the hypothesis that the diagnostic performance of deep learning-based highly-accelerated cardiac cine imaging (DL cine) can be equivalent pre- and post-contrast injection, by evaluating the cine image quality and quantification accuracy of biventricular volumes and functions.

### METHODS AND MATERIALS

Thirty patients (20 men, mean age 53.7 ± 17.8 years) underwent cardiac magnetic resonance (CMR) using a 1.5 T scanner (SIGNA Artist, GE HealthCare) for clinical indications, and pre- and post-contrast DL cine images were acquired on the short-axis view. The image quality scores was scored with three main criteria: blood-to-myocardial contrast, endocardial edge delineation, and presence of motion artifacts throughout the cardiac cycle. Biventricular end-diastolic volume (EDV), end-systolic volume (ESV), stroke volume (SV), ejection fraction (EF), and left ventricular mass (LVM) were analyzed. These measurements were compared between pre- and post-contrast DL cine images.

### RESULTS

The median actual time of acquisition of DL cine was 38.4 ± 9.1 s. There were no significant differences about the image quality scores between pre- and post-contrast injection ($p > 0.05$). The two sequences demonstrated no significant difference in terms of biventricular EDV, ESV, SV, EF, and LVM ($p > 0.05$). Moreover, the linear regression yielded good agreement between the two techniques ($r = 0.82$).

### CONCLUSION

The diagnostic performance of 2D DL cine is equivalent pre- and post-contrast injection for the assessment of image quality and ventricular function. Hence, the use of post-contrast 2D DL cine would contribute the shorter scan time while preserving image quality of CMR in the clinical setting.

### CLINICAL RELEVANCE/APPLICATION

With the use of deep learning-based highly-accelerated technique, 2D cine imaging can be performed after contrast injection during a waiting time for late gadolinium enhancement imaging.

## R2-SPCA-9 INCREASING THE RATE OF DATASETS AMENABLE FOR $CT_{FFR}$ AND QUANTITATIVE PLAQUE ANALYSIS: VALUE OF SOFTWARE FOR REDUCING STAIR-STEP ARTIFACTS

Thomas G. Flohr, PhD (*Abstract Co-Author*) Employee, Siemens AG
Matthias Eberhard, MD (*Abstract Co-Author*) Nothing to Disclose
Hatem Alkadhi, MD (*Abstract Co-Author*) Nothing to Disclose
Victor Mergen, MD (*Abstract Co-Author*) Nothing to Disclose
Costanza Lisi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the value of a new algorithm for reducing the prevalence and extent of stair-step artifacts for CTFFR and quantitative coronary plaque analyses in patients undergoing sequential mode coronary CT angiography (CCTA).

## METHODS AND MATERIALS

Forty patients (6 females, mean age 66 ± 17 years) undergoing sequential mode CCTA with dual-source photon-counting detector CT were included, who had at least one stair-step artifact in a coronary segment >1.5 mm diameter. Twenty patients (14 males; mean age, 57 ± 17 years) without coronary atherosclerosis constituted the population for CTFFR analysis (45 coronary segments with stairstep artifact). Twenty patients (20 males; mean age, 74 ± 13 years) had stair-step artifacts crossing an atherosclerotic plaque and constituted the population for quantitative coronary plaque analysis (22 coronary segments). Artifacts were graded and CTFFR and quantitative coronary plaque analyses were performed using advanced post-processing software in standard reconstructions and in those reconstructed with a new algorithm (ZeeFree algorithm). Wilcoxon tests were used to compare ordinal and continuous variables. Paired samples t test served to compare means. Statistical significance was assumed at a two-tailed P-value below 0.05.

## RESULTS

Stair-step artifacts grade was significantly reduced in ZeeFree compared to standard reconstructions ($p<0.05$). In standard reconstructions, CTFFR analyses were not feasible in 3/45 (7%) segments, while they were feasible in ZeeFree reconstructions in all segments (100%). In 9/45 (20%) segments without atherosclerosis, the ZeeFree algorithm led to a change of CTFFR values from pathologic (<0.80) in standard to physiologic (>0.80) values in ZeeFree reconstructions. In one segment (1/22, 5%), quantitative plaque analysis was not feasible in standard but in Zee Free reconstructions. The mean overall plaque volume (111 ± 60 mm3), the calcific (77 ± 47 mm3), fibrotic (31 ± 28 mm3), and lipidic plaque volume (4 ± 3 mm3) were higher in standard than in ZeeFree reconstructions (overall plaque volume 75 ± 50 mm3, $p<0.001$; calcific 51 ± 42mm3, $p<0.001$; fibrotic 22 ± 19 mm3, $p<0.05$; lipidic 3 ± 3 mm3, $p=0.055$).

## CONCLUSION

Preliminary evidence indicates that an algorithm for reducing the prevalence and extent of stair-step artifacts in sequential mode CCTA increases the rate and quality of datasets amenable to CTFFR and quantitative coronary plaque analysis.

## CLINICAL RELEVANCE/APPLICATION

Our study indicates that the occurrence of a commonly encountered problem in sequential mode CCTA, i.e. stair-step artifacts, can be considerably reduced when using a novel algorithm for image processing (ZeeFree), with improved results for both CTFFR and plaque analysis.

# Abstract Archives of the RSNA, 2024

R2-SPCH

**Chest Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPCH-1 ULTRA-LOW-DOSE VS. LOW-DOSE HIGH-RESOLUTION CHEST CT SCANS IN ADULTS WITH CYSTIC FIBROSIS ON THE PHOTON-COUNTING DETECTOR CT: A RADIATION DOSE AND IMAGE QUALITY STUDY

Halil Ibrahim Tazeoglu, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Regular disease monitoring with low-dose high-resolution chest CT scans is necessary for the clinical management of pwCF. The risk of induced malignancy increases with the radiation dose. Different CT protocols result in different radiation dose and image quality. The aim of this study was to compare the radiation dose and image quality of LD-HR and ULD-HR CT protocols for PCCT in pwCF.

### METHODS AND MATERIALS

This retrospective study included 60 pwCF, of which 30 received a LD-HR chest CT protocol and 30 received an ULD-HR chest CT protocol using a PCCT detector. Radiation dose and image quality was compared. The study measured the dose-length product (DLP), volumetric CT dose index (CTDIvol), effective dose and signal-to-noise radio (SNR). Three blinded radiologists assessed the overall image quality, image sharpness, image noise and the assessability of bronchiectasis, bronchial wall thickening, and mucoid impaction using a 5-point Likert scale ranging from 1 (poor) to 5 (excellent).

### RESULTS

ULD-HR PCCT used approximately 63% less radiation than LD-HR PCCT (median effective dose: 0.20 vs. 0.54 mSv, CTDIvol: 0.27 vs. 0.81 mGy; DLP: 10.15 vs. 31.15 mGy·cm; $p<0.0001$). There was no significant difference between the ULD-HR and LD-HR protocols for the subjective assessment of overall image quality, image sharpness, and image noise ($p<0.0001$) or the clinical parameters of bronchiectasis, bronchial wall thickening, and mucoid impaction ($p<0.0001$). The mean lung parenchyma SNR was lower with ULD-HR PCCT compared to LD-HR PCCT ($p<0.0001$).

### CONCLUSION

ULD-HR chest CT protocols for PCCT scans provide equivalent image quality, with significantly reduced radiation dose compared to LD-HR in pwCF.

### CLINICAL RELEVANCE/APPLICATION

Regular disease monitoring with CT scans is necessary for the clinical management of people with cystic fibrosis (pwCF). This is associated with an increased radiation dose and an increased risk of malignancy. Therefore, new technologies such as photon-counting CT (PCCT) are approaches to reduce the radiation dose in this patient cohort. Ultra-low-dose high-resolution (ULD-HR) CT protocols result in good image quality with reduced radiation dose in comparison to low-dose high-resolution (LD-HR) CT protocols.

## R2-SPCH-3 ENHANCED CHEST TOMOSYTHESIS THROUGH DEEP LEARNING

Manuel Desco-Menendez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Monica Abella, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

One limitation of plain radiography compared to computed tomography (CT), which is impractical for routine use due to cost and high radiation dose, is its lower sensitivity for detecting lung lesions. Tomosynthesis can substantially improve the radiological diagnostic accuracy in plain radiology systems, providing pseudo-tomographic information at a much lower dose. The incorporation of AI techniques in tomosynthesis image reconstruction could address the major limitation of tomosynthesis, namely, the lack of quantitative information. Attempts to enhance the quality of tomosynthesis images by incorporating a Deep-learning (DL) still fall short of achieving the quantitative precision characteristic of CT scans.

### METHODS AND MATERIALS

We present a DL multi-step approach that applies a first postprocessing step on the sagittal view of a preliminary FDK reconstruction, followed by second postprocessing step in the coronal view. The DL model is based on a modified version of the U-Net architecture implemented using Pytorch. Training was done for 50 epochs to minimize the mean squared error, using Adam as the optimizer, a weight decay equal to 10-3, with learning rate initialized to 10-3 and divided by 2 when the train loss function has reached a plateau.The database consisted of 75 chest CT studies, from which we generated tomosynthesis projections based on a standard chest tomosynthesis protocol with 61 projections, a source-to-detector distance of 1800 mm and a vertical source displacement of 960 mm.

**RESULTS**

The proposed method manages to recover details as nodules and ground glass texture that are neither seen in the planar radiography, nor in the conventional tomosynthesis reconstruction.

**CONCLUSION**

The pseudo-tomographic quality attained from tomosynthesis data suggests the potential of the proposed strategy to replace CT scans in applications where the radiation dose is critical such as lung screening.

**CLINICAL RELEVANCE/APPLICATION**

A low-dose and highly available pseudo-tomographic image would represent a paradigm shift in radiological examinations of the chest, potentially replacing the use of planar radiology for lung cancer screening, where plain radiography has demonstrated low sensitivity. This would also have a significant impact on cases such as patients arriving at the emergency department with an infection after a transplant, where avoiding false negatives is crucial for the patient's survival.

## R2-SPCH-4 INFLUENCE OF FOREIGN BODIES ON DARK-FIELD CHEST RADIOGRAPHS: FIRST EXPERIENCES

Lisa Steinhelfer (*Abstract Co-Author*) Nothing to Disclose
Florian T. Gassert, MD (*Abstract Co-Author*) Nothing to Disclose
Marcus R. Makowski (*Abstract Co-Author*) Nothing to Disclose
Daniela Pfeiffer, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Franz Pfeiffer (*Abstract Co-Author*) Nothing to Disclose
Theresa Urban, MSc (*Abstract Co-Author*) Nothing to Disclose
Alexander W. Marka, MD (*Abstract Co-Author*) Nothing to Disclose
Henriette Klein, MD (*Abstract Co-Author*) Nothing to Disclose
Lennard Kaster, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

X-ray dark-field imaging visualizes the condition of the lungs' alveolar structure by measuring the ultra-small-angle scattering of X-rays. In this study, we investigate the effects and artifacts caused by foreign bodies on both dark-field and conventional radiographs using the first human dark-field chest radiography system.

**METHODS AND MATERIALS**

Written informed consent was obtained from all participants. Subjects were selected from clinical studies conducted between 2018 and 2021, focusing on emphysema and COVID-19 cases. Images of study participants were obtained by using our in-house developed and commissioned clinical x-ray dark-field prototype, yielding both the conventional and dark-field radiographs simultaneously. Blinded readers independently assessed these images to evaluate the impact of various foreign bodies on image quality and artifacts.

**RESULTS**

Our investigation revealed distinct behavior based on the microstructure of foreign bodies. Those lacking microstructural features exhibited either a diminished dark-field signal or no recognizable signal. A similar pattern emerged for osseous structures overlaying lung areas. While conventional radiographs showed radiopaque signals from these structures due to X-ray attenuation, the dark-field radiographs remained devoid of discernible signals owing to their lack of microstructure. Conversely, materials with microstructure yielded an additional dark-field signal. Strongly attenuating foreign bodies (such as pacemakers) produced a dark-field signal, albeit not due to ultra-small-angle scattering, but as an artifact. Adjacent areas were unaffected by foreign bodies.

**CONCLUSION**

Our findings demonstrate that dark-field radiography enhances the overlay-free assessment of pulmonary tissue compared to conventional radiography. We observed reduced overlapping radiopaque artifacts within the investigated regions through minimized interfering signals. This improvement positively impacts image quality and interpretability, addressing the projection-related limitations of radiography compared to computed tomography (CT).

**CLINICAL RELEVANCE/APPLICATION**

Foreign bodies produce fewer signals and artifacts in dark-field radiographs, resulting in better image quality and interpretability. Dark-field radiography enhances an overlay-free assessment of pulmonary tissue compared to conventional radiography.

## R2-SPCH-5 ASSESSING THE IMAGE QUALITY OF DIGITALLY RECONSTRUCTED RADIOGRAPHS FOR CHEST CT

Hildo J. Lamb, MD, PhD (*Abstract Co-Author*) Consultant, Koninklijke Philips NV
Merlijn Sevenster (*Abstract Co-Author*) Nothing to Disclose
Olivier Paalvast, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate different Digitally Reconstructed Radiograph (DRR) construction methods qualitatively and quantitatively for DRRs constructed from ultra-low-dose chest (ULD) CT.

**METHODS AND MATERIALS**

A cohort of 200 patients who underwent an ULDCT and a chest X-Ray (CXR) on the same day, spanning from January 2016 to December 2017, was retrospectively included. DRRs were constructed for all patient cases using four methods identified in literature. A deep learning CXR disease classification network was used as a quantitative analysis tool to compare DRRs to the CXRs using the radiological report as ground truth. A subset of the DRRs was used in the qualitative evaluation, where six radiologists were recruited to score the DRRs on the diagnostic image quality of specified anatomic regions and to rank them with regards to the CXR of the same patient case.

**RESULTS**

The Area under the curve (AUC) for the disease classification network were 0.80, 0.81, 0.75, 0.82 and 0.82 for the original CXR, Method 1, Method 2, Method 3 and Method 4 respectively. In the qualitative evaluation Method 3 scored best overall in terms of diagnostic image quality and was chosen out of four DRRs as the best representation of a CXR 18 our 36 times.

### CONCLUSION

The 'softMip' method (Method 3) was found to the be preferred DRR construction method. DRRs are equivalent with regards to disease classification network performance and end-users generally appreciate their diagnostic potential, identifying potential improvements in the level of noise, the resolution and the look-and-feel.

### CLINICAL RELEVANCE/APPLICATION

DRRs constructed from chest CT can represent similar information visually when compared to chest X-Rays and may serve a role as an intermediary in the interpretation of chest CT scans.

## R2-SPCH-6 DEEP LEARNING-BASED VIRTUAL CONTRAST-ENHANCED CHEST CT FROM NON-CONTRAST CT: IMAGE QUALITY ASSESSMENT OF MEDIASTINAL LYMPH NODES

Motohiko Yamazaki, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Contrast-enhanced CT is generally superior to non-contrast CT in lesion visibility, but the use of contrast agents is limited in patients with iodine allergies. The purpose of this study was to develop a deep-learning model that generates contrast-enhanced chest CT images from non-contrast CT images and to investigate if the model helped improve the image contrast of mediastinal lymph nodes.

### METHODS AND MATERIALS

We used 504 chest CT examinations as training data and 100 chest CT examinations performed using a scanner of a different manufacturer as test data. Paired images of non-contrast and contrast CTs were trained using pix2pix, a deep learning architecture, with an input image size of 512×512×8, a batch size of 1, and 10 epochs. The similarity between the generated and true-contrast CT images were evaluated using structural similarity (SSIM). The image quality of mediastinal lymph nodes on the non-contrast and generated contrast CT images was quantitatively and qualitatively compared using signal-to-noise ratio (SNR), contrast-to-noise ratio between the lymph nodes and mediastinal fat (CNRLnFat), CNR between the lymph nodes and aorta (CNRLnAo), and a visual 3-point scale (better, almost equal, or worse, compared to non-contrast CT images).

### RESULTS

SSIM (mean±standard deviation) was high in both the training data (0.958±0.018) and the test data (0.910±0.025). In the test data, SNR and CNRs were significantly higher in generated contrast CT than in non-contrast CT (SNR, 9.123±3.366 vs. 2.987±1.270; CNRLnFat, 16.211±5.466 vs. 9.731±2.999; CNRLnAo, 4.851±1.797 vs. 0.951±0.722) (all $P < 0.001$). Two board certificated radiologists considered all generated contrast CT images of the test data to have better contrast of lymph nodes than the non-contrast CT.

### CONCLUSION

Deep-learning model that generates contrast-enhanced chest CT from non-contrast CT improved the image quality of the mediastinal lymph nodes compared with the original non-contrast CT.

### CLINICAL RELEVANCE/APPLICATION

Our deep-learning model that generates contrast-enhanced chest CT from non-contrast CT may contribute to improving lesion visibility in patients that cannot receive a contrast agent.

## R2-SPCH-7 COMPARISON BETWEEN PHOTON-COUNTING-DETECTOR CT AND MICRO-CT USING CADAVERIC HUMAN LUNGS: AIRSPACE, INTERLOBULAR SEPTA, AND GROUND-GLASS OPACITY

Keisuke Ninomiya (*Abstract Co-Author*) Nothing to Disclose
Masahiro Yanagawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuriko Yoshida (*Abstract Co-Author*) Nothing to Disclose
Yukiko Tokuda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shuhei Doi, MD (*Abstract Co-Author*) Nothing to Disclose
Ryo Ogawa, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Shigeyoshi Saito (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazuki Yamagata, MD (*Abstract Co-Author*) Nothing to Disclose
Daiki Nishigaki, PhD (*Abstract Co-Author*) Nothing to Disclose
Akinori Hata, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the performance of photon-counting-detector CT (PCD-CT) and energy-integrating-detector CT (EID-CT) to depict small airspace, normal interlobular septa (ILS), and internal texture of ground-glass opacity (GGO) using cadaveric human lungs compared with micro-CT.

### METHODS AND MATERIALS

Image data of 20 cadaveric lungs were acquired by EID-CT and PCD-CT at low radiation dose (CTDIvol 1.2mGy) and high dose (CTDIvol 9.0mGy). EID-CT images were reconstructed with 512 matrix, 350-mm filed-of-view (FOV), and 0.6-mm thickness. PCD-CT images were reconstructed with 1024 matrix, 100-mm FOV, and 0.2-mm thickness. A specimen per lung was obtained and scanned by a micro-CT system for small animals. The micro-CT images was acquired with 20μm (0.02 mm) of spatial resolution. The EID-CT and PCD-CT images were evaluated by a radiologist for airspace with emphysema on a 5-point scale (5=Granular structures on EID-CT/PCD-CT are consistent with normal alveolar ducts on micro-CT, 4=Dilated alveolar ducts can be identified, 3=Rough morphology of emphysematous lesions less than 5mm in size can be delineated, 2=Emphysematous lesions smaller than 5mm can be identified, but the morphology is not consistent with micro-CT, 1=Airspace consistent with micro-CT cannot be identified) and for normal ILS and GGO on a 3-point scale (ILS: 3=Clearly detectable, 2=Barely detectable, 1=Not detectable; GGO: 3=Septal structures inside the GGO are depicted, 2=GGO is detectable, but internal texture is not depicted, 1=GGO is not detectable). Airspace and ILS were evaluated at up to three regions per specimen; GGO was evaluated for the entire specimen. The Wilcoxon signed-rank test with Bonferroni correction was used for statistical analyses.

### RESULTS

Twenty-five regions of airspace, 24 ILSs, and 11 GGOs were evaluated. PCD-CT at high dose showed significantly better scores than others in the airspace and ILS evaluation ($p<0.005$). PCD-CT at low dose showed significantly better scores for the airspace evaluation than EID-CTs (<0.001). Normal interlobular septa were often detectable, especially on PCD-CT at high dose. There was no significant difference in the GGO evaluation. Normal alveolar ducts and septal structures inside the GGO were not depicted on all CTs.

### CONCLUSION

PCD-CT has a better potential to depict small structures of emphysema and interlobular septa than EID-CT.

### CLINICAL RELEVANCE/APPLICATION

Interlobular septa without thickening may be detectable on PCD-CT, which suggests that different practices may be required on PCD-CT compared with EID-CT. Further spatial resolution improvement is needed to differentiate interstitial and airspace lesions in GGO.

## R2-SPCH-8 CHEST CT-BASED AUTOMATED DETECTION OF SCOLIOSIS AND ITS APPLICATION IN COPD

Punam K. Saha, PhD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth A. Regan, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Comellas, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Carry (*Abstract Co-Author*) Nothing to Disclose
Syed Ahmed Nadeem, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Scoliosis is an abnormal rotational deformity of the spine affecting 2-3 percent of the population. It can worsen with age causing chronic pain, impaired mobility, respiratory problems, and cardiac compression. We present a chest CT-based automated method for thoracic scoliosis detection and examine the association of scoliosis with chronic obstructive pulmonary disease (COPD).

### METHODS AND MATERIALS

The image computational method involves the following steps (Figure 1): (1) segmentation and labelling of twelve thoracic and first lumbar vertebrae using a hybrid deep segmentation algorithm; (2) computation of spine centerline and lateral angles between every pair of vertebral endplate locations on the centerline; (3) scoliosis likelihood assessment using a fully-connected neural network (NN) classifier and 78 lateral angles between 13 vertebrae; and (4) optimization of likelihood threshold for scoliosis detection using receiver operating characteristic (ROC) curve analysis. The method was applied on inspiratory chest CT scans from the multi-site Genetic Epidemiology of COPD (COPDGene) study at baseline visits (N = 2,911; # of sites = 15). Expert manual grading of no scoliosis (n = 2,311), scoliosis (189), and no consensus (411) were used as the ground truth for both training (n = 450) and performance evaluation (2,461). Equal distribution across scoliosis grading was applied in partitioning training and performance evaluation datasets.

### RESULTS

The method was successfully applied on chest CT data of 2,911 participants (age (mean±standard deviation): 59.1±9.0 years; 1,422 (48.8%) females). The optimum value of 0.3 was determined for the scoliosis likelihood threshold a from the ROC curve corresponding to accuracy, sensitivity, and specificity of 92.0, 91.0, and 96.1%, respectively (Figure 1(c)). Application of the optimized method to the unseen data from 2,461 participants delivered the accuracy, sensitivity, and specificity of 91.1, 90.5, and 94.2%, respectively. Among the 2,911 participants examined in this study, it was observed that 5.6, 5.6, 7.4, and 8.0% of participants with preserved lung function, mild, moderate, and severe COPD, respectively, had scoliosis.

### CONCLUSION

An automated chest CT-based method for scoliosis detection has been developed and evaluated. The method is applicable to inspiratory chest CT scans and offers high accuracy, sensitivity, and specificity.

### CLINICAL RELEVANCE/APPLICATION

Observed performance and automation of the chest CT-based method demonstrate its feasibility for application to population-based thoracic studies investigating mechanistic interactions of spinal deformities with respective disease comorbidities, progression, and clinical outcomes.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R2-SPER

**Emergency Radiology Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPER-1 SENSITIVITY AND SPECIFICITY OF ARTIFICIAL INTELLIGENCE SOFTWARE IN THE DETECTION OF FRACTURES IN EMERGENCY DEPARTMENTS COMPARED WITH CT SCANS

Djamel Dabli (*Abstract Co-Author*) Nothing to Disclose
Julien FRANDON (*Abstract Co-Author*) Nothing to Disclose
Jean-Paul Beregi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joel Greffier, PhD (*Abstract Co-Author*) Nothing to Disclose
Fabien De Oliveira (*Abstract Co-Author*) Nothing to Disclose
Maxime PASTOR (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the diagnostic performance of artificial intelligence software in standard radiography for the detection of fractures of the pelvis, proximal femurs or extremities in emergency trauma situations in adults, compared with standard-dose CT examinations, as a gold standard.

### METHODS AND MATERIALS

The study was conducted in a sub-group of patients from the multicentric survey ULD-Traumato (4 french centres including adult patients with suspected traumatic fractures between January 2022 and August 2023 investigated by standard dose CT, Ultra-Low Dose CT and radiographs of the pelvis and/or hip and extremities). In this sub-group, artificial Intelligence software (AI, Rayvolve, AZmed, France) was used retrospectively on the radiographs with analysis of the results (suspected fracture yes/no and location of suspected fracture for all radiographs). The results were compared with the standard-dose CT scan interpretation performed by the senior radiologist.

### RESULTS

A total of 94 patients (63 women, mean age 56.4 ± 22.5 years) were included. 47 patients had at least one fracture and a total of 71 fractures were detected (26 hand/wrist, 16 pelvis, 29 foot/ankle) on CT scan. The sensitivity of the AZmed software was 81.6%, with 58 true positives and 13 false negatives (4 hand/wrist, 1 pelvis, 8 foot/ankle). The specificity of the AZmed software was 68.8%, with 33 true negatives and 15 false positives (5 hand/wrist, 1 pelvis, 9 foot/ankle).

### CONCLUSION

This study showed that the AI solution was highly sensitivity in detecting fractures, although some false positives were corrected by the radiologists. However, the presence of false negatives calls into question the use of this solution in triage.

### CLINICAL RELEVANCE/APPLICATION

AI software in the emergency department for the detection of fractures, could help improve patient management, but requires radiologist supervision, given the presence of false negatives.

# Abstract Archives of the RSNA, 2024

R2-SPGI

**Gastrointestinal Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPGI-12 EVALUATING APPARENT DIFFUSION COEFFICIENT (ADC) AS A PROGNOSTIC INDICATOR FOR SURVIVAL, PATHOLOGICAL RESPONSE, TUMOR GRADE IN PANCREATIC CANCER PATIENTS UNDERGOING NEOADJUVANT THERAPY

Cheng Hung Liao, MD, BA (*Presenter*) Nothing to Disclose

### PURPOSE

To assess ADC as prognostic indicators for survival, pathological response, and tumor grade in pancreatic cancer patients undergoing neoadjuvant therapy.

### METHODS AND MATERIALS

This retrospective study included 98 pancreatic cancer patients (52 males, 46 females, mean age 61) treated from December 2019 to July 2023. 19 had distant metastases at diagnosis, with 3 resectable, 29 borderline resectable, and 47 unresectable tumors, requiring neoadjuvant therapy. Mean ADC values were evaluated using pre-treatment and follow-up MRIs, typically 3 months apart, by a resident radiologist. Tumor resectability followed NCCN 2019 criteria. Inter-rater reliability was assessed via repeated measurements by another experienced radiologist, using the intraclass correlation coefficient(ICC). Spearman correlation tests examined relationships between ADC changes and CA19-9 or CEA levels. Statistical analyses, including the Wilcoxon rank-sum test and Cox regression analysis, assessed differences in ADC and patient survival, with significance set at $p<0.05$, using STATA 14.0.

### RESULTS

Surgery succeeded for 25 (26%) patients meeting resection criteria: no hepatic metastasis, normal CA19-9, and stable/reduced tumor size 4-6 months post-neoadjuvant treatment. Median follow-up: 923 days. ICC shows good to excellent reliability in baseline ADC (CI: 0.898-0.954) and follow-up ADC (CI: 0.943-0.977). A significant negative correlation emerged between baseline CA19-9 and ADC ($p<0.01$), while a borderline negative significance was observed between relative CA19-9 change and ADC relative changes ($p=0.08$). Patients with distant metastases had lower follow-up ADC ($p<0.01$) and relative changes ($p=0.02$). Grade 3 tumors had lower follow-up ADC values ($p<0.01$) and relative changes ($p<0.01$). Regarding OS, distant metastases correlated with worse outcomes (HR=2.02, $p=0.04$), while successful surgery correlated with improved OS (HR=0.16, $p<0.01$). Larger follow-up size (HR=1.45, $p<0.01$), higher size changes (HR=3.44, $p=0.02$), higher baseline CA19-9 ($p=0.01$), follow-up CA19-9 ($p<0.01$), and baseline CEA (HR=1.04, $p=0.02$) were associated with worse OS. No significant differences in OS were found for baseline/follow-up ADC or changes in ADC.

### CONCLUSION

Reliable ADC measurements highlight their potential as prognostic indicators, offering insights into tumor characteristics during neoadjuvant chemotherapy. They predict tumor grade and differences in metastatic disease but didn't show significant differences in OS. Further research is needed to explore their clinical utility in treatment decisions.

### CLINICAL RELEVANCE/APPLICATION

ADC measurement in advanced pancreatic cancer is reliable and may reveal the underlying nature of the disease status.

## R2-SPGI-4 PREDICTORS OF MORTALITY IN PATIENTS HOSPITALIZED FOR ALCOHOLIC HEPATITIS

Francisco Restrepo, PhD (*Abstract Co-Author*) Nothing to Disclose
Gene Im (*Abstract Co-Author*) Nothing to Disclose
Bachir Taouli, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Bayer AG;Consultant, Guerbet SA;Research Grant, Regeneron Pharmaceuticals, Inc
Octavia Bane, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Andrew Kirsner, MS, MD (*Abstract Co-Author*) Nothing to Disclose
Deborah Feldman, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuya Yasokawa, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The role of radiographic imaging in AH is not well defined. To identify clinical and imaging predictors of mortality in patients hospitalized for alcoholic hepatitis (AH).

### METHODS AND MATERIALS

This is a single center retrospective study of a cohort of 104 patients (M/F: 47/57, mean age: 44.8y) hospitalized for AH with definite or probable AH by National Institute on Alcohol Abuse and Alcoholism Alcoholic Hepatitis Consortia criteria who had CT (n=96) or MRI (n=8) within 3 months of diagnosis of AH and blood tests within 2 weeks of imaging. The following parameters were measured: liver (whole liver, right and left lobes) and spleen volumes; subcutaneous fat cross-sectional area, visceral adipose tissue area and both psoas muscle cross-sectional areas at the level of L3; liver, spleen and psoas muscle density on unenhanced images. Qualitative imaging evaluation included: cirrhosis, ascites, portal hypertension score, liver enhancement, steatosis, periportal edema, and lymphadenopathy. Demographics, blood tests and imaging variables were compared between patients who died vs those alive within 90 days.

### RESULTS

36 (35%) patients died within 90 days. 86 (83%) patients had cirrhosis on imaging. There were no differences in sex, age and cirrhosis between the 2 groups (p>0.12). The top performing parameters for predicting mortality were: psoas muscle density (AUC=0.71, P=0.006: Table.1), MELD (AUC=0.70, P=0.001), serum Cr (AUC=0.69, P=0.002), MELD-Na (AUC=0.67, P=0.004), T-Bili (AUC=0.66, P=0.01), ascites (AUC=0.66, P=0.004), visceral adipose tissue area (AUC=0.63, P=0.033), and subcutaneous fat cross-sectional area (AUC=0.62, P=0.049). Liver, spleen volumes/density, psoas muscle cross-sectional areas, and FIB-4 had no predictive value (P>0.07). Combination models for predicting death within 90 days were MELD+psoas muscle density+ascites (AUC=0.83, P<0.001; Fig.1).

### CONCLUSION

Blood tests and sarcopenia predict 90-day mortality in patients hospitalized for AH.

### CLINICAL RELEVANCE/APPLICATION

Sarcopenia measured on CT in addition to blood tests can have prognostic value in patients with alcoholic hepatitis.

## R2-SPGI-5 RACIAL DISPARITY IN CLINICAL FEATURES AND SURVIVAL OF GASTROINTESTINAL TUMORS (GISTS)

Francesco Alessandrino, MD (*Abstract Co-Author*) Nothing to Disclose
Haleh Amirian (*Abstract Co-Author*) Nothing to Disclose
Akash P. Naidu, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Jonczak (*Abstract Co-Author*) Nothing to Disclose
Julie Grossman (*Abstract Co-Author*) Nothing to Disclose
Ty K. Subhawong, MD (*Abstract Co-Author*) Research Consultant, Arog Pharmaceuticals, Inc;Stockholder, AbbVie Inc;Stockholder, AstraZeneca PLC;Stockholder, Johnson & Johnson;Stockholder, Pfizer Inc ;Stockholder, F. Hoffmann-La Roche Ltd;Stockholder, Teva Pharmaceutical Industries Ltd
Adrian Parra, BS (*Presenter*) Nothing to Disclose

### PURPOSE

GISTs are the most common mesenchymal tumors of the gastrointestinal tract. There is limited data on how racial and ethnic groups are affected by these tumors. We sought to evaluate clinical and imaging features, as well as overall survival (OS) and recurrence-free survival (RFS) among racial/ethnic groups in a diverse cohort of GIST patients.

### METHODS AND MATERIALS

A local cancer registry database of patients with diagnosis of GIST between January 2011 and December 2021 was queried for clinical, survival and demographic data. CT scans at diagnosis and during follow-up were retrospectively reviewed by a radiologist for evidence of metastases through PACS system. OS using Kaplan-Meier log-rank estimates was stratified by racial/ethnic groups.

### RESULTS

Of a total of 285 GISTs with available demographic and survival data, 57% were non-Hispanic White (NHW), 14% non-Hispanic Black, and 29% were Hispanic (H). Stomach was the most common primary site in all 3 groups, however, was significantly more common in NHB (86% vs. 56% NHW vs. 53% H, P=0.01). Recurrence occurred in 27% of patients and was significantly lower in Hispanics (16% vs. 34% NHW vs. 32% NHB; P=0.01). Peritoneal recurrence occurred in 13% of NHBs and 10% of NHW whereas only 1% of Hispanics (P=0.03). Sllightly more than half of patients (54%) had metastases which was significantly higher in NHWs (64% vs. 51% in NHB vs. 47% in H; P=0.03). Peritoneal metastases were observed more commonly in NHB and NHW compared to Hispanics (38% vs. 35% vs. 18% respectively; P=0.02). OS was not significantly different between NHW, NHB, and H (median OS 11 vs. 7 vs. 11 years respectively; P=0.23). However, RFS was significantly lower in NHB (1 vs. 4 NHW vs. 6 years in H; P=0.001).

### CONCLUSION

In our diverse cohort of patients with GISTs, we have found different clinical and imaging features as well as a gap in RFS among racial/ethnic groups with GIST. Our findings call for prospective studies to understand the etiology of these disparities and to close the gap among these populations.

### CLINICAL RELEVANCE/APPLICATION

As the most common mesenchymal tumor of GI tract, limited data is available on clinical features and imagingfindings of GISTs in different racial/ethnic groups. Knowing these information could be helpful while reviewing images on these patientpopulations. Additionally, understanding the racial/ethnic disparities in GIST patients could lead to further prospective studies on the underlyingfactors.

## R2-SPGI-7 PROGNOSTICATION OF POSTOPERATIVE OUTCOMES IN PANCREATIC DUCTAL ADENOCARCINOMA USING DYNAMIC CONTRAST-ENHANCED COMPUTED TOMOGRAPHY DERIVED EXTRACELLULAR VOLUME FRACTION

Takashi Ota, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideyuki Fukui, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toru Honda, MD (*Abstract Co-Author*) Nothing to Disclose
Hiromitsu Onishi, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masatoshi Hori, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Kengo Kiso, MD (*Abstract Co-Author*) Nothing to Disclose
Shohei Matsumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Yukihiro Enchi (*Abstract Co-Author*) Nothing to Disclose
Mitsuaki Tatsumi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
YASUNARI FUKUDA (*Presenter*) Nothing to Disclose

**PURPOSE**

Pancreatic ductal adenocarcinoma (PDAC) is associated with poor prognosis and presents challenges in postoperative outcome prediction. This study evaluates the prognostic value of the extracellular volume fraction (fECV), derived from contrast-enhanced CT (CE-CT), in predicting recurrence-free survival (RFS) and overall survival (OS) after PDAC surgery.

**METHODS AND MATERIALS**

This study included 71 consecutive patients who underwent CE-CT with precontrast and equilibrium phases before neoadjuvant chemotherapy and were diagnosed with PDAC post-surgery (35 males and 36 females; mean age, 70.3 years; 95% CI, 68.1-72.6; SD, 9.8; age range, 45-89 years). Pancreatic parenchyma in non-cancerous areas and pancreatic tumors were automatically segmented from the subtraction images of unenhanced and equilibrium-phase scans, excluding focal lesions, major vascular branches, and ducts, using a workstation application, and mean CT values for them were calculated respectively. The enhancement degree of the aorta (?Aorta) was also measured. The fECV was calculated using the equation: fECV = (100 - hematocrit) * (?Pancreas / ?Aorta). Univariate and multivariate analyses using the Cox proportional hazards model assessed fECV in the pancreatic parenchyma in non-cancerous area and tumor against variables such as age, gender, chemotherapy regimen, tumor marker, tumor location, tumor size, stage, and histological type, as well as RFS and OS. Time-dependent receiver operating characteristic curves were constructed to determine the optimal fECV cutoff values for predicting RFS and OS. The Kaplan-Meier method with the log-rank test was used to assess RFS and OS for patients with fECV rates above and below the derived cutoff values.

**RESULTS**

Multivariate analysis identified the adjuvant chemotherapy regimen, poorly differentiated adenocarcinoma, and fECV of pancreatic parenchyma in non-cancerous areas as independent predictors of OS ($P < 0.001$, $P = 0.045$, and $P = 0.019$, respectively), and the neoadjuvant gemcitabine and S-1 combination therapy, and TNM stage (IB) as independent predictors of RFS ($P = 0.019$ and $P < 0.01$, respectively). Patients with higher fECV in pancreatic parenchyma in non-cancerous areas had inferior RFS and OS compared to those with lower fECV based on optimal cutoffs of 40.3% for RFS and 43.6% for OS (RFS, $P = 0.036$; OS, $P < 0.001$). No significant disparity in RFS and OS was observed for tumor fECV.

**CONCLUSION**

fECV of pancreatic parenchyma in non-cancerous areas from CE-CT emerges as a significant predictor of survival outcomes in PDAC, with distinct cutoff values for RFS and OS.

**CLINICAL RELEVANCE/APPLICATION**

Incorporating fECV into postoperative evaluation may improve prognostic accuracy and inform treatment decisions for PDAC patients.

## R2-SPGI-9 PREDICTORS FOR DIAGNOSTIC INACCURACY OF PANCREATIC BIOPSY IN FOCAL PANREATIC LESIONS: A NESTED CASE-CONTROL STUDY

Weilu Chai (*Presenter*) Nothing to Disclose

**PURPOSE**

The study aimed to evaluate the effectiveness of pancreatic biopsy in diagnosing focal pancreatic lesions using ultrasound-guided techniques and to identify key factors that could contribute to diagnostic inaccuracies.

**METHODS AND MATERIALS**

The study included 1611 consecutive patients with 1674 cases who underwent ultrasound-guided core-needle biopsy (US-CNB) for focal pancreatic lesions from January 2017 to June 2023, with follow-up until December 2023. The study evaluated the diagnostic performance, technical success rate, and adverse events of US-CNB. Additionally, a nested case-control study was conducted to identify risk factors associated with inaccurate diagnoses of focal pancreatic lesions using US-CNB. The case group consisted of patients with inaccurate diagnoses of pancreatic biopsy, while controls with accurate diagnoses were matched. Conditional logistic regression was used to identify the independent factors associated with inaccurate diagnosis of pancreatic biopsy.

**RESULTS**

The study cohort included 1674 pancreatic biopsy procedures using US-CNB on 1611 patients, with a technical success rate of 99.8% (1670/1674). Out of the successful biopsies, US-CNB demonstrated a diagnostic accuracy of 96.3% (1609/1670), sensitivity of 96.2% (1545/1606), and specificity of 100% (64/64). In the analysis of 122 procedures using a nested case-control design, with 61 cases of inaccurate diagnosis and 61 accurately diagnosed controls, the median age was 64.0 years (interquartile range [IQR] 14.3), median BMI was 21.0 kg/m2 (IQR 4.2), and 62.3% (76/122) were male. The study found that tumor size (odds ratio [OR], 0.651; 95% CI: 0.454, 0.933; p=0.019) and exophytic and backward growth morphology (OR, 0.184; 95% CI: 0.041, 0.833; p=0.028) were independent predictors for inaccurate diagnosis of pancreatic biopsy by US-CNB.

**CONCLUSION**

In conclusion, US-CNB demonstrates excellent diagnostic performance and safety for focal pancreatic lesions. The size and morphology of the targeted pancreatic lesions were associated with inaccurate diagnosis of pancreatic biopsy by US-CNB.

**CLINICAL RELEVANCE/APPLICATION**

Ultrasound-guided pancreatic biopsy was a highly effective and safe method for diagnosing focal pancreatic lesions. It is important to note that the accuracy of the diagnosis was affected by the size and morphology of the targeted pancreatic lesions.

# Abstract Archives of the RSNA, 2024

R2-SPGU

**Genitourinary Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPGU-2 REDUCED BEAM HARDENING IN UROGENITAL IMAGING - A COMPARISON BETWEEN PHOTON COUNTING CT AND ENERGY INTEGRATING CT

Felix C. Muller, MD (*Abstract Co-Author*) Employee, Siemens AG
Yousef W. Nielsen, PhD (*Abstract Co-Author*) Nothing to Disclose
Erik Brandt, MD (*Abstract Co-Author*) Nothing to Disclose
Michael B. Andersen, MD, PhD (*Presenter*) Speaker, Koninklijke Philips NV;Speaker, Boehringer Ingelheim GmbH

### PURPOSE

To investigate if photon counting CT (PCCT) improves image quality in the lower pelvis and on the level of the kidneys, traditionally areas affected by beam hardening artifacts, in comparison to energy integrating CT (EID-CT).

### METHODS AND MATERIALS

We retrospectively identified 35 patients scanned on both EID-CT (Philips IQon or Siemens Force) and PCCT (Siemens Naeotom Alpha) in the period from October 2021 until December 2023, who had undergone a portal venous phase CT under suspicion for malignancy. Intravenous contrast (Iomeron 350mg/mL) were administered according to patient weight (1.5 mL/kg). Scans were reconstructed with BR44 Kernel and with 1.5 mm slice thickness and 1.5 mm increment.. Image quality was evaluated by four consultant radiologists in onco- or abdominal radiology, blinded to the CT scanner used in 2 sessions with a 4-week washout period. Scans were read in a random order between both sessions and readers. Image quality in the medial perirenal fat and the urinary bladder was rated on a 5-point Likert-scale (from 1=non-diagnostic with severe beam hardening To 5=no beam hardening), in both a standard abdominal W/L setting and a specialized W/L setting (i.e. C-100/W100 for the perirenal fat and C30/W100 for the urinary bladder). In addition, a single reader measured image noise (SD of HU measurements) in the medial perirenal fat and in the posterior urinary bladder and recorded the dose length product. All data analysis was performed with RStudio, version 2022.07.1. Continuous variables were compared with a paired t-test and mean image quality ratings with a Wilcoxon signed rank test.

### RESULTS

Image quality ratings were significantly higher for all readers and mean readers in PCCT compared to EID-CT, both in the perirenal fat and the lower pelvis. Mean scores for the perirenal fat were 4.45 (SD 0.378) vs 3.36 (SD 0.383), p<.001 and for the lower pelvis 4.45 (SD 0.933) vs 2.95 (SD 0.611), p<.001. Image noise was significantly lower in PCCT scans compared to EID-CT scans (Posterior Bladder 15.6HU vs 22.5HU, p <.001 Perirenal Fat 12.3HU vs 19.9HU, p<.001). Mean DLP was significantly lower in the PCCT scans with a dose reduction of reduction 21.5% (735.5 mGy*cm vs 936.8 mGy*cm, p <.001).

### CONCLUSION

Image quality in the portal venous phase in lower pelvis and perirenal areas was rated significantly higher, and image noise significantly lower, in PCCT compared to EID-CT scans at significantly reduced radiation doses.

### CLINICAL RELEVANCE/APPLICATION

EID-CT scans are often limited in the assessment of the lower pelvis, due to beam hardening and other artifacts. PCCT improves the image quality and potentially leads to better assessment of the upper and lower urinary tract.

## R2-SPGU-3 SURVIVAL PREDICTION OF BLADDER CANCER PATIENTS AFTER SURGERY BASED ON MACHINE LEARNING MODELS WITH RADIOMICS AND GENOMIC DESCRIPTORS

Richard H. Cohan, MD (*Abstract Co-Author*) Co-author, Wolters Kluwer nv
Chuan Zhou, PhD (*Abstract Co-Author*) Scientific Advisory Board, Perception Vision Medical Technology Co., Ltd
Karan Desai (*Abstract Co-Author*) Nothing to Disclose
Nathan Merrill (*Abstract Co-Author*) Nothing to Disclose
Di Sun, MEng, BEng (*Abstract Co-Author*) Nothing to Disclose
Sofia Merajver (*Abstract Co-Author*) Nothing to Disclose
Phillip Palmbos, MD (*Abstract Co-Author*) Research Grant, Immunomedics, Inc;Research Grant, F. Hoffmann-La Roche Ltd
Heang-Ping Chan, PhD (*Abstract Co-Author*) Nothing to Disclose
Elaine M. Caoili, MD, MS (*Abstract Co-Author*) Steering Committee, ProKidney, LLC
Aaron M. Udager, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lubomir M. Hadjiiski, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To study the feasibility of predicting the 2-year survival of bladder cancer patients after surgery by machine learning models using radiomics and genomic descriptors.

**METHODS AND MATERIALS**

With IRB approval, we retrospectively collected pre-surgical CT urography (CTU) exams from 2019 to 2021 for 85 patients with bladder cancer. The patients underwent procedures including primarily cystectomy and transurethral resection of a bladder tumor (TURBT) in the same timeframe, from which tissue samples were collected for genomic analysis. 2-year survival status was obtained as ground truth. We split the data into three sets: training (46 cases: 30 alive (A); 16 deceased (D)); validation (4 cases: 2 A; 2 D); and test (35 cases: 22 A; 13 D). We used our AI-CALS algorithm to segment the cancers. A total of 92 radiomics features (RF) including morphology, texture, and intensity-based features were extracted from the segmented cancers. 32 genomic markers (GEN) were obtained from the collected tissue samples for the same subjects. GEN markers associated with different cell types including luminal, basal, and EMT/Claudin were identified. A random forest classifier was used to generate 3 models: radiomics model (RFM), genomic model (GENM) and combined radiomics-genomics model (RF-GENM). The area under the ROC curve (AUC) was assessed for each model to estimate its performance in predicting 2-year post-surgery survival. Kaplan-Meier analysis was used to evaluate the classification performance on the held-out test set.

**RESULTS**

The test AUC for 2-year survival prediction was 0.63±0.10 for RFM and 0.69±0.10 for GENM. The AUC increased to 0.74±0.09 for the combined RF-GENM. The median survival times by Kaplan-Meier analysis for the two classes (deceased or alive) were 1.25 and 2 years ($p=0.014$) as estimated by the RFM, 0.195 and 2 years ($p<0.001$) as estimated by GENM, and 0.205 and 2 years ($p<0.001$) as estimated by RF-GENM. The useful radiomics biomarkers included 3 heterogeneity features, 1 gray level feature, and 4 contrast features. The useful genomic markers included ZEB2 (EMT/Claudin), DES, ZEB1 (EMT/Claudin), and FOXA1 (Luminal) based on selection by the random forest classifier. ZEB1 and ZEB2 are transcription factors that strongly correlate with metastasis invasion and decreased survival.

**CONCLUSION**

The machine learning techniques are promising in selecting useful radiomics and genomic biomarkers. Predictive models that merge these biomarkers may further enhance their effectiveness in providing decision support for bladder cancer survival prediction.

**CLINICAL RELEVANCE/APPLICATION**

An objective decision support tool that merges radiomic and genomic biomarkers in a predictive model may assist clinicians in making more accurate cancer survival prediction.

## R2-SPGU-5 THE PREDICTIVE VALUE OF MRI-BASED RADIOMICS FOR KIDNEY FUNCTION AND RENAL FIBROSIS IN PATIENTS WITH CHRONIC KIDNEY DISEASE

Chaogang C. Wei III, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and validate the predictive value of radiomics models based on native T1 mapping and diffusion-weighted imaging (DWI) for identifying the kidney function (KF) and renal fibrosis (RF) in patients with chronic kidney disease (CKD).

**METHODS AND MATERIALS**

In this prospective, single-center study, 122 patients with CKD underwent renal magnetic resonance imaging (MRI) examination and pathological confirmation by renal biopsy from October 2021 to December 2023. They were randomly assigned in a 7:3 ratio to 85 cases in the training cohort and 37 cases in the validation cohort. Patients were divided into three subgroups according to the CKD stages for KF (KF 1, normal KF; KF 2, mildly impaired KF; KF 3, moderately to severely impaired KF) and histopathological results for RF (RF 1, normal RF; RF 2, mild RF; RF 3, moderate to severe RF). 122 parenchyma ROIs of the right kidney were manually delineated slice by slice after setting imaging thresholds. Least absolute shrinkage and selection operator (LASSO) logistic regression was used for feature selection and developing radiomics models. The persistence and degree of KF (KF 1 vs. KF 2 and KF 3; KF 2 vs. KF 3) and RF (RF 1 vs. RF 2 and RF 3; RF 2 vs. RF 3) were analyzed. The diagnostic performance was assessed by receiver operating characteristic (ROC) curve in both the training and validation cohorts. The calibration curve and decision curve analysis were used to internally validate the goodness of fit and clinical effectiveness.

**RESULTS**

For KF 1 versus KF 2 and KF 3, the combined model achieved the best diagnostic performance with the highest AUC (training: 0.908; validation: 0.818), surpassing that of the native T1 mapping model (0.884, 0.815) and the ADC model (0.813, 0.792). For KF 2 versus KF 3, the combined model also reached the highest AUC (training: 0.923; validation: 0.880). Similarly, for RF 1 versus RF 2 and RF 3, the radiomic model had the highest AUC (training: 0.923, validation: 0.898), higher than that of the native T1 mapping model (0.897, 0.849), and the ADC model (0.785, 0.753). For RF 2 versus RF 3, the combined model with the highest AUC (training: 0.933, validation: 0.870). The combined model had favorable predictive abilities and satisfactory clinical benefits for the internal validation.

**CONCLUSION**

Both the native T1 mapping- and ADC-based radiomics models could better identify KF and RF in patients with CKD.

**CLINICAL RELEVANCE/APPLICATION**

The radiomics combined model exhibited robust and satisfactory diagnostic performance for the assessment of kidney function and renal fibrosis in patients with CKD, thus providing more information for CKD management and clinical decision-making.

## R2-SPGU-6 RENAL SHEAR WAVE ELASTOGRAPHY IN PEDIATRIC NEPHROTIC SYNDROME: CAN IT PREDICT THE CLINICAL OUTCOME?

Amita Malik, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Nephrotic syndrome is a common type of kidney disease seen in children. Imaging, to date, has not played a significant role in predicting the clinical outcome of pediatric patients with nephrotic syndrome. We performed this study for evaluation of ElastPQ renal shear modulus in pediatric patients with nephrotic syndrome and correlated it with the clinical subtype of the disease.

**METHODS AND MATERIALS**

This cross-sectional study consisted of 60 cases of nephrotic syndrome in the age group less than 12 years along with 60 age-matched controls. The cases were clinically classified as steroid responsive, steroid resistant, steroid dependent, frequent relapsing and infrequent relapsing. Grey scale ultrasound and Shear wave elastography of both kidneys was performed for all children. The mean values of the shear modulus of both kidneys were compared among the two groups. Among the cases, the mean shear wave modulus was correlated with the clinical status. p value <0.05 was considered as statistically significant.

**RESULTS**

The mean shear modulus of kidneys in cases was found to be higher than that in controls (5.31 vs 2.57 kPa, p<0.001). Mean shear modulus in steroid resistant, steroid dependant, frequent relapsing, infrequent relapsing and steroid responsive nephrotic patients was 7.44, 6.08, 4.93, 4.65 and 3.79 kPa, respectively. The shear modulus was found to be highest in steroid resistant patients. Maximum diagnostic accuracy of shear modulus for diagnosing steroid resistance was at 5.85 kPa (93 % sensitivity and 83.48 % specificity).

**CONCLUSION**

Shear-wave elastography is a promising ultrasound technique in predicting the clinical outcome in pediatric patients with Nephrotic syndrome.

**CLINICAL RELEVANCE/APPLICATION**

Prediction of response to steroid treatment in pediatric nephrotic syndrome and early institution of alternative therapy can induce remission or halt its progression to chronic renal failure.

## R2-SPGU-9 STANDARDIZATION OF BODY COMPOSITION STATUS IN PATIENTS WITH ADVANCED UROTHELIAL TUMORS: THE ROLE OF A CT-BASED AI-POWERED SOFTWARE FOR THE ASSESSMENT OF SARCOPENIA AND PATIENT OUTCOME CORRELATION

Carlo Catalano, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Martina (*Abstract Co-Author*) Nothing to Disclose
Martina Pecoraro, MD (*Abstract Co-Author*) Nothing to Disclose
Valeria Panebianco, MD (*Abstract Co-Author*) Nothing to Disclose
Ludovica Laschena, MD (*Abstract Co-Author*) Nothing to Disclose
Antonella Borrelli, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Sarcopenia is a well know prognostic factor in oncology, influencing patients' quality of life and survival. We aimed to investigate the role of sarcopenia, assessed by a Computed Tomography (CT)-based artificial intelligence (AI)-powered-software Quantib Body Composition® , as a predictor of objective clinical benefit in advanced urothelial tumors and its correlations with oncological outcomes.

**METHODS AND MATERIALS**

We retrospectively searched patients with advanced urothelial tumors, treated with systemic platinum-based chemotherapy and an available total body CT, performed before and after therapy. An AI-powered software was applied to CT to obtain the Skeletal Muscle Index (SMI-L3), derived from the area of the psoas, long spine, and abdominal muscles, at the level of L3 on CT axial images. Logistic and Cox-regression modeling was implemented to explore the association of sarcopenic status and anthropometric features to the clinical benefit rate and survival endpoints.

**RESULTS**

97 patients were included, 66 with bladder cancer and 31 with upper-tract urothelial carcinoma. Clinical benefit outcomes showed a linear positive association with all the observed body composition variables variations. The chances of not experiencing disease progression were positively associated with ?_SMI-L3, ?_psoas, and ?_long spine muscle when they ranged from ~10-20% up to ~45-55%. Greater survival chances were matched by patients achieving a wider ?_SMI-L3, ?_abdominal and ?_long spine muscle.

**CONCLUSION**

A CT-based AI-powered software body composition and sarcopenia analysis provide prognostic assessments for objective clinical benefits and oncological outcomes

**CLINICAL RELEVANCE/APPLICATION**

An AI-driven software that utilizes CT scans has the capability to automatically segment body composition and diagnose sarcopenia. Our research indicates that combining standardized radiological staging methods with sarcopenia analysis could assist in identifying patients who may benefit from customized nutritional therapies, ultimately resulting in improved outcomes and quality of life. The AI tool can represent a means to increase the clinical value of CT imaging reports and to promote the implementation of precision medicine.

# Abstract Archives of the RSNA, 2024

R2-SPHN

**Head & Neck Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPHN-1 MAGNETIC RESONANCE IMAGING-BASED PREDICTION MODELS FOR TUMOR STAGE AND CERVICAL LYMPH NODEMETASTASIS OF TONGUE SQUAMOUS CELL CARCINOMA

Simona Marzi (*Abstract Co-Author*) Nothing to Disclose
Vincenzo Dolcetti (*Abstract Co-Author*) Nothing to Disclose
Antonello Vidiri, MD (*Abstract Co-Author*) Nothing to Disclose
Francesca Piludu, MD (*Abstract Co-Author*) Nothing to Disclose
Raul Pellini (*Abstract Co-Author*) Nothing to Disclose
Sonia Lucchese, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the ability of preoperative MRI-based measurements to predict the pathological T (pT) stage and the cervical lymph node (LN) metastasis, by machine learning (ML)-driven models trained in squamous cell carcinoma of the tongue (OTSCC).

### METHODS AND MATERIALS

108 patients with a new diagnosis of OTSCC were enrolled in the present retrospective study. Preoperative MRI study including post contrast high resolution T1-weighted images were acquired in all patients. The entire dataset was randomly divided into a training set and a validation set. Different types of ML algorithms were trained on our dataset and compared in terms of accuracy.

### RESULTS

MRI-based depth of invasion (DOI) and tumor dimension, together with several shape-based and intensity based features, significantly discriminated the pT stage and LN status. The overall accuracy of the model for predicting the pT stage was 0.86 [95%CI, 0.78-0.92] and 0.81 [0.64-0.91] in the training and validation sets, respectively. When including also shape-based and intensity-based signature, no improvement in the model performance was observed. The proposed models for predicting the LN status had a fair to good accuracy, which was between 0.68-0.75 and 0.67-0.69 in the training and validation sets, respectively. The MRI-based radiomics has led to an improvement in the model sensitivity.

### CONCLUSION

MRI-based models, driven by ML algorithms, provided a good ability to stratify patients with OTSCC according to the pT stages and a fair ability to predict cervical LN metastasis.

### CLINICAL RELEVANCE/APPLICATION

We did not explore the correlation among MRI-based measurements, clinicopathological factors, and treatment outcomes, i.e.,locoregional control and disease-specific survival, which willbe the topic of future investigations.

## R2-SPHN-2 STEPWISE DECISION TREE MODEL IN DIFFERENTIAL DIAGNOSIS OF HEAD AND NECKKIMURA'S DISEASE

Yingwei Wu, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To distinguish Kimura's disease (KD) with Sjogren's syndrome with mucosa-associated lymphoma (SS with MALT lymphoma), neurofibromatosis (NF) and lymphoma in head and neck by using stepwise decision tree model.

### METHODS AND MATERIALS

202 patients diagnosed with KD, SS with MALT lymphoma, NF and lymphoma were collected from 2009 to 2024. Preoperative head and neck MR with diffusion weighted imaging (DWI) and dynamic contrast-enhanced imaging (DCE-MRI) were performed. Demographic data and MR variables were collected. Quantitative MR variables such as apparent diffusion coefficient (ADC), time to peak (TTP) and wash-in rate were measured and recorded. Chi-square test, Mann-Whitney U and Kruskal-Wallis H test were used to analyse categorical and continuous variables, respectively. A stepwise decision tree model was developed to distinguish KD and other three diseases and the differential diagnostic accuracy was assessed.

### RESULTS

Males(92%),skin thickening(72%) and lymphadenopathy(83%) were the most frequent characteristics involved in KD. Well-defined nodular and ill-defined infiltrative lesions can coexist in KD. Locations, lymphadenopathy, skin thickening and ADCs were the most predicable variables for distinguishing above four diseases. For the training and test set, the stepwise decision tree model achieved excellent accuracy of 97.6% and 95.2%, respectively, in

predicting the above four diseases individually. Moreover in the test set, the diagnostic accuracy of KD was 83.3%, and the other three confounding diseases were diagnosed correctly. 2 cases of KD were misdiagnosed as lymphoma and SS with MALT lymphoma.

**CONCLUSION**

KD had morphological as well as functional characteristics on MR. The decision tree model based on demographic and MR features yielded reliable accuracy in preoperative differential diagnosis of KD.

**CLINICAL RELEVANCE/APPLICATION**

The decision tree model enhances the precision of diagnosing Kimura's disease before surgery, offering guidance in crafting tailored clinical management plans for affected patients.l KD is characterized by male gender, skin thickening and lymphadenopathy.l ADCs and TICs patterns were distinguishable in differentiating KD, SS with MALT lymphoma, NF and lymphoma inhead and neck. l The stepwise decision tree model using demographic and MR features accessed great differential diagnosis on KD and other head and neck diseases.

## R2-SPHN-3 THE USEFULNESS OF HYPERPOLARIZED $^{13}$C-MRI IN ASSESSING LYMPH NODE METASTASES IN THE PATIENTS WITH HEAD AND NECK CANCERS

Kuan-Ying Lu, MS (*Abstract Co-Author*) Nothing to Disclose
Ching-Yi Hsieh, PhD (*Abstract Co-Author*) Nothing to Disclose
Gigin Lin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ying-Chieh Lai (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the application of hyperpolarized (HP) 13C-MRI in identifying lymph node metastases in the patients with head and neck cancers

**METHODS AND MATERIALS**

This prospective phase II clinical trial was approved by IRB. Patients with histopathologic proved head and neck cancers and having lymph node metastases on 18F-FDG-PET/CT were included. The patients underwent HP 13C-MRI using [1-13C]pyruvate as probe before treatment. The probe was hyperpolarized using a clinical polarizer, SPINlab, for 2-3 hours to reach a polarization level of 20%-40%. The solution, comprising the hyperpolarized probe, underwent meticulous quality control measures and was subsequently transported to an MRI scanner for administration in human subjects. The 13C signal was acquired using slice-selective pulse-and-acquire sequence followed by model-based imaging (IDEAL spiral CSI) and generic MRSI. The 13C data was analyzed through kinetic modeling (pyruvate-to-lactate conversion rates, kPL) and metabolite ratios (area under the curve [AUC] ratios).

**RESULTS**

Two patients were included (Patient 1: 60 years-old male having postcricoid hypopharyngeal cancer, cT1N3bM0; Patient 2: 54-year-old male having bilateral tongue cancers, cT4aN3bM0). Both patients underwent HP 13C-MRI targeted at their lymph node metastases at left neck level IV. Within the imaged lymph nodes, the downstream metabolites including [1-13C]lactate, [1-13C]alanine, and [1-13C]bicarbonate were detected. The kPL were 1.9 × 10-2 s-1 and 1.1 × 10-2 s-1 for patient 1 and 2, respectively. The metabolites-to-total carbon AUC ratios were 42.8 and 30.1 for lactate, 5.7 and 6.7 for alanine, and 2.3 and 4.2 for bicarbonate. Notably, the necrotic core of the lymph node in patients 2 did not display metabolite signal.

**CONCLUSION**

Hyperpolarized 13C-MRI has the potential to detect lymph node metastases for patients with head and neck cancer.

**CLINICAL RELEVANCE/APPLICATION**

MRI is a standard-of-care exam for evaluation of head and neck cancer. However, detecting lymph node metastasis has been a drawback of MRI. HP 13C-MRI can be integrated into the conventional MRI protocol to enhance the accuracy of MRI in detected lymph node metastasis.

## R2-SPHN-5 ENHANCED COCHLEAR IMPLANT EVALUATION: PRECISION ANALYSIS WITH PHOTON-COUNTING CT

Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Henner Huflage, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Cochlear duct length (CDL) measurement plays a key role in the context of individualized cochlear implant (CI) surgery regarding an individualized selection and implantation of the CI electrode carrier and an efficient postoperative anatomic fitting process. The level of detail of the preoperative temporal bone CT scan depends on the imaging modality with major impact on CDL measurement and CI electrode contact position determination. The aim of this study was to evaluate the accuracy of perioperative CDL measurement and electrode contact determination in photon-counting CT (PCCT).

**METHODS AND MATERIALS**

Ten human petrous bone specimens were examined with a first-generation PCCT. A clinically applicable radiation dose of 27.1 mGy was used. Scans were acquired before and after CI insertion. Postoperative measurement of the CDL was performed with an otological planning software and 3D-curved multiplanar reconstruction. Investigation of electrode contact position was performed by two different observers. Measurements were compared to a conventional multislice CT and to a high-resolution flat-panel volume CT with secondary reconstructions.

**RESULTS**

Pre- and postoperative CDL measurements in PCCT images showed no significant difference to high-resolution flat-panel volume CT. Postoperative CI electrode contact determination was also as precise as the flat panel CT-based assessment. PCCT and flat-panel volume CT were equivalent concerning interobserver variability.

**CONCLUSION**

Cochlear duct length measurement with PCCT was equivalent to flat-panel volume CT. PCCT enabled highly precise postoperative CI electrode contact determination with substantial advantages over conventional multislice CT scanners.

**CLINICAL RELEVANCE/APPLICATION**

Photon-Counting CT matches High-Resolution Flat-Panel Volume CT in precise pre- and postoperative Cochlear Duct Length measurements and electrode contact determination for Cochlear Implant evaluation

# Abstract Archives of the RSNA, 2024

R2-SPIN

**Imaging Informatics Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPIN-1 DEBIASING FOR MULTIPLE CONFOUNDING ATTRIBUTES USING GRADIENT REVERSAL

Ramon Correa-Medero, BS (*Abstract Co-Author*) Nothing to Disclose
Bhavik N. Patel, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Vedant Joshi (*Abstract Co-Author*) Nothing to Disclose
Imon Banerjee, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Deployment of AI models is limited by the impact biases formed from spurious correlations can have on patient populations. For minority groups, biased models would further existing health disparities. Debiasing techniques are training techniques to develop fair models. However, are only applied to one spurious feature, whereas multiple spurious correlations may exist. We introduce a debiasing technique alongside a loss balancing technique to tackle the issue of multiple biasing attributes.

### METHODS AND MATERIALS

We modify a convolutional neural network ( CNN) to use three auxiliary classifiers predicting confounding attributes: age, race, and presence of support devices(SD). The model is trained in two steps; during the first forward pass, the backbone and primary classifier are trained to predict the presence of 4 radiological findings ( No Finding, Pleural Effusion, Edema, and Lung Opacity). The auxiliary classifies one of the three confounding attributes. Their updates do not influence the backbone. During the second forward step, the auxiliary classifiers are updated, and the updates of the auxiliary classifiers are sent toward the backbone after its gradient direction has been flipped by the gradient reversal layer. The model backbone unlearns features related to the confounding attributes. Each confounding attribute classifier had its loss term weighted by a dynamic weight based on the loss value. The dynamic weight allowed the three confounding attributes to be equally weighted despite the differences in loss magnitudes. The model was trained using the Chexpert dataset; 190K images were randomly split into training validation tests by patient ID. The model was evaluated on MIMIC and Emory data containing 296K and 498K image. A model comp without debiased served as baseline. Bias was evaluated using the intersectional identity of patients across race(Asian, Black, White ), age ( lt 40,40-60,60+), and SD producing 18 demographic groups. True positive rate disparity(TPR) ratio was measured by comparing each group's TPR to the majority; values exceeding 0.8-1.2 were found to be biased.

### RESULTS

AUC on the Chexpert averaged 0.82 and 0.81 for the baseline and debiased models. Performance on MIMIC had an average AUC of 0.81 for both models. Both models averaged AUC of 0.79 on Emory. No finding bias decreased 11 to 7 groups in Chexpert. Mimic bias decreased from 13 to 3. Emory saw no disparity change for No Finding.

### CONCLUSION

Our proposed technique produces comparable average AUC across the three datasets, with noticeable reductions in prediction disparities across groups.

### CLINICAL RELEVANCE/APPLICATION

We present a debiasing technique that reduces the effects of multiple confounding attributes without significantly degrading model performance.

## R2-SPIN-2 EVALUATION OF A LONGITUDINAL AI MODEL FOR AUTOMATIC REPORT GENERATION FROM CHEST X-RAYS

Joseph N. Stember, MD, PhD (*Abstract Co-Author*) Founder, Authera, LLC;Patent holder, Authera, LLC
Sarah Eskreis-Winkler, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Dipit Vasdev (*Abstract Co-Author*) Nothing to Disclose
Nathaniel Swinburne, MD (*Abstract Co-Author*) Nothing to Disclose
Chinmay Hegde (*Abstract Co-Author*) Nothing to Disclose
Etay Ziv, MD,PhD (*Abstract Co-Author*) Research Grant, Johnson & Johnson;Research Grant, Novartis AG
Krishna Nand Keshava Murthy, PhD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Automatic generation of medical reports has the potential to lighten the workload of radiologists, aid accurate and timely diagnosis, and lower reporting errors. While several AI models can generate reports from images, few account for patient longitudinal information. We train and evaluate an existing large scale multi-modal AI model that incorporates prior chest X-ray (CXR)/report to generate findings from CXRs.

### METHODS AND MATERIALS

CXR-report pairs from the MIMIC CXR data set were extracted excluding patients with single visits, resulting in 26625 unique patients. Ordered by study date, 94169 pairs of current and prior CXR-report samples from consecutive visits were extracted into training (26156 patients; 92374 samples), validation (203 patients; 737 samples), and test (266 patients; 2,058 samples) sets. The longitudinal MIMIC CXR model based on the transformer architecture with cross attention and memory based decoder was trained to take current CXR, previous CXR/findings as input and generate current findings as output. BLUE, METEOR, ROUGE and CIDEr metrics were used to evaluate generation performance. Results on the test set were compared against zero-shot inference on the well established Large Language and Vision Assistant (LLaVA), CXR LLaVA models which don't account for longitudinal information.

### RESULTS

The longitudinal model was superior to CXR LLaVA and LLaVA with 300% and 700% improvement in BLUE-4, 8% and 20% improvement in METEOR, 92% and 89% improvement in ROUGE, and 550% and 900% improvement in CIDE scores respectively. Interestingly, excluding previous visit-CXR and/or report during inference for current CXR resulted in only marginal decrease in scores (up to 1%), whereas using random text/image as input resulted in legible (though inaccurate) text across models.

### CONCLUSION

The longitudinal model performs better than zero-shot large vision-language models that ignore prior information. The surprising behavior with missing prior/random input highlights the need for elaborate testing and appropriate metrics to understand model failures critical for clinical consumption.

### CLINICAL RELEVANCE/APPLICATION

Demonstrating the importance of incorporating longitudinal information and the need for understanding failure modes of large generative AI models are necessary steps to show usefulness in the clinic.

## R2-SPIN-3 MULTILINGUAL CLINICAL INFORMATION EXTRACTION FOR CHEST CT SCANNING AND POSTPROCESSING WORKFLOW AUTOMATION

Monica O. Bernardo, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias F. Froelich, MD (*Abstract Co-Author*) Consultant, Smart Reporting GmbH;Consultant, Guerbet SA
Chelsea Dunning, PHD (*Abstract Co-Author*) Nothing to Disclose
George S.K. Fung, PhD (*Abstract Co-Author*) Employee, Siemens AG
Alexander Katzmann (*Abstract Co-Author*) Consultant, Siemens AG
Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Anjaneya K. Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Oliver Taubmann (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Michael Suhling, PhD (*Abstract Co-Author*) Employee, Siemens AG
Julian H. He, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Contreras Yametti, MD (*Abstract Co-Author*) Nothing to Disclose
Parisa Kaviani, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To validate multilingual clinical context-based chest CT scanning and postprocessing workflow automation ("protocol refinement") for simplifying exam workflow and obtaining patient-tailored suggestions for improving the quality and consistency of results.

### METHODS AND MATERIALS

We built and tested a prototype (Siemens Healthineers) based on 376 rules/guidelines that takes clinical context in natural language (reasons for ordering CT and prior CT reports) to extract relevant information for selecting the best scan protocol, acquisition and reconstruction factors, and auto-image-processing with multiple AI models. We used an LLM (GPT-4) to extract and structure input information from multilingual clinical contexts in English, German, Persian, Spanish, Portuguese, and Mandarin Chinese from 214 chest CTs representing multiple scan protocols. The reports were split into development (n=49) and validation datasets (n=165). The system was developed using the English development dataset. Notably, no adaptations were made for other languages; the LLM prompts remained in English and contained no instructions that acknowledge other languages. The prototype outputs were compared to ground truth by one radiologist and one CT technologist. We estimated accuracy, precision, and recall (as applicable) for all languages and workflow steps.

### RESULTS

For English, the prototype had 91.5% accuracy (151/165), 95.2% (157/165), 93.9% (155/165) and 86.7% (143/165) for selecting the scan protocol, windowing, scan range, and image reformations. The corresponding values for other languages were 90.9%, 95.2%, 93.3%, 78.8% (German), 77.0%, 87.3%, 78.2%, 78.2% (Persian), 89.7%, 95.2%, 90.3%, 82.4% (Spanish), 89.7%, 95.2%, 92.1%, 84.2% (Portuguese), and 89.1%, 95.2%, 91.5%, 85.5% (Mandarin). The observed precision and recall for downstream AI tasks were 75.5%/76.4% (English), 76.0%/76.3% (German), 72.6%/75.7% (Persian), 75.4%/76.0% (Spanish), 75.3%/76.4% (Portuguese), and 74.8%/76.5% (Mandarin).

### CONCLUSION

Our multilingual clinical context-based scanning and postprocessing workflow automation prototype can automate the selection of scan protocol, acquisition and reconstruction factors, and postprocessing.

### CLINICAL RELEVANCE/APPLICATION

Multilingual rule-based solutions with LLMs can extend benefits of automation beyond the English-speaking world, potentially with negligible localization efforts for well-represented languages.

## R2-SPIN-4 DEVELOPMENT OF AN ARTIFICIAL INTELLIGENCE MODEL FOR PREDICTING ANESTHESIA REQUIREMENTS IN PEDIATRIC MAGNETIC RESONANCE IMAGING PROCEDURES

Claudio Silva, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Ricardo Castillo (*Abstract Co-Author*) Nothing to Disclose

Gonzalo Araya, MSc, MBA (*Abstract Co-Author*) Nothing to Disclose
Maria Victoria Rojas (*Presenter*) Nothing to Disclose

**PURPOSE**

Performing MRIs without anesthesia is challenging for children up to 8 years old due to the need for stillness and other complicating factors. Currently, pediatric patients at our institution are scheduled without anesthesia based on experiential criteria, leading to uncertainties and potential rescheduling. Our research aims to develop an AI model to predict anesthesia needs for patients from infancy to 8 years old.

**METHODS AND MATERIALS**

The methodology utilized for this project was: 1.- Data Preparation 2.-Variable SelectionC3.- Initial Model Building, various machine learning models were evaluated (logistic regression, decision trees, and random forests, among others)4.- Model Optimization5.- Evaluation of the Optimized ModelThe materials that were used, they were as follows: • Database built from our institution's Agfa Healthcare PACS.• Python programming language.• Google Colab to be able to write the code • Power BI for data visualization.

**RESULTS**

The research utilized a database of 304 pediatric patients aged 0 to 10, spanning from 2018 to 2021, with 13 variables. Key analyses identified AGE, FASTING, COMPANION, PROTOCOL, CONTRAST MEDIA (MDC), PAIN, DIAGNOSTIC HYPOTHESIS, and ORIGIN as critical predictors for anesthesia needs in MRI procedures. Patients older than 8, typically not requiring anesthesia, were excluded to prevent model bias, leaving 155 for training. The Random Forest model, selected for its superior performance with an accuracy of 93.75%, underwent hyperparameter optimization. It notably excelled with an AUC of 0.987, demonstrating excellent discriminatory power. Key influential variables included Fasting, Companion, Use of contrast medium, and Age.

**CONCLUSION**

Following a comprehensive data science approach, we developed an AI-based predictive model to forecast anesthesia use in pediatric patients up to 8 years old. The optimized Random Forest model emerged as the top performer, achieving 94% accuracy. It offers balanced precision and recall, excels in managing imbalanced classes, and is robust against overfitting. Key influential variables identified include Fasting, Companion, Use of contrast medium, and Age.

**CLINICAL RELEVANCE/APPLICATION**

The study's importance is demonstrated by the predictive model's utility in optimizing MRI exam scheduling, reducing pediatric patient stress by forecasting anesthesia needs, enhancing resource use, and improving model robustness with ongoing data training.

## R2-SPIN-5 PATIENT-FRIENDLY OR POTENTIALLY MISLEADING? QUALITATIVE AND QUANTITATIVE EVALUATIONS OF LLM-GENERATED SUMMARY FOR RADIOLOGY REPORT IMPRESSIONS

Brian A. Xavier, MD (*Abstract Co-Author*) Nothing to Disclose
Samer Albahra (*Abstract Co-Author*) Nothing to Disclose
Michael A. Bergen, MD (*Abstract Co-Author*) Nothing to Disclose
Scott Robertson (*Abstract Co-Author*) Nothing to Disclose
Allan B. Chiunda, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Chintan Shah, MD, MS (*Abstract Co-Author*) Spouse, Employee, Merck & Co, Inc
Po-Hao Chen, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Nancy A. Obuchowski, PhD, MS (*Abstract Co-Author*) Research Consultant, Siemens AG;Research Consultant, IBM Corporation;Research Consultant, Elucid Bioimaging Inc;Research Consultant, Takeda Pharmaceutical Company Limited
Namita S. Gandhi, MD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

1. To evaluate patient-friendly large language model (LLM) generated summary of radiology report impressions, for clarity, missing information, and hallucinations. 2. To evaluate the potential of using calculated metrics as a scalable replacement for human expert evaluation for radiology reports

**METHODS AND MATERIALS**

Single-institution, multi-site, retrospective study of 401 consecutive CT abdomen report impressions. WizardLM, a LLM based on the LLaMA 2 architecture with 70 billion parameters in 8-bit quantization, was instructed to generate a summary of the report impression at grade 8 reading level. Radiologists evaluated the report impression for complexity, the LLM-generated summary for clarity, missing information, and hallucinations. Content similarity scores like BERT Scores, Recall-Oriented Understudy for Gisting Evaluation (ROGUE), and Bilingual Evaluation Understudy (BLEU) were calculated.Spearman's rank correlation coefficients were used to assess correlation between complexity of the impression and LLM clarity and to assess correlation between LLM clarity and BERT scores, ROUGE, and BLEU. Logistic regression models were used to test for complexity of the interpretation as a predictor of LLM missing information and hallucinations at a significance level of 0.05Paired t-tests were used to compare Flesch Kincaid (FK) grade level and reading ease scores of LLM summaries with the original reports.

**RESULTS**

LLM provided a clear impression summary in 81%. The LLM summaries were missing key information in 3.5%, hallucinations were present in 10%. 1.3% of summaries were both missing information and contained hallucinations. There was no significant association between report complexity and clarity or hallucinations, but there was an association between complexity and missing key information (low scores :1%, high scores: 6.3%; p=0.004). There was a significant reduction in grade level ($p<0.001$) and a significant increase in reading ease ($p<0.001$) for the LLM summaries.LLM clarity score was not significantly associated with BERT Scores: Cosine Similarity ($r=0.07$, $p=0.168$), F1 ($r=0.09$, $p=0.071$), P ($r=0.02$, $p=0.629$, R($r=0.09$, $p=0.059$) nor with BLEU ($r=0.05$, $p=0.309$) or ROUGE ($r=0.08$, $p=0.133$).

**CONCLUSION**

LLM-generated summary is clear in the majority and provides improved reading ease and lower grade level of readability. However, in a minority of reports it misses key findings and introduces hallucinations. None of the calculated summarization metrics could replicate the results of human expert-assigned quality score.

**CLINICAL RELEVANCE/APPLICATION**

LLM generated reports can be significantly easier for patients to comprehend, but a human-in-the-loop workflow may be necessary to avoid inaccuracies.

## R2-SPIN-6 LEVERAGING LARGE LANGUAGE MODELS FOR AUTOMATIC CALCULATION OF O-RADS RISK STRATIFICATION SCORE FROM MRI REPORTS

Satheesh Krishna, MD (*Abstract Co-Author*) Nothing to Disclose
Masoom A. Haider, MD (*Abstract Co-Author*) Nothing to Disclose
Ankush Jajodia, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Tanya P. Chawla, MBBS (*Abstract Co-Author*) Nothing to Disclose
Genevieve Bouchard-Fortier (*Abstract Co-Author*) Nothing to Disclose
Yangqing Deng (*Abstract Co-Author*) Nothing to Disclose
Rajesh Bhayana, MD, FRCPC (*Presenter*) Nothing to Disclose

**PURPOSE**

O-RADS MRI helps facilitate management by stratifying malignancy risk and improving communication. But radiologist adoption is inconsistent. The purpose of this study was to evaluate large language models (LLMs) for automatically calculating O-RADS MRI scores from existing report descriptions.

**METHODS AND MATERIALS**

In this IRB-approved retrospective study, 144 consecutive gadolinium-enhanced MRI pelvis reports from July 2021 to October 2023 with at least one assigned MRI O-RADS score were included (189 masses). 10 random reports (16 masses) were used to create the applications, leaving 134 reports (173 lesions with 158 O-RADS assigned; test set 1). Since reports with O-RADS scores more likely use standard O-RADS descriptors, 140 additional consecutive reports (183 masses) from January 2018 to October 2019, before O-RADS MRI was established, were used for additional validation (test set 2). Reference standard O-RADS scores were determined by two radiologists interpreting reports after scores were redacted, with disagreements handled by an O-RADS expert radiologist. Two Auto-O-RADS application strategies were evaluated. The first involved few-shot learning with GPT-4 (version 0613), instructed to categorize masses using provided O-RADS MRI rules ("LLM-Only"). The second was a hybrid strategy that leveraged GPT-4 to classify key features (i.e. solid enhancing tissue, etc), and then applied a deterministic formula to calculate the score ("Hybrid"). Performance of each application was evaluated compared to the reference standard.

**RESULTS**

Of the 173 masses (test set 1), 40.5% were O-RADS 1/2 (n=70), 30.1% O-RADS 3 (n=52), and 29.5% O-RADS 4/5 (n=51) according to reference standard. For assigning O-RADS MRI scores, the Hybrid model (97%, 168 of 173) outperformed LLM-only (90%, 155 of 173; p=0.006). For lesions with an O-RADS score in the original report, the Hybrid model's accuracy exceeded the reporting radiologist (97 vs 88%, 153 and 139 of 158, p=0.004). For reports issued prior to O-RADS MRI implementation (test set 2), the hybrid model outperformed the LLM-only model (93 vs 86%, 170 and 158 of 183; p=0.04). Hybrid model performance was not different on reports prior to and after O-RADS implementation (93 vs 97%, p=0.12).

**CONCLUSION**

A hybrid LLM-based application, fusing LLM feature classification with deterministic elements, enabled high accuracy for calculating O-RADS MRI scores from report descriptions, exceeding an LLM-only strategy and the reporting radiologist in accuracy.

**CLINICAL RELEVANCE/APPLICATION**

Accurate automated calculation of O-RADS MRI scores from report descriptions could widely increase adoption of O-RADS MRI and improve the accuracy of assigned scores.

## R2-SPIN-7 AI DRIVEN SCREENING MAMMOGRAPHY OUTREACH PROGRAM IMPROVES 15-MONTH COMPLIANCE AND REDUCES THE GAP FOR UNDERSERVED POPULATIONS

Rishi Deshpande, BEng, MS (*Abstract Co-Author*) Nothing to Disclose
Aasim Ansari (*Abstract Co-Author*) Nothing to Disclose
Vaibhav Mathur (*Abstract Co-Author*) Nothing to Disclose
Hemlata Malav (*Presenter*) Nothing to Disclose

**PURPOSE**

Breast cancer screening provides early detection and more favorable outcomes only with compliance to regular screening intervals as guidelines recommend. Lack of compliance is more common in underserved populations, leading to delayed diagnosis, poorer outcomes and greater health disparities. The goal of this work is to study if an AI-based targeted outreach program can significantly increase compliance rates of breast cancer screening and reduce the historical gap between the majority and underserved populations.

**METHODS AND MATERIALS**

An AI driven outreach program for patients to schedule screening mammograms was started in Oct 2019 at 272 imaging clinics. The program determines outreach cadence based on an AI-generated score and conducts outreach over 3 months via multiple channels (e.g. text, voice call, or voicemail), starting 2 weeks before the annual mammogram due date. Data was collected from 6,629,027 patients (White 43.7%, Black/African American 23.2%, Asian 5.9%, Hispanic 12%, Others 15.2%) (<51yo 25.6%, 51-60yo 30.7%, 61-70yo 27.0%, >71yo 16.6%) over 9,185,808 visits before and after the outreach program (from Oct 2015 to Sept 2023). The compliance rate was calculated by determining the % of patients that returned for another mammogram within 15 months of their previous screening mammogram.

**RESULTS**

For the entire patient base we observed 8.0% increase in compliance over 4 years compared to the year before outreach started, with a particularly large increase in Black/African American women and younger age groups. Historically there had been a gap of 6.6% between White and Black/African American in the compliance which was brought down to 2.4% by the outreach program. Compliance was significantly improved across race (Black/African American +11.9%; Hispanic +4.9%; Asian +7.7%; White +7.7%; p<0.001) and age (<50yo +9.9%; 51-60yo +8.5%; 61-70yo +7.1%; >71yo +4.9%; p=0.002). The largest increase in compliance was seen among Black patients less than 60 years old (+13.3%; p=0.008), who are at particularly high risk for poor outcome and have multiple known barriers to screening attendance as compared to the white population.

**CONCLUSION**

Our study demonstrated a significant increase in compliance with an AI-based outreach program that reduced the health disparities across patient groups. The largest improvements were noted in groups who traditionally have lower compliance rates at screening such as Black women under 60.

**CLINICAL RELEVANCE/APPLICATION**

Increased compliance rate increases the chances of catching cancer at an early stage. This study demonstrated that an outreach program can be used to sustainably increase screening mammography rates, including in underserved populations, and may be a useful tool in reducing health disparities.

# Abstract Archives of the RSNA, 2024

R2-SPIR

**Interventional Radiology Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPIR-1 ROLE OF PERCUTANEOUS TRANSHEPATIC CHOLECYSTO CHOLANGIOGRAPHY (PTCC) IN PRE OPERATIVE EVALUATION OF INFANTS WITH SUSPECTED EXTRAHEPATIC BILIARY ATRESIA (EHBA)

Kushaljit S. Sodhi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Anmol Bhatia, MD (*Abstract Co-Author*) Nothing to Disclose
Vivek Garg (*Abstract Co-Author*) Nothing to Disclose
Sadhna Lal (*Abstract Co-Author*) Nothing to Disclose
Ravi Kanojia, MBBS (*Abstract Co-Author*) Nothing to Disclose
Akshay K. Saxena, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the role of percutaneous transhepatic cholecysto cholangiography (PTCC) in pre operative evaluation of infants with suspected extrahepatic biliary atresia (EHBA)

### METHODS AND MATERIALS

This was an ethics committee approved prospective study conducted in a tertiary care level teaching hospital. 22 infants with suspected EHBA were enrolled in the study after obtaining informed written consent from the parent/guardian. The children were excluded if there was refusal of consent, coagulopathy or non visualization of gallbladder on diagnostic sonography even after 4 hours fasting. PTCC was performed under ultrasound guidance by a consultant having more than 5 years of experience in Pediatric Interventional Radiology procedures. The diagnosis of EHBA was considered as excluded if there was opacification of right and left hepatic ducts, common hepatic duct and common bile duct with passage of contrast into the duodenum. In remaining patients PTCC was considered suggestive of EHBA and patient was subjected to intraoperative cholangiogram (IOC).

### RESULTS

PTCC was attempted in 21/22 patients where gall bladder was visualized and was technically successful in 20/21 patients. The mean age for performing PTCC in our study was 71.47 days ±17.06 days (range 40 days to 103 days). Diagnosis of EHBA was excluded in 2/20 patients which avoided negative laparotomy in these cases. Amongst the 18/20 patients where PTCC was suggestive of EHBA, a successful IOC was performed in 13 patients. The mean gap between the PTCC and IOC was 3.85days ± 2.48 days (range 0 days to 8 days). PTCC had sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) of 100%, 50%, 86.6% and 100% respectively in our study. Mild peritoneal leak of contrast was seen during PTCC in 7/20 (35%) patients. None of these patients had any hemodynamic instability after the PTCC procedure. The mean duration of hospital stay before confirmation (or exclusion) of diagnosis of EHBA in our study was 8.63 days ±3.99 days (range 2 to 17 days).

### CONCLUSION

PTCC is a minimally invasive simple procedure with a low rate of technical failure and haemodynamically significant complications. It can be performed successfully even in small babies. It can bring down the rates of negative laparotomies in patients suspected to have EHBA. However, the diagnosis of EHBA at PTCC is not infallible and IOC should continue as the gold standard investigation for the diagnosis of EHBA.

### CLINICAL RELEVANCE/APPLICATION

Pre operative PTCC is a safe minimally invasive radiological tool for establishing, or excluding, diagnosis of EHBA with potential for reducing the frequency of negative laparotomies.

## R2-SPIR-2 INITIAL EXPERIENCE WITH CT-GUIDED LOCALIZATION OF ENDOPHYTIC RENAL MASSES USING ADJACENT MICROCOIL IMPLANTATION PRIOR TO LAPAROSCOPIC PARTIAL NEPHRECTOMY: A FEASIBILITY AND DESCRIPTIVE STUDY

Tianhao Su, MD (*Abstract Co-Author*) Nothing to Disclose
Jin Long (*Abstract Co-Author*) Nothing to Disclose
Zhiyuan Zhang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To describe and assess computer tomography (CT)-guided percutaneous microcoil localization for guiding laparoscopic partial nephrectomy (LPN) for the treatment of totally endophytic renal masses.

### METHODS AND MATERIALS

Eleven patients with totally endophytic renal tumors were retrospectively enrolled from March 2021 to March 2023. Microcoils were placed next to the renal masses under CT guidance prior to LPN. The head of the microcoil was pinpointed adjacent to the target endophytic renal mass, and its end tail remained outside the renal surface. The outcomes assessed included the localization success rate, operative time, margin status, and complications.

### RESULTS

Eleven patients(57.0 [43.0, 64.0] years, 7males) with eleven lesions were included. Percutaneous microcoil localization was successful for eleven (11/11, 100.0%) lesions within 1 cm of the masses without dislodgement. The median duration of the preoperative CT-guided microcoil localization procedure was 30 [23.0, 37.0] minutes, and no major or minor complications related to the procedure were observed. The median time interval between CT-guided microcoil insertion and the initiation of the surgical procedure was 17.0 [15.0, 19.0] hours. All patients had negative surgical margins, with no intraoperative complications. At discharge, the median decrease in Hgb was 1.1 g/dl. No recurrences were observed at the 1-year follow-up. The median percent decrease in the eGFR at discharge was 13% (5-31%), and the 1-year decrease in the eGFR was 11.9% (1.0-19.1%).

### CONCLUSION

Percutaneous microcoil localization is a viable and safe technique for the precise localization of totally endophytic renal masses, facilitating LPN without the need for intraoperative imaging.

### CLINICAL RELEVANCE/APPLICATION

The management of completely endophytic renal tumors presents a notably intricate challenge. These tumors evade direct observation or palpation from the kidney's surface, rendering accurate localization primarily reliant on preoperative imaging. We recently introduced a novel method for precise preoperative localization of completely endophytic renal tumors prior to partial nephrectomy. This method addresses the limitations associated with previous percutaneous hookwire localization of abdominal masses. Localization with the microcoil is applicable not only for laparoscopic partial nephrectomy but also for robot-assisted partial nephrectomy. By employing CT-guided microcoil localization for the preoperative marking of completely endophytic renal tumors, we can achieve precise and expeditious tumor excision during laparoscopic partial nephrectomy, as evidenced by our preliminary results.

## R2-SPIR-3 DEFINING THE IDEAL PATIENT EXPERIENCE IN INTERVENTIONAL RADIOLOGY: EXPLORING INFLUENTIAL FACTORS FOR HIGH PATIENT SATISFACTION SCORES

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Esha Chadha, BA (*Presenter*) Nothing to Disclose

### PURPOSE

The focus on patient satisfaction has increased, leading to more use of online platforms for rating doctor experiences. These platforms provide insights into a physician’s care quality, including interventional radiologists, capturing positive and negative feedback. The purpose of this study was to evaluate study patients' online feedback about interventional radiologists, seeking insights into factors shaping patient experiences and satisfaction.

### METHODS AND MATERIALS

Patient satisfaction data on 300 randomly selected interventional radiologists from the Society of Interventional Radiology (SIR) website listing were examined. Public online patient satisfaction repositories utilized included US Health News, Share Care, Vitals, WebMD, and Google Reviews. Variables including rating, wait time, insurances accepted, patient satisfaction, cultural competency, procedural outcomes, and physician demographics were analyzed. Additional data on dissatisfaction reasons, such as procedural outcomes, bedside manner, and patient education, were collected for physicians rated below 5 stars.

### RESULTS

The study analyzed 1964 five-star reviews. Procedural patients accounted for 52% (2061), while nonprocedural patients contributed 48% (1903). Conversely, 139 less than five-star reviews encompassed 241 negative comments, with procedural patients providing 72% (174) and nonprocedural patients 28% (63). A chi-square test ($?^2 = 204.09$, $df = 1$, $p < 0.001$) revealed a significant association, indicating that patient type, whether procedural or nonprocedural, affects review ratings. Positive clinical comments mainly focused on medical explanations, while negative feedback often highlighted procedural outcomes (78%) and inadequate patient education (13%). Positive nonclinical remarks lauded good bedside manner (82%) and culturally sensitive care (78%), while negative comments frequently criticized poor bedside manner (92%) and long wait times (59%).

### CONCLUSION

Physicians excelling in communication, positive outcomes, and cultural competence receive high patient ratings. Conversely, shortcomings in procedural outcomes, patient education, and bedside manner contribute to negative feedback. Addressing these aspects can enhance patient experience and overall healthcare quality in Interventional Radiology.

### CLINICAL RELEVANCE/APPLICATION

In the setting of limited patient satisfaction data in Interventional Radiology, this work investigated predictors of high patient satisfaction scores to provide insights for interventionalists for optimal healthcare delivery.

## R2-SPIR-4 COMPUTED TOMOGRAPHY ASSESSMENT WITH TOTAL ABDOMINAL MUSCLES IN OUTCOMES OF PATIENTS WITH INTERMEDIATE TO ADVANCED HEPATOCELLULAR CARCINOMA UNDERGOING HEPATIC ARTERIAL INFUSION CHEMOTHERAPY

Chih-Horng Wu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jing-Wei Kang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In patients with liver cirrhosis and hepatocellular carcinoma (HCC), sarcopenia has been demonstrated as an independent predictor for poor prognosis. Computed tomography (CT)-based evaluation of sarcopenia provides a standardized method to assess abdominal skeletal muscle. Among total abdominal muscle (TAM), psoas muscle (PM) and paraspinal muscle (PS), which is an index muscle for sarcopenia remains unclear. Therefore, we investigated whether CT-based sarcopenia can serve as a prognostic factor for patients with intermediate to advanced HCC after hepatic arterial infusion chemotherapy (HAIC).

### METHODS AND MATERIALS

In this retrospective study, we enrolled patients who underwent HAIC for intermediate to advanced stage HCC between January 2012 and December 2019. Before HAIC treatment, the TAM, PM, and PS areas were evaluated using a single CT slice at the level of third lumbar vertebra. Sarcopenia was determined using the TAM, PS, PM indices divided by the square of the body height. Finally, we analyzed each muscle-defined sarcopenia to decide whether it can serve as a prognostic factor for overall survival (OS) in patients who underwent HAIC.

### RESULTS

We analyzed 75 (65 men and 10 women) patients with intermediate to advanced HCC and all patients underwent HAIC treatment. All types of muscle areas (TAM, PM, and PS) of men were significantly higher than those of women (all $p<0.001$). The patients with TAM-defined sarcopenia had significantly poorer OS than those without sarcopenia (median OS 14.4 vs. 8.6 months, $p=0.038$). There was no significantly difference in OS between sarcopenia and non-sarcopenia groups when defined by the PM or PS. In multivariate analysis, TAM-defined sarcopenia remained an independent predictor for the poor OS after adjustment for up-to-11 criteria, main portal vein thrombosis, treatment response.

### CONCLUSION

CT-based sarcopenia defined by TAM can be an independent prognostic factor for the poor prognosis of intermediate to advanced HCC after HAIC treatment.

### CLINICAL RELEVANCE/APPLICATION

Cancer related cachexia has been associated with poor cancer prognosis, but the diagnosis of cachexia is complicated. Sarcopenia can be measured easily by using CT scan, which is a common diagnostic tool for HCC and routinely used for cancer staging. Previous studies showed that sarcopenia was associated with postoperative complications, longer hospital stays, and poorer prognosis after liver transplantation, resection and radioembolization. Therefore, identifying patients with sarcopenia before HAIC is crucial. Further studies should investigate whether perioperative nutritional therapy and strength training to increase muscle mass can increase survival in patients undergoing HAIC treatment.

## R2-SPIR-6 A VIRTUAL REALITY-BASED INTERVENTIONAL RADIOLOGY SIMULATOR: ITS USEFULNESS FOR TEACHING MEDICAL STUDENTS

Toru Higaki, PhD (*Abstract Co-Author*) Nothing to Disclose
Keigo Chosa (*Abstract Co-Author*) Nothing to Disclose
Keigo Narita (*Abstract Co-Author*) Nothing to Disclose
Shogo Maeda, MD (*Abstract Co-Author*) Nothing to Disclose
Yuko Nakamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Wataru Fukumoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fuminari Tatsugami, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Chihiro Tani, MD (*Abstract Co-Author*) Nothing to Disclose
Hidenori Mitani (*Abstract Co-Author*) Nothing to Disclose
Shota Kondo (*Abstract Co-Author*) Nothing to Disclose
Haruka Higashibori (*Abstract Co-Author*) Nothing to Disclose
Ikuo Kawashita, PhD (*Abstract Co-Author*) Nothing to Disclose
Yukiko Honda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mana Ishibashi (*Abstract Co-Author*) Nothing to Disclose
Ryo Higashino (*Abstract Co-Author*) Nothing to Disclose
Shintaro Morishita (*Presenter*) Nothing to Disclose

### PURPOSE

To teach interventional radiology (IR) procedures to medical students or residents, we first train them on our IR simulator using a virtual reality system (VR-IR). We examined the effectiveness of this teaching method.

### METHODS AND MATERIALS

Ninety-nine fifth-year medical students who trained IR treatment for hepatocellular carcinoma transarterial chemoembolization in a 120-minute class from April 2022 to March 2023 were included in this study. We randomly divided them into a VR-IR simulator group (55 students) and a conventional classroom lecture group (44 students). Two students were subsequently excluded from the simulator group due to illness or equipment failure. After the VR-IR simulator or the lecture, the VIST® G5 (image-guided augmented rearity [AR-IR] simulator, Mentice, Gothenburg, Sweden) was used as a simulated patient. The total procedure time, amount of contrast media, fluoroscopic time, and patient peak skin dose for each group of the simulated patients using VIST® G5, were compared. An interventional radiologist also evaluated technical achievement level of students.The interventional radiologist evaluated items related to the procedure technique, each item were rated on a 1-5 (Likert scale), with a total score of 50 points. Results are shown as median [25% / 75% interquartile range] and statistical test to investigate difference between the 2 groups were performed using the Mann-Whitney's U test.

### RESULTS

The results of VR-IR simulator group and conventional group were total procedure time: 13.5 [11.8/14.5] vs.14.3 [12.3/16.8] minutes ($p = 0.11$), amount of contrast media : 28.0 [21.0/36.2] vs. 40.0 [32.3/50.9] mL ($p < 0.01$), fluoroscopic time: 10.1 [8.5/13.0] vs. 11.0 [8.6/13.7] minutes ($p = 0.31$), patient peak skin dose: 276 [243/373] vs. 303 [239/395] mGy ($p = 0.57$), and technical achievement score: 36 [34/44] vs. 31 [29/32] ($p < 0.01$), respectively. There was a significant difference between the two groups for amount of contrast media and evaluation technical score by IR specialists

### CONCLUSION

VR-IR simulator could reduce amount of contrast media in interventional procedures and improve technical achievement score of students. VR-IR simulator may contribute to the improvement education of interventional radiology procedures for medical students.

### CLINICAL RELEVANCE/APPLICATION

Our virtual reality-based simulator can be effective in education of interventional radiology procedures for medical students.

## R2-SPIR-7 ENHANCED VISUALIZATION OF VASCULAR STENT FRACTURE: A COMPARATIVE PHANTOM STUDY ON PHOTON COUNTING AND CONVENTIONAL CT

Reinoud Bokkers (*Abstract Co-Author*) Nothing to Disclose
Yiheng Tan (*Abstract Co-Author*) Nothing to Disclose
Marcel Greuter, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Vascular stents are widely used in endovascular therapy to treat both stenotic and dilating vascular diseases. Stent fractures are associated with adverse events such as stenosis and thrombosis but are difficult to detect. Photon counting computed tomography (PCCT) is a new technology that enables higher spatial resolution compared to conventional CT (CCT), energy resolved imaging and spectral post-processing. The aim of this study was to assess the visibility of vascular stent fractures on PCCT in comparison to CCT.

**METHODS AND MATERIALS**

In an abdominal phantom (QRM-20118) a total of 5 BeGraft peripheral balloon-expandable covered stents (Bentley InnoMed GmbH, Hechingen, Germany) with diameters of 7 mm were utilized. Scans were made on PCCT (Naeotom Alpha, Siemens Healthineers) in standard-resolution (SR) and ultra-high-resolution (UHR) mode. Two CCT scanners were used for comparison (Somatom AS and Force, Siemens Healthineers). Acquisition parameters were based on clinical abdominal CTA protocols. All images were reconstructed using median kernel. In addition, sharp kernel was used in PCCT. Five vascular stents were sequentially fractured from Type 1 to Type 4 and scanned individually (Type1: single strut fracture; Type2: multiple single fractures; Type3: complete transverse linear fracture without stent displacement; Type4: complete transverse linear fracture with stent displacement). Quantitative assessment was performed with an automatic algorithm on strut sharpness, blooming, and noise.

**RESULTS**

PCCT showed smaller blooming and better overall image quality than CCT. Type 1 and 2 fractures can be detected better on PCCT in UHR than in SR mode. Strut sharpness was significantly higher on PCCT UHR mode (?HU 4505±166) and SR mode (?HU 3009±140). Blooming and noise were significantly lower in PCCT UHR mode than on CCT. PCCT SR mode showed significantly less noise than CCT (all $p<0.01$), and smaller blooming than Force (0.39±0.01 to 0.43±0.01, $p<0.01$). On PCCT strut sharpness was significantly higher, and blooming was significantly lower with Br72 kernel than Br56 (all $p<0.05$). Noise was significantly higher with Br72 kernel in both resolution modes (all $p<0.01$). Br72 kernel improved fracture visibility in PCCT UHR mode but reduced in SR mode.

**CONCLUSION**

PCCT can visualize single-strut stent fractures that remain undetectable by CCT. Utilizing UHR mode and sharp kernel in PCCT further enhances the visibility of fractures. Additionally, PCCT offers significant improvement in strut sharpness, reduced blooming, and noise.

**CLINICAL RELEVANCE/APPLICATION**

PCCT can improve follow-up imaging capabilities for patients with post-endovascular therapy, enabling to distinguish clinically relevant stent fractures that need reintervention.

## R2-SPIR-8 REDUCTION OF RADIATION DOSE AND CONTRAST MEDIUM IN CATHETER-BASED INTERVENTIONS OF PERIPHERAL ARTERY DISEASE USING DIGITAL VARIANCE ANGIOGRAPHY

Thomas Zeller (*Abstract Co-Author*) Consultant, sanofi-aventis Group;Speaker, sanofi-aventis Group;Consultant, C.R. Bard;Speaker, C.R. Bard;Consultant, Johnson & Johnson;Speaker, Johnson & Johnson;Consultant, ev3 Inc;Speaker, ev3 Inc;Consultant, Boston Scientific Corporation;Speaker, Boston Scientific Corporation;Consultant, Straub Medical AG;Speaker, Straub Medical AG;Consultant, Invatec srl;Speaker, Invatec srl;Consultant, BIOTRONIK GmbH & Co KG;Speaker, BIOTRONIK GmbH & Co KG;Consultant, OptiMed Technologies, Inc;Speaker, OptiMed Technologies, Inc;Consultant, Edwards Lifesciences Corporation;Speaker, Edwards Lifesciences Corporation;Research grant, Cook Group Incorporated;Research grant, KRAUTH Medical KG GmbH & Co;Research grant, Pathway Medical Technologies, Inc;Research grant, Abbott Laboratories
Thomas Stein (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Christopher L. Schlett, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Dr. Elias Noory (*Abstract Co-Author*) Nothing to Disclose
Till Schurmann (*Presenter*) Nothing to Disclose

**PURPOSE**

Digital variance angiography (DVA) represents a pioneering image processing technique, which exhibits promising prospects in the reduction of radiation exposure and iodinated contrast medium (ICM) of digital subtraction angiography (DSA). This study aimed to determine the reduction in both radiation dose and ICM concentration in different regions of lower limb interventions.

**METHODS AND MATERIALS**

A software prototype for DVA (Kinepict Health Ltd., Budapest, Hungary) was utilized for patients undergoing percutaneous transluminal angioplasty (PTA). DSA normal dose (DSA-ND) protocols were revised from 1.20 µGy/frame and 0.81 µGy/frame to DVA low dose (DVA-LD) protocols with 0.36 µGy/frame and occasionally 0.24 µGy/frame based on specific examination requirements. In parallel, ICM concentration was systematically reduced by 80%. The cumulative dose area product (DAP) was evaluated retrospectively. Contrast-to-noise ratio (CNR) was measured pairwise for summated DVA-LD acquisitions and compared to DSA-LD at the subjective highest contrast for each individual image of the DSA series. CNR was calculated by defined ROIs on vessels and background, which were equally distributed from large (>3mm ?) to small vessels (<1mm ?).

**RESULTS**

Evaluation included 370 DSA-ND and 62 DVA-LD interventions of three lower limb regions (mean age: 72.8±10.9 years, 66.9% male). DVA-LD reduced DAP of DSA-ND significantly by 62.0%, 53.8%, and 59.4%, respectively. DAP decreased from 3238.6 [962.5-27538.8] to 1230.4 [528.9-11.675.4] cGy·cm² in pelvic regions ($p<0.005$), from 1190.9 [226.8-10393.7] to 550.8 [97.5-3739.1] cGy·cm² in femoral and popliteal regions ($p<0.0001$), and from 827.6 [197.5-4091.1] to 336.0 [69.8-1013.9] cGy·cm² in cruro-pedal regions ($p<0.0005$). With a total of 1644 ROIs in 66 acquisitions for CNR measurements, DVA-LD images exhibited enhanced contrast and decreased noise compared to DSA-LD in all regions. CNR increased from 8.8 [1.5-32.6] to 14.4 [2.1-128.0] in pelvic regions ($p<0.0001$), from 6.9 [0.6-43.2] to 17.8 [1.8-134.7] in femoral and popliteal regions ($p<0.0001$), and from 7.8 [0.6-36.1] to 17.3 [2.0-152.4] in cruro-pedal regions ($p<0.0001$).

**CONCLUSION**

DVA reveals significant dose reduction in lower limb PTA when applying 20% ICM of the standard concentration and enhances image contrast while decreasing noise, thereby ensuring adequate clinical image quality.

## CLINICAL RELEVANCE/APPLICATION

DVA can significantly reduce (stochastic) health risks of radiation exposure for both patients and angiologists. Furthermore, drastic reduction of ICM decreases the risk of iodine-induced adverse effects for patients and enables interventions, which could not be conducted previously due to higher ICM concentrations.

# Abstract Archives of the RSNA, 2024

R2-SPMK

**Musculoskeletal Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPMK-1 IMPLEMENTATION OF A NEW CLASSIFICATION AND STRATIFICATION SYSTEM FOR SOLITARY BONE TUMOR: OSSEOUS TUMOR RADIOLOGICAL AND INTERPRETATION AND MANAGEMENT SYSTEM (OT-RIMS)

Lin Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Jiachun Zhuang (*Abstract Co-Author*) Nothing to Disclose
Yingyi Zhu (*Abstract Co-Author*) Nothing to Disclose
Haijun Wu, MD,PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Due to the abundance and relative rarity of histological subtypes of bone tumors, an accurate histological diagnosis of bone tumors must be interpreted by an experienced bone tumor pathologist in collaboration with a musculoskeletal radiologist and discussed in a multidisciplinary team. Even for radiologists, achieving a pathologically consistent diagnosis is still a challenging task for the radiographic heterogeneity and morphological overlap of bone tumors. Therefore, a new radiological classification system oriented by tumor biological behavior and patient management, OT-RIMS, has been proposed to streamline the radiological evaluation of bone tumors and consolidate key radiological features into ordinal severity categories that would inform corresponding patient management actions.

### METHODS AND MATERIALS

This retrospective study between January 2015 and August 2022 evaluated patients with solitary bone tumors confirmed by pathology and imaging follow-up received two or three imaging modalities of radiographs, CT, or MRI. Three radiologists independently assessed radiological features, categorized bone lesions based on OT-RIMS criteria, and reached a consensus. Kappa statistics and observed agreement were calculated.

### RESULTS

A total of 341 patients (mean age, 26.0 years;159 women) were included, with 102 malignant, 177 benign, and 62 intermediate or low-grade malignant bone lesions. Sensitivity and specificity of readers 1, 2, and 3, respectively, in the identification of malignant tumors into OT-RIMS 4 were 93.1% (95 of 102) and 93.3% (223 of 239), 96.1% (98 of 102) and 91.6% (219 of 239), 92.2% (94 of 102) and 89.5% (214 of 239). Inter-reader agreement of OT-RIMS category for three readers was considered excellent (Kendall's W=0.924, $p<0.001$) with a kappa value of reproducibility in categories 12, 3, and 4 of 0.764, 0.528, and 0.930, respectively.

### CONCLUSION

The OT-RIMS category demonstrated excellent reproducibility despite the reader's expertise level in categorizing the risk stratification of bone tumors and informing patient management, with histological grades used as the reference standard.

### CLINICAL RELEVANCE/APPLICATION

This study confirmed that OT-RIMS categories demonstrated excellent diagnostic performance and reproducibility regardless of the professional experience of readers in the classification of bone tumor risk stratification and informing patient management. This work could promote a more standardized and streamlined evaluation of bone tumors and standardize patient management.

## R2-SPMK-2 ON THE FEASIBILITY OF DETECTING SPINAL STENOSIS USING DEEP LEARNING IN RADIOGRAPHY

Joon-Yong Jung, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Changmin Ryu (*Abstract Co-Author*) Nothing to Disclose
Sungwon Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Keum San Chun, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Magnetic resonance imaging (MRI) is considered the gold standard for diagnosing spinal stenosis for its capabilities in obtaining detailed information at tissue level. However, MRI requires longer scanning times and incurs higher costs compared to radiography. This study aims to explore the feasibility of using deep learning (DL) to automatically detect spinal stenosis in radiographs. To this end, we trained and validated a DL model using radiographs and corresponding labels obtained from MRI images.

### METHODS AND MATERIALS

Radiography and MRI images from 4,075 patients across five independent hospitals in South Korea were collected to develop a DL model for detecting spinal stenosis. Each radiographic data included anteroposterior (AP) and lateral (LAT) view images. From these images, three image segments were extracted for each vertebral joint, covering the range from the twelfth thoracic vertebra (T12) to the first sacral vertebra (S1). The three segments, each

representing a vertebral joint in the AP view and the LAT view, and a foramen in the LAT view, are designed to comprehensively capture crucial information for spinal stenosis. Collectively, the three segments constituted a single sample, and a total of 17,621 samples were obtained. Each sample was assigned a binary value based on the diagnosis derived from the accompanying MRI image. Each of the three segment images was processed using contrast limited adaptive histogram equalization before being input to a pre-trained ResNet50 model. The intermediate outputs from each of the three ResNet50 models were then passed through a linear layer to generate the final probability of spinal stenosis. The overall performance was assessed using a 10-fold cross-validation (CV), with performance reported in positive predictive value (PPV), sensitivity, and F1 score.

**RESULTS**

From 10-fold CV, the PPV, sensitivity and F1 scores were 75%, 69% and 72%, respectively. And the area under the curve (AUC) for the receiver-operating curve (ROC) was 79%, and the AUC for the precision-recall curve was 78%.

**CONCLUSION**

This study offers initial findings on DL-based automated spinal stenosis detection. The evaluation of the preliminary model demonstrates encouraging outcomes, suggesting the potential of the DL model as a supportive tool in diagnosing spinal stenosis, albeit the need for improved classification performance before clinical deployment. With improved classification accuracy, we envision this algorithm serving as a valuable tool for rapid and precise spinal stenosis diagnosis.

**CLINICAL RELEVANCE/APPLICATION**

Automated detection of spinal stenosis in radiography using DL can improve the diagnostic speed and accuracy while lowering the medical cost.

## R2-SPMK-3 VASCULAR DAMAGE RISK ASSESSMENT IN LUMBAR PEDICLE SCREW FIXATION

Giovanni Ambrogi (*Abstract Co-Author*) Nothing to Disclose
Greta Recchia (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD (*Abstract Co-Author*) Nothing to Disclose
Stefano Perotti SR, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandro Napoli, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Valenti, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to evaluate the distribution of vessels running anterior to the lumbar spine with a distance <5 mm and >5 mm in front of the vertebral bodies from D12 to L5 to determine the risk of vessel damage in lumbar pedicle screw fixation.

**METHODS AND MATERIALS**

This is a single-center retrospective study. During January-August 2023, 60 random abdomen CT scans with contrast were evaluated by an experienced MSK radiologist. The upper third of the vertebral bodies were divided into 4 equal sections (in the axial plane: right lateral, right median, left median, left lateral). We classified the vessels into major vessels (aorta, inferior vena cava and common iliac artery/vein) and minor vessels (considering vessels that had a diameter >4mm) and assessed the number of vessels with a distance of less than 5 mm from the bony cortical (cut-off chosen to correspond to the screw pitch used in our center) and at rooms greater than 5 mm from the bony cortical. Patients with previous vertebral procedures or scoliosis (Cobb's angle >10) and patients with tumor lesions of the vertebral soma were excluded. There were 60 patients including 30 males (50%) and 30 females (50%) ranging in age from 75 years to ±10.58. Measurements were measured by orienting the plane according to the angle of the vertebral soma . The quadrants of the vertebral soma were chosen considering the position and angle of the screws that is usually chosen during surgery.

**RESULTS**

The risk of causing damage to a major vessel has a minimum-average probability risk (0-10%) in all sections except: the left lateral sections of D12 and left median of L2 that have a high probability risk (10-12%) for arteries and the right lateral sections of L3 to L5 and right median of L3 and L4 have a high probability risk (11-24%) for veins. The risk of causing damage to a minor vessel has a minimum-medium probability (0-7%) in all sections except L5, which has a high risk (11-17%) in all sections.

**CONCLUSION**

This study may help surgeons to predict the risk of hemorrhage due to vessel injury during fixation of screws that may go beyond the alterior cortical of the vertebral soma.

**CLINICAL RELEVANCE/APPLICATION**

This study may help surgeons predict the severity of the complication based on the type of vessel injured, whether major vessel or minor vessel, which is more likely to be found at a given level of the lumbar spine and in a given quadrant of the vertebral soma undergoing surgical treatment.

## R2-SPMK-4 PREDICTION OF PATHOLOGICAL RESPONSE AND PROGNOSIS IN PATIENTS WITH BONE SARCOMA WHO RECEIVED NEOADJUVANT CHEMOTHERAPY USING IMAGING-BASED TISSUE ANALYSIS METHOD

Meltem Kursun, MD (*Abstract Co-Author*) Nothing to Disclose
Onur Bugdayci, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The aim of our study is to reveal the correlation between the pathological response after neoadjuvant chemotherapy (NACT) and MRI-based texture analysis method in primary bone sarcomas and to evaluate of this method in predicting overall-disease free survival.

**METHODS AND MATERIALS**

Our study included 116 patients who were diagnosed with Osteosarcoma or Ewing sarcoma after trucut biopsy and were operated after NACT. Treatment response was evaluated in four groups based on the postoperative pathology specimens.T1,T2-weighted and contrast enhanced sequences of the lesions were obtained from pre and post treatment MRI and texture analysis of the lesions was performed.

**RESULTS**

Among 116 lesions included in the study, 54 of them (% 46,5) had a good pathological response to treatment. A significant relationship was found between texture parameters AngScMom (p=0,01), InvDfMom (p=0,006), Entropy (p=0,02), DifEntrp (p=0,04) GLevNonU (p=0,03), LngREmph (p=0,004), ShrtREmp (p=0,007), Fraction values (p=0,005) - delta texture analysis parameters SumAverg (p=0,04), DifVarnc (p=0,03), LngREmph (p=0,04) values obtained from contrast enhanced images and NACT response. DifVarnc, LngREmph and SumEntrp parameters obtained from pre-treatment T2-weighted images showed statistically significant difference in predicting overall and event-free survival (p<0,05).In chondroblastic type

osteosarcoma, GLevNonU value obtained from pre-treatment T2-weighted images was significantly lower than the other type osteosarcomas statistically (p=0,03).

**CONCLUSION**

As a result, when pre- and post-treatment MRI examinations are evaluated together with pathology data obtained at diagnosis in patients with primary bone sarcoma, the tissue analysis method provides significant contributions beyond existing qualitative methods in predicting NACT response.

**CLINICAL RELEVANCE/APPLICATION**

We believe that pre-treatment T2A-based parameters can be utilized as prognostic markers. The successful prediction of necrosis rates using data obtained from post-treatment contrast-enhanced series raises hopes for earlier prediction of this response through interim evaluations during treatment.

## R2-SPMK-5 REDEFINING FRONTIERS IN CHONDROSARCOMA: A STUDY BASED ON DEMOGRAPHIC, RADIOLOGIC AND PATHOLOGY CHARACTERISTICS OF THE CASE SERIES FROM A SARCOMA REFERENCE CENTER

Ana M. Crespo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria J. Moreno Casado (*Abstract Co-Author*) Nothing to Disclose
Juan Arrazola (*Abstract Co-Author*) Nothing to Disclose
Maria Guerrero Martin (*Abstract Co-Author*) Nothing to Disclose
Sara Gomez Pena, MD (*Abstract Co-Author*) Nothing to Disclose
Alvaro Rueda-de-Eusebio, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Ų To describe the characteristics of the series of chondrosarcomas treated and followed up in our Sarcoma Reference Center. Ų To establish the criteria in radiography, CT and MRI to differentiate between low grade chondrosarcomas (atypical cartilaginous tumors and grade I chondrosarcoma) and high grade chondrosarcomas (grade II- III). Ų To determine radiological characteristics that differentiate grade I chondrosarcomas in the axial skeleton from atypical cartilaginous tumors of the appendicular skeleton, indistinguishable from the anatomopathological point of view, but with different prognosis. Ų To assess the influence of all the above on the follow-up and survival rate of these patients.

**METHODS AND MATERIALS**

We reviewed the PACS of our institution, as well as the archive of our Sarcoma Reference Center to identify all patients under follow-up for chondrosarcoma at our institution from 2003 to 2023. Different demographic, anatomopathology and radiology variables were collected. Tumor histology was classified according to the updated WHO classification of 2020, with special emphasis on the differentiation between atypical cartilaginous tumors (ACT) and grade I chondrosarcomas located in the axial skeleton. For the comparison between different groups, the t-test, Mann-Whitney test and the chi-square test were used where applicable. Kaplan-Meier test was used for survival analysis.

**RESULTS**

59 chondosarcomas were included in this study. Distinguishing features of high-grade chondrosarcoma (II-III) included endosteal scalloping greater than two-thirds of the cortical thickness (83% in high-grade, 26% in low-grade), extension of endosteal scalloping greater than two-thirds of the lesion length (50% in high-grade, 0% in low-grade), size ($p<0.001$), soft tissue mass and soft tissue edema ($p<0.05$). Regarding the distinction between axial grade I chondrosarcomas and ACTs, cortical destruction (62.5% vs. 20%, $p<0.05$) and soft tissue mass (62.5% vs. 6.7%, $p<0.01$) stood out. Fifty-six patients received surgical treatment, of which 18.6% recurred. 20.3% of the patients developed pulmonary metastases. 14 patients died during follow-up, with a median time to death of 20 months.

**CONCLUSION**

Given the difficulty in clinicopathologic classification of chondroid tumors, imaging findings are helpful in decision making by the multidisciplinary sarcoma committee.

**CLINICAL RELEVANCE/APPLICATION**

Our findings are consistent with the previously published regarding the differentiation between low-grade chondrosarcomas and high-grade chondrosarcomas. Given the recent implementation of the WHO 2020 classification, our work is the first to address the differentiation between ACT and grade I axial chondrosarcoma.

## R2-SPMK-6 DIAGNOSTIC PERFORMANCE AND REPRODUCIBILITY OF ACR BONE-RADS FOR THE RADIOGRAPHIC EVALUATION OF POTENTIALLY NEOPLASTIC BONE LESIONS

Domenico Albano (*Abstract Co-Author*) Nothing to Disclose
Luca Maria Sconfienza, MD, PhD (*Abstract Co-Author*) Travel support, Bracco Group;Travel support, Esaote SpA;Speakers Bureau, Esaote SpA;Travel support, ABIOGEN PHARMA SpA;Speakers Bureau, P&R Holding;Speakers Bureau, Pfizer Inc ;Speaker, Novartis AG;Speaker, Merck KGaA;Speaker, MSDF
Carmelo Messina, MD (*Abstract Co-Author*) Nothing to Disclose
Salvatore Gitto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Stefano Fusco, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic performance and the reproducibility of the recently introduced American College of Radiology (ACR) Bone-RADS score for the radiographic evaluation of potentially neoplastic bone lesions.

**METHODS AND MATERIALS**

Patients who underwent a bone biopsy for a focal bone lesion in their extremities were retrospectively enrolled, with a requirement for a radiograph conducted within three months before the biopsy. All radiographs were evaluated using the ACR Bone-RADS scoring system by two radiologists: one musculoskeletal radiologist with three years of experience in bone tumors, and one general radiologist with less than six months of musculoskeletal imaging training during residency. Interobserver agreement was determined for all the assessment categories of the ACR Bone-RADS using percent agreement and Cohen’s kappa coefficient (with 95% confidence intervals). The score's diagnostic performance was assessed using a ROC curve. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the score were calculated using histological results as the reference standard.

**RESULTS**

The study included 143 patients (80 males, 63 females), with atypical cartilaginous tumor being the most common histological diagnosis (33/143; 23.1%). Interobserver agreement was good for almost all ACR Bone-RADS categories, except for the "endosteal scalloping" category. Substantial

agreement was also observed for the final Bone-RADS score value (K = 0.806). The score demonstrated good diagnostic performance in distinguishing between benign and potentially aggressive lesions (AUC = 0.81). However, using a cutoff of Bone-RADS = 3 (intermediate risk lesions) resulted in suboptimal sensitivity and NPV. Exclusion of cases of atypical cartilaginous tumors significantly enhanced diagnostic performance, with an AUC of 0.93.

**CONCLUSION**

The ACR Bone-RADS score provides a standardized approach for reporting bone lesions based on radiographic features. It exhibited high reproducibility and accuracy in identifying benign lesions, offering valuable assistance to radiologists in patient care and management. The score may underestimate the risk of low-grade cartilaginous tumors, suggesting the consideration of advanced imaging instead of radiographic surveillance for low-risk chondroid lesions (Bone-RADS = 2).

**CLINICAL RELEVANCE/APPLICATION**

ACR Bone-RADS score offers a standardized framework for reporting bone lesions, helping radiologists in choosing the appropriate management for the patient.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R2-SPMS

**Multisystem Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPMS-1 DEEP LEARNING FOR AUTOMATED SEGMENTATION AND QUANTIFICATION OF COMPONENTS IN PERIPHERAL LYMPHEDEMA USING CT SCANS

Bushra Urooj (*Abstract Co-Author*) Nothing to Disclose
Kyung Won Kim, MD (*Abstract Co-Author*) CEO, Trial Informatics Company
Sejin Choi, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Computed tomography (CT) images provide specific imaging features and structural details of peripheral lymphedema, reflecting the clinical staging guidelines by the Consensus Document of the International Society of Lymphology. However, its application in clinical practice is limited due to the time-consuming process required to segment the tissue components. We aimed to develop a deep learning algorithm (DLA) for the automated segmentation of lower extremity components, enabling quantification and distribution analysis of tissue components using CT scans.

### METHODS AND MATERIALS

A DLA for lower extremity segmentation was trained using a development dataset of CT venography images from 118 patients. Of these, 102 CT scans covered three levels of the lower extremity (i.e., mid-thigh, knee, and mid-calf), and 16 scans provided full slices of the lower extremity, ranging from the ischial tuberosity to the talar dome. Segmentation maps of subcutaneous fat, muscle, and bone—manually drawn—as well as fibrotic tissue extracted based on attenuation, were created to serve as ground truth data. The performance of the DLA was evaluated using the Dice similarity coefficient (DSC) and volumetric similarity (VS) on both internal and external validation datasets, which included 10 CT scans from 10 subjects at our institution and an outside institution.

### RESULTS

The mean DSC for subcutaneous fat, muscle, and fluid-fibrosis components was high for both the internal (0.94, 0.97, 0.99, respectively) and external validation datasets (0.95, 0.96, 0.99, respectively). Volumetric measurements of each component also demonstrated high performance in both internal and external validatiMaon datasets, with a VS greater than 0.97 for all components in both datasets. The DLA exhibited high segmentation performance for both normal and diseased limbs, which varied in tissue composition and volume, achieving DSC of 0.97 for normal limbs and 0.96 for diseased limbs.

### CONCLUSION

The DLA demonstrated high performance and accuracy in the automatic segmentation and volumetric measurement of lower extremity components on CT images.

### CLINICAL RELEVANCE/APPLICATION

Automatic segmentation of CT images enhances the convenience and accessibility of lymphedema assessments, making easier to track and manage the condition.

# Abstract Archives of the RSNA, 2024

R2-SPNMMI

**Nuclear Medicine & Molecular Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPNMMI-1 FIBRONECTIN-TARGETING RADIOTHERAPY SENSITIZERS TO INDUCE PYROPTOSIS OF BREAST CANCER BY DUAL-ENERGY CT IMAGING-GUIDED CHEMO-RADIOTHERAPY

Dengbin Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Yanhong Chen (*Abstract Co-Author*) Nothing to Disclose
Defan Yao (*Abstract Co-Author*) Nothing to Disclose
Yuelin Huang (*Presenter*) Nothing to Disclose

### PURPOSE

Precise localization is the most important factor for successful radiotherapy. Dual-energy CT, with its ability to produce images at lower photon energies, has demonstrated the advantages of improving contrast resolution and precise localization. However, conventional iodinated contrast agents cannot meet the needs of dual-energy imaging at high keV. To improve the efficacy of radiotherapy, fibronectin-targeting radiotherapy sensitizers were designed to induce pyroptosis of breast cancer by dual-energy CT imaging-guided chemo-radiotherapy.

### METHODS AND MATERIALS

The fibronectin-targeting radiotherapy sensitizers, DAC@KBiF4 nanoclusters, were synthesized by a one-pot synthesis protocol and chemotherapy drug decitabine (DAC) loading into KBiF4 nanoparticles. DAC@KBiF4 nanoclusters were further modified with Cys-Arg-Glu-Lys-Ala (CREKA) peptide to target fibronectin for better biosafety.

### RESULTS

DAC@KBiF4 is an integrated diagnostic and therapeutic probe to localize tumors by CT imaging before radiotherapy. At the same time, the Bi ions were utilized to eliminate glutathione (GSH) and increase reactive oxygen species (ROS) levels through low-dose radiation irradiation. Subsequently, the chemotherapeutic agent decitabine was released to up-regulate GSDME, further inducing pyroptosis to achieve an anti-tumor immune response.

### CONCLUSION

In summary, we developed a GSH-responsive low-dose radiotherapy sensitizer DAC@KBiF4 targeting fibronectin to induce pyroptosis of breast cancer under the guidance of CT imaging. The results show that DAC@KBiF4 has a better localization ability in dual-energy CT. It can achieve anti-tumor immunity to effectively inhibit tumor growth under the synergy of chemotherapy and radiotherapy, which helps to improve the localization accuracy and efficacy of radiotherapy.

### CLINICAL RELEVANCE/APPLICATION

None.

# Abstract Archives of the RSNA, 2024

R2-SPNR

**Neuroradiology Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPNR-1 EFFECT OF DEEP LEARNING IMAGE RECONSTRUCTION ALGORITHM ON CT ANGIOGRAPHY OF CAROTID ARTERY ENTERING SKULL BASE

Yanhong Zhao, MMed,MMed (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the effect of deep learning image reconstruction (DLIR) on the image quality of CT angiography of carotid artery entering skull by comparing with FBP and hybrid iterative reconstruction algorithm (ASIR-V).

### METHODS AND MATERIALS

30 patients with suspected head and neck vascular diseases were selected. The head and neck CTA imaging was performed with revolution apex CT, The tube voltage was 100kV. Three groups of images were reconstructed by filtered back projection reconstruction (group A), 40% ASIR-V reconstruction (group B) and high level of DLIR (DLIR-H, Group C). The CT values and SD in petrosal bone segment, cavernous sinus segment, superior clinoid process segment and muscles at the same level of internal carotid artery were measured, and SNR and CNR were calculated, The subjective image quality was evaluated by two doctors with more than 5 years of diagnostic experience. The CT value, SD, SNR, CNR and subjective image quality of the carotid artery entering the skull base of the three groups were compared.

### RESULTS

There was no significant difference in the CT values of the three groups ($P > 0.05$). The noise of FBP, 40%ASIR-V, and DLIR-H images entering the internal carotid artery of the skull base were 24.52±3.18, 21.72±9.78, 16.61±3.67, respectively, and the differences were statistically significant ($P<0.05$). The noise of DLIR-H reconstruction algorithm is 32.26% lower than that of FBP, and 23.53% lower than that of 40% ASIR-V. There are statistically significant differences in the signal-to-noise ratio and contrast-to-noise ratio of the three groups of images (all $P<0.05$). The signal-to-noise ratio and contrast-to-noise ratio of DLIR-H reconstruction algorithm are higher than FBP and 40% ASIR-V. The subjective scores of FBP, 40%ASIR-V, and DLIR-H images were 3.60±0.50, 4.13±0.43, and 4.40±0.50, respectively. The subjective image quality score of DLIR-H was higher than that of FBP and 40%ASIR-V (P values are $<0.05$).

### CONCLUSION

DLIR-H reconstruction algorithm can reduce the image noise of CT angiography of carotid artery entering the skull base and improve the image quality of SNR, CNR and subjective image.

### CLINICAL RELEVANCE/APPLICATION

CT angiography of carotid artery entering the skull base is vulnerable to image noise. DLIR-H reconstruction algorithm can reduce the image noise of CT angiography of carotid artery entering the skull base and improve the image quality of SNR, CNR and subjective image.

## R2-SPNR-12 ADVANCING DIAGNOSTIC CAPABILITIES: DEEP LEARNING-BASED TOOL FOR ENHANCED DISCRIMINATION OF MULTIPLE SCLEROSIS AND SMALL VESSEL DISEASE ON ROUTINE NON-ENHANCED BRAIN MAGNETIC RESONANCE IMAGING

Melika Boroomand-Saboor, MD (*Abstract Co-Author*) Nothing to Disclose
Masoumeh Gity, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Mehran Arabahmadi, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

The diagnosis of Multiple Sclerosis (MS) primarily relies on clinical examination, supported by magnetic resonance imaging (MRI) interpreted by experienced radiologists. However, typical imaging features of MS can mimic other central nervous system diseases. Cerebral Small Vessel Disease (SVD) is one such pathology that may pose challenges for the radiologist in making a definitive diagnosis. Differential diagnosis is often difficult at the onset of the disease when the manifestations and symptoms are not yet spatially and temporally extensive. The aim of this study is to develop and evaluate a Computer-Aided Diagnosis (CAD) system based on brain MRI images using a robust deep neural network, to differentiate the diagnosis of MS from SVD in MRI images.

### METHODS AND MATERIALS

Brain MRI images obtained from a 3 Tesla scanner of patients with a definite diagnosis of multiple sclerosis (MS) in both stages, acute attack and clinically silent phase, as well as patients who underwent brain MRI for other reasons at the imaging center and were diagnosed with SVD by a radiologist based on their medical history of risk factors for cardiovascular diseases and imaging findings, were evaluated. The MRI images with FLAIR, T1 without contrast, and T2 without contrast sequences were enrolled. The white matter lesions were reported by an expert neuroradiologist with at least ten years of experience and then segmented via the pre-designed artificial intelligence software. Afterward, 80 percent of data used for training, 10 percent for validation, and 10 percent for the test. Finally, the results were evaluated by a neuroradiologist based on each patient diagnosis. The diagnostic performance of the artificial intelligence method was compared with the current gold standard (combination of clinical and imaging criteria).

### RESULTS

A total of 80 patients with multiple sclerosis (MS) including , 265 brain lesions, as well as 67 patients with cerebral small vessels disease (SVD) and 218 SVD lesions, were examined. The results of this study showed that the artificial intelligence tool had a sensitivity of 78.57% and specificity of 93.33% (P-value<0.05), with a positive predictive value (PPV) of 91.67, negative predictive value (NPV) of 82.35, balanced accuracy of 85.95, and area under the curve (AUC) of 78.71 (90.48-102.2).

### CONCLUSION

Artificial intelligence has the ability to differentiate between MRI images of patients with MS and those with SVD solely based on single MRI studies routine sequences.

### CLINICAL RELEVANCE/APPLICATION

The application of artificial intelligence in distinguishing MS and SVD brain lesions has the potential to revolutionize clinical practice by enhancing diagnostic accuracy and streamlining patient care for these neurological conditions.

## R2-SPNR-13 PERFORMANCE AND VALIDATION OF A MACHINE LEARNING-BASED ANEURYSM DETECTION TOOL IN THE CLINICAL SETTING

Ichiro Yuki (*Abstract Co-Author*) Research Grant, Siemens AG
Daniel S. Chow, MD (*Abstract Co-Author*) Stockholder, Avicenna.ai Medical Imaging ;Consultant, Canon Medical Systems Corporation;Grant, Canon Medical Systems Corporation;Consultant, Cullen & Grandy;Grant, NovoCure Ltd
Stephanie Shieh, RN, MS (*Abstract Co-Author*) Nothing to Disclose
Jennifer E. Soun, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Joseph Carbone, MD (*Abstract Co-Author*) Nothing to Disclose
Jacob Schlossman (*Presenter*) Nothing to Disclose

### PURPOSE

Cerebral aneurysm detection on CT angiography (CTA) is essential to prevent subarachnoid hemorrhage due to ruptured aneurysm. This study evaluated the performance of a commercially available CTA aneurysm detection tool in a real-life setting.

### METHODS AND MATERIALS

This was a retrospective, single center study using CTA Head scans performed at a quarternary medical center from 07/01/2023 to 12/31/2023. All scans were processed by Viz Aneurysm, an automated machine learning algorithm for the detection and triage of cerebral aneurysms = 4 mm in size. Ground truth was established by the original radiology report, which was written by a board-certified neuroradiologist and included the Viz Aneurysm performance assessment in its template . Overall performance was evaluated as well as subset analyses based on aneurysm location and size.

### RESULTS

703 CTA Head scans were included in this study, comprising 645 (91.7%) negative and 58 (8.3%) positive aneurysm scans. Viz Aneurysm demonstrated a sensitivity of 96.6%, specificity of 98.1%, and accuracy of 98.0%. Positive predictive value (PPV) was 82.4% and negative predictive value (NPV) was 99.7% percent. Viz Aneurysm detected 8 cases with multiple aneurysms and 21 cases with aneurysms < 4 mm in size. 56 anterior circulation and 9 posterior circulation aneurysms were detected. Missed cases included one case with a 4 mm aneurysm and another with multiple aneurysms.

### CONCLUSION

Viz Aneurysm successfully detected most of the aneurysms in our clinical dataset. This performance was consistent across subset analyses. This tool can augment the radiologist’s diagnostic accuracy in aneurysm detection, potentially allowing for improvements in triage for follow-up care.

### CLINICAL RELEVANCE/APPLICATION

This is one of the first studies to evaluate the performance of a machine learning-based aneurysm detection tool directly in the clinical setting. Future analyses will assess the follow up management of Viz Aneurysm detected cases and provide a cost effective analysis of the tool’s implementation.

## R2-SPNR-14 ARTIFICIAL INTELLIGENCE-ASSISTED VOLUME ISOTROPIC SIMULTANEOUS INTERLEAVED BRIGHT- AND BLACK-BLOOD EXAMINATION FOR BRAIN METASTASES

Kousei Ishigami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Makoto Obara (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Shunsuke Nishimura (*Abstract Co-Author*) Nothing to Disclose
Koji Yamashita, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshitomo Kikuchi (*Abstract Co-Author*) Spouse, Employee, Koninklijke Philips NV
Hiroyuki Toyoda (*Abstract Co-Author*) Nothing to Disclose
Daichi Momosaka, MD (*Abstract Co-Author*) Nothing to Disclose
Kazunori Fukasawa (*Abstract Co-Author*) Nothing to Disclose
Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Osamu Togao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazufumi Kikuchi, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to verify the effectiveness of artificial intelligence-assisted volume isotropic simultaneous interleaved bright-/black-blood examination (AI-VISIBLE) in diagnosing brain metastases.

### METHODS AND MATERIALS

This retrospective study included 20 patients with brain metastases and 20 patients without brain metastases. Seven independent observers (three radiology residents and four neuroradiologists) participated in two reading sessions: in the first session, brain metastases were detected using VISIBLE only; in the second session, the results of the first session were evaluated by adding AI-VISIBLE information. Sensitivity, diagnostic performance, and false-positives/case were evaluated. The diagnostic performance was assessed using figure of merit (FOM) calculated based on jackknife free-response receiver operating characteristics. Sensitivity and false-positives/case were evaluated using McNemar and paired t-tests, respectively.

### RESULTS

The McNemar test revealed a significant difference between AI-VISIBLE and VISIBLE ($p < 0.0001$). Averaged additional reading time with AI session was 95 sec. Significantly higher sensitivity (94.9% ± 1.7% vs. 88.3% ± 5.1%, $p = 0.0028$) and FOM (0.983 ± 0.009 vs. 0.972 ± 0.013, $p = 0.0063$) were achieved using AI-VISIBLE than using VISIBLE only. No significant difference in false-positives/case was observed between with and without AI information (0.23 ± 0.19 vs. 0.18 ± 0.15, $p = 0.250$). With AI assistance, radiology residents were comparable to neuroradiologists in terms of sensitivity and FOM (without AI information: sensitivity, 85.9% ± 3.4% vs. 90.0% ± 5.9%; FOM, 0.969 ± 0.016 vs. 0.974 ± 0.012; with AI information: sensitivity, 94.8% ± 1.3% vs. 95.0% ± 2.1%; FOM, 0.977 ± 0.010 vs. 0.988 ± 0.005).

### CONCLUSION

AI-VISIBLE improved the sensitivity and performance for diagnosing brain metastases.

### CLINICAL RELEVANCE/APPLICATION

Radiologists can identify brain metastases more accurately using AI-VISIBLE. This technology can easily detect brain metastases and thus facilitate prompt treatment.

## R2-SPNR-15 ROBUST MRI BRAIN TUMOR CLASSIFICATION: MITIGATING MOTION ARTIFACTS WITH PHYSICS-BASED AUGMENTATIONS

Beliz Gunel (*Abstract Co-Author*) Nothing to Disclose
Kristen W. Yeom, MD (*Abstract Co-Author*) Nothing to Disclose
Batuhan Sozer (*Abstract Co-Author*) Nothing to Disclose
Peter Chang, MD (*Abstract Co-Author*) Co-founder, Avicenna.ai;Stockholder, Avicenna.ai;Research Grant, Canon Medical Systems Corporation;Speakers Bureau, Canon Medical Systems Corporation;Research Grant, General Electric Company
Kerem Nernekli, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to compare two deep learning (DL) classification models trained using different augmentation techniques: 1) traditional image-based augmentation and 2) physics-based augmentation that takes MRI physics into account. When trained solely on artifact-free data, DL models may become less robust to the challenges encountered in clinical settings, such as motion artifacts. Our goal is to determine whether physics-based augmentation, which simulates motion artifacts by perturbing k-space, produces more robust models and leads to more effective classification under real-world conditions.

### METHODS AND MATERIALS

We used the fastMRI+ dataset, which includes fully sampled k-space data and label annotations for patients. Patients were included if their scans showed either a brain mass or appeared normal; our final study cohort consisted of 51 patients (1187 T1-weighted MRI scans). This cohort was divided into training, validation, and testing sets following a 60-20-20 split. We employed a MONAI 2D ResNet50 architecture for binary prediction of tumor vs non-tumor. The experiment compared two training groups with a single test group. The first training group used image-based augmentation with random rotations. The second group utilized physics-based augmentation, simulating motion artifacts in k-space using the TorchIO library's RandomMotion transform function (number of transforms = 5). Our balanced test set included MRIs with and without motion artifacts. We used five-fold cross-validation to develop five separate models. The PyTorch and frameworks on Python 3.9 were used for model training.

### RESULTS

We assessed the performance of all models using the receiver operating characteristic (ROC) curve. The average area under the ROC curve (AUC) from five-fold cross-validation demonstrated superior performance with physics-based augmentations (AUC of 0.94) compared to image-based augmentations (AUC of 0.82). The model with image-based augmentations achieved an accuracy of 0.63, sensitivity of 0.60, specificity of 0.66, and an F1 score of 0.51. In contrast, the model with physics-based augmentations demonstrated significantly enhanced results: accuracy of 0.92, sensitivity of 0.93, specificity of 0.92, and an F1 score of 0.90.

### CONCLUSION

We demonstrated that physics-based augmentations are superior to traditional image-based augmentations for the classification of brain tumors from MRI scans when motion artifacts are present.

### CLINICAL RELEVANCE/APPLICATION

Training DL models with physics-based augmentation techniques can lead to models that are more robust to common challenges, such as motion artifacts in MRI scans. This, in turn, could pave the way for the wider adoption of DL models in clinical settings.

## R2-SPNR-18 WHITE MATTER HYPERINTENSITIES PREFERENTIALLY ACCUMULATE WITHIN THE BORDER ZONES REGIONS OF THE BRAIN IN HEALTHY INDIVIDUALS

Kevin Whittingstall (*Abstract Co-Author*) Nothing to Disclose
Davy Vanderweyen, MD (*Presenter*) Nothing to Disclose

### PURPOSE

White matter hyperintensities (WMHs) are a common incidental finding on brain MRI, which is often associated with cerebral small vessel disease (CSVD) and tends to increase in severity with age. It is known that they preferentially accumulate in the periventricular white matter, but a more precise topology and chronology of their deposition with age is unknown. We hypothesized that CSVD would preferentially involve brain regions containing mostly microvasculature and with reduced perfusion, such as border zone regions (BZRs).

### METHODS AND MATERIALS

The arterial tree was segmented into anterior (ACA), middle (MCA), and posterior cerebral arteries (PCA) branches using an in-house automatic approach on 3T time-of-flight magnetic resonance angiography from 258 pathology-free cognitively intact participants (OASIS-3 database). BZRs were defined as voxel planes equidistant from two arteries based on distance maps. WMHs were segmented using an automated method. The intersection between WMHs and BZRs was computed and compared to WMHs outside BZRs.

### RESULTS

Mean patient age was 70.8 years old (range 42.7-92.3; SD=8.35). Across subjects, 70% of WMHs were located within 1 cm of the 3D border zone plane. As expected, WMHs burden increased significantly with age, with an average volume of 5.3 mL of WMH for patients <70 years and 14.6 mL for patients >70 years (p=2.6e-18). However, the fraction of WMHs within 1cm of the border zone decreased with age, with 71.1% of WMHs within the BZRs in patients <70 years and 67.6% in patients >70 years (p=0.002).

### CONCLUSION

In healthy subjects, WMHs initially accumulate in BZRs and spread to non BZRs as the disease progresses, pointing to an underlying vascular vulnerability of these regions to chronic ischemic insults. This data can be interpreted as an increased susceptibility of BRZs to CSVD compared to the rest of brain parenchyma, and this may be due to their location at the farthest point from main arteries and its reliance strictly on small vessels for nutrient delivery.

### CLINICAL RELEVANCE/APPLICATION

These insights into this common disease's localization may better explain the spatial distribution of incidental WMHs on brain imaging and provide the radiologist with a more accurate understanding of the distribution and chronology of WMHs. This could allow us to categorize these findings into “typical” disease where WMHs predominates in the BZRs and is more likely caused by CSVD, and “atypical” disease where there are more WMHs outside of the border zones, which could hint to a different etiology responsible for these WMHs, such as multiple microembolic events, which could alter patient treatment. This may also guide future research on WMHs pathophysiology.

## R2-SPNR-2 REDUCING BOTH RADIATION AND CONTRAST DOSES IN 80-KV HEAD AND NECK CT ANGIOGRAPHY WITH VARIOUS STRENGTH DEEP LEARNING IMAGE RECONSTRUCTION: COMPARISON WITH 100-KV CT ANGIOGRAPHY

Yu Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Min Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Jian Wang (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Tong Su, MD (*Abstract Co-Author*) Nothing to Disclose
Xinyue Zhang (*Abstract Co-Author*) Nothing to Disclose
Yun Wang (*Abstract Co-Author*) Nothing to Disclose
Jiajing Tong (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the use of 80-kV tube voltage combined with various strengths of deep learning image reconstruction (DLR) in head and neck CT angiography to reduce both radiation and contrast doses, by comparing with 100-kV regular protocol using hybrid iterative reconstruction (HIR).

### METHODS AND MATERIALS

Sixty-six patients were prospectively enrolled and divided into two groups randomly: low-dose group (n=33) with 80-kV, 25ml iodinated contrast agent, noise index (NI) of 15, reconstructed with HIR and DLR at low-, medium- and high-strength (DLR-L, DLR-M, and DLR-H). Regular-dose group (n=33) with 100-kV, 40ml contrast agent, NI of 10, and reconstructed with HIR. The CT attenuation, image noise, signal-to-noise ratio (SNR) of aorta, intracranial and extracranial arteries, brainstem and back muscle, the contrast-to-noise ratio (CNR) of vessels were calculated and compared between two groups. The subjective image quality was evaluated by two radiologists using a 5-point scale.

### RESULTS

Low-dose group significantly reduced contrast dose (37.5% reduction) and radiation exposure (0.41±0.08 mSv VS 1.18±0.12 mSv, P<0.01, 65% reduction) compared to regular-dose group. Compared with HIR of regular-dose group, DLR-H and DLR-M of low-dose group provided significantly lower image noise and significantly higher SNR in vessels (all P<0.05). The CNR of vessels was superior in DLR-H of low-dose group (all P<0.001), equivalent in DLR-M, when compared to HIR of regular-dose group. Subjective image quality score of low-dose group was increase with the improvement of strength and all scores were reach 3 point (DLR-H VS HIR of regular-dose: 3.70±0.81 VS 3.94±0.24, P=0.04) .

### CONCLUSION

The application of DLR in head and neck CTA acquired with 80kV tube voltage and 37.5% lower contrast dose maintained diagnostic image quality while exhibited lower image noise and higher CNR compared to regular-dose with HIR.

### CLINICAL RELEVANCE/APPLICATION

The DLR (especially DLR-H) has great potential to reduce radiation dose and improving image quality in head and neck CTA with 80-kV tube voltage.

## R2-SPNR-4 DETERMINATION OF PATIENT PROGNOSIS BASED ON UNRUPTURED BASILAR ARTERY ANEURYSM MORPHOLOGY BY A NOVEL DYNAMIC PREDICTION MODEL

Wenjun Yao, MD,MD (*Abstract Co-Author*) Nothing to Disclose
Yifan Fu (*Abstract Co-Author*) Nothing to Disclose
Mengcheng Du (*Abstract Co-Author*) Nothing to Disclose
Wanqin Wang (*Abstract Co-Author*) Nothing to Disclose
Keyi Lin (*Abstract Co-Author*) Nothing to Disclose
Tao Jiang (*Abstract Co-Author*) Nothing to Disclose
Shilin Liu (*Abstract Co-Author*) Nothing to Disclose
Yaotian Gao (*Abstract Co-Author*) Nothing to Disclose
Xiaoxuan Li (*Abstract Co-Author*) Nothing to Disclose
Minghao Xu (*Abstract Co-Author*) Nothing to Disclose
Wenxin Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Wei Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to createan assessment system for predicting the survival of patients with basilar artery aneurysms undergoing endovascular embolization by examiningthe morphological parameters of the aneurysms and surrounding vessels.

**METHODS AND MATERIALS**

A total of 100 consecutive patients who underwent brain computed tomography angiography in the North District of the First Affiliated Hospital of Anhui Medical University from 2019 to 2022 were included in this study, with 42 being exclusion. The retrospective analysis focused on fifty-eight patients who underwent endovascular embolization for basilar artery aneurysm. The survival rate of these patients at three months, six months, and one year after surgery was observed through long-term follow-up. An online dynamic column chart utilizinga proportional hazards regression model (COX model) was developed to predict the survival outcomes of patients with basilar artery aneurysm who underwent interventional embolization. The model's discrimination ability was assessed using the consistency index (C-index) and receiver operating characteristic (ROC) analysis.. Internal validation was performed through bootstrap resampling, and calibration curves were generated. Decision curve analysis (DCA) was employed to evaluate the clinical applicability of the model.

**RESULTS**

Cox regression analysis identified the basilar artery diameter (BA) and the neck of basilar artery aneurysm as significant risk factors impacting the survival following interventional embolization of the basilar artery aneurysm ($P<0.05$). The area under the ROC for BA was 0.745 (95% confidence interval [CI], 1.01-4.45), and that for the neck of basilar artery aneurysm was 0.823 (95% CI, 1.04-6.23). The C-index of the model was 0.805. Furthermore, the DCA curves indicated that the model provided greater net benefit compared to operating on all or none of patients, across a range of threshold probabilities from 0 to100%

**CONCLUSION**

The online dynamic columnar mapping based on basilar artery aneurysm morphology can reliably predict survival in patients undergoing interventional embolization for basilar artery aneurysm.

**CLINICAL RELEVANCE/APPLICATION**

Previous studies have highlighted significant differences in the MCA, internal carotid artery, and BA between patients with and without aneurysms.Vascular morphology, hemodynamics, hypertension, gender, age, smoking, and alcohol abuse are known risk factors in the development and progression of aneurysms. Among these factors, vascular morphological characteristics play an important role in the initiation, formation, and rupture of aneurysms.

## R2-SPNR-5 MYELIN IMAGING IN THE HUMAN BRAIN USING A 3D DOUBLE ADIABATIC INVERSION RECOVERY PREPARED ULTRASHORT ECHO TIME (3D DIR-UTE) SEQUENCE IN MULTIPLE SCLEROSIS

Jiang Du, PhD (*Abstract Co-Author*) Nothing to Disclose
Yajun Ma (*Abstract Co-Author*) Nothing to Disclose
Mahyar Daskareh, MD (*Abstract Co-Author*) Nothing to Disclose
Jiyo Athertya (*Abstract Co-Author*) Nothing to Disclose
Eric Y. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Soo Hyun Shin (*Abstract Co-Author*) Nothing to Disclose
James Lo (*Presenter*) Nothing to Disclose

**PURPOSE**

This study uses a novel 3D double adiabatic inversion recovery prepared ultrashort echo time (3D DIR-UTE) sequence to map myelin proton fraction (MPF) in patients with multiple sclerosis (MS).

**METHODS AND MATERIALS**

The DIR-UTE sequence utilizes two identical adiabatic full passage (AFP) pulses with carrier frequencies centered on the water peak to invert long T2 magnetization. TI1 is defined by the time between the centers of two AFP pulses, while TI2 is defined as the period from center of second AFP pulse to the center of multispoke acquisition. Three patients with MS diagnosis (54±15 years old, 2 females) and five healthy control participants (31±4 years old, 2 females) were scanned on a 3T clinical scanner (MR750, GE) using an eight-channel head coil. To estimate the MPF, a proton density-weighted UTE (PD-UTE) sequence was scanned in conjunction with DIR-UTE. For the in vivo subject scan, the parameters were as follows: (i) DIR-UTE: TR/TI1/TI2=200/100/47ms, echo time (TE)=0.032ms, flip angle (FA)=20°, number of spokes (Nsp)=5, field-of-view (FOV)=24×24×14.4cm3, matrix=108×108×24, and scan time=20min; (ii) PD-UTE: TR/TE=7/0.032ms, FA=1°, FOV=24×24×14.4cm3, matrix=108×108×24, and scan time=40sec. Regions of interest (ROIs) were manually delineated in eight white matter (WM) regions(the left and right centrum semiovale, periventricular regions, subcortical WM, the splenium and genu of the corpus callosum). Additional ROIs were drawn in lesions which were identified and localized on T2-FLAIR images. An independent t-test was conducted to compare MPF between NWM vs. NAWM, NAWM vs. lesions, and NWM vs. lesions. P values <0.05 were considered significant.

**RESULTS**

Representative images from DIR-UTE and PD-UTE images as well as MPF maps from a healthy control (32-year-old male) and a patient with MS (37-year-old female) are presented. A clinical T2-FLAIR image of the patient is included which shows confluent white matter plaques due to chronic demyelinating disease in the right centrum semiovale. There is an apparent signal loss in this interested region on the corresponding DIR-UTE images, consistent with demyelination. MPF of the normal white matter (NWM) in control brain is 5.42%, which is significantly higher than both NAWM (4.83%) and plaques (2.33%) in MS patients.

**CONCLUSION**

The 3D DIR-UTE sequence provided sufficient long T2 water signal suppression for selectivel myelin imaging in the brain and showed marked MPF reduction in MS lesions and a smaller reduction in NAWM compared with the NWM in volunteers.

**CLINICAL RELEVANCE/APPLICATION**

The proposed 3D DIR-UTE technique enables sufficient long T2 suppression for selective myelin imaging in the human brain. The measured MPF can be a useful biomarker for assessing various demyelinating diseases.

## R2-SPNR-7 AUTOMATED REFORMAT ALGORITHM IMPROVES BRAIN ALIGNMENT TO ENHANCE RADIOLOGIST AND RADIOGRAPHER WORKFLOW EFFICIENCY

Ludovic Sibille (*Abstract Co-Author*) Nothing to Disclose
Ronny Elor (*Abstract Co-Author*) Nothing to Disclose
Joel M. Stein, MD, PhD (*Abstract Co-Author*) Research Grant, Hyperfine Research, Inc;Consultant, Centaur Diagnostics, Inc
Ajit Shankaranarayanan (*Abstract Co-Author*) Employee, Subtle Medical, Inc
Praveen Gulaka, PhD (*Abstract Co-Author*) Employee, Subtle Medical, Inc
Thomas C. Arnold, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Growing demand for radiology services combined with workforce shortages has resulted in increased pressure on radiologists and radiographers for efficiency. Consistent, symmetric image orientation facilitates disease diagnosis and tracking. Poor image alignment necessitates manual realignment, causing workflow disruptions and frustration. Here we introduce an automated machine-learning-based brain alignment algorithm the was recently FDA cleared (K233699) and validate its performance using a diverse dataset.

**METHODS AND MATERIALS**

We analyzed 373 3D brain MRI scans, encompassing T1, T1+Gad, T2, and T2-FLAIR sequences from over 20 centers. Two neuroimaging experts (TCA and PG: 10 17 years experience, respectively) independently labeled four anatomical points (anterior/posterior commissures, left/right eye centers). A third-party neuroradiologist (JMS: 17 years experience) adjudicated cases where labels differed beyond a predetermined threshold (pitch<5°, roll<3°, or yaw<3°). We applied the image reformatting algorithm and compared its output with ground truth alignment to assess pitch, roll, and yaw error.

**RESULTS**

Raters exhibited high consistency, with pitch differing by <2° and both roll and yaw by <0.5°. Input image absolute errors averaged 10.46° ± 7.22° for pitch (-35° to 24°), 2.44° ± 2.10° for roll (-9° to 9°), and 2.95° ± 2.64° for yaw (-17° to 14°). The algorithm reduced absolute error by 77.9% for pitch (to 2.31°), 64.4% for roll (to 0.87°), and 78.1% for yaw (to 0.65°). Summed absolute error improved in 96.8% of subjects by an average of 8.2°. We assessed the impact of large anatomical anomalies on algorithm performance for 3 pathology subgroups: brain tumors (N=24, avg. 34cc, max 129cc), tumor resections (N=24, avg. 37cc, max 81cc), and neurodegenerative disorders (N=90). Pathology groups demonstrated stable performance (pitch: 2.28°, 2.49°, 2.01°, roll: 1.10°, 0.88°, 1.07°, yaw: 0.91°, 0.54°, 0.70°, respectively). Two pediatric subgroups (age 5-11: N=30, age 12-21: N=30) also showed similar performance (pitch: 2.11° 2.83°, roll: 0.73° 0.83°, yaw: 0.73° 0.64°).

**CONCLUSION**

Radiographer and radiologist workflows are frequently disrupted by poor image alignment, which impairs assessments of bilateral symmetry. We presented an algorithm that improved alignment in 96.8% of subjects with an average improvement of 8.2°. The algorithm can preprocess images prior to PACS display, thus eliminating manual reorientation and streamlining radiology workflows.

**CLINICAL RELEVANCE/APPLICATION**

Machine learning algorithms can automate brain alignment to preserve bilateral symmetry, thus eliminating manual reorientation and improving radiographer and neuroradiologist workflows.

## R2-SPNR-8 COMPACTNESS ANALYSIS FROM MAGNETIC RESONANCE RADIOMICS CORRELATES WITH SEIZURE ACTIVITY IN BRAIN ARTERIOVENOUS MALFORMATIONS

Chung-Jung Lin, MD (*Abstract Co-Author*) Nothing to Disclose
Chia-Feng Lu, PhD (*Abstract Co-Author*) Research support, Ministry of Science and Technology
Yong-Sin Hu, MD (*Abstract Co-Author*) Nothing to Disclose
Kang-Lung Lee, MD (*Abstract Co-Author*) Nothing to Disclose
JIH YUAN LIN (*Presenter*) Nothing to Disclose

**PURPOSE**

The assessment of brain arteriovenous malformations through angioarchitectural analysis is inherently subjective. This research aimed to objectively quantify the morphology and signal alterations in both the nidal and perinidal regions using MR radiomics. Additionally, it sought to evaluate the effectiveness of MR radiomics compared to angioarchitectural analysis in identifying epileptic BAVMs.

**METHODS AND MATERIALS**

Between 2010 and 2020, a retrospective study encompassed 111 patients diagnosed with supratentorial BAVMs, categorized based on their initial seizure presentation. Analysis of patients' angiograms and MR imaging aimed to delineate the corresponding angioarchitecture. The BAVM nidus was outlined using time-of-flight MR angiography, while the perinidal brain parenchyma was delineated on T2-weighted images, followed by radiomic analysis. Logistic regression analysis was conducted to identify independent seizure risk factors. Comparative analyses, including ROC curve analysis, decision and curve analysis (DCA), were performed to assess the diagnostic efficacy of angioarchitecture-based and radiomics-based models in detecting epileptic BAVMs.

**RESULTS**

In multivariate analyses, low compactness (OR: 2.27x104, p = .03) and angiogenesis (OR: 5.30, p = .01) were independently associated with a high risk of seizure after adjustment for age, sex, temporal location, and nidal volume. Intraobserver reliability and interobserver reliability of compactness were both 0.94. The AUC for the angioarchitecture-based and MR radiomics-based models was 0.672 and 0.783, respectively. DCA confirmed the clinical utility of the MR radiomics-based model.

**CONCLUSION**

Low nidal compactness and angiogenesis were linked to heightened seizure vulnerability in individuals diagnosed with BAVMs. Utilizing MR radiomics-derived tools offers a noninvasive and objective approach to assess the risk of seizures attributable to BAVMs.

**CLINICAL RELEVANCE/APPLICATION**

A correlation was found between low nidal compactness and elevated seizure susceptibility in individuals with brain arteriovenous malformations. Utilizing MR radiomics presents a promising avenue for noninvasive and objective assessment of seizure risk in BAVM patients.

## R2-SPNR-9 WIDENING THE TREATMENT OF SHALLOW INTRACRANIAL ANEURYSMS WITH INTRASACCULAR FLOW DISRUPTION: PRELIMINARY EXPERIENCE WITH THE FLAT WEB

Francesco G. Garaci, MD (*Abstract Co-Author*) Nothing to Disclose
Noemi Pucci (*Abstract Co-Author*) Nothing to Disclose

Francesca Di Giuliano, MD (*Abstract Co-Author*) Nothing to Disclose
Valerio Da Ros (*Presenter*) Nothing to Disclose

**PURPOSE**

Endovascular treatment of intracranial shallow wide-necked aneurysms remains an endovascular challenge. Among intrasaccular devices, the Woven EndoBridge (WEB) effectiveness and safety have been thoroughly assessed in several clinical practice trials and recently new dimensions (6-2 and 7-2 mm) are available on the market. We describe our preliminary experience with the use of the new "flat" WEBs for the treatment of shallow intracranial aneurysms

**METHODS AND MATERIALS**

We retrospectively analyzed data from all patients with intracranial unruptured and ruptured aneurysms treated with 6- and 7-2 mm flat WEB in two institutions between November 2023 and April 2024. Technical success, complications with early clinical and imaging follow-up were assessed

**RESULTS**

7 patients with 7 wide-necked aneurysms were included; one aneurysm was ruptured. All aneurysms involved the anterior circulation. Technical success of embolization was accomplished and no intraprocedural complications occurred. At early follow-up, adequate occlusion was obtained for all treated aneurysms.

**CONCLUSION**

Broad-based aneurysms with unfavorable height and aspect ratio are suitable for endovascular treatment using WEB intrasaccular flow disruption with good safety and feasibility profile. Larger series are needed to confirm their long-term efficacy.

**CLINICAL RELEVANCE/APPLICATION**

This is a preliminary experience with the new generation of intrasaccular device for broad based shallow intracranial aneurysms.

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# Abstract Archives of the RSNA, 2024

R2-SPPD

**Pediatric Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPPD-1 IMPROVING THE EXPLAINABILITY AND PERFORMANCE OF PEDIATRIC BRAIN TUMOR MOLECULAR SUBTYPE CLASSIFICATION THROUGH MULTIMODAL LEARNING

Birgit B. Ertl-Wagner, MD, PhD (*Abstract Co-Author*) Spouse, Employee, Siemens AG
Uri Tabori (*Abstract Co-Author*) Nothing to Disclose
Farzad Khalvati, PhD, MSc (*Abstract Co-Author*) Board of Directors, MESH Scheduling Inc
Cynthia Hawkins (*Abstract Co-Author*) Nothing to Disclose
Matthias W. Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Ketabi, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Detecting the genetic markers of pediatric low-grade glioma (pLGG), the most common brain tumor in children, is crucial for targeted treatment planning. Despite the significant performance of convolutional neural networks (CNNs) in diagnosing these genetic markers from brain magnetic resonance imaging (MRI), these models are not widely used in clinical settings mainly due to the lack of explainability. In other words, the features influencing a model's prediction are not typically understandable to radiologists. Radiology reports can be integrated with MR images to improve CNN explainability. In this study, we propose a multimodal framework to minimize the distance between the MRI and the corresponding report representations and maximize the distance between the mismatched MRI and reports. The learnt MRI representations can then be applied to improve the explainability and performance of pLGG genetic marker classification.

### METHODS AND MATERIALS

The dataset for this REB-approved retrospective study contains 341 FLAIR MR images for pLGG cases aged between 5 and 18, and associated radiology reports. To encode the whole MRI and reports, we apply 3D Residual Network (ResNet), initialized with a set of pretrained weights named “MedicalNet”, and a transformer called Clinical Longformer, respectively. The encoded representations are then compared based on the cosine similarity to adjust their distance. Consequently, similar MRI and report representations would be close to each other, while dissimilar pairs would be far apart. Next, we initialize ResNet with the weights extracted from this framework and fine-tune it on the genetic marker classification task using a subset of 204 MRIs. This subset relates to the two most important pLGG genetic markers, i.e., BRAF fusion and BRAF V600E mutation.

### RESULTS

Using a 5-fold cross validation, we calculated the area under the ROC curve (AUC) and Dice score between the model’s attention maps and manual tumor segmentation masks. The ResNet model initialized with the proposed weights outperforms a baseline classification model trained from scratch, achieving an AUC of 0.877 +/- 0.072 versus 0.748 +/- 0.083. Furthermore, this initialization increases the attention maps Dice score from 2% to 15.8%.

### CONCLUSION

Applying the proposed multimodal framework to the pLGG genetic marker classification significantly outperforms the baseline model, i.e., a 17.2% increase in the AUC. It also boosts the Dice score between the model attention maps and manual segmentation masks by a factor of six, enhancing model explainability.

### CLINICAL RELEVANCE/APPLICATION

The improved performance and explainability of pLGG genetic marker classification will aid in non-invasive tumor prognosis and efficient targeted treatment planning.

## R2-SPPD-2 EXPLORING THE IMPACT OF RADIOLOGY REPORTS ON MRI-BASED CLASSIFICATION OF PEDIATRIC BRAIN TUMOR GENETIC MARKERS

Birgit B. Ertl-Wagner, MD, PhD (*Abstract Co-Author*) Spouse, Employee, Siemens AG
Uri Tabori (*Abstract Co-Author*) Nothing to Disclose
Cynthia Hawkins (*Abstract Co-Author*) Nothing to Disclose
Matthias W. Wagner, MD (*Abstract Co-Author*) Nothing to Disclose
Farzad Khalvati, PhD, MSc (*Abstract Co-Author*) Board of Directors, MESH Scheduling Inc
Sara Ketabi, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Pediatric Low-grade Glioma (pLGG) is the most common brain tumor in children. Detecting pLGG genetic markers can assist in tumor prognosis and targeted treatment planning. The current gold standard for this task is biopsy, which is an invasive procedure. To mitigate the risks associated with

biopsies, convolutional neural networks (CNNs) have been proposed to detect genetic markers from MRI data noninvasively. Nonetheless, the impact of the integration of MR images with radiology reports, as invaluable information sources derived from radiologists' knowledge, on the CNNs prediction performance has yet to be explored. Thus, we concatenate radiology reports with MRI in a multimodal learning framework for diagnosing pLGG genetic markers and compare the predictive performance with that of MRI-based alone CNNs.

**METHODS AND MATERIALS**

Our dataset for this REB-approved retrospective study is related to pLGG cases aged between 5 and 18, containing 3D brain FLAIR MR images, corresponding radiology reports, and genetic marker labels. We used only the cases associated with the two most prevalent genetic marker labels, namely BRAF Fusion and BRAF V600E Mutation, resulting in a total of 204 datapoints. To examine the predictive performance of MR images alone, we trained a 3D ResNet model, initialized with a set of pretrained weights called "MedicalNet", along with a fully-connected (FC) classification layer. Subsequently, we concatenated report representation obtained from a transformer named Clinical Longformer, with image representation extracted from 3D ResNet. Two FC layers were applied on top of the fused representations to map them onto a joint space and perform the classification.

**RESULTS**

Area under the ROC curve (AUC) was used to compare the performance of the two models. Our results indicate that the AUC of the image-based model is 0.79 (±0.101). Applying the proposed multimodal learning framework (MRI and report) improves the classification performance by 0.073, achieving an AUC of 0.863 (±0.114). This demonstrates the significant effect of radiology reports and the interactions between image and text representations on the classification task.

**CONCLUSION**

We developed a multimodal learning framework for classifying pLGG genetic markers, as an important procedure for targeted treatment planning. We trained two separate models on MRI and MRI-report combination and showed that the latter notably enhanced the classification performance, revealing considerable correspondence between the two modalities.

**CLINICAL RELEVANCE/APPLICATION**

Our multimodal framework can serve as a helping hand to radiologists by providing high-performing pLGG genetic marker diagnosis, reducing the need for invasive biopsy and leading to efficient treatment planning.
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# Abstract Archives of the RSNA, 2024

R2-SPPH

**Physics Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPPH-1 REDUCING RADIATION DOSE AND IMPROVING SPATIAL RESOLUTION USING SUPER-RESOLUTION DEEP-LEARNING-BASED RECONSTRUCTION FOR ABDOMINAL CT: PHANTOM STUDY

Toshinori Hirai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasunori Nagayama, MD (*Abstract Co-Author*) Nothing to Disclose
Daisuke Sakabe, MS (*Abstract Co-Author*) Nothing to Disclose
Takashi Tsutsumi (*Abstract Co-Author*) Nothing to Disclose
Yutaka Chiba (*Abstract Co-Author*) Nothing to Disclose
Yoshinori Funama, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Super-resolution deep-learning-based reconstruction (SR-DLR) image for the dedicated abdominal region is newly developed and expects the improvement of spatial resolution for lower contrast while reducing radiation dose. This study aimed to examine the image quality of SR-DLR images compared with hybrid iterative reconstruction (HIR) and normal-resolution deep-learning-based DLR (NR-DLR) images at various radiation doses and field of view (FOV) sizes based on the data of the phantom study.

### METHODS AND MATERIALS

A Catphan phantom with an external body ring was utilized and scanned with 320-row multidetector CT (Aquilion ONE GENESIS; Canon Medical Systems, Tokyo, Japan). The CTDIvol for CT scanning was set at 7.9 and 11.0 mGy. All images were reconstructed with filtered back-projection (FBP) and HIR, NR-DLR, and SR-DLR with three noise reduction strengths: mild, standard, and strong at various FOVs. Noise power spectrum (NPS) was computed from all images using a uniform portion of the phantom. The noise magnitude ratio (NMR) and central frequency ratio (CFR) were determined from HIR, NR-DLR, and SR-DLR images relative to FBP images employing NPS. CFR indicates the degree of lower frequency shift for NPS. Task-based transfer function (TTF) with 50 HU contrast was also assessed from all CT images.

### RESULTS

NMR for SR-DLR, HIR, and NR-DLR with mild levels were 0.29 to 0.36, 0.40 to 0.44, and 0.27 to 0.31 at 7.9 mGy and 0.35 to 0.45, 0.46 to 0.76, and 0.32 to 0.39 at 11.0 mGy, respectively. SR-DLR obtained substantial noise reduction compared to HIR and the same level as NR-DLR regardless of noise reduction strengths. The CFR for SR-DLR was reduced with decreasing NMR and a similar tendency to that for NR-DLR. The TTF10% for SR-DLR, HIR, and NR-DLR with mild levels was 0.72 to 0.81 mm-1, 0.66 to 0.72 mm-1, and 0.65 to 0.76 mm-1 at 7.9 mGy and 0.78 to 0.98 mm-1, 0.69 to 0.76 mm-1, and 0.69 to 0.81 mm-1 at 11.0 mGy. The same tendency was achieved at standard and strong levels. Spatial resolution for SR-DLR was superior to HIR and NR-DLR.

### CONCLUSION

SR-DLR images for the dedicated abdomen demonstrate substantial noise reduction while improving spatial resolution, particularly beneficial for smaller FOV.

### CLINICAL RELEVANCE/APPLICATION

SR-DLR images for dedicated abdomen are expected to benefit not only adults but also pediatric patients in particular due to substantial radiation dose reduction and improvement of spatial resolution.

## R2-SPPH-11 IMPACT OF THE COVID-19 PANDEMIC ON RADIATION EXPOSURE OF EMERGENCY PATIENTS

Clemens C. Cyran, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias Klein (*Abstract Co-Author*) Nothing to Disclose
Katharina Schmidt (*Abstract Co-Author*) Nothing to Disclose
Sabine Woellert (*Abstract Co-Author*) Nothing to Disclose
Enrico Schulz (*Abstract Co-Author*) Nothing to Disclose
Jens Ricke, MD, PhD (*Abstract Co-Author*) Research Grant, Sirtex Medical Ltd;Research Grant, Bayer AG;Research Grant, Terumo Corporation;Research Grant, Boston Scientific Corporation
Maria Steinberger (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the impact of the COVID-19 pandemic on the number of emergency CT scans and the resulting radiation exposure of ER patients assessed via the average effective dose.

### METHODS AND MATERIALS

A total of n = 374,694 ER patients were included in this retrospective study. The study cohort was split into two age-related groups: 18-59 years (n = 227,010) and = 60 years (n = 147,684). The study period was divided into 3 phases: pre-pandemic (01/2018-02/2020), pandemic (03/2020-12/2022), post-pandemic (01/2023-12/2023). A total of n = 122,161 ER CT scans were performed during the study period. Radiation exposure was assessed via effective dose calculated as a risk-weighted average of organ doses. The use of a dose management system allowed matching patient data (patient ID, sex, age) and exam data (study ID, date, protocol, effective dose) and focusing on CT scans for selected COVID-19-related suspected diagnoses (stroke, pulmonary embolism (PE)). Differences among groups were assessed via Post-hoc Dunn-Test and effect size via Cohen's d. Index 1 refers to the comparison pre vs pandemic, 2 to pandemic vs post, 3 to pre vs post.

### RESULTS

In the pandemic and post-pandemic phase a significant increase of CT scans per day (n = 54.5 [pre] vs 54.1 [pandemic] vs 63.2 [post], P2,3 < 0.001, 0.5 = d2,3 < 0.8) was observed, with a particular, significant increase in stroke (n = 5.4 vs 5.6 vs 7.5, P2,3 < 0.001) and PE protocols (n = 2.0 vs 2.6 vs 3.7, P1,2,3 < 0.001). The number of CT scans per 100 ER patients increased significantly (n = 31.4 vs 33.3 vs 33.1, P1,3 < 0.001), especially for patients over 60 years (n = 47.1 vs 48.6 vs 49.2, P1,2,3 < 0.001). For stroke (n = 3.1 vs 3.4 vs 3.9, P1,2,3 < 0.001) and PE scans (n = 1.1 vs 1.6 vs 1.9, P1,2,3 < 0.001), a particular, significant increase was observed. The mean effective dose per ER patient due to CT scans showed a significant increase (E = 1.22 mSv vs 1.55 mSv vs 1.56 mSv, P1,3 < 0.001, d1,3 = 0.8) especially for patients over 60 years (E = 2.12 mSv vs 2.51 mSv vs 2.50 mSv, P1,3 < 0.001).

### CONCLUSION

Compared to the pre-pandemic phase, a significant increase of CT scans in ER patients was observed in the pandemic and post-pandemic phase, especially in stroke and PE protocols and for patients over 60 years. This increase was paralleled by a significant increase of mean effective dose per ER patient.

### CLINICAL RELEVANCE/APPLICATION

In the pandemic and post-pandemic phase, a significant increase of CT scans and radiation exposure per ER patient was observed. This finding was particularly significant for stroke and PE protocols, most likely due to the thromboembolic complication profile of COVID-19. In the post-pandemic phase, no significant reduction of ER CT scans was observed so far. An unchanged implicit bias of radiologists and ER physicians may be an influencing factor.

## R2-SPPH-3 INFLUENCE OF RADIATION DOSE REDUCTION AND RECONSTRUCTION ALGORITHMS TO QUANTITATIVE COPD EVALUATIONS ON HIGH-DEFINITION CT WITH SUPER-HIGH-RESOLUTION MODE IN SMOKERS

Kota Aoyagi (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hiroyuki Nagata (*Abstract Co-Author*) Canon Medical Systems Corporation
Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yoshiyuki Ozawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takahiro Ueda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kimoto (*Abstract Co-Author*) Nothing to Disclose
Kenji Fujii (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yuya Ito (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yoshihiro Ikeda (*Abstract Co-Author*) Nothing to Disclose
Hirona Kimata (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Masahiko Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Daisuke Takenaka, MD (*Abstract Co-Author*) Canon Medical Systems Corporation
Yoshiharu Ohno, MD, PhD (*Presenter*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology

### PURPOSE

High-definition CT (HDCT) with energy integrated detector is clinically available and can provide higher spatial resolution images by high-resolution (HR: 0.5 mm×80 rows/1792 channels) and super-high-resolution (SHR: 0.25 mm×160 rows/1792 channels) modes as compared with conventional multi detector row CTs. The purpose of this study was to determine the influence of radiation dose and reconstruction algorithms to quantitative chronic obstructive pulmonary disease (COPD) evaluation on HDCT with SHR mode in smokers.

### METHODS AND MATERIALS

49 smokers underwent HDCT with SHR mode at standard- (CTDIvol: 9.0±1.8mGy), reduced- (1.7±0.2mGy) and ultra-low-dose (0.8±0.1mGy) levels. All HDCT data were reconstructed with hybrid-type iterative reconstruction (IR), model-based IR and deep learning reconstruction (DLR). Standard protocol in this study was standard-dose HDCT with hybrid-type IR. According to pulmonary function test results, all smokers were divided into five groups as follows: 'non-COPD', 'GOLD I', 'GOLD II', 'GOLD III' and 'GOLD IV' groups. In each smoker, percentages of low attenuation volume within lung (%LAV) and wall area at sixth level bronchi (%WA) were automatically measured by means of our proprietary software. To determine the influence of radiation dose reduction and reconstruction algorithm to quantitative COPD evaluation, each index was correlated between each HDCT and standard protocols by Pearson's correlation. Moreover, paired t-test was performed to compare each index between each HDCT and standard protocols. Furthermore, both indexes on each HDCT protocol were compared among all groups by Tukey's HSD test.

### RESULTS

%LAV (0.97=r, p<0.0001) and %WA (0.92=r, p<0.0001) had excellent correlations between each HDCT and standard protocols, although no significant differences of both indexes were determined. At each HDCT protocol, both indexes of 'non-COPD' and 'GOLD I' groups had significant differences with those of others (p<0.05). Moreover, both indexes of 'GOLD II' group had significant difference with that of 'GOLD III' or 'GOLD IV' groups (p<0.05).

### CONCLUSION

HDCT has little influence of radiation dose reduction and reconstruction algorithm to quantitative CT evaluation of COPD on HDCT with SHR mode in smokers.

### CLINICAL RELEVANCE/APPLICATION

Quantitatively assessed HDCT has little influence of radiation dose reduction and reconstruction algorithm to COPD evaluation in smokers.

## R2-SPPH-5 HOW DOSE METRICS IN COMPUTED TOMOGRAPHY COMPARE TO RADIATION RISK IN BEIR VII

Christiane S. Burton, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Dose metrics in computed tomography (CT) are used to optimize patient exams and justify patient dose. However, these common dose metrics may not consider radiation risk based on age, gender or tissue type. This study compares dose metrics in CT to radiation risk in BEIR Report VII across 18 different CT scanners and 30 protocols.

**METHODS AND MATERIALS**

This study included 200 CT abdomen/pelvis and chest examinations from 30 protocols with techniques listed in Table 1. The 14 scanners' make and model were included in Table 2. Radimetrics (Bayer) was used to calculate organ doses for stomach, colon, liver, lung, breast, bladder. The following dose metrics were considered: relative effective dose (RED), organ dose-based effective dose (ICRP 103), volume computed tomography dose index (CTDIvol), dose-length product (DLP), size specific dose estimate (SSDE) calculated using the effective diameter (ED) and water-equivalent diameter (WED), and organ dose (OD). A linear regression (R2) was applied to compare the dose metrics to the lifetime attributable risk (LAR). The results were characterized in terms of risk sensitivity index (RSI) and risk differentiability index (RDI).

**RESULTS**

The R2 correlation between RED and LAR was 1.0 for all organs analyzed. RED also showed the best correlation in terms of RSI and RDI. The RSI ranged from 0.02 for CTDIvol and 1.0 (RED). RDI ranged between 0.00 (RED) and 0.92 (CTDIvol) cancers × 105patients/100 mGy. For patients of the same gender, similar age, and similar girth, the CTDIvol could differ by a factor of 4 between scanners.

**CONCLUSION**

The dose metrics attributed to risk of a population may lead to different characterizations. RED demonstrated the strongest correlation and differentiability between populations, whereas common dose metrics such as CTDIvol, DLP, and SSDE did not. When justifying dose or optimizing CT protocol, there should be more caution when attributing the radiation risk dose metrics that are unrepresentative of risk.

**CLINICAL RELEVANCE/APPLICATION**

Medical physicists and radiologists should be cautious about attributing dose metrics to radiation risk in order to justify and optimize protocols.

## R2-SPPH-6 RADIATION DOSE MANAGEMENT IN PEDIATRIC HEAD CT AT A DEDICATED CHILDREN'S HOSPITAL AND REGIONAL GENERAL HOSPITALS

Elena Tonkopi, MS (*Abstract Co-Author*) Nothing to Disclose
Jessica Kimber (*Abstract Co-Author*) Nothing to Disclose
Tahani M. Ahmad, MD (*Abstract Co-Author*) Nothing to Disclose
Catherine Gunn, MBA, RT (*Abstract Co-Author*) Nothing to Disclose
Yulia Kotlyarova (*Abstract Co-Author*) Nothing to Disclose
Megan Iwaskow, BSc, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare radiation doses and image quality from pediatric head CT examinations performed at a children’s hospital and general regional hospitals in Nova Scotia, Canada, and to establish provincial diagnostic reference levels (DRLs).

**METHODS AND MATERIALS**

Data were collected from five scanners in three hospitals including a pediatric facility. For comparison with published data, the patients were grouped by age: <1, 1-5, 6-10, and 11-15 years old. Most examinations were from 2020-2023 with some studies dating back to 2016 due to insufficient number of pediatric cases from general hospitals. The sample size from each scanner included 4-30 patients under 1 year and 13-30 cases in other age groups. Volume CT dose index (CTDIvol) and dose-length product (DLP) were retrospectively extracted from PACS. Provincial DRLs were established as the 75th percentile of the dose distributions and modeled as a continuous function of patients’ AP thickness using quantile regression for the 75th percentile. To evaluate image quality, samples of 25 studies from each scanner were randomized and blinded for review by a pediatric neuro-radiologist. Images were graded using a 4-point Likert scale (excellent, good, suboptimal, non-diagnostic) in 7 categories including GM-WM differentiation in the posterior fossa and supratentorial regions, bony detail, sharpness of subarachnoid spaces, reduction of image noise and reduction of artifact. Differences in the scores and radiation doses between scanners were assessed using the Kruskal-Wallis test with $p<0.05$ denoting statistical significance. Ordinary Least Squares (OLS) regression with robust standard errors was used to determine the effect of DLP values on total quality scores.

**RESULTS**

Dose survey included 358 studies, 125 of which were assessed for image quality. Provincial DRLs were established as discrete quantities in each age group and modeled as $DLP=142.3 \bullet e0.093 \bullet AP$. Differences in dose indices between scanners were statistically significant for all age categories, and median dose values obtained from the pediatric hospital were highest in the province for patients <1 year and 1-5 years old. Results of image quality evaluation demonstrated significant differences in distributions of total scores between all scanners; however, the OLS regression indicated that the impact of DLP on total score is insignificant for each scanner, showing joint p-value=0.783.

**CONCLUSION**

The study determined provincial DRLs in pediatric head CT and demonstrated potential for dose optimization without affecting image quality.

**CLINICAL RELEVANCE/APPLICATION**

The increased vulnerability to stochastic effects of radiation in children emphasizes the clinical need for pediatric-specific DRLs to inform dose-optimized CT imaging.

## R2-SPPH-7 BODY CT EXAMINATIONS IN ONCOLOGIC PATIENTS: THE IMPACT OF SUBSPECIALTY RADIOLOGY ON RADIATION EXPOSURE IN THE CLINICAL PRACTICE. A QUALITY CARE STUDY

Filippo del Grande, MD (*Abstract Co-Author*) Institutional research collaboration, Siemens AG;Speaker, Siemens AG;Speaker, Bayer AG
Maria Del Grande, MD (*Abstract Co-Author*) Nothing to Disclose
Ermidio Rezzonico (*Abstract Co-Author*) Nothing to Disclose
Stefano Presilla (*Abstract Co-Author*) Nothing to Disclose
Francesco Magoga, BSc (*Abstract Co-Author*) Nothing to Disclose
Luca Bonomo, MD (*Abstract Co-Author*) Nothing to Disclose
Stefania Rizzo (*Abstract Co-Author*) Nothing to Disclose
Veronica Minzolini (*Abstract Co-Author*) Nothing to Disclose

MATTEO MERLI (*Abstract Co-Author*) Nothing to Disclose
Andrea D'Ermo (*Abstract Co-Author*) Nothing to Disclose
Luca Bellesi, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The primary objective of this retrospective study was to assess whether the CT dose delivered to oncologic patients was different in a subspecialty radiology department, compared to a general radiology department. The secondary explorative objective was to assess whether the objective image quality of CT examinations was different in the two settings.

**METHODS AND MATERIALS**

Chest and abdomen CT scans performed for oncologic indications were selected from a general radiology department and a subspecialty radiology department. By using a radiation dose management platform, we extracted and compared CT dose index (CTDIvol) and dose length product (DLP) both for each phase and for the entire CT exams. For objective image quality evaluation, we calculated the signal-to-noise ratio (SNR) and the contrast-to-noise ratio (CNR) at the level of the liver and of the aorta. A P-value $< 0.05$ was considered significant.

**RESULTS**

A total of 7098 CT examinations were included. CTDIvol was evaluated in 12,804 phases; DLP in 10,713 phases and in 6714 examinations. The CTDIvol and DLP overall were significantly lower in the subspecialty radiology department compared to the general radiology department CTDI median (IQR) 5.19 (3.91-7.00) and 5.51 (4.17-7.72), DLP median and IQR of 490.0 (342.4-710.6) and 503.4 (359.9-728.8), $p < 0.001$ and $p = 0.01$, respectively. The objective image quality showed no significant difference in the general and subspecialty radiology departments, with median and IQR of 4.03 (2.82-5.51) and 3.84 (3.09-4.94) for SNRLiv ($p = 0.58$); 4.81 (2.70-7.62) and 4.34 (3.05-6.25) for SNRAo ($p = 0.30$); 0.83 (0.20-1.89) and 1.00 (0.35-1.57) for CNRLiv ($p = 0.99$); 2.23 (0.09-3.83) and 1.01 (0.15-2.84) for CNRAo ($p = 0.24$) with SNRLiv ($p = 0.58$), SNRAo ($p = 0.30$), CNRLiv ($p = 0.99$) and CNRAo ($p = 0.24$).

**CONCLUSION**

In a subspecialty radiology department, CT protocols are optimized compared to a general radiology department leading to lower doses to oncologic patients without significant objective image quality degradation.

**CLINICAL RELEVANCE/APPLICATION**

The Ri-organization of subspecialty radiology give the opportunity to compare the CT doses and image quality delivered to patients enabling reductions of the amount in ionizing radiation to patients while improving image quality.

## R2-SPPH-8 ASSESSMENT OF ORGAN DOSE THROUGH MONTE CARLO SIMULATION IN CT AUTOMATIC TUBE CURRENT MODULATION

Yoshinori Funama, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Ikenaga, RT (*Abstract Co-Author*) Nothing to Disclose
Hiroyasu Sanai, RT (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Tamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takanori Masuda, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryo Moriwake, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Monte Carlo simulation are commonly used for estimating organ doses in computed tomography (CT) examinations, however the precision of such as the calculated values remains uncertain. Therefore, we competed the radiation dose between organ dose characteristics derived from dose control simulation system and the actual measured values obtained through calculation with a fluorescent glass dosimeter inserted into a RANDO phantom.

**METHODS AND MATERIALS**

An Aquilion Prime SP (Canon Medical Systems) X-ray CT system was used in this study. The radiation dose was compared based on the calculated values from the simulation software of Radimetrics (Bayer Yakuhin) and the measured values from 65 GD-352M fluorescent glass dosimeters (AGC Techno Glass) inserted at each organ location (23 sites) in the RANDO phantom (The Phantom Laboratory). The measurement conditions were as follows: tube voltage 120 kV, X-ray beam width 0.5 x 80 mm, S-FOV 50 cm, and imaging slice thickness 5 mm. The scan range was 625 mm from the chest to the pelvis. The scan method was the helical scan, and 10 consecutive scans were taken using automatic tube current modulation. Image noise (standard deviation: SD) was performed at 8. The measurement process was repeated thrice, and the resulting values were averaged to obtain the final average value.

**RESULTS**

The simulated organ doses ranged from 0.33 to 27.42 mSv, while the measured doses ranged from 0.49 to 48.20 mSv, with mean values of 18.82 mSv. The relative error of the simulation compared to the measured values was -10.17%, with an absolute value of 20.66%.

**CONCLUSION**

When comparing the simulation-based organ doses with the measured values, we found a relative error of -10.17%. However, the absolute value of the relative error was larger, at 20.66%.

**CLINICAL RELEVANCE/APPLICATION**

In this study, we employed an 80-row MDCT, a novel addition not previously explored in similar research, alongside a Radimetrics dose management system. Furthermore, we expanded the scope to include 23 target organs, encompassing the entire trunk of the body. This approach provided valuable insights into the disparities between simulation software predictions and actual measured values. Armed with this understanding of the associated errors, simulation software can be utilized to assess organ doses for individual patients and effectively manage doses based on accumulated data.

# Abstract Archives of the RSNA, 2024

R2-SPRO

**Radiation Oncology Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPRO-1 OPTIMIZING MR IMAGING IN HEAD AND NECK RADIATION THERAPY: A COMPARATIVE STUDY OF A NEW FLEXIBLE COIL SET-UP FOR IMPROVED SIGNAL-TO-NOISE RATIO

Evy Nostvold (*Abstract Co-Author*) Nothing to Disclose
Helge Aurdal (*Presenter*) Nothing to Disclose

### PURPOSE

High precision modern radiation techniques require precise target definition to fully realize their potential for improving radiation therapy outcomes. In head and neck (HN) cancer, MRI provides superior soft tissue contrast, thereby increasing target definition. However, MRI in the context of radiation therapy for HN cancer is challenging. HN coils are typically heavy, non-flexible and cannot be placed directly onto the patient's radiation therapy mask. The standard set-up is to place the coil in a holder above the patient, which creates a distance from the coil elements to the patient and lowers the signal-to-noise ratio (SNR). The new coil set-up in this study uses a lightweight, flexible coil that can be fitted to the patient's mask. This should result in images with higher SNR. This study aimed to compare the SNR between a standard set-up with the coil above the mask and a new flexible coil set-up fitted to the mask.

### METHODS AND MATERIALS

In a clinical 3T MRI system, T2w images were acquired on a phantom and a volunteer using the standard set-up with the coil above the mask, and the new coil set-up with the flexible coil fitted to the mask. T2w offers the best soft tissue contrast for anatomy and thin 3D slices are well suited for image fusion with CT, therefore we selected an axial spin echo 3D T2w sequence with 1 mm isotropic resolution. The 3D spin echo sequence utilizes parallel imaging. Thus, we measured the SNR using the subtraction method described by Goerner and Clarke (2011). The subtraction images and measurements were conducted using a clinical standard tool in PACS (Sectra). The measurements were done in vertebra C4.

### RESULTS

Visual inspection of the MR images, both on the phantom and the volunteer, demonstrated a higher signal when using the new coil set-up. Furthermore, the subtraction images showed a lower noise level than the standard set-up. In the phantom, the new coil set-up achieved a 2.1 times higher SNR than the standard coil set-up. Similarly, in the volunteer, the new coil set-up achieved a 2.0 times higher SNR than the standard coil set-up.

### CONCLUSION

The new flexible HN coil set-up improves the SNR by a factor of two compared to the standard coil set-up.

### CLINICAL RELEVANCE/APPLICATION

Improved SNR can be translated to shorter scan times or higher image resolution. The MRI procedure, which requires the patients to wear a mask with a coil on top, is uncomfortable and claustrophobic. Therefore, a scan time as short as possible is highly desirable. However, development towards more conformal radiation therapy, such as stereotactic radiotherapy and proton therapy, require increasingly more accurate tumor delineation. With improved SNR, better image resolution is feasible without increasing the scan time.

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# Abstract Archives of the RSNA, 2024

R2-SPVA

**Vascular Imaging Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-SPVA-2 GOLDEN-ANGLE RADIAL SPARSE PARALLEL (GRASP) MR ANGIOGRAPHY FOR ENDOLEAK EVALUATION AFTER ENDOVASCULAR REPAIR OF THE AORTA: A PROSPECTIVE COMPARISON TO CONVENTIONAL TIME-RESOLVED MRA

Ulrich Grosse, MD (*Abstract Co-Author*) Nothing to Disclose
Haidara Al Mansour, MD, MEng (*Abstract Co-Author*) Nothing to Disclose
Christoph P. Artzner (*Abstract Co-Author*) Nothing to Disclose
Gerd Groezinger (*Abstract Co-Author*) Nothing to Disclose
Sven S. Walter, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Keyhole sampling of the k-space may mask smaller vessels particularly in peripheral anatomic regions. The purpose was to assess the feasibility of radial GRASP sequence (Golden-angle RAdial Sparse Parallel) in patients with inconclusive post-endovascular aortic repair (EVAR) endoleak status compared to the conventional TWIST (Time-Resolved angiography With Interleaved Stochastic Trajectories) MRA.

### METHODS AND MATERIALS

The prospective study enrolled adults with inconclusive findings regarding endoleak presence in multiphasic CT following EVAR for abdominal aortic aneurysm. Participants underwent contrast enhanced MRA with dynamic TWIST and GRASP sequences. Two independent radiologists assessed for image quality, diagnostic confidence, and the presence and type of endoleak. One reader performed quantitative assessment for signal-to-noise ratios (SNR) and contrast-to-noise ratios (CNR) in both sequences. Statistical analyses included interrater and intermethod agreement, and diagnostic performance testing.

### RESULTS

Twenty participants (mean, 72±9 years; 13 males) were included. Overall image quality was significantly better for GRASP than TWIST sequences (median: 1 [IQR: 1, 2], 2 [IQR: 2, 3]; P<.001) with predominantly absent motion artifacts (median: 1 [IQR: 1, 2], 3 [IQR: 3, 4]; P<.001) and very good interreader agreement (k=0.82 [95% CI:0.57, 1.0]). Diagnostic performance significantly improved for detecting type II endoleak with GRASP compared to TWIST (AUC: 0.96 vs 0.73; P=.04). Although diagnostic accuracy improved with GRASP for overall endoleak detection (AUC: 0.94 vs. 0.79) and endoleak type I detection (AUC: 1.0 vs. 0.90), the results were not significant (P=.08). Sequences performed the same for type III endoleaks (P=1.0). Interrater agreements for endoleaks in general, type I and type II endoleaks were higher for GRASP (k=0.89) than TWIST (k=63). TWIST sequences had significantly higher SNR for measurements in the clotted aneurysm sac (P=.01). However, measurements in the aorta and, if present, in the perfused aneurysm sac did not show significant differences (P=n.s.).

### CONCLUSION

Compressed sensing dynamic GRASP sequence provides superior subjective image quality and diagnostic confidence. It also outperformed the conventional dynamic TWIST sequence in detecting type II endoleaks. Furthermore, our results suggest that the GRASP sequence improves diagnostic accuracy for endoleaks in general and type I endoleaks.

### CLINICAL RELEVANCE/APPLICATION

Clinical precision of post-EVAR endoleak surveillance can be enhanced by utilizing GRASP MRA, providing detailed images with excellent image quality and blood flow dynamics around the stent graft. Thus, aiding in accurate detection and management of endoleaks.

# Abstract Archives of the RSNA, 2024

R5A-SPBR

**Breast Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPBR-1 ENHANCING RADIOLOGY RESIDENT TRAINING IN MAMMOGRAM INTERPRETATION: LEVERAGING GLOBAL MAMMOGRAPHIC RADIOMIC FEATURES TO IDENTIFY DIFFICULT CASES

Patrick C. Brennan, BS, PhD (*Abstract Co-Author*) Director, DetectED-X
Ziba Gandomkar (*Abstract Co-Author*) Nothing to Disclose
Somphone Siviengphanom (*Abstract Co-Author*) Nothing to Disclose
Sarah J. Lewis, PhD, MEd (*Abstract Co-Author*) Nothing to Disclose
Phuong Dung Trieu, PhD (*Abstract Co-Author*) Nothing to Disclose
Moayyad E. Suleiman, PhD (*Presenter*) CTO, DetectED-X

### PURPOSE

Radiology residents (RRs) have limited capability for global image processing. To accelerate and enhance trainee learning, identifying global image features in an image that make a normal case difficult to interpret for a trainee is of significant interest to radiology educators. This study therefore investigates whether difficult-to-interpret normal, cancer-free cases for RRs can be distinguished from easy-to-interpret cases using global mammographic radiomic features (GMRFs).

### METHODS AND MATERIALS

A set of retrospective de-identified reading data consisting of 280 normal screening mammographic cases from 137 RRs was utilized. These cases were categorized into difficult- vs. easy-to-interpret normal cases (70 cases each) based on the 75th and 25th percentiles of the cases containing the respective highest and lowest difficulty scores (i.e., percentage of incorrect reports per case). Thirty-four quantitative global radiomic features of images, extracted from a previous study, were investigated for the 140 difficult- and easy-to-interpret categories of normal cases. The GMRFs were then used to build a random forest machine learning classifier for predicting difficult- from easy-to-interpret normal cases of radiology trainees. The model was trained and validated using leave-one-out-cross-validation approach. The performance of the model was assessed using the area under the receiver operating characteristic curve (AUC).

### RESULTS

The model achieved an AUC of 0.75 (95% CI: 0.67-0.83), indicating the effectiveness of GMRFs in distinguishing difficult from easy-to-interpret cases for RRs. Significant differences in 15 out of 34 features were observed, with cluster prominence and range emerging as key predictors.

### CONCLUSION

GMRFs show promise in improving and accelerating RRs' interpretation skills and facilitating personalized training programs for mammogram interpretation. This approach may reduce false positive errors and enhance RRs' expertise in breast cancer screening.

### CLINICAL RELEVANCE/APPLICATION

Global mammographic radiomic features offer a valuable tool for facilitating the tailoring radiology resident’s education and help build required global image processing skills.

## R5A-SPBR-10 A PRELIMINARY STUDY USING DIGITAL BREAST TOMOSYNTHESIS (DBT) RADIOMICS COMBINED WITH CLINICAL INFORMATION IN PREDICTING BENIGN AND MALIGNANT BREAST MASSES

Huizhi Cao (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the predictive value of digital breast tomosynthesis (DBT) radiomics combined with clinical data for preoperative differentiation of benign and malignant breast masses.

### METHODS AND MATERIALS

A retrospective analysis included 381 patients with single breast mass-type lesions enrolled between March 15, 2023, and November 15, 2023. Clinical and imaging features were collected, followed by univariate and multivariate logistic analyses. Radiomics features were extracted from synthesized 2D and DBT images of CC and MLO views. Features were standardized, and model selection algorithms identified stable and optimal features for constructing different prediction models: a synthetic 2D imaging omics model (Model 1), a DBT-based imaging omics model (Model 2), and a combined DBT + clinical factors model (Model 3). Model performance was assessed using AUC, decision curve analysis, and calibration curves.

**RESULTS**

AUCs for Models 1, 2, and 3 were 0.75 (95% CI: 0.63-0.87), 0.83 (95% CI: 0.75-0.92), and 0.94 (95% CI: 0.88-0.99), respectively. Model 3 exhibited significantly better diagnostic performance than Models 1 and 2 (P < 0.05). Model 2 demonstrated higher AUC, accuracy, sensitivity, and specificity compared to Model 1. Calibration curves indicated good agreement between predicted and actual outcomes for all models, and decision curves demonstrated high clinical utility for predicting benign and malignant breast masses.

**CONCLUSION**

DBT-based radiomics models outperformed synthetic 2D models in predicting benign and malignant breast masses. The combined DBT imaging features with age and mass morphology yielded the highest performance, with superior AUC, accuracy, sensitivity, and specificity. These findings offer valuable insights for preoperative prediction of breast mass pathology.

**CLINICAL RELEVANCE/APPLICATION**

DBT-based radiomics combined with clinical information can provide clinical value for predicting benign and malignant breast mass before clinical operation.

## R5A-SPBR-3 PREVALENCE OF BREAST ARTERIAL CALCIFICATIONS VARIES BASED ON ETHNICITY AND BREAST DENSITY

Alyssa T. Watanabe, MD (*Presenter*) Officer, CureMetrix, Inc;Stockholder, CureMetrix, Inc

**PURPOSE**

We examine the prevalence of BAC and its dependency on age, breast density and ethnicity, using an artificial intelligence (AI) based device for detection and localization of BAC ion mammograms.

**METHODS AND MATERIALS**

A retrospective study analyzed a dataset of 20,029 mammograms collected from four sites in various geographic locations from 2005 to 2019. Patients' ages ranged from 40 to 89, (median age,56). The AI device (cmAngio, San Diego, CA) assessed the prevalence of BAC. Data extraction from clinical reports utilized the generative AI model, LLAMA. Two-sided proportion tests evaluated the statistical significance of BAC prevalence differences across age, ethnicity, and density groups, while one-sided pairwise proportion tests examined specific comparisons between these groups.

**RESULTS**

The BAC prevalence rate was 19.8%. breast density and ethnicity. BAC prevalence ranged 15.4% to 28.8% across sites, increasing significantly across age groups (8% in 40-49, up to 67% for patients aged 80-89). Compared with dense breasts, patients with non-dense breasts had significantly higher BAC prevalence 24.2% vs 12.2%, p<0.01). BAC prevalence was lowest in Asians (16.7%), highest in African Americans (23.2%), followed by non-white hispanics (22.5%) and whites (20.1%) (p for comparison <0.001). Variations in BAC prevalence across ethnicities could be linked to differences in average breast density among these groups. There were notable ethnic differences in breast density: proportion of dense breasts in Asians (64%), African Americans (27.6%), non-white Hispanics (38%) and whites (44%).

**CONCLUSION**

BAC prevalence increases with age, BAC varies significantly between ethnic populations with highest BAC in African American and non-white Hispanics. Given established ethnic disparities in cardiovascular disease, assessment of BAC in different ethnic groups may have additive value as a personalized risk marker for future CVD. BAC prevalence is lower with high tissue density which could be due to many potential variables.

**CLINICAL RELEVANCE/APPLICATION**

Disproportionately high CVD event rates are seen in certain ethnic minority subgroups who may have limited access to healthcare. Reporting BAC presence on screening mammograms provides an opportunity for earlier identification of at-risk patients, patient education, and consideration of lifestyle modifications.

## R5A-SPBR-4 HABITAT-BASED ANALYSIS OF MRI INTRA-TUMORAL PERFUSION HETEROGENEITY PREDICTS HER2-ZERO, -LOW, AND -POSITIVE TERNARY EXPRESSION STATUS IN BREAST CANCER

Xiaowen Liu (*Abstract Co-Author*) Nothing to Disclose
Shuxing Wang (*Abstract Co-Author*) Nothing to Disclose
Jingshan Gong, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The novel HER2-directed antibody-drug conjugate (ADC) had showed significant improve outcomes of patients with HER2-low metastatic breast cancers, which made it is necessary to discriminate HER2-zero, HER2-low, and HER2-positive breast cancers. The aim of this study was to explore whether radiomics models derived from imaging habitat to address intra-tumoral perfusion heterogeneity of dynamic contrasted enhanced (DCE) MRI could differentiate these three categories.

**METHODS AND MATERIALS**

This retrospective study included a total of 955 women with breast cancer who underwent MRI at three different centers (Centre A, B, C) between October 2017 and February 2024. Construction of voxel vectors based on three perfusion imaging parameters of dynamic contrast-enhanced MRI wash-in, wash-out and wash-out ratio map. Voxels with similar tumor perfusion imaging vectors were clustered into one group using the K-means method and three habitats were determined. Habitat radiomics features were then extracted for each of the three sub-regions and integrated to develop Habitat model, and a whole tumor model was constructed on the basis of radiomics features derived from the entail tumor. Patients from Center A were used as the training cohort (n=564), while patients from Center B (n=222) and C (n=169) were used as the two external test cohorts, respectively. Habitat and whole tumor models were developed for ternary classification regarding HER2 expression status, respectively. The area under the receiver operating characteristic curve (AUC) was used to evaluate the performance of the models.

**RESULTS**

The Habitat model archived AUC of 0.800 (95% CI: 0.740,0.861)for predicting HER2-zero, 0.760 (95% CI: 0.693,0.827)for HER2-low, and 0.770 0.770(95% CI: 0.695,0.845)for HER2-positive in the center B external test cohort, respectively. AUCs of the ternary prediction of the whole tumor model were 0.703(95% CI: 0.735,0.772), 0.663(95% CI: 0.590,0.735), and 0.712(95% CI: 0.633,0.790), respectively. In the Center C external test cohort, AUCs for the HER2-zero, -low, and -positive were 0.802 (95% CI: 0.731,0.873)vs. 0.656(95% CI: 0.571,0.741), 0.739 (95% CI: 0.661,0.817)vs. 0.652(95% CI: 0.566,0.737), and 0.775 (95% CI: 0.694,0.857)vs 0.711(95% CI: 0.627,0.796), respectively.

**CONCLUSION**

A radiomics model based on Habitat analysis of intra-tumoral perfusion heterogeneity could predict the ternary expression status of breast cancer accurately.

**CLINICAL RELEVANCE/APPLICATION**

Harnessing the intra-tumor heterogeneity, Habitat model could archive accurately ternary classifications of HER2 expression status of breast cancer to provide guide for state-of-art HER2-directed therapy.

## R5A-SPBR-5 THE MQSA NATIONAL STATISTIC TRENDS AND WHAT THE FUTURE ENTAILS

Miriam Sklair-Levy, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Eyal Klang, MD (*Abstract Co-Author*) Nothing to Disclose
Larisa Gorenstein, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

In a landmark move for public health, the Mammography Quality Standards Act (MQSA) was established as law on October 27, 1992. The Congress aimed at guaranteeing universal access to high-quality mammography service, to facilitate early detection of breast cancer, thereby improving treatment outcomes by identifying the disease in its most manageable stages. Our objective was to assess the MQSA's national statistics and provide insights.

**METHODS AND MATERIALS**

We accessed the MQSA National Statistics, publicly available on the FDA website (https://www.fda.gov/radiation-emitting-products/mammography-information-patients/mqsa-national-statistics). Available data from 2002 to 2024 was collected. The site was accessed on 04/04/2024, and the data is current to 04/01/2024. We also used state population projections of the CDC, publicly available (https://wonder.cdc.gov/population-projections.html).

**RESULTS**

An average of 382,646,076 mammography procedures were performed between 2004-2023 in an average of 8,752 certified facilities. There was an 8.2% increase in mammography procedures in the last decade, while the projected growth in the number of women in the ages of 40-74 at this period was 11.4%. The maximal number of accredited facilities was 9,306 in 2002 vs 8,834 facilities in 2024. Digital breast tomosynthesis units were first listed in 2016, with an average of 3,711 units, with a steady rise to 12,061 units in 2024, an increase of 325%. The average percent of inspections with no violation ranged between 64.2% and 88.9%, most of the violations were level 2.

**CONCLUSION**

We observed a higher growth rate of women eligible for mammography screening compared to the rate of expansion of mammography units and MQSA-approved facilities. Given these findings, there is a pressing need to prioritize regulatory resources towards the establishment of additional facilities and units.

**CLINICAL RELEVANCE/APPLICATION**

The allocation of regulatory resources towards increasing the number of accredited mammography facilities should be considered.

## R5A-SPBR-6 JOINT BREAST CANCER & CARDIOVASCULAR SCREENING: BEACON STUDY TO ASSESS OPPORTUNISTIC CARDIOVASCULAR SCREENING USING BREAST ARTERIAL CALCIFICATION ON MAMMOGRAPHY

Jean M. Seely, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Elsie Nguyen, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Kaitlin M. Zaki-Metias, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Vivianne Freitas, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Paula Harvey (*Abstract Co-Author*) Nothing to Disclose
Sandeep Ghai, MD (*Abstract Co-Author*) Nothing to Disclose
Charlotte J. Yong-Hing, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Hayley McKee, MSc, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Breast arterial calcifications (BAC) are incidental findings that are not routinely reported on mammography. Our study aimed to assess the utility of BAC for identifying coronary artery calcium (CAC) on cardiac computed tomography scans in asymptomatic participants undergoing mammography.

**METHODS AND MATERIALS**

Participants undergoing mammography at a single centre were prospectively recruited over 12 months. BAC were qualitatively scored (none/mild/moderate/severe) by two independent breast radiologists. All participants had non-contrast cardiac CT for CAC scoring by the Agatston method within 6 months of mammography. Cardiovascular risk factor data was collected on baseline questionnaires.

**RESULTS**

286 participants were included (median age 61±10). Overall prevalence of BAC was 13% (38/286). For BAC: 248 had none (87%), 18 (6%) had mild, 16 (5%) moderate, and 4 (1%) severe. 180 (62%) had CAC of 0, 70 (24%) had CAC score between 1-99 (mild), 28 (10%) had CAC score between 100-399 (moderate), and 8 (3%) had CAC score >400 (severe). For diagnosis of any CAC, presence of any BAC had high specificity (92%,166/180), low sensitivity (23%,24/106) and moderate positive predictive value (63%,24/38). 59% (14/24) of participants with positive BAC and CAC did not believe they were at higher risk of heart disease and only 8% (2/24) were on lipid-lowering agents.

**CONCLUSION**

We demonstrate low prevalence of BAC that may limit its utility for comprehensive cardiovascular screening during mammography. Though not common, BAC reporting can prompt cardiovascular risk factor assessment and appropriate investigations such as calcium score CT scans. Additionally, interventions such as lifestyle modifications and medical management can be implemented.

**CLINICAL RELEVANCE/APPLICATION**

Few participants with both CAC and BAC were on lipid lowering agents. BAC should be reported on mammography as an opportunistic cardiovascular screening tool given its high specificity to identify those who may benefit from optimal medical management and lifestyle modifications that may help

reduce future cardiovascular events.

## R5A-SPBR-7 ASSESSING THE AVAILABILITY OF MULTILINGUAL & ACCESIBLE MAMMOGRAM INFORMATION IN NORTH AMERICA

Charlotte J. Yong-Hing, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Sonali Sharma, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

Breast cancer screening is crucial for early detection and improved outcomes, and inadequate access to screening information in one's native language not only impedes understanding but also reduces screening participation. This study aimed to assess the availability of multilingual and accessible mammography guidelines on websites across Canadian provinces and territories, and American states.

### METHODS AND MATERIALS

Mammography screening guideline websites in each Canadian province and territory and each American state were evaluated for the availability of information in multiple languages and the presence of accessibility features such as the ability to increase text size, dyslexia-friendly formatting and the use of images/infographics.

### RESULTS

In the evaluation of 200 websites, our analysis highlighted that a significant portion, 58 websites (29%), provided content exclusively in English. Comparatively fewer websites offered multilingual support, with 86 websites (43%) including French or Spanish translations and 94 websites (47%) capable of offering translations into more than four languages. In terms of accessibility, only 42 websites (21%) featured enhancements such as increased text size and dyslexia-friendly formats. A statistical analysis was performed to determine the significance of these variations in translation and accessibility options among the websites. We found statistically significant disparities ($p < 0.05$), indicating that private practice websites are less likely to implement extensive language translation and accessibility features compared to academic websites.

### CONCLUSION

The study highlights a significant need for linguistic inclusivity and accessibility in mammography breast cancer screening. These findings emphasize the need for private practices to enhance their website's accessibility and language support to improve service delivery and patient engagement, which is essential for empowering individuals to understand and participate in breast cancer screening.

### CLINICAL RELEVANCE/APPLICATION

Information that is not accessible or available in a patient's first language can contribute to reduced screening participation, which is a critical factor in detecting breast cancer at an early stage. By prioritizing the translation and accessibility of mammogram information, potentially low screening attendance can be mitigated, leading to improved patient outcomes.

## R5A-SPBR-9 MULTICENTER RADIO-MULTIOMIC ANALYSIS FOR PREDICTING BREAST CANCER OUTCOME AND UNRAVELLING IMAGING-BIOLOGICAL CONNECTION

Weijun Peng, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jiayin Zhou (*Abstract Co-Author*) Nothing to Disclose
Yajia Gu (*Abstract Co-Author*) Nothing to Disclose
Xu Zhang (*Abstract Co-Author*) Nothing to Disclose
Shiyun Sun (*Abstract Co-Author*) Nothing to Disclose
Chao You, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Radiomics offers a noninvasive avenue for predicting clinicopathological factors. However, thorough investigations into a robust breast cancer outcome-predicting model and its biological significance remain limited. This study develops a robust radiomic model for prognosis prediction, and further excavates its biological foundation and transferring prediction performance.

### METHODS AND MATERIALS

Three breast cancer patient cohorts comprising preoperative dynamic contrast-enhanced MRI were retrospectively collected. In Cohort 1 ($n = 466$), Lasso was used to select features correlated with patient prognosis and multivariate Cox regression was utilized to integrate these features and build the radiomic risk model, while multiomic analysis was conducted to investigate the model's biological implications. Cohort 2 ($n = 619$) and Cohort 3 ($n = 128$) were used to test the performance of the radiomic signature in outcome prediction.

### RESULTS

A thirteen-feature radiomic signature was identified in the Cohort 1 training set and validated in the Cohort 1 testing set, Cohort 2 and Cohort 3 for predicting relapse-free survival (RFS) and overall survival (OS) (RFS: $p = 0.013$, $p = 0.024$ and $p = 0.035$; OS: $p = 0.036$, $p = 0.005$ and $p = 0.027$ in the three cohorts). Multiomic analysis uncovered metabolic dysregulation underlying the radiomic signature (ATP metabolic process: NES = 1.84, $p = 0.02$; cholesterol biosynthesis: NES = 1.79, $p = 0.01$). Regarding the therapeutic implications, the radiomic signature exhibited value when combining clinical factors for predicting the treatment response (Cohort 2, AUC = 0.72; Cohort 3, AUC = 0.73).

### CONCLUSION

A breast cancer outcome-predicting radiomic signature was identified in a multicenter radio-multiomic study, along with its biological significance in prognostic risk assessment, laying the groundwork for future prospective clinical trials in personalized risk stratification and precision therapy.

### CLINICAL RELEVANCE/APPLICATION

Our study presents a robust radiomic model for non-invasively predicting breast cancer outcomes, enhancing the personalization of treatment plans and improving prognostic stratification. By revealing differences in metabolic pathways between high- and low-risk tumor groups, our research suggests potential therapeutic targets, advancing the application of precision medicine in oncology. Additionally, our model showcased its potential for broader clinical implementation by effectively predicting the response to neoadjuvant chemotherapy through the synergistic integration of radiomic risk score and clinical factors.

# Abstract Archives of the RSNA, 2024

R5A-SPCA

**Cardiac Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPCA-1 THE IMPACT OF MATRIX SIZE ON SPATIAL RESOLUTION IN CARDIAC CT WITH ULTRA-HIGH-RESOLUTION PHOTON COUNTING CT

Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Audrey Rich, MD (*Abstract Co-Author*) Nothing to Disclose
Friedrich D. Knollmann, MD, PhD (*Abstract Co-Author*) Editor, Reed Elsevier
Harold I. Litt, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV
Peter Makhoul, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Photon counting CT (PCCT) has demonstrated multiple benefits over conventional CT imaging such as decreased radiation dose and higher spatial resolution, including "ultra-high" resolution (UHR) mode with 0.2 mm slice thickness. Coronary CT angiography is an established method for diagnosing coronary artery disease. The use of PCCT for the evaluation of coronary arteries and plaque characterization is currently of interest, though optimal image reconstruction parameters are not fully established. While conventional CT typically uses 512 x 512 matrices, UHR-CT can use higher matrix sizes, including 1024 x 1024 matrices. This study examines the effects of increasing matrix size on spatial resolution under cardiac motion conditions.

### METHODS AND MATERIALS

A cardiac motion simulator (phantom) with a mobile wire was used to replicate a moving coronary artery. Images were taken on a PCCT (NAEOTOM Alpha, Siemens Healthineers) using 512 x 512 and 1024 x 1024 matrices at rest, 75 bpm, and 88 bpm using UHR mode (0.2 mm slices). Parameters included a tube voltage of 120 kVp, field of view of 80 mm, and convolution filter of Bv44u. Images were reconstructed at 10% intervals. A square region of interest was drawn around the wire to include all image artifact and extract the pixel attenuation values. Areas at half maximum attenuation of the point spread function were determined for each reconstruction as a metric of spatial resolution, called dynamic spatial resolution (DSR), and these values were compared after adjusting for pixel size.

### RESULTS

For the non-moving phantom, the DSR was similar for both matrices at 0.974 mm2. At a heart rate of 75 bpm, the DSR was overall similar for both matrices but degenerated to different degrees at different times of the simulated cardiac cycle. Optimal DSR was obtained at a reconstruction of 60%, with a DSR of 1.211 mm2 for both the 512 and 1024 matrices. At a heart rate of 88 bpm, the DSR was also similar for both matrices with varying degeneration across the cardiac cycle. Optimal DSR was obtained at a reconstruction of 50%, with a DSR of 1.766 mm2 for the 1024 matrix and a DSR of 1.817 mm2 for the 512 matrix.

### CONCLUSION

For the imaging parameters and phantom model used, there was no significant difference in optimal dynamic spatial resolution at rest, 75 bpm, or 88 bpm between the 512 and 1024 matrices. There was therefore no benefit to spatial resolution by using the higher matrix size under these conditions.

### CLINICAL RELEVANCE/APPLICATION

Additional investigations are warranted to determine optimal imaging parameters, including matrix size, for coronary artery evaluation with photon counting CT.

## R5A-SPCA-4 FIRST IN VIVO USE OF 1000 FPS HIGH-SPEED ANGIOGRAPHY IN A SWINE MODEL OF CORONARY ARTERY DISEASE

Daniel Bednarek, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Vijay Iyer (*Abstract Co-Author*) Nothing to Disclose
Brian Weil (*Abstract Co-Author*) Nothing to Disclose
Stephen Rudin, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Ciprian N. Ionita, PhD (*Abstract Co-Author*) CEO, QAS.AI;Grant, Canon Medical Systems Corporation
Emily Vanderbilt (*Abstract Co-Author*) Nothing to Disclose
Venkat Keshav Chivukula (*Abstract Co-Author*) Nothing to Disclose
Swetadri Vasan Setlur Nagesh, MS, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the application of 1000 fps high-speed x-ray angiography (HSAngio) to measure dynamic flow through a coronary artery stenosis in swine.

### METHODS AND MATERIALS

A high speed x-ray detector, Aries from Varex Corporation, featuring a 7 cm x 5 cm field of view and 100 µm pixels, capable of 1000 fps acquisition rate, was mounted on a mechanical changer attached to the frontal c-arm of a Canon Medical Infinix biplane system. The detector automatically moves into the FOV for HSAngio imaging when a preprogrammed switch on the c-arm console is engaged. The system's x-ray tube and generator were unmodified. A 125 lbs. swine with chronic stenoses in the proximal left circumflex and left anterior descending arteries each was administered standard doses of heparin and sedated under general anesthesia. A 5F catheter was guided into the left main coronary artery using conventional 10 fps imaging. Subsequently, 1000 fps HSAngio images capturing flow of iodine contrast agent through the left circumflex artery stenosis were acquired. Contrast was injected at 120 ml/min for 0.5 seconds using a MEDRAD injector. Flow velocities were immediately calculated from the HSAngio images using optical flow methods and were made available to the operator performing the procedure.

### RESULTS

The HSAngio images clearly show that, during diastole, a contrast bolus is propelled through the stenotic section in a narrow jet. At the bifurcation, most of the flow divides between the two descending arteries, while a smaller fraction recirculates back toward the stenosis at a reduced pace, creating a disturbance similar to an eddy current. This can significantly affect shear forces on the blood and vessel wall, potentially inducing thrombus formation. Additionally, the velocity profile from the HSAngio images reveals higher velocities up to 40 cm/s within and beyond the stenotic region, as expected.

### CONCLUSION

The results highlight the utility of 1000 fps HSAngio imaging in cardiovascular procedures. The images clearly reveal detailed flow patterns in and around the stenotic region. From these images, velocity profiles distal and proximal to the stenosis are obtainable. These quantitative data can help determine the impact of stenoses on blood flow. Further such research will expand our understanding of HSAngio's applications in both cardiovascular research and clinical practice.

### CLINICAL RELEVANCE/APPLICATION

High-speed angiography at 1000 frames per second captures detailed flow patterns in stenotic coronary arteries, allowing immediate extraction of quantitative data such as flow velocities. This data can potentially aid in assessing the functional impact of a stenosis and diagnosing flow-affecting vascular pathologies such as Coronary Artery Disease (CAD).

## R5A-SPCA-5 INVESTIGATING THE DIAGNOSTIC PERFORMANCES OF CARDIOVASCULAR MAGNETIC RESONANCE IMAGING (CMR) PARAMETERS UTILIZED IN THE MODIFIED LAKE LOUISE CRITERIA FOR DIAGNOSING MYOCARDITIS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF INDIVIDUAL AND COMBINED CMR PARAMETERS

Latika Giri (*Abstract Co-Author*) Nothing to Disclose
Muhammad Umair, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

This systematic review and meta-analysis aimed to investigate the diagnostic performances of individual and combined quantitative CMR parameters within the framework of the 2018 LLC for myocarditis diagnosis.

### METHODS AND MATERIALS

We included original articles published within the last 10 years utilizing parametric mapping techniques for diagnosis of myocarditis from PubMed. We included data on sensitivity, specificity, and the area under the receiver operating characteristic curve. The data extraction and quality assessment using the Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) tool were conducted independently by two reviewers. The study protocol was registered in the PROSPERO with registration number: CRD42023484275.

### RESULTS

A total of 11 studies were included in the review, with a total of 788 patients from 11 cohorts. The Native T1 mapping had a sensitivity of 83% (95% Confidence Interval [CI] :78-83), specificity 86% (95% CI: 75-93), DOR 39(95% CI: 21.83 - 72.635) and AUC of 0.91. The T2 mapping had sensitivity 81% (95% CI:73-87), specificity 86% (95% CI: 76-92), DOR 25 (95% CI: 15.11-43.21) and AUC was 0.89. The sensitivity 71 % (95% CI: 62-79), specificity 81% (95% CI: 74-86), DOR 13 (95% CI: 7.39- 19.31) and AUC was 0.83 for ECV. The Native T1 mapping had higher diagnostic accuracy across all index tests. Subgroup analyses with meta regression showed no significant difference in diagnostic odds ratio based on reference standard as either myocardial biopsy or Clinical criteria for native T1 and T2 mapping, and ECV.

### CONCLUSION

The utilization of parametric CMR tests emerges as the optimal strategy for diagnosing myocarditis. The current meta-analysis has defined optimal cut points for ECV for the diagnosis of myocarditis and has shown that sensitivity and specificity is improved by using quantitative mapping techniques, and potentially test combinations.

### CLINICAL RELEVANCE/APPLICATION

Although parametric mapping is widely studied, there is vast heterogeneity in technical parameters, and patient population, hence a meta-analysis is important to combine these results to improve the combined evidence and help guide clinical decision making.

## R5A-SPCA-6 IMPACT OF PHOTON-COUNTING COMPUTED TOMOGRAPHY-BASED VIRTUAL MONOENERGETIC IMAGING ON DETECTING MYOCARDIAL LATE IODINE ENHANCEMENT COMPARED TO CARDIAC MRI

Dmitrij Kravchenko, MD (*Abstract Co-Author*) Nothing to Disclose
Emese Zsarnoczay, MD (*Abstract Co-Author*) Nothing to Disclose
Milan Vecsey-Nagy, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
U. Joseph Schoepf, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Bracco Group;Research Grant, Elucid BioImaging Inc;Consultant, Elucid BioImaging Inc;Research Grant: General Electric Company;Research Grant, Guerbet SA;Research Grant, Heartflow, Inc;Speakers Bureau, Heartflow Inc
Chiara Gnasso, MD (*Abstract Co-Author*) Nothing to Disclose
Giuseppe Tremamunno, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Pinos, MD (*Abstract Co-Author*) Nothing to Disclose
Akos Varga-Szemes, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Consultant, Elucid Bioimaging Inc;Research Consultant, Bayer AG
Tilman S. Emrich, MD (*Presenter*) Speaker, Siemens AG;Travel support, Siemens AG;Advisory Board, Siemens AG

**PURPOSE**

To investigate the image quality and diagnostic performance of photon-counting detector (PCD)-CT-based late iodine enhancement (LIE) at different virtual monoenergetic imaging (VMI) levels in detecting and characterizing myocardial scars, using late gadolinium enhancement (LGE)-MRI as reference.

**METHODS AND MATERIALS**

Patients with various cardiomyopathies who underwent LGE-MRI and same-day research LIE-CT on a PCD-CT system between July 2021 and January 2022 were included in this prospective study. LIE-CT scans were reconstructed at different VMI levels (40, 45, 50, 60, 70, and 90 keV). Two blinded readers evaluated subjective and objective image quality, presence, and pattern of scar on a per-segment level. Measures of diagnostic performance were calculated, and agreement with MRI in scar detection and pattern identification was evaluated with Cohen's ? statistics.

**RESULTS**

The LIE-CT scans of 27 patients (27% male, 52.9±17.2 years) who underwent same-day cardiac MRI were analyzed. VMI at 50 keV demonstrated an adequate trade-off between objective and subjective image quality and exhibited the highest sensitivity, specificity, and accuracy in scar detection, both in per-patient (100%, 93.3%, and 96.3%) and per-segment (87.4%, 97.8% and 95.9%, respectively) analyses, with a strong agreement with MRI in both cases (?= 0.93 and 0.86, respectively). These reconstructions also showed the highest concordance in discriminating different scar patterns. Notably, subepicardial scars and patchy fibrosis had excellent detection rates (100%).

**CONCLUSION**

PCD-CT LIE scans at 50 keV allow for an accurate evaluation of myocardial viability, not only in detecting the scar but also in characterizing different scar patterns.

**CLINICAL RELEVANCE/APPLICATION**

PCD-CCTA combined with LIE-CT holds the potential for becoming an increasingly utilized, noninvasive tool for comprehensive, simultaneous assessment of coronary artery and myocardial disease.

## R5A-SPCA-7 MODIFIED CT TECHNIQUE IMPROVES IMAGE QUALITY AND DIAGNOSTIC ACCURACY IN CARDIAC CONDUCTION DEVICE LEAD PERFORATION

Ali Ursani, MENG (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Behruz Karasfi (*Abstract Co-Author*) Nothing to Disclose
Ryan Huang (*Abstract Co-Author*) Nothing to Disclose
Narinder S. Paul, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Carestream Health, Inc
Felipe S. Torres, MD, PhD (*Abstract Co-Author*) Research support, Altis Labs
Gauri R. Karur, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Farah Cadour, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Jacques Du Plessis, MBChB, FFRad(D)SA (*Abstract Co-Author*) Nothing to Disclose
Paaladinesh Thavendiranathan, MD (*Abstract Co-Author*) Nothing to Disclose
Elsie Nguyen, MD, FRCPC (*Presenter*) Nothing to Disclose

**PURPOSE**

Metallic artifact near the lead tip of cardiac conduction devices (CCD) can limit CT evaluation for lead perforation. This study aims to assess a novel CT technique for improved detection of CCD lead tip perforation.

**METHODS AND MATERIALS**

In this single-center retrospective cohort study, patients who underwent cardiac CT for suspected CCD lead perforation were evaluated, including both standard and modified techniques. The modified technique involved decubitus patient positioning and angulation of the CT gantry to shift metallic artifact away from the lead tip. Three fellowship trained radiologists blinded to identifying information independently reviewed the CTs to determine if the lead had perforated through the right ventricular myocardium and rated image quality and level of confidence on a five-point Likert scale. Diagnostic accuracy for identification of perforation was compared against a reference standard determined by 2 other fellowship-trained readers (18 and 15 years of experience) and all available clinical information. Chi-square tests, Mann-Whitney U tests were performed and inter-rater reliability using Fleiss' Kappa were calculated between the three reviewers for the modified technique compared to standard CT technique from an age-matched control group.

**RESULTS**

Twenty-two patients were included with modified (n=11, 6/11 male, 60.2±10.2 years) and standard CT techniques (n=11, 7/11 male, 60.5±13.0 years). Overall, lead tips were perforated in 14 (8 modified and 6 standard) and non-perforated in 8 (3 modified and 5 standard) patients. Image quality was higher for the modified versus standard technique (3.12±0.29 vs. 2.21±0.47, p<0.001) with moderate agreement among raters (?=0.67). Diagnostic confidence was higher with the modified versus standard technique (4.52±0.34 vs. 3.45±0.57, p<0.001) with good agreement (?=0.75). Diagnostic accuracy was higher with the modified technique (82% accuracy versus 52% for the standard technique, p=0.009).

**CONCLUSION**

With careful manipulation of the patient position to optimize lead position in the gantry as well as adjustment of the gantry angle, we were able to improve image quality and more confidently and accurately identify CCD lead tip perforation.

**CLINICAL RELEVANCE/APPLICATION**

Our modified CT technique can be integrated into routine clinical practice to enhance imaging of CCD lead perforation and improve diagnostic accuracy.

## R5A-SPCA-8 IMPACT OF DEEP LEARNING-BASED NOISE REDUCTION ON LOW-DOSE CORONARY CT ANGIOGRAPHY IMAGE QUALITY AND CORONARY ARTERY DISEASE REPORTING AND DATA SYSTEM ASSESSMENT

Tatsuya Nishii, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation
Takuya Matsuda (*Abstract Co-Author*) Nothing to Disclose
Wataru Toshimori (*Abstract Co-Author*) Nothing to Disclose
Kazuki Yoshida, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Suekuni (*Abstract Co-Author*) Nothing to Disclose
Takaaki Hosokawa (*Abstract Co-Author*) Nothing to Disclose

Teruhito Kido, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hidetaka Toritani (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Yuki Tanabe (*Abstract Co-Author*) Nothing to Disclose
Tomoro Morikawa, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the effect of deep learning (DL)-based, post hoc noise reduction on image quality, CAD-RADS category assessment, and diagnostic performance in quarter-dose coronary CT angiography (CCTA), using full-dose images as the reference.

**METHODS AND MATERIALS**

In this IRB-approved retrospective study, forty patients (mean age: 71±7 years; 24 males; mean heart rate: 67±10 bpm) underwent ECG-gated CCTA using a third-generation dual-source CT scanner. Depending on the patient's heart rate, CCTA was performed at full dose during either the systolic or diastolic phase, while the alternate phase received a quarter dose. We acquired motion-free coronary images in both phases using an iterative reconstruction method. Additionally, a residual dense network, trained on external datasets, was utilized to denoise the quarter-dose images. Image analyses were conducted to compare the original and denoised quarter-dose images. Firstly, the quality of both the original and denoised quarter-dose images was assessed by comparing noise levels and contrast-to-noise ratios (CNR) in the aorta and coronary arteries using Tukey's test. Furthermore, excluding the myocardial bridge coronary segment, a segment-based evaluation was performed. CAD-RADS classification and diagnostic serial confidence levels were recorded. The consistency of the CAD-RADS classifications, relative to full-dose images, was assessed using Cohen's kappa. The diagnostic performance for identifying significant stenosis, using full-dose images as the reference, was evaluated by comparing the area under the ROC curves (AUC) with the DeLong test.

**RESULTS**

The denoising model reduced noise levels in quarter dose CCTA from 37 to 18HU (P <.001) achieving noise levels comparable to full-dose images (22HU). CNRs were significantly improved (P <.001 for all). Among total 523 segments, denoised images showed better CAD-RADS classification consistency (0.78 [95% CI, 0.72-0.83]) compared to original quarter-dose images (0.64 [95% CI, 0.58-0.70]). Furthermore, denoised images demonstrated superior diagnostic performance in detecting significant stenosis, with a higher AUC (0.97, [95% CI: 0.94-1.00]) compared to original quarter-dose images (0.93, [95% CI: 0.89-0.98]) (P=.03).

**CONCLUSION**

DL-based, post hoc denoising for quarter-dose CCTA significantly reduced image noise, and improved CAD-RADS agreement and diagnostic performance for significant stenosis detection.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning-based post-hoc denoising markedly enhanced image quality and diagnostic accuracy in quarter-dose CCTA. Our method showed promise in reducing radiation exposure without compromising CCTA outcomes.

## R5A-SPCA-9 IMPACT OF DEEP LEARNING IMAGE RECONSTRUCTION ALGORITHM ON (80-KV) MYOCARDIAL EXTRACELLULAR VOLUME FRACTIONS CALCULATION

Yuegui Jiang (*Abstract Co-Author*) Nothing to Disclose
Yunlei Chen (*Abstract Co-Author*) Nothing to Disclose
Yuantong Gao, MMedSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the impact of deep learning image reconstruction (DLIR) algorithms on myocardial extracellular volume (ECV) fractions calculation at 80-kV tube voltage.

**METHODS AND MATERIALS**

Consecutive patients who underwent coronary CT angiography (CCTA) at our hospital from February 2024 to March 2024 were enrolled. All patients underwent 256-row CT (GE Revolution APEX) scans including a 120-kV calcium scoring (CS), an 80-kV CS, a CCTA, a 120-kV late enhanced (LE) scan and an 80-kV LE. The CS images and LE images were all reconstructed using filtered back projection (FBP) and H-strength DLIR (DH). CT numbers and standard deviations (SD) of the left ventricular blood pool (LVB), the right ventricular blood pool (RVB) and interventricular septum (IS) were measured in CS and LE images. ECV fractions were calculated using the formula: ECV = (1- hematocrit) * (myocardial CT number in LE - myocardial CT number in CS) / (blood pool CT number in LE - blood pool CT number in CS). Additionally, signal-to-noise ratios (SNR) of LVB, RVB and IS, and contrast-to-noise ratios (CNR) of LVB-to-IS and RVB-to-IS were calculated and compared.

**RESULTS**

A total 80 patients were included. There was a statistically significant difference in the comparison of ECV among the four groups (120-kV DHgt;120-kV FBPgt;80-kV DHgt;80-kV FBP, Plt;0.001), the comparisons of DH versus FBP were not statistically different (for 120 kV and 80 kV, both Pgt;0.05) and the comparisons of 80-kV versus 120-kV were statistically different (for FBP and DH, both Plt;0.05). SNRs and CNRs were all statistically different among the four groups (Plt;0.001), with all of them being maximized by 120-kV DH, followed by 80-kV DH, 120-kV FBP, and 80-kV FBP, respectively (except, CNR of RVB-to-IS between 120-kV FBP and 80-kV FBP).

**CONCLUSION**

Reducing the tube voltage makes the calculated ECV fractions lower, while compared to FBP, DLIR does not interfere with the calculation of ECV fractions. And DH improves the image quality, especially the CNR of LVB and RVB contrast IS, making it easier to recognize the anatomy of the heart.

**CLINICAL RELEVANCE/APPLICATION**

Reducing the tube voltage makes the calculated ECV fractions lower, while compared to FBP, DLIR does not interfere with the calculation of ECV fractions. And DH improves the image quality, especially the CNR of LVB and RVB contrast IS, making it easier to recognize the anatomy of the heart.

# Abstract Archives of the RSNA, 2024

R5A-SPCH

**Chest Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPCH-1 OPENRADEVAL: AN OPEN-SOURCE LLM FOR LINE-BY-LINE, CLINICALLY RELEVANT RADIOLOGIST-LEVEL EVALUATIONS IN CHEST X-RAY REPORT GENERATION

Xiaoli Yang (*Presenter*) Nothing to Disclose

### PURPOSE

Evaluating generated radiology reports is fundamental for benchmarking, validating models, and analyzing failure patterns in the development of generative radiology AI systems. An efficient evaluator also opens up opportunities to incorporate reinforcement learning into the development of report generation models. Existing non-LLM metrics are limited because they fail to provide details on the number, location, and significance of individual errors with a single aggregate score for report texts. In this work, we introduce OpenRadEval, an open-source LLM-based evaluator for radiology report generation. OpenRadEval provides line-level evaluations by locating individual errors, identifying their error types, and assessing the severity based on clinical significance levels.

### METHODS AND MATERIALS

There are two parts to our methodology.Clinically relevant evaluation framework for line-level error analysis. We develop a detailed evaluation framework to categorize differences between generated reports and ground-truth reports. This framework classifies differences in each generated report line into four error types based on their causes, such as contradicting findings. It then assigns errors to one of ten severity levels according to the resulting harm to patients clinically. The levels range from minor issues, like “rephrasing with no clinical effects”, to major issues, like “missed or wrong findings with the potential to cause loss of life/organs within a day”.Model training and evaluation. To finetune open-source LLMs to generate evaluations according to our proposed framework, we construct a dataset using 5000 MIMIC-CXR report pairs. We created ground truths for the dataset by prompting GPT-4 to generate pseudo evaluations for these report pairs. We then finetune Mistral-7B on this dataset. The resulting model, named OpenRadEval, is evaluated on ReFiSco-v1, a dataset consisting of line-level radiologist error annotations for 100 report pairs.

### RESULTS

We demonstrate that OpenRadEval achieves evaluation consistency close to that of radiologists. It also exhibits higher consistency in its evaluations compared to evaluation variability among individual radiologists.

### CONCLUSION

This work introduces an efficient line-level evaluation method and tool for radiology report generation and demonstrates radiologist-level performance This proposed method and tool has the potential to greatly reduce costs pertaining to the development of clinically sound report generation models.

### CLINICAL RELEVANCE/APPLICATION

To the best of our knowledge, ours is the first work to provide an open-source LLM evaluator to provide line-by-line error analysis with categories fine-grained enough that align with real clinical setting.

## R5A-SPCH-2 INTRAPULMONARY IMAGING FEATURES OF COMPLEX LYMPHATIC MALFORMATIONS IN THE CHEST

Qi Hao (*Presenter*) Nothing to Disclose

### PURPOSE

To analyze the imaging features of conventional CT of thoracic complex lymphatic malformation (CLA) and explore the differences of the three groups of patients with different types, so as to clarify the diagnostic value of CT in this disease.

### METHODS AND MATERIALS

The clinical and imaging data of 119 patients with CLA were retrospectively analyzed, including 67 patients with GLA, 21 patients with Gorham-Stout disease (GSD), 31 patients with central conduction lymphatic abnormality (CCLA). All patients underwent routine CT and CTL examination, and the pulmonary imaging findings of the three groups were observed, including: ?GGO and morphology; ? peripheral interstitial changes; ? axial interstitial change; ? lung consolidation; (5) Pulmonary nodules; ? Special signs in the lung: a. frog egg sign, b. paving stone sign. Chi-square test or Fisher exact test was used, and Bonferroni test was used for pairwise comparison.

### RESULTS

Among 119 patients with complex thoracic lymphatic malformations, 67 patients had generalized lymphatic malformations (group A), 21 patients had Gorham-Stout disease (group B), and 31 patients had central conductive lymphatic malformations (group C). There were statistically significant

differences in pulmonary GGO (P=0.011) (FIG. 3), peripheral interstitial changes (P=0.013), compression lung consolidation (P=0.012) (FIG. 4) and cystic lung nodules (P=0.017) (FIG. 5) among the three groups, while there were no statistically significant differences in the remaining pulmonary signs. For three groups of patients after comparing the two findings: A group of patients in GGO lungs (P = 0.003), peripheral interstitial changes (P = 0.016) than group B, cyst type lung nodules (P = 0.014), compression type lung consolidation (P = 0.012) than in group C, the difference was statistically significant. There was no significant difference in pulmonary abnormalities between group B and group C.

**CONCLUSION**

The clinical and imaging manifestations of CLA are varied, and there are differences in pulmonary imaging manifestations among different types of patients. CT examination provides valuable imaging information for the diagnosis and differentiation of CLA, which is conducive to further accurate diagnosis and treatment.

**CLINICAL RELEVANCE/APPLICATION**

The clinical and imaging manifestations of CLA are varied, and there are differences in pulmonary imaging manifestations among different types of patients. CT examination provides valuable imaging information for the diagnosis and differentiation of CLA, which is conducive to further accurate diagnosis and treatment.

## R5A-SPCH-3 CT IMAGING OF BRONCHOSPASM IN ANAPHYLAXIS INDUCED BY NON-IONIC IODINATED CONTRAST MEDIA: A COMPARATIVE STUDY

Shigeki Kobayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Toyama (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Atsushi Teramoto, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Naruse (*Abstract Co-Author*) Nothing to Disclose
Eirin Sakaguchi (*Abstract Co-Author*) Nothing to Disclose
Seiichiro Ota, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Azuma, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology
Hidekazu Hattori, MD, PhD (*Presenter*) Research Grant, FUJIFILM Holdings Corporation

**PURPOSE**

Anaphylaxis, as outlined in the 2020 World Allergy Organization Anaphylaxis Guidance, is associated with bronchospasm, yet imaging findings have not been extensively documented. This study aims to compare bronchial lumen changes in patients with and without anaphylaxis caused by non-ionic contrast media using non-contrast-enhanced (non-CE-CT) and CE-CT scans.

**METHODS AND MATERIALS**

During April 2011 and October 2022, 69 cases who underwent non-CE- and CE-CT scans using non-ionic iodine contrast media were included in this study. The 69 cases were divided as follows: 46 patients without anaphylactic symptoms (non-Anaphylactic group), and 23 cases who required initial treatment for anaphylactic reactions (Anaphylactic group). The non-Allergic group was also divided as follows: 23 cases who had no contrast-induced symptoms at the time of CT examination (Normal group), and 23 cases who had mild to moderate allergic symptoms and no need for treatment (Allergic group). The normal group and allergic group were matched to the number of cases in the anaphylaxis group. All non-CE- and CE- CTs were reconstructed into 1mm section thickness and reviewed at lung window setting. The bronchial lumens of the right lung S9 to S10 were labeled by a board-certified radiologist. Then, the total lumen pixel was counted by self-made software for each case. In each patient, luminal change rate between non-CE- and CE-CTs was calculated. To determine the lumen pixel difference between non-CE- and CE-CTs in each group, paired t-test was performed. To compare luminal change rate between non-CE- and CE-CT among all subgroups, Tukey's HSD test was performed.

**RESULTS**

On comparison between non-CE- and CE-CTs, the lumen pixel of CE-CT was significantly smaller than non-CE-CT in the Anaphylactic group ($p<0.05$; p-value =0.0031). On comparison between non-CE- and CE-CTs, the lumen pixel of CE-CT was significantly larger than non-CE-CT in the Normal group ($p<0.05$; p-value =0.016). When comparing the luminal change rate among all subgroups, there was a significant difference between the Anaphylactic group and the Normal or Allergic group ($p<0.05$; p-value =0.00015 or 0.0067).

**CONCLUSION**

This study is the first to report visualization of bronchospasm in CT images of patients with anaphylaxis, adding to existing evidence that this symptom exists in such cases.

**CLINICAL RELEVANCE/APPLICATION**

Peripheral bronchospasm due to anaphylaxis can be demonstrated on CE-CT as compared with non-CE-CT and considered as may be one of the predictors for the onset of anaphylaxis.

## R5A-SPCH-4 DEEP LEARNING CHEST X-RAY AGE: ASSOCIATIONS WITH EPIGENETIC AND CARDIOPULMONARY AGING

Michael T. Lu, MD, MPH (*Abstract Co-Author*) Stockholder, NVIDIA Corporation;Institutional Research Grant, Kowa Company, Ltd;Institutional Research Grant, AstraZeneca PLC;Stockholder, Advanced Micro Devices, Inc;Stockholder, Intel Corporation
Vineet K. Raghu, PhD (*Abstract Co-Author*) Nothing to Disclose
Jay Chandra (*Presenter*) Nothing to Disclose

**PURPOSE**

Chronological age, the years since birth, is a cornerstone of medical decision-making. However, chronological age has limitations as individuals age at different rates. We recently released an open-source deep learning tool to assess biological age from chest radiograph images (CXR-Age), which predicts incident age-related disease better than chronological age. This abstract compares CXR-Age to established epigenetic aging clocks, to see which are more strongly associated with measures of cardiopulmonary disease.

**METHODS AND MATERIALS**

Our cohort consisted of 2,097 participants from the Project Baseline Health Study (PBHS), a prospective cohort study of individuals from four US sites enriched for cardiovascular and cardiometabolic disease risk factors. Each participant had posterior-anterior chest radiograph images and DNA Methylation data which were used to calculate CXR-Age and the Levine and Horvath epigenetic aging clocks, respectively. Linear regressions were used to assess the association of CXR-Age and epigenetic aging clocks with the coronary artery calcium (CAC) score, the 10-year atherosclerotic cardiovascular

disease (ASCVD) risk score, and measures of pulmonary function. Analyses were adjusted for chronological age, body mass index (BMI), sex, smoking status, and recruiting site.

**RESULTS**

There was moderate correlation between CXR-Age and chronological age (r=0.49, 95% CI: [0.47-0.53]), and a high correlation between epigenetic and chronological age (Levine: r = 0.93 [0.92-0.94], Horvath r = 0.95 [0.94-0.96]). There was no significant association between CXR-Age and both Levine age (ß = 0.11 [-0.01 - 0.22]) and Horvath age (ß = 0.02 [-0.07 - 0.11]) after adjusting for covariates including chronological age. Each year of CXR-Age was associated with a 1.13-fold [1.09-1.16] increase in CAC score, while there was no significant positive relationship between epigenetic ages and CAC. Similar trends were seen for the ASCVD risk score. Increasing CXR-Age was associated with worsening pulmonary function measures including FEV1/FVC ratio, DLCO, and FVC, while there was no relationship between epigenetic aging clocks and pulmonary function.

**CONCLUSION**

A deep learning-based CXR-Age was more strongly associated with subclinical coronary atherosclerosis and abnormal pulmonary function testing than two established epigenetic aging clocks.

**CLINICAL RELEVANCE/APPLICATION**

Opportunistic screening using CXR-Age may help identify high risk patients who could benefit from directed screening and prevention.

## R5A-SPCH-6 REVOLUTIONIZING HEALTH ASSESSMENT: THE EMERGENCE OF LDCT IN COMPREHENSIVE DISEASE SCREENING AND BODY ANALYSIS

Chun-Chieh Wang, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Low-dose CT (LDCT) screening is not only a lung cancer detection tool, we can extend the scope of LDCT to establish a comprehensive health assessment tool, incorporating evaluations of emphysema, coronary artery calcification (CAC) score, and body composition analysis (fat, bone density, muscle), as well as diagnosis like osteoporosis, sarcopenia, non-alcoholic fatty liver disease (NAFLD), and metabolic syndrome. This multifaceted approach enhances the value of LDCT in health assessment, clinical applications, and preventive healthcare.

**METHODS AND MATERIALS**

First, a cohort of 916 elderly participants underwent LDCT screening in five hospitals, and were prospectively analyzed. Besides, they received additional tests including laboratory tests, pulmonary function tests, Dual X-ray Absorptiometry (DXA) analysis, handgrip tests, and gaitspeed tests, for validation and training for body AI model. Advanced AI software for lung, was utilized for lung nodule detection, emphysema analysis, and CAC scoring (Big-3). Another AI tool assessed body composition metrics, including bone density, fat, and muscle (Body-3). Recently, another 448 mid-aged healthy participants were enrolled, and received big-3 and body-3 analysis. All these participants may have different data distribution and these data points contributed to the development of a potential health predictive tool.

**RESULTS**

The study observed strong correlation between the CAC score from LDCT and the Agatston score from EKG-gated CAC scans (R2 =.92). Moderate correlation was also noted between emphysema (Low attenuation area, LAA) volume and Forced Vital Capacity (FVC) (R2 =.33). For bone density in body composition, L1 bone HU from LDCT showed strong correlation with bone mineral density (BMD) and T-scores from DXA (R2 =.49). Additionally, the LDCT-based fat HU effectively classified varying degrees of NAFLD. About fat analysis, subcutaneous adipose tissue (SAT) and visceral adipose tissue (VAT) had different distribution in different sex. Besides, modified skeletal muscle index (SMI) by body AI was also strong correlated with DXA data (R2 =.53). All these data can give the participants a GOLD-CT Radar Index and an overall personal health profile by LDCT.

**CONCLUSION**

LDCT is not only a lung cancer screening tool, but also has more values to set up a health predictive model for healthy participants, and can be further refined with additional data.

**CLINICAL RELEVANCE/APPLICATION**

1. GOLD-CT Radar Index targets healthy participants, including lung cancer screening and health exam patients. 2. Give the correlation between clinical data (clinical disease) and health index. 3. Develop a predictive model based on GOLD-CT Radar Index, and this AI training model can be improved by enrolling more data.

## R5A-SPCH-7 ASSESSING THE IMPACT OF AI-ASSISTED TRIAGE ON ENDOTRACHEAL TUBE MANAGEMENT: A COMPARATIVE ANALYSIS OF WAIT TIMES

Eric P. Weinberg, MD (*Abstract Co-Author*) Nothing to Disclose
Jerome H. Avondo, PhD (*Abstract Co-Author*) Employee, Aidoc Ltd
Larry Stockmaster, BEng (*Abstract Co-Author*) Nothing to Disclose
Ali Vosoughi (*Abstract Co-Author*) Nothing to Disclose
Akhil Kasturi (*Abstract Co-Author*) Nothing to Disclose
Nathan Hadjiyski (*Abstract Co-Author*) Nothing to Disclose
Axel Wismueller, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the impact of a computer-assisted triage and prioritization artificial intelligence (AI) system in managing patients with misplaced endotracheal tubes (ETT).

**METHODS AND MATERIALS**

A total of 10,709 frontal chest radiographs were analyzed from the inpatient service of a large academic healthcare system between July 1, 2023 and December 31, 2023, using a commercial AI-based image analysis software (Aidoc Medical). A wait time metric was calculated for AI-notified cases with suspected malpositioned ETT findings and compared to negative non-AI-notified cases. Wait time was defined as the difference between the time of study acquisition completion to the time a radiologist opening the case for dictation. The median wait times were calculated for the AI-notified and non-AI-notified cases. A Mood’s median test was used to test for statistical significance.

## RESULTS

The AI solution provided prioritization notifications for 2.77% (297/10,412) suspected positive cases for ETT malpositioning. The median wait time was 32.1 minutes (IQR: 104.2 minutes) for the suspected positive cases compared to 63.2 minutes (IQR: 170.9 minutes) for the suspected negative cases. The observed median wait time reduction was statistically significant (p-value <0.05) at a 49.2% wait time reduction (31.1 minutes).

## CONCLUSION

This study provides compelling evidence that AI-assisted triage systems can play a critical role in enhancing the management of patients with potentially misplaced endotracheal tubes. The significant reduction in wait times for radiological assessment, as demonstrated by the 31.1-minute decrease in median response time, underscores the effectiveness of AI in prioritizing urgent cases in a clinical setting. These results suggest that AI can be a valuable tool in streamlining emergency care processes, ensuring that critical cases receive timely attention, which is paramount in preventing complications associated with delayed ETT repositioning.

## CLINICAL RELEVANCE/APPLICATION

The use of AI for triaging endotracheal tube placements can significantly enhance patient safety by promptly identifying suspected misplacements, thereby minimizing the risk of severe complications.

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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R5A-SPER

**Emergency Radiology Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPER-1 DETECTION OF ACUTE ABDOMINAL AORTIC DISSECTION IN CT IMAGING AS A STRATEGY TO STREAMLINE WORKFLOWS

Frank G. Zoellner (*Abstract Co-Author*) Nothing to Disclose
Anish Raj (*Abstract Co-Author*) Nothing to Disclose
Johann S. Rink, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Life-threatening acute aortic dissection (AD) demands timely diagnosis for effective intervention. Many patients present with unspecific symptoms and due to a lack of prioritization are at risk for suboptimal clinical outcomes. To streamline intrahospital workflows, automated detection of AD in computed tomography (CT) scans seems useful to assist humans. As there are no solutions available for the abdominal region, we aimed at creating a robust convolutional neural network (CNN) based pipeline, capable of real-time screening for signs of AD.

### METHODS AND MATERIALS

In this retrospective study, abdominal CT data from AD patients presenting with AD and from non-AD patients were collected (n=195, AD cases=94, mean age: 65.9 years, female ratio: 35.8%). A CNN-based algorithm was developed with the goal of enabling a robust, automated, and highly sensitive detection of abdominal AD. Two sets from internal (n=32, AD cases=16) and external sources (n=1189, AD cases=100) were procured for validation. The abdominal region was extracted, followed by the automatic isolation of the aorta region of interest (ROI) and highlighting of the membrane via edge extraction, followed by classification of the aortic ROI as dissected/healthy. A 5-fold cross-validation was employed on the internal set, and an ensemble of the 5 trained models was used to predict the internal and external validation set. Evaluation metrics included receiver operating characteristic curve (AUC) and balanced accuracy. The computation time was about 45 seconds on average.

### RESULTS

The AUC, balanced accuracy, and sensitivity scores of the internal dataset were 0.932 (CI: 0.891-0.963), 0.860, and 0.885, respectively. For the internal validation dataset, AUC, balanced accuracy, and sensitivity scores were 0.887 (CI: 0.732-0.988), 0.781, and 0.875, respectively. Furthermore, for the external validation dataset, AUC, balanced accuracy, and sensitivity scores were 0.993 (CI: 0.918-0.994), 0.933, and 1.000, respectively.

### CONCLUSION

The proposed AI pipeline which was trained and validated on heterogenous internal and external data yielded promising results for detection of acute AD in abdominal CT scans, offering potential high generalizability.

### CLINICAL RELEVANCE/APPLICATION

The proposed automated pipeline could assist humans in improving patient triage and to expedite intrahospital AD management workflows. Broad clinical implementation could benefit especially the subgroup of patients which are clinically not suspected with AD before imaging.

# Abstract Archives of the RSNA, 2024

R5A-SPGI

**Gastrointestinal Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPGI-1 SUPER-RESOLUTION DEEP LEARNING RECONSTRUCTION FOR ASSESSMENT OF PANCREATIC DUCTAL ADENOCARCINOMA ON THIN-SLICE ABDOMINAL CT

Toshinori Hirai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masafumi Kidoh, MD, PhD (*Abstract Co-Author*) Endowed Chair, Koninklijke Philips NV
SOICHIRO ISHIUCHI (*Abstract Co-Author*) Nothing to Disclose
Takeshi Nakaura, MD (*Abstract Co-Author*) Nothing to Disclose
Yuya Ito (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Ryuya Yoshida (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Taihei Inoue, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shinsuke Shigematsu (*Abstract Co-Author*) Nothing to Disclose
Yutaka Chiba (*Abstract Co-Author*) Nothing to Disclose
Hiroko Ueda (*Abstract Co-Author*) Nothing to Disclose
Yasunori Nagayama, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the impact of body-optimized super-resolution deep-learning reconstruction (SR-DLR) on the image quality of thin-slice multi-phase abdominal CT for the assessment of pancreatic ductal adenocarcinoma (PDAC).

### METHODS AND MATERIALS

This retrospective study included 31 patients (15 men, mean age 71 ± 9 years) with pathologically confirmed PDAC (head, n=17; body, n=12; tail, n=2) who underwent multi-phase pancreatic CT during pancreatic parenchymal phase (PPP) and portal venous phases (PVP) using a 320-row scanner. The images were reconstructed using hybrid iterative reconstruction (HIR), normal-resolution deep-learning reconstruction (NR-DLR), and SR-DLR algorithms with body parameter at a 0.5 mm slice thickness. The matrix size was 512×512 for HIR and NR-DLR and 1024×1024 for SR-DLR. Background image noise and the contrast-to-noise ratio (CNR) of the pancreatic parenchyma, PDAC, arteries, and veins were quantified. The edge rise slope (ERS) was employed to quantify the edge sharpness of superior mesenteric artery during PPP, main portal vein during PVP, and pancreatic parenchyma during both enhancement phases. Image sharpness, noise magnitude, texture fineness, delineation of PDAC, peripancreatic vessels, main pancreatic duct, and diagnostic confidence were visually ranked (1=worst, 3=best) among the three image series.

### RESULTS

Quantitative image noise during PPP and PVP was lowest with SR-DLR (9.2±0.9 and 9.5±0.9 HU, respectively), followed by NR-DLR (10.9±1.1 and 11.4±1.1 HU, respectively) and HIR (14.9±1.7 and 15.8±1.4 HU, respectively), with significant differences among the three series (all $p<0.01$). SR-DLR achieved the highest CNR and ERS for all structures, followed by NR-DLR and HIR, with significant differences between the series (all, $p<0.01$). SR-DLR also attained higher scores for all visual evaluation criteria (median score: 3) than NR-DLR (median score: 2) and HIR (median score: 1) ($p<0.01$).

### CONCLUSION

Compared with HIR and NR-DLR, the novel SR-DLR algorithm enhanced spatial resolution, reduced image noise, and improved the delineation of pancreatic tumors and adjacent structures in thin-slice multi-phase pancreatic CT, thus increasing diagnostic confidence for the assessment of PDAC.

### CLINICAL RELEVANCE/APPLICATION

The recently introduced SR-DLR algorithm optimized for body CT may facilitate a more confident and detailed assessment of PDAC owing to its superior spatial resolution, noise performance, and visibility of tumor and adjacent structures compared to HIR and NR-DLR algorithms.

## R5A-SPGI-10 PREDICTION OF PANCREATIC DUCTAL ADENOCARCINOMA AGGRESSIVENESS USING CT-BASE RADIOMICS

Bachir Taouli, MD (*Abstract Co-Author*) Research Grant, Bayer AG;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Bayer AG;Consultant, Guerbet SA;Research Grant, Regeneron Pharmaceuticals, Inc
Valentin Fauveau, MSc (*Abstract Co-Author*) Nothing to Disclose
Octavia Bane, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Kevin R. Adams, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuya Yasokawa, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the role of CT-based radiomics for prediction of outcomes in patients with pancreatic ductal adenocarcinoma (PDAC) who underwent neoadjuvant therapy (NAT) and resection.

**METHODS AND MATERIALS**

This is a single center retrospective study in which a cohort of 94 patients (M/F 42/52, mean age 67.9y) with PDAC who had pre-treatment CT were assessed. The cohort was divided into training and validation (70%/30%). 3D segmentation of the tumors was performed on post-contrast CT (portal venous phase) (Fig. 1) and radiomics features (shape, histogram, and texture features) were extracted from a volume of interest encompassing the tumor. The aggressiveness of PDAC was classified using histopathologic tumor grade (G1-2: well-moderately vs G3: poorly differentiated), and recurrence (absent vs present). The diagnostic performance of radiomics features to identify poorly differentiated tumors and to predict recurrence were assessed with ROC analysis. In addition, hazard ratios (HR) of clinical, CT and radiomics features for prediction of time to recurrence (TTR) and mortality were assessed using Cox uni/multivariate models.

**RESULTS**

Radiomic features predicted G3 tumors with AUC of 0.67 (CI [0.44; 0.89]) in the validation cohort (Fig. 2). CA19-9 combined with radiomics (AUC=0.61, CI [0.37; 0.85]) outperformed radiomics alone for predicting (AUC=0.56, CI [0.33; 0.78]) (Fig.3). Tumor size was predictive of TTR and mortality (HR=1.35, p=0.04 and HR=1.38, p=0.04, respectively), and 1 radiomics feature (Original Shape Compactness 1) was predictive risk of TTR (HR<0.0001, p=0.04). No radiomics features were predictive of mortality.

**CONCLUSION**

Larger tumor size and radiomics may predict TTR, to be confirmed.

**CLINICAL RELEVANCE/APPLICATION**

Tumor size and radiomics based on pre-treatment CT provide information for recurrence in patients with PDAC, which may help with personalized therapy and prognostication.

## R5A-SPGI-12 SPECTRAL CT PARAMETER COMBINATION WITH EXTRACELLULAR VOLUME IN PREOPERATIVE PREDICTION THE STATUS OF COLORECTAL CANCER PERINEURAL AND LYMPHOVASCULAR INVASION

Ting LU (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the value of spectral CT parameter and extracellular volume fraction (ECV) in the preoperative prediction of perineural invasion (PNI) and lymphovascular invasion (LVI) in colorectal cancer (CRC).

**METHODS AND MATERIALS**

A retrospective analysis was performed for 142 patients with CRC confirmed by postoperative pathology, all of whom underwent full abdominal contrast-enhanced spectral CT scan before surgery. Measure the iodine concentration (IC), standardized IC(NIC), effective-Z (Eff-Z) and extracellular volume fraction (ECV) in arterial phase(AP), venous phase(VP) and delay phase(DP), and compare the differences of various parameters between PNI and LVI group and non-PNI and LVI group. Logistic regression analysis was performed to determine the independent impact factors of CRC-PNI and LVI to construct combined parameters, and the performance of each parameter to distinguish between PNI and LVI group and non-PNI and LVI group individually and jointly was compared using the receiver operating characteristic (ROC) curves.

**RESULTS**

In thes tudy, a total of 142 patients were enrolled, including 80 cases of PNI and LVI, and 62 cases of non-PNI and LVI. The lesions in the PNI and LVI group were greater than those in the non-PNI and LVI group, including ICAP,Eff-ZAP,ICVP,NICVP,ECVVP,ICDP,NICDP,Eff-ZDP and ECVDP, and the differences between the two groups were statistically significant ($P < 0.05$), while the differences between NICAP, ECVAP and Eff-ZVP were not significant ($P > 0.05$). Among the single parameters, ECVDP was the best for predicting PNI and LVI and non-PNI and LVI, and the area under the curve (AUC) was 0.880 ($P <0.001$), which was significantly higher than that of other parameters. Multivariate logistic regression found that ECVDP (OR=1.132, 95%CI: 1.021-1.256, P=0.018) and Eff-ZDP (OR=1.046, 95%CI: 1.015-1.078, P=0.003) were independent risk factors for CRC-PNI, and the combined parameters of ECVDP and Eff-ZDP (AUC=0.902) were constructed. The sensitivity, specificity and accuracy were 95.20%, 73.80% and 83.10%, respectively.

**CONCLUSION**

The combination of spectral CT parameters and ECV can predict PNI and LVI in CRC before surgery. It is expected to promote further research and long-term clinical application of spectral CT in preoperative prediction of PNI and LVI in CRC.

**CLINICAL RELEVANCE/APPLICATION**

CRC-PNI and LVI is an independent risk factor for poor prognosis in CRC patients, but now can only through pathological evaluation of postoperative PNI and LVI. ECVDP and Eff-ZDP based on preoperative spectral CT can distinguish PNI and LVI, is expected to provide convenient and feasible imaging markers for preoperative prediction of CRC-PNI and LVI.

## R5A-SPGI-2 VALUE OF HISTOGRAM QUANTITATIVE SUSCEPTIBILITY MAPPING IN EVALUATING THE PATHOLOGICAL CHARACTERISTIC OF PANCREATIC DUCTAL ADENOCARCINOMA

Fuyao Liu (*Abstract Co-Author*) Nothing to Disclose
Junxin Lv (*Abstract Co-Author*) Nothing to Disclose
Jie Chen (*Abstract Co-Author*) Nothing to Disclose
Jinggang Zhang, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the value of histogram analysis quantitative susceptibility mapping (QSM) in preoperative prediction of pathological characteristic of pancreatic ductal adenocarcinoma (PDAC).

### METHODS AND MATERIALS

A total of 44 patients with pathologically confirmed PDAC were retrospectively analyzed. All patients underwent QSM and conventional MRI scans. According to the pathological results, they were divided into high-grade group and low-grade group. According to the fibrosis content of tumor tissue, more than 30% was defined as high fibrosis group, and less than 30% was defined as low fibrosis group. The histogram related texture parameters of quantitative susceptibility imaging were measured, including mean, minimum, maximum, standard deviation, skewness, kurtosis, entropy, 10% pixel value, 25% pixel value, 50% pixel value, 75% pixel value, and 90% pixel value. Independent sample t test (normal distribution) or Mann-Whitney rank sum test (skewed distribution) was used to compare the differences of QSM histogram parameters between high and low grade PDAC and high and low fibrosis PDAC. ROC was used to evaluate the efficacy of QSM histogram parameters in differentiating between high and low grade PDAC.

### RESULTS

The QSM mean value, maximum value, skewness, 50% pixel value, 75% pixel value and 90% pixel value of tumor tissues of patients with low-grade PDAC and high-grade PDAC were statistically different between the two groups (all $P < 0.05$). The minimum value, standard deviation, kurtosis, entropy, 10% pixel value and 25% pixel value had no statistical significance ($P > 0.05$). Among these parameters, mean had the largest area under the ROC curve (0.775) for differentiating between high and low grade PDAC. The mean value had the highest sensitivity (88.0%). The specificity of 50% and 75% pixel values was the highest (84.2%). However, there was no significant difference in QSM histogram parameters of PDAC between the high and low fibrosis groups ($P > 0.05$).

### CONCLUSION

In this study, QSM was applied to pancreatic ductal adencracinoma for the first time. QSM has certain value in predicting the pathologic grade of PDAC before surgery. Of course, further studies with a larger patient group are still needed to obtain data with a larger ample size to verify the value of QSM in evaluating the histological grading of PDAC.

### CLINICAL RELEVANCE/APPLICATION

QSM has certain value in predicting the pathologic grade of PDAC before surgery.

## R5A-SPGI-3 STUDY ON RESECTABLE EVALUATION OF PANCREATIC CANCERWITH VIRTUAL MONOCHROMATIC IMAGES OF SPECTRAL CT

Zixing Huang (*Abstract Co-Author*) Nothing to Disclose
Tao Shuai (*Abstract Co-Author*) Nothing to Disclose
Qianyuan Xue (*Abstract Co-Author*) Nothing to Disclose
Liqiong Liu (*Abstract Co-Author*) Nothing to Disclose
Haopeng Yu (*Abstract Co-Author*) Nothing to Disclose
Yuqi Wang (*Presenter*) Nothing to Disclose

### PURPOSE

Compared with conventional CT images, to discuss the application value of virtual monochromatic images of spectral CT in the evaluation of resectability of pancreatic cancer.

### METHODS AND MATERIALS

We retrospectively enrolled 47 consecutive patients who underwent pancreatic spectral CT enhanced examination in *** hospital from November 2019 to May 2021. All the patients were pathologically confirmed to be pancreatic cancer. Two observers measured tumor size and evaluated the resectability of pancreatic cancer according to the 2023 NCCN guidelines on conventional CT images and the optima monochromatic images. Interobserver agreements were determined by using kappa coefficient for the resectable assessment and ICC coefficient for tumor size. Taking the surgical pathological results as the gold standard, receiver operating characteristic curve was used to analyze the diagnostic efficacy of both images in evaluating the resectability of pancreatic cancer.

### RESULTS

Surgical pathological results confirmed that 16 cases were resectable, 13 cases were borderline resectable, and 18 cases were unresectable. Both tumor size and resectability on conventional CT images and optima monochromatic images demonstrated high agreement ($k=0.968$ vs 0.834, 0.989 vs 0.961, $p<0.05$). The sensitivity, specificity, negative predictive value, positive predictive value and accuracy of the optima monochromatic images in evaluating the resectable pancreatic cancer were 93.75%(95%CI: 69.77%~99.84%), 93.55%(95%CI : 78.58%~99.21%), 96.67%(95%CI :81.26%~99.49%), 88.24%(95%CI: 66.12%~96.65%), 93.62%(95%CI :82.46%~98.66%). Respectively the values for conventional images were 81.25%(95%CI: 54.35%~95.95), 80.65%(95%CI: 62.53%~92.55%), 89.29%(95%CI : 74.76%~95.91%), 68.42%(95%CI: 50.43%~82.19%), 80.85%(95%CI: 66.74%~90.85%). The area under the curve of both group was 0.920(95%CI :0.818~1.023) vs 0.811(95%CI :0.692~0.931), $z=2.269$,$p<0.05$.

### CONCLUSION

The consistency of both conventional CT images and the optimal monochromatic images was high. Compared with conventional CT images, the optimal monochromatic images had higher diagnostic value for resectability evaluation of pancreatic cancer.

### CLINICAL RELEVANCE/APPLICATION

Compared with conventional CT images, to discuss the application value of virtual monochromatic images of spectral CT in the evaluation of resectability of pancreatic cancer. It can provide a more accurate reference basis for the selection of pancreatic cancer treatment, thus effectively avoiding the emergence of "ineffective surgery" and "ineffective chemotherapy" and improving the survival rate and prognosis of patients.

## R5A-SPGI-6 QUANTITATIVE EVALUATION OF PANCREATIC CANCER DETECTION IN CT: COMPARISON OF PHOTON COUNTING DETECTOR CT AND DUAL ENERGY INTEGRATED DETECTOR CT

Kyo Noguchi, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuma Nishikawa (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Kawahara (*Abstract Co-Author*) Nothing to Disclose
Aki Kido, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Norihito Naruto (*Abstract Co-Author*) Nothing to Disclose
Ken Yamamoto (*Abstract Co-Author*) Nothing to Disclose
Mariko Doai (*Abstract Co-Author*) Nothing to Disclose
Takahito Niiyama (*Presenter*) Nothing to Disclose

**PURPOSE**

CT imaging is essential to determine the stage and resectability of pancreatic cancer. Advances in CT imaging technology have significantly enhanced the management of pancreatic cancer and impact clinical outcomes. The advent of dual-energy integrated detector CT (DE-CT) has improved the detection rate of pancreatic cancer compared to conventional single energy integrated detector CT (EID-CT). The recently developed photon counting detector CT (PCD-CT) is expected to have excellent tumor detection ability due to its ultra-high resolution and reduced radiation dose. Although there are reports showing that PCD-CT is superior to conventional EID-CT, no comparison with DE-CT was found. The purpose of this study is to quantitatively compare the ability of PCD-CT and DE-CT to detect pancreatic cancer.

**METHODS AND MATERIALS**

A total of 20 patients who underwent PCD-CT and 20 patients who underwent DE-CT for diagnostic workup of pancreatic cancer were included. Quantitative analysis was performed on the contrast ratio of the tumor and pancreas (TPR), and the contrast-to-noise ratio (CNR) of non-contrast CT images, early enhancement phase (42 sec), and late enhancement phase (180 sec). In addition, iodine concentrations were also measured in the aorta, pancreatic tumor, and normal pancreatic tissue on both early and late enhancement stages in 16 patients.

**RESULTS**

There was no significant difference in TPR (non-contrast: 0.71 vs. 0.98, P value 0.08, early enhancement stage: 0.60 vs. 0.58, P value 0.39, late enhancement stage: 1.16 vs. 1.08, P value 0.12, PCD-CT vs. DE - CT) and CNR (non-contrast: 2.55 vs. -0.23, P value 0.14; early enhancement stage: 17.01 vs. 19.55, P value 0.26; late enhancement stage: -4.01 vs. -2.18, P value 0.19). There was also no significant difference between PCD-CT and DE-CT regarding iodine concentration (initial 11.2 vs. 10.0, 1.42 vs. 1.78, 3.9 vs. 3.7, 3.7 vs. 3.8, 2.0 vs. 2.3, 2.0 vs. 2.3, respectively) in the aorta; pancreatic tumors, normal pancreatic tissue).

**CONCLUSION**

The image quality of pancreatic cancer in PCD-CT was comparable to DE-CT, and the tissue contrast in non-contrast and contrast-enhanced images was also not superior to DE-CT.

**CLINICAL RELEVANCE/APPLICATION**

PCD-CT and DE-CT were equivalent in detecting pancreatic cancer.

## R5A-SPGI-7 CT IMAGING FINDINGS FOLLOWING TREATMENT WITH COMBINATION SBRT AND CHEMOTHERAPY FOR LOCALLY ADVANCED PANCREATIC ADENOCARCINOMA

Olga R. Brook, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Bettina Siewert, MD (*Abstract Co-Author*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv
Alexander Brook, PhD (*Abstract Co-Author*) Nothing to Disclose
Robert G. Sheiman, MD (*Abstract Co-Author*) Nothing to Disclose
Abraham Fourie Bezuidenhout, MD (*Abstract Co-Author*) Nothing to Disclose
Vishaal Gudla, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Recognizing the CT imaging patterns of locally advanced pancreatic adenocarcinoma (LAPA) before, during and after stereotactic body radiotherapy (SBRT) is crucial when determining disease recurrence. Our study aims to evaluate the imaging features of patients with LAPA following treatment with combination SBRT and chemotherapy.

**METHODS AND MATERIALS**

This retrospective study examines the CT imaging features of LAPA patients who received combination SBRT and chemotherapy compared to those that received chemotherapy alone between 2005-2018. Comparisons were made both pre-treatment and at four standardized post-treatment intervals (1 month, 3-6 months, 7-12 months, greater than 12 months) to assess for change in imaging features over time in patients without disease progression. Evaluated variables included degree of vascular involvement graded on a standardized scale (0:no involvement, 1:encasement, 2:stenosis, 3:thrombosis), tumor location, tumor size, and peripancreatic mesenteric fat stranding. Patients in whom disease progression was noted, as determined by multidisciplinary tumor board based on clinical data and CA 19-9 trends, were excluded wherein data beyond the time of disease progression was excluded from analysis. Statistical analysis was performed including mixed effects logistic regression and ANOVA tests. A p value $<0.05$ was considered significant.

**RESULTS**

A total of 96 patients were included in this study, 64 treated with combination SBRT/chemotherapy (68 years +/- 11, 37 men) and 32 treated with chemotherapy only (69 years +/- 10, 17 men). The median length of follow up in the SBRT/chemotherapy group was 237 days, IQR 114-395, and in the chemotherapy group was 102 days, IQR 44-293. Vascular involvement as graded on CT was higher among the SBRT/chemotherapy group at all time intervals. Vascular involvement over time was significantly higher in the SBRT/chemotherapy group as compared to the chemotherapy group. ($p= 0.02$). The hepatic and celiac arteries were the most common vessels to demonstrate increased vascular involvement in the SBRT/chemotherapy group (23.4 and 20.3% of cases respectively) in the absence of disease progression.

**CONCLUSION**

Increased vascular involvement over time in LAPA patients treated with combination SBRT/chemotherapy should be an anticipated treatment effect of SBRT, not necessarily indicating disease progression.

**CLINICAL RELEVANCE/APPLICATION**

Vascular involvement progressing over time in LAPA patients treated with combination SBRT/chemotherapy could be due to the fibrotic response invoked by SBRT. In the absence of clinical disease progression, this should not be misconstrued as disease progression.

# Abstract Archives of the RSNA, 2024

R5A-SPGU

**Genitourinary Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPGU-5 THREE-DIMENSIONAL CONTRAST-ENHANCED TRANSRECTAL ULTRASOUND FOR THE DETECTION OF CLINICALLY SIGNIFICANT PROSTATE CANCER

Yaqing Chen (*Abstract Co-Author*) Nothing to Disclose
Wenbin Guan (*Abstract Co-Author*) Nothing to Disclose
Yunkai Zhu (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the performance of 3D contrast-enhanced transrectal ultrasound (CE-TRUS) for the detection of clinically significant prostate cancer (csPCa).

### METHODS AND MATERIALS

This prospective study included 84 consecutive patients scheduled for prostate biopsy, with a median age of 69 years (interquartile range: 65-78 years) and PSA of 9.99 ng/ml (interquartile range: 6.32-15.69 ng/ml). Before the biopsy, all patients underwent both 2D and 3D CE-TRUS evaluation. 2D CE-TRUS was performed at the plane of hypoechoic lesion, or using a sweeping method in patients without hypoechoic lesion on conventional TRUS. Whole gland 3D CE-TRUS images were acquired continuously for 90 seconds. For image analysis, the transverse, sagittal and coronal images were reconstructed using iPAGE software, with a slice thickness of 1 mm. Both 2D and 3D CE-TRUS images were rated using a five-point Likert score based on contrast enhancement on CEUS. Regions with Likert=3 were selected for targeted biopsy (TB) in addition to 12-core systematic biopsy (SB). The primary outcome was the detection of csPCa, defined as PCa with GG=2 at biopsy histopathology. Differences in proportions were compared using McNemar's test for matched pairs.

### RESULTS

The diagnosis of csPCa was histologically confirmed in 50 patients. The detection rate for csPCa was 48.8% (41/84) with SB, 44.0% (37/84) with 2D CE-TRUS, and 53.6% (45/84) with 3D CE-TRUS. The csPCa detection rate of 3D CE-TRUS was comparable to that of SB (P=0.267), and significantly higher than that of 2D CE-TRUS (P=0.008). With the combination of 3D CE-TRUS and SB, the csPCa detection rate could be further improved when compared with SB alone (59.5% [50/84] vs 48.8% [41/84], P=0.004). 3D CE-TRUS was scored Likert 1-2, 3, 4 and 5 in 29 (34.5%), 19 (22.6%), 14 (16.7%) and 22 (26.2%). For patients with Likert=3, the csPCa detection rate of TB increased with higher Likert score, with 68.4% (13/19), 71.4% (10/14) and 95.5% (21/22) for patients with scores of 3, 4, and 5, respectively (P = 0.029). For patients with Likert 1-2, SB resulted in the detection of two patients (6.9%, 2/29) with csPCa.

### CONCLUSION

3D CE-TRUS is an operator-independent imaging method that enables standardized dynamic contrast-enhanced imaging for the entire prostate gland. The multiplanar step-sectional reconstruction of 3D CE-TRUS images provide better depiction of csPCa lesions than 2D CE-TRUS. 3D CE-TRUS might be an ideal method for performing TB to improve csPCa detection.

### CLINICAL RELEVANCE/APPLICATION

Characterized by the standardized and multiplanar whole gland imaging, 3D CE-TRUS is an ideal method for the detection and localization of csPCa.

# Abstract Archives of the RSNA, 2024

R5A-SPHN

**Head & Neck Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPHN-1 IMPACT OF ADDITIONAL COMPUTED TOMOGRAPHY IN PATIENTS WITH LOW-RISK PAPILLARY THYROID MICROCARCINOMA ELIGIBLE FOR ACTIVE SURVEILLANCE

Ji Ye Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Taehyuk Ham, MD (*Abstract Co-Author*) Nothing to Disclose
Ji-Hoon Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Young Hun Jeon (*Presenter*) Nothing to Disclose

### PURPOSE

Active surveillance (AS) of low-risk papillary thyroid microcarcinomas (PTMC) is emerging as an alternative management option to immediate surgery. When considering the initiation of AS, it is crucial to confirm the appropriateness of the tumor to AS. Among several factors, the identification of clinically evident lymph node metastasis (LNM) is considered as inappropriate for AS and warrants immediate surgery. While the supplementary role of neck computed tomography (CT) is increasingly emphasized for detecting LNM in thyroid cancer, its role in the population appropriate for AS remains unclear. This study aims to investigate the impact of additional CT alongside ultrasound (US) for detecting cervical LNM and assessing the appropriateness of AS in patients with low-risk PTMC.

### METHODS AND MATERIALS

From February 2016 to December 2021, consecutive PTMC patients who underwent US and CT for staging were retrospectively analyzed. The number of patients with clinical N1 and pathologic N1 disease was assessed. The diagnostic performance of US, CT, and combined US/CT in assessing their nodal staging was calculated. The impact of CT on nodal staging revisions based on US was evaluated.

### RESULTS

Among 1,230 PTMC patients (mean age, 47.8 year ± 11.8 [SD], 967 female), 202 (16.4%) patients showed nodal positivity on preoperative imaging: 55 (4.5%) detected on both US and CT, 18 (1.5%) only on US, and 129 (10.5%) only on CT. Among them, 1,002 (81.5%) underwent surgery, 204 (16.6%) underwent AS, and 24 (2.0%) underwent radiofrequency ablation for their management. Among 977 patients who underwent thyroidectomy with neck dissection, 337 (34.5%) were diagnosed with pathologic N1 disease. Integrating CT with US significantly improved sensitivity for detecting microscopic (3.1% vs. 16.8%, $p < .001$), macroscopic (25.1% vs. 65.3%, $p < .001$), and all nodal metastases (15.0% vs. 42.8%, $p < .001$) without compromising specificity. In 156 cases (16.0%) with discordant nodal staging between US and CT, CT accurately identified 96 (9.8%) cases of nodal staging whereas US did not.

### CONCLUSION

The integration of CT with US altered nodal staging by increasing their sensitivity for detecting LNM in patients with low-risk PTMC eligible for AS. CT could be a useful risk stratification tool for eligibility assessments at the time of management plan decisions in patients with low-risk PTMC.

### CLINICAL RELEVANCE/APPLICATION

The combined approach of US and CT can identify more cases of LNM, which may not be detected using US alone in patients with low-risk PTMC. By providing a more accurate assessment of nodal staging, the combined approach could help in determining the most appropriate management strategy and potentially lead to outcomes in low-risk PTMC patients.

## R5A-SPHN-2 IMPROVING THE DIAGNOSTIC RISK STRATIFICATION OF BETHESDA INDETERMINATE THYROID NODULES VIA DEEP-LEARNING BASED INFERENCE

Chandra Sehgal, PhD (*Abstract Co-Author*) Nothing to Disclose
Hersh Sagreiya, MD (*Abstract Co-Author*) Nothing to Disclose
Jill E. Langer, MD (*Abstract Co-Author*) Nothing to Disclose
Lev Barinov, MD, PhD (*Presenter*) Research Consultant, Koios Medical, Inc;Stockholder, Koios Medical, Inc

### PURPOSE

Ultrasound is the primary imaging modality for risk stratifying thyroid nodules. For nodules deemed sufficiently suspicious on diagnostic imaging to warrant fine needle aspiration, up to 60% yield indeterminate cytopathology and necessitate subsequent molecular testing such as ThyroSeq®. Unfortunately, ThyroSeq®'s false positive rate can be as high as 50% in practice. We hypothesize that a deep learning-based analysis of indeterminate thyroid nodules on ultrasound can be used for effective risk stratification.

**METHODS AND MATERIALS**

A retrospective review of consecutive thyroid ultrasounds from 2021-2023 yielded 36,460 diagnostic studies containing 24,975 nodules. 5,214 were biopsied, and 2984 (57%) had either Bethesda III (atypia of undetermined significance) or IV (follicular neoplasm) cytopathological classification, which led to 1285 ThyroSeq® evaluations. We identified the subset that went on to receive hemi- or full thyroidectomy, which yielded 151 nodules across 145 patients; 48 (32%) were benign and 103 (68%) were malignant (or NIFTP) based on final surgical histopathology. Performance was evaluated via proportion metrics on the binary ThyroSeq® classifications and ROCAUC analysis on the continuous risk percentages. A ResNet-18-based convolutional neural network (CNN) was trained to delineate malignant and benign lesions. CNN performance was evaluated via 10-fold cross validation independently and as a fused-adjunct to the ThyroSeq® continuous risk percentages. We utilized TI-RADS assessments as a baseline to the performance of both ThyroSeq® and the CNN.

**RESULTS**

ThroSeq® sensitivity, specificity, PPV, and NPV were 85.44% [78.62 92.25], 41.67% [27.72 55.61], 75.86% [68.07 83.65], and 57.14% [40.75 73.54], respectively with 95% confidence intervals. TI-RADS, ThyroSeq®, CNN, and CNN+ThyroSeq® ROCAUCS were 0.55, 0.76, 0.64, and 0.77, respectively.

**CONCLUSION**

The false positive rate of ThyroSeq® is 58%, higher than what was originally published. This suggests that while there is some reduction in unnecessary surgery, most positive results are benign. CNN risk stratification is superior to TI-RADS with meaningful predictive power, but it is not yet as effective as ThyroSeq®. Fusing the CNN result with ThyroSeq® risk percentage improves AUC but does not impact the final operating point. Further development of the classifier may alleviate the need for additional expensive testing by analyzing already acquired diagnostic imaging.

**CLINICAL RELEVANCE/APPLICATION**

This study presents a method that can risk stratify indeterminate thyroid nodules more accurately than TI-RADS and beginning to approach the performance of diagnostic molecular assays.

## R5A-SPHN-3 PREDICTING LYMPH NODE METASTASIS OF PAPILLARY THYROID CARCINOMA USING DUAL-ENERGY CT NOMOGRAMS

Quanxin Yang (*Abstract Co-Author*) Nothing to Disclose
Kexin Zhang (*Abstract Co-Author*) Nothing to Disclose
Huizhi Mi (*Abstract Co-Author*) Nothing to Disclose
Xiaohui Li (*Abstract Co-Author*) Nothing to Disclose
Jiaxing Wu (*Abstract Co-Author*) Nothing to Disclose
Jingbin ZHANG (*Abstract Co-Author*) Nothing to Disclose
Haiqiao Sun (*Abstract Co-Author*) Nothing to Disclose
Bo Gao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the discriminative capacity of nomograms, integrating dual-energy CT (DECT) quantitative parameters and clinical data in distinguishing between metastatic and non-metastatic lymph nodes in papillary thyroid carcinoma (PTC)

**METHODS AND MATERIALS**

60 patients diagnosed with papillary thyroid carcinoma between 2021 and 2023 were retrospectively inculded. Preoperatively, all patients underwent cervical dual-energy contrast-enhanced CT. Following surgical resection, lymph nodes were categorized into metastatic lymph nodes (105 nodes) and non-metastatic lymph nodes (136 nodes). Groups based on pathological examination. various quantitative parameters, including iodine concentration (IC) of arterial phase, shape, short diameter, margin, enhancement degree, cystic change, calcification, arterial phase enhancement pattern, and capsule integrity, were analyzed in both groups. Independent risk factors for lymph node metastasis was identified through univariate and multivariate logistic regression analysis. A nomogram-based model was constructed and its calibration curve was generated.

**RESULTS**

Multivariate binary logistic regression analysis revealed that arterial phase iodine concentration =2.6 mg/ml, enhancement degree, enhancement pattern, short diameter =10mm, unclear margin, irregular shape, incomplete capsule of thyroid nodules were independent risk factors for predicting lymph node metastasis. The AUC of the nomogram model constructed based on this was 0.993 (95% CI 0.98~0.99), with a cutoff value of 0.5, sensitivity of 97.04%, and specificity of 95.28%.

**CONCLUSION**

The nomogram model derived from on dual-energy CT parameters and clinical data , demonstrates considerable clinical utility in preoperatively assessing lymph node metastasis in patients with papillary thyroid carcinoma , This model holds promise for informing, individualized treatment strategies.

**CLINICAL RELEVANCE/APPLICATION**

nomograms can help clinicians develop surgical approaches

## R5A-SPHN-4 DIAGNOSTIC PERFORMANCE OF AI MODEL FOR THYROID NODULES WITH INITIALLY NONDIAGNOSTIC CYTOLOGIC RESULTS

Jeong Hoon Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Eun Ju Ha, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Artificial intelligence (AI) model for thyroid ultrasonography (US) seems to be a promising diagnostic tool for patients with thyroid nodules. Prior studies have shown high diagnostic performance of AI models for predicting malignant thyroid nodules. However, studies on the role of AI model for thyroid nodules with initially nondiagnostic cytologic results are presently lacking. This study aimed to evaluate the diagnostic performance of AI model in thyroid nodules with nondiagnostic results at previous fine-needle aspiration (FNA).

**METHODS AND MATERIALS**

Between January 2019 and September 2023, 13,164 nodules underwent US-guided FNA at our institution. Among them, 413 nodules from 409 patients (121 men, 288 women) with a mean age of 51.3 years (age range, 18-81 years) with nondiagnostic results at previous FNA were reviewed retrospectively. AI-Thyroid, a deep learning model for identifying malignant thyroid nodules, was tested online (http://us.cdss.co.kr/). Model performance

was compared against blinded expert radiologist performance using Thyroid Imaging Reporting and Data System (TIRADS) interpretation. Sonographic characteristics associated with false positive diagnosis were analyzed.

**RESULTS**

A total of 413 thyroid nodules were analyzed, 102 (24.7%) comprising malignant nodules. Using AI-Thyroid, 318 nodules (77.0%, 318 of 413) had accurate diagnoses with high negative predictive value (92.9%, 234 of 252). The area under the receiver operative curve (AUROC), sensitivity, and specificity were 0.845, 82.4% (84 of 102), and 75.2% (234 of 311), respectively. The AUROC value was significantly higher for the AI-Thyroid, compared to the TIRADS-based classification (0.845 vs. 0.623, $p < 0.001$). The most important features associated with false positive diagnoses were presence of macrocalcifications and non-parallel orientation, respectively.

**CONCLUSION**

AI-Thyroid demonstrates high rates of accurate diagnoses with high negative predictive value in patients for whom previous FNA results were nondiagnostic, thereby reducing the need for unnecessary diagnostic surgery or repetitive FNAs.

**CLINICAL RELEVANCE/APPLICATION**

1. AI-Thyroid can be a promising diagnostic tool for patients with previous nondiagnostic FNA results to reduce the need for diagnostic surgery or repetitive FNAs. 2. AI-Thyroid showed high rates of accurate diagnoses (77.0%, 318 of 413) with high negative predictive value (92.9%, 234 of 252) in patients with previous nondiagnostic FNA results. 3. AI-Thyroid had a 23.0% incidence of incorrect diagnosis with macrocalcifications and non-parallel orientation being the main causes of false-positive diagnosis in patients with previous nondiagnostic FNA results.

## R5A-SPHN-5 DIAGNOSTIC VALUE OF CONTRAST-ENHANCED THYROID CT IMAGING WITH MODIFIED POSITIONING IN THYROID CANCER: PATHOLOGY AS REFERENCE

Huijun Xiao (*Abstract Co-Author*) Nothing to Disclose
Huijuan Huang (*Abstract Co-Author*) Nothing to Disclose
Wencong Yang (*Abstract Co-Author*) Nothing to Disclose
Weihua Lin (*Abstract Co-Author*) Nothing to Disclose
Dongyi Chen (*Abstract Co-Author*) Nothing to Disclose
Furong Luo (*Abstract Co-Author*) Nothing to Disclose
Ruigang Huang (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the performance of contrast-enhanced thyroid CT imaging with modified positioning in thyroid cancer-related diagnosis, with pathology as a reference.

**METHODS AND MATERIALS**

This prospective study enrolled 153 patients who underwent preoperative contrast-enhanced thyroid CT imaging and had pathology confirmed thyroid lesions. Patients were scanned with modified position (MP, n=70) and conventional position (CP, n=83). During scanning, an auxiliary postural support device was used in the MP group to ensure the patient's head was tilted back, shoulders sunk, and neck protruded, and no auxiliary postural device was used in the conventional position group. Two radiologists with different experience independently performed diagnosis from three perspectives: thyroid malignancy, thyroid tumor with capsular invasion, and cervical lymph node metastasis. With pathology as a reference, area under the curve (AUC), sensitivity, specificity, accuracy, negative predictive value (NPV), and positive predictive value (PPV) were calculated for evaluating the diagnostic performance.

**RESULTS**

Both junior and senior radiologists demonstrated improvements in diagnostic performance on MP images; the AUCs for diagnosing malignancy reached 0.9 (senior) and 0.83 (junior), for capsular invasion, 0.97 and 0.76, and for cervical lymph node metastasis, 0.84 and 0.79, while on CP images, those were 0.75 (senior) and 0.6 (junior) for malignancy identification, 0.82 and 0.77 for capsular invasion evaluation, and 0.74 and 0.61 for lymph node metastasis assessment, respectively. The sensitivity, specificity, accuracy, NPV, and PPV for the three conditions were also higher for radiologists with MP images. Particularly, the sensitivity, specificity, and accuracy were increased by 10% ~ 47% for junior, and by 5%~24% for senior. The kappa coefficients between junior and senior diagnosis were also improved to 0.76~0.79 for MP, compared to CP with 0.62~0.73.

**CONCLUSION**

Both junior and senior radiologists demonstrated improvements in diagnostic performance regarding thyroid malignancy, thyroid tumor with capsular invasion, and cervical lymph node metastasis on MP images.

**CLINICAL RELEVANCE/APPLICATION**

Modified positioning enhances the diagnostic efficacy of contrast-enhanced thyroid CT imaging, showing high clinical value in patients suspected of thyroid cancer.

# Abstract Archives of the RSNA, 2024

R5A-SPIN

**Imaging Informatics Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPIN-1 BENCHMARKING OPTIMAL TRAINING DATA SIZE FOR ACCURATE CLASSIFICATION IN RENAL SURGICAL PATHOLOGY REPORTS

Tessa S. Cook, MD, PhD (*Abstract Co-Author*) Grant, Independence Blue Cross;Speaker, Sectra AB;
Darco Lalevic (*Abstract Co-Author*) Nothing to Disclose
Rithvik Sukumaran (*Abstract Co-Author*) Nothing to Disclose
Charles Chambers (*Abstract Co-Author*) Nothing to Disclose
Hanna M. Zafar, MD (*Abstract Co-Author*) Nothing to Disclose
Satvik Tripathi (*Presenter*) Nothing to Disclose

### PURPOSE

Natural language processing (NLP) shows promise for improving diagnostic processes. This study investigates the optimal training data size for a renal pathology report classification task while also exploring differences in data requirements between different types of models and comparing binary and multiclass versions of the same model.

### METHODS AND MATERIALS

We employed a multi-channel convolutional neural network (CNN), a recurrent neural network (RNN), and a long short-term memory network (LSTM) for the classification of summary text from 1239 renal surgical pathology reports from three health systems in the same state to train and benchmark models. The reports were labeled by two experienced radiologists as "malignant," "indeterminate," "benign," or "ignore" (n = 301, 113, 426, and 399, respectively). "Ignore" indicated any pathology not specifically from a mass lesion in the kidney. The multiple model variants were trained with increasing amounts of training data (10%, 25%, 50%, 75%, 85%, and 95% of total available data) and evaluated with a 5-fold cross-validation against a held-out validation set (n = 200). The same experiment was performed with a binary classification version of the CNN that considered only "malignant" (n=301) and "benign" (n=302) reports.

### RESULTS

Precision, recall, and F1 were measured across each iteration of the models. As training data size increased, model accuracy increased in smaller and smaller increments, indicating diminishing returns. The CNN and LSTM reached 90% accuracy or more when given enough training data, but the RNN only achieved middling performance even with larger amounts of data. While the LSTM achieved the highest performance of all models when trained on 95% of the available data, the CNN consistently outperformed all other models at lower levels of data, reaching acceptable performance with as low as 50% of the available training data. This led to a study of the CNN in a binary classification task, which performed better on all accounts and achieved higher accuracy at lower levels of data.

### CONCLUSION

Identifying the ideal model type and optimal training data size offers guidance to maximize model performance in renal pathology report classification while minimizing factors such as training time and costs. The study also highlights the impact of reducing problem scope from multiclass to binary classification—when possible—to enhance performance with less data.

### CLINICAL RELEVANCE/APPLICATION

Automatic labeling of renal pathology reports can be achieved without exorbitant amounts of data or effort, facilitating enhanced treatment experiences.

## R5A-SPIN-2 SELF-SUPERVISED PRETRAINING IMPROVES TRANSFORMER MODEL PERFORMANCE ON MRI METADATA STANDARDIZATION TASKS

Ajit Shankaranarayanan (*Abstract Co-Author*) Employee, Subtle Medical, Inc
Ben Duffy, PhD (*Abstract Co-Author*) Employee, Subtle Medical, Inc
Thomas C. Arnold, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Metadata inaccuracies and inconsistencies can disrupt radiology workflows and pose significant challenges to applications that rely on DICOM header information. Deep learning algorithms have demonstrated promise for correcting metadata inconsistencies and improving standardization, however obtaining a sufficiently large labeled training dataset remains a challenging aspect of building such systems. Here, we examine the impact of self-supervised pretraining using unlabelled data on a transformer model's performance for predicting MRI sequence and body part from DICOM metadata.

**METHODS AND MATERIALS**

We developed transformed-based models for two tasks, MRI sequence and body-part prediction using DICOM metadata. For self-supervised pretraining, we used the masked language modeling task and a large dataset consisting of 464,285 DICOM series. Fine-tuning was carried out using smaller manually labeled datasets. Data were divided into training (N=21,639), validation (N=2,401), and test (N=2,160) sets for the sequence classification task. The body part prediction dataset was partitioned into training (N=15,489), validation (N=1,721), and test (N=3,480) sets. The benefit of pretraining in a limited data regime was examined by restricting the maximum number of training examples per class to 40, 80, and 160 instances.

**RESULTS**

For both tasks, model performance improved as the maximum number of training examples per class increased from 40 to 160. The gap between the pretrained and random initialization models narrowed with increasing dataset size, demonstrating the benefits of pretraining are most significant in the few-shot regime. Despite training on 21,639 examples for the sequence prediction task and 15,489 instances for the body part prediction task, there remained a performance gap between random initialization and the pretrained models. The best performing model achieved an accuracy of 0.996 on the sequence classification task and 0.96 on the body part classification task. The majority of misclassified examples for the body part classification task were attributed to more general labels that contain more specific anatomical regions. The most common example was "prostate" as the ground-truth label with the prediction being "pelvis".

**CONCLUSION**

We demonstrated that for metadata standardization tasks, self-supervised pretraining was effective for reducing data labeling burden. Pretraining strategies are critical for integrating large amounts of data and developing systems that perform well across a wide range of inputs.

**CLINICAL RELEVANCE/APPLICATION**

Pretraining deep learning algorithms can improve metadata harmonization performance, thus facilitating data sharing and standardization across large health systems.

## R5A-SPIN-3 AUTOMATING BODY MRI PROTOCOL SELECTION WITH RADBERT

Ali H. Dhanaliwala, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tessa S. Cook, MD, PhD (*Abstract Co-Author*) Grant, Independence Blue Cross;Speaker, Sectra AB;
Satyam Ghodasara, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

As the volume of radiology examinations rises, the burden of ancillary tasks such as protocol selection are also rising. Fortunately, recent developments in natural language processing can help automate these tasks. We fine-tuned RadBERT, a transformer model pretrained on radiology reports, to select the best body MRI exam protocol given basic patient demographic information and free-text indications from the ordering provider.

**METHODS AND MATERIALS**

Protocol data for 15,956 body MRI examinations performed from 3/1/23-2/29/24 was obtained from our single academic medical center. The following data points were combined into a free-text field for each exam: patient age, patient gender, ordering provider specialty, patient's relevant diagnosis, ordering provider's exam indication, and anatomic region (abdomen, pelvis, or both). The model was fine-tuned to predict the single best of 57 unique protocols. Each protocol consisted of a study type (enterography, prostate, renal, etc.), post-contrast acquisition type (dynamic, non-dynamic, or unenhanced), and plane of post-contrast imaging (axial, coronal, or sagittal). RadBERT was fine-tuned over 3 epochs on this protocol data (80% training, 20% validation). The overall accuracy was measured as the micro average of the individual accuracies with respect to each of the 57 protocols both before and after fine-tuning.

**RESULTS**

The overall accuracy of the base RadBERT model prior to fine-tuning was 1.9%. After fine-tuning on our protocol data, this increased to 78.8%. While the most common study (routine abdomen with dynamic axial plane post-contrast imaging) was correctly classified in 684 instances, it was partially misclassified in 69 instances as a pancreatic-biliary study and in 37 instances as a renal study, although the model correctly predicted performing dynamic axial plane post-contrast imaging. Another common study (female pelvis with dynamic axial plane post-contrast imaging) was correctly classified in 212 instances but partially misclassified in 28 as sagittal plane post-contrast imaging.

**CONCLUSION**

Fine-tuning the RadBERT model on our own protocol data dramatically boosted performance, enabling it to accurately predict the majority of body MRI protocols given patient demographic information and the ordering provider's exam indication. The model's errors typically only involved one component of the protocol, such as the plane of post-contrast imaging, and reflects ambiguities in protocol selection that also frequently occur in clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

The fine-tuned RadBERT model shows promise for use in clinical practice to assist radiologists in accurately selecting protocols for body MRI examinations.

## R5A-SPIN-4 COMPUTER VISION IN MEDICAL IMAGING SERVICE DELIVERY: EVALUATING PROCESS CAPACITY OF CT SCANS

Andrew D. Brown, MD (*Abstract Co-Author*) Nothing to Disclose
Aly Fawzy, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Effective coordination of CT scan resources enhances care access and quality while reducing costs. Despite the reliance on average wait times as a performance metric, current methods (manual tracking or tracking devices) lack comprehensive data to inform effective management decisions. Computer vision (CV) methods offer a more cost-effective, adaptable, and less intrusive alternative for data collection. The purpose of this study is to address this gap by developing and evaluating a CV system to automate the capture of essential process metrics—cycle time, throughput, maximum capacity, and utilization rate—during CT scans. This technology aims to enhance the efficiency of CT service delivery by providing accurate and precise real-time data to service providers.

**METHODS AND MATERIALS**

An edge computing device equipped with a Jetson Xavier NX and a camera was deployed in a CT suite at an academic hospital for one hour to capture real-time data. The system utilized a YOLOv7 neural network for anonymizing individuals into 2D representations and background subtraction to monitor equipment movement. This setup enabled a direct comparison of the CV-generated data with manual event timings recorded by research personnel. Three types of CT events were considered: preparing for scan, scanning, and discharging.

**RESULTS**

The CV system reported an average cycle time of 7.33 minutes per patient, broken down into preparation (2.01 mins), scanning (3.65 mins), and discharge (1.67 mins). The throughput was 4.2 patients per hour, with room utilization at 53%, and scanner utilization rate at 0.23 minutes per patient. The theoretical maximum capacity calculated was 7.3 patients per hour. The data from the CV system closely matched the manual records, demonstrating less than 1% variance.

**CONCLUSION**

The implemented CV system, employing YOLOv7 and background subtraction, has proven to be highly accurate and reliable in monitoring and improving the efficiency of CT scan processes. It provides a cost-effective, adaptable, and less intrusive alternative to traditional manual methods, significantly enhancing service quality and decision-making in medical imaging.

**CLINICAL RELEVANCE/APPLICATION**

This study highlights a significant advancement in the application of CV and deep learning within medical imaging, presenting a novel, efficient approach for operational enhancement of CT services. By automating data collection and analysis, the CV system not only surpasses outdated manual methods in terms of cost-effectiveness, adaptability, and intrusiveness but also supports improved resource allocation and decision-making. This has the potential to set a new standard for process monitoring, enhancing efficiency and service quality in radiology departments.

## R5A-SPIN-5 ARE WE ON THE RIGHT WAY FOR EVALUATING AI ALGORITHMS FOR MEDICAL SEGMENTATION?

Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Yucheng Tang, PhD (*Abstract Co-Author*) Nothing to Disclose
Sergio Decherchi (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrea Cavalli (*Abstract Co-Author*) Nothing to Disclose
Wenxuan Li, BS (*Abstract Co-Author*) Nothing to Disclose
Pedro Ricardo Ariel Salvador Bassi (*Presenter*) Nothing to Disclose

**PURPOSE**

To provide a large-scale, open benchmark across 44 advanced AI algorithms in anatomical structure segmentation across three critical dimensions, including accuracy, efficiency, and robustness.

**METHODS AND MATERIALS**

We have established a large-scale AI benchmark attracting 44 international research teams from 12 countries. These teams develop their AI algorithms, which they either authored first or last, using our expansive annotated CT database. In total, the database consists of 22,682 annotated CT volumes (i.e., 7.9M images) collected from 94 hospitals and 19 countries, where 5,195 out of 22,682 CT volumes are available for training AI algorithms, the remaining are reserved for external validation. Our benchmark evaluates a wide range of AI algorithms, categorized as CNN, Transformer, Mamba, Vision-Language. In addition, we also evaluate publicly available AI frameworks—which are more flexible and can support different backbones—in terms of their segmentation capacity. These frameworks include Auto3DSeg from NVIDIA, nnU-Net from DKFZ, and numerous other open-source repositories developed by researchers. These models and frameworks, which collectively have garnered over 102,000 citations, are evaluated independently by our team using an unseen dataset of 13,420 CT volumes from 12 hospitals to determine their performance measured by segmentation accuracy (DSC and NSD) and inference efficiency (running time per case). Our benchmarking effort is featured in challenges hosted by ISBI-2024 and MICCAI-2024, invited as a Lighthouse Challenge in MICCAI-2025, and is planned to expand over the next five years.

**RESULTS**

We have received 15 AI algorithms and expect at least 35 more. DSC scores vary from 82% (SegVol) to 92% (UniSeg) across AI algorithms, 70% (aorta) to 96% (liver spleen) across anatomical structures, and inference times range from 0.12 (SegVol) to 0.61 (Diff-UNet V2) seconds per CT slice.

**CONCLUSION**

Our AI benchmark addresses critical limitations in existing medical AI evaluations by ensuring that: (I) creators of 44 renowned AI algorithms use consistent training and testing splits to mitigate biased reproductions by other teams, (II) our team conducts all evaluations independently, prohibiting test-time adjustments that could lead to overfitting, and (III) the test set comprises a comprehensive, diverse, and entirely unseen collection of 13,420 CT volumes from 12 hospitals, making it the largest test set used to date.

**CLINICAL RELEVANCE/APPLICATION**

The outcome will be translated into clinical prototypes. These AI prototypes have been deployed and beta-tested in JHU and UCSF to assist radiologists in automated organ volume measurement and support surgeons in precise surgical navigation.

## R5A-SPIN-7 FROM SPOKEN WORDS TO COMPHRENSIVE REPORTS: TRANSFORMING RADIOLOGISTS' VERBAL DESCRIPTIONS INTO COMPREHENSIVE RADIOLOGY REPORTS VIA SPEECH RECOGNITION AND LARGE LANGUAGE MODELS

Xinghao Wang (*Abstract Co-Author*) Nothing to Disclose
Han Lv, MD (*Abstract Co-Author*) Nothing to Disclose
Jing Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Jia Li (*Presenter*) Nothing to Disclose

**PURPOSE**

This study combines speech recognition with large language models to transform radiologists' intermittent verbal descriptions into coherent, fully-formed radiology reports, reducing manual editing and data entry burdens.

**METHODS AND MATERIALS**

We developed an advanced radiology reporting system (RRS) integrating state-of-the-art speech recognition algorithms and a domain-specific large language model. The system was evaluated in a retrospective study involving 10 radiologists who reviewed chest imaging studies from 607 patients. The study compared the performance of the RRS against a benchmark system utilizing GPT-4 for report generation.

**RESULTS**

The RRS reduced report generation time by 45%, decreased mouse and keyboard clicks by 93%, and lessened radiologist fatigue. The system improved report coherence (from 3.5±0.5 to 4.9±0.1) and logicality (from 3.8±0.6 to 4.94±0.06). RRS enhanced accuracy to a perfect score of 5.0±0.0,

eliminating hallucinations. The system reduced manual editing from 10±2 to 3.2±0.8 edits per report.In a comparison based on 50 reports, RRS outperformed GPT-4 in coherence (4.90 vs. 4.30), logicality (4.94 vs. 4.38), and hallucination prevention (5.00 vs. 4.96). GPT-4 showed a slight advantage in accuracy (4.88 vs. 4.80).

**CONCLUSION**

The integration of large language models, such as the RRS, into the radiology reporting workflow represents a innovation approach. By automating report transcription and organization, this technology reduces report generation time, minimizes manual input, and improves overall report quality. Freeing radiologists to concentrate on image analysis, enhancing diagnostic accuracy and efficiency.

**CLINICAL RELEVANCE/APPLICATION**

The integration of large language models for radiology report generation markedly enhances the radiological workflow, focusing on improved patient care and diagnostic precision. By enabling radiologists to devote their full attention to image analysis, this technology minimizes distractions associated with manual transcription, thereby reducing errors and increasing diagnostic accuracy.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R5A-SPIR

**Interventional Radiology Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPIR-2 ENERGY CONSUMPTION IN INTERVENTIONAL RADIOLOGY: STATUS QUO AND EFFECTIVE REDUCTION

Meinrad J. Beer, MD (*Abstract Co-Author*) Nothing to Disclose
Billurvan Taskin (*Presenter*) Nothing to Disclose

### PURPOSE

Strategies to reduce energy consumption through imaging modalities in healthcare are an essential topic in the era of climate and energy crises. Angiography imaging systems have the second highest energetic impact, shortly behind MRI as the leading consumer. Currently, real-world measurements of angio systems in interventional radiology (IR) are largely lacking, as are extrapolations regarding reduction of idle times and/or smart utilization of biplane systems.

### METHODS AND MATERIALS

During a 6-weeks power consumption period, RIS log files and PACS reports were collected of a biplane angiography system (Azurion 7 B20, Philips) in a multifunctional tertiary hospital for neurologic, oncological and vascular diseases. Times for procedure, standby and turn-off were tracked, as well as the number and type of procedures, energy used (in kWh) and power (in W). Standby periods were subdivided into longer than 30, 60 and 120 min. The system was used in real biplane and sole monoplane mode. Extrapolated values were calculated for energy consumption in order to quantify the expectable yearly effects of three different energy reductions approaches.

### RESULTS

The evaluated system was in stand by for 17%, in procedure for 10% and turned off for 72% of the measurement period. Average power usage was slightly lower in standby mode than during an ongoing procedure (4.44 kW vs 4.98kW, $p<0.001$). In the off state, power usage was with 0.24 kW remarkably low. 82% of the standby periods were longer than 60 minutes. Thus, shutting down the system after 15 minutes of idle time has the potential to save 43% or 5464 kWh of annual energy. The already implemented shutdown periods on weekends and at night, will save 68% or 26629 kWh of annual energy compared to a full standby system. An option for selected procedures to use the genuine biplane system as a monoplane system (switch-off of the second tube + detection) would result in a further reduction in energy consumption of 5.3% or 681 kWh in a full year.

### CONCLUSION

The largest portion of the consumed energy of a biplane system is used for long standby periods since power usage is only slightly lower in standby than during an ongoing procedure. Turning off the device after 15 min of idle time would save nearly half of energy consumption. Moreover, an option to switch off the second tube plus detector during procedures, which do not require this dual use (e.g. in peripheral vascular interventions) would save an additional 5%.

### CLINICAL RELEVANCE/APPLICATION

Imaging modalities in IR consume significant amounts of energy. Optimization is mandatory in times of climate and energy crises. Reduction of idle times and smart use of biplane systems can have a major impact.

## R5A-SPIR-3 SAFETY AND EFFICACY OF DUAL ANTIPLATELET TREATMENT WITH TICAGRELOR AND ASPRIN IN STENT INVOLVING ENDOVASCULAR TREATMENT OF UNRUPTURED BRAIN ANEURYSMS: SINGLE CENTER EXPERIENCE

Abdurrahman Avcioglu (*Abstract Co-Author*) Nothing to Disclose
Duran Sahin (*Abstract Co-Author*) Nothing to Disclose
Duygu Dolen (*Abstract Co-Author*) Nothing to Disclose
Altay Sencer (*Abstract Co-Author*) Nothing to Disclose
Serra Sencer, MD (*Abstract Co-Author*) Nothing to Disclose
Mehmet Barbur (*Abstract Co-Author*) Nothing to Disclose
Sinan Seyrek, MD (*Abstract Co-Author*) Nothing to Disclose
Ilyas Dolas (*Abstract Co-Author*) Nothing to Disclose
Yegana Mammadova (*Abstract Co-Author*) Nothing to Disclose
Cafer Ikbal Gulsever (*Abstract Co-Author*) Nothing to Disclose
Tugrul Cem Unal, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Endovascular treatment (EVT) of brain aneurysms involving stents is a commonly used method that necessitates the use of antiplatelets. Antiplatelet treatment proves to be a major concern which may have a negative impact on the safety of the procedure, efficacy, and stability of treatment in the long-

term. The purpose of this study is to report a single center's experience with ticagrelor and acetylsalicylic acid(ASA) in terms of thromboembolic and hemorrhagic complications in stent-assisted EVT.

**METHODS AND MATERIALS**

128 patients treated at a single center between 2019 and 2023 for brain aneurysms via endovascular technique were included in this study. All aneurysms were treated with stents (59 with single stent assisted coiling; SSAC, 39 with flow diverters; FD, 26 with Y stent-assisted coiling and six with stent monotherapy). All patients received ticagrelor 90 mg twice daily and ASA 100 mg daily starting the day before treatment and continued with dual treatment for three months after the procedure and ASA for at least one year. This study was conducted with approval from the ethics committee, encompassing data from the hospital management system and the imaging archive (PACS) through retrospective scanning.

**RESULTS**

Out of 128 patients treated endovascularly, 99 (77%) were female, and 29 (23%) were male. The average follow-up duration of the patients was 20.5 (1-60) months and average age was 55.3 years (21-79). In both the FD and Y-stent groups, no intra or extra-cranial hemorrhagic events (HE) were observed during follow-up. In the FD group, there was one early clinical thromboembolic event (cTE) (0.7%). No significant difference in the frequency of cTEs or gender distribution was observed between the two groups (p=0.420 and p=0.633, respectively). No cTE event was detected in the SSAC group. There were three early HE (2.3 %). No significant relationship was found between the SSAC and Y-stent groups regarding the frequency of HE (p=0.238). No significant difference was observed between the SSAC and the FD groups regarding cTE and HE (p= 0.228 and p=0.142, respectively). Overall HE rate was 0.7% and cTE rate was 2.3% in this group of patients treated with stents (Table 1).

**CONCLUSION**

Overall cTE complication rate was lower when compared with results from literature involving other P2Y12 receptor inhibitors, and HE rate was not increased. The rate of complication development is the highest in treatment with SSAC, but no statistically significant difference was found between SSAC, FD, and Y-stent techniques in terms of complication development.

**CLINICAL RELEVANCE/APPLICATION**

This report may contribute to the literature in terms of predicting complications of antiplatelet treatment in EVT of unruptured brain aneurysms involving stents.

## R5A-SPIR-4 REAL-TIME DOSIMETRY IN INTERVENTIONAL RADIOLOGY - COMPARING SCATTER RADIATION DOSE IN LOWER EXTREMITY AND ABDOMINAL PROCEDURES

Thorsten A. Bley, MD (*Abstract Co-Author*) Speakers Bureau, F. Hoffmann-La Roche Ltd;Research Consultant, F. Hoffmann-La Roche Ltd;Speakers Bureau, Novartis AG;Research Consultant, Novartis AG;Research Consultant, Baltimore RH Typing Laboratory
Wolfram Voelker, MD (*Abstract Co-Author*) Nothing to Disclose
Annette Thurner (*Abstract Co-Author*) Nothing to Disclose
Ralph Kickuth, MD (*Abstract Co-Author*) Nothing to Disclose
Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Kristina Krompass (*Presenter*) Nothing to Disclose

**PURPOSE**

In the last decade, the number of interventional radiology procedures has increased considerably, highlighting a growing need for personnel dosimetry of medical staff. Due to its unpredictable nature, scattered radiation represents a risk factor for carcinogenesis in interventional radiologists. Optimization of radiation safety procedures has spurred the development of real-time dosimetry systems in recent years. This study investigated the occupational dose exposure of interventional radiologists' cranium/eye lens, hand, and body trunk during lower extremity and abdominal procedures.

**METHODS AND MATERIALS**

Over a 14-month period, real-time dosimetry was performed during 102 consecutive interventions (51 lower extremity, 51 abdominal). Radiation protection measures included protective glasses (lead equivalent 0.5 mm), thyroid shielding (0.5 mm), vests (0.35 mm), skirts (0.25 mm), as well as movable acrylic and table shields (both 0.5 mm) during all procedures. Dosimeters were attached to the protective glasses of the interventional radiologist on the side of the x-ray tube, to the dominant hand, and under the vest. Dose-area products and equivalent doses in all three positions were recorded for each intervention. For the latter, standardized values over time were used to account for time differences between the interventions.

**RESULTS**

Pelvic-leg interventions were associated with a substantially lower dose-area product (7.53±6.05 vs. 88.50±83.85 Gy×cm2) and exposure time (8.6±5.7 vs. 16.2±13.2 min) than abdominal procedures (both P<.001). For lower extremity interventions, the radiation exposure recorded by the hand, cranium/eye lens, and body trunk dosimeters was 4.13±4.86 µSv/min, 0.05±0.10 µSv/min, and 0.70±2.44 nSv/min, respectively. Abdominal procedures were associated with substantially higher equivalent doses to the hand (12.15±12.68 µSv/min), cranium/eye lens (0.88±1.32 µSv/min), and body trunk (0.12±0.15 µSv/min; all P<.001).

**CONCLUSION**

Real-time dosimetry confirmed sufficient protection against scatter radiation with the application of standardized safety measures even in high-dose abdominal procedures. The dominant hand of interventional radiologists is by far subjected to the highest radiation exposure, followed by the cranium/eye lens and the body trunk.

**CLINICAL RELEVANCE/APPLICATION**

Dedicated protective measures are essential to achieve compliance with the International Commission on Radiological Protection (ICRP) guidelines for occupational exposure in interventional radiology.

## R5A-SPIR-5 TRANSITIONING FROM INTERVENTIONAL RADIOLOGY

Richard B. Towbin, MD (*Abstract Co-Author*) Nothing to Disclose
Eric Vansonnenberg, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Y. Sze, MD, PhD (*Abstract Co-Author*) Consultant, Amgen IncConsultant, AstraZeneca PLCConsultant, Bristol-Myers Squibb CompanyConsultant, BTG International LtdConsultant, Eisai Co, LtdConsultant, Embolx, IncConsultant, W. L. Gore & Associates, IncConsultant, Johnson & JohnsonConsultant, Terumo CorporationMedical Advisory Board, Boston Scientific CorporationMedical Advisory Board, Koli MedicalMedical Advisory Board, Radguard Medical, IncShareholder, Confluent MedicalShareholder, Proteus Digital Health
Easton Neitzel (*Abstract Co-Author*) Nothing to Disclose
Chase Irwin (*Abstract Co-Author*) Nothing to Disclose
Stacy Ruther, BA (*Presenter*) Nothing to Disclose

**PURPOSE**

Interventional radiologists at some point will transition from Interventional Radiology (IR) to pursue other interests or retire. In this survey, we assessed factors that affect interventional radiologists' decision to transition from IR, and determined what activities they pursue following the transition.

**METHODS AND MATERIALS**

An online questionnaire gauging potential influences on interventional radiologists' decision to transition from IR was posted to the Society of Interventional Radiology Connect Forum. 167 questionnaires were completed voluntarily by respondents. 27/167 (16%) were interventionalists who had already transitioned from IR, 28/167 (17%) were in the process of transitioning, and 112/167 (67%) had not yet transitioned.

**RESULTS**

Nighttime call responsibilities (36/55, 65%), burnout (23/55, 42%), and age (20/55, 36%) were the major factors in those who were, or were currently, transitioning from IR. 21/53 (40%) respondents report they took on a greater Diagnostic Radiology (DR) workload during their transition. Other than DR, the most commonly pursued activities following transition were athletics (17/55, 31%) and mentorship to students/trainees (15/55, 27%). The greatest benefits of transitioning from IR among those who have transitioned include: more time with family/friends (33/55, 60%), reduced stress (27/55, 49%), and more time for non-medical hobbies/travel (27/55, 49%). Among respondents who have not yet transitioned, nighttime call responsibilities (81/112, 72%), burnout (64/112, 57%), and age (59/112, 53%) are the most influential factors in their decision of when to transition from IR. Among all respondents, job satisfaction during their career in IR has: increased (42/167, 25%), stayed the same (43/167, 26%), or decreased (82/167, 49%). 81% (136/167) of all respondents reported they would pursue the field of IR again.

**CONCLUSION**

Nighttime call responsibilities, burnout, and age are major influences in the decision to transition from IR. Job satisfaction decreases for nearly half of interventionalists during their career in IR.

**CLINICAL RELEVANCE/APPLICATION**

By determining the factors that influence interventionalists to transition from the field, action can be taken to minimize their impact, ultimately improving job satisfaction and longevity.

## R5A-SPIR-6 VIRTUAL REALITY EXPERIENCE IN INTERVENTIONAL RADIOLOGY: IRVARI STUDY. A RANDOMIZED CONTROLLED TRIAL

Henri GARREAU (*Abstract Co-Author*) Nothing to Disclose
Jean-Pierre J. Pelage, MD, PhD (*Abstract Co-Author*) Research Grant, Merit Medical Systems, Inc;Consultant, Merit Medical Systems, Inc;Research Grant, Cook Group Incorporated;Consultant, Cook Group Incorporated;Research Grant, Keocyt;Medical Board, Keocyt;Research Grant, Terumo Corporation;Consultant, Terumo Corporation;Research Grant, ALN;Consultant, ALN;Consultant, Boston Scientific Corporation;Research Grant, BTG International Ltd
Remi Morello (*Abstract Co-Author*) Nothing to Disclose
Audrey Fohlen, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the feasibility, safety and efficacy of a Virtual Reality (VR) experience during interventional radiology (IR) procedures to reduce patient anxiety and pain.

**METHODS AND MATERIALS**

This prospective randomized controlled trial enrolled 192 patients with indication for liver biopsy, transarterial chemoembolization, varicocele embolization, pelvic vein embolization or uterine fibroid embolization. Two groups were defined: VR conditions vs control. Intervention-induced anxiety was evaluated immediately after the procedure by the State-Trait Anxiety Inventory using its state anxiety part (STAI-YA). We also evaluated with a numeric rating scale (NRS) anxiety and pain before, during and after intervention. Evolution of hemodynamics parameters was recorded as well as medications consumption and procedure time. Side effects and patient satisfaction of VR experience were reported. The difference in anxiety between the two groups, as measured with the STAI-YA scale was compared using the Student's t test. The same statistical method was applied for the comparison of the pain experienced by patients as assessed by the NRS scale. The Pearsons' coefficient was applied to investigate the relationships between preoperative anxiety and the pain levels experienced during the procedure, quantified using the NRS.

**RESULTS**

The study included 72 patients in VR conditions and 71 for control group. The VR group had significantly lower mean score for anxiety according STAI-YA of 21.2% (25.4 vs 32.3; $p<0.01$) with an important effect size (Cohen's $d=0.717$). Evolution of anxiety and pain evaluated with NRS was significantly better ($p<0.001$) in the VR group. Systolic arterial blood pressure was significantly lower in the VR group ($p<0.001$). No difference was identified between both groups in terms of antalgic used or procedure time. Side effects were reported in 1.5% of patients while 88.9% of patients were satisfied with the VR experience.

**CONCLUSION**

Virtual Reality is safe, effective, and well tolerated and demonstrated reduced pain and anxiety during IR procedures.

**CLINICAL RELEVANCE/APPLICATION**

Virtual reality experience is associated with reduced anxiety and pain in patients undergoing interventional radiology procedures. Routine use of virtual reality may be advocated in patients undergoing interventional radiology procedures.

## R5A-SPIR-7 PRO-TRANSLATE IR: TRANSLATION OF INTERVENTIONAL RADIOLOGY PROCEDURAL INSTRUCTIONS USING LARGE LANGUAGE MODELS TO IMPROVE INFORMATION ACCESS TO NON-ENGLISH-SPEAKING PATIENTS

Sara E. Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Dezube (*Abstract Co-Author*) Nothing to Disclose
Wilton Fidelis (*Abstract Co-Author*) Nothing to Disclose
Dania Daye, MD, PhD (*Abstract Co-Author*) Research Consultant, Sigilon Therapeutics, Inc;Research Consultant, Medtronic plc
Mira Malavia (*Abstract Co-Author*) Nothing to Disclose
Shakthi K. Ramasamy, MD (*Abstract Co-Author*) Nothing to Disclose
Satvik Tripathi (*Abstract Co-Author*) Nothing to Disclose
Tarig Elhakim, MD (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the utility of GPT-4, for generating and translating Interventional Radiology (IR) procedural instructions. The study aims to assess its effectiveness in generating layman-friendly explanations for the technical terminology and medical jargon prevalent in IR. This can potentially provide insights to improve healthcare communication and patient understanding in multilingual settings.

## METHODS AND MATERIALS

Three commonly performed IR procedures were selected for assessment, including Radiofrequency Ablation (RFA), TransArterial ChemoEmbolization (TACE) and Uterine Fibroid Embolization (UFE). Prompts were prepared with a goal to explain the procedure in layman-friendly terms, followed by answering the 15 most common questions patients could potentially ask about a procedure. Once GPT-4 provided an answer, a prompt was then performed to translate from English to Spanish and to Arabic as a proof of concept. The evaluation involved a panel of 3 clinical assessors using a three-tier ordinal scale (fully, somewhat, and not appropriate) and up to 6 non-clinical assessors using a four-tier ordinal scale (poor, fair, good, and excellent understanding). Data was collected using an online survey tool.

## RESULTS

Responses generated by GPT-4 received a fully appropriate rating from clinical assessors for all three procedural instructions translated to Arabic. For the Spanish version, 2 instructions were fully appropriate while RFA instruction was deemed 66.7% fully appropriate and 33.3% somewhat appropriate. The 5 Arabic-speaking non-clinical assessors rated the RFA and TACE instructions as 80% excellent and 20% good understandability and clarity of the Arabic translated version while the UFE achieved 60% excellent and 25% good understandability and clarity. For the Spanish-version, the UFE and TACE instructions were rated as 83.3% excellent and 16.7% good understandability and clarity while the RFA achieved 66.7% excellent and 33.3% good understandability and clarity.

## CONCLUSION

GPT-4 has a great potential to provide translated educational instructions and answer the most common questions about various IR procedures with excellent to good clarity for non-English Speakers. Future studies can expand upon this foundation to develop validated patient educational materials accessible through a multi-language platform. This can significantly enhance patient-centered care in IR by ensuring easily accessible information for non-native English speakers.

## CLINICAL RELEVANCE/APPLICATION

Large Language Models can effectively translate instructions for Interventional Radiology procedural, thereby improving Information access to Non-English-Speaking Patients and enhancing patient centered care in IR

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RSNA 2024
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# Abstract Archives of the RSNA, 2024

R5A-SPMK

**Musculoskeletal Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPMK-1 VALIDATION OF THE BONE REPORTING AND DATA SYSTEM (BONE-RADS™) FOR CLASSIFYING FOCAL BONE LESIONS

Yusuhn Kang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Choong Guen Chee, MD (*Abstract Co-Author*) Nothing to Disclose
Youngjune Kim, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To validate the performance of Bone-RADSTM in discriminating benign and malignant bone lesions and to evaluate the inter-observer agreement of Bone-RADSTM assessment

### METHODS AND MATERIALS

This single-center retrospective study included patients visited our orthopedic oncology department between January 2019 and December 2020 for a focal bone tumor. Three musculoskeletal radiologists assessed the initial radiograph series performed for evaluating tumor-of-interest. First, they assessed whether the tumor is eligible for Bone-RADSTM assessment considering the axial location and radiodensity of the tumors. For the tumors judged to be eligible for Bone-RADSTM assessment, the radiologists rated descriptors of Bone-RADSTM (margin, periosteal reaction, endosteal reaction, pathologic fracture, and soft-tissue mass) and Bone-RADSTM categories were calculated accordingly. The performance in discriminating malignant bone lesion was assessed in terms of sensitivity and area under receiver-operating-characteristic curve (AUC). Gwet's AC1 was calculated for evaluating interobserver agreement of Bone-RADSTM category. The malignancy rate according to Bone-RADSTM category was calculated.

### RESULTS

A total of 379 patients (mean age ± standard deviation, 36.7 ± 22.5 years; 160 women; and 103 malignancy) were finally included. The reader 1 judged 283 tumors eligible for the assessment; reader 2, 283; and reader 3, 269. The sensitivities and AUCs in discriminating malignancy with Bone-RADSTM were 91.4-97.9% and 0.907-0.921. There was substantial interobserver agreement of Bone-RADSTM category with Gwet's AC1 of 0.619 (95% confidence interval, 0.558-0.679). The malignancy rates ranged 0.0-1.2% in Bone-RADSTM category 1; 3.8-9.1% in category 2; 18.5-25.6% in category 3; and 78.9-80.9% in category 4, respectively.

### CONCLUSION

Bone-RADSTM showed high sensitivity and AUC in discriminating malignant bone lesion despite substantial inter-observer agreement across the radiologists.

### CLINICAL RELEVANCE/APPLICATION

Bone-RADSTM could be utilized as a useful screening tool in discriminating malignant bone lesion using radiographs.

## R5A-SPMK-2 BONE STRESS INJURY DETECTION IN TIBIAL AND FIBULAR CORTICAL BONE USING QUANTITATIVE ULTRASHORT ECHO TIME MAGNETIC RESONANCE IMAGING: AN IN VIVO FEASIBILITY STUDY

Eric Y. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Saeed Jerban, PhD (*Abstract Co-Author*) Nothing to Disclose
Michael P. Andre, PhD (*Abstract Co-Author*) Researcher, Siemens AG
Erik L. Ramey, MD (*Abstract Co-Author*) Nothing to Disclose
Yajun Ma (*Abstract Co-Author*) Nothing to Disclose
Zenus J. Wilson, MD (*Abstract Co-Author*) Nothing to Disclose
Jiang Du, PhD (*Abstract Co-Author*) Nothing to Disclose
Alecio F. Lombardi, MD (*Abstract Co-Author*) Nothing to Disclose
Niloofar Shojaeiadib (*Abstract Co-Author*) Nothing to Disclose
Dina Moazamian, MD (*Abstract Co-Author*) Nothing to Disclose
James Lo, BS (*Presenter*) Nothing to Disclose

### PURPOSE

This study investigates the capability of ultrashort echo time (UTE)-MRI to quantify changes induced by stress injuries in vivo in fibular and tibial cortical bone.

### METHODS AND MATERIALS

Institutional review board approval and written informed consent were obtained for all recruited subjects. The injured and asymptomatic legs of four patients with a tibial or fibular stress injury (BSI) (21.5±3.3 years old, three male, one female) were scanned in the axial plane on a 3T clinical scanner (MR750, GE) employing an 8-channel transmit/receive knee coil. Scanning coverage was centered around the painful site reported by the patients. A dual-echo 3D Cones UTE sequence was performed [repetition time (TR) = 80 ms, echo times (TEs) = 0.032 and 2 ms, flip angle (FA) = 45°) for porosity index (PI) measurement (Eq.1)]. Off-resonance magnetization transfer (MT) weighted 3D Cones UTE sequence was performed without and with an MT pulse (pulse power = 1000° and a frequency offset of 2kHz, FA=8°, number of spokes=11) for MT ratio (MTR) measurement. The matrix dimension, the field of view (FOV), nominal in-plane pixel size, and slice thickness were 160×160×24, 140×140×120 mm3, 0.87 mm, and 5 mm, respectively. The total scan time was ~7 minutes.

### RESULTS

UTE-MTR and UTE-PI pixel maps of the tibial cortical bone of a representative patient are presented in Fig.1A and Fig.1B for the asymptomatic and injured leg, respectively. The box plots of the UTE-MTR and UTE-PI values of the injured vs. asymptomatic legs are presented in Fig.1C and Fig.1D. Significant differences in UTE-MTR and UTE-PI values were observed between the injured and asymptomatic legs.

### CONCLUSION

The capability of evaluating the in vivo BSI in lower leg cortical bone was investigated using quantitative UTE-MRI. The ex vivo capability of UTE-MRI detecting BSI was shown in a previous study (1). Lower MTR but higher PI values of the injured cortical bone were likely due to increased water content in potential microcracks and a reduced or disrupted organic matrix structure (2). More investigations should be performed with larger sample sizes to validate such conclusions while employing more sophisticated methods specific to organic matrix assessments, such as UTE-MT modeling.

### CLINICAL RELEVANCE/APPLICATION

Validating the capability of UTE-MRI techniques in the quantitative assessment of BSI may provide a more accurate diagnostic and monitoring tool and an improved return-to-activity plan for patients.

## R5A-SPMK-3 ASSESSMENT OF TIBIAL PLATEAU FRACTURES COMPARING A CT-LIKE 3D T1-WEIGHTED SPOILED MULTI-ECHO GRADIENT-ECHO MRI SEQUENCE (FRACTURE) WITH CONVENTIONAL CT

Frank Oliver G. Henes, MD (*Abstract Co-Author*) Nothing to Disclose
Inka Ristow, MD (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD (*Abstract Co-Author*) Nothing to Disclose
Lennart Well, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the diagnostic performance of a CT-like 3D T1-weighted spoiled multi-echo gradient-echo MRI sequence (FRACTURE-MRI) for the detection of tibial plateau fractures compared with conventional CT.

### METHODS AND MATERIALS

In this prospective, two-center study, all patients who received MRI of the knee due to presentation to the emergency departments following acute trauma of the knee from 05/2022 to 03/2024 were included. All patients underwent magnetic resonance imaging (MRI) at 3T including FRACTURE-MRI. FRACTURE-MRI consisted of a 3D T1-weighted spoiled multi-echo gradient-echo sequence (FOV 130 x 160 $mm^2$; Matrix ACQ 144 x 174; Voxel ACQ 0.9 x 0.92 x 0.9 $mm^3$; TR 23 ms; TE 4.6 ms; delta TE 5 ms). Following acquisition, a magnitude summation of all echoes was created and images from the last echo were subtracted from the summated images. Patients with acute fractures received a CT. CT served as the standard of reference for all fractures. Two radiologists independently evaluated FRACTURE-MRI for presence of fractures and image quality. Intraarticular tibial fractures were rated according to the AO/OTA classification and a 10-segment classification score. Diagnostic accuracy and agreement between MRI and CT and between radiologists were assessed. Image quality of FRACTURE-MRI was graded on a five-point scale. Image quality was assessed by estimated marginal means. Interreader assessment was evaluated by weighted Cohen's ?.

### RESULTS

The study collective comprised 126 patients (68 female, mean age= 39.6 years ± 14.5 years). CT revealed intraarticular fractures in 42/126 patients (33.3 %). According to the AO/OTA classification, fractures were rated by CT as: 2xA1; 2xA2; 1xA3, 7xB1, 11xB2, 8xB3, 11xC3. Fractures were correctly identified by both readers in 36/42 cases (85.7%). In the 10-segment classification score, CT identified 151/420 segments as fractured. The sum of correctly identified segments by both readers was 261/302 (86.4%). 45 segments were falsely classified as intact and 52 segments were falsely identified as fractured. Sensitivity and specificity of FRACTURE-MRI for detection of intraarticular fractures was 89.3% (95%-CI: 80.6 - 95%) and 94.6% (95%-CI: 90.1 - 97.5%), respectively. Estimated marginal means for image quality of FRACTURE-MRI were 4.3 (CI: 4.2 - 4.4). Cohen's ? was 0.937 ($p<0.001$) for the AO/ATO classification and 0.886 ($p<0.001$) for the 10-segment classification.

### CONCLUSION

Assessment of proximal tibial fractures using CT-like 3D T1-weighted spoiled multi-echo gradient-echo sequence (FRACTURE) at 3T is feasible and comparable to CT.

### CLINICAL RELEVANCE/APPLICATION

FRACTURE-MRI might pose a helpful alternative to conventional CT in an acute trauma setting by reducing both costs and radiation exposure.

## R5A-SPMK-5 DUAL-ENERGY COMPUTED TOMOGRAPHY (DECT) FOR THE ASSESSMENT OF SOFT TISSUE TUMOR RECURRENCE AND SCAR: COMPARISON WITH APPARENT DIFFUSION COEFFICIENT (ADC) VALUE

Yingyi Zhu (*Abstract Co-Author*) Nothing to Disclose
Lin Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Jiachun Zhuang (*Abstract Co-Author*) Nothing to Disclose
Haijun Wu, MD,PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the recurrence of lesions in patients with soft tissue tumors, patients with soft tissue tumors require regular examination after surgery. It is necessary to evaluate the dual-energy computed tomography (DECT) quantitative parameters and apparent diffusion coefficient (ADC) values for predicting recurrence and scar in patients with soft tissue tumors, This study seeks to contribute to the optimization of imaging protocols and diagnostic algorithms that can be utilized in the management of patients with soft tissue tumors.

### METHODS AND MATERIALS

38 patients with soft tissue tumor underwent postoperative DECT from December 2021 to November 2023, and 30 patients among them were performed in postoperative MRI. DECT quantitative parameters and ADC values were compared between recurrent lesions and scars using the Mann-Whitney U test and Independent Samples T test. Receiver-operating characteristic (ROC) analysis was used to assess the ability of DECT quantitative parameters and ADC values to diagnose recurrent lesions and scars.

### RESULTS

This study demonstrated significant differences in DECT parameters between recurrence and scar groups. Specifically, weighted averages in arterial, early venous, and late venous phases, along with iodine concentration and CT number differences, were higher in the recurrence group, with statistical significance ($P < 0.05$). Similarly, Diffusion-Weighted Imaging (DWI) results showed the Apparent Diffusion Coefficient (ADC) was significantly lower in the recurrence group, indicating its utility in distinguishing between recurrence and scar tissue. The ROC curve analysis revealed that DECT and DWI parameters could accurately identify recurrent lesions and scars, with areas under the curve ranging from 0.700 to 0.808.

### CONCLUSION

The combined use of DECT and DWI is shown to be effective in accurately detecting soft tissue tumors, highlighting their potential as valuable diagnostic tools in postoperative evaluations.

### CLINICAL RELEVANCE/APPLICATION

In this study, the postoperative DECT and MRI examination parameters of patients with soft tissue tumors were studied to determine their significance in predicting tumor recurrence, with the goal of advancing predictive capabilities and standardizing the management of patients in advance.

## R5A-SPMK-6 UNVEILING HETEROGENEITY IN RESPONSE EVALUATION OF SOFT TISSUE SARCOMA TO NEOADJUVANT RADIOTHERAPY: ASSOCIATIONS BETWEEN RADIOLOGY AND PATHOLOGY FINDINGS

Regina G. Beets-Tan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Annemarie Bruining, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Velichko, PhD (*Abstract Co-Author*) Nothing to Disclose
Stefano Trebeschi (*Abstract Co-Author*) Nothing to Disclose
Zuhir Bodalal (*Abstract Co-Author*) Nothing to Disclose
Nicolo Gennaro, MD (*Presenter*) Nothing to Disclose

### PURPOSE

For high-grade and locally advanced soft tissue sarcoma (STS), neoadjuvant radiotherapy (nRT) has emerged as a well-established treatment option. Despite being the best non-invasive modality for assessing response to nRT, MRI shows limited correlations with pathology findings. This study aimed to analyze changes in imaging and pathology findings after nRT and explore correlations between them.

### METHODS AND MATERIALS

In a study of 107 patients with histopathologically confirmed intermediate/high-grade soft tissue sarcoma (STS), tumor diameter, volume, and tumor-to-muscle signal intensity (SI) ratio were measured before and after neoadjuvant radiotherapy (nRT). These measurements were correlated with post-treatment pathology findings (viable cells, percentage of necrosis, and fibrosis) using the Spearman Rank test. Pathological complete response (pCR) was defined as the absence of any viable tumor cells, while near-complete pathological response (near-pCR) was defined as the presence of less than 10% viable cells.

### RESULTS

The median amount of necrosis, viable cells, and fibrosis after nRT were 10%, 30%, and 25%, respectively. Seven percent of patients achieved pCR and 22% achieved near-pCR. No significant changes in tumor volume were found overall. However, for specific subtypes changes were significant: myxoid liposarcoma (mLPS) showed a decrease of -54.47%, undifferentiated pleomorphic sarcoma (UPS) and dedifferentiated liposarcoma (dLPS) showed an increase of +24.22% and +35.91%, respectively. Median change in tumor-to-muscle SI ratio was -19.74% for the entire population, whereas it was more pronounced for UPS (-19.55%) and mLPS (-36.26%). Statistically significant correlations (positive and negative) were found between change in volume and the presence of necrosis ($rs=0.44$) or fibrosis ($rs=-0.438$), as well as between tumor-to-muscle SI ratio and viable cells ($rs= 0.331$) or fibrosis ($rs=-0.278$).

### CONCLUSION

STS displays extensive heterogeneity in response to nRT. For some subgroups, changes in tumor size and tumor-to-muscle SI ratio show significant correlations with the percentage of viable cells, fibrosis, and necrosis.

### CLINICAL RELEVANCE/APPLICATION

Strong correlation between radiology and pathology findings improves the interpretation of tumor response to nRT. It also highlights the limitations of RECIST criteria for specific STS histotypes, laying the ground for further research on the complimentary role of imaging in assessing neoadjuvant therapy for STS.

# Abstract Archives of the RSNA, 2024

R5A-SPMS

**Multisystem Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPMS-1 THEINFLUENCE OFDEEPLEARNINGIMAGERECONSTRUCTIONALGORITHM (DLIR) ONMULTIPARAMETERS OFLUMBARSPINEENERGYSPECTRUM CT

Yanhong Zhao, MMed,MMed (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the effect of deep learning image reconstruction (DLIR) on the image quality of lumbar spine spectral CT monochromatic image, effective atomic number image, hydroxyapitite (HAP)-water image and HAP-fat image by comparing with FBP and hybrid iterative reconstruction-veo (ASIR-V) algorithms.

### METHODS AND MATERIALS

20 patients with suspected lumbar diseases were selected. The spine spectral CT imaging was performed with revolution apex CT. Five groups of images were reconstructed by filtered back projection reconstruction (FBP), 40% ASIR-V reconstruction ,low level of DLIR (DLIR-L), middle level of DLIR (DLIR-M) and high level of DLIR (DLIR-H). 40-140keV monochromatic image, energy spectrum curve, base substance image (HAP-water, HAP-fat image) and effective atomic number image were reconstructed using the energy spectrum analysis software. CT values of monochromatic images (40 keV, 70 keV and 100 keV), HAP concentration of HAP-water image and HAP-fat image, effective atomic number and image noise of lumbar vertebrae were measured in five groups ,the signal-to-noise ratio (SNR) of each image was calculated, and the differences in the quality of the five groups of images were compared.

### RESULTS

There was no significant difference in CT values of 40 keV, 70 keV, 100 keV among five groups of images (all $P > 0.05$), the effective atomic number, the HAP concentration of HAP-water and the HAP concentration of HAP-fat image were also not significantly different among five groups (all $P>0.05$). There was significant difference in image noise and SNR of single energy images (40 keV, 70 keV and 100 keV), effective atomic number image, HAP-water image and HAP-fat image among five groups of images (all $P > 0.05$). The lumbar vertebrae image noise of FBP, 40%ASIR-V, DLIR-L , DLIR-M and DLIR-H images were 101.72±13.06,77.75±12.34,77.19±12.59,71.28±12.97and 64.85±13.37 HU,the noise of DLIR-H reconstruction algorithm is 36.25% lower than that of FBP, and 16.65% lower than that of 40% ASIR-V.Compared with FBP and 40% ASIR-V, the image noise of DLIR is lower than that of FBP and 40% ASIR-V, and the image signal-to-noise ratio is improved (all P values <0.05). DLIR -H has the lowest noise and the highest signal-to-noise ratio.

### CONCLUSION

In lumbar spine spectral CT imaging, DLIR has lower noise and higher signal-to-noise ratio than FBP and 40% ASIR-V in single-energy image, effective atomic number image, HAP-water image and HAP-fat image.

### CLINICAL RELEVANCE/APPLICATION

Compared with FBP and 40% ASIR-V reconstruction algorithm, deep learning image reconstruction algorithms have great potential and application value in improving the image quality of lumbar spine spectral CT .

## R5A-SPMS-2 CENTRAL NERVOUS SYSTEM INVOLVEMENT IN ERDHEIM-CHESTER DISEASE: A MAGNETIC RESONANCE IMAGING STUDY

Ritu Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Moozhan Nikpanah, MD (*Abstract Co-Author*) Nothing to Disclose
Fatemeh Homayounieh, MD (*Abstract Co-Author*) Nothing to Disclose
Rahul Dave (*Abstract Co-Author*) Nothing to Disclose
Nadia M. Biassou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Faraz Farhadi, BS (*Abstract Co-Author*) Nothing to Disclose
Ashkan A. Malayeri, MD (*Abstract Co-Author*) Nothing to Disclose
Fahimul Huda, MD (*Abstract Co-Author*) Nothing to Disclose
Mahshid Golagha, MD (*Abstract Co-Author*) Nothing to Disclose
Aryan Zahergivar, MD (*Abstract Co-Author*) Nothing to Disclose
William A. Gahl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mojdeh Mirmomen, MD (*Abstract Co-Author*) Nothing to Disclose
Fatemeh Dehghani Firouzabadi, MD (*Presenter*) Nothing to Disclose

## PURPOSE

Erdheim-Chester disease (ECD) is a rare, non-Langerhans cell histiocytosis frequently affecting the central nervous system (CNS), leading to a dire prognosis. The long-term effects of ECD disease activity in the CNS are not well understood. This study aims to characterize the brain MR imaging findings in a cohort of 58 patients with ECD and to evaluate the relationship between these findings and the BRAFV600E pathogenic variant.

## METHODS AND MATERIALS

ECD patients of any gender and ethnicity, aged 2-80 years, with biopsy-confirmed ECD based on pathology of affected organs were eligible to enrol in this study. Two radiologists experienced in evaluating ECD CNS disease activity reviewed the MRI studies. Any disagreements were resolved by a third reader. Frequencies of the observed involvements were reported. The association between the distribution of CNS involvements and the BRAFV600E pathogenic variant was evaluated using Fisher's exact test and odd ratio.

## RESULTS

The brain MRI of all 58 patients with ECD revealed some form of CNS involvement, most likely due to ECD. Cortical lesions was noted in 27/58 (46.6%) patients, cerebellar lesions in 15/58 (25.9%) patients, brain stem lesions in 17/58 cases (29.3%), and pituitary involvement in 10/58 (17.2%) patients. The frontal lobe was the most affected area the cerebrum. Premature cortical atrophy was observed in 8/58 (13.8%) patients. BRAFV600E pathogenic variant was significantly associated with cerebellar lesions (p-value = 0.016) and bilateral brain stem involvement (p-value = 0.043). A trend toward significance was noted for cerebral atrophy (p-value = 0.053).

## CONCLUSION

The study provides valuable insights into the brain MRI findings in ECD and their association with BRAFV600E pathogenic variant particularly its association in cases with bilateral lesions. We are expanding our understanding of how ECD affects cerebral structures.

## CLINICAL RELEVANCE/APPLICATION

The correlation between BRAFV600E mutation and brain MRI findings in ECD particularly bilaterality provides critical insights for prognosis and treatment planning, leading to more personalized and effective clinical management strategies, ultimately improving patient outcomes.

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# Abstract Archives of the RSNA, 2024

R5A-SPNMMI

**Nuclear Medicine & Molecular Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPNMMI-1 PERSONALIZED DOSIMETRY ANALYSIS FOR LUTETIUM-177-PSMA THERAPY OF PROSTATE CANCER AND LUTETIUM-177-DOTATATE THERAPY OF NEUROENDOCRINE TUMORS: KIDNEY ABSORBED DOSE ASSESSMENT

Aaron Scott (*Abstract Co-Author*) Nothing to Disclose
Christopher Huffman (*Abstract Co-Author*) Nothing to Disclose
Babak Saboury, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Faraz Farhadi, BS (*Abstract Co-Author*) Nothing to Disclose
Sheida Ebrahimi, MD (*Abstract Co-Author*) Nothing to Disclose
Michael A. Morris, MD, MS (*Abstract Co-Author*) Founder, Advanced Molecular Imaging and Therapy;Director, Advanced Molecular Imaging and Therapy;Advisory Board, Gentem Health, Inc;Advisory Board, Softhread, Inc
Julia Brosch-Lenz (*Abstract Co-Author*) Nothing to Disclose
Saeed Ghandili, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Kidneys represent one major organ at risk for radiopharmaceutical therapy (RPT). In this work, we aimed to evaluate the kidney absorbed dose in patients undergoing 177Lu-PSMA and 177Lu-DOTATATE RPTs for prostate and neuroendocrine cancers, respectively.

### METHODS AND MATERIALS

Multi-time point quantitative 177Lu SPECT/CT scans performed after each RPT cycle assessed the absorbed renal dose of 93 patients. Organs at risk were manually segmented in MIM at three 177Lu SPECT/CT time points for each treatment. Organ-absorbed doses were then calculated using MIM. Renal absorbed dose was analyzed in our patient population, and the average and cumulative absorbed dose for each patient was reported.

### RESULTS

All 93 patients receiving RPT demonstrated acceptable renal absorbed dose. 26 patients were treated with 177Lu-DOTATATE, and 67 received 177Lu-PSMA treatment. Certain patients were unable to complete the full course of treatment or attend the scheduled dosimetry scans for various reasons. On average, neuroendocrine cancer patients received dosimetry at 2.7 cycles and prostate cancer patients at 4.1 cycles. For 177Lu-DOTATATE, the median cumulative absorbed kidney dose was 8.0Gy across all cycles, the minimum dose across cycles (cumulative) was 2.5Gy, and the maximum dose across cycles was 15.9; also the maximum dose for one patient for one cycle was 7.1Gy. For 177Lu-PSMA, the median cumulative absorbed kidney dose was 8.1Gy across all cycles, the minimum dose across cycles (cumulative) was 1.1Gy, and the maximum dose across cycles was 18.2Gy; also, the maximum dose for one patient for one cycle was 9.4Gy. In general, we observed an increase of kidney absorbed dose towards later therapy cycles.

### CONCLUSION

Our assessment of kidney-absorbed dose for 177Lu-PSMA and 177Lu-DOTATATE demonstrated that patients in our population tolerate routine patient specific dosimetry following RPT. In our population, many patients had favorable personalized renal doses in consideration of future RPT. Also, some patients had a higher than expected personalized renal dose for a particular treatment, highlighting the importance of routine measurement for accurate cumulative dose calculation. Increased kidney absorbed dose with increasing therapy cycles may be attributed to the tumor sink effect. Additional efforts are needed to correlate patient specific renal dose and other patient specific factors with kidney function over time to better define the appropriate tolerated renal dose for specific RPTs to prevent radiation induced toxicity if patients were to have additional RPTs in the future.

### CLINICAL RELEVANCE/APPLICATION

To emphasize the relevance of personalized dosimetry after radiopharmaceutical therapy to monitor organ at risk absorbed dose.

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# Abstract Archives of the RSNA, 2024

R5A-SPNPM

**Noninterpretive Skills (Beyond Imaging) Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPNPM-2 IMPACT OF BRIEF MINDFULNESS ATTENTION TRAINING ON RADIOLOGIST ATTENTION AND NODULE DETECTION: A PILOT RANDOMIZED CONTROL TRIAL

Lilyane Saleh, MD (*Abstract Co-Author*) Nothing to Disclose
Tia Bhayana (*Abstract Co-Author*) Nothing to Disclose
Satheesh Krishna, MD (*Abstract Co-Author*) Nothing to Disclose
Yangqing Deng (*Abstract Co-Author*) Nothing to Disclose
Rajesh Bhayana, MD, FRCPC (*Presenter*) Nothing to Disclose

### PURPOSE

Attention lapses contribute to perceptual errors in radiology, which can impact patient outcomes. Mindfulness attention training (MAT) improves attention and visual perception in many domains. The purpose of this study was to assess whether brief MAT can improve radiologist attention and lung nodule detection.

### METHODS AND MATERIALS

In this IRB-approved pilot randomized control trial, 24 radiologists were included. At baseline (T1), participants performed the Sustained Attention to Response Task (SART), with attentional lapses (errors of commission) recorded and subjective attention, general wellbeing and burnout reported. An exploratory visual attention nodule detection (VAND) task was performed, in which participants detected and counted lung nodules on 50 CT images, with the number of correct answers recorded. At repeat assessment one-month later (T2), participants were randomly assigned to either receive brief MAT (10-minute video) or control (10-minute radiology video) prior to reassessment. Results for each group were compared between T1 and T2 using Wilcoxon signed rank tests. Changes from T1 to T2 were compared between both groups using Wilcoxon rank sum tests.

### RESULTS

Compared to baseline, radiologists had significantly fewer attentional lapses post-MAT (-14%, p=0.025). However, MAT did not significantly reduce attentional lapses compared to the control group (-14 vs -8%, p=0.45). MAT improved radiologist reported attention compared to control (likert +0.8 vs -0.2, p=0.04). Compared to control, MAT did not significantly improve wellbeing (+0.5 vs 0.1, p=0.29) or cognitive burnout (+0.1 vs -0.1, p=0.56). Radiologists who had MAT demonstrated greater raw improvement in nodule detection task scores than control (+6 vs 0.3%), but the difference was not significant in this pilot (p=0.54). Based on our pilot results, larger sample sizes are required to detect a difference between intervention and control groups for attentional lapses (n=176) and nodule detection task performance (n=348) with 80% power.

### CONCLUSION

Brief mindfulness attention training reduced attentional lapses in radiologists compared to baseline, but not more than control; it improved radiologist reported attention over control; it did not significantly improve nodule detection performance over control. Future studies with larger cohorts and more intensive training should be explored.

### CLINICAL RELEVANCE/APPLICATION

Brief interventions that improve radiologist attention could help reduce perceptual errors in radiology practice.

# Abstract Archives of the RSNA, 2024

R5A-SPNR

**Neuroradiology Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPNR-1 DIAGNOSTIC PERFORMANCE ANALYSIS ACROSS PEDIATRIC AGE GROUPS OF AI-BASED INTRACRANIAL HEMORRHAGE DETECTION SOFTWARE

Su Jeong Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Tae Jin Yun, MD (*Abstract Co-Author*) Nothing to Disclose
DURI HWANG (*Abstract Co-Author*) Nothing to Disclose
Miran Han, MD (*Abstract Co-Author*) Nothing to Disclose
Woosang Jung (*Abstract Co-Author*) Nothing to Disclose
Jin Wook Choi, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Multiple commercial AI-based intracranial hemorrhage (ICH) detection software products are available for adults; however, options for pediatric ICH are limited. Recent studies lack evidence on the performance of AI-based ICH detection software for adults when applied to pediatric cases. This study aims to evaluate the diagnostic accuracy of an AI-based ICH detection software across different pediatric age groups.

### METHODS AND MATERIALS

We retrospectively collected data on pediatric patients diagnosed with or without ICH by searching the PACS between January 2020 and December 2023. A neuroradiologist with 15 years of experience reviewed the pediatric brain CT images to confirm the presence of ICH. We analyzed the performance of InsightPlus (Medical Insight+ Brain Hemorrhage, SK CC, Republic of Korea) by evaluating the sensitivity, specificity, and AUC for each pediatric age group: newborns and infants (0 to 23 months), children (2 to 11 years), and adolescents divided into two groups (12 to 14 years, and 15 to 18 years).

### RESULTS

This study included data from 282 pediatric patients diagnosed with ICH and 1722 without a diagnosis of hemorrhage. For newborns and infants, the AUC was 0.81 ([95% CI: 0.753, 0.87]; $p < .001$) with a sensitivity of 54.1% and specificity of 92.1%. For children, the AUC was 0.879 ([95% CI: 0.816, 0.914]; $p < .001$) with a sensitivity of 56.1% and specificity of 99.4%. For early adolescents, the AUC was 0.94 ([95% CI: 0.882, 0.992]; $p < .001$) with a sensitivity of 65.5% and specificity of 100%. For older adolescents, the AUC was 0.95 ([95% CI: 0.916, 0.994]; $p < .001$) with a sensitivity of 82.9% and specificity of 100%.

### CONCLUSION

Across all pediatric age groups, the software effectively ruled out non-hemorrhagic cases with high specificity. Particularly in adolescents, the AI-based software demonstrated a higher diagnostic performance, suggesting that this AI-based software significantly enhances the accuracy of detecting ICH.

### CLINICAL RELEVANCE/APPLICATION

The study validates the high accuracy of AI-based InsightPlus software in detecting intracranial hemorrhage across pediatric age groups, highlighting its potential to enhance diagnostic precision and improve clinical outcomes by enabling timely and age-appropriate interventions. The results shows that AI-based software is helpful for optimizing clinical workflows and resource allocation in pediatric emergency care settings.

## R5A-SPNR-11 MRI IN DETECTION OF ACUTE OPTIC NEURITIS: A SYSTEMATIC REVIEW AND META-ANALYSIS

Stephan Altmayer, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Denise Sisterolli Diniz (*Abstract Co-Author*) Nothing to Disclose
Giovanni B. Torri, MD (*Abstract Co-Author*) Nothing to Disclose
Fillipe T. Xavier de Campos, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza G. Schmitt, MD (*Abstract Co-Author*) Nothing to Disclose
Guilherme De Oliveira (*Abstract Co-Author*) Nothing to Disclose
Naga Siva Naveen Chodisetti (*Presenter*) Nothing to Disclose

### PURPOSE

MRI if frequently performed as part of the diagnostic workup of patient with suspected acute optic neuritis (AON). Conflicting results exists regarding the overall diagnostic performance of MRI and the different MRI protocols in the diagnosis of AON. Our purpose was to perform a systematic review and meta-analysis evaluating the diagnostic performance of MRI for the detection of AON.

### METHODS AND MATERIALS

Relevant databases were searched through April 2024. Studies identified were assessed independently by two authors. Published original articles that met the following criteria were considered eligible for meta-analysis: (a) evaluated diagnostic performance of MRI compared to a valid reference standard and (b) provided data for the meta-analytic calculations. The bivariate random-effects model was used to find the pooled sensitivity and specificity of MRI for AON and 95% CIs. The hierarchical summary receiver operating characteristic model was used to draw the summary receiver operating characteristic curve and calculate area under the curve (AUC). Data analysis was conducted using RStudio version 2023.06.0+421.

### RESULTS

A total of 10 studies involving 5 sequences, 492 patients and 820 optic nerves, met the inclusion criteria and were included in the meta-analysis. MRI had a pooled sensitivity and specificity of 85.9% (95% CI: 76.5; 91.9) and 87.4% (95% CI: 79.5; 92.6), respectively. In the subgroup analysis per sequence, contrast-enhanced T1W (CE-T1W) sequence demonstrated the highest significant sensitivity 81.1% (95% CI: 67.9; 89.7), while FLAIR sequence demonstrated the highest significant specificity 83.1% (95% CI: 66.6; 92.4), among all sequences. The AUC of MRI was 90.6% (95% CI: 82.7, 91.5).

### CONCLUSION

MRI has a high sensitivity and specificity for the diagnosis of AON.

### CLINICAL RELEVANCE/APPLICATION

Incorporating contrast into MRI may increase the detection of AON. Brain or orbital dedicated FLAIR sequences can help to confirm clinical suspected AON.

## R5A-SPNR-12 COMPARATIVE STUDY OF SLASER AND PRESS TECHNIQUES IN MAGNETIC RESONANCE SPECTROSCOPY OF NORMAL BRAIN

Jae Hyoung Kim (*Abstract Co-Author*) Nothing to Disclose
Sung Hyun Baik (*Abstract Co-Author*) Nothing to Disclose
Byungse Choi, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Leonard Sunwoo, MD (*Abstract Co-Author*) Nothing to Disclose
Se Jin Cho, MD (*Abstract Co-Author*) Nothing to Disclose
Yun Jung Bae, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cheolkyu Jung, MD (*Abstract Co-Author*) Nothing to Disclose
SHINKU KIM (*Presenter*) Nothing to Disclose

### PURPOSE

The commonly used PRESS technique in magnetic resonance spectroscopy (MRS) has a limitation of incomplete water suppression. The recently developed sLASER technique is known for its improved effectiveness in suppressing water signal. However, no prior study has compared both sequences in a normal human brain. In this study, we firstly aimed to compare the performances of both techniques in brain MRS

### METHODS AND MATERIALS

From January 2023 to July 2023, thirty healthy participants (mean age 38 years, 17 male, 13 female) without underlying neurological diseases were enrolled in this study. All participants underwent single-voxel MRS using both PRESS and sLASER techniques on 3T MRI. Two regions-of-interest were allocated in the left medial thalamus and left parietal white matter (WM) by a single reader. The SpectroView Analysis (SW5, Philips, Netherlands) provided automatic measurements, including signal-to-noise ratio (SNR) and peak_height of water, N-acetylaspartate (NAA)-water/Choline (Cho)-water/Creatine (Cr)-water ratios, and NAA-Cr/Cho-Cr ratios. The measurements from PRESS and sLASER techniques were compared using paired T-tests and Bland-Altman methods, and the variability was assessed using coefficients of variation (CV).

### RESULTS

SNR and peak_heights of the water were significantly lower with sLASER compared to PRESS (left medial thalamus, sLASER SNR/peak_height 2092±475/328±85 vs. PRESS 2811±549/440±105); left parietal WM, 5422±1016/872±196 vs. 7152±1305/1150±278; all, $P<0.001$, respectively). Accordingly, NAA-water/Cho-water/Cr-water ratios and NAA-Cr/Cho-Cr ratios were significantly higher with sLASER than with PRESS (all, $P< 0.001$, respectively). The variabilities of NAA-water/Cho-water/Cr-water ratios and Cho-Cr ratio in the left medial thalamus were lower with sLASER than with PRESS (CV, sLASER vs. PRESS, 19.9 vs. 58.1/19.8 vs. 54.7/20.5 vs. 43.9 and 11.5 vs. 16.2)

### CONCLUSION

The sLASER technique demonstrated enhanced background water suppression, resulting in increased signals and reduced variability in brain metabolite measurements of MRS. Therefore, sLASER could offer a more precise and stable method for identifying brain metabolites

### CLINICAL RELEVANCE/APPLICATION

sLASER in MRS can enhance brain metabolite measurement precision, crucial for diagnosing and managing neurological disorders such as neurodegenerative, demyelinating, and metabolic diseases. It may improve early detection and treatment monitoring by accurately distinguishing between healthy and diseased tissues, especially in brain tumors, aiding in personalized treatment. This advancement promises significant clinical improvements both in neurology and radiology.

## R5A-SPNR-13 MOTOR TASK MULTIBAND FUNCTIONAL MRI COMPARED TO ROUTINE NON-MULTIBAND ACCELERATED FUNCTIONAL MRI IN PATIENTS WITH BRAIN LESIONS

Michele Aizenberg, MD (*Abstract Co-Author*) Research support, Arbor Pharmaceuticals Inc
Sean Kelly, MD (*Abstract Co-Author*) Nothing to Disclose
Yan Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fang Yu (*Abstract Co-Author*) Nothing to Disclose
Matthew L. White, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Functional MRI (fMRI) is a technique for brain mapping. Its utilization can enhance tumor resection with functional preservation. Multiband (MB) fMRI is a novel approach to acquire fMRI data and MB fMRI has been found to demonstrate increased signal. There has been limited MB fMRI analysis in patients with brain tumors which is a potential application of this technique. The increased signal detected with MB fMRI might be related to the faster acquisition of signal (2-6x) than conventional MRI. This greater speed allows for the activation signals to be sampled closer to where the activation occurs before the

BOLD signal changes in the blood are washed out by venous blood flow from non-activated areas.Hypothesis: MB fMRI motor tasks will demonstrate greater statistical activation patterns and activation closer to the areas of interest than seen with routine fMRI sequences.

**METHODS AND MATERIALS**

10 patients with gliomas and 5 with metastatic lesions (average age 45 yo (range 26-68)). 18 fMRI acquisitions were acquired. MRI: Philips 3T Ingenia MRI with multiband capabilities and a 32-channel head coil. Routine fMRI: voxel= 3mm x 3mm x 3mm , TR= 3000 , TE=35 , Sense= 1.8 , 5 minute acquisition, 100 time points. 4x MB fMRI: voxel= 3mm x 3mm x 3mm, TR= 750 , TE=30 , 5 minute acquisition, 400 time points. All tasks were block design with 9 finger tap, 8 ankle movement and 1 lip movement task. The fMRI maps were produced utilizing a test p-value that resulted in the best expected activation map. Bonferroni correction was applied. The fMRI data was processed with Olea software. Two analyses were performed. 1) The distance from the edge of the activation map to the edge of the area of interest was measured. 2) The p-value data were compared between the 4x MB and routine fMRI maps using a paired t test to account for the repeated measures design. One fMRI activation task was completely excluded from analyses since the routine fMRI failed. Another task excluded from the p-value analysis due to poor signal.

**RESULTS**

The average distance from the edge of the 4x MB fMRI activation map to the area of interest was 6.9 mm and for the routine fMRI was 11.12 mm (p-value< 0.00066). The average p-value for the 4x MB fMRI maps was 3.6x10-7 and for the routine fMRI 1.3x10-1. The 4x MB fMRI map p-values were significantly smaller (p-value=0.0000088).

**CONCLUSION**

4x MB fMRI with a motor task in patients with brain lesions demonstrate activation maps that extend closer to areas of interest than the routine fMRI sequence. The p-values utilized for the 4x MB fMRI analysis of the data were significantly smaller than that utilized for the routine fMRI data maps.

**CLINICAL RELEVANCE/APPLICATION**

4x MB fMRI data has a potential greater sensitivity to localize motor functions leading to more precise pre-operative brain mapping.

## R5A-SPNR-16 EXPLORING THE EFFICACY OF LARGE-SCALE GRANGER CAUSALITY (LSGC) IN DIAGNOSIS OF PARKINSON'S DISEASE USING FMRI NEUROIMAGING

Nathan Hadjiyski (*Abstract Co-Author*) Nothing to Disclose
Akhil Kasturi (*Abstract Co-Author*) Nothing to Disclose
Axel Wismueller, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ali Vosoughi (*Presenter*) Nothing to Disclose

**PURPOSE**

To create and test a machine learning approach for identifying individuals with Parkinson's Disease (PD) using large-scale Granger Causality (lsGC) to analyze changes in resting-state functional MRI (fMRI) brain connectivity.

**METHODS AND MATERIALS**

We analyzed 30 rsfMRI data sets from Parkinson’s Disease (PD) patients and healthy controls (15 PD, 15 controls) in-house acquired and preprocessed from [blinded for review]. To calculate directed functional connectivity between brain regions, we used the large-scale Granger Causality (lsGC) algorithm, which leverages dimensionality reduction for causal modeling in high-dimensional fMRI time series. We applied 10-iteration cross-validation with 85%/15% train/test ratio, Kendall's tau rank correlation feature selection, and support vector machine classification. To evaluate the diagnostic accuracy of lsGC in classifying PD patients and healthy controls, we compared its performance with multiple other methods, including local model (LM) connectivity, anti-symmetric correlation (ASC), and the current clinical standard for fMRI analysis, cross-correlation (CC). We report accuracy, area under the ROC curve (AUC), and f1-score to quantitatively evaluate lsGC performance.

**RESULTS**

The lsGC method outperformed all competing methods in classifying PD patients from healthy controls with AUC 0.844 (±0.161), accuracy 80.0% (±0.0%), and f1-score 81.1% (±2.3%).; local models also reached 80.0% accuracy but with slightly lower AUC and f1-scores of 0.850 (±0.179) and 75.2% (±7.2%), respectively, while ASC had AUC of 0.778 (±0.108), accuracy 78.7% (±5.0%), and f1-score 78.4% (±7.6%). Clinical standard CC technique fell behind, with AUC 0.828 (±0.133), accuracy 75.3% (±8.5%), and f1-score 72.0% (±10.5%). F1-score differences between lsGC versus CC and local models were statistically significant ($p<0.01$, Wilcoxon signed rank test).

**CONCLUSION**

Our results suggest that lsGC significantly enhances the diagnostic accuracy of identifying Parkinson's Disease (PD) patients from rsfMRI neuroimaging. We conclude that lsGC better captures disease-related changes of brain network connectivity in PD patients compared to conventional CC analysis, local models, and anti-symmetric correlation.

**CLINICAL RELEVANCE/APPLICATION**

The lsGC method effectively differentiates between PD patients and healthy individuals by identifying brain connectivity changes in fMRI scans. This indicates its value as a potential diagnostic tool for neurological disorders.

## R5A-SPNR-17 DIAGNOSIS OF AUTISM SPECTRUM DISORDER FROM FUNCTIONAL MR IMAGING USING LARGE-SCALE NONLINEAR GRANGER CAUSALITY (LSNGC)

Akhil Kasturi (*Abstract Co-Author*) Nothing to Disclose
Nathan Hadjiyski (*Abstract Co-Author*) Nothing to Disclose
Ali Vosoughi (*Abstract Co-Author*) Nothing to Disclose
Axel Wismueller, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To create and test a novel machine learning approach for identifying individuals with Autism Spectrum Disorder (ASD) using large-scale Nonlinear Granger Causality (lsNGC) to analyze brain connectivity in resting-state functional MRI (fMRI).

**METHODS AND MATERIALS**

We analyzed a subset of 59 resting-state fMRI data sets from ASD patients and healthy controls from the Olin Institute of Living at Hartford Hospital longitudinal sample, which is part of the publicly available Autism Brain Imaging Data Exchange II (ABIDE II) data repository. We calculated directed functional connectivity between brain regions using the recently developed large-scale Nonlinear Granger Causality (lsNGC) algorithm, which leverages

dimensionality reduction and non-linear prediction for causal modeling in high-dimensional fMRI time series. We applied 10-iteration cross-validation with 85%/15% train/test ratio. For feature selection, Kendall's tau was used, followed by support vector machine classification. To evaluate diagnostic accuracy of lsNGC, we compared its performance with multiple other methods, including local model (LM) connectivity, anti-symmetric correlation (ASC), and the current clinical standard for fMRI analysis, cross-correlation (CC). We report accuracy, area under the ROC curve (AUC), and f1-score to quantitatively evaluate lsNGC performance.

**RESULTS**

The lsNGC method outperformed all competing methods in classifying ASD patients from healthy controls with AUC 0.963 (±0.059), accuracy 89.6% (±7.5%), and f1-score 88.4% (±8.2%); local models achieved 83.7% accuracy but lower AUC and f1-scores of 0.913 (±0.075) and 81.5% (±8.5%), respectively, while ASC had AUC 0.918 (±0.075), accuracy 81.9% (±6.1%), and f1-score 78.9% (±7.4%). Clinical standard CC technique fell behind, with AUC 0.877 (±0.105), accuracy 81.9% (±11.3%), and f1-score 76.9% (±18.8%). Differences between lsNGC and competing methods were statistically significant ($p<0.01$, Wilcoxon signed rank test).

**CONCLUSION**

Our results suggest that lsNGC outperforms conventional CC, local models, and anti-symmetric correlation at detecting Autism Spectrum Disorder (ASD) from fMRI data. We conclude that lsNGC has the capability to identify disease-related changes in brain network connectivity in ASD patients and could serve as a promising diagnostic imaging biomarker for neurologic disease.

**CLINICAL RELEVANCE/APPLICATION**

The potential value of lsNGC as a diagnostic imaging biomarker for neurologic disease is demonstrated by its ability to accurately identify changes in fMRI connectivity that can classify patients with Autism Spectrum Disorder (ASD) and healthy controls. This suggests that lsNGC could be a useful tool for diagnosing and studying neurologic diseases.

## R5A-SPNR-18 VISUALIZATION OF LENTICULOSTRIATE ARTERIES ON CTA USING PHOTON-COUNTING DETECTOR CT: A POTENTIALLY CONSIDERABLE RECONSTRUCTION PARAMETER

Ji Liang Chen (*Abstract Co-Author*) Nothing to Disclose
Yan E Zhao (*Abstract Co-Author*) Nothing to Disclose
Dong Sheng Jin (*Abstract Co-Author*) Nothing to Disclose
Song Luo (*Abstract Co-Author*) Nothing to Disclose
Wen-Tian Tang (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess capability of head and neck photon-counting detector computed tomography (PCD-CT) angiography for visualizing lenticulostriate arteries and to identify an optimal reconstruction parameter.

**METHODS AND MATERIALS**

Patients who underwent head and neck CTA using PCD-CT and were found to have no significant intracranial vascular stenosis were retrospectively included in this study from January 2024 to April 2024. Each examination involved reconstruction of 0.2 mm thickness threshold three dimension(T3D) images, 0.4 mm thickness T3D images, 0.4 mm thickness vascular spectrum post-processing(VSPP) images, and 0.8 mm thickness T3D images(simulating energy-integrating detector CT images). Image quality and vascular visualization were assessed by radiologists using a four-point Likert scale and quantitative measures, respectively. The Friedman test with Holm-Bonferroni correction was used to compare characteristics from the four reconstruction images.

**RESULTS**

A total of 27 patients (61 years±15; 15 males) were included. The 0.4 mm VSPP images displayed the highest counts of lenticulostriate arteries(right side 4.15±1.06; left side 3.96±0.98). Regarding the measurements of the longest lenticulostriate arteries, the 0.4 mm VSPP images also indicated the maximum length(right side 24.77mm±4.54; left side 26.08mm±4.71), with no significant difference from the 0.2 mm T3D images and 0.4 mm T3D images, but significantly greater than the 0.8 mm T3D images(all $P < 0.01$). In Likert scale evaluations, the 0.2 mm T3D images presented the highest noise yet the sharpest edges. The 0.4 mm VSPP images scored highest in vascular smoothness, vascular contrast, and diagnostic confidence, notably outperforming the 0.8 mm T3D images (all $P < 0.05$).

**CONCLUSION**

Head and neck CTA using PCD-CT exhibits considerable potential in the visualization of lenticulostriate arteries, with the 0.4 mm VSPP images potentially offering greater imaging advantages.

**CLINICAL RELEVANCE/APPLICATION**

CTA using PCD-CT may provide valuable insights for the prevention and treatment of potential cerebral small vessel disease(CSVD) and intracranial atherosclerotic stenosis(ICAS) patients through the visualization of lenticulostriate arteries.

## R5A-SPNR-2 MYELIN LOSS DETECTION WITH 2D ADIABATIC T1ρ-PREPARED FAST SPIN ECHO (2D ADIAB-T1ρ-FSE) IMAGING AND ASSOCIATED BEHAVIORAL CHANGES IN AN OPEN-FIELD LOW-INTENSITY BLAST MOUSE MODEL OF MILD TRAUMATIC BRAIN INJURY (MTBI)

Jiang Du, PhD (*Abstract Co-Author*) Nothing to Disclose
Qingbo Tang (*Abstract Co-Author*) Nothing to Disclose
Dina Moazamian, MD (*Abstract Co-Author*) Nothing to Disclose
Yajun Ma (*Abstract Co-Author*) Nothing to Disclose
Jiyo Athertya (*Abstract Co-Author*) Nothing to Disclose
Eric Y. Chang, MD (*Abstract Co-Author*) Nothing to Disclose
James Lo, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

This study investigates the utility of Adiab-T1?-FSE MRI to detect myelin loss in mice with mild traumatic brain injury (mTBI) caused by an open-field low-intensity blast (LIB) injury model and associated behavioral disorders compared with the normal group (Sham).

### METHODS AND MATERIALS

All animal experiments followed approved protocols for the Care and Use of Laboratory Animals. 30 male 8-week-old C57BL/6 mice (Jackson Labs, ME) were randomly divided into mTBI (n=15) and sham (n=15) groups. The anesthetized mTBI mice experienced a reproducible open-field LIB injury with 350g explosion C4. After 5 days, behavioral testing (light Spot, open-field(FO)tests) assessed motor activity and anxiety. Later, They MRI-scanned using a 3T Bruker system with a 1-inch coil. The 2D Adiab-T1?-FSE technique was used with the following parameters: repetition time=1500ms, Echo time= 5.5ms, spin-locking time (TSL)= 0, 24, 48, and 96ms (number of adiabatic full passage (AFP) pulses=0,4,8, and 16), FA=180°, number of spokes=25; bandwidth=5000HZ, Slice thickness=0.3mm, FOV=11×11cm2, matrix size =120×120. The total scan time was 7 minutes. Medial of the corpus callosum (MCC) was selected to compare Adiab-T1? for the two groups. Velocity, movements, and time in the center by the FO test, and time in shelter (TIS) and time outside shelter (TOS) by the light Spot test were compared between groups with independent T-test and two-way ANOVA, respectively. (P values <0.05 significant).

### RESULTS

T1? fitting curves and pixel maps of a representative sham and a mTBI mouse are presented in Fig.1 A, B, and Fig.1 C, D, respectively. The average±SD, and percentage of differences are presented in Fig.1E. Significant, small T1? differences between the two groups were found. Fig1. F-H shows a significantly increased velocity and a reduced trend of movements and time in the center, respectively. Fig1. I-J shows significantly increased TIS and reduced TOS in mice, respectively.

### CONCLUSION

For the first time, the 2D Adiab-T1?-FSE technique can be used as a quantitative method for detecting open-field LIB-induced myelin loss in the brain's white matter. Significantly higher T1? values in the CC of mTBI mice could be due to changes in neuronal cellular density content. The mechanisms underlying these relaxation differences should be investigated in future studies. Our study shows acute decreased motor activity and increased anxiety, indicated by light Spot test and FO results.

### CLINICAL RELEVANCE/APPLICATION

The 2D Adiab-T1?-FSE sequence is a new approach for evaluating myelin loss in mTBI. It can ultimately be used for diagnosis and treatment monitoring which often remains under-diagnosed due to the lack of symptoms immediately after exposure as well as negative findings on conventional imaging.

## R5A-SPNR-5 DIFFUSION-RELAXATION CORRELATION SPECTROSCOPIC IMAGING FOR EVALUATING CHANGE OF WHITE MATTER OF X-LINKED ADRENOLEUKODYSTROPHY

Ru Wen (*Abstract Co-Author*) Nothing to Disclose
Liang Tan (*Abstract Co-Author*) Nothing to Disclose
Xingang Wang (*Abstract Co-Author*) Nothing to Disclose
Chen Liu (*Presenter*) Nothing to Disclose

### PURPOSE

To measure the changes in white matter composition and microenvironment in ALD patients using diffusion-relaxation correlation spectroscopic imaging (DR-CSI)

### METHODS AND MATERIALS

A total of 8 participants with 4 groups including health control(HC), Cerebral ALD(CALD), AMN, and Carrier (each group has 2 participants) were enrolled in this study. Examinations of all participants were performed on a 3.0 Tesla MRI scanner using a 32-channel Head coil. The DR-CSI was acquired using an axial singleshot spin-echo echo-planar-imaging (SE-EPI)-based DWI sequence, with 36 acquisitions of six different TEs. Imaging by DR-CSI is basically a two-dimensional correlation MRI method, simultaneously considering the signal attenuation caused by both the diffusion and the relaxation time of multiple components. For quantitative analysis, the spectra were segmented into three compartments, labeled by A (higher diffusivity, shorter T2), B (higher diffusivity, longer T2), and C (lower diffusivity). Boundaries of different compartments were decided case-by-case according to the principle that each compartment separately contain the three main peaks observed from spectral observations. The DR-CSI compartment volume fractions Vi (i = A, B, C) were calculated for each voxel by spectral integration, and then averaged for each patient. The ROIs were manually delineated on axial DWI with a short TE (50 msec), and were chosen to include the anterior, medial, posterior of white matter (Figure 1).

### RESULTS

This study evaluated white matter change in ALD patients by DR-CSI in terms of microenvironment analysis (Figure 2). Specifically, characteristic peaks have been observed (Figure 2), and difference have been found between DR-CSI-derived volume fractions of compartments A and B in the different area (Figure 2). Statistical analysis results show in anterior white matter (Figure 3), the HC group has highest fA compare to other group. In medial white matter (Figure 4), the HC group also has highest fA compare to other group, carrier group achevie highest fC and AMN group achevie highest fB. In posterior white matter (Figure 5), the HC group also has highest fA compare to other group, and AMN group achevie highest fB.

### CONCLUSION

Our findings may illustrate the potential of applying an invivo DR-CSI method for the evaluation changes of white matter of ALD. Specifically, DR-CSI could differentiate signal contributions from diverse compartments with different diffusion and relaxation properties.

### CLINICAL RELEVANCE/APPLICATION

The phenotypes of ALD are heterogeneous, exhibiting a variety of cerebral imaging changes. Changes in brain areas of different types of participants can be demonstrated by changes in f for each tissue compartment in voxels.

## R5A-SPNR-6 BRAIN AGE PREDICTION USING COMPUTED TOMOGRAPHY AND ITS ASSOCIATION WITH ALZHEIMER'S DISEASE

Steven A. Rothenberg, MD (*Abstract Co-Author*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC
Yu-Hua D. Fang, PhD (*Abstract Co-Author*) Nothing to Disclose
Adam Sturdivant (*Abstract Co-Author*) Nothing to Disclose
Andrew D. Smith, MD, PhD (*Abstract Co-Author*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms
Charles Baker (*Abstract Co-Author*) Nothing to Disclose
Omar A. Safarini, MD (*Abstract Co-Author*) Nothing to Disclose
Kennedye McGhee (*Abstract Co-Author*) Nothing to Disclose
Rafah Mresh, MD (*Abstract Co-Author*) Nothing to Disclose
Shruti Kumari (*Abstract Co-Author*) Nothing to Disclose
Aaron Haider (*Abstract Co-Author*) Nothing to Disclose

Jose A. Perucho, PhD, BEng (*Abstract Co-Author*) Nothing to Disclose
Maggie Phillips (*Abstract Co-Author*) Nothing to Disclose
John Eddins (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the ability of Computed Tomography (CT) images of the brain to predict biological brain age and evaluate the utility of these predictions to identify subjects with Alzheimer's Disease.

**METHODS AND MATERIALS**

A brain age prediction model was trained using subjects from the Open Access Series of Imaging Studies (OASIS) and a single academic medical system with a level 1 trauma center. Cognitively normal (CN) patients defined as a normal neuropsychiatric evaluation in the OASIS dataset or local patients presenting for trauma without intracranial pathology and no history neurodegenerative disease between the ages of 18-80 were included (N=1656). Subjects with AD (Alzheimer's dementia) were added to the testing dataset (N=226). The CN set of subjects were split by a training, validation, and testing ratio of 70, 20, and 10 respectively. Further, the split was done in a stratified sampling manner, to preserve the ratio of age groups - wherein subjects are binned by decade - in each subset. The CN subject sets had an age distribution by decade ratio as follows: 20's: 17% ; 30's: 12% , 40s: 10% , 50s: 14%, 60s: 15% , 70s: 23% , 80s: 8%. Brain age prediction was achieved by training a Simple Fully Convolutional Neural Network (SFCN) model using CT data as inputs and subjects' chronical age as the target value to be predicted. Data augmentations of ±5° rotations and ±10 voxel translations were done to reduce the risk of model overfitting. Brain ages were then corrected using a linear method. Brain ages were then predicted for the testing set that included both CN and AD subjects. Brain Age Gap (BAG) was then calculated by subtracting subject's chronological age from their predicted brain age. The Mann-Whitney-U test was used to compare the BAG of CN vs. AD subjects.

**RESULTS**

The brain age prediction model achieved a Mean Absolute Error (MAE) of 5.97 on the CN validation set, 6.05 on the CN testing set, and 8.86 on the AD testing set. The AD group (mean BAG = 4.505) was significantly higher than the CN group (mean BAG = 0.865) (p=0.002).

**CONCLUSION**

A supervised machine learning AI model trained on CT brain images can reasonably estimate the biological brain age in cognitively normal subjects. Furthermore, the brain age to chronological gap measured shows that subjects with Alzheimer's Disease have a significantly wider gap than cognitively normal subjects. Adding pre-processing steps to segment brain regions of interest may improve model performance.

**CLINICAL RELEVANCE/APPLICATION**

Brain CT is a widely available and commonly used diagnostic test. The estimation of brain age and calculation of BAG may facilitate opportunistic screening to identify patients at risk of Alzheimer's or other neurodegenerative disease.

## R5A-SPNR-7 CEREBRAL BLOOD FLOW IN MIDLIFE OBESITY: ASSOCIATIONS WITH VISCERAL AND SUBCUTANEOUS ABDOMINAL ADIPOSE TISSUE

Nancy Hantler (*Abstract Co-Author*) Nothing to Disclose
Bettina Mittendorfer (*Abstract Co-Author*) Nothing to Disclose
John Morris (*Abstract Co-Author*) Research support, Eli Lilly and CompanyConsultant, Eli Lilly and Company
Sara Hosseinzadeh Kassani (*Abstract Co-Author*) Nothing to Disclose
Mahshid Naghashzadeh (*Abstract Co-Author*) Nothing to Disclose
Caitlyn Nguyen (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC
Cyrus Raji, MD, PhD (*Abstract Co-Author*) Consultant, Brainreader ApS;Consultant, Neuroevolution, LLC;Consultant, Apollo Health
Weiying Dai, PhD (*Abstract Co-Author*) Nothing to Disclose
Joseph E. Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Abigayl McBee-Kemper (*Abstract Co-Author*) Nothing to Disclose
Tammie S. Benzinger, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company;Investigator, Eli Lilly and Company;Investigator, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Research Grant, Siemens AG;Consultant, ADM Diagnostics, LLC;Speakers Bureau, Biogen Idec Inc;Advisory Board, Biogen Idec Inc
Paul Commean (*Abstract Co-Author*) Nothing to Disclose
Lakisha Lloyd (*Abstract Co-Author*) Nothing to Disclose
Mahsa Dolatshahi, MD, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

Obesity and higher adiposity in midlife are recognized as contributors to Alzheimer disease, where vascular compromise and brain hypoperfusion play a role. In this study, we aimed to investigate the associations of body mass index (BMI), abdominal visceral and subcutaneous adipose tissue (VAT, SAT) with brain cerebral blood flow (CBF) in cognitively normal midlife individuals.

**METHODS AND MATERIALS**

A total of 66 middle-aged cognitively normal adults (age: 49.86 years, females: 66.7%, obesity: 51.5 %, BMI: 31.72 kg/m2) underwent abdominal and brain MRI, and brain PET scan. Using an in-house MATLAB-based program, abdominal VAT and SAT were automatically segmented followed by manual editing. A 3D Pseudo-Continuous Arterial Spin Labeling (pCASL) sequence, with a single post-labeling delay of 2.025 s, was used for assessing CBF. SPM 12 was used to generate ASL difference and absolute CBF (aCBF) maps with a single compartment model, co-registered to the gray matter segmentations, normalized to MNI space, and spatial smoothing with a 6mm FWMH Gaussian kernel. Using AAL3 atlas and Matlab, region of interest masks were created for amygdala, hippocampus, posterior cingulate, precuneus, parahippocampal, medial orbitofrontal, middle temporal, and Calcarine cortices, and applied to absolute CBF (aCBF) maps. The whole-brain and regional aCBF differences between the obese vs. non-obese, the low- vs. high-VAT, and low- vs. high-SAT group, and the association between whole-brain amyloid PET Centiloids were assessed. Also, BMI, VAT, and SAT as separate predictor variables, were used for voxel-wise analysis, with age and sex as covariates.

**RESULTS**

The high-VAT group showed lower whole-brain aCBF (p=0.004), particularly in the bilateral Calcarine gyri (p=0.001, 0.002). A lower whole-brain aCBF was found in the obese group (p=0.005), more prominent in the left middle temporal lobe (p=0.002). No significant difference was observed in global and regional aCBF in the high-SAT vs. low-SAT groups. Voxel-wise analyses showed significantly lower aCBF in association with BMI in small temporal, occipital, and frontal lobe clusters after false discovery rate correction. No association was found between whole-brain Centiloids and aCBF.

### CONCLUSION

Obesity and increased visceral abdominal fat are associated with a lower cerebral blood flow, with a more prominent decrease in the middle temporal cortex, as an AD-signature area, in cognitively normal midlife individuals. These findings highlight the role of obesity, especially visceral obesity, in brain hypoperfusion and potentially Alzheimer disease risk, as early as midlife.

### CLINICAL RELEVANCE/APPLICATION

Modifying visceral obesity can potentially improve brain perfusion and reduce the risk of Alzheimer disease.

## R5A-SPNR-8 MULTICOMPARTMENT IMAGING OF THE BRAIN IN MULTIPLE SCLEROSIS USING A COMPREHENSIVE MR IMAGING PROTOCOL

Graeme M. Bydder, MBChB (*Abstract Co-Author*) Nothing to Disclose
Kevin Du (*Abstract Co-Author*) Nothing to Disclose
Jiyo Athertya (*Abstract Co-Author*) Nothing to Disclose
Yajun Ma (*Abstract Co-Author*) Nothing to Disclose
Melissa Lou Silva, MD (*Abstract Co-Author*) Nothing to Disclose
James Lo, BS (*Presenter*) Nothing to Disclose

### PURPOSE

This study uses a new 3D magnetic resonance imaging (MRI) protocol to quantify and compare all the major tissue components in the brain, including macromolecules, myelin water, intra/extracellular water, and free water, between healthy volunteers and patients with multiple sclerosis (MS).

### METHODS AND MATERIALS

Five MS patients (55±11 years old, four females) and ten healthy volunteers (27±2 years old, six females) were scanned with the novel protocol that comprises four different sequences: 1) magnetization transfer prepared Cones (MT-Cones) for two-pool MT modeling to quantify macromolecular content; 2) short-TR adiabatic inversion-recovery prepared Cones (STAIR-Cones) for myelin water (MW) imaging; 3) proton-density weighted Cones (PDw-Cones) for total water imaging; and 4) highly T2 weighted Cones (T2w-Cones) for free water (FW) imaging, on a 3T clinical scanner (MR750, GE) employing an 8 channel head coil. By integrating these techniques, we quantified the brain macromolecular proton fraction (MMPF), MW proton fraction (MWPF), intra/extracellular water proton fraction (IEWPF), and free water proton fraction (FWPF). Regions of interest (ROIs) were drawn and measured in eight white matter (WM) regions, two grey matter (GM) regions, and apparent lesions. Measured brain tissues in healthy volunteers were considered as normal WM (NWM) or normal GM (NGM) while MS patients were considered as normal-appearing WM (NAWM), normal-appearing GM (NAGM), or lesions. Independent t-tests were calculated comparing all the PF measurements between NWM and NAWM, NWM and lesions, NAWM and lesions, and NGM and NAGM. P values $< 0.05$ were considered significant.

### RESULTS

MMPF and MWPF values of lesions (4.8%, 2.6%) and NAWM (9.6%, 7.2%) were lower than those in NWM (11.6%, 8.5%), respectively, consistent with diffuse demyelination. IEWPF values of NAWM (80.1%) were higher than both NWM (78.7%) and lesions (74.7%), while NGM (89.7%) were higher than those of NAGM (88.3%), consistent with elevated levels of extracellular water. In the FWPF, NAWM (3.1%) and NAGM (2.3%) measurements were higher than those of NWM (1.1%) and NGM (0.7%), respectively. Moreover, we observed dramatically higher FWPF values in lesions (18.4%) compared to those in both NWM and NAWM regions, a change consistent with the transition from lesion to cerebrospinal fluid due to atrophy. All comparisons, excluding those between MMPF and MWPF NGM and NAGM, were significant.

### CONCLUSION

The multicompartment brain imaging protocol can detect distinct and significant differences in the MMPF, MWPF, IEWPF, and FWPF measurements between normal volunteers and patients with MS.

### CLINICAL RELEVANCE/APPLICATION

This study demonstrates the capability of our protocol to detect brain compositional changes in MS.

## R5A-SPNR-9 TASK-SPECIFIC ARTIFICIAL INTELLIGENCE FOR SEGMENTATION OF IDH-MUTANT GLIOMAS

Albert D. Jiao, MD (*Abstract Co-Author*) Nothing to Disclose
Raymond Y. Huang, MD, PhD (*Abstract Co-Author*) Advisory Board, Vysioneer Inc;Consultant, Nuvation Bio, Inc ;Institutional research support, Bristol-Myers Squibb Company
Ian Pan, MD (*Presenter*) Consultant, MD.ai, Inc;Consultant, Centaur Labs Inc;Consultant, Diagnosticos da America SA;Consultant, CoRead AI

### PURPOSE

To develop a task-specific deep learning-based artificial intelligence (AI) model for segmentation of preoperative and postoperative isocitrate dehydrogenase (IDH)-mutant gliomas.

### METHODS AND MATERIALS

1,251 multiparametric MRI examinations (T1-weighted, T2-weighted, FLAIR, and post-contrast T1-weighted sequences) from 1,133 patients with glioblastoma in the Brain Tumor Segmentation (BraTS) Challenge dataset were used to train an initial segmentation model with 3 classes: 1) nonenhancing T2 signal abnormality, 2) enhancing tumor, and 3) necrosis. The segmentation model was based on the X3D convolutional neural network (CNN) architecture. 257 preoperative and 471 postoperative examinations from 262 patients, manually segmented by a board-certified neuroradiologist, with pathologically-proven IDH-mutant gliomas were then used to fine-tune the model. Performance was measured by the Dice similarity coefficient (DSC), and statistical comparison between the initial and fine-tuned models was performed using the bootstrap.

### RESULTS

No IDH-mutant gliomas in our dataset demonstrated necrosis; thus we report only on nonenhancing T2 signal abnormality and enhancing tumor. The initial BraTS-trained model achieved DSCs of 0.208 and 0.039 for these 2 entities, respectively, compared to a five-fold cross-validated DSCs of 0.806 and 0.263 for the fine-tuned model ($p<0.001$). For preoperative studies, the initial and fine-tuned models achieved DSCs of 0.306 and 0.057 vs. 0.870 and 0.316 ($p<0.001$). For preoperative studies, the initial and fine-tuned models achieved DSCs of 0.154 and 0.029 vs. 0.771 and 0.238 ($p<0.001$).

### CONCLUSION

Our IDH-mutant-specific glioma segmentation model achieved high performance for segmentation of nonenhancing T2 signal abnormality in both preoperative and postoperative examinations. Performance for enhancing tumor was lower, as many tumors demonstrated no or mild enhancement. The

fine-tuned model achieved significantly higher performance than the initial model, especially for postoperative studies.

**CLINICAL RELEVANCE/APPLICATION**

Task-specific segmentation models for IDH-mutant gliomas can improve performance for this tumor subgroup. Future studies will evaluate generalizability of these models to external datasets and correlate volumetric data obtained from these algorithms with tumor progression and patient outcomes.

# Abstract Archives of the RSNA, 2024

R5A-SPPD

**Pediatric Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPPD-2 SCREENING FOR INTRACRANIAL ANEURYSMS IN PEDIATRIC PATIENTS WITH POLYCYSTIC KIDNEY DISEASE

Zekordavar Rimba, MD (*Abstract Co-Author*) Nothing to Disclose
Arastoo Vossough, PhD, MD (*Abstract Co-Author*) Research Consultant, Syneos Health;Stockholder, DeepSight Technology, Inc
Amirreza Manteghinejad, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Autosomal dominant polycystic kidney disease (ADPKD) and autosomal recessive polycystic kidney disease (ARPKD) are disorders marked by the growth of numerous cysts in the kidneys. ADPKD and ARPKD also have extrarenal manifestations. The most serious extrarenal complication of polycystic kidney disease is intracranial aneurysm, which is commonly seen in ADPKD patients. The prevalence of intracranial aneurysms in ADPKD patients is 4 times higher than in the general population (7-13% vs. 2-3%). Moreover, patients with ADPKD have an intracranial aneurysm rupture at an approximate 10-year younger median age than those without ADPKD. As a result, intracranial aneurysm screening is recommended in adults with ADPKD.In contrast to the adult population, the data regarding intracranial aneurysms in pediatric PKD patients is very scarce. However, pediatric patients with PKD are sometimes screened for intracranial aneurysms. This study aimed to determine the yield of positive screening studies for intracranial aneurysms in pediatric patients with polycystic kidney disease.

### METHODS AND MATERIALS

This retrospective study included patients under 21 years of age referred to be screened by magnetic resonance angiography (MRA) for intracranial aneurysms based on their history of polycystic kidney disease between 1995 and 2022. In addition to imaging reports by pediatric neuroradiologists, a second board-certified pediatric neuroradiologist re-evaluated all the MRAs and the follow-up imaging in cases of suspicious screening to assess the presence or absence of aneurysms. The study sample size had >80% power for showing increased aneurysm prevalence.

### RESULTS

Thirty-six cases with a median age of 15.12 years (interquartile range, 8.89 - 17.16 years) were included in this study. The inheritance pattern of 25 (69.45%) cases was autosomal dominant, 5 (13.89%) was autosomal recessive, and 6 (16.66%) was unknown. Two patients (5.56%) had initially suspicious MRA for intracranial aneurysms. A confirmatory MRA for the first patient proved that the lesion was an infundibulum with the finding of a small branch vessel arising from the dome of the suspected outpouching. A volume rendering of the second patient's MRA study also showed the initial lesion to be an artifact, resulting in a final yield of 0% for screening intracranial aneurysms.

### CONCLUSION

Screening for intracranial aneurysms in pediatric patients with polycystic kidney disease has a low-to-zero prevalence and yield.

### CLINICAL RELEVANCE/APPLICATION

Although adult patients with polycystic kidney disease have an increased risk of developing intracranial aneurysms, screening pediatric polycystic kidney disease patients has very little to no yield for early detection of aneurysms.

## R5A-SPPD-3 NEUROIMAGING DELINEATION AND PROGRESSION OF SLSMD SYNDROMES

Arastoo Vossough, PhD, MD (*Abstract Co-Author*) Research Consultant, Syneos Health;Stockholder, DeepSight Technology, Inc
Amy Goldstein, MD (*Abstract Co-Author*) Nothing to Disclose
Rebecca Ganetzky (*Abstract Co-Author*) Nothing to Disclose
James Peterson (*Abstract Co-Author*) Nothing to Disclose
Francisco A. Perez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniela Longo (*Abstract Co-Author*) Nothing to Disclose
Marni Falk (*Abstract Co-Author*) Nothing to Disclose
Colleen Muraresku (*Abstract Co-Author*) Nothing to Disclose
Cesar Augusto P. Alves SR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Maria Camilla Rossi Espagnet, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Napolitano (*Abstract Co-Author*) Nothing to Disclose
Adeline Vanderver, MD (*Abstract Co-Author*) Nothing to Disclose
Amirreza Manteghinejad, MD (*Presenter*) Nothing to Disclose

### PURPOSE

We sought to determine the hallmarks of SLSMD syndromes and define their expected imaging progression to delineate their natural history further.

## METHODS AND MATERIALS

A retrospective, longitudinal study of 40 individuals diagnosed with SLSMDs at three major mitochondrial disease clinical centers was performed. MRI studies were reviewed to assess the prevalence and progression of brain lesions in different regions with statistical significance testing and Kaplan-Meier analysis. Hierarchical cluster analysis was performed for all the involved brain regions to stratify MRI findings into imaging phenotype groups.

## RESULTS

Among 40 SLSMD patients (median age of 9.26 years; IQR: 5.16-13.1), 67.5% had KSS, 15% exhibited KSS with a history of other clinical syndromes, mostly Pearson syndrome progressing to KSS (PSKSS), and 10% had Pearson syndrome only. A well-delineated phenotype could not be specified (NOS) for 1 (2.5%) individual, and 2 (5%) individuals had CPEO-plus (CPEO + additional extra-ocular symptoms). Initial MRI of KSS patients regardless of initial presentation revealed predominant lesions within selective areas of the upper brainstem tegmentum. Follow-up MRIs available for 26 patients showed lesion progression along other brainstem areas and white matter, the latter with typical centripetal progression. Log-rank tests demonstrated varying onset times by lesion type. Cluster analysis revealed two distinct neuroimaging groups: (1) pure KSS, CPEO-plus, and PSKSS versus (2) pure PS and NOS individuals. KSS and PSKSS showed indistinguishable neuroimaging features regardless of initial clinical presentation.

## CONCLUSION

We describe the first comprehensive cross-sectional and longitudinal neuroimaging pattern analysis in a multi-center clinical SLSMD disease cohort, delineating a predictable progression of brain lesions regardless of their presenting clinical feature. Understanding this complex pattern and disease progression will facilitate earlier diagnosis, natural history understanding, and future design of targeted interventions and therapies in SLSMD disorders.

## CLINICAL RELEVANCE/APPLICATION

This study provides a detailed imaging analysis of SLSMDs, highlighting distinctive imaging features and predictable imaging progression of KSS patients which are overall indistinguishable from CPEO-plus and PSKSS individuals, but highly different from isolated PS. KSS disorders manifest a distinct pattern of lesion distribution in the brain, with selective involvement of the brainstem nuclei, tegmental tracts, and basal ganglia structures representing the early imaging manifestations of these disorders.

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# Abstract Archives of the RSNA, 2024

R5A-SPPH

**Physics Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPPH-10 REDUCTION OF RADIATION BURDEN DUE TO MR-ONLY TREATMENT PLANNING FOR PROSTATE RADIOTHERAPY

Stefano Presilla (*Abstract Co-Author*) Nothing to Disclose
Margherita Casiraghi (*Abstract Co-Author*) Nothing to Disclose
Jeanne Berg (*Abstract Co-Author*) Nothing to Disclose
Luca Bellesi, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The use of MR-based synthetic CT (sCT) for radiotherapy (RT) planning improves target and OARs delineation, and enhances patient comfort and safety by reducing exams and imaging dose. We aim to evaluate the decreased radiation burden on the Ticino population from sCT for prostate RT.

### METHODS AND MATERIALS

The study included 188 prostate cancer patients treated with RT at our center. The percentage undergoing MR-only RT was determined. The validity of sCT planning was previously assessed by comparing dose distributions for 50 patients calculated on both sCT and standard planning CT (pCT), with a 1% dose difference acceptance threshold. The Radimetrics application was used to assess the mean cumulative effective dose (CED) per patient from pCTs. Using Ticino cancer register and our center data, the annual number of prostate patients benefiting from MR-only RT in our region was obtained. The total spared effective dose was calculated and the decrease in the collective dose was obtained considering the population subgroup of males over 40 years. The reduction of radiation-induced tumors was estimated based on BEIR VII data for the same subgroup.

### RESULTS

65% of patients could be treated with MR-only RT, while the remaining had a pCT. 5% of patients had contraindication to MR, and 30% required pCT as a backup due to sCT reconstruction failures from issues like metal implants, non-standard anatomy, or rectum-bladder preparation. The mean CED per patient was 14.2 mSv with 16% of patients having more than one pCT due to preparation issues. MR-only RT in Ticino resulted in an annual dose sparing of 1.1 Sv, leading to a collective dose spare of 11.4 μSv/year per capita and a reduction of 0.1 radio-induced tumors/year. Extrapolating to the Swiss population indicated a reduction of 2.6 tumors/year.

### CONCLUSION

While pCT dose is a small part of the dose delivered to RT patients, it impacts the lifetime CED and the population radiation burden. The wider use of MR-only RT, beyond clinical benefits, holds the potential to mitigate the detriment from medical exposure.

### CLINICAL RELEVANCE/APPLICATION

reducing imaging dose in radiation Therapy using MRI will be the future approach to optimize the dose to targe and Organs at risk.

## R5A-SPPH-2 LOW-DOSE HIGH-RESOLUTION PHOTON-COUNTING CT OF THE PARANASAL SINUS IN ADULTS WITH CYSTIC FIBROSIS: AN INTRAINDIVIDUAL RADIATION DOSE AND QUALITY STUDY

Marko Frings, MSc (*Abstract Co-Author*) Nothing to Disclose
Cornelius Deuschl (*Abstract Co-Author*) Nothing to Disclose
Yan Li (*Abstract Co-Author*) Nothing to Disclose
Denise Bos, MD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Zensen, MD (*Abstract Co-Author*) Nothing to Disclose
Marcel Opitz, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Forsting, MD (*Abstract Co-Author*) Nothing to Disclose
Abdullatif Kocak, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Patients diagnosed with Cystic fibrosis (CF) routinely undergo low-dose, high-resolution (LD-HR) CT scans of the paranasal sinuses as a crucial component of their clinical care plan and for disease management. The aim of this study was to assess and compare the intra-individual radiation dose and image quality between photon-counting CT (PCCT) and energy-integrating detector system (EID-CT) CT scanners using LD-HR protocols.

### METHODS AND MATERIALS

This retrospective analysis included 23 people with CF who underwent LD-HR CT scan of the paranasal sinuses with EID-CT and PCCT in clinical routine. In all patients, image quality was assessed using the signal-to-noise ratio (SNR). Three radiologists rated the overall image quality, sharpness, and noise of the paranasal sinuses on a 5-point Likert scale. To evaluate the radiation dose, an intra-individual comparison was performed in patients who had

previously undergone a similar examination with an EID-CT using the following parameters: effective dose, dose-length product (DLP) and volumetric CT dose index (CTDIvol).

**RESULTS**

PCCT demonstrated a reduction in radiation dose of approximately 37% compared to EID-CT (0.09 vs. 0.15 mSv, p<0.0001). The effective organ dose reduction was 43% for the eye lens (3.65 vs. 6.38 mSv, p<0.0001) and 39% for the brain (2.29 vs. 3.75 mSv, p<0.0001). PCCT consistently achieved superior scores for both overall image quality and image sharpness in comparison to EID-CT (p<0.0001). The mean SNR of PCCT was higher compared to the EID-CT (p<0.0001).

**CONCLUSION**

PCCT scans of the paranasal sinuses offer superior image quality and substantially reduce radiation exposure compared to EID-CT scans in people with cystic fibrosis.

**CLINICAL RELEVANCE/APPLICATION**

Since CF is a hereditary disease and patients accumulate a significant radiation exposure throughout their lives, the importance of radiation-associated diseases and the need for comprehensive strategies to minimize radiation exposure are paramount to avoid the risk of malignancy and damage to adjacent radiosensitive organs.

## R5A-SPPH-4 LATINSAFE INITIATIVE: MULTICENTER INTERNATIONAL STUDY TO ESTABLISH CLINICAL INDICATION BASED DIAGNOSTIC REFERENCE LEVELS FOR HEAD CT IN LATIN AMERICA

Valdair F. Muglia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Flavio Morgado (*Abstract Co-Author*) Nothing to Disclose
Felipe Kiipper (*Abstract Co-Author*) Nothing to Disclose
Nathan Wang (*Abstract Co-Author*) Nothing to Disclose
Monica O. Bernardo, MD (*Abstract Co-Author*) Nothing to Disclose
Parisa Kaviani, MD (*Abstract Co-Author*) Nothing to Disclose
Emiliano Garza Frias, MD (*Abstract Co-Author*) Nothing to Disclose
Anushree M. Burade, MBBS (*Abstract Co-Author*) Nothing to Disclose
Seyedehelaheh Hosseini, MD (*Abstract Co-Author*) Nothing to Disclose
Javier Contreras Yametti, MD (*Abstract Co-Author*) Nothing to Disclose
Roshan Fahimi, MD (*Abstract Co-Author*) Nothing to Disclose
Lina Karout, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The LatinSafe initiated efforts to establish clinical indication-based diagnostic reference level (DRLCI) for pediatric CT across multiple Latin American countries. In the ongoing initiative, we describe the initial results for DRLCI of head CT in children across multiple sites in Latin America.

**METHODS AND MATERIALS**

With local ethical committee approvals, we received data from 13 sites from 5 Latin American countries on 831 children (age < 18 years; F:M 427:831). All patients underwent head CT examinations. Collected data included demographic data (age, sex), CT scanner information (brand, model, number of detectors), scan acquisition factors (kV, mA, number of phases), clinical indication for CT, and radiation doses (dose length product - DLP and median volume CT dose index -CTDIvol). We calculate the total DLP (in mGy.cm) and median CTDIvol (mGy). We estimated overall and site-specific 50th (achievable doses - AD) and 75th percentile (diagnostic reference level - DRL) CTDIvol and DLP for each patient age group (0-<1, 1-<2, 2-<6 and 6-18 years) and clinical indication groups.

**RESULTS**

The ADs for the CTDIvol for Latin America were lower than the US standards for all age groups [0-<1 year: 17 vs. 19 mGy for US, 1-<2 years: 20 vs. 22 mGy for US, 2-<6 years: 21 vs. 25 mGy for US, 6-18 years: 31 vs. 46 mGy for US) (p<0.001). However, the ADs for DLP values were significantly higher than the US standards for all age groups (0-<1 year: 583 vs. 267 mGy for USA, 1-<2 years: 577 vs. 350 mGy for USA, 2-<6 years: 732 vs. 409 mGy for USA, 6-18 years: 937 vs. 748 mGy for USA) (p<0.001). Almost 95% (782/831) of all head CT were performed with a single acquisition phase. Compared with the typical 12-14 cm scan length for head CT exams, higher DLP was attributed to longer scan lengths with 15% of the head CTs with >23 cm scan lengths. Interestingly, there was a significant difference in radiation doses in all age groups between CT manufacturers with the highest dose CT vendor (0<1 year: CTDIvol 36 [26-44] mGy, 1-<2 years: CTDIvol=29 [22-40] mGy, 2-<6 years: CTDIvol=32[26-42] mGy and 6-18 years: CTDIvol=45[41-50]mGy) being significantly different from the lowest dose CT vendor (0<1 year: CTDIvol=11[8-17] mGy, 1-<2 years: CTDIvol=14[14-24] mGy, 2-<6 years: CTDIvol=14[14-17] mGy and 6-18 years: CTDIvol=16[14-26]mGy) (p<0.001).

**CONCLUSION**

Longer than necessary scan lengths for head CT are responsible for higher DLP in most Latin American sites despite having substantially lower CTDIvol values.

**CLINICAL RELEVANCE/APPLICATION**

There is a need for education and optimization regarding scan length reduction for head CT examinations.

## R5A-SPPH-5 ALL-IN-ONE DEEP LEARNING FRAMEWORK FOR MR IMAGE RECONSTRUCTION

Hyeonsoo Kim (*Abstract Co-Author*) Nothing to Disclose
Kyungeun Jang (*Abstract Co-Author*) Nothing to Disclose
Joonyoung Yang (*Abstract Co-Author*) Nothing to Disclose
Jeewook Kim (*Abstract Co-Author*) Nothing to Disclose
Geunu Jeong (*Presenter*) Nothing to Disclose

**PURPOSE**

This research introduces a novel, all-in-one deep learning framework for MR image reconstruction, enabling a single model to enhance image quality across multiple aspects of k-space sampling and to be effective across a wide range of clinical and technical scenarios.

**METHODS AND MATERIALS**

1.5 million MR raw data of various pulse sequences and anatomical regions from three vendors were collected. Multi-dimensional degradation was applied to raw k-space data to generate training input. This process involved a combined application of noise addition and multiple patterns of undersampling (uniform, random, kmax, partial Fourier, elliptical), with each method being applied across a range of factors to cover extensive sampling scenarios. Contextual data, including scan parameter information, were prepared to serve as auxiliary input to address the challenges posed by the unique learning task for each training pair, which arise from the varied degradation scenarios. The U-Net was modified to include an additional pathway for integrating contextual data.

**RESULTS**

Six performance evaluations were conducted through visual comparisons. 1) A series of deep learning reconstructions (DLRs) was applied to the same image, each adding a new dimension of improvement - starting with noise reduction, then adding frequency kmax, phase partial Fourier, phase kmax, to slice kmax. Incremental enhancement along each added dimension was demonstrated, confirming simultaneous multi-dimensional improvements. 2) A relative edge sharpness of approximately 3.0 between original and DLR images, indicating effective super-resolution, was achieved in each of the three encoding directions. 3) DLR images showed reduced truncation and intravoxel dephasing artifacts, which are prominent at lower resolutions, attributed to slice-directional super-resolution. 4) Images obtained from eight different sets of scan parameters that adjusted sampling and reconstruction pipeline, along with 5) images from three unseen vendors, demonstrated significant quality improvement after DLR, highlighting broad compatibility. 6) Image pairs from standard and fast protocols across four anatomical regions were acquired, with the fast images undergoing DLR. The DLR fast images exhibited superior quality compared to the standard images, demonstrating the feasibility of reducing scan times.

**CONCLUSION**

The proposed model enhances image quality in a multi-dimensional manner and offers versatility.

**CLINICAL RELEVANCE/APPLICATION**

The proposed model is compatible with a broad spectrum of scenarios, including various vendors, pulse sequences, scan parameters, and anatomical regions. Its DICOM-based operation particularly enhances its applicability for real-world applications.

## R5A-SPPH-6 BEAM CHARACTERIZATION AND IMAGE QUALITY ANALYSIS OF A SILVER FILTER FOR LOW DOSE LUNG CANCER SCREENING CT: A PHANTOM STUDY

Izabella Barreto, PhD (*Abstract Co-Author*) Nothing to Disclose
Graham Stoddard, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

A commercial silver filter was introduced to reduce radiation dose in low dose lung cancer screening CT (LDCT) exams. This study compares x-ray beam quality and phantom image quality using clinical LDCT protocols with and without the silver filter.

**METHODS AND MATERIALS**

We looked at two filters commercially installed in the same CT scanner: a large bowtie filter and a new flat silver filter. Half-value layer (HVL) was measured with all available kVp settings using a parked x-ray tube and with a helical scan and lead aperture. The ACR CT accreditation phantom was scanned with 5 dose levels (0.5, 0.9, 1.6, 2.1, 2.8 mGy) using 120 kVp, 0.275 s rotation time, pitch of 0.81, and 40 x 0.5 mm beam width. Images were reconstructed using a deep learning algorithm with 0.5 and 1.0 mm slices using a body sharp kernel and 0.5 mm slices using a lung kernel. Task Transfer Function (TTF), Contrast to Noise Ratio (CNR), and Noise Power Spectrum (NPS) were measured using an image analysis tool, imQuest.

**RESULTS**

For all kVp settings, HVL was significantly higher for the silver filter (Range: 10.71 - 15.91 mm Al) than the large bowtie filter (Range: 7.68 - 11.56 mm Al) ($p<0.05$). With its increased filtration, the silver filter had to use higher tube currents to achieve the dose levels. For all dose levels the 10% TTF value was 9.5% lower on average and for the 2 highest dose levels, this caused the scanner to use the larger focal spot, degrading spatial resolution compared to the large bowtie filter. For example, the bone insert reconstructed with the body sharp kernel had a 10% TTF of 1.04 mm-1 for the silver filter and 1.25 mm-1 for the large filter ($p<0.05$). At equivalent dose levels, the silver filter produced better noise (average: 9% lower) and CNR (average: 16.1% higher) than the large filter. For example the 0.5 mm thick lung images had a noise magnitude of 45.43 HU for the silver filter and 62.5 HU for the large filter ($p<0.05$). The silver filter did not significantly affect the noise texture at any dose level or reconstruction ($p>0.05$), indicating a similar visual match.

**CONCLUSION**

We measured that the silver filter can maintain noise and CNR with lower doses, or alternatively, produce better noise and CNR at matched dose levels. However, we also found worsened spatial resolution, which may be detrimental in annual LDCT exams. CT imaging is a balance and the reduced spatial resolution underscores why image quality must be considered for clinical adoption of new technology.

**CLINICAL RELEVANCE/APPLICATION**

A CT filter made of silver can reduce radiation dose in annual LDCT exams, however its effect on image quality demonstrates why protocol optimization for specific clinical tasks is vital. The technology presents multiple options for radiation dose and image quality optimization to meet clinical needs.

## R5A-SPPH-8 EVALUATION OF DOSE AND IMAGE QUALITY IN INNER EAR IMAGING: COMPARISON BETWEEN COMPUTED TOMOGRAPHY AND 3D ROTATIONAL ANGIOGRAPHIC ACQUISITIONS

alessandro cianfoni, MD (*Abstract Co-Author*) Nothing to Disclose
Elisa Ventura (*Abstract Co-Author*) Nothing to Disclose
Francesco Magoga, BSc (*Abstract Co-Author*) Nothing to Disclose
Gaetano Cancellato (*Abstract Co-Author*) Nothing to Disclose
Stefano Presilla (*Abstract Co-Author*) Nothing to Disclose
Luca Bellesi, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

An intercomparison was made to evaluate the relationship between radiation dose and image quality of two different diagnostic modalities carried out on inner ear diagnostic studies. Evaluations were made by comparing the diagnostic examinations, both simulated on two different phantoms, made by a multi-detector computed tomography (MDCT) scanner with respect to the same examinations carried out with an interventional angiography system, which can perform 3D rotational acquisitions (3DRA) reconstructed with CT-like advanced techniques.

## METHODS AND MATERIALS

All radiological images were acquired both using a 256-slice MDCT scanner and a biplane interventional angiography system integrated with 3DRA. Image quality for radiological systems was evaluated both using a CT Catphan phantom and a head anthropomorphic phantom. The scans of the two phantoms were performed both with standard and optimized protocols of study. Dosimetric measurements were also performed using a head-CTDI phantom and a pencil-type CT chamber connected with a calibrated electrometer. Dosimetry evaluation were done taking into account CTDI, DLP, DAP and effective dose calculated, for both MDCT and 3DRA acquisitions, using two different Monte Carlo systems to convert dose parameters to effective dose. Image quality was assessed, on phantom images, with an interventional radiologist evaluating high contrast spatial resolution, image noise and details detectability.

## RESULTS

Effective doses calculated with Monte Carlo systems, for both MDCT and 3DRA image acquisitions, are comparable in terms of numerical absolute values. The measures, carried out with the support of a pencil-type CT chamber, provide a slightly higher value for the images acquired using the interventional angiography system compared to the MDCT acquisitions; it is worth noting that each measurement obtained with the 3DRA has been multiplied by two because it is necessary to acquire one temporal bone at a time while, for MDCT, it is sufficient one single acquisition. 3DRA images showed a higher general image quality level compared to the MDCT images. Image quality was better for the 3DRA images which showed better high contrast spatial resolution, lower image noise and improved details detectability.

## CONCLUSION

Evaluations of image quality, for both the CT Catphan phantom and head anthropomorphic phantom, are in favour of the 3DRA in terms of better high contrast spatial resolution, image noise and details detectability. The dosimetric comparisons show a substantial equivalence between the two types of imaging modalities.

## CLINICAL RELEVANCE/APPLICATION

Knowing and using new imaging methodologies is essential to improve procedures in neurological interventional radiology

RSNA 2024
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# Abstract Archives of the RSNA, 2024

R5A-SPRO

**Radiation Oncology Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPRO-1 INVESTIGATION OF THE ANTI-ANGIOGENIC EFFECT OF CARBON ION IRRADIATION ON C6 GLIOMAS IN RATS

Yu feng Li, MMedSc (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the effects of carbon ion irradiation (CIR) in inhibiting angiogenesis in rat C6 gliomas by combining imaging and molecular pathology.

### METHODS AND MATERIALS

Establishing 78 rat C6 glioma models. Before CIR, all rats were subjected to energy-spectral CT-enhanced scans and 6 rats were randomly selected as molecular pathology controls, the rest were randomly divided into three groups using different doses of carbon ions irradiation (0 Gy, 1 Gy and 2 Gy). Energy-spectral CT-enhanced scans on day 7, 14 and 21 after CIR to obtain the best single-energy CT value (CT 70 keV), iodine concentration (IC) and slope of the energy-spectral curve (K (40-70 keV)) in the solid tumour area and to measure the tumour volume. Then, three rats were randomly selected for HE and immunohistochemical staining for HIF-1 a, VEGF, CD34, a-SMA at each time point in each group; three rats were randomly selected on day 7 and 14 after CIR to collect tumour tissues for the detection of vascular-associated protein expression by WB method.

### RESULTS

The tumour volume in the three groups still increased at 7 days after CIR, gradually decreased at 14 days in the 1 Gy and 2 Gy groups, and decreased significantly at 21 days in the 2 Gy group, while some tumour volumes increased at 1 Gy.Compared with the 0 Gy group, the tumour blood perfusion was reduced in the 2 Gy group at 7 days after CIR, and CT 70 KeV, IC and K (40-70 KeV) decreased; at 14 days after CIR, CT 70 KeV, IC and K (40-70 KeV) decreased significantly in the 1 Gy and 2 Gy groups; at 21 days after CIR, K (40-70 KeV) increased in the 1 Gy and 2 Gy groups. There was a good correlation between the percentage of HIF-1a, VEGF , CD34 and a-SMA positive cells and each quantitative parameter of the energy spectrum CT in each groups. The expression of vascular-related proteins in the 2 Gy group was gradually downregulated after CIR. Survival analysis showed that the survival time of the 1 Gy and 2 Gy groups were significantly higher than the 0 Gy group.

### CONCLUSION

Carbon ion radiotherapy inhibits the angiogenic effects of gliomas.Energy-spectral CT can be used as a non-invasive dynamic monitoring tool to respond to the inhibitory effect of carbon ions on angiogenesis in rat C6 gliomas.

### CLINICAL RELEVANCE/APPLICATION

CIR has the advantages of inverted deep dose distribution and high relative biological effects, and may provide an effective treatment for malignant and recurrent brain tumors. The quantitative energy spectrum parameters allow non-invasive and dynamic monitoring of the inhibitory effect of CIR on the angiogenesis of C6 gliomas in rats and provide a basis for the development of clinical treatment strategies. Our study provides an experimental basis for the clinical application of carbon ion radiation therapy for glioma.

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# Abstract Archives of the RSNA, 2024

R5A-SPVA

**Vascular Imaging Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-SPVA-2 ENHANCING VESSEL VISUALIZATION IN MOYAMOYA DISEASE: A COMPARATIVE ANALYSIS OF RAPID SPIRAL MRA TECHNIQUE

Bing Zhang (*Abstract Co-Author*) Nothing to Disclose
Maoxue Wang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Moyamoya vessels, leptomeningeal and transdural anastomoses play a crucial role in maintaining cerebral perfusion in patients moyamoya disease (MMD). Traditional MRA have a long scan time for visualizing small collaterals. Therefore, finding a fast and effective imaging technique capable of visualizing these collaterals is essential. This study aims to compare the vessel visualization in spiral MRA (MRAspiral) and compressed SENSE MRA (MRACS) in moyamoya disease (MMD) patients, with digital subtraction angiography (DSA) as the reference standard.

### METHODS AND MATERIALS

We prospectively collected MRAspiral with different acquisition windows (t = 4, 6, 10ms), MRACS and DSA images in MMD patients. Contrast-to-noise ratio (CNR) was measured in the M1, M2, M3, and M4 segments of the middle cerebral artery (MCA) for each MRA sequence. Vessel visualization of the distal MCA, leptomeningeal artery (LMA) collaterals, distal external carotid artery (ECA), and distal internal carotid artery (ICA) stenosis was qualitatively analyzed using scoring systems compared to DSA. A linear fixed-effects model was used to evaluate differences among the four sequences.

### RESULTS

A total of 98 hemispheres from 55 MMD patients (28 males, 46 years old ± 12.7) were included. Sixty-seven hemispheres had DSA within 3 months. CNR in the M2, M3 and M4 segment of the MCA was not significantly different between MRACS and MRAt4 or MRAt6, but it was significantly higher than MRAt10 (all $P<0.05$). MRAspiral sequences provided better visualization of the distal MCA, LMA collaterals and distal ECA compared to MRACS (all $P<0.001$). Visualization of distal ICA stenosis was superior in MRAt4 (2.90±0.35) and MRAt6 (2.87±0.39) compared to MRACS ($P<0.001$), while no significant differences was observed between MRCS and MRAt10.

### CONCLUSION

MRAspiral demonstrated superior vessel visualization in MMD patients compared to MRACS, with DSA as the reference standard. MRAt6 significantly reduced acquisition time by 32.31% while maintaining reliable image quality compared to MRACS.

### CLINICAL RELEVANCE/APPLICATION

MRAt6 can be considered as a contrast-free imaging method for evaluating vessels in MMD patients, which could aid in surgical decision-making and follow-up assessment.

# Abstract Archives of the RSNA, 2024

R5B-SPBR

**Breast Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPBR-1 BACKGROUND ECHOTEXTURE CLASSIFICATION OF PREOPERATIVE AUTOMATED BREAST US: ASSOCIATION WITH OUTCOMES IN EARLY-STAGE BREAST CANCER PATIENTS

Ji Soo Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Myoung Kyoung Kim (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate whether the background echotexture classification of preoperative ABUS is associated with the accurate preoperative evaluation of tumor extent or post-treatment recurrence in early-stage breast cancer patients.

### METHODS AND MATERIALS

A retrospective review of the collected databases of the multicenter prospective study (NCT04607473) identified women with early-stage breast cancers (clinical Tis, T1-2/N0) treated by surgery who had undergone ABUS adjunct to FFDM for preoperative local tumor staging between Oct 2019 and Apr 2021 at our institution. BE of preoperative ABUS was assessed in contralateral normal breast with BI-RADS classification (homogeneous-fat, homogeneous-fibroglandular, or heterogeneous) in all patients. In patients with mammographically dense breasts, glandular tissue component (GTC) was additionally assessed and grouped (high [moderate or marked] or low [minimal or mild]). Logistic regression was used to determine factors associated with accurate preoperative tumor extent evaluation of ABUS. Cox regression modeling was used to determine factors associated with post-treatment recurrence.

### RESULTS

Among 409 women (mean age, 50.2 years ± 8.7 [standard deviation]), 11 recurrences with a median follow-up of 26 months were detected. For preoperative local tumor stating, moderate or marked BPE on MRI (HR, 2.3 [95% CI: 1.1, 5.0], P=.033) was associated with inaccurate ABUS evaluation in patients with dense breasts. However, BE or GTC of ABUS showed no association with ABUS accuracy. For post-treatment recurrence, receiving adjuvant chemotherapy (HR, 4.6 [95% CI: 1.1, 19.2]; P =.039), pathologic invasive cancer size (HR, 2.2 [95% CI: 1.1, 4.2]; P =.022) and heterogeneous BE on ABUS (HR, 6.5 [95% CI: 0.3, 162.2]; P =.002) were independently associated with an increased risk of recurrence in all patients. In patients with dense breasts, pathologic invasive cancer size (HR, 2.1 [95% CI: 1.1, 4.1]; P =.028), moderate to marked GTC on ABUS (hazard ratio [HR], 10.4 [95% CI: 2.6, 42.4]; P = .001) and heterogeneous BE on ABUS (HR, 17.7 [95% CI: 3.2, 97.5]; P =.001) were independently associated with an increased risk of recurrence.

### CONCLUSION

In early-stage breast cancer patients, heterogeneous BE on ABUS was associated with recurrence but not with the accuracy of its preoperative local tumor staging. In patients with mammographic dense breasts, moderate to marked GTC of ABUS was also associated with recurrence but not with the accuracy of its preoperative local tumor staging.

### CLINICAL RELEVANCE/APPLICATION

Based on our research findings, BE and GTC of ABUS may serve as imaging markers to predict prognosis in early-stage breast cancer patients when ABUS is used as their preoperative staging tool.

## R5B-SPBR-10 RATES AND CHARACTERISTICS OF FALSE-NEGATIVE CANCERS WITH DIGITAL BREAST TOMOSYNTHESIS AMONG CAUCASIAN, AFRICAN AMERICAN, AND ASIAN WOMEN

Manisha Bahl, MD, MPH (*Abstract Co-Author*) Consultant, Lunit Inc;Expert Advisory Committee, 2nd.MD
Ariel Kniss, MD, PhD (*Presenter*) Intern, General Electric Company

### PURPOSE

Recent United States Preventive Services Task Force guidelines emphasize disparities in breast cancer outcomes among racial groups and comment about insufficient evidence about the effectiveness of mammographic screening for certain subgroups of women. The symptomatic false-negative rate (FNR), or interval cancer rate, of screening digital breast tomosynthesis (DBT) is considered to be a surrogate marker for long-term patient outcomes. The purpose of this study is to determine rates and characteristics of false-negative (FN) cancers with DBT among Caucasian, African American, and Asian women.

### METHODS AND MATERIALS

In this IRB-approved and HIPAA-compliant study, consecutive screening mammograms from January 2013 to June 2019 at an academic medical center were retrospectively reviewed. During this time period, all women presenting for screening mammography underwent combined DBT and digital 2D mammography. Breast cancers were considered FN cancers if diagnosed within 365 days of a negative screening examination. Medical records were

reviewed for patient age, race, mammographic breast density, mode of detection of the FN cancer, biopsy pathology results, and surgical pathology results. Rates and characteristics of FN cancers were compared among Caucasian, African American, and Asian women using standard statistical tests.

**RESULTS**

The overall FNR was 0.8 per 1000 screening examinations (231/279,165). The FNR was 0.9 per 1000 screening examinations in Caucasian women, 0.5 per 1000 in African American women, and 0.6 per 1000 in Asian women (p=0.25). The proportions of FN cancers detected on high-risk screening MRI in Caucasian, African American, and Asian women were 30.8%, 0%, and 50.0%, respectively. Asian women had the lowest proportion of invasive relative to in situ FN cancers, with 60.0% invasive cancers and 40.0% in situ cancers (p=0.02). In African American women, invasive FN cancers were more likely to be grade 3 (p<0.01) and triple-negative (p=0.01). No significant differences were observed in invasive FN cancer size at surgery or lymph node positivity among Caucasian, African American, and Asian women.

**CONCLUSION**

In our study cohort undergoing breast cancer screening with DBT, the FNR was 0.8 per 1000 screening examinations. The results suggest that FN cancers in African American women are more aggressive than FN cancers in Caucasian and Asian women.

**CLINICAL RELEVANCE/APPLICATION**

Further research is needed to understand factors associated with more aggressive FN breast cancers in African American women, which may include lower utilization of high-risk screening MRI; the role of supplemental screening with MRI in women at risk for interval cancers with DBT alone; and the impact of screening with DBT on long-term patient outcomes.

## R5B-SPBR-2 COMPARISON OF LONG-TERM PERFORMANCE METRICS FOR SCREENING MAMMOGRAPHY USING DIGITAL BREAST TOMOSYNTHESIS COMPARED WITH 2D MAMMOGRAPHY

Liane E. Philpotts, MD (*Abstract Co-Author*) Nothing to Disclose
Jihyun Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Rasha Ismail, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Digital breast tomosynthesis (DBT) has been shown in many studies to have improved metrics compared with 2D mammography. Whether initial improvements in metrics are sustained over time is less well established. The purpose of our study was to evaluate long-term screening performance metrics and outcomes of 2D mammography versus digital breast tomosynthesis.

**METHODS AND MATERIALS**

This is a retrospective historical cohort study utilizing the electronic breast imaging database (PenRad, Buffalo, MN) at a multisite tertiary care academic institution. Our study includes women aged 40-79 years who underwent screening 2D mammography (either film-screen or digital mammography) over a 12-year period (August 1999 to July 2011) and women who underwent screening DBT over the subsequent 12-year period (August 2011 to July 2023). All studies were read by dedicated, subspecialized breast imagers that varied over the 24 years. We compared the outcomes of recall rate (RR) over all 24 years. Information on Cancer Detection Rate (CDR) and positive predictive value of recall (PPV1) was available from 2006 through 2023. In addition, the recall rates for the two cohort groups were assessed by breast density categories. (A: almost entirely fatty; B: scattered areas of fibroglandular density; C: heterogeneously dense; D: extremely dense).

**RESULTS**

109,801 2D mammograms and 300,451 DBT mammograms were interpreted during the respective periods for a total of 410,252 screening mammograms. The RR for 2D mammography averaged 12.5% (range 10-15). DBT had a lower average RR of 7.8% (range 7-9). This difference is statistically significant. (p<0.00001). DBT had a sustained significantly higher CDR (average 5.5 per 1000, range 5-6) compared with 2D (3.4 per 1000, range 3-4) and higher positive predictive value of recall (PPV1) (7.4 for DBT vs. 3 for 2D) (p<0.00001). 2D mammography had a significantly higher RR than DBT for all dense breast categories (A:8% vs 4%; B:11% vs 7%; C:17% vs 8%; D:14% vs 8%,respectively) (p<0.00001).

**CONCLUSION**

DBT has significantly better performance metrics than 2D mammography with sustained lower RR and higher CDR and PPV1 rates.

**CLINICAL RELEVANCE/APPLICATION**

Our study further supports the use of DBT over 2D mammography by reducing unnecessary callbacks from screening while improving cancer detection. Clinically, this should improve breast cancer outcomes.

## R5B-SPBR-3 PROGNOSTIC ANALYSIS AND RISK FACTORS FOR REGIONAL RECURRENCE IN BREAST CANCER: CLINICAL SIGNIFICANCE OF INTERVAL REGIONAL RECURRENCE

Eun Sook Ko, MD (*Abstract Co-Author*) Nothing to Disclose
Myoung Kyoung Kim (*Presenter*) Nothing to Disclose

**PURPOSE**

Adjuvant treatment advancements have reduced isolated regional breast cancer recurrence to <2%. However, research on interval regional recurrence in women with personal breast cancer history (PHBC) is limited. This study examines survival outcomes and risk factors for screening-detected and interval regional recurrences.

**METHODS AND MATERIALS**

This retrospective cohort study examined medical records of patients who underwent invasive breast cancer surgery at a single institution from January 2011 to December 2019. Surveillance breast ultrasound, including axilla, internal mammary, and supraclavicular areas, was conducted semiannually for five years, then annually for those with PHBC. Interval regional recurrences were recurrences diagnosed after negative screening but before the next scheduled screening. Overall survival (OS) rates were estimated and compared across cohorts using time-dependent Cox regression. Factors associated with regional and interval regional recurrences were evaluated using the multivariable Fine-Gray subdistribution hazard model.

**RESULTS**

Among 13,406 women (mean: 49.8 years ± 10 [SD]), 126 (0.9%) developed regional breast cancer recurrence during a median follow-up of 6.5 years. This included 61 ipsilateral axillary, 39 ipsilateral internal mammary, 22 ipsilateral supraclavicular, one both axillary and internal mammary, and three both axillary and supraclavicular lymph node recurrences. Among these, 37 cases (0.3%) were interval regional recurrences. Patients with screening-detected and interval regional recurrences showed significantly poorer OS than those without recurrence. While interval regional recurrences tended to

have worse OS, it was not statistically significant (HR: 1.7 [0.6, 4.3]; P = .27). High nuclear grade (HR: 4.4 [0.2, 1.7]; P = .003) and high nodal stage at initial diagnosis (HR: 2.1 [1.2, 3.6]; P = .008) were associated with increased risk for regional recurrence. For interval regional recurrence, high nuclear grade, high nodal stage, and lymphovascular invasion were associated with increased risk, with hazard ratios of 7.7 (0.9, 63.2; P = .05), 1.3 (0.6, 2.1; P = .03), and 3.1 (1.5, 6.5; P = .002), respectively.

**CONCLUSION**

Our study indicates that patients with interval regional recurrence exhibit significantly poorer overall survival, associated with higher nuclear grade, higher nodal stage, and the presence of lymphovascular invasion.

**CLINICAL RELEVANCE/APPLICATION**

Enhanced postoperative screening protocols are recommended for patients at risk of interval regional recurrence, including those with higher nuclear grade, higher nodal stage, and lymphovascular invasion. Chest CT or PET-CT could offer early detection, potentially improving survival outcomes.

## R5B-SPBR-4 PATIENT SELF-PAY FOR AI-DRIVEN ENHANCED REVIEW PROGRAM IN SCREENING MAMMOGRAPHY: INITIAL EXPERIENCE

Leeann Louis, BS, PhD (*Abstract Co-Author*) Researcher, RadNet, Inc
A. Gregory Sorensen, MD (*Abstract Co-Author*) Employee, RadNet, Inc;Board member, IMRIS Inc;Board member, Siemens AG;Board member, DFB Healthcare Acquisitions Corp;Board member, inviCRO, LLC;;;;
Jacqueline S. Holt, MD (*Abstract Co-Author*) Nothing to Disclose
Janet M. Storella, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Bryan Haslam, PhD (*Presenter*) Employee, RadNet, Inc

**PURPOSE**

Though AI for screening mammography has garnered significant attention, adoption has been modest, perhaps in part because AI is not reimbursed. Some practices have elected to offer AI at additional cost, much like what was done when digital breast tomosynthesis was originally deployed. While quantification of benefit will require prospective controlled trials, and it is difficult to separate enrollment bias from the effectiveness of AI, we seek to share data from experience with initial implementations from several different practices that implemented a self-pay AI program.

**METHODS AND MATERIALS**

A self-pay AI-driven screening mammography program was deployed across 10 clinical practices ranging from a few sites up to 64 sites at the largest practice. Women who enrolled had FDA-cleared AI software applied to their mammogram and in relevant cases a safeguard review by a second interpreting radiologist. Cancer detection rate, recall rate and positive predictive value were calculated per practice using routine MQSA methodology.

**RESULTS**

Results were collected on 747,604 women who underwent screening mammography over a 12 month period and who were offered the option to pay for the AI-driven enhanced review. 23% of women chose to enroll, with the enrollment rate increasing over time (final month, 33% enrollment). The overall cancer detection rate was on average 43% higher for enrolled women vs unenrolled women (5.95 vs 4.15 per 1000). Overall, the recall rate was 21% higher for enrolled vs unenrolled women (10.9% vs 8.8%) and the positive predictive value (PPV1) was 15% higher (5.4% vs 4.6%). The higher PPV1 indicates each recall resulted in more cancer diagnoses in the enrolled population. All 10 practices saw a substantially higher CDR in enrolled women compared to unenrolled women.

**CONCLUSION**

Initial data shows significantly higher rates of cancers detected in a population enrolling in an AI-enhanced breast screening program. One limitation of these initial results is that the differences observed are a combination of the impact of the AI program and patient self-selection, this merits further research.

**CLINICAL RELEVANCE/APPLICATION**

Self-pay programs may be a way for patients to get access to AI-enhanced screening care that could result in more cancers detected early.

## R5B-SPBR-5 EXAMINING THE EFFICACY: DOES TELEPHONE COMMUNICATION OF BREAST DENSITY ENHANCE SCREENING BREAST ULTRASOUND UPTAKE

Stamatia V. Destounis, MD (*Presenter*) Medical Advisory Board, iCad, Inc

**PURPOSE**

To determine if communicating breast density via telephone would increase the likelihood that a woman would pursue screening breast ultrasound.

**METHODS AND MATERIALS**

Beginning in June 2023, we incorporated a telephone call to communicate with patients with heterogeneously dense or extremely dense breast tissue. The purpose of the call was to inform patients of their breast density and the option for supplemental screening with breast ultrasound. In this timeframe, we have had approximately 7,755 patients identified as having dense tissue but not having a screening breast ultrasound scheduled. 542 patients were excluded from being contacted due to: being recalled from their screening mammogram, having been spoken to at the time of their appointment about their breast density, had previously expressed they were not interested in having a screening ultrasound, resulting in 7,213 patients remaining. These patients were personally contacted by one of 4 trained staff members to review with the patient that she has dense breast tissue and to discuss the recommendation for supplemental screening ultrasound.

**RESULTS**

At the time of the telephone conversation, approximately 23.5% (1693/7213) scheduled an ultrasound for either the same year or at the time of their next annual screening mammogram. 21% (n=1487) declined scheduling an ultrasound; 65/1487 (4.4%) did call back and schedule. Lack of insurance coverage was the predominant reason for the decline. 8% of patients (n=606) stated they would like to speak with their primary care physician and would call back if they would like to pursue scheduling; of which 15% (n=88) did call back and schedule. 45% (3270/7213) had a message left or there was no answer, or no voicemail set up. Of these, 18% called back and scheduled (602/3270). 9 (0.1%) patients expressed that they were unhappy with receiving a phone call.

**CONCLUSION**

The overall response from patients was positive when receiving a phone call to discuss their breast density and the recommendation for screening ultrasound. We found that 33% of patients contacted scheduled a screening ultrasound. The biggest barrier to pursuing ultrasound from the patient's

perspective was the lack of insurance coverage.

**CLINICAL RELEVANCE/APPLICATION**

In NYS we have had breast density notification legislation since 2013. Since that time our private practice has been notifying patients in writing of their tissue type and offering screening breast ultrasound. Despite years of notification, some patients have not pursued additional screening.

## R5B-SPBR-7 EARLY PREDICTION OF NEOADJUVANT CHEMOTHERAPY RESPONSE IN BREAST CANCER PATIENTS BASED ON 3D PRESSURE ESTIMATION

Priscilla Machado, MD (*Abstract Co-Author*) Nothing to Disclose
Basak E. Dogan, MD (*Abstract Co-Author*) Research Grant, Seno Medical Instruments, Inc;Research Grant, MedCognetics, Inc
Kenneth L. Hoyt, PhD (*Abstract Co-Author*) Nothing to Disclose
Corinne Wessner (*Abstract Co-Author*) Consultant, Bracco Group
Maysa Abu-Khalaf (*Abstract Co-Author*) Nothing to Disclose
Flemming Forsberg, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research support, Canon Medical Systems Corporation;Research support, General Electric Company;Speaker, General Electric Company;Research support, Siemens AG;Research Grant, Butterfly Network, Inc;Research support, Lantheus Medical Imaging, Inc;Research support, Bracco Group
Berat Bersu Ozcan, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica H. Porembka, MD (*Abstract Co-Author*) Nothing to Disclose
Nisha Unni, MD (*Abstract Co-Author*) Advisory Board, Eisai Co, Ltd
Dominique James (*Abstract Co-Author*) Nothing to Disclose
Kibo Nam, PhD (*Presenter*) Equipment support, Canon Medical Systems Corporation;Equipment support, General Electric Company ;Support, Lantheus Medical Imaging;Research funded, Canon Medical Systems Corporation

**PURPOSE**

Elevated interstitial fluid pressure in breast cancers may promote disease progression by preventing the effective uptake of therapeutic agents. The aim of this ongoing multi-site study is to develop a new functional marker for early prediction of breast cancer response to NAC based on 3D pressure estimates using contrast-enhanced US (CEUS).

**METHODS AND MATERIALS**

This ongoing, prospective study enrolls patients scheduled to undergo NAC for breast cancer at two clinical sites. 3D CEUS with subharmonic-aided pressure estimation (SHAPE) was used to estimate the pressure gradient between breast tumor and adjacent tissue noninvasively. SHAPE utilizes the strong inverse linear relationship between subharmonic signal intensity from US contrast agents and ambient pressure. At 0, 10, and 30% completion of NAC, 3D SHAPE data were collected using a built-in subharmonic mode on a Logiq E9 scanner with an RSP 6-16D probe (GE HealthCare, transmit frequency of 9 MHz). The data were collected with and without intravenous infusion of Definity (Lantheus Medical Imaging). The gradient in the mean subharmonic signal intensity between the tumor and adjacent tissue as well as tumor volume at each time point were compared with the pathological and radiologic NAC response outcomes, independently and in combination. Subjects with tumor volume reduction =90% at 100% completion of NAC were considered radiologic responders.

**RESULTS**

The analysis included 31 subjects with 1 subject pending pathological outcome and 1 subject missing radiologic outcome. There were 11 subjects with pCR and 16 radiologic responders. The subharmonic signal difference between the tumor and adjacent tissue was significantly higher in pCR than in non-pCR subjects as well as in radiologic responders than in non-responders at 10% and 30% completion of NAC ($p<0.05$). The tumor size was not significantly different between pCR and non-pCR or between the radiologic responders and non-responders at any time point ($p>0.1$ and $p>0.06$, respectively). The areas under the receiver operating characteristic curves (AUCs) for detecting pCR/radiologic responders by the pressure gradient at 10% and 30% completion of NAC were 0.69/0.76 and 0.86/0.82, respectively. The AUCs for detecting pCR/radiologic responders at 10% completion of NAC were further improved to 0.82/0.87 by combining the pressure gradient and tumor volume.

**CONCLUSION**

Our preliminary results suggest that the SHAPE pressure gradients at two early time points, i.e.,10 and 30% completion of NAC, may predict pCR and radiologic responders independently or combined with the standard tumor volume measurements.

**CLINICAL RELEVANCE/APPLICATION**

The SHAPE gradient at 10% and 30% completion of NAC can be a new marker to predict NAC response in breast cancer patients.

## R5B-SPBR-8 DIAGNOSTIC MAMMOGRAM WITH TOMOSYNTHESIS IS SUFFICIENT IN THE EVALUATION OF FOCAL PAIN IN "ALMOST ENTIRELY FATTY" BREASTS

Xiaoqin J. Wang, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Aurela I. Clark, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To identify whether ultrasound (US) can be safely omitted in patients 30 years and older, with "almost entirely fatty" breasts, presenting only with focal pain.

**METHODS AND MATERIALS**

In this retrospective cohort, all initial negative/normal Digital Breast Tomosynthesis (DBT) mammograms for focal breast pain without associated symptoms were reviewed for women 30 years and older with "almost entirely fatty" breast composition who presented at our institution over a 5-year period (5/2016 - 5/2021). Subsequently performed targeted US were also reviewed. Women with prior reduction mammoplasty, excisional or benign core biopsy were included. Women were excluded with focal pain in the axilla, additional symptoms, prior history of breast cancer, or implants.

**RESULTS**

45 women ages 30-84 years old (age: mean +/- std, 55 +/- 15) met the inclusion criteria. 9 reported bilateral pain. A total of 54 diagnostic exams were performed, each exam consisted of a unilateral DBT mammogram followed by a focused breast US at the region of the focal pain. 50 out of 54 exams were concordant, both DBT and US were negative. 4 our of 54 exams were discordant, negative DBT, but positive US; 2 US findings were benign at initial assessment, BR2 (6mm cyst and 8mm mass consistent with fat necrosis, with prior sonographic stability), 1 US finding was probably benign, BR3 (a probable intramammary lymph node) confirmed stable at follow up imaging and downgraded to a BR2, and 1 US finding was of low suspicion for malignancy, BR4 with subsequent ultrasound guided biopsy revealing fat necrosis. 33 women with a total of 38 exams had follow up imaging, ranging

from 6 months to7 years, without cancer present at original site of pain. 12 women with a total of 16 exams, had no imaging follow up, and review of clinical notes did not mention pain as a persistent complaint, presumed resolved.

**CONCLUSION**

In our cohort of women with "almost entirely fatty" breasts presenting with focal pain without lump or discharge, we found that the addition of US to a negative or normal DBT did not increase the sensitivity for cancer detection. Our findings suggests that US may be safely omitted in the evaluation of focal breast pain in women who are 30 years and older when initial assessment with DBT mammography is negative for pain.

**CLINICAL RELEVANCE/APPLICATION**

Omitting US in the “almost entirely fatty” breast when initial DBT mammogram is negative/benign, will expedite patient care, reduce patient and health care costs, and increase imaging access for more patients.

## R5B-SPBR-9 PREDICTORS OF MALIGNANCY FOR MAMMOGRAPHIC ARCHITECTURAL DISTORTION

Onalisa D. Winblad, MD (*Abstract Co-Author*) Nothing to Disclose
John Eddy, DO (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study was to determine the effects of associated imaging findings on the likelihood of malignancy for architectural distortion (AD) identified on mammography.

**METHODS AND MATERIALS**

This IRB approved, retrospective cohort study included females, aged 18 and older, without concurrent ipsilateral breast malignancy who underwent needle biopsy at a single academic institution between 01/01/15- 12/31/20 for AD on diagnostic mammogram. Imaging and charts were reviewed to document any associated imaging findings, including mass, calcification, asymmetry, and ultrasound (US) correlate. Pathology outcomes were compared for AD with and without additional imaging findings to determine the positive predictive value (PPV) of AD for malignancy, benign with upgrade potential (BWUP) lesions, or other benign lesions. For BWUP lesions that underwent surgical excision, final surgical pathology was used for analysis.

**RESULTS**

There were 446 patients (mean age 57.6 + 13.3 years) meeting inclusion criteria with pathology yielding breast malignancy in 45.7% (204/446), BWUP lesion in 16.8% (75/446), benign lesion in 37.2% (166/446), and non-breast malignancy in 0.2% (1/446). Of the 446 patients, 59.6% (266/446) had AD with at least one associated mammographic finding and 40.4% (180/446) had no additional findings. For AD with associated mammographic findings, the PPV for malignancy was 57.5% (153/266), for BWUP lesion was 10.5% (28/266), and for benign lesion was 32.0% (85/266). For AD without associated mammographic findings, the PPV for malignancy was 28.3% (51/180), for BWUP lesion was 26.1% (47/180), and for benign lesion was 45.0% (81/180). US was not performed in 3.8% of patients (17/446). US correlate was identified in 95.1% (194/204) cases of malignancy, 73.3 % (55/75) BWUP lesions, and 69.2% (115/166) benign lesions. AD with US correlate had the highest relative risk for malignancy, 4.6 (95% CI: 2.6-9.0).

**CONCLUSION**

AD with at least one associated imaging finding has a high likelihood of malignancy. Isolated AD is most often a benign or BWUP lesion, though still necessitates biopsy due to gt;2% likelihood of malignancy. Close imaging-pathology correlation is needed for cases of AD with US correlate or mammographic mass as these are the strongest imaging predictors of malignancy.

**CLINICAL RELEVANCE/APPLICATION**

AD is increasingly identified on mammography due to widespread adoption of digital tomosynthesis. AD has gt;2% chance of malignancy and requires biopsy. Pathology of AD frequently yields cancer or BWUP lesions which historically undergo surgical excision. Implications of associated imaging findings may help guide management of AD, as newer literature supports surgical de-escalation in select BWUP cases.

# Abstract Archives of the RSNA, 2024

R5B-SPCA

**Cardiac Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPCA-1 EVALUATING EXPERIMENTAL TANTALUM OXIDE CONTRAST MATERIAL VERSUS IODINE FOR CALCIUM SIGNAL SEPARATION IN CORONARY ARTERY CALCIFICATIONS ON 4 DECT PLATFORMS: A PHANTOM STUDY

Peter Bonitatibus Jr. (*Abstract Co-Author*) Nothing to Disclose
Benjamin M. Yeh, MD (*Abstract Co-Author*) Grant, Koninklijke Philips NV;Grant, General Electric Company;Consultant, Canon Medical Systems Corporation;Speaker, Canon Medical Systems Corporation;Royalties, Oxford University Press;Shareholder, Nextrast, Inc;Board Member, Nextrast, Inc
Zhye Yin (*Abstract Co-Author*) Employee, General Electric Company
Brian Bales (*Abstract Co-Author*) Nothing to Disclose
Yuxin Sun, BS, MSc (*Abstract Co-Author*) Stockholder, Nextrast, Inc
Te Yu Lin, MS (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the calcium/contrast signal separation in a calcified coronary phantom between an experimental tantalum oxide nanoparticle (TaCZ) contrast agent and commercial iodine contrast in four DECT platforms.

### METHODS AND MATERIALS

We used a coronary phantom containing 6 groups of vessels with concentric and eccentric calcified plaques at 60, 40, and 20% HAP (hydroxyapatite) concentrations, and lumen diameters of 9, 6, and 3 mm. A seventh group without calcifications served as reference. The phantom was serially filled with water, iodine (Iopromide, Bayer), and tantalum (TaCZ, Nextrast Inc) solutions at 8 mg/mL and scanned on 4 commercial DECT scanners: Discovery CT750 HD and Revolution (GE HealthCare), IQon (Philips), and SOMATOM Force (Siemens). Vendor proprietary software was used to generate contrast- and calcium-specific image pairs. Calcium plaque and vessel lumen areas were calculated using an image threshold-based analysis to compare the signal separation accuracy between iodine and tantalum agents across all scanners.

### RESULTS

Across all scanners (n=4) for concentric plaques at all vessel diameters (n=3) and HAP concentrations (n=3), iodine (Iod) and tantalum (Ta) underestimated calcium area in 27/36 and 28/36 instances, respectively. However, in terms of accuracy of calcium plaque area quantifications, Ta exhibited superior performance compared to Iod in 30/36 comparisons (26/30 with $p<0.05$). For eccentric plaques, Iod and Ta agents underestimated calcium area in 27/36 and 34/36 instances, respectively. Based on percent error, Ta showed more accurate calcium area quantification in 32/36 comparisons (26/32 with $p<0.05$). For concentric plaques, vessel lumen area accuracy was underestimated with Iod at two scanners (18/36) and overestimated at the other two (18/36). While with Ta, 31/36 instances across all 4 scanners underestimated lumen area. Yet, Ta showed more accurate lumen area quantification than Iod in 31/36 comparisons (31/31 with $p<0.05$). For eccentric plaques, lumen area was also underestimated with Iod (18/36) and Ta (24/36), but based on percent errors, Ta outperformed Iod in 34/36 comparisons (29/34 with $p<0.05$).

### CONCLUSION

Tantalum-based contrast material enables more effective material separation from calcium plaque than iodine-based contrast across four different commercial DECT scanners. These results will inform clinical trials currently being planned.

### CLINICAL RELEVANCE/APPLICATION

Tantalum-based contrast agents hold promise over conventional iodine agents to better delineate vascular anatomy at DECT across different scanner platforms in the setting of calcified plaque.

## R5B-SPCA-2 DEEP-SILICON PHOTON-COUNTING CT VERSUS DUAL-ENERGY CT: COMPARISON OF CALCIUM FROM IODINE, GADOLINIUM, AND TANTALUM CONTRAST SIGNAL SEPARATION IN A CORONARY CALCIFICATION PHANTOM

Benjamin M. Yeh, MD (*Abstract Co-Author*) Grant, Koninklijke Philips NV;Grant, General Electric Company;Consultant, Canon Medical Systems Corporation;Speaker, Canon Medical Systems Corporation;Royalties, Oxford University Press;Shareholder, Nextrast, Inc;Board Member, Nextrast, Inc
Yuxin Sun, BS, MSc (*Abstract Co-Author*) Stockholder, Nextrast, Inc
Zhye Yin (*Abstract Co-Author*) Employee, General Electric Company
Peter Bonitatibus Jr. (*Abstract Co-Author*) Nothing to Disclose
Brian Bales (*Abstract Co-Author*) Nothing to Disclose
Te Yu Lin, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the performance of deep-silicon photon-counting CT (PCCT) and dual-energy CT (DECT) for material separation of iodine, gadolinium, or tantalum contrast signal from calcified plaques in a coronary calcification phantom.

**METHODS AND MATERIALS**

A thorax phantom with 6 groups of coronary vessels with concentric and eccentric calcified plaques at 60, 40, and 20% w/w HAP (hydroxyapatite), and lumen diameters of 9, 6, and 3 mm, and a seventh group without calcifications, was used. Contrast solutions of iodine (Iod), gadolinium (Gd), or tantalum (Ta) at concentrations of 8 mg/mL was serially filled into the vessels. The phantom was scanned on a prototype deep-silicon PCCT (GE HealthCare) and commercial DECT scanner (GE Revolution). Material decomposition contrast(no calcium) or calcium(no contrast) image maps were generated using GE PCCT prototype and proprietary AW Server 3.2 software. Accuracy of signal separation between contrast and plaques was assessed by image analysis to 1) compare the difference between the vessel lumen area on the contrast map and the true value on 120 kVp image; and by 2) calculating the percent error between the attenuation values within the vessel lumen and background on the calcium map.

**RESULTS**

In comparison of lumen area percent error across vessel sizes (n=3), degrees of calcification (n=3), calcification shapes (n=2), and contrast agents (n=3), 45/54 instances showed superior PCCT accuracy in material separation over DECT (42/45 with $p<0.05$). At DECT, between the 3 agents, Ta showed more accurate lumen area delineation compared to Iod or Gd (15/18 and 18/18 instances, respectively with $p<0.05$). Between agents at PCCT, Iod showed the most accurate lumen area measurements in 10/18 instances while Ta performed best in the remaining 8/18 instances (14/20 and 7/16, respectively with $p<0.05$). For lumen value error, PCCT consistently exhibited smaller errors compared to DECT for all agents across all 54/54 instances (49/54 with $p<0.05$). At DECT, Iod gave smaller lumen value percent errors in 13/18 instances, with Ta performing best in 5/18 instances (24/26 and 10/10, respectively with $p<0.05$). At PCCT, the lumen value error was lowest with Iod in 11/18 comparisons, and 7/18 with Ta (17/22 and 7/14, respectively with $p<0.05$).

**CONCLUSION**

Deep-silicon PCCT can outperform DECT in accuracy of delineating vessel lumen contrast signal (iodine, gadolinium, or tantalum-based) from calcified plaques, with particular improvement in iodine material separation. Further PCCT reconstruction algorithm optimizations are ongoing.

**CLINICAL RELEVANCE/APPLICATION**

Deep-silicon PCCT promises to improve accuracy over DECT for differentiating calcified plaque from both iodine and future non-iodine contrast agents now in development.

## R5B-SPCA-4 FEASIBILITY OF QUANTITATIVE MATERIAL DECOMPOSITION OF CORONARY PLAQUES INTO CONSTITUENT WATER, LIPID, PROTEIN, AND CALCIUM FRACTIONS WITH PHOTON COUNTING CT - A SIMULATION STUDY

Ashley E. Prosper, MD (*Abstract Co-Author*) Nothing to Disclose
Michael F. McNitt-Gray, PhD (*Abstract Co-Author*) Institutional research agreement, Siemens AG;Research Grant, Siemens AG;Scientific Advisory Board, Hura Imaging, LLC
Matthew S. Brown, PhD (*Abstract Co-Author*) Nothing to Disclose
John M. Hoffman, PhD (*Abstract Co-Author*) Nothing to Disclose
Jonathan G. Goldin, MD, PhD (*Abstract Co-Author*) Founder, MedQIA Imaging Core Laboratory
Logan Hubbard, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the mathematical feasibility of photon counting CT(PCCT)-based material decomposition of coronary plaques into their constituent water, lipid, protein, and calcium fractions. Accurate compositional analysis of coronary plaques may potentially improve identification and risk stratification of vulnerable plaques, such as those with thin fibrous capsules, low density lipid cores, and spotty calcifications.

**METHODS AND MATERIALS**

The energy-dependent X-ray mass attenuation coefficient spectra of water, lipid, protein, and calcium were obtained from the ICRU Report 44. Corresponding linear attenuation coefficient spectra were generated using the physical densities of each material. The linear attenuation coefficient spectra were then converted into Hounsfield unit (HU) spectra ranging from 30 to 130 KeV, matching the reconstruction range of clinical PCCT. The HU of each material at reconstruction energies of 40, 50, and 75 KeV were then extracted, corresponding to low, mid, and high-energy HU calibration coefficients. Next, four different virtual coronary plaques were generated with water, lipid, protein, and calcium mass fractions of: #1 - 80%, 5%, 15%, 0%; #2 - 60%, 35%, 5%, 0%; #3 - 70%, 15%, 10%, 5%; and #4 - 50%, 25%, 10%, 15%, where each plaque had a corresponding low, mid, and high-energy HU to which Gaussian image noise was added. PCCT-based material decomposition was then simulated using noise standard deviations from 5 - 50 HU, and plaque volumes from 1 - 1000 mm3. In each case, the average root-mean-square-error (RMSE) of decomposition was assessed. All simulation and analyses were performed in MatLab (Version 2020a, MathWorks, Inc., USA).

**RESULTS**

The average RMSE (%) of plaque decomposition into water, lipid, protein, and calcium fractions, for plaque volumes of 150 mm3 and image noise of 10 HU was 16.9 ± 0.5%, 5.7 ± 0.2%, 11.2 ± 0.3%, and 0.2 ± 0.0%, respectively. For volumes of 150 mm3 and noise of 25 HU, the RMSE was 45.2 ± 1.3%, 15.1 ± 0.4%, 29.7 ± 0.8%, and 0.4 ± 0.0%. For volumes of 250 mm3 and noise of 10 HU, the RMSE was 14.4 ± 0.3%, 4.8 ± 0.1%, 9.5% ± 0.2%, and 0.1 ± 0.0%. For volumes of 250 mm3 and noise of 25 HU, the RMSE was 33.6 ± 2.7%, 11.2 ± 0.9%, 22.1 ± 1.8%, and 0.3 ± 0.0%. Overall, the RMSE of decomposition increased in proportion to image noise and decreased in proportion to plaque volume.

**CONCLUSION**

Accurate quantitative PCCT-based material decomposition of coronary plaques into their constituent components - water, lipid, protein, and calcium - is mathematically feasible, assuming low enough reconstruction image noise and high enough plaque volume.

**CLINICAL RELEVANCE/APPLICATION**

Quantitative PCCT-based material decomposition of coronary plaques may improve identification and risk stratification of vulnerable plaques.

## R5B-SPCA-5 EXTRACELLULAR VOLUME QUANTIFICATION IN CARDIAC MAGNETIC RESONANCE IMAGING: A BRIGHT PROSPECT OR A DEAD END IN CLINICAL APPLICATION? EVALUATION OF INFLUENCING FACTORS

Tilman S. Emrich, MD (*Abstract Co-Author*) Speaker, Siemens AG;Travel support, Siemens AG;Advisory Board, Siemens AG
Moritz Halfmann, MD (*Abstract Co-Author*) Nothing to Disclose

Anton Kilburg (*Abstract Co-Author*) Nothing to Disclose
Philipp Locherer (*Presenter*) Nothing to Disclose

**PURPOSE**

Myocardial extracellular volume fraction (ECV) is quantified from cardiac MRI either by manual or semi-automated post-processing methods and requires the blood hematocrit (Hct). It has previously been shown that both the timing of the blood sample in relation to the cardiac MRI and type of post-processing used to calculate the ECV can significantly influence results. Therefore, this study aimed to investigate the influence of using a synthetic hematocrit and a semi-automated software solution compared to the reference standard of blood-sampling based hematocrit and manual calculation.

**METHODS AND MATERIALS**

A total of 78 consecutive patients with cardiomyopathies who had undergone cardiac MRI at 3 Tesla were retrospectively included in this study. Additionally, 50 prospectively recruited healthy volunteers were included as a control group to establish a formula for the estimation of the synthetic Hct based on in-scanner blood sampling. T1 maps were acquired using commercially available MOLLI sequences prior and 15 minutes after the injection of Gadolinium (0,2 mmol/ml/kg body weight). Pre- and post-contrast T1 maps were used to calculate ECV values either manually or by using a semi-automated software solution (CVI42, Calgary, Canada) and either by inputting the blood-sampling-based or synthetic hematocrit, respectively. Agreement of measurements was assessed by Wilcoxon signed-rank test, Pearson's correlation, ICC and Bland-Altman analyses. Diagnostic Accuracy to differentiate cardiomyopathies from healthy volunteers was assessed by ROC-curves and DeLong-Analysis.

**RESULTS**

ECV values based on the four different calculation methods showed high level of agreement (r = 0,83 - 0,93, all ICC > 0,9) with no systematic bias. However, the manual calculation led to significantly lower absolute ECV values, i.e. ECV Manual / Lab-based Hct: 26,73 % ± 4,61 % vs. ECV Automated / Synthetic Hct: 27,78 % ± 4,95 %, P<.001. Despite these, there was no evidence of a difference in regard to diagnostic accuracy in the differentiation between cardiomyopathy patients and healthy volunteers (AUC 0,66 to 0,76; P>.14).

**CONCLUSION**

Cardiac MRI based myocardial ECV can be quantified using synthetic hematocrit values and semi-automated assessment with clinically acceptable variation and similar diagnostic accuracy compared to the manual and blood-sampling based reference method.

**CLINICAL RELEVANCE/APPLICATION**

The results show potential to further automate ECV quantification from cardiac MRI, thus facilitating more widespread clinical implementation due to ease of use.

## R5B-SPCA-6 DEEP LEARNING RECONSTRUCTION IMPROVED THE IMAGE QUALITY OF LGE AND ENHANCED MYOCARDIAL SCAR DETECTION IN PATIENTS WITH VENTRICULAR ARRHYTHMIAS

An Sun (*Presenter*) Nothing to Disclose

**PURPOSE**

Cardiac magnetic resonance (CMR) late gadolinium enhancement (LGE) has been used for detecting myocardial scar tissue in patients with myocardial diseases. However, accurate detection still remains challenging in sustained ventricular tachycardia (VT)/aborted SCD patients. Assess the effectiveness of deep learning reconstruction (DLRecon) in detecting myocardial scars using CMR LGE, and its clinical application value in VT/SCD patients.

**METHODS AND MATERIALS**

Seventy-two patients with suspected or known cardiomyopathy were prospectively scanned with 3.0T CMR. Short-axis LGE images were reconstructed using conventional reconstruction (ConRecon) and deep learning-based reconstruction (DLRecon). Image quality of ConRecon and DLRecon images was scored on a 4-point scale (poor to excellent). Subgroups were analysed according to the presence of combined ventricular arrhythmia, left ventricular (LV) systolic dysfunction (LV ejection fraction <50%), and high heart rate (=75beats/min), and were compared using the nonparametric Wilcoxon test in terms of contrast ratio (CR), signal-to-noise ratio (CNR), and subjective image quality scores. The scar size was also quantified using standard deviation (SD) thresholding technique and full width at half maximum (FWHM) technique. Intra- and inter-observer agreement was analysed using the intraclass correlation coefficient (ICC).

**RESULTS**

Sixty-four patients (37 NVST patients, 27 VT/SCD patients) with a mean age (45±8 years, 38% female) and LV ejection fraction of 52% (IQR: 33%-64%) were finally included. In the VT/SCD group, DLRecon image quality was significantly higher than ConRecon LGE images (subjective quality score 3.7±0.6 vs. 2.9±0.6, P<0.001), and DLRecon images had improved CNR and CR for scar/blood pool and scar/cardiac (P<0.05). Using the 5SD quantification method, DLRecon LGE results were significantly higher than ConRecon images, and better LGE quantification results LGE were obtained especially in patients with high heart rate with combined VT/SCD. There was a good agreement of the measured results between physicians (all ICC >0.85).

**CONCLUSION**

Deep learning-based reconstruction of LGE images can indeed improve the quality of CMR LGE images in patients with VT/SCD, better display myocardial scars, and perform well in patients with VT/SCD with combined high heart rate.

**CLINICAL RELEVANCE/APPLICATION**

The application of DLRecon to CMR LGE can improve the image contrast between myocardial scar and adjacent structures, allowing for accurately diagnosing subtle subendocardial lesions in cardiomyopathy patients with VT/SCD.

## R5B-SPCA-7 PHOTON-COUNTING CT BASED HEMODYNAMIC EVALUATION OF EXTRINSIC OUTFLOW GRAFT STENOSES DURING LVAD THERAPY: AN INNOVATIVE COMPUTATIONAL APPROACH

Ann Bolger, MD (*Abstract Co-Author*) Nothing to Disclose
Tino Ebbers, PhD (*Abstract Co-Author*) Nothing to Disclose
Marten Sandstedt, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Linus Ohlsson, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Implantable left ventricular assist devices (LVAD) connect the left ventricle apex to the aorta via an outflow graft in patients with advanced heart failure. Extrinsic obstruction of the outflow graft (eOGO) is associated with serious morbidity and mortality and recently led to an FDA Class 1 device recall of HM3. The assessment of eOGO relies on anatomic imaging of the stenosis cross sectional area but not its functional severity. This study aimed to provide

a better understanding of the hemodynamic impact of eOGO by basing an innovative computational numerical approach on in vivo images acquired using state-of-the-art photon-counting computed tomography (PCCT).

**METHODS AND MATERIALS**

Cardiac scans of 2 asymptomatic patients with radiologically-identified HM3 eOGO were acquired using PCCT (NAETOM Alpha, Siemens Healthineer, Erlangen, Germany). Images were evaluated by the consensus of two experienced cardiovascular radiologists. Numerical evaluations of hemodynamics were conducted using a high-fidelity three-dimensional Computational Fluid Dynamics (CFD) approach using the patient-specific graft geometries, 2 virtually augmented stenotic severities, and 3 device flows.

**RESULTS**

Radiologic evaluation showed a baseline cross-sectional area (CSA) reduction of 29% and 36% respectively. The virtually augmented stenoses had CSA reductions up to 52% and 61% respectively. Visual analysis identified increased velocity, pressure, and turbulent flow in the outer anterior curvature of the outflow graft, however changes in graft pressure gradients were slight (1 to 9 mmHg) across the range of stenosis severities and flow rates tested. The correlation profiles between pressure and minimal CSA, peak velocity and turbulent flow demonstrated considerable variation between the baseline cases and their corresponding augmented stenosis severities.

**CONCLUSION**

Evidence of eOGO during HM3 support and the recent device recall may promote clinical apprehension and intervention. This numerical study of 2 asymptomatic patients revealed low hemodynamic impact of in vivo and numerically augmented eOGO severities. The hemodynamic impact of eOGO may be difficult to predict and easily overestimated when assessed only by visual evaluation and quantification of cross-sectional area reduction.

**CLINICAL RELEVANCE/APPLICATION**

These results suggests that, for clinically encountered flow rates and stenosis severities below 61% in cross-sectional area decrease, eOGO may have low hemodynamic impact in a clinically stable patient. This suggests that patients with demonstrable eOGO but without symptoms or signs suggesting hemodynamically significant obstruction might be managed expectantly.

## R5B-SPCA-8 EXPLORING THE RELATIONSHIP BETWEEN NT-PROBNP LEVELS AND CMR PARAMETERS IN HEART FAILURE WITH PRESERVED EJECTION FRACTION: IMPLICATIONS FOR DIAGNOSIS AND PROGNOSIS

Yi Zhu (*Abstract Co-Author*) Nothing to Disclose
Rui Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

Heart Failure with Preserved Ejection Fraction(HFpEF) is a complex syndrome with a high incidence. N-terminal pro-B-type natriuretic peptide (NT-proBNP) is a commonly used biomarker in cardiovascular diseases, but the test for NT-proBNP requires blood sampling and may exhibit variations due to the patient's health condition and other influencing factors.This study aims to investigate the correlation between NT-proBNP levels and CMR parameters in patients with HFpEF to identify markers that indirectly reflect NT-proBNP, enhancing cardiovascular disease assessment.

**METHODS AND MATERIALS**

In this retrospective study, patients with HFpEF underwent CMR imaging using a 3.0 T scanner. NT-proBNP levels were measured, and CMR parameters including left ventricular volumes, extracellular volume, and myocardial strain were assessed by the commercially available software (cvi42). Statistical analyses were conducted to evaluate correlations between NT-proBNP and CMR findings.

**RESULTS**

The study included 43 patients with HFpEF, with a median NT-proBNP value of 277 pg/mL. The results of this study showed that compared with patients with lower NT-proBNP, patients with higher levels of NT-proBNP had higher LVESVi, but there was no difference in LVEDVi, and SV, CO and LVEF were significantly reduced. NativeT1, Enhanced T1 and ECV showed no significant difference between the two groups. On the surface of myocardial stress-related parameters, GCS, GRS and GLS were significantly reduced in patients with higher NT-proBNP level compared with patients with lower NT-proBNP level.

**CONCLUSION**

NT-proBNP levels were associated with various CMR parameters in patients with HFpEF, indicating its potential as a biomarker for assessing cardiac function and remodeling in this population.NT-proBNP serves as an essential biomarker in assessing and predicting changes in left ventricular function in HEpEF patients, indicating its potential as a biomarker for assessing cardiac function and remodeling in this population. The revelation that myocardial stress parameters and Native T1 can serve as Non-invasive indirect indicators of NT-proBNP levels, facilitating the evaluation of heart failure severity and subsequent survival rates in patients.

**CLINICAL RELEVANCE/APPLICATION**

The findings suggest that NT-proBNP may serve as a valuable tool in evaluating cardiac structure and function in HFpEF patients undergoing CMR imaging, aiding in the management and monitoring of heart failure.

## R5B-SPCA-9 EVALUATION OF DIAGNOSTIC PERFORMANCE IN DEEP-LEARNING BASED CONTRAST MODEL OF CARDIAC CT ON MYOCARDIAL DISEASE: A COMPARATIVE STUDY WITH DELAYED-PHASE CMR

Sung Min Ko, PhD (*Abstract Co-Author*) Nothing to Disclose
Sung-Jin Cha, BS (*Abstract Co-Author*) Nothing to Disclose
Donghee Koh (*Abstract Co-Author*) Nothing to Disclose
Pil-Hyun Jeon, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Cardiac computed tomography (CCT) obtains not only arterial phase images but also 5-7minute delayed phase images and is used as an aid for left ventricular(LV) myocardial diagnosis. However, since the delayed examination is performed with minimal radiation exposure, image noise increases and the degree of contrast enhancement is unclear. Therefore, we attempted to demonstrate clinical effectiveness by emphasizing the degree of contrast enhancement and improving image quality using deep learning-based contrast boosting(DL-CB) method, a recently developed artificial intelligence(AI)-based CCT contrast enhancement.

## METHODS AND MATERIALS

In this retrospective study, 150 patients with cardiomyopathies who visited from July 2020 to December 2023, had CCT with delayed contrast enhancement (MDE) and cardiac magnetic resonance imaging (CMR) intervals of less than one month, were selected. The collected subjects were classified according to clinical information at the time of examinations. Each lesion was classified into myocardial infarction (MI), hypertrophic cardiomyopathy (HCMP), dilated cardiomyopathy (DCMP) and aortic stenosis (AS). MDE-CT with modeled iterative reconstruction(MBIR) was obtained 5 minutes after iodinated contrast agent administration and was performed after arterial phase-CCT acquisition. The obtained MDE-CCT image was applied to DL-CB to generate an iodine contrast enhancement and CMR-LGE (late gadolinium enhancement).

## RESULTS

In the quantitative evaluation, the noise of ADMIRE MDE-CT and AI-CEM MDE-CT obtained by PACS decreased by 12.94 ± 4.50, higher SNR 7.13 ± 4.47 and higher CNR 10.32 ± 6.07. All P-Values except epicardial fat showed statistical significance of less than 0.05. In AI-CEM MDE-CCT, the measured HU values of LV septum, LV lateral wall, descending aorta, and LV blood pool excluding epicardial fat increased by 21.1% on average. In the qualitative evaluation, the average score of AI-CEM MDE-CCT rose from 2.63 ± 0.78 on ADMIRE MDE-CCT to 3.75 ± 0.84, showing a score improvement of 42.7% ($p<0.05$).

## CONCLUSION

By applying AI-CEM to the standard technique and retrospectively reconstructing MDE-CCT images, the quality of MDE-CCT images and detection of lesions are better than those using MBIR, which can be widely applied to the diagnosis of LV myocardial diseases. MDE-CCT images could help detect LV myocardial lesions in clinical practice.

## CLINICAL RELEVANCE/APPLICATION

The proposed AI-CEM for MDE-CCT enables accurate detection compared to the reference standard, LGE-CMR, and effectively improves the diagnosis of various LV myocardial diseases. Our results expand the role of cardiac CT in detecting LV myocardial disease as well as coronary evaluation for a variety of cardiac diseases.

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# Abstract Archives of the RSNA, 2024

R5B-SPCH

**Chest Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPCH-1 THE IMPACT OF QUANTITATIVE ASSESSMENT USING CT PERFUSION FOR IDENTIFYING EXERCISE PULMONARY HYPERTENSION PATIENTS ACCORDING TO THE 2022 ESC/ERS GUIDELINE: A PROSPECTIVE STUDY

Midori Ueno, MD (*Abstract Co-Author*) Nothing to Disclose
Takatoshi Aoki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshiko Hayashida, MD (*Abstract Co-Author*) Nothing to Disclose
Haruka Oku (*Presenter*) Nothing to Disclose

### PURPOSE

The hemodynamic definition of pulmonary hypertension (PH) was recently updated in the 2022 European Society of Cardiology (ESC)/European Respiratory Society (ERS) guidelines and a new definition of exercise PH was introduced. Although the performance of imaging methods (eg. CT, MRI, and nuclear medicine) in identifying patients with a high risk of PH has been assessed, noninvasive imaging capable of identifying the exercise PH is not revealed at all. The purpose of this study is to assess the utility of quantitative assessment using CT perfusion for distinguishing the exercise PH patients from the non-PH patients.

### METHODS AND MATERIALS

We prospectively evaluated the patients clinically suspected of having PH who underwent CT perfusion at our institution. They all examined with exercise-stressed right heart catheterization. Among them, we selected non-PH patients and exercise PH patients defined by mean pulmonary artery pressure (mPAP) <20mmHg and mPAP/cardiac output slope >3mmHg/L/min during the transition from rest to end-exercise in this study. Maximum enhancement (ME) at pulmonary trunk (PT) and at bilateral main pulmonary arteries (mPA), and lung parenchymal enhancement of over 18 set areas on axial perfusion map images avoiding major vessels (Ameli-Tenani, et al. J Thorac Imaging 2014;29:98-106) were analyzed. Statistical analysis was performed with Mann-Whiteny U test, and diagnostic capability was assessed using ROC analysis.

### RESULTS

Thirty exercise PH patients and 12 non-PH patients were included in this prospective study (mean age 64.7, range 23-82). Right mPA-ME (589.5 HU) and left mPA-ME (609.5 HU) of exercise PH patients were significantly higher than those of non-PH groups (494.9 HU and 514.3 HU, $P<0.05$). The corresponding AUCs in ROC analysis for exercise PH were 0.7 for right mPA-ME and 0.703 for left mPA-ME, respectively. There was no significant difference between 2 patient groups for ME at PT and for lung parenchymal enhancement.

### CONCLUSION

Main pulmonary artery enhancement derived from CT perfusion can be a noninvasive predictor to identify exercise PH.

### CLINICAL RELEVANCE/APPLICATION

Quantitative assessment using CT perfusion would be useful for screening of early PH, and may minimize the need for invasive exercise-stressed right heart catheterization.

## R5B-SPCH-2 MECHANICAL OBSTRUCTION CONTRIBUTES DIFFERENTIALLY TO CHRONIC THROMBOEMBOLIC PULMONARY HYPERTENSION (CTEPH) PATHOPHYSIOLOGY DEPENDENT ON PATIENT FACTORS

John T. Granton, MD (*Abstract Co-Author*) Nothing to Disclose
Micheal McInnis, MD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Bayer AG
Laura Donahoe (*Abstract Co-Author*) Nothing to Disclose
Aly Muhammad Ladak (*Abstract Co-Author*) Nothing to Disclose
Marc Deperrot, MD (*Abstract Co-Author*) Nothing to Disclose
Gauri R. Karur, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Dayana Davoudi (*Presenter*) Nothing to Disclose

### PURPOSE

The correlation of chronic pulmonary embolism (PE) burden and pulmonary hypertension (PH) severity in CTEPH is poor as mechanical obstruction is just one factor in the pathophysiology of CTEPH. The purpose of this study was to correlate chronic PE burden CT scores with hemodynamic parameters and to identify subgroups where mechanical obstruction contributes greatest to PH severity.

### METHODS AND MATERIALS

This single centre retrospective study included adult patients who underwent pre-operative CT pulmonary angiography and pulmonary endarterectomy for CTEPH between 01/2017 and 09/2021. CT scans were scored by a blinded thoracic radiologist according to a previously reported 32-vessel model of the lung wherein each vessel was scored as patent, partly occluded, or occluded. Subsegmental disease was noted. Composite scores, the Qanadli index, and CT level of disease (CTLD) were calculated. Correlations were explored between these metrics and the pre-operative pulmonary vascular resistance (PVR) and reported as Spearman correlation coefficients. A p-value of <0.01 was considered significant given multiple comparisons.

### RESULTS

A total of 157 subjects (mean age 57±15 years, 54% female) were included. Qanadli index was weakly correlated with PVR (r=0.27, p=0.002) as was the total number of involved vessels (r=0.29, p<0.001), but a better correlation was seen with the number of lesions at the segmental level (r=0.35, p<0.001). Number of occlusions (p=0.09) and CTLD (p=0.54) did not correlate significantly with PVR. Number of involved segmental vessels was more strongly correlated with PVR in those who are younger than the median age of 60 years (r=0.45, p<0.001 vs. r=0.32, p=0.002), in patients with proximal disease (e.g., main or lobar vessel involvement, r=0.41, p<0.001) but not distal disease (p=0.02), in those who are obese (r=0.33, p=0.007) but not in non-obese (p=0.015), in patients with a history of PE (r=0.33, p<0.001) but not those without PE (p=0.2), and with no difference between sexes. Further subgroup analysis revealed stronger relationships between clot burden and PH in men under 50 years of age (Qanadli index: r=0.73, p=0.005) with no significant correlation in women under 50 years old (p=0.08).

### CONCLUSION

Correlation of clot burden with PVR was modest, likely because mechanical obstruction plays a varying role in the pathophysiology of CTEPH. Clot burden correlated best with PVR in young men, in proximal disease, and in those with history of PE.

### CLINICAL RELEVANCE/APPLICATION

Radiologists must be aware that mechanical obstruction is but one contributor to CTEPH and to tailor assessment of the vasculature to patient risk factors.

## R5B-SPCH-3 DETECTION OF THORACIC ASCENDING AORTIC DILATION FROM CHEST X-RAY

Ki Seok Choo, MD (*Abstract Co-Author*) Nothing to Disclose
Jong-Min Kim, PhD (*Abstract Co-Author*) Employee, Medical IP Co, Ltd
Sangjoon Park (*Abstract Co-Author*) Nothing to Disclose
Samuel Cho (*Abstract Co-Author*) Nothing to Disclose
Hyeyun Lee, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Dilation of the thoracic ascending aorta (TAA) is typically not read from a chest radiograph (CXR), as the overlap of tissues and skeleton makes it difficult to reliably discern the aorta with the human eye. However, unmonitored aorta aneurysm can lead to a 95% mortality, urging the need for an inexpensive method of screening, as rural or medically underserved communities do not have sufficient access to more advanced medical imaging equipments. Here, an external validation was performed of an AI algorithm, which visualizes the TAA and diagnoses for aneurysm from a single chest X-ray.

### METHODS AND MATERIALS

Patients who underwent both CT scan and CXR were recruited (n=236). The AI algorithm extracted the aorta image from the CXR using deep learning and then measured the maximum diameter perpendicular to the direction of the blood flow using image processing. This maximum diameter was compared to the maximum diameter from the CT, measured using a commercial software. Clinical guideline suggests thresholds of 4 cm and 4.5 cm for diagnosing dilation and aneurysm in the ascending aorta, respectively. Using these thresholds, the diagnosis from the AI algorithm was compared with the diagnosis from the CT. In addition, a team of two radiologists attempted to diagnose aortic aneurysm from the CXR, and the performance was compared with the performance of the AI algorithm.

### RESULTS

The maximum diameter from the AI algorithm showed good consistency with the GT maximum diameter. The mean absolute error (MAE) was 0.64 cm [0.58-0.71] and the mean absolute percent error (MAPE) was 14.3% [13.09-15.47]. In diagnosing dilation, AUROC was 0.85 [0.80-0.90] with sensitivity of 0.94 [0.91-0.98] and specificity of 0.39 [0.26-0.52]. In diagnosing aneurysm, AUROC was 0.74 [0.67-0.80] with sensitivity of 0.79 [0.72-0.86] and specificity of 0.54 [0.44-0.63]. For comparison, the team of two radiologists also attempted to diagnose dilation in the TAA. In result, the AUROC was 0.61 [0.55-0.66] with sensitivity of 0.31 [0.24-0.38] and specificity of 0.90 [0.81-0.98]. Compared to the radiologists, AI algorithm outperformed in accurately quantifying the dimensions of the TAA with high sensitivity.

### CONCLUSION

Generating the maximum diameter of the ascending aorta from a single CXR is a difficult task, but the AI algorithm can reliably screen for dilation and aneurysm in the TAA and outperforms human expert diagnosis.

### CLINICAL RELEVANCE/APPLICATION

An inexpensive and accessible screening method for TAA is needed, as a missed case of aneurysm can lead to a medical emergency. The AI algorithm can potentially screen for patients during routine chest X-ray examination, after which further testing can be done to confirm the diagnosis.

## R5B-SPCH-4 ROLE OF AI FOR CHEST X-RAY INTERPRETATION: IS IT A VALID SUPPORT?

Luca Giuliani (*Abstract Co-Author*) Nothing to Disclose
Nicholas Landini, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD (*Abstract Co-Author*) Nothing to Disclose
Valeria Panebianco, MD (*Abstract Co-Author*) Nothing to Disclose
Giorgio Maria Masci, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate whether AI represents an added value for chest X-ray (CXR) interpretation.

### METHODS AND MATERIALS

A dataset of CXR performed between March 2023 and January 2024 were retrospectively selected from the institutional PACS by a senior thoracic radiologist. The dataset included both normal and abnormal CXR with variable level of complexity. All CXR were evaluated by two young radiologists with

1 year of experience in chest imaging, who assessed the presence of several findings (consolidation, nodule, atelectasis, fibrosis, calcification, pneumothorax, cardiomegaly, pleural effusion, mediastinal enlargement, pneumoperitoneum). All examinations were then analyzed with an AI tool (Lunit INSIGHT CXR, Version 3.110) which assessed the same features. Finally, an additional AI-assisted evaluation was performed by the two radiologists. The ground truth was established by the radiologist in charge of image selection who classified the abnormalities as either visible or not visible on the radiograph. Sensitivity and specificity were measured using paired t tests.

**RESULTS**

A total of 548 CXR examinations were selected, of which 48 were excluded for low-image quality or presence of artifacts. From the 500 CXR analyzed, a total of 876 findings were reported either from the radiologists or from the AI tool. The two radiologists showed a sensitivity/specificity of 80.6%/93.2% and 87.2%/95.3%, respectively. AI showed a sensitivity/specificity of 96.9%/64.3%. With AI assistance, the sensitivity of the two radiologists increased to 82.9% (+2.3%) and 89.3% (+2.1%), while specificity decreased to 87.2% (-6%) and 89.5% (-5.8%), respectively. The abnormalities for which the radiologists showed higher disagreement with AI were fibrosis and calcification ($p<0.0001$), whilst the abnormalities for which the radiologists more often changed interpretation after AI evaluation were nodules, calcification, and pneumothorax ($p<0.0001$).

**CONCLUSION**

AI does not show significant increase of the diagnostic performance compared to standard radiological evaluation of CXR. Particularly, AI slightly increases sensitivity but at cost of a significant decrease in specificity. Therefore, standard radiological interpretation still remains the gold standard for CXR.

**CLINICAL RELEVANCE/APPLICATION**

Our study demonstrates that AI-assistance does not represent an added value for CXR interpretation compared to standard radiological evaluation.

## R5B-SPCH-6 QUANTITATIVE ASSESSMENT OF PULMONARY BLOOD FLOW REDISTRIBUTION IN THE CLASSIFICATION OF GROUP 1 AND GROUP 4 PULMONARY HYPERTENSION

Cong Shen JR, PhD,MD (*Presenter*) Nothing to Disclose

**PURPOSE**

All the patients with pulmonary hypertension (PH), without confirmed left-sided heart or lung diseases, need the the further distinguish between pulmonary arterial hypertension (PAH) and chronic thromboembolic pulmonary hypertension (CTEPH). This study aimed to investigate the value of the quantitative assessment of pulmonary blood flow redistribution in the further classification.

**METHODS AND MATERIALS**

Forty-six patients who underwent echocardiography and computed tomography pulmonary angiography at our hospital were included and categorized into a non-PH group (18 cases), a PAH group (12 cases), and a CTEPH group (16 cases). The diameter of the left ventricle, left atrium, right ventricle, and right atrium were measured. Additionally, the volumes of the main, right, and left pulmonary arteries were calculated. The total blood volume (TBV), the blood volume of vessels at the cross-section with an area <5 mm2 (BV5),-5-10 mm2 (BV5-10) and >10 mm2 (BV10), and the blood volume of the pulmonary arteries and veins, were quantitatively assessed.

**RESULTS**

The right ventricular diameter and volumes of the main and right pulmonary arteries were significantly higher in the PAH and CTEPH group than in the non-PH group ($P < 0.05$). The TBVs for the right lung and left upper lobe, arterial TBV, and BV10 were significantly higher in the PAH group than in the non-PH group ($P < 0.05$). The TBV of the right lung and right upper lobe and BV10 of the right lung and right lower lobe were significantly lower in the CTEPH group than in the non-PH group ($P < 0.05$). The TBV and BV10 were significantly lower in the CTEPH group than in the PAH group ($P < 0.05$). Age and BV10 of the right upper lobe were the most discriminative parameters, with an area under the curve of 0.950 in distinguishing PAH and CTEPH ($P < 0.05$).

**CONCLUSION**

Pulmonary vessel volume increased in PAH, particularly in larger-caliber vessels and the pulmonary artery, while it decreased in CTEPH, especially in larger-caliber vessels and the right lower lobe.

**CLINICAL RELEVANCE/APPLICATION**

By the quantitative assessment of pulmonary blood flow, can we tell the difference between PAH and CTEPH non-invasively.

## R5B-SPCH-8 ARTIFICIAL INTELLIGENCE APPLIED TO PRE-OPERATIVE CHEST X-RAYS: CAN WE ENTRUST AUTOMATED READINGS?

Angelo Vanzulli, MD (*Abstract Co-Author*) Nothing to Disclose
Luca A. Carbonaro, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Cuzzolin (*Abstract Co-Author*) Nothing to Disclose
Gianluca Folco, MD (*Abstract Co-Author*) Nothing to Disclose
Caterina B. Monti, MD, PhD (*Abstract Co-Author*) Travel support, Bracco Group
Francesco Rizzetto, MD (*Presenter*) Travel support, Bracco Group

**PURPOSE**

Pre-operative chest X-rays (CXRs) typically show a low likelihood of disease, making them ideal candidates for automated analysis by artificial intelligence (AI). This could expedite radiologists' workflow by automatically excluding exams identified as negative from the review process. Therefore, we aimed to assess the performance of a commercial AI software in reading pre-operative CXRs unsupervised.

**METHODS AND MATERIALS**

All pre-operative CXRs in two projections (posteroanterior and lateral) from standing adult patients (=18 years old), performed in January 2022 at a high-volume surgery center, were retrospectively analyzed using a commercial AI software. The software identifies lung consolidations, pulmonary nodules, pleural effusion, pneumothorax, and mediastinal alterations on CXRs. AI results were compared with radiology reports to appraise agreement for such findings. Sensitivity (SE), specificity (SP), positive likelihood ratio (PLR), negative likelihood ratio (NLR), and accuracy (ACC) were calculated, along with their 95% confidence intervals (CI95%). We also evaluated the number of CXRs with reports indicating findings other than those for which the AI was trained, assessing their clinical relevance.

## RESULTS

CXRs from 730 patients (416, 57% males) with a median age of 67 years (range: 18-93 years) were analyzed. Among them, 346 (47%) had a negative report, while 87 (12%) showed findings from the categories identified by the AI. For the analysis of these CXRs, AI demonstrated SE=57% (CI95%: 46-68%), SP=86% (CI95%: 83-88%), PLR=3.97 (CI95%: 3.06-5.16), NLR=0.50 (CI95%: 0.39-0.64), and ACC=82% (CI95%: 79-85%). Findings outside the categories identified by AI were present in the remaining 297 (41%) CXRs, most of which (77%) were identified as negative by AI. In 79 (27%) cases, these were findings with potential clinical relevance, such as emphysema, reticulations, cardiomegaly, aortic alterations, vertebral collapses, or hiatal hernia.

## CONCLUSION

The diagnostic performance of AI for pre-operative CXRs is still suboptimal, limiting its ability to provide reliable, standalone automated readings.

## CLINICAL RELEVANCE/APPLICATION

Despite the low likelihood of disease in pre-operative CXRs, further enhancing AI sensitivity and expanding its range of identified pathologies are necessary to enable accurate unsupervised readings.

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RSNA 2024
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# Abstract Archives of the RSNA, 2024

R5B-SPER

**Emergency Radiology Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPER-1 DIAGNOSTIC PERFORMANCE OF ULTRASOUND FOR DETECTION OF PEDIATRIC ELBOW FRACTURE. A META ANALYSIS

Sun Hwa Lee (*Abstract Co-Author*) Nothing to Disclose
Seong Jong Yun, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The aim of this meta-analysis was to evaluate the diagnostic performance of ultrasound for detection of elbow fracture in pediatric patients with trauma.

**METHODS AND MATERIALS**

PubMed and EMBASE databases were searched for diagnostic accuracy studies that used ultrasound for detection of elbow fracture in pediatric patients. Bivariate modelling and hierarchical summary receiver operating characteristic (HSROC) modelling were performed to evaluate diagnostic performance. The pooled proportions of the false-negative rate were assessed using a DerSimonian-Laird random-effects model. We performed meta-regression analyses for heterogeneity exploration.

**RESULTS**

Ten articles involving a total of 519 patients were included. The summary sensitivity, summary specificity, and area under the HSROC were 96% (95% confidence interval [CI], 88%-99%), 89% (95% CI, 82%-94%), and 0.97 (95% CI, 0.95-0.98), respectively. The pooled proportion of the false-negative rate of ultrasound was 3.7%. Among the various potential covariates, presence of extra musculoskeletal ultrasound training (trained [musculoskeletal radiologists, trained pediatric emergency physicians, or trained emergency physicians] vs. not trained [pediatricians or orthopedic surgeons]) were associated with heterogeneity of the specificity.

**CONCLUSION**

Elbow ultrasound demonstrated high performance in the diagnosis of pediatric elbow fracture, particularly in studies of musculoskeletal radiologists or physicians with extra-training in musculoskeletal ultrasound.

**CLINICAL RELEVANCE/APPLICATION**

Ultrasound may be performed by musculoskeletal radiologists or trained physicians as a first-line diagnostic tool to diagnose pediatric elbow fracture.

# Abstract Archives of the RSNA, 2024

R5B-SPGI

**Gastrointestinal Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPGI-1 RADIOGRAPHIC IMAGING OF ACUTE SPLENIC DISEASE IN PATIENTS WITH BABESIOSIS

John J. Hines JR, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah Byun (*Abstract Co-Author*) Nothing to Disclose
Douglas S. Katz, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To better understand the occurrence of splenic disease as a manifestation of babesiosis by retrospectively estimating the frequency of acute splenic injury on abdominal CT in a cohort of patients with babesia infection.

### METHODS AND MATERIALS

In a search of our single institution, suburban teaching community hospital database, 57 patients were found to have positive babesia infection between the years 2021-2023. 29 of these patients underwent abdominal CT (22 with and 7 without intravenous contrast), and 3 underwent abdominal ultrasound without any CT.

### RESULTS

20/32 patients who underwent any type of abdominal imaging had splenomegaly. 11/22 patients that underwent intravenous contrast-enhanced abdominal CT were male and 11/22 patients were female. 4/22 of these patients were found to have splenic infarction. One patient had multiple rounded hypoenhancing non-peripheral foci on both CT and MRI which did not meet criteria for infarction, in association with splenomegaly, and which resolved after treatment.

### CONCLUSION

Our study shows that splenic infarction is an uncommon manifestation of babesiosis in our retrospective CT series. Although our results are limited by the small sample size and the single center retrospective nature of our study, we found no association between parasitemia levels and presence of splenic infarction.

### CLINICAL RELEVANCE/APPLICATION

Babesiosis is a disease caused by babesia, a species of intraerythrocytic protozoa that are endemic to the northeastern and midwestern regions of the United States. It most often occurs in the summer months and is known to cause a wide range of clinical presentations from asymptomatic to severe disease. Symptoms can include fever, abdominal pain, pancytopenia, acute respiratory failure, renal and hepatic failure, and splenic disease. There is relatively sparse literature detailing splenic manifestations of acute babesia infection, including splenic enlargement, infarction and rupture. Results of our study show that acute splenic injury is an uncommon manifestation of babesiosis. This manuscript is pertinent as the prevalence of babesiosis infection has been steadily increasing in endemic regions, making it important for abdominal radiologists to be aware of this entity in the differential diagnosis for splenic infarction or non-traumatic rupture on abdominal CT scan.

## R5B-SPGI-10 EARLY DETECTION OF LIVER FIBROSIS IN PATIENTS UNDERGOING PRE- AND POST-HEMATOPOIETIC STEM CELL TRANSPLANTATION: A PRELIMINARY COMPARISON BETWEEN ULTRASOUND ELASTOGRAPHY AND TRANSIENT ELASTOGRAPHY

Maria Camarena (*Abstract Co-Author*) Nothing to Disclose
Paola Lopez-Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Joaquim Amorim Sortino, MD (*Abstract Co-Author*) Nothing to Disclose
Enrique de Miguel Campos (*Abstract Co-Author*) Nothing to Disclose
Mihail Poida, MD (*Abstract Co-Author*) Nothing to Disclose
Angela Garcia (*Abstract Co-Author*) Nothing to Disclose
Maria Luisa Prieto (*Abstract Co-Author*) Nothing to Disclose
Claudia Gerlotti, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Veno-occlusive disease (VOD) is a serious complication following post-hematopoietic stem cell transplantation (HSCT), with a mortality rate exceeding 80%, underscoring the critical need for early detection. Ultrasound and/or elastography suggestive of VOD onset are one of the criteria set by the EBMT. A preliminary comparison was done between ultrasound elastography (UE) and transient elastography (TE) to enhance liver fibrosis (LF) detection.

### METHODS AND MATERIALS

43 patients who had undergone HSCT were retrospectively studied from January 2023 to February 2024. Pre- and +14-day post-HSCT evaluation was done with TE (FibroScan) and 2D Shear Wave Elastography (2D-SWE) complemented with B-mode ultrasound and Doppler imaging. Inclusion criteria comprised patients aged more than18 years old, undergoing HSCT for an hematologic condition. LF staging utilized Metavir score and Canon Score categorizing TE and 2D-SWE respectively into F0-F1, F2, F3, and F4.

### RESULTS

The pre-HSCT group showed very poor UE-TE correlation with Lin's coefficient result equal to 0.19 and Kappa's coefficient result equal to -0.62. The post-HSCT group exhibited moderate correlation with Lin's coefficient result equal to 0.59 and Kappa's coefficient equal to 0.55. Significant dispersion was noted, specially, for grades F2, F3, and F4. Also, there was no statistically significant difference between UE and TE before and +14-day after HSCT.

### CONCLUSION

Post-HSCT UE and TE demonstrated moderate correlation, highlighting the potential advantages of UE in detecting VOD onset. The observed very poor pre-HSCT correlation may stem from varied evaluation times, patient basal conditions, and technique performance, being necessary for more standardized evaluation guidelines. Additionally, no significant difference was noted pre- and post-HSCT UE and TE, suggesting no onset of classical VOD during this period; however, posterior follow-up of these patients was not included in this analysis.

### CLINICAL RELEVANCE/APPLICATION

Early VOD diagnosis in patients undergoing HSCT is crucial. Ultrasound offers additional information, aiding VOD detection through gray-scale B-mode and Doppler imaging, demonstrating features such as hepatomegaly, splenomegaly, portal vein hypertension sings, hepatic venous abnormalities, gallbladder wall thickening and abdominal free fluid, compared to TE's singular fibrosis grade result.

## R5B-SPGI-11 QUANTITATIVE ASSESSMENT OF LIVER FIBROSIS: B1 INHOMOGENEITY-CORRECTED VFA T1 MAPPING ON GADOBENATE DIMEGLUMINE-ENHANCED MRI

Gongzheng Wang (*Abstract Co-Author*) Nothing to Disclose
Lianbang Wang (*Abstract Co-Author*) Nothing to Disclose
Ximing Wang (*Abstract Co-Author*) Nothing to Disclose
Hui Ma (*Abstract Co-Author*) Nothing to Disclose
Jin Cui (*Abstract Co-Author*) Nothing to Disclose
Xinya Zhao (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the value of gadobenate dimeglumin (Gd-BOPTA)-enhanced T1 mapping using B1 inhomogeneity-corrected variable flip angle (VFA) method for staging liver fibrosis in rats.

### METHODS AND MATERIALS

Sprague-Dawley rats were divided into a control group (n = 6) and carbon tetrachloride-induced liver fibrosis groups (n = 22). T1 mapping using B1 inhomogeneity-corrected VFA was performed before and 90 min after Gd-BOPTA administration. Pre-contrast T1 values (T1pre), post-contrast T1 values (T1post), and the reduction rate of T1 values (?T1%) were quantified on T1 mapping images. Their correlations with liver fibrosis stages and hepatocyte transporters expression levels were analyzed. The diagnostic performance was evaluated by area under the receiver operating characteristic curve (AUC).

### RESULTS

T1post and ?T1% showed significant correlations with liver fibrosis stages ($r = 0.832$, $p < 0.001$; $r = -0.798$, $p < 0.001$, respectively), whereas T1pre were not significantly correlated with fibrosis stages ($r = 0.357$, $p = 0.062$). The AUCs of T1post and ?T1% were higher than SIpost for diagnosing stage F2-F4 (0.936, 0.941 vs. 0.791; $p = 0.043$, 0.038, respectively), F3-F4 (0.928, 0.861, vs. 0.660; $p = 0.003$, 0.028, respectively) and F4 (0.965, 0.896 vs. 0.761; $p = 0.021$, 0.049, respectively). Oatp1a1 and Mrp2 expression levels correlated significantly with T1post ($r = -0.859$, $p = 0.001$; $r = -0.697$, $p = 0.017$) and ?T1% ($r = 0.891$, $p < 0.001$; $r = 0.685$, $p = 0.020$), respectively.

### CONCLUSION

Gd-BOPTA-enhanced T1 mapping using B1 inhomogeneity-corrected VFA is an accurate and reliable tool for quantifying liver fibrosis stages.

### CLINICAL RELEVANCE/APPLICATION

Liver fibrosis can be noninvasively assessed by Gd-BOPTA-enhanced B1-corrected T1 mapping. Accurate early diagnosis and assessment of liver fibrosis are important for treatment and prognosis.

## R5B-SPGI-12 PREDICTIVE VALUE OF MULTI-PARAMETER ULTRASOUND COMBINED WITH PHYSIOLOGICALINDICATORSFOR HIGH-RISK HEPATITIS IN PATIENTS WITH CHRONIC LIVER DISEASE

Liyun Xue, PhD (*Abstract Co-Author*) Nothing to Disclose
Hong Ding, MD (*Abstract Co-Author*) Nothing to Disclose
Guangwen Cheng (*Abstract Co-Author*) Nothing to Disclose
Xueqi Li (*Abstract Co-Author*) Nothing to Disclose
Xiaohui Qiao (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the predictive value of shear wave elastography (SWE), shear wave dispersion (SWD), attenuation imaging (ATI) and blood indexes for high-risk hepatitis in patients with chronic liver disease.

### METHODS AND MATERIALS

The patients with metabolic dysfunction-associated steatotic liver disease (MASLD) and other chronic liver diseases such as viral, autoimmune and drug-induced liver diseases were enrolled in this prospectively study. All patients underwent liver biopsy and were divided into training set and validation set by the proportion of 8:2 according to the enrollment time. Before liver biopsy, SWE, SWD and ATI were carried out and the obtained measurement was respectively liver stiffness (LS), dispersion slope (DS) and attenuation coefficient (AC). Meanwhile, the baseline data and serological indicators were recorded. High-risk hepatitis was defined as significant inflammation and fibrosis based on pathological results. The logistic regression analysis was used to screen the risk factors and construct predictive model. The receiver operating characteristic (ROC) curve and calibration curve were applied to evaluate the diagnostic efficacy and stability of the model.

**RESULTS**

A total of 247 patients with chronic liver disease were included, 197 in the training set and 50 in the validation set, with no significant difference of the baseline characteristics between the two groups. The Logistic regression analysis revealed that LS, DS, ALT and fasting blood glucose (FBG) were the risk factors of high-risk hepatitis ($P < 0.05$), and a prediction model was developed based on these indicators. In training set, the area under curve (AUC) of LS, DS and the predictive model for identifying high-risk hepatitis was respectively 0.888, 0.887 and 0.926, and in validation set it was 0.743, 0.732 and 0.835, respectively. Calibration curve analysis exhibited good consistency of the predicted and actual high-risk hepatitis in both training and validation sets.

**CONCLUSION**

The prediction model based on SWD, SWD, ALT and FBG can effectively identify high-risk hepatitis in patients with chronic liver disease, providing important reference basis for timely clinical intervention.

**CLINICAL RELEVANCE/APPLICATION**

Early identification of high-risk hepatitis in patients with chronic liver disease can reduce the incidence of liver-related events. The invasiveness of liver biopsy makes it unsuitable for universal screening of high-risk hepatitis population. The prediction model can assist doctors in risk stratification of patients with chronic liver disease to reduce unnecessary invasive biopsy.

## R5B-SPGI-2 AI-BASED HEPATIC STEATOSIS DETECTION IN NON-CONTRAST ABDOMEN CT: A NOVEL APPROACH TO ALTERNATING MR PROTON DENSITY FAT FRACTION

Jong H. Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Sihwan Kim, MSc (*Abstract Co-Author*) Nothing to Disclose
Changmin Park (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and validate a deep learning model automatically classifying hepatic steatosis from non-contrast abdomen CT by using CT-derived fat fraction (CDFF) substituting MR proton density fat fraction (PDFF).

**METHODS AND MATERIALS**

Retrospective analysis of paired 814 abdominal CT and MRI exams (397 dual-energy and 417 single energy) from 2016 to 2023 was performed. SECT images scanned with 120kV tube voltage were used for estimation model training; DECT images with blended 120kVp (4:6 ratio for 80kV/150kV) were used for testing. Four key features of hepatic steatosis were extracted: liver HU mean, skewness of liver HU, liver-spleen HU ratio (L/S ratio), and liver-spleen HU difference (L-S difference). For automatic liver and spleen segmentation, commercial AI-software (ClariHepato, Seoul, Republic of Korea) was used. To find the best estimation model for classifying hepatic steatosis, four models were compared: linear regression, multi-variable regression, support vector machine (SVM), and multi-layer perceptron (MLP). We defined the output of each model as the CDFF (%) predicting fat fraction from non-contrast CT images. Besides, to minimize the time difference variation of patient's physiological status, a subgroup with a study date difference of less than 60 days was additionally analyzed.

**RESULTS**

In the diagnostic performance, AUROC showed an overall performance of 0.83 or higher. While sensitivity and specificity are similar for each model(Sensitivity: 0.75 vs 0.81 vs 0.77 vs 0.82 and Specificity: 0.82 vs 0.82 vs 0.81 vs 0.82 respectively), the MLP model achieved the highest diagnostic accuracy. The multi-variable HU-based inference method appears to outperform the method that only reflects liver HU values. Diagnostic performance improved for all estimation models when a study date difference between CT and MRI was within 60 days. Depending on the severity of the fatty liver to be detected, it is deemed appropriate to select the optimal cutoff and apply it to the clinical environment.

**CONCLUSION**

In this study, we developed and evaluated four different estimation models to classify hepatic steatosis based on key features extracted from non-contrast abdomen CT. MLP-based hepatic steatosis classification accuracy indicated 0.82, demonstrating the feasibility of automatic hepatic steatosis classification from CT. This method has enough potential to replace traditional MR-PDFF for clinically practical fat quantification.

**CLINICAL RELEVANCE/APPLICATION**

Automatic quantification of liver fat in non-contrast abdomen CT can improve clinical workflow efficiency and reduce the cost compared to the MRI exam. The suggested AI-based algorithm allows radiologists to conveniently assess liver fat content without additional MRI examinations.

## R5B-SPGI-3 THE UTILITY OF ULTRASOUND VERSUS CT FOR THE DIAGNOSIS OF ACUTE CHOLECYSTITIS IN THE EMERGENCY SETTING

Brittany L. Miles, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Young, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Acute cholecystitis is one of the most common diagnoses in the emergency department that requires surgical intervention. The diagnosis of acute cholecystitis is traditionally made with ultrasound, though CT (computed tomography) has been increasingly more common as routine imaging for any patient presenting to the emergency department. Patients often receive both ultrasound and CT simultaneously for the evaluation of abdominal pain. We evaluated patients who received either abdominal ultrasound or abdominal CT to assess for the incidence of laparoscopic cholecystectomy within 48 hours of imaging.

**METHODS AND MATERIALS**

The TriNetX Diamond network was used for this study. TriNetX provides access to anonymized medical record information on more than 213 million patients in 92 large healthcare organizations. Two cohorts were created using the Current Procedural Terminology (CPT) codes. One cohort received abdominal ultrasound (CPT 76700 or 76705) and patients were excluded if they had received any CT of the abdomen or pelvis the same day. The other cohort received abdominal or pelvic CT (CPT 74150, 74160, 74170, 74176, 74177, 74178) and patients were excluded if they had received an abdominal ultrasound. The cohorts were balanced for age, race, gender, and ethnicity, resulting in 3,167,651 patients in each arm. They were then evaluated for undergoing laparoscopic cholecystectomy within 48 hours of imaging.

**RESULTS**

Patients who underwent abdominal CT were 20-fold less likely to undergo surgery (RR 0.052, 95% CI (0.051,0.054), p-value <0.0001.

### CONCLUSION

This study shows that patients who underwent ultrasound imaging were 20-fold more likely to undergo surgery for acute cholecystitis. As ultrasound is cheaper, widely available, and does not require the use of intravenous contrast, it remains the standard of care for initial abdominal imaging in this setting. Patients who present to the emergency department with the clinical suspicion of acute cholecystitis have a statistically significant increased percentage of receiving surgical intervention if ultrasound was performed over CT.

### CLINICAL RELEVANCE/APPLICATION

Abdominal CT is a mainstay in the emergency setting for the evaluation of abdominal pain, and many patients seemingly automatically receive a CT during their visit. However, the diagnosis of acute cholecystitis resulting in surgical intervention is higher in patients who undergo abdominal ultrasounds. An abdominal CT can often be performed faster than ultrasound and has the benefit of evaluating the entire abdomen. We hope this shows that abdominal CT does not need to be reflexively ordered on patients with the clinical suspicion of acute cholecystitis if an abdominal ultrasound is already being performed.

## R5B-SPGI-4 DOPPLER ULTRASOUND AND 2D SHEAR WAVE ULTRASOUND ELASTOGRAPHY FOR LIVER FIBROSIS EVALUATION IN FONTAN-ASSOCIATED LIVER DISEASE IN ADULTS

Nattaporn Sriwicha (*Abstract Co-Author*) Nothing to Disclose
Nakarin Inmutto, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To explore Doppler ultrasound findings in Fontan patients. We hypothesize that both Doppler ultrasound and 2D shear wave ultrasound are valuable tools in assessing the degree of hepatic fibrosis.

### METHODS AND MATERIALS

A retrospective study included 27 Fontan patients between January 2020 to December 2022. Participants underwent liver Doppler ultrasound, 2D-SWE, and biopsy. Data collected encompassed specifics of the Fontan operation, cardiac diagnosis, and relevant laboratory tests. Fibrosis severity, assessed via METAVIR scoring system.

### RESULTS

In 27 post-Fontan patients (mean age: 19 years). Most prevalent cardiac diagnosis was tricuspid atresia (37%). The APRI score in non-significant fibrosis was 0.26 ± 0.06. The APRI score in significant/cirrhosis groups was 0.38 ± 0.115. The FIB-4 score in non-significant fibrosis was 0.45 ± 0.13. The FIB-4 score in significant/cirrhosis groups was 0.67 ± 0.2. The Peask systolic velocity, resistive index and acceleration time of the hepatic artery between non-significant fibrosis group and significant/cirrhosis groups were not statically significant difference. The diameter of the main portal vein was not significantly different between the two groups, 0.86 cm and 0.85 cm. The mean velocity of main portal vein in significant/cirrhosis groups was slightly lower than non-significant fibrosis group, 11.38 cm/s and 13.24 cm/s respectively. Ultrasound liver elastography showed no significant difference in median stiffness among groups.

### CONCLUSION

Serum marker scoring system could be valuable in determining significant fibrosis / cirrhosis in FALD patients. Ultrasound elastography proved less helpful in definite non-significant fibrosis and significant fibrosis in FALD patients due to confounding factor from liver congestion.

### CLINICAL RELEVANCE/APPLICATION

Doppler ultrasound findings may offer a new tool in fibrosis monitoring, warranting further research.

## R5B-SPGI-5 ASSESSING THE PREDICTIVE VALUE OF ABDOMINAL VOLUMETRY FOR POST-SURGICAL COMPLICATIONS IN INCISIONAL HERNIAS WITH LOSS OF DOMAIN AT A TERTIARY HEALTH CENTER

Monica Chapa-Ibarguengoitia, MD (*Abstract Co-Author*) Nothing to Disclose
Denny Lara Nunez, MD (*Abstract Co-Author*) Nothing to Disclose
Jose A. Cienfuegos Alvear, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana De Los Ssantos Carmona, MD (*Abstract Co-Author*) Nothing to Disclose
Axel A. Torres Monarrez, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Evaluating the Role of Abdominal Volumetry in Predicting Postoperative Complications in Patients with incisional hernias with loss of domain at a Tertiary Care Hospital.

### METHODS AND MATERIALS

This cross-sectional study encompassed all patients diagnosed with incisional hernias with loss of domain who were referred to our institution between 2007 and April 2023. Patients lacking postoperative outcome data or with inadequate tomographic scans would be excluded from the trial. We conducted a retrospective analysis of 199 CT scans using the post-processing software "IntelliSpacePortal" version 9.0 from IQon Spectral CT. These scans were taken from 152 patients who had been diagnosed with incisional hernias with loss of domain.

### RESULTS

We retrospectively analyzed CT scans (n = 199) using post-processing software from 152 patients diagnosed with incisional hernias with loss domain. The two most common operations previously performed by these patients were Hartmann's procedure (15.13%, n=22) and intestinal resection (14.81%, n=21).CT scans were categorized as lacking or having the Valsalva maneuver; 121 CT scans were analyzed from the first group, and the subsequent measurements were documented: The average hernia index was 7.87 $cm^3$ (IQR 25-75: 4.56-11.82), total abdominal volume was 8358.5 $cm^3$ (IQR 25-75: 6754-9808.5), and hernia volume was 680 $cm^3$ (IQR 25-75: 407-1217). The total volume was 9262.6 $cm^3$ (IQR 25-75: 7519-10559).For the 47 CT scans performed with the Valsalva maneuver, the following measurements were observed: total abdominal volume was 7643 $cm^3$ (IQR 25-75: 6365-6625), hernia volume was 923 $cm^3$ (IQR 25-75: 468-2191), total volume was 9510 $cm^3$ (IQR 25-75: 7477-10911), and the average hernia index was 12.38 (IQR 25-75: 5.5-20.97).From the total patients, 61 (40.13%) experienced complications: 31 patients (20.39%) had postoperative wall complications, 15 patients (9.86%) had intra-abdominal complications, 39 patients (25.65%) had systemic complications.Finally, a significant correlation was found between the volumetric hernia ratio (CT scans without the Valsalva maneuver, n = 121) and postoperative complications in 48 patients (p: 0.0123).

### CONCLUSION

The volumetric hernia ratio can predict post-operative problems, helping surgeons plan pre-surgery IHLD. Therefore, a systematic and reproducible volumetric approach for hernias with loss of domain is needed.

### CLINICAL RELEVANCE/APPLICATION

The risk of complications caused by incisional hernias with loss of domain can be estimated by assessing the volumetric hernia ratio before surgical intervention. This information is important for surgeons, enabling them to reliably forecast postoperative difficulties prior to doing surgery for IHLD.

## R5B-SPGI-7 PERFORMANCE OF VENDOR SPECIFIC ULTRASOUND DERIVED FAT QUANTIFICATION METRICS USING LIVER BIOPSY AS THE REFERENCE STANDARD

Cheng Fang, MBBS (*Abstract Co-Author*) Nothing to Disclose
Paul S. Sidhu, BSc, FRCR (*Abstract Co-Author*) Consultant, Samsung Electronics Co, Ltd;Speaker, Samsung Electronics Co, Ltd;Speaker, Bracco Group;Consultant, Itreas Ltd;Speaker, Siemens AG
Nuran Seneviratne, MA, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

The accuracy of four vendor-specific ultrasound hepatic fat quantification metrics was assessed using steatosis histology grades as a reference standard. Tissue attenuation imaging™ (TAI) and tissue scatter distribution imaging™ (TSI) metrics were based on beam attenuation and backscatter, respectively. Fat fraction (FF), calculated from these metrics, along with an automated hepatorenal index (Ez-HRI™ Samsung Medison, Seoul, Korea) were also determined.

### METHODS AND MATERIALS

Patients with chronic liver disease, including suspected metabolic dysfunction associated fatty liver disease (MAFLD), scheduled for liver biopsy were prospectively enrolled. Five measurements for each metric were recorded on a Samsung RS85 Prestige™ ultrasound machine. FF was calculated using the manufacturer provided formula for median TAI and TSI scores.

### RESULTS

Preliminary results for the first 55 patients (30 male, median age 47 years, median body mass index [BMI] 28.4 mg/kg2, 36.4% MAFLD) are presented. Non-targeted liver biopsy was performed [Oberon1] in all participants. Liver steatosis on histopathology was graded as normal (S0, <5% steatosis, n=27), mild (S1, 5-33% fat, n=14), moderate (S2, 33-66% fat, n=10) and severe (S3, >66% fat, n=4). Correlation was good to excellent between each metric and steatosis grade (TAI 0.712, TSI 0.733, FF 0.773, Ez-HRI 0.838; all $P<0.05$ using Kruskall Wallis test). Multivariate analysis showed all metrics were not affected by age, BMI, or fibrosis stage. Performance was excellent for all metrics in differentiating mild (S1) or greater steatosis (TAI 0.85, TSI 0.88, FF 0.89, Ez-HRI 0.95; all $P<0.05$) and moderate (S2) or greater steatosis (TAI 0.9, TSI 0.88, FF 0.91, Ez-HRI 0.96; all $P<0.05$). Pairwise comparisons using Dunn-Bonferini post-hoc test showed significant differences between mild, moderate, and severe steatosis versus normal for TAI, FF, and Ez-HRI. Significant differences were seen between mild and moderate versus normal for TSI.

### CONCLUSION

The evaluated ultrasound-derived fat quantification metrics showed good correlation with steatosis grade, with an excellent ability to differentiate between normal, mild, and moderate liver steatosis.

### CLINICAL RELEVANCE/APPLICATION

Non-invasive hepatic fat assessment software is becoming more readily available in modern ultrasound machines. They provide an accurate estimate of hepatic steatosis, which can be used for screening and monitoring MAFLD, an increasing public health problem.

# Abstract Archives of the RSNA, 2024

R5B-SPGU

**Genitourinary Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPGU-1 VI-RADS-BASED ALGORITHM FOR BLADDER CANCER MANAGEMENT

Sabahattin Yuzkan (*Abstract Co-Author*) Nothing to Disclose
Emin Taha Keskin (*Abstract Co-Author*) Nothing to Disclose
Metin Savun (*Abstract Co-Author*) Nothing to Disclose
Merve Sam Ozdemir (*Abstract Co-Author*) Nothing to Disclose
Harun Ozdemir (*Abstract Co-Author*) Nothing to Disclose
Nurullah Kaya, BMedSc (*Presenter*) Nothing to Disclose

### PURPOSE

It is unclear if the Vesical Imaging, Reporting and Data System (VI-RADS) can replace repeated transurethral resection of bladder tumour (Re-TURBT) as in the new VI-RADS-based algorithm. To evaluate if VI-RADS can distinguish between non-muscle-invasive bladder cancers (NMIBC), muscle-invasive bladder cancer (MIBC), and high-risk non-muscle-invasive bladder cancers (HR-NMIBCs).

### METHODS AND MATERIALS

Sensitivity, specificity, and positive (PPV) and negative (NPV) predictive values of the VI-RADS score were calculated for mpMRI performance in patients undergoing TURBT and HR-NMIBC patients for only Re-TURBT.

### RESULTS

Of In 283 cases, when VI-RADS=3 lesions were considered muscle-invasive, its sensitivity was 95.7% and specificity was 92.5%. PPV and NPV were 86.6% and 97.7%, respectively. The area under the curve (AUC) was 0.942 (p <.001). Of Of the 89 patients undergoing post-Re-TURBT, 41 (46%) were tumour-free, and 47 (50.5%) showed permanent HR-NMIBC, and 3 (2.2%) were upgraded to MIBC. Per the new VI-RADS-based approach, 73 (41%) of the 178 HR-NMIBCs with VI-RADS= 2 would not undergo Re-TURBT. Of the 75 patients with VI-RADS = 4, 6 (6) had HR-NMIBCs (8%) would not undergo Re-TURBT. When incomplete resections were excluded, 35 60.3%) of the patients had complete resection, and 23 (39.7%) had residual disease, and complete resection would not have been performed in these patients, and 2 (100%) still had residual disease.

### CONCLUSION

The new VI-RADS-based algorithm helped VI-RADS = 4 patients by switching to radical treatment. Since the residual disease is high in cases with VI-RADS = 2, even if incomplete resections are excluded, TURBT should be continued.

### CLINICAL RELEVANCE/APPLICATION

VI-RADS-based decision-making will enable a paradigm shift from current TURBT-dependent practice, and our newly proposed algorithm may form the basis for further discussion.

## R5B-SPGU-4 USE OF 3D PRINTING IN SURGICAL PLANNING OF THE CLOACAL MALFORMATIONS: UC DAVIS EXPERIENCE

Zoe Saenz (*Abstract Co-Author*) Nothing to Disclose
Lotfi Hacein-Bey, MD (*Abstract Co-Author*) Nothing to Disclose
Osama A. Raslan, MD, MBBCh (*Abstract Co-Author*) Research Grant, Bracco Group;Contract, Shanghai United Imaging Healthcare Co, Ltd
Neha Antil, MD (*Presenter*) Nothing to Disclose

### PURPOSE

We aim to evaluate the use of 3-D cloacogram derived printed model for pre-operative planning of complex cloacal malformations, using intraoperative findings as the reference standard and comparing 3-D cloacogram data with endoscopic findings.

### METHODS AND MATERIALS

A retrospective case-based review was performed in patients with cloacal anomalies who underwent endoscopy, 2D and 3D cloacograms, and reconstruction surgery between 2020 and 2024. 3-D printing models were generated after 3-D cloacogram and cone beam CT were performed. The CT images were then imported into Mimics in Print 2.0 software (Materialise NV, Leuven, Belgium) and the following structures were segmented by the radiologist: common channel, bladder, rectum, vagina, uterus, and pelvic bone. Segmented data were then exported as standard tessellation language (STL) files and the models were printed and used for surgical planning. Demographics, imaging measurements (length of common cloacal channel), surgical approach planning, level of surgeon's readiness and confidence and level of parental understanding were recorded. Pre-operative imaging measurements were compared to the reference standard intraoperative measurement.

**RESULTS**

Five female patients with a median age of 30.52 +/- 12.61 months underwent endoscopy, 3D cloacogram and surgical repair. The abdomino perineal approach was used in 3, a perineal approach in one and transabdominal repair was used in one patient for cloacal repair. The length of the common channel on 3D cloacogram, endoscopy, and 3D printing model was accurately correlated to operative findings in 4/5 patients, 3/5 patients and 5/5, respectively. There were 3 anatomical discrepancies between endoscopy and 3D cloacagram/ 3D printed model, which led to abdominoperineal approach instead of perineal or transabdominal alone in 3/5 (60%) of cases. The model was pivotal for surgeon's better understanding of anatomy and parent's education and counseling.

**CONCLUSION**

In our experience, 3D cloacogram and 3D printed model accurately measured the common channel length and outperforms endoscopy and resulted in improved surgical planning and parent's understanding.

**CLINICAL RELEVANCE/APPLICATION**

3-D printing can be a useful tool for surgeons to better visualize the ideal anatomical simulation for surgical planning, especially in complex anatomy such as cloacal malformation. It can also be a valuable tool to educate families about the challenges of reconstruction and counsel on prognosis for future continence.

## R5B-SPGU-5 VALUE OF QUANTITATIVE SYNTHETIC DWI FOR DETECTING PI-RADS 3 CLINICALLY SIGNIFICANT PROSTATE CANCER

Akira Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Fukunaga (*Abstract Co-Author*) Nothing to Disclose
Yu Ueda, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Higaki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuichi Kojima (*Abstract Co-Author*) Nothing to Disclose
Yoshihiko Fukukura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Tamada, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To validate if multiparametric quantitative maps including ADC, T1, and T2 simultaneously obtained from synthetic diffusion-weighted imaging (syDWI) can bring added value to differentiate cancer from noncancer in suspicious lesions with PI-RADS category 3, which is about 30% cancer detection rate.

**METHODS AND MATERIALS**

Eighty-six patients with 103 PI-RADS v2.1 category 3 lesions were evaluated among those who underwent MRI-ultrasound fusion-guided prostate biopsy for lesions suggestive of prostate cancer on pre-biopsy multiparametric MRI between October 2021 and January 2024. All MR images were obtained with a 3T MRI (Ingenia Elition 3.0T; Philips). SyDWI acquisition includes b0 images acquired with two different TR and TE, and b1000 and b2000 acquired with single TR and TE (Figure 1). The detailed imaging parameters are described in Figure 2. The T1 can then be estimated by using the signal from 2 b0 images, varying TR and keeping TE constant, while T2 can be estimated from 2 b0 images with constant TR but varying TE. T1, T2, and ADC calculated from images at b-value of 0 and 1000 s/mm2 values were compared between PI-RADS category 3 target biopsy-proven cancers (Gleason score (GS) =7) and noncancers (GS=6 or benign tissue) by using Mann-Whitney U test. Logistic regression was used to assess T1, T2, and ADC in the differentiation of cancers versus noncancers. ROC curves and AUC were obtained from ordinary logistic regression of the binary outcome. $P < 0.05$ was considered to indicate a statistically significant difference.

**RESULTS**

Biopsy-proven prostate cancers and noncancers among 103 PI-RADS category 3 lesions were identified in 31 lesions and 72 lesions, respectively. Thus, the cancer detection rate was 30.1%. T1 (ms), T2 (ms), and ADC (×10-3 mm2/s) in PI-RADS category 3 target biopsy-proven cancers were significantly lower than those of noncancers (1947±267 and 2100±288, 59±10 and 70±17, and 1.00±0.18 and 1.14±0.22, respectively) ($P = 0.025$ to $P< 0.001$) in Figure 3. For separation between PI-RADS category 3 cancers and noncancers, the AUC for T2 (0.73) was higher than the AUC for T1 (0.64) and ADC (0.69) in Figure 4. Cut-off value was 58 for T2, 1983 for T1, and 1.07 for ADC, respectively. The combination of T1, T2, and ADC yielded an AUC of 0.75. Figure 5 shows representative clinical cases with cancer and noncancer.

**CONCLUSION**

Our results indicate that T1, T2, and ADC calculated from syDWI might enable more accurate diagnosis of suspicious lesions with PI-RADS category 3.

**CLINICAL RELEVANCE/APPLICATION**

T1, T2, and ADC calculated from syDWI acquisition used for synthetization of DW images may differentiate more accurately insignificant from significant lesion in suspicious cancers with PI-RADS Category 3, reducing unnecessary biopsies.

## R5B-SPGU-6 USEFULNESS OF URINARY BIOMARKER-BASED RISK SCORE AND MULTIPARAMETRIC MRI FOR CLINICALLY SIGNIFICANT PROSTATE CANCER DETECTION IN BIOPSY-NAïVE PATIENTS

Carlos Nicolau, MD (*Abstract Co-Author*) Nothing to Disclose
Mindaugas Jievaltas (*Abstract Co-Author*) Nothing to Disclose
Kristina Zviniene (*Abstract Co-Author*) Nothing to Disclose
Ingrida Pikuniene (*Abstract Co-Author*) Nothing to Disclose
Gytis Cholstauskas (*Abstract Co-Author*) Nothing to Disclose
Mantvydas Lopeta (*Abstract Co-Author*) Nothing to Disclose
Jurate Kemesiene, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to investigate the accuracy of magnetic resonance imaging (MRI), genetic urinary test (GUT) and prostate cancer prevention trial risk calculator version 2.0 (PCPTRC2) for the clinically significant prostate cancer (csPCa) diagnostic in biopsy-naḭve patients.

**METHODS AND MATERIALS**

In a single center study between 2021 and 2024 participants underwent prostate mpMRI, GUT and ultrasound (US) guided biopsy. The csPCa risk was calculated using PCPTRC2. Post digital rectal examination (DRE) GUT was performed measuring RNA levels of PCA3 and T:E fusion genes. The McNemar test compared detection rates between modalities.

### RESULTS

208 (mean age 62.9 years +/- 8.2) men were included prospectively. A positive GUT score was found in 67.8% and PIRADS =3 in 81.7% of all cases. The combination of GUT with mpMRI showed significantly higher sensitivity (99.1%) than GUT and mpMRI alone, 84.4% and 93.8%, respectively (p = 0.05). Similarly, very high sensitivity (99.0%) was achieved by combining mpMRI with PCPTCR2. Nevertheless, mpMRI plus GUT combination exceeded mpMRI plus PCPTCR2 by allowing to save a higher fraction of unnecessary biopsies, 25% and 2,4%, respectively.

### CONCLUSION

GUT and mpMRI combination would allow saving a substantial fraction of unnecessary biopsies with minimal risk of missing csPCa cases.

### CLINICAL RELEVANCE/APPLICATION

The combination of genetic urinary testing (GUT) and MRI enhanced the detection sensitivity of csPCa while substantially reducing unnecessary biopsies, thereby improving diagnostic efficiency and patient outcomes.

## R5B-SPGU-8 UNENHANCED COMPUTED TOMOGRAPHY-BASED RADIOMICS SIGNATURE IN DISTINGUISHING RENAL CYST FROM RENAL CARCINOMA

Wei Wei (*Abstract Co-Author*) Nothing to Disclose
Jinjing Yang (*Presenter*) Nothing to Disclose

### PURPOSE

To establish and validate a predictive radiomics model for prediction of renal cyst and renal carcinoma respectively in patients with renal disease using unenhanced CT.

### METHODS AND MATERIALS

In this retrospective study, a total of 79 patients with 39 cases of renal cyst and 40 cases of renal carcinoma were enrolled from September 2023 to February 2024. Lesion segmentation was conducted by using ITK-snap 3.8. The dataset was randomly assigned in a 7:3 ratio to either the training cohort or testing cohort. Radiomics features were extracted from unenhanced CT images using Pyradiomics and the most useful features in the training set were selected using LASSO algorithm. The selected features were then combined into a Rad-score, which was further assessed by ROC curve analysis in the training and testing sets.

### RESULTS

A total of 103 radiomics features were extracted and 3 features which met the criteria were selected. By evaluating the diagnostic value, the predictive model showed a good performance (area under the curve [AUC], 0.89; 95% confidence interval [CI] 0.78-0.96; sensitivity, 0.78; specificity, 0.99 in training cohort; AUC, 0.91; 95% confidence interval [CI] 0.71-0.99; sensitivity, 0.99; specificity, 0.84 in testing cohort). Decision curve analysis confirmed the clinical usefulness of the model.

### CONCLUSION

Unenhanced CT-based radiomics model could be helpful for prediction of renal cysts and renal carcinoma in patients with renal disease.

### CLINICAL RELEVANCE/APPLICATION

Renal round-like lesions tend to appear on Abdominal or chest unenhanced CT scans. Distinguishing renal cyst from renal carcinoma based on unenhanced CT images is challenge. Therefore, it is critical to build a radiological model only using unenhanced CT scan to identify renal cyst and renal carcinoma, and to screen out high-risk lesions, which is valuable for the clinical management of patients.

## R5B-SPGU-9 VALUE OF DUAL ENERGY CT DELAYED PHASE IODINE OVERLAY MAPS RADIOMICS IN DIFFERENTIATING TYPE I AND TYPE II OVARIAN CANCER

Ailian Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Ye Li (*Abstract Co-Author*) Nothing to Disclose
Qingling Song (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the value of dual energy CT delayed phase iodine overlay maps radiomics in differentiating type I and type II ovarian cancer.

### METHODS AND MATERIALS

A total of 154 patients with ovarian cancer underwent dual energy CT were randomly divided into training dataset (N = 123) and test dataset (N = 31). The clinical features included age, menstrual status, FIGO stage, and serum tumor markers including CA125, CA19-9 and HE4 were collected. The radiomics features were extracted from CT images of each patient. Multivariate logistic regression was employed to construct clinical and radiological models. The correlation analysis and least absolute shrinkage and selection operator algorithm were used to select radiomics features and build radiomics model. The important clinical, radiological factors, and radiomics features were integrated into a combined model by multivariate logistic regression. Receiver operating characteristics curve with area under the curve (AUC) were used to evaluate and compare predictive performance.

### RESULTS

FIGO stage was the independent clinical predictor. Laterality, 21 radiological features were left after dimensionality reduction. In the training dataset, the AUCs for the clinical and radiomics models in differentiating type I and type II ovarian cancer were 0.869 and 0.883, respectively. In the test dataset, the AUCs for two models were 0.886 and 0.977, respectively. The combined model in both the training and the test datasets with AUCs 0.948 and 0.977.

### CONCLUSION

Dual-energy delayed iodine overlay imaging model and clinical-imaging combined model can distinguish type I and type II ovarian cancer, which is helpful to the clinical management of patients with pre-treatment ovarian cancer.

### CLINICAL RELEVANCE/APPLICATION

Dual-energy CT, combined with clinical features and radiomics analysis, offers a robust method to differentiate between type I and type II ovarian cancer subtypes. This approach enhances pre-treatment planning and patient management, aiding in personalized treatment strategies for ovarian cancer patients.

# Abstract Archives of the RSNA, 2024

R5B-SPHN

**Head & Neck Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPHN-1 CONTRAST-ENHANCED US WITH PERFLUOROBUTANE TO DIAGNOSE THYROID BED NODULES AFTER PAPILARY THYROID CARCINOMA SURGERY

Longzhong Liu (*Abstract Co-Author*) Nothing to Disclose
Lingli Guo (*Presenter*) Nothing to Disclose

### PURPOSE

Approximately 34-55% thyroid bed (TB) nodules can be detected by ultrasound during follow-up of postoperative patients with papillary thyroid carcinoma (PTC). 2015 American Thyroid Association guidelines indicates that conventional ultrasound (US) is difficult to differentiate benign and malignant TB nodules. Our previous study (DOI:10.1145/radiol.221465) showed that contrast-enhanced US (CEUS) with perfluorobutane has a better diagnosis of metastatic small lateral cervical lymph nodes (LNs) in PTC. The purpose of this retrospective cohort study is to evaluate the diagnostic performance of CEUS with perfluorobutane for TB nodules.

### METHODS AND MATERIALS

This retrospective study included consecutive patients from October 2020 to January 2024 in our center. All patients had underwent total thyroidectomy or lobectomy and central lymph node dissection for PTC. All TB nodules underwent US and CEUS with intravenous perfluorobutane. The status of TB nodules were confirmed by fine-needle aspiration cytopathology or surgical histopathology. Features and diagnostic performance of US and CEUS were analyzed and compared by Pearson ?2 test and the area under the receiver operating characteristic curve (AUC).

### RESULTS

We retrospectively reviewed 63 lesions from 50 patients (median age, 39 years [IQR, 35-51 years]; 39 women), including 21 benign nodules and 42 malignant nodules. Increased vascularization was more often seen in malignant nodules in US (p=0.002). Both centripetal perfusion pattern in the vascular phase and non-isoenhancement (including hypoenhancement, partial enhancement, and no enhancement) in the postvascular phase of CEUS were significantly associated with malignant nodules (P=0.001 and P<0.001, respectively). 45.24% of malignant nodules (19/42) showed centripetal perfusion pattern + non-isoenhancement in the postvascular phase on CEUS. The AUC of CEUS (perfusion pattern + postvascular phase features) was significantly higher than that of US (0.90 vs 0.69; P<0.001).

### CONCLUSION

The perfusion pattern and postvascular phase features of CEUS with perfluorobutane demonstrated excellent performance for diagnosing TB nodules.

### CLINICAL RELEVANCE/APPLICATION

CEUS with perfluorobutane may be an effective and noninvasive method for the evaluation of TB nodules after PTC surgery, which provides more references for continued follow-up or invasive intervention for TB nodules.

## R5B-SPHN-2 THYROID NODULE CHARACTERIZATION: WHICH TIRADS IS MORE ACCURATE? A COMPARISON BETWEEN RADIOLOGIST WITH DIFFERENT EXPERIENCES AND AI SOFTWARE

Emanuele David (*Abstract Co-Author*) Nothing to Disclose
Carmen Solito (*Abstract Co-Author*) Nothing to Disclose
Vincenzo Dolcetti (*Abstract Co-Author*) Nothing to Disclose
Carlo Catalano, MD (*Abstract Co-Author*) Nothing to Disclose
Patrizia Pacini (*Abstract Co-Author*) Nothing to Disclose
Maurizio Renda (*Abstract Co-Author*) Nothing to Disclose
Vito Cantisani, MD, PhD (*Abstract Co-Author*) Speaker, Canon Medical Systems Corporation;Speaker, Bracco Group;Speaker, Samsung Electronics Co, Ltd;
Chiara Di Bella, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare: the performance of K-TIRADS, EU-TIRADS and ACR TIRADS when used by operators with different levels of experience compared with the gold standard cytology; to evaluate the diagnostic performance of CAD compared with TI-RADS systems.

### METHODS AND MATERIALS

323 thyroid nodules were evaluated in Patiens who were candidates for needle aspiration. Three operators with different levels of experience evaluated the diagnostic accuracy of three risk stratification systems (ACR TI-RADS, EU-TIRADS, K-TIRADS) and CAD software (S-Detect) in characterizing the

nodules. The results were compared with citology examination. All nodules were characterized in terms of shape, margins, composition, calcifications, size, echogenicity, microcalcifications and stratifyg individual nodules by using the three TIRADS systems; then S-detect software was applied and the data were compared with each other and with the gold standard.

**RESULTS**

At cytology, 308 benign and 33 malignant nodules were identified. ACR-TIRADS showed a sensitivity of 100%, a specifity of 86%, a positive predictive value of 43% and a negative predictive value of 100%. EU-TIRADS showed a sensitivity of 100%, a specifity of 79%, a positive predictive value of 33% and a negative predictive value of 100%. K-TIRADS showed a sensitivity of 100%, a specifity of 89%, a positive predictive value of 50% and a negative predictive value of 100%. S-DETECT combined with EU-TIRADS showed a high agreement (>95%) with gold standard.

**CONCLUSION**

K-TIRADS positive predictive power was slightly better than other TIRADS, suggesting greater accuracy in correctly diagnosing positive cases. S-DETECT combined with EU-TIRADS has similar results as S-DETECT with ACR- and K- TIRADS in terms of sensitivity, specificity and negative predictive power. However, it has a slightly better positive predictive power, suggesting greater accuracy in correctly diagnosing positive cases than the ACR- and K- classification systems. In general, S-Detect cannot yet be considered a substitute for the human operator but only an important support for human evaluation and an excellent and fast help to provide a comprehensive and complete report.

**CLINICAL RELEVANCE/APPLICATION**

S-Detect is a valuable tool for characterizing thyroid nodules, when integrated with radiologist evaluation. It is also an important support tool for less experienced operators. Particularly interesting is the approach of use in integrated combination of the K-TIRADS by the human operator with S-Detect using EU-TIRADS, which could increase the overall diagnostic efficiency of the systems used individually. CAD-classification systems, infact, appear to have more specificity, potentially helping to avoid unnecessary cytological examinations.

## R5B-SPHN-3 ASSESSMENT OF THYROID NODULES USING LOGISTIC REGRESSION ANALYSIS OF CONVENTIONAL AND FUNCTIONAL MRI FEATURES

Fan Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Tao (*Abstract Co-Author*) Nothing to Disclose
Peng Sun, MD,MD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Shuyi Peng (*Abstract Co-Author*) Nothing to Disclose
Wenying Zhu (*Abstract Co-Author*) Nothing to Disclose
Jie Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

Given the common occurrence of thyroid nodules among patients, there is a pressing need for an accurate diagnostic approach to differentiate between benign and malignant nodules. Fine-needle aspiration biopsy (FNAB) and thyroid ultrasound are currently used for this purpose. However, FNAB is complicated, time-consuming and expensive, and the accuracy of ultrasound varies significantly despite its reputation for being rapid and highly sensitive. Leveraging the advantageous soft tissue imaging capabilities of magnetic resonance imaging (MRI), this study aims to devise a diagnostic tool using logistic regression analysis with both conventional and functional MRI to effectively distinguish between malignant and benign thyroid nodules.

**METHODS AND MATERIALS**

A total of fifty-eight nodules (33 benign,25 malignant) confirmed by pathology were included. Imaging data comprised conventional MRI sequences (T1WI, T2WI) and functional imaging sequences (DCE, DWI). Nodule characteristics including shape, coverage, enhancement, cystic changes, hemorrhage/calcification, and ADC values were assessed. Significant risk factors for malignancy were identified by multivariable logistic regression, and ROC analysis was used to evaluate diagnostic performance.

**RESULTS**

Logistic regression identified three key MRI features (coverage, cystic changes, ADC values) for malignancy prediction. The logistic regression model was Logit(p)=-25.001+2.541×cystic +3.417×covering +22.561× ADC. Using a threshold of P>0.5 for malignancy, diagnostic accuracy reached 94.8%, with an AUC of 0.955.

**CONCLUSION**

Cystic degeneration, covering, and ADC values are pivotal for differentiating benign and malignant thyroid nodules. The logistic regression model utilizing both conventional and functional MRI is a valuable tool for nodule characterization.

**CLINICAL RELEVANCE/APPLICATION**

The logistic regression model with both conventional and functional MRI features (Cystic degeneration, covering, and ADC) is a valuable tool for thyroid nodule assessment.

## R5B-SPHN-4 ASSESSING THE UTILITY OF ACR-TIRADS ULTRASOUND CLASSIFICATION IN GUIDING MANAGEMENT OF THYROID NODULES DIAGNOSED AS TIR3A AT FNAC

Giovanni G. Pompili, MD (*Abstract Co-Author*) Nothing to Disclose
Gianpaolo Carrafiello, PhD (*Abstract Co-Author*) Nothing to Disclose
Alessia Moro, MD (*Abstract Co-Author*) Nothing to Disclose
Silvia Tresoldi, MD (*Abstract Co-Author*) Nothing to Disclose
Giovanni Irmici, MD (*Abstract Co-Author*) Nothing to Disclose
Loredana De Pasquale, MD (*Abstract Co-Author*) Nothing to Disclose
Filippo Locatelli (*Abstract Co-Author*) Nothing to Disclose
Elena Grimaldi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the correlation between ultrasound (ACR-TIRADS 2018) and cytological (SIAPEC-SIE) classifications in thyroid nodules categorized as Tir3a on fine-needle aspiration cytology (FNAC).

**METHODS AND MATERIALS**

In this ethical-committee approved retrospective study, all nodules diagnosed as TIR3A on fine needle aspiration cytology (FNAC) in consecutive patients over a 4-year period were selected, upon acquisition of informed consent. US was used to calculate Thyroid Imaging Reporting and Data System

(TIRADS) scores, with repeat assessments and FNAC performed six months post-diagnosis. Those still classified as Tir3a on cytology were further evaluated for either surgery or continued US follow-up. This study extended the follow-up period to five years after the initial cytological examination, providing insights into the outcomes of Tir3a nodules. High-frequency linear array probes and 23G or 25G needles were used for US and FNAC, respectively. Descriptive statistics were applied for analysis.

**RESULTS**

Between January 2016 and December 2019, 54 Tir3a thyroid nodules were identified in 54 patients, with a mean age of 61 years (±14 years, range 21-87 years). A total of 20.4% (11/54) patients were excluded due to retrospective TIRADS evaluation challenges. Initial evaluation revealed 5.5% (3/54) of Tir3a nodules classified as TIRADS 2, 35.2% (19/54) as TIRADS 3, 35.2% (19/54) as TIRADS 4, and 3.7% (2/54) as TIRADS 5. After six months, 7% (3/43) were reclassified as Tir2, while 91% (39/43) remained Tir3a with one reclassified as Tir3b. Nine Tir3a patients had a final diagnosis after surgery (2 papillar microcarcinoma - TIRADS 3; 2 hyperplasia - TIRADS 3; 5 adenomas - 3 TIRADS 3 and 2 TIRADS 4). The remaining 30 nodules were monitored for 12 months, with no progression exceeding 10%. Among these, 20 patients continued annual follow-up, confirming nodule stability.

**CONCLUSION**

TIRADS aids in monitoring thyroid nodules, particularly low TIRADS nodules showing no malignancy. US follow-up is recommended for Tir3a nodules with TIRADS score =3. Larger longitudinal studies will enhance understanding of ACR TIRADS' role in screening indeterminate thyroid nodules.

**CLINICAL RELEVANCE/APPLICATION**

This study offers insights into improving diagnostic accuracy and guiding appropriate management decisions for patients with thyroid nodules. These findings have the potential to empower clinicians by providing a reliable method to combine ultrosound characteristics with cytological results, thus optimizing patient care and potentially reducing unnecessary procedures or surgeries.
Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

R5B-SPIN

**Imaging Informatics Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPIN-1 GUIDANCE FOR CORRECTING SEGMENTATION ERRORS USING CONDITIONAL DIFFUSION MODELS TRAINED ON DIVERSE ANNOTATION MASKS IN CT IMAGES

Min Jin Lee, PhD (*Abstract Co-Author*) Nothing to Disclose
Helen Hong, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyu Won Shim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jinseo An, BS (*Presenter*) Nothing to Disclose

### PURPOSE

The study aims to offer guidance for manually correcting segmentation results, which are challenging to differentiate from surrounding tissues in CT images due to low contrast and ambiguous boundaries. We propose a method for generating multiple plausible segmentation outputs using a conditional diffusion model(CDM) by learning from the distribution of diverse annotation masks. Additionally, we provide meaningful guidance for manually correcting results in area where segmentation performance is low.

### METHODS AND MATERIALS

A dataset consisting of 71 facial CT images was divided into 57 train sets and 14 test sets. Each set was manually annotated by a neurosurgeon with over 15 years of experience(NS-A) and two senior medical students(MS-B, MS-C). To address discrepancies between three manual annotation masks caused by the ambiguous boundaries and thin structure, all annotation masks were utilized to learn diverse data distribution. We employed MedSegDiff-V2, which integrates a transformer mechanism with a U-Net backbone and uses feature maps extracted from the CT images through another U-Net to provide supplementary context. Segmentation performance was evaluated in regions vulnerable to discrepancies between manual annotations, specifically the orbital medial wall and orbital floor. Ground truth was established using masks generated by the STAPLE algorithm. In the experiment, we generated 20 segmentation masks for each image. Ambiguity-aware map was generated based on the frequency of occurrence from these masks and the final binary segmentation mask was determined by majority voting among these masks.

### RESULTS

The segmentation results obtained from the CDM indicated a DSC of 83.6% for the orbital medial wall and 89.95% in the orbital floor. The ambiguity-aware map, which incorporated 20 segmentation masks, effectively demonstrated the discrepancies among the diverse manual annotation masks. Furthermore, it was confirmed that these discrepancies correspond to the areas of the orbital bones characterized by ambiguous boundaries and thin structure.

### CONCLUSION

Our approach effectively leveraged the CDM to learn diverse expertise, presenting a range of segmentation results and ambiguity-aware maps to help clinicians in identifying uncertainty that may require correction. (This research was supported by a grant of the Korea Health Technology RD Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health Welfare, Republic of Korea (grant number: HI22C1496))

### CLINICAL RELEVANCE/APPLICATION

Our study is expected to provide guidance for manual correction of segmentation results, enabling more accurate surgical planning and creation of customized bone templates for 3D printing applications.

## R5B-SPIN-2 COLOR VISION DEFICIENCY AND RADIOLOGY: ADDRESSING AN UNDERAPPRECIATED INCLUSIVITY AND ACCESSIBILITY BLIND SPOT

Joshua D. Warner, MD,PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Most medical imaging data is viewed in grayscale, but color images represent a persistent and growing minority. From nuclear medicine to Doppler ultrasound to elastography, color images are used for diagnostic decisions and convey key information to referring providers and our patients. Color vision deficiency, a.k.a. red-green color blindness, is a common male-predominant congenital disorder with two major forms: deuteranopia (affecting approximately 6% of males) and protanopia (affecting approximately 2% of males). Recent improved models of the human visual system allow quantitative evaluation and perceptual comparison of color in those with and without color vision deficiency. The purpose of this work is to determine how well 4 color maps commonly used in medical imaging from DICOM Supplement 133 map to the color perception of those with and without color vision deficiency and propose accessible perceptually uniform alternatives.

### METHODS AND MATERIALS

We use the CAM02-UCS perceptually uniform color space; reference implementation provided by the `colospacious` Python library. The framework contains models for deuteranopia and protanopia. We calculate the derivative in perceptual space and find the root mean square error (RMSE) of the color transitions in the four DICOM color maps for full color perception, grayscale, and simulated deuteranopia/protanopia. We compare these results to a best-practice perceptually uniform public domain color map. Finally, we design and propose perceptually uniform alternatives.

### RESULTS

All color maps from DICOM Supplement 133 were poor in perceptual uniformity, even to people without color vision deficiency, and became quantitatively poorer representations of the underlying data in the models for color vision deficiency relative to the best-practice color map. Our alternatives are objectively superior color representations to those in the DICOM standard.

### CONCLUSION

Radiology and standards bodies have neglected advances in the science of human color perception, leaving behind those with color vision deficiency. We prove this is the case, but it need not be this way, as we demonstrate color map alternatives which are superior in accessibility and inclusivity. These or similar should be added to the DICOM standard.

### CLINICAL RELEVANCE/APPLICATION

Color vision deficiency or color blindness is a common congenital limitation of visual perception in the population. The color maps defined in the DICOM standard do not incorporate these advances and are poor perceptual representations. We confirm this quantitatively and provide a path forward to replacing these historic color maps with objectively superior modern analogues to best serve radiologists, referring providers, and our patients.

## R5B-SPIN-3 GENERATING LABELS FOR TRAINING CONVOLUTIONAL NEURAL NETWORKS FROM RADIOLOGY REPORTS USING OPEN SOURCE LARGE LANGUAGE MODELS

Keno K. Bressem, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Romanescu (*Abstract Co-Author*) Nothing to Disclose
Felix Dorfner (*Abstract Co-Author*) Nothing to Disclose
Lina Xu (*Abstract Co-Author*) Nothing to Disclose
Hartmut Hantze (*Abstract Co-Author*) Nothing to Disclose
Leonhard Donle (*Abstract Co-Author*) Nothing to Disclose
Felix Busch, MD (*Abstract Co-Author*) Nothing to Disclose
Aymen Meddeb (*Abstract Co-Author*) Nothing to Disclose
Lisa C. Adams, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fares Al Mohamad (*Presenter*) Nothing to Disclose

### PURPOSE

The use of deep learning algorithms in radiology has received a lot of attention in the recent past for its ability to assist radiologists in increasing their accuracy and save time on several tasks especially in the field of musculoskeletal radiology. However, training Convolutional Neural Networks (CNN) requires large data sets with labelled data, which can be very labour-intensive to prepare. Radiology reports contain a lot of potentially useful information for such tasks, but because they are often unstructured, they cannot be directly used for training. Many attempts have been made in the field of Natural Language Processing to harvest this information and interpret it in a structured manner to make it accessible for research and clinical purposes. The recent progress in transformer-based Large Language Models (LLMs) might introduce a new useful tool in interpreting radiology reports.

### METHODS AND MATERIALS

The LLM Mixtral-8x7B-Instruct-v0.1 was used for classifying radiology reports of ankle x-ray images. Various prompting strategies were tested on a small, manually labelled dataset of radiology reports. The best performing prompt was then tested on a different dataset of labelled reports to determine its accuracy. This prompt was then used to classify all available reports. The generated labels were then used to train a CNN with the DenseNet121 architecture to recognize fractures of the ankle. A separate small dataset of x-ray images of ankles labelled by a board-certified radiologist was used for validation and testing.

### RESULTS

The validation and test datasets of radiology reports consisted of 250 reports each. A total of 7780 radiology reports were available. Using common prompting strategies an accuracy of 92.4% was reached on the validation dataset of radiology reports. On the test data set this prompt reached an accuracy of 92%. Across all tested prompts (n = 31) zero-shot prompting resulted in higher accuracies (0.876 ± 0.025) compared to few-shot prompting (0.792 ± 0.108) $p < 0.001$. The CNN was trained for 200 epochs with the best performing model occurring on epoch 149. On the test dataset this model reached an accuracy of 87.4%, an area under the receiver operating characteristics curve of 0.921.

### CONCLUSION

In this work, we were able to demonstrate that radiology reports can be classified automatically with the help of an LLM. We were able to successfully utilise the resulting structured data as training data for a deep learning model without further manual classification or review by a radiologist.

### CLINICAL RELEVANCE/APPLICATION

LLMs can be used to obtain structured data from unstructured texts, such as radiology reports, avoiding the labour-intensive task of manually reviewing these texts.

## R5B-SPIN-4 STREAMLINING COMMON DATA ELEMENT CREATION: INTRODUCTION OF A NOVEL TOOLCHAIN THAT TRANSFORMS USER TEXT INPUT INTO FULLY ENCODED JSON

Tarik K. Alkasab, MD, PhD (*Abstract Co-Author*) Consultant, Nuance Communications, Inc;Medical Advisory Board, Nuance Communications, Inc
Roshan Fahimi, MD (*Abstract Co-Author*) Nothing to Disclose
Heather Chase, BS (*Abstract Co-Author*) Nothing to Disclose
Michael Hood, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To achieve the goal of encoding the rich, granular information contained within unstructured text of diagnostic radiology reports into standardized data, the expansion of a vast library of imaging Common Data Elements (CDEs) is essential. We introduce a novel toolchain developed to expedite the production of CDEs by enabling physician experts to efficiently contribute by authoring content in a simple, user-friendly text format.

### METHODS AND MATERIALS

The toolchain is written in Python and employs a three-stage process for CDE development: 1) initial authoring in a Markdown text file; 2) conversion of the text file to a preliminary "compact" CDE in JavaScript Object Notation (JSON) format; and 3) enrichment with standardized anatomic tags from ontologies including RadLex, SNOMED, and the American College of Radiology Common Anatomic Location Index to produce a fully annotated CDE in JSON. This final JSON file is capable of generating a message in the Fast Health Interoperability Resources (FHIR) specification, termed as a CDE-labeled FHIR Observation object. In practical use, the input Markdown format is uncomplicated and allows content experts to easily draft CDEs, which then are automatically converted into JSON while maintaining structural and metadata accuracy. This toolchain also facilitates rapid updates to CDEs, as iterative edits in the Markdown document are reflected in the JSON output.

### RESULTS

The pilot of this toolchain has successfully facilitated the creation of fully annotated JSON files that can generate CDE-labeled FHIR Observation objects, which are instrumental in encoding diagnostic radiology reports within the FHIR framework.

### CONCLUSION

The developed toolchain simplifies the process of developing imaging CDEs by enabling radiologists, particularly users who may not be familiar with a complex data structure like JSON, to directly contribute to their creation using a user-friendly Markdown format. This approach effectively lowers the technical barrier associated with CDE generation and permits content experts to engage in the process without the need for specialized knowledge in data coding. Ultimately, the democratization of this process is crucial, as a vast number of validated CDEs must be created and rigorously reviewed to build a comprehensive model capable of encoding complete diagnostic radiology reports.

### CLINICAL RELEVANCE/APPLICATION

The toolchain presented greatly reduces the technical barrier to CDE development by enabling content experts to contribute directly using a simple text input format.

## R5B-SPIN-5 NODE-RADS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF DIAGNOSTIC PERFORMANCE, CATEGORY-WISE MALIGNANCY RATES, AND INTER-OBSERVER RELIABILITY

Huan Zhang (*Abstract Co-Author*) Nothing to Disclose
Weiwu Yao (*Abstract Co-Author*) Nothing to Disclose
Jingyu Zhong, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To perform a systematic review and meta-analysis to estimate diagnostic performance, category-wise malignancy rates, and inter-observer reliability of Node Reporting and Data System 1.0 (Node-RADS).

### METHODS AND MATERIALS

Five electronic databases were searched for primary studies on the use of Node-RADS to report the possibility of cancer involvement of lymph nodes on CT and MRI from January 1, 2021, until April 15, 2024. The study quality was assessed by modified Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) and Quality Appraisal of Diagnostic Reliability (QAREL) tools. The diagnostic accuracy was estimated with the bivariate random-effects model, while category-wise malignancy rates were obtained with the random-effects model.

### RESULTS

Six Node-RADS-CT studies and three Node-RADS-MRI studies covering nine types of cancer were included. The study quality was mainly damaged by unclear index test and unknown flow and timing according to QUADAS-2, and inappropriate blindness during rating process according to QAREL. The aera under hierarchical summary receiver operating characteristic curve (95% conventional interval, CI) was 0.92 (0.89-0.94) for Node-RADS = 3 as positive, and 0.91 (0.88-0.93) for Node-RADS = 4 as positive, respectively. The pooled sensitivity (95% CI) and specificity (95% CI) of Node-RADS for identifying were 0.77 (0.59-0.90) and 0.90 (0.86-0.92) for Node-RADS = 3 as positive, and 0.54 (0.40-0.67) and 0.98 (0.95-0.99) for Node-RADS = 4 as positive, respectively. The diagnostic odds ratios (95% CI) were 30.85 (14.17-67.13) for Node-RADS = 3 as positive, and 57.78 (23.46-142.33) for Node-RADS = 4 as positive, respectively. The heterogeneity for the meta-analyses was low to high. The publication bias was not identified. The pooled malignancy rates (95% CI) for Node-RADS 1, 2, 3, 4, and 5 were 4.4 (1.1-7.7) %, 33.0 (3.4-62.6) %, 55.1 (34.5-75.7) %, 78.8 (61.4-96.2) %, and 89.9 (78.7-100.0) %, respectively. The pooled inter-observer reliability was not available due to insufficient data.

### CONCLUSION

Node-RADS presented high diagnostic performance with appropriate probability of malignant for each category. However, the evidence for inter-observer reliability of Node-RADS is lacking, and may hinder the implementation in routine clinical practice for lymph node assessment.

### CLINICAL RELEVANCE/APPLICATION

Node-RADS is a useful tool that standardized for reporting the possibility of cancer involvement of regional and distant lymph nodes on CT and MRI with high diagnostic performance. The malignancy rates were increasing with the Node-RADS rating. However, it is unclear whether the tool is with appropriate inter-observer reliability for clinical practice.

## R5B-SPIN-6 EVALUATING THE ACCURACY OF LUNG-RADS SCORE EXTRACTION FROM RADIOLOGY REPORTS: MANUAL ENTRY VERSUS NATURAL LANGUAGE PROCESSING

Stuart L. Cohen, MD (*Abstract Co-Author*) Consultant, Beijing Infervision Technology Co, Ltd;Research support, Siemens AG
Amir Gandomi (*Abstract Co-Author*) Nothing to Disclose
Brett Bade (*Abstract Co-Author*) Nothing to Disclose
Matthew L. Inra, MD (*Abstract Co-Author*) Nothing to Disclose
Gerard Silvestri, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Makhnevich, MD (*Abstract Co-Author*) Nothing to Disclose
Suhail Raoof (*Abstract Co-Author*) Nothing to Disclose
Jesse Chusid, MD (*Abstract Co-Author*) Nothing to Disclose
Subroto Paul (*Abstract Co-Author*) Nothing to Disclose
Eusha Hasan (*Presenter*) Nothing to Disclose

**PURPOSE**

Adherence to follow-up is essential for lung cancer screening (LCS). Lung CT Screening Reporting and Data System (Lung-RADS) is a structured radiology scoring system providing recommendations for LCS follow-up that are utilized (a) in clinical care and (b) by LCS programs monitoring rates of adherence to follow-up. Extraction of structured Lung-RADS scores from free-text radiology reports is critical in determining rates of adherence to follow-up. Unfortunately, due to variability in radiology reports, extraction of Lung-RADS scores is non-trivial, and best practices do not exist. The purpose of this project is to compare mechanisms to extract Lung-RADS scores from free-text radiology reports.

**METHODS AND MATERIALS**

We retrospectively analyzed reports of LCS low-dose computed tomography (LDCT) examinations performed at a multihospital integrated healthcare network in New York State between January 2016 and July 2023. We compared three methods of Lung-RADS score extraction: manual physician entry at time of report creation, manual LCS specialist entry after report creation, and an internally developed, rule-based natural language processing (NLP) algorithm. Accuracy, recall, precision, and completeness (i.e., the proportion of LCS exams to which a Lung-RADS score has been assigned) were compared between the three methods.

**RESULTS**

The dataset includes 24,060 LCS examinations on 14,243 unique patients. The mean patient age was 65 years, and most patients were male (54%) and white (75%). Completeness rate was 65%, 68%, and 99% for radiologists' manual entry, LCS specialists' entry, and NLP algorithm, respectively. Accuracy, recall, and precision were high across all extraction methods (>94%), though the NLP-based approach was consistently higher than manual entry in all metrics.

**CONCLUSION**

An NLP-based method of LCS score determination is an efficient and more accurate means of extracting Lung-RADS scores than manual review and data entry. NLP-based methods should be considered best practice for extracting structured Lung-RADS scores from free-text radiology reports.

**CLINICAL RELEVANCE/APPLICATION**

NLP represents a highly valuable tool for retrospectively tracking LCS program adherence. By using a tested NLP algorithm to identify Lung-RADS scores, LCS programs may concurrently increase data accuracy and the efficiency of their team. This would allow an LCS program to deliver more data-driven care based on the historical aggregate behavior of its respective patient population.

## R5B-SPIN-7 ENHANCING ORBITAL BONE SEGMENTATION ACCURACY IN CT IMAGES USING PROMPT-BASED SEGMENTATION WITH SELECTIVE MULTIPLE POINT PROMPTS

Min Jin Lee, PhD (*Abstract Co-Author*) Nothing to Disclose
Helen Hong, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyu Won Shim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jinseo An, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Ambiguous anatomical structures pose challenges in generating consistent label data, which may impact the segmentation results of conventional CNN-based methods relying on such labels. To improve the segmentation accuracy of orbital bones with thin structures and unclear boundaries in CT images, we propose a prompt-based segmentation method utilizing selective multiple point prompts.

**METHODS AND MATERIALS**

A dataset consisting of 355 facial CT images was divided into 228 for training, 56 for validation, and 71 for test sets. The orbital bone region was manually annotated by a neurosurgeon with over 15 years of experience. Our prompt-based segmentation network employs a 2D U-Net as the backbone, incorporating a transformer-based cross-attention module at the bottleneck layer to effectively integrates image feature maps from the encoder with specific prompts containing coordinate and label information. To evaluate the effect of point prompts, we assessed the performance of the orbital medial wall, characterized by low contrast and unclear boundaries. Within this region, we strategically selected multiple points and compared the results of CNN-based segmentation, including U-Net and MSDA-Net with a multi-scale dual-attention module.

**RESULTS**

Among the results obtained using one- to four-point prompts, the application of two-point prompts exhibited the highest segmentation performance, achieving a DSC of 85.65%, precision of 84%, and recall of 87.68%. In particular, the recall was significantly improved by 9.64% compared to U-Net and 6.75% compared to MSDA-Net, indicating the effectiveness of our prompt-based segmentation network in addressing segmentation failures caused by the misidentification of unclear boundary regions. Our prompt-based segmentation network demonstrated statistically significant differences in terms of DSC and recall compared to CNN-based segmentation results ($p<0.05$).

**CONCLUSION**

Our prompt-based segmentation network outperformed the CNN-based segmentation network, particularly in regions with unclear boundaries within the orbital bone. This approach enables more accurate segmentation of orbital bone by allowing clinicians to utilize selective multiple point prompts in regions with unclear boundaries. (This research was supported by a grant of the Korea Health Technology RD Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health Welfare, Republic of Korea (grant number: HI22C1496))

**CLINICAL RELEVANCE/APPLICATION**

Our study can help mitigate issues related to noisy annotations and provide more accurate segmentation result, which can be utilized in creating customized bone templates for 3D printing.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R5B-SPIR

**Interventional Radiology Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPIR-2 GEOSPATIAL MAPPING OF THE STATUS OF INTERVENTIONAL RADIOLOGY WORLDWIDE

Thomas McKeon (*Abstract Co-Author*) Nothing to Disclose
Monica M. Matsumoto, PhD (*Abstract Co-Author*) Nothing to Disclose
Fabian M. Laage Gaupp, MD (*Abstract Co-Author*) Nothing to Disclose
Constantinos T. Sofocleous, MD, PhD (*Abstract Co-Author*) Consultant, Siemens AG;Consultant, Johnson & Johnson;Research support, Johnson & Johnson;Consultant, Terumo Corporation;Consultant, Sirtex Medical Ltd;Research support, Sirtex Medical Ltd;Research support, Boston Scientific Corporation
Justin J. Guan, MD (*Abstract Co-Author*) Nothing to Disclose
Shams I. Iqbal, MD (*Abstract Co-Author*) Nothing to Disclose
Tarig Elhakim, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Geographic Information Science (GIS) integrate geographical data with descriptive analytics, enhancing our understanding of spatial patterns to facilitate better decision-making. Despite its potential, the application of GIS in assessing the global landscape of Interventional Radiology (IR) remains underdeveloped. This gap is critical as more than half of the global population lacks access to IR services due to various unexplored factors.

### METHODS AND MATERIALS

An anonymous survey was designed to collect information regarding the state of IR practice and education worldwide and to identify factors that impact access to IR services. The survey was distributed to members of major global IR societies and shared on social media. It remained open from 6/2022 to 9/2023. The survey data was then connected to a shapefile for geographical analysis. ArcGIS was utilized to create an interactive map for country-level survey responses. A logistic regression analysis was used to compare continent level responses.

### RESULTS

1263 respondents completed the survey, including 902 IRs, 176 DRs, 260 attending/consultants and 197 trainees, among others. Geographically, 413 (33%) of respondents practiced in Asia, 399 (32%) Europe, 189 (15%) Africa, 187 (15%) North America, 43 (3.5%) South America, and 14 (1.1%) Oceania. For country-level responses, an ArcGIS interactive map was created and hosted at arcgis.com (https://tinyurl.com/5hber8wu). IR public awareness was the greatest practice need globally, followed by patient referrals and education/training. Other challenges included hospital support and competition with other specialties. Compared to North America, there were significant shortages of IR training programs in Africa (OR 0.06, $p < 0.001$), Asia (OR 0.50, $p = 0.004$), Europe (OR 0.12, $p < 0.001$), and Oceania (OR 0.12, $p < 0.001$). Significant shortage of any IR exposure during radiology training was observed in Africa (OR 0.31, $p < 0.001$), Asia (OR 0.16, $p < 0.001$), and South America (OR 0.14, $p < 0.001$). The top three interventions recommended to provide the highest impact included establishing IR training programs in Africa (OR 7.51, $p<0.001$), access to online education in Africa (OR 3.03, $p <0.001$) and holding multidisciplinary conferences in South America (O.R 2.63, $p=0.005$).

### CONCLUSION

The survey results can help guide societal efforts to improve global access to IR. Geospatial mapping can be utilized to regularly collect country-level data to assess local IR needs, track development and support the expansion of IR worldwide.

### CLINICAL RELEVANCE/APPLICATION

There is a universal recognition of the need to increase public awareness about IR. Improving access to IR education and training is additionally important. Geospatial mapping can assist in IR expansion

## R5B-SPIR-3 QUANTIFYING THE LEARNING CURVE FOR INTERVENTIONAL RADIOLOGY ATTENDINGS: WHICH PROCEDURES HAVE THE LONGEST LEARNING CURVE?

Ernesto G. Santos Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Ken Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Hooman Yarmohammadi, MD (*Abstract Co-Author*) Grant, Guerbet SA
Vlasios S. Sotirchos, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph P. Erinjeri, MD,PhD (*Abstract Co-Author*) Advisory Board, AstraZeneca PLC;Consultant, Canon Medical Systems Corporation;
Chenyang Zhan, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Matthew Lynn, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

To quantify the learning curve for interventional radiology procedures performed by new attendings at a cancer center.

### METHODS AND MATERIALS

Between August 2010 and December 2023, 69014 procedures across 24 attending physicians were examined. Procedural information including procedural length, inpatient vs. outpatient status, anesthesia status, and months of attending practice was collected. To account for both 1) inter-faculty variability and 2) inter-procedure variability, median career procedure times by faculty and procedure were computed and subtracted from individual procedure times to create a normalized procedure time. The learning curve for IR procedures was constructed by stratifying normalized procedure times by months of practice. We examined the difference in normalized procedure times between the first 6 months and 6-12 years of practice using student's t test.

### RESULTS

There was a significant decrease in procedure time over the years of practice (-0.99 mins/procedure/year, $p< 0.001$). There was a biphasic learning curve, with rapid decrease in normalized procedure times in first 9 months of practice (-8.0 mins/procedure/year, $p< 0.06$), followed by slower steady significant decrease in normalized procedure times between 9 months and 9 years of practice (-0.87 mins/procedure/year, $p<0.001$). The procedures with show the greatest improvement in normalized procedure time between the first 6 months and 6-12 years of practice were SIRspheres treatment (-42 min, 19 vs -22, $p<0.006$), vascular chemoinfusion (-24 min, 8.8 vs -15, $p<0.029$), Therasphere treatment (-23 min, 8.6 vs -15, $p<0.017$), lung ablation (-20 min, 5.4 vs -15, $p<0.019$) and mapping arteriogram (-19 min, 10 vs -8.7, $p<0.006$). Procedures which showed no significant change in normalized procedure time between the first 6 months and 6-12 years of practice were CT guided abscess drain (-1.8 mins, 1.2 vs -0.7, $p<0.64$), thoracostomy placement (-1.3 min, 2.8 vs 1.5, $p<0.84$), nephrostomy placement (1.2 mins, 2.9 vs 4.1, $p<0.81$), abscess catheter check (-1.8 mins, -0.7 vs -2.5, $p<0.64$, and conversion of surgical drain to IR drain (1.2 min, -4.2 vs -3, $p<0.86$).

### CONCLUSION

Locoregional cancer treatments, such as Y-90 mappings/treatments, lung ablations and vascular chemoinfusions have the longest learning curves for new IR attendings. Procedures with little or no learning curve for new IR attendings include abscess catheter placement/check/exchange, nephrostomy placement and chest tube placement.

### CLINICAL RELEVANCE/APPLICATION

Quantifying the learning curve for interventional radiology procedures will allow department and hospital leaders to allocate appropriate time for procedures for new IR attendings.

## R5B-SPIR-4 GENICULAR ARTERY EMBOLIZATION FOR THE TREATMENT OF SYMPTOMATIC KNEE-OA: A COMPREHENSIVE ANALYSIS OF 167 PATIENTS

Bernd K. Hamm III, MD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation;Research Grant, Canon Medical Systems Corporation;Stockholder, Siemens AG;Research Grant, Siemens AG;Stockholder, General Electric Company;Research Grant, General Electric Company;Research Grant, Koninklijke Philips NV;Research Grant, Elbit Imaging Ltd;Equipment support, Elbit Imaging Ltd;Research Grant, Bayer AG;Research Grant, Guerbet SA;Research Grant, Bracco Group;Research Grant, B. Braun Melsungen AG;Research Grant, Krauth Medical KG GmbH & Co;Research Grant, Boston Scientific Corporation;Investigator, CMC Contrast AB
Bernhard Gebauer, MD (*Abstract Co-Author*) Speaker, PAREXEL International Corporation;Speaker, Becton, Dickinson and Company;Speaker, Sirtex Medical Ltd;Speaker, Abbott Laboratories;Speaker, Cook Group Incorporated;Speaker, AngioDynamics, Inc;Speaker, PharmCept;Speaker, ewimed GmbH;Speaker, Novartis AG;Speaker, F. Hoffmann-La Roche Ltd;Speaker, Merck & Co, Inc;Speaker, ICON plc;Speaker, Ipsen SA;Speaker, Bayer AG;Speaker, Pfizer Inc;Speaker, Guerbet SA;Speaker, Terumo Corporation
Federico Collettini, MD (*Abstract Co-Author*) Research Grant, PharmaCept Research Grant, Philips Research Grant, Siemens Healthineers Speakers Bureau, Bayer AG Speakers Bureau, PharmaCept Speakers Bureau, Angiodynamics
Timo A. Auer, MD (*Abstract Co-Author*) Nothing to Disclose
Florian N. Fleckenstein, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Genicular artery embolization (GAE) is an innovative minimally invasive therapy for patients with symptomatic knee osteoarthritis (OA) refractory to conservative treatments, aiming to reduce synovial arterial hypervascularity. This study evaluates the safety and efficacy of GAE for the treatment of symptomatic knee OA.

### METHODS AND MATERIALS

A retrospective, single-center study was conducted at our institution. Patients enrolled in the study were aged 40 to 90 years, had moderate to severe knee OA (Kellgren-Lawrence grade 2 to 4), and had previously experienced failure of conservative therapy. Baseline pain (assessed using the visual analog scale [VAS]) and symptom scores (Knee Injury and Osteoarthritis Outcome Score [KOOS]) were evaluated. After achieving femoral arterial access via a 4 Fr sheath, embolization was performed using Imipenem/Cilastatin. Target vessels were determined using digital subtraction angiography in correlation with the patients' pain points. Adverse events and symptom scores were assessed at six weeks, three months, and six months after GAE.

### RESULTS

167 patients with a total of 246 treatments were enrolled, with a median age of 69 years (IQR, 61, 74). Knee OA severity was grade 2 in 12% of cases, grade 3 in 41%, and grade 4 in 47%. Technical success was achieved in 100% of procedures. Transient skin discoloration and transient mild knee pain after the procedure were noted in 18% of all cases, as expected. No severe complications were reported. The KOOS quality of life index and VAS improved by 87% and 71%, respectively, at six months from a median baseline of 57 (of 100) and 7 (of 10), respectively.

### CONCLUSION

This retrospective study in a large patient cohort demonstrates that GAE is an effective and safe treatment for reducing OA-associated symptoms that are refractory to conservative therapy.

### CLINICAL RELEVANCE/APPLICATION

The development of this novel, minimally invasive technique allows interventional radiology communities worldwide to treat chronic joint disorders more efficiently. However, comprehensive and standardized data from large-scale studies remain limited. This study aims to provide a thorough analysis to support the standardization of GAE as a routine treatment for knee-OA.

## R5B-SPIR-5 OPIOID AND NON-OPIOID ANALGESIC MEDICATION USE IN PATIENTS WITH OSTEOPOROTIC VERTEBRAL COMPRESSION FRACTURES BEFORE AND AFTER KYPHOPLASTY OR VERTEBROPLASTY

Rylie Ju, MD (*Abstract Co-Author*) Nothing to Disclose
Bassel Ibrahim (*Presenter*) Nothing to Disclose

**PURPOSE**

Kyphoplasty (KP) and Vertebroplasty (VP) are two minimally invasive procedures that are commonly performed to treat painful osteoporotic vertebral fractures (OVF) refractory to medical management alone. However, recent studies show conflicting outcomes regarding their effect on reducing pain symptoms and analgesic medication use. The purpose of this study was to analyze the prevalence of opioid and non-opioid use in patients with OVF before and after undergoing KP or VP procedures.

**METHODS AND MATERIALS**

This retrospective study analyzed electronic health records from 65 healthcare organizations across the United States between April 2014 and April 2024. Inclusion criteria included adult patients with OVF refractory to medical management who underwent KP or VP within 1 year of PVF diagnosis. Patients were excluded if they had received an opioid prescription before OVF diagnosis, had a history of malignancy, or underwent surgical procedures within 1 year following the intervention. Patient demographics at baseline and new persistent opioid and non-opioid analgesic medication use at 1-mo pre-op and 1, 3, 6, and 12-mo post-op were reported.

**RESULTS**

Among 209,314 patients identified with OVF, 7633 underwent KP (mean age 75.2 ± 10.4, 68.53% female), and 2655 underwent VP (mean age 76.7 ± 10.7, 73.97% female). In the KP group, 94% of patients had new persistent opioid prescribing 1 month before the procedure. This number decreased to 17%,16%,17%, and 13% at 1, 3, 6 and 12 months, respectively. In the VP group, 96% of patients had OVF-associated persistent opioid prescribing 1-mo before the procedure. This number decreased to 19%,11%,19%, and 13% at 1,3,6 and 12 months, respectively. There was a statistical difference in opioid use between KP and VP at 1-mo pre-op ($p=.0001$), at 1-mo post-op ($p=.025$), and at 3-mo post-op ($p=.045$). Trends in the use of non-opioid analgesics were not statistically different between any period in both the KP and VP groups.

**CONCLUSION**

Patients undergoing VP had significantly higher opioid prescription rates than those undergoing KP 1-mo pre-op. KP led to a greater reduction in opioid refills compared to VP at 1, 3, and 6 mo post-op; however, this difference was not observed at 12 mo post-op. The use of non-opioid analgesics did not show statistically significant differences between the KP and VP groups during any of the periods measured. Following treatment, both KP and VP were associated with a reduction in opioid prescription fills, however, there was no change in the use of OVF-associate non-opioid analgesic use.

**CLINICAL RELEVANCE/APPLICATION**

Understanding the effect of KP and VP procedures on trends in opioid use is crucial for long-term pain management strategies in patients with osteoporotic vertebral compression fractures

## R5B-SPIR-6 IMPACT OF AN ENDOVASCULAR SIMULATOR AND VIDEO GAMES ON MEDICAL STUDENT INTERVENTIONAL RADIOLOGY INTEREST AND PROCEDURAL SKILL

Mina S. Makary, MD (*Abstract Co-Author*) Nothing to Disclose
Mina Dawod (*Abstract Co-Author*) Nothing to Disclose
Matthew Yoder (*Abstract Co-Author*) Nothing to Disclose
Mensur Koso, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine if student interactions with an endovascular stimulator will increase confidence performing procedures and interest in interventional radiology (IR) while assessing if past or present video game experience confers procedural skill.

**METHODS AND MATERIALS**

This IRB-approved prospective randomized control study evaluated medical student specialty interest and procedural performance from February to April of 2024. Participants were required to complete a pre-procedure survey and an initial simulated procedure utilizing an endovascular simulator before being randomized to either a Video Game (VG) or control arm. Students then proceeded to complete a second simulated procedure and a post-procedure survey. Before starting the procedure, a standardized explanation was read to each participant. Students randomized to the VG arm would play a video game within a ten-minute slot between the two procedures, while control arm students would rest. Survey data collected included demographic information, history of video gaming, confidence performing endovascular procedures, and interest in procedural specialties. Primary outcomes included self-reported procedural confidence and specialty interest on a five-point scale (five being the highest). Secondary outcomes included procedural skill as measured by time to completion for the simulated procedures.

**RESULTS**

A total of 48 medical students (mean age, 25.8 years; male 58%) participated in this study, with 24 students randomized to the VG arm and the remainder to the control arm. The cohort's average confidence performing procedures prior to participation was 2.4 (out of five), interest in procedural specialties was 4.1, and interest in IR was 2.9. After participation in the study, confidence performing procedures rose by 58% to 3.8 ($p<0.0001$), interest in procedural specialties rose by 7% to 4.4 ($p=0.04$), and interest in IR increased by 27% to 3.6 ($p<0.0001$). The time to completion for the first procedure for the VG group was 4 minutes while for the control it was 3.5 minutes. Time to completion for the second procedure was 3.1 minutes for the VG group compared to 2.5 minutes for control. The differences between the groups were not significant.

**CONCLUSION**

Student confidence performing procedures significantly increased after participating in the study, as did student interest in procedural specialties in general and in IR specifically. A history of video games and prospective VG group participation did not confer procedural skill as measured by time to completion.

**CLINICAL RELEVANCE/APPLICATION**

Increasing medical student confidence performing procedures and improving awareness of IR is critical to setting the foundations for procedural competency and attracting talent to the specialty.

## R5B-SPIR-7 BLEOMYCIN ELECTROSCLEROTHERAPY OF SLOW-FLOW MALFORMATIONS - OUTCOME IN ADULTS AND CHILDREN

Jens Ricke, MD, PhD (*Abstract Co-Author*) Research Grant, Sirtex Medical Ltd;Research Grant, Bayer AG;Research Grant, Terumo Corporation;Research Grant, Boston Scientific Corporation
Daniel Puhr-Westerheide, MD (*Abstract Co-Author*) Nothing to Disclose

Osman Ocal, MD (*Abstract Co-Author*) Nothing to Disclose
Jan P. Rudolph, MD (*Abstract Co-Author*) Institutional Grant, Siemens AG;Institutional Grant, Mediaire GmbH
Moritz Wildgruber, MD, PhD (*Abstract Co-Author*) Consultant, Sirtex Medical Ltd;Consultant, iThera Medical GmbH;Consultant, Bayer AG
Max Seidensticker (*Abstract Co-Author*) Grant, Sirtex Medical Ltd;Speaker, Sirtex Medical Ltd;Grant, Bayer AG;Speaker, Bayer AG;Speaker, Siemens AG;Speaker, Cook Group Incorporated;Speaker, Boston Scientific Corporation;Speaker, LIAM GmbH;
Walter A. Wohlgemuth (*Abstract Co-Author*) Nothing to Disclose
Vanessa F. Schmidt, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the safety and clinical outcome of bleomycin electrosclerotherapy (BEST) for treating extracranial slow-flow malformations.

**METHODS AND MATERIALS**

In this retrospective investigation of a multicenter cohort presenting symptomatic slow-flow malformations, patient records were analyzed with respect to procedural details and complications. A treatment-specific, patient-reported questionnaire was additionally evaluated, obtained 3-12 months after the last treatment, to assess the subjective outcomes, including mobility, aesthetic aspects, and pain, as well as the occurrence of postprocedural skin hyperpigmentation. All outcome parameters were compared according to patients' age.

**RESULTS**

Overall, 325 BEST treatments were performed in 233 patients after intralesional and/or intravenous bleomycin injection. The total complication rate was 10.2% (33/325), including 29/352 (8.9%) major complications. Patient-reported mobility decreased in 10/133 (8.8%), was stable in 30/113 (26.5%), improved in 48/113 (42.5%), and was rated symptom-free in 25/113 (22.1%) patients. Aesthetic aspects were rated impaired compared to baseline in 19/113 (16.8%), stable in 21/133 (18.6%), improved in 62/113 (54.9%), and perfect in 11/133 (9.7%) patients. Postprocedural skin hyperpigmentation occurred in 78/113 (69%) patients, remaining unchanged in 24/78 (30.8%), reduced in 51/78 (65.5%), and completely resolved in 3/78 (3.8%) patients. The median VAS pain scale was 4.0 (0-10) preprocedural and 2.0 (0-9) postprocedural. Children/adolescents performed significantly better in all parameters compared to adults (= 16 years) (mobility, $p = 0.011$; aesthetic aspects, $p < 0.001$; pain, $p < 0.001$).

**CONCLUSION**

BEST is effective for treating slow-flow vascular malformations, with few but potentially significant major complications. Regarding patient-reported outcomes, children seem to benefit better compared to older patients, suggesting that BEST should not be restricted to adults.

**CLINICAL RELEVANCE/APPLICATION**

Bleomycin electrosclerotherapy is a safe and effective approach and therapy should not be restricted to adults due to good clinical outcomes in children.

## R5B-SPIR-8 *IN-VITRO*-MR-GUIDED STENTING WITH A NOVEL DEMONSTRATOR USING A PRINTED VENOUS PHANTOM

Klaus During (*Abstract Co-Author*) Nothing to Disclose
Lisa Regler (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Wibke Uller, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Bock, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, MaRVis Interventional GmbH
Simon Reiss (*Abstract Co-Author*) Nothing to Disclose
Niklas Verloh, MD (*Presenter*) Speaker, Bayer AG;Research Funded, Bayer AG

**PURPOSE**

MR-guided venous stenting offers 3D vein imaging without ionizing radiation, and improved soft-tissue contrast over X-ray angiography, but MR-safe interventional instruments are lacking. This study uses a realistic pelvic venous phantom to test a new braided venous stent with an MR-compatible delivery system.

**METHODS AND MATERIALS**

A new braided nitinol venous stent (Alaxo, Germany) was tested in combination with an MR-compatible delivery system with repositioning possibility (MaRVis, Germany). This system was compared to a clinically available braided nitinol stent (Blueflow, Plus Medica, Germany) using a realistic phantom of the iliac vein (UnitedBiologics, USA). Positional accuracy was measured by the deviation of the stent's final position from its target. Stent expansion and apposition were assessed by comparing the post-deployment diameter to the nominal diameter and calculating the contact percentage with the vessel wall. Stent migration was evaluated by measuring the stent displacement after deployment. Image quality was determined from the visibility of the stent edges (5-point Lickert scale), and the number of successful repositions was recorded.

**RESULTS**

The two stents were successfully deployed and securely placed within the venous phantom. The delivery system demonstrated easy stent repositionability with a complete success rate of up to three repositioning attempts without compromising stent integrity or placement accuracy. Real-time MR images of the stent deployment with the MR-compatible delivery system had an image clarity of 5/5, clearly visible stent edges, and minimal artifacts. The stents were placed within ±2 mm from the targeted position, and no stent migration was observed. Post-deployment diameter measurements showed a 95% apposition to the vessel walls.

**CONCLUSION**

The study confirmed the feasibility of MR-guided venous stenting using a novel MR-compatible delivery system and a range of nitinol stents. This technique offers a promising non-ionizing alternative to conventional fluoroscopy, providing detailed, real-time 3D visualization of stent deployment and positioning, which is critical for enhancing venous interventions' safety and efficacy.

**CLINICAL RELEVANCE/APPLICATION**

MRI offers a safe alternative with superior soft-tissue contrast, 3D imaging capabilities, and reduced contrast agent use for minimally invasive stenting pelvic venous stenosis, thereby lowering radiation exposure and allergy risks, especially beneficial for younger women.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

R5B-SPMK

**Musculoskeletal Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPMK-1 INCREASED TUMOR SIZE ON MRI PREDICTS PATHOLOGICAL RESPONSE TO NEOADJUVANT RADIOTHERAPY IN UNDIFFERENTIATED PLEOMORPHIC SARCOMA

Ryan J. Avery, MD (*Abstract Co-Author*) Research Consultant, Konica Minolta, Inc
Hatice Savas, MD (*Abstract Co-Author*) Nothing to Disclose
Seth Pollack, MD (*Abstract Co-Author*) Consultant, Bayer AG;Consultant, Deciphera Pharmaceuticals, LLC;Consultant, Apexigen Inc;Consultant, T-Knife, GmbH;Consultant, Aadi Bioscience, Inc;Consultant, Epizyme, Inc;Consultant, Obsidian;Consultant, Sensei;Consultant, SpringWorks Therapeutics, Inc
Jessica L. Davis, MD (*Abstract Co-Author*) Research Consultant, Bayer AG;Research Consultant, Eli Lilly and Company
Meghana Karri (*Abstract Co-Author*) Nothing to Disclose
Ronen Sumagin (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Sean Sachdev, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolo Gennaro, MD (*Abstract Co-Author*) Nothing to Disclose
Yuri Velichko, PhD (*Abstract Co-Author*) Nothing to Disclose
Tugce Agirlar Trabzonlu, MD (*Abstract Co-Author*) Nothing to Disclose
Spyridon Bakas, PhD (*Abstract Co-Author*) Nothing to Disclose
Pedro Hermida De Viveiros (*Abstract Co-Author*) Nothing to Disclose
Amir Borhani, MD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Linda C. Kelahan, MD (*Abstract Co-Author*) Nothing to Disclose
Ulas Bagci, MSc, PhD (*Abstract Co-Author*) Ther-AI LLC
Laetitia Perronne, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Gorkem Durak, MD (*Abstract Co-Author*) Nothing to Disclose
Mariam Goreish (*Presenter*) Nothing to Disclose

### PURPOSE

Undifferentiated Pleomorphic Sarcoma (UPS) is a rare, aggressive and heterogenous tumor associated with high frequent recurrence, poor overall survival, and limited treatment options. Neoadjuvant radiotherapy (nRT) has been shown to improve surgery outcomes. However, evaluation of treatment response without surgical pathology remains a challenge. This study aims to correlate the tumor's pathological response with changes in its size measured on MRI scans before and after nRT.

### METHODS AND MATERIALS

In an IRB approved study of 38 patients with pathologically proven UPS, tumor size measurements were collected before and after nRT. Four independent readers, including three trained radiologists and a researcher, performed the measurements, including two perpendicular diameters in the axial plane and the longest vertical diameter. In addition to measurements, three cross-sectional areas and the volume were calculated. Inter-reader agreement was evaluated using Kendall's concordance coefficient. Patients with less or equal than 10% viable cells on pathology were classified as responders (R). Patients who did not meet this criterion were classified as non-responders (NR). Changes in tumor size were compared between responders and non-responders using one-way ANOVA and Tukey's honestly significant difference (HSD) test for multiple comparisons of means.

### RESULTS

The dataset included 14 responders and 24 non-responders. Inter-reader agreement for all size measurements was high (Kendall's $W > 0.85$, $p > 1E-6$). Responders exhibited a significantly greater increase in tumor size across multiple measures compared to non-responders. For example, the percentage change in the longest diameter (RECIST) was +31.9% for responders and +12.4% for non-responders, demonstrating a statistically significant difference of 19.5% (95% CI: 7.2 - 31.8, $p = 0.002$). Similarly, the change in cross-sectional area in the axial plane showed a statistically significant difference. Responders experienced a larger increase (+83.3%) compared to non-responders (+34.5%), with a difference of 48.8% (95% CI: 13.3 - 84.3, $p = 0.007$).

### CONCLUSION

UPS demonstrate an increase in tumor size after nRT, which is counterintuitive to the expected response of tumor shrinkage. Moreover, responders demonstrate a larger increase in size compared to non-responders. These findings were statistically significant across various measurements, including the longest diameter, cross-sectional area in the axial plane, and tumor volume.

### CLINICAL RELEVANCE/APPLICATION

While RECIST criteria may not be a reliable indicator of response to nRT in UPS, this study provides insights that can guide the development of more accurate methods for treatment response assessment in UPS population.

## R5B-SPMK-2 LEVERAGING DEEP LEARNING FOR PREDICTION OF INVOLVEMENT OF POST-SURGICAL TISSUE MARGINS IN SOFT TISSUE SARCOMA USING MULTI-PARAMETRIC MRI

Matthew J. Nyflot, PhD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Paul E. Kinahan, PhD (*Abstract Co-Author*) Co-founder, PET/X LLC
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Ehsan Alipour, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

Complete resection of the tumor in treating patients with soft tissue sarcoma (STS) is necessary. Positive tissue margins after resection are one of the most important risk factors for the recurrence of STS. This necessitates the development of strategies that can identify the patients who are at a higher risk for positive tissue margins. We propose a deep learning approach that uses pre and post-neoadjuvant treatment MR images of the tumor to predict the margin status after surgical removal of the tumor.

### METHODS AND MATERIALS

A retrospective cohort of patients with soft tissue sarcoma were selected. We included every patient with soft tissue sarcoma that had at least one pre-neoadjuvant treatment MRI. We extracted the latest MRI before neoadjuvant treatment and the earliest MRI after the neoadjuvant treatment before the resection. We used 4 MR sequences: fat saturated T2, Fat saturated T1 before and after intravenous contrast and T1. Preprocessing steps included resampling, z-score normalization of the intensity values and cropping them using a bounding box around the tumor boundaries that included 1cm of surrounding tissue on each side. Input images were 3D images of size 16*128*128 that had 8 channels, each channel corresponding to an individual sequence for the pre or post treatment images. The data was split into training and testing sets. We fine-tuned a pretrained 3D ResNet10 model to predict if the patient had a positive tissue margin based on the post-surgical biopsy report. 4-fold cross-validation on the training set was used to identify the best model. The final model was tested on the hold-out test set.

### RESULTS

Our cohort included 202 patients (159 training and 44 testing). There were 71 female and 131 male patients. The average age of diagnosis of STS was 54 years old. 52 patients had positive post-surgical tissue margins. The model that used both pre and post neoadjuvant therapy images achieved an AUROC of 0.74 on the hold out test set (57% sensitivity and 69% specificity using the optimum threshold determined using the Youden index) and 0.73 on cross validation. The model using only preneoadjuvant therapy images archived an AUROC of 0.65 on the test set and 0.71 on crossvalidation.

### CONCLUSION

We demonstrated that our 3D ResNet model can predict the involvement of post-surgical tissue margin status in patients with soft tissue sarcoma. We also demonstrated that incorporating post neoadjuvant therapy MR images in addition to pretreatment images can significantly improve the performance of the model.

### CLINICAL RELEVANCE/APPLICATION

Our model could be used in clinical practice to identify patients at a higher risk for post-surgical tissue margin involvement. This can help adjust treatment plans and provide more personalized care to patients with STS.

## R5B-SPMK-3 PREDICTING TREATMENT RESPONSE TO NEOADJUVANT RADIOIMMUNOTHERAPY (NRIT) IN SOFT TISSUE SARCOMA (STS) WITH MRI-BASED RADIOMIC SIGNATURE

Paul E. Kinahan, PhD (*Abstract Co-Author*) Co-founder, PET/X LLC
Matthew J. Nyflot, PhD (*Abstract Co-Author*) Nothing to Disclose
Atefe Pooyan, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Stephanie K. Schaub, MD (*Abstract Co-Author*) Nothing to Disclose
Arash Azhideh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Majid Chalian, MD (*Abstract Co-Author*) Grant, The Boeing Company
Ehsan Alipour, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

Early prediction of cancer treatment success is crucial for patients, particularly for high-grade soft tissue sarcoma (STS) cases. STS recurrence occurs in about 50% of cases, often leading to unresectable tumors or limb amputation. Given the limited effectiveness of existing STS treatments, there is growing interest in combining neoadjuvant radiotherapy and immunotherapy, termed neoadjuvant radioimmunotherapy (NRIT). In this study, we used radiomics features extracted from multiparametric STS magnetic resonance imaging (MRI) data in combination with radiologist evaluations, clinical data and pathology data to create a model to predict and monitor pathologic treatment response in patients undergoing NRIT.

### METHODS AND MATERIALS

We identified a list of patients with soft tissue sarcoma that had received neoadjuvant therapy and had pretreatment MRI imaging post-excision pathology reports. Regions of interest were manually segmented on each sequence by two radiologists. MRI sequences used included fat saturated T2-weighted images, Fat saturated T1-weighted before and after intravenous contrast administration and T1-weighted images. A list of important semantic radiologic features was extracted by the radiologists as the basis for comparison. Pathologic treatment response was considered good when above 50%. Univariate analysis and 5-fold cross-validation were used. XGBoost method was used to select the relevant features and develop the models. Shapley values were used for model explanation.

### RESULTS

The final cohort consisted of 229 patients (16 on the prospective wing). There were 173 cases in the training set and 40 in the testing set. The mean age of diagnosis was 53 (SD: 15.6) years old. There were 81 female patients compare to 132 male patients. The best performing model was the model that used all radiomics features in addition to the clinical and semantics features. By using 31 features, the mode achieved an AUROC of 0.73 (0.5-0.87) on the hold-out testing set and 0.7 on cross-validation. The Semantics only model achieved an AUROC of 0.65 on cross-validation. The best model achieved an AUROC of 0.63 on the prospective wing of the study that underwent NRIT.

### CONCLUSION

Our findings show that multi-modal radiomics based models can identify patients that are at a higher risk for not responding to neoadjuvant therapy. In addition, we demonstrated that radiomics based models perform at least as well as models based on radiologist evaluations in doing so. Our model can be used in clinical practice to identify patients that are at a higher risk of treatment failure.

**CLINICAL RELEVANCE/APPLICATION**

Our model can be used in clinical settings to identify patients who are at higher risk for bad treatment outcomes and direct treatment planning accordingly.

## R5B-SPMK-4 MRI DERIVED RADIOMICS MODEL FOR PREDICTING INTRATUMORAL TERTIARY LYMPHOID STRUCTURES IN SOFT TISSUE SARCOMA AND ITS PROGNOSTIC VALUE

Dapeng Hao, PhD (*Abstract Co-Author*) Nothing to Disclose
Tongyu Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

Intratumoral tertiary lymphoid structures (TLSs) of soft-tissue sarcoma (STS) is a biomarker associated with immunotherapy effect and prognosis, which is anticipated to be identified noninvasively through radiomics techniques.To develop an MRI-based radiomics model for predicting intratumoral TLSs status and to explore its prognostic value.

**METHODS AND MATERIALS**

This retrospective study included three cohorts from two medical centers between January 2017 and December 2021. The Laoshan and Shinan campus of the Affiliated Hospital of Qingdao University provided the development cohort (n=142) and internal validation cohort (n=58), respectively, while the Provincial Hospital Affiliated to Shandong First Medical University provided the external validation cohort (n=102). The preoperative MRI examinations of 302 patients were evaluated. Intratumoral and peritumoral radiomics features were extracted from axial fat-suppressed T2-weighted imaging and T1-weighted imaging sequences. The intratumoral, peritumoral, and combined radiomics models were built using a logistic regression algorithm. The univariate and multivariate analyses were performed to select independent risk factors from clinical, radiological, and pathological parameters. The performances were evaluated and compared by the area under the receiver operator characteristic curve (AUC) and the Delong test.

**RESULTS**

Among 302 STS patients, 114 (38%) were confirmed as TLSs-positive status. The combined radiomics model achieved the optimal performance than intratumoral model and peritumoral model, with an AUC of 0.878, 0.778, and 0.772 in the development cohort, internal validation cohort, and external validation cohort. Patients in the high Rad-score group (Rad-score = 0.5) showed a longer progression-free survival (PFS) time.

**CONCLUSION**

An MRI-based radiomics model enabled accurate prediction of intratumoral TLS status in STS patients, and this model was also correlated with PFS time.

**CLINICAL RELEVANCE/APPLICATION**

This combined radiomics model can help identify patients who may benefit from immunotherapy. It is beneficial to choose an individualized treatment plan for STS patients.

## R5B-SPMK-6 DIAGNOSTIC ACCURACY OF MRI FOR THE DETECTION OF LOCALLY RECURRENT MUSCULOSKELETAL SOFT TISSUE SARCOMA: SYSTEMATIC REVIEW AND META-ANALYSIS

Aashna Uppal (*Abstract Co-Author*) Nothing to Disclose
James Man Git Tsui (*Abstract Co-Author*) Nothing to Disclose
Soterios Gyftopoulos, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Samir Paruthikunnnan, MBBS (*Abstract Co-Author*) Nothing to Disclose
Natalia Gorelik, MD, FRCPC (*Abstract Co-Author*) Research Grant, General Electric Company
Lora Tzaneva (*Presenter*) Nothing to Disclose

**PURPOSE**

To systematically review the diagnostic accuracy of MRI in detecting local recurrence (LR) of musculoskeletal soft tissue sarcoma (STS).

**METHODS AND MATERIALS**

Medline, Embase, Scopus, and Cochrane CENTRAL were searched for original research studies published in peer-reviewed journals in the English or French language on the diagnostic accuracy of MRI in detecting LR of musculoskeletal STS in adults following curative resection. Study quality was assessed with an adapted QUADAS-2 tool. Per-scan sensitivity and specificity were pooled using a bivariate random-effects model. Diagnostic accuracy values between protocol subgroups were compared using a Chi-squared test.

**RESULTS**

A total of 4821 titles and abstracts were screened. Thirteen studies were included, comprising 10 cohort studies (7 retrospective, 3 prospective) and 3 case-control studies. A total of 2843 patients (mean age 50.2 years) were studied. Eight studies were at risk of bias, and 8 studies also had applicability concerns. The overall pooled sensitivity and specificity of all protocols combined were 85% [95% Confidence Interval 67%-92%] and 93% [85%-97%], respectively. Protocols based on T1 and fluid-sensitive fat-saturated (FS) sequences yielded a pooled sensitivity of 55% [45%-64%] and pooled specificity of 92% [68%-98%]. Protocols based on T1, fluid-sensitive FS, and T1 FS contrast-enhanced sequences achieved a pooled sensitivity and specificity of 88% [69%-96%] and 93% [82%-97%], respectively. Protocols based on T1, fluid-sensitive FS, T1 FS contrast-enhanced, and dynamic contrast-enhanced (DCE) sequences yielded a pooled sensitivity and specificity of 80% [17%-99%] and 90% [66%-98%], respectively. A statistically significant difference (p=0.01) in sensitivity was noted between protocols. There was no statistically significant difference (p=0.93) in specificity between protocols.

**CONCLUSION**

MRI achieves moderate to high sensitivity and high specificity in detecting LR of musculoskeletal STS, although the quantity and quality of evidence is limited. Protocols that include contrast-enhanced sequences improve the sensitivity of MRI examinations in detecting STS LR. Protocols that include DCE sequences do not appear to offer additional diagnostic accuracy benefits when compared to protocols with static contrast-enhanced images alone.

**CLINICAL RELEVANCE/APPLICATION**

MRI offers high accuracy for the detection of musculoskeletal STS LR. Protocols for routine surveillance should include contrast-enhanced sequences to improve early detection of LR and allow for early treatment, although protocols using DCE do not appear to offer higher performance than protocols with static contrast enhancement alone.

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# Abstract Archives of the RSNA, 2024

R5B-SPMS

**Multisystem Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPMS-2 ULTRA-HIGH-FREQUENCY ULTRASOUND EVALUATION OF CUTANEOUS TUMORS: CORRELATION WITH DERMOSCOPY AND HISTOLOGY

Leticia Cavalcante (*Abstract Co-Author*) Nothing to Disclose
Laura S. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Mariana Galupo (*Abstract Co-Author*) Nothing to Disclose
Almir Bitencourt, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ivana Gibbons (*Abstract Co-Author*) Nothing to Disclose
Soraia Damiao, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To describe the sonographic characteristics of cutaneous tumors in ultra-high-frequency (UHF) ultrasound and compare them with dermoscopy and histology.

### METHODS AND MATERIALS

This IRB-approved, prospective, single-center study included patients with suspicious skin lesions before surgical resection. All lesions were documented with clinical and dermatoscopic photos using a specific dermatoscope. Subsequently, UHF ultrasound was performed with a dedicated 24 MHz device (Aplio i800, Canon Medical Systems), and B-mode and Doppler parameters were described. After the ultrasonographic examination, the lesions were excised and sent for histopathological examination. All examinations were performed by a single observer.

### RESULTS

289 lesions were included, comprising 108 benign lesions and 181 malignant lesions, of which 105 were basal cell carcinomas (BCCs), 35 squamous cell carcinomas, 24 melanomas, 2 Merkel cell carcinomas, 15 less common malignant tumors and cutaneous metastases from other tumors. The most frequent benign lesions were melanocytic nevus, dermatofibroma, epidermal cysts, actinic and seborrheic keratoses. Each type of skin lesion had specific imaging features. Most lesions (87.6%) were located in the dermis, 267 (92.9%) were hypoechoic, 245 (84.5%) had homogeneous echotexture, 209 (72.1%) were well-defined, and 146 presented some degree of vascularization (50.3%). All malignant lesions were visualized at UHF ultrasound. In B-mode, benign and malignant lesions appeared as variable shapes with no statistically significant differences between the two groups in these criteria; the main difference was observed in Doppler mode. Vascularization was more frequent in malignant lesions, being the most relevant ultrasonographic parameter for differentiating malignant and benign lesions.

### CONCLUSION

UHF ultrasound proved useful in assessing skin tumors, supporting diagnosis, staging, assessing therapeutic response, and surveillance. However, it's still not possible to differentiate the main skin tumors based only on sonographic criteria. Therefore, the correlation between dermoscopy and histology is necessary for a definitive diagnosis.

### CLINICAL RELEVANCE/APPLICATION

Ultra-high-frequency ultrasound, particularly at 24 MHz or higher, is a valuable tool in the assessment of skin tumors. It aids in the diagnosis process, helps in cancer staging, response evaluation to therapy, and assists in follow-up after treatment.

# Abstract Archives of the RSNA, 2024

R5B-SPNMMI

**Nuclear Medicine & Molecular Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPNMMI-1 THE PROGNOSTIC VALUE OF EARLY TREATMENT RESPONSE ASSESSMENT WITH 177LU-PSMA WHOLE-BODY-SCINTIGRAPHY IN COMPARISON TO INTERIM PSMA-PET

Kambiz Rahbar (*Abstract Co-Author*) Nothing to Disclose
David Ventura (*Abstract Co-Author*) Nothing to Disclose
Philipp Schindler, MD (*Abstract Co-Author*) Nothing to Disclose
Wolfgang Roll (*Presenter*) Nothing to Disclose

### PURPOSE

PSMA-PET is an essential tool for patient selection prior to radioligand therapy (RLT), interim staging and follow up to monitor therapy. The value of post therapeutic whole-body scans (WBS) after injection off 177Lu-PSMA is underestimated. The aim of this study was to compare early response to treatment as assessed by post-therapeutic WBS with interim staging by PSMA-PET after 2 cycles to predict overall survival (OS)

### METHODS AND MATERIALS

Patients with metastatic castration resistant prostate cancer, who received at least two cycles of RLT, and interim PSMA-PET were retrospectively evaluated. The PROMISE V2 framework was used to categorise PSMA expression and assess response to treatment. Response was defined as either disease control in responders (DCR) or disease progression in those failing to respond.

### RESULTS

A total of 188 men treated with RLT between February 2015 and December 2021 were included. The comparison of various imaging modalities showed a robust and statistically significant correlation, as determined by the Cramer V test: e. g. response on WBS during second cycle compared to first interim PET (cf = 0.888, $P < 0.001$, n = 188). The median follow-up time was 14.7 months (range: 3-63 months; 125 deaths occurred). Median OS was 14.5 months (95% CI: 11.9-15.9). Early response assessment was associated with a significantly better OS: e.g. DCR of second cycle WBS (24 vs 13 months, $P < 0.001$) with a HR of 2.81 ($P < 0.001$) or DCR of interim PET after 2 cycles (24 vs 11 months, $P < 0.001$) with a HR of 3.5 ($P < 0.001$). A decline of at least 50% in PSA levels after two cycles of RLT also indicates a significantly lower likelihood of death (26 vs 17 months, $P < 0.001$) with a HR of 1.92 ($P = 0.001$).

### CONCLUSION

Routinely acquired WBS after RLT with 177Lu-PSMA can be used for interim analysis with comparable results to PSMA-PET and can identify patients at risk of poor outcomes.

### CLINICAL RELEVANCE/APPLICATION

Response prediction and early response assessment is warranted during radioligand therapies to prevent patients from unnecessary treatment related side effects and radiation exposure. Routinely acquired whole body scans after injection of 177Lu-PSMA provide comparable results to more cost-intensive PSMA-PET.

# Abstract Archives of the RSNA, 2024

R5B-SPNPM

**Noninterpretive Skills (Beyond Imaging) Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPNPM-1 ESTABLISHING THE FIRST PROTOCOL AND CLINICAL INDICATION BASED REGIONAL DIAGNOSTIC REFERENCE LEVELS FOR PEDIATRIC COMPUTED TOMOGRAPHY IN THE MIDDLE EAST AND NORTH AFRICA: A MULTICENTER STUDY OF 34 SITES FROM 17 COUNTRIES

Fawaz Baddour, MD (*Abstract Co-Author*) Nothing to Disclose
Emiliano Garza Frias, MD (*Abstract Co-Author*) Nothing to Disclose
Roshan Fahimi, MD (*Abstract Co-Author*) Nothing to Disclose
Zaid Alkaabneh (*Abstract Co-Author*) Nothing to Disclose
Charbel Saade, PhD, MS (*Abstract Co-Author*) GE Healthcare;Bayer
Jehad Z. Fataftah, MBBS (*Abstract Co-Author*) Nothing to Disclose
Shady Alkhazzam, PhD (*Abstract Co-Author*) Nothing to Disclose
Mohammed Elsir Elhag Mohammed, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mahmoud Elfiky (*Abstract Co-Author*) Nothing to Disclose
Laith Al Quran (*Abstract Co-Author*) Nothing to Disclose
Mohammad H. Kharita, PhD (*Abstract Co-Author*) Nothing to Disclose
Keffi Mubarak Musa (*Abstract Co-Author*) Nothing to Disclose
Seyedehelaheh Hosseini, MD (*Abstract Co-Author*) Nothing to Disclose
Walialdeen Biraima (*Abstract Co-Author*) Nothing to Disclose
Roaa Suliman (*Abstract Co-Author*) Nothing to Disclose
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Parisa Kaviani, MD (*Abstract Co-Author*) Nothing to Disclose
Anushree M. Burade, MBBS (*Abstract Co-Author*) Nothing to Disclose
Nathan Wang (*Abstract Co-Author*) Nothing to Disclose
Almotasem Bellah Elsharif, MD (*Abstract Co-Author*) Nothing to Disclose
Wafaa Shehada (*Abstract Co-Author*) Nothing to Disclose
Cesar Younan (*Abstract Co-Author*) Nothing to Disclose
Ibrahim Mutwakil Gamal Ahmed (*Abstract Co-Author*) Nothing to Disclose
Naser Obeidat (*Abstract Co-Author*) Nothing to Disclose
Safaa Ahmed Mohammad Al-Thour (*Abstract Co-Author*) Nothing to Disclose
Mohammed Abdellatif (*Abstract Co-Author*) Nothing to Disclose
Lina Karout, MD (*Presenter*) Nothing to Disclose

### PURPOSE

We describe the framework and data characteristics for establishing body region- and clinical indication-based diagnostic reference levels (DRL) and achievable doses (AD) for pediatric CT in the Middle East and North Africa (MENA).

### METHODS AND MATERIALS

Our project in partnership with Middle East Federation of Organizations of Medical Physics included 34 imaging sites from 17 countries in the MENA region, who contributed following data on 7917 pediatric patients (<19 years; F:M, 3168:4749) who had head (n=2979), chest (n=1770), abdomen-pelvis (AP, n=1943) or chest-abdomen-pelvis (CAP; n=1225) CT: patients' age, sex, weight, clinical indication for CT, CT scanner information, scan factors (tube current and potential), and radiation doses [volume CT dose index (CTDIvol) and dose length product (DLP)]. We estimated overall and site-specific 50th (AD) and 75th (DRL) percentile CTDIvol and DLP separately for each body region and clinical indication. Non-normal data were compared using the Kruskal-Wallis test.

### RESULTS

Most CT exams in children regardless of age groups were single phase acquisition without or with intravenous contrast (head CT 92%; chest CT 86%-91%; AP-CT 76%-85%) as opposed to 50% multiphase CAP-CT in all age groups. There was a significant variation in CTDIvol and DLP between the participating sites for body regions and clinical indications in all age groups (p=0.001). The protocol- and age group-matched MENA protocol-based ADs and DRLs were significantly higher (more than 50%) than the US levels. The head, chest, and AP-CT DLP DRLs were higher than the corresponding DLP DRLs in the US for 23/34 (68%), 21/34 (62%) and 23/34 (68%) of participating sites. There were significant differences in radiation doses across different CT scanner vendors (p<0.001). The low-income countries (LICs) had higher doses compared to middle- and high-income countries (HMIC): head (median LIC CTDIvol: 50 vs 40mGy for HMIC), chest (median LIC CTDIvol: 6 vs 4mGy for HMIC), AP (median LIC CTDIvol: 6.24 vs 4.9mGy for HMIC), CAP (median LIC CTDIvol: 51 vs 40mGy for HMIC) CT exams (p=0.001)

### CONCLUSION

Economic disparities and scanner distribution have a profound effect on the variations and use of higher radiation doses across the MENA regions with several-fold higher radiation doses for children scanned in low-income countries as compared with the high- and middle-income countries.

### CLINICAL RELEVANCE/APPLICATION

Socioeconomic factors resulting in higher radiation doses in MENA region warrant efforts on radiation dose education with incorporation of clinical indication-based protocols and upgrade of CT technology.

## R5B-SPNPM-2 CHANGING GADOLINIUM-BASED CONTRAST AGENTS TO PREVENT RECURRENT ADVERSE DRUG REACTIONS: PROPENSITY-MATCHED 6-YEAR COHORT STUDY

Ah Young Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Kyung-Hyun Do, MD (*Abstract Co-Author*) Nothing to Disclose
Choong Wook Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Jeong Hyun Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pyeong Hwa Kim (*Abstract Co-Author*) Nothing to Disclose
Ah Young Jung, MD (*Abstract Co-Author*) Nothing to Disclose
Dong Il Gwon (*Abstract Co-Author*) Nothing to Disclose
Chong Hyun Suh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Minwoo Han (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the preventive effect of changing the previous gadolinium-based contrast agents (GBCAs) for reducing the recurrence of GBCA-associated acute adverse drug reactions (ADRs).

### METHODS AND MATERIALS

This retrospective, observational, single-center study included patients who underwent GBCA-enhanced MRI examinations from January 2016 to December 2021, and had a history of acute GBCA-associated ADRs in the examination. Baseline participant characteristics, generic profile of GBCA, administration of premedication, history of prior ADR to iodine contrast agent, and symptoms of GBCA-associated acute ADRs were retrospectively analyzed. Multivariable logistic regression with generalized estimating equations and propensity score matching were used to adjust for selection bias.

### RESULTS

Among 238,743 examinations, 1,042 acute ADRs (0.44%; 95% CI: 0.41%-0.46%) were reported. Among them, a total of 373 patients who underwent 1,412 follow-up GBCA-enhanced MRI examinations were included. The overall recurrence rate was 31.9% (119/373). Multivariable logistic regression analysis revealed that the ADR recurrence rate was significantly lower in the GBCA change group (adjusted OR, 0.31; 95% CI: 0.12-0.77; P=0.012). After adjustment with propensity score matching, the recurrence rate was significantly lower in the GBCA change group than the GBCA non-change group (14.3% [6/42] vs. 36.9% [31/84], respectively; OR, 0.29 [95% CI: 0.11-0.77]; P=0.003). A history of ADR to iodinated contrast media (OR, 1.14; 95% CI: 0.68-1.90; P=0.62) and premedication (adjusted OR, 2.05; 95% CI: 0.92-4.58; P=0.081) did not significantly influence GBCA-associated ADR recurrence. In per exam analysis, multivariable logistic regression analysis also revealed that the ADR recurrence rate was significantly lower in the GBCA change group (adjusted OR, 0.36; 95% CI: 0.17-0.79; P=0.011). Subgroup analyses for recurrent hypersensitivity reactions demonstrated similar results.

### CONCLUSION

Changing the previous GBCA can effectively reduce the rate of recurrence of GBCA-associated adverse drug reactions, as shown with propensity-score-matched analysis.

### CLINICAL RELEVANCE/APPLICATION

Changing the previous gadolinium-based contrast agents (GBCA) is effective for lowering the recurrence rate of GBCA-associated adverse drug reactions, and the result was consistent after propensity score matching.

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# Abstract Archives of the RSNA, 2024

R5B-SPNR

**Neuroradiology Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPNR-1 ATLAS OF LOCATION-PROGNOSIS CORRELATION IN IDH WILD-TYPE GLIOBLASTOMA: UNVEILING INSIGHTS THROUGH A VOXEL-WISE COX REGRESSION ANALYSIS WITH OPEN-SOURCE DATASETS

Yukio Miki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Natsuko Atsukawa (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Tatekawa, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The impact of the glioblastoma's location on prognosis remains insufficiently explored, despite its potential importance in prognostic prediction. This study examined the correlation between tumor location and prognosis in cases of glioblastoma, employing MRI of IDH wild-type glioblastoma from The Cancer Imaging Archive.

### METHODS AND MATERIALS

A total of 769 subjects with IDH wild-type glioblastoma from the UCSF-PDGM and UPENN-GBM datasets were included for survival analysis. Patient/tumor demographics such as age, sex, MGMT methylation status, and tumor volume were used for the covariates of the subsequent analysis. After registration of every tumor ROI to the MNI standard space, a voxel-wise Cox regression analysis was conducted to create a hazard ratio (HR) map indicating the association of the tumor's presence or absence with prognosis in each voxel, adjusting for the covariates. Voxels that showed statistically significant were visualized. To validate the voxel-wise Cox regression model, subjects were classified into two groups based on whether the tumor ROIs of each subject overlapped the high/low HR regions to differentiate short- and long-term overall survival (OS) using the log-rank test.

### RESULTS

The HR map revealed that tumors in the medial frontobasal region and around the third to fourth ventricles were associated with worse prognosis in both datasets, underscoring the challenges in complete resection and treatment accessibility in these areas. Conversely, tumors located in the right temporal and occipital lobes exhibited favorable impact on prognosis, likely due to the potential for more extensive resection in the non-dominant hemisphere. Subjects whose tumor ROIs overlapped high HR regions showed significantly shorter OS in both datasets (both $p < 0.05$), while subjects whose tumor ROIs overlapped low HR regions showed significantly longer OS in UPENN-GBM dataset ($p = 0.002$). The log-rank test supported the results of the voxel-wise Cox regression model.

### CONCLUSION

This study represents a substantial step forward in our understanding of IDH wild-type glioblastomas, especially regarding the influence of tumor location on prognosis. Subjects with glioblastomas located in the medial frontobasal region and around the third to fourth ventricle were identified to have a poor prognosis, whereas subjects with glioblastomas in the right temporal and occipital lobes had a favorable prognosis.

### CLINICAL RELEVANCE/APPLICATION

This study highlights the correlation between tumor location and prognosis in IDH wild-type glioblastoma, revealing areas associated with better or worse outcomes. These insights can guide clinicians in tailoring treatment plans, potentially improving glioblastoma patient management.

## R5B-SPNR-11 MACHINE LEARNING ALGORITHMS WITH MAGNETIC RESONANCE IMAGING FOR DIAGNOSING IDIOPATHIC PARKINSON'S DISEASE: A DIAGNOSTIC ACCURACY META-ANALYSIS

Ahmed Benghatnsh (*Abstract Co-Author*) Nothing to Disclose
Abdelmohimen Adel M Elkhadar (*Abstract Co-Author*) Nothing to Disclose
Muhammed Elhadi (*Abstract Co-Author*) Nothing to Disclose
Ahmed Msherghi, MBBCh (*Presenter*) Nothing to Disclose

### PURPOSE

Idiopathic Parkinson's disease (IPD) is a common neurodegenerative disorder with a gradual onset and varying progression. Diagnosis relies solely on clinical criteria, often resulting in many cases remaining undiagnosed during the prodromal phase until the motor phase appears. Magnetic Resonance Imaging (MRI) has traditionally been used to exclude other diagnoses in suspected IPD cases. Recent advancements in MRI technology have sparked discussions on its potential role in IPD diagnosis. While some studies have explored Artificial Integration (AI) integration in MRI scans for of diagnosing IPD, a conclusive meta-analysis of its accuracy and practicality is needed.

**METHODS AND MATERIALS**

A systematic search was conducted in PubMed, EMBASE, Web of Science, and IEEE from inception to April 2024, focusing on the application of AI-integrated MRI for diagnosing IPD. Statistical analysis was carried out using R software (version 4.0.3) with the mada package. The analysis will explore sensitivity, specificity, false-positive rates, diagnostic odds ratio, and both positive and negative Likelihood Ratios (LRs), each with a 95% Confidence Interval (CI).

**RESULTS**

This analysis included 12 studies involving 3765 participants, with 2375 confirmed cases of IPD. The pooled sensitivity and specificity of AI-integrated MRI scans for identifying brain features of IPD were determined to be 83% (95% CI: 69-92%, I2=98.6%) and 85% (95% CI: 81.3-88.2%, I2=73.5%), respectively. The false-positive rate was reported as 15% (95% CI: 11.8-18.7%). The diagnostic odds ratio was calculated as 27.9 (95% CI: 10.60-73.41). The positive and negative Likelihood Ratios were found to be 5.57 (95% CI: 4.02-7.73) and 0.20 (95% CI: 0.10-0.39), respectively.

**CONCLUSION**

This study demonstrated the accuracy of AI-based algorithms in diagnosing Idiopathic Parkinson's disease through MRI scans.

**CLINICAL RELEVANCE/APPLICATION**

This study suggests that AI could be a beneficial addition in diagnosing Idiopathic Parkinson's disease. However, given the variability between studies, additional longitudinal large-scale studies are necessary to evaluate the practicality in clinical environments.

## R5B-SPNR-12 T1 PRE- AND POST-CONTRAST DELTA HISTOGRAM PARAMETERS IN PREDICTING THE GRADE OF MENINGIOMA AND THEIR RELATIONSHIP TO KI-67 PROLIFERATION INDEX

Hong Liu (*Abstract Co-Author*) Nothing to Disclose
Tao Han (*Abstract Co-Author*) Nothing to Disclose
Liu Xianwang (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the feasibility of delta histogram parameters (including absolute delta histogram parameters (AdHP) and relative delta histogram parameters (RdHP)) in predicting the grade of meningioma and to further investigate whether delta histogram parameters correlate with the Ki-67 proliferation index.

**METHODS AND MATERIALS**

Ninety-two patients with meningioma who underwent MRI examination (including T1-weighted (T1) and contrast-enhanced T1-weighted images (T1C)) were enrolled in this retrospective study. A total of 46 low-grade cases formed the low-grade group (grade 1, LGM), and a total of 46 high-grade cases formed the high-grade group (38 grade 2, 8 grade 3, HGM). Histogram parameters (HP) of T1 and T1C were extracted. Subsequently, morphological MRI features, AdHP (AdHP=T1CHP-T1HP), and RdHP (RdHP=(T1CHP-T1HP)/T1HP) were recorded and compared, respectively. Binary logistic regression analysis was used to obtain the combined performance of the significant parameters. Diagnostic performance was identified by ROC. Spearman's correlation coefficients were taken to assess the relationship between delta histogram parameters and the Ki-67 proliferation index.

**RESULTS**

In morphological MRI features, HGM is more prone to lobulation and necrosis/cystic changes (all $p<0.05$). In delta histogram parameters, HGM exhibits a higher mean, Perc.01, Perc.25, Perc.50, Perc.75, Perc.99, SD, and variance of AdHP, maximum, mean, Perc.25, Perc.50, Perc.75, and Perc.99 of RdHP, compared with LGM (all $p<0.00357$). The optimal predictive performance was obtained by combining morphological MRI features and delta histogram parameters with an AUC of 0.945. Significant correlations were observed between significant delta histogram parameters and the Ki-67 proliferation index (all $p<0.05$).

**CONCLUSION**

Delta histogram parameter is a promising potential biomarker, which may be helpful in noninvasive predicting the grade and proliferative activity of meningioma.

**CLINICAL RELEVANCE/APPLICATION**

Non-invasive prediction of the grade and proliferative activity of meningioma is of great clinical importance. Delta histogram parameter is a potential biomarker for the assessment of meningioma. Both AdHP and RdHP help predict the grade and proliferative activity of meningioma. The combined variable integrating conventional MRI features and delta histogram parameters yielded optimal diagnostic performance.

## R5B-SPNR-14 SIMULTANEOUS NEUROMELANIN AND NIGROSOME1 IMAGING USING A SINGLE 3D MULTI-ECHO GRE SEQUENCE

Hwan Heo, MENG (*Abstract Co-Author*) Nothing to Disclose
Jeongwon Jo (*Abstract Co-Author*) Nothing to Disclose
Aleum Lee, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Sung-Min Gho, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

We proposed a single 3D multi-echo GRE sequence for simultaneous neuromelanin (NM) and nigrosome1 (N1) imaging. This method utilizes product sequences without requiring any sequence modifications, and can be executed within a practically acceptable scan time (~5 min). Additionally, deep learning based analyses are applied to differentiate Parkinson's disease (PD) patients from controls, detect and segment the loss of the swallow tail sign, and identify changes in NM signal.

**METHODS AND MATERIALS**

Data acquisition We modified the previously proposed N1 imaging protocol to simultaneously obtain NM contrast by incorporating two spatial saturation pulses available in the product sequences of all vendors for magnetization transfer weighting. In total, 25 datasets (non-PD:16 PD: 9) were acquired using the scan protocol on 3T MRI scanners. Image processing analysis For N1 contrast, susceptibility map weighted images (SMWI) were reconstructed using data from the last three echoes. For NM contrast, magnitude images from the first echo were utilized. We quantified N1 and NM using models based on convolutional neural networks. A segmentation model was developed for the substantia nigra (SN), and a parcellation model was created for the spatial normalization of NM images. Additionally, we trained a model to locate and detect abnormalities in N1. For idiopathic PD (IPD), the reference standard was derived from 18F-FP-CIT PET findings.

**RESULTS**

The images from the non-PD display clearer NM contrasts compared to those from the IPD patients. The measured NM volume/Intracranial volume values were 3.04 and 2.54, respectively, indicating that NM volumes are relatively larger in non-PDs compared to IPD patients. Additionally, the comparative results of the N1 diagnostic performance, based on the 18F-FP-CIT PET scan results, show a sensitivity of 90%, specificity of 93%, positive predictive value of 90%, negative predictive value of 93%, and an accuracy of 92%. Clear swallow tail signs were observed in the non-PDs. However, the loss of the swallow tail sign was detected in the IPD patients on both sides.

**CONCLUSION**

We demonstrated that the proposed method for simultaneous NM and N1 imaging provides reliable estimates of NM-related volumes of the SN and detects the N1 regions within a practically acceptable scan time (~5 min). Our method, which is based on product sequences, will be easily compatible with equipment from most MRI vendors.

**CLINICAL RELEVANCE/APPLICATION**

Our proposed method has clinical significance as it allows for the simultaneous acquisition of images with two types of contrast (i.e. NM N1) in a reasonable scan time, which is particularly advantageous for PD patients who generally cannot undergo long scan times.

## R5B-SPNR-16 QUANTITATIVE ASSESSMENT OF MENINGIOMA CONSISTENCY USING SYNTHETIC MRI

Osamu Togao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kousei Ishigami, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Koji Yamashita, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazufumi Kikuchi, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Preoperative prediction of meningioma consistency is important for surgical planning. The purpose of this study was to determine whether the quantitative assessment using synthetic MRI (SyMRI) can predict meningioma consistency.

**METHODS AND MATERIALS**

Eighteen patients with meningioma (3 men and 15 women, median age 63 years) were included in the study. SyMRI was performed using 3T MRI with a 2D multi-dynamic multi-cho sequence. The SyMRI software (version 11.3) was used to acquire various quantitative maps, and regions of interest were placed in all slices of the tumor. The evaluation parameters were T1-, T2-values, and proton density. For comparison with the conventional method, mean values of tumor-to-thalamus signal intensity ratio on T1-weighted image (T1R), on T2-weighted image (T2R), and ADC generated from b-values 0 and 1000 s/mm2 of the DWI were also evaluated. The 10th, 25th, 50th, 75th, 90th percentiles, and the mean were calculated as histogram analysis. The consistency of meningiomas was evaluated intraoperatively by neurosurgeons using a 5-point scale according to the grading method of Zada et al. Meningiomas with a score of 3 or more were classified as hard, while those with a score of 1 or 2 were classified as soft. Statistical analysis was performed using the Mann-Whitney U test and receiver operating characteristic (ROC).

**RESULTS**

Soft meningiomas showed significantly longer T1 and T2 relaxation times and higher proton density compared to hard meningiomas (T1: 2701 ms vs. 1721 ms in the 90th percentile, P = 0.0007; T2: 111 ms vs. 94 ms in the mean, P = 0.0266; proton density: 92% vs. 85% in the 25th percentile, P = 0.0059). On ROC analysis, the 90th percentile value of T1 showed the best diagnostic performance (area under the curve 0.94). No significant differences were found in the other parameters.

**CONCLUSION**

Quantitative assessment using SyMRI could predict meningioma consistency.

**CLINICAL RELEVANCE/APPLICATION**

Preoperative assessment using synthetic MRI can optimize the surgical plan, including reducing bleeding and shortening operative time for patients with meningioma.

## R5B-SPNR-18 DIAGNOSTIC PERFORMANCE OF RADIOMICS IN PREDICTION OF KI-67 INDEX STATUS IN MENINGIOMA: A SYSTEMATIC REVIEW AND META-ANALYSIS

Hamed Ghorani, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammad Mohammadi (*Abstract Co-Author*) Nothing to Disclose
Sina Zakavi (*Abstract Co-Author*) Nothing to Disclose
Houman Sotoudeh, MD (*Abstract Co-Author*) Nothing to Disclose
Nima Broomand Lomer, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The Ki-67 marker serves as an indicator of tumor proliferation and is associated with the prognosis of meningiomas. Radiomics demonstrates potential in predicting both the grades of meningiomas and the status of Ki-67 index. Our meta-analysis aims to assess the diagnostic performance of radiomics in predicting Ki-67 index status within meningiomas.

**METHODS AND MATERIALS**

Following a systematic exploration of databases including Web of Science, PubMed, Embase, and Scopus, coupled with rigorous screening procedures, eligible studies underwent meticulous data extraction and evaluation of bias risk utilizing QUADS-2, RQS, and METRICS checklists. Sensitivity analysis was conducted employing the leave-one-out method, while assessment of publication bias involved contour-enhanced funnel plots and the trim and fill method. Pooled sensitivity, specificity, positive likelihood ratios (PLR), negative likelihood ratios (NLR), and diagnostic odds ratio (DOR) were computed. The summary receiver operating characteristic (SROC) curve was generated to assess overall accuracy. Subgroup analyses were performed to identify potential sources of heterogeneity.

**RESULTS**

The meta-analysis comprised eight studies, yielding pooled sensitivity and specificity estimates of 69% (95% CI [60%, 76%], I2 = 39%, p = 0.12) and 85% (95% CI [80%, 89%], I2 = 42%, p = 0.1), respectively. Correspondingly, the DOR, PLR, and NLR were computed as 13.01 (95% CI [8.40, 20.14]), 4.31 (95% CI [3.23, 5.77]), and 0.39 (95% CI [0.31, 0.50]), respectively. Notably, no indication of publication bias was detected (p = 0.565), and sensitivity analysis revealed no outliers. The median RQS score was 17.5 (48.6%), while the mean METRICS score stood at 78%. Employing the

QUADAS-2 tool, four studies were classified as low risk, and an equal number were categorized as high risk. Subgroup analysis delineated the superior performance of multiparametric MRI sequences in contrast to single sequences.

**CONCLUSION**

Radiomics exhibits considerable promise in predicting the Ki-67 index status among meningioma patients, thus potentially serving as a valuable instrument to enhance clinical decision-making and the management of meningioma cases.

**CLINICAL RELEVANCE/APPLICATION**

Radiomics analysis emerges as a pivotal tool in managing meningioma patients, predicting Ki-67 index status and enhancing prognostic evaluations. Multiparametric MRI sequences outperform single-sequence approaches, suggesting potential for refining imaging protocols and improving diagnostic accuracy and treatment stratification.

## R5B-SPNR-4 DEEP LEARNING-BASED QUANTIFICATION OF T2-FLAIR MISMATCH SIGN: EXTENDING IDH MUTATION PREDICTION IN ADULT-TYPE DIFFUSE LOWER-GRADE GLIOMA

Sun Won Park, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyu Sung Choi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Young Hun Jeon (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the predictive value of quantitative T2-FLAIR mismatch ratio (qT2FM) using fully automated tumor segmentation in adult-type diffuse lower-grade glioma (LGG).

**METHODS AND MATERIALS**

This single-center retrospective study included 218 consecutive patients (mean age, 47 years ± 15 [SD]; 125 male) diagnosed with adult-type diffuse LGG (WHO grade 2 and 3) from January 2011 to August 2021. The cohort was classified into three molecular subtypes: IDH wildtype (IDHwt), IDH mutant and 1p/19q codeletion (IDHmut-Codel), and IDH mutant and no 1p/19q codeletion (IDHmut-Noncodel). Tumor masks for quantitative T2FM analysis were obtained via deep learning-based tumor segmentation of pre- and post-contrast T1-weighted, T2-weighted, and FLAIR images. The qT2FM was calculated as the difference in normalized signal intensity ratios between T2 and FLAIR images at the tumor and normal-appearing white matter (NAWM). Multivariate logistic regression was used to identify significant predictors for distinguishing IDHmut-Noncodel from other molecular subtypes and for assessing IDH mutation status. Correlation analyses were conducted between qT2FM, vT2FM, and median apparent diffusion coefficient (ADC) value. Diagnostic performance was evaluated using the area under the receiver-operating characteristic curve (AUC).

**RESULTS**

The IDHmut-Noncodel group exhibited a higher qT2FM (0.37 ± 0.38, P = .004), compared to the other two groups, with IDHmut-Codel and IDHwt (0.24 ± 0.39 and 0.07 ± 0.62, respectively). Multivariate logistic regression revealed qT2FM as the only significant imaging predictor for distinguishing IDHmut-Noncodel from other groups (odds ratio [OR] 3.43, 95% CI; 1.30-9.05, P = .01). Additional significant predictors of IDH mutation included younger age, frontal lobe location, cortical involvement, and higher qT2FM. Significant correlations were observed between qT2FM and vT2FM (rpb = 0.214, P = .003) as well as median ADC value (R = 0.339, P < .001). The combined AUC of qT2FM and vT2FM provided superior diagnostic performance in identifying both IDHmut-Noncodel (AUC, 0.77, P = .005) and IDH mutation status (AUC, 0.77, P = .004), compared to using each parameter alone.

**CONCLUSION**

Quantification of T2-FLAIR mismatch ratio, derived from deep learning-based tumor segmentation, provides valuable predictive information for identifying IDH mutation and diagnosing IDHmut-Noncodel in patients with adult-type diffuse LGGs.

**CLINICAL RELEVANCE/APPLICATION**

The integration of qT2FM into clinical protocols may enhance diagnostic accuracy and influence treatment strategies, emphasizing the growing relevance of advanced imaging techniques in neuro-oncology.

## R5B-SPNR-6 PERFUSION TO THE RESCUE! DISTINGUISHING HIGH-GRADE AND LOW-GRADE GLIOMAS USING PERCENTAGE SIGNAL RECOVERY

Rohin Sharma, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Conventional MRI provides anatomic information about brain tumors however it does not provide information about their microstructure, such as microvasculature, neoangiogenesis, or cellularity. Perfusion MRI acts as a surrogate marker for tumor angiogenesis and addresses these drawbacks. The commonly used perfusion parameters include Cerebral blood volume (CBV) and flow (CBF), which are a measure of the neovascularization of malignant tissue. Percentage signal recovery (PSR) is a novel perfusion parameter that assesses the percentage drop of signal intensity post-contrast administration and is a measure of a multitude of factors; rate of flow of blood, amount of extravascular space, and leakage of contrast through the neovessels, and hence, unlike CBV/CBF, it assesses capillary permeability.There is a dearth of literature on the utility of PSR on a 3T scanner to distinguish high and low-grade gliomas.

**METHODS AND MATERIALS**

24 adults with primary intracranial gliomas were assessed with perfusion MRI on a 3T scanner and classified into high or low-grade based on the perfusion findings. The results were ultimately compared with the final histopathological grade. Classification of tumors based on PSR was compared with that of conventional perfusion parameters CBV and CBF, and their values relative to normal brain parenchyma.

**RESULTS**

Histopathologically, 15 out of 24 were proven high-grade and 9 were low-grade gliomas. Amongst conventional MRI parameters, only diffusion restriction could significantly differentiate high-grade from low-grade gliomas.Percentage signal recovery was found to be the best parameter to distinguish high-grade gliomas from low-grade, with a sensitivity and specificity of 100% and AUC of 1 at a cut-off of 78%. This was followed by rPSR with a diagnostic accuracy of 88%. rCBV and rCBF had diagnostic accuracies of 79% each while CBV had an accuracy of 71%. CBF could not statistically significantly distinguish the two groups.

**CONCLUSION**

Amongst the various perfusion MRI parameters, PSR fared better than conventional MRI and other perfusion MRI parameters in distinguishing high-grade from low-grade gliomas, with a diagnostic accuracy of 100% at a cut-off value of 78%.

**CLINICAL RELEVANCE/APPLICATION**

Perfusion MRI and percentage signal recovery may be considered for preoperative assessment and grading of primary intracranial gliomas in a non-invasive manner which can help in better patient management and operative planning.

## R5B-SPNR-7 UTILIZING MACHINE LEARNING TECHNIQUES ON MRI RADIOMICS TO IDENTIFY PRIMARY TUMORS IN BRAIN METASTASES

Weilin Yang (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to create a machine learning-based model, utilizing both clinical and radiomics data, to predict the primary origin of brain metastases using multiparametric magnetic resonance imaging (MRI).

**METHODS AND MATERIALS**

A retrospective analysis of 202 patients (87 males, 115 females) with a total of 439 brain metastases was conducted. Patients were categorized into training sets (brain metastases originating from lung cancer [BMLC] n=194, brain metastases originating from breast cancer [BMBC] n=108, brain metastases originating from gastrointestinal tumors [BMGiT] n=48) and test sets (BMLC n=50, BMBC n=27, BMGiT n=12). Quantitative image features (3404 in total) were extracted via semi-automatic segmentation from MRI scans (T1WI, T2WI, FLAIR, and T1-CE). Inter-rater reliability was assessed using the intra-class correlation coefficient (ICC). Radiomics features were selected employing analysis of variance (ANOVA), recursive feature elimination (RFE), and Kruskal-Wallis test. Three machine learning classifiers were utilized to construct the radiomics model, which was validated through five-fold cross-validation on the training set. A combined model incorporating both radiomics and clinical features was developed, and its diagnostic performance was assessed using area under the curve (AUC) and evaluated in an independent test set.

**RESULTS**

The radiomics model accurately differentiated BMGiT from BMLC (13 features, AUC = 0.915 ± 0.071) or BMBC (20 features, AUC = 0.954 ± 0.064). However, classification between BMLC and BMBC was less satisfactory (11 features, AUC = 0.729 ± 0.114). Nevertheless, the combined model improved predictive performance, achieving AUC values of 0.965 for BMLC vs. BMBC, 0.991 for BMLC vs. BMGiT, and 0.935 for BMBC vs. BMGiT.

**CONCLUSION**

The machine learning-based radiomics model exhibits promising capabilities in discerning the primary sites of brain metastases, potentially aiding in the identification of the primary tumor in cases where the history of the primary tumor is unavailable but brain metastasis is suspected.

**CLINICAL RELEVANCE/APPLICATION**

- Machine learning radiomics models offer predictive insights into brain metastasis tumor types.
- Quantitative features extracted from multiparametric MR images can serve as valuable biomarkers for tumor classification.
- Integration of clinical features with radiomics models enhances diagnostic accuracy.

## R5B-SPNR-8 ASSOCIATION OF GYMPHATIC SYSTEM DYSFUNCTION WITH SLEEP DISORDERS IN PARKINSON'S DISEASE

Teng Zhang (*Abstract Co-Author*) Nothing to Disclose
Yuting Li (*Presenter*) Nothing to Disclose

**PURPOSE**

Parkinson’s disease (PD) is a prevalent neurodegenerative disease characterized by abnormal deposition of a-syn proteins, which is closely associated with the glymphatic system dysfunction. During sleep period, the glymphatic system is more effective, and thus is susceptible to sleep disorders. Sleep disorders are considered as most common complications in PD. However, the relationship between sleep disorders and glymphatic system dysfunction in PD patients remains unknown. This study aims to investigate the impact of sleep disorders on glymphatic system in PD using a non-invasive imaging technique called diffusion tensor image analysis along the perivascular space (DTI-ALPS).

**METHODS AND MATERIALS**

A total of 123 PD patients and 55 healthy controls (HCs) underwent sleep questionnaires and MRI examinations as part of data collection from the Parkinson’s Progression Markers Initiative cohort. ALPS indices were compared between PD patients and HCs, as well as between PD patients with and without sleep disorders. Correlation was assessed between ALPS index and clinical characteristics. Furthermore, a 2-year follow-up analysis was performed to explore longitudinal impact of sleep disorders on glymphatic system function and disease progression.

**RESULTS**

PD patients showed significantly decreased ALPS indices compared with HCs (P=0.042). Within PD patients, ALPS index negatively correlated with duration (P=0.030), GDS (P=0.023), SCOPA-AUT (P=0.010), and MDS-UPDRS Total Score (P=0.007). PD patients with sleep disorders showed slightly decreased ALPS index compared with those with normal sleep (P=0.262). During follow-up, 10 patients transitioned from having normal sleep to experiencing sleep disorders, showing significant decreased ALPS index compared to baseline (P=0.028). In these patients, ?ALPS/T was negatively correlated with ?MOCA/T (P=0.004). In contrast, patients who maintained normal sleep showed no significant difference in ALPS index between baseline and follow-up (P=0.74).

**CONCLUSION**

Sleep disorders may contribute to dysfunction of glymphatic system and disease progression in PD patients, as indicated by ALPS index. Therefore, more attention should be devoted to addressing sleep disorders in order to prevent disease progression of PD.

**CLINICAL RELEVANCE/APPLICATION**

This study revealed the pathway of “sleep disorder-glymphatic system dysfunction-disease progression” in PD patients by employing the ALPS index. These findings emphasized the significance of addressing sleep disorders in treatment of PD.

# Abstract Archives of the RSNA, 2024

R5B-SPPD

**Pediatric Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPPD-1 STUDY OF MALE AND FEMALE DIFFERENCES IN IRON CONTENT IN NORMAL NEWBORN BRAIN BASED ON QUANTITATIVE SUSCEPTIBILITY MAPPING (QSM)

Xueyan Zhang (*Abstract Co-Author*) Nothing to Disclose
Shumeng Zhu (*Abstract Co-Author*) Nothing to Disclose
Yi Zhu (*Abstract Co-Author*) Nothing to Disclose
Xing Li (*Presenter*) Nothing to Disclose

### PURPOSE

Iron plays a crucial role in brain development, influencing cognitive and motor functions. This study utilizes Quantitative Susceptibility Mapping (QSM) to examine magnetic susceptibility in various nuclear clusters of male and female neonates. By investigating gender differences in brain iron content during the neonatal period, this research seeks to enhance our understanding of gender-specific neurodevelopmental pathways.

### METHODS AND MATERIALS

In this prospective study, 28 healthy neonates (16 males, 12 females) were scanned using a 3.0T scanner with a 32-channel head and neck coil. The magnetic-sensitive images for QSM were obtained through a Functool post-processing workstation. Seven brain regions were analyzed: bilateral globus pallidus, putamen, caudate nucleus head, dorsal thalamus, red nucleus, substantia nigra, and dentate nucleus of the cerebellum. The independent samples t-test was utilized to analyze the differences in magnetic susceptibility values between male and female neonates. Pearson correlation analysis was employed to investigate the relationships between the magnetic susceptibility values and age metrics.

### RESULTS

The susceptibility value of the left TH of male neonates was higher than that of female neonates, while the susceptibility value of the left DN was lower than that of female neonates, and the difference was statistically significant (t=3.251, P=0.003; t=-2.618, P=0.015). There was no correlation between the susceptibility value of each nucleus and the age.

### CONCLUSION

The study reveals significant gender-specific differences in the magnetic susceptibility values of certain brain nuclei in neonates, which may impact early neurodevelopment. Specifically, higher susceptibility in the male left dorsal thalamus suggests enhanced motor and decision-making skills, while elevated values in the female left dentate nucleus correlate with superior balance and cognitive abilities. Additionally, due to the limited age range of subjects, no age-related trends in susceptibility were observed in this study.

### CLINICAL RELEVANCE/APPLICATION

This study highlights the importance of considering gender in the neonatal brain. Understanding these differences could provide insights into the neurodevelopmental processes and help tailor early interventions based on gender-specific needs.

## R5B-SPPD-2 IMPROVING SPECIFIC ABSORPTION RATE MANAGEMENT SAFETY AND IMAGE QUALITY BY USING A HIGH DIELECTRIC CONSTANT PAD IN FETAL MRI AT 3.0T

Ming Li (*Abstract Co-Author*) Nothing to Disclose
Xin Zhang (*Abstract Co-Author*) Nothing to Disclose
Bing Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Chenchen Yan, MD (*Abstract Co-Author*) Nothing to Disclose
Zhengyang Zhu, MD (*Presenter*) Nothing to Disclose

### PURPOSE

As the static magnetic field strength increases, elevated specific absorption rate (SAR) value and dielectric artifacts are the two main technical challenges in fetal MRI at 3.0T. The elevated local temperature caused by radiofrequency induced current during the scanning may result in adverse impacts on fetal development. We aim to assess the potential of high dielectric constant (HDC) pad in increasing image quality and decreasing SAR in fetal MRI at 3.0T.

### METHODS AND MATERIALS

A total of 168 pregnant women were enrolled in this study, of which 128 subjects underwent bSSFP sequence and 40 subjects underwent SSFSE with and without HDC pad. Qualitative and quantitative image analysis were performed in each case. Qualitative analysis: A 5-point scale was used to score the images acquired with and without HDC pad by two pediatric radiologists. Quantitative analysis: firstly, the overall radiofrequency SAR values of the

images obtained with and without HDC pad were read on United Imaging software workstation. Secondly, four regions of interest (ROI) of frontal lobe, temporal lobe, thalamus and occipital lobe were placed on the standard level of each fetal brain. The signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated for each of the four ROIs. Wilcoxon test was used to analyze the differences between the image quality scores with and without HDC pad. Paired sample t-test or paired rank sum test was used to analyze the differences in SAR, SNR and CNR values with and without HDC pad. Spearman correlation test was used to detect correlations between image quality variable changes and patient clinical characteristics, such as gestational age, abdominal circumference, amniotic fluid index, body mass index and fetal presentation.

**RESULTS**

After adding HDC pad, image quality score, SNR and CNR was significantly higher ($p<0.001$) and whole-body SAR decreased significantly ($p<0.001$). For bSSFP sequence, there was 41.45% increase in SNR, 54.05% increase in CNR, and 32.6% decrease in whole-body SAR after adding HDC pad. For SSFSE sequence, there was 258.75% increase in SNR, 459.55% increase in CNR and 15.40% decrease in whole-body SAR after adding HDC pad. There was no significant correlation between image quality variable changes and patient clinical characteristics ($p>0.05$).

**CONCLUSION**

Adding HDC pad can reduce or eliminate the inhomogeneous dielectric artifacts in fetal MRI at 3.0T, resulting in significant increase of image quality. HDC pad can also lower SAR values, promoting fetal and maternal safety during 3.0T MRI scanning.

**CLINICAL RELEVANCE/APPLICATION**

HDC pad demonstrated significant potential for improving patient safety and imaging quality of fetal MRI at 3.0T, regardless of GA, AFI, AC, BMI and fetal presentation.

## R5B-SPPD-3 ADVANCING PAEDIATRIC BRAIN MAPPING: AN AI-DRIVEN ADAPTIVE FUNCTIONAL MRI PIPELINE FOR MAPPING OF FUNCTIONAL BRAIN NETWORKS

Radha Kumari (*Abstract Co-Author*) Nothing to Disclose
Akshay Kumaar M (*Abstract Co-Author*) Nothing to Disclose
Sachin Patalasingh (*Abstract Co-Author*) Nothing to Disclose
Malavika Ganesh (*Abstract Co-Author*) Nothing to Disclose
Rimjhim Agrawal, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Resting-state functional MRI (rs-fMRI) provides valuable insights into intrinsic brain functional organisation. However, in paediatric cases, developmental changes present challenges such as differences in head size, grey-white matter distribution, and myelination, rendering adult templates unsuitable for analyses. This complicates clinical problem-solving, hampering the understanding and treatment of neurodevelopmental disorders and conditions like epileptic lesions or brain tumours. This study introduces a novel adaptive pipeline for mapping brain networks in paediatric rs-fMRI for effective clinical management and understanding paediatric brain function.

**METHODS AND MATERIALS**

The raw resting-state functional MRI (N=50) underwent canonical reorientation, motion artefact correction, despiking, skull stripping, anatomical coregistration, and denoising. Normalisation was then applied using a paediatric MRI template. Resting state networks were extracted via Independent Component Analysis (ICA), with the best-fit ICA selected using a self-supervised neural network pretrained on adult networks and fine-tuned for paediatric data (N=10).

**RESULTS**

Leveraging the proposed framework, the Visual, Sensorimotor, Language, and Default Mode networks were mapped successfully using paediatric rs-fMRI. The fine-tuned neural network achieved an accuracy of ~96% in identifying the networks from the independent components of paediatric data post ICA.

**CONCLUSION**

In conclusion, this study introduces an innovative adaptable pipeline and proves the efficacy in mapping functional brain networks in paediatric rs-fMRI, marking a significant advancement in paediatric neuroimaging. Further refinement and validation of this pipeline may extend its utility to extract additional resting state networks. This study holds great potential for improving our comprehension of neurodevelopmental disorders and guiding treatment approaches for paediatric neurological conditions.

**CLINICAL RELEVANCE/APPLICATION**

This study explores the potential of paediatric resting-state fMRI in understanding the underlying mechanisms of various developmental disorders, including epilepsy, tumours, and traumatic brain injury. By mapping the functions of the brain, this method could change how paediatric patients are cared for, making diagnoses and treatments more accurate leading to better patient outcomes.

# Abstract Archives of the RSNA, 2024

R5B-SPPH

**Physics Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPPH-1 QUANTITATIVE LUNG IMAGING WITH CZT-BASED PHOTON-COUNTING CT: BENEFITS OF ULTRA HIGH-RESOLUTION IMAGING AND DEEP-LEARNING RECONSTRUCTION

Richard Thompson, PhD (*Abstract Co-Author*) Employee, Canon Medical Research, USA
Steven Ross, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhou Yu, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Amir Pourmorteza, PhD (*Abstract Co-Author*) Nothing to Disclose
Shobhit Sharma, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the combined benefits of ultra high-resolution imaging capabilities of CZT-based photon-counting CT (PCCT) and deep-learning reconstruction (DLR) for quantitative lung imaging.

### METHODS AND MATERIALS

A lung phantom (COPDGene2), with 3 reference foams (20-lb, 12-lb, and 4-lb with HU120kVp of -703, -824, and -937) and polycarbonate airways (inner diameter (ID): 2.5-6 mm, wall thickness (WT): 0.4-1.5 mm), was used. The phantom was scanned in axial mode on a prototype CZT-based PCCT at 120 kV using a 0.4x0.5 mm focal spot and exposures of 50, 100, and 200 mAs (CTDIvol = 3.2, 6.4, and 12.8 mGy, respectively). All scans were reconstructed in ultra high-resolution (UHR) mode using 3 different methods: (1) filtered-back projection (FBP), (2) FBP w/ iterative denoising (dnFBP), and (3) DLR. All images were reconstructed using a lung kernel (FC52) with a pixel size (PS) of 0.25 mm and slice thickness (ST) of 0.2 mm. To evaluate benefits of UHR with DLR, the following were quantified: (1) contrast and contrast-to-noise ratios (CNRs) for ground-glass nodules (GGNs) and emphysema (ES) (ST = 3.0 mm), and (2) measurement error in wall area percentage (WA%) for airways (ST = 1.2 mm). The 20-lb and 4-lb foams were used as surrogates for GGN and ES, while the 12-lb foam was used for normal lung tissue. CNRs for GGN and ES were computed as: CGGN,ES= |HUGGN,ES-HULung|; CNRGGN,ES=CGGN,ES/sLung. For airways, a custom code for estimating ID and WT based on peak analysis of airway intensity profiles was used, and WA% was computed as: WA% = (OD2 - ID2)/OD2 × 100, with OD = ID + (2 × WT).

### RESULTS

Noise for DLR was 79.9/76.6/70.1% lower than FBP and comparable to dnFBP at 50/100/200 mAs. CGGN, ES were higher for DLR with mean improvements for GGN/ES across all exposures of 4.3/9.9 and 3.0/10.1 HU over dnFBP and FBP, respectively. Consequently, CNRGGN, ES for DLR was comparable to dnFBP and much higher than FBP with mean improvements over all exposures of 326.5%/377.6% for GGN/ES. Mean errors in WAP% across all airways were lower for DLR at 4.1/4.1/3.0% compared to both dnFBP at 5.6/5.7/4.7% and FBP at 5.2/5.6/4.0% at 50/100/200 mAs, with benefits of DLR especially apparent for smaller airways.

### CONCLUSION

DLR in UHR imaging with CZT-based PCCT improves noise and preserves spatial resolution, as indicated by CNRs much higher than FBP and comparable to dnFBP at all exposures, while maintaining superior accuracy for WA% measurements. These benefits have potential for improvements in quantitative lung imaging while allowing for valuable reductions in patient dose.

### CLINICAL RELEVANCE/APPLICATION

The ability to accurately characterize changes in airway walls while reducing patient dose is crucial for monitoring progression of lung diseases such as COPD and pulmonary fibrosis.

## R5B-SPPH-10 IMPACT OF DEEP LEARNING IMAGE RECONSTRUCTION ALGORITHM ON CT RADIOMIC FEATURES IN PATIENTS WITH PULMONARY NODULES

Zhiming Xiang (*Abstract Co-Author*) Nothing to Disclose
Kun Ma (*Abstract Co-Author*) Nothing to Disclose
Zhijuan Zheng (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the effects of deep learning image reconstruction (DLIR) algorithm on radiomic features of patients with pulmonary nodules compared to adaptive statistical iterative reconstruction-V (ASIR-V) algorithm in ultra-low-dose computed tomography (ULD-CT).

### METHODS AND MATERIALS

Patients with pulmonary nodules underwent standard-dose computed tomography (SDCT) (4.30±0.36 mSv) and ULD-CT (0.33±0.04 mSv) plain scans. The SDCT was reconstructed with 50%ASIR-V, and ULD-CT with 50%ASIR-V, DLIR-M, and DLIR-H. Pulmonary nodules were segmented using artificial intelligence software (LungDoc 5.7) and 102 radiomic features (shape, first order, and texture features) were extracted from SDCT and ULD-CT images. The intraclass correlation coefficient (ICC) was employed to describe the reproducibility of radiomic features between ULD-CT and SDCT.

### RESULTS

A total of 89 participants (52 years ± 12) with 160 nodules were included in the study, consisting of 120 solid nodules and 40 pure ground-glass nodules. The ICC of radiomic features improved from 0.73±0.18 for 50%ASIR-V to 0.77±0.13 and 0.78±0.13 for DLIR-M and DLIR-H between ULD-CT and SDCT (P=0.013). In different reconstruction algorithms, the shape feature demonstrated the highest ICC value among all radiomic feature classes (the mean ICC=0.95), followed by first order feature (the mean ICC>0.85), while the texture feature displayed the lowest reproducibility (the mean ICC=0.75). Of the 102 radiomic features considered, 52.94% (54 of 102), 55.88% (57 of 102), and 67.65% (69 of 102) were reproducible (ICC = 0.75) for 50%ASIR-V, DLIR-M, and DLIR-H, respectively. In 50%ASIR-V, DLIR-M, and DLIR-H, 84.21% (16 of 19) of the first order features and 100% (8 of 8) of the shape features demonstrated reproducibility, while the reproducibility of the texture features was only 40.00% (30 of 75), 44.00% (33 of 75), and 60.00% (45 of 75), respectively.

### CONCLUSION

The majority of the radiomic feature classes of pulmonary nodules have a high level of reproducibility between ULD-CT and SDCT. Among them, the shape and first order features are highly reproducible between ULD-CT and SDCT. Compared with ASIR-V, DLIR can improve the reproducibility of texture features in ULD-CT.

### CLINICAL RELEVANCE/APPLICATION

DLIR technology can improve the reproducibility of radiomic features in ULD-CT scans. This improvement in reproducibility has important clinical significance. It means doctors can more reliably and accurately assess pulmonary nodules, whether using ultra-low-dose CT or standard-dose CT scan.

## R5B-SPPH-11 ENHANCING RELIABILITY OF BRAIN VOLUMETRIC ANALYSIS WITH DEEP LEARNING-BASED MRI DENOISING

Hackjoon Shim (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Seong Kyu Jeon (*Abstract Co-Author*) Nothing to Disclose
Jin Woo Kim (*Abstract Co-Author*) Nothing to Disclose
Juho Kim (*Abstract Co-Author*) Nothing to Disclose
Junhyung Kim (*Abstract Co-Author*) Nothing to Disclose
Chuluunbaatar Otgonbaatar, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hei-Jung Jang (*Abstract Co-Author*) Nothing to Disclose
Won Beom Jung (*Abstract Co-Author*) Nothing to Disclose
Jaekyun Ryu, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Brain MRI plays a crucial role in diagnosing neurodegenerative diseases by revealing structural changes. Accurate volumetric analysis of brain structures is pivotal for assessing disease progression. However, conventional image reconstruction techniques often compromise between signal-to-noise ratio (SNR) and scan duration, hindering optimal image quality within a reasonable acquisition time. Deep learning-based image reconstruction (DLR) using deep convolutional neural networks (DCNN) presents a promising solution to this challenge. Here, we evaluate the utility of DLR in brain MRI for volumetric analysis, comparing it with conventional methods.

### METHODS AND MATERIALS

We acquired structural MRI data from ten healthy subjects (M/F = 6/4; aged 25-50 years) using a 3T MRI scanner (Canon Medical Systems, Vantage Galan STD) with a 16-channel head and neck coil. T1-weighted structural MR images were obtained using a 3D magnetization-prepared rapid gradient-echo (MPRAGE) sequence. Three image sets were acquired per subject: original unfiltered images (NEX = 1, scan time = 5 mins 58 secs), images reconstructed using DLR (Advanced Intelligent Clear-IQ Engine, AiCE), and high SNR images (NEX = 3, scan time = 17 mins 54 secs). DLR was based on a DCNN trained with low and high SNR MR image pairs. For whole-brain voxel-based morphometry (VBM), we utilized the CAT 12 toolbox integrated into SPM12 software. The images were normalized to the standard MNI space, segmented into gray matter (GM), white matter (WM), and cerebrospinal fluid (CSF) using DARTEL, and smoothed with a 6-mm FWHM Gaussian kernel. Volumetric parcellations of subcortical GM regions were obtained using the Neuromorphometrics atlas.

### RESULTS

Figure 1 illustrates the efficacy of DLR in reducing non-uniform noise without loss of structural information. VBM analysis revealed significant volume reductions in specific brain regions with low SNR images compared to high SNR and DLR-enhanced images (Fig. 2). Subcortical volumetry corroborated these findings, highlighting the impact of image quality on quantitative measures (Fig. 3).

### CONCLUSION

Quantitative brain MRI analysis is increasingly valuable in clinical practice. Our study demonstrates that image noise affects tissue segmentation and volumetric measurements, crucial for detecting neurodegenerative diseases. DLR presents a viable approach to enhance the reliability of brain volumetric analysis without additional scan time, potentially improving clinical decision-making.

### CLINICAL RELEVANCE/APPLICATION

DLR allows for increased SNR and more equivocal brain volumetric measurements with fast scanning times compared to conventional imaging.

## R5B-SPPH-2 IMPACT OF CLINICAL TREATMENT PLANNING METHODOLOGY FOR YTTRIUM 90 RADIOEMBOLIZATION PATIENT DOSIMETRY

Stephanie Leon, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Dante E. Roa, PhD (*Abstract Co-Author*) Nothing to Disclose
Edmond Olguin, PhD (*Abstract Co-Author*) Nothing to Disclose
Oliver Paucar (*Abstract Co-Author*) Nothing to Disclose
Andres Gonzales Galvez (*Abstract Co-Author*) Nothing to Disclose
Terrance Moretti, PhD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

For glass microspheres used in Yttrium-90 Transarterial Radioembolization (TARE), the manufacturer-recommended dosimetry method is the partition model, which assumes a uniform distribution of activity in each compartment (liver, tumor, and lungs) and lack of cross-irradiation between compartments. However, more detailed imaging-based dosimetry models may result in differing calculated tumor and organ doses than treatment planning.

**METHODS AND MATERIALS**

IRB approval was acquired to acquire imaging and treatment planning data for ten patients who received TARE for hepatocellular carcinoma. Three Monte Carlo (MC) voxelized source models were developed for each of them: one based on their pre-treatment Tc99m SPECT/CT, one based on their post-treatment Y90 bremsstrahlung SPECT/CT, and one approximating the assumptions of the partition model (equal distribution of activity through the perfused areas of the liver and entire visible lung volume), referred to as the uniform perfused model. Using a Y90 source, simulations were performed for each of these models, and doses were assessed for the treated volume, healthy liver, and lungs. These were compared to the nominal doses from treatment planning. Dose-volume histograms (DVH) for these volumes were generated for each source model to evaluate differences in 3D dose distribution.

**RESULTS**

Mean doses within the tumor typically, but not always, matched the values predicted by the partition model. For patients undergoing lobectomy, differential uptake in the tumor resulted in higher doses than when the entire lobe was considered. Simulated lung doses did not always agree with those calculated during treatment planning, mainly due to tumor proximity to the lungs. Pretreatment SPECT/CT dose generally agreed with doses calculated during treatment planning. The bremsstrahlung images consistently resulted in lower doses within the tumor and healthy liver, which may have been the result of differing biodistribution or poor image quality. The partition model-based source term generated DVH's which had a more uniform and spread-out dose throughout the perfused liver. Depending on model, planned dose and calculated dose may differ by up to 86%.

**CONCLUSION**

The MC architecture in this work is appropriate for assessment of dose-volume effect for patients undergoing TARE. Continued use of the partition model is appropriate for mean doses within the perfused liver, but can cause miscalculation of doses to certain organs, particularly the lungs.

**CLINICAL RELEVANCE/APPLICATION**

The currently-used TARE partition model can overestimate or underestimate dose to tumor, normal liver, and lungs in ways that affect treatment planning. Use of a more detailed imaging-based model could help mitigate these inaccuracies.

## R5B-SPPH-3 AUTOMATED ORGAN-SPECIFIC CT RECONSTRUCTION USING A TUNABLE MULTI-AGENT ARCHITECTURE

John M. Hoffman, PhD (*Abstract Co-Author*) Nothing to Disclose
Joshua Genender, BA (*Presenter*) Nothing to Disclose

**PURPOSE**

When reading CT images, clinicians zoom into organ systems necessary to reach a diagnosis; however, the spatial resolution of these zoomed images is limited by parameters chosen at the scanner. To address this, we developed a pipeline that dynamically reconstructs CT images to organ-specific fields-of-view (FOVs), allowing for high-quality visualization of patient anatomy.

**METHODS AND MATERIALS**

Our dataset included projection data of 15 chest CT scans from the TCIA LDCTPD collection. Our pipeline used a multi-agent blackboard architecture that iteratively generated reconstructions based on patient anatomy. Reconstructions were generated through the interplay of three agents: (1) a CT reconstruction agent, which outputs reconstructed image series; (2) a segmentation agent, which performs organ segmentation (lungs, heart, aorta); and (3) a parameter tuning agent, which guides the reconstruction volume for the next iteration. Agreement between segmentations and semantic anatomical knowledge was used as a stopping criterion for the reconstruction loop. The image matrix size was doubled between iterations when necessary. Once the stopping criterion was satisfied, a final set of organ-specific reconstructions was generated from organ bounding boxes. To compare the spatial resolution of automated versus manually-zoomed images, we extracted an aortic calcification from one scan and computed the full width at half-maximum (FWHM) of the pixel intensity profile. Reconstructions were generated using the FreeCT tool and segmentations by an active contours model and TotalSegmentator.

**RESULTS**

Our pipeline successfully reconstructed images with the expected organ-specific FOVs for each case in our dataset. The FWHM for the automated calcification was 0.4 mm (21%) narrower than the manually zoomed calcification, suggesting improved spatial resolution. Intermediate results showed the system progressively narrowed its focus to the desired FOV, explained by its use of contextual information in low-quality images (early iterations) and fine details in high-quality images (late iterations).

**CONCLUSION**

The automated organ-specific reconstruction pipeline identified and limited reconstruction FOVs to patient anatomy with improved spatial resolution. This pipeline shows potential for use in complex CT quantitative imaging systems, particularly those with multiple interacting analysis components.

**CLINICAL RELEVANCE/APPLICATION**

This tool provides high-quality views of anatomy that would otherwise be generated by a technician or zoomed-in from a rib-to-rib image. Our tunable multi-agent architecture demonstrates cognitive AI methodologies in CT reconstruction, which we believe could allow for advanced quantitative imaging systems.

## R5B-SPPH-4 DEEP LEARNING-BASED MULTI-MODALITY MODEL FOR ACCURATE GROSS TUMOR VOLUME SEGMENTATION IN NASOPHARYNGEAL CARCINOMA RADIOTHERAPY

Le Lu (*Abstract Co-Author*) Nothing to Disclose
Jia Ge (*Abstract Co-Author*) Nothing to Disclose
Ying Chen (*Abstract Co-Author*) Nothing to Disclose
Zi Li (*Abstract Co-Author*) Nothing to Disclose
Xianghua Ye (*Abstract Co-Author*) Nothing to Disclose
Dakai Jin, MS (*Presenter*) Nothing to Disclose

## PURPOSE

In nasopharyngeal carcinoma (NPC) radiation therapy, clinicians must outline the primary gross tumor volume (GTV) precisely on the planning computed tomography (pCT) for accurate radiation dose delivery. Due to the limited contrast between NPC tumors and many adjacent normal tissues, oncologists need to manually delineate GTV with the help of diagnostic CT or MRI in clinical practice. In this study, we develop a series of multi-modality NPC GTV deep segmentation models using multi-center datasets.. The quantitative segmentation performance is evaluated on the internal test set and one independent external dataset.

## METHODS AND MATERIALS

We collected and curated an in-house dataset from the hospital for deep segmentation model development, which consisted 145 NPC patients with pCT, enhanced diagnostic CT, and diagnostic MRI (T1 T2 phases). Diagnostic CT and MRI were registered to pCT using affine and deformable transformation (DEEDS). Additionally, we collected and curated one publicly available dataset (SegRap2023) as external validation, containing 98 no-contrast pCT and enhanced CT. GTV annotations of all datasets were examined and edited by two experienced radiation oncologists following the international GTV delineation consensus guideline. We developed three deep segmentation models: the first model used pCT as input; the second used pCT and enhanced diagnostic CT as input; and the third took pCT, enhanced diagnostic CT with random masked MRI scans as input. We used nnUNet as the deep segmentation network. For evaluation, 20% of the in-house dataset was randomly selected as the internal testing set and the curated SegRap2023 was used as the external testing dataset.

## RESULTS

The quantitative NPC GTV segmentation performance is summarized in Table 1. In internal testing, the model using pCT alone achieved reasonably high performance with a 76.6% Dice score. When enhanced diagnostic CT were incorporated, the segmentation model slightly improved the performance by 0.3% Dice score. Further incorporating the masked MRI scans seemed not help with the performance. Regarding the external testing, pCT model experienced significant performance drop (76.6% to 60.3%) Yet, pCT + diagnostic CT model led to a much stable external testing result (63.1%), demonstrating the strength of enhanced CT in determining NPC GTV.

## CONCLUSION

We developed and tested a series of multi-modality deep-learning model for segmenting GTV in NPC patients. The model achieves high quantitative segmentation performance, which is evaluated on the internal test set and one independent external dataset.

## CLINICAL RELEVANCE/APPLICATION

It can be potentially used in radiotherapy practice to standardize the NPC GTV segmentation and reduce the workloads of radiation oncologists.

# R5B-SPPH-6 ENHANCING INTRA-OPERATIVE GUIDANCE FOR NEUROVASCULAR INTERVENTIONS OF INTRACRANIAL ANEURYSMS USING EPIPOLAR 3D RECONSTRUCTION FROM TWO VIEWS

Ciprian N. Ionita, PhD (*Abstract Co-Author*) CEO, QAS.AI;Grant, Canon Medical Systems Corporation
Swetadri Vasan Setlur Nagesh, MS, PhD (*Abstract Co-Author*) Nothing to Disclose
Parmita Mondal, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Bednarek, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Stephen Rudin, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Ahmad Rahmatpour, PhD (*Abstract Co-Author*) Nothing to Disclose
Parisa Naghdi, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyle Williams, BS (*Presenter*) Nothing to Disclose

## PURPOSE

This study investigates the application of a rule-based epipolar 3D reconstruction algorithm to enhance intra-operative guidance during neurointerventional procedures for intracranial aneurysms. By using only two angiographic views our approach eliminates the need for multiple cone beam CT (CBCT) acquisitions to reflect intra-operative changes.

## METHODS AND MATERIALS

Our study employed three patient-specific ICA aneurysm models obtained from clinical CT angiography reconstructions. We used computational fluid dynamics (CFD) simulations to generate detailed virtual angiograms of these aneurysms, including a 1.5-second iodine injection to simulate the contrast material dynamics during actual angiographic procedures. For the imaging simulations, we utilized the ASTRA Toolbox to create cone beam projection geometries that mimic those of standard clinical biplane C-arm systems. Angiographic data was simulated for two standard views (AP and lateral) which are routinely used during neurovascular interventions. These simulated high-resolution biplane x-ray images were inputs to our epipolar reconstruction algorithm. This algorithm efficiently reconstructs three-dimensional vascular geometries from only two planar images, eliminating the need for additional imaging exposures or complex co-registration processes. We quantified the accuracy of our 3D reconstructions using DICE coefficients, which provided a quantitative comparison between our reconstructed geometries against the original high-fidelity patient-specific aneurysm models.

## RESULTS

The epipolar reconstruction reported DICE = 0.734 ± 0.027 among the three models. Reconstruction errors were primarily observed above the carotid bifurcation. The results suggest epipolar reconstruction may prove useful for 3D quantitative angiography.

## CONCLUSION

The performance of our epipolar reconstruction algorithm suggests its potential to provide 3D neurointerventional imaging without high dose CBCT. The method efficiently recovers 3D vascular geometries from biplane angiographic views, with an estimated 83.3% reduction in cumulative air kerma, thus reducing radiation risk to the patient. Further refinement could improve its sensitivity and specificity, reinforcing its utility in real-time intra-operative guidance.

## CLINICAL RELEVANCE/APPLICATION

This epipolar reconstruction algorithm enhances neurointerventional accuracy by providing 3D vascular geometries from standard biplane angiographic views. Its ability to deliver precise, real-time visuals intraoperatively could improve surgical decision-making and patient outcomes in treating intracranial aneurysms.

## R5B-SPPH-7 TRAINING A DEEP-LEARNING-BASED NOISE REDUCTION METHOD TO REDUCE HALLUCINATED STRUCTURES IN ULTRA-LOW-DOSE CT

Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Kelly K. Horst, MD (*Abstract Co-Author*) Nothing to Disclose
Kendal Weger, MD (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhongxing Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

In ultra-low-dose (ULD) CT with strongly increased image noise, deep learning-based noise reduction (DLR) methods tend to generate artificial structures without appropriate training. The purpose of this work was to develop a DLR method using a training strategy dedicated to ULD CT to reduce hallucinated structures.

### METHODS AND MATERIALS

A deep neural network for ULD CT denoising (ULD-NET) was trained by mapping the synthesized noisy CT images to high quality target CT images. The target images were obtained by iterative reconstruction (IR) of routine dose (RD) projection data with slice thickness/interval of 2.0/0.5 mm and a sharp kernel (Qr68). The training inputs were synthesized by superimposing noise maps on the target images, where the noise maps were generated by subtracting the 25% dose (QD) filtered back projection (FBP) images from the corresponding RD FBP images, both with a thin slice thickness (0.8 mm). The QD images were reconstructed from QD projection data simulated by a projection noise insertion method. A U-Net architecture was adopted as the backbone of ULD-NET. The trained ULD-NET was applied to the original thin slice and sharp kernel FBP images. By using more realistic noise maps and cleaner target images, this training strategy was expected to reduce hallucinated structures compared to an existing model (GARNET) previously trained and clinically validated. The performance was evaluated in a pilot study including 5 pediatric thoracic CT cases scanned on a PCD-CT scanner (Alpha, Siemens) at ULD (CTDIvol < 0.1 mGy). Two pediatric radiologists evaluated 3 conditions: (1) IR, (2) GARNET, (3) ULD-NET in terms of spatial resolution, noise, hallucination in lung parenchyma (1-5, 1=widespread fake structures, 5=no fake structures), and overall diagnostic confidence (1-4, 4=high confidence).

### RESULTS

ULD-NET received the highest ratings in spatial resolution/noise/diagnostic confidence (3.81±0.37/3.75±0.46/3.75±0.46) compared to GARNET (3.12±0.69/2.38±0.35/3.13±0.44) and IR (2.63±0.52/2.19±0.59/3.06±0.62). In terms of hallucination, no significant difference was found between ULD-NET and IR (4.25±0.71 vs. 4.25±1.04, p=1), both higher than GARNET (2.12±0.83, p<0.01), demonstrating a significant reduction of hallucinated structures by ULD-NET.

### CONCLUSION

Using a training strategy dedicated to ULD, the proposed ULD-NET method improved the overall diagnostic image quality without introducing hallucinations that were significant in a prior denoising method.

### CLINICAL RELEVANCE/APPLICATION

DLR tends to generate hallucinated structures when the noise in input images is high. Our proposed ULD-NET has the potential to significantly alleviate the hallucination problem, allowing for more routine use of ULD-CT.

## R5B-SPPH-8 IS THERE A THRESHOLD LIMIT FOR BRAIN TUMOR TARGET SIZE AND OFF AXIS DISTANCE FROM ISOCENTER FOR HYPER ARC RADIOSURGERY USING MILLENNIUM 120 MLC?

Sumit Varadhan (*Abstract Co-Author*) Nothing to Disclose
Dharmin Desai, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryan Malmin (*Presenter*) Nothing to Disclose

### PURPOSE

Stereotactic Radiosurgery (SRS) using standard Millennium 120 leaf MLC is the most commonly used radiosurgery platform. However, in the era of HyperArc SRS, that employs automated delivery and treatment planning, the minimum target size that can be effectively treated using a Millennium 120 MLC as well as how far away off axis from the isocenter the target can be accurately treated remains a question of interest. The goal of this study is to characterize a minimum threshold target size and off axis distance from isocenter for high precision SRS using a measurement guided approach.

### METHODS AND MATERIALS

To test the hypothesis, we created incrementally decreasing pair of targets of sizes 10mm, 8mm, 5mm and 3mm in the Standard imaging LUCYR EA head phantom. The location of the first target was at the origin at isocenter (0, 0, 0). The second target was placed at (1, 1, 0) to (5 ,5, 0) coordinates (cm) in 1cm increments from the Z=0 coronal plane. Thus the smallest pair of targets treated was 3mm in diameter and the largest distance from the isocenter was 7.1 cm when the second target was at (5cm, 5cm, 0cm) location. The location of targets was chosen such that all the targets are encompassed in the 7.7 cm2 X 7.7 cm2 diode array when the verification plan is delivered to the SRS MapCHECK in a StereoPHAN phantom. A dose of 15 Gy in 1 fraction using 6FFF photons was planned and delivered using HyperArc SRS. All the targets received 100% dose to the target volume using Acuros XB 16.1 algorithm. Thus, a total of 25 HyperArc SRS plans of incrementally decreasing target size (10mm to 3mm) and increasing off axis distance (14 mm to 71 mm) was delivered to SRS MapCHECK. Further, the impact of rotational set up errors on delivered dose was investigated. This was done by intentionally moving the 6DOF couch in 0.5 degree increments in each of the rotational axis (roll, pitch and yaw) and the accuracy of delivered dose was ascertained with measurements on high resolution diode array

### RESULTS

All plans passed the SRS MapCHECK quality assurance with > 97% Gamma pass rate using a strict 2%/1mm criteria. With the introduction of 0.5, 0.7 and 1.0 degree rotational errors in roll, pitch and yaw axis, the pass rates were 91.6%, 85.1 % and 76.4% respectively.

### CONCLUSION

Brain tumors as small as 3mm in diameter and 70 mm away from each other can be accurately treated with Millennium 120 MLC in Hyper Arc SRS. 0.5 degree is the threshold rotational error in each of the rotational axis for accurate off axis delivery of HyperArc SRS for small targets.

### CLINICAL RELEVANCE/APPLICATION

High precision SRS using HyperArc technology can be used to treat targets as small as 3mm in size and as far away as 70mm off axis, using regular Millennium 120 MLC obviating the need for other approaches and expensive capital expenditures.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

R5B-SPVA

**Vascular Imaging Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-SPVA-1 VARIATIONS IN THE UTILIZATION OF INTRAVASCULAR ULTRASOUND (IVUS) IN THE MEDICARE POPULATION FROM 2013-2022

Richard E. Sharpe JR, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Aditya Khurana, MD (*Abstract Co-Author*) Nothing to Disclose
Jumana Baldawi, MD (*Abstract Co-Author*) Nothing to Disclose
Mustafa Al-Ogaili, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate utilization rate and geographical distribution of intravascular ultrasound (IVUS) among the Medicare population.

### METHODS AND MATERIALS

All IVUS CPT codes as classified by the NITOS system (a validated imaging CPT classification tool) were extracted from the Part B POSPUF database for the years 2013-2022. State locales were determined by cross referencing the Medicare administrator code (MAC) with the corresponding state the claim was billed in. Compound annual growth rates (CAGR) and absolute differences were calculated.

### RESULTS

The total number of IVUS grew from 16396.0 in 2013 to 204989.0 in 2022, for a CAGR of 32.4% The utilization rate of IVUS per 10,000 Medicare enrollees grew from 5.0 in 2013 to 69.9 in 2022, for a CAGR of 34.1% The three states with the highest gain in IVUS utilization were District of Columbia (1045.8 per 10,000 Medicare enrollees; 32.2 to 1078.0), California (177.5 per 10,000 Medicare enrollees; 5.8 to 183.3), and Connecticut (142.4 per 10,000 Medicare enrollees; 2.6 to 145.0)The three states with the lowest gain/greatest decrease were Nebraska (-7.9 per 10,000 Medicare enrollees; 24.6 to 16.7), West Virginia (-4.7 per 10,000 Medicare enrollees; 9.9 to 5.3), and Idaho (-1.5 per 10,000 Medicare enrollees; 4.4 to 2.8).

### CONCLUSION

IVUS is a newer sophisticated technology that is increasingly utilized by US Medicare beneficiaries over the past decade. The identification of significant state level variations raises potential concern for overutilization in some states, underutilization in others, and potential differences in patient access to emerging technologies.

### CLINICAL RELEVANCE/APPLICATION

IVUS allows for better periprocedural planning and may be useful in a variety of surgical and interventional procedures in the Medicare population.

# Abstract Archives of the RSNA, 2024

S3A-SPBR

**Breast Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPBR-1 MRI-BASED RADIOMICS ANALYSIS TO PREDICT THE LEVEL OF TUMOR-INFILTRATING LYMPHOCYTES (TILS) IN BREAST CANCE

Xiaomei Li (*Abstract Co-Author*) Nothing to Disclose
Guijing Jia (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the relationship between the level of tumor infiltrating cells (TILs) in breast cancer and its clinical, pathological and MRI-based radiomics features, and establish radiomics machine learning model to predict TILs level in breast cancer

### METHODS AND MATERIALS

This study included a total of 132 patients pathologically diagnosed as breast cancer. The clinical, pathological and MRI features of patients were collected, and divide patients into high TILs and low TILs groups based on pathology. The two groups were compared by two-sample t test or Chi-square test, and the features with statistical significance were selected for clinical model construction. Radiomics features were extracted from the early stage of DCE enhancement(DCE2), late DCE enhancement(DCE6) and T2 sequence. A least absolute shrinkage and selection operator regression was used to screen features and construct machine learning classification models (including random forest and support vector machine models). Three single-phase models and a multi-sequence radiomics model were constructed, and a combined radiomics-clinical model were further constructed. AUC, DCA and calibration curve were used to compare the efficacy of different models

### RESULTS

Low TILs group (n=65) and highTILs group (n=67) showed differences in Ki-67, triple-negative breast cancer, and ADC value ($p<0.05$). Compared with the low TILs group, the high TILs group had lower ADC value(789±130 VS 842±118 *10-6mm2/s), higher proportion of triple negative breast cancer (23.9% VS 9.2%) and higher proportion of Ki-67 hyperexpression(49.3% VS 29.7%). The three clinical features were used to construct a model and the AUC of the training set(TS) and validation set(VS) were 0.687 and 0.573. The radiomics features of the patients were extracted and screened from DCE2, DCE6 and T2 sequence.The model which constructed from 7 radiomics features in DCE2 performs the best among Three single-phase models , with AUC of 0.998 and 0.732 in the TS and VS . The RF model was obtained by fusion features of the three-stage sequence, and the AUC of the TS and VS were 0.972 and 0.935 . Finally, a combined radiomics-clinical model was constructed, and the AUC of the TS and VS were 0.973 and 0.931. DCA and calibration curves showed that the predictive efficiency of combined radiomics-clinical mode was higher than clinical model

### CONCLUSION

The MRI-based radiomics prediction model has a good performance in the classification of TILs levels, which is expected to be used as a non-invasive TILs level evaluation method to provide assistance for clinical practice

### CLINICAL RELEVANCE/APPLICATION

The machine learning model based on DCE-MRI has excellent capabilities in non-invasive evaluation of cancer TILs.

## S3A-SPBR-10 HIGH AI SCORE ON SCREENING MAMMOGRAMS BUT NO BREAST CANCER: A BLINDED CONSENSUS REVIEW OF 382 CASES

Solveig S. Hofvind (*Abstract Co-Author*) Nothing to Disclose
Henrik Koch, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Retrospective and prospective studies using artificial intelligence (AI) to analyze screening mammograms for cancer detection, have shown promising results. However, less attention has been given to cases with high AI score, but no cancer detected - a false positive AI alarm. In this retrospective review study, we explored mammographic features in screening mammograms with high AI score, but no breast cancer detected in the actual or two next screening rounds.

### METHODS AND MATERIALS

Mammograms from 69,165 women who participated in BreastScreen Norway 2010-2022 were analyzed with a commercially available AI system (Transpara, ScreenPoint Medical). An AI score from 1 to 10 indicated the suspiciousness of malignancy where 1 indicated low risk and 10 high risk. We selected cases with an AI score of 10 followed by two biennial, negative screening examinations. Of the 2,124 examinations matching these criteria, we selected 382 random examinations for a blinded consensus review. Three experienced breast radiologists reviewed the cases and classified

mammographic features (density, distortion, density with calcification, calcification, mass, spiculated mass), interpretation score (1; negative, 2; probably benign, 3; intermediate suspicion of malignancy, 4; probably malignant, 5; high suspicion of malignancy) and BI-RADS mammographic breast density (a-d). For cases with calcification, distribution and morphology of the calcification was recorded.

**RESULTS**

For all 382 cases, 91% (348/382) were given an interpretation score of 1 (negative) by the reviewing radiologists. All cases (26/26) classified as BIRADS density d were given an interpretation score of 1 (negative). For all cases, 31% (117/382) was classified as density, 1% (3/382) as distortion, 29% (112/382) as density with calcification, 39% (115/382) as calcification, 9% (34/382) as mass and 0% (1/382) as spiculated mass. Out of the 115 cases with calcification, 79% (91/115) were classified as benign (morphology), 77% (89/115) as cluster (distribution) and 62% (71/115) as a benign cluster.

**CONCLUSION**

The majority of cases with high AI score but no cancer detected, were easily dismissed as negative in the review, and would likely not be recalled for further assessment in a real screening setting.

**CLINICAL RELEVANCE/APPLICATION**

This knowledge is important to understand reasons for high AI scores on negative cases. The knowledge may help maintain and potentially even decrease the rate of false positive recalls when AI is implemented as part of the screening interpretation procedure.

## S3A-SPBR-2 MULTI-INSTITUTIONAL EVALUATION OF BACKGROUND PARENCHYMAL ENHANCEMENT CLASSIFICATION USING DEEP LEARNING

Susanne D. Diekmann, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Robert Grimm, MD (*Abstract Co-Author*) Employee, Siemens AG;Stockholder, Siemens AG
Hendrik O. Laue, PhD (*Abstract Co-Author*) Nothing to Disclose
Markus Wenzel, PhD (*Abstract Co-Author*) Nothing to Disclose
Heinrich von Busch (*Abstract Co-Author*) Employee, Siemens AG;Stockholder, Siemens AG;Stockholder, Koninklijke Philips NV
Hans Meine (*Abstract Co-Author*) Nothing to Disclose
Kai Geisler, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

This study presents an automated method for Background Parenchymal Enhancement (BPE) in breast magnetic resonance imaging (MRI). The method is based on deep learning and validated on a multi-institutional dataset according to the BI-RADS BPE classification.

**METHODS AND MATERIALS**

The dataset consists of 3000 patients collected retrospectively from seven clinical institutions located in Europe and eastern Asia. The class distribution is 53.6%, 28.4%, 13.3% and 4.7% for minimal, mild, moderate and marked BPE. Convolutional neural networks are trained to segment the breast tissue and the fibroglandular tissue (FGT) on 200 and 96 volumes, respectively. As indicator for BPE, the area under the cumulative histogram over the relative enhancement of voxels inside the FGT mask is computed. The pre-contrast image and the post-contrast image closest to 130 seconds after contrast-agent injection areused to compute the relative enhancement. 60% of the cases are used to compute thresholds on the BPE indicator and 40% are used for evaluation against BPE classifications from the different clinical sites. We compute the thresholds once across all sites and once for each site individually.

**RESULTS**

We asses the ROC-AUC for classifying BPE into low (minimal or mild) versus high (moderate or marked) BPE. It is 0.7656 when evaluated over all sites together. When evaluated for each site individually it ranges between 0.6606 and 0.8750 with a median of 0.8489. The four-class accuracy evaluated over all test cases equates to 48.18% when the thresholds are defined globally. When defining the thresholds per site this accuracy rises to 55.20%.

**CONCLUSION**

We observe that automatic classification of BPE in multi-institutional settings based on quantifying the enhancement in the fibroglandular tissue generalizes to a certain degree between institutions. However, the classification accuracy can be improved by calibrating the classification thresholds for each site individually. Reasons for this are differences in MRI acquisition protocols, contrast agents and patient cohort characteristics.

**CLINICAL RELEVANCE/APPLICATION**

BPE is assessed as part of BI-RADS reporting for breast cancer diagnostic in MRI. It is associated to breast cancer risk and the diagnostic accuracy of breast MRI readings, while being subject to very high inter-reader variability. This creates a need for robust observer-independent methods to estimate BPE.

## S3A-SPBR-4 PREDICTION OF BREAST LESIONS WITH CALCIFICATION USING RADIOMICS MODELS FROM ULTRASONIC IMAGES

Xinyi Wang, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and validate radiomics models to predict benign and malignant breast lesions with calcifications based on ultrasonic (US) images.

**METHODS AND MATERIALS**

Retrospective data from 490 patients undergoing breast US examinations from January to September 2021 yielded 508 breast lesions (334 malignant, 170 benign). Lesions with calcifications on both US and mammography were included. Pathological findings established the gold standard for lesions requiring biopsy, while lesions without biopsy underwent a minimum 24-month follow-up for benign diagnosis. The clearest US image displaying calcifications was selected for each lesion, with separate markings for calcifications and lesions. Radiomics models were developed based on calcification regions of interest (ROIs) and whole-lesion ROIs through feature extraction, selection, and machine learning modeling, utilizing Support Vector Machine, Logistic Regression, Decision Tree (DT), Multi-layer Perceptron, and Random Forest models. Performance evaluation included decision curve analysis and calculation of area under the receiver operating characteristic curve (AUC), accuracy, sensitivity, and specificity on internal and external test sets.

**RESULTS**

Models built solely on calcification ROIs exhibited higher AUCs on the internal test set but decreased significantly on the external test set. Models constructed using whole-lesion ROIs showed better AUCs on the internal test set, with variable performance on the external test set. The DT model demonstrated notable classification performance (AUC = 0.769), with an accuracy, sensitivity, and specificity of 0.800, 0.870, and 0.680, respectively, on

the internal test set, and 0.790, 0.860, and 0.570, respectively, on the external test set. Decision curve analysis indicated higher net income for the DT model at prediction probabilities < 89.2% and < 86.9% on the internal and external test sets, respectively.

**CONCLUSION**

Models based solely on calcification ROIs showed limited predictive efficacy. However, the DT model built on whole-lesion ROIs demonstrated promise in diagnosing breast lesions with calcifications on US images.

**CLINICAL RELEVANCE/APPLICATION**

Advancements in US technology allow high-frequency instruments to reveal subtle structures, including breast calcifications. While US may not fully display all calcifications like mammography, it can detect most within a lesion. Radiomics leverages extensive image features, providing decision support through quantitative analysis. This study demonstrates the potential of radiomics models, particularly the DT model, in predicting benign and malignant lesions containing calcifications, offering valuable clinical implications in breast lesion diagnosis.

## S3A-SPBR-5 REFINING MICROCALCIFICATION DETECTION IN FULL-FIELD DIGITAL MAMMOGRAPHY USING GENERATIVE AI: ENHANCED ACCURACY AND REDUCED FALSE POSITIVES

Manisha Bahl, MD, MPH (*Abstract Co-Author*) Consultant, Lunit Inc;Expert Advisory Committee, 2nd.MD
Synho Do, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Kyungsu Kim, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Calcifications on mammography may indicate ductal carcinoma in situ (Stage 0 breast cancer). This study aims to develop a novel deep learning (DL) solution that reduces false positives while maintaining high sensitivity to assist radiologists in detecting calcifications.

**METHODS AND MATERIALS**

We developed a DL network to segment calcifications on full-field digital mammograms, trained with the European Radiology dataset (81 mammograms) featuring pixel-level calcification masks. Despite excellent sensitivity (98.0%), the high false positive rate (PPV 3.2%) prompts us to explore refinement techniques for the DL mask. We evaluated two standard signal processing (SP) approaches (Gaussian difference and Top-Hat transform) and our novel Generative AI model. This model processes the baseline DL mask, transforming calcification-positive pixels into calcification-free areas, and generates a refined mask by subtracting the original pixels from the newly generated pixels. It was trained using our institutional dataset of 1121 mammograms, annotated for calcification-free regions, and validated using the external InBreast dataset (126 mammograms). To assess performance specific to tissue density, we catergorized the densities within and around each calcification as either interior or exterior.

**RESULTS**

Our Generative AI model improved PPV from 3.2% to 7.3% (a 2.3-fold increase) while maintaining a sensitivity above 95%. It significantly outperformed standard SP approaches in detecting calcifications, particularly in patients with small calcifications, enhancing detection accuracy by more than 1.3 times in calcifications smaller than 50 pixels, by over 1.9 times in those with low-interior density, and by more than 2.2 times in high-exterior density scenarios.

**CONCLUSION**

Our Generative AI model significantly reduces false positives and enhances sensitivity in detecting calcifications on mammography, particularly effective in complex cases involving small calcifications of varying densities.

**CLINICAL RELEVANCE/APPLICATION**

Our Generative AI model generates precise virtual normal mammograms, which when aligned with the original abnormal images, facilitate pixel-level difference analysis, assisting radiologists in the early detection of breast cancer.

## S3A-SPBR-6 AI SOFTWARE PERFORMANCE IN UNILATERAL MAMMOGRAPHY: SIMULATING TOTAL MASTECTOMY SCENARIOS

Jung Min Chang, MD (*Abstract Co-Author*) Research Consultant, Genoray Co, Ltd
Jung Oh Lee, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Janie M. Lee, MD, MSc (*Abstract Co-Author*) Research Grant, General Electric Company;Investigator, General Electric Company
Jiyeong An, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The contribution of contralateral breast information to the diagnostic accuracy of artificial (AI) algorithms for breast cancer detection on screening mammograms is poorly understood. Whether AI algorithms developed in training sets of bilateral mammograms perform comparably for unilateral mammograms in women who have undergone mastectomy is not yet established. This study aimed to evaluate the performance of commercially available AI software in unilateral mammogram simulating postmastectomy surveillance, compared with AI software used in bilateral mammograms from the same patients serving as controls.

**METHODS AND MATERIALS**

A retrospective database search identified consecutive patients who underwent breast cancer surgery between January 2021 and December 2021. A commercially available AI software application (Lunit INSIGHT MMG) was applied to the mammogram immediately preceding the breast cancer diagnosis in two modes: bilateral and unilateral analysis, with each unilateral mammogram replicating the conditions of contralateral mastectomy. AI outputs were reviewed and sensitivity, specificity, and number of marks per breast were compared between bilateral and unilateral analysis. Interobserver agreement of the maximum abnormality scores in cancer cases for each of the CC and MLO views between the two modes were assessed using the intraclass correlation coefficient (ICC).

**RESULTS**

A total of 694 women (mean age, 55.2 ± 10.8 years) with unilateral or bilateral breast cancer contributed mammograms for analysis; each breast was then separately evaluated in the unilateral post-mastectomy simulation (n=1388), of which 730 had breast cancer (52.6%) (mean invasive size = 1.1 cm) and compared with bilateral mammography analysis. The sensitivity of unilateral analysis was not inferior to that in the bilateral analysis (78.5% vs. 76.6%), with a difference of 1.9%. The specificity of unilateral analysis (81.3%; 95% CI: 78.1, 84.1) was inferior to that in the bilateral analysis (81.3% vs. 91.8%), with a difference of -10.5% being lower than the non-inferiority margin. The average number of marks per breast in both modes was 0.94. The maximum abnormality scores of cancers in bilateral and unilateral analysis showed excellent agreement (intraclass correlation coefficient: 0.985).

**CONCLUSION**

AI software performance in simulated unilateral mammography analysis demonstrated non-inferior sensitivity and inferior specificity compared to bilateral mammography.

**CLINICAL RELEVANCE/APPLICATION**

Non-inferior sensitivity of AI software in unilateral mammography compared to bilateral mammography supports use of AI software in the setting of surveillance mammography in patients treated with mastecomy.

## S3A-SPBR-7 THE DIAGNOSTIC VALUE OF MULTIMODAL IMAGING BASED ON MR COMBINED WITH ULTRASOUND IN BENIGN AND MALIGNANT BREAST DISEASES

Zhiqun Wang (*Abstract Co-Author*) Nothing to Disclose
Dong Bai (*Presenter*) Nothing to Disclose

**PURPOSE**

We aimed to construct and validate a multimodality MRI combined with ultrasound based on radiomics for the evaluation of benign and malignant breast diseases.

**METHODS AND MATERIALS**

The preoperative enhanced MRI and ultrasound images of 131 patients with breast diseases confirmed by pathology in Aerospace Center Hospital from January 2021 to August 2023 were retrospectively analyzed, including 73 benign diseases and 58 malignant diseases.Ultrasound and 3.0T multiparameter MRI scans were performed in all patients. Then, all the data were divided into training set and validation set in a 7:3 ratio.Regions of interest (ROI) were drawn layer by layer based on ultrasound and MR enhanced sequences to extract radiomics features. The optimal radiomic features were selected by the best feature screening method. Logistic Regression classifier was used to establish models according to the best features, including ultrasound model, MRI model, ultrasound combined with MRI model. The model efficacy was evaluated by the area under the curve(AUC) of the ROC(receiver operating characteristic), sensitivity, specificity, and accuracy.

**RESULTS**

The F-test based on ANOVA was used to screen out 20 best ultrasonic features, 11 best MR Features, and 14 best features from the combined model.Among them, texture features accounted for the largest proportion, accounting for 79%.The ultrasound combined with MR Image fusion model based on Logistic Regression classifier had the best diagnostic performance. The AUC of the training group and the validation group were 0.92 and 091, the sensitivity was 0.80 and 0.67, the specificity was 0.90 and 0.94, and the accuracy was 0.84 and 0.79, respectively.It was better than the simple ultrasound model (AUC of validation set was 0.82) or the simple MR model (AUC of validation set was 0.85).

**CONCLUSION**

Compared with the traditional ultrasound or magnetic resonance diagnosis of breast diseases, the multimodal model of MRI combined with ultrasound based on radiomics can more accurately predict the benign and malignant breast diseases, thus providing a better basis for clinical diagnosis and treatment.

**CLINICAL RELEVANCE/APPLICATION**

Multi-modality imaging methods make up for the shortcomings of single examination methods, and combine radiomics to avoid the mistakes of manual judgment, so as to make more accurate judgment of diseases.

## S3A-SPBR-9 DEVELOPMENT OF A DEEP LEARNING SYSTEM FOR PREDICTING ER-NEGATIVE, ER-LOW POSITIVE, AND ER-HIGH POSITIVE BREAST CANCER BASED ON MAGNETIC RESONANCE IMAGING

Guanxun Cheng, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhenwei Shi, PhD (*Abstract Co-Author*) Nothing to Disclose
Zaiyi Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Yi Dai, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and validate a dynamic contrast-enhanced (DCE)-MRI based deep learning system capable of discriminating different ER expressing statuses (ER-negative, ER-low positive, and ER-high positive) in breast cancer.

**METHODS AND MATERIALS**

This retrospective diagnostic study has been approved by the local institutional review board, and patient consent was waived. Pretreatment DCE-MRI data was collected from patients with breast cancer of six centers between February 2016 and August 2023. Patients were categorized into ER-negative, ER-low positive, and ER-high positive groups based on pathologic examination. Tumor segmentation was performed on the DCE image with peak enhancement using an automated deep learning algorithm. Four DCE-MRI based models were developed to discriminate between ER negative vs. ER-low/high positive, ER negative vs. ER-low positive, ER negative vs. ER-high positive, and ER-high positive vs. ER-low positive breast cancers. The model performance was evaluated using the area under the receiver operating characteristic curve (AUC).

**RESULTS**

A total of 3500 breast cancer patients from six institutions were retrospectively studied. One thousand eight hundred and sixty-two patients from Center 1 and 2 were included in the training dataset (mean [SD] age, 49 [11] years); 1638 patients from Center 3-6 formed the external test dataset (A-D) (mean [SD] age, 50 [11] years, 47 [8] years, 47 [10] years and 51 [10] years, respectively). The AUCs of the models yielded by the training set and the external test sets A-D were 0.759-0.827 for differentiating between ER negative versus -low/high tumors, 0.779-0.936 for ER negative versus -low positive, 0.765-0.842 for ER negative versus ER-high positive and 0.661-0.787 for ER-high positive versus ER-low positive, respectively.

**CONCLUSION**

These findings suggest that a DCE-MRI based deep learning system may have the potential to preoperatively predict ER statuses in breast cancer patients, with therapeutic implications.

## CLINICAL RELEVANCE/APPLICATION

The DCE-MRI based deep learning system could be used to noninvasively identify the new three-classification of ER expressing status in breast cancer, which is helpful to the decision-making for endocrine therapies.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

S3A-SPCA

**Cardiac Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPCA-1 IMPACT OF CORONARY ATHEROSCLEROSIS ON LEFT VENTRICULAR FUNCTION IN ESSENTIAL HYPERTENSION: CORRELATION BETWEEN MYOCARDIAL STRAIN AND GENSINI SCORE

Xin Tang, MD (*Abstract Co-Author*) Nothing to Disclose
Li Jiang, MD (*Abstract Co-Author*) Nothing to Disclose
Jin Wang (*Abstract Co-Author*) Nothing to Disclose
Yining Jiang (*Abstract Co-Author*) Nothing to Disclose
Wei-Feng Yan, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Coronary arterial atherosclerosis (CAS) significantly impacts morbidity and mortality in patients with hypertension (HTN). The extent of CAS's influence on left ventricular (LV) dysfunction in hypertensive patients remains unclear. This study explores the effects of CAS on LV systolic and diastolic functions in this population.

### METHODS AND MATERIALS

A total of 115 hypertensive patients clinically suspected of having coronary artery disease underwent cardiac MRI and digital subtraction angiography (DSA) assessments. Of these, 87 were confirmed to have coronary arterial sclerosis (CAS) while 28 did not. We assessed LV structure and function, global strains (including peak systolic and diastolic strain rates in radial, circumferential, and longitudinal orientations), and Gensini scores. Patients with HTN CAS+ were categorized into two subgroups based on the median Gensini score of 12. Multivariable linear regression analysis was used to identify factors influencing reduced LV strain.

### RESULTS

Compared to normal controls, hypertensive patients showed increased LV end-diastolic (160.9±43.7 vs. 130.9±27.6, P<0.01) and end-systolic volumes (83.2±44.7 vs. 47.7±14.6, P<0.01), along with reduced global peak strains (Radial: 26.6±12.5 vs. 36.9±9.2; Circumferential: 17.1±6.1 vs. 21.0±2.8; Longitudinal: 10.3±4.8 vs. 14.5±2.4, all P<0.05). HTN CAS+ patients exhibited a lower ejection fraction compared to healthy controls (53.0±18.4 vs. 63.8±7.16, P<0.01). A progressive reduction in all global peak strains and peak diastolic strain rates was observed from normal controls through those with a Gensini score =12 to those with a score >12. Gensini score independently affected global circumferential and longitudinal peak strains (GCPS, ß=0.28, P<0.05; GLPS, ß=0.38, P<0.05) after adjusting for confounding factors in hypertensive patients.

### CONCLUSION

CAS exacerbates LV dysfunction in hypertensive patients, particularly impairing diastolic function in early stages. There is a significant association between reductions in LV myocardial strain and increases in Gensini score.

### CLINICAL RELEVANCE/APPLICATION

This study highlights the significant role of cardiac MRI in evaluating the impact of coronary atherosclerosis on left ventricular function in hypertensive patients with concurrent coronary artery disease. By correlating myocardial strains measured by MRI with Gensini scores from DSA, we demonstrate that cardiac MRI provides critical insights for the precise management of patients with coronary artery disease.

## S3A-SPCA-2 HOW THE COMBINATION OF CONVENTIONAL FACTORS AND THE RADIOMICS SIGNATURE OF CORONARY PLAQUE TEXTURE COULD IMPROVE CARDIAC RISK PREDICTION

Stefan O. Schoenberg, MD, PhD (*Abstract Co-Author*) Research agreement, Siemens AG
Matthias F. Froelich, MD (*Abstract Co-Author*) Consultant, Smart Reporting GmbH;Consultant, Guerbet SA
Sandy Engelhardt (*Abstract Co-Author*) Nothing to Disclose
Theano Papavassiliu (*Abstract Co-Author*) Nothing to Disclose
Jannik Kahmann (*Abstract Co-Author*) Nothing to Disclose
Isabelle Ayx, MD (*Presenter*) Research Consultant, AstraZeneca PLC

### PURPOSE

High-risk plaques (HRP) have an elevated risk of causing cardiovascular events through plaque rupture or erosion. Changes in epicardial adipose tissue (EAT) are connected to cardiovascular disease (CVD) and HRP. Radiomics analysis could help understand the association between plaque texture, EAT, and cardiovascular risk. Photon-counting CT (PCCT) exhibits enhanced feature stability, offering the potential to further advance radiomics analysis.

**METHODS AND MATERIALS**

Coronary plaques were manually segmented in this retrospective, single-centre study and radiomic features were extracted using pyradiomics. The study population was divided into groups according to the presence of HRP, plaques with at least 70%, respective 50% stenosis, or triple-vessel disease. A combined group with patients exhibiting at least one of these risk factors was formed. Random forest feature selection identified differentiating features for the groups. EAT thickness and density were measured and compared with feature selection results.

**RESULTS**

306 plaques from 61 patients (13 female, mean age 61 years) were analysed. Plaques of patients with HRP features or relevant stenosis demonstrated a higher presence of texture heterogeneity through various radiomics features compared to patients with only an intermediate stenosis degree. While EAT thickness did not significantly differ, affected patients showed higher mean densities in the 50%, HRP, triple-vessel, and combined groups, but not in the 70% group.

**CONCLUSION**

The combination of a higher EAT density and a more heterogeneous plaque texture might offer an additional tool in identifying patients with an elevated risk of cardiovascular events.

**CLINICAL RELEVANCE/APPLICATION**

Cardiovascular disease is until today the leading cause of mortality in the world. Plaque composition and changes in the epicardial adipose tissue are connected to cardiac risk and MACE rate. A better understanding of the interrelation of these risk indicators can lead to improved cardiac risk prediction and early personalized therapy.

## S3A-SPCA-3 LEVERAGING AI FOR OPPORTUNISTIC SCREENING: IDENTIFYING CORONARY ARTERY CALCIFICATION ON NON-ECG GATED LUNG CANCER SCREENING CHEST CT

Kevin Pham, DO (*Abstract Co-Author*) Nothing to Disclose
Akash Dadlani (*Abstract Co-Author*) Nothing to Disclose
Ava Wexler (*Abstract Co-Author*) Nothing to Disclose
Devon A. Klein, MD, MBA (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate non-contrast lung cancer screening chest CT scans for coronary artery calcification (CAC) to identify cardiovascular risk. Our goal is to improve early detection strategies using commercially available artificial intelligence (AI) technology.

**METHODS AND MATERIALS**

A retrospective analysis was conducted applying Nanox AI's cardiac solution to non-contrast, non-ECG gated chest CTs in two phases. The study comprised two cohorts: the first included 497 adult non-contrast chest CTs, and the second consisted of 492 low-dose lung cancer screening CTs. In Phase 1, 382 (77%) were successfully analyzed by the software. The results were independently verified by an experienced radiologist. In Phase 2, 431 (87.6%) of the lung cancer screening studies were analyzed by the software. Phase 1 focused on validation of the AI solution, and Phase 2 emphasized reproducibility of results while revealing incidence of undocumented CAD in at-risk patients. The study population had a mean age of 67 years (SD = 5.8), with a range of 52 to 78 years. Among the patients (n=171), 70% were male (n=120) and 30% were female (n=51).

**RESULTS**

Phase 1: 41.62% (159) of the analyzed scans exhibited moderate to severe CAC; 30.1% had a CAC Score > 400 and 11.52% had a CAC Score from 100 to 400. Phase 2: 39.68% (171) demonstrated moderate to severe CAC; 23.4% had a CAC Score > 400 and 16.2% had a CAC Score from 100 to 400. 40% (68) had no history of CAD. 31% (53) patients with moderate to severe disease were unknown. No significant relationship was observed between Lung-RADS (13% (22); score =3 considered significant).

**CONCLUSION**

AI-driven CAC screening in lung cancer patients can lead to detection of moderate to severe CAC, prompting early intervention and improving outcomes.

**CLINICAL RELEVANCE/APPLICATION**

Atherosclerotic cardiovascular disease (ASCVD) is prevalent in the general population and can result in myocardial infarction and stroke. CAC scoring predicts mortality and informs ASCVD risk assessment, guiding management for primary prevention. Asymptomatic adults who are intermediate to high ASCVD risk are screened with dedicated ECG-gated CT scans. Incidental CAC can be identified on non-gated chest CT scans performed for other reasons. The Society of Cardiovascular Computed Tomography and Society of Thoracic Radiology recommend reporting CAC presence and severity in all non-contrast chest CTs. This would be clinically impactful in patients without known CAD who would not otherwise be screened. This AI-driven solution allows for consistent CAC reporting with a quantified measure of CAC severity using the Agatston score.

## S3A-SPCA-6 PREDICTION OF RADIATION THERAPY INDUCED CARDIOVASCULAR TOXICITY FROM PRETREATMENT CT IMAGES IN PATIENTS WITH THORACIC MALIGNANCY VIA AN OPTIMALBIOMARKER APPROACH

Steven J. Feigenberg (*Abstract Co-Author*) Nothing to Disclose
Caiyun Wu (*Abstract Co-Author*) Nothing to Disclose
Shannon O'Reilly, PHD (*Abstract Co-Author*) Nothing to Disclose
Jayaram K. Udupa, PhD (*Abstract Co-Author*) Co-founder, Quantitative Radiology Solutions, LLC
Drew A. Torigian, MD, MA (*Abstract Co-Author*) Co-founder, Quantitative Radiology Solutions LLC
Yubing Tong, PhD (*Abstract Co-Author*) Nothing to Disclose
Bonnie Ky (*Abstract Co-Author*) Nothing to Disclose
Nicholas Poole (*Abstract Co-Author*) Nothing to Disclose
Jennifer (Wei) Zou, PHD (*Abstract Co-Author*) Nothing to Disclose
Mujun Long (*Abstract Co-Author*) Nothing to Disclose
Mostafa Alnoury, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Cardiovascular toxicity is a well-known complication of thoracic radiation therapy (RT), potentially leading to increased morbidity and mortality in cancer patients, but existing techniques for prediction of cardiovascular toxicity have limitations. There is growing interest in the identification of predictive

biomarkers of cardiovascular toxicity to maximize patient oncologic and cardiovascular outcomes. In this work, an optimal biomarker (OBM) method is designed and tested to perform cardiotoxicity prediction from pre-treatment CT images.

**METHODS AND MATERIALS**

Manual segmentations of 10 cardiovascular objects of interest (heart, left ventricular myocardium, left atrium, right atrium, left ventricle, right ventricle, ascending aorta, aortic arch, descending thoracic aorta, and thoracic aorta) were performed on pre-treatment non-contrast-enhanced CT simulation images in 125 patients with thoracic malignancy (41 who developed cardiotoxicity and 84 who did not develop cardiotoxicity after RT based on reference standard serial echocardiography), and 1078 image-based features were extracted from these objects. The top 5 features in a specific combination that were maximally independent among themselves and with respect to all other features and that showed the best class-discriminative ability among the 1078 features were determined. A prediction model based on an SVM classifier utilizing these 5 features was designed and tested.

**RESULTS**

The number of data sets used for training, validation, and testing were 75, 25 and 25, respectively. The best 5-feature combination consisted of CT intensity-based and texture-based features derived from the left ventricle which yielded a testing prediction accuracy of 0.88. Several other combinations of 3 and 4 features derived from the heart, left atrium, thoracic aorta, and descending thoracic aorta yielded an accuracy of 0.84.

**CONCLUSION**

It is feasible to predict the future development of cardiotoxicity with high accuracy in individual patients with thoracic malignancy from available pre-treatment CT images acquired prior to the initiation of RT via advanced machine learning methods.

**CLINICAL RELEVANCE/APPLICATION**

The proposed method has the potential for personalized RT planning, risk prediction, and management of patients with malignancy, which may ultimately optimize oncologic and cardiovascular outcomes for each individual patient.

## S3A-SPCA-7 MYOCARDIAL EXTRACELLULAR VOLUME QUANTIFICATION IN CARDIAC CT: COMPARISON OF THE EFFECTS OF DEEP LEARNING RECONSTRUCTION AND ITERATIVE RECONSTRUCTION ALGORITHMS WITH MRI AS A REFERENCE STANDARD

Jianlin Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Hao Woo (*Abstract Co-Author*) Nothing to Disclose
Zhaoguo Cui (*Abstract Co-Author*) Nothing to Disclose
YAN WANG (*Abstract Co-Author*) Nothing to Disclose
Dong Yang, BMedSc, MMEd (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the effects of deep learning reconstruction- advanced intelligent clear-IQ engine (DLR-AiCE) and two different iterative reconstruction that incorporates myocardial extracellular volume (ECV) quantification by cardiac CT using MRI as a reference standard.

**METHODS AND MATERIALS**

In this prospective study Patients who underwent cardiac CT and MRI were collected., Paired CT image sets were reconstructed using DLR-AiCE, model-based iterative reconstruction (MBIR) and hybrid iterative reconstruction (HIR). Subtraction techniques were used to obtain subtraction images which used for calculation of CT-ECV. T1 mapping were used to evaluate the MR-ECV. We calculated correlations between the CT-ECV and MR-ECV via Pearson correlation analysis.

**RESULTS**

In the mid anterior wall of the left ventricle, there is a good correlation between the CT-ECV results calculated by DLR-AiCE, MBIR, and HIR compared to MR-ECV ($r=0.645$, $r=0.723$, $r=0.604$, $P<0.05$). In the mid anteroseptal wall of the left ventricle, there is also a good correlation between the CT-ECV results calculated by DLR-AiCE, MBIR, and HIR compared to MR-ECV ($r=0.633$; $r=0.668$; $r=0.627$, $P<0.05$). In the anterior lateral and inferior septal wall of the left ventricle, only CT-ECV results calculated by DLR-AiCE show a correlation with MR-ECV ($r=0.614$, $r=0.672$, $P<0.05$). In the inferior lateral and inferior walls of the left ventricle, none of CT-ECV resulted calculated by three reconstruction methods show a correlation with MR-ECV ($P>0.05$).

**CONCLUSION**

DLR-AiCE can improved accuracy of myocardial ECV quantification when compared with iterative reconstruction using MRI as a reference standard.

**CLINICAL RELEVANCE/APPLICATION**

Because of the lengthy acquisition time, the numerous contraindications and complexity associated with the scanning process, the prevalence of CMR is limited. Cardiac CT, on the other hand, is widely used due to its ease of access and quick acquisition times. Therefore, CT-ECV quantification derived from DLR-AiCE may represent a useful non-invasive alternative for assessing ischemic and non-ischemic cardiomyopathies.

## S3A-SPCA-9 RADIOMICS SIGNATURE OF AGING MYOCARD IN CARDIAC PHOTON COUNTING COMPUTED TOMOGRAPHY

Stefan O. Schoenberg, MD, PhD (*Abstract Co-Author*) Research agreement, Siemens AG
Isabelle Ayx, MD (*Abstract Co-Author*) Research Consultant, AstraZeneca PLC
Mustafa Kuru (*Abstract Co-Author*) Nothing to Disclose
Abhinay Krishna Vellala (*Abstract Co-Author*) Nothing to Disclose
Alexander Hertel, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Photon-counting computed tomography (CT) offers improved spatial and temporal resolution, allowing for detailed texture analysis in cardiovascular imaging. As cardiovascular diseases primarily affect individuals over 65, this technology could detect structural changes in the ageing left-ventricular myocardium. Identifying these changes may help establish an imaging-based cardiovascular profile that indicates premature biological ageing and the associated elevated risk of major cardiovascular events, providing crucial insights into the progression of coronary heart disease.

**METHODS AND MATERIALS**

This IRB-approved retrospective study examined 90 patients undergoing clinically indicated electrocardiography (ECG)-gated contrast-enhanced cardiac CT with a first-generation whole-body dual-source photon-counting detector CT (NAEOTOM Alpha, Siemens Healthcare GmbH). Patients were selected who had a similar Agatston score (between 0-100) and were then split into two age groups: 50-60 years and 70-80 years. The left ventricular myocardium was segmented and radiomics features extracted. Epicardial adipose tissue (EAT) density and thickness, along with other clinical parameters,

such as diabetes, hypertension, smoking, hyperlipidemia and more, were also recorded. The statistical analysis was conducted using R statistics and a Python-based random forest (RF) classifier.

## RESULTS

There were no significant differences between the recorded clinical parameters and the measured EAT density, as well as the right ventricular thickness, between the two age groups. This enabled a homogeneous comparison. The RF classifier was able to differentiate between the two age groups with a test accuracy of 0.74 and a train accuracy of 0.95. Several important features were identified.

## CONCLUSION

The radiomics texture features of the left ventricular myocardium demonstrated superior performance in differentiating between the two age groups, outperforming conventional parameters such as EAT density and thickness. This suggests that radiomics analysis of the left ventricular myocardium may serve as a potential imaging biomarker of myocardial aging.

## CLINICAL RELEVANCE/APPLICATION

Radiomics analysis of left ventricular myocardium offers a unique opportunity to visualize changes in myocardial texture during aging.

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# Abstract Archives of the RSNA, 2024

S3A-SPCH

**Chest Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPCH-1 IMPACT OF ULTRA-HIGH RESOLUTION CT PULMONARY ANGIOGRAPHY WITH PHOTON-COUNTING DETECTOR CT ON IMAGE QUALITY AND READER CONFIDENCE

Thorsten A. Bley, MD (*Abstract Co-Author*) Speakers Bureau, F. Hoffmann-La Roche Ltd;Research Consultant, F. Hoffmann-La Roche Ltd;Speakers Bureau, Novartis AG;Research Consultant, Novartis AG;Research Consultant, Baltimore RH Typing Laboratory
Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Nora Conrads, MD (*Abstract Co-Author*) Nothing to Disclose
Theresa Sophie Patzer, MD (*Abstract Co-Author*) Nothing to Disclose
Andreas Kunz, MD (*Abstract Co-Author*) Nothing to Disclose
Henner Huflage, MD (*Abstract Co-Author*) Nothing to Disclose
Philipp Gruschwitz, MD (*Abstract Co-Author*) Nothing to Disclose
Pauline Pannenbecker, MD, BA (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the impact of novel ultra-high resolution (UHR) photon-counting detector (PCD) CT on image quality and reader confidence in spectral CT pulmonary angiographies (CTPA) compared to standard resolution dual-energy CTPA with energy-integrating detector (EID) CT.

### METHODS AND MATERIALS

Between February and April of 2024, 32 CTPAs were acquired with a high-pitch UHR scan protocol on a PCD CT and retrospectively compared to 32 CTPAs performed with a standard resolution dual-energy protocol on a dual-source EID CT. For both protocols, 50ml of iodinated contrast medium were injected (flow rate 4ml/s). Pitch was set at 3.2 in the PCD group and at .55 in the EID group (default setting). Objective image quality was assessed with ROI-based measurements (CT attenuation, contrast-to-noise and signal-to-noise ratio (CNR, SNR)) within pulmonary vessels. Based on a five-point rating scale, four readers (R1-4) assessed CTPA images reconstructed in a medium soft kernel based on minimal slice thickness images (PCD group: 0.4mm, EID group: 0.6mm) and iodine maps with regard to overall image quality, assessability of pulmonary vessels and self-reported confidence in the diagnosis of pulmonary embolism.

### RESULTS

No difference in CT attenuation was ascertained for PCD and EID CTPAs (all $p > 0.05$). CNR and SNR in lobar arteries were higher in the UHR PCD group, e.g. median CNR 26.7 [21.1 - 42.8] vs. 22.7 [16.1 - 28.4] in the right lower lobe (PCD vs. EID, $p < 0.05$). Subjective image quality for UHR PCD CTPAs was rated higher by three of four readers with 81.25% of CTPAs rated as excellent (R1/R2/R3/R4) as opposed to 8.3%, 13.9% 8.3% of EID CTPAs (R1/R2/R3, $p < 0.05$). Iodine maps were rated higher in the UHR group by all readers (e.g. excellent image quality in 62.5% of PCD maps vs. 0% of EID maps (R1), all $p < 0.001$). In UHR PCD CTPAs, assessability of pulmonary vessels ranked higher with assessability down to peripheral subsegmental levels in 78.1%, 75.0%, 78.1% and 65.6% of PCD CTPAs vs. 3.1%, 6.2%, 3.1% and 25% of EID CTPAs (R1/R2/R3/ R4, $p < 0.01$). Self-reported diagnostic reader confidence was higher for UHR PCD CTPAs with highest confidence levels attributed in 78.1%, 84%, 71.9% and 65.6% of cases vs. 0%, 18.8%, 0% and 37.5% of EID CTPAs (R1/R2/R3 $p < 0.01$, R4 $p < 0.05$).

### CONCLUSION

UHR PCD CTPA allows for superior objective and subjective image quality and increased reader confidence in the diagnosis of pulmonary embolism compared to standard dual-energy EID CTPA.

### CLINICAL RELEVANCE/APPLICATION

PCD CTPA at UHR settings enables assessment of both anatomic images, as well as the full spectral dataset in the form of iodine maps. An improved image quality and therefore increased self-reported diagnostic confidence of readers is of potentially high relevance for patient safety and diagnostic accuracy.

## S3A-SPCH-3 PREDICTIVE MODELING FOR RECURRENT PULMONARY EMBOLISMS WITH DEEP LEARNING BASED ON COMPUTED TOMOGRAPHIC PULMONARY ANGIOGRAPHY AND CLINICAL DATA

Shreyas Kulkarni, BS (*Abstract Co-Author*) Nothing to Disclose
Michael K. Atalay, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Harrison X. Bai, MD (*Abstract Co-Author*) Founder, Radiology AI Inc
Zhicheng Jiao, PhD, BS (*Abstract Co-Author*) Nothing to Disclose
Sun Ho Ahn, MD (*Abstract Co-Author*) Nothing to Disclose
Scott Collins, RT (*Abstract Co-Author*) Nothing to Disclose

Zhusi Zhong (*Abstract Co-Author*) Nothing to Disclose
Vineethsubbu Somasundaram (*Presenter*) Nothing to Disclose

**PURPOSE**

Pulmonary embolisms (PE) pose a significant threat to public health in the United States, with high mortality rates despite available treatments. Recurrent PE episodes further compound the severity of the condition and exacerbate mortality risk. We aimed to develop a deep learning model leveraging computed tomographic pulmonary angiography (CTPA) and clinical data to predict recurrence in PE patients. We hypothesize that this deep learning model will outperform PE Severity Index (PESI) in predicting PE recurrence.

**METHODS AND MATERIALS**

An internal database of 3978 CTPA scans were collected from 927 patients (163 deceased, median age 64, range 13-99, 52% female) who have experienced a PE via retrospective review across three institutions. From this population, 418 patients had follow-up CTPA scans and 128 were diagnosed with at least one case of a persisting or recurrent PE. Data from one institution were randomly split 7:1:2 into training, validation, and internal testing sets. Data from the two remaining institutions were used as an external testing set. Imaging features extracted from PEnet and clinical data (PESI variables) were used to train Random Survival Forest models. Performance was evaluated with concordance index (c-index) and compared to PESI predictions with the Wilcoxon signed-rank test. Kaplan-Meier analysis was performed by stratifying patients into high- and low-risk groups based on the combined imaging and clinical model prediction.

**RESULTS**

Models based on (a) imaging, (b) clinical, (c) combined imaging and clinical data, and (d) combined imaging, clinical data, and PESI achieved c-index values of 0.587, 0.682, 0.678, and 0.695, respectively, on the internal testing set. The complete fusion model achieved a c-index value of 0.621 on the external testing set. For both the internal and external data sets, the combined model outperformed PESI (0.508 and 0.531, respectively, $p<0.001$). When stratifying patients into high- and low-risk groups, recurrence outcomes were significantly different for both the internal dataset and external dataset ($p<0.05$).

**CONCLUSION**

Deep learning models based on combined CTPA features and clinical data outperform other models and PESI for recurrence risk prediction in PE. The addition of imaging to clinical features mostly improves performance compared to clinical features alone, however the addition of PESI does not. The next steps will involve integrating additional data and implementing a foundational model to enhance performance on external datasets.

**CLINICAL RELEVANCE/APPLICATION**

This study addresses the pressing need for improved risk stratification in post-treatment PE management, ultimately enhancing patient outcomes and reducing the burden of PE-related complications.

## S3A-SPCH-7 AUTOMATIC VIRTUAL CONTRAST-ENHANCED CT SYNTHESIS USING DUAL-ENERGY CT AND RESIDUAL U-NET WITH ATTENTION MODULE FOR DETECTING HILAR LYMPH NODES

Jung Han Woo (*Abstract Co-Author*) Nothing to Disclose
Myung Jin Chung, MD (*Abstract Co-Author*) Research Consultant, Samsung Electronics Co, Ltd;Research Consultant, Pharmex Advanced Laboratories, SL;Research Grant, Lunit Inc;Research Grant, VUNO Inc
JAEMO KOO (*Abstract Co-Author*) Nothing to Disclose
Uju Jeon, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To propose an automatic virtual contrast-enhanced chest computed tomography (CT) synthesis using dual-energy CT and a Residual U-Net with an attention module to detect clinically significant hilar lymphadenopathy.

**METHODS AND MATERIALS**

We conducted a retrospective analysis of 2,082 patients who underwent dual-energy chest CT scans. Our approach utilized a Residual U-Net combined with a Convolutional Block Attention Module (CBAM) to transform non-contrast CT images into virtual contrast-enhanced CT images. We evaluated the effectiveness of our method through quantitative and qualitative analyses and an observer study involving thoracic radiologists, focusing on the detection of significant hilar lymph nodes.

**RESULTS**

Our method achieved an average peak signal-to-noise ratio (PSNR) of 25.082, a structural similarity index (SSIM) of 0.833, and mutual information (MI) of 1.568. The mean absolute error (MAE), mean squared error (MSE), and root mean squared error (RMSE) were reported as 0.040, 0.023, and 0.102, respectively. Compared to other methods, our proposed approach demonstrated superior performance across all evaluation metrics. In the observer study, our method exhibited a higher diagnostic accuracy for detecting hilar lymphadenopathy (69.2%) compared to the Residual U-Net-based GAN with CBAM (53.7%).

**CONCLUSION**

The integration of dual-energy computed tomography (DECT) with a Residual U-Net framework augmented by CBAM presents a highly effective technique for generating synthetic contrast-enhanced chest CT images. This novel approach significantly enhances the detection of clinically significant hilar lymphadenopathy, underscoring its potential clinical utility.

**CLINICAL RELEVANCE/APPLICATION**

The integration of dual-energy CT and a Residual U-Net enhanced by the Convolutional Block Attention Module (CBAM) significantly improves the detection of hilar lymphadenopathy, offering clear benefits in clinical settings. This approach reduces the need for contrast media, which is particularly advantageous for patients with contraindications such as renal insufficiency or allergies, thereby minimizing associated risks and operational costs.

## S3A-SPCH-9 INITIAL CLINICAL EXPERIENCES OF A NOVEL PHOTON COUNTING SYSTEM COMBINING CADMIUM ZINC TELLURIDE DETECTORS AND SUPER-HIGH RESOLUTION DEEP-LEARNING IMAGE RECONSTRUCTION

Luuk J. Oostveen, DIPLPHYS (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Mathias Prokop, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Canon Medical Systems Corporation;Research Grant, Siemens AG;Speakers Bureau, Siemens AG
Steven Schalekamp, MD (*Abstract Co-Author*) Nothing to Disclose
Willem Jan van der Woude (*Abstract Co-Author*) Nothing to Disclose

Pieternel Van Der Tol (*Abstract Co-Author*) Nothing to Disclose
Mirte Simmelink (*Abstract Co-Author*) Nothing to Disclose
Ewoud J. Smit, MD, PhD (*Presenter*) Speakers Bureau, Canon Medical Systems CorporationResearch Grant, Canon Medical Systems Corporation

## PURPOSE

To assess the quality of chest images acquired with a photon counting CT (PCCT) scanner that combines cadmium zinc telluride (CZT) detectors with super-high resolution deep-learning image reconstruction (SHR-DLR).

## METHODS AND MATERIALS

The first 18 patients who underwent imaging of the chest for various indications on a prototype PCCT scanner (Canon Medical Systems, Tokyo, Japan) were analyzed in this study. Scans were reconstructed as normal resolution images (NR; 0.62 mm sections, 512 matrix, hybrid iterative reconstruction, lung kernel) and as super-high-resolution images (SHR-DLR; 0.21 mm sections, 1024 matrix, deep learning reconstruction, lung kernel). Exposure dose (CTDIvol and DLP) were recorded. All images were reviewed by an experienced chest radiologist for image quality (IQ) in a random manner. Images were scored for overall IQ, sharpness, detail visibility, noise and artifacts, all on a 5-point scale (poor, moderate, good, very good, excellent). Image noise was measured over a homogeneous region in the left ventricle. The number of bronchial branching generations were counted in the upper right (1R), upper left (5L) and right lower lobe (10R). Bronchus volumes were automatically calculated. A signed rank test with a p-value below 0.05 indicated a significant difference.

## RESULTS

Exposure dose in this initial patient group was 5.4 (IQR 1.4-5.4) mGy CTDIvol and 188 (IQR 56-231) mGy.cm DLP. The SHR-DLR images were rated to have higher overall image quality (4.7 vs 3.4), image sharpness (4.7 vs 3.1), detail visibility (4.4 vs 3.3) and lower perceived image noise (4.1 vs 3.2) compared to the NR images (all $p<0.01$). No artifacts were seen in either reconstruction (both 4.0). Image noise was 36.5 (IQR 35.5-37.4) HU with SHR-DLR compared to 36.8 (IQR 31.7-39.6) HU with NR, but with finer noise texture on the SHR-DLR images. On average, 1.2 more peripheral bronchial branches could be assessed with SHR-DLR ($p<0.01$). Bronchial volume from automatic segmentation was higher for the DLR-SHR images with 54.1 mL compared to 47.2 mL for the NR images ($p<0.01$).

## CONCLUSION

Initial results show that PCCT combining CZT detectors and SHR-DLR reconstruction provides superior spatial resolution and excellent depiction of the bronchial system while keeping image noise low.

## CLINICAL RELEVANCE/APPLICATION

Photon counting CT systems with SHR-DLR providing low-noise super-high-resolution images of the chest may push diagnostic abilities past their current limits.

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# Abstract Archives of the RSNA, 2024

S3A-SPER

**Emergency Radiology Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPER-1 USING EXPLAINABLE ARTIFICIAL INTELLIGENCE (XAI) ASSISTED SYSTEMS TO ENHANCE THE RESCUE PROCESS FOR PATIENTS WITH CEREBRAL HEMORRHAGE IN RURAL HOSPITALS

Chih-Hsing Tang (*Presenter*) Nothing to Disclose

### PURPOSE

In modern times, the shortage of various medical personnel and the need for them to multitask due to harsh medical environments require the immediate establishment of a rapid and effective response model. Deep learning models are often questioned as "black boxes." To overcome these challenges, we have decided to introduce an explainable AI assisted system to aid in medical decision-making.

### METHODS AND MATERIALS

1.Our AI assisted diagnostic system utilizes convolutional neural networks for data training and model construction, followed by validation of explainability using the occlusion sensitivity map method. 2.After patients undergo brain CT scans, images are simultaneously transmitted to the PACS system and AI interpretation system. When the AI system detects positive bleeding cases, it sends alert SMS messages via the FHIR protocol to the attending and reporting physicians' phones, prompting prioritized interpretation or intervention.

### RESULTS

1.After explainability validation, errors were observed in images affected by motion artifacts, brain implants, and incomplete skull structures. Excluding these types, the system exhibited a sensitivity of 0.95 ($P < 0.05$) and accuracy of 0.94 ($P < 0.05$). 2.Improving Work Efficiency: The average completion time for emergency head CT reports has been reduced by 67%, with a 60% decrease in the median time. This reduction has alleviated pressure on employees, allowing each person to save an average of 10.6 hours per year in report writing. Based on an average hourly wage of $158 for radiologists, this translates to an annual savings of $1680 per person in labor costs. 3.Near miss incidents occurred with a success rate of approximately 1.47%, where rescue physicians failed to report minor brain bleeds. 4.Enhancing patient care efficiency: Medical decision-making time decreased from within 30 minutes to 20 seconds, a 90% speed increase, and reduced mortality rates associated with ongoing bleeding. 5.Reducing the time from emergency admission to surgical treatment: Due to timely SMS reminders, the proportion of patients undergoing surgery within an hour increased from 14% to 45%.

### CONCLUSION

The use of an explainable AI assisted diagnostic system improved the quality and efficiency of medical care. The AI system's ability to promptly notify results reduced physician workload. These results demonstrate the value and potential of enhancing human intelligence (HI) with artificial intelligence (AI), especially in small to medium-sized hospitals with limited resources, highlighting its significant value.

### CLINICAL RELEVANCE/APPLICATION

AI serves as an assistant rather than a replacement, and when used correctly and strategically, AI assisted systems can generate substantial benefits for healthcare quality.

## S3A-SPER-2 ASSESSMENT OF AN AI AID IN DETECTION OF ADULT APPENDICULAR SKELETAL FRACTURES, JOINT DISLOCATION AND JOINT EFFUSION BY EMERGENCY RADIOLOGISTS

Raquel Cano Alonso, MD (*Abstract Co-Author*) Nothing to Disclose
Vicente Martinez de Vega, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Fernandez Alfonso (*Abstract Co-Author*) Nothing to Disclose
Julia Lopez Alcolea, MD (*Abstract Co-Author*) Nothing to Disclose
David Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Diaz Moreno, MD (*Presenter*) Nothing to Disclose

### PURPOSE

We hypothesized that our Artificial intelligence (AI) applied to the reading of urgent bone X-rays could successfully detect fractures, joint dislocations and joint effusion with high sensitivity (Sens) and specificity (Spec) rates. Thus, the objectives of our study are: 1. To determine Sens and Spec rates of our AI software in the detection of bone fractures, joint dislocations and elbow-joint effusion on radiographs as compared to Gold Standard (GS). 2. To evaluate the concordance rate between the reading of radiographs by AI and Radiology residents (RR). 3. To determine and compare the proportion of doubtful results by AI and RR, as well as the rates that were confirmed by GS.

## METHODS AND MATERIALS

We designed an observational, transversal double-blind descriptive and retrospective study to evaluate all adult Bone X-rays (BXR) referred from the Emergency Department at our center from October to November 2022, obtaining a sample of 792 BXR, which was divided into three groups: large joint, small joint and long-flat bones. Our AI is trained to detect three variables (fractures, joint dislocations and elbow effusion) and provide a result as positive, negative or doubtful. We compared the diagnostic performance of AI and RR against a senior radiologist with more than ten years of experience (considered as GS).

## RESULTS

Our study sample population's median age was 48 years; 48,6% were male. Most radiological examinations included 2 projections (90.2%) and their quality was considered optimal for diagnostic purposes in the vast majority of cases (97.2%). Statistical analysis showed Sens=90.6%, and Spec=98% for fracture detection by RR and 95.8% and 97.6% by AI. RR achieved higher Sens (77.8%) and Spec (100%) for joint dislocation detection than AI. The Kappa Coefficient between RR and AI was 0.797 for fractures in the group of large joints; for all other variables and groups, the concordance rate was acceptable. Moreover, we described the frequency of doubtful cases in every category and how many of them were considered positive by GS.

## CONCLUSION

We designed a study to evaluate the impact of AI in a real working environment, comparing AI diagnostic performance vs radiologists (in training and senior). AI achieved high Sens, Spec and AUC in the diagnosis of bone fractures. Our study also demonstrated a high concordance rate between AI and RR performance. To conclude, AI could be a helpful screening method because it can reduce the rate of missed diagnosis in a real-life environment.

## CLINICAL RELEVANCE/APPLICATION

Radiography is the first-line imaging modality for the diagnosis of traumatic skeletal injuries. Our study evaluates an AI software diagnostic performance on bone fractures, joint dislocations and elbow-joint effusion detection in a real working environment.

# Abstract Archives of the RSNA, 2024

S3A-SPGI

**Gastrointestinal Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPGI-1 BASED ON CLINICAL AND CT RADIOMICS TO PREDICT THE EARLY RESPONSE OF CHEMOTHERAPY IN COLORECTAL CANCER LIVER METASTASIS

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Long Yuan (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to evaluate the predictive value of a combined model constructed with clinical, pathological and CT radiomics features in predicting the chemotherapy response in patients with colorectal cancer liver metastases (CRLMs).

### METHODS AND MATERIALS

A retrospective analysis was conducted on 169 patients with CRLMs in our hospital, including clinical, pathological and enhanced CT images.One liver metastasis (n=169) was randomly selected from each patient, including 75 responsive and 94 unresponsive.The lesions were randomly divided into a training set (n=118) and the validation set (n=51) at a 7:3 ratio. Radiomics features were extracted from portal venous phase CT images in the training set. And optimal radiomics features were selected using Select Percentile univariate analysis, Spearman correlation analysis, and the LASSO algorithm. The logistic regression (LR) classifier was used to construct the radiomics model and calculate the radiomics score (Radscore). Moreover, the clinical and pathological features were identified by t test, U test and chi-square test. Based on these features, clinical-pathological models and a combined model of both were developed. The predictive performance of the models were evaluated using receiver operating characteristic (ROC) curves. A nomogram was constructed based on the predictors of the combined model.

### RESULTS

A total of 9 radiomics and 3 clinical, pathological features were identified in this study, including liver metastasis type, CEA levels, and RAS gene status.In both training and validation sets, the efficacy of the combined model to predict chemotherapy response of CRLMs (AUC=0.896, 0.798) was similar to the radiomics model (AUC=0.895, 0.786), and the difference was not statistically significant (Z=-0.082, 0.548, P=0.935, 0.584). The efficacy of the combined model in predicting chemotherapy response of CRLMs in the training set was higher than that of the clinical-pathological model (AUC=0.681, Z= -4.346, P < 0.001), but there was no significant difference between the two models in the validation set (AUC=0.680, Z=1.536, P=0.125).

### CONCLUSION

The pre-chemotherapy CT radiomics features can effectively predict the chemotherapy response in CRLMs. Furthermore, combining clinical and pathological features can imporve the predictive performance of the model, but the value is limited.

### CLINICAL RELEVANCE/APPLICATION

This study presents a nomogram using clinical and CT texture features to early predict response of chemotherapy in CRLM, offering a basis for personalized treatment plans and patient prognosis evaluation, with potential application in clinical practice.

## S3A-SPGI-10 MACHINE LEARNING-BASED PREDICTION MODEL FOR KIRSTEN RAS (KRAS) MUTATION IN RECTAL CANCER USING RADIOLOGICAL FEATURES AT MR IMAGING

Sang Soo Shin, MD (*Abstract Co-Author*) Nothing to Disclose
Chung-Man Moon (*Abstract Co-Author*) Nothing to Disclose
Seong Woo Cho, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the association of Kirsten Ras (KRAS) mutation with radiological characteristics of rectal cancer at MR imaging to build a machine learning (ML)-based prediction model for diagnosis and clinical decision-making.

### METHODS AND MATERIALS

Three hundred one consecutive patients diagnosed with rectal cancer by endoscopic biopsy were included in this study. KRAS genotyping was performed after curative surgical resection. Qualitative MR image analysis was performed through consensus between two radiologists. The relationship between rectal MR imaging analysis and KRAS mutation was assessed using the univariate analysis. To build a KRAS mutation prediction model, radiological characteristics were confirmed through Random Forest (RF) and Linear Discriminant Analysis (LDA). Receiver operating characteristic curve (ROC) analysis was performed to prove the effectiveness of the ML model.

**RESULTS**

One hundred forty-seven patients had KRAS mutations, while 154 patients had no mutation (wild type). In univariate analysis, KRAS mutant tumors were associated with extramural vascular invasion, circumferential configuration, extramural mass formation, polypoid growth pattern, tumor signal intensity (SI) on T2-weighted images, tumor-to-muscle T2 SI ratio, and tumor-to-muscle T1 SI ratio among all 23 features ($P < 0.05$). Based on the optimal features identified by the RF and LDA methods, the area under the curve (AUC) of the ROC of the model was 0.757 (accuracy = 0.756) and 0.756 (accuracy = 0.754), respectively.

**CONCLUSION**

The diagnostic prediction model showed fair diagnostic accuracy for preoperative identification of KRAS mutations in rectal cancer.

**CLINICAL RELEVANCE/APPLICATION**

The diagnostic prediction model based on MR imaging findings can help clinical decision-making in patients with rectal cancer by providing KRAS mutation information in rectal cancer.

## S3A-SPGI-2 DEVELOPMENT OF A NON-INVASIVE DIAGNOSTIC MODEL FOR HIGH-RISK ESOPHAGEAL VARICES BASED ON RADIOMICS OF SPLEEN CT

Cheng Yan (*Abstract Co-Author*) Nothing to Disclose
Liqin Zhao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic performance of radiomic models derived from multi-phase spleen CT for HREV in cirrhotic patients.

**METHODS AND MATERIALS**

als between September 2019 and September 2023, with one serving as an external validation cohort. Non-contrast (NCP) and contrast-enhanced CT scans and endoscopic evaluations were performed. Patients were categorized into HREV and non-HREV groups based on endoscopy. Radiomic features were extracted from spleen CT images in NCP, arterial (AP), and portal venous phases (PVP). Feature selection was conducted using lasso regression and Pearson's correlation. Ten machine learning models were developed to diagnose HREV, assessed by AUC. Statistical significance was determined by the Kruskal-Wallis H test and Bonferroni-corrected Mann-Whitney U test ($p < 0.05$).

**RESULTS**

Among 233 patients, 11, 6, and 11 features were selected from NCP, AP, and PVP images, respectively. The AP models demonstrated the highest AUC values:0.8149 (CI: 0.8011, 0.8293) for the internal test set and 0.7703 (CI: 0.7558, 0.7794) for the external validation set. The NCP models revealed AUC values of 0.7095 (95% CI: 0.6889-0.7268) and 0.6540 (95% CI: 0.6335-0.6689) for the internal and external sets, respectively. The PVP models demonstrated AUCs of 0.7458 (95% CI: 0.7250-0.7632) and 0.7166 (95% CI: 0.7036-0.7311) for the same cohorts. Significant differences in AUC values were observed across phases ($p < 0.05$).

**CONCLUSION**

Radiomic models based on splenic CT, particularly those utilizing arterial phase imaging, demonstrate high diagnostic accuracy for HREV, enabling potential early detection and timely intervention.

**CLINICAL RELEVANCE/APPLICATION**

This study introduces a non-invasive method through multi-phase spleen CT, notably employing an arterial-phase spleen model, to more accurately diagnose high-risk esophageal varices and reduce reliance on invasive techniques, thereby enhancing maneuverability in clinical radiology.

## S3A-SPGI-3 THE FEASIBILITY OF A LOW-DOSE THREE-PHASE LIVER CT PROTOCOL (ULTRA-LOW-DOSE CT OF 60KVP TUBE VOLTAGE AT THE PORTAL VENOUS PHASE) FOR LIVER CANCER SCREENING AND FOLLOW-UP OF LIVER METASTASES

Zhen Li, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Qiuxia Wang (*Abstract Co-Author*) Nothing to Disclose
Hao Tang (*Abstract Co-Author*) Nothing to Disclose
Youfa Tang (*Presenter*) Nothing to Disclose

**PURPOSE**

The objective of this study is to validate the feasibility of a low-dose three-phase liver CT protocol (ultra-low-dose CT of 60kVp tube voltage at the portal venous phase) for liver cancer screening in high-risk populations and follow-up of liver metastases in cancer patients.

**METHODS AND MATERIALS**

68 participants with suspected liver cancer and metastases scheduled to undergo abdomen dynamic CT were enrolled during the accrual period of 2023 to 2024.The portal venous phase (PVP) of 60 kVp series(tube voltage 60kVp and tube current 500mAs)was obtained 12s after the AP scan, and the portal venous phase (PVP) of 120 kVp series(tube voltage 120kVp and automatic tube current modulation range, 90-500 mAs)was obtained 18s after 60 kVp series. The mean CT values and image noise were measured in the liver parenchyma, liver lesions, portal vein. The signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. The overall image quality, the visibility of the peripheral branches of hepatic vessels and the confidence in the diagnosis was rated on a 5-point scale.

**RESULTS**

1) The image noise and overall image quality were significantly worse in the 60kVp series than in the 120 kVp series. However, no image in the 60kVp series was less score of 3,which meant an image quality meeting routine clinical practice. And the 60kVp series had higher CNR in liver lesions than that of 120 kVp series. 2) DLP, and ED for reduced-dose group were significantly lower than those for standard-dose group(lower 24%).The sensitivity of readers 1, 2, and 3 was 85.0%, 80.6%and 84.8% for standard-dose group, respectively, 97.0%, 97.2%and 97.0% for reduced-dose group; the specificity was 97.0%, 97.2%and 97.3% for standard-dose group, respectively, 97.0%, 97.2%and 97.3% for reduced-dose group.

**CONCLUSION**

The reduced-dose three-phase liver CT group(60kvp series at PVP) demonstrated the specificity comparable and the sensitivity better to that of the standard-dose three-phase liver CT group(120kvp series at PVP)for liver lesions, indicating that the low-dose liver three-phase CT protocol (ultra-low-

dose CT at 60kVp tube voltage at the portal venous phase) has high clinical application potentiality for liver cancer screening in high-risk populations and follow-up of liver metastases in cancer patients

**CLINICAL RELEVANCE/APPLICATION**

a novel low-dose three-phase liver CT protocol (ultra-low-dose CT at 60kVp tube voltage at the portal venous phase) that maintains diagnostic performance while minimizing radiation exposure, might be a preferable option for liver cancer screening in high-risk populations and follow-up of liver metastases in cancer patients.

## S3A-SPGI-4 ASSESSING THE EFFICACY OF MACHINE LEARNING MODELS IN PREDICTING IMMUNOTHERAPY SURVIVAL FOR ADVANCED HEPATOCELLULAR CARCINOMA

Bang Bin Chen, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study assesses the effectiveness of machine learning models in predicting the survival outcomes of patients with advanced hepatocellular carcinoma (HCC) undergoing immunotherapy.

**METHODS AND MATERIALS**

This retrospective analysis involved data from 143 patients with advanced hepatocellular carcinoma (HCC) who underwent immunotherapy between 2015 and 2022. Three machine learning models—Gradient Boosting Machine (GBM), Kaplan-Meier, and Cox regression—were developed using variables such as patient demographics, hepatitis etiology, liver function reserve, tumor stage, Barcelona Clinic Liver Cancer (BCLC) stage, alpha-fetoprotein (AFP) levels, extent of tumor involvement, and CT scan characteristics. Follow-up for patients continued until December 31, 2022, with both progression-free survival (PFS) and overall survival (OS) being recorded. Model performance was evaluated using cross-validation metrics.

**RESULTS**

The median follow-up period was 36.3 months (95% CI, 29.1-43.5 months). The median PFS and OS were 4.8 months (95% CI, 3.5-6.1) and 16.5 months (95% CI, 10.1-22.9), respectively. For PFS, both the GBM and Cox regression models demonstrated similar discrimination power, while the Kaplan-Meier model exhibited better calibration. Among these, the GBM model showed the highest accuracy, achieving a concordance index (c-index) of 0.598. For OS, all three models displayed comparable discrimination power, and again, the Kaplan-Meier model showed superior calibration. The GBM model also achieved the highest accuracy for OS, with a concordance index of 0.651.

**CONCLUSION**

Machine learning models effectively predict the survival of patients with advanced HCC undergoing immunotherapy, providing valuable insights for personalized treatment planning.

**CLINICAL RELEVANCE/APPLICATION**

The integration of machine learning models into clinical settings can potentially refine the precision of immunotherapy for HCC, thereby enhancing patient outcomes and optimizing treatment strategies. Future studies should focus on incorporating real-time data and refining these models to further aid clinical decision-making.

## S3A-SPGI-5 MACHINE LEARNING-BASED PREDICTION OF HEPATIC DECOMPENSATION APPLYING COMBINED TOPOLOGICAL AND RADIOMICS SIGNATURES DERIVED FROM BODY COMPOSITION MODELS

Yashbir Singh, PhD, MEng (*Presenter*) Nothing to Disclose

**PURPOSE**

This research aims to address traditional imaging biomarkers' limitations in detecting hepatic decompensation, a crucial phase in liver disease progression that requires timely intervention. Our study introduces an innovative approach employing deep learning-based body composition models. By integrating topological and radiomics signatures derived from CT images, we strive to enhance the predictive accuracy for hepatic decompensation, potentially revolutionizing early detection and management strategies.

**METHODS AND MATERIALS**

Our study cohort comprised 277 patients diagnosed with Primary Sclerosing Cholangitis (PSC), each having undergone an abdomen CT scan in the portal venous phase. A deep-learning algorithm was developed in-house for the segmentation of Subcutaneous Adipose Tissue (SAT), Skeletal Muscle (SKM), Visceral Adipose Tissue (VAT), and Intermuscular Adipose Tissue (IMAT). The extraction of radiomics features was facilitated using the PyRadiomics platform, and topological features were derived from persistence images. These extracted features were then combined into a singular input vector, which served as the basis for a logistic regression classifier. The model underwent validation through a 5-fold cross-validation process and was additionally tested on an external dataset to ensure its robustness and applicability.

**RESULTS**

The logistic regression model demonstrated significant predictive capabilities, achieving an average AUC of 0.8 in the 5-fold cross-validation, indicating its robustness. When applied to an external validation dataset, the model maintained its performance, with a peak AUC of 0.8 on the ROC curve. These results underscore the model's potential effectiveness in predicting hepatic decompensation.

**CONCLUSION**

This study showed a novel machine learning-based methodology that effectively combines topological and radiomics features to predict hepatic decompensation from CT images. Our method opens new pathways for the early detection and intervention of hepatic decompensation, potentially improving patient outcomes.

**CLINICAL RELEVANCE/APPLICATION**

The clinical implications of this research are far-reaching, offering a promising tool for healthcare professionals in the early identification and management of patients at risk of hepatic decompensation. By providing a more accurate predictive model, clinicians can tailor interventions more effectively, thereby potentially reducing the morbidity and mortality associated with advanced liver disease. This study sets the groundwork for future clinical applications and underscores the importance of integrating advanced machine-learning techniques in medical diagnostics.

## S3A-SPGI-6 DEEP LEARNING-BASED PREDICTION OF HEPATIC DECOMPENSATION USING VARIOUS ANATOMIC REGIONS IN PATIENTS WITH PRIMARY SCLEROSING CHOLANGITIS VIA COMPUTED TOMOGRAPHY

Yashbir Singh, PhD, MEng (*Presenter*) Nothing to Disclose

**PURPOSE**

To study the efficacy of a deep learning model in predicting hepatic decompensation among patients with Primary Sclerosing Cholangitis (PSC) using Computed Tomography (CT) imaging to enhance early diagnosis and management strategies.

**METHODS AND MATERIALS**

This retrospective cohort study included 277 adult patients diagnosed with large duct PSC, all of whom underwent abdominal CT scans. The portal venous phase images were utilized as inputs for a 3D Densenet121 model, trained via five-fold cross-validation to classify hepatic decompensation. A deep learning approach was taken by training the model on various sections of the 3D CT images, including the right, left, anterior, posterior, inferior, and superior halves, to ascertain the contribution of each anatomic region to the model's predictive accuracy. AUROC performance was conducted for each section and the entire scan.

**RESULTS**

Over a median follow-up of 1.5 years (interquartile range 142-1318 days post-CT), hepatic decompensation was observed in 128 patients. The deep learning model demonstrated high predictive performances with a baseline mean AUROC of 0.89 ± 0.04. The analysis of individual anatomic sections yielded mean AUROC values of 0.83 ± 0.03 (left, right), 0.82 ± 0.09 (anterior), 0.79 ± 0.02 (posterior), 0.78 ± 0.02 (superior), and 0.76 ± 0.04 (inferior).

**CONCLUSION**

The deep learning model, particularly the 3D Densenet121 applied to CT imaging, shows significant potential in predicting hepatic decompensation in PSC patients. This study highlights the importance of leveraging advanced imaging analysis techniques for better clinical outcomes in chronic liver diseases.

**CLINICAL RELEVANCE/APPLICATION**

The findings underscore the value of deep learning in refining the predictive accuracy of medical imaging, offering a promising tool for clinicians to identify and manage patients at risk of hepatic decompensation in the context of PSC. This approach could pave the way for personalized treatment strategies and improved patient care.

## S3A-SPGI-7 PERFORMANCE OF RADIOLOGISTS IN CHARACTERIZING AND DIAGNOSING HEPATIC LESIONS USING DYNAMIC CONTRAST-ENHANCED CT WITH AND WITHOUT ARTIFICIAL INTELLIGENCE

Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Yanagawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shoji Kido, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akinori Hata, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiromitsu Onishi, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company
Takahiro Tsuboyama, MD (*Abstract Co-Author*) Nothing to Disclose
Daiki Nishigaki, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the performance of radiologists in characterizing and diagnosing hepatic lesions with and without the assistance of artificial intelligence (AI).

**METHODS AND MATERIALS**

This retrospective study included 83 nodules/masses from 69 patients who underwent dynamic contrast-enhanced CT of the liver. Image assessments were conducted by 20 radiologists grouped according to their level of experience (10 senior and 10 junior). Each radiologist determined the probability of eight characteristics based on enhancement patterns and the diagnosis with and without an AI which consists of convolutional neural networks to analyze 3-dimentional image data. Their results were compared with a reference standard determined by two board-certified abdominal radiologists and area under the receiver operating characteristic curves (AUCs) were analyzed using the multireader multicase method.

**RESULTS**

For 69 patients, 47 were male and the mean age was 63 ± 16 [SD] years. Using AI improved AUCs for the characterization of enhancement (without AI, 0.90 [95% CI 0.86, 0.93], with AI, 0.92 [95% CI 0.88, 0.96]; P = .018), nonperipheral washout (without AI, 0.89 [95% CI 0.83, 0.94], with AI, 0.91 [95% CI 0.86, 0.96]; P = .031), and delayed enhancement (without AI, 0.83 [95% CI 0.77, 0.89], with AI, 0.87 [95% CI 0.81, 0.93]; P = .005), and the diagnosis of hepatocellular carcinoma (without AI, 0.81 [95% CI 0.75, 0.88], with AI 0.83 [95% CI 0.77, 0.89]; P = .043). Improvements in AUCs for the characterization were observed in both the senior (enhancement, expansion and coalescence of enhancing areas, and delayed enhancement) and junior (delayed enhancement) groups.

**CONCLUSION**

Using AI improved the radiologists' performance in characterizing and diagnosing hepatic lesions. In terms of their capacity to assess imaging characteristics, improvements were observed regardless of their level of experience.

**CLINICAL RELEVANCE/APPLICATION**

The use of an AI system resulted in improved assessment of imaging features and more accurate diagnoses by radiologists, which is expected to improve the clinical care and prognosis of patients.

## S3A-SPGI-8 PREOPERATIVE PREDICTION OF LIVER REGENERATION FOLLOWING HEMIHEPATECTOMY USING MACHINE LEARNING MODEL

Qingqing Chen (*Abstract Co-Author*) Nothing to Disclose
Hongjie Hu, MD (*Abstract Co-Author*) Nothing to Disclose
Fang Wang (*Abstract Co-Author*) Nothing to Disclose
Dan Cao (*Presenter*) Nothing to Disclose

**PURPOSE**

The inadequate remnant liver regenerative capacity may directly lead to liver failure and even death for patients who underwent hemihepatectomy. The aim of this study is to explore the potential ability of machine learning model for preoperatively predicting the remnant liver regeneration in patients

following hemihepatectomy.

## METHODS AND MATERIALS

A total of 213 patients who underwent hemihepatectomy were retrospectively included. We semi-automatically segmented the future remnant liver from preoperative CT. The volume of future remnant liver (LVpre) was measured, and radiomics features were extracted from the future remnant liver in portal venous phase. The volume of postoperative remnant liver (LVpost) was measured on follow-up CT. The regeneration index (RI) was calculated by the following equation: (LVpost - LVpre)/LVpre) × 100 (%). The machine-learning model was developed by the Ada Boost analysis in the training cohort (n=121), the internal validation cohort (n=52) and the external validation cohort (n=40). The AUC, sensitivity, specificity, accuracy and F1 score were employed to evaluate the diagnostic efficiency of the machine-learning model for preoperative prediction of the remnant liver regenerative capacity.

## RESULTS

We developed a machine learning model that excellent prediction performance of the remnant liver regenerative capacity in the training cohort, the internal validation cohort and the external validation cohort, with AUC of 0.88 (95%CI: 0.81-0.96), 0.80 (95%CI: 0.65-0.95) and 0.85 (95%CI: 0.67-1.00) (Fig.1). The diagnostic sensitivity, specificity, accuracy and F1 score of the model in the training cohort were 0.79, 0.88, 0.85 and 0.79. In the internal validation cohort, the sensitivity, specificity, accuracy and F1 score of the model were 0.63, 0.86, 0.79 and 0.65. In the external validation cohort, the sensitivity, specificity, accuracy and F1 score of the model were 0.82, 0.83, 0.83 and 0.72 (Fig.2). A further analysis between radiomics features and remnant liver regenerative capacity indicated that the high radiomics scores were associated with high RI (Fig.3).

## CONCLUSION

The new machine learning model based on radiomics features may serve as a potential preoperative predictor of remnant liver regeneration capacity for patients who underwent hemihepatectomy.

## CLINICAL RELEVANCE/APPLICATION

The insufficient remnant liver regenerative capacity may lead to postoperative liver insufficiency and even liver failure for patients who underwent hemihepatectomy. The newly developed machine-learning model based on radiomics features may serve as a potential preoperative predictor of remnant liver regeneration capacity to ensure the safety of hepatectomy and improve prognosis.

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# Abstract Archives of the RSNA, 2024

S3A-SPGU

**Genitourinary Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPGU-1 ASSESSING THE FEASIBILITY OF MAGNETIC RESONANCE IMAGING COMPILATION FOR DETERMINING THE TREATMENT STRATEGIES AND PREDICTING THE RECURRENCE RISK FACTORS AND SHORT-TERM EFFICACY IN CERVICAL CANCER

Wenzheng Li, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Liu M. Hui I, MD (*Abstract Co-Author*) Nothing to Disclose
Yigang Pei, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaorong Ou (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the feasibility of using Magnetic Resonance Imaging Compilation (MAGiC: sy-T2WI; sy-T1, sy-T2, and sy-PD maps) to determine treatment plan and to predict recurrence risk factors (RRF) and short-term treatment efficacy (STE) in cervical cancer (CC) patients using high-resolution T2WI (hr-T2WI)and DWI as reference standards.

### METHODS AND MATERIALS

The study protocol was approved by the local Research Ethics Committee. Informed consent was obtained from all subjects. 194 patients suspected of CC were enrolled and undergone MAGiC, hr-T2WI and DWI (the parameter presented in Table 1) on 3.0T GE MRI (Fig 1a). The subjective evaluation of image quality and tumor staging using sy-T2WI and hr-T2WI were conducted. The accuracy, sensitivity and specificity of sy-T2WI were analyzed for making treatment plan (staging IB-IIA: surgery; IIB-IVA: CCRT) (Fig 1b). RRF was assessed by surgery (RRF and no-RRF groups) for staging IB-IIA (Fig 1c) and STE was evaluated by a repeat MRI at 2 months (complete response (CR) and no-CR groups) after concurrent chemoradiotherapy (CCRT) for IIB-IVA CC patients (Fig 1d). The area under the curve (AUC) was used to objectively predict RRF and STE using the quantitative sy-T1, T2, PD maps, their combinations and apparent diffusion coefficient (ADC).

### RESULTS

119 out of 194 CC patients were included, including 50 patients with surgery and 69 subjects with CCRT. For the image quality, sy-T2WI was no significant differences compared with hr-T2WI in four aspects (All $P>0.05$; Table 2, Fig 2). The accuracy, sensitivity and specificity of sy-T2WI was 0.908, 0.908 and 0.999, and an excellent agreement was found between sy-T2WI and hr-T2WI for differentiating IB-IIA from IIB-IVA ($k = 0.935$; $p < 0.001$) (Table 3, Fig 3). For the quantitative synthetic images, T2, T1 and ADC had a significant difference to identified RRF from no-RRF, CR from no-CR group respectively ($P < 0.05$) but PD ($P > 0.05$; Table 4). For RRF, the diagnostic performance of T2 (AUC: 0.908) and T1 (AUC: 0.854) were similar to ADC (AUC: 0.776; all $P > 0.05$) (Table 5, Fig 4). For STE, the predictive performance of T2 was superior to ADC (AUC: 0.902 vs. 0.737; $p = 0.030$) but T1 (AUC: 0.877; $p = 0.081$) (Table 5, Fig 5). Furthermore, T1+T2 was superior to ADC for predicting RRF (AUC: 0.980 vs 0.776; $p = 0.005$) and STE (AUC: 0.982 vs. 0.737; $p < 0.001$) (Table 5, Fig 4-5).

### CONCLUSION

MAGiC is a promising technique for deciding therapeutic plan and predicting RRF and STE in CC patients, which is similar and even superior to hr-T2WI and DWI.

### CLINICAL RELEVANCE/APPLICATION

MAGIC is a reliable technique for facilitating the synthetic morphologic images and quantitative synthetic images, which should be as an alternative strategy of hr-T2WI and DWI for deciding treatment plan and predicting RRF and STE in CC patients.

## S3A-SPGU-10 A REAL-WORLD COMPREHENSIVE ASSESSMENT OF SPACEOAR HYDROGEL EFFICACY, CLINICAL APPLICATIONS, AND COMPLICATIONS

Sandeep S. Arora, MBBS (*Abstract Co-Author*) Research support, Profound Medical Inc
Gary M. Israel, MD (*Abstract Co-Author*) Nothing to Disclose
Pavlo Mishyn, DO (*Abstract Co-Author*) Nothing to Disclose
Shadi Ebrahimian, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Radiation is the standard therapy for prostate cancer. However, it may cause damage to the surrounding organs including rectum. SpaceOAR hydrogel, is an FDA approved spacer, which increases the distance between the rectum and prostate, reducing rectal radiation exposure. However, it has some complications including suboptimal placement or migration of the hydrogel. This study aims to quantify the increased recto-prostatic distance after SpaceOAR placement and to assess the frequency of SpaceOAR related complications.

### METHODS AND MATERIALS

We conducted a search using the keyword of "SpaceOAR" among MRI pelvis reports in our department radiology reports search engine, "Montage, mPower Nuance". A total of 700 patients were found of which 181 patients MRI performed prior to and after SpaceOAR placement. A board-certified radiologist measured the distance between prostate and rectum (PRD) in nine different planes including one centimeter superior to the apex and inferior to the base and at the level of mid gland on sagittal views and one centimeter to the left, right, and midline of the prostate on axial views. The SpaceOAR related complications were also recorded. Microsoft Excel was used for data recording and analysis.

### RESULTS

The average PRD was significantly different before and after SpaceOAR placement at all locations ($p<0.001$). The mean PRD increased throughout the entire prostate (ranging from 0.8± 0.3 cm at base to 1.2±1.4 cm at the apex). Although the averages where significantly different, SpaceOAR was not observed in recto prostatic space among 12/181 (7%) patients, due to suboptimal placement. Asymmetric distribution of the SpaceOAR was noted, with no increase in PRD among 37/181 (20%) of patients at the apex level (up to 82/181 in left apex), 20/181 (11%) at the base (up to 46/181 in right base), and 10/181 (5%) at mid-prostate level. SpaceOAR related complications were noted in 23/181 of patients (12.7%) with infiltration into rectal wall as the most frequent one resulting in fistula formation in one patient.

### CONCLUSION

The PDR did not increase at the apex in a large proportion of patients following SpaceOAR placement. SpaceOAR related complications were noted in 13% of patients.

### CLINICAL RELEVANCE/APPLICATION

Although SpaceOAR increases the mean PRD, some portions of rectum may be spared due to asymmetric distribution of the SpaceOAR, predominantly in apex. This may increase the risk of radiation exposure to the rectum at this location. Additionally, the most common complications related to SpaceOAR placement includes rectal wall infiltration.

## S3A-SPGU-2 ARTIFICIAL INTELLIGENCE ASSISTANCE FOR PROSTATE MRI ANALYSIS : TOWARDS INCREASED TUMOR DETECTION SPECIFICITY

Roberto Ardon (*Abstract Co-Author*) Employee, AXA Venture Partners
Leo Alberge (*Abstract Co-Author*) Nothing to Disclose
Chloe Adam, PhD (*Abstract Co-Author*) Employee, Incepto Medical SAS
Maria Elena Laino, MD (*Abstract Co-Author*) Nothing to Disclose
Luc Beuzit (*Abstract Co-Author*) Nothing to Disclose
Guillaume Herpe (*Abstract Co-Author*) Medical Officer Incepto-France Grant, Guerbet
Martin Charachon (*Abstract Co-Author*) Nothing to Disclose
Gaspard d'Assignies, MD, PhD (*Presenter*) Founder, Incepto Medical SAS;Employee, Incepto Medical SAS;Stockholder, Incepto Medical SAS

### PURPOSE

To evaluate the impact of artificial intelligence (AI) models on diagnostic performances of a panel of readers in detecting clinically significant prostate cancer (csPCa) (ISUP = 2) on ProstateX dataset.

### METHODS AND MATERIALS

An evaluation dataset consisted of curated 202 prostate MR from a public dataset ProstateX (mean age 66, including 76 csPCa MRI, 36 of which are in the peripheral zone, 40 in the transition zone). Gold standard diagnosis for csPCa was established by histology and/or expertise.4 general radiologists (100 to 150 prostate MRI reading per year) were asked to review 202 examinations each without the help of the AI, and the same randomly shuffled dataset after a one month wash-out period assisted by the AI. One expert radiologist (> 400 prostate MRI reading per year) reviewed the 202 examinations without AI. A case-level PI-RADS score according to PI-RADS V2.1 was provided for each examination.The AI model was trained on a database of 5,000 MRI scans from 10 clinical sites, independent of the dataset explored here, providing lesion detection and a case level suspicion of malignancy in two grades, moderate or high.Readers' and AI performances at the exam-level were evaluated using sensitivity/specificity, and accuracy by considering the cut-off PI-RADS >=3.Interreader reproducibility was evaluated using Kappa score on PI-RADS 2.1 scores.Chi-square testing was used for statistical significance of performance comparisons.

### RESULTS

General radiologists performances (without/with AI) values were respectively sensitivity (.94,CI.95[.92,.97]/.94,CI.95[.91,.96], p=0.20), specificity (.34,CI.95[.31,.38]/.50,CI.95[.46,.54], p<0.001 ), accuracy (.55,CI.95[.52,.58] / .65,CI.95[.62,.68],p<0.001). Expert performances (without AI) were respectively sensitivity (.96,CI.95[.91,1.00]), specificity (.69CI.95 [.61,.78]), accuracy (.78,CI.95[.72,.84]). Standalone performances of the AI solution were respectively sensitivity (.91,CI.95[.84,.97]), specificity (.64,CI.95[.56,.72], accuracy (.73 CI.95[.67,.79]). Cohen's Kappa score on PI-RADS scores was .30 before AI and reached .60 after.

### CONCLUSION

AI assistance led to a significant increase of diagnostic performances,+9% for accuracy, of the general radiologists, as well as standardization of the PI-RADS scorings. But this study raises two remarks: firstly AI standalone performances were higher than the general radiologist aided by AI questioning the willingness for AI. Secondly, expert reading remains the most performant, assessing the continuous need for training.

### CLINICAL RELEVANCE/APPLICATION

AI improves and overcome significantly general radiologist diagnostics specificity and accuracy for prostate cancer detection in MRI.

## S3A-SPGU-3 AI DETECTS MISSED SMALL RENAL MASSES ON SINGLE PHASE CT

Masoom A. Haider, MD (*Abstract Co-Author*) Nothing to Disclose
Satheesh Krishna, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio Finelli (*Abstract Co-Author*) Nothing to Disclose
Girish Kulkarni, MD (*Abstract Co-Author*) Nothing to Disclose
Kristen McAlpine (*Abstract Co-Author*) Nothing to Disclose
Nikhil S. Mirajkar, MBChB, FRCR (*Presenter*) Nothing to Disclose

**PURPOSE**

Radiologists can miss incidental small renal masses (SRM's) on a single-phase CT. The purpose of this study was to evaluate the performance of a UNet based lesion segmentation model on SRM's missed by radiologists.

**METHODS AND MATERIALS**

We trained nnUNet v2 model on 1155 (radiologist annotated portal or nephrographic phase images) of which 489 were from the public domain C4KC-KiTs training set from the Cancer Imaging Archive and the rest were from our centre. The model was a cascade of a low-resolution 3D followed by a 3D full resolution classifier with 5-fold cross-validation. We retrospectively reviewed a dataset of 222 small renal masses to identify cases that had prior imaging with a missed SRM, and a prediction was run on these cases. This retrospective study was approved by our research ethics board and informed consent was waived.

**RESULTS**

Eleven cases (5% miss rate 11/222) were identified where a radiologist missed an SRM. Our model missed four cases (2% miss rate 4/222) equating to a 64% reduction (p value = 0.02) in miss rate. On lesion level analysis, 14 lesions were missed by the radiologist. Our model missed only 4 lesions, with a sensitivity of 71% (10/14). Lesions missed by our model included 3 SRM's incorrectly categorised as cysts and one tiny 6 mm central endophytic lesion. The model detected an additional 3 lesions which were not SRM's. The 3 false positive lesions were subcentimeter cysts that demonstrated long term stability. Average time interval between the baseline CT where the lesion was missed by the radiologist and follow up imaging where the lesion was first reported was 23 months. The average interval size change of the SRMs during this period was 0.8 cm/year. 3 patients had SRMs that rapidly increased in size within a short time interval with a significant delay in their diagnosis. The model detected all 3 of these high-risk masses on the baseline CT.

**CONCLUSION**

Our study demonstrates that a UNet model can detect missed SRM's with a sensitivity of 71%. The model reduces the miss rate of incidental SRM's from 5% (11/222) to 2% (4/222), a 64% reduction (p value = 0.02). Further multicentre data set testing on missed SRM's is planned.

**CLINICAL RELEVANCE/APPLICATION**

A UNet classifier shows strong potential to help reduce observational miss rates for incidental small renal masses.

## S3A-SPGU-5 3D V-NET-BASED SEGMENTATION OF ADRENAL GLANDS

Xiaodong Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Xiaoying Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Yaofeng Zhang (*Abstract Co-Author*) Nothing to Disclose
Yuanchong Chen, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To establish a 3D V-Net-based segmentation model of adrenal glands on CT.

**METHODS AND MATERIALS**

Retrospectively collecting CT image series of adrenal glands for the training of adrenal segmentation model. Inpatient abdominal CT examinations with normal adrenal glands and no diagnosed adrenal diseases upon discharge were retrospectively collected in the normal adrenal dataset (N = 3861). The abnormal adrenal glands dataset consists of the portal venous phase image series from contrast-enhanced CT examinations of patients diagnosed with adrenal adenoma or adrenal metastasis clinically or pathologically (N = 1799). All these datasets (N = 5660) were used to train the segmentation model of adrenal gland after being annotated by radiologists. Then, two groups of health check-up patients from the same institution (N = 6126) and another institution (N = 931) were included whose chest CT images were used for model validation. Indicators including Sụrensen-Dice similarity coefficient (DSC) were used to evaluate the efficacy of the model.

**RESULTS**

The DSC of the test set of left and right adrenal segmentation models were 0.910 (0.890 - 0.930) and 0.920 (0.890 - 0.930), respectively. The DSC in external validation datasets were 0.816 (0.744 - 0.866) (left adrenal gland), 0.819 (0.743 - 0.865) (right adrenal gland) and 0.752 (0.666 - 0.820) (left adrenal gland), 0.747 (0.673 - 0.812) (right adrenal gland), from the same institution and another institution, respectively.

**CONCLUSION**

The 3D V-Net-based adrenal segmentation model can achieve considerable segmentation efficacy that can be used in both abdomen and chest CT images.

**CLINICAL RELEVANCE/APPLICATION**

The 3D V-Net-based adrenal segmentation model with high internal validity as well as considerable external validity can lay the groundwork of automated imaging diagnosis of adrenal glands.

## S3A-SPGU-6 AI-ASSISTED COMPRESSED SENSING IMPROVES IMAGE QUALITY OF PROSTATE T2-WEIGHTED IMAGING

Hui Xu (*Abstract Co-Author*) Nothing to Disclose
Liting Shen (*Abstract Co-Author*) Nothing to Disclose
Wei Jie (*Abstract Co-Author*) Nothing to Disclose
Ying Yuan, BEng,BEng (*Abstract Co-Author*) Nothing to Disclose
Zhenghan Yang (*Abstract Co-Author*) Nothing to Disclose
Dan YU (*Abstract Co-Author*) Nothing to Disclose
Qian Liao (*Abstract Co-Author*) Nothing to Disclose
Liang Wang, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the image quality, lesion delineation abilities, and Prostate Imaging Reporting and Data System (PI-RADS) scoring performance of prostate T2-weighted imaging (T2WI) based on AI-assisted compressed sensing (ACS).

**METHODS AND MATERIALS**

The prospective study was conducted with forty adult male patients from urology department requiring prostate MRI. Each participant underwent three consecutive prostate MRIs in sagittal, coronal, and axial planes using both parallel imaging (PI) and ACS using two different reconstruction programs (T2WIPI, T2WIACS1 and T2WIACS2). Two radiologists performed quantitative and qualitative evaluations. Quantitative analysis included metrics such as signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), the slope profile and widest diameter of the largest or most suspicious lesion, and the edge rise distance (ERD) of the dorsal prostate capsule in the axial plane. Qualitative assessment employed a five-point Likert scale (from 1 = nondiagnostic to 5 = excellent) to rate image quality. T2WI and PI-RADS scores were assessed for the largest or most suspicious lesions. Statistical analysis involved one-way ANOVA with post hoc Tukey or Tamhane tests for continuous variables, and the Friedman test with Bonferroni post hoc adjustments for discrete variables. The intraclass correlation coefficient (ICC) measured the reliability of qualitative data.

**RESULTS**

The total acquisition time for three-plane T2WIACS1 and T2WIACS2 were reduced by 47% and 53%, respectively, compared to T2WIPI. CNR improvements were significant in sagittal T2WIACS1, sagittal T2WIACS2 and axial T2WIACS1 over T2WIPI ($P < 0.05$). Sagittal plane analysis revealed significant enhancements in overall image quality, image sharpness, PZ and TZ boundary clarity, artifacts, and lesion delineation for T2WIACS1 with T2WIACS2 showing notable artifact reduction ($P < 0.05$). In the coronal plane, T2WIACS1 demonstrated superior lesion delineation compared to both T2WIPI and T2WIACS2 ($P < 0.05$). The axial plane analysis indicated significant improvements in overall image quality and PZ and TZ boundary clarity for T2WIACS1 over T2WIPI ($P < 0.05$). No significant differences were observed in slope profile, widest diameter, and ERD ($P > 0.05$). And no significant differences were observed in T2WI and PI-RADS scores across the groups ($P > 0.05$) with excellent agreement (ICC: 0.83-0.95).

**CONCLUSION**

ACS significantly reduces prostate T2WI scanning times by at least half, while maintaining or enhancing image quality and diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

This advancement demonstrates clinical efficiency without affecting clinical decision-making and possesses great application potential.

## S3A-SPGU-7 APPLICATION VALUE OF CT LYMPHANGIOGRAPHY IN CLINICAL GRADING OF PRIMARY CHYLURIA

Qi Hao (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the value of CT lymphangiography (CTL) in the staging of primary chyluria.

**METHODS AND MATERIALS**

The clinical and CTL imaging data of 77 patients diagnosed with primary chyluria were collected retrospectively.All 77 patients underwent DLG and CTL. CTL was performed on patients with a Siemens Sensation 16 or Philips Brilliance iCT spiral CT machine 20 min to 2 h after DLG with a combined chest and abdomen CT scan from the inferior border of the thyroid cartilage in the neck to the inferior border of the pubic symphysis. Scan parameters: tube voltage 80-120 kV, tube current 250-300 mA, layer thickness 5 mm, layer interval 5 mm, and pitch 1. After completion of the scan, the raw data were transferred to the EBW workstation for transverse thin-layer reconstruction with 2 mm layer thickness and 1.8 mm layer interval, and 3D reconstruction was performed.Referring to the clinical grading criteria,seventy-seven patients were divided into mild and severe groups, and CTL indexes were recorded separately for each group.CTL indexes include: Abnormal deposition of lipiodol in the urinary system, chest, abdomen and pelvis.The CTL image findings of the two groups were statistically analyzed. ?2 test was used for counting data.,$P < 0.05$ was considered statistically significant.

**RESULTS**

Among 77 cases of primary chyluria, 27 cases were in mild group and 50 cases were in severe group. In the two groups,CTL showed abnormal lipiodol deposition in renal parenchyma in 10 cases (37.0%) and 25 cases (50.0%) respectively, and in bladder in 6 cases (22.2%) and 23 cases (46.0%) respectively.The difference of abnormal lipiodol deposition in renal parenchyma between the two groups was statistically significant ($P=0.031$), and the incidence of severe group (50.0%) was higher than that of mild group (37.0%).The difference of abnormal lipiodol deposition in bladder between the two groups was statistically significant ($P=0.040$), and the incidence in the severe group (46.0%) was higher than that of mild group (22.2%).There was no significant difference in abnormal lipiodol deposition in chest and abdomen, bone and thoracic duct between the two groups ($P > 0.05$).

**CONCLUSION**

CTL can be used for imaging diagnosis and evaluation according to the distribution of abnormal lipiodol deposition in abnormal lymphatic vessel in patients with primary chyluria, among which the suprhilar type and the whole kidney type can effectively indicate the clinical grade of primary chyluria.

**CLINICAL RELEVANCE/APPLICATION**

CTL can provide an important image basis for the diagnosis and treatment of primary chyluria.

## S3A-SPGU-9 AI-DRIVEN RADIOMICS MODEL TO PREDICT RESIDUAL TERATOMA/SEMINOMA IN METASTATIC NONSEMINOMATOUS GERM CELL TUMORS(MNSGCTS)

Neda Abdalvand (*Abstract Co-Author*) Nothing to Disclose
Ren Yuan, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Patients with mNSGCTs with retroperitoneal disease often have residual lesion(s) after chemotherapy. Some residuals contain teratoma or viable cancer requiring surgery; around 50% consist of necrotic or fibrotic tissue. Current guidelines recommend post-chemotherapy retroperitoneal lymph node dissection (PC-RPLND) for residual lesions >1 cm in the short axis, which leads to overtreatment in many cases. Accurate surgical patient selection is essential to avoid unnecessary harm, while it's challenging when differentiating teratoma/seminoma from benign residual masses, as the tumour markers are all normal. We propose an AI-radiomics approach using post-PC pre-RPLND CT images can help differentiate residual teratoma/seminoma from benign tissue.

**METHODS AND MATERIALS**

We retrospectively included 53 patients (19-58 years) with mNSGCT who received cisplatin-based chemotherapy, then normal serum tumor markers before RPLND, had residual lesions over 1 cm on pre-RPLND enhance CT, and detailed pathology reports of the RPLND (96 lesions: 56 teratomas, 22 fibrosis/necrosis, 18 viable seminomas). CT radiomics features of residual lesions were extracted using 3D slicer. Recursive Feature Elimination with Cross-Validation was used for feature selection. The data were randomly divided into 80% vs 20% for training and testing. 5-fold cross-validation was

applied to train the model. We trained prediction models using Random Forest (RF), Gradient Boosting (GB), and Support Vector Machine (SVM) algorithms. Model performance was assessed with the receiver operating characteristic (ROC) curve and Brier scores to select the best model.

## RESULTS

The three models all excel in discrimination (i.e., AUC/Sensitivity/Specificity: 0.84, 0.76, 0.79 for RF vs 0.75, 0.71, 0.69 for GB vs. 0.81,0.81,0.78 for SVM), while RF exhibited the highest AUC (0.84) and the lowest Brier score (0.1630), indicating superior discrimination and better calibration of predicted probabilities, respectively, compared to GB and SVM.

## CONCLUSION

The pilot study showed that in patients with mNSGCTs who received chemotherapy with residual retroperitoneal lesions, an ML model using CT images of radiomic features can distinguish teratoma/seminoma from benign pathology in the residual lesions.

## CLINICAL RELEVANCE/APPLICATION

The ML-radionics model has the potential to assist the decision-making of RPLND in avoiding unnecessary surgeries in patients with mNSGCTs who received chemotherapy and had residual lesions but normal tumor markers.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

S3A-SPHN

**Head & Neck Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPHN-1 CONTRAST-ENHANCED 3D T1 VIBE OUTPERFORMS MPRAGE FOR INTRACAVERNOUS CRANIAL NERVE VISUALIZATION IN DIPLOPIA

Dawon Jung, MD (*Abstract Co-Author*) Nothing to Disclose
Eunhee Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hongseok Ko, MD (*Abstract Co-Author*) Nothing to Disclose
Hyeji Lee (*Presenter*) Nothing to Disclose

### PURPOSE

We aimed to compare the visual conspicuity of contrast-enhanced 3D T1 volume-interpolated breath-hold examination (VIBE) and magnetization-prepared rapid-acquisition gradient-echo (MPRAGE) for assessment of intracavernous cranial nerve (CN) III, V1, V2 and VI in patients with diplopia.

### METHODS AND MATERIALS

We retrospectively included 74 patients who had undergone contrast-enhanced diplopia MRI from May 2023 to April 2024 in a single center. Contrast-enhanced 3D T1 VIBE and MPRAGE images with fat suppression were acquired in the coronal plane with a slice thickness of 1.5 mm. A neuroradiologist evaluated degree of cavernous sinus enhancement and visualization of bilateral intracavernous CN III, V1, V2 and VI (figure 1, 2). Cavernous sinus enhancement was scored using a three-level scale as follows: coarse granular enhancement as grade 1, mild granular enhancement as grade 2, avid homogenous enhancement as grade 3. The visual conspicuity of CN was scored using a five-level scale and defined as the identifiable proportion of the total cavernous segment of each CN. If less than 50% of the length of the intracavernous CN was identified, it was classified as grade 1, 50% to less than 75% as grade 2, 75% to less than 100% as grade 3, 100% as grade 4, and neural enhancement as grade 5 (pathologic status). Wilcoxon signed-rank test was used to compare the visualization scores between VIBE and MPRAGE.

### RESULTS

In 55 out of 74 patients (mean age 51.6 years; 26 females), all intracavernous CNs were found to be normal. Analysis using the Wilcoxon signed-rank test indicated that the median scores for cavernous sinus enhancement and visual conspicuity of all CNs were either equal to or higher on VIBE compared to MPRAGE (table 1). Among the 110 normal bilateral CNs evaluated, 105 CN IIIs were fully identified on VIBE (95%), while only 75 (68%) were identified on MPRAGE. For CN V1, 76 (69%) and 9 (5%) were graded as 4 on VIBE and MPRAGE, respectively. CN V2 was identified as grade 4 in 72 (65%) on VIBE and 44 (40%) on MPRAGE. For CN VI, 82 (74%) were identified as grade 4 on VIBE and 23 (20%) on MPRAGE.

### CONCLUSION

Our study demonstrates that contrast-enhanced 3D T1 VIBE MRI provides superior conspicuity of intracavernous CNs III, V1, V2 and VI compared to MPRAGE in patients with diplopia. This finding was evident in both the degree of cavernous sinus enhancement and the ability to identify the entire course of each CN within the cavernous sinus.

### CLINICAL RELEVANCE/APPLICATION

The contrast-enhanced coronal 3D T1 VIBE sequence with fat suppression represents the optimal sequence for assessing intracavernous CNs, providing uniform and robust enhancement of cavernous sinus. 3D T1 VIBE MRI may be the preferred neuro-ophthalmic imaging modality for evaluating intracavernous CNs in patients with diplopia.

## S3A-SPHN-2 CLINICAL TEMPORAL BONE IMAGING AT 0.55T: COMPARISON OF ANATOMIC EVALUATION TO 1.5/3T MRI AND HIGH-RESOLUTION CT

Nicole Seiberlich, PhD (*Abstract Co-Author*) Royalties, Siemens AG;Research support, Siemens AG
Mohannad Ibrahim, MD (*Abstract Co-Author*) Nothing to Disclose
Jayapalli R. Bapuraj, MD (*Abstract Co-Author*) Nothing to Disclose
Shruti Mishra, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Masotti (*Abstract Co-Author*) Nothing to Disclose
Ashok Srinivasan, MD (*Abstract Co-Author*) Nothing to Disclose
Radhika Rajeev, MD (*Abstract Co-Author*) Nothing to Disclose
Eric A. Liao, MD (*Abstract Co-Author*) Nothing to Disclose
Lauren Kelsey, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Reduced susceptibility artifacts at 0.55T may be advantageous for MRI of the temporal bone compared to 1.5/3T (high field; HF). This study aims to compare evaluation of normal temporal bone anatomy at 0.55T to HF by comparing visibility of key anatomic structures and clinically-relevant cochlear measurements, using high-resolution temporal bone computed tomography (HRCT) as a gold-standard.

**METHODS AND MATERIALS**

In this IRB-approved retrospective study, 10 patients (4M, 6F; avg. age 59 yrs.) who underwent internal auditory canal (IAC) imaging on Siemens Healthineers Magnetom Free.Max 0.55T with a comparison HRCT and IAC protocol 1.5/3T MRI (n=6 1.5T; n=4 3T) were included. The 3D T2w sampling perfection and application-optimized contrasts using flip angle resolution (3D T2w SPACE) sequence from the 0.55T protocol was used; one normal ear was selected from each study. At high-field, the comparison high-resolution 3D T2w sequence varied between T2w SPACE and vendor-specific gradient-recalled echo techniques. Exams were anonymized and reviewed independently by three board-certified neuroradiologists. Readers scored visualization of anatomic structures on a 4-point Likert scale (1=not visible, 4=well visualized), measured the length and width of the cochlea (oblique coronal view), and the width of the IAC porus acousticus (axial view). Readers also rated IQ (1=non-diagnostic, 4=excellent) for the MRIs.

**RESULTS**

One reader rated IQ of the 0.55T T2w SPACE lower compared to the HF sequence (p=0.03); there was no significant difference in IQ for the other two readers. For one measurement for one reader (cochlear width, R3), the 0.55T measurement was closer to HRCT (no sig.difference) compared to HF vs HRCT (p=0.002). One measurement for two readers (IAC width; R1, R3) was similar between 0.55T and HF, with both demonstrating significant differences to CT. No anatomic structure had significantly improved visibility at 0.55T compared to HF. One or more readers rated improved visibility at HF compared to 0.55T for the following structures: cochlear apical and middle turns (R2, R3), facial nerve (R2), vestibular nerve (R2), cochlear nerve (R2). Other relationships were not significantly different. All readers scored visualization of the vestibular aqueduct higher on CT compared to both HF and 0.55T.

**CONCLUSION**

Clinically-relevant temporal bone anatomy can be comparably evaluated at 0.55T using the 3D T2w SPACE sequence versus 1.5/3T MRI. Quantitative evaluation with clinically-relevant cochlear measurements was similar or better at 0.55T compared to 1.5/3T when using HRCT as the gold standard.

**CLINICAL RELEVANCE/APPLICATION**

Temporal bone imaging may represent a use-case where evaluation at 0.55T may be similar to conventional field strengths of 1.5/3T.

## S3A-SPHN-3 A COMPARATIVE STUDY OF 3D-FLAIR AND 3D-IR-REAL MR SEQUENCES FOR EVALUATION OF ENDOLYMPHATIC HYDROPS

Guixun Hong, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

3D-FLAIR and 3D-IR-Real MR sequences have been used to for the visualization of endolymphatic hydrops (EH) in Ménière disease (MD). The purpose of this study was to compare the clinical value of high-resolution 3D-FLAIR and 3D-IR-Real MRI sequences for the evaluation of EH.

**METHODS AND MATERIALS**

3D-FLAIR and 3D-IR-Real MR sequences were performed 8 hours after intratympanic gadolinium (Gd) perfusion through auripuncture. Two experienced radiologists reviewed the image quality of both sequences. The EH grades of vestibular, cochlear, and semicircular canals were evaluated using visual grading to compare the SNR and CNR of the 3D-FLAIR and 3D-IR-Real sequences. Paired t-test was used to compare the SNR and CNR of the two sequences. Cohen kappa test was used to evaluate the subjective score of image quality and the EH severity of the two sequences.

**RESULTS**

The image quality reliability between the two radiologists was excellent (0.7 < kappa < 0.9). The image quality difference between 3D-IR-Real and 3D-FLAIR sequences was statistically significant (P<0.001). The SNR of the 3D-IR-Real sequence (132.26±28.86) was higher than that of 3D-FLAIR (34.96±15.52), and the difference was statistically significant (t=-43.64, P<0.001). The CNR of the 3D-FLAIR sequence (22.09±14.15) was higher than that of the 3D-IR-Real (12.38±9.07), and the difference was statistically significant (t=11.92, P<0.001). More severe hydrops was detected with 3D-IR-Real sequences than with 3D-FLAIR sequences in the cochlear and vestibular hydrops (P < 0.001).

**CONCLUSION**

Compared with the 3D-FLAIR sequence, the high-resolution 3D-IR-Real sequence showed higher image quality and more sensitive to the detection of endolymphatic hydrops.

**CLINICAL RELEVANCE/APPLICATION**

3D-IR-Real sequence combined with visual evaluation has more advantages than 3D-FLAIR sequence for MR evaluation of EH. The 3D-IR-Real sequence is also superior to the 3D-FLAIR sequence in its ability to show details of cochlear and vestibular endolymphatic hydrops.

# Abstract Archives of the RSNA, 2024

S3A-SPIN

**Imaging Informatics Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPIN-1 MEDICARE REIMBURSEMENT FOR DIAGNOSTIC MRI: AN ANALYSIS OF THE 2020-2021 PUBLIC USE FILE

Hussein Alhashemy, MD (*Abstract Co-Author*) Nothing to Disclose
Kevin R. Carter, DO (*Abstract Co-Author*) Nothing to Disclose
Zain Hussain, BS (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to analyze the variation in Medicare reimbursement for diagnostic MRI procedures from 2020 to 2021, examining changes in reimbursement valuation and the implications of policy updates.

### METHODS AND MATERIALS

We utilized the '2020 and 2021 National Provider and Supplier Aggregate Report' from CMS, focusing on six MRI HCPCS codes across different anatomical sites. Inflation adjustment was applied using the CPI inflation rate from the U.S. Bureau of Labor Statistics. Compound Annual Growth Rates (CAGR) were calculated and compared across years.

### RESULTS

Inflation-adjusted reimbursement amounts showed significant declines across all examined procedures from 2020 to 2021. Overall, these procedures exhibited negative CAGR values ranging from -8.42% to -5.37%, indicating a consistent trend of decreasing Medicare reimbursement. There was a significant increase in the number of services performed in office settings as compared to facility settings. The MRI scans of the brain, both with and without contrast, demonstrated the highest decrease in reimbursement rates.

### CONCLUSION

Even after accounting for inflation, our findings reveal a concerning decline in Medicare reimbursement for commonly used MRI procedures, particularly for brain MRI. The decrease in reimbursement rates for MRI scans may affect the financial sustainability of providers and access to diagnostic imaging for Medicare beneficiaries. The shift towards more procedures being performed in office settings might reflect changes in practice patterns influenced by economic pressures.

### CLINICAL RELEVANCE/APPLICATION

Understanding the trends in MRI reimbursement is crucial for radiologists and healthcare administrators to adapt to economic changes and ensure the sustainability of diagnostic imaging services. The findings highlight the need for ongoing adjustments in Medicare reimbursement policies to keep pace with inflation and healthcare dynamics.

## S3A-SPIN-2 GENERATIVE AI-BASED FACE ANONYMIZATION METHOD ON HEAD MRI SCANS

Takafumi Nemoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kohei Yamamoto (*Abstract Co-Author*) Nothing to Disclose
Changhee Han (*Presenter*) Nothing to Disclose

### PURPOSE

Recently, the increasing demand for enhanced privacy has highlighted the need for a stringent yet non-detrimental method of anonymizing faces for AI model training and validation. This is particularly important given that Volume Rendering (VR) from head CT or MRI scans can reveal facial contours, potentially serving as visual cues for patient identification. Traditional anonymization methods, which typically involve removing the facial regions often compromise data quality and can cause domain shifts during AI model training and validation. We propose a novel generative AI-based method that effectively anonymizes faces in head MRI scans, while preserving the quality and continuity of the image in 2D.

### METHODS AND MATERIALS

The dataset comprised 195 brain MRI cases, with 156 allocated for training and 39 for validation. We utilized Large Mask Inpainting (LaMa), a Generative Adversarial Network (GAN)-based model for conditional image generation, to restore 2D MRI slices that had randomly-missing regions, ensuring continuity between adjacent slices. For validation, we employed a rule-based method to identify the facial regions and generate corresponding mask images. The areas missing from these masks were then fed into the trained model to regenerate the patients' facial areas. For visual assessment, we reconstructed the facial regions using VR.

### RESULTS

Figure 1 presents a comparison between a traditional anonymization method (Deficit) and our method (Generated) in axial view. The Deficit method significantly altered the visual appearance from the original state (Before) by removing the face front. In contrast, the Generated result, achieved by omitting the mask area before image generation, closely resembled the Before state. Figure 2 displays VR-based reconstruction results of the Before, Deficit, and Generated images. The Generated method achieved sufficient anonymization without compromising image quality. Although setting the mask to be thin results in more realistic images, it also makes it easier to identify individuals, so we used a thicker mask.

### CONCLUSION

We demonstrated that our generative AI-based method can effectively anonymize faces in head MRI scans without degrading 2D image quality.

### CLINICAL RELEVANCE/APPLICATION

Developing accurate medical AI models requires vast amounts of multi-institutional data. In this context, face anonymization is crucial for the safe usage of data. However, conventional anonymization methods often lead to considerable image quality degradation, which could result in accuracy drops in AI models due to data removal and domain shifts. This study offers a fundamental solution to this issue, and we plan to verify the AI model accuracy drops caused by conventional methods compared to our model.

## S3A-SPIN-3 DEVELOPING SYNTHETIC TUMORS IN LIVER, PANCREAS, AND KIDNEY USING GENERATIVE AI

Qi Chen (*Abstract Co-Author*) Nothing to Disclose
Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to generate synthetic tumors that can be generalized to detect and segment real tumors across various organs from CT volumes, encompassing a broad spectrum of patient demographics, imaging protocols, and healthcare facilities.

### METHODS AND MATERIALS

We observe that early-stage tumors tend to have similar imaging characteristics in computed tomography (CT), whether they originate in the liver, pancreas, or kidneys. Leveraging this observation, we introduce a novel framework, termed DiffTumor, that can learn the common imaging characteristics of tumors across various organs. The development of DiffTumor has three stages. (1) Training an Autoencoder Model on 9,262 unlabeled three-dimensional CT volumes. The use of large, diverse datasets can enhance the model's ability to generalize across CT volumes of different patient demographics and reduce the need for annotated tumor volumes for training Diffusion Models in the subsequent stages. (2) Training a Diffusion Model using latent features and tumor masks as conditions. Once trained, this model can generate features necessary for reconstructing CT volumes with tumors based on arbitrary shapes. (3) Training a Segmentation Model using synthetic tumors and their corresponding masks. With a large repository of healthy CT volumes, DiffTumor can produce a vast array of synthetic tumors, varying in location, size, shape, texture, and intensity, improving AI models for tumor detection/segmentation.

### RESULTS

Radiologists #1 (3-year experience) and #2 (7-year experience) only achieved a mean specificity of 30.3% (liver: 31.7%, pancreas: 22.5%, and kidney: 36.7 %) and 38.1% (39.2%, 34.2%, and 40.8%), respectively. Senior Radiologist #3 (10-year experience) and Radiologist #4 (13-year experience) achieved mean specificity of 50.8% (53.3%, 44.2%, and 55.0%) and 45.4% (45.8%, 38.8%, and 51.7%), respectively. In early tumor detection, AI models training with our synthetic tumors achieve Sensitivity of 82.2%, 71.4%, and 78.6%. In all-stage tumor segmentation, AI models training with our synthetic tumors achieve DSC of 70.9%, 64.8%, and 84.2% for liver, pancreatic, and kidney tumors, respectively.

### CONCLUSION

We explored the potential of generative AI for tumor synthesis, which requires minimal annotations, creating synthetic tumors in real-time, augmenting large-scale datasets of healthy organs, and improving tumor detection/segmentation.

### CLINICAL RELEVANCE/APPLICATION

Synthetic data showed promise to improve AI models in detecting early-stage tumors (radius < 2cm) and segment all-stage tumors. Larger-scale external validation (N=30,000) has been launched in collaboration with City of Hope (TGen) and UCSF to con& 7;rm the performance and robustness of these AI models.

## S3A-SPIN-4 PATIENT PRIVACY LEAKS IN LARGE LANGUAGE MODELS AFTER FEDERATED TRAINING ON MEDICAL REPORTS

Klaus Maier-Hein (*Abstract Co-Author*) Nothing to Disclose
Ralf Floca (*Abstract Co-Author*) Nothing to Disclose
Andres Martinez Mora (*Abstract Co-Author*) Nothing to Disclose
Benjamin Hamm (*Abstract Co-Author*) Nothing to Disclose
Dimitrios Bounias, MSc (*Abstract Co-Author*) Nothing to Disclose
Maximilian Zenk (*Abstract Co-Author*) Nothing to Disclose
Santhosh Parampottupadam, PhD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Transformer-based Large Language Models (LLMs), like ChatGPT, have seen remarkable progress in extracting insights from text datasets, including radiology reports. LLMs could maximize their impact by accessing large quantities of radiological reports from different sites. However, data protection laws (like HIPAA) impose strict regulations on data sharing, given the high sensitivity of these data. Federated Learning (FL) emerges as a promising solution for multi-institution environments, as it allows for training using robust datasets without data ever leaving the institution. However, if FL systems are not adequately protected against attacks, reconstruction techniques could leak data from model parameters. In this work, we show how report data from a public radiology dataset could be recovered from transformer models in a simulated FL setup, underscoring the need for proper privacy protection.

### METHODS AND MATERIALS

A transformer-based language AI model was trained on radiological reports from the public dataset Dischargesum, composed of 250k+ diagnosis reports and 68k+ discharge reports. The models were trained with a GPT-2 tokenizer, vocabulary size 50257, and sequences of length 32. Training data were distributed at random to six virtual clients to simulate an FL setup. Data was reconstructed by a malicious central server using gradients shared by the clients. By targeting specific clients, the server exploited scaled versions of the input data from the model's adjustments, applying adjustments in model biases to reconstruct effectively the original input data. The original client report data was compared to the reconstructed data by the server for evaluation. Reconstruction capabilities were assessed by measuring the accuracy of the number of sentences recovered from the original data.

### RESULTS

In the FL setup, a server successfully reconstructed 36% to 42% of the sentences from the diagnosis and discharge datasets. These results, obtained from batches of 64, 128, and 256 tokens, were averaged across ten experiments.

### CONCLUSION

In this work, we showcase how transformers, the backbone for popular LLMs, could expose training data from radiological reports. This is possible even in a FL environment, where patient privacy should be a priority. Consequently, if reports are to be used for AI model training, there is a need for robust privacy-preserving measures.

### CLINICAL RELEVANCE/APPLICATION

This proof-of-concept study underscores the need for robust privacy measures in training Large Language Models through federated learning, particularly as multi-institution collaborations in healthcare increase. The goal is to prevent the leakage of patient data from radiology reports while complying with stringent data protection regulations.

## S3A-SPIN-5 IS YOUR DE-IDENTIFIED RADIOGRAPH TRULY DE-IDENTIFIED?

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Cody Wyles, MD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Shahriar Faghani, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Taunton, MD (*Abstract Co-Author*) Consulting, DJO Global, Inc;Royalties, DJO Global, Inc
Pouria Rouzrokh, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

De-identifying (or anonymizing) medical imaging data is crucial for ensuring patient privacy during research endeavors, data transfers, and the development of artificial intelligence (AI) models. For radiographs, the two most common strategies for de-identification are: 1) the removal or substitution of tags containing protected health information (PHI) in the DICOM metadata, and 2) altering pixel values in areas containing PHI markers on the image itself (e.g., by covering them with a black box). Considering these strategies, we hypothesized that specialized AI models might still detect PHI "fingerprints" from imaging features, potentially revealing patient identities.

### METHODS AND MATERIALS

After obtaining institutional review board approval, we collected 661,124 anterior-posterior (AP), lateral, and oblique hip and pelvis radiographs from our institutional total joint arthroplasty registry. We de-identified them using the aforementioned strategies. The data were then split into training, validation, and test folds at the patient level. We trained a ConvNeXt (v2) model to encode each input radiograph into a one-dimensional vector of size 768. The model was designed to increase the cosine similarity between encoded vectors of imaging pairs belonging to the same patient, regardless of view and time distance, and to decrease it for other pairs. After training, we identified a cosine similarity cutoff threshold for distinguishing the output vectors for a pair of radiographs as belonging to similar or different patients by plotting the Receiver Operating Characteristic (ROC) curve of that prediction on our validation set. We then applied this threshold to our test set and also leveraged t-SNE plots and integrated gradient maps (IGMs) to elucidate the model's performance.

### RESULTS

The comparison of cosine similarity between encoded vectors for radiographic pairs against the calibrated threshold successfully detected true identity relationships in 94% of all possible pairs in the test set. The pipeline had reliable performance even across pairs that contained radiographs of different views and with years of time distance between them. IGMs highlighted the contour of the bones as the most prominent features learned by the model (Figure).

### CONCLUSION

Despite de-identifying radiographs by both of the two most common methods to protect PHI, a self-supervised AI model demonstrated the capability to reidentify them with 94% accuracy.

### CLINICAL RELEVANCE/APPLICATION

Relying solely on DICOM metadata alteration and pixel value changes in radiographs may not sufficiently de-identify them. Medical systems need more robust de-identification and anonymization strategies for highly sensitive data access situations.

## S3A-SPIN-7 UNLOCKING THE INFINITE DATA STREAM: CONTINUAL LEARNING FOR DYNAMIC MULTI-ORGAN AND TUMOR SEGMENTATION

Yu-Cheng Chou, BSc (*Abstract Co-Author*) Nothing to Disclose
Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop an efficient training strategy that enables artificial intelligence (AI) algorithms to learn from massive medical datasets (i.e., 8.5 million images) for multi-organ and multi-tumor segmentation.

### METHODS AND MATERIALS

We developed AI algorithms that can learn from massive computed tomography (CT) data by storing the most significant data in the Replay Buffer (RB). New data comes in and gets added to the RB, which has a defined memory size. When it is full, we discard the oldest data first. At the same time, mini batches are generated through random sampling from the buffer at a defined sampling rate. This ensures efficiency while maintaining the integrity of medical information. To make sure we only keep the most distinctive CT scans from different hospitals, we introduced a Data Pruning (DP) mechanism that computes the cosine similarity among all pairs of data within the RB, and then discard the ones with highest similarity. Furthermore, we formulated a Structure Uncertainty Prioritization (SUP) strategy that keeps data with the top K uncertainty to maintain a buffer focused on the most diagnostically challenging samples. We measure the uncertainty by assigning a weighted entropy based on the ratio of each class's annotation size to the total annotation size. Our experimental evaluation utilized two extensive abdominal CT datasets, one proprietary dataset comprising 15 organ classes split into 2,101 and 516 for training testing, and an assembled dataset consisting of 16 partially labeled sub-datasets offering 32 classes with 2,100 training cases and 583 testing cases. Notably, we maintained a consistent data flow without shuffling in any of our experiments.

**RESULTS**

The single-pass RB approach achieved a Dice Similarity Coefficient (DSC) of 82.22% on the proprietary dataset, closely matching the performance of traditional 100-epoch training (DSC of 82.60%) and significantly outperforming conventional training methods in varied data distributions, with a DSC of 47.22% on the assembled dataset compared to 0.65% with conventional methods. Notably, our approach demonstrated enhanced capability in detecting small structures like the Adrenal Gland, with a DSC of 55.34%.

**CONCLUSION**

Our study demonstrates a significant advancement in AI training for medical imaging, effectively managing large, continuous data flows and mitigating catastrophic forgetting, a common challenge in dynamic clinical environments.

**CLINICAL RELEVANCE/APPLICATION**

This training strategy significantly improves the efficiency and accuracy of AI models in medical image analysis, particularly in detecting intricate structures (e.g., adrenal gland) in massive datasets, enhancing the diagnostic capabilities of radiologists in high-volume clinical settings.

## S3A-SPIN-8 CHARACTERIZING THE IMPACT OF GPCI-ADJUSTMENT ON DIAGNOSTIC ULTRASOUND REIMBURSEMENT DISPARITIES: AN RVU-BASED ANALYSISOF BUDGET NEUTRALITY

Maryamnaz Falamaki, MD (*Abstract Co-Author*) Nothing to Disclose
Talha Ayaz, MD (*Abstract Co-Author*) Nothing to Disclose
Zain Hussain, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the efficacy of Medicare’s Geographic Practice Cost Indices (GPCI) adjustments in mitigating regional disparities in ultrasound reimbursement among diagnostic radiologists with regards to practice setting, provider gender and exam type.

**METHODS AND MATERIALS**

Using the 2021 Medicare Public Use File, we assessed claims for the following procedures: Ultrasound of the abdomen, complete (76700); Ultrasound of the head and neck (76536); Ultrasound of one breast, complete (76641); Ultrasound of the pelvis, complete, not related to pregnancy (76856); and Transvaginal ultrasound pelvis (76830). Data were standardized using the CMS Physician Fee Schedule Look-Up Tool and adjusted for inflation via the U.S. Department of Labor's CPI. Statistical analyses included univariable and multivariable linear regressions with generalized estimating equations to identify factors influencing Relative Value Units (RVUs) per beneficiary.

**RESULTS**

In 2021, 1,814,182 ultrasound services were provided to 2,160,804 Medicare beneficiaries across various regions and settings. The most frequently performed study was “ultrasound of the head and neck (CPT 76536)” with a total of 559,003 exams, followed by “ultrasound of the abdomen, complete (CPT 76700)” totaling 529,549 exams. After adjusting for inflation, statistical analyses showed that significant regional differences persist after controlling for GPCI, particularly with regards to facility settings consistently yielding lower RVUs than office settings. For example, the Midwest's coefficient shifted from -0.349 in the unadjusted model to -0.054 in the adjusted model. Similarly, the South's effect decreased from -0.268 to -0.002 (all $p<0.05$). When all three GPCI metrics were incorporated into the multivariable final risk model, the R squared value increased by approximately 1.3%, indicating GPCI partially mediates for regional disparities in RVUs per beneficiary.

**CONCLUSION**

This study illustrates that despite GPCI adjustment, some regional disparities in RVUs per beneficiary for diagnostic ultrasound reimbursement persist. This suggests that revision of reimbursement valuations is necessary to better reflect the true costs and needs across different regions.

**CLINICAL RELEVANCE/APPLICATION**

Findings from this study are crucial for policymakers and healthcare administrators, highlighting the necessity for refined Medicare reimbursement strategies to ensure equitable distribution of healthcare resources and quality care across the United States.

# Abstract Archives of the RSNA, 2024

S3A-SPIR

**Interventional Radiology Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPIR-1 EMBOLOTHERAPY FOR PULMONARY ARTERIOVENOUS MALFORMATIONS IN PEDIATRIC POPULATION WITH HEREDITARY HEMORRHAGIC TELANGIECTASIAS - A RETROSPECTIVE CASE SERIES

Haraldur Bjarnason, MD (*Abstract Co-Author*) Nothing to Disclose
Nadir Demirel (*Abstract Co-Author*) Nothing to Disclose
Vivek Iyer (*Abstract Co-Author*) Nothing to Disclose
Sanjay Misra, MD (*Abstract Co-Author*) Support, Cardinal Health, Inc
Emily C. Bendel, MD (*Abstract Co-Author*) Nothing to Disclose
Haseeb Mukhtar, MBBS, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To document the role of embolotherapy for pulmonary arteriovenous malformation (pAVM) management, and investigate factors associated with pAVM persistence after embolotherapy in pediatric patients with hereditary hemorrhagic telangiectasia (HHT).

### METHODS AND MATERIALS

Pediatric HHT patients who received embolotherapy for pAVMs at our institute were retrospectively identified from January 1st, 1999, to January 31st, 2024. Cases with adequate clinical and imaging follow-up and without prior pAVM treatment at another institute were included. Demographic, clinical, and procedural data were obtained from the electronic health record. Categorical variables were reported as count with percentage, while continuous variables were reported as median with range. Univariate Cox proportional hazard models were used to determine factors associated with primary pAVM persistence. Multivariate analysis could not be done due to the small sample size.

### RESULTS

Twenty-one patients (median age=15 years) were treated for 65 different pAVMs in 40 distinct procedures (Median follow-up time=7.56 years). ENG was the most common genetic mutation (84.6%). One major procedural complication occurred (coil embolization to the right middle cerebral artery). Persistence occurred in 15 out of the 65 treated pAVMs (23.1%). The cumulative probability of persistence at 5 years was 25.0% (95% CI: 63.7% - 84.8%). Recanalization was the most common cause of primary persistence (73.3%). Age below the median cutoff of 15 years (p=0.0436) and greater maximum diameter of the plug/coil (p=0.0106) were significantly associated with primary persistence on univariate analysis.

### CONCLUSION

Embolotherapy is an effective option for pAVM management in the pediatric population with HHT. The risk of primary persistence was associated with age below 15 years, and the use of larger diameter plugs/coils.

### CLINICAL RELEVANCE/APPLICATION

Data on pAVM embolotherapy specifically in pediatric HHT patients is limited. This study therefore sheds further light on this important subject and demonstrates the efficacy and safety of embolotherapy in this subgroup of patients.

## S3A-SPIR-2 CORRELATION BETWEEN VASCULAR ANATOMIC VARIANT OF PROSTATIC ARTERY AND CLINICAL EFFICACY OF PROSTATIC ARTERIES EMBOLIZATION

Maria A. Cova, MD (*Abstract Co-Author*) Nothing to Disclose
Michele Pontello (*Abstract Co-Author*) Nothing to Disclose
Manuel Belgrano, MD (*Abstract Co-Author*) Nothing to Disclose
Michelangelo Digregorio, MD (*Presenter*) Nothing to Disclose

### PURPOSE

the aim of this study is to correlate anatomical variations of the prostatic artery with short-term clinical efficacy.

### METHODS AND MATERIALS

this is a single-center retrospective study involving 132 patients with benign prostatic hyperplasia symptoms who underwent prostatic artery embolization from February 2016 to February 2023. Technical success is defined as embolization of the prostatic artery on at least one pelvic half. Short-term clinical efficacy is defined as the absence of symptoms requiring surgery within 12 months.

**RESULTS**

out of 132 patients, 95 (72%) underwent bilateral embolization, 28 (21.2%) underwent unilateral embolization, and 9 (6.8%) did not undergo embolization due to vessel non-visualization or particularly unfavorable vascular anatomy. The procedure was technically successful in 93,2% of cases. A total of 218 prostatic arteries were embolized. Type I variant was found 104 times (47.7%), type II variant was found 39 times (17.9%), type III variant was found 51 times (23.4%), and type IV variant was found 24 times (11%). Out of 123 technically successful procedures, surgery within 12 months was necessary in 13 cases (10.5%). 2 out of these 13 patients were treated with unilateral prostatic artery embolization, while the remaining 11 were treated with bilateral embolization. Type I variant was found at least on one side 10 times; Type II variant was found at least on one side 3 times; Type III variant was found at least on one side 1 time; and Type IV variant was found at least on one side 3 times. Type I variant on at least one pelvic half is associated with a short-term clinical efficacy rate of 90.4%. Type II variant on at least one pelvic half is associated with a short-term clinical efficacy rate of 92.3%. Type III variant on at least one pelvic half is associated with a short-term clinical efficacy rate of 98%. Type IV variant on at least one pelvic half is associated with a short-term clinical efficacy rate of 87.5%.

**CONCLUSION**

although the small size of the study population severely limits statistical significance, the type III variant seems to be associated with the highest short-term efficacy rate, while the type IV variant seems to be associated with the lowest short-term efficacy rate.

**CLINICAL RELEVANCE/APPLICATION**

the type of vascular anatomic variant of the prostatic artery could represent an additional variable to consider in patient selection.

## S3A-SPIR-3 CLINICAL AND IMAGING OUTCOMES OF DOXYCYCLINE EXCHANGE SCLEROTHERAPY FOR LYMPHATIC MALFORMATIONS

Prateek C. Gowda, BS (*Abstract Co-Author*) Nothing to Disclose
Clifford R. Weiss, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Siemens AG;Research Grant, Boston Scientific Corporation;Consultant, Boston Scientific Corporation;Research Grant, Medtronic plc;Consultant, Medtronic plc;Research Grant, Guerbet SA;Consultant, Guerbet SA
Anna J. Gong (*Abstract Co-Author*) Nothing to Disclose
Christopher Bailey, MD (*Abstract Co-Author*) Nothing to Disclose
Adham Khalil, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Robert M. Weinstein (*Abstract Co-Author*) Nothing to Disclose
Tushar Garg, MD (*Abstract Co-Author*) Conference Travel, Siemens Healthineers
William Morefield (*Abstract Co-Author*) Nothing to Disclose
Dana A. Schaar (*Presenter*) Nothing to Disclose

**PURPOSE**

Evaluate serial doxycycline exchanges (SDEs) for lymphatic malformations (LMs).

**METHODS AND MATERIALS**

We performed a retrospective, single-center chart review of patients undergoing LM sclerotherapy with SDE at our large, tertiary care academic institution from April 2003 through March 2023. Change in patient symptoms between pre- and post-treatment clinical notes was the primary outcome measure, which was assessed based on the resolution of patient-specific presenting symptoms. Secondary outcomes were percent change in lesion volume measured from imaging studies, evaluated using three-dimensional ellipsoidal approximation, and 30-day adverse events.

**RESULTS**

Forty-six patients (25 of 46 [54.3%] male) received an average of 1.9 (±1.0) treatments with 4.8 (±2.3) exchanges per treatment including the initial instillation in the interventional radiology suite. Patients presented at a mean age of 14.83 years (±21.65 years). Swelling (28/46; 60.9%) and discomfort (8/46; 17.4%) were the most prevalent initial symptoms. Of the 46 patients, 24 (52.2%) had one SDE admission, 14 (30.4%) had 2 separate admissions, and 8 (17.4%) had at least 3 separate admissions. Patients presented for additional treatment predominantly because of inadequate resolution of their initial presenting symptoms. Eight adverse events were observed, characterized as 4 mild, 3 moderate, and 1 severe. Of the 46 patients, 44 had appropriate follow-up to assess clinical change. Of the 44 patients, 4 (9.1%) experienced full clinical remission, 27 (61.4%) experienced improved clinical symptoms, and 13 (29.5%) experienced either unchanged or increased symptoms. LM size was reduced by a median of 63.4% (interquartile range [IQR] 63.9) after 1 series of exchanges and by an additional 64.4% (IQR 69.5) after a second series. Of 34 patients, 27 (79.4%) experienced a reduction in mean lesion size after all treatments, and 7 (20.6%) experienced an increase.

**CONCLUSION**

The majority of patients experienced improved clinical symptoms and a reduction in LM size at the conclusion of SDE therapy.

**CLINICAL RELEVANCE/APPLICATION**

SDE therapy is a safe and effective treatment of LMs that allows for multiple sessions of sclerotherapy with a single fluoroscopic procedure.

## S3A-SPIR-4 RELATIONSHIP BETWEEN PROPORTION OF ADENOMYOSIS AND EFFICACY OF UTERINE ARTERY EMBOLIZATION

Gyeong Sik Jeon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hyewon Yang (*Presenter*) Nothing to Disclose

**PURPOSE**

Uterine artery embolization (UAE) is a well-established treatment option for uterine fibroids and adenomyosis. The existing literature suggests that UAE efficacy is lower for patients with adenomyosis. Many patients present with concomitant uterine fibroids and adenomyosis, but few studies have addressed this patient population. The purpose of this study was to assess whether the proportion of adenomyosis affected treatment success and recurrence rates.

**METHODS AND MATERIALS**

This single-center retrospective study evaluated patients between March 1st, 2011 to June 30th 2023 undergoing UAE for adenomyosis. The patient's clinical characteristics and magnetic resonance imaging findings were analyzed. Patients were sorted into three groups based on proportion of adenomyosis: (a) Pure adenomyosis, (b) Mixed - myoma dominant (c) Mixed - adenomyosis dominant.Clinical symptoms were evaluated using the Uterine Fibroid Symptom and Quality of Life (UFS-QOL) questionnaire. UAE was considered successful when patients reported a decreased level of

symptom severity. Symptoms leading to a secondary surgical procedure or intervention was considered symptom recurrence. Descriptive statistics was used to evaluate clinical success rates and symptom recurrence between these three groups.

**RESULTS**

102 patients (mean age, 41 ± 5.4 years) with varying degrees of adenomyosis underwent UAE. 52 patients had only adenomyosis and 50 patients had concomitant uterine fibroids and adenomyosis. Of the latter, 24 patients had an adenomyosis volume larger than twice the summative volume of fibroids and were considered mixed - adenomyosis dominant. Average clinical follow-up was 9.4 months (range 1-65 months). Clinical success rates were 94.23% for the pure adenomyosis group (49/52), 92.31% for the myoma dominant group (24/26), and 91.67% for the adenomyosis dominant group (22/24) (p=0.9019). Symptom recurrence occurred in 40.82% (20/49), 29.17% (7/24), and 31.82% (7/22) (p=0.5633), respectively. There was no statistically significant difference between the three groups.

**CONCLUSION**

Our clinical experience suggests that treatment success and symptom recurrence in patients treated with UAE is not affected by proportion of adenomyosis.

**CLINICAL RELEVANCE/APPLICATION**

In patients with concomitant adenomyosis and uterine fibroids, the proportion of adenomyosis should not be a deterrent for treatment with uterine artery embolization.

## S3A-SPIR-5 PREDICTING THE THERAPEUTIC TEMPERATURE OF TRANSCRANIAL MRGFUS BASED ON MULTILAYER PERCEPTRON NETWORK

Mingliang Yang (*Abstract Co-Author*) Nothing to Disclose
Yan Li (*Abstract Co-Author*) Nothing to Disclose
Xin Lou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Haoxuan Lu (*Abstract Co-Author*) Nothing to Disclose
Yongqin Xiong (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a prediction model for predicting the treatment temperature of transcranial magnetic resonance-guided focused ultrasound with preset parameters, to quantitatively assess the accuracy of the predicted temperature, and to analyze the efficacy of different predictors on the predicted temperature.

**METHODS AND MATERIALS**

The authors retrospectively analyzed consecutive participants with essential tremor or Parkinson's disease who received MRgFUS treatment between January 2019 to June 2023 at their center. The average maximum temperature at the target were obtained for each sonication by using MR thermometry. The magnitude of the effect of 5 different predictors (e.g., energy per sonication) or combinations of predictors on the efficacy of the multilayer perceptron focused ultrasound temperature network (Fust-Net) for target temperature prediction at the target site was analyzed and tested.

**RESULTS**

A total of 90 participants (799 sonications; mean age, mean age, 64.00 years [SD, 9.27 years]; 67 male participants) were included in the study. Fust-Net obtained the best predictive performance from the combination of Skull Density Ratio (SDR), planned energy, planned duration, head size, and mean skull area predictors, achieving the prediction of the mean maximum temperature (mean absolute error 1.976, effective prediction temperature 91%), with test sets of 18 participants with 199 sonications data for each sonication. The sub-predictor importance was verified by ablation experiments for planned energy, SDR, planned duration, head size and average skull area, respectively.

**CONCLUSION**

A multilayer perceptron prediction model that predict the therapeutic temperature of MRgFUS treatment shows promise in setting the treatment parameters and improving the success rate and safety of treatment.

**CLINICAL RELEVANCE/APPLICATION**

A multilayer perceptron-based MRgFUS treatment temperature prediction model was developed which holds the potential to simplify MRgFUS treatment protocols, and improve patient's safety by enabling more accurate and facile temperature control during MRgFUS procedures.

## S3A-SPIR-6 SAFETY AND EFFICACY OF VENOUS COIL-EMBOLIZATION OF DO'S TYPE IIA PELVIC ARTERIOVENOUS MALFORMATIONS

Sang Yub Lee (*Abstract Co-Author*) Nothing to Disclose
Young Soo Doo (*Abstract Co-Author*) Nothing to Disclose
Lyo Min Kwon (*Abstract Co-Author*) Nothing to Disclose
Gwanghyun Kim, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the safety and efficacy of coil embolization of venous segments in patients with Do's type IIa pelvic arteriovenous malformations (AVM).

**METHODS AND MATERIALS**

A retrospective analysis from March 2017 to February 2023 was performed in 13 patients (mean age 42.2 ± 14.2 years, 7 males) who underwent transvenous coil embolization for type IIa pelvic AVM (AVM with multiple arterioles shunting to focal venous segments of the draining vein) without using additional liquid embolic agents. Treatment outcomes were analyzed based on clinical findings, post-angiography findings, and follow-up computed tomography (CT) scans to evaluate technical success, clinical success, and complete remission rates.

**RESULTS**

Of the 13 patients, 12 received single treatment with coil embolization [transvenous access (n=9) and direct puncture (n=3)]. In one patient, a transvenous approach was initially attempted but failed because of the untraceable draining vein, and successful embolization was performed in the second session with direct puncture. The technical success rate was 92.8% (13/14). All symptomatic patients experienced symptom improvement and asymptomatic patients remained symptom-free, resulting in a clinical success rate of 100% (13/13). Follow-up CT imaging in nine of the 12 patients showed complete occlusion of the AVM without recurrence. One minor complication, a small amount of retroperitoneal hemorrhage that resolved spontaneously, was observed in one patient; no major complications were observed.

### CONCLUSION

Coil embolization of the draining vein segment without the additional use of liquid embolic agents is safe and effective for managing type IIa pelvic AVM.

### CLINICAL RELEVANCE/APPLICATION

Type II pelvic AVMs can be managed safely and effectively through embolization using a coil only, without the additional use of the liquid embolic agent ethanol.

## S3A-SPIR-8 SUPERIOR HYPOGASTRIC NERVE BLOCK AS AN ADJUNCT TO UTERINE FIBROID EMBOLIZATION: A RETROSPECTIVE COHORT STUDY EVALUATING OPIOID-SPARING EFFECTS

Ali N. Harb, MD (*Abstract Co-Author*) Nothing to Disclose
Arif Musa, MD, MS (*Abstract Co-Author*) Research Grant, Stryker Corporation;Contract, WebMD Health Corp (WebMD, Inc)
Jawad Muayad (*Abstract Co-Author*) Nothing to Disclose
Zain Hussain, BS (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to evaluate the efficacy of Uterine Fibroid Embolization (UFE) with versus without Superior Hypogastric Nerve Block (SHPB) in reducing opioid use post-procedure, further addressing the paucity of data on opioid-sparing strategies in the management of uterine fibroids.

### METHODS AND MATERIALS

A retrospective cohort study utilized TriNetX data, analyzing opioid usage among women diagnosed with uterine leiomyomas who underwent UFE alone (CPT 37243) and UFE with SHPB (CPT 64517) within the 90-day post-operative period. Propensity score matching adjusted for demographics and comorbidities, ensuring balanced comparison across cohorts. Time-to-event analyses were conducted using Cox Proportional hazards modeling and Kaplan-Meier analysis.

### RESULTS

After matching, our study included two cohorts of 112 patients each. Within 90-days after surgery, the UFE with SHPB group showed a statistically significant reduction in opioid use post-procedure, with a Risk Difference of -13.393% (95% CI: -26.328%, -0.458%), Risk Ratio of 0.746 (95% CI: 0.558, 0.996), and Hazard Ratio of 0.673 (95% CI: 0.455, 0.995, p=0.0095) compared to the UFE alone group.

### CONCLUSION

UFE with SHPB is associated with significant reduction in opioid consumption in the postoperative period compared to UFE alone, highlighting the benefits of integrating SHPB as a pain management strategy in minimally invasive fibroid treatment.

### CLINICAL RELEVANCE/APPLICATION

These findings suggest that incorporating SHPB in UFE procedures can enhance postoperative recovery by minimizing opioid use, thus offering a potentially preferable treatment alternative for women with symptomatic uterine fibroids. This approach may reduce opioid-related side effects and improve overall patient outcomes.

## S3A-SPIR-9 COMPARATIVE PERI- AND POST-OPERATIVE COMPLICATIONS IN WOMEN AFTER UTERINE ARTERY EMBOLIZATION VERSUS HYSTERECTOMY FOR FIBROIDS AND ADENOMYOSIS

James B. Spies, MD (*Abstract Co-Author*) Nothing to Disclose
Stephen Bush (*Abstract Co-Author*) Nothing to Disclose
Frank Annie (*Abstract Co-Author*) Nothing to Disclose
Amy R. Deipolyi, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Uterine fibroids and adenomyosis are common women’s health issues that often require intervention. Despite prior studies showing the efficacy of uterine artery embolization (UAE), it is rarely performed compared with hysterectomy. This observational study used TriNetX, a multi-institution database of anonymous health information gleaned from electronic medical records, to compare large cohorts of women with fibroids and adenomyosis who underwent either UAE or hysterectomy, focusing on peri- and post-procedure complications.

### METHODS AND MATERIALS

All 141,119 consecutive women with fibroids and/or adenomyosis who underwent hysterectomy or UAE from 1/1/2016-1/1/2024 in US institutions participating in TriNetX were included. Demographic (age, race, location) and clinical (comorbidities) patient characteristics and adverse outcomes including pelvic floor prolapse, bowel obstruction, peri-procedure blood transfusion, and length of stay, were recorded. Hysterectomies were categorized as open or laparoscopic, and as transabdominal or transvaginal. A propensity score matching (PSM) analysis compared all UAE patients to subgroups of women who underwent different types of hysterectomy, matched by race, age, and medical comorbidities.

### RESULTS

139,621 women underwent hysterectomy whereas 1,498 (1%) underwent UAE. UAE utilization was more likely among women who were black (2.2 v. 0.6%; P<0.01) and younger (44±9 v. 50±11 years; P<0.01). Hysterectomy was associated with more frequent periprocedural blood transfusions (4.3 v. 0.7%, P<0.01), longer post-procedure hospitalizations (10 v. 1 day, P=0.01), and higher rates of intestinal obstruction (4.9 v. 1.7%, P<0.01) and pelvic floor prolapse (5.3 v. 1.2%, P<0.01) within 5 years. PSM analysis showed that abdominal hysterectomy had the longest hospitalizations (5 days) and highest blood transfusion rate (3%); vaginal hysterectomy had the highest rate of pelvic floor prolapse (17%). After UAE, there was a 3% reintervention rate and 17% pregnancy rate.

### CONCLUSION

Hysterectomy is associated with more perioperative blood transfusions, longer hospitalizations, and increased rates of intestinal obstruction and pelvic floor prolapse.

### CLINICAL RELEVANCE/APPLICATION

As a minimally invasive therapy, UAE may be superior to hysterectomy in the treatment of fibroids and adenomyosis, avoiding potential complications including pelvic floor prolapse and bowel obstruction.

# Abstract Archives of the RSNA, 2024

S3A-SPMK

**Musculoskeletal Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPMK-1 MRI FEATURES OF PLANTAR VEIN THROMBOSIS

Durval D. Santos, MD (*Abstract Co-Author*) Nothing to Disclose
Atul K. Taneja, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ariadne Obrigon (*Abstract Co-Author*) Nothing to Disclose
Laercio A. Rosemberg, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Adham A. Castro, MD (*Abstract Co-Author*) Nothing to Disclose
Alexandre L. Santos (*Abstract Co-Author*) Nothing to Disclose
Frederico C. Miranda, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Plantar vein thrombosis (PVT) is an underdiagnosed condition that affects the deep plantar veins, presenting a challenging clinical diagnosis, due to its non-specific symptoms that often resemble other foot pathologies.The goal of this study was to evaluate the magnetic resonance imaging (MRI) findings in patients diagnosed with plantar venous thrombosis and to enhance the understanding of this condition.

### METHODS AND MATERIALS

Comprehensive analysis was conducted on a substantial data which includedage (years), sex (male, female), weight (kg), height (m), symptoms (acute pain, chronic pain, trauma, asymptomatic), body mass index (BMI), time between the onset of pain and carrying out an MRI exam (days). This analysis encompassed data from 112 anonymized patients, with a total of 130 MRI exams (86 of the forefoot and 44 of the ankle) showing imaging findings of PVT.

### RESULTS

Upon evaluating all the veins of the foot, we observed a higher frequency of involvement of the lateral plantar veins (53.1%) when compared to the medial veins (3.8%). In the forefoot, the most affected vascular segments were the plantar metatarsal veins (45.4%), the plantar venous arch (38.5%), and the plantar communicating veins (25.4%). MRI revealed consistent findings, including perivascular edema (100%), muscular edema (86,2%), venous ectasia (100%), perivascular enhancement (100%), and venous filling defects (97,7%).

### CONCLUSION

This study evaluated the findings of PVT diagnosed by MRI, describing the frequency of the most affected veins. When considering the entire foot or just the ankle, the lateral plantar vein was most frequently affected (53.1% and 97.7%, respectively). In the forefoot, the plantar metatarsal veins were most commonly involved (68.6%). As for the imaging findings, venous ectasia, edema and perivascular enhancement were present in 100% of the cases, followed by filling defect, which was observed in 97.7% of the cases. In the assessment of painful conditions of the foot, it is crucial to consider PVT as a potential diagnosis. PVT appears to be a less common variant of a more proximal deep venous thrombosis, which is a more prevalent condition, sharing similar risk factors. However, mechanical load and stress appear to be a unique risk factor specifically associated with PVT.

### CLINICAL RELEVANCE/APPLICATION

As we enhance awareness of this condition and the corresponding MRI findings, it may become easier to recognize and accurately diagnose this pathology.

## S3A-SPMK-2 DEVELOPMENT OF DEEP LEARNING MODEL FOR DETECTING LOW BONE MINERAL DENSITY IN THE FEMORAL NECK AND LUMBAR VERTEBRAE USING CHEST RADIOGRAPHS

Takahiro Ideta (*Abstract Co-Author*) Nothing to Disclose
Takayuki Ishida, PhD (*Abstract Co-Author*) Nothing to Disclose
Kouichi Yamamoto (*Abstract Co-Author*) Nothing to Disclose
Yutaka Katayama (*Abstract Co-Author*) Nothing to Disclose
Akane Utsunomiya (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Matsuzawa (*Abstract Co-Author*) Nothing to Disclose
Takao Ichida, RT (*Abstract Co-Author*) Nothing to Disclose
Yukino Ohta (*Presenter*) Nothing to Disclose

### PURPOSE

Artificial intelligence (AI) technologies can detect overall osteoporosis on chest radiographs with high accuracy. Bone loss can appear in various body parts based on individuals' lifestyle and body shape, it is necessary to detect low bone mineral density (BMD) in each part to alert patients and enable early

treatment. Therefore, we developed two types of deep learning models to detect and differentiate low BMD in the femoral neck and lumbar vertebrae, and evaluated their effectiveness and characteristics.

**METHODS AND MATERIALS**

We used chest radiographs and BMD values, measured using dual-energy X-ray absorptiometry, of 2728 female examinees who underwent health examinations. Chest radiographs were categorized into low BMD (n=1358) and normal (n=1370) based on the BMD of the femoral neck. In addition, the radiographs were also classified into low BMD (n=562) and normal (n=2166) based on the BMD of the second to the fourth lumbar vertebrae. A deep learning model was developed to detect low BMD in the femoral neck and another to detect low BMD in the lumbar vertebrae. They were trained using whole chest radiographs, and 10-fold cross-validation method was used for training. The sensitivity, specificity, overall accuracy, and area under the curve (AUC) were used to evaluate the performance of the deep learning models. To get visual explanations in the images used by the deep learning models for classification, average heatmaps were generated using Explainable AI.

**RESULTS**

For detecting low BMD in the femoral neck, the sensitivity, specificity, overall accuracy, and AUC were respectively 75.4 %, 75.2 %, 75.3 % and 0.82. For detecting low BMD in the lumbar vertebrae, they were respectively 89.5 %, 89.1 %, 89.3 % and 0.96. The overall accuracy for the lumbar vertebrae was 14.0 % higher than that for the femoral neck. The heatmap distributions were near the distal ends of clavicle and cardiac shadow for the detection of low BMD in the femoral neck, whereas they were observed around the proximal ends of clavicle and upper thoracic vertebrae for the detection of low BMD in the lumbar vertebrae.

**CONCLUSION**

The proposed deep learning model could detect low BMD from chest radiographs and distinguish low BMD parts. Detecting low BMD in the femoral neck yielded moderate performance, whereas in the lumbar vertebrae yielded high performance. Detecting low BMD in the femoral neck was more challenging. Regions showing characteristics of low BMD in each part were respectively identified on the images.

**CLINICAL RELEVANCE/APPLICATION**

This model can detect low BMD, which is the early stage of osteoporosis, and identify parts with bone loss from chest radiographs. This enables simple screening and may be effectiveness for appropriate prevention and treatment depending on the bone loss parts.

## S3A-SPMK-3 RADIOMICS-BASED ARTIFICIAL INTELLIGENCE MODEL DIFFERENTIATING LIPOMA FROM ATYPICAL LIPOMATOUS TUMOR

Luz Moran (*Abstract Co-Author*) Nothing to Disclose
Rut Bernal Leon (*Abstract Co-Author*) Nothing to Disclose
Alberto Ramirez Garcia-Mina, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a Radiomics-based Machine Learning model able to distinguish between lipoma and atypical lipomatous tumor (ALT) on MRI and evaluate its performance.

**METHODS AND MATERIALS**

A total of 59 patients with a lipomatous soft tissue tumor were included from August 2015 to December 2023 retrospectively in a single institution. All patients had an MRI study including T1-weighted, T2-weighted, and PD SPAIR-weighted sequences and a core needle biopsy with the determination of MDM2 gene amplification by FISH. The lesion that had no MDM2 amplification was considered a lipoma, and the lesion with MDM2 amplification was defined as ALT. There were 42 lipomas (mean age, 60.2; sex ratio, 19:23) and 17 ALTs (mean age, 64.4; sex ratio, 9:8). A 3D segmentation was performed for each lesion in the three sequences using the software MM Radiomics (syngo.via Frontier v. 1.4.0). 854 radiomic features were extracted from each ROI from the original images (first-order, shape, and texture features) and the images obtained by applying Wavelet filter using MM Radiomics.Different Machine Learning models (support vector machine, K-nearest neighbors, decision trees, and neural network) were developed using Classification Learner in MATLAB. SMOTE (Synthetic Minority Oversampling Technique) was applied for handling imbalanced data, as ALTs were a minority class in the study population. The performance of the different models (ROC AUC score, accuracy, sensitivity, specificity, and F1-score) was evaluated using five-fold stratified cross-validation.

**RESULTS**

The best performance was achieved with a neural network model using only the T1-weighted images: accuracy, 94%; AUC-ROC, 0.97; sensitivity, 95.2%; specificity, 92.9%. Using the T2 or PD SPAIR-weighted images did not add value to the performance of the models. The best combined model with T1, T2, and PD SPAIR-weighted images was a support vector machine algorithm: accuracy, 92.9%; AUC-ROC, 0.94; sensitivity, 95.2%; specificity, 90.5%.

**CONCLUSION**

Machine learning based radiomics analysis using MR imaging can differentiate lipoma from atypical lipomatous tumor.

**CLINICAL RELEVANCE/APPLICATION**

Machine learning based radiomics analysis may help in more accurate identification of lipoma and atypical lipomatous tumor, with the potential to improve the diagnostic workflow of these lesions.

## S3A-SPMK-4 DIAGNOSTIC ACCURACY OF MULTIPLE FAST DEEP LEARNING-BASED MRI PROTOCOLS IN DIAGNOSING STRUCTURAL INJURIES OF THE KNEE: COMPARISON WITH STANDARD MRI PROTOCOL

Fabio Lombardo, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandro Spezia (*Abstract Co-Author*) Nothing to Disclose
Emanuele Quartuccio (*Abstract Co-Author*) Nothing to Disclose
Giovanni Foti, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Calculating the diagnostic accuracy of multiple deep learning (DL) protocols with decreasing acquisition times in identifying structural knee injuries, in comparison to standard magnetic resonance imaging (MRI) protocol.

**METHODS AND MATERIALS**

This prospective institutional review board-approved study included consecutive patients studied between June 2023 and March 2024. All patients underwent standard MRI knee protocol, including multiplanar 3 mm T1 (TR 671; TE 9.8), STIR (TR 3590; TE 46.4) and DP fat-saturated (TR 1706; TE

37.9) sequences (acquisition time 20 minutes) and commercially available DL protocols characterized by a reduction in acquisition times by 2, 4, and 6 times (acquisition time 10, 5 and 3 minutes) the same day. Four radiologists (21, 16, 13 and 5 years of experience, respectively), blinded to standard MRI protocol, evaluated the presence of meniscal, tendon, ligament tears, bone marrow or chondral lesions on DL protocols. Standard MRI images served as standard of reference. For each patient, 12 zones were considered. Diagnostic accuracy values of DL protocol (qualitative assessment) were calculated on a per-injury basis using a multi-reader multi-case analysis. Inter-observer agreement was calculated with Kendall coefficient. A value of $p<0.05$ was considered statistically significant.

**RESULTS**

100 patients (58 males, mean age 55 years) were enrolled, with 1200 zones evaluated. Standard MRI revealed the presence of structural abnormality in 344/1200 zones (29%). Sensitivity and specificity of two-fold, four-fold and six-fold reduced DL protocols were 99% (340/344) and 99% (854/856), 98% (336/344) and 99% (849/856), 78% (268/344) and 80% (681/856). Kendall's tau-b coefficient was calculated as 0.92, 0.91 and 0.77, for the two-fold, four-fold and six-fold reduced DL protocols, respectively.

**CONCLUSION**

The two-fold and four-fold reduced DL protocols of the knee showed high diagnostic accuracy values, with respect to standard MRI protocol. A drop in accuracy was achieved by using the six-fold protocol.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning two-fold and four-fold DL MRI protocols allowed to reduce the acquisition time with respect to standard MRI protocol, without any loose of diagnostic accuracy. DL sequences could be employed in clinical practice to reduce the acquisition time and the risk of motion artifacts.

## S3A-SPMK-5 MR T2 MAPPING ANALYSIS OF TALAR CARTILAGE IN THE ANKLE: INVESTIGATING CORRELATIONS WITH TRAUMA MECHANISMS

Jang Gyu Cha, MD (*Abstract Co-Author*) Nothing to Disclose
Yu Sung Yoon, MD (*Abstract Co-Author*) Nothing to Disclose
Eun Kyung Khil, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the physiological and functional characteristics of talar cartilage in ankle trauma patients through MRI T2 mapping analysis, delineating cartilage changes based on ankle trauma mechanisms.

**METHODS AND MATERIALS**

In this retrospective study, a total of 78 adult patients with ankle trauma underwent ankle MRI with T2 mapping between January 2021 and October 2022. Trauma mechanisms were classified using the Lauge-Hansen classification, dividing patients into supination (S group) and pronation (P group) groups. Patients were also categorized based on posterior malleolar (PM) involvement. T2 values of talar cartilage were quantitatively measured in six anatomical regions using MRI T2 mapping sequence protocols. Interobserver and intraobserver reliability of T2 mapping measurements were assessed by two experienced musculoskeletal radiologists. Comparative analyses of T2 mapping values in each anatomical region of the talus were conducted between the two groups stratified by trauma mechanism. Furthermore, comparisons were made based on PM involvement status within each group.

**RESULTS**

Among 78 patients (mean age: 38.62 ± 14.82 years; 60.3% male, 39.7% female), 53 were in the S group and 25 in the P group, with 53 having PM involvement. The P group exhibited significantly higher T2 values in the entire lateral portion of talar cartilage compared to those in the S group ($p < 0.001$). Conversely, individuals in the S group showed significantly higher T2 values in the entire medial portion ($p < 0.001$). Furthermore, PM involvement correlated with elevated T2 values in the posterior portion of talar cartilage (medial, lateral and bilateral compartments, $p= 0.005$, 0.011, 0.001, respectively). Interobserver and intraobserver reliability of T2 mapping measurements were 0.70-0.89 and 0.66-0.89, respectively.

**CONCLUSION**

Our study highlights significant T2 value discrepancies linked to trauma mechanisms and PM involvement. These findings underscore the clinical relevance of T2 mapping in ankle injury assessment and treatment guidance.

**CLINICAL RELEVANCE/APPLICATION**

Understanding regional talar cartilage alterations using T2 mapping could aid in assessing ankle trauma severity, guiding treatment decisions, and predicting patient prognosis, thereby improving clinical management strategies for ankle injuries.

## S3A-SPMK-6 MULTIPARAMETRIC MR IMAGING OF MORPHEA (LOCALIZED SCLERODERMA): DISEASE DISTRIBUTION AND IMAGING FINDINGS

Sarah Attia, BS (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Alireza Eajazi, MD (*Abstract Co-Author*) Nothing to Disclose
Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Alex Iancau, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Morphea has only been described on conventional MRI. To illustrate the spectrum of findings on multiparametric MRI (MPMRI) in clinically proven Morphea cases and assess disease extent and activity.

**METHODS AND MATERIALS**

In this cross-sectional IRB-approved study, electronic medical records were reviewed to identify patients diagnosed with morphea who underwent MPMRI screening over an 10-year period. The protocol included multiplanar T1W, fluid-sensitive 2D and 3D imaging, DWI, perfusion imaging, and delayed post-contrast 3D T1W imaging. MSK fellowship-trained radiologist evaluated all cases, assessing imaging quality, and categorizing the lesion’s compartmental depth and activity. Two other MSK readers were recruited to do inter-reader analysis.

**RESULTS**

Of the 49 patients with a diagnosis of Morphea, 37 (76%) were females, and 12 (24%) were males, with a mean age of 39.04 years (±16.12). The Morphea types were: linear (20/49), generalized (13/49); En coup de Sabre (5/49); Parry Romberg (4/49); plaque (2/49); eosinophilic fasciitis (3/49); and not otherwise specified (2/49). Among them, 14/49, 23/49, 11/49, and 1/49 affected the upper extremity, lower extremity, face, and torso, respectively. All MRI scans exhibited good quality with minimal motion artifacts. 32/49 (65%) and 17/49 (34%) were superficial and deep lesions, respectively, with 11/17 (65%) of deep lesions exhibiting muscle edema. Skin thickening and thinning were noted in 71% (35/49) and 20% (10/49) of scans, respectively. Fat atrophy and hypertrophy were observed in 71% (35/49) and 2% (1/49) of scans, respectively. Additionally, bone/joint involvement was detected in 4% (2/49) of cases. 28 active, 15 inactive, and 6 patients had undetermined disease activity based on clinical diagnosis. Out of the 28 patients who were clinically active with morphea, 19/28 (68%) scans had increased perfusion, with 4 of those scans missing perfusion in the MRI protocol ($P<0.001$). There were also 23/28 (82%) scans of patients with clinically active morphea who exhibited increased delayed post-contrast enhancement ($P<0.001$). Patients with clinically active lesions exhibited an average Apparent Diffusion Coefficient (ADC) of 1.27 (±0.63), while inactive lesions had an average ADC value of 0.74 (±0.63) ($P<0.05$).

**CONCLUSION**

In conclusion, MPMRI is valuable in assessing morphea lesions, depth of involvement, and activity- both qualitatively and quantitatively.

**CLINICAL RELEVANCE/APPLICATION**

The findings of this study emphasize the practical utility of MPMRI in improving morphea diagnosis, with high-resolution qualitative and quantitative markers, which can be used for tailored treatment strategies and track patient outcomes.

## S3A-SPMK-7 MONITORING CHANGES OF TIBIAL TALAR JOINT CARTILAGE IN AMATEUR MARATHON ATHLETES BY ULTRA-SHORT ECHO TIME MAGNETIC RESONANCE IMAGING: A PRELIMINARY STUDY

Shaolin Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Yijie Fang (*Abstract Co-Author*) Nothing to Disclose
DANTIAN ZHU (*Abstract Co-Author*) Nothing to Disclose
Yiyin Hu (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the value of ultra-short echo time magnetic resonance imaging (UTE-MT) magnetization transfer in identifying cartilage alterations in the tibial talar joint before and following long-distance running in amateur marathon runners.

**METHODS AND MATERIALS**

The Institutional Ethics Committee Review Board approved the study, and before the study, subjects gave written agreement. Twenty-seven amateur long-distance runners underwent magnetic resonance examinations of the tibial talar joint joints bilaterally pre-run, 48 hours post-run, and 4 weeks post-run. MRI scans were performed using the UT-MT sequences, and the UTE-MT ratio (UTE-MTR) was measured for tibial talar joint cartilage at three time points. One UTE slice each on the medial and lateral sides of the tibial talar joint was selected for data analysis. Each region was subdivided into 6 regions of interest (ROI): the front, the middle, and the rear tibial/talar cartilage (Fig. A). Changes in MTR values for each ROI at the three time points were compared and differences in values for each region were analyzed. Additionally, the inter-rater reliability and sequence reproducibility were examined. Two-way mixed intraclass correlation coefficient (ICC) was used to assess the reproducibility and inter-rater reliability of the UTE-MT.

**RESULTS**

The UTE-MTR measurements showed good reproducibility [ICC: 0.903 (0.882 - 0.924)] and inter-rater reliability [ICC: 0.944 (0.927 - 0.956)]. For most subregions of cartilage, the UTE-MTR values decreased 48 h post-run and increased after 4 weeks of rest (Fig. B). UTE-MTR values in rear tibial and talar cartilage showed a significant decrease at 48 h post-run compared to the other two time points ($P < 0.05$).

**CONCLUSION**

MR UTE-MT sequence can be used to quantitatively analyze the early changes of cartilage composition in the tibiotalar joint after long-term physical training, in which the cartilage microstructure of rear talar cartilage is more prone to change.

**CLINICAL RELEVANCE/APPLICATION**

UTE-MTR is a promising method for the detection of dynamic changes in tibial talar joint cartilage after long-distance running.

# Abstract Archives of the RSNA, 2024

S3A-SPMS

**Multisystem Sunday Poster Afternoon Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPMS-1 IMPACT OF DEEP-LEARNING 3D CAMERA ON WORKFLOW AND PATIENTS' POSITIONING IN CT EXAMINATIONS

Masayuki Matsuo, MD (*Abstract Co-Author*) Nothing to Disclose
Shingo Omata, MD (*Abstract Co-Author*) Nothing to Disclose
Nobuyuki Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroki Kato (*Abstract Co-Author*) Nothing to Disclose
Tetsuro Kaga, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masashi Asano, MD (*Abstract Co-Author*) Nothing to Disclose
Yukiko Takai (*Abstract Co-Author*) Nothing to Disclose
Toshiharu Miyoshi, RT (*Abstract Co-Author*) Nothing to Disclose
Yoshifumi Noda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fuminori Hyodo, PharmD (*Abstract Co-Author*) Nothing to Disclose
Akio Ito, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the impact of deep-learning 3D camera on workflow and patients' positioning in CT examinations by comparing to manual positioning by radiographers.

### METHODS AND MATERIALS

This prospective study included 596 participants (median age, 71 years; 364 men) who underwent unenhanced chest-abdomen-pelvis CT between October 2023 and January 2024 by either manual positioning (manual group) or automatic positioning using deep-learning 3D camera (camera group). The scan parameters used in the two groups were completely matched. The CT-room time, from entering to leaving CT scan room, was compared between the two groups. Additionally, off-center distance that is range difference between table height and scanner isocenter, CT dose-index volume (CTDIvol), dose-length product (DLP), and the standard deviation of the CT attenuation of the abdominal aorta at the midpoint of scan range as background noise were compared between the two groups.

### RESULTS

The median CT-room time was shorter in the camera group than in the manual group (223 s vs. 255 s; $P < .001$). No difference was found in median off-center distance (13 mm vs. 14 mm; $P = .30$), CTDIvol (5.4 mGy vs 5.5 mGy; $P = .58$), DLP (416 mGy*cm vs. 410 mGy*cm; $P = .64$), and the background noise (9 HU vs. 9 HU; $P = .19$) between the two groups.

### CONCLUSION

Patients' positioning with a deep-learning 3D camera improved workflow in CT examinations compared to manual positioning by radiographers.

### CLINICAL RELEVANCE/APPLICATION

A deep-learning 3D camera could improve workflow compared to manual positioning by radiographers.

## S3A-SPMS-2 REFERENCE VOLUMETRIC DATA OF ABDOMINAL SKELETAL MUSCLE AND ASSESSMENT OF CUT-OFF VALUES FOR THE DIAGNOSIS OF SARCOPENIA BY CT SCAN IN A HEALTHY KOREAN POPULATION

Bohyun Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Sung Eun Rha, MD (*Abstract Co-Author*) Nothing to Disclose
Seo Yeon Youn, MD (*Abstract Co-Author*) Nothing to Disclose
Soon Nam Oh, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate appropriate reference values for abdominal skeletal muscle volumetric data obtained from abdominal CT scans in a healthy Korean population for the diagnosis of sarcopenia

### METHODS AND MATERIALS

This study included 1129 healthy kidney donors (479 men and 650 women) aged 19 to 72 years who underwent abdominal CT examinations over a 10-year period from 2014 to 2023. Body composition assessment was conducted using an automated segmentation technique with commercial AI-based software. Sex-specific distributions of abdominal skeletal muscle volume (SMV) from T12-L4 were analyzed along with skeletal muscle area (SMA) and skeletal muscle index (SMI). Cutoff values for SMA and SMI to determine sarcopenia were defined as values at two standard deviations (SDs) below the

mean reference value in the young age group (20-44 years). Candidate cutoff values of abdominal SMV, including the 25th percentile (Q1), 5th percentile, and 2SDs values, were analyzed in the sex-specific young age group (20-44 years).

**RESULTS**

The cutoff values for SMA and SMI were 115.40 cm2 and 38.76 cm2/m2, respectively, in men, and 74.44 cm2 and 28.28 cm2/m2, respectively, in women. The mean, Q1 value, 5th percentile, and -2SDs values of abdominal SMV were 2420.2 cm3, 2176.1 cm3, 1787.4 cm3, and 1705.6 cm3, respectively, in men, and 1493.3 cm3, 1363.5 cm3, 1145.0 cm3, and 1043.1 cm3, respectively, in women of reference age.

**CONCLUSION**

We provide a set of cadidates for sex-specific cutoff values for abdominal SMV measured by AI-based CT acquisition in a healthy Korean population, which may aid in identifying sarcopenia and prognostic correlations with various diseases in this population.

**CLINICAL RELEVANCE/APPLICATION**

SMA and SMI values measured at the L3 level on abdominal CT scans are recognized as relatively accurate methods for diagnosing sarcopenia. The recent integration of AI enables volumetric measurement of abdominal skeletal muscle, offering more comprehensive and precise information on muscle mass. However, there are few studies on reference values in a healthy population. This study aims to find out which value in skeletal muscle volumetric data can be used as a cutoff for diagnosing sarcopenia, which can be used for prognostic correlation of various diseases.

# Abstract Archives of the RSNA, 2024

S3A-SPNMMI

**Nuclear Medicine & Molecular Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPNMMI-1 ENHANCING LOW-DOSE PET: A VALIDATION STUDY OF DEEP LEARNING APPROACH ON LIST-MODE SIMULATED DATA AND A NOVEL ATTENTION-MODEL UTILIZING MR ANATOMICAL STRUCTURE

Lei Xiang (*Abstract Co-Author*) Nothing to Disclose
Hongping Meng (*Abstract Co-Author*) Nothing to Disclose
Min Zhang (*Abstract Co-Author*) Nothing to Disclose
Xinrui Zhan (*Presenter*) Nothing to Disclose

### PURPOSE

The primary purpose of this combined study is twofold: firstly, to verify whether deep learning models trained on list-mode simulated low-dose PET data can enhance image quality in real-world low-dose scenarios; and secondly, to explore the utility of MR anatomical information and attention mechanisms in improving PET/MR image quality using a newly collected dataset of list-mode simulated data. This approach aims to reduce radiation exposure to patients while maintaining or enhancing image clarity, which is crucial for accurate disease detection and management.

### METHODS AND MATERIALS

The study utilized PET/MR images from a total of 84 cases: 30 from the first study collected using SOC procedure but compared low-dose due to various real-world factors, and 54 from the follow up study collected with list-mode scanning and low-dose PET data from 30s to 150s was reconstructed. All are captured using a Siemens Biograph mMR scanner with PSF-OP-OSEM. The datasets included multiple tracers: 20 68Ga-DOTATATE, 4518F-FDG, 368Ga-FAPI, and 1618F-FDG Deep learning enhancements were applied using an improved UNET model, incorporating MR anatomical structure attention to ensure effective feature integration from both PET and MR modalities. Model's performance will be evaluated with SNR and CNR on first study data and PSNR and SNR on second study data.

### RESULTS

Presented in Table 1 and Table 2, across the first 30 cases, there was an average SNR enhancement of 14.5% (Random-area), 6.8% (Liver), and 20.1% (Lung), while CNR showed improvements of 18.1% (Random-area), 7.9% (Liver), and 12.6% (Lung). On follow-up 54 list-mode dataset, there was an average SNR enhancement of 35.44±6.43% (18F-FDG), 43.27±9.05%(18F-PSMA-1007), and 53.54±20.40%(68Ga-DOTATATE). There was an average PSNR enhancement of 18.05±7.15% (18F-FDG), 21.157±9.45%(18F-PSMA-1007), and 53.54±20.40%(68Ga-DOTATATE).

### CONCLUSION

Deep-learning models trained on list-mode simulated data consistently enhance image quality in low-dose PET scans, aiding lesion detection and reducing false negatives in PET/MRI applications. As shown in Figure 1, noise reduction clarifies lesion visibility, improving diagnostic accuracy. Incorporating MR anatomical information and attention mechanisms has significantly advanced noise reduction and image fidelity, enhancing clinical utility.

### CLINICAL RELEVANCE/APPLICATION

This study confirms that deep learning, particularly using list-mode simulated data and attention mechanisms, improves PET imaging quality at lower doses. These advancements promise to enhance patient outcomes by reducing radiation exposure and refining the diagnostic process in clinical settings.

## S3A-SPNMMI-2 QUANTITATIVE COMPARISON OF NUCLEAR MEDICINE IMAGING WITH C-11 PITTSBURGH COMPOUND B AND F-18 FLUTEMETAMOL, AND TC-99M HMDP IN ATTR-CARDIAC AMYLOIDOSIS

Yoshihiro Nishiyama, MD (*Abstract Co-Author*) Nothing to Disclose
Yukito Maeda (*Abstract Co-Author*) Nothing to Disclose
Yuka Yamamoto, PhD (*Abstract Co-Author*) Nothing to Disclose
Takahisa Noma (*Abstract Co-Author*) Nothing to Disclose
Yasukage Takami (*Abstract Co-Author*) Nothing to Disclose
Takashi Norikane, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Bone scintigraphy using 99m-Tc hydroxy methylene diphosphonate (HMDP) and other radioactive tracers has been an important noninvasive diagnostic modality in the diagnosis of ATTR cardiac amyloidosis (ATTR-CA). Amyloid PET using C-11 Pittsburgh compound B (PiB), F-18 flutemetamol (FMM) and other radioactive tracers are also emerged as important PET tracers used in the detection of amyloid deposition. Although these radioactive tracers are considered as useful for diagnosing ATTR-CA, there are no studies comparing the accumulation of these tracers in detail. The purpose of this study was to compare the accumulation pattern of PiB, FMM and HMDP in patients with ATTR-CA.

## METHODS AND MATERIALS

A total of 17 ATTR-CA patients were included in this study. PET data was acquired in list mode using a 10 min table time and the acquisition was started 10 mins after the administration of both PIB and FMM. Chest SPECT images are obtained 3 hours after HMDP administration. For quantitative analysis, 17 segment polar map images were generated of all 3 images. On polar map images, the mean activity was measured for the whole heat and for each 17 segments. Relative uptake (RU) was calculated for each segment using the mean whole heart activity as a reference. The formula for calculating RU is defined as follows: RU= mean segment activity/mean whole heart activity. For PET data, myocardial-to-blood pool ratio of each segment (MBR-Seg) was also calculated as a reference of blood pool activity in the left ventricle.

## RESULTS

In the RU assessment, linear regression analysis showed a good correlation between PiB and FMM, PiB and HMDP, and FMM and HMDP accumulation (PiB vs FMM: $p<0.001$, ?=0.704, PiB vs HMDP: $p<0.001$, ?=0.634, FMM vs HMDP: $p<0.001$, ?=0.690, respectively). The Bland-Altman plot indicated no evidence of a fixed bias or a proportional bias. In the assessment radioactive tracer accumulation pattern, the one-way ANOVA revealed significant differences in RU per segment ($p<0.001$), with segment 17 demonstrating the lowest values (PiB: 0.93±0.05, FMM: 0.91±0.03, HMDP: 0.81±0.07, respectively) and segment 9 exhibiting the highest values (PiB: 1.09±0.05, FMM: 1.10±0.07, HMDP: 1.17±0.06, respectively) in all 3 images. The mean ± SD of MBRmax in PiB (1.90 ± 0.58) was significantly higher that in FMM (1.41 ± 0.26) ($p<0.001$). Linear regression analysis also showed a good correlation between PiB MBR and FMM MBR ($p<0.001$, ?=0.764).

## CONCLUSION

In conclusion, these preliminary results indicated that PiB, FMM, and HMDP demonstrated comparable accumulation patterns in patients with ATTR-CA.

## CLINICAL RELEVANCE/APPLICATION

PiB, FMM, and HMDP demonstrated comparable accumulation patterns in patients with ATTR-CA.

# Abstract Archives of the RSNA, 2024

S3A-SPNPM

**Noninterpretive Skills (Beyond Imaging) Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPNPM-1 DIAGNOSTIC IMAGING UTILIZATION ASSOCIATED WITH PRIMARY CARE TELEMEDICINE AND IN-PERSON VISITS IN A LARGE INTEGRATED HEALTH SYSTEM

Michael Gould (*Abstract Co-Author*) Nothing to Disclose
Peter Huynh (*Abstract Co-Author*) Nothing to Disclose
Rebecca Hill (*Abstract Co-Author*) Nothing to Disclose
Lee Barton (*Abstract Co-Author*) Nothing to Disclose
Ahmad Alach, BS (*Presenter*) Nothing to Disclose

### PURPOSE

This study examines how primary care visit formats (in-person, telephone, or video) influence the rate of imaging orders for the common medical concerns of back pain, knee pain, and abdominal pain. We hypothesized that imaging orders would be more common during telephone or video visits due to limitations in conducting physical exams.

### METHODS AND MATERIALS

In this retrospective cohort study, we analyzed health records from Kaiser Permanente Southern California to compare imaging orders during primary care visits for back pain, knee pain, or abdominal pain. Exclusions were made for visits with multiple diagnoses or prior diagnoses of the conditions. The study was approved by the institutional review board with a waiver of informed consent.

### RESULTS

The study analyzed 1,262,249 non-pregnant adult primary care visits from March 2018 to March 2022. Patients had a mean age of 49.7 years. 58.1% of patients were female. 43.2% of patients were Hispanic. Back pain was the most frequent diagnosis (41.9%), followed by abdominal pain (33.6%). Family Medicine physicians conducted 71.6% of visits, while internists conducted 28.4%.Most visits (74.8%) were in person, while 22.2% were over the phone. Only 3.1% were done via video call. 61.4% of visits were conducted prior to mid-March 2020, 38.8% were conducted after. Imaging tests were ordered in 32.3% of visits, mostly after in-person visits (86.2%), and especially among female patients (57.6%). Knee pain visits had the highest imaging order rate (54.0%), compared to 23.0% for back pain and 28.1% for abdominal pain.Compared to in-person visits, patients were less likely to receive an imaging order after either a telephone visit (OR 0.30; 95% CI [0.29-0.31]; p<.001) or a video visit (OR 0.42; 95% CI [0.42-0.44]; p<.001). Back pain (OR 0.27; 95% CI [0.26-0.28]; p<.001) or abdominal pain (OR 0.36; 95% CI [0.35-0.37]; p<.001) were less likely to result in imaging compared to knee pain. Similarly, Black (OR 0.81; 95% CI [0.79-0.82]; p<.001) or Hispanic (OR 0.91; 95% CI [0.90-0.92]; p<.001) patients were less likely to receive imaging than non-Hispanic white patients. Internists were more likely than family medicine physicians to order imaging (OR 1.12; 95% CI [1.08-1.17]; p<.001).

### CONCLUSION

In this retrospective cohort study, telemedicine visits did not yield more imaging for evaluation of back, knee, or abdominal pain. Imaging orders were also affected by other variables such as race, diagnosis, time of visit, and provider specialty.

### CLINICAL RELEVANCE/APPLICATION

In the evolving world of virtual care, it is vital to understand how telemedicine influences clinical decision-making and imaging usage. Our findings are significant for informing and expanding upon telemedicine practice across the country.

## S3A-SPNPM-2 WORKFLOW EFFICIENCY IN OUTPATIENT MR ABDOMINAL IMAGING: COMPARISON OF OPTIMIZED AND CONVENTIONAL FACILITY DESIGNS

James A. Brink, MD (*Abstract Co-Author*) Board of Directors, Accumen Inc
Onofrio A. Catalano, MD (*Abstract Co-Author*) Research Grant,Bayer AG;Consultant, IBM Corporation;
Leo L. Tsai, MD, PhD (*Abstract Co-Author*) Stockholder, Agile Devices Inc;Consultant, Agile Devices Inc
Min Lang, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Susie Y. Huang, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Barbara D. Wichtmann, MD, MSc (*Abstract Co-Author*) Speaker, Koninklijke Philips NV
Bryan Clifford, PhD (*Abstract Co-Author*) Employee, Siemens AG
Sean Hartmann (*Abstract Co-Author*) Nothing to Disclose
Waqas Majeed (*Abstract Co-Author*) Nothing to Disclose
Mukesh G. Harisinghani, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Weber, MD (*Abstract Co-Author*) Nothing to Disclose
Oleg S. Pianykh, PhD (*Abstract Co-Author*) Nothing to Disclose
Wei-Ching Lo (*Abstract Co-Author*) Employee, Siemens AG

Andrew Sharp, MS (*Abstract Co-Author*) Nothing to Disclose
Alexander J. Herold, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to assess the outpatient workflow efficiency of an optimized MRI facility in comparison to a conventional facility for abdominal examinations, while also evaluating the impact of workflow optimization efforts over a specified time period.

**METHODS AND MATERIALS**

A retrospective analysis was conducted, encompassing 2,122 contrast-enhanced MRI examinations of the prostate (n=1,353) and liver (n=769) between January 2021 and December 2023. The study compared an optimized facility (OF), equipped with three scanner bays, each of which includes a pair of dockable scanner tables, and a total of four dedicated preparation bays, to a reference facility (RF) utilizing a traditional single-scanner/single-table setup. All scans were performed on 3T scanners (MAGNETOM Vida, Siemens Healthineers, Forchheim, Germany). Efficiency metrics, including Total Gradient Time, Table Turnover Time, Table Preparation Time, Arrival to Begin Time, and Exam Turnaround Time, were derived from MRI scanner logs. Statistical analysis, including three-way ANOVA and chi-square tests, assessed the impact of facility, body region, and time on efficiency metrics.

**RESULTS**

The OF's innovative design facilitated the use of shorter patient time slots relative to RF (30 vs. 45 minutes, $p<0.001$). Table Turnover Time was significantly shorter at OF compared to RF for both liver and prostate exams ($p<0.001$), resulting in reduced Exam Turnaround Time by 3.9 minutes (11.5%, $p<0.001$) for liver and 4.4 minutes (12.3%, $p<0.001$) for prostate exams. OF also exhibited a higher proportion of exams with Table Turnover Time =3 minutes (57.4% vs. 3.2%, $p<0.001$). Arrival to Begin Time was significantly lower at OF ($p<0.001$). Over the study period, RF experienced significant reductions in Total Gradient Time and Table Turnover Time for both liver and prostate exams ($p<0.001$), while OF showed improvements in Total Gradient Time and a decrease in Table Turnover Time mainly for prostate exams ($p<0.05$).

**CONCLUSION**

The optimized MRI facility demonstrated superior workflow efficiency, particularly in Table Turnover Times, compared to the traditional facility for contrast-enhanced abdominal examinations. Moreover, both facilities experienced improvements over time, highlighting the effectiveness of workflow optimization efforts.

**CLINICAL RELEVANCE/APPLICATION**

Optimized MRI Facility design may increase scanner throughput and potentially improve cost-effectiveness and patient experience.

## S3A-SPNPM-3 BEYOND INTUITION: THE ROLE OF METACOGNITION IN RADIOLOGIC ACCURACY AND EFFICIENCY

Rakefet Ackerman (*Abstract Co-Author*) Nothing to Disclose
Eyal Bercovich, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to delve into cognitive dynamics to enhance diagnostic accuracy and patient care outcomes. We examine the role of metacognitive processes, including confidence and thinking time allocation, during medical imaging diagnosis.

**METHODS AND MATERIALS**

Metacognitive processes are hypothesized to be pivotal for decision-making efficacy. In our study, 30 radiologists interpreted 48 bone radiographs, which included a high rate of challenging cases. We tracked each radiologist's diagnostic accuracy, confidence ratings, decision times, and choice of a next step: submit, consult a senior, or ask for additional tests. We analyzed the relationships among these metacognitive components and their impact on diagnostic accuracy and efficiency.

**RESULTS**

Preliminary findings indicate a pivotal metacognitive effect on diagnostic accuracy. High confidence (90.85%) paralleled high accuracy (91.67%) in easier images, while more challenging images revealed a disparity between confidence (80.39%) and lower accuracy (47.14%). This discrepancy suggests overconfidence amidst complexity. Notably, the challenging cases, where success rates approach chance (50%), consume most of the radiologists' time. Response divisions by presence/absence of abnormalities and by the recommended next step shed light on the particular cases prone to confidence bias and waste of thinking time.

**CONCLUSION**

Identifying cases particularly prone to confidence bias and inefficient use of time holds potential for enhancing metacognitive awareness and optimizing radiologist work quality and efficiency. The study underscores the critical need for further research focused on medical decision-making, emphasizing metacognition as a key tool for understanding and improving diagnostic accuracy.

**CLINICAL RELEVANCE/APPLICATION**

Acknowledging Metacognitive pitfalls may enhance radiologists' ability to accurately assess their own knowledge and decision-making. By fostering metacognitive awareness, radiologists can better identify their diagnostic biases, particularly in complex cases.

# Abstract Archives of the RSNA, 2024

S3A-SPNR

**Neuroradiology Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPNR-1 OPTIMIZING CODE STROKE WORKFLOWS WITH A STRAIGHTFORWARD 65-SECOND FIXED CT PERFUSION PROTOCOL

Yuji Matsuzaki, RT (*Abstract Co-Author*) Nothing to Disclose
Shun Okuyama, RT (*Abstract Co-Author*) Nothing to Disclose
Hiroki Nakajima, RT (*Abstract Co-Author*) Nothing to Disclose
Rina Sakai (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Yasutoshi Ohta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Nishii, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation
Keizo Murakawa (*Abstract Co-Author*) Nothing to Disclose
Masaki Sakurai (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Saito, RT (*Presenter*) Nothing to Disclose

### PURPOSE

Head CT perfusion (CTP) is critical in treating acute cerebral infarction. It requires a 60-70 second imaging window to capture the 4D contrast dynamics from arrival to washout in the brain parenchyma. During "code stroke," accurately determining cardiac output (CO), which affects contrast agent kinetics, is challenging for physicians, complicating protocol selection. This study aims to assess whether a simplified 65 second fixed scan protocol achieves similar success rates compared to a more complex multi-protocol workflow.

### METHODS AND MATERIALS

We retrospectively analyzed 316 head CTP cases from January 2023 to April 2024 using a 256 row CT. Cases were excluded if they had cardiac devices or an arterial input function (AIF) peak < 100 HU. Three protocols were compared: 56 seconds (normal), 70 seconds (low CO), and 65 seconds (fixed). Contrast was injected at 4 ml/s with a total volume of 40 ml. The normal and fixed protocols had 20 phases, while the low CO protocol had 23. In the first half of the study period, physicians chose between normal and low CO protocols, while in the second half, all patients underwent the fixed protocol. Success rates and radiation exposure were evaluated. The time density curve (TDC) from automatic CTP analysis software extracted key time points for contrast agent arrival, AIF peak, venous output function (VOF) peak, and VOF plateau. Failure was defined as contrast arrival before scanning or if the venous plateau was absent. Additional data were collected, including age, gender, BMI, cardiothoracic ratio (CTR), and imaging protocol instructions. Multiple regression analysis identified factors affecting each timing in the TDC, while multivariable logistic regression was used to determine predictors for scans requiring more than 60 seconds.

### RESULTS

Among the 296 cases (median age 76 years [IQR 62-82], 147 females), 78 used the normal, 120 used the low CO, and 98 used the fixed protocol. The success rate was 98% across both halves of the study period. The average CTDIvol in the first half was 136 mGy, while it was 124 mGy in the latter half, resulting in an 8% reduction in radiation exposure ($P < .001$). Age, gender, BMI, and CTR significantly influenced each timing in the TDC. However, no significant factors could predict cases requiring more than 60 seconds, even when including physician protocol instructions.

### CONCLUSION

Switching from a complex multi-protocol workflow to a more straightforward 65 second fixed-time protocol yielded similar scan success rates and an 8% reduction in radiation exposure.

### CLINICAL RELEVANCE/APPLICATION

The 65 second fixed time CTP offers consistent success rates with reduced radiation exposure. This simplification can streamline acute stroke workflows, leading to quicker diagnosis and improved patient safety.

## S3A-SPNR-10 WHITE MATTER MICROSTRUCTURE ALTERATIONS OF COGNITIVE IMPAIRMENT IN AMYOTROPHIC LATERAL SCLEROSIS: A SYSTEMATIC REVIEW

Mahan Shafie (*Abstract Co-Author*) Nothing to Disclose
Mahsa Mayeli, MD,MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disease primarily affecting upper and lower motor neurons, leading to muscle weakness and paralysis. Despite the traditional perception of ALS as solely a motor disorder, more than half of ALS patients experience cognitive and behavioral symptoms, often resembling those seen in frontotemporal dementia (FTD). This systematic review aims to study microstructural white matter (WM) biomarkers of cognitive and behavioral impairment in ALS exploring whether diffusion tensor imaging (DTI) metrics alterations could identify the cognitive and behavioral profile of ALS patients.

**METHODS AND MATERIALS**

A systematic search on PubMed, Scopus, and Web of Science was conducted following PRISMA guidelines to identify relevant studies published up to Jan 2024. Studies reporting DTI findings in patients with ALS spectrum were included. Data extraction and quality assessment were performed independently by two reviewers.

**RESULTS**

A total of 27 studies met the inclusion criteria. Data from these studies, comprising 1,865 ALS patients, were reviewed. DTI investigations revealed that the corpus callosum (CC), uncinate fasciculus (UF), cingulum, corticospinal tract (CST), and superior longitudinal fasciculus (SLF) were the most frequently investigated WM tracts in ALS patients with cognitive impairment. DTI metrics of these tracts were associated with various cognitive domains.

**CONCLUSION**

DTI studies have identified consistent associations between WM tract alterations and cognitive impairment in ALS. However, the causal relationship between WM damage and cognitive impairment in ALS remains unclear. Further interventional and longitudinal studies with more inclusive sample sizes are needed to definitively establish this connection.

**CLINICAL RELEVANCE/APPLICATION**

Understanding the relationship between WM tract changes and cognitive dysfunction in ALS can aid in the early detection and monitoring of cognitive decline in these patients. Moreover, the identified associations between specific WM tracts and cognitive domains may provide valuable insights for the development of targeted therapeutic interventions aimed at preserving cognitive function in ALS. Consequently, DTI could serve as a valuable tool for assessing cognitive status and guiding clinical management strategies in ALS patients.

## S3A-SPNR-11 EVALUATION OF RADIOLOGIST REPORTING TIMES AND TREATMENT TIMES FOR PATIENTS PRESENTING VIA THE MOBILE STROKE TREATMENT UNIT

Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Abheek Raviprasad, MD (*Abstract Co-Author*) Nothing to Disclose
Evelyn Y. Anthony, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammadreza Hosseini-Siyanaki (*Abstract Co-Author*) Nothing to Disclose
Keith R. Peters, MD (*Abstract Co-Author*) Nothing to Disclose
Hakki S. Sagdic, MD (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Presenter*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc

**PURPOSE**

Randomized trials have demonstrated that mobile stroke treatment units (MSTU) increase stroke thrombolysis rates and reduce onset-to-treatment times. We evaluated the radiologist CT/CTA reporting times and treatment times in patients presenting via the MSTU with suspected stroke.

**METHODS AND MATERIALS**

Patients who presented to the emergency department via the MSTU and received a non-contrast CT (NCCT) or CTA head on a MSTU were included. NCCT and CTAs were initially reviewed by the stroke neurologist on call and automatically uploaded to each patient's EMR and PACS. Formal CT interpretation was then produced by a board-certified neuroradiologist or by radiology resident prior to final review by neuroradiologist. For every case, a log file was retrieved from the PACS, containing timestamps of every moment the study was modified. Examinations were considered positive if there was evidence of ICH, LVO, M2 and M3 segment occlusion, or acute large territory infarct.

**RESULTS**

184 consecutive patients who presented with stroke-like symptoms via the MSTU were included. The average time from exam start to image availability in PACS was 18 ± 15 min (interquartile range (IQR) 10-22). The average time from exam start to formal radiologist interpretation was 67 ± 50 min (IQR 33-86). In 126 cases, a radiology resident provided a preliminary interpretation. The average time from exam start to preliminary resident report was 42 ± 29 min (IQR 23-49). In some cases, image transfer times were noted to result in a significant delay in interpretation.27 patient examinations were positive for either ischemic or hemorrhagic infarcts. 22 patients received Tenecteplase on board the MSTU, with time from initial patient evaluation to administration time averaging 17 ± 7 min (IQR 12-21). Nine patients underwent endovascular thrombectomy, with time from initial patient evaluation to groin stick averaging 51 ± 4 min (IQR 47-55). All groin punctures occurred within 1 hour of evaluation by the MSTU.

**CONCLUSION**

MSTU allowed the neurologist to receive actionable radiology report within 60 minutes in a large proportion of suspected stroke cases. Treatment with thrombolysis or endovascular thrombectomy occurred in shorter times compared to previous studies evaluating patients presenting to the emergency department.

**CLINICAL RELEVANCE/APPLICATION**

Treatments for stroke, including thrombolysis and mechanical thrombectomy, are time-sensitive and MSTU equipped with CT scanners can enable expedited diagnosis and care in the prehospital setting. However, optimal set up of these systems should also take into account essential infrastructure, including internet connectivity and bandwidth, for optimal operational and time benefits.

## S3A-SPNR-12 USING MR FINGERPRINTING IN NORMAL PRESSURE HYDROCEPHALUS TO PREDICT RESPONSE TO CSF DRAIN TEST

Doksu Moon (*Abstract Co-Author*) Nothing to Disclose
Sean Nagel (*Abstract Co-Author*) Nothing to Disclose
Mark A. Griswold, PhD (*Abstract Co-Author*) Research support, Siemens AG;Royalties, Siemens AG;Contract, Siemens AG;Royalties, General Electric

Company
Stephen E. Jones, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Normal pressure hydrocephalus (NPH) is a neurodegenerative syndrome occurring in late life, comprising difficulties with memory, walking, and urinary incontinence. A characteristic is markedly enlarged ventricles not caused by any obstruction. NPH is treatable in a subset of patients by removal of CSF, usually by a neurosurgically implanted shunt catheter. A major drawback to date is no reliable non-invasive method to predict who will benefit. Thus, there remains an unmet need to develop a reliable non-invasive method to predict neurosurgical success.We hypothesize that treatable vs non-treatable NPH is related to a global disarray of water properties in brain tissue, without focal abnormality, and that this can be detected using whole brain quantitative measurements. We propose using whole-brain quantitative numbers from MR Fingerprinting (MRF) to detect subtle changes in water properties (specifically representative T1 and T2 relaxation times) before and after large volume drain, and relate those changes to clinical outcomes.

**METHODS AND MATERIALS**

20 NPH patients with a scheduled large volume CSF drain test were scanned before and after with MRF, using a 2D WIP obtained over 15-20 slices, in addition to a volumetric T1. Brain and ventricular volumes were obtained from FreeSurfer. Custom software using IDL fitted whole brain T1 T2 histograms to a log-normal two-gaussian fit, in both the white matter and grey matter. The peak of each fit formed two metrics representing brain water properties, and these could be compared normative data. Standard clinical assessment included 10m walking test (for time and the number of steps), and clinician assessment.

**RESULTS**

Of 20 NPH patients 11 showed response to CSF drain trial. All pre-treatment MRI metrics (for GM and WM; and T1 and T2), showed at least some ability to distinguish those who responded to treatment versus those who did not (AUCs between 0.756 and 0.839). Most of the patients who responded to treatment had lower T1 time (WM and GM average) post-treatment (8/9 = 89%). Similarly, most of the patients who did not respond to treatment had higher T1 time (WM and GM average) post-treatment (7/9 = 78%). T2 time was lower after treatment for most patients, regardless of their clinical response.

**CONCLUSION**

Whole brain T1 and T2 relaxation times using MRF in 20 NPH patients helped predict clinical response to large volume CSF drain trial.

**CLINICAL RELEVANCE/APPLICATION**

MR Fingerprinting offers promise as a non-invasive technique to predict neurosurgical success of a large volume CSF drain trial. This method easily addresses an unmet need and can have high clinical impact.

## S3A-SPNR-14 ARTIFICIAL INTELLIGENCE ENABLED STANDARDIZED AND AUTOMATED LONGITUDINAL MEASUREMENT AND REPORTING OF BRAIN METASTASIS

Cornelius Deuschl (*Abstract Co-Author*) Nothing to Disclose
Khaled Bousabarah, MSc (*Abstract Co-Author*) Software Engineer, Pro Medicus Limited
Ahmed W. Moawad, MD (*Abstract Co-Author*) Nothing to Disclose
Sven Schoenherr (*Abstract Co-Author*) Nothing to Disclose
Mingde Lin, PhD (*Abstract Co-Author*) Employee, PRO Medicus Ltd;Stockholder, PRO Medicus Ltd
Divya Ramakrishnan (*Abstract Co-Author*) Nothing to Disclose
Saahil Chadha (*Abstract Co-Author*) Nothing to Disclose
David Weiss (*Abstract Co-Author*) Nothing to Disclose
Ajay Malhotra, MD, MMM (*Abstract Co-Author*) Nothing to Disclose
Mariam S. Aboian, MD, PhD (*Abstract Co-Author*) Researcher, Blue Earth Diagnostics Ltd;Researcher, Fusion Pharmaceuticals;Research collaboration, Pro Medicus Limited
Malte Westerhoff (*Abstract Co-Author*) Employee, Pro Medicus Limited;Stockholder, Pro Medicus Limited
Klara Osenberg (*Abstract Co-Author*) Nothing to Disclose
Nader Ashraf, MBBS (*Presenter*) Nothing to Disclose

**PURPOSE**

Assessing and reporting on brain metastases (BM) over time is critical in determining the treatment course. However, the workflow is laborious. This study investigated utility of PACS-integrated artificial intelligence-enabled Lesion Tracking Tool (AI-LTT) for monitoring BMs longitudinally, focusing on workflow efficiency gains and accuracy in comparison to fully manual workflow on post Gamma Knife radiosurgery (GKR) patients.

**METHODS AND MATERIALS**

In this retrospective study, follow-up images of patients with BM who underwent GKR at our institution were examined on a research instance of our PACS (AI Accelerator, Visage Imaging, Inc.). In manual workflow, two board-certified neuroradiologists displayed up to eight studies of each patient and measured orthogonal lesion diameters manually. In AI-LTT workflow introduced at RSNA2023, a custom hanging protocol automatically selected, displayed, and 3D registered T1 gadolinium-enhanced MR sequences in up to eight studies. A nnU-Net validated on 158 post-GKR studies automatically detected and 3D segmented BMs from which the maximum diameters are extrapolated per RANO-BM criteria and presented in a chart. This enhanced report can be imported into the free-text MRI report as a CSV file, containing the longitudinally tracked lesions, the related image series, orthogonal diameters, and the percentage change of each brain tumor compared to the prior study. The neuroradiologists revised the AI measurements as needed. We recorded time and number of mouse clicks for both workflows from study open until completion of lesion measurement. We analyzed inter-observer variability of the reader`s manual measurements based on the BM evaluation by a third neuroradiologist.

**RESULTS**

Compared to manual measurements involving 50 studies of ten patients, the AI-LTT demonstrated a significant reduction of mean time (678.5vs.366.0 seconds, $P<0.01$; 103.6vs.52.1 seconds per lesion, $P<0.01$) and mean clicks (201.5vs.62.9 clicks, $P<0.01$; 29.2vs.9.0 clicks per lesion, $P<0.01$) across two neuroradiologists; intra-class and Spearman correlation coefficients of manual diameter measurements were 0.922 and 0.881, respectively. Mean Dice coefficient of nnU-Net segmentations was 0.704±0.311 and sensitivity and F1-score of correctly identified lesions (=5mm) were 0.816 and 0.855, respectively.

**CONCLUSION**

The AI-LTT allowed for a substantially faster workflow while maintaining accuracy. The planned translation of AI-LTT into clinical practice can enable lesion-specific treatment response monitoring and reporting.

### CLINICAL RELEVANCE/APPLICATION

Due to inter-observer variability and effort of manual longitudinal BM measurements in MRI reports, standardized and automated measurements are critically needed.

## S3A-SPNR-15 COMPARTMENTALIZATION OF SUBARACHNOID HEMORRHAGE ON CT SUGGESTING FIRST IN-VIVO VISUALIZATION OF THE SUBARACHNOID LYMPHATIC-LIKE MEMBRANE (SLYM)

Khaled Almohaimede, MD (*Abstract Co-Author*) Nothing to Disclose
Pejman Jabehdar Maralani, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Chinthaka C. Heyn, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Anish Kapadia, MD (*Abstract Co-Author*) Nothing to Disclose
Yusuf Alibrahim, BMedSc, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In this study, we aim to investigate the existence of a recently discovered fourth meningeal layer called the subarachnoid lymphatic-like membrane (SLYM) using imaging techniques. The SLYM potentially divides the subarachnoid space into superficial and deep compartments and acts as a barrier. By examining how subarachnoid hemorrhage compartmentalizes within the subarachnoid space at different degrees of hemorrhage, we can gain insight into the potential role of SLYM in this compartmentalization.

### METHODS AND MATERIALS

A retrospective analysis was conducted including examining medical records and CT scans from 97 patients who experienced acute aneurysmal subarachnoid hemorrhage (aSAH). The distribution of subarachnoid blood into superficial and deep subarachnoid spaces was classified based on proximity to the dural or pial surfaces, respectively, as seen on multiplanar CT head. Statistical analysis was performed to compare the observed blood distribution patterns with the severity of hemorrhage, as determined by the modified Fisher Scale.

### RESULTS

The study revealed interesting differences in blood distribution within the subarachnoid space between patients with low-grade and high-grade modified Fisher scores. In cases with lower MFS of 1-2, the blood distributes primarily towards the deeper or pial-adjacent subarachnoid space. We also observed that if SAH is positive in the deeper subarachnoid compartment at a certain level along the brainstem, it will be positive in the same compartment at different levels suggesting compartmental continuity. Conversely, patients with higher MFS of 3-4 are more likely to have SAH abutting both pial and dural surfaces.

### CONCLUSION

SAH appears to compartmentalize within the subarachnoid space with preferential involvement of the deep, pial adjacent compartment. We suspect this is related to the newly discovered SLYM. In higher grade SAH, there is an increased likelihood of involvement of the superficial, dural adjacent compartment. This may be due to displacement or rupture of the presumed SLYM.

### CLINICAL RELEVANCE/APPLICATION

Understanding the function of the SLYM could have significant implications for the pathophysiology, diagnosis, and treatment of aSAH and various neurological disorders. By elucidating its influence on CSF circulation, such research might shed light on related pathologies. Future studies based on these findings could lead to the development of improved diagnostic tools and potentially even novel therapeutic strategies targeting the SLYM function and integrity to manage certain neurological conditions.

## S3A-SPNR-16 GADOQUATRANE: DOSE-RESPONSE ASSESSMENT IN MR ANGIOGRAPHY FOR THE NOVEL TETRAMERIC MACROCYCLIC GBCA IN COMPARISON TO GADOBUTROL OR GADOTERATE IN A NON-CLINICAL AND A CLINICAL SETTING

Mark Klemens, MD (*Abstract Co-Author*) Employee, Bayer AG
Petra Palkowitsch (*Abstract Co-Author*) Nothing to Disclose
Gregor Jost, PhD (*Abstract Co-Author*) Employee, Bayer AG
Gesine Knobloch, MD (*Abstract Co-Author*) Nothing to Disclose
Birte M. Hofmann, DVM, PhD (*Presenter*) Employee, Bayer AG

### PURPOSE

The purpose of the investigations was to assess the signal enhancement (SE) properties of the novel macrocyclic GBCA gadoquatrane in vessels (MR Angiography) at different doses vs gadobutrol/gadoterate administered at the standard dose. Gadoquatrane has a unique tetrameric structure with high stability and high relaxivity, expected to enable a lower dose for CE-MRI compared to established macrocyclic GBCAs.

### METHODS AND MATERIALS

A non-clinical and a clinical cross-over study using time-resolved MRA (TWIST) were conducted using 1.5T clinical MR scanners with quantitative SE measurements in vessels. In the non-clinical setting, six Göttingen minipigs received two doses of gadoquatrane (0.025 and 0.03 mmol Gd/kg), gadobutrol and gadoterate (both 0.1 mmol Gd/kg) in 4 sessions. With the exception of gadoterate (volume 0.2 mL/kg, injection rate (2 mL/s) doses were administered at the same volume (0.1 mL/kg) and injection rate (1 mL/s). Thoracoabdominal vessels were analyzed by regions of interest measurements in 6 arteries (aorta and branches) and 2 veins (inferior vena cava, portal vein). In the clinical study, the dose-response relationship of gadoquatrane was assessed in healthy participants (N=43, 18-50 years) receiving gadoquatrane (0.01, 0.03, 0.06 mmol Gd/kg; 0.033, 0.1, 0.2 mL/kg) and gadobutrol (0.1 mmol Gd/kg; 0.1 mL/kg) intravenously (injection rate 1 mL/s) in randomized order. Immediately after injection, time-resolved MRA of the carotid arteries (aortic arch to skull base) was performed. SE within the carotid arteries was measured over approx. 2 minutes. Peak-SE and time-to-peak were determined to characterize the SE-profile of the bolus.

### RESULTS

Non-clinically, the vascular signal-time curves for each region showed similar bolus shapes and peak-SE for both doses of gadoquatrane and comparators (e.g., SE ascending aorta after mmol Gd/kg: gadoquatrane 0.025: 154 (SD 5.1); 0.03: 173 (SD 20.4); gadoterate 0.1: 160 (SD 11.7); gadobutrol 0.1: 182 (SD 16.5)). Clinically, peak-SE increased with increasing gadoquatrane dose. With 0.03 mmol Gd/kg, gadoquatrane reached a similar peak-SE (381, CV%20.1) as gadobutrol (371, CV%25.9) with 0.1 mmol Gd/kg bw. Time-to-peak of 0.03 mmol Gd/kg gadoquatrane was similar to gadobutrol injected at the same volume of 0.1 mL/kg.

### CONCLUSION

No relevant differences in SE kinetics and peak-SE were observed in the non-clinical or clinical study between gadoquatrane at a dose of 0.03 mmol Gd/kg and the approved GBCAs injected at a 70% higher Gd dose.

### CLINICAL RELEVANCE/APPLICATION

Gadoquatrane is a novel, tetrameric macrocyclic GBCA currently in development for MRI and MRA. It aims to substantially reduce not only the Gd per contrast enhanced MR procedure but due to the tetrameric structure also the molecule dose.

## S3A-SPNR-17 PREVALENCE OF ALZHEIMER DISEASE PATHOLOGY IN STUDIES OF MEMORY AND AGING

Suzanne E. Schindler, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
John Morris (*Abstract Co-Author*) Research support, Eli Lilly and CompanyConsultant, Eli Lilly and Company
Tammie S. Benzinger, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company;Investigator, Eli Lilly and Company;Investigator, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Research Grant, Siemens AG;Consultant, ADM Diagnostics, LLC;Speakers Bureau, Biogen Idec Inc;Advisory Board, Biogen Idec Inc
Brian A. Gordon, PhD (*Abstract Co-Author*) Nothing to Disclose
Nicole S. McKay, PhD (*Abstract Co-Author*) Nothing to Disclose
Molly Beatty (*Presenter*) Nothing to Disclose

### PURPOSE

Preclinical Alzheimer disease (AD) describes a period prior to symptom onset during which pathology begins to accumulate. Recent development of neuroimaging- and biofluid- measures of AD pathology has allowed for in vivo quantification of preclinical pathological burden. Prior work estimated that by age 85, only one third of older adults remain free of amyloid and AD-related atrophy. Using complementary multimodal biomarkers of AD pathology, we aimed to reproduce and extend these estimates of preclinical AD prevalence in a cohort of cognitively unimpaired (Clinical Dementia Rating (CDR) = 0) older adults.

### METHODS AND MATERIALS

Neuroimaging-derived measures of amyloid and neurodegeneration (cortical amyloid, cortical thickness, summary tau) as well as biofluid-derived measures of non-specific AD pathology (amyloid42:40, phosphorylated-tau217, neurofilament light) were drawn from the Knight Alzheimer Disease Research Center database. Gaussian mixture modelling defined the cutoff threshold for each modality, establishing biomarker positivity. Participant data corresponding with CDR of 0 was used when assessing probability of positivity, which we examined as a function of age.

### RESULTS

Our results reproduce and extend prior estimates of AD pathology in cognitively unimpaired older adults, confirming in our independent sample that AD pathology is present in cognitively unimpaired individuals. Cerebrospinal fluid-derived measures of amyloid peaked at a rate near 60%, but all measures of amyloid and neurodegeneration were observed to rise to be present in at least 40% of cognitively unimpaired older adults. Unsurprisingly, tau was observed at the lowest rate, potentially reflecting its close association with cognitive impairment. It is important to note that cohorts examining sporadic AD recruit individuals with family histories of AD and therefore have higher rates than average populations of apolipoprotein-variant carriers, which may influence the rates of AD pathology.

### CONCLUSION

Characterizing the prevalence of preclinical AD is critical for understanding the pathophysiology of AD, may inform the design of clinical trials or interventions, and may also provide important context for furthering our understanding of cognition across older adulthood. Ultimately, creating an awareness of preclinical AD among researchers is essential for future work surrounding aging and memory.

### CLINICAL RELEVANCE/APPLICATION

As adults in the U.S over 65 are predicted to outnumber children under the age of 18 in 2034, AD is a condition that will only increase in significance alongside an aging population, especially as we enter into the future realm of AD prevention.

## S3A-SPNR-19 ALTERED REGIONAL HOMOGENEITY AND FUNCTIONAL CONNECTIVITY IN PATIENTS WITH EARLY PARKINSON'S DISEASE

Wei Wei (*Abstract Co-Author*) Nothing to Disclose
Xipeng Yue (*Abstract Co-Author*) Nothing to Disclose
Yu Shen (*Abstract Co-Author*) Nothing to Disclose
Kaiyue Ding (*Abstract Co-Author*) Nothing to Disclose
Yan Bai (*Abstract Co-Author*) Nothing to Disclose
Meiyun Wang (*Abstract Co-Author*) Nothing to Disclose
Jiapei Xie (*Abstract Co-Author*) Nothing to Disclose
Xinhui Wang (*Presenter*) Nothing to Disclose

### PURPOSE

Parkinson's disease (PD) is a neurodegenerative disorder that primarily affects movement and significantly impacts patients' quality of life. Despite this, the underlying pathophysiological mechanism of the disease remain unclear. This study aims to investigate changes in regional homogeneity (ReHo) and functional connectivity (FC) in early PD patients using resting-state functional magnetic resonance imaging (rs-fMRI) to better understand the mechanism behind of the disease.

### METHODS AND MATERIALS

Rs-fMRI data using a 3-T system (MAGNETOM Prisma, Siemens Healthcare, Erlangen, Germany) equipped with a 64-channel head/neck coil were collected from 49 early PD patients and 57 age- and gender-matched healthy controls (HCs) in this study. The RESTplus software was utilized to analyze rs-fMRI data and compare ReHo differences between early PD patients and HCs. Brain regions exhibiting significant ReHo differences were then selected as regions of interest (ROIs), and the strength of functional connections between these ROIs and other areas of the brain were calculated to identify changes between early PD and HCs.

### RESULTS

Compared with HCs, the early PD patients showed a significant decrease in regional homogeneity in the sensorimotor network (Precentral_R, Postcentral_L and Postcentral_R). The functional connectivity analysis in which the three regions described above were used as ROIs revealed decreased

functional activity between the sensorimotor network (Precentral_R, Postcentral_L and Postcentral_R) and visual network(Occipital_Mid_L, Occipital_Inf_L, Occipital_Sup_R, Occipital_Mid_R, Lingual_R, Cuneus_R, Fusiform_R, Temporal_Mid_L, Temporal_Mid_R, Temporal_Inf_R).

**CONCLUSION**

The pathophysiological mechanism of early PD patients may be related to abnormal spontaneous neuronal activity patterns with weak synchronization of sensorimotor network, and the decreased connectivity of the sensorimotor network with the visual network.

**CLINICAL RELEVANCE/APPLICATION**

Abnormal spontaneous neuronal activity patterns in early PD patients may be related to the onset of the disease. These findings could help us better understand the underlying pathophysiological mechanisms of PD and potentially identify therapeutic targets for neuroregulation in PD patients.

## S3A-SPNR-3 ALTERED BRAINNETWORK AND MODULAR INTERACTIONSIN PEDIATRIC PATIENTS WITH COMPLETE SPINAL CORD INJURY(CSCI) : A RESTING-STATE FUNCTIONAL MRI(RS-FMRI)STUDY

Haotian Xin (*Abstract Co-Author*) Nothing to Disclose
Beining Yang (*Abstract Co-Author*) Nothing to Disclose
Yu Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate functional network and modular interactions changes and find the possible impact in children with CSCI.

**METHODS AND MATERIALS**

69 subjects were recruited, including 33 right-handed pediatric complete spinal cord injury (CSCI) patients(age range, 6-12 years; mean age, 9.15±1.922 y; 5 males, 28 females) and 36 age- and gender- matched healthy controls(HCs). All patients were evaluated for motor and sensory scores, injury level, age at injury, and time since injury. A single gradient echo-planar imaging sequence was conducted to capture rs-fMRI images of all participants using a 3T magnetic resonance system (Siemens, Erlangen, Germany). The functional network was constructed using a graph-theory method, resulting in a 90 × 90 matrix. Three scales of metrics in global, modular and nodal were obtained to investigate the alterations of the overall functional network organization and modular interactions. Two-sample independent t-tests, chi-squared test, permutation test, and Partial correlation were used in statistical analysis. Statistical significance was set at $P < 0.05$, and a False Discovery Rate(FDR) method was applied for multiple comparison correction.

**RESULTS**

Compared with HCs, pediatric CSCI patients showed a significant decrease in both nodal centralities and nodal efficiency of bilateral thalamus. For modular interactions, patients demonstrated increased connectivity between the default mode network(DMN) and attention network(AN) but reduced connections between the DMN and subcortical network(SN ), DMN and visual network(VN), AN and SN respectively. Besides, a reductive within-module connectivity was found in DMN. Moreover, decreased participant coefficient(Pc) were observed in the left thalamus and TPOmid, and the Pc values in left thalamus positively correlated with the time since injury. As for modular organizations divided based on algorithm, there exhibited 5 modules in HCs while 6 modules in CSCI patients, in which the main changes occurs in Module III (AN), where part of its area is functionally transformed to DMN and part is divided into a new Module VI. However, no significant differences were found in global metrics(small-worldnesss, Eloc, Eg).

**CONCLUSION**

The reorganization of brain functions after CSCI in children took place mainly in higher cognitive-related regions such as DMN, AN and SN, rather than in sensorimotor areas.

**CLINICAL RELEVANCE/APPLICATION**

This study reveals alterations in psychological and cognitive areas following spinal cord injury, indicating the necessary to ensure the cognitive, emotional, and psychological well-being of pediatric patients with CSCI for their integration into social life.

## S3A-SPNR-4 THE DIAGNOSTIC VALUE OF CONTRAST ENHANCEMENT VESSEL WALL MRI IN NEUROPSYCHIATRIC SYSTEMIC LUPUS ERYTHEMATOSUS

Yu Murakami (*Abstract Co-Author*) Nothing to Disclose
Koichiro Futatsuya (*Abstract Co-Author*) Nothing to Disclose
Takatoshi Aoki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuta Yoshimatsu (*Abstract Co-Author*) Nothing to Disclose
Yoshiya Tanaka, MD (*Abstract Co-Author*) Nothing to Disclose
Yuya Fujita (*Abstract Co-Author*) Nothing to Disclose
Satoru Ide, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Neuropsychiatric systemic lupus erythematosus (NPSLE) is a severe complication of SLE that is associated with neuroinflammation. Vessel wall imaging (VWI) can visualize the cerebral arterial wall and assess active inflammation using contrast agents, making it potentially useful in evaluating neuroinflammation. In NPSLE, cerebral vascular issues include vasculitis, non-inflammatory vasculopathy, atherosclerotic plaques, vascular spasms, and arterial dissection. Although contrast-enhanced (CE) -VWI is considered useful for evaluating these conditions, detailed studies on its effectiveness in diagnosing NPSLE are scarce. This study aims to evaluate the efficacy of CE-VWI in distinguishing NPSLE from non-NPSLE.

**METHODS AND MATERIALS**

Patients clinically suspected of having NPSLE who underwent MRI at our institution between March 2019 and October 2022 were included in this prospective study. Each participant underwent a 3T MRI with 3D T1WI-CUBE, featuring a spatial resolution of 0.7×0.8×0.9 mm and a scan time of 4 minutes. We evaluated vessel wall lesions (VWLs) across 15 intracranial artery segments (from internal carotid artery and basilar artery to 2nd segment of each cerebral artery), scoring them as positive or negative, and whether the lesion was enhanced. The VWL score counts segments with wall thickening, and the CE-VWL score counts those showing enhancement. Additional assessments included brain lesions, and stenotic lesions via MR angiography. We conducted intergroup comparisons on MRI findings, used multivariate analysis to identify factors linked to NPSLE, and assessed the diagnostic capability of VWI using ROC analysis.

**RESULTS**

According to the proposed criteria, 47 patients were classified as NPSLE and 55 as non-NPSLE, with mean ages of 44.3 (range 19-74) and 44.0 (range 16-80), respectively. Key differences included: 11% of NPSLE patients had large perforator infarctions compared to none in non-NPSLE ($p=0.01$). NPSLE

patients had higher median VWL score (11 vs. 6, p<0.001) and CE-VWL score (2 vs. 0, p<0.001). Stenosis on MRA was also more common in NPSLE (40% vs. 9%, p<0.001). Multivariate analysis revealed the CE-VWL score as the sole significant factor linked to NPSLE (OR 1.91; 95% CI 1.19-3.07; p=0.007). ROC analysis indicated an AUC of 0.78 for CE-VWL score, with a specificity of 91% and an odds ratio of 13.5 at the optimal cutoff value of 2.

**CONCLUSION**

CE-VWI is useful for differentiating NPSLE from non-NPSLE, particularly since CE-VWLs are characteristic of NPSLE.

**CLINICAL RELEVANCE/APPLICATION**

CE-VWI with 3D-CUBE could diagnose NPSLE, confirming VWL enhancement with high specificity. Its brief 4-minute scan can be readily incorporated into the clinical workflow for NPSLE assessments, enhancing practicality and accuracy.

## S3A-SPNR-6 FROM CYTOARCHITECTURE TO MRI BIOMARKERS: A PIPELINE TO INFORM AUTOMATIC SEGMENTATION OF THE MEDIAL TEMPORAL LOBE STRUCTURES WITH ANATOMICAL BOUNDARIES DERIVED FROM HISTOLOGY

David A. Wolk, MD (*Abstract Co-Author*) Research Consultant, General Electric Company;Instructor, Haymarket Media, Inc;Speaker, Quintiles Medical Education, Inc;Instructor, Quintiles Medical Education, Inc
Edward Lee (*Abstract Co-Author*) Nothing to Disclose
Amanda Denning (*Abstract Co-Author*) Nothing to Disclose
Karthik Prabhakaran (*Abstract Co-Author*) Nothing to Disclose
Alejandra Bahena (*Abstract Co-Author*) Nothing to Disclose
Sadhana Ravikumar (*Abstract Co-Author*) Nothing to Disclose
Paul Yushkevich, PhD (*Abstract Co-Author*) Investigator, KinetiCor, Inc
Sandhitsu Das, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel Ohm (*Abstract Co-Author*) Nothing to Disclose
Laura Wisse (*Abstract Co-Author*) Nothing to Disclose
Monica Munoz Lopez (*Abstract Co-Author*) Nothing to Disclose
Madigan Bedard (*Abstract Co-Author*) Nothing to Disclose
Yue Li (*Abstract Co-Author*) Nothing to Disclose
Dylan Tisdall, PhD (*Abstract Co-Author*) Nothing to Disclose
Ricardo Insausti Serrano (*Abstract Co-Author*) Nothing to Disclose
Sandra Cebada-Sanchez (*Abstract Co-Author*) Nothing to Disclose
Maria Del Mar Arroyo Jimenez (*Abstract Co-Author*) Nothing to Disclose
Sydney Anne Lim (*Abstract Co-Author*) Nothing to Disclose
David Irwin (*Abstract Co-Author*) Nothing to Disclose
John Robinson (*Abstract Co-Author*) Nothing to Disclose
Winifred Trotman (*Abstract Co-Author*) Nothing to Disclose
Ranjit Ittyerah (*Abstract Co-Author*) Nothing to Disclose
Jose Carlos Delgado Gonzalez (*Abstract Co-Author*) Nothing to Disclose
Niyousha Sadeghpour, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The medial temporal lobe (MTL) is targeted by both primary and concomitant molecular pathologies in Alzheimer's disease (AD). For the past two centuries, the complex anatomy of the MTL has been the subject of extensive research. However, current PET and MRI AD biomarkers use often crude parcellations of the MTL, lacking sufficient validation against anatomical ground truth. Here we use a unique dataset of finely annotated serial histology, ex vivo MRI and antemortem 3T in vivo MRI of the MTL from 17 brain donors to train and evaluate an automatic MTL subregion segmentation algorithm. To our knowledge, this is the most comprehensive attempt to infuse MRI biomarkers with cytoarchitectural reference annotations.

**METHODS AND MATERIALS**

A team of neuroanatomists annotated the boundaries of 27 MTL subregions on over 2000 serial Nissl histological sections from 17 brain donors. These boundaries were mapped to 9.4T ex vivo MRI (proton density, 0.2x0.2x0.2mm3) and, subsequently, to 3T in vivo MRI (T2-weighted, ~0.4x0.4x2.6mm3) using deformable registration. After each registration step, extensive manual editing was performed to correct for registration errors and ensure 3D continuity and smoothness. Deep learning method nnU-Net was trained on the resulting in vivo MRI annotations to automatically segment a set of major subregions (formed by merging smaller subregions). Surface-based registration between an MTL template and the output of nnU-Net was used to parcellate major subregions into the original 27 smaller subregions. Segmentation accuracy was assessed by five-fold cross-validation with the Dice Similarity Index (DSI).

**RESULTS**

The segmentation accuracy of the 10 major subregions varied considerably with the DSI ranging from 0.32 to 0.75. While accuracy is not as high as in some previous MTL subregion segmentation approaches, this is not surprising because the anatomical variability of cytoarchitecture-based ground truth annotations in our approach is likely much higher than in prior approaches where ground truth was generated by applying heuristic/geometric rules.

**CONCLUSION**

It is feasible to leverage cytoarchitecturally defined anatomical boundaries for automatic in vivo MRI segmentation. However, high variability in the location of cytoarchitectural borders poses clear limitations on MTL segmentation accuracy.

**CLINICAL RELEVANCE/APPLICATION**

Cytoarchitecturally defined anatomical boundaries for automatic segmentation of in vivo MRI scans opens avenues for more accurate and early detection of neurodegenerative diseases.

## S3A-SPNR-7 SLOWING OF APERIODIC NEUROPHYSIOLOGICAL ACTIVITY IN CONCUSSED ADOLESCENT FOOTBALL PLAYERS

Christopher T. Whitlow, MD, PhD (*Abstract Co-Author*) Consultant, Biogen Idec Inc
Joel Stitzel (*Abstract Co-Author*) Nothing to Disclose
Leonardo G. Bezerra (*Abstract Co-Author*) Nothing to Disclose
Joseph A. Maldjian, MD (*Abstract Co-Author*) Consultant, BioClinica, Inc;
Jillian Urban (*Abstract Co-Author*) Nothing to Disclose
Alex Wiesman (*Abstract Co-Author*) Nothing to Disclose
Kiran Kumar Solingapuram Sai, PhD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth M. Davenport, PhD (*Abstract Co-Author*) Nothing to Disclose

Laura Flashman (*Abstract Co-Author*) Nothing to Disclose
Kevin C. Yu (*Presenter*) Nothing to Disclose

**PURPOSE**

American tackle football is associated with high concussion rates, leading to neurophysiological disturbances and debilitating symptoms. Previous investigations of concussion using magnetoencephalography (MEG) have largely ignored aperiodic (i.e., arrhythmic) neurophysiological activity. We examined whether concussion during a season of high school football is related to changes in aperiodic activity, as well as whether any such changes are associated with clinical outcomes and co-localize with regions dense in specific neurotransmitter systems.

**METHODS AND MATERIALS**

Pre- and post-season resting state MEG data were collected from 91 high school football players, of whom 10 were diagnosed with concussion. Data were source-imaged, frequency-transformed, and parameterized using specparam. Linear mixed models were used to examine effects of concussion on pre-to-post-season changes in neurophysiological activity. Co-localization of the resulting beta-weight maps with 19 neuromaps atlases was conducted using autocorrelation-preserving null permutations. Scores on the Post-Concussive Symptom Inventory were correlated with pre-to-post-season physical, cognitive and behavioral symptoms to determine clinical relevance.

**RESULTS**

Concussion was associated with increased aperiodic exponents in superior-frontal cortices, and this aperiodic slowing mediated concussion effects on delta and gamma power. Aperiodic slowing was also associated with higher post-concussion symptoms across participants. The concussion-aperiodic relationship was strongest in brain regions with high normative densities of cholinergic and noradrenergic neurotransmitter systems.

**CONCLUSION**

We find that concussion is associated with increased aperiodic exponents in superior-frontal cortices, potentially accounting for concussion-related delta increases and gamma decreases in similar regions, and the strength of this slowing effect is associated with higher symptom report. Neurochemical contextualization suggests possible involvement of noradrenergic and cholinergic systems implicated in the neuropathophysiology of concussion, suggesting targets for future pharmacotherapeutic studies.

**CLINICAL RELEVANCE/APPLICATION**

Greater concussion-related aperiodic neurophysiological slowing may be associated with increased symptoms, potentially supporting its use as a clinical marker.

## S3A-SPNR-8 FUNCTIONAL MRI FINDINGS OF TRANSCRANIAL MAGNETIC STIMULATION IN PATIENTS WITH OBSESSIVE-COMPULSIVE DISORDER: A SYSTEMATIC REVIEW

Mahan Shafie (*Abstract Co-Author*) Nothing to Disclose
Mahsa Mayeli, MD,MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

Obsessive-compulsive disorder (OCD) is a chronic condition, which is believed to involve structural and functional abnormalities in the brain. As pharmacological treatments often yield inadequate responses in OCD patients, recent attention has turned to brain stimulation targeting these neural regions as safe therapeutic interventions. Despite the promising treatment efficacy of transcranial magnetic stimulation (TMS), the fundamental neural mechanisms underlying its effects remain understudied. This systematic review aims to evaluate functional MRI (fMRI) findings associated with TMS in OCD patients, exploring the potential impact of TMS and identifying predictors of intervention outcomes based on neuroimaging.

**METHODS AND MATERIALS**

A systematic search on PubMed, Scopus, and Web of Science was conducted following PRISMA guidelines to identify relevant studies published up to Feb 2024. Studies reporting fMRI findings in patients with OCD who underwent TMS were included. Data extraction and quality assessment were performed independently by two reviewers.

**RESULTS**

A total of eight studies met the inclusion criteria. Resting-state fMRI investigations revealed changes in functional connectivity (FC) between various brain regions following TMS treatment, with significant alterations observed in the dorsomedial prefrontal cortex (dmPFC) and its connections. Task-based fMRI studies identified neural correlates associated with symptom improvement and treatment response, particularly in regions such as the pre-supplementary motor area (preSMA), orbitofrontal cortex (OFC), and dorsolateral prefrontal cortex (dlPFC).

**CONCLUSION**

The findings of this systematic review suggest that TMS may modulate neural circuits implicated in OCD pathophysiology. Our comprehensive analysis of fMRI data after TMS in OCD patients concludes that there is an intricate interaction between brain connection patterns, target regions, and stimulation procedures. Targeting several brain regions, such as the dmPFC, dlPFC, SMA, and OFC, has shown promise in reducing OCD symptoms by modifying functional connectivity within the cortico-striato-thalamo-cortical circuit, despite the heterogeneity seen among studies. These results support the hypothesis that the pathophysiology of OCD is caused by abnormal connections within this circuitry.

**CLINICAL RELEVANCE/APPLICATION**

Understanding the neural mechanisms underlying TMS in patients with OCD is crucial for the development of targeted therapeutic interventions. This systematic review provides insights into the fMRI changes associated with TMS in OCD patients, highlighting its potential as a treatment modality and paving the way for more effective and personalized therapeutic approaches for OCD.

## S3A-SPNR-9 THE LINK BETWEEN HEPATIC FAT AND NEUROINFLAMMATION IN MIDLIFE OBESITY

Jake Weeks, BS (*Abstract Co-Author*) Nothing to Disclose
Lakisha Lloyd (*Abstract Co-Author*) Nothing to Disclose
Cyrus Raji, MD, PhD (*Abstract Co-Author*) Consultant, Brainreader ApS;Consultant, Neuroevolution, LLC;Consultant, Apollo Health
Tammie S. Benzinger, MD, PhD (*Abstract Co-Author*) Research Grant, Eli Lilly and Company;Investigator, Eli Lilly and Company;Investigator, F. Hoffmann-La Roche Ltd;Consultant, Siemens AG;Research Grant, Siemens AG;Consultant, ADM Diagnostics, LLC;Speakers Bureau, Biogen Idec Inc;Advisory Board, Biogen Idec Inc
John Morris (*Abstract Co-Author*) Research support, Eli Lilly and CompanyConsultant, Eli Lilly and Company
Sheng-Kwei Song, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahshid Naghashzadeh (*Abstract Co-Author*) Nothing to Disclose

Caitlyn Nguyen (*Abstract Co-Author*) Nothing to Disclose
Joseph E. Ippolito, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Paul Commean (*Abstract Co-Author*) Nothing to Disclose
Nancy Hantler (*Abstract Co-Author*) Nothing to Disclose
Claude B. Sirlin, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Bayer AG;Research Grant, Gilead Sciences, Inc;Research collaboration, Gilead Sciences, Inc;Research Grant, Koninklijke Philips NV;Research Grant, Pfizer Inc;Equipment support, General Electric Company;Consultant, Pfizer Inc;Consultant, AMRA AB;Consultant, Guerbet SA;Officer, Livivos, Inc;Advisor, Quantix Bio LLC
Sara Hosseinzadeh Kassani (*Abstract Co-Author*) Nothing to Disclose
Abigayl McBee-Kemper (*Abstract Co-Author*) Nothing to Disclose
Mahsa Dolatshahi, MD, MPH (*Presenter*) Nothing to Disclose

## PURPOSE

Obesity in midlife is a contributor to Alzheimer disease later in life. Adiposity in the liver and muscles are associated with increased systemic inflammation, insulin resistance and impaired cognition. In this study, we aimed to investigate the relationship between MRI-derived Positron Density Fat Fraction (PDFF) and thigh fat-to-muscle ratio (FMR), insulin resistance, systemic inflammation, and brain histology using Diffusion Basis Spectrum Imaging (DBSI) in cognitively normal midlife individuals.

## METHODS AND MATERIALS

In total, 67 cognitively normal middle-aged participants (Age: 50.02 years, female: 65.7%, obesity:53.7%, BMI: 31.72kg/m2) underwent brain, abdominal, and thigh MRI and metabolic assessment. Homeostatic Model Assessment for Insulin Resistance (HOMAIR) and serum IL-6, IL-10, and TNF-alpha were measured. The hepatic PDFF maps were derived from liver chemical shift encoded MR images followed by segmentation using a CNN model. After N4ITK bias correction on mid-thigh slices, thigh total fat (subcutaneous, inter-, and intra-muscular fat combined), and muscle volumes were segmented, and total thigh FMR was calculated. After eddy current and movement correction, DBSI maps including fractional anisotropy (overall integrity), axial diffusivity (axonal injury), radial diffusivity (myelin loss), restricted fraction (inflammation cellularity), hindered fraction (extracellular edema), and fiber fraction (axonal density) were calculated using an in-house MATLAB script. Voxel-wise analyses were performed using tract-based spatial statistics (TBSS) pipeline based on matrices contrasting PDFF, thigh FMR, HOMAIR, IL-6, IL-10, and TNF-alpha with age and sex as covariates, and a 0.05 false-discovery rate.

## RESULTS

There was a significant association between HOMAIR and PDFF ($p<0.001$) but not thigh FMR. No association was found between PDFF and thigh FMR with systemic inflammation markers. Obese individuals showed higher PDFF ($p=0.02$) but not HOMAIR ($p=0.12$) or FMR ($p=0.08$). We observed a significant positive association between PDFF and restricted fraction in widespread areas. There was no significant association between HOMAIR, systemic inflammatory markers, or thigh FMR and DBSI measures.

## CONCLUSION

Our results indicate the role of hepatic fat, but not thigh fat or insulin resistance in increased inflammation-related cellularity in the brain in cognitively normal midlife individuals. These findings suggest that excess hepatic fat may increase the risk for Alzheimer disease and cognitive impairment through promoting neuroinflammation.

## CLINICAL RELEVANCE/APPLICATION

Modifying hepatic fat and preventing fatty liver disease can act as a proxy for reducing neuroinflammation.

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# Abstract Archives of the RSNA, 2024

S3A-SPOB

**OB/Gynecology Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPOB-2 DEVELOPMENT OF AN ARTIFICIAL INTELLIGENCE-BASED SUPPORT SYSTEM FOR FETAL CARDIAC ULTRASOUND SCREENING

Kazuki Iwamoto (*Abstract Co-Author*) Nothing to Disclose
Naoaki Harada (*Abstract Co-Author*) Nothing to Disclose
Ryuji Hamamoto, MD (*Abstract Co-Author*) Research Grant, FUJIFILM Holdings Corporation
Ryu Matsuoka (*Abstract Co-Author*) Nothing to Disclose
Akihiko Sekizawa (*Abstract Co-Author*) Nothing to Disclose
Reina Komatsu (*Abstract Co-Author*) Nothing to Disclose
Masaaki Komatsu, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Fetal cardiac ultrasound screening is generally performed on all fetuses, however, the global prenatal detection rate for congenital heart disease (CHD) is still insufficient due to technical differences among examiners. Here, we have developed an artificial intelligence (AI)-based support system for this ultrasound screening toward clinical application.

### METHODS AND MATERIALS

We enrolled fetal cardiac ultrasound videos of 262 normal cases and 38 CHD cases who underwent fetal cardiac ultrasound screening in the second trimester. This dataset included 3 vendors; Voluson® P8/E8/E10/Expert22 (GE Healthcare, Chicago, IL, US), Aplio® i700/i900 (Canon Medical Systems, Otawara, Tochigi, Japan), and Arietta® 70 (Fujifilm Healthcare, Tokyo, Japan). The correct positions of 18 cardiac substructures were annotated with bounding boxes. The time-series information of these detection results was displayed using barcodes and detection rate graphs. First, the diagnostic accuracy of the automatic normal substructure detection was assessed. Then, we attempted to verify whether our AI system could enhance the screening performance of examiners. A comparative study was performed on the screening performance of 50 examiners (6 experts, 30 fellows, and 14 residents) with and without the AI system. In each situation, the examiners were given 60 randomly numbered videos of the normal and CHD cases and determined normal or abnormal. The multiplicity of statistical analyses was controlled by a fixed sequence procedure.

### RESULTS

The sensitivity for the normal substructure detection was 93.5%, showing superiority to the sensitivity threshold of 80% based on preliminary test results ($p < 0.001$). The specificity was 95.9%, indicating superiority to the specificity threshold of 80% ($p < 0.001$). In the subgroup analyses, both the sensitivity and specificity for the normal substructure detection of every vendor and machine achieved over 90%. Furthermore, the sensitivity of the screening of unskilled doctors (fellows and residents) using the AI system was 78.4%, showing superiority over the sensitivity of the examiner alone ($p = 0.005$). The specificity was 86.5%, showing superiority to the specificity of the examiner alone ($p < 0.001$). On the other hand, the screening performance of experts showed no significant difference with and without the AI system.

### CONCLUSION

Our AI system demonstrated sufficient accuracy in the automatic normal substructure detection and could enhance the screening performance of unskilled doctors in fetal cardiac ultrasound screening.

### CLINICAL RELEVANCE/APPLICATION

This system aims to support fetal cardiac ultrasound screening in a clinical scenario.

## S3A-SPOB-3 3D CRANIOFACIAL FETAL MRI: FORMALISATION OF A LANDMARKING AND MEASUREMENT PROTOCOL IN TRISOMY 21 AND HEALTHY CONTROL SUBJECTS

Christina Malamateniou, PhD, MA, BSC, MEd (*Abstract Co-Author*) Nothing to Disclose
Lisa Story, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sophie Arulkumaran, MBBS,FRCR (*Abstract Co-Author*) Nothing to Disclose
Alena Uus (*Abstract Co-Author*) Nothing to Disclose
Daniel Cromb (*Abstract Co-Author*) Nothing to Disclose
Alexia M. Egloff, MD (*Abstract Co-Author*) Nothing to Disclose
Mary Rutherford, MD,FRCR (*Abstract Co-Author*) Nothing to Disclose
Aysha Luis, MBBS (*Abstract Co-Author*) Nothing to Disclose
Jo Hajnal (*Abstract Co-Author*) Nothing to Disclose
Jana Hutter (*Abstract Co-Author*) Nothing to Disclose
Jacqueline Matthew, BSc, MSc (*Presenter*) Nothing to Disclose

## PURPOSE

To assess initial experiences of novel automated MRI biometrics using slice-to-volume registration fetal MRI.

## METHODS AND MATERIALS

A systematic literature review was performed to define anatomical landmarks appropriate for MRI in 3D space. The final protocol was agreed by consensus with 3 fetal MRI radiologists (fig 1 c.). Landmarks were propagated to subjects from a template atlas (31 weeks GA) using classical affine+non-rigid registration (fig1 b.). The centroid data of points was used to calculate biometrics, using 3D vector formulae. Biometric comparisons were made between cohorts and 10 random cases measured manually.

## RESULTS

108 control (mean GA=31+6) and 24 T21 subjects (mean GA=32+4) were assessed (MRI=1.5 or 3T). An analysis of variance between subject groups found differences in biometry for skull base, skull/midface length and nasopharyngeal areas (total 17/31 biometrics) correlating with known dysmorphology in T21 phenotypes (ANOVA, $p < 0.05$, see fig 1d.). The time to manually label 10 random cases was an average of 22mins/case versus 5mins/case to inspect automated labels. The manual versus automated biometry had a mean relative error of more than 5% in 8/35 biometrics and manual measurements were not possible for 22/350 measures due to variable image quality.

## CONCLUSION

Automated methodologies can assist in rapid quantitative craniofacial assessment for deep phenotyping. Since measurement error reduces precision, future work will focus on optimising MRI sequences, deep learning methods and validation in syndromic cohorts.

## CLINICAL RELEVANCE/APPLICATION

This work highlights the potential for quantitative 3D characterisation of craniofacial features with reconstructed fetal MRI, traditionally a subjective assessment using 2D raw data. Paired with our previously published MRI-based 3D surface rendering techniques (fig 1a), there are new opportunities for prenatal phenotyping to complement equivocal prenatal ultrasound exams.

# Abstract Archives of the RSNA, 2024

S3A-SPPD

**Pediatric Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPPD-1 EXTRACTION AND EVALUATION OF FEATURES OF PRETERM PATENT DUCTUS ARTERIOSUS IN CHEST X-RAY IMAGES USING DEEP LEARNING WITH HUMAN GUIDED TRAINING

Hyeonsung Choi (*Abstract Co-Author*) Nothing to Disclose
Jimin Lee (*Abstract Co-Author*) Nothing to Disclose
Hyun Ho Kim (*Abstract Co-Author*) Nothing to Disclose
Phillip Chang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to identify specific chest x-ray (CXR) features associated with preterm patent ductus arteriosus (PDA) using deep learning image analysis and to quantitatively assess these features.

### METHODS AND MATERIALS

We collected 17488 neonatal CXR images from 4617 echocardiogram cases in NICU, labeled based on PDA diagnosis. A subset of 463 randomly chosen images was isolated into a test group to evaluate a PDA prediction model. Our approach involved the 'human-guided easy learning' method we developed, where a non-pediatrician doctor was first shown 173 PDA positive and negative CXR images three times to identify PDA-specific features. Subsequently, the trained doctor diagnosed 4654 unlabeled CXR images. Of these, 3349 images that were correctly identified by the doctor were then used to train a deep learning model to predict PDA probability. Post-training, we applied GradCAM++ to identify critical predictive features.

### RESULTS

The deep learning model showed a specificity of 0.91, sensitivity of 0.33 and an ROC-AUC of 0.72 in the test group. GradCAM++ highlighted significant features in the upper thorax, left lower heart, and right lower lung areas. Based on the GradCAM++ analysis, we selected four critical radiologic features and identified significant differences in three features between PDA positive and negative images: the mean ratio of the upper heart width to the maximum heart width was 0.45 (95% CI, 0.44-0.47) in PDA positive versus 0.54 (0.53-0.54) in negative; the cardiothoracic ratio was 0.57 (0.57-0.58) versus 0.55 (0.55-0.55); the ratio of the upper heart width to the thorax width was 0.27 (0.26-0.28) versus 0.30 (0.30-0.31). The z-test p-value for each of these features were all less than 0.001. However, the mean normalized brightness of the lung fields was 0.51 (0.50-0.52 versus 0.51-0.52) for both groups, with a p-value of 0.48.

### CONCLUSION

Our trained deep learning model effectively identified key radiologic features for diagnosing PDA. The ratios of the upper heart width to both the maximum heart width and the thorax width, along with the cardiothoracic ratio, differed significantly between PDA positive and negative images.

### CLINICAL RELEVANCE/APPLICATION

PDA is common in preterm infants and typically diagnosed with echocardiograms, which require specialized pediatric expertise. Meanwhile, plain CXR imaging, favored for its convenience and minimal radiation exposure, is frequently used in NICU. The radiologic features identified by our study can serve as auxiliary diagnostic tools for PDA, particularly valuable when echocardiographic resources are limited. Additionally, our methodology could be applicable to other diseases lacking defined objective radiologic criteria but known to exhibit specific imaging features.

## S3A-SPPD-2 ENHANCING RHEUMATIC HEART DISEASE DETECTION IN LOW-RESOURCE SETTINGS WITH UNCERTAINTY-BASED ACTIVE LEARNING

Marius G. Linguraru, DPhil, MSc (*Abstract Co-Author*) Co-founder, PediaMetrix Inc
Andrea Beaton (*Abstract Co-Author*) Nothing to Disclose
Emmy Okello (*Abstract Co-Author*) Nothing to Disclose
Kelsey Brown (*Abstract Co-Author*) Nothing to Disclose
Craig A. Sable (*Abstract Co-Author*) Nothing to Disclose
Taylor Gloria Broudy (*Abstract Co-Author*) Nothing to Disclose
Vishwesh Nath, PhD (*Abstract Co-Author*) Nothing to Disclose
Holger R. Roth, PhD (*Abstract Co-Author*) Employee, NVIDIA Corporation;Researcher, NVIDIA Corporation
Joselyn Rwebembera (*Abstract Co-Author*) Nothing to Disclose
Pooneh Roshanitabrizi (*Presenter*) Nothing to Disclose

**PURPOSE**

We introduce a new automated system to detect rheumatic heart disease (RHD)—a critical health issue in low-resource settings—using point-of-care color Doppler echocardiograms. This system combines active learning (AL), a type of machine learning technique, and uncertainty assessment to enhance diagnostic precision with minimal data annotation, utilizing an uncertainty-generating mechanism for improved functionality.

**METHODS AND MATERIALS**

We analyzed 1,022 color Doppler echocardiography cine-loops (parasternal and apical views) from 511 children with mitral regurgitation (mean age 12±2 years; range 5 to 17 years) in Uganda. Echocardiograms, obtained with a GE VIVID Q or IQ portable echocardiography machine using a 5 MHz transducer, were reviewed by expert cardiologists to determine the presence or absence of RHD. Of the children studied, 229 were deemed normal and 282 were diagnosed with RHD. The research received IRB approval. Our automated detection method includes selecting echocardiogram views and systolic frames using a DenseNet-121 neural network, RHD detection from two views with a 3D residual neural network, and uncertainty estimation for AL using test-time augmentation and Monte Carlo dropout techniques.

**RESULTS**

Using 411 training datasets, our method attained an RHD detection accuracy of 85%, sensitivity of 79%, and specificity of 92% across 100 test datasets. Notably, our AL framework achieved comparable results with only 43% of the training datasets (i.e., 178 training datasets), yielding an accuracy of 77%, sensitivity of 73%, and specificity of 81%. The p-value of 0.15, calculated using the McNemar test at a significance level of 0.05, suggests that the differences between the full and reduced dataset performances are not statistically significant. This level of performance is akin to that of specialized cardiologists, whose agreement typically falls within the range of 66% to 83%.

**CONCLUSION**

The study underscores the efficiency of our approach in drastically reducing annotation efforts, which are expensive and impractical due to the specialized human skills required.

**CLINICAL RELEVANCE/APPLICATION**

This approach could enhance RHD detection in low- and middle-income countries, potentially saving lives in regions where RHD annually causes over 300,000 deaths.

## S3A-SPPD-3 UTILITY OF DILUTED CONTRAST MATERIALS FOR PEDIATRIC PATIENTS WITH CONGENITAL HEART DISEASE DURING THE COMPUTED TOMOGRAPHY ANGIOGRAPHY

Tomoyasu Sato (*Abstract Co-Author*) Nothing to Disclose
Atsushi Ono (*Abstract Co-Author*) Nothing to Disclose
Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Yoshinori Funama, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Nakaura, MD (*Abstract Co-Author*) Nothing to Disclose
Takanori Masuda, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Diluted contrast material is useful, contrast material reduction can be achieved using it in combination with lower-voltage scan on children with congenital heart disease. To investigate the contrast material dilution rates at varying tube voltages and compare the contrast enhancement and contrast material dose between undiluted 120 kVp and diluted 80 kVp protocols in clinical settings.

**METHODS AND MATERIALS**

Contrast material solution was diluted across a range of 2-1024 times using physiological saline. The injected iodine dose in undiluted 120 kVp protocol (n = 46) and doubly diluted 80 kVp protocol (n = 48) was 600 mg/kg (injection volume was body weight × 2.0 mL) and 300 mg/kg (injection volume was body weight × 2.0[1.0 mL CM + 1.0 mL saline]) during 12 s injection duration. The study included median computed tomography number for ascending aorta and pulmonary artery, image noise, contrast noise ratio, and radiation dose between two groups.

**RESULTS**

Comparable hounsfield unit (HU) values were achieved by diluting ~2 times at 80 kVp compared to 120 kVp. Under the doubly diluted 80 kVp protocol, contrast material dose was reduced by ~50% compared with undiluted 120 kVp protocol. No significant disparities were observed in median HU values for the ascending aorta and pulmonary artery between two protocols (p = 0.95 and 0.82).

**CONCLUSION**

Analogous range of HU values was attained using dilution factor of ~2 at 80 kVp compared to 120 kVp. Doubly diluted 80 kVp protocol curtailed the contrast material dosage by ~50% compared to undiluted 120 kVp protocol while preserving vessel enhancement.

**CLINICAL RELEVANCE/APPLICATION**

No detailed study revealing why the use of diluted CM increases contrast enhancement on CTA has been performed. Based on our study, we anticipate that utilizing diluted contrast material within a pediatric patient cohort would effectively elevate CT values on CTA examinations.

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S3A-SPPH

**Physics Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPPH-1 EFFECTIVE WHOLE-BODY LYMPH NODES DETECTION IN CT SCANS USING TRANSFORMER-BASED DETECTOR VIA LOCATION DEBIASED QUERY SELECTION AND CONTRASTIVE QUERY REPRESENTATION

Xianghua Ye (*Abstract Co-Author*) Nothing to Disclose
Qifeng Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Haoshen Li (*Abstract Co-Author*) Nothing to Disclose
Na Shen (*Abstract Co-Author*) Nothing to Disclose
Ke Yan (*Abstract Co-Author*) Nothing to Disclose
Yirui Wang, MS (*Abstract Co-Author*) Nothing to Disclose
Le Lu (*Abstract Co-Author*) Nothing to Disclose
Dazhou Guo (*Abstract Co-Author*) Nothing to Disclose
Qinji Yu (*Abstract Co-Author*) Nothing to Disclose
Dakai Jin, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Lymph node (LN) detection in CT is essential for cancer diagnosis, staging and treatment planning. Previous statistical learning-based or deep learning-based works concentrated on detecting LNs in a single body region, such as the chest or abdomen, and typically yield limited recall and high false positives (FPs) even for enlarged LNs = 10mm (e.g., 60.9% recall at 6.1FPs per patient for the chest region, and 73.9% at 9FPs for abdomen). In this study, using the latest transformer-based detector, we propose a LN DEtection TRansformer (LN-DETR) that can effectively tackle the challenging yet clinically important LN detection task across major body sections.

### METHODS AND MATERIALS

We collected and curated data from 7 institutions including 1067 patients with 10,000+ annotated LNs including various body parts (neck, chest, and upper abdomen) and different diseases (head neck cancer, esophageal cancer, lung cancer, COVID, and other diseases). Built upon a latest transformer-based object detection framework (Mask DINO), we first design an efficient multi-scale 2.5D fusion scheme to incorporate the 3D LN context across consecutive input slices. Then location debiased query selection and contrastive query learning were further proposed to enhance the representation ability of LN queries, important to increase the LN detection sensitivity and reduce FPs. We use five out of seven datasets to develop and internally test the LN detection performance (70% training, 10% validation, and 20% testing), and report the sensitivity at 1, 2, 4 FPs per patient/CT-volume. The left two institutional datasets are used for independent external testing.

### RESULTS

The proposed LN-DETR achieves an average recall of 70.90% and 64.63% for LNs = 7mm across 1 to 4 FPs/patient in the internal and external testing, significantly outperforming the leading CNN-based method (MULAN) by 4.90% and 5.24%, respectively. It is also noted that for the subgroup of enlarged LNs (= 10mm), LN-DETR reports a recall of 83.5% at 4FPs per patient and an average recall of 80.43% across 1 to 4 FPs/patient.

### CONCLUSION

The LN-DETR model significantly enhances lymph node detection performance and shows strong generalizability across different body parts and diseases.

### CLINICAL RELEVANCE/APPLICATION

The proposed algorithm can detect lymph nodes of multiple body parts in CT scans with high precision, potentially assisting in the clinical workflow of radiology and radiation oncology.

## S3A-SPPH-10 CRANIOCAUDAL CYCLIC LOAD IMPROVE RISK ASSESSMENT OF LUMBAR PEDICLE SCREW LOOSENING:FINITE ELEMENT ANALYSIS BASED ON QUANTITATIVE COMPUTER TOMOGRAPHY

Huishu Yuan (*Abstract Co-Author*) Nothing to Disclose
Chenyu Jiang (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study was to investigate influence of craniocaudal cyclic load on pedicle screw fixation strength by computed tomography (QCT) based finite element analysis (FEA) and we examined predict ability in pedicle screw loosening (PSL).

### METHODS AND MATERIALS

12 clinical PSL cases (7 men, 5 women) and 12 age- and sex-matched controls were enrolled for CT based FEA. Simple axial pullout load and axial pullout load with preset craniocaudal cyclic load (100 times cycle) were applied to each model respectively, and the ultimate pullout force under both conditions is calculated as the fixed strength and compared. Besides, average HU values of screw trajectory and the bone mineral density (vBMD) of vertebral trabeculae were measured. The ultimate pullout force and HU value were compared between PSL and controls cases.

### RESULTS

The cyclic load remarkably reduce the pullout force of pedicle screws (906.2±180.2 N vs. 729.3±172.3 N, $p<0.0001$) by CT based FEA. No significant difference between the PSL and the control group in the simple axial pull-out force and vBMD of vertebral trabeculae. But the pullout force with preset cyclic load (639.2±169.4 N vs. 819.4±125.1 N, $p=0.072$) and the HU value of the screw trajectory (177.5±43.8 vs. 217.2±29.6, $p=0.016$) in the PSL group is significantly lower than that in the control group. Area under receiver operating characteristic curve (ROC) revealed pullout force with preset cyclic load slightly better predicted PSL than HU value of the screw trajectory (AUC = 0.798 vs. 0.750).

### CONCLUSION

The craniocaudal cyclic load significantly reduces the screw fixation strength which may be related to the declining HU value of screw trajectory. The pullout force with preset cyclic load by QCT based FEA are helpful for the clinical prediction of PSL.

### CLINICAL RELEVANCE/APPLICATION

The FEA pipeline proposed in this study is effective for the evaluation of PSL. Based with QCT-FEA, the craniocaudal cyclic load significantly reduces the screw pullout force by progressively accumulating bone tissue failure around the screw, which may relate with bone mass loss around the screw trajectory.

## S3A-SPPH-11 AUTOMATIC LIVER TUMOR DIAGNOSIS IN CONTRAST-ENHANCED CT SCANS WITH VARIABLE INPUT PHASES

Yu Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Ling Zhang (*Abstract Co-Author*) Nothing to Disclose
Xu Han (*Abstract Co-Author*) Nothing to Disclose
Ting Bo Liang (*Abstract Co-Author*) Nothing to Disclose
Ke Yan (*Abstract Co-Author*) Nothing to Disclose
Wei Liu (*Abstract Co-Author*) Nothing to Disclose
Qi Zhang (*Abstract Co-Author*) Nothing to Disclose
Xiaoli Yin (*Abstract Co-Author*) Nothing to Disclose
Le Lu (*Abstract Co-Author*) Nothing to Disclose
Chunli Li (*Abstract Co-Author*) Nothing to Disclose
ZHANG XIAOMING (*Presenter*) Nothing to Disclose

### PURPOSE

We present a novel network dubbed LIDIA (LIver tumor DIAgnosis network), crafted for the differential diagnosis of eight liver tumor types through the analysis of multi-phase contrast-enhanced computed tomography (CECT) scans.

### METHODS AND MATERIALS

LIDIA features an iterative fusion module, which can effectively extract features from either a 4-phase sequence (non-contrast, arterial, venous, and delayed phases, NAVD) or a 3-phase sequence (NAV), leveraging rich radiological signs in all possible phases. We also introduce an asymmetric contrastive learning method to improve discrimination of rare liver lesion types from common ones in real-world scenarios. We curated an extensive dataset of CECT scans, including 1,921 patients, where two-thirds are NAVD scans and one-third are NAV ones . We comprehensively annotated 8,138 lesions, classified into eight categories. In addition to seven prevalent lesion types (HCC, ICC, metastases, hemangioma, FNH, calcification, and cyst), we integrated an "others" category to cover more than 20 types of less common tumors.

### RESULTS

LIDIA achieved an average patient-wise classification AUC of 93.6% within an eight-class framework and 94.6% in the binary classification of benign versus malignant lesions. For lesion-wise analysis, LIDIA reached a detection precision of 0.886, recall of 0.866, an 8-class classification accuracy of 0.881, and an overall segmentation Dice of 0.869. Evaluated on an external cohort of 828 patients from another institution, LIDIA maintained generalizability, with a mean patient-wise classification AUC of 89.3%. Notably, the iterative fusion module contributed to an AUC improvement of 0.105 in the eight-class tumor classification. A comparative reader study with 150 independent cases showed our model's accuracy paralleling that of a senior radiologist with 15 years of experience, both achieving 75.6%.

### CONCLUSION

We introduce LIDIA, a system designed to assist radiologists in the diagnosis of liver tumors through CECT imaging. Extensive evaluation on both internal and external patient groups, along with a reader study, has confirmed the effectiveness and clinical applicability of our approach.

### CLINICAL RELEVANCE/APPLICATION

LIDIA enhances liver tumor diagnosis with its quick and accurate analysis of CECT scans, enabling precise identification of various tumor types, including rare ones. This facilitates early treatment of malignancies and promotes a collaborative healthcare approach.

## S3A-SPPH-12 ONE-STOP WHOLE-BRAIN CTP RECOMBINATION IMAGE EVALUATION ON COLLATERAL CIRCULATION

Lu Song Tang (*Abstract Co-Author*) Nothing to Disclose
Fang Wang, PhD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the value of multiphase CT vascular imaging based on deep learning reconstruction (DLIR) one-stop whole brain CT perfusion data reorganization in collateral circulation in patients with unilateral middle cerebral artery (MCA) stenosis.

### METHODS AND MATERIALS

13 patients with unilateral MCA and whole-brain CTP and CTA were collected. CTP, scanning protocol: tube voltage 80 kV and tube current 150 mA. All data were obtained using the DLIR-H reconstruction algorithm. Using CTP raw data, arterial peak period (m-CTA), early vein (m-CTV 1) and late vein (m-CTV 2) images (2 arterial stage, 2 early vein, 2 late veins) were compared to the enhanced CT value, image noise, signal-noise-to-noise ratio (SNR),

contrast noise ratio (CNR), subjective image quality (score system: 0-2 points). Multistage CTA images were fused with workstation and collateral cycle scoring (5, below 2 cannot be assessed). CTA vessel enhancement CT values, image noise, SNR, and CNR were compared by paired t-test, and W ilcoxon signed rank sum test was used against normal distribution. Subjective ratings of m-CTA image quality, multistage collateral circulation scores were assessed by W ilcoxon signed rank sum test. Statistical significance was considered as p <0.05.

**RESULTS**

Comparison with the conventional CTA image quality, CT value of vascular enhancement in m-CTA fusion images (550.04±145.74VS 539.08 ± 115.33, P = 0.656) and SNR (22.16 ± 10 VS 19.87 ± 9.52, P = 0.531) was slightly higher than that in the conventional CTA group, CNR(20.59±10.76VS 23.34±10.05, P = 0.533) was slightly lower than that in the conventional CTA group, The image noise was higher than the conventional CTA group (28.43±9.93VS 25.92 ± 10.40, p=0.129), There was no statistical difference in the two groups. The subjective image quality was good (7.15±0.8VS 7.23 ± 0.6), and the collateral score in the m-CTA fusion images was higher than that in the CTA group (4.77±0.44vs 3.46 ± 0.66, p=0.003).

**CONCLUSION**

The image quality of recombinant m-CTA based on CTP raw data based on DLIR-H technique can be comparable to conventional CTA, while providing a comprehensive assessment of collateral circulation status in patients with middle cerebral artery stenosis.

**CLINICAL RELEVANCE/APPLICATION**

Based on DLIR-H technology, CTP raw data is reorganized into multiphase CTA, and brain tissue blood perfusion information and collateral circulation can be obtained simultaneously without increasing the radiation dose and contrast dose.

## S3A-SPPH-3 ENHANCING PERSONALIZED CONTRAST INJECTION IN COMPUTED TOMOGRAPHY: CLINICAL VALIDATION OF A MACHINE LEARNING ALGORITHM FOR ACCURATE FAT-FREE MASS ESTIMATION

Cyril Thouly (*Abstract Co-Author*) Nothing to Disclose
Natalie Heracleous, PhD (*Abstract Co-Author*) Nothing to Disclose
Federica Zanca, PhD (*Abstract Co-Author*) Nothing to Disclose
Hugues G. Brat, MD (*Abstract Co-Author*) Research Grant, General Electric Company;Speaker, General Electric Company;Shareholder, Groupe 3R
Benoit Dufour (*Abstract Co-Author*) Nothing to Disclose
Benoit Rizk, MD (*Presenter*) Shareholder, GLEAMER

**PURPOSE**

Contrast-enhanced CT is vital for liver lesion detection, with enhancement influenced by scan parameters, contrast type, and patient characteristics [1-5]. Personalized contrast injection is critical for precise diagnosis and kidney failure prevention. Research indicates Fat-Free Mass (FFM) effectively predicts enhancement but measuring it in practice is time-consuming. We developed and clinically validated an algorithm for theoretical FFM estimation for use in clinical practice.

**METHODS AND MATERIALS**

A multivariate linear regression model was developed for estimating Fat-Free Mass (FFM). The model utilized a dataset consisting of 689 abdominal CT scans from adult patients referred for liver lesion characterization or cancer follow-up. Data were collected between 2017 and 2022 from nine centers, using 15 CT scanners. The measured FFM served as the ground truth for model training.In a second phase, the model underwent validation in clinical settings, through integration into an algorithm that uses FFM to predict personalized contrast volume for liver CT. An earlier version of such algorithm included measured FFM and was validated in clinical settings for harmonized image quality (50 HU) across patients. To evaluate whether the theoretical estimation of FFM could replace the measured FFM, image quality was assessed by measuring a single Region of Interest (ROI) for both the portal and native phases of the CT scans. The resulting measurements were then plotted for analysis and compared to the data of the previous validation using measured FFM.

**RESULTS**

The results demonstrated excellent predictive performance for estimating Fat-Free Mass (FFM) within our patient dataset, characterized by high coefficient of determination (R2) of 0.91 +/- o.o2. In our clinical validation, we examined 109 cases across six distinct 3R diagnostic sites. Liver image quality was centered around 52 Hounsfield Units (HU), with 85% of images falling within an acceptable 30-70 HU range. This percentage is lower compared to earlier studies conducted by our team, where Fat-Free Mass (FFM) was measured (92% of images within 30-70 HU) [8]. Further analysis of additional cases, totaling 250 exams, will contribute to a more comprehensive understanding of the final results.

**CONCLUSION**

The validation of our model in clinical settings demonstrated very good enhancement, although further data will be crucial in solidifying its performance in practice.

**CLINICAL RELEVANCE/APPLICATION**

Accurate estimation of FFM allows saving time for effortless personalization of contrast volume injection, ensuring consistent enhancement of the liver in clinical practice.

## S3A-SPPH-4 EVALUATION OF A DEEP LEARNING CT RECONSTRUCTION ALGORITHM ON SMALL LOW-CONTRAST LUNG LESIONS USING 3D-PRINTED PHANTOMS

Peter B. Noel, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Speakers Bureau, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation
Sandra S. Halliburton, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Eddy Wong, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Franz Englbrecht (*Abstract Co-Author*) Nothing to Disclose
Harold I. Litt, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV
Kai Mei, PhD (*Abstract Co-Author*) Nothing to Disclose
Amy Perkins (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Jessica Im, BEng (*Presenter*) Nothing to Disclose

**PURPOSE**

Deep learning reconstruction (DLR) has been shown to improve image quality of low dose computed tomography (CT) scans, which is promising for lung cancer screening. While most malignant pulmonary nodules (PN) have high contrast on CT, ~20% of these lesions exhibit low contrast attenuations of = -600 Hounsfield Units (HU). Furthermore, for PNs which are thin in the z-axis direction, thinner reconstruction slice thicknesses are necessary for

resolving the lesion, at the cost of increased noise. This study uses a custom 3D-printed phantom to investigate the performance of a DLR algorithm on low contrast PNs of varying HU and sizes, and across various slice thicknesses and doses.

**METHODS AND MATERIALS**

The phantom in this study had a background lung-like attenuation of -800 HU, and inclusions of -750, -700, -650 and -600 HU, varying sizes between 1 - 10 mm, and thicknesses of 0.4 - 1 mm. The phantom was 3D-printed as a 10 cm cylinder out of polylactic acid, using PixelPrint technology. The phantom was placed in a 20 cm 3D-printed water equivalent ring inserted into a CT ACR 464 phantom body ring (33 x 26.4 cm) to mimic an average sized patient. CT scans were acquired on a conventional CT (Incisive CT, Philips Healthcare) at exposures between 0.5 - 20 mGy, with three scans acquired at each exposure. Images were reconstructed at slice thicknesses of 2, 1, and 0.8 mm using filtered back projection (FBP), iterative reconstruction (IR), and five denoising levels of a DLR algorithm (Precise Image, Philips Healthcare). The reconstructions were compared by measuring noise in each image, as well as line profiles, mean HU, and contrast-to-noise ratio (CNR) for each inclusion.

**RESULTS**

No significant difference in HU quantification was observed between the different reconstruction algorithms. HU quantification was primarily influenced by slice thickness, with slices of 2, 1, and 0.8 mm resulting in average HU errors of -87, -60, and -40 respectively for the 10 x 10 x 1 mm inclusion. Meanwhile, noise increased significantly as slice thickness decreased, with 1 and 0.8 mm slice thicknesses resulting in 59% and 89% mean increase in noise respectively compared to 2 mm slice thicknesses. CNR was primarily influenced by the reconstruction algorithm, with average percent improvements in CNR of 15% for IR and between 36-360% for DLR compared to FBP.

**CONCLUSION**

This study showed that using DLR with thinner slices enhances HU quantification and significantly improves CNR compared to both FBP and IR. These findings indicate that DLR is effective in improving the image quality of low-contrast PNs.

**CLINICAL RELEVANCE/APPLICATION**

The enhanced image quality and quantitative accuracy of thin-slice DLR images may enhance the sensitivity and specificity of lung cancer screening protocols.

## S3A-SPPH-5 OPTIMAL TRANSPORT FRAMEWORK TO INDICATE SOURCES OF AI PERFORMANCE BIAS THROUGH SUBGROUP FEATURE ALIGNMENT

Nicholas Petrick, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexis Burgon, BS (*Abstract Co-Author*) Nothing to Disclose
Yelena Yesha, PhD (*Abstract Co-Author*) Nothing to Disclose
Mohammad Abu Baker Siddique Akhonda (*Abstract Co-Author*) Nothing to Disclose
Kenny H. Cha, PhD (*Abstract Co-Author*) Nothing to Disclose
Ravi K. Samala, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The determination of appropriate inclusion of subgroups in performance assessment studies is needed to estimate the effectiveness of artificial intelligence (AI)-enabled medical devices. However, factors such as AI's ability to learn shortcut patterns can complicate the process, leading to a mismatch between human-intended and model-learned solutions. We propose a novel method to measure the difference in AI subgroup representation in the training data sets. This is used to indicate subgroups that may be sources of AI performance bias on the test data set.

**METHODS AND MATERIALS**

We hypothesize that sources of AI performance bias can be determined by assessing the similarity of the feature representations across subgroups. Optimal transport (OT) measurements are used to measure this similarity, which estimate the "cost" of transforming features between subgroups by framing the problem as an alignment issue between two distributions. An AI model trained to classify COVID-19 status on chest X-ray images was used to quantitatively analyze the differences in feature representations for case I: sex (male, female) and case II: race (white, black) subgroups. Different amounts of bias were simulated by varying the disease prevalence of a pair of subgroups (e.g., male vs female) in the training set. The measured OT values, after adjusting based on the inter-class cost, indicate the degree of dissimilarity between subgroup feature representations. The approach was validated by evaluating the model performance on equally stratified test sets.

**RESULTS**

A relationship between the OT values (from the training set) and the AI performance bias (from the test set) was observed for both cases. In case I, lower OT values were observed at equal prevalence (0.91±0.40) than at higher prevalence differences (1.30±0.55 and 1.29±0.50). A similar trend was observed in the model test performance, with lower subgroup sensitivity differences for models trained on equal prevalence (0.03±0.02) than for those trained on higher prevalence differences (0.47±0.06 and 0.45±0.05). A similar trend was observed for race subgroups in case II.

**CONCLUSION**

Our results show that the AI performance bias in the test set can be indicated via analyzing the difference in subgroup feature representations in the training data set.

**CLINICAL RELEVANCE/APPLICATION**

Misalignment between human-intended and model-learned solutions complicates the process of determining important subgroups for performance assessment studies involving AI-enabled medical devices. Our proposed method can indicate potential sources of bias, thus aiding in the determination of subgroups.

## S3A-SPPH-6 DUAL-VIEW, MULTI-MODAL SEQUENTIAL AI FOR DETECTION OF PROGRESSION TO CLINICALLY SIGNIFICANT PROSTATE CANCER IN BPMRI

Derya Yakar, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Maarten de Rooij, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Henkjan Huisman, PhD (*Abstract Co-Author*) Shareholder, QView Medical, Inc;Grant Support, Siemens AG;Grant Support, Canon Medical Systems Corporation
Christian Roest, MSc (*Abstract Co-Author*) Grant, Siemens AG
Anindo Saha, MSc (*Abstract Co-Author*) Nothing to Disclose
Vilma Bozgo, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore a novel hybrid deep learning (DL) and machine learning approach to compare two sequential MRI scans in detecting progression to clinically significant prostate cancer (csPCa).

**METHODS AND MATERIALS**

This retrospective study included a multi-center cohort of 7134 consecutive single scan patients and 896 patients between 2012-2021 with at least a prior and current biparametric MRI scan of the prostate. Clinical information (PSA density, age, volume) was also collected. csPCa in the current scan was defined as a histopathological grade of ISUP=2. We compared three dual-view AI systems to assess the effect of adding clinical variables and uncertainty. All three use a nnU-Net-based DL ensemble trained on the 7134 single MRI cases integrating 5 models. The DL model was applied to each scan to generate sensitive heatmaps. The heatmaps were summarized into three parameters. 1) The patient level suspicion score computed as the maximum voxel-level prediction in each heatmap; 2) csPCa volume estimated by integrating the thresholded heatmap at 50% suspicion; 3) uncertainty as the variance in DL predictions from the five component detection models. Differential scores were additionally computed as the difference in the parameters between the current and prior. The final stage in the three AI systems was a linear regression model of the DL and clinical parameters, and the differential scores to predict csPCa in the current scan. This resulted in three systems. 1) using only the current and differential suspicion and volumetric parameters. 2) system 1 extended with clinical parameters and 3) system 2 extended with uncertainty. We used the area under the receiver-operating characteristic curve (AUROC) to compare the three classification systems at patient level. Differences in AUROC were evaluated using DeLong's tests. Bootstrapping was performed to generate the 95% confidence intervals (CI).

**RESULTS**

136 of 931 sequential studies showed histopathological progression to csPCa. System 1 AUROC was 0.81 [CI: 0.71-0.88]. System 2 AUROC significantly improved to 0.85 (CI: 0.76-0.93, p=0.02) by incorporating clinical parameters (PSA, PSA density, age). System 3 including uncertainty improved AUROC to 0.86 (CI: 0.77--0.93), but without reaching statistical significance.

**CONCLUSION**

This study provides evidence that a hybrid AI combining deep learning and machine learning can potentially detect progression to csPCa in sequential MRI with promising diagnostic accuracy that becomes even better by adding clinical parameters.

**CLINICAL RELEVANCE/APPLICATION**

Artificial intelligence may help achieve a robust and sensitive non-invasive way for the detection of progression to clinically significant disease, helping reduce unnecessary biopsies and treatment.

## S3A-SPPH-7 A FRAMEWORK FOR ROC ANALYSIS OF RULE-OUT AND RULE-IN DIAGNOSTICS AND AN APPLICATION TO MAMMOGRAPHY DATA

Weijie Chen, PhD (*Abstract Co-Author*) Nothing to Disclose
Kwok Lung Fan (*Abstract Co-Author*) Nothing to Disclose
Elim Thompson, PhD (*Abstract Co-Author*) Nothing to Disclose
Frank W. Samuelson, PhD (*Abstract Co-Author*) Nothing to Disclose
Michelle Mastrianni, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

In recent years, there has been growing interest in leveraging AI imaging devices to reduce radiologist workload, particularly in screening scenarios. In a rule-out ("believe the negative" or BN) setting, patients deemed negative with high confidence by an AI imaging device could bypass radiologist review, while in a rule-in ("believe the positive" or BP) setting, those identified as highly suspicious would be autonomously recalled. This work proposes a theoretical approach to analyze rule-out, rule-in, and combination ROC curves given the marginals and correlations of the AI and radiologist interpretations.

**METHODS AND MATERIALS**

We use bivariate copulas to approximate rule-out and rule-in ROC curves and to examine the effect of radiologist-AI correlations on the AUC and other metrics. We validate our theoretical method on clinical mammography datasets using one of the winning AI algorithms in a 2023 RNSA challenge for breast cancer detection. For each test set, we fit two ROC curves (one for radiologist-alone and one for AI-alone) and calculate the non-diseased and diseased correlations between the radiologist and the AI. We then plot the theoretical rule-out ROC curves and compare them with the empirical radiologist performance under rule-out at various AI threshold levels.

**RESULTS**

A test set with mammography images (119 diseased and 272 non-diseased) and radiologist (Se, Sp) = (0.765, 0.768) saw Pearson's correlations between radiologist assessment and AI scores of 0.09 and 0.40 respectively for non-diseased and diseased images. At AI operating FPFs of 0.5 and 0.9 respectively, empirical rule-out (Se, Sp) was (0.697, 0.882) and (0.765, 0.782). These performance values fall within the range of three of our proposed models. At AI FPF 0.9, the PPV of the rule-out diagnostic is superior to that for the radiologist-alone.

**CONCLUSION**

Empirical results show that projected radiologist performance under a rule-out or rule-in scenario are consistent with the theory. Higher correlation among diseased cases leads to improved performance of the rule-out ROC curve, while higher non-diseased correlation leads to worsened performance. The converse holds true for rule-in curves.

**CLINICAL RELEVANCE/APPLICATION**

While we assume the radiologist operates at a fixed threshold in our calculations of the empirical radiologist performance under rule-out, the proposed ROC curves are particularly useful given that a radiologist may change his or her decision threshold with the presence of an AI imaging device, an intuition that remains underexplored in current research given the complexities of conducting rule-out studies.

## S3A-SPPH-8 DOUBLING AND QUADRUPLING FRAME RATES IN DIGITAL SUBTRACTION ANGIOGRAPHY THROUGH DEEP LEARNING FRAME INTERPOLATION

Kentaro Yamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jun'ichi Kotoku (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Kondo, MD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Takata, PhD (*Presenter*) Joint research, Shimadzu Corporation Patent license, MS Seisakusho

## PURPOSE

In interventional radiology, a high frame rate enhances the clarity of observed blood vessels and catheters. However, increasing the frame rate can proportionately elevate radiation exposure to patients and medical staff. This study aims to utilize deep learning-based frame interpolation on digital subtraction angiography (DSA) images, allowing the estimation of high frame rate equivalent DSA from low frame rate sources.

## METHODS AND MATERIALS

Conventional optical flow-based methods often fall short in accurately tracking the movement of fluids such as contrast agents. Consequently, we adopted the Flow-Agnostic Video Representations network for frame interpolation, which is a deep learning model designed to reason about non-linear motion trajectories, aiming to double and quadruple the frame numbers. We used models trained on the Vimeo90K and GOPRO_Large Dataset which are datasets of video frames of natural images. Test dataset included 1,194 and 1,023 DSA sequences with reduced frame counts to half and one-quarters, respectively. Then, frame interpolation was performed to achieve double and quadruple frame rates. The output interpolated frames were assessed against the omitted original frames using peak signal-to-noise ratio (PSNR) and structural similarity index measure (SSIM).

## RESULTS

The double and quadruple interpolation processes estimated 10,917 and 8,880 frames, respectively. The PSNR values recorded were 38.0 (interquartile range: 36.0-40.2) for the double interpolation and 36.2 (34.1-38.5) for the quadruple interpolation. SSIM scores were 0.935 (0.902-0.957) for the double interpolation and 0.915 (0.875-0.943) for the quadruple interpolation. The interpolated frames comfortably appeared as if the fluid was truly flowing.

## CONCLUSION

The deep learning models successfully interpolated DSA frames to an equivalent high frame rate with reasonable accuracy. Quadruple frame interpolation, which entailed higher frame reduction, resulted in poorer PSNR and SSIM values compared to double frame interpolation. This model would achieve clearer observation of DSA while mitigating radiation exposure risks to patients and medical staff.

## CLINICAL RELEVANCE/APPLICATION

High-precision frame interpolation could allow for lower frame rates in angiography, reducing radiation exposure while enabling detailed observations in DSA.

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# Abstract Archives of the RSNA, 2024

S3A-SPVA

**Vascular Imaging Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-SPVA-2 REDUCING BOTH RADIATION AND CONTRAST DOSES IN RENAL COMPUTED TOMOGRAPHY ANGIOGRAPHY IN SLIM PATIENTS USING 80KVP AND ASIR-V ALGORITHM IN COMPARISON WITH THE CONVENTIONAL 100-KVP PROTOCOL

Junjun Li (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the use of 80 kVp and high-strength adaptive statistical iterative reconstruction (ASIR-V) algorithm in renal computed tomographyangiography (CTA) for lean patients for reducing both radiation and contrast medium (CM) doses in comparison with the conventional 100-kVp protocol.

### METHODS AND MATERIALS

Twenty-eight slim patients (group A) with body mass index (BMI) 25kg/m2 =BMI=30kg/m2 were prospectively enrolled to undergo 80 kVp renal CTA with noise index (NI) of 17 HU and at weight-dependent CM dose rate of 19 mgI/kg/s for 10-s injection. Images were reconstructed with 70% ASIR-V. Radiation dose, contrast dose, and image quality were statistically compared with another 28 patients (group B) with matching BMI who underwent conventional renal CTA with 100-kVp and NI of 11 HU, 50ml of 350 mgI/ml CM at the flow rate of 4.5 ml/s and reconstructed with 50% ASIR-V. The CT values and SD values of the right and left renal arteries were measured to calculate the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). The image quality was subjectively scored by two experienced radiologists blindly using a five-point criterion. The CM dose and effective radiation dose in both groups were calculated and compared. Image quality between the two groups was also compared.

### RESULTS

There was no significant difference in patient characteristics between the two groups (P>0.05). Compared to group B, group A significantly reduced effectiveradiation dose by 15.4% (2.69±0.74mSv vs. 3.18±0.66mSv), CM dose by 19.4% (14.09g±1.49gI vs. 17.5gI), and injection rate by 14.4% (3.85±0.47ml/s vs.4.5ml/s) (all p<0.05). Group A had significantly lower SD values, higher CT values, SNR and CNR values of the renal arteries than group B (all P<0.05). There wasno difference in the subjective score of renal CTA images between the two groups (4.64±0.10 vs. 4.53±0.10) (P>0.05) and the two radiologists had excellentagreement in scoring (Kappa value >0.8, P<0.05).

### CONCLUSION

Renal CTA using 80 kVp and high-level ASiR-V provides diagnostic images with substantial reduction in both radiation and contrast doses for slim patients with 25kg/m2 =BMI=30kg/m2 compared to the conventional 100-kVp protocol.

### CLINICAL RELEVANCE/APPLICATION

BMI-based individualized kVp selection protocol in renal CTA imaging significantly reduces radiation dose and total iodine intake while maintaining diagnostic image quality and reduce the risk of contrast-induced nephropathy

## S3A-SPVA-3 PREDICTING OBSTRUCTIVE CORONARY ARTERY DISEASE IN PATIENTS WITH ACUTE ISCHEMIC STROKE OR TRANSIENT ISCHEMIC ATTACK: AN INTERPRETABLE MACHINE LEARNING APPROACH USING CT-BASED RADIOMICS

Yang Hou, MD (*Abstract Co-Author*) Nothing to Disclose
Yu Lan (*Presenter*) Nothing to Disclose

### PURPOSE

In acute ischemic stroke (AIS) and transient ischemic attack (TIA) patients, the threat of cardiovascular complications, especially CAD, is substantial. The appropriateness and selection criteria for coronary CTA (CCTA) screening in this cohort remain ambiguous. An interpretable machine learning (ML) model can provide critical insights into the significance of various risk markers for CAD prediction, thus refining patient selection for CCTA. The investigation leverages CT-based radiomics in an interpretable machine learning (ML) framework to assess obstructive coronary artery disease (CAD) risk in AIS and TIA patients. It focuses on correlating imaging biomarkers from head and neck CT angiography (CTA) with obstructive CAD incidence.

### METHODS AND MATERIALS

Utilizing the random forest algorithm, we developed an ML model that integrates a radiomic score (Rad_score) derived from CTA features, namely pericarotid adipose tissue, with established risk factors and the Framingham Risk Score (FRS). Our study retrospectively encompassed 175 patients, split into training and validation sets (7:3 ratio). Shapley additive explanations (SHAP) was used to assess how each feature contributed to risk evaluation.

## RESULTS

Of the 175 patients, 83 (47.43%) were diagnosed with obstructive CAD. A meticulous selection process whittled down 1,692 features to 10 pivotal variables for Rad_score. The composite model, integrating Rad_score, carotid artery stenosis degree, pericarotid fat density (PFD) and FRS, exhibited robust predictive capability (AUC: 0.877 in the training set, 0.801 in the validation set). SHAP analysis pinpointed the threshold values for each individual risk factor.

## CONCLUSION

Our interpretable ML model, underpinned by CT-based radiomics, effectively identifies patients at risk for obstructive CAD in AIS and TIA patients. The SHAP analysis demonstrated that the Rad_score, derived from pericarotid adipose tissue, along with the carotid stenosis degree, emerged as pivotal factors. This methodology could significantly enhance the precision of CCTA screening, offering a more nuanced approach to CAD risk stratification in this high-risk group.

## CLINICAL RELEVANCE/APPLICATION

Within the training set, an interpretable machine learning model facilitates precise risk forecasting for obstructive coronary artery disease in the patients with AIS or TIA (AUC = 0.877). An increased Rad_score emerges as a significant influence on the adverse outcome examined. Additionally, this model enables tailored recognition of key clinical and imaging factors that play a role in each patient's projected risk level.

# Abstract Archives of the RSNA, 2024

S3B-SPBR

**Breast Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPBR-1 DEVELOPMENT OF AN MRI RADIOMIC MACHINE LEARNING MODEL FOR TRIPLE NEGATIVE BREAST CANCER PREDICTION BASED ON FIBROGLANDULAR TISSUE OF THE CONTRALATERAL UNAFFECTED BREAST IN BREAST CANCER PATIENTS

Rosa E. Ochoa Albiztegui, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Daphne Resch (*Abstract Co-Author*) Nothing to Disclose
Katja Pinker-Domenig, MD, PhD (*Abstract Co-Author*) Speakers Bureau, European Society of Breast Imaging;Speakers Bureau, Siemens AG;Speakers Bureau, IDKD;Speakers Bureau, Canon Medical Systems Corporation;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Merantix Healthcare;Consultant, AURA Health
Sunitha B. Thakur, PhD (*Abstract Co-Author*) Nothing to Disclose
Sarah Eskreis-Winkler, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jayasree Chakraborty (*Abstract Co-Author*) Nothing to Disclose
Keitha Varela, BS (*Abstract Co-Author*) Nothing to Disclose
Maxine S. Jochelson, MD (*Abstract Co-Author*) Speaker, General Electric Company
Mark E. Robson, MD (*Abstract Co-Author*) Advisory Board, Pfizer Inc;Advisory Board, Abbott Laboratories;Advisory Board, sanofi-aventis Group;Advisory Board, General Electric Company ;Research funded, AstraZeneca PLC
Roberto Lo Gullo, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a radiomic-based machine learning model to predict triple negative breast cancer (TNBC) based on the contralateral unaffected breast's fibroglandular tissue (FGT) in breast cancer patients

### METHODS AND MATERIALS

This retrospective study included 541 patients (mean age, 51 years; range, 26-82) who underwent screening breast MRI between November 2016 and September 2018 and who were subsequently diagnosed with biopsy-confirmed, treatment-naĮve breast cancer. Patients were divided into a training set (n=250) and a validation set (n=291). Semi-automated 2D segmentation of FGT in the contralateral unaffected breast was performed using the T1-weighted fat-saturated first post-contrast sequence images. In the training set, 132 radiomic features were extracted from each segmentation using the open-source CERR platform. Following feature selection, the final prediction model was created, based on a support vector machine with a polynomial kernel of order 2. Model performance was evaluated in the validation set

### RESULTS

The training set included 250 patients (mean age, 50 years; range, 26-82), 156 with TNBC and 94 with non-TNBC; the validation set included 291 patients (mean age, 51 years; range, 26-82), 209 with TNBC and 82 with non-TNBC. The final prediction model, which included 4 radiomic features, achieved an AUC of 0.71, a sensitivity of 54% [47%-60%], a specificity of 74% [65%-84%], PPV of 84% [78%-90%] and NPV of 39% [31%-47%] in the validation set

### CONCLUSION

TNBC can be predicted based on radiomic features extracted from the FGT of the contralateral unaffected breast of patients, suggesting the potential for risk prediction specific to TNBC

### CLINICAL RELEVANCE/APPLICATION

This is a first necessary step towards the long-term goal of defining a subtype-specific risk score incorporating not only imaging features but also clinical and genetic data to identify women, including those who may not be categorized as high-risk by traditional risk models, who are at risk for TNBC

## S3B-SPBR-10 EVALUATION OF A MAMMOGRAPHY-BASED DEEP LEARNING RISK ALGORITHM FOR PREDICTING CANCER IN A TRIENNIAL BREAST SCREENING PROGRAM

Sarah Hickman, MBBS (*Abstract Co-Author*) Research collaboration, Vara;Research collaboration, ScreenPoint Medical BV;Research collaboration, Lunit Inc;Research collaboration, Kheiron Medical Technologies Ltd;Research collaboration, Alphabet Inc;Research collaboration, Volpara Health Technologies Limited
Priya S. Rogers, MBBS, BSc (*Abstract Co-Author*) Nothing to Disclose
Fleur Kilburn-Toppin, MBBChir, MA (*Abstract Co-Author*) Nothing to Disclose
Fiona J. Gilbert, MBChB, FRCR (*Abstract Co-Author*) Research Grant, Hologic, Inc Research Grant, General Electric Company Research Consultant, Alphabet Inc Research Consultant, Kheiron Medical Technologies Ltd Research support, Bayer AG Research collaboration, Volpara Health Technologies Limited Research collaboration Lunit Research collaboration Merantix Research collaboration Screenpoint Research collaboration Therapixel Research

support GSK Research collaboration RhinoHealth Research collaboration Curemetrix
Richard Black, MS (*Abstract Co-Author*) Nothing to Disclose
Joshua Kaggie (*Abstract Co-Author*) Grant, GlaxoSmithKline plc
Joshua Rothwell (*Abstract Co-Author*) Nothing to Disclose
Nicholas R. Payne, PhD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate a deep-learning breast risk prediction algorithm (Mirai) to determine sensitivity and specificity for detection of interval cancers (ICs) from yearly risk scores on screening mammograms.

**METHODS AND MATERIALS**

Consecutive screening mammograms from 2 cohorts of women (119,669 women mean age 58.96 ± 7.80 years) from 2014-2016 at 2 NHS Breast Screening Program sites were processed by Mirai. Receiver-operator curves (ROCs) were generated and the area under the curve (AUCs) calculated from output scores for 1, 2 and 3-year timepoints. Ground truth was histopathology for all cancers; screen detected cancers were excluded from analysis; there were 469 ICs, defined as those diagnosed before the subsequent three yearly screening examination. DeLong's test was used to compare AUCs; Harrell's C-index for overall performance. IC detection rates were found for if the top 10% of risk scores were recalled, and Mann-Whitney U tests used to compare score distributions between individuals developing no cancer (normals) and ICs.

**RESULTS**

Overall AUCs were 0.72 (CI: 0.66-0.78), 0.65 (CI: 0.62-0.69) and 0.67 (CI: 0.63-0.70), for years 1, 2 and 3 respectively; c-index = 0.68 (CI: 0.66-0.71), with statistically significant differences comparing year 1 to year 2 (p=0.0435), but no differences between years 1 and 3 (p=0.111), and 2 and 3 (p=0.563). When set at thresholds to recall the top 10% of scores, sensitivities were 37.0% (26.0-49.1%), 20.5 (15.0-27.0%) and 25.7% (19.9-32.4%) with specificities all 90.0% (89.9-90.2%), successfully predicting 27/77, 39/190 and 52/202 ICs for years 1, 2 and 3, respectively, totaling 118/469 in the three-year period. Distributions of assigned risk scores were statistically different when comparing normal cases and all ICs (plt;0.05), as well as comparing normal cases to ICs for each year (plt;0.05). IC scores consistently increased each year following screening, to a statistically significant extent (plt;0.05).

**CONCLUSION**

Compared to normal cases, Mirai assigned higher risk scores to individuals that developed ICs within a triennial screening program and predicted 25.2% of ICs when set at 90% specificity. Evaluation of this model in different populations and configurations would support generalization to prospective studies.

**CLINICAL RELEVANCE/APPLICATION**

20-30% of all breast cancers are ICs, carrying a poorer prognosis. Risk scores could be used to identify women who may benefit from supplemental imaging or shorter screening intervals to detect cancer earlier and reduce underdiagnosis. Large-scale prospective population-based evaluation of such models with appropriate threshold selection and health economic modelling would determine if models are better than density measures for offering enhanced screening.

## S3B-SPBR-2 AI-ENHANCED PRETREATMENT MRI FOR RESPONSE PREDICTION OF HIGH-RISK, EARLY-STAGE TRIPLE-NEGATIVE BREAST CANCER TO NEOADJUVANT TREATMENT WITH PEMBROLIZUMAB AND CHEMOTHERAPY

Katja Pinker-Domenig, MD, PhD (*Abstract Co-Author*) Speakers Bureau, European Society of Breast Imaging;Speakers Bureau, Siemens AG;Speakers Bureau, IDKD;Speakers Bureau, Canon Medical Systems Corporation;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Merantix Healthcare;Consultant, AURA Health
Jonas Teuwen, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Sarah Myers (*Abstract Co-Author*) Nothing to Disclose
Joren Brunekreef (*Abstract Co-Author*) Nothing to Disclose
Eric Marcus (*Abstract Co-Author*) Nothing to Disclose
Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Sarah Eskreis-Winkler, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Panagiotis Kapetas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Stephanie Downs-Canner, MD (*Abstract Co-Author*) Nothing to Disclose
Varadan Sevilimedu (*Abstract Co-Author*) Nothing to Disclose
Nour Abuhadra (*Abstract Co-Author*) Nothing to Disclose
Maxine S. Jochelson, MD (*Abstract Co-Author*) Speaker, General Electric Company
Lynn Han (*Abstract Co-Author*) Nothing to Disclose
Roberto Lo Gullo, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine whether pre-treatment MRI as part of standard-of-care staging can be enhanced with AI to predict pathologic complete response (pCR) to neoadjuvant pembrolizumab and chemotherapy in patients with early-stage triple-negative breast cancer (TNBC)

**METHODS AND MATERIALS**

Patients with high-risk, early-stage TNBC treated with neoadjuvant pembrolizumab and chemotherapy followed by surgical resection between July 2021 and July 2022 were retrospectively included. Classical machine learning models were trained based on clinical-only, image-only, or both image and clinical features. A deep learning 3D UNet segmentation network coupled with a convolutional classifier head attached to the bottleneck was used to train a hybrid network based on image-only or both image and clinical features

**RESULTS**

Of 110 patients, 59% (n=65) had pCR while 41% (n=45) had residual disease. On multivariable analysis, younger age (OR=0·96, 95% CI: 0·93-0·99, p=0·013) and smaller size on pre-treatment MRI (OR=0·98, 95% CI: 0·96-1·0, p=0·009) significantly predicted pCR. Classical machine learning models attained AUCs of 0·57±0·10 (sensitivity 73%, specificity 34%), 0·63±0·10 (sensitivity 77%, specificity 43%), and 0·64±0·12 (sensitivity 78%, specificity 44%) based on clinical-only data, image-only data, or both image and clinical data. Deep learning models attained AUCs of 0·53±0·12 (sensitivity 52%, specificity 52%) and 0·58±0·11 (sensitivity 61%, specificity 52%), based on image-only data or both image and clinical data

### CONCLUSION

Classical machine learning models including both clinical and radiomics-based MRI features from pre-treatment MRI scans are promising to inform on the probability of a patient with TNBC responding to combined neoadjuvant pembrolizumab and chemotherapy

### CLINICAL RELEVANCE/APPLICATION

This study provides novel evidence that machine learning models can be trained to predict pCR in TNBC patients after neoadjuvant ICI therapy and chemotherapy, suggesting that AI-enhanced standard-of-care pre-treatment MRI may be used to better select patients who could benefit from immunotherapy after validation in larger multi-institutional studies

## S3B-SPBR-3 RESIDUAL CONVOLUTIONAL NEURAL NETWORK BASED ON ENHANCED BREAST MRI INTRA- AND PERITUMORAL INFORMATION: A MULTIMODAL NEURAL NETWORK FOR PREDICTINGLYMPHOVASCULAR INVASION IN BREAST CANCER

Yun Liang (*Abstract Co-Author*) Nothing to Disclose
Yuhan Wei (*Abstract Co-Author*) Nothing to Disclose
Yaqin Zhang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Zichang Ma, MD (*Abstract Co-Author*) Nothing to Disclose
Huajin Liu (*Abstract Co-Author*) Nothing to Disclose
Junyu Lin (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to develop a multimodal model based on residual neural networks, which enhances the robustness of preoperative prediction of breast cancer lymphovascular invasion (LVI) by integrating intratumoral and peritumoral information from different modalities of dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI).

### METHODS AND MATERIALS

A preoperative DCE-MRI dataset was gathered, comprising 236 patients from 2016 to 2023, whose postoperative pathological examination verified their LVI status. 70% of the data (165 cases) were used for training, and the remaining 30% (71 cases) were used for testing. DCE-MRI, fat-suppressed T2-weighted images, and diffusion-weighted imaging were used to describe morphological feature data. Radiomics features were extracted from both intratumoral and peritumoral regions of interest. After statistical testing and feature selection, these features were combined with region-of-interest tensors as inputs into a multi-channel residual convolutional neural network. Multimodal fusion was performed at the fully connected layer to achieve LVI prediction.

### RESULTS

The deep learning model (Mdl) that integrated both intratumoral and peritumoral information showed the best performance, achieving an AUC of 0.85 (95% CI: 0.76, 0.93) for predicting LVI. This was superior to the radiomics machine learning model (Mml) that also combined intratumoral and peritumoral information (AUC = 0.80, 95% CI: 0.70, 0.89), the Mml that only included intratumoral information (AUC = 0.76, 95% CI: 0.67, 0.85), and the Mdl that only included intratumoral information (AUC = 0.75, 95% CI: 0.65, 0.85). All four models were pairwise compared using the DeLong test, resulting in all six p-values being less than 0.05.

### CONCLUSION

The Mdl, which combines both intratumoral and peritumoral information, can more effectively predict lymphovascular invasion in breast cancer.

### CLINICAL RELEVANCE/APPLICATION

Breast cancer patients with positive LVI have a significantly higher risk of local recurrence after breast-conserving therapy compared to those with negative LVI. Preoperative prediction of LVI status can aid in the selection of treatment plans.

## S3B-SPBR-7 CAN AN ARTIFICIAL INTELLIGENCE SYSTEM HELP ENTRY-LEVEL RADIOLOGISTS REDUCE UNNECESSARY BIOPSY OF BENIGN LESIONS IN MAMMOGRAMS?

Jie Ma (*Abstract Co-Author*) Nothing to Disclose
Lin Li (*Abstract Co-Author*) Nothing to Disclose
Xiaohui Lin (*Abstract Co-Author*) Nothing to Disclose
Rushan Ouyang (*Abstract Co-Author*) Nothing to Disclose
Tingting Liao (*Abstract Co-Author*) Nothing to Disclose
Yuting Yang (*Abstract Co-Author*) Nothing to Disclose
Chunyan Yi (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate whether a deep learning-based artificial intelligence (AI) system can assist entry-level radiologists to reduce unnecessary biopsy of benign lesions and improve the assessment accuracy of initial BI-RADS (Breast imaging reporting and data system) 3 and 4 cases in mammograms.

### METHODS AND MATERIALS

To investigate whether a deep learning-based artificial intelligence (AI) system can assist entry-level radiologists to reduce unnecessary biopsy of benign lesions and improve the assessment accuracy of initial BI-RADS (Breast imaging reporting and data system) 3 and 4 cases in mammograms.

### RESULTS

Of the 313 cases, 143 were benign and 170 were malignant. The attending radiologists (who composed the initial mammography reports) falsely recalled 81 unnecessary cases for biopsy and misclassified 15 malignant cases as BI-RADS 3 (probably benign). These numbers for the four entry-level radiologists were 71 and 24, respectively. Assisted by the AI, the numbers were reduced to 51 and 16, respectively. Assuming that BI-RADS 3 is benign and 4needs to be biopsied, the sensitivity of the attending radiologists was 0.91 (95% CI: 0.86 to 0.95), the specificity was 0.43 (0.35 to 0.52) and the accuracy was69.3% (63.9% to 74.4%). The AI system achieved a sensitivity of 0.79 (0.72 to 0.85), a specificity of 0.69 (0.60 to 0.76) and an accuracy of 74.1% (68.9% to 78.9%). The entry-level radiologists achieved a sensitivity of 0.86 (0.80 to 0.91), a specificity of 0.50 (0.42 to 0.59) and an accuracy of 69.7% (64.2% to 74.7%). These results of the entry-level radiologists were boosted to 0.91 (0.85 to 0.95), 0.64 (0.56 to 0.72) and 78.6% (73.6% to 83.0%) with the assistance of the AI system. The combination of the AI system and entry-level radiologists significantly increased the performance of diagnosis versus radiologists alone ($p<0.01$).

### CONCLUSION

The deep learning-based AI system surpassed entry-level radiologists and significantly improved the performance of entry-level radiologists in the assessment of BI-RADS 3 and 4 lesions by reducing unnecessary biopsy.

### CLINICAL RELEVANCE/APPLICATION

The deep learning-based AI system surpassed entry-level radiologists and significantly improved the performance of entry-level radiologists in the assessment of BI-RADS 3 and 4 lesions by reducing unnecessary biopsy.

## S3B-SPBR-8 PREDICTION OF TUMORSHRINKAGE PATTERN OF HR-POSITIVE, HER2-NEGATIVE BREAST CANCER AFTER NEOADJUVANT CHEMOTHERAPY BASED ON BASELINE ENHANCED MRI RADIOMICS

Tao Zhou (*Abstract Co-Author*) Nothing to Disclose
Lijia Wang (*Abstract Co-Author*) Nothing to Disclose
Jia-Liang Ren, MD (*Abstract Co-Author*) Nothing to Disclose
Yongchen Wang (*Abstract Co-Author*) Nothing to Disclose
LI YANG (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a predictive model incorporating pathologic features, MRI image features, and radiomic features to predict the tumor shrinkage pattern (TSP) of hormone receptor (HR)-positive, human epidermal growth factor receptor 2 (HER2)-negative breast cancer (BC) after neoadjuvant chemotherapy (NAC).

### METHODS AND MATERIALS

A retrospective analysis of 227 patients with HR+/HER2-BC who underwent surgical treatment after NAC was conducted. TSP was categorized into two groups based on baseline and preoperative MRI characteristics: Category I (complete response or simple concentric regression) and Category II (others). Clinical, pathologic and imaging features were recorded. Patients were randomly divided into a training cohort (N = 160) and a validation cohort (N = 67) at a 7:3 ratio. Feature selection was performed on the training cohort using univariable analysis and multivariable analysis to establish a clinical model. Tumor segmentation was performed on the baseline enhanced MRI sequences and radiomic features were extracted. Univariable analysis, correlation analysis, and the Boruta algorithm were used to select radiomic features to establish a radiomic model. A combined model was established by integrating the above features. The receiver operating characteristic (ROC) curves were used to assess the predictive performance of the three models. The areas under the curve (AUCs) of the three models were compared using DeLong's test. The calibration performance of the models was assessed using calibration curves. The net benefit of the models was assessed using decision curve analysis (DCA).

### RESULTS

Ki67 quantity was identified as an independent predictor of TSP. The AUCs of the three models in the training cohort and the validation cohort were 0.624 (95% CI: 0.539-0.709) and 0.551 (95% CI: 0.412-0.689), 0.826(95% CI: 0.764-0.888) and 0.808 (95% CI: 0.706-0.910), and 0.831 (95% CI: 0.770-0.891) and 0.810 (95% CI: 0.709-0.911) respectively. A nomogram was generated based on the combined model, with a prediction cut-point of 0.38. In both cohort, the combined model and the radiomic model exhibited higher AUCs than the clinical model ($P < 0.05$). The combined model had good calibration performance (the training cohort: $P = 0.011$, the validation cohort: $P = 0.13$). The combined model and radiomic model both demonstrated higher net benefit rates in the training and validation cohort than the clinical model.

### CONCLUSION

Baseline MRI radiomic features can accurately predict TSP in patients with HR+/HER2- BC after NAC.

### CLINICAL RELEVANCE/APPLICATION

Radiomic models of HR+/HER2- BC MRI images have predictive value for TSP after NAC, may guiding clinical decision making.

## S3B-SPBR-9 BREAST CANCER CARE: PREDICTING PATHOLOGIC RESPONSE TO NEOADJUVANT THERAPY USING A MACHINE LEARNING MODEL BASED ON RADIOMIC FEATURES EXTRACTED FROM MRI

Giulia Pruneddu (*Abstract Co-Author*) Nothing to Disclose
Daniela Bernardi, MD (*Abstract Co-Author*) Nothing to Disclose
Riccardo Levi (*Abstract Co-Author*) Nothing to Disclose
Paola Nardi (*Abstract Co-Author*) Nothing to Disclose
Rubina Manuela Trimboli (*Abstract Co-Author*) Nothing to Disclose
Giulia Vatteroni, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop and validate a machine learning model (ML) based on radiomic features extracted from Breast Magnetic Resonance (MRI) to predict response to Neoadjuvant Therapy (NAT) in patients with breast cancer.

### METHODS AND MATERIALS

Breast MRIs of women candidates for NAT performed between January 2019-March 2023 were retrospectively analysed. The inclusion criteria were: completion of all NAT cycles, availability of high-quality pre and post-NAT MRI, final surgical pathological report. MRIs were performed using 1.5 T scanners of 3 different vendors with a multiparametric protocol (T2w, DWI/ADC, 1 pre-contrast T1w+six post-contrast dynamic series). We manually segmented 30 lesions from the 3rd dynamic series using open-source software (3D Slicer) to train a deep learning 3D UNet model for automatic tumor segmentation. The remaining dataset was automatically segmented after the neural network training (nnUNet). Afterward, all MRI sequences were rigidly registered to the 3rd dynamic sequence and Radiomics features were extracted using the same tumor Region of Interest for each sequence. The ML model was developed with a Radiomics feature selection (based on Recursive Feature Elimination strategy), Random-forest classification algorithm and 5 folds-cross validation training strategy. The outcome was defined to predict the response as complete (CR), partial (PR) or non-response (NR). Statistical analysis was performed through univariate (T-Test or Mann-Whitney U test) and multiclass (One-Way ANOVA or Kruskal Wallis) analysis to distinguish among CR, PR and NR ($p<0.05$ significant). The ML model performances were assessed on test set (25% stratified by outcome) by means of accuracy, sensitivity and AUROC.

### RESULTS

Of the 200 candidates for NAT, 176 women were included in the analysis. Histologically, 97/176 (56%) resulted in CR, 68/176 (39%) in PR and 11/176 (6%) in NR. Over 759 radiomic features extracted and analyzed, 49 resulted statistically significant different among the 3 classes: notably, Slope wavelet

Gray Level Co-occurrence (p=0.001) and Kurtosis (p=0.0017) showed significant correlations with intra-tumoral heterogeneity and the NR category. The ML model exhibited an accuracy of 71% and a sensitivity of 76% in predicting response, with AUROC values of 0.94, 0.83, and 0.82 for PR, NR, and CR respectively.

**CONCLUSION**

Our ML model, based on radiomic features extracted from breast MRI, demonstrates promising capabilities in predicting response to NAT, especially in patients showing Partial Response.

**CLINICAL RELEVANCE/APPLICATION**

This study provides practical assistance to breast team members by facilitating the establishment of tailored therapeutic strategies through the pre-treatment stratification of NAT patient population.

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# Abstract Archives of the RSNA, 2024

S3B-SPCA

**Cardiac Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPCA-10 OPPORTUNISTIC AUTOMATED CORONARY ARTERY CALCIUM SCREENING ON ROUTINE CHEST CT SCANS TO COORDINATE PREVENTIVE CARDIOLOGIC CARE IN ASYMPTOMATIC ADULTS

Ross W. Filice, MD (*Abstract Co-Author*) Advisor, BunkerHill Health, Inc;Shareholder, BunkerHill Health, Inc;Speaker, General Electric Company;Speaker, Koios Medical;Researcher, Koios Medical
Angela Zhou (*Abstract Co-Author*) Nothing to Disclose
Devyani Shinde, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

Millions of patients undergo routine CT exams who have Coronary Artery Calcium (CAC) but are not informed because quantitation has not been feasible. Unlike traditional ECG-gated CAC scans, quantifying incidental CAC on routine chest CTs using a machine learning model can circumvent the need for separate dedicated exams, specialized imaging, and reduce healthcare disparities. We aim to study the applicability of noninvasive CAC screening using a reliable and accurate machine learning model on routine ungated chest CTs and integration of outpatient cardiac care in patients with subclinical atherosclerosis.

### METHODS AND MATERIALS

The study includes patients <75 years old, with no known atherosclerotic cardiovascular disease (ASCVD), not on dialysis, and not actively on a statin, with an AI CAC score of >= 100. Scores are reported from ungated unenhanced chest CTs using a deep learning algorithm supervised by a radiologist. Inclusion criteria are determined automatically from the electronic health record and confirmed by manual chart review. Eligible patients are notified by phone and offered a referral for an outpatient cardiology visit for personalized risk assessment and discussion of preventive therapies.

### RESULTS

We refined our care pathway through a pilot study of 3087 scans from 2217 unique patients between Jan-Feb ‘23. Model deployment began from Sept ‘23 and by March ‘24, we examined 1834 additional scans and contacted 77 eligible candidates (including from pilot) by April. Our preliminary findings include 27 referrals for cardiology intake, about 35% of those contacted. We excluded 7 patients with false positive elevated CAC scores.

### CONCLUSION

AI-enabled CAC screening of patients undergoing routine CTs provides an untapped avenue for identifying patients at risk for ASCVD. Coordinating a cardiology referral can close the loop by discussing preventive strategies and increasing awareness about cardiovascular health resulting in actual interventions to improve patient outcomes. Limitations include occasional challenges in identifying patients on statins due to inconsistent chart documentation, notifying some eligible patients by phone, inability to refer patients without requisite insurance, and patient discretion regarding referrals. Future steps include expanding model usage to more sites and systematic analysis of the clinical outcomes as a result of this program.

### CLINICAL RELEVANCE/APPLICATION

Deep learning-based quantification and screening of incidental CAC on routine CT exams may be of potential use to identify otherwise missed asymptomatic patients at-risk for ASCVD and provides a unique opportunity to close the care pathway loop through multidisciplinary care with cardiologists.

## S3B-SPCA-2 DEEP LEARNING SUPER-RESOLUTION RECONSTRUCTION FOR FAST AND HIGH-QUALITY CINE CARDIOVASCULAR MAGNETIC RESONANCE

Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Christoph Katemann (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Alexander Isaak, MD (*Abstract Co-Author*) Nothing to Disclose
Akos Varga-Szemes, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Consultant, Elucid Bioimaging Inc;Research Consultant, Bayer AG
Daniel Kuetting, MD (*Abstract Co-Author*) Nothing to Disclose
Claus C. Pieper, MD (*Abstract Co-Author*) Grant, Guerbet SA;Speakers Bureau, Guerbet SA;Speakers Bureau, Bayer AG;Speakers Bureau, Koninklijke Philips NV;Speakers Bureau, Julius Zorn GmbH
Narine Mesropyan, MD (*Abstract Co-Author*) Nothing to Disclose
Tilman S. Emrich, MD (*Abstract Co-Author*) Speaker, Siemens AG;Travel support, Siemens AG;Advisory Board, Siemens AG
Dmitrij Kravchenko, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare standard resolution balanced steady-state free precession (bSSFP) cine images with cine images acquired at low resolution but reconstructed with a deep learning (DL) super-resolution algorithm.

**METHODS AND MATERIALS**

In this prospective study, cine cardiovascular magnetic resonance (CMR) datasets (short-axis and 4-chamber views) were acquired in healthy volunteers and patients at normal resolution (cineNR; 1.89×1.96 mm2, reconstructed at 1.04×1.04 mm2) and at a low-resolution (2.98×3.00 mm2, reconstructed at 1.04×1.04 mm2). Low-resolution images were reconstructed using compressed sensing DL denoising and resolution upscaling (cineDL). Left ventricular ejection fraction (LVEF) and end-diastolic volume index (LVEDVi) were assessed. Apparent signal-to-noise (aSNR) and contrast-to-noise ratios (aCNR) were calculated. Subjective image quality (blood-pool to myocardium contrast, endocardial edge definition, and artefacts) was assessed on a 5-point Likert scale (1: non-diagnostic to 5: excellent). Student's paired t test, intraclass correlation coefficient (ICC), Blant-Altman plots, Pearson's r, and Wilcoxon matched pairs test were used for statistical analysis.

**RESULTS**

Thirty participants were analyzed (37±16 years; 20 healthy volunteers and 10 patients). For short-axis views, whole-stack acquisition duration of cineDL was 42% shorter compared to cineNR (57.5±8.7 vs 98.7±12.4 s, p<.0001). No statistical significant differences and excellent agreement were found for volumetric measurements: LVEF (59±7 vs 59±7 % p=.17, r = 0.96, ICC: 0.95) and LVEDVi (85.0±13.5 vs 84.4±13.7 ml/m2, p=.12, r= 0.99, ICC: 0.99) (Figure 1). Objective (aSNR (81±49 vs 69±38, p=.32), aCNR (53±31 vs 45±27, p=.33) and subjective image quality (5.0 [IQR 4.9-5.0] vs 5.0 [IQR 4.7-5.0], p=.99) was similar between both techniques.

**CONCLUSION**

Super-resolution DL reconstruction of cine images acquired at a lower spatial resolution led to decrease in acquisition times of up to 42% with shorter breath holds and did not affect volumetric results or image quality.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning super-resolution reconstructions of balanced steady-state free precession (bSSFP) cine images acquired at a lower spatial resolution reduce acquisition times while preserving diagnostic accuracy, improving clinical feasibility of cine imaging especially in vulnerable populations such as pediatric patients or patients with symptoms of heart failure by decreasing breath hold duration.

## S3B-SPCA-3 DIAGNOSTIC PERFORMANCE OF AI-ASSISTED CCTA IN DETECTING CORONARY ARTERY STENOSIS IN PATIENTS WITH SUSPECTED CORONARY ARTERY DISEASE

Weihua Yin (*Abstract Co-Author*) Nothing to Disclose
Bin Lu, MD (*Abstract Co-Author*) Nothing to Disclose
Yang Chen (*Presenter*) Nothing to Disclose

**PURPOSE**

Noninvasive coronary computed tomography angiography (CCTA) plays an important role in the screening of coronary artery disease (CAD). The interpretation of CCTA results is time-consuming and relies on the reader's expertise. we conducted a study to investigate the accuracy of deep learning in detecting CAD patients with =50% coronary artery stenosis.

**METHODS AND MATERIALS**

This retrospective, multicenter, and blinded evaluation study included 1765 patients undergoing CCTA from 5 centers. CCTA data from suspected CAD patients (mean age: 59.90 ±11.51 years, 47.3% female) were retrospectively analyzed using artificial intelligence (AI) based software for comprehensive assessment, including coronary segmentation, lumen, and vessel wall evaluation, plaque quantification and characterization, and stenosis determination with comparison to the reference standard of consensus by three experts.

**RESULTS**

The artificial intelligence(AI) performance at a patient level was excellent for accuracy, sensitivity, specificity, positive predictive value(PPV), and negative predictive value(NPV) for =50% stenosis as follows: 92.8%, 95.3%, 91.4%, 85.6%, and 97.3%, respectively. Excellent agreement is seen between expert readers and AI determined maximal diameter stenosis for per-patient (kappa coefficients: 0.84 (95% CI: 0.81-0.88)). Regarding diagnostic efficiency, comparing the AI versus human reader, the average reading time decreased from 5.94 min to 2.01 min (p < 0.0001).

**CONCLUSION**

A novel AI-based assessment of CCTA can accurately and rapidly identify patients with coronary artery stenosis =50% and effectively aid in triage, reducing unnecessary downstream procedures and optimizing the utilization of healthcare resources.

**CLINICAL RELEVANCE/APPLICATION**

Given CAD is the most important socioeconomic healthcare problem in the world, the application of AI-assisted CCTA to triage firstly this disease in suspected CAD patients is surprisingly helpful. Our study demonstrates that AI can swiftly screen patients with coronary artery stenosis =50%, potentially reducing unnecessary downstream procedures and optimizing the utilization of healthcare resources in real clinical practice. In addition, the divergent interpretations of CCTA findings among different radiologists. The implementation of AI can aid in the professional development of less experienced radiologists.

## S3B-SPCA-5 DEEP LEARNING MAY PREDICT EARLY CORONARY ARTERY DISEASE FROM PERICORONARY ADIPOSE TISSUE ATTENUATION AND FAT FRACTION IN CHEST CT ANGIOGRAPHY

Andrew Nguyen (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Summers, MD, PhD (*Abstract Co-Author*) Royalties,iCAD, Inc;Royalties, Koninklijke Philips NV;Royalties, ScanMed, LLC;Royalties, Ping An Insurance (Group) Company of China, Ltd;Royalties, Translation Holdings;Research support, Ping An Insurance (Group) Company of China, Ltd
Tejas Sudharshan Mathai, PhD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Coronary artery disease (CAD) is the leading cause of mortality worldwide. Pericoronary adipose tissue (PCAT) is an early biomarker of CAD. Prior semi-automated approaches measure PCAT at the right coronary artery (RCA) but not the left coronary artery (LCA) and its branches. The purpose of this project is to develop a fully automated approach to measure PCAT mean attenuation and fat fraction at both arteries.

### METHODS AND MATERIALS

A 3D full resolution nnUNet was trained (n = 745 studies) and tested (n = 183 studies) on the ImageCAS dataset to segment the RCA and LCA. PCAT was defined as the adipose tissue at twice the 3D radial distance from the artery centerline to the outer artery wall within [-190, -30] Hounsfield units (HU). For the RCA, PCAT was measured 10 mm from the ostium for a radius of 40 mm. For the LCA, PCAT was measured from the aorta to the first coronary branchpoint and from that branchpoint to a radius of 40 mm. The branchpoint was used to split the LCA into the left main (LM), left anterior descending (LAD), and left circumflex (LCX) arteries (Fig. 1a-c). The ASOCA dataset was used to externally validate our model to detect differences in studies with (n = 20) and without CAD (n = 20).

### RESULTS

For the ImageCAS test set, Dice scores for PCAT at the RCA and LCA were 0.70 ± 0.19 and 0.78 ± 0.12. For the ASOCA validation set, Dice scores for PCAT in CAD and non-CAD studies were 0.54 ± 0.08 vs. 0.49 ± 0.14 at the RCA, and 0.52 ± 0.07 vs. 0.47 ± 0.06 (p = 0.02) at the LCA (Fig. 1d). Of the four coronary arteries, mean PCAT attenuation (-75.08 ± 7.93 HU vs. -68.98 ± 8.04 HU; p = 0.02) and fat fraction (0.38 ± 0.11 vs. 0.30 ± 0.14; p = 0.04) at the left main artery were significantly different between CAD and non-CAD studies (Fig. 1e-g). Concordant with the literature, mean PCAT attenuation at the RCA was higher in CAD studies (-80.58 ± 6.43 HU vs. -83.40 ± 5.74 HU), though no significant difference was found. Furthermore, no significant difference in PCAT volume was found.

### CONCLUSION

We developed a fully automated method to measure PCAT attenuation and fat fraction at both the RCA and LCA. We found significant differences in mean PCAT attenuation and fat fraction at the left main artery between CAD and non-CAD studies.

### CLINICAL RELEVANCE/APPLICATION

Automated opportunistic screening of PCAT in chest CT angiography using deep learning promises to be an early predictor of CAD.

## S3B-SPCA-6 AI-BASED CHEST RADIOGRAPHIC CARDIOVASCULAR BORDER ANALYSIS FOR DIAGNOSING PULMONARY THROMBOEMBOLISM

Ki Seok Choo, MD (*Abstract Co-Author*) Nothing to Disclose
Jong Eun Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Dong Hyun Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Jiyun Ok (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the feasibility of AI-based cardiovascular border analysis on chest radiographs for the suspicion of pulmonary thromboembolism.

### METHODS AND MATERIALS

We collected posteroanterior chest radiographs from patients diagnosed with pulmonary thromboembolism before and after treatment, from January 2019 to December 2023. For comparison with a normal reference, we also gathered posteroanterior chest radiographs of healthy subjects aged 20 to 40. Our AI-based model for the automated diagnosis of cardiovascular abnormalities evaluated the radiographs based on the CT ratio, the distance from the midline to the borders of the superior vena cava (SVC)/aorta, right atrium (RA), aortic knob, pulmonary trunk, left atrium (LA) appendage, left ventricle (LV), descending aorta, and carina angle, as well as age-sex corrected Z-scores. To compare pre-treatment with post-treatment and the normal reference group, we used Student's t-test.

### RESULTS

Sixty-five patients with pulmonary thromboembolism, who had undergone both pre-treatment and post-treatment posteroanterior chest radiographs, were included along with 459 normal control subjects with posteroanterior chest radiographs. After treatment, the pulmonary thromboembolism group showed a significant reduction in the measured variables compared to pre-treatment values, aligning them closer to those of the normal reference. Age-sex corrected Z-scores also showed significant differences; pre-treatment values of the CT ratio, SVC/Aorta, RA border, aortic knob, pulmonary trunk, LA appendage, descending aorta, and Carina angle were significantly higher than the post-treatment values.

### CONCLUSION

The AI-based model for cardiovascular border analysis demonstrates potential in the suspicion of pulmonary thromboembolism in patients based on chest radiographs.

### CLINICAL RELEVANCE/APPLICATION

AI-based radiographic cardiovascular analysis represents a new clinical approach to diagnosing pulmonary thromboembolism, offering a more quantitative and comparable method for managing this serious condition.

## S3B-SPCA-7 PAIRED COMPARISON OF CARDIAC MRI AND CT FOR THE COMPREHENSIVE EVALUATION OF CARDIAC FUNCTION

James W. Goldfarb, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study compares global cardiac functional values from clinical cine cardiac CT (CCT) and cardiac MRI (CMR) patients to evaluate intermodality variability. It aims to determine the level of agreement and identify any systematic biases that might affect their interchangeability. Understanding agreement and bias between these modalities is essential for their effective use in clinical settings.

### METHODS AND MATERIALS

The retrospective study included 24 consecutive clinical patients (54% male; average age 74.6 ± 10.8 years), undergoing both CMR and 20-phase CCT within a 14-day period (average 5.3 ± 4.3 days). Measurements included left ventricular (mass, end-diastolic volume, end-systolic volume, ejection fraction, and stroke volume for all ventricles and atria. We compared fully automated deep learning-based 3D segmentation of CCT with conventional CMR segmentation using correlation coefficients, Bland-Altman plots, and ICC analysis.

### RESULTS

Despite the small sample size, the distribution of cardiac function values was normal, with a wide range observed: LV mass had a mean of 129g and range: 62-257g; LVEF had a mean of 54% and range: 30-80%. There was excellent correlation and agreement for LV mass between CMR and CCT ($r = 0.98$, $p < 0.001$, ICC = 0.99), although a significant bias was noted (-84 g, 95%CI: -132, -35 g), likely due to the inclusion of papillary muscles within

the LV cavity in CCT, but not in CMR tracings. Strong correlations (r = 0.82-0.91) were observed for LV measurements, alongside notable biases (LVEDV = +19 ml [95%CI: -31, 69]; LVESV = +23 ml [95%CI: -15, 62]; LVEF = -10% [95%CI: -25, 4]). RV measurements showed lower correlations (r = 0.52-0.80) and significant biases (RVEDV = -60 ml [95%CI: -110, -10]; RVESV = -60 ml [95%CI: -118, -1]). Left atrial measurements also demonstrated strong correlations (r = 0.70-0.90) but with substantial biases (LAEDV = -31 ml [95%CI: -68, 7]; LAESV = -31 ml [95%CI : -61, -1]; LAEF = -12% [95%CI: -1, 26%]). Right atrial values exhibited the weakest correlations (r = 0.42-0.67), with large biases and broad ranges of agreement.

**CONCLUSION**

The study reports strong correlation for LV mass between CCT and CMR, supporting the reliability of CCT with necessary adjustments for bias. However, variability in ventricular and atrial measurements suggests the need for caution when using these modalities interchangeably. Future research should focus on refining automated segmentation techniques to improve modality agreement and reliability.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning provides a powerful tool for the comprehensive functional evaluation of 3D cardiac CT cine acquisitions. However, clinically significant biases currently limit the interchangeability of values between CCT and CMR.

## S3B-SPCA-8 AUTOMATED AORTIC CALCIUM SEGMENTATION AND SCORING TOOL IN NON-CONTRAST CT IN CORE320

Bharath Ambale-Venkatesh, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Co-founder, Third Eye Health Inc;Research Grant, Myocardial Solutions, Inc
Armin A. Zadeh, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Joao A. Lima, MD (*Abstract Co-Author*) Nothing to Disclose
Sangmita Singh (*Abstract Co-Author*) Nothing to Disclose
Devina Chatterjee (*Presenter*) Nothing to Disclose

**PURPOSE**

Aortic calcification is associated with cardiovascular risk, but manual quantification is time-consuming for routine assessment. We investigated automated aortic calcium scoring as an incidental finding in CORE320 patients with a non-contrast CT

**METHODS AND MATERIALS**

381 participants referred for cardiac angiography were enrolled in CORE320, a prospective multicenter diagnostic study. MACE was defined myocardial infarction, cardiac death, hospitalization for chest pain over 5 years. Aortic calcification was manually quantified from non-contrast DICOMs using 3D Slicer, resulting in Agatston scores for 379 patients in the aortic root, ascending and descending aorta. For automated methods, segmentation of the aorta was achieved through 3D Slicer, using the TotalSegmentator algorithm. Aortic calcifications were segmented using Hounsfield Unit voxel thresholding (>130 HU). Noise was reduced through serial erosion and dilation. Agatston scores were calculated as previously described. Multivariable Cox regression associated aortic calcium with the 5-year clinical outcomes with adjustments for age, gender, race, statin use, and coronary calcium. Correlation coefficients evaluated the agreement between automated and manual scores

**RESULTS**

Mean age was 62 years, 34% were women. MACE occurred in 99/379 patients over 5-year follow-up. 45.1% had any aortic calcium scores (19.0% aortic root, 44.3% ascending aorta, 36.7% descending). Aortic root and total aortic calcium were not correlated with coronary artery calcium. The automated aortic root calcium score (r=0.98), ascending aorta (r=0.99), and descending aorta (r=0.99) demonstrated good agreement with manual scoring. Automated and manual aortic root, ascending aorta, descending aorta, and total aortic calcification scores were significantly associated with increased risk of MACE in both univariable and multivariable Cox regression analyses. Hazard ratios were comparable between automated and manual scoring methods, with aorta root (manual: 1.128; automated: HR 1.145), ascending (manual: 1.122; automated: HR 1.139), descending (manual: 1.086; automated: HR 1.096). The C-statistic for aortic root calcium scores (0.584), ascending (0.577), descending (0.579), and total (0.570) compared well to automated methods. All differences in C-statistics statistically insignificant

**CONCLUSION**

The study demonstrated the accuracy and predicability of automated aortic calcium scoring with no statistically significant differences in predictive performance

**CLINICAL RELEVANCE/APPLICATION**

Using the CORE320 study, automated aortic calcification is predictive of 5-year MACE, independent of coronary artery calcification, supporting its use as an incidental finding in routine scans

## S3B-SPCA-9 APPLICATION AND ACCURACY ANALYSIS OF CT-FFR IN PREDICTING MYOCARDIAL ISCHEMIC EVENTS CAUSED BY TYPE A AORTIC DISSECTION

Feifei Zhou, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to evaluate the accuracy of CT-FFR technology in predicting myocardial ischemic events caused by Type A aortic dissection and to explore its potential clinical applications.

**METHODS AND MATERIALS**

This retrospective study included patients diagnosed with Type A aortic dissection who had complete coronary computed tomography angiography (CCTA) imaging data. CT-derived fractional flow reserve (CT-FFR) measurements were performed using proprietary software developed by Siemens to analyze the CCTA images. The study examined the concordance between CT-FFR and myocardial ischemic events during hospitalization. Additionally, the predictive value of CT-FFR for coronary revascularization and major adverse cardiac events (MACE) was evaluated over a one-year follow-up period. The impact of CT-FFR on clinical decision-making processes was analyzed, along with its potential to improve patient outcomes.

**RESULTS**

This study analyzed data from 84 patients with Type A aortic dissection (mean age 43 ± 11 years; 78.6% male), among whom 45 experienced myocardial infarction during hospitalization and 7 encountered major adverse cardiac and cerebrovascular events (MACE) within one year. CT-derived fractional flow reserve (CT-FFR) demonstrated a sensitivity of 62.1% and a specificity of 49.1% in predicting myocardial infarction, with a positive predictive value (PPV) of 39.1% and a negative predictive value (NPV) of 71.1%. Receiver operating characteristic (ROC) curve analysis revealed that CT-FFR had moderate diagnostic accuracy for predicting myocardial ischemic events, with an area under the curve (AUC) of 0.556. In terms of predicting MACE, patients with positive FFR results were more likely to experience MACE, with the ROC analysis showing a CT-FFR AUC of 0.67 for MACE events.

These findings suggest that CT-FFR has moderate accuracy and potential clinical application in predicting myocardial ischemic events and MACE, particularly among high-risk patient groups.

## CONCLUSION

CT-FFR identifies high-risk patient groups through a non-invasive approach. FFR-CT may become an important tool for assessing cardiac risk and guiding clinical decisions in such patients.

## CLINICAL RELEVANCE/APPLICATION

AI-based CT-FFR can provide clinicians with crucial information about the risk of myocardial ischemia in patients with Type A aortic dissection. Accurately identifying patients at risk of major adverse cardiac events (MACE) can enhance the efficiency and cost-effectiveness of treatment.

# Abstract Archives of the RSNA, 2024

S3B-SPCH

**Chest Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPCH-1 A CT-BASED QUANTITATIVE NOMOGRAM FOR DIFFERENTIATING COPD AND ASTHMA

Li Fan, MD (*Abstract Co-Author*) Nothing to Disclose
Yueze Li (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the application value of a model established by combining quantitative features from chest CT with clinical information in distinguishing between patients with chronic obstructive pulmonary disease (COPD) and asthma.

### METHODS AND MATERIALS

A retrospective analysis was performed on the chest CT quantitative features and clinical data of 798 patients who were confirmed to have COPD or asthma through pulmonary function tests, including 516 COPD patients and 282 asthma patients. These patients were randomly divided into training and internal validation sets at a ratio of 7:3. Commercial software was used to perform whole-lung vessel segmentation on chest CT images and extract quantitative features of the lung vasculature. Pearson correlation analysis, the minimum Redundancy Maximum Relevance (mRMR) algorithm, and the Least Absolute Shrinkage and Selection Operator (LASSO) were applied for feature reduction and selection. A predictive model was established using multivariate logistic regression analysis, and a nomogram was plotted. The calibration, diagnostic efficacy, and clinical value of the nomogram were evaluated.

### RESULTS

Nineteen radiomics features were selected to calculate the Quantitative score. Multivariate logistic regression showed that age, height, and Quantitative score were independent predictors of the combined model. The area under the curve (AUC) of the combined prediction model in the training set was 0.78, which was higher than the clinical model (AUC=0.68) and the radiomics model (AUC=0.76). In the validation set, the AUC of the combined model was 0.74, also higher than the clinical model (AUC=0.67) and the radiomics model (AUC=0.72). Decision curve analysis revealed that the combined prediction nomogram demonstrated good clinical utility within the threshold range of 0.1 to 0.9.

### CONCLUSION

The combination of quantitative CT features and clinical characteristics can effectively differentiate between COPD and asthma patients.

### CLINICAL RELEVANCE/APPLICATION

The study has good predictive efficacy in distinguishing between COPD and asthma by incorporating age, height, and quantitative scores into a nomogram, offering considerable clinical benefits and providing a certain reference value for clinical decision-making and treatment.

## S3B-SPCH-2 ASSESSING EMPHYSEMA ON X-RAY DOSE-EQUIVALENT PHOTON-COUNTING DETECTOR CT: EVALUATION OF A DEEP LEARNING ALGORITHM AND VISUAL SCORING IN A PROSPECTIVE STUDY

Cecilia Strappa, MD (*Abstract Co-Author*) Nothing to Disclose
Jonas Kroschke (*Abstract Co-Author*) Nothing to Disclose
Falko Ensle (*Abstract Co-Author*) Nothing to Disclose
Thomas Frauenfelder, MD (*Abstract Co-Author*) Advisory Board, Agfa-Gevaert Group;Advisory Board, Boehringer Ingelheim GmbH
Lisa Jungblut, MD (*Abstract Co-Author*) Nothing to Disclose
Bjarne Kerber, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the feasibility and efficacy of visual scoring, low-attenuation volume (LAV) and deep learning methods for emphysema severity estimation in ultralow-dose Photon-counting detector CT, aiming to explore future dose reduction potentials.

### METHODS AND MATERIALS

In this IRB-approved, prospective study 101 patients underwent non-contrast low- and chest x-ray equivalent dose CT scans at the same day using a first-generation clinical dual-source photon-counting detector CT. Visual emphysema pattern (no, trace, mild, moderate, confluent and advanced destructive emphysema; as defined by the Fleischner Society) was assessed by two experienced radiologists for low- and ultralow-dose images independently. In a second step, automated emphysema quantification was performed using an established low attenuation volume (LAV) algorithm with a threshold of -950 HU and a commercially available deep learning model for automated emphysema quantification. The LAV algorithm applied to low-dose images served as the reference standard for emphysema quantification.

**RESULTS**

X-ray dose equivalent scans exhibited a significantly lower Computed Tomography dose index (CTDIvol) compared to low-dose scans (low-dose: 0.66 ± 0.16 mGy, X-ray dose equiv.: 0.11 ± 0.03 mGy, p<0.0001). Inter-reader agreement for visual scoring was excellent (? = 0.83). Visual emphysema scoring showed good agreement between low-dose and X-ray dose equivalent scans (? = 0.70), with significant and strong correlation (Spearman's ? = 0.79). While trace emphysema was underestimated in X-ray dose equivalent scans, there was no significant difference in the distinction of higher grade (mild to advanced destructive) emphysema (p=0.125) between the two scan doses. Deep learning and LAV algorithm demonstrated no significant difference in predicted emphysema volume (p=0.57) on low-dose and X-ray dose equivalent scans. Both models significantly overestimated emphysema volume compared to the reference standard (both p<0.0001) in X-ray dose equivalent scans.

**CONCLUSION**

Emphysema severity estimation is feasible with X-ray dose equivalent scans using visual scoring. A deep learning algorithm delivered promising results and performed comparable to an established LAV method on low-dose scans. Still, both quantification methods overestimated emphysema on X-ray dose equivalent scans. Therefore, more robust automated emphysema quantification methods are needed.

**CLINICAL RELEVANCE/APPLICATION**

Photon-counting detector CT enables diagnostic scans with significantly reduced radiation dose, facilitating optimized emphysema surveillance protocols for COPD patients.

## S3B-SPCH-5 CT FEATURES OF PATHOLOGICALLY PROVEN SMOKING-RELATED INTERSTITIAL FIBROSIS: COMPARED WITH EMPHYSEMA AND UIP

Chanu Jeong, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To differentiate smoking-related interstitial fibrosis(SRIF) from emphysema and usual interstitial pneumonia(UIP) on CT.

**METHODS AND MATERIALS**

From January 2016 to October 2023, total 123 patients who underwent lung surgery and pathologically proven SRIF (n=23), emphysema (n=50), and UIP (n=50) were included. Three radiologists retrospectively reviewed preoperative chest CTs for the presence of centrilobular/paraseptal emphysema, multiple thin-walled cysts(MTWC), honeycomb, traction bronchiectasis, subpleural GGO/reticulation, and centrilobular GGO and compared CT features by subgroups.

**RESULTS**

Centrilobular emphysema, paraseptal emphysema, MTWC, honeycomb, traction bronchiectasis, subpleural GGO/reticulation, and centrilobular GGO were identified in SRIF (100%, 100%, 73.9%, 8.7%, 100%, 100%, 34.8%), emphysema (94%, 60%, 2%, 2%, 4%, 8%, 12%), and UIP (48%, 40%, 0%, 42%, 100%, 100%, 8%) respectively. In univariate analysis of SRIF and emphysema, MTWC traction bronchiectasis, subpleural GGO/reticulation were predictive features of SRIF (p<0.05). In multivariate analysis of SRIF and emphysema, MTWC and subpleural GGO/reticulation were predictive features of SRIF (p<0.05). In both univariate and multivariate analysis of SRIF and UIP, MTWC was predictive features of SRIF (p<0.05).

**CONCLUSION**

MTWC, traction bronchiectasis, and subpleural GGO/reticulation on CT might be differentiating image feature of SRIF from emphysema and UIP.

**CLINICAL RELEVANCE/APPLICATION**

SRIF, emphysema and UIP have overlapping imaging/clinical features but different treatments and prognoses. This study may help differentiate these three diseases through CT imaging findings.

## S3B-SPCH-8 AUTOMATIC SEGMENTATION AND RADIOMIC ANALYSIS FOR DISCRIMINATING PRISM AND COPD PATIENTS

Taohu Zhou (*Presenter*) Nothing to Disclose

**PURPOSE**

It is vital to develop noninvasive approaches with high accuracy to discriminate the preserved ratio impaired spirometry (PRISm) group from the chronic obstructive pulmonary disease (COPD) groups. Radiomics has emerged as an image analysis technique. This study aims to develop and confirm the new radiomics-based noninvasive approach to discriminate these two groups.

**METHODS AND MATERIALS**

Totally 1066 subjects from 4 centers were included in this retrospective research, and classified into training, internal validation or external validation sets. The chest computed tomography (CT) images were segmented by the fully automated segmentation algorithm for radiomics feature extraction. We established the radiomics signature (Rad-score) using the least absolute shrinkage and selection operator algorithm, then conducted tenfold cross-validation using the training set. Last, we constructed a radiomics signature by incorporating independent risk factors using the multivariate logistic regression model.

**RESULTS**

The Rad-score, including 15 radiomic features in whole lung region, which was segmented by the fully automated segmentation algorithm, was demonstrated to be effective for discriminating between PRISm and COPD. Its diagnostic accuracy was improved through integrating Rad-score with a clinical model, and the AUCs were 0.82(95%CI 0.79-0.86), 0.77(95%CI 0.72-0.83) and 0.841(95%CI 0.78-0.91) for training, internal validation and external validation sets, respectively. As revealed by decision curve analysis, our constructed radiomics nomogram showed superior clinical utility.

**CONCLUSION**

The present work constructed the new radiomics-based nomogram and verified its reliability for discriminating between PRISm and COPD.

**CLINICAL RELEVANCE/APPLICATION**

The radiomics nomogram is developed in this study for differentiating PRISm from COPD groups, which may be used as the virtual approach for clinical radiologists.

# Abstract Archives of the RSNA, 2024

S3B-SPER

**Emergency Radiology Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPER-1 DIAGNOSTIC PERFORMANCE OF ARTIFICIAL INTELLIGENCE IN CHEST RADIOGRAPHS REFERRED FROM THE EMERGENCY DEPARTMENT

Raquel Cano Alonso, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Fernandez Alfonso (*Abstract Co-Author*) Nothing to Disclose
Randall Rojas, MD (*Abstract Co-Author*) Nothing to Disclose
David Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Vicente Martinez de Vega, PhD (*Abstract Co-Author*) Nothing to Disclose
Ana Alvarez Vazquez (*Abstract Co-Author*) Nothing to Disclose
Bianca Umana (*Abstract Co-Author*) Nothing to Disclose
Alejandro Diaz Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Sanabria, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Lopez Alcolea, MD (*Presenter*) Nothing to Disclose

### PURPOSE

• Evaluate sensitivity (Se) and specificity (Sp) of an AI software and a radiology resident in interpreting Chest X-ray examinations referred from the Emergency Department (ED) against a senior radiologist (considered the Gold Standard, GS). • Assess the concordance rate between AI and the resident. • Describe the frequency of doubtful cases in each category and determine how many were considered positive by the GS. • Evaluate other variables AI is not trained to detect to analyze its weaknesses and potential diagnoses.

### METHODS AND MATERIALS

We conducted an observational, transversal, double-blind descriptive, and retrospective study, analyzing thoracic radiographs from a sample of 784 patients referred from the ED at our hospital between October and November 2022. The AI is trained to detect five categorical variables: pulmonary nodule, pulmonary opacity, pleural effusion, pneumothorax, and fracture. Each finding is outlined with a bounding box and associated with a confidence label ("positive," "doubtful," or "negative"). We compared the diagnostic performance of AI and a resident against the GS and described the frequency of doubtful results and other variables not evaluated by AI (mediastinal abnormalities, surgical material, and other pulmonary findings).

### RESULTS

Se for fracture and pneumothorax was high (100%), moderate for pulmonary opacity (AI= 76%, resident= 71%), and reasonable for pleural effusion (AI= 60%, resident=67%), with NPV>95% and AUC>0.8. For pulmonary nodule, the resident's Se was moderate (75%), while AI's was low (33%). When AI doubted, only a few of these doubtful diagnoses were considered positive by the GS. The resident doubted less. The Kappa Coefficient between resident and AI was fair (0.3) for all variables, except for pleural effusion, which was moderate (0.5). The prevalence of other variables was: 16% mediastinal abnormalities, 20% surgical material, and 20% other pulmonary findings. Cardiomegaly was the most frequent finding (80%).

### CONCLUSION

Our study evaluates the impact of AI in a real work environment by comparing its diagnostic performance against radiologists. AI achieved high AUC and VPN for all variables, except for pulmonary nodule. Se was high for fracture and pneumothorax and moderate for pulmonary opacity. There was fair concordance between AI and resident.

### CLINICAL RELEVANCE/APPLICATION

Chest radiography is the most common diagnostic imaging examination performed in EDs. The integration of AI software in the evaluation of Chest X-ray examinations could assist clinicians (not only radiologists but also emergency physicians) and enhance accuracy and workflows. This could prioritize the reporting of patients with urgent findings and reduce reading times, benefiting patient care.

## S3B-SPER-2 ASSESSMENT OF THE EFFICACY OF USING A DEEP LEARNING-BASED MODEL TO SCREEN FOR HEART FAILURE ON CHEST RADIOGRAPHS IN EARLY DIAGNOSIS: PRELIMINARY STUDY

Yunkyoung Jun (*Abstract Co-Author*) Nothing to Disclose
DONGSEOP KIM (*Abstract Co-Author*) Nothing to Disclose
Dongbin Na (*Abstract Co-Author*) Nothing to Disclose
Yoona Hwang (*Abstract Co-Author*) Nothing to Disclose
Hyunwoo Kim (*Abstract Co-Author*) Nothing to Disclose
Hyungjoon Jang (*Presenter*) Nothing to Disclose

## PURPOSE

This preliminary study assesses the efficacy of a deep learning-based model to screen for heart failure (HF) using chest radiographs (CXR) for early diagnosis in emergency department settings.

## METHODS AND MATERIALS

This study evaluates a model for the early screening of heart failure (HF) using the publicly available MIMIC-CXR and MIMIC-IV datasets, which comprise data from emergency admissions. The proposed algorithm predicts HF likelihood by detecting pleural effusion in chest X-rays (CXRs) and calculating the cardiothoracic ratio (CTR) to assess cardiac enlargement. The reference standard was HF confirmed by ICD diagnosis codes (4280, 4281, 40291, I502, or I508 from the MIMIC-IV dataset). By applying natural language processing (NLP) to the MIMIC-CXR reports, we identified 7,866 studies mentioning heart failure. Only CXR images from the admission and discharge dates with corresponding ICD codes for HF (1,324 patients) were included as positive cases. Patients without a prior HF diagnosis (2,517 patients) were categorized as negative cases. We evaluated the model's efficacy by measuring sensitivity, specificity, positive likelihood ratio (LR+), and negative likelihood ratio (LR-).

## RESULTS

The model demonstrated a sensitivity of 71% and a specificity of 93%. The LR- of 0.31 indicated that the use of deep learning for early screening of HF on CXRs could moderately reduce the likelihood of disease occurrence when AI model results are negative. The LR+ of 10.14 implied that the use of deep learning for early screening of HF on CXRs could often generate conclusive shifts in probability and increase the likelihood of disease occurrence when AI model results are positive. These results are like a previous prospective, blinded study in the emergency physicians demonstrated a high specificity of 96% and a relatively moderate sensitivity of 59%, along with a positive likelihood ratio (LR+) of 14.6 and a negative likelihood ratio (LR-) of 0.43.

## CONCLUSION

While the AI model shows high specificity (93%) and relatively low sensitivity (71%), it effectively aids in identifying HF in emergency settings when present, though it could under-detect HF. Given the real-life clinical correlation, actual sensitivity might be higher, suggesting that AI could efficiently enhance early HF detection and potentially reduce hospital admissions due to late-stage HF identification.

## CLINICAL RELEVANCE/APPLICATION

Early HF screening and flagging potential HF cases by using the AI model could be useful tools in clinical applications for physicians to decide on diagnosis by combining medical records, ECG findings, or brain-type natural peptide criteria.

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# Abstract Archives of the RSNA, 2024

S3B-SPGI

**Gastrointestinal Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPGI-1 AUTOMATED ANALYSIS OF ABDOMINAL BODY COMPOSITION USING MRI: ALGORITHM DEVELOPMENT AND VALIDATION VIA CT COMPARISON

Sun Kyung Jeon, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Jong-Min Kim, PhD (*Abstract Co-Author*) Employee, Medical IP Co, Ltd
Sangjoon Park (*Abstract Co-Author*) Nothing to Disclose
Jeong Min Lee, MD, PhD (*Abstract Co-Author*) Grant, Bayer AG Grant, Canon Medical Systems Corporation Grant, Koninklijke Philips NV Grant, General Electric Healthcare Grant, Guerbet SA Grant, Samsung Electronics Co, Ltd Grant, Bracco Group Grant, Dongkuk Pharma Grant, Starmed Ltd Grant, RF medical Grant, Siemens AG Speakers, Bayer AG Speakers, Philips Healthcare Speakers, Samsung Medison Speakers, GE Healthcare
Han-Jae Chung (*Abstract Co-Author*) Employee, MEDICAL IP, Co
Ijin Joo, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a deep learning-based algorithm for analyzing abdominal body composition through fully-automated volumetric segmentation of MRI and validate its effectiveness via comparison with CT analysis.

### METHODS AND MATERIALS

A 3D nnU-Net-based deep learning algorithm for MRI was developed to perform fully-automated segmentation of three body components: abdominal visceral fat [AVF], abdominal subcutaneous fat [ASF], and skeletal muscle [SM]. This algorithm utilized 105 whole-body MRI dual-echo imaging scans acquired at 3T as input. Its segmentation performance was evaluated on dual-echo in-phase imaging in an external dataset consisting of 67 3T abdominal MRI scans, using the dice similarity coefficient (DSC). Inter-modality correlation and reliability between MRI-based and CT-based measurements of each body composition was assessed using the Pearson's correlation analysis and intraclass correlation coefficient (ICC) for both 2D (area [cm2] at L3 level) and 3D (volumetric [cm3]) approaches in 59 patients with both MRI and CT examinations.

### RESULTS

The developed algorithm achieved mean (± standard deviation) DSCs of 0.862 (± 0.077), 0.923 (± 0.045), and 0.920 (± 0.036), for the 3D segmentation of AVF, ASF, and SM on MRI, respectively, in the external test dataset. Additionally, for all AVF, ASF, and SM, MRI-based measurements demonstrated robust correlation (Pearson r = 0.971, 0.960, and 0.981 for 2D; and 0.993, 0.959, and 0.946 for 3D, respectively; Ps<0.001) and excellent agreement (ICC = 0.979, 0.990, and 0.980 for 2D; and 0.996, 0.978, and 0.967 for 3D, respectively) with CT-based measurements.

### CONCLUSION

Our deep learning-based algorithm provides accurate 3D segmentation of abdominal fat and muscle components on MRI, exhibiting strong correlation and agreement with CT-based measurements, thus showcasing its potential for efficient body composition analysis.

### CLINICAL RELEVANCE/APPLICATION

Automated MRI body composition analysis algorithm enables precise and efficient quantification of abdominal fat and muscle components, facilitating early detection and monitoring of conditions like visceral obesity and sarcopenia.

## S3B-SPGI-10 CHOLANGIO-NET: A DEEP LEARNING APPROACH FOR THE EARLY DETECTION OF CHOLANGIOCARCINOMA USING MRI

Yashbir Singh, PhD, MEng (*Presenter*) Nothing to Disclose

### PURPOSE

The primary aim of this study is to evaluate the efficacy of a deep learning model, specifically the 3D-DenseNet121, in detecting perihilar cholangiocarcinoma (CCA) in patients with primary sclerosing cholangitis (PSC) through MRI scans. This research aims to establish a more reliable early CCA identification method, potentially increasing the number of patients eligible for curative interventions.

### METHODS AND MATERIALS

We reviewed 310 adult patients diagnosed with large-duct PSC across multiple centers. Excluding 13 patients due to inadequate image quality, 297 were included, split into derivation (150 patients, 64 CCA cases) and validation (147 patients, 65 CCA cases) cohorts. The derivation cohort was used to train the 3D-DenseNet121 model using five-fold cross-validation. The model's best fold performance was then applied to the validation cohort to predict CCA presence.

### RESULTS

The model displayed robust diagnostic accuracy in the derivation cohort, with AUC scores of 91%, 96%, 94%, 93%, and 94% across the folds. The separate validation cohort effectively differentiated between PSC patients with and without CCA, achieving an overall sensitivity of 88%, specificity of 75%, and AUROC of 81%. These metrics surpassed the performance of traditional radiological assessments, particularly in identifying CCA cases.

### CONCLUSION

The findings underscore the potential of the 3D-DenseNet121 deep learning model to enhance early CCA detection in PSC patients via MRI. The model outperformed standard radiological methods and demonstrated high sensitivity and specificity, particularly in complex cases.

### CLINICAL RELEVANCE/APPLICATION

This study highlights a promising advancement in the diagnostic processes for PSC-associated CCA, suggesting that deep learning could play a crucial role in early detection and decision-making for potentially curative treatments. Further research and validation are necessary to confirm these results and facilitate the integration of such models into routine clinical practice, potentially improving outcomes for this high-risk patient population.

## S3B-SPGI-11 DWI OF THE RECTUM WITH DEEP LEARNING RECONSTRUCTION: COMPARISON OF PROPLLER, REDUCED FOV, AND CONVENTIONAL DWI

Hiromitsu Onishi, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Speakers Bureau, General Electric Company
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mitsuaki Tatsumi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideyuki Fukui, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toru Honda, MD (*Abstract Co-Author*) Nothing to Disclose
Takashi Ota, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shohei Matsumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Kengo Kiso, MD (*Abstract Co-Author*) Nothing to Disclose
Kaketaka Koki, MD (*Abstract Co-Author*) Nothing to Disclose
Takahiro Tsuboyama, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study was to compare the image quality and diagnostic ability of periodically rotated overlapping parallel lines with enhanced reconstruction (PROPELLER), reduced field of view (rFOV), and conventional diffusion-weighted imaging (cDWI) combined with deep learning reconstruction in the evaluation of rectal tumors.

### METHODS AND MATERIALS

This prospective study included 42 patients with rectal tumors who underwent initial staging or restaging MRI. Written informed consent was obtained. Three sequences of coronal DWI parallel to the tumor were obtained using deep learning reconstruction: PROPELLER-DWI, rFOV-DWI, and cDWI. The signal-to-noise ratios (SNRs) were measured on the 3 sequences. Two radiologists independently evaluated the image quality of DWI and assessed the extramural tumor spread, extramural venous invasion (EMVI), and response to chemoradiotherapy using T2-weighted imaging and DWI. The 5-point image quality scores were compared with Friedman's test. The diagnostic performance was compared with Cochran's Q test in 26 patients who underwent surgery after MRI without additional therapy.

### RESULTS

The SNR was significantly highest with PROPELLER ($P < 0.05$). In the image quality assessment, PROPELLER-DWI had significantly the least artifacts and distortion, but the worst noise for both readers ($P < 0.05$). rFOV-DWI showed significantly the best sharpness for both readers ($P < 0.05$). For overall image quality and rectal/tumor conspicuity, PROPELLER-DWI and rFOV-DWI were significantly superior to cDWI in both readers ($P < 0.05$), and PROPELLER-DWI was significantly the best in 1 reader ($P < 0.05$). Of the 42 patients, poor image quality (score 1 and 2) was found in 5 and 1 patient with PROPELLER-DWI, 14 and 6 with rFOV-DWI, and 29 and 25 with cDWI by the 2 readers. The accuracies were the highest with PROPELLER-DWI for both readers regarding EMVI and complete response, though not significant.

### CONCLUSION

PROPELLER-DWI of the rectum with deep learning reconstruction can provide high image quality by reducing artifacts and distortion, and may increase the diagnostic performance for the assessment of rectal cancer.

### CLINICAL RELEVANCE/APPLICATION

PROPELLER-DWI with deep learning reconstruction may have the potential to improve the assessment of local tumor extent and treatment response in rectal cancer.

## S3B-SPGI-12 APPLICATION OF A COMBINED CLINICAL PREDICTION MODEL BASED ON ENHANCED T1WI FULL VOLUME HISTOGRAM IN PERINEURAL INVASION AND LYMPHOVASCULAR INVASION IN RECTAL CANCER

Bin Huang (*Abstract Co-Author*) Nothing to Disclose
Yumeng Zhang (*Abstract Co-Author*) Nothing to Disclose
Yuntai Cao, MS,MS (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to use a combined clinical prediction model based on enhanced T1WI full-volume histogram to predict preoperative perineural invasion (PNI) and lymphovascular invasion (LVI) in rectal cancer.

### METHODS AND MATERIALS

We included a total of 68 PNI patients and 80 LVI patients who underwent surgical resection and pathological confirmation of rectal cancer from two medical institutions. According to the PNI/LVI status, patients were divided into PNI positive group (n=39), the PNI negative group (n=29), LVI positive group (n=48), and the LVI negative group (n=32). All patients underwent 3.0T magnetic resonance T1WI enhanced scanning. We use Firevoxel software to delineate the region of interest (ROI), extract histogram parameters, and perform univariate analysis, LASSO regression, and multivariate logistic regression analysis in sequence to screen for the best predictive factors. Then, we constructed a clinical prediction model and plotted it into a column chart for personalized prediction. Finally, we evaluate the performance and clinical practicality of the model based on the area under the curve (AUC), calibration curve, and decision curve.

### RESULTS

Multivariate logistic regression analysis found that variance and the 75th percentile were independent risk factors for PNI, while maximum and variance were independent risk factors for LVI. The clinical prediction model constructed based on the above factors has an AUC of 0.734 (95% CI: 0.591-0.878) for PNI in the training set and 0.731 (95% CI: 0.509-0.952) in the validation set; The training set AUC of LVI is 0.701 (95% CI: 0.561-0.841), and the validation set AUC is 0.685 (95% CI: 0.439-0.932).

### CONCLUSION

This study indicates that the combination of enhanced T1 WI full-volume histogram and clinical prediction model can be used to predict the perineural and lymphovascular invasion status of rectal cancer before surgery, providing valuable reference information for clinical diagnosis.

### CLINICAL RELEVANCE/APPLICATION

This study is based on the parameters of T1WI enhanced full volume histogram analysis, combined with the advantages of clinical prediction models, and proposes a new method to predict the neural and vascular invasion of rectal cancer. It provides useful reference information for patients to develop personalized diagnosis and treatment plans and evaluate the prognosis of rectal cancer.

## S3B-SPGI-13 DEEP LEARNING-BASED CT IMAGE RECONSTRUCTION: IMAGE QUALITY EVALUATION IN AMPULLARY AND PERIAMPULLARY LESIONS

Min Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Shi Tian Wang (*Abstract Co-Author*) Nothing to Disclose
Xuan Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Jia Xu (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the effect of a deep learning reconstruction (DLR) method on the conspicuity of ampullary and periampullary lesions on abdominal CT image, in comparison with iterative reconstruction (IR) algorithms (hybrid IR [AIDR3D]) and conventional filtered back projection (FBP).

### METHODS AND MATERIALS

This retrospective study included 30 patients who underwent contrast-enhanced abdominal imaging at our hospital between December 2021 and November 2023 with ampullary and periampullary lesions (include ampullary cancer, ampullary adenoma, distal common bile duct cholangiocarcinoma, duodenal adenocarcinoma, pancreatic adenocarcinoma). The arterial and portal venous phase scan data were reconstructed to obtain DLR (body and body sharp), HIR (AIDR3D, FC08) and FBP (FC08). Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of the lesions, bile duct, pancreas, duodenum wall, liver, as well as image noise (which was calculated as the SD of the CT values for anterior subcutaneous fat) were compared among the four datasets (DLR body, DLR body sharp, AIDR3D, FBP). CNR of the lesions were calculated as follow: CNR lesion to pancreas = (HU[lesion] - HU[pancreas])/SD[fat],CNR lesion to bile duct = (HU[lesion] - HU[bile duct])/SD[fat], CNR lesion to duodenum wall = (HU[lesion] - HU[duodenum wall])/SD[fat]. In qualitative image analyses, two radiologists independently ordered images (best: 4, worst: 1) based on the visual image quality. The Friedman and the Dunn-Bonferroni post-hoc tests were used for comparison.

### RESULTS

DLR body and DLR body sharp images yielded significant higher SNR and CNR than FBP and AIDR3D images in all regions of interest in both arterial and portal venous phases (all $P<0.05$). DLR body (arterial: 11.86±3.45, portal venous: 11.84±2.60) and DLR body sharp (12.82±3.04, 12.54±2.16) images showed significant lower image noise than FBP (28.1±6.70, 29.09±5.46) and AIDR3D (17.74±4.54, 18.31±4.03) in both arterial and portal venous phases (all $P<0.05$). AIDR3D showed significant higher SNR and CNR, and lower image noise than FBP images (all $P<0.05$). DLR body (arterial: 3.83[3;4], portal venous: 3.87[3;4]) and DLR body sharp (3.17[3;4], 3.13 [3;4]) images obtained higher scores than FPB (1,1) and AIDR3D (2,2) (all $P<0.05$). There were no significant differences in CNR, image noise, as well as qualitative scores between DLR body and DLR body sharp images (all $P>0.05$).

### CONCLUSION

DLR images yield significant lower the image noise, higher SNR and CNR compared to FBP and AIDR3D images. DLR images showed the best visual image quality of the ampullary and periampullary lesions.

### CLINICAL RELEVANCE/APPLICATION

DLR method can improve the image quality, resulted in a better observation of the ampullary and periampullary lesions.

## S3B-SPGI-3 DEEP LEARNING FOR AUTOMATED SEGMENTATION AND PREDICTION OF RECTAL CANCER ON T2-WEIGHTED MAGNETIC RESONANCE IMAGES

Sung Kyoung Moon (*Abstract Co-Author*) Nothing to Disclose
Myung-Won You, MD (*Abstract Co-Author*) Nothing to Disclose
Seong Jin Park, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Choongwui Cho, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop deep learning-based automated segmentation model for rectal cancer on T2-weighted(T2W) magnetic resonance(MR) images

### METHODS AND MATERIALS

A total of 212 patients who underwent baseline MR for rectal cancer were retrospectively enrolled from July 2007 to November 2018. Either the axial or coronal plane of the T2W images that best represented the tumor mass was selected for each patient, and an experienced radiologist labeled the mass on each slice of the entire tumor mass. After excluding 2 patients with erroneous images, 170 patients were grouped into training datasets and 40 patients were grouped into test datasets in an 8:2 ratio. Attention U-Net was trained on the T2W images of the training datasets to classify each voxel as tumor or non-tumor.

### RESULTS

At the stage of testing, the accuracy, intersection over union (IoU), and Dice similarity coefficient (DSC) were used to quantitatively evaluate the performance of tumor segmentation. Internal validation datasets selected from training datasets before training (1% of 1533 images) showed 99.40 % accuracy, 68.06% IoU, and 80.72% DSC. The accuracy, IoU, and DSC of the test datasets (437 images) were 98.88 %, 46.05 %, and 61.99 %.

### CONCLUSION

Deep learning-based automated segmentation model can predict rectal cancer with fair diagnostic ability.

### CLINICAL RELEVANCE/APPLICATION

Automated segmentation of rectal cancer using deep learning can aid both radiologists and clinicians in patient care.

## S3B-SPGI-4 HEPATIC STEATOSIS PREDICTION IN ABDOMINAL CT SCANS OF LIVING DONORS FOR LIVER TRANSPLANTATION USING DEEP LEARNING

Hyunjung Park, MSc (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD (*Abstract Co-Author*) Stockholder, Anymedi, Inc
Jongjun Won, BS (*Abstract Co-Author*) Nothing to Disclose
Hyunseok Lim, MS (*Presenter*) Nothing to Disclose

### PURPOSE

To predict a fatty liver (FL) severity on abdominal CT images of living donors for liver transplantation using deep learning.

### METHODS AND MATERIALS

A total of 5,468 cases of abdominal CT scans from living donors and their liver needle biopsy data prior to liver transplant surgery at a tertiary hospital from 2004 to 2023 were obtained. The dataset was initially split into internal (N = 574) and external (N = 106) datasets based on CT scans hospitals. The internal dataset was subdivided into training, validation, and test sets (4,193:573:574) for model training. From CT scans, three consecutive axial slices showing the largest areas of liver and spleen were selected as 3-channel inputs. The ImageNet pretrained Resnet50 was fine-tuned to classify three classes of fatty liver severity including normal, mild, and moderate to severe using cross-entropy loss and to predict the steatosis severity value using mean-squared-error loss . Each case was categorized into three steatosis severity classes: normal (<5%) (N = 3,405), mild (5-33%) (N = 1,784), moderate to severe (>33%) (N = 279). The ground truth of severity class and steatosis severity value was determined based on the biopsy results. The sampling rate for the moderate to severe groups doubled in a training set to address the class imbalance issue. We compared the performance of the classification and regression models with their classification accuracy by converting the predictions of the regression model into the previously mentioned three classes.

### RESULTS

The classification model had an accuracy of 0.683, sensitivity of 0.489, and F1 score of 0.505 across three fatty liver severity classes. The regression model achieved a concordance correlation coefficient (CCC) of 0.644, root mean squared error (RMSE) of 0.067, and mean squared error (MAE) of 0.039. When the regression results were classified into 3 classes, the model had an accuracy of 0.751, sensitivity of 0.503, and F1 score of 0.515. Both models tended to predict moderate/severe cases as mild due to data imbalance.

### CONCLUSION

Our regression models could better predict 3-classes of fatty liver severity to classification model using only abdominal CT images. To overcome the performance limitations caused by imbalances, better sampling strategies and better generative models such as different model would be required.

### CLINICAL RELEVANCE/APPLICATION

Based on biopsy results of liver donors for evaluating steatosis, functional prediction with deep learning using abdominal CT could be used as screening tool for finding suspected steatosis patients without the need for biopsy. This non-invasive approach has the potential to improve patient welfare.

## S3B-SPGI-5 THE IMPACT OF DEEP LEARNING RECONSTRUCTION ALGORITHM ON THE QUALITY OF ABDOMINAL IMAGES IN GASTRIC DISEASE PATIENTS BASED ON NEW DUAL INSTANTANEOUS CUT ENERGY SPECTRUM MODE

Jing Wang (*Abstract Co-Author*) Nothing to Disclose
Ya Wang (*Presenter*) Nothing to Disclose

### PURPOSE

The Impact of Deep Learning Reconstruction Algorithm on the Quality of Abdominal Images in Gastric Disease Patients Based on New Dual Instantaneous Cut Energy Spectrum Mode

### METHODS AND MATERIALS

Prospective collection of 47 patients for energy spectrum imaging (GSI) mode scanning, four sets of original images with different weights of ASiR-V40%, DLIR-L, DLIR-M, and DLIR-H were reconstructed, with a layer thickness of 1.25 mm. Record the dose length product ED (mSv) for each patient scan=DLP (mGy * cm) x ?, among ? Group as conversion factor, abdomen ?= 0.015mSv/(mGy * cm). Select abdominal venous phase images, use spectral analysis software GSI Viewer to delineate the area of interest (ROI, area approximately 50-150mm2) at the same level, measure abdominal aorta, gastric lesions, and left vertical muscle, further post-process to obtain CT values and noise (SD) of 70 keV, water iodine, and iodine water single energy images in each ROI, and calculate signal-to-noise ratio (SNR).

### RESULTS

The DLP of abdominal energy spectrum venous phase images in 47 patients was (504.07 ± 57.63) mGy * cm. In the same single energy image, there was no statistically significant difference in CT values among different reconstruction algorithms and DLIR levels (P>0.05). Among them, the CT values of 40% of the abdominal aorta in the ASiR-V40% of the 70keV, water iodine, and iodine water single energy images were (167.59 ± 20.04; 1017.91 ± 6.06; 57.54 ± 7.68) Hu, respectively; In the same single energy image, with different reconstruction algorithms and different DLIR levels, the SD value of the single energy image gradually decreases and the SNR gradually increases, resulting in a significant improvement in image quality. Among them, the SD values of the abdominal aorta for 70 keV, water iodine, iodine water single energy images ASiR-V40%, DLIR-L, DLIR-M, DLIR-H are (24.20 ± 1.95; 21.86 ± 3.14; 19.09 ± 3.26; 14.54 ± 3.23) Hu, (10.08 ± 1.17; 9.46 ± 1.18; 8.10 ± 0.90; 5.95 ± 0.79) Hu, (6.03 ± 0.82; 5.16 ± 1.02; 4.75 ± 1.23) Hu, and (6.03 ± 0.82; 5.16 ± 1.02; 4.75 ± 1.23) Hu, respectively. 2; 3.87 ± 1.28) Hu; And the SD value and SNR showed statistically significant differences between groups (P<0.05). The subjective scores of reconstructed images using different algorithms showed statistically significant differences (P<0.001).

### CONCLUSION

Deep learning reconstruction technology based on new dual instantaneous cut energy spectrum mode can optimize the quality of abdominal energy spectrum images

**CLINICAL RELEVANCE/APPLICATION**

Further improving the quality of abdominal energy spectrum images using depth reconstruction technology based on new dual instantaneous cut energy spectrum scanning mode without increasing radiation dose

## S3B-SPGI-9 A FORGOTTEN CORNER: IMAGING SIGNS OF ILEOCECAL VALVE IN CROHN'S DISEASE AND THEIR RELATIONSHIP TO DISEASE ACTIVITY

Li Shi, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The imaging features of the ileocecal valve (ICV) in Crohn’s disease (CD) patients have been poorly studied; therefore, little is known about their role in the course of CD. We aimed to summarize the imaging signs of the ICV in CD patients, explore their relationship with disease activity, and evaluate the correlation between ICV radiological and endoscopic findings.

**METHODS AND MATERIALS**

This retrospective study included 93 patients who simultaneously underwent endoscopic and radiological examinations; these patients were divided into Group 1 (G1, Simple Endoscopic Score for Crohn’s Disease [SES-CD] =3, n=57) and Group 2 (G2, SES-CD <3, n=36). The ICV where the terminal ileum projects into the caecum was located. The shape of the ICV was categorized as the labial, papillary, fatty infiltration, or deformed/indiscernible types. The height and hyperenhancement pattern of the ICV also were recorded. Disease remission was defined as a CRP concentration <5 mg/dl and an SES-CD <3. The follow-up endpoint was the time occurring penetrating lesion/surgery at the ileocecal area or September 30, 2023 if absent of adverse clinical outcome.

**RESULTS**

The shape of the ICV was significantly different between the two groups (P =0.007) and changed dynamically according to disease activity. The papillary and deformed/indiscernible types were the main ICV shapes on CTE at baseline (both 47.4% in G1; 52.8% and 22.2% in G2, respectively), and the deformed/indiscernible type not only accompanied a higher SES-CD than the other three types but was also a risk factor affecting CD remission (hazard ratio, 1.342). The fatty infiltration type may be related to remission. A moderate positive correlation in ICV shape was found between the CTE and endoscopy results (Cramer's V =0.325, P <0.0001). In addition, persistent hyperenhancement of the ICV during follow-up might suggest active CD.

**CONCLUSION**

The shapes and enhancement patterns of the ICV on CT may help evaluate CD activity and offer essential messages for clinical treatment, especially when patients with Crohn’s disease cannot accomplish endoscopic examination or endoscopy cannot reach the ileocecal valve area when intestinal stenosis or severe anal lesions are present.

**CLINICAL RELEVANCE/APPLICATION**

This study provided effective auxiliary information for clinicians to evaluate CD activity.

# Abstract Archives of the RSNA, 2024

S3B-SPGU

**Genitourinary Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPGU-1 ASSOCIATIONS BETWEEN MPMRI AND UPGRADING FROM BIOPSY-CONFIRMED TO WHOLE-MOUNT HISTOPATHOLOGY

Kyunghyun Sung, PhD (*Abstract Co-Author*) Nothing to Disclose
Steven S. Raman, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Merck & Co, Inc;Consultant, Amgen Inc;Consultant, Profound Medical Inc
Sara Babapour, MD (*Abstract Co-Author*) Nothing to Disclose
Sohaib Naim, MSc (*Abstract Co-Author*) Nothing to Disclose
Vishnu Murthy, BA (*Presenter*) Nothing to Disclose

### PURPOSE

Prior studies in the pre-multiparametric MRI (mpMRI) era have shown that more than 25% of clinically significant prostate cancer (csPCa) at biopsy is downgraded to indolent prostate cancer after robotic-assisted laparoscopic prostatectomy (RALP). This project aims to assess associations between mpMRI and upgrading of prostate cancer from biopsy-confirmed histopathology (BCHP) to whole-mount histopathology (WMHP).

### METHODS AND MATERIALS

In this retrospective study, we identified patients who underwent both mpMRI-ultrasound fusion biopsies and RALP from 2009 to 2022. Clinicodemographic, mpMRI, and histopathologic data were extracted from our prospectively maintained Integrated Diagnostics database with IRB and HIPAA approval. 399 true positive mpMRI lesions from 333 patients were mapped into a sector map, described in Prostate Imaging Reporting and Data System (PI-RADS) v2.1, for the standardized prostate segmentation model. Lesions were identified as being upgraded, downgraded, or isograded based on changes in their Gleason Grade from BCHP to WMHP. The number of lesions in each sector of the prostate that was upgraded, downgraded, or isograded was recorded, and adjusted weights were calculated based on the relative prevalence of lesions in each sector. The sum of adjusted weights was calculated for each region of the prostate (transition vs. peripheral zone, anterior vs. posterior, base vs. midgland vs. apex, and left vs. right). A modified $?^2$ test was used to assess associations between mpMRI lesion location, lesion PI-RADS score (<4 vs. >4), lesion size (<1cm vs. 1-2cm vs. >2cm), race (Black vs. Non-Hispanic White), and upgrading.

### RESULTS

Lesions in the peripheral zone and posterior region of the prostate had a higher likelihood of being upgraded than lesions in the transition zone and anterior region respectively ($p < 0.001$). Lesions in the base vs. midgland vs. apex and the left vs. right side of the prostate did not have a statistically significant difference in rates of upgrading vs. non-upgrading ($p = 0.93$ and 0.76 respectively). Lesion PI-RADS score, size, and race did not predict upgrading ($p = 0.93$; $p = 0.36$; $p = 0.28$ respectively). Table 1 summarizes the results of our analysis.

### CONCLUSION

mpMRI lesions in the peripheral zone and posterior region were more likely to be upgraded than those in the transition zone and anterior region respectively. Multicenter, prospective trials are necessary to further generalize the role of mpMRI in predicting discrepancies between BCHP and WMHP.

### CLINICAL RELEVANCE/APPLICATION

Linking prostate mpMRI with BCHP and WMHP within the same cohort allows us to directly assess the role of mpMRI in predicting upgrading patterns, which can improve the diagnosis and local treatment planning of csPCa.

## S3B-SPGU-3 AUTOMATIC BLADDERAND TUMORSEGMENTATION FROM CTUROGRAPHYIMAGES USING U-NET

Lili Xu (*Abstract Co-Author*) Nothing to Disclose
Li Mao (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Gu Mu Yang Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Xiaoxiao Zhang (*Abstract Co-Author*) Nothing to Disclose
Hao Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Chen Li (*Presenter*) Nothing to Disclose

### PURPOSE

Bladder cancer is the most prevalent malignancy within the urinary system. Bladder and tumor segmentation from CT images is an essential preorder procedure for planning pelvic radiotherapy treatment and evaluating the treatment response in bladder cancer patients. Thus, this study aimed to develop

a deep learning model for the segmentation of the bladder and tumors from CT Urography (CTU) images, which will serve as an integral part of a comprehensive system designed to assist in the management of bladder cancer patients.

**METHODS AND MATERIALS**

A dataset of 381 cases from two centers was used with Institutional Review Board approval. Including 280 training cases (275 with masses, 5 normal bladders), 56 internal validation cases(54 with masses, 2 normal bladders), and 45 external validation cases (44 with masses, 1 normal bladder). The dataset included nephrographic phase CTU scans with 0.625mm and 1mm slice thicknesses, where patients with lesions had definitive pathological confirmation. A reference standard, consisting of manual bladder and tumor contours for all cases, was initially provided by an experienced radiologist and was subsequently reviewed by a senior radiologist. The U-Net-based segmentation model was trained by the self-configuring nnU-Net framework, in which the model was trained in a five-fold manner and the ensemble prediction was used. Besides, the test-time augmentation was employed to further improve the model performance. The segmentation performance was quantified in the testing set by dice similarity coefficient (DSC), 95th-percentile Hausdorff distance (95% HD), and mean surface distance (MSD).

**RESULTS**

Results show that our approach achieves superb segmentation accuracy. Specifically, in the internal validation set, the U-Net-based model demonstrates excellent performance in segmenting the bladder, with a DSC of 97.9±5.6%, a 95% HD of 0.48±1.72mm, and an MSD of 3.43±10.75mm. The model's performance was even more precise in the external validation set, achieving a DSC of 98.4±1.9%, a 95% HD of 0.34±0.56mm, and an MSD of 2.52±4.21mm. When segmenting tumors, the model achieved a DSC of 76.6±27.3%, a 95% HD of 3.70±5.81mm, and an MSD of 19.15±23.83mm in the internal validation set, while the model's performance was slightly lower in external validation set but still robust, with a DSC of 74.4±30.6%, a 95% HD of 3.73±4.63mm, and an MSD of 22.08±24.01mm.

**CONCLUSION**

While the tumor segmentation performance was inferior to the segmentation of bladder, the U-Net-based model showed satisfied accuracy in segmenting bladder and tumors, with particularly high precision in delineating the bladder.

**CLINICAL RELEVANCE/APPLICATION**

The model has shown to be a valuable tool for detecting bladder cancer and assessing treatment responses.

## S3B-SPGU-4 ASSOCIATION BETWEEN DEEP LEARNING ESTIMATED SARCOPENIA ON ABDOMINAL CT AND 24-HOUR URINE MEASUREMENTS INFORM RISK OF KIDNEY STONE FORMATION

Anant Madabhushi, PhD (*Abstract Co-Author*) Stockholder, Elucid Bioimaging Inc;License agreement, Elucid Bioimaging Inc;Stockholder, Inspirata, Inc;Grant, Inspirata, Inc;Scientific Advisory Board, Inspirata, Inc;Researcher, AstraZeneca PLC;Scientific Advisory Board, AstraZeneca PLC
Viraj Master, MD (*Abstract Co-Author*) Nothing to Disclose
Dattatraya Patil, MBBS,MPH (*Abstract Co-Author*) Nothing to Disclose
Edouard Nicaise (*Abstract Co-Author*) Nothing to Disclose
Benjamin Schmeusser (*Abstract Co-Author*) Nothing to Disclose
Nisarg Negi (*Abstract Co-Author*) Nothing to Disclose
Rakesh Shiradkar, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Sarcopenia or progressive loss of skeletal muscle has been linked to increased risk of stone formation. Deep learning (DL) allows for automated segmentation of regions of interest on CT. We sought to identify association between DL estimated sarcopenia and kidney stone risk factors derived from 24-hour urine analysis.

**METHODS AND MATERIALS**

We identified CT scans of N=493 patients with kidney disease. Skeletal and intra-fat muscle, sub-cutaneous and visceral fat regions of interest (ROI) were manually segmented at the 3rd lumbar vertebra (L3) using a commercial software (sliceOmatic; Tomovision). N=133 CT scans were used to train a UNet based deep learning (DL) model to segment the above 4 ROIs and evaluated in terms of dice similarity coefficient (DSC). DL model was used to segment skeletal muscle on N=360 studies with kidney stones who underwent a 24-hour urine analysis. Skeletal muscle area was used to compute the skeletal muscle index (SMI) and identify presence of sarcopenia using previously identified gender and age specific thresholds from Framingham study. 22 metabolic measurements associated with risk of kidney stone formation were obtained from 24-hour urine analysis and differences between patients with and without sarcopenia were evaluated using the ranksum test ($p<0.05$).

**RESULTS**

DL accurately segmented the skeletal muscle regions on L3 slice of CT with a mean DSC of 0.90 ± 0.11 and mean absolute error of 3.3 for SMI. An average of 7.5 minutes is needed for manual segmentation of ROIs while the DL can obtain them under a second. SMI obtained from DL showed significant differences in 12 of 22 urine measurements (salt, acid concentrations) between patients with and without sarcopenia. Given that all patients considered in this study were diagnosed with nephrolithiasis, patients with sarcopenia had relatively lower concentrations of urine metabolites associated with higher risk of kidney stone formation. This indicates a need to identify alternate factors accounting for body composition to standardize risk thresholds.

**CONCLUSION**

Deep learning based segmentation can be used to automate body composition measurements from CT which can be used to identify a variety of risk factors associated with kidney stone formation. Further studies are warranted to standardize thresholds of various biomarkers for kidney stone formation and evaluate the role of body composition.

**CLINICAL RELEVANCE/APPLICATION**

Automated segmentation using deep learning methods on CT allows for accurate, rapid estimation of skeletal muscle and sarcopenia. Utilization of established reference ranges on 24-hour urine analysis to guide dietary and pharmacological management in prevention of recurrent nephrolithiasis may not be appropriate for patients with anatomic sarcopenia.

## S3B-SPGU-5 AUTOMATED PROSTATE SEGMENTATION MODEL TO ASSESS THE PROSTATE ZONAL GROWTH PATTERN IN BENIGN PROSTATIC HYPERPLASIA

Gu Mu Yang Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Jiahui Zhang (*Abstract Co-Author*) Nothing to Disclose
Hao Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose

Erjia Guo, MS, BA (*Abstract Co-Author*) Nothing to Disclose
Xiuli Li (*Abstract Co-Author*) Nothing to Disclose
Qianyu Peng (*Abstract Co-Author*) Nothing to Disclose
Xiaoxiao Zhang (*Abstract Co-Author*) Nothing to Disclose
Li Chen (*Abstract Co-Author*) Nothing to Disclose
Xin Bai III, MD (*Abstract Co-Author*) Nothing to Disclose
Lili Xu (*Presenter*) Nothing to Disclose

**PURPOSE**

To analyze the growth patterns of different zones of the prostate with the assistance of a previously developed automatic segmentation model.

**METHODS AND MATERIALS**

Consecutive benign prostatic hyperplasia (BPH) patients who had undergone at least two prostate MRI scans at our institution between December 2014 and December 2022 were identified. The deep learning model used in this study was previously developed to segment the prostate transition zone (TZ) and peripheral zone (PZ). The prostate zonal volumes and morphological features were computed from the segmentation results, and the annual absolute growth rate (AGR) and relative growth rate (RGR) of the volumes and morphological features were calculated.

**RESULTS**

A total of 398 patients with 902 MRI scans were included in the study (median age 62.0 [57.0-68.0] years). The whole-gland volume and TZ volume (TZv) increased with age, while the PZ volume (PZv) decreased with age (all $p < 0.05$). The median AGR was 2.22 mL/year for TZv and -0.15 mL/year for PZv. The RGR was 7.05%/year for TZv, and the value for the TZ base was significantly higher than that for midgland ($p = 0.003$). Patients aged 51-60 years had a significantly higher RGR than those aged = 50 years ($p < 0.05$). The RGR of PZv was -0.94%/year. While there was no significant difference among the prostate apex, midgland, and base. The RGR of PZv in patients aged 51-60 years was significantly lower than that in patients aged = 50 years ($p < 0.05$).

**CONCLUSION**

The prostate gland undergoes differential growth patterns between the TZ and PZ, which also varying with age. Additionally, the growth pattern of the TZv differed between the base and midgland. The 51-60 age group appears to be a turning point for TZv growth rate increases and PZv growth rate decreases.

**CLINICAL RELEVANCE/APPLICATION**

Our study revealed the development of the prostate zonal volumes and morphological features in the progression process of benign prostatic hyperplasia with the assistance of the deep learning-based segmentation model.

## S3B-SPGU-6 ASSOCIATION RENAL SURFACE NODULARITY WITH THE RENAL INJURY PROGRESSION IN PATIENTS WITH ARTERIAL HYPERTENSION

Qiong Wu (*Abstract Co-Author*) Nothing to Disclose
Wei Xing, MD (*Abstract Co-Author*) Nothing to Disclose
Jie Chen (*Abstract Co-Author*) Nothing to Disclose
Liang Pan, MD (*Abstract Co-Author*) Nothing to Disclose
Jiule Ding (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the association of Renal Surface Nodularity (RSN) with the renal injury progression in patients with arterial hypertension.

**METHODS AND MATERIALS**

This retrospective cohort study included patients with arterial hypertension, who underwent renal artery CT angiography or abdominal enhanced CT scans. Clinical and radiological data were collected. Patients with bilateral renal surface irregularities observed on CT imaging were defined as the RSN group, then the patients without RSN (non-RSN group) were matched to RSN group at a ratio of 1:1 based on age and gender. Baseline demographic, clinical, and radiological data were collected. They were followed up more than 0.5 year. The main endpoint was a reduction in estimated glomerular filtration rate (eGFR) = 20% from baseline or initiation of renal replacement therapy. We developed a self-developed automated method for quantifying RSN, including three surface roughness indicators (nodularity ten-point unevenness height, nodularity maximum height, and nodularity arithmetic mean deviation). Semi-quantitative scoring of RSN was based on both the distribution range of renal surface irregularities and of local indentations depth > 1/2 cortical thickness. A radiologist independently conducted the quantitative and semi-quantitative RSN analysis.

**RESULTS**

This study included 242 patients (median age of 64 years, male 70.25%). Strong positive linear correlations were identified between the quantitative indicators and semi-quantitative score (? > 0.9, all $P < 0.001$). Over a median follow-up period of 38.00 (22.00, 56.25) months, the main endpoint event was present in 44 patients in RSN group and 15 in non-RSN group, indicating a higher risk of renal dysfunction progression in patients with RSN (HR = 2.816, $P < 0.001$). In multivariate Cox regression analysis, after correcting co-existing diabetes and kidney volume, HR was 1.344 (1.117, 1.617) for nodularity ten-point unevenness height, 1.048 (1.004, 1.094) for nodularity maximum height, 1.239 (1.028, 1.494) for nodularity arithmetic mean deviation, and 1.196 (1.074, 1.332) for semi-quantitative scores. They were associated with the renal injury progression (all $P < 0.05$).

**CONCLUSION**

The developed quantitative analysis method for RSN demonstrates robust stability and high concordance with semi-quantitative Scoring. RSN was associated with renal injury progression among patients with arterial hypertension.

**CLINICAL RELEVANCE/APPLICATION**

RSN can potentially serves as an imaging biomarker for the renal injury progression.

## S3B-SPGU-7 ASSESSMENT OF CT-DERIVED PARAMETERS FOR MUSCLE INVASION IN BLADDER CANCER: EXTRACELLULAR VOLUME FRACTION AND TUMOR CONTACT LENGTH

Xuming Wan (*Abstract Co-Author*) Nothing to Disclose
Yongquan Yu (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the clinical utility of the extracellular volume fraction (ECV) and tumor contact length (TCL) parameters derived from contrast-enhanced CT in assessing muscle invasion in bladder cancer.

**METHODS AND MATERIALS**

Between October 2021 and September 2023, 46 patients with pathologically confirmed of bladder cancer were enrolled for analysis. patients were devided to non-muscle invasive bladder cancer (NMIBC) and muscle invasive bladder cancer (MIBC) groups according to the pathologically assessment results. All patients were underwent unenhanced and three-phase contrast-enhanced CT preoperatively. TCL was the length which the curves drawn at the base of the tumor where it contacted the bladder wall. CT value from unenhanced and equivalent phases images were measured to calculate tumor ECV fractions. The ECV fraction and TCL were compared between NMIBC and MIBC. The diagnostic performance of ECV, TCL and the combination were assessed with the area under the receiver-operator curve (AUC). AUCs were compared with DeLong test.

**RESULTS**

The ECV and TCL values in the MIBC were both significantly higher than those in the non-MIBC group(35.73±9.01 vs 28.92±9.22, 48.14±16.68 vs 20.41±11.18, both P<0.05). The diagnostic performance of combined ECV and TCL achieved an AUC of 0.97 (95%CI: 0.87-0.99), which was singnificiantly higher than that of ECV (AUC, 0.72 (95%CI: 0.57-0.84) or TCL (0.89 (95%CI: 0.77-0.97)).

**CONCLUSION**

The conbination of CT-based ECV and TCL showed excellent preformance in distinguishing between MIBC and non-MIBC bladder cancers.

**CLINICAL RELEVANCE/APPLICATION**

This non-invasive method can serve as a valuable preoperative supplement for treatment plan for patients with bladder cancer.

## S3B-SPGU-9 AUTOMATED TOTAL KIDNEY VOLUME QUANTIFICATION USING DEEP LEARNING AS A DIAGNOSTIC TOOL FOR ADPKD ON CT SCANS

Hilde Bosmans, PhD (*Abstract Co-Author*) Stockholder, Qaelum NV;Research Grant, Siemens AG;Research Grant, General Electric Company
Frederik De Keyzer (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Koukoutegos (*Abstract Co-Author*) Nothing to Disclose
Raymond Oyen (*Abstract Co-Author*) Nothing to Disclose
Tom Oyen (*Presenter*) Nothing to Disclose

**PURPOSE**

Accurate assessment of total kidney volume (TKV) is crucial for monitoring Autosomal Dominant Polycystic Kidney Disease (ADPKD) progression and prediction of renal function decline. This study aimed to develop and validate a fast, AI-based method applied on CT scans without contrast agent injection in a patient follow up study.

**METHODS AND MATERIALS**

A dataset of 72 unenhanced abdominal CT studies and their corresponding segmentation labels were used retrospectively in a 5-fold cross-validation setting to train and validate a 3D residual UNet. The 3D UNet was trained in a patch-based approach using extensive data augmentation (including random intensity shifting, gaussian noise, and flipping in all axes). Unenhanced CT images were resampled at 1.75mm3. The network implementation and training were performed using PyTorch v1.10 and MONAI v1.0, using a single NVIDIA GeForce RTX 3090 GPU. An independent test set of 20 subjects with 2 consecutive scans each was used to test the trained network's ability to assess the functionality. The Mayo Imaging Classification (MIC) was calculated using manual segmentation (by 2 radiology experts) and then compared to AI-based classifications.

**RESULTS**

The 3D UNet achieved an average Dice coefficient of 0.92 for the initial scan and 0.93 for the second scan of the consecutive sequence. The model's reliability in measuring TVK was excellent for both scans with intraclass correlation coefficient (ICC) values of 0.96 and 0.94 (p<.001), respectively, while the average volume error was 12% (95%CI: [5%, 22%]) and 11% (95%CI: [6%, 21%]). In addition, UNet-based renal axes measurements (length, width, and thickness) were supported by high ICC values of 0.94, 0.90, 0.97 and 0.97, 0.97, 0.98 for the two scans respectively (p<.001), demonstrating the model's ability in capturing key renal anatomical descriptors. AI-based classification demonstrated high concordance with manually-derived MIC, with agreement in 85% (34/40) of scans. AI overestimated severity in 5 scans (one MIC higher than manual). The average prediction time measured for a whole abdominal CT was 14.2s.

**CONCLUSION**

From a comparison with manual delineations and MIC classification, it was concluded that the 3D U-Net based measurements of TKV and renal axes from unenhanced CT scans closely match the manual values and the MIC classification.

**CLINICAL RELEVANCE/APPLICATION**

A newly developed AI-based method applied on unenhanced CT scans can offer a robust and standardized approach to TKV measurements in patients with ADPKD. These automated measurements, easily validated by a user/radiologist, could be integrated in every (follow-up) CT scan and provide the data for a (user independent) quantitative evaluation.

# Abstract Archives of the RSNA, 2024

S3B-SPHN

**Head & Neck Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPHN-1 DEEP LEARNING RECONSTRUCTION: CAPABILITIES FOR IMPROVING IMAGE QUALITY AND ANATOMICAL STRUCTURE VISUALIZATION ON HIGH-DEFINITION CT

Yoshiyuki Ozawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology
Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Daisuke Takenaka, MD (*Abstract Co-Author*) Canon Medical Systems Corporation
Kenji Fujii (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hiroyuki Nagata (*Abstract Co-Author*) Canon Medical Systems Corporation
Takahiro Ueda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuya Ito (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hirona Kimata (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Masahiko Nomura, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

It has been suggested that Ultra-high-resolution CT, using an energy integrated detector (also known as high-definition CT: HDCT), and photon counting detectors, have potential for ontological diseases. We hypothesized that newly developed deep learning reconstruction (DLR) for the inner ear can produce better image quality, diagnostic confidence level and abnormality detection on HDCT for the ear than can other reconstruction methods. The purpose of this study was to directly compare external, middle and inner ear evaluations obtained with hybrid-type iterative reconstruction (IR) and with DLR on HDCT for patients without ontological diseases.

### METHODS AND MATERIALS

Twenty inner and middle ears and temporal bones of three males (mean ± standard deviation: 64 ± 14 years) and seven females (55 ± 23 years) were examined using super high-resolution mode for HDCT. Signal-to-noise ratios (SNRs) of the temporal bone surrounding the aural vestibule of the ear and in the vestibule as well as the cerebellar hemisphere, overall image, artifact and detailed evaluation of the visibility of anatomical landmarks in middle and inner ear and temporal bone obtained with the two methods were assessed and statistically compared using the paired t-test or Wilcoxon's signed-rank test.

### RESULTS

Each SNR of DLR was significantly higher than that of hybrid-type IR ($p<0.05$). Overall image quality and artifacts of CT data reconstructed by means of DLR were significantly better than those reconstructed with hybrid-type IR (overall image quality: $p=0.009$, artifacts: $p=0.009$). On comparisons of detailed evaluation of the visibility of anatomical landmarks, CT data for middle ear, inner ear and temporal bone reconstructed by means of DLR scored significantly higher than those reconstructed by means of hybrid-type IR (middle ear: $p=0.01$; inner ear: $p=0.004$; temporal bone: $p=0.009$).

### CONCLUSION

Newly developed DLR showed superior potential to that of hybrid-type IR for better image quality and visualization of anatomical landmarks in middle and inner ears and temporal bones on HDCT used in clinical practice.

### CLINICAL RELEVANCE/APPLICATION

Newly developed DLR showed superior potential to that of hybrid-type IR for better image quality and visualization of anatomical landmarks in middle and inner ears and temporal bones on HDCT used in clinical practice.

## S3B-SPHN-2 THE STUDY OF PARANASAL SINUSES IMAGING USING GEMSTONE SPECTRAL IMAGING CT COMBINED WITH ADAPTIVE ITERATIVE RECONSTRUCTION ALGORITHM

Xiuxiu Tian (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the impact of adaptive iterative reconstruction-Veo (ASIR-V) algorithm on the quality and radiation dose of paranasal sinus CT energy spectrum imaging.

### METHODS AND MATERIALS

Eighty-six patients with suspected paranasal sinus diseases were enrolled and randomly divided into control group (n = 43) and observation group (N = 43). The control group was performed with conventional CT scan, 120 kv, FBP reconstruction, and the observation group was performed with ASIR-40% combined with energy spectrum CT scan, 100 kv,the observation group was scanned with Gemstone Spectral Imaging (GSI) mode and reconstructed with ASIR-V. The dose volume CT dose index (CTDIvol) , dose-length product (DLP) , imaging noise and contrast-to-noise ratio (CNR) on paranasal sinuses lesions, and diagnostic accuracy were compared among the two groups.

### RESULTS

There was no statistically significant difference in the sensitivity, specificity and accuracy of diagnosing paranasal sinus among the two group (P>0.05), while the observation group were higher (91.67% , 85.71% respectively vs 86.84%, 60.00% respectively). The subjective scores of the observation group were higher than those of the control group, while the CTDIvol and DLP were lower than those of the control group, and the difference was statistically significant (P<0.05). There was no significant difference in subjective evaluation noise and CNR between the two groups.

### CONCLUSION

The GSI CT combined with ASIR-V diagnoses paranasal sinus lesions with comparable efficacy and image quality to conventional CT, however, improves diagnostic confidence while reducing radiation dose.

### CLINICAL RELEVANCE/APPLICATION

The combination of Asir algorithm and energy spectrum CT can improve the imaging quality and reduce the radiation dose of patients without increasing the imaging noise, so it can be widely used in clinical practice.

## S3B-SPHN-5 RADIOMICS ANALYSIS BASED ON MRI-DWI FOR EVALUATING THE LYMPH NODE METASTASIS IN NASOPHARYNGEAL CARCINOMA

Jingjun Wu (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the value of radiomics analysis based on diffusion weighted imaging (DWI) MRI for evaluating the lymph node metastasis in nasopharyngeal carcinoma patients.

### METHODS AND MATERIALS

We retrospectively collected nasopharyngeal carcinoma patients newly diagnosed in our hospital. According to the histopathological examination, the lymph nodes were defined as metastatic lymph nodes (n=81) and non-metastatic lymph nodes (n=43). All patients were randomly assigned to training group and testing group according to 7:3. The DWI images were imported into 3D-Slicer software, and lymph nodes with volume more than 1 cm3 were included and segmented. The 851 radiomics features were extracted, including first-order features, shape features, texture features and wavelet transformed features. The intraclass correlation coeficient test, minimum redundancy maximum correlation (MRMR), least absolute shrinkage and selection operator (LASSO) algorithms were used to gradually select radiomics features. The clinical features were further collected and were used to constructed the clinical and combined model. Logistic regression was used to construct evaluation model. Receiver operating characteristic (ROC) analysis was used to analyze the diagnostic efficacy of the model.

### RESULTS

In present study, the 5 radiomics features were selected and included in the radiomics model, the AUCs were 0.89 in both training and testing group. The clinical feature of ki-67 protein expression level was further included into the combined model, and the AUCs in the training and testing group were 0.92 (95% CI [0.84, 0.97]) and 0.91 (95% CI [0.77, 0.98]), respectively.

### CONCLUSION

The radiomics analysis based on DWI is expected to be used for early noninvasive evaluation of lymph node metastasis in nasopharyngeal carcinoma patients.

### CLINICAL RELEVANCE/APPLICATION

The lymph node metastasis is common in patients with newly diagnosed nasopharyngeal carcinoma, and accurate diagnosis of lymph node metastasis is of great value for personalized treatment strategies. In this study, we found the radiomics features of MRI-DWI may serve as the potential imaging biomarkers for evaluation of lymph node metastasis in nasopharyngeal carcinoma patients. The radiomics analysis was a low-cost and non-invasive way to predict the lymph node metastasis, providing imaging clues for monitoring the node metastasis and assist individualized treatment.

# Abstract Archives of the RSNA, 2024

S3B-SPIN

**Imaging Informatics Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPIN-1 THE VALUE OF ELECTRON CLOUD DENSITY IMAGES OF SPECTRAL CT IN THE MEASUREMENT OF PERIHEMATOMA EDEMA IN PATIENTS WITH SPONTANEOUS INTRACEREBRAL HEMORRHAGE

Qiaoying Zhang (*Presenter*) Nothing to Disclose

### PURPOSE

Spontaneous intracerebral hemorrhage (sICH) is a subtype of stroke with high morbidity and mortality. Many previous studies have shown that perihematoma edema(PHE) is an independent predictor of prognosis, so it is crucial to accurately identify and measure the volume of PHE.At present, the measurement of PHE is based on conventional plain scan CT, but its boundary display is often fuzzy, which is easy to cause large errors, and the repeatability is low. In order to find a more accurate measurement method, this paper will study the value of electron cloud density images for measuring the volume of PHE based on spectral CT.

### METHODS AND MATERIALS

A total of 20 cases of sICH were selected. The first CT scan of patients was performed on spectral CT, and conventional CT images and reconstructed electron cloud density images were collected.The volume of PHE was measured on conventional CT images and electronic cloud density images respectively by two attending doctors, and recording whether the edema boundary is clear.The volume of PHE = total lesion volume-hematoma volume.Total lesion volume= sum of area of each layer (layer thickness is 10mm),same goes for hematoma volume.The volume of PHE measured by two doctors was statistically analyzed by paired T-test and $p<0.05$ was considered statistically significant.Intraclass correlation efficient (ICC) was used to test the consistency of the two methods.

### RESULTS

There were statistical differences in the volume of PHE measured on conventional CT images and on electronic cloud density images in the same patient by doctor1(P=0.012),and same with doctor2(P=0.001).There were statistical differences in the volume of PHE measured by different doctors on conventional CT images in the same patient (P=0.037).There was no statistical difference in the volume of PHE measured by different doctors on electron cloud density images in the same patient (P=0.269).The two doctors determined that on electronic cloud density images the PHE boundary was clear in 85% and 90% of cases, respectively, compared with 65% and 70%, respectively, on conventional CT images. The repeatability of measuring the volume of PHE by two doctors on electron cloud density images (ICC=0.998(P<0.01)) is higher than that on conventional CT images(ICC=0.987(P<0.01)).

### CONCLUSION

The electron cloud density images reconstructed in spectral CT is more clear to show the boundary of PHE than the conventional CT images.The volume of PHE of the same patient measured by different doctors on the electronic cloud density images had little difference ,and it also has better consistency and repeatability.

### CLINICAL RELEVANCE/APPLICATION

The measurement of PHE volume on electron cloud density images in spectral CT can better guide clinical risk grade and prognosis.

## S3B-SPIN-2 TOWARDS LABEL-FREE TUMOR SEGMENTATION TRAINING: SIMULATING TUMOR GROWTH AND GENERATING SYNTHETIC TUMORS IN HEALTHY COMPUTED TOMOGRAPHY IMAGES

Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuxiang Lai (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to evaluate whether data synthesis techniques can address the challenges in "AI for cancer detection" arising from (i) the low prevalence of early-stage tumor examples and (ii) the difficulty radiologists face in detecting and annotating them due to their subtle appearance, small size, and blurry boundaries.

### METHODS AND MATERIALS

We developed a data synthesis technique applicable to computed tomography (CT) that can simulate tumor development in the liver, pancreas, and kidney. This data synthesis is based on an old school algorithm called cellular automata, initially proposed for the Game of Life. Each cell (pixel) is assigned a ‘state’ between zero and ten to represent the tumor population, and a tumor can be developed based on three rules to describe the process of growth, invasion, and death, as well as the tumor-organ interaction. Finally, we integrate the tumor state into the CT scan to generate tumors in different

abdominal organs, allowing for sampling tumors at multiple stages. We collected and annotated a retrospective dataset of 972 subjects (liver: 201, pancreas: 282, kidney: 489 with tumors) and 1,217 healthy subjects as control. A reader study involving three expert radiologists evaluated the realism of synthetic tumors on 150 subjects (50% synthetic). We further used this synthetic data to train AI models and evaluated their performance, particularly for early-stage tumor detection (radius < 20mm), against models trained on real tumors.

**RESULTS**

Radiologist #1 (3-year experience) only achieved mean accuracy of 61.8% (liver: 60.9%, pancreas: 57.1%, and kidney: 67.6%). Radiologist #2 (7-year experience) achieved mean accuracy of 69.9% (69.1%, 65.7%, and 75.0%). Even senior Radiologist #3 (10-year experience) misidentified 47.1% of synthetic tumors as real, with a mean accuracy of 72.2% (68.4%, 72.4%, and 75.8%). In early tumor detection, AI models training on our synthetic tumors achieve Sensitivity of 82.6%, 62.5%, and 58.3%, Specificity of 75.5%, 77.6%, and 84.7%, and DSC of 47.2%, 36.5%, and 18.1%, for liver, pancreatic, and kidney tumors respectively.

**CONCLUSION**

We show the potential of synthetic data for AI cancer research, improving data augmentation, early (small) tumor detection, and accurate boundary segmentation. Furthermore, simulating tumor development in CT scans could substantially benefit medical education by offering detailed longitudinal examples for tumor studies.

**CLINICAL RELEVANCE/APPLICATION**

Synthetic data showed promise to improve AI models in detecting small tumors (radius < 20mm). Larger-scale external validation (N=30,000) has been launched in collaboration with City of Hope (TGen) and University of California, San Francisco to confirm the performance and robustness of these AI models.

## S3B-SPIN-3 AI-DRIVEN CASE SUPPLEMENTATION AUGMENTS AND DIVERSIFIES RESIDENT TRAINING EXPOSURE TO IMPORTANT PATHOLOGY: INITIAL EXPERIENCE IN PRECISION EDUCATION

Antonio Verdone (*Abstract Co-Author*) Nothing to Disclose
Michael P. Recht, MD (*Abstract Co-Author*) Nothing to Disclose
Malte Westerhoff (*Abstract Co-Author*) Employee, Pro Medicus Limited;Stockholder, Pro Medicus Limited
Anna Chen, MD (*Abstract Co-Author*) Nothing to Disclose
William R. Walter, MD (*Abstract Co-Author*) Nothing to Disclose
Renata La Rocca Vieira, MD (*Abstract Co-Author*) Nothing to Disclose
Ryan Cummings, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

A major component of diagnostic radiology resident education is exposure to a wide range of pathology through the daily readouts of clinical cases. However, the breadth of pathology in those cases varies, which may lead to underrepresentation of important but less common pathologies. This study assesses the effectiveness of a precision education curriculum created by supplementation of curated teaching cases based on a LLM's categorization of pathology seen by each resident.

**METHODS AND MATERIALS**

A list of 140 important pathologies (IP) was defined by members of our musculoskeletal (MSK) division in part based on the ABR Core Exam Blueprints. Each pathology was assigned high, intermediate, or low priority for each of three required MSK rotations (PGY2, 3, and 4). A teaching file with multiple examples of each pathology (2885 total cases) was curated by 3 MSK radiologists. A HIPAA compliant GPT-4 model analyzed 3 prior years of resident reports to determine exposure to these pathologies prior to implementation of a precision education curriculum. Over a four-month period, residents on 4-week MSK rotations each received 3 supplemental teaching file cases/day, selected by an algorithm to maximize novelty of pathology based on each resident's prior exposure and PGY level priority. These cases were dictated alongside clinical cases. GPT-4 tracked pathologies seen by each resident, updating exposure daily. Pathologies seen by residents were tallied before and after implementation of the algorithm and compared to a group of 56 MSK rotations (31 PGY-2, 17 PGY-3, and 8 PGY-4) without supplemented cases. Residents who read <20 supplemented cases were excluded. The Mann Whitney U-test was used to analyze differences between groups.

**RESULTS**

12 residents (3 PGY-2, 5 PGY-3, and 4 PGY-4) read >20 supplemental cases on their rotation during the study period. The algorithm increased average number of unique IPs seen by residents in each year of residency: 114% for PGY-2: (average = 32 vs 68, $p<0.01$), 65% for PGY-3: (44 vs 73, $p<0.01$); and 113% for PGY-4: (32 vs. 68, $p<0.01$). Excluding low-priority pathologies, an even greater increase of 227% (18 vs 60, $p<0.01$), 68% (66 vs 39, $p<0.01$) and 112% (64 vs 30, $p<0.01$) was seen in PGYs 2-4, respectively.

**CONCLUSION**

A precision education curriculum based on individualized case supplementation informed by a GPT-4 model significantly increases diversity of important musculoskeletal pathologies seen by residents compared to live clinical cases alone.

**CLINICAL RELEVANCE/APPLICATION**

Categorization of pathology of resident's reports by an LLM enables supplementation of pathology to ensure that residents see the required breadth of pathology.

## S3B-SPIN-4 HOW DO SUB-5-MINUTE NET MRI ACQUISITION TIMES TRANSLATE INTO CLINICAL PRACTICE? A TIME COMPONENT ANALYSIS

Jan Fritz, MD (*Abstract Co-Author*) Institutional research support, Siemens AG;Scientific Advisor, Siemens AG;Patent agreement, Siemens AG;Institutional research support, Johnson & Johnson;Institutional research support, Zimmer Biomet Holdings, Inc;Institutional research support, BTG International Ltd
Kai Tobias Block, PhD (*Abstract Co-Author*) Nothing to Disclose
Roy J. Wiggins, BA (*Abstract Co-Author*) Nothing to Disclose
Jan Vosshenrich, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The scientific literature typically cites the gradient time of MRI protocols, defined as the sum of the net acquisition times of each pulse sequence. However, clinical scan times are longer due to added sequence adjustments, shimming, idle time between sequences, technologist and patient interactions, and repeated pulse sequences. This study explores the transition of accelerated pulse sequence protocols into clinical settings by quantifying the differences between protocol gradient time and actual clinical scan time.

### METHODS AND MATERIALS

A retrospective analysis was conducted on 3,635 knee MRI examinations acquired across 10 outpatient sites on identically configured 3T scanners (MAGNETOM Vida, Siemens Healthineers) between January 2023 and December 2023. The imaging protocol encompassed five accelerated pulse sequences and an automated localizer for anatomic landmark identification (total acquisition time: 04:49 minutes). MRI examination log data was autonomously extracted utilizing an open-source software solution (Yarra LogServer, www.yarra-framework.org). Parameters including (1) examination duration, (2) scan time, (3) adjustment time, (4) idle time, and (5) repeat time were gauged and analyzed though descriptive statistics.

### RESULTS

The mean exam duration (from start of the localizer to completion of the last sequence) amounted to 07:42±02:19 minutes (median: 07:01 minutes). Scan time constituted 72.6% of the exam duration (mean: 05:30±01:27 minutes; median 04:57 minutes), while adjustment time and idle time represented 9.0% (mean: 00:40±00:14 minutes; median: 00:46 minutes) and 18.4% (mean: 01:32±01:15 minutes; median: 01:15 minutes), respectively. Repeat sequences accounted for 8.9% of the exam time (mean: 00:41±01:27 minutes; median: 00:08 minutes).For the five core diagnostic protocol sequences, deviations from the anticipated acquisition times due to parameter adjustments during individual MRI exams were negligible (mean: 00:03±00:13 minutes; median: 00:01 minutes).

### CONCLUSION

Modern image acceleration techniques facilitate net acquisition times below 5 minutes for joint MRI examinations. The actual clinical protocol durations are approximately 60% longer due to adjustment scans and idle time between pulse and repeat sequences. Data can be continuously measured and visualized as dashboards to monitor the efficiency within the department.

### CLINICAL RELEVANCE/APPLICATION

Even though net acquisition times of deep learning-enabled ultra-fast MRI suggest that sub-15-minute MRI booking slots can be easily established, substantial differences between gradient time and actual protocol duration need to be considered during scheduling to prevent delays in clinical routine.

## S3B-SPIN-5 RAPID HIGH-RESOLUTION COMPUTED TOMOGRAPHY WITH NEAR-MAXIMUM ENTROPY (MENT) USING UNIT-GAIN ERROR CORRECTING FEEDBACK LOOP

Wolfram R. Jarisch, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To present a novel MENT approach to computed tomography (CT) reconstruction that combines efficiency and robustness, matching the speed of Filtered Backprojection Type (FBPT) methods.

### METHODS AND MATERIALS

We introduce the MENT formulation with unique solution (Cover Thomas, 2006, Eqs. 12.1 -12.4) into an iterative, mildly non-linear estimator with a novel near unit-gain error feedback loop, derived from an extended Kalman filter with an FBPT gain. This approach rapidly adapts voxel density values via gain coefficients ?i to loop requirements. The uniqueness of the object density solution is retained and computed with minimal effort. Typically only one to a few percent of numerical effort with other ART-like methods (Biguri et al.; JPDC, 2020) or tomoCAM (Kumar et al.; JSR, 2023) are required. Gradually increasing resolution retains uniqueness and keeps the iterated numerical effort minimal. Furthermore, the MENT approach extracts information more efficiently than competing methods, permitting reduced measurement and numerical effort, and radiation. We evaluate our method through simulations and experimental studies.

### RESULTS

Our method enables enhanced voxel spatial and density resolution at greater imaging speeds, broader imaging ranges, and dynamic object changes in CT. It also allows for reduced X-ray intensity with a smaller focal spot size, resulting in sharper images and reduced patient exposure. In MRI, it offers the potential to reduce measurement time, improving patient comfort and increasing the throughput of imaging facilities.

### CONCLUSION

The novel MENT approach to CT and MRI reconstruction is highly efficient and robust, addressing the significant challenges of noise, sparse projections, high contrast, and stringent time constraints. It offers significant potential for medical diagnosis and non-destructive evaluation.

### CLINICAL RELEVANCE/APPLICATION

The practical applications of our high-speed and precise method are far-reaching. In CT, it enables enhanced voxel spatial and density resolution at greater imaging speeds, broader imaging ranges, and dynamic object changes, while reducing patient exposure to radiation. In MRI, it offers the potential to reduce measurement time, improving patient comfort and increasing the throughput of imaging facilities. These advancements hold significant potential for improved patient care and innovative industrial applications.

## S3B-SPIN-6 ACCURATE SKELETON SEGMENTATION WITHOUT MANUAL CONTOURING: A STUDY OF 9,262 SUBJECTS

Alan Yuille, PhD (*Abstract Co-Author*) Nothing to Disclose
Zongwei Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Yucheng Tang, PhD (*Abstract Co-Author*) Nothing to Disclose
Zheyuan Zhang (*Abstract Co-Author*) Nothing to Disclose
Wenxuan Li, BS (*Presenter*) Nothing to Disclose

### PURPOSE

To enhance automatic skeleton segmentation, this study integrates public AI models with anatomical priors, reducing the need for manual contouring by radiologists.

### METHODS AND MATERIALS

Manual contouring is an inevitable and labor-intensive task for radiologists to segment skeletal structures from computed tomography (CT) scans. We develop an automatic strategy called Bag of Priors (BoP) that leverages anatomical priors from medical knowledge with publicly available AI models to segment skeleton structures accurately without manual contouring from radiologists. The anatomical priors include the location, shape, size, intensity distributions, and other imaging characteristic features of skeletal structures. We assess the quality of skeleton segmentation, which includes 24 vertebrae, 24 ribs (L/R), clavicula (L/R), humerus (L/R), scapula (L/R), hip (L/R), sacrum, and femur (L/R). Specifically, a senior radiologist with 10 years of clinical experience conducted manual contouring, while five junior radiologists with three years of experience performed a visual inspection, rating the quality of both manual and automated segmentation by our BoP strategy on a scale from 1 to 5. No publicly available CT dataset with skeletal annotations

currently matches the precision of manual contouring. Examples of typical errors in TotalSegmentator (the latest public CT dataset; N=1,204) are presented in the figure. We have created and released an extensive dataset of 9,262 CT volumes (unique subjects), where all 59 skeletal structures were annotated per voxel. This is the largest public CT dataset to date with high-quality skeletal annotations. This dataset was used to assess the performance of public AI models and those enhanced by our BoP strategy.

**RESULTS**

Public AI models (U-Net as backbone) augmented with our BoP strategy achieved almost perfect segmentation performance across all skeleton structures, exceeding 90% DSC compared with manual contouring. Notably, the segmentation of clavicula, scapula, hip, sacrum, and femur reached > 95% DSC score. Our BoP strategy significantly improves the performance of public AI models by an average of 3.4%, where increases of 4.4% for vertebrae and 4.8% for femur segmentation specifically.

**CONCLUSION**

Our strategy significantly enhances the accuracy of skeletal segmentation across various structures, achieving near-manual quality without the need for radiologist manual contouring.

**CLINICAL RELEVANCE/APPLICATION**

Accurate skeleton segmentation is crucial for trauma diagnosis and image-guided surgery, enhancing fracture typing, pre-operative planning for fracture reduction, and screw fixation planning in clinical scenarios.

## S3B-SPIN-7 CAN PRIVACY-PRESERVING VISION-BASED LARGE LANGUAGE MODELS PRE-FILL THE FINDINGS SECTION OF RADIOLOGY REPORTS?

Qiao Jin (*Abstract Co-Author*) Nothing to Disclose
Zhizheng Wang (*Abstract Co-Author*) Nothing to Disclose
Ruida Cheng (*Abstract Co-Author*) Nothing to Disclose
Pritam Mukherjee, PhD (*Abstract Co-Author*) Nothing to Disclose
Benjamin Hou, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhiyong Lu (*Abstract Co-Author*) Nothing to Disclose
Xiuying Chen (*Abstract Co-Author*) Nothing to Disclose
Tejas Sudharshan Mathai, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Ronald M. Summers, MD, PhD (*Abstract Co-Author*) Royalties,iCAD, Inc;Royalties, Koninklijke Philips NV;Royalties, ScanMed, LLC;Royalties, Ping An Insurance (Group) Company of China, Ltd;Royalties, Translation Holdings;Research support, Ping An Insurance (Group) Company of China, Ltd
Qingqing Zhu (*Presenter*) Nothing to Disclose

**PURPOSE**

In this pilot experiment, the ability of vision-based large language models (VLMs) to pre-fill the "Findings" section of radiology reports was assessed. Also, GPT-4 (text-based) was assessed as a novel evaluator for the generated findings in contrast to a clinician.

**METHODS AND MATERIALS**

This retrospective study used a CT and report dataset (23436 CT slices; 8340 studies with reports, 3832 patients; mean age 51 ± 17 [s.d.] years; 2085 males, 1747 females). The report sentences containing prospective RECIST-based measurements (called "bookmarks") made by radiologists were extracted using regular expressions. An enclosed bounding box was also created from the measurement to highlight the finding in the CT slice. Next, the GPT-4 API was employed to structure the finding into six segments (Current {Description/Size}, Previous {Description/Size}, Comparison to Prior, Additional), which were validated by a clinician with two years of experience. The current description was used as the ground-truth. Three VLMs were evaluated for their ability to describe findings: GPT-4 with Vision (GPT-4V), LLaVA-Med, and RadFM. These models analyzed the CT slices (with/without bounding box), to generate descriptions. The descriptions were initially assessed using conventional metrics like BLEU, METEOR, and ROUGE to evaluate their linguistic quality. Further analysis using GPT-4 decomposed the findings into specific components (body part, location, type), enhancing the evaluation of their clinical relevance. Finally, the privacy-preserving RadFM model was fine-tuned on this dataset and its performance was also compared.

**RESULTS**

GPT-4 was highly consistent with clinicians' assessments ($0.87 \pm 0.02$, $p < 0.001$), showing its potential to aid radiologists in evaluating task. Using this method to test model performance, GPT-4V was best at correctly identifying location (17.1%), body part (46.4%), and type (44.6%) of findings without specific tuning. Despite its effectiveness, it lacks privacy features. To address this, we fine-tuned the RadFM model, enhancing its performance markedly: location accuracy increased from 3.41% to 12.8%, body part from 29.12% to 53%, and type from 9.24% to 30%. These improvements make RadFM a viable, privacy-conscious alternative to GPT-4V.

**CONCLUSION**

The use of the CT dataset and the novel evaluation framework has shown significant improvement in the automation of CT finding generation. Additionaly, the decomposed evaluation model helps identify the strengths and areas for enhancement in the model.

**CLINICAL RELEVANCE/APPLICATION**

Radiologists evaluating cancer burden and overseeing patient treatment will benefit from a "second reader" AI model that provides a structured list of suspicious lesions in the "Findings" section.

## S3B-SPIN-8 A FEASIBILITY STUDY OF PULMONARY NODULE DETECTION BY ULTRA-LOW-DOSE CT WITH DEEP LEARNING IMAGE RECONSTRUCTION ALGORITHM

Zhiming Xiang (*Abstract Co-Author*) Nothing to Disclose
Kun Ma (*Abstract Co-Author*) Nothing to Disclose
Zhijuan Zheng (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the effect of deep learning image reconstruction (DLIR) algorithm on the image quality and detection of pulmonary nodules in ultra-low-dose computed tomography (ULD-CT) in comparison with the adaptive statistical iterative reconstruction-V (ASIR-V) algorithm.

**METHODS AND MATERIALS**

152 patients underwent standard-dose CT (SDCT), followed immediately by ULD-CT. SDCT was the reference standard using ASIR-V at 50% strength (50%ASIR-V). ULD-CT was reconstructed with 50%ASIR-V, DLIR (Medium, High; TrueFidelity™). The number, type, and diameter of pulmonary nodules

were recorded in the SDCT image. Effective dose and image quality were compared between ULD-CT and SDCT. The logistic regression was used to analyze the independent predictors of pulmonary nodules detection sensitivity.

## RESULTS

The Effective Dose (ED) of SDCT is 4.30±0.32 mSv, while that of ULD-CT is 0.33±0.03 mSv. There was no difference between the ULD-CT and SDCT for the CT values of nodules and lung tissue, SD values of nodules, and SNR values of nodules (P>0.05). DLIR had significantly lower SD values of lung tissue and higher SNR values of lung tissue and CNR values of nodules compared with ASIR-V ( P>0.05). The SDCT revealed 727 nodules and the overall detection sensitivity on ULD-CT was 97.11%. In nodules with a diameter 2-6 mm, the detection sensitivity is 98.95% (565/571) for solid nodules (SN) and 85.58% (89/104) for pure ground glass nodules (pGGN). All SN, pGGN, and partial solid nodules (PSN) 6mm or larger in diameter were detected on ULD-CT (20/20, 24/24, 8/8). Based on multivariate analyses, BMI (P = 0.026), the nodule types (P<0.001), and the nodule diameter (P = 0.002) were independent predictors of nodule detection sensitivity. However, the gender and age of patients had no significant effect on the detection sensitivity of pulmonary nodules (P > 0.05).

## CONCLUSION

The DLIR algorithm is a promising reconstruction technique, which can reduce radiation dose, optimize image quality, and ensure the detection sensitivity of pulmonary nodules in ULD-CT scan.

## CLINICAL RELEVANCE/APPLICATION

The application of the DLIR algorithm in ULD-CT scan can significantly improve image quality and ensure good detection sensitivity. This technique is helpful to reduce radiation dose, improve diagnostic accuracy, and save medical resources, so it is of great significance in clinical practice.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

S3B-SPIR

**Interventional Radiology Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPIR-1 SAFETY AND EFFICACY OF GENICULAR ARTERY EMBOLIZATION USING CALIBRATED 250-µM PARTICLES: REAL-WORLD DATA FROM EARLY STAGES OF AN ACADEMIC PRACTICE

Theresa M. Caridi, MD (*Abstract Co-Author*) Consultant, Boston Scientific Corporation;Speaker, Boston Scientific Corporation;Consultant, Cook Group Incorporated;Speaker, Cook Group Incorporated;Consultant, Terumo Corporation;Speaker, Terumo Corporation;Consultant, Siemens AG;Speaker, Siemens AG;Speaker, Penumbra, Inc;Research Grant, Siemens AG
Emily Gullette (*Abstract Co-Author*) Nothing to Disclose
Omid Shafaat, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Genicular artery embolization (GAE) is a novel interventional radiology technique for managing knee pain attributed to osteoarthritis. This study assesses the safety and efficacy of GAE using calibrated 250-µm particles in a clinical setting, focusing on its impact on pain reduction and safety.

### METHODS AND MATERIALS

This retrospective study analyzed data from 17 patients undergoing 19 GAE procedures. Demographic data, procedural details, Visual Analog Scale (VAS) scores, pre- and post-procedure, and complication rate were evaluated. Statistical analyses included descriptive statistics, paired t-tests to compare pre- and post-procedure VAS scores, and 95% confidence intervals (CI) calculation.

### RESULTS

The patient cohort had a mean age of 54.7 years (SD = 15.4) and a mean BMI of 37.1 (SD = 8.9); most patients were female (70.6%). The average VAS score pre-procedure was 8.06 (SD = 1.68), which significantly decreased to 4.33 (SD = 2.50) post-procedure (p=0.00035). The mean number of arteries embolized per procedure is approximately 1.37 (SD=0.50). Complications were minor and occurred in only two procedures and were related to pain control and hematoma of femoral access that both resolved without interventions. The average fluoroscopy time was 34.17 minutes (SD=17.27), and the average radiation dose was 653.6 mGy (SD=470.39). The average time to post-procedure VAS assessment was 52 days (range 30-129 days). The average reduction in pain score was 3.67 points, suggesting effective pain relief.

### CONCLUSION

GAE using calibrated 250-µm particles significantly reduces knee pain in patients with osteoarthritis, demonstrating substantial clinical efficacy in pain management and safety with minor complications within an academic practice setting. Early results from real-world data, which represent some of the first findings outside of clinical trials, from this academic practice offer promising evidence supporting the efficacy and safety of GAE using calibrated 250-µm particles.

### CLINICAL RELEVANCE/APPLICATION

This study highlights the potential of GAE calibrated 250-µm particles to offer significant pain relief, enhance patient quality of life, and reduce reliance on more invasive procedures such as total knee arthroplasty. These findings warrant further study with larger cohorts and more extended follow-up periods to better understand the benefits and limitations of GAE using calibrated 250-µm particles in managing osteoarthritic knee pain.

## S3B-SPIR-5 EFFICACY OF PROSTATIC ARTERY EMBOLIZATION IN TREATING LARGE PROSTATES (≥ 80 CC) AT 12 MONTHS: A SYSTEMATIC REVIEW AND META-ANALYSIS

Pedro L. Lino, MD (*Abstract Co-Author*) Nothing to Disclose
Joao S. Pais, MD (*Abstract Co-Author*) Nothing to Disclose
Marcelo Liberato Coelho Mendes De Carvalho, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza A. Oliveira Gatto, MD (*Abstract Co-Author*) Nothing to Disclose
Andre M. Assis (*Abstract Co-Author*) Nothing to Disclose
Alessandra Caren Frey, MD (*Abstract Co-Author*) Nothing to Disclose
Mateus Esmeraldo, MD (*Abstract Co-Author*) Nothing to Disclose
Francisco C. Carnevale (*Abstract Co-Author*) Nothing to Disclose
Fernanda Uchiyama Golghetto Domingos (*Abstract Co-Author*) Nothing to Disclose
Matheus Fritzen, MD (*Abstract Co-Author*) Nothing to Disclose
Marcello Giovanni Messias Da Silva, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To perform meta-analysis of available data on prostatic artery embolization (PAE) as a treatment option for patients with symptomatic benign prostatic hyperplasia (BPH) with prostate = 80 mL.

**METHODS AND MATERIALS**

PubMed, Cochrane, and Scopus were searched up to April 1, 2024. Peer-reviewed studies with > 5 patients and standard deviations and/or individual-level data on one or more of the following outcomes were included: prostate volume (PV), peak flow rate (Qmax), postvoid residual (PVR), International Prostate Symptom Score (IPSS), quality of life (QOL) score and prostate-specific antigen (PSA) level. A random-effects meta-analysis was performed on the outcomes at 12 months after PAE compared with baseline values, with a $P < .05$ decision rule as the null hypothesis rejection criterion.

**RESULTS**

Thirteen of 1243 studies were included in data collection, with six included in the meta-analysis. At 12 months, PV decreased by 60.22 cm3 ($P < .001$), PSA remained unchanged ($P = .05$), PVR decreased by 56.93 mL ($P < .001$), Qmax increased by 5.06 mL/s ($P < .02$), IPSS improved by 15.13 points ($P < .001$), QOL score improved by -2.78 points ($P < .001$). Minor complications after PAE procedure frequently occur but typically resolve within a two-week period. Major complications were rare. There were no minor or major complications at 12 months.

**CONCLUSION**

PAE in large prostates (> 80 cc) provided improvement in Qmax, PVR, IPSS, and QOL at 12 months. There were no minor or major complications at 12 months, and there was no adverse effect on erectile function.

**CLINICAL RELEVANCE/APPLICATION**

This systematic review and meta-analysis underscores the clinical significance of PAE in managing BPH among patients with larger prostatic volumes (> 80 mL). Conventional therapeutic modalities for BPH often exhibit limited efficacy and heightened risks in the context of larger prostates, necessitating consideration of invasive procedures such as subtotal prostatectomy. However, the findings of this study highlight PAE as a promising alternative with notable efficacy and safety profiles.

## S3B-SPIR-6 MR-GUIDED VAGAL CRYOABLATION FOR THE TREATMENT OF OBESITY IN A CANINE ANIMAL MODEL - PRELIMINARY RESULTS

Clifford R. Weiss, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Siemens AG;Research Grant, Boston Scientific Corporation;Consultant, Boston Scientific Corporation;Research Grant, Medtronic plc;Consultant, Medtronic plc;Research Grant, Guerbet SA;Consultant, Guerbet SA
Dara L. Kraitchman, DVM, PhD (*Abstract Co-Author*) Advisory Board, Ardent Animal Health
Cheri Rice (*Abstract Co-Author*) Nothing to Disclose
Robert Anders (*Abstract Co-Author*) Nothing to Disclose
Eun Shin (*Abstract Co-Author*) Consultant, Boston Scientific Corporation;Consultant, Medtronic plc
Arun Kamireddy, MBBS, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess safety, feasibility, and efficacy of MR-guided vagal cryoablation for managing obesity in an obese canine model, based on promising results from a prior CT-guided cryovagotomy study.

**METHODS AND MATERIALS**

All studies were approved by IACUC. Pilot studies involved healthy dogs (30+2.64 kgs, n=3) with ~2 weeks follow-up, while chronic studies included obese dogs (14.12+0.63 kgs, n=4) with ongoing ~4 month follow-up. Procedure was performed using a 1.5T MRI under GA. Pre-procedural CBCT and MRI determined optimal entry point. Fat percentage (FP) maps were obtained with multi-echo DIXON sequences. Cryoprobe targeted posterior vagal trunk in lower thorax. Freeze-thaw durations varied (2-1-2-1, 4-2-4-2, and 6-3-6-3 minutes) in pilot dogs and were consistent 6-3-6-3 minutes in chronic studies. Post-procedure MRIs were repeated to assess immediate adverse events. Safety was monitored via weekly blood draws, follow-up MRI at ~2 weeks in pilot dogs, and at 1 and 4 months in ongoing chronic studies. Follow-up endoscopy (~7 days) was performed in chronic studies. Analysis involved comparing ROIs from FP maps of liver and intramuscular thigh. Subcutaneous and visceral fat areas were obtained. The Wilcoxon signed-rank test assessed changes in FP between pre- and post-procedures. Weekly weight and dietary intake were monitored, with pilot studies concluding with humane anesthesia and tissue harvest.

**RESULTS**

Cryoablation was successfully performed in all dogs. Three dogs from chronic studies showed an average weight gain of 7.1% over a two-month post-procedure follow-up. Dietary intake remained excessive at ~1000 kcal/day post-procedure in chronic studies. Statistical analysis found no significant differences ($p > 0.05$) in pre- and post-procedure FP measurements (Table). Minor cryoinjury of right lung adjacent to target area, without injury to aorta, IVC or azygos was seen in all dogs. In one sub-acute dog, over-advancement of cryoprobe led to esophageal perforation. Two dogs developed small, self-resolving pneumothorax immediately post-ablation. Endoscopy confirmed absence of esophageal or gastric inflammation in chronic studies. Pending histopathology and ghrelin assays may provide insights into metabolic and tissue-level effects.

**CONCLUSION**

Early data reveals technical challenges with MR-guided vagal cryoablation in canines, highlighting need for precise probe placement. Contrary to a prior CT-guided cryovagotomy study, observed weight gain suggests vagal cryoablation alone may not suffice for weight reduction.

**CLINICAL RELEVANCE/APPLICATION**

Although MR-guided vagal cryoablation is technically feasible, contrasting results of our study highlight the need to investigate long-term metabolic effects of vagal nerve modulation.

## S3B-SPIR-8 COMPARATIVE RANDOMIZED CLINICAL TRIAL OF A MASTER-SLAVE INTERVENTIONAL ROBOT FOR PERCUTANEOUS LUNG PUNCTURE

Xueling Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Wenge Xing (*Abstract Co-Author*) Nothing to Disclose
Zhi Guo, MD (*Abstract Co-Author*) Nothing to Disclose
Yong Li (*Abstract Co-Author*) Nothing to Disclose
Nan Wang (*Abstract Co-Author*) Nothing to Disclose

Bin Xiong (*Abstract Co-Author*) Nothing to Disclose
Haipeng Yu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

A novel CT fluoroscopy image guided master-slave robotic system was developed to improve clinical outcomes and avoid radiation to radiologists. The manipulator and end-effector of this system can be deployed in separate room. To assess the safety and feasibility of the robot in lung percutaneous puncture procedure, a multicenter randomized controlled clinical trial was conducted.

**METHODS AND MATERIALS**

136 patients (M: 80, F: 56; mean lesion size 4.75cm) were enrolled from three centers. 68/68 baseline-matched patients were randomly divided into study group and control group. The developed system was employed in study group, while the conventional CT freehand puncture approach was used in control group. The primary aim was one-time puncture success rate, the secondary aims included the entire procedure duration, puncture time, patient radiation dose of entire procedure and complication rate. The procedure time analysis of each step (including preoperative planning, sterilization and anesthesia, preparation, puncture and target confirmation) was also evaluated.

**RESULTS**

131 patients (67 control / 64 study group; M: 76, F: 55; mean lesion size 4.83cm) of Per Protocol Set were analyzed. The results of study and control group were respectively: one-time puncture success rate: 95.3% (61/64) vs 59.7% (40/67) (p<.01); Procedure duration: median 14.63min (12.96-18.65) vs 7.65min (IQR 6.01-10.27) (p<.01); Puncture time: 0.71min (0.38-1.33) vs 2.07min (1.03-2.84) (p<.01); Radiation dose: 4.60mSv (3.72-6.01) vs 10.40mSv (7.50-14.18) (p<.01); Complication rate: 15.63% (10/64) vs 22.39% (15/67) (p=.33). Specifically, the occurrence of pneumothorax, hemoptysis and bleeding were 10.94% vs 11.94% (p=.86), 1.56% vs 7.46% (p=.46) and 2.21% vs 2.99% (p=.23). The evaluation of procedure duration is shown in Figure 1.

**CONCLUSION**

The one-time puncture success rate, puncture time and radiation dose to the patients showed a significant difference with a margin of 35.6%, 1.36min and 5.80mSv better than control group. Procedure duration of study group was slightly increased due to longer preoperative planning (3.21min), anesthesia (1.93min) and preparation (4.21min) time. The complication rate had no significant difference between two groups, while the number of complications in study group decreased.

**CLINICAL RELEVANCE/APPLICATION**

In traditional approach, patient suffers from high radiation due to repeated CT scan and needle adjustments. This work suggested that the developed system benefits the patients in reducing radiation exposure and the duration of risky operations. Moreover, the system eliminates all radiation to physicians and minimizes their skill variability.

## S3B-SPIR-9 X-RAY ACOUSTIC COMPUTED TOMOGRAPHY (XACT) FOR RADIOLOGY INTERVENTION

Yuchen Yan (*Abstract Co-Author*) Nothing to Disclose
Liangzhong Xiang, PhD (*Abstract Co-Author*) Nothing to Disclose
Prabodh K. Pandey, PhD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Introduced in 2013 by Xiang et al., X-ray Acoustic Computed Tomography (XACT) overcomes traditional x-ray limitations and has enabled new clinical applications such as radiation therapy monitoring, interventional radiology, and non-destructive evaluations. This study demonstrates the use of 2D and 3D XACT imaging with arrays of 128 and 256 elements, respectively, enhancing needle monitoring and confirming its effectiveness in imaging X-ray contrast agents for potential blood clot monitoring.

**METHODS AND MATERIALS**

A portable X-ray device (Golden Engineering Inc., 10Hz repetition rate) emits X-ray pulses with a 50ns width, causing a minor thermal increase in millikelvins, which generates pressure waves known as the X-ray Acoustic (XA) signal. The setup features a linear ultrasound transducer (L12-5L40N-4, 5-12MHz, 39mm field of view, TELEMED Co.) with 128 elements that simultaneously captures 2D XA and ultrasound images. Additionally, a 1MHz ultrasound transducer (Doppler Co.) with a 16x16 element grid produces 3D XA images of the needle. A contrast agent (omnipaque 300) is injected into a silicone tube mimicking a blood vessel (2.5mm in diameter), enabling 3D visualization of the contrast agent. The image reconstruction utilizes a Model-Based XACT back-projection method with iterative regularized LSQR (Model-Based LSQR).

**RESULTS**

Using a 2D linear array, our system captures synchronized X-ray Acoustic (XA) and ultrasound images, displaying needle movements with a resolution of 0.1 mm at 5 frames per second. 3D XA images were produced with a resolution of 0.3 mm and captured using fewer than 10 X-ray pulses. This capability is crucial for real-time needle monitoring during therapeutic procedures.

**CONCLUSION**

The XA+US system integrates X-ray Acoustic (XA) imaging with ultrasound to enhance visualization of needles, contrast agents, and tissues, supporting its use in blood clot monitoring. Future enhancements might include higher energy X-rays and more sensitive ultrasound probes. Further ex vivo and in vivo studies are necessary to fully demonstrate its clinical effectiveness

**CLINICAL RELEVANCE/APPLICATION**

XACT + US technology aims to monitor the entire needle insertion process, contrast agent injection, and flow within tissues, applicable in embolism or blood clot monitoring. It provides comprehensive imaging with significantly lower radiation, aiding surgeons in precise targeting and minimizing damage to healthy tissues, thus improving medical interventions

# Abstract Archives of the RSNA, 2024

S3B-SPMK

**Musculoskeletal Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPMK-2 ASSOCIATION BETWEEN DEEP LEARNING PREDICTED BODY COMPOSITION FROM CXR AND SURVIVAL IN THE ELDERLY

Namkug Kim, PhD (*Abstract Co-Author*) Stockholder, Anymedi, Inc
Sunghwan Ji (*Abstract Co-Author*) Nothing to Disclose
Hong-Kyu Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Miso Jang (*Abstract Co-Author*) Nothing to Disclose
Kyungjin Cho, MSc, BS (*Abstract Co-Author*) Nothing to Disclose
Ki Duk Kim, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The objective of this study is to investigate the association between body composition predicted by a deep learning network of chest radiographs (CXR) and all-cause mortality in elderly individuals.

### METHODS AND MATERIALS

A total of 5,932 individuals aged 65 years and older were included in the survival dataset. Deep learning model predicted skeletal muscle mass and fat mass from CXR. All-cause mortality was assessed using the National Health Insurance eligibility status. Participants were grouped according to tertiles of bioelectric impedance analysis (BIA)-measured body composition (skeletal muscle mass divided by body mass index, SMM/BMI, and fat percent). Multivariable Cox proportional hazards regression adjusted for age was used to calculate hazard ratios (HRs) with 95% confidence intervals (CIs) comparing the second tertile group with other groups.

### RESULTS

During a median follow-up of 8.7 years, 417 (7.0%) participants died. In the survival analysis, lower CXR-measured SMM/BMI was associated with higher all-cause mortality in both female (HR: 1.50, 95% CI: 1.02-2.22, P-value=0.039) and male (HR: 1.77, 95% CI: 1.36-2.20, P-value<0.001). However, after the adjustment for age, only elderly population of males (HR: 1.42, 95% CI: 1.08-1.85, P-value=0.011) showed statistically significant association. The association was not statistically significant after the adjustment in females. The association between fat percent and mortality as not statistically significant in both BIA-measured fat percent and CXR-measured fat percent.

### CONCLUSION

In this deep learning model development and validation of survival impact in elderly individuals, SMM/BMI was significantly associated with all-cause mortality in elderly males. Fat percent was not statistically associated with all-cause mortality in elderly individuals.

### CLINICAL RELEVANCE/APPLICATION

Higher SMM/BMI was protective for elderly males. These findings suggest that deep learning analysis of routine CXR may provide valuable prognostic information regarding body composition in the management of elderly participants.

## S3B-SPMK-3 FULLY AUTOMATED 29 SUBSTRUCTURES TOTAL KNEEMRI SEGMENTATION USING DEEP LEARNING: IMPLICATIONS FOR POTENTIAL FACTORS OF OSTEOARTHRITIS PROGRESSION

Huimao Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Haoyu Liu (*Abstract Co-Author*) Nothing to Disclose
Lin Mu, MD,MS (*Presenter*) Nothing to Disclose

### PURPOSE

We aimed to develop a model that enables automatic segmentation of the 29 major anatomical structures in the whole knee Magnetic Resonance Imaging(MRI)and explore the potential precursors to Knee Osteoarthritis(KOA)based on the total knee radiomics features (TKRF).

### METHODS AND MATERIALS

The prospective nested case-control study analyzed 3.0T (MRI) ,DESS sequence of the right knee of 519 participants with Kellgren-Lawrence(KL) grade 0 or 1 at baseline from the Osteoarthritis Initiative(OAI). According to the occurrence of incident radiographic KOA during the 4-year follow-up period, participants with KOA(n=173) and without KOA(n=346) were distinguished with 1:2 propensity score matching(PSM) based on gender, race, Body Mass Index (BMI) and contralateral knee status at baseline.We employed the nnU-Net for an active learning strategy to progressively optimize the iterative model, and it were used to segment 29 anatomical structures in total knee (tibia, femur, patella and corresponding subchondral bone, 19 cartilage

subdivisions, anterior cruciate ligament, posterior cruciate ligament, meniscus and joint effusion). The final annotations served as the ground truth for training and testing. Dice similarity coefficients (Dice) was calculated to evaluate the model's performance. TKRF calculated 111 radiomics features in each substructure based on pyradiomics, and to investigate features with statistical differences in KOA progression cohort.

**RESULTS**

We developed a tool for segmentation of 29 knee anatomical structures on 519 MRI datasets obtained using different KL-related changes. The tool demonstrated high accuracy (mean Dice score 0.957) and works robustly on a wide range of clinical data, superior to other free segmentation tools. We assessed the TKRFs which describe 29 knee areas feature sets that capture the full richness of the image information to investigate possible causes for KOA progression. One of the shape features, Maximum 3D Diameter from effusion, is by far the most important parameter for automatic classification.The Least Axis Length of posterior lateral tibial cartilage, which is the most important cartilage features showed significant differences in the KOA progression datasets.

**CONCLUSION**

We developed a MRI segmentation model that is (1) easy to use; (2) segments most anatomically relevant structures in the whole MRI, and contains 19 divisions of cartilage (3) works robustly in any clinical setting.We introduce TKRF and show that rich radiomics-based feature enables improved predictive KOA progression.

**CLINICAL RELEVANCE/APPLICATION**

We propose that TKRF could spark the establishment of a new generation of KOA imaging biomarkers with benefits for a range of applications.

## S3B-SPMK-4 A CLINICAL-RADIOMICS NOMOGRAM BASED ON PRE-TREATMENT MRI FORPREDICTINGPROGRESSION-FREE SURVIVALAFTER NEOADJUVANT CHEMOTHERAPY FOR OSTEOSARCOMA: A MULTICENTER STUDY

Bin Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Haimei Chen (*Abstract Co-Author*) Nothing to Disclose
Xiaoyun Liang (*Abstract Co-Author*) Nothing to Disclose
Shui Xing Zhang Sr, MD (*Abstract Co-Author*) Nothing to Disclose
Xiao Zhang (*Abstract Co-Author*) Nothing to Disclose
Yuchi Tian (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and validate a clinical-radiomics nomogram based on pre-treatment MRI for progression-free survival (PFS) prediction after neoadjuvant chemotherapy for osteosarcoma.

**METHODS AND MATERIALS**

A total of 109 patients with histologically confirmed osteosarcoma without evidence of recurrence or distant metastases were enrolled from four hospitals (Hospital 1/2/3/4: n = 57/34/12/6), which were strictly divided into the training (Hospital 1 and 4) and validation cohorts (Hospital 2 and 3). Baseline clinical characteristics were derived from medical records. A set of 1130 radiomics features were extracted from contrast-enhanced fat-suppressed T1-weighted images (CE-FS-T1WI), further screened by Pearson correlation analysis and Relief algorithm, which were finally combined with the classifier to construct the optimal radiomics signature for predicting PFS. A clinical-radiomics nomogram was developed based on the Cox proportional hazards regression analysis, and the patients were divided into high- and low-risk groups according to their nomogram score. Furthermore, the predictive performance and clinical usefulness were assessed.

**RESULTS**

Seven features were identified to construct the radiomics signature. The corresponding radiomics feature maps of highly predictive texture features showed large difference in patients with different prognosis (FIGURE 1). The clinical-radiomics nomogram, incorporating the radiomics signature and a significant clinical risk factor, exhibited better prediction performance for PFS compared with either the clinical model or radiomics signature, with C-indexes of 0.845 (95% CI, 0.782-0.907) and 0.759 (95% CI, 0.674-0.844) in the training and validation cohorts, respectively (TABLE 1). The nomogram-defined high-risk group had a significantly shorter PFS than those in the low-risk group (FIGURE 2, $P < 0.05$). Clinical decision curve analysis confirmed the clinical utility of the clinical-radiomics nomogram (FIGURE 3).

**CONCLUSION**

Our results have demonstrated that the proposed CE-FS-T1WI-based clinical-radiomics nomogram could serve as a powerful predictor of PFS in patients with osteosarcoma.

**CLINICAL RELEVANCE/APPLICATION**

The proposed approach has the potential to assist doctors in making informed treatment decisions, which may prolong patient survival and improve patient treatment outcomes.

## S3B-SPMK-5 RADIOPSY, QUANTITATIVE WB-MRI ADC AND FAT FRACTION SEQUENCES FOR DISCRIMINATION OF SMOLDERING MULTIPLE MYELOMA AND MULTIPLE MYELOMA: A PROSPECTIVE OBSERVATIONAL STUDY

Anna Sarnelli (*Abstract Co-Author*) Nothing to Disclose
Federica Matteucci (*Abstract Co-Author*) Nothing to Disclose
Delia Cangini (*Abstract Co-Author*) Nothing to Disclose
Emiliano Loi (*Abstract Co-Author*) Nothing to Disclose
Giovanni Martinelli (*Abstract Co-Author*) Nothing to Disclose
Domenico Barone (*Abstract Co-Author*) Nothing to Disclose
Arrigo Cattabriga (*Abstract Co-Author*) Nothing to Disclose
Giada Sancini (*Abstract Co-Author*) Nothing to Disclose
Davide Bezzi (*Abstract Co-Author*) Nothing to Disclose
Alice Rossi, MD (*Abstract Co-Author*) Nothing to Disclose
Claudio Cerchione (*Abstract Co-Author*) Nothing to Disclose
Paola Caroli (*Abstract Co-Author*) Nothing to Disclose
Davide Nappi (*Abstract Co-Author*) Nothing to Disclose
Danila Diano (*Abstract Co-Author*) Nothing to Disclose
Andrea Prochowski Lamurri, MD (*Abstract Co-Author*) Nothing to Disclose
Matteo Marchesini (*Abstract Co-Author*) Nothing to Disclose
Giacomo Feliciani (*Presenter*) Nothing to Disclose

## PURPOSE

To distinguish between Multiple Myeloma and High-Risk Smouldering Myeloma at staging using image-based biomarkers obtained from Whole Body-MRI (WB-MRI) Apparent Diffusion Coefficient (ADC) and Fat Fraction (FF) sequences.

## METHODS AND MATERIALS

From January 2021 to March 2024, we enrolled consecutive myeloma patients at staging into an observational prospective trial and divided them into two groups based on International Myeloma Working Group (IMWG) criteria: High-risk Smouldering Multiple Myeloma (SMM, group 1) and Multiple Myeloma (MM, group 2). All patients underwent WB-MRI using the Myeloma Response Assessment and Diagnosis System (MY-RADS). We use the term "Radiopsy" to indicate the quantification and modelling of image characteristics nearby the biopsy site to predict patient status. An experienced radiologist placed a cylindrical, 5 cc VOI nearby the biopsy site and 5 more identical VOIs on distant sites such the pelvis bone and on D11 and L5 vertebrae. The dataset was split into a training and test set with a 70:30 ratio. LASSO algorithm was used to select the most predictive features and build logistic regression models, which were then validated using the test set. Receiver operating curves (ROC) and area under the curve (AUC) were used as metrics for models' performance assessment. Radiopsy models were tested on distant biopsy site to predict disease invasion.

## RESULTS

The study included 102 patients (46 males, mean age 63 ± 12 [SD]) with 60 diagnosed with MM and 42 with SMM. 144 quantitative features were extracted from the VOI at the biopsy site WB-MRI ADC and FF sequences for each patient. Radiopsy model showed a median AUC of 0.85 (0.79-0.95) in the training phase and a median AUC of 0.65 (0.55-0.80) in the test phase. The best predictive model had an AUC of 0.95 and 0.75 in the training and test phase, respectively. The models used to predict patient status at biopsy site were also predictive in distant VOIs.

## CONCLUSION

Radiopsy models can distinguish between MM and SMM with good performance nearby the biopsy site. Radiopsy can be used to predict disease invasion on distant sites where biopsy is not possible or not feasable

## CLINICAL RELEVANCE/APPLICATION

This observational prospective trial showed that using quantitative features extracted from WB-MRI ADC and FF sequences can help distinguish between high-risk SMM and MM at staging, thus potentially enhancing diagnostic accuracy.

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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

S3B-SPMS

**Multisystem Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPMS-1 LEVOTHYROXINE USE AND BONE LOSS IN EUTHYROID OLDER ADULTS: A LONGITUDINAL ANALYSIS FROM BALTIMORE LONGITUDINAL STUDY OF AGING

Shadpour Demehri, MD (*Abstract Co-Author*) Consultant, Toshiba Corporation;Research support, General Electric Company;Research Grant, Carestream Health, Inc
Jennifer Mammen (*Abstract Co-Author*) Nothing to Disclose
QIANLI XUE (*Abstract Co-Author*) Nothing to Disclose
Hamza Ibad, MBBS (*Abstract Co-Author*) Nothing to Disclose
Elena Ghotbi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Levothyroxine (LT4) is the second most commonly prescribed medication in older adults. Frank hyperthyroidism accelerates bone turnover and even subclinical hyperthyroid has been associated with increased fracture risk. Data indicates that a significant proportion of thyroid hormone prescriptions may be given to older adults without hypothyroidism raising concerns about subsequent relative excess of thyroid hormone even when treatment is targeted to reference range goals. In this study we aimed to determine whether LT4 use and higher thyroid hormone levels within the reference range are associated with higher bone loss over time in older adults.

### METHODS AND MATERIALS

Using the Baltimore Longitudinal Study of Aging a prospective observational cohort of community-dwelling older adults, participants age 65 and older at the baseline visit with at least 2 visits with thyroid function tests within the reference ranges at all visits were included.We employed propensity score matching (1:5), to match LT4 users with non-users according to relevant baseline characteristics: age, gender, BMI, race, history of alcohol intake, smoking, multi-pharmacy, and baseline serum TSH. Dual-Energy X-ray Absorptiometry were used to measure bone density and mass at each visit. Linear mixed-effects models and an interaction term of time interval between each visit and participant's first visit were used to estimate longitudinal relationships between exposure and outcomes. Stratified analyses were performed according to tertiles of average serum free thyroxine (FT4) level.

### RESULTS

The cohort included 81 euthyroid LT4 users (32 males, 49 females) and 364 non-users (148 males, 216 females), with a median age of 73 and thyrotropin levels of 2.35 at the index visit. LT4 use was found to be associated with greater longitudinal loss of total body bone mass (beta: -6.53; 95% CI: (-10.39, -2.67); $p < 0.001$) and total body bone density (beta: -0.0014; 95% CI: (-0.002, -0.0006); $p < 0.001$) over a median follow-up of 6.3 years (IQR: 4.0, 10.4). This association was stronger with increasing tertile of average FT4.

### CONCLUSION

Longitudinal loss of bone mass and density was greater among euthyroid LT4 users. The more pronounced effects at higher levels of FT4 suggest that LT4 use may be associated with a relative excess of thyroid hormone in some older adults on therapy, even with TSH levels within the reference range.

### CLINICAL RELEVANCE/APPLICATION

Even when adjusted to current treatment targets, bone loss may be an iatrogenic effect of levothyroxine use in older adults.

# Abstract Archives of the RSNA, 2024

S3B-SPNMMI

**Nuclear Medicine & Molecular Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPNMMI-1 DIAGNOSTIC IMAGING METHODS USED IN THE PLANNING AND FOLLOW-UP OF PATIENTS UNDERGOING RADIOEMBOLIZATION WITH YTTRIUM-90 AND HOLMIUM-166 - A REVIEW

Rubens dos Santos Barbosa, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Viviane Campos Vaz, MD (*Abstract Co-Author*) Nothing to Disclose
Emilia Sousa, MBBS (*Abstract Co-Author*) Nothing to Disclose
Laryssa Maia, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

Hepatic radioembolization with radiolabeled microspheres is a locoregional treatment for unresectable hepatocellular carcinoma. It is essential to perform PET-CT (Positron Emission Tomography and Computed Tomography) and/or SPECT-CT (Single Photon Emission Computed Tomography and Computed Tomography) to predict the biodistribution and dose of microspheres before treatment. The objective of this study is to compare the diagnostic imaging techniques used for therapeutic planning and follow-up of patients undergoing radioembolization with Yttrium-90 (Y-90) and Holmium-166 (166-Ho).

### METHODS AND MATERIALS

The present study is a systematic review of the literature. In February 2024, a search was carried out on the Pubmed and Scielo platforms using the following terms: holmium, yttrium, nuclear medicine and radioembolization. Articles from the last 5 years written in English were filtered.

### RESULTS

To evaluate an extrahepatic shunt, it is necessary to perform a liver perfusion scintigraphy using 99mTc-MAA or Ho-166 itself at a lower dose. Studies demonstrate that planning with Ho166 demonstrates greater agreement with therapy than planning with 99mTc-MAA, as MAA has different physical characteristics from microspheres, not exactly mimicking their biodistribution.

### CONCLUSION

Holmium, as a personalized treatment option, has generated interest due to its imaging options and more precise planning. 99mTc-MAA, despite being widely used, presented limitations in therapeutic planning. Holmium radioembolization demonstrates feasibility and safety together with intraprocedural MRI due to its paramagnetic characteristics.

### CLINICAL RELEVANCE/APPLICATION

Hepatocellular carcinoma has an aggressive profile with a high death rate. It is one of the types of tumors that benefit most from SIRT, due to its predominant arterial vascularization. Commonly diagnosed in more advanced states, conventional curative therapies such as surgical resection may be contraindicated, with radioembolization being one of the few viable options in these cases. Planning with Ho166 scout demonstrates greater agreement with therapy than planning with 99mTc-MAA, reducing the likelihood of a patient being erroneously excluded from therapy or receiving a suboptimal therapeutic dose.

## S3B-SPNMMI-2 EARLY PREDICTION OF RESPONSE TO REPEATED RADIOIMMUNOTHERAPY WITH $^{131}$I-RITUXIMAB IN LYMPHOMA USING SEQUENTIAL $^{18}$F-FDG PET/CT

Byeonghyeon Byeon (*Presenter*) Nothing to Disclose

### PURPOSE

We prospectively evaluated the usefulness of sequential 18F-FDG PET/CT scans before and after the first radioimmunotherapy with 131I-rituximab (RIT) to predict response to subsequent repeated RIT in patients with relapsed or refractory non-Hodgkin’s lymphoma.

### METHODS AND MATERIALS

A total of 26 clinical patients received RIT and patients who had no progression after the first RIT underwent subsequent repeated RIT until disease progression or up to a maximum of six cycles. Patients underwent 18F-FDG PET/CT and maximum standardized uptake values (SUVs) and the sums of the products of the greatest perpendicular diameters (SPDs) were measured before, 5 d, and 4 weeks after the first RIT. Then, the % changes of SUVs and SPDs were calculated and designated as %SUV5d, %SUV4w, %SPD5d, and %SPD4w, respectively. The response was evaluated 1 month after each cycle of RIT. We assessed the predictive values of imaging parameters for response to the first or repeated RIT. Then, a predictive model for predicting responders to repeated RIT based on imaging parameters were devised.

## RESULTS

Objective responses to RIT were observed in 12 of 26 patients (46%) after the first RIT and 19 of 26 patients (73%) after repeated RIT. ROC curve analysis revealed that %SUV4w and %SPD4w predicted response to the first RIT, while %SUV5d, %SUV4w, and %SPD4w predicted response to repeated RIT. In the first step of our prediction model, patients with %SPD4w > 40% and %SPD4w = 0% were predicted to be responders and non-responders, respectively. In the second step, patients with 0% < %SPD4w = 40% were categorized into 2 groups: %SUV5d > 2% (responders) and SCR1 = 2% (non-responders). By using this prediction model, sensitivity, specificity, PPV, NPV, and accuracy for predicting responders to repeated RIT were 95%, 86%, 95%, 86% and 92%, respectively.

## CONCLUSION

Serial 18F-FDG PET/CT scans before and after the first RIT, including day 5 PET, will be of benefit in the planning of subsequent repeated RIT considering its efficacy and toxicity.

## CLINICAL RELEVANCE/APPLICATION

18F-FDG PET/CT scans before and after the first RIT can predict non-responders to subsequent repeated RIT in relapsed or refractory NHL.

# Abstract Archives of the RSNA, 2024

S3B-SPNPM

**Noninterpretive Skills (Beyond Imaging) Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPNPM-1 REPRESENTATION OF INTERNATIONAL MEDICAL GRADUATES AMONG DIAGNOSTIC RADIOLOGY CHAIRS, NEURORADIOLOGY CHIEFS, AND PROGRAM DIRECTORS

David M. Yousem, MD, MBA (*Abstract Co-Author*) Royalties, RELX;Speaker, MRI Online;Board Member, MRI Online;
Mona Dabiri, MD (*Abstract Co-Author*) Nothing to Disclose
Mina Hesami, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Sheikhy, MD (*Abstract Co-Author*) Nothing to Disclose
Sara Ramezanpour (*Abstract Co-Author*) Nothing to Disclose
Mahla Radmard, MD (*Abstract Co-Author*) Nothing to Disclose
Fatemeh Dehghani Firouzabadi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The number of international medical graduates (IMGs) entering radiology residencies and neuroradiology fellowships averaged 9.7% and 20.9% from 2021-2023 respectively. We aimed to determine whether IMG graduates are populating leadership roles at a proportionate rate in diagnostic radiology (DR) and neuroradiology (NR).

### METHODS AND MATERIALS

We surveyed 191 DR program directors (PDs), 94 NR PDs, 192 chairs of DR and 91 directors of NR inquiring about their original citizenship and medical school [American Medical Graduates (AMG) vs IMG]. We reviewed institutional web sites to obtain missing data and recorded H indices for each person using Scopus.

### RESULTS

We confirmed the original citizenship and medical school location in 61 75% and 93-98% of each leadership group. We found that 19/119 (16.2%) DR PDs, 31/71 (43.7%) NR PDs, 33/116 (28.5%) DR Chairs and 28/69 (40.6%) NR Chiefs were not originally US citizens. The IMG rate was 18/188 (9.6%), 20/90 (22.2%), 26/186 (14.0%), and 19/85 (22.4%) for DR PDs, NR PDs, Chairs and NR Chiefs respectively. The most common country of origin and medical school cited was India for all leadership groups. IMGs had a median H index of 14 while AMGs 10, significantly different (p=0.021)

### CONCLUSION

Compared to the rate of DR/NR trainees entering from 2021-2023, IMGs are proportionately represented at the NR PD), NR chief, DR Chairs, and DR PDs positions. The H index of the IMGs was higher than AMGs. We conclude that IMGs have made substantial and proportionate inroads in radiology and neuroradiology leadership.

### CLINICAL RELEVANCE/APPLICATION

The proportional presence of IMGs in critical leadership roles within DR and NR, alongside their notably higher academic productivity, signifies a promising trend towards a more inclusive and dynamic leadership paradigm. This advancement not only enriches the diversity of perspectives but also enhances a culture of excellence and innovation within these pivotal medical specialties.

## S3B-SPNPM-2 THE INCREASING ROLE OF SUBSPECIALIZATION IN THE INTERPRETATION AND PERFORMANCE OF BREAST IMAGING EXAMINATIONS: MORE BREAST IMAGING EXAMINATIONS ARE PERFORMED BY BREAST RADIOLOGISTS

Richard E. Sharpe JR, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Aditya Khurana, MD (*Abstract Co-Author*) Nothing to Disclose
Alan Zhu, BS (*Abstract Co-Author*) Nothing to Disclose
Tariq Rashid (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study was to evaluate for potential subspecialization among radiologists interpreting breast imaging (BI) examinations for the US Medicare population.

### METHODS AND MATERIALS

Outpatient imaging claims for the US Medicare population from 2013 to 2021 were extracted from the CMS POSPUF database. Examinations were classified as either BI or not, and tallied by year, and by individual radiologists. A BI case mix was calculated for each radiologist. Radiologist BI case mixes were stratified into quartiles. Radiologists submitting 75th percentile of claims as BI examinations were considered breast subspecialized, and were

compared to radiologists submitting fewer BI claims. We further analyzed urban versus rural practice settings, geographic regions, and female versus male gender. T-test, Kruskal-Wallis one-way analysis of variance test, and Multivariate Linear Regression Analysis tests were computed.

**RESULTS**

The total number of BI examinations increased from 8009216.1 in 2013 to 13783647.0 in 2021 (+72.1%). The total number of BI wRVUs increased from 5593430.7 in 2013 to 9761024.8 in 2021 (+74.5%). The total number of radiologists interpreting BI examinations decreased from 13,770 in 2013 to 11,540 in 2021 (-16.2%). The proportion of all imaging wRVUs associated with BI exams increased from 25.1% in 2013 to 41.9% in 2021 (+24%). Radiologists with a high case mix of BI examinations (above the upper 75th percentile), the percent of their case mix that were BI examinations increased from 19.2% in 2013 to 57.3% in 2021 (P<0.01). The percent of their case mix that were BI wRVUs also increased from 33.1% in 2013 to 74.4% in 2021 (P<0.01). Increased subspecialization in BI was consistently observed with stratified cohorts of urban versus rural setting, Northeast US, United States in comparison to the rest of the country, and female versus male gender radiologists (all $p < 0.00001$).

**CONCLUSION**

Breast imaging services and wRVU trends from 2013 to 2021 suggest that interpretation of breast imaging examinations have become increasingly concentrated in a smaller number of subspecialized breast radiologists, particularly in the Northeast US, in urban practice settings and in relation to female gender radiologists. Practice leaders should optimize recruitment efforts and processes to support the trend of breast subspecialized radiologists performing most of their work in their specialty.

**CLINICAL RELEVANCE/APPLICATION**

While increasing subspecialization in breast imaging may lead to better overall care, this raises concern for increased discrepancies within the radiology workforce. Further attention to ensure that patients are adequately cared for across a spectrum of clinical settings throughout the United States is necessary.

## S3B-SPNPM-3 AI-DRIVEN REPORTING TIME STANDARDIZATION

Roberto Ardon (*Abstract Co-Author*) Employee, AXA Venture Partners
Maria Elena Laino, MD (*Abstract Co-Author*) Nothing to Disclose
Chloe Adam, PhD (*Abstract Co-Author*) Employee, Incepto Medical SAS
Guillaume Herpe (*Abstract Co-Author*) Medical Officer Incepto-France Grant, Guerbet
Leo Alberge (*Abstract Co-Author*) Nothing to Disclose
Tom Vesoul (*Abstract Co-Author*) Nothing to Disclose
Gaspard d'Assignies, MD, PhD (*Presenter*) Founder, Incepto Medical SAS;Employee, Incepto Medical SAS;Stockholder, Incepto Medical SAS

**PURPOSE**

To assess the time gain using AI algorithm among radiological tasks from differents commercially available algorithms

**METHODS AND MATERIALS**

A multi-reader, multi-case methodology was used in this retrospective multicentric study. The study dataset (n= 504 ) included 56% men and a mean age of 45 years (SD = ± 15.8 years). Three subsets consisted of 106 aortic scans ( segmentation ), 202 MRI scans of the knee ( detection ) , and 196 MRI scans of the prostate ( characterization ) of each of them with a controlled prevalence for each.Ground Truth for each task was established in consensus for each subset by two experts radiologist of each domain ( MSK, Vascular and Urogenital ).An Aortic segmentation algorithm (ARVA V2.0) analyzed the included CTA, an knee MR detection algorithm ( KEROS V2.0) analyzed the knee MR and a prostate cancer characterization algorithm ( PAROS V1.0 ) analyzed the Prostate MR.The dataset also presented to six general radiologist, with and without AI assistance, which including a washout period of one month. The main comparison criteria were the reading/analysis time for the three subset using similar annotation tool to ensure consistency ( Genesis V.2.1).

**RESULTS**

From the 504 examination included, 504 were finally analyzed.For the aortic scans, 618 segments of the aorta were annotated, The average time to measure the aortic diameters during an examination for both radiologists together demonstrated a significant mean decrease of 62% in time with AI assistance (138 ± 97 sec) compared to without AI assistance (364 ± 456 sec) ($p<0.001$). A significant decrease in standard deviation was also assessed ( - 80%,$p<0.001$ ).For the knee MR detection subset : The introduction of AI assistance led to an overall decrease in the average time required per exam by 38% (from 98.2 ± 64.2 to 60.9 ± 36.5seconds, $p<0.001$) associated with a significant decrease of standard deviation ( - 60% , $p<0.001$).For the prostate subset: The introduction of AI assistance led to an overall decrease in the average time required per exam by 38% (from 141.32 ± 55.6 to 66.6 ± 23.5seconds, $p<0.001$) associated with a significant decrease of standard deviation ( - 59 % , $p<0.001$).

**CONCLUSION**

AI algorithms have demonstrated an impact on the time taken to perform various radiological tasks, but an even greater impact on standardising the time taken to read examinations, paving the way for an improvement in the reproducibility of relative value units.

**CLINICAL RELEVANCE/APPLICATION**

AI significantly reduces exam times and enhances standardization across radiological evaluations, improving diagnostic efficiency and consistency.

# Abstract Archives of the RSNA, 2024

S3B-SPNR

**Neuroradiology Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPNR-1 CAN BRAIN-TO-TUMOR OUTER INTERFACE RADIOMICS IMPROVE THE EFFICIENCY OF MRI IN PREDICTING THE BRAIN INVASION OF MENINGIOMAS

Yunjing Xue, MD (*Abstract Co-Author*) Nothing to Disclose
Kai Wang (*Abstract Co-Author*) Nothing to Disclose
Yichao Zhang (*Abstract Co-Author*) Nothing to Disclose
Dingfu Wei (*Abstract Co-Author*) Nothing to Disclose
Lin Lin (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the diagnostic efficacy of predicting the brain invasion of meningiomas based on radiometric features extracted from three different regions: brain-to-tumor interface (BTI), brain-to-tumor inner interface (BTII), and brain-to-tumor outer interface (BTOI).

### METHODS AND MATERIALS

A retrospective study of 729 patients with pathologically confirmed meningiomas was conducted between 2013 and 2022. We constructed three radiomics models using features extracted from three different regions of interest (ROIs): BTII region (with an automatic 4mm shrinkage of the tumor ROI boundary, referred to as the BTII model), BTOI region (with an automatic 4mm expansion of the tumor ROI boundary, referred to as the BTOI model), and BTI region (with an automatic 4mm extension of the tumor ROI boundary, referred to as the BTI model). The features were extracted from T1-weighted, T1-weighted post-contrast, and T2-fluid attenuated inversion recovery magnetic resonance imaging. Support Vector Machine (SVM), Linear Discriminant Analysis (LDA), and Logistic Regression (LR) were employed as the classifiers. The decision curve analysis (DCA) and integrated discrimination improvement (IDI) index were used to compare the benefits of different models.

### RESULTS

The AUC values of BTOI, BTII and BTI models were 0.918, 0.883 and 0.898 in the training set and 0.894, 0.815 and 0.825 in the test set, respectively. The DCA curve shows that the BTOI model has the best net return. IDI showed that compared with BTII and BTI models, the BTOI model had a significant improvement in predicting the brain invasion of meningiomas ($P < 0.05$).

### CONCLUSION

Radiomic signatures from the BTOI region demonstrated the most robust performance in predicting meningioma brain invasion.

### CLINICAL RELEVANCE/APPLICATION

Brain invasion is an independent diagnostic criterion for the diagnosis of WHO grade 2 meningiomas, and preoperative prediction of brain invasion in meningiomas is crucial for making treatment decisions. Our findings have the potential to assist in predicting the brain invasion of meningioma before surgery.

## S3B-SPNR-10 ALTERATIONS IN CORTICAL THICKNESS AND VOLUMES OF SUBCORTICAL STRUCTURES IN PEDIATRIC PATIENTS WITH COMPLETE SPINAL CORD INJURY

Ling Wang (*Presenter*) Nothing to Disclose

### PURPOSE

To study the changes of cortical thickness and subcortical gray matter structures in children with complete spinal cord injury (CSCI), reveal the possible causes of dysfunction beyond sensory motor dysfunction after CSCI, and provide a possible neural basis for corresponding functional intervention training.

### METHODS AND MATERIALS

Thirty-seven pediatric CSCI patients and 34 age-, gender-matched healthy children as healthy controls (HCs) were recruited. The 3D high-resolution T1-weighted structural images of all subjects were obtained using a 3.0 Tesla MRI system. Statistical differences between pediatric CSCI patients and HCs in cortical thickness and volumes of subcortical gray matter structures were evaluated. Then, correlation analyses were performed to analyze the correlation between the imaging indicators and clinical characteristics.

**RESULTS**

Compared with HCs, pediatric CSCI patients showed decreased cortical thickness in the right precentral gyrus, superior temporal gyrus and posterior segment of the lateral sulcus, while increased cortical thickness in the right lingual gyrus and inferior occipital gyrus(Figure1). And the volume of the right thalamus in pediatric CSCI patients was significantly smaller than that in HCs(Figure2). No significant correlation was found between the imaging indicators and the injury duration, sensory scores, motor scores of pediatric CSCI patients.

**CONCLUSION**

These findings demonstrated that the brain structural reorganizations of pediatric CSCI occurred not only in sensory motor area, but also in cognitive and visual related brain regions, which may suggest that the visual processing, cognitive abnormalities and related early intervention therapy also deserve greater attention beyond sensory motor rehabilitation training in pediatric CSCI patients.

**CLINICAL RELEVANCE/APPLICATION**

Our study revealed the possible causes of dysfunction beyond sensory motor dysfunction after CSCI, and provide a possible neural basis for corresponding functional intervention training.

## S3B-SPNR-12 DIFFERENTIAL DIAGNOSIS BETWEEN MENINGIOMA AND SCHWANNOMA IN CEREBELLOPONTINE ANGLE REGION USING FIREFLY IMAGING

Xin Cao (*Presenter*) Nothing to Disclose

**PURPOSE**

The 3D contrast-enhanced T1-weighted Imaging Flow Sensitive Black Blood (CE-T1WI FSBB), known as "firefly imaging", suppresses the flowing blood signal by the flow phase destroying the pulse, thus providing a clear contrast compared with the enhanced brain tumor with a high signal. This study aimed to quantify image features of intratumoral vessels and intratumoral microbleeds by firefly imaging, and to investigate the biological behavior differences between meningiomas and schwannomas in the cerebellopontine angle region based on imaging features.

**METHODS AND MATERIALS**

Seventy-three cases of meningiomas and 24 cases of schwannomas confirmed by postoperative pathology were included. Two neuroradiologists independently counted intratumoral vessels and intratumoral microbleeds based on CE-T1WI FSBB images. The vessel density index (VDI) and microbleed density index (MDI) were the number of intratumoral vessels and the number of intratumoral microbleeds divided by the tumor volume, respectively. The consistency test of intratumoral vessel count and intratumoral microbleeds count between the two neuroradiologists based on the same image is summarized using 2-way random ICC (C, 1). Mann-Whitney U-test and chi-square test were used to determine significant differences between meningiomas and schwannomas and between fibrous meningiomas and epithelial meningiomas.

**RESULTS**

The ICC for intratumoral vessels count and intratumoral microbleeds count based on CE-T1WI FSBB was 0.89 (95%CI:0.85-0.93) and 0.99 (95%CI:0.99-0.99), respectively. A comparison of 73 meningiomas and 24 schwannomas based on CE-T1WI FSBB images revealed differences in the number of intratumoral microbleeds ($P<0.01$) and MDI values ($P<0.01$). Comparison between fibrous meningiomas and epithelial meningiomas based on CE-T1WI FSBB images revealed differences in the number of intratumoral microbleeds ($P<0.01$), MDI values ($P<0.01$), and sex of patients ($P<0.05$).

**CONCLUSION**

According to the CE-T1WI FSBB imaging features, schwannomas have a higher incidence of intratumoral hemorrhage, more intratumoral microbleeds, and higher MDI values than meningiomas, which aids in preoperative differential diagnosis and treatment decisions. Compared with fibrous meningiomas, epithelial meningiomas are more prone to imaging features of intratumoral microbleeds, which contributes to a better understanding of the biological behavior of different pathological types of meningiomas.

**CLINICAL RELEVANCE/APPLICATION**

This technique will help to distinguish meningiomas from schwannomas by imaging features based on biological behavioral differences.

## S3B-SPNR-13 VOLUME QUANTIFICATION OF INTRACEREBRAL HEMORRHAGE, INTRAVENTRICULAR HEMORRHAGE, AND PERIHEMATOMA EDEMA THROUGH DEEP LEARNING APPROACHES

Laurent Letourneau-Guillon, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Igor G. Padilha, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias Franco (*Abstract Co-Author*) Nothing to Disclose
Marie-Jeanne Noel (*Abstract Co-Author*) Nothing to Disclose
Luca Panetta (*Abstract Co-Author*) Nothing to Disclose
Tasha Cusson, MD (*Abstract Co-Author*) Nothing to Disclose
Eleyine Zarour, MD (*Abstract Co-Author*) Nothing to Disclose
Delphine Pilon (*Abstract Co-Author*) Nothing to Disclose
An Ni Wu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

We aimed to curate a multiclass segmentation dataset and develop models that can accurately segment intracerebral hemorrhage (ICH), intraventricular hemorrhage (IVH), and perihematoma edema (PHE) using non-contrast CT (NCCT).

**METHODS AND MATERIALS**

We extracted NCCT volumes from the RSNA Intracranial Hemorrhage Detection 2019 Kaggle dataset - a head NCCT dataset with image-level classification consisting of five subtypes of intracranial hemorrhage. A board-certified neuroradiologist filtered the database to extract volumes containing at least one image labeled with ICH. Through an iterative process, our team manually annotated ICH, IVH, and PHE regions. Inter-annotator reliability during the refinement process was calculated. The dataset was subdivided (105/22/30 train/validation/test splits) and brain extraction was performed. A self-configuring fully convolutional neural network UNet-based model (nnUNet) and one transformer-based model (Swin UNETR) were trained to segment ICH, IVH, and PHE classes. Model performances were assessed using the Dice coefficient, and agreement statistics on extracted volumes were calculated.

**RESULTS**

One hundred fifty-seven (157) volumes were annotated. Inter-rater reliability, measured by Dice coefficients (95% confidence interval) for 146 volumes, was 0.95 (0.94-0.96) for ICH, 0.78 (0.69-0.86) for IVH, and 0.81 (0.76-0.85) for PHE. In our test set, Dice coefficients were 0.84 (0.77-0.90), 0.42

(0.25-0.59), 0.52 (0.42-0.62) for nnUNet; 0.81 (0.73-0.87), 0.26 (0.13-0.39), 0.50 (0.40-0.59) for Swin UNETR. Relative volume differences were 4.0% (7.4-22.3), 44.5% (24.7-64.2), 103.5% (35.3-218.9) for nnUNet; and 19.0% (10.3-29.8), 43.5% (17.8-77.6), 104.5% (42.1-207.1) for Swin UNETR. The intra-class correlation coefficients were 0.99 (0.99-1.00), 0.86 (0.77-0.94), and 0.74 (0.53-0.87) for nnUNet; 0.99 (0.97-0.99), 0.86 (0.74-0.93), 0.68 (0.43-0.83) for Swin UNETR. Examples of predictions are illustrated in Figure 1.

**CONCLUSION**

We curated a multiclass ICH segmentation dataset and plan to release the labels in the near future. Our best model, nnUNet, achieved good accuracy for ICH volume estimation but needs further improvements for IVH and PHE.

**CLINICAL RELEVANCE/APPLICATION**

A publicly available dataset would allow the independent comparison of existing models. Accurately segmenting ICH and its complications can support clinical management and research on this topic.

## S3B-SPNR-14 QUANTITATIVE AND QUALITATIVE PARAMETERS OF DCE-MRI PREDICT CDKN2A/B HOMOZYGOUS DELETION IN GLIOMAS

Xin Zhang (*Abstract Co-Author*) Nothing to Disclose
Bing Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Huiquan Yang, PhD (*Abstract Co-Author*) Nothing to Disclose
Jianan Zhou (*Abstract Co-Author*) Nothing to Disclose
Zhengyang Zhu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Homozygous deletion of CDKN2A/B holds important prognostic value in gliomas. This study aimed to explore the predictive potential of conventional MRI imaging parameters combined with dynamic contrast-enhanced MRI parameters in predicting CDKN2A/B homozygous deletion status in gliomas.

**METHODS AND MATERIALS**

Preoperative MRI data of 105 patients (69 without CDKN2A/B homozygous deletion, and 36 with CDKN2A/B homozygous deletion) with gliomas were retrospectively collected. Conventional MRI features and dynamic contrast-enhanced-MRI qualitative parameter time-intensity curve types, quantitative parameters Ktrans, Kep, Ve, Vp, and iAUC were obtained. Logistic regression models for prediction of CDKN2A/B homozygous deletion status were constructed in all types of gliomas and both subtypes of IDH-mutant and IDH-wild gliomas.

**RESULTS**

Multivariate analysis for all patients demonstrated that age (OR = 1.103, p = 0.002) and Ktrans (OR = 1.051, p < 0.001) independently predicted CDKN2A/B homozygous deletion. In IDH-mutant subgroup, multivariate analysis results indicated that Ktrans (OR = 1.098, p = 0.031) emerged as autonomous predictors of CDKN2A/B homozygous deletion. In IDH-wild subgroup, age (OR = 1.111, p = 0.002) and Ktrans (OR = 1.032, p = 0.001) were independent predictors of CDKN2A/B homozygous deletion according to the multivariate analysis. The areas under the receiver operating characteristic curve of the corresponding models were 0.90, 0.95 and 0.84, respectively.

**CONCLUSION**

Ktrans can serve as valuable predictive parameters for identifying CDKN2A/B homozygous deletion status in both subtypes of IDH-mutant and IDH-wild gliomas.

**CLINICAL RELEVANCE/APPLICATION**

These findings provide a foundation for precise preoperative non-invasive diagnosis and personalized treatment approaches for glioma patients.

## S3B-SPNR-15 LANGUAGE REORGANIZATION IN PATIENTS WITH BRAIN TUMORS: A MULTI-NETWORK PERSPECTIVE

Antonio Napolitano (*Abstract Co-Author*) Nothing to Disclose
Andrei I. Holodny, MD (*Abstract Co-Author*) Nothing to Disclose
Kyung K. Peck, PhD (*Abstract Co-Author*) Nothing to Disclose
Mehrnaz Jenabi, MS (*Abstract Co-Author*) Nothing to Disclose
Luca Pasquini, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Tumors cause local impairment of brain function, but also widespread effects on brain networks, which may be due to tumor damage or adaptive neuroplasticity. Here we studied the modifications of resting-state (rs) networks induced by brain tumors and their participation in language reorganization. Our hypotheses were: 1) patients with language reorganization would display differences in the cognitive networks which support interhemispheric communication; 2) these differences would be associated with better clinical performance.

**METHODS AND MATERIALS**

Patients were selected with the inclusion criteria: newly diagnosed, pathologically confirmed left hemispheric tumor; right handedness; task-based (tb) and rs fMRI; no artifacts. Age matched healthy controls (HC) were recruited from open sources databases. Language laterality was calculated on tb fMRI. We characterized 6 rs networks through cosine similarity and quantified the difference between patients and HC through earth mover's distance (EMD). The effect of tumor location and grade on networks' EMD was studied with ANOVA and t test. EMD changes related to language reorganization were studied with t test. The role of networks modifications on patients' speech was assessed with t test.

**RESULTS**

142 right handed patients (35 low grade, 88 high grade glioma; 19 metastases) and 180 HC were included. Frontal tumors were associated with modifications of the default mode (DM, p=0.021), sensorimotor (SM, p=0.039), cognitive control (CC, p=0.014) networks; insular with CC (p=0.006); occipital with DM (p=7.362e-5); parietal with DM (p=0.005), CC (p=0.021) networks; central with CC (p=0.003). T test confirmed significant effects of lateralization on networks' EMD: CC with Wernicke's laterality index (LI) (p=0.004), SM with cerebellar LI (p=0.03), DM with hemispheric LI (p=0.03), auditory network with Broca's LI (p=0.011). All tumor types demonstrated significant effects on brain networks. Modification of CC was associated with less speech deficits 1 week after surgery (p=0.005).

**CONCLUSION**

CC, DM, SM and auditory networks were the most affected functional structures. Inter-hemispheric language reorganization may rely on the participation of these networks to wire the cerebral hemispheres. Cognitive control may play a role in the development of adaptive neuroplasticity of language, as

demonstrated by improved speech performance.

**CLINICAL RELEVANCE/APPLICATION**

The identification of 'facilitative networks' for language plasticity may help the development of targeted therapies to prompt speech preservation: before surgery, by guiding cognitive training to enhance plastic changes and allow for radical resection; after surgery, by improving the recovery of language during rehabilitation.

## S3B-SPNR-16 ASSESSMENT OF BRAIN DEVELOPMENT IN CHILDREN WITH CONGENITAL DIAPHRAGMATIC HERNIA - AN AUTOMATED BRAIN SEGMENTATION APPROACH

Larissa Gotz (*Abstract Co-Author*) Nothing to Disclose
Victor Saase (*Abstract Co-Author*) Nothing to Disclose
Eva Neumaier-Probst (*Abstract Co-Author*) Nothing to Disclose
Meike Weis (*Abstract Co-Author*) Nothing to Disclose
Sherif A. Mohamed, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

to assess the brain development of 2year old children who underwent CDH repair, comparing those who required ECMO with those who did not, alongside a healthy control group utilising a MRI-based automated segmentation approach.

**METHODS AND MATERIALS**

This study evaluated brain development in 31 children aged 2 years who had undergone CDH repair as neonates, comparing the subcohort of those who had received ECMO therapy (n = 10) with those who had not (n =21), alongside 31 healthy age-matched controls. The CDH patients derived from a longitudinal study of the University Medical Center of Mannheim. The control children were from the NIH database of the MRI Study of the normal brain development. For segmentation T1 weighted 3D MRI images were used. The image postprocessing was performed in MATLAB 2015a. Using CerebroMatic toolbox a customized DARTEL template for the age group of 24 months was created. Coregistration of the acquired MRI images to the DARTEL template was performed using the software SPM12. Automated segmentation of cerebrospinal fluid (CSF), white matter (WM), and gray matter (GM) was performed using CAT 12 toolbox. This segmentation process utilised surface based and voxel based morphometry algorithms, allowing for the automated measurement of cortical thickness (CT) and total intracranial volume (TIV).

**RESULTS**

CDH patients showed a statistically significant increase in GM ($p = 0.002$), CSF ($p = 0.009$), TIV ($p = 0.01$) and CT ($p < 0.001$) in comparison to healthy controls (HC). None of the before mentioned volumes showed statistically significant differences between the subcohorts of CDH patients ($p >0.05$). Observed decrease in WM in CDH patients did not reach statistical significance within the subcohorts ($p > 0.05$). CT was statistically significantly increased in all subcohorts compared to the HC ($p< 0.001$). CSF volume was significantly increased in CDH patients who did receive ECMO therapy compared to HC ($p = 0.005$).

**CONCLUSION**

The increases CT in CDH patients may be an indicator for structural abnormality and therefore the reported delayed neurodevelopment. Moreover, the observed increase in CSF volume maybe associated with the application of ECMO therapy.

**CLINICAL RELEVANCE/APPLICATION**

This study offers a nuanced exploration of neuroanatomical differences in children with CDH, shedding light on the complex interplay of factors influencing brain development. The observed changes warrant further research to understand their long-term implications and potential connections to ECMO therapy. The study's methodological insights into automated segmentation provide a foundation for future investigations in pediatric neuroimaging, emphasizing the importance of refining techniques for accurate and clinically relevant assessments.

## S3B-SPNR-17 LONGITUDINAL ASSOCIATION OF DTI-ALPS INDEX WITH COGNITIVE PERFORMANCE

Chang-Soo Yun (*Abstract Co-Author*) Nothing to Disclose
Youngjin Lee (*Abstract Co-Author*) Nothing to Disclose
Hajin Kim, BS (*Abstract Co-Author*) Nothing to Disclose
Kyuseok Kim (*Abstract Co-Author*) Nothing to Disclose
Sewon Lim, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

The diffusion tensor image analysis along the perivascular space (DTI-ALPS) index has been found to be associated with multiple cognitive scores through existing cross-sectional studies. As AD is progressive, cross-sectional studies can't quantify longitudinal changes in cognitive status and glymphatic function, necessitating a longitudinal approach. This study aims to evaluate the DTI-ALPS index's capability for detecting AD by investigating its association with longitudinal cognitive performance changes, specifically assessing how variations in the DTI-ALPS index correspond to shifts in cognitive status—ranging from cognitively normal to incident mild cognitive impairment (MCI), persistent MCI, and incident AD—over a two-year period.

**METHODS AND MATERIALS**

The DTI-ALPS index was measured in participants who were cognitively normal (n = 119), had incident MCI (n = 13), persistent MCI (n = 74), or incident AD (n = 19) from the Alzheimer's Disease Neuroimaging Initiative. We calculated the DTI-ALPS index and correlated them with montreal cognitive assessment (MOCA), mini mental state examination (MMSE), and clinical dementia rating scale (CDR) scores using partial correlation and linear regression which the influence of age, gender, APOE4 genes and education was controlled.

**RESULTS**

Comparative analysis of the two-year changes in the DTI-ALPS index among the cognitively normal, incident MCI, persistent MCI, and incident AD group revealed average changes (%) of -0.428 (SE = 0.601), -4.572 (SE = 1.145), -1.526 (SE = 0.653), and -5.296 (SE = 1.304), respectively. Significant differences in mean values were observed between the cognitively normal and the incident MCI group (ß = -4.112, P = 0.023), as well as between the cognitively normal and the incident AD group (ß = -5.196, P = 0.001). An analysis of the correlation between changes in the DTI-ALPS index and changes in cognitive performance over a period of two years revealed significant positive correlations between the changes in the DTI-ALPS index and changes in MoCA scores (r = 0.192, P = 0.004), MMSE scores (r = 0.167, P = 0.012), and CDR scores (r = 0.269, P < 0.001).

### CONCLUSION

In conclusion, this study validates the DTI-ALPS index as a longitudinal biomarker for Alzheimer's disease progression. Significant changes in this index correlate with cognitive decline, especially in groups transitioning to incident MCI and AD over two years. These results underline the utility of the DTI-ALPS index in predicting and tracking cognitive impairment progression.

### CLINICAL RELEVANCE/APPLICATION

The findings show that the DTI-ALPS index effectively emphasizes the glymphatic system's key role in cognitive progression in Alzheimer's research.

## S3B-SPNR-19 MACHINE LEARNING TO PREDICT AMYLOID POSITIVITY IN MILD COGNITIVE IMPAIRMENT BASED ON BRAIN ATROPHY

Soohwan Choi (*Abstract Co-Author*) Nothing to Disclose
Seongbeom Park, MS (*Abstract Co-Author*) Nothing to Disclose
Kichang Kwak (*Presenter*) Nothing to Disclose

### PURPOSE

Amyloid-beta deposition, a hallmark of AD, plays an increasingly pivotal role in mild cognitive impairment (MCI) progression. Recent advancements in neuroimaging have highlighted brain atrophy as a potential hallmark of MCI, indicating disease progression. 2D MRI scans, vital for diagnosis, provide crucial structural data, yet protocol variability challenges conventional analysis tools, limiting their clinical utility. Leveraging machine learning on 2D MRI data unlocks complex patterns indicative of amyloid positivity, aiding early AD intervention. This study aims to explore machine learning's efficacy in accurately predicting amyloid positivity from brain atrophy patterns in MCI, facilitating early AD diagnosis.

### METHODS AND MATERIALS

In this study, we predicted amyloid positivity in MCI subjects using machine learning, based on patterns of brain structural atrophy, cognitive test and APOE genotyping. The amyloid PET scans were analyzed from the Beaubrain Amylo. We generated 2D MRI by uniformly selecting slices from the 3D MRI. The deep learning model was developed to segment extracerebral cerebrospinal fluid (eCSF) volumes, with a focus on analyzing eCSF near the gray matter in each lobe region, as well as the anterior and posterior lateral ventricles, and neighboring volumes near the hippocampus regions.

### RESULTS

We analyzed data from 363 subjects, obtained from the Alzheimer's Disease Convergence Research Center at Samsung Medical Center in South Korea. We utilized support vector machine, which relies on multi-modal input data. 5-fold cross-validation was employed within the training set to optimize and fine-tune the model's performance, resulting in similar performance across the different folds. The model with the best performance achieved maximal accuracy of 91.74%, with an area under the curve (AUC) of the receiver operating characteristic (ROC) of 0.83 (95% CI: 0.75- 0.91).

### CONCLUSION

In summary, the findings indicate that patterns of atrophy in individuals with MCI are reliably predictable, suggesting their potential utility in forecasting amyloid positivity. Future research in this area may further refine predictive models and contribute to the development of personalized treatment strategies for individuals with MCI at risk of developing AD.

### CLINICAL RELEVANCE/APPLICATION

The use of 2D MRI scans and machine learning algorithms to predict amyloid positivity in individuals with MCI holds significant clinical relevance. Early identification of amyloid deposition, a hallmark of AD, enables timely intervention strategies, potentially slowing disease progression and improving patient outcomes. This approach has direct implications for enhancing the clinical management of individuals at risk for developing dementia.

## S3B-SPNR-3 IMPAIRMENT OF THE GLYMPHATIC SYSTEM ON THE SHORT-TERM PROGNOSIS OF PATIENTS WITH ACUTE ISCHAEMIC STROKE: A DTI-ALPS STUDY

Xiaolan Du, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The glymphatic system is significantly damaged after acute ischemic stroke (AIS).We aimed to confirm the correlation of glymphatic damage with short-term outcome in patients with acute ischemic stroke (AIS) by tracking the changes of two imaging parameters, diffusion tensor image analysis along perivascular space (DTI-ALPS), and enlarged perivascular spaces (EPVS).

### METHODS AND MATERIALS

Fifty AIS patients and fifty healthy control (HC) were included. The AIS group underwent brain magnetic resonance imaging at 24 hours, 7 days and 3 months, and the National Institutes of Health Stroke Scale (NIHSS) was used to score. The HC group was matched according to the same time interval. We assessed DTI-ALPS indices in the bilateral hemispheres and EPVS volume fractions in bilateral centrum semiovale (CSO), basal ganglia (BG), and lateral ventricles.

### RESULTS

AIS patients showed a mildly elevated ALPS index of 1.61±0.1 on the infarcted side within 24 hours (P=0.012), and a decreasing trend in ALPS index of 1.35±0.15 and 1.45±0.13 at 7 days and 3 months, respectively, (P<0.001). BG-PVS volume scores were significantly greater in stroke patients than HC group and were negatively correlated with ALPS index (r=-0.312,P=0.041). Lower ALPS index was associated with NIHSS score (r=0.515,P=0.021).

### CONCLUSION

Decreased DTI-ALPS was associated with increased BG-PVS and worse neurological function in the short term and can serve as non-invasive assessments for glymphatic dysfunction and its interventions in clinical studies.

### CLINICAL RELEVANCE/APPLICATION

To reveal the effect of glymphatic system damage on the short-term recovery of patients with ischemic stroke

## S3B-SPNR-5 FIRST DEMONSTRATION OF THE VENOUS PLEXUS OF REKTORZIK ON ULTRA-HIGH RESOLUTION VESSEL WALL MRI

Seena Dehkharghani, MD (*Abstract Co-Author*) Nothing to Disclose
Eytan Raz, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Siddhant Dogra, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The plexus of Rektorzik (PoR) is a venous arcade that surrounds the petrous internal carotid artery (ICA). The plexus has rarely been studied with imaging, mostly with sporadic exploration using high-resolution catheter angiography, and never with MRI. Vessel wall imaging (VWI) is increasingly used for characterizing intramural disease in the cerebral circulation. We recently reported a high-performance accelerated approach featuring robust flow suppression and achieving better than 400 micron isotropic multicontrast VWI. We observed a remarkably consistent enhancing vascular plexus corresponding anatomically to the expected PoR, exceeding vasa vasorum and persisting even with full flow suppression in the ICA. Further, we have noted the PoR commonly to engorge further in subjects with high-grade anterior circulation steno-occlusive disease and felt a formalization of this intriguing use of VWI to be timely.

### METHODS AND MATERIALS

28 patients underwent 35 VWI examinations using compressed sensing and CAIPI-accelerated variable-flip SPACE with DANTE as previously reported. Studies were assessed for asymmetric extraluminal enhancement surrounding the petrous ICA, blinded to history. Presence and location of stenoses derived from CTA and/or catheter angiography was noted afterward. A Z-test was used to compare the proportion of patients with and without high-grade ICA stenosis who demonstrated asymmetric ipsilateral extraluminal enhancement.

### RESULTS

Altogether 27 studies were evaluated, with one subject excluded due to absence of post-contrast VWI. 15 of 27 (55.6%) were determined to have asymmetrically increased enhancement about the petrous ICA. Among 15 patients without ICA stenosis, 5 (33.3%) showed bilateral enhancement while among 12 patients with high-grade ICA stenosis, 10 (83.3%) had strong asymmetric enhancement ($p = 0.009$), all on ipsilateral sides. No evidence for engorged vasa vasorum was noted elsewhere in the pathologic ICA and findings were isolated to the expected location of the PoR for all cases.

### CONCLUSION

We detected asymmetrically increased extraluminal enhancement surrounding the petrous ICA in a majority of patients undergoing VWI, proposed to represent the venous PoR in a manner not previously reported by MRI. This enhancement was observed significantly more frequently in patients with ICA stenoses, always on ipsilateral sides, suggesting a potential sensitivity to the hemodynamic effect of stenoses but requiring further dedicated study.

### CLINICAL RELEVANCE/APPLICATION

The venous plexus of Rektorzik may be encountered on vessel wall MR imaging, particularly in patients with high-grade ICA stenosis, requiring recognition and discrimination from unsuppressed flow or vasa vasorum proliferation.

## S3B-SPNR-6 INTRACRANIAL ATHEROSCLEROSIS IS LINKED TO LOWER VOLUME IN THE POSTERIOR BODY AND TAIL OF THE HIPPOCAMPUS

Julie A. Schneider, MD (*Abstract Co-Author*) Nothing to Disclose
Arnold M. Evia JR, PhD (*Abstract Co-Author*) Nothing to Disclose
David A. Bennett, MD (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Arfanakis, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahir Tazwar, BS (*Abstract Co-Author*) Nothing to Disclose
Gulam Mahfuz Chowdhury (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study is to investigate brain morphometric anomalies associated with intracranial atherosclerosis in a large number of community-based older adults.

### METHODS AND MATERIALS

This work included 891 community-based older adults participating in four cohort studies of aging: MAP, ROS, MARS, AACC. After autopsy, hemispheres from all participants were imaged approximately one month postmortem on 3T clinical MRI scanners using a multi-echo spin-echo sequence with a voxel size=0.6×0.6×1.5 mm3. All images were non-linearly registered to an ex vivo brain hemisphere template using ANTs. The logarithm of the Jacobian determinant of the deformation fields was calculated in each voxel and the resulting maps (LogJ) were smoothed using a Gaussian filter with a FWHM=4mm. Following ex-vivo MRI, all hemispheres underwent detailed neuropathologic examination. The assessed pathologies included atherosclerosis, arteriolosclerosis, cerebral amyloid angiopathy, gross and microscopic infarcts, Alzheimer's pathology, Lewy bodies, LATE-NC, and hippocampal sclerosis. Voxel wise linear regression was used to test the association of atherosclerosis with deformations shown in the smoothed LogJ maps, controlling for other age-related neuropathologies, demographics (age at death, sex, years of education), postmortem interval to fixation, postmortem interval to imaging, and scanner. The FSL PALM tool with 1000 permutations, threshold-free cluster enhancement, and tail acceleration was used for the statistical analysis. Associations were considered significant at $p<0.05$ after FWER correction for multiple comparisons.

### RESULTS

Intracranial atherosclerosis was significantly associated with lower volume in the posterior body and tail of the hippocampus ($p<0.05$), independently of the effects of other age-related neurodegenerative and vascular pathologies. No part of the brain showed significantly higher volume with atherosclerosis.

### CONCLUSION

This work combined DBM on ex-vivo MRI with detailed neuropathologic examination in a large number of community-based older adults and demonstrated that intracranial atherosclerosis is associated with lower volume of the posterior body and tail of the hippocampus.

### CLINICAL RELEVANCE/APPLICATION

This finding is of great interest due to the important role of the hippocampus in cognition. Furthermore, atherosclerosis is often mixed with Alzheimer’s pathology and/or LATE neuropathological change, which have previously shown independent associations with lower hippocampal volume. Therefore, hippocampal volume by itself cannot serve as a reliable marker of any of the three pathologies, but more localized metrics of hippocampal atrophy may potentially provide higher specificity.

## S3B-SPNR-7 EXPLORING THE BEST MONOCHROMATIC ENERGY LEVEL IN DUAL ENERGY SPECTRAL IMAGING FOR INTRACRANIAL VENOUS STENTS

Shobhit Mathur, MD (*Abstract Co-Author*) Nothing to Disclose
Vitor Mendes Pereira (*Abstract Co-Author*) Nothing to Disclose
Timothy Reynold U. Lim, MD (*Abstract Co-Author*) Nothing to Disclose
Yingming Amy Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Vinu Mathew, MD (*Abstract Co-Author*) Nothing to Disclose
Nicole Cancelliere (*Abstract Co-Author*) Nothing to Disclose
Joel Kosowan, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Dual energy spectral CT enables creation of virtual monoenergetic reconstructions, enhancing contrast-to-noise ratio (CNR) at lower monochromatic energy levels (MELs) and reducing artifacts such as beam hardening at higher MELs. Previous studies have evaluated the optimal MEL in the setting of endovascular aortic repair stent grafts, peripheral arterial and coronary stents, and intracranial aneurysm clips and coils. However, the application of dual energy CT in evaluating intracranial stents, particularly in venous stenting for idiopathic intracranial hypertension and pulsatile tinnitus, remains unexplored. Hence, we aimed to evaluate the optimal MEL in patients with intracranial venous stents.

### METHODS AND MATERIALS

A total of 13 stents were evaluated in 10 patients (3 with bilateral stents). Images were reconstructed at 10 keV intervals from 40 to 140 keV. Subjective image quality was evaluated by two neuroradiologists using a 5-point Likert scale with overall image quality, ability to evaluate the stent lumen and beam hardening artifacts as criteria. For quantitative analysis, ROIs (minimum 5 mm in diameter) were drawn within and outside the stented vessel, the internal jugular vein and masseter muscle (used as a surrogate measure of background) to measure CT values (HU). Contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) were calculated at different MELs.

### RESULTS

Images at 90 and 100 keV had the highest ratings for both radiologists. Overall Likert scale responses between the two raters showed high correlation ($R = 0.95$, $p<0.0005$). Statistically significant differences were found comparing 100 keV to other energy levels using Conover's all-pairs test for neuroradiologist 1 ($p<0.01$) but not for neuroradiologist 2 ($p = 0.096$). The mean CT value in-stent showed a decreasing trend with increasing MEL: [40-140 keV] (1180.72 ± 245.49) HU to (112.53 ± 15.65) HU. CNR and noise demonstrated a decreasing trend with increasing MEL: [40-140 keV] CNR: (50.91 ± 16.84) to (10.62 ± 4.47) and noise (444.89 ± 33.54) to (49.38 ± 3.94), while SNR stayed constant (11.15 ± 4.95) to (9.43 ± 3.15). Tukey's HSD showed no difference in CNR, SNR and noise between 90 keV and 70 keV, but CNR was significantly decreased at 100 keV compared to 70 keV ($p <0.05$).

### CONCLUSION

This study supports 90 keV as being the optimal MEL for imaging patients with intracranial venous stents, balancing CNR within the vessel being evaluated while minimizing beam hardening artifacts.

### CLINICAL RELEVANCE/APPLICATION

For CT performed for patients with intracranial venous stents on dual-energy CT scanners, 90 keV images should be preferred for review.

## S3B-SPNR-8 BEAMS: A BOUNDARY-ENHANCED APPROACH FOR MS LESION CHANGE SEGMENTATION

Prateek Mathur (*Abstract Co-Author*) Nothing to Disclose
Brendan Kelly, BMBCh, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The accurate identification of new or growing lesions in patients suffering from Multiple Sclerosis (MS) is crucial for treatment planning. We leverage longitudinal MRI imaging and boundary constraints of these lesions to build deep-learning pipelines and assess their impact on lesion segmentation.

### METHODS AND MATERIALS

A cohort of 170 patients with at-least two examinations, a baseline and a follow-up were included. Images were acquired on a 1.5 T system (SIEMENS MAGNETOM Avanto syngo MR B19, SIEMENS, Munich, Germany). Imaging included three-dimensional T2 fluid-attenuated inversion-recovery (FLAIR) sequences rigidly registered to the baseline T1 sequence. Lesion annotation involved two steps: automated lesion segmentation followed by manual cleanup and verification by two radiologists referencing original radiology reports, with final annotations verified by a third expert. The data is divided into training, validation and a hold-out test set which match the size of the external MSSEG2 validation dataset. A baseline and a follow-up image slice is fed to a deep-learning pipeline to identify and segment new or enhanced lesions. Pipelines included a 2D (1) nnUNet (2) Siamese-UNet (3) BEAMS Siamese UNet which are the lesion detection benchmark, a change detection model and a boundary enhanced change detection model respectively. The predicted area segmentation is re-stacked to form a volume. Evaluation metrics included Dice Scores (DSC), Precision (PRC), and Recall (REC) to assess pipeline efficacy in lesion identification.

### RESULTS

The trained pipelines are also evaluated on an external dataset with longitudinal MS data. Boundary-enhanced pipeline achieves best performance both on internal and external datasets(DSC=0.40,0.46;PRC=0.30,0.44;REC=0.71,0.25) followed by the Siamese UNet (DSC=0.39,0.42;PRC=0.25,0.43;REC=0.63,0.25) outperforming the nnUNet (DSC=0.21,0.28;PRC=0.014,0.022;REC=0.68,0.38).Evaluation on internal and external dataset showcases the generalization, robustness and reliability of the BEAMS pipeline.

### CONCLUSION

Our study demonstrates the BEAMS pipeline's superior performance validated on both internal and external datasets. These findings underscore the potential of boundary-enhanced methods and their utility in clinical practice.

### CLINICAL RELEVANCE/APPLICATION

Identification of new and enhancing MS lesions is a challenging and time consuming problem prone to observer bias. Automating lesion identification with a BEAMS pipeline offers swift and objective analysis, aiding clinicians in identifying probable regions of lesion growth and improving patient-care.

## S3B-SPNR-9 ASSOCIATION BETWEEN BODY MASS INDEX AND BRAIN AGINGIN ADULTS: A 16-YEAR POPULATION-BASED COHORT AND MENDELIAN RANDOMIZATION STUDY

Han Lv, MD (*Presenter*) Nothing to Disclose

## PURPOSE

High body mass index (BMI), a modifiable factor associated with poor cardiovascular health, is linked to brain health, but the causal relationship between BMI and brain health remains unclear. This study aimed to demonstrate the effect of cumulative BMI on neuroimaging features in adults of different ages and verify the causal relationship.

## METHODS AND MATERIALS

This study was based on the KaiLuan Study, a multicenter, long-term follow-up, community-based longitudinal cohort study of the adult population that began in 2006. The study included participants who visited the hospital at least 3 times and underwent brain MRI examination, with no evidence of dementia or mental disorders. Exclusion criteria were incomplete or poor-quality neuroimaging data and diagnosed cancer. We modeled the trajectories of BMI over 16 years to evaluate cumulative exposure. Multimodality neuroimaging data were collected using 3.0-T MRI, starting in 2020, for volumetric measurements of the brain structure, white matter hyperintensity (WMH), and skeletonized white matter tract at the voxel level. We performed two-sample Mendelian randomization analysis using genetic data from 681,275 individuals to analyze the causal relationship between BMI and neuroimaging features.

## RESULTS

In the population-based longitudinal study, clinical and neuroimaging data were obtained from 1,074 adults (aged 25-83 years). High BMI was associated with a wide range of negative brain health effects. For adults aged under 45 years, the differences in cerebral parenchyma volume between those with BMI > 26.2 kg/m2 and those with normal BMI corresponded to 12.0 years (95% confidence interval [CI], 3.0 to 20.0) of brain aging. The volumetric results corresponded to -17.9 ml (95% CI, -29.8 to -4.5). Differences in WMH were statistically significant for participants aged over 60 years, with a 6.0-ml (95% CI, 1.5 to 10.5) larger volume. Genetic analysis of 681,275 individuals indicated causal relationships among high BMI, smaller volume of the cerebral parenchyma and gray matter, and higher fractional anisotropy in projection fibers.

## CONCLUSION

These findings provide a basis for future brain health promotion and disease prevention strategies.

## CLINICAL RELEVANCE/APPLICATION

High BMI is causally associated with smaller brain volume and abnormal microstructural integrity in projection fibers, especially in young adults.

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# Abstract Archives of the RSNA, 2024

S3B-SPOB

**OB/Gynecology Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPOB-1 MRI TEXTURE FEATURES AND ADC VALUES FOR DIFFERENTIATING UTERINE SARCOMA AND CELLULAR UTERINE LEIOMYOMA

Chao Wei (*Abstract Co-Author*) Nothing to Disclose
Zhong Yang (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to evaluate the capability of MRI texture features and ADC values in the differential diagnosis of uterine sarcoma (US) from cellular uterine leiomyoma (CUL).

### METHODS AND MATERIALS

61 patients confirmed by pathology were retrospectively reviewed, including 27 cases of USs and 34 cases of CULs. All patients underwent conventional pelvic MRI and DWI (b values of 0 and 1000 s/mm2), and the ADC values (mean ADC value (ADCmean), min ADC value (ADCmin) and standardized ADC value (ADCst)) were measured and calculated. Whole tumors were segmented by manually drawing the lesion contours on each slice of T2WI and DWI images, then the texture features were selected by using the intraclass correlation efficient (ICC) analysis, Pearson correlation analysis, and the least absolute shrinkage and selection operator (LASSO). Mann-Whitney U test to compare the ADC values. The model(LRADC, LRtexture and LRcombinations) were developed using logistic regression analysis based on the optimal texture features, ADC value and their combinations respectively, and then area under receiver operating characteristic curve(AUC-ROC) was used to assess the diagnostic efficiency of each model.

### RESULTS

The ADCmean, ADCmin and ADCst of USs were significantly lower than those of CULs ($P < 0.05$). The LRcombinations model showed better performance for the tumor differentiation (AUC:0.921) than LRADC model(AUC:0.696),($z=3.358, P<0.001$). The calibration curve was basically the same as the ideal curve, and decision curve analysis confirmed better clinical usefulness than the other two models.

### CONCLUSION

MRI texture features and ADC values could be useful in the preoperative assessment of uterine masses to differentiate US with CUL. Incorporation of texture features into ADC values improves the differential diagnostic accuracy.

### CLINICAL RELEVANCE/APPLICATION

MRI texture features and ADC values give a better method to identify US and CUL, providing a more reliable basis for the choice of clinical treatment.

## S3B-SPOB-2 TIME-DEPENDENT DEPENDENT DIFFUSION MRI FOR QUANTITATIVE MICROSTRUCTURAL MAPPING OF ENDOMETRIAL CANCER

Qi Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Hua Li (*Abstract Co-Author*) Nothing to Disclose
Dandan Zheng (*Abstract Co-Author*) Nothing to Disclose
Ruxue Han (*Abstract Co-Author*) Nothing to Disclose
Wenyi Yue (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the feasibility of time-dependent diffusion MRI to delineate microstructural features for noninvasive evaluation of cellular characteristics in endometrial cancer (EC).

### METHODS AND MATERIALS

Patients with a clinical suspicion of EC were prospectively enrolled between September 2023 and April 2024. Time-dependent diffusion MRI data were prospectively acquired with pulsed and oscillating gradient diffusion MRI sequences, alongwith other routine clinical protocols, on a 3.0 T MR scanner. Microstructural parameters, such as cell diameter, intracellular volume fraction, cellularity, and diffusivities, were derived from the time-dependent diffusion MRI data, using a two-compartment model. The estimated microstructural parameters were evaluated for their efficacy in distinguishing patients with EC presenting different pathological characteristics including myometrial invasion status, lymphovascular space invasion (LVSI), status lymph node (LN) status and overall FIGO stage by an unpaired two-tailed t-test and one-way analysis of variance. Additionally, the correlations between the microstructural parameters were assessed by linear regression.

### RESULTS

A total of 21 women who underwent time-dependent diffusion MRI followed by surgical pathology were included in the study. We illustrated the comparison of microstructural parameters obtained from time-dependent diffusion MRI among different pathological characteristics of EC patients. The analysis revealed significant differences in diffusivities based on the myometrial invasion status, LVSI status, LN status and overall FIGO stage of EC ($P<0.05$). Specifically, early-stage EC and cases without LVSI showed higher diffusivities, whereas deep myometrial invasion and LN metastasis showed lower diffusivities. However, microstructural parameters did not show differences among progesterone receptor status, p53 status and aggressive histological types. Additionally, the relationship between microstructural parameters and conventionally used diffusivity at 0 Hz was examined at the participant level in EC participants with various pathological characteristics.

### CONCLUSION

The time-dependent diffusion MRI-derived microstructural properties in distinguishing the different microstructural features showed complementary strength in the clinical staging and identification of high-risk factors of EC patients.

### CLINICAL RELEVANCE/APPLICATION

The microstructural mapping based on time-dependent diffusion MRI correlates with pathological findings and holds promise for characterizing endometrial cancer.

## S3B-SPOB-3 INITIAL EVALUATION OF SENTINEL LYMPH NODES IN PATIENTS WITH CERVICAL AND VULVAR CANCER USING LYMPHOSONOGRAPHY COMPARED TO SURGICAL PATHOLOGY

Norman G. Rosenblum, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company
Aaron Shafer (*Abstract Co-Author*) Nothing to Disclose
Flemming Forsberg, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research support, Canon Medical Systems Corporation;Research support, General Electric Company;Speaker, General Electric Company;Research support, Siemens AG;Research Grant, Butterfly Network, Inc;Research support, Lantheus Medical Imaging, Inc;Research support, Bracco Group
Trang Vu (*Abstract Co-Author*) Nothing to Disclose
Priscilla Machado, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The identification of the sentinel lymph node (SLN) is an important aspect of predicting outcomes for patients with cancer. Lymphosonography is a contrast-enhanced US modality that uses subcutaneous injection of US contrast agents to localize the SLNs and it has been studied as a novel technique to lymphatic mapping. The objective of this study was to evaluate this technique in subjects diagnosed with cervical or vulvar cancer scheduled for surgery with SLN excision comparing the lymphosonography findings with pathology.

### METHODS AND MATERIALS

Subjects diagnosed with cervical or vulvar cancer scheduled for surgery with SLN excision were eligible to be enrolled in this ongoing, IRB-approved study. The US contrast agent Sonazoid (GE Healthcare, Oslo, Norway) was administrated in 4 aliquots at 12, 3, 6, and 9 o'clock positions around the primary tumor by the clinical surgical team, with 0.25 ml for each aliquot for a total dose of 1.0 ml. Real time contrast enhanced US imaging (CEUS) was performed to identify SLNs that demonstrated contrast-enhancement. Results were recorded and compared to the pathology results obtained after the surgical procedure. An Aplio i800 Prism scanner (Canon Medical Systems USA, Tustin, CA) with curvilinear (8C1) and linear (18L5) probes with CEUS capabilities were used during the study.

### RESULTS

A total of 11 SLNs in 5 subjects were surgically excised. Three subjects had cervical cancer with iliac SLNs being excised, 8 SLNS were sent to pathology. From the 8 SLNs, 6 were determined to be benign by pathology and 2 were determined to be malignant. Two subjects had vulvar cancer with inguinal SLNs being the ones excised, 3 SLNS were sent to pathology. From the 3 SLNs, 2 were determined to be benign by pathology, while 1 was determined to be malignant by pathology. Lymphosonography identified 17 SLNs in the 5 subjects. Comparing the surgically excised SLNs and the ones identified by lymphosonography showed that10 of the 11 SLNs surgically excised or 91% were identified by lymphosonography. Lymphosonography identified all the benign SLNs and 2 out of the 3 malignant SLNs.

### CONCLUSION

This initial evaluation on the use of lymphosonography to identify SLNs in subjects with cervical or vulvar cancer undergoing surgery with SLN excision demonstrate that lymphosonography identified 10 out of the 11 SLNs surgically excised, including all the benign SLNs and 2 malignant SLNs.

### CLINICAL RELEVANCE/APPLICATION

Lymphosonography is a US modality that uses US contrast agents to identify SLNs, which is an important aspect of predicting outcomes for patients with cancer.

## S3B-SPOB-4 DIAGNOSTIC ACCURACY AND INTER-OBSERVER AGREEMENT OF THE O-RADS SCORING SYSTEM

Li Tao (*Presenter*) Nothing to Disclose

### PURPOSE

The objective of this study is to evaluate the diagnostic accuracy, inter-observer agreement and inter-observer agreement of adnexal masses using the Ovarian-Adnexal Reporting and Data System (O-RADS) Magnetic Resonance Imaging (MRI) risk stratification system

### METHODS AND MATERIALS

A total of 572 adnexal lesions of 463 patients with pathological results were retrospectively collected in our hospital from June 2017 to May 2023. Two different experienced readers who were blinded to the patients' clinical data and pathological results independently evaluated the images and then assigned a score to each adnexal lesion using the O-RADS MRI risk stratification system. One of the readers reviewed the images and reassigned the scores after three months. Intra- and inter-observer agreements were evaluated with the k-coefficient value. The gold standard of O-RADS MRI score was determined by the evaluation of two senior radiologists with more than 20 years of experience. Any disagreements were resolved by re-review and discussion, and then the O-RADS MRI score of the adnexal lesions was finally determined with 1-5 points.

### RESULTS

Excellent intra-observer agreement and inter-observer agreement were observed with the k values of 0.941 (95 % CI, 0.926-0.960) and 0.854 (95 % CI, 0.821-0.881), respectively. Good sensitivity (90%-100%), positive predictive values (89%-100%) and variable specificity (78%-100%), negative

predictive values (74%-100%) were observed for each O-RADS MRI classification by two readers and one reader three months apart. The area under the curve (AUC) of readers ranged from 0.951 to 0.960 when regarded O-RADS MRI = 4 as malignancy. There was no statistical significance in the comparison of ROC curves between the two readers ($p > 0.05$).

**CONCLUSION**

intra-observer agreement and inter-observer agreement of O-RADS MRI were excellent with high diagnostic accuracy. O-RADS MRI can be used as a good diagnostic tool in clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

Radiologists encounter patients with adnexal masses every day,and correct preoperative diagnosis and risk classification can reduce the rate of unnecessary surgery for benign lesions and improve the prognosis for malignant lesions.O-RADS MR is a good tool to do that.

# Abstract Archives of the RSNA, 2024

S3B-SPPD

**Pediatric Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPPD-1 CLINICAL AND CMR ASSESSMENT OF CORONARY ARTERY DILATION ONLY IN CHILDREN WITH KAWASAKI DISEASE: ANALYSIS OF THE CHINA-COHORT STUDY

Lingyi Wen JR, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhongqin Zhou (*Abstract Co-Author*) Nothing to Disclose
Shengkun Peng, MD (*Abstract Co-Author*) Nothing to Disclose
Lei Hu (*Presenter*) Nothing to Disclose

### PURPOSE

Kawasaki disease (KD) is an acute vasculitis of childhood with unknown etiology. The most common and severe sequelae of KD is coronary artery lesion (CAL) and the American Heart Association (AHA) proposed the risk stratification resting on the severity of it. In the risk stratification guideline, KD patients with coronary artery (CA) no involvement and CA dilation only shared the same long-term management algorithm. The clinical and CMR assessment of KD patients would be an important reference for risk stratification and long-term management but this remains unclear in patients with CA dilation only. Therefore, our study aims to investigate the clinical and CMR characteristics and compare them with KD patients with CA no involvement.

### METHODS AND MATERIALS

455 KD patients diagnosed from 2012 to 2023 were recruited in the study. They were divided into the CA no involvement group (n=313, 180 males, average age 2.2±1.3 years) and the CA dilation only group (n=142, 86 males, average age 2.2±1.3 years). 50/311 (16.1%) and 22/142 (15.5%) of them underwent cardiac magnetic resonance (CMR) examinations during convalescence. The laboratory data, echocardiography results and CMR parameters between the two groups were compared and Kaplan-Meier analysis was performed to estimate the cumulative probability of the endpoints including coronary events, cardiac death, heart failure and new-onset malignant arrhythmias of KD patients.

### RESULTS

The abnormities of laboratory analysis and echocardiography results in KD patients recovered after the standard therapy and there were no significant differences between the two groups of KD patients both at onset and during convalescence (all $p>0.05$). For CMR assessment, no differences were discovered in cardiac diameters and volumes, cardiac function (GRS: 38.3±8.7% vs. 39.9±20.5%, $p=0.563$; GCS: -18.7±6.8% vs. -18.3±7.2%, $p=0.612$; GLS: -13.2±3.7% vs. -13.4±4.1%, $p=0.219$) and myocardial tissue parameters (native T1 values: 1296.5±74.1 ms vs. 1313.3±80.5 ms, $p=0.078$; global T2 values: 38.2±4.1 ms vs. 38.1±3.5 ms, $p=0.334$; LGE proportion: 4.0% vs. 2.5%, $p=0.876$) between the two groups. The median follow-up of 4.2 years revealed a favorable prognosis in both patients with CA no involvement and dilation only, with no adverse cardiovascular events observed.

### CONCLUSION

The clinical and CMR characteristics of CA dilation only in children with KD were similar to patients with CA no involvement and they shared a favorable medium- and long-term prognosis.

### CLINICAL RELEVANCE/APPLICATION

It's the first time to illustrate that the two groups of KD patients should follow the same long-term management algorithm from the perspectives of clinical and CMR, providing important support for the elevation of guideline evidence level.

## S3B-SPPD-2 FEASIBILITY OF VIRTUAL REALITY COMPARED TO MULTIPLANAR REFORMATION WITH BALLOON-SIZING AS THE GOLD STANDARD IN ASSESSING PULMONARY VALVE DIAMETERS IN PATIENTS WITH CONGENITAL HEART DEFECTS

Matthias Gutberlet, MD, PhD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Koninklijke Philips NV;Speaker, Bayer AG;Speaker, Bracco Group;Author, Thieme Medical Publishers, Inc
Anne Sophie Weber (*Abstract Co-Author*) Nothing to Disclose
Martin Kostelka (*Abstract Co-Author*) Nothing to Disclose
Sebastian Schaudt (*Abstract Co-Author*) Nothing to Disclose
Ingo Dahnert (*Abstract Co-Author*) Nothing to Disclose
Robin F. Gohmann, MD (*Abstract Co-Author*) Nothing to Disclose
Florian Loeffelbein (*Abstract Co-Author*) Nothing to Disclose
Christian Luecke, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

3D-visualizations including Virtual Reality (VR) have a long history in imaging; however, their benefit seems to be mainly visualization driven. Measurements in these visualizations are not sufficiently evaluated and radiologists rely on multiplanar reformations to measure the correct dimensions prior percoutanous pulmonary valve implantation (PPVI), [Ebel et al., 2019]. However, an intensive training might be needed to make residents familiar with these techniques, while VR has probably a more intuitive approach. We wanted to evaluate if one can assess essential right outflow tract (ROT) dimensions using VR on MRI data, in patients with congenital heart defects with repaired conotruncal anomalies, in regard to further interventions needed.

**METHODS AND MATERIALS**

23 patients, aged 8 to 59 years, underwent preinvasive 1.5 T MRI scans after corrective surgery. An ECG-gated diastolic 3D SSFP-whole-heart-sequence with a 300 mm FoV was acquired and reconstructed with voxel sizes down to 0.69 mm. A dedicated VR-software (Vea-Sim) and an Oculus Quest 2 VR headset was used to measure the area of the infundibulum (INF), the maximal (MAX) and minimal (MIN) diameter of the pulmonary outflow tract and the bifurcation (BIF), after calibration by the abdominal aorta. 4 patients were excluded due to stent artifacts. Reference measurements were performed using curved MPR (cMPR) by IntelliSpace Portal 12.1. Comparisons were performed using Bland-Altman plots. Balloon sizing was available as a standard of reference in 9 patients.

**RESULTS**

VR underestimated the diameter area vs. cMPR: At the height of INF the difference was -4.2 mm with an upper limit (UL) of 55.7 mm and lower limit (LL) of -64.1 mm. Mean bias at MIN was: : -8,8 mm², UL: 36,0 mm², LL: -53,7 mm², and at MAX was -15,7 mm², UL: 62,9 mm², LL: -94,3 mm² respectively. At BIF mean difference was -14,6 mm², with a LL of -89,2 mm², and an UL of 60,1 mm² (all differences not statistically significant p>0,123). Compared to the ballon sizing both methods showed excellent agreement with MIN at the possible landing zone. VR underestimated by -0.5 mm LL: 9.6 mm; UL: 8.6 mm and cMPR underestimated by -0.1 mm LL: -9.2 mm; UL: 9mm (both n.s. with p>0.8).

**CONCLUSION**

VR and cMPR based on MRI data both can assess essential diameters in non-stented ROT needed for PPVI, suggesting potential for non-invasive precise measurements in clinical routine via VR or cMPR.

**CLINICAL RELEVANCE/APPLICATION**

VR does not only offer an intuitive and potentially valuable educational tool but is able to enable imagers and interventionalists to evaluate crucial diameters from non stented ROT for PPVI. However, it requires further validation in larger cohorts against established measurement techniques to support this promising results.

## S3B-SPPD-3 DIAGNOSTIC AND PROGNOSTIC UTILITY OF CARDIAC MRI IN NEONATES AFTER CONGENITAL DIAPHRAGMATIC HERNIA REPAIR

Christopher Hart (*Abstract Co-Author*) Nothing to Disclose
Florian Kipfmueller (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Leon Bischoff, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Isaak, MD (*Abstract Co-Author*) Nothing to Disclose
Dmitrij Kravchenko, MD (*Abstract Co-Author*) Nothing to Disclose
Ulrike I. Attenberger, MD (*Abstract Co-Author*) Consultant, Bayer AG
Narine Mesropyan, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The triad of pulmonary hypoplasia, pulmonary hypertension, and early cardiac dysfunction has been postulated to be responsible for poor postnatal outcomes in neonates with congenital diaphragmatic hernia (CDH). The aim of this observational prospective study was to investigate whether cardiac MRI markers of cardiac dysfunction are associated with clinical outcomes in neonates after CDH repair.

**METHODS AND MATERIALS**

In this prospective study (from June 2020 to December 2022) neonates after CDH repair underwent cardiac MRI in a neonatal ICU-sited and neonatal-sized 3T scanner in deep sedation. Cardiac MRI protocol included assessment of biventricular function and volumes (left and right ventricular ejection fraction [LVEF, RVEF], end diastolic [EDV] and end systolic [ESV] volumes, shunt fraction [Qp/Qs], and lung perfusion). The study cohort was binarized based on median RVEF (cutoff value >54%) to compare clinical variables and outcome data (need for extracorporeal membrane oxygenation support (ECMO) and death) between the two groups. Measurements were performed separately and/or in consensus by two board certified radiologists. Unpaired t test, Mann-Whitney U test, Spearman correlation coefficient, and a univariable ordinal regression model were used for statistical analysis.

**RESULTS**

A total of 47 neonates (mean gestational age: 37±2 weeks, 11 female, 40 left-sided CDH, 22 "liver-up") were evaluated. Baseline anthropometric and clinical characteristics (incl. age, sex, birth weight and height [percentile], time to repair, etc.) were similar in both groups (P>0.05). Impaired RVEF correlated with the need for ECMO support after CDH repair (r=0.46, P=.042). Neonates with lower RVEF (<54%) had worse clinical outcomes (17 vs. 4% mortality, P=0.049; 52 vs. 17% ECMO, P=0.044). Univariable ordinal regression analysis revealed an association between MRI-derived RVEF and the need for ECMO support (odds ratio: 0.87, 95% confidence interval: 0.75-0.98; P=0.019). LVEF was more impaired in the group with RVEF<54% (LVEF: 55±4vs. 59±4%, P=0.023).

**CONCLUSION**

Cardiac MRI allows for accurate and objective assessment of cardiac dysfunction in neonates after CDH repair. MRI-derived parameters of right ventricular dysfunction were associated with adverse short-term clinical outcomes.

**CLINICAL RELEVANCE/APPLICATION**

Cardiac MRI might play an important role in risk stratification and clinical decision-making in neonates after CDH repair.

# Abstract Archives of the RSNA, 2024

S3B-SPPH

**Physics Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPPH-1 MULTISOURCE CBCT SCANNING GEOMETRY FOR THE REDUCTION OF METAL ARTIFACTS IN MAXILLOFACIAL APPLICATIONS

Antonio Minopoli (*Abstract Co-Author*) Nothing to Disclose
Jianping Lu (*Abstract Co-Author*) Consultant, Xintek Inc;Consultant, Surround Medical Systems, Inc;Consultant, XinRay Systems Inc
Shuang Xu (*Abstract Co-Author*) Nothing to Disclose
Otto Zhou, PhD (*Abstract Co-Author*) Board of Directors, Surround Medical Systems, Inc;Board of Directors, NuRay Technology Co, Ltd;Board of Directors, Xintek Inc
Christina R. Inscoe, PhD (*Abstract Co-Author*) License agreement, Xintek Inc
Antonio Sarno (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the use of a multi-source cone-beam CT (CBCT) scanner with unconventional scanning geometry for the reduction of metal artifacts from dental implants via experimental and in-silico studies.

### METHODS AND MATERIALS

Experimental studies were conducted on carbon-nanotube multi-source CBCT (ms-CBCT) developed at the Univ. of North Carolina on a phantom incorporating two metallic pins. The ms-CBCT scanner embodied a 99-μm pixel C-MOS flat-panel detector and the x-ray source was operated at 110 kV by using two focal spots placed on a segment parallel to the rotation axis. 300 projections were alternatively taken from the two sources - 150 projections per source - over a scanning angle of 360 deg. The distance between the two sources (H) was fixed during the scan. The image quality was investigated varying the distance H and as a function of the relative position of the segment and the metallic pins. Evaluations focused on the relation between H and both voxel fluctuations introduced by the metal artifacts and distortion on HU evaluation. Metal artifacts were evaluated as the normalized metal artefact index (nMAI) calculated as the square root of the difference between the variance in a region of interest between the pins and that evaluated within a region of interest not affected by metal artefacts; the value was normalized by the expected voxel value. Tests were also performed in-silico, via a GPU based Monte Carlo platform, that permitted to further explore the proposed scanning geometry.

### RESULTS

The nMAI presented a decrescent trend as the distance between the sources increased. It passed from 0.67 for CBCT configuration (H = 0), to 0.59 for H = 40 mm and 0.57 for H = 80 mm. A drastic reduction is obtained for H = 100 mm, down to 0.26. This may be mainly due to the fact that no portion of the two metallic pins is included in the same x-ray beam direction for H = 100 mm and the signal is spread over several planes by the reconstruction algorithm. From a visual point of view, the metal artefacts resulted drastically reduced in the axial slices containing the metallic inclusions.

### CONCLUSION

The proposed CBCT scanner configuration embodying a two-spot source allowed a reduction of metal artifacts due to the presence of small pins in a phantom. Such artefacts reduced as the distance between the focal spot increased, with the evaluated nMAI index reducing by 12% passing from CBCT to 40 mm distance focal spot configuration; nMAI reduced by 61% when used 100 mm between the two sources.

### CLINICAL RELEVANCE/APPLICATION

The proposed application showed the potential of reducing metal artifacts in CBCT maxillo-facial imaging towards an improvement of the image quality for planning and verification of implants, as well as for image guided surgery.

## S3B-SPPH-10 EFFECTS OF RADIATION DOSE LEVEL AND IODINE CONCENTRATION ON THE ACCURACY OF IODINE QUANTIFICATION USING DEEP LEARNING IMAGE RECONSTRUCTION IN DUAL-ENERGY SPECTRAL CT: AN IODINE PHANTOM STUDY

Le Cao (*Abstract Co-Author*) Nothing to Disclose
Jianxin Guo (*Abstract Co-Author*) Nothing to Disclose
Jianying Li, PhD (*Presenter*) Employee, General Electric Company

### PURPOSE

To investigate the accuracy of iodine quantification using deep learning image reconstruction (DLIR) in dual-energy CT (DECT) at different radiation dose levels and iodine concentrations.

**METHODS AND MATERIALS**

A DECT quality control phantom simulating adult abdomen (Multi-Energy CT Quality Assurance Phantom; GPH-75B, Science in Kyoto) with three iodine inserts (4.0, 8.0, 12.0mg/mL) was imaged using DECT mode. Scans were repeated 5 times at CT dose index (CTDIvol) levels of 4, 7, 10, 14mGy. Images were reconstructed using 50% adaptive statistical iterative reconstruction (ASIR-V) (ASIR-V50%) and DLIR at low (DLIR-L), medium (DLIR-M) and high (DLIR-H) settings. Iodine concentration of the three iodine inserts were measured. The coefficient of variation (CV) of iodine concentration in target inserts was calculated as CV = (SD÷M) * 100%, where SD and M refer to the standard deviation and mean of the iodine concentrations, respectively. The one way repeated-measures analysis of variance with Bonferroni correction was used to evaluate the differences in iodine concentration and CV among different reconstructions.

**RESULTS**

The iodine quantification did not differ significantly at different radiation dosages among reconstructions. The CV of the 4mg/mL iodine was significantly higher than that of the 8 and 12mg/mL iodine. With the increase of radiation dose, CV decreased significantly, and the difference was more obvious at low iodine inserts. The CV values on ASIR-V50% images at 4, 7, 10, 14mGy were 0.20, 0.15, 0.16, 0.13 for the 4mg/mL, 0.09, 0.09, 0.06, 0.06 for the 8mg/mL, and 0.07, 0.07, 0.05, 0.04 for the 12.0mg/mL iodine inserts, respectively. DLIR algorithms significantly reduced the measurement variability. At 4mGy, the CV values for the 4.0, 8.0, 12.0mg/mL iodine inserts (0.13, 0.05, 0.06) were the lowest on DLIR-H images, and highest (0.20, 0.09, 0.07) on ASIR-V50% images. Using DLIR, the CV values for iodine quantification at 4mGy were similar to ASIR-V50% images at 14mGy dose level (0.13, 0.06, 0.04), $P<0.001$.

**CONCLUSION**

DLIR significantly reduces the image variability and improves the accuracy of iodine quantification in low-dose conditions.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning image reconstruction to improve accuracy of iodine quantification.

## S3B-SPPH-12 VIRTUAL MONOENERGETIC IMAGING OF STENOSIS AT DIFFERENT KEV IN MOBILE PHOTON-COUNTING DETECTOR CT

Kwanhee Han (*Abstract Co-Author*) Employee, Samsung Electronics Co, Ltd
Su-Jin Park (*Abstract Co-Author*) Empolyee, Samsung Electronics Co, Ltd
Duhgoon Lee (*Abstract Co-Author*) Employee, NeuroLogica Corporation
Jinwook Jung (*Abstract Co-Author*) Employee, Samsung Electronics Co, Ltd
Junyoung Park (*Presenter*) Employee, Samsung Electronics Co, Ltd

**PURPOSE**

The main purpose of this study is to evaluate accurate quantification for the degree of carotid artery stenosis that causes ischemic stroke using virtual monoenergetic images (VMI) with mobile PCD-CT which can be brought closer to the bedside, the risks associated with transport can be reduced.

**METHODS AND MATERIALS**

In this study, the FDA 510(k) cleared mobile PCD-CT (OmniTom Elite PCD, Samsung-Neurologica, Danvers, MA, USA) was used. We developed our own VMI algorithm to find the inverse problem mathematically. The measured CT number in VMI for iodine inserts of Gammex phantom was compared with manufacturer reference values. In addition, VMI were generated between 33keV and 34keV to evaluate incremented signal of iodine which has k-edge as 33.2keV. Using the university of Dundee's soft embalmed perfused human cadaveric model, degree of stenosis was evaluated. The right common carotid artery was cannulated, and 10% iodine contrast was injected. VMI were obtained at 40, 60, 80, 100, 120 and 140keV. The degree of stenosis of the left internal carotid artery was assessed using the NASCET criteria.

**RESULTS**

To demonstrate the virtual monochromatic image (VMI) function, we evaluated that the CT values of the iodine rods (or other rods in the phantom) in the VMI images agree well with the CT values computed from NIST tables in the keV range available. The measured CT number in VMI for iodine inserts of Gammex phantom was compared with manufacturer reference values. The measured CT number in VMI closely matched the reference value with mean percent error of 5.615%. We also confirmed the iodine signal increased after k-edge energy of iodine (33.2keV). The degree of stenosis with the human cadaveric showed that as keV increased from 40keV to 100keV, percentage stenosis decreased from 100% to 39.59%. Between 100keV and 120keV, percentage stenosis increased from 39.59% to 40.16%, then decreased to 33.8% at 140keV. We confirmed improved the accuracy of carotid artery stenosis assessment by offering different inherent contrast images.

**CONCLUSION**

Our quantitative results of multi-energy phantom verified the accuracy of our VMI with mobile PCD-CD. In addition, the qualitative results of Gamex phantom demonstrate new possibilities for K-edge imaging which can distinguish different materials by a K-edge characteristics within single acquisition. Through VMI reconstructions at different keV and the qualitative and quantitative results, mobile PCD-CT has the potential to improve the accuracy of carotid artery stenosis assessment.

**CLINICAL RELEVANCE/APPLICATION**

The VMI with mobile PCD-CT can lead to simplified clinical imaging protocols and improved workflow for neuroimaging of critical patients with the risks associated with transportation and life-threatening illness.

## S3B-SPPH-2 EFFECTS OF SUBJECT MOTION AND ACQUISITION TIME ON CONE-BEAM CT IMAGE QUALITY FOR NOVEL FAST SCANNING PROTOCOLS

Alejandro Sisniega, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Micro-X Ltd;Research Grant, Izotropic Corporation
Michael J. Salerno, PhD,MBA (*Abstract Co-Author*) Nothing to Disclose
Taoran Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Boon-Keng K. Teo, PhD (*Abstract Co-Author*) Nothing to Disclose
David Adam, PHD (*Abstract Co-Author*) Nothing to Disclose
Xun Jia, PhD (*Abstract Co-Author*) Nothing to Disclose
William Hrinivich, PHD (*Abstract Co-Author*) Nothing to Disclose
Alexander Lu (*Presenter*) Nothing to Disclose

**PURPOSE**

Patient motion during cone-beam CT acquisition produces blur, streaks, shape distortion, and position shift of soft-tissue and high-contrast targets. Such effects hamper the utility of CBCT imaging for identification and targeting of structures experiencing motion for intra-procedural planning or guidance. This work systematically assesses the effects of reduced acquisition time (16 s to 6 s) on CBCT image quality, shape distortion, and target positioning accuracy in the presence of intra-acquisition patient motion for two on-board CBCT scanners.

**METHODS AND MATERIALS**

Two phantoms were used to characterize motion: a polyethylene cylinder bearing 6 electron-density inserts (P1) and a deformable abdominal phantom containing a liver with contrast-enhanced lesions and vascular surrogates (P2). Both phantoms were coupled to a 2-DOF motion actuator and imaged using two CBCT systems with acquisition times of 16.6 s (CBCT-16.6s) and 6 s (CBCT-6s). Sinusoidal motion (4 s period) was applied during image acquisition with translational amplitudes ranging from 0.0 to 10.0 mm, paired with rotational amplitudes from 0.0 to 19.5 degrees when imaging P1. High-contrast inserts (P1, P2) and low-contrast soft tissues (P2) were used to quantify spatial resolution, using edge spread function (ESF) measurements for each type of tissue. Circularity error and centroid excursion were also computed for high-contrast inserts (P1).

**RESULTS**

CBCT-6s demonstrated reduced blur and streak artifacts compared to CBCT-16.6s, with consistently improved edge sharpness and structural integrity in both phantoms for both high- and low-contrast regions. Under moderate motion (2.5 mm), median ESF was 1.37 and 0.88 mm, circularity error was 4.30 and 2.35 mm, and centroid excursion was 1.06 and 1.26 mm for the CBCT-16.6s and CBCT-6s scanners, respectively. For all motions, CBCT-6s was more robust to ESF degradation.

**CONCLUSION**

Reduced acquisition time improved the image sharpness and reduced circularity error in on-board CBCT images, but increased centroid excursion, suggesting a tradeoff between accurate target position and accurate target shape / sharpness.

**CLINICAL RELEVANCE/APPLICATION**

In the presence of patient motion, faster CBCT acquisition increases shape reconstruction accuracy, but may result in deviation in reconstructed object position.

## S3B-SPPH-3 DETECTABILITY OF IODINE IN MEDIASTINAL LESIONS ON PHOTON COUNTING CT: A PHANTOM STUDY

Mathias Prokop, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Canon Medical Systems Corporation;Research Grant, Siemens AG;Speakers Bureau, Siemens AG
Joric Centen (*Abstract Co-Author*) Nothing to Disclose
David Goos (*Abstract Co-Author*) Nothing to Disclose
Marcel Greuter, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the detectability of iodine in mediastinal lesions with photon counting CT (PCCT) compared to conventional CT (CCT).

**METHODS AND MATERIALS**

A 10cm diameter solid water phantom containing 5 cylindrical inserts with diameters from 1 to 12 mm was placed in the mediastinal area of an anthropomorphic chest phantom (QRM-thorax) including fat ring (QRM L-ring) 30cm x 40cm cross-section at inserts level. Inserts were filled with iodine contrast at concentrations of 0.24 to 27 mg/ml. The phantom was scanned with clinical chest protocol at 120 kV on PCCT (Naeotom Alpha, Siemens Healthineers) and on a high-end CCT (Somatom Force, Siemens Healthineers) using identical dose. For PCCT the effect of virtual mono-energetic images (VMI) was also examined at 40, 50, 60 and reference 70 keV, and the effect of dose reduction by 66%. Two observers with similar experience independently determined the smallest insert size for which iodine enhancement could still be detected. Consensus was reached when detectability thresholds differed between observers. This allowed for constructing contrast-detail curves for the various scan settings.

**RESULTS**

CTDIvol on PCCT and CCT were 3.8±0.1 and 3.6±1mGy, respectively. PCCT was substantially more sensitive than CCT for detection of iodine in mediastinal lesions 3-5mm: to detect a 3mm lesion, 11mg/ml iodine was needed with CCT while only 4.5 mg/ml was required with PCCT. A 66% dose reduction on PCCT at 70 keV still yielded results that were equal to PCCT at 70 keV at 100% dose. VMI at 40 and 50 keV improved detectability over reference PCCT reconstruction, except for 1-mm lesions, for which it yielded equal detectability to CCT. The detection threshold for 5-mm lesions, however, could be reduced from 4.5mg/ml iodine for CCT to 1.4mg/ml for VMI at 60 keV and 0.24 mg/ml for 40 and 50 keV VMI at PCCT.

**CONCLUSION**

Iodine detectability with PCCT is superior to CCT for simulated mediastinal lesions 3-5mm. Iodine detectability further increases with virtual monoenergetic images for lesions = 3 mm, with best results seen for 40 and 50 keV. Chest CT with PCCT obtained at 1.3mGy yields better iodine detectability than CCT at 3.8mGy at 66% dose reduction.

**CLINICAL RELEVANCE/APPLICATION**

PCCT can detect small iodine-enhanced lesions at a lower iodine concentration or a substantially lower exposure dose than CCT.

## S3B-SPPH-4 PATIENT-SPECIFIC ANALYSIS OF IMAGE QUALITY OF VIRTUAL MONOCHROMATIC IMAGES AND ORGAN DOSES IN ABDOMINAL DUAL ENERGY CT EXAMINATIONS

Yutaka Chiba (*Abstract Co-Author*) Nothing to Disclose
Masafumi Shinozaki, RT (*Abstract Co-Author*) Research Grant, Amin Inc
Saeko Mochinaga, RT (*Abstract Co-Author*) Nothing to Disclose
Yoshihisa Muramatsu, PhD, RT (*Abstract Co-Author*) Nothing to Disclose
Keiichi Nomura, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuichi Nagai (*Abstract Co-Author*) Nothing to Disclose
Keisuke Fujii, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The aims of this study are to evaluate image quality of virtual monochromatic (VM) images and organ doses for individual patients in abdominal dual energy CT (DECT) examinations, and to compare the image quality and organ doses in DECT examinations with them in single energy CT (SECT)

examinations.

**METHODS AND MATERIALS**

We evaluated image quality of 50-80 keV VM images for 20 normal weight and overweight patients in abdominal DECT examinations with the administration of iodine contrast agent (Iopamidol 370, Bayel) and CT images for the 20 patients in the SECT examinations with Aquilion ONE / PRISM Edition (Canon Medical Systems). SECT and VM images were reconstructed with deep learning reconstruction algorithms of Advanced intelligent Clear-IQ Engine (AiCE) Body and Spectral Body, respectively. We set region of interests (ROIs) of 40×40 pixels on liver region of the plain SECT and VM images, applied moving average filters in the ROI, and evaluated apparent noise from standard deviation of the mean CT values for each filter size. Image contrast was also calculated as differences between CT values of aorta region on the late arterial phase images and those of liver region on the plain images, and contrast-to-noise ratio (CNR) was calculated as the ratio of the contrast and apparent noise of each image. Next, we performed Monte Carlo simulations for each voxelized phantom of the patients in abdominal SECT and DECT scans with the CT scanner by inputting the CT images, descriptions of each CT scanner, and scanning parameters including our estimated tube current modulation profiles into MC simulation software ImpactMC (Advanced Breast CT, GmbH). ROIs of liver region were set on the simulated dose distribution images, and liver doses for each patient were calculated as average doses within liver ROIs.

**RESULTS**

Apparent noise of 70 keV VM images was lower than the other keV VM images, and it was approximately 25% lower than SECT images. Image contrast of VM images exponentially decreased as the VM energy increased while contrast of 70 keV VM images was approximately 30% higher than SECT images. CNR of the 60 and 70 keV VM images was approximately 2 times higher than SECT images. Liver doses for patients in abdominal DECT scans were 16-22 mGy, the doses in abdominal SECT scans were 12-24 mGy, and there was no significant difference in liver doses between abdominal SECT and DECT scans.

**CONCLUSION**

60 and 70 keV VM images from abdominal DECT examinations provide higher CNR than SECT images while liver doses in DECT examinations are similar to those in the SECT examinations.

**CLINICAL RELEVANCE/APPLICATION**

60 and 70 keV VM images for patients in abdominal DECT examinations can be useful in the detection of low contrast lesions because CNR of the VM images are higher than SECT images.

## S3B-SPPH-5 COMPARISON OF THE SPECTRAL PERFORMANCE BETWEEN TWO DUAL-SOURCE CT SYSTEMS ON LOW-ENERGY VIRTUAL MONOENERGETIC IMAGES: A PHANTOM STUDY

Maxime PASTOR (*Abstract Co-Author*) Nothing to Disclose
Julien Erath, MSc (*Abstract Co-Author*) Employee, Siemens AG
Jean-Paul Beregi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joel Greffier, PhD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Faby, DIPLPHYS (*Abstract Co-Author*) Employee, Siemens AG
Julien FRANDON (*Abstract Co-Author*) Nothing to Disclose
Djamel Dabli (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the spectral performance of two different DSCT (DSCT-Pulse and DSCT-Force) on virtual monoenergetic images (VMIs) at low energy levels.

**METHODS AND MATERIALS**

An image quality phantom was scanned on the two DSCTs at three dose levels: 11/6/1.8mGy. Level 3 of an advanced modeled iterative reconstruction algorithm was used. Noise power spectrum and task-based transfer function were computed on VMIs from 40 to 70 keV to assess noise magnitude and noise texture (fav) and spatial resolution (f50). A detectability index (d') was computed to assess the detection of one contrast-enhanced abdominal lesion as a function of the keV level used.

**RESULTS**

For all dose levels and all energy levels, noise magnitude was higher with DSCT-Pulse than with DSCT-Force (12.2±0.9% at 1.8 mGy, 9.0±0.4% at 6 mGy and 3.9±0.5% at 11 mGy). For all energy levels, fav values were higher with DSCT-Pulse than with DSCT-Force (4.7±2.2% at 1.8 mGy, 4.5±1.4% at 6 mGy and 2.6±0.8% at 11 mGy). For all energy levels, f50 values were higher with DSCT-Pulse than with DSCT-Force (13.4±0.9% at 1.8 mGy, 17.0±0.7% at 6 mGy and 13.2±0.1% at 11 mGy). For all keV, similar d' values were found with both DSCT-Force and DSCT-Pulse at 11 mGy (-1.1±0.5%). For other dose levels, d' values were lower with DSCT-Pulse than with DSCT-Force (-8.4±0.7% at 1.8 mGy and -6.4±0.1% at 6 mGy).

**CONCLUSION**

Compared with the DSCT-Force, the DSCT-Pulse improved noise texture and spatial resolution, but noise magnitude was slightly higher and detectability slightly lower, particularly when the dose level was reduced.

**CLINICAL RELEVANCE/APPLICATION**

In this study, we assessed the quality of virtual monoenergetic images at low energy levels on a new dual-source CT for the first time.

## S3B-SPPH-6 COMPARISON OF LOW-ENERGY VIRTUAL MONOENERGETIC IMAGES BETWEEN PHOTON-COUNTING CT AND ENERGY-INTEGRATING DETECTORS CT: A PHANTOM STUDY

Julien Erath, MSc (*Abstract Co-Author*) Employee, Siemens AG
Djamel Dabli (*Abstract Co-Author*) Nothing to Disclose
Maxime PASTOR (*Abstract Co-Author*) Nothing to Disclose
Sebastian Faby, DIPLPHYS (*Abstract Co-Author*) Employee, Siemens AG
Jean-Paul Beregi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julien FRANDON (*Abstract Co-Author*) Nothing to Disclose
Joel Greffier, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study was to assess image quality and dose level using a photon-counting CT (PCCT) scanner by comparison with a dual-source CT (DSCT) scanner on virtual monoenergetic images (VMIs) at low energy levels.

**METHODS AND MATERIALS**

A phantom was scanned on a DSCT and a PCCT with a volume CT dose index of 11 mGy, and additionally at 6 mGy and 1.8 mGy for PCCT. Noise power spectrum and task-based transfer function were evaluated from 40 to 70 keV on VMIs to assess noise magnitude and noise texture (fav) and spatial resolution on two iodine inserts (f50), respectively. A detectability index (d') was computed to assess the detection of two contrast-enhanced lesions according to the keV level used.

**RESULTS**

For all keV levels, noise magnitude values were lower with PCCT than DSCT at 11 and 6 mGy, but higher at 1.8 mGy. fav values were higher with PCCT than with DSCT at 11 mGy (8.6 ± 1.5 [standard deviation [SD]] %), similar at 6 mGy (1.6 ± 1.5 [SD] %) and lower at 1.8 mGy (17.8 ± 2.2 [SD] %). For both inserts, f50 values were higher with PCCT than DSCT at 11- and 6 mGy for all keV levels, except at 6 mGy and 40 keV. d' values were higher with PCCT than with DSCT at 11- and 6 mGy for all keV and both simulated lesions. Similar d' values to those of the DSCT at 11mGy, were obtained at 2.25 mGy for iodine insert at 2 mg/mL and at 0.96 mGy for iodine insert at 4 mg/mL at 40keV.

**CONCLUSION**

Compared to DSCT, PCCT reduces noise magnitude and improved noise texture, spatial resolution and detectability on VMIs for all low-keV levels.

**CLINICAL RELEVANCE/APPLICATION**

VMIs obtained with PCCT may offer great potential for dose reduction for patients undergoing dual-energy CT of the abdomen.

## S3B-SPPH-7 ACCURACY AND CONSISTENCY OF EFFECTIVE ATOMIC NUMBER OVER OBJECT SIZE USING DEEP SILICON PHOTON-COUNTING DETECTOR CT

Hiroki Kawashima, PhD (*Abstract Co-Author*) Kyoto kagaku, Research collaboration
Zhye Yin (*Abstract Co-Author*) Employee, General Electric Company
Scott Slavic, MS (*Abstract Co-Author*) Employee, General Electric Company
Aria Salyapongse, BS (*Abstract Co-Author*) Nothing to Disclose
Meghan G. Lubner, MD (*Abstract Co-Author*) Spouse, Consultant, Elephas Bio
Timothy P. Szczykutowicz, PhD (*Abstract Co-Author*) Consultant, Aidoc Medical Ltd;Consultant, Flowhow.ai;Consultant, medInt Holdings, LLC;Consultant, Alara, Inc;Consultant, AstoCT, Inc;Research Grant, General Electric Company;Research Grant, Canon Medical Systems Corporation
Giuseppe V. Toia, MD, MS (*Abstract Co-Author*) Research Consultant, General Electric Company;Research Grant, General Electric Company
Sean Rose, PhD (*Abstract Co-Author*) Research Grant, medInt Holdings, LLC;
Teva Shapiro (*Presenter*) Nothing to Disclose

**PURPOSE**

Photon-counting (PCD) CT is the newest generation of CT detector technology. Thus, it is critical to characterize its performance in measuring important biomarkers used in quantitative CT including effective atomic number (EAN). More accurate EAN measurements could be beneficial in tissue classification and proton therapy tasks. Previous work has shown that PCD CT can measure CT number more consistently and accurately. This study measures the precision and accuracy of EAN in a prototype deep silicon PCD CT over multiple water-equivalent diameters (WED).

**METHODS AND MATERIALS**

A Gammex Mercury phantom containing clinically relevant inserts was scanned at 120 kV using a deep silicon PCD CT. EAN maps were generated. Variation of EAN of the inserts was analyzed over the different WEDs (157, 203, 251, 298, and 345 mm) for polystyrene, water, iodine, and bone inserts. The measured EANs were compared to ideal values based on the elemental composition of the inserts provided by the manufacturer and calculated using their electron fraction weighted EAN.

**RESULTS**

The maximum percent difference between the measured EANs of the center of the phantom (251 mm WED) and the other sections (157-345 mm) for the polystyrene, water, iodine, and bone inserts were 5.9%, 7.2%, 0.5%, and 1.0% respectively. The average percent difference between the measured and ideal EANs across all inserts was 3.6% and the maximum percent difference was 7.2%.

**CONCLUSION**

When compared to previous studies using energy integrating detectors, this study shows a higher accuracy in EAN measurements. The high consistency and accuracy of measured EAN using deep silicon PCD CT could make quantitative CT increasingly possible over a large range of patient sizes. The results of this study also help us understand uncertainties which should be considered when using these biomarkers in clinical decision making. Additionally, this study may help to improve the algorithms used to calculate these quantities. Limitations of this study include that it used a prototype which may not accurately reflect the final product and that the scatter and beam hardening corrections for the prototype were not fully developed at the time of this study.

**CLINICAL RELEVANCE/APPLICATION**

The use of CT as a biomarker for tissue classification has historically been impeded by inaccurate and unreliable CT numbers; this study demonstrated deep silicon based PCD CT may move CT closer to be used more effectively as a biomarker.

## S3B-SPPH-8 ASSESSING IODINE QUANTIFICATION ERRORS WITH PARTIAL IODINE VOXEL CONTENT DURING IODINE-WATER BASIS PAIR MATERIAL DECOMPOSITION

Timothy P. Szczykutowicz, PhD (*Abstract Co-Author*) Consultant, Aidoc Medical Ltd;Consultant, Flowhow.ai;Consultant, medInt Holdings, LLC;Consultant, Alara, Inc;Consultant, AstoCT, Inc;Research Grant, General Electric Company;Research Grant, Canon Medical Systems Corporation
Aria Salyapongse, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Iodine quantification is an important CT based biomarker in quantitative CT imaging. This study quantifies sources of errors in quantitative spectral CT.

**METHODS AND MATERIALS**

This work examines the theoretical relationship between linear attenuation coefficients, material decomposition basis pairs, and material quantification. Voxels are simulated using the spektr MATLAB package with clinically appropriate volume fractions of iodine and tissue backgrounds. Voxel linear attenuation coefficients were calculated using the National Institute of Standards and Technology (NIST) XCOM database for tissue chemical compositions and clinical concentrations of iodine. Then the voxels' contents are decomposed onto an iodine-water basis pair and the iodine volume fraction was

calculated. This value was then compared with the known iodine volume fraction as a percent error. Quantification errors are also demonstrated experimentally using a clinically relevant phantom with known iodine and background density inserts.

**RESULTS**

For a voxel of some background material and iodine with the choice of a water-iodine material basis pair for material decomposition of iodine in the range of 0.2-2.0 mg/mL, the error in iodine density was 0% for a water background, 6.6% to 66% for a muscle background, 9.1% to 91% for a lung background, 6.9% to 69% for a soft tissue background, 13% to 134% for a blood background, -57% to -572% for an adipose tissue background and over 15,000% for a bone background. This translates to a difference in iodine mass of 0 mg/mL for a water background, 0.03 to 0.05 mg/mL for muscle, lung, soft tissue, and blood backgrounds, -0.23 mg/mL for an adipose tissue background, and 6.92 mg/mL for a bone background. A negative mass difference means the calculated iodine mass was underestimated, and a positive mass difference means the calculated iodine mass was overestimated.

**CONCLUSION**

We derive two new understandings: (1) iodine-water material decomposition is never accurate in vivo, and (2) for error free material decomposition a voxel must only consist of the basis decomposition vectors. Our work demonstrates material quantification is fundamentally limited when measured in vivo due to measurement conditions differing from assumed conditions and the errors are at or above detection limits for spectral iodine quantification. To define CT derived biomarkers, the errors we demonstrate should either be avoided or built into uncertainty bounds.

**CLINICAL RELEVANCE/APPLICATION**

Improving error bounds in quantitative CT, specifically in iodine quantification, could further the development of CT biomarkers.

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RSNA 2024
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# Abstract Archives of the RSNA, 2024

S3B-SPRO

**Radiation Oncology Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPRO-1 CT AND MRI BIMODAL RADIOMICS NOMOGRAM FOR PREDICTING EGFR STATUS INNSCLC PATIENTS WITH BRAIN METASTASES:A MULTICENTER STUDY

Ouyang Zhiqiang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In advanced non-small cell lung cancer (NSCLC), brain metastasis (BM) is one of the most common types of distant metastases. These metastases are closely related to the status of epidermal Growth Factor Receptor (EGFR). The aim of this study is to fully utilize the radiomics information from both NSCLC primary tumors and BM, and develop and validate a bimodal radiomics nomogram that can accurately predict the EGFR status.

### METHODS AND MATERIALS

A total of 309 NSCLC patients with BM from three independent centres were recruited to conduct the retrospective multicentre cohort study. All chest CT and brain MRI images of each patient were obtained for image registration and sequence combination within a single modality. After image preprocessing, 1037 radiomics features were extracted from each single sequence. Six machine learning algorithms were used to construct the radiomics signature for CT and MRI respectively. The best CT and MRI radiomics signatures were fitted to establish the bimodal radiomics nomogram for predicting the EGFR status.

### RESULTS

The CT-CE_XG Boost and MRI-T2WI+T1CE_Random Forest models were chosen as the radiomics signature representing primary lesion and BM. Both models were found to be independent predictors of EGFR mutation, with OR values and 95% confidence intervals (CI) of 11.859 (3.922-35.856) and 17.064 (5.858-49.707), respectively. The bimodal radiomics nomogram, which incorporated CT radiomics signature and MRI radiomics signature, demonstrated a good calibration and discrimination in the internal test cohort (AUC, 0.866; 95% CI, 0.778-0.950) and the external test cohort (AUC, 0. 0.818; 95% CI, 0.691-0.938).

### CONCLUSION

Our CT and MRI bimodal radiomics nomogram could timely and accurately evaluate the likelihood of EGFR mutation in patients with limited access to necessary materials.

### CLINICAL RELEVANCE/APPLICATION

Making up for the shortcoming of plasma sequencing and promoting the advancement of precision medicine.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

S3B-SPVA

**Vascular Imaging Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-SPVA-2 HOW QIR SHOULD IT BE? - INFLUENCE OF QUANTUM ITERATIVE RECONSTRUCTION STRENGTH IN PHOTON-COUNTING CT ANGIOGRAPHY OF THE UPPER LEG

Jan P. Grunz, MD (*Abstract Co-Author*) Research Consultant, Siemens AG
Henner Huflage, MD (*Abstract Co-Author*) Nothing to Disclose
Viktor Hartung (*Abstract Co-Author*) Nothing to Disclose
Jan-Lucca Hennes (*Abstract Co-Author*) Nothing to Disclose
Thorsten A. Bley, MD (*Abstract Co-Author*) Speakers Bureau, F. Hoffmann-La Roche Ltd;Research Consultant, F. Hoffmann-La Roche Ltd;Speakers Bureau, Novartis AG;Research Consultant, Novartis AG;Research Consultant, Baltimore RH Typing Laboratory
Theresa Sophie Patzer, MD (*Abstract Co-Author*) Nothing to Disclose
Robin Hendel (*Abstract Co-Author*) Nothing to Disclose
Kristina Krompass (*Abstract Co-Author*) Nothing to Disclose
Philipp Gruschwitz, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study was to evaluate the influence of different quantum iterative reconstruction (QIR) levels on the objective and subjective image quality of vascular convolution kernels in femoral photon-counting CT angiographies (PCD-CTA) using an extracorporeally perfused human in-vitro model.

### METHODS AND MATERIALS

Ultra-high resolution PCD-CTA were obtained from both extremities of 5 cadavers using constant tube voltage and max. radiation dose (71.2±11.0mGy). Images were reconstructed with 3 kernels (Bv48,60,76) and the 4 available levels of QIR. Signal attenuation in the arterial lumen, muscle, and fat were measured. Contrast-to-noise-ratios and blurring scores were calculated for objective assessment. Six radiologists evaluated the subjective image quality using a browser-based pairwise comparison tool. Significance was assumed for any p-level =.05. Objective and subjective image quality were compared using Friedman's rank test. Interrater-agreement was determined using Kendall's concordance coefficient.

### RESULTS

Higher QIR level resulted in a reduction of image noise regardless of kernel selection (e.g., Bv60: Q1 11.5±6.3HU vs. Q4 9.5±2.3HU; p<.001). Both the absolute reduction in noise and the noise difference between the individual QIR levels were larger for sharper convolution kernels (Bv76: Q1 19.3±3.2HU vs. Q4 13.9±1.1HU; p<.001) than for softer ones (Bv48: Q1 7.1±2.4HU vs. Q4 6.6±3.2HU; p=.001). CNR increased significant with higher QIR levels. The gain Q1 vs. Q4 creates a dose saving potential of ~25% without image quality loss. Blurring decreased with higher QIR levels for soft, remained constant for medium, and increased for sharp reconstructionsSharper kernels were preferred over softer ones by all raters. While there was no unanimous consensus for the subjectively preferred QIR level, interrater agreement was very high. Bv48Q1 was rated the worst and Bv76Q3 the best combination overall. Bv48Q4, Bv60Q2, and Bv76Q3 achieved the best subjective ratings per kernel.

### CONCLUSION

Quantum iterative reconstruction of PCD-CTA has a positive influence on their image quality in terms of image noise and CNR. In particular, reconstructions with sharp convolution kernels benefit quantitatively from higher QIR levels. While the subjectively preferred QIR level is dependent on kernel selection, QIR level 3 provided the best objective and subjective image quality results over all reconstruction settings.

### CLINICAL RELEVANCE/APPLICATION

This study provides a recommendation for the reconstruction of PCD-CTA of the lower extremity runoff to achieve the best possible image quality based on objective and subjective image parameters to improve the diagnostic value of PCD-CTA and/or enable for reduction of radiation dose.

# Abstract Archives of the RSNA, 2024

T2-SPBR

**Breast Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPBR-1 PERFORMANCE OF A DIGITAL BREAST TOMOSYNTHESIS AI DETECTION ALGORITHM IN COMMON US RACIAL/ETHNIC GROUPS

Scott Pohlman, MSc, BEng (*Abstract Co-Author*) Employee, Hologic, Inc
Andrew P. Smith, PhD (*Abstract Co-Author*) Employee, Hologic, Inc
Ashwini Kshirsagar (*Abstract Co-Author*) Nothing to Disclose
Sarah M. Friedewald, MD (*Presenter*) Consultant, Hologic, Inc;Research Grant, Alphabet Inc

### PURPOSE

Artificial intelligence (AI) algorithms can exhibit racial disparities, potentially due to underrepresentation of certain racial or ethnic groups in the training data. Thus, it is important to evaluate the performance of AI algorithms in racial/ethnic groups for which they will be used clinically. This study evaluated the performance of a commercially available digital breast tomosynthesis (DBT) AI system in racial/ethnic groups common in the US.

### METHODS AND MATERIALS

DBT cases with available ground truth data were consecutively selected from a pool of biopsy-proven malignant cancer cases and normal cases that were read as BI-RADS 1 or 2 at screening. These cases were not involved in the training or development of the AI algorithm. Each case was placed into one of the following self-identified racial/ethnic cohorts: White (non-Hispanic), Black (non-Hispanic), Hispanic, Asian, or Other. AI performance for each cohort was measured using several metrics: Receiver Operating Characteristics (ROC) curves, area under the ROC curve (AUROC), location specific sensitivity, and specificity. ROC curves and their areas and uncertainties were calculated using a maximum likelihood estimation of binormal ROC curves from continuously distributed test results.

### RESULTS

The cohort included 7519 examinations overall (2532 with cancer). The breakdown of examinations was 72% White (5395 cases, 1653 cancers), 13% Black (956 cases, 446 cancers), 10% Hispanic (774 cases, 274 cancers), 4% Asian (279 cases, 117 cancers), 2% Other (115 cases, 42 cancers). AUROC (2 Standard Deviation Error) by race/ethnicity was 0.91 (0.01) White, 0.92 (0.02) Black, 0.93 (0.02) Hispanic, 0.95 (0.02) Asian, and 0.94 (0.05) Other. Sensitivity (95% CI) by race/ethnicity was 90.3% (88.9-91.7%) White, 88.6 (85.6-91.6%) Black, 90.1% (86.6-93.6%) Hispanic, 91.5% (86.4-96.6%) Asian, 95.2% (84.2-98.7%) Other. Specificity (95% CI) by race/ethnicity was 60.0% (58.4-61.6%) White, 61.2% (56.9-65.3%) Black, 57.6% (53.2-61.9%) Hispanic, 71.6% Asian (64.2-78.0%), 52.6% (40.8-63.2%) Other. The only performance metrics which demonstrated a statistically significant ($p<0.05$) difference when compared to the overall cohort (AUROC = 0.92, sensitivity = 90.1%, specificity = 60.1%) were AUROC and specificity in the Asian cohort.

### CONCLUSION

Except for a small improvement in AUROC and specificity in the Asian cohort, the measured performance of the AI algorithm was similar for all the race/ethnicity cohorts which were evaluated. Future studies with larger populations are warranted.

### CLINICAL RELEVANCE/APPLICATION

To reduce the risk of disparities in clinical practice, the performance of medical AI systems should be evaluated in the racial/ethnic populations for which they will be used clinically.

## T2-SPBR-10 ARTIFICIAL INTELLIGENCE-ASSISTED SYSTEM ASSIST THE CLASSIFICATION OF BREAST ULTRASOUND GLANDULAR TISSUE COMPONENT IN DENSE BREAST TISSUE

Xiao-jing Xu (*Abstract Co-Author*) Nothing to Disclose
Lifang Yu (*Abstract Co-Author*) Nothing to Disclose
Chaochao Dai (*Abstract Co-Author*) Nothing to Disclose
Ling-yun Bao, MD (*Abstract Co-Author*) Nothing to Disclose
Yan Hongju, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to investigate the viability of implementing a novel artificial intelligence-assisted system for aiding physicians in the accurate classification of glandular tissue component (GTC) in dense breast tissue.

### METHODS AND MATERIALS

A total of 1848 breast ultrasound images, categorized as category C or D glandular tissue on mammography, the GTC were classified into four groups based on the ratio of glandular tissue to fibrous stroma: minimal (P1) <25%, mild (P2) 25-49%, moderate (P3) 50-75%, and marked (P4) >75%. Three ultrasound specialists more than 10-year-experiences in breast imaging established the gold standard. An artificial intelligence image processing segmentation-classification model, ResNet101, was established. 1325 images were used for model training, while 523 images for external validation. 3 breast specialists (Group A) and 3 non-breast specialists (Group B) were involved in the validation of the model. Each of the six physicians conducted independent image reviewes and utilized AI-assisted mage interpretation.

### RESULTS

In the validation set comprising 523 images, there were 109 cases of P1, 166 cases of P2, 131 cases of P3, and 117 cases of P4. In Group A, the AI-assisted group exhibited significantly sensitivity compared to the independent group for P1, P2 and average sensitivity (45.2% vs. 23.8%, 73.4% vs. 63.6%, and 58.6% vs. 51.6%, respectively) ($P < 0.05$). It`s also showed significantly specificity compared to the independent group for P3(74.4% vs. 68.7%)($P < 0.05$). Regarding accuracy, the AI-assisted group outperformed the independent group in P3 and average accuracy, significantly statistical disparities (73.1% vs. 56.1%, 79.8% vs. 74.7%) ($P < 0.01$). In Group B, the AI-assisted group showed superior sensitivity in P1, P2, and the average sensitivity compared to the independent group (41.2% vs. 31.1%, 69.4% vs. 43.5%, and 53.3% vs. 46.3%, respectively) ($P < 0.01$). In P3, P4, and average specificity, the AI-assisted group showed superior performance (63.9% vs. 58.7%, 95.3% vs. 79.4%, and 83.2% vs. 78.7%) ($P < 0.05$). In accuracy, the AI-assisted group outperformed the independent group, with statistically significant differences observed in the accuracy of P3 and P4, as well as average accuracy (69.8% vs. 60.4%, 86.1% vs. 71.7%, and 76.9% vs. 71.0%, respectively) ($P < 0.01$).

### CONCLUSION

The ResNet101 AI image processing segmentation-classification model has demonstrated its effectiveness in aiding medical professionals in accurately classifying breast GTC, particularly benefiting non-breast specialists. Additionally, it has shown potential to enhance the accuracy of classifying P3 and P4 glandular types.

### CLINICAL RELEVANCE/APPLICATION

Artificial intelligence, dense breast, glandular tissue component

## T2-SPBR-11 EVALUATING NNU-NET FOR DETECTING MALIGNANT BREAST LESIONS ON MRI

Masoom A. Haider, MD (*Abstract Co-Author*) Nothing to Disclose
Supriya R. Kulkarni, DMRD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Renata Pinto, MS (*Abstract Co-Author*) Nothing to Disclose
Frederick Au, MBBS (*Abstract Co-Author*) Nothing to Disclose
Sandeep Ghai, MD (*Abstract Co-Author*) Nothing to Disclose
Vivianne Freitas, MD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

This study evaluates an open-source machine-learning model for detecting malignant breast MRI lesions.

### METHODS AND MATERIALS

We reviewed breast MRIs from one institution from January 2006 to April 2021, which were approved by the research ethics board with consent waived. Inclusion criteria were patients with a BI-RADS scored lesion, biopsied or followed-up for two years if not biopsied. Two breast radiologists, each with over 20 years of experience, classified all cases using the BI-RADS lexicon, resolving discrepancies by consensus. We used nnU-Net v2 in a two-step cascade. A 5-fold cross-validation for detecting any lesions using the first and last subtracted dynamic contrast-enhanced (DCE) series followed by a second model to segment breast cancers only. True positives were cancers detected by AI and confirmed by pathology; true negatives had no cancer on pathology or follow-up and were undetected by AI. False positive regions were assessed by overlap percentage between predicted voxels and radiologist-segmented cancers.

### RESULTS

Of 19,473 MRIs, 12,243 were excluded as normal, and 314 were excluded for inadequate follow-up, leaving 6,916 MRIs (5,028 benign/normal and 1,898 malignant). After randomly selecting 1,000 for manual segmentation, 191 were excluded due to technical issues, resulting in 809 cases (524 training, 131 validation, 154 tests (85 benign, 69 malignant)). Case-level comparison of radiologists (BI-RADS threshold of >=4a) to the 3D and 2D models showed: 100% sensitivity vs. 88.4% [0.82, 0.92] and 91.3% [0.85, 0.95]; 60% specificity [0.52, 0.67] vs. 71.8% [0.64, 0.78] and 60% [0.52, 0.67]; 67% PPV [0.59, 0.74] vs. 71.8% [0.64, 0.78] and 64.9% [0.57, 0.72]; 100% NPV vs. 88.4% [0.82, 0.92] and 89.5% [0.84, 0.94]; 77.9% accuracy [0.71, 0.84] vs. 79.2% [0.72, 0.85] and 74% [0.67, 0.8]. Models were close to radiologist performance, with overlapping confidence intervals for most metrics. Mean voxel overlap was 55% for 2D and 56% for 3D models. In cancer cases with predicted lesions, only two had no overlap for both models.

### CONCLUSION

An open-source model closely matches the performance of subspecialty breast radiologists in distinguishing benign from malignant lesions on MRI, paving the way for large-scale, open-model collaborations.

### CLINICAL RELEVANCE/APPLICATION

An open-source AI model promises near-human-level performance in differentiating benign from malignant breast lesions. This can enhance transparency in machine learning methodologies and foster multicenter collaboration.

## T2-SPBR-2 AI-DRIVEN AUTONOMOUS RULE-OUT PROCESS HELPS UNDER-PERFORMING RADIOLOGISTS EXCEED ACCEPTABLE PERFORMANCE STANDARDS

Giorgia Grisot, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Bryan Haslam, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Jiye G. Kim, PhD (*Abstract Co-Author*) Employee, RadNet, Inc
Matthew McCabe, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

A major obstacle to mammography screening effectiveness is variability in radiologists' interpretive performance, with studies suggesting that close to 50% underperform in terms of recall rate (RR) or cancer detection rate (CDR). One proposal to reduce RR while increasing CDR is to use AI tools both as a reading aid, and to automatically rule-out the lowest suspicion exams (i.e. decide to not recall them without further review by a radiologist). We explore

the benefits of this combined approach and of using varying levels of Autonomous Rule-out (AR) on a dataset of >193k patients imaged with DBT, and focus on how it could standardize patient care by helping radiologists' with different degrees of baseline performance.

**METHODS AND MATERIALS**

Our study cohort included 26 radiologists at three U.S. practices, covering 40 clinical sites, who interpreted a total of 154,636 screening mammograms across two consecutive periods (a standard of care period and an intervention period; radiologists must have read at least 800 exams per period to be included), from January 2022 to January 2023, with exam counts of 66,037 and 88,599 respectively. These included 832 screen detected cancers. In the first period, radiologists read mammograms according to standard-of-care without AI assistance. In the second period, they used an AI-based CADe/x tool. AI scores indicating the level of suspicion for cancer (ranging from 0 to 1), were used to simulate different levels of AR by increasing the proportion of low suspicion exams autonomously read by the device. RR, CDR, and positive predictive value of recalls (PPV1) were computed during both study periods, as well as across different levels of AR simulation.

**RESULTS**

Before AI-CADe/x introduction, 3 radiologists had CDRs below the performance benchmark of 2.5 per 1000 exams, and 7 radiologists had RRs above the performance benchmark of 12%. In total, 38% of radiologists (10/26) were categorized as "underperforming." Reading with the AI-CADe/x tool increased CDR by 15%, RR by 8%, and PPV1 by 7%, and helped all radiologists achieve CDRs >2.5. Still, 34% of radiologists (9/26) had RRs >12%. Simulated rule-out of a large fraction of low-suspicion mammograms was very effective at reducing RR: an AR threshold of 60% brought almost all radiologists (24/26, 92%) into an acceptable range for both RR and CDR.

**CONCLUSION**

Combining AI-CADe/x with an AR tool may be effective at helping radiologists detect more cancers, reduce recalls and perform above acceptable performance standards.

**CLINICAL RELEVANCE/APPLICATION**

Combining AI-CADe/x with AI-driven autonomous rule-out may improve screening mammography outcomes by increasing cancers found and lowering the number of recalls.

## T2-SPBR-3 INFLUENCE OF PATIENT CHARACTERISTICS ON AN AI ALGORITHM'S SCREENING DIGITAL BREAST TOMOSYNTHESIS FALSE NEGATIVE PERFORMANCE

Joseph Lo, PhD (*Abstract Co-Author*) Research Grant, iCAD, Inc
Yinhao Ren (*Abstract Co-Author*) Nothing to Disclose
Jeffrey Nelson (*Abstract Co-Author*) Nothing to Disclose
Samantha Thomas (*Abstract Co-Author*) Nothing to Disclose
Lars J. Grimm, MD (*Abstract Co-Author*) Advisor, Hologic, Inc;Consultant, Hologic, Inc;Editorial Advisory Board, WebMD Health Corp (WebMD, Inc)
Tyler Jones (*Abstract Co-Author*) Nothing to Disclose
Derek L. Nguyen, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To understand the impact of patient characteristics on the performance of an AI algorithm in evaluating screening detected malignancies.

**METHODS AND MATERIALS**

This retrospective cohort study identified screening DBT examinations from our academic institution from 2/1/19 to 12/31/2023 with screening detected malignancies. This final cohort was interpreted by an FDA approved AI algorithm (ProFound AI 3.0, iCAD, Inc) which generated case scores for each mammogram. Per the vendor, examinations with case scores > 49 have a high certainty for malignancy. Therefore, a false negative examination in our study was defined as having a case score = 49. Patient characteristics (age, race/ethnicity, and breast density) were compared between those with and without false negative case scores and logistic regression was used to estimate the association of characteristics with the odds of a false negative case score.

**RESULTS**

373 unique patients (median age: 64 years [range: 37-91]) were included. The cohort's race/ethnicity distribution was 62% (233/373) Non-Hispanic White, 28% (104/373) Non-Hispanic Black, and 10% (36/373) other. The cohort's breast density distribution was 5% (19/373) almost entirely fatty, 51% (191/373) scattered fibroglandular density, 39% (145/373) heterogeneously dense, and 5% (18/373) extremely dense. The AI's false negative rate was 11% (42/373). Breast density was significantly associated with a false negative case score ($p=0.03$) while patient age and race/ethnicity were not significantly associated with a false negative case score ($p=0.86$ and $p=0.22$, respectively). Heterogeneously or extremely dense patients comprised of 62% (26/42) of the examinations with a false negative case score compared to 42% (137/331) of dense patients with a positive case score. This remained significant on multivariate analysis when adjusting for age and race.

**CONCLUSION**

The AI's false negative rate was 11%. Breast density did influence the performance of an AI algorithm in evaluating screening detected malignancies. However, patient demographics (age and race/ethnicity) did not influence the AI algorithm's performance.

**CLINICAL RELEVANCE/APPLICATION**

Like radiologists, the performance of an FDA-approved AI algorithm for breast cancer detection is influenced by breast density. Therefore, it is essential to train these algorithms on diverse datasets to enhance their diagnostic accuracy regardless of breast density.

## T2-SPBR-4 EVALUATING THE BENEFIT OF USING ARTIFICIAL INTELLIGENCE SYSTEM FOR BREAST ULTRASOUND: RESULTS OF A MULTICENTER, READER STUDY

Won Hwa Kim, MD, PhD (*Abstract Co-Author*) Stockholder, BeamWorks
Jaeil Kim, PhD (*Abstract Co-Author*) Stockholder, BeamWorks, Inc.
Kyunghwa Han, PhD (*Abstract Co-Author*) Nothing to Disclose
Jung Hyun Yoon, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the diagnostic performances of breast ultrasound (US) examinations before and after using artificial intelligence (AI) system for decision support among readers of different experience levels.

**METHODS AND MATERIALS**

For this multicenter reader study, 1,000 (500 cancer, 250 benign, 250 normal) breast US images were retrospectively collected from three institutions. A deep learning-based AI system for breast US was developed to localize abnormalities as heatmaps highlighting the area of abnormality with corresponding 1) AI score (0-100%) and 2) BI-RADS (category 1-5) assessment. Fifteen readers (6 radiologists, 6 clinicians, 3 radiographers) participated in the reader study and assessed each breast US image in terms of probability of malignancy (POM, 0-100%) and BI-RADS assessment. Readings were in two sessions, without AI vs. with AI, separated by 2 weeks for wash-out. Area under the receiver operating characteristic curve (AUC), sensitivity, and specificity were evaluated for multireader, multicase studies. Subgroup analysis was performed according to the level of experience (11 readers <5years, 4 readers =5 years of experience) in breast US.

**RESULTS**

Reader performances for detecting cancers measured by mean AUC for 1) POM increased 0.053 (95% CI: 0.032, 0.073, P<0.001), from 0.892 to 0.945, and 2) BI-RADS assessment increased 0.046 (95% confidence interval [CI]: 0.029, 0.063, P<0.001), from 0.891 to 0.937. Mean sensitivity was significantly increased from 85.3% without AI to 95.0% with AI (9.7%, 95% CI: 8.5%, 10.8%, P<0.001) while mean specificity was significantly decreased from 79.3% without AI to 76.5% with AI (-2.8%, 95% CI: -4.3%, -1.3%, P<0.001), respectively. Subgroup analysis showed that mean AUC of readers <5years of experience increased 0.058 (95% CI: 0.036, 0.079, P<0.001), from 0.873 to 0.937, but did not show significant differences for readers =5 years of experience, from 0.933 to 0.956 (P=0.091).

**CONCLUSION**

Using AI for decision support for assessing breast US images was found to improve the performances in a reader study demonstrating significant increase in AUC and sensitivity, with a tradeoff for decreased specificity. Less experienced readers had significantly increased AUC after using AI reaching the level of experienced readers, but not for experienced readers.

**CLINICAL RELEVANCE/APPLICATION**

Using a deep learning-based AI system for decision support for assessing breast US was found to improve the performances of readers of various medical professions. AI benefits less experienced readers by improving performances to the level of experienced readers, reflecting the potential of improved cancer detection when AI for breast US is incorporated for supplemental screening.

## T2-SPBR-5 AUTOMATIC CLASSIFICATION OF PUBERTAL BREAST SONOGRAPHY IN CHILDREN USING ARTIFICIAL INTELLIGENCE

Chao Geng (*Abstract Co-Author*) Nothing to Disclose
Li Yuan, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Accurate classification of the adolescent mammary gland is essential for assessing the developmental status of adolescent breasts. We propose a hybrid convolutional neural network (CNN)-Transformer model to enhance the automated classification of breast ultrasound images.

**METHODS AND MATERIALS**

A retrospective cohort of adolescent breast ultrasound images was assembled from a hospital database. The samples were randomly divided into a training(n=1676) and a testing(n=300) set. All images were categorized into five stages, the staging protocol is proposed based on a previous study, where different staging features of breast ultrasound correspond to respective Tanner stages (figure 1). The gold standard for classification was established by a highly experienced ultrasonographer. The classification performances of the proposed model StransXNet was assessed using accuracy, recall, precision, and specificity, and was compared with two alternative models; Swin-T and ResNet34. Furthermore, the model was compared with ultrasonographers of varying clinical experience and professional background: two resident physicians and two attending physicians, with accuracy as the classification performance evaluation metric.

**RESULTS**

The StransXNet model exhibited superior performance in the classification task relative to the other two models. The model achieved an accuracy of 0.880, a recall of 0.884, a precision of 0.880, and a specificity of 0.970. Furthermore, the model outperformed two resident physicians with respective accuracies of 0.727 and 0.730 and closely matched the proficiency of two attending physicians, with accuracies of 0.857 and 0.773.

**CONCLUSION**

The proposed StransXNet model demonstrated promising capabilities in classifying pubertal breast stages from ultrasound images, achieving high accuracy comparable to that of human ultrasonographers.

**CLINICAL RELEVANCE/APPLICATION**

The accurate evaluation of breast development is essential for diagnosing and monitoring various conditions that affect adolescents, especially in discerning between normal puberty and precocious puberty. Traditionally, the classification of pubertal breast stages has relied on subjective assessments by clinicians or ultrasonographers, which can vary in accuracy and consistency. The advent of our proposed model offers a standardized, efficient, and replicable method for breast tissue classification. By reducing inter- and intra-observer variability, our model contributes to reducing variability, facilitating standardized management practices, shortening the learning curve for physicians, and enhancing diagnostic accuracy.

## T2-SPBR-6 THE EFFECTIVENESS OF BREAST CANCER DIAGNOSTIC ASSISTANCE SOFTWARE (VIS-BUS) IN DETERMINING WHETHER LESIONS ON ULTRASOUND ARE BENIGN OR MALIGNANT, ADDS VALUE FOR THE BREAST RADIOLOGIST

Mijung Jang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoon Ah Do (*Abstract Co-Author*) Nothing to Disclose
Hunjong Lim, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Bo La Yun, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Soyeon Ahn (*Abstract Co-Author*) Nothing to Disclose
Sun M. Kim, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the value of computer-aided diagnosis (CAD) programs utilizing artificial intelligence (AI) for diagnosing and characterizing breast lesions on ultrasound (US), considering the radiologist's experience level.

**METHODS AND MATERIALS**

Transverse and longitudinal sets of US images of 258 breast masses from 258 women (from May 2010 to December 2016) were collected and retrospectively analyzed by AI-CAD (Vis-BUS, Barreleye, Seoul, Republic of Korea). AI-CAD provided the suspicion of the lesion (benign or suspicious), the likelihood of cancer on a scale from -100 (very low probability) to 100 (very high probability), and the region of interest (ROI). Four general radiologists and 1 experienced breast imaging radiologist reviewed images from all cases in two visits separated by a memory washout period of approximately 2 weeks. Each radiologist read the US during visit 1 without CAD results and the US plus CAD during visit 2. Radiologists also provided their assessment on the same scale, where negative values (-100 to 0) denote a lower likelihood (benign) and positive values (0 to 100) denote a higher likelihood (malignant) of cancer. The diagnostic performance and reading time of radiologists with or without CAD were evaluated.

**RESULTS**

Out of the 258 breast masses, 129 (50%) were malignant and 129 (50%) were benign. The sensitivity (91.5%-96.9% vs 94.6%-97.7%, respectively) and AUC (0.89-0.942 vs 0.937-0.974, respectively) were increased with CAD in all reviewers but statistically significant in the breast radiologist and 2 general radiologists in AUC ($p < 0.05$). The specificity (41.1%-73.6% vs 61.2%-81.4%, respectively), positive predictive value (62.2%-77.6% vs 71.6%-83.8%, respectively), and accuracy (69.0%-82.6% vs 79.5%-88.8%, respectively) were statistically significantly increased with CAD assistance in 4 general radiologists (all $P < .05$). The reading time (3.09 sec - 10.3 sec vs 2.37 sec - 6.78 sec) of all radiologists decreased with CAD but statistically significant in the breast radiologist and 2 general radiologists ($p < 0.05$).

**CONCLUSION**

The use of computer-aided diagnosis programs in breast ultrasound imaging significantly enhances diagnostic performance, especially in terms of sensitivity, specificity, and accuracy among general radiologists. Additionally, CAD reduces reading time for all radiologists, thereby improving efficiency in clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

These findings underscore the potential of CAD systems, integrated with artificial intelligence, to augment the diagnostic capabilities of radiologists, especially in breast imaging where accurate and timely diagnosis is crucial for patient care.

## T2-SPBR-7 OBESITY AND SARCOPENIA IN BREAST CANCER PROGNOSIS COULD BODY COMPOSITION ANALYSIS PREDICT THERAPEUTIC RESPONSE IN BREAST CANCER?

Federica Pediconi, MD (*Abstract Co-Author*) Nothing to Disclose
Francesca Galati, MD (*Abstract Co-Author*) Nothing to Disclose
Federica Cicciarelli, MD (*Abstract Co-Author*) Nothing to Disclose
Veronica Rizzo, MD (*Abstract Co-Author*) Nothing to Disclose
Roberto Maroncelli, MD (*Abstract Co-Author*) Nothing to Disclose
Marcella Pasculli, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the relationship between each individual body composition parameter (VAT, SAT, SMA, SMI) and the outcomes of patients with ER-positive/HER2-negative metastatic breast cancer treated with CDK 4/6 inhibitors, with the goal of defining their prognostic value.

**METHODS AND MATERIALS**

The design of our research is prospective. During the first semester of our study, we enrolled all of the patients. Mammography, ultrasound, and/or breast MRI were performed to assess breast lesions. The enrolled patients underwent a total body CT scan as part of the standard diagnostic protocol in methastatic disease. CT scanner (Somatom Sensation 64; Siemens Healthineers, Erlangen, Germany): Non contrast phase acquisition, Portal venous phase acquisition, Slice thickness 1-5 mm, 120 kvp. The baseline patients' CT scans were uploaded to the "Quantib, body composition" software, which automatically extracted the axial slice passing through the third lumbar vertebra. The software calculated the area of adipose tissue and muscle tissue based on the automated assessment of the different densities using the Hounsfield scale. According to the literature, a VAT area greater than 130 cm2 suggests obesity, while a SMI value less than 40 cm2/m2 indicates sarcopenia. Recist criteria were used to identify and classify the response to therapy in Progressive disease, stable disease, partial response and complete response.

**RESULTS**

52 patients met the inclusion and exclusion criteria. Of all the patients, 33 were obese, 30 were sarcopenic. 19 patients showed obesity and sarcopenia at the same time. After 6 months of therapy: 4 patients had a progressive disease, 13 patients a stable disease, 29 a partial response and 6 a complete response to treatment. Overall, 17 patients showed a poor response and 35 a good response to treatment. Statistical analysis demonstrated a significant correlation between skeletal muscle area and response to therapy.

**CONCLUSION**

In conclusion our study confirms the role of sarcopenia as a potential early predictor of prognosis in metastatic BC patients treated with CDK 4/6 inhibitors and that the evaluation of body composition may be useful in personalizing treatment approaches.

**CLINICAL RELEVANCE/APPLICATION**

to be useful in personalizing treatment approaches in metastatic BC patients.

## T2-SPBR-8 ENHANCING AI-BASED MULTI-VIEW MEDICAL IMAGE ANALYSIS WITH RANDOM TOKEN FUSION

Fredrik Strand, MD, PhD (*Abstract Co-Author*) Speaker, Lunit Inc
Kevin Smith, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Christos Matsoukas (*Abstract Co-Author*) Nothing to Disclose
Jingyu Guo (*Presenter*) Nothing to Disclose

**PURPOSE**

Artificial intelligence systems (AI CAD) must be able to effectively leverage complementary information from different views to minimize ambiguity. However, current AI-based methods for multi-view analysis often overfit to view-specific features, leading to suboptimal diagnostic performance. To address this issue, we propose a novel approach named Random Token Fusion (RTF), which encourages AI models to emulate the way physicians interpret scans, thereby improving diagnostic performance.

### METHODS AND MATERIALS

This retrospective study was performed on two public benchmark datasets: CBIS-DDSM for mammography and CheXpert for chest X-rays. We developed RTF as a model-agnostic training technique that can be integrated with existing multi-view fusion strategies in AI models. RTF randomly drops tokens (intermediate features) from different views during the fusion phase of training, encouraging the model to learn more generalized and robust representations across all views. We examined how area under the receiving operating characteristic curve (AUC) and region of interest (ROI) assessments by AI CAD were affected by training using RTF.

### RESULTS

In a study involving 708 mammography exams from 636 patients (46% malignant, 54% benign), AI CAD with RTF achieved an AUC of 0.811 (± 0.004), compared to 0.807 (± 0.003) without RTF. Additionally, in an analysis of 31,413 chest X-rays from 22,414 patients, annotated for 14 diagnostic observations, AI CAD with RTF demonstrated an average AUC of 0.848 (± 0.004), versus 0.841 (± 0.001) without RTF. In both cases, saliency maps revealed that RTF directly influences the ROIs of AI models, promoting a more comprehensive focus between views. Moreover, RTF generally improves the quality of intermediate representations, with increased attention on relevant areas.

### CONCLUSION

RTF can enhance the performance and improve diagnostic accuracy of AI models for multi-view medical image analysis. By encouraging models to integrate insights from multiple views, RTF contributes to more robust and informative representations, thereby increasing the trustworthiness of the models.

### CLINICAL RELEVANCE/APPLICATION

RTF enables AI CAD to effectively utilize information from multiple views. Our findings highlight the potential of RTF to advance AI-based medical diagnosis and support healthcare professionals in the clinical decision-making process.

## T2-SPBR-9 IMPROVEMENT OF MAMMOGRAPHY BREAST POSITIONING QUALITY SCORES WITH TECHNICAL REPEAT VIEWS

Julia Kay Harms (*Abstract Co-Author*) Nothing to Disclose
Robyn Letts (*Abstract Co-Author*) Nothing to Disclose
Melissa L. Hill, BEng, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the likelihood of improved mammography breast positioning quality score by technical repeat (TP).

### METHODS AND MATERIALS

We retrospectively identified two cohorts with negative 4-view screening mammograms for clients aged 47-73 from the OPTIMAM database (2 UK sites). No Repeat (NR) studies are controls relative to Same Day Repeat (SDR) cases with one paired original-repeated view, coded as a TP for technologist or client reasons. Volpara Imaging Software was used to evaluate breast volume (BV), Volpara Density Grades (VDG), compression pressure (CP), and breast positioning quality scores, according to Perfect, Good, Moderate, Inadequate (PGMI) classification. Univariate statistical analyses were performed to identify confounding variables between the NR and SDR groups; Coarsened exact matching yielded 827 NR and 1532 SDR studies. Study-level comparisons between NR and original SDR (before retake), and between NR and final SDR (includes repeated image) were performed. Paired analysis was carried out on Study PGMI between SDR original and final studies. Transition matrices compared paired unaccepted original (UO) and accepted final (AF) image-level PGMI scores. Conditional logistic regression was used to model the effect of image PGMI on an image being AF rather than UO using a simple and expanded model.

### RESULTS

Study-level comparison of SDR original and SDR final showed that the PGMI distribution changed significantly ($p<0.001$) with TP; 250 (19%) M-ranked studies improved to G, while only 1/1532 SDR studies reduced PGMI score ($p<0.001$). Final SDR studies displayed greater frequencies of M rankings compared to NR studies (OR=9.77, $p<0.05$). P and I frequencies were low across all groups. Image-level comparison between paired UO-AF images indicated significant changes in PGMI rankings ($p<2.2e-16$). Following repeat, at least half of P, G, and M did not change score, while 87% of I improved, (44% to M and 38% to G) only 4% of M and 6% of G reduced to I ($p<0.001$). Logistic regression confirmed this trend. As image PGMI reduces from P, the odds of an image being a repeat vs original drastically decrease (OR: G=0.47; M=0.098, I=0.015; $p<0.01$), indicating that repeat of lower score views is likely to result in quality improvement.

### CONCLUSION

Study-level mammogram PGMI was shown to be relatively stable in response to single-view TP, with a trend for quality improvement. In contrast, image-level PGMI is greatly sensitive to TP, with substantial net movement to a better quality score.

### CLINICAL RELEVANCE/APPLICATION

Automated PGMI scores show strong potential to inform technical repeat decisions. Low image-level PGMI scores, especially I, suggest a high probability that the positioning quality could be improved by technical repeat.

# Abstract Archives of the RSNA, 2024

T2-SPCA

**Cardiac Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPCA-1 ADJUSTING ATRIAL SIZE PARAMETERS FOR BODY SURFACE AREA: DOES IT AFFECT THE ASSOCIATION WITH PULMONARY EMBOLISM-RELATED ADVERSE EVENTS?

Diana Litmanovich, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Brook, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniela M. Tridente, MD (*Abstract Co-Author*) Nothing to Disclose
Antonio C. Monteiro Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Rachael Kirkbride, MBChB, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Jason Matos, MD (*Abstract Co-Author*) Nothing to Disclose
Rokas Liubauskas, MD (*Abstract Co-Author*) Nothing to Disclose
Warren J. Manning, MD (*Abstract Co-Author*) Nothing to Disclose
Galit Aviram, MD (*Abstract Co-Author*) Nothing to Disclose
Benedikt H. Heidinger, MD (*Abstract Co-Author*) Nothing to Disclose
Brett Carroll, MD (*Abstract Co-Author*) Research Consultant, Reliant Medical;Research Grant, Bristol Meyers Squibb
Yuval Liberman, MD, MMedSc (*Presenter*) Nothing to Disclose

### PURPOSE

Small left atrial (LA) volume was recently reported to be one of the best predictors of acute pulmonary embolism (PE)-related adverse events (AE). There is currently no data available regarding the impact that body surface area (BSA)-indexing of atrial measurements has on the association with PE-related adverse events. Our aim is to assess the impact of indexing atrial measurements to BSA on the association between computed tomography (CT) atrial measurements and AE.

### METHODS AND MATERIALS

Retrospective study (IRB: 2015P000425). A database of hospitalized patients with acute PE diagnosed on CT pulmonary angiography (CTPA) between May 2007 and December 2014 was reviewed. Right and left atrial volume, largest axial area, and axial diameters were measured. Patients undergo both echocardiographies (from which the BSA was extracted) and CTPAs within 48 hours of the procedure. The patient's body weight was measured during each admission. LA measurements were correlated to AE (defined as the need for advanced therapy or PE-related mortality at 30 days) before and after indexing for BSA. The area under the ROC curve was calculated to determine the predictive value of the atrial measurements in predicting AE.

### RESULTS

The study included 490 acute PE patients; 62 (12.7%) had AE. There was a significant association of reduced BSA-indexed and non-indexed LA volume (both <0.001), area (<0.001 and 0.001, respectively), and short-axis diameters (both <0.001), and their respective RA/LA ratios (all <0.001) with AE. The AUC values were similar for BSA-indexed and non-indexed LA volume, diameters, and area with LA volume measurements being the best predictor of adverse outcomes (BSA-indexed AUC=0.68 and non-indexed AUC=0.66), followed by non-indexed LA short-axis diameter (indexed AUC=0.65, non-indexed AUC=0.64), and LA area (indexed AUC=0.64, non-indexed AUC=0.63).

### CONCLUSION

Adjusting for BSA does not substantially affect the predictive ability of atrial measurements on 30-day PE-related adverse events, and therefore, this adjustment is not necessary in clinical practice. While LA volume is the better predictor of AE, LA short-axis diameter has a similar predictive value and is more practical to perform clinically.

### CLINICAL RELEVANCE/APPLICATION

Adjusting for BSA does not substantially affect the predictive ability of atrial measurements on 30-day PE-related adverse events, and therefore, this adjustment is not necessary in clinical practice.

## T2-SPCA-10 PRELIMINARY STUDY OF CMR COMBINED WITH MYOCARDIAL STRAIN IMAGING FOR LEFT ATRIAL FIBROSIS ASSESSMENT IN ATRIAL FIBRILLATION PATIENTS

Fuhua Yan, MS (*Abstract Co-Author*) Nothing to Disclose
Lahu Like (*Abstract Co-Author*) Nothing to Disclose
Wenjie Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Haipeng Dong (*Abstract Co-Author*) Nothing to Disclose
Peng Wu (*Abstract Co-Author*) Nothing to Disclose
Huanhuan Chong (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the effectiveness of 3D-LGE CMR and strain techniques for assessing left atrial (LA) fibrosis in paroxysmal or persistent atrial fibrillation (AF; PaAF, PeAF).

**METHODS AND MATERIALS**

80 patients with PaAF and PeAF who were scheduled for ablation from January 2022 to May 2023 at our institution were retrospectively enrolled. LA storage function, conduit function, booster pump function, total strain (es), passive strain (ee), active strain (ea), and corresponding strain rates (SRs, SRe, SRa) were analyzed. The extent and degree of LA wall enhancement were quantitatively analyzed using the ratio of signal intensity between the LA wall and blood pool (IIR) as a reference. Independent t-tests, Mann-Whitney U tests, and multivariate logistic regression were used to stratify AF categories and develop models.

**RESULTS**

Compared to PaAF, PeAF exhibited significantly increased total volume, sphericity, end-diastolic volume, and end-systolic volume ($P<0.05$). LA storage function, conduit function, booster pump function, es, ee, ea, SRs, SRe, and SRa were significantly reduced in PeAF ($P<0.001$). In the 20-minute and 30-minute 3D-LGE sequences, the PeAF group displayed a higher area and proportion of enhanced myocardium (IIR > 1.2), scar tissue (IIR > 1.32), and interstitial fibrosis (IIR 1.2~1.32) compared to the PaAF group. Multivariate logistic regression revealed that in the clinical subgroup, BMI (OR 1.195, $P=0.012$) and CHA2DS2-VASc score (OR 1.471, $P=0.008$) were independent risk factors for PeAF, yielding an AUC of 0.753 ($P<0.001$). In the myocardial strain subgroup, es (OR 0.749, $P<0.001$) and LA conduit function (OR 1.079, $P=0.038$) were independent predictors of AF classification (AUC=0.927, $P<0.001$). In the 3D-LGE subgroup, the 20-minute LA enhancement total area (OR 1.080, $P<0.001$) and interstitial fibrosis percentage (OR 1.377, $P<0.001$) were independent risk factors for stratifying PeAF and PaAF (AUC=0.933, $P<0.001$). After integrating the aforementioned parameters, the comprehensive model achieved an AUC of 0.957 ($P<0.001$), with ea (OR 0.709, $P=0.024$) and 30-minute LA enhancement total area (OR 1.060, $P=0.005$) as independent predictors.

**CONCLUSION**

Preoperative 3D-LGE CMR with strain techniques can provide a quantitative and visual assessment of LAF, offering crucial imaging evidence for surgical planning and intraoperative electrophysiological navigation fusion.

**CLINICAL RELEVANCE/APPLICATION**

Our research provides a promising imaging tool for the management of AF patients, with potential translational applications focused on quantitatively and visually assessing LA function and structural remodeling, personalizing treatment, and enabling long-term monitoring.

## T2-SPCA-5 RIGHT VENTRICULAR FUNCTION PREDICTS OUTCOME IN HEART FAILURE WITH PRESERVED EJECTION FRACTION: STRAIN ANALYSIS DERIVED FROM MR FEATURE-TRACKING

Jian He, MD (*Abstract Co-Author*) Nothing to Disclose
Shihua Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Minjie Lu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leyi Zhu (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the association between right ventricular (RV) strain parameters derived from cardiac magnetic resonance feature tracking (CMR-FT) and adverse outcomes in patients with heart failure with preserved ejection fraction (HFpEF).

**METHODS AND MATERIALS**

Patients with HFpEF who underwent CMR examination from January 2010 to December 2018 were retrospectively enrolled. FT strain analysis was performed to measure left ventricular (LV), left atrial (LA), and RV strain parameters. The primary endpoint was all-cause death, and the secondary endpoint was cardiovascular death. The association between variables and clinical outcomes was assessed by Cox proportional regression and receiver operating characteristic analysis.

**RESULTS**

A total of 1170 consecutive patients with HFpEF (age 56.7±12.2 years; 70% male) were enrolled in this study. During a median follow-up of 7.3 years (interquartile range, 5.2-10.1 years), 128 (10.9%) patients reached the primary endpoint, and 111 (9.5%) patients reached the secondary endpoint. In multivariable Cox regression analysis, RV global longitudinal strain (RV-GLS) and RV global circumferential strain (RV-GCS) were independent predictors for the primary endpoint (hazard ratio [HR] per 1% increase, 1.08 [95% CI: 1.02, 1.14; P = .007] and 1.11 [95% CI: 1.02, 1.21; P = .017], respectively) and for the secondary endpoint (HR per 1% increase, 1.09 [95% CI: 1.03, 1.17; P = .006] and 1.12 [95% CI: 1.02, 1.23; P = .016], respectively), whereas LV-GLS was not for either endpoint. The full model (Model 3) based on clinical, conventional imaging, and RV strain (RV-GLS and RV-GCS) variables for the primary endpoint improved the discrimination ability (C-index = 0.785) compared with Model 1 based solely on clinical variables (C-index = 0.708, P < .001) and Model 2 incorporating clinical variables and left atrial volume index (C-index = 0.746, P < .001). In receiver operating characteristic analysis for the primary endpoint, the addition of left atrial volume index and RV strain (RV-GLS and RV-GCS) yielded an improved area under the curve of 0.793 for Model 1 (P < .05).

**CONCLUSION**

RV-GLS and RV-GCS derived from CMR-FT were independent predictors for adverse clinical outcomes in patients with HFpEF, providing incremental prognostic value over traditional clinical and CMR-derived risk markers.

**CLINICAL RELEVANCE/APPLICATION**

RV strain analysis derived from CMR-FT into the assessment of patients with HFpEF shows promise in improving risk stratification beyond traditional risk markers. The current study provides supplementary insights into the prognostic value of RV dysfunction evaluated by CMR-FT in patients with HFpEF.

# Abstract Archives of the RSNA, 2024

T2-SPCH

**Chest Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPCH-1 LUNG CANCER SCREENING CT TEMPLATE WITH STRUCTURED FIELDS FOR LIVER AND VERTEBRAL BODY ATTENUATION IMPROVES HEPATIC STEATOSIS, OSTEOPENIA, AND OSTEOPOROSIS REPORTING RATES

Arun Krishnaraj, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Tyler Foley, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Cross-sectional imaging often includes valuable information unrelated to the study indication. Leveraging this additional data for patient benefit is known as opportunistic screening. Three findings which can be noted on low-dose computed tomography (LDCT) of the chest are hepatic steatosis, osteopenia, and osteoporosis. It is unknown how frequently these diagnoses are reported in practice. The aim of this study was to determine if there is a gap between prevalence and reporting of the aforementioned findings on lung cancer screening CTs.

### METHODS AND MATERIALS

One year of LDCTs obtained at a large academic center were reviewed for the presence of hepatic steatosis, osteopenia, and osteoporosis. Liver attenuation was measured in four regions on an axial slice, then averaged. Hepatic steatosis was defined as an average attenuation of <40 Hounsfield units (HU). L1 vertebral body attenuation on an axial slice was measured, with osteopenia defined as 100-130 HU and osteoporosis <100 HU. Reports of each CT were analyzed for inclusion of “steatosis,” “osteopenia,” or “osteoporosis.” After acquisition of baseline data, a modified lung cancer screening CT report template including structured fields for liver and L1 vertebral body attenuation was disseminated. Data was then collected for three months after template distribution.

### RESULTS

In the pre-intervention period (August 2022-July 2023), 1,926 LDCTs were analyzed. The post-intervention group included 632 scans between February-April 2024. Patient demographics and prevalence of steatosis, osteopenia, and osteoporosis were similar between the two groups. Of all cases in which steatosis was present, 19.8% were identified using the standard reporting template. Using the modified template, 85.7% ($p<0.001$) of reports included steatosis when present. Similarly, reporting of osteopenia improved from 0.7% to 41.4% ($p<0.001$), and osteoporosis from 0% to 48.8% ($p<0.001$).

### CONCLUSION

Hepatic steatosis, osteopenia, and osteoporosis are not consistently reported when present on lung cancer screening LDCTs. Templates with structured fields to measure liver and L1 vertebral body attenuation markedly increased radiologist reporting of these findings.

### CLINICAL RELEVANCE/APPLICATION

Though time-intensive, manual measurement of liver and vertebral attenuation on LDCT can provide useful information to patients. Validated artificial intelligence tools capable of detecting steatosis, osteopenia, and osteoporosis without radiologist input could improve the consistency with which these findings are reported.

## T2-SPCH-2 PERFORMANCES OF AN END-TO-END AI/ML CADE/CADX SAMD FOR NODULE DETECTION AND CHARACTERIZATION IN LUNG CANCER SCREENING ON INDEPENDENT COHORT AND COMPARISON TO RADIOLOGISTS

Benoit HUET, PhD (*Abstract Co-Author*) Nothing to Disclose
Danny Francis (*Abstract Co-Author*) Nothing to Disclose
Van Khoa LE (*Abstract Co-Author*) Nothing to Disclose
Benjamin Renoust (*Abstract Co-Author*) Nothing to Disclose
Ezequiel Geremia (*Abstract Co-Author*) Nothing to Disclose
Pierre-Henri Siot (*Abstract Co-Author*) Nothing to Disclose
Gwendoline De Bie (*Abstract Co-Author*) Nothing to Disclose
Charels Voyton, PhD (*Abstract Co-Author*) Employee, Median Technologies
Pierre Baudot, PhD (*Presenter*) Employee, MEDIAN Technologies

### PURPOSE

The detection and characterization of pulmonary nodules during lung cancer screening is challenging. We introduce a new AI model for computer-aided detection and characterization (CADe/CADx) to improve Lung Cancer Screening (LCS). We compare its performances against both radiologists and Lung-RADs, and evaluate it on an independent cohort.

**METHODS AND MATERIALS**

The model was trained on 10,872 patients from NLST and LIDC datasets. Diagnosis criteria included up to 6-years stability follow-up for benign nodules and histopathology proof for cancer. The model comprises 3D-CNN detection models for nodule localization and large parallel ensembles of 3D-CNNs, 2D-CNNs, radiomics-based classifiers and full-CT 3D-CNNs for malignancy risk prediction. Performances are evaluated on NLST test set (n=2,163, 136 cancers), a subset assessed by 4 groups of Chest CT radiologists, on a nodule detection and malignancy LIDC-like rating task1 (n=485, 136 cancers), and a subset with Lung-RADs1.1 assessment by 6 radiologists2 with prior time point CT information (n=404). Evaluation on an independent cohort is conducted on 264 patients (88 cancers) collected from US and European sites.

**RESULTS**

On NLST test set, patient-level AUC-ROC was 0.979 (CI 95% [0.972 0.986], 5000 bootstraps). At lesion level, FROC exhibits 0.57 FP/scan for a sensitivity of 95.9%. For the subset assessed by radiologists, mean AUC-ROC was 0.974 (CI [0.968 0.979]) compared to radiologists' mean AUC-ROC of 0.889 (CI [0.872 0.905]). Welch t-test showed significant superiority of our AI model over radiologists ($p<0.0001$). The model outperforms readers on each nodule size subgroups: in [4,10]mm range, model's mean AUC is 0.924[0.881, 0.959] vs. reader's 0.747[0.627, 0.856]; in [10,20]mm range, 0.95 vs. 0.877; in [20,30]mm range, 0.98 vs. 0.882. Lung-RADs scores had a mean AUC-ROC of 0.882 (CI [0.862 0.901]), significantly lower than our AI model ($p<0.0001$). On the independent cohort, patient-level AUC-ROC was 0.953 (CI 95% Hanley [0.922-0.985]).

**CONCLUSION**

Our AI model demonstrates high performance in detecting and predicting malignancy risk on LCS populations with a single LDCT. This result is reproductible on an independent cohort. It significantly outperforms Chest CT radiologists and Lung-RADS that use prior CT informations.

**CLINICAL RELEVANCE/APPLICATION**

The model's reliable nodule detection and malignancy risk predictions on a single timepoint could enhance LCS clinicians' clinical routines and patient management on their very first screening visit. 1. Armato, S. G. et al. Med. Phys. 38, 915-931 (2011). 2. Ardila, D. et al. Nat. Med. 25, 954-961 (2019).

## T2-SPCH-4 UTILIZING MULTI-CONDITIONAL GENERATIVE MODEL TO PREDICT LUNG NODULE APPEARANCE IN FOLLOW-UP CT SCANS FOR IMPROVEMENT OF EARLY DIAGNOSIS OF LUNG CANCER AT BASELINE SCREENING

Lubomir M. Hadjiiski, PhD (*Abstract Co-Author*) Nothing to Disclose
Chuan Zhou, PhD (*Abstract Co-Author*) Scientific Advisory Board, Perception Vision Medical Technology Co., Ltd
Lei Ying (*Abstract Co-Author*) Nothing to Disclose
Ella A. Kazerooni, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Heang-Ping Chan, PhD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Yifan Wang, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a deep learning generative model to predict lung nodule appearance in follow-up CT exam using information from baseline screening LDCT scan and study its feasibility of improving early diagnosis of lung cancer at baseline.

**METHODS AND MATERIALS**

We developed a new multi-conditional Wasserstein Generative Adversarial Network (mcWGAN) model to predict nodule progression in follow-up screening CT scans. From the National Lung Screening Trial (NLST) database, we randomly selected 776 patients containing 1121 pairs of nodules (223 malignant and 898 benign) from baseline and up to 2-year annual follow-up LDCT exams to train the mcWGAN model. The model was trained to simultaneously predict nodule size and synthesize a corresponding image of the nodule that would appear in the follow-up CT scans using the learned nodule progression path. The patient's demographics (age, sex, etc.) and radiographic risk factors provided by radiologists (nodule size, attenuation, etc.) were used as the conditional input to enhance the relevance and effectiveness for predicting the nodule size and to improve the accuracy in the synthesis of pixel-wise nodule image in the follow-up CT scan. The trained mcWGAN model was deployed to an independent test set of 450 baseline LDCT scans (53 malignant and 397 benign) from 450 patients. The predicted follow-up nodule image was input to our previously developed Lung Cancer Risk Prediction model (LCRP) to estimate the likelihood of malignancy of the nodule. The predicted follow-up nodule size was used as one of the inputs to the Brock model to simulate the clinical assessment of nodule malignancy.

**RESULTS**

For classification of mcWGAN-predicted follow-up lung nodules from the baseline CT scans, the LCRP model achieved a test AUC of 0.841±0.025, which was significantly higher than that using the baseline nodule image (AUC: 0.801±0.029, p=.03) and comparable to that using the real follow-up nodule image (AUC: 0.874±0.024, p=.13). In addition, the performance of the Brock model improved when using the mcWGAN-predicted nodule size (AUC: 0.782±0.029, p=.03) compared to using the size of the baseline nodule (AUC: 0.750±0.034, p=.14), but was lower than using the size of the real follow-up nodule (AUC: 0.844±0.028, p=.02).

**CONCLUSION**

Using the follow-up nodule image and size predicted by our mcWGAN model at baseline screening, the diagnostic accuracies of both the LCRP and Brock models were improved compared to that with the baseline nodules.

**CLINICAL RELEVANCE/APPLICATION**

Using baseline exams to predict the nodule size and its image appearance in future LDCT exams has the potential to improve early diagnosis of lung cancer and also provide radiologists with a "virtual" visualization of nodules at follow-up exams.

## T2-SPCH-5 CANARY IN THE COAL MINE: LESSONS FROM THE ANCILLARY FINDINGS OF LUNG SCREENERS

Elizabeth K. Proffitt, MD (*Abstract Co-Author*) Nothing to Disclose
Susan K. Hobbs, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vivek Batra, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of the study is to investigate the utilization of new significant cardiovascular findings on lung cancer screening CT for initiation or adjustment of cardiovascular medications.

### METHODS AND MATERIALS

Using retrospective design and two independent databases, TriNetX and Nuance Empower, patients who underwent a lung cancer screening study between March 1, 2020, to June 30, 2023, with ages between 50-89 years old were identified in a large health network. Patients with pre-existing versus new chronic ischemic heart disease based on the lung screening report were tabulated in conjunction with Lung-RADS modifier S. Data on initiation of antiplatelets, anti-hypertensive or cholesterol lowering medications in the six months after the lung screening study was collected in the patients who had new cardiac findings.

### RESULTS

Using TriNetX database, 15,060 patients had lung screening performed in the health network during the study period. 3170 had pre-existing ischemic heart disease, and 550 had new coronary artery calcification (CAC) identified within six months of completion of the lung screening CT. 320 out of the 550 patients who had been diagnosed with new CAC were on a cardiac mediation, and 70 out of the 550 patients were started on a new cardiac medication within six months after completion of the lung screening CT. The Nuance Empower database generated 19,423 patients. Patients with moderate and severe coronary disease was 2334 and 1077 respectively (total 3411). Modifier S was used in 1669, and modifier S along with moderate or severe coronary artery disease was used in approximately 668 patients. The burden of pre-existing ischemic heart disease is 21% using TriNetX and 17.6% using Nuance Empower in the patients undergoing lung screening CT. About 3.6% and 3.4% patients had new (or significant) moderate or severe coronary artery disease in the TriNetX and Nuance Empower respectively. Only 58% of the patients who were diagnosed with new (or significant) moderate or severe coronary artery disease were on a cardiac medication within six months after completion of the study. Only 12.7 % of the patients who were diagnosed with new (or significant) moderate or severe coronary artery disease were started on a new cardiac medication within six months after completion of the study.

### CONCLUSION

Cardiovascular disease has significant morbidity and mortality and is undertreated. Using CT lung screening report CAC documentation, radiologists play a role in management of patients who may not have been treated otherwise.

### CLINICAL RELEVANCE/APPLICATION

CT lung cancer screening CAC results could have far-reaching effects on decreasing morbidity and mortality from cardiovascular events.

## T2-SPCH-6 PREDICTING INVASIVENESS OF GROUND-GLASS NODULES IN PULMONARY ADENOCARCINOMA USING DEEP LEARNING AND RADIOMICS-BASED MULTI-INSTANCE LEARNING

Jing Shen, MD (*Abstract Co-Author*) Nothing to Disclose
Jianlin Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Hai Du (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the diagnostic efficacy of preoperative CT prediction of invasive lesions in appearing as GGN lung adenocarcinomas using a combined model by both radiomics and deep learning features through multi-instance learning (MIL).

### METHODS AND MATERIALS

A retrospective analysis was conducted on preoperative chest CT images of appearing as GGN lung adenocarcinomas surgically resected and a total 1182 cases with 1247 GGNs were recruited. Two different models were established based on postoperative pathological results, distinguishing the invasive group (IAC) from the non-invasive group (AAH, AIS, MIA): (1) Standalone Radiomics Model Radiomics features were extracted using the Pyradiomics tool. (2) Radiomics and Deep Learning Joint Model (MIL-DL-Rad).These features were fused using multi-instance learning after dimensionality reduction and input into machine learning models (RF, ExtraTrees, XGBoost, LightGBM) to construct the optimal MIL-DL-Rad model.The predictive performance of the standalone radiomics model and the MIL-DL-Rad model which best suited the machine learning model were compared. ROC curves were used to evaluate these models, with AUC values compared for diagnostic efficacy. Calibration curves were used to assess discriminative ability and calibration.

### RESULTS

A total of 1247 GGNs the invasive group consisted of 841 cases (67.44%), the non-invasive group comprised 406 cases (32.56%). Results showed statistically significant differences ($P<0.001$) between the invasive and non-invasive groups in terms of age, volume, maximum diameter, minimum diameter, mean diameter, and CT value, while gender differences were also observed ($P<0.005$). The radiomics model based on ExtraTrees showed balanced performance in the test_qd, test_dl, and test_zjg test sets, with AUC values of 0.828, 0.936, and 0.914, respectively. In the MIL-DL-Rad model, the ExtraTrees model performed the best, with AUC values of 0.868, 0.926, and 0.918 in the three test sets.

### CONCLUSION

The combined model developed by both radiomics and deep learning features using multiple instance learning shows superior overall performance and discriminative capability compared to traditional radiomics models in predicting the invasiveness of pulmonary adenocarcinoma which appearing as GGN, offering a new perspective on feature fusion.

### CLINICAL RELEVANCE/APPLICATION

Radiomics and deep learning features using multiple instance learning shows superior overall performance and discriminative capability compared to traditional radiomics models in predicting the invasiveness of pulmonary adenocarcinoma which appearing as GGN.

## T2-SPCH-7 THE VALUE OF CT-BASED RADIOMICS FOR PREDICTING VISCERAL PLEURAL INVASION IN EARLY-STAGE NON-SMALL CELL LUNG CANCER

Heshui Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Shen Gui (*Abstract Co-Author*) Nothing to Disclose
Qinyue Luo (*Presenter*) Nothing to Disclose

### PURPOSE

The presence of visceral pleural invasion (VPI) upstages tumors =3 cm from T1 to T2a in the eighth edition of the tumor-node-metastasis (TNM) staging system. This study aimed to develop and validate a CT-based radiomics model for preoperative prediction of VPI in early-stage non-small cell lung cancer (NSCLC).

## METHODS AND MATERIALS

We retrospectively enrolled 461 patients with histologically proven stage IA (T1N0M0) and stage IIA (T1N1M0) NSCLC from December 2019 to June 2022. Patients were divided into a training set (n=295), a validation set (n=127) and a testing set (n=39) at a ratio of 6:3:1. On all CT images, densities of nodules (pure ground-glass opacity [pGGO], mixed GGO [mGGO] and solid), five types of tumor pleura relationships (type I-V) were recorded. Region of interest (ROI) segmentation was performed semi-automatically. Radiomics features were extracted from CT images. The least absolute shrinkage and selection operator (LASSO) was applied to select radiomics features and construct a radscore. We built three predictive models (clinical model, radiomics model and combined model) based on CT features, selected radiomics features and the combination of CT features and radiomics features, respectively. The predictive performances of these three models were assessed by the area under the receiver operating characteristic curve (AUC).

## RESULTS

A total of 1291 radiomics features were extracted, and 14 optimal features were selected to construct the radiomics model. The AUC of the radiomics model was 0.843, 0.705 and 0.813 in the training, validation and testing sets. Furthermore, seven CT features were selected by multivariable logistic regression (LR) to construct the clinical model. The clinical model achieved good performance with an AUC of 0.855, 0.717 and 0.841 in the three sets. Compared with the clinical model and radiomics model, the combined model showed higher AUC (0.938 in the training set, 95% CI: 0.907-0.969; 0.924 in the validation set, 95% CI: 0.8228-1.00; 0.935 in the testing set, 95% CI: 0.889-0.980) and greater net benefit to patients.

## CONCLUSION

The CT-based radiomics model demonstrated satisfactory diagnostic performance in early-stage NSCLC for preoperatively predicting VPI, with superiority to the clinical model.

## CLINICAL RELEVANCE/APPLICATION

VPI is a known indicator of poor prognosis in NSCLC, and preoperative detection of VPI could assist in choosing an appropriate surgery type. Combining CT features with radiomics is a valuable approach for preoperative prediction of VPI, it could provide more imaging support for clinical diagnosis and treatment strategy formulation of VPI.

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# Abstract Archives of the RSNA, 2024

T2-SPER

**Emergency Radiology Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPER-1 CT IMAGING IN THE EMERGENCY DEPARTMENT TO EVALUATE ABDOMINAL PAIN IN PATIENTS REPORTING INTIMATE PARTNER VIOLENCE

Bharti Khurana, MD, MBA (*Abstract Co-Author*) Consultant, General Electric Company;Editor, Wolters Kluwer nv;Author, Cambridge University Press;Consultant, ROKIT Healthcare, Inc
Patrick Lenehan, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Intimate partner violence (IPV) is associated with physical health consequences including abdominal and pelvic pain, but the radiologic manifestations of these pain syndromes have not been studied. Here we investigate the use of and reported findings on CT imaging in patients reporting IPV who presented to the emergency department (ED) with abdominal pain.

### METHODS AND MATERIALS

Cases (N = 254) were defined as females who reported physical IPV to our institution's violence prevention support program and underwent at least one imaging study in the ED. Controls (N = 377) were age- and race-matched females who have never reported IPV but also underwent at least one imaging study in the ED. From a total of 8,746 ED imaging studies, we identified 102 abdominal CT studies that were performed to evaluate pain. A retrospective review of the corresponding reports was performed to determine whether a radiologic explanation for the pain was identified. The proportions of patients undergoing abdominal CT to evaluate pain were compared with a crude odds ratio and Fisher exact test. Logistic regression was used to compare the proportions of studies with findings that could explain the reported pain, with adjustment for age at the time of the study.

### RESULTS

Abdominal CT to evaluate pain was performed at least once for 32 of 254 (12.6%) cases versus 25 of 377 (6.6%) controls (OR: 2.0; 95CI 1.1, 3.7, p=0.02). It comprised 4.4% (60/1377) and 6.7% (42/626) of all ED imaging studies for cases and controls, respectively (OR: 0.64; 95CI 0.41, 0.98; p=0.03). Radiologists indicated the absence of acute pathology or findings that explain the patient's pain in 37 of 60 (62%) studies for cases versus 16 of 42 (38%) studies for controls (aOR: 2.5; 95CI 1.1, 5.8; p=0.026). Explicit documentation that CT findings could not explain the abdominal pain was observed for 52% of case studies versus 17% of control studies (aOR: 5.1; 95CI 2.0, 14.3; p<0.001).

### CONCLUSION

This study reveals a higher incidence of unexplained abdominal pain on ED CT scans among patients reporting IPV compared to controls, highlighting potential dysregulation of the gut-brain axis.

### CLINICAL RELEVANCE/APPLICATION

Awareness by ED radiologists and providers that negative CT results do not negate the presence of pain is critical to ensure a compassionate and equitable approach to diagnosing and treating patients who have experienced IPV.

## T2-SPER-2 EXAMINATION OF EARLY PROGNOSIS OF TYPE A AORTIC DISSECTION: CORRELATION WITH PULMONARY ARTERY ADVENTITIAL HEMATOMA DUE TO RUPTURED TYPE A AORTIC DISSECTION AND EARLY DEATH

Eijun Sueyoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Ryo Toya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hirofumi Koike (*Presenter*) Nothing to Disclose

### PURPOSE

Pulmonary artery adventitial hematoma (PAAH) due to ruptured type A aortic dissection (AD) can occur and has been reported to correlate with prognosis. However, PAAH due to ruptured type A AD with early death has not yet been fully elucidated.This study aimed to evaluate the relationship between PAAH and early prognosis in type A AD patients.

### METHODS AND MATERIALS

We retrospectively studied 344 type A AD patients in our institution from April 2008 to November 2023. Patients were divided into those who died within 1 week of onset (early death group; n = 33, 9.6%) and those who survived (alive group; n = 311, 90.4%). We analyzed the relationship between CT findings including PAAH and early death. PAAH was classified into three stages on the basis of CT findings: Stage 1, PAAH only in the mediastinum; Stage 2, PAAH that extended into the lung field (changes in only lung segments with PAAH); and Stage 3, blood in the alveoli beyond the tissue surrounding the pulmonary artery (changes beyond lung segments with PAAH).

## RESULTS

Compared with the alive group, the early death group had higher rates of PAAH ($P = 0.002$), Stage 3 PAAH ($P < 0.001$), pericardial hemorrhage ($P = 0.001$), mediastinal hemorrhage ($P < 0.001$), hemothorax ($P < 0.001$), renal ischemia ($P = 0.002$), limb ischemia ($P = 0.001$), and myocardial ischemia ($P = 0.004$). In the multivariable analysis, stage 3 PAAH, limb ischemia, and myocardial ischemia were significant risk factors for early death ($P < 0.001$, $P = 0.022$, and $P = 0.001$, respectively).

## CONCLUSION

Stage 3 PAAH was one of significant risk factors for early death in patients with type A AD.

## CLINICAL RELEVANCE/APPLICATION

The results of this study are clinically important for clinicians and radiologists who encounter patients with Stanford type A AD. We can detect Stage 3 PAAH as a risk factor for early death. However, we may misdiagnose Stage 3 PAAH as pneumonia or pulmonary edema if we do not understand PAAH because pulmonary hemorrhage with stage 3 PAAH sometimes mimic those in CT.

# Abstract Archives of the RSNA, 2024

T2-SPGI

**Gastrointestinal Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPGI-1 SPECTRAL CT-BASED NOMOGRAM FOR PREOPERATIVE PREDICTION OF LAUREN CLASSIFICATION IN LOCALLY ADVANCED GASTRIC CANCER: A PROSPECTIVE STUDY

Zhao Xiang Ye, PhD (*Abstract Co-Author*) Nothing to Disclose
Rongji Gao (*Abstract Co-Author*) Nothing to Disclose
Xiao Mei Lu, MMed (*Abstract Co-Author*) Nothing to Disclose
Juan Zhang (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a nomogram based on clinical features and spectral quantitative parameters to preoperatively predict the Lauren classification for locally advanced gastric cancer (LAGC).

### METHODS AND MATERIALS

Patients diagnosed with LAGC by postoperative pathology who underwent abdominal triple-phase enhanced spectral computed tomography (CT) were prospectively enrolled in this study between June 2023 and December 2023. All the patients were categorized into intestinal- and diffuse-type group according to the Lauren classification. Traditional characteristics, including demographic information, serum tumor markers, gastroscopic pathology, and image semantic features, were collected. Spectral quantitative parameters, including iodine concentration (IC), normalized iodine concentration (nIC), effective atomic number (Zeff), normalized effective atomic number (nZeff), and slope of the energy spectrum curve from 40 keV to 70 keV (?), were measured three times for each patient by two blinded radiologists in arterial/venous/delayed phases (AP/VP/DP). Differences in traditional features and spectral quantitative parameters between the two groups were compared using univariable analysis. Independent predictors of the Lauren classification of LAGC were screened using multivariable logistic regression analysis. Receiver operating characteristic (ROC) curve analysis was used to assess the discriminating capability. Ultimately, the nomogram including clinical features and spectral CT quantitative parameters was developed.

### RESULTS

Gender, nIC in AP (APnIC), and ? in DP (?d) were independent predictors for Lauren classification. The nomogram based on these indicators produced the best performance with an area under the curve of 0.841 (95% confidence interval: 0.749~0.932), specificity of 85.3%, accuracy of 76.4%, and sensitivity of 68.4%.

### CONCLUSION

The nomogram based on clinical features and spectral CT quantitative parameters exhibits great potential in the preoperative and non-invasive assessment of Lauren classification for LAGC.

### CLINICAL RELEVANCE/APPLICATION

Through the spectral CT-based nomogram, the preoperative prediction of the Lauren classification in LAGC can not only help physicians guide the appalication of chemotherapy before or after surgery, but also help surgeons detremine the range of surgical resection.

## T2-SPGI-10 COMPARISONS OF FLUOROSCOPY PULSE RATES (15 PULSES/SECOND V.S. 7.5 PULSES/SECOND) IN PANCREATICOBILIARY INTERVENTIONS: CLINICAL RETROSPECTIVE ANALYSIS

Tatsuya Sato (*Abstract Co-Author*) Nothing to Disclose
Osamu Abe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Katsuyuki Tabei (*Abstract Co-Author*) Nothing to Disclose
Toshikazu Imae (*Abstract Co-Author*) Nothing to Disclose
Saori Koshino, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Naminatsu Takahara (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Sakai, MSc, RT (*Presenter*) Nothing to Disclose

### PURPOSE

Radiation exposure is a significant concern for both patients and operators during endoscopic and percutaneous interventions such as endoscopic retrograde cholangiopancreatography (ERCP) and percutaneous transhepatic biliary drainage (PTBD) for pancreaticobiliary diseases. However, there is limited evidence regarding the radiation dose necessary to achieve sufficient imaging quality for ensuring appropriate diagnosis and therapeutic intervention. Optimization of fluoroscopy pulse rate is an effective technique for radiation dose reduction. Our purpose was to retrospectively compare fluoroscopy dose and fluoroscopy time using 15 pulses/second (p/s) with those using 7.5 p/s and to pursue the feasibility of pancreaticobiliary interventions in low-dose radiation.

**METHODS AND MATERIALS**

The institutional review board approved the clinical retrospective analysis. We extracted pancreaticobiliary interventions including ERCP, PTBD, balloon-assisted endoscope-guided ERCP (BAE-ERCP), interventional endoscopic ultrasonography (EUS), and endoscopic gastrointestinal stentings using 15 p/s fluoroscopy (from March 26, 2018 to March 31, 2021) and 7.5 p/s fluoroscopy (from April 1, 2021 to October 21, 2022). We compared the dose area product (DAP) and the fluoroscopy time between the 15 p/s fluoroscopy group (n = 3254) and the 7.5 p/s fluoroscopy group (n = 1704). We used the Mann-Whitney U test to identify any significant differences between the groups in the DAP and fluoroscopy time. A P-value less than .05 was considered statistically significant.

**RESULTS**

The extracted 4958 pancreaticobiliary interventions (3160 males and 1798 females) were consisted of 3909 ERCP, 164 PTBD, 317 BAE-ERCP, 510 interventional EUS, and 58 endoscopic gastrointestinal stentings. The median (range) of ages and body mass index were 67.0 (17.0 to 100.0) years and 21.4 (11.7 to 47.8) kg/m2, respectively. The X-ray pulse rate of 7.5 p/s reduced the DAP of fluoroscopy by 49.5% (15 p/s, median, 11899.5 mGy•cm2, range, 25.0 to 258130.0 mGy•cm2; 7.5 p/s, median, 6007.0 mGy•cm2, range, 16.0 to 78410.0 mGy•cm2; P < .001) without extending the fluoroscopy time (15 p/s, median, 690.5 seconds, range, 2.0 to 9059.0 seconds; 7.5 p/s, median, 699.5 seconds, range, 2.0 to 6897.0 seconds; P = .85) compared with the X-ray pulse rate of 15 p/s.

**CONCLUSION**

Fluoroscopy dose was reduced by 49.5% without extending fluoroscopy time in pancreaticobiliary interventions by decreasing X-ray pulse rate from 15 p/s to 7.5 p/s.

**CLINICAL RELEVANCE/APPLICATION**

Radiation dose reduction of patients and operators could be achievable in pancreaticobiliary interventions without prolonging fluoroscopy time using 7.5 p/s fluoroscopy.

## T2-SPGI-11 PROGNOSTIC VALUE OF EXTRACELLULAR VOLUME FROM EQUILIBRIUM CONTRAST-ENHANCED CT IN STAGE II-III GASTRIC CANCER

Yusuke Nishimuta, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Gastric cancer (GC) remains a significant cause of mortality worldwide, particularly in patients with stage II-III disease, who experience high recurrence rates despite curative surgery and adjuvant chemotherapy. Identifying reliable prognostic markers is critical for optimizing treatment strategies and improving outcomes. This study aimed to evaluate the prognostic significance of the extracellular volume (ECV) derived from equilibrium contrast-enhanced CT (CT-ECV) in predicting postoperative recurrence for patients with pStage II-III GC.

**METHODS AND MATERIALS**

We conducted a retrospective analysis of 74 patients with pathologically confirmed pStage II-III gastric adenocarcinoma who underwent preoperative triphasic contrast-enhanced CT and gastrectomy without prior treatment. We analyzed the correlation between preoperative CT-ECV and recurrence risk, utilizing comprehensive imaging and clinicopathological data. Disease-free survival (DFS) was assessed using Cox proportional hazards models, with CT-ECV values compared between recurrence and recurrence-free groups. The optimal cut-off value of CT-ECV for predicting postoperative recurrence was determined using receiver operating characteristic (ROC) curve analysis with the Youden index.

**RESULTS**

The mean CT-ECV value was 56.1 ± 16.8%. Patients who experienced postoperative recurrence exhibited significantly higher CT-ECV values (P < 0.001) with an optimal cutoff value identified at = 62.9% for predicting recurrence. High CT-ECV was independently associated with poor DFS (HR, 4.47; 95% CI: 1.39-14.44; P = 0.012), confirming its potential as a predictive marker of adverse outcomes.

**CONCLUSION**

CT-ECV is a non-invasive, preoperative prognostic indicator in patients with stage II-III GC, with higher values associated with increased recurrence risk and reduced DFS.

**CLINICAL RELEVANCE/APPLICATION**

CT-ECV could guide more tailored therapeutic approaches, potentially improving patient management and outcomes.

## T2-SPGI-13 RADIOMICS MODEL ASSESSMENT FOR GASTRIC SCHWANNOMAS AND GASTROINTESTINAL STROMAL TUMORS ACROSS RISK GRADES

Zimei Yang (*Abstract Co-Author*) Nothing to Disclose
LI YANG (*Abstract Co-Author*) Nothing to Disclose
Jia-Liang Ren, MD (*Abstract Co-Author*) Nothing to Disclose
Fei C. Ma (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to develop and validate an enhanced computed tomography (CT) imaging radiomics model, assessing its potential in distinguishing gastric schwannomas (GS) from gastrointestinal stromal tumors (GIST) across various risk categories.

**METHODS AND MATERIALS**

We conducted a retrospective analysis of 26 GS and 82 GIST cases, confirmed by postoperative pathology, and divided into training and validation cohorts at a 7:3 ratio. We documented patient demographics, clinical presentations, and detailed CT imaging characteristics. Univariable and multivariable logistic regression analyses were used to identify independent predictors for distinguishing GS from GIST and to construct a conventional model. Manual 3D segmentation was performed on venous phase thin-slice CT images (1mm or 1.25mm) using ITK-SNAP software (version 3.8.0), and radiomic features were extracted using pyradiomics (version 3.0.0). Univariable and correlation analyses were used to identify significant features,which were then selected using the Least Absolute Shrinkage and Selection Operator (LASSO) regression and stepwise multivariable logistic regression to construct a radiomics model. A combined model was established by integrating the independent predictors from the conventional model with the radiomic score through multivariable analysis. The diagnostic performances of all models in differentiating GS from GIST and stratifying GISTs according to malignancy risk were evaluated using the Receiver Operating Characteristic (ROC) curve analysis, the Decision Curve Analysis (DCA), the Integrated Discrimination Improvement (IDI) index.

**RESULTS**

Tumor location, cystic changes, degree of enhancement in arterial phase, and enhancement uniformity, were independent predictors for discriminating between GS and GIST. The conventional model exhibited AUCs of 0.939 and 0.869 in the training and validation cohort, respectively. The radiomics model, based on eight pivotal radiomics features, demonstrated AUCs of 0.949 and 0.839. The combined model achieved AUCs of 0.989 and 0.964 in the respective cohorts. Notably, the combined model's diagnostic precision in distinguishing GS from GIST, as well as in stratifying GISTs by high or low malignancy potential, was statistically significant, evidenced by IDI values of 0.2538, 0.2418, and 0.2749 ($P<0.05$ for all).

**CONCLUSION**

The combined model, incorporating CT imaging features and radiomics features, emerges as a promising non-invasive method for the preoperative differentiation between GS and GISTs.

**CLINICAL RELEVANCE/APPLICATION**

Both entities manifest as submucosal masses complicate differentiation. This model provides new ideas for distinguishing GS and GIST and guiding clinical treatment plan.

## T2-SPGI-4 HISTOGRAM ANALYSIS OF WHOLE-TUMOR APPARENT DIFFUSION COEFFICIENT VALUE TO SELECT OPTIMAL NEOADJUVANT THERAPY FOR ADVANCED ESOPHAGEAL SQUAMOUS CELL CARCINOMA

Hisahiro Matsubara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toru Tochigi, MD (*Abstract Co-Author*) Nothing to Disclose
Gaku Ohira (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Kurata (*Abstract Co-Author*) Nothing to Disclose
Atsushi Hirata (*Abstract Co-Author*) Nothing to Disclose
Koichi Hayano, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study is to evaluate whether histogram analysis of apparent diffusion coefficient (ADC) of the tumor can be a useful tool to select optimal neoadjuvant treatment for advanced esophageal squamous cell carcinoma (ESCC).

**METHODS AND MATERIALS**

We retrospectively identified 128 patients with ESCC who received chemoradiation therapy (CRT) or chemotherapy (CT) followed by curative surgery between 2009 and 2016. Histogram analysis of ADC value in whole-tumor lesion was performed before neoadjuvant treatment, and ADC value, Kurtosis, and Skewness of the tumor were measured. These DWI derived pretreatment parameters were compared with recurrence free survival (RFS) in CRT cases (n=58) as well as in CT cases (n=70).

**RESULTS**

In CRT cases, tumors achieved pathological complete response (pCR, 10 patient; 17.2%) showed significant lower ADC, higher kurtosis, and higher skewness than those of non-pCR ($p=0.005$, 0.007, <0.001, respectively). Receiver operating characteristics analysis demonstrated skewness was the best predictor for pCR (AUC=0.87), with a cut off value of 0.50 (accuracy, 86.2%). In Kaplan-Meier analysis, patients with high skewness tumors (>0.50) showed a significantly better RFS ($p=0.03$, log-rank). Whereas, in CT cases, Kaplan-Meier analyses demonstrated that high skewness and high kurtosis of the tumor significantly associated with worse survival ($P=0.04$, 0.02, respectively). Therefore, it was demonstrated that high skewness of tumor ADC value leaded to better RFS in CRT, whereas it leaded to worse RFS in CT.

**CONCLUSION**

Histogram analysis of tumor ADC may enable selection of optimal neoadjuvant treatment in advanced ESCC patients

**CLINICAL RELEVANCE/APPLICATION**

Our results revealed that the value of histogram parameters of tumor ADC in patients with favorable outcome showed opposite values between CRT and CT; and therefore, we may be able to invent new personalized neoadjuvant therapy for advanced ESCC patients according to histogram parameters of tumor ADC. For example, patients in CT cases of this study included 17 patients who had tumors with more than 0.5 of kurtosis in tumor ADC. Such patients might have achieved pCR with accuracy of 86.2%, if they received CRT rather than CT. We believe that our new findings can change current clinical practice of ESCC, leading to better outcome of advanced ESCC.

## T2-SPGI-5 FDG UPTAKE OF METASTATIC LYMPH NODE ENABLES PROGNOSTIC STRATIFICATION OF LYMPH NODE-POSITIVE ESOPHAGEAL CANCER PATIENTS

Hisahiro Matsubara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Kurata (*Abstract Co-Author*) Nothing to Disclose
Toru Tochigi, MD (*Abstract Co-Author*) Nothing to Disclose
Gaku Ohira (*Abstract Co-Author*) Nothing to Disclose
Koichi Hayano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Hirata (*Presenter*) Nothing to Disclose

**PURPOSE**

Esophageal cancer (EC) with metastatic lymph nodes is considered as advanced EC with poor prognosis. Therefore, prognostic stratification of EC patients with metastatic lymph node (MLN) would be of value. On the other hands, FDG-PET has been served as a tool for detecting MLNs in the diagnosis of EC. However, it is not clear whether FDG uptake of MLN have prognostic impact in EC patients with MLN. The purpose of this study is to evaluate whether FDG uptake of pathologically confirmed MLN station can stratify prognosis of EC patients with MLN.

**METHODS AND MATERIALS**

Surgically treated 134 EC patients with MLNs who received preoperative PET-CT (113 M / 21 W; median age: 70.0 years) were retrospectively investigated. Surgical specimens were pathologically evaluated, and MLN stations were identified. SUVmax > 3.0 of pathologically confirmed MLN is defined as PET positive MLN (PP-MLN), whereas SUVmax = 3.0 of pathologically confirmed MLN station is as PET negative MLN (PN-MLN). Disease specific survival (DSS) was compared between patients with PP-MLN and those with PN-MLN.

### RESULTS

In Kaplan-Meier analysis, patients with PP-MLN showed a significantly worse DSS than those with PN-MLN (P=0.0008, log-rank test). On the other hands, patients with PN-MLN. Multivariate cox regression analysis demonstrated that PP-MLN was an independent prognostic factor for DSS (P=0.01) among T stage, lymphatic invasion, and venous invasion.

### CONCLUSION

FDG uptake of MLN can successfully stratify prognosis of EC patients with MLN. EC patients with PP-MLN might need more effective multidisciplinary adjuvant treatments to improve their outcome.

### CLINICAL RELEVANCE/APPLICATION

There is no established biomarker for prognostic stratification of EC patients with MLN. Our results suggested that FDG uptake of MLN can stratify survival of EC patients with MLN. Considering extremely worse survival of EC patients with PP-MLN, they might need more effective adjuvant multidisciplinary treatments to improve their outcome.

## T2-SPGI-6 ADDED VALUE OF REINTERPRETATION OF OUTSIDE IMAGING AND REVIEW AT HEPATOBILIARY MULTIDISCIPLINARY TUMOR BOARD (MDTB) ON THE DIAGNOSIS AND MANAGEMENT OF PATIENTS WITH HEPATOBILIARY NEOPLASMS

Jeff L. Fidler, MD (*Abstract Co-Author*) Nothing to Disclose
Sudhakar K. Venkatesh, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Jay P. Heiken, MD (*Abstract Co-Author*) Patent agreement, Guerbet SA;
Christopher L. Welle, MD (*Abstract Co-Author*) Nothing to Disclose
Zachary S. Kelm, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Michelle Nguyen (*Presenter*) Nothing to Disclose

### PURPOSE

Radiologist participation in MDTB can be onerous and requires a significant amount of preparation time. Anecdotally radiologist participation is felt to be helpful identifying discrepancies in previous interpretations however there is limited data assessing the added value or impact on patient management. The purpose of this prospective study is to assess the value of reinterpretation of outside imaging and review at MDTB on the diagnosis and management of patients with hepatobiliary neoplasms.

### METHODS AND MATERIALS

Prospective analysis of all patients presented at weekly hepatobiliary MDTB between 6/13/23-2/6/24. One radiologist reviewed available reports of outside imaging, reinterpretation of outside imaging, updated local imaging, and discussion of the case at MDTB. MDTB included 3 abdominal radiologists who had reviewed the case. The number of discrepancies and reason for disagreement was recorded. If there was a disagreement, impact on patient management (5-point Likert scale) was determined by the radiologists present at MDTB, and clinician if needed.

### RESULTS

135 cases (81 males, 68 cirrhotic patients) were presented at MDTB between 6/13/23-2/6/24. 75 cases had imaging from outside institutions, 31 cases had imaging formally overread by our institution's radiologists, and 105 cases had updated imaging done at our institution (local). There was a significant disagreement found in either detection or interpretation of lesions in 42/135 (31.1%) cases. A discrepancy rate of 6/31 (19.4%) was found between outside imaging reports and our institution's formal overreads, with a change in management seen in 4/6 (66.7%) cases. Discrepancies between interpretations of imaging done locally and either the outside imaging report or the overread of outside imaging were seen in 8 instances, with a change in management found in 7/8 (87.5%) cases. Discrepancies between MDTB interpretations and either outside imaging reports, local overreads of outside imaging, or interpretation of imaging done locally were found in 31 instances with a change in management seen in 18/31 (58.1%) cases. Overall, a change in management was seen in 16/25 (64%) and 13/17 (76.5%) of discrepancies found in cirrhotic and non-cirrhotic patients, respectively.

### CONCLUSION

Our study found a discrepant interpretation in 42/135 (31.1%) of cases reviewed at a weekly MDTB. A change in clinical management was found in 29/42 (69%) of these discrepant interpretations. This data emphasizes the importance of reinterpretation of prior imaging and the presence of radiology at MDTB to guide appropriate management.

### CLINICAL RELEVANCE/APPLICATION

Patient care is significantly impacted by reinterpretation of prior imaging and participation of radiologists at hepatobiliary tumor board.

## T2-SPGI-7 FOUR-SECTION FORMULA BASED ON AXIAL&CORONAL CT IN THE DISCRIMINATION OF SIEWERT TYPES OF ADENOCARCINOMA OF ESOPHAGOGASTRIC JUNCTION

Lei Tang, MD (*Abstract Co-Author*) Nothing to Disclose
Yiting Liu (*Presenter*) Nothing to Disclose

### PURPOSE

To build an easy-handled formula to judge the Siewert type of AEG on CT images, through the comparison with the pathological findings.

### METHODS AND MATERIALS

A total of 56 type II and type III AEG cases that were misclassified by conventional preoperative CT March 2019 to March 2023 enrolled. All patients underwent preoperative enhancement CT and had postoperative Siewert type. Siewert type on CT was performed by two radiologists on venous phase. The following steps are taken to determine the Siewert type: On the coronal CT image, find the angular notch (A in the figure) and the counterpart point on the lesser curvature (B in the figure). Connect the two points with a smooth arc to get the EGJ line. The midpoint of the line on axial image equals to EGJ layer. Then we judge Siewert type using the layer numbers on axial images with two-section formula (TSF): formula 1. Positive values signified as Siewert III, and negative ones will use formula 2 to further discriminate between Siewerts I and II, the positive values will be determined as Siewert II, and negative values as Siewert I. (The formula will be shown in PDF attachment.)When scanned in the supine position, the distal end of the stomach is relatively anteriorly inclined and closer to the horizontal direction, while the long axis of the gastric lumen in the esophagogastric conjunction is closer to the vertical direction, so the calculated value of the infiltration range of the stomach is shorter than the actual situation (Fig. 1), which resulted in the misclassification of the Siewert type III as type II. Therefore, we roughly classified the gastric lumen alignment in the coronal position into leftward and rightward, and retrospectively included 51 patients with pathological diagnosis of Siewert type II and III AEG from June 2020 to December 2022 in our hospital, and measured the angle of leftward or rightward deviation of the main portion of the tumor with the gastric lumen alignment. The median left

deviation angle of the gastric lumen was calculated to be 35° , and the median right deviation angle was 45° .Corrections were made using the calculated values of the above angles.

**RESULTS**

The interobserver agreement was good (kappa value = 0.83). Our formula method and pathological findings reached consensus in 28 patients. The accuracy of patients with traditional imaging misdiagnosis of AEG by our formula method was 80%, and the accuracy of type III was 94.12%

**CONCLUSION**

Four-section formula using axial combing with coronal CT information provided a potential method in the preoperative judgement of the Siewert type of AEG.

**CLINICAL RELEVANCE/APPLICATION**

It might be applied to gastric cancer structured report for more convenient calculation in daily report writing.

## T2-SPGI-8 THE UTILITY OF CHEST CT IN DIAGNOSING POST-ENDOSCOPY ESOPHAGEAL PERFORATION

Peter Young, MD (*Abstract Co-Author*) Nothing to Disclose
Brittany L. Miles, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Diagnostic and operative endoscopy have been a mainstay in the evaluation and treatment of intraluminal upper gastrointestinal pathologies. Perforation is a rare and unfortunate complication of upper endoscopy, and patients suspected of esophageal perforation will require prompt evaluation. The fluoroscopy upper GI series examination has traditionally been the study of choice, though chest CT protocols have been developed to provide wider evaluation of the other mediastinal structures and thorax. We evaluated patients who presented with pain following upper endoscopy and received either fluoroscopic evaluation of the esophagus or chest CT to assess for the diagnosis of esophageal perforation within 48 hours of imaging.

**METHODS AND MATERIALS**

The TriNetX Diamond network was used for this study. TriNetX provides access to anonymized medical record information on more than 213 million patients in 92 large healthcare organizations. Two cohorts were created using the International Classification of Disease-10 (ICD-10) codes. All patients were required to have undergone endoscopy of the esophagus (CPT 74245) 48 hours prior to developing nausea and vomiting (R11) or pain in the chest and throat (R07). One cohort received fluoroscopic evaluation of the esophagus and stomach (CPT 74220 or 74240 or 74245) and patients were excluded if they had received a chest CT (CPT 71250 or 71260). The other cohort received a chest CT (CPT 71250/71260) and patients were excluded if they had received any fluoroscopic evaluation. The cohorts were balanced for age, race, gender, and ethnicity, resulting in 2562patients in each arm. They were then evaluated for the diagnosis of esophageal perforation (K22.3) within 48 hours of imaging.

**RESULTS**

The diagnosis of esophageal perforation was significantly more common in the Chest CT cohort, with a risk ratio of 1.449 (95% CI (1.011, 2.077) p-value 0.0421) and risk difference of 0.859% (95% CI (0.031%, 1.687%) p-value 0.0421).

**CONCLUSION**

Patients who received a chest CT for the workup of chest and throat pain, nausea, and vomiting within 48 hours of having received an upper endoscopy had statistically significant increased incidences of esophageal perforation discovered compared to patients who received fluoroscopic evaluation without chest CT. We hope to further discussion among specialists to determine whether a chest CT may provide benefit in the diagnosis of esophageal perforation.

**CLINICAL RELEVANCE/APPLICATION**

The utility of chest CT and specific Esophagraphy protocols for the diagnosis of esophageal perforation is growing and will hopefully be more widespread and accepted across the nation. Currently there is no specific CPT code for CT Esophagraphy, which would add research benefit.

## T2-SPGI-9 PREDICTION OF MICROVASCULAR INVASION OF HEPATOCELLULAR CARCINOMA USING RADIOMICS OF MULTI-PARAMETRIC MRI FEATURES INCLUDING INTRATUMOR AND PERITUMORAL REGIONS

Kumi Ozaki, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate if the multi parametric gadoxetic acid-enhanced MRI-based radiomics machine learning predicts the microvascular invasion (MVI) of hepatocellular carcinoma (HCC).

**METHODS AND MATERIALS**

Patients with pathologically proven 113 HCC from April 2010 to December 2022 were retrospectively included. Radiomics features were extracted from intratumor and peritumoral regions on preoperative gadoxetic acid-enhanced MRI including T2- weighted, diffusion weighted, arterial phase, and hepatobiliary phase images. Data sets were randomly split (7:3) into training and validation cohort. Univariate analysis and least absolute shrinkage and selection operator (LASSO) was performed to select the optimal radiomics features for analysis. Random forest was used for model prediction.The performance was evaluated by area under the receiver operating characteristic curve (AUC) and was compared among radiomics algorithm. The stability of each model was verified by 5-fold cross-validation.

**RESULTS**

The radiomics signatures based on the random forest algorithm achieved the optimal predictive performance. Radiomics of intratumor with peritumoral regions improved the AUC, and AUCs reached 0.854, 0.879, 0.775, and 0.764 for intratumor and peritumoral, intratumor, and peritumoral regions respectively.

**CONCLUSION**

Radiomics using multi-parametric MRI features including intratumor and peritumoral regions can improve the prediction of MVI of HCC.

**CLINICAL RELEVANCE/APPLICATION**

Radiomics using multi-parametric MRI features including intratumor and peritumoral regions can predict MVI of HCC. Information of peritumoral region can improve the predeciton of MVI of HCC.
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# Abstract Archives of the RSNA, 2024

T2-SPGU

**Genitourinary Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPGU-1 EFFICACY AND SAFETY OF MRI-GUIDED TRANS-PERINEAL CRYOABLATION IN THE TREATMENT OF PRIMARY PROSTATE CANCER: A PROSPECTIVE STUDY

Lance A. Mynderse, MD (*Abstract Co-Author*) Researcher, Koninklijke Philips NV;Equipment support, Koninklijke Philips NV;Investigator, Nanospectra Biosciences, Inc;Researcher, Nanospectra Biosciences, Inc
Juna Musa (*Abstract Co-Author*) Nothing to Disclose
Scott M. Thompson, MD, PhD (*Abstract Co-Author*) Research Consultant, Boston Scientific Corporation
Aiming Lu, PhD (*Abstract Co-Author*) Nothing to Disclose
David A. Woodrum, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Daniel A. Adamo, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Ganjizadeh, MD (*Abstract Co-Author*) Nothing to Disclose
Setayesh Sotoudehnia Korani, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the incidence of biopsy-confirmed recurrences and adverse events in native prostate cancer patients treated with MRI-guided trans-perineal focal cryoablation.

### METHODS AND MATERIALS

In this prospective study, approved by the Institutional Review Board (IRB), 84 patients diagnosed with primary prostate cancer underwent 1.5T MRI-guided trans-perineal cryoablation from December 2020 to April 2024. The procedure on average involved the use of four cryoneedles with typically three freeze/thaw cycles. A urethral warmer was used to protect the urethra. T2-weighted MRI sequences (~20 sec) were used to monitor iceball expansion and target coverage. Post-ablation follow-up consisted of serum PSA every three months, prostate multi-parametric MRI every 6 months, and a follow-up biopsy at 1-2 years post-ablation. Addtionally, the impact on patients' urinary symptoms and sexual health was measured using the American Urological Association Symptom Score (AUASS) and the Expanded Prostate Cancer Index Composite (EPIC) with assessments at 6 and 12 months post-ablation.

### RESULTS

Trans-perineal MRI-guided cryoablation was performed on 84 male patients, mean age of 68 years (52-83), mean Body Mass Index of 29.2 (21-44) with biopsy proven primary prostate cancer. Target lesion size was 1.3 cm (0.2-5.3). 33 of 84 patients have not sought their one-year post-ablation imaging or biopsy. At 1 year follow-up, 51 of 84 patients had a significant reduction in post-ablation PSA compared to pre-ablation PSA levels at 3 months (60.71% ± 33.68; $p<0.0001$), 6 months (59.13% ± 27.02; $p<0.0001$), and 12 months (57.90% ± 26.90; $p<0.0001$). AUASS suggested that symptoms of stream strength, urgency, incomplete emptying, and hesitancy remained in the mild category in all follow-ups. (mild is considered as 1-7). One-year follow-up biopsies demonstrated 6 of 51 (12%) patients with cancer on post-ablation biopsy with five of six demonstrating in-field recurrence in the ablation zone (10%) and one of six demonstrating a out-of-field new cancer (2%) in another region of the prostate. For erectile function, 12 of 84 patients (14%) had worsening erectile dysfunction treated with Viagra/Cialis. One patient also complained of perineal pain at 6 months post-procedure and was prescribed steroids and antibiotics with resolution of the pain.

### CONCLUSION

MRI-guided trans-perineal focal cryoablation is an effective treatment combining the treatment efficacy of cryoablation with the superior soft tissue resolution and ablation monitoring capability of MRI.

### CLINICAL RELEVANCE/APPLICATION

Prostate cancer is the #1 occurrence of cancer in men and #3 cancer cause of death. Developing less morbid and more accurate methods of treatment for prostate cancer is essential.

## T2-SPGU-2 EFFECT OF DEEP LEARNING-BASED PRE-OPERATIVE AUXILIARY PLANNING SYSTEM ON KIDNEY RESECTION: A RANDOMIZED CONTROLLED NON-INFERIORITY TRIAL

Fule Wu (*Abstract Co-Author*) Employee, Infervision
Shaokang Wang (*Abstract Co-Author*) Nothing to Disclose
Ji Qi (*Abstract Co-Author*) Nothing to Disclose
Bing Zhong (*Abstract Co-Author*) Nothing to Disclose
Chen Xia (*Abstract Co-Author*) Nothing to Disclose
Gongcheng Wang (*Abstract Co-Author*) Nothing to Disclose
Dawei Wang, PhD (*Presenter*) Employee, Infervision

### PURPOSE

To evaluate whether the performance of a deep learning (DL)-based pre-operative auxiliary planning system is non-inferior to that of the conventional semi-automated systems in aiding surgery planning.

### METHODS AND MATERIALS

A total of 40 patients who underwent nephrectomy were retrospectively enrolled. Preoperative CT scans (thickness =2mm), surgery videos, and records were collected. An experienced chief surgeon established gold standards for important targeted vessel variations with collected peri-operative information. Two associate chief surgeons and 2 attending surgeons participated in the pre-operative planning simulation reader study and were randomly divided into two groups, with one assisted with conventional semi-automated system while the other aided by DL-based auxiliary planning system (InferOperate Urology Planning, Infervision). Anatomical structure identification accuracy was set as the primary endpoint, with the residual volume ratio consistency, surgery methods selection accuracy, planning time consumption, and software user satisfaction as the secondary endpoints.

### RESULTS

For the primary endpoints, higher identification accuracy for surgery related renal arteries, renal artery anatomical variations, and targeted blocking renal arteries reached 66.25%, 67.50%, and 80.00% in experimental group. The identification accuracy differences were 0.45 (95%CI: 0.24, 0.61), 0.06 (95%CI: -0.14, 0.26), and 0.09 (95%CI: -0.10, 0.27), respectively, whose lower bound of 95% CI were all above non-inferiority margin d of -0.15. Besides, the surgical method selection accuracy was also non-inferior as evidenced by a 0.06 (95%CI: -0.07, 0.2) accuracy difference. Residual volume ratios estimation between two groups was super consistent as evidenced by ICC of 0.925. Average time consumption of 3’40’’ was much shorter than that of control group (30’40’’), lower bound of 95%CI was lower than superior margin of 0. Software user satisfaction rate of 97.5% was higher than that in control group (76.25%).

### CONCLUSION

Validated DL system exhibited non-inferior performance in aiding surgeons in identifying surgery-related renal arteries and selecting surgery methods to the conventional semi-automated system. Additionally, the DL-empowered system is much more efficient and user-friendly.

### CLINICAL RELEVANCE/APPLICATION

Semi-automated three-dimensional reconstruction and auxiliary planning tools have been utilized in clinical settings. Efficiency and convenience constrained its applicability. DL-based pre-operative auxiliary planning system realized the automatic 3D reconstruction of urological structures and surgery simulation, making accurate surgery planning for each patient possible.

## T2-SPGU-3 EARLY GLEASON 3+4 PROSTATE CANCER DEMONSTRATES HETEROGENEITY OF HYPERPOLARISED MRI IN-VIVO MEASURED GLUCOSE METABOLISM

Clement Orczyk, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Richard L. Hesketh (*Abstract Co-Author*) Nothing to Disclose
Yangcan (fiona) Gong, BA (*Abstract Co-Author*) Nothing to Disclose
Lorna Smith (*Abstract Co-Author*) Nothing to Disclose
Max Bullock (*Abstract Co-Author*) Nothing to Disclose
Shonit Punwani, MBBS (*Abstract Co-Author*) Nothing to Disclose
Natasha Thorley, MD (*Abstract Co-Author*) Nothing to Disclose
Adam Retter, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
David Atkinson (*Abstract Co-Author*) Nothing to Disclose
Rafat Chowdhury (*Presenter*) Nothing to Disclose

### PURPOSE

Hyperpolarised 13C-MR (HP-MR) allows real time metabolic imaging in-vivo. Here we investigate the glucose metabolic characteristics of prostate cancer (PCa) in patients undergoing active surveillance.

### METHODS AND MATERIALS

A cohort of 28 men (mean age 67, range 58-74) with biopsy confirmed Gleason 3+4 disease on active surveillance using multi-parametric MRI (mpMRI) and visible lesions were recruited (using mpMRI). All men underwent HP-MR using an injection of [1-13C] pyruvate and imaging at 3T (as previously described). Metabolic maps visualising pyruvate to lactate conversion (kP) within the prostate were produced. Higher kP values indicate higher glucose metabolism and Warburg effect. Tumour and healthy tissue ROIs were drawn on the kP maps (using mpMRI and biopsy results as guidance) and compared using a paired t-test. Tumour metabolic activity (reflected by kP) was correlated against PSA, lesion diameter and radiologist Likert scores. The distribution of kP values across all Gleason 3+4 cancers was histographically assessed.

### RESULTS

kP was significantly higher (0.0183±0.010 vs 0.00245±0.0041, $p<0.05$) in cancer compared with non-cancer regions. The mean PSA across patients was 5.49 ng/ml (range 3-19ng/ml). The mean lesion diameter was 11mm (range 5-17 mm). The mpMRI Likert lesion scores for biopsy confirmed cancer sites were: 3/5=10, 4/5=15 and 5/5=3. There was no correlation between metabolism kP (at the cancer site) and PSA ($p=0.05$). No correlation was found between kP and lesion diameter ($p=0.02$). There was a trend towards increasing kP with lesion Likert score (mean kP±SD for 3, 4 and 5/5 scored cancer was 0.0171±0.0081 s-1, 4/5 = 0.0222±0.011 s-1, 5/5 = 0.0248±0.0107 s-1). A skewed distribution of kP was found across cancers of the same Gleason grade (with a 6-fold difference in metabolism between the least and most metabolically active).

### CONCLUSION

There was marked heterogeneity in tumour metabolism across our relatively uniform active surveillance cohort. Cancer metabolism did not reflect differences in lesion size or patient PSA. Correlations with ADC and DCE metrics will be determined and may explain the relationship with Likert score.

### CLINICAL RELEVANCE/APPLICATION

Presently, there is no reliable method for prognostication in early PCa. Quantifying metabolism in early stage PCa using in-vivo HP-MR offers the opportunity to explore glucose metabolism as a prognostic indicator in men on active surveillance.

## T2-SPGU-5 EFFECT OF RECTAL SIZE ON PROSTATE MRI PI-RADS AND CNN DIAGNOSTIC ASSESSMENT QUALITY

Markus Hohenfellner, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter W. Schlemmer, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG
David Bonekamp, MD (*Abstract Co-Author*) Speaker, Bayer AG

Thomas Hielscher (*Abstract Co-Author*) Nothing to Disclose
Kevin S. Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Nils Netzer (*Abstract Co-Author*) Nothing to Disclose
Regula Gnirs (*Abstract Co-Author*) Nothing to Disclose
Magdalena Goertz (*Abstract Co-Author*) Nothing to Disclose
Carolin Eith (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate stratify diagnostic performance of clinical PI-RADS (clinPIRADS) assessment and fully automatic convolutional neural network (CNN)- based PI-RADS prediction (cnnPIRADS) by rectal volume determined using fully automatic CNN segmentation.

**METHODS AND MATERIALS**

Rectum segmentations were performed on T2-weighted images of 285 prostate MRI examinations, followed by two-stage CNN training for rectal segmentation to obtain a fully automated rectal volume segmentation model which was applied to the entire cohort. In addition, manual axial measurements of the rectum were performed. The volume of the rectal segment posterior (VolumeR) to the prostate was calculatedfrom the 3D-segmentation and the planimetric maximum ellipsiod area of the rectum determined from the manual measurements (AreaA). A previously established semantic lesion segmentation CNN based on nnUnet was applied to bi-parametric MRI images. The two rectum size parameters were used to investigate the effects of rectal volume on clinPIRADS and cnnPIRADS. ROC AUC was compared using the DeLong test. ROC regression was used to assess how rectum volume affects diagnostic performance.

**RESULTS**

VolR and AreaR were highly correlated (R=0.87; p<0.001). ROC-AUC of clinPIRADS and cnnPIRADS were nearly identical at 0.78 (p=1). ROC AUC of clinPIRADS was 0.87 (p<0.04 vs. the other 2 values)/0.73/0.75 for small/medium/large retum volume, while it was 0.88 (p<0.02)/0.73/0.73 for cnnPIRADS. ROC regression yielded regression coefficient of -0.27 (p=0.18) for clinPIRADS and -0.48 (p=0.04) for cnnPIRADS.

**CONCLUSION**

Medium and large rectal volume is associated with reduced diagnostic performance of prostate MRI compared to small rectal volume, with clinical and CNN-based PI-RADS assessment being affected similarly.

**CLINICAL RELEVANCE/APPLICATION**

Large rectum volume should be noted on prostate MRI examinations as a factor limiting assessment quality, and measures to reduce rectal filling during exam preparation discussed in this context.

## T2-SPGU-6 EVALUATING THE DIAGNOSTIC ACCURACY AND INTER-READER AGREEMENT OF THE TARGET SCORING SYSTEM FOR POST-FOCAL THERAPY RECURRENT PROSTATE CANCER DETECTION ON MULTIPARAMETRIC MRI

Bradford J. Wood, MD (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;Researcher, Koninklijke Philips NV;Intellectual property, Koninklijke Philips NV;Equipment Support, Koninklijke Philips NV;Researcher, Celsion Corporation;Research Grant, Celsion Corporation;Researcher, BTG International Ltd;Intellectual property, BTG International Ltd;Researcher, Boston Scientific Corporation;Research Grant, Boston Scientific Corporation;Intellectual property, Boston Scientific Corporation;Researcher, Siemens AG;Equipment Support, Siemens AG;Researcher, Sarasota Interventional Radiology;Researcher, NVIDIA Corporation;Research Grant, NVIDIA Corporation;Equipment support, AngioDynamics, Inc;Equipment support, Profound Medical Inc;Researcher, Canon Medical Systems Corporation;License agreement, Canon Medical Systems Corporation;Researcher, AstraZeneca PLC;Researcher, Exact Imaging Inc
Peter Pinto (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;License agreement, Koninklijke Philips NV;
Enis Yilmaz, MD (*Abstract Co-Author*) Nothing to Disclose
Yan Mee Law, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
David Gelikman (*Abstract Co-Author*) Nothing to Disclose
Peter L. Choyke, MD (*Abstract Co-Author*) Nothing to Disclose
Sandeep Gurram (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Harmon, PhD (*Abstract Co-Author*) Nothing to Disclose
Omer Esengur, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the effectiveness of the Transatlantic Recommendations for Prostate Gland Evaluation with MRI after Focal Therapy (TARGET) scoring system in detecting clinically significant prostate cancer (csPCa) recurrence on multiparametric MRI (mpMRI) following various focal therapies (FT).

**METHODS AND MATERIALS**

A retrospective study was performed on a cohort of 38 patients (median age=69, median PSA=6 ng/mL) treated with primary FTs, including focal laser ablation (FLA) (n=28), high-intensity focused ultrasound (HIFU) (n=6), and cryoablation (n=4) for csPCa between 2013 and 2023. Post-treatment mpMRI scans were scored retrospectively using the TARGET system by two expert genitourinary radiologists. The effectiveness of the TARGET scoring system in predicting in-field recurrence of csPCa was evaluated by applying a TARGET score threshold of 4. Statistical analysis included sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy, and inter-reader agreement using quadratic weighted Cohen's kappa (?).

**RESULTS**

In total, 37% (14/38) of the patients had in-field recurrent csPCa. The scoring distribution of radiologist 1 was 37% (14/38) for TARGET-1, 3% (1/38) for TARGET-2, 18% (7/38) for TARGET-3, 0% for TARGET-4, and 42% (16/38) for TARGET-5, while for radiologist 2, 29% (11/38) for TARGET-1, 0% for TARGET-2, 5% (2/38) for TARGET-3, 8% (3/38) for TARGET-4, and 58% (22/38) for TARGET-5. Radiologist 1 scored 11 of the recurrent cases as TARGET=4 (sensitivity: 78.6%) while radiologist 2 scored all of them as TARGET=4 (sensitivity: 100%). Out of the 22 cases that radiologist 1 scored as negative for recurrence (TARGET<4), 19 of them were negative diagnoses (NPV: 86.4%), while all 13 cases that were scored as negative by radiologist 2 were negative diagnoses (NPV: 100%). For radiologist 1, specificity was found 79.2%, PPV 68.8%, and accuracy 78.9%. For radiologist 2, these were 54.2%, 56%, and 71.1%, respectively. Inter-reader agreement was moderate (? = 0.57).

**CONCLUSION**

The TARGET scoring system may be used to effectively identify recurrent csPCa following FT, demonstrating a particularly high ability to detect recurrences and to confirm absence of csPCa. Despite this, the moderate agreement between the two radiologists suggests the need for its validation with larger studies.

### CLINICAL RELEVANCE/APPLICATION

The TARGET scoring system has the potential to identify recurrent csPCa, enhancing post-FT patient monitoring and care optimization.

## T2-SPGU-8 ERECTILE DYSFUNCTION EVALUATION USING SMI AND SWE US TECHNIQUES

Ji-Bin Liu, MD (*Abstract Co-Author*) Research Grant, General Electric Company
Paul H. Chung, MD (*Abstract Co-Author*) Nothing to Disclose
Aaron Hochberg (*Abstract Co-Author*) Nothing to Disclose
Flemming Forsberg, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research support, Canon Medical Systems Corporation;Research support, General Electric Company;Speaker, General Electric Company;Research support, Siemens AG;Research Grant, Butterfly Network, Inc;Research support, Lantheus Medical Imaging, Inc;Research support, Bracco Group
Priscilla Machado, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Erectile dysfunction (ED) is a highly prevalent condition that affects approximately 30 million men in the United States. While penile duplex ultrasound (DUS) has long been considered standard of care, recent advances in ultrasound (US) technology warrant investigation. Superb microvascular imaging (SMI) is a new microvascular flow imaging mode, which uses adaptative clutter suppression to extract flow signals from large and small vessels represented as a color overlay image or as a grayscale map of flow, named cSMI and mSMI, respectively. Shear wave elastography (SWE) is a technique to measure tissue stiffness. This study investigated the use of SMI and SWE to evaluate ED in subjects undergoing penile US pre and post injection of vasoactive agent.

### METHODS AND MATERIALS

To date 20 adult male subjects (=18 years old) with clinical ED defined by International Index of Erectile Function (IIEF) scores were enrolled in this ongoing, IRB-approved study. Subjects underwent spectral Doppler, CDI, PDI, cSMI, mSMI and SWE examination of the penis before and after intracavernosal injection of vasoactive agent using Aplio i800 Prism US system (Canon America Medical Systems, Tustin, CA) with an i18LX5 linear probe. Data was analyzed comparing pre (flaccid penis) and post injection (erect penis) for all images modalities using t-tests.

### RESULTS

The mean age of subjects was 51 years (range: 31 -70). The mean IIEF score was 10 (range: 3-19; lower values indicate more severe ED). The mean spectral Doppler PSV ± SD were 23.64 ± 10.98 cm/s pre injection and 40.47 ± 17.94 cm/s post injection ($p < 0.0001$), mean RI ± SD were 0.90 ± 0.07 pre injection and 0.88 ± 0.08 post injection ($p = 0.28$). The mean cSMI pixel counts ± SD were 99.64 ± 6.64 pre injection and 101.10 ± 6.14 post injection ($p = 0.69$). The mean mSMI pixel counts ± SD were 124.10 ± 3.72 pre injection and 124.0 ± 3.67 post injection ($p = 0.89$). The mean SWE ± SD were 38.44 ± 20.14 kPa pre injection and 39.63 ± 22.58 kPa post injection ($p = 0.82$).

### CONCLUSION

The values of SMI pixel counts showed no significant statistical difference between pre and post injections for cSMI or mSMI ($p > 0.65$). The evaluation of tissue stiffness using SWE also showed no significant statistical difference pre and post injections ($p = 0.20$) The results are encouraging with the findings indicating that the use of SMI and SWE without injection of vasoactive agent (flaccid penis) may be a way to diagnose ED.

### CLINICAL RELEVANCE/APPLICATION

Understandably, the sensitive nature of ED, intimate process of penile US and the need to inject medication into the penis to induce erection makes for a less than ideal patient experience. SMI and SWE may be able to identify characteristics consistent with ED in flaccid penis facilitating clinical practice and improving patient experience.

## T2-SPGU-9 EVALUATION OF CONSISTENCY BETWEEN PRIMARY CHYLURIA CTL GRADING AND CLINICAL GRADING

Qi Hao (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the application value of CT lymphangiography in grading in patients with primary chyluria.

### METHODS AND MATERIALS

Clinical and CTL imaging data of 79 patients diagnosed with primary chyluria were collected retrospectively. For CTL, the indexs were?Involved kidney and distribution of abnormal lymphatic vessels in the kidney:unilateral or bilateral kidney,renal sinus ,renal parenchymal,suprahilar area and subhilar area; ? Distribution of perirenal and retroperitoneal abnormal lymphatic vessels: retroperitoneal area,lumbar trunk area, renal perivascular area, fatty capsule area, adrenal area, etc; ?Imaging grading: the imaging grading was carried out according to the range of retroperitoneal involvement, and the retroperitoneal area was divided into 10 areas,including left and right suprahilar area, subhilar area, perirenal area, perivascular area and lumbar trunk area,involvement of five or fewer areas were defined as mild, and involvement of six or more were defined as severe. In addition, clinical classification was performed according to the clinical symptoms of patients with primary chyluria: mild symptoms showed intermittent milky discharge or milky white urine without any other clinical symptoms; Severe symptoms are characterized by intermittent or persistent discharge of milky or milky urine, with chylous clots and/or hematuria, with or without urinary retention and weight loss.The CTL signs of patients with primary chyluria were statistically described by the composition ratio of classification variables, and the consistency of imaging grade and clinical grade of patients with primary chyluria was evaluated by Kappa test.

### RESULTS

Among the 79 patients with primary chyluria, according to clinical classification, 27 cases were mild and 52 cases were severe; according to imaging classification, 40 cases were mild and 39 cases were severe. Among them, 5 cases with severe CTL image grading had mild clinical grading, and 18 cases with mild CTL image grading had severe clinical grading.The consistency of the two grades was moderate ($Kappa=0.420$, $P < 0.05$).

### CONCLUSION

CTL can accurately evaluate the distribution and range of intrarenal and retroperitoneal dilated lymphatic vessels in patients with primary chyluria, providing imaging basis for the classification of primary chyluria.

### CLINICAL RELEVANCE/APPLICATION

CTL is helpful for the classification of primary chyluria and has guiding significance for the formulation of surgical plan of primary chyluria.

# Abstract Archives of the RSNA, 2024

T2-SPHN

**Head & Neck Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPHN-1 MULTICENTRE VALIDATION OF AN MRI-BASED RADIOGENOMIC MODEL PREDICTING HUMAN PAPILLOMAVIRUS STATUS IN OROPHARYNGEAL CANCER

Regina G. Beets-Tan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hedda Van Der Hulst (*Abstract Co-Author*) Nothing to Disclose
Luc Karssemakers (*Abstract Co-Author*) Nothing to Disclose
Bas Jasperse, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Roland Martens (*Abstract Co-Author*) Nothing to Disclose
Zuhir Bodalal (*Abstract Co-Author*) Nothing to Disclose
Conchita Vens (*Abstract Co-Author*) Nothing to Disclose
Michiel W. Van Den Brekel, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Pim De Graaf, MD (*Abstract Co-Author*) Nothing to Disclose
Paula Bos (*Abstract Co-Author*) Nothing to Disclose
Jonas A. Castelijns, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Milad Ahmadian, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Human papillomavirus (HPV) is a critical biomarker in oropharyngeal squamous cell carcinoma (OPSCC). As an emerging field, radio(geno)mics offers a significant potential for non-invasively predicting the HPV status using imaging morphological information. This study aimed to externally validate the predictive performance of an MRI-based radiogenomic model for determining HPV status in OPSCC and to evaluate the impact of post-processing on the model's generalisability.

### METHODS AND MATERIALS

Post-contrast and contrast-enhanced T1-weighted MR images with histologically confirmed HPV status in OPSCC patients from two different centre cohorts were manually segmented. After radiomic feature extraction, the predictive model, trained on an internal training set (60%, n=91), was subsequently validated on both an internal validation set (40%, n=62) and an external cohort (n=157). We examined post-processing options, including data harmonisation, dropping radiomic features unstable across different segmentation and scan protocols, and removing highly correlated features to assess their impact on the model's generalisability.

### RESULTS

The predictive model, trained without post-processing, showed high performance on the internal test set, with an AUC of 0.79 (95% CI: 0.66-0.90, $p<0.001$). However, when tested on the external validation set, the model failed to generalise, resulting in an AUC of 0.55 (95% CI: 0.48-0.61, $p=0.095$). The model's generalisability substantially improved after harmonising data, identifying the stable radiomic features, and removing the correlated variables. The AUC for the internal validation reached 0.76 (95% CI: 0.63-0.87, $p<0.001$), while for the external cohort, the predictive model achieved an AUC of 0.76 (95% CI: 0.68-0.84, $p<0.001$).

### CONCLUSION

We validated a radiogenomic HPV prediction algorithm on an external patient cohort. When applied before model development, post-processing steps significantly enhanced the generalisability of the predictive radiomic models.

### CLINICAL RELEVANCE/APPLICATION

This study demonstrates that post-processing techniques in radiogenomi models enhance the non-invasive prediction of HPV status in oropharyngeal cancer, aiding in more tailored treatment approaches.

## T2-SPHN-2 DEEP LEARNING FOR INCIDENTAL SCREENING OF PAROTID TUMORS ON CT IMAGING

Chanon Chantaduly (*Abstract Co-Author*) Nothing to Disclose
Cynthia Crystal Tang (*Abstract Co-Author*) Nothing to Disclose
Eleanor Chu, MD (*Abstract Co-Author*) Nothing to Disclose
Shirin Salehi (*Abstract Co-Author*) Nothing to Disclose
Wei Shao (*Abstract Co-Author*) Nothing to Disclose
Peter Chang, MD (*Presenter*) Co-founder, Avicenna.ai;Stockholder, Avicenna.ai;Research Grant, Canon Medical Systems Corporation;Speakers Bureau, Canon Medical Systems Corporation;Research Grant, General Electric Company

### PURPOSE

Parotid gland tumors (PGT) are the most common salivary gland tumors. With increasing imaging utilization, most PGTs are detected incidentally on cross-sectional CT or MR imaging. Of these incidental PGTs, approximately 8% exhibit malignant pathology. Despite this, PGTs are often overlooked in routine exams as radiologists tend to prioritize evaluation of acute pathology. This study proposes a deep learning (DL) method to enhance incidental PGT screening and characterization on routine head CT.

### METHODS AND MATERIALS

A retrospective cohort of 11,449 consecutive non-contrast head CT exams were aggregated from two academic centers. PGTs, defined in this study as a parotid mass >10 mm, were identified from radiology and/or histopathology reports and subsequently visually confirmed. All masses were annotated with a 3D tumor mask by one of two CAQ-certified neuroradiologists. A two-stage DL pipeline was developed for PGT detection. In the first stage, the bounds of each parotid gland is identified. In the second stage, PGTs are detected with a segmentation model implemented as a 3D fully convolutional U-Net based architecture with deep supervision. Based on segmentation outputs, global thresholds for number of positive voxel predictions were calibrated to determine optimal screening sensitivity and specificity. Both voxel-level segmentation and population-level screening characteristics were assessed using a five-fold cross-validation technique.

### RESULTS

A total of 225 parotid masses were identified from a combined 11,449 exams from two academic centers (N=118 hospital A, N=107 hospital B). The median tumor volume was 4.62 cm3 (IQR 2.40-12.50 cm3). Parotid mass segmentation yielded a Dice score of 0.743 (IQR 0.567-0.819). For the screening task, 186/225 parotid tumors were identified yielding a sensitivity of 0.83. Of the algorithm positive predictions, six tumors were missed by the original interpreting physician. Out of 11,449 exams, only 52 false positives were identified yielding a PPV of 0.78. Overall, the model yielded screening AUC, accuracy, sensitivity, specificity, PPV, NPV of 0.92, 0.99, 0.83, 0.99, 0.78, and 0.99. No significant differences in performance were noted between different academic centers or imaging protocols (p>0.05).

### CONCLUSION

In a consecutive cohort of over 11k CT exams, the proposed algorithm identifies over 80% of PGTs including six tumors missed during routine interpretation. For positive cases, segmentation of identified tumors allows for volume quantification and facilitates downstream machine learning workflows.

### CLINICAL RELEVANCE/APPLICATION

A deep learning algorithm can identify incidental PGTs on routine CT imaging with high accuracy including tumors missed in a realistic clinical workflow.

## T2-SPHN-3 DETECTION OF OROPHARYNX CARCINOMA IN CT IMAGES WITH ARTIFICIAL INTELLIGENCE TECHNIQUES

Inmaculada Gonzalez Almendros (*Abstract Co-Author*) Nothing to Disclose
Javier Ignacio Perez Lara (*Abstract Co-Author*) Nothing to Disclose
Gretsy R. Quintana Sanchez, MMed (*Abstract Co-Author*) Nothing to Disclose
Francisca Escalona Perez (*Abstract Co-Author*) Nothing to Disclose
Almudena Perez-Lara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Carmen Morales (*Abstract Co-Author*) Nothing to Disclose
Sofia Bretos Azcona, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Oropharyngeal cancer accounts for 15-20% of squamous cell carcinomas of the head and neck. Its incidence has increased in the last 20 years, and is linked to infection by papillomavirus. Sometimes it can be complex to detect small lesions located at the base of the tongue or in the tonsil, and they may not be adequately differentiated from normal healthy tissue.The objective of this study is to assess whether the use of artificial intelligence (AI) techniques based on radiomics is useful for distinguishing between squamous cell tumors of the oropharynx and healthy tonsillar tissue.

### METHODS AND MATERIALS

Forty patients with oropharyngeal cancer (squamous cell carcinoma with available histology; oncologic group) and 40 patients with no abnormalities in the oropharynx (healthy controls) are selected. All patients have undergone a pre-treatment CT study in the oncology group.A segmentation of the entire tumor is performed in the oncological group, and of a palatine tonsil in the control group, using the 3D Slicer software. Subsequently, first-order statistics are extracted with the same software. Multiple Machine Learning algorithms are generated with the extracted radiomics data, including logistic regression, K Means, Random Forest and Support Vector Machine.

### RESULTS

Mean age exceeded 60 years in both groups. The proportion of men was higher in the cancer group. Alcohol and tobacco use increased the risk of cancer, with a combined effect resulting in a 39-fold increase in risk. Forty-two percent of cancer patients had the p16 mutation. The most common stage was T2, and the most frequent tumor location was the tonsil.The weighted voting system demonstrated 'Support vector machine,' 'Random forest,' and 'Ada Boost' as the best predictors, with 'Ada Boost' standing out for its accuracy rate of 86% and high sensitivity of 90%. Most predictors exhibited similar results, enhancing the robustness of the data obtained.

### CONCLUSION

Radiomics data analysis enables detection of oropharyngeal carcinoma with an accuracy of 86% and a sensitivity of 90% thus AI techniques may be useful in differentiating between healthy and tumor tissue in the oropharynx.

### CLINICAL RELEVANCE/APPLICATION

These findings suggest potential applications as a screening method for oropharyngeal carcinomas or for determining suspicious enhancements and could serve as a foundation for automated detection of oropharyngeal tumor lesions, which are often challenging to detect using CT alone. Expanding this study with larger databases could enhance precision, sensitivity, and specificity, thus improving the model.

## T2-SPHN-4 ARTIFICIAL INTELLIGENCE-BASED MODEL TO ASSIST NECK LYMPH NODES ULTRASOUND DIAGNOSIS: A DUAL-CENTER, RETROSPECTIVE, DIAGNOSTIC STUDY

Chunyan Li (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a dual-modality multi-feature fusion lymph node network (DMFLNN) for neck lymph nodes (LNs) assessment, and explore its utility to radiologists with varying experience levels.

**METHODS AND MATERIALS**

In this retrospective, dual-center, diagnostic study, we collected 21,298 B-mode and color Doppler flowing imaging (CDFI) images of 10,649 neck LNs (2,675 benign and 7,974 malignant) in hospital 1 for model development. We also collected 2,366 images of 1,183 neck LNs (297 benign and 886 malignant) in Hospital 1 and 776 images of 388 neck LNs (124 benign and 264 malignant) in Hospital 2 for internal and external validation, respectively. We compared DMFLNN's diagnostic performance with junior radiologists (2-5 years' experience) and senior radiologists (10-20 years' experience) and investigated whether DMFLNN could enhance their diagnostic accuracy in test sets. All neck LNs were pathologically confirmed by biopsy.

**RESULTS**

DMFLNN outperformed radiologists average, achieving an AUC of 0.937 (95%CI, 0.921-0.951) vs 0.796 (0.785-0.806) in the internal set and 0.875 (0.836-0.912) vs 0.752 (0.732-0.771) in the external set, all $P < 0.001$. Subgroup analysis in the internal set also showed DMFLNN' superior performance in smaller neck LNs (AUC, 0.885 [0.824-0.941]) compared with radiologists average (AUC, 0.726 [0.698-0.757], $P < 0.001$). Moreover, with DMFLNN's assistance in diagnosing neck LNs, the AUC of senior radiologists was improved from 0.814 (0.798-0.830) to 0.836 (0.821-0.851), and of junior radiologists from 0.778 (0.761-0.794) to 0.847 (0.832-0.861), all $P < 0.001$. Similar trends were observed in the external set. The average false-positive rate of radiologists decreased by 3.8% and 9.8% in internal and external sets, respectively. Additionally, DMFLNN enhanced inter-reader agreement of senior radiologists (kappa value: from 0.590 to 0.696 in the internal set; from 0.589 to 0.714 in the external set) and junior radiologists (from 0.571 to 0.750 in the internal set; from 0.453 to 0.713 in the internal set).

**CONCLUSION**

DMFLNN demonstrated superior diagnostic accuracy for neck LNs compared with radiologists and could help improve the performance of radiologists, potentially reducing unnecessary biopsies of neck LNs.

**CLINICAL RELEVANCE/APPLICATION**

The status of neck LNs is crucial for the subsequent decision-making management and nodal stage. Ultrasound, the most accessible method, relies on the radiologists' experience, leading to inconsistent diagnosis. Our proposed model DMFLNN, developed on B-mode and CDFI images spanning over ten years from diverse ultrasound machines, ensures robustness and generalizability for accurate diagnoses.

## T2-SPHN-5 PREDICTING LOCAL RECURRENCE IN HYPOPHARYNGEAL CANCER USING MAGNETIC RESONANCE IMAGING-DERIVED RADIOMICS AND MACHINE LEARNING FOLLOWING DEFINITIVE CONCURRENT CHEMORADIOTHERAPY

Weichung Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Cheyu Hsu, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Chun Hao Chang (*Abstract Co-Author*) Nothing to Disclose
Shihmin Lin, MD (*Abstract Co-Author*) Nothing to Disclose
HE LIN KU, MA (*Abstract Co-Author*) Nothing to Disclose
Rou-Yi Chen, MSc (*Abstract Co-Author*) Nothing to Disclose
Hsin-Han Tsai (*Presenter*) Nothing to Disclose

**PURPOSE**

The purpose of this study was to develop a machine learning model utilizing radiomics features from MRI imaging to predict local recurrence following definitive concurrent chemoradiotherapy (CCRT) in patients with hypopharyngeal cancer.

**METHODS AND MATERIALS**

In this retrospective analysis, MRI and clinical outcome data from 334 patients treated for hypopharyngeal cancer were assessed. Patients were categorized based on the occurrence of local recurrence post-CCRT. The dataset was partitioned into a training set (n=268) and an internal testing set (n=66). From T2-weighted MRI scans, 1,781 radiomics features were extracted. Feature selection processes, including adjustments for skewness, reproducibility assessments, and screening for high Pearson correlation, were implemented to optimize model performance. A Light Gradient Boosting Machine (LightGBM) based model, employing nested 5-fold cross-validation, was devised to evaluate the likelihood of local recurrence.

**RESULTS**

.The machine learning model, dubbed ML_radiomics, selected 208 pertinent features and exhibited robust predictive capability. It achieved a corrected C-index of 0.802 and 0.778 in the training and internal testing cohorts, respectively. Using an ML_radiomics cut-off value of 0.181, the model predicted local recurrence with accuracies of 79.3% and 72.1% in the training and internal testing set. Patients classified into the low-risk category demonstrated significantly enhanced outcomes in terms of progression-free, laryngectomy-free, and overall survival in all analyzed groups. SHAP analysis highlighted five key features—ZoneEntropy, MaximumProbability, Kurtosis, MinorAxisLength, and Skewness—as critical in influencing the predictive accuracy of ML_radiomics.

**CONCLUSION**

The ML_radiomics prove to be effective predictors of local recurrence in hypopharyngeal cancer patients post-CCRT. This model offers a valuable tool for clinicians to identify patients at higher risk, potentially guiding more aggressive or alternative treatment strategies.

**CLINICAL RELEVANCE/APPLICATION**

Our ML_radiomics enhances the ability to predict local recurrence in hypopharyngeal cancer following definitive concurrent chemoradiotherapy, allowing for personalized treatment plans. By identifying high-risk patients early, clinicians can tailor interventions more effectively, potentially improving survival outcomes and optimizing healthcare resources.

## T2-SPHN-6 DUAL-ENERGY CT-BASED RADIOMICS NOMOGRAM FOR DISTINGUISHING PAROTID WARTHIN TUMOR FROM PLEOMORPHIC ADENOMA

Yilin Han (*Abstract Co-Author*) Nothing to Disclose
Jianying Li, PhD (*Abstract Co-Author*) Employee, General Electric Company
Lijun Wang (*Abstract Co-Author*) Nothing to Disclose
Zhiwei Gong (*Presenter*) Nothing to Disclose

## PURPOSE

To investigate the diagnostic performance of a radiomics nomogram based on Dual-energy CT (DECT) in differentiating the most common benign parotid gland tumors of pleomorphic adenomas (PA) from Warthin tumors (WT).

## METHODS AND MATERIALS

Imaging and clinical information on 43 patients with PAs and 30 patients with WTs of the parotid gland, which were pathologically confirmed, were retrospectively analyzed. In the enhanced images and material-decomposition (MD) images (iodine(water)),tumor CT enhancement degree, iodine concentration (IC), normalized IC (NIC), lymph node enlargement, cystic degeneration, and other radiological features were measured. Tumor radiomics features were extracted using u-AI software by outlining the tumor region of interest (ROI) layer by layer to obtain volume of interest (VOI). Clinical-radiological models were constructed by screening independent clinical and radiological predictors with analysis of variance and multifactorial logistic regression analysis. K-Best and LASSO were used to filter radiomics features. Support vector machine (SVM), random forest, and XGBOOST models were constructed from the selected radiomics features, and their diagnostic efficiency evaluated. The optimal radiomics model was combined with the clinical-radiologic model to create a joint model. The combined model was finally plotted on a nomogram, and its utility was assessed using calibration curves and decision curve analysis (DCA).

## RESULTS

Cystic degeneration and NIC(AP) were independent predictors, with AUC of the overall ROC of 0.837, sensitivity of 70%, and specificity of 73.9%. The radiomics model with the most consistent diagnostic efficacy was the SVM from arterial iodine (water) images, with a AUC of 0.778, sensitivity of 63.3%, and specificity of 74.2%. Ultimately, the joint model AUC amounted to 0.926, sensitivity was 66.7%, and specificity was 88.9%. The DCA showed that its nomogram had a high net clinical benefit over a wide range of thresholds.

## CONCLUSION

Clinical-radiological model based on MD images in DECT has good performance in identifying PA and WT, and its combination with radiomics further improves the diagnostic efficiency.

## CLINICAL RELEVANCE/APPLICATION

PAs is relatively aggressive compare to WTs and has a malignant tendency and a chance of recurrence after resection. WTs cause peripheral inflammation and are usually treated conservatively. The prognoses and treatment methods are also different for PAs and WTs. Therefore, it is very important to accurately diagnose PA and WT prior to operation. The aim of this study is to construct a combined model of MD technology and radiomics with spectral CT to help differentiate PAs and WTs in clinical diagnosis.

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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

T2-SPIN

**Imaging Informatics Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPIN-1 REPEATABILITY OF AI-BASED CORONARY ARTERY CALCIUM SCORING (CACS) IN NON-GATED ROUTINE CHEST CT: PRECISION ANALYSIS AND RISK STRATIFICATION

Changmin Park (*Abstract Co-Author*) Nothing to Disclose
Jong H. Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoonseong Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Sihwan Kim, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

To check the repeatability of AI-based computer aided diagnosis (CAD) for coronary artery calcification (CAC) scoring and cardiovascular (CV) risk stratification in chest CT scan.

### METHODS AND MATERIALS

For a repeatability check, the public-access dataset (RIDER Lung CT, The Cancer Imaging Archive) was used. It consists of data from two CT scans on the same day for the same patient. A total number of CT scanned patients were thirty-two, but after excluding patients with metal artifacts or stents, data (46 CT scans) from 23 patients was used. The CT data was scanned with a tube-voltage of 120 kV and reconstructed with slice thickness of 1.25 mm. In this study, AI-based automatic CAC scoring software (ClariCardio, Seoul, Rep. of Korea) was used. As the one qualitive approach for checking a quality of AI-CAD performance, especially for CAC segmentation, seven-years experienced radiologist evaluated the similarity of the segmentation masks resulted from the prior and subsequent CT scan using 5-point Likert scale. To check for performance variability of AI-CAD on CAC scoring, Bland-Altman (BA) analysis and interclass correlation coefficient (ICC) were performed. The analysis targets in the BA analysis were the agatston scores at left-main (LM) coronary artery, left-anterior descending (LAD) artery, left-circumflex (LCX), right-coronary artery (RCA), and total coronary arteries (Total). The Cohen's kappa was used to evaluate the agreement of CV risk stratification between the pair-wised chest CT data. The severity of CV risk was stratified into four stages based on a total agatston score (TAS); normal for TAS = 0, mild for 0 < TAS = 99, moderate for 100 = TAS < 300, and severe for TAS = 300.

### RESULTS

For the 5-point Likert scoring on CAC segmentation, the score was turned out to be about 4.4 out of 5. The ICC value between the total agatston score of the prior and the subsequent CT data was 0.99 [95%CI, 0.978-0.996] and it was statistically significant ($p < 0.001$). The mean difference of agatston score derived from the BA analysis were 7.95, -44.04, 8.58, 2.54, and 24.79 for LM, LAD, RCA, LCX and Total, respectively. The Cohen's kappa for the CV risk stratification was 0.73 [95%CI, 0.50-0.97, $p<0.001$]. Both qualitative and quantitative results represented good reliability of AI-CAD for diagnosis assist.

### CONCLUSION

The AI-CAD for CAC scoring and CV risk stratification is found to be reliable for repetitively acquired CT scan data. We expect that it could be further applicated to a monitoring of CAC progression in low-dose chest screening CT for reliable quantification.

### CLINICAL RELEVANCE/APPLICATION

Fully automated AI-CAD to both CAC scoring and cardiovascular risk stratification would improve the prediction of future CV events in patients with suspected coronary artery disease.

## T2-SPIN-2 STATE OF NATIONAL INSTITUTES OF HEALTH GRANT FUNDING OF AI IN RADIOLOGY

Kirti Magudia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
David F. Kallmes, MD (*Abstract Co-Author*) Research support, Terumo Corporation;Research support, Medtronic plc;Consultant, Medtronic plc;Research support, General Electric Company;Consultant, General Electric Company;Stockholder, Superior Medical Solutions, Inc;Stockholder, Marblehead Medical, LLC;Research support, NeuroSigma, Inc;Research support, Neurogami Medical, Inc;Research support, Insera Therapeutics, LLC
Waleed Brinjikji, MD (*Abstract Co-Author*) Consultant, Terumo Corporation;Consultant, Johnson & Johnson;Ownership Interest, Marblehead Medical LLC
Evan D. Calabrese, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vikash Gupta, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Barbaros S. Erdal, PhD (*Abstract Co-Author*) Nothing to Disclose
Miriam Chisholm (*Abstract Co-Author*) Nothing to Disclose
Mohamed Sobhi Jabal, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to delineate the current state of National Institutes of Health (NIH) funding for artificial intelligence (AI) applications in radiology, highlighting trends by funding institute, grant mechanism, investigator demographics, and ranking of funded institutions.

**METHODS AND MATERIALS**

Data on active NIH-funded AI projects in radiology were collected from the NIH-RePORTER database using a combination of MeSH and free-text terms with boolean logic. Descriptive statistics were derived for grant types, administering institutes/centers, and principal investigator (PI) details. Correlations between PI gender, number of PIs involved, and previous grant experience were analyzed. Text mining techniques were employed to identify prevalent terms and topics in project titles and descriptions.

**RESULTS**

A total of 1,064 active AI grants in radiology, amounting to $697 million in funding, were identified. The National Institute on Aging (NIA) provided the most funding (17.6%), followed by the NIMH, NCI, NHLBI, NINDS, and NIBIB. R01 grants accounted for the largest share of funds at 40.2%. While no correlation was found between PI gender and funding amount, however the majority of PIs (68.8%) were males. Machine learning, magnetic resonance imaging (MRI), and clinical applications emerged as the most prevalent topics. Massachusetts General Hospital, University of Pennsylvania, and Stanford University secured the highest funding. The top funded states were Massachusetts, Pennsylvania, and California. The most awarded departments were radiation-diagnostic/oncology, followed by engineering, internal medicine/medicine, psychiatry, psychology, and neurology.

**CONCLUSION**

The study provides a comprehensive snapshot overview of the current landscape of NIH funding for AI research in radiology. The findings offer insights into funding patterns across institutes, mechanisms, investigators, and research topics, and key areas of focus of the awarding institutions and contributing scientists in the field.

**CLINICAL RELEVANCE/APPLICATION**

Understanding the characteristics, focus areas, and trends in AI research grants in radiology is crucial for investigators seeking funding opportunities and policymakers aiming to support impactful research. The insights gained from this study can help guide resource allocation, collaboration, and strategic decision-making to advance AI innovation in radiology.

## T2-SPIN-3 IMPROVED SEGMENTATION OF LUNG TUMORS WITH VARIED SIZES AND ATTACHMENTS USING DUAL-WINDOW FULL-SCALE SEGMENTATION NETWORK

Helen Hong, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoonseon OH (*Abstract Co-Author*) Nothing to Disclose
Min Jin Lee, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to achieve consistent segmentation of lung tumors in chest CT images, regardless of variations in size and location, including isolated tumors or those attached to chest wall, mediastinal, or vascular structures. We propose a Dual-Window Full-Scale Segmentation Network(DWFS-Net) that integrates feature map fusion obtained from dual-window images considering both lung and mediastinal windows, and incorporates full-scale concatenation paths.

**METHODS AND MATERIALS**

We evaluated 152 tumors from the NSCLC-Radiomics public dataset provided by the Cancer Imaging Archive, comprising 39 lung adenocarcinomas and 113 lung squamous cell carcinomas. To address the varied locations of lung tumors, we generated dual-window images using the lung window setting for better visualization of isolated tumors and the mediastinal window setting for tumors attached to surrounding structures. Each dual-window image underwent processing by separate encoders, and feature map fusion was achieved by concatenating the output feature maps from each layer. To effectively handle the diverse sizes of lung tumors, we employed the UNet3+ backbone with full-scale concatenation paths and deep supervision. We compared both single-lung and single-mediastinal window methods with a single encoder. Additionally, we analyzed segmentation results based on tumor size and attachment, as well as overall lung tumor segmentation.

**RESULTS**

Our DWFS-Net demonstrated the highest performance with a DSC of 79.44% in overall tumors segmentation. Compared to the single lung window method, our DWFS-Net showed slightly lower recall but higher precision, effectively reducing the number of false positives. Segmentation results across all size groups demonstrated a consistent trend with those for the overall tumors. In the heavily attached group, our DWFS-Net achieved a precision of 75.39%, indicating an improvement of 3.86% compared to the single-lung window method and 3.59% compared to the single-mediastinal window method. This result demonstrated effective mitigation of over-segmentation caused by leakage into adjacent attached structures.

**CONCLUSION**

Our DWFS-Net significantly reduced false positives (FP) in adjacent structures by utilizing dual window images that include both lung and mediastinal windows. It also achieved consistent segmentation results across tumors of various sizes by leveraging full-scale concatenation paths. This research was supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIT)(No. RS-2023-00207947)

**CLINICAL RELEVANCE/APPLICATION**

Our study can assist in accurately measuring tumor volume and size, which are essential for assessing treatment response and monitoring disease progression.

## T2-SPIN-4 RACOON: ESTABLISHING A SUSTAINABLE NATIONWIDE RADIOLOGICAL INFRASTRUCTURE FOR COLLABORATIVE IMAGING RESEARCH

Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hans-Ulrich Kauczor, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Koninklijke Philips NV;Speakers Bureau, Koninklijke Philips NV;Speakers Bureau, AstraZeneca PLC;Speakers Bureau, Boehringer Ingelheim GmbH;Speakers Bureau, Merck & Co, Inc
Christiane K. Kuhl, MD, PhD (*Abstract Co-Author*) Advisory Board, Guerbet SA;Speaker, Bracco Group;Speaker, Bayer AG
Diane M. Renz, MD (*Abstract Co-Author*) Nothing to Disclose
Tobias Penzkofer, MD (*Abstract Co-Author*) Researcher, Aprea Therapeutics AB;Researcher, Astellas Group;Researcher, AstraZeneca PLC;Researcher, Bristol-Myers Squibb Company;Researcher, Genmab A/S;Researcher, Incyte Corporation;Researcher, Lion Biotechnologies, Inc;Researcher, Takeda Pharmaceutical Company Limited

Matthias S. May, MD (*Abstract Co-Author*) Speakers Bureau, Siemens AG
Heinz-Peter W. Schlemmer, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG
Jens Kleesiek (*Abstract Co-Author*) Nothing to Disclose
Bernd K. Hamm III, MD (*Abstract Co-Author*) Research Consultant, Canon Medical Systems Corporation;Research Grant, Canon Medical Systems Corporation;Stockholder, Siemens AG;Research Grant, Siemens AG;Stockholder, General Electric Company;Research Grant, General Electric Company;Research Grant, Koninklijke Philips NV;Research Grant, Elbit Imaging Ltd;Equipment support, Elbit Imaging Ltd;Research Grant, Bayer AG;Research Grant, Guerbet SA;Research Grant, Bracco Group;Research Grant, B. Braun Melsungen AG;Research Grant, Krauth Medical KG GmbH & Co;Research Grant, Boston Scientific Corporation;Investigator, CMC Contrast AB
Gerald Antoch, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias A. Fink, MD, BSc (*Abstract Co-Author*) Nothing to Disclose
Walter Heindel, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Konstantin Nikolaou, MD, MBA (*Abstract Co-Author*) Advisory Panel, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Siemens AG;Advisory Panel, Bayer AG;Speakers Bureau, Bayer AG;Research Grant, Bayer AG
Rickmer Braren, MD (*Abstract Co-Author*) Nothing to Disclose
Felix G. Meinel, MD (*Abstract Co-Author*) Nothing to Disclose
Andreas Bucher, MD (*Presenter*) Travel support, Bayer AG Travel support, Guebert SA Travel support, Pharmacept

**PURPOSE**

To provide a sustainable nationwide infrastructure as an end-to-end solution for a broad scope of radiological research projects, with a focus on AI training and imaging biomarker development.

**METHODS AND MATERIALS**

Initially launched in response to the pandemic emergency, RACOON (RAdiological COOperative Network) has built a unique network infrastructure connecting all of the country's university hospitals. Its capabilities have since been expanded to address a wide range of research topics, and it has evolved into a long-term infrastructure solution for the management, annotation and aggregation of imaging data of the country. This development has been carried out in strict compliance with privacy regulations and legal requirements. The infrastructure includes its own cloud solution, which enhances data accessibility and security. In addition, RACOON supports federated learning capabilities, facilitating AI training across distributed environments without compromising privacy.

**RESULTS**

Within the RACOON infrastructure, more than 17,300 thoracoabdominal CT datasets - enriched with more than 2.2 million complementary clinical parameters - have been annotated using standardized radiologist reports (containing more than 7.5 million report items) and manual annotations. This has resulted in the creation of the largest collaborative dataset of its kind. Applications now include neuroradiology MRI and CT datasets, musculoskeletal analysis of CT scans, and pediatric X-ray and CT studies. Recent use cases include a prospective gynecologic MRI cohort for adenomyosis characterization and advanced image analysis for pediatric non-Hodgkin's lymphoma, pulmonary embolism, and pancreatic adenocarcinoma, which also facilitate training and evaluation of specific AI applications. To date, the infrastructure supports more than 76 image-based research applications and has expanded its collaborative scope to include a variety of other clinical disciplines.

**CONCLUSION**

RACOON has successfully implemented a transformative and unique network that significantly reduces the organizational overhead associated with federated and centralized AI training and a broad range multicentric studies. It provides robust and scalable infrastructure, ensuring high-quality data acquisition and fostering advanced image analysis research and AI development across diverse medical fields.

**CLINICAL RELEVANCE/APPLICATION**

This initiative can provide pandemic preparedness but also sets a precedent for future collaborative research endeavors, making it a pivotal element in Germany's healthcare research infrastructure.

## T2-SPIN-5 COMPARATIVE ANALYSIS OF LUNG TUMOR SEGMENTATION WITH CNN-BASED APPROACHES USING DUAL-WINDOW IMAGES IN VARIOUS FUSION METHODS

Helen Hong, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoonseon OH (*Abstract Co-Author*) Nothing to Disclose
Min Jin Lee, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to improve the segmentation performance of lung tumors by overcoming the difficulties in segmentation caused by various tumor sizes and attachment degrees to surrounding structures. To achieve this, meaningful context extracted from dual-window images in chest CT scans is fused through various fusion methods to compare and analyze segmentation effects.

**METHODS AND MATERIALS**

We evaluated 152 tumors from NSCLC-Radiomics public dataset provided by the Cancer Imaging Archive, consisting of 39 lung adenocarcinomas and 113 lung squamous cell carcinomas. Utilizing the UNet3+ backbone with full-scale skip connections, deep supervision, and hybrid loss functions, we effectively addressed the size diversity of lung tumors and improved their segmentation performance. While the lung window image offers better visualization of isolated tumors, distinguishing lung tumors from surrounding structures with similar intensities is challenging. Conversely, the mediastinal window image offers optimal contrast, aiding in differentiation from adjacent structures, although tumors may appear smaller compared to the lung window image. To leverage the advantages of dual-window images, we employed various fusion methods, including early-fusion, intermediate-fusion, and late-fusion. Segmentation performance was evaluated for each fusion method, analyzing the results based on tumor size groups, degrees of attachment, and overall lung tumor segmentation.

**RESULTS**

Intermediate-fusion of dual-window images outperformed the other methods, achieving the highest DSC across all size groups and for heavily attached lung tumors, with 79.44% for the overall tumors and 77.57% for heavily attached lung tumors. This indicates that this method effectively incorporates the distinctive features of individual images. Conversely, early-fusion exhibited the lowest performance across all metrics, suggesting difficulty in effectively handling the characteristics of individual images. Late-fusion demonstrated performance similar to that of the single-window methods.

**CONCLUSION**

This study demonstrated that the intermediate-fusion method, utilizing dual-window images, outperformed other fusion methods across tumor size groups and degrees of attachment, while also effectively leveraging the benefits of dual-window images. (This research was supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIT) (No. RS-2023-00207947))

### CLINICAL RELEVANCE/APPLICATION

Improving the accuracy of lung tumor segmentation is essential for accurately measuring tumor volume and size, which are necessary for assessing treatment response and monitoring disease progression.

## T2-SPIN-6 DEFINING CT-BASED NORMATIVE VALUES FOR BODY COMPOSITION INDICES IN AN INDIAN COHORT

Saugata Sen, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Karteek Popuri (*Abstract Co-Author*) Nothing to Disclose
Manali Mukherjee (*Abstract Co-Author*) Nothing to Disclose
Mirza Faisal Beg (*Abstract Co-Author*) Nothing to Disclose
Priya Ghosh, MD,MBBS (*Abstract Co-Author*) Nothing to Disclose
Subhasis Goswami (*Abstract Co-Author*) Nothing to Disclose
Anurima Patra, MD, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

To determine sex-specific cut-off values for fat and skeletal muscle indices among healthy Indian adults at the L3 vertebral level using CT scans

### METHODS AND MATERIALS

This was a single-center study of patients who underwent Contrast CT abdomen or KUB between 2020-2023 for acute abdomen, renal calculi or blunt accidental trauma. Patients with any prior history of malignancy, or any neoplastic masses detected on the CT were excluded. Body composition analysis was performed using automated segmentation via Data Analysis Facilitation Suite by Voronoi Health Analytics, Inc. Skeletal muscle area (SMA), skeletal muscle index [SMI; SMA/height] and visceral-to-subcutaneous adipose tissue area ratio (VSR) were measured at 5mm axial CT sections at L3 vertebrae level using Hounsfield unit (HU) threshold of -30 to +150 HU for muscle, -150 to -50 HU for visceral adipose tissue and -190 to -30 HU for subcutaneous adipose tissue. Mean minus 2 standard deviation (SD) values were used to define sex-specific cut-offs for SMA, SMI and VSR. The values were compared with those in existing literature.

### RESULTS

There were 556 adults [270 males, 286 females) included in the study. The overall mean (range) age was 48.9 (18-96) yrs]. The mean +/- SD SMA ($cm^2$) and SMI ($cm^2/m^2$) for males and females was 103.3+25.4 and 75.9 + 14.2, and 39.1 + 9.1 and 33.3 + 5.8 respectively. Cutoff values for SMA ($cm^2$) for males and females were 52.5 and 47.5 respectively, and for SMI ($cm^2/m^2$) was 20.9 and 21.7 respectively. The VSR cut-offs for males and females were found to be 42.7 and 45.5 respectively (Tables 1 and 2).

### CONCLUSION

We used data from healthy Indian adults to establish sex-specific cutoffs for body composition indices. These values can aid in defining sarcopenia in the Indian population.

### CLINICAL RELEVANCE/APPLICATION

Body composition indices vary globally due to differences in body size, lifestyles and ethnicities. Applying a set of universally recommended threshold values derived from predominantly Western data to define sarcopenia in regional populations can lead to erroneous results. Currently, normative CT-based data specific to the Indian population are lacking. We found that our cut-offs were lower than the reference standards laid by the European Working Group on Sarcopenia. Large-scale prospective studies are required to validate whether our cut-offs are successful in predicting outcomes in Indian population.

## T2-SPIN-7 PUBLISHING OPEN ACCESS OR SUBSCRIPTION-BASED ACCESS? A COMPARATIVE ANALYSIS OF CITATIONS AND ALTMETRIC ATTENTION SCORES IN THE FIELD OF RADIOLOGY

Onur Simsek, MD (*Abstract Co-Author*) Nothing to Disclose
Arastoo Vossough, PhD, MD (*Abstract Co-Author*) Research Consultant, Syneos Health;Stockholder, DeepSight Technology, Inc
Dana Alkhulaifat, MD (*Abstract Co-Author*) Nothing to Disclose
Amirreza Manteghinejad, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Research teams seek to increase the impact of their work by sharing it with a wider audience, thereby enhancing its potential impact. To publish their works, researchers currently have two options: publishing as open-access (OA) or subscription-based access (SA). OA publishing is thought to have the potential to increase citation rates and attention in social media through greater accessibility. However, previous studies have produced inconsistent results and a systematic review regarding the citation counts has identified biases in many of these studies. This study aimed to focus on clinical radiology journals and use a matched methodology to compare citation counts and Altmetric attention scores between OA and SA articles in radiology journals.

### METHODS AND MATERIALS

This study is a cross-sectional study conducted on original and review articles published from 2000 to 2023 in clinical radiology journals indexed in Web of Science (WoS) and MEDLINE having a hybrid publishing model. Conference papers were excluded from this study. After obtaining the data, we performed a 1:1 matching of OA and SA papers by multiple article characteristics to minimize confounding and bias. These characteristics included the journal itself, type of study (original vs. review), publication date, number of authors, corresponding author country category based on gross national income per capita and number of references. Papers without a corresponding match were excluded. Matching of the number of authors and references was done with a tolerance of 2 and 10, respectively, to prevent excessive data loss. We also extracted citation counts and Altmetric attention scores using WoS and Altmetric Explorer platforms. We used the Mann-Whitney test to compare the citation counts and Altmetric attention scores.

### RESULTS

This study evaluated 274185 papers from 105 journals.183636 (67%) were SA papers and 90822 (33%) were open access. After article matching, 57586 were included in this study (28793 OA papers vs. 28793 SA papers). Comparing the citation counts showed a significant difference between the OA and SA papers (median=16 [IQR: 6-39] vs. 13 [IQR: 5-32], $p<0.001$). Comparing Altmetric attention scores also showed a significant difference between the OA and SA papers (median = 2 [IQR: 0-5] vs. 1 [IQR: 1-4], $p<0.001$).

### CONCLUSION

A feature-matched comparison analysis between OA and SA papers published in clinical radiology journals supports the idea of citation and attention advantage of OA radiology papers.

### CLINICAL RELEVANCE/APPLICATION

While there is no direct clinical application for this study, it is important that institutions, labs, and research teams know that publishing their projects as OA can lead to higher visibility and citations of their work, including in the same journal.

## T2-SPIN-8 TEXTURAL HETEROGENEITY OF LIVER LESIONS IN CT IMAGING - COMPARISON OF COLORECTAL AND PANCREATIC METASTASES

Stefan O. Schoenberg, MD, PhD (*Abstract Co-Author*) Research agreement, Siemens AG
Hishan Tharmaseelan (*Abstract Co-Author*) Nothing to Disclose
Florian Haag (*Abstract Co-Author*) Nothing to Disclose
Matthias F. Froelich, MD (*Abstract Co-Author*) Consultant, Smart Reporting GmbH;Consultant, Guerbet SA
Friedrich Pietsch (*Presenter*) Nothing to Disclose

### PURPOSE

Tumoral heterogeneity poses a challenge for personalized cancer treatments. Especially prevalent in metastasized cancer, it remains a major limitation for successful targeted therapy, often leading to drug resistance due to tumoral escape mechanisms. This work explores a non-invasive radiomics-based approach to capture textural heterogeneity in liver lesions and compare it between colorectal cancer (CRC) and pancreatic cancer (PNC).

### METHODS AND MATERIALS

In this retrospective single-center study, 1291 liver metastases of 42 colorectal cancer (430 metastases) and 31 pancreatic cancer (861 metastases) patients were segmented fully automated on contrast-enhanced CT images by a UNet for medical images. Radiomics features were extracted using the Python package Pyradiomics. To quantify the heterogeneity the mean absolute coefficient of variation (ACV) was calculated patient-wise for each feature. An unpaired t-test identified features with significant differences in feature variation between CRC and PNC metastases.

### RESULTS

In both colorectal and pancreatic liver metastases, interlesional heterogeneity can be observed. 75 second-order features were extracted to compare the varying textural characteristics. In total, 18 radiomics features showed a significant difference ($p<0.05$) in their expression between the two malignancies. Out of these, 16 features showed higher levels of variability in the cohort of pancreatic metastases. Visual analysis of a created radar plot suggests greater textural heterogeneity for this entity.

### CONCLUSION

Radiomics has the potential to identify the interlesional heterogeneity of CT texture among individual liver metastases originating from the same primary entity. The analysis of quantitative image data can detect differing textural expressions and a variation in the extent of heterogeneity levels in CRC and PNC liver metastases.

### CLINICAL RELEVANCE/APPLICATION

This study serves as a proof of concept for comparing the heterogeneity between liver metastases in CT imaging across two gastrointestinal tumor entities, while also illustrating the interlesional heterogeneity among individual liver metastases originating from the same primary entity. Quantifying and improving the comparability of tumoral heterogeneity holds great potential to foster the tailoring of diagnostics and subsequent therapy.

# Abstract Archives of the RSNA, 2024

T2-SPIR

**Interventional Radiology Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPIR-1 USING MACHINE LEARNING TO DETECT ATHEROSCLEROTIC RENAL ARTERY STENOSIS FROM SPECTRAL DOPPLER WAVEFORMS - A PILOT STUDY

Shahriar Faghani, MD (*Abstract Co-Author*) Nothing to Disclose
Sanjay Misra, MD (*Abstract Co-Author*) Support, Cardinal Health, Inc
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Seyed M. Rassoulinejad Mousavi, MD (*Abstract Co-Author*) Nothing to Disclose
Haseeb Mukhtar, MBBS, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate whether machine learning (ML) can be used to determine atherosclerotic renal artery stenosis (ARAS) from spectral doppler waveforms in renal duplex ultrasound (DUS).

### METHODS AND MATERIALS

Patients with unilateral ARAS (contralateral normal kidney) confirmed on renal angiogram and requiring renal artery stent placement were retrospectively identified from January 2000 to January 2022. Patients were excluded if they had a transplanted kidney, more than 1 renal artery on either side, a previously placed renal artery stent with in-stent restenosis, RAS due to nonatherosclerotic causes, or if pre-operative duplex scan images were unavailable. 200 patients were selected; the affected kidney was used as the positive cases, and the contralateral kidney as the control. The spectral waveforms were reconstructed by tracing the outer envelope manually using WebPlotDigitizer. The graphical coordinates obtained were then converted to one-dimensional velocity signals. Signals were labeled as ARAS and normal and then randomly divided into training (80%) and testing (20%) datasets. A one-dimensional convolutional neural network was trained to classify the signals and detect ARAS. The Adam optimizer with a learning rate of 0.001 and cross-entropy loss function were utilized. The model was trained for 500 epochs.

### RESULTS

396 signals from 198 patients were used (2 signals from each patient, 1 ARAS, and 1 control) after excluding 2 patients due to inadequate signal extraction (median age=72 years, females=51.0%). The overall accuracy of our trained model was 95%, with 94% specificity, and 94% precision. The area under the receiver operator characteristic curve was 0.97.

### CONCLUSION

Machine learning was successfully employed to detect ARAS using arterial spectral doppler waveforms in DUS.

### CLINICAL RELEVANCE/APPLICATION

This work demonstrates that artificial intelligence can be effectively used to detect ARAS using doppler waveforms. This could potentially open the door to automating the diagnosis and management of clinically significant ARAS. Future directions of this study include developing a model that can accurately determine the degree of stenosis and utilizing AI techniques to predict the risk of in-stent restenosis or progression to renal replacement therapy post renal artery stenting.

## T2-SPIR-3 AI-BASED IMAGE QUALITY ENHANCEMENT IN LOW DOSE C-ARM CT: A POTENTIAL SOLUTION FOR RADIATION REDUCTION IN TRANSARTERIAL CHEMOEMBOLIZATION (TACE)

Jong H. Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Yong-Su Bae, RT (*Abstract Co-Author*) Nothing to Disclose
Saebeom Hur, MD (*Abstract Co-Author*) Nothing to Disclose
Chul kyun Ahnn (*Abstract Co-Author*) Nothing to Disclose
AHYEONG LEE, BEng (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the potential of deep learning based denoising technique for radiation dose reduction and image quality (IQ) enhancement in C-arm based computed tomography angiography (CTA).

### METHODS AND MATERIALS

This study collected low-dose (LD) C-arm CBCT data from the Seoul National University Hospital, where each scan was conducted at a quarter level of the routine dose (RD) from 2020 to 2021. The data comprised of images from 139 patients undergoing transarterial chemoembolization (TACE) using Axiom Artis C-arm system (Siemens Healthcare, Forchheim, Germany). LD C-arm CBCT images were reconstructed via filtered back projection (FBP) and additionally denoised using commercial AI-denoising software (ClariCT.AI, ClariPi Inc., Seoul, Republic of Korea). Image quality superiority was evaluated between LD and denoised LD (DLD) images. The qualitative IQ evaluation was performed based on subjective noise, blood vessel visibility, and vessel smoothness using pairwise comparison method by three radiologists. Each qualitative evaluation categories were analyzed in Axial, maximum intensity projection (MIP), and volume rendering, respectively. The quantitative evaluation was performed based on image noise, signal-to-noise ratio (SNR) and the image sharpness. The sharpness was measured using edge rise distance (ERD) acquired by measuring 90 % and 10 % of maximum HU at the edge structure.

### RESULTS

The qualitative IQ score were 1.67 for the quantum noise, 0.47 for horizontal blood vessel visibility, and 0.36 for vessel smoothness. The visual assessment results exhibited significant superiority of AI-based DLD over LD approach. It demonstrated DLD showed significantly lower noise level than that of LD (Mean noise of DLD vs LD for liver parenchyma, erector muscles, and aorta: 36 vs 86 HU, 37 vs 174 HU, and 53 vs 117 HU, respectively). The SNR was increased by mean 2.4 times in DLD images compared to LD images. ERD in common hepatic artery was 1.18 ±0.11 mm for LD and 1.05 ±0.14 mm for DLD, indicating superior sharpness in DLD images compared to LD images.

### CONCLUSION

The utilization of DL-based denoising technique in low-dose C-arm CBCT significantly improves image quality. Implementing the DL-based denoising technique in C-arm CT has the potential to decrease patient radiation exposure during TACE procedures, a critical intervention for liver cancer treatment.

### CLINICAL RELEVANCE/APPLICATION

Application of DL-based denoising technique can be applied to C-arm based CBCT to reduce patient radiation dose for TACE which is widely used in liver cancer procedures.

## T2-SPIR-4 PRESCREENING RADIOLOGY REPORTS FOR PROSTATE CANCER RECURRENCES USING A LARGE LANGUAGE MODEL (LLM)

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
David A. Woodrum, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shahriar Faghani, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Ganjizadeh, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study was to evaluate the efficiency and accuracy of using the Mixtral 8x7b v0.1 Instruct LLM to prescreen radiology reports for prostate cancer recurrences post-MR-guided seminal vesicle cryoablation.

### METHODS AND MATERIALS

This retrospective study included 164 patients who underwent seminal vesicle cryoablation and were followed up with either PET or MRI scans every three months until 2 years. A total of 582 radiology reports were assessed using the Mixtral 8x7b v0.1 LLM, which was not fine-tuned but provided specific details about prostate cancer and radiological report analysis. The LLM analyzed the reports for recurrence indications at the ablation site without anatomical guidance. The performance of the model was evaluated by comparing its predictions with manual assessments of the radiology reports.

### RESULTS

The model identified 21 true positive and 498 true negative reports, alongside 63 false positive and no false negative results. The performance metrics were: PPV = 25.00%, NPV = 100.00%, sensitivity = 100.00%, and specificity = 88.77%. The use of a language model for the prescreening of radiology reports substantially enhances efficiency, processing 582 reports in approximately 4 hours.

### CONCLUSION

This study demonstrates the potential of using an LLM for prescreening radiology reports to facilitate the detection of prostate cancer recurrences. Despite a high rate of false positives, which were largely attributed to anatomical proximity errors in token embedding, the model effectively ensured that no recurrence was missed. This emphasizes its utility as a clinical tool for enhancing radiologist awareness. Further refinement of the model's performance is necessary to reduce false positives.

### CLINICAL RELEVANCE/APPLICATION

The application of LLMs in prescreening radiological reports for cancer recurrence offers a significant time-saving advantage and ensures high sensitivity in clinical settings. This technology can serve as a supplementary tool to assist radiologists in managing large volumes of data, focusing on high-priority cases, improving patient care, and improving the early detection and management of cancer recurrences. This leads to timely interventions and improved patient outcomes.

## T2-SPIR-6 RISK FACTORS PRECEDING UTERINE ARTERY EMBOLIZATION IN THE SETTING OF POSTPARTUM HEMORRHAGE

Arsalan Saleem, MD (*Abstract Co-Author*) Nothing to Disclose
Gautam Edhayan, MD (*Abstract Co-Author*) Nothing to Disclose
Rylie Ju, MD (*Abstract Co-Author*) Nothing to Disclose
Yash Ramgopal (*Abstract Co-Author*) Nothing to Disclose
Devin Reddy (*Presenter*) Nothing to Disclose

### PURPOSE

Uterine artery embolization (UAE) is a minimally invasive, uterine-sparing intervention that can help control postpartum hemorrhage (PPH) when more conservative management has failed. While the risk factors for PPH are well established, those leading to the use of embolization remain unclear. This study was designed to determine how maternal history, pregnancy characteristics, and peripartum events impact the utilization of UAE for PPH in the peripartum period.

### METHODS AND MATERIALS

This retrospective cohort study queried electronic health records from 78 healthcare organizations in the United States for patients with PPH from April 2014 to April 2024. Patients who did and did not undergo UAE were then analyzed for risk factors in the preceding year from their initial event.

### RESULTS

Among 158,741 patients identified with postpartum hemorrhage, 796 underwent UAE (mean age 32.1±6.4 years), and 157,945 did not undergo UAE (mean age 29.7±6.6 years). Patients with a history of uterine scar (attributable risk (AR) 57.20%, p<0.0001), uterine fibroids (AR 57.86%, p<0.0001), and endometriosis (AR 45.79%, p=0.01) had a significantly increased risk PPH treated with UAE. Pregnancy characteristic at significantly increased risk for PPH treated with UAE included advanced maternal age (AR 43.74%, p<0.0001), conception via assisted reproductive technology (AR 59.52%, p<0.0001), uterine over-distension (AR 29.17%, p=0.0001), placental abnormalities (AR 59.66, p<0.0001), and pre-eclampsia (AR 37.56%, p<0.0001). Peripartum events of cesarean delivery (AR 55.81%, p<0.0001), acute anemia (AR 76.62%, p<0.0001), disseminated intravascular coagulation (AR 93.21%, p<0.0001), thrombocytopenia (AR 57.39%, p<0.0001), and shock (AR 94.46%, p<0.0001) had a significantly increased risk of PPH treated with UAE. Other risk factors for PPH were not associated with a significant increase in the utilization of UAE.

### CONCLUSION

In this large retrospective cohort of patients with PPH, significant risk factors for treatment with UAE included a history of uterine scars and fibroids, and pregnancy characteristics of conception through assisted reproductive technology, and placental abnormalities. Identifying these critical risk factors can help preemptively identify patients at higher risk of needing UAE, potentially reducing maternal and neonatal morbidity and mortality.

### CLINICAL RELEVANCE/APPLICATION

Patients with PPH are at increased risk for maternal and neonatal harm. The risk factors identified in this study enable early identification of patients who may require UAE. The findings in this study can be used to improve multidisciplinary coordination of care and response times, ultimately reducing maternal and neonatal morbidity and mortality.

## T2-SPIR-7 NON-CONTRAST CT BASED AI-ENABLED EMERGENT LARGE VESSEL OCCLUSION SCREENING: IMPROVEMENT OF WORKFLOW THROUGH TIME REDUCTION FROM HOSPITAL DOOR TO REPERFUSION

Dohyun Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Soohwa Song, PhD (*Abstract Co-Author*) Nothing to Disclose
Dong Hoon Shin, MD (*Abstract Co-Author*) Nothing to Disclose
Aleum Lee, PhD, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study is to evaluate the time reduction from hospital door to endovascular treatment (EVT) when using a non-contrast CT (NCCT) basis artificial intelligence (AI) solution to classify and notify patients with emergent large vessel occlusion (ELVO). In real-clinical practice, the NCCT is mainly used to identify whether cerebral hemorrhage has occurred. However, if patients of suspected ELVO can be quickly screened and notified to clinicians in step of the NCCT test, it has the advantage of improving the prognosis by reducing the time required for treatment. Therefore, it was compared the time from the door of emergency room (ER) to reperfusion before and after to use of AI solution for evaluating clinical effectiveness aspects.

### METHODS AND MATERIALS

Patients over 19 years of age who visited a thrombectomy capable stroke center with acute stroke symptoms and underwent EVT were compared before and after application of AI solution basis triage and notification. For the Post-AI group, cases were collected prospectively after applying the AI solution [2022.05.01~2023.12.31], and cases with similar age, gender, and NIHSS with Post-AI group were retrospectively collected as the Pre-AI group [2020.05.01~2022.04.31]. The primary endpoint of study was the statistical difference of time from ER door to endovascular treatment between Pre-AI and Post-AI groups. Additionally, time from ER door to CT scan, CT scan to Stroke team treatment (STT), and STT to EVT were compared between groups as a secondary endpoint. Differences in time between groups were statistically compared using an unpaired t-test with Welch's correction.

### RESULTS

A total of 25 cases were enrolled as the Pre-AI group, and total 70 cases were selected after 1:3 propensity score matching with age, gender and NIHSS in retrospective ELVO cases. As a result of primary endpoint, time from ER door to EVT was significantly different between Pre-AI (174.7±75.0 min.) and Post-AI (147.7±31.6 min) [p=0.0155]. In detail results of time comparison, only time from CT scan to Stroke team treatment was significantly reduced in Post-AI group (20.2±7.9 min. vs. 35.4±41.3 min., p=0.0043).

### CONCLUSION

It has been confirmed that quickly screening ELVO patients and notifying clinicians by an AI solution at the very front of the clinical process can significantly reduce the time from ER admission to EVT, and it will influence to prognosis outcome. Therefore, it is highly recommended to use for effective workflow in clinical environment.

### CLINICAL RELEVANCE/APPLICATION

This study demonstrated how AI improved the hyperacute endovascular treatment workflow, by showing the impact on reducing door-to-reperfusion time. It will be particularly valuable in remote regions where clinical experts may be limited.

## T2-SPIR-8 TRANSFORMATIVE APPROACH TO PREVENTING CATHETER-ASSOCIATED URINARY TRACT INFECTIONS WITH ZN/AGNP-COATED URINARY CATHETERS

Yubeen Park (*Abstract Co-Author*) Nothing to Disclose
Jung-Hoon Park, PhD (*Abstract Co-Author*) Nothing to Disclose
Dong-Sung Won, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Catheter-associated urinary tract infections (CAUTIs) are caused by prolonged catheterization, which lead to bacterial colonization and biofilm formation. Commercial catheters coated with silver nanoparticles (AgNP) inhibit bacterial growth, but their long-term efficacy is limited due to reduced silver ion release. Dual-coating strategies, targeting both antimicrobial and antiseptic actions, have emerged. This study aims to investigate the safety and efficacy of Zn/AgNP both in vitro and in vivo.

## METHODS AND MATERIALS

A commercially available silicone catheter (8 Fr, 20 cm) was coated with polydopamine, followed by silver nanoparticles (AgNP) and zinc (Zn) via RF sputtering, creating uncoated, AgNP-coated, and Zn/AgNP-coated catheter samples. Surface analysis included FESEM-EDS and FIB-EDS. Contact angle, tensile properties, ion release, and antimicrobial effects were assessed. In vivo, rabbits were divided into groups receiving each catheter type, followed by sacrifice after 4 weeks for analysis of urine, cystoscopy, and surface characteristics. HE, MT, and TUNEL analysis evaluated inflammation, epithelial layer, collagen deposition, and apoptosis.

## RESULTS

AgNP-coated and Zn/AgNP-coated catheters were successfully synthesized and showed rough and smooth surface characteristics, respectively, in FESEM images. The dual-layered strategy successfully attained a bactericidal effect while mitigating cytotoxicity through the sustained and controlled release of AgNPs and Zn ions. Catheter placement was successful without complications and all rabbits survived until the end of the study. Urethroscopic examination showed significant differences in sludge formation area among the groups ($p < 0.001$). Microscopic analysis showed significant differences in biofilm area between groups ($p < 0.001$). Moreover, histopathologic analysis showed significant differences in inflammatory cell infiltration, epithelial layer thickness, and TUNEL-positive deposition ($p < 0.001$).

## CONCLUSION

The dual-layer Zn/AgNP coating not only aims to improve the clinical management of urinary catheterizations by reducing CAUTIs, but also substantially decreases the risk of complications associated with prolonged catheter usage.

## CLINICAL RELEVANCE/APPLICATION

The introduction of Zn/AgNP-coated urinary catheters offers a transformative approach to CAUTIs by combining the antimicrobial properties of AgNPs and Zn ions with sustained release kinetics. This advanced strategy has the potential to manage patient care and minimize the incidence of healthcare-associated infections.

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RSNA 2024
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# Abstract Archives of the RSNA, 2024

T2-SPMK

**Musculoskeletal Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPMK-2 COMPARATIVE ANALYSIS OF PATELLOFEMORAL AND TIBIOFEMORAL MOTION PATTERNS IN HEALTHY AND PATELLOFEMORAL PAIN SYNDROME KNEES: INSIGHTS FROM DYNAMIC CT-IMAGING

Gert van Gompel, PhD (*Abstract Co-Author*) Nothing to Disclose
Thierry Scheerlinck (*Abstract Co-Author*) Research Consultant, Mathys Ltd Bettlach;Research Grant, Mathys Ltd Bettlach;Speaker, Mathys Ltd Bettlach
Savanah Hereus (*Abstract Co-Author*) Nothing to Disclose
Benyameen Keelson, MSc (*Abstract Co-Author*) Nothing to Disclose
Luca Buzzatti, MS,BSC (*Abstract Co-Author*) Nothing to Disclose
Erik Cattrysse, PhD,MSc (*Abstract Co-Author*) Nothing to Disclose
Nicolas Van Vlasselaer (*Abstract Co-Author*) Nothing to Disclose
Nico Buls, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the impact of patellofemoral pain syndrome (PFPS) on the dynamic weight-bearing kinematics of patellofemoral (PF) and tibiofemoral (TF) joints by conducting a comprehensive 3D analysis of intra-articular joint motion in both healthy individuals and PFPS patients via dynamic CT (4DCT) acquisition.

### METHODS AND MATERIALS

Five healthy and five PFPS patients were recruited to undergo dynamic four-dimensional CT imaging of a knee flexion-extension motion. Multiple subsequent 3D images of the knee joint in motion were acquired in cine mode at 80 kVp,140 mAs, 160 mm detector coverage and 0.28 s rotation time, resulting in a CTDIvol of 6.24 mGy. Total scanning time was 6.2 seconds. While scanning, a supine squat motion was performed utilizing an in-house built weight-bearing device. The acquired images were processed using a deep-learning-based semantic segmentation. Dynamic rigid registrations were applied to isolate and align the knee bones throughout the dynamic scan sequences. To quantify TF and PF kinematics, coordinates of key anatomical landmarks on the femur, tibia and patella were extracted and transformed into local reference frames for precise calculations of tibial adduction (TA) (knee varus angle), internal tibial rotation (ITR) and patellar spin (PS) (x-y-z cardan joint angles). In addition, the bisect-offset (BO) and lateral patellar tilt (LPT) (orthopedic parameters) were assessed. A Mann-Whitney U test ($p<0.05$) was used to compare the differences between the two groups.

### RESULTS

Statistically significant differences were found in the ITR and the PS between healthy subjects and PFPS patients (all $p = 0.032$). The BO demonstrated higher values in PFPS patients, while the LPT and TA demonstrated lower values compared to healthy subjects. However, these differences were not found to be significantly different ($p > 0.05$).

### CONCLUSION

Our findings, derived from dynamic CT scans acquired in weight-bearing conditions, suggest kinematic variations in knee motion between healthy individuals and those with PFPS. Moreover, our findings suggest a potential involvement of the screw-home mechanism of the knee in contributing to these observed differences.

### CLINICAL RELEVANCE/APPLICATION

4DCT enables acquisition of a series of high temporal-resolution 3D CT datasets of moving joints. This capability facilitates in-depth analysis of intra-articular joint kinematics, offering improved diagnostic precision and valuable insights into the dynamic behaviors of joints. These thorough analyses could potentially guide both diagnostic approaches and treatment decisions.

## T2-SPMK-3 DIFFERENCES IN ANATOMICAL FEATURES AND CONCOMITANT INJURIES BETWEEN TIBIAL SPINE AVULSION FRACTURES AND ANTERIOR CRUCIATE LIGAMENT TEARS IN THE PEDIATRIC POPULATION

Matthew P. Moy, MD (*Abstract Co-Author*) Nothing to Disclose
Tony T. Wong, MD (*Abstract Co-Author*) Nothing to Disclose
Sonali Lala, MD (*Abstract Co-Author*) Nothing to Disclose
Charles A. Popkin, MD (*Abstract Co-Author*) Travel support, Arthrex, Inc;Educational support, Arthrex, Inc;Educational support, Smith & Nephew plc;
Jin Yoon, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To determine if there are differences in femoral intercondylar notch width index (NWI) and tibial slope in pediatric patients with tibial spine avulsion fractures (TSF) compared to those with anterior cruciate ligament tears (ACLT) and controls.

### METHODS AND MATERIALS

We performed a retrospective study evaluating patients (age lt; 18) with TSF on MR between 1/1/2010 and 10/31/2023 (n = 30). Age- and gender-matched ACLT patients (n = 30) and control patients were identified (n = 30). Anatomic measurements including femoral intercondylar notch width index, medial tibial slope angle (MTS), and lateral tibial slope angle (LTS) were measured by 2 fellowship-trained musculoskeletal radiologists in consensus. Concomitant injuries, such as meniscal tears or osteochondral injuries, in TSF and ACLT patients were documented based on MR reports and analyzed using Fisher's exact test. Differences in the NWI, MTS, and LTS were assessed with one-way ANOVA and t-tests.

### RESULTS

A total of 90 patients were analyzed for the study (22 males:8 females in each of the 3 patient cohorts). The average ages of the cohorts were 12.5, 14.0, and 13.2 years old for TSF, ACLT, and control cohorts, respectively. In the TSF cohort, the Meyers and McKeever Classification distribution was as follows: Type I/II/III/IV (n = 9/9/8/4, respectively). The one-way ANOVA with post-hoc Turkey HSD test showed that the NWI was significantly higher in the TSF cohort than the control cohort (TSF 0.301 ± 0.039 vs control 0.292 ± 0.031, p = 0.01), and the NWI was significantly lower in the ACLT cohort than the control cohort (ACLT 0.271 ± 0.033 vs control 0.292 ± 0.031, p = 0.02). There was no significant difference in LTS, MTS or concomitant injuries in all three cohorts.

### CONCLUSION

In conclusion, we found that the NWI was the highest in the TSF cohort, followed by the control cohort and then the ACLT cohort. There were no significant relationships between the tibial slope angles or concomitant injuries in any of the 3 cohorts.

### CLINICAL RELEVANCE/APPLICATION

Therefore, the NWI may play a role in predisposing pediatric patients to TSF or ACLT. Our future work includes developing a machine learning algorithm to predict the risk of injury in pediatric patients.

## T2-SPMK-4 CLINICAL 4-MINUTE SIXFOLD ACCELERATED DEEP LEARNING SUPER-RESOLUTION MRI OF THE KNEE - ARTHROSCOPY-VALIDATED DIAGNOSTIC PERFORMANCE FOR INTERNAL DERANGEMENT

Ricardo Donners, MD (*Abstract Co-Author*) Nothing to Disclose
Sven S. Walter, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Fritz, MD (*Abstract Co-Author*) Institutional research support, Siemens AG;Scientific Advisor, Siemens AG;Patent agreement, Siemens AG;Institutional research support, Johnson & Johnson;Institutional research support, Zimmer Biomet Holdings, Inc;Institutional research support, BTG International Ltd
Aline Serfaty Sr, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatiane C. Rodrigues, MD (*Abstract Co-Author*) Nothing to Disclose
Markus M. Obmann, MD (*Abstract Co-Author*) Nothing to Disclose
Hanns-Christian Breit, MD (*Abstract Co-Author*) Nothing to Disclose
Jan Vosshenrich, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the diagnostic performance of a 4-minute clinical combined sixfold simultaneous multislice (SMS) and parallel imaging (PI) accelerated deep learning super-resolution (DLSR) knee MRI for diagnosing internal derangement.

### METHODS AND MATERIALS

Adults with painful knee conditions who underwent sixfold SMS-PI-accelerated 2D-TSE DLSR 3T knee MRI between October 2022 and July 2023 and had arthroscopic knee surgery within eight weeks of the MRI examination were retrospectively included. Seven fellowship-trained musculoskeletal radiologists independently evaluated the knee MRI studies for ligamentous, meniscal, tendinous, and cartilaginous injuries. Cartilage defects were divided into partial and full thickness defects, and assessed for each joint compartment individually. Statistical analyses included kappa-based interreader agreements and diagnostic performance testing (significance level p <.05).

### RESULTS

124 adults (mean age: 46±17 years; 79 men) who underwent arthroscopy within a median of 28 days (range: 4-56) were evaluated. Interreader agreement for detecting arthroscopy-verified structural abnormalities was good or very good (? > 0.71 [95% CI: 0.67, 0.74]). Diagnostic performance testing confirmed good to excellent AUC values for all abnormalities (> 0.81 [95% CI: 0.77, 0.86]). For the diagnosis of ACL tears (n=34), sensitivity was 100% (range among the seven readers: 82%-100%), specificity was 99% (94%-100%), and accuracy was 99% (94%-100%). For PCL tears (n=1), sensitivity, specificity, and accuracy were 100% (100%-100%). Medial meniscus tears (n=85) were diagnosed with a sensitivity, specificity, and accuracy of 95% (86%-98%), 92% (69%-97%), and 94% (87%-98%), respectively. Lateral meniscus tears (n=38) were diagnosed with a sensitivity, specificity, and accuracy of 76% (71%-84%), 97% (83%-98%), and 90% (83%-92%), respectively. The diagnosis and grading of cartilage defects (n=178) had a sensitivity of 85% (69%-84%), a specificity of 88% (86%-97%), and an accuracy of 88% (85%-91%).

### CONCLUSION

Clinical 4-minute 6-fold PI-SMS-accelerated DLSR MRI of the knee has excellent diagnostic performance for diagnosing ligamentous, meniscal, and cartilaginous abnormalities.

### CLINICAL RELEVANCE/APPLICATION

Deep learning-augmented ultra-fast MRI of peripheral joints adds value to musculoskeletal radiology practice by maximizing scan efficiency without sacrificing diagnostic accuray.

## T2-SPMK-6 JUVENILE OSTEOCHONDRITIS DISSECANS LESION STAGING USING SHORT ECHO TIME T2* MRI IMAGES

Jutta Ellermann, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Brent Burg, BA (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the interrater reliability of a novel Juvenile Osteochondritis Dissecans (JOCD) lesion staging system based on lesion healing1.

### METHODS AND MATERIALS

This retrospective IRB and HIPAA-compliant study included 52 MRIs collected for the diagnostic workup for JOCD lesions. Three board-certified MSK radiologists and two MSK fellows staged the studies based on a protocol including short-echo time (~4 ms) T2* MRI images into one of five stages

(entirely cartilaginous = I, rim mineralization = II, ossification = III, fully ossified + bridged = IV, or failed/loose body = II/IIIF)1. A simplified stability criterion was evaluated based on T2 FS images (fluid signal at interface + articular cartilage fissure = unstable). T1/PD nFS images were included to identify healed stage IV lesions. Interrater reliability was analyzed across five raters via Fliess' Kappa according to guidelines in "Radiology"2. The studies were classified into one of three clinical outcomes: conservative therapy, surgery, or both via electronic medical records. Of the 52 studies, 14 were excluded from outcome analysis due to incomplete records.

## RESULTS

Fliess' Kappa was 0.71 ($p < 0.01$), consistent with substantial interrater reliability for the staging system. Agreement for the stability classification was 0.571 ($p < 0.01$), moderate. Of the 38 studies with sufficient timeline information, 21 (43%) healed with conservative therapy, 12 (32%) failed conservative therapy requiring subsequent surgery, and five (13%) patients required immediate surgery.

## CONCLUSION

This staging system, based on JOCD pathogenesis as a disease of epiphyseal cartilage that requires mineralization and ossification to heal, generates improved interrater agreement compared to other systems3. Adding a clinically readily acquired T2* sequence allows for analysis of lesion composition across the stages of healing1. While lesion stability informs the clinical need for immediate surgery on unstable lesions, most are stable. Of these stable lesions, up to 50% eventually require surgical intervention4, emphasizing the need for a staging system that allows for earlier identification of stable lesions that require surgery. This reliable staging system could fill this need. Further research should explore the identification of stable lesions that would benefit from earlier surgery based on this system.

## CLINICAL RELEVANCE/APPLICATION

This study proposes a reliable staging system based on JOCD lesion healing that could inform treatment decisions before instability occurs.1. Ellermann et al. Radiology. 2017;282(3):798-806.2. Benomar et al. Radiology. 2023;309(3):e230492.3. Andriolo et al. Cartilage. 2022;13(3):19476035221121789.4. Cahill et al. Am J Sports Med. 1989;17(5):601-606.
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RSNA 2024
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# Abstract Archives of the RSNA, 2024

T2-SPMS

**Multisystem Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPMS-2 WHOLE-BODY MRI SCREENING TO DETECT EARLY CANCER IN INDIVIDUALS WITH LI-FRAUMENI SYNDROME

Angela George, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Syed A. Sohaib, MBBS (*Abstract Co-Author*) Nothing to Disclose
Erica D. Scurr, BSc (*Abstract Co-Author*) Nothing to Disclose
Caroline S Clarke (*Abstract Co-Author*) Nothing to Disclose
Richard W. Lee, PhD,MRCP (*Abstract Co-Author*) Research Grant, Optellum Ltd;Research Grant, Aidence;Research Grant, F. Hoffmann-La Roche Ltd;Research Grant, Qure.ai
Sofia Sardo Infirri (*Abstract Co-Author*) Nothing to Disclose
Catey Bunce (*Abstract Co-Author*) Nothing to Disclose
Jing Yi (jessica) Weng (*Abstract Co-Author*) Nothing to Disclose
Ros Eeles (*Abstract Co-Author*) Nothing to Disclose
Elena Cojocaru (*Abstract Co-Author*) Nothing to Disclose
Samuel J. Withey, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

Li-Fraumeni syndrome (LFS), caused by a pathogenic germline variant of the TP53 tumour suppressor gene, is an autosomal dominant condition that predisposes affected individuals to multiple cancers and at a young age. International guidelines recommend yearly screening to identify cancers: in addition to yearly breast MRI in female patients and full dermatological skin check, patients should undergo whole body imaging. Whole body MRI (wbMRI) can image from vertex to toes in a single examination without use of ionising radiation. We aimed to assess the utility of wbMRI in detecting malignancy in patients with LFS.

### METHODS AND MATERIALS

Patient with LFS were identified and invited to undergo annual wbMRI. MRI was performed at 1.5T from vertex to toes without contrast, requiring 6 to 7 imaging stations. The imaging comprised: axial T2-weighted imaging; axial T1-weighted DIXON imaging; axial diffusion-weighted imaging (free-breathing single-shot echo planar imaging; b values 50, 600, 900). Images were reviewed independently by two experienced oncological radiologists, with disagreement resolved by consensus. Suspicious lesions and incidental findings were discussed in a multidisciplinary meeting, with further investigation and management performed on a case-by-case basis as per best clinical practice.

### RESULTS

We report the baseline and 12-month follow-up screening imaging results for 54 individuals (14 male, 40 female) with LFS who underwent wbMRI between June 2022 and April 2024. At the time of abstract submission, 44 patients had undergone the second scan at 12 months. Following baseline wbMRI, 9 patients underwent biopsy/excision (16.7%), identifying 4 cancers (7.4%), stage 1-3. A further 9 patients required additional dedicated imaging (n=16.7%). Five patients developed cancer (3 invasive, 2 superficial) between baseline and 12-month wbMRIs. These were either outside of the initial wbMRI field-of-view (i.e. upper limb sarcoma, breast carcinoma), or had developed since the initial scan, including on targeted re-review of baseline imaging. Following the 12-month wbMRI, 6 patients underwent biopsy/excision (13.6%), identifying 5 cancers (11.4%), stage 0-4. Only 2 further patients underwent further dedicated imaging (4.5%). The cancer locations and stages are shown in the uploaded PDF Figure.

### CONCLUSION

WbMRI can identify early cancers in the high-risk setting of LFS screening, with cancers identified at baseline and on 12-month follow-up screening. The burden of additional investigations for incidental findings decreases with repeat imaging.

### CLINICAL RELEVANCE/APPLICATION

Whole body MRI can effectively screen for cancers in high-risk individuals.

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# Abstract Archives of the RSNA, 2024

T2-SPNMMI

**Nuclear Medicine & Molecular Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPNMMI-1 EFFECTS OF DATA-DRIVEN RESPIRATORY GATING ON VISUALIZATION AND QUANTIFICATION OF LIVER AND PANCREATIC TUMORS IN FDG PET-CT EXAMINATIONS

Naomi Morita (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsuya Okada (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akira Kida (*Abstract Co-Author*) Nothing to Disclose
Risa Momoi (*Abstract Co-Author*) Nothing to Disclose
Mitsuaki Tatsumi, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Data-driven respiratory gating (DDG) has recently been introduced to improve image quality in PET portion of PET-CT examinations. The latest DDG system (OncoFreeze AI, Siemens) requires no specific devices without additional examination time. The purpose of this study was to evaluate the effects of this new DDG system on visualization and quantification of liver and pancreatic tumors in FDG PET-CT examinations, comparing the results to those obtained using the standard free-breathing PET acquisition protocol.

### METHODS AND MATERIALS

This study included 85 upper abdominal tumor (67 liver and 18 pancreatic) lesions examined with FDG PET-CT. PET images were acquired with a Biograph mCT scanner and reconstructed using standard (STD) and DDG algorithms. Lesion blurring and conspicuity were each evaluated visually with a 3-point scale (1: poor to 3: excellent). Longest diameter (LD), SUVmax, and metabolic tumor volume (MTV, 40% of SUVmax threshold) of the lesions were used for quantitative analysis. Fifty-six texture features (TFs) were also evaluated, and entropy, homogeneity, low- and high- gray-level zone emphasis (LGZE, HGZE), and short- and long- run emphasis were included as recommended for their robustness by Orlhac, et al (JNM 2014). Visual scores and quantitative metrics were compared between STD and DDG images.

### RESULTS

Visual scores for lesion blurring and conspicuity in DDG were significantly higher than those in STD ($p < 0.0001$ for both). Increase in scores for blurring and conspicuity was observed in 29 (34%) and 20 (24%) of all 85 lesions, respectively. SUVmax and MTV in DDG were significantly higher and lower, respectively, than those in STD ($p < 0.0001$ for both). Increase in SUVmax and decrease in MTV were observed in 80 (94%) and 63 (74%) of all 85 lesions, respectively. Decrease in MTV with DDG was correlated with LD, SUVmax, or MTV in STD (Spearman ?= 0.42, 0.31, or 0.45, respectively, $p < 0.005$ for all), whereas increase in SUVmax with DDG solely correlated with SUVmax in STD (?= 0.34, $p < 0.005$). Thirty-five out of 56 TFs showed statistical differences between STD and DDG. Entropy, HGZE, and LGZE were included in the 35 TFs, and their changes indicated that lesions in DDG represented more homogeneous FDG uptake than those in STD.

### CONCLUSION

This study demonstrated that deviceless DDG improved visualization and quantification of liver and pancreatic tumors in FDG PET-CT without increasing examination time. PET images less affected by respiratory motion exhibited increase in SUVmax and decrease in MTV and may contribute significantly to the accurate evaluation of tumor lesion activity.

### CLINICAL RELEVANCE/APPLICATION

Deviceless DDG improved visualization and quantification of liver and pancreatic tumors in FDG PET-CT without increasing examination time.

## T2-SPNMMI-2 TOWARDS CLINICAL APPLICATION OF MR CELL SIZE IMAGING FOR CHARACTERIZATION OF THE TUMOR MICROENVIRONMENT

Cornelius Faber (*Abstract Co-Author*) Nothing to Disclose
Bastian Maus (*Abstract Co-Author*) Nothing to Disclose
Heiner N. Raum (*Abstract Co-Author*) Nothing to Disclose
Jochen Bauer (*Abstract Co-Author*) Nothing to Disclose
Moritz Wildgruber, MD, PhD (*Abstract Co-Author*) Consultant, Sirtex Medical Ltd;Consultant, iThera Medical GmbH;Consultant, Bayer AG
Enrica Wilken (*Abstract Co-Author*) Nothing to Disclose
Emily Hoffmann (*Presenter*) Nothing to Disclose

## PURPOSE

Given the growing significance of characterizing the tumor microenvironment (TME) in personalized therapeutic strategies, preclinical studies have identified mean cell size analysis of tumor tissue as a promising imaging biomarker. MR cell size imaging can capture cellular changes within the TME, including cell swelling or shrinkage as an early marker of tumor necrosis, as well as the infiltration of different immune cell populations, such as T-cells and macrophages. This study aims to demonstrate the applicability of MR cell size imaging in a clinical setting.

## METHODS AND MATERIALS

MR cell size imaging was performed using sine-shaped oscillating-gradient diffusion-weighted MRI (OGSE-DWI) implemented on a clinical 3 T Philips MR7700 system, followed by data analysis using the Imaging Microstructural Parameters Using Limited Spectrally Edited Diffusion (IMPULSED) model for cell size quantification. The accuracy of the clinical IMPULSED-derived cell size analysis was assessed by conducting in vitro measurements on 4T1 breast cancer cell pellets. The same pellets were scanned on the 3 T clinical MRI scanner, followed by measurements on a 9.4 T Bruker BioSpec small animal MRI system to compare result for mean cell sizes between settings. Additionally, tumor cell size was evaluated by optical microscopy.

## RESULTS

The OGSE-DWI sequence was successfully implemented on the 3 T clinical scanner, achieving high spatial resolution (875 μm) and sufficient signal-to-noise ratios of 160 ± 11 (for b = 0 ms/μm2). Using the IMPULSED model, cell size quantification of tumor cell pellets was possibe, allowing region-of-interest and pixel-wise quantification. Only minor differences were found between the clinical and preclinical MRI system: clinical measurements detected mean cell radii of 8.36 ± 0.06 μm in the cell pellets, compared to mean radii of 8.25 ± 0.08 μm from the previously established preclinical setup. Microscopic examination revealed mean cell radii of 8.62 ± 0.37 μm.

## CONCLUSION

The present study demonstrates that MR cell size imaging using OGSE-DWI is feasible in vitro for breast cancer cell pellets on a clinical MR scanner. This validation, including direct comparison with established preclinical MR cell size imaging and microscopic evaluation, will set the ground for subsequent first-in-human studies, ensuring robust and reliable translation of MR cell size imaging into clinical application.

## CLINICAL RELEVANCE/APPLICATION

The ability to assess changes in cell size using MR cell size imaging presents a potential early marker of treatment response to targeted cancer therapies. The clinical translation of MR cell size imaging may enable personalized treatment decisions based on specific changes within the TME, beyond mere lesion size and anatomy.

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# Abstract Archives of the RSNA, 2024

T2-SPNPM

**Noninterpretive Skills (Beyond Imaging) Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPNPM-1 ADVANCING ACCESS OF VARYING EDUCATIONAL BACKGROUNDS TO RADIOLOGY: THE ROLE OF AI IN PATIENT EMPOWERMENT

Zaheer Badat (*Abstract Co-Author*) Nothing to Disclose
Ubaid Tanzim (*Abstract Co-Author*) Nothing to Disclose
Sabeeh Syed, MD, BSc (*Abstract Co-Author*) Nothing to Disclose
Salil Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Rawaha Husam Al-Deen (*Abstract Co-Author*) Nothing to Disclose
Mohammed Bilal Aziz (*Abstract Co-Author*) Nothing to Disclose
Mohammed Blaaza, BSC,MBBS (*Abstract Co-Author*) Nothing to Disclose
Mohamed Rashad Ramali, MBBS, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

This study investigates the potential for artificial intelligence (AI) to improve the understanding of radiology reports across a range of educational backgrounds. By doing so, we aim to address the comprehension gap patients face with clinical imaging results and promote patient empowerment in healthcare decision-making.

### METHODS AND MATERIALS

A survey with 64 participants assessed how well they understood 10 anonymised radiology reports. 5 reports were radiologist-authored, and 5 were AI-summarised using GPT-3.5-Turbo. Participants rated their understanding of each report using a Likert scale, where a higher score indicated greater understanding. Education levels of the participants were grouped into 6 strata, increasing from pre-university to radiologist.

### RESULTS

AI-summarised reports yielded a higher average understanding score (5.68/7) than radiologist-authored reports (3.47/7). Using paired t-tests by education level, pre-university participants showed the largest mean difference, with a 3.54 point increase in understanding for AI reports compared with radiologist-authored reports ($p<0.001$). Whereas, radiologists had a -2.35 decrease in understanding AI reports compared with radiologist-authored reports ($p<0.001$). Linear regression predicted a 0.73 point increase in understanding radiology-authored reports per increase in education level ($p<0.001$), but no significant increase in understanding AI reports with increased education ($p=0.35$).

### CONCLUSION

Overall, AI-summarised reports outperformed radiologist-authored reports in comprehension. The notable benefit to pre-university level participants, coupled with the linear regression predictions, suggest that AI could play a significant role in equalising understanding of healthcare for all patients. Nevertheless, radiologists' decreased understanding of AI reports underscores a potential limitation of these summaries at the specialist level.

### CLINICAL RELEVANCE/APPLICATION

The use of large language models in medical care is in its infancy. There are many safety concerns related to large scale use of LLMs, given inherent flaws related to hallucination and variability in response, particularly with direct patient intervention. Using LLMs/AI to improve healthcare equity, however, remains a significantly lower risk use case and one with great potential. This principle can be applied to aid patient autonomy across educational backgrounds and remove selective access to and understanding of one's own health

## T2-SPNPM-2 PREVALENCE OF HEALTH-RELATED SOCIAL NEEDS AND ASSOCIATION WITH IMAGING APPOINTMENT CANCELLATIONS AMONG PATIENTS WITH CANCER

Ali Rashidi, MD (*Abstract Co-Author*) Nothing to Disclose
Gelareh Sadigh, MD (*Abstract Co-Author*) Nothing to Disclose
Angellica Gordon, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Health-related social needs (HRSNs) such as transportation, housing instability, and financial hardship may result in delayed patients' diagnosis and care. We aimed to assess the prevalence of health-related social needs and its association with imaging appointment cancellations among patients diagnosed with cancer.

## METHODS AND MATERIALS

In this retrospective observational study, we included patients =18 years with a diagnosis of cancer who completed an oncology wellness form as part of their usual care evaluation at a single comprehensive cancer center between Jan 2022 and September 2023, and had at least one imaging exam scheduled at the same health system within 3 months after completion of the form. The form inquired patients about presence of HRSNs (financial, transportation, and housing), patients' desire to receive written information or speak to someone about their HRSN, and their quality of life measured by Patient Reported Outcomes Measurement Information System (PROMIS)-10. We further assessed whether patients had any missed imaging appointment in the next 3 months after completion of the form. Multivariable regression models were used to assess the association between HRSNs and quality of life and imaging cancellations.

## RESULTS

2,511 patients with 2,890 encounters for which a wellness form was completed were included (Mean age: 61.6±15.9; 50% were female; 57% were white; 20% Asian; 3% Black). A total of 21% were Hispanic. The majority (45%) had Medicare, 36% commercial insurance and 16% Medicaid. A total of 22.9% reported at least one HRSNs with the most common being financial hardship (18.8%), transpiration (9.2%) and housing (8.5%). Mean mental and physical health PROMIS t-scores were 47.4±9.1 and 45.0±10.2. Mean pain score was 3.0±2.9 (range 0-10). A total of 70% of patients cancelled or did not show up to at least one imaging encounter in the 3 months after completion of their form. 22.5% of patients with missed appointments reported HRSNs vs. 17.3% of those without missed appointments (P=0.002). Adjusting for demographics and neighborhood deprivation index, patients reporting at least one HRSNs were more likely to miss their imaging appointment (OR, 1.5; 95%CI, 1.2-1.9). With 1 unit increase in patients' pain score, they were more likely to miss imaging appointment (OR, 1.1; 95% CI, 1.0-1.1). Patients were less likely to miss their appointments with every 1 unit increase in PROMIS score (OR, 0.97; 95% CI, 0.96-0.98).

## CONCLUSION

Cancer patients with self-reported HRSN, higher pain score and lower quality of life tend to have higher missed imaging appointments.

## CLINICAL RELEVANCE/APPLICATION

Systems should be in place to screen for HRSNs and address them to help reduce imaging and healthcare non-adherence and improve patients' outcomes.

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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

T2-SPNR

**Neuroradiology Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPNR-11 BRAIN ATROPHY IN ALZHEIMER'S AND LATE NEUROPATHOLOGY

Abdur Raquib Ridwan, PhD (*Abstract Co-Author*) Nothing to Disclose
Julie A. Schneider, MD (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Arfanakis, PhD (*Abstract Co-Author*) Nothing to Disclose
David A. Bennett, MD (*Abstract Co-Author*) Nothing to Disclose
Khalid Saifullah, BSc (*Presenter*) Nothing to Disclose

### PURPOSE

Alzheimer's disease neuropathologic change (AD-NC) and limbic-predominant age-related TDP-43 encephalopathy neuropathologic change (LATE-NC) are common in older adults and have been associated with brain atrophy, cognitive decline, and dementia. Since AD-NC and LATE-NC are often comorbid and due to the fact that LATE-NC can only be detected at autopsy, in this work, we combined deformation-based morphometry (DBM) on ex-vivo brain MRI and detailed neuropathological evaluation in a large number of community-based older adults to investigate the difference in brain atrophy patterns associated with AD-NC and LATE-NC.

### METHODS AND MATERIALS

Cerebral hemispheres from 912 older adults participating in four longitudinal, clinical-pathologic cohort studies of aging were included in this work: MAP, ROS, MARS, and AA Core of the Rush Alzheimer's Disease Research Center (Rush ADRC). All hemispheres were imaged ex-vivo on 3T clinical MRI scanners approximately 1-month postmortem while immersed in 4% formaldehyde solution. T2-weighted images of all hemispheres were non-linearly registered and logarithm of the Jacobian determinant (LogJ) of the deformation field was calculated in each voxel. Following ex-vivo MRI, the pathologies that were assessed were AD-NC, LATE-NC, Lewy bodies, gross infarcts, microscopic infarcts, arteriolosclerosis, atherosclerosis, and cerebral amyloid angiopathy. AD-NC-pos was defined as intermediate or high AD-NC according to the NIA-AA criteria, and LATE-NC-pos was defined as LATE-NC stages 2 or 3.Voxel-wise linear regression was used to test the association of the deformations observed in the smoothed log Jacobian maps with the four different groups, controlling for all other neuropathologies, demographics, postmortem intervals, and scanner. We used 5000 permutations, and statistical significance was set at $p<0.05$ after family wise error (FWE) correction.

### RESULTS

Both the AD-NC-pos LATE-NC-neg group as well as the AD-NC-neg LATE-NC-pos group were associated with lower tissue volume mainly in medial temporal lobe structures. The AD-NC-pos LATE-NC-pos group showed substantially lower volume in the temporal, frontal, and parietal lobes. Interestingly, the AD-NC-neg LATE-NC-pos group showed lower volume in the anterior portion of the hippocampus than the AD-NC-pos LATE-NC-neg group. These results are in agreement with previous research.

### CONCLUSION

The findings suggest that in the presence of LATE-NC, the volume of the hippocampus cannot serve as a marker of AD-NC.

### CLINICAL RELEVANCE/APPLICATION

Providing crucial insights for accurate diagnosis, targeted treatment development, and improved disease monitoring in neurodegenerative disorders.

## T2-SPNR-13 FUSION BRAIN NETWORK ANALYSIS RELATED TO CANCER PAIN IN LUNG CANCER PATIENTS

Jiahui Zheng (*Abstract Co-Author*) Nothing to Disclose
Daihong Liu (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study is to explore the interaction of structural and functional alterations related to cancer pain, based on the fusion brain networks.

### METHODS AND MATERIALS

A total of 59 lung cancer patients without pain (CP-), 62 lung cancer patients with pain (CP+), and 34 healthy controls (HC) were prospectively recruited for this study. Structural network (SN) and functional network (FN) were derived from diffusion spectrum imaging (DSI) examinations and the resting-state functional magnetic resonance imaging (rs-fMRI) data, respectively. And FBN was constructed by using self-attention mechanism algorithm. Next, connectivity strength was analyzed at both regional and modular levels by utilizing nature business system (NBS) analysis and network analysis, respectively. Finally, relationships between connectivity strength and scales scores were evaluated.

### RESULTS

The NBS analysis demonstrated that increased connectivity strengths were present both in CP+ and CP- patients, compared to HC. Two increased connectivity components were found in CP+, which primarily included in the default mode network (DMN). 36 increased connectivity components were found in CP-, which mainly included among the DMN, executive control network (ECN), salience network (SN), and limbic system. Notably, compared to CP-, 4 decreased connectivity components were found in CP+, which primarily included between DMN and the limbic system, and between ECN and SN. Network analysis demonstrated that increased connectivity strengths were present in Feeder network in CP- patients, compared to HC. Moreover, positive correlations were found between the connectivity strength of the right precentral gyrus and the inferior occipital gyrus and both SAS and SDS scores.

### CONCLUSION

Our study confirmed the correlations of FBN-related differences with cancer pain and provided novel information on the nature of cancer pain in lung cancer patients.

### CLINICAL RELEVANCE/APPLICATION

Taken together, our results reveal brain region-specific structure-function interaction as neural correlate of individual differences in cancer pian and provide insights into the basis of efficient information processing as fundamentally implicated in cancer pain.

## T2-SPNR-15 SKELETAL MUSCLE LOSS IS ASSOCIATED WITH INCREASED RISK OF DEMENTIA-RELATED OUTCOMES: LONGITUDINAL OBSERVATIONAL STUDY USING ADNI BRAIN MRIS

Yuxin Zhu (*Abstract Co-Author*) Nothing to Disclose
Shadpour Demehri, MD (*Abstract Co-Author*) Consultant, Toshiba Corporation;Research support, General Electric Company;Research Grant, Carestream Health, Inc
Hanzhang Lu, PhD (*Abstract Co-Author*) Nothing to Disclose
Eleanor Simonsick (*Abstract Co-Author*) Nothing to Disclose
Soheil Mohammadi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Sara Momtazmanesh (*Abstract Co-Author*) Nothing to Disclose
Kamyar Moradi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Age-related skeletal muscle loss (i.e., sarcopenia), which is largely undiagnosed and potentially modifiable, is often seen in older adults with Alzheimer's disease (AD) dementia. This study aimed to examine whether temporalis muscle loss (a measure of skeletal muscle loss) is associated with an increased risk of AD dementia in non-demented older adults.

### METHODS AND MATERIALS

To quantify sarcopenia, we utilized baseline T1 brain MRIs from the Alzheimer's Disease Neuroimaging Initiative (ADNI) cohort. In non-demented participants aged =70 years, we manually segmented the bilateral temporalis muscles and calculated the sum cross-sectional area (CSA) of these muscles. Based on the CSA, participants were categorized into two distinct groups using the Maximally Selected Rank Statistics method: large CSA and small CSA. Outcomes included subsequent AD dementia incidence, and change in cognitive and functional scores, and brain volumes between the groups.

### RESULTS

We included 621 non-demented participants (age mean±SD:77.3±4.9, female/male:0.7) and established a cut-off of 1076.4 $mm^2$ to define large and small CSA. At the study baseline, 131 participants had a large CSA and 488 participants had a small CSA. Median follow-up was 5.8 years. According to the Cox proportional hazard model fitting result (adjusted for age, sex, years of education, marital status, APOE-e4 status, and intracranial volume), a small temporalis CSA was associated with a higher incidence risk of AD dementia (hazard ratio, 95% confidence interval (CI): 1.59, 1.09 to 2.33, P:0.016). Furthermore, linear mixed-effect regression models showed that having a smaller temporalis CSA was associated with a greater decrease in memory composite score, functional activity questionnaire score, as well as structural brain volumes, including whole brain, hippocampus, entorhinal cortex, and fusiform gyri over the follow-up period (P values< 0.05).

### CONCLUSION

Temporalis muscles size (a measure of skeletal muscle loss i.e., sarcopenia) is an early risk factor for cognitive decline in older adults.

### CLINICAL RELEVANCE/APPLICATION

Utilizing brain MRI scans to quantify sarcopenia, specifically through the measurement of temporalis muscle biomarkers, may serve as a readily available predictive tool for assessing the likelihood of future dementia incidence in brain imaging studies.

## T2-SPNR-2 QUANTIFICATION OF PETQUANT AMYLOID TRACER PREDICTS CLINICAL AMYLOID BURDEN STATUS

Carrie P. Marder, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Cheryl E. Vanier, PhD (*Abstract Co-Author*) Nothing to Disclose
Alan Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Travis H. Snyder, DO (*Abstract Co-Author*) Nothing to Disclose
Thomas Knoblauch, MS (*Abstract Co-Author*) Nothing to Disclose
Robert L. Delapaz, MD (*Abstract Co-Author*) Nothing to Disclose
John P. Uglietta, MD (*Abstract Co-Author*) Nothing to Disclose
Priya Santhanam, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Amyloid burden and regional brain atrophy are considered biomarkers of Alzheimer's disease (AD). This study compares neuroradiologist classification of amyloid presence to regional distribution of amyloid-ß (Aß) plaques using PET-based quantification and associated regional volumetrics in affected patients.

### METHODS AND MATERIALS

Anatomical 3T MRI and PET CT imaging using Aß tracers were performed on 163 patients (mean age=75 yrs, range=64-88) clinically diagnosed with mild cognitive impairment (MCI) and/or AD. Patients were classified as positive (n=88) or negative (n=75) for Aß presence based on neuroradiologist interpretation of PET images. Normalized (z-scores) amyloid tracer data from PETQuant and raw volumes from NeuroQuant from 54 regions of interest were analyzed in a hierarchical cluster analysis to identify potential sub-groups relative to Aß status. Machine learning models provided insight for regional PETQuant and volumetrics most relevant to classifying patients into Aß status groups or to four sub-groups derived from the cluster analysis.

Separate random forest models were run, using regional values or principal component scores of PET or PET+volumetric data and intracranial volume and age. Sensitivity and specificity of the model are reported, and the Gini index for classification was used to indicate variable importance.

**RESULTS**

The first three principal components from PET and volumetric data led to models with higher classification accuracy than models using the raw data. Hierarchical clustering using PET data clustered 66 of the 75 of those in the Aß negative group, characterized by having low amyloid across regions; 14% in the 'negative' cluster were classified as positive by a neuroradiologist. There were three subgroups within the predominantly Aß positive group, each with specific regional patterns of amyloid deposit (Figure 1). Random forest modeling showed good classification accuracy (88%) relative to neuroradiologist rating using PET data alone; addition of volumetric data did not improve accuracy (87%). The random forest model with four PET principal components had specificity of 88% and sensitivity of 88%.

**CONCLUSION**

PETQuant-based quantification of amyloid tracer is a good marker for predicting amyloid status on radiological read in patients with MCI and/or AD. While volumetric data did not contribute to the classification model, one subgroup of Aß positive patients did have significantly smaller hippocampal volume, possibly indicating advanced disease state. Further analysis is needed to validate the patient subgroups with respective clinical associations.

**CLINICAL RELEVANCE/APPLICATION**

PETQuant software provides predictive information for clinical determination of amyloid-ß burden status.

## T2-SPNR-3 AUTOMATIC GENERATION OF RADIOLOGY REPORTS FOR DIAGNOSING NEURODEGENERATIVE DISORDERS AND COMPARISON WITH THEBOARD-CERTIFIED NEURORADIOLOGIST-WRITTEN STRUCTURED REPORT

Wooseok Jung, MSc (*Abstract Co-Author*) Nothing to Disclose
Saehyun Kim (*Abstract Co-Author*) Nothing to Disclose
Seung Hyun Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Dong-Hee Kim (*Abstract Co-Author*) Nothing to Disclose
Chong Hyun Suh, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to develop and evaluate an advanced AI platform for generating radiology reports for the diagnosis of neurodegenerative diseases using medical imaging data processed through an AI-based quantitative MRI software.

**METHODS AND MATERIALS**

VUNO-Med DeepBrain, an AI-based quantitative MRI software was utilised to analyze input brain MRI scans. The model uses 3D image segmentation model to quantify brain atrophy and MTA scores, whereas 2D segmentation models were applied to detect WMH and lacunes. Additional machine learning methods were leveraged to provide CSF analysis results. Merging these findings, the AI platform automatically produce a structured report comprising quantitative measurements and descriptive findings. Key quantitative metrics reported by DeepBrain from a 3D T1 MRI include hippocampal and diffusive brain atrophy information derived from regional normative percentiles, followed by CSF analysis such as Ventriculomegaly determined by Evans' index, high convexity tightness, Sylvian fissure enlargement, DESH, narrow callosal angle, and choroid plexus volumes. Subsequently, the software extracted periventricular and WMH volumes and their associated Fazeakas scale. Lacunes are also detected from the FLAIR scan and their number is reported. The report generation pipeline summarized key positive findings to generate a brief conclusion. We evaluated the proportion of agreement of 10 indicies, including left/right MTA scores, periventricular/deep Fazekas scales, number of lacunes, ventriculomegaly, high convexity tightness, Sylvian fissure enlargement, DESH, narrow callosal angle between board-certified neuroradiologist's radiology reports and AI-generated reports.

**RESULTS**

3D T1 and FLAIR scans of 200 randomly selected subjects in ADNI database were collected. The average full inference time including MRI analysis and report generation was 70 seconds per case. The order of components in the report is: 1. Brain hippocampal atrophy, 2. Cerebral WMH, 3. Number of lacunes, 4. CSF analysis, and Conclusion. The proportion of agreement of 10 indicies between radiologist's radiology reports and AI-generated reports were 84%.

**CONCLUSION**

This study verified the performance of the automated reports generated by the output from DeepBrain compared to reports created by radiologists. The DeepBrain program automatically produced reliable structured reports with quantitative measurements and descriptive findings.

**CLINICAL RELEVANCE/APPLICATION**

This deep learning-based model, providing automatic generation of radiology report, will reduce typing workload for radiologists, produce a prompt and accurate standardized report, and ultimately improve patient management for neurodegenerative diseases.

## T2-SPNR-4 CAN AI SUPPORT ON-THE-FLY BRAIN MRI SCAN PROTOCOL ADAPTATION?

Silvia Ingala (*Abstract Co-Author*) Nothing to Disclose
Michael Bachmann Nielsen, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Frederik Carlsen (*Abstract Co-Author*) Nothing to Disclose
Amine M. Korchi, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas Clement Truelsen (*Abstract Co-Author*) Nothing to Disclose
Akshay Pai (*Abstract Co-Author*) Stockholder, Cerebriu A/S;Employee, Cerebriu A/S
Kaining Sheng (*Presenter*) Nothing to Disclose

**PURPOSE**

Real-time brain MRI protocol adaptation requires detection of findings on an abbreviated set of scan sequences. This study evaluates the diagnostic accuracy of an AI model (Apollo™, Cerebriu A/S), MR technologists, and consultant neuroradiologists in detecting critical findings (brain infarct, intracranial hemorrhage, and intracranial tumors) on an abbreviated protocol set as prerequisite for on-the-fly protocol adaptation.

**METHODS AND MATERIALS**

We collected a retrospective consecutive cohort with patients referred to receive a routine brain MRI scan. The cohort was consecutively enriched with positive findings of brain infarcts, hemorrhages, and tumors from routine scans. Some findings were beyond Apollo™ intended use definitions, however still clinically relevant and thus included. Three neuroradiologists, three MR technologists, and Apollo™ assessed findings using a 3-sequence protocol

(DWI, SWI/T2*, T2-FLAIR), each radiologist and technologist analyzing a third of the cohort. Reference findings for each scan were determined by a fourth neuroradiologist with access to all scan sequences and corresponding reports.

**RESULTS**

A total of 414 patients were included (56 years ± 19, 238 men) with 65 confirmed brain infarcts, 65 intracranial hemorrhages, and 65 intracranial tumors. Using the abbreviated 3-sequence set, neuroradiologists detected infarct, hemorrhage, and tumors with a pooled sensitivity of 88% (95% CI: 84, 91), 85% (95% CI: 74, 91), and 72% (95% CI: 60, 82), respectively, and specificity of 99% (95% CI: 98, 100), 98% (95% CI: 96, 99), and 97% (95% CI: 94, 98), respectively. MR technologists detected infarct, hemorrhage, and tumors with a pooled sensitivity of 92% (95% CI: 83, 97), 69% (95% CI: 57, 79), and 35% (95% CI: 25, 48), respectively, and specificity of 90% (95% CI: 83, 94), 95% (95% CI: 92, 97), and 97% (95% CI: 95, 99), respectively. Apollo™ detected infarcts, hemorrhages, and tumors with a sensitivity of 94% (95% CI: 85, 98), 83% (95% CI: 72, 90), and 71% (95% CI: 59, 80), respectively, and specificity of 86% (95% CI: 82, 89), 84% (95% CI: 80, 87), 60% (95% CI: 55, 65), respectively.

**CONCLUSION**

Given an abbreviated 3-sequence protocol set, Apollo™ has on par sensitivity with neuroradiologists and better sensitivity than MR technologists in recognizing critical findings in need of specialized scan sequences, thus providing a framework for relevant and configurable on-the-fly scan adaptation. The risk of false positive findings must be mitigated by human confirmation of findings and consequent actions.

**CLINICAL RELEVANCE/APPLICATION**

This study provides early evidence of using AI as a human support to implement a real-time adaptive MR scan acquisition workflow, that can potentially reduce scan recalls.

## T2-SPNR-6 ALTERATIONS OF FUNCTIONAL CONNECTIVITY IN COVID-19 PATIENTS MEDIATE THE RELATIONSHIP BETWEEN SERUM CRP AND AUTE-PHASE FATIGUE

Xingpu Quan (*Abstract Co-Author*) Nothing to Disclose
Yuanshuo Ouyang (*Abstract Co-Author*) Nothing to Disclose
Xuan Niu (*Abstract Co-Author*) Nothing to Disclose
Ming Zhang (*Abstract Co-Author*) Nothing to Disclose
Wenrui Bao (*Abstract Co-Author*) Nothing to Disclose
Youchi Wan (*Abstract Co-Author*) Nothing to Disclose
Qiange Zhu (*Presenter*) Nothing to Disclose

**PURPOSE**

The SARS-CoV-2 infection emerges as a prominent model for investigating the intricate mechanisms underlying fatigue development. This study aimed to identify objective evidence of functional connectivity alterations in individuals experiencing acute post-COVID fatigue using fMRI and further explore the biological mechanisms with circulating inflammatory biomarkers.

**METHODS AND MATERIALS**

299 patients with mild SARS-COV-2 infection underwent MRI scans and fatigue assessments using Fatigue Assessment Scale (FAS) within 1 month post-infection. Among these patients, plasma samples were collected from 138 individuals within 48 hours before/after the MRI scan. After preprocessing the imaging data using the atlas parcellation scheme in Conn, we compared the resting state whole-brain and seed-to-voxel connectivity between patients with fatigue (n = 145) and those without fatigue (n = 154). Then, the functional connectivity (FC) values of statistically significant connections were selected for the correlation analysis with FAS scores in the full sample. Furthermore, we conducted an exploratory analysis to investigate the role of FC in the association between selected plasma inflammatory biomarkers and fatigue.

**RESULTS**

Firstly, we observed widespread increased connectivity in the fatigue group in the ROI-ROI connections from the right inferior cerebellum (cerebellum_10_R) to multiple brain regions (PFWE < 0.05). Secondly, a seed-based FC analysis was carried out for the cerebellum_10_R as the seed. Compared with non-fatigue group, the fatigue group presented six clusters of increased connectivity covering the bilateral superior frontal gyrus, bilateral middle frontal gyrus, and right inferior frontal gyrus (cluster-level PFWE < 0.05). CRP levels were significantly higher in adults with acute fatigue than those without, and positively correlated with the total FAS scores. Moreover, the Mediation analysis revealed that the relationship between CRP and FAS scores was mediated by the FC strength between right inferior cerebellum and cluster 3 (bilateral middle frontal gyrus).

**CONCLUSION**

Patients with fatigue exhibited significantly increased connectivity between the right inferior cerebellum and frontoparietal network, providing neural basis for the association between CRP and post-COVID-19 fatigue. Moreover, these findings have implications for elucidating the biological mechanism of acute fatigue.

**CLINICAL RELEVANCE/APPLICATION**

By investigating the underlying mechanisms of post-COVID fatigue, we are hopeful to acquire a deeper understanding of the nature of fatigue, ultimately paving the way for more effective prevention and therapeutic strategies.

## T2-SPNR-8 INVESTIGATION ON THE APPLICATION VALUE OF DEEP LEARNING MODEL BASED ON MULTIMODAL MRI IN THE DIFFERENTIAL DIAGNOSIS OF GLIOBLASTOMA, SOLITARY BRAIN METASTASES AND PRIMARY CENTRAL NERVOUS SYSTEM LYMPHOMA

Peng Du, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The accurate identification of glioblastoma (GBM), solitary brain metastases (SBM) and primary central nervous system lymphoma (PCNSL) plays a decisive role in the formulation of treatment plan. Deep learning (DL) can accurately, automatically and efficiently extract the features of medical image data, and plays an important role in the field of precision medicine. This study attempts to use DL technology to extract the features from pre-treatment multimodal MRI of GBM, SBM and PCNSL, to establish a classification prediction model for the three types of tumors and achieve non-invasive and accurate diagnosis before treatment.

**METHODS AND MATERIALS**

The standardized medical imaging database of brain tumors established by Xuzhou Medical University was reviewed, and clinical data of patients with pathologically confirmed GBM, SBM and PCNSL between March 2012 and October 2018 were consecutively analyzed. The enrolled patients were randomly

divided into training set and test set according to the ratio of 3:1. Convolutional neural networks (CNN) were used to perform deep feature extraction from CE-T1WI and T2-Flair sequences on patients' pre-treatment MRI, to establish the single modality-based classification-net (SC-Net) and multimodality MRI-based classification-net (MC-Net). Feature fusion was performed by L1-norm strategy, and finally the multimodality MRI feature fusion-based classification-net (MFFC-Net) was built and compared with the diagnostic results of radiologists.

**RESULTS**

A total of 1225 patients were enrolledd in the study, including 419 GBM, 412 SBM and 394 PCNSL. In the training set, the AUCs of the SC-Net models based on CE-T1WI and T2-Flair were 0.970 and 0.940, respectively, and the AUC of the MC-Net model based on CE-T1WI combined with T2-Flair was 0.980. The AUC of the MFFC-Net model based on the fusion of CE-T1WI and T2-Flair features was 0.990. In the test set, the AUCs were 0.707, 0.832 and 0.951 for junior, intermediate and senior radiologists, respectively, and the AUC of the MFFC-Net model was 0.960. The diagnostic performance of MFFC-Net model was not significantly different from that of senior radiologist (P=0.641).

**CONCLUSION**

MFFC-Net, a triple classification network for brain tumors based on multimodal MRI feature fusion, can achieve non-invasive and accurate diagnosis of GBM, SBM and PCNSL before treatment, providing basis for the follow-up treatment of patients, which is conducive to better prognosis of patients.

**CLINICAL RELEVANCE/APPLICATION**

The deep Learning model based on multimodal MRI established in this study can achieve non-invasive and accurate diagnosis of GBM, SBM and PCNSL before treatment, providing basis for the follow-up treatment of patients, which is conducive to better prognosis of patients.

## T2-SPNR-9 ALTERED DYNAMIC AMPLITUDE OF LOW-FREQUENCY FLUCTUATION IN INDIVIDUALS AT HIGH RISK FOR ALZHEIMER'S DISEASE

Ming Qi (*Abstract Co-Author*) Nothing to Disclose
Shuxian Wu (*Abstract Co-Author*) Nothing to Disclose
Shui Tian (*Abstract Co-Author*) Nothing to Disclose
Qinqin Zhu (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the dynamic amplitude of low-frequency fluctuation (dALFF) alterations in patients at high risk for Alzheimer's disease and to explore its correlation with clinical cognitive assessment scales for identifying an early imaging biomarker of these special populations.

**METHODS AND MATERIALS**

A total of 152 participants, including 72 subjective cognitive decline (SCD) patients, 44 mild cognitive impairment (MCI) patients and 36 healthy controls (HCs), underwent a resting-state functional magnetic resonance imaging and were assessed with various neuropsychological tests. The dALFF was measured by sliding-window analysis. We employed canonical correlation analysis (CCA) to examine the bi-multivariate correlations of the neuropsychological scales with altered dALFF across multiple regions in SCD and MCI patients.

**RESULTS**

Compared to those in the HC group, both the MCI and SCD groups showed higher dALFF values in the right opercular inferior frontal gyrus, as well as lower dALFF values in the left precuneus (voxel $P < 0.001$, cluster $P < 0.05$, GRF correction). CCA models revealed that the SCD and MCI behavioral items measuring inattention were correlated with the dALFF of the right middle frontal gyrus and right opercular inferior frontal gyrus, which are involved in frontoparietal networks ($R = 0.43$, $P = 0.024$).

**CONCLUSION**

SCD and MCI patients performed significantly worse than HCs on neuropsychological scales, and the neural activity of specific brain functional areas changed in the early stages of cognitive impairment. We provide insights of the brain dynamics of neural activity in frontal areas into the shared neural basis underlying SCD and MCI.

**CLINICAL RELEVANCE/APPLICATION**

The neural activity of specific brain functional areas changed in the early stage of cognitive impairment, which may act as a valuable imaging marker for early detection and intervention of patients at high risk for AD.

# Abstract Archives of the RSNA, 2024

T2-SPOB

**OB/Gynecology Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPOB-1 HEMORRHAGIC OVARIAN CYSTS OVER 50 MM ("LARGE HOCS"): PREVALENCE AND VALUE OF EXPERIENCED RADIOLOGIST ASSESSMENT

Mark D. Sugi, MD (*Abstract Co-Author*) Consultant, Nextrast, Inc;Author with royalties, RELX
Tara A. Morgan, MD (*Abstract Co-Author*) Nothing to Disclose
Maitray D. Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Scott W. Young, MD (*Abstract Co-Author*) Nothing to Disclose
Alan Zhu, BS (*Presenter*) Nothing to Disclose

### PURPOSE

Evaluate the prevalence of large HOC and utility of routine follow-up ultrasound when characterized by an experienced radiologist..

### METHODS AND MATERIALS

Consecutive pelvic US reports on 18-50 yo women between 01/2017 to 10/2022 at one organization with separate academic and community radiology departments were retrospectively reviewed to identify adnexal masses over 50 mm maximum diameter described as possibly being HOC (large HOC). EMR review established outcome based on surgical removal or follow-up imaging (US or MR). Four academic radiologists experienced with gynecologic ultrasound independently reviewed studies blinded to outcome, scoring two assessments:.1. Mass has US features most consistent with an ovarian hemorrhagic mass (HOC or endometrioma) rather than another diagnosis..2. Mass meets O-RADS definition of characteristic HOC except for size; follow-up would not be recommended if <= 50 mm in diameter..

### RESULTS

51,305 age-appropriate women had 68,859 examinations, with 457 (0.9 %) having US report indicating possible HOC over 50 mm. For 366 patients with established outcomes (192 at a community center, 174 at an academic center), 226 had a large HOC..Experienced radiologist review of the 366 patients designated hemorrhagic mass (HOC or endometrioma) as the most likely diagnosis in 320; outcomes showed 224 (70.0%) HOC, 89 (27.8%) endometrioma, 4 (1.3%) TOA, 2 (0.6%) borderline tumor, and 1 (0.3%) cystadenoma/adenofibroma..For 46 patients, experienced radiologists would not have suggested a hemorrhagic mass; 32 had been evaluated at a community center (16.7% of the 194 community patients) and 14 at an academic center (8.0% of the 174 academic patients). In the 32 community patients, outcomes showed 27 neoplasms (23 benign, 2 borderline, and 2 malignant). In the 14 academic patients, outcomes showed 11 neoplasms (10 benign, 1 borderline, and 0 malignant)..For 191 patients designated by an experienced radiologist as having a characteristic HOC such that follow-up would not be recommended if 50 mm or smaller, outcomes showed 181 (94.8%) HOC, 9 (4.7%) endometrioma, and 1 (0.5%) cystadenoma/adenofibroma..

### CONCLUSION

For experienced radiologists, routine imaging follow-up of a characteristic large HOC has limited value. For less experienced radiologists, second-opinion review of suspected large HOC can be valuable, as nearly 1 of 6 masses classified as a possible large HOC by less experienced radiologists proved to be neoplasms, some malignant..

### CLINICAL RELEVANCE/APPLICATION

An estimated 0.5% of premenopausal women undergoing pelvic US will have an HOC over 50 mm (large HOC). Experienced radiologist review of a mass classified as a possible large HOC has potential to reduce follow-up and interpretation errors.

## T2-SPOB-2 UTERINE PERISTALSIS OF ADENOMYOSIS PATIENTS ON CINE MR IMAGING

Kyo Noguchi, MD (*Abstract Co-Author*) Nothing to Disclose
Shinya Fujii, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuki Himoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuji Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ikuko Ota (*Abstract Co-Author*) Nothing to Disclose
Toshihide Ogawa, MD (*Abstract Co-Author*) Nothing to Disclose
Aki Kido, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Adenomyosis is a common benign gynecologic disease, and can be an important cause of infertility and dysmenorrhea. Uterine peristalsis (UP) is wave-like movement of the endometrial-myometrial junction. Abnormal UP is considered linked to infertility and chronic pelvic pain. The aim of this study is to compare UP between uterine wall with adenomyosis and normal wall to evaluate the effect of adenomyosis on UP on MRI.

### METHODS AND MATERIALS

The study included 139 adenomyosis patients. MRI were obtained using a sagittal T2-weighted turbo spin echo images and a half-Fourier acquisition single-shot turbo spin-echo (HASTE) images for display on cine mode. The uterus was divided into walls with and without adenomyosis, and a comparative evaluation was conducted. One radiologist evaluated the presence or absence of UP depending on the menstrual cycle phases: proliferative, luteal and menstrual phases. In cases where UP was present, frequency, direction and the presence/absence of outer myometrial conduction (OMC) were evaluated. For uterine wall with adenomyosis, characteristics of UP were evaluated: irregular signal movement and mucosal movement. In proliferative phase, UP was further evaluated in cases with and without endometriotic cysts.

### RESULTS

UP was observed significantly more often in walls with adenomyosis (113/182) than in normal walls (47/96), especially in luteal phase, but the frequency was not significantly different (6.9 vs.7.4). No significant differences were observed in the presence and the frequency of peristalsis between respective menstrual cycle phases. Peristaltic direction was observed in cervix to fundus in proliferative and luteal phase, and mixed in menstrual phase. Regarding characteristics of UP in walls with adenomyosis, half of the cases showed irregular signal movement and mucosal movement. One quarter of the cases accompanied both conduction and irregular signal movement. OMC was observed more frequently in adenomyosis patients only in proliferative (29/49 vs.7/24). In cases with endometriotic cysts, significant decrease of peristalsis was observed compared with cases without them (3/6 vs.46/48).

### CONCLUSION

Even in patients with adenomyosis, UP was observed as normal myometrium, but the tendency of hyperperistalsis was observed in luteal phase. Characteristic peristaltic movement within adenomyosis lesion, low signal conduction or irregular signal movement, was observed in half of the adenomyosis patients.

### CLINICAL RELEVANCE/APPLICATION

Adenomyosis does not disturb peristaltic movement, but characteristic peristaltic movement and signal conduction were observed within adenomyosis lesion.

## T2-SPOB-4 LEVATOR ANI MUSCLE SHAPE CHANGES IN WOMEN WITH STRESS URINARY INCONTINENCE USING DUAL-ENERGY COMPUTED TOMOGRAPHY AND 3T MAGNETIC RESONANCE IMAGING

Kun Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Kun Ou (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the levator ani muscle imaging manifestations of patients with stress urinary incontinence (SUI) and healthy group on MR and dual-energy computed tomography (DECT) images.

### METHODS AND MATERIALS

This study enrolled 50 healthy volunteers and 58 patients with SUI underwent pelvic examinations including 3.0-T MR and non-enhanced CT gemstone spectral imaging. The thickness of iliococcygeus muscle (tICM) and the angle of iliococcygeus (aICM) from coronal position were collected and compared. The correlation between results of CT and MRI was also evaluated.

### RESULTS

The measured values of CT and magnetic resonance imaging MRI had strong and positive correlation (left tICM, r=0.825, P<0.001; right tICM, r=0.719, P<0.001; left aICM, r=0.737, P<0.001; right aICM, r=0.855, P<0.001). Our MRI results showed that the tICM of SUI group (left, 3.08±0.78 mm; right, 2.98±0.87 mm) was significantly lower than that of healthy group (left, 3.60±0.91 mm, P=0.018; right, 3.78±0.98 mm, P=0.001), and the aICM (left, 33.89±6.99& 4;; right, 35.69±7.89& 4;) was higher than that of the healthy group (left, 26.90±7.15& 4;, P=0.005; right, 25.69±6.88& 4;, P=0.001). And in CT, the tICM of SUI group (left, 3.15±0.64 mm; right, 3.08±0.76 mm) was also significantly lower than that of healthy group (left, 3.69±0.98 mm, P=0.007; right 3.84±0.99 mm, P<0.001), and the aICM (left, 34.30±6.38& 4;; right, 34.98±7.99& 4;) was higher than that of the healthy group (left, 26.34±7.99& 4;, P=0.002; right , 26.59±6.24& 4;, P<0.001).

### CONCLUSION

DECT and MRI measured shape-related value of anus levator anatomy has significant correlation. The thickness of iliococcygeus muscle of SUI patients is lower than that of healthy people, and the angle of iliococcygeus is higher than that of healthy people.

### CLINICAL RELEVANCE/APPLICATION

Currently the imaging of levator ani muscle damage is still confined to MRI and ultrasound, this study proves that spectral imaging of DECT is feasible to detect levator ani muscle damage, showing strong correlation with MRI. DECT has the advantages of fast scanning speed. For patients such can't tolerate MRI examination, DECT scanning is clinically valuable.

# Abstract Archives of the RSNA, 2024

T2-SPPD

**Pediatric Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPPD-1 ABNORMAL PANCREATICOBILIARY JUNCTION IN CHILDREN: PREVALENCE AND ASSOCIATED COMPLICATIONS AS SEEN ON MRCP

Govind B. Chavhan, MD (*Abstract Co-Author*) Nothing to Disclose
Khuld Saeedi, MD (*Abstract Co-Author*) Nothing to Disclose
Caroline Rutten, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the prevalence and clinical significance of abnormal pancreaticobiliary junction (PBJ) in the pediatric population using magnetic resonance cholangiopancreatography (MRCP).

### METHODS AND MATERIALS

Single-center, retrospective study of MRCP examinations in children 0-18 years from 2012 to 2022. The imaging studies in each patient was reviewed by two independent readers for visibility of the PBJ, abnormal PBJ and length of common channel, pancreas divisum, choledochal cyst, lithiasis and pancreatitis. Findings were correlated with clinical history of pancreatitis, cholecystitis, any lithiasis, and ERCP or surgical findings when available.

### RESULTS

A total of 635 MRCP were included (47.3% female; mean age 12.1 ± 5.1 years), with the most common indications being primary sclerosing cholangitis (25.4%) and pancreatitis (21.7%). Interobserver agreement was fair to moderate (kappa 0.34 and 0.44) for visibility of PBJ. The PBJ was visible in 88.7% of cases. An abnormal junction was observed in 106 (19.3%) of cases, with a long common channel in 54 (9.9%) of cases and an average common channel length of 10.3 ± 4.8 mm (range, 3-25 mm). Significant associations were found between an abnormal PBJ and complications, including choledochal cyst (P<0.0001), history of pancreatitis (P=0.0002) and lithiasis (P<0.0001). 19/54 (35%) common channels (median age of 3.8 years) showed stones within them. The common channel length was also significantly associated with complications (P=0.014), with complication-free cases having an average length of 6.3 mm compared to 11.0 mm in complicated cases.

### CONCLUSION

The abnormal PBJ with long common channel is frequent on MRCPs in children. Its presence is significantly associated with choledochal cyst, pancreatitis and lithiasis. The common channel can show stones within them, particularly in small children.

### CLINICAL RELEVANCE/APPLICATION

It is important to look for abnormal PBJ and common channel in children as it is often complicated by choledochal cyst, history of pancreatitis and lithiasis.

## T2-SPPD-2 SOCIAL FACTORS AFFECTING ACR APPROPRIATENESS CRITERIA COMPLIANCE AMONG CHILDREN DIAGNOSED WITH PYELONEPHRITIS IN THE UNITED STATES

Cory Pfeifer, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Kevin Vo (*Abstract Co-Author*) Nothing to Disclose
Mehrtash Hashemzadeh (*Abstract Co-Author*) Nothing to Disclose
Garrett Trang (*Presenter*) Nothing to Disclose

### PURPOSE

Pyelonephritis, a common complication of urinary tract infections, can lead to sepsis and high medical costs. Computed tomography (CT), preferred for diagnosing pyelonephritis complications such as abscesses, poses radiation risk for children, leading to ultrasound (US) preference as reflected in the ACR Appropriateness Criteria. This study examines predictors of US utilization in children according to multiple social determinants of health.

### METHODS AND MATERIALS

Using the National Emergency Department Sample (NEDS), patients aged =17 years with a diagnosis code for pyelonephritis who received CT or US in 2019-2020 were analyzed. Patients who had both CT and ultrasound were excluded. Demographic and baseline clinical characteristics were reported as means/standard deviations for continuous variables and frequencies; percentages for categorical variables. Two-sample t-tests and Chi-squared/Fisher's Exact Test were used to compare continuous and categorical variables, respectively. P-values were 2-sided with p<0.05 as statistically significant.

## RESULTS

39,528 patients met study criteria (mean age 9.00 years). In patients with CT or US (n = 6240), 74% received CT. Mean CT recipient age (n=4,624) was 14.27 years vs. 10.19 for US (p<0.001). CT was favored among white children (14.96% vs. 6.28% Hispanic), while US preference was opposite (5.02% vs 4.11% White). Income was associated with lower CT utilization rates (14.52%, <$48,000; 7.52%, =$82,000) and higher US rates (3.69%, <$48,000; 5.09%, =$82,000). Private insurance correlated with higher CT (12.84%) and US (4.15%) utilization compared to Medicaid. CT utilization was lower in metropolitan teaching hospitals (6.96% vs. 21.61% non-teaching, p <0.001) but similar for US (4.48% vs. 4.12% non-teaching). US frequency was lower in non-metropolitan hospitals (1.93%). CT utilization was greater in the Midwest (18.05 vs. 6.45% West) while US preference was reversed (3.49% Midwest vs. 4.76% West). Mean ED service charges was $5,585; $11,291 for encounters with CT and $8,531 for encounters with US (p=0.001).

## CONCLUSION

Despite the ACR Appropriateness criteria favoring US for pediatric pyelonephritis, children are nearly three times more likely to undergo CT than US. Older age, lower income, metropolitan teaching hospital, and West region are associated with decreased CT and increased US utilization. Both modalities are associated with increased ED costs, CT greater than US.

## CLINICAL RELEVANCE/APPLICATION

Pediatric patients with pyelonephritis are three times more likely to undergo CT than US. Investigation into the reasons for this disparity is imperative to reduce unnecessary radiation exposure in the pediatric population and improve adherence to evidence-based recommendations.

# T2-SPPD-3 ASSESSMENT OF INTERSTITIAL FIBROSIS IN PEDIATRIC RENAL TRANSPLANTATION USING T2* BOLD MRI: VALIDATION WITH RENAL BIOPSY

Yurie Shirai (*Abstract Co-Author*) Nothing to Disclose
Akihiro Inoue, MD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shuji Sakai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Michinobu Nagao, MD, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

For pediatric patients with end-stage renal failure, kidney transplantation is the only treatment that can provide growth and long-term survival. Although rejection is the common cause of renal dysfunction, there are other causes of chronic transplant nephropathy, in which the transplanted kidney develops interstitial fibrosis. We used a hybrid approache of T2*-BOLD and 4D flow MRI to assess interstitial fibrosis in pediatric transplanted kidneys and compared it to the degree of interstitial fibrosis evidenced by renal biopsy.

## METHODS AND MATERIALS

Data of T2*-BOLD and 4D flow MRI for transplanted kidney in the pelvis collected from 60 patients [mean age, 15 years; 42 boys (70%); average 38 months after transplantation; eGFR, 65±21mL/min/1.73m2; 45 living donor kidneys and 15 cadaveric kidneys] using a 3-tesla scanner were prospectively analyzed. T2*-BOLD was conducted using the black blood, breath-hold, and multi-echo gradient-echo sequence. Regions of interest were drawn in the cortex and medulla of the transplanted kidney and R2* values were measured. A free-breathing 4D flow sequence with echo-planar imaging was used as 4D flow MRI. Patients with loss of arteriovenous flow in the renal cones on 4D flow MRI were excluded. A renal biopsy performed at the same time as the MRI divided the fibrosis of the renal interstitium into Banff classification. Ci0 was defined as no fibrosis, Ci1 as mild fibrosis, and Ci2 to 3 as moderate to severe fibrosis. The relationship between the degree of fibrosis in the renal biopsy and the R2* on T2*-BOLD was examined.

## RESULTS

R2* in renal cortex was 17.3±2.4ms-1 for non-fibrosis (n=31), 17.8±2.3ms-1 for mild fibrosis (n=20), 21.1±4.5 ms-1 for moderate to severe fibrosis (n=9). R2* in renal medulla was 22.0±2.7ms-1 for non-fibrosis, 24.2±4.1ms-1 for mild fibrosis, 26.8±4.4ms-1 for moderate to severe fibrosis. R2* in both renal cortex and medullar had significant correlations with the progression of fibrosis (renal cortex: Spearman r, 0.319; renal medulla: Spearman r, 0.42). ROC analysis revealed that the optimal cut-offs of R2* 17.5 ms-1 for the renal cortex and 24.3 ms-1 for the renal medulla distinguished patients with moderate to severe fibrosis, with area under the curves of 0.797 and 0.815, sensitivities of 89% and 89%, specificities of 61% and 76%.

## CONCLUSION

T2*-BOLD for pediatric transplanted kidney strongly correlates with the degree of interstitial fibrosis on renal biopsy and can be an non-invasive means of diagnosing chronic transplant nephropathy.

## CLINICAL RELEVANCE/APPLICATION

T2*-BOLD MRI does not need the use of contrast media and is a minimally invasive and safe techniqu. It may be an alternative to renal biopsy for surveillance of pediatric transplanted kidneys.

# Abstract Archives of the RSNA, 2024

T2-SPPH

**Physics Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPPH-1 EVALUATION OF LUNG NODULE VOLUMES USING CONVENTIONAL CT AND CDZNTE-PHOTON COUNTING CT WITH HYBRID AND DEEP LEARNING RECONSTRUCTION METHODS

Elsa Pimenta (*Abstract Co-Author*) Nothing to Disclose
Gisell Ruiz Boiset (*Abstract Co-Author*) Nothing to Disclose
Luuk J. Oostveen, DIPLPHYS (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Paulo R. Costa, PhD (*Abstract Co-Author*) Nothing to Disclose
Raissa Aline Moura (*Abstract Co-Author*) Nothing to Disclose
Ioannis Sechopoulos, PhD (*Presenter*) Research Grant, Siemens AG;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation;Research Grant, Sectra AB;Research Grant, ScreenPoint Medical BV;Research Grant, Volpara Health Technologies Limited

### PURPOSE

To evaluate the precision and accuracy of volume measurements of solid (SN) and ground glass opacity (GGO) lung nodules in images acquired using conventional and CdZnTe-photon counting CT (PCCT) systems and reconstructed using hybrid iterative (HIR) and deep-learning based (DLR) reconstructions.

### METHODS AND MATERIALS

A patient-based anthropomorphic 3D printed lung phantom and four printed SNs of different size and one GGO were developed and validated. Ultra-high-resolution images of the nodules were acquired using a micro-CT system with 10μm voxel size. The phantom including the nodules was imaged using conventional CT (CCT)and a prototype PCCT system, both with a CTDIvol of 1.4 mGy. Ten acquisitions were performed per scanner with phantom repositioning to mimic clinical positioning variations. The conventional images were reconstructed in normal resolution (NR) using HIR and DLR. The PCCT images were reconstructed in normal resolution (NR) and high resolution (HR) with HIR and DLR. 3D Slicer (version 5.6.2, Slicer Community) was used to calculate the volume of the nodules in the μCT, conventional, and PCCT images. Semi-automatic segmentation based on region growing was used. The nodule volume estimates resulting from the μCT images were used as ground truth (GT). The accuracy was calculated as the relative error (RE) of the nodule volumes against the GT, and the coefficient-of-variation (CV) was used to calculate precision. ANOVA was used to determine the effect of CT systems, reconstruction methods, and spatial resolution mode (significance at $p<0.05$) on volume estimates. Bland-Altman plots were used to show measurement agreement.

### RESULTS

The GT volumes of the SNs were 4, 22, 1150, and 1774 mm3 and the GT volume of the GGO was 425 mm3. The RE varied from -21.5% (PCCT/HIR) to -0.03% (PCCT/DLR), showing a tendency to underestimate the volume of smaller SNs. The CV varied from 23% (CCT/HIR) to 6% (PCCT/DRL) for the small nodule volume. ANOVA demonstrated that acquisition system, reconstruction algorithm, and resolution setting all have a statistically-significant effect on the volume estimates. Bland-Altman analysis demonstrated a small bias of -3.7 mm3 across the solid nodule volumes, but an average disagreement of 10.6 mm3 on the volume determination of the GGO.

### CONCLUSION

The best performance in terms of measurement precision and accuracy was found using PCCT/DLR, closely followed by the PCCT/HIR.

### CLINICAL RELEVANCE/APPLICATION

The accurate and precise estimation of lung nodule volumes is essential for the optimal follow-up of screening- or incidentally-detected nodules.

## T2-SPPH-10 DEVELOPMENT AND VALIDATION OF AN OPEN-SOURCE SOFTWARE PACKAGE FOR CT SYSTEM QUALITY ASSURANCE

Frank N. Ranallo, PhD (*Abstract Co-Author*) Grant, General Electric Company
Jonathan L. Troville, PhD (*Presenter*) Research support, Canon Medical Systems Corporation

### PURPOSE

The purpose of this work is to present an open-source software package which provides comprehensive computed tomography (CT) quality assurance (QA). We also address limitations of similar packages available in literature.

### METHODS AND MATERIALS

A graphic user interface (GUI) was developed in MATLAB and batch providing the following functionality: 1) objective low contrast detectability (LCD) evaluation, 2) slice thickness measurements from averaged slice sensitivity profile (SSP) full width at half maximum (FWHM) measurements, 3) water CT number accuracy, 4) CT noise performance, 5) CT number scale accuracy, 6) spatial resolution (modulation transfer function (MTF)) measurements using two methods. The code is designed to analyze images of the CATPHAN 500 modules as well as a uniform water phantom provided by the manufacturer. Prior to analyzing the images, sorting is performed on a group and series basis with the dcm4che package. Our methods were performed during annual and acceptance tests for GE Lightspeed VCT and Canon Aquilion ONE scanners. Validations of the slice thickness, MTF, and objective LCD measurements were performed using standard qualitative measurements.

### RESULTS

The average water CT number measured in the center ROI ranged from -0.51 HU up to 0.33 HU across all tube voltages (80, 100, 120, and 140 kV). The total variation of CT number over the image at 120 kV was 0.55 HU (0.5 s rotation time) and 1.35 HU (1 s rotation time), lying well within the manufacturer tolerance of 3.0 HU. All CT numbers for the CATPHAN 500 material inserts fell in agreement with ACR and manufacturer tolerances, except for air inside the phantom at the 40 mm beam width in axial mode and LDPE at the 40 mm beam width in helical mode; air measured outside the phantom was well within ACR tolerances. Objective LCD performance at an observer SNR of 3.29 fell within the manufacturer specifications of 0.32%: 1) 5 mm object diameter: 0.24% at 200 mAs, 2) 3 mm object diameter: 0.26% at 560 mAs. Slice thicknesses were accurate with the SSP FWHM absolute error ranging from 0.0 mm to 0.3 mm. Spatial resolution analysis was highly accurate with absolute error ranging from: 1) Method 1: IQR of 0.0 lp/cm to 1.0 lp/cm, 2) Method 2: -0.2 lp/cm to 0.3 lp/cm.

### CONCLUSION

A comprehensive open-source software package for CT QA can greatly improve the consistency of system testing results by removing inter-operator variability associated with qualitative methods. Furthermore, software-based CT system evaluation may assist with improved throughput for both the testing site and medical physicist given the potential for less time spent scanner-side.

### CLINICAL RELEVANCE/APPLICATION

This work better equips medical physicists in the community for consistent and objective CT system evaluations.

## T2-SPPH-11 EVALUATION OF A WHOLE HEART MOTION COMPENSATION METHOD FOR CARDIAC CT

Zhou Yu, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Jian Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Chih-Chieh Liu (*Abstract Co-Author*) Nothing to Disclose
Liang Cai (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
John Schuzer, ARRT, BS (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Qiulin Tang (*Presenter*) Nothing to Disclose

### PURPOSE

Computed tomography angiography (CTA) serves as a pivotal clinical modality for diagnosing cardiac pathologies, encompassing conditions such as coronary artery defects, valvular anomalies, and myocardial abnormalities. Despite significant advancements in CT gantry rotation speed over the past decade, the temporal resolution offered by many commercial scanners is still limited in capturing real coronary artery motion. As such, motion artifacts are often seen in cardiac CTA images at different cardiac phases, especially for patients with fast heart rates. We have developed a novel reconstruction method to compensate motion for all cardiac region at various heart rates. Here we perform preliminary evaluations for this motion-compensated reconstruction method.

### METHODS AND MATERIALS

The assessments were performed utilizing cardiac volume scans obtained via a Canon Aquilion One 320-slice CT scanner. The entire dataset covers a wide range of dose and contrast levels as well as heart rates. A target cardiac phase was empirically chosen either the systolic period (~45%) or diastolic period (~75%) for each case. The proposed method has been implemented in an in-house reconstruction tool, to produce both images with and without motion compensation for the chosen target phase. The results were evaluated using visual inspection by clinical specialists.

### RESULTS

Without motion compensation, artifacts, including blurring, appears in both the aorta region and coronary arteries (refer to figures 1a-1b, left). After motion-compensated reconstruction, these artifacts are effectively suppressed, resulting in enhanced clarity of the aortic valve (refer to figures 1a-1b, right). Furthermore, substantial enhancement in the visualization of the lateral wall of the left ventricle is noted (refer to figures 1c-1d, right). Effective motion compensation is also noticeable in other regions, such as the encircled area and the mitral valve.

### CONCLUSION

Evaluations based on clinical data have been performed for a cardiac motion-compensated reconstruction method. The result shows that the method significantly reduces cardiac motion artifacts across all region.

### CLINICAL RELEVANCE/APPLICATION

Cardiac Computed Tomography Angiography (CTA) stands as one of the foremost applications in cardiac CT imaging, pivotal for precise clinical diagnosis of cardiac ailments. Mitigation of motion artifacts holds paramount importance in ensuring the fidelity and accuracy of diagnostic outcomes.

## T2-SPPH-12 IMAGE QUALITY AND DOSE REDUCTION POTENTIAL OF DUAL-SOURCE CT EQUIPPED WITH ENERGY-INTEGRATING OR PHOTON-COUNTING DETECTORS ON ABDOMINAL CT IMAGES: A STUDY ON PHANTOMS

Jean-Paul Beregi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Julien Erath, MSc (*Abstract Co-Author*) Employee, Siemens AG
Djamel Dabli (*Abstract Co-Author*) Nothing to Disclose
Maxime PASTOR (*Abstract Co-Author*) Nothing to Disclose
Sebastian Faby, DIPLPHYS (*Abstract Co-Author*) Employee, Siemens AG
Joel Greffier, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the image-quality and dose reduction potential of a photon-counting CT (PCCT) system with two different dual-source CT systems (DSCT-Pulse and DSCT-Force, respectively) for different clinical indications in abdominal CT.

**METHODS AND MATERIALS**

Acquisitions on phantoms were performed on the two DSCTs and one PCCT at 4 dose levels (13/6/3.4/1.8mGy). Noise power spectrum (NPS) and task-based transfer function (TTF) were computed to assess noise magnitude and noise texture and spatial resolution (f50), respectively. Detectability indexes (d') were computed to model the detection of abdominal lesions: one unenhanced high-contrast task, one contrast-enhanced high-contrast task and one unenhanced low-contrast task. Image quality was subjectively assessed on an anthropomorphic phantom by two radiologists.

**RESULTS**

For all dose levels, noise magnitude values were lower with PCCT than with DSCTs. For all CT systems, similar noise texture values were found at 13 and 6mGy, but the highest noise texture values were found for DSCT-Pulse and the lowest for PCCT at 3.4 and 1.8mGy. For high-contrast inserts, similar or lower f50 values were found with PCCT than with DSCT-Force and the opposite pattern was found for the low-contrast insert. For the three simulated lesions, d' values were higher with PCCT than with DSCTs. Abdominal images were rated satisfactory for clinical use by the radiologists for all dose levels with PCCT and for 13 and 6mGy with DSCTs.

**CONCLUSION**

Compared to DSCTs, PCCT reduced the image-noise and improved the detectability of simulated abdominal lesions without altering the spatial resolution and image texture. Image-quality obtained with PCCT seem to indicate greater potential for dose optimization than those obtained with DSCTs.

**CLINICAL RELEVANCE/APPLICATION**

The images obtained with PCCT may offer great potential for dose reduction in patients undergoing abdominal CT examinations.

## T2-SPPH-2 PILOT APPLICATION OF A PROTOTYPE ULTRA-HIGH RESOLUTION CT SYSTEM IN THE THORACIC REGION

Hiroki Kawashima, PhD (*Abstract Co-Author*) Kyoto kagaku, Research collaboration
Katsuhiro Ichikawa, PhD (*Abstract Co-Author*) Nothing to Disclose
Koichiro Nakabayashi (*Presenter*) Nothing to Disclose

**PURPOSE**

The aim of this study was to develop a prototype ultra-high resolution CT system (UHRCT) for the delineation of lung microstructures. The system was also tested in healthy volunteers to investigate whether micro vessels and bronchioles in the lung could be visualized at practical doses.

**METHODS AND MATERIALS**

The system uses half-scanning to achieve a detector trajectory close to the lung and collect data at a low magnification rate. This allows an effective focal spot size of approximately 0.2 mm, which is combined with a high-resolution CMOS detector with a pixel size of approximately 0.08 mm at the rotation center. The modulation transfer function (MTF), the noise power spectrum (NPS), and the slice thickness were measured with a 0.1 mm diameter wire phantom, a water phantom, and an acrylic block, respectively. The CT dose index (CTDIw) was measured using the standard method. The NPS was compared with that of a clinical CT system at the same dose. After ethics committee approval, two healthy volunteers were scanned and the CT images were reconstructed with a pixel size of 0.16 mm.

**RESULTS**

The 5%MTF was 3.0 mm-1 (0.16 mm resolution) even with an unenhanced reconstruction kernel. The slice thickness was ~0.2 mm. The NPS was approximately twice that of a clinical CT system due to the very small voxel of UHRCT. The CTDIw was 19 mGy which was practical. In the CT images of the healthy volunteers, noise was conspicuous, as was the result of the NPS, but micro vessels and bronchi were easily visible.

**CONCLUSION**

The developed UHRCT system presented high-resolution CT images with a completely different level at a practical radiation dose. The achievement of this study suggested the possibility of clinical application of ultra-high resolution CT in the thoracic region.

**CLINICAL RELEVANCE/APPLICATION**

There are high resolution clinical CT systems with detector pith of 0.2 to 0.25 mm; however, these are not sufficient to visualize bronchiole (0.3-0.5 mm) and small vessels (0.1-0.5 mm) because the actual resolutions of such systems are equal to or larger than the sizes. Therefore, it has not been shown whether these 'in vivo' microstructures can be imaged by CT. This study presents unprecedented high-resolution lung CT images and discusses their clinical potential.

## T2-SPPH-3 DEEP SCATTER ESTIMATION (DSE) FOR STATIC CT

Marc Kachelriess, PhD (*Abstract Co-Author*) Nothing to Disclose
Karl Stierstorfer, PhD (*Abstract Co-Author*) Employee, Siemens AG
Eric Fournie (*Abstract Co-Author*) Employee, Siemens AG
Christian Hofmann (*Abstract Co-Author*) Employee, Siemens AG
Martin Petersilka, PhD (*Abstract Co-Author*) Employee, Siemens AG
Joscha Maier, PhD (*Abstract Co-Author*) Nothing to Disclose
Julien Erath, MSc (*Abstract Co-Author*) Employee, Siemens AG
Andreas Heinkele (*Abstract Co-Author*) Nothing to Disclose
Lukas Hennemann, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

4th generation static CT scanners are composed of a ring-shaped detector and an X-ray source ring. The absence of rotating parts results in many advantages, such as arbitrary firing patterns, mechanical simplification, and faster data acquisition. Still, all currently built medical CT scanners are 3rd generation scanners. One reason is that 4th generation scanner do not allow using anti-scatter grids (ASGs) due to the scanner geometry. Recently, the deep scatter estimation (DSE) offers a new deep learning-based approach that outperforms conventional methods for clinical CT [Med. Phys. 46(1):238-249, January 2019]. This work investigates deep learning-based scatter correction for 4th generation static CT.

**METHODS AND MATERIALS**

DSE is based on a U-net architecture and inferences the scattered radiation from the acquired projection data. For clinical scanners, the acquired data consist of the overlay of primary radiation and scatter. However, for static CT, the detector ring facilitates the measurement of backscattered radiation outside of the primary fan beam, which may contain additional depth information about the object that can be provided to the U-net to improve performance. In this work, DSE is generalized and trained for a static CT geometry. The training dataset consists of 200 circular and elliptic water

phantoms as well as semi-anthropomorphic thorax phantoms. The phantoms vary in size, aspect ratio, and position relative to the scanner center. The ground truth (GT) for the training dataset was generated by Monte Carlo simulations. Testing was done with a semi-anthropomorphic thorax phantom that was not contained in the training dataset. The scatter correction with DSE was compared to the correction with a kernel-based model [Eur Radiol. 9(3):563-9, 1999].

**RESULTS**

Employing DSE, visible scatter artifacts can be well corrected for. The mean absolute error (MAE) in the phantom center can be reduced from 64 HU to 8 HU. In comparison, the kernel-based model reduces the MAE to 25 HU. Even though the DSE was only trained on water and thorax phantoms, it also generalizes very well to our semi-anthropomorphic head phantom.

**CONCLUSION**

Scatter artifacts for static CT can be corrected effectively by using DSE. The adapted DSE outperforms the classical kernel-based model for a static CT geometry.

**CLINICAL RELEVANCE/APPLICATION**

While currently 4th generation scanners are not in clinical use, they may have benefits in certain use cases. E.g. in interventional CT due to the compact design or in general applications where very fast acquisition is crucial. However, since ASGs cannot be deployed for static CT, scatter artifacts have been one of the major issues in the past. Our work shows that this issue can be approached with deep learning-based methods such as the DSE.

## T2-SPPH-4 SPECTRAL PERFORMANCE OF A DUAL-SOURCE, DUAL-KV PHOTON COUNTING DETECTOR (PCD) CT

Timothy Winfree, BS, MS (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Shuai Leng, PhD (*Presenter*) License agreement, Siemens AG

**PURPOSE**

To evaluate the performance of a novel dual-source (DS) PCD-CT scan mode and compare it to single-source (SS) PCD-CT and DS dual-energy CT with energy-integrating detectors (DS-EID-CT).

**METHODS AND MATERIALS**

A 30cm x 40cm anthropomorphic body phantom with four iodine inserts (2, 5, 10, and 15 mg/mL) was scanned with three modalities at matched radiation dose (CTDIvol: 12 mGy): SS (120 kV) PCD-CT with two energy thresholds, DS (90/Sn150 kV) PCD-CT with three energy thresholds, and DS-EID-CT (90/Sn150 kV). For each modality, images were reconstructed with FBP algorithm using a quantitative (Qr40) kernel, 1mm slice thickness, and 500mm FOV. These images were used as the input to an image-domain least squares material decomposition algorithm with two base materials (iodine and water). The linear reconstruction (FBP) and material decomposition (least squares) algorithms were selected to compare the spectral performance of the three modalities without non-linear factors such as different iterative reconstruction algorithms. Image noise in the iodine map was used as a figure of merit. To enable a fair comparison of the iodine map noise between the three modalities, spatial resolution (point spread function, PSF) needed to be matched. When scanning in a DS configuration, the dose budget is split between two detectors, reducing the detected counts per pixel and increasing the strength of the signal-dependent filter compared to a single source acquisition. To account for this effect, the PSF for each modality was measured from a 0.05 mm tungsten wire placed in the phantom. Then, a linear filter was applied to the SS images to match the SS PSF to that of DS.

**RESULTS**

The 10% MTF cutoffs were 1.12, 1.13, 1.2, and 1.14 lp per mm for DS-EID, DS-PCD, SS-PCD, and SS-PCD-MTF-matched, respectively. Without accounting for the signal-dependent filter, the noise of SS-PCD with 2 thresholds was 8.8% higher compared to that of DS-EID. However, after matching the MTFs, the noise in the SS-PCD iodine map was 22% lower than that of the DS-EID. The best performing scan mode was DS-PCD, for which the noise was 44.7% lower compared to the DS-EID.

**CONCLUSION**

SS PCD-CT with two thresholds outperforms DS-EID-CT in terms of image noise of basis material images when spatial resolution is matched. DS PCD-CT gives the best performance due to PCD technology and improved spectral separation from the different tube potentials and beam filters.

**CLINICAL RELEVANCE/APPLICATION**

Our findings of improved material decomposition performance due to improved spectral characteristics further enhance the applications of PCD-CT in clinical practice.

## T2-SPPH-6 EVALUATION OF STENT IMAGING USING SUPER-RESOLUTION DEEP LEARNING IMAGE RECONSTRUCTION IN CORONARY CT ANGIOGRAPHY : COMPARATIVE STUDY OF IMAGE RECONSTRUCTIONTECHNOLOGY BY 3 DIFFERENT CT MANUFACTURERS USING PHANTOMS AND INVITRO

Jhii-Hyun Ahn (*Abstract Co-Author*) Nothing to Disclose
Donghee Koh (*Abstract Co-Author*) Nothing to Disclose
Pil-Hyun Jeon, PhD (*Abstract Co-Author*) Nothing to Disclose
Sung-Jin Cha, BS (*Abstract Co-Author*) Nothing to Disclose
Chuluunbaatar Otgonbaatar, MD, MS (*Abstract Co-Author*) Nothing to Disclose
JEON SANG HYUN (*Abstract Co-Author*) Nothing to Disclose
Sung Min Ko, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Coronary computed tomography angiography (CCTA) is a widely used noninvasive imaging tool for diagnosing significant coronary artery diseases. Blooming artifacts, which appears larger than their actual size, can arise from coronary stents, leading to an overestimation of in-stent restenosis and artificial in-stent luminal narrowing. Super-resolution deep learning reconstruction (SR-DLR) has been developed for CT imaging, which is trained with images acquired using commercially available ultra-high resolution CT with small detector elements. We aimed to investigate the effects of image reconstruction methods on the visualization of coronary artery stent in both in vitro and vivo studies.

**METHODS AND MATERIALS**

In vivo, a stent phantom was conducted using CT imaging on three different scanners. Stents were inserted into a plastic tube filled with contrast. Stents of 2.5 mm and 3.5 mm in diameter sized stents were evaluated, and image sharpness was assessed across the three different CT scanner. In the vivo study, Sixty-three patients (mean age, 61±11 years; range, 18-81 years; 40 men) who had undergone coronary CTA between June-October 2022 were

retrospectively included. Image noise, SNR, and CNR were quantified in both proximal and distal segments of the major coronary arteries. Two independent reviewers scored overall image quality, image noise, image sharpness, and myocardial homogeneity. The image was reconstructed with filtered-back projection (FBP), hybrid iterative reconstruction (HIR), deep learning reconstruction (DLR), and SR-DLR. The image noise, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), 10-90% edge rise slope (ERS), and 10-90% edge rise distance (ERD) were performed.

**RESULTS**

In vivo, the image sharpness was resulted in higher for DLR and SR-DLR in each differet scanner compared with FBP and IR. In vitro, Image noise in HU was significantly lower ($p<0.001$) for the SR-DLR (11.2±2.0) compared to those associated with other image reconstruction methods including FBP (30.5±10.5), hybrid IR (20.0±5.4), and DLR (14.2±2.5) in both proximal and distal segments. SR-DLR significantly improved SNR and CNR in both the proximal and distal segments of the major coronary arteries. Two reviewers graded subjective image quality with SR-DLR higher than other image reconstruction techniques.

**CONCLUSION**

SR-DLR resulted in significantly lower blooming artifact with clear stent lumen and strut, decreased the image noise, increased the SNR and CNR compared with FBP, HIR, and DLR.

**CLINICAL RELEVANCE/APPLICATION**

Coronary CT angiography with DLR resulted in lower blooming artifacts, thereby improving visualization of increased in-stent stenosis and luminal changes.

## T2-SPPH-8 TO EXPLORE THE DISCREPANCY BETWEEN HEAD AND NECK DUAL-ENERGY CTA AND THE PEAK PHASE OF CT BRAIN PERFUSION IN EVALUATING CEREBRAL ARTERY STENOSIS

Zi Tian Tsang, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to evaluate the discrepancy of diagnosing cerebral artery stenosis by analyzing arterial phase images from head and neck dual-energy CT angiography (DECTA) and peak phase images(maximum iodine concentration) from CT brain perfusion(CTP) scans.

**METHODS AND MATERIALS**

Data of 22 patients who underwent brain CT perfusion and head-neck DECTA at our hospital from December 2023 to March 2024 were respectively collected. Monochromatic image at at 68keV(100kVp-like) was reconstructed from head-neck DECTA. All perfusion images and head-neck DECTA were reconstructed with adaptive statistical iterative reconstruction-Veo at 40% strength (40%ASIR-V). Stenosis was evaluated by two radiologists using 68keV image and categorized into four grades: mild (<50%), moderate (50%-70%), severe (71%-99%), and occlusive (100%). Image quality of the peak phase of brain perfusion was assessed on a 5-point Likert scale, focusing on image quality, vessel edges, and vascular opacification versus noise. The inter-rater consistency was also analyzed. Lastly, Standard Deviation(SD) value of temporal muscle was measured in two group of images to assess background image noise.

**RESULTS**

The mean standard deviation (SD) values of DECTA and CTP were 14.60 and 26.70, respectively, with a significant difference between the two groups ($P<0.05$). The study comprised 22 patients, evenly distributed by gender (11 males, 11 females), aged between 37 to 87 years old. The Kruskal-Wallis test indicated no significant differences in vascular stenosis grading among the groups ($Z=0.947$, $P>0.05$). The image quality in the M1 segment of the middle cerebral artery and A4/A5 segments of the anterior cerebral artery met diagnostic requirements for both radiologists (=3 points). The subjective assessment scores from radiologists for these segments were as follows: M1: 4.69±0.55, 4.75±0.53 A4: 3.98±0.65, 4.09±0.76 A5:3.01±1.01;2.61±0.91.(kappa: 0.67, $p<0.05$).

**CONCLUSION**

Despite the substantial difference in background noise between the peak phase of brain CTP and head-neck CTA, there was no significant variance in diagnostic efficacy between the two.

**CLINICAL RELEVANCE/APPLICATION**

This study aimed to compare the diagnostic performance of cerebral artery stenosis between head-neck CTA images and the peak phase of CT brain perfusion. The study sought to determine whether peak phase imaging from CT brain perfusion could potentially aid in diagnosing cerebral artery stenosis for patients who are unable to undergo CTA examination. The findings may have implications for clinical practice.

## T2-SPPH-9 PERFORMANCE EVALUATION OF A DEEP-LEARNING-BASED NOISED REDUCTION METHOD FOR LESION CHARACTERIZATION USING A VIRTUAL IMAGING TRIAL

Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Scott S. Hsieh, PhD (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Joel G. Fletcher, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Pfizer Inc;Research Grant, Takeda Pharmaceutical Company Limited;Consultant, Takeda Pharmaceutical Company Limited;Research Grant, Nextrast, Inc;Consultant, Medtronic plc
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Hao Gong, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Zhongxing Zhou, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Characterization of malignant and benign lesions is a critically important clinical task. Performance evaluation of deep learning-based image reconstruction and non-linear noise reduction methods (collectively referred to as DLIR) remains challenging for this task. The purpose of this study was to apply a patient-data-based virtual imaging trial to evaluate the performance of a DLIR method for a lesion characterization task.

**METHODS AND MATERIALS**

The patient-data-based virtual imaging trial (VIT) framework recently developed in our group consists of five steps: (1) lesion- and (2) noise-insertion in projection domain to generate images at different lesion and noise conditions; (3) application of DLIR to denoise these images; (4) creation of DLIR-processed patient image ensembles from a large number of noise and lesion realizations; and (5) evaluation of image quality and diagnostic performance using ensemble DLIR images. A DLIR model trained on patient liver images was evaluated using this VIT framework. Cylindrical lesions (5-mm height, 15-mm diameter) with and without spiculated boundaries were inserted into the patient data to mimic malignant and benign lesions, respectively.

Ensembles of projection data were generated by 600 independent noise realizations for each of three dose levels (12.5%, 25%, and 50% of routine dose) and five lesion contrasts (-5, -10, -20, -30, and -50HU) for both round and spiculated lesions. Channelized Hotelling observer (CHO)-based index of detectability (d') was calculated using 600 pairs of images (round and spiculated) at different conditions. Multiple reconstructions were evaluated, including filtered-backprojection (FBP), iterative reconstruction (IR), and the DLIR at 3 strength settings (weak, medium, and strong).

**RESULTS**

Compared to FBP and IR, DLIR improved d' for lesion characterization in all conditions studied. For example, DLIR-Strong improved d' over IR/FBP at -5, -10, -20, and -30HU contrast (at 50% dose): 0.94/0.72/0.68, 1.78/1.36/1.26, 3.19/2.68/2.49, 4.95/4.35/4.10; and for 12.5%, 25%, and 50% dose (at -30 HU): 1.71/1.35/1.26, 2.77/2.32/2.17, 4.95/4.35/4.10. With the decrease of lesion contrast, the improvement of d' by DLIR over FBP and IR decreased.

**CONCLUSION**

Using a patient-data-based virtual imaging trial, DLIR was demonstrated to have less performance improvement at lower lesion contrast, indicating a diminishing radiation dose reduction potential for low-contrast lesion characterization tasks.

**CLINICAL RELEVANCE/APPLICATION**

The reduced performance improvement by DLIR for lesion characterization at lower lesion contrast implies less dose reduction potential for challenging lesion characterization tasks.

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RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

T2-SPRO

**Radiation Oncology Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPRO-1 ENHANCING LUNG CANCER TUMOR DELINEATION WITH CLOUD-BASED AI-DRIVEN CT IMAGE SEGMENTATION

Yaqi Miao, MSc, BA (*Presenter*) Nothing to Disclose

### PURPOSE

This study focuses on improving lung cancer tumor delineation using advanced artificial intelligence techniques. Previous works have been experimented on public datasets with restricted diversity and scope. Integrating a comprehensive dataset from two major institutions, this study introduces an optimized 3D U-Net architecture designed to automate tumor segmentation more efficiently, overcoming challenges related to processing times and memory demands.

### METHODS AND MATERIALS

The dataset used in this research was sourced from 1042 CT scans collected at two institutions. The study trains a 3D DynUnet model leveraging AWS cloud A100 GPU instances with 5-fold cross-validation for training. Inputs to the model are lung CT scan images, and outputs are segmented tumor regions. The architecture is designed to fully take advantage of available GPU memory and the distributed computing infrastructures. The model employs data augmentation and preprocessing to manage memory consumption and optimize training efficiency. Two inference modes and various postprocessing approaches were investigated for the optimal performance in clinical settings.

### RESULTS

The optimized 3D DynUnet model achieved an averaged testing Dice Similarity Coefficient (DSC) of 0.7149 within the ROI patch and a DSC of 0.6052 for the whole image, significantly outperforming existing models. Moreover, this new model demonstrated enhanced spatial consistency and the ability to detect multiple tumors when only one is initially marked. The inference of the model requires minimal resources and can be executed on CPU with a standard lab computer within a practical amount of time. This indicates a notable improvement in the accuracy and efficiency of tumor segmentation over traditional methods.

### CONCLUSION

The results demonstrated the effectiveness of 3D modeling in achieving accurate lung tumor segmentation. The implementation of data augmentation and parallel processing effectively tackled the challenges of memory limitations and processing speed. As a result, the success of the 3D DynUnet model represents a significant advancement in lung cancer treatment planning, suggesting a promising direction for future research in medical imaging AI.

### CLINICAL RELEVANCE/APPLICATION

This study's advancements in tumor delineation have significant implications in clinical settings. The increased accuracy in tumor segmentation enables more precisely targeted radiotherapy treatments, potentially improving patient outcomes. Additionally, the model's capability to identify multiple tumors when only one is initially detected supports earlier and more comprehensive treatment interventions.

# Abstract Archives of the RSNA, 2024

T2-SPVA

**Vascular Imaging Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-SPVA-1 A CONTROLLED STUDY OF 5.0T MR VASCULAR IMAGING AND CT ANGIOGRAPHY FOR THE EVALUATION OF MMD BYPASS VESSELS

Tingting Zhou (*Presenter*) Nothing to Disclose

### PURPOSE

To analyze and compare 5.0T ultra-high field MR three-dimensional time leap vascular imaging (5.0T 3D TOF MRA) and CT vascular imaging (CTA) in the evaluation of Mpatency.

### METHODS AND MATERIALS

A total of 25 patients diagnosed with MMD with intracranial and external revascularization in the First Affiliated Hospital of USTC of China from May 2023 to February 2024 were collected from the data of 13 males and 12 females, aged 15 to 42 years, average (31 ± 5) years.25 patients included 21 lateral superficial temporal artery-middle cerebral artery bypass + temporal muscle application (STA-MCA + EDMS) and 4 lateral brain-meningeal-arterial-temporotemporal muscle application (EDAMS). All patients underwent cranial 5.0T 3D TOF MRA and CTA examination within 1 week after surgery, which were divided into 5.0T 3D TOF MRA and CTA groups.The bypass vessels were divided into three sections, including extracranial segment (ECS segment), perforating skull segment (TS segment), and intracranial segment (ICS segment). The image score of bypass vessel patency was performed by the 5-point scoring method, including 0 to 4 points.4 is excellent, indicating that the bypass vessels are smooth with no stenosis; 3 are good, indicating visible contrast filling and no obvious stenosis; 2 are good, indicating mild stenosis; 1 is poor, which means that although the walking area of bypass vessel is visible, there is severe stenosis; 0 is poor, indicating that the bypass vessels are unclear. Comparative analysis of the two examination methods was performed by using the t-test.

### RESULTS

5.0T 3D TOF MRA The mean score of extracranial segment (ECS segment) compared with CTA, P> 0.05. t test. 5.0T 3D TOF MRA The mean score for bypass vessel puncture segment (TS segment) and intracranial segment (ICS segment) were higher than CTA, P <0.05 by t-test. Memean score of 5.0T 3D TOF MRA for bypass vessel was higher than CTA, P <0.05 by t-test.

### CONCLUSION

5.0T ultra high field strength 3D TOF MRA showed significantly better than CTA, especially for intracranial and cranating segments.5.0T 3D TOF MRA is a non-invasive examination technology, and no radiation, no contrast allergy and other hazards, especially suitable for low-age patients and patients who need long-term follow-up.

### CLINICAL RELEVANCE/APPLICATION

3D TOF MRA is a safe and noninvasive examination technology, which does not require the application of injection contrast agents, does not exist ionizing radiation, is cheaper than CTA, and patients feel better, especially suitable for younger patients and patients who need long-term follow-up.

## T2-SPVA-2 COMPARISON OF AORTIC HEMODYNAMICS BEFORE AND AFTER ROSS PROCEDURE BY 4D FLOW MRI

Alexander Lenz, MD (*Abstract Co-Author*) Nothing to Disclose
Hermann Reichenspurner, MD (*Abstract Co-Author*) Nothing to Disclose
Evaldas Girdauskas, MD (*Abstract Co-Author*) Nothing to Disclose
Christoph Riedel, MD (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD (*Abstract Co-Author*) Nothing to Disclose
Inka Ristow, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Bannas, MD (*Abstract Co-Author*) Nothing to Disclose
Lukas Huber, MSc, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare aortic flow patterns in patients with congenital aortic valve disease before and after Ross procedure by 4D flow MRI.

### METHODS AND MATERIALS

12 patients (median age 35.5 years; IQR 33.0-44.5; 4 female) with either severe aortic valve stenosis or severe regurgitation were enrolled in a prospective monocentric study and underwent 4D flow MRI at 3 T before and after Ross procedure. Analysis planes were placed at the level of sinotubular junction (STJ), mid-ascending aorta (midAAo) and proximal arch (proxAA). Aortic regurgitant fraction (%) was estimated. The degree of helical and

vortical flow was graded on a 3-point scale. Relative flow displacement (FD) as a measure of flow eccentricity and wall shear stress (WSS) were estimated. Pre- and postoperative results were statistically compared using Wilcoxon matched-pairs test.

**RESULTS**

All patients underwent successful Ross procedure with a significant reduction of the aortic regurgitation fraction (38 ± 24 ml vs. 24 ± 19 ml; p = 0.01). The degree of helical flow in the ascending aorta (median pre/post = 2/1; p = 0.01) as well as the descending aorta (median pre/post = 2/0; p = 0.02) decreased significantly postoperatively but showed no significant difference in the aortic arch (median pre/post = 2/0; p = 0.08). The degree of vortical flow decreased significantly in the ascending aorta (median pre/post = 2/1; p = 0.004) and the aortic arch (median pre/post = 2/1; p = 0.01) but showed no significant difference in the descending aorta (median pre/post = 1/0; p = 0.4). FD decreased significantly at all levels: STJ (0.27 ± 0.12 vs. 0.12 ± 0.10; p = 0.003), proxAA (0.36 ± 0.07 vs. 0.25 ± 0.12; p = 0.019) and midAAo (0.35 ± 0.09 vs. 0.24 ± 0.10; p = 0.009). WSS was significantly reduced at midAAo (0.84 ± 0.36 N/m² vs. 0.58 ± 0.19 N/m²; p = 0.04) and proxAA (0.98 ± 0.59 N/m² vs. 0.57 ± 0.14 N/m²; p = 0.02) but showed no significant difference at STJ (0.43 ± 0.22 N/m² vs. 0.46 ± 0.08 N/m²; p = 0.42).

**CONCLUSION**

4D flow MRI-based assessment of aortic hemodynamics after Ross procedure revealed fewer flow alterations, less regurgitation and reduced WSS in the ascending aorta as compared to preoperative aortic hemodynamics, resulting in more physiological flow patterns.

**CLINICAL RELEVANCE/APPLICATION**

In our study 4D flow MRI allows evaluation of the success of the Ross procedure in patients with congenital aortic valve disease and may help to optimize surgical procedures in the future.

## T2-SPVA-3 IDENTIFICATION OF DISTINCT MARFAN PATIENT SUBGROUPS BY CLUSTER ANALYSIS BASED ON AORTIC 4D FLOW MRI AND Z-SCORE

Yskert von Kodolitsch (*Abstract Co-Author*) Nothing to Disclose
Christoph Riedel, MD (*Abstract Co-Author*) Nothing to Disclose
Shuo Zhang, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Martin Sinn (*Abstract Co-Author*) Nothing to Disclose
Flora Amanda Bahr (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD (*Abstract Co-Author*) Nothing to Disclose
Lennart Well, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Bannas, MD (*Abstract Co-Author*) Nothing to Disclose
Bjoern P. Schoennagel, MD (*Abstract Co-Author*) Co-founder, North Medical GmbH;Stockholder, North Medical GmbH
Alexander Lenz, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Identification of distinct Marfan patient subgroups using aortic 4D flow MRI and Z-scores to categorize different hemodynamic patterns and clinical characteristics through hierarchical cluster analysis.

**METHODS AND MATERIALS**

100 Marfan patients were prospectively included who underwent baseline aortic 4D flow MRI at 3T. Z-scores, degree of helical and vortical flow, wall shear stress (WSS), flow displacement (FD) and peak velocity were determined in the ascending aorta. Sex, age, BMI, antihypertensive medication, and presence of dural ectasia were recorded. Hierarchical cluster analysis was performed using 4D flow MRI-variables and Z-scores as input.

**RESULTS**

Cluster analysis revealed three distinct clusters distinguished by different Z-scores (mean ± SD; cluster 1: 0.4±1.1 vs. cluster 2: 3.1±1.1 vs. cluster 3: 3.6±1.9). These clusters exhibited significant variations in helical (global p=0.003) and vortical (global p<0.001) flow patterns, as well as WSS (0.49±0.11 vs. 0.44±0.12 vs. 0.37±0.09 N/m2, all pairwise ? p<0.037), FD (0.11±0.05 vs. 0.16±0.08 vs. 0.15±0.07, ? cluster 2 to cluster 1 and ? cluster 3 to cluster 1 p<0.009), and peak velocity (76.3±9.0 vs. 60.1±7.3 vs. 56.0±7.8 cm/s, all pairwise ? p<0.04). Patients in cluster 1 and 2 were notably younger compared to those in cluster 3 (32±14 vs. 33±13 vs. 40±15 years, all pairwise ? p<0.0297). Sex, BMI, antihypertensive medication, and presence of dural ectasia did not exhibit significant differences among the three clusters (all global p>0.2).

**CONCLUSION**

Using hierarchical cluster analysis with aortic 4D flow MRI and Z-scores, we identified three subgroups among Marfan patients, each exhibiting distinct hemodynamic profiles and clinical characteristics. Longitudinal follow up is warranted to determine whether our stratification based on 4D flow MRI and Z-scores can predict future aortic dilatation.

**CLINICAL RELEVANCE/APPLICATION**

Utilizing both Z-scores and 4D flow MRI-derived parameters could assist in identifying subgroups among Marfan patients, revealing different stages or phenotypes of aortic disease, thus allowing for tailored management strategies.

# Abstract Archives of the RSNA, 2024

T5A-SPBR

**Breast Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPBR-2 ENHANCING BREAST RADIOGRAPHERS' PERFORMANCE IN TOMOSYNTHESIS SCREENING WITH AN AI-BASED AUTOMATED EVALUATION SYSTEM

Ying Guo (*Abstract Co-Author*) Nothing to Disclose
Xuefei Lv (*Abstract Co-Author*) Nothing to Disclose
Fang Fang (*Abstract Co-Author*) Nothing to Disclose
Ellisa 1020 (*Presenter*) Nothing to Disclose

### PURPOSE

To improve breast radiographers' performance by using an AI-based system to automatically evaluate the breast positioning in tomosynthesis screening.

### METHODS AND MATERIALS

2396 images of digital mammography over three consecutive quarters were evaluated according to the standards regulated by the Mammography Quality Standards Act (MQSA) on a four-point-scale (1 = poor, 4 = excellent). Incidence of inadequate positioning, which was defined by AI system as any of the following errors were recorded and compared: incomplete gland coverage, incomplete pectoralis major muscle inclusion, over or insufficient exposure, skin fold, nipple not in the contour line, shoulder overlap shadow, abdominal skin, contralateral breast, and foreign body.The positioning data from the study acquired at the start of the project were used as baseline, while the data obtained over three consecutive quarters were used to compare with the first quarter. The percentage of views rated perfect or good and the percentage of views were used to assess changes in performance.

### RESULTS

For all quarters, the pass rates for CC views were significantly higher than MLO views. CC views achieved 100% pass rates for "abdominal skin included" and "pectoralis muscle not satisfactorily displayed." Compared to the second quarter, the positioning pass rates for CC views significantly improved in the third (OR=2.1, 95%CI:1.8-2.5) and fourth quarters (OR=2.5, 95%CI:2.1-3.0). MLO views exhibited a similar trend (third quarter OR=1.9, 95%CI:1.6-2.3; fourth quarter OR=2.7, 95%CI:2.2-3.3). There were significant differences in image score distributions across the three quarters ($P<0.001$), with the fourth quarter scoring significantly higher than the second ($P<0.001$). Within each quarter, CC view scores were significantly higher than MLO views (all $P<0.001$). Images score increases of 2.6 ($P<0.001$) and 3.5 ($P<0.001$) in the third and fourth quarters, respectively, compared to the second. CC view scores were 2.1 points higher ($P<0.001$) than MLO views.

### CONCLUSION

In all quarters, the positioning pass rates and image quality scores for CC views were significantly better than MLO views, potentially due to the higher technical difficulty of MLO views. Over time, the radiographer's positioning pass rates and image quality scores improved significantly for both CC and MLO views, reflecting the substantial improvement brought about by accumulated experience.

### CLINICAL RELEVANCE/APPLICATION

this study validates the application value of AI-assisted assessment in monitoring and improving mammographic image quality, providing strong evidence for promoting diagnostic quality, guiding continuous technologist education, and ensuring the overall efficacy of breast cancer screening.

## T5A-SPBR-3 ASSISTING RADIOLOGISTS FOR ACCURATE BREAST ULTRASOUND LESION DETECTION IN SCREENING USING DEEP LEARNING

Nan Zhang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study is to develop a breast lesion detection model for dynamic ultrasound videos using deep learning to assist physicians in accurately identifying lesions.

### METHODS AND MATERIALS

Our dataset included dynamic ultrasound videos from 2,141 patients. We developed a dynamic video detection model for breast lesion diagnosis. The model’s performance was evaluated using sensitivity rates and mean Average Precision (mAP). Additionally, to gauge the model’s impact on clinical diagnosis, a reader study with one senior and two junior physicians assessed the model’s diagnostic aid.

**RESULTS**

The model achieved a sensitivity rate of 98.4% for lesion detection and a frame-level mAP50 of 89.9%, indicative of its effectiveness. In the reader study, the model helped increase the sensitivity rates of a senior physician and two junior physicians from 87.27%, 78.51%, and 76.32% to 95.75%, 92.85%, and 90.71%, respectively, suggesting the model's potential in assisting physicians in breast lesion detection.

**CONCLUSION**

The deep learning model demonstrated high accuracy and sensitivity for breast lesion detection.

**CLINICAL RELEVANCE/APPLICATION**

It has the potential to support screening efforts and augment physicians' diagnostic skills. The integration of AI into diagnostics could promote earlier breast cancer detection and improve patient care.

## T5A-SPBR-5 COMPARING THE PERFORMANCE OF TOP RANKED AI MODELS FROM THE RSNA 2023 SCREENING MAMMOGRAPHY BREAST CANCER DETECTION AI CHALLENGE TO A COMMERCIAL AI MODEL

Linda Moy, MD (*Abstract Co-Author*) Grant, Siemens AG Advisory Board, Lunit Inc Advisory Board, iCad, Inc
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Tara A. Retson, MD, PhD (*Abstract Co-Author*) Research Consultant, CureMetrix, IncStock options, CureMetrix, Inc
John Mongan, MD, PhD (*Abstract Co-Author*) Research Grant, General Electric Company;Research Grant, Siemens AG;Research Grant, Amazon Web Services, Inc;Royalties, General Electric Company;Spouse, Employee, Annexon, Inc;Spouse, Employee, AbbVie Inc
Maryam Vazirabad (*Abstract Co-Author*) Nothing to Disclose
George Partridge (*Abstract Co-Author*) Nothing to Disclose
Adam E. Flanders, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe C. Kitamura, MD, PhD (*Abstract Co-Author*) Consultant, MD.ai, Inc Speaker, General Electric Company Speaker, SPCC (Sharing Progress in Cancer Care)
Helen Frazer, FRANZCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Robyn L. Ball, PhD (*Abstract Co-Author*) Nothing to Disclose
Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Tatiana Kelil, MD (*Abstract Co-Author*) Nothing to Disclose
Yan Chen, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Artificial intelligence (AI) has the potential to revolutionize breast cancer screening programs. In 2023, the RSNA hosted a Screening Mammography Breast Cancer Detection AI Challenge, where participants were invited to develop AI models to interpret mammograms. Here we assess the performance of the Top 7 ranked models and compare their performance to a commercially available AI model.

**METHODS AND MATERIALS**

RSNA Challenge teams were provided a training-set of 11,913 2-view 2D digital mammogram (2DDM) screening cases, from two institutions (US and Australia) for AI training. Models were tested using an independent test-set of 4,811 2DDM cases from the same source. In both sets, cancer cases were pathology proven and non-cancer cases had at least 1-year of normal follow-up. Performance of the Top 7 ranked challenge AI models (as per pF1 score in the RSNA Challenge https://www.kaggle.com/competitions/rsna-breast-cancer-detection/leaderboard) and ensemble models created from these is evaluated. A commercially available AI model for assessment of 2D screening mammograms also analyzed the cases from the independent test-set. The performance of the Top 7 ranked models, and combined ensemble models, was compared to the performance of the commercial AI model.

**RESULTS**

Across the Top 7 ranked algorithms, the mean recall rate (RR) was 1.6%, sensitivity 47.4%, specificity 99.4% and PPV 61.2%. Combining the Top 3 and Top 7 ranked algorithms into ensemble models demonstrated an increased RR (2.4% and 3.0%), while achieving a marked improvement in sensitivity (60.6% and 63.7%), with limited effect on specificity (98.8% and 98.2%, respectively). At the manufacturers' recommended recall threshold, the commercial AI model demonstrated a much higher RR of 8.3% compared to all individual top ranked models from the Challenge and their ensembles. However, the sensitivity of the commercial product was much greater at 75.6%, with a specificity of 93.0%.

**CONCLUSION**

The commercially available AI algorithm outperformed the Top ranked challenge algorithms and ensemble models in terms of sensitivity, equating to an additional 23 cancers detected compared to the Top 7 ensemble model.

**CLINICAL RELEVANCE/APPLICATION**

Cancer detection AI challenges can be a useful starting point for algorithm development, but products require more extensive testing and training before their performance is clinically or commercially useful.

## T5A-SPBR-6 COMPARING BREAST CANCER DETECTION CAPABILITIES OF MACHINE LEARNING MODELS TRAINED ON DCE PERFUSION VERSUS SINGLE EARLY POSTCONTRAST MR IMAGES

Sangam G. Kanekar, MD (*Abstract Co-Author*) Nothing to Disclose
Alison L. Chetlen, DO (*Abstract Co-Author*) Nothing to Disclose
Scott N. Hwang, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Michelle Le, BEng (*Abstract Co-Author*) Nothing to Disclose
Gavin Jones, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Machine Learning (ML) classification algorithms may play a role in the detection and diagnosis of cancer on MRI scans. Dynamic contrast-enhanced perfusion MRI (DCE-MRI) is a highly sensitive technique for breast cancer detection. Temporal enhancement data from DCE-MRI passes can be merged into the different channels of the red, green, and blue components of an RGB color image. Overlaying multiple passes of DCE-MR time points into a single RGB image may serve to augment the amount of data available to ML algorithms to aid in cancer detection. The aim of this study is to investigate whether ML models benefit from this incorporation of DCE data into training images by comparing them with models trained with single postcontrast images.

### METHODS AND MATERIALS

Using Microsoft Custom Vision, a commercially available ML tool, two types of classification models to detect breast cancer were created using a public dataset of 922 radiologist-annotated malignancies localized on DCE-MRI. Identical sets of images were used for training: one single postcontrast set and one DCE set. The set of DCE images was created by taking a single pre-contrast, early-postcontrast, and late-postcontrast slice and designating each pass to a different channel of an RGB image. Both models were verified with 5-fold cross-validation. Following validation, the performance of the models trained on single postcontrast and DCE images was compared using ROC curves.

### RESULTS

The AUCs for the single postcontrast and DCE models were 0.934 ± 0.010 and 0.968 ± 0.004 respectively (p-value=<0.001). At a probability threshold of 0.5, both models had comparable sensitivities of 0.913 ± 0.015 (single postcontrast) and 0.922 ± 0.009 (DCE). The DCE model had statistically significant improvement in both specificity (0.752 ± 0.064 vs 0.893 ± 0.037, p-value=0.005) and accuracy (0.833 ± 0.033 vs 0.907 ± 0.016, p-value=0.004).

### CONCLUSION

This study demonstrates that there is a benefit to utilizing DCE when creating ML models for the detection of invasive malignancies in breast cancer patients. Ultimately, both the models generated from single postcontrast and DCE-MR images function successfully as breast cancer screening tools. The use of DCE images did show improvement when compared to the model based on traditional grayscale MR images.

### CLINICAL RELEVANCE/APPLICATION

AI and ML models may serve as an adjunct to traditional evaluation methods for clinically detecting breast malignancies. Including perfusion imaging may also be helpful for assessing pathologies at other anatomical sites.

## T5A-SPBR-7 UNSUPERVISED MAMMOGRAM ANOMALY DETECTION WITH TRANSFORMER

Bhavik N. Patel, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Zhemin Zhang (*Abstract Co-Author*) Nothing to Disclose
Imon Banerjee, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Out-of-distribution (OOD) detection plays an important role in mammograms screening. For downstream models the OOD samples would have negative impact on accuracy. However, due to the limited number of labeled OOD samples, unsupervised learning is preferred. The existing methods for unsupervised OOD detection in medical imaging are predominately CNN based. Also few conduct research on mammograms. Inspired by hybrid architecture composed of CNN and transformer in other medical tasks, we are motivated to apply the hybrid architecture to mammogram OOD detection in unsupervised learning methods.

### METHODS AND MATERIALS

We propose an unsupervised anomaly detection model based on CNN and transformer architecture by incorporating reconstruction loss and discriminator loss trained with self-supervised fashion as anomaly score. A discriminator branch is added with six image augmentations to help the model to understand the in-distribution (ID) images. The image with augmentation is labeled 1, otherwise is labeled 0. The discriminator branch takes the latent space after the transformer to MLP to get predicted label score. During training, reconstruction loss updates the entire model. Discriminator loss between actual label and predicted value updates CNN encoder and transformer. At inference time, reconstruction error and discriminator predicted value are used together to get an anomaly score.

### RESULTS

The dataset is from RSNA mammography screening, and manually reviewed to remove OOD samples in the training. 11,722 samples are used for training. The internal test set includes 1,227 samples, including 302 ID, and 925 OOD samples. The external test set is from Mayo Clinic, with 77 ID samples, and 178 OOD samples. The hybrid model with the discriminator is compared against CVAD, f-AnoGAN, VQ-VAE, and hybrid architecture without discriminator. The hybrid model with the AUC score of 0.934 for internal evaluation outperforming the highest 0.929 from baseline f-AnoGAN. However, the f-AnoGAN AUC drop to 0.672 in external. The hybrid model with discriminator branch has AUC score of 0.73, which maintains the best performance for external evaluation.

### CONCLUSION

Our contribution includes 1) to the best of our knowledge, this is the first extensive study of experiments of various existing unsupervised anomaly detection techniques to mammograms. 2) the proposed hybrid model with discriminator has better performance to identify different categories of OOD samples both in internal and external evaluations.

### CLINICAL RELEVANCE/APPLICATION

The proposed method has better performance to detect OOD samples on internal and external performance across the other existing models, that to improve the downstream diagnosis tasks.

## T5A-SPBR-8 BMI PREDICTION FROM MAMMOGRAPHY IMAGES AND ITS IMPLICATIONS FOR BREAST CANCER RISK

Frank Li (*Abstract Co-Author*) Nothing to Disclose
Seyed Mohammadreza Chavoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Theodorus Dapamede, MD, PhD (*Presenter*) Intern, MARS BioImaging Ltd

### PURPOSE

Traditional breast cancer risk models often underperform, especially in minority populations. Recent advances like the image-based deep learning models Mirai and Asymirai outperform these traditional models but lack explainability of the image features influencing their predictions. Body mass index (BMI) is a well-known, explainable risk factor for breast cancer, affecting pre- and post-menopausal women differently. This study aims to predict BMI from mammograms, potentially shedding light on explainable features within deep-learning-based breast cancer risk prediction models.

### METHODS AND MATERIALS

We acquired a dataset of 11,874 patients who had undergone 4-view screening mammography with corresponding BMI measurements from 2012 to 2021. Mammograms were labeled with the BMI at the time of the study and divided into 80/20 training and testing splits at the patient level. Bilateral images were created by stitching left and right images. We trained six ConvNext-based models for different views (LMLO, LCC, RMLO, RCC, BMLO, BCC) and assessed their performance using MAE and R^2 metrics, incorporating GradCAM++ for explainability. We conducted subgroup analyses based on race, sex, age, marital status, tissue density, and BIRADS score, and additionally predicted BIRADS and pathological severity from biopsy using the pre-logit model layer.

### RESULTS

All 6 models performed similarly, with mean R2 of 0.76 (SD: 0.03) and mean MAE of 2.5 kg/m2 (SD: 0.14 kg/m2). The RMLO model outperformed others with R2 of 0.80, suggesting sufficient BMI encoding in unilateral mammograms. Subgroup analysis on race revealed higher model performance in White patients compared to Black patients across all models, notably RMLO (R2=0.81 vs. R2=0.76, respectively). Model performance was lower in postmenopausal-age women (R2=0.70 vs. R2=0.76, respectively). BIRADS Breast Density C and BIRADS score 1 yielded the highest performance with R2=0.67 - 0.69 and R2=0.74, respectively. Finally, pre-logit prediction showed signal in predicting BIRADS scores with AUROC= 0.61 - 0.74.

### CONCLUSION

DL models demonstrate the ability to predict BMI, a risk factor in breast cancer, from mammography exams with acceptable performance. Models trained for BMI prediction were also able to predict BIRADS scores by a classification head on the last layer. This demonstrates common underlying signals that may contribute to performance of DL breast cancer risk prediction models.

### CLINICAL RELEVANCE/APPLICATION

As image based breast cancer DL models are deployed clinically, evaluation of explainability and confounders is critical to guarantee model robustness and equitable performance across groups, as the complexity and “black box” nature of these models continues to increase.

## T5A-SPBR-9 DEEP LEARNING MAMMOGRAPHY-BASED AGE PREDICTION: INSIGHTS INTO MODEL PERFORMANCE AND DEMOGRAPHIC DISPARITIES

Seyed Mohammadreza Chavoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Theodorus Dapamede, MD, PhD (*Presenter*) Intern, MARS BioImaging Ltd

### PURPOSE

To develop and evaluate deep learning models for age prediction using bilateral and unilateral mammograms and to investigate model performance across various demographic subgroups.

### METHODS AND MATERIALS

A dataset of 84,968 mammograms from the EMBED dataset (71,816 training; 13,152 testing) was used. The mean age was 57.0 years for both sets. ConvNext-base CNN and DenseNet-121 models were trained on resized (512x512) and padded images to predict age using unilateral (left, right) and bilateral mammograms. Subgroup analyses were performed on race, marital status, tissue density, and BI-RADS. The penultimate model features were used to predict these demographic factors to see if these are considered by the model when predicting patients’ age.

### RESULTS

Bilateral mammograms yielded better age prediction (ConvNext: $R^2$=0.73, MAE=4.79; DenseNet: $R^2$=0.70, MAE=5.09) compared to unilateral (ConvNext: $R^2$=0.69, MAE=5.04; DenseNet: $R^2$=0.68, MAE=5.18). Subgroup analysis revealed lower performance for African-Americans ($R^2$=0.69) compared to Caucasians ($R^2$=0.76). The model performed best on married patients ($R^2$=0.73) and those with BI-RADS 1 ($R^2$=0.74) and tissue density type C ($R^2$=0.74). The penultimate model features predicted race and density with AUCs >0.90, except for density type B (AUC=0.86).

### CONCLUSION

Deep learning models can predict age from mammograms with high accuracy, and bilateral imaging yields superior results compared to unilateral. However, the models exhibit demographic disparities, with lower performance in African-American and non-married patients. Importantly, the penultimate features of the age prediction model can predict sensitive demographic information such as race and breast density with high AUCs, indicating that the model considers these factors during age prediction. This finding is alarming as it suggests potential bias in the model's predictions. Furthermore, the presence of pathology acts as a confounder, decreasing the model's performance in age prediction.

### CLINICAL RELEVANCE/APPLICATION

Age prediction from mammograms using deep learning has potential applications in identifying patients with accelerated aging or increased breast cancer risk, which could inform personalized screening strategies and risk assessment. However, the demographic disparities in model performance and the model's ability to predict sensitive patient information raise significant concerns about the fairness and transparency of these algorithms. These findings underscore the need for diverse training data, rigorous bias evaluation, and further investigation into the clinical implications of demographic differences in model performance.

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# Abstract Archives of the RSNA, 2024

T5A-SPCA

**Cardiac Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPCA-1 THE ASSOCIATION BETWEEN RADIOMIC PHENOTYPE OF PERI-CORONARY ADIPOSE TISSUE AND ATRIAL FIBRILLATION

Wu Jingping (*Presenter*) Nothing to Disclose

### PURPOSE

Epicardial adipose tissue (EAT) contribute to atrial fibrillation (AF). We sought to explore the role of FAI (fat attention index), volume, fat radiomic profile (FRP) from peri-coronary artery adipose tissue (PCAT) on coronary computed tomography angiography (CCTA) in determining the presence of AF and differentiating AF types.

### METHODS AND MATERIALS

This study enrolled 300 patients underwent CCTA retrospectively and divided them into AF (n=137) and non-AF groups (n=163). The imaging parameters of FAI, volume and FRP were excavated and measured after PCAT segmentation. Every coronary artery extracted 853 radiomics and a total of 2559 radiomics were collected. Significant and relevant FRP was screened by random forest algorithm based on machine learning, and then compared three models of VF (FAI and volume), FRP and FRPC (FRP and clinical factors). Among AF individuals, the FRP and FRPC scores of persistent AF (PerAF, n=44) and paroxysmal AF (PAF, n=93) were compared with boxplot.

### RESULTS

In the test cohort, FRP score performed excellent distinctive ability to identify AF with an AUC of 0.89 compared with the model enrolling FAI and volume (AUC = 0.83), and FRPC model showed improved AUC of 0.98 combining clinical factors. Among AF types, FPR and FRPC scores are significantly higher in the PerAF than PAF patients ($p < 0.001$). And twenty most contributive features were selected in identifying AF.

### CONCLUSION

Textural radiomic features derived from PCAT on coronary CTA detect micro-pathophysiological information associated with AF, which may help identify and differentiate AF and provide a hopeful imaging target.

### CLINICAL RELEVANCE/APPLICATION

l This study mainly studied the association between peri-coronary arteries fat and atrial fibrillation.l The analysis of epicardial tissue around coronary arteries help identify and differentiate atrial fibrillation and its types. l Fat radiomic profiles derived from peri-coronary arteries fat could provide non-invasive tool for atrial fibrillation.

## T5A-SPCA-10 ASSESSMENT OF CORONARY REMODELING AS A PROGNOSTIC MARKER FOR CORONARY ARTERY DISEASE: A 10-YEAR PROSPECTIVE STUDY

Bennett A. Landman, PhD (*Abstract Co-Author*) Nothing to Disclose
David R. Jacobs JR, PhD (*Abstract Co-Author*) Nothing to Disclose
Cora E. Lewis, MD (*Abstract Co-Author*) Institutional Research Grant, Novo Nordisk AS
Yuankai Huo, PhD (*Abstract Co-Author*) Nothing to Disclose
Sangeeta Nair, DVM (*Abstract Co-Author*) Nothing to Disclose
Ravi Kalhan (*Abstract Co-Author*) Nothing to Disclose
Ivana Isgum, PhD (*Abstract Co-Author*) Research Grant, Pie Medical Imaging BV;Research Grant, 3mensio Medical Imaging BV;Research Grant, Koninklijke Philips NV;Research Grant, Esaote SpA;Co-founder, Quantib BV;Shareholder, Quantib BV;Researcher, Quantib BV;;;
George R. Washko, MD (*Abstract Co-Author*) Spouse, Employee, Merck & Co, Inc
Aravind Krishnan (*Abstract Co-Author*) Nothing to Disclose
James G. Terry, MS (*Abstract Co-Author*) Nothing to Disclose
James Shikany (*Abstract Co-Author*) Nothing to Disclose
Raul San Jose Estepar, PhD (*Abstract Co-Author*) Nothing to Disclose
John J. Carr, MD, MS (*Presenter*) Institutional Research Grant, Francisco Partners Management, LP;Investigator, Francisco Partners Management, LP;Institutional Research Grant, General Electric Company;Investogator, General Electric Company;Institutional Research Grant, Siemens AG;Researcher, Siemens AG;Institutional Research Grant, Medtronic plc;Investigator, Medtronic plc

### PURPOSE

Positive remodeling in coronary atheroma is a precursor to macroscopic calcifications. This study evaluates the hypothesis that larger coronary artery cross-sectional area (CSA) in early adulthood predicts a greater incidence of subclinical coronary artery disease (CAD), as indicated by CT coronary artery

calcium (CAC) scores.

**METHODS AND MATERIALS**

The study participants were part of The Coronary Artery Risk Development in Young Adults (CARDIA) Study, a community-based study with initial recruitment in 1985-86. We conducted a prospective assessment of the CSA at the proximal left anterior descending artery (LAD-CSA) during the 2010-11 exam using non-contrast, ECG-gated CT. This report is a subset of 474 participants (315 females, 176 Black) who had CAC scores of zero at the 2010-11 exam and participated in the chest CT exams in 2020-22. The chest CT exams were analyzed using a deep-learning algorithm with additional expert review for the presence and amount of CAC. Logistic regression models, adjusted for demographic and clinical variables, evaluated the association between baseline LAD-CSA and incident CAC.

**RESULTS**

The mean participant age at baseline was 49.8 years (SD 3.6), BMI was 29.3 kg/m2 (SD 6.9), and LAD-CSA was 18.3 mm2 (SD 6.0). During the 10-year interval, 33.1% of participants developed any CAC. Each standard deviation increase in LAD-CSA was associated with 1.33 times (95% CI, 1.05-1.70; p=0.019) the odds of incident CAC after adjusting for study field center, race, sex, age, smoking, alcohol intake, physical activity, BMI, education, blood pressure, diabetes, total cholesterol, HDL cholesterol, C-reactive protein, and cholesterol and hypertension treatment.

**CONCLUSION**

Larger LAD-CSA in middle-aged adults free from CAC is associated with increased risk of developing subclinical CAD over ten years. These findings suggest that coronary artery remodeling, as measured by LAD-CSA, could serve as a non-invasive imaging biomarker to stratify CAD risk earlier in life and enhance the value of the CT CAC exam.

**CLINICAL RELEVANCE/APPLICATION**

The onset of coronary artery calcification (CAC) occurs at varying ages, impacting the timing, approach, and cost of strategies for cardiovascular disease prevention. LAD-CSA, as a marker of coronary remodeling, predicts development of CAC and subclinical CAD 10 years later, among those individuals negative for CAC, providing an enhanced approach for CAD risk management in middle-aged adults.

## T5A-SPCA-2 PROPOSED CT PERFUSION PROTOCOL: SUB-MILLISIEVERT APPROACH WITH FOUR-DIMENSIONAL SIMILARITY FILTER

Yusuke Kobayashi (*Abstract Co-Author*) Nothing to Disclose
Teruhito Kido, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takaaki Hosokawa (*Abstract Co-Author*) Nothing to Disclose
Yuta Yamamoto, MD (*Abstract Co-Author*) Nothing to Disclose
Yuki Tanabe (*Abstract Co-Author*) Nothing to Disclose
Tomoro Morikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Kazuki Yoshida, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Two computed tomography perfusion (CTP) protocols are useful for diagnosing myocardial ischemia: dynamic CTP (multiple heartbeats of about 30 s) and static CTP (single-heartbeat). However, CTP leads to radiation exposure (particularly in dynamic CTP), has difficulty in capturing the optimal scan timing (static CTP), and shows low contrast compared with that of magnetic resonance imaging. A four-dimensional similarity filter (4D-SF) was developed using a similarity algorithm to reduce noise. At least four CTP images were required for proper operation. We analyzed if using a 4DSF would improve image quality and enable use of a new CTP protocol (named multi-static CTP (MS-CTP)) that reduces radiation dose compared with dynamic CTP with optimum timing for imaging in patients with obstructive coronary artery disease (CAD).

**METHODS AND MATERIALS**

Patients (n=28) who underwent dynamic myocardial CTP before invasive coronary CT were retrospectively included. Obstructive CAD was defined as the presence of severe (=70%) or moderate (50-69%) lesions with a fractional flow reserve of =0.8. Three CTP datasets (dynamic CTP, single-shot static CTP (SS-CTP), and MS-CTP) were reconstructed from dynamic CTP data. Dynamic CTP was reconstructed using iterative reconstruction (IR) and 4D-SF, and then the SS-CTP (IR alone) was cropped from dynamic CTP according to SCCT expert consensus. MS-CTP was obtained from five phases of CTP scanning (IR and 4D-SF).For quantitative image assessment, the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of SS-CTP and MS-CTP were compared. The diagnostic accuracy of MS-CTP (visual assessment) was compared with that of SS-CTP (visual assessment) and mean myocardial blood flow derived from dynamic CTP. The probability of capturing the optimum scan timing was compared between MS-CTP and SS-CTP.

**RESULTS**

The SNR and CNR in MS-CTP images (IR and 4D-SF) were significantly higher than those in SS-CTP (IR alone) (median SNR: 9.7 vs. 6.1; median CNR: 24.9 vs. 16.2, respectively; $p < 0.05$). Sensitivity and specificity were 83% and 86% for MS-CTP, 56% and 88% for SS-CTP, and 59% and 91% for dynamic CTP, respectively. MS-CTP showed the highest sensitivity ($p < 0.05$). MS-CTP had a higher probability of achieving optimal scan timing than did SS-CTP (96.4 vs. 7.1%; $p < 0.01$) and lower radiation dose compared with that of dynamic CTP (0.96 vs. 4.13 mSv; $p < 0.01$).

**CONCLUSION**

The MS-CTP protocol improved the image quality and probability of capturing the optimal scan timing compared with SS-CTP, with significantly higher sensitivity for obstructive CAD compared with dynamic those of CTP and SS-CTP.

**CLINICAL RELEVANCE/APPLICATION**

The MS-CTP protocol may reduce radiation exposure and increase CTP's clinical value in managing ischemic heart disease.

## T5A-SPCA-3 ELECTRICAL AND ANATOMICAL LEFT VENTRICULAR AXES IN PATIENTS UNDERGOING TAVR EVALUATION: INFLUENCE OF BASELINE CHARACTERISTICS, FUNCTIONAL AND STRUCTURAL PARAMETERS, AND ECG APPEARANCE

Mohamed Abdel-Wahab (*Abstract Co-Author*) Nothing to Disclose
Matthias Gutberlet, MD, PhD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Koninklijke Philips NV;Speaker, Bayer AG;Speaker, Bracco Group;Author, Thieme Medical Publishers, Inc
Christian Krieghoff, MD (*Abstract Co-Author*) Proctor, Edwards Lifesciences CorporationSpeaker, Bracco Group
Florian Fahr (*Abstract Co-Author*) Nothing to Disclose
Patrick Seitz (*Abstract Co-Author*) Nothing to Disclose
Robin F. Gohmann, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

In this retrospective study, we compare the electrical axis to the anatomical left ventricular (LV) axis and determine the influence of base line characteristics, functional and structural parameters and ECG appearance.

**METHODS AND MATERIALS**

Overall, 1675 consecutive patients examined with CT before transcatheter aortic valve replacement (TAVR) were screened. For 981 patients, an electronically stored pre-interventional ECG was available and interpretable. ECGs were grouped into normal (n=301) and abnormal ECGs (n=680). Whenever possible, further ECG sub-characterization and subgroup analysis for hypertrophy were performed. Anatomical LV axis was measured on ECG-synchronized CT at end diastole (reconstruction at 70% of RR interval) perpendicular to the patients' long axis.

**RESULTS**

Mean electrical axis (55±15°, 0.3±57°, p<0.001) and proportion of female gender (178 [59%], 291 [43%], p<0.001) differed significantly between patients with normal and abnormal ECGs. No differences in anatomical or functional parameters were present. There was a weak correlation between the axes in normal ECGs ($R^2$=0.033, p=0.002), which was absent in the group and subgroups with abnormal ECGs. The subgroup with no hypertrophy and normal ECG showed a strong correlation ($R^2$=0.409, p<0.001). No correlation between LV mass and difference between electrical and anatomical axis was observed.

**CONCLUSION**

Electrical and anatomical LV axis seem to be connected in patients being evaluated for TAVR with normal ECGs. This correlation was weakened by conduction distortions caused by LV hypertrophy, frequently observed in patients before TAVR.

**CLINICAL RELEVANCE/APPLICATION**

The electrical frontal axis is a routine parameter in ECG interpretation. It has been reported to correlate with the anatomical LV axis, but the literature is conflicting.

## T5A-SPCA-4 MYOCARDIAL STRAIN COMBINED WITH CLINICAL RISK FACTORS IN THE PREDICTION OF IN-HOSPITAL HEART FAILURE AMONG PATIENTS WITH ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION

Lei Xu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jianlin Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Hui Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Hao Woo (*Abstract Co-Author*) Nothing to Disclose
Dong Yang, BMedSc, MMEd (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the predictive value of myocardial strain derived from cardiac magnetic resonance (CMR) combined with clinical indicators for in-hospital heart failure in STEMI patients.

**METHODS AND MATERIALS**

In all, 139 STEMI patients were included, with 28 in the heart failure group and 111 in the non-heart failure group, and clinical and laboratory data were collected. Left ventricular (LV) global radial strain (GRS), global longitudinal strain (GLS), global circumferential strain (GCS), left ventricular ejection fraction (LVEF), stroke volume (SV), and infarct size (IS) were assessed by CMR.

**RESULTS**

The heart failure group had worse GRS, GLS, GCS, LVEF, SV, larger IS , longer symptom to balloon time (SBT) and higher levels of high-sensitivity C-reactive protein (hs-CRP) and neutrophil percentage (N%) than the non-heart failure group (P<0.05). There was a strong correlation between GRS and LVEF (r=0.741, P<0.001). After adjustment for CMR and clinical risk factors, GRS<15.6%, LVEF<37.7%, symptom to balloon time (SBT)<350 min, hs-CRP>11.45 mg/L, and N%>74% were independently associated with heart failure. CMR model (GRS<15.6%+LVEF<37.7%) and clinical model (SBT<350 min+hs-CRP>11.45 mg/L+N%>74%) were associated with a lower diagnostic accuracy for predicting in-hospital heart failure in patients with STEMI than the co-model including CMR and clinical independent risk factors: area under the curve (AUC) for CMR model=0.759 (95% confidence interval[CI]=0.679-0.827; P<0.001), AUC for clinical model=0.824(95%CI=0.750-0.883; P<0.001), and AUC for CMR and clinical co-model =0.918(95%CI=0.859-0.957; P<0.001).

**CONCLUSION**

GRS combined with clinical risk factors, especially for LVEF, SBT, hs-CRP, and N% maybe an effectively predictor for in-hospital heart failure in patients with STEMI, and may provide new evidence for early prognosis assessment.

**CLINICAL RELEVANCE/APPLICATION**

Recent decades have witnessed continuous advancements in medical technology, enabling clinicians to derive increasingly comprehensive diagnostic evidence from imaging, serum markers, clinical history, among other sources. However, the challenge of timely and efficiently selecting the most relevant clinical indicators from dozens, sometimes hundreds, for diagnosis and treatment has emerged as a significant obstacle in clinical practice. Research on heart failure in patients with STEMI has historically concentrated on understanding the mechanisms underlying heart failure in adverse prognostic events and evaluating the predictive value of associated markers.

## T5A-SPCA-5 LEFT ATRIAL REMODELLING AND FIBROSIS QUANTIFICATION BY LATE ENHANCEMENT COMPUTED TOMOGRAPHY: A PILOT STUDY

Gudrun Feuchtner, MD (*Abstract Co-Author*) Nothing to Disclose
Pietro Giacomo Lacaita, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Left atrial (LA)-fibrosis mapping by CMR provides a roadmap for guidance of LA-catheter ablation. Cardiac CT may be a reasonable alternative. Therefore, the purpose of our pilot study was to evaluate late enhancement fibrosis mapping by CT.

### METHODS AND MATERIALS

Patients with atrial fibrillation (AF) who underwent 128-slice-dual-source high-pitch (3.2) ECG-synchronized CT-Angiography (CTA) prior to LA-catheter ablation between 2015 and 2019 were screened, and those who had both CTA and a late enhancement (LE) CT-scan 7 min after CTA (high-pitch,3.4; 80-100kV) were finally included.1) CTA: Left atrial wall thickness (LAWT) as marker for the severity of LA remodeling was measured at 3 sites along the LA-ridge.2) Late enhancement (LE) was quantified by placing 3 ROI co-axially aligned into LAWT on CTA. LE was defined as enhancement of more than 90HU. Focal and diffus LE, and mixed LE pattern were distinguished. Left atrial wall artifacts were recorded, distinguished subjectively from LE by an experienced observer, and quantified.

### RESULTS

Of 126 patients (age 59.8 years, 35 females (27.8%) screened), 95 with complete CTA and LE scans were finally included. 86/95 (90.5%) had a mean LAWT >1.5mm and 72/95 (75.8%) had LAWT >2mm. Of 86 patients with LAWT >1.5mm, 69 (80.2%) had LE, while the frequency of LE was significantly higher in LAWT >2mm with 68/72 (94.4%) (p= 0.014). Of 58 patients with LE, 42 (72.4%) had focal LE, 11 diffuse (19%) and 5 (8.6%) patients had mixed (focal+diffuse) LE pattern. Mean CT-density (HU) of focal LE was 106.91+/-17.5, and density of diffuse or mixed focal/ diffuse LE 97.6+/-4.4 HU, with a trend toward higher values for focal LE but not significant (p=0.086). LAWT was mean 2.6 +/-1.2 mm (max. 5.7mm), increasing LAWT and LE HU as marker for fibrosis density were mild positively correlated (r=0.257;p=0.031). Left atrial wall artifacts (mainly: beam hardening, streaks, motion) had higher HU (mean 154.11HU) as compared to LE (114.2 HU)(p=0.002;t-test). Mean radiation dose for the LE-CT scan was 0.95 mSv (range, 0.52-1.2mSv).

### CONCLUSION

Left atrial fibrosis mapping by LE-CT is feasible. Late enhancement is found more frequently in LAWT more than 2mm, and LE density correlated with increasing LA-remodelling.

### CLINICAL RELEVANCE/APPLICATION

Left atrial fibrosis mapping by CT may provide a reasonable alternative to CMR, for both the guidance of a more precise LA ablation, and as prognosticator for outcome in patients with atrial fibrillation.

## T5A-SPCA-6 CORRELATION BETWEENLEFT ATRIUM FRACTAL DIMENSION ANDCARDIAC FUNCTION INPATIENTS WITHATRIAL FIBRILLATION

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Mengyuan Jing (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the correlation between left atrial (LA) morphology and left ventricular (LV) systolic function in patients with atrial fibrillation (AF).

### METHODS AND MATERIALS

We studied 1066 patients admitted to our institution between December 2018 and December 2022 for AF. All patients underwent cardiac computed tomography angiography (CTA) and transthoracic echocardiography. LV systolic function was assessed using transthoracic echocardiography. On cardiac CTA images, we measured the LA diameter (LAD) and quantified LA morphology using the fractal dimension (FD). The correlations among LAD, LA FD, and LV systolic function were evaluated.

### RESULTS

Among the enrolled participants, 677 (63.50) were men and 389 (36.50) were women. The average age of all participants was 64.00 (55.00, 71.00) years. Correlation analysis showed that the LAD was negatively associated with the ejection fraction (EF) (r=-0.175, P<0.001) and fractional shortening (FS) (r=-0.172, P<0.001) and positively associated with end-systolic volume (ESV) (r=0.090, P=0.003). LA FD was negatively correlated with the EF (r=-0.092, P=0.003) and FS (r=-0.083, P=0.007) and positively correlated with end-diastolic volume (EDV) (r=0.086, P=0.005) and ESV (r=0.094, P=0.002). The restricted cubic spline (RCS) curves with four knots demonstrated a nonlinear correlation between LA FD and ESV (overall P=0.0459, nonlinear P=0.0345) and EDV (overall P=0.0019, nonlinear P=0.0001) and a linear relationship with EF (P=0.037, P=0.1249). Specifically, EDV and ESV decreased as LA FD increased, then increased and decreased again, whereas EF continuously decreased.

### CONCLUSION

The correlation between LV systolic function and LA FD suggests that LA shape may also be used as a tool to assess LV systolic function in patients with AF.

### CLINICAL RELEVANCE/APPLICATION

In the clinical setting, in addition to the left atrial diameter, the left atrial fractal dimension may also provide clues to altered left ventricular systolic function in this patient population.

## T5A-SPCA-7 CAD-RADS 2.0: AGREEMENT OF METHODS FOR ASSESSMENT OF PLAQUE BURDEN

Felix Heidrich (*Abstract Co-Author*) Nothing to Disclose
Ivan Platzek, MD (*Abstract Co-Author*) Nothing to Disclose
Ralf-Thorsten Hoffmann, MD (*Abstract Co-Author*) Nothing to Disclose
Stefanie Jellinghaus (*Abstract Co-Author*) Nothing to Disclose
Krzysztof Nocon (*Abstract Co-Author*) Nothing to Disclose
Suela Mema (*Presenter*) Nothing to Disclose

### PURPOSE

The current version of the Coronary Artery Disease Reporting and Data System (CAD-RADS 2.0) introduced a plaque burden sub-classification (P), which allows for values between P1 and P4. Three methods for assessing plaque burden are allowed: coronary artery calcium (CAC) testing, segment involvement score (SIS) and visual estimate.The aim of this study was to evaluate the agreement of the methods of coronary plaque burden assessment approved by CAD-RADS 2.0.

### METHODS AND MATERIALS

The RIS radiology information system (RIS) of our hospital was searched for patients who underwent coronary computed tomography angiography (CCTA) in November and December 2023 (including CAC testing).The CCTAs were evaluated by two board-certified radiologists, with 12 and 4 years of experience with CCTA, respectively. The total CAC score was automatically calculated according to the Agatston method. Each reader independently

determined the segment involvement score and the overall visual assessment score P (visual). The summary segment involvement score and visual assessment score were determined in consensus.Based on these findings, P (CAC), P (SIS) and P (visual) were determined for each patient according to CAD-RADS 2.0.The Friedman test was used to assess differences between the P scores determined based on the three different methods. A p value of 0.05 was considered statistically significant.Weighted kappa was used to quantify the agreement between the three different methods.

**RESULTS**

One hundred and thirty two consecutive patients were included in this retrospective study (mean age 62,8 y; 40 f, 82 m; age range 35 - 87 y).Agatston scores varied between 0 and 6351 (mean Agatston score 366,05 ± 968, 62). Segment involvement scores varied between 0 and 13 (median SIS 1).P (CAC) was 0 in 49 cases, 1 in 41 cases, 2 in 8 patients, 3 in 23 cases and 4 in 11 patients.P (SIS) was 0 in 47 cases, 1 in 33 cases, 2 in 22 cases, 3 in 13 patients and 4 in 17 patients.P (visual) was 0 in 47 cases, 1 in 43 patients, 2 in 20 cases, 3 in 9 cases and 4 in 13 patients.The Friedman test detected no significant differences between the three methods (p = 0.204). Weighted Kappa values for method agreement were 0. 743 for agreement between P(CAC) and P(SIS), 0.762 for agreement between P (CAC) and P(visual) and 0.853 for agreement between P(SIS) and P(visual).

**CONCLUSION**

The current study shows a good agreement between the three methods of plaque burden estimation allowed in CAD-RADS 2.0. Based on these results, we do not expect a significant impact of the choice of plaque estimation method on clinical recommendations based on plaque burden.

**CLINICAL RELEVANCE/APPLICATION**

When using CAD-RADS 2.0, the method for plaque burden estimation should be chosen based on local requirements and time available for scan evaluation.

## T5A-SPCA-8 DIAGNOSIS AND PROGNOSIS OF ISCHEMIA WITH NO OBSTRUCTIVE CORONARY ARTERY USING $^{13}$N-AMMONIA POSITRON EMISSION TOMOGRAPHY

Shuji Sakai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akiko Sakai, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Masateru Kawakubo, PhD (*Abstract Co-Author*) Nothing to Disclose
Risako Nakao, MD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Yamamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yurie Shirai (*Abstract Co-Author*) Nothing to Disclose
Akihiro Inoue, MD (*Abstract Co-Author*) Nothing to Disclose
Koichiro Kaneko, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Michinobu Nagao, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Ischemia with no obstructive coronary arteries (INOCA) is a condition characterized by angina with no angiographic stenosis. INOCA is associated with an increased risk of cardiovascular morbidity and mortality. Endotypes include coronary spastic angina and coronary microvascular dysfunction, with both often coexisting. Comprehensive coronary artery function testing by invasive catheterization is needed to determine the endotype of INOCA and to select appropriate treatment. 13N-ammonia PET (NH3-PET) quantification can identify coronary microvascular dysfunction noninvasively. We investigated the usefulness of NH3-PET in diagnosing INOCA and predicting prognosis.

**METHODS AND MATERIALS**

A total of 433 consecutive patients with symptoms of angina pectoris who underwent adenosine-stress NH3-PET were enrolled. The NH3-PET assessments were summed stress score (SSS), myocardial flow reserve (MFR) reflecting vascular endothelial function under adenosine-stress, papillary muscle ischemia (PMI) on high-resolution cine imaging, and resting to stress ratio of the circumferential strain (strain ratio) exclusively for NH3-PET. Patients were divided into three groups based on comprehensive functional assessment of invasive coronary catheters: coronary artery disease (CAD), non-coronary artery disease (non-CAD), and INOCA. A prognostic study was conducted for INOCA and non-CAD groups with major adverse cardiac accidents (MACE) as the endpoint.

**RESULTS**

Finally, 293 patients were diagnosed with CAD, 95 with non-CAD, and 45 with INOCA. SSS for non-CAD (0.89±2.42) and INOCA (0.82±1.62) groups was significantly lower than that for CAD (9.85±7.96) group. MFR for CAD (2.08±0.66) and INOCA (1.84±0.54) groups was significantly lower than thar for non-CAD (2.68±0.67) group. The frequency of papillary muscle ischemia was significantly higher in INOCA group (40%) than in CAD (11%) and non-CAD groups (11%). Cox proportional hazards regression analysis of the factors that define MACE showed that a strain ratio lt;0.93 was obtained as an independent factor, even after adjusting for age and sex (Odds ratio 11.8, plt;0.007). In the Kaplan-Meier survival curve, INOCA patients with a strain ratio lt;0.93 had significantly more MACEs than the other patients.

**CONCLUSION**

NH3-PET findings in patients with INOCA are characterized by decreased MFR despite the absence of regional ischemia. Papillary muscle ischemia is more frequent, and the strain ratio reduction obtained from NH3-PET is useful in predicting MACE.

**CLINICAL RELEVANCE/APPLICATION**

NH3-PET is a minimally invasive and safe technique with excellent reproducibility in INOCA diagnosis and monitoring the treatment progress.

# Abstract Archives of the RSNA, 2024

T5A-SPCH

**Chest Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPCH-2 RADIOMICS MODEL PREDICTS PATHOLOGIC RESULTS FOR LUNG CANCER SCREENING BASED ON THREE-DIMENSIONAL ULTRASHORT ECHO TIME (3D-UTE) AND T2-WEIGHTED (T2W)IMAGING

Jian-Xing Qiu, MD (*Abstract Co-Author*) Nothing to Disclose
Jiejin Yang (*Abstract Co-Author*) Nothing to Disclose
Rile Nai (*Abstract Co-Author*) Nothing to Disclose
Shuai Ma, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate radiomics techqiques based on 3D-UTE and T2-weighted (T2w) Imaging for a MR lung cancer screening program and compare the predict performances.

### METHODS AND MATERIALS

53 patients with 56 nodules (mean size 19.37mm) who had undergone chest MRI examination were retrospectively collected. Spiral UTE-MRI was performed using a MAGNETOM Aera 1.5T MR scanner (Siemens Healthcare, Erlangen, Germany). A prototype 3D Spiral UTE-MRI sequence was acquired in the coronal plane. The T2w multi-shot Turbo Spin Echo sequence (BLADE) was acquired in coronal orientation during breath-hold. The final surgical pathology was treated as gold standard for model construction. Radiomics features were extracted from 3D-UTE and T2ws. The radiomics models were constructed by using the machine learning methods (SVM, KNN, NaiveBayes and logistic regression) with five-fold cross validation, respectively. Two experienced radiologists independently rated multi-parameter MR images of each lesion. The final radiologists‘ diagnosis was reached by consensus and were compared with the radiomics models’ diagnostic outcomes. AUCs of the models were compared to evaluated the predict performance.

### RESULTS

The enrolled lesions were randomly divided into training and test dataset (8:2). The radiomics signature (build by LR method) with the best performance based on the 3D-UTE, T2w and merged models demonstrated AUCs of 0.85, 0.82 and 0.93, respectively. The merged model outperformed each single sequence competitors. Predict performance did not show a statistically difference between each radiomics model and radiologists (P values range from 0.06 to 0.80), while a tendency of superiority of merged radiomics was obvious concerning sensitivity, accuracy and AUC.

### CONCLUSION

The MR-based radiomics technique can serve as a promising radiation-free alternative to computed tomography,performing noninferiorior diagnostic efficacy compared with manual diagnosis, serving as a promising noninvasive predictor of lung cancer screening program for clinical decisions.

### CLINICAL RELEVANCE/APPLICATION

Our initial results suggest that radiomics information based on 3D-UTE and T2w both can be used to differentiate benign from malignant nodules, and the noninferiority was achieved when compared with radiologists concerning the diagnostic efficacy, which shows that the MR-based radiomics approach is at least equally appropriate for diagnosis of pulmonary nodules as compared to conventional manual diagnosis based on domain knowledge and enough experience.

## T5A-SPCH-3 AI-ENHANCED PREDICTION OF LUNG CANCER RISK FROM IMAGING BIOMARKERS IN CHEST RADIOGRAPHS: AN EXTERNAL VALIDATION STUDY

Ulas Bagci, MSc, PhD (*Abstract Co-Author*) Ther-AI LLC
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Stephen M. Borstelmann, MD (*Abstract Co-Author*) Nothing to Disclose
Ayis T. Pyrros, MD (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Theodorus Dapamede, MD, PhD (*Presenter*) Intern, MARS BioImaging Ltd

### PURPOSE

This study explores the potential of artificial intelligence to predict lung cancer risk using imaging features from chest radiographs (CXRs), independently of traditional risk factors like smoking history. This approach could serve as an early detection tool in populations lacking comprehensive patient histories.

### METHODS AND MATERIALS

This IRB-approved study utilized a dataset of 249,749 initial frontal non-portable CXRs (51.5% Black, 48.5% White) from 2008 to 2021 to identify patients with lung cancer via ICD10 codes. The dataset was divided 80/20 for training and testing. A pre-trained ICD-10 comorbidity CNN model predicted 10 risk factors, utilized by an XGBoost model for lung cancer prediction. Additionally, a logistic regression (LR) model served as a baseline. Model performance was evaluated using AUC, sensitivity, and specificity metrics. External validation was conducted on a geographically distinct dataset comprising 160,244 patients. SHAP values were employed for model explainability.

### RESULTS

For logistic regression (LR), the area under the curve (AUC) was 0.76 [95% CI: 0.74 - 0.79], with a sensitivity of 0.89, specificity of 0.53. The XGBoost (XGB) model showed slightly improved performance with an AUC of 0.79 [95% CI: 0.76 - 0.82], a sensitivity of 0.85, specificity of 0.58.. Furthermore, on the external dataset, the LR model demonstrated an AUC of 0.77 [95% CI: 0.76 - 0.79], sensitivity of 0.75, specificity of 0.68. The XGB model exhibited comparable results with an AUC of 0.79 [95% CI: 0.77 - 0.80], sensitivity of 0.73, specificity of 0.72.

### CONCLUSION

In conclusion, our study highlights AI's potential in forecasting lung cancer risk using CXR imaging biomarkers, providing a non-invasive method irrespective of conventional risk factors like smoking history.

### CLINICAL RELEVANCE/APPLICATION

The integration of AI-driven predictive models utilizing CXR imaging biomarkers offers a non-invasive and potentially transformative approach for early lung cancer detection, especially beneficial in populations with incomplete patient histories, ultimately enhancing screening effectiveness and patient outcomes.

## T5A-SPCH-5 SINGLE AND MULTIPARAMETRIC MOLECULAR INFORMATION FROM MRI: COMPARISON OF CAPABILITY FOR POSTOPERATIVE RECURRENCE PREDICTION WITH FDG-PET/CT IN STAGE I NON-SMALL CELL LUNG CANCER PATIENTS

Masato Ikedo (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hiroyuki Nagata (*Abstract Co-Author*) Canon Medical Systems Corporation
Maiko Shinohara (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takeshi Yoshikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology
Masao Yui (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Daisuke Takenaka, MD (*Abstract Co-Author*) Canon Medical Systems Corporation
Kaori Yamamoto (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takahiro Ueda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiko Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshiyuki Ozawa, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the quantitative prediction capability for postoperative recurrence of between FDG-PET/CT and MRI-based molecular information from chemical exchange saturation transfer (CEST) imaging and diffusion-weighted imaging (DWI) in stage I non-small cell lung cancer (NSCLC) patients.

### METHODS AND MATERIALS

79 pathologically diagnosed and surgically treated NSCLC patients underwent CEST imaging, DWI and FDG-PET/CT as preoperative examinations, follow-up and pathological examinations. According to the follow-up and pathological examination results, all patients were divided as recurrence (n=13) and non-recurrence (n=66) groups. In each lesion, magnetization transfer ratio asymmetry at 3.5ppm (MTRasym), apparent diffusion coefficient (ADC) and SUVmax of each nodule were assessed by ROI measurements. To compare all indexes between each two groups, Student’s t-test was performed. To determine the significant predictors, multiple logistic regression analysis was performed among all indexes. Then, ROC analysis was performed to compare distinguishing two groups among all indexes and combined significant predictors. Finally, sensitivity (SE), specificity (SP) and accuracy (AC) were compared among all methods by McNemar’s test.

### RESULTS

There were significant difference of each index between two groups ($p<0.05$). Multiple logistic regression analyses determined MTRasym (Odds ratio [OR]: 1.31, $p=0.03$) and ADC (OR: 0.002, $p=0.008$) as significant predictors in this setting. When applied each feasible threshold value, SPs and ACs of MTRasym (SP: 81.8%, AC: 82.2%), ADC (SP: 87.9%, AC: 86.1%) and combined predictors (SP: 89.4%, AC: 89.9%) were significantly higher than those of SUVmax (SP: 69.7%, $p<0.05$; AC: 72. %, $p<0.05$). Moreover, AC of combined predictors was significantly higher than that of MTRasym ($p=0.03$).

### CONCLUSION

MRI-based molecular information has better potential for prediction of postoperative recurrence than FDG-PET/CT in stage I NSCLC patients. Moreover, combined CEST and DWI information can improve prediction capability of CEST imaging in this setting.

### CLINICAL RELEVANCE/APPLICATION

MRI-based molecular information has better potential for prediction of postoperative recurrence than FDG-PET/CT in stage I NSCLC patients. Moreover, combined CEST and DWI information can improve prediction capability of CEST imaging in this setting.

## T5A-SPCH-6 NATURAL HISTORY AND CLINICAL CHARACTERISTICS OF SUBSOLID PULMONARY NODULES IN PEDIATRIC PATIENTS

Shushan Dong (*Abstract Co-Author*) Researcher, Koninklijke Philips NV
Jianlin Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Hong Yu, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hua Ren, MMed (*Presenter*) Nothing to Disclose

### PURPOSE

The natural history of subsolid pulmonary nodules in pediatric patients remains unclear. There are no guidelines for optimal management of these subsolid nodules (SSNs). To investigate the natural course of SSNs in the pediatric patient population and to gain insights into the best mode of follow-up.

### METHODS AND MATERIALS

At least two CT follow-up records of patients aged 18 years or younger with SSNs were retrospectively reviewed and assessed between January 2010 and December 2020. The incidence of interval growth; clinical, radiologic, and pathological features; and follow-up outcomes of these SSNs were investigated. Growth of SSNs was judged by increase in the diameter of the entire nodule or solid portion of 2 mm or more or new appearance of solid portions within SSNs.

### RESULTS

A total of 35 patients (median age, 17 years; range, 13-18 years; 16 women) with 52 SSNs (including 49 pure ground-glass nodules [PGGNs] and 3 part-solid nodules [PSNs]) were analysed and evaluated. One of the 52 SSNs (2.2%) (one PSN) showed interval growth. The PSN showed an increase in nodule size without any change in the size of the solid component. The interval from the initial computed tomography examination to growth was 20 months. Four SSNs (7.7%) (three PGGNs and one PSN) in four patients disappeared within 2-7 months during follow-up. Among the 21 SSNs (18 PGGNs, 3 PSNs) in 19 studied individuals who underwent pulmonary resection, eight were invasive adenocarcinomas, seven minimally invasive adenocarcinomas, five adenocarcinomas in situ, and one bronchiolar adenoma. All the patients survived without recurrence.

### CONCLUSION

Only 2.2% of SSNs in pediatric patients with no history of malignancy showed subsequent growth. The much higher likelihood of persistent SSNs in pediatric patients that represent a primary lung tumour rather than metastasis or infectious causes should be followed up with long intervals and appropriate surgical treatment after thoughtful discussion.

### CLINICAL RELEVANCE/APPLICATION

A follow-up strategy involving a long interval and appropriate surgical treatment after thoughtful discussion should be considered for SSNs in pediatric patients.

## T5A-SPCH-7 MAGNETIC RESONANCE OF PULMONARY NODULES IN ONCOLOGICAL PATIENTS

Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sandro B. da Silva, MD (*Abstract Co-Author*) Nothing to Disclose
Amanda Acevedo (*Abstract Co-Author*) Nothing to Disclose
Rosana S. Rodrigues, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Joice C. Prodigios, MD (*Abstract Co-Author*) Nothing to Disclose
Alysson Roncally Carvalho, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Abstract Co-Author*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc
Bruce Steinberg (*Abstract Co-Author*) Nothing to Disclose
Ronak Kundalia (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to assess the accuracy of pulmonary nodule detection via magnetic resonance imaging (MRI) compared to the gold standard, computed tomography (CT), in patients with cancer.

### METHODS AND MATERIALS

During a 2-year period, MRI of the chest was performed on oncological patients for staging of extrathoracic cancer and subsequently compared to their CT. Only the largest nodule was considered in patients with multiple nodules. Nodule size and malignancy were recorded for each modality, as well as the presence of interstitial lung disease (ILD), adenopathy, cardiomegaly, pleural effusion, pericardial effusion, and vertebral fracture. All cases were read by 2 thoracic radiologists and any discrepancies were resolved by discussion.

### RESULTS

A total of 154 nodules >3 mm in diameter were found in 241 participants (mean age: 59 years [11-105]). No nodules were found in the remaining 91 patients. Average nodule diameter was 11.5mm (range: 3.9 - 29.1mm; SD: 8.1mm). MRI detected all nodules greater than 5mm. Malignancy was detected in 37 nodules. The sensitivity, specificity, and accuracy values of MRI for all nodules were 90.9%, 100%, and 94.8%, respectively. For ground glass nodules (n = 11), the values were 43.6%, 100%, and 65.0%, respectively. When compared to CT, long-axis diameter measured by MRI was underestimated by 9 ± 2.3% (P < .001). There was a strong correlation between measurements of CT and MRI (? = 0.70-1.00). Furthermore, MRI accurately detected the presence ILD (92.8%), adenopathy (95%), cardiomegaly (96.7%), pleural effusion (97.4%), pericardial effusion (100%) and bone lesions (99.3%). Accuracy of diffusion-weighted imaging to detect nodule malignancy was 93.75%.

### CONCLUSION

These findings suggest that lung MRI accurately detected pulmonary nodules and other thoracic pathologies commonly observed in oncological patients.

### CLINICAL RELEVANCE/APPLICATION

Lung MRI may serve as a substitute to CT for oncological patients undergoing routine extra-thoracic surveillance, thereby decreasing radiation exposure.

## T5A-SPCH-8 DEEP LEARNING RECONSTRUCTION IMPROVES PULMONARY NODULE DETECTION AND MEASUREMENT ACCURACY FOR ULTRA-LOW-DOSE CHEST CT COMPARED TO HYBRID ITERATIVE RECONSTRUCTION

Lan Song, MD (*Abstract Co-Author*) Nothing to Disclose
Wei Song, MD (*Abstract Co-Author*) Nothing to Disclose
Xin Sui, MD (*Abstract Co-Author*) Nothing to Disclose
Jinhua Wang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the image quality and pulmonary nodule detectability and measurement accuracy between deep learning reconstruction (DLR) and hybrid iterative reconstruction (HIR) of chest ultra-low-dose CT (ULDCT).

### METHODS AND MATERIALS

Participants who underwent chest standard-dose CT (SDCT) followed by ULDCT from October 2020 to January 2022 were prospectively included. ULDCT images reconstructed with HIR and DLR were compared with SDCT images to evaluate image quality, nodule detection rate, and measurement accuracy using a commercial deep learning-based nodule evaluation system. Detected nodules with long diameter and volume measured by SDCT were used as

references. Nodules with long diameter =3 mm but <30 mm were categorized into three subgroups (3-6 mm; 6-10 mm; =10 mm) and three types (subsolid, solid, and calcified). To analyze differences between the measured data and the reference data, the systematic percentage error (SPE) and absolute percentage error (APE) of long diameter and volume were calculated. Bland-Altman analysis and Wilcoxon signed-rank test were used to evaluate the differences between ULDCT and SDCT images.

**RESULTS**

Eighty-four participants (54 ± 13 years; 26 men) were finally enrolled. The effective radiation doses of ULDCT and SDCT were 0.16 ± 0.02 mSv and 1.77 ± 0.67 mSv, respectively (P < 0.001). The mean ± standard deviation of the lung tissue noises was 61.4 ± 3.0 HU for SDCT, 61.5 ± 2.8 HU and 55.1 ± 3.4 HU for ULDCT reconstructed with HIR-Strong setting (HIR-Str) and DLR-Strong setting (DLR-Str), respectively (P < 0.001). A total of 535 nodules were detected. The nodule detection rates of ULDCT HIR-Str and ULDCT DLR-Str were 74.0% and 83.4%, respectively (P < 0.001). The SPEs in nodule volume from that of SDCT was 17.1% in ULDCT HIR-Str versus 8.5% in ULDCT DLR-Str ( P < 0.001). The APEs in nodule volume from that of SDCT was 19.5% in ULDCT HIR-Str versus 17.9% in ULDCT DLR-Str (P < 0.001).

**CONCLUSION**

DLR was superior to HIR in terms of image noise and image quality at ultra-low-dose settings. DLR also increased the lung nodule detection rate and improved measurement accuracy of nodule volume in comparison with HIR.

**CLINICAL RELEVANCE/APPLICATION**

The study prospectively evaluated the performance of DLR applied to chest ultra-low-dose CT for image quality improvement and lung nodule assessment using a deep learning-based nodule evaluation system.

## T5A-SPCH-9 A MACHINE LEARNING MODEL BASED ON DUAL-LAYER DETECTOR SPECTRAL CT TO PREDICT AND CLASSIFY INVASIVENESS OF LUNG ADENOCARCINOMA

Lian Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Bingxin Gong (*Abstract Co-Author*) Nothing to Disclose
Peng Sun, MD,MD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Shen Gui (*Abstract Co-Author*) Nothing to Disclose
Zhen Quan (*Abstract Co-Author*) Nothing to Disclose
Jiayu Wan (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the utility of a machine learning (ML) model based on dual-layer detector spectral CT (DLCT) parameters for predicting the invasiveness of lung adenocarcinoma manifesting as ground glass nodules (GGNs) prior to surgical intervention.

**METHODS AND MATERIALS**

In a retrospective study, 300 patients with lung adenocarcinoma were included, comprising 160 cases of invasive adenocarcinomas (IA) and 140 cases of pre-invasive minimally invasive adenocarcinoma (MIA). These patients were subsequently divided into a training group (n=190) and a test set (n=110). The study focused on the automated detection and segmentation of each lesion. Four ML models were developed using three DLCT parameters: conventional, electron density, and effective atomic number. The predictive performance of each ML classifier was evaluated using equivalent hyper parameters on the test set, and the diagnostic effectiveness was assessed by calculating the area under the receiver operating characteristic curve (AUC), along with sensitivity, specificity, and overall accuracy of the ML algorithm.

**RESULTS**

Ten important features were derived from ML model based on different DLCT parameters. The conventional plus electron density model performed better than ML models with other DLCT parameters, achieving AUC values of 0.930 and 0.955 in the training and test sets, respectively. The clinical model, which included age, sex, smoking, and alcohol history, had AUCs of 0.667 and 0.736 in the training and test sets, respectively. The clinical model and rad-score were incorporated into a logistic regression to construct a model (joint model), with the AUC of the joint model being 0.964 and 0.959 in the training and test sets, respectively.

**CONCLUSION**

The ML model based on DLCT parameters can help predict the invasiveness of GGNs, classifying GGNs as different risk grade.

**CLINICAL RELEVANCE/APPLICATION**

This study investigates the medical imaging characteristics of DLCT and its correlation with the invasiveness of lung adenocarcinoma. Furthermore, this study established a ML model that significantly aids in predicting the invasiveness of lung adenocarcinoma and guides radiologists in predicting and classifying the invasiveness of this condition.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

T5A-SPER

**Emergency Radiology Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPER-2 PULMONARY TUMOR THROMBOEMBOLIC MICROANGIOPATHY: IMPORTANT RADIOLOGIC FINDINGS WITH CLINICAL MANIFESTATION

Sung-A Chang (*Abstract Co-Author*) Nothing to Disclose
Min Yeong Kim, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Pulmonary tumor thromboembolic microangiopathy (PTTM) is a change of pulmonary microvasculature by microscopic tumor cell emboli, and which leads to a rapid progression of dyspnea, pulmonary hypertension, right heart failure and death. This study was purposed to evaluate CT findings of PTTM with clinical manifestation.

### METHODS AND MATERIALS

Among chest CT scans of emergency room (ER) from 2013 to 2021, twenty-five patients were found to have PTTM after review of medical records including echocardiography. Analysis of CT findings included ratio of the right ventricle (RV) to the left ventricle (LV), diameter of main pulmonary artery (MPA), visible pulmonary arterial thromboembolism (PTE), centrilobular GGOs, vascular tree in bud appearance, and mismatched perfusion defects on dual energy iodine maps.

### RESULTS

The most common primary cancer was sex dependent, with seven out of 14 women having breast cancer and five out of 11 men having stomach cancer. The ratio of RV to LV more than 1 were observed in 21 patients, MPA more than 2.9 cm were in 22 ones. Only 2 CT scans revealed PTE in segmental branches. Centrilobular GGOs were found in 15 patients, 10 of them diffusely involved both lungs. Vascular tree in bud appearance was found in 9 patients. Sixteen CT exams performed with dual-energy CT scanner and included iodine perfusion map, all of which revealed various degree of mismatched perfusion defects. Severity of pulmonary hypertension was moderate in 22 patients, severe in 2 ones. Sixteen patients died within a week and only two patients have been alive more than one year after immediate chemotherapy with adequate cardiologic management.

### CONCLUSION

Most cases of PTTM tend to be found in ER due to rapid clinical progression and its mortality rate within 7 days was more than 60%. The diagnosis of PTTM begins with CT scanning and the CT findings are very specific to proper diagnosis.

### CLINICAL RELEVANCE/APPLICATION

To avoid rapid progress to death by PTTM, both radiologists and ER physicians should be aware of PTTM for early diagnosis and proper management.

# Abstract Archives of the RSNA, 2024

T5A-SPGI

**Gastrointestinal Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPGI-1 RADIOMICS ANALYSIS BASED ON GD-EOB-DTPA-ENHANCED MRI FOR PREDICTING EARLY RECURRENCE IN HEPATOCELLULAR CARCINOMA AFTER PARTIAL HEPATECTOMY

Yuxi Tao (*Abstract Co-Author*) Nothing to Disclose
Zichang Ma (*Abstract Co-Author*) Nothing to Disclose
Yaqin Zhang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Hanqiu Zeng (*Presenter*) Nothing to Disclose

### PURPOSE

Hepatocellular carcinoma (HCC) has a high incidence and poor prognosis, with surgical resection being the primary treatment method. Early recurrence is a major cause of death in HCC patients who undergo curative liver resection. Identifying high-risk patients for early recurrence preoperatively and implementing adjuvant therapy can improve prognosis and increase survival rates. However, there is currently no comprehensive, intuitive, and reliable tool for predicting early recurrence in clinical practice.

### METHODS AND MATERIALS

In this bicentric study, 239 patients with HCC who underwent Gd-EOB-DTPA-enhanced MRI before resection were divided into training (n = 168) and validation (n = 71) sets. Radiomics features were extracted from multi-sequence MR (mp-MR) images using FAE. Consistency analysis was used to select stable features, Spearman rank correlation coefficient test was used to eliminate redundant features and reduce feature dimensions, and the least absolute shrinkage and selection operator algorithm was used to select radiomics features with the most predictive value for early recurrence. Univariate and multivariate logistic regression analysis to determine independent risk factors associated with early recurrence and construct a clinical-radiologic prediction model. A combined nomogram was built by incorporating radiomics features and significant clinical-radiologic variables to achieve early recurrence prediction.

### RESULTS

The radiomics model based on mp-MRI outperformed all other radiomics models in the training set and validation set. Age, AST, rim arterial phase hyperenhancement, mosaic architecture, and satellite tumors were independent risk factors for early recurrence. The combined nomogram outperformed the radiomics model and the clinical-radiologic model in the training set (0.783 vs. 0.753 vs. 0.744) and validation set (0.734 vs. 0.691 vs.0.704). Excellent calibration was achieved in the combined nomogram. Decision curve analysis confirmed the clinical usefulness of combined nomogram.

### CONCLUSION

The radiomics model based on preoperative Gd-EOB-DTPA-enhanced MRI can effectively predict early recurrence in HCC patients. The combined nomogram incorporating clinical-radiologic features and radiomics features demonstrates superior predictive performance.

### CLINICAL RELEVANCE/APPLICATION

The nomogram developed based on this provides a simple and intuitive tool for preoperatively predicting early recurrence in HCC, identifying high-risk patients, guiding the development of personalized treatment plans, optimizing postoperative monitoring strategies, and improving the prognosis of HCC patients.

## T5A-SPGI-10 MULTIPLE MAGNETIC RESONANCE DIFFUSION MODELS FOR PREOPERATIVE PREDICTING MACROTRABECULAR MASSIVE HEPATOCELLULAR CARCINOMA

Wenjian Wang (*Abstract Co-Author*) Nothing to Disclose
Ke Xue (*Abstract Co-Author*) Nothing to Disclose
Zhe Wang (*Abstract Co-Author*) Nothing to Disclose
Ye Jing (*Abstract Co-Author*) Nothing to Disclose
Martin R. Prince, MD, PhD (*Abstract Co-Author*) Patent agreement, General Electric Company;
Xianfu Luo (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the feasibility of intravoxel incoherent motion (IVIM) and fractional order calculus (FROC) models in characterizing macrotrabecular massive hepatocellular carcinoma (MTM-HCC).

### METHODS AND MATERIALS

168 patients suspected of HCC prospectively underwent liver MRI scanning on a 3.0-tesla scanner. All patients receive routine liver scanning protocol and an additional 12 b-values(0-2000s/mm²) diffusion-weighted imaging. Patients with tumor resection histologically confirmed HCC were divided into MTM-HCC and non-MTM-HCC groups. The IVIM and FROC models derived parameters including true diffusion coefficient (Dt), pseudo diffusion coefficient (Dp), perfusion fraction (f), diffusion coefficient (D), fractional order parameter (ß), and microstructural quantity (μ) were calculated, and compared in MTM and non-MTM HCC groups. Apparent diffusion coefficient (ADC) values were also included in the comparison. Image features including arterial phase hypovascular and maximum tumor diameter (=5cm) were also compared in the two groups by using an independent student t-test or Mann-Whitney U test. The prediction performance was evaluated by receiver operating characteristic (ROC) analysis and areas under ROC curves (AUC)s were compared by the DeLong test.

### RESULTS

A total of 58 HCC patients including 16 MTM and 42 non-MTM HCC patients were enrolled in this study. The arterial phase hypovascular component and the maximum tumor diameter were statistically significant differences between MTM and non-MTM HCC (P=0.040, 0.036). Dp, f, ß, and μ showed no significant difference. While ADC, Dt, and D between the MTM and non-MTM HCC groups were statistically significant (P=0.047, 0.010 and 0.008). MTM-HCC group showed lower Dt values [(0.93±0.14) ×10-3 mm2/s vs. (1.27±1.36) ×10-3 mm2/s ], and lower D values [(1.05±0.16)×10-3mm2/s vs. (1.20±0.19)×10-3mm2/s ], along with lower ADC values [(0.96±0.11)×10-3mm2/s vs. ( 1.03±0.14 )×10-3mm2/s ]. The AUC values of arterial phase hypovascular component, maximum tumor diameter, ADC, Dt, and D were 0.647, 0.653, 0.656, 0.720, and 0.722, respectively.

### CONCLUSION

IVIM and FROC models-based parameters showed promising ability in identifying MTM-HCC and were superior to ADC and MRI imaging features.

### CLINICAL RELEVANCE/APPLICATION

Multiple magnetic resonance diffusion models were feasible for preoperative predicting the more aggressive subtype of hepatocellular carcinoma, specifically macrotrabecular massive hepatocellular carcinoma (MTM-HCC).

## T5A-SPGI-2 THE VALUE OF R2* COMBINED WITH AUTOMATIC QUANTIFICATION OF INTRATUMORAL MAGNETIC SENSITIVE SIGNAL IN PREDICTING THE EARLY CURATIVE EFFECT OF HEPATOCELLULAR CARCINOMA AFTER TACE

Ailian Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Mingrui Zhuang (*Abstract Co-Author*) Nothing to Disclose
Ying Zhao JR (*Abstract Co-Author*) Nothing to Disclose
Jun Li (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the value of R2 * combined with automatic quantification of intratumoral magnetic sensitive signal (ITSS) in predicting the early efficacy of TACE in HCC.

### METHODS AND MATERIALS

The clinical and imaging data of patients with HCC who received TACE for the first time in our hospital from October 2011 to April 2023 were collected. All patients underwent 1.5T MRI examination of upper abdomen before TACE. According to the mRECIST standard, the postoperative efficacy of TACE was divided into complete remission (CR), partial remission (PR), disease stability (SD) and disease progression (PD). CR and PR were recorded as effective group (n=45), SD and PD as ineffective group (n=35). ESWAN sequence images generate amplitude map, phase map and R2* map on the workstation. Two observers referred to the T2WI image and placed three equal regions of interest (ROI) on the R2 * image of the largest plane of the tumor and recorded the average value. Using AntopySketch software, the tumor outline was drawn on the largest plane of the tumor and the septum between the upper and lower poles on the amplitude map, and the ITSS ratio was obtained automatically. Intra-group correlation coefficient (ICC) was used to compare the consistency of the measured data between the two observers; Kolmogorov-Smirnov test was used to test the normality of parameters; independent sample t-test or Mann-WhitneyU test was used to compare the differences between the two groups; subjects operating characteristic (ROC) curve was used to evaluate the prediction performance; Logistic regression was used to construct a joint prediction model; Delong test was used to compare the prediction efficiency of each parameter and the joint model.

### RESULTS

The R2* and ITSS ratios measured by the two observers were in good agreement (ICC > 0.75). The R2 * value and ITSS ratio in the effective group were significantly lower than those in the ineffective group (P < 0.001). The R2* and ITSS ratio in the effective group were significantly lower than those in the ineffective group (P < 0.001). The area under the curve (AUC) of R2*, ITSS and the combination of R2* and ITSS to predict the early outcome after HCC were 0.773, 0.766 and 0.839 respectively. There was no significant difference between the prediction efficiency of R2* and ITSS (P = 0.911). The prediction efficiency of the combination of R2* and ITSS was better than that of the single parameter of ITSS (P = 0.040).

### CONCLUSION

Both R2* and ITSS can predict the early curative effect after TACE in patients with HCC, and the predictive efficiency is improved after the combination of R2* and ITSS.

### CLINICAL RELEVANCE/APPLICATION

This study helps clinicians to make individualized treatment plans and improve the survival rate of patients with liver cancer.

## T5A-SPGI-6 THE VALUE OF ENHANCED T2 * WEIGHTED IMAGING IN PREDICTING EARLY RECURRENCE OF HEPATOCELLULAR CARCINOMA AFTER HEPATECTOMY

Ailian Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Ying Zhao JR (*Abstract Co-Author*) Nothing to Disclose
Jun Li (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the value of enhanced T2 * weighted angiography (enhancedT2-starweightedangiography,ESWAN) in predicting early recurrence of hepatocellular carcinoma (HCC) after hepatectomy.

## METHODS AND MATERIALS

29 patients with hepatocellular carcinoma who underwent upper abdominal MRI (including ESWAN sequence) and underwent hepatectomy (15 cases of early recurrence (ER) and 14 cases of early non-recurrence (NER)) were collected retrospectively. In AW4.6 workstation (GEHealthcare), ESWAN quantitative parameter maps, including amplitude map, phase map, R2* map and T2* map, are automatically generated by Functool software. According to the T2WI images, three equal-sized circular regions of interest (ROI) were placed in the tumor, the peri-tumor area (1cm) and the distal peri-tumor normal liver parenchyma (5cm) at the maximum level of the lesion, and the amplitude, phase, R2* and T2* values were recorded. The average values of 3 ROI were used for statistical analysis. Kolmogorov-Smirnov test was used to evaluate the normality of the parameters, and independent sample t-test or Mann-WhitneyU test was used to compare the differences of quantitative parameters between the two groups. The diagnostic performance was evaluated using subject operating characteristics (ROC) analysis.

## RESULTS

The amplitude value (tumor), peri-tumor value, liver value, R2* (tumor), R2* (peritumor) and R2* (liver) in ER group were significantly higher than those in NER group. There was no significant difference in other quantitative parameters between the two groups ($P > 0.05$). The area under the curve (AUC) of amplitude value (tumor), amplitude value (peri-tumor), amplitude value (liver), R2 * (tumor), R2 * (peri-tumor) and R2 * (liver) for predicting early recurrence were 0.590, 0.600, 0.681, 0.890, 0.924 and 0.929, respectively. When amplitude value (tumor), amplitude value (peri-tumor), amplitude value (liver), R2* (tumor), R2* (peritumoral) and R2* (liver) parameters were combined, the predictive efficiency increased (AUC=0.971).

## CONCLUSION

Multiple quantitative parameters of ESWAN sequence have certain value in predicting early recurrence of hepatocellular carcinoma after hepatectomy.

## CLINICAL RELEVANCE/APPLICATION

Help clinicians to develop individualized treatment plans

# T5A-SPGI-7 COMBINING CEUS AND CT/MRI LI-RADS MAJOR IMAGING FEATURES: DIAGNOSTIC ACCURACY FOR CLASSIFICATION OF INDETERMINATE LIVER OBSERVATIONS IN PATIENTS AT RISK FOR HCC

Paul S. Sidhu, BSc, FRCR (*Abstract Co-Author*) Consultant, Samsung Electronics Co, Ltd;Speaker, Samsung Electronics Co, Ltd;Speaker, Bracco Group;Consultant, Itreas Ltd;Speaker, Siemens AG
Virginia B. Planz, MD (*Abstract Co-Author*) Nothing to Disclose
Corinne Wessner (*Abstract Co-Author*) Consultant, Bracco Group
Annalisa Berzigotti (*Abstract Co-Author*) Nothing to Disclose
Iuliana Pompilia Radu (*Abstract Co-Author*) Nothing to Disclose
Kristen Bradigan (*Abstract Co-Author*) Nothing to Disclose
Andrej Lyshchik, MD, PhD (*Abstract Co-Author*) Royalties, RELX;Speaker, General Electric Company;Consultant, General Electric Company;Research support, General Electric Company;Consultant, BioClinica, Inc;Consultant, WCC, Inc;Consultant, Bracco Group;Advisory Board, Bracco Group
Fabio Piscaglia (*Abstract Co-Author*) Research support, Esaote SpA;Advisory Board, Bayer AG;Speaker, Bayer AG;Speaker, Bracco Group;Speaker, Bristol-Myers Squibb Company;Advisory Board, Eisai Co, Ltd;Speaker, Eisai Co, Ltd;Advisory Board, AstraZeneca PLC;Advisory Board, General Electric Company;Advisory Board, Siemens AG;Advisory Board, Tiziana Life Sciences
John R. Eisenbrey, PhD (*Abstract Co-Author*) Support, General Electric Company;Research Grant, General Electric Company;Support, Lantheus Medical Imaging, Inc;Speaker, Lantheus Medical Imaging, Inc;Support, Siemens AG
Aylin Tahmasebi, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Kuon Yeng Escalante (*Abstract Co-Author*) Nothing to Disclose
Yuko Kono, MD, PhD (*Abstract Co-Author*) Equipment support, Canon Medical Systems Corporation;Equipment support, General Electric Company;Support, Lantheus Holdings;Support, Bracco Group
Alexandra Medellin, MD (*Abstract Co-Author*) Nothing to Disclose
David T. Fetzer, MD (*Abstract Co-Author*) Research support, General Electric Company;Research support, Koninklijke Philips NV;Research support, Siemens AG;Consultant, Koninklijke Philips NV;Advisory Board, Koninklijke Philips NV;Consultant, General Electric Company;Advisory Board, General Electric Company
Stephanie R. Wilson, MD (*Abstract Co-Author*) Equipment support, Koninklijke Philips NV;Equipment support, Siemens AG;Equipment support, Samsung Electronics Co, Ltd;Research support, Samsung Electronics Co, Ltd;
Flemming Forsberg, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research support, Canon Medical Systems Corporation;Research support, General Electric Company;Speaker, General Electric Company;Research support, Siemens AG;Research Grant, Butterfly Network, Inc;Research support, Lantheus Medical Imaging, Inc;Research support, Bracco Group
Aya Kamaya, MD (*Abstract Co-Author*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation
Shuchi K. Rodgers, MD (*Abstract Co-Author*) Royalties, RELX
Tania Siu Xiao, MD (*Presenter*) Nothing to Disclose

## PURPOSE

This study aimed to determine diagnostic accuracy of combining contrast-enhanced ultrasound (CEUS) and CT/MRI Liver Imaging Reporting and Data System (LI-RADS) major imaging features for the improved classification of indeterminate liver observations.

## METHODS AND MATERIALS

A retrospective analysis using a database from a prospective study conducted at 11 centers in North America and Europe from 2018 through 2022 included a total of 109 participants at risk for hepatocellular carcinoma (HCC) who had liver observations with indeterminate characterization on both CEUS and CT/MRI (LR3, LR-4, and LR-M). The individual LI-RADS major features for HCC on both CEUS and CT/MRI were extracted and analyzed in various combinations. Biopsy, explant histology, and follow-up CT/MRI were used as the final reference standard. The diagnostic performance of LI-RADS major features combinations for definitive diagnosis of HCC (LR-5) were calculated. A reverse, stepwise logistical regression sub-analysis was also performed.

## RESULTS

This study included 114 observations indeterminate on both CT/MRI and CEUS. These observations were initially classified as LR-3 (n=37), LR-4 (n=41), and LR-M (n=36) on CT/MRI and LR-3 (n= 48), LR-4 (n= 36), LR-M (n= 29), and LR-TIV (n=1) on CEUS. Of them, 43.0% (49/114) were confirmed as HCC, 37.3% (43/114) were non-malignant, and 19.3% (22/114) were non-hepatocellular malignancies. The highest diagnostic accuracy among the combinations of imaging features was achieved in CT/MRI LR-3 observations, where the combination of CEUS arterial phase hyper-enhancement (APHE) + CT/MRI APHE had 96.7% specificity, 75.0% positive predictive value and 86.5% accuracy for HCC. CEUS APHE was the variable that showed synergism between benign versus malignant and HCC versus any other observation.

### CONCLUSION

The combination of LI-RADS major features on CT/MRI and CEUS showed higher specificity, positive predictive value, and accuracy compared to individual modalities' assessments, particularly for CT/MRI LR-3 observations. These combinations can produce a definitive diagnosis of HCC in a small percentage of cases with inconclusive imaging on individual modalities.

### CLINICAL RELEVANCE/APPLICATION

By using the combination of CEUS and CT/MRI LI-RADS major features, a definitive diagnosis of HCC can be achieved in cases where individual modalities produce inconclusive results, particularly in LR-3 observations. This comprehensive approach may lead to early intervention.

## T5A-SPGI-8 NEOPLASTIC VERSUS BLAND PORTAL VEIN THROMBOSIS IN HEPATOCELLULAR CARCINOMA: QUANTITATIVE ANALYSIS BASED ON MR DIFFUSION-WEIGHTED IMAGING

Maimoona Siddique, FRCR, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

We investigated to establish specific criteria to diagnose PVT in patients with hepatocellular carcinoma (HCC), based on MR diffusion-weighted imaging (DWI). Our aim was to distinguish the bland from neoplastic PVT by doing quantitative analysis between attenuation values on Triphasic Computed Tomography (TP-CT) and Apparent Diffusion Coefficient (ADC) values on MR DWI.

### METHODS AND MATERIALS

A total of 47, age and sex-matched, HCC patients with PVT, classified based on Doppler ultrasound and TP-CT imaging-based criteria of PV expansion and venous contrast filling defect, were selected. Correlative MR images were reviewed independently. Visual analysis of diffusion restriction was based on signal intensity change. Quantitative parameters including ADC values for regions of interest drawn over thrombus, background liver parenchyma, and dominant HCC lesion, as well as the ratios of the thrombus to liver and tumor (T:L ADC and T:T ADC, respectively) values, were recorded. Receiver operator curve analysis (ROC) was used to define cut off ADC values to differentiate malignant from benign PVT.

### RESULTS

Of the total 47 cases with PVT [32 males, 15 females; mean age 48 years±10.2], the mean Alpha-Fetoprotein level was 2173 ±946 ng/ml. On TP-CT, neovascularity and early arterial enhancement of PVT were depicted in 36/47 cases with malignant PVT and non-depicted in 11/47 cases with benign PVT. PVTs were complete in 40 patients and partial in seven. In all cases, the venous contrast filling defects on TP-CT showed correlative signal involving the entire width of the portal vein lumen or its segmental which approximated (with T1 weighting) and exceeded (with T2 weighting) the intensity of the hepatic parenchyma while the hepatic veins showed a complete flow void. There was slightly lower sensitivity for detecting segmental PVT compared with that of major PVT in the malignant PVT cases, possibly related to partial volume effect. There was a statistically significant [P value < 0.05] difference between ADC and ADC ratio values of the benign versus malignant PVT. ROC curve revealed cutoff value (& 7;1), with sensitivity (100%), and specificity (84%).

### CONCLUSION

MR DWI has an excellent diagnostic yield in the differentiation of malignant from benign PVT in HCC. However, the sensitivity is limited in cases with segmental PVT, particularly in cases with curative intent.

### CLINICAL RELEVANCE/APPLICATION

Diffusion weighted limited MR liver imaging can serve as a better substitute for equivocal cases of malignant portal venous thrombosis on dynamic CT imaging, or those with a history of iodinated contrast allergy.

## T5A-SPGI-9 PREDICTION OF TREATMENT EFFICIENCY OF HCC PATIENTS AFTER TRANSCATHETER ARTERIAL CHEMOEMBOLIZATION BASED ON IVIM TEXTURE ANALYSIS

Ailian Liu, MD (*Abstract Co-Author*) Nothing to Disclose
SHUO ZHANG (*Abstract Co-Author*) Nothing to Disclose
Ying Zhao JR (*Abstract Co-Author*) Nothing to Disclose
Qianyu Zhang (*Abstract Co-Author*) Nothing to Disclose
SIQI WANG (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the value of texture analysis based on IVIM images in predicting the efficacy of hepatocellular carcinoma (HCC) after transcatheter arterial chemoembolization (TACE).

### METHODS AND MATERIALS

A retrospective analysis of 76 patients with HCC at our hospital from June 2015 to October 2018 was performed. For the IVIM analysis, Maps were reconstructed of the IVIM parameters (fast mono, slow mono, fraction of fast mono and standard ADC). They were randomly divided into a training group and a test group (7:3). The enrolled patients were divided into an objective response group and non-objective response group according to the treatment effect after TACE according to the mRECIST standard. Lesions of all the HCC patients were delineated manually through ITKSNAP software. Observers used United Imaging uAI Research Portal platform and FeAture Explorer Pro (FAE, V 0.5.2) on Python (3.7.6) to extract texture parameters. Analysis of variance (ANOVA) were used for feature selection to construct the predictive model. The linear discriminant analysis (LDA) method was used to combine texture parameters. The predictive performance of the test texture parameters was analyzed by receiver operating characteristic curve (ROC).

### RESULTS

A total of 1184 texture features were obtained after IVIM-based texture analysis of each patient, 5 significant texture features were selected after screening to construct the predictive model.1 feature was from fast mono;4 features were from fraction of fast mono. The AUC, sensitivity and specificity scores of training group were 0.7918(95%CI, 0.6684-0.9151), 83.87% and 63.64%. The AUC, sensitivity and specificity scores of test group were 0.600(95%CI, 0.3155-0.8845),92.31% and 60.00%.

### CONCLUSION

Texture analysis of IVIM images have potential clinical value in predicting the treatment effect of HCC patients after TACE. It is of feasibility to provide guidance for better clinical individual treatment.

## CLINICAL RELEVANCE/APPLICATION

It may be possible to provide guidance regarding better clinical treatment for patients who undergo TACE by analyzing IVIM texture images.

# Abstract Archives of the RSNA, 2024

T5A-SPGU

**Genitourinary Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPGU-1 EVALUATION OF SPLIT RENAL FUNCTION USING MR-DERIVED STRUCTURE AND ARTERIAL SPIN-LABELED PERFUSION FEATURES IN CHRONIC OBSTRUCTIVE NEPHROPATHY

Wenhao Guan (*Abstract Co-Author*) Nothing to Disclose
Jinzhi Yang (*Abstract Co-Author*) Nothing to Disclose
Xiancheng Li (*Abstract Co-Author*) Nothing to Disclose
Yang Dong (*Abstract Co-Author*) Nothing to Disclose
Yuqing Cai (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the value of magnetic resonance arterial spin-labeled (ASL) imaging and renal structural characteristics in quantitative evaluation of the split renal function (SRF) in obstructive nephropathy.

### METHODS AND MATERIALS

Consecutive forty-six patients with obstructive hydronephrosis were recruited for a 3-T conventional and ASL-MRI examination from January 2022 to August 2023 prospectively. The 92 independent kidneys were divided into 3 groups based on split GFR obtained by renal scintigraphy (RS). (1) normal renal function: GFR=40ml/min, renal parenchymal radioactivity uptake and clearance is good; (2) mild to moderate impairment: 20ml/min= GFR<40ml/min, a mild or moderate reduction in renal parenchymal radioactivity uptake; (3) severe impairment or no function: GFR<20ml/min, there is a marked reduction in renal parenchymal radioactivity uptake, with thinning of the cortex or little or no renal parenchyma. Renal blood flow (RBF) and renal parenchymal thickness (RPT), renal pelvic dilation (RPD) were assessed on ASL and T1WI maps. One-way analysis of variance (ANOVA) and Kruskal-Walli's test was used to analyze the differences among the three groups. Pearson and Spearman rank correlation analysis approach were adopted to analyze the correlation between RBF, RPT, RPD and GFR, and ROC curve was used to compare their efficacy.

### RESULTS

Renal cortical RBF, RPT, and RPD could distinguish the SRF pairwise subgroups with different renal function impairments ($p<0.001$). The correlation coefficients were 0.767, 0.635, and -0.589, respectively. ROC curve analysis showed that RBF, RPT, and RPD could distinguish the renal function grades with obstructive hydronephrosis. The combination of RBF, RPT and RPD achieved the highest diagnostic efficacy in distinguishing different degrees of renal dysfunction. The AUC valves were 0.869 (95% CI, (0.768-0.937)), 0.883 (95% CI, (0.756-0.959)) and 0. 994 (95% CI, (0.931-1.00)) in normal and mild to moderate impairment groups, mild to moderate impairment group and severe impairment or no function group, normal and severe impairment or no function group, separately.

### CONCLUSION

MR structural and ASL imaging enables quantitative measurements of RPT, RPD, and renal cortical RBF. They were correlated with RS and SRF. The combination of which achieved high diagnostic efficacy and demonstrated clinical potential in noninvasive evaluation of SRF in obstructive nephropathy.

### CLINICAL RELEVANCE/APPLICATION

MR structural features and ASL-RBF are correlates with SRF obtained by RS in obstructive nephropathy. RBF combines with RPT and RPD can improve the diagnostic efficiency of split renal impairment furtherly. MRI provides a non-invasive quantitative measurement method for assessing split renal function.

## T5A-SPGU-2 INTERMEDIATE PI-RADS LESIONS: IS THERE A ROLE FOR THE PRIMARY SCORE?

James Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Maryam Rahmani, MD (*Abstract Co-Author*) Nothing to Disclose
Vahid Yaghmai, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Garrett G. Ward, MD (*Abstract Co-Author*) Nothing to Disclose
Seyedeh Niloufar Rafiei Alavi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

While PI-RADS has greatly improved tumor localization and biopsy guidance, a significant portion of patients still receive intermediate results. We evaluated role of PRIMARY score on PSMA PET/CT in patients with PIRADS=3

### METHODS AND MATERIALS

Patients with intermediate mpMRI results (PIRADS=3) who also had available PSMA-PET/CT scans were evaluated. We reviewed the PSMA PET/CT results and scored prostate findings using the PRIMARY score—a novel standardized scoring system for interpreting PSMA PET/CT within the prostate. PI-RADS

scores were upgraded to PIRADS=4 if the PRIMARY score was 3 or higher, or downgraded to PIRADS=2 if PRIMARY score was 1-2. Final lesion diagnoses were correlated with pathology results, with clinically significant prostate cancer defined as a Gleason Score =7. We calculated sensitivity and specificity for detecting clinically significant PCa by combining mpMRI and PSMA PET/CT. ROC curve analyses was performed to calculate the area under the curve for PRIMARY and compare it to two previously described methods for classification of PIRADS=3 lesions

**RESULTS**

We identified 42 PIRADS=3 lesions in patients who also had undergone PSMA PET/CT. Biopsy results revealed that 26/42 (62%) of these lesions were clinically significant PCa (GS =7), while 8/42(19%) were GS=3+3, and 8/42 (19%) were benign. Using PRIMARY, all benign lesions were correctly classified as PRIMARY=2, and only 25% of favorable medium-risk lesions (GG=3+4) were missed. The use of PSMA PET/CT for PIRADS 3 lesions resulted in a sensitivity of 88% and specificity of 81.25% for detecting clinically significant PCa on mpMRI. ROC analyses showed higher diagnostic accuracy for the PRIMARY score (AUC= 0.829 [0.691-0.967]) compared to PSA density cutoff (> 0.15) (AUC=0.464 [0.283-0.644]), and SUVmax cutoff (>5) alone (AUC=0.683 [0.516-0.850]).

**CONCLUSION**

PSMA PET/CT provides valuable information for assessing the risk of malignancy in PIRADS 3 lesions. Incorporating PSMA PET/CT prostate findings can reduce false positives and false negatives in MRI-guided prostate biopsies.

**CLINICAL RELEVANCE/APPLICATION**

The incorporation of PSMA PET/CT and the PRIMARY scoring system into the assessment of PI-RADS 3 lesions enhances the diagnostic accuracy for detecting clinically significant prostate cancer, reducing unnecessary biopsies, and optimizing patient management.

## T5A-SPGU-3 FOLLOW-UP OF NON-PALPABLE INCIDENTALOMAS <1CM: DOES GROWTH RATE ALLOW DISTINGUISH BETWEEN MALIGNANT AND NON-MALIGNANT LESIONS?

Pietro Pavlica, MD (*Abstract Co-Author*) Nothing to Disclose
Paul S. Sidhu, BSc, FRCR (*Abstract Co-Author*) Consultant, Samsung Electronics Co, Ltd;Speaker, Samsung Electronics Co, Ltd;Speaker, Bracco Group;Consultant, Itreas Ltd;Speaker, Siemens AG
Michele Bertolotto, MD (*Abstract Co-Author*) Nothing to Disclose
Lorenzo E. Derchi, MD (*Abstract Co-Author*) Nothing to Disclose
Laurence M. Rocher, MD (*Abstract Co-Author*) Nothing to Disclose
Simon Freeman (*Abstract Co-Author*) Nothing to Disclose
Irene Campo (*Abstract Co-Author*) Nothing to Disclose
Gianluca Visalli, MD (*Abstract Co-Author*) Nothing to Disclose
Jia Cheng Yuan, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

a) to substantiate whether small, incidentally detected testicular lesions can be safely followed up; b) to assess the growth rate of surgically proven benign, malignant and non-neoplastic lesions; c) to investigate whether a threshold could be identified for a reliable differentiation between benign/non neoplastic lesions and malignant tumours based on growth characteristics.

**METHODS AND MATERIALS**

From October 2001 to November 2021, 127 patients with nonpalpable testicular lesions <1cm were monitored in seven diagnostic centers. Patients had negative tumor markers, and cysts were excluded. High-frequency, broadband probes were used for ultrasound. For patients with multiple lesions, the largest was considered. Follow-up, adhering to ESUR recommendations, was mostly every three months for 12 months then annually. Surgery was scheduled for 39 lesions due to growth or patient/urologist preference.

**RESULTS**

Among 127 initially followed-up testicular lesions, 6 disappeared, 8 reduced, 85 remained stable, and 28 grew. Follow-up duration ranged from 1 to 22 years. Histology was available for 39 operated, 11 stable, and 28 growing lesions. Among stable ones, 1 was benign, 10 non-neoplastic; among growing, 18 malignant, 8 benign, 2 non-neoplastic. Initial volumes didn't statistically differ between malignant and non-malignant. Growth rates were significantly higher for malignant tumors. Best indicators to differentiate malignancy were specific growth rate, doubling time, and growth in maximum and average diameters. All malignant tumors were removed within 18 months, all stage IA.

**CONCLUSION**

This retrospective study represents the first attempt to estimate the growth rate of testicular incidentalomas, to identify thresholds to differentiate surgical from non-surgical lesions, and benign from malignant lesions. We found that benign and malignant lesions can be effectively differentiated based on growing parameters, even though superimposition exists. These results are promising, but the strength of the evidence suffers from the retrospective design of the study. Prospective multicenter studies with a larger number of lesions are necessary to substantiate them, leading to an evidence-based paradigm shift in the management of small testicular incidentalomas.

**CLINICAL RELEVANCE/APPLICATION**

Our data suggest that malignant small, non-palpable incidentalomas are mostly seminomas (17/18 in our series, 94%). All were identified and removed within 18 months after discovery, and all were stage IA tumours.

## T5A-SPGU-4 IMPACT OF THE USE OF ENDORECTAL COIL ON DIAGNOSTIC ACCURACY OF MRI FOR EXTRAPROSTATIC EXTENSION IN PROSTATE CANCER

Bradford J. Wood, MD (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;Researcher, Koninklijke Philips NV;Intellectual property, Koninklijke Philips NV;Equipment Support, Koninklijke Philips NV;Researcher, Celsion Corporation;Research Grant, Celsion Corporation;Researcher, BTG International Ltd;Intellectual property, BTG International Ltd;Researcher, Boston Scientific Corporation;Research Grant, Boston Scientific Corporation;Intellectual property, Boston Scientific Corporation;Researcher, Siemens AG;Equipment Support, Siemens AG;Researcher, Sarasota Interventional Radiology;Researcher, NVIDIA Corporation;Research Grant, NVIDIA Corporation;Equipment support, AngioDynamics, Inc;Equipment support, Profound Medical Inc;Researcher, Canon Medical Systems Corporation;License agreement, Canon Medical Systems Corporation;Researcher, AstraZeneca PLC;Researcher, Exact Imaging Inc
Peter Pinto (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;License agreement, Koninklijke Philips NV;
Enis Yilmaz, MD (*Abstract Co-Author*) Nothing to Disclose
David Gelikman (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Harmon, PhD (*Abstract Co-Author*) Nothing to Disclose

Sandeep Gurram (*Abstract Co-Author*) Nothing to Disclose
Yue Lin, BA (*Abstract Co-Author*) Nothing to Disclose
Peter L. Choyke, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamin Simon, BS, BA (*Abstract Co-Author*) Nothing to Disclose
Maria Merino, MD (*Abstract Co-Author*) Nothing to Disclose
Mason Belue, MD (*Abstract Co-Author*) Nothing to Disclose
Omer Esengur, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the impact of endorectal coil (ERC) use on MRI accuracy in detecting extraprostatic extension (EPE) in prostate cancer patients by comparing National Cancer Institute EPE grading with post-radical prostatectomy (RP) pathology findings.

**METHODS AND MATERIALS**

In this retrospective study, 956 consecutive patients (median age=62 [IQR: 57-67], median PSA=9.7 ng/mL [IQR: 4.8-10.5]) who underwent prostate MRI with ERC (ERC+) or without (ERC-) between January 2007 and March 2024 were included. Prospectively reported EPE grades of ERC+ and ERC- patients were compared with EPE status on post-RP histopathology. Diagnostic metrics were calculated at EPE grade =1 and =3 cutoffs for ERC+ and ERC- groups. Additional statistical analysis was done using Fisher's exact test, receiver operating characteristic curve (AUC), and DeLong's test.

**RESULTS**

A total of 228 patients out of 956 (24%) were found to have EPE on histopathology. In the entire study sample, the sensitivity was 70%, specificity was 69%, PPV was 41%, NPV was 88% and accuracy was 69% for the EPE grade=1 threshold. At EPE grade=1 cutoff, sensitivity (75% vs 63%) and NPV (90% vs 84%) were higher for ERC+ compared to the ERC- group. Specificity was found to be similar across the ERC+ and ERC- groups at both EPE grade=1 (67% vs 72%) and EPE grade=3 (94% vs. 95%) thresholds. NPV was found to be high across all settings, especially for EPE grade=1 (90% for ERC+, 84% for ERC-). Accuracy was found to be similar at EPE grade=1 (69% for ERC+, 70% for ERC-) and slightly higher for ERC+ (80%) compared to ERC- (75%) EPE grade =3. Detection of EPE on MRI was significant across EPE thresholds of =1 and =3 in ERC+ and ERC- patients ($p<0.05$). The AUC was 0.742 for ERC+ and 0.697 for ERC- ($p=0.25$).

**CONCLUSION**

While ERC improves detection of EPE and reliability in correctly identifying patients who do not have EPE, it does not significantly enhance MRI accuracy. This suggests that routine ERC use may not be justified in clinical practice, especially considering the cost and patient discomfort associated with its use.

**CLINICAL RELEVANCE/APPLICATION**

Considering the minimal impact of ERC on improving diagnostic outcomes, its routine use in prostate MRI may not be warranted, potentially reducing both costs and patient discomfort.

## T5A-SPGU-5 IMPACT OF PROSTATE MR IMAGE QUALITY ON PROSTATE CANCER DETECTION: IS BEAUTY IN THE EYE OF THE BEHOLDER?

Andrei S. Purysko, MD (*Abstract Co-Author*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;
Ryan Ward, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer Bullen, MSc (*Abstract Co-Author*) Nothing to Disclose
Emily Knott (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine if a prostate MR Image quality improvement initiative increased the sensitivity and negative predictive value of prostate MRI for clinically significant prostate cancer (grade group [GG] =2).

**METHODS AND MATERIALS**

Single-center prospective study included patients who underwent PI-RADS compliant prostate MRI followed by MRI-guided biopsy for prostate cancer detection before and after implementation of image quality improvement measures. PI-QUAL and PI-RADS scores were performed as part of routine clinical care by 1 of 19 abdominal radiologists. MRI-targetd and/or systematic prostate biopsies were performed by 1 of 6 urologists using a transperineal approach.

**RESULTS**

There were 288 MRIs pre-intervention (before 6/5/2023) and 689 MRIs post-intervention (after 8/31/2023). Image quality improvement interventions included measures to reduce artifacts from motion and rectal gas, such as dietary restrictions and enema prior to the MRI. Scans with PI-QUAL score = 4 significantly increased after the interventions (figure 1). Compared to pre-intervention, post-intervention scans were similar with respect to patient age, scanner vendor, model, and magnetic field. The sensitivity for GG = 2 cancer detection increased from 85% (40/47) to 89% (139/157). The negative predictive value pre and post interventions was 90% (63/70 and 162/180, respectively).

**CONCLUSION**

Image quality improvement interventions resulted in a small increase in sensitivity for prostate cancer detection while the negative predictive value remained unchaged.

**CLINICAL RELEVANCE/APPLICATION**

In practice, expert readers can achive high performance for clinically significant prostate cancer detection in PI-RADS compliant MR exams, despite artifacts from motion and rectal air.

## T5A-SPGU-6 FAST PROSTATE MRI VS CONVENTIONAL MULTIPARAMETRIC PROSTATE MRI: COMPARISON AND OUTCOMES

Hussein D. Aoun, MD (*Presenter*) Reviewer, Galil Medical Ltd

**PURPOSE**

To assess whether fpMRI can potentially be utilized as a screening tool in early prostate cancer, as well as its association with PSA and available targeted biopsy results.

### METHODS AND MATERIALS

This is an IRB approved single institution retrospective review of 100 men between the ages of 50 and 80 who underwent mpMRI exams from January 2016 to May 2021. The patient population included 50 African American (AA) and 50 non-African American (non-AA) men. The mpMRI exams selected came from three categories: Group A (PI-RADS 1-2); Group B (PI-RADS 3); and Group C (PI-RADS 4-5). There were 20, 30, and 50 studies in groups A, B, C, respectively. The axial high resolution T2 weighted images and axial diffusion weighted images (fpMRI sequences) from each mpMRI exam were separated and de-identified. Two masked radiologists (R1 and R2) assigned each fpMRI case the highest possible lesion PI-RADS score. The collected fpMRI scores were then compared to the mpMRI results, PSA values, and available targeted biopsy outcomes.

### RESULTS

The median age for AA men and non-AA men was 66.5 and 66.0, respectively. The median PSA for AA men and non-AA men was 8.19 and 6.59, respectively. Median PSA for selected mpMRI groups A, B, C for AA men were 9.98, 6.79 and 8.05, respectively and 4.82, 7.15 and 7.40 for non-AA men. The concordance rates between the two fpMRI reviewers and mpMRI for groups A B, C were 0.69 (95% confidence interval [CI], 0.62 to 0.75). The Kappa statistics between the two fpMRI reviewers and mpMRI for groups A, B, C were 0.51 (95% CI,0.41 to 0.62). There were slight differences in median PSA values across groups A, B, C whether those PI-RADS groups were determined by mpMRI, by R1 fpMRI, or by R2 fpMRI. The positive predictive value (PPV) of group C for Gleason score (GS) > 7 for mpMRI, for R1 fpMRI, and for R2 fpMRI was 0.76 (= 35/46; 95% CI, 0.61 to 0.87), 0.76 (= 34/45; 95% CI, 0.60 to 0.87), and 0.79 (= 30/38; 95% CI, 0.63 to 0.90), respectively. The PPV of groups B or C combined for GS > 7 for mpMRI, R1 fpMRI, and R2 fpMRI was 0.62 (= 40/64; 95% CI, 0.50 to 0.74), 0.67 (= 40/60; 95% CI, 0.53 to 0.78), and 0.72 (= 39/54; 95% CI, 0.58 to 0.84), respectively. The negative predictive value (NPV) of group B or C combined for GS = 7 on mpMRI, R1 fpMRI, and R2 fpMRI was 100% (= 3/3; 95% CI, 29 to 100%), 100% (= 7/7; 95% CI, 59 to 100%), and 92% (= 12/13; 95% CI, 64 to 100%), respectively.

### CONCLUSION

The concordance rates, PPV and NPV between the mpMRI and fpMRI results for groups B and C were moderately high, moderately high, and very high, respectively. This pilot study suggests that a larger prospective study might be beneficial to help establish fpMRI as a screening tool for prostate cancer.

### CLINICAL RELEVANCE/APPLICATION

This study was performed to assess the overall concordance of fpMRI protocol versus mpMRI protocol.

## T5A-SPGU-7 FROM PIXELS TO REALITY: RADIOMICS-DRIVEN MACHINE LEARNING FOR ISUP CLASSIFICATION IN CLEAR CELL RENAL CELL CARCINOMA AND SHAP EXPLAINABILITY FOR FEATURE IMPORTANCE

M. Milagros Otero-Garcia, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alejandra Garcia Baizan, MD (*Abstract Co-Author*) Nothing to Disclose
Paolo N. Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Inmaculada Aymerich Lopez (*Presenter*) Nothing to Disclose

### PURPOSE

Radiomic features were widely used to develop predictive models to support clinical decisions in different pathologies. Concerning clear cell renal cell carcinoma (ccRCC), studies for its classification according to Fuhrman grade were published. However, the ISUP grade is currently used and more research should be done in that direction.The objective of this work is to determine the ISUP grade of ccRCC from the nephrographic series of abdominal CT using machine learning models with radiomic features. SHAP values will be employed to enhance explainability of the model and feature importance.

### METHODS AND MATERIALS

This is a retrospective observational study with the approval of the Local Ethics Committee. 109 patients were recruited from 2019 to 2021. Subjects with contrast-enhanced CT prior to nephrectomy as well as pathological confirmation of the diagnosis were included. The nephrographic phase of each study was selected. Tumor volumes were segmented and 105 radiomic variables for each VOI were extracted. For feature selection, the intraclass correlation coefficient of each feature was calculated using the segmentation of three radiologists. Only features with an excellent ICC were selected. Then, highly correlated variables were avoided and the MRMR (maximum relevance minimum redundancy) algorithm was used. Then, different machine learning models were trained and their performance was evaluated. SHAP values were calculated to assess the importance of the features in each decision. Python software was used.

### RESULTS

After calculating the ICC of the 105 radiomic features, 65 had an excellent ICC value. Of these, 20 were selected, as the rest were highly correlated with each other. These features were ordered according to their highest degree of relevance and least redundancy and the 5 most relevant were selected. Several machine learning models were trained with these features, using 8-fold and grid search to optimize the model hyperparameters. Among them, logistic regression was the one that had the best metrics (accuracy 81.8%, AUC 0.86). SHAP values were computed, demonstrating that Major axis length is the feature that contributed the most to the prediction.

### CONCLUSION

The ISUP grade of ccRCC can be predicted from a selection of radiomic features extracted from the CT nephrographic series. These features acted as biomarkers within a machine learning model based on logistic regression.

### CLINICAL RELEVANCE/APPLICATION

Clinical implementation of models for ISUP grade prediction of ccRCC holds promise in enhancing patient care since it could provide insight into the aggressiveness of the tumor before biopsy or surgical intervention, offering valuable guidance for clinicians in determining optimal and personalized therapeutic strategies.

## T5A-SPGU-8 IMPACT OF PROSTATE MRI IMAGE QUALITY ON DIAGNOSTIC PERFORMANCE FOR CLINICALLY SIGNIFICANT PROSTATE CANCER (CSPCA)

Yue Cheng (*Abstract Co-Author*) Nothing to Disclose
Yao Niu (*Abstract Co-Author*) Nothing to Disclose
Liang Wang, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the image quality of the main sequences in PI-RADS base on several subtle image differences and explore it’s effects on clinically significant prostate cancer(csPCa) detection, positive predictive value(PPV) and radiologist’s diagnosis in different sequences and prostate zones.

## METHODS AND MATERIALS

This single-center retrospective study included 306 patients undergoing prostate MRI prior to biopsy. All pathological specimens were reported by dedicated urogenital pathologist. csPCa was considered as Gleason=7(ISUP=2). Three readers evaluated the image quality of different aspects of each MRI sequence and compared with the PI-RADS score before biopsy and pathological results. Diagnostic accuracy and statistical significance were calculated with Wilson’s 95% confidence intervals.

## RESULTS

High-quality images had higher diagnostic accuracy and PPV of csPCa, which was more significant in T2WI and DWI. PI-RADS 3 had more poorer quality images and DWI-related image quality had a significant effect on PI-RADS classification. Regarding the relationship between prostate zone and image quality, csPCa detection rates showed statistical differences between high- and low-quality images only at the peripheral zone, while this difference was not significant at the transition zone or lesions involved both transition and peripheral zones.

## CONCLUSION

Prostate MRI quality may have an impact on the diagnostic performance. The poorer image quality is associated with lower csPCa detection rates and PPV, which can lead to an increase in radiologist’s ambiguous diagnosis (PI-RADS 3), especially for the lesions located at the peripheral zone.

## CLINICAL RELEVANCE/APPLICATION

These findings emphasize the importance of sufficient quality control of MRI scan based on the patient's own situation and clinical needs, as well as the necessity of adjusting the doctor's diagnostic strategy appropriately based on scan quality, which can be used to guide more helpful and relevant clinical decisions.

Printed on: 05/28/25

# Abstract Archives of the RSNA, 2024

T5A-SPHN

**Head & Neck Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPHN-2 CONGENITAL ISOLATED MIDDLE EAR MALFORMATION: WHAT CAN PREOPERATIVE MSCT TELL US AND WHAT CAN'T?

Chunlin Zhang (*Abstract Co-Author*) Nothing to Disclose
Jiajie Tian (*Abstract Co-Author*) Nothing to Disclose
Xiaoxi Chen (*Presenter*) Nothing to Disclose

### PURPOSE

Congenital isolated middle ear malformation (CIMEM) is extremely rare. This study aims to analyze which middle ear structural abnormalities of CIMEM can be diagnosed preoperatively on multi-slice computed tomography (MSCT) and which cannot.

### METHODS AND MATERIALS

This was a retrospective study. Patients diagnosed with CIMEM during surgery at the Affiliated Hospital of Zunyi Medical University from January 2018 to June 2023 were enrolled. All patients underwent temporal bone CT scanning before surgery using the GE Optima CT680 Series under the following conditions: 140 kV, 300 mA, slice thickness of 0.625 mm, with bone algorithm. Imaging studies were interpreted by consensus of two neuroradiologists.

### RESULTS

A total of 36 patients were included in this study, including 24 males (66.6%) and 12 females (33.3%), with a median age of 16.5 years (range: 6-48 years). A total of 43 ears underwent surgery, with 7 bilateral surgeries and 29 unilateral surgeries. Preoperative MSCT demonstrated a 100% detection rate for complete absence or deformity of the stapes superstructure, absence of the incudial long process, abnormal position of the incudial long process, abnormal or absent incudial body, absence of the incudial short process, malleus malformation, displacement and bifurcation of the tympanic segment of facial nerve canal, and adherence of the facial nerve canal to the ossicular chain. The CT detection rate for absence of the stapedial footplate and concomitant oval window atresia was 92.9%. Incudomalleolar joint fusion was observed in only 41.7% of cases on CT. Situations where CT was unable to determine included soft tissue connection between the incudial body and long process, soft tissue connection between the incudostapedial joint, and fixation of the stapedial footplate.

### CONCLUSION

Preoperative MSCT can effectively demonstrate the absence or deformity of ossicular chain components, oval window atresia, and displacement and bifurcation of the tympanic segment of facial nerve canal. However, MSCT has a lower detection rate for incudomalleolar joint fusion and cannot assess situations such as soft tissue connection between ossicles and fixation of the stapedial footplate.

### CLINICAL RELEVANCE/APPLICATION

This study can provide imaging guidance for clinical doctors in the preoperative management of CIMEM.

## T5A-SPHN-4 SPONTANEOUS CUTANEOUS EXTRUSION OF PAROTID GLAND STONE: A CASE REPORT AND LITERATURE REVIEW

Mashael M. Alharthi, MBBS,MBBS (*Abstract Co-Author*) Nothing to Disclose
Ghouth A. Waggass, MBBS (*Abstract Co-Author*) Nothing to Disclose
Abdulmalik Abumohssin, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

The parotid gland is an exocrine salivary gland composed of superficial and deep lobes within a facial capsule.The formation of stone within the salivary ducts is termed sialolithiasis; 5-20 percent arise in the parotid glands. Clinically present with pain and swelling but may be asymptomatic. Diagnostic workups include imaging and direct visualization with sialoendoscopy. Treatment regimens include parotid gland resection, extracorporeal shock-wave lithotripsy (ESWL), and transoral duct surgery (TDS).

### METHODS AND MATERIALS

The purpose of the study is to discuss a case of parotid gland stone migration with cutaneous extrusion and provide a literature review.Literature review: searched using PubMed, Google Scholar, and ScienceDirect, along with a manual review of references. Articles were limited to those in the English language.

**RESULTS**

A 50-year-old male with a background of hypertension was referred to the ENT clinic at our hospital due to left-side recurrent parotitis for the last two years that was treated by antibiotics. The patient presented with painless swelling. The clinical exam showed stable vital signs, a small firm, non-tender, palpable 1-2 cm mass on the left parotid areas, and no palpable lymph nodes. The facial nerve is intact, and the bimanual exam didn't show any purulent discharge. CT Neck from outside was provided, and two small stones were shown along the course of the left parotid duct. A 16-month follow-up CT scan shows cutaneous migration and extrusion of the previously described stone. Otherwise, there are no signs of acute inflammation. Ultrasound correlation showed calcified subcutaneous focus in the area of concern with a small amount of fluid collection. The sialogram showed complete occlusion of the Stenson's duct on the left without visualization of the parotid gland. On operation day, the patient brought the stone intact in a box. It was spontaneously extruded without the intention of removing it. The texture was hard with a trace of blood stain on it; the wound site did not completely heal, but there were no signs of active infection or bleeding.

**CONCLUSION**

Parotid gland stones are rare entities compared to submandibular stones.Our case is seventh in the medical literature.CT scan can be used for stone localization and follow-up.

**CLINICAL RELEVANCE/APPLICATION**

Conservative management can be considered in uncomplicated parotid gland stones.

## T5A-SPHN-5 FEASIBILITY OF ELECTRON DENSITY MAP DERIVED FROM UNENHANCED DUAL-ENERGY CT FOR DETECTING PERITONSILLAR ABSCESS

Koji Takumi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ryota Nakanosono, MD (*Abstract Co-Author*) Nothing to Disclose
Tsubasa Nakano (*Abstract Co-Author*) Nothing to Disclose
Ryoji Yamagishi (*Abstract Co-Author*) Nothing to Disclose
Junki Kamizono (*Abstract Co-Author*) Nothing to Disclose
Takuro Ayukawa (*Abstract Co-Author*) Nothing to Disclose
Hiroto Hakamada (*Abstract Co-Author*) Nothing to Disclose
Fumiko Kanzaki (*Abstract Co-Author*) Nothing to Disclose
Takashi Yoshiura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kiyohisa Kamimura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Fumitaka Ejima (*Abstract Co-Author*) Nothing to Disclose
Hiroaki Nagano, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the feasibility of electron density (ED) map derived from unenhanced dual-energy CT (DECT) for detecting peritonsillar abscess.

**METHODS AND MATERIALS**

This study included 116 consecutive patients who were clinically suspected of peritonsillar abscess and underwent DECT (99 abscesses and 17 tonsillitis). The final diagnosis of peritonsillar abscess was determined by typical imaging findings on contrast-enhanced CT. A board-certified radiologist evaluated the presence or absence of peritonsillar abscess on unenhanced conventional 120-kVp images (CTconv), 70- and 40-keV virtual monochromatic images (VMIs), and ED map by using a 4-point diagnostic score as follows: 4, highly likely; 3, likely; 2, unlikely; and 1, highly unlikely. For each image, cases rated as 3 or 4 on the diagnostic s score were defined as with peritonsillar abscess, while those rated as 1 or 2 were defined as without abscess. The contrast-to-noise ratio (CNR) of abscess lesions was calculated using the following formula: CNR= [adjacent tonsils - abscess center]/ [standard deviation in adjacent tonsils]. In cases confirmed to have peritonsillar abscess, the diagnostic score was compared between unenhanced CTconv and DECT images using the Mann-Whitney U test. CNR was also compared using the paired t-test. In addition, sensitivity, specificity, and diagnostic accuracy of peritonsillar abscess were calculated for each image and their diagnostic performances were compared by the McNemar test.

**RESULTS**

The diagnostic score for detecting peritonsillar abscess and CNR for ED map were significantly greater than those for CTconv (both, $p < 0.001$). The sensitivity, specificity, and accuracy for diagnosing peritonsillar abscess were 62.2%, 83.3%, and 65.5% for CTconv, respectively; and 78.6%, 83.3%, and 79.3% for ED map. The accuracy of ED map was significantly greater than that of CTconv ($p < 0.001$).

**CONCLUSION**

ED map derived from unenhanced DECT may enable efficient identification of peritonsillar abscess without the use of contrast agents.

**CLINICAL RELEVANCE/APPLICATION**

ED map provides useful information to detect peritonsillar abscess without the use of contrast agents.

# Abstract Archives of the RSNA, 2024

T5A-SPIN

**Imaging Informatics Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPIN-2 MULTI-RESOLUTION CHEST X-RAY DIFFUSION MODEL WITH RADIOLOGY REPORT CONDITIONING: AN OPEN SOURCE MODEL-AS-A-DATASET

Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Pouria Rouzrokh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Leo Anthony Celi (*Abstract Co-Author*) Research Consultant, Koninklijke Philips NV
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Cody Wyles, MD (*Abstract Co-Author*) Nothing to Disclose
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Theodorus Dapamede, MD, PhD (*Abstract Co-Author*) Intern, MARS BioImaging Ltd
Sanaz Vahdati, MD (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Saptarshi Purkayastha, PhD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

Synthetic data generation plays a crucial role in enhancing model explainability and performance improvement in medical imaging. We present an open-source diffusion model capable of generating multi-resolution chest radiographs conditioned on radiology reports, serving as a model-as-a-dataset for the research community to leverage and develop upon.

### METHODS AND MATERIALS

A Matryoshka diffusion model was developed and trained on the MIMIC-IV dataset containing 220,000 chest radiographs. The model generates multi-resolution images (642, 2562, 10242) and can be extended to higher resolutions. Conditioning is based on the findings section of radiology reports embedded using the publicly available OpenAI large embedding model, which enables more detailed image descriptions compared to previous works conditioned only on the impression section. The model was trained to support positive and negative prompts, allowing for the disentanglement of image attributes and removal of confounding factors. Additionally, the model's output is post-processed by an image de-identification algorithm to ensure robustness and remove potential PHIs.

### RESULTS

It cost $2.14 to embed the 16 million tokens of all MIMIC-IV CXR reports. Generating 1000 images (all three resolutions) takes 14.8 minutes. A review of 50 generated 10242 images and 50 real cases revealed a discrimination rate of 58%. The Fréchet Inception Distance (FID) of 5,000 generated images, a metric quantifying the quality and diversity of the generated images (lower is better), was 2.4 for 642, 6.8 for 2562, and 18.7 for 10242 images. These FID scores significantly outperform the previously reported value of 54.9. Additionally, the model’s capabilities in inpainting were evaluated based on text prompts; whereby an area of the CXR is marked by the user and asked to be filled with a specific pathology.

### CONCLUSION

We developed an open-source multi-resolution chest X-ray diffusion model with granular conditioning on radiology reports findings, demonstrating high-quality image generation, with low FID. This model-as-a-dataset approach enables researchers to generate synthetic chest X-rays with desired characteristics, facilitating model explainability and performance improvement.

### CLINICAL RELEVANCE/APPLICATION

The proposed model serves as a valuable tool for radiologists and researchers, enabling the generation of diverse, high-resolution chest X-rays with specific pathologies and characteristics. Besides its educational value, this can aid in the development and validation of computer-aided diagnosis systems and support research on rare pathologies. The open-source nature of the model fosters collaboration and accelerates advancements in the field of medical imaging.

## T5A-SPIN-3 MODEL-AGNOSTIC EXPLANATIONS FROM A DEEP-LEARNING COX MODEL SUGGEST THAT FIRST-ORDER AND GRAY-LEVEL RADIOMIC FEATURES ARE THE BEST PREDICTORS OF SURVIVAL IN PATIENTS WITH NON-SMALL CELL LUNG CANCER

Suhrud Panchawagh (*Abstract Co-Author*) Nothing to Disclose
Ashish L. Atre, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Lung cancer is the highest cause of mortality among all cancers. Literature suggests that the 5-year survival rate for non-small cell lung cancer ranges from 17% to 37%. Given the aggressive nature of the malignancy, counseling the patients and their relatives regarding survival times takes precedence. Radiomics involves extracting large quantities of features from medical images using data-characterization algorithms, aiding in disease diagnosis and treatment predictions. We propose a deep-learning survival model relying on radiomic high-resolution computed tomography features to estimate survival time.

**METHODS AND MATERIALS**

We comprehensively analyzed 422 CT scans from the NSCLC-Radiomics dataset from The Cancer Imaging Archive. Expert radiologists meticulously segmented primary neoplasms. Using PyRadiomics, we extracted 2446 radiomic features and retained 104 after ensemble feature selection. We used a Cox proportional hazards (Cox PH) framework, parameterized with a multi-layer perceptron neural network, to analyze survival data by adjusting the baseline hazard function based on the provided covariates. Model hyperparameters were optimized using a validation set. Local interpretable model-agnostic explanations (LIME) were used to explain model predictions.

**RESULTS**

The median age of the participants was 69 years, and 31% were females. The median survival time was 1.53 years, and 89% of deaths occurred during the study duration. The model achieved a time-dependent concordance score of 0.98, an integrated Brier score of 0.011, and an integrated negative binomial log-likelihood score of 0.04. LIME revealed that the gray-level size zone matrix, gray-level dependence matrix, and first-order features passed through original and local binary pattern filters were the most responsible for survival.

**CONCLUSION**

Our multi-layer perceptron survival model revealed excellent performance metrics. Tumor heterogeneity and coarseness explained patient survival the most. Further model refinements can be done using more extensive multicentric data, hand-crafting feature selection, tuning model hyperparameters well, and observational studies using this model in clinical settings.

**CLINICAL RELEVANCE/APPLICATION**

Current tools estimating survival times rely primarily on subjective estimates, considering clinical features, imaging, and histopathological examination. To the best of our knowledge, no quantitative objective estimate exists to estimate survival times specific to the patient. Integrating such robust models into clinical practice could substantially enhance the accuracy of survival predictions, thereby supporting more personalized treatment planning.

## T5A-SPIN-4 ACUTE PULMONARY EMBOLISM RISK STRATIFICATION BASED ON IMAGING, LABORATORY AND CLINICAL DATA USING MACHINE LEARNING: A PILOT STUDY

Jiri Weichet, MD (*Abstract Co-Author*) Nothing to Disclose
Hana Malikova, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Michal Buk, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Scoring systems for acute PE (pulmonary embolism) risk assessment, such as the Simplified Geneva Score (SGS), pulmonary embolism rule-out criteria (PERC) or age-adjusted D-Dimer value (DD), are together with clinical experience commonly used to indicate CT pulmonary angiography (CTPA), the gold standard diagnostic test for PE. However, they are based mainly on empirical evidence and domain knowledge and are inherently simplistic, disregarding relative importance and relationships between clinical and/or laboratory parameters they are based on. This commonly leads to overuse of CTPA, meaning unnecessary burden of the patient with ionizing radiation and iodine contrast, and associated costs. The aim of this study is to use clinical and laboratory data of patients who underwent CTPA for suspected PE and construct a model using machine learning for predicting high risk PE patients.

**METHODS AND MATERIALS**

Our dataset contained 690 patients with suspected PE who underwent clinical and laboratory examination and subsequent CTPA. In total 27 clinical and laboratory parameters were gathered. An experienced radiologist assessed the CTPA for presence of PE and assigned a score according to the most proximal level of the pulmonary vasculature where PE was present, which served as the ground truth. For the training group, 551 patients were randomly selected, and the remaining 139 served as the test group. A classification model using the XGBoost algorithm was trained to assess the probability of PE, using a threshold value to label high risk patients. Using the same test group, the SGS was also calculated, labeling the patient as high risk in case of SGS = 3 and/or elevated age-adjusted DD.

**RESULTS**

Using SGS in combination with DD to estimate high risk PE patients yielded 27 true positive, 95 false positive, 15 true negative and 2 false negative results, which translates to 93.1 % sensitivity and 13.64 % specificity. Using our model to predict high risk PE patients yielded 35 true positive, 59 false positive, 44 true negative and 1 false negative result, which translates to 97.22 % sensitivity and 42.72 % specificity. When comparing these two, there were 22.86 % more true positive, 61.02 % less false positive, 65.91 % more true negative and 100 % (1 case) less false negative results using our model.

**CONCLUSION**

On our test group, our model outperforms the gold standard of SGS and DD for selecting high risk PE patients, mainly producing significantly less false positive results, therefore having much higher specificity, and slightly increased sensitivity.

**CLINICAL RELEVANCE/APPLICATION**

When applied to clinical practice using this model might reduce the number of unnecessary CTPA examinations and could be more precise than previous empirically based PE risk assessment tools.

## T5A-SPIN-5 CONSTRUCTION OF A SYSTEM TO PREVENT CONTRAST AGENT MISADMINISTRATION USING A.I. AND COMPARISON BETWEEN SMART GLASSES AND FIXED-POINT CAMERAS

Michimasa Suzuki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Satoru Kawai (*Abstract Co-Author*) Nothing to Disclose
Noboru Hojo (*Abstract Co-Author*) Nothing to Disclose
Chinatsu Ozawa (*Abstract Co-Author*) Nothing to Disclose
Kenzo Muroi (*Abstract Co-Author*) Nothing to Disclose
Shinsuke Kyogoku, MD,PhD (*Abstract Co-Author*) Nothing to Disclose

TAKASHI OMINO (*Abstract Co-Author*) Nothing to Disclose
Kazuya Abe (*Presenter*) Nothing to Disclose

**PURPOSE**

Iodine contrast media used in CT and other procedures can cause serious side effects such as anaphylactic shock. If a patient has had an adverse reaction to a contrast agent in a previous examination, the use of the same contrast agent is contraindicated due to the risk of recurrence of the adverse reaction. Therefore, the patient is interviewed and the history of side effects is checked prior to the examination, and a different contrast agent is used if there is an adverse reaction and its use is clinically unavoidable. However, there have been incidents in which the same contrast agent was administered as the one with a history of side effects due to insufficient confirmation. Currently, there is no system specifically designed to prevent such incidents. Therefore, we have developed a system that analyzes images from a fixed-point camera and smart glasses, and sounds an alarm when a specified contrast syringe is used. We compared the two systems and report the results.

**METHODS AND MATERIALS**

The real-time object detection algorithm YOLO (You Only Look Once), which is deep learning, was used for detection. The contrast syringe used to construct the model was a four-material type adopted by the hospital. The fixed-point camera was set up so that the CT system and the bed could be seen and the examination room could be seen widely. The patient wore smart glasses, held the contrast syringe in his hand, and moved around the bed to take images. A total of 377-412 images were prepared for the study. The Microsoft annotation tool Vott was used to annotate the images. These images were used to build the model. The alert sounding system was created in Python.

**RESULTS**

All formulations were more detectable with the smart glasses than with the fixed-point camera. In addition, data trained with both images performed better than data trained with each image alone.

**CONCLUSION**

The system was developed and verified to prevent misadministration. Smart glasses were superior to fixed-point cameras in detection. If the fixed-point camera can also sufficiently satisfy factors such as installation location, it will be possible to reduce the misadministration of contrast media.

**CLINICAL RELEVANCE/APPLICATION**

Currently, there is no system specifically designed to prevent the administration of contraindicated contrast agents. Being able to identify the syringe from the video image would be a protective barrier to prevent human error.

## T5A-SPIN-6 HIPAA-COMPLIANT OPEN-SOURCE LARGE LANGUAGE MODELS (LLMS) FOR RADIOLOGY REPORT ANNOTATION: A COMPREHENSIVE ANALYSIS OF MODEL SIZE, PROMPTING STRATEGIES, AND PATHOLOGY COMPLEXITY

Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Amirali Khosravi (*Abstract Co-Author*) Nothing to Disclose
Frank Li (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Seyed Mohammadreza Chavoshi, MD (*Abstract Co-Author*) Nothing to Disclose
Theodorus Dapamede, MD, PhD (*Abstract Co-Author*) Intern, MARS BioImaging Ltd
Babajide Owosela (*Abstract Co-Author*) Nothing to Disclose
Anirudh Bikmal (*Abstract Co-Author*) Nothing to Disclose
Sara Garg (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Abstract Co-Author*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;
Saptarshi Purkayastha, PhD (*Abstract Co-Author*) Nothing to Disclose
Bardia Khosravi, MD, MPH (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the impact of model size and chain-of-thought (CoT) prompting on the performance and efficiency of open-source, HIPAA-compliant large language models for annotating chest radiograph reports with varying degrees of pathology complexity.

**METHODS AND MATERIALS**

A random subset of 2,000 chest radiograph reports from MIMIC-IV, a publicly available dataset, was manually annotated. These were used to evaluate the performance of open-source LLMs: Phi-3 (3B), Zephyr-beta (7B), Llama-3 (8B and 70B variants). The reports were annotated for three pathologies with increasing complexity: pneumothorax (simplest; explicitly mentioned in text), rib fracture (moderate; requires distinguishing from other fractures like scapula), and cardiomegaly (most complex; necessitates deduction from patient results, e.g., enlarged cardiac silhouette). Models were tested with and without CoT prompting on an A100 GPU, assessing performance metrics and compute time.

**RESULTS**

Without CoT, Phi-3, Zephyr, and Llama-3-8B processed each report (with three pathologies) in 0.6s, while Llama-3-70B took 2.6s (4 times slower). With CoT, each report was analyzed in 32.3s with Llama-3-70B, 13.8s by Zephyr and Llama-3-8B, and 10.8s by Phi-3. Larger models generally outperformed smaller ones, with the 70B model achieving the highest F1 scores and NPVs across all pathologies. CoT improved average sensitivity by 0.44% to 1.73% for larger models (7-70B) but decreased it by 19.03% for the smallest model (3B), likely due to hallucinations based on the generated reasonings. For the simplest pathology (pneumothorax), medium-sized models (7B and 8B) performed very well, with sensitivities >95%, suggesting their adequacy for easier pathologies that involve simple text searches.

**CONCLUSION**

Model size significantly influenced performance, especially for complex pathologies like cardiomegaly. While CoT prompting slightly enhanced performance for larger models, the gains were negligible. Compute time increased with model size and CoT usage, presenting a trade-off between performance and efficiency.

**CLINICAL RELEVANCE/APPLICATION**

Our research provides insights into optimizing open-source LLM selection and prompting strategies for automated radiology report annotation while maintaining HIPAA compliance. Researchers can make informed decisions when implementing these technologies in their workflows by considering pathology complexity, model size, and computational resources. While we recognize the potential of large, open-source language models for various radiology tasks, there is no one-size-fits-all highlighting a need for careful model selection and prompting.

## T5A-SPIN-7 STUDY ON THE TEXT-CNN CLASSIFICATION OF DIAGNOSIS REPORT ON LUNG CT AND THE RECOMMENDATION OF ACR ENCODING

Zhangzhen Shi (*Abstract Co-Author*) Nothing to Disclose
Lihui Zu (*Abstract Co-Author*) Nothing to Disclose
Jingxin Liu (*Abstract Co-Author*) Nothing to Disclose
Dong-Hong An (*Presenter*) Nothing to Disclose

### PURPOSE

To use text-CNN to automatically classify the conclusions of lung CT report, and to automatically recommend ACR coding of Radiology Diagnostic conclusions in local language.

### METHODS AND MATERIALS

A total of 80,000 lung CT diagnostic reports (2017-2023), were downloaded from the RIS-PACS system of the hospital's data center. The conclusion part of the diagnostic report in local language was subjected to text preprocessing, including text cleaning, word segmentation in local language, and word frequency analysis. According to the local language version of ACR encoding, obtain the training grouping scheme for diagnostic disease name corresponding to the keywords in local language. The content includes 10 common lung diseases, including nodules, calcification, inflammation, fibrosis, fluid accumulation, emphysema, bullae, fractures, deposition, tuberculosis, etc. Chunk the conclusion of the report according to periods or semicolons. Query and group a single sentence according to the above 10 disease groups, generate a single label dataset, and obtain a total of 255,026 samples. Quantify each sentence in the text. Complete the sample dataset and divide it into training and validation sets in an 8:2 ratio. Train the text-CNN model. Also, We compared the text-CNN classification and ACR code recommendation with the fast-CNN model which were generated simultaneously. In the experiment, Python 3.7, tensorflow 2.0, pandas 1.3.5, sklearn 1.0, jieba 0.42.1, seaborn 0.12.2, etc. were used.

### RESULTS

By Training, fine-tuning, we obtained a text-CNN model, which embedding dimension is 20, number of convolution kernels is 32, and convolution kernel size is [2,3,4]. For the validation set, the recognition rate can reach 75%. The recognition rate of the fast-CNN model is 72%

### CONCLUSION

Machine learning methods such as text-CNN can be used to automatically recommend ACR codes for conclusions of radiology diagnostic reports in local language and accelerate the encoding speed of report's conclusions in the RIS system . Clarify the accumulated data on the daily RIS stock over the past decade. Improve RIS-PACS data reuse performance. Create a good conditions for the clinical, educational, and scientific application of RIS-PACS data. Specially creating a good conditions for the jointed training of text-image AI models in RIS-PACS.

### CLINICAL RELEVANCE/APPLICATION

This research may improve reuse performance of RIS-PACS data and create a good conditions for the clinical, educational, and scientific application of RIS-PACS data.

## T5A-SPIN-8 CHATGPT ON ACR APPROPRIATENESS CRITERIA: CAN CONTEXTUALIZED GPT OUTPERFORM HUMANS IN ASSESSING MUSCULOSKELETAL MRI SCAN REQUEST APPROPRIATENESS?

Jin Rong Tan, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Gita Y. Karande, MMEd, FRCR (*Abstract Co-Author*) Nothing to Disclose
Keefe Lai, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Lai-Peng Chan, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Anh N. Tran (*Abstract Co-Author*) Nothing to Disclose
May S. Mak, MBChB, FRCR (*Abstract Co-Author*) Nothing to Disclose
Sudharsan Madhavan, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Large Language Models (LLM) are potentially useful clinical decision support tools, especially when grounded with domain-specific knowledge. In radiology, there is currently limited evidence regarding LLM solutions to assess imaging appropriateness. The purpose of this study is to evaluate a contextualized LLM's performance in assessing musculoskeletal MRI scan request appropriateness, and to compare LLM performance against humans across a range of clinical experience.

### METHODS AND MATERIALS

A contextualized LLM with GPT-4 to validate the appropriateness of MRI scan orders within clinical contexts was developed. To mitigate hallucination and enhance LLM knowledge, a retrieval-augmented generation framework was used to equip the LLM with a domain-specific knowledge base constructed from 33 American College of Radiology Appropriateness Criteria guidelines for musculoskeletal conditions. A test dataset of 70 fictional case scenarios was created based on the same guidelines, including cases with insufficient clinical information to justify a scan request. Quantitative evaluation using the McNemar mid-P test was performed, comparing standard GPT-4, contextualized GPT-4, and human clinicians, including two subspecialist radiologists, two radiology trainees, and an orthopaedic surgeon. Qualitative assessment compared the output of standard (non-RAG) GPT-4 with the contextualized model.

### RESULTS

The contextualized model achieved an accuracy of 88.57%, and demonstrated statistically significant superior performance compared to the human radiology trainees, orthopaedic surgeon and standard GPT-4 model. It had numerically superior performance compared to two radiologists, although not statistically significant. The standard GPT-4 model achieved an accuracy of 55.71%, and demonstrated inferior performance compared to the subspecialist radiologists and a radiology trainee. Notably, the contextualized model correctly identified all cases which had insufficient clinical information, whereas the standard GPT-4 LLM could not.

### CONCLUSION

A contextualized LLM is more effective than a standard LLM in assessing scan appropriateness based on ACR guidelines. Contextualized LLM outperformed human respondents including subspecialist radiologists, emphasizing their potential as a clinical decision support tool.

### CLINICAL RELEVANCE/APPLICATION

A chatbot grounded with domain-specific knowledge of imaging appropriateness guidelines is more effective than a standard model, and outperformed human respondents including subspecialist radiologists in assessing musculoskeletal MRI scan appropriateness.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

T5A-SPIR

**Interventional Radiology Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPIR-5 TRANSJUGULAR INTRAHEPATIC PORTOSYSTEMIC SHUNT COMBINED WITH VARICEAL EMBOLIZATION REDUCES THE RISK OF REBLEEDING FOR PATIENTS WITH POST-TIPS PPG GREATER THAN 12 MMHG

Chuansheng Zheng, MD (*Abstract Co-Author*) Nothing to Disclose
Yaowei Bai (*Presenter*) Nothing to Disclose

### PURPOSE

The consensus on whether Transjugular intrahepatic portosystemic shunt (TIPS) should be combined with variceal embolization in the treatment of portal hypertension bleeding has not yet been reached. This study aimed to compare the difference in rebleeding incidence between TIPS and TIPS combined with variceal embolization and to analyze the optimal population for variceal embolization.

### METHODS AND MATERIALS

Clinical data of 721 patients undergoing TIPS creation were retrospectively collected. After screening based on inclusion and exclusion criteria, 406 patients were included. Patients were divided into two groups according to whether TIPS combined with variceal embolization was performed: TIPS group (n=155) and TIPS+E group (n=251). Kaplan-Meier (KM) curves were used to analyze prognostic differences between the two groups, and subgroup analysis was conducted based on post-TIPS portal pressure gradient (PPG) exceeding 12 mmHg.

### RESULTS

After TIPS placement, the mean PPG significantly decreased for all patients (27.4±6.1 mmHg vs. 12.2±4.6 mmHg, P<0.001). A total of 51 patients (12.6%) experienced rebleeding, with 24 cases (15.9%) in the TIPS group and 27 cases (10.6%) in the TIPS+E group. There was no significant difference in cumulative rebleeding incidence between the TIPS+E and TIPS groups (HR=0.69, 95%CI=0.39-1.21, Log-rank P=0.18). In the subgroup with post-TIPS PPG greater than 12 mmHg, the cumulative rebleeding incidence was significantly lower in the TIPS+E group compared to the TIPS group (HR=0.47, 95%CI=0.24-0.93, Log rank P=0.026). In the subgroup with post-TIPS PPG less than 12 mmHg, there was no significant difference in cumulative rebleeding incidence between the two groups.

### CONCLUSION

For patients with post-TIPS PPG exceeding 12 mmHg, simultaneous variceal embolization with TIPS placement is recommended to significantly reduce the risk of post-TIPS rebleeding.

### CLINICAL RELEVANCE/APPLICATION

For patients with post-TIPS PPG exceeding 12 mmHg, simultaneous variceal embolization with TIPS placement is recommended to significantly reduce the risk of post-TIPS rebleeding.

## T5A-SPIR-6 MANAGEMENT OF MALIGNANT BILIARY OBSTRUCTION BY IMPROVING BILIARY STENTING WITH ZINC-SIROLIMUS-LOADED BIODEGRADABLE STENTS

Jung-Hoon Park, PhD (*Abstract Co-Author*) Nothing to Disclose
Yubeen Park (*Abstract Co-Author*) Nothing to Disclose
Dong-Sung Won, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Biodegradable biliary stents (BDBS) have emerged as a potential alternative, addressing concerns regarding stent removal in patients with unresectable malignant biliary obstruction (MBO). However, stent-induced tissue hyperplasia and biofilm formations challenges for removal. Drug-eluting multifunctional stents, incorporating silver nanoparticles, sirolimus (SRL), and paclitaxel have been demonstrated potential to mitigating these obstacles; however, translating these benefits into clear clinical efficacy remains challenging. This study aims to assess the efficacy and safety of Zn-SRL-loaded BDS in inhibiting tissue hyperplasia and bacterial activity in the rabbit common bile duct (CBD).

### METHODS AND MATERIALS

Polycaprolactone (PCL) composite with silica was fabricated with BDBS using a 3D printing system, subsequently coated with either SRL or Zn-SRL. The multi-functionalized stents were comprehensively characterized, including evaluation of surface properties, mechanical behavior, degradation and drug release kinetics, antibacterial efficacy, and cellular biocompatibility. Twenty male New Zealand white rabbits were divided into four groups: PCL, fPCL, SRL@fPCL, and Zn-SRL@fPCL. Hematological examination, cholangiography, and histological analysis were performed to evaluate mucosal changes and stent patency.

**RESULTS**

The multi-functionalized stents were exhibited tunable mechanical properties and sustained released kinetics to inhibit the bacterial activity and cytotoxicity. Stent placement was successful in all cases without complications. Jaundice was observed at 10-18 d in six rabbits in the PCL (n = 3), fPCL (n = 2), and SRL@fPCL (n = 1) groups. Cholangiography showed luminal narrowing and sludge formation in the PCL and fPCL groups, and stent patency was well preserved in the Zn-SRL@PCL group than in SRL@PCL group. Hematological and histological findings differed significantly among the groups ($p < 0.05$).

**CONCLUSION**

Application of SRL and Zn in fPCL significantly inhibited tissue hyperplasia and biofilm formation, resulting in well preserved stent patency without hepatobiliary dysfunction in rabbit CBD. Multi-functionalized BDBSs offer therapeutic potential of preventing stent-related complications and obviating the need for stent removal in inoperable patients.

**CLINICAL RELEVANCE/APPLICATION**

Zn-SRL-loaded BDBS show promise in reducing stent-induced tissue hyperplasia and biofilm formation in biliary stenting, potentially improving patency and decreasing complications in patients with MBO.

## T5A-SPIR-7 3D AUTOMATIC BODY COMPOSITION ANALYSIS TO PREDICT THE RISK OF POST-TIPS OVERT HEPATIC ENCEPHALOPATHY: A MULTICENTER STUDY

Xiaoqiong Chen (*Abstract Co-Author*) Nothing to Disclose
Shuoling Zhou (*Abstract Co-Author*) Nothing to Disclose
Jinqiang Chen (*Abstract Co-Author*) Nothing to Disclose
Yujie Zhao (*Abstract Co-Author*) Nothing to Disclose
Meiyan Huang (*Abstract Co-Author*) Nothing to Disclose
Sirui Fu, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Hepatic encephalopathy (HE) after transjugular intrahepatic portosystemic shunt (TIPS) placement is highly prevalent and refractory; therefore, patients should be screened preoperatively. This study aimed to construct a malnutrition model based on a three-dimensional (3D) automatic assessment of skeletal muscle and fat tissues to predict overt HE post-TIPS.

**METHODS AND MATERIALS**

A total of 459 patients undergoing TIPS from five hospitals were divided into training (N=308) and external validation (N=151) groups. For subsequent comparison of the self-developed 3D (T12 to the L3 vertebrae) and existing two-dimensional (2D; at the middle level of the L3 vertebrae) assessment methods, we performed 3D automatic and 2D manual segmentation of muscle and fat tissues using preoperative computed tomography images, respectively. Next, we extracted their morphological and radiomic features and constructed the 3D-auto and 2D-manual MF Models. After comparing the two models via discrimination and calibration, we selected the better-performing method. Based on 26 clinical indicators, 26 morphological features, and 2,102 radiomic features, we developed the Clinical, 3D-auto MF, and Integrated Models, using LASSO and logistic regression. The optimal model was determined via discrimination and calibration.

**RESULTS**

First, for the assessment method of muscle and fat tissues, in discrimination the area under the curve (AUC) of the 3D-auto compared to the 2D-manual Model was 0.769 vs. 0.666 in the training set and 0.763 vs. 0.597 in the validation set. Meanwhile, the 3D-auto method performs better in terms of calibration curves. Therefore, we selected 3D-auto segmentation as the final assessment method for muscle and fat tissues. The Clinical Model incorporated two indicators. The 3D-auto MF Model incorporated nine indicators: four morphological and five grayscale-related radiomic features. The Integrated Model combined all these 11 indicators. Among these three models, the Integrated Model had a higher AUC than the Clinical and 3D-auto MF Models, both in the training (0.813 vs. 0.684 vs. 0.769) and validation sets (0.801 vs. 0.672 vs. 0.763); the Integrated Model also showed superior performance in the Delong test, net reclassification improvement, and integrated discrimination improvement. Similar results were observed for calibration.

**CONCLUSION**

We successfully developed a high-performance predictive model for overt HE post-TIPS, based on 3D automatic muscle and fat tissue assessment.

**CLINICAL RELEVANCE/APPLICATION**

Compared to 2D manual assessment, 3D automatic assessment of skeletal muscle and fat tissues could provide further information for the prediction of overt HE post-TIPS, thereby assisting in better patient selection for TIPS.

## T5A-SPIR-9 EFFICACY OF UTERINE ARTERY EMBOLIZATION USING GELATIN SPONGE PARTICLES FOR THE TREATMENT OF UTERINE LEIOMYOMA - A SYSTEMATIC REVIEW AND META-ANALYSIS

Obaid Ur Rehman (*Abstract Co-Author*) Nothing to Disclose
Eeshal Fatima (*Abstract Co-Author*) Nothing to Disclose
Zain Nadeem (*Abstract Co-Author*) Nothing to Disclose
Arsalan Nadeem, MBBS (*Abstract Co-Author*) Nothing to Disclose
Eeman Ahmad (*Abstract Co-Author*) Nothing to Disclose
Umar Akram (*Abstract Co-Author*) Nothing to Disclose
Ali Husnain, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Uterine leiomyoma is a benign tumor that, in addition to medical and surgical interventions, can be treated by uterine artery embolization (UAE). One of the embolic agents used for UAE is gelatin sponge particles. We aim to conduct a systematic review and meta-analysis to assess the efficacy of UAE using gelatin sponge particles.

**METHODS AND MATERIALS**

We reviewed PubMed, Embase, Scopus, and Google Scholar from the inception of the databases to April 2024. The inclusion criterion was the use of gelatin sponge particles for UAE in leiomyoma patients. Studies reporting outcomes such as mean reduction in the dominant leiomyoma volume and improvement in menorrhagia, dysmenorrhea, and bulk-related symptoms were included.

## RESULTS

Five studies involving a total of 391 participants were included in the analysis. Pooled proportion of mean reduction in the dominant leiomyoma volume was 42.17% at 3 months (95% CI: 33.65-50.68), 53.37% at 6 months (95% CI: 47.89-58.86), and 58.71% at 12 months (95% CI: 47.38-70.04). Pooled proportion of improvement in menorrhagia was 88% (95% CI: 85-91) at 3 months, 95% at 6 months (95% CI: 70-100), and 98% at 12 months (95% CI: 92-100). Pooled proportion of improvement in dysmenorrhea was 90% at 3 months (95% CI: 53-100), 96% at 6 months (95% CI: 66-100), and 89% at 12 months (95% CI: 61-100). Pooled proportion of improvement in bulk-related symptoms was 90% at 3 months (95% CI: 74-99) and 99% at 6 (95% CI: 92-100) as well as at 12 months (95% CI: 95-100).

## CONCLUSION

UAE using gelatin sponge particles is an effective treatment option for managing uterine leiomyoma. It significantly improves menorrhagia, dysmenorrhea, and bulk-related symptoms, which are symptoms related to increasing tumor size.

## CLINICAL RELEVANCE/APPLICATION

UAE using gelatin sponge particles for treating uterine leiomyoma is a promising intervention. This meta-analysis establishes its efficacy in reducing the tumor burden, in addition to improving menorrhagia, dysmenorrhea, and bulk-related symptoms.

# Abstract Archives of the RSNA, 2024

T5A-SPMK

**Musculoskeletal Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPMK-1 ASSOCIATION OF TIBIAL SLOPE ALTERATIONS WITH ANTERIOR CRUCIATE LIGAMENT (ACL) INJURY AND MUCOID DEGENERATION

Shuda Xia (*Abstract Co-Author*) Nothing to Disclose
Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Flavio Duarte Silva (*Abstract Co-Author*) Nothing to Disclose
Mahad Rehman, BS, BA (*Abstract Co-Author*) Nothing to Disclose
Varun Ravi, BA (*Presenter*) Nothing to Disclose

### PURPOSE

To determine the association of tibial slope (TS) alterations at the knee with ACL lesions by comparing radiographic measurements of lateral TS (LTS), medial TS (MTS), and coronal TS (CTS) with MRI defined intact, injured, and mucoid-degenerated native ACL knees and determine inter-reader reliability.

### METHODS AND MATERIALS

Patient records from two years at tertiary care hospitals were reviewed for individuals aged 18-100 who underwent both 3-Tesla knee MRI and radiographs. Two randomly selected cohorts, control, and pathologic ACLs on MRI with 86 patients each, were matched by age, gender, and BMI. A fellowship trained musculoskeletal radiologist revaluated all curated images, and characterized the ACL as normal, partially torn, completely torn, or having mucoid degeneration considering available reports from electronic health records. Two trained medical students independently collected clinical information and measured slopes on radiographs, blinded to the clinical and MRI findings. Intra-class correlation coefficient (ICC) estimates and case-control matching were done with the SPSS statistical package. ICC and analysis of variance were used for comparisons.

### RESULTS

Among 172 patients with 172 MRIs and radiographs, there were 86 controls and 86 ACL lesions. There were 108/172 (62.79%) males and 64/172 (37.21%) females. ICCs were 0.966 for MTS, 0.975 for LTS, and 0.978 for CTS. Mucoid degeneration patients had a higher BMI and were older than our controls ($p < .05$) or completely torn ($p < .001$) ACL patients. There was no difference in TS between normal and pathologic ACLs, however, LTS-MTS differences were larger with partial tears (2.5 +/- 4.9) than normal ACLs by 4.5 degrees (+/-1.2, $p < .001$), complete tears by 4.5 degrees (+/- 1.3, $p < .001$) and mucoid degeneration by 4.9 degrees (+/- 1.5, $p = .001$).

### CONCLUSION

Our results show that patients with partial ACL tears have a greater lateral-to-medial slope difference compared to patients with normal ACLs or other types of ACL pathologies. Additionally, patients with mucoid degeneration of the ACL tend to be older and have higher BMIs compared to patients with normal or completely torn ACLs. Furthermore, XR seems to be a reliable modality for separately measuring the medial, lateral, and coronal tibial slope.

### CLINICAL RELEVANCE/APPLICATION

These findings underscore the importance of considering biomechanical factors in ACL injury risk assessment and may inform future research endeavors aimed at elucidating the mechanisms underlying ACL pathology.

## T5A-SPMK-2 EFFICACY OF KNEE MR AI ALGORITHM IN PREDICTING CLINICAL SYMPTOMS OF PATELLAR INSTABILITY

Pascal Zille (*Abstract Co-Author*) Employee, Incepto Medical
Guillaume Herpe (*Abstract Co-Author*) Medical Officer Incepto-France Grant, Guerbet
Roberto Ardon (*Abstract Co-Author*) Employee, AXA Venture Partners
Chloe Adam, PhD (*Abstract Co-Author*) Employee, Incepto Medical SAS
Kevin Maarek (*Abstract Co-Author*) Nothing to Disclose
Philippine Cordelle (*Abstract Co-Author*) Nothing to Disclose
Tom Vesoul (*Abstract Co-Author*) Nothing to Disclose
Gaspard d'Assignies, MD, PhD (*Presenter*) Founder, Incepto Medical SAS;Employee, Incepto Medical SAS;Stockholder, Incepto Medical SAS

### PURPOSE

Patellar instability is a common pathology that leads to patellar dislocations during acute phases, potentially resulting in progressive cartilage damage and severe arthritis if not adequately treated. Magnetic resonance imaging (MRI) serves as the primary diagnostic tool to identify anatomical patterns contributing to patellar instability. However, the laborious and time-consuming measurements related to these patterns are often underreported in

radiological reports. Artificial intelligence algorithms facilitate the automatic extraction of this crucial information. This study aims to investigate the relationship between reported symptoms of instability and the occurrence of high-risk patterns in images based on an analysis of over 10,000 MRI cases.

**METHODS AND MATERIALS**

In a prospective controlled study, we have extracted, using regular expression tools, the examinations performed for patients consulting for clinical symptoms of patellar instability from our external validation database of 11,074 MRI knee studies ( comparative arm ). A control arm containing patients without symptoms of patellar instability was included in the analysis. The selected exams were analyzed with our CE-marked automatic knee MRI AI algorithm. We analyzed all of the following parameters from the 3 knee compartments : Cartilages, Meniscus, ligaments, bone edema, TT-TG, trochlear sulcal depth, trochlear lateral inclination, Patellar height (Caton Deschamps index and Insall Salvati), joint effusion and Trochlear asymmetry ratio. Statistical Analysis : A univariate analysis was performed : for each variable, a logistic regression model was trained to predict the "patellar instability" class. This metric measures the ability of each individual variable to linearly predict the "patellar instability" class.

**RESULTS**

175 MRI were included in the comparative arm ( mean age, sex ratio ) and 175 in the control arm ( mean age, sex ratio ). The results of the analysis assessed the respective predictive accuracy : Trochlear sulcal depth ( 0.70 ), trochlear sulcus angle ( 0.70 ), trochlear lateral inclination ( 0.69 ), patellar height using Insall Salvati (0.65 ), patellar height using Caton Deschamps ( 0.60). The other variables resulted in accuracy values under 0.60.

**CONCLUSION**

Trochlear bone biometric features are the most predictive and the best correlated with symptoms. Given the time-consuming nature of the measurement, AI seems ideal in this context. However, AI must also adapt to the features most commonly used in clinical practice and those that have the most impact on patient management before adoption.

**CLINICAL RELEVANCE/APPLICATION**

Clinical symptom prediction of patellar instability can be achieved using automated AI measurment.

## T5A-SPMK-4 IMPACT OF THIGH MUSCLE AND FAT VOLUME ON THE 4-YEAR PROGRESSION OF KNEE OSTEOARTHRITIS IN OBESE PARTICIPANTS WHO ENGAGE IN PHYSICAL ACTIVITY

John A. Lynch, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabby B. Joseph (*Abstract Co-Author*) Nothing to Disclose
Thomas M. Link, MD, PhD (*Abstract Co-Author*) Research Consultant, General Electric Company
Richard B. Souza, PhD (*Abstract Co-Author*) Nothing to Disclose
Upasana U. Bharadwaj, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the impact of thigh muscle and subcutaneous fat volume on the 4-year progression of knee osteoarthritis (OA) in obese participants who engage in physical activity, stratified by the type of activity.

**METHODS AND MATERIALS**

A total of 357 participants with BMI >= 25 kg/mm2 who engaged in various types of physical activity: ball sports (n=57), bicycling (n=58), elliptical trainer (n=84), jogging (n=67), racquet sports (n=37), and swimming (n=54) were selected from the Osteoarthritis Initiative cohort. Participants with Kellgren-Lawrence grade (KLG) > 3, missing knee MRI at baseline or 48-month follow up, missing thigh MRIs, or those who did not engage in any physical activity were excluded. Progression of knee OA was characterized using the difference in Whole-Organ Magnetic Resonance Imaging Score (WORMS) between baseline and 48-month knee MRI. A deep learning segmentation pipeline was used to compute subcutaneous fat and muscle volumes as well as cortical thickness from the corresponding axial T1-weighted thigh MRI at baseline. Associations were evaluated using linear regression adjusted for age, sex, BMI, KLG.

**RESULTS**

Significant association was found between the volume of quadriceps and 4-year progression of WORMS for meniscus (T=-2.19, p=0.03) across all activities; no significant associations were found for other muscle groups or subcutaneous fat. The bicycling group showed significant association for quadriceps (T=-2.69, p=0.01) and hamstrings (T=-2.01, p=0.04) with WORMS meniscus; as well as for quadriceps (T=-2.06, p=0.04) and cortical thickness (T=-2.27, p=0.03) with WORMS bone marrow lesions. The jogging group showed significant association for subcutaneous fat volume and WORMS cartilage (T=2.09, p=0.04). The racquet sports group showed significant association for cortical thickness (T=-2.09, p=0.04) and WORMS bone marrow lesions. No significant associations were found for elliptical, swimming, or ball sports.

**CONCLUSION**

Lower quadriceps volume was significantly associated with 4-year progression of WORMS meniscus across all activities. Bicycling, jogging, and racquet sports showed significant association for WORMS progression whereas elliptical, swimming, and ball sports did not show any progression.

**CLINICAL RELEVANCE/APPLICATION**

These results can potentially inform clinical management; namely, strengthening quadriceps and reducing subcutaneous fat volume in those engaging in rigorous activities such as bicycling, jogging, and racquet sports may delay progression of knee osteoarthritis.

## T5A-SPMK-6 MULTICENTER AND CROSS-DISCIPLINARY VALIDATION OF AI-BASED KELLGREN-LAWRENCE GRADING MODEL FOR KNEE OSTEOARTHRITIS ON PLAIN RADIOGRAPHY

Chang Ho Kang, MD (*Abstract Co-Author*) Nothing to Disclose
Jae-Joon Lee (*Abstract Co-Author*) CEO, Crescom Inc
Seungbong Han (*Abstract Co-Author*) Nothing to Disclose
Chong Bum Chang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyung-Sik Ahn, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
SANGUN KIM, MD (*Abstract Co-Author*) Nothing to Disclose
Kyu-Chong Lee, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To validate the multicenter reading efficacy of AI based Kellgren-Lawrence (KL) grading model for knee osteoarthritis (OA) and investigate the differences based on specialty and clinical experience.

## METHODS AND MATERIALS

The AI-based KL grading model, capable of detecting osteophytes and joint space narrowing, was developed using NASNet. For multicenter validation, a total of 458 matched subjects who undertaken knee radiographs in two tertiary hospitals were enrolled. Ground truth was built by the consensus of 4 experts with more than 10 years of experience. First, model performance was evaluated by AUC, accuracy, and reliability (?) compared with ground truth. Second, for user-oriented model validation, 4 trainees (2 radiologists and 2 orthopedic surgeons) with less than 5 years of experience evaluated KL grades in two sessions: with and without AI assistance. This validation compared AUC and ? of 4 users with and without software assistance. Finally, KL interpretation differences were evaluated using ? based on specialty and clinical experience.

## RESULTS

For model performance, the overall AUC, accuracy, and ? of the model were 0.918, 0.923.and 0.845, respectively. For user-oriented validation, AUCs of 4 users were increased with model assistance in entire KL grades. The overall ? of two expert radiologists and two expert orthopedic surgeons were 0.8629, and 0.7077, respectively and the difference ? (0.1550) was statistically significant (p=0.001). Especially, for KL 01 and 2, indicative of mild OA, the ? of the expert radiologists was significant higher (0.736 vs 0.505, p=0.0081, and 0.872 vs. 0.660, p=0.0068, respectively). Institution A, with less cumulative clinical experience had a significant lower ? (0.3883) than institution B (?=0.5592) without AI assistance. Furthermore, the improved ? values of institution A and B with AI assistance were 0.4594, and 0.2342, respectively, indicating a significantly higher improvement in institution A with lower clinical experience (difference=0.2253, p<0.001). Finally, one resident showed significantly higher improvement in AUC compared to the other three fellows, with the maximum increase in AUC approximately doubling (0.470 to 0.903).

## CONCLUSION

The AI-based KL grading model has equivalent accuracy to human experts. Additionally, the AI model appears to enhance the accuracy and reliability of both radiologists and orthopedic surgeons, especially for doctors with less clinical experience.

## CLINICAL RELEVANCE/APPLICATION

The newly developed AI model is useful for KL grading with feasible accuracy. Furthermore, this program could reduce different interpretations between the radiologists and orthopedic surgeons and is particularly beneficial for doctors with less clinical experience.

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# Abstract Archives of the RSNA, 2024

T5A-SPMS

**Multisystem Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPMS-1 EVALUATION OF TISSUE EFFECTS OF RADIOFREQUENCY ABLATION ON SOLID TUMOR: 7T MRI WITH HISTOLOGICAL ANALYSIS ON MURINE-MODEL

Niccolo Faccioli, MD (*Abstract Co-Author*) Nothing to Disclose
Flavio Spoto, MD (*Abstract Co-Author*) Nothing to Disclose
Mirko D'Onofrio, MD (*Abstract Co-Author*) Speaker, Bracco Group;Speaker, Siemens AG;Consultant, Siemens AG;Speaker, Hitachi, Ltd
Riccardo De Robertis, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Todesco (*Abstract Co-Author*) Nothing to Disclose
Francesca Pasquazzo, MD (*Abstract Co-Author*) Nothing to Disclose
Eda Bardhi (*Presenter*) Nothing to Disclose

### PURPOSE

To analyze neoplastic tissue adjacent to radiofrequency thermal ablation (RFA) areas to demonstrate early perfusion anomalies and to suggest the synergic role of ablative techniques with chemotherapy treatments.

### METHODS AND MATERIALS

In this prospective study, a total of 10 mice were subjected to a colon-carcinoma cell implantation and after the tumor colonization, the RFA procedure was performed. All mice underwent a 7T MRI including 2D single-echo single-shot dynamic-contrast-enhanced (DCE) sequences with intravenous injection of gadolinium-based contrast agent (CA), before and after 72 hours from RFA treatment. Data-driven segmentation of the tumor mass enabled the identification of three ROIs with peculiar pharmacokinetic profiles of CA uptake: (i) VTA, viable tumor area; (ii) PNA, partial necrotic area; (iii) CNA, complete necrotic area. Within these ROIs, permeability (K-trans and extravascular-extracellular volume fraction, Ve) and perfusion (time to peak, TTP) indices were evaluated with non-parametric paired samples Wilcoxon tests.

### RESULTS

Robust increase of Ve (PNA and VTA, $p=0.014$, $p<0.001$, respectively) and TTP (VTA, $p<0.01$) is consistent with severe cellular and vascular damage induced by RFA.

### CONCLUSION

Perfusion MRI enables robust detection of significant modulation of the microvasculature within 72 hours from radiofrequency-induced ablation in a murine model of colon carcinoma. This opens a potentially new time window for the evaluation of therapeutic effects of RFA-enhanced chemotherapy.

### CLINICAL RELEVANCE/APPLICATION

Percutaneous treatments are increasingly used to manage different malignancies, with the purpose of being potentially curative. Remarkable modification of perfusion and permeability state of tumor’s growth were found after radiofrequency ablation, according to the neoplasia’s inner features. Considering a possible human application, assessment of perfusion changes in the ablated-zone and their quantification with DCE-MRI could help to identify a viable cell area with improved permeability and a potential target for further therapeutic approaches after thermal-ablation.

## T5A-SPMS-2 DEEP LEARNING BODY COMPOSITION ANALYSIS OF STAGING CT SCANS PREDICTS OUTCOMES AND FRAILTY IN GERIATRIC ONCOLOGY PATIENTS

James Hallinan, MBChB (*Abstract Co-Author*) Nothing to Disclose
Andrew Makmur, MD (*Abstract Co-Author*) Nothing to Disclose
Desmond Lim Shi Wei, MBBS, FRCR (*Presenter*) Nothing to Disclose

### PURPOSE

The body composition of an elderly cancer patient can be determined from staging CT scans using deep learning segmentation tools. Utilising the model “Total Segmentator”, we derived quantitative measurements including total muscle and fat volume along with qualitative analysis of fatty infiltration within muscle groups.We compared these body composition biomarkers against validated geriatric assessment scores (used to determine frailty in elderly patients), and survival outcomes.

### METHODS AND MATERIALS

We recruited 189 patients aged 70 years or older with newly diagnosed cancer. Each patient received a Geriatric Assessment in accordance with the American Society of Clinical Oncology. Each patient's staging CT scan (CT Thorax, Abdomen Pelvis) was put through a deep learning tool for organ

segmentation (Total Segmentator) to derive volumes and average intensities (in Houndsfield Units, HU) for each segmented organ including fat and muscle. All patients were categorised into groups according to their frailty status (fit vs frail) and their outcome (survival vs death during the study). T-tests were used to identify differences between the body composition biomarkers against clinical groups.

## RESULTS

The median age was 75 years old (70 - 90). The range of diagnoses included: gastrointestinal cancers (34.8%), lung cancers (18.7%) and breast cancers (12.6%), etc. At diagnosis 59.6% were receiving palliative intent treatment. Comparing between the fit vs frail group, there were significant differences (p-value less than 0.05) in the following biomarkers: extent of fatty infiltration of the paraspinal muscles (32HU vs 20HU, p-value = 0.003), gluteus muscles (29HU vs 18HU, p-value = 0.003) and all truncal muscles (HU34 vs HU29, p-value = 0.001), ratio of gluteus muscle volume against total muscle volume (0.020 vs 0.018, p-value = 0.003). Comparing between patients who survived vs died during the study (2 years duration), there were significant differences in the: average iliopsoas intensity (HU54 vs HU51, p-value = 0.01) and total subcutaneous fat (8.9L vs 7.9L, p-value = 0.049).

## CONCLUSION

Frail and fit elderly cancer patients show significant differences in some aspects of body composition which can be derived from staging CT scans.

## CLINICAL RELEVANCE/APPLICATION

A multivariable prognostication tool can be developed using CT derived body composition biomarkers and clinical scoring. This can be used to identify elderly cancer patients which may benefit from interventions to improve body composition and thus change outcome.

# Abstract Archives of the RSNA, 2024

T5A-SPNMMI

**Nuclear Medicine & Molecular Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPNMMI-1 VEGFR2 TARGETED BIOSYNTHETIC NANO GAS VESICLES-BASED ULTRASOUND MOLECULAR IMAGING IMPROVING THE DIAGNOSTIC SENSITIVITY OF CANCER

Jianhua Zhou, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Xiaoxin Liang, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The vascular endothelial growth factor receptor 2 (VEGFR2) is not only a key effector in angiogenesis and cancer progression, but also expressed on the tumor cells, leading to tumor initiation. In recent years, microbubbles targeted to VEGFR2 have proven to improve the efficacy of ultrasound molecular imaging (USMI) of cancer. However, these microbubbles are restricted within the vasculature due to their relatively large particle size. Herein, we developed a VEGFR2-targeted gas vesicles (V2-GVs) with the particle size about 200 nm for tumor cells targeting in MB49 subcutaneous tumor mice and DEN/CCl4-induced orthotopic liver cancer mice.

### METHODS AND MATERIALS

V2-GVs were prepared by conjugating VEGFR2 antibody to the surface of GVs by amide reaction. The contrast-enhanced imaging features of non-targeted control GVs (Con-GVs) and V2-GVs were compared in MB49 subcutaneous tumor mice and DEN/CCl4-induced orthotopic liver cancer mice. The expression of CD31 and VEGFR2 of different sizes of tumors were assessed by fluorescence immunohistochemistry. The difference of signal intensity of V2-GVs and Con-GVs at 10 min were plotted to analyze the correlation between the USMI signal and the cell expression levels of VEGFR2 or CD31. The penetration ability of V2-GVs in tumor tissues was assessed by fluorescence immunohistochemistry.

### RESULTS

We found VEGFR2-targeted nanobubbles based USMI could successfully distinguish different lesions in diameter of 3-15 mm. The in vivo USMI experiments showed that V2-GVs produced stronger and longer retention in the subcutaneous bladder cancer and DEN/CCl4-induced liver cancer than that of the non-targeted Con-GVs (All $P < 0.05$). In addition, small lesions in diameter of 3-5 mm showed more expression of CD31 than those over 5 mm ($P < 0.0001$). However, the larger lesions in diameter > 10 mm showed more expression of VEGFR2 ($P < 0.001$). Moreover, the difference of signal intensity of V2-GVs and Con-GVs at 10 min showed a good linear correlation with the cell expression levels of VEGFR2 rather than CD31 (All $R2 > 0.82$, $P < 0.05$). Fluorescence immunohistochemistry confirmed that V2-GVs could penetrate the tumor vascular into the interstitial space of the tumors.

### CONCLUSION

VEGFR2-targeted nanobubbles have huge prospects for monitoring angiogenesis and tumor progression in different tumors.

### CLINICAL RELEVANCE/APPLICATION

VEGFR2-targeted nanobubbles based USMI have huge potential for clinical application of different cancers, providing the foothold for future studies on the imaging screening of this patient population.

## T5A-SPNMMI-2 REVERSE MAGNETIC RESONANCE TUNING NANOPLATFORM WITH HEIGHTENED SENSITIVITY FOR NON-INVASIVELY MULTISCALE VISUALIZING FERROPTOSIS-BASED TUMOR THERAPY

Zhongling Wang (*Abstract Co-Author*) Nothing to Disclose
Yi Zhu (*Presenter*) Nothing to Disclose

### PURPOSE

Ferroptosis-based therapy has garnered considerable attention for their ability to kill drug-resistant cancer cells. Consequently, it holds great significance to assess the therapeutic outcomes by monitoring ferroptosis-related biomakers. Nevertheless, conventional imaging technology suffer from limitations including reduced sensitivity and difficulty in achieving real-time precise monitoring. Therefore, we need a high-sensitive biological quantitative imaging for MR-guided multiscale dynamic tumor-related ferroptosis therapy.

### METHODS AND MATERIALS

We introduced a tumor acidic-microenvironment-responsive nanoplatform with “Reverse Magnetic Resonance Tuning (ReMRT)” property that is coupled with calculus-based “Area Reconstruction” for specific and quantitative imaging of ferroptosis. The T1 mapping image was turned “ON” when in the acidic TME, while the T2 mapping image was turned “Reverse ON”. R1 value increased gradually with an increase in acidity, whereas the R2 value decreases gradually, thereby leading to a more pronounced contrast between the R1 and R2 values, demonstrating the so-called ReMRT properties. Then, we will conduct a correlation analysis between this reverse MR mapping change and ferroptosis-related biomarkers.

## RESULTS

We present a simple yet powerful strategy with ReMRT property that enables versatile non-invasive imaging of the ferroptosis process in breast tumors, encompassing the evaluation of ROS yield and drug release. Acidity-triggered release of iron ions acted as an effective ferroptosis inducer because it increased ROS production through the Fenton's reaction to produce ·OH, and at the same time depleted endogenous GSH. Notably, the difference between R1 and R2 becomes more obvious as the acidity increases. We show that ?R1 and ?R2 values are sensitive for the determination of ROS yield and DOX release, and that the ReMRT nanoprobe in neutral microenvironment show little or no such correlation.

## CONCLUSION

This ReMRT nanoplatform is a highly efficacious chemo-ferroptosis agent and provides a superior tool for identifying intracellular hallmarks during ferroptosis by utilizing the relationship between relaxation time and ROS expression. Furthermore, implementing the "Area Reconstruction"method presents significant improvements in sensitivity of MR analysis, ensuring greater visualization than conventional MR R1/R2 values.

## CLINICAL RELEVANCE/APPLICATION

Collectively, these results demonstrate the translational potential of this biocompatible probe, which in the future may serve as a breast cancer therapeutic and valuable tool to quantify variances in the pH levels within the tumor microenvironment to evaluate treatment potential and tumor burden.
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# Abstract Archives of the RSNA, 2024

T5A-SPNPM

**Noninterpretive Skills (Beyond Imaging) Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPNPM-1 DECODING PUBLIC PREFERENCES IN BREAST CANCER SCREENING COST SHARING

A. Mark Fendrick, MD (*Abstract Co-Author*) Consultant, Abbott LaboratoriesConsultant, AstraZeneca PLCConsultant, sanofi-aventis GroupConsultant, F. Hoffmann-La Roche LtdConsultant, GlaxoSmithKline plcConsultant, Merck & Co, IncConsultant, Neocure Group LLCConsultant, Pfizer IncConsultant, POZEN IncConsultant, Precision Health Economics LLCConsultant, The TriZetto Group, IncConsultant, ZanzorsSpeakers Bureau, Merck & Co, IncSpeakers Bureau, Pfizer IncResearcher, Abbott LaboratoriesResearcher, AstraZeneca PLCResearcher, sanofi-aventis GroupResearcher, Eli Lilly and CompanyResearcher, F. Hoffmann-La Roche LtdResearcher, GlaxoSmithKline plcResearcher, Merck & Co, IncResearcher, Novartis AG Researcher, Pfizer Inc
Gelareh Sadigh, MD (*Abstract Co-Author*) Nothing to Disclose
Ruth C. Carlos, MD, MS (*Abstract Co-Author*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company
Ozivefueshe Dimowo, MD,MPH (*Abstract Co-Author*) Nothing to Disclose
Olutola Akande (*Abstract Co-Author*) Nothing to Disclose
Michal Horny, PhD (*Abstract Co-Author*) Nothing to Disclose
Darrys Reese (*Abstract Co-Author*) Nothing to Disclose
Kevin Dao, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Although most health plans are required to cover screening mammography (SM) for women 40 and over without cost sharing, out-of-pocket costs (OOPC) for indicated diagnostic tests after a positive SM potentially deter the completion of SM and follow-up care. In our study, we aimed to investigate public preferences for health insurance benefit design to enhance adherence to the entire breast cancer screening process.

### METHODS AND MATERIALS

A prospective discrete choice conjoint survey was administered to English-speaking, US-resident, female Amazon Mechanical Turk respondents aged 40-74 in April 2024. Participants were presented with six tasks and asked to select the best of three hypothetical scenarios in which they would undergo SM (in addition to the option to forgo SM). In each scenario, we paired two attributes at three varied levels: [1] OOPC for SM (free, $5, and $20) and [2] OOPC for follow-up imaging (free, $200, unknown ranging from $0 to $2000). Data were analyzed using Hierarchical Bayesian conjoint analysis to derive attribute importance and preference for each of the nine scenarios.

### RESULTS

A total of 103 female participants with a mean age of 48 years (SD = 6) were included. 81 (79%) were White, 20 (19%) were Asian, and 2 (2%) were American Indian/Alaskan Native. 32 (31%) identified as Hispanic, Latinx, or of Spanish origin. The participants were insured by Medicare (45; 44%), Medicaid (39; 38%), private insurance (17; 16%), and VA (1; 1%). One participant was uninsured (1;1%). The relative attribute importance of "OOPC for follow-up imaging" was significantly greater than "OOPC for SM" (62%; 95% CI: 58-67 vs 38%; 95% CI: 33-42). Public preferences were highest for the scenarios offering $5 SM and $0 follow-up imaging (14.5%; 95% CI: 13-16) and $5 SM and $200 follow-up imaging (14.5%; 95% CI: 12-17). Preferences were lowest for scenarios offering $0 SM and unknown follow-up imaging OOPC (7.7%; 95% CI: 6-9) and $20 SM and unknown follow-up imaging OOPC (7.5%; 95% CI 6-9).

### CONCLUSION

These findings suggest that it is more important for participants considering breast cancer screening to be informed about OOPC for follow-up diagnostic care. Public preferences align with an episode-based cost sharing model that provides upfront OOPC for the entire breast cancer screening process, from initial screening to final diagnosis.

### CLINICAL RELEVANCE/APPLICATION

Understanding patient preferences for health insurance design is crucial for policymakers, insurers, and healthcare providers in developing strategies to promote preventive care use. Our findings suggest that episode-based cost sharing could be a promising approach to enhance adherence to recommended breast cancer screening services.

## T5A-SPNPM-2 ASSOCIATION BETWEEN PRICE TRANSPARENCY AND PATIENT DECISION TO COMPLETE OUTPATIENT IMAGING

Thao Pham (*Abstract Co-Author*) Nothing to Disclose
Gelareh Sadigh, MD (*Abstract Co-Author*) Nothing to Disclose
Diya Garg (*Abstract Co-Author*) Nothing to Disclose
Aldo Arce (*Abstract Co-Author*) Nothing to Disclose
Ali Rashidi, MD (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the prevalence of price estimator tool utilization for outpatient imaging appointments and the association between patients' price estimator use and imaging appointment completion.

## METHODS AND MATERIALS

In this retrospective study, all adult patients aged 18 years or older who were scheduled for an outpatient radiology examination between August 2022 and 2023 at a tertiary academic imaging center were included. Data regarding the generation of out-of-pocket price (OOPP) estimates for imaging encounters in patient portal, view of such estimate by patient, appointment status, and patients' demographic characteristics were extracted. Generalized estimation equation (GEE) models were used to assess the association between patients' price estimator use and imaging appointment completion.

## RESULTS

A total of 470,422 imaging encounters (mean age: 55.6 ± 19.1; 57.5% female; 56.3% white) were included. A total of 70,437 (14.97%) OOPP estimates were generated (99.9% by staff and 0.1% by patients). Only 149 (0.21%) of estimates were viewed by patients prior to imaging; 498 (0.70%) were viewed after imaging completion, and 99.09% were never viewed. There was a significantly higher number of uninsured among patients who viewed OOPP prior to imaging (55.4%), vs. those who viewed after imaging (33.5%) vs. those who never viewed the price (3.7%) ($P<0.001$). A higher proportion of patients who viewed the OOPP estimate prior to imaging had OOPP >$295 (88.6%), vs. those who viewed after imaging (57.8%) and those who never viewed the price (24.5%) ($P<0.001$). In patients for whom OOPP estimate was generated (regardless of viewing of price), the odds of imaging completion were higher than those without OOPP (OR 1.91; 95%CI: 1.87, 1.95; $P < 0.001$). However, in patients who viewed the OOPP on the portal prior to exam, the chance of imaging completion was significantly lower vs. those who did not view it (OR, 0.35; 95%CI: 0.23, 0.53; $P < 0.001$).

## CONCLUSION

Price estimator tools are more commonly used among patients who are self-pay or expecting higher OOP payments. Viewing of the OOPP estimate prior to imaging is associated with decreased imaging completion in the same imaging center. Completion of exams at other imaging centers with lower OOPP estimates is not clear. Increased imaging completion among those with an OOPP generation, might be due to patients not knowing the price vs. the price being communicated by staff.

## CLINICAL RELEVANCE/APPLICATION

Viewing OOPP estimates prior to imaging can impact the decision to complete the exam at the same imaging center. Direct communication of OOPP estimates as opposed to having the patient view OOPP on their own might be a better solution to improve decision-making.

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# Abstract Archives of the RSNA, 2024

T5A-SPNR

**Neuroradiology Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPNR-10 IDENTIFYING DISCRIMINATIVE FEATURES OF ESSENTIAL TREMOR USING MACHINE LEARNING RANDOM FOREST MODEL

Xueyan Zhang (*Presenter*) Nothing to Disclose

### PURPOSE

Due to the lack of effective biomarkers, the diagnosis of ET relies predominantly on clinical symptoms. This study aims to extract discriminative features of essential tremor combined with a machine learning random forest model.

### METHODS AND MATERIALS

In this study, 127 ET patients and 120 HCs were scanned through resting-state functional magnetic resonance imaging (Rs-fMRI). After image processing, a total of 13366 resting-state functional connectivity features were extracted from each participant. Firstly, we randomly separated all subjects into a training set and a test set according to the ratio of 7:3 (training set = 172, testing set = 75). Then, we performed dimensionality reduction on our feature matrices to eliminate unnecessary features, reduce computational complexity, prevent over-fitting during classifier training and increase classification performance. Finally, 44 resting-state functional connectivity features were selected for the construction of the random forest model to identify ET from HCs. The accuracy, sensitivity, specificity and the area under the curve (AUC) were used to evaluate the classification performances., Also, we can extract important features using the "feature_importances_" property of the random Forest Classifier function.

### RESULTS

The demographic characteristics of the clinical subjects included in the study are shown in Table 1. For the classification of ET and HCs, the random forest model gives an accuracy of 90.67%, specificity 86.11%, sensitivity 94.87%, and AUC of 0.919 (the confusion matrix results is shown in Figure 1. Figure 2 highlights the top ten features generated in ranking order of importance.

### CONCLUSION

The random forest model achieves high accuracy to identify ET patients from HCs. The most resting-state functional connectivity features were mainly located within or across the typical motor network and some selected some also involved in non-motor areas.

### CLINICAL RELEVANCE/APPLICATION

Several discriminative features may assist in the identification of essential tremor patients.

## T5A-SPNR-11 VOXEL-BASED ANALYSIS OF THE TEMPORAL EVOLUTION OF MULTIPLE SCLEROSIS LESIONS

Sangam G. Kanekar, MD (*Abstract Co-Author*) Nothing to Disclose
Jack Quillen (*Abstract Co-Author*) Nothing to Disclose
Scott N. Hwang, PhD, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Assess the temporal evolution of multiple sclerosis (MS) lesions based on MRI with a focus on the voxels that transition from brain to lesion or lesion to brain. These may relate to active versus smoldering MS plaques.

### METHODS AND MATERIALS

MR images (FLAIR, MPRAGE, proton-density, and T2) were obtained from The 2015 Longitudinal MS Lesion Segmentation Challenge. Provided preprocessing of images include inhomogeneity-correction using N4, skull/dura-stripping, and rigid registration to a 1 mm isotropic MNI template. Each contributor was imaged 4 or 5 times at approximately 1 year intervals. Image masks showing lesion segmentation were manually generated by two experienced raters for 5 datasets at all timepoints. 14 additional datasets are provided without masks.Voxels were classified into 4 groups as brain voxels which remain brain, lesion voxels which remain lesion, brain voxels which become lesion, and lesion voxels which become brain at each of the timepoints compared to the earliest images. Differences in voxel intensities were assessed. Processing was performed with plugins written in Java on Fiji, an open-source program for image analysis. Pairwise Mann-Whitney U Tests were performed to assess for significant differences and the Bonferroni correction was applied.

### RESULTS

While some lesions enlarge, others contract, possibly secondary to smoldering lesions. Statistically significant differences are present with relative FLAIR hyperintensity in normal-appearing (to the human eye) brain voxels which become lesion voxels compared to brain voxels which do not change

($p<0.001$). The differences are significant for transitions at 1, 2, and 3 years after baseline. Subtle hypointensity is also present in lesion voxels which transition to brain compared to lesion voxels which do not change ($p<0.001$).

**CONCLUSION**

Statistically significant differences can be identified between normal-appearing brain voxels which stay normal and normal brain voxels which become lesion voxels. This is true at for voxel transitions between baseline and at 1-3 years later. Subtle differences are also present between voxels which transition from lesion to normal-appearing brain, mostly at the periphery of what may represent smoldering lesions.

**CLINICAL RELEVANCE/APPLICATION**

Defining response to disease-modifying therapy (DMT) in MS patients can be difficult, relying on the number of clinical attacks or new MRI-detected lesions. Voxel-based early detection of subtle abnormalities may provide a means of predicting transitions from normal-appearing brain to lesions before they become overt and may thus provide useful metrics for managing treatment. Early identification of potential transitions may also help characterize smoldering lesions.

## T5A-SPNR-13 WHITE MATTER HYPERINTENSITY SEGMENTATION IN MULTIPLE SCLEROSIS AND NEUROMYELITIS OPTICAL SPECTRUM DISORDERS USING 2.5D FRC-RESUNET

Chunjie Guo, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The study aims to develop a precise segmentation method to evaluate the multiple and irregularly shaped white matter hyperintensity (WMH) lesions in the brain, occurring in patients with multiple sclerosis (MS) and neuromyelitis optical spectrum disorder (NMOSD). This method is essential for accurate diagnosis, effective treatment, and prognosis of these conditions.

**METHODS AND MATERIALS**

In this study, we propose a 2.5D FrC-ResUnet deep learning algorithm for segmenting WMH in the brains of patients with MS and NMOSD. This algorithm utilizes a Spectral Encoder to extract global information, enabling the accurate segmentation of dispersed lesions. Additionally, the model incorporates the Selective Features Module (SFM) and the Convolutional Block Attention Module (CBAM) to enhance the differentiation of lesion background and provide a clear outline of the pathology. The study utilized a public dataset from the MICCAI 2016 MS Lesion Segmentation Challenge and local datasets for MS and NMOSD, which included 36 MS and 33 NMOSD subjects.

**RESULTS**

Our approach was assessed on both the public and local datasets for MS and NMOSD. In comparison to U-Net, ResUNet, FC-DenseNet, AttentionUNet, and LPA algorithms, the 2.5D FrC-ResUnet demonstrated the highest Dice Similarity Coefficient (DSC) on three different datasets, with values of 0.710, 0.667, and 0.822, respectively.

**CONCLUSION**

The 2.5D FrC-ResUnet demonstrates accurate and robust segmentation of NMOSD brain WMH. Meanwhile, the model excels in segmenting MS brain WMH, especially when confronted with irregularly shaped and dispersed lesions.

**CLINICAL RELEVANCE/APPLICATION**

The clinical application of the 2.5D FrC-ResUnet model promises for advancing the imaging analysis of WMH in patients with MS and NMOSD, which could potentially enhance clinical outcomes by improving diagnostic and therapeutic strategies.

## T5A-SPNR-14 AN EXPERIMENTAL EVALUATION OF THE RELATIONSHIP BETWEEN THE INDUCED RADIOFREQUENCY HEATING NEAR AN IMPLANTED CONDUCTIVE MEDICAL DEVICE DURING MRI, SCANNER-REPORTED B1+RMS, AND SCANNER REPORTED AVERAGE TRANSMIT POWER

John T. Vaughan, PhD (*Abstract Co-Author*) Nothing to Disclose
Devashish Shrivastava (*Abstract Co-Author*) Nothing to Disclose
David Gultekin, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Time-varying radiofrequency (RF) fields necessary to perform magnetic resonance imaging (MRI) may induce excessive heating near implanted conductive medical devices during MRI. Both time and space-averaged root mean square of the effective magnetic field (B1+rms) and whole-body average specific absorption rate (SAR) (time-averaged RF power per unit body weight) have been proposed as metrics to control the induced heating and avoid unintended thermal injury. The purpose of this study is to experimentally evaluate the relationship between the induced RF heating near an implanted conductive medical device, scanner-reported B1+rms, and scanner-reported RF power.

**METHODS AND MATERIALS**

RF heating was measured near the electrodes of deep brain stimulation (DBS) lead placed in a gel phantom using fluoroptic temperature probes in a commercial 3T scanner during MRI. Four transmit and receive RF coil combinations were used, a circularly polarized head transmit and receive coil, a 20-channel head and neck, a 32-channel head, or a 64-channel head and neck receive-only coil with a whole-body transmit coil. RF heating was induced by running a 2D GRE sequence with two RF pulse types (fast and normal) with varying flip angles of 30, 60, and 90 degrees and by turning the receive-only coils off and on. The scanner-reported B1+rms and RF power were recorded.

**RESULTS**

Measurements show that the induced temperature change (dT) correlated linearly with both the scanner-reported RF power and the square of the B1+rms for each coil combination. However, the variation in the induced heating for various RF coil combinations appeared to be much larger for the scanner-reported B1+rms compared to the scanner-reported RF power.

**CONCLUSION**

Additional studies across other MR scanners are needed to better understand the full extent of the variation in the induced heating near implanted conductive devices as a function of the scanner-reported B1+rms and RF power to develop conservative and reliable patient labeling.

**CLINICAL RELEVANCE/APPLICATION**

RF-induced heating near implants, RF transmit power and B1+rms depend on the combinations of RF coils routinely used in radiological practice and must be considered for imaging patients with implants safely.

## T5A-SPNR-15 OPTIC RADIATION MICROSTRUCTURAL TISSUE DIFFERENCES IN PEDIATRIC ANTI-MOG DISEASE AND MULTIPLE SCLEROSIS WITH OPTIC NEURITIS

Navoda Perikala, BA (*Presenter*) Nothing to Disclose

**PURPOSE**

Pediatric optic neuritis (PON) is a predominant manifestation of many pediatric demyelinating diseases but varies broadly in clinical disability. Patients with myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) have similar degrees of optic nerve injury as those with multiple sclerosis (MS), but comparatively better visual outcomes. We hypothesize that this may be attributed to tissue microstructural differences in the retro-chiasmatic visual pathway, occult to fundoscopic examination and optical coherence tomography (OCT). The goal was to address limitations of current clinical tools in characterizing visual pathway disease burden in MOGAD and MS patients with PON by using advanced diffusion and myelin-sensitive MR imaging.

**METHODS AND MATERIALS**

We evaluated focal lesions and normal appearing white matter (NAWM) in the optic radiations (OR) of 25 adolescent subjects with PON and either MS or MOGAD using multi-shell diffusion (neurite orientation dispersion and density index [NODDI]) and myelin (macromolecular tissue volume [MTV]) imaging techniques. We calculated MRI-based estimates for microstructural tissue integrity with myelin volume fraction (MVF) from MTV, neurite density index, and the g-ratio, which serves as a biomarker for the relative degree of axon myelination. Using the unpaired t-test and Wilcoxon rank sum, we compared means of G-ratio, MVF, and NDI for focal lesions and NAWM along the OR.

**RESULTS**

We found the g-ratio to be significantly greater in MS lesion and NAWM when compared to MOGAD. The significantly greater g-ratio in MS indicates disproportionately greater myelin loss in OR compared to MOGAD and supports the existing pattern of differences in vision outcome.

**CONCLUSION**

Through advanced diffusion and myelin-sensitive imaging, we found that MS patients with PON have a greater demyelinating disease burden in their OR compared to MOGAD patients. We show the utility of the g-ratio in advanced MRI as a sensitive and non-invasive marker of pathology with potential application in treating PON.

**CLINICAL RELEVANCE/APPLICATION**

The importance of this finding is in its potential to aid in predicting progression of visual outcomes in patients with pediatric demyelinating disease by combining the g-ratio, diffusion, and myelin-sensitive MR imaging. In PON, early recognition of findings associated with higher likelihood of progression to MS help to distinguish among alternate diagnoses, minimize delay in treatment, mitigate subsequent attacks and reduce the likelihood and extent of permanent vision loss.

## T5A-SPNR-16 3D CATHETER TIP SHAPE ENABLES SELECTION OF LEFT VERTEBRAL ARTERY VIA RADIAL ACCESS

Scott B. Raymond, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nathan T. Franssen, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

While the use of radial access in neurointervention is increasingly popular, some tasks such as selection of the left vertebral artery, are much more difficult than the traditional femoral access, with failure rates approaching 50% {1}. A 3D catheter shape should make it easier to select the left vertebral artery from a right radial approach. We tested a series of different tip shapes to determine the optimal orientation for left vertebral artery selection.

**METHODS AND MATERIALS**

We used the standard Simmons 2 glide catheter (Microvention; Aliso Viejo, California) as a base model and created variant catheters using computer aided design (CAD, Onshape; Boston, MA). We rotated the distal tip 90, 180 and 270 degrees to make 3 new tip shapes (c90, c180, and c270). Their performance was tested in a silicone vascular phantom approximating human anatomy including a right radial approach (Mentice; Gothenburg, Sweden). The silicone-aortic arch was 3D printed using a patient CTA from our human arch database {2}, selected for type-I geometry and median size/shape characteristics. Up to 6 operators tested 4 catheters on three tasks: left vertebral artery selection, reforming at the arch with a wire, and reforming without a wire. Trials were video recorded and scored for speed and accuracy.

**RESULTS**

In our aortic arch model, selection of the left vertebral artery was challenging, with only one success out of 70 attempts using the Simmons 2 catheter (control). The success rate with the 3D variants ranged from 26-93%, best for the c90 variant. The average time to select the left vertebral artery was 80, 17.3, 36.1, and 18.2 s for the Simmons 2, c90, c180, and c270 catheters respectively. The variant catheters were easily reformed at the arch using standard technique without a wire, with average times ranging from 6.9 - 8.2 s with no statistical difference between catheters. The c90 and c180 variants were much harder to reform using the wire, averaging 30.1 and 27.2 s compared to 11 s for the Simmons.

**CONCLUSION**

Catheter shape affects performance of different tasks and there are tradeoffs when shape is optimized for a specific task. A 3D catheter shape with the tip rotated out of plane (c90) simplifies selection of the left vertebral artery from a right radial approach while remaining easy to reform in the aortic arch without a wire.

**CLINICAL RELEVANCE/APPLICATION**

Some tasks such as selection of the left vertebral artery via right radial are much more difficult than the traditional femoral access. A 3D catheter shape makes it easier to select the left vertebral artery from a right radial approach.

## T5A-SPNR-17 DIFFERENT BRAIN STRUCTURAL AND FUNCTIONAL MECHANISMS FOR COGNITIVE FUNCTION AND GAIT CHARACTERISTICS IN IDIOPATHIC NORMAL PRESSURE HYDROCEPHALUS

Zhang Zhang (*Abstract Co-Author*) Nothing to Disclose
Huijie Yu (*Abstract Co-Author*) Nothing to Disclose

Zeyang Yu (*Abstract Co-Author*) Nothing to Disclose
Wenjin Zhao (*Abstract Co-Author*) Nothing to Disclose
Chen Zhang (*Abstract Co-Author*) Nothing to Disclose
Che Zhang (*Abstract Co-Author*) Nothing to Disclose
Ningnannan Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Yunfei Zhao (*Abstract Co-Author*) Nothing to Disclose
Han Zhang (*Abstract Co-Author*) Nothing to Disclose
Jie Sun, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To identify the brain structural and functional abnormalities related to potential idiopathic normal pressure hydrocephalus (iNPH) before and after the cerebrospinal fluid (CSF) tap test, aiming to understand iNPH pathophysiology with different clinical phenotypes of responders.

**METHODS AND MATERIALS**

Thirty iNPH patients (age 67.6±4.8 year-old; nine females) were underwent MR scan before tap test, included 3D T1WI and T2WI, pseudo-continuous arterial spin labeling, and phase-contrast cine MR imaging. The clinical indicators such as mini-mental state examination (MMSE), the Timed Up and Go (TUG) test, 10-meter walk test, 180° and 360° Spin Test were collected before and 24h after CSF tap test.

**RESULTS**

Before/after the tap test, MMSE scores were positively correlated with global gray matter volume (GMV) and negatively correlated with CSF volume. Besides, GMV in parietal, temporal, and occipital lobes were positively correlated with MMSE scores before test. Specifically, the whole brain GMV was positively correlated with MMSE improvement after tap test. The cerebral blood flow (CBF) in lenticular nucleus before tap test were negatively correlated with spin test and TUG; while the length of midbrain tegmentum diameters and the temporal horn diameters were positively correlated with 10-meter walk test. After tap test, aqueductal CSF stroke volume and net flow volume and the temporal horn diameters were positively correlated with TUG. Additionally, the rates of TUG improvement were positively correlated with global and parietal lobe white matter volume, and the reverse average velocity. Furthermore, reverse average velocity was found to be an independent factor for TUG improvement (ß = 0.696, P = 0.048, 95%CI: 0.008, 1.384).

**CONCLUSION**

Our results suggest the presence of a clinical phenotype-dependent brain structural and functional mechanism in iNPH. Patients with no significant cognitive improvement after tap test exhibit more severe global cerebral atrophy. On the other hand, the impact on gait is in a regional distribution pattern but comprehensive, involving regional CBF in basal ganglia, parietal lobe white matter volume and aqueductal CSF flow parameters.

**CLINICAL RELEVANCE/APPLICATION**

The tap test, which serves as an effective pre-evaluation method, has already been implemented as the strong evidence for cerebrospinal fluid shunt surgery. However, this study showed the improvement of cognitive and gait following the tap test is heavily reliant on brain imaging. Therefore, it is important to fully consider the clinical phenotype-dependent brain structural and functional mechanism to determine whether it truly bring surgery benefits for individual iNPH patients.

## T5A-SPNR-18 DIFFUSION MRI AND BIOPHYSICAL MODELING FOR LINKING WHITE MATTER MICROSTRUCTURE AND DISABILITY IN MULTIPLE SCLEROSIS

Benjamin Ades-Aron, PhD (*Abstract Co-Author*) Stockholder, Microstructure Imaging Inc
Els Fieremans, PhD (*Abstract Co-Author*) Scientific Advisory Board, Microstructure Imaging, Inc;Stockholder, Microstructure Imaging, Inc;Royalties, General Electric Company
Dmitry S. Novikov, PhD (*Abstract Co-Author*) Scientific Advisor, Microstructure Imaging, Inc;Stockholder, Microstructure Imaging, Inc
Santiago Coelho, PhD (*Abstract Co-Author*) Nothing to Disclose
Timothy M. Shepherd, MD, PhD (*Abstract Co-Author*) Co-founder, MICroStructure Imaging
Ilya Kister (*Abstract Co-Author*) Nothing to Disclose
Filip Szczepankiewicz, PhD (*Abstract Co-Author*) Nothing to Disclose
Valentin N. Stepanov, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to elucidate the cellular pathology of white matter (WM) underlying cognitive and motor decline in Multiple Sclerosis (MS) using diffusion MRI biophysical modeling (the Standard Model (SM), in combination with conventional diffusion tensor imaging (DTI) and diffusion kurtosis imaging (DKI)).

**METHODS AND MATERIALS**

This IRB-approved study enrolled 85 MS patients (64 females, mean age 48 ± 11.4 years, median EDSS 3 ± 2.3). Cognitive and motor functions were assessed using the Symbol Digit Modalities Test (SDMT), Expanded Disability Status Scale (EDSS) and the 25-foot walk test (FWT). MRI was performed on 3T Siemens Prisma, and included multi-shell diffusion MRI (2mm isotropic resolution). The following SM maps were generated: (axonal water fraction [f], free water fraction [fw] , intra-axonal diffusivity [Da] , extra-axonal axial/radial diffusivities [De||/De_perp], fODF anisotropy [p2] intra/extra-axonal T2 [T2a/T2e]) in addition to conventional DTI (axial -AD, mean -MD and radial -RD diffusivities and fractional anisotropy -FA) and DKI (axial -AK, mean -MK and radial -RK kurtosis) metrics. Average values were extracted from corona radiata and corpus callosum using registration to the JHU atlas. Spearman rank tests were performed, adjusted for age at disease onset, with correlation coefficients (?) reported, and significance set at $p < 0.05$.

**RESULTS**

For cognitive function, AD, RD and MD showed consistent negative correlations with SDMT (-0.46, -0.46, -0.40 respectively), while MK and RK correlated positively (0.43, 0.44). SM metrics T2e and fw negatively correlated with SDMT (-0.50, -0.46), suggesting edema. Positive correlation with f (0.41) was indicative for axonal loss. For motor function, the alternative metric FWT demonstrated the strongest correlations: Da in the corticospinal tract (-0.41) indicative for axonal swelling, and both T2e (0.42) and De|| (-0.40) in the corpus callosum suggested gliosis. Conversely, the EDSS showed weaker correlations with SM metrics, such as f (-0.33) in the posterior corona radiata and extra-axonal diffusivity perpendicular to the axon De_perp (0.34), indicative of demyelination.

**CONCLUSION**

Diffusion MRI, enhanced by biophysical modeling using the Standard Model (SM), provides specificity to different white matter pathological processes changes underlying both cognitive and motor declines in MS.

### CLINICAL RELEVANCE/APPLICATION

Our findings suggest that incorporating advanced diffusion metrics, especially the SM, could improve the sensitivity and specificity of MRI in monitoring MS, potentially influencing therapeutic decision-making and patient management.

## T5A-SPNR-19 A MACHINE LEARNING-DRIVEN MODEL TO IDENTIFY FREEZING OF GAIT IN INDIVIDUALS WITH PARKINSON'S DISEASE

Virendra Mishra, PhD (*Abstract Co-Author*) Nothing to Disclose
Gaurav Nitin Rathi, MS (*Presenter*) Nothing to Disclose

### PURPOSE

To identify predictive MRI biomarkers of freezing of gait (FoG) in individuals with Parkinson's Disease (PD) using T1-weighted MRI data and machine learning techniques.

### METHODS AND MATERIALS

Thirty-seven participants, including 16 PD-FoG (4 females) and 21 PD-nFoG (7 females), underwent a standard 1mm3 T1-weighted MRI on a 3T Siemens Skyra scanner. In addition, age (PD-FoG: 68.81± 6.56 years; PD-nFoG: 69.05±6.68 years), sex, handedness (PD-FoG: 1 left-handed; PD-nFoG: 3 left-handed), and years of education (PD-FoG: 15.19± 2.29 years; PD-nFoG: 15.76±2.95 years) were matched between the groups. FreeSurfer-7 was used to estimate various measures, such as subcortical volume, cortical volume, cortical mean curvature, cortical area, cortical local gyrification index (LGI), and cortical thickness from different regions of interest (ROIs). Thirteen PD-FoG and 15 PD-nFoG participants were included in the discovery cohort, and 3 PD-FoG and 6 PD-nFoG participants made up the independent testing cohort. To predict PD-FoG, three machine learning models: the Random Forest Classifier, the Support Vector Machine (SVM) with Linear Kernel, and the Support Vector Machine (SVM) with Non-Linear (RBF) Kernel—were trained on the chosen biomarkers from the LASSO regression over the discovery cohort for a total of 127 combinations of various measures from different ROIs along with the clinical measurements (Affected Side, Levodopa Equivalent Doses, MDS-Unified Parkinson's Disease Rating Scale-III (OFF-state), Disease Duration). The most appropriate biomarkers from each category of brain measures were chosen using LASSO regression, to decrease the high-dimensional biomarker space. Area Under the Curve (AUC), precision, sensitivity (recall), and specificity were the metrics used to assess the trained models' performance on the independent testing cohort.

### RESULTS

LGI from 25 ROIs could differentiate PD-FoG from PD-nFoG with an AUC of 0.75, 83.33% precision (7/9 PD-Fog/nFoG), 83.33% sensitivity (5/6 PD-nFoG), 67.77% specificity (2/3 PD-FoG). A significant correlation between the identified biomarkers and the clinical measures was observed using multivariate statistics.

### CONCLUSION

Our study demonstrates the potential of LGI from volumetric ROIs to identify PD-FoG.

### CLINICAL RELEVANCE/APPLICATION

Identifying the biomarkers that could identify PD-FoG individuals using routine MRI and our proposed ML algorithm aids clinical accuracy. It enhances the understanding of the pathophysiology of poorly understood PD-FoG.

## T5A-SPNR-3 DIFFUSION TENSOR IMAGE ANALYSIS ALONG THE PERIVASCULAR SPACE OF BRAIN GLYMPHATIC SYSTEM ABNORMALITIES IN MESIAL TEMPORAL LOBE EPILEPSY

Qiang Xu (*Abstract Co-Author*) Nothing to Disclose
Jianrui Li (*Abstract Co-Author*) Nothing to Disclose
Guangming Lu (*Abstract Co-Author*) Nothing to Disclose
Zhiqiang Zhang, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Fang Yang (*Abstract Co-Author*) Nothing to Disclose
Zhaojie Wang (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the functional differences of the brain glymphatic system (GS) between patients with medial temporal lobe epilepsy with hippocampal sclerosis (mTLE-HS) and healthy controls and between different seizure types using DTI-ALPS, and to analyze the correlation between GS function and the course of disease, and to predict the surgical outcomes.

### METHODS AND MATERIALS

A total of 171 patients with mTLE-HS who were treated at our hospital, from July 2009 to July 2021 were retrospectively enrolled, and 75 healthy volunteers were included as healthy control group. The MPRAGE and DTI sequence images were collected, and the cerebrospinal fluid volume was segmented and calculated using the VBM analysis method. The ALPS index of bilateral brain was calculated using the Atlas-based DTI-ALPS method. Independent sample t test was used to compare the differences between mTLE-HS group and HC group, and between different seizure types. Pearson correlation analysis was performed between bilateral ALPS index and disease duration. ROC curve was used to evaluate the diagnostic value of ALPS index for surgical outcome, and the predictive efficacy was tested by leave-one-out cross-validation between patients with good and poor surgical outcomes.

### RESULTS

The ALPS index was significantly lower in the patient group than in the control group. The ALPS index on the affected side of patients with secondary generalized seizures was significantly lower than that of patients with only partial seizures. There was no significant difference between the healthy sides of patients with different seizure types. There was a significant negative correlation between the bilateral ALPS index and the disease duration in LHS patients, but no significant correlation between the bilateral ALPS index and the disease duration in RHS patients. The DTI-ALPS index has a good diagnostic and predictive efficacy for surgical outcomes. The AUC of ALPS index on the affected side for the classification of surgical efficacy was 0.778, and the accuracy of leave-one-out cross-validation was 70.3%.

### CONCLUSION

The patients with mTLE-HS have brain glymphatic system dysfunction, and the degree of damage is related to the type of seizure and the course of epilepsy. ALPS index, which characterizes GS function, has good predictive and prognostic efficacy for surgical outcomes.

### CLINICAL RELEVANCE/APPLICATION

Our study demonstrates the robustness of DTI-ALPS method. GS function may serve as a potential feature of postoperative seizure free. Combining GS function may not only improve the prediction model of surgical efficacy, but also provide new objective quantitative indicators for the diagnosis and treatment of epilepsy patients, and accelerate the clinical transformation of brain imaging science.

## T5A-SPNR-8 TRANSIENT SYMPTOMS EXPERIENCED DURING SONICATION WHILE UNDERGOING MAGNETIC RESONANCE-GUIDED FOCUSSED ULTRASOUND (MRGFUS) THALAMOTOMY FOR MEDICALLY REFRACTORY TREMOR

Lubdha M. Shah, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Shervin Rahimpour (*Abstract Co-Author*) Nothing to Disclose
Samantha Yost, BS (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the spectrum of transient symptoms experienced by patients undergoing magnetic resonance-guided focused ultrasound (MRgFUS) thalamotomy at the time of sonication.

### METHODS AND MATERIALS

Patients with essential tremor or tremor-dominant Parkinson's disease undergoing MRgFUS treatment, were prospectively included. Exclusion criteria included hearing impairment, and difficulty communicating. Immediately after each sonication, patients were asked to describe any sensations they experienced (e.g., heat, pain, vertigo, pressure) and to numerically rate (i.e. 1-10).

### RESULTS

26 patients (81% male, mean age 73[± 8]) were included in the analyses. During the treatment sonications, 62% experienced heat, 65% experienced pain, 69% experienced vertigo and 46% experienced pressure. Commonly, heat was experienced along the forehead (50%) and pain in the temporal regions (53%). Of those that experienced vertigo, 61% and 27% had backward and forward rotation sensation, respectively. The mean intensity of the sensation for each category was 4.5 (±2.1) for heat, 4.0 (± 1.9) for pain, 3.6 (±1.7SD) for vertigo and 2.75 (±2.2SD) for pressure.

### CONCLUSION

Patients undergoing MRgFUS experience transient vertigo and pain during sonications. Heterogeneity in FUS lesion location and subjective perception may explain the differences in evoked sensations between patients and will be further studied.

### CLINICAL RELEVANCE/APPLICATION

MRgFUS is a common procedure for drug-refractory tremor as well several other emerging indications. Patients may experience transient and sometimes uncomfortable symptoms during treatment that may lead to aborting therapy. Symptoms include heat, pain, nausea, vertigo, and pressure. Little is known regarding the frequency and likelihood of these symptoms. More knowledge as to why and how often patients experience such transient symptoms could help in the consenting process with the goal of adjusting protocol to help patients complete their treatment.

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# Abstract Archives of the RSNA, 2024

T5A-SPOB

**OB/Gynecology Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPOB-4 MRI-BASED ENSEMBLE MACHINE LEARNING APPLICATION FOR EVALUATING INTRAOPERATIVE BLOOD LOSS IN PATIENTS WITH SUSPECTED PLACENTA ACCRETA SPECTRUM

Guang Yang (*Abstract Co-Author*) Research Consultant, Shanghai Colorful Magnetic Resonance Co, LtdResearch partner, General Electric Company
He Zhang (*Abstract Co-Author*) Nothing to Disclose
Qi Zhang (*Abstract Co-Author*) Nothing to Disclose
Xiaoyun Liang (*Abstract Co-Author*) Nothing to Disclose
Wenyi Yue (*Abstract Co-Author*) Nothing to Disclose
Ruxue Han (*Abstract Co-Author*) Nothing to Disclose
Haijie Wang (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to establish a predictive model for intraoperative blood loss (IBL) in pregnancies complicated by Suspected Placenta Accreta Spectrum (PAS) which could substantially guide delivery planning, facilitate transfusion requirements and reduce maternal risks.

### METHODS AND MATERIALS

From January 2015 to December 2023, 538 patients underwent MRI due to suspected PAS were retrospectively retrieved from two medical centers. All patients underwent cesarean delivery. Images from 1.5T and 3.0T MR scanners were examined and Estimated Blood Loss (EBL) and postpartum PAS diagnosis were obtained from medical records. All visible placental tissue was marked by two radiologists. We built an ensemble machine learning framework includes four classifiers, Elastic Net, Support Vector Regression (SVR), Random Forest (RF) and Convolutional Neural Networks (CNN) to predict EBL. The Center 1 data was randomly divided into a training set (n=358) and an internal test set (n=154). The Center 2 data was used as an external test set (n=26). We processed the data using a radiomics pipeline adhered to IBSI standards for feature extraction, normalization, and selection. DenseNet architecture was chosen as the CNN model. Severity of EBL was divided into three categories: moderate (EBL <= 1000 ml), severe (EBL 1000-2000 ml), and extremely severe (EBL >= 2000 ml). We optimized hyperparameters of algorithms with ranges. Clinical features including maternal age, gravidity, parity, gestational week and placenta position were used to build a clinical model. The scores from different algorithms were used to train an ensemble model with 5-fold cross-validation. Mean Absolute Error (MAE) and triple classification accuracy (ACC) were used to quantify the calibration of the models. The Spearman correlation coefficient and p-value between the predicted IBL and observed EBL were computed to quantify the discriminative power.

### RESULTS

Clinical model achieved a Spearman r of 0.55 (ACC=0.81) and 0.29 (ACC=0.33) in the internal and external test sets, respectively. With substantial predictive capability, our ensemble model demonstrated a significant correlation with patient outcomes (internal set: r=0.60, ACC=0.85; external set: r=0.63,ACC=0.64). The correlation between the predicted blood loss and EBL was shown.

### CONCLUSION

Our research introduces a sophisticated, integrative machine learning model for the precise prediction of IBL in PAS-suspected patients and helps guide delivery planning.

### CLINICAL RELEVANCE/APPLICATION

Our frame work helps guide delivery planning, facilitate transfusion requirements and reduce maternal risks.

# Abstract Archives of the RSNA, 2024

T5A-SPPD

**Pediatric Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPPD-1 TIPS IN PEDIATRIC PATIENTS: COMPARISON BETWEEN THE STANDARD TRANSJUGULAR APPROACH AND HYBRID PERCUTANEOUS TECHNIQUES

Francesco S. Carbone, MD (*Abstract Co-Author*) Nothing to Disclose
Riccardo Muglia (*Abstract Co-Author*) Nothing to Disclose
Ludovico Dulcetta, MD (*Abstract Co-Author*) Nothing to Disclose
CLAUDIO SALLEMI (*Abstract Co-Author*) Nothing to Disclose
Sandro Sironi, MD (*Abstract Co-Author*) Nothing to Disclose
Paolo Marra, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare technical success, safety and clinical outcomes of TIPS performed with conventional technique or assisted by percutaneous approach in pediatric patients and young adults with altered anatomy.

### METHODS AND MATERIALS

From January 2019 consecutive pediatric patients or young adults with native liver or split liver grafts undergoing TIPS were retrospectively reviewed. Patients were retrospectively allocated to group A if they underwent TIPS through a standard transjugular approach; to group B if they underwent TIPS aided with a percutaneous approach, either transhepatic or transplenic, including the gun-sight technique. Technical success in terms of correct TIPS placement, safety in terms of complications and clinical outcomes in terms of bleeding and ascites control were assessed and compared between groups.

### RESULTS

Sixteen patients underwent TIPS placement due to portal hypertension and variceal bleeding (n=10), portal vein thrombosis (n= 4), Budd-Chiari syndrome (n=1) or refractory ascites (n=1). Out of 6 patients with portal vein thrombosis, 4 were affected by chronic portal vein thrombosis and cavernous transformation, who failed percutaneous portal vein recanalization or surgical meso-rex shunt. In 2 cases TIPS was a bridge to liver transplant. In group A, 8 patients (n= 4 with regular anatomy; n=3 with cavernoma; n=1 with Budd-Chiari) successfully underwent TIPS with septic shock in 1 patient with cavernoma and portal biliopathy. In group B, 8 patients (n=4 with regular anatomy; n=4 with cavernoma) successfully achieved TIPS creation with severe bleeding and precipitating liver failure in 1 case that was managed with urgent liver transplantation. No technical failures were recorded. Clinical outcome was good in all patients. Despite the median age did not differ between groups, group B included 3 patients with the lowest age (1, 2 and 4 year-old) and a higher prevalence of altered anatomy.

### CONCLUSION

Hybrid percutaneous techniques for TIPS creation provide high technical and clinical success rates with a complication rate comparable to the standard approach. In pediatric patients and altered anatomy transhepatic- and transplenic-assisted TIPS may be considered.

### CLINICAL RELEVANCE/APPLICATION

Advanced techniques and alternative percutaneous approaches for TIPS creation may provide good outcomes in small pediatric patients and young adults with altered anatomy.

## T5A-SPPD-3 STRUCTURAL ASSESSMENT AND ASIA IMPAIRMENT SCALE PREDICTION IN PEDIATRIC SPINAL CORD INJURIES: INTEGRATING IMAGING PARAMETERS AND DEEP LEARNING METHODS

Christian Raimondo (*Abstract Co-Author*) Nothing to Disclose
Adam E. Flanders, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Krisa (*Abstract Co-Author*) Nothing to Disclose
Ze Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Feroze B. Mohamed, PhD (*Abstract Co-Author*) Nothing to Disclose
Mahdi Alizadeh (*Abstract Co-Author*) Nothing to Disclose
Devon M. Middleton (*Abstract Co-Author*) Research Grant, Advanced Neuromodulation Systems
Sara Naghizadehkashani (*Abstract Co-Author*) Nothing to Disclose
Zahra Sadeghi Adl, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Spinal cord injuries (SCI) in pediatric populations present unique challenges in diagnosis and prognosis due to the ongoing development of the central nervous system. Accurate assessment of structural changes in the spinal cord is essential for effective treatment planning. The International Standards

for Neurological Classification of Spinal Cord Injury (ISNCSCI) rating offers a standardized framework for evaluating the severity of spinal cord injury. This study aimed to use high resolution MRI images to assess structural changes in pediatric SCI by comparing cross-sectional area (CSA), anterior-posterior (AP) width, and right-left (RL) widths between typically developing (TD) and SCI subjects. Additionally, the study aimed to utilize these structural measures, alongside deep learning methods, to detect SCI subjects and predict their ASIA Impairment Scale category.

**METHODS AND MATERIALS**

Sixty pediatric subjects (ages 6-18), including 20 SCI patients and 40 TD controls, were enrolled, and scanned on a 3T scanner. All SCI subjects underwent ASIA tests to assess their neurological function and determine their ASIA Impairment Scale category. T2-weighted MRI scans were utilized to measure CSA, AP width, and RL widths along the entire cervical and thoracic cord. These measures were automatically extracted at every vertebral level using the SCT toolbox. Deep learning techniques, particularly convolutional neural networks (CNN), were utilized to classify subjects into SCI/TD groups and predict their ASIA Impairment Scale based on structural parameters.

**RESULTS**

Significant differences ($P<0.05$) in all the structural measures were observed between SCI and TD subjects, reflecting structural alterations associated with SCI. The CNN-based models achieved an accuracy of 96.59% in classifying subjects into TD/SCI groups. Furthermore, integrating structural parameters with deep learning models enabled prediction of ASIA impairment scale categories with 94.92% accuracy.

**CONCLUSION**

This study demonstrates the utility of integrating cross sectional structural imaging measures with deep learning for pediatric SCI assessment. The findings underscore the potential of this approach in enhancing diagnostic accuracy and prognostic capabilities, improving patient care and outcomes in pediatric SCI management.

**CLINICAL RELEVANCE/APPLICATION**

This study will advance neuroimaging as a biomarker for SCI. With objective imaging biomarkers, decisions about treatment paradigms could be tailored to individuals. The ability to predict outcomes SCI with greater degree of certainty would also guide rehabilitation therapies and allow for better clinical trial design and efficiency by optimizing patient stratification.

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# Abstract Archives of the RSNA, 2024

T5A-SPPH

**Physics Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPPH-1 CAN EXPOSURE INDEX BE USED TO DEVELOP DIAGNOSTIC REFERENCE LEVELS FOR DIGITAL RADIOGRAPHY?

Yuqi Zhao, PhD (*Abstract Co-Author*) Nothing to Disclose
Katie Hulme, MS (*Abstract Co-Author*) Nothing to Disclose
Erin B. Macdonald, PhD (*Abstract Co-Author*) Nothing to Disclose
Samuel L. Brady, PHD (*Abstract Co-Author*) Nothing to Disclose
Emily Marshall, PhD (*Abstract Co-Author*) Scientific Advisory Board, Bayer AG;Consultant, Bayer AG;Scientific Advisory Board, Radimetrics Dosimetry Services;Consultant, Radimetrics Dosimetry Services
Shady Alkhazzam, PhD (*Abstract Co-Author*) Nothing to Disclose
Kathleen Scilla, MS (*Abstract Co-Author*) Nothing to Disclose
Zaiyang Long, PhD (*Abstract Co-Author*) Nothing to Disclose
Adrian A. Sanchez, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ashley Tao, PhD (*Abstract Co-Author*) Nothing to Disclose
Ioannis Tsalafoutas (*Abstract Co-Author*) Nothing to Disclose
Xiang Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Bryan C. Schwarz, PhD (*Abstract Co-Author*) Nothing to Disclose
Suha Alshehri (*Abstract Co-Author*) Nothing to Disclose
Matthew Hoerner, PHD (*Presenter*) Nothing to Disclose

### PURPOSE

The exposure index (EI) gives an important real-time feedback mechanism for imaging technologists to identify the appropriateness of detector plate exposure. This study explored the feasibility of establishing diagnostic reference levels (DRLs) based on EI.

### METHODS AND MATERIALS

A method was developed to normalize system reported clinical EI values to a nominal (EIdet) value corresponding to the detector air kerma (Kdet) from the Automatic Exposure Control (AEC) system under a set of uniform field conditions. A procedure for estimating EIdet, which utilized an RQA-5 filter, was built to account for the dependence of EIdet on x-ray tube potential and correct for density and/or AEC speed adjustments. Clinical EI data was collected for each unit using machine-produced exposure log files and was sorted by Bucky, body part, view, and AEC settings including speed, density, and active imaging cells. Eight protocols with seven different body parts were examined in this study.

### RESULTS

Over thirty-seven thousand images from twenty-five x-ray systems of six different equipment manufacturers were included in this study. The results demonstrate that clinical EI (EIclinical) varies significantly ($p<0.05$) with body part, view, and manufacturer for comparable Kdet. Normalized ratios (Rnorm = EIclinical/EIdet) measured in this study may be used to correct for these factors and convert clinical EI values to EIdet.

### CONCLUSION

The utilization of EI as a DRL quantity requires unique context, separating it from other DRLs which are more straight-forward in their derivation. The potential of converting clinical EI values to EIdet via measured Rnorm and utilizing EIdet as a DRL is promising but should be explored further to define nuances associated with AEC characterization.

### CLINICAL RELEVANCE/APPLICATION

DRLs play a key role in radiology protocol optimization. While the current presence of EI in the clinic lends itself as a promising DRL quantity, there are many ill-defined factors affecting this EI value that must first be characterized. This work defines these factors, developing a full understanding of EI clinical application in representation of standard DRL values.

## T5A-SPPH-10 USEFULNESS OF THE SECOND-GENERATION WHOLE-HEART MOTION CORRECTION ALGORITHM (SSF2) IN FURTHER IMPROVING CLARITY AND DIAGNOSTIC CONFIDENCE FOR CORONARY STENT OF CORONARY CT ANGIOGRAPHY

Jianying Li, PhD (*Abstract Co-Author*) Employee, General Electric Company
Jianxin Guo (*Abstract Co-Author*) Nothing to Disclose
Tingting Qu (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the usefulness of the second-generation whole-heart motion correction algorithm (SSF2) on further improving image quality and diagnostic confidence of coronary stent in coronary CT angiography (CCTA) compared to the first-generation motion correction (SSF1).

**METHODS AND MATERIALS**

A total of 51 patients (with 70 stents) underwent CCTA were included, and images were generated with both SSF1 and SSF2. Subjective scoring (5-point method) and objective evaluation were performed. Subjective evaluation included the severity of stent motion artifacts, clarity of stent display, and diagnostic confidence within the stent. Objective evaluation included CT and SD values of the fat outside the stent with the most severe stent artifacts, in-stent lumen diameter, external stent diameter and severity of blooming artifact (blooming artifact = (external stent diameter - in-stent lumen diameter)/external stent diameter * 100). Paired sample T test was used for objective data that conforms to a normal distribution, while the Wilcoxon test was used for data that does not conform to a normal distribution and the subjective scores of two groups.

**RESULTS**

The stent motion artifacts score of SSF2 (0.27±0.48) was statistically lower than SSF1 (0.84±0.75) (P<0.001). The clarity of stent (4.30±0.62) and the diagnostic confidence score (3.77±1.11) of SSF2 were significantly higher than SSF1 (3.70±0.84, 3.37±1.12) (all P<0.001). SSF2 had statistically lower CT and SD values for the fat outside the stent with the most severe stent artifacts than SSF1 (all P<0.001). The stent reconstructed with SSF2 had the statistically larger in-stent lumen diameter (1.46±0.55mm) and the smaller blooming artifact (73.67±8.63) compared to SSF1 (1.35±0.56mm, 75.90±9.49) (all P<0.001).

**CONCLUSION**

The application of SSF2 technology in CCTA further reduces the motion artifacts of the coronary stents compared to SSF1, resulting in better display of the coronary arteries inside the stents and improved diagnostic confidence.

**CLINICAL RELEVANCE/APPLICATION**

SSF2 technology can make coronary stent display clearer and improve diagnostic confidence, making it a highly recommended coronary reconstruction technique.

## T5A-SPPH-2 VIRTUAL HUMAN TWINS IN LUNG HEALTH: A COMPREHENSIVE IN SILICO SCREENING APPROACH

William P. Segars, PhD (*Abstract Co-Author*) Nothing to Disclose
Liesbeth Vancoillie, PhD (*Abstract Co-Author*) Nothing to Disclose
Cindy McCabe (*Abstract Co-Author*) Nothing to Disclose
Lavsen Dahal (*Abstract Co-Author*) Nothing to Disclose
Saman Sotoudeh Paima, MS (*Abstract Co-Author*) Nothing to Disclose
Ehsan Samei, PHD (*Abstract Co-Author*) Research Grant, General Electric Company;Advisory Board, General Electric Company;Research Grant, Siemens AG;Advisory Board, Siemens AG;Advisory Board, medInt Holdings, LLC;Advisory Board, Metis Health Analytics;Research Consultant, Nanox Imaging Ltd;Royalties, General Electric Company;Royalties, medInt Holdings, LLC;Royalties, 12 Sigma Technologies;Royalties, Mirion Technologies, Inc;Royalties, Cambridge University Press;Royalties, John Wiley & Sons, Inc
Brian Harrawood, MS (*Abstract Co-Author*) Nothing to Disclose
Ehsan Abadi, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyle Lafata, PhD (*Abstract Co-Author*) Nothing to Disclose
Sheng Luo, PhD (*Abstract Co-Author*) Nothing to Disclose
Joseph Lo, PhD (*Abstract Co-Author*) Research Grant, iCAD, Inc
Amar Kavuri (*Abstract Co-Author*) Nothing to Disclose
Milo Fryling (*Abstract Co-Author*) Nothing to Disclose
Dhrubajyoti Ghosh (*Abstract Co-Author*) Nothing to Disclose
Fakrul Islam Tushar, PhD, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To enhance lung cancer screening by integrating in silico trials with statistical modeling, minimizing traditional trial limitations such as cost, time, and radiation exposure. This approach simulates the entire imaging chain and diagnostic process, improving screening efficiency and accuracy.

**METHODS AND MATERIALS**

We created 313 unique virtual patient models based on actual patients with mean age of 59 ± 14 years with 44% female representation. Within this cohort, 174 models include a total of 512 digitally inserted lung nodules, distributed between uniform (n=202) and variable (n=310) textures, with a range of diameters to mirror the distribution in the National Lung Screening Trial (NLST) for true-to-life simulation. The virtual cohort was digitally imaged employing a verified CT simulation software, and subsequently reconstructed with the agnostic MCR toolkit, ensuring broad applicability and adherence to standard imaging protocols. Our virtual reader emulates clinical diagnostics by combining detection and classification in a 3D AI model. Simulated nodules were "statistically labeled" as benign or malignant with random probability informed by radiomics features, thus facilitating the important transition in tasks from nodule identification to cancer diagnosis. The primary outcome focused on the variation in the Receiver Operating Characteristic Area Under the Curve (AUC) for both patient-level nodule detection and cancer diagnosis, supplemented by a detailed lesion-level analysis within sub-groups.

**RESULTS**

Using the in silico pipeline on a parallel computing cluster, we produced 1,878 simulated chest CT scans in 52 hours, averaging 36 scans per hour. Analysis of 313 virtual patients yielded a patient-level nodule detection AUC of 0.85 (95% CI: 0.80-0.89), compared to the more difficult task of cancer diagnosis with AUC of 0.70 (95% CI: 0.61-0.78). Subgroup evaluations revealed that the virtual reader model was more effective in identifying homogeneous lesions (AUC 0.97) than heterogeneous lesions (AUC 0.71), with particularly high performance for nodules larger than 8 mm (AUC 0.98).

**CONCLUSION**

Our research demonstrates the value of in silico trials in enhancing the calibration and efficacy of imaging-based diagnostic technologies. Our statistical labeling of simulated lung nodules demonstrates a new approach to bridge in silico trials toward clinically relevant endpoints. Future work will also consider the additional in silico modeling of demographic and clinical data.

**CLINICAL RELEVANCE/APPLICATION**

This study confirms the practicality of in silico trials and their potential to enhance diagnostic accuracy, directly informing the advancement of imaging techniques and patient care strategies in lung health.

## T5A-SPPH-4 DYNAMIC MEASUREMENT OF THE MITRAL VALVULAR-VENTRICULAR COMPLEX IN MITRAL VALVE PROLAPSE PATIENTS USING MOTION-COHERENT MODELING-BASED IMAGE PROCESSED 4D-CT

Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Hiroki Horinouchi (*Abstract Co-Author*) Nothing to Disclose
Tomoro Morikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Midori Fukuyama, MD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Saito, RT (*Abstract Co-Author*) Nothing to Disclose
Toshimitsu Tanaka, RT (*Abstract Co-Author*) Nothing to Disclose
Yoshiaki Morita (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Nishii, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation
Akiyuki Kotoku, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Emi Tateishi (*Abstract Co-Author*) Nothing to Disclose
Yasutoshi Ohta, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate whether 4D-dynamic tracking based on ECG-gated CT of the mitral valve provides quantitative information on dynamic measurements of the mitral valve complex and to investigate geometry changes in patients with mitral valve prolapse (MVP)

### METHODS AND MATERIALS

Retrospective ECG-gated dual-source CT data from 15 patients (68±13 years) with mitral valve prolapse scheduled for robotic mitral valve repair and 15 control subjects (82±6 years) were analyzed. The CT data set was converted to 40 phases/cycle by motion coherence imaging, and voxel position tracking in the cardiac cycle was calculated at the workstation. The dynamic changes of the mitral valve annulus, papillary muscle, and apical geometry were automatically tracked. Mitral valve annular perimeter, trigone distance, area, the distance among annular point and papillary muscles, inter-papillary muscle distance (IPD), and papillary muscle angle (PMA) are dynamically measured over the cardiac cycle. Multiple comparisons were used to investigate the hallmarks of the mitral valvular-ventricular complex and evaluate the feasibility of anatomical differences between MVP patients and control subjects.

### RESULTS

On average, the annular dimensions were dynamically changed during the cardiac cycle ($p < 0.001$) and significantly larger in MVP than in control subjects ($p < 0.001$). Mitral annulus perimeter (11.9±7.2 vs. 6.5±3.1mm, $p=0.012$) and inter-trigone distance (3.9±2.8mm vs. 1.7±0.5mm, $p=0.0053$) were elongated in patients with MVP compared to control subjects (MVP vs. control). The inter-cycle differences between IPDs and PMA were significantly higher in the MVP group than in the control group (12.7±3.8mm vs. 8.5±1.7mm, $P<0.001$) (16.5±5.1° vs. 12.0±3.4°, $p=0.009$), and inter-cycle change was affected by the disease ($p<0.001$)

### CONCLUSION

The results of this study render the clinical feasibility of mitral valve measurement to provide physiological motion of the mitral valve components during the cardiac cycle.

### CLINICAL RELEVANCE/APPLICATION

The dynamic measurement by using motion-coherent modeling provides a better in vivo evaluation of 3-dimensional geometric changes of the mitral valvular-ventricular complex for surgical repair techniques or transcatheter mitral interventions.

## T5A-SPPH-5 AI-BASED DENOISING ON DIGITAL BREAST TOMOSYNTHESIS USING IN-SILICO IMAGING TOOL: FEASIBILITY STUDY FOR CLINICAL APPLICATION

Chul kyun Ahnn (*Abstract Co-Author*) Nothing to Disclose
Jong H. Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
AHYEONG LEE, BEng (*Presenter*) Nothing to Disclose

### PURPOSE

To validate the performance of a deep learning (DL)-based denoising algorithm trained on in-silico breast imaging data and to check the feasibility of its application to clinical digital breast tomosynthesis (DBT) images.

### METHODS AND MATERIALS

Throughout the U.S. Food and Drug Administration (FDA) proven Virtual Imaging Clinical Trial for Regulatory Evaluation (VICTRE) pipeline, Monte Carlo based digital mammography (mcDM), mcDBT simulator and voxelized anthropomorphic breast phantoms were used for conducting in-silico imaging trials. This study used The Cancer Imaging Archive (TCIA) VICTRE dataset (2986 virtual phantom data) and Korean population dataset (80 virtual phantom data). The Korean population dataset was simulated using 3D anthropomorphic breast phantoms that reflected the breast density, a size and thickness of women through the VICTRE pipeline. Training dataset consisted of pairwise mcDM and center projected mcDBT images simulating with 6% dose level of the mcDM image. A modified U-net was trained to predict the noise map in the mcDBT. Among the 3066 cases (313 for dense, 1220 for heterogeneously, 1220 for scattered, 313 for fatty), 2766 cases were used for AI-model training and the rest 300 cases were used for evaluating the AI algorithm performance. Peak signal-to-noise ratio (PSNR) and Haar wavelet-based perceptual similarity index (HaarPSI) were measured to assess how the noisy images were restored closely to the mcDM images after the AI-denoising. This study used DBT images of thirty clinical patients as independent test set to evaluate the denoising performance using the signal-to-noise ratio (SNR).

### RESULTS

In virtual DBT images, through the AI-denoising, PSNR was increased from 10.9 to 20.0. The HaarPSI were 0.26 for original image and 0.39 for denoised image. Denoised virtual DBT images were much closer to the less noisy mcDM. In clinical data of DBT, the SNR increased as 10% in the denoised image compared to the original image (Mean SNR of denoised images vs original images: 158.6 vs 143.8). It demonstrated denoised clinical DBT image showed same trend in virtual phantom experiment; significantly lower noise level than that of original DBT images.

### CONCLUSION

The AI-denoising algorithm trained with in-silico phantom data demonstrated the potential to restore images closely to the mcDM and to improve image quality. It was able to successfully reduce noise and applicable to human subject DBT.

### CLINICAL RELEVANCE/APPLICATION

Application of DL-based denoising algorithm with in-silico imaging can be applied to clinical DBT images to reduce the radiation dose for DBT scan.

## T5A-SPPH-6 QUANTITATIVE ACCURACY OF BONE MINERAL DENSITY MEASUREMENTS FROM MULTI-ENERGY LOCALIZER RADIOGRAPHS ON A CLINICAL PHOTON-COUNTING-DETECTOR CT SYSTEM

Francis I. Baffour, MD (*Abstract Co-Author*) Nothing to Disclose
Tristan Nowak (*Abstract Co-Author*) Employee, Siemens AG
Joseph R. Swicklik, RT, BS (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Shanblatt, PhD (*Abstract Co-Author*) Employee, Siemens AG
Soeren Jasper (*Abstract Co-Author*) Nothing to Disclose
Kishore Rajendran, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the quantitative accuracy and stability of areal bone mineral density (aBMD) measured using photon-counting-detector (PCD) CT localizer radiographs.

### METHODS AND MATERIALS

An anthropomorphic spine phantom (European Spine Phantom, ESP) with hydroxyapatite inserts (HA, 0.5, 1.0, and 1.5 g/cm2) was scanned on a clinical PCD-CT system (Siemens NAEOTOM Alpha) at 120 kV and 140 kV tube potentials. To assess aBMD accuracy, four phantom thicknesses (18, 26, 34, and 40 cm) were emulated using synthetic soft tissue and scanned using eight tube current values (15-120 mA for 120 kV and 10-80 mA for 140 kV). Additionally, multi-energy localizers for the 18 cm phantom were acquired twice daily for a week, and once per week for five weeks to assess reproducibility. Quantitative HA maps were reconstructed using a prototype two-material decomposition software. One-way analysis of variance (ANOVA) was performed to test for statistical significance. Coefficient of variation was used to quantitate the stability of aBMD for daily and weekly measurements. Mean absolute percent error (MAPE) was calculated to quantify error in aBMD measurements. To demonstrate clinical feasibility, a patient (59-year-old male) was scanned using PCD-CT localizer at 140 kV and 40 mA, and the corresponding aBMD values were compared with patient's dual-energy x-ray absorptiometry (DXA) results.

### RESULTS

The aBMD measurements from phantom localizers showed excellent day-to-day stability (coefficient of variation 0.42%-0.53%, MAPE=5%) and excellent week-to-week stability (0.17%-0.60%, MAPE=5%). The MAPE range was 4.65% to 5.71% across different tube currents and phantom sizes. No significant difference in accuracy was observed between different tube currents for each phantom size and tube potential. PCD-CT showed lower MAPE (3.3%) than DXA (11.2%) for 18 cm ESP. Lumbar aBMD values from patient PCD-CT localizer showed 0.07% to 9.8% deviation relative to DXA measurements.

### CONCLUSION

Multi-energy PCD-CT localizers demonstrate accurate aBMD measurements across different patient thickness and tube potential with less than 10% deviation relative to current clinical standard (DXA). Reproducible aBMD values can be obtained from PCD-CT localizers.

### CLINICAL RELEVANCE/APPLICATION

Our study demonstrates the accuracy and reproducibility of bone mineral density values obtained from clinical PCD-CT localizers, which is suitable for opportunistic bone quality measurements.

## T5A-SPPH-7 CEREBRAL CT ANGIOGRAPHY USING A PATIENT-SPECIFIC ACQUISITION TIME

Justin Truong (*Abstract Co-Author*) Nothing to Disclose
ABDELRAHMAN ALSALEH (*Abstract Co-Author*) Nothing to Disclose
Sabee Y. Molloi, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Alireza Shojazadeh, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop an optimal acquisition timing for cerebral CT angiography with optimal image quality.

### METHODS AND MATERIALS

A total of six swine (55 ± 24 kg) underwent multiple consecutive cerebral CT angiograms over 30 seconds post-contrast injection (1 mL/kg, 5 mL/s, Isovue 370) to capture the entire carotid enhancement curves and determine true peak time totaling 21 acquisitions. We hypothesize that contrast enhancement peak time following bolus tracking is directly proportional to the duration time for contrast injection. Specifically, the optimal time to peak corresponds to half of the injection duration time plus a predetermined dispersion time. To apply this theory, a gamma variate function was used to calculate the reference time to peak (TTP) of carotid enhancement from 21 scans. The calculated time to peak was then correlated to one-half contrast injection time where the intercept was used as the dispersion time for developing patient-specific optimal acquisition protocol. To evaluate the accuracy of the optimized TTP, nine patients (41-87 years old) suspected of cerebral ischemia were used to compare attenuations at the internal carotid artery in addition to contrast to noise ratio (CNR) in the middle cerebral artery (MCA) at the level of circle of Willis. The results from our protocol were then compared with the standard TTP of 5 seconds and the reference peak. Statistical analysis for all data was conducted using mixed regression analysis, box-and-whisker plot, and root-mean-square error.

### RESULTS

Linear regression analysis demonstrated a significant correlation between half contrast injection time ( TInj) and reference TTP (TRef) in swine, described by TRef = 1.04 (TInj/2) + 2.50 (Pearson's r= 0.94, root mean square error= 2.73 s). In patient studies, enhancements in the internal carotid artery under optimal and standard CT protocols differed from reference values by 19 ± 13 and 100 ± 72 Hounsfield units respectively. Additionally, the mean CNR values in the MCA from the optimal and standard CT acquisitions relative to reference were calculated to be 1.30 ± 1.41 and 3.89 ± 2.24, respectively.

### CONCLUSION

This study develops a patient specific technique for acquisition of cerebral angiograms at peak contrast enhancement. As a result, this study shows potential to visualize intracranial arteries at the peak of contrast enhancement and improve CNR for clinical applications.

### CLINICAL RELEVANCE/APPLICATION

Currently two main techniques are used for cerebral CT angiograms including fixed scan-delay following bolus tracking and the test bolus technique and no globally accepted protocol. Optimizing cerebral enhancement during CT angiogram is of key clinical importance for the assessment of both ischemia and aneurysm.

## T5A-SPPH-8 DEEP LEARNING-BASED MOTION CORRECTION (CLEAR MOTION): CAPABILITY OF QUANTITATIVE AND QUALITATIVE IMAGE QUALITY IMPROVEMENTS ON CHEST CT IN PATIENTS WITH THORACIC DISEASES

Masahiko Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Kenji Fujii (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hiroyuki Nagata (*Abstract Co-Author*) Canon Medical Systems Corporation
Yoshiharu Ohno, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology
Hirona Kimata (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takahiro Ueda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Naruomi Akino (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Daisuke Takenaka, MD (*Abstract Co-Author*) Canon Medical Systems Corporation
Yuya Ito (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yoshiyuki Ozawa, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Motion artifacts including cardiac motion are main causes for decreasing image quality on chest CT in patients with pulmonary diseases. Recently, we have developed and clinically set deep learning (DL)-based motion correction algorithm (CLEAR Motion) for chest CT examination. The purpose of this study was to directly compare the utility of CLEAR Motion for image quality improvements with conventional reconstruction method on chest CT examination in patients with various thoracic diseases.

### METHODS AND MATERIALS

56 consecutive patients with various thoracic diseases who underwent non-electrocardiogram gated chest helical CT examination at a 320-detector row CT system and reconstructed with conventional reconstruction method and CLEAR Motion. On quantitative image quality evaluations on both CT protocols, CT value, cardio-pulmonary edge distance(C-PED) and slope (C-PES) were measured by ROI measurements or profile curve assessments by a board-certified chest radiologist. On qualitative image quality assessments on each CT protocol, two board-certified chest radiologists independently and visually assessed overall image quality and artifacts at lung and mediastinal window settings and region conspicuity at lung window setting on axial, sagittal and coronal planes. Then, each final value was determined as consensus of two readers. To compare each quantitative image quality index between CLEAR Motion and conventional method, paired t-test was performed. To determine each inter-observer agreements, kappa statistics followed by ?2 test. To compare each qualitative image quality index between two methods, Wilcoxon's signed-rank test was performed.

### RESULTS

C-PED and C-PES of CLEAR Motion were significantly superior to those of conventional method ($p<0.05$). Each interobserver agreement was determined as almost perfect (CLEAR Motion: 0.84=?=0.92, $p<0.0001$; conventional method: 0.87=?=0.94, $p<0.0001$). At lung window setting, overall image quality, artifacts and region conspicuity of CLEAR Motion were significantly better than those of conventional method ($p<0.0001$).

### CONCLUSION

DL-based motion correction is considered as more useful for image quality improvement than conventional method on chest CT in patients with various thoracic diseases.

### CLINICAL RELEVANCE/APPLICATION

DL-based motion correction is considered as more useful for image quality improvement than conventional method on chest CT in patients with various thoracic diseases.

## T5A-SPPH-9 IMPROVING CORONARY STENOSIS ASSESSMENT IN ENERGY-INTEGRATING-DETECTOR (EID) CT THROUGH DEEP LEARNING-BASED MONOENERGETIC IMAGING: A COMPARISON WITH ULTRA-HIGH RESOLUTION PHOTON-COUNTING-DETECTOR (PCD) CT

Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Hao Gong, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Emily Koons (*Abstract Co-Author*) Nothing to Disclose
Cynthia H. McCollough, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Jamison Thorne, BSc (*Abstract Co-Author*) Nothing to Disclose
Shaojie Chang, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Photon counting detector (PCD) CT has been shown to reduce blooming artifacts and enhance the accuracy of stenosis quantification through its ultra-high-resolution (UHR) and multi-energy imaging capabilities. However, most coronary CT angiography (cCTA) exams are performed using single-energy mode with conventional energy-integrating detector (EID) CTs. We aim to produce virtual mono-energetic images (VMIs) for single-energy EID-CT to improve stenosis assessment through Deep-learnIng bAsed MONoenergetic imaging at Different energies (DIAMOND).

### METHODS AND MATERIALS

DIAMOND was developed by training a simplified U-Net model on ten cCTA exams scanned with multi-energy mode on a clinical PCD-CT (NAEOTOM Alpha, Siemens Healthineers). The 70 keV PCD VMIs (equivalent to the single-energy EID-CT scanned at 120 kV) were used as input, and 100 keV PCD VMIs as target. All VMIs were reconstructed following the standard clinical protocol, using an iterative reconstruction (IR) algorithm at strength 4, Bv60 kernel, and 0.6 mm slice thickness. For inference, DIAMOND was deployed on unseen EID-CT cCTA patient cases (n=10), reconstructed using IR-4, Bv40 kernel, and 0.6 mm slice thickness. In addition to visual evaluation, we quantitatively assessed percent diameter stenosis using commercial software (Syngo.Via, Siemens) and compared results across EID, DIAMOND, and PCD images.

### RESULTS

DIAMOND effectively reduced blooming artifacts from the calcium and provided better visualization of the lumen compared to the EID-CT inputs, resulting in images closer to PCD-CT. The percent diameter stenosis determined from DIAMOND showed a reduction across all ten patients compared to their

original EID-CT images. Specifically, the average percent diameter stenosis from the original EID-CT was 43.3%, which is known from phantom experiments to overestimate the stenosis severity. It was decreased to 30.5% when processed with DIAMOND, aligning more closely with the 28.6% observed in UHR PCD-CT, which is considered a more accurate reflection of true stenosis. Using UHR PCD-CT as a reference, DIAMOND overestimates the percent stenosis by only 6.6%, which represents a significant improvement over the 51% overestimation by the original EID-CT data.

**CONCLUSION**

DIAMOND equips EID-CT systems with virtual mono-energetic imaging capabilities, reducing blooming artifacts, enhancing stenosis assessments, and achieving results that approximate the quality of PCD-CT.

**CLINICAL RELEVANCE/APPLICATION**

DIAMOND enhances the performance of EID-CT by reducing blooming artifacts and improving the accuracy of coronary stenosis assessments, which has a significant impact on patient care due to the widespread installation of EID-CT (>99% of installed CT scanners are EID-CT).

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# Abstract Archives of the RSNA, 2024

T5A-SPRO

**Radiation Oncology Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPRO-1 ADENOVIRUS-MEDIATED TRANSFERRIN RECEPTOR REPORTER GENE (TFRC) EXPRESSION IN COLORECTAL CANCER MODELS AND MRI IMAGING STUDY

Zhijun Wang, MMedSc (*Abstract Co-Author*) Nothing to Disclose
Xinxin Guo (*Abstract Co-Author*) Nothing to Disclose
Na Gao (*Abstract Co-Author*) Nothing to Disclose
Hua He, MMedSc (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the overexpression of adenovirus vector-mediated transferrin receptor reporter gene (TFRC) transfection in colorectal cancer LoVo cells and to observe the imaging changes of a colorectal cancer model (7.0T MRI) in vivo.

### METHODS AND MATERIALS

TFRC-luciferase adenovirus was used to infect human colorectal cancer LoVo cells. Bioluminescence imaging was used to detect luciferase expression in vitro cultured LoVo cells. Real-time fluorescent quantitative polymerase chain reaction (QPCR) was used to detect and analyze TFRC gene expression in LoVo cells. Cell Counting Kit-8 (CCK-8) was utilized to test cell toxicity. Transferrin-coupled ultrasmall superparamagnetic iron oxide (TFTC-USPIO) was used to label the reporter gene adenovirus in vitro. A LoVo colon tumor model was established by subcutaneously inoculating 1×107 double-labeled LoVo cells into the groin of BALB/c mice. Then TFTC-USPIO molecular probes were administered intravenously via the tail vein, and dynamic monitoring of signal changes in the tumor was conducted using T2, T2map and T2*map sequences with 7.0T MRI. Signal intensity was analyzed and the tumor was dissected for Prussian blue staining.

### RESULTS

Real-time fluorescent quantitative PCR results showed that TFRC reporter gene was significantly overexpressed in LoVo cells transfected with Ad-TFRC-luciferase. CCK-8 tests demonstrated that the double-reporter gene expression labeled with Ad-TFRC-luciferase had no adverse effects on cell proliferation and vitality. In vitro, the signal intensity of USPIO-labeled LoVo cells decreased. In vivo, the low signal area of tumor cells expanded rapidly with time. Prussian blue staining showed iron accumulation in tumor tissue.

### CONCLUSION

MRI combined with a bioluminescence double-reporter gene imaging system can achieve dual-mode tracking of labeled cells and dynamically monitor and evaluate changes in tumor growth during treatment in vivo.

### CLINICAL RELEVANCE/APPLICATION

This study provides basic research data for the diagnosis and targeted treatment of colorectal cancer.

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# Abstract Archives of the RSNA, 2024

T5A-SPVA

**Vascular Imaging Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-SPVA-3 CLINICAL AND ULTRASONOGRAPHIC CORRELATES OF POSTTHROMBOTIC VENOUS REMODELING IN BEHÇET'S SYNDROME: A CROSS-SECTIONAL STUDY

Ibrahim Adaletli (*Abstract Co-Author*) Nothing to Disclose
Omer Faruk Sariahmetoglu, MD (*Abstract Co-Author*) Nothing to Disclose
Seyfullah Karagoz, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study was to determine the clinical and ultrasonographic parameters affecting venous remodeling.

### METHODS AND MATERIALS

Patients diagnosed with Behcet's syndrome (BS) according to international criteria and who had venous thrombosis in upper leg veins were included in the study. Clinical-Etiology-Anatomy-Pathophysiology (CEAP) and Villalta scores were used to evaluate the clinical severity of postthrombotic syndrome (PTS). Two independent radiologists blinded to the clinical diagnosis of the patients performed the ultrasound examinations. The measurement results of the wall thickness and diameter of the common femoral vein (CFV) and great saphenous vein were recorded bilaterally. If a thrombus was present, B-mode ultrasound were used first to assess the thrombus morphology. Thrombus location, echogenicity, thickness, and longitudinal extent were noted. CFV wall elastography was also performed bilaterally in each patient.

### RESULTS

79 BS patients (71M/8F) were included in this study. A total of 35 obvious thrombi were observed in 32 patients. Although no significant difference was detected in thrombus stiffness over time, the stiffness of thrombi tended to be higher in the first six months. While there was a trend towards an increase in the probability of severe PTS as the stiffness of the CFV wall increased, we found a negative relationship between CFV wall thickness and severe PTS. Moreover, as venous reflux time (sc) increased, the probability of severe PTS) and stasis ulceration increased.

### CONCLUSION

Our study shows venous reflux and fibrotic bands within the veins are the most critical parameters for severe PTS. Also, thrombus material in the veins probably causes venous reflux by disrupting the structure of the venous valves. Fibrosis in the vein wall, possibly due to chronic thrombus, contributes to venous insufficiency by making the vein wall stiffer and thinner. Age, disease duration, relapses, and thrombotic events in both legs stand out as clinical factors that trigger adverse venous remodeling and predispose to severe PTS. Achieving complete recanalization of the thrombus and preventing recurrent thrombotic attacks are the ultimate goals of treating BS thrombus.

### CLINICAL RELEVANCE/APPLICATION

This study underlines the importance of detailed ultrasonographic evaluation in predicting severe PTS in BS.

# Abstract Archives of the RSNA, 2024

T5B-SPBR

**Breast Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPBR-1 CONTRAST ENHANCED MAMMOGRAM BIOPSY CANNOT REPLACE MRI-GUIDED BIOSPY FOR SUSPICIOUS BREAST MRI FINDINGS

Vilert A. Loving, MD, MMM (*Abstract Co-Author*) Nothing to Disclose
Hannah A. Lawther, MD (*Abstract Co-Author*) Nothing to Disclose
Molly Harrison, MD (*Abstract Co-Author*) Nothing to Disclose
Danielle E. Summers, MD (*Abstract Co-Author*) Nothing to Disclose
Leslie A. Welk, MD (*Abstract Co-Author*) Nothing to Disclose
Shayna Klein, MD (*Abstract Co-Author*) Nothing to Disclose
Brian Johnston, MD (*Abstract Co-Author*) Nothing to Disclose
Michael F. Morris, MD (*Presenter*) Educator, Medtronic plc

### PURPOSE

Contrast enhanced mammogram (CEM) has similar diagnostic accuracy to breast MRI, however it is uncertain if CEM biopsy can be used instead of MRI-guided biopsy to obtain tissue samples of suspicious findings on breast MRI.

### METHODS AND MATERIALS

Consecutive patients from 2 sites within an integrated healthcare network with BIRADS 4/5 findings on breast MRI and a recommendation for MRI-guided breast biopsy were referred for attempted CEM biopsy as part of an institutional protocol. Patients with more than one suspicious finding on MRI, a mass or non-mass enhancement <5mm diameter, or history of iodinated contrast reaction were excluded from the protocol. A modified Likert scale assessed conspicuity of CEM findings, ranging from much less conspicuous than MRI (score 1) to much more conspicuous than MRI (score 5). For abnormalities not identified at attempted CEM biopsy, MRI-guided biopsies were performed. Descriptive statistics were performed.

### RESULTS

From 5/2023 to 10/2023, 21 breast MRI patients were referred for CEM biopsy (Hologic, Marlborough, MA), including 95% (20/21) for non-mass enhancement and 5% (1/21) for a mass. CEM targets corresponding to MRI findings were identified in 28.5% (6/21) patients and CEM biopsies were performed. Findings on MRI did not significantly differ between patients with a CEM correlate compared to patients without a CEM correlate (Table). CEM targets were rated as being either much less conspicuous or slightly less conspicuous than the MRI findings (mean 1.83 +/- 0.4). All CEM biopsy results were benign, with no interval suspicious findings at 6-12 month follow-up mammography, Patients without a CEM correlate (71.5%; 15/21) were subsequently referred to MRI-guided biopsy, with interval resolution of MRI findings in two patients. In the remaining cohort, MRI-guided biopsy yielded malignancy in 23% (3/13), high-risk histology in 15% (2/13), and benign histology in 62% (8/13). One high-risk lesion upstaged to cancer at surgical excision (total cancers 4/13; 31%). Having no CEM correlate to the MRI finding yielded a negative predictive value of 73% for malignancy.

### CONCLUSION

In patients with predominately suspicious non-mass enhancement referred for MRI-guided breast biopsy, only 28.5% had corresponding targets for CEM biopsy. Lack of enhancement at CEM biopsy had a negative predictive value of 73% for malignancy. However, all cases of malignancy diagnosed by MRI-guided biopsy were not detected at initial attempted CEM biopsy.

### CLINICAL RELEVANCE/APPLICATION

In patients with suspicious breast MRI findings, CEM biopsy should not be used as a replacement for MRI-guided biopsy.

## T5B-SPBR-10 IMPACT OF MENSTRUAL CYCLE ON BACKGROUND PARENCHYMAL ENHANCEMENT AND BREAST CANCER DETECTABILITY IN CONTRAST-ENHANCED SPECTRAL MAMMOGRAPHY

Huizhi Cao (*Presenter*) Nothing to Disclose

### PURPOSE

Prominent background parenchymal enhancement (BPE) in contrast-enhanced spectral mammography (CESM) may hinder lesion detection and diminish diagnostic performance. This study aimed to investigate the effect of the menstrual cycle on BPE and cancer detectability in a large cohort of breast cancer patients undergoing CESM.

### METHODS AND MATERIALS

After ethical approval, we identified 1253 potentially eligible patients under through CESM from five china hospitals in different regions. 512 patients were examined in menstrual phase (days 1-4), 444 patients in the proliferative phase (days 5-14), and 505 patients in the secretory phase (days 15-30). The BPE on CESM were evaluated independently by three experienced radiologists and classified as minimal, mild, moderate, marked. The caner detectability was assessed as Excellent, good, or poor, respectively. Using ROC curve to analyze the diagnostic performance of CESM in breast cancer patients with different phase of menstrual cycle.

### RESULTS

1369 breast lesions were found in 1253 patients, in which 688 were benign and 681 were malignant according to histopathological results. Most patients had minimal BPE (1020/1369; 74.5%) at CESM modality. BPE was determined as marked in 1.6%, 3.6% and 12.1% at the menstrual, proliferative and secretory phases ($p < 0.001$), respectively, indicating that the degree of BPE is demonstrated significant associated with secretory status. The detectability of breast cancer was classified as poor in 0.2%, 2.4% and 10.0% at menstrual, proliferative and secretory phases, respectively, showing the secretory phases reduce the detection rate of breast cancer. On the basis of ROC curve analysis, the CESM from patients of menstrual or proliferative phase is higher than that from secretory phase phase (0.901 vs. 0.887vs. 0.702, $p<0.05$), Additionally, the CESM with menstrual or proliferative phase groups show higher sensitivity and specificity(menstrual phase:0.914, 0.892; proliferative phase:0.892,0.801; secretory phase group:0.758,0.655;), and a lower False-Negative and False Positive (menstrual phase:0.022, 0.112; proliferative phase:0.040,0.168; secretory phase group:0.231,0.564).

### CONCLUSION

The menstrual phase and the proliferative phase seem to be suitable for breast CESM.

### CLINICAL RELEVANCE/APPLICATION

The menstrual and proliferative phases appear to be more suitable for breast CESM, as they offer better diagnostic performance and higher cancer detectability while minimizing the impact of background parenchymal enhancement.

## T5B-SPBR-2 GLOBAL-LOCAL LEARNING FOR EXPLAINABLE BREAST CANCER RISK PREDICTION FROM SCREENING MAMMOGRAMS

Jonas Teuwen, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Zahra Babaei Aghdam (*Abstract Co-Author*) Nothing to Disclose
Xinglong Liang (*Abstract Co-Author*) Nothing to Disclose
Chunyao Lu (*Abstract Co-Author*) Nothing to Disclose
Eric Marcus (*Abstract Co-Author*) Nothing to Disclose
Regina G. Beets-Tan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Antonio Portaluri, MD (*Abstract Co-Author*) Nothing to Disclose
Yuan Gao, MS (*Abstract Co-Author*) Nothing to Disclose
Tao Tan (*Abstract Co-Author*) Nothing to Disclose
Tianyu Zhang (*Abstract Co-Author*) Nothing to Disclose
Luyi Han (*Abstract Co-Author*) Nothing to Disclose
Xin Wang, MS (*Presenter*) Nothing to Disclose

### PURPOSE

Mammogram-based deep learning (DL) breast cancer (BC) risk prediction models show huge potential for personalized BC screening. To enhance the explainability and generalizability of the risk prediction, we propose a global-local transformer framework-based (GL) risk prediction model.

### METHODS AND MATERIALS

We collected two datasets: an IRB-approved large inhouse (internal) and a public CSAW (external) dataset. The inhouse dataset is collected from 2004-2020, and involves 171,168 mammograms from 9,133 patients. All methods are built on the inhouse dataset, which is split into training/validate/test sets based on patient level. The external public dataset including 98,776 images on 8,723 patients is used to evaluate the models' generalizability. Our DL risk model was designed to mimic the process of mammogram reading by radiologists, which firstly figure out globally high-risk characteristics (e.g. dense tissue, architectural distortion et al.), and then further analyze the local suspicious areas (such as micro-calcifications). The GL risk model outputs the risks at multiple time points from 1 year to 5 years and bounding boxes of the high-risk areas. We compared the models' performance with AUC and Precision-Recall AUC (PR-AUC) metrics for each risk assessment interval and overall C-index metric on both datasets with baseline methods.

### RESULTS

For the internal test set (25,244 images / 1,706 positives within 5 years), the proposed GL risk model achieved the best 5-year C-index of 0.774±0.005, with the highest AUC of 0.864±0.005 and PR-AUC of 0.504±0.013 at 1-year risk prediction. The AUC and PR-AUC of the GL model for the long-term 5-year risk prediction are 0.769±0.005 and 0.457±0.009, respectively. The GL risk model improved upon the two baseline models for all metrics (?C-index=0.7-2.4%; ?AUC= 0.5-4.4%; ?PR-AUC=0.34-11.3%). For the external validation on the public CSAW-CC dataset (98,776 images / 3,652 positives within 5 years), our model achieved the best performance compared with both baseline methods, with 5-year C-index of 0.693±0.003. Our model surpasses other baselines on all metrics. The visualization results also show that the GL model could accurately figure out the high-risk area.

### CONCLUSION

Compared with baseline risk prediction models, the global-local transformer-based risk prediction model enhances explainability and generalizability.

### CLINICAL RELEVANCE/APPLICATION

The global-local mechanism provides a clear focus on the potential high-risk areas from whole mammograms. It can guide radiologists in their decision-making process. Besides, the improved generalization performance of the risk model may facilitate the clinical application enabling the development of a personalized screening policy.

## T5B-SPBR-3 CANCERS SEEN BY ONE OBSERVER ON CONTRAST-ENHANCED MAMMOGRAPHY IN WOMEN WITH PERSONAL HISTORY OF BREAST CANCER

Jules H. Sumkin, DO (*Abstract Co-Author*) Research Grant, Hologic, Inc;
Margarita L. Zuley, MD (*Abstract Co-Author*) Investigator, Hologic, Inc
Amy E. Kelly, MD (*Abstract Co-Author*) Nothing to Disclose

Bronwyn Nair, MD (*Abstract Co-Author*) Nothing to Disclose
Marie A. Ganott, MD (*Abstract Co-Author*) Nothing to Disclose
Adrienne Vargo, MD (*Abstract Co-Author*) Nothing to Disclose
Kimberly S. Harnist, MD (*Abstract Co-Author*) Nothing to Disclose
Jeremy M. Berg, PhD (*Abstract Co-Author*) Nothing to Disclose
Luisa Wallace (*Abstract Co-Author*) Nothing to Disclose
Amy H. Lu, MD (*Abstract Co-Author*) Nothing to Disclose
Wendie A. Berg, MD, PhD (*Presenter*) Institutional Research Grant, Koios Medical, Inc

**PURPOSE**

In the prospective TOCEM trial, women with a personal history of breast cancer have three annual rounds of screening with digital breast tomosynthesis (DBT) and contrast-enhanced mammography (CEM). We sought to evaluate factors affecting cancer detection by one versus two specialist breast imaging radiologists.

**METHODS AND MATERIALS**

In an IRB-approved, HIPAA-compliant trial, from 10/19/19 through 4/15/24, 1647, 1227, and 819 women completed year 1, 2, and 3 screening, respectively. Two radiologists interpret each paired examination: reader 1 (R1) interprets DBT first and records findings, then CEM, and reader 2 (R2) interprets CEM first. For recalled findings, we recorded which modality prompted recall, and if the finding was seen only in retrospect on DBT. We examined influence of lesion and breast factors on cancer detection by only one vs. both readers: lesion size, conspicuity (low=1, moderate=2, high=3), seen on only one view (on retrospective review), breast density, and background parenchymal enhancement (BPE). Statistical differences were inferred by using nonparametric bootstrapping of 10,000 replicates (R Studio).

**RESULTS**

There were 87 malignant lesions in 68 women. Of these 87, 41 (47%) were seen by at least one reader on DBT: 35 (40%) were identified by R1 on DBT as were 30 (34 %) by R2 [24 (28%) by both]. Of 87 malignant lesions, 60 (69%) were seen by R1 on CEM as were 58 (67%) by R2 [49 (56%) by both]. Twenty cancers were seen only by one reader on CEM, including: 9 DCIS (four grade 3, five grade 2), 2 IDC (0.6, 1.0 cm, both grade 2), 4 IDC-DCIS (0.6, 1.0, 1.2, 2.0 cm), all grade 2, 3 ILC (0.5 cm each, all grade 2), 1 ILC-DCIS, 0.9 cm, grade 2, and 1 pleomorphic LCIS. Of 69 (79% of all) malignant lesions seen by either observer on CEM, 32 (46%) were also seen on DBT, 11 (16%) were deemed visible in retrospect on DBT, and 26 (38%) were not visible even in retrospect by either reader. Three malignancies were seen only on DBT and low-energy (LE) images, all DCIS. Two malignancies were manifest as calcifications seen only on DBT, not visible on LE images, one 0.4 cm IDC-DCIS and one DCIS. Mean size of cancers seen by both readers on CEM was larger at 16.4 mm vs. 7.9 mm by only one reader (P=0.001) and mean CEM conspicuity was higher (mean 2.5 vs. 2.0, P=0.0048). One-view findings, binarized breast density, and BPE did not significantly influence one- vs. two-reader detection on CEM.

**CONCLUSION**

A substantial proportion of malignant lesions are subtle on CEM, with 20/69 (29%) seen by only one reader; this compares with 17/41 (41%) seen by only one reader on DBT.

**CLINICAL RELEVANCE/APPLICATION**

Interpreting radiologists need to be attentive to small enhancing lesions and those of low conspicuity on CEM. Further study of the role of DBT with CEM is warranted.

## T5B-SPBR-4 BENIGN AND SUSPICIOUS CONTRAST-ENHANCED MAMMOGRAPHY FINDINGS AT THE SITE OF BREAST-CONSERVING THERAPY

Shiva Yagobian, BS (*Abstract Co-Author*) Nothing to Disclose
Marie A. Ganott, MD (*Abstract Co-Author*) Nothing to Disclose
Madyson McDougal (*Abstract Co-Author*) Nothing to Disclose
Wendie A. Berg, MD, PhD (*Abstract Co-Author*) Institutional Research Grant, Koios Medical, Inc
Jeremy M. Berg, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuying Cao, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To identify benign and suspicious findings on contrast-enhanced mammography (CEM) at the lumpectomy scar in women with a personal history of breast cancer (PHBC).

**METHODS AND MATERIALS**

In an IRB-approved, prospective clinical trial, 1647 women with PHBC are undergoing three rounds of annual screening with digital breast tomosynthesis (DBT) and CEM. From 10/19/2019 - 4/15/2024, 1647 women had year 1, 1227 year 2, and 819 women year 3 screening, including 3261 breasts with BCT in 1369 women. We prospectively recorded enhancement at or near (< 2 cm) the scar. Enhancing scars were then retrospectively reviewed, and imaging features recorded, as were all ipsilateral malignancies diagnosed during the study to date. Lesion features (+/- rim enhancement; mass, or nonmass enhancement [NME]) were compared between breasts with benign and malignant results with Fisher exact test.

**RESULTS**

Median age of participants with BCT was 67 years (range 34 to 87). Among 3261 breasts with BCT, there were 53 (16.6/1000) diagnosed with cancer, including 15 at the scar, 7 near, 29 > 2 cm away, and 2 in the axilla. A total of 687 breasts were described as having enhancement at or near the scar, with 318 of those only in overlying skin on review, leaving 369/3261 (11.3%) breasts for this analysis. Enhancement at the scar was described as rim or partial rim for 205/369 (55.6%) with median rim thickness 2 mm (range 1 to 21): 105 rims were described as smooth and 100 as nodular; 2 malignancies showed rim enhancement at the scar, one DCIS with thin rim enhancement and 15-mm NME and grouped coarse heterogeneous calcifications similar to the primary cancer, and one thick, nodular enhancement (10 mm) and grouped coarse heterogeneous calcifications. There were 42 breasts with an enhancing mass at or near the scar with 13/42 malignant (31%). Of 100 with NME at or near the scar, 9 (9%) were malignant and 11 with enhancing asymmetry, none malignant. Rim enhancement at the scar was significantly associated with benign etiology ($p < 0.001$). Among non-rim enhancing findings at/near the scar, lesion type (mass vs NME) was more strongly associated with malignancy ($p = 0.002$). Of 40 also with ipsilateral enhancing findings > 2 cm from the scar, 29 (73%) were malignant.

**CONCLUSION**

More than half of CEM-enhancing findings at/near the BCT scar were rim enhancement. Rim enhancement at the scar alone was not associated with recurrent malignancy, but an associated enhancing mass or NME at or near the scar should be viewed as suspicious, with 13/42 (31%) such masses and 9/100 (9%) NME malignant.

### CLINICAL RELEVANCE/APPLICATION

Knowledge of benign and suspicious appearances of post-lumpectomy changes on CEM assists in appropriate interpretation and recommendations and should reduce unnecessary biopsies.

## T5B-SPBR-5 DISTANCE TO ACCREDITED BREAST MR FACILITIES COMPARED WITH MAMMOGRAPHY AND ULTRASOUND FACILITIES

Anand K. Narayan, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Y. Rula, PhD (*Abstract Co-Author*) Nothing to Disclose
Robert Rosenblatt, BS (*Abstract Co-Author*) Nothing to Disclose
Bhavika K. Patel, MD (*Abstract Co-Author*) Research support, GRAIL, Inc;Research Grant, Hologic, Inc
Anika Patel (*Abstract Co-Author*) Nothing to Disclose
Ruth C. Carlos, MD, MS (*Abstract Co-Author*) In-kind support, RELX;Editor, RELX;Travel support, General Electric Company
Eric Christensen, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

For high-risk women, breast magnetic resonance (MR) is the preferred supplemental imaging option, but spatial access differences may exacerbate outcome disparities. Accordingly, the purpose of this study is to determine (for accredited breast imaging facilities) the relative distance to the nearest MR facility compared with mammography and ultrasound facilities.

### METHODS AND MATERIALS

Cross-sectional study examining distance between U.S. ZIP codes and the nearest breast imaging facility by imaging type (MR, mammography, ultrasound) using data for accredited breast imaging facilities from the Food and Drug Administration and the American College of Radiology. Linear regression was used to assess distance differences controlling for Area Deprivation Index (ADI), urbanicity, and population size.

### RESULTS

Among the 29,629 ZIP codes with an ADI and known urbanicity, unadjusted mean distance (in miles) to breast MR was 23.2±25.1 (SD) compared with 8.9±10.0 for mammography and 22.2±25.0 for ultrasound. Hence, the relative distance was 61% less for mammography than breast MR while the distances to breast MR and breast ultrasound were comparable. ADI and urbanicity were associated with increased distance to the nearest breast imaging facility. The added distance associated with the least advantaged areas compared with most advantaged areas was 12.2 (95%CI: 11.3, 13.2) for MR, 3.9 (95%CI: 3.6, 4.3) for mammography, and 11.5 (95%CI: 10.6, 12.3) for ultrasound. Compared with metropolitan areas, the added distance to breast MR facilities was 13.7 (95%CI: 12.8, 14.6) for micropolitan and 23.2 (95%CI: 22.5, 24.0) for small/rural areas.

### CONCLUSION

Spatial access differences are substantially less for standard mammography sites compared with breast MR or breast ultrasound sites. Spatial access differences increase with area deprivation and rurality.

### CLINICAL RELEVANCE/APPLICATION

For high-risk women, MR is the preferred supplemental screening option, yet there are distance-based access disparities. While lessening these MR access disparities is desirable, doing so is economically impractical. Therefore, access to contrast-enhanced mammography, which can be offered at mammography sites with minimal upgrades, may mitigate the more important breast cancer outcome disparities. Given the substantially lower spatial access disparities for standard mammography compared with MR, expanding the use of contrast-enhanced mammography at these sites can potentially lessen outcome disparities for women needing supplement screening.

## T5B-SPBR-6 BREAST CANCERS CHARACTERISTICS IN WOMEN IDENTIFIED TO BE AT HIGH-RISK FOR FUTURE BREAST CANCER BY A MAMMOGRAPHY-BASED BREAST CANCER RISK MODEL THAT COMBINES ARTIFICIAL INTELLIGENCE FOR LESION DETECTION AND MAMMOGRAPHIC TEXTURE

Nico Karssemeijer, PhD (*Abstract Co-Author*) CEO, ScreenPoint Medical BV;Shareholder, ScreenPoint Medical BV;Shareholder, Volpara Health Technologies Limited;Shareholder, QView Medical, Inc
Mads Nielsen, PhD (*Abstract Co-Author*) Stockholder, Biomediq A/SResearch Grant, Nordic Bioscience A/SResearch Grant, SYNARC IncResearch Grant, AstraZeneca PLC
Ilse Vejborg, MD (*Abstract Co-Author*) Nothing to Disclose
Martin Lillholm (*Abstract Co-Author*) Shareholder Biomediq A/S;Shareholder, Cerebriu A/S
Ritse M. Mann, MD, PhD (*Abstract Co-Author*) Researcher, Siemens AG;Consultant, Siemens AG;Researcher, Bayer AG;Consultant, Bayer AG;Researcher, Medtronic plc;Consultant, Medtronic plc;Researcher, Becton, Dickinson and Company;Consultant, Becton, Dickinson and Company;Researcher, ScreenPoint Medical BV
Andreas Lauritzen, PhD (*Presenter*) (Former) Researcher, ScreenPoint Medical BV, NL Scientific Assistant at Gentofte Hospital, DK

### PURPOSE

A recent mammography-based risk model combined an artificial intelligence (AI) detection model, mammographic texture, breast density, and age. This study aims to retrospectively validate an updated version of this model and compare breast cancer characteristics among women classified as high-risk and non-high-risk.

### METHODS AND MATERIALS

The risk model was trained on a development sample of women screened in a Danish program, from 2012-2015, and a Dutch program from 2003-2015. This sample comprised 197.957 negative screenings, with 5-10 years of follow-up, where 5.976 were in women with a future breast cancer diagnosis. The risk model combined an AI score indicating probability of cancer, texture, volumetric breast density, and age to a single risk score. The risk model was validated on a consecutive screening sample of Danish women from January 2016 to December 2017 with 5-7 years of follow-up. Risk prediction performance was evaluated using area under the ROC curve (AUC) for cancers (invasive and in situ) diagnosed at least 180 days after screening. Cancer characteristics were determined for high-risk (10th risk decile) and non-high-risk women, in terms of invasive cancers (IC), ICs >1cm in size, and lymph node positive (NP) ICs.

### RESULTS

The validation sample comprised 47.388 unique women of whom 978 were diagnosed with breast cancer at least 180 days after screening. In this sample, the risk model achieved an AUC of 0.74 (95% CI: 0.72, 0.75). Limiting follow-up to 2, 4, and 6 years the AUC was 0.79 (95% CI: 0.76, 0.82), 0.76 (95% CI: 0.74, 0.78), and 0.74 (95% CI: 0.72, 0.76), respectively. In the high-risk group 36.9% (361/978) of cancers were found. Of those, 91.1% (329/361) were invasive at diagnosis, while for cancers in the non-high-risk group, 89.5% (552/617) were invasive, which was not different from the

high-risk group (P=.40). For the high-risk group with a measured lesion size, 74.1% (240/324) of ICs were >1cm in comparison to 67.0% (354/528) for the non-high-risk group, which was lower (P=.03). For the high-risk group with a lymph node test, 19.1% (60/314) of ICs were NP, while for non-high-risk group 6.4% (33/515) of ICs were NP, which was lower (P<.001).

**CONCLUSION**

In an independent screening sample, the risk model achieved an AUC of 0.79 at 2 years after screening and retained high risk prediction performance 6 years after screening with an AUC of 0.74. Invasive cancers in the high-risk group were more likely to be larger in size and to be node positive relative to the non-high-risk group.

**CLINICAL RELEVANCE/APPLICATION**

The risk model may be used to select high-risk women for supplemental screening, e.g. MRI, US, tomosynthesis, or contrast enhanced mammography, which might lead to earlier diagnosis of up to 36.9% of breast cancers in women attending screening.

## T5B-SPBR-7 REDUCING BIOPSY RATES OF BREAST ULTRASOUND BIRADS 4 LESIONS IN OUTPATIENT SETTINGS THROUGH CONTRAST-ENHANCED MAMMOGRAPHY

Huizhi Cao (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic efficacy of contrast-enhanced mammography(CEM)in assessing breast ultrasound BIRADS 4 lesions in outpatient settings and to reduce benign biopsy rates.

**METHODS AND MATERIALS**

A retrospective analysis was conducted on patient data from September 2021 to July 2023. Patients with ultrasound-diagnosed BIRADS 4 lesions who underwent CEM examination were included. During CEM, a nonionic iodinated contrast agent (Iohexol 350 mg I/mL, 1.5 mL/kg) was power-injected intravenously. Images were evaluated independently by two breast radiologists. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were calculated. Diagnostic efficacy of CEM and combined examination (CEM + ultrasound) for BIRADS 4 lesions was evaluated against pathological diagnosis.

**RESULTS**

Out of 232 outpatient patients,166 lesions were classified as BIRADS 4. Pathologically,125 lesions were benign (predominantly fibroadenomas) and 41 were breast cancer cases. CEM demonstrated a sensitivity of 95.1%, specificity of 86.5%, accuracy of 88.6%, PPV of 69.6%, and NPV of 98.2%. Ultrasound showed a sensitivity of 65.9%, specificity of 83.2%, accuracy of 78.9%, PPV of 56.3%, and NPV of 88.1%. Combined US + CEM exhibited a sensitivity of 100%, specificity of 93.6%, accuracy of 98.1%, PPV of 83.7%, and NPV of 100%. The addition of CEM significantly reduced benign biopsy rates by 77.6%.

**CONCLUSION**

Incorporating CEM examination for ultrasound BIRADS 4 lesions in outpatient settings can effectively decrease the benign biopsy rate.

**CLINICAL RELEVANCE/APPLICATION**

CEM enhances diagnostic accuracy and reduces unnecessary biopsies, particularly in cases of indeterminate BIRADS 4 lesions. Its high NPV provides radiologists with confidence in imaging assessment, alleviating patient anxiety and conserving healthcare resources.

## T5B-SPBR-8 DIAGNOSTIC VALUE OF CONTRAST-ENHANCED MAMMOGRAPHY FOR SUSPECTED BREAST CALCIFICATION: A TWO-CENTER STUDY

Huizhi Cao (*Presenter*) Nothing to Disclose

**PURPOSE**

Exploring the clinical value and significance of contrast-enhanced mammography for suspicious calcification.

**METHODS AND MATERIALS**

Retrospective study of 160 patients with suspected calcification (diagnostic report defined as BI-RADS4) on dual center conventional FFDM from 2020 to 2023, all of whom underwent CEM examination. The calcified area was observed for enhanced signs through CEM images, and the correlation between these imaging features and pathology was studied. Finally, the diagnostic value of the images and differential diagnostic ability of CEM for suspected calcification were evaluated using pathological results as the gold standard.

**RESULTS**

The mean age of patients was 50.1 years (range: 18-71 years). Among the 160 lesions, 85 were benign and 75 were malignant. The consistency in BI-RADS classification was higher with CEM than FFDM (0.86 vs. 0.74). CEM demonstrated a sensitivity of 94.5%, specificity of 90.2%, positive predictive value of 93.2%, negative predictive value of 95.4%, and accuracy of 95% in identifying suspicious calcifications.

**CONCLUSION**

CEM has a high diagnostic efficacy for suspected breast calcification. Therefore, CEM has reliable clinical practical value in determining calcified lesions, locating suspicious calcifications through puncture, and evaluating the nature of lesions before surgery.

**CLINICAL RELEVANCE/APPLICATION**

Contrast-enhanced mammography exhibits high diagnostic efficacy for suspected breast calcifications and is useful in guiding the localization of suspicious calcifications for biopsy.

## T5B-SPBR-9 ASSESSING DIAGNOSTIC PERFORMANCE AND TUMOR SIZE ACCURACY OF CONTRAST-ENHANCED SPECTRAL MAMMOGRAPHY WITH LOW-DOSE CONTRAST AGENTS FOR BREAST LESIONS DETECTION

Huizhi Cao (*Presenter*) Nothing to Disclose

## PURPOSE

This study aims to investigate the clinical value of contrast-enhanced spectral mammography (CESM) with low-dose contrast agents in evaluating breast lesions, considering diagnostic performance and tumor size accuracy.

## METHODS AND MATERIALS

A total of 223 patients undergoing CESM were randomly assigned to two protocols: 113 patients underwent the examination with a conventional dose of Iohexol (1.5ml/kg body weight; 300-350 mg/ml), while the remaining 100 patients received the exam with a low dose of Iohecol (1 ml/kg body weight; 300-350 mg/ml). All patients also underwent MRI examination within one week. The images from CESM, MRI, and histopathological data were analyzed. The clinical utility of CESM performed with low-dose contrast agents or conventional dose contrast agents, in conjunction with MRI, was evaluated based on histopathological results. The ROC curve was applied to analyze clinical efficiency. Tumor size measurements were obtained from CESM, MRI modalities, and pathological data. Bland-Altman analysis was utilized to assess the consistency of the maximum tumor size among different imaging methods.

## RESULTS

Histopathologic analyses revealed 33 benign and 67 malignant lesions in low dose group (100 patients), 35 benign and 78 malignant lesions in conventional dose group. By evaluating diagnostic value, CESM obtained from conventional group had similar AUC area, sensitivity, specificity, PPV, NPV to MRI imaging (0,928, 0.962, 0.846,0.783,0.821 vs. 0.903,0.974,0.809,0.805,0.856). CESM from low dose group showed a comparison of clinical performance to MRI as well. (AUC area: 0.944 vs. 0.925; sensitivity:0.990 vs.0.941; specificity:0.825vs.0.831; PPV:0.802 vs. 0.825; NPV:0.855 vs. 0.895). For tumor size measurement, mean tumor size was 3.51 cm for CESM (conventional dose) and 3.61 cm for MRI, compared with 3.38 cm on histopathological results, the average difference of diameters between CESM (conventional dose ), MRI and Histopathologic size was -0.02, -0.10cm, respectively. Additionally, average sizes were measured as 4.02 cm, 3.76 cm, 3.96 cm for CESM (low dose ), MRI and Histopathologic result, and the difference diameters compared to Pathologic data were -0.05, -0.08. Bland-Altman analysis showed best consistency on tumor size between CESM (low dose ), MRI and pathological results.

## CONCLUSION

Low doses (1.0ml/kg) of contrast agents for CESM exhibit comparable diagnostic performance and accuracy in tumor size assessment compared to CESM with conventional doses.

## CLINICAL RELEVANCE/APPLICATION

CESM performed with low-dose contrast agents can fulfill clinical and imaging requirements without compromising diagnostic accuracy, offering a promising alternative for breast lesion evaluation.

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# Abstract Archives of the RSNA, 2024

T5B-SPCA

**Cardiac Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPCA-1 HEAD-TO-HEAD COMPARISON OF TWO COMMERCIAL ARTIFICIAL INTELLIGENCE SOFTWARE FOR CORONARY CT ANGIOGRAPHY WITH CORONARY ANGIOGRAPHY IN PATIENTS WITH CAD-RADS CATEGORIES 4 AND 5

Ji Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Hui Zhou, MD (*Abstract Co-Author*) Nothing to Disclose
Jing Luo (*Abstract Co-Author*) Nothing to Disclose
Yangzhen Hou (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the automated diagnostic results of coronary stenosis provided by two commercial artificial intelligence (AI) software for coronary CT angiography (CCTA) with coronary angiography (CAG) in patients with CAD-RADS categories 4 and 5.

### METHODS AND MATERIALS

This retrospective study included 123 consecutive patients with CAG-confirmed severe stenosis (stenosis 70%-99%) or occlusion (stenosis 100%) in at least one vessel. The same set of CCTA raw images of the patients were simultaneously sent to two commercial AI software (K-software and M-software) servers for analysis. The maximum degree of stenosis of the left main(LM), left anterior descending(LAD), left circumflex(LCX) and right coronary artery(RCA), number of stenosed vessels, number of vessels with stenosis =70% were recorded and compared.

### RESULTS

The maximum degree of stenosis of LAD, LCX and RCA calculated by both software are lower than that of CAG (all $p < 0.001$), with the measurements in M-software being lower than those of K-software (all $p < 0.001$). The number of vessels with stenosis and vessels with stenosis =70% provided by both software are significantly less than that shown by CAG (all $p < 0.001$). On Spearman correlation analyses analysis, the degree of stenosis measured by two software is significantly correlated in LM, LAD, LCX and RCA ($r=0.431$, 0.350, 0.618, 0.522, respectively; $p < 0.001$). On Bland-Altman analysis, the mean difference (95% limits of agreement) between CAG and K-software in LM, LAD, LCX and RCA is 9%(5%-13%), 23%(19%-27%), 34%(29%-39%), 18%(13%-22%), respectively. The mean difference (95% limits of agreement) between CAG and M-software in LM, LAD, LCX and RCA is 14% (10%-19%), 51%(47%-55%), 56%(51%-60%), 51%(47%-56%), respectively.

### CONCLUSION

The degree of coronary artery stenosis automatically measured by two commercial AI software were both significantly lower than the results of CAG, and both two AI software identified significantly fewer stenosed vessels than CAG.

### CLINICAL RELEVANCE/APPLICATION

This study shows that two commercial AI software for CCTA both significantly underestimate the extent and number of coronary stenosis. It is essential that the results provided by the AI software should be reviewed and corrected by experienced radiologists.

## T5B-SPCA-2 THERAPEUTIC EFFICACY OF TAFAMIDIS IN ADVANCED-STAGE PATIENTS WITH TRANSTHYRETIN AMYLOID CARDIOMYOPATHY

Seitaro Oda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masafumi Kidoh, MD, PhD (*Abstract Co-Author*) Endowed Chair, Koninklijke Philips NV
Shinpei Yamaguchi (*Abstract Co-Author*) Nothing to Disclose
Yasunori Nagayama, MD (*Abstract Co-Author*) Nothing to Disclose
Toshinori Hirai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Nakaura, MD (*Abstract Co-Author*) Nothing to Disclose
Fumihiro Yoshimura, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Tafamidis improves prognosis in patients with transthyretin amyloid cardiomyopathy (ATTR-CM). While it is recommended to initiate tafamidis treatment at an early disease stage for optimal therapeutic efficacy, real-world data on its effectiveness in advanced-stage patients are scarce. This study aimed to evaluate the efficacy of tafamidis in advanced-stage ATTR-CM, defined by extracellular volume fraction (ECV).

### METHODS AND MATERIALS

This is a single-center, retrospective observational study. We assessed the clinical characteristics and outcomes of 80 patients with wild-type ATTR-CM treated with tafamidis. Patients were categorized into advanced-stage (ECV = 59%) and early-stage (ECV < 59%) groups based on ECV values obtained from cardiac MRI at tafamidis initiation. The 12-month therapeutic effect of tafamidis was determined using NYHA classification, blood biomarkers, and left ventricular ejection fraction criteria. We evaluated differences in treatment resistance rates 12 months post-treatment initiation between advanced-stage and early-stage groups.

### RESULTS

The mean ECV values for the advanced-stage (n=35) and early-stage (n=45) groups were 70.7±8.2% and 47.5±7.4%, respectively. There were no significant differences in treatment resistance rates based on NYHA classification criteria (18.8% vs. 7.0%, p = 0.14), blood biomarkers criteria (28.6% vs. 33.3%, p = 0.65), left ventricular ejection fraction criteria (37.1% vs. 31.1%, p = 0.57), and combined criteria (62.1% vs. 60.0%, p = 0.84) between advanced-stage and early-stage groups. No relationship between ECV and the 12-month therapeutic effect of tafamidis was observed.

### CONCLUSION

Even in advanced-stage patients (ECV = 59%), the 12-month therapeutic effect was comparable to that in early-stage patients (ECV < 59%).

### CLINICAL RELEVANCE/APPLICATION

The therapeutic effect of tafamidis can be anticipated even in advanced-stage ATTR-CM patients with ECV = 59%.

## T5B-SPCA-3 EXPLORING THE CAUSE OF THE DARK-BLOOD LGE PHENOMENON IN CARDIAC AMYLOIDOSIS USING CHANGES IN MYOCARDIAL CONTRAST MEDIUM CONCENTRATION THROUGH PHARMACOKINETIC ANALYSIS

Akiyuki Kotoku, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Miki Sawano (*Abstract Co-Author*) Nothing to Disclose
Yoshiaki Morita (*Abstract Co-Author*) Nothing to Disclose
Emi Tateishi (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Nishii, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation
Midori Fukuyama, MD (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Hiroki Horinouchi (*Abstract Co-Author*) Nothing to Disclose
Tomoro Morikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Toshimitsu Tanaka, RT (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Saito, RT (*Abstract Co-Author*) Nothing to Disclose
Yasutoshi Ohta, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the 'dark-blood' phenomenon's etiology in cardiac amyloidosis, evident by lower left ventricle signal on delayed contrast, compared with hypertrophic cardiomyopathy (HCM) that is important for differentiating hypertrophic hearts, through contrast medium concentration by pharmacokinetic analysis.

### METHODS AND MATERIALS

Twenty subjects (73 yrs, IQR 42,87) referred for CMR examination were included in this study, in which 7 subjects are biopsy-proven cardiac amyloidosis, and 13 subjects are HCM. A two-compartment pharmacokinetic model from dynamic T1 maps predicted myocardial contrast medium concentration (MCC) and left ventricular blood pool concentration (LVC), estimating myocardial ECV and contrast differences between MCC and LVC (diffConc). We calculated T1 values for the myocardium (MCT1) and left ventricle (LVT1), assessing their disparities (diffT1). PSIR images at 10 minutes after contrast administration were used to qualitatively evaluate the presence of dark-blood blood pool.

### RESULTS

MCC was higher in amyloidosis than in HCM during the entire evaluation time ($p<0.01$), ranging from 0.53 to 0.19 mM/L in amyloidosis and decreasing over time from 0.32 to 0.12 mM/L in HCM ($p<0.01$). LVC was lower in amyloidosis than in HCM at all time points ($p<0.01$), with significant ($p<0.01$) decreases over time from 0.63 to 0.24 mM/L in amyloidosis and from 0.74 to 0.29 mM/L in HCM. The diffConc at the time of observation ranged from -0.06 to 0.04 mM/L for amyloidosis and from -0.35 to -0.15 mM/L for HCM, showing a significant difference between the disease groups. ECV values ranged from 51% to 61% in amyloidosis, showing an upward convex pattern with maxima at 10 minutes, significantly higher than in HCM ($p<0.01$).HCM showed a convex pattern with maxima at 10 and 15 minutes, ranging from 27% to 33%. The MCT1 was consistently lower in amyloidosis (from 289 to 544 msec) than in HCM (from 404 to 651 msec) during the evaluation time and increased over time ($p<0.01$). LVT1 increased over time from 280 to 540 msec in amyloidosis ($p<0.01$), and from 239 to 465 msec in HCM, which is higher in amyloidosis. The diffT1 (6,-26,-49,-55,-48,-25msec) showed negative values in amyloidosis except after 5 min. In contrast, in HCM, all diffT1 values were positive (160,140,128,130,145,170msec).

### CONCLUSION

The LGE dark-blood phenomenon in amyloidosis is caused by blood T1 values higher than blood values, which may be due to contrast agent concentrations equal to or higher than the blood pool.

### CLINICAL RELEVANCE/APPLICATION

Pharmacokinetic methods can elucidate the dark-blood phenomenon and, in addition to T1 maps, can help distinguish between cardiac amyloidosis and HCM.

## T5B-SPCA-4 METABOLIC IMAGING BIOMARKER USING LIPID-SPECIFIC PEAK IN SINGLE BREATH-HOLD 1H-MR SPECTROSCOPY FOR ASSESSMENT OF MYOCARDIAL DISEASE ASSOCIATED WITH TYPE 2 DIABETES MELLITUS(T2DM)

Yoshiaki Morita (*Abstract Co-Author*) Nothing to Disclose
Keizo Murakawa (*Abstract Co-Author*) Nothing to Disclose
Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Tatsuhiro Yamamoto (*Abstract Co-Author*) Nothing to Disclose
Yoshito Ichiba, RT (*Abstract Co-Author*) Employee, Siemens AG
Miki Sawano (*Abstract Co-Author*) Nothing to Disclose
Yasutoshi Ohta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Ryogo Enoki, RT (*Abstract Co-Author*) Nothing to Disclose
Masaru Shiotani, RT (*Presenter*) Nothing to Disclose

**PURPOSE**

Increasing evidence is emerging that lipid oversupply to cardiomyocytes plays a role in the development of myocardial dysfunction in type 2 diabetes mellitus (T2DM), by causing lipotoxic injury and myocardial steatosis.Therefore, measurement of myocardial lipid deposition is important.1H-MR Spectroscopy (MRS) has a potential as lipid-specific biomarker to directly measure the abnormal accumulation.A single breath-hold ECG-gated 1H MRS acquisition can be applied as a time-efficient approach to measure myocardial lipid.This study aimed to assess the feasibility of MRS for detection of myocardial lipid accumulation in patients with myocardial disease associated with T2DM.

**METHODS AND MATERIALS**

Written informed consent was obtained from all subjects enrolled in the study. Thirty-five patients with myocardial disease associated with T2DM, 12 patients with non-ischemic cardiomyopathies without T2DM (NICM group), and 16 healthy volunteers underwent cardiac MRS. Among the T2DM patients, 23 patients were diagnosed with myocardial infarction (=MI group), 12 patients with cardiac dysfunction (LV hypertrophy, LV diastolic dysfunction and LA dilatation) without MI (=Non-MI group). MRS was obtained using single voxel PRESS sequence positioned within LV septum with single breath-hold. The peak of lipid (0.9+1.3 ppm) and water (4.7 ppm) were used as metabolic indicators of triglyceride content. Lipid/water ratio (LWR) was compared among T2DM patients, NICM group and volunteers. ROC analysis determined cutoff values for differentiation of these groups using LWR.

**RESULTS**

The LWR in T2DM patients was significantly higher compared to volunteers (0.296 vs. 0.105, $p < 0.05$). The cutoff value of LWR for distinguishing between T2DM patients and volunteers was 0.127 (sensitivity 81.1%, specificity 75.0%, AUC 0.846).Also, compared with NICM group patients, the LWR in T2DM patients were significantly higher in both MI and Non-MI groups (0.149, 0.321 and 0.248, $p<0.05$, respectively).The cutoff value of LWR for distinguishing between non-MI group and NICM group was 0.260 (sensitivity 58.3%, specificity 100%, AUC 0.764).

**CONCLUSION**

The LWR using single breath-hold 1H MRS acquisition showed the higher values in T2DM associated myocardial disease and enabled the detection of abnormal lipids deposition with high diagnostic accuracy.

**CLINICAL RELEVANCE/APPLICATION**

Single breath-hold MRS can acquire the direct and rapid quantification of myocardial lipid contents. Lipid peak of MRS could be disease-specific imaging biomarker for assessing myocardial triglyceride accumulation of T2DM associated myocardial disease beyond the conventional sequences. This metabolic imaging has a potential for evaluation of the disease severity and indication of therapy.

## T5B-SPCA-5 EVALUATION OF CARDIAC CHANGES IN PATIENTS WITH HIGH-ALTITUDE HEART DISEASE BY MAGNETIC RESONANCE MAPPING AND LGE

Hai Hua Bao (*Abstract Co-Author*) Nothing to Disclose
Li Meng (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate cardiac function and right ventricular myocardial changes in patients with high-altitude heart disease (HAHD) by magnetic resonance mapping and late gadolinium enhancement (LGE).

**METHODS AND MATERIALS**

12 HAHD patients and 15 matched healthy volunteers (the same altitude gradient and age range) in the same period were selected for cardiovascular magnetic resonance (CMR) mapping using 3.0 T magnetic resonance imaging (MRI) .

**RESULTS**

(1)The right ventricular end-diastolic volume (RVEDV, 169 ± 66 mL) and right ventricular end-systolic volume (RVESV, 97 ± 43 mL) were significantly higher in the HAHD group than in the control group. The right ventricular ejection fraction (RVEF, 43 ± 9 mL) was lower in the HAHD group. The right ventricular stroke volume (RVSV, 71 ± 30 mL), right ventricular cardiac index (RVCI, 2.6 ± 1.1 L/min/m2), and right ventricular cardiac output (RVCO, 4.9 ± 1.9 L/min) were higher in the HAHD group. The left ventricular end-systolic volume (LVESV, 77 ± 39 mL) and left ventricular cardiac output (LVCO, 5.7 ± 1.1 L/min) were significantly higher in the HAHD group. The left ventricular end-diastolic volume (LVEDV, 153 ± 60 mL), left ventricular stroke volume (LVSV, 84 ± 15 mL), and left ventricular cardiac index (LVCI, 3.1 ± 0.9 L/min/m2) were higher in the HAHD group than in the control group.The left ventricular ejection fraction (LVEF, 54 ± 10 mL) was lower in the HAHD group than in the control group.(2) In the HAHD group, pre-/post-enhancement T1 values and the extracellular volume fraction (ECV)% of all myocardial segments of the right ventricle (RV) were higher than those in the control group. For the right ventricle, the mean pre-enhancement T1 value was 1,374.3 ± 157.6, the mean post-enhancement T1 value was 551.7 ± 42.2, and the mean ECV% was 34.2 ± 6.8; the differences were significant.(3) The T2 value of the RV middle myocardial segment (42.1 ± 4.6) was significantly lower in the HAHD group than in the control group.However, the mean T2 value of the RV myocardium (42.8 ± 3.5) was lower in the HAHD group.(4)Delayed enhancement of the ventricular septum or RV endocardium was observed in some patients.

**CONCLUSION**

(1)In the HAHD group, RV enlargement and myocardial hypertrophy, right heart insufficiency;the disease might involve the left ventricle.(2) the patients might have different degrees of myocardial edema and inflammatory changes. The post-enhancement T1 values and ECV% of HAHD patients were significantly higher, and delayed enhancement in the ventricular septum and right ventricular endocardium was observed in some patients, indicating the possibility of fibrosis in the RV myocardium of the patients.

**CLINICAL RELEVANCE/APPLICATION**

To provide a new diagnostic basis and methods for HAHD patients and guide treatment.

## T5B-SPCA-6 EVALUATION OF THE MYOCARDIAL DAMAGE IN DUCHENNE MUSCULAR DYSTROPHY USING CARDIAC MAGNETIC RESONANCE IMAGE INTRA-VOXEL INCOHERENT MOTION ANALYSIS

Masami Yoneyama (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Risako Nakao, MD (*Abstract Co-Author*) Nothing to Disclose
Yasuhiro Goto (*Abstract Co-Author*) Nothing to Disclose
Akihiro Inoue, MD (*Abstract Co-Author*) Nothing to Disclose
Michinobu Nagao, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Koichiro Kaneko, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shuji Sakai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akiko Sakai, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Yamamoto, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Duchenne muscular dystrophy (DMD) is characterized by progressive and fatal myopathy due to dystrophin protein deficiency. Myocardial involvement appearing after the teenage years, resulting in heart failure. Heart failure has become an increasing cause of death in recent years, however, the lack of imaging examination that can assess myocardial damage is a problem. Diffusion-weighted image (DWI) provides diffusion-limited proton molecules within cells as a high signal intensity. Cardiac magnetic resonance image intra-voxel incoherent motion (CMR-IVIM) using DWI is a new technique to simultaneously quantify tissue perfusion and diffusion. The quantitative values of diffusion and perfusion fraction are expressed as D and F values, and they have the potential to detect early myocardial damage not visualized by late gadolinium enhancement. We aimed to assess myocardial damage using D and F values measured by IVIM analysis quantitatively in patients with DMD.

**METHODS AND MATERIALS**

Data of CMR for 12 patients with DMD (mean age, 14 years) between January 2021 to December 2023 was retrospectively analyzed. Imaging was performed with 3 tesla CMR scanner. D and F values were measured placing region of interest on the septum of the mid myocardium. 6 healthy volunteers (age range: 22-48 years) were analyzed as the comparison group. The parameters of two groups were compared using the Mann-Whitney U test.

**RESULTS**

Mean D and F values of patients with DMD were 2.45 and 0.61. D value in patients with DMD was significantly higher than that in healthy volunteers (2.45 vs. 1.87, p=0.0057). F value in DMD group was equivalent to that in healthy volunteer group (0.61 vs. 0.57, p=0.60). The result suggested that diffusion was increased in the myocardium of mid-stage DMD compared to normal volunteers. Previous autopsy study has reported hypertrophy of cardiomyocytes in the myocardium of Duchenne muscular dystrophy, and this disease-specific mechanism and compensatory hypercontraction of the residual myocardium could be the reason for the increased diffusion in the damaged myocardium.

**CONCLUSION**

D and F values derived from CMR IVIM analysis are new indicators to evaluate the properties of myocardial tissue in patients with DMD.

**CLINICAL RELEVANCE/APPLICATION**

The new quantitative values obtained from IVIM analysis using DWI are useful for further detailed assessment of myocardial properties without radiation exposure and contrast media. Therefore, it is suitable for repeated imaging for follow-up of patients with DMD cardiomyopathy, who are mostly young.

## T5B-SPCA-8 PERIPARTUM CARDIOMYOPATHY IS ASSOCIATED WITH ABNORMALITIES OF MYOCARDIAL DEFORMATION AND LATE GADOLINIUM ENHANCEMENT

Elsie Nguyen, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Rahul B. Gujrathi, MD (*Abstract Co-Author*) Nothing to Disclose
Gauri R. Karur, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Will Warnica, MD (*Abstract Co-Author*) Nothing to Disclose
Victor S. Chan, FRCR, MBBS (*Abstract Co-Author*) Nothing to Disclose
Kate Hanneman, MD, MPH (*Abstract Co-Author*) Speaker, Groupe Sanofi;Speaker, Amicus Therapeutics, Inc
Hayley McKee, MSc, BSc (*Abstract Co-Author*) Nothing to Disclose
Rachel Wald, MD (*Abstract Co-Author*) Nothing to Disclose
Jacques Du Plessis, MBChB, FFRad(D)SA (*Presenter*) Nothing to Disclose

**PURPOSE**

Peripartum cardiomyopathy (PPCM) affects women in late pregnancy and in the postpartum period. Cardiovascular magnetic resonance (CMR) can contribute to the diagnosis and management of women with PPCM. The aim of this study was to explore CMR findings in PPCM with a focus on myocardial strain quantification and late gadolinium enhancement (LGE) pattern.

**METHODS AND MATERIALS**

In this retrospective single-center study, women with a clinical diagnosis of PPCM and clinically indicated CMR performed between 2010 to 2018 were included. Exclusion included other causes for cardiomyopathy. CMR parameters, including ventricular function, LGE, and quantitative myocardial strain, were compared between the PPCM group and a control group of healthy women.

**RESULTS**

Thirty-two women with PPCM were included (mean age 42±6 years) and 26 healthy women (mean age 43±14 years). Women with PPCM had significantly lower left ventricular (LV) ejection fractions (median 37.5%, 25.5-45.5 vs. 60.5%, 57.0-63.0, p<0.001), higher LV end-diastolic volumes (median 108 ml/m2, 93.5-135.5 vs. 76 ml/m2, 71.0-88.0, p<0.001), reduced global LV circumferential strain (mean -11.1±4.5 vs -19.2±1.6 p<0.01), reduced global LV radial strain (mean 16.0±8.1 vs 33.2±4.5, p<0.001), and reduced global LV longitudinal strain (mean -11.4±4.2 vs -18.6±1.4, p<0.001), compared to controls. Eighteen patients (58%) had non-ischemic pattern LGE, with no LGE in the controls. LGE was most prevalent in the basal anteroseptum (n=12) and mid anteroseptum (n=8). LGE patterns observed included linear mid-wall (n=8), linear subepicardial (n=6), and right ventricular side of the interventricular septum (n=3).

**CONCLUSION**

LGE is frequent in patients with PPCM, most often in a non-ischemic pattern at the basal or mid anteroseptum. Quantitative myocardial strain values are also abnormal in PPCM compared to heathy controls.

**CLINICAL RELEVANCE/APPLICATION**

We identified a non-ischemic pattern LGE that is nonspecific in isolation but could suggest PPCM in the correct clinical context along with abnormal CMR strain values. Future study should evaluate the clinical application of these findings to facilitate earlier diagnosis and enhance management.

## T5B-SPCA-9 CLINICAL-RADIOLOGIC CORRELATION OF COMMON CONDUCTION SYSTEM ABNORMALITIES AND POSITIVE IMAGING FINDINGS IN CARDIAC SARCOIDOSIS

Dhiraj Baruah, MBBS, MD (*Abstract Co-Author*) Grant, Blue Eye Soft Corp;Consultant, ImBio, LLC
Ismail M. Kabakus, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Brendan McNeal (*Abstract Co-Author*) Nothing to Disclose
Jordan H. Chamberlin, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Major conduction abnormalities such as third-degree heart block and ventricular tachycardia have long been considered suspicious for cardiac involvement in sarcoidosis as identified by Fludeoxyglucose-18 Positron Emission Tomography (18FDG-PET) or cardiac MRI (CMR). However, there is substantial uncertainty regarding the implications of the much more common "low-grade" conduction abnormalities and ectopy discovered on routine electrocardiogram (ECG) screening. Recent advances in non-invasive cardiac imaging and prophylactic treatment necessitate an updated assessment of prevalence and predictive value.

### METHODS AND MATERIALS

126 patients with biopsy-proven systemic sarcoidosis who underwent advanced imaging (18FDG-PET and CMR) were retrospectively included. Cardiac sarcoidosis (CS) diagnosis was defined by the 2017 Japanese Circulation Society (JCS) criteria. Before the advanced imaging, ECGs and cardiac event monitors recorded the presence of atrioventricular blocks (AVB), bundle branch blocks (BBB), and ectopy. Prevalence, odds ratios, and positive predictive values (PPV) were then calculated.

### RESULTS

58 (46.0%) patients were found to have CS by JCS criteria. The most prevalent conduction system abnormality in patients with CS was ectopy (Premature Ventricular Contraction PVCs = 51.7%; Premature Atrial Contraction PACs = 29.3%), followed by any BBB (27.7%; RBBB = 17.2%), and any AVB (15.5%, 1° = 12.1%). Incomplete BBBs had the highest PPV (83.3%), followed by 1° AVB (77.8%). PVCs only had a PPV of 50.8%. Positive LGE, T2, or FDG-PET uptake was observed in over 50% of patients with 1° AVB and Incomplete BBBs, and greater than 25% of patients with PVCs, PACs, LBBBs, and RBBBs. The average prevalence of LGE, FDG-PET uptake, and T2 hyperintensity was 75%, 72.1%, and 87.1%, respectively.

### CONCLUSION

Ectopy and "low-grade" conduction system abnormalities were observed to have a higher-than-expected prevalence in conjunction with imaging findings of CS.

### CLINICAL RELEVANCE/APPLICATION

Cardiac imagers and clinicians should be aware of increased associations and consider potential indications for expedited advanced cardiac imaging for earlier diagnosis of disease.

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# Abstract Archives of the RSNA, 2024

T5B-SPCH

**Chest Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPCH-1 TEXTURE-LESS DEEP LEARNING FOR HIGH-GRADE LUNG ADENOCARCINOMA HISTOLOGIC PATTERNS PREDICTION ON COMPUTED TOMOGRAPHY

Jin-Shing Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Min-Shu Hsieh, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
De,Xiang Ou (*Abstract Co-Author*) Nothing to Disclose
Mong-Wei Lin (*Abstract Co-Author*) Nothing to Disclose
Yeun-Chung Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Yeefan Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Yi-Chang Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Chung-Ming Chen (*Abstract Co-Author*) Nothing to Disclose
Yu-Chien Chang, MD (*Abstract Co-Author*) Nothing to Disclose
Li Wei Chen (*Abstract Co-Author*) Nothing to Disclose
Shun-Mao Yang, MD (*Abstract Co-Author*) Nothing to Disclose
CHUN-YU HUANG (*Abstract Co-Author*) Nothing to Disclose
Kuan Yu Chen (*Presenter*) Nothing to Disclose

### PURPOSE

Computed tomography-based deep learning (CT-DL) shows promise in predicting high-grade lung adenocarcinoma histologic patterns (HGP), aiding the novel prognostic grading of adenocarcinoma. However, texture variation due to CT parameters challenges the model's generalizability. This study investigated whether solely utilizing binary tumor masks can reduce texture dependence and predict HGP, potentially enhancing model generalizability.

### METHODS AND MATERIALS

A retrospective study enrolled patients (2012-2021) with complete lung resection, non-/ contrast-enhanced chest CT, and confirmed pathology. The Texture-Less Deep Learning (TL-DL) model, comprising a convolutional neural network (CNN) and graph convolutional network, employed only binary tumor masks was developed in this study. Specifically, the tumor mask was automatically extracted with U-net and refined by the physicians, and it was then partitioned into a ground-glass opacity (GGO) mask by a threshold of -534 HU. The tumor and GGO mask intend to provide the texture-independence shape message and basic texture information (i.e., consolidation-to-tumor [C/T] ratio) for deep feature learning. The model performance was evaluated by the AUC and compared with CT-DL (CNN with CT images alone) and C/T ratio by DeLong's test in the testing set. Furthermore, for the model interpretation, the deep features were visualized by the integrated gradients, and correlated with shape features using Spearman's rank correlation coefficient.

### RESULTS

A total of 539 patients were studied, including 422 in the training set and 117 in the testing set. The proposed TL-DL achieved an AUC of 0.88 for the internal 5-fold cross-validation, and an AUC of 0.93 (sensitivity of 91% [10/11], specificity of 90% [95/106]) in external validation which significantly outperformed the CT-DL (AUC of 0.87, $P < .05$) and C/T ratio (AUC of 0.86, $P < .05$). The deep features represent different lesion types and demonstrate a strong correlation with shape irregularity (Spearman's ? = 0.7).

### CONCLUSION

We have proposed a new TL-DL model relying solely on binary tumor masks, which reduces texture dependence, yielding promising results for HGP prediction (0.93 AUC). The model's interpretability, revealing deep features' correlation with shape irregularity, offers a potential biomarker to radiologists in HGP diagnosis.

### CLINICAL RELEVANCE/APPLICATION

Training DL with only binary tumor masks holds promise for histologic pattern prediction, mitigating texture dependence and potentially increasing generalizability for varying CT settings. Furthermore, the interpretable deep features of the proposed method may provide valuable insights for radiologists' clinical diagnosis of HGP.

## T5B-SPCH-5 AI-BASED CLASSIFICATION USING PRE-RECONSTRUCTION IMAGES OF TOMOSYNTHESIS: SYSTEM DEVELOPMENT AND VALIDATION

Myung Jin Chung, MD (*Abstract Co-Author*) Research Consultant, Samsung Electronics Co, Ltd;Research Consultant, Pharmex Advanced Laboratories, SL;Research Grant, Lunit Inc;Research Grant, VUNO Inc
Hakje Yoo (*Abstract Co-Author*) Nothing to Disclose
Seongje Oh, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

Chest Digital Tomosynthesis (CDTS) is a medical device supporting three-dimensional visual diagnosis while minimizing patient radiation exposure compared to CT scans. However, CDTS provides lower image quality compared to CT scans due to limited angles, and the under-sampling during the reconstruction process may lead to inaccurate results. Hence, there is a need for a sophisticated artificial intelligence (AI) model for automated detection of chest diseases in CDTS that minimizes the information loss resulting from the reconstruction process, ensuring accurate diagnosis. Accordingly, we proposed an AI model for CDTS diagnosis.

**METHODS AND MATERIALS**

We propose a CDTS-specific AI model called 2Dto3D, which minimizes information loss due to reconstruction compared to conventional methods that learn from reconstructed CDTS. our approach utilizes the pre-reconstruction projection images for diagnosis. Specifically, we acquire feature maps of projected images through a 2D classifier. These maps are then fused into 3D feature maps, which are subsequently diagnosed using a 3D classifier. we collected 1000 CT scans, including 500 normal, 200 tuberculosis, and 300 pneumonia cases. These CT scans were acquired using the same imaging technique as CDTS, generating seven projection images at 120-degree intervals. We compared our method with conventional 3D model using CDTS reconstructed into seven views and CDTS reconstructed into 26 views.

**RESULTS**

The proposed AI system demonstrated an AUC (Area Under the Receiver Operating Characteristic Curve), accuracy, sensitivity, and specificity of 0.937, 0.870, 0.860, and 0.880, respectively. Compared to the conventional method (0.914, 0.829, 0.822, and 0.840, respectively) trained on CDTS images reconstructed with the same dose, it showed performance improvements of 2.3%, 4.1%, 3.8%, and 4%, respectively. Additionally, despite using only 7 views, the proposed AI system exhibited similar AUC results to the conventional method using CDTS images reconstructed into 26 views (0.937 vs. 0.930), while also achieving enhanced accuracy (0.870 vs. 0.847), sensitivity (0.860 vs. 0.838), and specificity (0.880 vs. 0.856) compared to the conventional method.

**CONCLUSION**

The proposed AI model improved the diagnostic performance of lung diseases based on tomosynthesis. Additionally, it demonstrated similar results to those obtained from higher radiation dose data when compared with reconstructed CDTS, validating its efficacy in minimizing radiation exposure.

**CLINICAL RELEVANCE/APPLICATION**

Our AI model has been validated based on CDTS, but we expect it to be applicable to other data reconstructed into three dimensions based on projection images similar to CDTS.

## T5B-SPCH-6 A MULTI-CLASSIFICATION MODEL BASED ON RADIOMICS TO DISTINGUISH PATHOLOGICAL TYPES OF PULMONARY GGNS

Kai Ji (*Abstract Co-Author*) Nothing to Disclose
Junyan Yue (*Abstract Co-Author*) Nothing to Disclose
Haipeng Liu (*Abstract Co-Author*) Nothing to Disclose
Xiaoyun Liang (*Abstract Co-Author*) Nothing to Disclose
Mengzhou Sun (*Presenter*) Nothing to Disclose

**PURPOSE**

This study performed three classifications (IA: invasive adenocarcinoma, MIA: minimally invasive adenocarcinoma, and PIA: pre-invasive adenocarcinoma) on CT images of patients with pulmonary ground glass nodules (GGN) based on different multi-classification model. The aim is to help clinicians accurately intervene and treat different types of pulmonary nodules.

**METHODS AND MATERIALS**

A total of 282 CT images of patients with pulmonary nodules were included. According to the types of pulmonary nodules, they were allocated into one of three groups: IA (127), MIA (80) and PIA (117). A total of 1609 radiomics features were extracted from radiologist annotations based on segmented results of nodular lesions by using the U-Net network . In addition, 16 sets of clinical and imaging feature data corresponding to the patients (age, smoking, density, etc.) were collected as well. Two comparative experiments were conducted as follows: prediction based on radiomics features and prediction based on radiomics features plus clinical and imaging features. Firstly, 90 features were selected from 1609 radiomics features with the recursive feature elimination method; the clinical and imaging features were reduced from 16 to 5 through univariate linear regression. Secondly, the data were divided into a training set (80%) and a test set (20%), and five-fold cross-validation was used to select the optimal model. We used three machine learning models in the sklearn package on Python: Random Forest (RF), Support Vector Machine (SVM), and Logistic Regression (LR). Finally, three weak classifiers were integrated into one strong classifier (ensemble learning).

**RESULTS**

Four metrics were employed to evaluate the developed models (Table 3): accuracy, precision, recall and F1-score. Among the 3 models, the model with the best performance in prediction based on radiomics classification is LR, with an accuracy of 0.719, and the accuracy of SVM and RF are 0.707 and 0.7, respectively. Further combination of clinical and radiomics features improved the performance of all three models, yielding accuracy values of 0.753, 0.717, and 0.747 for LR, SVM, and RF models, respectively. As expected, the best model was the ensemble learning model (clinical plus radiomics features), with values of 0.817, 0.797, and 0.779 for the accuracy, recall, and precision metrics, respectively.

**CONCLUSION**

In conclusion, our results have demonstrated that the fused model proposed in this article can effectively distinguish pathological types of pulmonary nodules, which may benefit diagnosis and clinical treatment.

**CLINICAL RELEVANCE/APPLICATION**

The employment of ensemble learning can predict the category of pulmonary nodules more accurately, thus improving the treatment outcomes.

## T5B-SPCH-7 3D RADIOMICS IN LONGITUDINAL FOLLOW-UP CT SCANS AS USEFUL MARKERS IN DIFFERENTIATING MALIGNANT POTENTIAL FOR PURE GROUND GLASS OPACITY IN LUNG

YUAN TING CHANG (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate whether 3D radiomics can differentiate malignant potential of pure ground glass opacities (pGGO) in baseline and longitudinal follow-up CT scans.

**METHODS AND MATERIALS**

Participants with pGGO who underwent surgery from 2017-2019 with at least two prior CT scans available in Mackay Memorial Hospital, a tertiary medical center in Taiwan, were retrospective recruited. Pathological results of atypical adenomatous hyperplasia and adenocarcinoma in situ were classified as non-invasive group, while minimal invasive adenocarcinoma and invasive adenocarcinoma as invasive group. Radiomics for analysis were preselected based on previous literature and clinical relevance. The volume of the lesions were also collected. Baseline and follow-up CT scans, as well as the difference across time span were analyzed. Wilcox test was applied to compare the radiomics between non-invasive and invasive lesions.

**RESULTS**

A total of 30 patients with 79 pGGOs was analyzed in this study. In both baseline and follow-up CT scans, invasive lesions had significantly higher entropy, maximum, mean absolute deviation, range, and variance than non-invasive lesions. Moreover, the difference of the abovementioned radiomics between baseline and follow-up CT as well as the difference accounted for follow-up interval was also larger in the invasive group; albeit only the result of variance reached significance (variance by time, median: invasive 23.0, non-invasive 4.4, p=0.04). In contrast, no significant difference between invasive and non-invasive groups was found for volume of the lesion at either time point. The difference of volume between baseline and follow-up CT was not significant, either.

**CONCLUSION**

This pilot study suggests that certain 3D radiomics, including entropy, maximum, mean absolute deviation, range, and variance, but not volume, are higher and may progress more rapidly over time in invasive pGGOs compared to the non-invasive pGGOs.

**CLINICAL RELEVANCE/APPLICATION**

Certain radiomics may be useful in assisting clinicians in evaluating pGGOs, improving risk stratification and guiding treatment strategy.

## T5B-SPCH-8 PROGNOSTIC VALUE OF AI-DRIVEN PREOPERATIVE CHEST RADIOGRAPH ANALYSIS IN SURGICALLY RESECTED PATHOLOGIC STAGE 1 NON-SMALL CELL LUNG CANCER

Eun Hye LEE (*Abstract Co-Author*) Nothing to Disclose
Hyun Joo Shin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Young Joo Suh, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Nayoung Kim (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the prognostic value of the artificial-intelligence (AI)-driven analysis of preoperative chest radiographs (CXR) in patients with surgically resected pathologic stage 1 non-small cell lung cancers (NSCLCs).

**METHODS AND MATERIALS**

We retrospectively enrolled consecutive patients who underwent curative surgical resection for pathological stage 1 NSCLCs from March 2020 to February 2021 at two referral hospitals. AI-driven preoperative CXR analysis was performed for the detection for nodules, consolidation, fibrosis, and atelectasis, from which abnormality scores were derived. The visibility of lung cancer lesions on preoperative CXRs and lesion detectability on AI (abnormality score threshold of = 15) were assessed by experienced radiologists. Logistic regression analysis was performed to evaluate the association of lesion detectability on AI with pathological or radiological factors. Cox proportional hazards regression analyses were performed to determine predictors of recurrence-free survival.

**RESULTS**

Among 416 patients (mean age, 65.6 years ± 9.9; 197 men), 257 patients (61.8%) had CXR-visible lung cancers. Among CXR-visible lung cancers, 208 lesions (80.9%) were detected by AI (197 nodules, 53 consolidations, 48 fibroses, and 8 atelectases). AI-detectable lung cancers were associated with a larger solid portion size on preoperative CT (odds ratio [OR] 1.17, 95% confidence interval [CI] 1.14-1.21 per 1 mm increase; P<0.001), lesion type of part-solid nodule or solid nodule (OR 9.6 [95% CI 3.7-25.1] and OR 30.3 [95% CI 11.4-80.6]; P<0.001), and higher pathologic stage (P<0.001) compared to AI non-detectable lung cancers. During a follow-up period of 1060 ± 200.7 days, 34 patients (8.2%) experienced disease recurrence. Both AI abnormality score and AI detectability were significant independent risk factors for poor recurrence-free survival (hazard ratio [HR] 1.03 [95% CI 1.02-1.04] per score increase; P<0.001, HR 7.04 [95% CI 2.47-20.10]; P<0.001) when adjusting for clinical variables. A prognostic model based on AI abnormality score and clinical variables showed similar performance (C-index 0.8 [95% CI 0.741-0.859]) compared to the models based on pathological stage and clinical variables (C-index 0.821 [95% CI 0.762-0.881]), and solid portion size on CT and clinical variables (C-index 0.846 [95% CI 0.798-0.894]; P>0.05 for all comparison).

**CONCLUSION**

AI-driven analysis of preoperative CXR can enhance the preoperative prediction of postoperative prognosis in patients who undergoing surgical resection for early stage of NSCLCs.

**CLINICAL RELEVANCE/APPLICATION**

AI abnormality score on preoperative CXR can aid to predict postoperative recurrence in patients with surgically resected pathologic stage 1 NSCLCs.

## T5B-SPCH-9 THE DIAGNOSTIC PERFORMANCE OF AN AI-BASED COMPUTER-AIDED DETECTION SYSTEM FOR PULMONARY NODULES CONSIDERING LOCALIZATION AND LUNG-RADS CATEGORIES: A MULTI-CENTER, RETROSPECTIVE CLINICAL TRIAL

Dahye Lee (*Abstract Co-Author*) Nothing to Disclose
Soobum Kim (*Abstract Co-Author*) Nothing to Disclose
Ro-Woon Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Burnyoung Kim (*Abstract Co-Author*) Nothing to Disclose
Jaehyeok Lee (*Abstract Co-Author*) Nothing to Disclose
Kibok Nam (*Abstract Co-Author*) Nothing to Disclose
Yeon Joo Jeong, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hoseok I, MD, PhD (*Abstract Co-Author*) Nothing to Disclose

Juyoung Lee (*Abstract Co-Author*) Nothing to Disclose
Gucheol Jung (*Presenter*) Nothing to Disclose

**PURPOSE**

We evaluated the diagnostic performance of a deep-learning based computer-aided detection (CAD) system, which provides information on the texture (solid, ground-glass opacity and part-solid), size, malignancy classification, lung-RADS category and localization of pulmonary nodules in low-dose Computed Tomography (LDCT) images.

**METHODS AND MATERIALS**

This clinical trial was designed as a multi-center, retrospective using external validation datasets of 455 LDCT (malignant 135, benign 190, normal 130) images. Using medical image annotation software, two radiologists from each institution independently annotated the texture and size of abnormalities on each radiograph and marked the localized abnormal regions with a freehand drawing tool. After radiologists completed the annotation, the medical device software (DEEP:LUNG, DL-LN-02, DEEPNOID Inc., Seoul, Korea) interpreted the LDCT images. As a primary endpoint in a clinical trial, we evaluated localization-adjusted sensitivity, specificity for detecting lung nodules and AUROC for classifying malignancy of lung nodules. The secondary endpoint evaluated the performance according to the lung-RADS categories. We also compared the sizes directly measured by radiologists using annotation software with the size predicted by the CAD.

**RESULTS**

As a primary endpoint, the sensitivity for pulmonary nodule detection was 91.38%, the specificity for pulmonary nodule detection was 93.08% and the AUROC for malignancy classification was 89.62%. As a secondary endpoint, the sensitivities for lung-RADS category 1 to 4A, 4B were 93.08%, 68.92%, 23.81% and 88.15%, while the specificities for lung-RADS category 1 to 4A, 4B were 100.00%, 90.55%, 89.35% and 90.62%, respectively. In solid nodules and ground-glass opacity nodules, the sizes were equivalent with a margin of 2mm and 3mm, respectively, according to the equivalence test ($p=0.0458$, $p=0.0004$).

**CONCLUSION**

In conclusion, DL-LN-02 indicates that its sensitivity, specificity, and malignancy classification AUROC demonstrate superior performance in the detection and classification of pulmonary nodules and malignancies by radiologists. It is anticipated that the proposed medical device software could offer valuable assistance in clinical diagnosis within medical practice.

**CLINICAL RELEVANCE/APPLICATION**

To apply deep-learning based automated analysis algorithm into actual practice, we propose a detection and segmentation model to select the subject image for analysis of lung nodules, which is required to be low-dose CT images.

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# Abstract Archives of the RSNA, 2024

T5B-SPER

**Emergency Radiology Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPER-1 STAND-ALONE PERFORMANCE COMPARISON OF AN AI MODEL PERFORMANCE FOR THE DETECTION OF PNEUMOPERITONEUM ON CHEST RADIOGRAPHS

Karen Rodriguez, MD (*Abstract Co-Author*) Nothing to Disclose
Roshan Fahimi, MD (*Abstract Co-Author*) Nothing to Disclose
Bernardo C. Bizzo, MD, PhD (*Abstract Co-Author*) Consultant, Diagnosticos da America (Dasa)
Anjaneya K. Singh, MD (*Abstract Co-Author*) Nothing to Disclose
Parisa Kaviani, MD (*Abstract Co-Author*) Nothing to Disclose
Victorine V. Muse, MD (*Abstract Co-Author*) Nothing to Disclose
Subba R. Digumarthy, MD (*Abstract Co-Author*) Consultant, Merck & Co, Inc;Consultant, Pfizer Inc;Consultant, Bristol-Myers Squibb Company;Consultant, Novartis AG;Consultant, F. Hoffmann-La Roche Ltd;Consultant, Polaris;Consultant, Cascadian;Consultant, AbbVie Inc;Consultant, Gradalis, Inc;Consultant, Bayer AG;Consultant, Zai Lab Limited;Consultant, Biengen;Consultant, Riverain Technologies, LLC;Consultant, Resonance Health;Consultant, Annalise-AI Pty Ltd;Research Grant, Lunit Inc;Research Grant, General Electric Company;Research Grant, Qure.ai;Speaker, Siemens AG
Mannudeep K. Kalra, MD (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Riverain Technologies, LLC;Research Grant, Coreline Inc
Emiliano Garza Frias, MD (*Abstract Co-Author*) Nothing to Disclose
James M. Hillis, MBBS, DPhil (*Abstract Co-Author*) Research funded, General Electric Company;Research funded, Annalise-AI Pty Ltd;Investor, Elly Health Inc
Seyedehelaheh Hosseini, MD (*Abstract Co-Author*) Nothing to Disclose
Lina Karout, MD (*Abstract Co-Author*) Nothing to Disclose
Anushree M. Burade, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

Pneumomediastinum is an incidental but importantfinding on chest x-rays. A prompt detection and clinical correlation plays avital role in urgent patient management. We assessed the performance of an AIalgorithm for detecting the presence of pneumoperitoneum on CXRs as compared toradiologists.

### METHODS AND MATERIALS

With IRB (Institutional Review Board)approval, a total of 600 cases were included in the study, in a consecutive andretrospective manner. Out of 600 cases, 300 cases were positive forpneumomediastinum, and 300 were negative for pneumomediastinum, based on theoriginal radiology reports. Following the image quality review, ground truthinterpretation by 1st/2nd radiologists yielded results for 234 (39.0%) positiveand 366 (61.0%) negative cases for pneumomediastinum. 87 (14.5%) cases requiredadjunct review by 3rd radiologist, for the discrepant cases. After AI modelinference, 599 (99.8%) cases were inferenced and 1 case was excluded due tofailure in processing by the model. Descriptive analyses were performed todetermine the AUC, sensitivity, and specificity of the AI model to detect thepresence of pneumomediastinum finding on chest x-rays.

### RESULTS

The mean age and SD for the cases was 62.5 ±17.0, ranging from age 22 to 99 years. The cohort consisted of 341 males(58.8%), and 239 females (41.2%). The AUC for the identification ofpneumomediastinum by the AI model was calculated to be 0.886 (95% CI:0.856-0.912). At predetermined operating point of 0.0368, AI model hadsensitivity of 59.9% (95% CI: 53.2%-66.2%), and specificity of 95.0% (95% CI:92.7%-97.2%). The AUC, sensitivity and specificity for females are 0.868,53.8%, and 93.2% and males are 0.9, 64.1% and 96.2% respectively. The AUC,sensitivity and specificity for patient positioning in erect subgroup are0.934, 75.5%, and 95.0% and in supine subgroup are 0.828, 43%, and 95%,respectively. The AUC, sensitivity and specificity for CXR AP or PA withoutlateral projection are 0.877, 57.7%, and 95.1% respectively. The AUC,sensitivity and specificity for CXR AP or PA with lateral projection are 0.934,75%, and 94.4% respectively.

### CONCLUSION

The AI algorithm can detect the presence ofpneumomediastinum with high specificity.

### CLINICAL RELEVANCE/APPLICATION

AI model can be used as an adjunct in detectionof pneumomediastinum for equivocal or non-specific chest x-rays in suspectedpneumomediastinum patients.

## T5B-SPER-2 1.EXPLORING THE EFFECTIVENESS OF ENERGY SPECTRUM CT WATER-HYDROXYAPATITE DECOMPOSITION TECHNIQUE IN CHRONIC OSTEOMYELITIS-RELATED BONE MARROW EDEMA

Kaibo He (*Abstract Co-Author*) Nothing to Disclose
Jing Liu (*Abstract Co-Author*) Nothing to Disclose

Zhang Zekun (*Abstract Co-Author*) Nothing to Disclose
Qian Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the value of dual-energy CT hydroxypatite(HAP) Water decomposition technique in chronic osteomyelitis.

**METHODS AND MATERIALS**

The CT and MRI data of 15 patients with chronic osteomyelitis examined in our hospital were retrospectively analyzed. Taken MRI results as reference standards, the colored image of Water(HAP) obtained by energy spectrum CT scan was evaluated,and the water density, the HAP density, effective atomic number(Zeff) of the bone marrow edema area and the contralateral position of the healthy side was compared by t-test.The consistency of Water(HAP) image and MRI image was tested by Kappa.

**RESULTS**

The water density of bone marrow edema area was significantly higher than that in healthy side,there was statistically significant differences between the two groups of data,t=6.473,P=0.00<0.05.The HAP density of bone marrow edema area was significantly lower than that in healthy side,there was statistically significant differences between the two groups of data,t=-2.975,P=0.01<0.05.There was no statistically significant differences between the two groups of Zeff.The diagnostic results of bone marrow edema by Water(HAP) image and MRI image were in moderate agreement,kappa=0.432,P=0.04<0.05.

**CONCLUSION**

Energy spectrum CT scan can be used in the diagnosis and quantitative analysis of bone marrow edema in chronic osteomyelitis.

**CLINICAL RELEVANCE/APPLICATION**

Energy spectrum CT is helpful for the diagnosis and quantitative analysis of bone marrow edema in chronic osteomyelitis, and improves the diagnostic efficacy of CT in bone marrow edema.

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# Abstract Archives of the RSNA, 2024

T5B-SPGI

**Gastrointestinal Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPGI-1 THE CLINICAL VALUE OF MACHINE LEARNING MODELS BASED ON MRI AND CLINICAL INDICATORS IN PREDICTING DISTANT METASTASIS OF HEPATIC HYDATID CYSTS

Changyou Long (*Abstract Co-Author*) Nothing to Disclose
Pengqi Tian (*Abstract Co-Author*) Nothing to Disclose
Xueqian Zhang (*Abstract Co-Author*) Nothing to Disclose
Yujie Xing (*Abstract Co-Author*) Nothing to Disclose
Yeang Tenzin (*Abstract Co-Author*) Nothing to Disclose
Hai Hua Bao (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the feasibility of machine learning models in predicting distant metastasis of hepatic hydatid cysts.

### METHODS AND MATERIALS

This study recruited a total of 257 patients diagnosed with hepatic hydatid cysts who underwent magnetic resonance imaging (MRI) at our hospital between January 2014 and March 2024 (distant metastasis: without metastasis = 88:169). Clinical baseline indicators and imaging features on MRI of hepatic hydatid cysts were collected for each patient. Features closely associated with multi-organ metastasis of hepatic hydatid cysts were selected through basic statistical methods. These selected features were then used to construct five independent classification models based on random forest (RF), support vector machine (SVM), logistic regression (LR), bagging decision tree (Bagging DR), and Gaussian process (GP) algorithms using 10-fold cross-validation. The efficiency of the models was evaluated using receiver operating characteristic (ROC) curves and the area under the curve (AUC), and compared with the diagnoses of seven resident physicians with two years of experience and two professionally trained radiologists with seven years of experience using the DeLong test.

### RESULTS

Eleven optimal features were selected based on traditional statistical methods, and machine learning models were constructed. In both the training and validation sets, the model based on clinical and MRI imaging features performed best under the Bagging decision tree (AUC: training = 0.946; validation = 0.926). The AUC values of resident physicians and professionally trained radiologists were both lower than the best-performing Bagging decision tree model (test set AUC: 0.640 and 0.766, respectively).

### CONCLUSION

Machine learning models based on MRI and clinical indicators have achieved high accuracy in predicting multi-organ metastasis of hepatic hydatid cysts, demonstrating their potential to assist in early clinical intervention.

### CLINICAL RELEVANCE/APPLICATION

These models improve early detection and prognosis, helping doctors tailor treatments and enhance patient outcomes in hepatic hydatid cyst management. By blending MRI with clinical data, they boost diagnostic accuracy, guiding more informed decisions for better care.

## T5B-SPGI-10 PREDICTION OF HISTOPATHOLOGIC GROWTH PATTERNS AND PROGNOSIS OF COLORECTAL LIVER METASTASES WITH MR IMAGING FEATURES

Kumi Ozaki, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To identify the distinguishable MR imaging features of replacement histopathologic growth pattern (rHGP) of colorectal liver metastasis (CRLM) from that of desmoplastic HGP (dHGP).

### METHODS AND MATERIALS

One hundred and four CRLMs in 79 patients (46 men and 33 women, mean age, 66.1) who underwent gadoxetic acid-enhanced MRI followed by partial hepatectomy between January 2011 and December 2021 were included. CRLMs were pathologically divided into rHGP or dHGP according to international consensus guidelines. Clinical data and imaging findings of MR imaging (contrast-to-noise ratio [CNR] at T1-, T2-, diffusion-weighted images [WI], ADC value, CNR and enhanced ratio at enhanced images) with focusing on the both tumor itself and segmented tumor-liver interface zones (peritumoral area) of CRLMs were evaluated, and were statistically analyzed.

### RESULTS

No patients with more than one CRLM revealed the different HGPs. No significant difference was found in any factors between the patients with CRLMs of rHGP and dHGP other than in overall survival. Forty-three CRLMs were diagnosed as rHGP, while 61 were diagnosed as dHGP. In quantitative assessment of the tumor itself, there were no significant differences between rHGP and dHGP in the maximum diameter, location, CNR at T2-, T1-, and diffusion WI, ADC value, CNR and enhanced ratio at arterial, portal, and hepatobiliary phase images. At peritumoral area, thickness of peritumoral area at arterial phase image, CNR and enhanced ratio at arterial and portal phase images are significantly larger in rHGP than those of in dHGP (plt;0.05). Area under the receiver operating characteristic curves of distinguishing rHGP from dHGP were 0.920 [0.871-0.969] in CNR at arterial phase image, 0.839 [0.766-0.911] in thickness of peritumoral area, and 0.795 [0.706-0.885] in enhanced ratio at arterial phase image, 0.727 [0.629-0.824] in enhanced ratio of arterial phase to portal phase, 0.665 [0.553-0.777] in CNR at portal phase image, 0.612 [0.498-0.726] in enhanced ratio at portal phase image. Kaplan-Meier overall survival curves were significantly worse in the patients with CRLMs predicting rHGP by MR images of CNR at arterial phase image, enhanced ratio at arterial phase image, and thickness of peritumoral area (p lt; 0.05).

### CONCLUSION

MR imaging features of CRLMs can discriminate rHGP from dHGP and predict the prognosis.

### CLINICAL RELEVANCE/APPLICATION

MR imaging features of colorectal liver metastases can discriminate histopathologic growth patterns and predict the prognosis.

## T5B-SPGI-12 EXTRACELLULAR VOLUME FRACTION BASED ON CONTRAST ENHANCED CT FOR PREOPERATIVE PREDICTING OF MACROTRABECULAR-MASSIVE HEPATOCELLULAR CARCINOMA

Xin Yang (*Abstract Co-Author*) Nothing to Disclose
Wenjian Wang (*Abstract Co-Author*) Nothing to Disclose
Xianfu Luo (*Abstract Co-Author*) Nothing to Disclose
Jiale Hang (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the potential of extracellular volume fraction (ECV) based on contrast-enhanced CT(CECT) in predicting macrotrabecular-massive hepatocellular carcinoma (MTM-HCC).

### METHODS AND MATERIALS

The preoperative CECT images of 79 patients with hepatocellular carcinoma were retrospectively analyzed. 23 cases of MTM-HCC and 56 cases of nMTM-HCC (none-macrotrabecular-massive hepatocellular carcinoma) were enrolled. All patients underwent abdominal plain scan and contrast-enhanced CT examination. The CT values of the abdominal aorta area, tumor area and normal liver parenchyma around the tumor were measured by circular region of interest (ROI) in the plain scan and equilibrium phase images, and the extracellular volume fraction (ECV) of the tumor area and normal liver parenchyma around the tumor was calculated. The differences of ECV between MTM-HCC group and nMTM-HCC group were compared. The ECV model for predicting MTM-HCC was developed, and its predictive efficacy was evaluated by the area under the receiver operating curve (AUC).

### RESULTS

The Etumor (CT value of the tumor area in equilibrium phase) was lower in the MTM-HCC group than that in nMTM-HCC group (64.5±16.8Hu vs.78.6±16.8Hu, P=0.001). The ?tumor (absolute enhancement value of the tumor area) was lower in MTM-HCC group than that in nMTM- HCC group (23.2±9.5 Hu vs. 36.3±14.2 Hu, P<0.001).The ECVtumor (ECV of the tumor area) value of the MTM-HCC group was lower than that of the nMTM-HCC group (16.8±5.2% vs. 26.6±7.9%, P<0.001), and the ECVliver (ECV of the normal liver parenchyma around the tumor) value of the MTM-HCC group was lower than that of the nMTM-HCC group (27.5±7.9% vs. 30.2±6.5%, P=0.132). The AUC of Etumor, ?tumor and ECVtumor for the diagnosis of MTM-HCC were 0.74, 0.77 and 0.87, respectively.

### CONCLUSION

Extracellular volume fraction based on CECT shows promise for predicting macrotrabecular-massive hepatocellular carcinoma.

### CLINICAL RELEVANCE/APPLICATION

Preoperative CECT based ECV for identifying of the aggressive HCC subtypes MTM-HCC may have strong prognostic and therapeutic implications.

## T5B-SPGI-13 Q-SPACE TRAJECTORY IMAGING OF FOCAL LIVER LESIONS

Kouhei Kamiya, MD (*Abstract Co-Author*) Nothing to Disclose
Koji Kamagata, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shuji Sato (*Abstract Co-Author*) Nothing to Disclose
Akiyoshi Suzuki (*Abstract Co-Author*) Nothing to Disclose
Shigeki Aoki, MD, PhD (*Abstract Co-Author*) Speakers Bureau, DAIICHI SANKYO Group;Speakers Bureau, General Electric Company;Speakers Bureau, Bayer AG;Speakers Bureau, Canon Medical Systems Corporation;Speakers Bureau, Guerbet SA;Speakers Bureau, Bracco Group;Speakers Bureau, Eisai Co, Ltd;Speakers Bureau, FUJIFILM Holdings Corporation;Research Grant, DAIICHI SANKYO Group;Research Grant, General Electric Company;Research Grant, Guerbet SA;Research Grant, Eisai Co, Ltd;Research Grant, FUJIFILM Holdings Corporation;
Masaaki Hori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Issei Fukunaga (*Abstract Co-Author*) Nothing to Disclose
Hideo Kawasaki (*Abstract Co-Author*) Nothing to Disclose
Katsutoshi Murata, MSc (*Abstract Co-Author*) Employee, Siemens AG
Takashi Arai (*Abstract Co-Author*) Nothing to Disclose
Satoru Kamio (*Abstract Co-Author*) Nothing to Disclose
Yuya Tanaka (*Abstract Co-Author*) Nothing to Disclose
Ryohei Kuwatsuru, MD (*Abstract Co-Author*) Nothing to Disclose
Wataru Uchida (*Abstract Co-Author*) Nothing to Disclose
Yuki Fukumura (*Abstract Co-Author*) Nothing to Disclose
Tomoko Maekawa, MD (*Abstract Co-Author*) Nothing to Disclose
Akio Saiura (*Abstract Co-Author*) Nothing to Disclose
Katsuhiro Sano, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Q-space trajectory imaging (QTI) is a state-of-the-art technique and yields not only fractional anisotropy (FA), but also isotropic, anisotropic, and total mean kurtosis (MKi, MKa and MKt), and microscopic anisotropy (μFA). The purpose of this study was to investigate these QTI values in focal liver lesions (FLLs).

**METHODS AND MATERIALS**

The study included 137 lesions in 93 consecutive patients (men: women=57: 36, 64.5±14.4 y.o.) who underwent gadoxetic acid-enhanced magnetic resonance imaging to diagnose FLLs between November 2022 and April 2024. Linear tensor encoding (LTE) and spherical tensor encoding (STE) were scanned using a 3T MR system, MAGNETOM Prisma (Siemens Healthcare). The scan parameters were as follows: TR/TE=1700/73; diffusion directions=47 (LTE) and 41 (STE); max b value = 1000; slice thickness=5. The diagnosis of FLLs (39.7±35.0mm) were as follows: 41 hepatocellular carcinomas (HCC); 9 intrahepatic cholangiocarcinomas (ICC); 43 metastatic tumor (META); 17 liver hemangiomas; 7 focal nodular hyperplasias (FNH); 15 simple cysts; 5 complicated cysts. A maximum of three lesions per person was included and nodules smaller than 10 mm were excluded. Diseases with fewer than five counts were excluded. ROIs were set in the liver parenchyma and FLLs in images b=0, and FA, μFA, and mean kurtosis (MKi, MKa, MKt) were calculated.

**RESULTS**

Mean results of liver parenchyma and FLLs of FA, μFA, and mean kurtosis were as follows: FA=0.38±0.14, μFA=0.52±0.11, MKi=0.94±0.33, MKa=0.44±0.28, MKt=1.37±0.44 for liver parenchyma; FA= 0.43±0.20, μFA=0.62±0.16, MKi=0.70±0.30, MKa=0.69±0.44, MKt=1.37±0.36 for HCCs; FA=0.44±0.20, μFA=0.63±0.22, MKi=0.45±0.41, MKa=0.74±0.67, MKt=1.13±0.33 for ICCs; FA=0.58±0.24, μFA=0.71±0.19, MKi=0.55±0.46, MKa=1.03±0.77, MKt=1.43±0.71 for METAs; FA=0.44±0.15, μFA=0.38±0.17, MKi=0.61±0.14, MKa=0.11±0.21, MKt=0.71±0.21 for hemangiomas; FA=0.36±0.11, μFA=0.31±0.13, MKi=0.99±0.13, MKa=0.15±0.12, MKt=1.14±0.10 for FNHs; FA=0.42±0.17, μFA=0.29±0.15, MKi=0.18±0.36, MKa=0.09±0.21, MKt=0.29±0.44 for simple cysts; FA=0.42±0.13, μFA=0.41±0.05, MKi=0.27±0.21, MKa=0.08±0.09, MKt=0.37±0.25 for complicated cysts. μFA and MKa were able to significantly differentiate between benign and malignant diseases.

**CONCLUSION**

QTI can provide new microstructural information for the diagnosis of FLL. In the future, the radiologic-pathologic correlation of malignant tumors should be considered.

**CLINICAL RELEVANCE/APPLICATION**

QTI can provide new microstructural information such as isotropic, anisotropic, and total mean kurtosis (MKi, MKa and MKt), and microscopic anisotropy.

## T5B-SPGI-3 DEVELOPMENT AND VALIDATION OF FUNCTIONAL LIVER IMAGING SCORE MODEL TO PREDICT PROGNOSIS IN HEPATOCELLULAR CARCINOMA

DING Feier (*Abstract Co-Author*) Nothing to Disclose
Gongzheng Wang (*Abstract Co-Author*) Nothing to Disclose
Lianbang Wang (*Abstract Co-Author*) Nothing to Disclose
Xinya Zhao (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop a model based on the functional liver imaging score (FLIS) derived from hepatobiliary-specific contrast enhanced magnetic resonance imaging (MRI) to predict long-term survival in HCC patients after surgical resection.

**METHODS AND MATERIALS**

Patients who underwent hepatobiliary-specific contrast enhanced MRI and surgical resection with pathologically proven HCC were retrospectively included from three medical centers. The FLIS derived from gadobenate dimeglumine-enhanced MRI was calculated by summing the points (0-2) of three hepatobiliary-phase features: hepatic enhancement, biliary excretion, and portal vein signal intensity. A nomogram was established integrating FLIS and clinical factors for better prediction. Overall survival (OS) and recurrence-free survival (RFS) were estimated by the Kaplan-Meier method and compared with the log-rank test.

**RESULTS**

This study included 467 patients (median age, 57 years). The area under the receiver operating characteristic curves of FLIS were 0.777, 0.818 and 0.741 in training cohort, internal validation cohort and external validation cohort, respectively. In multivariable analysis, FLIS, alpha-fetoprotein (AFP) > 400 ng/mL, major resection and tumor size > 5cm were independent predictors of OS. The FLIS model incorporating these variables was developed, and showed good concordance statistics of 0.950, 0.927, and 0.945 in training cohort, internal validation cohort and external validation cohort, respectively. Harrell's concordance index for the FLIS model was significantly higher than FLIS and other conventional systems (all $p < 0.05$). Kaplan-Meier curves demonstrate that patients in the FLIS model-low risk group show a longer OS and RFS than those in the FLIS model-high risk group ($p < 0.05$).

**CONCLUSION**

We developed a novel model based on FLIS to predict long-term survival in HCC patients after surgical resection. This tool could be used as a reference for clinicians and surgeons to help them in clinical decision-making.

**CLINICAL RELEVANCE/APPLICATION**

Compared with other prognostic systems, such as BCLC score, MELD score, and ALBI score, the FLIS showed greater prediction performance for predicting OS, indicating that the FLIS is a more reliable and effective diagnostic indicator for selecting eligible surgical candidates before performing surgical resections.

## T5B-SPGI-4 EVALUATION OF THE CONTRAST-ENHANCED ULTRASOUND NONRADIATION TREATMENT RESPONSE ASSESSMENT LI-RADS V2024 USING DATA FROM A MULTI-CENTER TRANSARTERIAL CHEMOEMBOLIZATION STUDY

Esika Savsani (*Abstract Co-Author*) Nothing to Disclose
Rohit Nagaraj (*Abstract Co-Author*) Nothing to Disclose
John R. Eisenbrey, PhD (*Abstract Co-Author*) Support, General Electric Company;Research Grant, General Electric Company;Support, Lantheus Medical Imaging, Inc;Speaker, Lantheus Medical Imaging, Inc;Support, Siemens AG
Joy Li, MD (*Abstract Co-Author*) Nothing to Disclose
Aylin Tahmasebi, MD (*Abstract Co-Author*) Nothing to Disclose
Cristina Kuon Yeng Escalante (*Abstract Co-Author*) Nothing to Disclose
Michael C. Soulen, MD (*Abstract Co-Author*) Consultant, F. Hoffmann-La Roche Ltd;Consultant, Guerbet SA;Consultant, AstraZeneca PLC;Research

support, Guerbet SA;Research support, Sirtex Medical Ltd;Research support, Pfizer Inc
Andrej Lyshchik, MD, PhD (*Abstract Co-Author*) Royalties, RELX;Speaker, General Electric Company;Consultant, General Electric Company;Research support, General Electric Company;Consultant, BioClinica, Inc;Consultant, WCC, Inc;Consultant, Bracco Group;Advisory Board, Bracco Group
Corinne Wessner (*Abstract Co-Author*) Consultant, Bracco Group
Ji-Bin Liu, MD (*Abstract Co-Author*) Research Grant, General Electric Company
Yuko Kono, MD, PhD (*Abstract Co-Author*) Equipment support, Canon Medical Systems Corporation;Equipment support, General Electric Company;Support, Lantheus Holdings;Support, Bracco Group
Amr Mohammed, MD (*Abstract Co-Author*) Nothing to Disclose
Tania Siu Xiao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to evaluate the diagnostic performance of the new ACR contrast-enhanced ultrasound (CEUS) Nonradiation TRA LI-RADS v2024 in HCC treated with transarterial chemoembolization (TACE).

**METHODS AND MATERIALS**

This retrospective observational study included 87 patients treated with TACE from a previously reported cohort. At 15- and 30-days post-treatment, 68 and 72 HCC lesions were evaluated. Three blinded radiologists with different levels of CEUS experience interpreted the images independently. According to CEUS Nonradiation TRA LI-RADSv2024, both intralesional and perilesional tumor viability were evaluated and final TRA categories were as follows: TR-Nonviable, TR-Equivocal, and TR-Viable. Reference standard used was a composite of histology and imaging. Diagnostic performance and Cohen's kappa test was performed.

**RESULTS**

140 HCC lesions were analyzed. At 15 days post-treatment, the sensitivity (SN), specificity (SP), positive predictive value (PPV), negative predictive value (NPV), and accuracy of TR-Viable classification ranged from 72.5-94.3%, 72.2-86.4 86.8-91.4%, 65.6-86.7%, 76.9-86.8%, respectively. At 30 days post-treatment, the SN, PPV, and NPV of TR-Viable classification decreased, ranging from 65.9-84.2%, 85.7-90.6%, and 59.5-73.9%, respectively, while the SP increased, ranging from 80.0-88.0%. Kappa values ranged from 0.557-0.730, indicating moderate to substantial agreement.

**CONCLUSION**

CEUS Nonradiation TRA LI-RADS is a reliable tool for the detection of viable tumors in lesions treated with TACE and demonstrates reproducibility across readers.

**CLINICAL RELEVANCE/APPLICATION**

Using the new ACR CEUS Nonradiation TRA LI-RADS v2024 can lead to early detection of residual tumor post TACE treatment and prompt intervention as early as 15 days.

## T5B-SPGI-5 TO INVESTIGATE THE VALUE OF PRE-TREATMENT GADOXETIC ACID-ENHANCED MAGNETIC RESONANCE IMAGING (MRI) USING LIVER IMAGING REPORTING AND DATA SYSTEM (LI-RADS) V2018 IN PREDICTING THE RESPONSE TO INITIAL TRANSARTERIAL CHEMOEMBOLIZATION (TACE) IN HEPATOCELLULAR CARCINOMA (HCC)

Liqin Zhao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the value of pre-treatment gadoxetic acid-enhanced magnetic resonance imaging (MRI) using Liver Imaging Reporting and Data System (LI-RADS) v2018 in predicting the response to initial transarterial chemoembolization (TACE) in hepatocellular carcinoma (HCC).

**METHODS AND MATERIALS**

A total of 151 HCC patients who received gadoxetic acid-enhanced MRI before TACE were retrospectively recruited. Analysis was evaluated by LI-RADS v2018 and other image features. Independent factors were identified through logistic regression analyses, and a combined model incorporating clinical, laboratory and gadoxetic acid-enhanced MRI findings was established as a nomogram. The performance of the nomogram was assessed by receiver operating characteristic (ROC) curves and validated by fivefold cross-validation.

**RESULTS**

Among the 151 patients, 80 (52.98%) were TACE response (TR), while 71 (47.02%) were non-TACE response (nTR). Multivariate analysis revealed that TACE alone, central tumor zone, larger tumor size, and nonsmooth tumor margin were independent factors associated with nTR ($p < 0.05$). The area under the curve (AUC) and the corresponding 95% confidence interval (CI) of the nomogram were 0.767 (0.692-0.842), accuracy of 0.715, sensitivity of 0.789.

**CONCLUSION**

The nomogram incorporating clinical and gadoxetic acid-enhanced MRI features using LI-RADS v2018 achieved potential efficacy of response to TACE in HCC patients.

**CLINICAL RELEVANCE/APPLICATION**

LI-RADS v2018 may assist clinicians in selecting the most appropriate treatment options for individual HCC patients.

## T5B-SPGI-9 EARLY PREDICTION OF THE EFFICACY OF LIVER METASTASES CHEMOTHERAPY COMBINED WITH TARGETED THERAPY FOR COLORECTAL CANCER BASED ON CT RADIOMICS

Junlin Zhou, PhD (*Abstract Co-Author*) Nothing to Disclose
Shenglin Li, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the feasibility of contrast enhanced CT (CECT)-based radiomics for early efficacy prediction of chemotherapy combined with targeted therapy in colorectal cancer liver metastases (CRLM).

**METHODS AND MATERIALS**

Retrospectively collected CECT images of 90 patients (255 lesions) with CRLM diagnosed by pathology or imaging follow-up from May 2018 to October 2022 at multicentre before treatment and after early treatment (2-4 cycles), manually outlined and extracted the radiomics features within the target

lesions, and classified them with the long-term treatment efficacy of 12 cycles of treatment (RECIST v1.1) as a classification label Construct an imaging histology early efficacy prediction model. Target lesions were randomly divided into training set (n=135), test set (n=53) and external validation set (n=53). Models were constructed Model_Clinical, Model_Pre, Model_Pos, Model_Pre+Pos, Model_Ratio, Model_Detla, Model_ DetlaABS and Model_COMB efficacy prediction models. AUC values, sensitivity and specificity were used to assess the predictive efficacy of the models. The goodness of fit tests and calibration curves were used to assess the stability of the predictive models.

**RESULTS**

Among the clinical variables, only the mutation status of the K-RAS gene [odds ratio (OR): 0.17; 95%CI: 0.04-0.57, P= 0.003] and the BRAF gene (OR: 4.06; 95%CI: 0.91-22.75, P= 0.067) were found to be closely associated with the early treatment response of target lesions. The Model_Clinical exhibited AUCs of 0.728(95%CI: 0.644-0.812), 0.761(95%CI: 0.637-0.886), and 0.514(95%CI: 0.398-0.629) in the training, test, and external validation sets, respectively. The Model_COMB, which incorporated all radiomic features from pre- and post-treatment, AUC values of 0.956(95%CI: 0.926-0.986), 0.894(95%CI: 0.803-0.984), and 0.833(95%CI: 0.740-0.925) in the training, test, and external validation sets when using the treatment response of individual target lesions as the criterion. When using the overall patient disease progression as the standard, the Model_COMB prediction model achieved AUC values of 0.963(95%CI: 0.915-1.000), 1.00(95%CI: 1.00-1.00), and 0.858(95%CI: 0.727-0.989) in the training, test, and validation sets, respectively. Calibration curves and goodness of fit tests indicated that the model maintained stable predictive power in the training and test sets($P > 0.05$).

**CONCLUSION**

The radiomics features of target lesions from CECT images pre- and post- chemotherapy combined with bevacizumab can effectively predict the early efficacy of targeted therapy.

**CLINICAL RELEVANCE/APPLICATION**

Our study results are providing a favorable clinical evaluation scheme for precise targeted therapy for CRLM.
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# Abstract Archives of the RSNA, 2024

T5B-SPGU

**Genitourinary Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPGU-1 MRI AND MR VOIDING CYSTOURETHROGRAPHY IN THE EVALUATION OF MALE PRIMARY BLADDER NECK OBSTRUCTION

Marco Di Girolamo, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Evaluation of male with Primary bladder neck obstruction (PBNO) using MRI and MR Voiding Cystourethrography (MR-VCU) to study both anatomical aspects of bladder neck and urethral lumen.

### METHODS AND MATERIALS

In this retrospective study 21 male patients (mean-age 33±14) with urodynamic diagnosis of PBNO and 5 healthy volunteers ((mean-age 28±2) as control group, were enrolled. Both patients and control group underwent 1.5T MRI. Sagittal and oblique coronal Turbo-Spin-Echo T2-weighted scans were performed. Only patients underwent MR Voiding -Cystourethrography (MR-VCU) performed with T1-weighted spoiled 3D Gradient-Echo sagittal acquisitions. Bladder lumen was filled with contrast-material-enhanced urine. Blinded test by two radiologists was performed to evaluate causes of bladder outlet obstruction evaluating MR-VCU. Anatomical MRI features of both control group and patients were compared in consensus by senior radiologist and urologist using the analysis of variance (ANOVA) test.

### RESULTS

MRI allowed evaluation of the bladder neck muscular structures. We found 4 groups of PBNO patients: 52% hypertrophy of posterior lip of bladder sphincter; 20% asymmetry of lateral portion of bladder sphincter; 14% bladder neck cyst; 14% showed normal aspect of bladder neck. Comparison between the control group and first and second PBNO groups was considered statistically significant ($p<0.05$) with diagnostic accuracy of 87%. Only 13 patients (61%) were able to perform MR-VCU and radiologists always made the diagnosis of PBNO.

### CONCLUSION

MRI together with MR-VCU provides useful anatomical and functional information in the study of bladder neck and urethral lumen. These preliminary results suggest that MRI could substitute for standard cystourethrogram in patients with PBNO.

### CLINICAL RELEVANCE/APPLICATION

MRI with voiding MR.cystourethrography could be performed in male patients with PBNO in order to diagnose and to visulize all the anatomical and functional aspect of the bladder neck.

## T5B-SPGU-2 MCW-171: A POPULATION-LEVEL T2W MRI PROSTATE TEMPLATE FOR ENHANCED GROUP ANALYSIS AND PATHOLOGY INTEGRATION

Kathleen Y. Bhatt, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel Bobholz, BS (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Vincent-Sheldon, MD (*Abstract Co-Author*) Nothing to Disclose
Leela Chaudhary, MD (*Abstract Co-Author*) Nothing to Disclose
Aleksandra Winiarz (*Abstract Co-Author*) Nothing to Disclose
Peter S. Laviolette, PhD (*Abstract Co-Author*) Nothing to Disclose
Katherine M. Troy, MD (*Abstract Co-Author*) Nothing to Disclose
Savannah Duenweg (*Abstract Co-Author*) Nothing to Disclose
Allison Lowman (*Abstract Co-Author*) Nothing to Disclose
Biprojit Nath (*Presenter*) Nothing to Disclose

### PURPOSE

In neuroimaging, standardized brain templates like the MNI152 have significantly enhanced group-level analyses by enabling spatial normalization and facilitating comparisons across diverse datasets. However, the field of prostate imaging lacks a widely recognized anatomical template, which poses challenges due to the considerable anatomical variations between patients. To fill this gap, we developed a prostate template from T2-weighted (T2w) MR images of 171 patients with clinically confirmed prostate cancer (PCa). The MCW-171 template has been utilized to analyze the spatial distribution of cancer densities for different Gleason grades on a population level.

### METHODS AND MATERIALS

This study involved 171 prostate cancer patients who underwent MRI scans without an endorectal coil, using a 3T scanner. The images were intensity normalized and bias corrected using Advanced Normalization Tools (ANTs), then registered to a starting template to refine and optimize it over eight iterations, creating the high-quality 'MCW171' template. Following MRI, patients underwent radical prostatectomy, where a custom 3D-printed slicing jig was utilized to ensure the excised prostate tissue was oriented accurately according to the MRI scans. These slices from the tissue were then processed and stained with Hematoxylin and Eosin (HE) to enhance the visualization of tissue structure and cellular details. The slides were digitized and annotated by a board-certified pathologist to precisely identify cancerous regions. The digitized histological slides were carefully aligned to the MRI scans using non-linear control point warping techniques. The aligned histological data were then integrated into the MCW171 template using ANTs deformable registration, enabling precise anatomical correspondence. This process facilitated the generation of cancer probability maps across different Gleason grades, effectively illustrating the spatial variability of cancer occurrence within the prostate.

### RESULTS

The MCW171 template effectively delineates various regions of the prostate, highlighting critical landmarks. Notably, the analysis revealed a distinct asymmetry in the distribution of Gleason grades across the studied population, with a higher propensity for tumors in the Peripheral Zone. Additionally, higher-grade cancers were predominantly located in both the Peripheral and Transition Zones, with greater occurrence in the Peripheral Zone.

### CONCLUSION

The development of the 'MCW171' T2-weighted prostate templatey enhances prostate imaging by providing a reliable standard for comparison.

### CLINICAL RELEVANCE/APPLICATION

The MCW171 template refines prostate cancer diagnosis and management by providing precise mappings of cancer distributions.

## T5B-SPGU-3 KIDNEY TUMOR CHARACTERIZATION SCORING SYSTEM (KISSS): QUALITATIVE MRI BASE APPROACH USING MACHINE LEARNING

Ashkan A. Malayeri, MD (*Abstract Co-Author*) Nothing to Disclose
Evrim B. Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Nathan S. Lay, PhD (*Abstract Co-Author*) Inventor, ScanMed
Fion Obiezu (*Abstract Co-Author*) Nothing to Disclose
Aditi Chaurasia, MBBS (*Abstract Co-Author*) Nothing to Disclose
Pouria Yazdian, MD (*Abstract Co-Author*) Nothing to Disclose
Safa Samimi (*Abstract Co-Author*) Nothing to Disclose
W. Marston Linehan, MD (*Abstract Co-Author*) Nothing to Disclose
Jovitha Nelson (*Abstract Co-Author*) Nothing to Disclose
Negin Jarrah, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Renal cell tumors present diverse histological subtypes, each with unique prognostic andtherapeutic implications. Magnetic Resonance Imaging (MRI) plays a crucial role in the pre-surgical evaluation of renal masses, yet the interpretation of these images remains challenging andsubjective. This study leverages machine learning models to enhance the classification accuracyof renal cell tumors using MRI features, aiming to improve diagnostic accuracy.

### METHODS AND MATERIALS

We analyzed MRI data from 54 patients with 111 pathologically confirmed renal celltumors. Pathologies were, clear cell Renal Cell Carcinoma (ccRCC), Renal Angiomyolipoma(AML), Oncocytic Renal tumors (Oncocytoma), Papillary renal cell carcinoma (pRCC),Chromophobe renal tumors (Chromophobe). Patients were selected from a prospectivelymaintained registry from 2010 to 2023. Two expert radiologists evaluated the lesions acrossvarious MRI sequences, assigning scores based on predetermined criteria. A stacking Classifierwith Logistic Regression using Machine learning models, including XGBoost Classifier andFormatted: Indent: First line: 0.5", Line spacing:DoubleRandom Forest Classifier, were trained for categorizing 5 renal tumor pathologies and a binaryclassification of ccRCC versus non-ccRCC. Model performance was assessed using accuracy, F1-scores, positive predictive value (PPV), sensitivity, and SHapley Additive exPlanations (SHAP)for feature importance analysis.

### RESULTS

Among lesions, clear cell renal cell carcinoma (ccRCC) was identified as the most commontumor, accounting for 55 (50%) of the lesions, while Chromophobe carcinoma had the lowestprevalence with 10 (9.0%) lesions. The mean age of the patients was 49.8 ± 10.6 years. The studyfound moderate inter-reader reliability in most of the questioned features. The modelsdemonstrated an overall accuracy of 0.62 ± 0.051 for multi-class classification and 0.77 ± 0.064for binary classification, with ccRCC being the most accurately characterized pathology. SHAPanalysis highlighted the importance of T1 signal intensity, peak enhancement, and T2 signalintensity in lesion characterization.

### CONCLUSION

Using machine learning can help the radiologists to characterize the lesions usingqualitative image features with high accuracy and it can provide a precise decision forcharacterizing and classifying lesions.

### CLINICAL RELEVANCE/APPLICATION

The application of machine learning in MRI analysis enhances the characterization of renaltumors, facilitating more accurate and clinically relevant diagnoses, thereby aiding in personalizedtreatment planning.

## T5B-SPGU-4 MR-GUIDED CRYOABLATION OF SEMINAL VESICLES: A 10-YEAR EXPERIENCE

David A. Woodrum, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Lance A. Mynderse, MD (*Abstract Co-Author*) Researcher, Koninklijke Philips NV;Equipment support, Koninklijke Philips NV;Investigator, Nanospectra Biosciences, Inc;Researcher, Nanospectra Biosciences, Inc
Daniel A. Adamo, MD (*Abstract Co-Author*) Nothing to Disclose
Aiming Lu, PhD (*Abstract Co-Author*) Nothing to Disclose
Scott M. Thompson, MD, PhD (*Abstract Co-Author*) Research Consultant, Boston Scientific Corporation
Setayesh Sotoudehnia Korani, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Ganjizadeh, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the efficacy and safety of MR-guided cryoablation for the treatment of local recurrence of prostate cancer in the seminal vesicles.

### METHODS AND MATERIALS

This single-center study included 164 patients with 187 ablation sites from 2013 to 2024. The ablation sites were distributed as follows: right seminal vesicle (74), left seminal vesicle (63), bilateral (35), and take-off (14). The mean age of patients was 72.44 years (range: 51-88). Cryoablation procedures were performed under MRI guidance, with 2-3 freeze/thaw cycles and a 3-5 mm margin. Normal saline was injected to form a protective separation between the ablated site and the rectum. Follow-up included PSA and PET PSMA, PET 11-C Choline, or MRI every 3±1 months for 24 months. An open-source large language model prescreened 3074 reports, and a radiologist reviewed the relevant reports and imaging.

### RESULTS

Out of 187 ablations, 21 (11.23%) led to local recurrences in 20 patients, with 76.19% (16 cases) occurring within the first year. The timing of recurrences was as follows: 2 at 3 months, 3 at 6 months, 7 at 9 months, and 4 at 12 months. Recurrences were noted predominantly in the left seminal vesicle (7), right seminal vesicle (5), bilateral vesicles (5), and take-off (2). Eleven of 21 patients with recurrences exhibited other lesions and had a higher Gleason score (mode: 8, range 7-9), contrasting with those with solitary seminal vesicle recurrence (mode: 7, range 6-9). PET was more effective than MRI in the initial detection of recurrences, identifying 9 cases compared to 7 by MRI in the first year.

### CONCLUSION

MR-guided cryoablation of seminal vesicles demonstrates a robust local control rate of 88.77%. This technique leverages MRI's superior soft tissue visualization and real-time monitoring capabilities to precisely delineate tumor margins and adjacent critical structures. The clear visualization of the ablation zone and distinct ice ball margins on MRI allows for accurate targeting, ensuring complete tumor coverage while minimizing collateral damage to surrounding nerves, blood vessels, and other healthy tissues. Moreover, MRI guidance enables access to lesions in anatomically complex or high-risk locations that may be challenging to reach with CT guidance alone.

### CLINICAL RELEVANCE/APPLICATION

By providing enhanced procedural precision and safety, MR-guided cryoablation emerges as a valuable therapeutic modality for effectively managing local recurrences of prostate cancer with minimal associated complications. This positions it as a promising option in the urological oncology armamentarium for achieving optimal oncologic outcomes while preserving functional integrity.

## T5B-SPGU-5 MR IMAGING CHARACTERISTICS OF PROSTATE ADENOCARCINOMA WITH NEUROENDOCRINE DIFFERENTIATION (PAND) AND PURE NEUROENDOCRINE TUMORS

Muhamad Serhal, MD (*Abstract Co-Author*) Nothing to Disclose
Eric Li, MD (*Abstract Co-Author*) Nothing to Disclose
Frank H. Miller, MD (*Abstract Co-Author*) Advisory Board, Bayer AG;Advisory Board, Guerbet SA
Amir Borhani, MD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Anugayathri Jawahar, MD (*Abstract Co-Author*) Nothing to Disclose
Roberta Catania, MD (*Abstract Co-Author*) Institutional Research Grant, Siemens AG
Maryam Haghshomar, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Prostate neuroendocrine tumors are very rare and there is not enough literature on unique imaging characteristics of PAND and prostate neuroendocrine tumors. Diagnosing prostate adenocarcinoma and prostate adenocarcinoma with neuroendocrine differentiation (PAND) and pure neuroendocrine tumors on prostate MR can be a challenging task. Our objective was to compare the MR imaging features of PAND and pure neuroendocrine tumors with corresponding lab values and clinical presentation.

### METHODS AND MATERIALS

In this retrospective study, we included patients with pathology-confirmed PAND or pure neuroendocrine tumors. Immunohistochemical markers, including chromogranin and neuron-specific enolase, were utilized to confirm pathology. Two radiologists with more than 10 years of clinical practice read the prostate MR images and reported imaging findings on T2, DWI, post-contrast sequences. Further clinical data including PSA levels, and prostate health index (PHI) were collected.

### RESULTS

A total of 37 patients with PAND (mean age 68 years) and 3 patients with pure neuroendocrine tumors (mean age 67 years) were included in this study. The mean values for prostate volume, largest diameter, and density were 57.68 ml, 5.45 cm and 0.44. The mean size of lesions was 2.73 cm with the smallest lesion being 0.5 cm and largest lesion being 8.9. MRI findings of pure neuroendocrine tumor were as followed: 63% of patients had uniformly hypointense T2 signal 100% had Restricted diffusion, 63% had focal early enhancement, 100% had extracapsular extension, 33% had Seminal vesicle involvement, 63% had Bladder involvement and 33% had Lymph node involvement. There were false negative PSMA-PET results in highly evolved neuroendocrine tumor. MRI findings of PAND tumors were as followed: 76% were homogeneously hypointense, 59% had marked restriction diffusion, 53% had early enhancement, 59% had Extracapsular extension: 53% had Seminal vesicle involvement, 18% had Bladder involvement and 47% had LN involvement. Metastases to organs other than bone, brain, lungs, and liver were present. Bone metastasis lesions were lytic.

### CONCLUSION

Prostate neuroendocrine tumors present as large, heterogeneous tumors (low to intermediate T1, high T2, heterogeneous high DWI, moderate low signal on ADC, avid enhancement) with low PSA level when in pure neuroendocrine tumor.

### CLINICAL RELEVANCE/APPLICATION

Establishing unique imaging characteristics of PAND and pure prostate neuroendocrine tumors can help radiologists distinguish them from prostate adenocarcinoma with significant changes in management decisions.

## T5B-SPGU-6 INTRATUMOURAL AND PERITUMOURAL MPMRI-BASED DELTA-RADIOMICS RADIOMICS MODEL FOR THE PREDICTION OF THE RESPONSE TO ANDROGEN DEPRIVATION THERAPY IN PROSTATE CANCER

Yajia Gu (*Abstract Co-Author*) Nothing to Disclose
Bingni Zhou (*Abstract Co-Author*) Nothing to Disclose
Shiyun Sun (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the value of the delta-radiomics of the intratumoural area (IA) and peritumoural area (PA) based on multiparameter magnetic resonance imaging (mpMRI) to predict the response to androgen deprivation therapy (ADT) in prostate cancer (PCa).

**METHODS AND MATERIALS**

Patients with PCa who underwent mpMRI before and after ADT were analysed retrospectively. The patients were divided into a significant residual (SR) group and complete remission and minimal residual (CR/MRD) group according to pathological results. Three types of volumes of interest (VOIs) were obtained for each lesion: IA VOI, IA + 3 mm PA VOI, and IA + 6 mm PA VOI. Radiomics features were extracted, and delta-radiomics data were calculated. The delta-radiomics model was built by the radiomics score (RS). & 9;The clinical model was constructed by univariate and multivariate analyses. The combined model was developed with the RS and selected clinical features. Model performance was assessed by the area under the curve (AUC).

**RESULTS**

In total, 69 patients in the SR group and 40 patients in the CR/MRD group were included. The AUCs of the IA, IA + 3 mm PA and IA + 6 mm PA delta-radiomics models were 0.78, 0.84 and 0.79, respectively. The AUC of the clinical model was 0.80. The AUCs of the combined models of IA, IA + 3 mm PA, and IA + 6 mm PA were 0.89, 0.92, and 0.90, respectively.

**CONCLUSION**

Delta-radiomics can effectively predict the response to ADT. And the combined model (IA + 3 mm PA) improved the prediction performance.

**CLINICAL RELEVANCE/APPLICATION**

Utilizing radiomics techniques to analyze mpMRI images features within and around the lesions in the response to ADT.

## T5B-SPGU-7 IS THERE ENOUGH EVIDENCE SUPPORTING THE CLINICAL ADOPTION OF CLEAR CELL LIKELIHOOD SCORE (CCLS)? AN UPDATED SYSTEMATIC REVIEW AND META-ANALYSIS

Huan Zhang (*Abstract Co-Author*) Nothing to Disclose
Yang Song (*Abstract Co-Author*) Nothing to Disclose
Weiwu Yao (*Abstract Co-Author*) Nothing to Disclose
Jingyu Zhong, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To review the evidence for clinical adoption of clear cell likelihood score (ccLS) for identifying clear cell renal cell carcinoma (ccRCC) from small renal masses (SRM).

**METHODS AND MATERIALS**

We distinguished the literature on ccLS for identifying ccRCC via systematic search using PubMed, Embase, Web of Science, China National Knowledge Infrastructure, and Wanfang Data until 31 March, 2024. The risk of bias and concern on application was assessed using the modified Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool. The diagnostic accuracy was estimated with the bivariate random-effects model. The level of evidence supporting clinical adoption of ccLS for identifying ccRCC was determined based on meta-analyses.

**RESULTS**

Eight MRI studies and three CT studies were included. The risk of bias and application were mainly related to the index test and flow and timing, due to incomplete imaging protocol, unclear rating process, and inappropriate interval between imaging and surgery. The diagnostic odds ratios (95% confidence intervals) of MRI and CT ccLS were 14.69 (9.71-22.22; 6 studies, 1429 SRM, 869 ccRCC), and 5.64 (3.34-9.54; 3 studies, 296 SRM, 147 ccRCC), respectively, for identifying ccRCC from SRM. The aeras under hierarchical summary receiver operating characteristic curve (95% conventional intervals) MRI and CT ccLS were 0.86 (95% CI 0.82-0.89), and 0.76 (95% CI 0.69-0.82), respectively. The evidence level for clinical adoption of MRI and CT ccLS were both rated as weak. MRI ccLS version 2.0 potentially has better diagnostic performance than version 1.0 (1 study, 700 SRM, 509 ccRCC). Both T2-weighted-imaging with or without fat suppression might be suitable for MRI ccLS version 2.0 (1 study, 111 SRM, 82 ccRCC).

**CONCLUSION**

ccLS has promising diagnostic performance for identifying ccRCC from SRM, but evidence for adopting ccLS in clinical routine is still weak.

**CLINICAL RELEVANCE/APPLICATION**

Both MRI and CT ccLS algorithms has promising diagnostic performance in identifying ccRCC from SRM. The clinical adoption of ccLS algorithms is yet hindered by unstandardized imaging protocol, nonadherence to the current guideline, and lacking in appropriate management suggestion. Nonetheless, the characterization of SRM can be in a more accurate and clinically useful fashion applying MRI and CT ccLS algorithms, thereby providing patients with optimized decision making for initial management.

## T5B-SPGU-8 LEVATOR ANI MUSCLE FAT INFILTRATION INFEMALES WITH AND WITHOUT STRESS URINARY INCONTINENCE EVALUATED BYSPECTRAL CT MATERIAL DECOMPOSITION TECHNIQUE AND IDEAL-IQ SEQUENCE: A PROSPECTIVE CASE-CONTROL STUDY ON108 VOLUNTEERS

Kun Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Kun Ou (*Presenter*) Nothing to Disclose

**PURPOSE**

Using IDEAL-IQ sequence of MRI and spectral CT material decomposition (MD) technique to evaluate fat infiltration of levator ani muscle in patients with stress urinary incontinence (SUI), comparing with healthy people.

**METHODS AND MATERIALS**

This study enrolled 50 healthy volunteers and 58 patients with SUI who underwent pelvic examinations including 3.0-T MR and non-enhanced CT gemstone spectral imaging. The fat fraction (FF) value was measured for levator ani muscle on axial FF images and the fat contents were measured on coronal fat-based MD images respectively. Then we evaluated the correlation between FF value and fat contents, and the differences between the healthy group and the SUI group. Receiver operating characteristic (ROC) analysis was used to access the performances of FF and fat content in differentiating SUI.

## RESULTS

There was no significant difference of FF value and fat contents between the left and right sides. The fat content and FF value had moderate correlation (r=0.625, P<0.001). Our result shows that the FF value of SUI group (28.78±3.83) was significantly higher than that of healthy group (25.90±4.98 P=0.005), and the fat content (90.09±12.39 mg·cm-3) was also higher than that of the healthy group (79.86±13.98 mg·cm-3, P=0.017). The area under curve (AUC) in differentiating SUI and healthy population was higher for FF (AUC=0.756) and lower for fat content (AUC=0.679).

## CONCLUSION

The fat content and FF value of levator ani muscle are moderately correlated; the fat infiltration of levator ani muscle of SUI patients is higher than that of healthy people.

## CLINICAL RELEVANCE/APPLICATION

The mechanism for SUI was complicated, which might be caused by muscle degeneration and injury manifested as deepening of fat infiltration. The IDEAL-IQ sequence can directly measure the muscle fat fraction, but the MRI scan takes long time and is prone to motion artifacts. Spectral CT imaging has the advantage of fast scanning. This study found that MD technique in spectral CT imaging was able to achieve comparable performance to IDEAL-IQ. It shows that MD technique in spectral CT imaging can also be used to evaluate the fat infiltration after pelvic floor muscle injury.

# Abstract Archives of the RSNA, 2024

T5B-SPHN

**Head & Neck Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPHN-2 DEEP LEARNING-BASED RECONSTRUCTION OF DIFFUSION-WEIGHTED IMAGING IMAGES TO ASSESS THE ACTIVITY OF THYROID-ASSOCIATED OPHTHALMOPATHY

Yunmeng Wang (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the value of deep learning reconstruction (DLR) orbital diffusion weighted imaging (DWI) images in the assessment of active and inactive stages of thyroid-associated ophthalmopathy (TAO).

### METHODS AND MATERIALS

This study included 73 clinically diagnosed TAO patients (46 active, 27 inactive) and 26 healthy controls from April to September 2023. All participants underwent orbital MRI scans using a 3.0 T MRI scanner. DWI sequences with FOCUS MUSE were reconstructed by conventional reconstruction (ConR) and DLR. Two diagnostic radiologists independently subjectively evaluated the image quality using a four-point Likert scale. The Wilcoxon was applied to test the difference of SNR, CNR, and ADC between ConR and DLR DWI, separately. Using the Clinical Activity Score (CAS) as the gold standard. The Kruskal-Wallis test was used to compare the difference of ADC between healthy controls, active and inactive TAO patients. The ROC were used to compare the diagnostic performance of EOM ADC for differentiating TAO activity between ConR and DLR DWI. The correlation between the EOM ADC and CAS of TAO patients was analyzed using Spearman's rank correlation coefficient.

### RESULTS

DLR DWI had higher subjective scores than ConR DWI for Sharpness of boundaries and overall image quality. The intra- and inter-reader agreement for both sequences was good (K>0.650). Significantly higher SNR and CNR in DLR DWI compared to ConR DWI (all P<0.001). However, there was no significant difference in ADC values (P>0.050). In both sequences, the EOM ADC obtained was significantly higher in the active TAO than in inactive TAO and healthy controls, respectively (all P<0.001). There was no significant difference of EOM ADC between inactive TAO and healthy controls (P>0.050). The EOM ADC extracted from both ConR DWI (R=0.637, P<0.001) and DLR DWI (R=0.662, P<0.001) was positively correlated with the CAS. Compared with ConR DWI, DLR DWI presented better performance for discriminating active from inactive TAO patients (AUC: 0.959 vs. 0.939, P=0.020).

### CONCLUSION

DLR improved the image quality of orbital DWI without increasing scan time. Compared to ConR, ADC values obtained based on DLR DWI were improved in identifying the activity of TAO and correlation with CAS.

### CLINICAL RELEVANCE/APPLICATION

Clinically, TAO is classified into active and inactive phases based on clinical activity scores. Active and inactive TAO were treated with hormonal/anti-inflammatory drugs and surgical decompression, respectively. DLR can improve the image quality of orbital DWI and further improve the prediction of the activity of TAO. Thus, it contributes to the precise and timely selection of treatment options in clinical practice.

## T5B-SPHN-3 IMAGING OF THE PARANASAL SINUSES WITH PHOTON-COUNTING CT, COMPARISON OF THE FEASIBILITY OF THE LOW-DOSE AND ULTRA-LOW-DOSE PROTOCOL IN SUSPECTED SINUSITIS

Thomas G. Flohr, PhD (*Abstract Co-Author*) Employee, Siemens AG
Bernhard Schmidt, PhD (*Abstract Co-Author*) Employee, Siemens AG
Stefan Ulzheimer, PhD (*Abstract Co-Author*) Employee, Siemens AG
Eva Ferdova, MD (*Abstract Co-Author*) Nothing to Disclose
Hynek Mirka, PhD (*Abstract Co-Author*) Nothing to Disclose
Jiri Ferda, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

to assess the feasibility of ultra-low dose CT with an integrated photon-counting-detector system (PC-CT) in the imaging paranasal sinuses

### METHODS AND MATERIALS

PC-CT examinations in suspected chronic or acute sinusitis were evaluated divided in the equal two groups per 100 patients: 1/ low-dose imaging with 100 kV and tin filtration, image quality level setting 20 with automatic exposure control, 2/ ultra-low-dose sinuses with the 90 kV and 4 mAs fixed setting without automatic exposure control. All examinations were performed with the use of detector element size of 0.4 mm, the images were reconstructed with the thickness of 1 mm, with kernel 60. The diagnostic quality of the acquired images was assessed based on the imaging of key structures -

osteomeatal unit and nasolacrimal duct and the brain noise level in five-point scale, 1 excellent, 5 - undiagnostic. The dose length product and noise level were compared within both groups using Wilcoxon test for independent samples, the independence was tested using Kruskal-Wallis test.

**RESULTS**

Ultra-low-dose images exhibited diagnostic sufficient image quality (mean quality value 1.5) compared with the low-dose (mean quality value 1.2), the dose was significantly lower - DLP in ultra-low-dose 4.2 mGycm, low-dose 45.2 respectively ($p < 0.0001$). Low-dose exhibited the significantly higher ratio between brain signal and background noise ($p < 0.0001$).

**CONCLUSION**

Ultra-low-dose PC-CT in patients with suspected sinusitis showed imaging sufficient diagnostic quality at extreme low-dose values, enabling sufficient imaging of the bone framework

**CLINICAL RELEVANCE/APPLICATION**

Ultra-low-dose imaging of the paranasal sinuses reaches the doses relevant to those obtained from X-ray

## T5B-SPHN-4 MULTIMODAL INVESTIGATION OF STRUCTURAL-FUNCTIONAL COUPLING IN POST-COVID AND POST-TRAUMATIC OLFACTORY DYSFUNCTION

Aocai Yang (*Abstract Co-Author*) Nothing to Disclose
Liu Jianfeng (*Abstract Co-Author*) Nothing to Disclose
Jixin Luan, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Olfactory dysfunction (OD) is manifested with disrupted topology of the structural connection network (SCN) and the functional connection network (FCN). However, the SCN and its interactions with the FCN remain to be further investigated. This multimodality study attempted to investigate the differences in structural-functional coupling between post-COVID olfactory dysfunction (PCOD), post-traumatic olfactory dysfunction (PTOD), and healthy control (HC) subjects.

**METHODS AND MATERIALS**

A total of 27 individuals with PCOD, 20 individuals with PTOD, and 27 HC subjects were enrolled who underwent diffusion tensor imaging (DTI) and resting state functional magnetic resonance imaging (rs-fMRI) to generate structural and functional networks. The topological prosperities of both the SCN and the FCN were analyzed, followed by quantification of the SCN-FCN couplings across scales. We defined each region of interest from automated anatomical labeling (AAL) atlas consisting of 90 regions as a network node. Topological properties werre performed by the GRETNA toolbox. The quantification of SCN-FCN coupling involves calculating correlation coefficients at two levels: global coupling across the entire SCN and FCN matrix and nodal coupling within each region of the matrix. In the patients group, the exploration of potential correlations between the SCN-FCN coupling and the network topology as well as between these metrics and clinical scale scores were conducted using the Spearman rank correlation test, respectively, at a statistically significant threshol d of p value $< 0.05$.

**RESULTS**

PCOD patients exhibited significantly lower Assortativity in both SCN ($p = 0.0077$) and FCN ($p = 0.0039$) compared to HC. In the FCN, PCOD patients displayed significantly lower Lambda ($p = 0.0017$). PTOD patients showed decreased Betweenness Centrality (BC), Degree Centrality (DC), and Nodal Local Efficiency (NLe) in specific regions compared to HC. Global SCN-FCN coupling was significantly reduced in PTOD compared to HC ($p = 0.0086$). PTOD group also demonstrated impaired nodal centrality in the visual network (VIS) compared to HC ($p < 0.05$). Impaired SCN-FCN coupling in the default mode network (DMN) was observed in PTOD compared to PCOD ($p < 0.05$). Correlation analysis revealed significant associations between SCN-FCN coupling and network topology in PCOD, but not in PTOD.

**CONCLUSION**

Our findings revealed disrupted topology in both the SCN and the FCN in PCOD patients compared to HC participants. PTOD patients also showed specific alterations in SCN and FCN.

**CLINICAL RELEVANCE/APPLICATION**

These findings provide insights into the distinct characteristics of PCOD and PTOD and shed light on the disrupted structural-functional coupling in olfactory dysfunction.

# Abstract Archives of the RSNA, 2024

T5B-SPIN

**Imaging Informatics Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPIN-2 ASCENDING AORTIC DIAMETER MEASUREMENT ON A NON-ECG-GATED CHEST CT USING DEEP LEARNING

Ayaz Aghayev, MD (*Abstract Co-Author*) Nothing to Disclose
Yusuf Abdi (*Abstract Co-Author*) Nothing to Disclose
Fargana Aghayeva (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study is to develop a deep learning model (DLM) for automated segmentation and ascending aortic (AA) diameter measurement on non-ECG-gated chest CT scans. AA dilatation, defined as a diameter exceeding 4.0 cm, which increases the risk of aortic dissection, and carries a high risk of morbidity and mortality. Often, AA dilatation may go unnoticed in chest CT scans performed for other reasons. The goal is to improve the accuracy and efficiency of AA measurement, with potential applications in detecting AA dilatation in the large cohorts.

### METHODS AND MATERIALS

The study utilized the NIH Clinical Center's public imaging database (https://nihcc.app.box.com/v/DeepLesion) to analyze 280 chest CT scans. A radiologist identified the slice with the largest aortic aneurysm (AA) diameter as the "focus image" and labeled other slices as "non-focus," also manually delineating the AA contour on the focus image. A Convolutional Neural Network (CNN) was designed to classify these images accordingly. The model was trained with a custom dataset class for handling DICOM images, employing data augmentation and random splitting to improve robustness and generalization. The RMSprop optimizer was used for network parameter optimization, incorporating learning rate scheduling and gradient clipping. Visualization of segmentation results was done using matplotlib, showcasing the model’s accuracy in delineating AA contours. Additionally, a UNet architecture facilitated semantic segmentation, and diameter measurements of segmented regions were conducted using OpenCV, which calculated the largest contour's diameter within the segmented mask for quantitative AA assessment.

### RESULTS

The CNN model demonstrated high accuracy, achieving a confidence level of 99.9% in classifying focus and non-focus images. The segmentation performance of the UNet architecture effectively delineated the AA contours. During validation testing for diameter measurement, the results precisely matched the manually annotated mask images, correctly identifying AA diameters =4.0 cm.

### CONCLUSION

The study demonstrates that the developed DLM are reliable and efficient tools for identifying the dilated AA and measuring its max diameter.

### CLINICAL RELEVANCE/APPLICATION

The developed pipeline offers an effective and accurate means to detect AA dilatation on non-ECG-gated chest CT images, which might otherwise be overlooked by radiologists. This tool has significant potential for application across a large retrospective cohort of non-gated chest CT studies to detect AA dilatation, thereby aiding in the timely intervention to prevent severe complications.

## T5B-SPIN-3 GENERATING HIGH-RESOLUTION KNEE CT SCANS FROM BI-PLANAR RADIOGRAPHS USING A MODULAR DIFFUSION MODEL: POTENTIAL FOR REDUCED RADIATION DOSE AND ENHANCED PREOPERATIVE PLANNING

Cody Wyles, MD (*Abstract Co-Author*) Nothing to Disclose
Bradley J. Erickson, MD, PhD (*Abstract Co-Author*) Board of Directors, VoiceIt Technologies, LLC;Stockholder, VoiceIt Technologies, LLC;Board of Directors, FLOWSIGMA Inc;Officer, FLOWSIGMA Inc;Stockholder, FLOWSIGMA Inc;Officer, Yunu Inc;Stockholder, Yunu Inc
Pouria Rouzrokh, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Michael Taunton, MD (*Abstract Co-Author*) Consulting, DJO Global, Inc;Royalties, DJO Global, Inc
Bardia Khosravi, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a modular diffusion model capable of generating multi-resolution CT scans from bi-planar knee radiographs, reducing radiation dose and enhancing preoperative planning in orthopedic surgery.

### METHODS AND MATERIALS

A dataset of 16,730 CT scans and 54,340 AP and lateral knee radiographs from patients aged 28-90 (54% female) across three tertiary centers was used. The 400-million-parameter model is based on the Matryoshka diffusion architecture, which is a powerful generative model that iteratively denoises Gaussian noise to create realistic images. The model encodes radiographs using a ConvNext CNN, and the features are cross-attended during the diffusion process to generate CTs at $32^3$, $64^3$, and $128^3$ resolutions. The model is conditioned on pixel spacing and slice thickness. The $128^3$ volumes are

supersampled to $512^3$ using a patch-based diffusion super-resolution model. The model was incrementally trained on batch sizes of 224, 80, and 16. Generated bone accuracy was evaluated using the mean Hausdorff distance on 10 samples after registration.

**RESULTS**

Model training on 16 A100 GPUs took 10 days. The model generated $128^3$ CTs in 1 minute and 27 seconds, with supersampling to $512^3$ taking an additional 6 minutes (under 8 minutes total). The generated bone had a mean Hausdorff distance of 0.75 from the original, demonstrating high accuracy. The Fréchet Inception Distance (FID), a metric quantifying the similarity between real and generated images, was 32.8 on 1000 generated images.

**CONCLUSION**

The modular diffusion model successfully generates high-resolution CT scans from bi-planar knee radiographs, offering a radiation dose reduction solution. Validation on the OAI dataset will further confirm its performance and generalizability. The integration of this technology with robotic surgery, virtual reality, and augmented reality will enhance surgical planning and execution. Successful implementation could lead to improved patient outcomes and healthcare delivery worldwide, particularly in regions with limited access to advanced imaging.

**CLINICAL RELEVANCE/APPLICATION**

This model significantly reduces radiation exposure in patients requiring CT scans for orthopedic conditions. The high-resolution CTs enable enhanced preoperative planning, potentially improving surgical outcomes and patient care. It could greatly improve diagnostic capabilities as a rapid screening tool in resource-limited settings. Furthermore, this technology bridges the gap between 2D imaging and 3D surgical planning, allowing for precise anatomical characterization essential for accurate diagnosis and treatment planning across various medical specialties.

## T5B-SPIN-5 GEOGRAPHICAL GENERALIZABILITY OF AI MODELS: A CASE STUDY VALIDATING THE RSNA INTRACRANIAL HEMORRHAGE DETECTION CHALLENGE ON HEAD CTS FROM TANZANIA

Bardia Khosravi, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Frank J. Minja, MD (*Abstract Co-Author*) Nothing to Disclose
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Frank Li (*Abstract Co-Author*) Nothing to Disclose
SAID SALUM (*Abstract Co-Author*) Nothing to Disclose
Aawez Mansuri (*Abstract Co-Author*) Nothing to Disclose
Balowa M. Baraka, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the geographical generalizability of the top-performing algorithms from the 2019 RSNA Intracranial Hemorrhage (ICH) Detection Challenge by applying them to a head CT dataset from Tanzania.

**METHODS AND MATERIALS**

The third-place algorithm from the 2019 RSNA ICH Detection Challenge, trained on data from two hospitals in the US and one hospital in Brazil, was applied to a dataset from Tanzania. This algorithm is an ensemble of 17 convolutional neural networks (CNNs) that processes consecutive slices of the CT image and predicts a probability for four different hemorrhage types (intraparenchymal, subdural (SDH), subarachnoid (SAH), and intraventricular (IVH)) and one study-level probability for the presence of any type of hemorrhage. The Tanzanian dataset comprised of 169 patients with 658 series, manually annotated by expert radiologists blinded to the model predictions. The maximum probability for each label was aggregated per series and used as the patient-level label. To evaluate the model's performance, the Youden index was used to determine the optimal threshold for calculating the threshold-based metrics.

**RESULTS**

The model achieved an AUROC of 0.72 for SDH and AUROCs of 0.90-0.98 for other hemorrhage types. For detecting any hemorrhage, the model had an AUROC of 0.84. The optimal thresholds ranged from 0.97 to 0.99 for the different hemorrhage types, showing the miscalibrated model outputs. The model achieved high sensitivity for IVH (100%) but lower sensitivity for SDH (75%) and SAH (73%). These results lag behind the previously reported overall AUROC of 0.98 for detecting any ICH in a recently published meta-analysis.

**CONCLUSION**

The discrepancy between the model's performance on the Tanzanian dataset and the reported performance in the meta-analysis underscores the importance of assessing the geographical generalizability of machine learning models before clinical deployment. Factors such as differences in patient populations, imaging protocols, and disease prevalence may contribute to the observed performance gap, highlighting the need for further research and model adaptation to ensure robust performance across diverse geographical settings.

**CLINICAL RELEVANCE/APPLICATION**

ICH is a critical condition requiring rapid diagnosis and intervention. Automated detection models have the potential to assist radiologists in prioritizing cases and reducing time to treatment, particularly in resource-constrained environments. However, the geographical generalizability of these models is a crucial consideration for their safe and effective implementation in clinical practice. This study emphasizes the need to validate and potentially adapt ICH detection models to local patient populations for optimal performance.

## T5B-SPIN-6 BRAIN AGE GAP ESTIMATION (BRAINAGE): INFLUENCE OF SCANNER MANUFACTURER, FIELD STRENGTH AND SEQUENCE PARAMETERS

Christian Rubbert, MD (*Abstract Co-Author*) Nothing to Disclose
Julian Caspers (*Abstract Co-Author*) Nothing to Disclose
Marius Vach (*Abstract Co-Author*) Nothing to Disclose
Daniel Weiss (*Abstract Co-Author*) Nothing to Disclose
Dennis Hedderich, MD (*Abstract Co-Author*) Nothing to Disclose
Luisa Wolf (*Abstract Co-Author*) Nothing to Disclose
Vivien Lorena Ivan, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

MRI-brain-scan-based Brain Age Gap Estimation (BrainAGE), the difference between a machine-learning predicted brain age and chronological age, is explored as an imaging biomarker for several conditions, e.g., lifestyle-choices-driven aging. In cognitively normal, healthy subjects a BrainAGE of zero is expected. This study investigates how variations in study criteria, MRI scanner characteristics, and sequence parameters impacts BrainAGE.

## METHODS AND MATERIALS

A total of 2,414 participants from four population-based studies (ADNI, HCPA, OASIS3 and PPMI) were included. BrainAGE was computed using a previously established model. In essence, gray matter features were extracted using CAT12 for SPM12, followed by smoothing, spatial resampling and principal component analysis. Gaussian process regression predicted age, and BrainAGE was calculated as predicted minus chronological age. BrainAGE was compared across different cohorts and differences in BrainAGE based on scanner manufacturer, field strength, and imaging type (unaccelerated or accelerated 3D T1) were analyzed when data was available. Significant differences ($p<0.05$) were assessed using Welch's two-sample t-test or ANOVA, including the Tukey post-hoc test, as applicable. Mean absolute error (MAE) between chronological and predicted age was calculated.

## RESULTS

Across the different cohorts, the BrainAGE MAE for ADNI was 6.7, for HCPA 5.9, for OASIS3 5.8, and for PPMI 5.3 with a $p<0.0001$ (ANOVA). Only OASIS3/HCPA ($p=0.17$) and PPMI/HCPA ($p=0.1$) did not show significant differences. Comparing the field strength, we found that scans performed at 1.5T resulted in a smaller BrainAGE (ADNI MAE 4.2; OASIS3 4.1, PPMI 4.2) than scans acquired at 3T (ADNI MAE 7.5; OASIS3 5.9, PPMI 5.8). $p<0.0001$ for ADNI, $p=0.007$ for OASIS3, and $p=0.03$ for PPMI. HCPA only acquired scans at 3T.Scans in ADNI and PPMI were acquired on scanners from different vendors. In ADNI, scans acquired on GE scanners resulted in a BrainAGE MAE 7.3, on Philips of 6, and on Siemens MAE 6.7. $p=0.03$ (ANOVA), with statistically significant differences between Philips/GE ($p=0.008$). For PPMI, the MAE was 6.2 for GE scanners, 5.1 for Philips and Siemens. $p=0.005$ (ANOVA), with statistically significant difference between Siemens/GE ($p=0.008$).In ADNI, accelerated (MAE 7.6) and unaccelerated (MAE 7.3) imaging was available acquired at 3T ($p=0.47$).

## CONCLUSION

Researchers and clinicians should be aware that several factors, such as choice of scanner manufacturer and field strength, may influence BrainAGE derivatives.

## CLINICAL RELEVANCE/APPLICATION

Comparisons of BrainAGE across different cohorts may not be suitable. Future research should try to make BrainAGE independent of factors such as scanner manufacturer or field strength.

# T5B-SPIN-7 EXPLORING PERCEPTIONS AND PERSPECTIVES: A QUALITATIVE SURVEY STUDY OF HEALTHCARE PROFESSIONALS' VIEWS ON AI-ASSISTED CHEST RADIOGRAPH INTERPRETATION

Thiago Fellipe Ortiz De Camargo (*Abstract Co-Author*) Nothing to Disclose
Giovanna Mendes (*Abstract Co-Author*) Nothing to Disclose
Luan Silva (*Abstract Co-Author*) Nothing to Disclose
Guilherme Ribeiro (*Abstract Co-Author*) Nothing to Disclose
Gabriel Ferracioli (*Abstract Co-Author*) Nothing to Disclose
Sergio Luiz Lima (*Abstract Co-Author*) Nothing to Disclose
Pedro V. Santana-Netto, MD (*Abstract Co-Author*) Nothing to Disclose
Joselisa P. Paiva (*Abstract Co-Author*) Nothing to Disclose
Pedro Vinicius Alves Silva (*Abstract Co-Author*) Nothing to Disclose
Maria Carolina Bueno da Silva, MD (*Presenter*) Nothing to Disclose

## PURPOSE

Few studies have investigated the attitudes of healthcare professionals towards the integration of artificial intelligence (AI) tools to support medical decisions. This study investigates the perceptions and perspectives of healthcare workers regarding an AI tool aiding chest radiograph (CR) interpretation, focusing on its tolerability and motivation to increase adoption in healthcare.

## METHODS AND MATERIALS

We conducted a cross-sectional study using an online-based questionnaire with healthcare professionals from various institutions across the country, who were recruited during a conference, in 2023. The survey was divided into sections that examining the respondents' opinions about the affinity towards AI tools in healthcare, their personal perceptions regarding the use of algorithms to assist in CR interpretation, and their sociodemographic characteristics. Fifteen closed-ended questions and twelve closed-ended questions were applied for physicians and non-physician, respectively. Additional questions were posed to physicians regarding CR interpretation, such as "would implementing an AI diagnostic tool do aid CR improve your work routines". None of the questions were deemed obligatory. Researchers discussed the statistical analysis of the questionnaire responses to reach a consensus on the final set of findings. The study has received approval from the Institutional Review Board (IRB) and participants gave their informed consent.

## RESULTS

From a total of 523 recruited participants, 63 agreed to participate and answered all questions. The majority of respondents (74.6%) did not have access to AI tools at work. Asked on their general perception, 98,9% of the respondents rated the use of an AI tool to aid CR interpretation in medical practice as positive, with only 0,1% as not beneficial. In general, the respondents denied concerns about AI replacing physician, but strongly agreed that it should be used in cooperation with them. Overall, participants denied any negative impact on doctor-patient interactions and some positive characteristics of AI pointed was the improved diagnosis accuracy. However, the primary worry appears to be data leaking.

## CONCLUSION

AI tools to aid medical imaging interpretation are not yet widely available in most healthcare services. However, there is a growing interest among healthcare workers in new technologies.

## CLINICAL RELEVANCE/APPLICATION

This study focused on the acceptability of AI software to aid chest x-ray interpretation and its potential to increase adoption in the healthcare industry, by examining the opinions of healthcare professionals about its use in assisting.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

T5B-SPIR

**Interventional Radiology Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPIR-2 HIGH-INTENSITY FOCUSED ULTRASOUND (HIFU) IN ADVANCED PANCREATIC CANCER: GERMAN EXPERIENCE

Milka Marinova, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Holger Strunk, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In patients with locally advanced pancreatic adenocarcinoma prognosis is extremely poor. Their quality of life is often reduced due to cancer-related pain. This prospective observational study aimed to evaluate ultrasound-guided high-intensity focused ultrasound (HIFU) in Caucasian patients with inoperable pancreatic cancer for feasibility, local tumor response, and changes in quality of life and symptoms.

### METHODS AND MATERIALS

HIFU was performed in 104 patients with locally advanced inoperable pancreatic carcinoma and tumor-related pain symptoms, 42 with UICC stage III, 59 with UICC stage IV. 98 patients underwent simultaneous standard chemotherapy. Ablation was performed using JC HIFU system (Chongqing, China HAIFU Company) with an ultrasonic device for real-time imaging. Clinical and imaging follow-up (US, CT, MRI) was performed before and up to 24 months after HIFU. Clinical assessment included evaluation of quality of life and symptom changes using standardized questionnaires.

### RESULTS

In 85% of patients, a significant early pain relief was achieved by US-guided HIFU independent of metastatic status which persisted during follow-up. Furthermore, 50% of patients did not require any analgesic treatment 6 weeks post-ablation. Tumor volumes could be considerably reduced over time in 80% of patients, with a mean tumor volume reduction of about 60% after 6 months in HIFU-treated pancreatic tumors. There were no severe or long-lasting HIFU-related complications. There were no severe or long-lasting HIFU-related complications.

### CONCLUSION

US-guided HIFU can be used successfully for local tumor control and pain relief in patients with locally advanced pancreatic cancer.

### CLINICAL RELEVANCE/APPLICATION

US-guided HIFU is feasible and safe for patients with unresectable pancreatic cancer. HIFU can considerably reduce tumour volume. Patients treated with HIFU experienced significant and lasting reduction of pain intensity. HIFU seems to have a potential survival benefit for advanced pancreatic cancer patients HIFU has a crucial clinical benefit for patients with pancreatic cancer.

## T5B-SPIR-3 PERCUTANEOUS IMAGE-GUIDED THERMAL ABLATION OF RENAL TUMORS: ANALYSIS OF THE PROSPECTIVE REGISTRY OF THE GERMAN SOCIETY FOR INTERVENTIONAL RADIOLOGY AND MINIMALLY INVASIVE THERAPY (DEGIR) 2018-2023

Michael Forsting, MD (*Abstract Co-Author*) Nothing to Disclose
Johannes Haubold, MD (*Abstract Co-Author*) Speaker, Siemens AG
Thomas Dertnig, MD (*Abstract Co-Author*) Nothing to Disclose
Sebastian Zensen, MD (*Abstract Co-Author*) Nothing to Disclose
Hannah Luisa Steinberg-Vorhoff, MD (*Abstract Co-Author*) Nothing to Disclose
Benedikt M. Schaarschmidt, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Percutaneous renal thermal ablation (TA) with cryoablation, microwave ablation (MWA) and radiofrequency ablation (RFA) is a highly effective treatment modality for small tumors that is underrepresented in most guidelines due to the lack of sufficient data. The aim of this evaluation was to analyze the use, technical success and complications of TA based on the prospectively managed multinational registry data of the German Society for Interventional Radiology and Minimally Invasive Therapy (DeGIR, Deutsche Gesellschaft für Interventionelle Radiologie und minimal-invasive Therapie).

### METHODS AND MATERIALS

A total of 1102 patients (mean patient age: 72.5±11.6 years; female: 33.6%, 370/1102; male: 66.4%, 732/1102) treated with TA between 2018 and 2023 in 92 centers in Germany and Austria were examined. TA with a ablative margin was considered technical success. Complications were classified according to the Society of Interventional Radiology in minor (Grade A-B) and major (Grade C-F). High-volume centers were defined as hospitals with =20 TAs during the analyzed time span.

### RESULTS

Cryoablation was used in 13.3% (147/1102), MWA in 41.9% (462/1102) and RFA in 43.6% (481/1102, other: 1.2%, 12/1002). The mean lesion diameter was 24 ± 11 mm. 94.6% (1043/1102) of TAs were technically successful. Heat-based TAs were significantly less successful in tumors measuring 3-4cm (89.8%, 97/108) compared to =3cm (96.1%, 567/590; p=0.005). In cryoablations, no significant difference between the groups was detected (3-4cm: 85.7%, 12/14; =3cm: 97.9%, 94/96; p=0.078). Treatment success of renal TA was not influenced by the volume of the treating center (high-volume center: 94.8%, 677/714; low-volume center: 94.1%, 365/388; p=0.602). Furthermore, heat-based TAs had a significantly higher overall complication rate (5.4%, 51/947) than cryoablations (1.4%, 2/145, p=0.034). However, no significant difference between the two groups could be found concerning the rate of major complications (heat-based TA: 2.5%, 24/947; cryoablation: 0.7%, 1/147; p=0.162).

### CONCLUSION

Percutaneous renal TA have a high technical success rate. However, cryoablation seems to be favorable in tumors measuring 3-4 cm and shows a lower overall complication rate than heat-based TA.

### CLINICAL RELEVANCE/APPLICATION

Thermal ablations of renal tumors are safe and effective interventions. However, cryoablation seems to be advantageous compared to heat-based procedures concerning tumors measuring 3-4 cm and overall complication rate.

## T5B-SPIR-4 ENHANCING TUMOR VISIBILITY IN RENAL ABLATION THROUGH SPECTRAL CT ELECTRON DENSITY COLOR OVERLAY

Thomas D. Atwell, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel A. Adamo, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Juna Musa (*Abstract Co-Author*) Nothing to Disclose
Ahmad Parvinian, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Favazza, PhD (*Abstract Co-Author*) Nothing to Disclose
Nathan Huber, PhD (*Abstract Co-Author*) Nothing to Disclose
Rebecca Hibbert, MD, FRCPC (*Presenter*) Nothing to Disclose

### PURPOSE

Accurate visualization of renal tumors during CT-guided percutaneous ablation is crucial for effective procedural planning and precise probe placement. However, endophytic renal masses pose a challenge due to their limited visibility on non-contrast CT images. While intravenous (IV) contrast can enhance lesion detection, its use may be contraindicated in impaired renal function or contrast allergy. This study aims to assess whether a narrow window, electron density (ED) color overlay on conventional non-contrast CT can augment visualization of endophytic renal tumors, potentially reducing the need for additional contrast-enhanced CT imaging during renal ablation.

### METHODS AND MATERIALS

This IRB approved and HIPAA compliant retrospective study consisted of renal ablation cases performed from January to December 2023. Two interventional radiologists independently assessed 25 procedures involving endophytic tumors. Each radiologist reviewed and rated two series for each case: a conventional non-contrast CT series alone and an electron density color overlay series. Owing to its low noise properties, the ED spectral result was chosen for color overlay with a narrow dynamic range (WW/WL: 8/103 %EDW). Tumor conspicuity was evaluated on a continuous sliding scale ranging from poor (1) to exceptional (100). Each reader determined whether renal ablation could proceed based on visualization using the non-contrast CT series alone, using the color overlay series, or if additional IV contrast-enhanced CT would be advised for optimal guidance. Statistical assessment was performed using a two-sided Wilcoxon signed-rank test.

### RESULTS

There was a significant ($p < 0.001$) improvement in tumor conspicuity with the ED overlay series (MED = 36.3) compared to the conventional series alone (MED = 19.2). When evaluating adequacy of tumor visualization for procedural planning, readers were more likely to proceed without a contrast-enhanced CT when reviewing the ED color overlay series (44% of reads; 22/50) rather than the conventional series alone (22% of reads; 11/50). Moreover, a discernable parabolic relationship was noted between readers' scores and lesion density.

### CONCLUSION

The addition of a narrow window, electron density color overlay to non-contrast CT showed a significant improvement in the visibility of endophytic renal tumors, indicating a simple yet effective approach to reduce the need for additional IV contrast-enhanced imaging prior to probe placement during renal ablation.

### CLINICAL RELEVANCE/APPLICATION

Adequate tumor visibility is paramount for precise planning and execution of percutaneous renal ablation. This technique offers a viable alternative to using IV contrast to enhance tumor visibility during CT-guided renal ablation.

## T5B-SPIR-5 HIGH-INTENSITY FOCUSED ULTRASOUND (HIFU) IN ADVANCED PANCREATIC CANCER - COMPARATIVE STUDY OF OVERALL SURVIVAL IN PATIENTS UNDERGOING PALLIATIVE THERAPY WITH VERSUS WITHOUT LOCAL HIFU TREATMENT

Holger Strunk, MD (*Abstract Co-Author*) Nothing to Disclose
Hans H. Schild, MD (*Abstract Co-Author*) Nothing to Disclose
Markus Essler, MD (*Abstract Co-Author*) Nothing to Disclose
Milka Marinova, PhD, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Pancreatic cancer remains a challenge in oncology, particularly in its advanced stages where therapeutic options are still limited. High-intensity focused ultrasound (HIFU) has emerged as a promising modality for local tumor ablation. This study aims to compare overall survival (OS) outcomes of patients with advanced pancreatic cancer undergoing palliative chemotherapy with and without local HIFU treatment.

### METHODS AND MATERIALS

A comparative analysis was conducted on a cohort of 285 patients diagnosed with advanced pancreatic cancer between 2014 and 2022. The HIFU cohort included a total of 161 patients: 67 with UICC stage III, 94 patients with UICC stage IV disease. 83 patients received local HIFU during 1st line, 40 during

2nd line, 10 during 3rd line, and 3 during 4th line palliative chemotherapy. 25 patients underwent HIFU while receiving best supportive care only. The historical cohort consisted of 124 patients, 35 in UICC stage III and 89 in UICC stage IV. Kaplan-Meier analysis was used to estimate the median OS of both patient cohorts.

**RESULTS**

The median OS was 15.8 months (95%CI, 12.4-19.1) for HIFU-treated patients versus 9.8 months (95%CI, 7.6-11.4) for the historical cohort (HR 0.52; 95%CI, 0.33-0.86; p=0.01), regardless of sex, tumor grading, ECOG, stage of disease and chemotherapy regimen (p<0.001). For UICC stage III, the median OS survival was 18.5 months (95%CI, 12.8-21.4) versus 10.8 months (95%CI, 6.6-15.1) with versus without HIFU treatment, respectively (p=0.0018). For UICC stage IV, the median OS was 13.1 (95%CI, 9.9-18.2) versus 9.3 months (95%CI, 6.4-11.4) with versus without HIFU treatment, respectively (p=0.006). The survival rate (6 months, 1 and 2 years) since palliative diagnosis was 92.8%, 61.5%, and 21.7% in the HIFU cohort versus 65.9%, 38.3%, and 10.9% in the historical cohort, respectively. The 1-, 2-, and 3-year OS showed a significant difference between both patient cohorts (p=0.0014, 0.0015, and 0.0094, respectively).

**CONCLUSION**

This study suggests that the addition of local HIFU treatment to palliative chemotherapy may offer a survival advantage in patients with advanced pancreatic cancer. Further prospective studies are warranted to validate these findings and elucidate the optimal integration of HIFU into the treatment paradigm for this patient population.

**CLINICAL RELEVANCE/APPLICATION**

In advanced pancreatic cancer, the addition of local HIFU treatment to palliative chemotherapy may confer a survival advantage for patients. These findings underscore the potential of HIFU as an adjunctive treatment option. Additional prospective studies are necessary to confirm these results and clarify the most effective incorporation of HIFU into the treatment approach for patients with advanced pancreatic cancer.

## T5B-SPIR-6 NK CELL INFUSION ENHANCES TUMOR CONTROL AFTER SUB-LETHAL HYPERTHERMIA IN VITRO AND IN VIVO: IMPLICATIONS OF MHC-1 SHEDDING

Janet Pham (*Abstract Co-Author*) Nothing to Disclose
Jillian Poulsen (*Abstract Co-Author*) Nothing to Disclose
Steven S. Raman, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Merck & Co, Inc;Consultant, Amgen Inc;Consultant, Profound Medical Inc
Sonia Virk (*Abstract Co-Author*) Nothing to Disclose
Anahid Jewett (*Abstract Co-Author*) Nothing to Disclose
Jason Chiang, MD,PhD (*Abstract Co-Author*) Consultant, Intuitive Surgical, Inc;Equipment support, Johnson & Johnson
Sara Huerta (*Abstract Co-Author*) Nothing to Disclose
Po-Chun Chen (*Presenter*) Nothing to Disclose

**PURPOSE**

This in vitro and in vivo study assesses the effectiveness of NK-cell based immunotherapy after sub-lethal thermal ablation in treating hepatocellular carcinoma (HCC). Image-guided thermal ablation, the standard of care for unresectable early-stage HCC, exposes tumor cells to non-lethal hyperthermic temperatures near the ablation margins. Most residual and recurrent tumor growth after ablation occurs at ablation zone peripheries, with recent studies suggesting that poorly differentiated HCCs are linked to higher progression rates. This study focuses on the potential of NK cell immunotherapy to control residual disease in both well- and poorly differentiated HCC following ablation.

**METHODS AND MATERIALS**

Flow cytometry evaluated immunological stemness markers, particularly MHC-class I (MHC-I) expression and shedding after hyperthermia stress, in well- (HepG2) and poorly differentiated (SNU-423) HCC cell lines. HCC cells were heated at 37, 43, and 47°C for 10 minutes, followed by a 20 minute cooling at 25°C. After that, HCC cells were exposed to various NK cells—primary NK (pNK), IL-2 stimulated NK (IL-2+pNK), and supercharged NK (sNK) cells. NK cell cytotoxicity to these heat-treated HCC cells was assessed via real-time cell imaging and chromium release assays. The aggressiveness and susceptibility to NK cell-based therapy of HCC subtypes were further validated in an NSG orthotopic tumor mouse model, measuring tumor weight, size, and Gaussia luciferase level in the blood.

**RESULTS**

NK cell therapies showed enhanced cytotoxicity in non-lethal hyperthermia treated HCC at 47°C compared to 37°C, which was confirmed by the chromium release assay showing higher lytic units 30 in both IL-2+pNK and sNK cells. MHC-I surface expression notably decreased on HCC cells at 47°C, suggesting a potential mechanism for increased cytotoxicity. In vivo, NSG mice with SNU-423 tumors had shorter survival than those with HepG2 tumors. Additionally, sNK cell infusion trended towards reducing tumor weight and size, though not significantly. Notably, the luciferase levels indicated that sNK cells reduced the growth rates of HepG2 tumors by Day 46, with p-values of 0.0145 and 0.0604 at Day 43.

**CONCLUSION**

Our findings highlight the potential of sNK cell therapy to slow tumor growth in NSG mice with non-heated HCC tumors. Although thermal ablation alone offers significant benefits for controlling early stage HCC, augmenting this treatment with NK cell based therapy could further enhance therapeutic outcomes. Additional in vivo studies are necessary to validate the effectiveness and integration of this immunotherapy approach.

**CLINICAL RELEVANCE/APPLICATION**

Adding adjuvant NK cell infusion after standard of care thermal ablation can enhance treatment outcomes for HCC.

## T5B-SPIR-7 INJECTABLE X-RAY VISIBLE TARGETS FOR IN VIVO CBCT-GUIDED HISTOTRIPSY TREATMENTS

Grace Minesinger, BS (*Abstract Co-Author*) Nothing to Disclose
Saryn Doucette (*Abstract Co-Author*) Nothing to Disclose
Fred T. Lee JR, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Patent agreement, Medtronic plc;Royalties, Medtronic plc;Board of Directors, HistoSonics, Inc;Stockholder, HistoSonics, Inc;Stockholder, Elucent Medical
Paul F. Laeseke, MD, PhD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, NeuWave Medical, Inc;Shareholder, HistoSonics, Inc;Consultant, HistoSonics, Inc;Research Grant, HistoSonics, Inc;Shareholder, Elucent Medical;Consultant, Elucent Medical;Shareholder, McGinley Orthopaedic Innovations, LLC
Timothy J. Ziemlewicz, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Research support, Johnson & Johnson;Consultant, HistoSonics, Inc;Shareholde, HistoSonics, Inc;
Michael Speidel, PhD (*Abstract Co-Author*) Institutional research agreement, Siemens AG
Martin Wagner, PhD (*Abstract Co-Author*) Research Consultant, HistoSonics, Inc
Katrina L. Falk, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Histotripsy is an emerging focused ultrasound (US) liver tumor therapy that is guided by US, which limits its use to only acoustic targeting windows. The therapeutic energy can be delivered to all areas, so a new targeting technique with cone beam CT (CBCT) is being developed to overcome this limitation. Given the expense and relative lack of large animal tumor models, research is done on healthy swine without tumor targets. The purpose of this work is to compare three percutaneously injectable surrogate targets that are visible on pretreatment CBCT images and non-disruptive to histotripsy treatment (tx).

**METHODS AND MATERIALS**

Barium sulfate paste (EZ Paste) mixed with either saline (n=2, 4:1 barium:saline, 0.175mL) or autologous blood (n=2, 2:1 or 4:1 barium:blood, 0.2mL), and a platinum pushable coil (n=1, Terumo AZUR 18, 6mm x 10cm) were used. The targets were percutaneously injected into the livers of 4 in vivo swine. Histotripsy treatment zones (TZ) (15-20 mm) were created over the 5 targets and 1 control (no target) using a 700kHz multi-element transducer (HistoSonics) and 2 mobile C-arms (Siemens CIOS, GE OEC). The average absolute error in TZ diameter (CC, AP, lateral) versus prescribed was measured. The average of 3 CNR measurements of the TZ was measured on the post tx MDCT w/ con and compared to the control. After tx, the swine were sacrificed and the liver with the coil and control tx was excised for histologic analysis.

**RESULTS**

During the tx planning workflow, cavitation was visible around the liquid injectable targets, but preferentially occurred at the coil edges in the coil tx. The TZ around the targets had CNR values of 7.3 and 4.5 for the barium-saline, 3.3 and 5.1 for the barium-blood, 4.8 for the coil and 5.9 for the control tx. The average absolute error in diameter from prescribed was 7.7 and 8.4 mm for the barium-saline and 10.3 and 9.5 mm for barium-blood mixture. The coil and control had an average absolute error of 14.1 and 7.6 mm, respectively. On histopathology, there was complete tissue homogenization adjacent to the coil and within the TZ. No thermal damage was identified near the coil. The transition between treated and untreated tissue were histologically the same in both the coil and control TZ.

**CONCLUSION**

Injectable barium and coil-based x ray visible targets were successfully treated with histotripsy. TZ CNRs and diameters were similar in the target and control cases suggesting the target did not disrupt the tx. Per histology, the metal coil did not change tx efficacy but did negatively impact tx planning workflow, which may decrease targeting accuracy.

**CLINICAL RELEVANCE/APPLICATION**

Developing X-Ray visible targets that do not disrupt histotripsy tx will help increase accuracy, precision, reproducibility and rigor of CBCT guided histotripsy.

## T5B-SPIR-8 EVALUATION OF A CT-MRI MULTIMODAL REGISTRATION SYSTEM FOR LOCALIZATION OF COLORECTAL CANCER LIVER METASTASES DURING CT GUIDED PERCUTANEOUS RADIOFREQUENCY/MICROWAVE ABLATION

Xia Wu (*Abstract Co-Author*) Nothing to Disclose
Lumin Chen, MD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Computed tomography (CT)-guided liver ablation is widely used in the treatment of colorectal cancer liver metastases (CRLMs) and often involves using unenhanced images for the procedure. However, during percutaneous radiofrequency/microwave ablation, the visibility of tumor metastases on CT may be poor, making the localization of target lesions challenging. This retrospective study aims to evaluate the accuracy of a novel deep-learning-based computer-aided system (DL-CAS) via CT-MRI multimodal registration for localization of colorectal cancer liver metastases during CT guided percutaneous radiofrequency/microwave ablation.

**METHODS AND MATERIALS**

From January 2021 to August 2023, paired CT and MRI images of 105 patients diagnosed with liver metastasis of colorectal cancer and treated with CT-guided liver microwave or radiofrequency ablation from one hospital were collected for performance evaluation in this retrospective study. The decision to ablate all liver metastases was discussed through MDT. DL-CAS was previously developed with a two-stage cascaded registration framework involving rigid and non-rigid deformation, which is employed to align the CT-MRI multimodal liver images. We calculated the distance between the predicted location of raters or DL-CAS with ground truth and then compared their deviation to evaluate the accuracy of detecting the liver metastases.

**RESULTS**

In total 220 liver metastases lesions in the external validation dataset were scored. Two junior physicians joined the comparative experiment as raters. DL-CAS showed a lower deviation (5.791 ± 2.817 mm vs. Rater1: 7.613 ± 9.21 mm or Rater2: 7.058 ± 9.5 mm, $p < 0.001$) compared to the two Raters.

**CONCLUSION**

DL-CAS for the localization of CRLMs during percutaneous radiofrequency/microwave ablation has shown favorable performance in the external validation dataset.

**CLINICAL RELEVANCE/APPLICATION**

Assisting interventional radiologists in localizing liver metastases from colorectal cancer during CT-guided percutaneous radiofrequency/microwave ablation procedures.

## T5B-SPIR-9 IMAGE-GUIDED HDR-BT TREATED PATIENT SERUM CAN INCREASE PROLIFERATION OF HCC IN VITRO AND IS ASSOCIATED WITH RESPONSE AND SEROLOGIC GROWTH FACTORS

Philipp M. Kazmierczak, MD (*Abstract Co-Author*) Nothing to Disclose
Moritz Nikolaus Groper (*Abstract Co-Author*) Nothing to Disclose
S. Nahum Goldberg, MD (*Abstract Co-Author*) Consultant, Cosman Medical, Inc;Consultant, Sarasota Interventional Radiology
Lukas Salvermoser (*Abstract Co-Author*) Nothing to Disclose
Jens Ricke, MD, PhD (*Abstract Co-Author*) Research Grant, Sirtex Medical Ltd;Research Grant, Bayer AG;Research Grant, Terumo Corporation;Research Grant, Boston Scientific Corporation
Marianna Alunni-Fabbroni (*Abstract Co-Author*) Nothing to Disclose
Matthias M. Stechele, MD (*Presenter*) Nothing to Disclose

## PURPOSE

To determine whether patient serum after CT-guided High-Dose-Rate Brachytherapy (HDR-BT) can induce HCC growth in vitro by release of growth factors and whether this correlates with outcome.

## METHODS AND MATERIALS

In this study, 24 HCC patients (BCLC AB) were treated by HDR-BT (1×15 Gy). Patients were either classified as Responders (R, n=12) who had no progression within 6m and no diffuse systemic progression within 2yrs or Non-responders (NR, n=12) who had recurrence within 6m and/or diffuse systemic tumor progression (i.e. exceeding 3 nodules/nodule diameter >3cm) or extrahepatic disease within 2yrs. Serum was obtained at baseline and 48hr post-procedure. Two HCC cell lines (HepG2 and Huh7) were incubated for 72hr in the presence of 20% patient serum in standard condition. Proliferative Indices (PI) were assessed comparing cell proliferation of serum incubation at 48hr post-HDR-BT and baseline. Results were correlated with response and serologic levels of EGF and Angiopoietin-1.

## RESULTS

PI of Non-responders were significantly elevated compared to Responders for both HepG2 (median R:0.74; median NR:1.12) and Huh7 (R:0.53; NR:1.96) ($p<0.05$, both comparisons). Kaplan-Meier analyses demonstrated significantly shorter time to systemic progression in patients with increased PI compared to those with decreased PI ($p<0.01$, both cell lines). Increased PI correlated best with increased EGF levels ($p<0.05$ for HepG2 and Huh7, respectively) and with increased Angiopoietin-1 ($p<0.05$ for Huh7).

## CONCLUSION

Poor outcome following image-guided HDR-BT is associated with increased growth of HCC cell lines in vitro after patient serum incubation as well as production of serologic growth factors.

## CLINICAL RELEVANCE/APPLICATION

Our in-vitro platform represents a potential predictor of outcome in HCC patients undergoing HDR-BT already at a very short time after therapy. Accordingly, this data can identify patients at risk and potential candidates for a personalized treatment approach.

# Abstract Archives of the RSNA, 2024

T5B-SPMK

**Musculoskeletal Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPMK-1 THE ASSOCIATION BETWEEN TISSUE-SPECIFIC CHANGES IN BODY COMPOSITION WITH LOSS OF MUSCLE STRENGTH AND PHYSICAL PERFORMANCE: A 5-YEAR FOLLOW-UP STUDY

Fengyun Zhou (*Abstract Co-Author*) Nothing to Disclose
Ling Wang (*Abstract Co-Author*) Nothing to Disclose
Xiaoguang Cheng (*Abstract Co-Author*) Nothing to Disclose
Yandong Liu (*Abstract Co-Author*) Nothing to Disclose
Wenshuang Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yi Yuan (*Presenter*) Nothing to Disclose

### PURPOSE

Our objective was to examine longitudinal changes in body composition in older individuals in relation to changes in physical performance.

### METHODS AND MATERIALS

We included 120 community-dwelling individuals aged 60-85 years from the neighborhood of our hospital. CT scans and measurements of handgrip strength (HGS) and the Timed Up and Go test (TUG) were obtained at baseline and follow-up after 5 years. We assessed changes in muscle size and muscle density of the paraspinal muscles, psoas major muscles, pelvic muscles, thigh muscles, changes in adipose area (subcutaneous adipose area [SAA], visceral adipose area, [VAA], and total adipose area [TAA]) and changes in liver fat accumulation. Associations of changes in body composition with changes in HGS and TUG were tested in logistic regression models after adjusting for baseline age, height, weight and type 2 diabetes. Age strata < 70 years and > 70 years were compared in gender-stratified analyses using paired T-tests.

### RESULTS

Muscle atrophy was greater in individuals over 70 years ($P<0.05$) compared to younger individuals (psoas major, -11.6% vs. -8.9% for females, -12.2% vs. -9.2% for males; abductors, -8.0% vs. -3.0% for females, -8.9% vs. -4.7% for males; posterior compartment of the thigh muscles, -24.9% vs. -17.8% for females, -24.4% vs. -16.8% for males). In females over 70 years, increases in visceral adipose area (VAA) were less than in older women (8.5% vs. 16.3%, $P=0.03$), while liver fat content decline was greater (-17.4% vs. -5.8%, $P<0.01$) in the younger women. Among females, each decrease (per cm2) of anterior compartment of thigh muscle size was associated with a 10% decrease of HGS (95% confidence interval [CI], 1.02-1.19; $P=0.02$) and an 11% longer TUG (95%CI, 1.02-1.20; $P=0.01$). Among males, each decrease (per cm2) of anterior compartment of thigh muscle size was associated with a 15% decreased HGS (95%CI, 1.02-1.29; $P=0.02$) and a 44% longer TUG (95%CI, 1.10-1.88; $P<0.01$). Similarly, in males, each decrease (per cm2) of medial compartment of thigh muscle size was associated with a 12% decreased HGS (95%CI, 1.02-1.23; $P=0.02$).

### CONCLUSION

CT-based body composition changes atrophy of thigh muscles in particular associated with loss of muscle strength and physical performance.

### CLINICAL RELEVANCE/APPLICATION

The results from this longitudinal study showed that elderly individuals display atrophy of skeletal muscles, decrease of liver fat and hypertrophy of adipose areas during the sixth decade in males and females. Atrophy of thigh muscles was associated with loss of muscle strength and actual physical performance. A comprehensive understanding of body composition changes with aging would assist to make novel strategies to promote healthy aging and improve the quality of life in older individuals.

## T5B-SPMK-2 MRI APPEARANCE OF REGENERATIVE PERIPHERAL NERVE INTERFACE

Samer L. Soussahn, MD (*Abstract Co-Author*) Nothing to Disclose
Theodore Kung (*Abstract Co-Author*) Nothing to Disclose
Qiaochu Chen (*Abstract Co-Author*) Nothing to Disclose
Paul Cederna, MD (*Abstract Co-Author*) Nothing to Disclose
Yoav Morag, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To describe the MRI appearance of Regenerative peripheral nerve interface (RPNI) and potential association between the MR appearance and a following RPNI revision.

**METHODS AND MATERIALS**

A retrospective assessment of MRI studies performed following RPNI surgery performed at our institution between 1/1/2010- 7/29/2023 with clinical correlation.

**RESULTS**

14 patients (8 males, 6 females, age range 31-80 years, median age- 51 years) with technically adequate MRI of RPNIs were included in this study including 5 patients with below knee amputation (BKA) with 5 tibial and 4 CPN RPNI, 8 patients with above knee amputations (AKA) with a sciatic RPNI and one patient following forequarter amputation with a brachial plexus RPNI. Two patients had undergone revision RPNI surgery x3 (AKA-sciatic nerve) for a total of 6 RPNI revisions. On T1 weighted sequences, all RPNIs were isointense to muscle and blended with the surrounding scar and muscle tissues while on T2 weighted sequences, all RPNIs were hyperintense in signal compared to muscle. All but one RPNI underwent post contrast enhancement in variable patterns. No statistically significant difference in RPNI MR appearance was found between studies with or without a following RPNI revision surgery.

**CONCLUSION**

RPNI on MRI typically have a bright and intermediate signal on T2 and T1 weighted sequences accordingly, and typically undergo postcontrast enhancement in variable patterns without a statistically significant difference between cases with and without following RPNI revision.

**CLINICAL RELEVANCE/APPLICATION**

Persistent increased signal on T2 weighted sequences and post contrast enhancement of RPNIs should not be misconstrued as indicative of pathology.

## T5B-SPMK-3 EFFECTS OF BARIATRIC SURGERY ON GASTRIC VOLUME, BODY COMPOSITION, AND HEPATIC STEATOSIS: AI-BASED CT SCAN ANALYSIS

Jai Keun Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyung-Min Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Jimi Huh, MD (*Abstract Co-Author*) Nothing to Disclose
Kyung Won Kim, MD (*Presenter*) CEO, Trial Informatics Company

**PURPOSE**

To evaluate the changes in gastric volume, subcutaneous fat (Sfat), visceral fat (Vfat), skeletal muscle, bone mineral density (BMD), and hepatic steatosis following bariatric surgery from fully automatic AI measurement technique on opportunistic CT gastrography images.

**METHODS AND MATERIALS**

From prospectively collected 60 obese patients undergoing bariatric surgery, changes in body composition indicators were assessed on preoperative period and at 3 months and 1-year post-surgery follow-up CT scans. Using AI techniques, we assessed gastric volume, Sfat, Vfat, BMI-adjusted skeletal muscle index (SMI), BMD, and the liver/spleen attenuation ratio (L/S ratio). Linear Mixed Models (LMM) were employed to determine the statistical significance of changes over time, with age and sex adjustments.

**RESULTS**

Postoperative assessments revealed significant reductions in gastric volume, decreasing from a 954.7 ± 183.6 preoperatively to 180.6 ± 77.2 at 3-months and 245.8 ± 92.4 at 1-year post-surgery ($p<0.001$). Similarly, Sfat reduced from 476.8 ± 157.7 preoperatively to 365.8 ± 139.1 at 3-months and further to 242.7 ± 121.4 at 1-year post-surgery, while Vfat declined from 276.7 ± 85.2 preoperatively to 179.4 ± 70.5 at 3-months and 100.0 ± 71.5 at 1-year post-surgery ($p<0.001$ for both). Notably, there were no significant changes in bone mineral density (BMD) between pre- and post-surgery. The SMI has been gradually increased at 3-months and 1-year post-surgery. Additionally, the L/S ratio, a marker of hepatic steatosis, has been increased post-surgery.

**CONCLUSION**

AI measurement from opportunistic CT scans demonstrated that bariatic surgery not only significantly reduces body fat but also improves hepatic steatosis and SMI.

**CLINICAL RELEVANCE/APPLICATION**

These findings highlight the multifaceted benefits of bariatric surgery beyond mere weight loss, showcasing its potential in managing and potentially reversing complications associated with obesity.

# Abstract Archives of the RSNA, 2024

T5B-SPMS

**Multisystem Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPMS-1 PATIENT ELIGIBILITY FOR TRIALS WITH IMAGING RESPONSE ASSESSMENT AT THE TIME OF MOLECULAR TUMOR BOARD PRESENTATION

Wolfgang G. Kunz, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Michael Winkelmann, MD (*Abstract Co-Author*) Nothing to Disclose
Nabeel Mansour (*Abstract Co-Author*) Nothing to Disclose
Jens Ricke, MD, PhD (*Abstract Co-Author*) Research Grant, Sirtex Medical Ltd;Research Grant, Bayer AG;Research Grant, Terumo Corporation;Research Grant, Boston Scientific Corporation
Michael von Bergwelt-Baildon (*Abstract Co-Author*) Nothing to Disclose
Volker Heinemann, MD (*Abstract Co-Author*) Research funded, Merck KGaAResearch funded, F. Hoffmann-La Roche LtdResearch funded, Amgen IncResearch funded, sanofi-aventis GroupAdvisory Board, Merck KGaAAdvisory Board, F. Hoffmann-La Roche LtdAdvisory Board, Amgen IncAdvisory Board, sanofi-aventis Group
Maurice Heimer, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the eligibility of patients with advanced or recurrent solid malignancies presented to a molecular tumor board (MTB) at a large precision oncology center for inclusion in trials with the endpoints objective response rate (ORR) or duration of response (DOR) based on Response Evaluation Criteria in Solid Tumors (RECIST version 1.1).

### METHODS AND MATERIALS

Prospective patients with available imaging at the time of presentation in the MTB were included. Imaging data was reviewed for objectifiable measurable disease (MD) according to RECIST v1.1. Additionally, we evaluated the patients with MD for representativeness of the identified measurable lesion(s) in relation to the overall tumor burden.

### RESULTS

262 patients with different solid malignancies were included. 177 patients (68%) had MD and 85 (32%) had non-measurable disease (NMD) at the time point of MTB presentation in accordance with RECIST v1.1. MD was not representative of the overall tumor burden in eleven patients (6%). The main reasons for NMD were lesions with longest diameter shorter than 10 mm (22%) and non-measurable peritoneal carc inomatosis (18%). Colorectal cancer and malignant melanoma displayed the highest rates of MD (>75%). In contrast, gastric cancer, head and neck malignancies, and ovarian carcinoma had the lowest rates of MD (<55%). In case of MD, the measurable lesions were representative of the overall tumor burden in the vast majority of cases (94%).

### CONCLUSION

Approximately one-third of cancer patients with advanced solid malignancies are not eligible for treatment response assessment in trials with endpoints ORR or DOR at the time of MTB presentation. The rate of patients eligible for trials with imaging endpoints differs significantly based on the underlying malignancy and should be taken under consideration during the planning of new precision oncology trials.

### CLINICAL RELEVANCE/APPLICATION

The findings of this study emphasize the need to tailor trial eligibility based on cancer type for precision oncology studies with imaging endpoints.

## T5B-SPMS-2 LESIONS DETECTION REVIEW IN LONGITUDINAL CROSS-SECTIONAL ONCOLOGICAL IMAGING WITH A GRAPH-BASED APPROACH

Richard Lederman, MD (*Abstract Co-Author*) Consultant, HighRAD Ltd
Jacob Sosna, MD (*Abstract Co-Author*) Stockholder, HighRAD Ltd
Beniamin Di Veroli (*Abstract Co-Author*) Nothing to Disclose
Leo Joskowicz, PhD (*Presenter*) Officer, HighRAD Ltd

### PURPOSE

Missed and misidentified neoplastic lesions in longitudinal studies of oncology patients are pervasive and may affect the evaluation of the disease status. Two newly identified patterns of lesion changes, lone lesions and non-consecutive lesion changes, may help radiologists to detect these lesions. This study evaluated a new interpretation revision workflow of lesion annotations in three or more consecutive scans based on these suspicious patterns.

**METHODS AND MATERIALS**

The interpretation revision workflow was evaluated on manual and computed lesion annotations in longitudinal oncology patient studies. For the manual revision, a senior radiologist and a senior neurosurgeon (the readers) manually annotated the lesions in each scan and later revised their annotations with the workflow using the automatically detected patterns of lone and non-consecutive lesions. For the computerized revision, lesion annotations were first computed with a previously trained nnU-Net and were then automatically revised with an AI-based method that automates the workflow readers' decisions. The evaluation included 67 patient studies with 2295 metastatic lesions in lung (19 patients, 83 CT scans, 1178 lesions), liver (18 patients, 77 CECT scans, 800 lesions) and brain (30 patients, 102 T1W-Gad MRI scans, 317 lesions).

**RESULTS**

Revision of the manual lesion annotations revealed 120 missed lesions and 20 misidentified lesions in 31 out of 67 (46%) studies. The automatic revision reduced the number of computed missed lesions by 55 and computed misidentified lesions by 164 in 51 out of 67 (76%) studies.

**CONCLUSION**

Our experimental studies demonstrate that the automated detection of two suspicious lesion change patterns, lone lesions and non-consecutive matching lesions that can be only found in three or more consecutive studies may help in identifying missing and misidentified lesions.

**CLINICAL RELEVANCE/APPLICATION**

Automatic analysis of three or more consecutive volumetric scans helps find missed and misidentified lesions and may improve the evaluation of temporal changes of oncological lesions, potentially improving disease management.

# Abstract Archives of the RSNA, 2024

T5B-SPNMMI

**Nuclear Medicine & Molecular Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPNMMI-1 AN INITIAL OBSERVATIONAL STUDY ON SURPRISING FAVORABLE HEALTHCARE DISPARITIES WITH RADIUM 223 THERAPY

Marjorie Lam (*Abstract Co-Author*) Nothing to Disclose
Mary Roselin Nittala (*Abstract Co-Author*) Nothing to Disclose
Logan Lamar (*Abstract Co-Author*) Nothing to Disclose
Vani Vijayakumar, MD (*Abstract Co-Author*) Nothing to Disclose
Roger Mishoe (*Abstract Co-Author*) Nothing to Disclose
Johnny Yang, BS, BA (*Presenter*) Nothing to Disclose

### PURPOSE

Prostate cancer (PC) is the second leading cause of cancer-related death and the most common cancer diagnosis for men in the United States (US). The incidence of PC among African American (AA) males is approximately 70% higher than Caucasian males. When stratified by race, one of the many risk factors contributing to poor PC outcomes is social determinants of health (SDOH). Radium-223 dichloride (Ra-223) is indicated in castrate-resistant prostate cancer with bone metastases and no visceral metastases. Patients with metastatic castrate-resistant prostate cancer (mCRPC) treated with Ra-223 experience prolonged overall survival (OS), particularly AAs, compared to Caucasians. The state of Mississippi struggles with various health metrics and has one of the worst cancer survival rates in the country. This study aims to elucidate the interplay between treatment outcomes of Ra-223 in mCRPC patients when stratified among races and SDOH.

### METHODS AND MATERIALS

A retrospective review is conducted for mCRPC patients diagnosed and treated with Ra-223 at an academic medical center to elucidate patient characteristics, staging, imaging characteristics, and SDOH variables that may affect patient outcomes. Race, the average income of the city of residence, healthcare access, and distances traveled for treatments are the primary SDOH variables, and the outcomes include OS, and treatment-related morbidity for a population in the Southern US. Univariate analysis by Kaplan-Meier is employed.

### RESULTS

After treatment with Ra-223, an overall median survival time of 14 months and 11 months is observed for AAs and Caucasians, respectively (p=0.359). 66.7% of AAs and 50% of Caucasians travel greater than 50 miles for treatments (p=0.635). 66.7% of AAs and 33.3% of Caucasians reside in cities with an average salary of less than $35,000 (p=0.343). Caucasian patients exhibit more treatment-related complications than AAs (66.7% vs. 33.3%), but AAs were diagnosed with anemia at higher rates (100% vs. 16.7%, p=0.018). All patients had healthcare insurance; none demonstrated KPS improvement (p=0.023); however, all patients achieved pain palliation.

### CONCLUSION

This study reports improved OS in AAs compared to Caucasians with mCRPC treated with Ra-223. As AAs in this study face more significant adversities with SDOH, this paradoxical observation may suggest a protective factor for AAs likely secondary to biological genetic factors. The study's primary limitations are a small cohort size and limited specificity of SDOH, which warrant further investigation.

### CLINICAL RELEVANCE/APPLICATION

mCRPC can be managed with various therapeutics. However, Ra-223 has been shown to palliate pain in all patients and may possess an additional overall survival benefit for AAs.

# Abstract Archives of the RSNA, 2024

T5B-SPNPM

**Noninterpretive Skills (Beyond Imaging) Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPNPM-1 PROJECTED IMAGING DEMAND, 2025-2055

Eric M. Rubin, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Y. Rula, PhD (*Abstract Co-Author*) Nothing to Disclose
Jay R. Parikh, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Eric Christensen, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To project future imaging utilization through 2055 based on historical imaging utilization and U.S. Census population projections.

### METHODS AND MATERIALS

We used CMS Medicare claims from a 5% nationally representative sample of Medicare fee-for-service beneficiaries (2012-2021) to assess mean imaging use by sex, age, and modality in 2021 as well as time trends for how utilization was increasing, constant, or decreasing over this decade. Future imaging use was modeled by applying 2021 per person imaging rates to the U.S. Census projections of the future population, which include increases in the total population as well as an increasingly larger proportion of older individuals. This is a static projection based on 2021 utilization rates. We also modeled future utilization per person assuming the 2012-2021 trends in imaging use by modality will continue through 2030 or 2035 and thereafter be constant.

### RESULTS

The U.S. population size is projected to be 362.4 million in 2055, which is 8.2% larger than the 2023 population. This increase is driven by the 65+ population, which is projected to increase 43% by 2055 (and 164% for the 85+ population). Given the trends of Medicare beneficiaries shifting to Medicare Advantage (MA), the MA population is expected to increase 70.7% by 2055 compared with 8.9% for the Medicare fee-for-service population. Regression analysis shows a substantial increase in CT and MR studies per person between 2012 and 2021. For example, CT and MR use in 2021 were 43.3% and 23.7% higher than in 2012. Conversely, nuclear medicine (NM) and interventional radiology (IR) procedures for females were 22.0% and 27.5% lower, respectively, in 2021 than in 2012. Assuming per person imaging utilization remains static at 2021 levels, higher utilization is projected in 2055 compared with 2023 due to population increases and demographic changes: 26% for CT, 19% for MR, 25% for NM, 19% for ultrasound, 23% for radiography/fluoroscopy (XR), and 17% for IR. If current per person imaging utilization trends continue through 2035 and are constant thereafter, 2055 utilization compared with 2023 utilization will be higher for CT (86%), MR (40%), ultrasound (22%), and XR (22%) and lower for NM (-3%) and IR (-7%).

### CONCLUSION

Given population projections and historical imaging utilization, demand for CT, MR, ultrasound, and XR are projected to be larger than the overall population growth. This is driven by the disproportionate growth of the 65+ population and the higher imaging utilization rate of this population.

### CLINICAL RELEVANCE/APPLICATION

Modelling imaging utilization will facilitate future estimates of radiologist adequacy in the U.S. for interpretation of imaging studies and assist policy decision making regarding funding of radiology trainees.

## T5B-SPNPM-2 BEYOND THE BLACK BOX: THE NEED FOR MORE TRANSPARENCY IN REGULATING AI/ML RADIOLOGICAL DEVICES VIA THE FDA 510(K) PATHWAY

David B. Larson, MD, MBA (*Abstract Co-Author*) Research Grant, Siemens AG ;Advisor, Bunkerhill Health;Shareholder, Bunkerhill Health
John N. Grimes, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Lina Cheuy (*Abstract Co-Author*) Nothing to Disclose
Alaa Youssef, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The majority of marketed AI/ML medical devices, most of which have a radiological function, have been cleared through the FDA 510(k) pathway. This study assessed the publicly available 510(k) summaries of AI/ML-enabled computer-assisted detection (CAD) devices to evaluate if the summaries detailed the algorithmic input, how rigorously the devices were evaluated, and if there was substantial equivalence in function and modality with the claimed predicate device.

### METHODS AND MATERIALS

Using the FDA AI/ML public database, we identified all CAD devices cleared through the FDA 510(k) pathway from May 2018 to October 2023.We extracted details relevant to algorithm development, including image annotation instructions and ground truth definitions, from each device's 510(k)

summaries, product webpages, and relevant publications. The device details were cross-referenced using the AI Central database from the American College of Radiology - Data Science Institute. Predicate lineages were then mapped by manually tracing product numbers included within the 510(k) summaries.

**RESULTS**

In total, 98 CAD devices were cleared, with the majority being computer-assisted triage (CADt) devices (67/98). None of the cleared CAD devices provided image annotation details, and only one product mentioned access to its training data. More than half of the devices did not disclose how the ground truth was defined. Only 13 CAD devices were reported in peer-reviewed publications, and only two were evaluated in prospective studies. The mapped predicate lineages revealed significant variations in clinical function and imaging modality between the cleared devices and the claimed predicate.

**CONCLUSION**

The 510(k) summaries reveal a concerning lack of details describing the algorithmic development process and significant mismatches in clinical function and imaging modality between newly cleared medical devices and their claimed predicate device.

**CLINICAL RELEVANCE/APPLICATION**

The current FDA 510(k) process for clearing AI/ML medical devices has led to substantial gaps in transparency and consistency that could undermine public trust in such devices. Broad interpretations of the FDA requirements have led to questionable equivalence between the cleared devices and their claimed predicate devices. Coupled with the inconsistent availability of details describing the AI/ML algorithm development process in the public 510(k) summaries, these findings underscore existing concerns about the safety of diagnostic AI/ML medical devices cleared through the FDA 510(k) pathway for use in patient care. A more stringent and transparent regulatory process is needed to promote the public's trust in the clearance of AI/ML medical devices.

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# Abstract Archives of the RSNA, 2024

T5B-SPNR

**Neuroradiology Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPNR-1 ADVANCED 3D PRINTED MODEL OF MIDDLE MENINGEAL ARTERY FOR ENDOVASCULAR NAVIGATION

Pouya Metanat, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Luis Savastano (*Abstract Co-Author*) Nothing to Disclose
Atakan Orscelik, MD (*Abstract Co-Author*) Nothing to Disclose
Yigit Can Senol (*Abstract Co-Author*) Nothing to Disclose
Nishanth Krishnan (*Abstract Co-Author*) Nothing to Disclose
Mona Asghariahmadabad, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Benchtop models have been extensively utilized to test a variety of endovascular devices. Our objective is to design and create a 3D printed model of the middle meningeal artery using both rigid and elastic resin, as well as a cast silicon model. This is intended to facilitate practice in catheter navigation through various tortuous geometries, particularly in older patients.

### METHODS AND MATERIALS

The DICOM files from cadaveric-derived CT angiography of the middle meningeal artery were exported and digitally converted into CAD files. These files were then modified to create a solid model for casting a silicone and a hollow-out structure for printing with both rigid and elastic resin materials. Consequently, the 3D printed model and silicone cast were connected to silicon or glass model replicate the vascular pathway from aortic arch.

### RESULTS

3D printed and silicon models mimicking the human middle meningeal artery were produced, demonstrating anatomical accuracy and comparable catheter navigability. All models provided clear visualization of catheters both by direct observation and under fluoroscopy.

### CONCLUSION

To the best of our knowledge, this study is the first of its kind to offer a detailed description of process for creating 3D-printed and silicon models of the middle meningeal artery. These models are intended for benchtop catheter navigation practice especially within tortuous vascular anatomy.

### CLINICAL RELEVANCE/APPLICATION

A 3D-printed model of the middle meningeal artery can significantly enhance anatomical understanding and interventional planning for procedures such as middle meningeal artery embolization used in treating subdural hematomas. By providing a tactile, spatial representation, these models allow clinicians to practice and refine their techniques in a risk-free environment before performing actual surgeries. Additionally, they serve as excellent educational tools, offering trainees a more interactive and engaging learning experience, which can improve their anatomical knowledge and technical skills.

## T5B-SPNR-10 Distinct Brain Network Patterns in Complete And Incomplete Spinal Cord Injury Patients Based on Graph Theory Analysis

Beining Yang (*Presenter*) Nothing to Disclose

### PURPOSE

Accurate functional assessment is crucial for patients with spinal cord injuries (SCI), but existing evidence has suggested challenges in differentiating between complete spinal cord injury (CSCI) and incomplete spinal cord injury (ICSCI). Therefore, this study aims to compare the changes in brain network topological properties and structure-function coupling in patients with CSCI and ICSCI, to unveil the potential neurobiological mechanisms underlying the different effects of CSCI and ICSCI on brain networks and identify objective neurobiological markers to differentiate between CSCI and ICSCI patients.

### METHODS AND MATERIALS

A total of 35 spinal cord injury (SCI) patients (20 with CSCI and 15 with ICSCI) and 32 healthy controls (HCs) were included. Network construction was based on resting-state functional magnetic resonance imaging to analyze functional connectivity (FC) and diffusion tensor imaging for structural connectivity (SC). Graph theory analysis was utilized to examine SC and FC networks, as well as to estimate SC-FC coupling values.

### RESULTS

The results of this study found that compared to HCs, ICSCI patients exhibited increased path length (Lp) and decreased global (Eg) and local efficiency (Eloc) in SC. For FC, ICSCI patients showed increased small-worldness, clustering coefficient (Cp), normalized clustering coefficient, and Eloc. ICSCI

patients also had increased Cp and Eloc compared to CSCI patients, along with reduced SC-FC coupling values. In CSCI patients, significant correlations were observed between SC network metrics (Lp and Eg) and motor scores, whereas in ICSCI patients, FC network metrics (Cp, Eloc) and SC-FC coupling values were correlated with sensory/motor scores.

**CONCLUSION**

The findings indicate that CSCI and ICSCI have distinct effects on brain networks. CSCI patients demonstrate decreased efficiency in the SC network, whereas ICSCI patients show increased local connections and decreased SC-FC coupling, suggesting different underlying neurobiological mechanisms.

**CLINICAL RELEVANCE/APPLICATION**

This study's identification of distinct neurobiological characteristics and objective markers for CSCI and ICSCI patients has significant clinical relevance. It provides a scientific basis for developing more accurate diagnostic tools and tailoring rehabilitation strategies to the specific neural alterations associated with each type of spinal cord injury. By understanding the unique effects of CSCI and ICSCI on brain networks, clinicians can better predict outcomes and optimize treatments, ultimately improving the functional assessment and care of SCI patients.

## T5B-SPNR-11 ASSESSMENT OF BRAIN IRON LEVELS IN THE LIMBIC SYSTEM'S WHITE MATTER IN PREECLAMPSIA: A CROSS-SECTIONAL AND LONGITUDINAL STUDY BASED ON QUANTITATIVE SUSCEPTIBILITY MAPPING

Qihao Zhang, BS (*Abstract Co-Author*) Nothing to Disclose
Tao Chen (*Abstract Co-Author*) Nothing to Disclose
Linfeng Yang (*Abstract Co-Author*) Nothing to Disclose
Meng Li (*Abstract Co-Author*) Nothing to Disclose
Lingfei Guo, MD (*Abstract Co-Author*) Nothing to Disclose
Chaofan Sui (*Presenter*) Nothing to Disclose

**PURPOSE**

The Papez circuit within the limbic system connects emotions, memory, cognition, and behavior. White matter (WM) changes in the Papez circuit may be crucial to alterations in emotion, memory, and cognition observed in preeclampsia. This study aimed to examine altered WM iron levels in the limbic system of preeclampsia using quantitative susceptibility mapping (QSM) and to explore influencing factors.

**METHODS AND MATERIALS**

A total of 152 women with preeclampsia, 73 pregnant healthy controls (PHC), and 125 non-pregnant healthy controls (NPHC) were included and underwent laboratory examinations, cognitive assessments, blood biochemical tests, and brain QSM imaging. One-way ANOVA was applied to evaluate the QSM values in WM fibers of the limbic system among the three groups. Multiple regression analysis was performed to analyze the influencing factors and the longitudinal changes of QSM, and its relationship with proteins and inflammatory factors in preeclampsia.

**RESULTS**

The QSM values of bilateral anterior thalamic radiation (ATR), the dorsal segment of right cingulum subsection (CBD), the peri-genual part of right cingulum subsection (CBP), the temporal part of bilateral cingulum subsection (CBT) and bilateral fornix (FX) of preeclampsia were significantly higher than those in the NPHC and PHC groups (FDR corrected, $P<0.05$). Multiple stepwise regression analysis showed that age, body mass index, hypoxia-inducible factor-1a (HIF-a), Aß1-42, total tau (T-tau), and group status significantly influenced the susceptibility values of different fibers in the limbic system. Notably, changes in QSM in the right CBP affected cognitive function regardless of pregnancy or preeclampsia status. In the longitudinal study of preeclampsia, susceptibility values in most WM fibers of the limbic system showed no significant changes, except the right CBD, which was lower than that from 3 years prior. Additionally, brain iron level changes in WM of the limbic system were related to the longitudinal changes of HIF-a, but not to the longitudinal changes of Aß1-42 and T-tau.

**CONCLUSION**

Iron concentration in WM fibers of the limbic system was higher in preeclampsia than in healthy controls, and most WM fibers did not change over time, suggesting that WM damage in preeclampsia is a long-term process. Both cross-sectional and longitudinal studies identified HIF-a as a significant factor affecting QSM values in preeclampsia.

**CLINICAL RELEVANCE/APPLICATION**

Cross-sectional and longitudinal changes in brain iron in preeclampsia and their relationships with clinical features have not been adequately studied. In this study, QSM can be used to measure brain iron noninvasively in pregnant women and can serve as a biological marker for detecting damage in some brain regions.

## T5B-SPNR-12 INTOLERANCE OF UNCERTAINTY MEDIATES THE LINK OF ORBITOFRONTAL CORTEX GRAY MATTER VOLUME TO DISTRESS SYMPTOMS DURING THE COVID-19 PANDEMIC

Xueling Suo (*Abstract Co-Author*) Nothing to Disclose
Li Chen (*Presenter*) Nothing to Disclose

**PURPOSE**

Intolerance of uncertainty (IU) is an underlying feature of different mood disorders that may mediates psychological distress problems associated with public health events (e.g., the COVID-19 pandemic). We attempted to identify the neuroanatomical features of IU and further explore potential neuropsychological mechanisms.

**METHODS AND MATERIALS**

Structural magnetic resonance imaging (MRI) data and behavioral tests were collected from 115 general college students before COVID-19 pandemic who were re-contacted COVID-related IU and follow-up general distress. We employed whole-brain voxel-based morphometry analysis and brain-behavioral correlation analysis to identify brain regions related to IU. Mediation analyses were conducted to explore the role of IU in the brain-general distress model.

**RESULTS**

In whole-brain correlation analyses, IU was significantly and positively correlated with the pre-pandemic gray matter volume (GMV) of right orbitofrontal cortex (R_OFC). Mediation analyses revealed that IU mediated the effect of R_OFC's GMV on COVID-related general distress. The above findings show relationships between brain structural signatures, IU and general distress.

### CONCLUSION

This study provided evidence for the structural neural markers of IU and reveal an underlying neuropsychological pathway to predict distress symptoms in which brain structural feature affects general distress via IU.

### CLINICAL RELEVANCE/APPLICATION

Our findings provided evidence for the neurobiological substrates of IU, which might serve as a mediator in the link between structural brain alterations and general distress, this might help to guide IU-related psychotherapeutic interventions.

## T5B-SPNR-13 IMPAIRED GLYMPHATIC SYSTEM FUNCTION IN RELATION TO CUMULATIVE BLOOD GLUCOSE EXPOSURE: A POPULATION-BASED COHORT STUDY

Han Lv, MD (*Abstract Co-Author*) Nothing to Disclose
Sihui Guo (*Abstract Co-Author*) Nothing to Disclose
Xiaoshuai Li (*Abstract Co-Author*) Nothing to Disclose
Jing Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Zhenchang Wang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yufan Zhang (*Presenter*) Nothing to Disclose

### PURPOSE

The relationship between blood glucose exposure and the function of the glymphatic system in the brain remains unknown. This study aimed to investigate the association between cumulative blood glucose levels and brain glymphatic system function.

### METHODS AND MATERIALS

This study was conducted in a multicenter, community-based cohort study. Brain magnetic resonance imaging (MRI) data were collected once between 2020 and 2022. The neuroimaging indicator of brain glymphatic system function was assessed using diffusion tensor imaging analysis along the perivascular space (DTI-ALPS) index. Cumulative fasting blood glucose (FBG) values from 2014 to 2018 were calculated for each participant to represent 4 years of prolonged exposure to hyperglycemia, while a single measurement of FBG levels at the same time of neuroimaging data acquisition represented short-term measurement. A generalized linear model was used to evaluate the association of blood glucose exposure and DTI-ALPS index.

### RESULTS

A total of 251 subjects aged 25-82 years were included in this study. Prolonged cumulative hyperglycemic exposure with FBG =7.0 mmol/L was significantly associated with lower average DTI-ALPS index(ß = -0.058, 95% confidence interval, -0.096 to -0.019). These findings remained significant only among participants over 60 years old and those not taking hypoglycemic medication. No significant associations were observed between single measurement FBG levels and DTI-ALPS values.

### CONCLUSION

Prolonged exposure to hyperglycemia plays a pivotal role in the impairment of glymphatic function, particularly among elder individuals. Hypoglycemic medication demonstrates a protective effect on maintaining glymphatic function. Maintaining long-term normal FBG levels and using appropriate hypoglycemic medication are essential for promoting optimal brain health.

### CLINICAL RELEVANCE/APPLICATION

Understanding the relationship between long-term hyperglycemia status and glymphatic system function may provide novel evidence for preventing and treating neurological diseases associated with impaired glymphatic function.In this study, glymphatic function is impaired when profound hyperglycemia persists for up to 4 years. There is an association between a lower DTI-ALPS index and long-term cumulative exposure to profound hyperglycemia. According to the results of this study, we should attach great importance to early preventive measures. For patients with moderate hyperglycemia, timely treatment and other means should be used to prevent the development of severe hyperglycemia, avoid continuous exposure to profound hyperglycemia, and avoid functional disorders of the glial lymphatic system leading to brain health damage.

## T5B-SPNR-14 ASSESSMENT THE IMPACT OF IDH MUTATION STATUS ON WHITE MATTER INTEGRITY IN GLIOMA PATIENTS: INSIGHTS FROM PEAK WIDTH OF SKELETONIZED MEAN DIFFUSIVITY AND FREE WATER METRICS

Hongquan Zhu (*Abstract Co-Author*) Nothing to Disclose
Yuanhao Li (*Abstract Co-Author*) Nothing to Disclose
Shihui Li (*Abstract Co-Author*) Nothing to Disclose
Jiaxuan Zhang (*Abstract Co-Author*) Nothing to Disclose
Wenzhen Zhu (*Abstract Co-Author*) Nothing to Disclose
Nanxi Shen (*Presenter*) Nothing to Disclose

### PURPOSE

To identify the utility of Peak Width of Skeletonized Mean Diffusivity (PSMD) and Peak Width of Skeletonized Free Water (PSFW), and Axonal Water Fraction (AWF) for evaluating glioma-induced alterations in normal-appearing white matter (NAWM), and their relationship with IDH1 mutation status.

### METHODS AND MATERIALS

105 glioma patients and 53 healthy controls (HCs) underwent DKI and conventional MRI. PSMD and PSFW were computed to quantify NAWM integrity, and to explore the association between these diffusion metrics and clinical variables, including IDH1 mutation status. Corpus callosum (CC) injury, quantified by the AWF, was evaluated to assess a mediated effect of IDH mutation on contralesional PSMD and PSFW values. Statistical analyses, including ANCOVA, linear regression, and mediation analysis, were performed to explore the relationships between these metrics, IDH mutations, and other clinical variables.

### RESULTS

Significant differences in PSMD and PSFW were observed between glioma patients and HCs ($p = 0.005$ and $p < 0.001$ for left-sided; $p < 0.001$ for right-sided gliomas), and between bilateral sides ($p < 0.001$). IDH1 mutant gliomas were associated with less severe changes in PSMD ($p < 0.01$) and PSFW ($p < 0.001$). The injury to the CC, quantified by AWF, acts as a critical mediator in the relationship between IDH1 mutation and changes in PSMD and PSFW in NAWM.

### CONCLUSION

PSMD and PSFW, along with AWF, are effective in detecting glioma-induced alterations in NAWM and assessing the extent of CC injury, revealing their association with IDH1 mutation status.

### CLINICAL RELEVANCE/APPLICATION

These findings underscore the potential of advanced diffusion metrics in enhancing the diagnostic and therapeutic strategies for glioma patients, providing insights into the molecular and structural factors affecting WM integrity.

## T5B-SPNR-18 EVALUATION OF GLYMPHATIC SYSTEM AND LENTICULOSTRIATE ARTERIES IN CEREBRAL SMALL VESSEL DISEASE

Peipei Chang (*Presenter*) Nothing to Disclose

### PURPOSE

To compare lenticulostriate arteries (LSAs) morphology, diffusion tensor imaging analysis along the perivascular space (DTI-ALPS) index,and other imaging features of cerebral small vessel disease (CSVD) and to investigate the relationship between glymphatic system and other imaging features.

### METHODS AND MATERIALS

Fifty-six patients with suspected CSVD were prospectively enrolled. All subjects underwent multimodal magnetic resonance imaging (MRI) and high-resolution vascular wall MRI (3D HR VMI) to assess intracranial non-stenotic atherosclerotic plaques. Among 56 patients with CSVD, there were 28 with intracranial atherosclerotic plaque (IAP) and 28 with non-IAP. The morphological characteristics of visible LSAs (the number of stems and branches) were quantitatively analyzed by two radiologists. Typical image features indexes of CSVD including white matter hyperintensities (WMHs), lacunes, enlarged perivascular spaces (EPVS), microscopic bleedings (CMBs) and recent small subcortical infarct (RSSI) were assessed. We established index for diffusion tensor image analysis along the perivascular space (ALPS-index), which was calculated on diffusion tensor image (DTI). The periventricular white matter volume (PWMV) and deep white matter volume (DWMV) in both groups were measured by the uAI Research Portal V1.1 (Shanghai United Imaging Intelligence, Co., Ltd.). To assess the imaging parameters between groups, independent-samples t test, nonparametric tests and Chi-square test were used. To analyze the correlation between the ALPS index and other neuroimaging indicators, Spearman's correlation analysis can be employed.

### RESULTS

CSVD with IAP is more prone to RSSI ($p<0.001$), while there is no statistical difference in neuroimaging markers between the remaining two groups. Regardless of whether comparing overall or individually for each group, the ALPS index demonstrates a negative correlation with PWMV and DWMV. Upon overall comparison, the ALPS index exhibits a positive correlation with the stems and branches of the lenticulostriate arteries, except for the right stems. There were no relationship between ALPS index and CSVD burden.

### CONCLUSION

There is no difference in the ALPS index between CSVD with IAP and with non-IAP. The ALPS index is associated with white matter hyperintensity volume and the morphology of the lenticulostriate arteries.

### CLINICAL RELEVANCE/APPLICATION

Multi-parameters help clinically evaluate cerebral small vessel diseases and predict prognosis.

## T5B-SPNR-2 RELATING BRAIN GREY MATTER VOLUME TO FATIGUE IN A LONGITUDE SAMPLE OF COVID-19 PATIENTS USING GROUP REGULARIZED CANONICAL CORRELATION ANALYSIS

Xuan Niu (*Abstract Co-Author*) Nothing to Disclose
Tao Lu (*Abstract Co-Author*) Nothing to Disclose
Xingpu Quan (*Abstract Co-Author*) Nothing to Disclose
Gengchen Ye (*Abstract Co-Author*) Nothing to Disclose
Wenrui Bao (*Abstract Co-Author*) Nothing to Disclose
Ming Zhang (*Abstract Co-Author*) Nothing to Disclose
Qiange Zhu (*Presenter*) Nothing to Disclose

### PURPOSE

Fatigue has been reported to be one of the most common and debilitating symptoms during the acute COVID-19 disease as well as in the post-COVID syndrome. However, fatigue is unspecific and may manifest in various forms such as physical and mental fatigue during different phases after COVID-19. The neural mechanisms of post-COVID fatigue have not fully been elucidated yet. Brain gray matter volume (GMV) has been well characterized as a neurobiological marker to predict future behavioral performance in neuropsychiatric disease processes. This study aimed to identify associations between inter-individual variability in brain structure and fatigue in longitudinal cohorts by using multivariate method.

### METHODS AND MATERIALS

This multi-center, longitudinal cohort study, conducted from January to April 2023 across nine hospitals. All 258 participants following a mild SAS-COV2 infection completed MRI scans and fatigue assessments at one-month follow-up. By the three-month mark, the cohort reduced to 229.

### RESULTS

Using regularized canonical variate analysis, significant correlations were found between GMV and both mental and physical dimensions of fatigue. At one month, key regions included the superior frontal gyrus, precentral gyrus, superior temporal gyrus, and others, with notable weights for mental fatigue (0.67) and physical fatigue (0.66). After three months, a different set of regions was identified, including the superior frontal gyrus, basal ganglia and insular gyrus, with adjusted weights for mental fatigue (0.61) and physical fatigue (0.80). Crucially, the persistent fatigue group showed an increase in brain canonical variate scores compared to the non-persistent fatigue group.

### CONCLUSION

These results revealed different manifestations of fatigue associated with a whole-brain structural pattern, the neural mechanisms of post-COVID fatigue vary from phase after COVID-19 infection. brain canonical variate scores. Furthermore, increased brain canonical variate scores were associated with persistent fatigue.

### CLINICAL RELEVANCE/APPLICATION

The findings provide new insights into the neural mechanisms of post-COVID-19 fatigue and may facilitate the development of new treatments for this symptom of fatigue.

## T5B-SPNR-4 CAN EX VIVO MRI AND QUANTITATIVE SUSCEPTIBILITY MAPPING DISTINGUISH BETWEEN INTRAPLAQUE HEMORRHAGE AND LIPID-CONTAINING AREAS IN CAROTID ENDARTERECTOMY SAMPLES?

Hideki Ishimaru (*Abstract Co-Author*) Nothing to Disclose
Ryo Toya, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ayano Ishiyama, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Carotid plaque MR imaging visualizes a lipid-rich/necrotic core (LRNC) and intraplaque hemorrhage (IPH), which are considered risk factors for plaque rupture, but cannot reliably distinguish between the two. Quantitative susceptibility mapping (QSM), which provides a quantitative measure of tissue magnetic susceptibility, has been reported to be useful for characterizing the composition of carotid plaques. We aimed to investigate whether ex vivo high-resolution MRI, including QSM, can distinguish between intraplaque hemorrhage and lipid-containing areas.

### METHODS AND MATERIALS

24 carotid endarterectomy (CEA) specimens from 24 male patients (8 symptomatic and 16 asymptomatic) aged 63 to 88 years (mean age, 73.8 years) were included. CEA specimens were resected en bloc and immediately fixed in formaldehyde and embedded into 2% agarose gel, and were imaged on a 3T MR scanner. Spin-echo vessel wall images, including T1-, T2-, PD-weighted images, and multi-echo 3D FLASH were acquired. The first echo time images (TE = 4.38 msec) of 3D FLASH were used instead of time-of-flight (TOF). QSM was calculated from the phase images of the 3D FLASH. The specimens were continuously cut at the same angle as the MRI cross-section and examined histologically using immunostaining for glycophorin A (to highlight the presence of intact and degraded erythrocytes) and adipophilin (to highlight intracellular lipid).After the registration of histological and MRI cross-sections by a radiologist, a pathologist evaluated a total of 79 sections and determined the ROIs of the IPH and lipid-containing areas. These ROIs were traced on MRI and QSM by two radiologists, and the signals were measured and averaged. Contrast-to-noise ratio (CNR) on T1WI, T2WI, PDWI, and TOF) between each component and agarose gel was calculated. On QSM, relative susceptibility value (SV) was calculated.

### RESULTS

The pathologist identified 59 LRNC, 13 foam cell aggregates (FA), 41 lipid-rich loose matrices (LRLM) as lipid-containing areas, and 23 IPH. Compared to IPH, FA showed lower signal intensity on TOF and LRLM showed higher signal intensity on T2WI (p lt; 0.05). Conventional MR images (T1-, T2-, PDWI, and TOF) showed no significant differences in CNR between LRNC and IPH. Meanwhile, SV of IPH measured on QSM was higher than that of all lipid-containing areas (plt;.01).

### CONCLUSION

In atherosclerotic plaques, lipids existed as LRNC, LRLM, or FA. Conventional MR seemed to have difficulty distinguishing LRNC from IPH, however, SV measured on QSM was significantly higher in IPH than that of all lipid-containing areas, including LRNC.

### CLINICAL RELEVANCE/APPLICATION

Ex vivo QSM was able to reliably distinguish between IPH and lipid-containing areas.

## T5B-SPNR-5 CHOROID PLEXUS ENLARGEMENT INDUCED MOTOR DYSFUNCTION IN SPINOCEREBELLAR ATAXIA TYPE 3

Chen Liu (*Abstract Co-Author*) Nothing to Disclose
Zhiming Zhen (*Presenter*) Nothing to Disclose

### PURPOSE

Spinocerebellar ataxia type 3 (SCA3) is an autosomal-dominant inherited disorder caused by CAG repeats in the ATXN3 gene. Neuroinflammation exacerbates SCA3 pathology, which has also been verified to increase choroid plexus (CP) damage. CP is a crucial structure for cerebrospinal fluid (CSF) production and brain homeostatic regulation. Few previous studies have assessed the relationship between CP and SCA3. We investigated CP structural changes and their correlation with motor dysfunction and disease progression in SCA3 patients.

### METHODS AND MATERIALS

MRI scans and clinical assessment on 56 SCA3 patients (12 pre-symptomatic and 44 symptomatic) and 45 healthy controls were performed. The CP volume (CPV) and other brain regions were measured using Freeusurfer7.3 software. Partial correlation, structural equation modeling, and multivariate regression were analyzed to explore the relationships among CPV, CAG repeats, brain structures, and motor scales.

### RESULTS

CPV was significantly increased in symptomatic SCA3 patients compared to controls and pre-symptomatic patients. CPV was positively correlated with CAG repeats, CSF volume, motor impairment and negatively correlated with cerebellar and brainstem volume. Structural equation modeling revealed that CPV mediated the effect of CAG repeats on motor function through CSF volume and brainstem atrophy. CPV and brainstem volume were independent predictors of motor function and could distinguish pre-symptomatic from symptomatic patients.

### CONCLUSION

This article first demonstrates that CP enlargement is a novel biomarker of motor dysfunction in SCA3. CP may be involved in the pathogenesis of SCA3 by affecting CSF circulation and brain homeostasis. Targeting CP could be a potential therapeutic strategy for SCA3.

### CLINICAL RELEVANCE/APPLICATION

Prior to the onset of ataxia, previous evidence suggested that there was already an initiation of neuronal dysfunction and neurodegeneration within cerebral structures. We have increased the physiological understanding of this part.The results suggest that aberrant CPV may play a crucial role in regulating SCA3 dysmotility, and early biomarkers could be utilized for monitoring disease progression in SCA3.CP is expected to provide a new target for the protection of SCA3 motor function.

## T5B-SPNR-6 ROLE OF DIFFUSION TENSOR IMAGING AS AN IMAGING BIOMARKER IN AMYOTROPHIC LATERAL SCLEROSIS: INSIGHTS INTO WHITE MATTER INVOLVEMENT ACROSS VARIOUS BRAIN REGIONS IN LIMBVSBULBARONSET

Maulik P. Vora, MBBS, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Amyotrophic lateral sclerosis (ALS) is a devastating neurodegenerative disease characterized by the progressive degeneration of motor neurons. This study aimed to investigate DTI metrics across various brain regions in ALS patients and explore their potential as imaging biomarkers.

**METHODS AND MATERIALS**

Twenty-one ALS patients were recruited and were classified according to the revised El-Escorial criteria as definite (n=7), probable (n=7), and possible (n=7) ALS. Patients were further categorized based on bulbar and limb onset. Thirteen healthy volunteers formed the control group. Standard MRI prescreening procedures were used to exclude subjects with contraindications or previous brain injury. DTI data were analyzed using commercial software. Regions of interest (ROIs) were manually defined in the white matter of the primary motor cortex, genu and splenium of the corpus callosum, mid-portion of the posterior limb of the internal capsule, and pyramidal eminence of the medulla oblongata. FA and MD values were measured by an experienced neuroradiologist and a radiologist.

**RESULTS**

Significant alterations in DTI metrics were observed, with decreased FA and increased MD values in the primary motor cortex and the posterior limb of the internal capsule bilaterally ($P < 0.05$). Additionally, reductions in FA and elevations in MD values were evident in the genu and splenium of the corpus callosum (CC) ($P < 0.05$). Significant differences was found in FA and MD values between ALS patients and controls across all examined brain regions in the definite disease group. In the probable disease group, significant alterations were observed in the primary motor cortex, posterior limb of the internal capsule, and CC. Among patients with possible disease, significant decreases in FA and increases in MD values were observed in the primary motor cortex and the posterior limb of the internal capsule ($P = 0.05$). However, no significant differences in FA or MD values were detected in the CC or pyramid in this subgroup.

**CONCLUSION**

DTI metrics revealed widespread white matter alterations in ALS patients, suggesting the involvement of various brain regions in disease pathology. The observed changes in FA and MD values may serve as potential imaging biomarkers for disease diagnosis and monitoring, particularly in differentiating between ALS subtypes and disease stages.

**CLINICAL RELEVANCE/APPLICATION**

The identification of distinct diffusion tensor imaging (DTI) patterns in amyotrophic lateral sclerosis (ALS), particularly in limb versus bulbar onset, provides crucial insights for early diagnosis, disease monitoring, and prognosis.

## T5B-SPNR-7 ADVANCED IMAGING TECHNIQUES USING A CARBON NANOTUBE-BASED MULTI-BEAM X-RAY SYSTEM WITH ANGIOGRAPHIC HEAD PHANTOM FOR VASCULAR IMAGING

Hanna Lee (*Abstract Co-Author*) Nothing to Disclose
Jehwang Ryu, PhD (*Abstract Co-Author*) Nothing to Disclose
Jinho Choi (*Presenter*) Nothing to Disclose

**PURPOSE**

This research aims to redefine the standards of vascular imaging by integrating a sophisticated multi-beam carbon nanotube (CNT) based X-ray system with the angiographic CT head phantom. The goal is to achieve unparalleled diagnostic precision planning in the field of neurovascular medicine.

**METHODS AND MATERIALS**

We have deployed the angiographic CT head phantom, featuring anatomically accurate synthetic skulls and precisely contrast-enhanced cerebral arteries, including the left anterior and middle cerebral arteries with diameters ranging from 0.5 mm to 4.0 mm. This high-fidelity phantom is used in conjunction with our advanced multi-beam X-ray system. The multi-beam system utilizes cutting-edge CNT technology, which allows for multiple simultaneous X-ray beams from diverse angles, thereby achieving comprehensive coverage and exceptional detail in the images captured. This system's capability for dynamic imaging is demonstrated through 3D reconstructions of CT data that vividly illustrate the cerebral vasculature's complexity.

**RESULTS**

The integration of the multi-beam X-ray system with the angiographic head phantom has produced striking imaging results. The enhanced resolution and multi-angle capability allow for detailed visualization of vascular pathologies, including the subtle features of cerebral aneurysms and arteriovenous malformations. The system has shown potential in providing clinicians with a more comprehensive understanding of vascular structures, essential for accurate diagnosis and strategic intervention planning. The 3D reconstructions derived from this system have significantly improved the visual assessment of vascular anomalies compared to traditional single-beam systems.

**CONCLUSION**

The use of a multi-beam system equipped with CNT technology in conjunction with an angiographic CT head phantom represents a significant advancement in the technology of vascular imaging. This system not only surpasses the capabilities of traditional X-ray imaging in terms of clarity and detail but also reduces exposure times and increases the efficiency of diagnostic processes. Its high-resolution, multi-perspective imaging offers a more thorough and nuanced understanding of complex vascular structures.

**CLINICAL RELEVANCE/APPLICATION**

The advanced imaging capabilities provided by this system are particularly beneficial for clinical practices specializing in neurology and vascular medicine. It enables detailed assessments that are critical for effective treatment planning and patient care in complex cerebrovascular conditions. As this technology continues to evolve, it is expected to play a pivotal role in advanced diagnostic, setting new benchmarks in the accuracy and efficacy of vascular imaging.

## T5B-SPNR-9 HYPOTHALAMIC SUBREGION VOLUMES AND FUNCTIONAL CONNECTIVITY IN ALCOHOL USE DISORDERS

Hyeonseok S. Jeong (*Abstract Co-Author*) Nothing to Disclose
Jin Kyoung Oh (*Abstract Co-Author*) Nothing to Disclose
Yong-An Chung, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The hypothalamus is involved in reward processing, with multiple nuclei having distinct functions and connectivity. However, in vivo human neuroimaging studies on their structural and functional alterations were scarce in drug addiction. This study investigated volumes and resting-state functional connectivity of the hypothalamic subregions in patients with alcohol use disorder (AUD) using the novel segmentation algorithm.

## METHODS AND MATERIALS

Twenty-four individuals with AUD and 24 healthy controls underwent brain magnetic resonance imaging. The hypothalamus was automatically segmented into five subregions. Volumes and functional connectivity of each subunit were compared between the two groups, and their clinical correlations were examined in the patients.

## RESULTS

AUD patients exhibited smaller volumes in the anterior- and tuberal-superior subregions, and altered functional connectivity in these subunits and anterior-inferior hypothalamus. Higher disease severity and longer duration of heavy drinking were associated with smaller volumes in the anterior- and tuberal-superior subunits, respectively, while total duration of abstinence was correlated with larger volumes in these subregions and enhanced functional connectivity of the tuberal-superior hypothalamus.

## CONCLUSION

This study provides initial evidence highlighting specific regional alterations within the hypothalamus associated with AUD. Our results suggest that both structural and functional abnormalities are predominant in the superior subregions and may be reversible with prolonged abstinence.

## CLINICAL RELEVANCE/APPLICATION

(1) Hypothalamic subregion volume and functional connectivity (FC) were examined in AUD. (2) AUD patients showed smaller volumes and altered FC in the superior subregions. (3) Disease severity and duration were inversely related to the superior unit volumes. (4) Abstinence period was positively associated with the superior unit volumes and FC. (5) Alcohol-induced deficits in the superior subregions may be recovered by abstinence.

# Abstract Archives of the RSNA, 2024

T5B-SPOB

**OB/Gynecology Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPOB-1 CLINICAL VALIDATION OF EXPERT CONSENSUS STATEMENTS ON MRI EVALUATION OF ATYPICAL UTERINE MASSES

Audrey E. Jacques, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Sarah Natas, BSc, FRCR (*Abstract Co-Author*) Nothing to Disclose
Anum Pervez, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Sultana Hasso, MBBS (*Abstract Co-Author*) Nothing to Disclose
Salil Patel, MD (*Abstract Co-Author*) Nothing to Disclose
Stephan Edey, MBBS, FRCR (*Presenter*) Nothing to Disclose

### PURPOSE

To validate the expert consensus MRI criteria proposed by the NYU Grossman School of Medicine group in the Radiological Society of North America (RSNA) 2023 publication for evaluating the risk of leiomyosarcoma in atypical uterine masses.

### METHODS AND MATERIALS

This retrospective study included patients who underwent pelvic MRI from 2015 to 2023 with reported atypical fibroids and subsequent surgery with histology. Two radiologists independently interpreted the MRI data blinded to histology, applying the criteria outlined in the RSNA publication. Radiological suspicion of malignancy was compared to final histological diagnosis. Key MRI features analysed included lesion size, apparent diffusion coefficient (ADC) values (binary cut-off of =0.905 x 10-3 mm2/s), T2 signal intensity, high b-value diffusion-weighted imaging (DWI) signal, extrauterine disease, and overall impression.

### RESULTS

Peritoneal implants and abnormal lymph nodes, although rare (5%), showed high specificity for sarcoma (96-98% for both radiologists). ADC values =0.905 x 10-3 mm2/s demonstrated moderate sensitivity (50-75%) and specificity (54-61%) for both radiologists. The combination of high T2 signal, high b1000 DWI signal, and low ADC yielded variable sensitivity (25-75%) and specificity (73-89%) between radiologists. Lesion size and volume showed moderate sensitivity (25-50%) and specificity (48-50%). Radiologists' overall impression had 50% sensitivity and 72-85% specificity for sarcoma, with fair interobserver agreement (Cohen's kappa 0.18, 68% agreement). Feature importance analysis revealed lesion size, ADC, and T2 signal as top predictors. Impression-based predictions demonstrated comparable performance between radiologists.

### CONCLUSION

This study highlights the potential of MRI for evaluating leiomyosarcoma risk, with peritoneal implants and abnormal lymph nodes demonstrating high specificity. While ADC values below =0.905 x 10-3 mm2/s and signal characteristics showed variable performance, their combination with lesion size may improve sarcoma prediction. Fair interobserver agreement emphasizes the need for further standardization and validation of MRI criteria.

### CLINICAL RELEVANCE/APPLICATION

Integrating the RSNA consensus MRI criteria into multidisciplinary preoperative planning, with a focus on lesion size, ADC values below =0.905 x 10-3 mm2/s, and extrauterine disease, may enhance risk stratification for atypical uterine masses. Further refinement of these criteria could optimize clinical management, balancing fertility preservation with oncologic principles.

## T5B-SPOB-3 THE VALUE OF DWI AND HIGH SPATIAL-TEMPORAL RESOLUTION MULTIPHASIC CONTRAST-ENHANCED MRI IN THE DIAGNOSIS OF ENDOMETRIAL CARCINOMA WITH MICROCYSTIC, ELONGATED, AND FRAGMENTED (MELF) PATTERN INVASION

Takashi Ota, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hideyuki Fukui, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Nakamoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kengo Kiso, MD (*Abstract Co-Author*) Nothing to Disclose
Shohei Matsumoto, MD (*Abstract Co-Author*) Nothing to Disclose
Toru Honda, MD (*Abstract Co-Author*) Nothing to Disclose
Kaketaka Koki, MD (*Abstract Co-Author*) Nothing to Disclose
Takahiro Tsuboyama, MD (*Presenter*) Nothing to Disclose

## PURPOSE

To assess the MRI findings of endometrial carcinoma with microcystic, elongated, and fragmented (MELF) pattern invasion and to evaluate the optimal sequences to detect deep myometrial invasion with MELF.

## METHODS AND MATERIALS

This retrospective study included 85 patients with endometrial cancer who underwent preoperative MRI, including high spatial-temporal resolution multiphasic dynamic contrast-enhanced MRI (DCE). DCE included 11 early phases (voxel size, 0.6*1.0*4.0 mm) in which the first 10 phases were acquired from 20 to 50 s after contrast injection with temporal resolution of 3 s, followed by 11th phase at 60 s. MELF pattern invasion was found pathologically in 17 patients. Three independent radiologists evaluated deep myometrial invasion and MRI findings possibly related to MELF. They first assessed T2WI and equilibrium phase CE-MRI, and then evaluated additional DWI and DCE. The MRI findings predictive of MELF were identified using a Chi-squared test and logistic regression analysis. The diagnostic performance for deep myometrial invasion was compared with and without additional DWI and DCE using the McNemar test in MELF and non-MELF groups.

## RESULTS

DWI signal gradation at the invasion front with DWI-CE mismatch (DG-DCM), tumor-myometrium synchronous early enhancement (TME), and peritumoral enhancement (PTE) type 2 were seen more frequently in the MELF group than in the non-MELF group by all readers ($P<0.05$). In logistic regression analysis, significant predictive factors for MELF were TME in all readers (sensitivity, 70.6-82.4%; specificity, 94.1-95.6%) and DG-DCM in 2 readers (sensitivity, 58.8-76.5%; specificity, 94.1-98.5%). For the diagnosis of deep myometrial invasion in the MELF group, the addition of DWI+DCE had significantly improved sensitivity for 2 readers (91.7 vs 16.7%, 83.3 vs 16.7%, $P < 0.01$), and accuracy for 1 reader (82.4 vs 35.3%, $P < 0.01$). In contrast, diagnostic accuracy did not change with the addition of DWI+DCE in the non-MELF group.

## CONCLUSION

Endometrial carcinoma with MELF may have characteristic MRI findings of DWI signal gradation with DWI-CE mismatch and TME. The value of DWI and DCE in detecting deep myometrial invasion may be high in MELF.

## CLINICAL RELEVANCE/APPLICATION

Endometrial carcinoma with MELF has been reported to be associated with a high frequency of lymphovascular invasion and underestimation of myometrial invasion on MRI. Our results may provide a clue for the correct preoperative diagnosis of MELF invasion and deep myometrial invasion.

# Abstract Archives of the RSNA, 2024

T5B-SPPD

**Pediatric Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPPD-1 ASSOCIATION OF QUANTITATIVE SUSCEPTIBILITY MAPPING (QSM) OF THE NEONATAL BRAIN WITH EARLY NEURODEVELOPMENTAL OUTCOMES IN CONGENITAL HEART DISEASE

Di Cui (*Abstract Co-Author*) Nothing to Disclose
Megan Martin (*Abstract Co-Author*) Nothing to Disclose
Janine M. Lupo, PhD (*Abstract Co-Author*) Grant, General Electric Company
Patrick McQuillen (*Abstract Co-Author*) Nothing to Disclose
Duan Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Shabnam Peyvandi (*Abstract Co-Author*) Nothing to Disclose
Jingwen Yao (*Abstract Co-Author*) Nothing to Disclose
Lauren Christopher (*Abstract Co-Author*) Nothing to Disclose
Elizabeth George, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Quantitative susceptibility mapping (QSM), due to its ability to distinguish oxyhemoglobin from deoxyhemoglobin, may provide noninvasive assessment of brain oxygenation in neonates in congenital heart disease (CHD). The purpose of this study is to assess the relationship of total and regional brain susceptibility (?) from QSM with 18-month neurodevelopmental outcomes in CHD.

### METHODS AND MATERIALS

Neonates with critical CHD who underwent MRI with 3D T2* GRE at 3T prior to surgical intervention were identified. QSM images were generated using custom-built processing pipeline and registered to the UNC brain atlas to derive total and regional (deep gray nuclei (DGN) and white matter (WM)) susceptibility (?). The total and regional ? were normalized to the ventricle ?. ND outcome was assessed at 18-months using Bayley Scales of Infant and Toddler Development (BSID). The primary outcomes were abnormal motor, cognition, or language defined as a score < 85 in the corresponding domain. The secondary outcome was death/severe neurodevelopmental delay defined as death or BSID motor, cognition, or language score <70. The median normalized total and regional susceptibility were compared between those with normal vs abnormal outcome using Wilcoxon rank sum test.

### RESULTS

The study included 21 neonates with neonatal MRI with QSM and neurodevelopmental outcomes. The cohort was majority male (81%, 17/21) with a mean gestational age (GA) at birth of 38.9 ± 1.0 weeks. The MRI was done at mean 6.0 ± 6.3 days of life and 39.6 ± 1.3 weeks GA. The cohort included 52.3% (11/21) transposition of great arteries, 38.1% (8/21) single ventricle physiology, and 9.5% (2/21) other CHD lesions.The median normalized DGN ? was higher among those with death/severe delay (-0.07 vs. -0.26, p=0.05, Figure). Those with abnormal motor, language, and cognition also tended to have higher median normalized DGN ? (p=0.06-0.15, Figure) than those with normal outcomes. The total and WM normalized ? were not significantly different among those with normal vs. abnormal neurodevelopmental outcome at 18 months.

### CONCLUSION

In this preliminary study, high neonatal normalized DGN ? tended to be associated with abnormal 18-month neurodevelopmental outcomes.

### CLINICAL RELEVANCE/APPLICATION

Regional ? may potentially be a marker of relative oxy- to deoxyhemoglobin content and hence of oxygenation in the neonatal brain and tended to be associated with early neurodevelopmental outcomes in CHD.

## T5B-SPPD-2 THE QUANTIFICATION OF CEREBRAL GLYMPHATIC SYSTEM IN CHILDREN DIAGNOSED WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER IS LINKED TO INSUFFICIENT SLEEP

Wen Chen (*Abstract Co-Author*) Nothing to Disclose
Rui Hu, MS (*Abstract Co-Author*) Nothing to Disclose
Yanwei Miao (*Abstract Co-Author*) Nothing to Disclose
Wei Du (*Abstract Co-Author*) Nothing to Disclose
Fan Tan (*Presenter*) Nothing to Disclose

### PURPOSE

To quantitative evaluation whether the abnormal glymphatic system function is relevant to attention-deficit/hyperactivity disorder (ADHD) using multimodal MRI imaging and explore the association of these changes with clinical indicators and executive function.

### METHODS AND MATERIALS

83 patients with ADHD (61 males and 22 females), median age 9.1 (8.0, 10.3) and 52 HC (36 males and 16 females), median age 10.0 (8.0, 11.7) were recruited through advertisements and voluntarily participated in the study and signed informed consent. All of the participants underwent routine MRI sequences, 3D-T1 BRAVO, diffusion kurtosis imaging (DKI) on a GE SIGNA architect 3.0T MRI. Statistical analysis was conducted on the clinical data, diffusion indices, and analysis along the perivascular space (ALPS) index of the ADHD and HC groups. The diffusion indices and ALPS index were corrected for multiple comparisons using FWE ($p < 0.05/10$). Age, gender, and years of education were used as covariates in a partial correlation analysis. Use the AUC of the ROC to evaluate the ability of ALPS index to diagnose ADHD. Establishing a combined diagnostic model based on the ALPS index and sleeping time to evaluate the diagnostic performance using logistic regression.

### RESULTS

Compared with the HC group, ADHD group participants had shorter sleeping times than HC participants, and ADHD group participants performed worse on attention, hyperactivity, and BRIEF tests ($p < 0.05$). Compared with HC (1.479 ± 0.145), ADHD patients had a lower ALPS index (1.384 ± 0.122). Results from partial correlation analysis revealed that the ALPS index was negatively correlated with hyperactivity ($r = -0.419$, $p = 0.000$), attention deficit scores ($r = -0.423$, $p = 0.000$), and also negatively correlated with working memory ($r = -0.441$, $p = 0.000$) and MI ($r = -0.274$, $p = 0.014$) in BRIEF. The ALPS index is positively correlated with sleeping time ($r = 0.496$, $p = 0.000$). A negative correlation existed between sleeping time and hyperactivity score ($r = -0.229$, $p = 0.041$) and working memory ($r = -0.340$, $p = 0.002$). ROC indicated good diagnostic efficiency for the combined model based on the ALPS index and sleeping time, with an AUC of 0.820.

### CONCLUSION

The glymphatic system functions are reduced in the brain in ADHD patients, and its activity is closely linked to sleep, symptoms, and executive function. Pathogenesis of ADHD might be linked to changes in the glymphatic system.

### CLINICAL RELEVANCE/APPLICATION

DTI-ALPS provided neuroimaging evidence for the dysfunction of the glymphatic system in patients with ADHD, which had certain clinical significance for the diagnosis and might have potential to evaluate the pathological and physiological changes associated with ADHD.

## T5B-SPPD-3 ASSOCIATION BETWEEN NEONATAL BRAIN INJURY AND MRI-VISIBLE PERIVASCULAR SPACE VOLUME

Sewon Oh (*Abstract Co-Author*) Nothing to Disclose
Jimin Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Oh Joon Kwon (*Abstract Co-Author*) Nothing to Disclose
Yoonho Nam (*Abstract Co-Author*) Nothing to Disclose
Dayeon Bak (*Abstract Co-Author*) Nothing to Disclose
Hyun Gi Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Arum Choi, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Injury can alter the glymphatic system in the neonatal brain. The objective of this study was to determine the association between MRI-visible perivascular space (PVS), which may reflect glymphatic system and brain injuries in neonates.

### METHODS AND MATERIALS

This retrospective study was performed at a single institution. Neonatal brain MRIs scanned at term-equivalent age were collcted. Neonates were grouped into those with visible brain injuries and those without injuries on brain MRIs. Using 3D T2-weighted sequences, automated segmentation and volume extraction were performed on the PVS in the basal ganglia (BG-PVS). By dividing the BG-PVS volume by the deep grey matter volume, the BG-PVS fraction was calculated. The volume and fraction of the BG-PVS were compared between neonates with and without brain injuries using the Mann-Whitney test.

### RESULTS

A total of 146 neonates (median [interquartile range, IQR] postmenstrual age at MRI scan, 38 [37-39] weeks; 74 [51%] females) were included, comprising 46 neonates with brain injuries (39 [37-40] weeks; 24 [52%] males) and 100 neonates without brain injuries (38 [37-39] weeks; 52 [52%] females). There were no significant differences in gestational age (P = .09) or postmenstrual age at MRI scan (P = .38) between the neonates with injuries and the control group. BG-PVS volumes were lower in neonates with brain injuries (median [IQR] volume in neonates with injury vs. without injury; 24 mm3 [14-42 mm3] vs. 34 mm3 [20-52 mm3]; P = .007). The BG-PVS fraction was significantly different between the two groups (median [IQR] fraction in neonates with injury vs. without injury; 0.003 [0.002-0.006] vs. 0.005 [0.003-0.008]; P = .04).

### CONCLUSION

Neonates with brain injuries had lower volumes and fractions of perivascular space in the basal ganglia, suggesting potential changes in glymphatic function in neonates with brain injuries.

### CLINICAL RELEVANCE/APPLICATION

This study show that neonates with brain injuries have reduced basal ganglia perivascular space volumes and fractions compared to their control group, suggesting glymphatic function alteration in the neonate with injuries. These findings underscore the clinical relevance of perivascular space evaluation in neonates to better understand the glymphatic system alterations associated with brain injuries, which may influence future diagnostic and therapeutic strategies.

# Abstract Archives of the RSNA, 2024

T5B-SPPH

**Physics Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPPH-1 ROBUST CBCT ENHANCING CONDITIONAL DDPM WITH STRUCTURE AND HISTOGRAM LOSS

Minkook Cho, PhD (*Abstract Co-Author*) Employee, Samsung Electronics
Seungyoung Kang (*Abstract Co-Author*) Nothing to Disclose
Sunjung Kim (*Abstract Co-Author*) Nothing to Disclose
Hyunwoo Lee, MS (*Abstract Co-Author*) Nothing to Disclose
Taeseong Kim (*Presenter*) Nothing to Disclose

### PURPOSE

Conventional CBCT images have lower uniformity compared to MDCT, and because of this, HU values are also inaccurate. To solve this problem, we propose a DDPM-based model with structure and histogram loss that improves CBCT using paired MDCT data.

### METHODS AND MATERIALS

CBCT were collected from 5 skull phantoms with a conventional dental CBCT scanner (T2 plus, Osstem Implant Co., Ltd., Seoul, South Korea) and paired MDCT were collected from 2 skull phantoms (skull 1 and 2). For skulls 3, 4 and 5, only CBCT was obtained and used for qualitative performance evaluation. MDCT was manually registered after changing voxel pitch, slice thickness, and FOV to match CBCT. For training, MDCT and CBCT were resized to 256 size. Skull 1 was used for model training, and skulls 2, 3, 4, and 5 were used for evaluation. Proposed model is based on conditional DDPM. MDCT and CBCT features were extracted using separate encoder, and concatenated at high level. Structure loss and histogram loss were added to MSE loss used in conventional DDPM. The structure part was taken from the SSIM as the structure loss, and the differentiable histogram loss was used as the histogram loss. The weight between each loss was set empirically. All models were trained using Nvidia GeForch RTX 4090 24GB and PyTorch, with 160k iteration.

### RESULTS

When structure loss is added to MSE loss, structural distortion does not occur during sampling process. MDCT, CBCT, and proposed method were compared in the same tissue (air, soft tissue, and teeth). In terms of HU value, the proposed method for all three tissues showed similar results to MDCT, and the difference in HU values depending on location on one slice was also reduced, showing better results in terms of uniformity compared to CBCT. Also line profile of proposed method showed the uniformity and HU value became more accurate with histogram loss. When sampling with skull 3, 4, 5 and clinical CBCT, the proposed method well performed without structural deformation even in severe cracks or airways that were not present in the training data.

### CONCLUSION

The proposed method maintained the structure of condition CBCT despite pixel-wise differences between CBCT and MDCT that existed even after manual registration. Also enhanced CBCT showed MDCT-level uniformity and HU accuracy. The proposed method can be applied to image translation in other modalities or between modalities

### CLINICAL RELEVANCE/APPLICATION

With CBCT scanning, MDCT level quality can be obtained, enabling accurate diagnosis and obtaining additional information such as bone density.

## T5B-SPPH-10 DIAGNOSTIC VALUE OF MR LYMPHANGIOGRAPHY IN PRIMARY CHYLURIA

Qi Hao (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the application value of MRL in the diagnosis of primary chyluria.

### METHODS AND MATERIALS

A total of 55 patients diagnosed with primary chyluria were retrospectively collected. All patients received MRL examinations. All MRL images were reviewed by two radiologists respectively. The statistical indexes included:?the morphology and dilatation of lymphatic vessels in the bilateral iliac, bilateral lumbar trunks, bilateral renal sinuses, thoracic duct, bilateral bronchial mediastinal trunks, bilateral cervical trunks, and bilateral subclavian trunks; ? the abnormalities of lymphatic vessels in the urinary system, abdominopelvic and thoracic region. The MRL signs of primary chyluria patients were statistically described by composition ratio of classification variables. Results Among the 55 cases of primary celiac disease, 45 (81.8%) had dilated left iliac lymphatics, 34 (61.8%) had dilated right iliac lymphatics, 54 (98.2%) had dilated retroperitoneal lymphatics, 53 (96.4%) had dilated left lumbar trunk, 34 (61.8%) had dilated right lumbar trunk, 15 (27.3%) had dilated left bronchial mediastinal trunk, 7 ( 12.7%) right bronchial mediastinal trunk dilation, 9 cases (16.4%) left cervical trunk dilation, 10 cases (18.2%) right cervical trunk dilation, 23 cases (41.8%) left subclavian trunk dilation, 15

cases (21.3%) right subclavian trunk dilation, 50 cases (90.9%) thoracic duct end dilation, 52 cases (94.5%) right thoracic duct dilation, 21 cases ( 38.2%) dilated left renal sinus lymphatics, 18 (32.7%) dilated right renal sinus lymphatics, 9 (16.4%) dilated pelvic lymphatics, 6 (10.9%) dilated mesenteric lymphatics, 3 (5.5%) dilated perineal lymphatics, 2 (3.6%) dilated bladder lymphatics, 1 (1.8%) dilated peripancreatic lymphatics, 8 (14.5%) splenic cystic lesions, and 3 (5.5%) skeletal cystic lesions.

**RESULTS**

MRL can clearly show the abnormalities of the central abdominal lymphatics in primary chyluria, and it can further show the site and degree of abnormal dilatation of the thoracic lymphatic trunk, the end of the thoracic duct, and the right lymphatic duct, and both can complement each other.

**CONCLUSION**

MRL can provide detailed image information for the diagnosis and treatment of primary chyluria, which is of great significance for preoperative evaluation and formulation of surgical plan.

**CLINICAL RELEVANCE/APPLICATION**

MRL can provide detailed image information for the diagnosis and treatment of primary chyluria, which is of great significance for preoperative evaluation and formulation of surgical plan.

## T5B-SPPH-11 FEASIBILITY OF DEEP LEARNING ALGORITHM-CONSTRUCTED SPECTRAL COMPUTED TOMOGRAPHY PULMONARY ANGIOGRAPHY IMAGES REPLACING AORTIC-PHASED IMAGING

Yuanfen Liu (*Abstract Co-Author*) Nothing to Disclose
Borong Tang (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine the feasibility of deep learning algorithm-reconstructed 40/50 keV monoenergetic Computed Tomography Pulmonary Angiography (CTPA) images for aortic phase imaging

**METHODS AND MATERIALS**

A retrospective analysis was conducted on 93 patients who underwent spectral CT pulmonary angiography (CTPA) and aortic phase (AP) imaging from July to August 2023. Monoenergetic CTPA images at 40keV and 50keV were reconstructed using deep learning image reconstruction algorithms at the medium (CTPA-40keV-DM) level. Additionally, 100-kVp and 120-kVp images for AP were reconstructed with an adaptive statistical iterative reconstruction (AR) algorithm, with a blending weight of 50% (AP-100kVp-AR, AP-120kVp-AR). Quantitative measurements and calculations were performed to assess the CT value (HU), standard deviation (SD), signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) within the aorta. Two board-certified radiologists independently performed subjective scoring on image quality using a 5-point scale.

**RESULTS**

On the aorta, CTPA-40keV-DM images showed comparable CT values with AP-100kVp-AR images, while CTPA-50keV-DM images had equal CT values to AP-120kVp-AR images (all $P > 0.05$). SD values were not statistically different between CTPA-50keV-DM and AP-120kVp-AR images ($P>0.05$). SNR comparisons indicated that CTPA-40keV-DM and AP-100kVp-AR, CTPA-50keV-DM and AP-120kVp-AR had comparable SNR values (all $P > 0.05$). In CNR comparisons, CTPA-40keV-DM and AP-100kVp-AR exhibited similar performance (all $P > 0.05$). For subjective scoring, the CTPA-50keV-DM images achieved the highest subjective score.

**CONCLUSION**

CTPA-50keV-DM images showed the same CT value and SD value as AP-120kVp-AR aortic phased-images, met the diagnostic requirement in terms of image quality, and even showed better in some parts.

**CLINICAL RELEVANCE/APPLICATION**

DLIR spectral CTPA images at low energies show potential for replacing AP scans to optimize patient radiation dose while maintaining diagnosis-required image quality.

## T5B-SPPH-12 ENHANCING BONE MRI: ADVANCED EDGE DETECTION, CS/CAIPI VIBE SEQUENCES, AND DEEP LEARNING RECONSTRUCTION ACROSS DIVERSE MODELS

Sheen-Woo Lee, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ieun Yoon, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To optimize MRI sequences for high-resolution bone imaging, comparing with CT. To develop an edge analysis method for quantitative assessment of phantom, CS VIBE, CAIPI-Dixon toward high resolution bone MRI.

**METHODS AND MATERIALS**

This IRB-approved study employed a 3.0-Tesla MR system and standard MDCT. The 3D CAIPI-DIXON VIBE sequence acquired four different contrast images, enhanced using a deep neural network (DNN) based on 2D U-net architecture (SwiftMR, AIRS Medical, Korea). ISMRM/NIST system phantom was imaged with following three MRI sequences: compressed sensing (CS), original (“Ori”) and deep learning-denoised (“Swi”) 3D CAIPI VIBE Dixon. MRI and CT images were analyzed for patients who underwent imaging within one month at a tertiary hospital. Five modalities were compared: conventional CT, original and DNN-enhanced Dixon MRI in both in- (“In”) and opposed-phase (“Op”) images. Linear regions of interest (ROIs) were drawn on high-contrast structures including phantom pin, glenohumeral cortex, and any bony Bankart lesion surfaces and then normalized against background noise. Metrics and grey scale values reflecting image sharpness—such as distances, value differences and gradients between the minimal and maximal points of greyscale values—were calculated. Qualitative assessments by a 4-point Likert scale were performed by two radiologists.

**RESULTS**

The difference between maximal and minimal grey values, indicating higher margin contrast, was highest in Swi-In compared to CS and Ori-In (CS, 891±81; Ori-In, 964±68; Swi-In, 1043±41; $p<0.05$) on phantom study. The study included 39 patients; 15 with and 24 without bony Bankart lesions. Cortex sharpness scores in both in- ($p<0.001$) and opposed-phase images ($p=0.02$) were higher with DNN and comparable to CT ($p=0.004$). The diagnostic accuracy for detecting bony Bankart lesions was excellent in all MRI modalities (93.3%±4.5%), similar to CT (97.5%). DNN reconstruction markedly reduced the noises in MRI ($p<0.001$). The value differences and the gradients between the greyscale values, after normalization, were significantly enhanced by DNN in both in- and opposed-phase images ($p<0.05$). The distances between minimal and maximal grey value points were significantly shorter in MRI than in CT for bony Bankart lesions and cortices ($p<0.05$), indicating greater sharpness in MRI images.

**CONCLUSION**

The 3D CAIPI VIBE Dixon MRI with DNN reconstruction provided sharply defined bone images, matching the diagnostic accuracy of CT. This suggests that Swi-CAIPI-Dixon can surpass conventional CS VIBE MRI in both quantitative and qualitative analyses.

**CLINICAL RELEVANCE/APPLICATION**

The 3D CAIPI VIBE Dixon MRI could potentially replace CT for evaluating bone, reducing radiation exposure and costs.

## T5B-SPPH-2 ADAPTIVE NOISE REDUCTION METHOD FOR FLAT-PANEL DIGITAL X-RAY DETECTORS

Minkook Cho, PhD (*Abstract Co-Author*) Employee, Samsung Electronics
Jinwoo Kim (*Abstract Co-Author*) Nothing to Disclose
Jongcheul Kim (*Presenter*) Nothing to Disclose

**PURPOSE**

The conventional denoising filters used to remove noise in x-ray images reduce noise but have the disadvantage of decreasing the spatial resolution of the image. In this study, we propose an adaptive denoising filter for x-ray projection images that minimizes the loss of spatial resolution while removing noise.

**METHODS AND MATERIALS**

The proposed denoising filter consists of a conventional smoothing filter and a logical mask restricting the filtering area. The logical mask checks whether the values of adjacent pixels fall within a pre-measured noise range for the signal of the pixel of interest. The logical mask can be calculated in two steps. First, the projections for several thicknesses of polymethyl methacrylate (PMMA) slabs are acquired for a specific x-ray spectrum. Second, the mean signal and noise are measured from the projections and curve fitting is performed. Each convolution operation is selectively performed by the logical operations. The logical mask prevents the blurring of material edges while smoothing uniform areas. The evaluations of the proposed method are performed for a commercial cone-beam computed tomography (CBCT) system (T2 Plus, Osstem Implant Co., Ltd., Seoul, KR).

**RESULTS**

Comparative analysis of modulation-transfer functions (MTFs) calculated from edge-knife images filtered by conventional and proposed filtering methods shows that the former significantly degraded the MTF performance, while the latter preserved the MTF curve. The visual inspection of the axial slices of a real-bone skull phantom reconstructed using raw and denoised projections shows that the material edges are well preserved in the proposed method, compared to the conventional mean filtering.

**CONCLUSION**

The proposed method can be used to denoise x-ray projections while minimizing spatial resolution loss. Further study includes extensive investigation of filter sizes, shapes, and logical masks for various imaging tasks.

**CLINICAL RELEVANCE/APPLICATION**

The proposed method will be helpful for the diagnosis of dental diseases by denoising CBCT images with minimal loss of spatial resolution.

## T5B-SPPH-3 DEEP LEARNING BASED METAL ARTIFACT REDUCTION IN DENTAL CBCT

Minkook Cho, PhD (*Abstract Co-Author*) Employee, Samsung Electronics
Sunjung Kim (*Abstract Co-Author*) Nothing to Disclose
Hyunwoo Lee, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

In dental cone-beam computed tomography (CBCT), it is essential to suppress metal artifacts caused by multiple metallic restorations. In this study, we propose an enhanced metal artifact reduction (MAR) approach that combines deep learning and a metal correction algorithm to improve the image quality of dental CBCTs.

**METHODS AND MATERIALS**

Firstly, metallic segments are accurately extracted from initial volume in an unsupervised manner. This step incorporates generative adversarial network (GAN) based domain transfer and convolutional neural network (CNN) based weakly supervised learning without using any predefined volumetric metal masks. After acquiring the corresponding metal-only projections, the metal regions in projection domain are restored using the proposed metal correction algorithm. This step includes gradient searching, hermite spline interpolation, and offset correction methods. Finally, after reconstructing a metal-free volume using the metal-corrected projections, the metallic segments extracted from initial volume are blended using the alpha-blending method.

**RESULTS**

After evaluated with intersection of union (IOU) and dice score (DCS), the proposed metal extraction method showed more than 90% accuracy regardless of the number of metallic segments. In addition, compared with conventional threshold-based method visually, the extracted metal masks showed high degree of similarity to the manual labels, reducing both false positive and negative errors. As for the MAR results, compared with conventional MAR method (LiMAR), proposed method achieved significant reduction of streak artifact and clearer edges of metallic segments in both axial and sagittal views.

**CONCLUSION**

The proposed method showed highly improved MAR performance. It is significant that the task of accurate metal extraction, fundamental to MAR, has been effectively addressed. Furthermore, the proposed metal correction algorithm substantially enhanced the representation around metallic segments by refined techniques such as calculation of surrounding gradients. Future work will involve comparative analysis with other MAR methods and evaluation of potential image distortions.

**CLINICAL RELEVANCE/APPLICATION**

In clinical settings, it is expected that the observation of surrounding teeth and bone tissues, often degraded by metal artifacts, will improve. Additionally, verifying the bone density around implants could help guide dental implant treatments.

## T5B-SPPH-4 EFFECTS OF DIFFERENT RECONSTRUCTION ALGORITHMS ON VIRTUAL MONOCHROMATIC AND IODINE/WATER MATERIAL DECOMPOSITION IMAGES BY CONTRAST-ENHANCED DUAL-ENERGY CT ON ROBUSTNESS OF

## RADIOMICS FEATURES OF RENAL CELL CARCINOMA

Hitoshi Takeuchi, MD (*Abstract Co-Author*) Nothing to Disclose
Haruhiko Machida, MD (*Abstract Co-Author*) Nothing to Disclose
Hidenori Yamaguchi (*Abstract Co-Author*) Nothing to Disclose
Shingo Harashima (*Abstract Co-Author*) Nothing to Disclose
Wakana Samejima (*Abstract Co-Author*) Nothing to Disclose
Yun Shen, PhD (*Abstract Co-Author*) Employee, General Electric CompanyResearcher, General Electric Company
Isao Tanaka (*Abstract Co-Author*) Nothing to Disclose
Rika Fukui (*Abstract Co-Author*) Nothing to Disclose
Etsuko Tate, MD (*Abstract Co-Author*) Nothing to Disclose
Makiko Nishikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Toshiya Kariyasu (*Abstract Co-Author*) Nothing to Disclose
Yuta Hirose, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

Radiomics analysis of virtual monochromatic (VMIs) and iodine/water material decomposition images (iodine MDIs) by contrast-enhanced dual-energy CT (ceDECT) is expected to predict the histological subtypes and grades of histological malignancy of renal cell carcinoma (RCC) and to monitor the tumor response to chemotherapy by machine learning at different iodine loads based on the patient's renal function. We performed a pilot study to investigate effects of different reconstruction algorithms on VMIs at various energy levels and iodine MDIs by ceDECT on robustness of the radiomics features.

### METHODS AND MATERIALS

We retrospectively enrolled 26 patients with clear-cell RCC who underwent ceDECT during the nephrographic phase with a 256-detector DECT scanner (Revolution CT, GE) using our routine protocol (the standard iodine load [600 mgI/kg], 9 patients with estimated glomerular filtration rate (eGFR) of = 45 mL/min/1.73 m2; 75% iodine load [450 mgI/kg], 10 patients with eGFR of = 30 and < 45; 50% iodine load [300 mgI/kg], 7 patients with eGFR of < 30; and volume CT dose index, 12.2 ± 3.3 [6.3-17.2] mGy) from March 2018 through December 2023 and were histologically proved. VMIs at 50, 60, and 70 keV and iodine MDIs of 1.25-mm slice thickness were reconstructed with iterative reconstruction (IR) and deep-learning reconstruction (DLR) algorithms (ASiR-V and TrueFidelity, respectively; GE). A region of interest was placed within each RCC semi-automatically segmented to extract the radiomics features, which were calculated using PyRadiomics, an open-source python library. We calculated 93 radiomics features of each RCC on the VMIs at 50, 60, and 70 keV and iodine MDIs to compare them between IR and DLR using Wilcoxon signed rank test.

### RESULTS

As shown in the Table, 44-66% of the radiomics features were comparable between IR and DLR (P = 0.09-0.98), except 52 features on the VMIs at 50 keV; 35 features, 60 keV; 32 features, 70 keV; and 42 features on the iodine MDIs. The robustness of the effects of these algorithms on the features was increased as the energy level on VMIs increased from 50 to 60 to 70 keV and more than a half of the features were robust on the VMIs at 60 and 70 keV and iodine MDIs.

### CONCLUSION

Effects of IR and DLR algorithms on the VMIs and iodine MDIs by ceDECT on 44-66% of the radiomics features of RCC are robust. Use of these algorithms on appropriate ceDECT images may allow image augmentation to train and build machine learning and/or deep learning models.

### CLINICAL RELEVANCE/APPLICATION

Use of IR and DLR algorithms may be helpful for developing computer-aided diagnosis systems and improving the diagnostic performance to predict the histological subtypes and grades of histological malignancy of RCC and to monitor the tumor response to chemotherapy by ceDECT.

## T5B-SPPH-5 DEEP LEARNING-BASED SPATIAL RESOLUTION IMPROVING ALGORITHM (PRECISE IQ ENGINE: PIQE) FOR MRI AT DIFFERENT ANATOMICAL AREAS: COMPARISON OF CAPABILITY FOR SCAN TIME REDUCTION AND IMAGE QUALITY IMPROVEMENT WITH CONVENTIONAL PROTOCOL WITH AND WITHOUT ZERO-INTERPOLATION FILLING (ZIP) AT 1.5 AND 3T SYSTEMS

Takahiro Ueda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiko Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshiyuki Ozawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Nagata (*Abstract Co-Author*) Canon Medical Systems Corporation
Yuichiro Sano, RT (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Maiko Shinohara (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Masao Yui (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Daisuke Takenaka, MD (*Abstract Co-Author*) Canon Medical Systems Corporation
Kaori Yamamoto (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Masato Ikedo (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takeshi Yoshikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD (*Presenter*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology

### PURPOSE

Deep learning reconstruction (DLR) and zero fill interpolation (ZIP) technique have been clinically applied for improving image quality and spatial resolution on routine clinical MRIs. Instead of ZIP technique, deep learning-based spatial resolution improving algorithm with denoising (Precise IQ Engine: PIQE) has been newly utilized to reduce scan time and transform MR data from original low-spatial resolution data to high-spatial resolution data. The purpose of this study was to directly compare utilities of PIQE for scan time reduction and image quality improvement of MRIs as compared with conventional MR protocols reconstructed by DLR with and without ZIP techniques at different anatomical areas.

### METHODS AND MATERIALS

28 consecutive patients suspected with 17 various brain tumors, 6 different spinal diseases and 5 musculoskeletal diseases were prospectively scanned with conventional MR protocols (224-382×256-512matrix) and new MR protocols (160-192×192-416matrix), which were obtained same sequences. Then, each conventional MR data was reconstructed by DLR with and without ZIP technique, and all new protocol data were reconstructed with and without ZIP or PIQE techniques (total five data sets). At each anatomical area, standard protocols were determined as conventional MR sequences reconstructed by DLR without ZIP technique. To compare scan time reduction and quantitative spatial resolution improvement among all protocols, mean examination time including reconstruction time and signal-to-noise ratios (SNRs) of different anatomical structures on each MR data at anatomical area were compared between standard protocol and others by Dunnett's test. To evaluate qualitative spatial resolution improvement, overall image quality,

artifact, normal structure visualization and diagnostic confidence level were assessed by 5-point scales and compared between standard protocol and others by Steel's multiple comparison test.

**RESULTS**

Mean examination times of new MR protocols were significantly shorter than that of conventional protocols ($p<0.05$), although SNRs had no significant differences between standard protocol and others. When compared with standard protocol at each anatomical area, overall image quality, artifact and normal structure visualization were significantly improved by conventional protocol reconstructed by DLR with ZIP and new protocol with PIQE ($p<0.05$).

**CONCLUSION**

PIQE can reduce examination time and has equal to or superior potential for image quality improvements, when compared with DLR with and without ZIP technique.

**CLINICAL RELEVANCE/APPLICATION**

PIQE can reduce examination time and has equal to or superior potential for image quality improvements, when compared with DLR with and without ZIP technique.

## T5B-SPPH-6 IMPROVED RESOLUTION AND PRECISION CARTILAGE T2 MAPPING USING DEEP LEARNING RECONSTRUCTION

Dawn Berkeley, BS (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Mo Kadbi, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation;
Wissam Alghuraibawi (*Abstract Co-Author*) Nothing to Disclose
Brian Tymkiw, ARRT, BS (*Abstract Co-Author*) Nothing to Disclose
Hung P. Do, PhD, MSc (*Presenter*) Employee, Canon Medical Systems Corporation

**PURPOSE**

Deep Learning Denoising Reconstruction (DLR) [1-2] has clinically used providing improved image quality, scan time, and resolution compared to Conventional reconstruction (CONV). Rigorous assessment of how DLR performs for quantitative imaging is needed before widespread clinical adoption. This study focuses on comparing T2 values and precision of the cartilage Multi-Echo Spin-Echo (MESE) T2 mapping sequence reconstructed with DLR and CONV.

**METHODS AND MATERIALS**

The MESE T2 mapping sequence with parameters shown in Fig 1 was performed at 3T on an NIST CaliberMRI Phantom (Boulder, CO) and in healthy subjects' knees. To assess the precision, the MESE T2 mapping sequence was scanned repeatedly 16 times. Vials with reference T2 of ~30-70ms were selected for the analysis [3]. Each MESE T2 data was reconstructed with both CONV and DLR.Regions of Interest (ROIs) were drawn identically on the DLR and CONV T2 maps on the selected vials. Mean and standard deviation (STD) of T2 values within each ROI were recorded for analysis. The precision for each vial was calculated as temporal STD of 16 repeated measurements [4]. Bland-Altman, Linear Regression, and paired Student's t-test were used to compare T2 values and precision between DLR and CONV [5].

**RESULTS**

T2 values from DLR and CONV are strongly correlated ($R2>0.997$) with negligible bias (<0.77ms) as shown in Fig 2 and 3. DLR provides an average of 33% smaller STD of T2 measurements compared to CONV.As seen in Fig 4, DLR improved precision by 35% and 54% ($p < 0.001$) compared to CONV for (256x256, R=2) and (320x320, R=3), respectively.Representative T2 maps acquired on a volunteer are shown in Fig 5. DLR provides T2 maps with higher SNR compared to CONV, especially in the short scan time and/or high-resolution settings (2nd and 3rd columns). DLR allows better delineations of the knee cartilage and small features, as indicated by the arrows.

**CONCLUSION**

High-resolution quantitative T2 mapping is often desired to reduce measurement errors due to partial volume effects and to better delineate superficial, middle, and deep layers of the cartilage. However, higher resolution leads to reduced SNR and longer scan time. This study demonstrated that, DLR allows acquisition of T2 maps with shorter scan time and/or higher resolution while maintaining T2 values with improved SNR and precision compared to CONV.

**CLINICAL RELEVANCE/APPLICATION**

DLR significantly improves SNR and precision of cartilage T2 mapping without affecting the T2 values. The SNR and precision gain allow DLR to acquire cartilage T2 maps with shorter scan time and higher resolution, making it clinically relevant (i.e., higher resolution than typically recommended [6] in less than 5-min scan time).

## T5B-SPPH-8 IMPACT OF MONOCHROMATIC ENERGY LEVELS AND ITERATIVE ALGORITHMS ON RIGHT ADRENAL GLAND IMAGE QUALITY INTHE PORTAL PHASEDUAL ENERGY CT

Mingyue Wang, BS (*Abstract Co-Author*) Nothing to Disclose
Zi Tian Tsang, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the influence of different monochromatic energy levels and adaptive statistical iterative reconstruction-Veo (ASiR-V) algorithm, on the image quality of the right adrenal gland in the portal phase dual energy CT (DECT).

**METHODS AND MATERIALS**

21 patients who underwent upper abdominal enhanced portal venous phase DECT scanning (Revolution CT, GE) were retrospectively enrolled. The virtual monochromatic images, including 40 keV,55keV and 70 keV, were reconstructed by ASiR-V at 0%,20%,40%,60%, and 80% strength levels, respectively. 15 image groups were reconstructed. The CT value, standard deviation (SD), the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of right adrenal gland in all image groups were calculated respectively. Additionally, subjective scoring using a 5-point scale (scores >3 for diagnosis) was conducted for the body, medial branch, and lateral branch of the right adrenal gland to evaluate anatomical structure, details, and edge visibility. The objective and subjective evaluations were compared at different image groups.

**RESULTS**

No significant statistical differences were found in the CT values of the right adrenal gland among six different ASiR-V reconstruction strength levels for each of the three monochromatic image sets (All $P >0.05$, such as CT values of ASIR-V weights from 0%-80% at 55 keV: 158.29±26.01Hu, 161.05±38.90Hu, 156.00±26.39Hu, 154.71±25.94Hu, 153.29±26.08Hu). As the ASiR-V strength increased, the SD values decreased gradually, while

SNR and CNR increased in different monochromatic image sets. (All P < 0.05, such as SD at 55 keV: decreased from 47.9±12.1 to 27.2±11.2, respectively). The subjective scoring of 60%ASiR-V have highest score at 40 and 55 keV (both were 5.00±0.00) than other image groups.

**CONCLUSION**

according to subjective and objective evaluation, ASiR-V at 60% strength provided optimal image quality for the right adrenal gland at 40 and 55 keV images.

**CLINICAL RELEVANCE/APPLICATION**

40~55 KeV with ASiR-V at 40% ~60%strength was clinically significant for observing fine anatomical structures in the abdomen, such as the right adrenal gland. This allows for clear visualization of anatomical structures, details, and edges, facilitating accurate diagnosis of lesions. ASiR-V weighting strength below 40% may increase image noise, while strength exceeding 60% may reduce spatial resolution. Therefore, ASiR-V at 40%~60% reconstruction is recommended for observing small anatomical structures.

# Abstract Archives of the RSNA, 2024

T5B-SPVA

**Vascular Imaging Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-SPVA-2 PERFORMANCE OF AAA AI TRIAGE SOFTWARE ON REAL-WORLD PATIENT DATA

Matthew S. Lazarus, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Edward Mardakhaev, MD (*Abstract Co-Author*) Nothing to Disclose
Tim Duong, PhD (*Abstract Co-Author*) Nothing to Disclose
Lilian D. Atlan, MD (*Abstract Co-Author*) Nothing to Disclose
Skip McCann (*Abstract Co-Author*) Nothing to Disclose
Devaraju Kanmaniraja, MD (*Abstract Co-Author*) Nothing to Disclose
Maayan Gerbi (*Abstract Co-Author*) Nothing to Disclose
Nieves Morales, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Abdominal aortic aneurysm (AAA) is a potentially life-threatening dilation of the abdominal aorta and is frequently undiagnosed until rupture. AAA affects between 0.4% and 7.6% of the general population. AAA is most commonly diagnosed using Computed Tomographic Angiography (CTA). This study retrospectively evaluated the performance of an FDA-approved artificial intelligence (AI)-based triage software to detect AAA for accuracy of detection in a large metropolitan healthcare system.

### METHODS AND MATERIALS

A total of 341 retrospective CTAs extracted from the Montefiore Health System from 2020 to 2023 were analyzed using an FDA-approved AAA identification algorithm (Viz.ai, inc), of which 158 of these CTAs were positive for AAA and 183 CTAs were negative. There were 25 positive scans that had a graft repair present at the time of CTA acquisition. Algorithm findings were compared with previous radiologist reads of the CTA scans and assessed for accuracy. Findings were reviewed by three board-certified radiologists and consensus was reached in all cases.

### RESULTS

Of the 341 total CTAs, there were 21 discrepancies between ground truth and AI software AAA identification. There were 161 CTA found to be positive by the AI software, and 3 false positives. Reasons for the false positives were aortic ectasia (1), aortic dissection pathology (1), and incorrect CTA location (1). All 25 patients with graft repairs were identified by the Viz AAA algorithm as positive. There were 201 CTAs read as negative by the AI software, of which 18 were found to be false negatives. Reasons for the false negatives were aortic thrombus or plaque (9), aortic dissection pathology (3), CTA scan artifacts (1), blurred scan boundaries (1), and unexplainable (4). AAA algorithm sensitivity was calculated to be 88.6%, and specificity was calculated to be 98.4%.

### CONCLUSION

These results further support AI-based detection and referral software for AAA is accurate and has the potential to assist radiologists to improve clinical care.

### CLINICAL RELEVANCE/APPLICATION

Abdominal aortic aneurysm is a common and life-threatening condition. This AI-based detection tool has the potential to improve diagnosis and facilitate proper follow-up.

# Abstract Archives of the RSNA, 2024

W2-SPBR

**Breast Imaging Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPBR-1 DIAGNOSTIC ACCURACY OF AN IMAGE-ONLY DEEP LEARNING MODEL TO PREDICT SPECTRUM OF DIVERSE TUMOR SUBTYPES

Madeline H. Carney, MD (*Abstract Co-Author*) Nothing to Disclose
Constance D. Lehman, MD, PhD (*Abstract Co-Author*) Institutional Grant, General Electric Company;Institutional Grant, Hologic, Inc;Co-founder, Clairity, Inc.
Sarah Mercaldo, PhD (*Abstract Co-Author*) Nothing to Disclose
Leslie Lamb, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Andrew R. Carney, MS (*Abstract Co-Author*) Nothing to Disclose
Heba Albasha, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Breast cancers have diverse biologic features associated with variable prognoses. Prognosis informs the course of illness, treatment selection, and stratification for experimental treatments. The purpose of this study is to assess the performance of an image-only deep learning (DL) risk model to predict breast cancer histologic subtypes, grades, and molecular subtypes.

### METHODS AND MATERIALS

This retrospective, multisite study included consecutive women >40 years undergoing routine bilateral screening mammography across six sites from 2015 to 2022. A DL 5-year image-only model was used to assess risk. Mammograms used for model development and those with bilateral cancers were excluded. Patient demographics were retrieved from electronic health records. Cancer outcomes were obtained through linkage to a regional tumor registry. Diagnostic accuracy of DL model in predicting histologic subtypes, grades, and molecular subtypes were estimated using areas under the receiver operating characteristic curve (AUCs) with DeLong test ($P<0.05$).

### RESULTS

258,753 bilateral screening mammograms in 92,454 patients met inclusion criteria. Mean age was 60y (IQR: 51-69y). 20.1% (51,896/258,753) had a family history of breast cancer, 79.2% (205,060/258,753) were post-menopausal, and 39.9% (102,994/258,154) had dense breasts. 1326 cancers were diagnosed: 78.1% (1035) invasive and 21.9% (291) DCIS. There was no evidence of a significant difference in predicting invasive cancer, AUC 0.83 (95% CI: 0.82, 0.84) vs DCIS, 0.85 (95% CI: 0.82, 0.87), P=0.28. The AUC was higher in predicting IDC, 0.84 (95% CI: 0.82, 0.85) vs ILC, 0.78 (95% CI: 0.74, 0.83), P=0.02. For invasive disease, the higher the grade, the higher the AUC (P range 0.05-<0.001). This trended for DCIS. The AUC in predicting luminal A cancers was 0.82 (95% CI: 0.80, 0.83), luminal B 0.90 (95% CI: 0.87, 0.94), triple negative 0.85 (95% CI: 0.79, 0.90), and HER2 enriched 0.90 (95% CI: 0.85, 0.96). For DCIS, the AUC of the model in predicting ER+ and/or PR+ disease was 0.85 (95% CI: 0.82, 0.88) and ER- and PR- 0.77 (95% CI: 0.68, 0.86).

### CONCLUSION

Mammograms contain highly predictive biomarkers of future cancer risk. A DL model using screening mammography alone can accurately discriminate patients at risk of developing diverse tumor histologic subtypes, grades, and molecular subtypes, including poor prognostic cancers.

### CLINICAL RELEVANCE/APPLICATION

An image-only DL risk model derived automatically at the time of screening mammography can accurately identify patients at risk of developing poor prognostic cancers. DL assisted radiomics has the potential to improve current prognostic models based on tumor biology and enhance future approaches to guide personalized treatment.

## W2-SPBR-10 ENHANCING DIAGNOSTIC EFFICACY OF ULTRASOUND LESIONS WITH CONTRAST-ENHANCED MAMMOGRAPHY (CEM)

Huizhi Cao (*Presenter*) Nothing to Disclose

### PURPOSE

The aim is to evaluate the diagnostic efficacy of contrast-enhanced mammography (CEM) in distinguishing between benign and malignant breast ultrasound lesions, with the goal of enhancing the accuracy of breast disease diagnosis.

**METHODS AND MATERIALS**

A retrospective analysis was conducted on patient data from our hospital between September 2022 and October 2023. Patients with clinically diagnosed breast lesions underwent both CEM and ultrasound examinations. Pathological diagnosis served as the reference standard to analyze the diagnostic performance of single (CEM or ultrasound) and combined (CEM and ultrasound) examinations for breast lesions.

**RESULTS**

The study comprised 144 subjects, including 27 cases of breast cancer and 117 benign lesions, with an average age of 40.5 years (range: 22 to 69 years). Ultrasound exhibited sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV) of 70.4%, 92.3%, 88.2%, 67.9%, and 93.1%, respectively. Contrastingly, CEM demonstrated significantly improved sensitivity (100%) and NPV (100%), with a smaller change in accuracy (89.6%). Specificity (87.2%) and PPV (64.3%) decreased for CEM. CEM showed a significantly higher breast cancer detection rate than ultrasound ($P < 0.05$). Moreover, the combination of CEM and ultrasound yielded superior diagnostic performance compared to either modality alone, with significantly improved sensitivity (100%), specificity (99.1%), PPV (96.4%), NPV (100%), and accuracy (99.3%).

**CONCLUSION**

CEM enhances the sensitivity and NPV of ultrasound screening, suggesting its utility in improving diagnostic accuracy. Combining CEM with ultrasound boosts clinical diagnostic confidence.

**CLINICAL RELEVANCE/APPLICATION**

CEM, with its capability to detect calcifications and assess hemodynamic features, complements ultrasound findings. The combination of CEM and ultrasound substantially enhances the diagnostic efficiency of breast lesions, offering considerable clinical value.

## W2-SPBR-2 RETHINKING RADIAL SCARS: EFFECT OF RADIOLOGY-PATHOLOGY CONCORDANCE REVIEW ON RADIAL SCAR MANAGEMENT

Ramapriya Ganti, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Jessie Jahjah, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela K. Cunha, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Nguyen, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Radial scars (RS) have typically been sent for excision despite a low rate of upgrade to malignancy on surgical excision. At our practice, we initiated a protocol of collaborative review by radiologists and pathologists for every RS found on core needle biopsy. We are now only recommending excision for RS cases that are suspicious on imaging, potentially undersampled, such as if the imaging finding is larger than 1 cm, or not largely excised on pathology. The purpose of this study is to evaluate the change in rate of upgrade to malignancy for RS that were recommended for excision after implementing this practice change and investigate the incidence of interval cancers in RS cases that were not recommended for excision.

**METHODS AND MATERIALS**

A HIPAA compliant retrospective review was performed at a single institution. Our biopsy database was reviewed to collect all RS found on core needle biopsy from 1/1/2022 after we implemented the change in managing RS (post-protocol) until 6/1/2023. For comparison time period, the database also collected all RS between the time period of 1/1/2018 until 12/31/20, when every RS was recommended for surgical excision at our institution (pre-protocol). RS associated with malignancy or with atypical ductal hyperplasia were excluded. For both time periods, the surgical pathology after excision was reviewed. For the patients who had imaging followup recommended, the patient's electronic medical record was reviewed and analyzed for subsequent breast cancer development within one year of biopsy.

**RESULTS**

During the 2022-2023 period, there were 61 cases of RS found on core needle biopsy. Of these, 28/61 (45.9%) patients had imaging surveillance recommended after radiology-pathology review with no interval cancers development seen in this group within a year after the biopsies. The remaining 33 (54.1%) patients were recommended for surgical excision after the biopsy. Of the 33 lesions that were surgically excised, 3/33 (9.1%) were found to have ductal carcinoma in situ (DCIS) on surgical pathology. In contrast, 72 cases of RS were found on core needle biopsy during the 2018-2020 time period, which were all recommended for surgical excision. 5 of those cases (6.9%) were upgraded to DCIS on surgical excision.

**CONCLUSION**

The upgrade rate of RS recommended for surgical excision increased after selective excision of RS based on radiology-pathology concordance review. No interval cancers developed in patients that appeared appropriately sampled.

**CLINICAL RELEVANCE/APPLICATION**

Clinicians should be aware of the upgrade potential of RS to malignancy. Understanding the upgrade potential of RS to malignancy and the role of radiology-pathology correlation may help tailor surgical decisions and potentially reduce surgery in certain cases.

## W2-SPBR-3 DISCORDANCE OF RADIOLOGIC AND PATHOLOGIC COMPLETE RESPONSE IN PATIENTS WITH TRIPLE-NEGATIVE BREAST CANCER UNDERGOING NEOADJUVANT CHEMOTHERAPY

Dezheng Huo (*Abstract Co-Author*) Nothing to Disclose
Frederick M. Howard, MD (*Abstract Co-Author*) Nothing to Disclose
Rita Nanda, MD (*Abstract Co-Author*) Advisory Board, Cardinal Health, Inc;Advisory Board, FUJIFILM Holdings Corporation;Advisory Board, ITeos Therapeutics;Advisory Board, OncoSec Medical Incorporated;Research funded, OncoSec Medical Incorporated;Advisory Board, Merck & Co, Inc;Research funded, Merck & Co, Inc;Research funded, Arvinas, Inc;Research funded, AstraZeneca PLC;Research funded, Bristol-Myers Squibb Company;Research funded, Corcept Therapeutics Inc;Research funded, F. Hoffmann-La Roche Ltd;Research funded, Immunomedics, Inc;Research funded, Merck & Co, Inc;Research funded, Cubist Pharmaceuticals;Research funded, Odonate Therapeutics;Research funded, Pfizer Inc;Research funded, Otsuka Holdings Co, Ltd
Kirti M. Kulkarni, MD (*Abstract Co-Author*) Nothing to Disclose
Wenji Guo (*Abstract Co-Author*) Nothing to Disclose
Asim Dhungana (*Presenter*) Nothing to Disclose

**PURPOSE**

Pathologic complete response (pCR) following neoadjuvant chemotherapy (NAC) is a key marker of long-term outcomes in patients with triple-negative breast cancer (TNBC). Accurate radiologic assessment of response to NAC using breast MRI and US plays an important role in guiding decisions regarding

choice and duration of treatment. We examined the discordance between post-NAC radiologic complete response (rCR) and pCR in patients with TNBC.

**METHODS AND MATERIALS**

This is a retrospective cohort study of patients from a single institution diagnosed between January 2013 and April 2022 with TNBC who underwent dynamic contrast-enhanced MRI or US breast imaging before and after NAC. Radiology reports of post-NAC MRI and US scans were examined for presence of rCR, and these findings were correlated with pathologic stage on surgical resection. Concordance between rCR and pCR was measured using Cohen's kappa (?) statistic. Association between the receipt of immunotherapy (IO) and pCR among patients without rCR on post-NAC MRI/US was measured using Fischer's exact test. P-values less than 0.05 were considered statistically significant.

**RESULTS**

We identified 186 patients (all female, mean age 52 years) from the cohort meeting the inclusion criteria, including 82 (44%) Black, 82 (44%) White, 12 (6.5%) Asian, 8 (4.3%) Hispanic, 1 (0.5%) Native American, and 1 (0.5%) Other. 166 (89%) patients had high tumor grade, 174 (94%) patients had ductal histologic subtype, 81 (44%) patients had pCR, and 34 (18%) patients received IO. Overall, concordance between pCR and MRI was found in 109/137 (80%) patients (? = 0.57), while concordance between pCR and US was found in 96/142 (68%) patients (? = 0.30). Among patients not receiving IO, pCR and MRI were moderately concordant (? = 0.60), and pCR and US were weakly concordant (? = 0.42). Discordance was pronounced in those receiving IO, with reduced concordance between pCR and MRI (? = 0.39), and no concordance between pCR and US (? = 0.05). Among patients with no rCR on MRI, there was a strong association between IO and pCR (p = 0.009) with a poor negative predictive value (NPV) of 50% in patients who received NAC with IO compared to an NPV of 84% in patients who received NAC without IO.

**CONCLUSION**

We present novel data that demonstrate a statistically significant reduction in the NPV of post-NAC MRI in patients with TNBC who received IO.

**CLINICAL RELEVANCE/APPLICATION**

These findings suggest that post-NAC MRI may overcall residual tumor in patients with TNBC receiving IO, potentially leading to unnecessary continuation of chemotherapy. Further research is necessary to better characterize the underlying radiologic features responsible for discordance and whether alternative metrics or modalities may better assess response to neoadjuvant therapy.

## W2-SPBR-4 CONTRAST ENHANCED MAMMOGRAPHY GUIDED BIOPSY USING A PRONE TABLE: INSIGHTS AND PRELIMINARY OUTCOMES

Vittorio Miele, MD (*Abstract Co-Author*) Nothing to Disclose
Cecilia Boeri (*Abstract Co-Author*) Nothing to Disclose
Ludovica Anna Incardona (*Abstract Co-Author*) Nothing to Disclose
Jacopo Nori Cucchiari (*Abstract Co-Author*) Nothing to Disclose
Federica Di Naro, MD (*Abstract Co-Author*) Nothing to Disclose
Giulia Bicchierai (*Abstract Co-Author*) Nothing to Disclose
Lucia Giudice (*Abstract Co-Author*) Nothing to Disclose
Ermanno Vanzi, MD (*Abstract Co-Author*) Nothing to Disclose
Elsa Cossu, MD (*Abstract Co-Author*) Nothing to Disclose
Diego De Benedetto (*Abstract Co-Author*) Nothing to Disclose
Chiara Bellini, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To describe our single-center experience of contrast-enhanced mammography (CEM)-guided biopsy using a prone table in terms of procedural features and histopathological results.

**METHODS AND MATERIALS**

We retrospectively reviewed all consecutive CEM examinations performed at our institution for presurgical staging or problem solving for inconclusive findings from December 2023 to January 2024. We considered eligible for CEM-guided biopsy any suspicious finding visible just in recombined images (RC) and negative at conventional imaging, defined as "only-CEM lesion" (OCLs). All the biopsies were performed after intravenous administration of contrast media and dual-energy acquisition with a vacuum-assisted biopsy system. Patient age, breast density, background parenchymal enhancement (BPE), presence and type (mass, non-mass and enhancing asymmetry) of enhancement of the target lesion, procedural time, complications and histopathological results were collected.

**RESULTS**

A total of 19 suspicious OCLs in 19 patients (median age 63 years) were referred for CEM-guided biopsy in the study period. Breast density was predominantly B (42.1%) and C (26.3%), with background parenchymal enhancement (BPE) mostly mild (42.1%) or moderate (36.8%). Of the 19 OCLs referred for CEM-guided biopsy, 3 (15.8%) did not show a clearly visible enhancement during the procedure, while 9 (47.3%) presented as mass enhancements and 7 as non-mass enhancements (36.8%), with a median size of 17.26 mm. The median procedural time was 15.8 min (range 15 - 20 min). Complications were limited to self-limiting hematomas in 26% (5/19) of cases; no vasovagal reactions were recorded. Histological evaluation revealed 2 (10.5%) malignant lesions, one invasive ductal carcinoma (IDC) and one ductal carcinoma in situ (DCIS), and 2 (10.5%) lesions of uncertain malignant potential, including a radial scar and lobular intraepithelial neoplasia, with the remaining 15 lesions (78.9%) being benign, such as fibrocystic changes, mastopathy, and fibroadenomas.

**CONCLUSION**

Preliminary results from using prone-table for CEM-guided biopsies underscore its potential to enhance procedural comfort and efficiency, validating this innovative approach.

**CLINICAL RELEVANCE/APPLICATION**

CEM-guided biopsy using a prone-table system is feasible and can be a safe and comfortable procedure for enhancing-only lesions.

## W2-SPBR-7 PREDICTORS OF MALIGNANCY FOR INCIDENTAL BREAST FINDINGS DETECTED ON PRIOR NON-BREAST IMAGING

Ramin Khorasani, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Catherine S. Giess, MD (*Abstract Co-Author*) Nothing to Disclose
Fatima Salah, MD, FRCR (*Presenter*) Nothing to Disclose

**PURPOSE**

Incidental breast findings detected by radiologists in patients undergoing non-breast imaging exams frequently generate recommendations for diagnostic mammography. Purpose is to assess the rate and predictors of malignancy in diagnostic mammography of breast findings detected by radiologists on a prior non-breast imaging exam.

**METHODS AND MATERIALS**

This Institutional Review Board-approved, retrospective cohort study was conducted at a tertiary academic medical center and affiliated outpatient centers. The study cohort included all unique patients with diagnostic mammograms performed to evaluate breast findings detected on prior non-breast imaging exams between 1/1/2016-12/31/2018. Patient- and imaging-related factors were extracted from the institutional data warehouse; BIRADS score and tissue diagnosis from the electronic health record. Malignancy, the primary outcome, was defined as subsequent diagnosis of breast or other cancer (e.g., metastasis) at the original breast finding site =2 years after index mammogram. Percent of actionable findings (BIRADS =3) and of patients undergoing breast procedures was recorded. Univariate analysis and multivariable logistic regression determined factors associated with malignancy.

**RESULTS**

Overall 210 of 22,273 (0.94%) diagnostic mammography patients underwent imaging to evaluate a breast finding detected on prior CT, PET/CT, or non-breast MRI. Average patient age was 58.9 years, predominantly female (201/210, 95.7%), and almost half (47.6%; 100/210) were scored BIRADS =3. More than one-third (36.2%; 76/210) underwent a breast-related procedure based on a recommendation in the index mammogram report. 21.4% of all patients (45/210), and 47.4% (36/76) of those who underwent a procedure, were subsequently diagnosed with malignancy. On multivariate analysis, older age (Odds Ratio 1.03; 95%Confidence Interval 1.00-1.06) and PET/CT study as the initial imaging modality (Odds Ratio 5.74; 95%Confidence Interval 2.38-13.87) were more likely to be associated with malignancy. Prior personal or family history of breast cancer were not significantly associated with a malignancy outcome on univariate analysis. Asymmetry was the least likely initial finding to yield malignancy.

**CONCLUSION**

A substantial percentage of incidental breast findings initially detected by non-breast imaging and referred for diagnostic breast evaluation yield actionable findings, including malignancy.

**CLINICAL RELEVANCE/APPLICATION**

Incidental breast findings detected on non-breast imaging exams, particularly masses found on PET/CT, are commonly associated with malignancy, and should be carefully evaluated.

## W2-SPBR-8 MID-TERM OUTCOMES OF MRI/ULTRASOUND FUSION-GUIDED BIOPSY FOR MRI-DETECTED BREAST LESIONS: AN IN-DEPTH EVALUATION OF DIAGNOSTIC ACCURACY AND FALSE-NEGATIVE CASES

Takayoshi Uematsu, MD, PhD (*Abstract Co-Author*) Research collaboration, FUJIFILM Holdings Corporation;
Taiyo L. Harada (*Abstract Co-Author*) Nothing to Disclose
Kazuaki Nakashima, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

The objective of this study is to assess the mid-term diagnostic accuracy and false negatives of breast biopsy using MRI/ultrasound (US) fusion technology for breast lesions detected by MRI but not identified by second-look US.

**METHODS AND MATERIALS**

A total of 275 lesions in 255 Asian patients who underwent MRI/US fusion-guided biopsy between 2015 and 2023 were analyzed. The lesions were detected on contrast-enhanced breast MRI which was performed for the preoperative assessment of breast cancer or screening for hereditary breast and ovarian cancer, but not identified by following second-look US. MR and US images were synchronized and displayed simultaneously on the US monitor using a commercially available magnetic position tracking system composed of US scanner, magnetic field generator, and magnetic sensor. We evaluated the histopathological results of MRI/US fusion-guided biopsies and surgeries, the accuracy of the biopsies, and cases that were found to be malignant during follow-up observation after biopsy (false negatives).

**RESULTS**

The pathological results of the biopsies were as follows: invasive carcinoma (7%, 20 cases), non-invasive ductal carcinoma (16%, 43 cases), atypical ductal hyperplasia (ADH) or lobular neoplasia (7%, 19 cases), and benign (70%, 193 cases). The benign lesions were followed up for 0-105 months (median 39 months). Two non-mass enhancements, measuring 18mm and 28mm in diameter and initially diagnosed as benign, were later identified as invasive cancer and ADH in re-biopsies. Consequently, the false negative rate of MRI/US fusion-guided biopsies was determined to be 1% (2 out of 193 cases).

**CONCLUSION**

The false-negative rate of breast biopsy using MRI/US fusion for MRI-detected lesions was demonstrated to be very low. Most cases that were difficult to identify with fusion technology were benign lesions. Early diagnosis of non-invasive cancer prior to progression to invasive cancer seems to be possible even for such false-negative cases through appropriate imaging follow up.

**CLINICAL RELEVANCE/APPLICATION**

In the current situation where MRI is becoming more common for breast cancer screening according to breast cancer risk, this study has shown that MRI/US fusion technology can be safely used as an alternative option for MRI-guided biopsy, especially for Asian women.

## W2-SPBR-9 PURE DUCTAL CARCINOMA IN SITU (DCIS) AT VACUUM ASSISTED BIOPSY (VAB): ANALYSIS OF UPGRADE AND PREDICTORS OF INVASIVENESS

Daniela Bernardi, MD (*Abstract Co-Author*) Nothing to Disclose
Daria Volpe (*Abstract Co-Author*) Nothing to Disclose
Riccardo Levi (*Abstract Co-Author*) Nothing to Disclose
Francesco Patrone (*Abstract Co-Author*) Nothing to Disclose
Isabella Bolengo, MD (*Abstract Co-Author*) Nothing to Disclose
Alessandra Sapori (*Abstract Co-Author*) Nothing to Disclose
Rubina Manuela Trimboli (*Abstract Co-Author*) Nothing to Disclose
Giulia Vatteroni, MD (*Presenter*) Nothing to Disclose

## PURPOSE

To report the upgrade rate to invasive breast cancer (IBC) of pure Ductal Carcinoma In Situ (DCIS) diagnosed at stereotactic-Vacuum Assisted Biopsy (VAB) and to identify preoperative variables associated with stromal invasion at subsequent surgical pathology.

## METHODS AND MATERIALS

We retrospectively reviewed all percutaneous stereotactic-guided VAB performed at our Institution from January 2018 to April 2023. Pure DCIS with a final surgical pathology were included in the analysis. Patient's age, lesion type (mass, calcification, architectural distortion) and size, calcification morphology and distribution, residual calcifications, BI-RADS category, needle gauge and nuclear grade were considered as preoperative variables. Chi-squared test was used to investigate the association between each preoperative variable and the occurrence of IBC considering $p<0.05$ as significant.

## RESULTS

Among 301 patients with pure DCIS at VAB, 271 with a mean age of 58-year-old (± 11 SD; range 30-92) were included in the analysis. There were 247/271 (91%) pure calcifications, 21/271 (8%) opacities/architectural distortion associated with calcifications and 3/271 (1%) architectural distortions. At final surgical pathology 56/271 (21%; IC: 95% 14.7%, 26.3%) cases were upgraded to IBC. Pre-operative variables associated with upgrade to invasiveness were: lesion size =20mm (vs<20 mm, $p<0.001$); fine linear and fine linear branching calcification morphology (vs amorphous, coarse heterogeneous and fine pleomorphic, $p<0.001$); segmental distribution (vs regional, grouped, linear, $p<0.001$) and residual post-biopsy calcifications (vs no residual calcifications, $p=0.002$). Lesion type ($p=0.459$), patients' age ($p=0.582$), BI-RADS categories ($p=0.025$), nuclear grade ($p=0.191$) and needle gauge ($p=0.758$) were not associated to underestimation. Invasive cancer was found in 17/90 (19%), 34/162 (21%), 5/19 (26%) cases using 7, 9 and 10 gauge needle.

## CONCLUSION

One out of five DCIS diagnosed at VAB is under-staged using large needle vacuum assisted biopsy, without differences between 7, 9 and 10 gauge. Preoperative variables associated with underestimation included morphology and distribution of calcifications and the presence of residual post-biopsy calcifications.

## CLINICAL RELEVANCE/APPLICATION

Fine linear and fine linear branching calcifications extended for =20mm in segmental distribution should be extensively sampled by vacuum assisted biopsy in order to reduce underestimation rate of invasive breast cancers and allow a one-stop final surgical treatment.

# Abstract Archives of the RSNA, 2024

W2-SPCA

**Cardiac Imaging Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPCA-1 NON-INVASIVE DIFFERENTIATION OF IDIOPATHIC INFLAMMATORY MYOPATHY WITH CARDIAC INVOLVEMENT FROM ACUTE VIRAL MYOCARDITIS USING CARDIOVASCULAR MAGNETIC RESONANCE IMAGING T1 ,T2 MAPPINGAND FEATURE TRACKING

Zhang Yanling (*Presenter*) Nothing to Disclose

### PURPOSE

Idiopathic inflammatory myopathy (IIM) is a group of autoimmune diseases that may involve the myocardium with systemic myositis. Cardiac involvement in IIM is usually subclinical, but some patients may also present with clinical manifestations similar to acute viral myocarditis (AVM). The objective of this study was to Investigated the effectiveness of combined analysis of cardiovascular magnetic resonance (CMR) T1-mapping and T2-mapping parameters and myocardial strain in differentiating cardiac involvement between AVM and IIM.

### METHODS AND MATERIALS

This retrospective study included 42 subjects (age 45±16 years) : 22 patients with AVM, 20 patients with IIM and cardiac involvement, and 20 healthy controls. Both subjects and healthy control group were examined by CMR, and their T1-mapping, T2-mapping, ECV and feature tracking were analyzed by post-processing technology.

### RESULTS

The T1-mapping, T2-mapping and ECV values of the AVM group, IIM group and healthy control group were statistically different, and the T1-mapping and T2-mapping values of the IIM group were higher than those of the AVM group, and there was no statistically significant difference in ECV values between the two groups. Compared with healthy volunteers, IIM group and AVM group had significant differences in the overall left ventricular radial, circumferential and longitudinal strain and left ventricular ejection fraction, while IIM group had statistically significant differences in the overall left ventricular longitudinal strain (-17.4±2.4V.S. -20.1±2.2,P<0.001)and circumferential strain(-18.8±2.4V.S. -20.9±2.4,P<0.001) compared with AVM group, but no statistically significant differences in the overall left ventricular radial strain(36.8±7.0V.S. 42.4±7.6,P=0.003).

### CONCLUSION

Cardiac involvement of AVM and early IIM is often difficult to distinguish in clinical manifestations and laboratory tests, there for CMR T1-mapping, T2-mapping and FT-CMR may provide evidence for distinguishing them.

### CLINICAL RELEVANCE/APPLICATION

The use of non-invasive imaging techniques to distinguish viral myocarditis and idiopathic inflammatory myopathy heart damage, to provide evidence and support for early diagnosis and timely treatment of patients, reduce the medical burden, improve the survival rate of patients.

## W2-SPCA-3 DIAGNOSTIC PERFORMANCE OF CT-DERIVED EXTRACELLULAR VOLUME FRACTION IN AORTIC STENOSIS, CARDIAC AMYLOIDOSIS AND DUAL PATHOLOGY

Toshinori Hirai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Nakaura, MD (*Abstract Co-Author*) Nothing to Disclose
Masafumi Kidoh, MD, PhD (*Abstract Co-Author*) Endowed Chair, Koninklijke Philips NV
Fumihiro Yoshimura, MD (*Abstract Co-Author*) Nothing to Disclose
Seitaro Oda, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yasunori Nagayama, MD (*Abstract Co-Author*) Nothing to Disclose
Hidetaka Hayashi, MD (*Abstract Co-Author*) Nothing to Disclose
Shinpei Yamaguchi (*Presenter*) Nothing to Disclose

### PURPOSE

There is limited evidence regarding the comparison of CT-derived extracellular volume fraction (CT-ECV) in patients with lone aortic stenosis (AS), dual pathology of AS and transthyretin cardiac amyloidosis (AS-ATTR), and ATTR cardiac amyloidosis without AS (lone ATTR). We investigated CT-ECV in patients with lone AS, AS-ATTR, and lone ATTR, and to examine the diagnostic performance and optimal cutoff values of CT-ECV for differentiating between patients with AS-ATTR and lone AS, and between patients with lone ATTR and lone AS.

**METHODS AND MATERIALS**

This retrospective study included patients with moderate-to-severe AS (including lone AS and AS-ATTR) and lone ATTR who underwent CT-ECV analysis between January 2018 and March 2024 in our university hospital. The diagnostic performance of CT-ECV for detecting cardiac amyloidosis was evaluated using the area under the receiver operating characteristic curve (AUC).

**RESULTS**

Of 153 patients (mean age, 79 years ± 8 [SD]; 109 men), 55 had lone AS, 21 had AS-ATTR and 77 had lone ATTR. CT-ECV of patients with lone AS, AS-ATTR, and lone ATTR was 31 ± 5%, 44 ± 12%, and 54 ± 13%, respectively. CT-ECV was significantly lower in patients with AS-ATTR than lone ATTR (44 ± 12% vs 54 ± 13%, P =.008). The AUC for differentiating patients with AS-ATTR from lone AS was lower than for lone ATTR from lone AS (0.89 [95% CI: 0.79, 0.95] vs 0.96 [95% CI: 0.91, 0.99]). The cutoff values of CT-ECV for differentiation between patients with lone AS and AS-ATTR were lower than those between patients with lone AS and lone ATTR (37% vs 38% [Youden index]; 30% vs 34% [for 95% sensitivity, suitable for screening for cardiac amyloidosis]).

**CONCLUSION**

CT-ECV of patients with AS-ATTR was lower than that of patients with lone ATTR, and the diagnostic performance and optimal cutoff values of CT-ECV for differentiating between patients with AS-ATTR and lone AS were lower than those between patients with lone ATTR and lone AS.

**CLINICAL RELEVANCE/APPLICATION**

The findings from this study may contribute to the accurate detection of cardiac amyloidosis and lead to early drug treatment.

## W2-SPCA-5 PROGNOSTIC VALUE OF RIGHT ATRIAL FUNCTION DERIVED FROM CARDIAC MAGNETIC RESONANCE IMAGING IN PATIENTS WITH LIGHT-CHAIN AMYLOIDOSIS

Yinqiu Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the prognostic value of right atrial (RA) function derived from cardiac magnetic resonance imaging (CMR) in patients with light-chain (AL) amyloidosis.

**METHODS AND MATERIALS**

From December 2011 to January 2020, patients with histologically proven AL amyloidosis who underwent CMR were included in this prospective cohort study. RA volume, RA emptying fraction (RAEF) and RA strain parameters were measured based on CMR. The primary endpoints were all-cause death. Cox regression analysis and Kaplan-Meier analysis were used to evaluate the association of variables with death. The incremental prognostic values evaluated using C indexes and ?2 value.

**RESULTS**

A total of 140 patients with AL amyloidosis were included (mean age, 58 years ± 10 [SD]; 84 male). Over a median follow-up of 31 months, 92 patients (65.7%) reached the primary endpoint. In multivariate Cox regression analysis, only RAEF total [hazard ratio (HR) 1.021 per 1% decrease, 95% confidence interval (CI) 1.001-1.041, P =0.038] and Mayo stage (HR 1.493, 95% CI 1.063-2.097, P=0.021) remained independently associated with the primary endpoint. The addition of RAEF total to Mayo stage model (C-statistic 0.692, ?2 30.3) improved model discrimination for the primary endpoints(C-statistic 0.732, ?2 37.4 P=0.004). Moreover, RAEF total with a cutoff of 29.3% further discriminated the survival probability in subgroups of patients with focal patchy LGE or global LGE (log-rank P<0.001, P=0.012, respectively).

**CONCLUSION**

RAEF total was an independent predictor of all-cause death in patients with AL amyloidosis and provided incremental prognostic value to Mayo stage.

**CLINICAL RELEVANCE/APPLICATION**

RAEF total could be a suitable non-invasive CMR parameter for predicting all-cause mortality in AL amyloidosis and could further improve risk stratification in patients with AL amyloidosis.

## W2-SPCA-7 CARDIAC MAGNETIC RESONANCE EVALUATION OF LEFT VENTRICULAR REMODELING INDEX IN LIGHT-CHAIN CARDIAC AMYLOIDOSIS

Yue Gao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

We aimed to evaluate the ratio of left ventricular mass to LV end-diastolic volume (LVMVR) in patients with light-chain cardiac amyloidosis (AL-CA) and determine the effects on the occurrence of major adverse cardiac events (MACE).

**METHODS AND MATERIALS**

Fifty-five AL-CA patients who underwent cardiac magnetic resonance (CMR) scanning were included. LV function, LVMVR, and LV global peak strains were measured. The primary endpoint of the study was the occurrence of MACE. Pearson's analysis was performed to investigate the correlation between LVMVR and CMR parameters. Long-term MACE was assessed using Kaplan-Meier survival analysis and compared among the groups using the log-rank test.

**RESULTS**

LVMVR showed significantly correlation with LVEF (r = -0.298, P = 0.027) and LV global longitudinal peak strain (r = 0.516, P <0.001). All the patients with AL-CA have completed the follow-up analysis. The median follow-up duration for the entire cohort was 4.5 years (IQR, 3.2-5.9 years). Kaplan-Meier survival analysis revealed that AL-CA patients with higher LVMVR (>1.175) had a significantly higher risk of MACE during follow-up.

**CONCLUSION**

For patients with AL-CA, the increase of LVMVR was associated with poor cardiovascular outcomes at follow-up.

**CLINICAL RELEVANCE/APPLICATION**

Provide additional information for prognostic management and clinical decision making in patients with AL-CA.

## W2-SPCA-8 FEASIBILITY OF T2 MAPPING FOR THE DETECTION OF MYOCARDIAL INJURY IN HYPERTROPHIC CARDIOMYOPATHY: A CASE-CONTROL STUDY

Shihua Zhao, MD (*Abstract Co-Author*) Nothing to Disclose
Jiaxin Wang (*Abstract Co-Author*) Nothing to Disclose
Shujuan Yang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The application of T2 mapping has been introduced in hypertrophic cardiomyopathy (HCM). This study aims to explore the association between T2 value and myocardial injury in HCM patients.

### METHODS AND MATERIALS

25 HCM patients with elevated high-sensitivity cardiac troponin I (hs-cTn I), 25 age-matched HCM patients with normal hs-cTn I, and 20 healthy volunteers underwent CMR including parametric mapping. Hs-cTn I was defined as a marker of myocardial injury (>0.016ng/mL). Global T2 values were quantified for three left ventricular (LV) short-axis slices. The maximum T2 value and T2 value assessed conservatively within the septum (ConSept T2) were measured from the maximal value of 16 segments and the middle septum, respectively.

### RESULTS

The HCM group with elevated hs-cTnI (20 males, 50±13 years) had higher T2 global, ConSept T2, T2 max, T1 global, ConSept T1 values, and LGE extent($P<0.05$) than the HCM group with normal hs-cTnI (17 males, 49±14 years). The ConSept T2 value ($r=0.52$, $P<0.001$) and LGE extent ($r=0.52$, $P<0.001$) were all moderately correlated with hs-cTnI. Among all parametric parameters, ConSept T2 value showed the best performance in identifying myocardial injury (AUC=0.83). In bivariate logistic regression analyses, after adjusting LV ejection fraction, LV end-diastolic volume index, maximal ventricular wall thickness, LV myocardial mass index, LGE extent, T1 global, and ConSept T1 values, respectively, ConSept T2 value was still significantly associated with elevated hs-cTnI ($P<0.01$).

### CONCLUSION

In this case-control study, we confirmed the feasibility of T2 mapping for detecting myocardial injury in HCM. T2 value was associated with an elevated hs-cTnI, which provided in-vivo evidence by CMR for the ongoing myocardial injury in HCM.

### CLINICAL RELEVANCE/APPLICATION

This study confirmed the feasibility of T2 mapping for detecting myocardial injury in HCM. T2 value measured using the ConSept approach was highly reproducible and correlated with elevated hs-cTn I. T2 mapping might become an integral part of the comprehensive evaluation and management of patients with HCM.

# Abstract Archives of the RSNA, 2024

W2-SPCH

**Chest Imaging Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPCH-1 THE VALUE OF ARTIFICIAL INTELLIGENCE ITERATIVE RECONSTRUCTION ON DETECTABILITY OF SMALL PULMONARY NODULES AT ULTRA-LOW-DOSE CT SCAN PROTOCOLS: A PHANTOM EVALUATION

Guozhi Zhang (*Abstract Co-Author*) Nothing to Disclose
Yan Zhang (*Abstract Co-Author*) Nothing to Disclose
Jing Li (*Abstract Co-Author*) Nothing to Disclose
Xiaozheng Dong (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the effect of a new artificial intelligence iterative reconstruction (AIIR) algorithm on detectability of small pulmonary nodules under ultra-low-dose computed tomography (CT) scan protocols.

### METHODS AND MATERIALS

Six artificial pulmonary nodules of varying densities [two solid nodules (SNs) and four ground glass nodules (GGNs); densities: 100HU, -630 HU, -800 HU; diameter: 5 mm, 3 mm] were sequentially placed at the ten regions (right and left lung: up, middle, down, inside, and outside) in chest phantom and scanned on a 320-row CT scanner. Five scan protocols were performed at 5mAs with various tube voltages (120, 100, 80, 70, 60kVp). Raw data were reconstructed using filtered back-projection (FBP), hybrid iterative reconstruction (HIR), and the AIIR at 1.0mm thickness, respectively. All images were automatically analyzed using a commercially available artificial intelligence software. The effective radiation dose was recorded. The detection rate of pulmonary nodules was calculated. The score of image quality and nodule edge on the small pulmonary nodules were scored using a four-point scale (1: poor, 4: excellent).

### RESULTS

The corresponding radiation doses of five ultra-low-dose scanning protocols were 0.387, 0.227, 0.106, 0.062, and 0.032mGy, respectively. For the nodule with a density of 100HU, the detection rate of three algorithms was the same, with detection rate of 100% for 5mm and 50% for 3mm at ultra-low dose conditions of 0.032 mGy. The detection rates of AIIR algorithm were the highest (30%) for nodules with a density of -630 HU (0.032mGy for diameter of 5mm and 0.062 mGy for diameter of 3mm). For GGNs with density of -800 HU and 5mm, only the AIIR images could be successfully detected (50%) under ultra-low dose conditions of 0.106 mGy. Compared with FBP and HIR algorithms, the nodules edge were improved by the AIIR algorithm (proportion of scores 3 and 4: AIIR=96% vs. HIR=66% vs. FBP=66%).

### CONCLUSION

Compared to FBP and HIR algorithms, application of AIIR returns the highest detection rate for small pulmonary nodules, even at ultra-low radiation doses. The optimal ultra-low-dose scanning protocol for small pulmonary nodules is tube voltage of 80kV, a tube current of 5mAs, and the radiation dose of 0.057mSv.

### CLINICAL RELEVANCE/APPLICATION

The AIIR algorithm could be a promising reconstruction technique to enhance the detection rate of small pulmonary nodules and pulmonary micro-nodules in ultra-low dose lung screening.

## W2-SPCH-2 LUNG NODULE SIZE EVALUATION ON CHEST CT: A COMPARISON BETWEEN MANUAL AND AI ANALYSIS

Marly Van Assen, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Irene (tai-Lin) Lee (*Abstract Co-Author*) Nothing to Disclose
Benjamin Bottcher (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Covanos, Inc
Gianluca G. Siciliano, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study compares accuracy of manual and AI-based lung nodule diameters and volume assessment on baseline and follow-up chest CT scans.

### METHODS AND MATERIALS

The study included 142 patients who underwent baseline and follow-up chest CT for lung nodule evaluation, which were analyzed by two radiology residents independently. Up to 5 nodules per patient were selected and measured at baseline and follow-up. Using clinically available software (syngo.via VB60, Siemens Healthineers), volume (mm3), max diameter (mm), and mean diameters (mm) were recorded. After manual analysis, scans were analyzed by AI software (AIRC Research, Chest CT Explore, V1.3.4, Siemens Healthineers) in a fully automated approach. Using a CNN, the AI algorithm

detects lung nodules and measures diameters and volume. Agreement between readers and between manual and AI analysis was conducted with Pearson Correlation (r). Sub-analyses were performed based on nodule size, location, HU density, and shape. Manual and AI correlation was also evaluated in a 34 patient set read by an expert reader and a resident.

**RESULTS**

A total of 640 nodules were analyzed across baseline and follow-up. Median volume, max diameter, and mean diameter were 97 mm3 (52-268), 7 mm (5.6-9.5), and 6.2 mm (5-8.3); results will be presented in this order. Agreement between resident readers was excellent: r = 0.99, 0.97, and 0.97 ($p<0.001$). Manual and AI analysis correlation for the two readers were r = 0.91, 0.91, and 0.94 ($p<0.001$), and r = 0.91, 0.89, and 0.91 ($p<0.001$). Correlation using mean measures was r = 0.91, 0.91, and 0.93 ($p<0.001$). Sub-analysis on nodule size showed highest correlation between 10 and 20 mm: r = 0.96, 0.84, and 0.88 ($p<0.001$), and the lowest in nodules < 5 mm: r = 0.30, 0.16, and 0.23 ($p >0.05$). Correlation was good for all locations, with subpleural nodules showing the weakest correlation: r = 0.81, 0.89, and 0.89 ($p<0.001$). Other locations showed r > 0.90 ($p<0.001$) across all parameters. Density did not impact AI performance with r > 0.89 ($p<0.001$) overall. Non-spherical nodules showed the lowest correlation: r = 0.63, 0.84, and 0.85 ($p<0.001$), which increased in spherical nodules: r = 0.98, 0.94, 0.95 ($p<0.001$). Expert and resident reader agreement in the 34 patient set (144 nodules) was excellent: r = 0.99, 0.96, and 0.98 ($p<0.001$), as well as correlation with AI: r = 0.99, 0.97, and 0.98 ($p<0.001$).

**CONCLUSION**

The study shows high agreement between manual and AI analysis across low and high-experienced readers in assessing lung nodule volume, max, and mean diameters.

**CLINICAL RELEVANCE/APPLICATION**

AI-assisted lung nodule size assessment shows high accuracy comparable to manual methods, potentially streamlining lung nodules evaluation, and reducing time burden, and variability across readers.

## W2-SPCH-4 LUNG-CADEX: FULLY AUTOMATIC ZERO-SHOT DETECTION & CLASSIFICATION OF LUNG NODULES IN THORACIC CT IMAGES

Furqan Shaukat (*Abstract Co-Author*) Nothing to Disclose
Syed M. Anwar, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Lung cancer has been one of the major threats to human life for decades. Computer-aided diagnosis can help with early lung nodule detection and facilitate subsequent nodule characterization. Large Visual Language models (VLMs) have been found effective for multiple down-stream medical tasks that rely on both imaging and text data. However, lesion level detection and subsequent diagnosis using VLMs have not been explored yet.

**METHODS AND MATERIALS**

We propose CADe, for segmenting lung nodules in a zero-shot manner using a variant of the Segment Anything Model called MedSAM. CADe trains on a prompt suite on input computed tomography (CT) scans by using the CLIP text encoder through prefix tuning. We also propose, CADx, a method for the nodule characterization as benign/malignant by making a gallery of radiomic features and aligning image-feature pairs through contrastive learning. Training and validation of CADe and CADx have been done using one of the largest publiclyavailable datasets, called LIDC. To check the generalization ability ofthe model, it is also evaluated on a challenging dataset, LUNGx.

**RESULTS**

We have done our evaluations on two different datasets LIDC (Lung Image Database Consortium) containing 1186 nodules and 2) LUNGx which contains hard malignancy labels (pathology proven) of 73 nodules. Standard performance metrics, namely area under the curve, sensitivity, accuracy, and specificity, were used for evaluation. We have compared our test results with notable recent studies. Our experimental results show that the proposed methods achieve a sensitivity of 0.86 compared to 0.76 that of other fully supervised methods.

**CONCLUSION**

We present an end-to-end pipeline using both CADe and CADxfor lung nodule detection and its subsequent malignancy characterization. We used a variant of the Segment Anything Model called MedSAM in a zero-shot manner for the detection part and a CLIP model for further characterization of nodules into benign and malignant. We replaced the visual prompts of MedSAM with textual prompts and designed a prompt suite for this specific downstream task. After segmenting the nodule patches, we formed a radiomic feature gallery and trained the modified CLIP model with nodule patches and their associated radiomic feature sets. During inference, the model gave the most similar classfed to a linear classifier for the final decision.

**CLINICAL RELEVANCE/APPLICATION**

Our results have shown significant value in the detection of large and diverse data. The proposed tool can be used for early lung cancer screening in an end-to-end manner. It also has the potential to improve the quality of life of patients by assisting with early diagnosis, reducing misdiagnoses, and facilitating more informed follow-up recommendations.

## W2-SPCH-5 BENIGNITY/MALIGNANCY PREDICTION OF PART-SOLID PULMONARY NODULES BASED ON IMAGE FEATURES AND ARTIFICIAL INTELLIGENCE SOFTWARE QUANTITATIVE CHARACTERISTICS

Li Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Qi Wang, BSc (*Abstract Co-Author*) Nothing to Disclose
Gaofeng Shi, MD (*Abstract Co-Author*) Nothing to Disclose
Tongxin Xu (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to analyze the predictive value of CT image features and artificial intelligence (AI) software quantitative characteristics of part-solid nodules (PSNs) in differentiating malignant PSNs from atypical benign PSNs that require surgical resection after failure of anti-inflammatory treatment

**METHODS AND MATERIALS**

A retrospective analysis was conducted on 192 patients with PSNs of = 30 mm in mean diameter which were surgically removed and pathologically confirmed . These patients were divided into a training set and a validation set at a ratio of 7:3. Thin-slice imaging was utilized to record clinical features, PSN image features (presence or absence of emphysema, PSN location and shape, tumor-lung interface, presence or absence of lobulation, burr, and pleural retraction sign, presence or absence of vacuole, air bronchogram, and traversing vessel, presence or absence of abnormal pulmonary veins, solid component location and boundary, mean diameters of nodules and solid components, and solid component diameter ratio), and AI quantitative characteristics (nodule volume and mass, solid component volume, mass, and their proportions, maximum, minimum, mean, and standard deviation of

nodule CT value, and solid component volume, mass, and ratio). In the training set, univariate and multivariate logistic regression analyses were performed on the recorded characteristics to identify the independent risk factors predictive of the benign or malignant nature of PSNs, so as to establish a combined model. The diagnostic performance of each independent risk factor and the combined model was assessed using the receiver operating characteristic (ROC) curve, and the area under the curve (AUC) was calculated. The AUCs of independent risk factors and the combined model were compared using DeLong's test.

**RESULTS**

In the training set, 8 independent risk factors for diagnosing of PSNs were identified by the multivariate logistic regression analysis ($P < 0.05$): nodule location and shape, tumor-lung interface, presence or absence of lobulation and burr, presence or absence of abnormal pulmonary vein, and solid component volume and mass. The ROC curve analysis showed that the combined model containing the 8 independent risk factors had the highest AUC (training set: AUC = 0.934, 95% CI: 0.893-0.974; validation set: AUC = 0.921, 95% CI: 0.856-0.986).

**CONCLUSION**

Based on image features and AI quantitative characteristics, the benign or malignant nature of PSNs with a mean diameter of = 30 mm can be effectively predicted.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrates good diagnostic performance in predicting the benign or malignant nature of pulmonary nodules, possessing substantial clinical application value.

## W2-SPCH-6 A MULTI-CENTER RETROSPECTIVE STUDY OF NODULE TYPE CLASSIFICATION USING ARTIFICIAL INTELLIGENCE FOR LUNG-RADS SCORING WITH CT

Junghyun Kang (*Abstract Co-Author*) Nothing to Disclose
Doohyun Park (*Abstract Co-Author*) Nothing to Disclose
Changhyun Park (*Abstract Co-Author*) Nothing to Disclose
Jonghun Jeong (*Presenter*) Nothing to Disclose

**PURPOSE**

The American College of Radiology regularly updates the guidelines for lung cancer screening, known as the Lung Imaging Reporting and Data System (Lung-RADS). Across all versions of the guidelines, it is always important to accurately classifying nodule types—solid, part-solid, and ground-glass nodules (GGN)—on computed tomography (CT) images. Therefore, the purpose of this study was to evaluate the performance of the computer-aided diagnosis (CADx) model in nodule type classification.

**METHODS AND MATERIALS**

We collected data from 238 patients at a referral hospital, where two radiologists identified 1,904 nodules by consensus. After excluding 11 part-solid and 8 segmentation fail nodules, 1,413 nodules were used to develop the model, and 472 nodules were used for testing. Additionally, we collected data from 170 patients at an independent hospital. Here, two radiologists reviewed the images. After the exclusion of 113 part-solid and 1 segmentation fail nodules, 941 nodules were used for external validation. By utilizing nodule segmentation masks to obtain radiomic features, we developed an artificial intelligence-based model for nodule type classification. This work operates end-to-end by using the CADx model.

**RESULTS**

In the internal and external validation sets, respectively, the classification of 472 and 941 nodules yielded an area under the receiver operating characteristic (ROC) curve (AUC) of 0.972 (0.951-0.992, 95% confidence interval [CI]) and 0.993 (0.989-0.997, 95% CI). In the internal set, the sensitivity was 0.953 for solid nodules (402 out of 422) and 0.900 for GGNs (45 out of 50). In the external set, the sensitivity was 0.993 for solid nodules (815 out of 821) and 0.808 for GGNs (97 out of 120). Consequently, the accuracy on the internal and external sets was 0.947 (447 out of 472) and 0.969 (912 out of 941), respectively.

**CONCLUSION**

The classification of nodule types using CT scans is a critical component of Lung-RADS scoring for lung cancer screening. In this study, the CADx model has proven to be a robust tool in distinguishing between solid and ground-glass nodules, setting the stage for more accurate and clinically dependable Lung-RADS scores. Future studies will validate the performance of the classification of part-solid and cystic nodules, in accordance with the latest Lung-RADS guidelines.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrated the clinical utility of the CADx model in practice, potentially improving diagnostic precision and thereby impacting patient management and outcomes in lung cancer screening.

## W2-SPCH-7 EFFECT OF DEEP LEARNING IMAGE RECONSTRUCTION ALGORITHM ON IMAGE QUALITY AND QUANTITATIVE ANALYSIS OF PULMONARY NODULES IN ULTRA-LOW-DOSE CHEST CT

Zhiming Xiang (*Abstract Co-Author*) Nothing to Disclose
Kun Ma (*Abstract Co-Author*) Nothing to Disclose
Zhijuan Zheng (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the image quality, detectability, and measurement accuracy of pulmonary nodules between deep learning image reconstruction (DLIR) and adaptive statistical iterative reconstruction-V (ASIR-V) in ultra-low-dose CT (ULD-CT) for facilitating large-scale lung cancer screening.

**METHODS AND MATERIALS**

Participants underwent ULD-CT (UL-A, 0.56±0.04 mSv and UL-B, 0.33±0.03 mSv) and standard-dose CT (SDCT) plain scans, with the 50%ASIR-V reconstructed SDCT serving as the reference standard. The ULD-CT was reconstructed using 50%ASIR-V and DLIR algorithms at medium (DLIR-M) and high (DLIR-H) levels. The objective measurements including image noise, signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) were used to quantify the image quality performance of ULD-CT. A 5-point scale was used to analyze subjective image quality scores. The nodule detection results and nodule features of different reconstructed images were analyzed. The logistic regression analysis was used to determine the independent predictors of nodule detection.

### RESULTS

302 participants with 1541 nodules were included, including 814 nodules in UL-A group and 727 nodules in UL-B group. DLIR-H excellently exceeds 50%ASIR, not only has a significant advantage in image noise, SNR and CNR, but also can even compete with or exceed 50%ASIR-V in subjective evaluation in ULD-CT. Sensitivities for nodules detection of 50%ASIR-V, DLIR-M and DLIR-H in ULD-CT were identical (97.53%, 1503/1541). In ULD-CT, the detection sensitivity was 99.12% (1233/1244) for solid nodules (SN), 90.46% (256/283) for pure ground glass nodules (pGGN), and 100.00% (14/14) for partial solid nodules (PSN). In multivariate analysis, the body mass index (BMI), nodule diameter, and nodule type were independent predictors for the sensitivity of nodule detection ($p < 0.001$). Friedman test showed that the absolute percentage error (APE) in nodule volume of ULD-CT reconstructed with DLIR-M (-2.41%±43.33% and 2.87%±86.51%) and DLIR-H (-1.36%±82.16% and -0.81%±58.87%) was significantly lower than that of ULD-CT reconstructed with 50%ASIR-V (1.78%±41.41% and 10.79%±99.75%) ($P < 0.001$).

### CONCLUSION

The ULD-CT can significantly reduce the CT radiation dose while maintaining good sensitivity for nodule detection. DLIR can provide good image quality and improve the accuracy of the nodule measurement compared with ASIR-V in ULD-CT.

### CLINICAL RELEVANCE/APPLICATION

This is a clinical study designed to evaluate the clinical value of DLIR in participants with pulmonary nodules on ULD-CT. The application of ULD-CT scan combined with DLIR is of great significance in clinical practice, which can improve the quality of diagnosis and treatment of patients and reduce the potential adverse effects on patients.

## W2-SPCH-8 EFFECT OF DEEP LEARNING IMAGE RECONSTRUCTION ALGORITHM ON THE RADIOMIC QUANTIFICATION OF PULMONARY NODULES IN ULTRA-LOW-DOSE CT

Zhiming Xiang (*Abstract Co-Author*) Nothing to Disclose
Kun Ma (*Abstract Co-Author*) Nothing to Disclose
Zhijuan Zheng (*Presenter*) Nothing to Disclose

### PURPOSE

The lack of reproducibility of radiomic features in response to variations in reconstruction algorithm. The purpose of this study was to investigate the effects of the deep learning image reconstruction (DLIR) algorithm and adaptive statistical iterative reconstruction-V (ASIR-V) algorithm on the reproducibility of radiomic features between ultra-low-dose CT (ULD-CT) and standard-dose CT (SDCT).

### METHODS AND MATERIALS

The study prospectively enrolled 183 patients who underwent non-contrast ULD-CT (UL-A, 0.57±0.09 mSv or UL-B, 0.33±0.04 mSv)and standard-dose computed tomography (SDCT) (4.30±0.36 mSv). SDCT was reconstructed with 50%ASIR-V, and ULD-CT with 50%ASIR-V, DLIR-M, and DLIR-H. 102 radiomic features (shape, first order, texture features) of pulmonary nodules were extracted from both SDCT and ULD-CT images. The intraclass correlation coefficient (ICC) was used to evaluate the reproducibility of these radiomic features. The proportion of features with ICC >0.75 between ULD-CT and SDCT was also compared.

### RESULTS

221 solid nodules (SN) and 89 pure ground-glass nodules (pGGN) were analyzed. There was no significant difference for the proportion of features in SN between SDCT and ULD-CT reconstructed by 50%ASIR-V, DLIR-M, and DLIR-H, which were 35.29% (36/102), 32.35% (33/102), and 38.24% (39/102), respectively (P=0.68). The proportion of reproducibility of 50%ASIR-V, DLIR-M, and DLIR-H in pGGN were 60.78% (62/102), 61.76% (63/102), and 77.45% (79/102), respectively (P=0.02). In SN, DLIR-M and DLIR-H improved the ICC values from 0.67±0.21 to 0.71±0.17 and 0.73±0.15 compared with 50%ASIR-V (P<0.001). In pGGN, DLIR-M and DLIR-H improved the ICC values from 0.74±0.22 to 0.79±0.17 and 0.83±0.12 compared to 50%ASIR-V (P<0.001). In addition, both SN and pGGN have high reproducibility in 50%ASIR-V, DLIR-M, and DLIR-H, with the ICC value of over 0.75 for shape and first order features. In texture features, DLIR-M and DLIR-H showed improved the ICC values for pGGN from 0.69±0.23 to 0.75±0.18 and 0.81±0.12, respectively, compared to 50%ASIR-V. Similarly, the ICC values for SN increased from 0.60±0.19 to 0.66±0.14 and 0.69±0.13, respectively.

### CONCLUSION

The reconstruction algorithm significantly affects the quantification of ULD-CT radiomic features in pulmonary nodules. Compared with ASIR-V, the application of DLIR algorithm can improve the reproducibility of radiomic features in ULD-CT. Furthermore, pGGN is more reproducible than SN in ULD-CT.

### CLINICAL RELEVANCE/APPLICATION

DLIR can improve the reproducibility of radiomic features in ULD-CT. The ULD-CT combined with the DLIR algorithm can not only reduce the risk of patients receiving radiation, but also improve the diagnostic accuracy and reliability of clinical applications.

## W2-SPCH-9 LUNG NODULE GROWTH EVALUATION ON BASELINE AND FOLLOW-UP CHEST CT USING AI-ASSISTED ANALYSIS

Benjamin Bottcher (*Abstract Co-Author*) Nothing to Disclose
Marly Van Assen, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Carlo N. De Cecco, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Covanos, Inc
Irene (tai-Lin) Lee (*Abstract Co-Author*) Nothing to Disclose
Gianluca G. Siciliano, MD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to evaluate accuracy of lung nodule growth evaluation using manual and AI-based measurements using baseline and follow-up chest CT scans.

### METHODS AND MATERIALS

The study included 142 patients who underwent baseline and follow-up chest CT for lung nodule evaluation, which were analyzed by two radiology residents independently. A radiologist with 10+ years of experience in cardiothoracic imaging analyzed a subset of 34 patients. Nodules were selected and measured at baseline and follow-up. Using clinically available software (syngo.via VB60, Siemens Healthineers), volume (mm3), max diameter (mm), and mean diameter (mm) were recorded. Each nodule's growth between baseline and follow-up scans was assessed. After manual analysis, AI software (AIRC Research, Chest CT Explore, V1.3.4, Siemens Healthineers) analyzed the CT cases fully automatically, allowing for individual lung nodule analyses to be accepted or rejected based on clear mismatch, inclusion of vessels, or pleural tissue. Agreement on growth evaluation between residents and between manual and AI analysis for resident and expert readers was conducted using Pearson Correlation (r). Sub-analysis based on acceptance/rejection status was also conducted.

## RESULTS

A total of 320 nodules were measured on baseline and follow-up imaging. Median follow-up time was 5 months (3-7). Median growth was 2.5mm3 (-10-22), 0.15mm (-0.3-0.6), and 0.15mm (-0.2-0.5) for volume, max, and mean diameter respectively; results will be presented in this order. Agreement between residents was substantial: r = 0.97, 0.74, and 0.82 ($p<0.001$). For all cases analyzed, correlation between manual and AI analysis was good: r = 0.91, 0.76, and 0.73 ($p<0.001$). Analyzing only accepted nodules (n= 266, 83%) correlation increased, to r = 0.93, 0.85, and 0.86 ($p<0.001$), and decreased to 0.60, 0.16, and 0.16 ($p>0.05$) for rejected nodules (n=54, 17%). For the expert reader (34 patients, 72 nodules) correlation with AI analysis was good: r = 0.96, 0.69, and 0.77 ($p<0.001$). Analysis based on acceptance/rejection status showed r = 0.96, 0.86, and 0.88 ($p<0.001$) for accepted nodules (n=61, 85%), and r = 0.75, 0.10, and 0.15 ($p>0.05$) for rejected nodules (n=11, 15%).

## CONCLUSION

The study shows good concordance between manual and AI analysis across low and high-experienced readers in assessing lung nodule growth. AI-assisted lung nodule assessment showed higher performance in accepted nodules, emphasizing its use to assist radiologists, instead of an independent reader.

## CLINICAL RELEVANCE/APPLICATION

AI-assisted lung nodule growth evaluation shows high agreement with manual-only assessment. This could streamline lung nodule growth assessment and management pathway, reducing time burden, and variability.

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# Abstract Archives of the RSNA, 2024

W2-SPER

**Emergency Radiology Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPER-1 EVALUATION OF DISCREPANCIES BETWEEN COMMUNITY RADIOLOGIST AND EMERGENCY RADIOLOGIST INTERPRETATION OF TRAUMA IMAGING PERFORMED FOR PATIENTS TRANSFERRED TO A LEVEL 1 TRAUMA CENTER

Allison Crone, MD (*Abstract Co-Author*) Nothing to Disclose
Scott D. Steenburg, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Second opinion overreads are common in the setting of trauma patients, who are often transferred to level 1 trauma centers to obtain a higher level of care and expertise. This study evaluated the rate of discrepancies between the outside radiologists' interpretations of trauma studies and those of emergency radiologists at an academic level 1 trauma center.

### METHODS AND MATERIALS

A search of the institution's Radiology Information System (RIS) was performed to find overreads of trauma patients that were performed by emergency radiologists in a 1-year period (Jan 1, 2023-Dec 31, 2023). The outside report was obtained, if possible, and comparison was made to our Emergency Radiology Division overread. Discrepancies between reports were divided into major and minor, with major discrepancy defined as change in interpretation that altered patient management (additional tests ordered, major change in medical management, IR procedure, or surgery) and minor discrepancy defined as change in interpretation that did not alter management. A one-way ANOVA test was used to compare the no change in interpretation, minor change, and major change groups.

### RESULTS

A total of 506 overreads for 266 patients were found during the study period. 383 (75.7%) exams were obtained in the setting of trauma, of which 82 did not have outside reports. The study cohort therefore consisted of the remaining 301 studies on 135 patients from 29 institutions. Mean age was 52.3 years (range 19-97), of which 63.7% of patients were male. The average Injury Severity Score (ISS) was 13 (range 1-51). The most common injury mechanisms were falls (43.0%) and motor vehicle collisions (31.1%). Major discrepancies were found in 26 exams (8.6%) affecting 25 patients (18.1%), resulting in 2 IR procedures and 5 surgeries. Minor discrepancies were found in 49 exams (16.3%) affecting 42 patients (30.4%). In total, some discrepancy was found in 75 (24.9%) exams affecting 62 patients (44.9%). There was no statistically significant difference in ISS between the no change (12.9), minor change (13.8), and major change (12.5) groups [p=0.815].

### CONCLUSION

Our emergency radiologists identified a discrepancy in nearly half of imaging exams performed on trauma transfer patients, with major discrepancies impacting patient management in 8.6% of trauma exams overread by our emergency radiology staff, affecting 18.9% of patients. There was no significant difference in discrepancy rate based on patient ISS.

### CLINICAL RELEVANCE/APPLICATION

These findings support the utility of second opinion overreads by dedicated emergency radiologists with expertise in trauma imaging, to provide potentially management-altering information for patients and the clinicians caring for them.

## W2-SPER-2 ANALYSIS OF RARE COMPLICATIONS CAUSED BY SWALLOWED PENETRATING OR MIGRATORY FOREIGN BODIES: A RETROSPECTIVE STUDY

Ci Cheng (*Presenter*) Nothing to Disclose

### PURPOSE

Ingestion of foreign bodies is a common etiology for emergency visits, but some rare complications caused by penetrating or migratory FBs are often unrecognized and not completely understood. This study aimed to analyze patients who encountered infrequent complications caused by foreign bodies to reduce occurrences of missed and inaccurate diagnoses.

### METHODS AND MATERIALS

We conducted a retrospective analysis of 21 patients who experienced atypical complications caused by penetrating or migratory foreign bodies. We analyzed and summarized the mechanisms, diagnoses and treatment modalities of rare complications related to foreign bodies. The role of imaging examinations was emphasized in this study.

## RESULTS

Among the 21 cases, the most common complication occurred in the digestive system, followed by the circulatory and respiratory systems. The most common complication was intestinal necrosis or inflammation (5/21, 23.8%), followed by cervical abscess or inflammation (3/21, 14.3%). Other complications included liver inflammatory mass or abscess (2/21, 9.5%), internal jugular vein penetration (1/21, 4.8%) and pericardial perforation (1/21, 4.8%), etc. The fishbone was the predominant type of foreign body. Fourteen patients underwent surgical treatment, five underwent endoscopic treatment, one opted for conservative treatment and one did not receive treatment.

## CONCLUSION

The symptoms and manifestations resulting from swallowed penetrating or migratory foreign bodies can vary greatly. Accordingly, clinicians should consider integrating patients' medical histories, clinical and imaging features to better exclude the possibility of foreign body ingestion, particularly when encountering relatively uncommon complications.

## CLINICAL RELEVANCE/APPLICATION

This study elaborated in detail the mechanisms of complications related to penetrating or migratory FBs, as well as misconceptions and recommendations regarding diagnosis and treatment. A series of infrequent complications of penetrating FBs were summarized, which could assist clinicians in reaching diagnostic accuracy and providing timely treatment for urgent patients.

# Abstract Archives of the RSNA, 2024

W2-SPGI

**Gastrointestinal Imaging Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPGI-11 ASSESSMENTOF PREOPERATIVE STAGING OF RECTAL CANCER USINGRESTRICTION SPECTRUM IMAGING

Yu Shen (*Abstract Co-Author*) Nothing to Disclose
Nan Meng (*Abstract Co-Author*) Nothing to Disclose
Wei Wei (*Abstract Co-Author*) Nothing to Disclose
Yan Bai (*Abstract Co-Author*) Nothing to Disclose
Meiyun Wang (*Abstract Co-Author*) Nothing to Disclose
Xinhui Wang (*Presenter*) Nothing to Disclose

### PURPOSE

The accurate preoperative staging of rectal cancer patients is crucial for selecting appropriate surgical methods and assessing surgical prognosis. Restricted spectrum imaging (RSI) is a novel diffusion MRI model that can capture the unique diffusion characteristics of tumors. Our objective was to evaluate the ability of the RSI model in preoperative staging of rectal cancer.

### METHODS AND MATERIALS

Difusion-weighted MRI (DWI) data using a commercial 3.0 T scanner (SIGNA Architect, GE Healthcare) equipped with a 16-channel body coil were collected from twenty-one patients with diferent rectal cancer staging confrmed by biopsy in this study. Three experienced radiologists, who were blinded to the histopathological findings, manually delineated the region of interest (ROI) corresponding to the cancer on the DWI images. We obtained RSI, DKI, and ADC model parameters (including C1, C2, C3, DKI-D, DKI-K, and ADC). Mean ± standard deviation, two-sample t-test, and ROC analysis were employed in this study.

### RESULTS

The volume fraction of the restricted compartment C2 from RSI showed a significant difference between stage I and stage II-III (P=0.033), whereas no statistically significant difference was observed between ADC and DKI. The area under the curve (AUC) for C2 in differentiating between stage I and stage II-III was 0.789, with a sensitivity of 66.7% and a specificity of 86.7%.

### CONCLUSION

The three-compartment RSI model shows promising potential in distinguishing between stage I and stage II-III rectal cancer. These findings suggest that the model exhibits superior performance in the preoperative staging of rectal cancer when compared to traditional ADC and DKI models.

### CLINICAL RELEVANCE/APPLICATION

RSI was employed to assess the unique diffusion characteristics of tumor in rectal cancer, aiming to accurately determine the preoperative staging of the disease. This information is crucial in selecting the most appropriate treatment plan for patients and enhancing the overall treatment outcomes for rectal cancer.

## W2-SPGI-13 THE ADDED VALUE OF LIVER MR ELASTOGRAPHY IN THE MANAGEMENT OF TYPE 1 GAUCHER DISEASE

Marie-claude Miron, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Ramy El-Jalbout (*Abstract Co-Author*) Nothing to Disclose
Luca Panetta (*Presenter*) Nothing to Disclose

### PURPOSE

Gaucher disease is a rare genetic disorder characterized by the mutation of the lysosomal enzyme glucocerebrosidase. Its substrate, glucocerebroside, accumulates in the reticuloendothelial system and causes cytopenia, hepatomegaly, liver fibrosis, splenomegaly, and bone marrow infiltration. MR Elastography (MRE) has increasingly become an available tool for an accurate assessment of liver stiffness (LS) and liver fibrosis. The purpose of this study was to determine the relevance of MRE in the routine follow-up of patients with type 1 Gaucher disease (GD1). The study also aimed to analyze the variation of LS as compared to other parameters used in standard workup of GD1 patients with repeated MRE imaging.

### METHODS AND MATERIALS

A prospective IRB approved observational study was conducted for all GD1 patients between February 2020 and March 2024. A routine follow-up at two academic medical centers included outpatient visits, treatment regimen assessment, blood tests including complete blood count, liver enzymes, ferritin and angiotensin-converting enzyme, MRI of the abdomen, MRE, and bone imaging. Blood results were categorized as low, normal, or high according to lab reference values. The DS3 score for disease burden was calculated. MRE was conducted using a standardized protocol at 60 Hz on a 1.5T MRI machine. Spearman correlation and linear regression were used to analyze correlation between variables. Qualitative variables were analyzed via the

Kruskal-Wallis test. Additional analysis was done for patients with a follow-up MRE exam. The p value was significant if <0.05. For Spearman correlation, a positive tendency for significant correlation was considered if 0.05<p<0.2.

**RESULTS**

A total of 29 patients (17 females [58.6%]; mean age, 36.2 years ± 18.6 [SD]) with at least one MRE exam were included. Twenty patients had follow-up imaging. There was a positive but non-significant correlation between LS and splenic volume (r = 0.26, p = 0.17) and between LS and the DS3 score (r = 0.32, p = 0.08). Although not significant, LS values were higher in men. Though not significant, there was also a tendency for a positive correlation between LS and duration of treatment (r = 0.47, p = 0.06).

**CONCLUSION**

There was a tendency towards positive correlations between LS, splenic volume, DS3 scores, and duration of treatment in GD1 patients, but no statistically significant association. However, results were limited due to lack of power of the small sample size.

**CLINICAL RELEVANCE/APPLICATION**

Since patients with GD1 with suboptimal management are at increased long-term risk of liver fibrosis, there is an interest in the periodic assessment of LS. However, there is little scientific literature documenting the use and benefits of MRE for the routine follow-up of LS in GD1 patients.

## W2-SPGI-2 NON-CONTRAST LIVER MRI IS HIGHLY ACCURATE FOR DETECTION OF UVEAL MELANOMA LIVER METASTASIS

Hyun Jung Chung (*Abstract Co-Author*) Nothing to Disclose
June Park, MD (*Abstract Co-Author*) Nothing to Disclose
Kyunghwa Han, PhD (*Abstract Co-Author*) Nothing to Disclose
Nieun Seo, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

We aimed to evaluate the diagnostic performance of different abbreviated MRI sets including non-contrast MRI (NC-MRI) from a complete gadoxetic acid-enhanced MRI, and to investigate potential additional value of hepatobiliary phase (HBP) to detect uveal melanoma liver metastasis.

**METHODS AND MATERIALS**

This retrospective study included 27 uveal melanoma patients who underwent gadoxetic acid-enhanced MRI for suspected liver metastasis. Two independent readers reviewed three MR imaging sets: NC-MRI (T1-weighted, T2-weighted, and diffusion-weighted imaging), dynamic-MRI (NC-MRI and dynamic phases), and full-MRI (dynamic-MRI and HBP) to detect hepatic metastases. Overall diagnostic performance for detecting metastases was evaluated using alternative free-response receiver operating characteristic curve analysis. The sensitivity, and positive predictive value (PPV) were compared among imaging sets by using logistic regression with generalized estimating equations.

**RESULTS**

Of 27 patients, 23 patients had 80 hepatic metastases. Overall diagnostic performance for detecting metastases was not significantly different among three MRI sets (P = 0.327). The reader-averaged area under the curve [AUC] was 0.951 (95% CI, 0.911-0.991) for NC-MRI, 0.967 (0.937-0.998) for dynamic-MRI, and 0.963 (0.930-0.995) for full-MRI, without significant difference between NC-MRI and full-MRI (P = 0.597), and between dynamic-MRI and full-MRI (P > 0.999). The sensitivity to detect liver metastasis was 86.9% (78.1-95.7) for NC-MRI, and 91.9% (86.8-97.0) for both dynamic-MRI and full-MRI, without significant difference between NC-MRI and others (P = 0.072). The PPV was 94.6% (90.0-99.1) for NC-MRI, 94.8% (90.4-99.2) for dynamic-MRI, and 93.6 (89.1-98.2) for full-MRI without significant difference among them (P = 0.282).

**CONCLUSION**

NC-MRI is highly accurate for diagnosis of uveal melanoma liver metastasis comparable to full-protocol gadoxetic acid-enhanced MRI. In addition, there was no incremental value of HBP compared to dynamic-MRI for uveal melanoma liver metastasis.

**CLINICAL RELEVANCE/APPLICATION**

NC-MRI can be an alternative to gadoxetic acid-enhanced MRI for detecting uveal melanoma liver metastasis. Furthermore, there is no advantage in using hepatobiliary contrast agent for liver MRI in patients with uveal melanoma.

## W2-SPGI-5 QUANTITATIVE EVALUATION OF LIVER METASTASES OPTIMIZATION IN ARTERIAL PHASE STUDY USING PHOTON COUNTING CT

Akio Hiwatashi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masahiro Nakashima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Kawai, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Shota Oba (*Abstract Co-Author*) Nothing to Disclose
Takayuki Noro, MD (*Abstract Co-Author*) Nothing to Disclose
Misugi Urano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Toshihide Itoh, PhD (*Abstract Co-Author*) Employee, Siemens AG
Tatsuhito Yamamoto (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess characteristic CT findings of liver metastases on virtual monochromatic image (VMI) generated by a photon-counting detector CT(PCD-CT) and to explore conditions for their optimal visualization.

**METHODS AND MATERIALS**

This retrospective study included patients with liver metastasis who underwent contrast-enhanced PCD-CT (NAEOTOM Alpha, Siemens Healthineers, Forchheim, Germany) between March 1 and December 31. Early (40 seconds after injecting contrast medium) and delayed phase images were obtained. Subjects with =10 liver lesions or lesions measuring = 5-cm diameter were excluded. The CT value and its standard deviation (SD) in the ring-enhancing area (RE), central low-attenuating area (LAA), and unaffected liver parenchyma were measured on virtual monochromatic image (VMI) by placing region of interests (ROIs), thereafter, the contrast-noise ratios (CNRs) of RE and LAA relative to the liver parenchyma were calculated. These evaluations were performed on 40-keV, 55-keV, 70-keV, and 90-keV VMI with ROIs copied and pasted accordingly. Statistical analysis was performed using a paired t-test. P-values less than 0.05 was considered as statistically significant.

**RESULTS**

Seventy liver metastases in 35 patients (mean age: 64 years; 18 males) were subjected to analysis. The average CNR of the RE was 0.62, 0.43, 0.34, and 0.13 at 40, 55, 70, and 90 keV, respectively. Paired t-tests revealed significant differences between 70 vs. 40 keV, 70 vs. 55 keV, and 70 vs. 90keV. The average CNR of LAA was 0.39, 0.41, 0.49, and 0.46 at 40, 55, 70, and 90keV, respectively. A significant difference was observed only between 70 vs. 90 keV. SD(LAA) were 2.08, 1.37, 9.93, and 8.31 at 40, 55, 70, and 90keV, respectively. Significant differences were observed when comparing data obtained at 70 vs. 40 keV, 70 vs. 55 keV, and 70 vs. 90keV.

**CONCLUSION**

Quantitative evaluation of this study suggests ring enhancement and heterogeneous enhancement in low attenuation area of liver metastases visualize more clearly at 40 ,55keV, than at 70keV.

**CLINICAL RELEVANCE/APPLICATION**

Photon-counting detector CT enhances visualization of characteristic contrast-enhanced CT findings of liver metastasis by utilizing virtual monochromatic imaging, potentially leading to earlier therapeutic decisions in malignant diseases.

## W2-SPGI-9 THE ROLE OF HELICAL FLOW PHENOMENON IN MAIN PORTAL VEIN AS A BIOMARKER OF THE PRESENCE OF ESOPHAGEAL VARICES WITH RED COLOR SIGN IN PATIENTS WITH LIVER CIRRHOSIS

Chung-Man Moon (*Abstract Co-Author*) Nothing to Disclose
Sang Soo Shin, MD (*Abstract Co-Author*) Nothing to Disclose
Seong Woo Cho, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To verify the feasibility of helical flow phenomenon in main portal vein (PV) for assessing esophageal varices (EVs) with red color (RC) sign using four-dimensional flow magnetic resonance imaging (4D flow MRI).

**METHODS AND MATERIALS**

A total of 106 patients with liver cirrhosis (LC) caused by hepatitis B and/or C virus underwent 4D flow MRI using a 3-T scanner (Skyra; Siemens Healthcare, Erlangen, Germany), obtaining images at both proximal and distal main PV. Patients were classified into three groups: patients without EVs (Group 1, n = 46, 35-80 years); patients with EVs without RC sign (Group 2, n = 42, 41-81 years); patients with EVs and RC sign (Group 3, n = 18, 44-81 years). The presence of the RC sign was defined by the observation of erythrogenic findings on the varices during endoscopy. Hemodynamic information was acquired at the proximal and distal main PV, respectively. In-plane velocity data were analyzed to obtain through-plane vorticity, as a marker of rotational blood flow. The maximum vorticity (vorticitymax) was subsequently obtained throughout the cardiac cycles. The presence of helical flow was defined as a vorticitymax at the proximal PV higher than 0.7 s-1. The chi-square test and two-tailed unpaired t-test were performed to evaluate a statistical difference between the groups.

**RESULTS**

The helical flow was observed in 65.2%, 52.4%, and 22.2% of patients in groups 1, 2, and 3, respectively (P= 0.008). In addition, Group 1 exhibited 1.09 s-1 of vorticitymax at the proximal PV, and this value decreased to 0.83 s-1 for Group 2 (P< 0.05; with Group 1) and 0.60 s-1 for Group 3 (P< 0.05; with Group 1). Meanwhile, vorticitymax at the distal PV significantly decreased from 0.82 s-1 for Group 1 to 0.57 s-1 for Group 3 (P< 0.001). While a significant difference in vorticitymax at the proximal PV between Group 2 and Group 3 was not observed, vorticitymax at the distal PV for Group 3 significantly decreased to 0.57 s-1 (P< 0.05; with Group 2).

**CONCLUSION**

The helical flow phenomenon of the main portal vein was negatively correlated with the presence of esophageal varices with red color sign in patients with liver cirrhosis.

**CLINICAL RELEVANCE/APPLICATION**

The helical flow phenomenon of main portal vein derived from 4D flow MRI may play an important role in predicting the presence of esophageal varices with a high risk of bleeding in patients with liver cirrhosis.

# Abstract Archives of the RSNA, 2024

W2-SPGU

**Genitourinary Imaging Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPGU-1 MRI-RADIOMICS MODEL PREDICTS PROGRAMMED CELL DEATH-LIGAND 1 EXPRESSION STATUS IN UROTHELIAL CARCINOMA

Young Taik Oh, MD (*Abstract Co-Author*) Nothing to Disclose
Jae Hyon Park, MD (*Abstract Co-Author*) Nothing to Disclose
Jongjin Yoon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Dae Chul Jung, MD (*Abstract Co-Author*) Nothing to Disclose
Insun Park (*Abstract Co-Author*) Nothing to Disclose
Byung Chul Kang (*Abstract Co-Author*) Nothing to Disclose
Taeyoun Lee, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop and validate an MRI-radiomics model with optimized feature selection and machine learning techniques for predicting programmed cell death-ligand 1 (PD-L1) expression status in urothelial carcinoma (UC) in the urinary bladder.

### METHODS AND MATERIALS

This retrospective study included consecutive patients with newly diagnosed and pathologically confirmed UC with PD-L1 immunohistochemistry results (74 patients in the training-set, 20 patients in the test-set). An MRI-radiomics model was built using 1308 radiomics features from T2-weighted images after optimizing various combinations of four feature selections and five machine learning techniques. Tumor characteristics (tumor length, radiologic tumor stage, multiplicity, and morphology), ADC values, and their combinations were used to construct the tumor model, the ADC model, and the tumor + ADC model, respectively. All models were trained using five-folds cross validation and evaluated on the test-set. The area under the receiver operating characteristic curve (AUROC) of these models was compared.

### RESULTS

A total of 94 patients (69.3±10.2 years; 75 [80%] men) were included, and oversampling was performed to account for the data imbalance between PD-L1 (+) and PD-L1 (-) UC (33% [31/94] vs. 67% [63/94]). The radiomics model using a correlation filer and random forest showed the highest AUROC (0.91, 95% CI, 0.62-0.99), followed by the tumor model (0.70, 95% CI, 0.45-0.89, P=0.082), the ADC model (0.66, 95% CI, 0.44-0.86, P=0.043), and the tumor + ADC model (0.59, 0.34-0.81, P=0.012).

### CONCLUSION

The radiomics model may hold clinical utility in screening PD-L1 (+) UC patients who could potentially benefit from immune checkpoint inhibitors.

### CLINICAL RELEVANCE/APPLICATION

MRI-based radiomics models could provide a non-invasive and cost-effective alternative to sequencing, with the potential to be utilized for drug selection and prognosis prediction in personalized treatment strategies.

## W2-SPGU-3 MRI DIFFUSION MODELS FOR NONINVASIVE ASSESSMENT OF RENAL INTERSTITIAL FIBROSIS AND ANNUAL LOSS OF KIDNEY FUNCTION OF CHRONIC KIDNEY DISEASE

Ping Liang (*Abstract Co-Author*) Nothing to Disclose
Zhouyan Liao (*Abstract Co-Author*) Nothing to Disclose
Chuou Xu (*Abstract Co-Author*) Nothing to Disclose
Guanjie Yuan (*Abstract Co-Author*) Nothing to Disclose
Zhen Li, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to explore the capability of seven diffusion models including DWI, IVIM, DKI, CTRW, FROC, SEM, and sADC to assess renal interstitial fibrosis (IF) and annual loss of kidney function of CKD.

### METHODS AND MATERIALS

106 CKD patients and 30 controls underwent a ZOOMit diffusion sequence scan. The CKD group was divided into mild (=25%) and moderate-to-severe (>25%) IF subgroups based on the percentage of interstitial fibrosis lesions in the sampled tissue area. Least absolute shrinkage and selection operator (LASSO) regression was used to select the significant diffusion parameters in assessing IF severity and ROC analysis was applied to evaluate the

diagnostic efficacy. Linear mixed-effects models were used to calculate annual patient-specific estimated glomerular filtration rate (eGFR) slope and evaluate the association between diffusion parameters and 1~3 years eGFR slope.

**RESULTS**

The Lasso regression showed that in assessing IF severity, combining cortical DFROC, MKDKI, fpIVIM, and Medullary sADC achieved good performance in the training (0.954, 95% CI 0.880-0.989) and testing (0.859, 95% CI 0.687-0.957) cohort, respectively. 52, 36, and 15 patients met the one-year, two-years, and three-years follow-up periods, with average eGFR slope of 1.371, -0.160, and -0.337, respectively. After adjustment for baseline covariates including age, sex, baseline eGFR group, etiology (primary or secondary), use of ACEI/ARB, use of immunosuppressants, fibrosis score, and fibrosis score×time, linear mixed effect model indicated that cortical fpIVIM was associated with change in eGFR over time of one year (cortical fpIVIM×time: 0.031, 95% CI 0.001-0.062, p=0.044), cortical aCTRW was associated with change in eGFR over time of two years (cortical aCTRW×time: 0.090, 95% CI 0.031-0.150, p=0.004), corticalaSEM was associated with change in eGFR over time of three years (cortical aSEM×time: 0.086, 95% CI 0.036-0.135, p=0.002).

**CONCLUSION**

MRI Diffusion parameters can serve as feasible and effective imaging biomarkers in identifying different degrees of renal IF and assessing the annual loss of kidney function of CKD. The combination of cortical DFROC, MKDKI, fpIVIM, and Medullary sADC can better evaluate the severity of fibrosis. The higher cortical fpIVIM, aCTRW, and aSEM reflect the lower loss of eGFR in one year, two years, and three years, respectively.

**CLINICAL RELEVANCE/APPLICATION**

The baseline diffusive MR parameters can reflect the severity of renal fibrosis and the level of 1~3 years eGFR loss, which can help patients avoid puncture pain and early understand prognosis, and help clinicians make treatment decisions and follow-up.

## W2-SPGU-4 MULTIMODAL APPROACH TO OPTIMIZE BIOPSY DECISION-MAKING FOR PI-RADS 3 LESIONS AT MULTIPARAMETRIC MRI

Peter L. Choyke, MD (*Abstract Co-Author*) Nothing to Disclose
Bradford J. Wood, MD (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;Researcher, Koninklijke Philips NV;Intellectual property, Koninklijke Philips NV;Equipment Support, Koninklijke Philips NV;Researcher, Celsion Corporation;Research Grant, Celsion Corporation;Researcher, BTG International Ltd;Intellectual property, BTG International Ltd;Researcher, Boston Scientific Corporation;Research Grant, Boston Scientific Corporation;Intellectual property, Boston Scientific Corporation;Researcher, Siemens AG;Equipment Support, Siemens AG;Researcher, Sarasota Interventional Radiology;Researcher, NVIDIA Corporation;Research Grant, NVIDIA Corporation;Equipment support, AngioDynamics, Inc;Equipment support, Profound Medical Inc;Researcher, Canon Medical Systems Corporation;License agreement, Canon Medical Systems Corporation;Researcher, AstraZeneca PLC;Researcher, Exact Imaging Inc
Nathan S. Lay, PhD (*Abstract Co-Author*) Inventor, ScanMed
Maria Merino, MD (*Abstract Co-Author*) Nothing to Disclose
Sandeep Gurram (*Abstract Co-Author*) Nothing to Disclose
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Stephanie A. Harmon, PhD (*Abstract Co-Author*) Nothing to Disclose
Kutsev Ozyoruk, PhD (*Abstract Co-Author*) Nothing to Disclose
Peter Pinto (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;License agreement, Koninklijke Philips NV;
Enis Yilmaz, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Chen (*Abstract Co-Author*) Nothing to Disclose
David Gelikman (*Abstract Co-Author*) Nothing to Disclose
Omer Esengur, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and assess a multimodal approach including clinical, laboratory and biparametric MRI-based AI model for determining the necessity of prostate biopsy in patients with PI-RADS 3 lesions.

**METHODS AND MATERIALS**

A retrospective analysis was conducted on a prospectively recruited patient cohort with PI-RADS 3 lesions between April 2019 and February 2024. All patients underwent multiparametric MRI, and subsequent MRI/US fusion-guided biopsy. Demographic data, PSA and PSA density (PSAD) levels, prostate volumes, lesion characteristics, prior biopsy history, and AI evaluations were retrospectively analyzed clinically significant prostate cancer (csPCa) (GG=2). Statistical analysis included Fisher's exact test, logistic regression (LR), and decision curve analysis (DCA).

**RESULTS**

In 248 patients, 312 PI-RADS 3 lesions underwent MRI/US fusion-guided biopsy (n=258 non-csPCa, n=44 csPCa). The AI model demonstrated a sensitivity of 57% for detecting csPCa, and a specificity of 62% for csPCa with a PPV of 18% and NPV of 89%. Subgroup analyses based on zonal origin, and index lesion PI-RADS category (3 vs =4) revealed notably a high NPV for transition zone lesions (88%). While the NPV for patients with an index lesion of PI-RADS 3 was found to be high (91%), no difference was observed in AI detection between csPCA and non-csPCA patients (OR= 2.1, p=.21). Similar analysis done for PSAD showed an NPV of 92%, a sensitivity of 61%, and a strong association between a higher PSAD (= .15 ng/mL2) and presence of csPCa in PI-RADS 3 index lesions (OR=6.6, p<.001). Combining AI and PSAD enhanced sensitivity to 78% while maintaining a high NPV of 93%. LR identified age (p=.03) and PSAD (p=.03) as significant predictors for csPCa. LR also did not identify any predictors of AI performance. DCA showed that using the AI model for minimizing unnecessary biopsies outperforms conventional biopsy strategies, providing greater net benefits within specific threshold probabilities (.206 - .348). Across all thresholds, the AI method outperforms both the biopsy-all and biopsy-none approaches, achieving a peak net reduction in interventions of .723, most notably within the .195 to .351 range by achieving the largest differences.

**CONCLUSION**

Integrating AI to PSAD maximizes csPCa detection performance. Moreover, the high capabilities of the multimodal approach in ruling out csPCa offer a promising strategy for improving biopsy decision-making for PI-RADS 3 lesions.

**CLINICAL RELEVANCE/APPLICATION**

Integrating AI with PSAD elevates biopsy precision, potentially reducing unwarranted procedures for PI-RADS 3 lesions and streamlining patient management.

## W2-SPGU-5 MULTIPARAMETRIC MAGNETIC RESONANCE IMAGING IN PROSTATE CANCER SCREENING AT THE AGE OF 45 - RESULTS FROM THE FIRST SCREENING ROUND OF THE PROBASE TRIAL

Peter Albers, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD (*Abstract Co-Author*) Nothing to Disclose

Lars Schimmoeller, MD (*Abstract Co-Author*) Nothing to Disclose
Kai Jannusch (*Abstract Co-Author*) Nothing to Disclose
Matthias Boschheidgen (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the efficacy of multiparametric MRI (mpMRI) in men aged 45 years participating in a PC screening trial (PROBASE) based on their baseline prostate-specific antigen (PSA) levels.

**METHODS AND MATERIALS**

Men with confirmed PSA levels =3 ng/ml were offered mpMRI followed by MRI/transrectal ultrasound fusion biopsy (FBx) comprising targeted and systematic cores. mpMRI scans from the initial screening round for men randomized to immediate PSA testing in the PROBASE trial were evaluated by local readers and two reference radiologists (each with experience exceeding 10,000 prostate MRI examinations) blinded to histopathology. Comparison of local and reference Prostate Imaging-Data and Reporting System (PI-RADS) scores, along with calculation of sensitivity, negative predictive value (NPV), and accuracy for both readings at various cutoffs (PI-RADS 3 vs. 4).

**RESULTS**

Among 186 participants, 114 underwent mpMRI and FBx, with 47 (41%) diagnosed with PC, of whom 33 (29%) had clinically significant PC (csPC; International Society of Urological Pathology grade group =2). Interobserver reliability between local and reference PI-RADS scores was moderate (? = 0.41). At a PI-RADS 4 cutoff, reference reading demonstrated superior performance for csPC detection (sensitivity 79%, NPV 91%, accuracy 85%) compared to local reading (sensitivity 55%, NPV 80%, accuracy 68%). No PC cases were missed by reference reading at a PI-RADS <3 cutoff. Employing PI-RADS =4 as a biopsy cutoff could reduce negative biopsies by 68% through mpMRI and avoid detection of nonsignificant PC in 71% of cases.

**CONCLUSION**

Interpreting prostate MRI in a young screening cohort poses challenges. The accuracy of MRI for detecting csPC is significantly influenced by reader experience, suggesting the potential benefit of double reading. Further data are warranted before incorporating MRI into PC screening protocols for men aged 45 years.

**CLINICAL RELEVANCE/APPLICATION**

Our results indicate that MRI accuracy is moderate for men aged 45 years but can be increased by a second reading of the images by expert radiologists. For broad application of MRI in routine screening, double reading may be advisable.

## W2-SPGU-6 MRI FEATURES AND ONCOLOGICAL SURVEILLANCE IN PATIENTS DIAGNOSED WITH HIGH-RISK PROSTATE CANCER

Birte Valentin, MD (*Abstract Co-Author*) Nothing to Disclose
Kai Jannusch (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Albers, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lars Schimmoeller, MD (*Abstract Co-Author*) Nothing to Disclose
Jan P. Radtke (*Abstract Co-Author*) Nothing to Disclose
Matthias Boschheidgen (*Presenter*) Nothing to Disclose

**PURPOSE**

This single-center cohort study aimed to analyze the multiparametric MRI (mpMRI) features of patients diagnosed with International Society of Urological Pathology (ISUP) grade group (GG) 4 or 5 prostate cancer (PC) and to investigate the correlation between MRI parameters and the occurrence of biochemical recurrence (BCR) following radical prostatectomy (RPE).

**METHODS AND MATERIALS**

Consecutive patients with mpMRI and ISUP GG 4 or 5 PC were retrospectively assessed. Clinical data, MR-guided biopsy results, and diagnostic mpMRI parameters were analyzed. A subgroup of patients who underwent RPE with follow-up was examined separately. Univariate and multivariate analyses were conducted to identify parameters associated with BCR after RPE.

**RESULTS**

A total of 145 patients (mean age 70 years, median PSA 10.9 ng/ml) were included. Ninety-nine percent had a PI-RADS classification of 4 or 5, 48% showed MRI T3 stage, and the median diameter of the MRI index lesion (IL) was 15 mm. The IL exhibited a median ADC value of 668 ×10-6 mm2/s and showed contrast enhancement in 94% of cases. Among patients with follow-up after RPE (n = 82; mean follow-up time 68 ± 27 months), MRI parameters such as the contact length of the IL to the pseudocapsule (LCC), MRI T3 stage, and IL localization differed significantly ($p < 0.05$). Higher PSAD and MRI T3 stage were identified as independent predictors for the risk of BCR when considering clinical, biopsy, and MRI parameters.

**CONCLUSION**

ISUP GG 4 or 5 PC presents distinct characteristics on mpMRI, which were detected on MRI in all cases. Furthermore, higher PSAD and MRI T3 stage were significant predictors for BCR following RPE.

**CLINICAL RELEVANCE/APPLICATION**

Elevated MRI staging parameters alongside higher PSAD levels appear to correlate with an increased risk of biochemical recurrence (BCR) during follow-up, potentially aiding clinicians in the early identification of these patients. Nevertheless, integrating MRI into standardized PSA screening protocols may mitigate the underdiagnosis of advanced prostate cancer stages in older men.

## W2-SPGU-7 MRI CHARACTERISTICS PREDICT RISK OF DISEASE PROGRESSION OR POSSIBLE SAMPLING ERROR IN PATIENTS WITH ISUP GRADE GROUP 1 PROSTATE CANCER

Birte Valentin, MD (*Abstract Co-Author*) Nothing to Disclose
Kai Jannusch (*Abstract Co-Author*) Nothing to Disclose
Gerald Antoch, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Albers, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lars Schimmoeller, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias Boschheidgen (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to analyse multiparametric MRI (mpMRI) characteristics of patients diagnosed with ISUP grade group (GG) 1 prostate cancer (PC) on initial target plus systematic MRI/TRUS fusion-guided biopsy and investigate histopathological progression during follow-up.

**METHODS AND MATERIALS**

A retrospective single-centre cohort analysis was conducted on consecutive patients with mpMRI visible lesions (PI-RADS=3) and detection of ISUP-1-PC at the time of initial biopsy. The study assessed clinical, mpMRI, and histopathological parameters. Subcohorts were analysed with i) patients who had confirmed ISUP-1-PC and ii) patients who experienced histopathological upgrading to ISUP = 2 PC during follow-up either at re-biopsy or radical prostatectomy (RP).

**RESULTS**

A total of 156 patients (median age 65y) between March 2014 and August 2021 were included. Histopathological upgrading to ISUP = 2 was detected in 55% of patients during a median follow-up of 9.5 month (IQR 2.2-16.4). When comparing subgroups with an ISUP upgrade and sustained ISUP 1 PC, they differed significantly in contact length of the index lesion to the pseudocapsule, ADC value, PI-RADS category, and the MRI grading group (mGG) ($p<0.05$). In the ISUP GG = 2 subgroup, 91% of men had PI-RADS category 4 or 5 and 82% exhibited highest mGG (mGG3). At multivariate analysis, mGG was the only independent parameter for predicting ISUP=2-PC in these patients.

**CONCLUSION**

MRI reveals important information about PC aggressiveness and should be incorporated into clinical decision making when ISUP-1-PC is diagnosed. In cases of specific MRI characteristics adverse to the histopathology early re-biopsy might be considered.

**CLINICAL RELEVANCE/APPLICATION**

In cases with clear MRI characteristics for a csPC (e.g., mGG 3 and/or PI-RADS 5, or clear focal PI-RADS 4 lesions on MRI) and missed/negative targeted biopsy early re-biopsy (e.g., within 6 months) might be considered.

## W2-SPGU-8 MULTIPARAMETRIC FUNCTIONAL MRI OF THE KIDNEYS IN ONCOLOGIC PATIENTS UNDERGOING RADIONUCLIDE THERAPY - PRELIMINARY RESULTS OF A PROSPECTIVE STUDY

Fritz Schick, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Thomas Kuestner, DIPLENG (*Abstract Co-Author*) Nothing to Disclose
Christian La Fougere (*Abstract Co-Author*) Nothing to Disclose
Aya Ghoul (*Abstract Co-Author*) Nothing to Disclose
Nils Trautwein (*Abstract Co-Author*) Nothing to Disclose
Isabelle Loster (*Abstract Co-Author*) Nothing to Disclose
Brigitte Gueckel (*Abstract Co-Author*) Nothing to Disclose
Petros Martirosian, PhD (*Abstract Co-Author*) Nothing to Disclose
Helmut Dittmann (*Abstract Co-Author*) Nothing to Disclose
Ferdinand F. Seith, MD, BSc (*Abstract Co-Author*) Nothing to Disclose
Cecilia Liang, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Radionuclide therapy uses intravenously injected radiopharmaceuticals for targeted radiotherapy. Radiation-induced nephropathy is observed in up to 10%, which is difficult to detect at early stages and can limit the treatment options in individual patients. Multiparametric renal MRI has proven great potential in assessing functional and structural changes in different kidney diseases. The aim of this study was to evaluate if multiparametric MRI can detect changes in renal parenchyma in patients undergoing radionuclide therapy to potentially detect radiation-induced nephropathy.

**METHODS AND MATERIALS**

In this prospective study, 23 patients with advanced prostate cancer (n=9) or neuroendocrine tumor (n=14) scheduled for radionuclide therapy were recruited between April 2021 and April 2022 (mean age 71 y/o, 6f). Depending on the number of treatment cycles, up to 4 MR examinations/patient were performed with following MR-protocol: arterial spin labeling (ASL), diffusion weighted imaging (DWI), blood oxygen-dependent (BOLD) imaging, T1 and T2 mapping. Blood tests for serum creatinine and glomerular filtration rate (GFR) as well as renal scintigraphy were performed regularly. The radiation dose of the kidneys at each cycle was calculated using SPECT/CT. Additionally, MRI scans with the same protocol were performed in a reference group with 10 healthy volunteers (mean age 31 y/o, 5f).

**RESULTS**

In total, 82 MR-Examinations were performed: n=4 in 7 patients, n=3 in 5 patients, n=2 in 8 patients and 10 volunteers, n=1 in 3 patients. The radiation dose was 3630 ± 1571 mGy per kidney. Compared to healthy volunteers, patients showed lower values in ASL and kidney volume at the first treatment cycle ($p<0.05$). In patients with a significant decrease of GFR under therapy (>10% decrease, n=8), significant differences were found in following MR-parameters in follow-up scans: ASL, DWI, BOLD, T1 mapping. No significant correlation could be found between MR parameters and renal scintigraphy or MR parameters and radiation dose per kidney. No significant difference could be found between patients with neuroendocrine tumor and prostate cancer.

**CONCLUSION**

In this prospective pilot study, changes in multiparametric renal MRI were observed in patients with decreasing kidney function under radionuclide therapy. This might indicate a possible role for MRI in detecting radiation-induced nephropathy. Studies with larger patient cohorts are needed to confirm these results.

**CLINICAL RELEVANCE/APPLICATION**

Multiparametric renal MRI could serve as an additional non-invasive diagnostic tool to detect and monitor treatment-induced nephropathy under oncologic therapy. This might help to adapt treatment regimens to preserve kidney function in these patients in the future.

# Abstract Archives of the RSNA, 2024

W2-SPHN

**Head & Neck Imaging Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPHN-1 COMPARISON OF TWO DIFFERENT IODINE IMAGING GENERATED FROM DUAL-ENERGY COMPUTED TOMOGRAPHY (CT) AND SUBTRACTION FOR THE EVALUATION OF SINONASAL AND NASOPHARYNGEAL MALIGNANCIES

Tatsushi Kobayashi, MD (*Abstract Co-Author*) Support, Canon Medical Systems Corporation
Hirofumi Kuno, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomoaki Sasaki, MD (*Abstract Co-Author*) Nothing to Disclose
Shioto Oda, MD (*Abstract Co-Author*) Nothing to Disclose
Yusuke Miyasaka, MD (*Abstract Co-Author*) Nothing to Disclose
Takashi Hiyama, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Iodine images generated by dual-energy CT (DECT) or subtraction improve tumor delineation. This study aimed to investigate the iodine imaging modality superior for evaluating the extent of sinonasal and nasopharyngeal malignancies.

### METHODS AND MATERIALS

We enrolled 28 consecutive patients (15 men and 13 women; median of age, 66 years) diagnosed with sinonasal or nasopharyngeal malignancies who underwent non-contrast and contrast-enhanced DECT. Iodine images derived from DECT (DEII) were generated using commercial software. Subtraction iodine imaging (SII) was performed by subtracting the pre- and post-contrast scans using multi-energy virtual monochromatic images (45-75 keV in increments of 5 keV). The contrast-to-noise ratio (CNR) of the SII was calculated for each energy to determine the optimal energy. Two blinded radiologists evaluated tumor delineation using a 5-point scale with DEII and SII created from the energy with the highest CNR. Subsequently, two radiologists assessed the presence of invasion in the orbit, skull base, intracranial and prevertebral muscles, and paranasal sinuses using a 5-point scale with magnetic resonance imaging (MRI) as the standard reference. The assessment was conducted three times: CCT alone, CCT-plus DEII, and CCT-plus SII. The delineation scores were evaluated using the Wilcoxon signed-rank test. A score of 3 or above was considered positive to assess the diagnostic performance. Area under the curve (AUC) analysis was performed, and the inter-rater agreement between the two scores was evaluated using the kappa coefficient.

### RESULTS

The CNR of SII was the highest at 65 keV. The tumor delineation score was significantly higher for the SII than for the DEII (median: 2 and 4, respectively; $p < 0.001$). The AUC for each subsite showed no significant differences ($p>0.05$) among the CCT, CCT-plus SII, and CCT-plus DEII. In the overall assessment, CCT-plus-SII exhibited significant diagnostic performance compared with CCT and CCT-plus-DEII (AUC: 0.918, 0.928, and 0.960, respectively; $p < 0.017$). The CCT-plus-SII showed higher sensitivity (86.36%, 86.57%, 94.03%; $p < 0.05$) and specificity (83.33%, 84.91%, 94.34%; $p = 0.08$) than the CCT or CCT-plus-DEII. The inter-rater agreement rates were all > 0.8, indicating high consistency.

### CONCLUSION

SII outperforms DEII in tumor delineation and has the potential to assess accurately the extent of sinonasal and nasopharyngeal malignancies.

### CLINICAL RELEVANCE/APPLICATION

In CCT, the evaluation of the extent of sinonasal and nasopharyngeal malignancies is impeded by bony structures ; however, incorporating SII has the potential to facilitate a more precise assessment of tumor extension.

## W2-SPHN-2 PARAMETERS BASED ON DUAL ENERGY CT FOR THE PREDICTION RESPONSE TO INDUCTION CHEMOTHERAPY IN NASOPHARYNGEAL CARCINOMA

Junhao Huang (*Abstract Co-Author*) Nothing to Disclose
Yao Huang (*Abstract Co-Author*) Nothing to Disclose
Jing Zhang (*Abstract Co-Author*) Nothing to Disclose
Jiuquan Zhang (*Abstract Co-Author*) Nothing to Disclose
Daihong Liu (*Abstract Co-Author*) Nothing to Disclose
Huanhuan Ren (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to investigate whether the parameters from dual-energy computed tomography (DECT) can predict the response to chemotherapy in nasopharyngeal carcinoma (NPC) based on the Response Evaluation Criteria in Solid Tumors guidelines.

### METHODS AND MATERIALS

In this retrospective study, a total of 61 NPC patients [male: 48 (76.9%); average age: 52.04 ± 10.87] underwent a non-enhanced and venous phase of contrast-enhanced DECT from March 2019 to November 2023. The DECT-derived iodine concentration, effective atomic number, and electron density of the tumour lesions in non-enhanced and venous phases were calculated to predict the response to induction chemotherapy in NPC. We employed univariate analysis and stepwise backward multivariate analysis to identify significant clinical variables and DECT parameters of chemotherapy response. Subsequently, we developed a clinical model incorporating significant clinical variables and a DECT model integrating relevant DECT parameters using logistic regression. A combined model was developed using independent predictors. ROC analysis, calibration curves, and decision curve analysis were performed to evaluate the performance of the three predictive models.

### RESULTS

Sixty-one patients (including 39 responders and 22 non-responders) were enrolled. The combined model achieved an AUC of 0.77 [95% confidence interval (CI), 0.69-0.79], which was higher than that of the DECT model [AUC, 0.71 (95% CI, 0.54-0.78)] or clinical model (Ki67) [AUC, 0.63 (95% CI, 0.58-0.72)].

### CONCLUSION

The proposed simple combined model using iodine concentration from DECT provided accurate response prediction to induction chemotherapy for patients with NPC and may be used to facilitate clinical decision-making.

### CLINICAL RELEVANCE/APPLICATION

The prediction treatment response to induction chemotherapy can be easily obtained for all patients with NPC by inputting two types of information into the model. They help in the decision-making for optimal personalized treatment.

## W2-SPHN-3 IMAGE QUALITY OF VIRTUAL MONOCHROMATIC AND MATERIAL DENSITY IODINE IMAGES FOR EVALUATION OF HEAD AND NECK NEOPLASMS USING DEEP LEARNING-BASED CT IMAGE RECONSTRUCTION - A RETROSPECTIVE OBSERVATIONAL STUDY

Ulf K. Teichgraeber, MD (*Abstract Co-Author*) Research Consultant, W. L. Gore & Associates, Inc;Research Consultant, Siemens AG;Research Consultant, CeloNova BioSciences, Inc ;Research Consultant, General Electric Company
Lucja Mlynska, MD (*Abstract Co-Author*) Nothing to Disclose
Florian Burckenmeyer (*Abstract Co-Author*) Nothing to Disclose
Stephanie Graeger, MD (*Abstract Co-Author*) Nothing to Disclose
Felix V. Guettler (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the quality of deep learning image reconstructed (DLIR) virtual monochromatic images (VMI) and material density (MD) iodine images from dual-energy computed tomography (DECT) for the evaluation of head and neck neoplasms with CT scans from a conventional single-energy protocol.

### METHODS AND MATERIALS

A total of 294 head and neck CT scans (98 VMIs operated at 60 keV, 102 MD iodine images, and 94 images from a 120 kVp single-energy CT (SECT) protocol) were retrospectively evaluated. VMIs and MD iodine images were generated using the Gemstone Spectral Imaging (GSI) mode using DLIR and metal artifact reduction (MAR) algorithms. SECT images were generated using adaptive statistical iterative reconstruction (ASIR-V). Images were scored by two independent readers on a 6-point Likert-type scale for overall image quality, vessel contrast, soft tissue contrast, noise texture, noise intensity, artifact reduction, and sharpness.

### RESULTS

Subjective overall image quality was rated as superior or excellent in 98% of DLIR-based MD iodine images and VMIs, but only in 55% of ASIR-V-based SECT images. For each individual quality criterion, image quality of VMIs and MD iodine images was rated as better than that of SECT images ($p < 0.001$ in each case). Noise texture and intensity were rated better in MD iodine images than in VMIs.

### CONCLUSION

DECT using both DLIR and MAR for the generation of VMIs and MD iodine images resulted in higher subjective quality of oncologic head and neck images than ASIR-V-based SECT. Noise reduction and noise texture were best achieved with DLIR-based MD iodine images.

### CLINICAL RELEVANCE/APPLICATION

(1) Dual-energy CT with deep learning reconstruction improved contrast and sharpness. (2) Material density iodine images reduced noise intensity and improved noise texture. (3) The metal artifact reduction algorithm ideally complemented the dual-energy CT.

## W2-SPHN-4 MACHINE LEARNING-BASED MRI RADIOMICS FOR PREDICTING THE LYMPH NODE METASTASIS IN LARYNGEAL SQUAMOUS CELL CARCINOMA

E.Dilara Topcuoglu (*Presenter*) Nothing to Disclose

### PURPOSE

Laryngeal squamous cell carcinoma (LSCC) is one of the most prevalent tumor types among head and neck malignancies. The tumor stage is affected by lymph node (LN) involvement and distant metastasis, which in turn affects treatment strategies. The objective of this study is to investigate whether machine learning (ML)-based radiomic feature analysis of magnetic resonance imaging (MRI) can predict local metastasis in treatment-naİve patients with LSCC.

### METHODS AND MATERIALS

Between January 2010 and December 2023, patients with histologically confirmed LSCC and pre-treatment MRI were included. Presence of LN metastases were detected either by surgery or by FDG-PET scan. Tumor segmentation was obtained from the contrast-enhanced T1-weigthed (CET1W) images and radiomic features were extracted using the 3D Slicer application (version 5.5.0). Age, sex, tumor involvement site and T stage were also noted as clinical features. The dataset was partitioned into an 80:20 ratio for training and testing purposes. In the training set, more than 80% correlating features were eliminated, and the top 5 features were selected using SelectKBest method with 5-fold cross-validation. Subsequently, three distinct ML algorithms—Random Forest (RF), XGBoost (XGB), and Logistic Regression (LR)—were trained. Each trained algorithm was tested on an unseen test set. The performance metrics were calculated for each classifier.

## RESULTS

A total of 65 patients met the inclusion criteria out of 123 patients (M/L: 58/7). 8515 radiomics features were identified. The top five selected features were ranked as Coarseness, ZoneEntropy, GrayLevelNonUniformity, Idn, and Sphericity. AUC in the training set were 0.84±0.13 for LR, 0.83±0.13 for RF, and 0.77±0.10 for XGB. There were no significant differences in AUCs between models in the training set (p=0.196, Friedman test). In the test set, the AUCs were 0.81, 0.88 and 0.93 for LR, RF, XGB, respectively. Cochran's Q test showed no significant differences between the test set predictions (p=0.368). When the optimal cut-off was selected for each classifier according to Youden's index, sensitivity and specificity were found as 66.7% and 57.1% for LR, 66.7% and 85.7% for XGB, 83.3% and 71.4% for RF, respectively.

## CONCLUSION

ML-based MRI radiomics feature analysis can predict lymph node metastasis in patients with LSCC, in this series.

## CLINICAL RELEVANCE/APPLICATION

The potential of the ML-based pre-treatment MRI radiomics in predicting LN metastases in patients with LSCC, were demonstrated in the current study. The findings can augment future studies using larger datasets with standardized methods that could lead to a clinical guidance tool for optimal treatment planning.

# W2-SPHN-5 THE NATURAL HISTORY AND RADIOLOGICAL CONTROL OF WARTHIN TUMOR: THE UTILITY OF DIFFERENT IMAGING METHODS

Regina L. Elia Gomes, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Alcivan Morais Filho, MD (*Abstract Co-Author*) Nothing to Disclose
Amr Kalander, MD (*Abstract Co-Author*) Nothing to Disclose
Cleiton A. Freitas, MD (*Presenter*) Nothing to Disclose

## PURPOSE

To evaluate the natural progression of Warthin Tumors (WT) in an outpatient clinic, focusing on using radiological analysis tools (ultrasonography, CT, MRI) to determine tumor growth rates. Additionally, the study aimed to provide epidemiological and clinical evaluations of WT patients.

## METHODS AND MATERIALS

This observational study included 191 WT patients confirmed by histological or cytological analysis over 14 years. Data were collected from digital records and imaging reports. Inclusion criteria were age 18 or older, confirmed WT diagnosis, and available imaging records. Exclusion criteria were age under 18, missing imaging records, incomplete data, or refusal to participate. Fifty-two patients were excluded. Patients needed at least two imaging exams with a 180-day interval. Epidemiological and clinical data were statistically analyzed using IBM SPSS Statistics® version 29.0.

## RESULTS

Epidemiological analysis revealed a higher prevalence among males (53%) and Caucasians (85%), with a mean age of 64 years and 81% being smokers. Among 139 patients, 84 underwent serial imaging exams, totaling 124 ultrasonographies, 73 CT scans, and 7 MRIs. One hundred tumors were identified because some patients had bilateral lesions. The Spearman test correlation between time and volumetric increase was statistically significant ($p < 0.001$) for the one hundred tumors analyzed, with a volumetric increase of 1.5 $cm^3$ per year, representing a growth rate of 26% per year and a mean volume doubling time of 3.8 years, and the correlation coefficient (R) was 0.265. However, tumor volume reduction occurred in 27% of cases, and two tumors disappeared. In the subgroup evaluated solely by ultrasonography (34 tumors), the Spearman test correlation was also statistically significant ($p = 0.034$), with 0.43 $cm^3$ yearly increase, 15% growth/year, and 6.5 years mean doubling time ($R = 0.386$).

## CONCLUSION

The evaluation of Warthin tumors' progression can be performed using various imaging methods. Ultrasonography was predominantly used. The choice of imaging method was individualized and not yet standardized, but the data obtained suggest a preference for axial methods when the lesions had shorter volumetric doubling times, while there’s a preference for ultrasonography when lesions grew slowly (higher Spearman test correlation coefficient).

## CLINICAL RELEVANCE/APPLICATION

These observations may contribute to developing a radiological management protocol for WT. Considering some lesions may spontaneously regress, understanding Warthin tumors' growth patterns can aid treatment decisions and improve patient outcomes.

# Abstract Archives of the RSNA, 2024

W2-SPIN

**Imaging Informatics Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPIN-1 NEXT STEP TOWARD FOUNDATION MODELS IN RADIOLOGY? QUANTITATIVE ASSESSMENT OF GPT-4V(ISION)'S MULTIMODAL CAPABILITIES

Laura Kupke (*Abstract Co-Author*) Nothing to Disclose
Gerardo Napodano (*Abstract Co-Author*) Nothing to Disclose
Isabel Wiesinger (*Abstract Co-Author*) Nothing to Disclose
Christian R. Stroszczynski, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Katharina Murtz (*Abstract Co-Author*) Nothing to Disclose
Andreas Schicho (*Abstract Co-Author*) Nothing to Disclose
Christina Wendl (*Abstract Co-Author*) Nothing to Disclose
Okka W. Hamer, MD (*Abstract Co-Author*) Speaker, Intermune, Inc;Speaker, AstraZeneca PLC
Quirin Strotzer, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The potential of Large Language Models in processing medical texts is well-established. With the recent introduction of GPT-4V(ision), a multimodal vision-language model that accepts image inputs, further progress in medical imaging is to be expected. We aimed to conduct a quantitative evaluation of GPT-4V's ability to interpret radiological imaging.

### METHODS AND MATERIALS

This IRB-approved, HIPAA-compliant retrospective study encompassed a mix of common pathologies and normal controls across neuroradiology, chest imaging, and musculoskeletal radiology. A representative image for each case (CT or MRI section, or radiograph as appropriate) was used to generate reports via the application programming interface. The factual correctness of free-text reports and the performance in detecting pathologies in binary classification tasks (25 positive and negative images for each pathology) were assessed using accuracy, sensitivity, specificity, F1-score, and AUC. Binary classification performance was compared to that of a first-year non-radiological resident.

### RESULTS

In total, 515 images were included in the analysis. GPT-4V correctly identified modality and body part in 100% and 99.2% of images, respectively. Accuracy in diagnosing common conditions when tasked to create a free-text report was mixed with results between 0% for pneumothorax (CT and X-ray) up to 90% for brain tumors at MRI. In binary classification tasks, GPT-4V showed overall poor performance with AUCs between 0.46 [95% confidence interval: 0.32, 0.62] for ischemic stroke and 0.64 [0.54, 0.74] for pneumonia compared to an aggregated AUC of 0.97 [0.95, 0.98] for the non-radiological resident reader across all tasks. The model showed a clear tendency towards overdiagnosing pathologies, with 86.5% and 67.7% false-positive rates for the free text and binary classification tasks, respectively.

### CONCLUSION

GPT-4V, in its current version, reliably determines modality and anatomical region from single images. It must not be used to detect, classify, or rule out pathologies. Although the model still lacks performance, the technology may serve as a basis for future foundation models in radiology (models that can perform a wide range of different tasks without requiring special training). Currently, possible use cases include detecting out-of-distribution data in upstream analyses, obviating the need to create task-specific data sets and models.

### CLINICAL RELEVANCE/APPLICATION

Medical professionals and patients alike need to be aware that GPT-4V(ision) (or ChatGPT) is not able to interpret radiological images accurately.

## W2-SPIN-2 AI-DRIVEN ULTRASOUND DETECTION OF OVARIAN CANCER THAT GENERALIZES: AN INTERNATIONAL MULTICENTRE VALIDATION STUDY

Robert Welch (*Abstract Co-Author*) Nothing to Disclose
Pawel Herman (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Epstein (*Abstract Co-Author*) Nothing to Disclose
Kevin Smith, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Emir Konuk (*Abstract Co-Author*) Nothing to Disclose
Adithya Raju Ganeshan (*Abstract Co-Author*) Nothing to Disclose
Filip Christiansen, MSc, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Ovarian lesions are common, and often incidentally detected. A critical shortage of expert ultrasound examiners has raised concerns of unnecessary interventions and delayed cancer diagnoses. Artificial intelligence (AI)-driven diagnostic support has the potential to alleviate this burden and improve patient outcomes. Deep learning has shown promising results in ovarian cancer detection in ultrasound images; however, external validation is lacking. We aimed to develop an AI model for ovarian cancer detection, evaluate its robustness and ability to generalize in a large multicenter setting, and assess an AI-assisted triage strategy.

**METHODS AND MATERIALS**

We retrospectively collected 17,119 ultrasound images from 3,652 women with an ovarian lesion (2,224 benign, 1,428 malignant) from 20 centers in eight countries. A total of 2,660 cases were reviewed by a minimum of seven expert and six non-expert examiners. For each center in turn, we trained a transformer-based model using data from the remaining 19 centers and compared the models' diagnostic performance with that of 33 expert and 33 non-expert examiners, considering sensitivity, specificity, F1 score, and area under the receiver operating characteristic curve (AUC). Furthermore, we retrospectively simulated and assessed how these models could be used in AI-assisted triage and compared it to current practice.

**RESULTS**

The models demonstrated robust performance across centers, ultrasound systems, and histological diagnoses, with an AUC of 0.93 (95% CI 0.92-0.94) and F1 score of 83.5% (95% CI 82.1-84.9) on cases from unseen centers. They outperformed all expert and non-expert examiners, with F1 scores of 79.4% (95% CI 77.9-80.9; ? = 4.1 [95% CI, 2.6-5.5, p lt; 0.0001]) and 74.1% (95% CI 72.4-75.8; ? = 9.4 [95% CI, 7.8-11.0, p lt; 0.0001]), respectively. The models were further shown to produce well-calibrated predictions. In a retrospective simulation, AI-assisted diagnostic support reduced the number of referrals to experts by 63%, from 52% of cases (current practice) to 19%, while significantly increasing the diagnostic performance (F1 77.2% vs 82.7%; ? = 5.5 [95% CI, 4.3-6.7, p lt; 0.0001]).

**CONCLUSION**

The models exhibit strong generalization and outperform expert examiners in diagnostic accuracy. The models' robust performance under comprehensive evaluation indicates that they are ready for prospective clinical implementation studies, bringing us closer to the adoption of AI-assisted diagnostics in clinical settings.

**CLINICAL RELEVANCE/APPLICATION**

AI-driven diagnostic support has the potential to alleviate the shortage of expert ultrasound examiners and improve patient outcomes by increasing diagnostic accuracy and optimizing clinical workflow.

## W2-SPIN-3 MULTITASK MODEL FOR OPPORTUNISTIC SCREENING FOR CORONARY ARTERY CALCIUM DEPOSITION USING CHEST RADIOGRAPHS

Jiwoong J. Jeong, BS (*Abstract Co-Author*) Nothing to Disclose
Imon Banerjee, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Coronary calcium (CAC) score estimates coronary artery disease (CAD) burden and is an established and effective tool for cardiovascular risk assessment. It may guide clinical decisions and preventative measures However, CAC scans are not universally available and are subject to expense, resource constraints and additional radiation exposure. Leveraging artificial intelligence (AI) on chest x-ray (CXR) images to estimate CAC may provide transformative potential for universal opportunistic screening.

**METHODS AND MATERIALS**

We designed a multitask learning (MTL) paradigm - MTL CAC fusion model by combining major adverse cardiovascular events (MACE)prediction as an auxiliary task that is clinically correlated with CAC to support the primary categorical CAC prediction task. MACE was defined as acute myocardial infarction, ischemic stroke, hospitalization due to heart failure, and cardiovascular mortality. We trained a ResNeXt101 backbone with the MTL strategy that uses shared CNN for both tasks. Tabular data including patient demographics (age, gender) and X-ray manufacturer category were injected using a decision level fusion strategy. Model Performance was evaluated by area under the receiver operative curve (AUROC).

**RESULTS**

We evaluated the MTL CAC fusion model on a hold-out internal test set from Mayo clinic (n=341) and independent external dataset from Emory - EUH (n=386) and Taiwan - VGHTPE (n=499). On the internal testset, the model achieved 0.72 and 0.66 AUROC for the =100 CAC and 0 CAC respectively (which are clinically significant categories). The performance was suboptimal for the intermediate 0-99 CAC category (0.58 AUROC), with similar trend observed for the EUH and VGHTPE external datasets. We also evaluated the MTL fusion model performance for binary classification tasks to differentiate high CAC candidates and experimented with both '0 vs 100+' and '0 vs 400+'. The model demonstrated high performance (0.84 average AUROC) for differentiating high from low CAD burden using only CXR imaging and achieved fair performance (0.75 average AUROC) for moderate category on both internal and external datasets.

**CONCLUSION**

This novel and externally validated CXR-based AI model for opportunistic CAC screening can robustly identify patients with undiagnosed CAD.

**CLINICAL RELEVANCE/APPLICATION**

It may provide clinicians a simple, accessible and cost-efficient tool for opportunistic risk stratification of a wider population, ultimately facilitating preventative measures, timely interventions and improved patient outcomes for CAD.

## W2-SPIN-5 INTERPRETABLE CONVOLUTIONAL NEURAL NETWORK FOR PREDICTING MRI PROTON DENSITY FAT FRACTION FROM LIVER ULTRASOUND IMAGES: AN ATTENTION-BASED MULTIPLE INSTANCE LEARNING APPROACH

Neha Antil, MD (*Abstract Co-Author*) Nothing to Disclose
Luyao Shen, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmed El Kaffas, PhD (*Abstract Co-Author*) Co-founder, Oncoustics AI
Aya Kamaya, MD (*Abstract Co-Author*) Royalties, RELX;Research Grant, Canon Medical Systems Corporation
Lindsey M. Negrete, MD (*Abstract Co-Author*) Nothing to Disclose
Krishna Bhatraju (*Abstract Co-Author*) Nothing to Disclose
Thodsawit Tiyarattanachai (*Presenter*) Nothing to Disclose

**PURPOSE**

Hepatic steatosis is affecting 32.4% of the global population. In this work, we developed a convolutional neural network (CNN) using an Attention-based Multiple Instance Learning (MIL) approach, for prediction of MRI Proton Density Fat Fraction (MRI-PDFF) from B-mode liver ultrasound images. By using the attention mechanism, we demonstrated interpretability of the model and its capability in identifying key images that contribute to the predictions.

**METHODS AND MATERIALS**

A total of 8429 B-mode liver ultrasound images from 401 patients were included. Each patient has a corresponding ground truth MRI-PDFF value. The dataset was randomly split into training, validation and test sets in a 7:1:2 ratio. The Attention-based MIL CNN model is composed of two main components: a CNN backbone which extracts image-level features, and an attention module which aggregates image-level predictions into a patient-level prediction. The primary evaluation was regression of MRI-PDFF values. In addition, MRI-PDFF cutoffs were applied to evaluate performance in classifying steatosis grades: S0 vs =S1, =S1 vs =S2, and =S2 vs S3. We demonstrated interpretability of the model by visualizing ultrasound images along with corresponding attention weights.

**RESULTS**

On the test set, the models with and without attention module achieved Root mean square error (RMSE) of 5.72 vs 6.01, coefficient of determination (R2) of 0.684 vs 0.651, and Pearson correlation coefficient of 0.831 vs 0.828, respectively, in regression of MRI-PDFF values. After applying steatosis grade cutoffs and using the higher steatosis grades as the positive class, the models with and without attention module achieved sensitivities of 95.1% (95%CI: 88.5 - 100.0) vs 90.2% (81.2 - 99.3) and specificities of 79.5% (63.7 - 90.1) vs 92.3% (83.9 - 100.0) for classifying S0 vs =S1; sensitivities of 81.2% (62.1 - 100.0) vs 68.8% (46.0 - 91.5) and specificities of 87.5% (79.4 - 95.6) vs 93.8% (87.8 - 99.7) for classifying =S1 vs =S2; sensitivities of 70.0% (41.6 - 98.4) vs 30.0% (1.6 - 58.4) and specificities of 91.4% (84.9 - 98.0) vs 97.1% (93.2 - 100.0) for classifying =S2 vs S3. Examples of images to which the model assigned high attention weights include images with significant visible portion of the liver, images comparing echogenicity of the liver and kidney, and images visualizing the diaphragm.

**CONCLUSION**

The attention-based MIL approach could improve performance of CNN in predicting MRI-PDFF values from liver ultrasound images. The attention module enhanced interpretability as the model could identify key images in the steatosis assessment.

**CLINICAL RELEVANCE/APPLICATION**

Our motivation was to develop an approach that aligns with how radiologists assess hepatic steatosis on ultrasound examinations in practice.

## W2-SPIN-6 A MULTI-TASK DEEP-LEARNING MODEL ON CECT TO SEGMENT AND CLASSIFY ADRENAL NODULES AS LIPID-POOR ADENOMA AND NODULAR HYPERPLASIA: A MULTI-CENTER STUDY

Zhengyu Jin, MD (*Abstract Co-Author*) Nothing to Disclose
Zhong Zhang (*Abstract Co-Author*) Nothing to Disclose
Xiaopeng Guo (*Abstract Co-Author*) Nothing to Disclose
Hao Sun, MD (*Abstract Co-Author*) Nothing to Disclose
Gu Mu Yang Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Xin Bai III, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Differentiating between lipid-poor adrenal adenoma (LPA) and nodular hyperplasia is challenging on contrast-enhanced CT (CECT) images yet it is critical for determining the appropriate treatment approach. The study aimed to segment and classify adrenal nodules on CECT by developing a multi-task deep-learning model, and to evaluate its performance.

**METHODS AND MATERIALS**

This retrospective study enrolled 164 patients from two institutions (median age, 51 years; 93 women). They were divided into training (83 patients with LPA and 45 patients with nodular hyperplasia) and external test datasets (20 patients with LPA and 16 patients with nodular hyperplasia). All cases were pathologically and clinically confirmed. Adrenal glands and nodules were manually delineated by experienced radiologists on the portal-venous phase CT images. We proposed the Mamba-USeg framework, based on State Space Models (SSMs) and specifically designed to improve the modeling of long-range dependencies among pixels. Deep learning segmentation and classification models were developed on the training dataset and evaluated on the external test dataset. Segmentation performance was evaluated with the Dice similarity coefficient (DSC) and classification performance with sensitivity and specificity.

**RESULTS**

The model achieved a DSC of 0.855 for segmenting adrenal glands (interquartile range [IQR]: 0.809-0.932). The model for segmenting adrenal nodules yielded an average DSC of 0.869 (IQR: 0.827-0.938) for LPA and 0.863 (IQR: 0.781-0.943) for nodular hyperplasia. The classification sensitivity and specificity for LPA were 95.3% (95% confidence interval [CI]: 91.3%-96.6%) and 92.7% (95% CI: 91.9%-93.6%), respectively. For nodular hyperplasia, sensitivity was 94.2% (95% CI: 89.7%-97.7%) and specificity was 91.5% (95% CI: 90.4%-92.4%). The novel model's average DSC for LPA and nodular hyperplasia outperformed previous frameworks, MultiResUNet (LPA: 0.831 [IQR: 0.767-0.929], nodular hyperplasia: 0.847 [IQR: 0.772-0.935]) (P lt; 0.01) and CPFNet (LPA: 0.850, [IQR: 0.801-0.936]), nodular hyperplasia: 0.848 [IQR: 0.753-0.939]) (P lt; 0.05).

**CONCLUSION**

A multi-task deep-learning model comprising segmentation and classification of adrenal nodules can effectively and accurately discriminate between LPA and nodule hyperplasia on CECT images.

**CLINICAL RELEVANCE/APPLICATION**

The proposed model provides a reliable approach for the differential diagnosis of adrenal LPA and nodular hyperplasia, offers valuable guidance for clinical decision-making and reduces unnecessary surgeries for patients with hyperplasia.

## W2-SPIN-7 AUTOMATION OF CEREBRAL BLOOD FLOW MAPPING FROM CTA IMAGES WITH NNUNET

Abhinav Changa, MD (*Abstract Co-Author*) Nothing to Disclose
Jacky Cheung (*Abstract Co-Author*) Nothing to Disclose
Hayit Greenspan (*Abstract Co-Author*) Nothing to Disclose
Andy Ho Wing Chan (*Abstract Co-Author*) Nothing to Disclose

Benjamin Kummer (*Abstract Co-Author*) Nothing to Disclose
Nicholas J. Primiano, MD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Endovascular thrombectomy (EVT) is the standard of care for the treatment of patients presenting with acute ischemic stroke (AIS) due to large-vessel occlusions (LVO). Although CT perfusion (CTP) can aid patient selection for EVT, this imaging modality adds time to AIS care processes and can therefore cause patient harm. To potentially accelerate patient selection for EVT, we developed an AI model to directly generate cerebral blood flow (CBF maps) from head and neck CT angiography (CTA) images, which are more commonly obtained in standard stroke workflows.

**METHODS AND MATERIALS**

We identified patients who presented to our academic medical center between May 2019 and June 2021 with AIS from LVO and underwent CTA and CTP within a 30-minute time window. Using the raw CTA and CTP images from our institutional radiology imaging database, we manually extracted CBF volumes generated by a third-party post-processing algorithm (Viz.ai) as labels. We used a segmentation package (TotalSegmentator) to isolate brain structures from CTA images and co-registered CTA slices to corresponding CTP slices. We then trained a 3-dimensional, convolutional neural network (nnU-Net) against our labeled dataset to predict CBF maps directly from co-registered CTA mages. Ground-truth CBF maps were stratified into 5 intensity ranges.

**RESULTS**

We identified 106 patients that met study criteria. The nnU-Net model achieved a root mean square error of 0.24(±0.03) and a DSC of 0.45(±0.04).

**CONCLUSION**

Using a deep learning, cross-modality approach, we developed a segmentation model that demonstrated moderate performance in segmenting CBF maps directly from head and neck CTA images. Future work will aim to predict cerebral blood volume and time-to-maximum maps using a generative framework.

**CLINICAL RELEVANCE/APPLICATION**

Rapid generation of CBF maps from CTAs may facilitate earlier interventions in stroke care, enhancing triage and treatment decisions. This tool could be used to stratify patients where perfusion techniques or neurological expertise are unavailable, or to alert clinicians to occult regions of "at-risk" tissue in motion-degraded CTP studies, representing a step toward improved patient outcomes.

## W2-SPIN-8 ASSESSMENT OF A WEB-BASED TOOL FOR PRECISION MEASUREMENT OF ACETABULAR COMPONENT ORIENTATION IN TOTAL HIP ARTHROPLASTY

Christine Yoon (*Presenter*) Nothing to Disclose

**PURPOSE**

Hip dislocation after total hip arthroplasty can be linked to the orientation of acetabular component placement, characterized by acetabular inclination and anteversion angles obtained from pelvic radiographs. We introduce a novel web tool to streamline the subjective and lengthy process of manual measurement. This tool assists in collecting data that will be used to train an AI model for automation.

**METHODS AND MATERIALS**

One board-certified orthopedic surgeon annotated anteroposterior radiographs of 80 patients who underwent unilateral hip arthroplasty from 1/12/2017 to 12/18/2017. Manual and web tool measurements included abduction angle (degrees), S/TL ratio, and Liaw's anteversion angle (degrees). One board-certified orthopedic surgeon used the web tool to mark 6 points on the radiographs: each end of the teardrop line, each end of the horizontal diameter of the acetabular cup, 1 point along the circumference of the acetabular cup, and 1 point along the acetabular head. A line connecting the teardrop line, an ellipse around the acetabular cup perimeter, and an ellipse around the coronal view of the acetabulum were automatically mapped to measure the abduction angle and S/TL ratio, which were inputted into Liaw's formula to calculate acetabular angle and safe zone determination (Fig. 1). Results were obtained in under 10 seconds per radiograph. Differences between manual and web tool measurements were compared using a paired t-test. $P<0.05$ was considered statistically significant.

**RESULTS**

There were no statistically significant differences in abduction angle (43.59±5.97 annotated vs 42.82±5.49 web tool, p=0.251), anteversion angle (20.75±7.81 vs 22.80±10.79, p=0.080), and S/TL ratio (0.43±0.15 vs 0.44±0.16, p=0.456) between annotated and web tool measurements.

**CONCLUSION**

Preliminary results show the web tool is accurate compared to manual annotation. This tool improves efficiency of angle measurement for intraoperative use and data collection. Future work includes training AI models for automatic angle detection, safe zone determination, and adapting to mobile devices. The web tool may contribute to other areas of radiology where geometry bears relevance to outcomes.

**CLINICAL RELEVANCE/APPLICATION**

Our tool refines hip arthroplasty by enhancing the precision of acetabular measurements, aiding surgical planning, and reducing complications.

# Abstract Archives of the RSNA, 2024

W2-SPIR

**Interventional Radiology Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPIR-1 CHARACTERIZING PRE-ABLATION PROTEOMIC SIGNATURES TO ENHANCE THERMAL ABLATION EFFICACY IN HEPATOCELLULAR CARCINOMA

Jason Chiang, MD,PhD (*Abstract Co-Author*) Consultant, Intuitive Surgical, Inc;Equipment support, Johnson & Johnson
Steven S. Raman, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Merck & Co, Inc;Consultant, Amgen Inc;Consultant, Profound Medical Inc
Tu Nguyen (*Presenter*) Nothing to Disclose

### PURPOSE

Hepatocellular carcinoma (HCC) is the fourth leading cause of cancer death worldwide. Thermal ablation has emerged as the standard of care for non-surgical HCC patients because of its similar efficacy to resection with fewer complications. However, more than 50% of ablation patients will have recurrence within 5 years, necessitating additional treatments. Recurrence rates are hypothesized to be related to underlying HCC biology. The goal of this study was to analyze the proteomic profiles of pre-ablation HCC biopsy samples and correlate proteomic changes to post-ablation outcomes. Proteomic markers of ablation resistance were then validated in an in vitro model.

### METHODS AND MATERIALS

Clinical HCC biopsy samples were obtained prior to microwave ablation (UCLA IRB#23-000131). Recurrence rates in ablation responders (n=12) versus non-responders (n=12) were then tracked for two years. Differential proteomic profiles acquired through LC-MS mass spectrometry were compared using biopsy samples between the responders and non-responders. The identified protein markers were confirmed with internally validated ablation-responsive and ablation-resistant HCC cells (SNU-423 and HepG2/C3a, respectively) via Western Blotting. Furthermore, a pharmacological approach was employed to demonstrate that these proteomic changes directly modulate thermal resistance in these cell lines.

### RESULTS

Proteomic analysis of HCC biopsy samples revealed that galectin-class proteins were upregulated two-fold in ablation non-responders versus responders ($p < 0.001$). Additionally, galectin-class proteins were found to be markedly upregulated in thermally-resistant HepG2/C3a. Subsequently, in-vitro studies using selective galectin inhibitors to target galectin proteins increased thermal sensitivity in thermally-resistant HepG2/C3a.

### CONCLUSION

This study revealed a key correlation between elevation of galectin-class proteins and thermal resistance in HCC biopsy samples. Moreover, galectin-class proteins were found to play a modulatory role in thermal resistance. These findings can be leveraged to develop novel galectin-based therapies to increase the efficacy of thermal ablation in HCC patients.

### CLINICAL RELEVANCE/APPLICATION

This project identified proteomic signatures that contribute to HCC resistance following ablation. These biomarkers can be used to determine the optimal windows of vulnerability to maximize the success of ablation and minimize the recurrence rates. They also hold immense promise for personalizing ablation therapy based on individual proteomic profiles, ultimately improving outcomes for HCC patients.

## W2-SPIR-2 CUSTOMIZED WHOLE-GLAND MR-GUIDED TRANSURETHRAL ULTRASOUND ABLATION (TULSA) FOR TREATMENT OF LOCALIZED PROSTATE CANCER: A SINGLE CENTRE RETROSPECTIVE ANALYSIS OF 73 PATIENTS

Roland Rose (*Abstract Co-Author*) Nothing to Disclose
Amanda Beserra (*Abstract Co-Author*) Senior Clinical Scientist, Profound Medical
Busch Kathy (*Abstract Co-Author*) Nothing to Disclose
Joseph J. Busch, MD (*Presenter*) Nothing to Disclose

### PURPOSE

MRI-guided transurethral ultrasound ablation (TULSA) is an interventional MRI procedure for treating prostate cancer that aims to reduce the sexual and urinary impacts of surgery. Regulatory studies applied whole-gland ablation without sparing of neurovascular bundles (NVB) or ejaculatory ducts (EJD). We report the real-world safety and efficacy of customized whole-gland TULSA (whole-gland ablation sparing the NVBs and/or EJD to optimize functional outcomes).

### METHODS AND MATERIALS

A retrospective analysis was performed in PCa patients with>=3-month follow-up after customized whole-gland TULSA at our clinic. NVB/EJD sparing was defined by patient preference and disease factors, using intraoperative DWI, ADC, and T2w imaging. Patients were followed daily for 2 weeks, PSA 3m, with MRI, IPSS, IIEF at 6-9 months. Radiologic recurrence was defined as PI-RR>=4 on mpMRI, or positive PSMA-PET after PI-RR=3. Biochemical recurrence (BCR) was defined as nadir + 2 ng/ml.

### RESULTS

73 patients were identified (62 primary PCa, 11 salvage). Median (IQR) age and follow-up duration were 63 (IQR 59-69) years and 11 (9-15) months. The proportions of men with primary GG 1-5 PCa were: 15%, 49%, 19%, 9%, 8%. Aside from 2 men with GG1 disease, all were MRI visible. Whole-gland ablation with no sparing was performed in 23% of men, uni/bilateral NVB sparing in 19%/45%, NVB+EJD sparing in 33%; the extreme apex was targeted in 36%. Prostate volume was 46cc (33-62, range 16-160); 99% (97-99%) of the target volume achieved lethal thermal dose >=240CEM43. PSA nadir after primary treatment was 0.7 (0.3-1.1) ng/mL. 84% (48/57) are free of radiologic and biochemical recurrence. 1/9 experienced BCR with no imaging follow-up available. 4/8 radiologic recurrences are BCR-free and remain on surveillance, 1/8 underwent salvage TULSA. 6/8 had residual disease near EJD sparing, which we have since discontinued. Failures occurred when either MRI thermometry or ultrasound propagation was compromised by significant calcifications or motion. Grade 1-2 adverse events in 8 men (LUTS, mild hematuria, bladder spasms) resolved within 4 weeks with oral medication. Two men had Grade 3 events requiring endoscopic intervention (retention/obstruction). Urinary symptoms (IPSS) were stable. Two men incurred early post-op urine leakage, 100% are pad-free beyond 4 months. 88% maintained erection firmness sufficient for penetration (IIEF Q2>=2).

### CONCLUSION

Customized whole-gland TULSA demonstrates promising real-world safety and efficacy. Continued refinement of patient selection and technique may further enhance prostate cancer treatment with TULSA.

### CLINICAL RELEVANCE/APPLICATION

Customized whole-gland TULSA balances effective disease control with favorable functional and safety outcomes.

## W2-SPIR-3 AI-BASED METAL ARTIFACT REDUCTION ALGORITHM IN SPECTRAL CT IMAGES FOR INTERVENTIONAL ONCOLOGY (SPECTRAL MARIO): READER-BASED ASSESSMENT OF MODEL PERFORMANCE ACROSS VIRTUAL MONOENERGETIC IMAGES

Daniel A. Adamo, MD (*Abstract Co-Author*) Nothing to Disclose
Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Rebecca Hibbert, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Wenchao Cao, PhD (*Abstract Co-Author*) Nothing to Disclose
Ahmad Parvinian, MD (*Abstract Co-Author*) Nothing to Disclose
Andrew Missert, PhD (*Abstract Co-Author*) Nothing to Disclose
Christopher P. Favazza, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the performance of a deep convolution neural network framework for metal artifact reduction in interventional oncology spectral CT images, spectral MARIO, to reduce metal artifact from ablation probes and assess its potential to enable low keV imaging intraprocedurally during CT-guided ablations.

### METHODS AND MATERIALS

Image domain data from phantom scans containing multiple configurations of ablation probes and pre-ablation patient planning images were used to generate a library of precisely registered spectral basis images (photoelectric and Compton scattering images, Spectral CT7500, Philips Healthcare) with and without metal artifacts. A modified U-Net architecture was trained using 100,000 128x128 pixel image patches derived from this library, with the photoelectric and Compton components stacked in the channel dimension. Spectral MARIO was then applied to 15 previously unseen patient images acquired during the 6-minute timepoint of a freeze cycle during renal cryoablation procedures. From the original and spectral MARIO basis images, 70 keV Virtual Monoenergetic Images (VMI) were generated. Three experienced, board-certified interventional radiologists performed an independent blinded review of the 15 image sets both with and without spectral MARIO. In this evaluation, the reader first scored the metal artifact in a 70 keV VMI on a 1(worst)-5(best) Likert scale. Then the reader adjusted the VMI energy level for each of the original and the spectral MARIO data to the lowest value in which the artifact rating was above average diagnostic quality (Likert Score = 4) A two-tailed Wilcoxon test was applied to the average of the paired original and spectral MARIO reader results.

### RESULTS

Compared to original images, spectral MARIO visually demonstrated substantial metal artifact reduction, particularly at lower VMI energy levels. The median artifact score at 70 keV improved from 3 to 4 ($p<0.001$) with spectral MARIO. The minimum keV required to achieve an above average diagnostic quality decreased from 112 keV (86-167) for the original data to 67 keV (44-108) with spectral MARIO ($p<0.001$).

### CONCLUSION

The spectral MARIO was effectively trained and applied to spectral basis images, which produced metal artifact reduction across various monoenergetic energy levels. Further, spectral MARIO was demonstrated to effectively reduce the monoenergetic energy level across all patient images.

### CLINICAL RELEVANCE/APPLICATION

Spectral MARIO significantly reduced metal artifact in virtual monoenergetic images (VMI)—especially at lower energy levels. These results suggest that spectral MARIO could be leveraged to enable low monoenergetic imaging, thus providing higher soft tissue and iodinated contrast in proximity metal ablation probes.

## W2-SPIR-4 IRREVERSIBLE ELECTROPORATION COMBINED WITH IMMUNOTHERAPY VERSUS IRREVERSIBLE ELECTROPORATION ALONE FOR LOCALLY ADVANCED PANCREATIC CANCER: A SYSTEMATIC REVIEW AND META-ANALYSIS

Miriana E. Mariussi, MD (*Abstract Co-Author*) Nothing to Disclose
Stephan Altmayer, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo Gobbo (*Abstract Co-Author*) Nothing to Disclose
Sofia D. Gambetta I, MD, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Murad (*Abstract Co-Author*) Nothing to Disclose
Laura Costa De Oliveira Lima (*Abstract Co-Author*) Nothing to Disclose

Giovanni B. Torri, MD (*Abstract Co-Author*) Nothing to Disclose
Luiza G. Schmitt, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

We performed a systematic review and meta-analysis to evaluate the safety and survival benefits of percutaneous irreversible electroporation (IRE) combined with immunotherapy compared to irreversible electroporation alone in patients with locally advanced pancreatic cancer (LAPC).

**METHODS AND MATERIALS**

We systematically searched Embase, Cochrane Central Register of Controlled Trials, and Pubmed from inception to January 10th of 2024 for studies published with the following medical subject heading terms: "irreversible electroporation", "immunotherapy" and "locally advanced pancreatic cancer". In addition, the references of included studies and systematic reviews were evaluated for additional studies. The outcomes of interest were progression-free survival (PFS), overall survival (OS), and adverse events. The PFS and OS were assessed using pooled hazard ratios (HR), while we used odds ratio (OR) for the adverse events.

**RESULTS**

Our pooled analysis included four studies (3 clinical trials and 1 observational study) with 310 patients. IRE combined with immunotherapy significantly prolonged PFS compared to IRE alone (HR: 0.56; 95% CI 0.39 - 0.80; $p < 0.002$; $I^2$: 9.65%). Additionally, patients on IRE plus immunotherapy achieved a greater OS compared to IRE alone (HR = 0.52; 95% CI 0.37 - 0.73; $p < 0.001$; $I^2$: 0%). There was no significant difference in the occurrence of adverse events such as nausea and vomiting (OR = 2.80; 95% CI 0.81 - 9.68; $p = 0.10$; $I^2$: 54%) and gastroparesis (OR = 0.88; 95% CI 0.23 - 3.40; $p = 0.86$; $I^2$: 0%) between the groups.

**CONCLUSION**

The combination of percutaneous irreversible electroporation with systemic immunotherapy has been shown to be an effective and safe local treatment method for pancreatic malignancies. The findings of this meta-analysis provide supporting evidence for the clinical utility of irreversible electroporation combined with immunotherapy in the management of advanced pancreatic cancer.

**CLINICAL RELEVANCE/APPLICATION**

Locally advanced pancreatic cancer includes tumors staged as III and IV, which are often unresectable due to vascular involvement, leaving patients with limited curative options. Palliative chemotherapy regimens have only moderately improved survival rates. IRE, which has demonstrated immunomodulatory effects and provides a safe non-thermal approach to ablating pancreatic tumors, can be further enhanced when combined with immunotherapy.

## W2-SPIR-5 INCREASED VOXEL-BASED Y90 RADIOEMBOLIZATION DOSE TO HEPATOCELLULAR CARCINOMA IMPROVES IMAGING RESPONSE

Helena D. Rockwell, MD,BSC (*Abstract Co-Author*) Nothing to Disclose
Kathryn J. Fowler, MD (*Abstract Co-Author*) Consultant, Bayer AG;Research support, General Electric Company;Research Grant, Pfizer Inc;Institutional Grant, MEDIAN Technologies;Consultant, General Electric Company
Joy Liau, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Zachary Berman, MD (*Abstract Co-Author*) Nothing to Disclose
Akhilesh Yeluru, MS, BS (*Abstract Co-Author*) Nothing to Disclose
Jeet Minocha (*Abstract Co-Author*) Nothing to Disclose
Steven C. Rose, MD (*Abstract Co-Author*) Stockholder, Sirtex Medical Ltd Proctor, Sirtex Medical Ltd Scientific Advisory Board, Surefire Medical, Inc Consultant, Surefire Medical, Inc Stockholder, Surefire Medical, Inc Consultant, Embolx, Inc Consultant, Guerbet SA Consultant, XLSciTech, Inc
Cairine McNamee, MD (*Abstract Co-Author*) Nothing to Disclose
Ashwin Ganesh (*Abstract Co-Author*) Nothing to Disclose
Kurt Pianka, BS (*Abstract Co-Author*) Nothing to Disclose
Shanmukha Srinivas, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the correlation between radioembolization tumor dose and imaging response in hepatocellular carcinoma (HCC) treated with radioembolization.

**METHODS AND MATERIALS**

A retrospective single-institution study was conducted on treatment-naÏve HCC patients who underwent transarterial radioembolization (TARE) from November 2017 to September 2020. Dose-volume histograms (DVH) were generated from post-Y90 single photon emission computed tomography. Cross-sectional imaging was performed at 3 and 6 months post-radioembolization and reviewed by three blinded abdominal radiologists.

**RESULTS**

Forty-one eligible patients underwent radioembolization, with a median age of 67 years (range: 41-84), including 11 females. At 3 months, 23 (56%) patients showed complete response (CR), 9 (22%) had partial response (PR), and 8 (20%) exhibited stable disease (SD) according to mRECIST criteria. By 6 months, these numbers changed to 19 (76%) CR, 5 (20%) PR, and 1 (4%) progressive disease (PD). DVH analysis revealed that increased dose to various tumor volumes significantly correlated with complete imaging response at 3 months ($p < 0.05$ for all). Receiver operating characteristic (ROC) analysis identified a dose threshold of 687 Gy to 95% of the tumor volume with the highest area under the curve (AUC) of 0.86 (95% CI: 0.73-0.95) for predicting complete response by both mRECIST and LI-RADS criteria.

**CONCLUSION**

Voxel-based dosimetry indicates several dose thresholds predictive of complete imaging response using both mRECIST and LI-RADS criteria. A dose threshold of 687 Gy to at least 95% of the tumor volume demonstrated the highest accuracy in predicting complete response according to both criteria.

**CLINICAL RELEVANCE/APPLICATION**

Understanding the correlation between voxel-based tumor dose and imaging response to radioembolization in HCC can aid in treatment planning and predicting patient outcomes. This knowledge may facilitate personalized treatment approaches and improve the efficacy of radioembolization in managing HCC patients.

## W2-SPIR-6 TACKLING CERVICAL METASTASES FROM THYROID CARCINOMA: A PROSPECTIVE STUDY WITH CRYOABLATION, LASER OR RADIOFREQUENCY ABLATION UNDER ULTRASOUND GUIDANCE

Ana Amelia F. Hoff, PhD (*Abstract Co-Author*) Nothing to Disclose
Pedro Naime B. Araujo I, MD (*Abstract Co-Author*) Nothing to Disclose
Marco Aurelio V. Kulcsar, PhD,MD (*Abstract Co-Author*) Nothing to Disclose
Maria Cristina Chammas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ricardo M. Freitas, MD, PhD (*Presenter*) Research Grant, Varian Medical Systems, Inc

### PURPOSE

To evaluate:a. Safety and efficacy of thermal ablation of cervical metastases from thyroid carcinomab. Best response to thermal ablation defined as lymph node reduction or volume stabilityc. Tumor marker response after ablationd. Complications, side effects and tolerability differences among laser (LA), radiofrequency (RF) or cryoablation (CA)

### METHODS AND MATERIALS

This prospective clinical trial obtained IRB approval. All patients provided informed consent, including those with differentiated or medullary thyroid carcinoma confirmed by fine-needle aspiration biopsy. Ablation techniques (LA, RF, CA) were randomly assigned to participants. Eligible subjects presented with up to six concurrent lesions larger than 0.8 cm diameter. US examinations were conducted at baseline, 6, 12, and 24-months post-treatment. Data was systematically collected in a web-based tool. Evaluation criteria included changes in tumor volume, rates of technical success, complications, tumor marker response and need for additional surgery.

### RESULTS

Seventy-two patients (n=145 tumors) were evaluated. Mean age was 67.8±15.1 years, 54 (75%) being females. Technical success rate reached 100%. Baseline mean and standard deviation lymph node volumes (cc) for each ablation group were as follows: LA, 0.83±1.14 (range: 0.15-4.34); RF, 2.49±6.9 (range: 0.1-25.6); CA, 1.28±2.12 (range: 0.12-8.08). Significant lymph node volume reduction was observed at 6, 12, and 24 months up to 97.9% of volume reduction ratio (all $P < 0.001$). No instances of volume regrowth were detected. Absolute decrease of tumor markers was noted. Major complication rate was 1.4% (n=1): one vocal cord palsy, leading to bronchopneumonia, prolonged hospitalization and eventual fatality. Minor complications rates were 9.2% (n=7): 1.4% (n=1) of cutaneous fistulae with brief spontaneous resolution, and 7.9% (n=6) of transient vocal cord palsy with complete recovery after one month. Only 2.6% (n=2) patients were treated twice for tumor persistence. None of the patients required additional neck surgery due to ablation failure over time. All patients with new recurrent cervical metastases (n= 18, 25%) were treated by additional ablation sessions.

### CONCLUSION

a. Both thermal ablation modalities (LA, RF, CA) were feasible, effective and safe in well selected patients with cervical metastases from thyroid carcinoma.b. Adequate local control and overall tumor marker reduction was achieved.c. No significant difference among the thermal ablation methods in terms of complications, side effects and tolerability were observed.

### CLINICAL RELEVANCE/APPLICATION

??Thermal ablation is a feasible, safe, and effective alternative therapy for the treatment of cervical lymph node metastases from thyroid carcinoma.

## W2-SPIR-7 RADIOLOGY-PATHOLOGY EVALUATION OF HISTOTRIPSY-TREATED SWINE LIVERS DEMONSTRATES HIGH CORRELATION BETWEEN IMAGING AND GROSS PATHOLOGY

Charles Bradley (*Abstract Co-Author*) Research Consultant, HistoSonics, Inc
Emily Knott (*Abstract Co-Author*) Nothing to Disclose
Fred T. Lee JR, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Patent agreement, Medtronic plc;Royalties, Medtronic plc;Board of Directors, HistoSonics, Inc;Stockholder, HistoSonics, Inc;Stockholder, Elucent Medical
Timothy J. Ziemlewicz, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Research support, Johnson & Johnson;Consultant, HistoSonics, Inc;Shareholde, HistoSonics, Inc;
Paul F. Laeseke, MD, PhD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, NeuWave Medical, Inc;Shareholder, HistoSonics, Inc;Consultant, HistoSonics, Inc;Research Grant, HistoSonics, Inc;Shareholder, Elucent Medical;Consultant, Elucent Medical;Shareholder, McGinley Orthopaedic Innovations, LLC
Jim K. White, BS (*Abstract Co-Author*) Nothing to Disclose
Edwarda Golden, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Histotripsy is a non-invasive, non-thermal focused ultrasound treatment modality that was recently FDA approved for the focal destruction of liver tumors. As clinical adoption accelerates, understanding the post-treatment imaging findings is imperative. This study evaluates the correlation between contrast-enhanced MRI images and gross pathology of histotripsy treatment zones.

### METHODS AND MATERIALS

Eleven histotripsy treatment zones were created in 10 swine livers using a clinical histotripsy unit (VortxRx, Histosonics, Inc., Plymouth, MN). All animals underwent MRI within 1 hour of treatment followed by euthanasia within 1 hour of imaging. Treated liver was fixed in formalin and subsequently sliced through the center of the treatment zone for gross pathologic analysis. Portal venous phase MRI series were reconstructed to match the gross pathology sections using internal fiducials such as blood vessels and the hepatic surface on a clinical PACS (Change Healthcare, Nashville, TN). The non-enhancing treatment zone on MRI and the treatment zone at gross pathology were each measured in equivalent orthogonal planes (M1 (longest) x M2 (perpendicular)) and the area of the treatment zone was calculated using an ellipsoid formula. Coefficient of determination was calculated for each measurement and the area of the treatment. Sections were obtained from multiple edges of each treatment zone for histopathologic correlation of complete treatment.

### RESULTS

The treatment zones (M1 x M2) averaged 3.5 x 2.9 cm (area 8.0 cm2) at imaging and 3.4 x 2.9 cm (area 7.5 cm2) at gross pathology. The M1 and M2 measures of the non-enhancing zone on MRI and the M1 and M2 measures of the treated zone at gross pathology differed by an average of 0.0 cm each (range -0.3 to +0.3 cm for M1 and -0.5 to +0.3 cm for M2) and the area by an average of 0.1 cm2 (range -2.0 to +1.5 cm2). There was strong correlation for M1 ($r2=0.75$), M2 ($r2=0.73$), and area ($r2=0.70$). Histopathologic analysis demonstrated a well-defined treatment zone with narrow zone of transition ranging from 1-3 mm.

## CONCLUSION

There is a strong correlation between the area of non-enhancement on portal venous phase MRI and gross pathology following hepatic histotripsy. The zone of non-enhancement can serve as a reliable biomarker for tissue destruction when evaluating post-histotripsy images.

## CLINICAL RELEVANCE/APPLICATION

As histotripsy begins commercial adoption, understanding the post-treatment appearance of complete cell death will allow evaluation of treatment efficacy.

## W2-SPIR-8 INCIDENCE OF HEPATOBILIARY INFECTION AFTER LIVER MICROWAVE ABLATION IN PATIENTS WITH COLONIZED BILIARY SYSTEMS

Steven S. Raman, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Merck & Co, Inc;Consultant, Amgen Inc;Consultant, Profound Medical Inc
Daniel Kim, BA, MS (*Abstract Co-Author*) Nothing to Disclose
David S. Lu, MD (*Abstract Co-Author*) Nothing to Disclose
James Z. Hui, MD, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

Patients with colonized biliary systems, as seen in those with biliary-enteric anastomosis or indwelling biliary stents, are at higher risk of hepatobiliary infections, such as hepatic abscess formation or cholangitis, after radioembolization or radiofrequency ablation (RFA), with reported rates ranging from 11-50%. However, despite the rising popularity of microwave ablation (MWA) due its ability to deliver faster and larger treatments, the risk for infection after MWA has not been well defined. We aim to evaluate the rate of hepatobiliary infection in this at-risk population.

## METHODS AND MATERIALS

This IRB-approved, HIPAA-compliant retrospective study included 40 MWA procedures treating 56 primary or secondary malignant liver lesions, performed between February 2016 - February 2024, in 23 patients with either biliary stent (26%, 6/23) or biliary-enteric anastomosis (74%, 17/23). Patient demographics, treatment history, ablation details, periprocedural antibiotic management, and any postablation infectious complications were collected through electronic medical records.

## RESULTS

All 40 MWA procedures targeting 56 tumors were technically successful without immediate complications. Most patients received extended course post-ablation prophylactic antibiotics (up to 8 weeks), with regimens consisted of oral fluoroquinolone with or without concurrent metronidazole (37/40, 92.5%). Five cases of hepatic abscesses or cholangitis (12.5%, 5/40) occurred after a median of 30 days postprocedure (range: 15 - 51 days). Three abscesses (7.5%, 3/40) occurred while on an antibiotic regimen. One case of abscess occurred after completing a six-week antibiotic course, while a case of cholangitis occurred in a patient who did not receive post-procedural antibiotics. Abscess drainages and/or antibiotics were initiated in all cases. No death occurred due to the initial infection or subsequent drain placement.

## CONCLUSION

In this single-center retrospective study with the largest reported cohort to date of MWA procedures in patients with colonized biliary systems, the rates of hepatobiliary infection were found to be 10% in those receiving 6 weeks of prophylactic oral antibiotics regimen, which is favorable compared to the rates reported after RFA and radioembolization.

## CLINICAL RELEVANCE/APPLICATION

MWA is popular ablative modality for oligometastases in the liver. This study demonstrates MWA has a low risk for hepatobiliary infection when used along with the extended antibiotics in patients with colonized biliary systems.

# Abstract Archives of the RSNA, 2024

W2-SPMK

**Musculoskeletal Imaging Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPMK-5 EVALUATING RADIOGRAPHIC AND MR CORRELATIONS TO FUNCTIONAL OUTCOMES IN SURGICALLY PROVEN HIP ABDUCTOR TEARS

Avneesh Chhabra, MD, MBA (*Abstract Co-Author*) Consultant, ICON plc;Consultant, Treace Medical Concepts, Inc;Author with royalties, Wolters Kluwer nv;Author with royalties, Jaypee Brothers Medical Publishers Ltd;Speaker, Siemens AG;Medical Advisor, ImageBiopsy Lab;Research Grant, ImageBiopsy Lab
Zuhair Zaidi, BS (*Presenter*) Nothing to Disclose

### PURPOSE

To correlate inter-reader reliability with the accuracy of diagnosing hip abductor tendon tears in surgically confirmed cases. Additionally, we aim to evaluate how pre-operative radiographic and MRI findings correlate with functional outcomes in patients, both before and after undergoing surgical reconstruction.

### METHODS AND MATERIALS

From July 2022 to April 2024, 15 patients (16 hips: 5 left, 1 bilateral, and 9 right), predominantly female (12/15), with a mean BMI of 27.5 underwent abductor tendon reconstructions. Two independent MSK faculty readers analyzed the pre-operative imaging, and the findings were compared to pre- and post-operative functional outcomes using validated HOOS scores. Inter-reader reliability was assessed.

### RESULTS

Imaging of surgically confirmed abductor tendon tears were evaluated, revealing a spectrum of tear patterns with varying inter-reader reliability. On MRI, gluteus minimus displayed six partial- and six full-thickness tears, with four cases showing no tears; gluteus medius (lateral facet) revealed four partial and twelve full tears; the posterior superior facet attachment showed three partial- and one full-thickness tear; gluteus maximus tendon recorded one partial tear with fifteen intact tendons. Inter-reader agreement for tendon tears was moderate to high, scoring 0.73 for minimus, 0.59 for medius, and 0.64 for maximus. The presence of enthesophytes on radiographs had a moderate agreement at 0.45. In contrast, bursal fluid detection varied significantly, with fair agreement in submaximus bursa (0.31) and poor for subgluteus medius and minimus bursae. Pre-operatively, abductor strength was significantly correlated with avulsed fragment/calcification ($r = 0.57$) and gluteus subminimus fluid ($r = 0.57$), while hip tonnis grade negatively correlated with Activities of Daily Living Score ($r = -0.53$) and Total Hip Outcome Score ($r = -0.57$). Post-operatively, significant correlations persisted, such as subcortical sclerosis with iHOT 12 Score ($r = 0.52$) and Hip Osteoarthritis Outcome Score ($r = 0.51$), and gluteus minimus fluid with iHOT 12 Score_2 ($r = 0.78$). Notably, gluteus medius tears showed a significant negative correlation with hip abduction both pre- ($r = -0.83$) and post-operatively ($r = -0.53$). All values reached $p<0.05$ significance.

### CONCLUSION

Radiographic and MRI findings of gluteal pathology correlate significantly with functional outcomes and can be predictors of patient performance following tendon repair. This correlation shows the potential of imaging in guiding surgical management and prognostication.

### CLINICAL RELEVANCE/APPLICATION

Imaging allows pre-operative planning and can also be used to predict functional outcomes among surgically treated hip abductor tear patients.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

W2-SPMS

**Multisystem Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPMS-2 ARTIFICIAL INTELLIGENCE FOR VERTEBRAL FRACTURE DETECTION IN CANCER PATIENTS: ENHANCING DIAGNOSTIC ACCURACY AND CLINICAL MANAGEMENT

Corinne Balleyguier, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Samy Ammari, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tarek Assi (*Abstract Co-Author*) Nothing to Disclose
Baptiste Bonnet (*Abstract Co-Author*) Nothing to Disclose
Sarah Quenet, MD (*Abstract Co-Author*) Employee, Avicenna.ai
Julie Kiewsky (*Abstract Co-Author*) Nothing to Disclose
Astrid Orfali Camez, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Zemmouri (*Abstract Co-Author*) Nothing to Disclose
Nathalie B. Lassau, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Lambros C. Tselikas, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Angela Ayobi, MENG,MSc (*Abstract Co-Author*) Employee, Avicenna.ai
El Mehdi Mniai, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Cancer and cancer treatments induce profound depletion of serum estrogen levels and can lead to an increased risk of vertebral fractures (VF). This study aimed to evaluate the performance of artificial intelligence (AI) in detecting vertebral fractures in cancer patients compared with radiological assessment. The secondary objective was to determine to what extent the detection of these VF, particularly for severe fractures, could have modified treatment management by offering an interventional radiology procedure.

### METHODS AND MATERIALS

Chest, abdominal and pelvis CT follow-up exams acquired from September to December 2023 for adult patients treated for stage IV cancer were retrospectively reviewed to evaluate the performance of an AI tool, CINA-VCF, to detect incidental VF. The AI tool quantifies intra-vertebral height loss and height loss relative to neighboring vertebrae. VF were categorized into three stages according to the degree of height loss: grade 1 with a loss of 20-25%; 26-40% for grade 2 and > 40% for grade 3. Grade 3 were considered as severe fractures. AI also calculated the mean value of L1 trabecular attenuation using a fully automated tool on healthy L1 vertebrae - to estimate bone mineral density and identify patients at risk of osteoporosis. We also collected relevant demographic and clinical information such as age, sex, type of cancer, type of treatment, bone metastatic status, and spinal treatment history. Two expert interventional radiologists in cancer treatment (IR1 and IR2), with over 10 and 2 year’s experience respectively, assessed whether or not they would have treated severe fractures with vertebroplasty.

### RESULTS

We included 1501 patients over a three-month period. Among these patients, AI detected VF in 501, with 436 true positives (TP) and 65 false positives (FP). The Predictive Positive Value was 87%. 51 % of patients were at risk of osteoporosis and 32 % had vertebral metastasis. 81 % of fractures detected by the AI tool had not been described on the initial radiological report, including 10 severe fractures, with 9 requiring an interventional treatment. Overall, based on expert opinion, 89.6 % of severe fractures had an indication for cementoplasty.

### CONCLUSION

AI detects more incidental VF than radiologists in cancer patients, including severe VF that, according to expert opinion, could have benefited from specific management.

### CLINICAL RELEVANCE/APPLICATION

AI could assist radiologists to detect more incidental vertebral fractures in adult cancer patients, optimizing timely treatment and reducing associated morbidity and economic burden. Automated assessment of L1 trabecular attenuation offers potential for osteoporosis screening, facilitating early identification of at-risk individuals.

# Abstract Archives of the RSNA, 2024

W2-SPNMMI

**Nuclear Medicine & Molecular Imaging Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPNMMI-1 COMPREHENSIVE ASSESSMENT OF GENETIC MUTATIONS AND QUANTITATIVE IMAGING PARAMETERS IN LIVER METASTASES OF MCRPC PATIENTS UNDERGOING PSMA TARGETED RADIONUCLIDE THERAPY (PSMA-TRT)

Sandra Huicochea, MD (*Abstract Co-Author*) Nothing to Disclose
Scott Tagawa, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Sun (*Abstract Co-Author*) Nothing to Disclose
Debra D'Angelo (*Abstract Co-Author*) Nothing to Disclose
Samuel Ruder (*Abstract Co-Author*) Nothing to Disclose
Andres Ricaurte Fajardo, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph R. Osborne, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Elisabeth O'Dwyer, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Neil Bander (*Abstract Co-Author*) Nothing to Disclose
David Nanus, MD (*Abstract Co-Author*) Nothing to Disclose
Judith Stangl-Kremser, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Divya Yadav, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

To describe a cohort of patients with mCRPC and liver metastases treated on clinical trials of PSMA-TRT emphasizing on genetic mutations and quantitative imaging parameters and their effect on clinical outcomes.

### METHODS AND MATERIALS

We retrospectively analysed 39 patients with liver metastases who received alpha therapy (225Ac-J591), beta therapy (177Lu-PSMA-617, 177Lu-J591) or a combination of both (225Ac-591 and 177Lu-PSMA-IT) as part of PSMA-TRT trials between 2006-2022. 19 patients had PSMAPET-CT imaging available for analysis. Total tumor volume, whole body SUV mean, visual and quantitative PSG (qPSG) scores were calculated. PSG was classified into three groups: high, intermediate and low Imaging parameters and germline mutations were correlated to biochemical response defined as >50% PSA decline post-treatment (PSA50), PSA progression-free survival (PFS) and overall survival (OS).

### RESULTS

Median age was 69 years, with median PSA 85.7. 56.4% received more than 1 ARPI, 59.0% had more than 1 chemotherapy, 33.3% received sip-T, 17.9% had Ra-223, and 10.2% prior TRT. Median PSMA-imaging score (PSMA-IS) was 4 (range 1-4), with 7 (17.9%) 1-2 and 32 (82.1%) 3-4. 9 (23.0%) received alpha-TRT, 26 (66.7%) beta-TRT, and 4 (10.3%) combo-TRT. Mean whole body TTV was 1120.13, whole body SUV mean was 8.41, 55% of cases had high qPSG and visual PSG scores, 45% had intermediate qPSG vs 38.8% in visual PSG score and none had low qPSG versus 6.2% in visual PSG score. Somatic or germline analysis was completed in 15/39 patients. Overall 39 mutations were identified from all tissue samples, 27.5% of mutations were found in Androgen Receptor (AR) and TP53, 17.5% had TMPRSS2-ERG mutation and 15% had CHEK2 mutations. AR (100%), TMPRSS2-ERG and APC (80%) mutations were the most frequently found in the liver samples. PSA50 rate in alpha-TRT was 4 (44.4%), beta-TRT 8 (30.7%), combo-TRT 3 (75%). PSA50 in patients with PSMA-IS 1-2 was 1 (14.2%) compared to 14 (43.9%) in PSMA-IS 3-4. Median PFS was 66 days.

### CONCLUSION

This dataset adds to the collective literature of two subgroups of patients with mCRPC receiving TRT: those with liver disease and those with mutations in DNA repair pathways. The results of this study suggest higher rates of response in patients receiving alpha therapy, either alone or in combination with beta therapy.

### CLINICAL RELEVANCE/APPLICATION

The findings emphasize the significance of personalized treatment strategies for mCRPC, particularly with liver metastases and genetic mutations affecting DNA repair pathways. We highlight the potential efficacy of alpha therapy, especially when combined with beta therapy, and underscores the prognostic value of high radiotracer uptake on PSMA-PET imaging.

## W2-SPNMMI-2 EXTERNAL VALIDATION OF PREDICTION MODELS FOR PATIENTS WITH METASTATIC CASTRATION-RESISTANT PROSTATE CANCER RECEIVING $^{177}$LU-PSMA-617 THERAPY AND EXTENSIONS TO INCORPORATE PSMA-PET TOTAL TUMOR VOLUME

Evan Yu (*Abstract Co-Author*) Research Consultant, Advanced Accelerator Applications;Research Consultant, Bayer AG;Research Consultant, Exelixis, Inc;Research Consultant, Johnson & Johnson;Research Consultant, Merck & Co, Inc;Research Consultant, Oncternal;Research Grant, Bayer AG;Research Grant, Blue Earth Diagnostics Ltd;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Sanpower Group Co., Ltd;Research Grant, Lantheus

Holdings;Research Grant, Merck & Co, Inc;Research Grant, Otsuka Holdings Co, Ltd
Delphine L. Chen, MD (*Abstract Co-Author*) Grant, Telix Pharmaceuticals Limited;Speaker, Telix Pharmaceuticals Limited
Heather Cheng (*Abstract Co-Author*) Research Grant, Clovis Oncology, Inc;Research Grant, Color Genomics;Research Grant, Johnson & Johnson;Research Grant, Pfizer Inc;Research Grant, Phosplatin;Research Grant, Groupe Sanofi;Research Consultant, AstraZeneca PLC
Michael Schweizer (*Abstract Co-Author*) Consultant, Groupe Sanofi;Speaker, Groupe Sanofi;Consultant, AstraZeneca PLC;Speaker, AstraZeneca PLC;Consultant, PharmaIN, Corp;Speaker, PharmaIN, Corp;Consultant, Resverlogix Corp;Speaker, Resverlogix Corp;Institutional research support, Zenith Epigenetics;Institutional research support, Bristol-Myers Squibb Company;Institutional research support, Merck & Co, Inc;Institutional research support, Immunomedics, Inc;Institutional research support, Johnson & Johnson;Institutional research support, AstraZeneca PLC;Institutional research support, Pfizer Inc;Institutional research support, Madison Vaccines, Inc
Jessica Hawley (*Abstract Co-Author*) Institutional research support, Regeneron Pharmaceuticals, Inc;Institutional research support, Sanpower Group Co., Ltd;Consultant, Merck & Co, Inc
Ridvan A. Demirci, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Haffner (*Abstract Co-Author*) Nothing to Disclose
Andrei Gafita, MD (*Abstract Co-Author*) Nothing to Disclose
Amir Iravani, MD (*Abstract Co-Author*) Nothing to Disclose
Bruce Montgomery (*Abstract Co-Author*) Nothing to Disclose
Todd Yezefski (*Abstract Co-Author*) Consultant, Sanpower Group Co., Ltd;Speaker, Pfizer Inc;Speaker, Sumitomo Chemical Co, Ltd
Roman Gulati (*Abstract Co-Author*) Nothing to Disclose
Lukas Owens (*Abstract Co-Author*) Nothing to Disclose
Alireza Ghodsi, MD (*Presenter*) Nothing to Disclose


**PURPOSE**

Given the heterogeneous response to lutetium-177 prostate-specific membrane antigen (Lu-PSMA) in patients with metastatic castration-resistant prostate cancer (mCRPC), determining informative outcome predictors is crucial for effective clinical implementation. Here we validate previously developed nomograms in a real-world cohort and propose replacing a binary indicator of metastatic burden with continuous PSMA PET total tumor volume (TTV).

**METHODS AND MATERIALS**

This single-center retrospective cohort study included a consecutive series of eligible patients with PSMA-positive mCRPC who underwent PSMA PET/CT within 3 months of initiating Lu-PSMA. Quantitative analysis of PSMA PET scans used semi-automated whole-body tumor segmentation. Previously developed nomograms for overall survival (OS), PSA-progression-free survival (PSA-PFS), and PSA decline of =50% from baseline (PSA50) were fit and evaluated using the concordance index. The previously developed nomogram for OS includes variables such as time since diagnosis, chemotherapy status, baseline hemoglobin, dichotomized number of metastases (<20 vs. =20), tumor SUVmean, bone and liver involvement. We then replaced a binary indicator of the number of metastases with continuous TTV and tested the incremental improvement in concordance.

**RESULTS**

A total of 133 patients (median age: 73 years) with a median follow-up of 13 months (range: 1-20) were included. Patients received a median of 4 cycles (IQR: 2-6) of Lu-PSMA, and 53 (39.9%) patients deceased at last follow-up. Kaplan-Meier estimation found marginal evidence that OS was associated with a binary indicator of the number of metastases ($p=0.09$) and strong evidence of association with TTV partitioned into tertiles ($p<0.001$). The previously developed nomograms applied to our cohort achieved a concordance index of 0.69 (95% CI: 0.61-0.77) for OS, 0.67 (95% CI: 0.61-0.73) for PSA-PFS, and 0.70 (95% CI: 0.54-0.86) for PSA50, values numerically similar to published estimates. Replacing the binary number of metastases with continuous TTV significantly increased the concordance index by 0.07 (95% CI: 0.01-0.13; $p=0.009$) for OS.

**CONCLUSION**

Previously developed nomograms in patients with mCRPC receiving Lu-PSMA were prognostic in our independent cohort. Our analysis supports replacing a binary measure of metastatic burden with continuous TTV for predicting OS. External validation of the modified nomograms is warranted.

**CLINICAL RELEVANCE/APPLICATION**

The integration of PSMA PET TTV into a validated nomogram enhances prognostic accuracy for OS in patients with mCRPC receiving Lu-PSMA therapy, offering clinicians a more precise tool to guide treatment decisions and potentially improve patient outcomes.


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# Abstract Archives of the RSNA, 2024

W2-SPNPM

**Noninterpretive Skills (Beyond Imaging) Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPNPM-1 FINANCIAL CONFLICTS OF INTEREST AND DISCLOSURE ACCURACY AMONG PHYSICIAN AUTHORS OF ACR APPROPRIATENESS CRITERIA

Mihir Khunte (*Abstract Co-Author*) Nothing to Disclose
Ajay Malhotra, MD, MMM (*Abstract Co-Author*) Nothing to Disclose
Dheeman Futela, MBBS (*Presenter*) Nothing to Disclose

### PURPOSE

The accuracy and completeness of self-disclosures by authors of imaging guidelines are not well known. This study aimed to assess the accuracy of financial disclosures by US authors of ACR appropriateness criteria (AC).

### METHODS AND MATERIALS

We reviewed financial disclosures provided by US-based authors of all ACR AC published in 2019, 2021, and 2023. For each US-based author, payment reports were extracted from the Open Payments Database (OPD) in the previous 36 months related to general category and research payments categories. We analyzed each author individually to determine if the reported disclosures matched results from OPD.

### RESULTS

A total of 633 authorships, including 333 unique authors were included from 38 ACR AC articles in 2019, 606 authorships (387 unique authors) from 35 ACR AC articles published in 2021, and 540 authorships (367 unique authors) from 32 ACR AC articles published in 2023. Among authors who received industry payments, the median amount received per authorship was $5038 in 2019, $3876 in 2021, and $6040 in 2023. Failure to disclose any financial relationship was seen in 125/147 unique authors in 2019, 142/148 unique authors in 2021, and 95/125 unique authors in 2023. The median non-disclosed amount per authorship was $4614 in 2019, $3876 in 2021, and $3272 in 2023. The proportion of non-disclosed total value of payments was 86.1% in 2019, 88.6% in 2021 and 56.7% in 2023. General category payments were non-disclosed up to 94.1% in 2019, 89.7% in 2021, and 94.4% in 2023 by payment value.

### CONCLUSION

Industry payments to authors of radiology guidelines are frequently undisclosed, and clear instructions for disclosure of all financial relationships would bring greater transparency.

### CLINICAL RELEVANCE/APPLICATION

The lack of transparency in disclosure of financial conflicts of interest may erode public trust in biomedical research and peer review processes. Inaccurate disclosure may undermine the integrity of ACR AC guidelines, diminishing physician and patient confidence in the recommendations. Clear, unambiguous journal guidelines for disclosure of all financial relationships whether related to the manuscript or not, are needed.

## W2-SPNPM-2 UNINTENDED CONSEQUENCES OF PRICE TRANSPARENCY INITIATIVES: IMPACT ON PATIENT DECISION-MAKING FOR IMAGING SERVICES

Gelareh Sadigh, MD (*Abstract Co-Author*) Nothing to Disclose
Ali Rashidi, MD (*Abstract Co-Author*) Nothing to Disclose
George Grant (*Presenter*) Nothing to Disclose

### PURPOSE

In the U.S. healthcare system, opaque pricing and the risk of accruing medical debt highlight the need for better price transparency to empower patients' informed decision making. However, impact of price transparency on adherence to recommended care is unclear. We aimed to assess the association between awareness of out-of-pocket cost (OOPC) estimates prior to receipt of imaging and the appointment completion status.

### METHODS AND MATERIALS

In this cross-sectional prospective study, we surveyed 608 patients with a scheduled imaging appointment (421 exam completions and 187 cancellations/no shows) at a tertiary imaging center between November 2022 to May 2023. Participants were asked about their pre-imaging OOPC estimate knowledge, information sources for the estimate, demographics, and insurance. We used descriptive statistics and multivariable logistic regression model to assess association between pre-imaging OOPC estimate knowledge and imaging completion status.

## RESULTS

Mean age of the 608 participants were 56.3 ± 15.8. A total of 58% were female; 54% were white, 20% Hispanic and 20% Asian. Majority (49%) had commercial insurance, followed by 36% Medicare, 11% Medicaid and 2% self-pay. A total of 14% were aware of their OOPC estimates prior to receipt of imaging. The most common sources for estimates were patients actively calling health insurance or imaging center billing office (32%), receipt of the estimate by imaging center without asking for it (20%), and use of price estimator tools offered by hospital or health plan (15%). A total of 48% of patients with pre-imaging OOPC estimate knowledge missed their appointment vs. 28% of those who did not know their estimate ($P<0.001$). Adjusting for demographics, comorbidities and neighborhood deprivation index, patients with pre-imaging OOPC estimate knowledge were 17.5-point percentage (95% CI, 6.2 - 28.8) less likely to complete their exam when compared with those without the knowledge ($P=0.002$).

## CONCLUSION

Our findings echo concerns regarding the unintended consequences of price transparency initiatives, potentially associated with appointment non-completion. We hypothesize that the absence of provider guidance in navigating cost information may contribute to this phenomenon.

## CLINICAL RELEVANCE/APPLICATION

Our findings underscore the complexity of implementing price transparency initiatives in healthcare and emphasize the importance of ensuring that transparency initiatives are effectively integrated into patient care pathways to avoid unintended consequences such as decreased care adherence.

# Abstract Archives of the RSNA, 2024

W2-SPNR

**Neuroradiology Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPNR-10 A RADIOMIC-RISK SCORE FOR SURVIVAL PREDICTION IN GLIOMA: A LARGE MULTI-INSTITUTIONAL RETROSPECTIVE VALIDATION STUDY

Michael C. Veronesi, PhD (*Abstract Co-Author*) Nothing to Disclose
Pallavi Tiwari, PhD (*Abstract Co-Author*) Nothing to Disclose
Marwa Ismail (*Abstract Co-Author*) Nothing to Disclose
Gustavo Adolfo Pineda Ortiz (*Presenter*) Nothing to Disclose

### PURPOSE

Gliomas are the most aggressive brain tumors with dismal survival. Radiomics has been extensively utilized as non-invasive biomarkers for survival prediction in gliomas, attempting to capture tumor heterogeneity and infiltration. However, rigorous validation for these techniques on large, multi-institutional data is still needed for them to become clinically actionable. This work attempts to evaluate a radiomic-based survival risk assessment score on a large multi-institutional cohort of Glioma patients. Our rationale is that optimizing and validating radiomic features that capture intensity-based textural variations and morphology-based changes (e.g., local curvature and global contour) on large multi-institutional cohorts can allow for robust risk assessment in Glioma.

### METHODS AND MATERIALS

A total of n=668 pre-operative T1w MRI scans for Glioma patients from 4 sites were analyzed. 2 sites were publicly available (University of California San Francisco "UCSF" (n=495), LUMIERE (n=86)) and the other 2 datasets were obtained from xCures (n=13), and Cleveland Clinic (CCF) (n=74). Subjects from UCSF, CCF, and xCures were used for training, whereas subjects from the LUMIERE cohort were used for hold-out testing. Pre-processing was conducted, including intensity-standardization for scans across all sites and tumor segmentation into Edema (ED) and Enhancing tumor (ET) regions. A total of n=1558 radiomic features were extracted from the tumor regions (779 per region), namely, 31 global contour features, 20 curvature-based features, 624 gradient co-occurrence statistics, and 104 Collage features. Cox regression models were employed on the radiomic features, to create a radiomic risk score (RRS) for every subject, as well as on clinical and demographic variables (IDH, MGMT, sex, age), for survival analysis.

### RESULTS

Our radiomics risk score (RRS) consisted of 43 top discriminative radiomic features from the regression model, and the associated clinical and demographic variables (CDS) which independently demonstrated significant differences between high and low risk groups in the training (RRS: p=0.043, HR = 2, CSD: p=0.0031, HR = 2.8) and testing sets (RRS: p=0.0096, HR = 1.8, CSD: p=0.0071, HR = 1.8). Combining RRS and CDS improved the OS prediction at group level (p=3.6e-6, 0.0011, HR=5.4, 2, for training and testing, respectively).

### CONCLUSION

Our multi-institutional radiomic analysis demonstrates promise in reliable risk-stratification in glioma patients

### CLINICAL RELEVANCE/APPLICATION

Radiomic features provide means for noninvasive survival prediction, which enable reliable risk assessment and efficient targeted therapies.

## W2-SPNR-13 A PRELIMINARY STUDY OF SUPER-RESOLUTION DEEP LEARNING RECONSTRUCTION WITH CARDIAC OPTION FOR EVALUATION OF ENDOVASCULAR-TREATED INTRACRANIAL ANEURYSMS

Chuluunbaatar Otgonbaatar, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Sung-Jin Cha, BS (*Abstract Co-Author*) Nothing to Disclose
Hackjoon Shim, PhD (*Abstract Co-Author*) Nothing to Disclose
Jin Woo Kim (*Abstract Co-Author*) Nothing to Disclose
JEON SANG HYUN (*Abstract Co-Author*) Nothing to Disclose
Jaekyun Ryu, PhD (*Abstract Co-Author*) Nothing to Disclose
Hyunjung Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Pil-Hyun Jeon, PhD (*Abstract Co-Author*) Nothing to Disclose
Sung Min Ko, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the usefulness of super-resolution deep learning reconstruction (SR-DLR) with cardiac option in the assessment of image quality in patients with stent-assisted coil embolization, coil embolization, and flow-diverting stent placement compared with other image reconstructions.

### METHODS AND MATERIALS

This single-center retrospective study included fifty patients (mean age, 59 years; range, 44-81 years; 13 men) who were treated with stent-assisted coil embolization, coil embolization, and flow-diverting stent placement between January and July 2023. The images were reconstructed using filtered back projection (FBP), hybrid iterative reconstruction (IR), and SR-DLR. The objective image analysis included image noise in the Hounsfield unit (HU), signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and full width at half maximum (FWHM). Subjectively, two radiologists evaluated the overall image quality for the visualization of the flow-diverting stent, coil, and stent.

### RESULTS

The image noise in HU in SR-DLR was 6.99±1.49, which was significantly lower than that in images reconstructed with FBP (12.32±3.01) and hybrid IR (8.63±2.12) ($p<0.001$). Both the mean SNR and CNR were significantly higher in SR-DLR than in FBP and hybrid IR ($p<0.001$ and $p<0.001$) (Fig. 1). The FWHMs for the stent ($p<0.004$), flow-diverting stent ($p<0.001$), and coil ($p<0.001$) were significantly lower in SR-DLR than in FBP and hybrid IR (Table 1 and Fig. 2). The subjective visual scores were significantly higher in SR-DLR than in other image reconstructions ($p<0.001$) (Table 2 and Fig. 3).

### CONCLUSION

SR-DLR with cardiac option is useful for follow-up imaging in stent-assisted coil embolization and flow-diverting stent placement in terms of lower image noise, higher SNR and CNR, superior subjective image analysis, and less blooming artifact than other image reconstructions.

### CLINICAL RELEVANCE/APPLICATION

SR-DLR with cardiac option allow better visualization of the peripheral and smaller cerebral arteries. SR-DLR with cardiac option can be beneficial for CT imaging of stent-assisted coil embolization and flow-diverting stent.

## W2-SPNR-14 DETECTION OF INTRACRANIAL HEMORRHAGE USING ULTRALOW-DOSE BRAIN COMPUTED TOMOGRAPHY WITH DEEP LEARNING RECONSTRUCTION VERSUS CONVENTIONAL-DOSE COMPUTED TOMOGRAPHY

Jaekyun Ryu, PhD (*Abstract Co-Author*) Nothing to Disclose
Hackjoon Shim, PhD (*Abstract Co-Author*) Nothing to Disclose
JEON SANG HYUN (*Abstract Co-Author*) Nothing to Disclose
Won Beom Jung (*Abstract Co-Author*) Nothing to Disclose
Sung Min Ko, PhD (*Abstract Co-Author*) Nothing to Disclose
Sung-Jin Cha, BS (*Abstract Co-Author*) Nothing to Disclose
Hyunjung Kim, MD (*Abstract Co-Author*) Nothing to Disclose
Jin Woo Kim (*Abstract Co-Author*) Nothing to Disclose
Pil-Hyun Jeon, PhD (*Abstract Co-Author*) Nothing to Disclose
Chuluunbaatar Otgonbaatar, MD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to evaluate the diagnostic performance, image quality, and radiation dose among ultralow-dose protocol with deep learning reconstruction (DLR), ultralow-dose computed tomography (CT) with iterative reconstruction (IR), and conventional-dose protocols for detecting intracranial hemorrhage.

### METHODS AND MATERIALS

This retrospective study enrolled 93 patients (median age: 67 years; interquartile range [IQR]: 59-76 years; 61 males). All patients underwent follow-up noncontrast CT with ultralow-dose setting after initial conventional-dose CT within 5 days. A conventional-dose CT was obtained using 123-188 mA and IR. Ultralow-dose CT was obtained using 50 mA with IR and DLR (Table 1). Qualitative assessments (CT attenuation, noise level, signal-to-noise ratio [SNR], and contrast-to-noise ratio [CNR]) and quantitative assessments (image noise, differentiation between gray and white matter, and artifact) were conducted. The diagnostic performance for detecting intracranial hemorrhage using ultralow-dose CT with IR and ultralow-dose CT with DLR was assessed.

### RESULTS

An approximately 84.0% reduction in median volume CT dose index was found in the ultralow-dose CT protocol (5.6 mGy) compared with conventional-dose CT (35.02 mGy; IQR: 33.09-37.36). Ultralow-dose CT with DLR significantly ($p < 0.001$) improved image noise, SNR, and CNR compared with ultralow-dose CT with IR and conventional-dose CT (Figure 1). Ultralow-dose CT with DLR resulted in higher sensitivity (99.3% vs. 98.6%) and specificity (97.5% vs. 97.5%) for detecting intracranial hemorrhage than ultralow-dose CT with IR (Table 2 and Figure 2).

### CONCLUSION

Ultralow-dose CT with DLR is an acceptable technique that provides higher image quality and diagnostic performance with a reduction in radiation dose of approximately 87.7% compared with conventional-dose CT.

### CLINICAL RELEVANCE/APPLICATION

The present study investigated the value of ultralow-dose CT with DLR for the assessment of image quality and the evaluation of intracranial hemorrhage compared with ultralow-dose CT with IR and conventional-dose CT. Image quality was significantly improved in terms of image noise, SNR, and CNR, and higher diagnostic performance was observed with ultralow-dose CT with DLR than with ultralow-dose CT with IR.

## W2-SPNR-15 ARTIFICIAL INTELLIGENCE ACCURATELY DIFFERENTIATES RADIONECROSIS FROM TRUE PROGRESSION IN BRAIN METASTASIS TREATED WITH STEREOTACTIC RADIOSURGERY: ANALYSIS OF 104 HISTOLOGICALLY ASSESSED LESIONS

Marta Scorsetti (*Abstract Co-Author*) Nothing to Disclose
Riccardo Levi (*Abstract Co-Author*) Nothing to Disclose
Pierina Navarria (*Abstract Co-Author*) Nothing to Disclose
Letterio S. Politi, MD (*Abstract Co-Author*) Nothing to Disclose
Federico Pessina (*Abstract Co-Author*) Nothing to Disclose
Giovanni Savini (*Abstract Co-Author*) Nothing to Disclose
Elena Clerici (*Abstract Co-Author*) Nothing to Disclose
Gaia Ressa, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To develop automated models able to discriminate radionecrosis from disease progression in brain metastases treated with stereotactic radiosurgery (SRS).

### METHODS AND MATERIALS

This single-centre retrospective study included all patients who underwent neurosurgery for suspected brain metastasis progression after SRS, between 2012 and 2022. Presurgical FLAIR and post-contrast T1 (T1ce) acquisitions were segmented using a convolutional neural network (CNN) into non-enhancing, enhancing, and edema volumes of interest (VOIs). Radiomics features (n=321) were extracted from each sequence and VOI, and their significance to radionecrosis was assessed through univariate and multivariate analyses. A Random Forest machine learning model was trained on 70% of the sample and evaluated on the remaining 30% using Bayesian optimization and 10-fold cross-validation. A 3D ResNet-based CNN was trained on the same split dataset. Post-surgical histology was available for all cases.

### RESULTS

104 lesions from 96 patients (n=40 males, mean age 56.4 years) were included. Sole radionecrosis was histologically detected in 29 cases (28%), while in the remaining varying percentages of neoplastic cells were present. Univariate analysis identified 131 significantly different radiomics features (RFs) between the two groups, including GLDM Dependence Non Uniformity Normalized (GLDM_DNUN, $p<0.001$) and GLDM Small Dependence Emphasis (GLDM_SDE, $p<0.001$) within the enhancing area of T1ce. Multivariate analysis confirmed these findings: GLDM_DNUN (OR 0.39, 95% CI 0.22-0.69, $p<0.001$) and GLDM_SDE (OR 0.28-0.69, $p<0.001$) were significantly associated with radionecrosis. The Random Forest model yielded a 0.79 of accuracy, 0.81 of AUROC and 0.87 of sensitivity in radionecrosis prediction, whereas the CNN ResNet model performed with higher accuracy (86.9%), AUROC (0.889) and sensitivity (87.8%).

### CONCLUSION

Artificial intelligence could be employed to differentiate between radionecrosis and disease progression upon-SRS, potentially reducing unnecessary brain surgery interventions.

### CLINICAL RELEVANCE/APPLICATION

Accurate discrimination between radionecrosis and tumor progression/recurrence in brain metastases post-SRS remains a significant diagnostic challenge. Conventional MRI together with advanced imaging modalities, such as diffusion/perfusion-weighted imaging and CT-PET with amino acid tracers, still present limitations, often requiring histopathologic assessment via brain surgery to achieve a definitive diagnosis. Integrating artificial intelligence models with conventional MRI offers a promising non-invasive approach, potentially revolutionizing diagnostic methodologies in this challenging clinical context.

## W2-SPNR-16 DEEP-LEARNING-ACCELERATED MPRAGE VERSUS STANDARD MPRAGE FOR QUANTITATIVE BRAIN MORPHOMETRY AND VISUAL GRADING OF CORTICAL VOLUME LOSS

Susie Y. Huang, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Marcel D. Nickel (*Abstract Co-Author*) Employee, Siemens AG
Wei-Ching Lo (*Abstract Co-Author*) Employee, Siemens AG
Bryan Clifford, PhD (*Abstract Co-Author*) Employee, Siemens AG
Sittaya Buathong, MD (*Abstract Co-Author*) Nothing to Disclose
Azadeh Hajati, MD (*Abstract Co-Author*) Nothing to Disclose
Azadeh Tabari, MD (*Abstract Co-Author*) Nothing to Disclose
Nelson H. Gil JR, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate a novel deep-learning-accelerated T1-weighted MPRAGE (DL-MPRAGE) sequence for quantitative volumetric brain MRI and qualitative assessment of cortical volume loss relative to a standard MPRAGE (STD-MPRAGE).

### METHODS AND MATERIALS

We prospectively recruited adult patients undergoing memory loss protocol MRI on 3T MRI scanners (MAGNETOM Vida, Siemens Healthineers, Forchheim, Germany). The research application DL-MPRAGE uses a two-step deep-learning-based image reconstruction. The first step alternates between data consistency updates and neural network evaluation and the second step incorporates a super-resolution algorithm. We estimated cortical volume in DL- and STD-MPRAGE images for each patient with the longitudinal FreeSurfer pipeline in 11 brain regions and quantified differences between the two sequences across patients with the absolute symmetrized percent change (ASPC). In addition, we performed Bland-Altman analysis to determine 95% limits of agreement for the mean differences between each anatomical region. For qualitative review, two blinded neuroradiologists rated levels of cortical volume loss for anatomical regions based on a standardized five-point scale. We computed the mean difference in ratings between DL- and STD-MPRAGE for each anatomical region.

### RESULTS

64 patients (29 female, 62.4 ± 16 years old) being evaluated for memory loss (N = 53, 83%) or traumatic brain injury (N = 11, 17%) were included. DL-MPRAGE achieved both superior image resolution by a factor of 2.0 (0.5 mm vs. 1.0 mm) and improved acquisition speed by a factor of ~2.5 (2 min, 11 sec vs. 5 min, 21 sec) compared to STD-MPRAGE. The mean regional volumes for DL-MPRAGE scans were lower than for STD-MPRAGE (e.g. 17226 vs. 17923 mm3 for the cingulate gyrus, $p < 0.005$, paired t-test). Nevertheless, corresponding ASPC values for these differences were low, averaging 2.8% across brain regions. Furthermore, mean differences between volumes almost all lay within the 95% limits of agreement, suggesting that observed differences in ASPC are driven by a few outliers. There was essentially no difference in qualitative ratings of regional cortical volume loss between DL-MPRAGE and STD-MPRAGE across anatomical regions among the two neuroradiologists. At least 94% of the differences in ratings were 0.

### CONCLUSION

DL-MPRAGE offers quantitatively and qualitatively equivalent volumetric estimation compared to STD-MPRAGE while achieving improved image resolution and acquisition speed.

### CLINICAL RELEVANCE/APPLICATION

DL-MPRAGE improves on the current standard in the assessment of brain volume loss by offering both improved image resolution and acquisition speed compared to STD-MPRAGE while maintaining equivalence for quantitative and qualitative analysis.

## W2-SPNR-18 AUTOMATED DETECTION OF STENO-OCCLUSIVE LESION ON TIME-OF-FLIGHT MAGNETIC RESONANCE ANGIOGRAPHY: AN OBSERVER PERFORMANCE STUDY

Jae-Hyeop Jung, MD (*Abstract Co-Author*) Nothing to Disclose
Sung Il Hwang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonard Sunwoo, MD (*Abstract Co-Author*) Nothing to Disclose
Hunjong Lim, MD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

Intracranial steno-occlusive lesions are responsible for acute ischemic stroke. However, the clinical benefits of artificial intelligence-based methods for detecting pathologic lesions in intracranial arteries have not been evaluated. We aimed to validate the clinical utility of an artificial intelligence model for detecting steno-occlusive lesions in the intracranial arteries.

**METHODS AND MATERIALS**

Overall, 138 TOF-MRA images were collected from two institutions, which served as internal (n = 62) and external (n = 76) test sets, respectively. Each study was reviewed by five radiologists (two neuroradiologists and three radiology residents) to compare the usage and non-usage of our proposed artificial intelligence model for TOF-MRA interpretation. They identified the steno-occlusive lesions and recorded their reading time. Observer performance was assessed using the area under the Jackknife free-response receiver operating characteristic curve and reading time for comparison.

**RESULTS**

The average area under the Jackknife free-response receiver operating characteristic curve for the five radiologists demonstrated an improvement from 0.70 without artificial intelligence to 0.76 with artificial intelligence (P = .027). Among three radiology residents, the average area under the Jackknife free-response receiver operating characteristic curve enhancement was more pronounced with artificial intelligence usage (increasing from 0.68 to 0.76, P = .002). Despite anincreased reading time upon using artificial intelligence, there was no significant change among the readings by radiology residents. Moreover, the use of artificial intelligence resulted in improved inter-observer agreement among the reviewers (the intraclass correlation coefficient increased from 0.734 to 0.752).

**CONCLUSION**

Our proposed artificial intelligence model offers a supportive tool for radiologists, potentially enhancing the accuracy of detecting intracranial steno-occlusion lesions on TOF-MRA. Less-experienced readers may benefit the most from this model.

**CLINICAL RELEVANCE/APPLICATION**

Our study advances knowledge by demonstrating the clinical utility of an AI model in improving radiologists' accuracy in detecting intracranial steno-occlusive lesions. This suggests that AI can be a valuable support tool, especially for less-experienced readers, potentially increasing diagnostic performance and contributing to better patient outcomes.

## W2-SPNR-2 DEEP LEARNING-BASED SIGNAL AMPLIFICATION OF T1-WEIGHTED SINGLE-DOSE IMAGES FOR METASTASIS DETECTION IN BRAIN MRI

Robert Haase, MD (*Abstract Co-Author*) Nothing to Disclose
Katerina Deike-Hofmann (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter W. Schlemmer, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG
Kai Schlamp, MD (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Cornelius Deuschl (*Abstract Co-Author*) Nothing to Disclose
Frederic Carsten Schmeel (*Abstract Co-Author*) Nothing to Disclose
Johannes Haubold, MD (*Abstract Co-Author*) Speaker, Siemens AG
Erich Kobler, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Martha Foltyn-Dumitru, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Alexander Effland (*Abstract Co-Author*) Nothing to Disclose
Zeynep Bendella (*Abstract Co-Author*) Nothing to Disclose
Martin Vahlensieck, MD (*Abstract Co-Author*) Nothing to Disclose
Claus P. Heussel, MD (*Abstract Co-Author*) Nothing to Disclose
Arndt-Hendrik Schievelkamp (*Abstract Co-Author*) Nothing to Disclose
Daniel Paech, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mathias Meetschen, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Radbruch (*Abstract Co-Author*) Nothing to Disclose
Thomas Pinetz, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

To test the benefit in sensitivity and precision of a deep learning-based signal amplification of the contrast signal in true single-dose T1-weighted (T-SD) images creating artificial double-dose (A-DD) images for metastasis detection in brain MRI.

**METHODS AND MATERIALS**

In this prospective, multicentric study, a deep learning-based method for signal amplification originally trained on a diverse dataset of unenhanced, low-dose (10%-33% of a single-dose) and single-dose T1-weighted brain images was applied to single-dose images of a test dataset of 30 participants (mean age, 58.5±11.8 [SD] years, 23 women) prospectively acquired between November 2022 and June 2023 in an external institution not included in training. Two board-certified neuroradiologists searched for brain metastases on participants' T-SD and A-DD images in random order with a period of four weeks between readings. Cases were reviewed by a reference reader to determine any metastases present. Performances were compared using Mid-p McNemar tests for sensitivity and two-sided Wilcoxon signed-rank tests for false-positive findings.

**RESULTS**

88 metastases were identified by the reference reader. Reader 1 found significantly more metastases using the A-DD images (73/88, 83.0%) instead of T-SD images (62/88, 70.5%, p=.008) with a similar precision in both reads (A-DD: 79.3%, 19 false-positive lesions, T-SD: 81.6%, 14 false-positive lesions). In reader 2, no significant difference could be shown with three more metastases found on the A-DD images (A-DD: 65/88, 73.9%, T-SD: 62/88, 70.5%, p=.424) - also with a similar precision between sequences (A-DD: 81.3%, 15 false-positive lesions, T-SD: 84.9%, 11 false-positive lesions). The number of false-positive lesions did not differ significantly between sequences. For small metastases with a diameter of less than or equal to 5 mm, the difference in sensitivity was even more pronounced (Reader 1, A-DD: 33/48 (68.8%), T-SD: 25/48 (52.1%), p=.035; Reader 2: A-DD: 27/48 (56.3%), T-SD: 24/48 (50.0%), p=.424).

### CONCLUSION

Both readers found a comparable number of metastases in the T-SD images. One reader was able to strongly benefit from the use of artificial contrast enhancement with a significant increase in sensitivity for brain metastases without loss of precision. In this study with 30 test participants, eleven and three additional metastases were found using artificial double-dose images by readers 1 and 2, respectively. This benefit was particularly pronounced for small metastases.

### CLINICAL RELEVANCE/APPLICATION

The benefits of double-dose brain imaging conflict with concerns about the effects of gadolinium-based contrast agents on patients and the environment, preventing availability.

## W2-SPNR-4 A COPILOT FOR RADIOLOGY: VISION-LANGUAGE MODELS ACHIEVE ACCURATE BRAIN MRI INTERPRETATION

Harini Veeraraghavan (*Abstract Co-Author*) Nothing to Disclose
Maxime Kayser (*Abstract Co-Author*) Nothing to Disclose
Aneesh Rangnekar, PHD (*Abstract Co-Author*) Nothing to Disclose
Aleksandr Petrov (*Abstract Co-Author*) Nothing to Disclose
Nathaniel Swinburne, MD (*Presenter*) Nothing to Disclose

### PURPOSE

While artificial intelligence (AI) applications to radiology can automate tasks such as disease detection and lesion segmentation, the development of robust foundational models has been thwarted by the need for manual data annotation, preventing scalable training methods analogous to those achieving success in large language model (LLM) development. We aim to overcome these limitations by leveraging fully automated dataset curation to train a new vision-language model (VLM), "ViLaMet", to analyze brain MRIs and generate report text.

### METHODS AND MATERIALS

We data mined our cancer center's PACS to extract all brain MRIs acquired from 2012-2017 (77,228 MRIs from 24,262 patients), isolating the axial T1 post-contrast (T1C+) images and report text. After patient-wise dataset splitting (76,087 training and 1,141 test data pairs), the reports were pre-processed using GPT-3.5/4 to remove references to findings not visible on T1C+ images or to change from prior studies. To facilitate quantitative model evaluation, 16 close-ended, single- or multiple-choice instruction-answer pairs were created for each report (e.g. "List all the locations that contain enhancing lesions."). A subset of 50 randomly-selected test reports was manually labeled as ground truth.At this initial stage, our VLM has been trained on the original reports on the tasks of report generation (RRG) and image-report matching (IRM). ViLaMet incorporates a 3D vision encoder and an LLM connected via a bridging module, mapping MRI features into a latent space for language processing. We optimized model training using Low-Rank Adaptation and varied the architecture by comparing different vision encoders and LLM sizes.

### RESULTS

The best report generation scores (Bleu-1 0.247, Bleu-4 0.060, and Meteor 0.132) were obtained using an 8B Llama3 model with a frozen DenseNet-121, which was pre-trained via RRG and RM. ViLaMet correctly classifies 89.7% of image-report pairs as matching (random chance is 50%). Our GPT-4 report processing achieves 92% accuracy in extracting correct instruction-answer pairs (versus 81% for GPT-3.5).

### CONCLUSION

Our VLM achieves excellent accuracy at automated brain MRI report generation despite a heterogeneous and complex test patient population. The ability to harness massive clinical radiology datasets at scale for model training suggests a path to achieving generalizable foundational radiology AI models. In ongoing work we are training ViLaMet on the GPT-4 processed reports to reduce hallucinations and improve evaluation.

### CLINICAL RELEVANCE/APPLICATION

A VLM trained using data-mined brain MR images and report text achieves excellent accuracy in automated report generation, offering a path to next-generation radiology computer-aided diagnostics.

## W2-SPNR-5 FORTE: FEATURE-ORIENTED RADIOLOGY TASK EVALUATION FRAMEWORK FOR MULTIMODAL LARGE LANGUAGE MODELS IN VOLUMETRIC BRAIN CT REPORT GENERATION

Jiing-Feng Lirng, MD (*Abstract Co-Author*) Nothing to Disclose
Kao-Jung Chang (*Abstract Co-Author*) Nothing to Disclose
Cheng-Yi Li (*Presenter*) Nothing to Disclose

### PURPOSE

To relieve radiologists' time-consuming and tedious burden, this study aims to investigate the capability of Multi-modal large language models (MLLMs) to generate comprehensive image reports for 3D brain CT.

### METHODS AND MATERIALS

In this study, we curated a three-dimensional brain CT (3D-brainCT) dataset comprising 18,885 text-scan pairs. We trained BrainGPT to generate 3D brain CT reports using the visual instruction tuning (VIT) technique on the Otter foundation model. Then, we examined the caption efficacy by (1) applying traditional BLEU/ METEOR/ ROUGE-L/ CIDEr-R metrics, (2) proposing a clinical-oriented FORTE metric, (3) validating BrainGPT generalizability in the CQ500 dataset, and (4) conducting the physician Turing test.

### RESULTS

The performance of BrainGPT (BLEU-1 = 44.35, BLEU-4 = 20.38, METEOR = 30.13, ROUGE_L = 47.6, CIDEr-R = 211.17) was significantly higher than general Otter model (BLEU-1 = 6.87, BLEU-4 = 0.01, METEOR = 3.02, ROUGE_L = 7.88, CIDEr-R = 4.12). Our Pearson correlation analysis results demonstrated that, compared to traditional NLG metrics, FORTE better reflects the clinical essence of the medical context. In the CQ500 dataset, our BrainGPT captioned midline shift at decent 0.91 accuracy. A Turing test on 11 physician raters evaluated the writing styles and radiology context of the generated reports; in most cases, the BrainFlamingo reports are more challenging to distinguish (accuracy = 25.76%) than radiologist reports (46.97%) from physicians' viewpoints. The ensuing linguistic questionnaire highlights the importance of writing style as we connect physician accuracy and criteria importance.

### CONCLUSION

As the inaugural work to apply MLLM in 3D Brain CT, our study embodies a comprehensive framework that suggests modulated solutions and style-based optimization to the technical hurdles when applying MLLMs to brain CT and other complex medical captioning tasks.

### CLINICAL RELEVANCE/APPLICATION

Our study highlights the potential of MLLMs in enhancing diagnostic accuracy and report consistency in 3D brain CT scans, promising improved clinical decision-making and patient outcomes through advanced AI-driven report generation and analysis.

## W2-SPNR-6 DEEP LEARNING INSIGHTS INTO THE RADIOGRAPHIC FEATURES OF NORMAL PRESSURE HYDROCEPHALUS USING GRADIENT CLASS ACTIVATION MAPPING

Kevin S. King, MD (*Abstract Co-Author*) Nothing to Disclose
Emily Foldes (*Abstract Co-Author*) Nothing to Disclose
Matthew Borzage (*Abstract Co-Author*) Nothing to Disclose
Raza Mushtaq, MD (*Abstract Co-Author*) Nothing to Disclose
Joseph Wilson (*Abstract Co-Author*) Nothing to Disclose
Christian Henriksen (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a deep learning convolutional neural network (CNN) for the diagnosis of normal pressure hydrocephalus (NPH) from head computed tomography (CT) and to use gradient class activation mapping (GradCAM) to analyze which imaging features the CNN has learned to associate with NPH.

### METHODS AND MATERIALS

We collected 590 head CT images, 295 from patients with suspected NPH who had quantitative improvement in gait after lumbar tap test, and 285 CT images from age- and gender-matched controls that had normal CT findings. Collected CT images were pre-processed to include only the intracranial contents in the final CT image. We trained our CNN to convergence on 464 patients, and reserved 87 patients for validation and 29 patients for evaluation. The final model was evaluated using a confusion matrix. Using GradCAM, saliency maps were calculated for the final convolutional layer of the final model and color-mapped in 3D space for each CT exam in the validation and evaluation sets.

### RESULTS

The final model was able to accurately detect NPH with a sensitivity of 100% on the validation and evaluation sets and a specificity of 97.2% and 94.1%, respectively, misclassifying a single false positive in either set.On CT images that were classified as NPH, saliency maps revealed consistently strong positive attributions in the parafalcine area, the inferolateral and anteromedial regions of the ventricles, the choroid plexus, and the edges of the intracranial volume. Weak positive attributions were consistently observed throughout the sulcal topography of the brain, and occasionally observed at the Sylvian fissure. On CT images classified as normal, strong negative attributions were present in the parafalcine area, inferolateral and anteromedial regions of the ventricles, the choroid plexus, and the edges of the intracranial volume.

### CONCLUSION

The saliency maps of the model underscore the importance of the above features in the morphology of NPH. Continued work will involve strengthening the model as a feature extractor by using occlusion-based data augmentation techniques as well as improving the clinical applicability of the model and further clarifying the semantic precision of the saliency maps by collecting CT images of patients with non-NPH causes of dementia (e.g. Alzheimer's disease) as well as other pathologies and normal findings.

### CLINICAL RELEVANCE/APPLICATION

This project presents a model for the automated diagnosis of NPH from head CT. The saliency maps suggest the importance of the above features for the radiographic identification of NPH.

## W2-SPNR-7 DEEP LEARNING OF BRAIN CT SCANS TO IDENTIFY PEDIATRIC CARDIAC ARREST AND PREDICT OUTCOME

Shandong Wu, PhD (*Abstract Co-Author*) Nothing to Disclose
Amirreza Manteghinejad, MD (*Abstract Co-Author*) Nothing to Disclose
Dooman Arefan, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Matthew Kirschen (*Abstract Co-Author*) Nothing to Disclose
Arastoo Vossough, PhD, MD (*Abstract Co-Author*) Research Consultant, Syneos Health;Stockholder, DeepSight Technology, Inc
Alexis Topjian (*Abstract Co-Author*) Nothing to Disclose
Jonathan Elmer (*Abstract Co-Author*) Nothing to Disclose
Jiren Li (*Presenter*) Nothing to Disclose

### PURPOSE

Hypoxic-ischemic brain injury is the primary cause of morbidity and mortality after pediatric cardiac arrest. Brain computerized tomography (CT) scans performed early after cardiac arrest may be helpful for risk stratification, outcome prediction, and to direct clinical care. The goal of this study was to leverage deep learning to identify patients who had a cardiac arrest compared to controls and to predict outcome.

### METHODS AND MATERIALS

Retrospective observational study of patients at a single institution who had a brain CT scan performed as part of clinical care within 24 hours of cardiac arrest. Patient outcomes were measured by the pediatric cerebral performance category scale (PCPC) [1 (normal) to 6 (death)]. Unfavorable outcome was defined as PCPC 4-6 at hospital discharge and a change of =1 from pre-arrest baseline. We excluded patients with pre-arrest PCPC =4. Four age-matched controls for each cardiac arrest patient were abstracted from our radiology database. All control CT scans were verified to have no intracranial pathology. A preprocessing pipeline (including skull stripping, intensity normalization, and slice thickness resampling) was applied on each CT scan. We designed a convolutional neural network on the 3D CT scans to 1) classifying cardiac arrest patients vs. controls and 2) predicting survival and unfavorable outcomes for patients who had a cardiac arrest. We used 5-fold cross-validation for model evaluation, and the proportion of children younger than 1 year old is controlled the same in each fold. Model performance was measured by the area under the ROC curve (AUC). We generated heatmaps to visualize brain regions which were key in informing outcome metrics.

### RESULTS

We analyzed 714 patients including 146 post-cardiac arrest (41: < 1 year, 24: 1-2 years, 79: 2-18 years) and 568 age-matched controls. Among cardiac arrest patients 61 died (41.8%), and 88 (60.3%) had an unfavorable outcome. The mean AUC (mean±std) was 0.89±0.018 for classifying whether the CT scan was derived from a cardiac arrest vs control patient. The AUC to predict mortality was 0.80±0.025. For unfavorable vs favorable outcome prediction, there was a large variation across the five folds due to sample size limitation. The highest AUC was 0.73 (mean AUC: 0.57±0.048). The occipital region was frequently observed in heatmaps of the post-arrest patients.

### CONCLUSION

Deep learning of brain CT can identify distinct imaging features of cardiac arrest relative to control patients and predict post-cardiac arrest mortality. The model in predicting neurologic outcomes needs to be further evaluated on larger datasets.

### CLINICAL RELEVANCE/APPLICATION

Deep learning models on brain CT images may assist with risk stratification and outcome prediction after pediatric cardiac arrest.

## W2-SPNR-8 CLINICAL UTILITY OF DEEP-LEARNING RECONSTRUCTED ZERO-ECHO TIME MRI FOR ASSESSING CERVICAL SPINE DEGENERATION IN COMPARISON TO CT

Cynthia T. Chin, MD (*Abstract Co-Author*) Nothing to Disclose
Vinil Shah, MD (*Abstract Co-Author*) Nothing to Disclose
Joe D. Baal, MD (*Abstract Co-Author*) Nothing to Disclose
Pingni Wang, PhD (*Abstract Co-Author*) Nothing to Disclose
Sharmila Majumdar, PhD (*Abstract Co-Author*) Research Grant, General Electric Healthcare;Research Grant, Biosplice Therapeutics, Inc;Research Grant, Siemens AG
Misung Han (*Abstract Co-Author*) Nothing to Disclose
Sagar Mandava (*Abstract Co-Author*) Nothing to Disclose
Maggie M. Fung, MENG (*Presenter*) Employee, General Electric Company

### PURPOSE

Zero echo-time (ZTE) MRI has been developed to image cortical bone, facilitating the assessment of fractures, ossifications, and calcifications, similar to CT imaging. Deep-learning (DL) reconstruction, employing a deep convolutional neural network, has been increasingly used for various clinical MRI to reduce imaging time and to denoise while improving image sharpness. This study aims to assess the clinical utility of DL-reconstructed ZTE (DL ZTE) imaging for the cervical spine.

### METHODS AND MATERIALS

In vivo cervical spine scans were conducted using 3T GE Premier scanners (GE Healthcare, Waukesha, WI). ZTE sequence parameters (sagittal prescription) were first optimized through a healthy volunteer study as 24 x 24 cm2 FOV, 266 x 266 matrix size, 0.9 x 0.9 x 1 mm3 resolution, 192 slices, 4 NEX, ±62.5 kHz bandwidth, and 2° flip angle, with a total scan time 5 min 30 sec. ZTE imaging for patients was performed during routine clinical cervical spine exams. Offline DL reconstruction with a noise reduction factor set at 75% was applied to raw data from thirteen patients. Subsequently, N4 coil bias correction, additional image-based denoising, air/background removal, and image inversion were performed. Qualitative comparison between DL ZTE images and CT scans acquired within one year of MRI scans was conducted for seven patients.

### RESULTS

Our healthy control study revealed well-delineated bone structures using ZTE with both 1° and 2° flip angle. A flip angle of 2° additionally provided slight T1 contrast, resulting in myelographic signal difference between the spinal cord and the cerebrospinal fluid (CSF) within the subarachnoid space. Across all acquired patient exams, DL reconstruction notably improved image quality by enhancing SNR and image sharpness. DL ZTE was able to depict bone pathology such as osteophytes and fractures similar to CT though further comprehensive evaluation is warranted. Axial reformats demonstrated clear visualization of the subarachnoid space without significant CSF flow artifacts. Even in a case involving fusion hardware, DL ZTE maintained good depiction of the spinal canal, contrasting with CT images suffered from significant metal streak artifacts.

### CONCLUSION

DL reconstruction can improve ZTE image quality and detection of bone pathology. DL ZTE can also provide additional clinical utility for assessing the spinal canal by generating robust signal contrast between the spinal cord and CSF.

### CLINICAL RELEVANCE/APPLICATION

DL ZTE efficiently enables CT-like depiction of the vertebrae while allowing for a myelographic effect to aid in diagnosis of various spinal canal pathology. DL ZTE may be a potential noninvasive alternative to CT myelography.

## W2-SPNR-9 COMPARING ACCURACY OF GPT-4 AND A BAYESIAN INFERENCE-BASED PLATFORM IN DIAGNOSING BRAIN MRI PATHOLOGY

Suyash Mohan, MD (*Abstract Co-Author*) Research Grant, NovoCure Ltd;Research Grant, Galileo CDS, Inc;Consultant, Northwest Biotherapeutics, Inc;Consultant, AIRS Medical Inc;Consultant, Qynapse SAS
Shawn Lyo, MD (*Abstract Co-Author*) Nothing to Disclose
Mitul Gupta (*Abstract Co-Author*) Nothing to Disclose
R. Nick Bryan, MD, PhD (*Abstract Co-Author*) Stockholder, Galileo CDS, Inc;Officer, Galileo CDS, Inc
John Pruitt, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Rosero Castro, BS (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the diagnostic accuracy of GPT-4, a widely used large language model (LLM), to that of a Bayesian inference-based clinical decision support tool (Galileo CDS) in generating differential diagnoses on brain MRI studies using human-extracted key imaging features in real cases. Though LLMs have garnered attention for this purpose, Bayesian networks, unlike LLMs, can explain their reasoning.

### METHODS AND MATERIALS

Predefined characteristic imaging features of 476 MRIs from a prior study representing 120 clinically proven neurologic diseases were extracted by 2 resident radiologists, 2 fellow neuroradiologists, and 2 attending neuroradiologists. The 32 cases with the highest inter-reader key feature agreement were selected, and their key features were used to query GPT-4 and Galileo CDS. Key features included relative lesion signal intensity on FLAIR, T1, and T2, presence of enhancement, diffusion characteristics, presence of susceptibility on GRE, character of mass effect, number, side, location, and size of lesion(s), and patient age.Each platform generated a ranked list of most likely diagnoses, each of which were compared to clinical ground truth and given a score of 0 (correct diagnosis not included in top 3), 1 (correct diagnosis ranked first), or 3 (correct diagnosis in top 3, but not first). A composite value (1+3) represented scenarios where the correct diagnosis was “at least” within the top 3 diagnoses. The diagnostic accuracies of both tools were compared.

## RESULTS

GPT-4 and Galileo CDS showed a 18.8% and 46.9% accuracy by composite score, respectively. GPT-4 ranked the correct diagnosis first in 12.5% of cases, while Galileo did so in 21.9% of cases. Chi-square analysis yielded a statistically significant difference ($p<.05$) in scoring distribution between platforms. For perspective, a prior study showed an attending reader composite accuracy of 72.1% across diagnoses from the same source cases.

## CONCLUSION

While LLMs may eventually aid radiologic diagnosis, GPT-4 currently struggles to match human readers in generating clinically sound reports. We show here that a platform based on Bayesian inference outperforms GPT-4 in diagnostic accuracy across real cases. This may be partially explained by differences in reasoning; GPT-4 queries a broad, generic database of information, whereas Bayesian tools can incorporate focused prior knowledge in their evaluation despite demonstrating only modest accuracy when compared to human readers.

## CLINICAL RELEVANCE/APPLICATION

This study provides benchmarking data comparing the diagnostic accuracy of LLMs versus Bayesian inference-based software for neuroradiologic conditions, highlighting potential limitations of both computational techniques and the need for continued evaluation.

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# Abstract Archives of the RSNA, 2024

W2-SPPD

**Pediatric Imaging Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPPD-1 ABSOLUTE VS RELATIVE VOLUMETRY OF WHITE AND GRAY MATTER: IMPLICATIONS FOR THE CHARACTERIZATION OF SEXUAL DIMORPHISMS IN A LARGE COHORT OF EXTREMELY PRETERM ADOLESCENTS

Hernan Jara, PhD (*Abstract Co-Author*) Author with royalties, World Scientific Publishing;
Bindu Setty, MD (*Abstract Co-Author*) Nothing to Disclose
Laurie Douglass (*Abstract Co-Author*) Nothing to Disclose
Robert Joseph (*Abstract Co-Author*) Nothing to Disclose
Maha Alsufyani (*Abstract Co-Author*) Nothing to Disclose
Ali A. Elzieny (*Presenter*) Nothing to Disclose

### PURPOSE

To study the potential existence of sexual dimorphisms in a large American cohort of extremely preterm born adolescents using qMRI-based absolute vs. relative volumetry.

### METHODS AND MATERIALS

This prospective multicenter study (ELGAN-ECHO) included adolescents who were born extremely preterm (gestational ages<28 weeks) and underwent Triple Turbo Spin Echo brain MRI at age 15. The image processing pipeline consisted of semi-automated segmentation, volumetry, and qMRI mapping algorithms (Python with Anaconda Navigator), which required a preparation step for fine editing the intracranial matter (ICM) and deep gray matter (dGM) segments with Fiji (ImageJ). Absolute and ICM-relative volumetry outputs for all participants were generated and analyzed in a statistical package (SPSS) for sexual differences.

### RESULTS

A total of 368 participants were included (48.6% males). Males had significantly larger absolute volumes than females for ICM, total brain, gray matter, dGM, and white matter (1440.3±152.4 vs 1295.6±148.1, 1140.1±140.3 vs 1021.6±128.7, 751.1±105.1 vs 675.6±92.9, 65.9±11.9 vs 60.9±8.8, and 388.9±70.5 vs 345.9±60.9; p-value <0.001 respectively), and nonsignificant larger cerebrospinal fluid volumes (157.1±112.1 vs 143.5±92.4, p-value 0.206). These sexual differences were absent in the relative volumetry data, except for dGM where females had higher relative volume than males (4.7±0.5 vs 4.5±0.6, p-value 0.038).

### CONCLUSION

In a large cohort of extremely preterm adolescents, sexual dimorphisms observed in absolute brain volumetry are not maintained when data are adjusted to the total intracranial volume (relative volumetry).

### CLINICAL RELEVANCE/APPLICATION

Caution must be exercised when reporting absolute brain volumetry findings in radiological reports and scientific literature, as male and female brains appear equal in relative volumetry.

## W2-SPPD-2 ALTERATION OF WHITE-MATTER FUNCTIONAL NETWORK IN CHILDREN WITH DRUG REFRACTORY EPILEPSY:A GRAPH-THEORETICAL STUDY

Zhang T. Tijiang I, MD (*Abstract Co-Author*) Nothing to Disclose
YU XIN XIE (*Abstract Co-Author*) Nothing to Disclose
Haifeng Ran (*Abstract Co-Author*) Nothing to Disclose
HUANG KEXIN (*Presenter*) Nothing to Disclose

### PURPOSE

Previous studies on drug refractory epilepsy (DRE) mainly examined the structural architecture of white matter (WM) by diffusion tensor imaging, but it is not clear whether there are WM function alterations in children with DRE. Hence, this study was aimed to comprehensively analyze the topological properties of WM functional networks among children with DRE. To provide a new perspective for a deeper comprehension of the neuropathological mechanisms underlying this disease.

### METHODS AND MATERIALS

This study included 43 children with DRE and 48 healthy controls(HCs). All participants underwent MRI scans using a 3.0-T magnetic resonance scanner (GE Healthcare). Meanwhile, all DRTLE children underwent standardized neuropsychological assessments using the Wechsler Intelligence Scale-Fourth

Edition for Children-Revised, which measure five Intelligence quotient (IQ) variables in each subject. Global and nodal topological properties were assessed based on the weighted WM functional networks. Independent samples t-test was used for comparisons of global topological properties and nodal topological properties (FDR corrected) between groups. The correlation between the altered WM functional network topological properties and neuropsychological tests were analyzed using spearman's correlation analysis.

**RESULTS**

Both DRE and HCs showed a small-world topology(Sigma = 1.1) of the WM functional network. As compared to the HCs group, the Sigma and Network Efficiency in DRE group was significantly decreased. Further more, significant results were found in nodal properties as BetweennessCentrality(BC), DegreeCentrality(DC), Nodal Clustering coefficient(NCC), NodalEfficiency (NE) and Nodal Local efficiency(NLe)For association fibers, there is a decrease in node properties on multiple white matter fibers. Interestingly, increased nodal properties in the DRE group were found in the commissural fibers and projection fibers. There was a significant association between degree of nodes and one set age, verbal comprehension.

**CONCLUSION**

Our results suggested that global integration ability and functional segregation ability imbalance properties alteration in the white matter brain network of children DRE.The local network efficiency is also regionally reduced or improved, it is suggested a deeper understanding of the potential neuropathological mechanisms and biomarkers in seizure generation.

**CLINICAL RELEVANCE/APPLICATION**

Base on graph-theoretical brain networks, we found correlation between the level of the nodal brain network and the severity of cognitive impairment. Therefore, the white matter abnormalities and network alterations contribute to the discovery of new targets for DRE treatment.

## W2-SPPD-3 ALTERED NEUROVASCULAR COUPLING IN CHILDREN WITH REFRACTORY TEMPORAL LOBE EPILEPSY

Zhang T. Tijiang I, MD (*Abstract Co-Author*) Nothing to Disclose
YU XIN XIE (*Abstract Co-Author*) Nothing to Disclose
HUANG KEXIN (*Abstract Co-Author*) Nothing to Disclose
Guiqin Chen (*Abstract Co-Author*) Nothing to Disclose
Xuhong Li (*Abstract Co-Author*) Nothing to Disclose
Jie Hu (*Abstract Co-Author*) Nothing to Disclose
Haifeng Ran (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to evaluate the neurovascular coupling (NVC) alteration and its clinical significance in childhood refractory temporal lobe epilepsy (TLE) combining resting-state functional magnetic resonance imaging (rs-fMRI) and arterial spin labeling (ASL), providing a new perspective to understand the neuropathological mechanisms of this disease.

**METHODS AND MATERIALS**

The study finally included 63 right-handed subjects (34 children with refractory TLE and 29 healthy controls [HCs]). All participants underwent MRI scans. Amplitude of low-frequency fluctuation (ALFF) and cerebral blood flow (CBF) were calculated based on the rs-fMRI and ASL. For each participant, across-voxel correlation analyses were performed between ALFF and CBF in the whole gray matter to quantitatively evaluate the global NVC. For all voxels, we calculated the CBF/ALFF ratio using the original values of CBF and ALFF to represent the regional NVC. The intergroup differences in CBF, ALFF, and CBF/ALFF ratio maps were analyzed using two-sample t-test, adjusting for the covariates of age, sex, and years of education. For the resulting CBF, ALFF, and CBF/ALFF ratio maps, the Gaussian random field method ($P < 0.05$) was selected to correct for multiple comparisons. The mean value of each cluster with significant between-group differences in CBF, ALFF, and CBF/ALFF ratio was extracted and correlated with the clinical variables using Pearson correlation.

**RESULTS**

The refractory TLE group showed significantly higher regional NVC in the left superior frontal gyri (SFG) compared to the HCs group. The refractory TLE also showed a significantly lower CBF than the HCs group in the left midcingulate cortex, the right pars opercularis of the inferior frontal gyrus, and the right the orbitofrontal cortex. The refractory TLE group exhibited a lower ALFF in the right middle temporal gyrus compared to the HCs group, but the brain region of higher ALFF was not reported. The results showed a significant positive correlation ($r = 0.346$, $P = 0.045$)between the increased CBF/ALFF ratio in the left SFG and the processing speed scores of Wechsler Intelligence Scale.

**CONCLUSION**

These findings provide new neuroimaging evidence of neurovascular decoupling in children with refractory TLE and may be helpful for a deeper understanding of the potential neuropathological mechanisms in seizure generation, providing new biomarkers of cognitive performance in childhood refractory TLE.

**CLINICAL RELEVANCE/APPLICATION**

The study shed a new insight into the pathophysiology of epilepsy and provided the potential imaging biomarkers of cognitive performances in children with refractory TLE by combing rs-fMRI and ASL.

# Abstract Archives of the RSNA, 2024

W2-SPPH

**Physics Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-SPPH-10 CLINICAL APPLICATION OF ULTRAHIGH-FIELD-STRENGTH ROUTINE KNEE MRI: 3T AND 5T COMPARISON STUDY

Suwei Liu (*Presenter*) Nothing to Disclose

### PURPOSE

Ultrahigh-field-strength MRI at 5T may permit superior visualization of knee pathologic conditions, particularly due to its high signal-to-noise ratio compared with the clinical standard of 3 T, but direct comparison studies are lacking.

### METHODS AND MATERIALS

In this prospective study, patients experiencing knee underwent 3T and 5T MRI with 2D and 3D standard fast spin echo(FSE) sequences (2D sagittal T1WI, 2D sagittal fat-suppressed proton-density [FS_PDWI], 2D coronal FS_PDWI, 2D transversal FS_PDWI, 3D sagittal FS_PDWI and additional reconstruction sequences[coronal/transversal FS_PDWI] on the same day, from December 2023 to April 2024. For quantitative analysis, SNR was determined using these 5 sequences and 2 additional reconstruction sequences. For a semiquantitative assessment of diagnostic confidence, a diagnostic confidence score (DCS) was assigned, using a 5-point scale. Images were scored by three musculoskeletal radiologists. The overall image quality, presence of artifacts, homogeneity of fat suppression, and visualization of 22 potential pathological findings, in total, in 4 anatomically defined areas in the knee joint were semiquantitatively assessed and rated their diagnostic confidence.

### RESULTS

In total, 60 participants (mean age, 44 years ± 16; 39 men) were included. Overall image quality (P = .002) and less presence of artifacts at T1WI, 2D/3D FS_PDWI MRI were superior at 5T. Visualization of cartilage was superior at 5T (P < .001), while for the residual potential pathological findings, there was no statistically significant difference observed. Interreader reliability showed slight to substantial agreement for the detected pathologic conditions (? = 0.67-0.85).

### CONCLUSION

Ultra-high-field MRI at 5T improved the overall diagnostic confidence in routine MRI of the knee joint compared with that at 3 T.

### CLINICAL RELEVANCE/APPLICATION

This is especially true for small joint structures and subtle lesions, particularly in cartilage assessment. However, the problem of chemical shift artifacts needs to be solved.

## W2-SPPH-3 CLINICAL HEAD MRI IMAGE QUALITY IN FINNISH MR IMAGING SITES

Henri Leskinen, MSc (*Abstract Co-Author*) Nothing to Disclose
Nea Pulkkinen, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study was to evaluate three widely used clinical sequences for head magnetic resonance image (MRI) using a traveling test subject in all major MR imaging sites in Finland to gain understanding on the clinical image quality of head MR images. According to the Radiation and Nuclear Safety Authority of Finland, nearly one out of five of the MRI studies done annually in Finland are head MRIs.

### METHODS AND MATERIALS

The head of a volunteer was scanned in 14 hospitals participating in this study. 26 different MRI scanners were used; 17 with field strength of 1.5 T and 9 with 3 T. Scanners were from four different vendors: 16 Siemens, 4 GE, 4 Philips and 2 Canon. Three clinical sequences were obtained using site adaptations in the clinical routine protocol: 3D T1 weighted Ultrafast Gradient Echo, T2 weighted Turbo Spin Echo and T2 weighted motion correction with radial blades sequence. Three regions of interest (ROIs) were selected and segmented for the data analysis: cerebrospinal fluid (CSF), white matter (WM) and grey matter (GM) using the SynthSeg auto-segmentation tool. For each ROI, three image quality metrics were calculated: signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR) and SNR divided by acquisition time.

### RESULTS

Median SNR for the 3D T1 sequence was for CSF 15.66 and 22.78, for WM 45.25 and 49.52, for GM 42.18 and 46.79, for 1.5T and 3T, respectively. Median SNR for the T2 blade sequence was for CSF 90.59 and 175.97, WM 30.87 and 42.34, GM 61.81 and 91.48 for 1.5T and 3T, respectively. Median SNR for T2 TSE sequence was for CSF 110.56 and 107.38, WM 41.83 and 30.33, GM 78.99 and 62.58 for 1.5T and 3T scanners, respectively.

### CONCLUSION

Medians of the SNR were 46% and 94% higher for 3T scanners in 3D T1 and T2 Blade sequences, respectively, and 3% lower for the T2 TSE sequence. Few scanners had significantly lower noise levels due to image processing specific to the scanner, which produced outliers for the SNR. This was more significant in 3T scanners due to the lower number of such scanners. A few 1.5T scanners used AI image reconstruction algorithms in T2 TSE, which can affect the median SNR. A clear difference in visual image quality was seen between the lowest and highest SNR images for all sequence types.

### CLINICAL RELEVANCE/APPLICATION

Since head MRIs represent a significant proportion of MRI studies in Finland, a better understanding of the image quality, and of features that affect the quality between sites and vendors can help improve imaging practices at different imaging sites across Finland and elsewhere. Large variation of the image quality metrics between similar scanners highlights the significance of sequence optimization for each individual scanner. Results of this study can be used to better image quality in MR locally and across Finland.

## W2-SPPH-4 PREDICTING 15-MINUTE MYOCARDIAL EXTRACELLULAR VOLUME USING SYNTHETIC CONCENTRATION MAPS FROM DYNAMIC T1 MAPPING WITHIN 10 MINUTES WITH PHARMACOKINETIC ANALYSIS

Tetsuya Fukuda, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, General Electric Company
Yuji Matsuzaki, RT (*Abstract Co-Author*) Nothing to Disclose
Yasutoshi Ohta, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Masaru Shiotani, RT (*Abstract Co-Author*) Nothing to Disclose
Shun Okuyama, RT (*Abstract Co-Author*) Nothing to Disclose
Hiroki Nakajima, RT (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Nishii, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Guerbet SA;Speakers Bureau, General Electric Company;Speakers Bureau, Siemens AG;Research Grant, Canon Medical Systems Corporation
Keizo Murakawa (*Abstract Co-Author*) Nothing to Disclose
Tatsuya Saito, RT (*Abstract Co-Author*) Nothing to Disclose
Masaki Sakurai (*Abstract Co-Author*) Nothing to Disclose
Toshimitsu Tanaka, RT (*Presenter*) Nothing to Disclose

### PURPOSE

In cardiac MRI (CMR), myocardial extracellular volume (ECV) measurements may vary depending on the timing of T1 map imaging after contrast administration. Consistent timing is preferable for follow-up, but clinical practice often involves late-gadolinium enhancement imaging, causing variability in T1 map imaging times. This study aimed to determine whether synthetic concentration maps derived from a pharmacokinetic model using dynamic T1 maps at intervals of up to 10 minutes can accurately predict the ECV at 15 minutes, compared with the reference 15-minute T1 mapping during CMR.

### METHODS AND MATERIALS

In this IRB-approved prospective study, 40 patients (mean age: 66 years, 16 women) underwent 3T CMR for cardiomyopathy evaluation. T1 maps were acquired before and after contrast administration at 2, 5, 9, and 15 minutes. The time-series T1 maps were aligned using non-rigid registration, and a pharmacokinetic Brix model was applied to generate synthetic concentration maps for 15 minutes based on the data at 2, 5, and 9 minutes. Radiologists placed ROIs in segments #8 and 9 of the septum and the lumen. They then compared the ECV values at 15 minutes (ECV15min) from the actual T1 map with those derived from the synthetic concentration maps (Synthetic_ECV15min). Correlation coefficients and Bland-Altman analysis were used to evaluate ECV2min, ECV5min, ECV9min, and Synthetic_ECV15min compared with the reference ECV15min. Paired T-tests were employed to compare deviations from the reference ECV15min between ECV9min and Synthetic_ECV15min.

### RESULTS

For the 40 patients (80 segments), the reference ECV15min was 29.9±2.8%, while Synthetic_ECV15min was 29.6±3.2%. A strong correlation was observed (R=0.96 [95% CI 0.94-0.98]), with a mean difference of -0.3% (95% CI, -0.07 to 0.03). ECV2min, ECV5min, and ECV9min significantly underestimated the ECV compared to the reference ($P < .001$). The error in Synthetic_ECV15min was significantly lower than in ECV9min when compared to the reference ($P=0.01$).

### CONCLUSION

Dynamic T1 maps at three-time points within 10 minutes after contrast administration can accurately predict the ECV at 15 minutes using synthetic concentration maps generated from pharmacokinetic modeling.

### CLINICAL RELEVANCE/APPLICATION

These findings support using synthetic concentration maps to predict ECV, potentially enabling faster and more efficient cardiac MRI protocols.

## W2-SPPH-6 3D CHEMICAL EXCHANGE SATURATION TRANSFER (CEST) IMAGING VS. DIFFUSION-WEIGHTED IMAGING (DWI) WITH AND WITHOUT CEST IMAGING: CAPABILITY FOR DISTINGUISHING MALIGNANT FROM BENIGN PROSTATIC AREAS

Masato Ikedo (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yoshiyuki Ozawa, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshiharu Ohno, MD, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Daiichi Sankyo Co, Ltd;Research Grant, Ministry of Education, Culture, Sports, Science and Technology
Masao Yui (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Hiroyuki Nagata (*Abstract Co-Author*) Canon Medical Systems Corporation
Kaori Yamamoto (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Daisuke Takenaka, MD (*Abstract Co-Author*) Canon Medical Systems Corporation
Masahiko Nomura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeshi Yoshikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Maiko Shinohara (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Takahiro Ueda, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

3D Chemical exchange saturation transfer (CEST) imaging is recently reported as useful for obtain regional CEST information within entire tumor. The purpose of this study was to compare the capability for distinguishing malignant from benign prostatic areas among 3D CEST imaging, diffusion weighted imaging (DWI) and combined both information.

### METHODS AND MATERIALS

Fifty-two suspected prostatic cancer patients underwent DWI at b value as 0 and 1500 s/mm2 and 3D CEST imaging at a 3T MR system, surgical treatments and pathological examinations. According to the pathological results, 154 areas were determined as malignant prostatic areas, and 154 out of 470 areas were computationally selected as benign prostatic areas. On each 3D CEST imaging, magnetization transfer ratio asymmetry (MTRasym) at 3.5 ppm map was generated from z-spectra by pixel-by-pixel analyses. Then, 308 ROIs were placed over malignant or benign areas on each map, and MTRasym and ADC values were determined. Each index was compared between malignant and benign areas by Student's t-test. Then, logistic regression analysis was performed to investigate the discriminating factors. ROC analysis was performed to compare diagnostic performance among MTRasym, ADC and combined discriminators. Finally, sensitivity, specificity and accuracy were compared among all methods by McNemar's test.

### RESULTS

MTRasym and ADC of malignant area had significant differences with those of benign area (MTRasym: $p<0.0001$, ADC: $p<0.0001$). MTRasym (Odds ratio [OR]: 1.01, $p<0.0001$) and ADC (OR: 0.03, $p<0.0001$) were determined as significant discriminators. Area under the curves (AUC) of combined discriminators (AUC=0.86) was significantly better than that of MTRasym (AUC=0.81, $p=0.001$) and ADC (AUC=0.76, $p<0.0001$). Specificity (SP) and accuracy (AC) of combined discriminators (SP: 72.1%, AC: 78.6%) were significantly higher than those of MTRasym (SP: 60.4%, $p<0.0001$; AC: 73.1%, $p<0.0001$) and ADC (SP: 64.2%, $p<0.0001$; AC: 74.0%, $p<0.0001$).

### CONCLUSION

3D CEST imaging is considered at least as valuable as DWI and can improve capability for differentiation of malignant from benign prostatic areas with DWI.

### CLINICAL RELEVANCE/APPLICATION

3D CEST imaging is considered at least as valuable as DWI and can improve capability for differentiation of malignant from benign prostatic areas with DWI.

## W2-SPPH-7 POSTURAL EFFECTS ON CARDIAC FUNCTION AND STRAIN: EVALUATION USING MULTIPOSTURE MRI

Tosiaki Miyati, PhD, PhD (*Abstract Co-Author*) Nothing to Disclose
Seiya Nakagawa, BA (*Abstract Co-Author*) Nothing to Disclose
Naoki Ohno, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Cardiac cine MRI and ultrasound (US) are widely used to assess cardiac function and diagnose heart diseases. Previous studies using US have indicated that body posture can influence measurements of cardiac function. However, US has limitations in terms of analytical accuracy. Although cine MRI can assess cardiac function with higher accuracy than US, measurements in different body postures, such as standing or sitting, have been limited by the architecture of conventional MRI systems. This study investigated the effects of body posture on cardiac function and strain using a multiposture MRI system, which allows for data acquisition in various body postures.

### METHODS AND MATERIALS

Cardiac function was assessed in ten healthy male subjects (mean age, 22.1 ± 0.5 years) in the supine and standing postures using a 0.4T multiposture MRI. Electrocardiogram-synchronized cardiac cine MRI in the short axis of the left ventricle was performed using a balanced steady-state free precession sequence. The left ventricular cavity in each image was automatically delineated using a cardiac function analysis software. Then, left ventricular end-diastolic volume (EDV), end-systolic volume (ESV), stroke volume (SV), heart rate (HR), cardiac output (CO), ejection fraction (EF), global radial strain (GRS), and global circumferential strain (GCS) were determined. We compared these parameters between the two postures using the Wilcoxon signed-rank test. Statistical significance was set at $P < 0.05$.

### RESULTS

In the standing posture, the EDV, ESV, and SV were significantly reduced compared to the supine posture, likely due to fluid redistribution to the lower body, which decreases venous return to the heart. The HR increased significantly in the standing posture, while the CO was significantly lower. These changes suggest that despite increased sympathetic activity in the standing posture, which raises HR, it does not fully offset the reduction in CO. The EF remained relatively stable across postures, suggesting minimal impact from changes in body posture. The GCS increased significantly in the standing posture, whereas the GRS did not show a significant difference between the postures.

### CONCLUSION

Standing posture decreases EDV, ESV, SV, and CO and increases HR and GCS compared with supine posture. Multiposture MRI enables the assessment of postural effects on cardiac function and strain.

### CLINICAL RELEVANCE/APPLICATION

Multiposture MRI has demonstrated differences in cardiac function and strain between standing and supine postures, offering new diagnostic insights into how the heart adapts to gravitational changes.

## W2-SPPH-8 INFLUENCE OF FAT SUPPRESSION AND FAT SIGNAL ON QUANTIFICATION OF MAGNETIZATION TRANSFER BASED ON SPIN-LOCK MRI

Winnie C. Chu, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Yiyou Sun (*Abstract Co-Author*) Nothing to Disclose
Jian Hou (*Abstract Co-Author*) Nothing to Disclose
Min Deng (*Abstract Co-Author*) Nothing to Disclose
Weitian Chen (*Abstract Co-Author*) Nothing to Disclose
Ziqin Zhou, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

A new magnetization transfer (MT) imaging technique to quantify macromolecule content, termed macromolecular proton fraction (MPF) mapping based on spin-lock (MPF-SL), has attracted increasing attention. We investigated whether different fat saturation (FS) methods and fat fraction (FF) influence on its quantification.

## METHODS AND MATERIALS

MPF-SL sequence comprises two measurements with individual off- resonance spin-lock (SL) preparation following MPF-SL condition, the SL RF amplitude and frequency offset were: ?1: 100Hz, ?2: 600Hz; ??:1 1000Hz, ??2: 6000Hz. Half-Fourier Acquisition Single-shot Turbo Spin Echo (HASTE) was selected for image acquisition (TR/TE: 4000/25ms; FOV: 200 x 200mm; resolution: 1mm x 1mm x 4mm). A map of a relaxation rate termed Rmpfsl was computed from difference of two measurements. Note Rmpfsl removes signal from water pool and can be converted to MPF based on a dictionary approach.Three FS methods were compared, including Short Tau Inversion Recovery (STIR), Spectral fat saturation (FatSats FatSatw), and Spectrally Adiabatic Inversion Recovery (SPAIRs SPAIRw) at both strong and weak settings. FF maps were collected with vender-provided DIXON. MPF-SL imaging was conducted on agar phantoms (concentration:1% to 5%) with peanut oil on top, and on two health volunteers, respectively. To estimate Rmpfsl changes, regions of interest were drawn on agar/oil junction and calf muscle. Bloch-McConnel simulation was performed using RF pulses used in three FS methods on skeletal muscle.

## RESULTS

The Rmpfsl difference between FS methods correlates with agar concentration reflecting increase in MT signal (Figure 1). Residual fat signal increases with FF, leading to decreased Rmpfsl in absence of FS (Figure 2). Rmpfsl difference between FS methods observed in calf muscle was substantially higher than that in phantoms (Figure 3 4). Validated by BM simulation, measured Rmpfsl with FatSat is slightly higher than reference value, while Rmpfsl decreases with SPAIR and STIR (Figure 5).

## CONCLUSION

The Rmpfsl of agar phantoms and human muscle shows visible dependence on FS methods and FF. In absence of fat, RF pulses used for FS affect MT signal, thus perturbing Rmpfsl quantification. Dictionary shall be built to account for this effect when calculating MPF from Rmpfsl. Conversely, with presence of fat, the residual fat signal due to imperfect FS may result in errors in MPF-SL quantification.

## CLINICAL RELEVANCE/APPLICATION

FS methods and FF variation may introduce bias into Rmpfsl. Bias correction with FS and FF factor may avoid misleading or erroneous Rmpfsl value interpretation. Effective solution is anticipated to obtain reliable MPF from Rmpfsl to benefit clinical trials where MPF is primary endpoint.

# Abstract Archives of the RSNA, 2024

W5A-SPBR

**Breast Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPBR-1 DIFFERENTIAL DIAGNOSIS OF BREAST MUCINOUS CARCINOMA AND FIBROADENOMA ON MRI BYINTRATUMORAL AND PERITUMORAL ADC MEASURESWITH MASSENHANCEMENT

Li Na Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Hongbing Liang (*Abstract Co-Author*) Nothing to Disclose
Siqi Zhao (*Abstract Co-Author*) Nothing to Disclose
Ning Ning (*Abstract Co-Author*) Nothing to Disclose
Yueqi Wu (*Abstract Co-Author*) Nothing to Disclose
Moyun Zhang (*Abstract Co-Author*) Nothing to Disclose
Yuanfei Li (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the value of the intratumoral and peritumoral ADC based on DWI for distinguishing breast mucinous carcinoma (MC) from fibroadenoma (FA) with mass enhancement (ME).

### METHODS AND MATERIALS

A total of 61 patients with ME were included in this study. The patients were categorized into the MC group (n=25) and FA group (n=36) according to pathology results. All the patients underwent preoperative 3.0T MRI (GE Signa HDxt 3.0T MR, GE healthcare, USA) with a 8-channel breast coil. The conventional MRI features (mass maximum diameter, T2WI signal, internal enhancement mode, TIC type), intratumoral ADC(ADCintra), peritumoral ADC (ADCperi) values and BI-RADS scores were recorded. The average ADC values of three regions of interest (ROIs) were placed in the different areas of the mass. The ROC curve was drawn, the differential diagnosis threshold was obtained and the diagnostic efficiency was analyzed. SPSS 25.0 was used for statistical analysis.

### RESULTS

Compared with the FA group, the MC group was older (50.64 ± 8.17years). The MC group mainly showed high signal intensity on T2WI, inhomogeneous enhancement, TIC type II. The ADCintra value was higher than the ADCperi value [(1.97 ± 0.36) × 10-3mm2/s, (1.48 ± 0.21) × 10-3mm2/s, P=0.028] of MC group. The ADCintra value and was lower than the ADCperi value of FA group [(1.50 ± 0.26)×10-3mm2/s and(1.54 ± 0.19)×10-3mm2/s respectively and there was no significant difference in the MC group (P =0.521). Furthermore, the ADCintra value in the FA group was lower than the MC group, and there was significant difference between them (P< 0.01). The ADCperi value of MC group was higher than that of FA group, and there was no significant difference between the two groups (P > 0.05). The area under the ROC curve of breast MC and FA the ADCintra was 0.608, the diagnostic threshold was 1.655 × 10-3mm2/s, the AUC was 0.877, the sensitivity was 92.0%, the specificity was 77.8%, and the diagnostic accuracy was 83.6%.

### CONCLUSION

This study validated the clinical use of ADCintra cutoffs for discrimination breast MC from FA disease manifesting as Mass Enhancement, which results in an increased number of avoidable biopsies.

### CLINICAL RELEVANCE/APPLICATION

This study highlights efficiency of the Intratumoral ADC cutoffs for discrimination breast MC from FA disease manifesting as Mass Enhancement.

## W5A-SPBR-2 TOMOELASTOGRAPHY COMPLEMENTING DIFFUSION-WEIGHTED IMAGING FOR THE PREDICTION OF PATHOLOGICAL COMPLETE RESPONSE TO NEOADJUVANT CHEMOTHERAPY IN PATIENTS WITH BREAST CANCER

Jiuquan Zhang (*Abstract Co-Author*) Nothing to Disclose
Yao Huang (*Abstract Co-Author*) Nothing to Disclose
Xiaoxia Wang (*Presenter*) Nothing to Disclose

### PURPOSE

To gain further knowledge about temporal trends of neoadjuvant chemotherapy (NAC)-associated ADC and biomechanical parameters quantified with tomoelastography and predict pCR.

### METHODS AND MATERIALS

In this prospective longitudinal study, participants with breast cancer who received NAC were enrolled from February 2021 to May 2022. Participants underwent breast MRI at pre-NAC (T1), after 2 cycles (T2), 4 cycles (T3), and 6 cycles of NAC (T4). ADC, shear-wave-speed (c) and loss-angle (f)

quantifying stiffness and fluidity were obtained and compared by generalized estimating equation. Predicative performance was assessed with area under the receiver operating characteristic curve (AUC) analysis.

**RESULTS**

A total of 109 participants (mean age, 50.15 years ± 7.86 [standard deviation]) were enrolled, 29 participants experienced pCR. The ADC showed a significant upward trend in total participants, c and f decreased significantly among total participants and three molecular subgroups (all $P < 0.001$). For predicting pCR, ADC combined with c and f achieved the highest predictive performance at T3 (AUC, 0.803; 95% confidence interval [CI]: 0.715, 0.874), better than either ADC ($P = 0.006$) or c ($P = 0.043$) alone. In Luminal B subtype, f at T3 was highly predictive of pCR (AUC, 0.832; 95% CI: 0.703, 0.921), while combining ADC, c and f at T2 achieved the highest predictive performance in human epidermal growth factor receptor 2-enriched (AUC, 0.771; 95% CI: 0.531, 0.921) and triple negative breast cancer subtypes (AUC, 0.864; 95% CI: 0.678, 0.965).

**CONCLUSION**

During the course of NAC, the increase in ADC and decreases in stiffness and fluidity were more significant in patients with pCR, combining ADC and biomechanical properties at mid-NAC could predict pCR with good accuracy.

**CLINICAL RELEVANCE/APPLICATION**

This prospective longitudinal study demonstrated that MRI parameters used to detect treatment-induced intratumoral changes in patients with breast cancer could predict pathologic response to neoadjuvant chemotherapy. Our findings confirmed them to be complementary and accurate in predicting pathological complete response, which will benefit clinical decision-making.

## W5A-SPBR-3 BREAST GALACTOGRAPHY WITH CONTRAST-ENHANCED MAMMOGRAPHY (CEM)—AN INNOVATIVE ATTEMPT

Shuyi Peng (*Abstract Co-Author*) Nothing to Disclose
Fan Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Wenying Zhu (*Abstract Co-Author*) Nothing to Disclose
Jie Liu (*Abstract Co-Author*) Nothing to Disclose
Juan Tao (*Presenter*) Nothing to Disclose

**PURPOSE**

This study used CEM protocol in galactography for the first time. To evaluation the application value of Contrast-enhanced mammography (CEM) in breast galactography.

**METHODS AND MATERIALS**

24 patients with pathological nipple discharge were examined using CEM-galactography and MRI. CEM-galactography presents two kinds of images per breast and per view— low-energy image and recombined image. Evaluation of the images created with the different imaging modalities was done by 3 investigators with varying levels of experience with complementary breast diagnostics (8 ,9 and 21 years), and their evaluations were compared with the histological findings. AGD differences were analyzed by Mann-Whitney U test.

**RESULTS**

The average age of the 24 patients was 45.9 years. The average glandular dose (AGD) of CEM-galactography (median:1.65 mGy) was 21.8% higher than low-energy imaging(1.29 mGy) ($P<0.001$) in CC view, while the AGD of CEM-galactography(1.65 mGy) increased by 21.8% compared with low-energy imaging(1.29 mGy)($P<0.001$)in ML view. Their evaluations were compared with the histopathological assessment of the surgical specimens resected from the 24 patients. There were 4 cases of intraductal carcinoma, 5 cases with ductal carcinoma in situ 11 cases with intraductal papilloma and 4 cases with duct ectasia. The recombined image generated by CEM showed that the size of the lesion was closer to that of histopathological findings.

**CONCLUSION**

CEM-galactography can better display the size of the lesions and the details of the catheter branch than the low-energy image. It could be a useful complementary procedure for the diagnosis of breast anomalies and could herald a new aissance of this method. Compared with low-energy imaging, the investigators achieved better results with recombined image, as confirmed by histopathological findings.

**CLINICAL RELEVANCE/APPLICATION**

This is the first time CEM was used in galactography. CEM displays better size than regular imaging, so it can better guide clinical surgical scope.

## W5A-SPBR-4 AXILLARY NODAL EVALUATION USING NODE REPORTING AND DATA SYSTEM (NODE-RADS) IN BREAST CANCER: INVASIVE DUCTAL CARCINOMA VS INVASIVE LOBULAR CARCINOMA

Hee Jeong Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hee Jung Shin, MD (*Abstract Co-Author*) Nothing to Disclose
Woo Jung Choi, MD (*Abstract Co-Author*) Nothing to Disclose
Joo Hee Cha, MD (*Abstract Co-Author*) Nothing to Disclose
Hak Hee Kim, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hye Joung Eom (*Abstract Co-Author*) Nothing to Disclose
Eun Young Chae, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Imaging characteristics may vary according to the histologic type of breast cancer, and we aimed to investigate the differences in the applicability of the recently introduced Node-RADS score in patients with invasive ductal carcinoma (IDC) or invasive lobular carcinoma (ILC).

**METHODS AND MATERIALS**

In this retrospective study, we reviewed 850 consecutive women with pathologically proven IDC or ILC who underwent breast MR imaging before surgery. Axillary nodal status was assessed using Node-RADS scores to predict the likelihood of lymph node metastases. Node-RADS scores were determined based on size and configuration criteria, which were then combined into scores ranging from 1 (very low likelihood) to 5 (very high likelihood). Diagnostic performance parameters using Node-RADS were calculated and compared according to histologic type of breast cancer (IDC vs ILC).

**RESULTS**

Of the 850 women, including 8 cases of bilateral breast cancer, 780 were diagnosed with IDC, and 78 were diagnosed with ILC. The frequency of lymph node metastasis did not show a significant difference between the two groups ($p=0.980$). Overall, Node-RADS demonstrated comparable performance of an AUC of 0.826 in IDC and 0.739 in ILC ($p=0.232$). With a Node-RADS score = 3 as a cut-off, the sensitivity, specificity, Youden's index were 66.7%,

84.9%, and 0.516 for IDC, and 52.6%, 86.4%, and 0.391 for ILC, respectively. The other performance parameters showed no significant difference between the two groups, however, the sensitivity was significantly lower in the ILC group (p=0.024).

**CONCLUSION**

Although Node-RADS scores demonstrated comparable performance for axillary nodal evaluation in IDC and ILC groups, a statistically significant difference was observed in terms of sensitivity.

**CLINICAL RELEVANCE/APPLICATION**

Node-RADS scores are expected to yield promising results in IDC patients, however, caution may be warranted in the adoption of this system in patients with ILC.

## W5A-SPBR-7 INVESTIGATION OF THE EFFECTIVENESS OF ULTRAFAST DCE-MRI ON A WIDELY USED 1.5T-MRI SYSTEM

Yoshihide Kanemaki (*Abstract Co-Author*) Nothing to Disclose
Takafumi Haraguchi, MD (*Abstract Co-Author*) Nothing to Disclose
Yukiko Michishita, MD (*Abstract Co-Author*) Nothing to Disclose
Yuka Goto, RT (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the diagnostic performance of ultrafast dynamic contrast enhanced (UF-DCE) MRI, which is expected to reduce examination time through initial contrast evaluation, with standard DCE MRI to differentiate malignant from benign breast lesions on a 1.5T-MRI system.

**METHODS AND MATERIALS**

Women who underwent standard DCE MRI and UF-DCE MRI for suspected breast cancer diagnosis at our institution from November 2022 to April 2023 were retrospectively assessed. 1.5T-MRI system with a 16-ch breast coil was used. UF-DCE MRI using high-speed 3D gradient-echo (GRE) with Compressed-SENSE was repeated 16 times for 6 sec/scan (two pre-contrast and 14 after contrast). The DCE MRI using fat suppressed 3D GRE was performed once pre-contrast and twice after contrast (early phase at 90 sec and delayed at 300 sec). Two radiologists (Reader-1 and Reader-2) independently placed ROIs using UF-DCE MRI and DCE MRI data sets on the most suspicious lesions. We calculated time to enhancement (TTE) and maximum slope (MS) as initial enhancement in UF-DCE MRI. The washout ratio (WR) was delivered from washout kinetic curve in DCE MRI; WR was calculated from the percentage difference in signal intensity between the early and delayed phases. Morphological assessment was performed using the Breast Imaging Reporting and Data System (BI-RADS) MRI 5th edition, and BI-RADS categories were defined in conjunction with WR.

**RESULTS**

In total 210 women (mean age 57) with 216 malignant and 54 benign lesions were included. Both TTE and MS showed significant differences between malignant and benign lesions (all, p <.001). The AUC values for Reader-1 and Reader-2 respectively were 0.780 and 0.744 in TTE (intra-class correlation coefficient=0.628), 0.795 and 0.771 in MS (0.760), 0.792 and 0.754 in WR (0.714), and 0.860 and 0.858 in BI-RADS categories (0.905). The AUC values for BI-RADS categories was statistically significantly superior to TTE only for Reader-1 (p =.028; MS and WR, p>.05) and to all kinetic parameters for Reader-2 (TTE, p=.006; MS, p=.044; WR, p=.012). The sensitivity was 58.3% for both readers in TTE, 89.4% and 87.0% in MS, and 73.6% and 83.3% in WR. The specificity was 85.2% and 81.5% in TTE, 63.0% for both readers in MS, and 80.0% and 66.7% in WR.

**CONCLUSION**

The MS demonstrated diagnostic performance equivalent to WR in differentiating benign and malignant breast lesions. On widely used 1.5T-MRI systems, by combining the BI-RADS morphological assessment with MS instead of WR, it is expected to reduce examination time while keeping diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

This is the first report regarding diagnostic performance of UF-DCE MRI on a widely used 1.5T-MRI systems. The current data will be useful for the development of more general protocols for UF-DCE MRI.

## W5A-SPBR-9 POSITIVE PREDICTIVE VALUE OF BI-RADS ASSESSMENT CATEGORY 4 SUBDIVISIONS FOR HIGH-RISK SCREENING AND DIAGNOSTIC MRIS

Jean M. Seely, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Mary B. Bissell, Md, MSc (*Abstract Co-Author*) Nothing to Disclose
Gianna Cox, BSc (*Presenter*) Nothing to Disclose

**PURPOSE**

Breast lesions identified at mammography (MG) and ultrasound (US) that require biopsy are risk-stratified based on their morphology into BI-RADS category 4 (BR4) or 5, which reflect the likelihood of a malignant diagnosis. For US and MG, BR4 is subdivided into 4A, 4B, and 4C, which respectively indicate an increasing likelihood of a malignant diagnosis. While BI-RADS does not currently mandate BR4 subdivisions for MRI detected lesions, our current institutional practice utilizes these subcategories to triage biopsy bookings.Our objective was to determine the positive predictive value (PPV2 and PPV3) of BR4 subcategory assessments for lesions detected at both diagnostic and screening breast MRI, and to determine if the predictive values are comparable to the existing benchmarks established for MG and US.

**METHODS AND MATERIALS**

A single-center retrospective review of all High-Risk Ontario Breast Screening Program (HR-OBSP) and diagnostic breast MRIs performed over a two-year period (01/01/2021 - 31/12/2022) was conducted. Data extracted from the patient chart included the BI-RADS assessment categories and, if applicable, biopsy result. PPV2 and PPV3 for each BR4 subcategory were calculated.

**RESULTS**

3348(54.0%) HR-OBSP and 2850(46.0%) diagnostic breast MRIs (excluding those without contrast) were performed over our two-year study period (01/01/2021 - 31/12/2022). For the HR-OBSP population, 234 biopsies (7.0% of total exams) were recommended with 123(52.6%) category 4A, 85(36.3%) category 4B, 22(9.4%) category 4C and 4(1.7%) category 5 assessments (cancer detection rate (CDR) of 9.0/1000). For diagnostic MRIs, 481 biopsies (16.9% of total exams) were recommended with 136(28.3%) category 4A, 199(41.4%) category 4B, 92(19.1%) category 4C and 54(11.2%) category 5 assessments (CDR of 55.4/1000). PPV2 for screening | diagnostic exams were Category 4A 4.9%|6.6%, Category 4B 12.9%|17.1%, Category 4C 45.5%|51.1% and Category 5 75.0%|74.1%. PPV3 for screening | diagnostic exams were Category 4A 7.5%|9.8%, Category 4B 17.7%|20.7%, Category 4C 45.5%|57.3% and Category 5 75.0%|93.0%.

## CONCLUSION

Malignancy predictive values of BI-RADS category 4 subdivisions for breast MRI align with the established benchmarks for MG and US for lesions identified on both screening and diagnostic breast MRI.

## CLINICAL RELEVANCE/APPLICATION

The current ACR BI-RADS does not subcategorize MRI-detected lesions, however the next iteration has announced this as a change. BI-RADS category 4 subdivisions offer an accurate and valuable method for triage of suspicious breast lesions detected via MRI. These subdivisions aid in optimizing resource allocation, ensure timely interventions for high-risk findings, and are a valuable communication tool between consultants.

# Abstract Archives of the RSNA, 2024

W5A-SPCA

**Cardiac Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPCA-10 FEATURE TRACKING STRAIN WITH RAPID CARDIAC MR FOR SUBCLINICAL MYOCARDIAL DYSFUNCTION IN THALASSEMIA PATIENTS

Priya Jagia, MD (*Abstract Co-Author*) Nothing to Disclose
Vineeta Ojha, MD (*Abstract Co-Author*) Nothing to Disclose
Aprateem Mukherjee, MD, FRCR (*Presenter*) Nothing to Disclose

### PURPOSE

In patients undergoing regular blood transfusion therapy for thalassemia syndromes, iron overload cardiomyopathy (IOC) is a serious problem and considered to be leading cause of cardiac dysfunction, failure and death. Strain analysis with feature tracking (FT)-CMR has been shown to detect subclinical myocardial dysfunction before conventional parameters such as left ventricular ejection fraction (LVEF) is deranged. Our aim was to detect whether strain analysis detects subclinical myocardial contractile dysfunction in myocardial iron overload (MIO) and whether it correlated with conventional marker of cardiac iron, that is, T2*.

### METHODS AND MATERIALS

100 consecutive thalassemia patients undergoing regular blood transfusion were prospectively included. All patients underwent CMR with T2* used as gold standard for detecting MIO. Patients were divided into two groups - those with MIO (T2* < 20ms) and those without MIO (T2* = 20 ms).

### RESULTS

100 patients (66 males and 34 females) underwent CMR cardiac iron assessment with mean age of 16.1 years. There were 22 patients (12 males, 10 females) with significant MIO (T2*< 20 ms) and 78 patients (54 males and 24 females) without significant MIO. LV GRS, LV GLS, RV GLS and RV GRS were significantly reduced in patients with MIO group compared to non-MIO group. LV GLS cut-off of>-14.1 had the highest AUC of 0.786 to detect myocardial iron (T2* < 20 ms) with a sensitivity of 63.64% and specificity 84.62%. There was significant but weak correlations between LV GRS and T2* (r = 0.2491, 95% CI 0.05539 to 0.4247, p = 0.0124) and LV GLS with T2* (r= -0.4212, 95% CI -0.5704 to -0.2450, p <0.0001). There was no statistically significant correlation between LV GCS, RV strain parameters (RV GCS, RV GRS, RV GLS) and myocardial T2*.

### CONCLUSION

Myocardial strain as determined by FT CMR analysis is deranged in patients with MIO compared to those without MIO, without any overt decline in cardiac functions in these patients likely signifying onset of subclinical ventricular dysfunction. LV GRS and LV GLS correlated with T2*. FT CMR may be used as an early marker for myocardial dysfunction in these patients.

### CLINICAL RELEVANCE/APPLICATION

Early myocardial dysfunction detected by strain analysis may help to initiate/upstage even earlier iron chelation therapy before overt myocardial dysfunction develops as detected by echocardiography, thereby help to prevent mortality caused by myocardial iron deposition in transfusion dependent thalassemia patients.

## W5A-SPCA-4 T1, T2, AND ECV MAPPING DERIVED FROM A SINGLE-SLICE MEASUREMENTS IS OFTEN NON-INFERIOR COMPARED TO MEAN OF MUTIPLE VIEWS IN DIAGNOSING MYOCARDITIS: INSIGHTS FROM THE MYORACER TRIAL

Borek Foldyna, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Seitz (*Abstract Co-Author*) Nothing to Disclose
Matthias Gutberlet, MD, PhD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Koninklijke Philips NV;Speaker, Bayer AG;Speaker, Bracco Group;Author, Thieme Medical Publishers, Inc
William Rutschke (*Abstract Co-Author*) Nothing to Disclose
Clara Frank (*Abstract Co-Author*) Nothing to Disclose
Karin Klingel, MD (*Abstract Co-Author*) Nothing to Disclose
Philipp Lurz (*Abstract Co-Author*) Nothing to Disclose
Christian Luecke, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Mapping aids to diagnose myocarditis on cardiac MRI. First aim: to compare the diagnostic performance of single slice T1, ECV, and T2 mapping vs. mean, performed in two-chamber-(2CH), four-chamber-(4CH) views and midventricular short-axis-orientation (SA). Second aim: to find the slice orientation with the best diagnostic performance compared to endomyocardial biopsy (EMB).

### METHODS AND MATERIALS

This study is a sub study of the prospective MyoRacer trial (Lurz et al. 2016) with imaging parameters as published. Mapping was acquired as single slices in 2CH, 4CH and SA orientations and measured on a dedicated cMR-workstation. The readers were blinded to the biopsy results. We compared the discriminative capacity of individual single-slice-mapping with the means of multi-slice measures using ROC analysis and biopsy as reference. Diagnostic performance was examined by using ROC-analysis, AUCs were compared.

### RESULTS

Among 88 included patients (20 (32%) women; 43±12y), 62 (70,4%) were EMB positive for myocarditis. AUC for T2 mapping were 0.696 for the mean, 0.693 for SA, 0.671 for 2CH, and 0.62 for 4CH and did not differ significantly p>0.125. AUC for T1 mapping were 0.667 for the mean, 0.667 for 4CH, 0.662 for the 2CH, and 0.583 for the SA orientation. The difference between mean and SA was statistically significant p=0.0256 (other differences p> 0.19). AUC for ECV calculation were 0.667 for the mean, 0.635 for SA, 0.679 for 2CH, and 0.629 for 4CH, not statistically significant (p>0.18).

### CONCLUSION

Although the mean of three measurements shows the best diagnostic performance, even a single slice of native T1 or T2 Mapping or ECV-analysis delivers similar diagnostic accuracy in patients with suspected myocarditis. Long axis T1 mapping can however outperform a single slice T1 mapping in midventricular short axis orientation.

### CLINICAL RELEVANCE/APPLICATION

The ability of single-slice T1, T2 mapping, and ECV analysis to match the diagnostic accuracy of multi-slice averages suggests that MRI protocols can be simplified. This can reduce scan times and improve patient throughput in busy clinical settings.

## W5A-SPCA-6 RIGHT VENTRICULAR CMR STRAIN ANALYSIS DETECTS SUBCLINICAL MYOCARDIAL DAMAGE AFTER ANTHRACYCLINE-BASED CHEMOTHERAPY IN PATIENTS WITH BREAST CANCER

Jennifer Erley, MD (*Abstract Co-Author*) Nothing to Disclose
Enver G. Tahir, MD (*Abstract Co-Author*) Nothing to Disclose
Gerhard B. Adam, MD (*Abstract Co-Author*) Nothing to Disclose
Destina Gizem Aydemir, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate possible anthracycline-induced cardiotoxicity by analyzing right ventricular (RV) function using cardiovascular magnetic resonance myocardial feature tracking (CMR-FT).

### METHODS AND MATERIALS

This prospective monocentric study included 30 female patients with first-time breast cancer (50±11 years), who received systemic anthracycline-based chemotherapy including 4 cycles of epirubicin (90 mg/m2) combined with cyclophosphamide (600 mg/m2) and 12 cycles of paclitaxel (80 mg/m2) according to the guidelines. CMR was performed on all patients before initiating chemotherapy and at a follow-up of 12 months after first administration. Right ventricular ejection fraction (RVEF), end diastolic (RVEDV), end systolic (RVESV) and stroke volumes (SV) were determined by CMR using a commercially available software (cvi42). CMR-FT was used to determine RV global longitudinal (GLS), radial (GRS) and circumferential strain (GCS). Paired t-test was used to assess the differences in strain values between baseline and follow-up.

### RESULTS

Only 7 out of 30 patients showed a reduction in RVEF after 12 months, but overall RVEF remained unchanged (54±6% vs. 56±6%, p=0.2). All patients with reduced RVEF demonstrated attenuated RV GLS at follow-up. RV GLS was attenuated at 12 months following chemotherapy (-25±4% vs. -21±4%, p<0.001). RV GRS (18±7% vs. 20±7%, p=0.08) and RV GCS (-11±4% vs. -12±3%, p=0.4) remained unchanged at 12 months after chemotherapy. No differences were observed for RVEDV, RVESV and RVSV (all p>0.05).

### CONCLUSION

Right ventricular strain analysis using CMR-FT can detect myocardial impairment following anthracycline-based chemotherapy. Right ventricular GLS could serve as an early marker of subclinical cardiotoxicity.

### CLINICAL RELEVANCE/APPLICATION

Changes in RV GLS after anthracycline-based chemotherapy could serve as an early marker of subclinical cardiotoxicity and should thus be routinely determined in patients with suspected chemotherapy-induced cardiomyopathy.

## W5A-SPCA-7 PERIVASCULAR INFLAMMATION IN PATIENTS WITH HYPERTROPHIC CARDIOMYOPATHY AND ITS POTENTIAL CLINICAL IMPLICATION

Yang Peng (*Abstract Co-Author*) Nothing to Disclose
Lin Peng (*Abstract Co-Author*) Nothing to Disclose
Jun Yuan (*Abstract Co-Author*) Nothing to Disclose
Yuying Chen (*Presenter*) Nothing to Disclose

### PURPOSE

To assess pericoronary adipose tissue inflammation in patients with hypertrophic cardiomyopathy (HCM) using a novel imaging biomarker, the perivascular fat attenuation index (FAI) derived from coronary computed tomography angiography (CCTA), and to investigate potential factors associated with FAI.

### METHODS AND MATERIALS

The retrospective study enrolled 34 patients diagnosed with HCM and 62 individuals with normal cardiac structure who underwent cardiac magnetic resonance (CMR) and CCTA scans within 2 weeks from January 2021 to December 2023. Perivascular FAI was evaluated using commercially available software (Shukun, FAI, V1.7, Beijing, China), evaluating specific segments of the proximal right coronary artery (RCA-FAI), left anterior descending artery (LAD-FAI), and left circumflex artery (LCX-FAI). The maximum wall thickness (MWT), end-diastolic volume index to body surface area (EDVi), mass index to body surface area (massi), ejection fraction (EF), and late gadolinium enhancement (LGE) percent was quantified using CVI 42 software. White blood cell count (WBC), high-sensitivity C-reactive protein (hsCRP), procalcitonin (PCT), high-sensitivity troponin (cTNT-T), and N-terminal pro-brain natriuretic peptide (NT-proBNP) were simultaneously assessed. The Correlations between continuous variables were assessed using either Pearson's correlation coefficient or Spearman's rank correlation coefficient, as appropriate.

### RESULTS

The LAD-FAI, LCX-FAI, and RCA-FAI exhibited significantly higher values in patients with HCM compared to controls (-75.71±11.02HU vs. -83.02±10.60HU, p=0.002; -70.00±9.74HU vs. -80.24±9.57HU, p<0.001; -77.09±10.50HU vs. -84.76±11.02HU, p=0.002; respectively). A moderately positive correlation was observed between LAD-FAI, LCX-FAI, and RCA-FAI and PCT level in patients with HCM (r=0.481, p=0.01; r=0.522, p=0.004; r=0.505, p=0.006, respectively).

### CONCLUSION

Pericoronary adipose tissue inflammation is elevated in patients with HCM and perivascular FAI is moderately correlated with PCT level.

### CLINICAL RELEVANCE/APPLICATION

Elevated levels of inflammatory cytokines are observed in HCM, accompanied by low-grade myocardial inflammation, narrowed intramyocardial small arteries, and perivascular fibrosis. Our study revealed a significant increase in perivascular FAI among HCM patients, which exhibited a moderate correlation with PCT level. This finding may suggest a potential association between FAI and congestive heart failure. However, the role of FAI in risk stratification and prognosis assessment for HCM patients remains undefined.

## W5A-SPCA-9 EFFECT OF TRIGLYCERIDE-GLUCOSE INDEX ON LEFT VENTRICULAR DEFORMATION DYSFUNCTION OF TYPE 2 DIABETES MELLITUS WITH OR WITHOUT DYSLIPIDEMIA

Zhigang Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Li Jiang, MD (*Presenter*) Nothing to Disclose

### PURPOSE

It remains unclear whether the association between dyslipidemia status and triglyceride-glucose index (TyG index) and left ventricular (LV) dysfunction is different and in what pattern varies in the context of type 2 diabetes mellitus (T2DM). Therefore, LV structure, function, myocardial perfusion microvascular function, and deformation were analyzed to determine the effect of TyG index on LV deformation dysfunction of T2DM with or without dyslipidemia.

### METHODS AND MATERIALS

A total of 235 T2DM patients, comprising 113 with dyslipidemia and 122 without dyslipidemia, were included, and were divided into three groups based on the TyG index tertiles: T1, T2 and T3 group. CMR-derived LV perfusion parameters, global function index (GFI) and strain were assessed and compared among the groups. A multivariable backward linear regression model was employed to evaluate the effects of various variables on LV strain.

### RESULTS

With the increase of TyG index, LV volume and LV ejection fraction showed no significant statistical difference (All $p > 0.05$), while the higher TyG index group showed higher LV mass, higher remodeling index and lower LV GFI (All $p = 0.001$). Patients with a higher TyG index presented a lower perfusion index, lower upslope, lower MaxSI, and higher TTM (All $p = 0.002$), however, there was no significant difference in microvascular perfusion parameters between the two groups with lower TyG index. The linear multivariate analysis showed that TyG index (PS-radial, ß = -0.176[-0.311, -0.041], $p = 0.011$; PS-circumferential, ß = 0.245[0.130, 0.361], $p < 0.001$; PS-longitudinal, ß = 0.372[0.246, 0.485], $p<0.001$) and LV EDVi (PS-radial, ß = -0.134[-0.259, -0.010], $p<0.001$; PS-circumferential, ß = 0.431(0.320, 0.549), $p<0.001$; PS-longitudinal, ß = 0.211[0.097, 0.321], $p<0.001$) were independent determinants of PS reduction in the three directions. Hypertension (PS-radial, ß = -0.206(-0.320, -0.098), $p<0.001$; PS-longitudinal, ß = 0.182(0.07, 0.291), $p = 0.001$) and perfusion index (PS-radial, ß = 0.150[0.036, 0.277], $p=0.011$; PS-longitudinal, ß = -0.124[-0.244, -0.011], $p=0.032$) were independently correlated with PS in radial and longitudinal direction, while dyslipidemia was not significantly correlated with reduced LV deformation (all $p > 0.05$).

### CONCLUSION

Patients with a higher TyG index had a higher LV remodeling index, lower LV GFI, decreased LV myocardial perfusion function and decreased LV strain. In patients with DM, TyG index, but not dyslipidemia status, independently predicted PS reduction in all three directions.

### CLINICAL RELEVANCE/APPLICATION

This highlights the importance of addressing quantitative, qualitative, and kinetic changes in major circulating lipids as therapeutic targets to mitigate associated LV dysfunctional.

# Abstract Archives of the RSNA, 2024

W5A-SPCH

**Chest Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPCH-1 UNVEILING THE IMPACT OF RIVERAIN'S VESSEL SUPPRESSION: BREAKTHROUGH OR BUST?

Jonathan R. Medverd, MD (*Abstract Co-Author*) Nothing to Disclose
Brian W. Bresnahan, PhD (*Abstract Co-Author*) Stockholder, Johnson & Johnson
Kenneth Tharp, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Nathan M. Cross, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hamid Chalian, MD (*Abstract Co-Author*) Nothing to Disclose
Charles Watt (*Abstract Co-Author*) Nothing to Disclose
Kevin Chorath, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The detection of pulmonary nodules on computed tomography (CT) chest scans is a critical yet time-consuming component of quality patient care, bearing significant clinical and medicolegal implications. ClearRead CT Vessel Suppression (Riverain Technologies, Miamisburg, Ohio), a novel computer-aided detection (CAD) software, aims to enhance nodule detection by highlighting nodules by suppressing vascular, bronchial, and fissural structures. While previous studies have demonstrated improvements in controlled settings, real-world radiology workflows and the software's impact on clinically significant nodules and reading times remain understudied.

### METHODS AND MATERIALS

This retrospective review assesses the impact of Vessel Suppression on reading speeds and detection of punctate (=2mm) pulmonary nodule by radiology residents at our institution over 14 months, both pre- and post implementation. The study includes CT chest exams targeting nodule detection in patients with active, past, or heightened malignancy risk. Reading times were calculated from study opening to preliminary sign timestamps. Using a natural language processing (NLP) algorithm (AIdoc, Tel Aviv, Israel), final reports were analyzed for the largest nodule size and mentions of nodules =2mm.

### RESULTS

In total, 4,429 unique CT chest scans were assessed (1,002 pre-implementation and 3,427 post-implementation). The average time from study opening to preliminary sign decreased significantly (19.1 minutes to 12.2 minutes; $p<0.01$). Moreover, there was a notable increase in punctate nodule reporting post-implementation (13.0% of studies pre-implementation vs. 24.2% post-implementation; $p<0.01$).

### CONCLUSION

Vessel Suppression proves beneficial for improving CT chest reading speeds among radiology residents, especially for patients with cancer or elevated cancer risk. However, it also increases the detection of punctate pulmonary nodules, whose clinical significance remains uncertain and requires further research and QI evaluation.

### CLINICAL RELEVANCE/APPLICATION

Vessel Suppression increases radiology resident's reading speeds for CT chest and leads to heightened detection of punctate pulmonary nodules, which are of uncertain clinical significance.

## W5A-SPCH-2 QUANTITY OR CERTAINTY: CAN AMBIGUOUSLY ANNOTATED DATA IMPROVE LUNG NODULE DETECTION PERFORMANCE?

Junghyun Kang (*Abstract Co-Author*) Nothing to Disclose
Chanmin Park (*Abstract Co-Author*) Nothing to Disclose
Doohyun Park (*Abstract Co-Author*) Nothing to Disclose
Jonghun Jeong (*Presenter*) Nothing to Disclose

### PURPOSE

In the field of deep learning (DL), constructing a large and well-curated dataset is essential. However, when developing DL-based computer-aided detection (CADe) models for pulmonary nodule detection in computed tomography scans, observer variability poses challenges to dataset curation. For example, under the LUNA16 dataset protocol, a nodule is identified only if at least three out of four observers agree on its presence. Therefore, this study aims to analyze how ambiguously annotated data affects model performance.

### METHODS AND MATERIALS

We collected a dataset consisting of 891 nodules identified by the radiologist across 223 cases sourced from the United States. In this study, the dataset was then divided into a 7-fold with case-level splits, with 161 cases (5 folds) containing 624 nodules for the training set and the remaining 62 cases (2

folds) containing 267 nodules for the test set. These nodules were re-annotated by a new radiologist. The training set was divided into Group A, consisting of 376 nodules on which both radiologists agreed, and Group B, consisting of 248 nodules on which only the initial radiologist agreed. Three models were subsequently trained with different groups to analyze the impact of ambiguously annotated data: 1) a model trained with Group A, 2) a model trained with Groups A and B, and 3) a model trained with Group B. All models used the same ResNext network architecture and were trained for approximately 100,000 iterations. The performance of these models was evaluated on 52 cases from the test set, containing 154 nodules approved by all radiologists.

**RESULTS**

Model performance was analyzed using the Free-Response ROC curve. The model trained with Group A achieved an average sensitivity of 0.880 across thresholds of 1, 2, 4, 8, and 16 false positives per scan. The model trained with Groups A and B showed an average sensitivity of 0.803, while the model trained with Group B, which was approved by only one radiologist, had the lowest average sensitivity of 0.729.

**CONCLUSION**

This study demonstrates that the performance of CADe systems improves when trained with data where multiple annotators consistently agree on a nodule. Conversely, an increase in ambiguous data leads to decreased performance. The results indicate that using reliable data verified by multiple experts enhances CADe system effectiveness, making lung nodule screening more accurate and efficient in clinical settings.

**CLINICAL RELEVANCE/APPLICATION**

Advancements in CADe development are important for early lung cancer screening through improved nodule detection. The findings of this study enable more accurate identification of nodules, thereby enhancing early lung cancer detection.

## W5A-SPCH-4 ULTRA-HIGH-RESOLUTION CT-BASED RADIOMICS TO PREDICT HIGH-GRADE PATTERNS OF LUNG INVASIVE ADENOCARCINOMA

Qinling Jiang (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to develop and validate a radiomics model based on pre-treatment ultra-high-resolution CT images to predict high-grade patterns of invasive lung adenocarcinoma.

**METHODS AND MATERIALS**

Patients with pathologically confirmed invasive lung adenocarcinoma from May 2016 to December 2023 from 2 hospitals were retrospectively analyzed. The lesions were classified into high-grade pattern (HGP) and non-high-grade pattern (n-HGP) groups according to the percentage of tissue types in the pathologic results. Preoperative conventional chest CT images were converted to high-resolution chest CT images (HRCT) and ultra-high-resolution target scan images (UHRCT) using a two-channel GAN Model. After segmenting the lung nodules from chest CT, the radiomics features including shape-based features, first order statistics, and textural features were extracted. Least absolute shrinkage and selection operator (Lasso) was applied to select the strong correlation features. A prediction model was consequently constructed using Gaussian Process Classification. The efficacy of the model was assessed through receiver operating curve analysis, and the performance of the model was validated both internally and externally.

**RESULTS**

A total of 540 patients from 2 hospitals were included (the HGP was found in 213 of the 540 patients, 39.4%). Hospital 1 was divided into the training set (n=320) and the internal test set (n=81), and hospital 2 was used as the external test set for the model (n=139). The AUC values of NRCT, HRCT, and UHRCT for the model were 0.945, 0.946, and 0.957 in the internal test and 0.759, 0.760, and 0.872 in the external test set, respectively.

**CONCLUSION**

UHRCT-based radiomic model can predict HGP effectively of invasive lung adenocarcinoma and outperforms conventional resolution images.

**CLINICAL RELEVANCE/APPLICATION**

According to the WHO Classification of Thoracic Tumors, 5th edition, any lung adenocarcinoma with a high-grade component of =20% should be classified as HGP, because these tumors have a more aggressive biological behavior and a worse prognosis. Therefore, preoperative prediction of lung adenocarcinoma with or without HGP is important to help accurately determine pathology, surgical selection, and patient management. In this study, the UHRCT-based radiomic model demonstrated good diagnostic performance and outperformed conventional resolution images, which can help clinically assess the prognosis of patients and determine the surgical method before surgery.

## W5A-SPCH-6 ROLE OF INTRATUMORAL AND PERITUMORAL CT-BASED RADIOMICS FEATURES FOR THE PREDICTION OF MALIGNANCY AND INVASIVENESS OF PULMONARY GROUND-GLASS NODULES

Menglong Zheng (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the predictive value of a CT-based radiomics model that incorporates intratumoral and peritumoral features for benign or malignant status of pulmonary ground-glass nodules (PGGNs) and the invasiveness of malignant PGGNs.

**METHODS AND MATERIALS**

A total of 1659 PGGNs from 1561 patients with preoperative CT scans were involved in this retrospective study; 236 PGGNs were diagnosed with inflamed or infected benign lesions, 55 atypical adenomatous hyperplasia (AAH,) 301 adenocarcinoma in situ (AIS), 728 minimally invasive adenocarcinoma (MIA) and 339 invasive adenocarcinoma (IAC). All patients were confirmed by operation and had complete pathological data. Malignant PGGNs are classified according to clinical management strategies, AAH, AIS, and MIA were classified as non-invasive lesions; IAC was classified as invasive lesions. Two types of regions of interest (ROIs), including gross tumor volume (GTV) and peritumoral volume (5mm and 10 mm around the tumor, PTV1 and PTV2), were annotated from the CT images. We extracted 3441 CT-based radiomics features from GTV, PTV1 and PTV2. After feature selection, 5 models were developed to predict the malignancy and invasiveness of PGGNs. The performance of all five models was evaluated by receiver operating characteristic (ROC) curves.

**RESULTS**

For malignancy predictions, all radiomics models demonstrated satisfactory discrimination abilities. GTV+PTV1+PTV2 model achieved highest performance in training set with AUC 0.929 (95% Confidence Interval 0.900, 0.962). In testing, GTV+PTV1 model achieved highest AUROC value of 0.895 (95% CI 0.774,0.925). For invasiveness predictions, GTV+PTV1+PTV2 model achieved highest AUROC in training dataset (AUC 0.829 [0.743,0.896]), GTV+PTV1 model achieved highest numerical AUROC in the testing set (AUC 0.781 [0.640, 0.849]).

### CONCLUSION

Both radiomic signatures of GTV and PTV had a good prediction ability in the prediction of malignancy and invasiveness of PGGNs. The predictive performance of the GTV+PTV-based model was more effective than that of the GTV-based model.

### CLINICAL RELEVANCE/APPLICATION

The proposed new radiomics strategy that extracts image features from the intra- and peritumoral regions could greatly improve the diagnostic performance for the prediction of benign or malignant status of PGGNs and the invasiveness of malignant PGGNs and may help serve as a powerful tool to assist clinicians in making personalized treatment strategies.

## W5A-SPCH-7 VIRTUAL BIOPSY THROUGH CT IMAGING: CAN RADIOMICS DIFFERENTIATE BETWEEN SUBTYPES OF NON-SMALL CELL LUNG CANCER?

Andrea Laghi, MD (*Abstract Co-Author*) Speaker, General Electric Company;Speaker, Bayer AG;Speaker, Bracco Group;Speaker, Merck & Co, Inc
Michela Polici, MD (*Abstract Co-Author*) Nothing to Disclose
Damiano Caruso, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Marta Zerunian, MD (*Abstract Co-Author*) Nothing to Disclose
Stefano Nardacci, MD (*Abstract Co-Author*) Nothing to Disclose
Federica Palmeri, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the performance of radiological and radiomic models in differentiating lung adenocarcinoma (ADC) from squamous cell carcinoma (SCC)

### METHODS AND MATERIALS

A total of 330 patients with available baseline contrast-enhanced CT scans were retrospectively enrolled between April 2014 and January 2023. Pathological diagnosis and radiological features (T and N radiological stage, peripheral or central location of the lesion, presence of emphysema) were collected for each patient. Inclusion criteria: a) histological diagnosis of ADC or SCC; b) baseline contrast-enhanced chest CT. Exclusion criteria: a) significant motion artifacts; b) nodules too small to be segmented (<3 mm). Patients were divided into two groups: adenocarcinoma and squamous cell carcinoma. Two expert radiologists in consensus manually segmented lung cancers on baseline CT scans at the portal-venous phase by using dedicated software (3DSlicer v5.2.2). Then, 107 radiomic features were extracted and compared between two groups (T-test or Mann-Withney-U). Radiomics and radiological features performance was assessed by receiver operating characteristic (ROC) curves; univariate and multivariate logistic regression were performed to build models to predict the histology (radiomics only, radiologic features only and combined). P< .05 was considered significant

### RESULTS

The final groups consisted of 200 patients with ADC and 100 with SCC. 53 radiomic features showed significant differences between the two groups. Among these, 2 features achieved the best performance: DifferenceVariance and Skewness (AUC: 0.708 and 0.67, respectively, P< .001). Among the radiological features, 2 features were also found to be statistically significant: location of the lesion and presence of emphysema (AUC: 0.67 and 0.62, respectively, P < .0001). Univariate analysis showed 2 radiological features and 27 radiomic features independently correlated with histology (all P< .04). The multivariate analysis of the radiological features showed an AUC of 0.733 with 72% of cases correctly diagnosed; all significant features included in the radiomics model showed an AUC of 0.811 with 73% of cases correctly classified, while the combined model was able to correctly classify 76% of cases with an AUC of 0.852 (all P < .0001)

### CONCLUSION

The combined radiologic-radiomics model showed the best performance to differentiate lung adenocarcinoma from squamous cell carcinoma and, in the future, might be used as a non-invasive method to overcome the limits of biopsy

### CLINICAL RELEVANCE/APPLICATION

Radiomics holds promise to be a non-invasive diagnostic tool for pulmonary nodules, overcoming biopsy tissue undersampling, with benefits expected to be higher in patients at high risk of periprocedural complications

## W5A-SPCH-8 APPLICATION OF DUAL-MODALITY ULTRASOUND DEEP LEARNING MODEL BASED ON VIDEO IMAGE RECOGNITION IN THE DIAGNOSIS OF SUBPLEURAL LUNG NODULES

Martin R. Prince, MD, PhD (*Abstract Co-Author*) Patent agreement, General Electric Company;
Ke Bi (*Abstract Co-Author*) Nothing to Disclose
Kaiwen Wu (*Abstract Co-Author*) Nothing to Disclose
Yin Wang, PhD, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Quantitative parameters of contrast-enhanced ultrasound (CEUS) showed excellent diagnostic accuracy for subpleural lung lesions (SLLs) with vertical diameters =3cm but limited diagnostic ability for subpleural lung nodules (SLNs) with vertical diameters <3 cm. The purpose of this study is to develop and validate a novel deep learning (DL) model based on gray-scale ultrasound (GSUS) and contrast-enhanced ultrasound (CEUS) video recognition to improve the diagnostic accuracy of SLN.

### METHODS AND MATERIALS

A dataset of US videos in patients with SLNs confirmed as malignant or benign by pathology and culture from A Hospital (193 studies on 193 patients from August 2017 to December 2020) and an independent external test set from B Hospital and C Hospital (26 studies on 26 patients from January to December 2021), had all SLNs labeled by Cardiothoracic Radiologists. The model, which includes video preprocessing based on medical domain knowledge and a video understanding model integrating features of time-intensity curve (TIC) and grayscale lung ultrasound (LUS) videos, was trained on 80% of A Hospital dataset and validated on the remaining 20%, as well as on the independent external test set. Model performance was analyzed using area under the receiver operating characteristic curve (AUC), accuracy, sensitivity, and specificity, comparing to US, CT and other DL models.

### RESULTS

Our model diagnosed SLN as benign or malignant with an AUC of 0.85 (95% confidence interval [CI]: 0.63, 0.96) in the external test set, which was significantly higher than US, CT, and other models including TimeSformer, ViViT, I3D, and SlowFast (Table 1). The ablation study demonstrated that incorporation of dual-modality understanding, TIC analysis, and clinical information all independently contributed to model performance(Table 2). The accuracy (ACC), sensitivity, specificity, positive predictive value and negative predictive value were 77.3% (95% CI: 61.7, 82.0), 87.7% (95% CI: 68.3, 94.4), 73.3% (95% CI: 68.6, 77.3), 60% (95% CI: 42.7, 81.6) and 91.7% (95% CI: 88.8, 94.4), respectively.

### CONCLUSION

This DL model improves the discrimination of benign from malignant SLNs based on US videos recognition and may provide an early diagnostic strategy for SLNs.

### CLINICAL RELEVANCE/APPLICATION

Patients with SLNs can be assessed by contrast enhanced pulmonary ultrasound to determine whether they are benign or malignant. Our DL model will improve the diagnostic accuracy.

## W5A-SPCH-9 PERFORMANCE OF AI FOR PREOPERATIVE CT ASSESSMENT OF LUNG METASTASES: RETROSPECTIVE ANALYSIS OF 167 PATIENTS

Marie-Pierre Revel (*Abstract Co-Author*) Consultant, General Electric Company;Consultant, Gleamer;Speaker, Bracco Group;Speaker, Boehringer Ingelheim GmbH
Emma Canniff, FFR(RCSI) (*Abstract Co-Author*) Nothing to Disclose
Guillaume Chassagnon, MD (*Abstract Co-Author*) Nothing to Disclose
Arvin Calinghen, MD (*Abstract Co-Author*) Nothing to Disclose
Giorgio Maria Masci, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the performance of artificial intelligence (AI) in the preoperative detection of lung metastases on CT.

### METHODS AND MATERIALS

Patients who underwent lung metastasectomy in our institution between 2016 and 2020 were enrolled, their preoperative CT reports having been performed before an AI solution (Veye Lung Nodules, version 3.9.2, Aidence) became available as a second reader in our department.All CT scans were retrospectively processed by AI. The sensitivities of unassisted radiologists (original CT radiology reports), AI reports alone and both combined were compared. Ground truth was established by a consensus reading of two radiologists, who analyzed whether the nodules mentioned in the pathology report were retrospectively visible on CT. Multivariate analysis was performed to identify nodule characteristics associated with detectability.

### RESULTS

A total of 167 patients (men: 62.9%; median age, 59 years [47-68]) with 475 resected nodules were included. AI detected an average of 4 nodules (0-17) per CT, of which 97% were true nodules. The combination of radiologist plus AI (92.4%) had significantly higher sensitivity than unassisted radiologists (80.4%) ($p<0.001$). In 27/57 (47.4%) patients who had multiple preoperative CT scans, AI detected lung nodules earlier than the radiologist. Vascular contact was associated with non-detection by radiologists (OR:0.32[0.19, 0.54], $p<0.001$), whilst the presence of cavitation (OR:0.26[0.13, 0.54], $p<0.001$) or pleural contact (OR:0.10[0.04, 0.22], $p<0.001$) was associated with non-detection by AI.

### CONCLUSION

AI significantly increases the sensitivity of preoperative detection of lung metastases and enables earlier detection, with a significant potential benefit for patient management.

### CLINICAL RELEVANCE/APPLICATION

In this study, we demonstrated that AI assistance has the capacity to significantly increase the radiologists' sensitivity for the preoperative detection of lung nodules, at a cost of a few false positive detections, with potential benefit for patient's management.

# Abstract Archives of the RSNA, 2024

W5A-SPER

**Emergency Radiology Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPER-1 INTEGRATION OF A ROTATION-FREE GANTRY SPECTRAL CT INTO MOBILE STROKE UNITS: DESIGN, IMPLEMENTATION, AND CLINICAL IMPACT

Bo Kyung Cha, PhD (*Abstract Co-Author*) Nothing to Disclose
Minjae Lee (*Abstract Co-Author*) Nothing to Disclose
Minkook Cho, PhD (*Abstract Co-Author*) Employee, Samsung Electronics
Hyosung Cho (*Abstract Co-Author*) Nothing to Disclose
Jinwoo Kim (*Presenter*) Nothing to Disclose

### PURPOSE

The integration of mobile technologies such as transportable computed tomography (CT) scanners with emergency medical services and telemedicine presents a significant opportunity to enhance prehospital stroke care. Our study introduces a novel CT scanner design optimized for mobile use, featuring a rotation-free rectangular gantry and a photon-counting detector (PCD), coupled with a deep-learning approach for reconstructing under-sampled projections, aiming to maintain high diagnostic reliability within these constraints (i.e., compact environments like small ambulances without compromising safety in terms of radiation exposure).

### METHODS AND MATERIALS

In response to the need for compact and efficient medical imaging in prehospital settings, we designed a specialized CT system for use in mobile stroke units (MSU). This system includes a rectangular scanner configuration equipped with dual-line X-ray sources, each line housing 20 sources to a total of 40, operating at 120 kVp through a 2 mm aluminum filter. The system's geometry is defined by a source-to-detector distance (SDD) of 50 cm and a source-to-object distance (SOD) of 25 cm, which accommodates the restricted space within small ambulances while ensuring optimal imaging performance. The PCD utilizes cadmium telluride (CdTe) material for the detector, with a pixel resolution of 225 μm and adjustable energy thresholds at 20, 50, 65, and 80 keV to optimize imaging for various clinical needs. We developed and implemented a learning-based reconstruction to restore high-quality images from under-sampled data. This approach was validated through comparison with conventional methods like filtered back projection (FBP) and compressed sensing (CS), using fully sampled, diagnostic-quality CT images from established public datasets to ensure the system's efficacy and safety in a clinical setting.

### RESULTS

We successfully reconstructed various hemorrhages, including epidural, intracerebral, intraventricular, subarachnoid, and subdural hematomas, demonstrating superior efficacy and precision in detecting these critical conditions. Additionally, we implemented imaging of brain micro-hemorrhages using both low- and high-energy images obtained from the PCD.

### CONCLUSION

Our results indicate that the proposed scanner effectively shows potential for stroke detection in prehospital ambulances. The integration of a rotation-free gantry spectral CT into MSU is expected to significantly enhance the capacity for prehospital diagnosis and immediate treatment of strokes.

### CLINICAL RELEVANCE/APPLICATION

This novel prehospital spectral CT scanner enhances the rapid diagnosis of acute stroke in mobile units, significantly improving early treatment outcomes.

## W5A-SPER-2 FORECASTING TRENDS OF RISING EMERGENCY DEPARTMENT CHEST IMAGING USING MACHINE LEARNING

Nikhil H. Ramaiya, MD (*Abstract Co-Author*) Nothing to Disclose
Ashish R. Khandelwal, MD (*Abstract Co-Author*) Nothing to Disclose
Sirui Jiang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sreeharsha Tirumani, MD (*Abstract Co-Author*) Nothing to Disclose
Kaustav Bera, MD (*Abstract Co-Author*) Nothing to Disclose
Satheesh Krishna, MD (*Abstract Co-Author*) Nothing to Disclose
Sishir Doddi (*Presenter*) Nothing to Disclose

### PURPOSE

Recent literature has shown that imaging studies have been steadily increasing in the United States, especially in emergency department and at urgent care facilities. In this report, we assess for trends in chest CT and chest CTA imaging in ED and UCF settings for trends from 2010 to 2021 and forecast future utilization with machine learning.

## METHODS AND MATERIALS

We queried chest CT claims billed from emergency departments and urgent care facilities from the Centers for Medicare and Medicaid to assess for compound annual growth rate (CAGR) and predict future trends with ARIMA modeling.

## RESULTS

Chest CT imaging in the ED or UCF settings has steadily from 2010 (273,063) to 2021 (540,047) in the US. Chest CTA imaging also saw an increase from 175,554 in 2010 to 705,727 in 2021. Analysis found that ED and urgent care Chest CT imaging has increased from 2010 to 2021 with a CAGR of 7.5% ($p<0.001$). Similarly, chest CTA imaging has also increased during this time period with an average CAGR or 13.0% ($p<0.001$). When attempting to forecast future trends, the ARIMA model forecast for ED and UCF CT chest imaging predicts a continued increase in volume of CT imaging reaching 614,995 in 2024 and 760,851 in 2030. Chest CTA is predicted to have an even higher increase up to 850,320 in 2024 and 1,139,505 in 2030 assuming the trend observed over the past decade is consistent.

## CONCLUSION

In conclusion, from 2010 to 2021, we found an increasing trend in ED chest CT and CTA imaging with forecast predicting volume up to twice of volume in 2030 compared to a decade ago.

## CLINICAL RELEVANCE/APPLICATION

While imaging holds a significant role in patient care, inappropriate utilization can result in unnecessary radiation exposure, prolonged wait times, and an increase in burden of healthcare resources.

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# Abstract Archives of the RSNA, 2024

W5A-SPGI

**Gastrointestinal Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPGI-1 DEEP LEARNING-BASED RECONSTRUCTION FOR T2-WEIGHTED AND CONTRAST-ENHANCED T1-WEIGHTED MAGNETIC RESONANCE ENTEROGRAPHY IN PATIENTS WITH CROHN'S DISEASE: ASSESSMENT OF IMAGE QUALITY AND DIAGNOSTIC UTILITY

Seong Jin Park, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sung Kyoung Moon (*Abstract Co-Author*) Nothing to Disclose
Myung-Won You, MD (*Abstract Co-Author*) Nothing to Disclose
Choongwui Cho, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the image quality of deep learning-based reconstruction for T2-weighted half-Fourier single-shot turbo spin echo sequence (DL T2 HASTE) and for contrast-enhanced T1-weighted sequence (DL CE-T1W) in MR enterography(MRE).

### METHODS AND MATERIALS

Fifty-six patients with Crohn's disease who underwent MRE between December 2022 to November 2023 were enrolled. Deep learning-based reconstruction was applied to coronal T2 HASTE and dynamic CE T1W sequences. Two reviewers assessed subjective image quality at the patient level and active inflammation at the bowel segment level in T2 HASTE with and without DL reconstruction, and DL CE-T1W enteric phase. Comparison with CE-T1W enteric phase without DL reconstruction was performed in twenty-two patients with prior MRE.

### RESULTS

Mean image quality scores of two reviewers were compared between T2 HASTE and DL T2 HASTE images; sharpness (4.25 vs. 4, p=0.0014), motion artifact (5 vs. 4, p<0.0001), and blurring (4.25 vs.4, p=0.0009) were better in DL T2 HASTE images than in T2 HASTE images, while synthetic appearance was increased in DL T2 HASTE (3.75 vs. 4.5, p<0.0001). When comparing CE-T1W and DL CE-T1W, contrast (5 vs. 4.5, p=0.08) and sharpness (5 vs. 4.5, p=0.07) were slightly better with DL CE-T1W than with CE-T1W, although the difference was not statistically significant. Acquisition time decreased with DL T2W HASTE (15s) and DL CE-T1W enteric phase(13s) compared to T2W HASTE without DL (38s) and CE-T1W without DL (17s). The per-segment diagnostic performance of active inflammation was identical between T2 HASTE and DL T2 HASTE images for both reviewers (R1: sensitivity 76.2 % (48/63), specificity 89.5 % (94/105), R2: sensitivity 63.5 % (40/63), specificity 86.6 % (91/105)).

### CONCLUSION

DL T2 HASTE and DL CE-T1W images showed improved sharpness with reduced blurring, motion artifacts, and reduced acquisition time compared to T2 HASTE and CE-T1W without DL reconstruction. However, DL reconstruction also increased synthetic appearance, and the diagnostic performance of active inflammation was identical between DL T2 HASTE and T2 HASTE without DL reconstruction.

### CLINICAL RELEVANCE/APPLICATION

Deep learning-based reconstruction for MRE images has reduced acquisition time however, the actual benefit for image quality improvement is controversial

## W5A-SPGI-10 COST EFFECTIVENESS OF DIFFERENT IMAGING MODALITIES FOR THE STAGING OF OESOPHAGEAL CANCER IN WESTERN COUNTRIES

Naik Vietti Violi, MD (*Abstract Co-Author*) Nothing to Disclose
Nicolas Guignard (*Abstract Co-Author*) Nothing to Disclose
Clarisse Dromain, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Mario Jreige, MD (*Abstract Co-Author*) Nothing to Disclose
Laura Haefliger (*Abstract Co-Author*) Nothing to Disclose
Karine Moschetti (*Abstract Co-Author*) Nothing to Disclose
Vincent Levy, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Cost-effectiveness analysis of 4 different imaging strategies, including MRI, for the initial staging of oesophageal cancer (EC) in Switzerland, Australia, Italy, United Kingdom (UK) and United states of America (USA).

### METHODS AND MATERIALS

The cost-effectiveness of TNM stating using 4 different combinations of imaging (EUS + PET-CT, EUS + PET-CT + CECT, EUS + PET-CT + MRI and MRI + PET-CT) was prospectively analysed in 62 patients. Patients were classified into 3 groups based on treatment strategy : (1) upfront surgery (T1/T2/N0/M0), (2) neoadjuvant therapy (T3/T4a/N+/M0) and (3) palliative treatment (T4b/M+). The diagnostic performance was defined as the agreement between the classification made by each strategy compared to the multidisciplinary consensus. A dichotomized analysis (group 1 vs 2+3 and 1+2 vs 3) was employed to identify the most effective and accurate staging strategy.

### RESULTS

The cost (USD) of the TNM staging in Switzerland were 3044 for EUS + PET-CT (1010 in Australia, 1468 in Italy, 2555 in UK, 3578 in US), 3718 for EUS + PET-CT + CECT (1349 in Australia, 1775 in Italy, 3046 in UK, 4315 in US), 3719 for EUS + PET-CT + MRI (1302 in Australia, 1666 in Italy, 3303 in UK, 4044 in US) and 3071 for MRI + PET-CT (912 in Australia, 1390 in Italy, 2521 in UK, 2044 in US). Diagnostic performances for differentiating group 1 vs 2+3 were 0.944 for EUS + PET-CT, 0.935 for EUS + PET-CT + CECT, 0.932 for EUS + PET-CT + MRI and 0.915 for MRI + PET-CT. Diagnostic performances for differentiating group 1+2 vs 3 were 0.944 for EUS + PET-CT, 0.952 for EUS + PET-CT + CECT, 0.949 for EUS + PET-CT + MRI and 0.966 for MRI + PET-CT.

### CONCLUSION

The combination of MRI + PET-CT demonstrates non inferiority and lower cost when compared to the current strategy of EUS + PET-CT + CECT used in Switzerland for the initial staging of oesophageal cancer . The validity of this study extends beyond Switzerland to encompass countries such as the United States, Australia, the United Kingdom, and Italy.

### CLINICAL RELEVANCE/APPLICATION

This study advocates for replacing the current staging strategy of EUS + PET-CT + CECT with the combination of MRI + PET-CT, asserting it as a diagnostically accurate, cost effective and non-invasive approach for EC staging, thereby enhancing the overall efficiency and accessibility of EC staging.

## W5A-SPGI-11 ENHANCING RESPONSE ASSESSMENT IN RECTAL CANCER AFTER TOTAL NEOADJUVANT THERAPY: THE VALUE OF CONTRAST-ENHANCED MRI

Ying-Chieh Lai (*Abstract Co-Author*) Nothing to Disclose
An-Hsin Chen (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the benefit of adding contrast-enhanced sequences (CE) to routine T2-weighted imaging (T2WI) and diffusion-weighted imaging (DWI) in assessing treatment response for rectal cancer following total neoadjuvant therapy (TNT).

### METHODS AND MATERIALS

A retrospective review was conducted on patients with histopathologically confirmed rectal cancer who underwent MRI-based response assessment three months post-TNT. This study spanned from January 2020 to December 2022 and included 124 patients. Imaging features from T2WI, DWI, and CE sequences were evaluated to predict a complete response (CR), as outlined in Figure 1. CR was defined as either pathologic CR or no tumor regrowth for at least one year following clinical CR. Receiver operating characteristic (ROC) analysis assessed the accuracy of these imaging features. Logistic regression identified independent predictors of CR, and decision tree analysis determined the optimal combination of MRI features for predicting CR.

### RESULTS

Of the participants, 45 (36%) achieved CR. ROC analysis indicated that the "reversed mural sign" on CE is an effective predictor of CR, showing greater efficacy than T2WI and DWI, with an accuracy, sensitivity, and specificity of 72.6%, 73.3%, and 72.2%, respectively. In comparison, T2WI reached 66.1% accuracy, 53.5% sensitivity, and 72.8% specificity, and DWI recorded 70.2% accuracy, 68.9% sensitivity, and 70.9% specificity. Multivariate logistic regression analysis confirmed DWI and CE as independent predictors of CR (p-values of 0.032 and <.001, respectively). Decision tree analysis combining DWI and CE yielded the highest performance, achieving an accuracy of 76.6%, with a sensitivity of 60% and a specificity of 86.1%. This performance surpassed those from combining T2WI and DWI, which had 70.2% accuracy, 46.7% sensitivity, and 83.5% specificity.

### CONCLUSION

CE significantly enhances the MRI assessment of treatment response in rectal cancer after TNT.

### CLINICAL RELEVANCE/APPLICATION

Implementing the CE sequence to improve the accuracy of predicting CR via MRI post-TNT can assist in guiding decisions regarding curative-intent surgery or adopting organ-preserving strategies.

## W5A-SPGI-12 INCREASED IMPLEMENTATION OF EOB-MRI IN THE PATIENTS WITH PANCREATIC CANCER

Naoto Fujikawa, MSc, MBA (*Abstract Co-Author*) Nothing to Disclose
Satoshi Goshima, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takashi Tsuji, BS (*Abstract Co-Author*) Nothing to Disclose
Tomoyuki Taguchi (*Presenter*) Nothing to Disclose

### PURPOSE

It has been reported that gadoxetate sodium-enhanced MRI (EOB-MRI) have incremental value over contrast enhanced-computed tomography (CE-CT) in detecting liver metastases in patients (pts) with pancreatic cancer (PaC), particularly small lesions that may be missed on CE-CT. Although the recent development of adjuvant chemotherapy (AC) and neoadjuvant chemotherapy (NAC) has provided more treatment options for PaC than before, there have been no reports on how such evolvement of treatment options is related to the use of EOB-MRI over time. This study aimed to investigate the actual use of EOB-MRI in the treatment of PaC and the impact of EOB-MRI on the treatment choice.

### METHODS AND MATERIALS

This was a retrospective cohort study using a nationwide hospital-claims database in Japan. Pts diagnosed with PaC with a record of any treatments, who had one or more imaging modalities between January 2011 to October 2021 were included. Pts were grouped into EOB-MRI and non EOB-MRI groups, and the treatment patterns were described in both. In addition, pts were classified into year groups (A: 2011-12, B: 2013-18, C: 2019-21) by the start date of the initial treatment.

**RESULTS**

39,624 pts were included, of them, 4,477 (11.3%) pts had EOB-MRI prior to the initial treatment and the proportions of pts with EOB-MRI in the year groups were A: 7.0%, B: 9.8%, and C: 13.6%. Among the pts with EOB-MRI, 1,852 (41.4%) pts had surgical resection as initial treatment, and 1,243 (27.8%) pts had NAC and/or AC with surgery. Of 35,147 (88.7%) pts without EOB-MRI, 12,174 (34.6%) pts had any surgical resection as initial treatment, and 7,089 (20.2%) pts had NAC and/or AC with surgery. The proportions of pts with surgery in the EOB-MRI group in the year groups were A: 31.4%, B: 41.7%, and C: 41.7%, and the proportions of pts with NAC and/or AC were A: 18.3%, 26.3%, and 29.3%. The proportions of pts with surgery in the non EOB-MRI group in the year groups were A: 29.0%, B: 36.3%, and 33.3%, and the proportions of pts with NAC and/or AC were A: 14.4%, B: 20.7%, and C: 20.4%. The results by the year-group showed the proportion of pts with NAC or AC tended to increase in the EOB-MRI group.

**CONCLUSION**

Through this study, the actual status of diagnosis and treatment choices, including treatment modalities, in the management of PaC were clarified. The EOB-MRI performed for PaC is increasing year by year, and in parallel, pts followed with NAC or AC, rather than just undergoing surgery, is increasing among pts who had EOB-MRI.

**CLINICAL RELEVANCE/APPLICATION**

As effective treatment options for pts with PaC expand, more accurate imaging modalities, such as EOB-MRI, are being in the pathway of diagnosis and treatment of PaC.

## W5A-SPGI-13 MAGNETIC RESONANCE ELASTOGRAPHY OF LIVER IN HEALTHY TUNISIAN POPULATION

Younes Arous (*Abstract Co-Author*) Nothing to Disclose
Mariem GHARBI (*Abstract Co-Author*) Nothing to Disclose
Moncef Aloui (*Abstract Co-Author*) Nothing to Disclose
Sonia Esseghaier (*Abstract Co-Author*) Nothing to Disclose
Jihene Bettaieb (*Abstract Co-Author*) Nothing to Disclose
Malek Mokbli, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The diagnosis and the quantification of hepatic fibrosis during the follow-up of patients with chronic liver diseases are fundamental. Magnetic resonance elastography (MRE) is a novel method for quantifying hepatic fibrosis based on the calculation of the velocity of wave propagation in liver parenchyma.The purposes of our study were to establish the range of normal values for MRE and to determine the epidemiological and clinical factors that may influence MRE values.

**METHODS AND MATERIALS**

It was a descriptive cross sectional monocentric study, realised in the radiology department of Military Hospital of Tunis that included 163 volunteers.Regions of interest in each liver segment were delineated MRE sequence to determine the MRE value. We also examined the correlation between the MRE and epidemiological parameters, lifestyle habits, and medical history. Furthermore, we investigated the correlation between the elastography MRI value and "Fat-Fraction" and liver iron concentration (LIC)

**RESULTS**

The MRE value in the healthy population ranges from 1.6 to 2.6 kPa.Age is the most significant factor increasing the liver stiffness measured by MRE, in healthy population, (CC at 0,49 and $p<10-3$), with a strong linear correlation. BMI also affects the elastography MRI value.Ethnicity and gender do not interfere with MRE ( Pearson Coefficient at 0,31 and $p<10-3$).Sedentary increases MRE value. However, we did not find any variation in MRE with smoking ($p=0,75$) or moderate alcohol consumption($p=0,59$) .A history of diabetes($p=0,02$), hypertension ($p<10-3$), or dyslipidemia ($p<10-3$) increases the MRE value.

**CONCLUSION**

The mean value of MRE in healthy patients was 2.02 ± 0.16 kPa.Age was the most significant factor increasing liver stiffness.MRE is not affected by ethnicity and gender and varies only slightly with technical parameters.

**CLINICAL RELEVANCE/APPLICATION**

The originality of our study lies in the following points:Our study is the first in Africa and the Arab world to focus on establishing normal values for liver stiffness in healthy volunteers and the first globally to consider a study population across different age groups. Our results determined the range of normal values among a healthy Tunisian population using a 1.5 T MRI machine, thus enabling better interpretation of images in clinical practice to evaluate hepatic stiffness and fibrosis.Additionally, our study highlighted the high incidence and underdiagnosis of hepatic steatosis in an asymptomatic population. Our results underscored the role of MRI as a noninvasive technique, aided by new quantification sequences, in the diagnosis and monitoring of overload diseases.

## W5A-SPGI-2 RESPIRATORY TRIGGERED T2WI MRI WITH ARTIFICIAL INTELLIGENCE-ASSISTED TECHNIQUE IN ABDOMINAL IMAGING: COMPARISON WITH MOTIONE SUPPRESSED RESPIRATORY TRIGGERED T2 WEIGHTED IMAGING

Qingwei Song, MD (*Abstract Co-Author*) Nothing to Disclose
Ying Zhao JR (*Abstract Co-Author*) Nothing to Disclose
Ailian Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Dan YU (*Abstract Co-Author*) Nothing to Disclose
Qi An (*Abstract Co-Author*) Nothing to Disclose
Nan Wang (*Presenter*) Nothing to Disclose

**PURPOSE**

This study evaluates the effectiveness of respiratory-triggered T2-weighted imaging with artificial intelligence-assisted compressed sensing technique (ACS-RT T2WI) in abdominal MRI, compared to conventional standard-resolution acquisition with motion suppression RT T2WI sequence (ARMS-RT T2WI), both qualitatively and quantitatively.

**METHODS AND MATERIALS**

In this prospective study, 334 patients with upper abdominal discomfort underwent upper abdominal 3.0T MRI, including both ARMS-RT T2WI and ACS-RT T2WI. Image quality was assessed by two independent readers using a five-point Likert scale, along with quantitative analyses such as SNR, CNR, PSNR, and sharpness. Lesion detection rates and contrast ratios (CR) were also evaluated.

**RESULTS**

A significant reduction in median scanning time with the ACS-RT T2WI protocol compared to ARMS-RT T2WI, showcasing a decrease from 148.22 ± 38.37 seconds to just 13.86 ± 1.72 seconds. While ARMS-RT T2WI showed higher PSNR (39.87±2.72 VS 38.69±3.00, P < 0.05). For the 201 liver lesions, ARMS-RT T2WI detected 193 (96.0%) and ACS-RT T2WI detected 192 (95.5%) (P = 0.787). For the 97 biliary system lesions, ARMS-RT T2WI identified 92 (94.9%) and ACS-RT T2WI detected 94 (96.9%) (P = 0.721). Pancreatic lesion detection showed 102 out of 110 (92.7%) for ARMS-RT T2WI and 104 (94.5%) for ACS-RT T2WI (P = 0.784). CR analysis indicated superior performance of ACS-RT T2WI in certain lesion types.

**CONCLUSION**

ACS-RT T2WI ensures clinical reliability with substantial scan time reduction ( > 80%). Despite minor losses in detail and SNR reduction, ACS-RT T2WI does not impair lesion detection, marking its efficacy in abdominal imaging.

**CLINICAL RELEVANCE/APPLICATION**

The study confirms the clinical reliability of ACS-RT T2WI, despite potential shortcomings in fine structure depiction. While ACS-RT T2WI offers improved image quality and reduced scanning time compared to ARMS-RT T2WI, further validation and multi-center studies are needed to fully realize its potential benefits, especially in patients with irregular breathing or severe illness.

## W5A-SPGI-3 DIAGNOSTIC EVALUATION OF LIVER FIBROSIS USING B1-CORRECTED T1 MAPPING AND DWI-BASED VIRTUAL ELASTOGRAPHY

Yuanqiang Zou (*Abstract Co-Author*) Nothing to Disclose
Chen Hui Li (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess the diagnostic utility of virtual magnetic resonance elastography (vMRE) utilizing diffusion-weighted imaging (DWI) and B1-corrected T1 mapping for identifying CCl4-induced liver fibrosis in rabbits.

**METHODS AND MATERIALS**

Fifty rabbits were categorized into two groups: CCl4-induced fibrosis (n=43) and control (n=7). Following Gd-EOB-DTPA administration, DWI and T1 mapping sequences were executed at 5 and 10 minutes. Diagnostic efficacy and correlations of vMRE and T1 mapping in a rabbit liver fibrosis model were evaluated.

**RESULTS**

Rabbits were classified into three groups: Control (n=7), Nonadvanced fibrosis (F1-F2, n=20), and Advanced fibrosis (F3-F4, n=13). The AUC values for T1post_5min, T1post_10min, r?T1_10min, and μdiff in distinguishing controls from nonadvanced and advanced fibrosis groups were (0.78, 0.82, 0.71), (0.82, 0.85, 0.77), and (0.62, 0.69, 0.74), respectively, with μdiff showing (0.90, 0.93, 0.66). A significant positive correlation existed between μdiff and liver fibrosis grade (r=0.534, p<0.001).

**CONCLUSION**

Gd-EOB-DTPA-enhanced T1 mapping and DWI-based vMRE provide substantial noninvasive assessment of liver fibrosis.

**CLINICAL RELEVANCE/APPLICATION**

The study significantly contributes to noninvasive assessment of liver fibrosis induced by CCl4 in rabbits, combining Gd-EOB-DTPA-enhanced T1 mapping with DWI-based virtual MR elastography (vMRE), with vMRE demonstrating superior efficacy in fibrosis evaluation, enhancing diagnostic precision and staging in clinical practice.

## W5A-SPGI-4 CORRELATION OF R2 VALUES FROM MULTIECHO MRS AND R2* VALUES FROM MRI-PDFF FOR MEASURING HEPATIC IRON DEPOSITION

Seo Yeon Youn, MD (*Abstract Co-Author*) Nothing to Disclose
Joon-Il Choi, MD, PhD (*Abstract Co-Author*) Research Grant, Guerbet SA;Research Grant, Samsung Electronics Co, Ltd
Hokun Kim, MD (*Abstract Co-Author*) Research Grant, TAEJOON Pharmaceutical Co, Ltd
Ga-Eun Park, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

R2 and R2*, two MRI parameters that can assess hepatic iron concentration (HIC), utilize spin-echo and gradient-echo techniques, respectively. The relationship between the R2* obtained from multiecho PDFF and HIC is relatively well evaluated. However, for R2, the analysis value using a commercial program (Ferriscan) is known, but the threshold of R2 obtained by multiecho MRS is not well known. The aim of this study is to compare and correlate R2 measured by MRS with R2* measured by PDFF in liver transplant donor candidates and recipients who have already undergone transplantation.

**METHODS AND MATERIALS**

175 participants, comprising 115 potential donors and 60 recipients, underwent multiecho MRS (HISTO by Siemens Healthineers) and MRI-PDFF (Liver Evaluation by Siemens Healthineers) for hepatic fat signal fraction evaluation using three 3T MRIs (Magnetom Vida, Siemens Healthineers). To correct hepatic iron deposition, R2 values in multiecho MRS and R2* values for PDFF were calculated. In each participant, two distinct R2* values were derived: 1) from a segmented liver volume auto-segmented by software (R2*-seg), and 2) from an ROI equivalent to MRS (R2*-ROI). We correlated R2 and R2* values using simple correlation analysis. Also, we calculated mean values and standard deviation of R2 and R2* values.

**RESULTS**

Mean R2, R2*-seg, R2*-ROI were 38.0±5.2 (16.7-50.8), 55.3±13.7 (6.2-95.4) and 44.1±15.1 (15.1-125.2), respectively. Correlation coefficients were 0.5676 between R2 and R2*-seg, 0.5724 between R2 and R2*-ROI and 0.6076 between R2*-seg and R2*-ROI. Between R2 and R2* values, correlation graph shows curved shape correlation.

**CONCLUSION**

R2 measured by Multiecho MRS and R2* measured by PDFF were positively correlated. As R2* values, which has already proven useful, R2 values measured by multiecho MRS has the potential to be used to diagnose hepatic iron storage disease.

### CLINICAL RELEVANCE/APPLICATION

Using the R2 value obtained when performing Multiecho MRS to measure hepatic steatosis on 3T MRI, it may be possible to evaluate hepatic iron deposition disease at no additional cost.

## W5A-SPGI-5 EVALUATION OF RECTAL ADENOCARCINOMA USING DIFFUSION-WEIGHTED MAGNETIC RESONANCE IMAGING: A STUDY ON NEURAL INVASION IN RECTAL CANCER USING SINGLE AND MULTIPLE B-VALUES

Deshuo Dong (*Abstract Co-Author*) Nothing to Disclose
Ailian Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Wenjun Hu (*Abstract Co-Author*) Nothing to Disclose
Nan Wang (*Abstract Co-Author*) Nothing to Disclose
Liangjie Lin (*Abstract Co-Author*) Nothing to Disclose
Yue Wang (*Abstract Co-Author*) Nothing to Disclose
Chen Anliang (*Presenter*) Nothing to Disclose

### PURPOSE

Exploring the predictive ability of single and multiple b-values of apparent diffusion coefficient (ADC) in diffusion-weighted magnetic resonance imaging for neural invasion in rectal adenocarcinoma.

### METHODS AND MATERIALS

A retrospective analysis was performed on 25 rectal adenocarcinoma patients confirmed with neural invasion (NI) according to their postoperative pathology results who received pelvic 3.0 T MRI scan (Ingenia CX, Philips, Holland) in our hospital. They were divided into non-NI group (18 patients; 14 males, 4 females, mean age: 66.61 years, range: 51-88 years) and NI group (7 patients, 5 males, 2 females, mean age: 61.57 years, range: 27-75 years).Single and multiple b-value sequences obtained using IVIM sequences: 0, 800 s/mm2 (first sequence: DWI1), 0, 2000 s/mm2 (second sequence: DWI2), 0, 800, 2000 s/mm2 (third sequence: DWI3), and 200, 800, 2000 s/mm2 (fourth sequence: DWI4). Apparent diffusion coefficients (ADCs) of the rectal adenocarcinoma were calculated on ADC maps. The ADC values of different sequences were analyzed with Manny-whitey U test. The ROC curve was generated using the ADC value, and the area under curve (AUC) was calculated to analyze the diagnostic performance of using the ADC value in predicting NI of rectal adenocarcinoma.

### RESULTS

There was a statistically significant difference in the ADC value of DWI4 sequence between non-NI group (media 0.55 (0.54, 0.58) mm2/s) and NI group (media 0.66 (0.56, 0.76) mm2/s) ($p<0.05$). The AUC, maximum Youden index and diagnostic threshold of using the ADC value of DWI4 sequence for NI of rectal cancer was 0.778, 0.444 and 0.55 mm2/s, and the sensitivity and specificity were 100.0% and 44.4%, respectively. The ADC value of DWI1, DWI2 and DWI3 sequences between non-NI group and NI group were no statistically significant differences.

### CONCLUSION

ADC values determined with multiple b-values of 200, 800, 2000 s/mm2 sequence was useful for predicting neural invasion of rectal adenocarcinoma.

### CLINICAL RELEVANCE/APPLICATION

Compared with single b-value DWI sequence, ADC values determined with multiple b-values DWI sequence has a prospective clinical application in predicting the neural invasion of rectal adenocarcinoma for the treatment decision-making.

## W5A-SPGI-7 SPECTRAL CT PARAMETER COMBINATION WITH EXTRACELLULAR VOLUME FRACTION FOR PREOPERATIVELY PREDICTING COLORECTAL CANCER PERINEURAL INVASION

Ting LU (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the value of spectral CT parameters and extracellular volume fraction (ECV) in the preoperative prediction of perineural invasion (PNI) in colorectal cancer (CRC) .

### METHODS AND MATERIALS

123 CRC patients confirmed by postoperative pathology were retrospectively analyzed and all CRC patients underwent triple whole-abdomen enhanced spectral CT scans before surgery. Iodine concentration (IC), normalized IC (NIC), slope of the spectral curve (?H) at triple enhanced phase and extracellular volume fraction (ECV) were measured to compare the differences in each parameter between the PNI and nPNI groups. Parameters with statistically significant differences were included in binary logistic regression analyses to construct a combined model and to compare the performance of each parameter individually and in combination to differentiate between PNI and nPNI, and its capability was determined by the receiver operating characteristic (ROC) curves.

### RESULTS

In the stuty, a total of 123 patients were enrolled, including 71 cases of PNI and 52 cases of non-PNI (nPNI), the lesions in the PNI group were greater than those in the nPNI group, including triple enhanced phase IC, ?H, venous and delayed phase NIC and ECV, and the differences between the two groups were statistically significant ($P < 0.05$), while the differences between arterial phase NIC were showed no statistically significant difference between the two groups ($P > 0.05$). The area under the curve (AUC) of a single parameter for predicting PNI status was 0.632-0.820, and the AUC of the combined model for predicting PNI state was 0.859, and the sensitivity and specificity were 76.10% and 86.50%, respectively.

### CONCLUSION

Spectral CT parameters and ECV were able to predict PNI in CRC before surgery, which is expected to promote further research and long-term clinical application of spectral CT in preoperative prediction of PNI in CRC.

### CLINICAL RELEVANCE/APPLICATION

CRC is one of the malignancies of the digestive system with high morbidity and mortality in the world. PNI is a nerve fiber infiltrated by tumor cells in or around it, and is an independent predictor of poor prognosis in CRC. However, the gold standard for evaluating PNI is postoperative histopathological examination, which cannot guide the adjustment of preoperative treatment strategies for CRC. Spectral CT can obtain multiple parameters and has been widely used in tumor staging and treatment evaluation. ECV is mainly used for grading assessment of pancreatic and hepatic fibrosis. The purpose of this study was to investigate the value of spectral CT parameters combined with ECV in predicting PNI before CRC.

## W5A-SPGI-8 RESULTS AT 3 YEARS AFTER BEGINNING A WATCH AND WAIT PROGRAM FOR MANAGEMENT OF RECTAL CANCER IN A SINGLE CENTER

Manuel J. Moreno Rojas, MD (*Abstract Co-Author*) Nothing to Disclose
Gerard Rafart (*Abstract Co-Author*) Nothing to Disclose
Ana Otero (*Abstract Co-Author*) Nothing to Disclose
Joan Maurel Santasusanaurel (*Abstract Co-Author*) Nothing to Disclose
REINALDO MORENO ZAMBRANO (*Abstract Co-Author*) Nothing to Disclose
Yoelimar Guzman (*Abstract Co-Author*) Nothing to Disclose
Carles Perez-Serrano (*Abstract Co-Author*) Nothing to Disclose
Maria Mayoral Penalva, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Raquel Bravo (*Abstract Co-Author*) Nothing to Disclose
Juan-Ramon R. Ayuso, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the performance of MRI, endoscopy/rectoscopy (E/R) and digital rectal examination (DRE) for evaluating clinical response in patients with rectal cancer (RC) treated with chemoradiotherapy (CRT) and to describe patient evolution after 3 years of implementing a Watch and Wait (WW) program in a tertiary Hospital in Spain.

### METHODS AND MATERIALS

Between June 2020 and May 2023, 63 out of 130 patients with RC had no metastatic disease and were scheduled for CRT as initial therapy. All of them were scanned for local staging with MRI and rescanned after CRT. Additionally, 45/63 and 44/63 patients underwent E/R and DRE, respectively after CRT. Pathologic results for resected patients or at least 1 year of recurrence-free clinical follow up for patients in WW were taken as gold standard for response evaluation. Criteria for response evaluation followed the International Consensus Recommendations. Receiver operating characteristic (ROC) curves and area under the curve (AUC) data were obtained to evaluate the sensitivity and specificity of each test to identify complete responses (CR) or near complete responses (nCR) after CRT. Patients who achieved a CR or an nCR were offered to be included in the WW program if there were no other contraindications.

### RESULTS

No differences were observed in the identification of CR/nCCR vs residual tumor between the three tests. However, AUC was slightly better for E/R (0.84) than for DRE or MRI (0.78 and 0.77, respectively) Sensitivities were 87%, 71%, and 55%, and specificities were 83%, 80%, and 93%, respectively. 18/63 patients (28.3%) met criteria to be included in the WW program. 6/18 patients (33.3%) had suspicion of tumor regrowth during the first year of follow-up and were resected. Two of them still maintained a pathologic CR. Therefore, 12/18 (66.6%) showed a sustained response allowing surveillance in the first year. One additional patient experienced local regrowth at 20 months. Consequently, 11/18 (61%) patients maintained long term organ preservation management.

### CONCLUSION

Over a quarter of patients with locally advanced RC (28.3%) could be selected for a WW program. Their follow-up must be strict as only 66.6% of them remain surgery- and regrowth-free in the first year after CRT completion. There were no differences in the performance of MRI, E/R, and DRE for the evaluation of response to CRT treatment, although the sensitivity of MRI was lower than the others to identify complete clinical responders.

### CLINICAL RELEVANCE/APPLICATION

The implementation of a WW program in patients with locally advanced rectal cancer allowed us to achieve comparable results to those described in the literature, following the recommendations of the International Consensus Group.

## W5A-SPGI-9 VALUE OF PREDICTING TRADITIONAL CHINESE MEDICINE SYNDROME TYPE OF PRIMARY LIVER CANCER BASED ON LI-RADS MAGNETIC RESONANCE SIGNS AND CLINICAL FEATURES

Xirong Zhang (*Abstract Co-Author*) Nothing to Disclose
Ying Wang (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the efficacy of LI-RADS based on magnetic resonance signs and clinical features of nomogram in predicting traditional Chinese medicine (TCM) syndrome type of primary liver cancer (PLT).

### METHODS AND MATERIALS

The clinical data, TCM syndrome types and magnetic resonance characteristics of LI RADS of 147 patients with PLT were retrospectively analyzed, and randomly divided into training group and test group according to the ratio of 7:3. Siemens Skyra (VE11C) 3.0T MRI examination was performed in all patients, and T1WI scanning was performed first, DWI axis scanning parameters: b=50, 800 mm/s2, TR 6700 ms, TE 48 ms, voxel size 3.1mm × 3.1mm × 5.0mm, rotation Angle 5°, matrix 128 ×128, FOV 380 mm× 306 mm. Gd-DTPA was injected into the anterior cubital venous high pressure syringe at a rate of 2.5 ml/s and a dose of 0.1 mmol/kg. The images of arterial phase, portal vein phase and equilibrium phase were obtained by T1-weighted three dimensional (3D) gradient echo sequences at 20-30 s, 70 s and 180 s after injection of contrast agent, respectively. Firstly, the clinical data and magnetic resonance signs of LI-RADS were analyzed by single factor analysis, and the factors with statistical significance were analyzed by Logistics regression analysis to obtain independent risk factors. Construct a risk factor nomogram model and evaluate its effectiveness.

### RESULTS

There were statistically significant differences in Child-Pugh stage, Alb, AFP, AST, ALT, CEA, DBIL, TBIL, portal cancer embolus, extrahepatic metastasis, Mosaic sign, node-in-node-in-node-ring enhancement and envelope ($P < 0.05$) , as shown in Table 1 ,Table 2 . AFP, Alb, extrahepatic metastasis, Mosaic sign and halo ring enhancement were independent predictors of TCM syndrome types of PLT, as shown in Table 3. The AUC value, sensitivity, specificity and accuracy of the nomogram model in the training group and the test group were 0.835, 81.0%, 72.7%, 78.6%, 0.878, 90.5%, 88.9% and 90.0%, respectively, and the model had a high clinical net benefit, as shown in Table 4 , Figure 1 , Figure 2 , Figure 3.

### CONCLUSION

LI-RADS nomogram based on magnetic resonance signs and clinical characteristics can effectively assist in differentiating TCM syndrome differentiation of PLT, and provide an objective reference basis for it.

## CLINICAL RELEVANCE/APPLICATION

The LI-RADS nomogram model based on MRI signs and clinical indicators has a good performance in predicting the TCM syndrome types of PLT, enabling patients to obtain higher clinical benefits, providing an objective, standard and comprehensive imaging tool for TCM doctors to distinguish the syndrome types, so as to enable patients to obtain the most appropriate treatment.

# Abstract Archives of the RSNA, 2024

W5A-SPGU

**Genitourinary Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPGU-1 PREDICTING GENETIC SUBTYPES OF PROSTATE CANCER USING RADIOMICS FEATURES FROM T2-WEIGHTED PROSTATE MRI IMAGES

Hyunho Han (*Abstract Co-Author*) Nothing to Disclose
Byung Chul Kang (*Abstract Co-Author*) Nothing to Disclose
Young Taik Oh, MD (*Abstract Co-Author*) Nothing to Disclose
Dae Chul Jung, MD (*Abstract Co-Author*) Nothing to Disclose
Jongsoo Lee (*Abstract Co-Author*) Nothing to Disclose
Jongjin Yoon, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Prostate cancer presents diverse genetic subtypes, affecting prognosis and treatment response. Four genetic subtypes have been identified using public single-cell RNA sequencing data: 1) Luminal A: Adipogenic/AR (Androgen Receptor)-active/Prostate Specific Antigen-high; 2) Luminal S: Secretory/Prostatic Acid Phosphatase-high; 3) AVPC-I: Aggressive Variant Prostate Cancer-Immune-infiltrative; and 4) ACPV-M: Myc-active. This study aims to develop a machine learning model to predict these genetic subtypes using radiomic features from T2-weighted prostate MRI images, potentially aiding in personalized treatment strategies.

### METHODS AND MATERIALS

In this prospective study, 195 patients (213 target lesions) with pathologically proven prostate cancer were enrolled from July 2020 to April 2022. RNA sequencing and CIBERSORT deconvolution were used to determine probabilities for the four genetic subtypes. T2-weighted MRI images were segmented in the train set (n = 128) through consensus between reader 1 (a faculty GU radiologist) and reader 2 (a fellow GU radiologist) and in the test set (n = 85) by reader 2. PyRadiomics was employed to extract 1,422 radiomic features. Feature selection was carried out using the ICC (intraclass correlation coefficient), least absolute shrinkage and selection operator, and multiple machine learning binary classifiers were utilized for classification. The synthetic minority oversampling technique was used to address imbalanced data. Performance evaluation considered AUROC and various binary classifier metrics. Scikit-learn and Python were used for statistical analysis.

### RESULTS

ICCs in train set demonstrated excellent agreement (excellent: 88.0%, good: 1.7%, fair: 0.2%, poor: 10.1%). For distinguishing the AR inhibitor-resistant subtype (AVPC subtype), the Random Forest (RF) model showed an AUROC of 0.98 in the train set and 0.84 in the test set. For differentiating docetaxel-resistant subtypes (Luminal A and AVPC-M subtypes), the RF model exhibited an AUROC of 0.95 in the train set and 0.77 in the test set. The RF model's performance was equivalent or superior to other classifiers (adaptive boosting, support vector machine, and naive Bayesian classifier).

### CONCLUSION

Our pilot study demonstrated promising results for a radiomics model capable of predicting genetic subtypes of prostate cancer. This model demonstrated its ability to predict AR inhibitor-resistant and docetaxel-resistant genetic subtypes with AUROCs of 0.84 and 0.77, respectively.

### CLINICAL RELEVANCE/APPLICATION

MRI-based radiomics models may provide a non-invasive and cost-effective alternative to RNA sequencing, with the potential to be utilized for drug selection and prognosis prediction in personalized treatment strategies.

## W5A-SPGU-2 NON-INVASIVE FUNCTIONAL MR IMAGING FOR STAGING OF DIABETIC KIDNEY DISEASE: EVALUATION OF CORTICOMEDULLARY DIFFERENTIATION USING SSPP WITH INVERSION RECOVERY PULSE WITH MULTI-INVERSION TIME

Mitsuru Takeuchi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Higaki, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tsutomu Tamada, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akihiko Kanki, MD (*Abstract Co-Author*) Nothing to Disclose
Yoshihiko Fukukura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroki Nakamura (*Abstract Co-Author*) Nothing to Disclose
Yu Ueda, PhD (*Abstract Co-Author*) Nothing to Disclose
Akira Yamamoto, MD, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Despite the complex pathology of diabetic kidney disease (DKD), staging diagnosis is currently only evaluated based on urinary albumin and GFR. Accurate assessment requires evaluation with multiple parameters. The purpose of this study is to evaluate the staging of DKD using functional MR imaging.

**METHODS AND MATERIALS**

A total of 122 cases, including 23 healthy volunteers and 99 diabetic patients, were studied. Diabetic patients were classified into 5 groups; low risk group (n=27), moderate risk group (n=19), high risk group (n=12), very high risk group (n=22), and highest risk group (n=19) based on the KDIGO 2022 Clinical Practice Guideline for Diabetes Management in CKD. All cases were imaged with a 3 Tesla MRI for T1 value, T2 value, and steady-state free precession with inversion recovery pulse with multi-inversion time (SSFP with IR pulse using multi TI) (TI=1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800 msec). Corticomedullary differentiation (CMD) was calculated by "signal intensity (SI) of cortex / SI of medulla" for all images. The TI with the highest CMD value was adopted as the optimal inversion time (TI) for SSFP with IR pulse with multi TI. CMD values were compared among the staging classifications.

**RESULTS**

Significant differences were observed in T1 value between low risk group (0.78±0.03) vs. moderate risk group (0.82±0.04) (P<0.001) and moderate risk group (0.82±0.04) vs. high risk group (0.88±0.04) (P=0.001), in T2 value between healthy group (0.97±0.06) vs. low risk group (1.01±0.09), and in SSFP with IR pulse on optimal TI between healthy group (4.66±1.21) vs. low risk group (5.32±1.25) (P=0.016), low risk group (5.32±1.25) vs. moderate risk group (4.11±1.36) (P=0.004), very high risk group (2.79±0.82) vs. highest risk group (2.22±0.93) (P=0.011).

**CONCLUSION**

In DKD, increased cortical water content can be observed in the early stage due to glomerular hypertension and hyper filtration. The increase in CMD of T2 value is thought to reflect this phenomenon. In accordance with DKD more progresses, glomerulosclerosis and interstitial fibrosis are observed in the cortex. This result is thought to be reflected in the increase in CMD of T1 value. Since SSFP signal is T2/T1, it is reflect both the increase in water content in the early stage and the fibrosis in the progressive stage. By adopting the optimal TI with the largest CMD, the staging of DKD can be evaluated more sensitive. SSFP with IR pulse on optimal TI has the potential to be a new parameter for non-invasive evaluation of DKD.

**CLINICAL RELEVANCE/APPLICATION**

Urinary albumin and GFR only assess glomerular function, while MRI is thought to reflect not only glomerular changes but also changes including the interstitial change and may be a potential new parameter for evaluating the DKD.

## W5A-SPGU-3 NOVEL ADAPTIVE RADIOMIC FEATURE ENGINEERING METHODS FOR CLEAR CELL RENAL CELL CARCINOMA IMMUNE MICROENVIRONMENT PREDICTION

Vinay A. Duddalwar, MD, FRCR (*Abstract Co-Author*) Consultant, Radmetrix Inc;Consultant, DeepTek Inc;Consultant, Cohere Inc;Consultant, Westat Inc;Research Grant, Samsung Electronics Co, Ltd
Steven Cen, PhD (*Abstract Co-Author*) Nothing to Disclose
C. C. Jay Kuo (*Abstract Co-Author*) Nothing to Disclose
William Dean Wallace (*Abstract Co-Author*) Nothing to Disclose
Yixing Wu (*Abstract Co-Author*) Nothing to Disclose
Alexander Shieh, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Understanding the tumor immune microenvironment (TIME) in clear cell renal cell carcinoma (ccRCC) is crucial for patient selection and response assessment of emerging immunotherapies. Radiomic signatures from diagnostic imaging can be biomarkers for assessing ccRCC TIME. However, the prediction performance on specific TIME measurements needs to be improved in the existing literature. In this work, we investigated two markers that were shown to predict clinical outcomes: (1) elevated CD68+/PanCK+ cell ratio and (2) elevated PD1+CD8+/CD8+ ratio. We provided a baseline with a conventional radiomics pipeline and then used novel adaptive feature engineering strategies to enhance the prediction performance.

**METHODS AND MATERIALS**

A total of 78 primary ccRCC tumors from contrast-enhanced multiphase CT were segmented, and their radiomic signatures were generated using a phantom-validated pipeline. The tumor specimens obtained via nephrectomy were stained with PanCK, CD8, PD1, and CD68 using the Opal multiplex immunofluorescence (mIF) kit. After cell and tissue segmentation using the inForm software, the intratumoral CD68+/PanCK+ ratio and PD1+CD8+/CD8+ ratio were calculated. The novel feature engineering pipeline includes three stages: the redundancy removal stage to exclude highly correlated features, the discriminant feature test (DFT) stage to select important features, and the least-square normal transform (LNT) to generate new feature combinations. We compare the performance of this novel pipeline to conventional direct prediction by random forest. All experiments were conducted with five-fold cross-validation, and AUROC was used to compare model performance.

**RESULTS**

From mIF staining, we identified 3.2 million cells using our computational pathology analysis. After a grid search of DFT and LNT parameters (the number of selected and new features), AUROC improved from baseline 0.73 (95% CI: [0.60, 0.87]) to 0.85 (95% CI: [0.76, 0.93]). For the CD68+/PanCK+ experiment, the performance improved from 0.77 (95% CI: [0.63, 0.91]) to 0.79 (95% CI: [0.59, 1.00]).

**CONCLUSION**

Using the novel adaptive feature engineering strategies, we improved the performance of radiomic prediction to ccRCC TIME. These fast and data-efficient feature selection and generation techniques have been used in general computer vision tasks and can now be helpful in radiomic predictions.

**CLINICAL RELEVANCE/APPLICATION**

With a better performing and more robust CT radiomics pipeline, predicting ccRCC TIME non-invasively with routine diagnostic imaging can become a reality. These image-based biomarkers can provide dynamic TIME information for clinical decision-making in the future.

## W5A-SPGU-4 NOVEL ANATOMICAL OBSERVATIONS OF PENILE VENOUS DRAINAGE IN MEN WITH REFRACTORY POST-PROSTATECTOMY ERECTILE DYSFUNCTION

Sebastian Flacke, MD, PhD (*Abstract Co-Author*) Consultant, BTG International Ltd;Consultant, Surefire Medical, Inc;Consultant, Koninklijke Philips NV;Consultant, XACT Robotics Ltd
James Trussler, MD (*Abstract Co-Author*) Nothing to Disclose

Andrew McCullough, MD (*Abstract Co-Author*) Nothing to Disclose
Mohanned Alnammi, MD (*Abstract Co-Author*) Nothing to Disclose
Karl Benz, MD, BA (*Presenter*) Nothing to Disclose

**PURPOSE**

To describe penile venous leak anatomy for the first time in men with medication refractory erectile dysfunction after radical prostatectomy.

**METHODS AND MATERIALS**

A prospectively maintained institutional CT cavernosography database was queried for men with medication refractory erectile dysfunction after radical prostatectomy and cystoprostatectomy. Exclusion criteria included a history of nodal positive disease at prostatectomy, pelvic radiation, and penile surgery. Data were collected with regards to demographics, comorbidities, and the procedure itself. 3D image reconstruction was used to anatomically define the venous leak pathways.

**RESULTS**

18 patients met inclusion criteria, 17 (94%) demonstrated venous leak. 16 men (89%) had venous leak through the superficial veins into the external pudendal vein and saphenofemoral system. 16 men (89%) had venous leak into the deep pelvic veins including internal pudendal and internal iliac veins. 15 men (83%) demonstrated venous leak from the corpus cavernosum into the corpus spongiosum, of which 14 (78%) communicated directly with the external pudendal system.

**CONCLUSION**

This study uncovers the uniquely novel finding that venous leak from the spongiosum communicates directly with the external pudendal system in 78% of patients in this population.

**CLINICAL RELEVANCE/APPLICATION**

Not only is this the first known study to anatomically describe venous leak anatomy in patients with medication refractory erectile dysfunction after radical prostatectomy, it uncovers a unique venous leak pathway and sets the stage for future prospective studies comparing venous anatomy pre- and post-radical prostatectomy. It raises numerous questions for future study. Is the newly described pathway a result of the procedure? Could the novel leak pathway reside outside the normal veno-occlusive mechanism and contribute to erectile dysfunction itself? Can pre-operative venous drainage variation predict those getting post-radical prostatectomy venous leak and severe ED? Answering such questions, among others, in future studies could alter the pre-operative workup, optimize pre-operative counseling, and deepen the understanding of the pathophysiology of severe erectile dysfunction after radical-prostatectomy.

## W5A-SPGU-5 NORMATIVE CURVES OF HEALTHY KIDNEY VOLUME FOR THE ADULT POPULATION: AN UPDATE USING AI-BASED KIDNEY VOLUMETRY

Lesley Cockmartin, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Konstantinos Koukoutegos (*Abstract Co-Author*) Nothing to Disclose
Hilde Bosmans, PhD (*Abstract Co-Author*) Stockholder, Qaelum NV;Research Grant, Siemens AG;Research Grant, General Electric Company
Frederik De Keyzer (*Abstract Co-Author*) Nothing to Disclose
Liesbeth De Wever (*Abstract Co-Author*) Nothing to Disclose
Richard 's Heeren, MMEd (*Presenter*) Nothing to Disclose

**PURPOSE**

Total Kidney Volume (TKV) holds important clinical information about kidney function and patient's health. AI-based methods now enable accurate TKV measurement. Comparing TKV to 'healthy' kidney volume holds promise for improved diagnostic performance and potential automated detection of incidental findings. This study aims to establish normative curves of healthy TKV from abdominal CT scans and accounting for patient demographic and clinical data.

**METHODS AND MATERIALS**

This retrospective study included abdominal CT scans performed on the adult population (19-99 years) in our emergency department over one year. Medical files were reviewed chronologically, applying exclusion criterium to ensure no kidney pathologies were present. Cases were included until each 10-year age group reached 29 cases, with fewer in the >90-year group. An in-house developed 3D UNet convolutional neural network was applied to the CT scans to calculate the TKV. The AI predictions were verified for accuracy across all CT slices. Demographic and clinical data were collected from patient files. The relationship between these parameters and TKV was assessed using null hypothesis testing (with p-value) and linear regression for the continuous variables and univariate analysis of variance (ANOVA) for the nominal variables, with R2 values reported.

**RESULTS**

In total, 204 patients (66 men,138 women) were selected with mean age of 56 years, and mean TKV of 297 mL (standard deviation 69 mL). Significant correlations with TKV were found for age ($p<0.001$, $R^2=0.14$), length ($p<0.001$, $R^2=0.33$), weight ($p<0.001$, $R^2=0.24$), BMI ($p=0.027$, $R^2=0.031$), BSA ($p<0.001$, $R^2=0.32$), urea ($p<0.001$, $R^2=0.055$), and eGFR ($p<0.001$, $R^2=0.170$). Mean TKV differed significantly by gender ($p<0.001$, $R^2=0.14$), smoking ($p=0.002$, $R^2=0.056$), diuretic use ($p<0.001$, $R^2=0.072$), and vascular disease ($p=0.008$, $R^2=0.034$). The significant relationship with chronic hypertension ($p=0.022$, $R^2=0.032$) disappeared when length and weight were accounted for. Most blood values did not correlate. TKV could be predicted from TKV = -248.51 - 0.061 A2+ 5.86 A + 2.28 L + 0.97 W - 23.59 S, where A=age (years), L=height (cm), W=weight (kg) and S = 1 for women and 0 for men.

**CONCLUSION**

Utilizing an AI-based automatic kidney segmentation tool allowed, with a reasonable effort, to establish a normative curve equation for healthy TKV that aligns with previous scientific literature.

**CLINICAL RELEVANCE/APPLICATION**

Certain diseases cause changes in TKV. Comparing the patient's AI-based automatic TKV evaluation with their predicted healthy TKV, may allow to detect abnormalities in an early stage.

## W5A-SPGU-7 PELVIC ROSETTA CLASSIFICATION (PRC) PROJECT: AN INTERDISCIPLINARY PROPOSAL FOR A LYMPH NODE MAP OF THE PELVIS IN PROSTATE CANCER

Matthias J. Eiber, MD (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter W. Schlemmer, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG

Alexander Schlaefer (*Abstract Co-Author*) Nothing to Disclose
Gernot Ortner (*Abstract Co-Author*) Nothing to Disclose
Xenia Hoderlein (*Abstract Co-Author*) Nothing to Disclose
Christoph Wuernschimmel (*Abstract Co-Author*) Nothing to Disclose
Dirk Beyersdorff, MD (*Abstract Co-Author*) Nothing to Disclose
Lale Umutlu, MD (*Abstract Co-Author*) Consultant, Bayer AG;Speaker, Siemens AG;Research funded, Siemens AG
Ken Herrmann (*Abstract Co-Author*) Co-founder, SurgicEye GmbH;Stockholder, SurgicEye GmbH;Consultant, Sofie Biosciences;Consultant, Ipsen SA;Research Grant, Ipsen SA;Consultant, Siemens AG;Research Grant, Advanced Accelerator Applications SA;
Irene A. Burger (*Abstract Co-Author*) Nothing to Disclose
Agostino Mattei (*Abstract Co-Author*) Nothing to Disclose
Markus Graefen (*Abstract Co-Author*) Nothing to Disclose
Tobias Maurer (*Abstract Co-Author*) Nothing to Disclose
Georg Salomon, MD (*Abstract Co-Author*) Nothing to Disclose
Isabel Rauscher (*Abstract Co-Author*) Nothing to Disclose
Lars Budaeus (*Abstract Co-Author*) Nothing to Disclose
Markus Sauer, MD (*Abstract Co-Author*) Nothing to Disclose
Francesco Barbato (*Abstract Co-Author*) Nothing to Disclose
Lars Schimmoeller, MD (*Abstract Co-Author*) Nothing to Disclose
Lennart Maack (*Abstract Co-Author*) Nothing to Disclose
Ines Maric (*Abstract Co-Author*) Nothing to Disclose
Daniel F. Koehler, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The Pelvic Rosetta Classification (PRC) Project was initiated to create a landmark-based lymph node map of the pelvis for patients with prostate cancer (PCa) planned for surgical intervention. Aim of this new system is to harmonize communication between imaging specialists and urologists, and to facilitate localization of suspicious extraprostatic lesions during surgery.

**METHODS AND MATERIALS**

The project lead defined anatomical margins of eight pelvic (external iliac, obturator fossa cranial/caudal, dorsal internal iliac, vesico-prostatic pedicle, mesorectal, presacral, retropubic) and two extrapelvic (common iliac, intercommon) lymph node areas using anatomical landmarks that are consistently recognizable on MRI, CT, and intraoperatively. Regions were contoured by 21 experts on five representative axial contrast-enhanced CT images of a patient with PCa, depicting all defined areas. Contours were evaluated qualitatively and quantitatively. The mean Sųrensen-Dice coefficient and the corresponding standard deviation (SD) were calculated in comparison to a baseline contour that was created by the project lead, which was not available to the experts at the time of contouring to analyze the reproducibility of the proposed definitions.

**RESULTS**

Strong agreement between experts was found for the lymph node regions of the mesorectal and retropubic spaces. Largest variations were observed for regions bordering the peritoneum and without a continuously identifiable margin on CT (e.g., obturator fossa). The mean Sųrensen-Dice coefficients were lower for the vesico-prostatic pedicle (0.59, SD 0.27), obturator fossa (caudal: 0.54, SD 0.22; cranial: 0.67, SD 0.19), presacral (0.6, SD 0.17), and dorsal internal (0.64, SD 0.17) areas compared to the intercommon (0.71, SD 0.26), external (0.75, SD 0.2), common (0.77, SD 0.15), retropubic (0.83, SD 0.27), and mesorectal (0.86, SD 0.24) regions. In the first consensus meeting, the areas "obturator fossa" (cranial and caudal), "internal", and "vesico-prostatic pedicle" were revised, and the inguinal lymph node region was defined. Furthermore, techniques to differentiate the intraperitoneal and extraperitoneal spaces were elaborated (e.g., identifying the course of mesenteric vessels).

**CONCLUSION**

The proposed lymph node map of the pelvis for PCa already demonstrates fair reproducibility. Further development and validations are ongoing to ensure the successful implementation of the new classification in clinical practice.

**CLINICAL RELEVANCE/APPLICATION**

A multidisciplinary consensus-based map of pelvic lymph nodes in PCa will facilitate communication and improve patient care in individuals with suspected locoregional PCa metastases undergoing surgical treatment.

## W5A-SPGU-8 PERINEPHRIC MYXOID PSEUDOTUMOR OF FAT (PMPF): A RELATIVELY NEW ENTITY

Mark D. Sugi, MD (*Abstract Co-Author*) Consultant, Nextrast, Inc;Author with royalties, RELX
Kumaresan Sandrasegaran, MD (*Abstract Co-Author*) Nothing to Disclose
Alecio F. Lombardi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Given the limited literature on this subject, we wanted to identify the imaging features of PMPF in a large cohort.

**METHODS AND MATERIALS**

Institutional radiology and pathology databases were queried for PMPF for the period January 2010 to December 2023. Of 22 identified subjects, two were excluded due to non-availability of CT or MR images and five due to lack of pathological confirmation. The study cohort comprised of 15 subjects (males = 11) with median age of 59 years (range 26 to 83 years, involving a transplant in the youngest patient). Two abdominal radiologists in consensus reviewed all relevant CT and MRI images.

**RESULTS**

Eighteen tumors were analyzed since three subjects had bilateral lesions. The tumors were located at the renal hilum (n=15) or perinephric space (n=3). Two imaging patterns were seen: hazy ill-defined predominantly fatty mass (n=7) or a soft tissue mass (n=11) with variable fat content (estimated 30-90%). The tumors ranged in size from 3.8 to 18.7 cm (median 7.5 cm). The median precontrast and postcontrast CT densities were -21 and 42 Hounsfield units, respectively. Eight (n=8) cases had MR images available that showed areas of increased T1/T2 signal hyperintensity within the tumors consistent with myxoid content. Signal loss on opposed phase in four tumors corresponded to areas of fat density on CT images. One case had PET/CT images available which did not show FDG uptake within the tumor. Mild to moderate delayed enhancement was seen in all six tumors with multiphasic studies. The perihilar tumors encased central renal vessels without occlusion or thrombus. Mild hydronephrosis was seen in 3 of 18 kidneys. Most (9 of 13) of the affected native kidneys and all transplant kidneys (n=5) showed poor contrast enhancement. Slow progressive growth was seen in all 7 tumors with longer than 1-year follow up. Pathology showed diffuse fibromyxoid stroma, spindle cells and fat content. Negative MDM2 gene amplification on FISH testing excluded liposarcoma.

## CONCLUSION

PMPF may be considered in the diagnosis of tumors with soft tissue and fat components situated at the renal hilum or perinephric space. The delayed contrast enhancement, relative lack of mass effect for size, and poor function of affected kidney are diagnostic features.

## CLINICAL RELEVANCE/APPLICATION

The differential diagnosis among fat-containing retroperitoneal masses includes well known benign etiologies such as fat necrosis, perirenal lipomatosis and angiomyolipoma, as well as malignant ones among which liposarcoma is the most common. Perinephric myxoid pseudotumor is a relatively new entity that may arise from the fat surrounding native and transplanted kidneys. Knowing its imaging characteristics is important to narrow the differential diagnosis and exclude liposarcoma.

# W5A-SPGU-9 NORMALIZATION OF IODINE DENSITY IN RENAL CELL CARCINOMA AT CONTRAST-ENHANCED DUAL-ENERGY CT WITH DIFFERENT IODINE LOADS: A POTENTIAL INDICATOR TO MONITOR TUMOR RESPONSE TO CHEMOTHERAPY

Etsuko Tate, MD (*Abstract Co-Author*) Nothing to Disclose
Shingo Harashima (*Abstract Co-Author*) Nothing to Disclose
Yun Shen, PhD (*Abstract Co-Author*) Employee, General Electric CompanyResearcher, General Electric Company
Isao Tanaka (*Abstract Co-Author*) Nothing to Disclose
Toshiya Kariyasu (*Abstract Co-Author*) Nothing to Disclose
Hidenori Yamaguchi (*Abstract Co-Author*) Nothing to Disclose
Hitoshi Takeuchi, MD (*Abstract Co-Author*) Nothing to Disclose
Makiko Nishikawa, MD (*Abstract Co-Author*) Nothing to Disclose
Haruhiko Machida, MD (*Abstract Co-Author*) Nothing to Disclose
Yuta Hirose, MSc (*Abstract Co-Author*) Nothing to Disclose
Rika Fukui (*Abstract Co-Author*) Nothing to Disclose
Wakana Samejima (*Presenter*) Nothing to Disclose

## PURPOSE

Response of renal cell carcinoma (RCC) to chemotherapy, such as molecular targeted therapy, can be accurately monitored by quantifying intra-tumor iodine density at contrast-enhanced dual-energy CT (ceDECT), even complicated by intra-tumor hemorrhage. We retrospectively performed a pilot study to assess feasibility of normalizing iodine density in RCC at ceDECT with different iodine loads based on the patient's estimated glomerular filtration rate (eGFR) as a potential indicator to monitor the tumor response.

## METHODS AND MATERIALS

From February 2018 through March 2024, clear cell RCC (ccRCC) was postoperatively diagnosed in 54 patients and papillary RCC (pRCC), 7 patients who all underwent ceDECT during the nephrographic phase using routine (600 mgI/kg), 75% (450 mgI/kg), or 50% iodine load (300 mgI/kg) based on his/her eGFR with a 256-detector DECT scanner (Revolution CT, GE). We used deep learning reconstruction (TrueFidelity, GE) to generate 1.25-mm-slice iodine/water density images; placed regions of interest to quantify iodine density in the most avidly enhanced area of each RCC and in the abdominal aorta at the same level; divided the iodine density in each RCC by that in the aorta to normalize the intra-tumor iodine density. In patients with ccRCC, Kruskal-Wallis test with Bonferroni correction was used to compare the intra-tumor iodine density with/without the normalization among the different iodine loads. Mann-Whitney U test was used to compare the normalized iodine density between ccRCC and pRCC. A receiver operating characteristic (ROC) analysis was adopted to compare diagnostic performance to differentiate ccRCC from pRCC between the iodine density with/without the normalization.

## RESULTS

The routine, 75%, and 50% iodine loads were administered in 18, 22, and 14 patients with ccRCC, respectively. Whereas the intra-tumor iodine density decreased from the routine to 75% to 50% iodine load with significant differences between the routine and 50% iodine loads and between the routine and 75% iodine loads ($P < 0.001$ for both), the normalized intra-tumor iodine density was comparable among the different iodine loads ($P = 0.252$). The normalized iodine density was significantly greater in ccRCC ($0.82 \pm 0.21$) than in pRCC ($0.36 \pm 0.15$) ($P < 0.001$) and increased area under the ROC curve from 0.90 to 0.96.

## CONCLUSION

The normalized iodine density in RCC at ceDECT may be feasible to accurately monitor the tumor response to chemotherapy because it is independent of administered iodine load and more sensitive to the histological difference.

## CLINICAL RELEVANCE/APPLICATION

The normalized iodine density in RCC at ceDECT can accurately monitor tumor response to chemotherapy even with reduced iodine load in patients with renal impairment.

# Abstract Archives of the RSNA, 2024

W5A-SPHN

**Head & Neck Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPHN-3 PERI-OPTIC NERVE ENHANCEMENT AS AN IMAGING FINDING AFTER RADIATION THERAPY

Kei Yamada, MD, PhD (*Abstract Co-Author*) Research funded, Fukushima SiC Applied Engineering, Inc;Research funded, Nihon Medi-Physics Co, Ltd;Research funded, PDR Network, LLC;Research funded, Doctor-NET. Inc
Katsumi Hayakawa, MD (*Abstract Co-Author*) Nothing to Disclose
Kentaro Akazawa (*Abstract Co-Author*) Nothing to Disclose
Keita Watanabe, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Kentaro Yuba, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Radiation therapy that includes the optic nerve in the irradiation field can occasionally lead to severe complications such as optic neuropathy. For the early detection of such damage, knowledge of post-radiotherapy imaging findings will be important. The aim of this study is to investigate the imaging findings of the optic nerve and its surrounding structures following radiotherapy.

### METHODS AND MATERIALS

This is a retrospective study that was carried out for cases between April 2019 and March 2024, targeting patients who received contrast-enhanced MRI following radiation therapy for periorbital malignancies at our institution, conducted as part of routine follow-up to check for recurrence. A total of sixteen patients were included with histological types: maxillary sinus carcinoma (n = 8), ethmoid sinus carcinoma (n = 3), nasal cavity malignant melanoma (n = 2), esthesioneuroblastoma (n = 2), and nasal cavity sarcoma (n = 1). Radiation treatment modalities consisted of proton beam therapy as monotherapy in 2 cases and chemoradiotherapy in 12 cases, delivering doses ranging from 64 Gy to 81.4 Gy. Additionally, postoperative radiation involved 30 Gy of proton beam therapy in 2 cases. Image evaluation around the optic nerve was performed conjointly by two experienced radiologists. The protocol included contrast enhanced 2D coronal T1-weighted images or 3D sagittal T1-weighted images with fat suppression. The optic nerve assessment included unilateral evaluation in cases of maxillary sinus carcinoma and lacrimal gland apocrine adenocarcinoma, with bilateral evaluation in all other instances, cumulatively assessing 24 optic nerve sides.

### RESULTS

Out of 24 sides examined, enhancement around the optic nerve was observed in 7 sides. Furthermore, enhancement within the optic nerve was noted in 4 sides. Naturally, all sites showing enhancement were within the irradiation field. The abnormal enhancement was observed post-radiation therapy at 627 ± 552 (median ± SD), range 78-1364 days. There was no significant difference in radiation dose between sites with and without abnormal enhancement ($p < 0.05$). A retrospective review of medical records revealed that one case with abnormal enhancement of the left optic nerve was diagnosed with a relative afferent pupillary defect by an ophthalmologist. However, no complaints of visual acuity or field deficits were reported in the other cases.

### CONCLUSION

Post-radiotherapy imaging can exhibit perineuritic-like enhancement around the optic nerve, which is often subclinical with few self-reported symptoms.

### CLINICAL RELEVANCE/APPLICATION

The knowledge of post radiation imaging is vital for radiologists to avoid misdiagnosis and to ensure proper patient management.

## W5A-SPHN-5 A NOVEL 3D VISUALIZATION AND ASSESSMENT TOOL IMPROVES SURGICAL PLANNING OF NECK DISSECTION

Tommaso D'Angelo, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leona Alizadeh, MD (*Abstract Co-Author*) Nothing to Disclose
Ibrahim Yel, MD (*Abstract Co-Author*) Nothing to Disclose
Philipp Thoenissen (*Abstract Co-Author*) Nothing to Disclose
Leon D. Gruenewald, MD (*Abstract Co-Author*) Nothing to Disclose
Mirela Dimitrova (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Vitali Koch, MD (*Abstract Co-Author*) Nothing to Disclose
Christian Booz, MD (*Presenter*) Speaker, Siemens AG

### PURPOSE

To evaluate the impact of a dedicated software tool enabling 3D measurements and visualization of MRI/CT on surgical planning of neck dissection.

## METHODS AND MATERIALS

In this prospective study, a total of 96 patients (mean age 68 ± 13 years, range 39 - 101 years) with oral squamous cell carcinoma and preoperative MRI/CT were included. Dedicated postprocessing software was used for 3D visualization of primary tumour and cervical lymph node metastases including tumor volumetry and 3D distance and angulation measurements. Data such as tumour volume, 3D distances to cervical lymph node metastases and their cervical 3D localization as well as the corresponding freely rotatable colored 3D map were collected and shown to surgeons. Board-certified surgeons (n=3) rated software-based data concerning staging results display, diagnostic confidence and surgical work step planning of neck dissection compared to standard MRI/CT images using 5-pont-Likert scales. In addition, correlation analyses between tumor volume / T parameter and lymph node metastasis distance were performed using Spearman correlation.

## RESULTS

Colored 3D visualization and tumor volumetry as well as 3D distance and angulation measurements received superior ratings concerning staging results display, diagnostic confidence and surgical work step planning of neck dissection compared to standard MRI/CT images (all criteria, $p<.001$). In 9 cases surgical work steps of neck dissection were modified from standard approach due to information provided by the 3D tool. Correlation analyses showed low correlation between the volume of the primary tumor and the distance of cervical lymph node metastases with a Spearman correlation coefficient r of 0.374 ($p < .001$). No correlation was found between the volume of lymph node metastases and their distance ($r = 0.054$, $p = 0.601$) and between the distance and the T parameter of the TNM classification ($r = 0.157$, $p = 0.126$).

## CONCLUSION

A novel 3D visualization and assessment tool improves significantly surgical planning of neck dissection and leads directly to surgical work step modifications of neck dissection in certain cases compared with standard preoperative imaging.

## CLINICAL RELEVANCE/APPLICATION

Surgical planning of neck dissection can be improved by application of a novel 3D visualization and assessment tool for preoperative MRI/CT scans.

RSNA 2024
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# Abstract Archives of the RSNA, 2024

W5A-SPIN

**Imaging Informatics Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPIN-2 ASSOCIATION OF VISUAL ACUITY LOSS WITH LOCALIZED MAGNETIC RESONANCE IMAGING FEATURES IN ANTERIOR VISUAL PATHWAY AMONG CHILDREN WITH NF1-OPG

Roger Packer (*Abstract Co-Author*) Research Consultant, Bayer AG
Abhijeet Parida (*Abstract Co-Author*) Nothing to Disclose
Xinyang Liu (*Abstract Co-Author*) Nothing to Disclose
Michael Fisher (*Abstract Co-Author*) Nothing to Disclose
Marius G. Linguraru, DPhil, MSc (*Abstract Co-Author*) Co-founder, PediaMetrix Inc
Holger R. Roth, PhD (*Abstract Co-Author*) Employee, NVIDIA Corporation;Researcher, NVIDIA Corporation
Syed M. Anwar, PhD (*Abstract Co-Author*) Nothing to Disclose
Robert A. Avery, DO (*Abstract Co-Author*) Research Consultant, Takeda Pharmaceutical Company Limited
Yucheng Tang, PhD (*Abstract Co-Author*) Nothing to Disclose
Zhifan Jiang, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Half of children with optic pathway gliomas secondary to neurofibromatosis type 1 (NF1-OPG) are at risk for visual acuity (VA) loss. NF1-OPGs manifest along the anterior visual pathway (optic nerve, chiasm, tract; AVP), where the overall shape and volume of AVP from magnetic resonance imaging (MRI) have been recently associated with VA loss. To investigate the added benefits of localized MRI features within the optic nerves (ONs) and chiasm, we introduce an automated deep-learning framework for VA loss detection through volumetric and radiomic analysis of ONs, chiasm, and AVP.

### METHODS AND MATERIALS

MRIs of 60 children with NF1-OPG from Site A (GE platform) and 75 from Site B (Siemens platform) were collected. MRI sequences included T1 (0.9×0.78×0.78 mm3), T2 (0.49×0.55×2 mm3) and T2-FLAIR (0.43×0.43×4.8 mm3). Volumetric ground truth was defined by expert delineation of the AVP. Neuro-ophthalmic evaluation identified VA loss (>= 0.2 LogMAR decline) in 52/135 children. Automatic AVP segmentation was performed using the Swin transformer network. The ONs and chiasm were segmented through template-based registration. We used brain volume, tumor location, child age, and 1,172 radiomic features to detect VA loss using support vector machines. Sequential feature selection based on sensitivity and univariate statistical tests (ANOVA) identified risk factors for VA loss. We initially assessed VA loss detection based on AVP alone and then investigated whether more detailed analysis on ONs and chiasm offered improvement.

### RESULTS

The average Dice volumetric overlap for automatic AVP segmentation was 0.791±0.075, consistent with the reported inter-observer variability for manual AVP segmentation (0.75±0.06). Cross-validated assessment of VA loss detection using AVP alone resulted in accuracy, sensitivity, specificity, and AUROC of 0.865, 0.647, 0.971, 0.728, respectively. Analyzing ONs and chiasm led to balance and improvements in these metrics, resulting in 0.865, 0.882, 0.857, 0.899, respectively. Significant risk factors were maximal image intensity and gray level run length entropy in T2-FLAIR for ONs, and image intensity range in T2-FLAIR for chiasm. The increase in AUROC was statistically significant (DeLong’s test, p=0.028).

### CONCLUSION

The use of deep learning to analyze MRI reveals that newly identified localized radiomic features within the ONs and chiasm are associated with VA loss. These features have improved predictive power for VA loss detection.

### CLINICAL RELEVANCE/APPLICATION

Reliable and relevant NF1-OPG MRI features can assess the risk of VA loss. If validated through larger data and longitudinal studies, this framework has the potential to guide the treatment decisions for children with NF1-OPGs.

## W5A-SPIN-3 ASSESSING THE PERFORMANCE OF AI ASSISTANCE FOR PROSTATE MULTIPARAMETRIC MRI: A TWO-CENTER STUDY INVOLVING EXPERIENCED AND LESS-EXPERIENCED RADIOLOGISTS

Xiaoying Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Wenpeng Huang (*Abstract Co-Author*) Nothing to Disclose
Kexin Wang (*Abstract Co-Author*) Nothing to Disclose
Zhaonan Sun (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the performance of both experienced and less-experienced radiologists in detecting clinically significant prostate cancer (csPCa) with and without the assistance of an AI algorithm.

### METHODS AND MATERIALS

A total of 900 multiparametric MRI datasets were retrospectively collected from two hospitals. Systematic combined with targeted biopsy served as the reference standard. Ten less-experienced radiologists and six experienced radiologists participated, with cases equally distributed among less-experienced radiologists. Additionally, 90 cases were randomly assigned to each experienced radiologist. Each case underwent two readings: one without AI assistance and one with AI assistance. The area under the curve (AUC), sensitivity, specificity, positive predictive value, and negative predictive value were compared between the two reading modes. Reading time and diagnostic confidence were also assessed, alongside inter-reader consistency among experienced radiologists across both reading modes.

### RESULTS

AI assistance significantly improved lesion-level sensitivity in detecting csPCa exclusively among less-experienced radiologists, elevating it from 0.78 to 0.88 ($P < 0.001$). Furthermore, with AI assistance, the AUC for detecting csPCa by less-experienced radiologists increased from 0.84 to 0.93 ($P < 0.001$) at the sextant level and from 0.84 to 0.89 ($P < 0.001$) at the patient level. Similarly, experienced radiologists exhibited an enhanced AUC in detecting csPCa, rising from 0.82 to 0.91 ($P < 0.001$) at the sextant level and from 0.91 to 0.94 ($P = 0.02$) at the patient level with AI assistance. AI-assisted readings resulted in reduced reading time (316 s vs. 164 s, $P < 0.001$) and increased diagnostic confidence (5 [4,5] vs. 5 [4,5], $P < 0.001$) across all experience levels, along with improved consistency among experienced radiologists (0.53 vs. 0.61, $P = 0.040$).

### CONCLUSION

AI-assisted reading improved the diagnostic performance of detecting csPCa on multiparametric MRI for both less-experienced and experienced radiologists, with greater benefits observed among less-experienced radiologists.

### CLINICAL RELEVANCE/APPLICATION

This study highlights the transformative potential of AI-assisted reading in improving the diagnostic accuracy and efficiency of detecting csPCa on multiparametric MRI. It emphasizes the particular benefits for less-experienced radiologists.

## W5A-SPIN-4 DEEP LEARNING-BASED BIOLOGICAL AGE ESTIMATION FROM MRI PREDICTS MAJOR ADVERSE CARDIOVASCULAR EVENTS IN THE GENERAL POPULATION

Michael T. Lu, MD, MPH (*Abstract Co-Author*) Stockholder, NVIDIA Corporation;Institutional Research Grant, Kowa Company, Ltd;Institutional Research Grant, AstraZeneca PLC;Stockholder, Advanced Micro Devices, Inc;Stockholder, Intel Corporation
Vineet K. Raghu, PhD (*Abstract Co-Author*) Nothing to Disclose
Fabian Bamberg, MD, MPH (*Abstract Co-Author*) Speakers Bureau, Bayer AG;Speakers Bureau, Bracco Imaging;Speakers Bureau, Siemens AG;Research Grant, Siemens AG
Jakob Weiss, MD (*Abstract Co-Author*) Nothing to Disclose
Susanne Rospleszcz (*Abstract Co-Author*) Nothing to Disclose
Marco Reisert (*Abstract Co-Author*) Nothing to Disclose
Matthias Jung, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Chronological age is an imperfect measure of aging. Measures of biological age, which reflect an individual's overall health status, could provide a more nuanced understanding of aging and improve medical decision-making. We propose a new deep learning framework (MRI-Age) for estimating biological age from MRI and investigate its value in predicting major adverse cardiovascular events (MACE) in the general population.

### METHODS AND MATERIALS

MRI-Age was developed using data from 30,389 asymptomatic individuals (20-75 years; 44.2% female) from the German National Cohort (NAKO): In Step 1, a model was trained to segment body composition (BC) including subcutaneous (SAT), visceral (VAT), intramuscular adipose tissue (IMAT) and skeletal muscle (SM) from the 1st to 5th lumbar vertebra. In Step 2, a second model was trained that takes the 3D BC segmentation masks as input and outputs an age estimate in years. Then, we calculated MRI-Age acceleration, defined as an age-specific z-score of Step 2 model output (Positive MRI-Age acceleration is biologically older, negative is younger). We validated this framework in an independent testing set of 36,317 UK Biobank (UKBB) participants. Primary outcome was incident MACE (fatal and non-fatal myocardial infarction, stroke, or heart failure). To investigate time to MACE, cumulative incidence curves were computed. Cox regression assessed the association between MRI-Age acceleration and MACE after adjustment for age, sex, BMI, race, BC volumes,diabetes, hypertension, cancer, alcohol consumption, smoking status. Results are for UKBB only.

### RESULTS

In 36,317 UKBB participants (65.1±7.8 y, 51.7% female; 2.7% [969/36,317] MACE; median follow-up 4.8 years), cumulative incidence curves showed a higher incidence of MACE in individuals with positive MRI-Age acceleration versus negative MRI-Age acceleration (Log-rank $p<0.0001$). Univariable Cox regression revealed an association between MRI-Age acceleration and MACE (HR per standard deviation of MRI-Age acceleration: 1.09, 95% CI 1.02-1.17, $p=0.01$). This signal remained robust after full adjustment for demographics and cardiometabolic risk factors (aHR: 1.09, 95% CI 1.01-1.18, $p=0.02$).

### CONCLUSION

A deep learning framework can estimate biological age from MR imaging and predict MACE in the general population beyond chronological age, MRI-derived BC measures, and cardiometabolic risk factors.

### CLINICAL RELEVANCE/APPLICATION

Our deep learning model leverages currently unused information about age-related changes in BC, which are widely available on existing clinical MRI scans of the abdomen. Applying our model to routine MRI scans can opportunistically extract biological age measures to inform cardiovascular risk assessment and clinical decision-making.

## W5A-SPIN-6 MULTI-TASK DEEP LEARNING FOR DETECTION OF PNEUMOPERITONEUM ON PLAIN RADIOGRAPHS IN NEONATAL INTENSIVE CARE UNIT

Hee Mang Yoon, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
JINWHA CHOI (*Abstract Co-Author*) Nothing to Disclose

Minsung Kim (*Abstract Co-Author*) Nothing to Disclose
Namkug Kim, PhD (*Abstract Co-Author*) Stockholder, Anymedi, Inc
Changhyun Park, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

To develop and validate a Multi-task Learning (MTL) model incorporating semantic segmentation (SEG) and classification (CLS) for detecting pneumoperitoneum (PP) on plain radiographs in neonatal intensive care unit (NICU).

**METHODS AND MATERIALS**

An X-ray dataset from NICU of a tertiary hospital for development of MTL model was used (N=244 without PP, and 281 with PP). The internal dataset was split into training, validation, and test sets (N=419:55:51). Gold standard (absence of PP, indeterminate, and presence of PP) was determined through review of clinical and surgical findings as well as ultrasound and follow-up imaging findings by a pediatric radiologist with 10 years of clinical experience. Region-of-interests were drawn in 281 cases with PP. An external dataset (N=165 without PP, and 216 with PP ) from different eleven tertiary hospitals were enrolled. Gold standards were defined by consensus reading of three pediatric radiologists with 3 to 24 years of clinical experience. To maximize sensitivity, indeterminate cases were considered as test positive. We developed a MTL model to leverage binary CLS and SEG tasks, employing a U-Net architecture with a DenseNet-169 encoder. MTL was implemented by extracting features from the model's bottleneck layer to generate the CLS output. We analyzed the area under receiver operating characteristic curve (AUROC), F1-score, and accuracy and compared the AUROC between the MTL model and CLS-only model using the Delong test.

**RESULTS**

In internal validation, the MTL model achieved significantly higher AUROC than the CLS-only model (0.98 vs. 0.77, p=0.001). In external validation, the MTL model outperformed the CLS-only model (AUROC, 0.89 vs. 0.58, p<0.001). For the MTL and CLS-only models, internal F1-scores were 0.94 and 0.69, and external F1-scores were 0.84 and 0.39; internal accuracies were 94% and 69%, and external accuracies were 84% and 57%, respectively.

**CONCLUSION**

The MTL model demonstrated high diagnostic performance for detecting pneumoperitoneum on NICU X-rays, outperforming the CLS-only model.

**CLINICAL RELEVANCE/APPLICATION**

Our enhanced MTL model, trained with a relatively small number of neonatal radiographs featuring subtle lesions of pneumoperitoneum, demonstrated strong performance and robustness on both internal and external datasets, even though these datasets were acquired from various clinical environments. It could be useful in actual clinical settings, assisting both physicians and non-expert pediatric radiologists.

## W5A-SPIN-7 DEEPSPINE: A COMPREHENSIVE DEEP LEARNING MODEL FOR MULTI-TASK LUMBAR SPINE MRI ANALYSIS

Stuart R. Pomerantz, MD (*Abstract Co-Author*) Support, General Electric Company
Christopher Bridge, DPhil (*Abstract Co-Author*) Institutional support, NVIDIA Corporation;Institutional support, General Electric Company;Institutional support, Nuance Communications, Inc
Satvik Tripathi (*Abstract Co-Author*) Nothing to Disclose
Kay Wu, MD, MS (*Presenter*) Nothing to Disclose

**PURPOSE**

A lumbar spine MRI is vital for diagnosing persistent low back pain etiologies. Spinal MR interpretation is time-consuming and subject to inter-reader variability. We extend upon a deep learning model tailored for comprehensive, automated analysis of lumbar spine MRI to detect and grade nine degenerative spinal conditions.

**METHODS AND MATERIALS**

DeepSPINE was trained and evaluated on a dataset of 54,739 T2-weighted lumbar MRI studies (31,439 female, 23,300 male, mean age 58.3 years) to predict the presence and severity of spinal pathologies: left (LFS) and right foraminal (RFS) and spinal canal stenosis (SCS), disc bulging (DB), disc osteophyte complex (DOC), left (LFA) and right facet arthropathy (RFA), ligamentum flavum thickening (LFT), and epidural lipomatosis (EL). Using natural language processing, intervertebral level-by-level ground-truth labels of pathological processes from associated radiology reports were extracted. From the studies, automatic segmentation of the vertebral bodies was performed. Using the segmentations, the intervertebral discs were localized and image volumes in the axial and sagittal planes of each disc were extracted. Each image volume was then fed into a convolutional neural network based on ResNeXt with softmax activation and categorical cross-entropy loss to perform the classification tasks.

**RESULTS**

DeepSPINE demonstrated within-one class accuracies of 96.1%, 96.1%, and 97.0% and quadratic Cohen's kappa of 0.745, 0.750, and 0.781 in classifying the severity of LFS, RFS, and SCS, respectively. For binary DB, DOC, LFA, RFA, LFT, and EL classification, AUC scores were 0.861, 0.838, 0.628, 0.632, 0.669, and 0.638.

**CONCLUSION**

We successfully trained an efficient multi-task, multi-class, and multi-input deep learning model to automatically predict and grade various spinal pathologic processes. DeepSPINE achieved strong performance across classification tasks at each spinal level. To our knowledge, this is the first model trained on such a large and robust dataset to generate more comprehensive, descriptive level-by-level predictions of lumbar spine disease.

**CLINICAL RELEVANCE/APPLICATION**

DeepSPINE's comprehensive analysis of lumbar spine MRI shows potential to improve patient care by enhancing diagnostic accuracy for spinal diseases, providing standardized interpretations, streamlining workflow, and facilitating tailored treatment planning for spinal diseases. We expect it to alleviate the burden on radiologists and enhance efficiency and timely access to care.

# Abstract Archives of the RSNA, 2024

W5A-SPIR

**Interventional Radiology Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPIR-1 "NOT ONLY SIZE, BUT TIME MATTERS": A CRITICAL EVALUATION OF LIVER VENOUS DEPRIVATION VERSUS SINGLE PORTAL EMBOLIZATION IN LIVER SURGERY CONDITIONING

Angela Garcia (*Abstract Co-Author*) Nothing to Disclose
Arturo Alvarez Luque IV, MD (*Abstract Co-Author*) Nothing to Disclose
Claudia Gerlotti, MD (*Abstract Co-Author*) Nothing to Disclose
Miguel Echenagusia JR, MD (*Abstract Co-Author*) Nothing to Disclose
Enrique Calleja Carton SR, MD (*Abstract Co-Author*) Nothing to Disclose
Maria Camarena (*Abstract Co-Author*) Nothing to Disclose
Mihail Poida, MD (*Abstract Co-Author*) Nothing to Disclose
Fernando Carretero Lopez (*Abstract Co-Author*) Nothing to Disclose
Carlos Ballano Franco, MD (*Abstract Co-Author*) Nothing to Disclose
Luis Mullor Delgado (*Abstract Co-Author*) Nothing to Disclose
Manuel Gonzalez Leyte, MD (*Abstract Co-Author*) Nothing to Disclose
Paola Lopez-Gomez, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Hepatic resection is crucial in the curative treatment for primary or metastatic liver tumors but is hampered by postoperative liver failure, a leading cause of death. Patient selection criteria and efficient preoperative tools are needed to provide an adequate future liver remnant (FLR). Preoperative portal vein embolization (PVE) has extended liver resection indications and improved postoperative outcomes, becoming the gold standard for FLR hypertrophy. However, liver resection remains contraindicated in 30% of cases after PVE due to insufficient FLR hypertrophy or tumor progression. Recent alternative techniques aim to increase the number of patients eligible for curative resection. This study evaluated whether liver venous deprivation (LVD) offers advantages in inducing hypertrophy compared to single PVE.

### METHODS AND MATERIALS

We retrospectively gathered data from 52 patients who underwent either PVE (n=29) or LVD (n=23) from 2013 to 2024 before extended hepatectomy for primary or secondary liver tumors. FLR volume was measured using a computed tomography (CT) scan before and after embolization. The same experienced reader performed the volumetric measurements. FLR growth percentage was calculated and compared.

### RESULTS

During the study period, 52 patients underwent vascular interventional radiology procedures intending to optimize the FLR volume. Of these patients, 29 underwent PVE (PVE group), and 23 had LVD (LVD group). The mean age was 63,8, and male patients were predominant (63,7%). The most common tumor type was colorectal liver metastases (24 patients, 46,2%), followed by cholangiocarcinoma (22 patients, 42,3%). There was no statistical difference in the mean percentage of FLR ratio hypertrophy between LVD and PVE groups (8,5% vs 11,9%, p=0.14). None of the patients had complications after the procedure. The time to achieve hypertrophy was significantly lower in the LVD group compared to the PVE group (27,09 days vs 33 days, p=0,020). There was, however, no difference in the time elapsed between the procedure and the surgery (84,67 days in the LVD group vs 85,14 days in the PVE group, p=0.98), although the variability was considerably high (SD of 61,08 and 78,73 days respectively).

### CONCLUSION

Despite the limitations, including a small number of patients and a retrospective review, our survey reveals no difference between LVD and PVE regarding liver hypertrophy. Conversely, LVD might shorten the time of primary liver resection with no more morbidity.

### CLINICAL RELEVANCE/APPLICATION

The study of alternative techniques to single PVE is crucial to increase the number of patients with primary or metastatic liver tumors eligible for curative resection.

## W5A-SPIR-3 MULTIPARAMETRIC MRI-BASED RADIOMICS NOMOGRAM PREDICTS THE RECURRENCE OF HEPATOCELLULAR CARCINOMA AFTER POSTOPERATIVE ADJUVANT TRANSARTERIAL ARTERIAL CHEMOEMBOLIZATION

Jiansong Ji, MD (*Abstract Co-Author*) Nothing to Disclose
Liyun Zheng (*Abstract Co-Author*) Nothing to Disclose
Xinyu Guo (*Presenter*) Nothing to Disclose

**PURPOSE**

This study was undertaken to develop and validate a radiomics model baed on multiparametric magnetic resonance imaging (MRI) for predicting recurrence in patients with hepatocellular carcinoma (HCC) following postoperative adjuvant transcatheter arterial chemoembolization (PA-TACE).

**METHODS AND MATERIALS**

In this retrospective study, 117 HCC patients (81 for training, 36 for validation) treated with PA-TACE were included. Multiparametric radiomics features were extracted from three MRI sequences. Least absolute shrinkage and selection operator (LASSO)-COX regression was utilized to select radiomics features. Optimal clinical characteristics selected by multivariate Cox analysis were integrated with Rad-score to develop a recurrence-free survival (RFS) prediction model. The model performance was evaluated by time-dependent receiver operating characteristic (ROC) curves, Harrell's concordance index (C-index), and calibration curve.

**RESULTS**

Fifteen optimal radiomic features were selected and the median Rad-score value was 0.434. The median RFS of patients with low-risk signature was 47 months, much higher than those with high-risk signature(P<0.0001). Multivariate Cox analysis indicated that neutrophil-to-lymphocyte ratio (NLR) (hazard ratio (HR)=1.49, 95% confidence interval (CI): 1.1-2.1, P=0.022) and tumor size (HR=1.28, 95% CI: 1.1-1.5, P=0.001) were the independent predictors of RFS after PA-TACE. A combined model was established by integrating Rad-score, NLR, and tumor size in the training cohort (C-index 0.822; 95% CI 0.805-0.861) and validation cohort (0.823; 95% CI 0.771-0.876). The calibration curve exhibited a satisfactory correspondence in two cohorts.

**CONCLUSION**

A multiparametric MRI-based radiomics model can predict RFS of HCC patients recieving PA-TACE and a nomogram can be served as an individualized tool for prognosis.

**CLINICAL RELEVANCE/APPLICATION**

We have developed and validated a multiparametric MRI-based radiomics model that provides personalized assessments of HCC recurrence risk before treatment.

## W5A-SPIR-4 NUMERICAL AND EXPERIMENTAL INVESTIGATION OF MAGNETIC MICROBEAD NAVIGATION FOR LIVER TUMOR EMBOLIZATION BY MAGNETIC RESONANCE NAVIGATION

Ning Li (*Abstract Co-Author*) Nothing to Disclose
Jiri Pesek (*Abstract Co-Author*) Nothing to Disclose
Irene Vignon-Clementel (*Abstract Co-Author*) Nothing to Disclose
Gilles P. Soulez, MD, MSc (*Abstract Co-Author*) Speaker, Siemens AG;Research Grant, Siemens AG;Research Grant, Cook Group Incorporated;Advisory Board, Cook Group Incorporated;Patent agreement, Cook Group Incorporated;Research Grant, ViTAA Medical Solutions Inc;Advisory Board, ViTAA Medical Solutions Inc
Mahdi Rezaei Adariani (*Presenter*) Nothing to Disclose

**PURPOSE**

Comprehensively understand the dynamics of micro-particles utilized in Magnetic Resonance Navigation (MRN), a new approach for liver tumor treatment which utilizes MRI magnetic fields to aggregate particles and guide them through vessels. Our ultimate objective is to optimize MRN for enhanced efficacy and clinical outcomes. This will be achieved through a synergistic approach combining computational modeling and in-vitro experimental validation.

**METHODS AND MATERIALS**

A glass phantom replicated the hepatic artery's initial stage, with systole/diastole transient flow induced by a cardiac heart pump. Outlet flow from the phantom's branches was manually measured and cross-validated with 2D cine phase-contrast MRI data. Aggregates of 10, 20, and 30 particles were injected into the phantom under MRI conditions, at different angulations relative to the MRI static magnetic fields (B0). The particles were guided by Magnetic Gradient, gravity, and flow drag force. Friction between particles and the phantom wall was determined by attracting aggregates with a magnetized metallic ball, measuring the distance at which the force overcame static friction.

**RESULTS**

The computational results of the fluid field were initially compared with 4D flow MRI data, demonstrating satisfactory agreement between in-vitro experimental outcomes and computational results as shown in Figure 1. Comparing particle motion in the computational model with experimental observations revealed insights into aggregate steering and efficiency. Without steering gradient, the distribution of aggregates between left and right branches varied with phantom angulation relative to B0. Specifically, at 0°, 45°, and 90° relative to B0, 55%, 25%, and 75% of aggregates respectively took the right branch. Perfect (100%) steering efficiency was achieved after injecting 20 aggregates for all gradient directions and phantom angulations.

**CONCLUSION**

Preliminary findings highlight the satisfactory agreement between the computational model and experimental outcomes, yet challenges in accurately modeling flow drag force underscore the need for further refinement. Despite this, the successful guidance of aggregates to desired branches emphasizes MRN potential for targeted therapy. Future investigation, particularly into random-shaped aggregates, is vital for optimizing MRN and improving clinical outcomes.

**CLINICAL RELEVANCE/APPLICATION**

The insights gained from this study hold significant promise for advancing MRN as a targeted approach for liver tumor treatment. By optimizing the understanding of micro-particle dynamics, we aim to improve MRN efficacy, ultimately enhancing patient outcomes in clinical practice.

## W5A-SPIR-5 ABLATIVE RADIOEMBOLIZATION IS CORRELATED WITH IMPROVED OUTCOMES FOR HEPATOCELLULAR CARCINOMA GREATER THAN 4 CM

Jeet Minocha (*Abstract Co-Author*) Nothing to Disclose
Kathryn J. Fowler, MD (*Abstract Co-Author*) Consultant, Bayer AG;Research support, General Electric Company;Research Grant, Pfizer Inc;Institutional Grant, MEDIAN Technologies;Consultant, General Electric Company
Zachary Berman, MD (*Abstract Co-Author*) Nothing to Disclose
Vasan Jagadeesh (*Abstract Co-Author*) Nothing to Disclose
Kurt Pianka, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

For smaller hepatocellular carcinoma (HCC) tumors, transarterial radioembolization (TARE) ablative doses (> 190 Gy) have led to better outcomes. This study examined whether ablative dosing correlated with better response outcomes in patients with tumors >= 4 cm.

**METHODS AND MATERIALS**

This retrospective single-center study included all patients with HCC undergoing TARE between June 2011 - December 2022 (n=205). Patients with HCC >= 4 cm without tumor in vein were included (n=50). All patients were treated with Y-90 glass microspheres. mRECIST response criteria were applied to 3-month post-TARE imaging. Single compartment dose was categorized as > 400 Gy (High), 190 - 400 Gy (Medium), or < 190 Gy (Low).

**RESULTS**

The High (n=21), Medium (n=19), and Low (n=10) groups were well-matched in baseline characteristics. The median HCC size was 5.4 cm (range 4.1 - 14.0 cm; interquartile range 2.7 cm). There was a positive correlation between higher dose and overall and target mRECIST response ($r=0.29$, $p < 0.05$; $r=0.43$, $p < 0.01$). Overall CR was obtained in 52% (11/21), 37% (7/19), and 10% (1/10) of the High, Medium, and Low dose groups, respectively ($p=0.08$). 57% (12/21) of High dose patients achieved target CR versus 42% (8/19) of Medium and 10% (1/10) of Low dose patients ($p < 0.05$). OS did not differ based on the > 400 Gy or > 190 Gy thresholds. However, a trend towards decreased probability of distant progression within 12-months was seen in the High dose group: 24% (5/21) versus 52% (15/29) in the Medium and Low dose patients ($p=0.09$).

**CONCLUSION**

There was a dose-response relationship for larger HCCs undergoing TARE with the best imaging responses noted with higher ablative dosing (> 400 Gy).

**CLINICAL RELEVANCE/APPLICATION**

Large HCC tumors without vascular invasion are more likely to achieve superior imaging response when treated with ablative dose TARE strategies.

## W5A-SPIR-6 THE DIAGNOSTIC VALUE OF SUBTRACTIONCT IN EVALUATING THE EFFICACY OF TRANSCATHETER ARTERIAL CHEMOEMBOLIZATION IN HEPATOCELLULAR CARCINOMA PATIENTS COMPARED TO CONVENTIONAL CT AND MRI

Fucheng Ding (*Abstract Co-Author*) Nothing to Disclose
Mingyang Mao (*Abstract Co-Author*) Nothing to Disclose
Feng Duan (*Abstract Co-Author*) Nothing to Disclose
Fengxian Hu, MMEd (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to evaluate the diagnostic value of subtraction CT in assessing the efficacy of transcatheter arterial chemoembolization (TACE) in patients with hepatocellular carcinoma compared to conventional CT and MRI.

**METHODS AND MATERIALS**

73 pathologically confirmed hepatocellular carcinoma patients (97 lesions) who underwent TACE treatment were retrospectively collected. All patients underwent follow up examinations including multiphasic CT, multiphasic MRI and digital subtraction angiography (DSA). The subtraction images of arterial phase were obtained by using Subtraction Iodine Mapping software (Canon medical systems). Two senior radiologists classified the lesions into Liver Imaging Reporting and Data System (LI-RADS) v2018 treatment response (LR-TR) algorithm (LR-TR viable, LR-TR equivocal and LR-TR nonviable) and evaluated the diagnostic confidence of lesions in multiphase CT images, multiphase CT with subtraction images and multiphase MR images. The sensitivity, specificity and accuracy of LR-TR algorithm in three image sets were evaluated using DSA as the gold standard.

**RESULTS**

The sensitivity and accuracy of LR-TR viable category in multiphase CT with subtraction images were significantly higher than in multiphase CT images (89.4% vs 44.7%, 82.1% vs 47.8%, all $p<0.05$), respectively. The sensitivity, specificity and accuracy in multiphase CT with subtraction images were comparable with in multiphase MR images (all $p>0.05$). For diameter of lesion = 6 mm, the sensitivity and accuracy of LR-TR viable category in multiphase CT with subtraction images were significantly higher than in multiphase CT and MR images (92.3% vs 23.1%vs23.1%, 84.1% vs 21.1%vs 21.1%, all $p<0.05$). The interobserver agreement between two radiologists were good in multiphase CT with subtraction images (?=0.754). The diagnostic confidence in multiphase CT with subtraction images were higher than in multiphase CT and MR images (both $p<0.05$).

**CONCLUSION**

The multiphase CT with subtraction images can significantly improve the sensitivity and accuracy of LR-TR algorithm , especially in lesions with a diameter = 6mm. Subtraction images can improve the diagnostic confidence for detecting viable tumor in TACE-treated patients.

**CLINICAL RELEVANCE/APPLICATION**

Comparing with multiphase CT and MR, the multiphase CT with subtraction images provide high accuracy for evaluation of viability of tumor in HCC patients after TACE.

## W5A-SPIR-7 SUPER-RESOLUTION DEEP-LEARNING RECONSTRUCTION IMPROVES THE IMAGE QUALITY OF CT DURING HEPATIC ARTERIOGRAPHY

Kazuo Awai, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Research Grant, Hitachi, Ltd;Research Grant, Fujitsu Limited;Research Grant, Nemoto Kyorindo co, Ltd;Research Grant, FUJIFILM Holdings Corporation
Hidenori Mitani (*Abstract Co-Author*) Nothing to Disclose
Masakazu Matsuura, MS (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Yuko Nakamura, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kazushi Yokomachi, PhD (*Abstract Co-Author*) Nothing to Disclose
Toru Higaki, PhD (*Abstract Co-Author*) Nothing to Disclose
Keigo Chosa (*Abstract Co-Author*) Nothing to Disclose
Kenji Kodakari, BA (*Presenter*) Nothing to Disclose

**PURPOSE**

CT during hepatic arteriography (CTHA) is essential for transcatheter arterial chemoembolization in patients with hepatocellular carcinoma because it increases the detection of tumor-feeding arteries compared to digital subtraction angiography. Super-resolution deep-learning reconstruction (SR-DLR) is a new image reconstruction method that provides CT images with higher spatial resolution and lower image noise by using a deep convolutional neural

networks trained on high-resolution CT images. The application of SR-DLR to CTHA is expected to improve its image quality. We investigated the clinical feasibility of SR-DLR-CTHA.

**METHODS AND MATERIALS**

We evaluated 30 patients who had undergone CTHA. The images were reconstructed with SR-DLR or conventional hybrid iterative reconstruction (Hybrid-IR). Curved multiplanar reformations (CPR) of the right and left hepatic artery were created and their CT value was recorded from their origin to their distal site. Attenuation of the hepatic parenchyma was measured; the standard deviation of the attenuation in the hepatic parenchyma was defined as the image noise. The contrast-to-noise ratio (CNR) = (ROIA - ROIL)/N was calculated; ROIA is the attenuation of the hepatic artery, ROIL the mean attenuation of the hepatic parenchyma, and N the noise. A 20-mm smoothing filter was applied to the CNR curve to reduce the influence of the image noise. The distance from the origin to the distal site of the hepatic artery with a CNR larger than 10 (CNRD10) was calculated on images subjected to both reconstruction methods. The longer the CNRD10, the better was the visualization of the small hepatic artery at the distal site. Differences between the two reconstruction methods were compared with the Wilcoxon signed-rank test.

**RESULTS**

Image noise was lower on SR-DLR- than Hybrid-IR images (median image noise 9.3 vs 19.2 HU, $p<0.01$). The CNRD10 was significantly longer on SR-DLR- than Hybrid-IR images (median for left hepatic artery 132.7 vs 111.3 mm, $p<0.01$; median for right hepatic artery 116.6 vs 98.0 mm, $p<0.01$).

**CONCLUSION**

The visualization of the hepatic arteries on CTHA images was better with SR-DLR than Hybrid-IR.

**CLINICAL RELEVANCE/APPLICATION**

As SR-DLR yielded better visualization of the hepatic arteries on CTHA images than Hybrid-IR, it is recommended for the visualization of small vessels.

# Abstract Archives of the RSNA, 2024

W5A-SPMK

**Musculoskeletal Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPMK-1 ANALYSIS OF FAT FRACTIONS OF THE GLUTEUS MEDIUS AND MINIMUS MUSCLES IN ELDERLY ASYMPTOMATIC HIPS USING 2-POINT-DIXON MRI - WHAT IS NORMAL?

Sophia Goller, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Patrick Zingg, MD (*Abstract Co-Author*) Nothing to Disclose
Reto Sutter, MD (*Abstract Co-Author*) Nothing to Disclose
Georg Wilhelm Kajdi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To establish quantitative reference values for fatty infiltration of the main hip abductors in elderly asymptomatic hips - in patients suffering from unilateral greater trochanteric pain syndrome (GTPS) on the contralateral side - using 2-point-DIXON MRI derived fat fractions (FF).

### METHODS AND MATERIALS

In this prospective single-center study, two radiologists assessed fatty infiltration of the gluteus minimus (Gmin) and medius (Gmed) muscles in both hips of patients with unilateral GTPS using 2-point-DIXON MRI derived FF. Additionally, fatty infiltration was assessed using the Goutallier classification. Differences in fatty infiltration between the symptomatic and asymptomatic hip were assessed for both methods using the Wilcoxon signed-rank test.

### RESULTS

42 patients (mean age 65.1 ± 13.7 years, 28 females) with unilateral GTPS were analyzed. The mean FF in asymptomatic hips was 14.54 ± 13.70 % for the Gmin and 15.29 ± 10.28 % for the Gmed. Quantitative FF were significantly higher in symptomatic hips with FF of 15.05 ± 12.49 % ($P < 0.001$) for the Gmin and 19.36 ± 14.42 % ($P = 0.001$) for the Gmed, when compared to the asymptomatic side. There was a significant difference between the fatty infiltration of the symptomatic and asymptomatic sides using the Goutallier classification for the Gmin muscle ($P = 0.046$), whereas there was no significant difference for the Gmed muscle ($P = 1.00$).

### CONCLUSION

2-point-DIXON derived quantitative FF of Gmin and Gmed of elderly patients were significantly lower on the asymptomatic side compared to the contralateral symptomatic side, but notably higher compared to values reported in young healthy individuals. Asymptomatic hips of elderly individuals had a mean FF of 14.54 ± 13.70 % for the Gmin and 15.29 ± 10.28 % for the Gmed, respectively.

### CLINICAL RELEVANCE/APPLICATION

These results can serve as quantitative reference values for further studies on hip fatty infiltration.

## W5A-SPMK-2 THE RELATIONSHIP BETWEEN OSTEOARTHRITIS GRADING AND THE RISK OF SUBSEQUENT HIP FRACTURES IN OLDER WOMEN: A PROSPECTIVE COHORT STUDY

Ling Wang (*Abstract Co-Author*) Nothing to Disclose
Fengyun Zhou (*Abstract Co-Author*) Nothing to Disclose
Xiaoguang Cheng (*Abstract Co-Author*) Nothing to Disclose
Yandong Liu (*Abstract Co-Author*) Nothing to Disclose
Yi Yuan (*Abstract Co-Author*) Nothing to Disclose
Wenshuang Zhang, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the relationship between Kellgren-Lawrence (KL) grading of osteoarthritis (OA) and the risk of hip second fractures in older women.

### METHODS AND MATERIALS

Hip computed tomography (CT) and radiographic examinations were conducted post-first fracture. Areal bone mineral density (aBMD) at total hip (TH), femoral neck (FN), trochanter (TR), and intertrochanter (IT) of contralateral femur was measured using CT X-ray absorptiometry. HOA classification was assessed on baseline KL grades. HRs for the risk of second hip fractures were evaluated using Cox proportional hazards models. AUC with 95%CI was calculated using multivariate logistic regressions to assess predictive power of incorporating OA grading into models combining BMD parameters.

**RESULTS**

The average age at baseline was 74.9(±9.5) years. Initial HOA Grade distribution was 108 in Grade0, 79 in Grade1, 16 in Grade2, and 3 in Grade3. Over 4.5 years, 35 participants experienced second hip fractures, 153 without refractures, and 18 deceased. In second fracture group, HOA grades were distributed as 14 in Grade0, 17 in Grade1, 3 in Grade2, and 1 in Grade3. Significant HRs for predicting second hip fractures were observed for TH aBMD (HR,1.79;p=.02) and IT aBMD (HR,2.04;p<.01). Except for the combined HOA Grades2 and 3 (HR,4.27;p=.04), no significant HRs were found for HOA classification. The AUC for models incorporating OA grading was higher than 77%, but the difference in AUC between models with and without OA grading was not statistically significant.

**CONCLUSION**

The presence of OA in the contralateral hip may increase the risk of hip second fractures in older women, although the exact statistical impact of incorporating OA grading into predictive models requires further investigation.

**CLINICAL RELEVANCE/APPLICATION**

This study highlights a noteworthy association between the severity of osteoarthritis (OA) and the heightened risk of subsequent hip fractures in older women, particularly emphasizing the significant risk increase with higher OA grades. Despite this association, incorporating OA grading into predictive models did not markedly improve their accuracy beyond that achieved with traditional bone mineral density (BMD) assessments. These findings suggest that while OA severity is an important factor in evaluating fracture risk, it is one of many factors that need to be considered. The complexity of predicting hip fractures calls for further research to develop more comprehensive models that integrate both established and novel risk factors, aiming for a holistic approach to assess and mitigate fracture risk in this vulnerable population.

## W5A-SPMK-3 PROSPECTIVE DEEP LEARNING MRI OF THE PELVIS: A NOVEL APPROACH TO ENHANCE CLINICAL EFFICIENCY

Renate M. Hammerstingl, MD (*Abstract Co-Author*) Nothing to Disclose
Leon D. Gruenewald, MD (*Abstract Co-Author*) Nothing to Disclose
Christian Booz, MD (*Abstract Co-Author*) Speaker, Siemens AG
Scherwin Mahmoudi, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer Gotta (*Abstract Co-Author*) Nothing to Disclose
Thomas J. Vogl, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Ralph Strecker (*Abstract Co-Author*) Employee, Siemens AG
Simon S. Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Katrin Eichler, MD (*Abstract Co-Author*) Nothing to Disclose
Ibrahim Yel, MD (*Abstract Co-Author*) Nothing to Disclose
Vitali Koch, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to investigate the effectiveness of combining deep learning (DL)-based parallel reconstruction technique (PAT) and simultaneous multislice (SMS) acceleration magnetic resonance imaging (MRI), in contrast to conventional pelvic imaging.

**METHODS AND MATERIALS**

Adults who underwent clinically indicated pelvic MRI were prospectively recruited between January 2024 and April 2024. The participants received coronal T2-weighted sequences with both conventional 2-fold PAT (P2) and DL-based 4-fold PAT combined with 2-fold SMS acceleration imaging (P4S2). Three independent readers assessed pelvic structures, overall image quality, image noise, and diagnostic confidence. Diagnostic performance was calculated using a consensus reading as the reference standard. For quantitative image assessment, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and radiomics features were calculated. Interreader agreement was measured using Fleiss ?.

**RESULTS**

A total of 28 patients (mean age, 46 ± 21 years; 15 women) were included in this study. The diagnostic performance for detecting pathologies and the overall image quality were similar among both protocols. SNR and CNR were lower using the DL-based SMS protocol than with conventional imaging ($P < 0.01$). Interreader and intermethod agreements were excellent (? = 0.870 and ? = 0.910, respectively). In addition, the mean acquisition time was reduced by 44% when using P4S2, compared with conventional P2 imaging.

**CONCLUSION**

Combined DL-accelerated imaging (4-fold PAT with 2-fold SMS) performed similarly to conventional 2-fold PAT for evaluating pelvic structures, with a 44% reduction in acquisition time.

**CLINICAL RELEVANCE/APPLICATION**

We showcase the signal preservation capabilities of combined DL-accelerated imaging, which provides comparable diagnostic performance while achieving improved SNR and CNR. Additionally, this approach allows for approximately 44% shorter acquisition times than conventional imaging, thus potentially improving clinical pelvic MRI efficiency.

## W5A-SPMK-5 CT-GUIDED PERCUTANEOUS SACROPLASTY: A STANDARD OF CARE FOR INSUFFICIENCY SACRAL FRACTURES?

Lara Berrocal, MD (*Abstract Co-Author*) Nothing to Disclose
Sonia C. Carbo, MD (*Abstract Co-Author*) Nothing to Disclose
Anna Marin, MD (*Abstract Co-Author*) Nothing to Disclose
Vladimir Cheranovskiy, MD (*Abstract Co-Author*) Nothing to Disclose
Jorge Garcia Gomez, MD (*Abstract Co-Author*) Nothing to Disclose
Alba Anton-Jimenez, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

- To describe the procedure of CT-guided percutaneous sacroplasty as a treatment for sacral insufficiency fractures.- To review efficacy of the technique in a series of patients with symptomatic sacral fractures in our population.- To study outcome predictors to clinical benefit and possible complications of the procedure.

**METHODS AND MATERIALS**

This retrospective study included 12 consecutive patients with sacral insufficiency fractures that were treated in our institution between 2012-2024, using CT-guided sacroplasty.After intravenous sedation, a 13-G needle was inserted percutaneously using a posterior short-axis approach (perpendicular to the dorsal cortex of the sacrum). Needle placement along the fracture lines was proved under CT-fluoroscopy guidance, prior to injection of polymethyl

methacrylate cement (PMMA) (see attached figures). Cement injection was monitored by axial CT-fluoroscopy acquisition to assess potential cement migration into the sacral foramen and spinal canal.To describe clinical outcomes, visual analogue scale (VAS) was assessed before and after 3 months of treatment. Complications during and after the procedure were reported.

**RESULTS**

Twelve patients (female n=10 and mean age 80,5 years, range 62-92) were treated with CT-guided sacroplasty.Sacroplasties were performed on unilateral (n=1) or bilateral sacral alae (n=11) in all patients, and an average of 3,7 mL (range, 2,5-7) of cement was injected at each sacral fracture site.Mean volume of cement injected into the unilateral sacral fracture was 2 mL.Technical success was achieved in almost all patients without any significant complication. One patient developed a small asymptomatic cement leak into the S1 foramen, without any significant neurological repercussion.All patients tolerated the procedure under intravenous sedation.The mean pre-procedure VAS for pain was 8 (range 7-9) with a mean symptom duration of 4 months, and the mean VAS score post-procedure was 2.So patients showed continued symptomatic relief defined as a VAS rate decrease of more than 5 points after the procedure (p<0,05).Only 1 patient experienced pain recurrence, probably due to the presence of other lumbar vertebral fractures.Volume of cement injected was independent of pain relief and functional improvement after the procedure (p>0,05).

**CONCLUSION**

Percutaneous sacroplasty is a reliable, safe and highly effective technique for pain relief in patients with insufficiency sacral fractures, with a significant functional improvement and no clinically relevant complications.

**CLINICAL RELEVANCE/APPLICATION**

CT-guided sacroplasty represents an excellent alternative treatment for sacral insufficiency fractures that are resistant to conservative management.

## W5A-SPMK-6 APPLICATION VALUE OF PROXIMAL FEMUR RADIOMICS MODEL BASED ON ABDOMEN- PELVIC CT IN OPPORTUNISTIC SCREENING OF OSTEOPOROSIS

Yijun Liu (*Abstract Co-Author*) Nothing to Disclose
Changyu Du (*Presenter*) Nothing to Disclose

**PURPOSE**

To establish an automatic BMD assessment model based on abdomen-pelvic CT images of proximal femur and explore its application value in opportunistic screening of osteoporosis.

**METHODS AND MATERIALS**

A total of 351 patients who underwent abdomen-pelvic plain CT examination in our hospital from November 2023 to March 2024 were retrospectively collected and randomly divided into the training cohort (n=245) and the test cohort (n=106) according to a ratio of 7:3. All images were transferred to the QCT post-processing workstation, and the BMD of the left proximal femur was measured. According to the QCT BMD T value, the patients were divided into osteoporosis group (T value =-2.5), bone loss group (-2.5 < T value < -1) and normal bone group (T value =-1). The left proximal femur (femoral head to minor trochanter) was dissected using an automatic segmentation model, and two three-classification BMD evaluation radiomics models were constructed using random forest (RF) and logistic regression (LR) classifiers, respectively. Receiver operating characteristic curve (ROC) was constructed, and indicators such as area under the curve (AUC), sensitivity and specificity were calculated to evaluate the diagnostic performance of the two models. Delong test was used to compare the differences between the models.

**RESULTS**

The AUC of RF model and LR model were 0.953 and 0.954 for osteoporosis, 0.894 and 0.870 for osteopenia, and 0.975 and 0.982 for normal bone, respectively. The results of model performance comparison showed that there was no statistical difference in the ability of RF model and LR model to identify the three bone states in the training set and the test set (P > 0.05).

**CONCLUSION**

Both RF and LR radiomics models based on abdomen-pelvic plain CT can be used for the screening of opportunistic osteoporosis with good diagnostic efficacy.

**CLINICAL RELEVANCE/APPLICATION**

The imaging model of proximal femur based on abdominal and pelvic plain scan CT can be used for the screening of opportunistic osteoporosis,and the three-classification diagnosis efficiency is good.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

W5A-SPMS

**Multisystem Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPMS-2 EVALUATING LARGE LANGUAGE MODELS FOR AUTOMATED REPORTING AND DATA SYSTEMS CATEGORIZATION: CROSS-SECTIONAL STUDY

Yan Bai (*Abstract Co-Author*) Nothing to Disclose
Meiyun Wang (*Abstract Co-Author*) Nothing to Disclose
Yaping Wu (*Abstract Co-Author*) Nothing to Disclose
Wei Wei (*Abstract Co-Author*) Nothing to Disclose
Xuan Yu (*Abstract Co-Author*) Nothing to Disclose
Lijuan Chen (*Abstract Co-Author*) Nothing to Disclose
Qingxia Wu (*Abstract Co-Author*) Nothing to Disclose
Qingxia Wu (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate three LLM chatbots - Claude-2, GPT-3.5, and GPT-4 - on assigning Reporting and Data Systems (RADS) categories to radiology reports and assess the impact of different prompting strategies.

### METHODS AND MATERIALS

This cross-sectional study compared three chatbots using 30 radiology reports (10 per RADS criteria), utilizing a three-level prompting strategy: zero-shot, few-shot, and guideline PDF-informed prompts. The cases were grounded in LI-RADS® CT/MRI v2018, Lung-RADS® v2022, and O-RADS™ MRI, meticulously prepared by board-certified radiologists. Each report underwent six assessments. Two blinded reviewers assessed the chatbots' response at patient-level RADS categorization and overall ratings. The agreement across repetitions was assessed using Fleiss's kappa.

### RESULTS

Claude-2 achieved the highest accuracy in overall ratings with few-shot prompts and guideline PDFs (Prompt-2), attaining 57% (17/30) average accuracy over six runs and 50% (15/30) accuracy with k-pass voting. Without prompt engineering, all chatbots performed poorly. The introduction of a structured exemplar prompt (Prompt-1) increased the accuracy of overall ratings for all chatbots. Providing Prompt-2 further improved Claude-2's performance, an enhancement not replicated by GPT-4. The inter-run agreement was substantial for Claude-2 (k=0.66 for overall rating, k=0.69 for RADS categorization), fair for GPT-4 (k=0.39 for both), and fair for GPT-3.5 (k=0.21 for overall rating and k=0.39 for RADS categorization). All chatbots showed significantly higher accuracy with LI-RADS v2018 compared to Lung-RADS v2022 and O-RADS (P<.05), with Prompt-2, Claude-2 achieved the highest overall rating accuracy of 75% (45/60) in LI-RADS v2018.

### CONCLUSION

When equipped with structured prompts and guideline PDFs, Claude-2 demonstrated potential in assigning RADS categories to radiology cases according to established criteria such as LI-RADS v2018. However, the current generation of chatbots lags in accurately categorizing cases based on more recent RADS criteria.

### CLINICAL RELEVANCE/APPLICATION

LLMs demonstrate potential in assigning RADS categories to radiology cases according to established criteria.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

W5A-SPNMMI

**Nuclear Medicine & Molecular Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPNMMI-1 [18F]FDOPA HYBRID PET/ MRI IN BRAIN TUMORS AND SUSPECTED OF TUMOR RECURRENCE VERSUS RADIONECROSIS: DIAGNOSTIC VALIDITY AND INTEROBSERVER AGREEMENT

Laura Rodriguez-Bel (*Abstract Co-Author*) Nothing to Disclose
Michal Pudis (*Abstract Co-Author*) Nothing to Disclose
Montserrat Cortes (*Abstract Co-Author*) Nothing to Disclose
Javier Robles Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Reynes-Llompart (*Abstract Co-Author*) Nothing to Disclose
Marina Suarez-Pinera (*Presenter*) Nothing to Disclose

### PURPOSE

PET/MRI is an imaging technique that provides valuable metabolic, functional and morphological information needed in neuro-oncological diseases. At present, data on its performance in clinical practice are still limited. Ours aims hve been : 1. To analyse the diagnostic validity of [18F]FDOPA PET/MRI in patients with brain tumours (BT) and suspected tumour recurrence TR) versus radionecrosis (RNC) and 2. To assess interobserver variability in both visual and semi-quantitative analysis using this technique

### METHODS AND MATERIALS

Retrospective study of 29 PET/MRI FDOPA performed in 24 patients (12 female, mean age 57yrs) and 33 lesions evaluated: 6 primary tumors and 27 brain metastases. All BT have been treated previously and some patients were undergoing immunotherapy treatment during the PET/MRI scan. All PET/MRI examinations were carried out on a 3 tesla PET/MR (GE SIGNATM) at least 6 months after radiotherapy. Images were analyzed visually and quantitatively independently by two nuclear physicians. Ratios: SUVmaxlesion/SUVmaxstriatum(L/S), SUVmaxlesion/SUVmaxcortex (L/C) were calculated. Sensitivity (S), Specificity (Sp), positive predictive value (PPV) and negative predictive value (NPV) were calculated. Mann Whitney test was used to compare the difference between groups. Optimal FDOPA PET parameter cut-off was obtained by ROC analysis. Cohen's Kappa coefficient was assessed to measure interobserver PET agreement. Perfusion-weighted imaging (PWI) was visually and quantitatively analysed by a neuroradiologist. Results were compared with clinical-radiological follow-up and/or histopathology.

### RESULTS

Of 33 lesions 10(30%) were considered TR and 23 (70%) RNC. FDOPA PET/MRI showed higher ratios in TR (L/S 1.15±0.25,L/C 2.29±0.69) than RC (L/S 0.85±0.26, L/C1.5±0.69) p>0.05. These ratios were assessed in conjunction with the visual analysis. S, Sp, PPV, NPV of FDOPA were 100%,83%,69% and 100% respectively, 4 false positive and 0 false negative. The best cut-off points were L/ C 1.73 and L/S 0.91. Interobserver agreement was 91%, Cohen Kappa index 0.86. S, Sp, PPV, NPV of PWI MRI were 56%,73%,45% and 80% respectively, in 2 cases PWI was not valuable. The results of FDOPA and PWI were concordant in 23/31 (74%).

### CONCLUSION

Conclusions: [18F]FDOPA hybrid PET/MR showed high accuracy and high interobserver agreement in the diagnostic of TR versus RNC in brain tumors The information provided by PWI and FDOPA was not always concordant and the role of both techniques is likely to be complementary. The availability of hybrid PET/MR equipment allows this information to be obtained in a single scan while reducing the number of scans performed in these patients.

### CLINICAL RELEVANCE/APPLICATION

Impact in the management of neuro-oncology patients

# Abstract Archives of the RSNA, 2024

W5A-SPNPM

**Noninterpretive Skills (Beyond Imaging) Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPNPM-1 PRECISE FRAMEWORK AND EVALUATION FOR ENHANCED RADIOLOGY REPORTING USING CHATGPT FOR PATIENT-CENTERED CARE

Christopher Bridge, DPhil (*Abstract Co-Author*) Institutional support, NVIDIA Corporation;Institutional support, General Electric Company;Institutional support, Nuance Communications, Inc
Komal M. Awan, MBBS (*Abstract Co-Author*) Nothing to Disclose
Liam Mutter (*Abstract Co-Author*) Nothing to Disclose
Suhani Dheer (*Abstract Co-Author*) Nothing to Disclose
Emiliano Garza Frias, MD (*Abstract Co-Author*) Nothing to Disclose
Meghana Muppuri (*Abstract Co-Author*) Nothing to Disclose
Dania Daye, MD, PhD (*Abstract Co-Author*) Research Consultant, Sigilon Therapeutics, Inc;Research Consultant, Medtronic plc
Azadeh Tabari, MD (*Abstract Co-Author*) Nothing to Disclose
Michael Dezube (*Abstract Co-Author*) Nothing to Disclose
Satvik Tripathi (*Presenter*) Nothing to Disclose

### PURPOSE

In this study, ChatGPT, a Large Language Model (LLM), was applied to enhance the findings from radiology reports into patient-centric text. Utilizing the PRECISE (Patient-Focused Radiology Reports with Enhanced Clarity and Informative Summaries for Effective Communication) framework, the objective is to improve patient comprehension and care by providing insightful, accessible interpretations of complex medical images.

### METHODS AND MATERIALS

Utilizing a publicly available chest X-ray dataset from Indiana University, we produced patient-friendly and readable text summaries for the findings in 500 radiology reports with the ChatGPT (GPT-4) prompt “summarize the given radiology report.” We evaluated the PRECISE text’s readability with non-medical volunteers using standard metrics (Flesch Reading Ease, Gunning Fog Index, Automated Readability Index). For reliability, expert clinicians categorized the PRECISE text as "Appropriate," "Inappropriate," or "Unreliable," through comparison with the original reports. Understandability was assessed by 4 non-medical volunteers who rated the text on a 0-2 scale (0 = Not Understandable, 1 = Understandable with Clarifications Needed, 2 = Fully Understandable), after a blind review of 1000 mixed PRECISE and original reports.

### RESULTS

The PRECISE text performed well in all evaluations. Readability scores averaged 81±3.9 (Flesch Reading Ease), 7±1.9 (Gunning Fog Index), and 6±2.8 (ARI), indicating readability at a 6th-grade level or higher. In the reliability test averaged across graders, 95% was classified as "appropriate," 4% as "inappropriate," and 1% as "unreliable" or containing false medical information. In the understandability test, blind test volunteers, 97% of the time, chose “not-understandable” for the actual report and “fully understandable” for the PRECISE text.

### CONCLUSION

Our study shows that the PRECISE framework significantly enhances patient-centric radiology reporting. The PRECISE text’s readability and reliability effectively communicate complex medical details, aligning with expert clinician evaluations and making it accessible to non-medical readers.

### CLINICAL RELEVANCE/APPLICATION

With appropriate prompt engineering, general LLMs can help improve the comprehensibility of radiology reports while simultaneously producing medically appropriate summaries at 6th-grade level.

## W5A-SPNPM-2 HOW DO CLINICIANS READ MEDICAL IMAGING REPORTS ? A NATIONAL SURVEY

Yasmine Kassab (*Presenter*) Nothing to Disclose

### PURPOSE

There is growing interest in standardizing imaging practices and reports. However, limited attention has been given to how clinicians read radiological reports (RR). We developed a questionnaire for non-radiologists to better understand their approach to reading our radiology reports (CT, MRI) with the aim of improving report clarity and optimizing medical decision-making.

### METHODS AND MATERIALS

An anonymized questionnaire (16 questions) was distributed from July to December 2023 to physicians of all specialties across four French regions via mailing lists of private and hospital establishments and social networks. The questionnaire is divided in 3 sections: 1) respondent profile, 2) questions

about radiology reports (reading order of paragraphs, placement of key images...), 3) how practitioner utilize the RR and its therapeutic impact. The questionnaire ends with a free-form box.

## RESULTS

The response rate was 40% (1,000 out of 2,200). Section 1 revealed that 84.2% of respondents were aged between 20 and 34, with 61% women. 66.2% were interns or fellows, with 86.4% having a medical specialty, primarily in general or emergency medicine, intensive care anesthesia, and pediatrics. Section 2 indicated that 71.4% read the entire radiology report or its body, while 15.0% only read the conclusion. Key images were reported to enhance understanding and confidence in the radiologist's conclusion by 37.5% and 29.1% of respondents, respectively. Section 3 showed that 60.5% were confident in our diagnostic hypotheses, and 66.5% attempted to follow our recommendations for further imaging. Once obtained, 59.2% copied the radiologist's conclusion verbatim into their medical observations. In case of life-threatening emergencies, the fellows on duty often communicate the imaging results directly, but 76.0% read the radiology report retrospectively. In case of a life-threatening emergency, 18.9% report referring directly to specialists, regardless the radiologist's opinion. A recurrent request is that the clinician should be promptly contacted to prevent potential harm to the patient.

## CONCLUSION

Comprehensive reports are emphasized, , with 71.4% of clinicians reading the entire content. Diagnostic hypotheses take precedence over the purely descriptive elements. To our knowledge, the added value of key images has not been demonstrated yet. A significant portion of clinicians await validation of preliminary reports before making medical decisions, potentially causing delays in patient management. Feedback highlights the importance of prompt communication regarding significant modifications to preliminary reports to avoid patient harm.

## CLINICAL RELEVANCE/APPLICATION

Comprehensive but concise radiology report, importance of key images.

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# Abstract Archives of the RSNA, 2024

W5A-SPNR

**Neuroradiology Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPNR-1 THE CLINICAL APPLICATION OF 5.0 T 3D TOF MRA IN THE IMAGING OF ACHA AND RELATED CEREBROVASCULAR DISEASES

Jianxian Liu (*Abstract Co-Author*) Nothing to Disclose
Jie Gan (*Abstract Co-Author*) Nothing to Disclose
Dan YU (*Abstract Co-Author*) Nothing to Disclose
Zhangzhu Li (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to evaluate and compare the image quality and diagnostic accuracy of 5.0T and 3.0T Time-Of-Flight (TOF) Magnetic Resonance Angiography (MRA) in visualizing the anterior choroidal artery.

### METHODS AND MATERIALS

A retrospective analysis was conducted on patients undergoing MRA, 2023. The study included 48 patients who underwent 3.0T MR scans and 46 patients who underwent 5.0T MR scans. All participants underwent Time-of-Flight Magnetic Resonance Angiography (TOF-MRA). The image quality was objectively assessed using the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) extracted. Additionally, the quality of cerebral artery visualization was subjectively rated using a 5-point scale. Measurements of the length and maximum diameter of the anterior choroidal arteries were performed. Quantitative data were compared between the two groups using independent sample t-tests and the Mann Whitney U test.

### RESULTS

The study involved 88 individuals, comprising 41 males and 47 females, with ages ranging from 16 to 87 years (mean age 59±13). The 5.0T MR Group exhibited higher SNR (93±5) and CNR (75±6) values compared to the 3.0T MR Group (65±3 and 52±4, respectively), with these differences being statistically significant ($P<0.001$). The lengths and diameters of the left and right anterior choroidal arteries imaged with 5.0T MR were (24.4±7.3 mm), (23.3±9.0 mm), (1.1±0.1 mm), and (1.1±0.1 mm), respectively. In contrast, the 3.0T MR Group showed (18.7±9.2 mm), (17.9±8.4 mm), (0.9±0.3 mm), and (0.9±0.2 mm), respectively, with these differences also being statistically significant ($P<0.05$).

### CONCLUSION

The 5.0T ultra-high field intensity MR scan demonstrates superior capabilities in delineating intracerebral arteries, significantly enhancing the clinical diagnosis and treatment of conditions related to the anterior choroidal artery.

### CLINICAL RELEVANCE/APPLICATION

The 5.0T MR imaging's superior visualization of AChA paves the way for better diagnosis and management of deep brain vascular diseases, potentially influencing treatment outcomes and advancing neurovascular research.

## W5A-SPNR-10 RADIOMICS FOR PREDICTING GRADES, IDH MUTATION AND MGMT PROMOTER METHYLATION OF ADULT DIFFUSE GLIOMAS: COMBINATION OF STRUCTURAL MRI, ADC AND SWI

Xin Zhang (*Abstract Co-Author*) Nothing to Disclose
Huiquan Yang, PhD (*Abstract Co-Author*) Nothing to Disclose
Bing Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Jingfei Shen (*Abstract Co-Author*) Nothing to Disclose
Jianan Zhou (*Abstract Co-Author*) Nothing to Disclose
Yu Sun (*Abstract Co-Author*) Nothing to Disclose
Zhengyang Zhu, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the predictive value of radiomics features extracted from Structural MRI, ADC, and SWI in determining WHO Grade, IDH mutation and MGMT promoter methylation status in patients with diffuse gliomas.

### METHODS AND MATERIALS

539 patients were enrolled in this study. The training, internal validation, external test cohort included 426(median aged 60 years, 168 female), 67(median aged 56 years, 31 female), 46(median aged 55 years, 22 female) patients, respectively. A total of 7896 radiomics features were extracted from 6 sequences within two ROIs. Feature selection was conducted using analysis of variance F-test, and the random forest classifier were employed to

establish predictive models. This research also compared the performance of radiomics models with that of both a 5-year-experienced radiologist and a 1-year-experienced radiologist.

**RESULTS**

For WHO Grade task, the combined model of Structural MRI, ADC and SWI achieved the highest AUC of 0.951 on the external test cohort. For IDH mutation task, the structural MRI model achieved the highest AUC of 0.917 on external test cohort. For MGMT task, the combined model of structural MRI and ADC achieved the highest AUC of 0.650 on the internal validation cohort.

**CONCLUSION**

The radiomics models have achieved promising performance in assessing WHO Grade and IDH mutation status but shown no efficacy in predicting MGMT methylation status. Adding SWI features cannot provide extra information to structural MRI and ADC features in predicting WHO grade and IDH mutation status.

**CLINICAL RELEVANCE/APPLICATION**

This work has considerable clinical significance that would help neuro-oncologists better understand the radiological manifestation and microstructure of adult diffuse gliomas and make more appropriate treatment plans for patients.

## W5A-SPNR-11 INITIAL EXPERIENCE WITH ULTRA LOW-FIELD POINT-OF-CARE MRI IN ANIMAL STROKE MODELS

John Pitts (*Abstract Co-Author*) Nothing to Disclose
VINAY JAIKUMAR (*Abstract Co-Author*) Nothing to Disclose
Carmon Koenigsknecht (*Abstract Co-Author*) Nothing to Disclose
Annabel Sorby-Adams (*Abstract Co-Author*) Nothing to Disclose
Adnan Siddiqui, MD,PhD (*Abstract Co-Author*) Investor, Shifamed LLC;Consultant, Alexion Pharmaceuticals, Inc;Advisory Board, Alexion Pharmaceuticals, Inc;Consultant, Amnis Therapeutics;Advisory Board, Amnis Therapeutics;Investor, Amnis Therapeutics;Investor, Bendit Technologies, Ltd;Investor, Blinktbi Inc ;Consultant, Boston Scientific Corporation;Advisory Board, Boston Scientific Corporation;Investor, Boston Scientific Corporation;Investor, Buffalo Technology Partners, Inc;Consultant, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation;Consultant, Cardinal Health, Inc;Advisory Board, Cardinal Health, Inc;Investor, Cardinal Health, Inc;Consultant, Cerebrotech Medical Systems, Inc;Advisory Board, Cerebrotech Medical Systems, Inc;Investor, Cerebrotech Medical Systems, Inc;Investor, Cognition Medical;Consultant, Endostream Medical, Ltd;Advisory Board, Endostream Medical, Ltd;Investor, Endostream Medical, Ltd;Consultant, Imperative Care, Inc;Advisory Board, Imperative Care, Inc;Investor, Imperative Care, Inc;Investor, Instylla, Inc;Consultant, IRRAS AB;Advisory Board, IRRAS AB;Investor, IRRAS AB;Consultant, Johnson & Johnson;Advisory Board, Johnson & Johnson;Committee member, Johnson & Johnson;Investor, NeuroRadial Technologies, Inc;Investor, Neurovascular Diagnostics, Inc;Consultant, Perflow Medical Ltd;Advisory Board, Perflow Medical Ltd;Investor, Perflow Medical Ltd;Consultant, Q'Apel Medical Inc;Advisory Board, Q'Apel Medical Inc;Investor, Q'Apel Medical Inc;Investor, Radical Catheter Technologies, Inc;Consultant, Integra LifeSciences Holdings Corporation;Advisory Board, Integra LifeSciences Holdings Corporation;Investor, Integra LifeSciences Holdings Corporation;Investor, RIST Neurovascular, Inc;Investor, Sense Diagnostics LLC ;Consultant, Serenity Medical Inc;Advisory Board, Serenity Medical Inc;Investor, Serenity Medical Inc;Consultant, Siemens AG;Advisory Board, Siemens AG;Consultant, Silk Road Medical;Advisory Board, Silk Road Medical;Investor, Silk Road Medical;Investor, Spinnaker Medical Consultants ;Consultant, StimMed;Advisory Board, StimMed;Investor, StimMed;Investor, Synchron AB;Investor, Truvic Medical, Inc;Investor, Vastrax , LLC;Investor, VICIS;Investor, Viseon Inc;Consultant, Viz.ai Inc;Advisory Board, Viz.ai Inc;Investor, Viz.ai Inc;Consultant, Medtronic plc;Advisory Board, Medtronic plc;Committee member, Medtronic plc;Consultant, Terumo Corporation;Advisory Board, Terumo Corporation;Committee member, Terumo Corporation;Consultant, Minnetronix Medical, Inc;Advisory Board, Minnetronix Medical, Inc;Consultant, Penumbra, Inc;Advisory Board, Penumbra, Inc;Committee member, Penumbra, Inc;Consultant, Rapid Medical;Advisory Board, Rapid Medical;Consultant, Stryker Corporation;Advisory Board, Stryker Corporation;Consultant, VasSol, Inc;Advisory Board, VasSol, Inc;Consultant, W. L. Gore & Associates, Inc;Advisory Board, W. L. Gore & Associates, Inc
Benjamin Morrish, MD (*Abstract Co-Author*) Nothing to Disclose
William T. Kimberly, MD,PhD (*Abstract Co-Author*) Research Grant, Remedy Pharmaceuticals, Inc
Liza Gutierrez (*Abstract Co-Author*) Nothing to Disclose
Donald Pionessa (*Abstract Co-Author*) Nothing to Disclose
Nandor K. Pinter, MD (*Presenter*) Consultant, Koninklijke Philips NV

**PURPOSE**

Large animal models are recommended to improve selection of novel stroke therapies prior to clinical trial. Leveraging clinically relevant outcome measures such as MRI biomarkers facilitates translation. Portable, ultra low-field MRI (LF-MRI) systems may offer an accessible and affordable method to image the brain of large animal species at multiple time points. We developed and tested brain imaging protocols in a canine stroke and a swine intracranial hemorrhage (ICH) model on a LF-MRI scanner.

**METHODS AND MATERIALS**

Two mongrel dogs and 3 Yorkshire pigs were scanned on a 0.064T LF-MRI (Hyperfine, Inc., Guilford, CT.) under anesthesia. Dogs underwent left middle cerebral artery (MCA) coil embolization to create hemispheric stroke and were scanned with coronal FLAIR and DWI at 30min and 2.5 hours post-stroke in the first dog, and 1 hour and 6 hours in the second. Pigs were either healthy (n=2) or underwent craniotomy and injection of blood to develop a model of ICH (n=1). Healthy pigs underwent sagittal and axial T1 and T2-weighted scans. The ICH model was scanned with a combination of T1w, T2w, DWI and FLAIR 1 hour postoperatively. General image quality, animal positioning and DWI positivity were evaluated qualitatively.

**RESULTS**

The brain was on the periphery of the field-of-view (FOV) due to the long snout of both species, with 6.5mm between the center of the brain and the center of FOV. In both dogs, DWI positivity and FLAIR hyperintensity was evident in the left MCA territory on the second acquisition, although lesion conspicuity was variable between the 2 dogs and DWI hyperintensity was visible in the ipsilateral soft tissue. In the swine model, axial scans were least informative, while sagittal scans were helpful in assessing the position of the brain, and coronal T2w scans were most useful to assess the craniotomy, parenchymal damage, and fluid collection. These findings were not visualized on DWI or T1w scans.

**CONCLUSION**

Our initial findings demonstrate that LF-MRI can be used to detect hemispheric stroke and intracranial postsurgical changes in large animals. The long snout in both models positioned the brain suboptimally within the FOV, which could be overcome by using a different breed or with a dedicated coil. DWI artifacts created uncertainty in stroke detection. In ICH model, T2w coronal scan was the most useful in evaluating postsurgical changes. Sequence development and advances in post-processing are avenues for future research to improve feasibility of utilizing LF-MRI in large animals.

**CLINICAL RELEVANCE/APPLICATION**

Portable LF-MRI scanners can offer a more accessible and affordable way to evaluate brain tissue. Developing dedicated imaging protocols and hardware for large animal stroke models may contribute to improving translational research.

## W5A-SPNR-12 APPLICATION OF SYMRI QUANTITATIVE TECHNIQUE IN MEDIAL TEMPORAL LOBE EPILEPSY WITH HIPPOCAMPAL SCLEROSIS

Jian Li (*Abstract Co-Author*) Nothing to Disclose
Bing Chen (*Abstract Co-Author*) Nothing to Disclose
Jinqin Li (*Abstract Co-Author*) Nothing to Disclose
Yan Mengnan (*Abstract Co-Author*) Nothing to Disclose
Yanling Zhang (*Abstract Co-Author*) Nothing to Disclose
Yiting Wang (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the value of synthetic magnetic resonance imaging (SyMRI) in the quantitative study of various subregions in medial temporal lobe epilepsy (MTLE) with hippocampal sclerosis (HS).

### METHODS AND MATERIALS

51 patients with unilateral HS in our hospital from January 2021 to January 2024 were included as a case group. 88 volunteers were included as a control group. All subjects underwent T1-weighted three-dimensional magnetisation-prepared rapid gradient-echo (3D T1 MP-RAGE) and synthetic magnetic resonance imaging (MAGiC) scans. 3D T1 MP-RAGE was post-processed by Freesurfer V7 to obtain the regions of interest (ROI); After processing with SyMRI StandAlone 8.0.4, MAGiC can obtain T1, T2, and PD quantitative maps; The quantitative maps were fused with the ROI to obtain the T1, T2 and PD values. One way ANOVA and Kruskal-Wallis H test were used to compare the values of various parameters, and further multiple comparisons were made. Parameters with statistically significant differences between groups were screened for significant variables using stepwise regression analysis, and receiver operating characteristic curve (ROC) and area under curve (AUC) were used to evaluate the diagnostic efficacy of significant parameters and multi parameter combination.

### RESULTS

The differences between the three groups were statistically significant, except for PD values in the subiculum (SUB). The comparison between two groups showed that the T2 and T1 values of CA1, CA3, CA4 and dentate gyrus (DG) and the PD values of CA1 and CA3 were higher in the affected group than in the healthy group and the control group. The T2 and T1 values of SUB and the PD values of CA4 and DG in the affected group were higher than those in the control group; The T2 values of SUB, CA1, CA3, CA4 and DG, T1 and PD values of CA4 and T1 values of DG in the healthy group were higher than those in the control group ($P<0.05$). The stepwise regression method was used to show that the T2 values of CA1, CA3, and SUB were significant variables. The results of Delong test showed that the diagnostic efficiency of T2 value in CA1 and CA3 was better than that of SUB, and the combination of the three could improve the diagnostic efficiency, with an AUC of 0.995, and compared with the single index, the differences were statistically significant ($P<0.05$).

### CONCLUSION

The quantitative measurement of relaxation time in hippocampal subregions of MTLE-HS by SyMRI can provide a more accurate clinical imaging reference, especially the combined parameters of T2 values of CA1, CA3 and SUB can effectively improve the diagnostic efficacy.

### CLINICAL RELEVANCE/APPLICATION

The quantitative study of SyMRI subregions can effectively improve the diagnostic efficiency of HS,and have certain application value in the diagnosis and lateralization of HS.

## W5A-SPNR-13 ARTERIAL COLLATERAL STATUS AND ENDOVASCULAR TREATMENT EFFECT IN LARGE ISCHEMIC STROKES: A SECONDARY ANALYSIS OF THE TENSION TRIAL

Martin Bendszus (*Abstract Co-Author*) Nothing to Disclose
Jens Fiehler (*Abstract Co-Author*) Nothing to Disclose
Gotz Thomalla, MD (*Abstract Co-Author*) Consultant, Covidien, Medtronic, Inc;Consultant, Pfizer Inc;Consultant, Bayer AG;Consultant, Boehringer Ingelheim GmbH
Helge C. Kniep, DIPLENG (*Abstract Co-Author*) Nothing to Disclose
Fabian Flottmann (*Abstract Co-Author*) Nothing to Disclose
Laurens Winkelmeier, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Randomized clinical trials have demonstrated that endovascular thrombectomy is efficacious in reducing functional disability in patients with acute ischemic stroke and large infarction. We investigated whether arterial collateral status modifies the treatment effect of endovascular thrombectomy in patients with large infarction.

### METHODS AND MATERIALS

This study is a post-hoc analysis of the TENSION trial. TENSION (The Efficacy and Safety of Thrombectomy in Stroke with Extended Lesion and Extended Time Window) was a prospective, multicenter, randomized trial of patients with acute large ischemic stroke and large infarction due to anterior circulation large vessel occlusion. Patients were randomly assigned to receive endovascular thrombectomy with medical treatment or medical treatment alone up to 12 hours from stroke onset. The enrollment of patients was performed at 41 centers in Europe and Canada between February 2018 and January 2023. Large infarction was defined as an Alberta Stroke Program Early Computed Tomography Score (ASPECTS) of 3-5. The Tan score was used to assess the arterial collateral status on computed tomography angiography. Patients were subdivided into poor collaterals (grade 0-1) and good collaterals (grade 2-3). Primary outcome was the shift on the 90-day modified Rankin Scale (mRS).

### RESULTS

A total of 201 patients met the inclusion criteria (51.2% female; median age, 74 years [IQR, 66-80]). Of those, 103 patients (51%) received endovascular thrombectomy and 98 patients (49%) received medical treatment alone. Good collaterals were less frequent than poor collaterals (73 patients [36%] versus 128 patients [64%]). There was no modification of endovascular treatment effect by collateral status (interaction term, P=.88). There was a significant shift in the distribution of 90-day mRS scores favoring endovascular thrombectomy over medical treatment alone in patients with good collaterals (adjusted common odds ratio [acOR], 3.93, 95%CI, 1.65-9.69, P=.002) and in patients with poor collaterals (acOR, 3.92, 95%CI, 1.86-8.52, P<.001). Good collaterals were associated with improved 90-day mRS scores (acOR, 2.88, 95%CI, 1.63-5.11, P<.001).

### CONCLUSION

In this TENSION subanalysis, endovascular thrombectomy reduced functional disability in patients with acute ischemic stroke and large infarction irrespective of good or poor collateral status.

### CLINICAL RELEVANCE/APPLICATION

Our findings suggest that endovascular thrombectomy should not be withheld based on collateral status in patients with acute ischemic stroke and large infarction presenting within 12 hours after stroke.

## W5A-SPNR-14 CORRELATION OF CEREBRAL BLOOD FLOW AND INFLAMMATORY CYTOKINE ALTERATIONS WITH SYMPTOM SEVERITY IN PREMENSTRUAL SYNDROME

Kaixuan Zhou (*Presenter*) Nothing to Disclose

### PURPOSE

Premenstrual syndrome (PMS) causes persistent distress in females of reproductive age and increases the lifetime risk of depression. There is preliminary evidence showing that altered central nervous system (CNS) processing is associated with PMS, and inflammation alterations are related to its etiology. However, it's unclear whether serum levels of inflammatory cytokine are associated with neural substrate. This study aimed to identify the brain regions and inflammatory cytokines that potentially mediate PMS, as well as explore their relationship with premenstrual symptom severity.

### METHODS AND MATERIALS

A total of 54 females with PMS and 71 controls underwent CBF (Cerebral blood flow) measurements by arterial spin labeling (ASL) scanning, peripheral blood inflammatory cytokines analysis in the late-luteal phase of menstrual cycle, and all participants were evaluated by the Daily Record of Severity of Problems (DRSP) for two consecutive menstrual cycles. Whole-brain voxel-based and seed-based connectivity methods were combined to depict the CBF differences between the groups. Correlation analysis was performed to investigate the relationship between regional CBF, inflammatory cytokines, and premenstrual symptom severity.

### RESULTS

PMS had increased CBF in the parahippocampal gyrus, inferior temporal gyrus, fusiform gyrus, precuneus, and inferior occipital gyrus, and decreased CBF in the supplementary motor area relative to controls. We also found that inflammatory cytokines were raised in PMS. The following correlation results were observed: (1) there was a significant correlation between the DRSP scores and CBF of all regions with inter-group differences; (2) the DRSP scores were positively correlated with TNF-a; (3) TNF-a was correlated with the CBF of all regions with inter-group differences.

### CONCLUSION

The present study demonstrated altered CBF in the Default Mode Network (DMN) in PMS. The precuneus and parahippocampal gyrus, as key nodes of the DMN, are associated with pro-inflammatory cytokine and symptom severity. The findings may provide preliminary evidence for the underlying neuroinflammatory mechanism in PMS and contribute to a better understanding of its pathophysiology.

### CLINICAL RELEVANCE/APPLICATION

According to the findings, the precuneus and parahippocampal gyrus might serve as potential therapeutic targets for non-invasive neurostimulation.

## W5A-SPNR-15 WHITE MATTER HYPERINTENSITY IN THE BRAIN TO DIFFERENTIATE NEUROMYELITIS OPTICA SPECTRUM DISORDER FROM MULTIPLE SCLEROSIS USING AN EXPLAINABLE THREE-DIMENSIONAL FRAMEWORK - LPV-NET

Chunjie Guo, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The overlapping clinical characteristics and magnetic resonance (MR) imaging features of Neuromyelitis Optica Spectrum Disorder (NMOSD) and Multiple Sclerosis (MS) could lead to potential diagnostic confusion. Using deep learning as a supporting tool to differentiate between NMOSD and MS is a promising method. However, current models struggle with complexity, accuracy, and interpretability. Therefore, our objective of this study is to develop a deep learning model that is computationally efficient and interpretable, explicitly designed to distinguish between NMOSD and MS through analysis of brain MR images.

### METHODS AND MATERIALS

A multi-center dataset containing 30 subjects with MS and 30 with NMOSD from * hospital, and 39 MS and 47 NMOSD subjects from the # hospital, was used in this study. The 2-stage model, Lesion Probability Vector Net (LPV-Net), using T2 fluid-attenuated inversion recovery (T2-FLAIR) MR images of each subject as input to differentiate MS and NMOSD patients. The classification performance of LPV-Net was evaluated based on accuracy (ACC), sensitivity (SN), and specificity (SP).

### RESULTS

The proposed model demonstrates superior performance compared to other three-dimensional models, with lower computational cost. It achieved an ACC of 0.948±0.006, a SN of 0.894±0.067, and a SP of 0.973±0.019 in differentiating MS and NMOSD, surpassing the capabilities of experienced neuroradiologists.

### CONCLUSION

Through our interpretability method, the decision-making process of the model becomes apparent and distinctly illustrates the different lesion distribution between MS and NMOSD. As a result, the proposed deep learning method could serve as an effective and reliable diagnostic tool for supporting clinical practices in the diagnosis of MS and NMOSD.

### CLINICAL RELEVANCE/APPLICATION

The clinical application of the study aims to using the LPV-Net, a deep learning model, in accurately differentiating between NMOSD and MS based on brain MR images. This model provides a low-complexity, highly interpretable framework that surpasses the diagnostic accuracy of experienced neuroradiologists. It has the potential to serve as a robust clinical tool for the precise diagnosis of these two similar yet distinct neurological disorders.

## W5A-SPNR-2 REGIONAL STRUCTURAL-FUNCTIONAL CONNECTIVITY COUPLING IN MAJOR DEPRESSIVE DISORDER IS ASSOCIATED WITH NEUROTRANSMITTER AND GENETIC PROFILES

Haizhu Xie (*Abstract Co-Author*) Nothing to Disclose
Tongpeng Chu (*Abstract Co-Author*) Nothing to Disclose
Fanghui Dong (*Abstract Co-Author*) Nothing to Disclose
Qun Gai (*Abstract Co-Author*) Nothing to Disclose
Ning Mao (*Presenter*) Nothing to Disclose

**PURPOSE**

Abnormalities in structural-functional connectivity (SC-FC) coupling have been identified on a global scale in patients with major depressive disorder (MDD). However, investigations have neglected the variability and hierarchical distribution of these abnormalities across different brain regions. Furthermore, the biological mechanisms underlying regional SC-FC coupling patterns are not well understood.

**METHODS AND MATERIALS**

We enrolled 182 individuals diagnosed with MDD and 157 healthy control (HC) subjects, quantifying the intergroup differences in regional SC-FC coupling. XGBoost, SVM and RF models were constructed to assess the potential of SC-FC coupling as biomarkers for MDD diagnosis and symptom prediction. Then, we examined the link among changes in regional SC-FC coupling, neurotransmitter distributions, and gene expression in individuals with MDD.

**RESULTS**

We observed increased regional SC-FC coupling in default mode network ($T = 3.233$) and decreased coupling in frontoparietal Network ($T = -3.471$) in MDD relative to HC. The XGBoost (AUC = 0.853), SVM (AUC = 0.832) and RF ($p < 0.05$) models exhibited good prediction performance. The alterations in regional SC-FC coupling in the patients with MDD were correlated with the distributions of four neurotransmitters ($p < 0.05$) and the expression maps of specific genes. These genes were strongly enriched in genes implicated in excitatory neurons, inhibitory neurons, cellular metabolism, synapse function, and immune signaling. These findings were replicated on two brain atlases.

**CONCLUSION**

This study quantified differences in regional subcortical-cortical (SC-FC) coupling between patients with MDD and HC. It also linked regional SC-FC coupling to neurotransmitter levels and gene expression, supporting the notion that the DMN, FPN, protein binding, cellular metabolic processes, and organismal systems are implicated in the neuropathophysiology of MDD. Furthermore, we demonstrated that abnormalities in neuroexcitatory (Neuro-Ex) and neuroinhibitory (Neuro-In) cells may be associated with changes in regional SC-FC coupling in MDD patients.

**CLINICAL RELEVANCE/APPLICATION**

This work enhances our understanding of MDD and pave the way for the development of additional targeted therapeutic interventions.

## W5A-SPNR-3 REDUCED BRAIN VENTRICULAR VOLUME OBSERVED IN FETUSES WITH PRENATAL OPIOID EXPOSURE

Rupa Radhakrishnan, MD, MS (*Abstract Co-Author*) Nothing to Disclose
William Reynolds (*Abstract Co-Author*) Nothing to Disclose
Sanjali Kherde (*Abstract Co-Author*) Nothing to Disclose
Ashok Panigrahy, MD (*Abstract Co-Author*) Nothing to Disclose
Jonathan Class, MD (*Abstract Co-Author*) Nothing to Disclose
Senthilkumar Sadhasivam (*Abstract Co-Author*) Nothing to Disclose
Ramana V. Vishnubhotla, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Opioid use amongst pregnant women has been increasing over the past two decades. Prenatal opioid exposure (POE) carries the risk of neonatal opioid withdrawal syndrome (NOWS) and poor long term developmental outcomes in these infants. Imaging may help in prediction of these poor outcomes in POE. Therefore, this study aims to assess differences in brain development in fetuses with prenatal opioid exposure compared to control fetuses without opioid exposure.

**METHODS AND MATERIALS**

This was a prospective IRB approved study. Two-dimensional (2D) 3T MR images of the fetal brain were acquired using a Half-Fourier Single-shot Turbo spin-Echo (HASTE) sequence in the axial, coronal, and sagittal planes in pregnant women with POE and control unexposed pregnant women. Manual brain masking of the HASTE images were used to generate high resolution isotropic three-dimensional (3D). Gestational age-appropriate atlas-based segmentation identified whole brain volumes and lateral ventricle volumes. Linear regression was used to assess the association of POE and smoking exposure on brain and ventricular volumes, after accounting for fetal sex, race, maternal age, and gestational age.

**RESULTS**

There were 59 pregnant mothers, including 30 with POE. Average gestational age was (M=33.9, SD=3.5) in POE and (M=32.5, SD=3.6) in controls. There were 16 male fetuses in POE and 10 male fetuses in the control group. Lateral ventricular volumes were significantly lower in fetuses with opioid exposure ($p=0.015$). However, there were no significant differences associated with whole brain volume. No gross brain malformations were identified in this cohort.

**CONCLUSION**

Smaller lateral ventricular volumes were identified in fetuses with POE compared to control unexposed fetuses without differences in corresponding brain volumes.

**CLINICAL RELEVANCE/APPLICATION**

In the absence of major morphological abnormalities, reduced lateral ventricle size in fetuses POE may indicate subtle alterations in brain development and neuronal migration. Next steps include longitudinal postnatal evaluation of brain growth and development in these fetuses, as well as correlations with clinical outcomes such as NOWS.

## W5A-SPNR-5 DEVELOPMENT AND VALIDATION OF A DEEP LEARNING-BASED CT PLANNING BOX FOR STROKE, OFFERING HIGH ACCURACY AND REPRODUCIBILITY FOR CLINICAL APPLICATION

Yang Wang (*Abstract Co-Author*) Nothing to Disclose
Runqiu Huang (*Presenter*) Nothing to Disclose

**PURPOSE**

Computed tomography (CT) is pivotal in the classification of stroke, estimation of penumbra dimensions, and facilitation of studies relevant to stroke radiomics. The acquisition of standardized, precise, and replicable images for follow-up purposes presents significant challenges. To address this issue, we have developed an intelligent CT system designed for comprehensive evaluation of stroke throughout the follow-up period.

**METHODS AND MATERIALS**

To augment conventional computed tomography (CT) systems with artificial intelligence, we deployed a combination of a Region Proposal Network (RPN) and V-Net architecture. The RPN facilitated facial detection by pinpointing jaw-adjacent positions, using a dataset of 76,382 human faces and a 2D camera. V-Net was applied for segmenting two regions of interest (ROIs) from a dataset of 295 subjects. A calibration table enabled precise calculations for the scanning couch's movement. This system's effectiveness was verified using 1,124 patients across three clinical settings, demonstrating significant enhancement in CT imaging capabilities.

**RESULTS**

The CAPITAL-CT, a novel system for cranial imaging, was introduced, incorporating an RPN model that exhibited a training error of 4.46 ±0.02 pixels with a 98.7% accuracy, and in validation, achieved a perfect success rate with a 2.23 ±0.10 pixel error. V-Net segmentation maintained clinical acceptability with a mean distance error of 3 mm and angle deviation within 3°. This innovation enables real-time, accurate, and consistent scanning, markedly lowering radiation exposure ($P < 0.001$), showcasing significant advancements in neuroimaging technology.

**CONCLUSION**

The CAPITAL-CT system produced standardized and replicable images, potentially streamlining radiologists' tasks. This advancement is expected to significantly contribute to the monitoring of stroke patients and facilitate diverse research endeavors within the field of neuroscience.

**CLINICAL RELEVANCE/APPLICATION**

The introduction of CAPITAL-CT heralds a pivotal advancement in combining Artificial Intelligence (AI) with medical imaging to enhance stroke diagnosis and patient monitoring. Addressing a crucial deficiency in medical imaging's initial capture phase, CAPITAL-CT offers an innovative, standardized, and repeatable CT scanning methodology. It significantly aids in the meticulous follow-up of stroke patients by ensuring the consistent quality of CT images, critical for monitoring acute ischemic stroke progression and facilitating timely, informed treatment decisions. CAPITAL-CT's revolutionary approach streamlines radiologists' tasks and improves stroke diagnosis and care accuracy, marking a notable contribution to neuroscience.

## W5A-SPNR-6 COMPARATIVE ANATOMY OF VENOUS SINUSES: ENDOSCOPY, FLAT PANEL CT, AND ANGIOGRAPHY

Yigit Can Senol (*Abstract Co-Author*) Nothing to Disclose
Nishanth Krishnan (*Abstract Co-Author*) Nothing to Disclose
Atakan Orscelik, MD (*Abstract Co-Author*) Nothing to Disclose
Luis Savastano (*Abstract Co-Author*) Nothing to Disclose
Mona Asghariahmadabad, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The intracranial venous sinuses are receiving increasing attention due to advancements in neuroimaging techniques, which have led to a higher rate of diagnoses and intervention of cerebral venous diseases. However, there is limited knowledge regarding the intraluminal structures of these dural sinuses. Given this gap, there is a critical need for a deeper investigation into the anatomical structures of the cerebral venous sinuses. Therefore, we aim to conduct a comparative anatomical study using the venous phase of digital subtraction angiography (DSA), venous sinus flat panel computed tomographic (CT) imaging, and endoscopic images of a cadaveric model of the venous sinus.

**METHODS AND MATERIALS**

Fresh, never-frozen head and neck human cadaver models were obtained from Willed Body program at UCSF. The carotid arteries, vertebral arteries, and jugular veins were cannulated as part of the preparation. Following cannulation, the cadavers were perfused with 4% formalin for light embalming. Subsequently, saline was circulated using pumps and tubing to maintain physiological flow and pressure, and to clear any remaining clots from the vascular test bed. Venography of major dural sinuses and flat-panel CT scans were then conducted with contrast injected through the jugular veins. A small craniotomy was made at the rostral midline of the skull to allow the insertion of a borescope. During the endoscopy, saline was pumped through the jugular vein to maintain physiological flow and pressure.

**RESULTS**

Pre-procedural quality control revealed no distal occlusion in the vascular pathways on contrast-enhanced fluoroscopic images and roadmaps. The intraluminal endoscopic images identified the protrusion of arachnoid villi into the superior sagittal sinus’s lumen as well as multiple septations with a thickness of 0.1 to 1mm inside the sinus lumen. These features were not apparent in the DSA images or the flat-panel CT scans of the specimens.

**CONCLUSION**

Improving neuroimaging techniques to better visualize intraluminal septations and the protrusion of arachnoid villi into the venous sinus lumen is crucial for advancing our understanding of cerebral venous disease. Such improvements are essential for distinguishing between physiological and pathological septations and arachnoid villi. Additionally, these advancements would enhance the effectiveness of interventions in the cerebral venous sinuses.

**CLINICAL RELEVANCE/APPLICATION**

Comparing different imaging modalities enhances the understanding and details of intraluminal structures within the dural sinuses. These findings lead to improved diagnostic and treatment approaches, ultimately enhancing patient outcomes in modern neuro-angiography suites.

## W5A-SPNR-7 PHASE-CONTRAST MRI EVALUATION OF CEREBROSPINAL FLUID DYNAMICS IN PATIENTS WITH LEPTOMENINGEAL SEEDING FROM LUNG ADENOCARCINOMA

Chunmiao Xu (*Abstract Co-Author*) Nothing to Disclose
Hailiang Li (*Abstract Co-Author*) Nothing to Disclose
Zhe Ma (*Abstract Co-Author*) Nothing to Disclose
Bingjie Zheng, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This prospective study aims to utilize phase-contrast MRI (PC-MRI) to evaluate cerebrospinal fluid (CSF) dynamics in patients diagnosed with leptomeningeal seeding from lung adenocarcinoma and to assess the differences in CSF parameters between patients with and without leptomeningeal seeding.

**METHODS AND MATERIALS**

PC-MRI scans were prospectively obtained from 36 patients, with 20 patients diagnosed with leptomeningeal seeding and 16 without, recruited between October 2023 and March 2024. The MRI scans were performed using a 3.0-T superconducting scanner. Axial T1-weighted, T2-weighted, and phase-

contrast MRI (PC-MRI) sequences were acquired for each patient. Quantitative analyses of CSF flow dynamics were performed using dedicated PC-MRI angiography software. Various parameters were measured and compared between the two groups.

**RESULTS**

Patients with leptomeningeal seeding exhibited a significantly higher heart rate (82.30 ± 15.34 vs. 71.75 ± 12.77, p = 0.034) and lower forward flow volume (0.021 ± 0.019 vs. 0.042 ± 0.017, p = 0.002) compared to those without seeding. Additionally, patients with seeding had a significantly lower peak velocity (6.53 ± 2.63 vs. 8.48 ± 2.43, p = 0.030) and mean flux (0.16 ± 0.19 vs. 0.49 ± 0.46, p = 0.012) compared to patients without seeding. No significant differences were observed in other parameters between the two groups.

**CONCLUSION**

This prospective study demonstrates significant alterations in CSF dynamics in patients with leptomeningeal seeding from lung adenocarcinoma compared to those without seeding, as observed through phase-contrast MRI.

**CLINICAL RELEVANCE/APPLICATION**

Phase-contrast MRI offers valuable insights into the CSF dynamics of lung adenocarcinoma patients with leptomeningeal seeding. The observed alterations in CSF flow parameters, such as forward flow volume, velocity, and mean flux, highlight potential imaging biomarkers for disease progression and severity. These findings equip radiologists with essential diagnostic information for accurately identifying leptomeningeal seeding in patients, especially before traditional imaging abnormalities manifest. Moreover, the utilization of phase-contrast MRI in this context underscores its clinical utility as a non-invasive imaging modality for evaluating CSF dynamics and guiding therapeutic decision-making in oncological settings.

## W5A-SPNR-8 TRANSCRANIAL 3D CONTRAST-ENHANCED ULTRASOUND (3D-CEUS) FOR BEDSIDE CEREBRAL ANGIOGRAPHY AND PERFUSION IMAGING FOLLOWING ANEURISMAL SUBARACHNOID HEMORRHAGE (SAH)

Maxime Gauberti (*Abstract Co-Author*) Nothing to Disclose
Vincent Hingot (*Abstract Co-Author*) Nothing to Disclose
Sylvain Bodard (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the effectiveness of transcranial 3D contrast-enhanced ultrasound (3D-CEUS) in detecting early signs of cerebral vasospasm and hypoperfusion post-aneurysmal subarachnoid hemorrhage (SAH), aiming to prevent delayed cerebral ischemia (DCI).

**METHODS AND MATERIALS**

For this study, a custom 3D ultrasound scanner was developed to reach a 1kHz volume rate at 9 cm depth along a 30° pyramid using a 2 MHz matrix probe. Each imaging session involved a standard 2.4 ml bolus of SonoVue followed by a 10 ml saline flush, with continuous acquisition through the temporal window over 3 minutes to monitor the entire bolus progression and washout phases. Patients underwent 3 imaging sessions: within 72 hours of admission post-aneurysm rupture, on day 5 during peak cerebral vasospasm risk, and before 14 days or upon discharge, assessing both hemispheres.

**RESULTS**

In this observational study of 15 consecutive patients with aneurysmal SAH, Time Intensity Curves (TIC) derived from SonoVue injections provided a reliable measure of contrast enhancement, serving as the primary evaluative metric. We reconstructed angiographic and perfusion images to identify cerebral vasospasm and hypoperfusion signs, complemented by comparative analysis of routine care data, including daily Transcranial Doppler (TCD) measurements and Computed Tomography Angiography (CTA) and Perfusion (CTP) imaging.

**CONCLUSION**

Preliminary results suggest that 3D-CEUS could by a promising tool for monitoring cerebral hypoperfusion in SAH patients, offering real-time data essential for timely intervention.

**CLINICAL RELEVANCE/APPLICATION**

Implementing 3D-CEUS in neurocritical care could enhance the monitoring of cerebral blood flow, potentially reducing the risk of secondary brain injury in patient susceptible to DCI.

# Abstract Archives of the RSNA, 2024

W5A-SPOB

**OB/Gynecology and Pediatric Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPOB-1 RETROSPECTIVE CLINICAL VALIDATION OF CONSENSUS MRI DIAGNOSTIC ALGORITHM FOR EVALUATION OF UTERINE MASSES AT RISK OF LEIOMYOSARCOMA

Pejman Ghanouni, MD, PhD (*Abstract Co-Author*) Medical Advisory Board, InSightec Ltd;Scientific Advisory Board, SonALASense
Priyanka Jha, MBBS (*Abstract Co-Author*) Nothing to Disclose
Stephan Altmayer, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Luyao Shen, MD (*Abstract Co-Author*) Nothing to Disclose
Sarah Miller, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In 2022 a consensus statement, developed with radiologists and gynecologists, that introduced an MRI-based imaging algorithm designed to classify atypical uterine masses, with preliminary reports indicating high accuracy. However, its clinical adoption hinges on further external validation studies. Our objective was to evaluate the algorithm diagnostic performance in differentiating benign and malignant masses on pelvic MRI.

### METHODS AND MATERIALS

In this institutional review board-approved single-center we identified radiology reported atypical uterine masses on pre-operative pelvic MRI. Final histological diagnosis was used as the reference standard. We adhered to the 2022 consensus guidelines to classify the masses as “benign”, “likely benign”, or “suspicious/highly suspicious” for malignancy. Imaging analysis was performed by a radiologist with >10 years of experience in interpreting pelvic MRI. Sensitivity and specificity were calculated along with the 95% confidence interval using Clopper-Pearson method. Data analysis was conducted using RStudio version 2023.06.0+421

### RESULTS

30 patients with atypical uterine masses were identified. Of those, 20 were ultimately diagnosed with leiomyosarcoma, whereas the remainder 10 had benign histology. No malignant mass was classified in the “benign” category. Three malignant cases (3/20; 15%) were categorized as “likely benign”, while 8/20 (40%) were “highly suspicious” due to extrauterine disease, and 9/20 (45%) as “suspicious” based on ADC signal intensity. Among benign masses, 5/10 (50%) were classified as “benign”, 2/10 (20%) as “likely benign”, and 3/10 (30%) as “suspicious for malignancy”. Using the threshold of “suspicious/highly suspicious for malignancy” to define malignancy, MRI algorithm had a sensitivity of 85% (95% CI, 47-83%) and specificity of 70% (95% CI, 35-93%). When patients with extrauterine disease were excluded from the analysis, the sensitivity and specificity of MRI were 75% (95% CI, 43-95%) and70% (95% CI, 35-93%). Analysis of false negative results showed lesions with large amount of necrosis, hemorrhage and atypical location.

### CONCLUSION

The MRI consensus algorithm demonstrated a sensitivity of 85% and a specificity of 70% for stratification of malignancy in atypical uterine masses. The sensitivity reduced to 75% upon the exclusion of patients with extrauterine disease.

### CLINICAL RELEVANCE/APPLICATION

The consensus algorithm for the evaluation of atypical uterine masses based on MRI shows moderate diagnostic performance to distinguish malignant from benign masses, particularly when patients with extrauterine disease are not considered in the analysis. Lesions with large amount of necrosis and atypical locations are at risk for false negative results.

## W5A-SPOB-2 A COMPARISON OF 2D AND 3D MAGNETIC RESONANCE IMAGING-BASED INTRATUMORAL AND PERITUMORAL RADIOMICS MODELS FOR THE PROGNOSTIC PREDICTION OF ENDOMETRIAL CANCER: A PILOT STUDY

Ning Lang, MD (*Abstract Co-Author*) Nothing to Disclose
Ruixin Yan (*Presenter*) Nothing to Disclose

### PURPOSE

Accurate prognostic assessment is vital for the personalized treatment of endometrial cancer (EC). Although radiomics models have demonstrated prognostic potential in EC, the impact of region of interest (ROI) delineation strategies and the clinical significance of peritumoral features remain uncertain. Our study thereby aimed to explore the predictive performance of varying radiomics models for the prediction of LVSI, DMI, and disease stage in EC.

## METHODS AND MATERIALS

Patients with 174 histopathology-confirmed EC were retrospectively reviewed. ROIs were manually delineated using the 2D and 3D approach on T2-weighted MRI images. Six radiomics models involving intratumoral (2Dintra and 3Dintra), peritumoral (2Dperi and 3Dperi), and combined models (2Dintra+peri and 3Dintra+peri) were developed. Models were constructed using the logistic regression method with five-fold cross-validation. Area under the receiver operating characteristic curve (AUC) was assessed, and was compared using the Delong's test.

## RESULTS

No significance differences in AUC was observed between the 2Dintra and 3Dintra models, or the 2Dperi and 3Dperi models in all prediction tasks ($P > 0.05$). Significant difference was observed between the 3Dintra and 3Dperi models for LVSI (0.738 vs. 0.805) and DMI prediction (0.719 vs. 0.804). The 3Dintra+peri models demonstrated significantly better predictive performance in all 3 prediction tasks compared to the 3Dintra model in both the training and validation cohorts ($P < 0.05$).

## CONCLUSION

Comparable predictive performance was observed between the 2D and 3D models. Combined models significantly improved predictive performance, especially with 3D delineation, suggesting that intra- and peritumoral features can provide complementary information for comprehensive prognostication of EC

## CLINICAL RELEVANCE/APPLICATION

1. Radiomics can provide the non-invasive prediction of LVSI, DMI, and FIGO stage of EC.2. 2D and 3D delineation showed comparable results both in intra- and peritumoral radiomics models.3. Combined intra- and peritumoral features can further enhance the models' predictive ability.

# Abstract Archives of the RSNA, 2024

W5A-SPPD

**Pediatric Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPPD-1 APPLICATION OF SYNTHETIC MRI QUANTITATIVE ASSESSMENT IN BRAIN DEVELOPMENT OF CHILDREN WITH BRONCHOPULMONARY DYSPLASIA

Shaoyu Wang (*Abstract Co-Author*) Nothing to Disclose
Shengfang Xu (*Presenter*) Nothing to Disclose

### PURPOSE

This study primarily investigates the application of SyMRI quantitative assessment in the brain development of children with BPD.

### METHODS AND MATERIALS

A total of 31 infants aged 2-24 months with BPD were prospectively collected as the observation group,and healthy infants matched for age and gender as the control group.NBNA was performed for all participants in both groups. All participants underwent multi-dynamic multi-echo (MDME) scanning on a 3.0 T MRI scanner(MAGNETOM Lumina, Siemens Healthineers, Erlangen, Germany).. MDME raw data were processed using in-house MDME post-processing software to automatically generate T1, T2, and PD maps. Using ITK-SNAP 4.0.1 software, anatomical regions of interest (ROI) were manually delineated on the T1, T2, and PD maps for both groups (Figure 1), and T1, T2, and PD values were calculated (Figure 2).while independent samples t-tests were employed for comparison of T1, T2, and PD values between different brain region ROIs in the two groups. Intergroup comparison of NBNA scores was also conducted. Pearson correlation analysis was performed to assess the correlation between regions showing differences in T1, T2, PD values and NBNA scores. ROC curves were generated to evaluate the diagnostic performance of T1 and T2 values with statistical significance in diagnosing abnormal brain development in BPD patients.

### RESULTS

In the observation group, the T1 and T2 values of the PLIC, PTR,CereP, CS, and Frontal White Matter were higher than those in the control group, with statistically significant differences for both T1 and T2 values. Additionally, the T2 value of occipital white matter in the observation group was higher than that in the control group, with statistical significance (Figure 3). Pearson correlation analysis revealed that NBNA scores in the observation group were lower than those in the control group. Furthermore, NBNA scores were negatively correlated with the T1 and T2 values of the PTR and CereP, as well as with the T1 value of Frontal White Matter (Table 1). ROC curve analysis demonstrated that the T1 and T2 values of the PTR, T1 value of CereP, T2 value of CS, and T1 value of Frontal White Matter had AUCs greater than 0.720 for diagnosing abnormal brain development in BPD patients (Figure 4).

### CONCLUSION

SyMRI quantitative assessment aids in the early detection of abnormal brain development in children with BPD, providing a basis for early clinical assessment and timely intervention.

### CLINICAL RELEVANCE/APPLICATION

SyMRI multiparameter indices can serve as imaging reference indices for brain development in children with BPD, assisting clinicians in early detection of neurodevelopmental issues in these patients and providing a basis for early clinical assessment and timely intervention.

## W5A-SPPD-3 RE-EVALUATING THE TIMING OF SEQUENTIAL CRANIAL ULTRASOUND SCREENING IN VERY PRETERM INFANTS FOR PREDICTING NEURODEVELOPMENTAL OUTCOMES

Sunaina Ramdass, MBChB (*Abstract Co-Author*) Nothing to Disclose
Jehier Afifi (*Abstract Co-Author*) Nothing to Disclose
Tahani M. Ahmad, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Among the myriad challenges in caring for preterm infants, the accurate prediction and early detection of neurodevelopmental impairment (NDI) stands as a crucial endeavour for healthcare providers. Sequential cranial ultrasound (CUS) remains the work horse for imaging evaluation of brain injury in this patient population. There is no worldwide consensus on the timing and frequency of CUS screening. At our institution, similar to the European Brain group and the 2001 Canadian Pediatric Society recommendations, at least 4 time point CUS are performed for routine screening in preterm infants. This includes CUS scanning at the 1st week, 2nd week, 6th week and at Term-Equivalent Age. Our hypothesis is that the 2-week CUS is not necessary in NDI prognostication, without a significant abnormality on the 1st week CUS, mandating a short-term interval follow up.

## METHODS AND MATERIALS

In this retrospective, single-centre, population-based cohort, we included all liveborn preterm infants 220-306 weeks' gestation who were born between January 2004 and December 2016 at our institution and had neurodevelopmental assessment at 36 months corrected age. A model dropping 2-week ultrasound was compared to a reference model that includes gestational age, infant sex as well as 2 and 6-week ultrasound gradings. Decision curves were fit for all proposed models to help guide the trade-off between accuracy and potential uptake.

## RESULTS

Out of 786 preterm babies born during the study period, 656 survivors were included in the analysis. Thirty percent of our cohort has NDI as per clinical assessment. The mean gestational age was 27.8 weeks with the mean birth weight being 1133 grams, and 55% being male infants. The negative predictive value of sequential CUS varied between 76 - 81% for CUS conducted at 2-week and 6-week time points, respectively. Overall, there does not appear to be strong evidence that the addition of the 2-weeks' CUS, following a normal initial CUS, meaningfully contributes to the risk prediction of any NDI or significant NDI when making predictions at the time of hospital discharge. Models with and without the 2-weeks' CUS showed near identical performance across a broad set of metrics.

## CONCLUSION

In this population-based cohort, we compared two methods of sequential CUS screening (3 and 4 time-points) and showed reliable performance of the 3 time points model to predict NDI at 36 months of corrected age.

## CLINICAL RELEVANCE/APPLICATION

The need for a 2-week CUS to predict NDI can be eliminated if no significant abnormalities are detected during the initial 1-week CUS, promoting prudent resource allocation and stewardship in healthcare.

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# Abstract Archives of the RSNA, 2024

W5A-SPPH

**Physics Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPPH-1 PERFORMANCE CHARACTERISATION OF AN ULTRA-LOW-DOSE, STATIONARY, TOMOGRAPHIC MOLECULAR BREAST IMAGING SYSTEM PROTOTYPE

Ian Baistow, BSC (*Abstract Co-Author*) Nothing to Disclose
Kjell Erlandsson (*Abstract Co-Author*) Nothing to Disclose
Kris Thielemans, PhD (*Abstract Co-Author*) Research Grant, GE Healthcare;Research Grant, Siemens Healthcare;Research Grant, GlaxoSmithKline;
Brian F. Hutton, PhD (*Abstract Co-Author*) Research Grant, GE Healthcare;;Research Grant, Siemens Healthcare;;Research Grant, GlaxoSmithKline
Nathan Atkins (*Abstract Co-Author*) Nothing to Disclose
Alexander Cherlin, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Molecular Breast Imaging (MBI) demonstrates high sensitivity in detecting cancer, particularly in dense breast tissue. Nonetheless, long imaging time and higher radiation exposure compared to mammography hinder its widespread adoption. Following successful feasibility studies where a novel ultra-low-dose stationary tomographic MBI system demonstrated a potential for dose/measurement time reduction of a factor of ~8, a small field of view (FOV) prototype has been built and evaluated.

### METHODS AND MATERIALS

A small FOV prototype comprised of two camera heads. A head comprising a 6x4 array of Kromek's 3D position sensitive 5mm thick CZT detectors covering the FOV of 132 mm x 88 mm, and a densely packed multi-pinhole 3D printed tungsten collimator with ~300 pinholes. The detectors have an 11x11 array of 2mm pixels. The system produces tomographic images with significant multiplexing resulting in adverse artefacts which are mitigated by de-multiplexing algorithms utilising detector 3D position of interaction information. The detector data is analysed using a machine-learning-based (ML) model which provides strong improvement in sub-pixel position resolution. The initial calibration of the prototype is complete, and its performance evaluated using point sources and 99mTc-filled phantoms.

### RESULTS

The initial assessment of the prototype's performance, through reconstructed 2D images, has shown significant advancement in detector resolution achieving 5x5 sub-pixelization of physical 2 mm pixels. This performance leads to an major enhancement in the image resolution, surpassing any previous demonstration by a SPECT or MBI system with CZT detectors. These outcomes have been implemented in both simulated and experimental data image reconstruction, showcasing significant improvements in reconstructed tomographic image quality and de-multiplexing performance of reconstruction algorithms. The system's performance characterization with phantoms and quantification of dose/time reduction factors will be presented.

### CONCLUSION

These results reveal substantial improvement in detector performance, which in turn enhances the performance of tomographic image reconstruction. Building upon the outcomes reported last year, we anticipate further enhancements in our dose/time reduction efforts to reduce the injected patient dose to approximately 2 mCi/75 MBq (equivalent to a mammography dose of ~0.5 mSv) significantly shortening the MBI scan time to below the current 40 minutes.

### CLINICAL RELEVANCE/APPLICATION

Reduction of patient dose, scan time, and 3D localisation, aiding biopsy, should fulfil American College of Radiology's criteria (2018) for accepting MBI for cancer screening, especially for patients with dense breast tissue.

## W5A-SPPH-10 RELIABILITY, AGREEMENT, AND BIASES OF DEEP LEARNING RECONSTRUCTIONS FOR QUANTITATIVE SUSCEPTIBILITY MAPPING (QSM)

Dawn Berkeley, BS (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation
Wissam Alghuraibawi (*Abstract Co-Author*) Nothing to Disclose
Min-Ying Su, PhD (*Abstract Co-Author*) Nothing to Disclose
Peter Chang, MD (*Abstract Co-Author*) Co-founder, Avicenna.ai;Stockholder, Avicenna.ai;Research Grant, Canon Medical Systems Corporation;Speakers Bureau, Canon Medical Systems Corporation;Research Grant, General Electric Company
Hon J Yu (*Abstract Co-Author*) Nothing to Disclose
Brian Tymkiw, ARRT, BS (*Abstract Co-Author*) Nothing to Disclose
Jennifer E. Soun, MD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Mo Kadbi, PhD (*Abstract Co-Author*) Employee, Canon Medical Systems Corporation;
Hung P. Do, PhD, MSc (*Presenter*) Employee, Canon Medical Systems Corporation

**PURPOSE**

Deep Learning Reconstruction (DLR) has been used clinically for qualitative imaging providing improved image quality, SNR, resolution, and scan time compared to conventional reconstruction (CONV) [1-4]. Rigorous assessment of DLR for quantitative imaging is needed before widespread clinical adoption. This study aimed to evaluate two DLR methods named Deep Learning-based Denoising Reconstruction (DL-DR) and Deep Learning-based Super-resolution Reconstruction (DL-SR) for quantitative susceptibility mapping (QSM) [5].

**METHODS AND MATERIALS**

Five patients were scanned using a 3T MRI scanner under approved IRB. The scan protocol consists of routine brain sequences and a 3D multi-echo gradient echo (mecho-GRE) sequence for QSM. Each mecho-GRE data was reconstructed with CONV, DL-DR, and DL-SR.Morphology Enabled Dipole Inversion (MEDI) [6] was used to generate QSM maps. Deep gray matter regions of interest (ROIs) on substantia nigra and red nucleus were drawn.Linear regression was used to assess reliability while Bland-Altman and Lin's concordance correlation coefficient were used to assess agreement as recommended by Berchtold et al. [7]. Quantitative metrics such as SSIM, PSNR, NRMSE were also calculated for comparison.

**RESULTS**

Fig 1 2 show representative GRE magnitude images and QSM maps from two subjects. Qualitatively, as seen in Fig 1, substantia nigra (green arrowhead) and red nucleus (red arrow) are darker compared to surrounding tissues in the first subject (top row) than in the other one (bottom row). However, the major drawback of the qualitative assessment is that the MR signal intensity, tissue contrast, SNR, and CNR are dependent on subject, scan protocol, and scanning conditions, which confound objective assessment of iron deposition.Alternatively, QSM provides an objective assessment of iron deposition. As shown in Fig 3, the quantitative regional QSM values for the two subjects can be objectively compared. It is noted that measured QSM values are similar among the three reconstructions.Fig 4 5 show correlations between CONV vs. DL-DR ($R2 > 0.99$) with biases of 5.93 ppb and between CONV vs. DL-SR ($R2>0.98$) with biases of 6.96 ppb. Lin's concordance correlation coefficients were all larger than 0.97 for QSM values for both comparisons.

**CONCLUSION**

Deep Learning-based Denoising Reconstruction and Deep Learning-based Super-Resolution Reconstruction have excellent correlation and agreement with conventional reconstruction for QSM.

**CLINICAL RELEVANCE/APPLICATION**

It is imperative to rigorously evaluate DLR for quantitative MRI before clinical adoption. This study demonstrated that DLR has excellent correlation and agreement with CONV for QSM quantification. That would facilitate the clinical adoption of DLRs for QSM.

## W5A-SPPH-2 APPLICATION OF CARDIAC MAGNETIC RESONANCE DWI SEQUENCE IN THE DIAGNOSIS OF MYOCARDIALFIBROSIS IN HYPERTROPHIC CARDIOMYOPATHY

Xiaowei Ruan (*Presenter*) Nothing to Disclose

**PURPOSE**

Given the importance of diagnosing HCM for predicting patient outcomes, our goal was to enhance the detection rate of myocardial fibrosis using DWI sequences.

**METHODS AND MATERIALS**

The clinical and CMR data of 14 HCM patients (HCM group) and 23 patients with normal CMR structure (control group) were retrospectively collected, and all patients underwent CMR examination, including T1 mapping sequence, DWI and delayed enhancement (LGE) scan, LGE was recorded as LGE+ ,LGE-, respectively, all images were imported into cardiovascular image post-processing software (CVI42) for analysis, and left ventricular Strain and nativeT1 were semi-automatically measured m and ECV. The ROI was placed in the significant myocardial thickening area (group A), the thickening area adjacent to the myocardium (group B), and the thickening area with distal myocardium (group C), and the ROI was manually delineated on the T1mpping diagram and the T1 and blood pool T1 values before and after intensification were calculated, and the ECV of the three groups was obtained. Subsequently, the images were imported into the cardiovascular image post-processing workstation (ISP), and the ROI was placed in the above-mentioned areas of the same layer DWI image on the left ventricular short-axis image according to the range of delay enhancement in the LGE image, and all DWI images were analyzed to obtain diffusion images and measure the ADC values of the three groups.

**RESULTS**

1. Clinical data. (See Table 1 for the basic information of the HCM group and the healthy control group). 2. The 3D global strain parameters of HCM patients and healthy control groups are detailed in Table 2. The peak values of circumferential and longitudinal strain in the HCM group were significantly lower than those in the healthy control group ($P<0.05$), and the peak radial strain was lower than that in the healthy control group, and the difference was not statistically significant. 3. The native T1 value of the HCM group was lower than that of the control group, and the difference was statistically significant ($t=P<0.05$), and the ECV of the HCM group was slightly lower than that of the healthy control group, and the difference was not statistically significant. 4. Comparison of ADC values: In the HCM group, the ADC values of group A were lower than those of groups B and C (both $P < 0.05$) Table 4

**CONCLUSION**

The results of this study suggest that cardiac DWI technology has a high value in identifying and quantifying myocardial fibrosis in cardiohypertrophic cardiomyopathy.

**CLINICAL RELEVANCE/APPLICATION**

The results of this study suggest that cardiac DWI technology has a high value in identifying and quantifying myocardial fibrosis in cardiohypertrophic cardiomyopathy.

## W5A-SPPH-6 DATA-DRIVEN RESPIRATORY GATING PATIENT MANAGEMENT FOR DIGITAL BGO PET/CT

John A. Kennedy, PhD (*Abstract Co-Author*) Nothing to Disclose
Zohar Keidar, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tala Palchan Hazan, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Data-driven methods for respiratory gating (DDRG) in PET imaging have shown a positive impact on image quality. However, the use of quiescent period gating (QPG) in reconstruction methods that rely on DDRG typically require additional scan time to reduce image noise. Consequently, scans requiring this additional acquisition time alter patient workflow, relevant for the planning of radiotracer injection and scan times, as well as negatively affecting

patient comfort. This study evaluated the clinical application of a commercially available DDRG system that employs principal component analysis in a digital bismuth germanate (dBGO) PET/CT scanner.

**METHODS AND MATERIALS**

Forty-two whole-body ("head to thighs") PET/CT scans were collected using list mode data from a high-sensitivity dBGO scanner, with a two-minute scan duration per bed position. The DDRG tool targeted two specific bed positions, the thorax and abdomen, where respiratory motion is most predominant. This tool produces an R index, quantifying the degree of respiratory motion. The R-index needed to trigger the implementation of QPG was determined for each scan. The percentage of scans triggered at the manufacturer's default value (R = 15) was determined, as well as for R-indexes ranging from 0 to 50 (increments of 5). Reconstructions using QPG were compared against non-gated reconstructions with specific attention to the maximum standardized uptake value (SUVmax) of well-defined lesions in the thorax or abdomen.

**RESULTS**

Measurements of the R indexes, derived for the two bed positions in each scan, showed that 57% of the scanned population exhibited minimal R indexes of = 15, indicating that about half the scans would be triggered to require additional acquisition time for this threshold of respiration. In comparison, approximately one-third of the population demonstrated R indexes of 20 or higher. In terms of total daily PET scan times for 26 patients, this represents a decrease from 280 minutes for R = 15 to 250 minutes for R = 20. Females displayed a slightly higher average R index (23.5) compared to males (20.9) in the thoracic bed position. Employing DDRG significantly increased the SUVmax of focal lesions, by an average of 28% ($P<0.007$) observed in lesions located in bed positions with R value of = 15, indicating a more defined focal uptake.

**CONCLUSION**

Based on the distribution of R indexes, the threshold can be established for the R value needed to implement respiratory gated corrections during acquisition. This strategy aims to enhance clinical workflow by optimizing scan time while preserving image quality.

**CLINICAL RELEVANCE/APPLICATION**

Precise understanding of the implementation of data driven respiratory gating enables proper patient care via workflow planning for digital BGO PET/CT.

## W5A-SPPH-7 ROBUSTNESS OF MRI RADIOMICS FEATURES IN ABDOMEN: IMPACT OF DEEP LEARNING RECONSTRUCTION AND ACCELERATED ACQUISITION

Yang Song (*Abstract Co-Author*) Nothing to Disclose
Weiwu Yao (*Abstract Co-Author*) Nothing to Disclose
Huan Zhang (*Abstract Co-Author*) Nothing to Disclose
Jingyu Zhong, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the impact of deep learning reconstruction and accelerated acquisition on reproducibility and variability of radiomic features in abdominal MRI.

**METHODS AND MATERIALS**

Seventeen volunteers were prospectively included to undergo abdominal MRI on a 3.0-T scanner for axial T2-weighted, axial T2-weighted fat-suppressed, and coronal T2-weighted sequences. Each sequence was scanned for four times using original acquisition with standard reconstruction, original acquisition with deep learning reconstruction, accelerated acquisition with standard reconstruction, and accelerated acquisition with deep learning reconstruction. The regions of interest were drawn for ten anatomical sites. Ninety-three radiomics features were extracted via PyRadiomics after z-score normalization. The reproducibility was evaluated using original acquisition with standard reconstruction as reference by intraclass correlation coefficient (ICC) and concordance correlation coefficient (CCC). The variability among four scans was assessed by coefficient of variation (CV) and quartile coefficient of dispersion (QCD).

**RESULTS**

The average ± standard deviation, median (quartile) of overall ICC and CCC values were 0.473 ± 0.226, 0.451 (0.305, 0.583) and 0.472 ± 0.226, 0.450 (0.304, 0.582). The overall percentage of radiomics features with ICC>0.90 and CCC>0.90 were 8.1% and 8.1%. The average ± standard deviation, median (quartile) of overall CV and QCD values were 17.4% ± 49.5%, 9.4%, (4.9%, 17.2%) and 9.6% ± 33.1%, 4.9%, (2.5%, 9.7%). The overall percentage of radiomics features with CV<10% and QCD<10% were 51.9% and 75.0%.

**CONCLUSION**

Deep learning reconstruction and accelerated acquisition led to a poor reproducibility of radiomics features, but more than a half of the radiomics feature values varied within an acceptable range.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning reconstruction and accelerated acquisition significantly impacts on radiomic features, necessitating caution to the generalizability when performing radiomic analysis using images from different reconstruction algorithms and acquisition protocols.

## W5A-SPPH-8 ROBUSTNESS OF RADIOMICS WITHIN PHOTON-COUNTING CT: IMPACT OF ACQUISITION AND RECONSTRUCTION FACTORS

Weiwu Yao (*Abstract Co-Author*) Nothing to Disclose
Huan Zhang (*Abstract Co-Author*) Nothing to Disclose
Lan Zhu, MD (*Abstract Co-Author*) Nothing to Disclose
Jingyu Zhong, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To assess robustness of radiomics within photon-counting CT.

**METHODS AND MATERIALS**

A phantom with twenty-eight diverse texture materials was scanned with different acquisition and reconstruction factors including reposition, scan mode (standard and high pitch), tube voltage (120 and 140 kVp), slice thickness (1.0 and 0.4 mm), radiation dose level (0.5, 1.0, 3.0, 5.0, and 10.0 mGy), quantum iterative reconstruction level (0, 2, and 4), and reconstruction kernel (Qr40, Qr44, and Qr48). Thirteen sets of virtual monochromatic images at 70 keV were reconstructed. The regions of interest were drawn and copied with rigid registrations. Ninety-three radiomics features were extracted from each material per PyRadiomics. The reproducibility of radiomics features was evaluated using intraclass correlation coefficient (ICC) and concordance

correlation coefficient (CCC). The variability of radiomics features was assessed by coefficient of variation (CV) and quartile coefficient of dispersion (QCD).

**RESULTS**

The percentage of features with ICC>0.90 and CCC>0.90 were high when repositioned (88.2% and 88.2%) and tube voltage were changed (87.1% and 87.1%), but none of the features were with ICC>0.90 and CCC>0.90 when scan mode and slice thickness were different. The percentage of features with CV<10% and QCD<10% were high when repositioned (47.3% and 68.8%) and tube voltage were changed(64.2% and 71.0%), but that with CV<10% and QCD<10% were low between different scan modes (16.1% and 26.9%) and slice thickness (19.4% and 29.0%).

**CONCLUSION**

The radiomics features within photon-counting CT were robust against reposition and tube voltage, but brittle to scan mode and slice thickness.

**CLINICAL RELEVANCE/APPLICATION**

The scan mode and slice thickness should be set with careful attention to allow a higher robustness of radiomics features before its implementation of radiomics analysis in clinical routine.

## W5A-SPPH-9 ROBUSTNESS OF RADIOMICS AMONG FIVE CT SYSTEMS: A TEXTURE PHANTOM STUDY

Huan Zhang (*Abstract Co-Author*) Nothing to Disclose
Lan Zhu, MD (*Abstract Co-Author*) Nothing to Disclose
Weiwu Yao (*Abstract Co-Author*) Nothing to Disclose
Jingyu Zhong, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate robustness of radiomics features on texture phantom scans.

**METHODS AND MATERIALS**

A texture phantom consisting of twenty-eight materials was scanned with one photon-counting detector CT (PCD-CT) system and four dual-energy CT (DECT) systems (dual-source, rapid kV-switching, dual-layer, and sequential scanning) at three dose levels twice. Thirty sets of virtual monochromatic images at 70 keV were reconstructed. Regions of interest were delineated for each material with a rigid registration. Ninety-three radiomics were extracted per PyRadiomics. The test-retest repeatability between repeated scans was assessed by Bland-Altman analysis. The intra-system reproducibility between dose levels, and inter-system reproducibility within the same dose level, were evaluated by intraclass correlation coefficient (ICC) and concordance correlation coefficient (CCC). Inter-system variability among five scanners was assessed by coefficient of variation (CV) and quartile coefficient of dispersion (QCD).

**RESULTS**

The test-retest repeatability analysis presented that 97.1% of features were repeatable between scan-rescans. The mean ± standard deviation ICC and CCC were 0.945 ± 0.079 and 0.945 ± 0.079 for intra-system reproducibility, respectively, and 86.0% and 85.7% of features were with ICC>0.90 and CCC>0.90, respectively, between different dose levels. The mean ± standard deviation ICC and CCC were 0.157 ± 0.174 and 0.157 ± 0.174 for inter-system reproducibility, respectively, and none of the features were with ICC>0.90 or CCC>0.90 within the same dose level. The inter-system variability suggested that 6.5% and 12.8% of features were with CV<10% and QCD<10%, respectively, among five CT systems.

**CONCLUSION**

The radiomics features were non-reproducible with significant variability in values among different CT techniques.

**CLINICAL RELEVANCE/APPLICATION**

The technique of photon-counting detector CT and dual-energy CT systems significantly influences radiomic features, necessitating careful attention to improve the cross-system generalizability of radiomic features before implementation of radiomics analysis in clinical routine.

RSNA 2024
Building Intelligent Connections

# Abstract Archives of the RSNA, 2024

W5A-SPVA

**Vascular Imaging Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-SPVA-1 FEASIBILITY OF DUAL-FLOW INJECTION TECHNIQUE COMBINED WITH LOW TUBE VOLTAGE BASED ON AI DEEP LEARNING RECONSTRUCTION IN AORTIC CTA

Enfu Du (*Abstract Co-Author*) Nothing to Disclose
Qianqian Han (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the feasibility of a dual-flow injection technique combined with low tube voltage scanning based on AI deep learning reconstruction in aortic CTA.

### METHODS AND MATERIALS

A total of 120 patients with post-operation or suspected aortic disease were divided into 3 groups: A(n=40; tube voltage: 100 kV; conventional injection), B(n=40; tube voltage: 100 kV; dual-flow injection)and C(n=40; tube voltage: 60 kV; dual-flow injection). The ratio of contrast medium to normal saline by volume was 55% : 45% for dual-flow injection. Group C was divided into two subgroups, C1 was reconstructed by traditional iterative algorithm (Clearview)and C2 was reconstructed by deep learning algorithm(AIClearInfinity), while groups A and B's algorithm were the same as C1. Scanning was performed from the thoracic inlet to the superior border of the pubic symphysis, the monitoring level was the plane of the pulmonary artery bifurcation, and the ROI was placed at the level of the descending aorta. The CT values of different cross-sectional levels of the aorta in the images of groups A, B, and C were measured. In groups A, B, C1, and C2, measure the CT values and standard deviation (SD) of subcutaneous fat or mediastinal fat at the same level as the aortic ROI to calculate the signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). A 5-point scale was used for the subjective assessment of the images. Objective evaluation (the CT values of aorta, SD, SNR, and CNR), subjective scoring, contrast agent dose, and effective dose (ED) were compared and analyzed among groups.

### RESULTS

The CT values at different aortic levels in group C were higher than those in groups A and B (both $P<0.05$). The SD values of group C1 were higher than those of groups A, B, and C2 (all $P<0.05$). There was no statistical significance in SNR and CNR at most levels between groups A and C2 ($P>0.05$); the SNR and CNR values in groups A and C2 were higher than those in groups B and C1 (all $P<0.05$). The subjective scores of the image quality in groups A and C2 were higher than those in groups B and C1 (all $P<0.05$). The contrast medium dose in groups B and C had a 45% reduction compared to group A. Group C's ED was lower than groups A and B's (both $P<0.05$). [please refer to attached for details]

### CONCLUSION

In aortic CTA, a dual-flow injection technique combined with low-tube voltage scanning based on AI deep learning reconstruction significantly reduces contrast medium dose and radiation dose without compromising image quality.

### CLINICAL RELEVANCE/APPLICATION

The dual-flow injection technique combined with low tube voltage enables low contrast medium usage and low radiation dose; the AIClearInfinity reduces image noise, enhances contrast, and improves image quality. The aforementioned solutions are clinically feasible.

# Abstract Archives of the RSNA, 2024

W5B-SPBR

**Breast Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPBR-1 PREOPERATIVE PREDICTION OF HER2-ZERO, -LOW AND - POSITIVE BREAST CANCERS USING MULTIPARAMETRIC MRI AND MACHINE LEARNING MODELING

Meihao Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Yang Zhang, PhD (*Abstract Co-Author*) Nothing to Disclose
Jiejie Zhou, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Yan-Lin Liu (*Abstract Co-Author*) Nothing to Disclose
Jeon-Hor Chen, MD (*Abstract Co-Author*) Nothing to Disclose
Min-Ying Su, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

HER2-targeted therapies have dramatically improved the prognosis of HER2-positive breast cancer (BC) patients. Partial HER2-negative BCs express HER2, and HER2-low breast cancers could benefit from new anti-HER2 drug conjugate therapies. This study aimed to use breast MRI BI-RADS (Breast Imaging-Reporting and Data System) features to build models for classifying three HER2 levels, first to distinguish HER2-zero from HER2-low/positive (Task-1), and then to distinguish HER2-low from HER2-positive (Task-2).

### METHODS AND MATERIALS

Six hundred twenty-one patients pathologically confirmed with BC were retrospectively investigated. Pathological information (histological grade and molecular biomarkers) and BI-RADS features were compared using univariate and multivariate analyses. Random Forest algorithm was used to select MRI features, and then four machine learning algorithms: decision tree (DT), support vector machine (SVM), K-nearest neighbors (KNN), and artificial neural nets (ANN), were applied to build models. MRI features included morphology as mass or non-mass enhancement (NME), shape, margin, number of lesions, internal enhancement pattern (IEP), peritumoral edema, ADC value, largest diameter on MRI, DCE kinetic curve, suspicious invasion of adjacent tissue, BI-RADS category.

### RESULTS

Peritumoral edema was found in 69% HER2-positive, 54% HER2-low, and 49% HER2-zero. Multiple lesions were present in 40% HER2-positive, 27% HER2-low, and 24% HER2-zero. The presentation as non-mass enhancement (NME) was found in 36% HER2-positive and 26% HER2-low. For the first task of distinguishing HER2-zero from non-zero (low+positive), multiple lesions, edema, margin, and tumor size were selected, and the KNN model achieved the highest AUC of 0.86 in the training set and 0.79 in the testing set. For the second task of differentiating HER2-low from HER2-positive, multiple lesions, edema, and margin were selected, and the DT model achieved the highest AUC of 0.79 in the training set and 0.69 in the testing set.

### CONCLUSION

ML models could achieve a good classification performance, and suggested breast MRI could be used to help assess HER2, to determine patients with HER2-zero who were not eligible for targeted therapy, HER2-low who could benefit from new antibody-drug conjugates, and HER2-positive who can be well treated with trastuzumab and pertuzumab.

### CLINICAL RELEVANCE/APPLICATION

MRI features of breast cancer are associated with different HER2 expression levels. MRI-based ML models have the potential to preoperatively predict the HER2 expression status.

## W5B-SPBR-2 UNLOCKING THE MYSTERY: ARE INCIDENTAL OSSEOUS LESIONS ON BREAST MRI ALWAYS SIGNIFICANT?

Omar P. Nemer, MD (*Abstract Co-Author*) Stockholder, Novartis AG
Jonathan D. Pierce, MD (*Abstract Co-Author*) Nothing to Disclose
Anahita Tavana, MD (*Abstract Co-Author*) Nothing to Disclose
Donna M. Plecha, BA, MD (*Abstract Co-Author*) Hologic Inc., speaking engagement at SBI 2022.Mammotome Inc, speaking engagement at AsBRS 2022
Navid Faraji, MD (*Abstract Co-Author*) Nothing to Disclose
Shahrzad Tavana, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Incidental osseous lesions are frequently encountered on breast MRIs, involving the manubrium, sternum, ribs, as well as spine depending on the field of view. The objective of this study is to scrutinize the outcomes of incidentally detected osseous lesions encountered during diagnostic and screening breast MRIs.

### METHODS AND MATERIALS

A retrospective analysis of all the breast MRIs performed at a large academic medical center between 2010 and 2020 was performed using the keywords "incidental, sternum, sternal, osseous, manubrium, and rib." The analysis included all the diagnostic MRIs following diagnosis of breast cancer and all the screening MRIs, including the abbreviated screening protocol examinations and full protocol examinations for screening of patients with greater than 20% lifetime risk of breast cancer. Exclusion criteria were applied to eliminate examinations including the implant protocol MRIs, traumatic fractures or degenerative changes without underlying lesions, non-osseous incidental findings, invasion of chest wall structures by breast cancer, and the patients lost to follow-up. Osseous lesions were determined as malignant if they exhibited hypermetabolic activity on subsequent PET scans or radiotracer uptake on bone scans. Osseous lesions without hypermetabolic activity on the PET scan, radiotracer uptake on the bone scan, any corresponding suspicious abnormality on the follow-up chest CT, evidence of malignancy on a subsequent biopsy, or those that remained unchanged on follow-up imaging for two years were deemed to represent a benign process.

### RESULTS

The analysis included a total of 98 examinations after exclusions, comprising 44 screening MRIs and 54 diagnostic MRIs. In the screening group, no incidental osseous lesion was determined to be malignant, while 27.8% of the lesions in the diagnostic group were determined to be malignant. All malignant lesions in the diagnostic group were identified in patients already diagnosed with stage 4 breast cancer at the time of the MRI.

### CONCLUSION

The study findings suggest that incidentally discovered osseous lesions on screening breast MRIs are more inclined to represent benign processes. Conversely, in MRIs conducted for patients with stage 4 breast cancer, any incidental osseous lesion may indicate metastatic involvement, warranting a bone scan as a recommended confirmatory follow-up examination.

### CLINICAL RELEVANCE/APPLICATION

Given that bones serve as one of the primary sites for breast cancer metastasis, identification of osseous lesions on breast MRIs poses a clinical challenge for radiologists, impacting their assessment of clinical relevance and follow-up recommendations. This study seeks to ascertain the clinical importance of these incidental findings.

## W5B-SPBR-3 CLUSTER ANALYSIS OF KINETIC PARAMETERS FOR QUANTITATIVE ULTRAFAST DCE-MRI FOR GRADING DCIS

Hiroyuki Abe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hyunji Shim, BS (*Abstract Co-Author*) Nothing to Disclose
Xiaobing Fan, PhD (*Abstract Co-Author*) Nothing to Disclose
Kirti M. Kulkarni, MD (*Abstract Co-Author*) Nothing to Disclose
Gregory S. Karczmar, PhD (*Abstract Co-Author*) Stockholder, QMIS TBS Capital Group Corp
Zhen Ren, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To determine whether contrast media kinetics measured at high temporal resolution in DCIS can accurately stratify grade of DCIS at surgery. Since DCIS is typically diffuse and heterogenous, we tested whether cluster analysis based on kinetics would help to identify aggressive DCIS.

### METHODS AND MATERIALS

72 patients with histologically confirmed pure ductal carcinoma in situ (DCIS, low grade n = 4, intermediate grade n = 23, and high grade n = 29) or DCIS co-existing with IDC (microinvasion n = 11, IDC n = 5) who underwent ultrafast DCE-MRI (i.e., temporal resolution = 3 - 9 seconds per image, 3T/3D fast spoiled gradient echo) prior to surgery were enrolled in this retrospective study. DCIS lesions were segmented by an experienced breast MRI radiologist. Signal enhancement ratio over time per voxel within the DCIS was fitted with an empirical mathematic model (EMM) to calculate maximum uptake (A), uptake rate (a) and A·a. Then DCIS was divided into five clusters using K-means clustering (KMC) method based on A·a and which were sorted in ascending order. The arterial input function (AIF) was traced over the descending aorta or heart area. Averaged signal intensity as a function of time was calculated for each cluster and fitted with the EMM to characterize A and a. Contrast agent concentration curve was calculated and fitted with extended Tofts model to extract physiological parameters (Ktrans, ve, vp and kep). Grading in pure DCIS at surgical pathology was compared using kinetic parameters via Kruskal-Wallis test. Pure DCIS and DCIS with invasive cancer were compared via the Wilcoxon rank-sum test.

### RESULTS

The vp, which reflects vascular volume, of the 4th KM cluster was significantly higher in patients with DCIS with invasive cancer than in patients with pure DCIS ($p = 0.03$). Other parameters were not significant in separating pure DCIS from DCIS with invasive cancer. In patients with pure DCIS, on average low-grade DCIS had lower vp than intermediate- or high-grade DCIS. Although the differences in vp between low grade and high grade DCIS are not significant in this dataset ($p > 0.2$), the results suggest that this approach can identify ~31% of women who are likely to have DCIS with IDC and ~30% of women who are likely to have low grade DCIS.

### CONCLUSION

KMC analysis of quantitative ultrafast DCE-MRI could effectively distinguish pure DCIS from DCIS co-existing with invasive cancer. Vp could be a surrogate marker to identify the risk of DCIS upgrade. DCIS with low vp could be considered as a weakly vascularized lesion with low risk and that may be considered for less aggressive treatment or surveillance.

### CLINICAL RELEVANCE/APPLICATION

Quantitative ultrafast DCE-MRI may separate low risk DCIS patients who can benefit by surveillance from high-risk DCIS patients who need surgery.

## W5B-SPBR-4 COMPARISON BETWEEN ABBREVIATED MRI AND FULL MRI PROTOCOL FOR ASSESSING TUMOR EXTENT IN PATIENTS WITH NEWLY DIAGNOSED BREAST CANCER

Hye Jung Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Gab Chul Kim, PhD (*Abstract Co-Author*) Nothing to Disclose
Byung Geon Park, MD (*Abstract Co-Author*) Nothing to Disclose
So Mi Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Jihoon Hong (*Abstract Co-Author*) Nothing to Disclose
Jongmin Park, MD (*Abstract Co-Author*) Nothing to Disclose
Kyung Min Shin, MD (*Abstract Co-Author*) Nothing to Disclose
Won Hwa Kim, MD, PhD (*Abstract Co-Author*) Stockholder, BeamWorks
Seo Young Park, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The aim of this study was to assess the concordance rate and correlation between tumor extents measured using full protocol MRI (full-MRI) and abbreviated MRI (ab-MRI) with pathologic tumor extent according to tumor subtypes.

### METHODS AND MATERIALS

A total of 319 patients with 330 index breast cancers were enrolled in the study. Two radiologists had two review sessions of full- MRI and ab- MRI, respectively, with a 1-month wash-out period. The total tumor extent was determined by the maximum extent of the index lesion containing adjacent suspicious lesions less than 1.5cm from index cancer. The tumor extent and concordance rate were compared between full-MRI and ab-MRI with pathology (histopathologic and molecular subtypes). Additionally, the correlation and agreement of tumor extent between each MR and pathology were evaluated.

### RESULTS

Mean tumor extent and concordance rate between each MRI with pathology did not show significant difference (Ps = 1, Ps > 0.5). The concordance rate was highest in invasive ductal carcinoma (89.3% and 89.7%, reader 1; 89.3% and 89.7%, reader 2) and triple negative subtype (96.6% and 96.6%, reader 1 and 2) and lowest in DCIS (57.9% and 55.3%, reader 1; 52.6% and 60.5%, reader 2) and Her-2 subtype (54.2% and 58.3%, reader 1; 50.0% and 58.3%, reader 2). The correlation for tumor extent between each MR and pathology was highest in other type (0.73 and 0.80 reader 1; 0.73 and 0.77, reader 2) and triple negative subtype (0.79 and 0.81, reader 1; 0.84 and 0.81, reader 2) and lowest in ILC (0.49 and 0.60, reader 1; 0.47 and 0.58, reader 2) and Luminal A (0.65 and 0.66, reader 1) and Her-2 subtype (0.53 and 0.55, reader 2). The correlation and agreement of tumor extent between each MR and pathology was not significantly different (Ps >0.4).

### CONCLUSION

Ab-MRI demonstrated its feasibility for preoperative tumor extent in breast cancer patients, showing comparable concordance rate and correlation in tumor extent compared to full-MRI.

### CLINICAL RELEVANCE/APPLICATION

This suggests that ab-MRI can serve as a potential complement to full-MRI when patients having difficult condition including claustrophobia or socioeconomic reasons.

## W5B-SPBR-5 MULTIPARAMETRIC WHOLE BODY MAGNETIC RESONANCE IMAGING IN ADVANCED BREAST CANCER: ACCURACY AND THERAPEUTIC IMPLICATIONS

Michela Palleschi (*Abstract Co-Author*) Nothing to Disclose
Arrigo Cattabriga (*Abstract Co-Author*) Nothing to Disclose
Davide Bezzi (*Abstract Co-Author*) Nothing to Disclose
Danila Diano (*Abstract Co-Author*) Nothing to Disclose
Filippo Merloni (*Abstract Co-Author*) Nothing to Disclose
Andrea Prochowski Lamurri, MD (*Abstract Co-Author*) Nothing to Disclose
Alice Rossi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

In case of advanced bone advanced breast cancer (BC), standard imaging techniques (SITs) such as computed tomography (CT), bone scintigraphy (BS) and positron emission tomography (PET-CT) may not always produce reliable results. Our study sought to determine whether multiparametric whole-body magnetic resonance imaging (WB-MRI) could improve accuracy for detecting bone metastases when employed in cases of unclear outcome to CT, BS, and/or PET-CT. The main goal of the study was to examine the differences between SITs and WB-MRI. The secondary aim was to evaluate WB-MRI's impact on treatment planning and to determine which histological subtypes mostly benefit from WB-MRI assessment.

### METHODS AND MATERIALS

From January 2021 to January 2024, we enrolled into a prospective trial consecutive BC patients who underwent regular SITs employed in conjunction with WB-MRI for two distinct groups of BC patients. The first group included patients with bone-predominant lesions who were eligible for cyclin-dependent kinase 4 and 6 (CDK 4/6) inhibitors, while the second one was represented by BC patients with indeterminate imaging findings. All WB-MRI were performed following the Metastasis Reporting and Data System for Prostate Cancer (MET-RADS) guidelines.

### RESULTS

The study included 59 BC patients (mean age, 55 years ± 12 [SD]). They underwent a WB-MRI after a CT, BS, or PET-CT scan. Of these, 25 patients (42.4%) had undetermined lesions on SITs that were later determined by WB-MRI to be metastatic. In twenty-one patients (40%), WB-MRI resulted in change of treatment strategy. Specifically, the therapeutic decision changed in 11 patients (22%), due to the identification of new lesions or progressive disease on WB-MRI alone. It is noteworthy that in (18) 83% of patients with lobular tumors, additional metastases were found, and in (10) 45% of cases, the treatment plan was changed. Furthermore, biopsy was avoided in 13 cases (38%) since WB-MRI showed clear signs of disease progression. The concordance rate between WB-MRI and SITs was 47% among the 35 patients who had at least one reassessment. Seven of these patients had discordant data, which led to a 21% therapeutic strategy modification rate.

### CONCLUSION

This study demonstrated the potential value of WB-MRI in the staging and follow-up of BC patients, particularly in lobular cancer histotypes. Further prospective studies are required to confirm the role of WB-MRI as a clinical tool with consistent clinical impact.

### CLINICAL RELEVANCE/APPLICATION

Our prospective trial supports the potential utility of multiparametric WB-MRI in the staging and follow-up of BC patients, especially in case of lobular histology, overcoming the limitations of standard imaging techniques.

## W5B-SPBR-6 IMPACT OF BACKGROUND PARENCHYMAL ENHANCEMENT (BPE) ON DIAGNOSIS OF BREAST CANCER IN MRI: A ROI-BASED STUDY

Sonja Bechyna, MD,BSC (*Abstract Co-Author*) Nothing to Disclose
Ambra Santonocito, MD (*Abstract Co-Author*) Nothing to Disclose
Thomas H. Helbich, MD, MBA (*Abstract Co-Author*) Grant, Siemens AG;Grant, Bracco Group;Grant, Guerbet SA;Grant, Hologic, Inc;Grant, Novomed GmbH

Pascal A. Baltzer, MD (*Abstract Co-Author*) Nothing to Disclose
Paola Clauser, MD, PhD (*Presenter*) Speaker, Siemens AG

**PURPOSE**

Dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) is highly sensitive for detecting breast cancer. However, not only suspicious lesions enhance on DCE-MRI, but also normal breast parenchyma, referred to as background parenchymal enhancement (BPE). There is controversial evidence regarding whether BPE compromises the accuracy of breast MRI by masking or mimicking suspicious enhancements. Our aim was to investigate the influence of BPE in the detection of breast lesions by DCE-MRI using a ROI-based approach.

**METHODS AND MATERIALS**

Images of consecutive patients that underwent MRI in line with ACR/EUSOBI recommendations between May 2020 to September 2022 were retrospectively analyzed. Both breasts were divided in 10 regions of interest (ROI) and BPE, BI-RADS and lesion type were assessed according to the BI-RADS lexicon for MRI for each ROI by two blinded readers. BPE was dichotomized in minimum/mild (BPE1) and moderate/marked (BPE2). The study included women with non-specific or suspicious findings on mammography or ultrasound (BI-RADS 0, 3, 4, 5). Patients without a standard reference were excluded. The standard reference was defined as histology or 1 year follow-up. The performance of MRI was assessed using ROC analysis in a region-based analysis. Inter-reader agreement was assessed using k statistics. P-values <.01 were considered statistically significant.

**RESULTS**

A total of 319 patients (mean of 53.9 years old SD 10,6; range 31-84) were included. Out of the 283 lesions histopathologically analysed, 126 were malignant and 158 were benign. BPE1 was observed in 78.3% patients and BPE2 in 21.7% patients. The area under the ROC curve did not differ between BPE1 (0.975) and BPE2 (0.987), p>0.05. Sensitivity of MRI was equally 95.7% in patients with BPE1 and BPE2 while specificity was nearly the same with BPE1 96.9% and BPE2 97.2%, p>0.05

**CONCLUSION**

Our study demonstrates that BPE does not affect the diagnostic accuracy of breast MRI. Our results provide strong evidence suggesting that the presence of BPE does not compromise the ability to detect and identify suspicious lesions on breast MRI.

**CLINICAL RELEVANCE/APPLICATION**

The study confirms that BPE doesn't influence the accuracy of breast MRI in the detection of suspicious lesions.

## W5B-SPBR-7 EFFECT OF BREAST MRI LESION SIZE ON MALIGNANCY RATE VARIES BY PATIENT AGE

Richard E. Sharpe JR, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Robert W. Maxwell, MD (*Abstract Co-Author*) Managing Member, Maxwell Publishing Company LLC
Aditya Khurana, MD (*Abstract Co-Author*) Nothing to Disclose
Tariq Rashid (*Abstract Co-Author*) Nothing to Disclose
Jacob Varner (*Abstract Co-Author*) Nothing to Disclose
Richard Ellis, MD (*Abstract Co-Author*) Nothing to Disclose
Alan Zhu, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the positive predictive values (PPVs) of different lesion sizes and age ranges in MRI-detected breast findings that underwent image-guided biopsy.

**METHODS AND MATERIALS**

This retrospective study was conducted across a multispecialty healthcare enterprise that provides care at 18 imaging sites across 4 US states. All findings detected by breast MRI that underwent image-guided biopsy from October 31, 2017 to April 26, 2024 were extracted. MRI examinations were performed using a 3T unit for indications including high-risk screening, extent of disease, and problem solving. Lesion size was reported prospectively by the radiologist prior to biopsy. The PPV was calculated by different lesion sizes and patient age ranges by decade. Significance between categorical variables was assessed using the 2-tailed chi-square test.

**RESULTS**

Of 5566 findings in 4242 patients (mean age 54.3 years ± 12.6 [SD]; 4242 female), the mean lesion size was 21.9 mm. There was no significant difference in PPV between findings =5 mm (19.1%, n=863) and >5 mm (20.0%, n=4614; p=0.543). Overall, PPV increased gradually with lesion size, with malignancy found in 550 of 2567 (21.4%) findings >10 mm, 270 of 1148 (23.5%) of findings >20 mm, 159 of 621 (25.6%) findings >30 mm, and 108 of 367 (29.4%) findings >40 mm. PPV differences among these 4 lesion size categories were significant in every decade of patient ages from 20-89 except for ages 30-39, when lesions >10 mm, >20 mm, >30 mm, >40 mm had PPVs of 7.0% (n=267), 7.0% (n=156), 6.3% (n=65), and 7.7% (n=25; p = 0.99) respectively. This decade of life (30-39) also had the lowest average PPV of all decades (7.4%), despite the PPV increasing with age in every other decade.

**CONCLUSION**

This is the largest study to date comparing PPVs of biopsy in MRI-detected breast findings by the lesion size and age range. Greater lesion size was associated with increased PPV except in the age range 30-39 that was also the only decade with no significant difference in PPV by lesion size.

**CLINICAL RELEVANCE/APPLICATION**

Radiologist awareness of the PPV by lesion size and age range in breast MRI-detected findings can support informed discussions and decision-making in patients potentially undergoing breast biopsy.

## W5B-SPBR-8 SYSTEMATIC REVIEW AND META-ANALYSIS OF SCREENING BREAST MRI OUTCOMES IN WOMEN WITHOUT PERSONAL HISTORY OF BREAST CANCER

Nikiforos Vasiniotis Kamarinos, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the diagnostic performance of screening breast MRI in high-risk women without a personal history of breast cancer.

**METHODS AND MATERIALS**

Databases were searched to identify studies published from 2005 to 2024 related to the outcomes of screening breast MRI in women without a personal history of breast cancer. A meta-analysis was performed to obtain summary sensitivity and specificity values using a bivariate random-effects model. Studies without MRI outcome metrics in the specific population of interest and studies without false positive or false negative rates were excluded.

**RESULTS**

Eight studies with a total of 12911 screening MRIs were included in the final qualitative and quantitative meta-analysis. The pooled sensitivity and specificity for cancer detection were 85% (95% CI, 72%-93%) and 89% (95% CI, 83%-93%), respectively. Moderate study heterogeneity was identified (bivariate correlation coefficient = 0.5). Most of the cancers were detected at an early stage. Indications for screening MRI included lifetime risk of breast cancer =20%, history of genetic predisposition, high-risk lesion, chest irradiation for Hodgkin's lymphoma, and/or family history of breast cancer. The overall diagnostic odds ratio of screening MRI was 34.68 (95% CI, 18.16-66.24).

**CONCLUSION**

Screening breast MRI is a valuable diagnostic tool for high-risk women without a personal history of breast cancer and can detect cancer at an early stage.

**CLINICAL RELEVANCE/APPLICATION**

A meta-analysis of 8 studies, including 12911 screening breast MRIs in high-risk women without a personal history of breast cancer, demonstrates favorable cancer detection outcomes supporting the use of MRI in this patient population.

## W5B-SPBR-9 TIME TO ENHANCEMENT (TTE) RELATIVE TO BACKGROUND PARENCHYMAL ENHANCEMENT (BPE) AS A NOVEL PARAMETER DIFFERENTIATING BENIGN AND MALIGNANT SMALL MASSES ON ULTRAFAST BREAST MRI

Samantha L. Heller, MD, PhD (*Abstract Co-Author*) Research support, Koios Medical, Inc
Xiaochun Li (*Abstract Co-Author*) Nothing to Disclose
Judith Goldberg (*Abstract Co-Author*) Nothing to Disclose
Yiming Gao, MD (*Abstract Co-Author*) Nothing to Disclose
Helaina Regen-Tuero, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate whether clinically available kinetic features of ultrafast MRI (UFMRI) can classify malignancy of small masses.

**METHODS AND MATERIALS**

IRB-approved, HIPAA compliant retrospective review of all UF-MRI (July 1, 2019 to April 30, 2023) with subsequent MRI-guided biopsy of enhancing masses 5 mm or smaller (124 patients). The electronic medical record was reviewed to collect patient demographic and exam data (age, menopausal status, personal and family breast cancer history, genetic mutation, exam indication, breast density, and BPE, as well as lesion characteristics (size, TTE, T2 signal, stability, and distance from known cancer if applicable). The difference in TTE of the lesion versus TTE of BPE was calculated. Images were analyzed with DynaCAD to determine maximum slope (MS) of enhancement. Logistic regression was conducted. No multiple testing adjustments were made and a significance level of 0.05 (2-sided) was used.

**RESULTS**

124 patients (mean age 53, range 29-78) underwent MR-guided biopsy of 124 small masses. 51.6% (64/124) were postmenopausal and 57.3% (71/124) had a history of breast cancer. 65.3% (81/124) had a family history and 35.3% (33/94) of patients had a genetic mutation. The majority of exams were performed to evaluate extent of disease (47.6%; 59/124) followed by screening (41.9%; 52/124). Most patients had heterogeneously dense breasts (58.1%; 72/124) and mild BPE (57.3%; 71/124). Final pathology demonstrated 21 malignant lesions in 21 patients: 5 DCIS and 16 invasive. No demographic factors were associated with increased likelihood of malignancy. The odds of malignancy increased 1.054 with each second increase in the difference of TTE of the lesion compared to TTE of BPE (95% CI: 1.016, 1.094), p=0.006. No other kinetic parameters or lesion characteristics were useful for classification.

**CONCLUSION**

The relative difference of the TTE of small masses compared to the TTE of BPE may be a useful parameter to classify small masses as malignant or benign. Further studies are needed to evaluate how well this classification works in independent sets of patients.

**CLINICAL RELEVANCE/APPLICATION**

Improved classification of small mass malignancies on MR imaging could prevent unnecessary biopsies.

# Abstract Archives of the RSNA, 2024

W5B-SPCA

**Cardiac Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPCA-1 MYOCARDIAL EXTRACELLULAR VOLUME ASSESSMENT USING CT LATE ENHANCEMENT AND NON-CONTRAST CT SCANNED AT DIFFERENT TUBE VOLTAGE ON SINGLE-ENERGY CT

Yamato Shimomiya (*Abstract Co-Author*) Employee, Ziosoft, Inc
Teruhito Kido, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yusuke Kobayashi (*Abstract Co-Author*) Nothing to Disclose
Yuki Tanabe (*Abstract Co-Author*) Nothing to Disclose
Kazuki Yoshida, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomoyuki Kido (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Suekuni (*Abstract Co-Author*) Nothing to Disclose
Takaaki Hosokawa (*Presenter*) Nothing to Disclose

### PURPOSE

Myocardial extracellular volume (ECV) is an established marker for myocardial fibrosis and infiltrative diseases. Cardiac CT is a possible alternative to MRI for ECV evaluation. On single-energy CT, ECV is calculated using subtraction of CT late enhancement (CT-LE) and non-contrast CT scanned at the same setting. However, CT-LE is commonly acquired at low tube voltage, necessitating an additional low-tube-voltage non-contrast CT scan. We hypothesized that coronary calcium CT (CAC CT) could be used instead of a low-tube-voltage non-contrast CT to estimate ECV. We aimed to assess the feasibility of estimated ECV (ECVest) calculated using CAC CT.

### METHODS AND MATERIALS

This retrospective study enrolled 70 patients who underwent pre-operative CT scans for transcatheter aortic valve implantation. All patients underwent 80 kVp non-contrast CT, 120 kVp CAC CT, and 80 kVp CT-LE. The patients were divided into derivation (n = 50) and validation (n = 20) groups. ECV was measured by subtracting non-contrast CT from CT-LE (ECVref) and subtracting CAC CT from CT-LE (ECVcac). The regression equation for ECVest was derived from ECVref and ECVcac for the derivation group. The accuracy of ECVest was evaluated using ECVref as the reference standard in the validation group.

### RESULTS

The regression equation for ECVest was ECVest = 0.892*ECVcac + 1.173. ECVref and ECVest were 27.6±3.6% and 27.6±3.8%, respectively, with no significant difference ($p = 0.95$) and a strong correlation ($r = 0.97$, $p < 0.001$). Bland-Altman analysis showed a bias of 0.01% and limits of agreement of -1.88 to 1.92%. The two one-sided tests showed significant equivalence between ECVref and ECVest ($p < 0.01$) with an equivalence bound of 2.5% of the mean ECVref value (0.69%).

### CONCLUSION

This study demonstrated that ECV estimation using CAC CT is feasible and accurate. ECV estimation allows a routine cardiac CT protocol with CT-LE to measure the ECV without additional low-tube-voltage non-contrast CT scans using single-energy CT.

### CLINICAL RELEVANCE/APPLICATION

Cardiac CT is expected to be an alternative modality for ECV evaluation. Accurate estimation of ECV using CAC CT offers high clinical availability without additional scans or radiation exposure with single-energy CT.

## W5B-SPCA-10 SEMI-QUANTITATIVE ANALYSIS OF RIGHT VENTRICULAR MYOCARDIAL FIRST-PASS PERFUSION USING CARDIAC MAGNETIC RESONANCE IMAGING: REPRODUCIBILITY ASSESSMENT

Steven L. Hsu, MD (*Abstract Co-Author*) Nothing to Disclose
Iman Yazdani Nia, MD (*Abstract Co-Author*) Nothing to Disclose
Bharath Ambale-Venkatesh, PhD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation;Co-founder, Third Eye Health Inc;Research Grant, Myocardial Solutions, Inc
Ihab R. Kamel, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG
Stefan L. Zimmerman, MD (*Abstract Co-Author*) Consultant, Siemens AGSupport, Siemens AG
Paul M. Hassoun, MD (*Abstract Co-Author*) Scientific Advisory Board, Gilead Sciences, Inc
Stephen M. Mathai (*Abstract Co-Author*) Nothing to Disclose
Ali Borhani, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

In this study, we aimed to employ a semi-quantitative approach in cardiac magnetic resonance (CMR) imaging to measure RV wall first-pass perfusion and to evaluate the intra- and inter-reader reproducibility of this approach.

**METHODS AND MATERIALS**

This study included 23 (69.5% male; 58.2.1 ± 12 years) patients who underwent rest and adenosine stress perfusion CMR imaging to assess pulmonary hypertension with a 3T scanner. Two readers delineated three regions of interest (ROIs) within the visible RV myocardium and manually traced the contours of endocardial and epicardial borders of LV in two planes. Semi-quantitative perfusion analysis was done with a dedicated software for the measurement of first-pass myocardial perfusion. The concordance correlation coefficient (CCC) test was employed to evaluate inter- and intra-reader agreement among measurements of two readers.

**RESULTS**

The agreement between two readers for semi-quantitative perfusion measurements of the RV for the rest phase was 0.85 (range: 0.74 - 0.95), for the stress phase was 0.92 (range: 0.86 - 0.98), and for the perfusion reserve index was 0.795 (range: 0.63 - 0.95). Regarding LV perfusion measurement, the agreement between two readers for the rest phase was 0.981 (range: 0.96-0.99), and for the stress phase, it was 0.99 (range: 0.98-0.99), with an agreement of 0.90 (range: 0.834-0.97) for the perfusion reserve index. The intra-reader agreement, for the RV for the rest phase was 0.90 (range: 0.77 to 1.00), for the stress phase, it was 0.99 (range: 0.98 to 1.00), and for the perfusion reserve, it was 0.66 (range: 0.30 to 1.00). For the LV, intra-reader agreement for the rest phase was 0.99 (range: 0.97 to 1.00), for the stress phase, it was 0.99 (range: 0.98 to 1.00), and for the perfusion reserve index, it was 0.87 (range: 0.72 to 1.00).

**CONCLUSION**

Our study underscores CMR's potential as a reliable tool for assessing first-pass RV perfusion as it is technically feasible and shows excellent inter-reader agreement.

**CLINICAL RELEVANCE/APPLICATION**

In clinical practice, it is beneficial to have a standardized and validated method for measuring myocardial perfusion of the RV. Semi-quantitative analysis offers a useful way to estimate myocardial perfusion in CMR. Its relative simplicity reduces variation across research and clinical groups and is less prone to methodological errors.

## W5B-SPCA-2 REDUCTION OF CT ARTIFACTS FROM THE LATEST-GENERATION LEADLESS PACEMAKER USING SINGLE-ENERGY METAL ARTIFACT REDUCTION ALGORITHM

Yan Xing II, PhD, MD (*Abstract Co-Author*) Nothing to Disclose
Hu Yahui (*Presenter*) Nothing to Disclose

**PURPOSE**

Previous studies have reported the superior feasibility and safety of leadless pacemakers (PMs), underscored by their comparatively favorable complication profiles. This study aimed to evaluate the efficacy of single-energy metal artifact reduction (SEMAR) algorithm in removing artifacts for patients implanted with leadless cardiac PMs compared to those with conventional transvenous PMs.

**METHODS AND MATERIALS**

Between March and August 2023, we prospectively included 30 patients with transvenous PMs and 30 patients with leadless PMs who underwent coronary CT angiography (CCTA) examinations at our institution. All images were reconstructed using two methods: a conventional hybrid-iterative reconstruction (HIR) algorithm, and the HIR combinedwith SEMAR algorithm. The artifact index (AI) was calculated for both image sets to quantitatively assess the artifact reduction. Two senior radiologists independently evaluated the images by overall extent artifact (5, best; 1, worst), and artifact-impaired tissues based on a 3-point scale (non-impaired, impaired, equivocal). The Wilcoxon Signed-Rank testand the Mann-Whitney U test were used for analyzing paired and independent samples, respectively. Inter-observer agreement was also determined.

**RESULTS**

he leadless-PMSEMAR exhibited significantly lower AIs than with the conventional algorithm ($p < 0.001$), with improved correction of hypodense artifacts ($p < 0.001$) and a significant reduction of hyperdense artifacts ($p < 0.001$). The AIs of leadless PMs performed with and without SEMAR were slightly lower than that of transvenous PMs, although no statistical difference existed (all $p > 0.05$). Qualitatively, the overall artifact extent of SEMAR significantly outperformed non-SEMAR in both types of PM ($p < 0.001$). The tissues such as aorta, right coronary artery, right atrium, and left ventricle were less in leadless-PMnon-SEMAR compared to transvenous-PMnon-SEMAR (all $p < 0.05$). Additionally, the RCA and RA showed fewer impairments in leadless-PMSEMAR than those in the transvenous-PMSEMAR ($p < 0.05$).

**CONCLUSION**

SEMAR provides effective reduction of metal artifacts from leadless PMs. The artifact-impaired tissues are fewer on leadless PMs than that on transvenous PMs.

**CLINICAL RELEVANCE/APPLICATION**

The results of this study demonstrate that SEMAR efficiently reduces metallic artifacts from leadless PMs, thereby improving the image quality of CCTA (Fig. 1-2). SEMAR can also enhance the diagnostic confidence of the cardiac and extra-cardiac complications associated with transvenous and leadless PMs.

## W5B-SPCA-4 PROGNOSTIC VALUE OF T2 MAPPING IN NON-ISCHEMIC CARDIOMYOPATHY: A SYSTEMATIC REVIEW AND META-ANALYSIS

Hui Zhou, MD (*Abstract Co-Author*) Nothing to Disclose
Jing Luo (*Abstract Co-Author*) Nothing to Disclose
Yangzhen Hou (*Abstract Co-Author*) Nothing to Disclose
Ji Yang, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The aim of this systematic review and meta-analysis was to evaluate the prognostic value of T2 mapping in patients with non-ischemic cardiomyopathy (NICM).

**METHODS AND MATERIALS**

PubMed and Web of Science were searched for studies focusing on the prognostic value of T2 mapping in patients with NICM. The primary endpoints included all-cause mortality, cardiac death and aborted sudden cardiac death (SCD), ventricular arrhythmia, and heart failure hospitalization. Pooling of hazard ratios was performed using a random-effects model, and heterogeneity was assessed using the I2 statistic.

**RESULTS**

Eight studies involving 1477 patients were included in this meta-analysis. The mean age range was 45.6 to 74.6 years, and 54.57% of patients were male. The results showed that patients with higher T2 values have a higher risk of cardiovascular events. The increase of native T2 per = 2ms was associated with the development of the primary endpoint [pooled adjusted hazard ratio (HR): 1.57 (1.20-2.07), I2=54%], whereas the increase per 1 ms was not significantly correlated with prognosis [pooled unadjusted HR: 1.07 (0.98-1.17), I2=59%].

**CONCLUSION**

Myocardial native T2 as a biomarker may be independently associated with prognosis in patients with NICM. Different definitions of the variable native T2 have different effects on risk stratification, and defining a range of increase in native T2 as a variable may be more helpful in identifying high-risk patients.

**CLINICAL RELEVANCE/APPLICATION**

Myocardial Native T2 may be a prognostic marker in patients with NICM. And the increase of T2 value caused by myocardial edema can occur before the clinical related indexes and positive manifestations of LGE, suggesting that clinical diagnosis and intervention can be performed before irreversible damage occurs, which may be more helpful in improving patient prognosis.

## W5B-SPCA-5 IS IT POSSIBLE TO IDENTIFY INFECTIVE ENDOCARDITIS ON ROUTINE ENHANCED CHEST CT?

Saebyol Ma, MD (*Abstract Co-Author*) Nothing to Disclose
Seung Min Yoo (*Abstract Co-Author*) Nothing to Disclose
Son Min Ji (*Presenter*) Nothing to Disclose

**PURPOSE**

Echocardiography is the primary method for diagnosing infective endocarditis (IE), but routine enhanced chest CT is frequently performed in the emergency room for non-specific symptoms like fever or dyspnea. The authors noted instances where patients who underwent routine chest CT were later confirmed to have IE. Despite this, no studies have assessed the diagnostic accuracy of routine chest CT for IE. This study aims to evaluate the accuracy of routine enhanced chest CT for diagnosing IE

**METHODS AND MATERIALS**

Approved by the Institutional Review Board (2023-12-028), this study examined 53 patients with fever or dyspnea diagnosed with IE between January 1, 2007, and April 3, 2024. Twenty were excluded due to missing CT data, prosthetic valves (3), or severe valvular calcification (3), leaving 27 patients. A control group of 35 randomly selected patients with similar symptoms during the same period was used. Routine enhanced chest CT and echocardiography were performed within one month for all subjects.Two thoracic radiologists analyzed CT findings of potential vegetation (nodular thickening on mitral or aortic valves; nodular thickening with a blind end or different orientation from normal aortic, mitral valve leaflets, potential CT sign of oscillating vegetation) and extracardiac findings visible on routine chest CT such as splenic or renal infarction as embolic phenomena of IE. These findings were compared between patient and control groups.

**RESULTS**

Nodular thickening on the aortic or mitral valves was found in 67% (18/27) of the patient group versus 8.6% (3/35) in the control group ($p < 0.0001$). Nodular thickening with a blind end or different orientation from normal valve leaflets was observed in 30% (8/27) of the patient group versus 0% (0/35) in the control group ($p = 0.0007$). Splenic or renal infarction occurred in 52% (14/27) of the patient group and 3% (1/35) of the control group ($p < 0.0001$). Combining nodular thickening with a blind end or different orientation from normal valve leaflets and splenic or renal infarction findings resulted in 100% specificity (35/35) and 100% positive predictive value (7/7), suggesting a strong association with IE.

**CONCLUSION**

Nodular aortic or mitral valve thickening with a blind end may be specific CT finding in patients with acute dyspnea or fever, particularly accompanied by splenic or renal infarction.

**CLINICAL RELEVANCE/APPLICATION**

Routine enhanced chest CT is commonly used in the emergency room for patients with fever or acute dyspnea. Recognizing key CT findings may lead to immediate diagnosis and proper management of IE.

## W5B-SPCA-6 UNVEILING SUBCLINICAL MYOCARDIAL CHANGES IN A COHORT OF TREATMENT-NAIVE CANCER POPULATION WITH DIFFUSE LARGE B-CELL LYMPHOMA (DLBCL) AND BREAST CANCER: IS ADVANCED CANCER A CARDIOVASCULAR SYNDROME?

Marco Francone, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Costanza Lisi, MD (*Abstract Co-Author*) Nothing to Disclose
Federica Catapano, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Functional and myocardial tissue modifications can affect cancer patients naive to chemotherapy, as the result of uncontrolled inflammation and neuro-hormonal activation, as well as pathologic angiogenesis. All these mechanisms may cause myocardial alterations and could represent subclinical imaging markers of potential cardiac dysfunction, leading to a comprehensive cardiotoxicity assessment and improved patient's management. The present study aims to explore cardiac-MR (CMR) potentials in shedding light on cancer-associated uncontrolled immune activation hypothesis and to provide early biomarkers of myocardial damage.

**METHODS AND MATERIALS**

This is a prospective single-center study including 70 patients. Study population consisted of two matched groups of 35 healthy individuals and 35 patients with a de novo diagnosis of diffuse large B cell lymphoma (DLBCL) or breast cancer. They all underwent Cardiac-MR before starting chemotherapy. Uni- and multi-variate analysis was conducted to identify differences in myocardial tissue characterization and functional parameters between the two groups.

### RESULTS

A statistically significant difference in native T1 mapping time between the two groups was found (p<0.01) (median oncologic native T1=998 msec, median healthy native T1=979.5 msec). Furthermore, a significant difference between the two groups was also evident (p<0.01) in global longitudinal strain (GLS) values (median oncologic GLS =15.06, median healthy GLS =19.9). No correlation was demonstrated between native T1 increase and GLS decrease in the oncologic group.

### CONCLUSION

Advanced cancer is a complex syndrome deeply involving the cardiovascular system, which, inducing tissue inflammation, oxidative stress and neuro-hormonal activation, relevantly affects myocardial tissue. These changes may manifest as myocardial fibrosis and apoptosis, possibly responsible for native T1 increase and GLS decrease in the naȷve cancer group. Further studies should confirm these results and extend them to the general oncologic population.

### CLINICAL RELEVANCE/APPLICATION

This preliminary study focuses on early tissue modifications as sub-clinical biomarkers of cardio-toxicity and may leave space for a revised relevance attributed to chemotherapy-induced myocardial changes.

## W5B-SPCA-7 ASSESSING LEFT VENTRICULAR TRABECULAR COMPLEXITY BY CARDIAC COMPUTED TOMOGRAPHY: A CONSISTENCY ANALYSIS WITH CARDIAC MAGNETIC RESONANCE

Yang Peng (*Abstract Co-Author*) Nothing to Disclose
Lin Peng (*Abstract Co-Author*) Nothing to Disclose
Jun Yuan (*Abstract Co-Author*) Nothing to Disclose
Chuanbao Deng (*Abstract Co-Author*) Nothing to Disclose
Yuying Chen (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the consistency between fractal dimension (FD) by cardiac CT (CCT) and by cardiac MR (CMR) for evaluation of left ventricular trabecular complexity.

### METHODS AND MATERIALS

The retrospective study included 170 patients who underwent CMR and CCT scans within 2 weeks from January 2021 to December 2023, of which 92 had diastolic CCT datasets, 63 had systolic datasets, and 15 had both. Short-axis views in 8-mm thickness were reconstructed using the CCT datasets and aligned with the cine images of CMR. For each patient, 5 consecutive intermediate slices were obtained for analysis. Trabeculae were quantified with fractal analysis to estimate the FD using both the reconstructed CCT images (CT-FD) and end-diastolic short-axis cine slices of CMR (MR-FD). Since severe left ventricular hypertrophy can lead to inaccuracy of endocardium and trabeculae detection in the systole, patients with a maximum wall thickness over 15mm at end-diastolic short-axis cine images were recorded. The consistency between CT-FD and MR-FD was evaluated using intraclass correlation coefficient (ICC) and Bland-Altman plots.

### RESULTS

Of the 63 patients with systolic CCT datasets, 17 presented with severe left ventricular hypertrophy. The mean diastolic CT-FD and corresponding MR-FD were 1.2527±0.0899 and 1.2508±0.1011 with high consistency (n=535, ICC=0.882, 95%CI: 0.861-0.899, P<0.001). The mean systolic CT-FD and corresponding MR-FD were 1.2682±0.0703 and 1.2866±0.0850 with good consistency (n=390, ICC=0.724, 95% CI: 0.643-0.785, P<0.001). For patients without left ventricular hypertrophy, the consistency was much higher (n=305, ICC=0.776, 95%CI: 0.704-0.828, P<0.001) than those with myocardial hypertrophy (n=85, ICC=0.533, 95% CI: 0.308-0.690, P<0.001).

### CONCLUSION

CCT images can be used to assess left ventricular trabecular complexity with good accuracy compared with CMR, except for patients with severe left ventricular hypertrophy and systolic reconstruction.

### CLINICAL RELEVANCE/APPLICATION

Fractal analysis by CMR cine images can be used to assess the left ventricular trabecular complexity, and provide incremental prognostic value for adverse cardiac events. This study confirmed the good consistency between FD by CCT and by CMR, which suggests that CT-FD may serve as a more accessible alternative in case CMR is not applicable.

## W5B-SPCA-8 ULTRA-SHORT TERM LEFT VENTRICULAR EJECTION FRACTION ANALYSIS USING CORONARY CT ANGIOGRAPHY

Takuya Matsuda (*Abstract Co-Author*) Nothing to Disclose
Hiroshi Suekuni (*Abstract Co-Author*) Nothing to Disclose
Teruhito Kido, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Takanori Kouchi (*Abstract Co-Author*) Nothing to Disclose
Kazuki Yoshida, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuki Tanabe (*Abstract Co-Author*) Nothing to Disclose
Tomoro Morikawa, MD (*Abstract Co-Author*) Nothing to Disclose
SHUN SAWADA (*Presenter*) Nothing to Disclose

### PURPOSE

Coronary computed tomography angiography (CCTA) plays a crucial role in diagnosing coronary artery disease. While prospectively ECG-triggered acquisition is commonly utilized to minimize radiation exposure during CCTA scans, it does not facilitate left ventricular (LV) ejection fraction (EF) analysis. This study aims to assess the feasibility of ultra-short term LVEF (UST-LVEF) analysis based on volumetric changes over 100ms which is also available in prospectively ECG-triggered CCTA with padding technique.

### METHODS AND MATERIALS

This retrospective study included 77 patients who underwent retrospectively ECG-triggered CCTA and cardiac magnetic resonance (CMR). Nine CCTA data sets, each comprising three phases with a 50ms interval, were reconstructed: 1) 0-100ms, 2) 50-150ms, 3) 100-200ms, 4) 150-250ms, 5) 200-300ms, 6) 250-350ms, 7)300-400ms, 8) 350-450ms, and 9) 400-500ms post-QRS. The assessable rate was evaluated at a segment level in the nine CCTA data sets focusing on motion artifact to exclude data sets with poor image quality. UST-LVEF was calculated using the change rate between maximum and minimum LV volumes among the three phases. Additionally, full LVEF was assessed using CCTA data for one cardiac cycle. On the basis of CMR, LV

dysfunction was defined as LVEF <55% and severe LV dysfunction was defined as LVEF <35%. The diagnostic accuracy of UST-LVEF for detecting LV dysfunction was assessed using receiver operating characteristic curve analysis and compared with full LVEF.

**RESULTS**

Of 77 patients, 55 patients were defined as LV dysfunction, including 23 patients with severe LV dysfunction. The assessable rate in CCTA300-400ms was the highest of 96% with no significant difference compared to CCTA200-300ms, CCTA250-350ms, and CCTA350-450ms. The area under the curves (AUC) for detecting LV dysfunction were 0.87, 0.77, 0.67, 0.69, and 0.92 for UST-LVEF200-300ms, UST-LVEF250-350ms, UST-LVEF300-400ms, UST-LVEF350-450ms, and full LVEF, respectively. For detecting severe LV dysfunction, AUCs were 0.88, 0.79, 0.80, 0.82, and 0.97 for UST-LVEF200-300ms, UST-LVEF250-350ms, UST-LVEF300-400ms, UST-LVEF350-450ms, and full LVEF, respectively. There was no significant difference in the AUCs for detecting LV dysfunction and severe LV dysfunction between UST-LVEF200-300ms and full LVEF. However, significant differences in AUCs were observed for the other UST-LVEF in comparison with full LVEF ($p < 0.05$).

**CONCLUSION**

UST-LVEF200-300ms may serve as a comparable indicator to full LVEF for assessing LV dysfunction.

**CLINICAL RELEVANCE/APPLICATION**

In prospectively ECG-triggered CCTA imaging with padding technique, data acquisition at mid-systole timed 200-300ms after the QRS allows for assessing both coronary artery and LV function.

## W5B-SPCA-9 THE SHORTEST DISTANCE BETWEENLEFT ATRIAL APPENDAGEAND LEFT SUPERIORPULMONARY VEINDERIVED FROM CARDIAC COMPUTED TOMOGRAPHY PREDICTS ATRIAL FIBRILLATION RECURRENCE AFTER ABLATION

Yi Xu (*Abstract Co-Author*) Nothing to Disclose
Dandan Wu (*Presenter*) Nothing to Disclose

**PURPOSE**

Many predictors of atrial fibrillation (AF) recurrence after ablation have been described, such as left atrial (LA) enlarged, left atrial appendage (LAA) morphologies, and particular pulmonary vein anatomic variations. The purpose of this study was to investigate the shortest distance between LAA and left superior pulmonary vein(LSPV) derived from cardiac Computed Tomography (CT) in predicting AF recurrence after ablation within 2 years.

**METHODS AND MATERIALS**

Contrast-enhanced cardiac CT images of 342 consecutive AF patients (median age 64 years; 119 females) who underwent initial ablation from August 2018 to December 2021 were retrospectively analyzed. Clinical features and cardiac CT derived quantitative parameters were recorded. The shortest distance between LAA and LSPV(LAA-LSPV) was determined by visual using multiplanar projection images and measured from the posterior wall of LAA to the frontier border of LSPV. The diameter and area of LAA orifice, the LAA depth (LAAD), the LAA volume and LA volume were measured by using dedicated software. The body surface area indexed maximum and minimum volume of LA (LAVImax, LAVImin) and LAA (LAAVImax, LAAVImin) were calculated. Independent predictors of AF recurrence were determined using Cox regression analysis. The clinical model, the imaging model, and the combined model (clinical +imaging) were built to predict recurrence. The predictive performance of these models was assessed using the area under the receiver operating characteristics curve (AUC).

**RESULTS**

106 (31.0%) patients recurred AF within 2 years after ablation at a median follow-up of 24 months (IQR 18, 26). LAVImax, LAVImin, LAAVImax, LAAVImin and LAAD significantly increased in patients with AF recurrence (all $P<0.05$). The proportion of patients with LAA-LSPV<2mm was higher in AF recurrence group (47.2% vs 25.0%, $P<0.001$). Persistent AF (HR=1.600, 95%CI:1.068-2.397, P=0.023), NT-proBNP (HR=1.000, 95%CI: 1.000-1.000, P=0.044), LAAVImax (HR=1.162,95%CI:1.097-1.229,P<0.001) and LAA-LSPV<2mm (HR=1.923,95%CI:1.295-2.856,P=0.001) were independent predictors for AF recurrence. The combined model exhibited superior predictive performance than the clinical model (AUC 0.739 vs 0.656, P=0.006). Kaplan-Meier curves of AF recurrence-free survival shows that patients with LAA-LSPV<2mm (log-rank $P<0.001$) presented a higher risk of AF recurrence.

**CONCLUSION**

Cardiac CT-derived LAA-LSPV<2mm was an independent predictor for AF recurrence after ablation within 2 years and can provide a complementary value for AF recurrence risk assessment.

**CLINICAL RELEVANCE/APPLICATION**

Predicting the risk of post-operative recurrence before ablation is helpful for individualized prevention and treatment plans as for AF patients.

# Abstract Archives of the RSNA, 2024

W5B-SPCH

**Chest Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPCH-1 DUAL-ENERGY CT QUANTITATIVE PARAMETERS FOR EVALUATING THE KI-67 EXPRESSION LEVELS IN ESOPHAGEAL SQUAMOUS CELL CARCINOMA

Dechun Zheng, MD (*Abstract Co-Author*) Nothing to Disclose
Jing Sun (*Presenter*) Nothing to Disclose

### PURPOSE

To assess the value of quantitative parameters derived from dual-energy computed tomography (DECT) for evaluating the Ki-67 expression levels of esophageal squamous cell carcinoma (ESCC).

### METHODS AND MATERIALS

Fifty-seven patients with ESCC who underwent enhanced dual-phase DECT scans, including an arterial phase (AP) and venous phase (VP) from June 2019 to August 2020 were enrolled in this study. Iodine concentration (IC), water concentration (WC), normalized iodine concentration (NIC), the slope of the spectral Hounsfield unit curve (?Hu), and effective atomic number parameters (Zeff) of two phases were measured. Univariate and multivariate analyses were conducted to identify independent risk predictors of different Ki-67 expression status. In addition, the diagnostic capability of DECT of the statistically significant parameters was evaluated using receiver operating characteristic (ROC) curve analysis. Sensitivity, specificity, accuracy, and optimal thresholds were determined with 95% confidence intervals using Youden's index.

### RESULTS

The high-expression state of Ki-67 tended to display higher venous phase Zeff and IC compared with the low-expression state of Ki-67 (individually, P = 0.047, 0.049; area under the curve [AUC] of 0.67, 0.67). Patients with lower arterial phase WC had a higher rate of high-expression of Ki-67 than those with higher venous phase WC (P = 0.021; AUC of 0.70).Multiparametric analysis showed that venous phase IC and arterial phase WC were the most independent predictive factors ($p < 0.05$) for differentiating Ki-67 overexpression. The AUC of the two-factor combination for predicting the presence of Ki-67 overexpression was 0.802 (95% CI, 0.677-0.927; $p < 0.001$).

### CONCLUSION

Dual-energy CT parameters held great potential for detecting the Ki-67 status of ESCC.

### CLINICAL RELEVANCE/APPLICATION

Dual-energy spectral CT imaging parameters can provide supplementary information for the characterization of ki-67 status, especially for patients who cannot undergo biopsy or surgery and may be a useful method to guide clinical diagnosis and prognosis

## W5B-SPCH-2 DIAGNOSTIC PERFORMANCE OF NODE-RADS-BASED CLINICAL FEATURES COMBINED WITH CT TEXTURE ANALYSIS FOR PREDICTING THE BENIGN OR MALIGNANT STATUS OF ENLARGED MEDIASTINAL LYMPH NODES

Bin Shi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The conventional assessment of lymph node size possesses inherent limitations and remains a subject of ongoing controversy. The utilization of Node Reporting and Data Systems (Node-RADS) has facilitated the radiographic assessment of mediastinal lymph nodes in clinical practice, as well as the implementation of structured reports. Our study aimed to investigate the diagnostic performance of Node-RADS-based clinical features combined with CT texture analysis in accurately predicting the benign or malignant status of enlarged mediastinal lymph nodes.

### METHODS AND MATERIALS

The present retrospective study included 93 patients with pathologically confirmed 118 enlarged mediastinal lymph nodes (with a short axis =10 mm) that were accurately detected by endobronchial ultrasonography (EBUS). A total of 41 clinical features based on Node-RADS were individually assessed, including subcategories such as gender, age, size, CT values, configuration and Node-RADS scores. Additionally, 1874 texture features were extracted from CT images in venous phase. Feature selection was performed using Pearson Correlation,SelectKBest and LASSO algorithms. Then logistic regression analysis was utilized to construct predictive models. Finally, the diagnostic performance of each model was evaluated by constructing Receiver Operating Characteristic (ROC) curves.

### RESULTS

In discrimination analysis, the most informative predictive cues for constructing the aforementioned models included long axis, short axis, CT value of lesion in venous phase, sum score of configuration, Node-RADS score, as well as six texture features ($p<0.01$). The area under ROC curves of clinical model, radiomics model and conjoint model were 0.8383, 0.8095, 0.8403 in training sets; and 0.7188, 0.8359, 0.875 in testing sets, respectively. The calibration curve demonstrated that the predictive value of the optimal conjoint model remained consistent with the observed values.

### CONCLUSION

The integration of Node-RADS-based clinical features with CT texture analysis demonstrates promising potential in accurately predicting the benign or malignant status of enlarged mediastinal lymph nodes.

### CLINICAL RELEVANCE/APPLICATION

The findings of this study suggest that Node-RADS may serve as a suitable tool for structured reporting of mediastinal lymph nodes. Additionally, incorporating texture analysis could enhance the quantitative prediction in clinical relevance.

## W5B-SPCH-3 SUPER-EFFICIENT AI FOR LUNG NODULE CLASSIFICATION IN CT BASED ON SMALL-DATA MASSIVE-TRAINING ARTIFICIAL NEURAL NETWORK (MTANN)

Ze Jin, PhD (*Abstract Co-Author*) Nothing to Disclose
Takeyuki Watadani, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Osamu Abe, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kenji Suzuki, PhD (*Abstract Co-Author*) Nothing to Disclose
Seyed Mohammad Chavoshian (*Abstract Co-Author*) Nothing to Disclose
Shogo Kodera (*Presenter*) Nothing to Disclose

### PURPOSE

Deep learning (DL) AI for diagnostic aid has been successful in achieving high performance for various diseases. DL, however, requires "big data" for training and substantial work for radiologists to annotate them. To address this issue, we developed a novel approach based on our MTANN that requires a smaller number of cases to train while maintaining high performance in classification between malignant and benign lung nodules in CT.

### METHODS AND MATERIALS

The LIDC-IDRI database, consisting of 1018 chest CT scans with annotations, was used in this study. Our small-data 3D MTANN model employed an image-based teacher scheme and a patch-based learning scheme, which allow small-sample training. Its minimum network architecture with only 17,251 parameters allows super-efficient computation. To verify the performance and efficiency of our small-data model, we conducted two experiments in 10-fold cross-validation tests: Experiment 1 used a training-to-testing sample ratio of 9:1, with 616 training and 68 test nodules, to form a "large training set" scenario; Experiment 2 inverted this ratio to 1:9, with only 68 training and 616 test nodules, to form a "small training set" scenario.

### RESULTS

We evaluated our MTANN and the state-of-the-art DL models, i.e., nnU-Net, 3D ResNet and Vision Transformer (ViT) with transfer learning, using the area under the receiver-operating-characteristic (ROC) curve (AUC). Our model, with merely 0.05%-0.005% of the parameters of the conventional models, significantly surpassed all the state-of-the-art (SOTA) models in efficiency (reduction in training and inference times by factors of 75 and 15, respectively). Our model trained with small and large datasets (68 and 616 cases) achieved remarkable AUC of 0.92 and 0.96 with statistical significance ($P<.05$), compared to 0.59-0.86 and 0.83-0.89, respectively, by the SOTA models.

### CONCLUSION

We developed super-efficient AI based on a small-data MTANN model for lung nodule classification in CT (with an inference time of 8.15 ms), which achieved the highest performance (AUC of 0.92) of all SOTA models while using a small training dataset (only 68 cases). Our small-data model would resolve the issue of the requirement of "big data" for DL models; and it would mitigate the challenges for small to medium-sized hospitals due to the lack of the availability of a large number of cases.

### CLINICAL RELEVANCE/APPLICATION

Our small-data MTANN-based AI system would be helpful in assisting radiologists in efficient and effective diagnostic aid under the limited resources of training cases and computational power.

## W5B-SPCH-4 PREDICTING PULMONARY METASTATIC NODULES AT CHEST CT WITH MULTIMODAL DATA-BASED DEEP LEARNING MODELS IN PATIENTS WITH COLORECTAL CANCER

Qiuxia Yang (*Abstract Co-Author*) Nothing to Disclose
Jiahui Xu (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a multimodal data-based deep learning (DL) model for predicting metastatic nodules on enhanced thin-section chest CT in patients with colorectal cancer and investigate the potential improvement of model efficiency by incorporating a novel probabilistic fusion method.

### METHODS AND MATERIALS

A retrospective study encompassing 3367 nodules (2033 metastatic and 1334 benign) from 619 patients between January 2017 and April 2021 was conducted. These nodules were randomly divided into training (n = 2991), validation (n = 125), and testing cohort (n = 251). Six DL models were constructed to predict pulmonary metastatic nodules. Initially, three base models were developed: model 1 (DenseNet model), model 2 (MilNet + DenseNet model), and model 3 (Clinical information + MilNet + DenseNet model). Subsequently, an enhanced version of these models (models 4-6) was introduced, which integrated a novel probabilistic fusion technique that considers the maximum lesion probability (lesion_prob_max) for each individual patient. Model performance was evaluated using the area under curve (AUC), accuracy, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and F1-score.

### RESULTS

In testing cohort, the multimodal DL model with novel probabilistic fusion (model 6) achieved AUC 0.957 (95%CI: 0.935-0.980), accuracy 0.896, sensitivity 0.895, specificity 0.897, PPV 0.862, NPV 0.923, and F1-score 0.878. In comparison, without fusion (model 3), AUC was 0.950 (95%CI: 0.924-0.976), accuracy 0.884, sensitivity 0.886, specificity 0.884, PPV 0.845, NPV 0.915, and F1-score 0.865. The incorporation of a novel probabilistic fusion method demonstrated improvement of model efficiency.

### CONCLUSION

The multimodal data-based DL model incorporating a novel probabilistic fusion method, which takes into account the maximum lesion probability per patient, demonstrated excellent efficiency in predicting pulmonary metastatic nodules in patients with colorectal cancer.

### CLINICAL RELEVANCE/APPLICATION

This multimodal DL model, augmented by the probabilistic fusion method, has the potential to serve as a valuable adjunctive tool in clinical practice, assisting in the early detection and management of pulmonary metastases in patients with colorectal cancer.

## W5B-SPCH-5 SINGLE CLICK LUNG LESION SEGMENTATION AND TRACKING ACROSS LONGITUDINAL SCANS: COMPARISON WITH MANUAL ANNOTATION FOR TREATMENT MONITORING IN IMMUNOTHERAPY

Anant Madabhushi, PhD (*Abstract Co-Author*) Stockholder, Elucid Bioimaging Inc;License agreement, Elucid Bioimaging Inc;Stockholder, Inspirata, Inc;Grant, Inspirata, Inc;Scientific Advisory Board, Inspirata, Inc;Researcher, AstraZeneca PLC;Scientific Advisory Board, AstraZeneca PLC
Kaustav Bera, MD (*Abstract Co-Author*) Nothing to Disclose
Amit Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Amogh Hiremath, PhD, MS (*Abstract Co-Author*) Nothing to Disclose
Vamsidhar Velcheti (*Abstract Co-Author*) Nothing to Disclose
Omid Haji Maghsoudi (*Abstract Co-Author*) Nothing to Disclose
Kai Zhang (*Abstract Co-Author*) Nothing to Disclose
Haojia Li (*Abstract Co-Author*) Nothing to Disclose
Nathaniel Braman, PhD (*Presenter*) Former Employee, Tempus Labs;Intellectual property, Tempus Labs;Stockholder, Tempus Labs;Employee, Picture Health;Intellectual property, Picture Health;Stockholder, Picture Health;

### PURPOSE

Accurate tracking of lesion size is crucial in evaluating treatment response in oncology, yet it relies on time-consuming and often subjective manual measurement by radiologists. We have developed a single-click, multi-timepoint monitoring tool, ClickTrack, for delineating and tracking size of lesions across CT scans throughout treatment. We evaluate ClickTrack's ability to track changes in lung lesion size for treatment monitoring in the immunotherapy setting.

### METHODS AND MATERIALS

ClickTrack was evaluated on a dataset of 69 non-small cell lung cancer (NSCLC) patients receiving immunotherapy, each with a pre-treatment and follow-up scan 6 weeks later. From a single user-selected click point within a lesion on the pre-treatment scan, the system segments and measures the lesion across all imaging timepoints. Sum of lesion diameters (SLD) are computed for up to 2 target lesions. The algorithm was compared against measurements from manual annotations from two radiologists working in consensus. We computed the Pearson correlation coefficient (r) and Intraclass Correlation Coefficient (ICC) for both SLD measurements and percent change in lesion size between scans.

### RESULTS

The semi-automated SLD showed a strong correlation and agreement with manual measurements, yielding r=0.87 ($p < 1e-10$) and ICC=0.86 ($p < 1e-10$, CI 95%: 0.79 - 0.91) for the pre-treatment scans. Correlation was similarly high for on-treatment scans, with r=0.81 ($p < 1e-10$) and ICC=0.79 ($p < 1e-10$, CI 95%: 0.68 - 0.87), demonstrating accurate follow-up measurement without further user guidance. The percent change in SLD over time calculated by ClickTrack also aligned closely with manual evaluation (r: 0.71, $p < 1e-10$; ICC: 0.71, CI 95%: 0.56 - 0.81, $p < 1e-10$).

### CONCLUSION

ClickTrack, a system for longitudinal segmentation and monitoring of lesions across exams throughout cancer treatment, showed robust accuracy and reliability in SLD measurements and size changes of lung lesions compared to manual readers.

### CLINICAL RELEVANCE/APPLICATION

A semi-automated lesion tracking system could significantly accelerate response monitoring in both the clinical care and clinical trial settings, requiring only a single radiologist click to segment and track lesions across follow-up imaging.

## W5B-SPCH-6 DEEP LEARNING-BASED DETECTION OF LUNG NODULES ON WHOLE-BODY MAGNETIC RESONANCE IMAGING (WB-MRI) FOR CANCER SCREENING

Giuseppe Petralia, MD (*Abstract Co-Author*) Nothing to Disclose
Cristiano Girlando, MD (*Abstract Co-Author*) Nothing to Disclose
Fabio Zugni (*Abstract Co-Author*) Nothing to Disclose
Cornelius Jacob (*Presenter*) Nothing to Disclose

### PURPOSE

Lung nodules serve as critical indicators of emerging malignancies, necessitating accurate detection for early intervention. While whole-body MRI (WB-MRI) has shown efficacy in early cancer detection, a significant challenge persists due to the abundance of images across various contrasts, leading to time-intensive and error-prone image interpretation. This study aims to address this issue by developing and evaluating a deep learning (DL) model for the detection of lung nodules in WB-MRI for cancer screening (CS). The objective is to evaluate the potential of artificial intelligence (AI) compared to the performance of human readers in assessing lung nodules in WB-MRI of the general population.

### METHODS AND MATERIALS

A training dataset comprising 100 case-positive WB-MRI CS studies, including voxel-based annotations verified by a junior radiologist (5 years of experience in chest imaging), was used for network training. We utilized the nnDetection framework for DL development, using designated thoracic T1 GRE high-spatial-resolution images as network input. Performance evaluation was performed on a test dataset applying receiver operating characteristic (ROC) and free-response receiver operating characteristic (FROC) analysis. The dataset consisted of 148 consecutive WB-MRI CS studies, including 37 nodules (2.8 mm to 7.7 mm in diameter), across 33 patients. Ground truth was annotated by a senior radiologist with 20 years of experience in chest imaging. To compare AI's performance with human readers, we assessed the detection performance of six radiologists, divided into a junior radiologist group (5-8 years of experience in chest imaging) and a radiology resident group (1-2 years of experience in chest imaging).

### RESULTS

The DL network demonstrated comparable performance to both the junior reader group (AI: 53.0% Sensitivity (SE) at 0.06 false positives per patient (FPPP); junior radiologist group: 46.8% mean SE at 0.06 mean FPPP) and the radiology resident group (36.0% mean SE at 0.01 mean FPPP). At

increased false positive rates of 1.0 FPPP and 2.23 FPPP, the AI achieved a maximum SE of 92.1% and 100%, respectively. The patient-level Area Under the Curve (AUC) of the AI was 0.89.

**CONCLUSION**

Our study demonstrates the efficacy of a DL algorithm for detecting lung nodules in WB-MRI for CS. Our DL model exhibited performance on par with human readers which underscores the potential of incorporating AI-driven solutions into WB-MRI image evaluation.

**CLINICAL RELEVANCE/APPLICATION**

This study exhibits the potential of DL algorithms in WB-MRI for CS. By demonstrating comparable performance to human readers, we highlight a promising avenue for integrating AI into clinical workflows and streamline CS to improve early cancer detection and patient outcomes.

## W5B-SPCH-7 ANNOTATION-FREE AI LEARNING OF LUNG NODULE SEGMENTATION IN CT USING WEAKLY-SUPERVISED MASSIVE-TRAINING ARTIFICIAL NEURAL NETWORKS

Yuqiao Yang, MS (*Abstract Co-Author*) Nothing to Disclose
Tianyi Qu (*Abstract Co-Author*) Nothing to Disclose
Kenji Suzuki, PhD (*Abstract Co-Author*) Nothing to Disclose
Ze Jin, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Deep learning (DL) models show excellent performance in segmentation tasks, but their high-performance training requires a large number of cases with precise manual annotations by radiologists. We developed a novel annotation-free approach to segmentation of lung nodules in CT using weakly-supervised massive-training artificial neural networks (MTANNs). Instead of relying on precise manual annotations, our AI started from initial inexact labels which are free from annotations and proceeded with iterative refinements of the labels to realize annotation-free learning.

**METHODS AND MATERIALS**

In this study, we used the Lung Nodule Analysis 2016 (LUNA16) dataset, which included 888 thoracic CT scans featuring 1186 lung nodule candidates along with numerous non-nodule candidates. Our weakly supervised learning methodology was centered on an iterative training process that incrementally refined initial inexact teaching image labels by using an explainable AI (XAI) method within massive-training artificial neural networks (MTANNs). The process started with a rough Gaussian distribution image based on initial knowledge on lung structures. During each iteration, function maps generated by the XAI method in the MTANN model were utilized as refined teaching image labels. This iterative cycle continued until the performance did not improve further, at the point where the label images closely resembled manual segmentation.

**RESULTS**

Our proposed weakly supervised learning method refined the initial inexact teaching image label with a rough Gaussian distribution and created more exact segmentation labels as the training iterations went. During three iterative training cycles, the segmentation performance in terms of Dice scores of our weakly-supervised MTANN model increased from 0.716, to 0.753, and 0.788 ($P << 0.05$), which approached to a Dice score of the "gold-standard" fully-supervised model (trained with radiologists' manual segmentation) of 0.794 without statistical significance ($P > 0.05$).

**CONCLUSION**

We developed a revolutionary "annotation-free" scheme for the segmentation of lung nodules in CT, which eliminated the need for radiologists' manual precise annotations, but only using "one-click" input on the nodule by a person.

**CLINICAL RELEVANCE/APPLICATION**

Our "annotation-free" AI model performed on par with the gold-standard fully-supervised model in lung nodule segmentation in CT, which eliminated the need for labor-intense manual segmentation by radiologists.

## W5B-SPCH-8 SPEED AND EFFICIENCY: EVALUATING PULMONARY NODULE DETECTION WITH AI-ENHANCED 3D GRADIENT ECHO IMAGING

Kilian Weiss, PhD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Marcus R. Makowski (*Abstract Co-Author*) Nothing to Disclose
Thomas Huber, MD (*Abstract Co-Author*) Consultant, BrainLAB AG;Consultant, Smart Reporting GmbH
Markus Graf (*Abstract Co-Author*) Nothing to Disclose
Joshua F. Gawlitza (*Abstract Co-Author*) Nothing to Disclose
Dimitrios C. Karampinos (*Abstract Co-Author*) Research Grant, Koninklijke Philips NV
Tristan Lemke (*Abstract Co-Author*) Nothing to Disclose
Sebastian Ziegelmayer, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander W. Marka, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aims to evaluate the diagnostic feasibility of accelerated pulmonary MR imaging for the detection and characterization of pulmonary nodules using artificial intelligence-boosted compressed sensing.

**METHODS AND MATERIALS**

A prospective trial was conducted with patients who had benign and malignant lung nodules and were admitted between December 2021 and December 2022. Participants underwent chest CT and pulmonary MRI using a respiratory-gated 3D gradient echo sequences. The MRI was accelerated using a combination of parallel imaging, compressed sensing, and deep learning, with three different acceleration factors (CS-AI 7, CS-AI 10, and CS-AI 15). Two readers, blinded to the CT results, evaluated image quality (using a 5-point Likert scale), nodule detection, and characterization (size, morphology) for all sequences. Reader agreement was determined using the intraclass correlation coefficient (ICC).

**RESULTS**

A total of 37 patients with 64 pulmonary nodules were analyzed in the study. Of these nodules, 65.5% were metastases, 12.5% were primary lung cancer, and 22% were benign (inflammatory or granuloma). The nominal scan times for the different acceleration factors were CS-AI 7 at 3:53 minutes, CS-AI 10 at 2:34 minutes, and CS-AI 15 at 1:50 minutes. The lowest acceleration factor (CS-AI 7) showed significantly higher image quality; however, image quality for all examined structures remained diagnostic even with the highest acceleration factor (CS-AI 15). Detection rates of pulmonary nodules were 100%, 98.4%, and 96.8% for CS-AI 7, CS-AI 10, and CS-AI 15, respectively. Nodule morphology was best assessed with the lowest acceleration

and was substantially inferior to CT in 5% of cases, compared to 10% for CS-AI 10 and 23% for CS-AI 15. The nodule size was comparable for all sequences, with an average deviation of <1 mm from the CT size.

**CONCLUSION**

The combination of compressed sensing and AI allows for a substantial reduction in lung MRI scan time while maintaining a high detection rate for pulmonary nodules. Although subjective image quality decreases with increasing acceleration, the images remain diagnostic and nodule size can be accurately displayed.

**CLINICAL RELEVANCE/APPLICATION**

Incorporating compressed sensing and AI in pulmonary MRI achieves significant time savings without compromising nodule detection or characteristics. This advancement holds clinical promise, enhancing efficiency in lung cancer screening without sacrificing diagnostic quality.

## W5B-SPCH-9 CT-BASED RADIOMICS NOMOGRAM OF LUNG AND MEDIASTINAL FEATURES TO IDENTIFY CARDIOVASCULARDISEASE IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE: A MULTICENTER STUDY

Xiaoqing Lin (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the performance of a CT-based lung or mediastinum or combined lung and mediastinum radiomics nomogram for identifying cardiovascular disease (CVD) in patients with chronic obstructive pulmonary disease (COPD).

**METHODS AND MATERIALS**

In total, 686 participants with COPD (328, 140 and 218 in training, internal and external validation cohorts, respectively) were included. Clinical data and visual coronary artery calcification (CAC) scores were analyzed. Radiomics features of whole lung and mediastinum were extracted from non-contrast chest CT images. Lung, mediastinum, and combined lung and mediastinum radiomics signatures were constructed. Multivariate logistic regression analysis was used to establish lung, mediastinum, combined lung and mediastinum radiomics nomograms, also including clinical risk factors, with AUC as outcome. The performance of the radiomics nomogram was evaluated by receiver operating characteristic curves, calibration curves and decision curve analysis.

**RESULTS**

Age, neutrophilic granulocyte percentage, hematokrit and GOLD were independent clinical risk factors for CVD in COPD patients. 1218 lung, 1218 mediastinum, and 2436 combined lung and mediastinum features were extracted, then reduced to 12, 6 and 6 features to build radiomics signatures, respectively. In the training cohort, internal and external validation cohort, the 3 models of radiomics combined with clinical factors(AUC: 0.788; 0.863; 0.863) showed better discriminatory capability ($p<0.05$) than the clinical risk factors model(AUC: 0.707) and visual CAC score model (AUC: 0.646), respectively. There was no significant difference in AUC between 3 combined models in internal and external validation cohorts($p>0.05$). Decision curve analysis demonstrated the lung, mediastinum, and combined lung and mediastinum nomograms outperformed the clinical factors model across the majority of the range of reasonable threshold probabilities.

**CONCLUSION**

We developed 3 CT-based nomograms to identify CVD in COPD patients, indicating radiomics nomogram on chest CT in COPD may help in CVD assessment, especially the whole-lung radiomics nomogram, suitable for lung cancer screening to screen COPD.

**CLINICAL RELEVANCE/APPLICATION**

We developed and compared 3 CT-based nomograms to identify CVD in COPD patients, all of them showed good performance, indicating each of them could identify the CVD in patients with COPD, especially the whole-lung radiomics nomogram, suitable for the large scale of lung cancer screening to screen COPD.

# Abstract Archives of the RSNA, 2024

W5B-SPER

**Emergency Radiology Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPER-1 INCIDENCE OF CONTRAST-INDUCEDACUTE KIDNEY INJURY (CI-AKI)INTRAUMA PATIENTS UNDERGOING CONTRAST-ENHANCED COMPUTEDTOMOGRAPHY USING ISO-OSMOLAR CONTRAST AGENT

Jimi Huh, MD (*Abstract Co-Author*) Nothing to Disclose
Jayoung Moon, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Iodixanol is a nonionic dimeric iso-osmolar contrast agent with expected effect to reduce contrast-induced acute kidney injury (CI-AKI). In trauma patients, no report has been published on the preventive effect of iso-osmolar contrast agent for CI-AKI. Thus, we aimed to evaluate the incidence and severity of CI-AKI, and those predictive factors in trauma patients.

### METHODS AND MATERIALS

From the institutional trauma registry in a regional trauma center of South Korea, patients who underwent CT scan with iodixanol and followed up at least 72 hours after CT scan were consecutively included. Patient demographic details, co-morbidities and laboratory test results were collected. CI-AKI was defined by the 2012 Kidney Disease Improving Global Outcomes (KDIGO) guideline. The severity of CI-AKI was classified by the RIFLE criteria. The severity of trauma was assessed by the injury severity score (ISS) category. The predictive factors of CI-AKI were evaluated by univariate and multivariate logistic regression.

### RESULTS

Of 1115 patients who underwent CT with iodixanol, 799 with completed data were included in this study. The incidence of CI-AKI was 3.80% (30/799). Of these, severe renal failure according to RIFLE criteria was 2.87% (23/799). The incidence of CI-AKI according to the ISS category were 1.52% (9/592) in minor group, 3.95% (7/177) in moderate group, 42.30% (11/26) in serious group, and 75.0% (3/4) in severe group. In univariate analysis, significant predictive factors of CI-AKI based odds ratio (OR) included hypertension [2.87 (95% CI, 1.37-6.00)], heart disease [4.06 (95% CI, 1.32-12.42)], ISS serious category [47.50 (95% CI, 17.14-131.63)], and ISS severe category [194.33 (95% CI, 18.40-2052.06)]. In multivariate analysis, significant predictive factors were ISS serious category [16.70 (95% CI, 16.70-138.96], and ISS severe category [245.22 (95% CI, 21.88-2748.38)].

### CONCLUSION

In trauma patients who underwent CT with iodixanol, the overall incidence of CI-AKI of 3.8% (30/799) was considerably low. The main predictive factors of CI-AKI involved hypertension, heart diseases and ISS serious and severe category, but its incidence and severity largely relied on the severity of trauma.

### CLINICAL RELEVANCE/APPLICATION

In trauma patients, the CT scans with iodixanol might be helpful to reduce the occurrence of CI-AKI.

## W5B-SPER-2 DIAGNOSTIC PERFORMANCE OF ANKLE ULTRASOUND FOR DIAGNOSING ANTERIOR TALOFIBULAR AND CALCANEOFIBULAR LIGAMENT INJURIES. A META-ANALYSIS

Sun Hwa Lee (*Abstract Co-Author*) Nothing to Disclose
Seong Jong Yun, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

This meta-analysis was aim to evaluate the diagnostic performance of ankle ultrasound for anterior tibiofibular ligament (ATFL) and calcaneofibular ligament (CFL) injuries.

### METHODS AND MATERIALS

PubMed and EMBASE databases were searched for diagnostic accuracy studies that used ultrasound for diagnosing ATFL and CFL injuries. Bivariate and hierarchical summary receiver operating characteristic (HSROC) modeling were used to evaluate diagnostic performance. Subgroup analysis was performed using studies according to severity of the injury (complete and partial ATFL tear). We performed meta-regression analyses for heterogeneity exploration.

### RESULTS

Ten articles involving a total of 380 patients were included. For ATFL injury, the summary sensitivity, summary specificity, and area under the HSROC (AUC) were 0.99, 0.92, and 0.99, respectively. For CFL injury, the summary sensitivity, summary specificity, and AUC were 0.95, 0.99, and 0.95,

respectively. In subgroup analysis, for complete ATFL tear, the summary sensitivity, summary specificity, and AUC were 0.96, 0.82, and 0.96, respectively. For partial ATFL tear, the summary sensitivity, summary specificity, and AUC were 0.90, 0.82, and 0.93, respectively. Among the various potential covariates, proportion of ATFL tear ($p<0.01$), ultrasound interpreter ($p=0.03$), and reference standard ($p<0.01$) were associated with specificity heterogeneity.

**CONCLUSION**

Ankle ultrasound demonstrates high diagnostic performance in the diagnosis of ATFL and CFL injuries. We recommend ultrasound performed by a musculoskeletal radiologist as a first-line diagnostic tool to diagnose ATFL and CFL injuries.

**CLINICAL RELEVANCE/APPLICATION**

Using US, accurate and timely diagnoses of ATFL and CFL injuries are possible without invasiveness or radiation.

# Abstract Archives of the RSNA, 2024

W5B-SPGI

**Gastrointestinal Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPGI-11 DUAL-ENERGY CT-BASED RADIOMICS SIGNATURE IN PREDICTING THE PROGNOSIS OF RESECTABLE ADVANCED GASTRIC CANCER PATIENTS

LI YANG (*Abstract Co-Author*) Nothing to Disclose
Ao Liu (*Presenter*) Nothing to Disclose

### PURPOSE

This study aimed to develop a radiomics prognosis model based on dual-energy computed tomography (DECT) venous-phase iodine map (IM) and 120 kVp equivalent mixed images (MIX) to predict the 1,3 and 5 years of overall survival (OS) and disease-free survival (DFS) of resectable advanced gastric cancer patients, thereby providing personalized treatment for patients.

### METHODS AND MATERIALS

183 resectable advanced gastric cancer patients underwent DECT scans. Radiomics features were extracted from manually segmented volume of interest (VOI) of the IM and MIX images by using the radiomics software. The least absolute shrinkage and selection operator (LASSO) algorithm and multivariate Cox regression analysis were used to determine the optimal texture features and build a radiomics prognosis model. Calculated Radscore based on radiomics features and correlation coefficients. Performed a Cox regression analysis on all clinical factors and select variables with P values<0.05 in univariate and multivariate analysis as risk factors to build a clinical prognosis model. Incorporated Radscore as an independent risk factor into the clinical prognosis model to construct a clinical-radiomics combined prognosis model. Compared the predictive performance of three models.

### RESULTS

Training set (n=128) and testing set (n=55) were randomly assigned at a ratio of 7:3. There was no statistically significant difference in baseline information between two sets. After correlation analysis and LASSO-COX regression analysis, 26 and 18 features were selected from 3382 to predict the OS and DFS of patients, of which 15 and 10 were derived from IM. Performed threshold effect analysis on Radscore and divided patients into low- and high-risk groups. The Log Rank test confirmed a statistically significant difference between the two groups(P<0.001). Chemotherapy, CEA, CA199 and stage were selected to predict the OS of patients. CEA was selected to predict the DFS of patients. The radiomics prognosis model has better predictive performance in predicting OS and DFS and a higher C-index(C-index of radiomics, clinical-radiomics combined and clinical prognosis model:0.89 vs. 0.85 vs. 0.74 and 0.85 vs. 0.79 vs. 0.61).

### CONCLUSION

The radiomics signature successfully stratified those patients into high- and low-risk groups with significant differences in DFS and OS. The radiomics prognosis model performed better than the clinical prognosis model, demonstrating well the incremental value of the radiomics signature for individualized DFS and OS estimation.

### CLINICAL RELEVANCE/APPLICATION

The radiomics prognosis model developed based on DECT could help clinicians determine which patients will benefit from more intensified treatment and prevent overtreatment in low-risk patients.

## W5B-SPGI-12 COMBINING RADIOMICS AND ARTIFICIAL INTELLIGENCE-BASED PATHOLOGICAL FEATURES TO PREDICT THE PROGNOSIS OF STAGE II COLORECTAL CANCER: A MULTI-CENTER RETROSPECTIVE STUDY

Zening Rong (*Abstract Co-Author*) Nothing to Disclose
Tong Tong, PHD (*Abstract Co-Author*) Nothing to Disclose
Huifen Ye, MMEd (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the predictive value of integrating radiomics features and artificial intelligence-based pathological features for prognosis and the benefit of postoperative adjuvant chemotherapy in stage II colorectal cancer (CRC) patients.

### METHODS AND MATERIALS

This study retrospectively included stage II CRC patients underwent CT examination and surgical treatment from 3 independent centers. CT radiomics features were extracted using PyRadiomics and pathological features were defined and calculated based on the tissue and nuclei segmentation using U-Net on HE-stained whole-slide images. To predict patients' survival, we developed radiomics model, pathological model and clinical model using Cox proportional hazards regression. Then a Patho-Radio model and a Patho-Radio-Clinical model were constructed. We used C-index and AUC to evaluate

model's performance. Pearson correlation coefficients between radiomics features and pathological features were calculated. Kaplan-Meier survival analysis was conducted to compare the prognosis between the high-risk group and low-risk group divided by models.

**RESULTS**

660 stage II CRC patients from 3 institutions were enrolled in this study (406 in the training cohort and 254 in the validation cohort). The Patho-Radio model exhibited improved OS prediction (C-index = 0.665, AUC = 0.682) over the Radiomics model (C-index = 0.638, AUC = 0.651) and Pathological model (C-index = 0.600, AUC = 0.599) in the external validation cohort, and the Patho-Radio-Clinical model demonstrated best performance (C-index = 0.727, AUC = 0.762). Kaplan-Meier analysis revealed distinct OS and DFS between high-risk and low-risk groups divided by all models in 2 cohorts ($p < 0.05$). Patients predicted as low-risk showed no significant difference in overall survival with or without adjuvant chemotherapy ($p = 0.58$), while for patients predicted as high-risk, postoperative adjuvant chemotherapy significantly improved survival ($p = 0.02$).

**CONCLUSION**

The fusion model integrating radiomics features, pathological features, and clinical risk factors can effectively predict the prognosis of stage II CRC patients and the benefit of adjuvant chemotherapy. Its performance surpasses that of single-modal models and exhibits robust performance in the external validation cohort.

**CLINICAL RELEVANCE/APPLICATION**

The Patho-Radio-Clinical model offers a comprehensive approach for guiding personalized clinical decision-making of stage II CRC patients.

## W5B-SPGI-13 PREDICTION OF PANCREATIC DUCTAL ADENOCARCINOMA GRADING USING DYNAMIC NOMOGRAM CONSTRUCTED ON THE BASIS OF CT FEATURES AND EXTRACELLULAR VOLUME FRACTION

Jiadong Song (*Abstract Co-Author*) Nothing to Disclose
Yang Dong (*Abstract Co-Author*) Nothing to Disclose
Meng Zhang (*Abstract Co-Author*) Nothing to Disclose
Tianyu Zhao (*Abstract Co-Author*) Nothing to Disclose
Wenhao Guan (*Abstract Co-Author*) Nothing to Disclose
Jinzhi Yang (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the value of CT imaging features and extracellular volume fraction (ECV) in the pathological grading evaluation of pancreatic ductal adenocarcinoma (PDAC) and construct a dynamic nomogram for predicting the pathological grading of PDAC.

**METHODS AND MATERIALS**

Patients with low- and high-grade PDAC who underwent unenhanced and equilibrium contrast-enhanced CT with a single-energy scanner between January 2018 and July 2023 were identified retrospectively. For each lesion, the CT features were analyzed, including location, tumor maximum diameter, bile duct dilatation, main pancreatic duct dilatation, pancreatic atrophy, peripancreatic tumor infiltration, suspicious lymph node metastasis, necrosis, arterial (celiac trunk, superior mesenteric artery, and common hepatic artery) involvement, portal and superior mesenteric vein involvement. The unenhanced and equilibrium contrast-enhanced attenuation in the solid area of PDAC and the aortic lumen at the same level were measured. CTenhancement (tumor equilibrium contrast-enhanced minus unenhanced attenuation [HU]) and ECV ((1- hematocrit) × [(tumor CT valueequilibrium - tumor CT valueunenhancement)/ (aortic CT valueequilibrium - aortic CT valueunenhancement)]×100%) were calculated. CT features and ECV were statistically analyzed for correlation with PDAC pathological grading. Multivariate logistic regression analysis was used to construct a diagnostic nomogram containing statistically significant features. Using the web application-R shiny and the R programming language software to build an immediately adjustable dynamic nomogram.

**RESULTS**

A total of 103 patients (65.1±10.3 years, 66 men) with PDAC were analyzed, including 46 cases of low-grade and 57 cases of high-grade. Tumor maximum diameter, necrosis, distant metastasis, CTenhancement, and ECV were significantly higher in low-grade vs high-grade PDAC ($P = 0.003$, 0.023, 0.007, 0.004, 0.015). ECV significantly correlated with the PDAC pathological grading ($P = 0.04$, $r = -0.240$). The combination of the significant parameters above had the highest area under the ROC curve (AUC = 0.73). Furthermore, we developed a dynamic web application utilizing the constructed nomograms available at https://liexiantu1.shinyapps.io/dynnomapp/.

**CONCLUSION**

CT features and ECV could provide information for the pathological grading diagnosis of PDAC. Dynamic nomogram based on the CT images could provide high diagnostic efficacy.

**CLINICAL RELEVANCE/APPLICATION**

The combination of the proposed CT features and ECV may contribute to evaluate the prediction of PDAC pathological grading. Meanwhile, we developed a network-based dynamic nomogram to assist doctors in preoperative evaluation of the PDAC pathological grading.

## W5B-SPGI-2 NEW METHOD TO EVALUATE CT COLONOGRAPHY USING TEXTURE ANALYSIS

Hisahiro Matsubara, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Atsushi Hirata (*Abstract Co-Author*) Nothing to Disclose
Gaku Ohira (*Abstract Co-Author*) Nothing to Disclose
Koichi Hayano, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshihiro Kurata (*Abstract Co-Author*) Nothing to Disclose
Toru Tochigi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

The texture analysis is a technique to quantify the heterogeneity of the figure. Recently some studies focused on the biomarker acquired by using texture analysis. We have studied computed tomographic colonography (CTC) images using texture analysis and tried to apply them to the prediction of the treatment effect of chemotherapy or diagnosis of malignancy of the tumor. The purpose of this study is to investigate whether texture analysis of CTC images could be a novel biomarker for colorectal cancer (CRC).

**METHODS AND MATERIALS**

This retrospective study investigated 263 patients with CRC who underwent contrast-enhanced CTC (CE-CTC) before curative surgery between January 2014 and December 2017. Multiple texture analyses (fractal, histogram, and gray-level co-occurrence matrix (GLCM) texture analyses) were applied to

CE-CTC (portal-venous phase), and fractal dimension (FD), skewness, kurtosis, entropy, and GLCM texture parameters, including GLCM-correlation, GLCM-autocorrelation, GLCM-entropy, and GLCM-homogeneity, of the tumor were calculated. These texture parameters were compared with pathological factors (tumor depth, lymph node metastasis, vascular invasion, and lymphatic invasion) and the overall survival (OS).

**RESULTS**

Tumor depth was significantly associated with FD, kurtosis, entropy, GLCM-correlation, GLCM-autocorrelation, GLCM-entropy, and GLCM-homogeneity (P=0.001, 0.001, 0.001, 0.001,0.018, 0.008, and 0.001, respectively); lymph node metastasis was associated with GLCM-homogeneity (P=0.004); lymphatic invasion was associated with GLCM-correlation and GLCM-homogeneity (P=0.001 and 0.012, respectively); and venous invasion was associated with FD, entropy, GLCM-correlation, GLCM-autocorrelation, and GLCM-entropy of the tumor (P=0.001, 0.033, 0.021, 0.046, respectively). In the Kaplan-Meier analysis, patients with high GLCM-correlation tumors or high GLCM-homogeneity tumors showed significantly worse OS than others (P=0.001 and 0.04, respectively). Multivariate analyses showed that the GLCM correlation was an independent prognostic factor for the OS (P=0.021).

**CONCLUSION**

texture parameters derived from CE-CTC may be clinically useful biomarkers for assessing the malignancy of CRC.

**CLINICAL RELEVANCE/APPLICATION**

texture analysis with CTC could give us beneficial information for practice and is useful for tailor-made medicine.

## W5B-SPGI-3 MRI DIAGNOSTIC PERFORMANCE IN THE EVALUATION OF THE DEGREE OF TUMOR REGRESSION IN RECTAL CANCER FOLLOWING NEOADJUVANT TREATMENT

Vicente Martinez de Vega, PhD (*Abstract Co-Author*) Nothing to Disclose
David Garcia, MD (*Abstract Co-Author*) Nothing to Disclose
Alejandro Diaz Moreno, MD (*Abstract Co-Author*) Nothing to Disclose
Mar Jimenez (*Abstract Co-Author*) Nothing to Disclose
Ana Fernandez Alfonso (*Abstract Co-Author*) Nothing to Disclose
Lucia Sanabria, MD (*Abstract Co-Author*) Nothing to Disclose
Julia Lopez Alcolea, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

• Locally advanced lower rectal tumors typically require treatment with abdominoperineal amputation, resulting in permanent colostomy and significant psychological impact on the patient. • Therefore, identifying 'good responders' to neoadjuvant treatment would be highly beneficial, as they could be managed with less aggressive approaches, such as endoanal resection surgery or even adopting a 'wait and see' surveillance strategy, with the option for rescue surgery if needed.

**METHODS AND MATERIALS**

We designed an observational, descriptive and retrospective study, which included patients with locally advanced rectal cancer (stages T4, T3, and/or with lymph node involvement) diagnosed by MRI and endoscopy, evaluated in a multidisciplinary committee of digestive oncology, who underwent neoadjuvant treatment with chemoradiotherapy at our center from 2015 to 2020, resulting in a sample size of 39 patients.The degree of tumor regression was assessed with a second MRI ((MR-TRG) using the Mercury Guide (2016)) and endoscopy, followed by surgery with subsequent histopathological analysis of the specimen using the Modified Ryan scheme (p-TRG) CAP 2020 protocols (College of American Pathologists). Patients were classified as good responders (MRI-TRG I and II, Ryan score 0-1), moderate responders (MRI-TRG III, Ryan score 2), and poor responders (MRI-TRG IV and V, Ryan score 3) to study the correlation between MRI and pathological anatomy results. Good responders were identified on the second post-treatment MRI to consider non-surgical treatment strategies.

**RESULTS**

The degree of agreement between MRI and histopathological response was fair (Cohen's Kappa= 0.305), consistent with findings from previous studies.

**CONCLUSION**

The agreement between radiologists and pathologists is fair. Therefore, MRI cannot be considered a precise predictor of rectal tumor regression post-neoadjuvant treatment.

**CLINICAL RELEVANCE/APPLICATION**

Locally advanced lower rectal tumors typically require treatment with abdominoperineal amputation, resulting in permanent colostomy and significant psychological impact on the patient. Therefore, identifying 'good responders' to neoadjuvant treatment would be highly beneficial, as they could be managed with less aggressive approaches, such as endoanal resection surgery or even adopting a 'wait and see' surveillance strategy, with the option for rescue surgery if needed.

## W5B-SPGI-4 THE CLINICAL VALUE OF SPECTRAL CT MULTIPARAMETER IN THE DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS OF DUODENAL TUMORS

Bo Duan (*Abstract Co-Author*) Nothing to Disclose
Ruibo Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

Energy spectrum CT measured the iodine concentration (IC) and standardized iodine concentration (NIC) of lesions to evaluate the accuracy of benign and malignant duodenal tumors, and to guide clinical treatment decisions.

**METHODS AND MATERIALS**

33 patients with duodenal tumor were selected as research objects, and the patient's pathologically confirmed and complete energy spectrum CT data before surgery were retrospectively collected, and the iodine concentration (IC) and standardized iodine concentration in the arterial and venous stages of the parenchymal area of the lesion were analyzed (the ratio of iodine concentration of the lesion to the iodine concentration of the aorta in the same layer, NIC). The diagnostic compliance rate of energy spectrum CT was calculated based on the pathological results, and the IC and NIC values of the parenchymal region of the lesion were used to evaluate the diagnostic efficacy of duodenal tumors.

**RESULTS**

The pathological results of the enrolled patients were 6 benign tumors (3 adenomas, 2 lipomas, 1 schwannoma), tumors with malignant potential (12 stromal tumors), and 15 malignant tumors (15 adenocarcinomas). The diagnostic compliance rate of energy spectrum CT was 73%; The IC and NIC

values of stromal tumor and adenocarcinoma in the arterial and venous stages were greater than those of benign tumors, with statistically significant differences ($p<0.05$), the area under the curve (AUC) in the arterial stage IC and NIC stage was 0.827 and 0.863, and the area under the curve (AUC) in the venous stage was 0.842 and 0.890, respectively.

**CONCLUSION**

Multi-parameter energy spectrum CT is helpful for the diagnosis and differential diagnosis of duodenal tumors, among which venous phase NIC has the best diagnostic performance.

**CLINICAL RELEVANCE/APPLICATION**

Multiparametric quantitative analysis of duodenal tumors by spectral CT

## W5B-SPGI-5 PREVALENCE AND MISSED RATE OF SACROILIITIS ON ABDOMEN-PELVIC COMPUTED TOMOGRAPHY IN PATIENTS WITH INFLAMMATORY BOWEL DISEASE AND ASSESSMENT OF ASSOCIATED FACTORS FOR SACROILIITIS [ON THE KOREAN MILITARY]

Dowon Yoon, MD (*Abstract Co-Author*) Nothing to Disclose
Dong Kyu Kim (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate the prevalence and missed rate of sacroiliitis on abdomen-pelvic computed tomography (APCT) in patients with inflammatory bowel disease (IBD). Factors associated with sacroiliitis were also assessed.

**METHODS AND MATERIALS**

From 2015 to 2021, a total of 210 IBD patients (mean age: 31.1 ± 8.1 years) who underwent APCT were included in this retrospective study. ??e? a?e a?? s??d?e?s, a?d ?e ???µed at t?e ???ea ??µed F???es ?ap?ta? ??sp?ta?.Based on a validated APCT scoring tool, bilateral sacroiliac (SI) joints on APCT in all study population were retrospectively reviewed. Then, the study patients were classified into two groups: sacroiliitis (+) group, patients with sacroiliitis; sacroiliitis (-) group, patients without sacroiliitis. Univariate and multivariate regression analysis was used to elucidate the factors associated with sacroiliitis.

**RESULTS**

Sacroiliitis was identified in 26 of 210 patients (12.4%). However, sacroiliitis was recognized on primary reading in only 5 of 26 patients (19.2%) and was missed on initial report in the remaining 21 patients (80.8%). Furthermore, of the 21 patients, 20 patients (95.2%) were finally diagnosed with axial spondyloarthritis (axSpA). There was more female sex ($p = 0.040$), upper gastrointestinal involvement ($p = 0.039$), and back pain ($p < 0.001$) in sacroiliitis (+) group than sacroiliitis (-) group. However, on multivariate analysis, presence of back pain was the only associated factor for sacroiliitis ($p = 0.010$).

**CONCLUSION**

Radiologists should pay attention to SI joints on APCT in patients with IBD for early diagnosis of sacroiliitis, which could result in early diagnosis of axSpA. If IBD patients complained of back pain, possibility of sacroiliitis should be considered.

**CLINICAL RELEVANCE/APPLICATION**

The prompt diagnosis and treatment of sacroiliitis are crucial for ensuring optimal long-term military service, particularly considering the significance of physical activity among service members. Such prompt management not only aids in alleviating immediate discomfort but also contributes significantly to facilitating sustained military readiness and performance.

## W5B-SPGI-6 SIGNIFICANCE OF PREOPERATIVE CT EVALUATION OF SOFT TISSUE REACTION AROUND ABDOMINAL AORTIC BRANCHES FOLLOWING NEOADJUVANT CHEMOTHERAPY FOR GASTRIC CANCER

Lei Tang, MD (*Abstract Co-Author*) Nothing to Disclose
Yiting Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

Perivascular soft tissue edema and fibrosis are commonly observed during surgery after neoadjuvant chemotherapy (NACT). This phenomenon lacks a pathological explanation but is common in clinical practice. This phenomenon increases the difficulty of surgical procedures for lymph nodes and vascular dissection. The authors identified the corresponding CT imaging signs to predict such changes preoperatively.

**METHODS AND MATERIALS**

A retrospective research at Beijing Cancer Hospital comprised 42 patients with SOX/XELOX NACT and 10 patients with direct-surgery. Ten gastrointestinal surgeons with 6-25 years of experience reviewed the surgical videos on perivascular operation without knowing patients' condition. They analyzed the videos and arranged patients into 2 groups: easy-to-dissect and hard-to-dissect. On preoperative CT before and after NACT, a 7-year-experienced radiologist examined the tissue around the celiac axis (CA), left gastric artery (LGA), common hepatic artery, superior mesenteric artery, and splenic artery. Intraoperative videos were utilized as the gold standard to evaluate the performance of CT after NACT to predict perivascular reactivity to surgical manipulation.

**RESULTS**

36 out of the 42 patients deemed difficult to resect by the surgeon displayed perivascular tissue edema and fibrosis in the surgical video, affecting the power of surgical instruments and the discrimination of tissue levels. 15 patients presented with a moderate perivascular reaction. In 83.3% (35/42) of NACT group, the reaction was severe; in 70% (7/10) of the direct surgery group, the reaction was modest. Of the 52 patients, a total of 36 patients were evaluated by the surgeon as "difficult to dissect". In the surgical videos, edema and fibrosis of the perivascular tissues were observed, differentiation of tissue levels and make surgery difficult. Another 16 patients were evaluated as "easy-to-dissect" In the neoadjuvant chemotherapy group, 83.3% (35/42) had a severe reaction; in the direct surgery group, 70% (7/10) had a mild reaction. Post-NACT CT images of difficult-to-operate patients showed a blurred increase in perivascular density and stripes (occurrence rate: CA 76.19%, LGA 45.24%). CT had a sensitivity of 91.67%, a specificity of 93.75%, and an accuracy of 92.3% in predicting perivascular reaction, and were correlated with longer operation duration ($p < 0.05$).

**CONCLUSION**

On CT, perivascular blur and stripe can indicate edema and fibrosis, which are good indicators of gastric cancer perivascular resection difficulty and longer surgical duration.

**CLINICAL RELEVANCE/APPLICATION**

CT signals of abdominal aortic branch perivascular tissue after NACT predict gastric cancer surgical vascular manipulation ease.

## W5B-SPGI-7 THE VALUE OF DIFFUSION-WEIGHTED MAGNETIC RESONANCE IMAGING WITH DIFFERENT B-VALUES IN EVALUATING LYMPHOVASCULAR INVASION IN RECTAL ADENOCARCINOMA

Ailian Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Nan Wang (*Abstract Co-Author*) Nothing to Disclose
Yue Wang (*Abstract Co-Author*) Nothing to Disclose
Liangjie Lin (*Abstract Co-Author*) Nothing to Disclose
Chen Anliang (*Abstract Co-Author*) Nothing to Disclose
Wenjun Hu (*Abstract Co-Author*) Nothing to Disclose
Deshuo Dong (*Presenter*) Nothing to Disclose

**PURPOSE**

To explore the value of apparent diffusion coefficient (ADC) in predicting lymphovascular invasion in rectal adenocarcinoma using diffusion-weighted magnetic resonance imaging with different b-values.

**METHODS AND MATERIALS**

A retrospective analysis was performed on 25 rectal adenocarcinoma patients confirmed with lymphovascular invasion (LVI) according to their postoperative pathology results who received pelvic 3.0 T MRI scan (Ingenia CX, Philips, Holland) in our hospital. They were divided into non-LVI group (16 patients; 13 males, 3 females, mean age: 66.94 years, range: 51-88 years) and LVI group (9 patients, 6 males, 2 females, mean age: 64.11 years, range: 27-77 years).The ADC value of different b-value obtained using IVIM sequences: 0, 800 s/mm2 (first sequence: DWI1), 0, 1200 s/mm2 (second sequence: DWI2), and 0, 2000 s/mm2 (third sequence: DWI3). Apparent diffusion coefficients (ADCs) of the rectal adenocarcinoma were calculated on ADC maps. The ADC values of different sequences and their differences were analyzed with Manny-whitey U test. The ROC curve was generated, and the area under curve (AUC) was calculated to analyze the diagnostic performance of using the ADC value or difference in predicting LVI of rectal adenocarcinoma.

**RESULTS**

There was a statistically significant difference in the ADC difference value of DWI1 (b=0, 800 s/mm2) and DWI2 (b=0, 1200 s/mm2) between non-LVI group (media 0.07 (0.05, 0.10) mm2/s) and LVI group (media 0.03 (-0.01, 0.08) mm2/s) ($p<0.05$). The AUC, maximum Youden index and diagnostic threshold of using the ADC difference value of DWI1 and DWI2 for LVI of rectal adenocarcinoma was 0.760, 0.494 and 0.04 mm2/s, and the sensitivity and specificity were 93.8% and 55.6%, respectively. The ADC value of DWI1, DWI2, DWI3 and ADC difference value of DWI1-DWI3, DWI2-DWI3 between non-LVI group and LVI group were no statistically significant differences.

**CONCLUSION**

The ADC difference value of DWI1 (b=0, 800 s/mm2) and DWI2 (b=0, 1200 s/mm2) was useful for predicting lymphovascular invasion of rectal adenocarcinoma.

**CLINICAL RELEVANCE/APPLICATION**

Compared with b-value DWI sequence, ADC difference value has a prospective clinical application in predicting the lymphovascular invasion of rectal adenocarcinoma for the treatment decision-making.

## W5B-SPGI-8 FAT SANDWICH SIGN - EVIDENCE OF AN INTACT SUBMUCOSA FOR THE DIAGNOSIS OF EARLY GASTRIC CANCER AT STAGE T1A

Zhilong Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Lei Tang, MD (*Abstract Co-Author*) Nothing to Disclose
Wanying Ji (*Abstract Co-Author*) Nothing to Disclose
Yiting Liu (*Presenter*) Nothing to Disclose

**PURPOSE**

In the normal gastric wall, submucosal fat can occasionally be observed. Fat density in the submucosal layer of EGC lesions may indicate that the submucosal layer remains unaffected, which is compatible with the limited mucosal invasion in stage T1a lesions. In our study, we utilized the new sign of "submucosal fat sign" to differentiate T1a and T1b stage lesions in preoperative CT.

**METHODS AND MATERIALS**

A total of 176 patients with EGC who underwent direct surgery from January 2019 to March 2024 at Beijing Cancer Hospital were included (Fig. 1), including 87 cases of T1a-stage and 88 cases of of T1b-stage EGC, and the fat sign was assessed using three-phase thin-slice CT images (plain, arterial, and venous phases). A chi-square test was used to assess whether the sign was statistically different between the two groups.

**RESULTS**

There were statistical differences in submucosal fat sign between T1a and T1b groups ($p<0.05$). We hypothesize the cause as follows: in the normal gastric wall, submucosal fat can occasionally be observed. Fat density in the submucosal layer of EGC lesions may indicate that the submucosal layer remains unaffected, which is compatible with the limited mucosal invasion in stage T1a lesions.

**CONCLUSION**

The submucosal fat sign of the primary tumor can assist in the diagnosis of T1a and T1b gastric cancer.

**CLINICAL RELEVANCE/APPLICATION**

According to the NCCN guideline, early gastric cancer (EGC) lesions in Tis and T1a stages locally invades the mucosal layer, so tumors are removed by minimally invasive treatments such as endoscopic mucosal resection (EMR) or endoscopic mucosal dissection (ESD). While T1b lesions require conventional surgical treatment. For T2 stage lesions, perioperative chemotherapy is preferred for better outcomes. In our study, we found a new sign, "submucosal fat sign", which is easier to diagnose in T1a stage and avoid excessive surgical treatment.

## W5B-SPGI-9 SARCOPENIA AND POSTOPERATIVE OUTCOMES IN PATIENTS WITH PERITONEAL CARCINOMATOSIS UNDERGOING CYTOREDUCTIVE SURGERY WITH HYPERTHERMIC INTRAPERITONEAL CHEMOTHERAPY

Diego A.
Aguirre, MD (*Abstract Co-Author*) Nothing to Disclose
Sergio Valencia, MD (*Abstract Co-Author*) Nothing to Disclose
Manuela Gallo, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To determine the association of sarcopenia and postoperative outcomes in patients with peritoneal carcinomatosis (PC) undergoing cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (CRS-HIPEC).

**METHODS AND MATERIALS**

This retrospective observational analytic study included patients with PC who underwent CRS-HIPEC between January 2010 and December 2022. Sarcopenia was assessed using the L3 skeletal muscle index (SMI) on all subjects with available preoperative abdominal computed tomography (CT) to estimate the prevalence of sarcopenia. Cutoff values determined by Albano et. al were used to classify the participants as sarcopenic or nonsarcopenic. Clinical and surgical variables during hospitalization for surgery were assessed through univariate and bivariate analysis to determine the association between sarcopenia and outcomes after CRS-HIPEC.

**RESULTS**

A total of 156 participants were included, with a mean age of 52.33 years (± 11.01 [SD], with 112 [71,79%] women); 69 participants (44.52%) had appendiceal cancer. Sarcopenia was present in 101 participants [64.74%] based on preoperative CT, with a mean muscular mass of 109 $cm^2$ ± 27.76 [SD] and a mean Body Mass Index of 24.45 ± 3.41 [SD]. No differences in postoperative outcomes between sarcopenic and nonsarcopenic patients were found. Most relevant clinical outcomes included length of stay (23.5 days for the sarcopenic group (SG) vs. 21.73 days for the nonsarcopenic group (NSG); $p = 0.557$), intensive care unit length of stay (5.5 days for the SG vs. 4.1 days for the NSG; $p = 0.379$), and extubation time (17.8 hours for the SG vs. 26.6 hours for the NSG; $p = 0.107$). Among surgical outcomes, the most relevant measures were surgical reintervention (7 participants in the SG vs. 5 in the NSG; $p = 0.629$), surgical site infection (4 in the SG vs. 2 in the NSG; $p = 0.911$), thrombosis (30 in the SG vs. 22 in the NSG; $p = 0.192$), and the presence of postoperative fistulae (16 in the SG vs. 3 in the NSG; $p = 0.055$).

**CONCLUSION**

Assessing skeletal muscle depletion using non-invasive measures like CT-based SMI offers a straightforward method for nutritional screening in major surgery candidates. While prior studies have linked muscle mass assessment to prognostic value in various neoplasms in other clinical scenarios, the lack of correlation between sarcopenia and post-surgical outcomes in CRS-HIPEC patients suggests no need for preoperative nutritional reconditioning. This finding is advantageous, eliminating treatment delays and potentially enhancing survival rates by prompt intervention.

**CLINICAL RELEVANCE/APPLICATION**

CRS-HIPEC alters PC prognosis. Clarifying preoperative sarcopenia's role aids in reducing postoperative complications.

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# Abstract Archives of the RSNA, 2024

W5B-SPGU

**Genitourinary Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPGU-1 PREDICTION OF MEST SCORE USING ARTIFICIAL INTELLIGENCE AND DEVELOPMENT OF PERIODIC PROGNOSIS EVALUATION MODEL IN PATIENTS WITH IGA NEPHROPATHY

Jae Hyon Park, MD (*Abstract Co-Author*) Nothing to Disclose
Young Taik Oh, MD (*Abstract Co-Author*) Nothing to Disclose
Dae Chul Jung, MD (*Abstract Co-Author*) Nothing to Disclose
Byung Chul Kang (*Abstract Co-Author*) Nothing to Disclose
Jongjin Yoon, MD, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

IgA nephropathy (IgAN) is the leading cause of end-stage renal disease in Asia, affecting over 1.5 individuals per 100,000 worldwide annually. In 2019, the International IgAN Prediction Tool(IIgAN-PT) was proposed, which utilizes clinical variables and the pathologic results of renal biopsy(MEST score) as predictors. However, its dependence on invasive biopsy limits its utility and makes repeated evaluation during the treatment period difficult. The purpose of this study is to develop a model that can predict the prognosis of IgAN patients by estimating the MEST score based on radiomics information extracted from precontrast CT of histologically proven IgAN patients.

### METHODS AND MATERIALS

A total of 326 patients with pathologically proven IgAN who underwent a precontrast CT scan within 1 month before renal biopsy were retrospectively enrolled from Mar 2010 to Feb 2023 and were randomly divided in an 8:2 ratio to create training and test sets. The Oxford criteria were used for histologic classification. Bilateral kidney segmentation was performed using a pre-trained nnUNet network. Radiomics features were extracted using PyRadiomics. Individual models were developed to predict mesangial(M)/endocapillary hypercellularity(E), segmental glomerulosclerosis(S), and tubular atrophy/interstitial fibrosis(T), respectively. To assess the performance of the nnUNet model, the DICE score was measured. Classification performance was evaluated using metrics, including AUROC et al. The R^2 was calculated to measure the correlation between the prognosis predicted by histologic MEST score and radiomics MEST score.

### RESULTS

The DICE score between handcrafted segmentation and the outputs of nnUNet for the right, left, and bilateral kidneys were 0.90, 0.91, and 0.89, respectively. The AUROC scores for predicting each category of MEST ranged from 0.80 to 0.92 in the training set and 0.69 to 0.80 in test set. A correlation of y=1.0536x and an R^2 of 0.79 were recorded between the probability of developing ESRD after 5 years as predicted by histologic MEST score and those predicted by radiomics MEST score when applied to the IIgAN-PT.

### CONCLUSION

We developed a machine learning model using nnUNet and binary classifiers to predict the MEST score for patients with IgAN based on precontrast CT of both kidneys. The model achieved moderate to high classification performance of MEST score and a strong correlation in the predicted prognosis between histologic and radiomics MEST scores.

### CLINICAL RELEVANCE/APPLICATION

This semi-automated MEST score prediction model can reduce the need for renal biopsies, enabling periodic prognosis assessments for IgAN patients. It is expected to improve the long-term outcomes of IgAN patients by enabling periodic re-assessment.

## W5B-SPGU-2 PREOPERATIVE INCREMENTAL VALUE OF NON-CONTRAST-ENHANCED VESSEL WALL MRI FOR T3 RENAL CELL CARCINOMA

Xin-Gui Peng, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Ying Cui, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To explore the diagnostic performance of contrast-enhanced computed tomography (CECT), conventional MRI (con-MRI) and vessel wall MRI (VW-MRI) in preoperative assessment of T3 renal cell carcinoma (RCC), and to evaluate the incremental value of con-MRI and VW-MRI.

### METHODS AND MATERIALS

In this a single-centre retrospective study, RCC patients with pathological T3 stage from January 2016 to December 2023 were included. patients who did not undergo CECT or con-MRI or VW-MRI scan in our hospital were excluded. Images were independently and blindly evaluated at four-week intervals by

three readers. The T stage reported in the pathological report combined with clinical data was used as the reference standard. The incremental value in preoperative staging T3 were calculated using net reclassification improvement (NRI) and integrated discrimination improvement (IDI). A P value of less than 0.05 indicates that the result is statistical significance.

**RESULTS**

Eighty-two patients (median age, 65 years, 55 men) with T3 RCC were enrolled (Figure 1). The accuracy of T staging based on CECT (n = 59), con-MRI (n = 49) and VW-MRI (n = 30) images were 69.5%, 71.4% and 93.3%, respectively. In patients both had VW-MRI and CECT scans (n = 27), VW-MRI had a statistically incremental value for CECT in the preoperative evaluation of T3a-c stages (T3a: NRI = 0.066, P = 0.039; IDI = 0.013, P = 0.045. T3b: NRI = 0.085, P = 0.017; IDI = 0.673, P = 0.005. T3c: NRI = 0.178, P = 0.023; IDI = 0.283, P = 0.018), especially in assessing the invasion of renal pelvicalyceal (NRI = 0.154, P = 0.039; IDI = 0.222, P = 0.043) and vena cava wall invasion (NRI = 0.263, P = 0.011; IDI = 0.387, P = 0.027). Besides, statistically significant preoperative incremental effects were obtained in the assessment of T3a-c stages (T3a: NRI = 0.264, P = 0.013; IDI = 0.219, P = 0.018. T3b: NRI = 0.373, P = 0.029; IDI = 0.497, P = 0.032. T3c: NRI = 0.202, P = 0.045; IDI = 0.138, P = 0.031), renal vein invasion (NRI = 0.630, P = 0.032; IDI = 0.704, P = 0.049) and vena cava wall invasion (NRI = 0.185, P = 0.022; IDI = 0.237, P = 0.025) when added VW-MRI into CECT, in thirty patients had both con-MRI and VW-MRI scans (Table 1). In 27 patients with all three imaging scans, VW-MRI changed 24% (4/27) of the previous CECT- and con-MRI- based surgical plan, especially in patients undergoing primary resection and suturing of the vena cava.

**CONCLUSION**

VW-MRI added incremental value for evaluating preoperative T stage of T3 RCC, especially in the evaluation of tumor thrombus and vena cava wall invasion.

**CLINICAL RELEVANCE/APPLICATION**

The incremental value of VW-MRI in preoperative evaluation of T3 stage, especially in the evaluation of tumor thrombus and vena cava wall invasion, was helpful to guide clinical treatment and improve prognosis.

## W5B-SPGU-3 PRESENCE OF A FEEDING ARTERY AS AN INDICATOR OF CLINICALLY SIGNIFICANT PROSTATE CANCER

Leo L. Tsai, MD, PhD (*Abstract Co-Author*) Stockholder, Agile Devices Inc;Consultant, Agile Devices Inc
Abraham Fourie Bezuidenhout, MD (*Abstract Co-Author*) Nothing to Disclose
Noel Delgado, MD (*Abstract Co-Author*) Nothing to Disclose
Zeynep Nur Akyol Sari, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Prostate MRI is currently the imaging gold standard for detecting clinically significant prostate cancer (csPCa). The presence of a feeding prostate artery is not part of PIRADS criteria, nor has it been described. However, prior studies looking at ultrasound of prostatic capsular/feeding arteries have shown some utility in predicting csPCa. Our primary objectives with this project were to establish a definition for a feeding prostatic artery on MRI and determine if the presence of such an artery may be an indicator of csPCa, specifically for lesions in the peripheral zone.

**METHODS AND MATERIALS**

This study was a retrospective review of patients who underwent prostate MRI followed by tissue sampling for one or more suspicious lesions in the peripheral zone. 51 patients were included, of which 13 had a PIRADS 3 lesion, 19 had PIRADS 4, and 19 had PIRADS 5. The presence of a “feeding artery” was defined as an asymmetrically early enhancing and/or enlarged prostate artery (as compared to the contralateral side), coursing directly to an ipsilateral index lesion in the peripheral zone . Two radiologists agreed on the presence or absence of a feeding artery prior to reviewing the pathology results. Any association between categorical variables was determined by means of a Fischer’s exact test, with p lt 0.05 deemed statistically significant. Clinically significant prostate cancer was defined as prostatic adenocarcinoma Gleason 7 (3+4) or greater.

**RESULTS**

The presence of a feeding artery was strongly associated with underlying clinically significant prostate cancer (p lt 0.0001). The overall specificity of a feeding artery for csPCa was 93%, and overall sensitivity was 62%. The calculated positive predictive value was 79 and the negative predictive value was 85. Incidence was 23% in PIRADS 3 lesions, 16% in PIRADS 4 lesions and 47% in PIRADS 5 lesions, with a combined incidence of 29%. When a feeding artery was present, 67% of PI-RADS 3 lesions were found to have csPCa, versus 100% for PIRADS 4, and 89% for PIRADS 5. There was no difference in mean size for lesions with the presence of a feeding artery versus no artery (1.8 cm versus 1.4 cm, respectively, p=0.12).

**CONCLUSION**

The presence of a feeding artery may be a strong indicator of clinically significant prostate cancer for peripheral zone lesions.

**CLINICAL RELEVANCE/APPLICATION**

When present, the finding of a feeding artery may be a useful tool in identifying clinically significant prostate cancer on prostate MRI and recommending prostate biopsy. This may be especially valuable in cases when the imaging findings and thus the need for biopsy is deemed equivocal.

## W5B-SPGU-4 QUANTIFYING STRUCTURAL CHANGES OF THE BLADDER WALL WITH MRI AND MRF

Vikas Gulani, MD, PhD (*Abstract Co-Author*) Research support, Siemens AG;Consulting, Cook Group Incorporated
Jesse I. Hamilton, PhD (*Abstract Co-Author*) Nothing to Disclose
Hero K. Hussain, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Yun Jiang, PhD (*Abstract Co-Author*) Nothing to Disclose
Jesus Fajardo, MD (*Abstract Co-Author*) Nothing to Disclose
Shane A. Wells, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson
Maria Masotti (*Abstract Co-Author*) Nothing to Disclose
Aymen Bahsoun, BS, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To quantify T1 and T2 of the bladder in diabetic men with 3D MR Fingerprinting (MRF).

**METHODS AND MATERIALS**

Multiparametric MRI of the pelvis that included a 3D MRF method, that employs variable flip angles, repetition times, inversion recovery times and T2 preparation dephasing times, for mapping bladder T1 and T2 was performed on 51 men with very low and low-risk prostate cancer on active surveillance. Men voided prior to the scan session. Clinical (age, BMI, diabetes, hypertension, symptomatic benign prostatic hyperplasia) variables were collected from the EMR. The anterior bladder wall thickness, prostate, and transition zone (TZ) size were measured; prostate and TZ volume were estimated with the

ellipsoid formula. Two regions-of-Interest (ROI) were placed on the para-midline right and left anterior bladder wall. The Wilcoxin rank sum test and Kruskal-Wallis rank sum test associations between the clinical and imaging variables.

**RESULTS**

Diabetic men had significantly lower detrusor T1 [1239 (IQR: 1183-1251) vs 1633 (1368-2015), p<0.001] compared to non-diabetic men. Diabetic and non-diabetic men had similar detrusor T2 [86 (IQR: 60-91) vs 62 (IQR: 35-106), p=0.4]. Detrusor T1 and T2 and bladder wall thickness were not associated with age, prostate volume, symptomatic benign prostatic hyperplasia, BMI, or hypertension (p=0.1-0.9).

**CONCLUSION**

Structural changes of the detrusor in diabetic men can be quantified with MRI and MRF.

**CLINICAL RELEVANCE/APPLICATION**

There is a paucity of non-invasive, quantitative imaging techniques to evaluate the lower urinary tract. Development and validation of MRF could improve the diagnosis and clinical management of patients with diabetes-mediated bladder dysfunction.

## W5B-SPGU-5 RAPID MULTIPARAMETRIC MRI ASSESSMENT FOR CLEAR CELL RENAL CELL CARCINOMA IN SMALL RENAL MASSES: COMPARISON WITH THE CLEAR CELL LIKELIHOOD SCORE

Haiyi Wang, MD (*Abstract Co-Author*) Nothing to Disclose
Huanhuan Kang (*Abstract Co-Author*) Nothing to Disclose
Huiping Guo (*Abstract Co-Author*) Nothing to Disclose
Bai Xu, PhD (*Abstract Co-Author*) Nothing to Disclose
Yuanhao Ma (*Abstract Co-Author*) Nothing to Disclose
Xueyi Ning (*Abstract Co-Author*) Nothing to Disclose
Mengqiu Cui (*Abstract Co-Author*) Nothing to Disclose
Honghao Xu (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate clinical usefulness of a rapid assessment for clear cell renal cell carcinoma (ccRCC) in small renal mass (SRM)

**METHODS AND MATERIALS**

This retrospective multicenter cross-sectional study included pathological confirmed SRM patients undergoing multiparametric MRI between December 2016 and August 2023 at three centers. Univariable and multivariable logistic regression were performed to determine significant imaging features for ccRCC. Rapid assessment was built based significant imaging features. In addition, Delong test and McNemar test was used to compare the performance between the rapid assessment and clear cell likelihood score (ccLS).

**RESULTS**

A total of 151 lesion from 147 patients (mean age, 53 years ± 12 [SD], 85 men) were evaluated. The mean size of lesion was 2.6 cm ± 0.9 (range: 0.8, 4.0). The pseudocapsule, intense enhancement in corticomedullary phase, and lipid was used for built rapid ccRCC assessment diagnostic flowchart. Compare with ccLS, the rapid assessment had a higher sensitivity of 86.25% (73 of 80 lesions [95%CI: 76.7, 92.9]) vs 71.25% (57 of 80 lesions [95%CI: 60.0, 80.8]) (P = 0.002), a similar specificity of 80.28% (53 of 71 lesions [95%CI: 69.1, 88.8]) vs 83.10% (59 of 71 lesions [95%CI: 72.3, 91.0]) (P = 0.201). The area under the curve of rapid and ccLS was 0.904 and 0.816, respectively (P = 0.013).

**CONCLUSION**

The rapid multiparametric MRI assessment could be quick and accurate to diagnose ccRCC in SRM compare with ccLS.

**CLINICAL RELEVANCE/APPLICATION**

Compared with ccLS, rapid assessment only requires three imaging features to quickly diagnose ccRCC, reducing the learning burden for radiologists and achieving fast diagnosis of ccRCC.

## W5B-SPGU-6 REAL-WORLD EFFICACY OF MRI-GUIDED TRANSURETHRAL ULTRASOUND ABLATION OF THE PROSTATE: INITIAL REPORT FROM THE CUSTOMIZED ABLATION REGISTRY (CARE)

Martin I. Cohen, MD (*Abstract Co-Author*) Nothing to Disclose
Gregory Frey (*Abstract Co-Author*) Nothing to Disclose
David M. Sella, MD (*Abstract Co-Author*) Nothing to Disclose
Robert A. Princenthal, MD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Gina M. Clarke, PhD (*Abstract Co-Author*) Employee, Profound Medical Inc
Edward Steiner, MD (*Abstract Co-Author*) Key Opinion Leader, Koninklijke Philips NV ;Speaker, Koninklijke Philips NV;Speaker, Quantib BV;Research support, Profound Medical Inc ;Speaker, Profound Medical Inc
Xiaosong Meng (*Abstract Co-Author*) Nothing to Disclose
Daniel N. Costa, MD (*Presenter*) Research support, Bayer AG

**PURPOSE**

The Customized TULSA-PRO Ablation Registry ("CARE", NCT05001477) was established to prospectively collect real-world data from patients treated with MRI-guided transurethral ultrasound ablation. Here we report the first multicenter efficacy outcomes from CARE for patients treated with focal to whole-gland ablation plans for primary, localized PCa.

**METHODS AND MATERIALS**

Between July 2020 and March 2024, patients across 5 U.S. centers (3 academic hospitals, 1 imaging center, and 1 private urology group) underwent TULSA according to the local standard of care and consented to prospective data collection. Follow-up included PSA, quality of life, and adverse events at 0, 3, 6, 12 months and annually thereafter, along with MRI, biopsy, and additional PCa treatment.

**RESULTS**

Of the 169 consented patients who received the TULSA procedure, 156 (92%) had primary localized PCa. At baseline, median (IQR) age, PSA, and prostate volume were 68 (64-68) years, 6.4 (4.9-9.3) ng/mL, and 41 (32-53) cc. The grade group (GG) distribution was 14% GG1, 59% GG2, 18% GG3, 3% GG4, 7% unknown. 86 patients completed 1-year follow-up; median (IQR) follow-up duration is 12 (3-24) months. At 1 year, the median prostate volume (not correcting for ablation cavity volume) decreased 50 (30-70)% to 23 (13-29) cc. Median (IQR) PSA decreased 89 (70-96)% to a nadir of 0.77

(0.28-1.78) ng/mL, stable to 0.99 (0.40-1.94) ng/mL at 1 year. 81 patients had 6-12 month follow-up MRI available; 13 were positive (PI-RADS=4, 16%). 33 underwent biopsy; 5 (6%) had clinically significant disease (all GG2). 5 men received salvage PCa treatment between 9-24 months without unexpected complications: 3 hormonal therapy, 2 external beam radiation therapy plus hormonal therapy.

**CONCLUSION**

This first multicenter report of real-world clinical efficacy for MRI-guided TULSA highlights excellent radiologic and histologic control of primary PCa in patients with GG1-GG4 disease treated with focal to whole-gland ablation. Level 1 evidence is being generated by an ongoing randomized controlled trial (CAPTAIN, NCT05027477) comparing safety and efficacy of TULSA to radical prostatectomy.

**CLINICAL RELEVANCE/APPLICATION**

First reported multicenter real-world evidence with TULSA demonstrates effective ablation and excellent early oncologic control. The CARE registry is generating evidence supporting TULSA as a safe and effective tool for managing PCa in the routine clinical care of broadly selected patients with tailored ablation plans.

## W5B-SPGU-7 RADIOLOGY REPORT-GUIDED PROSTATE CANCER DETECTION WITH MRI USING MULTI-MODAL DEEP LEARNING

Stephanie A. Harmon, PhD (*Abstract Co-Author*) Nothing to Disclose
Enis Yilmaz, MD (*Abstract Co-Author*) Nothing to Disclose
Bradford J. Wood, MD (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;Researcher, Koninklijke Philips NV;Intellectual property, Koninklijke Philips NV;Equipment Support, Koninklijke Philips NV;Researcher, Celsion Corporation;Research Grant, Celsion Corporation;Researcher, BTG International Ltd;Intellectual property, BTG International Ltd;Researcher, Boston Scientific Corporation;Research Grant, Boston Scientific Corporation;Intellectual property, Boston Scientific Corporation;Researcher, Siemens AG;Equipment Support, Siemens AG;Researcher, Sarasota Interventional Radiology;Researcher, NVIDIA Corporation;Research Grant, NVIDIA Corporation;Equipment support, AngioDynamics, Inc;Equipment support, Profound Medical Inc;Researcher, Canon Medical Systems Corporation;License agreement, Canon Medical Systems Corporation;Researcher, AstraZeneca PLC;Researcher, Exact Imaging Inc
Baris Turkbey, MD (*Abstract Co-Author*) Nothing to Disclose
Peter Pinto (*Abstract Co-Author*) Royalties, Koninklijke Philips NV;License agreement, Koninklijke Philips NV;
Fahmida Haque, PhD (*Abstract Co-Author*) Nothing to Disclose
Peter L. Choyke, MD (*Abstract Co-Author*) Nothing to Disclose
Omer Esengur, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Chen (*Abstract Co-Author*) Nothing to Disclose
Benjamin Simon, BS, BA (*Abstract Co-Author*) Nothing to Disclose
David Gelikman (*Abstract Co-Author*) Nothing to Disclose
Sandeep Gurram (*Abstract Co-Author*) Nothing to Disclose
Nathan S. Lay, PhD (*Presenter*) Inventor, ScanMed

**PURPOSE**

Prostate cancer (PCa) is one of the most common malignancies among biologically male individuals. Deep learning (DL)-based models have great potential to aid physicians in detecting PCa using MRI. However, current DL models for medical imaging are limited to using images, and the use of radiology reports, which contain valuable clinical information, is currently underexplored. Using recent advances in large language models and multi-modal fusion modules, we developed a novel model that learns from both MRI scans and radiology reports to improve prostate lesion detection.

**METHODS AND MATERIALS**

A large language model, Instructor, was used to encode radiology reports into embeddings tailored to the medical domain, and a multi-modal fusion module, pixel-word attention module (PWAM), combined the report with the nnU-Net architecture for segmentation. A cohort consisting of 1472 full MRI scans and their respective radiology reports coming from 1361 patients (median age = 72 years, median serum PSA = 6.8 ng/ml) scanned between 2015-2023 was queried from our institutional database. All scans contained actionable findings (2593 total lesions; 689 PI-RADS 5, 1128 PI-RADS 4, 778 PI-RADS 3 lesions) and each lesion was annotated by a genitourinary radiologist. Models were trained on 1106 scans and tested on a held-out test set of 366 scans. Performance was measured with Dice Similarity Coefficient (DSC), lesion-level sensitivity, and false positive (FP) lesions per scan.

**RESULTS**

Using only images for training, nnU-Net, currently state-of-the-art for prostate lesion detection, achieved a test DSC of 0.44. The model had a sensitivity of 0.60 while detecting 0.43 FP per scan. When using a lower threshold to maximize sensitivity, the model had 1 FP per scan with a sensitivity of 0.70 (sensitivity of 0.79 for PIRADS = 4). After integrating the radiology reports through multi-modal fusion, our model achieved a test DSC of 0.45. At a sensitivity of 0.60, the model had a lower number of FPs per scan at 0.37. At a lower threshold, achieved a sensitivity of 0.71 (sensitivity of 0.80 for PIRADS = 4) while detecting 1 FP per scan.

**CONCLUSION**

Our research presents a novel approach leveraging DL-based multi-modal techniques to enhance prostate lesion detection. By incorporating radiology reports with MRIs, our model demonstrates improved performance compared to state-of-the-art imaging data only methods, achieving a higher DSC with reduced false positives per scan while maintaining sensitivity.

**CLINICAL RELEVANCE/APPLICATION**

The multi-modal integration of radiology reports with MRIs enhances diagnostic accuracy by leveraging valuable clinical information alongside imaging data, promising more effective detection and management of prostate cancer in clinical practice.

# Abstract Archives of the RSNA, 2024

W5B-SPHN

**Head & Neck Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPHN-3 VISUALIZATION OF METABOLIC-VASCULAR UNCOUPLING IN HEAD AND NECK CANCER- POTENTIAL MULTI-MODAL IMAGING OF TUMOR HYPOXIA

Seong-Eun Kim (*Abstract Co-Author*) Nothing to Disclose
Melissa Warstadt, MD (*Abstract Co-Author*) Nothing to Disclose
Ying J. Hitchcock, MD (*Abstract Co-Author*) Nothing to Disclose
John A. Roberts, PhD (*Abstract Co-Author*) Nothing to Disclose
Yoshimi Anzai, MD, MPH (*Presenter*) Nothing to Disclose

### PURPOSE

Hypoxia is a hallmark of treatment resistance and poor prognosis for head and neck cancer (HNC). Hypoxic tumors upregulate HIF-1 (hypoxia-inducible factor -1), which facilitates the cascade of hypoxia responses, including the activation of VEGF and Glucose transport. Those newly formed tumor vessels are disorganized and leaky, and they are not efficient in delivering oxygen. The ability to facilitate glucose metabolism despite inefficient or low perfusion is called metabolic-vascular uncoupling, and the affected subregion of the tumor is adapted to a hypoxic environment. The purpose of this study is to visualize the metabolic-perfusion uncoupling in patients with head and neck cancer.

### METHODS AND MATERIALS

This study is part of a multi-center prospective study, enrolling 20 subjects with newly diagnosed HNC. The patients underwent DCE MRI and FDG-PET/CT prior to the initiation of chemoradiotherapy (CRT). FDG-PET/CT was performed 3-4 months after CRT to assess treatment response. Semi-automated image co-registration of PET with DCE-MR Images was performed with Python developed at our lab. An expert radiologist annotated primary tumors and lymph node metastases on T2W images using ITKSnap, open-source software. First, the composites of FDG-PET images and Ktrans map on DCE MR images were created using the RGB color model. To reduce the millions of colors produced by the RGB approach, we then perform a statistical analysis of the annotated pixels across all subjects to find the median values. For each contrast, we compute the median value of all annotated pixels across all subjects. Pixels are then displayed with a color to indicate whether they fall below or above that median.

### RESULTS

In the RGB compositing approach, the co-registered PET images were assigned to the green channel with the quantitative Ktrans map assigned to a combination of the blue and red channels. The hypothetical “hypoxia quadrant” where high glucose metabolism with low perfusion, is displayed in shades between green-blue, whereas well-perfused, low glucose metabolic region is displayed between red and yellow. In contrast, a simplified approach reduced the millions of colors to 4, where the hypoxic quadrant is shown in red (Figure).

### CONCLUSION

We have developed an image analysis tool that visualizes a subregion of metabolic-perfusion uncoupling, indicative of tumor hypoxia in patients with newly diagnosed head and neck cancer, as a proof of concept.

### CLINICAL RELEVANCE/APPLICATION

The metabolic-perfusion compound map allows visualization of the hypoxia subregion, which has the potential to be incorporated into intensity-modulating radiotherapy.

## W5B-SPHN-4 JAW TUMORS IN CHILDREN: IMAGING MARKERS

Rahul Yadav (*Abstract Co-Author*) Nothing to Disclose
Ashu S. Bhalla, MD (*Abstract Co-Author*) Nothing to Disclose
Manisha Jana, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Smita Manchanda, MD (*Abstract Co-Author*) Nothing to Disclose
Deepika Mishra (*Abstract Co-Author*) Nothing to Disclose
Lokesh Lokesh, MBBS, MD (*Presenter*) Nothing to Disclose

### PURPOSE

The objective of this study was to review the imaging features of histologically proven jaw tumors in children less than 5 years old and to detect the key distinguishing features

## METHODS AND MATERIALS

We retrospectively assessed multidetector computed tomography (CT) images of 16 children (mean age 3 ± 1.8 years) with jaw tumors. Various CT image descriptors were used to characterize the lesions-Lytic/sclerotic/mixed, locularity, bone expansion, lesion border, multiplicity, cortical integrity, periosteal reaction, growth pattern of the lesion, associated soft tissue, resorption of tooth, peri coronal/periapical location.

## RESULTS

The ages of the children ranged from 3 months to 5 years (8 male and 8 female). The study revealed that 68.7% of tumors were benign, and 31.2% were malignant with eleven distinct histopathological entities were identified. However, there was no statistically significant difference between the two groups i.e. $p>0.05$, suggesting an overlap between the benign and malignant cases as malignant tumors did not show permeative pattern or periosteal reaction as seen in adults. Melanocytic neuroectodermal of infancy (MNTI) showed aggressive features but were exclusively seen in infants. Other common tumor types were LCH and metastatic neuroblastoma within the age group of 1-3 years.Most of the tumors were lytic (87.5%), of which 71.4 % were benign and 28.5 % were malignant. 60% of malignant tumors were unilocular, while most benign tumors were multilocular (63.6 %). Bone expansion and growth patterns in both groups were found to be similar. Multiplicity, loss of cortical integrity, and associated soft tissue were seen in malignant cases.

## CONCLUSION

Combination of age and radiological features allow confident diagnosis in certain entities such as MNTI, ABC, ossifying fibroma and the rest has overlapping features

## CLINICAL RELEVANCE/APPLICATION

Confident diagnosis in few characteristic entities can avoid unnecessary biopsy in children.

# Abstract Archives of the RSNA, 2024

W5B-SPIN

**Imaging Informatics Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPIN-1 HIGH-ACCURACY DETECTION AND IDENTIFICATION OF PULMONARY EMBOLISM ON NON-CONTRAST CT SCANS

Hongkun Zhang (*Abstract Co-Author*) Nothing to Disclose
Le Lu (*Abstract Co-Author*) Nothing to Disclose
Yilang Xiang (*Abstract Co-Author*) Nothing to Disclose
Minfeng Xu (*Abstract Co-Author*) Nothing to Disclose
Yujian Hu (*Abstract Co-Author*) Nothing to Disclose
Yan-Jie Zhou (*Presenter*) Nothing to Disclose

### PURPOSE

We explored the feasibility of applying a deep learning approach to non-contrast CT (NCT) scans for pulmonary embolism (PE) identification and embolism segmentation, which could potentially be employed as an economical, accessible, precise, and interpretable tool for PE identification in clinical practice.

### METHODS AND MATERIALS

We propose a novel cross-phase mutual learning framework that fosters knowledge transfer from computed tomography pulmonary angiography (CTPA) to NCT, while concurrently conducting embolism segmentation and abnormality classification in a multi-task manner. We trained the model using 1,150 paired NCT and CTPA scans from three hospitals, including 269 PE patients and 881 normal subjects. Three experienced radiologists (10-15 yrs cardiopulmonary specialist) manually annotate embolisms on the CTPA, referring to radiology reports and clinical records when necessary. Then, a robust image registration method is used to register the annotated mask from the CTPA to the NCT. The model was evaluated on a combined internal test set of 289 NCT scans (65 PE and 224 normal). A reader study was carried out involving: an expert radiologist (12 yrs experience), a senior radiologist (8 yrs experience), and a junior radiologist (3 yrs experience) on the test set.

### RESULTS

The model's ROC curve in the task of abnormality detection (PE vs normal) is above all three readers, with an area under the curve (AUC) of 0.990. The model achieves a patient-level sensitivity of 95.4% in PE identification, which significantly exceeds that of radiologists (18.5%, 43.1%, and 53.8%) while maintaining a high specificity of 99.6% (78.6% for mean radiologists). We additionally compare with the CTPA (gold standard), at a similar specificity level, our solution exhibits a marginally slight decrease in sensitivity (95.4% vs 96.9%). Compared with a state-of-the-art CTPA AI system for PE detection, the model achieves better embolism segmentation performance (Dice 78.5% vs 72.4%). More importantly, the extra information about predicted embolism masks and class activation map (CAM) generated from the classification head improves the interpretability of identification.

### CONCLUSION

The proposed model could identify PE on NCT, that achieves high sensitivity and specificity and outperforms the average of specialty radiologists by large margins.

### CLINICAL RELEVANCE/APPLICATION

We investigate a relatively convenient, simple, accurate detection solution for PE with NCT. Compared with the CTPA, our work suggests the good feasibility of using NCT scans as a promising clinical tool for PE identification and rule-out to reduce the risks of missed diagnosis and standardize diagnostic decisions on advanced imaging in the emergency department.

## W5B-SPIN-2 DETECTING DISTANT INTRACRANIAL RECURRENCE VIA CNN MODEL VISUALIZATION

Kurtis Johnson (*Abstract Co-Author*) Nothing to Disclose
Chi Zhang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kyuhak Oh, PhD (*Abstract Co-Author*) Nothing to Disclose
Justin Burr (*Abstract Co-Author*) Nothing to Disclose
Yu Lei, PhD (*Abstract Co-Author*) Nothing to Disclose
Isabella Zhang (*Abstract Co-Author*) Nothing to Disclose
Shuo Wang, PHD (*Presenter*) Nothing to Disclose

### PURPOSE

Distant intracranial recurrence after stereotactic radiosurgery (SRS) for brain metastases is common, with surveillance brain imaging recommended indefinitely after treatment. There are limited tools to accurately predict those at higher risk of recurrence. In this study, we aim to establish a convolutional neural network (CNN)-based model that can predict and visualize distant recurrence following SRS.

### METHODS AND MATERIALS

We retrospectively collected 121 patients who underwent SRS or fractionated SRS (fSRS). High-resolution T1-weighted MRI images with contrast were retrieved from 1 to 6 months before the radiographic diagnosis of a recurrent lesion. The recurrent lesion for each subject was delineated on the MRI that demonstrated recurrence. This MRI was then fused to the MRI acquired 1 to 6 months before diagnosis ("prior image") and the delineation was transferred to approximate the future location of recurrence on the "prior image" when the recurrent lesion was not detectable. An expansion area around the prospective recurrent lesion on the "prior image", along with a corresponding healthy area of the same size on the contralateral side, were extracted to form the binary classification groups (disease vs. healthy). We then employed a 17-layer 3D-CNN model for binary classification. The collected datasets were divided into training, validation, and testing sets, with an 80%-10%-10% split, respectively. Additionally, data augmentation (image rotation and resampling) was implemented to increase the data size and improve accuracy. Furthermore, we applied the Grad-CAM technique to generate 3D attention maps from the last convolutional layer within the 3D-CNN model for each patient to investigate interpretability of decision-making processes through visualization.

### RESULTS

The predictive model achieved 100% accuracy in predicting prospective recurrent brain metastases, though the accuracy was lower for identifying healthy tissue, initially recorded at 38.5%. With the incorporation of data augmentation, both prediction accuracies reached 100%. Moreover, 84.6% of the test subjects demonstrated that high attention (95th percentile) regions, revealed by Grad-CAM, coincided within a 1 cm expansion area of the prospective recurrent lesion.

### CONCLUSION

We have developed a deep-learning-based classification tool with robust predictive capabilities for identifying distant intracranial recurrence following stereotactic radiosurgery for brain metastases. Our visualization findings indicate that we may be able to identify suspicious areas of recurrence using an explainable CNN model.

### CLINICAL RELEVANCE/APPLICATION

Our study has the potential to detect distant intracranial recurrence following radiosurgery.

## W5B-SPIN-3 DEEP LEARNING-BASED DETECTION AND LOCALIZATION OF ENDOTRACHEAL TUBE ON CHEST RADIOGRAPHS OF PEDIATRIC PATIENTS

Hailong Li, DPhil (*Abstract Co-Author*) Nothing to Disclose
Neeraja Mahalingam, MSc,BSC (*Abstract Co-Author*) Nothing to Disclose
Alex Towbin, MD (*Abstract Co-Author*) Author, RELX;Consultant, Anderson Publishing, Ltd;Advisory Board, KLAS Enterprises LLC;Travel support, Merative LP
Lili He, MD (*Abstract Co-Author*) Nothing to Disclose
Bohan Zhang (*Abstract Co-Author*) Nothing to Disclose
Steve Standage (*Abstract Co-Author*) Nothing to Disclose
Elanchezhian Somasundaram, PhD, MS (*Presenter*) Nothing to Disclose

### PURPOSE

To develop a deep learning algorithm that can automatically detect the presence of an endotracheal tube (ETT) on a pediatric chest radiograph (CXR) and localize its distal tip.

### METHODS AND MATERIALS

A retrospective study was performed. 1024 single-view CXRs performed in 2021 were randomly selected (494 with ETT and 530 without ETT). Supervised by a board-certified pediatric radiologist, two image analysts manually annotated pixel location (x, y coordinates) of the distal ETT tip using 3D slicer (version 4.1.1). The radiologist reviewed each annotated CXR and modified the annotation if needed. All images were normalized to a resolution of 1024×1024, and preprocessed with a CLAHE technique to enhance the contrast of details. A two-module deep learning pipeline was developed. First, a Vision Transformer (ViT)-based binary image classification model was created to detect the presence of ETT. If an ETT is not detected, the pipeline ends with 'No ETT detected.' If an ETT is detected, the CXR is sent to the second module, a ViT-based image regression model, to localize the x and y coordinates of the ETT tip. Instead of training the models from scratch, we used pre-trained ViT models with 12 transformer blocks based on ~1.2 million ImageNet images, then fine-tuned the ViT models for the detection and localization of ETTs. We randomly split the dataset into 7:1:2 for model training, validation, and testing at the subject level. For ETT detection, model accuracy, sensitivity, specificity, and AuROC were assessed. For tip localization, we determined mean absolute error (MAE), root mean squared error (RMSE), and Euclidean distance (ED) between ground truth and predicted coordinates in millimeters.

### RESULTS

1,024 CXRs from 551 pediatric patients [mean ± standard deviation age of 4.7 ± 7.8 years, 238 (43.2%) females] were included. Our ETT detection module had an accuracy of 92.5% [95% confidence interval (CI): 89.3%, 95.4%], sensitivity of 97.3% [94.6%, 99.4%], specificity of 87.9% [82.4%, 92.5%], and AuROC of 0.98 [0.97, 0.99]. We display the confusion matrix for the performance of ETT detection. The ETT tip localization module achieved a MAE of 13.4 [11.7, 14.3], RMSE of 20.5 [16.3, 21.2], and ED of 21.6 [18.6, 22.9]. We visualize the distribution of ground truth and predicted ETT tips.

### CONCLUSION

The model achieved promising performance on detecting the presence of ETT and localizing the distal ETT tip on pediatric CXRs.

### CLINICAL RELEVANCE/APPLICATION

Localizing the tip of an ETT in a mechanically ventilated patient in the pediatric ICU is a frequent and vital function. An automated tool that rapidly identifies the ETT tip would enhance patient care and potentially reduce patient harm.

## W5B-SPIN-4 UNVEILING HIDDEN SHORTCUTS: EXAMINING THE IMPACT OF EXPOSURE PARAMETERS IN CHEST RADIOGRAPHY ON AI MODELS

Po-Chih Kuo, PhD (*Abstract Co-Author*) Nothing to Disclose
Han-Jay Shu, BS (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to reveal the under-recognized influence of exposure parameters (e.g., exposure time) as potential shortcuts in AI models trained on chest X-ray (CXR) images. Identifying these shortcuts, often stemming from condition-specific exposure adjustments, is vital for improving model

robustness. This is particularly important as it highlights a common issue where models show strong internal performance but falter in external applications.

**METHODS AND MATERIALS**

We utilized two databases, MIMIC and MDRC, for our study. From MIMIC, we selected 25,861 AP CXR images, of which 5,706 were labeled with 'pneumothorax' and 20,155 with 'no findings'. From MIDRC, we collected 9,234 AP CXR images, including 804 COVID-positive cases. We classified the images from both datasets into two groups, A and B, based on four exposure parameters (Exposure, ExposureTime, XRayTubeCurrent, ExposureInuAs). Group A primarily included images labeled with the clinical condition (positive), while Group B mainly consisted of images without the condition (negative). This setup aimed to explore whether AI models, when trained under these conditions, would rely on exposure parameters as shortcuts instead of learning clinical indicators of the disease. The training set and test set 1 were primarily composed of Group A/Positive and Group B/Negative images while test set 2 was configured oppositely, containing Group A/Negative and Group B/Positive images.

**RESULTS**

Our analysis revealed significant model biases, evidenced by varying accuracies across different test sets. For pneumothorax, the accuracy declined from 83.2±0.7% in test set 1 to 47.7±3.2% in test set 2. Similarly, for COVID-19, the accuracies observed were 76.2±1.9% in test set 1 and 38.5±1.5% in test set 2. These results suggest that the models predominantly learned to recognize groups defined by exposure parameters rather than the actual clinical indicators of the diseases.

**CONCLUSION**

The significant drop of performance in model accuracy between test sets suggests that exposure parameters can act as shortcuts in learning processes, potentially compromising the clinical utility of X-ray imaging models and underscores the need for careful dataset curation.

**CLINICAL RELEVANCE/APPLICATION**

The identification of biases in machine learning models due to exposure parameters highlights a critical vulnerability in medical imaging AI. Understanding and mitigating this influence is essential to prevent models from relying on non-relevant features, thus ensuring that these tools support accurate clinical diagnostics. Our findings provide a foundation for future research aimed at preventing such shortcuts, ultimately improving the reliability and clinical utility of diagnostic AI systems.

## W5B-SPIN-6 ENHANCING PEDIATRIC FRACTURE DETECTION: ASSESSING THE EFFICACY OF A DEEP LEARNING AI MODEL AND ITS IMPACT ON RADIOLOGIST PERFORMANCE

John Simon, MD (*Abstract Co-Author*) Nothing to Disclose
Barry J. Sadegi, MD (*Abstract Co-Author*) Nothing to Disclose
Sean D. Raj, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study investigates the efficacy of a deep learning-based artificial intelligence (AI) model (Rayvolve), in detecting pediatric fractures on musculoskeletal (MSK) radiographs. Additionally, it evaluates how this AI assistance impacts the performance of both specialist and non-specialist radiologists.

**METHODS AND MATERIALS**

The study comprised two phases. In phase 1, the performance of the AI model was evaluated on 3016 MSK pediatric radiographs (mean age, 13.8 ± 4.8 years; range: 2-21 years) from 4 imaging centers, with a minimum of 26 radiographs per subgroup (age, gender, anatomic region, machine of acquisition, radiographic view, type of fracture). Ground truth was established by consensus among 3 MSK radiologists. In phase 2, a retrospective multi-reader multi-center study was conducted using 189 cases randomly selected from the phase 1. Twenty readers (including 10 MSK/pediatric radiologists and 10 non-specialist radiologists), participated in two separate reading sessions evaluating for fracture, with and without AI assistance, with a one-month washout period. Performance metrics (AUC, sensitivity and specificity) and reading time were compared with and without AI assistance.

**RESULTS**

The AI model achieved a high standalone accuracy (0.9399), sensitivity (0.9611), and specificity (0.8597). Subgroup analysis revealed that the AI model performed with high accuracy across the study types and potential confounders, including: age (AUC>0.9213; sensitivity>0.9389), gender (AUC>0.9373; sensitivity>0.9559), anatomic region (AUC>0.9263; sensitivity>0.9298), and type of fracture (sensitivity>0.9337). With AI assistance, reader accuracy increased significantly by 2.89% [95.8 % (95.3%; 96.3%) vs. 92.9% (92.1%; 96.6%), $p < 0.05$], sensitivity improved from 0.863 (95% CI: 0.843, 0.88) to 0.932 (95% CI: 0.918, 0.945), and specificity improved from 0.937 (95% CI: 0.927, 0.946) to 0.945 (95% CI: 0.936, 0.954). Average reading time per exam was shortened by 26% with AI assistance. Radiologist performance and improved reading times were more pronounced with non-specialist radiologists.

**CONCLUSION**

The AI model exhibited high accuracy in detecting pediatric fractures, and its integration significantly enhanced reader performance.

**CLINICAL RELEVANCE/APPLICATION**

The robust performance of the AI algorithm across diverse subgroups supports Rayvolve as a reliable tool for detecting fractures in pediatric patients in a real-world clinical setting.

## W5B-SPIN-7 TUMOR PROGRESSION QUANTIFICATION WITH UNSUPERVISED IMAGE REGISTRATION AND SPARSELY-SUPERVISED UNIVERSAL LESION SEGMENTATION

Brian Wehrle, MSc (*Abstract Co-Author*) Nothing to Disclose
Joel Schaerer (*Abstract Co-Author*) Nothing to Disclose
Erin M. Bowman, MD (*Abstract Co-Author*) Nothing to Disclose
Dharmendra Modi, BS (*Abstract Co-Author*) Nothing to Disclose
Alessandro Delmonte, MSc (*Presenter*) Nothing to Disclose

**PURPOSE**

According to RECIST 1.1 criteria, tumor progression and response is determined by repetitive annotation of lesions on serial cross-sectional imaging datasets. Automatic longitudinal propagation of these baseline lesions is highly desirable to reduce annotation burden at scale. We present an automatic tumor contour propagation method combining deep image registration and prompt-based universal lesion segmentation (ULS). Trained from sparsely

annotated RECIST findings, our solution tracks lesion progression and response, generalizing to multiple tumor types, lesion locations and acquisition protocols.

**METHODS AND MATERIALS**

An AI system performing universal lesion segmentation was prompted to contour longitudinal CT datasets based on radiologist's baseline lesion selection. ULS was trained on 4,238 target lesions by embedding radiologist knowledge using strong anatomical priors. Prompts were automatically issued by an anatomy-aware image registration AI method trained on 1,098 retrospective multiphasic CT datasets. A total of 667 datasets acquired using heterogeneous protocols were manually annotated by expert radiologists following RECIST 1.1 criteria for evaluation. The annotated lesions represented 22 anatomical sites and 5 primary tumor types. Both registration and segmentation performance were assessed with respect to follow-up manual annotations. Registration was evaluated using the mean Euclidean distance (mED), with a 50% limit on lesion area variation to limit bias due to tumor morphological changes. Dice Similarity Coefficient (DSC) and Pearson correlation were evaluated for lesion segmentation.

**RESULTS**

The registration error at lesions barycenter was 5.39 mm (median: 3.86 mm). Prompted at lesion center, ULS showed high overlap (DSC=75.77%) and very strong correlation for all RECIST biomarkers (SD r=0.91, LD r=0.88, Sum of axis r=0.91). No statistically significant differences were found in short axis (p=0.26). Strong correlation was confirmed for off-center prompts (DSC=68.90%, r=0.86) up to the 90th percentile of the registration error (ED90=10.09mm).

**CONCLUSION**

The AI system enabled precise longitudinal lesion location and contour propagation of primary tumors, metastases, and adenopathy in 22 anatomical locations. Barycenter estimation by image registration consistently allowed to exploit the remarkable segmentation performance of ULS to automatically propagate contours between time points.

**CLINICAL RELEVANCE/APPLICATION**

Automatic tumor propagation using the proposed AI system will allow for reproducible lesion segmentation over time which can decrease burden on the clinical radiologist and increase accuracy of the RECIST results over time.
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# Abstract Archives of the RSNA, 2024

W5B-SPIR

**Interventional Radiology Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPIR-2 PROGNOSTIC ROLE OF TRANSIENT HEPATIC INTENSITY DIFFERENCE FOLLOWING DRUG-ELUTING BEAD TRANSARTERIAL CHEMOEMBOLIZATION IN PATIENTS WITH HEPATOCELLULAR CARCINOMA

Yuan-Cheng Wang (*Abstract Co-Author*) Nothing to Disclose
Noble Chibuike Opara (*Abstract Co-Author*) Nothing to Disclose
Shuwei Zhou (*Presenter*) Nothing to Disclose

### PURPOSE

Transient Hepatic Intensity Differences (THID) observed on MRI may serve as a prognostic factor for patients who have undergone DEB-TACE for HCC. This study explores the potential link between THID and long-term clinical outcomes in these patients.

### METHODS AND MATERIALS

A retrospective, single-arm, multicenter study was conducted to assess the impact of Transient Hepatic Intensity Differences (THID) on 102 patients diagnosed with Hepatocellular Carcinoma (HCC) between December 2017 and December 2020. All patients had baseline MRI examinations for analysis. Two independent radiologists evaluated the presence of THID visually. Tumor response was evaluated using the modified Response Evaluation Criteria in Solid Tumors (mRECIST) criteria, focusing on changes in viable tumor volume. Additionally, the study investigated the association of THID with the development of various complications, including biliary injury, metastasis, and thrombosis. The evaluation of treatment outcomes such as Overall Survival (OS) and Progression-Free Survival (PFS) were performed using the Kaplan-Meier method. Finally, the Chi-square test was employed to assess the correlation between THID and the development of biliary injury, metastasis, and thrombosis. A logistic regression model was used to identify independent factors associated with the development of THID.

### RESULTS

A total of 74 patients (72.5%) developed THID following DEB-TACE treatment for HCC. Multivariable analysis identified; baseline direct bilirubin levels (odds ratio [OR] = 0.86; 95% confidence interval [CI] = 0.75-0.97; P = 0.020) and number of tumors (OR = 3.47, 95% [CI] = 1.17-10.24; P = 0.024) as independent predictors of THID development. Patients with THID showed a significantly increased risk of biliary injury compared to the non-THID group (P = 0.002). Analysis of patient survival revealed a statistically significant difference in both (OS) and (PFS) between the THID and non-THID groups (P = 0.019; P = 0.038, respectively).

### CONCLUSION

Our findings suggest that in patients who underwent DEB-TACE treatment for HCC, both the number of tumors and baseline direct bilirubin levels emerged as significant predictors of THID development. Patients with THID had a significantly increased risk of biliary injury compared to the non-THID group. The development of THID correlated to lower OS and PFS.

### CLINICAL RELEVANCE/APPLICATION

THID is a common observation following DEB-TACE for HCC, whereas it is always ignored in clinical practice. Our study indicated that THID is a potential biomarker for post-procedural complications like biliary injury and worse long-term survival (lower OS and PFS). Baseline factors including bilirubin levels and the number of tumors were predictive of THID development.

## W5B-SPIR-4 LIVER VENOUS DEPRIVATION VERSUS PORTAL VEIN EMBOLIZATION FOR PATIENTS WITH EXTENSIVE COLORECTAL LIVER METASTASES: PROPENSITY SCORE MATCHED ANALYSIS

Sanjay Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Ethan Y. Lin, MD (*Abstract Co-Author*) Nothing to Disclose
Ching-wei Tzeng, MD (*Abstract Co-Author*) Nothing to Disclose
Alda L. Tam, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Research Grant, Boston Scientific Corporation;Research Grant, Johnson & Johnson;Consultant, AstraZeneca PLC;Consultant, Endocare, Inc;
Joshua D. Kuban, MD (*Abstract Co-Author*) Nothing to Disclose
Peiman Habibollahi, MD (*Abstract Co-Author*) Nothing to Disclose
Hop Tran Cao, MD (*Abstract Co-Author*) Nothing to Disclose
Antony Haddad (*Abstract Co-Author*) Nothing to Disclose
Steven Y. Huang, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno C. Odisio, MD, PhD (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Siemens AG;Speaker, Siemens AG;Research Grant, Johnson & Johnson;
Mohamed E. Abdelsalam, MD (*Abstract Co-Author*) Nothing to Disclose
Armeen Mahvash, MD (*Abstract Co-Author*) Nothing to Disclose

Jean-Nicolas Vauthey, MD (*Abstract Co-Author*) Nothing to Disclose
Mohammad M. Khavandi, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Portal vein embolization (PVE) is traditionally used to induce future liver remnant (FLR) hypertrophy in patients requiring liver resection. However, not all patients achieve sufficient FLR regeneration, especially those with multiple risk factors affecting liver hypertrophy. Liver venous deprivation (LVD), a relatively novel approach for concurrent PVE and hepatic vein embolization (HVE), has emerged as a superior alternative. The role of LVD, in comparison with PVE, in patients with colorectal liver metastases (CLM) and high-risk factors is not well known.

**METHODS AND MATERIALS**

This single-center retrospective cohort study included 301 patients undergoing PVE (n=279) or LVD (n=22) before planned hepatectomy for CLM from 1998 to 2023. Patients who underwent LVD were propensity score matched to patients who underwent PVE in a 1:3 match. Propensity score accounted for pre-procedure standardized FLR (sFLR), body mass index, number of systemic therapy cycles, extension of PVE to segment IV portal vein branches, prior resection, and suspicion of chemotherapy associated liver injury (CALI) based on pre-intervention imaging and lab tests. Pre- and post-intervention FLR volumes were quantified using CT volumetric analysis, and standardized liver volume was calculated using the previously described Vauthey formula. Key variables such as post-procedure sFLR, degree of hypertrophy (DH), and kinetic growth rate (KGR) were compared between the groups. Data regarding technical success and complications associated with each procedure was also recorded.

**RESULTS**

The matched cohort included 78 patients including 22 in the LVD group and 56 in the PVE group. The technical success was 100% for both LVD and PVE groups. There were no CTCAE>=3 grade complications in either arm. Patients who underwent LVD showed significantly higher DH (15.7% vs 10.5%, p=0.017) and KGR (3.9% vs 2.4%, p=0.006) compared to the PVE group. The rate of successful surgical resection was comparable between both groups (68% (15/22) for LVD vs 70% (39/56) for PVE, p=0.9). One patient in the PVE cohort had postoperative hepatic insufficiency (Peak Tbil >7 mg/dl) versus none in the LVD group without statistical significance (p =0.531).

**CONCLUSION**

LVD demonstrated significantly better sFLR hypertrophy compared to PVE alone in patients with extensive CLM and high-risk features, based on DH and KGR. However, the rate of successful surgical resection was similar between groups, which highlights the need for further prospective clinical trials to assess the efficacy of LVD in patients with CLM and high-risk factors.

**CLINICAL RELEVANCE/APPLICATION**

LVD shows higher potential over traditional PVE to achieve superior hypertrophy of FLR in patients with extensive colorectal liver metastases.

## W5B-SPIR-5 EFFICACY AND SAFETY OF TRANSARTERIAL EMBOLIZATION VERSUS PERCUTANEOUS SCLEROTHERAPY IN PATIENTS WITH HEPATIC VENOUS MALFORMATION: A SYSTEMATIC REVIEW AND META-ANALYSIS

Hadi Rokni Yazdi (*Abstract Co-Author*) Nothing to Disclose
Faeze Salahshour (*Abstract Co-Author*) Nothing to Disclose
Saharnaz Pezeshgi (*Abstract Co-Author*) Nothing to Disclose
Ramin Pourghorban, MD (*Abstract Co-Author*) Nothing to Disclose
Niloofar Ayoobi Yazdi (*Abstract Co-Author*) Nothing to Disclose
Hojat Dehghanbanadaki (*Abstract Co-Author*) Nothing to Disclose
Mohammad Mehdi M. Mehrabi Nejad (*Abstract Co-Author*) Nothing to Disclose
Seyed Mohammad Hossein Tabatabaei, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

There remains a conspicuous absence of randomized clinical trials (RCTs) comparing the efficacy and safety of transarterial embolization (TAE) versus percutaneous sclerotherapy (PS) in patients with hepatic venous malformations (HVMs), historically referred to as liver hemangiomas. This study aims to conduct a systematic review and meta-analysis of the literature, elucidating the aggregated efficacy and safety profiles of these two interventional radiology procedures.

**METHODS AND MATERIALS**

A comprehensive search encompassing PubMed-MEDLINE, Scopus, and Web of Science databases was undertaken to identify original articles reporting on the safety or efficacy of TAE or PS in adult patients with HVMs up to April 24, 2024. We pooled the weighted mean difference in volume and diameter of HVMs before and after intervention. Additionally, we pooled the weighted proportion of major complications (>grade 2), post-embolization syndrome (PES) and hepatic enzyme elevations following each intervention. We used the random effect model for meta-analysis in STATA.

**RESULTS**

From a total of 1334 identified studies, 33 met the inclusion criteria, comprising 25 studies investigating TAE and 8 focusing on PS in patients with HVMs. Our pooled analysis showed that both PS and TAE decreased the volume of HVMs, 384.52 cc (95%CI: 177.31, 591.72) and 193.50 cc (95%CI: 115.61, 271.39) and diameter of HVMs, 4.04 cm (95%CI: 3.13, 4.95) and 4.15 (95%CI: 2.70, 5.61), respectively; however, neither intervention was superior to the other in reducing volume and diameter (P=0.09 and P=0.90, respectively). Additionally, the pooled rate of major complications was 3% (95%CI: 0%, 7%) for TAE and 3% (95%CI: 0%, 13%) for PS (P-value of group difference=0.67). The pooled rate of post-intervention PES was 49% (95%CI= 26%, 72%) for TAE and 0% (95%CI: 0%, 1%) for PS (P-value of group difference<0.01). The pooled rate of post-procedure hepatic enzyme elevations was 54% (95%CI: 16%, 89%) for TAE and 0% (95%CI: 0%, 1%) for PS (P-value of group difference<0.01).

**CONCLUSION**

Both TAE and PS are effective and safe in the management of HVMs. Although no statistically significant disparity in lesion size reduction was observed between these interventions, PS exhibited lower incidences of PES and hepatic enzyme elevations post-procedure. Further, RCT studies are required to confirm our results.

**CLINICAL RELEVANCE/APPLICATION**

The study's findings offer clinicians valuable insights into the optimal interventional radiological approaches for treating HVMs. Moreover, the notably higher safety rate with PS underscores its potential as a preferred treatment option, aiding clinical decision-making and improving patient outcomes.

## W5B-SPIR-6 RADIOMICS FOR THE PREDICTION OF PATIENT RESPONSE TO IMMUNOEMBOLIZATION INTERVENTION IN METASTATIC UVEAL MELANOMA

John Papaioannou, MSc, BS (*Abstract Co-Author*) Research Consultant, QView Medical, Inc
Hui Li, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrew A. Gomella, MD (*Abstract Co-Author*) Nothing to Disclose
Nikolas J. Tsiouplis (*Abstract Co-Author*) Nothing to Disclose
Maryellen L. Giger, PhD (*Abstract Co-Author*) Stockholder, Hologic, Inc;Royalties, Hologic, Inc;Shareholder, Quantitative Insights, Inc;Co-founder, Quantitative Insights, Inc;Shareholder, QView Medical, Inc;Royalties, General Electric Company;Royalties, Median Technologies;Royalties, Riverain Technologies, LLC
Li Lan (*Abstract Co-Author*) Nothing to Disclose
Robert W. Ford, MD (*Abstract Co-Author*) Nothing to Disclose
Russell A. Reeves, MD (*Abstract Co-Author*) Nothing to Disclose
Gabriel B. Casella, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

The liver is the primary site for secondary cancer deposition in metastatic uveal melanoma (MUM). The prognosis for these patients is generally poor despite various transarterial treatments, and predicting treatment outcomes remains a challenge. Dynamic contrast-enhanced (DCE) MRI, employing hepatocyte-specific contrast agents, is routinely conducted since these agents are not retained by metastases. Radiomics, have demonstrated significant diagnostic value in various oncologic settings. This study seeks to identify whether radiomics can predict which patients will benefit from a liver-directed immunoembolization (IE).

**METHODS AND MATERIALS**

A retrospective dataset of T1-weighted axial sequences of hepatocyte-avid DCE-MR studies from 401 patients taken before therapeutic interventions by IR. A total of ~1500 unique metastatic lesions have been annotated by expert radiologists. Studies are temporally registered, and lesions are segmented using a fuzzy C-means algorithm with bounding-box initialization. Radiomics features such as morphology, texture, margin, and contrast kinetics are extracted from each lesion, and Combat is used for covariate batch correction.

**RESULTS**

Seven frequent data curation challenges were identified, each with varying frequencies: such as acquisition protocol not fully followed (94/201; 46.7%), image stack inversion (22/87; 25.2%), temporal axial misalignment (78/87; 89.6%), and alternative contrast used (60/201; 29.8%). Furthermore, batching effects on radiomics features were associated with each study's imaging manufacturer of origin; however, Combat corrected these potential confounding effects. In the coming months, we will finalize the radiomics quantification of the fully annotated set of lesions, and will have final results on the prognostic utility of radiomics features for IE response.

**CONCLUSION**

Our team has assembled the most extensive imaging dataset for patients with MUM. We anticipate that our models will identify lesions likely to respond well to transarterial immunoembolization, particularly those showing strong arterial enhancement, and high intrinsic T1 signal intensity.

**CLINICAL RELEVANCE/APPLICATION**

Identifying in advance patients likely to have a favorable response to IE is crucial. This enables us to customize treatments more effectively, adjust how often patients are monitored, and improve communication of expectations to patients and healthcare providers. As healthcare continues to move towards precision medicine, radiomics stands out by facilitating the development of personalized treatment plans. Its integration into clinical practice could revolutionize how diseases are treated, making it a critical area for continued research in radiology.

## W5B-SPIR-7 AN INVESTIGATION INTO THE HETEROGENEITY OF YTTRIUM-90 (Y-90) MICROSPHERE DISTRIBUTION WITHIN TREATED TUMOR WITH CT VERSUS PET AFTER RADIOEMBOLIZATION USING MULTIMODAL Y-90 MICROSPHERES

Robert J. Abraham, MD, FRCPC (*Abstract Co-Author*) Co-Founder, ABK Biomedical Inc;Stockholder, ABK Biomedical Inc;Spouse, Stockholder, ABK Biomedical Inc;Chief Medical Officer, ABK Biomedical Inc;Co-founder, Covina Biomedical Inc;Stockholder, Covina Biomedical Inc;
Alasdair Syme (*Abstract Co-Author*) Nothing to Disclose
Amit Verma, PhD,MPH (*Abstract Co-Author*) Employee of ABK Biomedical
E Courtney Henry (*Abstract Co-Author*) Nothing to Disclose
David Dobrowski (*Abstract Co-Author*) ABK biomedical
Andrew Kennedy (*Abstract Co-Author*) Nothing to Disclose
Aravind Arepally, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

Histopathology studies have verified significant heterogeneity in Y-90 microsphere distribution following radioembolization1,2. However, current post-treatment PET demonstrates non-specific homogenous distribution mainly due to low spatial resolution and is also confounded by respiratory and subject motion. Investigational multimodal imageable Y-90 glass microspheres (Eye90) leverage the superior spatial and temporal resolution of Computed Tomography (CT) to directly image Y-90 microspheres and may depict the actual heterogeneous distribution. The purpose of this study was to extract and compare signal distribution of Y-90 microspheres in tumor on CT and PET after Eye90 radioembolization.

**METHODS AND MATERIALS**

4.7 GBq (401 mg) of Eye90 microspheres were selectively administered to treat a solitary liver tumor (38.6 mL). Post-administration, PET and CT imaging provided voxelized distributions with units of Y-90 activity concentration (MBq/mL) for PET and Hounsfield Units (HU) for CT. The voxelized signal (HU and MBq/mL) within the tumor volume was extracted and compared between the two modalities using the ratio of the signal median to the interquartile range (IQR) and the ratio of the full-width-at-half-maximum (FWHM) of the distribution’s peak to the signal maximum over the whole range of data (Smax).

**RESULTS**

Qualitatively, the PET signal appears smooth and uniform while the CT signal reveals discrete, isolated regions of microsphere uptake throughout the tumor. For both modalities, the signal distribution was roughly Gaussian with a tail extending into high-signal regions. The median/IQR of signal in the tumor was 310% and 87% for CT and PET imaging, respectively. The FWHM of the distribution’s peak was 20 HU for CT and 13.16 MBq/mL for PET, while Smax was 454 HU for CT and 83.93 MBq/mL for PET. The ratio of the FWHM to Smax was 0.157 and 0.044 for PET and CT, respectively. Given its high median/IQR and FWHM/Smax that is 3 times less than PET, CT reveals a more heterogeneous microsphere distribution.

**CONCLUSION**

CT imaging of Eye90 microspheres presents a novel opportunity to accurately define the heterogenous Y-90 activity distribution. Due to improved spatial resolution and mitigation of motion effects, CT-based evaluation of Eye90 microsphere distribution may be superior to PET-based evaluation.1. Kennedy et al. Int J Radiat Oncol Biol Phys. 2004 Dec 1;60(5):1552-63. 2. Högberg et al. EJNMMI Res. 2014 Dec;4(1):48.

## CLINICAL RELEVANCE/APPLICATION

Multimodal imageable radiopaque Y-90 microspheres depiction of the actual heterogenous microsphere distribution in tumor may improve tumor targeting and provide a better determination of Y-90 dose distribution and thereby improve outcomes.
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# Abstract Archives of the RSNA, 2024

W5B-SPMK

**Musculoskeletal Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPMK-1 ENHANCING ACCURACY IN ADOLESCENT IDIOPATHIC SCOLIOSIS DIAGNOSIS IN COMMUNITY HOSPITALS: A COMPARATIVE STUDY OF MACHINE LEARNING VERSUS MANUAL MEASUREMENT OF COBB ANGLES

Andrea S. Doria, MD, PhD (*Abstract Co-Author*) Baxalta-Shire (Research Grant), Novo Nordisk (Research Grant), Terry Fox Foundation (Research Grant), PSI Foundation (Research Grant), Society of Pediatric Radiology (Research Grant), Garron Family Cancer Centre (Research Grant)
Farzad Khalvati, PhD, MSc (*Abstract Co-Author*) Board of Directors, MESH Scheduling Inc
Dorothy Kim (*Abstract Co-Author*) Nothing to Disclose
Chaojun Chen (*Abstract Co-Author*) Nothing to Disclose
David E Lebel (*Abstract Co-Author*) Nothing to Disclose
Ayesha Hadi, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Nearly one-third of adolescent idiopathic scoliosis (AIS) patients present late, as likely surgical candidates. The accuracy of community spine radiology for AIS is suboptimal, impacting timely referrals. Our study objectives were (1) To evaluate the effectiveness of a machine learning (ML) algorithm in accurately assessing Cobb angles from community-obtained spine radiographs for patients with suspected adolescent idiopathic scoliosis (AIS). (2) To compare these measurements with those made manually by community and academic radiologists to determine potential improvements in diagnostic accuracy and referral timelines.

### METHODS AND MATERIALS

Our retrospective analysis included community acquired spine radiographs from 115 AIS patients previously seen for initial evaluation at a tertiary pediatric hospital. Cobb angle measurements were taken both manually by academic and community radiologists and were compared to those obtained through a two step- instance segmentation based deep learning architecture model called YOLACT model.

### RESULTS

The instance segmentation model demonstrated a Symmetric Mean Absolute Percentage Error (SMAPE) of 9.64% in comparison with community radiologists and 6.37% compared to trained academic radiologists. Further, the mean absolute difference between ML and community radiologists was 7.07 degrees in contrast to 4.40 degrees between ML and academic radiologists. This reflects a higher accuracy and reliability of the ML model in measuring Cobb angles than manual measurements obtained by community radiologists.

### CONCLUSION

There was a notable agreement between our ML model and measurements taken by academic radiologists, highlighting the model's precision. Conversely, significant discrepancies were observed between the ML model and the measurements taken by community radiologists. These findings suggest the utility of an ML model to support accurate measurements obtained by community radiologists, which may subsequently impact timely referral of AIS patients to tertiary care.

### CLINICAL RELEVANCE/APPLICATION

Inaccuracies between community radiology and tertiary care have a significant impact on the timely presentation of AIS patients, leading to missed opportunities for non-operative management and increasing the numbers of avoidable spine surgeries. To our knowledge, there is no previous literature validating an ML model for substandard community acquired spine radiographs. The integration of ML for Cobb angle measurements in community radiology may improve diagnostic accuracy of AIS patients, reduce measurement variability, and expedite appropriate referrals to tertiary care.

## W5B-SPMK-4 STUDY ON REDUCING METAL ARTIFACTS OF SPINAL PEDICLE SCREWS WITH VIRTUAL MONOENERGETIC IMAGE AND O-MAR

Jia Meng (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the effect of dual-layer detector spectral CT virtual monoenergetic images combined with O-MAR on reducing metal artifacts of pedicle screws.

### METHODS AND MATERIALS

In this prospective study, 40 patients who underwent spinal surgery for bone tumors, disc herniation, and prolapse from April to December 2022 were re-examined by dual-layer spectral CT. Male 19 cases, female 21 cases, with an average age: 56±13 years old. The screws were located in the cervical spine

in 3 cases, the thoracic spine in 5 cases, and the lumbar spine in 32 cases. CI, O-MAR images and 140-160 keV images were reconstructed respectively, with a total of 8 groups of VMI and VMI+O-MAR images at intervals of every 10 keV. The most severe metal artifact level was selected and ROI was mapped in the spinal canal, posterior pedicle nail, lateral soft tissue and artefact free adipose tissue of each group of images. CT value and SD were measured, and AI was calculated and analyzed statistically. Two subjective evaluations were conducted by a physician with reference to the Likert5-point scale for the cortical bone, trabecular bone and soft tissue around the vertebral body near the pedicle screw, and the mean value was taken as the final score.

**RESULTS**

The intravertebral AI values in 150keV VMI and 140-160keV VMI+O-MAR images were lower than CI, $P < 0.001$. The O-MAR image, 140-160keV VMI and VMI+O-MAR image AI in the posterior and lateral soft tissues of the pedicle screw were all lower than CI ($P < 0.05$). The subjective scores of the cortical bone and trabecular bone near the pedicle screw in 140-160 KeV VMI were higher than those in 140-160 KeV VMI+O-MAR images, and the difference was statistically significant ($P < 0.05$) when comparing the same energy levels. The subjective score of paravertebral soft tissue in 140-160 KeV VMI was lower than that in 140-160 KeV VMI+O-MAR image, and the difference was statistically significant when comparing the same energy level ($P < 0.001$).

**CONCLUSION**

VMI+O-MAR at 140-160keV significantly reduced spinal pedicle screw artifact, improved visualization of bone structure and soft tissue.

**CLINICAL RELEVANCE/APPLICATION**

For intravertebral lesions, 140-160keV VMI and VMI+O-MAR images can be reconstructed respectively for comparative observation to prevent new artifacts introduced by O-MAR.

## W5B-SPMK-5 A STANDARDIZED SPINAL MRI PROTOCOL FOR THE DIAGNOSIS OF SPONTANEOUS INTRACRANIAL HYPOTENSION AND CORRELATION ANALYSIS WITH BRAIN MRI FINDINGS

Eun Kyung Khil, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Sang Won Jo, MD (*Abstract Co-Author*) Nothing to Disclose
Yu Sung Yoon, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

To demonstrate the utility of a new uniform cervical-thoracic-lumbar (CTL) contrast-enhanced MRI protocol, analyze spinal findings in spontaneous intracranial hypotension (SIH) using a consistent protocol, and investigate correlation with brain MRI findings.

**METHODS AND MATERIALS**

This retrospective study included patients with suspected SIH who underwent 3T MRI using a new CTL MRI protocol between March 2019 and February 2023. Clinical diagnosis of SIH was made according to the ICHD-3 criteria, and MRI imaging criteria were evaluated as follows: spine MRI findings included epidural fluid collection (EFC), epidural vein/plexus engorgement, dural enhancement, C1-2 sign, and extraspinal fluid collection at other levels; brain MRI findings included three qualitative (venous sinus engorgement, pachymeningeal enhancement, subdural effusion, cerebellar sagging) and five quantitative (suprasellar cistern, prepontine, mamillopontine distance, pontomesencephalic angle]. Evaluation was conducted by two experienced musculoskeletal radiologists and one neuroradiologist. Only patients who underwent both spine and brain MRI were included in the final study population. Patients were divided into two groups based on positive brain findings (group 1) and absence of such findings (group 2), and demographic characteristics and symptoms of the patients were compared. Furthermore, spine findings were compared and analyzed by t-tests or chi-square statistics.

**RESULTS**

Of the 98 patients recruited, 53 met the criteria for SIH, and ultimately, 42 patients (mean age: 43.95 years, 66.7% female) with SIH were analyzed. Group 1 exhibited a significantly shorter pain duration (12.37 days, $p<0.001$) compared to group 2. Group 2 revealed more atypical headaches, fewer neurological symptoms, and higher persistence/recurrence; however, there were no significant differences. In group 1, spinal MRI demonstrated a wider extent of epidural fluid collection (EFC) involvement (encompassing C, T, L levels; $p<0.001$), circumferential axial location ($p = 0.011$), and a significantly higher prevalence of C1-C2 sign ($p = 0.024$).

**CONCLUSION**

This study highlights the importance of early comprehensive spinal MRI evaluation using a standardized CTL MRI protocol with contrast for suspected SIH, especially when brain MRI is negative or equivocal.

**CLINICAL RELEVANCE/APPLICATION**

Using a standardized protocol, early advocacy of comprehensive spinal MRI for suspected SIH, even with negative brain MRI, allowing optimal detection of spinal markers prevalent in brain MRI positive cases.

# Abstract Archives of the RSNA, 2024

W5B-SPMS

**Multisystem Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPMS-1 INTERNATIONAL PEER LEARNING: THE NEXT STEP IN GLOBAL RADIOLOGY

Karen Chetcuti, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Damalawo Phiri, MBChB (*Abstract Co-Author*) Nothing to Disclose
Diana Nguyen (*Abstract Co-Author*) Nothing to Disclose
Benjamin Brown, BS (*Abstract Co-Author*) Nothing to Disclose
Katrina A. McGinty, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Educational initiatives are essential for capacity building in low- and middle-income countries (LMICs). One model has been partnership with a university or organization in a high-income country. This model is traditionally unidirectional and didactic, but there is a shift towards interactive, bidirectional learning, to benefit participants from both high and low resource settings, facilitating relationship building and reducing hierarchical imbalances. Our project was to create a bidirectional learning experience between an academic medical center in the Southeastern United States and a newly created radiology residency in Malawi by creating an international peer learning conference and assessing its impact on learners.

### METHODS AND MATERIALS

This conference started October 2022, structured in four-week blocks rotating by subspeciality. Weekly sessions using teleconferencing software alternated presentations between the US residents and Malawian residents. Cases were classified as great call, learning opportunity, interesting/classic case, or quality improvement. Open-source educational modules were created from the presented cases and teaching points for review following the conferences. Participant feedback was solicited at 1, 3, and 6 months.

### RESULTS

Over 10 months, there were 22 conferences reviewing 90 cases. Mean attendance was 13 participants (range 9-24) with an average of 4 cases per conference (range 1-8). The most common case type was interesting/classic case (80), followed by learning opportunity (8) and quality improvement (2). 38 cases have been made available via online modules. When surveyed, 85% of participants felt the conferences were relevant to their practice, 78% preferred a systems-based format, and 85% found the work required for the conference was manageable. Feedback was positive, with main criticisms related to internet connectivity, image viewing or material being advanced for level of training. Subjectively, there was increased communication and participation between trainees at both sites and improved presentation skills. Since its inception, the conference has become a regular and expected part of resident education for both the US based and Malawian residencies.

### CONCLUSION

International peer learning between high and low resources setting is an effective and low-cost method to bolster sustainable capacity building and education in LMICs.

### CLINICAL RELEVANCE/APPLICATION

To improve sustainability and capacity building in radiology, it is important to emphasize low cost, sustainable and replicable educational tools, and relationship building, such as this peer learning conferences. Additionally, this format can be replicated with minimal cost and infrastructure by other institutions.

## W5B-SPMS-2 US RADIOLOGY RESIDENCY PROGRAMS WITH CLINICIAN EDUCATOR TRACK AND BEYOND: WHO AND WHERE THEY ARE?

Mohamed Muneer, MD (*Presenter*) Nothing to Disclose

### PURPOSE

While the faculty clinician-educator track is an excellent pipeline to provide the academic community with physicians who excel in patient care, education, and research, specialized clinician-educator tracks for those in training are not as well developed (1,2) . We believe studying the currently available longitudinal clinical-educator tracks is the first step in further guiding the development of new ones, honing established ones, and directing future research.

### METHODS AND MATERIALS

A list of a total of 197 radiology residency programs in the US was generated via AMA-FRIEDA (3). Each program website was searched for the presence or absence of a longitudinal clinical-educator track, not including research-scholar tracks. Also, additional programs were added using the “Academic or Clinician Educator” special track filter tool. Additional programs were identified through personal communication/connection.

## RESULTS

A total of 23 radiology residency programs out of 197 (11.7%) were identified to have a clinician-educator track. Table 1 summarizes these programs and provides a direct link to their clinician-educator track and its details, when available. While the prevalence of longitudinal clinical-educator tracks across U.S. radiology residency programs is not high, these results do not capture other forms of health profession education efforts and capacity building by different programs. For example, Kansas University offers their 2nd-year radiology residents 10 half-day workshops on principles of health profession education, adult learning, and assessment as well as effective feedback. Other programs, such as our own ***, offer longitudinal protected time to their residents to foster their academic interests which could be dedicated towards medical education, as well as continuous development programs across the institute such as the *** Program.Other disciplines with more established longitudinal clinician-educator tracks, such as general internal medicine, have seen broad benefits to their residents (8,9). Also, a survey of Alliance of Directors and Vice Chairs of Education in Radiology (ADVICER) members showed that they support the development of a clinician-educator track as well as a national curriculum. Future research evaluating programs' experience, challenges, and success is warranted(10).

## CONCLUSION

These results support the increased development of clinician-educator pathways for radiology residents.

## CLINICAL RELEVANCE/APPLICATION

This abstract encompasses all the available radiology residency programs in the US with a clinician-educator track. which is helpful for collaboration, facilitating future research efforts, and guiding other programs trying to establish new tracks.

# Abstract Archives of the RSNA, 2024

W5B-SPNMMI

**Nuclear Medicine & Molecular Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPNMMI-1 OPTIMIZING VOLUMETRIC $^{18}$F-FDG PET/CT TUMOR ASSESSMENT IN ENDOMETRIAL CANCERS

Camilla Krakstad, PhD (*Abstract Co-Author*) Nothing to Disclose
Julie Andrea Dybvik, MD (*Abstract Co-Author*) Nothing to Disclose
Sunniva Lindas (*Abstract Co-Author*) Nothing to Disclose
Ankush Gulati (*Abstract Co-Author*) Nothing to Disclose
Ingfrid H. Haldorsen, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Kristine E. Fasmer, PhD, MSc (*Presenter*) Nothing to Disclose

### PURPOSE

To establish an optimal method for metabolic tumor volume (mtv) delineation in 18F-fluoro-deoxy-glucose (FDG) positron emission/computed tomography (PET/CT) of endometrial cancers, by assessing interobserver agreement for different mtv delineations, their correlation to anatomical tumor volume (atv) from magnetic resonance imaging (MRI), and ability to predict aggressive disease.

### METHODS AND MATERIALS

This study included 154 consenting patients with histologically confirmed endometrial cancer who had undergone preoperative FDG PET/CT on two scanners, Siemens TruePoint (n=74) and Siemens Vision (n=80). Reader 1 (R1) defined the outer primary tumor borders using a masking tool, in which six different thresholds were applied: mtv2.5 (suv > 2.5), mtv20%-60% (suv > 20, 30, 40, 50 and 60% of suvmax). Reader 2 (R2) independently measured mtv2.5 and mtv40%, and intraclass correlation coefficients (ICCs) between R1 and R2 were calculated. Preoperative contrast-enhanced T1-weighted MRIs were available for 153/154 patients, from which atv were segmented by reader 3 (R3). Correlation between atv and the mtvs were assessed using Spearman's rank coefficient (?). Combat harmonization of the mtvs was applied to correct for interscanner variation, before deriving area under receiver operating characteristic curves (AUC ROCs) and time dependent ROCs (AUC tdROC) for predicting lymph node metastases (LNM), advanced stage (International Federation of Gynecology and Obstetrics (FIGO) stage III-IV), and progressing disease, respectively.

### RESULTS

Interobserver agreement was highest for mtv2.5 (ICC [95% confidence interval (CI)]:0.98 [0.96-0.98]), while slightly lower for mtv40% (ICC [95% CI]: 0.91 [0.88, 0.93]). mtv2.5 yielded highest correlation to atv (?=0.90), while mtv20-60% yielded decreasing correlation with increasing thresholds (?: 0.75-0.87). The median % difference from atv was highest for mtv2.5 (87%) and lowest for mtv30% (-3%). The ROC/tdROC AUCs for predicting LNM, FIGO III-IV, and progression, were overall similar for mtv2.5 and mtv20-50% (0.69-0.72 for LNM; 0.77 for FIGO III-IV 0.72-0.74 for progression), however incrementally lower for mtv60% (0.66 for LNM; 0.74 for FIGO III-IV; 0.72 for progression).

### CONCLUSION

Of the investigated metabolic tumor thresholds, mtv2.5 yielded highest interreader agreement and correlation to atv, while mtv30% was most similar (in volume) to atv. For predicting advanced/aggressive disease, mtv2.5 and mtv20-50% yielded similar AUCs.

### CLINICAL RELEVANCE/APPLICATION

Calculating FDG PET/CT metabolic tumor volume using suv >2.5 as threshold, yields excellent interobserver agreement, high correlation to MRI tumor volume, and may aid in staging and prognostication of endometrial cancers.

# Abstract Archives of the RSNA, 2024

W5B-SPNPM

**Noninterpretive Skills (Beyond Imaging) Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPNPM-1 ARTIFICIAL INTELLIGENCE UTILIZATION IN U.S. RADIOLOGY PRACTICES

Jay R. Parikh, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Eric M. Rubin, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth H. Dibble, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate the use of artificial intelligence (AI) in radiology practices in the United States

### METHODS AND MATERIALS

The ACR Commission on Human Resources fielded the 2023 ACR/RBMA Workforce Survey from 1/5/24-2/4/24. The sample drew from the ACR members (31,085) and non-members (11,565) and RBMA members (1,739). The survey used structured closed-end questions, consistent with earlier surveys. Responses were group practice deduplicated and weighted and compared to 2022 and 2021. Statistical significance was defined as $p<0.05$.

### RESULTS

1642 respondents completed the survey. There has been a significant growth in the proportion of practices using both clinical and non-clinical AI (Figure), now with nearly half of respondents indicate utilizing some form of AI in their practice, and 16% utilizing it for both clinical and non-clinical use in 2023 compared to 11% in 2022 (p=0.02). When examined by subspecialty, there has been a significant growth in the use of AI in neuroimaging in 2023 compared to 2022 (60% in 2023 versus 47% in 2022, p=0.01, Figure). AI use in thoracic imaging, emergency imaging, general radiology, cardiovascular imaging, and musculoskeletal imaging also grew in 2023, although these increases did not reach significance. Compared to 2023, there has been a significant growth in the utilization of AI for clinical productivity, now with 58% of respondents indicating utilization of AI to improve productivity compared to 41% in 2022, p=0.02 (Figure). Other non-clinical uses of AI include use for billing/coding, for research, for exam assignments, for patient scheduling, and for prior authorization.

### CONCLUSION

The utilization of AI in radiology grew in 2023 compared to 2022, with nearly half of survey respondents indicating some form of utilization of AI in their practice. Utilization of AI grew significantly in neuroradiology in 2023 compared to 2022, and utilization of AI for non-clinical purposes grew significantly in 2023 compared to 2022.

### CLINICAL RELEVANCE/APPLICATION

Knowledge of current AI use among radiology practices in the United States can help practices benchmark their utilization of AI compared to other practices and enable informed decisions regarding incorporation of AI into their practices.

## W5B-SPNPM-2 CORRELATION OF PRACTICE CHOICE BY GRADUATING RADIOLOGY RESIDENTS BASED ON US MACRO ECONOMIC GDP CYCLE: THE ECONOMY MATTERS!

William W. Mayo-Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Palma (*Abstract Co-Author*) Nothing to Disclose
Sara M. Durfee, MD (*Abstract Co-Author*) Nothing to Disclose
Glenn C. Gaviola, MD (*Abstract Co-Author*) Nothing to Disclose
Dionne Zhen (*Abstract Co-Author*) Nothing to Disclose
Khushboo Jhala, MD,MBA (*Presenter*) Nothing to Disclose

### PURPOSE

To determine if there is a correlation between US Economic Cycle and Radiology Resident's Choice of Academic vs Private Practice.

### METHODS AND MATERIALS

United States Gross Domestic Product (GDP) from 2002-2023 was obtained to determine periods of GDP deceleration, notably the 2008 mortgage crisis and the 2020 COVID-19 pandemic. An alumni database including 3 years of graduating classes pre and post the two periods of GDP deceleration was created for the years 2005 - 2010 (n=53) and 2019 - 2024 (n=59). Public internet database search query was used to gather information on graduates' current practice type and leadership positions. Student's T-test was used to compare ratios of alumni in academic practices vs other practice model types (private, tele, community hybrid), for graduation years pre versus post GDP decelerations.

## RESULTS

64% (18/28) of alumni that graduated during the COVID GDP deceleration currently practice in an academic radiology setting vs 32% (10/31) of alumni that graduated during the post-COVID GDP acceleration ($P<0.05$). 31% (9/29) of alumni that graduated during the mortgage crisis GDP deceleration currently practice in an academic setting vs 8% (2/24) of those that graduated during the period of GDP acceleration before the crisis. Teleradiology was the largest growing new segment of practice model type in the past six years with 12% (7/59) of total 2019 - 2024 graduates currently signed to this type of practice model, compared to 0% (0/53) from 2005-2010. Alumni in private practices have “academic adjunct” leadership positions with examples including Director of AI and Global Outreach.

## CONCLUSION

There is an inverse relationship between alumni graduating during a period of economic growth, and practice in an academic radiology setting. Academic Radiology practices should develop new recruitment strategies during periods of economic growth to maintain a stable workforce.

## CLINICAL RELEVANCE/APPLICATION

Amidst global staffing shortages, there is higher market competition to recruit graduating radiology trainees. Understanding recruitment competition and competitive advantages based on GDP cycle can help academic practices triage when to invest resources in recruitment.

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# Abstract Archives of the RSNA, 2024

W5B-SPNR

**Neuroradiology Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPNR-10 IMPACT OF ARTIFICIAL INTELLIGENCE-BASED DETECTION OF LARGE VESSEL OCCLUSION AMONG STROKE PATIENTS

Huanwen Chen (*Abstract Co-Author*) Nothing to Disclose
Dheeraj Gandhi, MBBS, MD (*Abstract Co-Author*) Research Grant, Stryker CorporationResearch Grant, Medtronic plc
Marco Colasurdo, MD (*Abstract Co-Author*) Nothing to Disclose
Mihir Khunte (*Abstract Co-Author*) Nothing to Disclose
Ajay Malhotra, MD, MMM (*Presenter*) Nothing to Disclose

### PURPOSE

To study the role of artificial intelligence (AI)-based detection algorithms for large vessel occlusion (LVO) strokes in comparison to standard human-guided detection methods.

### METHODS AND MATERIALS

The National Inpatient Sample Database 2021 was queried to identify adult patients (18 years or older) with a primary diagnosis code for cerebral infarction due to internal carotid artery (ICA) and middle cerebral artery (MCA) occlusion. The use of AI-based detection was determined based on the presence of the designated ICD-10 Procedure Code for AI software in LVO detection (4A03X5D). Patient demographics, medical comorbidities, stroke risk factors, treatment with intravenous thrombolysis and endovascular thrombectomy (EVT), and treatment center characteristics were identified. The rate of EVT, good outcomes, and mortality were compared between patients who received AI-based LVO detection and those who did not. Secondary outcomes include length of stay (LOS) and cost of hospitalization. Multivariable logistic regression analyses were conducted to adjust for confounders.

### RESULTS

163,460 LVO stroke patients were identified; 14,885 (9.1%) received AI-based LVO detection. The patients in the LVO group were a little older, more likely to have MCA strokes, and more likely to have an intermediate or high frailty score. Patient demographics such as race and income quartile were similar across both groups. After multivariable adjustments, AI patients had higher odds of receiving EVT (OR 1.55 [95% CI 1.35 - 1.79], p= <0.001). The odds of good outcome were similar (OR 0.94 [95% CI 0.83 - 1.06], p= 0.332) across both groups but the odds of morality were significantly lower in the AI group (OR 0.81 [95% CI 0.67 - 0.98], p= 0.029). The LOS was similar between both groups (+0.1 [95% CI -0.3- 0.5], p=0.563). AI was moderately associated with increased costs (+$1,716 [95% CI -$104 - $3,535], p=0.065).

### CONCLUSION

AI-based LVO detection software was associated with increased rates of EVT utilization and decreased mortality. The odds of good outcome and length of stay were similar between the AI and non-AI groups.

### CLINICAL RELEVANCE/APPLICATION

Artificial intelligence-based large vessel occlusion detection software is associated with increased rates of endovascular thrombectomy utilization and decreased mortality. The odds of good outcome and length of hospital stay may not be impacted by the use of AI LVO detection software.

## W5B-SPNR-12 CHANGES OF GABA AND PH IN MILD COGNITIVE IMPAIRMENT USING BIOMAGNETIC RESONANCE

Jing Wang (*Abstract Co-Author*) Nothing to Disclose
Qian Qin (*Abstract Co-Author*) Nothing to Disclose
Dongyong Zhu (*Abstract Co-Author*) Nothing to Disclose
Jue Lu (*Abstract Co-Author*) Nothing to Disclose
Peng Sun, MD,MD (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Xinli Zhang (*Abstract Co-Author*) Nothing to Disclose
Xiaona Fu (*Presenter*) Nothing to Disclose

### PURPOSE

Mild cognitive impairment (MCI), an intermediate transition state between normal aging and dementia, is accompanied by changes in the internal environment within the brain, such as neurotransmitters, and PH. The purpose of this study was to investigate the GABA levels in the anterior and posterior cingulate cortex (ACC/PCC) and PH in the bilateral hippocampus of MCI patients using the MEGA-PRESS and CEST biomagnetic resonance technologies.

### METHODS AND MATERIALS

This study included 14 MCI patients and 15 healthy controls (HC), all of whom underwent neuropsychological assessments. Afterward, the ACC and PCC were scanned using MEGA-PRESS, and the bilateral hippocampus was scanned using CEST for all participants. The GABA levels were automatically calculated by the Gannet 3.1 software package. Measurement of in vivo absolute pH using AACID by multipool Lorentzian fitting of CEST MRI. P <0.05 was significant.

### RESULTS

Compared with HC, the MCI group had lower levels of GABA+/Cr (p=0.010) and Glx/Cr (p=0.012) in the ACC. In addition, the MCI group showed reduced amine (p=0.036) and AACID (p=0.021) in the right hippocampus and elevated AACID (p=0.021) in the left hippocampus. The MCI patients also had significantly worse MoCA and episodic memory. In addition, patients showed significantly worse FDS (p =0.005) and BDS (p =0.018) scores and longer STT-B (p<0.001) consumption time. Of all participants, the GABA+/Cr in the ACC was significantly positively correlated with MoCA (p=0.015), AVLT-immediate recall (p=0.006), and AVLT-delayed recall (p=0.016). The Glx/Cr in the ACC was positively correlated with MoCA (p=0.032) and AVLT-delayed recall (p=0.025). This study also showed that AACID in the right hippocampus was significantly negatively correlated with FDS scores (r=-0.485, p=0.012), and a tendency for AACID in the left hippocampus to be negatively correlated with AVLT-immediate recall scores (r=-0.385, p=0.052). However, there were no significant correlations between right hippocampal amine and cognitive scales.

### CONCLUSION

This study reveals that GABA in ACC and PCC and bilateral hippocampal AACID were altered in MCI patients compared to the HC group. Meanwhile, GABA and AACID are closely associated with cognitive function, which further suggests that the GABA levels in the ACC, and AACID in the bilateral hippocampus may be the potential imaging markers for diagnosing MCI patients.

### CLINICAL RELEVANCE/APPLICATION

The levels of GABA in the ACC and PH in the bilateral hippocampus hold promise as potential biomarkers for diagnosing and guiding therapeutic interventions in MCI patients.

## W5B-SPNR-13 EVALUATION OF GLYMPHATIC SYSTEM ACTIVITY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS BY DIFFUSION MRI WITH DTI-ALPS

Wei-wei Wang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hongjun Jiang (*Abstract Co-Author*) Nothing to Disclose
Shuncheng Yu (*Presenter*) Nothing to Disclose

### PURPOSE

Our study aims to utilize the Diffusion tensor image analysis of the perivascular space (DTI-ALPS) technique to assess the function of the glymphatic system in T2DM patients, and to explore whether such changes are correlated with cognition level and diffusion parameters.

### METHODS AND MATERIALS

The study involved 41 patients with T2DM(mean age, 60.49±8.88 years) and 27 healthy controls(mean age, 58.00±7.63 years). All subjects underwent MRI examination, cognitive assessment, and laboratory tests. The ALPS index was used to evaluate glymphatic system function. Tract-based spatial statistics (TBSS) was used to evaluate white matter changes. GLM was performed to check the DTI-ALPS index difference between T2DM and HC groups. Spearman correlation analysis and partial correlation analysis was used to analyze the correlation between the DTI-ALPS index, diffusion properties, cognitive scales.

### RESULTS

Independent two-sample t-test revealed a lower ALPS index in the T2DM group compared to the HC group(P < 0.001). The mean value of the ALPS index was lower in T2DM (1.30±0.13) than in HC (1.44±0.11). After controlling for age, gender, years of education, BMI, triglyceride, total cholesterol , low-density lipoprotein, and high-density lipoprotein, GLM analysis showed a lower ALPS index in the T2DM group than in the HC group(P=0.007).Spearman correlation analysis showed that the Montreal Cognitive Assessment (MoCA) score was significantly correlated with the ALPS index in T2DM patients(r=0.387,P=0.012). Partial correlation analysis showed that MoCA score still correlates with ALPS index after including age, gender, years of education BMI, triglyceride, total cholesterol , low-density lipoprotein, and high-density lipoprotein as covariates(r=0.352,P=0.044). Patients with T2DM had a significant increase in both mean diffusivity (MD) and radial diffusivity (RD) and decrease in fractional anisotropy (FA) in these clusters compared to the HC group. No correlation between the DTI-ALPS index and TBSS index were observed in T2DM group, including MD(r=0.070, P=0.666), RD cluster 1(r=0.004,P=0.981), RD cluster 2(r=0.028,P=0.860), FA(r=0.012,P=0.943).

### CONCLUSION

The results suggest that the glymphatic system function is declined in T2DM patients and associates with cognitive level.

### CLINICAL RELEVANCE/APPLICATION

First, we found that the mean value of the ALPS index in T2DM patients was lower compared to healthy controls. Second, we found a significant correlation between ALPS index and MoCA score in T2DM patients.

## W5B-SPNR-14 THE MEDIATION EFFECTS OF WHITE MATTER MICROSTRUCTURAL ABNORMALITIES IN THE ASSOCIATIONS BETWEEN CEREBRAL SMALL VESSEL DISEASE BURDEN AND COGNITIVE IMPAIRMENT

Na Wang (*Abstract Co-Author*) Nothing to Disclose
Lingfei Guo, MD (*Abstract Co-Author*) Nothing to Disclose
Xinyue Zhang (*Abstract Co-Author*) Nothing to Disclose
Yian Gao (*Abstract Co-Author*) Nothing to Disclose
Changhu Liang, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hongwei Wen (*Abstract Co-Author*) Nothing to Disclose
Yiwen Chen (*Abstract Co-Author*) Nothing to Disclose
Zhenyu Cheng (*Abstract Co-Author*) Nothing to Disclose
Yuanyuan Wang (*Abstract Co-Author*) Nothing to Disclose
Pengcheng Liang (*Abstract Co-Author*) Nothing to Disclose
Chaofan Sui (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study was to characterize white matter (WM) microstructural abnormalities in subjects with cerebral small vessel disease (CSVD) coexisting with different CSVD burdens and further to investigate the exactly mechanism for how different CSVD burdens influence cognitive decline in CSVD.

### METHODS AND MATERIALS

Fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD) and radial diffusivity (RD) images from 56 subjects with severe CSVD burden (CSVD-s), 109 subjects with mild CSVD burden (CSVD-m) and 81 healthy controls were analyzed using diffusion tensor imaging (DTI)-derived tract-based spatial statistics to detect WM diffusion changes among groups. Partial correlations between cognitive parameters and regional diffusion metrics/CSVD burdens for CSVD subjects were investigated. Furthermore, mediation analysis was conducted to examine whether ROI-wise diffusion biomarkers could modulate the relationship between CSVD burdens and cognitive function.

### RESULTS

The CSVD-s group showed significantly decreased FA and increased AD, RD and MD in multiple WM clusters, mainly including the forceps minor, bilateral anterior thalamic radiation (ATR), corticospinal tract (CST), superior longitudinal fasciculus (SLF) and inferior fronto-occipital fasciculus (IFOF). Compared to FA and AD, the WM alterations characterized by RD and MD were more extensive. Furthermore, significant partial correlations were observed between cognitive parameters and regional diffusion metrics/CSVD burdens for CSVD subjects. The simple mediation model showed that the presence of brain WM diffusion biomarkers played a significant mediating role in the relationship between CSVD burden and the scores of Montreal Cognitive Assessment (MoCA), Symbol Digit Modalities Test (SDMT), Stroop Color and Word Test (SCWT).

### CONCLUSION

The CSVD-s group exhibits extensive WM microstructural deterioration and cognitive dysfunction. The presence of brain WM diffusion biomarkers played a significant mediating role in the relationship between CSVD burden and cognitive impairment. Combining DTI-derived diffusivity and anisotropy metrics can provide complementary information for assessing WM alterations associated with cognitive dysfunction, which helps us to understand the mechanism of cognitive impairment in CSVD-s.

### CLINICAL RELEVANCE/APPLICATION

CSVD is the main cause of stroke and cognitive impairment, which seriously affects people's quality of life. Combining DTI-derived diffusivity and anisotropy metrics can provide complementary information for assessing WM alterations associated with cognitive dysfunction and serve as a potential discriminative pattern to detect CSVD at the individual level.

## W5B-SPNR-15 EVALUATION OF EFFECTIVENESS OF ICH AND LVO DETECTION ALGORITHMS ON CT IMAGES ACQUIRED FROM THE MOBILE STROKE TREATMENT UNIT

Mohammadreza Hosseini-Siyanaki (*Abstract Co-Author*) Nothing to Disclose
Keith R. Peters, MD (*Abstract Co-Author*) Nothing to Disclose
Hakki S. Sagdic, MD (*Abstract Co-Author*) Nothing to Disclose
Abheek Raviprasad, MD (*Abstract Co-Author*) Nothing to Disclose
Evelyn Y. Anthony, MD (*Abstract Co-Author*) Nothing to Disclose
Bruno Hochhegger, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Reza Forghani, MD, PhD (*Presenter*) Consultant, General Electric Company;Research Grant, General Electric Company;Research Grant, Intel Corporation;Research Grant, Toronto-Dominion Bank;Research Grant, McGill University Health Centre Foundation;President, Montreal Imaging Experts Inc

### PURPOSE

Mobile stroke treatment units (MSTU) equipped with CT scanners enable expedited stroke diagnosis and care in the prehospital setting. Artificial intelligence (AI) algorithms that assist in detection of intracranial hemorrhage (ICH) and large vessel occlusion (LVO) potentially allow for more accurate and timely diagnosis and management of patients presenting with stroke. We evaluated the diagnostic ability of RAPID ICH and RAPID CTA on imaging acquired via the MSTU.

### METHODS AND MATERIALS

RAPID ICH and RAPID CTA algorithms were automatically applied to select non-contrast CT (NCCT) and head CTA studies acquired within the MSTU at our institution. A consensus reading between a board-certified neuroradiologist and vascular neurologist was used as the reference standard. In cases of discrepancy between neurologist and radiologist, another board-certified academic neuroradiologist provided the final reference standard. Examinations were considered positive if there was evidence of ICH, LVO, M2 and M3 segment occlusion, or an acute large territory infarct. The diagnostic accuracy of RAPID ICH and RAPID CTA were determined by calculating the sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV), and overall accuracy.

### RESULTS

One hundred eighty-four consecutive patients who presented with stroke-like symptoms via the MSTU were included for analysis, consisting of a mixture of NCCT only and head CTAs. RAPID ICH was applied to 179 NCCT studies and RAPID CTA was applied to 64 CTA studies. RAPID ICH correctly identified 5/5 ICH cases and 173/173 ICH negative cases, resulting in sensitivity of 100%, specificity of 99.42%, PPV of 83.33%, NPV of 100%, and accuracy of 96.73%. There was 1 false positive interpretation by the algorithm due to a partially calcified cavernoma. Using 45% relative vessel density threshold, RAPID CTA achieved sensitivity of 63.15%, specificity of 84.44%, PPV of 63.15%, NPV of 91.66%, and accuracy of 78.12%. When using a 60% relative vessel density threshold, sensitivity and NPV increased to 84.21% and 91.66%, respectively. Notably, 2 of the false positive RAPID CTA results were due to IV failures prior to CTA acquisition. In one case, RAPID CTA identified a mid M2 occlusion that was initially overlooked by the human expert.

### CONCLUSION

RAPID ICH and RAPID CTA at 60% vessel density threshold demonstrated high sensitivity for ICH and LVO detection on CT and CTA images, respectively, acquired on the MSTU.

### CLINICAL RELEVANCE/APPLICATION

Imaging acquired via the MSTU can often be technically deficient and is first evaluated by the vascular neurologist. High sensitivity automated detection algorithms can lead to more accurate interpretation of stroke imaging and expedited treatment.

## W5B-SPNR-16 LEFT FRONTAL CONNECTIVITY ATTENUATES THE ADVERSE EFFECT OF SYSTEMATIC INFLAMMATION ON MEMORY

Qihui Wang (*Abstract Co-Author*) Nothing to Disclose
Qi Yang, MD (*Abstract Co-Author*) Nothing to Disclose
Xiuqin Jia (*Presenter*) Nothing to Disclose

### PURPOSE

The current study aimed to examine the postoperative changes in congitive reserve (CR) and to explore its protective effect on memory function after cardiac surgery.

### METHODS AND MATERIALS

A total of 25 patients underwent heart valve replacement were recruited to complete neuropsychological assessments and MRI examinations at baseline, 7-day and 30-day after cardiac surgery compared to 25 age- and sex-matched healthy controls. CR was calculated by global left frontal cortex connectivity (gLFC-connectivity) using fMRI. Inflammatory markers were measured by blood levels of Interleukin-6 (IL-6) and tumor necrosis factor-a (TNF-a). In the moderation analysis, we tested the interaction term gLFC connectivity ×inflammatory biomarkers on variations in cognitive function following surgery.

### RESULTS

In the longitudinal follow-up study, gLFC-connectivity was significantly reduced at the 7-day post-surgery compared to the healthy control group ($p = 0.003$). However, there was no statistically difference at the 30-day post-surgery (Figure 1). After controlling for age, gender, and years of education, the study found that the increase in IL-6 from baseline to 7-day post-surgery was significantly negative association with the change of Corsi Block Test (ß [95 % CI] = -0.57 [-0.94, -0.21], $p = 0.004$) from 7-day to 30-day post-surgery. GLFC-connectivity at baseline moderated the negative relationship (ß [95 % CI] = 0.38 [0.07, 0.68], $p = 0.020$) (Figure 2).

### CONCLUSION

GLFC-connectivity attenuates the negative impact of systemic inflammation on postoperative memory recovery. Moreover, cognitive reserve, which aids in the recovery of cognitive function after surgery, can be partially attributed to the enhanced connectivity within the left frontal cortex.

### CLINICAL RELEVANCE/APPLICATION

GLFC-connectivity as a proxy for CR offers a more objective and dynamic reflection of the cognitive reserve. Enhancing preoperative gLFC-connectivity presents a novel approach that may aid in the postoperative recovery of patients' cognitive functions.

## W5B-SPNR-17 TO INVESTIGATE THE EVOLUTION OF EDEMA AROUND HEMATOMA OF HYPERTENSIVE INTRACEREBRAL HEMORRHAGE IN PLATEAU AREA BASED ON CT

Xueqian Zhang (*Abstract Co-Author*) Nothing to Disclose
Hai Hua Bao (*Presenter*) Nothing to Disclose

### PURPOSE

This study aims to explore the evolution of PHE in patients with hypertensive intracerebral hemorrhage at different altitudes in high-altitude areas through CT imaging technology.

### METHODS AND MATERIALS

We collected clinical data from patients with hypertensive intracerebral hemorrhage who underwent non-surgical treatment in our hospital from January 2022 to May 2023. These patients were divided into two groups based on altitude gradients: a medium altitude group and a high altitude group. CT scans were performed on the hematoma (HE) of these patients during the hyperacute, acute, subacute, and chronic phases. Using United Imaging Intelligence analysis software, we calculated the volumes and corresponding CT values of HE (HE1-HE4) and PHE (PHE1-PHE4) for each phase, and recorded other imaging features and clinical indicators. Initially, basic statistical methods were used to explore differences in imaging and clinical characteristics between the two groups. Subsequently, the Scheirer-Ray-Hare test was employed to compare the evolution trends of PHE between the two groups.

### RESULTS

A total of 135 patients with HICH were collected, including 77 in the medium altitude group and 58 in the high altitude group. Statistically significant differences were observed between the two groups in terms of HE1-HE4 volumes, HE1 CT value, (PHE1-PHE3) CT values, red blood cell count, hemoglobin, hematocrit, time from onset to treatment, D-dimer, gender, and ethnicity (all $p < 0.05$). The Scheirer-Ray-Hare test revealed a statistically significant difference in the evolution of PHE between the two groups ($p < 0.05$), and there were also statistically significant differences in PHE volumes across the four phases within the high altitude group ($p < 0.05$).

### CONCLUSION

There exist certain differences in imaging, clinical indicators, and the evolution of PHE between the two groups of patients with hypertensive intracerebral hemorrhage.

### CLINICAL RELEVANCE/APPLICATION

These findings contribute to the clinical personalization of treatment for patients at different altitudes and provide more targeted recommendations for clinical treatment and rehabilitation.

## W5B-SPNR-18 CORRELATION STUDY BETWEEN CHANGES IN BRAIN NEUROVASCULAR COUPLING ON MRI AND INTESTINAL FLORA IN PATIENTS WITH T2DM

Jianlin Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Xuyang Wang (*Abstract Co-Author*) Nothing to Disclose
Dong Yang, BMedSc, MMEd (*Presenter*) Nothing to Disclose

### PURPOSE

To quantitatively evaluates the changes in neurovascular coupling (NVC) in the gray matter within the T2DM patients and analyze their correlation with abnormal changes in gut microbiota.

### METHODS AND MATERIALS

Forty patients with type 2 diabetes mellitus and 24 healthy controls were prospectively collected in our study. The mTI-ASL sequence and resting state BOLD-fMRI sequence were preprocessed respectively to obtain the whole brain ReHo and CBF maps of all subjects. and the stool samples of all subjects were collected 1 day before the MRI examination . The ReHo/CBF ratio of each voxel under the gray template of all subjects was calculated. The two-sample t-test was performed on the ReHo/CBF ratios of the two groups, and the Mantel correlation analysis was performed on the ReHo/CBF ratios of the brain regions with statistically significant differences between the two groups.

### RESULTS

(1) T2DM group NVC showing increased ReHo/CBF ratios in bilateral inferior frontal gyrus, left central sulcus cap, left rectus gyrus, bilateral insula, bilateral anterior cingulate gyrus, right middle cingulate gyrus, bilateral superior temporal gyrus (all $P<0.05$, FDR correction);decreased ReHo/CBF ratios in left anterior central gyrus, left middle cingulate gyrus, bilateral fusiform gyrus, left posterior central gyrus, left parietal gyrus, bilateral caudate nucleus, left inferior temporal gyrus, left paracentral lobule (all $P<0.05$, FDR correction). (2) There was a correlation between intestinal flora disorder and brain NVC, showing positive correlations between the abundance of Actinobacteria and ReHo/CBF ratios in left rectus gyrus ($r =0.290$, $P=0.003$), left posterior central gyrus, and left paracentral lobule ($r=0.266$, $0.268$, $P=0.029$, $0.008$);positive correlations between the abundance of Bifidobacterium and ReHo/CBF ratios in left rectus gyrus ($r =0.283$, $P=0.001$), left anterior central gyrus, and left paracentral lobule ($r=0.186$, $0.218$, $P=0.014$, $0.004$).

### CONCLUSION

There is a correlation between the abnormal changes in NVC and the abundance and diversity of intestinal flora, indicating that they may play an important mutual regulatory mechanism through the flora-gut-brain axis, which is expected to provide new ideas and imaging and microbiological markers for the further research and clinical diagnosis and treatment of T2DM in the future.

### CLINICAL RELEVANCE/APPLICATION

The combination of the rs-fMRI and ASL technology can used to quantitatively evaluate changes in neurovascular coupling in T2DM patients , which is expected to provide new ideas and imaging and microbiological markers for the further research and clinical diagnosis and treatment of T2DM in the future.

## W5B-SPNR-2 METASTASIS DETECTION USING TRUE AND ARTIFICIAL T1-WEIGHTED POST-CONTRAST IMAGES IN BRAIN MRI

Katerina Deike-Hofmann (*Abstract Co-Author*) Nothing to Disclose
Zeynep Bendella (*Abstract Co-Author*) Nothing to Disclose
Martin Vahlensieck, MD (*Abstract Co-Author*) Nothing to Disclose
Claus P. Heussel, MD (*Abstract Co-Author*) Nothing to Disclose
Ralf Clauberg (*Abstract Co-Author*) Nothing to Disclose
Thomas Pinetz, PhD (*Abstract Co-Author*) Nothing to Disclose
Alexander Radbruch (*Abstract Co-Author*) Nothing to Disclose
Daniel Paech, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Erich Kobler, PhD, MSc (*Abstract Co-Author*) Nothing to Disclose
Heinz-Peter W. Schlemmer, MD (*Abstract Co-Author*) Speaker, Siemens AG;Speaker, Bayer AG
Kai Schlamp, MD (*Abstract Co-Author*) Nothing to Disclose
Julian A. Luetkens, MD (*Abstract Co-Author*) Speakers Bureau, Koninklijke Philips NV;Research Consultant, Bayer AG
Martha Foltyn-Dumitru, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Alexander Effland (*Abstract Co-Author*) Nothing to Disclose
Robert Haase, MD (*Presenter*) Nothing to Disclose

### PURPOSE

To compare the sensitivity and precision in metastasis detection on true contrast-enhanced T1w images and artificial images synthesized by a deep-learning method using low-dose images.

### METHODS AND MATERIALS

In this prospective, multicentric study (five centers, twelve scanners), 917 patients received a brain MRI scan between October 2021 and March 2023 including T1w low-dose (0.033 mmol/kg) and full-dose images (0.1 mmol/kg). A stratified random sample of 60 participants was selected as test set. Of these, 40 participants with cerebral metastases or unremarkable brain findings were used as reading set (mean age, 54.3±15.1 [SD] years, 24 men). Participants' true and artificial T1w images were evaluated in random order with a period of four weeks between readings by two board-certified neuroradiologists. The readers guessed the assessed sequence's identity and marked all presumed metastases. Cases were reviewed by a reference reader, utilizing all available sequences, reports, and readers' findings to determine any metastases present. Performances were compared using Mid-p McNemar tests for sensitivity and two-sided Wilcoxon signed-rank tests for false-positive findings.

### RESULTS

Both readers guessed the correct identity in 40/80 cases. 97 metastases were identified by the reference reader. The sensitivity of reader 1 did not differ significantly between sequences (sensitivity [precision]; true: 66.0% [98.5%], artificial: 61.9% [98.4%], p=.38). Having a lower precision than reader 1, reader 2 found significantly more metastases using true images (sensitivity [precision]; true: 78.4% [87.4%], artificial: 60.8% [80.8%], p<.001). There was no significant difference in sensitivity for lesions larger than 5 mm. The number of false-positive lesions did not differ significantly between sequences.

### CONCLUSION

There was a similar detection performance for lesions larger than 5 mm. However, one reader showed a significantly higher overall sensitivity using true images when accepting a lower precision.

### CLINICAL RELEVANCE/APPLICATION

Small lesions are the limiting factor for reducing gadolinium-based contrast agents in brain MRI.

## W5B-SPNR-3 IMMEDIATE MODULATORY EFFECTS OF DIFFERENT FREQUENCIES OF TRANSCUTANEOUS AURICULAR VAGUS NERVE STIMULATION ON THE BRAIN NETWORKS IN SUBJECTIVE COGNITIVE DECLINE

Lingyan Liang (*Abstract Co-Author*) Nothing to Disclose
Xiaocheng Li (*Presenter*) Nothing to Disclose

**PURPOSE**

The aim of this study was to investigate the immediate modulatory effects of different frequencies of transcutaneous auricular vagus nerve stimulation (taVNS) on brain networks in subjective cognitive decline (SCD) .

**METHODS AND MATERIALS**

A total of 49 SCD patients and 39 age-, sex-, years of education-matched healthy controls (HCs) were included in this study. We used amplitude of low frequency (ALFF) to compare the differences of the brain activity between SCD and HCs at baseline, and to investigate the immediate modulatory effects of 1Hz-taVNS, 20Hz-taVNS and sham-taVNS (staVNS) on the spontaneous neural activities of SCD patients.

**RESULTS**

Compared with the HCs, the ALFF values of the right middle temporal gyrus, right inferior temporal gyrus, and right superior frontal gyrus decreased at baseline in SCD. At the time of taVNS stimulation, compared with baseline, the ALFF values increased in the right fusiform gyrus, right occipital gyrus and right middle temporal gyrus in the 1Hz-taVNS group, while decreased in the left dorsolateral superior frontal gyrus, left dorsolateral middle frontal gyrus, left precentral gyrus and left supplementary motor area; In the 20Hz-taVNS group, the ALFF values increased in the right middle temporal gyrus, right inferior temporal gyrus, right middle occipital gyrus, right inferior occipital gyrus, right fusiform gyrus and right angular gyrus, while decreased in the right medial and paracuneus gyrus, right supplementary motor area, right orbito frontal supramarginal gyrus, left precentral gyrus, left dorsalateral superior frontal gyrus; No significant changes of ALFF values of the brain could be found in staVNS group.

**CONCLUSION**

The spontaneous neural activities decreased and preferred the right hemisphere in SCD. taVNS could activate the neural activities of the right hemisphere and inhibit that of the left hemisphere to keep the balance in SCD, the barin regions mainly involved the limbic system, default mode network, central executive network, visual network, and sensory-motor network. 20Hz-taVNS made more extensive modulation effect on the brain networks related to cognitive functions than 1Hz-taVNS, and hold great potential for the treatment of SCD.

**CLINICAL RELEVANCE/APPLICATION**

SCD is regarded as the preclinical stage of Alzheimer's disease (AD) and may be a critical window of the prevention and treatment of AD. This study obtained the appropriate frequency of taVNS for the interventions of SCD and provided basis for its future clinical application.

## W5B-SPNR-5 COMPARATIVE ANALYSIS OF CERVICAL SPINE FRACTURES AND MECHANISMS OF INJURY IN DIFFERENT AGE COHORTS

Mahla Radmard, MD (*Abstract Co-Author*) Nothing to Disclose
David M. Yousem, MD, MBA (*Abstract Co-Author*) Royalties, RELX;Speaker, MRI Online;Board Member, MRI Online;
Akua Amoah, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Armin Tafazolimoghadam (*Abstract Co-Author*) Nothing to Disclose
Shuchi Zinzuwadia, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

There was a distinction made in the 2001, Canadian Cervical Spine Rule (CCR) regarding patients 65 and over and younger than 65 studied from 1996-1999 as far as indications for cervical spine computed tomography (CSCT) scanning. We sought to determine if there are differences in the fractures seen between these two age groups and their symptoms, mechanisms of injury, fracture locations, and types that are still relevant in 2024.

**METHODS AND MATERIALS**

This IRB-approved retrospective study of CSCT reports from two hospitals' emergency department practices in our health system reviewed 5 years of data on trauma patients. In addition to the primary variable of age, we looked at fracture types, sites, surgical or medical treatments, and also mechanism of injury. Patients were separated into symptomatic/asymptomatic and 65 and older/younger than 65 cohorts.

**RESULTS**

21,986 CSCTs reports were evaluated. 190/9455 (2.0%) of participants aged 65 and older and 199/12531 (1.6%) under 65 exhibited cervical spine fractures. Overall, fractures were identified in 1.8% of the scans. The data indicated a higher prevalence of upper cervical fractures in the older age group, with fewer fractures attributed to motor vehicle accidents. There were many more cases of falls from standing [106 (55.8%)] and falls from height [46 (24.2%)] in the older age group and this mechanism was associated with a higher risk of C1 and C2 fractures [52 (27.4%) and 78 (41.1%) respectively]. Among the C1 fractures, anterior and posterior arch fractures predominated [37(19.5%)]. For C2 fractures, types 2 and 3 odontoid fractures [39(20.5%) and 12(6.3%)] were more common in the older cohort. Motor vehicle collisions were more common in the younger cohort (89(44.7%) and they were associated with more C5-C7 fractures [47 (23.6%), (60 (30.2%), and 66 (33.2%) respectively] including the facets [49 (24.6%)], spinous processes [31 (15.6%)], and transverse processes [52 (26.1%)]. Overall the rates of instability, surgical intervention, and asymptomatic fractures were similar in the younger than and older than 65 age groups. These trends have not changed since the late 1990s CCR data.

**CONCLUSION**

Cervical spine fractures occur in about 1.8% of the CT scans performed in a busy ED environment. Fractures in the elderly occur more commonly due to falls, are located at C1 and C2, and may involve ligamentous injuries. Younger patients incur trauma more commonly due to MVCs and are more likely to affect the posterior elements, especially of C5-C7. These findings have persisted over time since the CCR was established.

**CLINICAL RELEVANCE/APPLICATION**

The study highlights how age-specific injury patterns in cervical spine fractures could enhance imaging guidelines and emergency care, potentially improving patient outcomes.

## W5B-SPNR-6 MESOPOROUS MANGANESE-DOPED NANO-ANTIOXIDANT SUPPRESSES PYROPTOSIS FOR EFFECTIVE ISCHEMIC STROKE THERAPY

Jun Zhang, MD (*Abstract Co-Author*) Nothing to Disclose
Jingyi Zhang (*Presenter*) Nothing to Disclose

**PURPOSE**

Ischemic stroke, a leading cause of global morbidity and mortality, induces cerebral ischemia/reperfusion (CI/R) injury, marked by reactive oxygen species (ROS) generation, oxidative stress, microglial M1 polarization, inflammatory cascade reactions, and cell pyroptosis. Traditional small molecular drugs face limitations, necessitating innovative therapies. Nanozymes, particularly cerium oxide, exhibit promise due to their enzymatic mimicking

capabilities. With this in mind, our goal is to develop a nanoenzyme that can be utilized for stroke diagnosis and treatment under MRI. This will be achieved by hindering cellular pyroptosis and mitigating oxidative stress, leveraging the nanoenzymes' catalytic activity alongside its specially designed drug-loading capability.

**METHODS AND MATERIALS**

In this study, we proposed the synthesis of mesoporous manganese-doped cerium oxide nanoparticles using a hard template method to enhance the catalytic activity of CeO2 through manganese loading and harness its MRI imaging capability. The caspase-1 inhibitor VX765 was encapsulated within the nanoparticles, and the surface was modified with Angiopoietin-2 (Ang2) and DSPE-PEG, yielding DSPE-Ang2-VX765@MMC. After establishing oxygen-glucose deprivation/reperfusion (OGD/R) and middle cerebral artery occlusion/reperfusion (MCAO/R) models in vitro and in vivo, we employed various techniques, including confocal laser microscopy, ELISA, cell and tissue immunofluorescence, and Western blotting, etc., to verify the possible outcomes.

**RESULTS**

The outcomes demonstrate that DSPE-Ang2-VX765@MMC effectively suppressed the complex pathways centered around oxidative stress, cell pyroptosis, and inflammatory cascade reactions, while also regulating the polarization of microglial cells toward the anti-inflammatory M2 phenotype. DSPE-Ang2-VX765@MMC also exhibited excellent MRI capability and the ability to penetrate the blood-brain barrier (BBB).

**CONCLUSION**

DSPE-Ang2-VX765@MMC serves as an ideal example for the integration of nanoenzyme in the diagnosis and treatment of ischemic stroke, offering a promising approach for future research in this field.

**CLINICAL RELEVANCE/APPLICATION**

It can provide strategies for the integration of stroke diagnosis and treatment based on magnetic resonance imaging.

## W5B-SPNR-7 3D STIR SYNTHESIS FOR SPINE MRI BY COMBINING 2D T1W AND 3D T2W INPUTS

Long Wang (*Abstract Co-Author*) Nothing to Disclose
Thomas C. Arnold, PhD (*Presenter*) Nothing to Disclose

**PURPOSE**

Algorithms that synthesize Short Tau Inversion Recovery (STIR) spinal sequences from sagittal T1w and T2w images have shown promise in reducing scan times. However, STIR synthesis algorithms typically require T1w and T2w inputs to have the same slice thickness. Here, we examine the performance of a STIR synthesis algorithm that combines 2D and 3D inputs of varying slice thicknesses.

**METHODS AND MATERIALS**

Data from 25 patients who underwent spinal MRI (cervical: 8, thoracic: 1, lumbar: 16) on a Siemens 3T scanner were analyzed. Each study included three sagittal sequences: 3D T2w, 2D T1w, and 2D STIR. STIR images were synthesized from 2D T1w and 3D T2w inputs using a deep-learning-based algorithm. As part of the preprocessing pipeline, 2D acquisitions are interpolated to match 3D sequence slice thickness. Synthetic STIR image resolution matches the higher resolution input (e.g. 3D T2w). For quantitative evaluation, we compared inputs and synthesized STIR images to the standard-of-care acquired STIR sequences using peak signal-to-noise ratio (PSNR), structural similarity (SSIM), and normalized root mean-squared error (NRMSE).

**RESULTS**

Synthesized and acquired STIR images exhibited comparable in-plane quality, with synthesized images demonstrating notable improvements in through-plane resolution over standard-of-care 2D STIR. Quantitatively, the algorithm yielded promising results, with synthesized images demonstrating increased quantitative performance across all three metrics (PSNR: 20.29 ± 1.58 dB, SSIM: 0.55 ± 0.05, NRMSE: 0.59 ± 0.12) compared to either input image (paired t-test, $p<0.001$). Synthesized images exhibited a 17% increase in PSNR, 15% increase in SSIM, and 58% decrease in NRMSE relative to input images.

**CONCLUSION**

Deep-learning-based methods for STIR synthesis are robust to different slice thickness values for T1w and T2w inputs. Synthesized STIR images generated with 3D sequence inputs showed improved through-plane resolution over standard-of-care 2D STIR sequences.

**CLINICAL RELEVANCE/APPLICATION**

Synthetic STIR generation can accelerate scan times by eliminating the need to collect a 2D STIR. Additionally, high-resolution 3D STIR could offer further acceleration by mitigating the need for axial GRE imaging.

## W5B-SPNR-8 CHANGE IN MANAGEMENT FOR DSA-IDENTIFIED FALSE-POSITIVE TVAI

Hamza A. Shaikh, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Tonetti (*Abstract Co-Author*) Nothing to Disclose
Corey Mossop (*Abstract Co-Author*) Nothing to Disclose
Jessica Vankawala (*Abstract Co-Author*) Nothing to Disclose
Jane Khalife (*Abstract Co-Author*) Nothing to Disclose
Nicole Fox, MD (*Abstract Co-Author*) Nothing to Disclose
Manisha Koneru (*Abstract Co-Author*) Nothing to Disclose
Renato Oliveira (*Abstract Co-Author*) Nothing to Disclose
Anna Goldenberg Sandau (*Abstract Co-Author*) Nothing to Disclose
Zixin Yi, BS (*Presenter*) Nothing to Disclose

**PURPOSE**

For patients with suspected Traumatic Vertebral Artery Injury (TVAI), CT Angiography (CTA) stands as the first-line screening modality. Digital Subtraction Angiography (DSA) serves as the confirmatory diagnostic imaging, and is the gold standard for cerebrovascular injury assessment, due to its higher sensitivity and specificity. Among patients with TVAI based on CTA who have undergone follow-up DSA, this study aims to investigate the prevalence and clinical significance of a negative result on follow-up DSA, with a specific focus on how diagnostic alterations affect clinical management.

**METHODS AND MATERIALS**

A retrospective review was conducted of a TVAI patient registry over 7 years (2016-2023) at a level 1 trauma center to screen for patients who underwent both CTA and DSA imaging. Patients undergoing angiography for neurointerventional purposes rather than diagnostic screening were excluded.

Among patients initially screened positive on CTA but subsequently negative on DSA, their pre- and post-intervention management was compared, and summarized utilizing odds ratio (OR) analysis.

**RESULTS**

Among the 72 patients studied (excluding 4 patients), 26.39% were determined to have false-positive TVAI upon subsequent DSA evaluation. The likelihood of a change in clinical management (i.e., stopping antithrombotic, adjusting intervention plans, etc.) in patients with negative DSA results was significant ($p < 0.01$). Furthermore, within the negative DSA group, 47.37% experienced immediate changes in clinical management following the revised diagnosis. Among patients maintaining the original treatment plan post negative DSA, a majority exhibited concurrent vascular injuries, warranting continued benefit from prescribed medication, such as continued anticoagulation.

**CONCLUSION**

While DSA typically remains reserved as a confirmatory study for CTA-negative patients with a high clinical suspicion of TVAI, there exists a potential advantage in extending DSA utilization to CTA-positive patients with low suspicion to rule out TVAI. Larger cohort analyses are needed to refine imaging algorithms and optimize clinical outcomes for TVAI patients.

**CLINICAL RELEVANCE/APPLICATION**

This study demonstrates that, despite initial CTA imaging suggestive of TVAI, follow-up DSA imaging negative for TVAI has a significant impact in changing clinical management, including cessation of antithrombotic therapy or modifications to surgical interventions. Thus, for TVAI patients with inconclusive CTA findings, DSA may be considered in the diagnostic workup.

## W5B-SPNR-9 ASSOCIATIONS OF CERVICAL CAROTID PLAQUE CALCIFICATION FEATURES WITH STENOSIS DEGREE IN PATIENTS WITH ISCHEMIC STROKE

Yu Sakai, MD (*Abstract Co-Author*) Nothing to Disclose
Scott Kasner (*Abstract Co-Author*) Nothing to Disclose
John H. Woo, MD (*Abstract Co-Author*) Nothing to Disclose
Luca Saba, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Bos, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Haehn (*Abstract Co-Author*) Nothing to Disclose
Jae W. Song, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Andrew Hu (*Abstract Co-Author*) Nothing to Disclose
Quy Cao (*Abstract Co-Author*) Nothing to Disclose
Brett Cucchiara (*Abstract Co-Author*) Nothing to Disclose
Quynh-Anh Dang (*Abstract Co-Author*) Nothing to Disclose
Jiehyun Kim (*Abstract Co-Author*) Nothing to Disclose
Elias Johansson (*Abstract Co-Author*) Nothing to Disclose
Grace Wang (*Abstract Co-Author*) Nothing to Disclose
Huy Q. Phi (*Presenter*) Nothing to Disclose

**PURPOSE**

Plaque calcifications (Pcalc) are prevalent in cervical carotid atherosclerosis, yet their relationship with stenosis and plaque vulnerability remains unclear. We investigated associations between carotid stenosis and Pcalc features on CTA neck exams in ischemic stroke patients.

**METHODS AND MATERIALS**

The Vascular Quality Initiative and institutional stroke registries were retrospectively reviewed to identify patients treated with carotid revascularization for symptomatic stenosis (>70%) and patients who met criteria for embolic stroke of undetermined source (<50% stenosis) and unilateral anterior circulation strokes, respectively. Patients with CTAs and carotid Pcalcs ipsilateral to stroke side were included. Pcalcs across the carotid bifurcation were manually segmented (3D-Slicer) to measure density (Hounsfield units, HU), diametermax, surface area, and volume. Maximum non-calcified plaque thickness was also manually measured. Per-plaque level analyses were performed. Mann-Whitney U tests compared Pcalc features between groups. Spearman correlation analysis examined Pcalc density and non-calcified plaque thicknessmax. Multivariate logistic regression examined associations of Pcalc features by stenosis, adjusting for age, sex, cardiovascular risk factors, and non-calcified plaque thicknessmax.

**RESULTS**

Twenty-six >70% stenotic (agemed=71years, N=6 female) and 60 <50% stenotic plaques (agemed=68years, N=27 female) met inclusion criteria. >70% stenotic plaques had higher total Pcalc volume and surface area per plaque, Pcalc diametermax, and non-calcified plaque thicknessmax ($p<0.001$). Pcalcs from >70% stenotic arteries had lower HUmin and HUmedian values than <50% stenotic arteries ($p<0.001$). Among the >70% stenotic plaques, HUmax showed a moderate negative correlation with non-calcified plaque thicknessmax (?=-0.50, p=0.01). Multivariate logistic regression analyses showed >70% stenotic plaque was associated with higher total Pcalc volumes (ß=0.032, p=0.02) and lower HUmedian (ß=-0.034, p=0.03).

**CONCLUSION**

Pcalcs in >70% stenotic carotid arteries were larger in volume, surface area, and diameter, indicating that Pcalc size contributes to structural stenosis. >70% stenotic plaque also had greater non-calcified plaque thicknessmax and Pcalcs with lower densities, suggesting lower density Pcalcs are associated with non-calcified inflammatory plaque components.

**CLINICAL RELEVANCE/APPLICATION**

Advanced plaques with hemodynamically severe stenosis may result from large Pcalcs or lower-density Pcalcs associated with vulnerable non-calcified plaque. Imaging biomarkers, accounting for plaque composition features, may provide further guidance on stroke risk stratification and treatment.

# Abstract Archives of the RSNA, 2024

W5B-SPOB

**OB/Gynecology and Pediatric Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPOB-1 ANALYSIS OF STRESS CHANGES IN THE LIGAMENT-FREE UTERUS SUBJECTED TO ABDOMINAL PRESSURE BASED ON THREE-DIMENSIONAL PELVIC FLOOR MR MODELING

Ailian Liu, MD (*Abstract Co-Author*) Nothing to Disclose
Ye Li (*Presenter*) Nothing to Disclose

### PURPOSE

To analyze the stress changes of the ligament-less stretched uterus subjected to abdominal pressure using a three-dimensional model of the pelvic floor in healthy volunteers.

### METHODS AND MATERIALS

Data from pelvic floor magnetic resonance imaging (MRI) were collected from 29-year-old healthy women (BMI=21.09 kg/m2, anterior uterus) using an Ingenia 3.0T CX MR scanner (Philips Healthcare, Best, the Netherlands) to obtain compression-aware thin-layer high-resolution 3D T2WI based on the compression-aware thin-layer (5x CS-SENSE acceleration, TR/TE=1250ms/148ms, FOV=300×300mm2, FA: 90°, layer thickness/spacing:1.0mm/-0.5mm, number of layers 240, time 4min55s) to model and remodel the pelvis in 3D, which included the uterus (without cavity), bladder, and rectum. Stress analysis, strain analysis, and maximum displacement analysis of the uterine surface and interior in the Valsalva state were explored by finite elements.

### RESULTS

A three-dimensional model of a ligament-free pelvis was successfully established by pelvic floor MR. The uterus showed that: the stress analysis showed that the maximum stress of the uterus appeared in the anterior wall of the uterine isthmus (Fig. 1a), the maximum displacement appeared in the uterine fundus and body, and the peak appeared in the posterior wall of the uterine body (Fig. 1b). Inside the uterus: the stress analysis showed that the stresses inside the uterus appeared mainly in the body of the uterus (Fig. 2a), and the stresses in the body of the uterus were greater than those on the uterine surface (Fig. 2a vs. Fig. 1a). The maximum displacement occurred in the uterine body and peaked at the posterior wall of the uterine body (Fig. 2b), and the internal uterine displacement was smaller than that indicated by the uterus (Fig. 2b vs. Fig. 1b).

### CONCLUSION

For the uterus without ligament support, the internal uterine isthmus was subjected to the greatest force under abdominal compression, and the uterus showed more stress than the internal. The dorsal displacement of the body of the uterus was the greatest in the pressurized state, and the uterus indicated greater stress than the interior. Through the finite element analysis of the ligamentless uterus, the direct effects of abdominal pressure on the internal and external uterus were preliminarily determined, which can provide some references for clinical work.

### CLINICAL RELEVANCE/APPLICATION

Pelvic floor stress analysis provides an effective adjunct to clinical patient symptom imaging.

## W5B-SPOB-2 SIZE THRESHOLD AS A RISK FOR MALIGNANT TRANSFORMATION IN TYPICAL OVARIAN DERMOID CYSTS: A SCOPING REVIEW

Gavin Low, FRCR (*Abstract Co-Author*) Nothing to Disclose
Mitchell Wilson, MD, FRCPC (*Presenter*) Nothing to Disclose

### PURPOSE

The O-RADS malignancy risk stratification of typical ovarian dermoid cysts by using a 10 cm threshold is based on expert consensus rather than analysis of objective clinical data. This comprehensive scoping review consolidated all currently available studies evaluating typical benign ovarian dermoid cyst size and risk for malignant transformation.

### METHODS AND MATERIALS

A systematic review of MEDLINE, Embase, Scopus and the Cochrane library was performed from inception to January 14, 2024 using PRISMA-ScR guidelines. A grey literature search and forward searching of reference lists from included studies were additionally performed. Case reports and case series evaluating dermoid cyst size and malignant transformation as defined by a pathological reference standard were included in review. Studies were independently screened by one author with full text review and data extraction performed by a second author, both with prior experience in systematic reviews for diagnostic test accuracy studies. Data synthesis was provided as a qualitative review of the existing literature.

### RESULTS

Twenty-five studies were included in qualitative synthesis comprising 6 case reports and 19 retrospective studies with a total of 15,295 dermoid cysts. Of these, 215 lesions demonstrated malignant transformation. Studies reporting dermoid size with malignant transformation ranged from 1-32 cm with 44/180 total malignant transformation lesions measuring < 10 cm in studies where individual size measurements were reported. Solid enhancing components were infrequently reported but all measured > 1 cm when described.

### CONCLUSION

As many as 25% of dermoid cysts with malignant transformation may be missed with the current 10 cm O-RADS malignancy risk threshold. Although surveillance of lesions > 3 cm may improve sensitivity, lower size thresholds for recommending MRI O-RADS with evaluation of solid enhancing tissue may also be appropriate. A large prospective trial is ultimately needed for more accurate evaluation of diagnostic accuracy.

### CLINICAL RELEVANCE/APPLICATION

This study serves as the most comprehensive review and qualitative assessment of dermoid cysts with malignant transformation available to date. Future revisions of the US O-RADS risk stratification system may be improved with lower size thresholds recommendations for MRI O-RADS scoring in ovarian dermoid cysts.

## W5B-SPOB-3 MAGNETIC RESONANCE IMAGING FEATURES OF MESONEPHRIC-LIKE ADENOCARCINOMA OF THE UTERINE BODY

Harushi Mori, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hiroyuki Fujii, MD (*Abstract Co-Author*) Nothing to Disclose
Hiroki Kato (*Abstract Co-Author*) Nothing to Disclose
Kaori Yamada (*Abstract Co-Author*) Nothing to Disclose
Mitsuru Matsuki, MD (*Abstract Co-Author*) Nothing to Disclose
Yuki Himoto, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Tomohiro Kikuchi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Saki Yamamoto, MD (*Presenter*) Nothing to Disclose

### PURPOSE

Mesonephric-like adenocarcinoma (MLA) of the uterine body was adopted as a new histological type in the World Health Organization 2020 classification. It comprises 1% of all endometrial carcinomas and shares similar morphological, molecular, and immunophenotypic characteristics with mesonephric adenocarcinoma of the uterine cervix. Recent studies have hypothesized that coexisting adenomyosis in the Müllerian duct could be the origin of MLA of the uterine body. In this multi-institutional study, we retrospectively reviewed the magnetic resonance imaging (MRI) findings of 15 patients with MLA of the uterine body and investigated their characteristic features and associations with adenomyosis.

### METHODS AND MATERIALS

The mean age of the patients was calculated, and the presentation of MLA was examined at detection. The MRI scans of the 15 patients pathologically diagnosed with MLA of the uterine body were obtained from four institutions. The following MRI features were independently evaluated by two radiologists blinded to the clinical information: tumor size and apparent diffusion coefficient (ADC) values, tumor growth pattern (endophytic/exophytic), signal intensities compared to the skeletal muscle, heterogeneity on T2-weighted imaging (T2WI), intratumoral hemorrhage on T1-weighted imaging (T1WI), heterogeneity of enhancement on gadolinium (Gd)-enhanced T1WI, and coexistence of adenomyosis. Differences in evaluations were resolved by consensus.

### RESULTS

The mean age of the patients was 60.5 years. The patients were either symptomatic (n=9) or asymptomatic (n=6). The mean tumor size and ADC values were 58.0 ± 26.7 mm and 0.69 ± 0.10 × 10-3 mm2/s, respectively. The percentages of the respective features were as follows: endophytic growth, 87%; exophytic growth, 13%; heterogeneously high intensity on T2WI, 87%; intratumoral hemorrhage on T1WI, 27%; heterogeneous enhancement, 80%; and coexistence of adenomyosis, 53%.

### CONCLUSION

MLAs of the uterine body tend to be bulky tumors with endophytic growth in the myometrium. This characteristic endophytic growth pattern may explain the high frequency of asymptomatic cases despite a large tumor size. Moreover, in more than half of the cases, coexisting adenomyosis was identified on pathology and MRI, supporting the hypothesis of a Müllerian duct origin.

### CLINICAL RELEVANCE/APPLICATION

MLA of the uterine body infiltrates aggressively with endophytic growth pattern, and has a poor prognosis due to delayed detection. This study suggests that MLA of the uterine body may be associated with adenomyosis, thereby, periodic follow-up of the adenomyosis using MRI should be discussed in the future.

# Abstract Archives of the RSNA, 2024

W5B-SPPD

**Pediatric Imaging Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPPD-1 ALTERED STATES OF BRAIN WATER HOMEOSTASIS IDENTIFIED BY MULTIPARAMETER QMRI OF PD, T1, AND T2 IN A LARGE COHORT OF ADOLESCENTS BORN EXTREMELY PRETERM

Ali A. Elzieny (*Abstract Co-Author*) Nothing to Disclose
Bindu Setty, MD (*Abstract Co-Author*) Nothing to Disclose
Laurie Douglass (*Abstract Co-Author*) Nothing to Disclose
Hernan Jara, PhD (*Presenter*) Author with royalties, World Scientific Publishing;

### PURPOSE

Individuals born extremely preterm (GA <28 weeks) demonstrate a very wide range of cerebrospinal fluid (CSF) volumes, from about 3% to 45% of the total intracranial volume. Hence, the purpose herein is to study the different states of parenchyma-to-CSF homeostasis by multiparameter quantitative (MP-) MRI of the proton density (PD) and the relaxation times T1, and T2, parameters which are sensitive to water content.

### METHODS AND MATERIALS

This prospective multicenter study (ELGAN-ECHO) included 370 adolescents (181 males) who were born extremely preterm (gestational ages<28 weeks). Image acquisition: 3T (GE, Philips, Siemens): Triple Turbo Spin Echo brain MRI: voxel = 0.5x0.5x2mm3, 80 slices, scan time < 10min. Image processing: multiparameter (PD, T1, and T2) qMRI mapping algorithms, automated segmentation of white and gray matter (WM and GM), and volumetry (Python 3.9.13 with Anaconda Navigator 2.32).

### RESULTS

Representative MP-qMRI results are shown in Fig. 1A, B for an adolescent with a highly elevated CSF content of 44%. Full cohort results in the scatter plots below (Fig. 1 C, D), indicate that PD decreases (strong dependence: GM r -0.51 p-value <0.001 vs WM r -0.36 p-value <0.001), and the relaxation times increase as functions of %CSF (T2 strong dependence: GM r 0.84 p-value <0.001 vs WM r 0.82 p-value <0.001, and T1 weaker dependence: GM r 0.27 p-value <0.001 vs WM r 0.21 p-value <0.001).

### CONCLUSION

MP-qMRI shows distinct PD (decrease), T1 (weak increase), and T2 (strong increase) dependencies as functions of increasing %CSF. Therefore, for a fixed age (15 years), the brain parenchyma appears to adjust to the dyer and wetter conditions of CSF homeostasis by reducing intra-parenchymal water content as demonstrated by decreasing PD, and by augmenting water mobility as indicated by the increasing transverse relaxation time T2.

### CLINICAL RELEVANCE/APPLICATION

The primary qMRI parameters PD, T1, and T2 of the white and gray matter are dependent on the conditions of water homeostasis as represented by the intracranial CSF percentage. Hence, the conditions of water homeostasis should be considered to correct these qMRI measures. These findings could have clinical reporting implications and for research studies particularly, for qMRI studies as a function of age.

## W5B-SPPD-2 MATURATION AND REORGANIZATION OF STRUCTURAL CONNECTIVITY IN INFANTS WITHIN HALF A YEAR

Tingting Liu (*Presenter*) Nothing to Disclose

### PURPOSE

Although brain networks have been extensively investigated, networks based on diffusion imaging are remain under-explored, particularly for infants in the early postnatal period, during which time axons undergo overproduction and elimination, complicated by increased axon diameter and myelination, which may cause alterations in topology of intercortical connections. However, the structural network refinement in early life is still under-researched.

### METHODS AND MATERIALS

Totally, 104 preterm infants with few complications aged 0 and 6 months were enrolled. The whole-brain tractography was performed for each participant using the second-order integration over the fiber orientation distribution method, which were then sifted to 1 million streamlines. The network density was set from 0.2 to 0.3 with an interval of 0.01, and then averaged the measures at all densities.

### RESULTS

The present study discovered that although the clustering coefficients of the entire brain tended to increase with age, while the degree of the temporo-parieto-occipital lobe gradually decreased, whereas the frontal lobes demonstrated the opposite. The hub edges between the hemispheres mainly connected the bilateral cingulate gyrus, cuneus and calcarine cortex, and the betweenness of the cuneus and calcarine cortex increases with age. Besides,

the hub edges within the hemispheres were U-fibers, and their topology was gradually regular and symmetrical. Modularity in infants within half a year was found an age-related decline.

**CONCLUSION**

The present study discovered that the temporo-occipital lobe matures earlier in infancy in structural brain networks compared with the frontal lobe, manifesting as a decline in energy consumption along with a progressive increase in whole-brain information transfer efficiency. Besides, the visual cortex showed a rapid maturation within the first few months of life, which is sensitive to injury. Finally, the subcortical fibers are matured earlier than long fibers in infancy.

**CLINICAL RELEVANCE/APPLICATION**

This study revealed the developmental characteristics of structural brain networks in early infancy, deepened the understanding of infant brain development, and provided a reference for early identification of infants with abnormal development.

## W5B-SPPD-3 DENTIFY CHILDREN GROWTH HORMONE DEFICIENCY AND IDIOPATHIC SHORT STATURE (ISS): QUANTITATIVE MRI ASSESSMENT WITH A MULTIDYNAMIC MULTIECHO SEQUENCE

Yong Zhang, DO (*Abstract Co-Author*) Nothing to Disclose
Mengzhu Wang (*Abstract Co-Author*) Nothing to Disclose
Ankang Gao (*Abstract Co-Author*) Nothing to Disclose
Gaoyang Zhao, MD (*Presenter*) Nothing to Disclose

**PURPOSE**

This study aimed to explore the correlation between pituitary function and relaxivity values of T1, T2 and PD maps in short stature children with normal pituitary morphology using a multidynamic multiecho (MDME) sequence.

**METHODS AND MATERIALS**

From October 2023 to February 2024, children were recruited in the First Affiliated Hospital of Zhengzhou University, whose height below 2-3 standard deviations(SD) of the mean height for their age and sex, to exclude other diseases potentially causing short stature, according to growth hormone stimulation test. Children with peak growth hormone (GH) level between 5 and 10 ng/mL were diagnosed with partial growth hormone deficiency(PGHD), peak GH level of =5 ng/mL were diagnosed with complete growth hormone deficiency (CGHD) and GH peak of = 10 ng/mL were as idiopathic short stature (ISS) group. Coronal MDME sequence was performed on a 3 T MR scanner (VIDA, Siemens Healthineers, Erlangen, Germany) with a 64 channel of head-neck coil for signal reception. The scanning parameters were as follows: field of view 220 × 220 mm2, section thickness 2.0 mm; 20 slices; TR 4500 ms; TE 30,105 ms; TI 4303, 2053, 703, 253ms; bandwidth 101 Hz/Px; echo spacing 14.96 ms.T1, T2 and PD maps were derived from the MDME sequence using an inhouse developed MDME_BETA. Regions of interest (ROI) were delineated on anterior pituitary using ITK-snap, and histogram features were obtained via FAE software. The Mann-Whitney U test was performed to compare the GHD and ISS group. DeLong test was used to assess differences in the area under the receiver operating characteristic curve (AUC) for the extracted features.

**RESULTS**

75 children (4-17 year-old, 17 girls, 52 boys) diagnostic division ISS group (n=12), CGHD group (n=32) and PGHD group (n=31) were included. There were no statistically significant differences in all parameters between the CGHD and PGHD groups. However, significant differences were observed in the histogram features (10th, 90th percentile, mean, median, minimum, RMS) of T2 map between the ISS and CGHD groups, as well as in 10th percentile, mean, minimum, RMS of T2 map in ISS and PGHD group. For the ISS and CGHD groups, the AUCs for the 10th, 90th percentile, mean, median, minimum, and RMS of T2 map (0.77,0.71,0.76,0.73,0.76,0.74) showed no remarkable difference. Similarly, for the ISS and PGHD groups, AUC of 10th percentile, mean, minimum, RMS of T2 map (0.73,0.74,0.73,0.74) has no remarkable difference.

**CONCLUSION**

MDME as a quantitative MRI is a promising non-invasive method for distinguishing between ISS and GHD. T2 map may reflect the functional status of the anterior pituitary gland.

**CLINICAL RELEVANCE/APPLICATION**

These findings provide a reliable reference for distinguishing between ISS and GHD.

# Abstract Archives of the RSNA, 2024

W5B-SPPH

**Physics Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPPH-1 VOLUMETRIC BREAST DENSITY ESTIMATION IN DIGITAL MAMMOGRAPHY: APPLICATION OF A DEEP LEARNING FRAMEWORK TRAINED WITH VIRTUAL BREASTS TO CLINICAL IMAGES

Alessandra Tomal, PhD (*Abstract Co-Author*) Nothing to Disclose
Rodrigo T. Massera, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

To evaluate a previously developed deep learning framework for volumetric breast density (VBD) estimation applied to clinical images of real patients. In addition, to compare the predicted values with a commercial well established software that calculates VBD.

### METHODS AND MATERIALS

The deep learning framework (DLF) consists of three distinct neural networks, one designed for a specific task. The first one segments the mammography image between background, skin plus nipple and inner tissues. The second neural network predicts the relative height for each pixel that is classified as inner tissue. Afterwards, the third network predicts the relative glandular height for each pixel. The first and second neural networks are based on the XNet architecture, while the third is an ensemble of 5 multi-layer perceptrons. The framework was previously trained and validated based on simulated images from virtual breasts. The dataset consists of 199 real mammography anonymized images (for processing, craniocaudal projection) of patients undergoing routine breast screening examinations, and were selected stochastically. For each image, the VBD was quantified using the DLF and Volpara software (Volpara Health, New Zealand, v. 1.5.1). The obtained VBD values were compared for all images, and the coefficient of determination (r2) was calculated.

### RESULTS

On each image, 20% (median) of the pixels analysed by the DLF returned density values outside the allowed range, which were rounded by the nearest possible one. The median(10%-90% percentiles) VBD intervals obtained were 8.6%(4.0%-21.1%) and 6.9%(3.1%-19.4%) using Volpara and DFL, respectively. The $r^2$ score for VBD between DLF and Volpara was 0.72, with average(standard deviation) differences of -1%(4%). When a linear fit is applied ($y=ax+b$), we found $a=0.99|b=-0.85|r^2=0.79$ between DLF and Volpara.

### CONCLUSION

The volumetric breast density predicted by the deep learning framework, trained with virtual breasts, presented a good agreement compared to Volpara software for this dataset of real images.

### CLINICAL RELEVANCE/APPLICATION

The application of a deep learning framework, trained with virtual breasts, could be a complementary method of determining breast density, which is one of the risk factors of developing breast cancer.

## W5B-SPPH-11 CLINICAL VALUE OF DEEP LEARNING IMAGE RECONSTRUCTION-BASED 60 KEV MONOENERGETIC IMAGES OF SUB-MILLIMETER THICKNESS FOR PATIENTS WITH DIFFERENT BODY MASS INDEX IN SPECTRAL CT PULMONARY ANGIOGRAPHY

Yuanfen Liu (*Abstract Co-Author*) Nothing to Disclose
Borong Tang (*Presenter*) Nothing to Disclose

### PURPOSE

To investigate the clinical value of deep learning image reconstruction-based 60 keV monoenergetic images (MIs) of 0.625 mm thickness for patients with different body mass index (BMI) in spectral CT pulmonary angiography (CTPA).

### METHODS AND MATERIALS

Ninety-three patients who underwent spectral CTPA were retrospectively analyzed. The patients were divided into two groups: 53 patients with BMI <25 kg/m2; 40 patients with BMI > 25 kg/m2. MIs at 60keV were reconstructed using adaptive statistical iterative reconstruction (AR) algorithm with weight of 50% at 1.25 mm thickness. Additionally, at 0.625 mm thickness, 60keV MIs were reconstructed using deep learning image reconstruction algorithms of middle level (DM) and high level (DH). CT values, standard deviation (SD), signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) of the pulmonary trunk, right and left pulmonary artery, as well as the beam hardening artifact indexes (BHA) of the aortic arch and the anterior chest wall muscles affected by beam hardening artifacts were measured or calculated. Two radiologists performed independent and double-blind subjective assessment on the image quality using a 5-point scale.

**RESULTS**

CT values of the pulmonary trunk, right and left pulmonary artery for BMI<25 kg/m2 were slightly higher than those for BMI>25 kg/m2. SD values, SNR and CNR were slightly worse on the images for BMI>25 kg/m2 group than on the BMI<25 kg/m2 group. For all three pulmonary arteries, CT values were not statistically different on 60keV images with different layer thicknesses and reconstruction algorithms (all P > 0.05). SD value comparison: 0.625mm DH < 0.625mm DM < 1.25mm AR (all P < 0.05). SNR and CNR comparison: 1.25mm AR < 0.625mm DM < 0.625mm DH (all P < 0.05). Comparison of vascular and muscle BHA: 0.625mm DH < 0.625mm DM < 1.25mm AR (all P < 0.05). Comparison of subjective scoring: 0.625mm DH > 0.625mm DM > 1.25mm AR (all P < 0.05).

**CONCLUSION**

DLIR algorithm reduces image noise and beam hardening artifacts on 60keV images in spectral CTPA for patients with different BMI, and 0.625-mm DLIR images show higher image quality than 1.25-mm AR images.

**CLINICAL RELEVANCE/APPLICATION**

DLIR improves image quality of low-energy monochromatic images with sub-millimeter-thickness in spectral CTPA imaging for different-size patients, also shows potential for further dose reduction, with high clinical value.

## W5B-SPPH-2 EFFECTS OF DIFFERENT LEVELS OF ADAPTIVE STATISTICAL ITERATIVE RECONSTRUCTION -V TECHNIQUE ON CTPA IMAGE QUALITY AND RADIATION DOSE

Yanhong Zhao, MMed,MMed (*Presenter*) Nothing to Disclose

**PURPOSE**

To compare the image quality and radiation dose of computed tomography pulmonary angiography(CTPA) based on different levels of adaptive statistical iterative reconstruction V (ASiR-V) .

**METHODS AND MATERIALS**

Forty-five patients suspected pulmonary embolism were enrolled. The patients were randomly divided into three groups(A,B and C, n = 15 for each group).All the patients underwent CTPA on a 256 row wide-coverage volumetric CT (Revolution CT, GE healthcare, Milwaukee, WI). Automatic tube current modulation technique was applied to each patient. The Tube voltage (kV) were 100kV,Noise index(NI) were 13. ASiR- V was per-set as 30% for group A,50% for group B and 70% for group C respectively.The image noise ,the signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), the image quality subjective scores and effective dose (ED) were calculated and compared with one-way ANOVA.

**RESULTS**

Age, Scanning range and BMI were found not statistically different among the three groups. (P > 0.05). The CT numbers,the image noise,the SNR and CNR were not statistically different among the three groups. (P > 0.05).The ED in group B (1.3±0.2mSv) and group C (0.8±0.1mSv) were both lower than that in group A (2.1±0.70mSv) (each p <0.05), the decrease rates of ED in group B and C were 38.1% and 61.9% respectively. The image quality of three groups were all acceptable for the requirement of the diagnosis.There was no significant difference of subjective image quality between group A and group B (P>0.05).Subjective image quality score in group C were lower than that in group A (P <0.05).

**CONCLUSION**

With the level of Adaptive statistical iterative reconstruction V increase ,the radiation dose was significantly reduced ,but when the ASIR-V percentage level increased to 70%, the image quality decreased greatly. CT scans with Level of 50% of Adaptive statistical iterative reconstruction V could significantly reduce radiation dose without sacrificing image quality.

**CLINICAL RELEVANCE/APPLICATION**

With the level of Adaptive statistical iterative reconstruction V increase ,the radiation dose was significantly reduced ,but when the ASIR-V percentage level increased to 70%, the image quality decreased greatly. CT scans with Level of 50% of Adaptive statistical iterative reconstruction V could significantly reduce radiation dose without sacrificing image quality.

## W5B-SPPH-4 EVALUATION OF A DEEP LEARNING RECONSTRUCTION ALGORITHM FOR CORONARY SPECTRAL PHOTON-COUNTING CT ANGIOGRAPHY

Jean-Paul Beregi, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Philippe C. Douek, MD, PhD (*Abstract Co-Author*) Grant, Koninklijke Philips NV
Joel Greffier, PhD (*Abstract Co-Author*) Nothing to Disclose
Marjorie Villien (*Abstract Co-Author*) Working for Philips Healthcare
Angele Houmeau (*Abstract Co-Author*) Nothing to Disclose
Sara Boccalini, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Elias Lahoud (*Abstract Co-Author*) Employee, Koninklijke Philips NV
Salim Si-Mohamed, MD, PhD (*Abstract Co-Author*) Speakers Bureau, Boehringer Ingelheim GmbH
Djamel Dabli (*Abstract Co-Author*) Nothing to Disclose
Paul Menard (*Abstract Co-Author*) Nothing to Disclose
Hugo Lacombe (*Presenter*) Nothing to Disclose

**PURPOSE**

To evaluate image quality of a dedicated deep learning reconstruction (DLR) algorithm for coronary spectral photon-counting (SPCCT) CT angiography.

**METHODS AND MATERIALS**

A phantom study and prospective Human study in 5 patients after ethical approval were performed using a clinical SPCCT prototype. Matched acquisition parameters were used, i.e., retrospective ECG-gated protocol at 256 mAs, 120kVp. Reconstruction parameters consisted of 1024 matrix, 0.25 mm slice-thickness, 220 mm field of view and a data set with 2 high-frequency filters (Detailed 2, Sharp) and an iterative reconstruction algorithm (iDose4 6) and a data set with Sharp filter and DLR algorithm (100% level). Noise power spectrum (NPS), task-based transfer function (TTF) with f50 (mm-1) for bone and iodine inserts and detectability index (d') were assessed on phantom for two clinical tasks of 1mm diameter, i.e., stent and distal coronary arteries. Two radiologists rated overall noise, sharpness of stents and detectability of small vessels in patients using a 5-point-quality score. Objective analysis consisted in: noise measured in trachea, lumen stent sharpness as full-width half maximum of lumen stent and detectability index for distal vessels were assessed using an in-house Python code.

## RESULTS

Noise was reduced for DLR phantom images (8.20 HU) compared to Detailed 2 (47.7 HU) and Sharp (85.00 HU). Average frequency was similar for DLR images compared to Sharp (0.93 mm-1 vs 0.97mm-1) and higher compared to Detailed 2 (0.63 mm-1). f50 was similar for DLR, detailed 2, and Sharp for iodine insert (0.77mm-1) but slightly lower for DLR for bone insert (respectively 0.85, 0.89 and 0.94). d' was 9-foldhigher for DLR images compared to iDose4 images for stent imaging and for distal coronary vessels (respectively 80.92, 8.86 and 8.34 for iodine insert). DLR patient images had a 3-fold decrease in noise compared to Detailed 2 and an 8-fold decrease when compared to Sharp yet greater according to radiologists (respectively 5 [5;5], 4[3;4], 3[2;3], $p<0.05$). Sharpness of stent was slightly decreased for DLR images compared to Sharp and similar to Detailed 2 images (15.46 ± 4.63, 12.67±4.92 and 13.00 ±5.84) and was confirmed by subjective analysis (4[3;4], 5[4;5] and 4[4;4], $p<0.05$). Detectability of low contrast structures was improved for DLR patient images compared to Detailed 2 and Sharp (respectively 34.88 ± 7.17, 5.44 ± 4.88 and 2.68±3.09).

## CONCLUSION

In coronary SPCCT angiography, DLR algorithm outperformed in image quality in both phantom and patients, leading an improvement in detectability.

## CLINICAL RELEVANCE/APPLICATION

Coronary SPCCT angiography with DLR algorithm outperforms detectability of coronary vessels for a greater detection and characterization of coronary artery disease.

# W5B-SPPH-5 EVALUATING THE EFFICACY OF MULTIMODAL MACHINE LEARNING IN THE PREDICTION OF RETREATMENT FOR INTRACRANIAL ANEURYSM

Ciprian N. Ionita, PhD (*Abstract Co-Author*) CEO, QAS.AI;Grant, Canon Medical Systems Corporation
Adnan Siddiqui, MD,PhD (*Abstract Co-Author*) Investor, Shifamed LLC;Consultant, Alexion Pharmaceuticals, Inc;Advisory Board, Alexion Pharmaceuticals, Inc;Consultant, Amnis Therapeutics;Advisory Board, Amnis Therapeutics;Investor, Amnis Therapeutics;Investor, Bendit Technologies, Ltd;Investor, Blinktbi Inc ;Consultant, Boston Scientific Corporation;Advisory Board, Boston Scientific Corporation;Investor, Boston Scientific Corporation;Investor, Buffalo Technology Partners, Inc;Consultant, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation;Consultant, Cardinal Health, Inc;Advisory Board, Cardinal Health, Inc;Investor, Cardinal Health, Inc;Consultant, Cerebrotech Medical Systems, Inc;Advisory Board, Cerebrotech Medical Systems, Inc;Investor, Cerebrotech Medical Systems, Inc;Investor, Cognition Medical;Consultant, Endostream Medical, Ltd;Advisory Board, Endostream Medical, Ltd;Investor, Endostream Medical, Ltd;Consultant, Imperative Care, Inc;Advisory Board, Imperative Care, Inc;Investor, Imperative Care, Inc;Investor, Instylla, Inc;Consultant, IRRAS AB;Advisory Board, IRRAS AB;Investor, IRRAS AB;Consultant, Johnson & Johnson;Advisory Board, Johnson & Johnson;Committee member, Johnson & Johnson;Investor, NeuroRadial Technologies, Inc;Investor, Neurovascular Diagnostics, Inc;Consultant, Perflow Medical Ltd;Advisory Board, Perflow Medical Ltd;Investor, Perflow Medical Ltd;Consultant, Q'Apel Medical Inc;Advisory Board, Q'Apel Medical Inc;Investor, Q'Apel Medical Inc;Investor, Radical Catheter Technologies, Inc;Consultant, Integra LifeSciences Holdings Corporation;Advisory Board, Integra LifeSciences Holdings Corporation;Investor, Integra LifeSciences Holdings Corporation;Investor, RIST Neurovascular, Inc;Investor, Sense Diagnostics LLC ;Consultant, Serenity Medical Inc;Advisory Board, Serenity Medical Inc;Investor, Serenity Medical Inc;Consultant, Siemens AG;Advisory Board, Siemens AG;Consultant, Silk Road Medical;Advisory Board, Silk Road Medical;Investor, Silk Road Medical;Investor, Spinnaker Medical Consultants ;Consultant, StimMed;Advisory Board, StimMed;Investor, StimMed;Investor, Synchron AB;Investor, Truvic Medical, Inc;Investor, Vastrax , LLC;Investor, VICIS;Investor, Viseon Inc;Consultant, Viz.ai Inc;Advisory Board, Viz.ai Inc;Investor, Viz.ai Inc;Consultant, Medtronic plc;Advisory Board, Medtronic plc;Committee member, Medtronic plc;Consultant, Terumo Corporation;Advisory Board, Terumo Corporation;Committee member, Terumo Corporation;Consultant, Minnetronix Medical, Inc;Advisory Board, Minnetronix Medical, Inc;Consultant, Penumbra, Inc;Advisory Board, Penumbra, Inc;Committee member, Penumbra, Inc;Consultant, Rapid Medical;Advisory Board, Rapid Medical;Consultant, Stryker Corporation;Advisory Board, Stryker Corporation;Consultant, VasSol, Inc;Advisory Board, VasSol, Inc;Consultant, W. L. Gore & Associates, Inc;Advisory Board, W. L. Gore & Associates, Inc
Ahmad Rahmatpour, PhD (*Abstract Co-Author*) Nothing to Disclose
Swetadri Vasan Setlur Nagesh, MS, PhD (*Abstract Co-Author*) Nothing to Disclose
Mohammad Mahdi Shiraz Bhurwani, PhD (*Abstract Co-Author*) Stockholder, qas.ai
Kyle Williams, BS (*Abstract Co-Author*) Nothing to Disclose
Parmita Mondal, PhD (*Abstract Co-Author*) Nothing to Disclose
Parisa Naghdi, PhD (*Presenter*) Nothing to Disclose

## PURPOSE

This study investigates whether treatment failures in intracranial aneurysms (IAs) are linked to hemodynamic changes, evidenced by angiographic parametric imaging (API) from digital subtraction angiography (DSA). It also examines the impact of specific patient characteristics, identified in preclinical studies as vital to treatment outcomes. Employing a multimodal machine learning approach that combines deep learning with API and extensive patient data, we seek to improve the prognosis and predictability of treatment efficacy.

## METHODS AND MATERIALS

Data from 340 patients with treated IAs were analyzed, incorporating API parameters from DSA scans. We employed a dual normalization process on API data to control for variability in arterial input and pre-treatment conditions. This dataset was initially analyzed to assess quantitative angiographic parameters at the aneurysm dome, with outcomes recorded at 6 months post-treatment, determining whether the IA remained occluded, required retreatment, or needed continued observation. Further analysis included categorical information about IA location within the carotid segments and IA size. Additional patient characteristics such as age, gender, race, presence of subarachnoid hemorrhage, medication, hypertension, BMI, smoking history, and family history of IA were also included. A deep neural network (DNN) was trained on these data and evaluated using metrics like area under the ROC curve, sensitivity, and specificity, employing a 20-split Monte Carlo cross-validation.

## RESULTS

The integration of biomarkers and API parameters into our DNN significantly improved model performance. Using API parameters alone yielded an AUC of 0.74 (±0.4), with sensitivity at 72% (±2%) and specificity at 75% (±4%). Adding morphological parameters to API parameters modestly increased the AUC to 0.76 (±0.5), maintaining sensitivity at 72% (±2%) and increasing specificity to 76% (±4%). The combination of API parameters and full morphological parameters further improved the AUC to 0.80 (±0.5), with sensitivity rising to 76% (±2%) and specificity to 79% (±4%).

## CONCLUSION

This study validates the practicality of using DNN for predicting retreatment in aneurysm patients. While incorporating biomarkers enhance the precision of treatment predictions, adding excessive features does not improve sensitivity significantly, suggesting a need for careful selection of relevant biomarkers.

## CLINICAL RELEVANCE/APPLICATION

This study demonstrates the utility of DNNs in predicting retreatment for intracranial aneurysm patients. Integrating API data and patient-specific characteristics, our model enhances predictability of aneurysm outcomes, offering the potential for more personalized treatment strategies.

## W5B-SPPH-6 FROM HEPATIC LESION DIAMETER MEASUREMENTS TO VOLUMETRY: OBTAINING CONSISTENT ACCURACY USING DUAL ENERGY CT, INTELLIGENT AUTO-SEGMENTATION, AND MANUAL INTERVENTION

Christina M. Lee, BS,ARRT (*Abstract Co-Author*) Nothing to Disclose
Emi Eastman, BA (*Abstract Co-Author*) Nothing to Disclose
Yifang Zhou, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Focal hepatic lesions are currently evaluated using diameters with RECIST criteria. Although lesion volumetry is expected to be a better measure due to its more comprehensive spatial scope, the accuracy can be compromised by the uncertainty of three-dimensional segmentations. We hypothesized that the measurement accuracy can be significantly improved with the following approaches: dual energy CT for contrast enhancement, newer segmentation algorithms with built-in artificial intelligence, and manual intervention for necessary correction. We aimed to apply these approaches to find the volume and diameter measurement accuracies in a multi-phase environment.

### METHODS AND MATERIALS

An anthropomorphic liver phantom was custom made with composition substitutes consistent with ICRU report 44. To simulate the early arterial, late arterial, and portal venous phases, iodine of different concentrations (0, 0.68, and 1.89 mg/cc, with HU = 50, 65, and 88 at 80 keV) was perfused to three consecutive slabs. Iodinated lesions were placed with various shapes (spherical, ellipsoidal, and lobular), concentrations (0.05- 2.31 mg/cc), and sizes (0.09-8.57 cc, 10-35 mm). Repeated dual energy acquisitions were made using a GE Revolution CT (CT dose index CTDIvol =14 mGy, slice width=2.5 mm). Lengths in the longer dimension > 10 mm (diameters) and volumes > 0.5 cc were independently measured at 50- 100 keV by three investigators with an intelligent 3-D auto-segmentation tool (intelligent VCAR) from GE AW-3.2. Careful manual corrections were made. A figure-of-merit incorporating the volume measurement consistency and accuracy was used to obtain the optimal keV.

### RESULTS

The linear dimension (diameter) measurements were not found sensitive to keV variation and did not suggest a single optimal keV. The results showed root-mean-square (RMS) errors of 6.98% and 7.44%, at 75 keV and 100 keV, respectively. For volume measurements, optimal virtual monochromatic energies were found at 65 and 60 keV for the early arterial, and late arterial and venous phases, respectively. The RMS error was 8.51%.

### CONCLUSION

With optimal keV selection from dual energy and careful volume contouring combining intelligent auto-segmentation and necessary manual correction, the hepatic lesion volumetry was found to be nearly as accurate as the diameter measurements.

### CLINICAL RELEVANCE/APPLICATION

Liver lesion quantification.

## W5B-SPPH-7 BIAS REDUCTION IN 2D QUANTITATIVE ANGIOGRAPHY USING A COMBINATION OF FORESHORTENING AND INJECTION VARIABILITY CORRECTION: IN-SILICO STUDY

Ciprian N. Ionita, PhD (*Abstract Co-Author*) CEO, QAS.AI;Grant, Canon Medical Systems Corporation
Ahmad Rahmatpour, PhD (*Abstract Co-Author*) Nothing to Disclose
Parisa Naghdi, PhD (*Abstract Co-Author*) Nothing to Disclose
Allison Shields, PHD (*Abstract Co-Author*) Research Grant, Canon Medical Systems Corporation
Adnan Siddiqui, MD,PhD (*Abstract Co-Author*) Investor, Shifamed LLC;Consultant, Alexion Pharmaceuticals, Inc;Advisory Board, Alexion Pharmaceuticals, Inc;Consultant, Amnis Therapeutics;Advisory Board, Amnis Therapeutics;Investor, Amnis Therapeutics;Investor, Bendit Technologies, Ltd;Investor, Blinktbi Inc ;Consultant, Boston Scientific Corporation;Advisory Board, Boston Scientific Corporation;Investor, Boston Scientific Corporation;Investor, Buffalo Technology Partners, Inc;Consultant, Canon Medical Systems Corporation;Advisory Board, Canon Medical Systems Corporation;Consultant, Cardinal Health, Inc;Advisory Board, Cardinal Health, Inc;Investor, Cardinal Health, Inc;Consultant, Cerebrotech Medical Systems, Inc;Advisory Board, Cerebrotech Medical Systems, Inc;Investor, Cerebrotech Medical Systems, Inc;Investor, Cognition Medical;Consultant, Endostream Medical, Ltd;Advisory Board, Endostream Medical, Ltd;Investor, Endostream Medical, Ltd;Consultant, Imperative Care, Inc;Advisory Board, Imperative Care, Inc;Investor, Imperative Care, Inc;Investor, Instylla, Inc;Consultant, IRRAS AB;Advisory Board, IRRAS AB;Investor, IRRAS AB;Consultant, Johnson & Johnson;Advisory Board, Johnson & Johnson;Committee member, Johnson & Johnson;Investor, NeuroRadial Technologies, Inc;Investor, Neurovascular Diagnostics, Inc;Consultant, Perflow Medical Ltd;Advisory Board, Perflow Medical Ltd;Investor, Perflow Medical Ltd;Consultant, Q'Apel Medical Inc;Advisory Board, Q'Apel Medical Inc;Investor, Q'Apel Medical Inc;Investor, Radical Catheter Technologies, Inc;Consultant, Integra LifeSciences Holdings Corporation;Advisory Board, Integra LifeSciences Holdings Corporation;Investor, Integra LifeSciences Holdings Corporation;Investor, RIST Neurovascular, Inc;Investor, Sense Diagnostics LLC ;Consultant, Serenity Medical Inc;Advisory Board, Serenity Medical Inc;Investor, Serenity Medical Inc;Consultant, Siemens AG;Advisory Board, Siemens AG;Consultant, Silk Road Medical;Advisory Board, Silk Road Medical;Investor, Silk Road Medical;Investor, Spinnaker Medical Consultants ;Consultant, StimMed;Advisory Board, StimMed;Investor, StimMed;Investor, Synchron AB;Investor, Truvic Medical, Inc;Investor, Vastrax , LLC;Investor, VICIS;Investor, Viseon Inc;Consultant, Viz.ai Inc;Advisory Board, Viz.ai Inc;Investor, Viz.ai Inc;Consultant, Medtronic plc;Advisory Board, Medtronic plc;Committee member, Medtronic plc;Consultant, Terumo Corporation;Advisory Board, Terumo Corporation;Committee member, Terumo Corporation;Consultant, Minnetronix Medical, Inc;Advisory Board, Minnetronix Medical, Inc;Consultant, Penumbra, Inc;Advisory Board, Penumbra, Inc;Committee member, Penumbra, Inc;Consultant, Rapid Medical;Advisory Board, Rapid Medical;Consultant, Stryker Corporation;Advisory Board, Stryker Corporation;Consultant, VasSol, Inc;Advisory Board, VasSol, Inc;Consultant, W. L. Gore & Associates, Inc;Advisory Board, W. L. Gore & Associates, Inc
Swetadri Vasan Setlur Nagesh, MS, PhD (*Abstract Co-Author*) Nothing to Disclose
Mohammad Mahdi Shiraz Bhurwani, PhD (*Abstract Co-Author*) Stockholder, qas.ai
Kyle Williams, BS (*Abstract Co-Author*) Nothing to Disclose
Parmita Mondal, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

The purpose of this study is to enhance the accuracy of 2D Quantitative Angiography (QA) for applications in neurovascular interventions. By addressing biases such as projection-induced foreshortening and variability in contrast injection, this study aims to improve the reliability of QA used for diagnosing disease severity.

### METHODS AND MATERIALS

We employed Computational Fluid Dynamics (CFD) to create 3D virtual angiograms for three distinct aneurysm geometries, testing three inflow velocities (25 cm/sec, 35 cm/sec, and 45 cm/sec) and three contrast injection durations (0.5, 1.0, and 1.5 seconds) to simulate various angiographical conditions. To mitigate the bias from the tortuosity of neurovascular architecture in DSA pixel intensity, a path-length correction algorithm was developed. This involved employing ray-casting techniques to accurately trace the paths of X-rays through the vascular structures within the 3D model, from their origin to their intersection with the vascular geometry. These traced paths were used to correct the 2D DSA projections, thus compensating for foreshortening

biases and enhancing the accuracy of the resulting images. Time-density curves (TDCs) were generated for both the inlet and the aneurysm dome of the path-length corrected virtual angiograms. Variants of Single Value Decomposition (SVD)—including standard SVD (sSVD) with classical Tikhonov regularization, block-circulant SVD (bSVD), and oscillation index SVD (oSVD)—were applied to these TDCs to calculate impulse response functions (IRF). QA metrics such as Peak Height (PH_IRF), Area Under the Curve (AUC_IRF), and Mean Transit Time (MTT) were evaluated. Notably, we used the slope of MTT versus injection duration as a critical metric for data analysis, as MTT in the aneurysm, should remain consistent regardless of injection duration.

**RESULTS**

Path length correction and deconvolution significantly reduce the dependence of QA parameters on injection duration. Without correction, the average slope of MTT vs injection duration was 0.573, but with path-length correction and application of sSVD, bSVD, and oSVD, the slopes improved to 0.01, 0.029, and 0.019, respectively, demonstrating a substantial enhancement in measurement precision.

**CONCLUSION**

The integration of path-length correction and SVD-based deconvolution techniques effectively reduces foreshortening and injection variability in QA parameters, thereby enhancing the diagnostic capabilities of 2D QA.

**CLINICAL RELEVANCE/APPLICATION**

Using a combined method of SVD and path length correction in QA analysis removes the impact of injection variability and foreshortening error, thus resulting in pristine data. The pristine data may be valuable for improving neurovascular treatment prognosis.

## W5B-SPPH-9 EFFECTS OF RADIATION DOSE AND CALCIUM CONCENTRATION ON THE ACCURACY OF CALCIUM QUANTIFICATION USING DEEP LEARNING IMAGE RECONSTRUCTION IN DUAL-ENERGY SPECTRAL CT: A CALCIUM PHANTOM STUDY

Jianxin Guo (*Abstract Co-Author*) Nothing to Disclose
Jianying Li, PhD (*Abstract Co-Author*) Employee, General Electric Company
Le Cao (*Presenter*) Nothing to Disclose

**PURPOSE**

To investigate the accuracy of calcium quantification in dual-energy CT (DECT) with deep learning image reconstruction (DLIR) at different radiation dose levels and calcium concentrations.

**METHODS AND MATERIALS**

A DECT quality control phantom simulating adult abdomen (Multi-Energy CT Quality Assurance Phantom; GPH-75B, Science in Kyoto) with three calcium inserts (100, 200, 300 mgCa/ml) was imaged using DECT mode. Scans were repeated 5 times at CT dose index (CTDIvol) levels of 4, 7, 10, 14mGy. Images were reconstructed using 50% adaptive statistical iterative reconstruction (ASIR-V) (ASIR-V50%) and DLIR at low (DLIR-L), medium (DLIR-M) and high (DLIR-H) settings. Calcium concentrations were measured. The coefficient of variation (CV) of calcium concentration was calculated as CV = standard deviation/ mean of the calcium concentrations *100%. The differences in calcium concentration and CV among different reconstructions were compared.

**RESULTS**

For the same calcium insert, the calcium quantification accuracy increased, and CV decreased with the increase of radiation dose. The decrease in CV was more obvious in high calcium concentration than in low calcium concentration. The calcium quantification did not differ significantly among reconstructions. The CV of the 100mgCa/ml calcium was significantly higher than that of the 200 and 300mgCa/ml calcium. With the increase of radiation dose, CV decreased significantly, and the difference was more obvious at low concentration. The CV values on ASIR-V50% images at 4, 7, 10, 14mGy were 10.20%, 7.64%, 8.12%, 7.88% for the 100mgCa/ml, 9.88%, 5.56%, 4.25%, 4.36% for the 200mgCa/ml, and 3.27%, 3.19%, 2.71%, 3.15% for the 300mgCa/ml calcium inserts, respectively. DLIR algorithms significantly reduced the measurement variability. At 4mGy, the CV values for the 100, 200, 300mgCa/ml calcium inserts (4.53%, 5.18%, 2.34%) were the lowest on DLIR-H images, and highest (10.20%, 9.88%, 3.27%) on ASIR-V50% images. $P<0.001$.

**CONCLUSION**

The calcium quantification accuracy increased with the increase of radiation dose, DLIR significantly reduces the image variability of calcium quantification.

**CLINICAL RELEVANCE/APPLICATION**

Deep learning image reconstruction to improve accuracy of calcium quantification.

# Abstract Archives of the RSNA, 2024

W5B-SPRO

**Radiation Oncology Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-SPRO-1 ENHANCED-MRI SYNTHESIS FROM PLAIN SCAN USING A TUMOR GUIDED IMAGE SYNTHESIS NETWORK

Xiaowu Deng (*Abstract Co-Author*) Nothing to Disclose
Yutao Tang (*Abstract Co-Author*) Nothing to Disclose
Bin Wang (*Abstract Co-Author*) Nothing to Disclose
Yao Lu, PhD (*Presenter*) Nothing to Disclose

### PURPOSE

Accurately identifying and segmenting brain tumors from medical images is important for diagnosis and treatment planning, and doctors often require multimodal MR Images or contrast-enhanced T1 images. Currently, patients are required to inject GBCA daily in magnetic resonance guided Adaptive radiotherapy (MRgART), and clinicians need to consider the safety of the patient's contrast agent and the patient's own tolerance. Therefore, synthesizing contrast-enhanced T1 images has the potential to alleviate this problem and assist physicians to better identify and segment brain tumors.

### METHODS AND MATERIALS

However, the existing methods often only consider from the perspective of synthetic images, and do not pay extra attention to the synthesis effect of tumor regions, resulting in unsatisfactory results. We propose a novel tumor-guided Image Synthesis network (TGSNet) that can efficiently obtain synthetic target images of end-to-end brain tumors, and can combine learning contrast enhancement image synthesis and tumor segmentation.

### RESULTS

The experimental results show that in this task of the tumor-guided Image Synthesis network in this study, Peak signal-to-noise ratio(PSNR) and Structural Similarity(SSIM) indexes increase from 28.69 and 0.904 to 31.11 and 0.946 respectively, and MAE indexes decrease from 0.102 to 0.075. The PSNR and SSIM indexes of tumor region in synthetic images increased from 23.65 and 0.652 to 24.05 and 0.708, respectively, and the MAE index decreased from 0.813 to 0.719.Image quality has been improved to a large extent. Based on the contour of T1c image, the average DSC values of GTV-T1w and GTV-synT1c are 0.752 and 0.792, respectively ($P<0.01$). Statistical analysis showed that the mean DSC of the target mapped based on synT1c was significantly higher than that of T1w.

### CONCLUSION

Compared to existing studies, this approach highlights the challenges of tumor regions in synthesis and optimizes their performance on synthetic images through tumor-guided knowledge integration. The experimental results show that compared with the existing synthetic network model, our TGSNet greatly improves the recognition rate of tumors, improves the accuracy of segmentation, and forms a more advanced image synthesis method in this task.

### CLINICAL RELEVANCE/APPLICATION

Contrast-enhanced MRI (CE-MRI) plays a very important role in the diagnosis of brain tumors and is the primary reference image for brain tumor diagnosis. Due to the current demand for daily GBCA injections in magnetic resonance guided Adaptive radiotherapy (MRgART), clinicians need to consider both the safety of the contrast agent and the patient's own tolerance. Therefore, this study can provide CE-MRI without contrast agent to alleviate this clinical problem.

# Abstract Archives of the RSNA, 2024

M2-QI

**Quality Improvement Reports Monday Morning Poster Discussions**

Monday, Dec. 2 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## M2-QI-1 MRI SAFETY FMECA: ENGINEERING OUT LATENT SAFETY THREATS ON AN ENTERPRISE SCALE

Sean B. Reiter, MD (*Abstract Co-Author*) Nothing to Disclose
Leann M. Kania, MD (*Abstract Co-Author*) Nothing to Disclose
Haresh V. Naringrekar, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher G. Roth, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Shuchi K. Rodgers, MD (*Presenter*) Royalties, RELX

### INTRODUCTION

According to 10 years of data reported to the FDA, there is approximately 1 safety event for every 300 MRI studies, 1 projectile event resulting in injury each month and 1 MRI-related death annually. Our enterprise experience echoed that data, underscoring the need to take action.

### METHODS

The MRI safety incidents across the enterprise for the past 2 years were reviewed to assess the magnitude of the problem and identify potential trends by the chair of the enterprise quality and safety council. Serious safety events were quantified to use as a key performance indicator. A steering committee was convened and a project charter created outlining the operational leaders, the project scope, the timeline and process and outcome metrics. Process maps were created to plan for site visits to observed the work as performed at the main hospitals in each of the enterprise divisions. Failure modes were identified and prioritized and a safe table was convened to brainstorm potential solutions. Solutions were ranked top solutions were slated for implementation.

### RESULTS

The top failure mode solutions were to optimize the MRI screening process, universally deploy and standardize the use of ferromagnetic detectors (FMDs) and minimize the utilization of unnecessary multipart MRI studies. An MRI safety task force including technologists, IT staff, nursing and physicians was convened to streamline the MRI screening form and process leading to a consolidation of screening form questions and an alignment with scope of practice. A capital request was submitted to acquire and replace FMDs and the MRI safety task force was tasked with creating a standardized workflow for their use. An EHR popup window was engineered to fire when duplicative MRI studies were ordered and the enterprise pathways and protocols council is working on a spine imaging algorithm to guide ordering practices. Enterprise MRI serious events dropped from 4 to 0 from pre- to post-FMECA completion. MRI near miss and no-harm incidents were also collected and reviewed.

### DISCUSSION

MRI safety incidents are often low-frequency, high-acuity events and demand process optimization to prevent. This requires detailed ethnographic assessment of existing processes and reengineering the process by identifying failure modes and promulgating and implementing solutions. Engineering the MRI process in this way prevents the potential for human error to lead to patient and/or staff harm.

## M2-QI-2 INCREASING USAGE OF PEDIATRIC PROTOCOLS AND LOWERING PEDIATRIC CT DOSE THROUGH AN IMPROVED PROTOCOLLING INTERFACE AND STAFF EDUCATION

Amita Sharma, MBBS (*Abstract Co-Author*) Nothing to Disclose
Bob Liu, PhD (*Abstract Co-Author*) Nothing to Disclose
Kai Yang, PhD (*Abstract Co-Author*) Research Consultant, Malcova, LLC.
Xinhua Li, PhD (*Abstract Co-Author*) Employee, MorphoSys AG ;Employee, Elevation Oncology
Cristy Savage, MS, RT (*Abstract Co-Author*) Nothing to Disclose
Theodore Marschall, PhD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Our institution monitors doses for CT exams and compares nationally with ACR Dose Index Registry (DIR) as part of our radiation safety program. Given concerns about radiosensitivity in children, we aim to use CT protocols designed for pediatric populations whenever possible. Our median doses for pediatric exams were usually below the median for all DIR facilities, but doses for abdomen/pelvis examinations for the 11-14 and 15-18 age groups were often higher. This project aimed to determine the factors leading to higher doses for pediatric abdomen/pelvis CT examinations in 11-18-year-olds and ultimately achieve median doses at or below the national median.

### METHODS

We initially collected data from 1 year (2022) for all routine pediatric abdomen/pelvis CT exams from 14 CT scanners across six facilities submitted to the DIR. Our local dose monitoring software (Bayer Radimetrics) was used to obtain patient data and exam info. We identified a significant portion of exams

for patients aged 11-18 performed using adult rather than pediatric protocols and identified three potential reasons and interventions. 1) A "Pediatric Protocol" header from the protocoling interface appeared for exams in the Pediatric Radiology division but not from other divisions, notably the ED. The software was changed to add the header to all CT exams for patients under 19. 2) Technologists may have chosen an adult protocol for larger pediatric patients due to their size, so they were instructed to use pediatric protocols for all patients under 19. 3) Residents or fellows protocoling may not have specified a pediatric protocol or, in rarer cases, specified an adult dose, so we implemented a follow-up with radiologists for cases where a pediatric protocol was overridden. Our measures for improvement were the percentage of exams using pediatric protocols and the total dose length product (DLP), which is used by the DIR and is readily comparable for single or multiphase exams. Trends in these measures were examined over several years.

**RESULTS**

Patient weight and exam protocol were the two factors most closely correlated with higher doses. Adult protocols were found to be more frequently used for larger patients, with an average patient weight of 73.7 kg for adult protocols versus 58.7 kg for pediatric protocols (p=6e-15). For the two years prior to the intervention, the percentage of CT exams performed on 11-18-year-olds using adult protocols was 46%, and in the following year, this was reduced significantly to 16% (p=2e-17). The mean DLP was also reduced from 480 to 374 mGy.cm after intervention (p=0.0002).

**DISCUSSION**

Limitations of this study include a lack of granular knowledge of the imaging situation leading to each choice of protocol. It is important to balance dose considerations with image quality, so our follow-up with radiologists provides opportunity to address image quality concerns.

## M2-QI-3 IMPROVING CT SCANS DELAYS FOR ED PATIENTS DURING NURSING HANDOVER

Farah Majeed, MD (*Abstract Co-Author*) Nothing to Disclose
Sam T. Beardsmore-Rust, MBBS,PhD (*Abstract Co-Author*) Nothing to Disclose
Stephen Perrio, MBBS (*Abstract Co-Author*) Nothing to Disclose
Jasmin Panesar, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Staff in the radiology department have observed persistent delays in transferring patients from the emergency department (ED) to the CT scanning unit at our UK local district general hospital, specifically during evening nursing handover when patient escorts are often necessary. This delay creates a backlog of CT scans after handover, leading to longer ED wait times, inefficient CT resource utilization, and extended shifts for on-call radiologists to report urgent scans. The aim of our study was to corroborate these delays and propose potential solutions to address them. By doing so, we aim to streamline ED workflow, enhance efficiency for radiology staff (including radiographers and reporting radiologists), and ultimately improve patient care.

**METHODS**

This retrospective review was conducted at a single site, focusing on data collected in 15-minute intervals during a 24-hour period from January 1st, 2023, to January 1st, 2024. The intervention involved implementing a twilight nurse to facilitate and optimize patient transport from the emergency department (ED) to the CT scanning unit, as well as several other staff rota changes during handover times (19.45-20.15). Following this change, a second cycle of data collection took place from April 15th to April 29th, 2024. Analysis of all collected data was performed using Microsoft Excel.

**RESULTS**

During the first cycle, analysis revealed a notable 40% decrease in CT scans conducted during the designated ED nursing handover period (19:45-20:15) compared to the preceding 30-minute interval (19:15-19:45). Additionally, there was a significant 62% surge in CT scans performed immediately after the handover concluded, between 20:15 and 20:45.In the second cycle, after implementing a number of rota changes there was an improvement in the number of scans performed during handover with a corresponding reduction in patient delays in the emergency department.

**DISCUSSION**

The findings thus far confirm a delay in CT scans during ED nursing handover, with the introduction of a twilight nurse and changes to other staff rotas emerging as practical and cost-effective solution to enhance ED-CT workflow. Following the intervention, there is a noteworthy 31.3% improvement of CT scans performed during the handover period, and a subsequent significant reduction in the number of scans delayed and then conducted within the 30 minutes following handover. The main limitation of this review is the relatively short duration of data collection for the second cycle; however, this project is ongoing, with plans to assess the impact over a one-year period. Whilst this study is conducted at a single site, the issues identified and proposed solutions hold potential for broader applicability, given the common occurrence of ED delays.

## M2-QI-4 ENHANCING RADIOLOGY REPORTING ACCURACY WITH AI DRIVEN ERROR DETECTION

Miguel Angarita, MD (*Abstract Co-Author*) Nothing to Disclose
Felipe Mendez, MD (*Abstract Co-Author*) Nothing to Disclose
Lina Maria Acosta Buitrago, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

The US healthcare system grapples with high costs and suboptimal outcomes, with inefficiencies in radiology reporting being a significant contributing factor. Despite the integration of voice recognition technology, preventable errors persist, leading to addendums, potential patient care delays, and increased healthcare expenditure. To address this, we present an innovative AI-powered solution designed to dynamically identify and rectify errors within radiology reports before finalization, promoting accuracy and efficiency.

**METHODS**

Our solution leverages a ChatGPT model, specifically fine-tuned on a comprehensive dataset encompassing 25 common reporting errors. These errors range from simple laterality mistakes to complex misinterpretations, ensuring a wide scope of detection. The system seamlessly integrates with existing web-based RIS/PACS systems through an API, dynamically extracting and analyzing the plain text of each report. Upon analysis, the model identifies potential errors and provides tailored suggestions for correction, all while maintaining patient privacy by refraining from storing any report data. Each identified error is categorized and logged for ongoing statistical analysis, facilitating continuous model improvement and refinement.

**RESULTS**

Initial results demonstrate the efficacy of our AI-driven approach, with the model successfully detecting up to 30% of errors spanning a range of severities. While large language models have demonstrated similar capabilities, they often incur substantial computational costs and latency issues. Our solution utilizes smaller, open-source models that, when fine-tuned, achieve comparable performance at a fraction of the cost and complexity. This affordability and efficiency broaden accessibility, even within resource-constrained environments.

### DISCUSSION

This AI-powered error detection system holds immense potential to revolutionize radiology reporting by enhancing both quality and efficiency. By proactively identifying and correcting errors prior to report finalization, we can minimize the need for addendums, expedite report turnaround times, and ultimately elevate the standard of patient care. Future research endeavors will concentrate on expanding the breadth of error detection capabilities, refining model performance, and exploring seamless integration with other healthcare workflows. Furthermore, we envision expanding the capabilities of this AI model to encompass a broader range of checks within the radiology report. This includes identifying textual inconsistencies, grammatical errors, and potential medical inconsistencies based on the presented information.

## M2-QI-5 IMPROVING TIME-OUT COMPLIANCE

Gaurav V. Watane, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Loren Cicero (*Abstract Co-Author*) Nothing to Disclose
Michael P. Spearman, MD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey S. Mueller, MD (*Abstract Co-Author*) Nothing to Disclose
Warren Chang, MD, MBA (*Presenter*) Nothing to Disclose

### INTRODUCTION

Preprocedural timeout completion was either not performed or not documented properly which can potentially lead to errors such as wrong site, wrong patient, or wrong procedure. At our hospital, the timeout was reported to be performed in 84% of patients undergoing procedures in IR, CT, FL, US, Mammography, or MRI. The purpose of the project was to increase timeout completion and proper documentation to 100%.

### METHODS

Context and Intervention: Retrain and reeducate all parties involved in performing and documenting preprocedural timeout (including redistribution of related company policies and procedures). Identify workflow issues in each procedural area. Creation of visual controls to post in procedural areas. Review timeout compliance report pulling information properly in EHR. Study of the Intervention: Responsible, Accountable, Consulted, and Informed (RACI) Matrix utilized to identify the following parties involved in timeout compliance; responsible, consulted, informed, and accountable. EHR timeout compliance report pulled monthly for review.Measures/Metrics: Report pulled from EHR system to show monthly compliance percentage for each procedural imaging department/location, as well as each providers individual compliance.Analysis: A quantitative reporting system was used to collect the data. A qualitative approach was used to retrain, reeducate, and improve workflows completed by staff from August 2022 through October 2022. The data was collected and reviewed from January 2022 through November 2022; with an average of 84% timeout compliance rate from January-August 2022.

### RESULTS

November 2022 the timeout compliance rate was 98%; a 14% improvement from the January-August 2022 average of 84%. Implemented solutions included: (1) Staff education/training. (2) Monthly review of timeout compliance report. (3) Documented explanation provided for any non-compliant timeout. (4) Review non-compliance with individual in charge of documenting timeout to provide additional education.

### DISCUSSION

Overall, this was a successful project that improved hospital imaging department procedural timeout compliance, ultimately increasing patient safety and decreasing room for error. Reporting will need to continue to be reviewed monthly to ensure compliance does not fall off track, and to ensure if/when compliance is less than 100%, proper investigation and documentation occurs.

## M2-QI-7 CT SHOULDER: USING PDSA CYCLE IN REDUCING RADIATION DOSE AND MOTION ARTIFACTS

Xueci Lee (*Abstract Co-Author*) Nothing to Disclose
Bryan Choo (*Abstract Co-Author*) Nothing to Disclose
Shi Yun Teo (*Abstract Co-Author*) Nothing to Disclose
Mei Choo Chong (*Abstract Co-Author*) Nothing to Disclose
Nurarini Anwar, BSc (*Presenter*) Nothing to Disclose

### INTRODUCTION

Computed Tomography (CT) is a key modality for detailed anatomical visualization and preoperative planning, especially in the shoulder. Our hospital practices CT shoulder scans using helical scan mode and fixed tube current (mA) technique, resulting in higher radiation dose and motion artifact. A team consisting of radiographers and a musculoskeletal (MSK) radiologist was formed to strategize in reducing motion artifacts and effective dose (ED) by 40%.

### METHODS

This QI project was conducted in a radiology department in a tertiary hospital from January 2020 to Dec 2023. A total of 4 "Plan-Do-Study-Act (PDSA)" cycles were carried out while closely monitoring the image quality in achieving the best protocol to adopt.Radiation dose information retrieved were dose length product (DLP) and computed tomography dose index (CTDI). Effective dose (ED) was calculated using formula: k-factor of chest x DLP.1st PDSA cycle, breathing instructions were given to mitigate motion artifacts. A sample size of 5 was used. While artifacts reduced, radiation dose remained high. Volume scan mode was introduced in the 2nd cycle. At 0.75 second a scan, it eliminated the need for breathing instructions. However, the dose reduction was not significant.In the 3rd cycle, the CT scanner application specialist was consulted and introduced automatic tube current modulation (ATCM). This method reduces the tube current in regions of lower attenuation while maintaining an acceptable level of image noise, thus improving radiation dose efficiency. ATCM was tested in helical scan mode.In the 4th cycle, volume scan mode combined with ATCM further reduced radiation dose while maintaining image quality. 2 standard deviation (SD) technique were explored. Two independent radiologists rated the image quality of the fixed and modulated mA qualitatively and quantitatively using a five-point scale. Signal-to-noise ratio (SNR) also measured. The image quality defined in five criteria was analyzed using Chi-squared test. The CT scanners were updated to the desired shoulder protocol and utilized. The image quality and radiation dose indicators were closely monitored and audited by the team.

### RESULTS

The effective dose successfully reduced by 87.9% with minimization of breathing artifact. There was no significant difference in subjective image quality between ATCM and fixed mA in presence of artifact, noise and diagnostic acceptability. However, there is significant difference for sharpness and confidence in diagnosis at SD of 7.5. There was also no significant difference in SNR for inter and intra comparison of fixed and modulated mA.

### DISCUSSION

Volume scan mode with mA modulation is an effective technique for reducing radiation dose in CT shoulder imaging without compromising the diagnostic quality. Higher radiation dose does not necessarily warrant a good quality scan.

## M2-QI-8 REDUCING REDUNDANCY IN IMAGING FOR PATIENTS AND AUTOMATING VETTING: A DATA VISUALISATION SOLUTION BASED ON DATA WITHIN ELECTRONIC MEDICAL RECORDS

James Hallinan, MBChB (*Abstract Co-Author*) Nothing to Disclose
Andrew Makmur, MD (*Abstract Co-Author*) Nothing to Disclose
Desmond Lim Shi Wei, MBBS, FRCR (*Presenter*) Nothing to Disclose

### INTRODUCTION

In the era of sub-specialised patient care, different specialists may order imaging studies with overlapping anatomical coverage and similar diagnostic value thus creating redundancy. For e.g. a patient scheduled for an MRI liver and ultrasound of the hepatobiliary system within 1 month of each other.An internal audit over 20 months showed 211 redundant requests for CT scans in our tertiary healthcare institution. These requests were prevented but required disproportionate effort from technicians and radiologists.Redundant imaging should be prevented to minimise the risk of the patient to ionising radiation and contrast media. Furthermore, reducing redundant imaging relieves the workload on limited manpower to perform and interpret these scans.

### METHODS

We created a dashboard/visualisation tool of outpatient imaging requests based on the electronic medical records. The dashboard identifies patients with redundant imaging requests based on prior scans and incoming scan requests (mainly CT and MRI).In our institution, an average of 6500 CTs and 3600 MRIs are performed monthly in the outpatient setting. The dashboard allows us to automate part of the vetting process and thus reduce workload.The dashboard solution is built using an artificial intelligence-based analytics platform which receives EPIC-EMR data in real time hosted by our institution. The dashboard is an operational backend model consisting of Structured Query Language codes (SQL). As no external cloud software is required for data storage or training, patient privacy is preserved.

### RESULTS

The performance of the dashboard in identifying redundant imaging requests was compared against the radiologists.The dashboard had high negative predictive value of 99%, sensitivity and specificity of 91% and 95% respectively. The positive predictive value was 18%. Due to the high negative predictive value, the imaging requests excluded by the dashboard are no longer checked by the radiologist. We have experienced a reduction in serious reportable incidents pertaining to unnecessary radiation/investigation since the deployment of the dashboard.The use of this dashboard solution has reduced 90% of vetting time (previously 108 minutes per day). Preventing redundant CTs equates to cost savings of technician time amounting to $26,102 (USD) per year and cost savings in terms of CT Machine Utilization worth $97,064 (USD) (idle time cost avoidance). In terms of redundant MRI scans, the use of the dashboard has prevented 121 studies, equating to 4840mins (81 hours) of MRI scan time.

### DISCUSSION

Using this solution, our department has saved time/manpower in vetting imaging requests, saved considerable patient cost and reduced operational costs/workload. We are expanding the dashboard to also automate the checking of renal function, drug allergies, reactive airway disease and cross modality redundancy.

## M2-QI-9 TOTAL LEAD TIME REDUCTION FOR PLUVICTO TREATMENT PATIENTS

Kristi Rindels (*Presenter*) Nothing to Disclose

### INTRODUCTION

With the introduction of Pluvicto therapy in the nuclear medicine practice, there has been an increased need for access available for cancer patient treatments. Pluvicto therapy consists of six cycles of therapy, with the first cycle requiring a longer appointment duration. With current state lead times for cycle one appointments, there was limited room to add additional access in the schedule. The purpose of this project was to reduce the total lead time for cycle one Pluvicto therapy appointments, allowing for increased access to treat additional patients.

### METHODS

An improvement project team was formed including radiology leaders, nurses, nuclear medicine technologists, advanced practice providers, radiologists, and process improvement specialists. The team used the DMAIC (Define, Measure, Analyze, Improve, Control) framework to identify current gaps, measure current state, analyze root causes, and improve processes through tests of change (PDSAs). Current condition was obtained through value stream mapping, process observations and manual timings. Utilizing a fishbone diagram, the team brainstormed potential root causes leading to the increased lead times from appointment arrival to therapy completion. Based on root causes identified, a series of discussions were held to develop interventions to test with future cycle one patients. The interventions are being tested in a phased approach, with the first few phases completed. Continued interventions are currently being implemented and continued improvements are expected.

### RESULTS

The interventions brainstormed and tested were aimed to address the root causes of communication and handoff barriers, visual management barriers, and clarifications needed to address patient questions and concerns. The total lead time started at 164 minutes from check-in to therapy completion, for an appointment that has a scheduled duration of 120 minutes. Initial remeasurement, with interventions in place addressing visual management showed a decrease in total lead time of 22 minutes. We anticipate additional decreases in total lead time with the third and fourth rounds of PDSAs planned in the months of June and July. Overall final results will be available for final presentation.

### DISCUSSION

The evolution of theranostics in the nuclear medicine department shows a continued need for process improvement and efficiencies. Through the continued PDSAs that are planned over the next few months, the project team anticipates the ability to reduce the total lead time from check-in to completion of the therapy to below 120 minutes, which was our team goal. The team learned so many valuable lessons along the way, however the most influential part of the process was the collaboration and teamwork across many roles, coming together to deliver effective, efficient care to cancer patients.

# Abstract Archives of the RSNA, 2024

M5A-QI

**Quality Improvement Reports Monday Afternoon Poster Discussions I**

Monday, Dec. 2 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## M5A-QI-1 QUIET- QUALITY IMPROVEMENT EDUCATION (IN) TRAINING FOR RESIDENTS

Jonathan A. Flug, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Shina Zehnder, MD (*Abstract Co-Author*) Nothing to Disclose
Cathy Hannafin, MBA,BSN (*Abstract Co-Author*) Nothing to Disclose
Amelia Eyshoy (*Abstract Co-Author*) Nothing to Disclose
Lisa Ponce, RT (*Presenter*) Nothing to Disclose

### INTRODUCTION

The Accreditation Council for Graduate Medical Education (ACGME) requires residents to participate in activities related to safety event root cause analysis and action planning. Compliance is assessed through the ACGME Survey which demonstrated a downward trend in our program in 2021-2022. A project was initiated to improve the resident educational experience with regards to quality improvement (QI) and patient safety. The specific project aim was to improve the ACGME score of the question "Participation in safety event investigation and analysis" by 33%, from 75% to 100%, by 6/30/23, without adversely impacting the education and clinical care balance.

### METHODS

A team comprised of residents, residency leadership, and radiology quality staff used DMAIC (Define, Measure, Analyze, Improve, Control) improvement methodology. Using a fishbone diagram and the 5 Whys tool, key causes were identified and selected, including: No defined process to notify residents of patient safety event reviews, no clear record keeping of safety event participation, lack of education for the residents related to interpreting survey questions, completing safety event reports, and knowing what constitutes a safety event. Five interventions were selected. First-year residents joined the Rad Quality Committee, increasing the opportunity to review safety events. A MedHub log was created to track participation in safety event investigation. Safety event reporting education was provided to the residents and the onboarding curriculum. The ACGME survey lecture was updated to clarify survey questions. Finally, a multi-disciplinary RCA simulation event requiring action plan creation was held. Residents were surveyed before and after the educational initiatives, which showed a significant increase in confidence levels regarding safety event reporting and identification (Figure 1).

### RESULTS

22-23 ACGME survey results were 100% compliance, meeting the project aim (Figure 2). The balancing measure score remained at 100%. Residents were surveyed before and after the mock RCA. Survey results showed a 50% increase in the ability to identify system issues and a 44% increase in the ability to identify process improvement actions (Figure 3).

### DISCUSSION

The project addressed gaps that residents face regarding safety event reporting and limited opportunities to engage in event investigation during training. A positive outcome of the project was the restructuring of the onboarding process. Lessons learned during the project were that QI tools help to eliminate “blind spots” while working through the DMAIC process, increased frequency of project meetings maintains momentum and allows more members to engage, and simulation is an effective experience to overcome scheduling barriers. Our hope is that these trainees will be more comfortable reporting and actively engaging in QI early in their practice.

## M5A-QI-2 HOW WE FIGHT FOR HEALTH EQUITY. A NOVEL APPROACH TO MOBILE SCREENING AND PATIENT EDUCATION IN RURAL COMMUNITIES: MAMMOGRAPHY AND BEYOND

Gwendolyn M. Bryant-Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Daniela A. Ochoa, MD (*Abstract Co-Author*) Nothing to Disclose
Scott B. Harter, MD (*Abstract Co-Author*) Nothing to Disclose
Patrick Jennings, MD (*Abstract Co-Author*) Nothing to Disclose
Heta Ladumor, MD (*Abstract Co-Author*) Nothing to Disclose
Ronda Henry-Tillman, MD (*Abstract Co-Author*) Nothing to Disclose
Aditi Chaurasia, MBBS (*Abstract Co-Author*) Nothing to Disclose
Winson Chee (*Abstract Co-Author*) Nothing to Disclose
Giridhar Dasegowda, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Health disparities disproportionately affect the underserved population who have systematically experienced the geographic, racial, and socioeconomic barriers. The literature reflects the feasibility of mobile mammography for cancer screening. Our study evaluates the impact of multifaceted approach for cancer screening in rural communities with limited access to health care.

**METHODS**

With 41% of the population residing in rural areas, Arkansas's incidence and mortality rates for cancers are well above the national average. A phased collaborative care improvement model was implemented focused on counties with the lowest life expectancies (red counties) and underserved counties (pink counties) without permanent mammography facilities. A screening mobile mammography, MammoVan, was implemented with a team of a certified Mammography Quality Standards Act (MQSA) technologist, a technical assistant, fellowship trained breast radiologists, a multidisciplinary team of cancer physicians, and a navigation team that provide mammography at low or no cost through a state sponsored program. A phased approach was begun by involving the Mexican consulate and local primary and community centers to raise awareness and education for accessible screening. For the next phase in 2018, a colorectal cancer coordinator and team was introduced on the MammoVan to provide FIT tests to the patients aged 45 years or older or to those with a positive family history. For the next stage in 2022, we added lung cancer screening with the smoking cessation counselor who traveled on the MammoVan to provide education and referral for qualified patients for low dose CT scans. We obtained data from 2014-2022 on the screening trends including the number of screenings, retained follow up, racial/ethnic demographics and geographic location.

**RESULTS**

A total of 15,703 patients underwent screening mammography on the MammoVan between 2014-2022. The ethnic distribution for mammography is as follows: Black (28%), Hispanic (8%), Caucasian (61%) and others (3%). The graphical representation on yearly mammography with interventions has been represented in figure 1. The mammography screenings yielded in the diagnosis of 79 cancers (biopsy-proven). In addition to the screening mammography, the colorectal screening program identified 7773 referrals and 3979 screenings. The screenings yielded 418 positive FIT tests and diagnosed 59 malignancies. The lung cancer screening provided 441 smoking cessation interventions and referrals.

**DISCUSSION**

The implementation of the MammoVan through a multidisciplinary collaborative model to address rural health disparities for not only breast cancer screening but also colorectal screening and lung cancer education is a novel approach towards health equity.

## M5A-QI-3 TIME IS MONEY, SO IS "MEETING TIME": MEETING STRUCTURE PROCESS MAPPING AND ITS IMPACT ON ACADEMIC MEDICAL CENTRE - HOSPITAL SYSTEM

Dushyant Sahani, MD (*Abstract Co-Author*) Advisory Board, Koninklijke Philips NV;Advisory Board, Canon Medical Systems Corporation;Advisory Board, General Electric Company;
Sarabjeet Singh, MD, MBA (*Abstract Co-Author*) Research Grant, Siemens AG;Research Grant, Toshiba Corporation;Research Grant, General Electric Company;Research Grant, Koninklijke Philips NV
Karthika Devi D S, MBBS (*Abstract Co-Author*) Nothing to Disclose
Justin Deese, MBA (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Unnecessary meetings cost time, money as well as opportunity cost. On the other hand, meetings play an important role in decision making and collaboration. Finding the right balance of number of meetings as well as structure of the meetings becomes crucial, especially at executive/Vice-Chair level. The purpose of this study was to estimate time cost involved in meetings at the Vice-Chair level organized across the Academic Medical Center-Hospital System (AMC-HS).

**METHODS**

We retrospectively reviewed data from 2019 for our organization structure at AMC-HS, meetings organized, meeting attendees as well other relevant information available. We started by first creating a process map of meetings in 2019, including the committees, meeting attendees, time of meeting and frequency. We then prospectively reorganized the meeting structure gradually from 2019 to 2024, to reduce the executive committee size, stratify decision making at vice chair level, including operations, finance admin, quality safety, faculty affairs, education, research as well as EDI. We further estimated the hourly rate per attendees, based on salary range at vice-chair level. Meeting time, frequency and attendees was tabulated on Microsoft Excel and Microsoft Visio.

**RESULTS**

In 2019, highest level of meeting structure was the executive committee, which included 30 committee members and was meeting on monthly basis, see attached Figure 1. Finance and administration meetings included 5 attendees and on a weekly basis. Operational meetings occurred in person at each hospital site (University of Washington Medical Center [UWMC] {30 attendees}, Fred Hutch Cancer Center [FHCC] {15 attendees, 30 mins} Harborview Medical Center [HMC] {15 attendees}) on a weekly basis. Other meetings included education and research at Vice-Chair level, which were organized once a month with 20 25 attendees respectively. Total estimated cost of executive level meetings was $672,000 per year. Post reorganization, executive committee size reduced from 30 to 25, operations meetings became stratified and limited Vice-Chair level meetings to 8 attendees weekly with waterfall communication plans. Finance and administration, research, and education meetings remained largely the same. Vice-Chairs started meeting on monthly basis. The total cost of meetings was eventually reduced by 49% ($343,250/$672,000) per year in 2024.

**DISCUSSION**

Careful planning of meeting agendas, attendees and organizational structure help save time at the executive level. Furthermore, this time saving translated to an average saving of $102,750 per year and opening up executive time to reduce opportunity cost. Limitations for our study included inability to quantify productivity or engagement for meeting attendees. Future efforts to assess meetings productivity would include survey data to gauge meeting feedback.

## M5A-QI-4 IMPROVING RADIATION SAFETY COMPLIANCE AMONG RADIOLOGY RESIDENTS DURING FLUOROSCOPY PROCEDURES BY FACILITATING DOSIMETER ACCESS AND IMPLEMENTING A NOVEL PRE-PROCEDURAL SAFETY TIME OUT

Ali N. Harb, MD (*Abstract Co-Author*) Nothing to Disclose
Aniruddh Mannari, MD (*Abstract Co-Author*) Nothing to Disclose
Stephan Miller, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Ionizing radiation exposure during image-guided diagnostic and interventional procedures is an important occupational risk to operators and ancillary staff. Limited published studies have demonstrated the efficacy of protocol development to improve dosimeter compliance (Massey P et al., JBJS 2022). Currently, only 1 in 4 residents in our department wear dosimeters while working on procedural rotations. The purpose of our project was to increase compliance with wearing radiation dosimeter badges among radiology residents by 50% in one year.

### METHODS

This project was conducted in the radiology department of a large, urban, tertiary care academic medical center where dosimeter badges are provided in resident mailboxes, far from the procedural area. Resident survey showed the "lack of central accessibility" comprised 43% of responses. The target cohort is all resident physicians in the radiology residency program (n=40). We first relocated badges to a central workroom. Signage illustrating the proper use of the dosimetry badge was placed throughout the department. Notably, there were no other process improvement initiatives taking place, allowing us to attribute any changes to our interventions only. Compliance was measured during the intervention time frames. To address the issue of wearing dosimeters during fluoroscopic procedures, a pre-procedure dosimeter reminder was implemented after all residents had been made aware. The results of our interventions were evaluated using the Statistical Process Control (SPC) Chart with +/- 3 standard deviation control limits using standard parameters.

### RESULTS

Process control analysis shows that making dosimeters more easily accessible nominally increased compliance, with maximum compliance of 100% after 6 months. Subsequent implementation of the pre-procedural dosimeter checks corresponded to approximately 50% increased compliance with little variability in the system thereafter. This indicates that compliance with appropriately wearing personal dosimeter badges was optimized when we performed active pre-procedure checks of residents in the procedure room and they were easily available.

### DISCUSSION

Our interventions demonstrate that ease of access to dosimeters and verbal reminders to wear them as part of the pre-procedural time out protocol increased compliance as intended. Further process improvement methodologies are needed to optimize compliance and thereby improve radiation safety for the primary procedural operators in our department. Out study has some important limitations, including inconsistent pre-procedural checks due to time constraints and asynchronous resident scheduling on procedural rotations. Further education and optimization of this process is needed to improve occupational radiation safety.

## M5A-QI-5 REDUCTION OF SENTINEL WRONG LINE PLACEMENT EVENTS USING A STRUCTURED, LONGITUDINAL APPROACH TO SAFETY EVENT REVIEWS

Jared A. Christensen, MD (*Abstract Co-Author*) Advisory Board, F. Hoffmann-La Roche Ltd
Ellen J. Higgins, MS (*Abstract Co-Author*) Nothing to Disclose
Glenn E. Houck JR, MS, ARRT (*Abstract Co-Author*) Nothing to Disclose
Jason Battaglia, BS (*Abstract Co-Author*) Nothing to Disclose
Crystal Blank (*Presenter*) Nothing to Disclose

### INTRODUCTION

In a complex work environment it is important to address system issues that contribute to increased risk for patients. High reliability organizations incorporate a process of continuous improvement to mitigate risk and create a culture which works towards a zero-harm environment. HRO principles created a safety culture that resulted in an increase in reported safety events. This allowed us to identify several wrong line placement events in our interventional radiology unit using a structured longitudinal review process to implement interventions.

### METHODS

After the adoption of HRO principals, our institution developed structured formal review templates aimed at assisting reviewers in evaluating the individual failure modes that lead to patient risk. This format asks the same questions for each event, identifying recurring themes. An initial sentinel event for a wrong line placement was identified in Dec 2022. The review identified a causal risk related to the look-alike, sound-alike nature of two vascular access catheters. An initial intervention was implemented in February 2023 consisting of labeling these catheters with a red sticker indicating their intended use. After the initial intervention, we continued to have wrong line events reported. Formal reviews evaluating the system issues that contributed to the events were conducted with a significant gap in communication of the care plan from the consulting provider to the proceduralist was. In Oct 2023 additional interventions were implemented with the care plan documented in a note in the EMR. Compliance of documentation was audited on a regular basis. In addition, the treatment plan was confirmed during the preprocedural timeout process with all team members.

### RESULTS

Our first intervention did not address the gap in communication between all team members. The addition of a progress note into the EMR detailing the care plan was adopted to bridge that gap and to improve communication to the entire care team. Initial audits showed a documentation rate of 50%. Continued auditing and assignment of accountability has increased our compliance to 90%. Since the adoption of the new processes, there have been no additional wrong line events.

### DISCUSSION

A longitudinal, structured review system of similar safety events allowed us to identify key gaps in our processes. Addressing these gaps incrementally has led to elimination of sentinel events for wrong line placement. It is important to note that our first intervention did not address the root cause of wrong line placements, and that only the use of incremental structured review allowed us to identify the system issues. Adoption of these new processes was associated with challenges related to adding additional responsibilities to the workload of the IR teams. This was addressed using a regular audit with assignment of accountability by our safety team.

## M5A-QI-7 ENGINEERING STRUCTURAL WORKFLOW EFFICIENCIES IN THE OUTPATIENT IMAGING CENTER: THE SYNTHESIS OF HUMAN INTERVENTION (HI) AND ARTIFICIAL INTELLIGENCE (AI) FOR ACTIONABLE INCIDENTAL FINDINGS

Kirby Quinn, BS (*Abstract Co-Author*) Nothing to Disclose
Cinthia Del Toro (*Abstract Co-Author*) Nothing to Disclose
Felipe Munera, MD (*Abstract Co-Author*) Nothing to Disclose
Jean Jose, DO (*Abstract Co-Author*) Nothing to Disclose
Alexander M. McKinney IV, MD, BEng (*Abstract Co-Author*) CEO, VEEV, Inc
Thiago A. Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Ayden Jacob, MD (*Presenter*) Consultant, Aidoc Medical Ltd

### INTRODUCTION

Incidental imaging findings, defined as a pathology detected by an imaging examination performed for an unrelated reason, will occur in 5%-30% of imaging studies. Actionable incidental findings (AIFs) discovered in the outpatient setting create an opportunity for radiologists to spearhead the most appropriate next best steps in clinical management. The purpose of this study was to build an operational workflow model whereby patients detected by artificial intelligence (AI) in the outpatient setting with incidental intracranial hemorrhage (ICH) or pulmonary emboli (PE) were directed to the emergency department (ED).

### METHODS

After obtaining IRB approval, an AI software was implemented at outpatient imaging centers which flagged all incidental PEs and ICHs. When the AI algorithm flags a positive case, the radiology technician contacts the Advanced Registered Nurse Practitioner (ARNP) and the patient is transferred to a nursing waiting area. The ARNP contacts the radiology clinical coordinator, who confirms with the attending radiologist that a true positive incidental finding is present. If an AIF is confirmed by the radiologist, the clinical coordinator contacts the ARNP to send the patient to the ED.

### RESULTS

Training of the ARNP and clinical radiology coordinators are of utmost importance in creating operational efficiencies with AIFs. Familiarity with the AI software requires robust information technology infrastructure. From July 2023 to February 2024, median turnaround time for positive incidental pulmonary emboli was 71.3 minutes (IQR: 448.3 minutes), compared to 267.6 minutes (IQR: 1322.3 minutes) for negative cases ($P<0.05$). The median turnaround time for outpatient positive incidental intracranial hemorrhages was 69.15 minutes (IQR: 255.8 minutes), compared to 176.9 minutes (IQR: 1665.5 minutes) for negative intracranial hemorrhage cases ($P<0.05$). AI flagged 51 patients with incidental PE and 150 patients with incidental ICH.

### DISCUSSION

This study underscores the potential of Point-of-Care AI Deployment (POC-AID) to augment the management of incidental findings encountered at outpatient imaging facilities. By expediting the detection and management of AIFs, such workflows have the capacity to enhance patient outcomes. Rapid identification of AIFs using POC-AID within the outpatient context enhances the radiologist's ability to direct clinical care in a manner that is timely and clinically relevant. Within the outpatient realm, radiologists can employ POC-AID to prioritize AIFs and collaborate with allied healthcare professionals to expedite patient referrals to the ED. The implementation of our POC-AID workflow demonstrates the viability of integrating AI with human intervention (HI) to facilitate swift and cost-effective clinical intervention.

## M5A-QI-8 INVESTIGATING THE QUALITY DIVIDE: ASSESSING DISPARITIES IN APPROPRIATE LUNG CANCER SCREENING FOLLOW-UP

Katie Decell (*Abstract Co-Author*) Nothing to Disclose
Charles Watt (*Abstract Co-Author*) Nothing to Disclose
Brian W. Bresnahan, PhD (*Abstract Co-Author*) Stockholder, Johnson & Johnson
Matthew Triplette (*Abstract Co-Author*) Nothing to Disclose
Jonathan R. Medverd, MD (*Abstract Co-Author*) Nothing to Disclose
Sudhakar N. Pipavath, MD (*Abstract Co-Author*) Nothing to Disclose
Adlai R. Grayson, MD (*Abstract Co-Author*) Nothing to Disclose
Michelle Ho, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Lung cancer is the leading cause of cancer mortality in the United States. Despite 10 years of guideline recommendations for lung cancer screening (LCS), studies document low uptake and poor follow-up adherence. Our institution previously identified delays in follow up for 47% of Lung RADS 3 and 4 studies from 1/1/2015-1/20/2021. In response, a centralized follow-up for all positive LCS findings was instituted. Our project investigated impacts on LCS adherence and if differences in follow-up of positive findings existed between at risk individuals empaneled in two distinct settings: an institution catering to vulnerable populations and an academic cancer care institution.

### METHODS

This project was conducted at a multi-site LCS program with a hybrid centralized-decentralized model. The LCS program serves many hospitals and clinics including academic teaching hospital, county safety net hospital, and Comprehensive Cancer Center.We reviewed medical records of patients screened from 1/1/2021 - 12/31/2023 with actionable findings (Lung-RADS 4A, 4B, or 4X) and 1/1/2023 -12/31/2023 with Lung-RADS 3 findings. LDCT with positive Lung-RADS 3, 4A, 4B, 4X findings were considered index scans.Adherence to recommended follow-up interval was defined as within 30 days of the Lung-RADS recommendation. Follow-up clinical visit was defined as any visit where LCS results were discussed. Follow-up imaging and procedures included diagnostic CT, PET/CT, and tissue sampling.Cohort A included patients whose index scan was ordered by county safety net affiliated hospital/clinic. Cohort B included all other LCS patients. We expected lower follow-up adherence for Cohort A than Cohort B (primary outcome), and a lower proportion in Cohort A to have PET/CT follow-up imaging (secondary).Statistical analysis was performed using chi-squared and fisher’s exact tests.

### RESULTS

Total of 175 patient records were reviewed (27 Lung RADS 3, 75 Lung RADS 4A, 53 Lung RADS 4B, 20 Lung RADS 4X).There was no significant difference in appropriate versus delayed follow-up (odds ratio: 0.837, $p = 0.8755$) between Cohort A and B. Appropriate follow-up rates were not significantly different between cohorts: 75% vs 74% Lung-RADS 3 and 80% and 83% Lung RADS 4, for Cohorts A and B, respectively.There was no significant difference in type of follow-up imaging/procedure between cohorts.

### DISCUSSION

We extended earlier work by assessing LCS program follow-up imaging rates among diverse settings in our system to better characterize racial, socio-economic, and geographic disparities. Our results suggest improvements in follow-up adherence after implementing centralized intervention and no difference in follow-up between safety-net and other settings. Future subgroup analysis in zip-code-specific areas may help identify and improve any, if at all, differences in access, follow up and adherence to LCS.

## M5A-QI-9 IMPROVING REPORTING OF CRITICAL RESULTS: DIAGNOSTIC RADIOLOGY RESIDENT QUALITY IMPROVEMENT PROJECT

Morgan P. McBee, MD (*Abstract Co-Author*) Nothing to Disclose
Claire Stephanie Adcock, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Holbrook, MD (*Abstract Co-Author*) Nothing to Disclose
Connor D. Crowley, MD (*Abstract Co-Author*) Nothing to Disclose
Kelly N. Howard, ARRT, MBA (*Abstract Co-Author*) Nothing to Disclose
Anna K. Fairfax, BS, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Timely communication of critical findings by radiologists can greatly influence patient outcomes. Missing or delayed communication of critical findings can lead to patient harm, delay in treatment, or even fatal consequences. Therefore, it is important that radiology residents recognize critical findings and appropriately document communication with clinical teams. In this project, we aimed to enhance radiology residents' knowledge of and adherence to our current "critical results" policy including which findings are defined as "critical" and how to appropriately document communications. We aimed to achieve a 10% increase in the identification of critical results over a 3-month period and decrease the incorrectly documented results by 20%. Our broader objective was to bolster timely and accurate reporting, thereby reducing patient harm.

## METHODS

Pre-Intervention Data were gathered for the months of July, September, and October and to provide a baseline number of reported “critical results” and how many were incorrectly documented. Intervention: An educational lecture was given to the radiology residents covering the significance of reporting critical results, criteria per department, protocols for reporting critical findings, and how to appropriately document our communication of these findings in final reports. The current department dictation macros for result communications were modified to include a pick-list where the resident must choose to either report a Critical Result or other “non-critical” finding. Additionally, documents outlining department-specific critical findings were installed throughout reading rooms as a constant visual reminder of critical findings. Post-intervention: Data gathered for the months of December, January, and February were analyzed to determine the number of times the “Critical Results” macro was used and determine if there were any instances where it was used incorrectly.

## RESULTS

There was increased awareness/reporting of critical results and improved adherence to timely reporting/appropriate documentation. Compared to pre-intervention data, there was a 225% increase in critical results documented with a concurrent decrease in the incorrectly documented/reported findings by 53.8%.

## DISCUSSION

Strengths of the project included buy-in and easy usability of the new macro. Additionally, the improved macro served as a forcing function for reporting radiologists to state whether a result was "critical" and the previous "critical results" macro auto-populated, seamlessly aligning with previous documentation practices. By empowering radiology residents with knowledge of the significance of timely reporting of critical findings and facilitating the ease of their documentation, we can contribute to a culture of patient safety, improving patient outcomes, and streamlining clinical workflow.

# Abstract Archives of the RSNA, 2024

M5B-QI

**Quality Improvement Reports Monday Afternoon Poster Discussions II**

Monday, Dec. 2 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## M5B-QI-1 HIPAA COMPLIANT TEXT MESSENGER APP FOR REDUCTION OF PHONE CALL INTERRUPTIONS ON THE CARDIAC CT SERVICE

Brian B. Ghoshhajra, MD, MBA (*Abstract Co-Author*) Research Grant, Siemens AG;Consultant, Koninklijke Philips NV;Consultant, Siemens AG
Sandeep S. Hedgire, MD (*Abstract Co-Author*) Nothing to Disclose
Badr Badreldin, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Sadia Sultana, MRCP,FRCR (*Abstract Co-Author*) Nothing to Disclose
Mangun Randhawa, MD (*Abstract Co-Author*) Nothing to Disclose
Laura A. Naccarato, MD, MBA (*Presenter*) Nothing to Disclose

### INTRODUCTION

High volume of interruptions is a significant concern in radiology department workflow and the safe interpretation of imaging. Prior studies have shown that frequent interruptions in complex cognitive tasks lead to errors and decreased efficiency. On our Cardiac CT service, several factors, including a high percentage of studies requiring image checks, questions regarding protocol details, and administration of nitroglycerin, drive a large volume of phone interruptions. Our study's purpose was to evaluate the change in phone call volume before and after the implementation of a HIPAA compliant text messaging app.

### METHODS

Number, type, and timestamp of phone calls received by the Cardiac CT service between the hours of 8 AM and 5 PM were recorded over 1 week of the pre-intervention period. The HIPAA compliant texting application was implemented over 2 weeks. Technologists were encouraged to contact the radiologists for any non-urgent issues via the messenger application. Following the roll-out, type, number, and timestamp of phone calls received by the Cardiac CT service were again collected over a 1-week.The Chi-Square Test for Independence was initially employed to evaluate the overall difference in the number of calls between the pre- and post-intervention periods. Fisher's Exact Test was then applied for specific call types with lower frequencies, where the expected counts were less than 5. The average time between phone calls were compared using a T-test.

### RESULTS

Following intervention, the number of phone calls received by the radiology Cardiac CT service over a 1-week period declined from 275 to 191 ($p < 0.001$). A large driver of the change was driven by decrease in calls pertaining to non-urgent issues, including requests for protocols to be entered for upcoming studies, protocol clarifications, questions about contrast, and questions about nitroglycerin administration. These types of calls decreased from 78 to 31 (p .002). The number of minutes between phone calls also decreased, from 9.8 minutes in the pre-intervention period to 14.3 minutes in the post-intervention period ($p < 0.05$).

### DISCUSSION

Phone interruptions present a unique challenge to timely and accurate interpretation of imaging studies. Answering a phone call requires the interpreting physician’s immediate attention, irrespective of the actual urgency of the call. A large share of issues that will eventually require physician attention need to be addressed in a prompt, yet non-urgent timeframe. For these types of concerns, a text messaging system is particularly effective. In our study, the primary drivers of the reduction in volume were those that require the attention of the radiologist in a prompt, not emergent timeframe. The triage of these phone calls to a message allows radiologists to focus on interpretation of studies and address these questions between times of active study interpretation.

## M5B-QI-2 STRATEGIC IMPLEMENTATION OF AN AI FRACTURE DETECTION ALGORITHM SEQUENTIALLY ACROSS FOUR HOSPITALS IN NORWAY TO ENHANCE RADIOLOGY DEPARTMENT WORKFLOW EFFICIENCY

Line Tveiten, BMedSc (*Abstract Co-Author*) Nothing to Disclose
Jonas Vardal, MD (*Abstract Co-Author*) Nothing to Disclose
Bjorn Anton Graff (*Abstract Co-Author*) Nothing to Disclose
Ramprabananth Sivanandan, MD, MBBS (*Presenter*) Nothing to Disclose

### INTRODUCTION

Annually, the volume of radiological investigations increases by approximately 15 %, a growth rate that outpaces the availability of reporting radiologists. To address this imbalance, a CE-approved, commercially available AI-based fracture detection algorithm was integrated into the real-world workflow at the Vestre-Viken Hospital Trust (VV) in Norway. The objective was to delegate simpler tasks to AI, thereby enabling radiologists to concentrate on more complex cases and enhance overall workflow efficiency in the radiology department.

### METHODS

This pioneering initiative in Norway entailed the external validation and pilot implementation of the selected AI application at one hospital, followed by a sequential rollout to other three hospitals. This AI application detected fractures in digital skeletal X-rays taken for patients with a history of recent trauma. Following implementation, workflow patterns were streamlined from six to one pattern. Patient waiting times at the radiology department ranged from 8 to 30 minutes, waiting time for consultation varied from 33 to 174 minutes, and consultation durations for patients without fractures spanned 10 to 15 minutes across hospitals. Workflow triaging for radiologists was enhanced by integrating AI results into the Radiology Information System (RIS). Team collaboration played a crucial role in change management, and user manuals for the AI application were created and distributed among team members, including radiologists, radiographers, clinicians, and emergency doctors. A follow-up system was established to report false negative AI results.

### RESULTS

The external validation showed that the AI's accuracy was 91.3%, compared to 95,2% for radiologists (Fig.1). And with AI assistance, radiologists' accuracy improved to 98.4%. The implementation also significantly reduced patient waiting times by 10% to 35% across hospitals (Fig.2). Additionally, triaging in RIS increased the efficiency of radiologists in prioritized reporting of doubtful and positive cases. The created user manual streamlined the adoption of the AI applications among different stakeholders in the AI team. A feedback system for reporting false negative cases supports the secure usage of the AI application.

### DISCUSSION

The implementation of the AI application prioritized patients with fractures for treatment and significantly reduced waiting times for those without fractures and were sent home. The streamlined workflow processes increased efficiency within the radiology department and facilitated the development of a structured five-phase implementation process for future AI applications. This strategic approach (Fig.3) not only decluttered existing workflows but also set a precedent for the integration of other AI applications getting installed in our healthcare settings.

## M5B-QI-3 AI-POWERED TOOLS FOR ADMINISTRATIVE TASKS: TIME SAVINGS DRAFTING LETTERS OF PROMOTION

Ryan L. Melvin, PhD,MA (*Abstract Co-Author*) Nothing to Disclose
Ryan Godwin, MS, PhD (*Abstract Co-Author*) Nothing to Disclose
Srini Tridandapani, MD, PhD (*Abstract Co-Author*) Co-founder, Camerad Technologies, LLC;Spouse, Co-founder, Camerad Technologies, LLC;Officer, Camerad Technologies, LLC;Spouse, Officer, Camerad Technologies, LLC
Steven A. Rothenberg, MD (*Abstract Co-Author*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC
Alexander Lee (*Abstract Co-Author*) Nothing to Disclose
Jonah Barrett (*Presenter*) Nothing to Disclose

### INTRODUCTION

Physicians' time spent on administrative tasks has been shown to increase their risk of burnout while decreasing their work satisfaction. Generative AI techniques have the potential to reduce the burden from administrative tasks by assisting with non-clinical responsibilities. The purpose of this study was to investigate the utility of large language models (LLMs) for streamlining non-interpretive tasks for drafting letters of promotion for academic faculty.

### METHODS

The single-center prospective study was determined to be exempt by the IRB. A custom web application was developed using the OpenAI API and LangChain to implement a custom retrieval-augmented generation (RAG) workflow that ingests a curriculum vitae (CV) and career information as inputs to generate personalized promotion letter drafts. Physicians at our institution were solicited via email to provide their CVs before receiving an AI-generated promotion letter and a link to an online survey. Descriptive statistics and a Net Promoter Score (NPS) were calculated based on the physicians' responses.

### RESULTS

The 22 physicians who agreed to participate in the study varied in their academic rank and time since their last training. Of the physicians, 15 (68.2%) were radiologists of various subspecialties. 19 physicians completed the study survey. The average estimated time savings for using the tool was 64.5 minutes (SD = 47.0). On a scale of 1-10, the most common response to the question, "How likely are you to recommend this tool to a friend or colleague?" was 10 endorsed by 5 (26.3%) physicians. The NPS was 15.8, indicating the tool had more promoters than passives and detractors. 14 physicians (73.7%) indicated that they were planning on using the tool in the future to generate letters of support for a friend or colleague. 3 (15.8%) of the physicians indicated there was a hallucination in their promotion letter.

### DISCUSSION

A single-center investigation of the utility of a custom generative AI workflow for assisting with non-interpretive tasks demonstrated potential time savings for drafting letters of promotion. However, as evidenced by multiple hallucinations in the study's AI-drafted letters, these tools are not without faults and may occasionally fabricate or embellish information. Therefore, users of this tool need to carefully review the AI-generated content for accuracy. Limitations of this study include recruiting only faculty members from a single academic institution, a small sample size, and a lack of variance in CV formats used to generate promotion letters. Further, developers of similar applications need to take appropriate measures to ensure data privacy as CVs contain personal information with content that could be used for identity theft. Letter writers should ensure that letters capture their true impressions of each candidate's merit to maintain the integrity of the faculty promotion process.

## M5B-QI-4 IMPROVING SELF REPORTING OF COMPLICATIONS: CURRENT STATUS AND CONCEPT OF GLOBAL TRIGGER TO IMPROVE AUTOMATED CAPTURE OF COMPLICATIONS USING AI ALGORITHMS

Anil K. Pillai, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Rakesh K. Varma, MD, MBBS (*Abstract Co-Author*) Speaker, Becton, Dickinson and Company
Jayesh Soni, MD (*Abstract Co-Author*) Nothing to Disclose
Daniel Lamus, MD (*Abstract Co-Author*) Nothing to Disclose
Ahmad Arar (*Presenter*) Nothing to Disclose

### INTRODUCTION

10% of hospitalized patients experience an adverse event with half occurring during invasive disciplines such as surgery and other procedural specialty. Medical errors in interventional radiology (IR) result from various causes, including procedure complexity, patient factors, workflows, provider experience, organizational expertise, and the specific safety measures in place. Identification of improvement opportunities heavily depends on self-reporting. We present the status of self-reporting of complications and discuss a novel automated process to improve the identification of adverse events.Purpose-Discuss the current status of self-reporting of complications in medicine

**METHODS**

We delve into the factors contributing to the low levels of self-reporting in IR, including subjectivity in complication identification, the added burden of self-reporting, the absence of follow-up mechanisms, and provider reluctance. Furthermore, we introduce an innovative automated system designed to identify complications using billing data and artificial intelligence. This system leverages the association between ICD 10 and CPT codes, employing a Global trigger concept to prompt chart reviews for potential complications.

**RESULTS**

Our examination of previous studies underscores the high incidence of preventable errors during procedures and the adverse consequences of underreporting. Notably, only a fraction of medical errors are self-reported, underscoring the need for alternative detection methods. We describe the potential role of an automated tool in identifying outliers and potential complications without relying on traditional self-reporting mechanisms.The automated identification of complications using the billing data based on association of ICD 10 (indication for procedure) and CPT code (Procedure code) is an effective way to identify outliers (complications). If the CPT codes do not correspond to the ICD 10 code, a chart review can be triggered to identify the reason for extra procedures and identify complications- the concept of Global trigger. Creating an artificial intelligence dashboard for weekly identification of outliers and reviewing the triggered charts removes the need for dependence on self-reporting to identify complications.

**DISCUSSION**

We discuss the challenges of self-reporting of complications in a tertiary-level academic center. By implementing the automated tool presented in this abstract, we anticipate significant advancements in patient safety through the timely identification of complications. A pilot to automate the identification of potential complications utilizing billing information and an AI algorithm will be presented in this report.

## M5B-QI-5 RADIUS: COMMUNITY-DRIVEN RADIOLOGY AI LARGE LANGUAGE MODEL AND VISION LANGUAGE MODEL LEADERBOARD

Jaron Chong, MD (*Abstract Co-Author*) Nothing to Disclose
David Li, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

The recent exponential growth of large language models (LLMs) and nascent vision-language models (VLMs) presents tremendous potential to transform radiology. However, evaluating and comparing LLM and VLM performance has proven exceedingly challenging, necessitating rigorous, standardized, and transparent benchmarks to ensure reliability and reproducibility. We developed the Radiology AI LLM and VLM Leaderboard (RADIUS), with the aim of establishing a community-driven benchmarking platform to assess LLM and VLM performance in radiology.

**METHODS**

RADIUS features a standardized platform for evaluating and comparing LLMs and VLMs across diverse radiological datasets encompassing both text and images, ensuring comprehensive assessment of each model. An evaluation and voting framework is devised, incorporating domain-specific criteria to accurately assess model performance. The leaderboard was initialized using existing results published in the academic literature. Leading AI researchers and industry partners are invited to submit their model evaluations using both public and proprietary datasets to this community-driven initiative.

**RESULTS**

The feasibility and effectiveness of RADIUS in evaluating LLMs for radiology tasks has been demonstrated. Multiple LLMs and VLMs are assessed across different radiology-specific tasks and datasets. Model performance is transparently reported and ranked, with longitudinal analysis provided for each dataset and task over time. The performance of three proprietary and one open-access LLMs on a text-based differential diagnoses task is illustrated (Fig. 1). For subjective interpretive tasks, a blinded voting system allows registered academic and industry researchers to submit model outputs, with pairwise competitions reported and ranked using the Elo rating system.

**DISCUSSION**

The establishment of RADIUS represents a significant step towards standardizing the evaluation of LLMs and VLMs in radiology. By providing a centralized benchmarking platform, RADIUS promotes fairness, transparency, and collaboration within the radiology and AI communities. Continued development and expansion will facilitate the safe integration of generative AI into clinical practice. Early results suggest that the ranking of top-performing LLMs and VLMs on radiology-specific tasks may differ from general purpose or computer science leaderboards, further making the case for scalable radiology-specific quality improvement efforts.

## M5B-QI-6 IMPROVING THE RATE OF LUNG CANCER SCREENING AT AN URBAN SAFETY-NET HOSPITAL

Christina A. LeBedis, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Christian J. Ashby, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Lung cancer is one of the leading causes of morbidity and mortality in the United States. Lung cancer screening with low-dose computed tomography reduces lung cancer mortality by 20% and all-cause mortality by 6.7%. In 2013, the United States Preventive Services Task Force began recommending annual LCS with LDCT in adults aged 55-80 years with a 30 pack-year smoking history and currently smoke or quit within the past 15 years. In 2021, the USPSTF updated their guidelines to include more at-risk populations by decreasing the age of screening initiation to 50 years, and by decreasing the smoking history threshold to 20 pack-years. In 2015, our institution, Boston Medical Center, implemented a comprehensive LCS program targeting our at-risk population. However, internal retrospective analysis revealed that only 16% of LCS-eligible patients ultimately received their screening LDCT. The purpose of this QI project is to increase smoking history gathering and identification of high-risk smokers so we can enroll more of these patients in LDCT exams.

**METHODS**

We offered an LCS Questionnaire to all BMC patients arriving for radiology appointments in the radiology waiting areas. The questionnaires assessed patient demographics, lung cancer risk, LCS eligibility, relevant past medical history, and relevant family history, and were available in the five languages spoken. For patients who self-identified as LCS-eligible, we performed chart review to determine whether they were currently undergoing LCS. If not, we contacted the patient's primary care physician via EPIC to notify them of this finding and to emphasize the importance of LCS.

**RESULTS**

We collected 1644 questionnaires from 3/11/2021 to 4/21/2021 (41 days). 113 patients (6.9 %) self-identified as LCS eligible; 56 (49.6%) met the 2013 USPSTF LCS criteria, of whom 21 (37.5%) were not currently undergoing LCS; 57 additional patients (50.4%) met only the 2021 USPSTF LCS criteria, and none were currently undergoing LCS. Most patients were women (75 of 113, 66.4%), median age 62.5 years, average 40.1 pack-years, with high

school education or less (57 of 113, 50.4%), and were either Black (44 of 113, 38.9%) or White (47 of 113, 41.6%). Most patients did not have a previous diagnosis of COPD (85 of 113, 75.2%) or emphysema (99 of 113, 87.6%). 7 of 113 (6.2%) had a previous diagnosis of lung cancer, and 7 of 113 (6.2%) had a previous diagnosis of breast cancer. Most patients did not have a family history of lung cancer (101 of 113, 89.4%). As of 4/27/2021, after notifying primary care providers of patient LCS eligibility, 3 of the 21 patients (14.3%) meeting 2013 LCS criteria had baseline LCS exams ordered for 2021.

**DISCUSSION**

Over one-third of LCS-eligible patients are not currently undergoing LCS. By administering voluntary patient questionnaires, we improved smoking history collection and identification of high-risk patients qualifying for LCS.

## M5B-QI-7 WHEN TIME IS OF THE ESSENCE: OPTIMIZING TRAUMA RADIOGRAPH WORKFLOW TO DECREASE TIME TO CT

Christopher I. Fung, MD (*Abstract Co-Author*) Stockholder, Mikata Health
Brett Mador (*Abstract Co-Author*) Nothing to Disclose
Jessica Kwok (*Abstract Co-Author*) Nothing to Disclose
Brendan C. Kelly, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Time to intervention is a critical metric in trauma care with increased length of stay in the Emergency Department (ED) being directly associated with increased patient mortality (Mowery N, J Trauma 2011). Computed tomography (CT) is heavily relied on in this setting to rapidly diagnose life-threatening injuries that require urgent management. Recommendations for time from patient arrival in the ED to transfer to CT vary, with the notion of the "Golden Hour" to initiate definitive trauma care often considered the standard. At our center, transfer to CT has at times been delayed due to excessive time spent perfecting patient positioning or repeating radiographs in the trauma room despite acute findings often being evident on single or incomplete views. Therefore, the objectives of this study were to optimize trauma radiograph workflow to decrease the average time to complete chest/pelvic radiographs to under 10 minutes, extremity radiographs to under 20 minutes, and transfer to CT to under 45 minutes.

**METHODS**

The project was completed at a quaternary care hospital with the initiative team including Radiology Technologists, Radiologists, Trauma Surgeons, and Emergency Medicine Physicians. After consultation with stakeholders, it was determined trauma room radiograph workflow be altered to instead perform limited radiograph series prior to transfer to CT with delay of additional views until after CT is complete. A memorandum outlining these changes was distributed on April 25, 2023 with changes effective May 1, 2023. Intervention impact was determined by recording the average time to complete chest/pelvic radiographs, extremity radiographs and transfer the patient to CT for trauma activations in the 6 months preceding and following the intervention. The study population included 146 pre-intervention and 159 post-intervention patients. Time to complete radiographs was defined as the difference between the exam start time and latest radiograph upload time. Transfer time to CT was defined as the difference between the upload time of the first scout CT image and the earliest documented time of patient arrival in the ED. Statistical analysis was completed using a two sample T-Test.

**RESULTS**

The average time to complete chest/pelvic radiographs was decreased from 13.1 minutes to 7.3 minutes (plt;0.001), and the average time to complete extremity radiographs was decreased from 22.3 minutes to 17.5 minutes (p=0.04). The average transfer time to CT was decreased from 49.6 minutes to 44.8 minutes (p=0.02).

**DISCUSSION**

Through a relatively simple initiative, the study objectives were met, and the average time taken to complete trauma room radiographs and transfer the patient to CT was significantly decreased. Limitations of the study include potential confounding bias related to concurrent improvements in trauma care that occurred over the course of the study.

## M5B-QI-8 TIME IS SPINE: EFFECT OF A SPINE ONCOLOGY REPORTING MACRO ON TIME TO TREATMENT FOR PATIENTS WITH SPINE METASTASES

Charles E. Kahn JR, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Alvand Hassankhani, MD (*Abstract Co-Author*) Nothing to Disclose
Raghav Mattay, MD (*Abstract Co-Author*) Nothing to Disclose
Laurie A. Loevner, MD (*Abstract Co-Author*) Research Grant, Guerbet SA;Investigator, Guerbet SA
Colbey W. Freeman, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Spine metastases affect approximately 30% of patients with cancer. Communication gaps between radiology and treatment teams are a source of delayed treatment, potentially leading to adverse outcomes and reduced quality of life, and a common source of litigation. The purpose of this study was to determine the impact of a standardized spine MRI reporting macro coupled with an automated electronic notification to treatment teams on reducing the time to radiation oncology or spine surgery consultations and treatment initiation for outpatients with spine metastases.

**METHODS**

We developed a Spine Oncology Imaging Score (SOIS) and optional text macro for spine oncology MRI reports comprising MRI features from the Spine Instability Neoplastic Score and the Epidural Spinal Cord Compression scale. Immediately after a macro-containing report was signed, an automated script sent an email to a monitored spine oncology treatment team account. Outpatient reports containing the macro between April 2021 and February 2023 were retrospectively identified. Spine MRIs during the same period with osseous metastases but no macro were identified as controls and retrospectively assigned SOIS scores. Time intervals between MRI completion and subsequent radiation oncology or spine surgery consultation and initiation of radiation or surgery were calculated from the medical record. Data were analyzed using multivariate multiple linear regression. To control for potential confounders, patient age, sex, STAT status, visit department, treatment type, and SOIS score were included as independent variables with days to consultation and treatment as dependent variables.

**RESULTS**

The macro system was activated in April 2021. During the study period, 274 outpatients had spine MRI reports containing the macro: 213 with follow-up visits and 154 with subsequent treatment. Of 152 control patients, 117 had follow-up visits and 58 had subsequent treatment. Age (mean 63.2 years with macro, 62.4 years without, p=0.52), sex (58.8% female with macro, 57.2% without, p=0.76), and epidural scores (p=0.30) were not significantly different between groups. Studies with the macro were more likely to be STAT (33.2% vs 19.7%, p = 0.003) and had lower SOIS numerical scores (mean 5.4 of 13 vs 6.0, p=0.009). Time to consultation (mean 5.4 days vs. 9.1 days, p=0.02) and to treatment (16.2 days vs. 22.2 days, p=0.03) were both shorter for the macro group.

### DISCUSSION

The SOIS reporting system supplements other methods of communication. In a statistical model that controlled for several potential confounders, the macro and notification system were associated with earlier consultations and treatment by the spine oncology team. Ultimately, such reporting systems may help address gaps in communication and facilitate and direct multidisciplinary care by delivering structured imaging results to treatment teams.

## M5B-QI-9 REFERRAL GUIDELINES: A DESCRIPTIVE COMPARISON OF TWO NATIONAL RADIOLOGY SOCIETIES' GUIDELINES DEVELOPMENT AND DISSEMINATION ACTIVITIES WITH DATA ANALYSIS

Amanda Wells (*Abstract Co-Author*) Nothing to Disclose
David Kurth (*Presenter*) Nothing to Disclose

### INTRODUCTION

Radiology referral guidelines aid clinicians to select appropriate imaging to answer a diagnostic question. These guidelines help avoid unnecessary care and facilitate timely access to the appropriate treatment by ensuring the patient starts their care pathway with the right image. During these times of global workforce shortages in healthcare, referral guidelines directly help address the demand for imaging and reduce the burden of low value care. The American College of Radiology (ACR) and the Royal College of Radiology (RCR) have produced radiology referral guidelines for over 30 years, from the US and UK respectively, varying in format to align to different healthcare systems and needs but similar in rigor of evidenced based methodology. This presentation will demonstrate their intrinsic value beyond meeting requirements and will demonstrate the benefits of radiology referral guidelines through the analysis of data available from the National Health Service (NHS) in England.

### METHODS

A descriptive comparison regarding the development and dissemination successes and barriers is illustrated in a slide presentation. We will describe two approaches to referral guidelines, both have informed development guideline systems in other countries. The presenters will describe the challenge of guideline development as an evidence-based, transparent process and will highlight variations in their processes. Clinical Decision Support (CDS) systems are implemented in secondary and primary care in approximately 55% of hospital trusts in England. Impact data were gathered that showed the change or cancellation rate, the impact on overall appropriateness and rejection rates, and calculated cost savings based on changed behavior. The presenters will discuss literature that indicates the benefit of using CDS for image ordering in the US. This literature will be contrasted with the other approach which has rich CDS data illustrating improvements in patient care.

### RESULTS

Both societies have successfully developed and disseminated robust radiology referral guidance to ordering providers. Data seems to indicate that implementation of clear, in-workflow guidelines can improve appropriate imaging. Use of CDS in radiology referrals shows an impact of 10-15% and extrapolated yearly cost savings of around £300k per hospital based on the referral impacts against NHS tariffs.

### DISCUSSION

The data gathered demonstrates a positive impact, supporting the hypothesis that use of radiology guidelines are impactful in terms of patient care, management of backlogs, efficiencies of service and reduction in exposure to ionizing radiation, with an increase in appropriateness and decrease in rejections if vetting is performed. Further analysis in various settings may demonstrate how this varies globally. Taking England as one model is a useful step to understand global impact potential.

# Abstract Archives of the RSNA, 2024

R2-QI

**Quality Improvement Reports Thursday Morning Poster Discussions**

Thursday, Dec. 5 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## R2-QI-2 PIPELINE DEVELOPMENT TO IMPROVE DIVERSITY, EQUITY, AND INCLUSION IN RADIOLOGY: A DATA-DRIVEN PROGRAM

Hrishikesh Bhaththiwala, MBA, BA (*Abstract Co-Author*) Nothing to Disclose
Viraja Alluri, BS (*Abstract Co-Author*) Nothing to Disclose
Karen L. Xie, DO (*Abstract Co-Author*) Nothing to Disclose
Emily Chuang (*Abstract Co-Author*) Nothing to Disclose
Divya M. Surabhi, MD, MPH (*Presenter*) Nothing to Disclose

### INTRODUCTION

Despite growing awareness of the persistent gender, racial, and ethnic imbalance in the radiology training and workforce, there are improvements to be made at targeting the gap. Our institution has designed and implemented a longitudinal education program to increase knowledge, awareness, and interest in radiology among undergraduate and medical students. We used the 5C's of Radiology (5C's) (curriculum, coaching, collaborating, career, and commitment) as a framework for our program, and data-driven strategies were incorporated for baseline evaluation and continued monitoring and improvement. The goal is to target leaky pipelines and increase the racial and gender diversity of medical students pursuing a career in radiology.

### METHODS

Virtual and in-person events were conducted at an urban, academic medical school and affiliated university from 2022-2024. Medical student events included 9 career advising sessions, 8 skills workshops, 3 procedure workshops, 5 shadowing/mentorship programs, and 2 intersectionality in radiology events. 7 undergraduate outreach events were held. At the end of each event, students completed a demographics and knowledge questionnaire. The demographics questionnaire gathered information regarding gender, race/ethnicity, school year, and radiology exposure; the knowledge questionnaire assessed students' misconceptions and perception of work-life balance along with event quality and future interest. Responses were obtained using a Likert scale. Surveys were analyzed for trends by question type, race/ethnicity, gender, radiology exposure, and school year. There were 287 attendees with a 64% survey completion rate (184 responses). Two-tailed t-tests assessed statistical significance for race/ethnicity, gender, radiology exposure, and year in medical school trends.

### RESULTS

Undergraduate students had a statistically significant improvement in knowledge regarding misconceptions and a positive trend in perceived quality of events compared to medical students.?

### DISCUSSION

Limitations include limited follow-up, as we have not captured data regarding how many program participants apply to radiology residency. In 2024, we are expanding undergraduate outreach, career advising and intersectionality in radiology events, and outreach to women. Future data analysis includes exploring the differences in in-person and virtual events along with longitudinal follow-up with participants.

## R2-QI-4 REMOTE OR ON-SITE DIAGNOSTIC BREAST IMAGING: PERFORMANCE COMPARISON AND ACCEPTANCE

Margarita L. Zuley, MD (*Abstract Co-Author*) Investigator, Hologic, Inc
Carley Siedlecki (*Abstract Co-Author*) Nothing to Disclose
Luisa Wallace (*Abstract Co-Author*) Nothing to Disclose
Avery Wang, BS (*Presenter*) Nothing to Disclose

### INTRODUCTION

Breast imaging practices have evolved significantly due to technological advancements and COVID-19, with many radiologists favoring hybrid work primarily for screening and MRI interpretation. Literature indicates increased productivity and high patient satisfaction. However, concern remains for understanding of patient, staff and physician acceptance and accuracy with remote diagnostic care.

### METHODS

One breast imaging radiologist with 24 years experience who previously left our academic subspecialty practice for relocation, returned and began remote diagnostic breast imaging in October 2021. Performance metrics were compared between remote and on-site assessments and to pre-implementation metrics. Cancer detection rate (CDR), positive predictive value (PPV2), and frequency of BI-RADS 3 ratings were assessed. Patient and technologist attitudes were assessed with retrospective, anonymous surveys. Patient responses were obtained immediately following a visit. Ten participating technologists with varying degrees of experience were surveyed.

### RESULTS

De-identified assessment data was obtained from 9,596 patients seen by this radiologist before and after hybrid reading, with 2,305 under the hybrid reading model (1,903 remote, 402 on-site). Beginning with the year of implementation, no statistically significant differences were found between remote and on-site diagnosis in CDR (remote: 30.91 - 49.92, on-site: 37.59 - 57.21), PPV2 (remote: 38% - 43%, on-site: 42% - 57%), and the frequency of BI-RADS 3 (remote: 7.38% - 14.02%, on-site: 8.70% - 10.98%). An increase was seen in BI-RADS 3 ratings after implementation, but CDR and PPV2 remained consistent.Patients returned 101 surveys (86 remote care, 15 on-site) and reported high overall satisfaction with their radiologist, with satisfaction rates of 91% (72/79) when remote and 86% (12/14) when on-site. Of those with a remote radiologist, 73/82 (89%) were satisfied with visit duration, compared to 15/15 (100%) on-site. No patients reported experiencing technical issues, and only one patient was unlikely to return to a remote breast radiologist.With the radiologist remote, all technologists (10/10) rated clinic functionality positively and communication as easy. 7/10 (70%) reported experiencing technical issues less than 25% of the time, relating to image transfer delays and auditory clarity.

### DISCUSSION

The lack of significant differences in performance metrics suggests comparable diagnostic accuracy and reliability between remote and on-site diagnostic care. The observed frequency of BI-RADS 3 diagnoses after 2016 could be attributable to a change in reading style following return to our practice. High patient and technologist satisfaction indicates acceptance of remote reading, supporting continued utilization and optimization of remote breast radiology services in clinical practice.

## R2-QI-5 DIRECTING CARE WITH POINT OF CARE ARTIFICIAL INTELLIGENCE DEPLOYMENT (POC-AID): CLINICAL IMPACT OF ESTABLISHING PURPOSEFUL OUTPATIENT AI-DIRECTED MANAGEMENT OF INCIDENTAL PULMONARY EMBOLI

Jean Jose, DO (*Abstract Co-Author*) Nothing to Disclose
Cinthia Del Toro (*Abstract Co-Author*) Nothing to Disclose
Felipe Munera, MD (*Abstract Co-Author*) Nothing to Disclose
Thiago A. Braga, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander M. McKinney IV, MD, BEng (*Abstract Co-Author*) CEO, VEEV, Inc
Kirby Quinn, BS (*Abstract Co-Author*) Nothing to Disclose
Ayden Jacob, MD (*Presenter*) Consultant, Aidoc Medical Ltd

### INTRODUCTION

Translating imaging AI results into clinically relevant information that guides appropriate medical therapy requires streamlined IT infrastructure and advanced practitioner support. The purpose of this study was to evaluate the impact of an outpatient point of care AI-guided triage solution on appropriately directing patients with positive incidental pulmonary emboli (iPE) on CT imaging to the emergency department for medically necessary therapy in an expedited fashion.

### METHODS

An AI software was implemented in July 2023 at outpatient imaging centers which flagged all iPE. 11,700 outpatient CT chest and CT abdomen scans were analyzed with an AI-based software from July 2023- March 2024. When the AI algorithm flags a positive case, the radiology technician contacts the Advanced Registered Nurse Practitioner (ARNP) and the patient is transferred to a nursing waiting area. The ARNP contacts the radiology clinical coordinator, who confirms with the attending radiologist that a true positive incidental finding is present. If an iPE is confirmed by a radiologist, the clinical coordinator contacts the ARNP to send the patient to the emergency department (ED).

### RESULTS

A total of 80 iPEs were detected by the AI software and confirmed by a radiologist. The average age for patients with iPE was 62.7, with 60% being male and 40% female. 94% of iPE patients had an oncologic diagnosis as part of their past medical history. Median turnaround time for positive incidental pulmonary emboli detected by AI was 66.4 minutes (IQR: 526.3 minutes), compared to 383.6 minutes (IQR: 1502.3 minutes) for negative cases ($P<0.05$), resulting in an observed 82.7% (317.2 minutes) decreases in wait time for the AI notified cases. 35% of iPEs were categorized as segmental. 29% of patients with iPE went directly to the ED from the outpatient imaging center. Of those ED patients, 78% were admitted to the hospital with an average length of stay of 4.4 days. 83% of patients with an iPE who went to the ED were started on anticoagulation. 1 patient underwent mechanical thrombectomy and the Pulmonary Embolism Response Team was activated in 4 patients.

### DISCUSSION

Our study demonstrates the effectiveness of an outpatient POC-AID triage solution in expediting the identification and management of iPE. By integrating AI into imaging workflows, we observed a significant reduction in turnaround time for positive iPE cases, enabling prompt referrals to the ED and initiation of necessary therapy. The streamlined process facilitated by the AI triage system led to expedited transitions from outpatient imaging centers to the ED, minimizing delays in care delivery. Our study demonstrates the clinical utility of AI technology in improving patient outcomes and optimizing resource utilization in the management of incidental findings in the outpatient imaging setting.

## R2-QI-6 IMPACT OF A COLLABORATIVE SMALL BOWEL OBSTRUCTION IMAGING AND CARE PROTOCOL WITH THE GENERAL SURGERY SERVICE ON RADIOLOGY WORKFLOW AND RESOURCE UTILIZATION

Stephen M. Seedial, MD (*Abstract Co-Author*) Nothing to Disclose
Mark Glover (*Abstract Co-Author*) Nothing to Disclose
Bashir H. Hakim, MD (*Abstract Co-Author*) Nothing to Disclose
Trevena Metias (*Abstract Co-Author*) Nothing to Disclose
Amy Braddock (*Abstract Co-Author*) Nothing to Disclose
Nathaniel Sertu (*Abstract Co-Author*) Nothing to Disclose
Kaitlin M. Zaki-Metias, MD, FRCPC (*Presenter*) Nothing to Disclose

### INTRODUCTION

Small bowel obstruction (SBO) is a common cause of diagnostic imaging, hospital admission, and surgical consultation. At our institution, following initial CT imaging without oral contrast demonstrating SBO, a second CT with oral contrast was typically obtained. A new protocol has been implemented in a collaboration between the department of surgery to eliminate the second CT, using water-soluble oral contrast and serial abdominal radiographs for further assessment of SBO in clinically stable patients. This study aims to assess the impact of this protocol on radiation exposure and resource utilization.

### METHODS

A retrospective cohort study was conducted on patients with SBO diagnosed on initial abdominopelvic CT for whom the general surgery service was consulted. Patients who underwent two abdominopelvic CT scans within 24 hours, one after the administration of oral contrast and one without, prior to

implementation of the new protocol were selected for the control group. Ionizing radiation exposure, contrast media utilization, and CT technologist time were recorded for both groups.

**RESULTS**

Eighteen patients were included in the experimental group and 38 patients were included in the control group. Total effective dose (mSv) and CT technologist time were significantly less with the new protocol ($p=0.02$ and $p<0.001$, respectively). There was decreased use of intravenous contrast media in the experimental group relative to the control group, although this was not statistically significant ($p=0.06$).

**DISCUSSION**

The implementation of a collaborative SBO imaging and care algorithm between general surgery and radiology resulted in reduced radiation exposure to patients and decreased CT technologist time.

## R2-QI-7 A REVISED CLASSIFICATION SYSTEM FOR COMMUNICATION ERRORS IN RADIOLOGY TO FACILITATE IMPLEMENTATION OF PREVENTIVE MEASURES

Suzanne Swedeen, MSc (*Abstract Co-Author*) Nothing to Disclose
Jennifer M. Cutts, MD (*Abstract Co-Author*) Nothing to Disclose
Olga R. Brook, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Bettina Siewert, MD (*Abstract Co-Author*) Editor, Wolters Kluwer nv;Reviewer, Wolters Kluwer nv
Meghavi Mashar, MBBChir, MA (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Communication errors are a major contributor or the sole cause of 65% of serious adverse events. In radiology, 38% directly impact patient care with moderate to severe adverse impact on outcomes. Errors stem from many causes, such as information transfer, appropriate understanding by the recipient and timeliness of the message. Creation of effective countermeasures is based on root cause analysis (RCA) and identification of contributors. Whilst communication classification systems exist, none are specific to radiology. This study aimed to characterise communication errors in radiology and develop a dedicated classification system to aid the development of countermeasures.

**METHODS**

We searched hospital and radiology quality assurance (QA) databases for incidents reported under the categories "communication/coordination/handoff" and "communication issue" and performed RCA. Errors were categorised using the observation classification created by Lingard et al. into one of audience, content, occasion, and purpose. During RCA, additional themes were noted allowing subcategory development.

**RESULTS**

285 incident reports were recorded, 17 with two errors, totalling 302 communication events. Purpose errors were most frequent (146/ 302, 48.1%), then content (137/302, 45.4%), occasion (14/302, 4.6%) and audience (5/302, 1.7%) (Table 1). Subcategories were developed for content (missing information, inaccurate information and unclear information), occasion (communication occurred too early or too late), and purpose (key individual (KI) could not be contacted, KI could not be reached, misunderstanding, lack of understanding and lack of closed loop). Occasion errors were limited to timing of communication, and purpose errors consisted of transfer issues.

**DISCUSSION**

We revised the classification system by Lingard et al. for use in radiology. Errors in the purpose category related to transfer of information. We suggest renaming this category as such. Occasion errors were related to timing of communication. This was the major cause of the error for real-time communication in the operating room for which Lingard et al.'s classification was designed. The new subcategories for content outlined above are helpful as each requires different countermeasures. Missing information may benefit from inclusion on checklists or in the electronic health record. In the purpose subcategories: "KI could not be reached" needs better contact information for referring provider, a known issue in large healthcare networks. "KI not contacted" would benefit from communication policy development. Closed loop protocol development is key in many scenarios. A limitation is that errors not listed under communication categories in QA databases may have been missed.

# Abstract Archives of the RSNA, 2024

R5A-QI

**Quality Improvement Reports Thursday Afternoon Poster Discussions I**

Thursday, Dec. 5 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## R5A-QI-2 TECHNOLOGIST-FOCUSED PROCESS IMPROVEMENT STRATEGIES FOR IMPLEMENTATION OF SPECTRAL CT TECHNIQUES IN RADIOLOGY WORKFLOW TO GUIDE RENAL STONE MANAGEMENT

Ramandeep Singh, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Natally AlArab, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Jacob Elam, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Dual-energy computed tomography (DECT) has been documented to be valuable non-invasive modality for characterizing renal stone composition, impacting treatment per American Urological Association guidelines. However, integrating DECT into radiologic workflows for stone analysis is challenging and largely underexplored. We aimed to implement process improvement technologist-focused interventions in a Plan Do Study Act fashion (PDSA) for renal/ureteric stone analysis (RSA), streamlining and integrating the derived results to picture archiving and communication system (PACS) for accurate stone composition.

### METHODS

Aimed at a step wise approach, surveys were given to the CT technologists asking various questions about their experience, training, and confidence using RSA tools in SyngoVia prior to their education session. Serial meetings with CT technologists were conducted which included tiered education sessions on generating material decomposition (MD) images and using RSA tools in SyngoVia (Siemens Healthineers, Forchheim, Germany) organized for CT technologists (techs) by a PGY-2 resident under the supervision of a board-certified radiologist/medical director. DECT data gathered with stone protocols from 1/11/24 to 3/15/24 was processed by CT techs through SyngoVia for MD and exported to PACS. This marked PDSA 1. RSA during this time was performed manually for some cases to demonstrate as example cases to the techs. Following this, CT techs underwent training on RSA, with subsequent workflow implementation (PDSA 2). PDSA 3 was conducted to reduce pitfalls, such as phleboliths and prostatic calcifications.

### RESULTS

Baseline data included (11/11/23 to 1/10/24) 117 patients scanned with DECT stone protocol without MD or RSA with 65 (56%) positive for stones. From 1/11/24 to 3/15/24 (PDSA 1), 128 patients were scanned using DECT stone protocol with 128 (100%) MD and 3 (2%) RSA. In total, 67 (52%) had renal (RS) and 38 (30%) ureteric (US) stones. From 3/18/24 to 4/18/24 (PDSA 2), 34 DECTs were performed with MD in 34 (100%), RS in 21 (62%) and US in 12 (35%), 18 (53%) underwent RSA (RS 14, US 10). From 4/18/24 to 4/30/24 (PDSA 3), 33 patients were scanned using DECT stone protocol. 33 (100%) underwent MD. 9 studies (27%) were positive and 4 (12%) underwent RSA. 1 case (3%) was missed with a clinically significant stone (> 3 mm).

### DISCUSSION

Our study showcases effective technologist-driven process improvements, integrating RSA into the radiology workflow. In PDSA 2, techs accurately identified positives but also marked pitfalls and produced false positives. However, in PDSA 3, techs improved significantly, correctly identifying most clinically significant stones (> 3 mm) while avoiding pitfalls. Notably, cases with stones < 3 mm bypassed RSA due to software limitations. Given the questionable clinical significance of such stones, this approach is deemed acceptable.

## R5A-QI-3 AUTOMATED ASSESSMENT OF BREAST POSITIONING QUALITY IN TOMOSYNTHESIS SCREENING USING AN AI-BASED EVALUATION SYSTEM

Ying Guo (*Abstract Co-Author*) Nothing to Disclose
Xuefei Lv (*Abstract Co-Author*) Nothing to Disclose
Fang Fang (*Abstract Co-Author*) Nothing to Disclose
Ellisa 1020 (*Presenter*) Nothing to Disclose

### INTRODUCTION

Mammography quality assurance initiatives are priorities in the implementation of public health screening services. The passive audit approach consists of regularly repeated rounds of review of random samples followed by a training effort and a monitoring work. It has been a time-consuming process and less efficiency. Automation and standardization of quality assessment enable real-time feedback to technicians and radiologists that shall reduce a number of inadequate examinations and provide a dependable training platform for inexperienced technicians.

### METHODS

2396 images of digital mammography over three consecutive quarters were evaluated according to the standards regulated by the Mammography Quality Standards Act (MQSA) on a four-point-scale (1 = poor, 4 = perfect). Incidence of inadequate positioning, which was defined by AI system as any of the following errors were recorded and compared: incomplete gland coverage, incomplete pectoralis major muscle inclusion, over or insufficient exposure,

skin fold, nipple not in the contour line, shoulder overlap shadow, abdominal skin, contralateral breast, and foreign body.The percentage of views rated perfect or good and the percentage of views with inadequate positioning were used to assess changes in performance.

**RESULTS**

After the implementation of quality control, the percentage of images rated as perfect or good in both CCs and MLOs were significantly increased. Improvements ranged from 10 to 15% for CC and 8 to 12% for MLO views. Compared to the second quarter, the positioning pass rates for CC views significantly improved in the third (OR=2.1, 95%CI:1.8-2.5) and fourth quarters (OR=2.5, 95%CI:2.1-3.0). MLO views exhibited a similar trend (third quarter OR=1.9, 95%CI:1.6-2.3; fourth quarter OR=2.7, 95%CI:2.2-3.3).There were significant differences in image score distributions across the three quarters (P<0.001), with the fourth quarter scoring significantly higher than the second (P<0.001). Within each quarter, CC view scores were significantly higher than MLO views (all P<0.001). Images score increases of 2.6 (P<0.001) and 3.5 (P<0.001) in the third and fourth quarters, respectively, compared to the second. CC view scores were 2.1 points higher (P<0.001) than MLO views.

**DISCUSSION**

In this study for all quarters, the positioning pass rates and image quality scores for CC views were significantly better than MLO views, potentially due to the higher technical difficulty of MLO views. Over time, the radiographer's positioning pass rates and image quality scores improved significantly for both CC and MLO views, reflecting the substantial improvement brought about by accumulated experience.The AI quality control system effectively provided objective data support for mammographic quality control.

## R5A-QI-4 BOOSTING STAFF CONFIDENCE AND EFFICIENCY: TRANSFORMING A COMPUTED TOMOGRAPHY (CT) PROTOCOL MANAGEMENT SYSTEM (PMS)

Christopher P. Favazza, PhD (*Abstract Co-Author*) Nothing to Disclose
Shuai Leng, PhD (*Abstract Co-Author*) License agreement, Siemens AG
Michael R. Bruesewitz, RT (*Abstract Co-Author*) Nothing to Disclose
Lifeng Yu, PhD (*Abstract Co-Author*) Nothing to Disclose
Andrea Ferrero, PhD (*Abstract Co-Author*) Nothing to Disclose
Joseph R. Swicklik, RT, BS (*Presenter*) Nothing to Disclose

**INTRODUCTION**

CT technologists and RN staff often struggle to find the correct scanning instructions due to a growing number of protocols and a difficult-to-navigate protocol instruction management system (PMS). This led to outdated instructions due to staff shortages and minimal editing time. The project aimed to improve scan instruction usability for frontline staff and expedite the editing process for the lead team.

**METHODS**

On average, 112 staff accessed 2,132 instruction documents daily through a PMS using PDFs and WordPress, which was cumbersome and error prone. To address these issues, a new PMS was developed using Microsoft SharePoint, simplifying navigation and editing with a user-friendly interface (Figure 1-A,B,C). The launch included a three-week parallel run with the old system, supported by comprehensive training and presentations to ease the transition.Three user groups assessed the impact: lead technologists on editing efficiency, and nurses and CT technologists on locating and using the correct instructions. Improvements were measured in time savings and confidence. Satisfaction levels were measured for all groups comparing the usability of the new PMS with the old system.

**RESULTS**

Time saved by the lead technologist group was on average 27 minutes for each document. Their Net Promoter Score (NPS) for the usability of the site increased by 89% (Figure-1D). Nursing staff, when assessed for time finding protocols, showed a savings of 3.75 minutes per document (Figure-1A). Their NPS score for usability of the site increased by 51%, and 95% of staff surveyed said their confidence in selecting the correct protocol increased (Figure-1E). 93% of CT technologists also stated their confidence increased with the new system (Figure-1F). The analysis of the data revealed that staff's ability to find protocols and increased confidence were due to the new system's search capabilities and the ability to add protocol number metadata to each instruction document (Figure-1G). Additionally, with staff now viewing the source file type, broken links proved to no longer be an issue.

**DISCUSSION**

Leveraging SharePoint’s infrastructure, a new PMS was designed which increased confidence, usability, and should allow for easier upkeep. Limitations of our study include the absence of timed data to evaluate time savings and the reliance on staff surveys, which had a limited response rate.

## R5A-QI-5 ENHANCING REAL-WORLD EVIDENCE ANALYSIS IN MEDICAL IMAGING WITH GENERATIVE AI

Victor Gadelha (*Abstract Co-Author*) Nothing to Disclose
Flavia P. Lopes, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Leonardo Vedolin, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Gustavo Corradi, MD (*Abstract Co-Author*) Nothing to Disclose
Eduardo M. Farina, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

In medical research, the integration of artificial intelligence (AI) is increasingly prevalent, particularly in real-world evidence (RWE) analysis. This study explores the utilization of Google's Medpalm2, a generative AI model, to scrutinize patterns within medical imaging reports, aiming to augment RWE accuracy.

**METHODS**

We employed Medpalm2 to parse through endoscopic imaging reports, comparing its efficacy against traditional methods like regular expressions (regex) in identifying medical findings. Through rigorous testing, we evaluated Medpalm2's accuracy and efficiency in processing data and extracting insights.

**RESULTS**

Comparing the performance metrics, we observed that the traditional method of regex achieved an accuracy rate of 73.4%, whereas Medpalm2 surpassed this with an impressive accuracy rate of 86.7% for the identification of adenocarcinoma suspicious lesions described. This notable difference underscores the efficacy of utilizing Medpalm2 for RWE analysis in medical imaging. By leveraging its generative AI capabilities, Medpalm2 demonstrated a significant improvement in accuracy, thus enhancing the reliability of findings extracted from medical imaging reports. This suggests that Medpalm2 not only outperforms traditional methods but also holds immense promise in revolutionizing the landscape of RWE studies. Its ability to process vast datasets with greater precision not only streamlines the analysis process but also augments the depth and quality of insights garnered. Consequently, Medpalm2 emerges as a cornerstone tool for researchers and healthcare professionals seeking to extract meaningful insights from complex medical data, thereby driving advancements in healthcare research and practice.

### DISCUSSION

In conclusion, our study underscores the pivotal role of generative AI, exemplified by Medpalm2, in advancing RWE analysis in medical imaging. Its demonstrated accuracy and efficiency herald a promising future for AI integration in medical research, shaping the trajectory of RWE studies and fostering enhanced insights in healthcare.

## R5A-QI-6 OPTIMIZING HRCT PROTOCOLS IN A LARGE COMMUNITY HOSPITAL SETTING WITH PRONE EXPIRATORY IMAGING

Sagar B. Amin, MD (*Abstract Co-Author*) Nothing to Disclose
Muhammad Naeem, MD, MBBS (*Abstract Co-Author*) Nothing to Disclose
Robin Jaleel, MD (*Abstract Co-Author*) Nothing to Disclose
Thangalakshmi Sivathapandi, MD (*Abstract Co-Author*) Nothing to Disclose
Chenxi Wu, MD, PhD (*Presenter*) Nothing to Disclose

### INTRODUCTION

High-resolution computed tomography (HRCT) is indispensable in the diagnosis of interstitial lung diseases. In our large safety net hospital (Grady Memorial Hospital), different HRCT protocols were used before with suboptimal and inconsistent diagnostic quality. This quality improvement project aimed at creating and implementing a new HRCT protocol which standardized prone expiratory imaging to improve imaging quality and increase the diagnostic accuracy and confidence among radiologists.

### METHODS

The new HRCT protocol consisted of supine inspiratory and prone expiratory scans. Technologists' education was conducted before initiation. HRCT data before (Feb to Aug 2023, 91 scans) and after the implementation of new protocol (Aug 2023 to Jan 2024, 139 scans) was reviewed. The evaluation of inspiratory effor, expiratory effort, and motion was analyzed. "Good expiration effort" was defined by posterior membrane bowing or flattening, and no such findings was considered "good inspiratory effort." Exclusion criteria included patients on research protocol, could not lay prone, and if any of the data was missing on the old HRCT. Imaging data from the old and new HRCT group were analyzed using Pearson Chi-square test, and $p < 0.01$ is considered statistically significant. A structured questionnaire was distributed to cardiothoracic radiologists 6 months after starting new HRCT protocol. Responses were scored using a 4 and 5-point Likert scale system.

### RESULTS

89 old HRCT and 109 new HRCT scans were included. There was good consistency and reproducibility among technologists after the training on performing the new protocol. Only 3 scans (3/109, 2.8%) had quality issues or were not performed in accordance with the new protocol. The new protocol led to an enhanced expiratory effort on proning (49.4% vs 78.3%, $p < 0.01$) and reduction in motion (62.9% vs 20.2%, $p < 0.01$). Inspiratory efforts were identical among the two groups (88.8% vs 96.3%, $p > 0.05$). Four radiologists' questionnaires were collected. All considered the overall imaging quality under new protocol was "excellent" or "good" (average score 3.5 out of 4) Image quality for prone expiratory was "much better" or "somewhat better" compared to supine expiratory (4.5 out of 5). The visibility and clarity of ILD patterns has "significantly improved" or "somewhat improved" (4.5 out of 5), their diagnostic confidence has "significantly improved" or "somewhat improved" (4.5 out of 5), and this new HRCT protocol was "very useful" or "moderately useful" in clinical decision-making for ILD patients (3.75 out of 4).

### DISCUSSION

Prone expiratory scan is technically easy, reproducible, and can significantly improve the evaluation of air trapping. Furthermore, this new protocol improves efficiency in our busy practice by not having to decide if additional prone imaging is needed, while also maintaining only two acquisitions.

## R5A-QI-7 OBJECTIVE JUSTIFICATION OF CT AND MRI EXAMS IN LARGE SAMPLES

Oskar Lofgren, MD (*Abstract Co-Author*) Nothing to Disclose
Henriettae Stahlbrandt, MD, PhD (*Presenter*) Nothing to Disclose

### INTRODUCTION

In Sweden, as in most countries, cross-sectional imaging is steadily increasing. National data shows a 56% increase in CT exams and a 49% increase in MRI exams between 2012-2021. Justification of exams should be based on guidelines, and is a joint responsibility between referrers and radiologists. Guidelines are however not integrated in the referral system, and justifications are most of the time based upon the individual knowledge of the physicians. In this study, the largest in Europe to date, a retrospective analysis of CT and MRI exams was performed to study the ratio of justified and non-justified exams, as well as referrer patterns in justification.

### METHODS

All CT and MRI exams of patients 18 years and above within four Swedish healthcare regions during October 2021 were collected (n=25,032). The data included was: gender, age, exam, level of healthcare referring (university hospital/other hospital/primary care). CT and MRI protocols were matched to equivalent protocols in the European iGuide database v.15, translated to Swedish (matching rate 93%, n=23,196) . iGuide, as ACR Select, is a profession-driven knowledge database including over 2,300 indications and over 1,000 protocols, giving guidance on which exams/protocols are justified (score 7-9; green); may be justified (score 4-6; yellow), or probably not justified (score1-3; red). All exams performed with matched protocols were consequently matched on indication level (matching rate = 56%, n=13,075).

### RESULTS

Overall results of justified exams (score 7-9) were 63% for CT and 75% for MRI. Primary care units had the lowest justification of CT exams (46.9%), but the highest justification for MRIs (81.1%). University hospitals and other hospitals had the same level of justified CTs (66%), but the university hospitals had a lower degree of justified MRIs (72.5% compared to 76.6% for other hospitals). Of the CT exams with scores 1-6, 32% could achieve higher levels of justification by changing to another CT protocol, 24% to x-ray, and 5% did not have a corresponding exam with a higher score. Of the MRI exams with scores 1-6, 33% could achieve higher levels of justification by changing to CT, 21% to x-ray, and 17% did not have a corresponding exam with a higher score.

### DISCUSSION

Not all CT and MRI exams were justified despite being evaluated by a referring physician and a radiologist in beforehand. The number of potential non-justified exams, and thus the total number of exams, can be reduced by following existing guidelines. Discussions regarding justification and guideline accessibility need to continue at all levels of healthcare, from primary care to university hospitals, since potential non-justified exams come from all referrer levels. A limitation of the study of the mapping rate of indications of 56%. However, the final number of mapped exams is large, and the results are comparable to previous studies.

## R5A-QI-8 IMPACT OF REVISED ORAL CONTRAST GUIDELINES ON CT EFFICIENCY IN PEDIATRIC EMERGENCY DEPARTMENTS: A MULTI-SITE STUDY

Geetika Khanna, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Erica Riedesel, MD (*Abstract Co-Author*) Nothing to Disclose
Ashishkumar K. Parikh, MD (*Abstract Co-Author*) Nothing to Disclose
Farid Hajibonabi, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Oral contrast media (OCM) was used in all routine computed tomography (CT) imaging for non-traumatic acute abdominal pain in our children's hospital system. Prior literature has demonstrated diminishing benefits in usage of OCM, resulting in prolonged wait times and increased costs. This study aims to assess the effects of revised OCM guidelines within a large multi-site children's hospital system.

### METHODS

Following the identification of the high rate of OCM utilization at our institution, an effort was made to revise the OCM guidelines (Figure 1). Prior to this, OCM was given to any patient presenting with acute non-traumatic abdominal pain of greater than 48 hours duration. In 2021, we revised guidelines for administering OCM for abdominal CT scans to restrict its usage to clinical request only. Then we evaluated all abdominal CT scans during the years 2019 and 2023 which were indicative of pre and post intervention periods. Data were gathered from electronic health records. We assessed OCM usage rates and turnaround time (TAT) before and after guideline implementation, employing multiple linear regression analysis to evaluate the impact of the intervention. Measures included OCM usage rates and TAT. Analysis involved quantitative methods, including multiple linear regression with significance at $p<0.05$ and using SPSS (IBM v29.0).

### RESULTS

A total of 2,259 abdominal CT exams from the ED were evaluated, including 1101 (48.7%, 1101/2259) and 1158 (51.3%, 1158/2259) before and after OCM guideline change respectively. Patient demographics and chief complaint did not differ significantly between time periods. Mean (SD) TAT for hospital 1 was 114.38 (79.51) and for hospital 2 was 109.01 (104.31) . Prior to OCM guideline change, OCM was used in 278 (32.7%, 278/851) exams at Hospital 1 and 104 (41.6%, 104/250) exams at Hospital 2. Following the change, OCM use decreased at Hospital 1 to 5.4% and at Hospital 2 to 2.5% (p-value for both < 0.001). With decreased use of OCM, mean TAT at Hospital 1 decreased from 129 min to 100 min ($p<0.001$) and at Hospital 2 decreased from 152 min to 76 min ($p<0.001$). Additionally, controlling for age and year of the exam, multiple regression analysis showed that contrast utilization was significantly associated with increased TAT in hospital 1 (Beta = 139.10; CI [131.47 - 146.74], $p<0.001$) and hospital 2 (Beta = 163.14; CI [144.11 - 182.17]).

### DISCUSSION

Revisions to oral contrast media (OCM) guidelines for abdominal CT scans in our pediatric emergency departments resulted in significant reductions in OCM usage and turnaround time (TAT). Limitations include the retrospective design and uncertainty regarding the clinical impact of missed or delayed diagnoses. Future research should explore the specific clinical scenarios in which administering OCM for abdominal CT provides the most benefit.

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# Abstract Archives of the RSNA, 2024

R5B-QI

**Quality Improvement Reports Thursday Afternoon Poster Discussions II**

Thursday, Dec. 5 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## R5B-QI-1 ENERGY AND COST SAVINGS OBTAINED WITH A MODIFIED PANCREAS MRI PROTOCOL IN DEFINED CLINICAL SETTINGS

Greg Stortz, PhD, BEng (*Abstract Co-Author*) Nothing to Disclose
Silvia D. Chang, MD, FRCPC (*Abstract Co-Author*) Nothing to Disclose
Maura J. Brown, MD (*Abstract Co-Author*) Synthesis Health Inc - research collaboration, no financial relationship at this time ( Nov 2022).
Caoimhe Byrne, MBBCh (*Presenter*) Nothing to Disclose

### INTRODUCTION

Surveillance of intraductal pancreatic mucinous neoplasms (IPMNs), a common premalignant cystic neoplasm is typically performed by MRI. Surveillance is a growing demand on resources at a time when there is a need for imaging departments to deliver more sustainable healthcare. Standard pancreas MRI (PMRI) includes contrast enhanced sequences. Studies have shown abbreviated protocols omitting gadolinium (AMRI) are suitable for detecting worrisome features and high risk stigmata without missing malignancy. AMRI is safe and has time and cost savings. This is supported by a review performed at our institution, following which AMRI was introduced for follow up of IPMNs. The purpose of this study was to quantify the effects of AMRI in terms of environmental, time and cost savings.

### METHODS

A process map was created. Estimates of energy consumed by each protocol were calculated and were based on total time actively scanning as well as time in idle and ready-to-scan states. An inventory of materials saved by AMRI (e.g. cannula, disposable injector kit) was made. Savings in energy and materials were used as input to a life cycle assessment (LCA) using SimaPro software. The ReCiPe 2016 Endpoint methodology was used to quantify environmental benefits of AMRI compared to PMRI.

### RESULTS

Time taken and energy used during the AMRI is less than PMRI. In our institution, the impact of material consumption is the same magnitude as energy consumption. This owes to the fact that electricity in our region is generated from ~95% renewable sources. When the model is recomputed using data specific to the US, including electricity generated through burning of fossil fuels, environmental impact is dominated by energy consumption.Regarding time and cost savings P-MRI has an active scan time of 24:42. It is booked in a 45 minute time slot during daytime hours. AMRI has an active scan time of 11:07. It is booked in a 25 minute slot and can be booked outside of daytime hours. Cost of equipment to administer gadolinium is $64.16 (CAD) per examination. Cost savings in terms of energy expenditure is $1.63 per scan.

### DISCUSSION

A limitation of this study is that calculations regarding energy expenditure of MRI are based on available published data. Also, gadobutrol is not available in the SimaPro database. Gadolinium is a contaminant of aquatic ecosystems, the full effects of which are not currently known.AMRI for follow up of IPMNs provides safe and effective surveillance while reducing environmental effects through decreased consumption of energy and single use materials. Cobenefits include lower costs, more flexible scheduling and improved patient comfort through shorter scan times and the avoidance of cannulation.

## R5B-QI-3 DOLLARS AND DISPLAYS: AN ACTIVITY-BASED COSTING APPROACH TO ASSESSING THE TOTAL COST OF OWNERSHIP OF COMMERCIAL-GRADE DISPLAYS VERSUS DIAGNOSTIC-GRADE DISPLAYS FOR REMOTE DIAGNOSTIC STATIONS

Po-Hao Chen, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Roy Kittelberger (*Abstract Co-Author*) Nothing to Disclose
Masai McDaniel (*Abstract Co-Author*) Nothing to Disclose
Douglas Nachand, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer Arnold (*Abstract Co-Author*) Nothing to Disclose
Monica Sanchez (*Abstract Co-Author*) Nothing to Disclose
Ryan Thomas (*Abstract Co-Author*) Nothing to Disclose
Jason Massey (*Abstract Co-Author*) Nothing to Disclose
Namita S. Gandhi, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Katie Hulme, MS (*Presenter*) Nothing to Disclose

### INTRODUCTION

With increasing demand for hybrid or remote work, the adoption of diagnostic Workstations with Commercial-grade Displays (WCDs) is on the rise, sometimes replacing Workstations with Diagnostic-grade Displays (WDDs). While WCDs promise substantial upfront cost savings, they also bring complex

financial implications due to increased manual efforts in quality control (QC), deployment, and maintenance. We applied an activity-based costing (ABC) approach to evaluate the overall economic impact of WCDs versus WDDs.

### METHODS

Our study examined the lifecycle of a WCD from procurement through to operation. We evaluated both indirect costs, ranging from equipment requests to IT support, and direct costs including hardware and software. Analysis assumed mean hourly wages of IT analysts, physicists, and radiologists reported by the US Bureau of Labor Statistics. Equipment and supply costs were based on the manufacturer's suggested retail prices (MSRP), averaging MSRP values from various vendors for comparable equipment where necessary. Although activity-based costing (ABC) typically spreads equipment costs through depreciation, we recorded these costs in year one to reflect the immediate cash outlay required for deploying a workstation. Each activity was scrutinized to identify significant cost drivers. We estimated the total cost of ownership (TCO) for both WCD and WDD by projecting the annual costs of each over the expected lifespan (assumed to be 5 years).

### RESULTS

Analysis revealed 18 indirect cost activities and several direct cost components. Because WCDs necessitated stations be built in full the purposes of calibration, acceptance testing, and radiologist QC training, and then disassembled for distribution, overall deployment activities were estimated to add an additional $784, on average, to the TCO for WCD, compared to $348 for WDD. Incremental yearly costs for WCD depended on frequency of manual QC (calibration, etc.) and QC failures, and time required to track and enforce routine user-initiated QC. Year one cost for WCD was $8,813, compared to $17,039 for WDD, mainly driven by equipment cost. The activity-cost for yearly maintenance was ~$664 for WCD, compared to ~$160 for WDD. The major contributing drivers for WCD's higher yearly activity cost were manual QC and calibration, IT support for QC failures, and physicist oversight related to QC. TCO for WCD was $11,469-$20,006 (pending frequency and failure-rate of QC), compared to $17,678 for WDD.

### DISCUSSION

Radiology workstations with commercial-grade displays offer significant initial cost savings compared to those with diagnostic-grade displays. However, the higher ongoing operational expenses for maintenance and support of WCDs may negate these initial savings over time. The balance between short-term savings and long-term financial benefits depends on the budgetary needs of the radiology practice.

## R5B-QI-4 ASSESSING FOR ALGORITHM BIAS: DIFFERENTIAL PERFORMANCE OF AN AI ALGORITHM BETWEEN US AND AFRICAN HOSPITALS

Houman Sotoudeh, MD (*Abstract Co-Author*) Nothing to Disclose
Steven A. Rothenberg, MD (*Abstract Co-Author*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC
Kevin L. Junck, PhD (*Abstract Co-Author*) Nothing to Disclose
Jordan D. Perchik, MD (*Abstract Co-Author*) Nothing to Disclose
Grant D. Smith, BS (*Presenter*) Nothing to Disclose

### INTRODUCTION

The number of artificial intelligence (AI) applications entering the radiology marketplace continue to increase each year, however there are gaps in AI testing that can result in patient harm. Algorithm bias, degraded performance of an AI application on specific patient populations, is notoriously difficult to detect and monitor. Patients from underrepresented backgrounds and from low- and middle-income countries are particularly susceptible to algorithm bias due to underrepresentation in algorithm training data. This project compares the performance of an intracranial hemorrhage detection algorithm between patients at a US hospital and two African hospital systems.

### METHODS

Non-contrast head CTs performed at two hospital systems in Africa (Cameroon and Ethiopia) from January 1, 2024 to March 31, 2024 were reviewed. Precision, recall, and accuracy of the ICH algorithm were calculated and compared to the host US hospital and to published results by the AI vendor.

### RESULTS

266 exams were performed during the study period. A higher number of false positives were observed during the first two months of data collection, resulting in a recall of 0.74 and 0.55 compared to a published recall of >0.95. This prompted an intervention by the vendor between the second and third months of data collection, resulting in an improved recall of 0.92. Accuracy also increased from 0.90 and 0.88 during the first two months to 0.96 after the intervention compared to a published accuracy of >0.90. A low number of false positives were observed, resulting in a high precision of the algorithm throughout the study period, measuring 0.89, 1.0, and 0.96. This was higher than the precision observed at the US hospital of 0.78.

### DISCUSSION

Initial evaluation of algorithm performance demonstrated a significant disparity between the African and US cohorts. After vendor intervention, algorithm performance approached or exceeded the baseline. Assessing for algorithm bias between different geographic locations and between different patient populations can uncover disparities in algorithm performance.

## R5B-QI-5 QUALITY CONTROL OF DEEP LEARNING MR IMAGE RECONSTRUCTION AT 0.55 TESLA

Andrew D. Smith, MD, PhD (*Abstract Co-Author*) Owner, AI Metrics LLC;Chairman, AI Metrics LLC;Officer, AI Metrics LLC;Patent agreement, AI Metrics LLC;Owner, Radiostics LLC;CEO, Radiostics LLC;Speaker, Canon Medical Systems Corporation;Patent holder, AI and Image Processing Algorithms
Constantine M. Burgan, MD (*Abstract Co-Author*) Nothing to Disclose
Asser Abou Elkassem, MD (*Abstract Co-Author*) Nothing to Disclose
Houman Sotoudeh, MD (*Abstract Co-Author*) Nothing to Disclose
Srini Tridandapani, MD, PhD (*Abstract Co-Author*) Co-founder, Camerad Technologies, LLC;Spouse, Co-founder, Camerad Technologies, LLC;Officer, Camerad Technologies, LLC;Spouse, Officer, Camerad Technologies, LLC
Steven A. Rothenberg, MD (*Abstract Co-Author*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC
Manoj Tanwar, MD (*Abstract Co-Author*) Nothing to Disclose
Samuel J. Galgano, MD (*Abstract Co-Author*) Research support, Blue Earth Diagnostics Ltd;Research support, Novartis AG;Research Support, Curium SAS
Yulia Melenevsky, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

The integration of deep learning (DL) into magnetic resonance (MR) imaging reconstruction at 0.55 Tesla (T) is a recent development with limited clinical validation for various clinical applications. The goals of DL image reconstruction for MRI are to improve diagnostic accuracy by increasing signal to noise and spatial resolution while avoiding creation of artifacts that lead to false positives or negatives. The objective of this quality improvement report is to highlight clinically-relevant unexpected image findings encountered while implementing DL into MR imaging reconstruction at 0.55T.

### METHODS

27 volunteers underwent various body (n=15) and musculoskeletal (n=12) MRI exams on a 0.55T Siemens scanner. For comparison, images were reconstructed in pairs, using traditional methods and then separately using DL reconstruction methods. Three board-certified academic radiologists conducted a comprehensive visual assessment of the image pairs. Each radiologist assessed the image quality of the routine and DL reconstructed images, focusing on parameters such as tissue contrast, image noise, spatial resolution, and overall diagnostic clarity. Potential false positives and negatives were described.

### RESULTS

For MSK applications, there were limitations in identifying meniscal tears (n=3), and assessing cartilage morphology (n=1) using the DL reconstruction images, which tended to mask pathologies due to exuberant smoothing, contributing to potential false negatives. In addition, the DL reconstructed images led to abnormal signal hyperintensities and potential false positive meniscus tears on T1, Proton density (PD), and PD fat-saturated series, which were contradicted by negative findings on PD fat-saturated coronal images and the volunteer's denial of medial joint line pain. For body MRI applications, there was variability in obtaining respiratory gated abdominal images using the provided navigation sequence, contributing to long acquisition times that exceeded 20 minutes for a single series. Despite some obstacles, there were also instances of improvements in image quality with DL reconstruction, though this was variable across the volunteers and body regions.

### DISCUSSION

While DL reconstruction of MR images at 0.55T is intended to improve image quality, significant artifacts and clinically-relevant suboptimal performance were found in our prospective evaluation of volunteers on a new scanner. There was masking of pathology and abnormal signal hyperintensities that could contribute to false negatives and positives, respectively. Further investigation is needed prior to widespread adoptions.

## R5B-QI-6 CHEST X-RAY IMAGE QUALITY IMPROVEMENT

Ai-lee Chang, MD, FRCR (*Presenter*) Nothing to Disclose

### INTRODUCTION

There was perception that planar chest imaging in our department was not of the standard expected quality. The purpose of this quality improvement project was to bring back the culture of standard planar chest images in all settings.

### METHODS

Using the Plan, do, study and act format.Plan : All out patient chest x-rays to be of standard quality Standard quality is specified as : - Every effort should be made to perform a PA erect chest x-ray - The standard will vary between different referral groups - ie in-patient (IP), general practice (GP), out patient (OP) or Emergency department (ED) referral. - The standard includes, technical adequacy of exposure/penetration, inspiratory effort, rotation, angulation .Target : 75% PA erect for IP and ED patientsDo: Following local ethics committee approval, team engagement from planar imaging leads, radiology manager, education lead, initial retrospective audit of 100 chest x-rays performed in the ED over 3 days in March 2023. Portable radiographs were excluded. Study :The following observations were made :- AP or PA- Presence of artefacts (removable eg clothing )- Number of images acquired for the episode- Lordosis (if any)- Rotation (if any)- Sub lordotic angulation (if any)- Suboptimal inspiration- Supine view- Image cut off - Good PA / APAct:Interventions June to October 2023 / March 20241. Feedback to Radiographer leads and Radiology manager 2. One on one confidential feedback to individual radiographers by Radiographer leads3. Educational sessions by Education Lead and Radiographer Leads The audit cycle was repeated in November 2023 and March 2024.

### RESULTS

There is progressive improvement of the culture of standard chest x-ray quality, with zero artefacts and increase to 70% of PA images from 43%. See figure 1Taking 2 images is down to 4% from 15%.Good PA images increased from 4% to 55%. Good AP images increased from 0% to 17%

### DISCUSSION

Recommendations: 1. Continue one on one feedback 2. Continue practical and educational sessions and mentorship. 3. If issues with the equipment, radiographer leads / manager to attend. 4. Radiographers are encouraged to record specific issues and suggestions 5. Radiologists educational sessions emphasing the diagnostic importance of good quality chest x-rays. Limitations : the mode of transport has not been ascertained.Conclusions: The culture of standard chest x-rays and quality has become an expression of pride in our radiographer teams in seeing the product. Bringing out the best of oneself has been a great reward for the entire team. T

## R5B-QI-7 PERCUTANEOUS TRANSTHORACIC NEEDLE LUNG BIOPSY:A SINGLE INSTITUTION REVIEW

Yanzhi Wang (*Abstract Co-Author*) Nothing to Disclose
Daniel B. Gans, MD (*Abstract Co-Author*) Nothing to Disclose
Andy Tu, MD (*Abstract Co-Author*) Nothing to Disclose
Ting-Chang Sheu, DO, MPH (*Abstract Co-Author*) Nothing to Disclose
Daniel Sudrzynski, DO, BS (*Abstract Co-Author*) Nothing to Disclose
Faisal Al-Qawasmi (*Presenter*) Nothing to Disclose

### INTRODUCTION

The purpose of our study was to investigate the associations between patient characteristics and complication (overall, pneumothorax, hemorrhage, and hemoptysis) rates following computed-tomography (CT) guided transthoracic percutaneous lung biopsies.

### METHODS

At the OSF St. Francis radiology department, 620 patients with CT-guided percutaneous lung biopsies, dating from January 2017 to December 2019, were retrospectively analyzed. We collected data including past medical history, patient positioning, lesion location, lesion size, biopsy needle size, number of passes, blood patch use, complication and diagnostic yield were acquired from electronic medical records (EMR), specifically procedure reports and CT images.

### RESULTS

Our study involved 620 patients, yielding a biopsy diagnostic rate of 98.4%. Complications occurred in 38.2% of cases, with pneumothorax being the most common (30.2%). COPD was associated with higher complication rates ($p = .015$). We also found using 20G needles increased complication ($p < .001$) and hemorrhage rates ($p < .001$). Larger lesion sizes correlated with fewer overall complication ($p = .0001$), pneumothorax ($p = .0015$), and hemorrhage rates ($p = .0046$). Multivariate analysis confirmed COPD, needle gauge size, and lesion size as independent predictors of complication rates. Adjusted odds ratios showed COPD patients were 1.485 times more likely to experience complications ($p = 0.0356$), and 20G needles associated with a 1.965-fold increase in complication likelihood ($p = .0002$). Larger lesion sizes were inversely associated with complication ($p = .0003$) and pneumothorax

rates (p = .0019). 20G needles resulted in 3.889 times higher hemorrhage rates (p = .0002), while larger lesion sizes resulted in .675 times lower hemorrhage likelihood (p = .0065).

**DISCUSSION**

Transthoracic percutaneous lung biopsy is a valuable diagnostic tool, yet associated with notable complications. Our single-institution study reaffirms PTX, hemorrhage, and hemoptysis as common post-biopsy complications, occurring in 38.2% of patients. COPD significantly increases complication risk (43.4%). Needle gauge size influences hemorrhage rates, though technique likely plays a larger role. Larger lesions are associated with lower complication rates. Age, hypertension, diabetes, lesion location, patient position, and smoking status do not significantly impact outcomes. Our findings inform risk assessment and procedural planning, emphasizing tailored interventions for high-risk patients and optimizing biopsy techniques to improve safety and efficacy.

## R5B-QI-8 DIGITALIZATION OF ULTRASOUND QUALITY CONTROL - A STREAMLINED SOLUTION TO COVER HOSPITAL DISTRICT -WIDE OPERATION

Juha Peltonen, DSc (*Abstract Co-Author*) Nothing to Disclose
Anne-Mari Vitikainen, PhD (*Abstract Co-Author*) Nothing to Disclose
Mika K. Kortesniemi, PhD (*Abstract Co-Author*) Nothing to Disclose
Satu Inkinen (*Abstract Co-Author*) Nothing to Disclose
Juuso Ketola, PhD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Technical quality control (QC) of medical ultrasound (US) systems is essential to secure diagnostic image quality and safety. Image quality deviations in US are usually attributable to transducer damage resulting from impact or wearing. Damaged crystals can be seen as signal voids in in-air reverberation (IAR) patterns. External damage can be visually inspected. Measurements using phantoms are meaningful in quantitative assessment, but have little impact in routine QC, are time-consuming, and require trained personnel. The purpose of this study was to streamline our US QC program by focusing on monthly inspection and IAR image acquisition by local staff. Additionally, we developed a web-based QC result browser for documentation and automated analysis.

**METHODS**

A web application was developed for documenting and viewing QC results. It was built on top of our modular platform containing QC applications also for other modalities. A digital form is filled with queries regarding the general condition of the device and transducers. A form for inspecting the monitor using the AAPM TG18 image is also included. IAR images taken with a standardized protocol are automatically sent from PACS to a DICOM QC server and saved to the database. Signal depth and uniformity measures are also calculated. Site-specific QC report pages display local US devices and inspection records, and transducer-specific pages display IAR images, quantitative results, and observations.

**RESULTS**

During first four months, 16 sites with 50 US devices and 183 transducers deployed the new QC program. During this time, signal voids were identified in 26 transducers. Faulty connector was the cause of four defects. Four transducers were either repaired or replaced. One transducer exhibited only a subtle signal void and a minor lens cut, but electrical safety measurements revealed excess leakage current leading to replacement. Rest of the defective transducers are monitored if further degradation occurs.

**DISCUSSION**

Focusing QC practices to most relevant tasks allows for more frequent and efficient testing. A web-based QC platform enables prompt input of observations and browsing of history. There are over 80 US devices and 270 transducers in our department with large geographical coverage. Thus, it’s not feasible to perform phantom measurements with frequency recommended by guidelines (such as EFSUMB, BMUS, IPEM and AIUM). Based on our initial experience, simple monthly tests are justified and effective. This also saves resources when on-site QC experts or special equipment are not required. Our platform also removes the need for manual image processing. In future, we aim to improve our system by developing automatic signal void detection and deviation alerts. By adopting the new QC program our department has been able to receive QC reports more frequently, enabling prompt reaction to transducer defects.

# Abstract Archives of the RSNA, 2024

S3A-QI

**Quality Improvement Reports Sunday Afternoon Poster Discussions I**

Sunday, Dec. 1 11:45AM - 12:15PM Room: LEARNING CENTER

**Sub-Events**

## S3A-QI-1 OPTIMIZATION OF OUTPATIENT INTERVENTIONAL RADIOLOGY SCHEDULING AND APPROVAL PROCESS

Timothy M. Baran, PhD (*Abstract Co-Author*) Nothing to Disclose
Erin Panter (*Abstract Co-Author*) Nothing to Disclose
Lindsay Marchetti (*Abstract Co-Author*) Nothing to Disclose
Tanisha Henderson (*Abstract Co-Author*) Nothing to Disclose
Andrew J. Cantos, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Interventional Radiology (IR) is a multifaceted sub-speciality that performs a wide array of minimally invasive procedures, with services spanning the full spectrum of patient populations across outpatient, inpatient, and emergency room (ED) settings. The convergence of these variables poses a unique challenge in the workflow of IR. In the outpatient setting, IR consults for procedures require review and approval prior to scheduling. Inefficiencies in this process risk delayed patient care and reduced patient satisfaction. The purpose of this project was to streamline the current outpatient approval process of IR procedures with the goal to turnaround time (TAT).

### METHODS

This project was performed by the division of Interventional Radiology at a tertiary care, large academic institution. TAT for outpatient IR consults were obtained over a 22-month period. For each subset of data, two time points were obtained: time from consult placement to scheduling and time from consult placement to procedure completion. The differences in TAT was calculated and analyzed. Interventions included transitioning to electronic requests (July 2022) and implementation of swing shift and consult approval to daily responsibilities (July 2023). Statistical analysis was performed using Mann-Whitney test and Kruskal-Wallis test to determine significance. Multiple performance improvement methodologies, including Gemba walks, control charts, and fishbone diagrams were devised.

### RESULTS

During the 22-month period, 13,456 procedures were performed, 6,664 (50%) of which were from the outpatient population. From June 2022 to June 2023, the average IR order to procedure completion TAT (days) was 19.2, with average IR review TAT 7.07. From July 2023 to March 2024, the average procedure completion TAT was 14.7 ($p < 0.0001$) with average IR review TAT 4.94 ($p < 0.0001$). When divided into smaller 6-month increments, the average procedure completion TAT reduced: 21.1 (June 22-Dec 22), 17.1 (Jan 23-June 23), 16.0 (July 23 to Dec 23), 13.2 (Jan 24-March 24), with an overall decrease of 37% ($p < 0.0001$). Similarly, the average IR review TAT reduced: 8.12 (June 22-Dec 22), 5.79 (Jan 23-June 23), 4.9 (July 23 to Dec 23), 3.6 (Jan 24-March 24), with an overall decrease of 56% ($p < 0.0001$). During the reviewed 22 months, the average outpatient case volume increased by 18%, from 270 to 318 cases per month.

### DISCUSSION

IR scheduling is a complex process, balancing patient populations across multiple settings with different workflows. By optimizing the outpatient IR consultation process, there was a decrease in TAT for consultation approval by 56% and reduced TAT for procedure completion by 37%. By improving the TAT process, outpatient procedural volumes ultimately increased 18% during this time period. Continued efforts to enhance outpatient workflows are vital for improving timely access to IR services.

## S3A-QI-2 QUALITY IMPROVEMENT (SAFETY, EFFICIENCY) THROUGH RADIOGRAPHER COMPETENCY BASED KEY PERFORMANCE INDICATORS

Siok Mei Ng, BMedSc, MMedSc (*Abstract Co-Author*) Nothing to Disclose
Michael Ong, BSc, MSc (*Presenter*) Nothing to Disclose

### INTRODUCTION

Key Performance Indicators (KPI) that are specific, measurable, achievable, relevant and time bound are needed to objectively measure radiographers' performance and to drive quality improvement.

### METHODS

IOM's domains of quality, Ensure Safer Systems standards (JCI collaboration) and healthcare cluster goals were used to establish competency based KPIs for radiographers. The KPIs and targets were reviewed yearly using the Plan-Do-Check-Act tool. Performance data for the KPI data is obtained through observational audits, retrospective audits, system generated data or externally generated data. Radiographers make up the audit teams measuring different indicators. The smallest data collection audit team for reflective reports is a 3-man team while the largest audit team for General image quality audits is an 80-man team. Core audit teams are formed to consolidate data collection, perform analyses, set targets, and implement interventions to

drive improvement. Audits that have >90% sampling rate are x-ray image reject rate and RIS/PACS errors. Quality improvement (QI) is achieved through QIP projects, educational talks, journal club sessions and meeting updates.

**RESULTS**

Over the period of 10 years from 2011 to 2023, despite 58% increase in workload, the monitoring data was used to drive quality improvement:Hand hygiene compliance rate: 57% (2011) - 94% (2023)2 Patient ID documentation compliance rate: 59% (2011) - 99% (2023), patients visually verify their information and sign on the imaging form. This has reduced Sentinel Events reportable to the Ministry of Health to zero for the last 6 years.Reject rates: 7% (2014) to 6.9% (2023). In 2014, replacement of CR x-ray equipment with DR units started and it was observed that with DR, benchmark reject rates were higher than the CR reject rates. Despite increase in workload of 58%, PACS and RIS Errors have reduced by 70% from 2014 (10,000 errors/year) to 2023 (3,000 errors/year) ensuring timely reporting and no wrong images uploaded. Significant manpower savings from correcting errors was also observed.

**DISCUSSION**

Apart from KPI data collection, other data that drives patient safety like near-miss incidences of patients arriving with MRI contraindications is also monitored so interventions can be done to prevent actual incidences. Objectivity in performance appraisal increases radiographers' satisfaction and provides tangible goals to strive towards.CONCLUSION: The value of manpower invested to track data is reflected in quality improvement and patient safety. KPIs is a measure of a radiographers' competency.

## S3A-QI-3 REDUCING ANESTHESIA REQUESTS FOR ADULT INPATIENT MRI EXAMS

Jay K. Pahade, MD (*Abstract Co-Author*) Consultant, General Electric Company;Consultant, Clario Medical Imaging, Inc;
David Facchini, MBA, BS (*Abstract Co-Author*) Nothing to Disclose
Sandra Barbiero (*Abstract Co-Author*) Nothing to Disclose
Carly Brown (*Abstract Co-Author*) Nothing to Disclose
Marie Hausner, ARRT, RT (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Use of the Department of Anesthesia to sedate patients in need of an inpatient or ED MRI is associated with increased healthcare costs and delays. At our institution, we noted that many anesthesia requests for MRI orders were not needed. For example, claustrophobia may not be relevant when an exam involves positioning of the head outside of the bore and many patients can be scanned using floor prescribed anxiolytics, eliminating need for anesthesia team. A multidepartment team launched an initiative to reduce the number of inpatient MRI anesthesia orders by 25%, from baseline mean of 56 orders per month, within 3 months.

**METHODS**

Baseline data was collected for 6 months to investigate order-to-begin (O-B) times for adult inpatient and ED MRI exams ordered with anesthesia, types of MR orders, patient positioning in relation to the bore, and MR scan times. The primary intervention for this project was creation of an inpatient MRI anesthesia care pathway embedded into our medical record. The pathway included guidance for ordering providers on non-pharmacological options, patient position for common exams (head within or outside of bore), and floor prescribed pharmacological options with links to the appropriate drug orders.

**RESULTS**

Scan time ranged from 10-120 minutes. At baseline mean O-B time for inpatient MRI exams with anesthesia versus those without was six times longer (129 vs 22 hours). After pathway launch, the number of MRI exams ordered with anesthesia per month decreased by 23% (baseline 56, post intervention 43) with 16% improvement in O-B of MRI exams with anesthesia (129 vs 108 hours). To study the effect of using the pathway, a one-month (January 2024) assessment was completed looking at all uses of the pathway in patients who subsequently had an inpatient MRI completed. There were 43 unique patients where the ordering provider utilized the pathway. For those patients, 63% had an exam completed without anesthesia, 9% were completed with anesthesia and 28% did not have a completed MRI. During this month, a total of 27 patients had an MRI ordered with anesthesia, of which 85% did not utilize the pathway.

**DISCUSSION**

Implementation of a clinical care pathway led to a reduction in anesthesia requests for adult inpatient MRI exams by 23%, reducing healthcare costs and resource utilization. The O-B time for anesthesia MRI cases also improved by 16%. The pathway provided guidance and made it easy to order premedication for anxiety, pain control or movement disorders. Use of the pathway was associated with a reduction in anesthesia orders compared to non-utilization of the pathway. When the pathway was utilized, only 9% of patients ended up having an MRI with anesthesia. However, most MRI exams ordered with anesthesia (85%) did not consult the pathway. Suggesting the pathway has been successful in providing anesthesia alternatives, and there is opportunity to increase pathway utilization.

## S3A-QI-4 DECREASING INCORRECTLY SCHEDULED SCREENING ULTRASOUNDS FOR HIP DYSPLASIA IN PREMATURE INFANTS

Lauren J. Ehrlich, MD (*Abstract Co-Author*) Nothing to Disclose
Daniella Asch, MD (*Abstract Co-Author*) Nothing to Disclose
Landra Knoth (*Abstract Co-Author*) Nothing to Disclose
Jay K. Pahade, MD (*Abstract Co-Author*) Consultant, General Electric Company;Consultant, Clario Medical Imaging, Inc;
Janelle Van Luling, RT, ARRT (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Screening ultrasound (US) for developmental hip dysplasia in infants with risk factors should be performed after 6 weeks corrected gestational age (CGA). Scanning before this age leads to higher false positive rates and potential need for repeat exam, creating waste and undue stress on child and family. Our pediatric radiologists observed many premature infants arrived too early for their screening ultrasounds. This study aimed to reduce incorrectly scheduled screening exams from a baseline rate of 50% to less than 25% within 6 months.

**METHODS**

Our quality improvement (QI) team along with pediatric radiology and orthopedics, ultrasound, IT, and scheduling utilized model for improvement QI methodology to assess current state, identify key drivers and test interventions to decrease exams scheduled before CGA of 6 weeks. In our initial PDSA cycle, an order question was added in the Electronic Health Record (EHR) to clearly identify which exams were ordered for positive physical exam finding vs screening and thus should be scheduled after 6 weeks CGA. The question also embedded scheduling guidance and displayed CGA (if available). Scheduling error rates were calculated by manual audit of all hip US orders that had a screening clinical indication and CGA available. In the next PDSA cycle, a special work queue was created to leverage expertise of certain schedulers.

### RESULTS

Baseline 6 month mean rate of incorrectly scheduled exams was 50%. After intervention 1 (provider education; report to facilitate manually rescheduled exams), mean rate decreased to 29%. After intervention 2 (EHR order question with scheduling guidance), mean rate reduced to 27%. Investigation showed exams were ordered via fax, requiring schedulers to select proper indication based on the provided history. Additionally, CGA was not calculated in the EHR for many infants requiring calling parents to obtain age and schedule properly. Since scheduling many exams could not be accomplished with available EHR information and inconsistencies in scheduling based on CGA by scheduling, decision was made to trial a special work queue (intervention 3) managed by a small group of trained schedulers. After this change, mean error rate decreased to 10%.

### DISCUSSION

This project decreased incorrectly scheduled screening pediatric hip ultrasounds by 80%. People-, process-, and system-related interventions were tested and implemented to drive change. The initial project goal was to create an IT-driven scheduling solution to prevent screening exams from being booked before 6 weeks CGA. However, given EHR programming limitations, missing patient information and many paper orders, initial IT modifications prevented us from achieving our goal. Subsequent PDSA cycles led to a solution using informatics and scheduling process changes. A limitation is that error rates could only be tracked for patients with CGA in the EHR.

## S3A-QI-5 IMPROVING PROSTATE MR IMAGE QUALITY COLLABORATIVELY

Ben C. Wandtke, MD, MS (*Abstract Co-Author*) Clinical Advisory Board, CAK Tech, Inc
Eric P. Weinberg, MD (*Abstract Co-Author*) Nothing to Disclose
Wing-Chi E. Kwok, PhD (*Abstract Co-Author*) Nothing to Disclose
Peter A. Rosella, MD (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Purysko, MD (*Abstract Co-Author*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;
Erin Panter (*Presenter*) Nothing to Disclose

### INTRODUCTION

Approximately 13% of men are diagnosed with prostate cancer during their lifetime.(1) High quality magnetic resonance imaging (MRI) serves a valuable role in the detection of prostate cancer, yet image quality is not routinely audited. Poor image quality limits diagnostic confidence and the accuracy of image guided biopsies. The project's goal was to improve prostate MRI image quality through use of the Prostate Imaging Quality (PI-QUAL) scoring metric, improving detection of prostate cancer.

### METHODS

In partnership with the ACR Learning Network®,this project was performed at two outpatient MRI facilities within a large academic medical center. The PI-QUAL scoring system was utilized to evaluate the diagnostic quality of multiparametric prostate MRI exams. The system used a 5-point Likert scale to determine if the exam had sufficient quality to "rule-in" or "rule-out" clinically significant prostate cancers. (2,3)The project team consisting of fellows, radiologists and radiologic technologists (RT) were trained in the use of PI-QUAL. To obtain baseline data, the team audited 276 exams over 8 weeks. As DWI poses the greatest challenge to high-quality prostate MR exams, we decided to focus on our DWI images in addition to the overall PI-QUAL score. Our goal was to improve the number of exams meeting a PI-QUAL score of >4 (91% to 93%) and optimal DWI images (71% to 80%). 30 exams/week were then audited over 6 months.Using the A3 performance improvement methodology, our multidisciplinary team identified multiple potential root causes for poor image quality. From these, key drivers were determined, and interventions tested and implemented using PDSA cycles.

### RESULTS

1,206 exams were audited. Weekly PI-QUAL scoring >4 increased from an average of 91% to 99% (9%) and DWI images rated optimal increased from an average of 71% to 88% (24%).

### DISCUSSION

Key drivers included: (1) a sustainable process for evaluating image quality and (2) standard day of exam preparation. Since baseline PI-QUAL scores were deemed exceptional without an enema preparation and potential patient dissatisfiers, the team focused on bowel gas reduction techniques. Patients were told to refrain from consuming caffeine and carbonated beverages beginning eight hours prior to their MRI. Patient instructions were scripted and shared with staff who perform pre-MRI screening. To help troubleshoot artifacts, an MRI technologist was assigned as "coach of the day". Manual retrospective PI-QUAL auditing was time consuming. This process was improved by implementing an imbedded PI-QUAL score within the standardized report template. At many institutions, enemas are standard in the preparation for prostate MRI. Without adding an enema and without increasing examination duration, we significantly improved our outcomes. This project helped our MRI team gain a better understanding of each member's role in image quality.

## S3A-QI-6 IMPROVING PROSTATE MRI QUALITY

Jennifer Bullen, MSc (*Abstract Co-Author*) Nothing to Disclose
Kevin McDermott (*Abstract Co-Author*) Nothing to Disclose
Andrei S. Purysko, MD (*Abstract Co-Author*) Contract, Profound Medical Inc;Research support, Blue Earth Diagnostics Ltd;Consultant, KOELIS;
Rachel Harris (*Abstract Co-Author*) Nothing to Disclose
Ryan Ward, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

High quality prostate MRI is important for cancer detection and reader confidence. Artifacts, primarily due to rectal gas and motion, and noncompliance with MR technical standards can limit the assessment for prostate cancer on MRI. The purpose of this project was to improve prostate MR image quality, as assessed by the Prostate Imaging Quality (PI-QUAL) scoring framework.

### METHODS

In collaboration with ACR Learning Network, this performance improvement project was performed at the main campus of a large multihospital health system. We sought to 1) Increase the rate of prostate MRI exams that received a PI-QUAL score = 4 from 55% to 80%, and 2) Increase the rate of Diffusion Weighted Images (DWI) scored as "optimal" from 60% to 80% during the 9-month study period.The A3 performance improvement methodology was employed to assess the nature of the problem. Weekly volumes of prostate MRIs were tracked and scored for quality. Additional patient, technologist, and scanner-level data was tracked and assessed for contribution to poor image quality. Data was reported within a dashboard, viewable by key stakeholders.

### RESULTS

1370 prostate MRIs (from 1366 patients) were scored using the PI-QUAL framework in the 12 months between March 2023 March 2024. Key drivers of poor quality included bowel gas and motion artifact, no or incorrect patient preparation, inconsistent technologist training, lack of standards in image

quality, and variability in scanner protocols. Compared to pre-intervention scans, post-intervention scans were similar with respect to patient age, scanner vendor, model, and magnetic field. Image quality scores increased after the intervention, with overall PI-QUAL score rates reaching 93% and DWI score rates reaching 83% by the end of the study period, exceeding the established goal benchmarks. PI-QUAL scores have also remained above benchmarks in ongoing quality assessments.

**DISCUSSION**

Interventions included standardized technologist troubleshooting and scanner protocols, delivering consistent, timely, and effective patient preparation instructions, and developing consensus on image quality. The most important interventions to improve image quality related to removing gas from the patient's rectal vault with improved observed image quality, particularly on the diffusion weighted images. Using a team-based approach, our organization was able to achieve sustainable performance improvement. The project has also facilitated a sustainable quality control process through the development of tools to automate quality reporting. To date, over 2000 prostate MRIs have been scored using the PI-QUAL scoring system with results available in a real-time dashboard.

## S3A-QI-7 REDUCING THE OCCURRENCE OF UNFILLED OUTPATIENT APPOINTMENTS IN GIGU DEPARTMENT

Ravinder Sidhu, MD (*Abstract Co-Author*) Nothing to Disclose
Erin Panter (*Abstract Co-Author*) Nothing to Disclose
Susan Perry (*Abstract Co-Author*) Nothing to Disclose
Ben C. Wandtke, MD, MS (*Presenter*) Clinical Advisory Board, CAK Tech, Inc

**INTRODUCTION**

Fluoroscopy procedures are performed to diagnose conditions within the gastrointestinal track or genitourinary systems (GIGU). GIGU appointments canceled without notification result in inefficiency. In October 2023, there was an 8-week scheduling backlog for GIGU appointments, and average resource utilization was 76%. The no-show and same day cancellation rate was higher than other modalities in the department. We intended to improve GIGU room utilization by reducing unused appointment slots.

**METHODS**

This project was performed in a large urban academic hospital. We aimed to improve GIGU fluoroscopy room utilization from 76% to 85% within 6 months. Resource utilization and same day cancellations were measured weekly. Same-day cancellations were defined as patients who cancel the day of appointment or no-show. Using several performance improvement methodologies including Gemba walks, control charts, fishbone diagrams, and PDSA cycles our multidisciplinary team was able to identify multiple potential root causes. Key drivers were determined, interventions tested and implemented. Reports were generated and analyzed weekly to determine exam volume, cancelations, and scheduling backlog. The scheduling backlog was defined as the day of the 3rd next available examination.

**RESULTS**

Room utilization increased from an average of 76% to 86% (13%). Same day cancelation rate decreased from 22% to 13% (41%). Average exam volume increased from 52 exams to 58 exams per week (12%). GIGU scheduling backlog decreased from 8.3 weeks to 7.2 weeks.

**DISCUSSION**

Our lengthy GIGU appointment scheduling backlog and the inability to backfill same day cancellations were primary root causes of poor room utilization. During initial Gemba observations, it was realized that one of the cancelation reports was no longer accessible by the scheduling staff, which immediately improved the no-show rate. The interdisciplinary team of scheduling and front-line staff worked with EPIC® to develop an imaging appointment waitlist and create a new workflow for cancelations. Scheduling reviewed open appointments and notified waitlist patients of available appointments. An imaging waitlist workflow was implemented which immediately improved room utilization and increased exam volumes performed. While these efficiency gains resulted in a modest 1-week improvement in scheduling backlog, the new system should continue to have a slow but steady impact on backlog over time. Since the primary intervention performed, the development of an EMR based waitlist workflow, was developed in a shared EMR with numerous other sites providing GIGU fluoroscopy services, we anticipate being able scale this process system wide. Prior to scaling our new workflow, our Department is exploring a technical solution to replace our manual waitlist process utilizing the EMR to automatically back fill open available slots.

## S3A-QI-8 DECREASING INAPPROPRIATE MRCP WITHOUT AND WITH IV CONTRAST EXAMS: IMPACT OF EMR-EMBEDDED CLINICAL CARE PATHWAY

Jay K. Pahade, MD (*Abstract Co-Author*) Consultant, General Electric Company;Consultant, Clario Medical Imaging, Inc;
Gowthaman Gunabushanam, MD (*Abstract Co-Author*) Nothing to Disclose
Marie Hausner, ARRT, RT (*Abstract Co-Author*) Nothing to Disclose
Kelsey Cole (*Abstract Co-Author*) Nothing to Disclose
Daniella Asch, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Magnetic resonance cholangiopancreatography (MRCP) exams are commonly performed in the emergency department (ED) and inpatient population. Frequently, a noncontrast MRCP protocol is sufficient to answer the clinical question, but many of these exams are ordered without and with contrast due to insufficient understanding by the ordering provider as well as lack of guidance from radiology at the point of order entry. Changing to noncontrast exams after a contrast-enhanced exam has been ordered typically requires discussion with the clinical team and can be a time-consuming process. When exams are performed with contrast unnecessarily, they increase health care costs, expose patients to gadolinium-based contrast unnecessarily and increase MR scan times. The goal of this project was to decrease utilization of MRCP with contrast by 20%.

**METHODS**

A team of radiology quality improvement specialists, hospital Care Signature Team, and GI physicians, worked to establish consensus on indications for MRCP and preferred imaging protocols. An MRCP order panel with care pathway was created with embedded clinical guidance and links to the appropriate orders. MRCP orders were removed from the electronic medical record for ED and inpatients, with all providers directed to the clinical care pathway to place orders. Number of MRCP exams performed without IV contrast vs with IV contrast were tracked over time. Retrospective chart review for one month of data was performed by abdominal radiology fellows before and after intervention to assess appropriateness of MRCP with IV contrast orders based on clinical history/indication.

**RESULTS**

At baseline, 77% of MRCPs were performed with IV contrast which decreased to 58% after the intervention (25% relative reduction). At baseline, 50% of these were deemed inappropriate based on chart review at our tertiary care center which improved to 25% after intervention (50% improvement). Mean MRCP with IV contrast scan time was 10 minutes longer than MRCP exams without IV contrast. A decrease in MRCP orders with contrast and concomitant increase in MRCPs without contrast after intervention was noted. Total number of MRCPs (both without contrast and with IV contrast) declined by 15% after intervention (mean 180/month vs 153/month).

## DISCUSSION

Creation of an order panel and clinical care pathway at the point of order entry successfully decreased ordering of contrast-enhanced MRCP exams for ED and inpatients by 25% and improved clinical appropriateness of MRCP with contrast orders by 50%. By correctly "nudging" ordering providers to noncontrast MRCP orders, healthcare costs and unnecessary gadolinium exposure can be reduced, and MR scanner efficiency improved. This model can be applied to other imaging exams for which there is an opportunity to decrease waste by hard-coding well-designed, clinical ordering guidance created by a multidisciplinary team.

## S3A-QI-9 IMPROVING THE EFFICIENCY OF THE FETAL MRI SERVICE AT AN OUTPATIENT CLINIC

Jennifer D. Smith, MD (*Abstract Co-Author*) Nothing to Disclose
Jeannie K. Kwon, MD (*Abstract Co-Author*) Nothing to Disclose
Rebekah L. Clarke, MD (*Abstract Co-Author*) Nothing to Disclose
Veena Peraka (*Presenter*) Nothing to Disclose

## INTRODUCTION

Fetal MRI is a crucial tool to characterize an abnormality detected on prenatal ultrasound, and the results can be difficult for patients to receive. At our institution, radiologists provide an immediate face-to-face counseling session with patients to review results, so it is a significant aberration from the typical radiology workflow. With increasing volumes, radiologists are rushed to evaluate images and discuss results which can negatively affect quality of care. Issues with patient-centered care can arise since radiologists may not have all available information to discuss complex cases. The aim of this project is to improve the workflow of pediatric radiologists performing fetal MRI scans without compromising patient satisfaction, by decreasing the time spent per patient on all patient-related activities by 25% on a fetal MRI workday in 12 weeks.

## METHODS

This project was performed using the PDSA methodology at an outpatient clinic at an academic medical center. At baseline, it takes radiologists approximately 90 minutes per patient to complete all patient activities. Counseling comprised a significant amount of time, an average of 20 minutes per patient. Our first intervention tested the idea of eliminating counseling for patients referred by willing providers. The second iteration of this intervention fully eliminated counseling for all patients.The intervention was assessed live each workday by the process measure of average number of minutes spent per patient. The outcome measure was the turnaround time for patient reports, defined as the difference between imaging exam end time and report completion, as documented in the electronic medical record. The balancing measure was assessed by a survey administered pre-scan to determine patients' preference for receiving results, to ensure patient values were not compromised. No other changes occurred that would impact results. Analysis was performed using statistical process control charts (SPC) with analysis of variation done through observing the 3-sigma control limits.

## RESULTS

SPC analysis revealed that the average time spent per patient decreased from 89.8 to 60.5 minutes (p=.0003). This was a 32% reduction in time spent which exceeded our goal of 25% reduction. The turnaround time for patient reports decreased from an average of 6.32 to 2.79 hours per patient, a 55% reduction (p=.0249). Patient survey results showed that 81.3% of respondents preferred receiving results from their maternal fetal medicine specialist or OB/Gyn over the radiologist.

## DISCUSSION

The removal of counseling in the fetal MRI service improves radiologist efficiency without compromising patient satisfaction. Future advantages include increased appointment and radiologist availability. Limitations of the study include the lack of follow up with patients and providers to determine satisfaction with results communication.

# Abstract Archives of the RSNA, 2024

S3B-QI

**Quality Improvement Reports Sunday Afternoon Poster Discussions II**

Sunday, Dec. 1 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## S3B-QI-1 AUTOMATIC GENERATION OF PRESURGICAL IMAGING CHECKLISTS USING INTERACTIVE MULTIMEDIA REPORT DATA

Adrian Prisacariu (*Abstract Co-Author*) Employee, Patrisoft Outsourcing Srl
Andreea Pitici (*Abstract Co-Author*) Consultant, VisionSR, Inc
Ciprian Dorin Craciun (*Abstract Co-Author*) Consultant, VisionSR, Inc
Cristian Popovici (*Abstract Co-Author*) Software engineer, Patrisoft Outsourcing SRL
Mark Kontak (*Abstract Co-Author*) Consultant, VisionSR, Inc
David J. Vining, MD (*Presenter*) Royalties, Bracco Group;CEO, VisionSR, Inc;Stockholder, VisionSR, Inc

### INTRODUCTION

Radiology is an important component of presurgical evaluation. Surgeons often seek specific information from a radiology report about the extent of disease, vascular involvement, and comorbidities before operating. Due to the success of the World Health Organization's Surgical Safety Checklist, presurgical imaging checklists are being advocated for certain procedures to make certain that radiology reports contain essential information. Extracting desired information from unstructured narrative reports can be tedious, time-consuming, and hindered by missing information. A solution is to dictate a radiology report into a specific template, but that product may not meet the needs of all users. An alternative solution shown in this exhibit employs interactive multimedia reporting (IMR) to populate an anatomical-based template or any number of presurgical imaging checklists using interchangeable discrete data elements.

### METHODS

We developed a radiology reporting solution that records key images and voice descriptions of findings, tags the findings with metadata using natural language processing referenced to an ontology describing the anatomic location and radiological diagnosis/observation of each finding, and assembles an IMR report formatted according to an anatomical hierarchy. However, the interchangeable discrete data can be used for other purposes, including the creation of presurgical imaging checklists that highlight the essential information required by a surgeon. The anatomy, diagnosis, or combination of anatomy-diagnosis metadata are specified in an extensible markup language (XML)-formatted template to direct findings to specific sections of a report. For any report section without specific radiographic findings, normal verbiage is inserted into that section. A user can automatically select what style of report is output from the system. The presurgical imaging checklists that have been constructed to date include those used for hepatic resection, ovarian cancer debulking, and pancreaticoduodenectomy.

### RESULTS

The system has been used to date to create 3,579 multimedia reports of which approximately 100 have been performed for hepatic surgery planning, 25 for ovarian cancer debulking, and 20 for pancreaticoduodenectomy.

### DISCUSSION

A benefit of IMR is that it employs discrete data elements that can be used for multiple purposes, including the generation of presurgical imaging checklists and data mining for medical outcomes. Radiological data that traditionally has been trapped in static documents can be transformed into a much more valuable commodity.

## S3B-QI-2 A QUANTITATIVE STUDY ON IMPROVING RADIOLOGY REPORT DESCRIPTIVENESS USING LARGE LANGUAGE MODELS

Dr. Praveen Shastry (*Abstract Co-Author*) Nothing to Disclose
Naveen K (*Abstract Co-Author*) Nothing to Disclose
Kishore Prasath Venkatesh (*Abstract Co-Author*) Nothing to Disclose
Bargava Subramanian (*Abstract Co-Author*) Nothing to Disclose
Sivasailam Kalyan (*Presenter*) Nothing to Disclose

### INTRODUCTION

A quantitative study on improving radiology report descriptiveness using large language models Problem Description: India faces a critical shortage of radiologists relative to its population needs, which poses significant challenges in maintaining consistent and accurate radiology reports. This shortfall leads to potential delays and variability in clinical decision-making, impacting patient care across the country.Available Knowledge: Standard radiology reporting varies greatly, depending on individual skill levels, leading to variability in report quality.Purpose: This project aimed to systematically improve the quality and accuracy of radiology reports through the integration of LLMs, thereby standardizing reports and enhancing clinical outcomes.

**METHODS**

General: Utilizing the Plan, Do, Study, Act (PDSA) methodology, this study implemented a series of interventions involving LLMs to improve the descriptiveness and accuracy of radiology reports.Context and Intervention: Challenges such as ambiguous reports and lack of detailed descriptions set the stage for this intervention. Initially, 150 radiologists conducted baseline assessments of 109,639 reports to establish metrics that included descriptive scores and error rates. These reports covered over 400 pathologies in CT Abdomen Pelvis studies.Study of the Intervention: Following the baseline assessment, a phased approach was used to gradually integrate three different AI models (RAG, RAG + Instruction Fine-tuning, RAG + RLHF), allowing for the evaluation of performance improvements against a set of predefined KPIs.Measures/Metrics: Metrics focused on descriptive scores, error rates, and turnaround times. RADPEER Scoring Analysis was used to categorize errors, and improvements were measured across multiple phases of LLM integration.

**RESULTS**

At baseline, the average descriptive score was 5.59, and the error rate was 8.37%. Over the course of the study, the integration of AI models yielded significant improvements:RAG: Achieved a descriptive score of 6.1 and an error rate of 7.45%, but faced limitations in capturing the nuanced understanding of complex pathologies, leading to increased report turnaround times.RAG + Instruction Fine-tuning: Enhanced accuracy with a descriptive score of 7.6 and an error rate of 4.5%, demonstrating improved report quality while occasionally diverging from human preferences.RAG + RLHF: This final phase saw a descriptive score rise to 8.75 and an error rate decrease to 1.2%, indicating substantial improvements in report actionability and diagnostic reliability.

**DISCUSSION**

Conclusions: Integrating LLMs into radiology reporting processes significantly enhances report quality and consistency, reduces error rates, and decreases turnaround times, which may contribute to better clinical decision-making and patient outcomes.

## S3B-QI-3 PRIORITIZE, OPTIMIZE AND ACHIEVE: ENHANCING STAT IMAGING ORDER EFFICIENCY FOR REDUCED TURN AROUND TIME!

Rajendra P. Kedar, MD, DMRD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

STAT priority is typically used to indicate a medical emergency Misuse of the STAT priority is also widespread1. Inappropriate STATradiology orders could have a negative impact on patient care. Our institution's STAT priority was used to expedite imaging delays, obtain non-urgent radiologic tests before discharge, and ensure imaging was complete before rounds. This misuse of the STAT priority led to an upward of 67% of Head CT orders being ordered as STAT.

**METHODS**

Our team included radiology leadership, inpatient physicians, radiology technologists, and information technology support. Through workgroup consensus, we defined radiology priorities for our institution. We piloted our intervention with the CT head as this had the highest percentage of STAT priority. We added an attestation to the image order requiring the physician to attest they agree with the priority. We created a priority and process for an ASAP pathway and monitored the number of orders, ordering priority, and order-to-completion time (OTC) in a Qlik dashboard. The order priority definition and order to completion time were as follows: 1. Stat: Loss of life and limb -2 hours. 2. ASAP: Urgent treatment or surgery -6 hours. 3. Routine: Investigate or stable for more than 12 hours - 12 hours

**RESULTS**

We educated all providers on the new definitions and order changes through flyers and division meetings. One month after the order change, we saw a 58.5% decrease in the number of STAT image orders sustained over four months. We improved our OTC from 3hr 8m to 2hr. We increased our ASAP orders from 0-3 to over 80 per month. OTC for ASAP was less than our goal of 6 hours. Since the project started, data was shared weekly with physician champions to disseminate with their colleagues.

**DISCUSSION**

Clear institutional definitions of radiology priorities and order attestations improved appropriate ordering compliance.Involving physician champions helps promote physician engagement.

## S3B-QI-4 RADIOLOGY PRE-APPOINTMENT COMMUNICATION SYSTEMS: IMPACT ON REDUCING MISSED CARE OPPORTUNITIES FOR OUT-PATIENT CT EXAMS

James J. Sheehan, BA (*Abstract Co-Author*) Nothing to Disclose
Saurabh Gupta (*Abstract Co-Author*) Nothing to Disclose
Jay K. Pahade, MD (*Abstract Co-Author*) Consultant, General Electric Company;Consultant, Clario Medical Imaging, Inc;
Gowthaman Gunabushanam, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Missed care opportunities (MCO) (defined as patients who do not arrive for their appointment or cancel on day of appointment) can lead to delayed care and reduced scanner operational efficiency. The purpose of this project was to assess the impact of a pre-appointment reminder communication system (primarily via texting) in reducing MCO for out-patient CT at our institution.

**METHODS**

We implemented a pre-appointment texting system on 8/24/2023 for our institution’s 4 out-patient CT locations. Patients who listed a cell phone in the medical record received text messages, and the remaining patients received interactive voice response (IVR) phone calls. Unique to our texting program is the inclusion of appointment reminders, scan preparation, way finding information and niche reminders for select tests that have diet restrictions. Content was developed in English and Spanish. We assessed our MCO % rate, defined as number of MCO/ total scheduled scans for 6 months before (baseline) and after program implementation (post-launch). We also assessed patient engagement with the text messages (by tracking replies back via text) and performed subgroup analysis to study health equity differences based on age, race and ethnicity.

**RESULTS**

A total of 46,581 appointments for CT scans were created between 2/24/2023 and 2/23/2024. At baseline (2/24/2023 - 8/23/2023), the MCO rate was 13.67% (3159/23110) versus 13.20% (3097/23471) post-launch (8/24/2023 - 2/23/2024). This represented a 3.47% relative reduction (RR) and 0.47% absolute reduction (AR) in MCO. Among patients gt;= 80 years of age, the MCO rate was 11.90% (299/2513) at baseline versus 10.24% (262/2558) post-launch, a 13.92% RR and 1.66% AR in MCO rate. Among African Americans, the MCO rate was 27.64% (866/3133) at baseline versus 25.36%

(760/2997) post-launch, a 8.26% RR and 2.28% AR in MCO rate. For Hispanics, the MCO rate was 22.39% (544/2430) at baseline versus 21.06% (502/2384) post launch, a 5.94% RR and 1.33% AR in MCO rate. Communication was primarily via texting (97%, 22697/23471) with 3% (774/23471) receiving IVR calls. Engagement with the program was similar across all groups, ranging from 79-81%. Patient initiated appointment cancellation was 11% (2544/22697) via text message and 15% (114/774) for IVR phone calls.

**DISCUSSION**

Use of a pre-appointment communication program for out-patient CT led to a nominal reduction in overall missed care opportunities for our study population. However, more robust decreases in MCO rates were noted for demographic groups typically considered at higher risk of MCOs with a relative reduction of 8% for African Americans and 6% for Hispanics. The more pronounced impact for these demographic groups suggests that this may represent a better way to engage these populations to encourage out-patient CT completion. A limitation of our study is we did not correlate results with poverty indices.

## S3B-QI-5 DEVELOPMENT OF A FRAMEWORK TO EVALUATE RADIOLOGY AI MODELS FOR POTENTIAL CLINICAL DEPLOYMENT

James R. Galt, PhD (*Abstract Co-Author*) Research Support, Sirtex Medical Ltd
Jean M. Kunjummen, DO (*Abstract Co-Author*) Nothing to Disclose
Neil U. Lall, MD (*Abstract Co-Author*) Nothing to Disclose
Peter A. Harri, MD (*Abstract Co-Author*) Radiology Advisory Board, Sectra AB
Aws S. Hamid, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Marly Van Assen, MSc, PhD (*Abstract Co-Author*) Nothing to Disclose
Elias Kikano, MD (*Abstract Co-Author*) Nothing to Disclose
Ninad V. Salastekar, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Brian Howard, MD (*Abstract Co-Author*) Nothing to Disclose
Nabile M. Safdar, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Colin M. Segovis, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Damian Dyckman, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Sumir S. Patel, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Judy W. Gichoya, MBChB, MS (*Abstract Co-Author*) Consultant, Softbrew Digital LTD
Xiao T. Li, MD (*Abstract Co-Author*) Nothing to Disclose
Hari Trivedi, MD (*Presenter*) Founder, Lightbox AI ; Consultant, Sirona Medical, Inc ; Consultant, Flatiron Health ; Consultant, PMX Inc ; Research support, Kheiron Medical Technologies ; Research support, Clairity, Inc ; Research support, Nightingale Open Science ;

**INTRODUCTION**

With nearly 500 FDA-cleared radiology AI models available, selecting the right one for a clinical setting remains challenging. Adoption is often influenced by marketing rather than objective metrics. To address this, we established a Radiology AI Clinical Council to develop a reproducible framework for evaluating AI models, ensuring that large hospital systems can make informed decisions amid growing demands for AI integration in healthcare.

**METHODS**

Sixteen representatives across all radiology clinical divisions plus revenue cycle, operations, and research were recruited for the Radiology AI Council. A rubric for AI model evaluation for deployment was developed over a 3-month period with a structured approach that considers available evidence, integration complexity, radiologists' needs, operational impact, medicolegal challenges, financial considerations, and post-deployment monitoring. The framework is currently being used to evaluate several proposed radiology AI solutions.

**RESULTS**

The framework comprises 50 questions across 10 sections. Eleven questions have scoring metrics attached to yield a final scorecard for the model. Select sections are summarized:1. Validation - Models are scored based on presence of peer-reviewed evidence, subgroup evaluation for bias assessment, and validation using data from our institution.2. Deployment and Integration: Assessment includes model compatibility with current systems, deployment type, integration points within existing infrastructure, whether clinicians may receive results before radiologists3. Monitoring and Management: Post-deployment monitoring strategies, management of alerts to multiple users, and responsibilities for ongoing model performance evaluations.4. Impact: Department and enterprise-wide alignment of strategic priorities, impact on radiologist and clinicians, patient safety concerns, workflow efficiency, addressing burnout,5. Financial implications: model cost, expected revenue generation or cost recovery, direct reimbursement opportunities.6. Legal and Ethical Considerations: Potential medicolegal issues, compliance with existing policies, durability of model results

**DISCUSSION**

Appropriate selection of AI models for clinical deployment has widespread and potential longstanding impacts on care quality, radiologist quality of life, and business considerations within a radiology department. We introduce a framework to standardize the evaluation of Radiology AI models for clinical use, aiming to develop a comprehensive assessment mechanism to address both scientific and practical considerations of model selection. This framework can assist in selecting models that align with the needs of patients, radiologists, and the healthcare system.

## S3B-QI-6 IMAGING SELF-SCHEDULING

Tarek N. Hanna, MD (*Abstract Co-Author*) Nothing to Disclose
Susan Reich (*Abstract Co-Author*) Nothing to Disclose
Laura A Benson (*Abstract Co-Author*) Nothing to Disclose
Nadja Kadom, MD (*Abstract Co-Author*) Nothing to Disclose
Patricia Balthazar, MD, MPH (*Presenter*) Dr. Balthazar received research support from the Association of University Radiologists GE Radiology Research Academic Fellowship.

**INTRODUCTION**

Problem Description Wait times for outpatient imaging exams are a critical quality metric that reflects system efficiency and patient access. Extended lead times from order to exam schedule and completion can delay patient care and contribute to network leakage.Available Knowledge Rising volumes and clinical demands complicate access to healthcare services, influencing the efficiency of outpatient imaging services.Purpose The purpose of this study was to perform a series of scheduling optimizations to decrease the order-to-schedule time (OTS) in the radiology department and simultaneously improve patient satisfaction with the scheduling experience.

**METHODS**

General This quality improvement project employed the Plan, Do, Study, Act (PDSA) cycle methodology, appropriate for iterative interventions.Context and Intervention The study was conducted at a large urban quaternary care academic healthcare system in the US South. Interventions included scheduling slot optimization through interchangeable templating with standard slot lengths and enabling an online patient portal self-scheduling feature for certain examination types.Study of the Intervention The primary outcome measures were the median OTS time (in days) and the percentage of OTS

within 10 days by imaging modality (XR, US, CT, MR). These outcomes were used to assess the impact of the interventions.Measures/Metrics Measures chosen for the study included median OTS time and percentage of OTS within 10 days by imaging modality. The rationale for choosing these metrics was their direct reflection on scheduling efficiency and patient accessibility.Analysis The quantitative analysis included a comparison of metrics before and after intervention implementation to draw inferences and understand data variation over the study period.

**RESULTS**

The overall median OTS time improved from 16.9 days in FY 22-23 to 5.6 days in the first 5 months of FY 23-24. By modality, significant improvements were noted (CT: from 17.2 to 5.6; MR: from 18.3 to 6.9; US: from 16.4 to 5.1; XR: from 17.7 to 6.1). The percentage of OTS times within 10 days increased across all modalities, with overall improvement from 73% to 86%. The implementation of patient self-scheduling led to 19,950 self-scheduled exams, distributed among the modalities (CT: 1647; MR: 1298; US: 5989; XR: 1606).

**DISCUSSION**

Limitations The study is limited by its single-center design and the short duration of post-intervention follow-up.Conclusions Scheduling slot optimization and the introduction of patient self-scheduling significantly decreased OTS time across all imaging modalities and improved patient scheduling experience. Future directions include enhancing schedule-to-arrival times and enabling scheduling “fast-pass” (waitlist for earlier slots for patients with certain health insurances that do not require pre-authorization).

## S3B-QI-7 SEQUENTIAL IMPROVEMENT IN PARATHYROID ADENOMA LOCALISATION (SIMPAL)

Amit Parekh, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Jennifer Downs (*Abstract Co-Author*) Nothing to Disclose
Emma O'Shaughnessy (*Abstract Co-Author*) Nothing to Disclose
Tristan Richardson (*Abstract Co-Author*) Nothing to Disclose
Kat Dixon (*Abstract Co-Author*) Nothing to Disclose
Peter Jarvis, FRCR, MBBS (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Parathyroidectomy is the treatment of choice in primary hyperparathyroidism. Localisation of an adenoma allows a surgeon to perform focused excision rather than full neck exploratory surgery, leading to reduced complication rate, recovery time and cost. This study implemented multiple rounds of quality improvement in our parathyroid localisation service to ensure the maximum number of patients benefited from minimally invasive surgery.

**METHODS**

Following discussion with radiologists, physicists, endocrinologists, technologists and surgeons, a series of improvements were proposed.Cycle 1: Acquisition of new SPECT/CT scanners.Cycle 2: Optimise image acquisition in 3 ways. 1, moving to step and shoot acquisition over our previous continuous acquisition. 2, increasing administered activity from 750MBq to 900MBq 99mTc-Sestamibi and 3, Using phantom data applied to patients to change SPECT reconstruction parameters (reducing iterations and increasing subsets).Cycle 3: Addition of arterial phase iodinated contrast.We collected baseline and post intervention data following each cycle. Successful adenoma localisation was confirmed using the pathological specimen report at surgery. A 5-point scale was used to assess the degree of confidence in the radiologist report. Sensitivity, specificity and receiver operating characteristic (ROC) curves were calculated following each intervention.

**RESULTS**

Baseline audit of 194 patients showed 31% of studies failed to localise an adenoma and only 44% of studies were confident in their localisation. 163 patients underwent surgery with sufficient data to calculate ROC with area under the curve (AUC) of 0.92 (sensitivity 69.8%, specificity 95.7%).Following cycle 1, an audit of 59 patients showed a reduction in localisation failure to 24% and increase in confident localisations to 54%. 47 patients underwent surgery with improved AUC to 0.95 (p0.22, sensitivity 77.6%, specificity 93.3%).Following cycle 2, an audit of 103 patients showed further reduction in localisation failure to 18%, with 48% showing confident localisation. 72 patients underwent surgery with significant improvement in AUC to 0.98 (p0.004, sensitivity 84.3%, specificity 95.9%).Following cycle 3, an audit of 71 patients showed further reduction in localisation failure to 6% and increase in confident localisations to 67%. 22 patients have undergone surgery with significant improvement in AUC to 0.99 (p0.002, sensitivity 100%, specificity 82.6%).

**DISCUSSION**

We demonstrated improved adenoma localisation and reporter confidence following each intervention, with significant improvement in AUC on ROC analysis. Better adenoma localisation has resulted in fewer exploratory surgeries and therefore improved patient safety and reduced cost. Patient numbers in the final cycle are low due to limited follow up time, however data collection is ongoing.

## S3B-QI-8 IMPROVING ORDERING OF ED AND IN-PATIENT SPINE MRI: IMPACT OF ORDERING PANEL AND CARE PATHWAYS

Daniella Asch, MD (*Abstract Co-Author*) Nothing to Disclose
Marie Hausner, ARRT, RT (*Abstract Co-Author*) Nothing to Disclose
Amit Mahajan, MBBS (*Abstract Co-Author*) Nothing to Disclose
Kelsey Cole (*Abstract Co-Author*) Nothing to Disclose
Gowthaman Gunabushanam, MD (*Abstract Co-Author*) Nothing to Disclose
Jay K. Pahade, MD (*Presenter*) Consultant, General Electric Company;Consultant, Clario Medical Imaging, Inc;

**INTRODUCTION**

Spine MRI reflects a complex study that is often confusing to order for inpatient and ED providers. At our institution, ordering error review revealed 3 recurrent issues: 1. Over-ordering of total spine (vs limited) imaging 2. Inappropriate ordering of contrast 3. Lack of awareness and limited access to an abbreviated acute cord compression (ACC) total spine MRI protocol.Incorrect order placement creates waste for radiologists secondary to time spent fixing the order, while failure to change the order may result in suboptimal or excessive imaging. This is particularly problematic for total spine orders, as they are resource intensive, both for MR scan time and radiologist interpretation time. The purpose of this QI project was to redesign spine MRI ordering in our electronic health record (EHR) by creating a new spine MRI order panel and pathway, with a goal of reducing total spine MRI exams performed by 20% and steering ordering providers to an abbreviated noncontrast total spine MRI order when acute cord compression (ACC protocol) was suspected.

**METHODS**

A multidisciplinary team was formed, consisting of experts from Radiology Quality and Safety, Neuroradiology, Neurosurgery, Neurology and our Care Signature Team, to redesign how clinicians order spinal MRI. Sixteen unique spine orders were “hidden” and replaced with a single MRI order panel which was iteratively tested using human-centered design principles. Six months of data were assessed before and after intervention, tracking total spine MRI orders and use of ACC spine MRI protocol across a health system compromised of a single academic tertiary center and 5 additional free-standing hospitals. The ACC protocol was made accessible at all hospital sites during this project (previously limited to tertiary care center only).

## RESULTS

At our institution, total spine MRI scan time takes 60-90 minutes , while the abbreviated acute cord compression total spine MRI takes 10-20 minutes. After launching the new order panel, the mean monthly total spine orders (without contrast and without and with contrast) decreased from 129 to 105 (19% reduction), while use of ACC protocol increased from 12 to 26 (117% increase).

## DISCUSSION

This QI report describes successful creation of a new order panel and pathway for spine MRI that significantly altered how ED and inpatient providers place orders. Instead of relying on the provider to know the correct order based on the clinical indication, the panel provides the most common indications for spinal MRI and then links the provider to the correct order. Feedback from ordering providers has been positive, with many noting that the panel has removed uncertainty about what test to pick. These interventions successfully reduced total spine MRI volume by 19% and increased use of an abbreviated, noncontrast total spine protocol by 117%, allowing for more timely, tailored, and cost-effective care.

# S3B-QI-9 IMPROVING THE THYROID ABLATION ORDERING PROCESS THROUGH STANDARDIZED WORKFLOWS

Chance Colvin, BS (*Presenter*) Nothing to Disclose

## INTRODUCTION

The Radiology Ablation Scheduling Team is experiencing large numbers of incorrect thyroid ablation orders. There is no standardized process to request a thyroid ablation for a patient, this results in delays in Radiology triage of potential thyroid ablation candidates and scheduling of procedures. The purpose of this study was to develop a standardized thyroid ablation ordering process to reduce the number of incorrect orders being placed. The goal of the project is to simplify the ordering process reducing the number of incorrect orders from 66% to 35% by October of 2024, working towards eliminating incorrect orders.

## METHODS

A team of Radiology Ablation and Endocrinology staff including physicians, nurses, schedulers, and Radiant architects. The help quality improvement personnel worked together using the Define Measure Analyze Improve Control and the Plan Do Study Act frameworks. A report of ordered procedures was pulled to determine which orders were placed incorrectly, and a description of why the order was incorrect. The team performed a root cause analysis using a swimlane to map out the current process for ordering a Thyroid Ablation. This allowed the team to see how confusing and disorganized the process was. This also allowed the team to see where the confusion stemmed from early in the process, showing that there was no process for ordering these procedures. As the first phase of this improvement the team worked together to develop a new standard process to improve efficiency for the ordering providers. Not only did the team develop a new standardized process, but they also worked with a Radiant architect to build a new order panel. This consisted of providing developed pathways for each thyroid process, preselected labs and imaging, and options for any pre-procedural additions if needed. Education was provided to all physicians in Rochester involved with these procedures, including a presentation during the Endocrinology Divisional Business meeting. Instructions detailing how to add the order panel number to their preference list was sent to providers in Radiology and Endocrinology, to reduce the risk of providers defaulting to the old process.

## RESULTS

The outcome of the project has slowly progressed with physicians adopting the new order panel process. Since the order panel has gone live the number of incorrect orders has decreased by 15% from 66% to 51% since November 16, 2023. The team continues to record and monitor the ordering data. The next phase is to set the new order panel as the default order by an electronic change request.

## DISCUSSION

During this project the team has learned that having all necessary stakeholders involved with the process is vital, the team could not have been able to get to the root cause without everyone’s different perspectives. Teamwork is a vital portion of this project, having clear communication is key since the project involves multiple areas.

# Abstract Archives of the RSNA, 2024

T2-QI

**Quality Improvement Reports Tuesday Morning Poster Discussions**

Tuesday, Dec. 3 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## T2-QI-1 ENHANCING TIMELY SERVICE FOR HIGH-PRIORITY (STAT) PORTABLE DR/XR EXAMS IN PICU: ENSURING ACCURATE PRIORITIZATION OF CASES

Summer L. Kaplan, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Hannah Stinson, MD (*Abstract Co-Author*) Nothing to Disclose
Eatrice Hinton (*Abstract Co-Author*) Nothing to Disclose
Marcy Hutchinson (*Abstract Co-Author*) Nothing to Disclose
Valerie Rigby (*Abstract Co-Author*) Nothing to Disclose
Mohammad Jalloul, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Timely response to urgent portable x-ray orders is crucial for safe management of patient care. Without a shared understanding of a STAT level response, and standard language methods for communicating the urgency reason for exam, the volume of STAT orders can become unmanageable. This leads to failure to provide optimal patient care. The current state analysis of the workflow revealed that only 59% of STAT portable XR exams in the Pediatric ICU (PICU) meet the order-to-begin-exam time (response time) of = 30 minutes and 36% align with STAT criteria. The global aim of this project is to provide timely and effective patient care by enhancing imaging stewardship and ensuring that the right patient receives the right exam at the right time. Our project goal is to increase the % of STAT exams with a response time of = 30 minutes from 59% to 80% and increase the % of STAT orders that meet STAT criteria from 37% to 80% by the July 2024.

### METHODS

A multidisciplinary team including critical care and radiology services collaborated to investigate portable XR exams conducted on inpatients in the PICU, spanning all hours and days of the week. Through Gemba walks, the root causes of delayed response times were attributed to unclear communication processes, ambiguous prioritization and timing of orders, and lack of clarity regarding the clinical need for STAT exams. Moreover, STAT exams were not meeting criteria due to frequent ordering of exams for unurgent conditions and misuse of STAT priority for non-clinical reasons. Interventions are being tested to shorten duration of STAT response, including a nursing tip sheet to guide clear communication to the technologist, use of a “triage tech” to manage and assign all in-coming portable exam orders, and changing the staffing model so technologists cover specific areas of the hospital. To ensure STAT appropriateness, the team proposed instructing radiologists to follow a defined list of clinical criteria to determine priority. Process measures used for STAT appropriateness included % of exams correctly ordered according to the criteria list. The project outcome metric is the % of STAT exams done in =30 minutes from exam order.

### RESULTS

As of now, the % of exams done =30 minutes and aligning with the STAT priority list remain at baseline performance of 59% 36% respectively. This is due to the project being in early testing phase focused in a small area of PICU. Additional PDSA cycles for interventions will be tested across all areas of PICU. We anticipate measurable improvement in both the process and outcome metrics.

### DISCUSSION

Development of a shared understanding between the PICU and Radiology as to what makes an exam STAT and how we best communicate that to illicit a timely response is the key take away from this project. Using a systematic, team-based approach to improvement contributes to the success by opening the lines of communication between the two departments.

## T2-QI-2 TAKING THE FEAR OUT OF MRI SAFETY QUERIES. TRAINING THE EXPERTS

Jenny Wu, MD (*Abstract Co-Author*) Nothing to Disclose
Alexander Scott, MD (*Abstract Co-Author*) Nothing to Disclose
Olivia Hallas, DO (*Presenter*) Nothing to Disclose

### INTRODUCTION

Radiologists are tasked with a range of MRI safety issues including approving MRI exams on patients with implants, answering questions related to MRI safety, and responding to contrast reactions. Having a foundation in MRI safety knowledge is critical to functioning as a MR radiologist. Inadequate training with ACR MRI safety guidelines and protocols may lead to delayed exams, inappropriately canceled exams, or adverse safety events.Within our academic imaging institute, 39% of 105 staff radiologists did not feel confident making decisions or performing tasks involving MRI safety. The purpose of this study was to provide MR safety education to increase the reported confidence of radiologists on making MRI safety related decisions.

### METHODS

Utilizing the SOLVE curriculum, we analyzed the institutional conditions of MRI safety training and knowledge of radiologists. A survey of staff radiologists was conducted to assess institutional knowledge and confidence in MRI safety topics. Process maps of commonly reported MRI safety deficits were created with points of interest for possible areas of system failure. A root cause analysis was conducted. Based on an effort-impact matrix, a mandatory, recurring training module was recommended as the highest impact countermeasure. A training module for radiologists was developed with the assistance of the MRI safety team.Intervention outcomes were determined by two measures. Measure 1 was 'reported confidence with MRI safety protocols' which was measured by the percentage of radiologists who responded 'yes' to, 'has your confidence level in making decisions or performing tasks involving MRI safety increased after taking this module?', in a post training survey. Measure 2 was 'ability to correctly answer MRI safety questions' which was measured by the percent of correct answers on an MRI safety pre and post-intervention test and with number of attempts to achieve a perfect score on the post-intervention test.

### RESULTS

277 in-training and staff radiologists completed the training module in 2023. 95% of radiologists who completed the training module reported that the module increased their confidence level in making decisions or performing tasks related to MRI safety. Average post-intervention first attempt test score increased by 39% from the pre-intervention test. Median of two attempts to achieve a perfect score on the post-test.

### DISCUSSION

Mandatory MRI safety training for radiologists was well received at our institution and improved subjective confidence and objective competency in MRI safety tasks. It has been implemented as an annual training requirement for all radiologists at our institution. MRI Safety knowledge may be a commonly overlooked deficit for radiologists across the country. Implementing a formal, recurring MRI safety training for radiologists can help ensure that your MRI safety experts are indeed experts.

## T2-QI-3 INCREASING UTILIZATION OF A RAPID OSTEOMYELITIS MRI PROTOCOL TO IMPROVE PATIENT THROUGHPUT

Geetika Khanna, MD, MS (*Abstract Co-Author*) Nothing to Disclose
Ashishkumar K. Parikh, MD (*Abstract Co-Author*) Nothing to Disclose
Nadja Kadom, MD (*Abstract Co-Author*) Nothing to Disclose
Olivia Ries (*Abstract Co-Author*) Nothing to Disclose
Christabell C. Ndibe, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Problem Description: The clinical standard for imaging evaluation of possible osteomyelitis requires MRI with and without intravenous contrast. The length of the scan and need for sedation in young patients results in delays in scheduling and diagnosis. Available Knowledge: Rapid MRI protocols are being developed for many indications to facilitate patient throughput. Prior studies have shown that intravenous contrast is not essential for diagnosis of primary osteomyelitis in children beyond the neonatal age group. The available knowledge was used to develop an institutional rapid osteomyelitis (rOM) MRI protocol. Purpose To increase use of the rOM MRI protocol to greater than 50% in children with suspected acute musculoskeletal infection.

### METHODS

General: We used the Scientific Method for Improvement and Model for Improvement Methodologies and tested our theory with PDSA cycles. Control chart was used to monitor improvement. Context and Intervention: Our initial state analysis showed about 9% usage of the rOM MRI protocol. Team members were a group dedicated to musculoskeletal imaging which comprised of MRI technologists, physicists, and pediatric subspecialist physicians. Our root cause analysis showed lack of physician awareness of the availability of the rOM protocol and lack of an order set in the electronic health record (EHR) as barriers preventing its use. Interventions: Presentations about the rOM protocol was given to our consulting colleagues in 2022 and 2023. A new order set for rOM was also developed and implemented in September 2023. Study of the Intervention: We recorded the number of MRI exams performed using the rapid osteomyelitis protocol vs. standard protocol for suspected osteomyelitis in all eligible inpatients between August 2022 and March 2024. Measures/Metrics: 1. Rate of utilization pre and post education for awareness. 2. Rate of utilization pre and post implementation of the electronic order set. Analysis: We analyzed our data results using a statistical process p chart with 3-sigma control limits.

### RESULTS

Out of a total of 158 osteomyelitis MRIs from Aug 2022 to March 2024, 72 were performed with the rOM MRI protocol. The p chart showed an increased use of the rOM MRI protocol after education in April 2023, but then fell to baseline levels. A drastic and sustained change occurred in usage of the rOM MRI protocol once a specific order set was available in the EHR in September 2023 (0 to 100%).

### DISCUSSION

Use of our rOM MRI protocol increased transiently after educating our clinical partners. Creation of an order set in the EHR led to a sustained increase in utilization. Consistent use of this protocol in the long term will require continuous education on its availability and regular quality assurance. A limitation of our study is the relative infrequency of MRIs performed for osteomyelitis at our institution, averaging around 8 cases a month.

## T2-QI-4 STRUCTURED REPORTING AND SEMI-AUTOMATED RULE BASED TNM CLASSIFICATION FOR NSCLC STAGING IN A MULTICENTER FEASIBILITY STUDY

Clemens C. Cyran, MD (*Abstract Co-Author*) Nothing to Disclose
Matthias P. Fabritius, MD (*Abstract Co-Author*) Nothing to Disclose
Yevgeniy Dikhtyar (*Abstract Co-Author*) Nothing to Disclose
Boj Friedrich F. Hoppe, MD (*Abstract Co-Author*) Research Grant, Siemens AG
Judith Spiro (*Abstract Co-Author*) Nothing to Disclose
Maurice Heimer, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

While structured reporting has shown to improve report completeness and interdisciplinary communication in NSCLC staging, the majority of radiology reports are written in prose and lack TNM classification. This multi-center study harmonized imaging protocols and proposed a structured reporting framework for structured reporting of NSCLC. The aim of this study was to develop and evaluate a software based structured reporting tool with semi-automated, rule based TNM classification.

### METHODS

The Bavarian Oncology Radiology Network (BORN) has evolved as radiological platform for protocol and reporting harmonization for a variety of tumor entities including NSCLC. Six major academic centers participated. The framework was translated into an interactive image-based software for TNM based structured reporting with data warehousing capacity (mint Lesion TM, Mint Medical GmbH, Heidelberg, Germany). A rule-based algorithm was developed

to generate semi-automated TNM classification based on annotations and descriptions. The structured reporting tool was tested by 9 radiologists of five of the institutions on n = 20 representative 18F-FDG-PET/CT studies staging NSCLC. Readers received pictorial-based guidance to simulate a multidisciplinary team meeting which was used as reference to compare correctness of TNM-classification with and without assistance of the structured reporting and classification tool. Also, participants were surveyed on their experience with structured reporting and TNM classification at their respective radiology departments, as well as perceptions and expectations regarding structured reporting.

**RESULTS**

The reporting framework culminated in an image-based structured report template that provided semi-automated, rule-based TNM classification at staging. The semi-automated TNM classification was non-inferior to classification without assistance, compared to the reference. All annotation based classifications were correct with regard to input. However, incorrect annotation resulted in inaccurate classification by the algorithm. Overall, participants rated the potential impact of structured reporting and the semi-automated TNM classification tool as positive; the pre- and post-analysis demonstrates that raters improved their TNM-knowledge (p=0.039) using the algorithm, trust the semi-automated algorithm (p=0.041) and that the structured reporting tool improved M-staging (p=0.041).

**DISCUSSION**

This multi-center study facilitated multi center protocol harmonization and yielded a robust software-based structured reporting tool for NSCLC with semi-automated classification capacity. The survey results reflect an overall positive perception on structured reporting in NSCLC, promising potential for clinical translation.

## T2-QI-5 EMPOWERING CHILDREN IN MRI: USING VIRTUAL REALITY TO BUILD COMFORT AND AVOID ANESTHESIA

Anastasia Peacock (*Abstract Co-Author*) Nothing to Disclose
Hari Gopalan (*Abstract Co-Author*) Nothing to Disclose
Tania Dafer (*Abstract Co-Author*) Nothing to Disclose
Jennifer Boucher (*Abstract Co-Author*) Nothing to Disclose
Cassandra Kapoor, BSC (*Abstract Co-Author*) Nothing to Disclose
Matthew Head (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Pediatric patients under 6 years of age often require general anesthesia (GA) during their magnetic resonance imaging (MRI) exam to ensure immobility for quality diagnostic images. However, the use of GA requires the child to fast for 4-6 hours beforehand, has potential side effects including nausea or sore throat, and impacts to motor function for up to 24 hours. Furthermore, MRIs with GA require longer appointment times, increased costs, and lengthy wait times for an appointment. The aim of our program, the MR Success Clinic (MRSC), is to use a virtual reality (VR) platform to empower patients and families by increasing their knowledge of the MRI exam, instilling confidence and reducing overall anxiety related to MRI. Through VR simulation, children can experience the sight, sound and feeling of an MRI in a safe environment where they are in control.

**METHODS**

Children between 3-7 years of age referred for a GA MRI are scheduled for a MRSC visit. During the MRSC visit, children meet one on one with a pediatric MRI Technologist (MRT) and have a VR simulation with an avatar-led game that simulates an MRI exam. The VR platform is managed by the MRT who can detect real-time head movement which is used to (1) coach the child to stay still and (2) determine whether the child could undergo a successful MRI without GA. Following the MRSC visit, children are scheduled for their MRI exam within 1 week, further improving the chance of success by maintaining recency of a familiar experience.

**RESULTS**

To date, the MRSC has had 13 patients (mean age of 5.8 years +/- 2.15), with 100% completing a diagnostically acceptable MRI within 1 week. An initial proof of concept (POC) study also showed 100% success in 18 patients (mean age of 5.03 years +/- 1.28). The greatest measurable impact to the families is the amount of time spent in hospital, an average of 1.5 hours for a MRSC visit and MRI without GA compared to 5 hours for a pre-anesthesia visit and GA MRI.

**DISCUSSION**

The MRSC offers a simple and accessible solution to empower children before undergoing an MRI without GA. From the initial POC, the VR simulation was limited to children with head MRIs and the visit took place 2 hours before the non-GA MRI, but the staffing model was not sustainable. Recognizing the potential patient impact, the MRSC was established with a dedicated MRT, and the criteria was expanded to all scans with a 30-minute duration. Although the MRSC and POC have small cohorts of patients, we have heard positive patient feedback, and 100% success of patients shows this is an encouraging tool. Our future direction includes expanding criteria to oncology children with serial staging MRIs who would benefit the most. Our goal remains empowering children, normalizing the MRI experience, and placing patient-centered care at the forefront.

## T2-QI-6 LEVERAGING A QUALITY & SAFETY CONTINUOUS PROCESS IMPROVEMENT FRAMEWORK TO ADDRESS DISPARITIES IN BREAST CANCER SCREENING

Tia Goodman (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD (*Abstract Co-Author*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Nita Amornsiripanitch, MD (*Abstract Co-Author*) Nothing to Disclose
Eleni Balasalle (*Abstract Co-Author*) Nothing to Disclose
Zoe Sodickson (*Abstract Co-Author*) Nothing to Disclose
Dana Jessup (*Abstract Co-Author*) Nothing to Disclose
Diego Collazo-Irizarry, BSc (*Abstract Co-Author*) Nothing to Disclose
Erin Orlandino (*Abstract Co-Author*) Nothing to Disclose
Oleg S. Pianykh, PhD (*Abstract Co-Author*) Nothing to Disclose
Gabriel Camareno-Soto, BSc (*Abstract Co-Author*) Nothing to Disclose
Heather Johnston (*Abstract Co-Author*) Nothing to Disclose
Pragya Dhar, MPH (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Disparities in breast cancer disproportionately historically underserved populations and screening mammography (SM) can decrease these disparities through early detection. However, we experienced high cancellation rates (up to 52%) at two of our sites: A community health center serving predominately Hispanic/Latino women, and a mobile mammography unit serving predominantly racial/ethnic minorities and people with Limited English Proficiency. Quality Safety (QS) frameworks provide systematic approaches to identify factors influencing SM cancellations and inform scalable interventions to address them. Our purpose was to leverage a QS continuous process improvement (QS-CPI) framework to reduce SM cancellations at these sites with high cancellation rates.

### METHODS

Process mapping, driver diagram and Pareto chart with key radiology partners and patients were done to identify factors for SM cancellations and to develop a multilevel intervention. Plan, Study, Do, Act (PDSA) cycles with continuous data monitoring were used to develop and refine our multilevel intervention that included: multimedia text message (TM) reminder program in multiple languages sent 48-hrs prior to SM appointment, rideshare transportation assistance, and culturally-tailored, multilingual 1-min educational videos about annual SM. These were developed and implemented over 12 months (Jan 2023 - Jan 2024). To assess the effect of the multilevel intervention on SM cancellation rate, we collected EHR data on patient demographics and the following SM appointment metrics: appointments scheduled/completed/cancelled, and appointments confirmed via TM. We also collected data on number rideshare roundtrips, and SM educational video views. Statistical analyses were performed to assess for differences in SM cancellation rate after intervention implementation.

### RESULTS

2728 SM appointments were scheduled post-intervention, 72% (1968/2728) appointments completed, and 66% (1792/2728) received TM reminders. Overall cancellation rate was 28%, and those that confirmed SM appointment via TM had a 19% cancellation rate. 18% (488/2728) of patients cancelled or confirmed SM appointment via TM. 22% (107/488) of patients who cancelled/confirmed via TM clicked the SM educational video link, and 69% of those who clicked completely or partially watched the video. 10% of patients used the rideshare service accounting for 270 roundtrips completed for patients called back for BIRADS 0.

### DISCUSSION

Multilevel intervention designed through a QS-CPI lowered SM cancellation rate among those who confirmed their appointment via TM. This framework allows us to systematically scale the intervention to allow our radiology workforce to focus on delivering person-centered care, increase capacity by decreasing cancellations, and decrease appointment reminder administrative tasks.

## T2-QI-7 IMPLEMENTING APPROPRIATENESS CRITERIA FOR USE OF IMAGING TECHNOLOGY (PROJECT ACUITY) ON MRI LUMBAR SPINE - A SINGAPORE EXPERIENCE

Cher Heng Tan, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Lai-Peng Chan, FRCR,MBBS (*Abstract Co-Author*) Nothing to Disclose
Meng-Ai Png, MBBS, FRCR (*Abstract Co-Author*) Nothing to Disclose
Gita Y. Karande, MMEd, FRCR (*Abstract Co-Author*) Nothing to Disclose
Hiok Yang Y. Chan, MBBS, FRCR (*Presenter*) Nothing to Disclose

### INTRODUCTION

Acute low back pain is a leading cause of years lived with disability. Majority of uncomplicated acute low back pain is self-limiting which does not warrant imaging. However, despite current indications for judicious imaging, many patients with low back pain continue to receive routine spinal imaging (XR, CT, MR) . Inappropriate MRI lumbar spine orders result in increase healthcare costs and manpower resources. The Singapore's Ministry of Health convened a multidisciplinary workgroup to develop and incorporate a consensus MRI lumbar spine guideline into the electronic radiology order forms. We review and analyse the outpatient MRI lumbar spine orders following implementation of this guideline.

### METHODS

A list of "appropriate" and "inappropriate" indications was developed based on existing literature (ACR Appropriateness Criteria and NICE guidelines). These indications were inserted into the MRI lumbar spine request form in the electronic system. It was made mandatory for clinicians to specify on a drop-down list of indications. For those who selected an "inappropriate" indication, a free-text "pop-up" was required for clinicians to elaborate on their clinical reasoning.

### RESULTS

Baseline pre-intervention data was collected over 3 months. A total of 492 MRI lumbar spine scans were performed of which 74 (15.0%) orders were classified as "inappropriate". Post-intervention, we analysed two sets of data over 3 months in 2021 and 3 months in 2022. In 2021, there were 86 (9.1%) "inappropriate" orders out of 940 scans performed. In 2022, there were 38 (7.3%) "inappropriate" studies out of 521 studies performed. There was a statistical significant overall decrease in inappropriate scans from 15.0% pre-intervention to 7.3% post-intervention (p-value <0.001). Among all the 124 "inappropriate" studies post intervention, only 1 patient eventually required surgery. On subgroup analysis, most imaging orders came from the Orthopaedic surgery followed by internal medicine and neurology.

### DISCUSSION

Overuse of MRI in low back pain is widely prevalent. Acute and non-specific back pain has poor correlation with imaging findings. "Inappropriate" imaging result in higher costs to the patient (unnecessary surgery and invasive treatment), healthcare system (manpower, delaying other patients' appropriate scans) and society (delayed return to work, higher disability compensation). There is no clear evidence on the most effective method to reduce overuse of imaging. We believe the best form of educating clinicians will be compulsory "appropriate" or "inappropriate" indications to serve as a last line of check. Our study demonstrates the positive impact of EMR implementation of a local guideline in reducing inappropriate MRI studies for low back pain. Further studies on the impact of other behavioural nudges are recommended.

## T2-QI-9 DEVELOPMENT OF READABLE AND UNDERSTANDABLE RADIOLOGIC PATIENT EDUCATION MATERIALS USING CHATGPT-4.0 AND PATIENT AND FAMILY ADVISOR REVIEW

Jada Hislop, BA (*Abstract Co-Author*) Nothing to Disclose
DeAngelo Harris, MD,MS (*Abstract Co-Author*) Nothing to Disclose
Nadja Kadom, MD (*Abstract Co-Author*) Nothing to Disclose
Timothy Arleo, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Problem: Our Department of Radiology lacked simplified and standardized patient education materials (PEM). Available Knowledge: Health literacy influences health outcomes, with lower health literacy increasing risk of adverse outcomes by 1.5-3x. The average adult reads at an 8th-grade level in the USA, yet a recent review found PEM from radiologyinfo.org read at the 12th-grade level. Artifical intelligence (AI) platforms like ChatGPT can aid in improving readability and understandability of PEM. Additionally, there is best practice for design of PEM that facilitates understandability and actionability. Purpose: To develop new standardized PEM that meets readability levels below 12th grade and are designed to enhance understandability and actionability.

## METHODS

General: We used a multi-disciplinary team approach, including patients, and performed iterative improvements. Context: This project was conducted at an urban quaternary academic hospital radiology department lacking standardized, patient-reviewed PEM. Intervention: Documents for the following examinations were created: CT, MRI, ultrasound, fluoroscopy, and radiography. We used a tiered approach to create new documents: (1) Source existing PEM; (2) Combine multiple content sources; (3) Simplify language below the 8th grade level using chatGPT4.0; (4) Subject matter expert review; (5) Patient and family advisor (PFA) review using the Patient Educational Material Assessment Tool (PEMAT-P) survey; (6) Final edits and institution-specific branding. Study of the Intervention/Metrics: Readability and understandability/actionability were assessed with the Flesch-Kincaid readability test and the PEMAT-P, respectively. We also collected qualitative input from subject-matter experts and patients. Analysis: The average PEMAT-P scores were compared to the recommended PEMAT-P minimum score (70%).

## RESULTS

The readability of the baseline documents (step 3) was at a 7th grade reading level using the Flesch-Kincaid readability test. The final CT, MRI, and fluoroscopy documents were readable at a 7th grade reading level, while ultrasound and radiography were readable at an 8th grade level.40 PFA were invited to participate, and 26 patients responded (65% response rate). The ratings yielded an average PEMAT-P score of 94.5%, and standard deviation of 9.7%. All average PEM scores exceeded the recommended understandability criteria by PEMAT-P (>70%).

## DISCUSSION

Our process utilized AI for language simplification, subject matter expert review for accuracy, and PFA review to assure understandability/actionability from the patients' perspective. This project establishes a pipeline for future educational materials on specific imaging procedures. As a next step, we aim to integrate PEM into our system's electronic health record system and patient portal.

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# Abstract Archives of the RSNA, 2024

T5A-QI

**Quality Improvement Reports Tuesday Afternoon Poster Discussions I**

Tuesday, Dec. 3 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## T5A-QI-1 THE ROUTINE COLLECTION OF "JUST IN CASE" THYROID ASPIRATES FOR MOLECULAR TESTING AT THE TIME OF INITIAL FINE NEEDLE ASPIRATION. IMPACT ON WORKFLOW

Adrian A. Dawkins, MBBS (*Presenter*) Nothing to Disclose

### INTRODUCTION

Molecular testing has become commonplace in the evaluation of thyroid nodules. In particular, nodules assigned a Bethesda III classification on cytologic analysis may benefit from genomic sequencing to determine the likelihood of underlying malignancy. This avoids unnecessary surgical intervention for Bethesda III nodules since the majority of these nodules turn out to be benign. Genomic sequencing requires dedicated samples from the thyroid nodule and the decision to acquire these samples is typically made after the formal cytologic interpretation. This creates anxiety and inconvenience for patients who must return for a repeat biopsy on another day. At our institution, a recent change was made to routinely collect "just in case" samples from each thyroid nodule, in addition to the regular cytology samples. We evaluate the impact of this change on workflow.

### METHODS

Over a seven month period, we made the workflow change to routinely acquire two further “just in case” passes for molecular testing, at the time of initial biopsy, prior to cytologic interpretation. Thus, a minimum of four samples were acquired for each nodule, two for routine cytologic analysis and two for possible genomic sequencing. Nodules subsequently determined to be Bethesda III, were further evaluated via sending the prospectively acquired material for genomic sequencing. We retrospectively reviewed the medical record of all consecutive patients over the seven month period to gauge impact on workflow and outcome.

### RESULTS

Patient ages ranged from 24 to 88 years. 16 were male and 63 were female. Of the 69 patients, 6 had two nodules sampled, yielding total of 75 nodules. Of the 75 nodules, 23 (30.7%) were classified as TI-RADS 3, 33 (44%) TI-RADS 4 and19 (25.3%) TI-RADS 5. Of these 75 nodules, 4 (5.3%) were Bethesda I, 37 (49.3%) Bethesda II, 30 (40%) Bethesda III, 0 (0%) Bethesda IV, 1 (1.3%) Bethesda V and 3 (4%) Bethesda VI. Of the 30 Bethesda III, 18 (60%) were deemed benign-4% risk by genomic testing. 9 (30%) were deemed with 50% or 75% suspicious for malignancy. Two (6.7%) were deemed to provide insufficient material for analysis and one (3.3%) analysis was canceled due to nonpayment. There were no patient complications.

### DISCUSSION

40% of FNA samples within our practice were determine to be Bethesda III. This would have resulted in a fairly high call-back rate for repeat biopsy for genomic testing, with the alternative being unnecessary surgery for the majority of these patients. While two additional passes were obtained for genomic testing, there were no complications at the time of the procedure or subsequently. Thus, we find the routine collecting of samples for possible genomic testing at the time of initial biopsy to be worthwhile and efficient. It is also well-tolerated and is more convenient for patients.

## T5A-QI-2 LONGITUDINAL PATIENT RECORD - A NEW CONCEPT FOR RADIOLOGY REPORTING

Mark Kontak (*Abstract Co-Author*) Consultant, VisionSR, Inc
Ciprian Dorin Craciun (*Abstract Co-Author*) Consultant, VisionSR, Inc
Andreea Pitici (*Abstract Co-Author*) Consultant, VisionSR, Inc
Adrian Prisacariu (*Abstract Co-Author*) Employee, Patrisoft Outsourcing Srl
Cristian Popovici (*Abstract Co-Author*) Software engineer, Patrisoft Outsourcing SRL
David J. Vining, MD (*Presenter*) Royalties, Bracco Group;CEO, VisionSR, Inc;Stockholder, VisionSR, Inc

### INTRODUCTION

Traditional radiology practice produces an independent narrative report for each exam that is performed. Information continuity across exams exists only when a radiologist explicitly dictates a comparison of prior findings to current observations. When patients have large numbers of prior studies, information discontinuity often exists. A longitudinal patient record combines data from various sources to produce a comprehensive medical history, but implementing this concept in radiology is challenging due to the pervasive nature of unstructured reports. A solution involves the use of interactive multimedia reporting (IMR) with discrete data elements to assimilate data from prior exams into a single integrated report. The IMR longitudinal record efficiently communicates a patient’s health status via graphs, tables, and hyperlinked content.

### METHODS

We developed an IMR solution that records radiological images and voice descriptions of image findings, tags the findings with metadata using natural language processing referenced to an ontology describing each anatomical location and the diagnosis/observation, and assembles a longitudinal patient record with connected information linked in timelines. The system presents integrated multidisciplinary information over a patient’s lifetime, and the data

can be filtered to show information for a particular anatomy, disease, and/or time interval. Data can be added asynchronously, and warnings are sounded when unrelated data is linked to a finding. Furthermore, patient cohorts can be created with these longitudinal patient records to support clinical trials, generate real-world evidence for regulatory decision-making, and calculate medical outcomes.

**RESULTS**

The system has been used to date to create 3,579 longitudinal patient records containing 22,544 timelines comprising 68,804 items of connected information. Each timeline represents a finding of connected items. The system is currently in use to support 51 clinical trials.

**DISCUSSION**

A longitudinal patient record built on IMR principles represents an evolution in radiology reporting. Rather than creating independent reports, data integrated into a single interactive multimedia report can efficiently communicate a patient's complete medical history and health status. The visual presentation of data in graphs, tables and hyperlinked content provides physicians with efficient access to information at the point of care, facilitates information exchange between medical specialists, mitigates potential medical record errors, and supports the derivation of medical outcomes.

## T5A-QI-3 RETROSPECTIVE WRONG-PATIENT ERROR ANALYSIS USING POINT-OF-CARE VISIBLE LIGHT IMAGING

Carson A. Wick, PhD (*Abstract Co-Author*) Employee, CameRad Technologies, LLC ;Co-founder, CameRad Technologies, LLC;Officer, CameRad Technologies, LLC
Nabile M. Safdar, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Srini Tridandapani, MD, PhD (*Presenter*) Co-founder, Camerad Technologies, LLC;Spouse, Co-founder, Camerad Technologies, LLC;Officer, Camerad Technologies, LLC;Spouse, Officer, Camerad Technologies, LLC

**INTRODUCTION**

Errors in radiology imaging are often corrected without adequate reporting resulting in the nature of the error being lost for downstream users. This missing information makes it difficult, or even impossible, for the user to determine the type of error, e.g., wrong-patient, wrong-site, wrong-exam-type, laterality, and positioning errors. Point-of-care (POC) patient visible light (VL) images can be used to efficiently classify and confirm imaging errors. This work focuses specifically on confirming and quantifying wrong-patient errors.

**METHODS**

An existing deployment of a POC patient VL imaging system on portable radiography machines at a large academic hospital was used to automatically obtain patient VL images. These VL images were automatically paired to the corresponding radiograph images in PACS as a new DICOM series. Retrospective querying of PACS using the logs of the VL imaging system was performed for studies with VL images to find radiology imaging errors for a 30-day period. PACS was queried for each radiograph image with a corresponding VL image, according to the VL imaging system logs, to find images that were no longer present in the hospital PACS, indicating an error.For errors found this way, archived VL images and patient information were compared against that patient's data that was still present in PACS. The patient's other radiograph studies still present in PACS also contain VL images allowing for a visual comparison against the VL image from the error study. If the VL images were of different patients, a wrong-patient error had occurred.

**RESULTS**

Over a 30-day period, 1781 portable radiography studies with POC VL images were acquired. Of these, 12 (0.7%) were no longer present in PACS under the same Accession Number and Study/Series/SOPInstanceUIDs (unique identifiers). The patient VL images for these 12 studies were manually reviewed and compared against other VL images of that patient still in PACS. Within these 12 studies, 3 wrong-patient errors were confirmed as indicated by non-matching patient VL images. This results in an estimated wrong-patient error rate of 1 in 594.

**DISCUSSION**

An extensible method for detecting errors in radiology imaging by quantifying discrepancies in images in PACS over time was developed. Results of this method, in conjunction with POC VL images, were used to investigate and quantify wrong-patient errors. The wrong-patient error rate found was higher than previously assumed (~1/600 vs 1/4000). These techniques will be used to provide insight into which radiology areas to direct improvement measures.

## T5A-QI-4 FROM THE SCANNER TO THE READING ROOM: A NOVEL SYSTEM THAT AUTO-POPULATES ACCURATE MUSCULOSKELETAL RADIOGRAPHIC VIEWS IN REPORT TEMPLATES

Peter H. Pham, MD (*Abstract Co-Author*) Nothing to Disclose
Jeremy Johnson, MD (*Abstract Co-Author*) Nothing to Disclose
Christopher Sahagian (*Presenter*) Nothing to Disclose

**INTRODUCTION**

The number of radiographic views documented in radiology reports are used by medical billing coders to create reimbursement claims. Given large volume of musculoskeletal (MSK) radiographs, and wide breadth of views we obtain to evaluate MSK patients, it may be difficult for radiologists to accurately report views. This is especially true for the many views for the shoulder. This QI project seeks to outline a potential solution: designing software within the electronic medical records (EMR) that accurately auto-populates radiographic views directly into report templates. The goal is to improve workflow efficiency, enhance report accuracy, and ensure appropriate reimbursement of radiologists' work.

**METHODS**

We planned to promote efficiency and fair reimbursement of MSK radiographic reads. We designed and integrated a multiple-choice questionnaire into the EMR system, for technologists to mark which views they obtained after scanning patients. We ensured proper training for all participants. Data entered by technologists was linked to our dictation software via a ubiquitous radiology information system and were programmed to auto-populate special fields within the report template. We studied efficiency by surveying average time spent manually reporting MSK views. We gauged awareness of how reimbursement claims are generated and surveyed intended use of this workflow. We also studied report accuracy by counting shoulder radiograph reports that incorrectly reported technique views, before (March 2023) and after (March 2024) implementation of this project. We then acted upon our data to refine and expand the workflow to include knees, spine, and arms.

**RESULTS**

At our institution, radiologists spend an average of 7 seconds manually reporting MSK radiographic views for each report. Thus, if an average MSK radiologist reads about 100 radiographs per 8-hour workday, and works 230 days per year, using this semi-automated workflow could save approximately 5.6 workdays per year. When gauging awareness of how reimbursement of MSK radiographs is determined by coders, only 30% of radiologists knew it was pulled from the views listed in reports. After training participants, all radiologists and technologists expressed the intent to utilize it daily. 4% of sampled shoulder radiograph reports in March 2023 reported less views than actual number of views obtained; samples from March 2024 had no such errors.

### DISCUSSION

Employing this semi-automated workflow could save radiologists substantial time spent drafting reports for MSK radiographs every year, effectively improving productivity, while also enhancing accuracy, which ensures correct reimbursement. As a single-center project, limitations include its probable lack of universal replicability or feasibility. Additionally, our time analyses exclude the potential added time of inputting data by the technologists.

## T5A-QI-5 CLOSING THE GAP: TAKING CT IMAGING ON THE ROAD TO RURAL COMMUNITIES

Oliver Mulcock, BSc (*Presenter*) Nothing to Disclose

### INTRODUCTION

Our Local Health District is geographically a similarly size to Germany, but with a population of around 284,000. In such a rural area, access to a CT Scanner often means extensive travel (400km) to bigger cities.The use of telehealth and video consultations were accelerated during the recent COVID-19 pandemic, pathology can be collected at point of care and tested off site, however radiology has long been a sticking point of diagnostics where travel to a suitable facility is essential.Our Mobile CT Service has allowed us to close this gap with access to diagnostic imaging which many of us in metro areas take for granted these days. Instead of asking many patients to travel, we are now taking the scanner closer to them.Globally, Mobile CT is not a new concept, however, more often than not, mobile scanners are used to add capacity to existing facilities rather than being the sole service in a rural acute care setting.

### METHODS

The idea of taking CT Scanner on the road in the back of truck originally came from one of our Radiologists back in 2010, and we spent 10 years formulating the business case, sourcing funding and developing the project.We reviewed health facilities within our district located with good road access, appropriate facilities, staff support and located where residents of nearby smaller towns could access imaging without significant travel.We settled on 3 main locations to travel between and used data from the Ministry of Health and local health practitioners to estimate the demand for service.We spent a further 2 years designing our mobile scannerand having it built into a rigid framed truck.

### RESULTS

We scanned our first patient in May 2023, and in our first 11 months of operation, we have scanned 1,420 patients over our 3 sites, (1226 Outpatients, 81 Inpatients and 113 Emergency).From outpatient scans alone, we have saved 713,000 kilometres of patient travel, which leads to AU$285,000 of cost savings from the statewide Isolated Patients Travel and Accommodation Scheme.In addition, we are also able to avoid inter-hospital patient transfers in an acute setting where a CT scan can be the difference between surgical management in a larger hospital rather than medical management in the community.We are also ensuring Emergency Department patients are diagnosed promptly and, where required, transferred to suitable tertiary centre for ultimate end point care.

### DISCUSSION

Taking CT Scanning to the rural communities of our local health district has transformed the care they are able to receive in a primary setting, enabling faster diagnostics and earlier treatment.The benefits in the acute care setting are limited by the fact we are a travelling service an only in each location for 1 week at a time, however the benefits for chronic and non-urgent patients is much more permanent as they can be confident of access to a CT appointment within 3 weeks, local to home and any support they may require.

## T5A-QI-7 FROM IMAGING FINDINGS TO FRACTURE LIAISON SERVICE: ARE RADIOLOGY REPORTS FOR VERTEBRAL FRAGILITY FRACTURES ACTED UPON?

Christopher Watura, FRCR, MBChB (*Abstract Co-Author*) Nothing to Disclose
Henry Conchie, MBChB, BSc (*Presenter*) Nothing to Disclose

### INTRODUCTION

Vertebral Fragility Fractures (VFFs) are common yet increasingly under-diagnosed on imaging. This is a missed opportunity to refer patients to the Fracture Liaison Service (FLS) for assessment and prevention of further fractures, at the detriment of patient morbidity and cost to the health service. Patients with incidental vertebral fractures have a 41% risk of developing a further fracture in the subsequent year, and severe vertebral fracture strongly predicts subsequent hip fracture. UK National guidance is in place, which advocates the use of VFF Alert systems for ensuring timely signposting of VFF cases to the FLS.We assess the imaging referral pathway for VFFs to a FLS at our tertiary level institution, with the aim to optimise the radiology alert system for VFFs.

### METHODS

To evaluate the extent of the problem, all radiology reports completed during a three-month period were retrieved from the picture archiving system (PACS) for CT scans which included terms associated with VFFs for patient aged over 50 years. The amount of VFF Alerts were recorded, and those cases were then investigated by the Rheumatology team to evaluate the FLS referral rate. Institutional changes were subsequently made following our findings, and a second analysis performed.

### RESULTS

In the first analysis, only 7% (13/175) of the VFF reports included the VFF Alerts. Of the VFF Alert cases, none were referred to the FLS. This prompted the employment of a new dedicated FLS nurse to ensure the safety of the referral pathway, whose role involves monitoring of the Alert email inbox notifications. Additionally a new Rheumatology Consultant was employed with a designated managerial role within the FLS service. Within the Radiology Department, we increased awareness amongst consultants and trainees regarding the VFF Alert and its importance through departmental meetings, emails and mobile phone group messages.In the repeat analysis, again only 7% (11/162) included of VFF reports included the VFF Alert. However, all cases with the Alert had been appropriately acted upon by the newly appointed FLS nurse.

### DISCUSSION

It is incumbent on the full multidisciplinary team to engage with an electronic alert system in order for it to be 'fail-safe'. Significant shortcomings were detected in the FLS system on the first study cycle, and there is still work to be done to increase non-specialist radiologists' and referrers' awareness regarding the importance of the detection, reporting and appropriate further investigation and treatment of VFFs. Automated email alert systems can serve as robust pathway for referring VFFs from radiology to the FLS when the Alerts are correctly recorded and the generated referrals are appropriately monitored.

## T5A-QI-8 KANGAROO MOTHER CARE MRI: A NOVEL APPROACH TO HIGH QUALITY IMAGING IN NEUROPEDIATRICS

Elida Vazquez, MD (*Abstract Co-Author*) Nothing to Disclose
Ignacio Delgado, MD (*Abstract Co-Author*) Nothing to Disclose

Luis Riera Soler, MD (*Abstract Co-Author*) Nothing to Disclose
Lucia Riaza Martin, MD (*Abstract Co-Author*) Nothing to Disclose
Juan Fernando Casanova Barba, MD (*Abstract Co-Author*) Nothing to Disclose
Sandra Lopez Coello, MD (*Abstract Co-Author*) Nothing to Disclose
Jose Miguel Escudero-Fernandez, MD (*Abstract Co-Author*) Nothing to Disclose
Marta Gonzalo Carballes, BMBCh (*Abstract Co-Author*) Nothing to Disclose
Maria Ibnoulkhatib, MD (*Abstract Co-Author*) Nothing to Disclose
Ramon Almodovar, MD (*Abstract Co-Author*) Nothing to Disclose
Alex Espinal Colominas, MD (*Abstract Co-Author*) Nothing to Disclose
German Ramos Rubio, MD (*Abstract Co-Author*) Nothing to Disclose
Ana Coma, MD (*Abstract Co-Author*) Nothing to Disclose
Angel Sanchez-Montanez, MD (*Presenter*) Nothing to Disclose

## INTRODUCTION

It is widely acknowledged that studying infants via MRI poses challenges. Many infants may experience discomfort, exhibit movement, and require sedation, which may not always be available or even possible. Consequently, alternative techniques have been sought to enhance comfort and minimize motion artifacts. Over the past 15 years, our efforts have been focused on improving imaging quality in neuropediatrics. A recent innovation from our group involves adapting the method pioneered by Rey and Martinez in 1983 for use in pediatric neuroradiology.

## METHODS

By securing the infant within the mother's embrace and implementing skin-to-skin contact on the mother's bare chest, we alleviate the infant's stress and reduce motion artifacts. This approach enhances image fidelity and provides superior spatial and temporal resolution for both brain and spine studies. Employing body coils to envelop both mother and infant during breastfeeding ensures a tranquil and relaxed environment. This method offers an easy, straightforward, cost-effective, and replicable means of achieving the necessary goals in pediatric radiology.

## RESULTS

In recent years, we have explored the implementation of Kangaroo mother care (KMC) technique. The idea first arose during a spinal cord MRI study involving a non-sedatable infant, following exhaustive attempts and tips and tricks to mitigate motion. Technological strategies included PROPELLER/BLADE sequences and single-section T2-weighted sequences like HASTE (Half fourier Single-shot Turbo spin-Echo), alongside new sequences designed for sound reduction. Classical techniques involving the collaborative efforts of our technicians and nurses proved invaluable in securing the child, providing acoustic protection, and fostering a serene environment. Our initial endeavor with KMC proved successful, prompting further application in brain and spinal MRI for non-sedatable patients. Feedback from both mothers and our medical team has been overwhelmingly positive. The team of technicians and nurses also appreciate it, and we believe the child even more so.

## DISCUSSION

Kangaroo mother care MRI emerges as a valuable alternative when sedation is either impractical or contraindicated due to airway concerns or inadequate fasting time for anesthesia. However, its effectiveness is limited in non-breastfed children. Our experience indicates that images obtained using this technique are sufficient for accurate diagnosis, obviating the need for repeat studies. We urge other centers to adopt and promote this simple method, feasible in hospitals worldwide, irrespective of resource constraints.

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# Abstract Archives of the RSNA, 2024

T5B-QI

**Quality Improvement Reports Tuesday Afternoon Poster Discussions II**

Tuesday, Dec. 3 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## T5B-QI-2 REDUCING WASTE OF IODINATED CONTRAST AND PLASTIC IN A MULTI-SITE ACADEMIC CT PRACTICE

Kim Pongsatianwong, RDMS, RVT (*Abstract Co-Author*) Nothing to Disclose
Jessica M. Forsythe, MBA, RT (*Abstract Co-Author*) Nothing to Disclose
Kelly Albury, BA (*Abstract Co-Author*) Nothing to Disclose
Xunbo Xu, ARRT (*Abstract Co-Author*) Nothing to Disclose
Lakshmi Ananthakrishnan, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Iodine is a nonrenewable resource that is expensive to mine and process. Iodinated contrast media (ICM) used in CT is supplied in single-use vials of varying sizes and 500-mL multi-use vials (4-6 patients per vial, expire after 8 hours). Strategies to decrease ICM and plastic waste in CT include using multi-use vials (500 mL, 4-6 patients per vial, expire after 8 hours) and syringeless injectors (decrease plastic consumables compared to dual headed syringe injectors, and may decrease ICM waste). In addition, ICM recycling programs are now available; unused ICM is collected and sent back to the manufacturer for recycling, with a 90% reported iodine harvest rate. The global ICM shortage of 2022 forced us to assess ICM waste during routine practice. The goal was to decrease ICM waste in CT while implementing environmentally conscious processes, including reducing plastic waste and recycling ICM waste.

### METHODS

This project was carried out at a large academic center that provides hospital- and outpatient-based CT services. Prior to 2022, single-use 100-mL vials were used with 1-2 vials opened per patient; unused ICM was discarded. Dual-headed syringe injectors were used, requiring two large syringes and plastic tubing per patient. Three interventions were performed. Two targeted waste reduction; quantity of ICM opened and given to the patient was tracked for one week prior to and one week after the intervention. Differences in ICM waste and estimated cost were recorded. The third intervention targeted ICM recycling. 1) Outpatient: multi-use vials were used with a dual-headed syringe injector. 2) Hospital: multi-use vials were used with syringeless injectors. In addition to tracking ICM waste, the differences in cost of plastic tubing was estimated. 3) ICM recycling containers were placed in two CT suites at one busy outpatient site. Amount of ICM collected and total quantity of ICM supplied to the CT department during a 10-month time period were recorded.

### RESULTS

1) Outpatient: Adoption of multi-use 500 mL vials reduced ICM waste by 12.6 mL per injection, projected to yield $9,270 cost savings over 6 months. 2) Hospital: Interventions decreased the amount of disposable plastic tubing used, projected at $29,850 cost savings over 6 months. Unexpectedly, a marked increase in ICM waste was noted, estimated at 68.8 mL ICM per patient. 3) Over the course of 10 months, the recycling program collected 19.5 liters of ICM, or 2.8% of all ICM pulled from that outpatient location.

### DISCUSSION

Multi-use vials led to a decrease in ICM waste in the outpatient setting, but this same intervention increased ICM waste in the hospital. Suspected causes include low utilization of certain scanners, unpredictable scan volume, and the vial's 8-hour expiration. Future work will target these areas. Syringeless injectors may decrease plastic waste, and ICM may be recycled via manufacturer-led programs.

## T5B-QI-3 SAVING LIVES: INCREASING CAPACITY IN BREAST IMAGING

Haydee Ojeda-Fournier, MD (*Presenter*) Research Consultant, View Point Medical, Inc;Stock options, CureMetrix, Inc

### INTRODUCTION

Breast cancer is the most common malignancy in American women. The most common way breast cancer is detected is by screening mammograms. Screening mammograms are indicated for average-risk asymptomatic women, starting at age 40 and every year thereafter.

### METHODS

Problem statement: Low capacity in the breast imaging center leads to backlogs and patients either not undergoing recommended imaging or going to other facilities for their care. Numerous analyses were performed, including time observations, reviewing data from the RIS (radiology information system), and reviewing PACS (picture achieving and communication systems) time stamps. The observed data was reflective of actual room utilization and statistically significantly different from data extracted from RIS and PACS. A small group was convened to analyze the data, and a series of PDSA cycles were performed. Observation data showed that the median time of patient in the room to out of the room during a screening mammogram was 10 minutes. A modeling was performed by analyzing the templates showing an increase in capacity with various adjustments, which included standardizing allowing patients to use changing rooms (previously closed due to COVID and leading to procedure room underutilization) rather than changing in

examination rooms. We also standardized technologists' procedures, such as the start and end times of exams in EPIC. The screening templates were adjusted to q15-minute intervals from the current 20 minutes. Tests after a week showed that we failed, and capacity decreased rather than increased. This failing (not a failure) motivated a second template review, adjustments, and data analysis round. After an additional observation period, further analysis showed increased capacity!

**RESULTS**

We compared historical data for screening mammograms to current data for a matched period. This is done because we had shown fluctuation in visits over the year (surge during October breast cancer awareness month or lows during summer vacations). Comparing January to June of 2022 to 2023 showed a net increase of 1441 screening studies, representing a 15.2% increase (we had targeted a 10% increase in volume). Net increase and percent change were recorded. This increase translates to an estimated $400,252.16 to $1,233,207.80 of additional revenue. Most importantly, the changes implemented saved lives, which is priceless. The patient satisfaction scores were unchanged from before and after changes were implemented.

**DISCUSSION**

This is an ongoing quality improvement project. After further data analysis, a second decrease in the screening time to 12 minutes (current 15) will be undertaken to increase capacity further. Additional attention is being paid to the increase in diagnostic volume, with interventions being planned. Finally, capacity will be added by offering evening and weekend screening appointments.

## T5B-QI-4 ENHANCING PATIENT SAFETY IN CT EXAMINATIONS: ESTABLISHMENT OF A STANDARDIZED MANUAL TO REDUCE HIGH-VOLUME CONTRAST EXTRAVASATIONS AND PREVENT AIR EMBOLISMS

Choong Beom Seo, RT, BS (*Abstract Co-Author*) Nothing to Disclose
Yong Hwan Chung, RT (*Abstract Co-Author*) Nothing to Disclose
Chang Min Dae (*Abstract Co-Author*) Nothing to Disclose
BYOUNGJUN KIM, BSc (*Presenter*) Nothing to Disclose

**INTRODUCTION**

In 2021, a total of 144,602 contrast-enhanced examinations were conducted at our institution, among which 66 incidents of extravasation occurred. Of these, 21 cases involved large volumes of over 30 CC, accounting for a rate of 31%. In 2022, out of 152,136 examinations, 27 large-volume incidents of more than 30 CC were recorded, increasing the rate to 41%. Additionally, there were 2 cases of significant air embolism in 2022. Currently, the Extravasation Detection Accessory (EDA) is only attached during bolus tracking exams, while timed exams are conducted through manual palpation and visual inspection by the operator. Therefore, we aim to develop and implement a standard CT examination protocol that not only minimizes the risk of large-volume extravasation during contrast administration but also fundamentally prevents air embolism, thereby enhancing patient safety.

**METHODS**

From September 2023 to February 2024, we evaluated 80,745 patients who underwent contrast-enhanced CT examinations at our institution. To reduce large-volume extravasation the Nemoto Extravasation Sensor was attached to all eligible patients, and a Patient Safety Process was developed to prevent air embolism and evaluate its adherence rate. To improve the application rate of the patches, we prepared necessary items for better attachment of the extravasation sensor in the examination room and conducted training on the effectiveness and proper use of the EDA for the operators. In order to prevent air embolism, we changed the settings of the Auto Injector air check and improved the environment to facilitate the verification of the remaining contrast volume. Periodically, we conducted training on the causes and risks of extravasation and air embolism, and shared actual case studies with the staff.

**RESULTS**

During the measurement period, the application rate to patients of the Extravasation Sensor Patch increased from 32% to 95%. There were a total of 70 incidents of extravasation, of which 18 were large-volume incidents involving more than 30 CC, decreasing from 40.9% to 25.7%, a reduction of 15.2%. There were no occurrences of significant air embolism during the measurement period.

**DISCUSSION**

By attaching the Extravasation Sensor to all patients using contrast agents and implementing the Patient Safety Process, we can prevent and reduce patient safety incidents during CT examinations. Continued education and activities can also contribute to an increase in medical staff confidence.

## T5B-QI-5 THE IMPACT OF SOCIAL DETERMINANTS OF HEALTH ON FOLLOW-UP OF ACTIONABLE INCIDENTAL FINDINGS

Susan K. Hobbs, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Akshya Gupta, MD (*Abstract Co-Author*) Nothing to Disclose
Kristen Hans (*Abstract Co-Author*) Nothing to Disclose
Arjun Byju, MD (*Abstract Co-Author*) Nothing to Disclose
Ben C. Wandtke, MD, MS (*Abstract Co-Author*) Clinical Advisory Board, CAK Tech, Inc
Timothy M. Baran, PhD (*Abstract Co-Author*) Nothing to Disclose
Aniruddh Mandalapu (*Abstract Co-Author*) Nothing to Disclose
Denes Szekeres, BS (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Multistage recommendation-tracking systems improve patient adherence to imaging follow-up recommendations for actionable incidental findings. Our institution implemented such a system with escalating reminders to the ordering provider via the electronic health record, mail, and by phone. While there were improvements in follow-up across the study population, it is unclear if these are equitably distributed across socioeconomic groups. The present study reviews data from our institutions' recommendation-tracking system to determine how different social determinants of health impact completion of recommended follow-up imaging.

**METHODS**

A post-hoc analysis of our recommendation-tracking system dataset was analyzed including data on insurance, area deprivation index (ADI), race and ethnicity, use of language interpretation. The outcome of imaging examination completion after notification was compared between demographic variables using McNemar's test, with prediction of examination completion analyzed with univariate and multivariable logistic regression.

**RESULTS**

The study cohort included 1336 patients with associated imaging follow-up recommendations. The recommendation-tracking system increased imaging examination completion from 46.8% to 72.8% in patients with Medicare/Medicaid and 46.3% to 68.3% in all other forms of payment. Imaging follow-up improved from 43.5% to 63.0% in Black patients and from 47.3% to 72.3% in White patients. Univariate analysis showed higher odds of imaging completion for patients with Medicare/Medicaid versus other forms of payment (1.24, 95%CI [0.95, 1.63], p = 0.11) and significantly lower odds for

patients identifying as Black versus White (0.65, 95%CI [ 0.43, 0.99], p = 0.04). There were no significant differences by ADI, modality, imaging site, ethnicity, or use of language interpretation. However, when including ADI in multivariable regression, there were no longer any significant differences by race (0.62, 95%CI [0.34, 1.13], p = 0.12) but instead by insurance (1.45 95%CI [1.03, 2.04], p = 0.03).

**DISCUSSION**

The data suggests that insurance status plays a key role in exam completion when follow-up recommendations are made. This may reflect differences in deductible cost for patients on Medicare/Medicaid compared to other forms of payment. On univariate analysis, patients identifying as Black were less likely to complete follow-up imaging, potentially introducing a disparity by implementation of multi-stage tracking. However, incorporating ADI, this difference was no longer statistically significant. Similarly, ethnicity and language barriers did not appear to contribute to inequitable examination completion. Additional research to understand barriers to completing follow-up imaging should be explored to better suit the needs of the community.

## T5B-QI-6 IMPACT OF HIGH RELIABILITY ORGANIZATION TRAINING ON QUANTITY AND EFFECTIVENESS OF RISK REPORTING IN RADIOLOGY AT A LARGE ACADEMIC CENTER

Crystal Blank (*Abstract Co-Author*) Nothing to Disclose
Prachi P. Agarwal, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Lee, MD (*Abstract Co-Author*) Nothing to Disclose
Glenn E. Houck JR, MS, ARRT (*Abstract Co-Author*) Nothing to Disclose
Ashok Srinivasan, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Electronic reporting of quality and safety concerns allows for appropriate event documentation, evaluation of contributing factors and creation of action plan for problem solving. Our organization transitioned to a high reliability organization (HRO) in 2019 including an extensive and focused employee training to emphasize basic principles reiterating the non-punitive nature of reporting quality/safety concerns, which rely on identifying system issues rather than individual level factors. However, when training ended, there were also concerns about a potential increase in frivolous and non-actionable risk reports. The aim of this study was to therefore study the long term impact of HRO training on the quantity of risk reports and effectiveness when pertaining to Radiology.

**METHODS**

In this study, we analyzed reporting of all risk events pertaining to Radiology, pre and post HRO training, with the goal of identifying trends after implementation. The following metrics were measured before and after HRO training: - overall volume of risk reports (events), number of events categorized as >E3 (defined as more than temporary harm-physical), number of reports filed by different employee types number of action items (including local reviews, apparent cause analysis, multidisciplinary reviews). The data was analyzed from 1/1/2018 till 12/31/2023. Since the Program Manager position for Radiology Safety commenced only in 2021, accurate data for action items was available only from 2022-2024.

**RESULTS**

The overall number of events and those with harm >E3 from 2018-2023 were {1555, 1764, 1580, 1801, 1988 and 2373} and {157, 259, 188, 228, 227 and 341} respectively. Number of action items in 2022 and 2023 were 6 and 28 respectively. Analysis of employee types filing risk reports showed a steady increase in the physician (including faculty and trainees) category with no significant trends in other employee categories (technologist, nursing staff, physician assistants, manager/supervisor/administrative personnel).

**DISCUSSION**

3 years post HRO training, there was an increase in overall number of events and those with significant harm. While the data for action items was limited to 2 years only, there was a year over year increase in this number. We also found that the physician group, which was historically not associated with risk report filing, showed a year over year increase in number of reports filed. Thus, HRO training is associated with increased reporting of quality safety events that also result in more action items, and probably increased awareness amongst physicians about the process. This can help institutions identify system related issues and empower more employees to express their concerns.

## T5B-QI-7 ENHANCING CONVENTIONAL BIOPSIES: ULTRASOUND-GUIDED PERCUTANEOUS BONE MARROW BIOPSY AND ASPIRATION

Caroline Cushman (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Percutaneous bone marrow aspiration and biopsy play a crucial role in the histopathological and microbiological assessment of various hematological disorders. Traditionally, these procedures have relied on either open surgical techniques or x-ray guided methods, which carry risks such as radiation exposure and invasiveness. However, ultrasound guidance offers a radiation-free alternative with rapid image acquisition. This quality improvement study proposes a hybrid ultrasound-guided technique integrating landmark and image-guided methods, along with interdisciplinary efforts to enhance patient safety and biopsy sample integrity.

**METHODS**

This quality improvement study was conducted in an urban, academic hospital. Prior to this initiative, bone marrow biopsies at our institution were guided by either CT imaging or fluoroscopy. With the patient-centered goal of refining biopsy accuracy and reducing risk, we implemented ultrasound guidance due to its significant benefits, including the elimination of ionizing radiation, rapid image acquisition, detailed structural and vascular analysis, and bedside convenience.We employed a novel ultrasound-guided approach designed for lesions with osteolysis and extensive cortical disruption. This technique involved administering local anesthetic and moderate IV conscious sedation, and ultrasound-guided access with the patient placed prone and a 10-gauge needle advanced to the iliac bone of the pelvis.Our methodology included direct pathologist involvement at the bedside to verify sample accuracy, which helped to address possible repeat sample collection and need for reintervention. Success metrics measured included (1) patient satisfaction, (2) precision of sample acquisition, and (3) technical procedural success, to best gauge the intervention's impact on clinical outcomes and patient experience.

**RESULTS**

Since its implementation, our technique has been utilized in a sample of n=1,246 patients, achieving a 100% accuracy rate in sample collection without any significant adverse events or need for repeated biopsies due to inadequate sampling. Moreover, there have been no reported patient complaints; instead, we have received positive feedback.

**DISCUSSION**

Ultrasound-guided percutaneous bone marrow biopsy and aspiration presents as a promising technique, providing several benefits compared to traditional approaches. This innovation has proven effective in our institution and holds promise for wider adoption in clinical settings focused on enhancing diagnostic accuracy, technique safety, and patient experience.

## T5B-QI-8 UTILIZATION OF QA NOTES TO IMPROVE X-RAY IMAGE QUALITY IN THE DIGITAL AGE

Brian D. Gale, MD, MBA (*Abstract Co-Author*) Nothing to Disclose
Mina Al-Ani, MBBCh (*Abstract Co-Author*) Nothing to Disclose
Aala Saadallah, MBChB (*Abstract Co-Author*) Nothing to Disclose
Deborah L. Reede, MD (*Abstract Co-Author*) Nothing to Disclose
Adil N. Afridi, MD (*Abstract Co-Author*) Nothing to Disclose
Zenab Jamil, BA (*Presenter*) Nothing to Disclose

### INTRODUCTION

Currently, the assessment of radiological image quality of digital radiographs is performed by radiology technicians and physicians reading the image. Quality Assurance (QA) notes in the Radiology Information System (RIS) enable radiologists to report image artifacts, poor technique, missing images, and defective equipment. This can improve image quality, diagnostic accuracy, and communication between radiologists and technicians. This project aimed to institute department-wide QA note training sessions in an academic radiology department to encourage radiologists to use QA notes, identify preventable imaging issues, and establish short-term and long-term solutions to improve image quality.

### METHODS

We structured the project using the PDSA model and evaluated QA notes from January-June 2023. Radiology attendings and residents documented quality or workflow problems in the RIS QA system. Radiology house staff dictate preliminary reports that were subsequently signed off by faculty. Radiologists' reporting rates were quantified. House staff and faculty reports were compared. If the resident did not report an issue that the attending identified, it was labeled a "miss."A PowerPoint presentation was developed to teach radiologists how to log QA notes and identify common QA issues and their impact on image quality and patient safety. This tutorial included long-term solutions to rectify common issues. All residents took a pre- and post-training quiz; scores were analyzed using paired T-Test. Post-training analysis of QA notes from September 2023-February 2024 was performed to evaluate changes in the number/type of imaging problems reported and conduct a root cause analysis. Outcomes were measured using the frequency of QA notes, categorized by issues, and analyzed using graphical analysis. During the second phase of the study, a teaching module was developed for radiology technicians. Post-training analysis was performed to re-evaluate QA issue frequency.

### RESULTS

The average resident score rose significantly between the pre-test and post-test ($p= 0.05$). Compared to the January-June analysis, the September-February analysis demonstrated a significant increase in reported QA issues. Post-training analysis showed the total number of QA notes entered per month by radiologists increased by 53.4% following the didactic session. Resident failure to report rates dropped from 30% to 19% after the didactic session demonstrating that residents were more likely to report common QA issues when reading exams.

### DISCUSSION

Educating radiologists about the RIS QA note system resulted in an overall increase in the reporting rate, which can improve image quality of digital radiographic images and enhance the accuracy of radiological reports. Study limitations include a small data sample restricted to plain film radiography.

# Abstract Archives of the RSNA, 2024

W2-QI

**Quality Improvement Reports Wednesday Morning Poster Discussions**

Wednesday, Dec. 4 9:00AM - 9:30AM Room: LEARNING CENTER

**Sub-Events**

## W2-QI-1 TELEMEDICINE RADIOLOGY PROVIDER CONSULTATION SERVICE POST-ACQUISITION OF OUTPATIENT SPINE IMAGING: A PILOT STUDY

Todd L. Siegal, MD (*Abstract Co-Author*) Nothing to Disclose
Khuram S. Kazmi, MD (*Abstract Co-Author*) Nothing to Disclose
Manisha Koneru (*Abstract Co-Author*) Nothing to Disclose
Hamza A. Shaikh, MD (*Abstract Co-Author*) Nothing to Disclose
Lucinda Lau, BS (*Presenter*) Nothing to Disclose

### INTRODUCTION

As the use of electronic medical records (EMR) increases, outpatient imaging results are now readily available to patients, often before their follow-up with the referring provider. The language within reports may cause confusion and stress from otherwise clinically insignificant findings. As patient understanding is paramount, radiology consultation services are a potential solution to allow patients to clarify questions regarding their imaging report. Still, little is known about the scale of potential benefit, optimal format, and barriers to implementing this service. The purpose of this pilot study is to explore how consultation services may enhance patient comprehension of their imaging, enabling them to make informed healthcare decisions.

### METHODS

Adult patients scheduled for a magnetic resonance imaging study of the lumbar spine with the complaint of “back pain” and associated diagnoses will be extracted and contacted via EMR messaging service prior to their scan and offered the opportunity to receive a free 30-minute virtual consultation with a neuroradiologist. A survey will be administered prior to follow-up with the referring physician. The survey assessed points including: patient understanding of their imaging, satisfaction with the service, preference for visit duration, and amount willing to pay for the service. Descriptive analyses were used to summarize survey responses.

### RESULTS

Of 7 participants, median age was 59 years (IQR 41-76), and 85.7% were female. 42.9% of patients listed bachelor’s degree as their highest level of education. Most were referred by pain management (42.9%). On a scale of 1 (none) to 5 (high), median rating of patient understanding of the imaging pre-consultation was 3 (IQR 2-4) and post-consultation was 5 (IQR 5-5). All agreed that the service was helpful and would opt for a similar service in the future. Majority had no preference whether on virtual or in-person meetings (57.1%). Patients noted that the highest they would pay was $40-$60 (28.6%) or $80-100 (28.6%), with a high degree of variation in reported preferences. Overall, all patients reported the highest satisfaction score with this experience.

### DISCUSSION

Use of radiology consultation services enhance health competency, allowing for better patient satisfaction and care. The virtual setting allows for greater accessibility and is generally accepted by most patients. Furthermore, there is potential to enact this as a billable telemedicine service, as evident through patient willingness to pay for the service. This pilot study is limited by small sample size and extensive process of patient enrollment and scheduling through EMR review. Automation of scheduling through EMR integration to select pre-set time slots can optimize the workflow. Future studies with a larger cohort can explore the impact of this novel consultation service on patient experiences.

## W2-QI-2 CULTIVATING RADIOLOGY LEADERSHIP: FORGING A PATH TO A FAIR & JUST CULTURE

Nadja Kadom, MD (*Abstract Co-Author*) Nothing to Disclose
Lisa Reynolds (*Abstract Co-Author*) Nothing to Disclose
Zachary Grunewald (*Abstract Co-Author*) Nothing to Disclose
Susan Reich (*Presenter*) Nothing to Disclose

### INTRODUCTION

Problem Description: Currently, our Department of Radiology lacks a dedicated training program tailored to foster this cultural change. Existing training programs are not specifically designed for radiology and lack sufficient depth to address our department's unique needs. Available Knowledge: Creating a culture of safety and trust is critical cornerstone for healthcare institutions seeking to achieve optimal patient safety. It is well known that healthcare organizations with enhanced cultures of safety and expectations of interpersonal management have increases in safety event reporting, greater trust among colleagues, improved employee experience, and increased leadership engagement. Purpose: Accordingly, we implemented a comprehensive training seminar on Fair Just Culture (FJC) for our radiology leaders within Emory Healthcare and determined the impact on knowledge of key concepts.

### METHODS

General: Ninety-nine leaders with roles within our Emory Healthcare Department of Radiology underwent a structured 2.5-hour long course on FJC principles and knowledge was assessed. Leadership roles in included executive leaders, directors, managers, and supervisors. Context and Intervention: The course reviewed key concepts in FJC, human-factors engineering, human errors, Emory Healthcare's FJC algorithm, error reporting, investigation, as well as psychology concepts on the second victim syndrome, giving feedback, and apologizing. Study of the Intervention: Pre- and post-test survey data was collected via Microsoft Forms. Measures:/Metrics: A 21-question test was given to participants to test their knowledge of key concepts and gather feedback. Analysis: Data was analyzed in Excel via T-test under three key domains: skill, attitude, and knowledge.

### RESULTS

Ninety-nine individuals completed the pre-test while 93 completed the post-test. Following the training, participants increased the number of correct responses across all domains by 67.1% (P=0.00002). Increases in correct responses were observed in the following domains: knowledge 1.54-fold (P=0.0004), skills 3.68-fold (P=0.04), attitude 1.74 (P=0.38, NS). Notably, within these domains, participants noted increased levels of confidence in coaching methods, investigation abilities, and understanding of FJC principles in qualitative free response feedback.

### DISCUSSION

We found that implementing a structured course on FJC specific to radiology resulted in enhanced knowledge, skills, and attitude among our leaders. Future work will seek to understand the impact our structured training had on employee experience metrics, patient safety events, and leader coaching within our radiology department. We encourage others to consider implementing FJC training in their organizations to help increase outcomes related to patient safety, employee trust, and inter-personal communication.

## W2-QI-3 BUILDING A QUALITY AND SAFETY TEAM TO INCREASE EVENT REPORTING FOR PATIENT SAFETY IN RADIOLOGY

Janelle Van Luling, RT, ARRT (*Abstract Co-Author*) Nothing to Disclose
Daniella Asch, MD (*Abstract Co-Author*) Nothing to Disclose
Marie Hausner, ARRT, RT (*Abstract Co-Author*) Nothing to Disclose
Jay K. Pahade, MD (*Abstract Co-Author*) Consultant, General Electric Company;Consultant, Clario Medical Imaging, Inc;
Nicole Nardecchia, MBA, ARRT (*Presenter*) Nothing to Disclose

### INTRODUCTION

Patient safety in healthcare is a global top priority. According to the World Health Organization, 1 in 10 patients is harmed in healthcare each year[1]. It is estimated at least 50% of these are preventable. In radiology, areas with high process variability are most error prone. Errors include incorrect protocol, patient falls, and misadministration of contrast/radioisotopes. Quality improvement (QI) teams are an essential part of radiology to aid in event investigations, coach teams on QI methodology, and drive process change. We aimed to improve reporting by developing a supportive culture.[1] https://www.who.int/news-room/fact-sheets/detail/patient-safety#:~:text=Around%201%20in%20every%2010,annually%20due%20to%20unsafe%20care.

### METHODS

The purpose of this improvement report is to explain the structure and evolution of our Quality and Safety team and correlate it with event reporting. We wanted to understand the impact of expanding our team with event reporting culture. We analyzed the number of event reports submitted to our reporting software (RL Solutions, Performance Health Partners) over time as each member/role was added to the team. Our team members consist of one manager, two coordinators, one data/epic analyst, and three radiologists. We work closely with operational staff to encourage reporting.

### RESULTS

In 2017 (with 1 manager and 1 radiologist) 303 events were reported. With each additional team member/role added over time, our team increased event reporting by supporting safety culture and by addressing issues brought forward by frontline staff. By adding 1 coordinator the first year, reporting increased from 303 event reports to 925 (205%), which remained largely steady for the next three years, increasing another 38% by 2021. When our team expanded again in 2021, reporting rose another 53% within the next three years. The total annual events reported in 2023 (with 1 manager, 2 coordinators, 3 radiologists, and 1 data/epic analyst) increased 543% to 1950. The rise in reporting helped our team create QI initiatives and increased stewardship of imaging services (including those requiring ancillary support).

### DISCUSSION

Over the last 7 years, our department has seen a 543% growth in safety event reporting which has correlated with a growth in our team size. The growth of our quality and safety team has encouraged reporting as our team has greater resources to address process/safety issues and help support initiatives improving care for patients and staff. Increased event reporting is proven to decrease patient safety events and improve patient experience. A limitation in using event reporting as a success measure is its reliance on people taking time to fill out forms. All institutions likely have untapped potential in areas with reduced reporting, which may be due to time constraints, competing priorities, and technology barriers.

## W2-QI-5 PULSE SURVEYS FOR DEPARTMENTAL ENGAGEMENT: FINDING THE PEBBLE IN YOUR SHOES

Steven A. Rothenberg, MD (*Abstract Co-Author*) Founder, Empower Therapeutics Inc ;Member, Translation Holdings LLC;Consultant, Radiostics LLC
Rachel Z. Bass, MD (*Abstract Co-Author*) Nothing to Disclose
Elainea N. Smith, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Feedback is essential to creating an optimal work environment to improve job satisfaction and solve problems within an organization. Traditional surveys are performed infrequently, typically have low engagement and only reflect a single moment in time. The purpose of this quality improvement project was to create a mechanism to improve employee feedback by more frequent engagement while decreasing the activation energy required through pulse surveys.

### METHODS

A longitudinal departmental and wellness survey was developed with the goal of answering short 1-2 pulse survey questions that would take 60 seconds or less to complete. The amount of data collected was the same as standard survey except at a higher frequency over a longer time period. The surveys also included open-ended questions for faculty and trainees to voice opinions on select topics. The initiative was first introduced at a faculty meeting before surveying began. The results from the pulse surveys were included in a departmental weekly newsletter and anonymous comments were reviewed by radiology leadership. Engagement was determined by the number of participants that responded per pulse survey.

### RESULTS

Thirteen pulse surveys were sent between October 23, 2023 and April 22, 2024 on a bimonthly basis. Weeks of major holidays and major radiology conferences were omitted to maximize participation. Initial participation was low - with an average of 23 responses in weeks 1-5. In weeks 6-10, participation increased to a weekly average of 44 (p=0.04). Faculty provided 127 free text responses with largest engagement providing kudos to coworkers (N=23) and ideas for improving job satisfaction (N=25).

### DISCUSSION

Longitudinal email surveys can be a valuable tool to gain department-wide feedback on various topics. Bimonthly surveys with single questions are best with minimal time and effort required for engagement. Our brief experience demonstrated after a few weeks of distribution and discussion, engagement gradually increased. With continued future use, this could ideally track wellness or resiliency changes within the department longitudinally over a period of time. Further, these data identified key issues for leadership to intervene on workplace inefficiencies such as our outside image interpretation workflows and utilization of departmental incidental findings macros. Continued experience is needed to gain an understanding of most ideal format and best phrasing of questions.

## W2-QI-6 VALUE OF INJECTION SITE MONITORING USING A SMARTPHONE DURING DYNAMIC CONTRAST-ENHANCED CT

Noriyuki Tomiyama, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Hisayo Suzuki (*Abstract Co-Author*) Nothing to Disclose
Yukihiro Enchi (*Abstract Co-Author*) Nothing to Disclose
SHUCHI KAWABATA (*Abstract Co-Author*) Nothing to Disclose
Kazuhiko Satoh, MBBS (*Abstract Co-Author*) Nothing to Disclose
Takahiro Tsuboyama, MD (*Presenter*) Nothing to Disclose

### INTRODUCTION

Contrast media extravasation is particularly problematic when performing dynamic contrast-enhanced CT (DCE-CT) because visual assessment of the injection site is not possible due to bolus tracking scans that begin shortly after the start of contrast injection. Although pressure monitoring is the main method to detect extravasation, it may not be reliable in all cases. Therefore, we developed an injection site monitoring method using a smartphone and evaluated its value for injection site safety during DCE-CT.

### METHODS

From February to March 2024, 26 radiology department members, including 14 radiologists and 12 technologists, who performed a total of 156 DCE-CT examinations, participated in this survey. Each participant conducted three examinations with pressure monitoring only and three examinations with both pressure and injection site monitoring during contrast injection. Injection site monitoring was performed using an iPhone which was attached to the overhead arm support on the CT bed, with the monitoring video output to a tablet device in the operating room. For each examination, the participants assigned a confidence score regarding the safety of the contrast injection. The Mann-Whitney test was used to compare the 78 examinations conducted with and without the injection site monitoring system. For the per-staff confidence analysis, the Wilcoxon test was used to compare the mean scores of three examinations each with and without the injection site monitoring system in the 26 participants.

### RESULTS

There were no significant differences in the injection rate and volume ($P = 0.16$) between DCE-CT examinations with and without injection site monitoring. Confidence scores were significantly higher in examinations with injection site monitoring than those without the system (mean, 4.3 and 2.9, $P < 0.01$). For the per-staff analysis, the confidence scores were significantly increased by the addition of injection site monitoring to the pressure monitoring ($P < 0.01$). Two extravasations occurred in each of the examinations with and without injection site monitoring. The two extravasations were unnoticed during the contrast injection with pressure monitoring only, and the estimated leaked volumes were 20 and 30 ml. In contrast, the injection site monitoring system successfully detected the two extravasations immediately after their occurrence, with an estimated leaked volume of less than 5 ml.

### DISCUSSION

The limitations of this study include the small sample size of extravasation cases and the lack of generalizability due to the single-center study design. Despite these limitations, the method is simple, widely available, and has the potential for future integration of artificial intelligence in automated detection of extravasation.

## W2-QI-7 IMPLEMENTING AN INNOVATIVE SAFETY-CHECKPOINT PROCESS FOR CLINICAL DEPLOYMENT OF AI IN BREAST CANCER SCREENING: FIRST RESULTS AND EXPERIENCES AT 14 SITES

Nerys Forester, MBBCh, PhD (*Abstract Co-Author*) Nothing to Disclose
Annie Ng, PhD (*Abstract Co-Author*) Researcher, Kheiron Medical Technologies Ltd
ALAN REDMAN (*Abstract Co-Author*) Nothing to Disclose
Alice Leaver (*Abstract Co-Author*) Nothing to Disclose
Anna Ford (*Abstract Co-Author*) Nothing to Disclose
Furhan Razzaq, MBChB (*Abstract Co-Author*) Nothing to Disclose
Shama Puri, MRCP, FRCR (*Abstract Co-Author*) Nothing to Disclose
Amruta Talwalkar, MBBS (*Abstract Co-Author*) Nothing to Disclose
Alexandra Christou, MD (*Abstract Co-Author*) Nothing to Disclose
Ben Glocker, PhD (*Abstract Co-Author*) Employee, Kheiron Medical Technologies Ltd;Employee, HeartFlow, Inc;Researcher, Microsoft Corporation
Sarah Kerruish (*Abstract Co-Author*) Nothing to Disclose
Carla Brackstone (*Abstract Co-Author*) Nothing to Disclose
Bhavani Rengabashyam, FRCR (*Abstract Co-Author*) Nothing to Disclose
Amrita Kumar, MD, FRCR (*Abstract Co-Author*) Nothing to Disclose
Roisin Bradley, MBBCh, MRCP (*Abstract Co-Author*) Nothing to Disclose
Olga Strukowska (*Abstract Co-Author*) Nothing to Disclose
Catharina Oberije, PhD (*Abstract Co-Author*) Nothing to Disclose
Georgia Fox (*Abstract Co-Author*) Nothing to Disclose
William Wei Lian Teh, MBChB (*Abstract Co-Author*) Speaker, Hologic, Inc;Speaker, Devicor Medical Products, Inc
Amira H. Helal, MD, MSc (*Abstract Co-Author*) Nothing to Disclose
Jonathan Nash, MBBS (*Abstract Co-Author*) Nothing to Disclose
Lisa Bisset (*Abstract Co-Author*) Nothing to Disclose
Annie Arkle-Howard (*Abstract Co-Author*) Nothing to Disclose
Peter D. Kecskemethy, PhD (*Presenter*) CEO, Kheiron Medical Technologies

### INTRODUCTION

AI shows promise for improving breast screening quality. Study results are encouraging, but their translation into everyday practice is not guaranteed. A step-wise, safety-focused deployment process with comprehensive monitoring is required to confirm whether experimentally measured benefits translate into real-world deployments. This service evaluation demonstrates the implementation of initial stages of a safety-checkpoint (SC) process, which has evolved through extensive experience in developing, validating, deploying, monitoring and working with AI. The first SC involves technical integration and testing. The second involves assessing local generalisability and expected outcomes when using AI in its intended workflows using recent historic cases. The third involves clinical review of real-world cases with the AI. Subsequent SCs involve clinical training, live pilots, and live use with monitoring. This work covers the first three SCs at 14 sites in varied regions.

### METHODS

A commercially available AI system was deployed across 14 new sites (never previously used in the AI's development or validation) in 2 cohorts: 1) with 6 sites who underwent SC 1 and 3, and 2) with 8 sites who underwent SC 1-3. A checklist was developed to ensure standardised reporting and facilitate performance comparisons for SC 2. The workflow presented for SC 2 uses AI as Reader-2 when the AI and Reader-1 agreed to not recall, otherwise the human Reader-2 opinion was used (Fig 1). In SC 3, the AI was deployed as a 'silent' reader of prospective cases. Clinical teams reviewed AI-flagged cases not recalled by standard double reading (DR) (positive discordant cases).

### RESULTS

118,584 cases were included in the generalisability evaluations (SC 2) across Cohort 2. The AI's AUC ranged from 0.94-0.96. Modelling DR with AI resulted in an expected relative -3.0% recall rate (reduction range: 1.6-4.4%), a rel. -0.3% screen-detected cancer detection rate (reduction range: 0.0-1.1%), a rel. +2.8% positive predictive value (increase range: 1.6-4.6%), and 20-28% workload savings. 4,778 positive discordant cases (8.5%) were reviewed at the first 5 Cohort 1 sites. 18 women were recalled from these reviews, 9 (50.0%) of whom were found to have cancer. Clinical reviews at the remaining 9 sites are in process.

### DISCUSSION

The use of a specially-designed safety-checkpoint process for clinical deployment of AI has been demonstrated. Conducting it at 14 sites with varying levels of clinical experience with AI enabled a standardised way of confirming the generalisability of the AI system and it's expected benefits translating locally and showed that the approach is scalable. Trialling the initial stages of the safety-checkpoint process across multiple sites from different regions has demonstrated its suitability for moving safely towards the next safety-checkpoints: training and live use with monitoring.

## W2-QI-8 LARGE SCALE ARTIFICIAL INTELLIGENCE DEPLOYMENT IN THE EMERGENCY AND RADIOLOGY DEPARTMENTS IN 17 HOSPITALS IN A CITY FOR THE DETECTION, TRIAGE AND MANAGEMENT OF PATIENTS WITH ACUTE INTRACRANIAL HEMORRHAGE

Wai-lun Poon, FRCR, MPH (*Abstract Co-Author*) Nothing to Disclose
K.W.S. Ko (*Abstract Co-Author*) Nothing to Disclose
Neeraj R. Mahboobani, MBBS, FRCR (*Presenter*) Nothing to Disclose

### INTRODUCTION

Intracranial hemorrhage (ICH) is a diagnosis that needs to be detected and managed promptly, and failure to do so can have serious consequences. An automated workflow incorporating vendor artificial intelligence (AI) software was devised for the detection and management of patients with ICH in the Emergency (ED) and Radiology (RD) departments of a tertiary hospital. This workflow was subsequently scaled for use in 17 hospitals in the city.

### METHODS

A validation study was performed to ascertain the accuracy of ICH detection and segmentation by the AI software. A pilot study was then performed to establish proof of concept (POC) of detecting patients with ICH and facilitating timely management of such patients in the ED. To this end, an automated workflow incorporating the AI software was established, whereby the AI results could be accessed by ED physicians and radiologists on an interactive portal on the hospital's intranet, and this was made accessible in all clinical bays in the ED and on all PACS workstations in the RD. The portal included a dashboard and notification mechanism to identify patients with ICH, thereby alerting physicians to attend to them promptly. This workflow was then subsequently scaled for use in 17 hospitals.

### RESULTS

The validation study included 811 CT brain scans. The sensitivity, specificity and accuracy of ICH detection were 97.3%, 96.7% and 96.8% respectively. The AI result for each scan was available within 1 minute after the CT scan. An automated workflow was then established, whereby the AI results and notifications of 'Critical' findings, if any, could be accessed by authorized ED physicians on the hospital's clinical management workstations and by radiologists on the PACS workstations via an interactive portal established on the hospital's local intranet by the Information Technology Department (ITD). This workflow was well received by ED physicians and radiologists, and was subsequently scaled for use in 17 hospitals in the city. It analyses approximately 180,000 CT brain scans a year, and is accessible by about 900 authorized doctors on approximately 1,200 workstations across the 17 hospitals.

### DISCUSSION

This quality improvement project describes augmenting the detection and management of patients with ICH presenting to the ED using AI software to devise an automated and authenticated workflow which is readily accessible via an interactive portal established on a hospital's intranet. This workflow acted as an 'assistant' to ED physicians and radiologists, and reduced 'stress' in detecting ICH in patients, especially in patients with subtle ICH, or at times of constrained manpower or fatigue during overnight shifts. The process of validation, establishment of POC, and workflow covering network infrastructure, data and cyber security, user access control, and means to subsequently scale up to cover 17 hospitals will be discussed.

# Abstract Archives of the RSNA, 2024

W5A-QI

**Quality Improvement Reports Wednesday Afternoon Poster Discussions I**

Wednesday, Dec. 4 12:15PM - 12:45PM Room: LEARNING CENTER

**Sub-Events**

## W5A-QI-1 OPTIMIZING SCREENING MAMMOGRAM TAT: A QUALITY IMPROVEMENT MISSION

Thomas Brim, DO (*Abstract Co-Author*) Nothing to Disclose
Nanditha George, MBBS (*Presenter*) Nothing to Disclose

### INTRODUCTION

Screening mammograms remain an important tool for the detection of breast cancer in asymptomatic women, 40 years and older. The FDA requires that facilities provide patients with an easy-to-understand report within 30 days of their mammogram. Prior imaging is paramount in reporting screening mammograms. Obtaining priors, among other causes, can lead to reporting delays and in turn patient anxiety. In our institution, all radiology studies have to be reported within a certain time frame to prevent loss of departmental revenue. A color scheme was implemented to identify studies at risk of falling out of turn-around time compliance and thus preventing the loss of department revenue.

### METHODS

The implementation of a color-coded interface for the screening mammogram list was created to provide a quick visual representation of which studies needed to be read before falling out of compliance. Red was used for studies that were on the last day, yellow for 2-3 days and green for 4 days before running out of compliance. Grey was used for the remaining studies on the list. All breast radiologists were made aware of the new color-coding scheme. The change was implemented on 12/1/2023. The 3 months prior to and after the change was analyzed to gauge impact.

### RESULTS

The number of screening mammograms performed before and after the change were similar i.e. 3922 from September 2023 to November 2023 (pre-implementation) and 3838 from December 2023 to February 2024 (post-implementation). There was an 86.45% decrease in the number of screening mammograms that fell out of compliance and a commensurate 81.81% decrease in lost revenue in the post-implementation phase.

### DISCUSSION

The implementation of a simple, quick and cost-effective change to the mammography user interface greatly impacted the ability to report screening mammograms in a timely manner as well as decrease the loss of departmental revenue. This project highlights how a color-coded interface can capture the attention of a reader and thus facilitate efficiency. This process could be easily adopted by other radiology divisions or satellite centers and help to prioritize specific studies on the worklist.

## W5A-QI-2 CONTRAST COST REDUCTION FOR CT PULMONARY ANGIOGRAPHY AND ABDOMEN AND PELVIS

Maureen Gregory (*Abstract Co-Author*) Nothing to Disclose
Gaurav V. Watane, MBBS, MD (*Abstract Co-Author*) Nothing to Disclose
Jeffrey S. Mueller, MD (*Abstract Co-Author*) Nothing to Disclose
Michael P. Spearman, MD (*Abstract Co-Author*) Nothing to Disclose
Warren Chang, MD, MBA (*Presenter*) Nothing to Disclose

### INTRODUCTION

From May 2023 through October 2023, the average cost for contrast used on PE and standard Abdominal CT scans has been calculated to be $6,907/month. This results in greater cost to the patient and the department. The goal of this project is to reduce the average monthly cost of contrast by 10% or decrease the monthly contrast cost to $6217/month by August 31, 2024.

### METHODS

Using the DMAIC (define/measure/analyze/improve/control) technique, we identified, categorized, and prioritized causes of contrast waste that result in increased cost to the patient and the department. The identified drivers for the need to reduce monthly contrast cost are summarized as waste reduction, procedure failure, and staff process. Both the current and future state injection processes were arranged. We measured the contrast cost in milliliters used per month. The Bayer Certegra Manager website provided drilled down data that included contrast volume used and volume wasted for each patient on each injector. Patient volume was also measured. We analyzed our standard injection protocols and our staff workflow. Consistent use of the P3T weight based contrast volume software was implemented. Communication about the importance project became, and remains, a priority.

### RESULTS

The project start date was December 2023. Solutions were implemented starting January 1, 2024. The average cost of contrast from January - March 2024 was $6276/month, barely shy of the 10% cost reduction goal. Wasted contrast cost for PE Standard AP studies was reduced dramatically from

$1050 in October 2023 to $198 in March 2024. Consulted Radiologists agree that we are maintaining quality imaging with this reduction in contrast volume.

**DISCUSSION**

One identified root cause of contrast waste that is not controlled by Radiology is the fact that there are many occasions when contrast orders are placed at different times resulting in the patient receiving multiple contrast doses within hours of one another. Ideally, the goal would be to prevent this from occurring. In conclusion, the front-line staff must be recognized for their workflow implementation and continuous, conscious effort to reduce contrast waste.

## W5A-QI-3 INTEGRATED DIAGNOSTICS SHARED RESOURCE'S QUALITY IMPROVEMENT WORKFLOW FOR RADIOLOGY-PATHOLOGY CORRELATION OF PROSTATECTOMY

Dieter R. Enzmann, MD (*Abstract Co-Author*) Nothing to Disclose
Steven S. Raman, MD (*Abstract Co-Author*) Consultant, Johnson & Johnson;Consultant, Bayer AG;Consultant, Merck & Co, Inc;Consultant, Amgen Inc;Consultant, Profound Medical Inc
William Hsu, PhD (*Abstract Co-Author*) Nothing to Disclose
Preeti Ahuja, PhD (*Abstract Co-Author*) Nothing to Disclose
Nashla Barroso (*Abstract Co-Author*) Nothing to Disclose
Alondra Prado, BS (*Presenter*) Nothing to Disclose

**INTRODUCTION**

The diagnosis and treatment of prostate cancer (PCa) depends on a series of interconnected results, including imaging and pathology, which do not always correlate, complicating treatment decisions for patients. The Integrated Diagnostics Shared Resource (IDx) is an interdisciplinary program integrating imaging with histopathology and molecular diagnostics to understand the nature and biology of cancers. IDx uniquely operationalizes quality control (QC) metrics through structured correlation workflows that identify radiological-pathological (RadPath) discrepancies and, in turn, creates a curated dataset available for researchers to use. In this study, we aim to assess the impact of IDx's QC-centered workflow by quantifying the improved accuracy of RadPath findings.

**METHODS**

The IDx operational team tracks all PCa prostatectomies (RALPs) at our institution and helps create patient-specific, 3D-printed prostate molds. Surgical pathology uses the molds during prostate grossing to generate high-quality whole-mount histopathology slides (WMHP) for clinical reports. RALPs are then reviewed at IDx Multidisciplinary "Match" Meetings, where radiologists and pathologists consensually match PCa WMHP lesions (the gold-standard) to MRI lesions, while the operational team captures the results in an IDx database. Between 2023-2024, we reviewed/matched 190 unique cases, including 242 MRI lesions and 361 WMHP lesions. We filtered all MRI/WMHP lesions for discrepancies between originally reported characteristics versus characteristics retrospectively noted and/or amended upon retrospective review.

**RESULTS**

Of 242 MRI lesions reviewed, 228 were noted on clinical reports, 4 were not visible upon retrospective review (1.7%) and 16 were amended (6.6%) due to inaccurate location. The radiologists retrospectively identified 14 (5.8%) new lesions. Of 361 WMHP lesions reviewed, 352 were noted on clinical reports, 3 were not visible upon retrospective review (0.8%) and 33 were amended (9.1%) due to inaccurate location (73.4%) and grading/histology (27.3%). The pathologists retrospectively identified 9 (2.5%) new lesions.

**DISCUSSION**

Previously missed lesions and clinically-relevant characteristics are among the many corrections resulting from IDx's QC workflows. Implementation of such workflows and creation of curated datasets at high-volume academic medical centers can help improve the accuracy of image-based cancer detection by accurately correlating results with pathology, ultimately improving patient care. Obtaining a second review of imaging and WMHP serves as a valuable educational tool for meeting attendees, including trainees. IDx plays a critical role in ongoing PCa research by implementing unique QC-centered workflows that help address and improve RadPath discrepancies, ultimately helping improve the image-based detection of PCa.

## W5A-QI-4 LEVERAGING ARTIFICIAL INTELLIGENCE IN RADIOLOGY MULTIDISCIPLINARY ROUNDS: ENHANCING CLINICAL DECISION-MAKING AND COLLABORATION

Waqas Ahmad I, MBBS (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Radiology multidisciplinary rounds (MDRs) are pivotal for collaborative patient care. Integrating artificial intelligence (AI) into these rounds holds promise for enhancing clinical decision-making. This abstract explores the role of AI in radiology MDRs and its potential to improve outcomes.

**METHODS**

This study involved the integration of AI-powered decision support tools into radiology MDRs at a tertiary care hospital. AI algorithms were trained to analyze imaging studies and provide automated insights into findings, differential diagnoses, and recommended next steps. Radiologists, clinicians, surgeons, oncologists, and other relevant specialists participated in MDRs where AI-generated reports were presented alongside traditional radiology interpretations.To evaluate the impact of AI on MDRs, data on clinical decision-making, treatment planning, and patient outcomes were collected before and after the implementation of AI. Surveys and interviews were conducted to gather feedback from healthcare professionals regarding the usability, accuracy, and perceived benefits of AI in MDRs. Additionally, key performance indicators such as time to diagnosis, treatment initiation etc were assessed to measure the effectiveness of AI-enabled MDRs.

**RESULTS**

The integration of AI in MDRs facilitated more informed discussions, leading to consensus-driven treatment decisions and personalized care plans. AI contributed to reductions in time to diagnosis and treatment initiation, improving patient outcomes and satisfaction. Healthcare professionals reported high satisfaction with the usability and accuracy of AI tools, appreciating the efficiency gains and diagnostic support provided.

**DISCUSSION**

AI-enabled MDRs hold promise for improving clinical decision-making and patient care outcomes. By providing timely information and fostering collaboration, AI enhances the effectiveness of MDRs. However, ongoing evaluation and refinement of AI algorithms, as well as attention to issues of data privacy and bias, are crucial for responsible integration.

## W5A-QI-5 MULTIDISCIPLINARY PROCESS FOR QUALITY IMPROVEMENT OF MULTIPARAMETRIC MRI OF THE PROSTATE AND PROSTATE BIOPSIES

Samir S. Taneja, MD (*Abstract Co-Author*) Royalties, Reed Elsevier;Consultant, TROD Medical;Consultant, InSightec Ltd;Consultant, Francis Medical;Consultant, Exact Imaging Inc;Consultant, Johnson & Johnson;Investigator, MDxHealth SA
Fang-Ming Deng, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Angela Tong, MD (*Presenter*) Equipment support, Siemens AG

**INTRODUCTION**

Multiparametric MRI of the prostate (mpMRI) in conjunction with targeted prostate biopsy have been incorporated in the normal workflow for prostate cancer workup, thus increasing the number of both mpMRIs and biopsies we perform. A process to assess rad/path discordances is necessary to maintain and improve patient care in prostate cancer diagnosis.

**METHODS**

To localize problem areas in our mpMRI and biopsy program, we implemented a structured multidisciplinary meeting to review discordant radiology/pathology findings. Radiology, urology, and pathology were present for each meeting. The structured process included: 1) defining the type of discordance, 2) evaluating a list of reasons for the discordances including image quality, image interpretation with expert prostate imager and consensus reads if necessary, biopsy targeting error, and histologic etiology, 3) classifying the type of discordance from the evaluation, and 4) validating the discordant result. We investigated discordant prostate biopsy results from 1/25/2022 to 2/13/2023 and recorded the steps for each discordance to reveal any areas of improvement in our workflow. Descriptive statistics were performed.

**RESULTS**

A total of 472 biopsies were performed during the time period with 61 discordant cases (mean age 69±7 years). Mean time between MRI and biopsy included 69±47 days, 13% (8/61) were post focal therapy cases. 19% (12/61) had mpMRI performed at an outside institution with consultation interpretation in house. Of the 61 discordances, the types of discordances were as follows: Targeting errors 23%, High Prostate Imaging Reporting Data System (PI-RADS) score with benign/non-clinically significant prostate cancer (grade group (GG) 1) 18%, Incorrect PI-RADS 16% (clinically significant prostate cancer (csPCa) defined as >GG1 occult on mpMRI) 15%, Histologic reasons for discordance 13%, Low volume of csPCa disease (<10% pattern 4) 11%, Poor image quality 3%.

**DISCUSSION**

39% of the discordances were from targeting errors and image interpretation errors, which will be further investigated and corrected with education. 46% were validated to be true discordances on imaging and histology including high PI-RADS with benign or non-csPCa, histologic reasons for discordance, and occult csPCa on MRI, which will all require hypothesis driven research to understand further. Uncovering the distribution of discordance types has given us directions to improve our mpMRI/biopsy program and also important research questions. Continued structured assessment is needed to track the efficacy of our interventions and to uncover any other areas for improvement.

## W5A-QI-6 3D-PRINTED MODELS FOR COMPLEX PEDIATRIC SURGICAL CASES - MULTI-DISCIPLINARY PERSPECTIVES ON A "MODEL" FOR QUALITY IMPROVEMENT

Gregory M. Sturgeon, MS (*Abstract Co-Author*) Nothing to Disclose
Joseph Y. Cao, MD (*Abstract Co-Author*) Nothing to Disclose
Elizabeth Horne (*Abstract Co-Author*) Nothing to Disclose
Mary Moya-Mendez (*Abstract Co-Author*) Nothing to Disclose
Susan A. Churchill (*Abstract Co-Author*) Nothing to Disclose
Cathlyn Medina (*Abstract Co-Author*) Nothing to Disclose
Elisabeth Tracy (*Abstract Co-Author*) Nothing to Disclose
Harold Leraas (*Abstract Co-Author*) Nothing to Disclose
Catherine Beckhorn (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Three-dimensional (3D) modeling has been increasingly used in surgical planning across multiple disciplines. At our institution, 3D-printed models have recently been incorporated into our pediatric general surgery practice for several complex cases; however, we have yet to seek clinician feedback regarding their use. Therefore, we aimed to assess the impact of 3D-printed models on surgical planning and multidisciplinary team discussion.

**METHODS**

We utilized the "Plan-Do-Study-Act" (PDSA) framework, focusing on the "Study" of recent implementation of these models. A survey was distributed to the care team (pediatric oncologists, anesthesiologists, cardiothoracic surgeons, neurosurgeons, resident/fellow trainees) involved in recent complex pediatric surgical cases utilizing 3D-printed models at a large academic institution. Using Likert scales (1 = strongly disagree; 5 = strongly agree) and free responses, we assessed the models' usefulness in preoperative and intraoperative planning. Basic descriptive statistics were performed.

**RESULTS**

Eight respondents completed the survey (two pediatric oncologists, two pediatric anesthesiologists, one pediatric cardiothoracic surgeon, and two general surgery residents and one medical student on the pediatric surgery service). All participants (8/8; 100%) reviewed the models with the primary pediatric general surgeon. All either strongly agreed or somewhat agreed that the model helped them better understand the "tumor location" (mean 4.5) and "anatomy close to the tumor" (mean 4.6). The majority (7/8; 88%) strongly agreed or somewhat agreed that the model impacted their case preparation (4.3), noting its help with "visualization of location of mass and associated anatomic structures of importance," and "preoperative planning for access, blood availability, and resuscitation strategy." Even "reviewing the model in virtual tumor board" helped clinicians; only 5/8 (63%) strongly agreed that physically holding the model (mean 4.3) was necessary for it to be helpful.

**DISCUSSION**

In conclusion, providers across multiple specialties and levels of training (resident, fellow, attending) found reviewing 3D models (in person or virtually) helpful for planning complex pediatric surgeries. While limitations exist, such as the cost and time required for 3D-printing, their use should be considered in anatomically or technically challenging cases. Although a small sample size, our institutional experience with 3D-printed models has been promising. Results can iteratively shape PDSA quality improvement efforts and inform clinical practice at our institution, while serving as a model for other institutions seeking to incorporate this technology. Future research should capture perspectives from other key stakeholders, such as pediatric general surgeons, patients, and their caregivers.

## W5A-QI-7 NEURORADIOLOGISTS IDENTIFY AND TRACK LOW VALUE STUDIES AT THE TIME OF DICTATION FOR INTERDEPARTMENTAL QUALITY IMPROVEMENT

Vivek P. Patel, MD,PhD (*Abstract Co-Author*) Nothing to Disclose
Colbey W. Freeman, MD (*Abstract Co-Author*) Nothing to Disclose

Shahodat Voreis, MD (*Abstract Co-Author*) Nothing to Disclose
Linda J. Bagley, MD (*Abstract Co-Author*) Nothing to Disclose
Michael J. Hoch, MD (*Abstract Co-Author*) Nothing to Disclose
Benjamin G. Steyer, MD, PhD (*Abstract Co-Author*) Nothing to Disclose
Alvand Hassankhani, MD (*Abstract Co-Author*) Nothing to Disclose
Rebecca Simstein, MD (*Abstract Co-Author*) Nothing to Disclose
Grace Tewkesbury, MD (*Abstract Co-Author*) Nothing to Disclose
Douglas Roberts-Wolfe, MD, PhD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Low value neuroimaging in the Emergency Department harms patients, burdens healthcare systems, and is unsustainable. To address this issue, we incorporated a dictation macro into our clinical workflow, enabling neuroradiologists to flag suspected low value studies with minimal clinical disruption. We hypothesized that flagged studies would be driven either by a subset of "superuser" ordering providers and/or systemic overutilization of specific exam types (e.g. CT head, MRI brain, etc.)

**METHODS**

Between March and December 2023, studies were flagged with an alphanumeric code enabling subsequent retrieval by Nuance Montage. Pareto analysis was used to determine whether 20% of causes ("superusers" vs. exam types) drove 80% of flagged studies. Studies prioritized by Pareto analysis underwent retrospective chart review by neuroradiology attendings and residents. Each exam component of the report was individually judged "reasonable" or "unnecessary" and an overall rationale was provided. A subset of exams were re-reviewed for interrater reliability. Rationales were categorized by reason for exam inappropriateness, and for clinical indications common to unnecessary exams.

**RESULTS**

775 reports comprising 1531 exams were flagged. Pareto analysis did not support our hypothesis that "superusers" disproportionately drive flagged studies (the top 20% of ordering providers drove ~60% of flagged studies). However, the top 20% most common exams drove 80% of flagged studies. Further, the top 5% drove 65%, and were components of workup for large vessel occlusion (LVO), including CTA head, CTA neck, CT head, and CT perfusion. Studies including both CTA head and neck were thus prioritized for chart review. 257 reports comprising 731 exams underwent chart review (135 charts were reviewed by two reviewers and 122 by one reviewer). Though differing somewhat by exam type, interrater reliability was ~70% overall, and ~60% of studies were confirmed unnecessary. Supporting rationales included low NIHSS, alternative neurologic etiology, non-neurologic etiology, duplicate imaging, and chronic symptoms. Three clinical presentations appeared commonly in unnecessary CTA head/neck: vertigo, headache, and seizure.

**DISCUSSION**

Neuroradiologists can identify suspected low value imaging with negligible impact on the clinical workflow. 60% of studies thus identified are confirmed to be of low value after chart review. Low value imaging is driven by system-wide overutilization of LVO imaging (CTA head/neck and CT perfusion), rather than by individual "superuser" ordering providers. Low value LVO imaging in turn is most commonly performed in patients presenting with vertigo, headache, or seizure. In collaboration with neurology and emergency medicine we will next turn our attention to development of clinical and imaging pathways for patients presenting with these conditions.

## W5A-QI-8 INCREASING LUNG CANCER SCREENING PARTICIPANTS AT THE MEDICAL UNIVERSITY OF SOUTH CAROLINA

Reginald F. Munden, MD, MBA (*Abstract Co-Author*) Investor, TheraBionic GmbH;Advisory Board, Optellum Ltd;Stock options, Optellum Ltd
Dhiraj Baruah, MBBS, MD (*Abstract Co-Author*) Grant, Blue Eye Soft Corp;Consultant, ImBio, LLC
Anthony Poole (*Abstract Co-Author*) Nothing to Disclose
Cassie Frazier (*Abstract Co-Author*) Nothing to Disclose
Kelly N. Howard, ARRT, MBA (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Patients underutilize our lung cancer screening program, which leads to missed opportunities for early cancer detection and management

**METHODS**

Identifying four key root causes impeding the effectiveness of our LCS program- incomplete documentation, limited patient awareness, provider unfamiliarity with LCS processes, and inadequate data utilization. Collectively, these interventions represent a proactive approach to addressing systemic barriers, promoting provider engagement, enhancing data quality, and improving the efficacy and impact of LCS programs. All data for the study was collected through Eon Health, a third-party vendor that MUSC uses to track lung cancer screening throughout the health system. The weekly volume for the year before the study was evaluated. Receiving a weekly volume report allowed us to quickly identify significant positive and negative changes at each site to determine if interventions were impactful. Monthly reports were also generated to track LDCT total volume, LDCT through the centralized programs, short interval CT chest follow-up, PET scans, cases requiring multi-disciplinary review, referrals to lung nodule clinic, procedures (bronchoscopy, needle biopsy, surgery), lung cancer diagnoses, and other cancer diagnoses. The other measure evaluated was adherence rates to annual LDCT.

**RESULTS**

The weekly volume of LDCTs improved from an average of 55 in 2022 to 91 in 2023. This was in part due to changes in the national guidelines for LCS, lowering the starting age from 55 to 50 and the pack years from 30 to 20. However, additional volume increases were noted after the interventions were implemented. The monthly reports also reveal an increase in LDCT volume as well as referral to the centralized program, procedures, multi-disciplinary review, and lung cancer diagnoses from 2022 to 2023. Adherence to annual lung cancer screening was higher in patients screened through the centralized programs at all four sites. The relationships built through this project between the lung cancer screening program, the quality team, radiology, and primary care have resulted in other project ideas and one grant submission.

**DISCUSSION**

Many of the interventions tested were done in conjunction with other changes happening outside of the project, making it difficult to determine what had the most significant impact on volume.There has been no recent follow-up with the primary care providers to see if the changes to the BPA are helping or hindering their workflow. No interventions were implemented to decrease open referrals for lung cancer screening (patients with orders for LDCTs that were not completed or referrals to the centralized program that never established care).This project focused on systems and tools within an academic healthcare system to improve identification of eligible patients and referrals for lung cancer screening.

# Abstract Archives of the RSNA, 2024

W5B-QI

**Quality Improvement Reports Wednesday Afternoon Poster Discussions II**

Wednesday, Dec. 4 12:45PM - 1:15PM Room: LEARNING CENTER

**Sub-Events**

## W5B-QI-1 UTILIZING 3D PRINTED ANATOMICAL MODELS TO IMPROVE PATIENT EDUCATION IN A NORMAL PRESSURE HYDROCEPHALUS CLINIC

Kevin S. King, MD (*Abstract Co-Author*) Nothing to Disclose
Christian Henriksen (*Abstract Co-Author*) Nothing to Disclose
Elise Dunning (*Abstract Co-Author*) Nothing to Disclose
Justin Hoskin (*Abstract Co-Author*) Nothing to Disclose
Daniel Spalinski, BSc (*Presenter*) Nothing to Disclose

### INTRODUCTION

Patient and family education for normal pressure hydrocephalus (NPH) relies heavily on discussions of radiographic findings and the anatomy of ventriculoperitoneal shunt placement. Providing the best possible patient education experience in this setting has become a quality improvement effort among our neurology and neuroradiology departments. The purpose of this project is to assess the effects of the usage of 3D-printed models on patient understanding, patient perceived understanding, and patient satisfaction in the setting of newly diagnosed NPH.

### METHODS

This project was performed in the neurology division of an urban, quaternary, academic hospital. Sagittal- and axial- split models of both NPH and normal neuroanatomy were printed using a Formlabs Form 3 SLA Resin printer. Patients were randomized into control and educational intervention groups. In the control group, patients received the standard-of-care physician education utilizing patient MRI imaging. In the educational intervention group, patient received physician education that utilized 3D printed models of a NPH and control brain in addition to MRI imaging. Exclusion criteria included patients working in healthcare, requiring the use of a translator, and/or with a MoCA score < 21.The impact of the educational intervention was assessed using a standardized two-part patient questionnaire. The experience portion of the survey quantified patients' satisfaction with their education, comfort, and stress levels on a 1 to 5 rating scale. Patients who received the educational intervention were also asked to quantify model usefulness on a 1 to 5 rating scale. The knowledge portion of the survey quantified patients' understanding of NPH with 7 multiple choice questions regarding the anatomy and pathophysiology of the condition.

### RESULTS

Questionnaires were collected from 30 patients, with 15 in the intervention group and 15 in the control group. Results of the questionnaires were compared using chi-squared and independent t-tests where p=0.05 was considered significant. For patients receiving the educational intervention, there was a significant increase in the mean number of correct answers for the knowledge survey (p=0.05) as well as a significant decrease in the number of "I don't know" responses (p=0.05). There was no significant difference in levels of patient satisfaction (p=0.50), stress (p=0.36), or comfort (p=0.29). Usefulness of the 3D model received a mean score of 4.29/5.

### DISCUSSION

Limitations of our study include variations in patient cognitive impairment despite MoCA score screening and a single-center, single-physician study population. Using a 3D printed brain anatomical model during visits for newly diagnosed NPH, we were able to improve patient knowledge regarding their condition while maintaining patient levels of satisfaction, stress, and comfort.

## W5B-QI-2 TEACHING CHEST RADIOGRAPH INTERPRETATION THROUGH SIMULATED RESUSCITATION SCENARIOS: A NOVEL APPROACH TO MEDICAL STUDENT EDUCATION

Nuran Seneviratne, MA, MBBS (*Abstract Co-Author*) Nothing to Disclose
Mirza Shaheer Baig (*Abstract Co-Author*) Nothing to Disclose
Sagar Kulkarni, MBBS, BS (*Presenter*) Nothing to Disclose

### INTRODUCTION

Chest radiograph (CXR) interpretation is an important skill in medical student education, however, CXR teaching provided by medical schools is often insufficient. This study's aim was to evaluate whether CXR interpretation could be taught via an engaging, simulation-based approach.

### METHODS

We recruited third year medical students on their internal medicine and surgery clinical rotations. The programme consisted of three 15-minute simulation scenarios (tension pneumothorax, pleural effusion and pneumonia) on a simulated ward. Low-fidelity mannequins were used and students were expected to use an advanced cardiovascular life support (ACLS) approach and to request appropriate imaging to aid their diagnosis and management. At each scenario, a CXR was provided upon request of the student participant. Students rotated through each scenario sequentially in pairs and were debriefed on

CXR interpretation and acute illness management at the end of the session. Pre- and post-session questionnaires using 5-point Likert scales were taken using Google Forms. Statistical significance was calculated using the paired samples t-test.

**RESULTS**

20 participants attended the sessions. Before the session, the mean confidence at interpreting CXRs was 2.55 out of 5. After the session, mean confidence rose to 4.25 out of 5 (increased by 1.70, $p < 0.00001$) . In terms of usefulness, participants rated the session 4.8 out of 5 on average. Free text comments mentioned the case mix, integration of radiographs into the ACLS assessment and teaching on systematic methods to interpret radiographs as being assets of the program.

**DISCUSSION**

Simulation can improve student confidence in CXR interpretation. Students find simulation-based scenarios to be an engaging and interactive way to learn about imaging. To improve student confidence and ability further, we could introduce multiple radiology-based sessions throughout their rotation.

## W5B-QI-3 SIMULATION TRAINING IN RADIOLOGY: IMPROVING RADIOLOGISTS KNOWLEDGE IN CONTRAST REACTIONS

Julie G. Champine, MD (*Abstract Co-Author*) Nothing to Disclose
Jessica H. Porembka, MD (*Abstract Co-Author*) Nothing to Disclose
Kristen Bishop, MD (*Abstract Co-Author*) Nothing to Disclose
Jennifer G. Schopp, MD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Allergic reactions to IV contrast, occur 0.2-3% of the time, most are mild and self limited, although 2-3% of the reactions are severe and life threatening. Given the infrequency of severe reactions, a radiologist may go years without managing a severe reaction. There are 5 key reactions to contrast, each of which can be life threatening. Knowledge of contrast reaction management is essential and can be life saving. Specialized training is needed to maintain skills in identification of reaction type and selection of proper medications to treat. We aimed to improve recognition and treatment of contrast reactions through creation of a simulation program for radiology faculty.

**METHODS**

The team was assembled with three physician course directors writing 5 key scenarios. Supplies were obtained from pharmacy to create mimic contrast reaction kits, CT backdrop was created, dry runs performed, and budgeting was planned. Scheduling of faculty was performed. Scenarios include 5 radiologists in 3 hour sessions, each radiologist leading 1 of the 5 key reaction scenarios. A 5 question pre-test was administered, with a brief introductory lecture to follow. The scenarios were carried out, with post session debriefing, followed by the post test.

**RESULTS**

Total of 28 faculty have been trained at Simulation Center within a 4 month period, on track for 100 faculty within 1 year (all within 2 years). Post testing improvement is demonstrated on each key concept, with nearly all at 100% (except vasovagal concept).

**DISCUSSION**

Our Multidisciplinary approach was effective in creating and implementing training, with excellent post test scoring indicating improvement post simulation training. Future improvements to implement include a pre simulation training vasovagal lecture and pre and post confidence testing, as the vasovagal post test improvements were not as robust compared to other key teaching points. Interdisciplinary team will prove useful for future plans, including our RNs and technologists for team training and scope of practice awareness.

## W5B-QI-4 IMPROVING PROSTATE MRI REPORTING STANDARDS: REFLECTIVE PRACTICES AND SIMPLE FEEDBACK

Alex P. Kirkham, MBChB, MD (*Abstract Co-Author*) Nothing to Disclose
Shonit Punwani, MBBS (*Abstract Co-Author*) Nothing to Disclose
Tom Syer (*Abstract Co-Author*) Nothing to Disclose
Adam Retter, MD, PhD (*Presenter*) Nothing to Disclose

**INTRODUCTION**

Pre-biopsy mpMRI with targeted biopsy has shown high sensitivity and negative predictive value (NPV) for the diagnosis of clinically significant cancer (ISUP grade=/>2). However, positive predictive value (PPV) and the proportion of scans scored 3 (or indeterminate) varies across centres. A score of 3/5 can cause uncertainty and complicate clinical discussion, and too many scores of 3/5 can lead to over biopsy and over diagnosis of insignificant tumour.Problem: Observation suggests that 'cautious' radiologists may lean towards scoring 3/5 rather than 2/5, possibly leading to unnecessary biopsies and a subsequent decrease in PPV.

**METHODS**

An initial audit retrospectively assessed all new patients referred to the UCLH one-stop suspected prostate cancer clinic who underwent mpMRI (including contrast) for suspicion of prostate cancer Feb-April 2021. The audit was repeated following an intervention for a further 3-month period (June-August 2021). Descriptive statistics are presented for Likert scores and biopsy outcomes for all included patients and by individual radiologists. Positive predictive values with Wilson's 95% confidence intervals were calculated for the pre-specified Likert score cut-offs. All analysis was undertaken with Stata v17. 81 patients were required to ensure a 95% confidence level that the proportion of Likert 3 scores were within 10% of the 30% target.Standard There is no agreed standard for the proportion of Likert scores or PPV of MRI prostate reporting. However, PROMIS indicated 29% of patients scored 2/5 or less and 30% 3/5. Similarly, Westphalen et al indicated that in 5030 patients, 29.1% scored 3/5, and estimated overall PPV across all centres following biopsies for =3, =4, 3, 4 and 5 were 35%, 49%, 15%, 39% and 72% respectively. Multiple studies show minimal differences between PI-RADS and Likert scores, so we have used the same standards for this audit.InterventionThe results of the audit were discussed with each included radiologist, including personal scores and comparison with the group.

**RESULTS**

136 patients were included in the analysis who attended clinic prior to the intervention and 135 following. Proportions for all Likert scores and of Likert2 to 3 scores for individual reporting radiologists indicate that at preintervention, standards were not met with 40% scans reported as Likert3 and 19% as Likert2. Postintervention scoring proportions showed improvement approaching initial set standards, with 31% Likert3 (reduced by 9%) and 27% Likert2 (increased by 8%). An overall reduction in biopsies was observed across all Likert scores, with rates decreasing from 50% (68/136) pre-intervention to 44% (59/135) post-intervention with insignificant change in PPV for significant cancer detection.

**DISCUSSION**

Simple feedback can help radiologists stay aligned and meet standards.

## W5B-QI-5 LEVERAGING A QUALITY IMPROVEMENT FRAMEWORK TO IMPROVE TRANSGENDER CARE IN ULTRASOUND: THE BRIITE-US EDUCATIONAL SESSION

Robin P. Goldenson, MD, MPH (*Abstract Co-Author*) Nothing to Disclose
Efren J. Flores, MD (*Abstract Co-Author*) Speaker, WebMD LLC;Speaker, Consulting Medical Associates, Inc
Nicolas Freeman, MD, BA (*Presenter*) Nothing to Disclose

### INTRODUCTION

Transgender and gender diverse (TGD) patients face significant health inequities, worse health outcomes, and poor patient experiences in medicine including radiology. At our academic radiology center, the challenges TGD patients encounter had not been addressed. Using a quality improvement (QI) framework, the [Institution Name] Radiology Initiative for Inclusive Transgender Experiences in Ultrasound (BRIITE-US) assessed actionable areas of TGD patient experiences and led to interventions emphasizing patient autonomy and respect with trauma-informed care within ultrasound (US). This study evaluated the effectiveness, acceptability, and feasibility of a TGD educational session for radiologists and staff as part of BRIITE-US.

### METHODS

The IRB-exempt study evaluated the BRIITE-US educational session that targeted patient interactions in a process map. Session Design and Implementation: The session was created by the study team with experience and expertise in TGD care. It was designed for radiologists, sonographers, and radiology staff and included (1) a presentation on foundational TGD terms/concepts, gender pronouns, staff responses for modeling challenging TGD interactions, and US exam practices, and (2) a question-and-answer session. Effectiveness and Acceptability: A twelve-item, pre- and post-educational session survey was designed based on a previously validated survey and given to participants. Eight items used a 5-point Likert scale analyzed using the logrank test between timepoints. Feasibility: Needed resources, time, and costs were assessed.

### RESULTS

Effectiveness and Acceptability: In the pre-session survey (n=39), 36% had prior TGD training. In the post-session survey (n=28), 96% found the session helpful. Four survey items showed a significant improvement: (1) Worrying about making mistakes or offending TGD patients ($P=0.002$); (2) Feeling comfortable asking about pronouns ($P<0.001$); (3) Responding to mistakes where the wrong name or pronouns were used ($P<0.001$); and (4) Accessing gender-related data on the exam requisition ($P=0.002$). Feasibility: Sessions were administered in less than an hour either in person or online and incurred no additional costs.

### DISCUSSION

Leveraging a QI framework to help improve TGD US experiences in radiology, the BRIITE-US educational session was highly effective, acceptable, and feasible. The session improved participants' knowledge, competency, and preparedness for TGD interactions. Respondents were less worried about making mistakes or unintentionally offending TGD patients and were better prepared to ask about pronouns, respond to instances of misgendering, and find gender-related information on requisitions. This QI initiative increased organizational readiness to improve TGD patient experiences while promoting institutional values of diversity, inclusion, and belonging.

## W5B-QI-6 IMPROVING IMAGE QUALITY AND EFFICIENCY OF CARDIAC FOUR-CHAMBER VIEW SCANNING USING THREE-POINT POSITIONING METHOD

Ning Pan (*Abstract Co-Author*) Nothing to Disclose
Jianxin Guo (*Abstract Co-Author*) Nothing to Disclose
Lihong Chen (*Presenter*) Nothing to Disclose

### INTRODUCTION

Four-chamber view is the basic acquisition in CMR to simultaneously visualize the mitral valve, tricuspid valve, and cardiac apex, providing important morphological information. It is also the anatomical basis for subsequent acquisitions such as left ventricle, outflow tract, and myocardial perfusion imaging. This study aimed to evaluate the application value of the three-point positioning method in improving the image quality and scanning efficiency of the four-chamber view in CMR.

### METHODS

A total of 215 patients who underwent four-chamber view imaging from January 2022 to October 2023 were retrospectively collected and divided into two groups. The control group (before the introduction of the three-point positioning method, n=109) used the conventional positioning method, while the study group (n=106) used the three-point positioning method. Image quality of the mitral valve, tricuspid valve, and cruciform structure in the four-chamber view images were assessed by two radiologists using a 4-point Likert scale. The time from scout imaging to completion of the four-chamber view imaging was recorded. Chi-squared test and two-sample t-test were used to compare constituent data and numerical data, respectively. The kappa test was used to analyze the interobserver consistency.

### RESULTS

There were no significant inter-group differences in the experience of radiographer, as well as the gender, age, and disease profile of patients. The mean quality scores of mitral valve, tricuspid valve, and cruciform structure for the control group and study group were $3.44 \pm 0.64$ and $3.63 \pm 0.49$ ($P=0.023$), $3.43 \pm 0.67$ and $3.53 \pm 0.60$ ($P=0.202$), $3.71 \pm 0.49$ and $3.83 \pm 0.35$ ($P=0.047$), respectively. The difference in image quality scores for mitral valve and cruciform structure reached statistical significance. The mean time to complete a four-chamber view acquisition for the control group and study group were $11.67 \pm 3.49$ minutes and $7.212 \pm 1.83$ minutes, respectively, with statistically significant differences ($P<0.001$).

### DISCUSSION

It was found that the image quality of the mitral valve and the cruciform structure in the four-chamber view obtained by the three-point positioning method was significantly better than that of the conventional positioning technique, and the scanning efficiency was also significantly improved. This study has several limitations. First, the time for patients to complete all CMR sequences was not analyzed. Second, the radiographer for the control group and the study group were not strictly identical because of shift changes and personal rotation. Compared with the conventional positioning method, the four-chamber view obtained by the three-point positioning method can better display the mitral valve, tricuspid valve, and cruciform structure, and also shorten the imaging time.

## W5B-QI-7 LEVERAGING ROBOTIC PROCESS AUTOMATION TO IMPROVE WORKPLACE EFFICIENCY THROUGH IDENTIFICATION OF DUPLICATE SCANS

Tan Yang Loo (*Abstract Co-Author*) Nothing to Disclose
Jia Jun Ng, MSc (*Abstract Co-Author*) Nothing to Disclose
Jiang Peng Ng, BSc (*Presenter*) Nothing to Disclose

## INTRODUCTION

Advancement in technology and ease of access to imaging has led to notable increase in imaging requests. These lead to a rise in duplicate requests. which are often manually identified before patients enter the scan room. A lapse in service exists as patient care is not provided in a timely or efficient manner. The purpose of this initiative is to utilize robotic process automation (RPA) to identify and reduce duplicate requests.

## METHODS

An analysis of computed tomography (CT) orders cancelled in 2022 was conducted. Out of a total of 41020 orders, there were 407 duplicates (1%). This number is non exhaustive. Despite the low number, it is significant as CT involves radiation which should be kept as low as reasonably achievable. Root cause analysis was performed using cause and effect diagram. Educating multidisciplinary teams emerged as a key area in reducing duplicate CT orders. The Plan Do Study Act (PDSA) method was utilized to facilitate the change. The first PDSA cycle did not lead to change due to lack of continual education. Clinicians were also commonly rotated through various local hospitals with differing policies. A second PDSA cycle was conducted, and RPA identified as the new change agent. Current workflow and radiological information system (RIS) capabilities were analyzed to determine steps in the workflow for RPA injection. Various key factors and unique identifiers were labelled. Proof of concept using Microsoft Excel confirmed the project's feasibility. A working database was set up to ensure the dataset validity, allowing RPA to perform with increased sensitivity. Effectiveness of RPA will be measured by number of duplicates it captures before patients' scheduled appointments. A three month test period will be set aside for data collection.

## RESULTS

Early results show that RPA identified 89 potential duplicates across 588 scheduled CT orders. These cases form the department's average weekly workload. With further analysis, there were three true positive duplicate. RPA reduced identification of duplicates by 84.9%. Remaining false positives were shown in an easy to view format, enhancing workflow for duplicate orders identification. It is forecasted that RPA will be able to capture 95% of duplicate orders.

## DISCUSSION

Current RPA model is not integrated in RIS due to security limitations. Manual upload of scheduled scan orders and refreshing worklists are required. There exists a chance of data loss that will be reduced upon integration with RIS. RPA requires human input to trigger decision making in early models. Through Artificial intelligence (AI) upgrades, automation is achievable. With a combination of AI and standardized guidelines, it is expected that enhanced RPA model would be able to identify and cancel duplicate requests. The automation will improve patients' experience; as radiographers' time and attention are diverted towards direct patient care.

# W5B-QI-8 IMPROVED DETECTION OF ACUTE INTRACRANIAL HEMORRHAGE DETECTION: A DEEP LEARNING APPROACH ON A NON-CONTRAST HEAD CTS

Ross W. Filice, MD (*Abstract Co-Author*) Advisor, BunkerHill Health, Inc;Shareholder, BunkerHill Health, Inc;Speaker, General Electric Company;Speaker, Koios Medical;Researcher, Koios Medical
Joseph H. Yacoub, MD, MD (*Abstract Co-Author*) Stockholder, NVIDIA Corporation
Rashmi S. Thakkar, MD (*Presenter*) Nothing to Disclose

## INTRODUCTION

Timely and precise identification of acute intracranial hemorrhages (ICH) is imperative for prompt medical interventions, mitigating neurological damage, and enhancing overall patient outcomes. Swift and effective response to these critical medical emergencies significantly influences survival rates and quality of life. This study aims to assess the efficacy of a commercial deep learning algorithm to retrospectively detect missed acute ICHs on non-contrast head CTs.

## METHODS

Between March 27, 2023, and April 10, 2023, non-contrast head CT studies were consecutively gathered at our institutions. A natural language processing (NLP) algorithm was employed to classify radiological reports as negative or positive for ICH. A commercial deep learning AI algorithm was applied to imaging data to identify instances of missed acute ICH (negative by NLP, positive by AI). Ground truth was assumed for concordant cases. Discordant cases underwent review by a neuroradiologist to establish ground truth.

## RESULTS

There were 2,052 consecutive retrospective cases collected over a two-week period. The prevalence of acute ICH was 5.1% (105/2052) based on positive reports. The algorithm flagged 22 cases as suspected missed acute ICH. 31.8% (7/22) of these cases were determined to be true positive ICH, resulting in a 6.6% (7/105) enhanced detection rate. There were 11 false positive cases flagged by the algorithm. Sensitivity and specificity for radiologist was 93.75% and 99.85% respectively; and for AI it was 95.54% and 99.43% respectively.

## DISCUSSION

This study underscores the potential of deep learning systems as quality improvement tools to help identify missed acute intracranial hemorrhages, showcasing the promise of advancements in medical imaging technologies.Clinical Relevance A commercially available AI algorithm for acute ICH may be beneficial in detecting additional hemorrhages in 3.4 out of every 1,000 patients who undergo a non-contrast head CT.